

# Genie™ 2000 Spectroscopy Software

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Operations

9233652F V3.1



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Canberra's True Coincidence Summing Correction for Radiation Detectors is covered by US Patent 6,225,634.

**This volume contains the operating manuals for four related programs, each separated by a blue divider.**

**Part 1 - The Genie 2000 Operations Manual, including the S501 Gamma Analysis option.**

**Part 2 - Model S505 QA Software User's Manual**

**Part 3 - Model S506 Interactive Peak Fit User's Manual**

**Part 4 - Model S509 Alpha Analysis User's Manual**

**Note:**

**A PDF for each of these manuals is located on your distribution CD.**

# Notes

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# 1. Introduction

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## Welcome to Genie™ 2000 Spectroscopy Software

Canberra is pleased that you have chosen to join the ranks of Genie 2000 users. We feel that Genie 2000 represents the true state of the art in spectroscopy software platforms. It offers the exceptional ease of use that gets you up and running quickly – combined with the extensive flexibility that lets you operate your system your way.

No matter what your application, you will find Genie 2000 to offer the power and flexibility you need. Whether you are using the software for simple spectral data collection and viewing – or for complete assay of complex samples, Genie 2000 gives you the tools to get the job done.

This manual is a comprehensive reference on the capabilities and operation of Genie 2000. While others may consider the user manual to be an afterthought, Canberra considers it to be an integral part of the product – an essential tool for you to take full advantage of the capabilities of the system. As such we are proud of the effort and consideration that went into the development of this user documentation.

The other chapters of this manual are dedicated to the details. This chapter is intended to give you an overview of the system and its architecture.

Note: This and other Genie 2000 manuals may also be available in computer readable format (PDF) in the <G2K Install Path>\PDF\DOCS folder on your hard disk. <G2K Install Path> is the top level directory you have chosen for the installation of the Genie 2000 software (C:\GENIE2K by default). During the installation of Genie 2000 you may select whether the electronic manuals are copied and whether you want to install the application required to view these manuals (Adobe Acrobat® Reader®).

## Overview of Genie 2000

Genie 2000 is a comprehensive set of capabilities for acquiring and analyzing spectra from Multichannel Analyzers (MCAs). Its functions include MCA control, spectral display and manipulation, basic spectrum analysis and reporting. Optional capabilities include comprehensive spectrum analysis for alpha and gamma spectroscopy, quality assurance, system automation and turnkey packages for specific, dedicated applications.

A block diagram of the Genie 2000 architecture is shown in Figure 1.

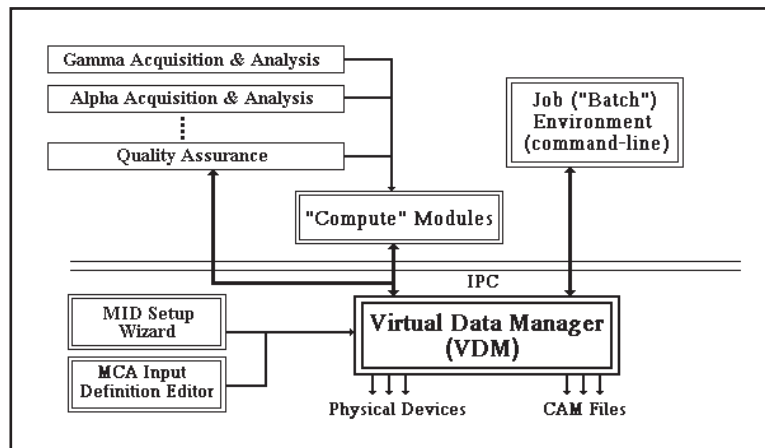


Figure 1 The Genie-2000's Architecture

The core of the Genie 2000 software is a module known as the Virtual Data Manager or VDM. The VDM manages all information flow within the system. It is responsible for communications with both data files and MCA devices – and for presenting information from them to the subsequent layers of software in a consistent manner. Thus, the VDM makes it possible for the user to operate on all spectra – whether from a data file or from one of the supported MCA hardware products – with consistent display, user interface and analysis. VDM and its attached hardware drivers maintain all the low level communications to MCAs as well as data transfer from MCAs to data files.

The VDM is designed to communicate to subsequent layers of software via a layer called inter process communication or IPC. IPC is designed to function both within a single computer and over a network. Thus an MCA hardware device connected to one computer's VDM can be accessed for control, display and analysis over a network from another computer.

The next layers are the compute modules. These are small modular programs that perform basic functions – start/stop of acquisition, transfer of spectrum from MCA to disk, peak search, etc. This modular nature makes possible the extensive flexibility in Genie 2000 – individual modules can be operated together in a sequence to meet specific application requirements.

Tying the compute modules together are two completely separate user interface environments – the interactive environment and the batch procedure environment. These distinct environments were developed for very different needs – in recognition of the fact that there can be very different uses of a single system.

The interactive environment – embodied in the Gamma Acquisition and Analysis Window and (optionally) in the Alpha Acquisition and Analysis Window – is intended for direct hands on operation of all aspects of the system. From an integrated window featuring pull down menus, a tool bar, status pages, a report window and spectral display, the user can do essentially anything with the system. Acquisition control, analysis, spectrum manipulation are all very interactive and are all available to the user all the time. This makes the environment very powerful for the knowledgeable user – the experienced spectroscopist reviewing difficult spectra, testing system performance on unique samples, optimizing analysis routines, etc.

However, many lab operations consist mostly of routine repetitive operations using less skilled operators – users who are not trained as scientists or radiochemists, but technicians who are trained to count samples by specific procedures. These users do not need immediate access to everything – in fact their access to sensitive setup functions needs to be controlled. For this group of users, the batch procedure environment provides a step-by-step guide through the process of counting samples – as well as other operations. Additionally, the batch procedure environment features a security system that prevents access to various functions by operators not qualified to operate them.

Both the interactive and batch user interface environments operate on a common set of compute modules – so consistency of operation and results is assured irrespective of the environment used. They can (and most typically do) exist side by side in a given system – with the batch environment used for routine operations and the interactive used for the non-routine.

The power of the batch environment is exploited by a range of dedicated applications software for specific applications. If you are involved in applications such as routine alpha and gamma sample counting, whole body counting, safeguards confirmatory measurements, waste assay or a host of others – applications packages built on the batch environment address the unique requirements of those applications very specifically. Consult your local Canberra office for information and availability.

We expect that you will find Genie 2000 to provide you a comprehensive set of capabilities for nuclear measurements. We also value your feedback – as this is the input that leads us to continuous improvement of our capabilities. Feel free to contact us with your comments at any time. Call and ask for the Genie 2000 Product Manager or visit our home page at <http://www.canberra.com>. We look forward to hearing from you.

## **Genie 2000 Support Services**

We view support services as a key ingredient to your overall success with a spectroscopy system. Support services are widely varied and can be tailored to meet your specific requirements. A brief overview of available Genie 2000 support services appears below. For more details, see our Customer Services Catalog.

## Training

Our training department offers a wide array of training courses for the Genie 2000 user. These range from basic and advanced operations courses, to customization/applications development courses and operations courses on dedicated application software. There are also related courses in basic nuclear measurements and techniques – gamma and alpha spectroscopy, health physics, etc. Training can be conducted either at our training center in Meriden, Connecticut, USA or at your site anywhere in the world.

## Maintenance Contracts

Software maintenance contracts are available for Genie 2000 for an annual fee. The contract customer enjoys unlimited telephone and Internet support, newsletters containing useful information on using the software, Software Services Bulletins notifying them of any software problems and – most importantly – free copies of all software updates released during the contract period. Typically, releases occur twice per year. Thus the user who keeps up a service contract is always assured of running the very latest developments in spectroscopy software.

### Updates

Updates are also available for users who do not choose to take a maintenance contract. Although most find the contract to be more cost effective, the availability of updates still assures that the Genie 2000 customer can use the latest technology.

## About this Manual

If you bought a complete system from Canberra, you'll find the early chapters are designed to get you up and running quickly. If you're installing the software and hardware yourself, you'll first want to refer to Appendices A and B for installation information.

## Operations

Volume 1, *Operations*, contains information for day-to-day operation of the Genie 2000 system.

Chapter 1, *Introduction*, this chapter, lists the software available for the Genie 2000, the typographic conventions used in the manual, and the keyboard conventions for using the program without a mouse.

Chapter 2, *MCA Input Definition*, takes you through system configuration, the definition of physical MCA inputs. The first part of the chapter discusses the MID Wizard, which will quickly and easily set up your system's MCA for most common situations. The remainder of the chapter is devoted to the MCA Input Definition Editor, which is available for those setups which will use other parameter settings.

Chapter 3, *Gamma Acquisition and Analysis*, provides a structured reference where you can easily locate specific information.

The next three chapters discuss the Nuclide Library Editor, the Certificate File Editor, and the Analysis Sequence File editor. These utilities create and edit calibration standard certificate files, nuclide library files, analysis sequence files. Comprehensive standard libraries are included with the package and can serve as the basis for easily defined custom libraries.

These are followed by chapters on using Cascade Correction, the Geometry Composer and Datasource Preview.

### **The Appendices**

Software installation, a nearly automatic process, is covered in detail Appendix A, *Installing the Software*. Appendix B, *Genie 2000 Configuration*, discusses many modifiable Windows® parameters; though most users won't need to customize their Windows setup, the information in this section is useful for configuring Windows for specific situations. Appendix C, *Technical Information*, covers hardware adjustments, and the Genie 2000 Status Screen. Appendix D, *Correcting Cascade Summing*, talks about why efficiency calibration correction is needed and how to do it. Appendix E, *The InSpector 2000 Simulator*, discusses the InSpector 2000 Simulator software and its functions. Appendix F, *Line Activity Consistency Evaluator*, gives detail description of how the Line Activity Consistency Evaluator works.

## **Customization Tools**

Volume 2, *Customization Tools*, contains a great deal of specialized material for advanced users, such as how to program a Report Template to your needs, the meaning of all CAM parameters, Genie 2000 algorithm descriptions, and so on.

### **Batch Tool Support**

All of the material on batch tool commands, including error messages, has been moved from the *Customization Tools* manual to the *Model S561 Batch Tool Support Reference Manual*.

## **Genie 2000 Software**

Genie 2000 software is available in several variations and with several layered optional packages, most of which are covered in this manual.

In the interest of clarity, this manual does not associate individual features of the Genie 2000 system with the model numbers purchased to implement those features. This section summarizes the differences between the various models.

## Software Covered by This Manual

### S500 Genie 2000 Basic Spectroscopy Software

#### Includes:

- Acquisition control for all Canberra acquisition devices.
- Gamma acquisition and analysis window.
- Flexible reporting system.
- Second difference peak search.
- Library directed peak search.
- Tentative Nuclide Identification.
- User ROI peak definition.
- Summation and non-linear least squares fit.
- Complete calibration functions.
- Certificate file editor.
- Nuclide library editor and comprehensive gamma libraries.
- Ability to import efficiency calibration data generated by LabSOCS or ISOCS.

### S501 Genie 2000 Gamma Analysis Software option

#### Includes:

- Peak area background subtract.
- Efficiency correction.
- Nuclide identification.
- Automatic interference correction.
- Weighted mean activity calculation.
- Minimum detectable activity.
- Post-NID processing (action levels).
- Canberra's patented Cascade Summing Correction algorithms.
- Parent/Daughter decay correction.
- Workspace save/restore Acquisition and Analysis Settings.
- Requires S500 or S502.



S502 Genie 2000 Basic Spectroscopy Software (Standalone)  
Same as S500, except:

- Supports one MCA Input only.
- Does not support Multiplexers.

S511 Genie 2000 Right to Copy (Standalone)

- Right to copy and execute S501, S502, S503, S505, S506 and S509 on one additional computer in the same location.
- Requires purchase of S502 and optionally S501, S503, S505, S506 or S509 for one computer at the location.

S520 Genie 2000 Right to Copy (Basic)  
Including:

- Right to copy and execute S500, S501, S503, S505 and S510 on one additional networked computer.
- Requires purchase of S500, and optionally S501, S503, S505, S506 or S510 for one computer at the location.

### **Application Options**

There are a large number of optional application software packages available for the Genie 2000 spectroscopy platform. Several of these optional applications are described below.

For easy reference, the printed version of this manual includes the Models S505 QA, S506 IPF, and S509 Alpha Spectroscopy User's Manuals. The PDF versions of these manuals are in separate files.

S505 Genie 2000 Quality Assurance Software

- Tracks and reports on the performance of your Genie 2000 spectroscopy system.
- Interactively establishes a database of key system performance parameters.
- Warns you if the parameters drift outside the allowable warning and error limits which you have set.
- Includes a comprehensive statistical analysis, reporting, and plotting facility for tracking system performance.

S506 Genie 2000 Interactive Peak Fit

- Displays peak fit information allowing review of peak search results.
- Allows user to adjust peak search results by adding/deleting peaks, adjusting fit regions, etc.

- Requires S500 or S502.

### S509 Genie 2000 Alpha Analysis Software

Includes:

- Alpha acquisition and analysis window.
- Peak area and ROI background subtract.
- Reagent correction.
- Efficiency correction.
- Nuclide identification.
- Automatic interference correction.
- Weighted mean activity calculation.
- Minimum detectable activity.
- Post-NID processing (action levels).
- Workspace save/restore Acquisition and Analysis Settings.
- Requires S500 or S502.

### S544 Genie 2000 NuChart Nuclide Table Software

- Color-coded Chart of Nuclides.
- Comprehensive compilation of nuclear data from the Brookhaven NuDat database.
- Presents data on alpha, beta, gamma, x-ray and neutron decay.
- Quick search by nuclide name.
- Comprehensive search by energy window, intensity, half-life, radiation type, etc.
- Shows parent/progeny relationship.
- Creates CAM file nuclide libraries for Genie.

### S560 Genie 2000 Programming Library

- Allows a programmer to interact directly with Genie 2000 capabilities from a C++ language environment.
- Allows the addition of user-coded analysis engines to the Genie 2000 environment.
- The Programming Library also provides a set of ActiveX components which can easily be used with any ActiveX compliant programming environment like Microsoft® Visual Basic™ and others.

- Using the Programming Library assumes a basic knowledge of C++ or Microsoft Visual Basic programming and an understanding of the basic operation of 32-bit Windows environments and Genie 2000's data structures and architecture.

S561 Genie 2000 Batch Programming Support

- Provides REXX script language environment for advanced automated procedure development.
- Requires S500 or S502.

S573 Genie 2000 ISOCS *In Situ* Calibration Software

- Mathematical efficiency calibration software. No radioactive sources needed !
- Eliminates the cost of purchasing radioactive standards, creating custom distributions, and radioactive waste disposal.
- Results are available within a few seconds.
- Calibrations valid from zero distance out to 500 meters.
- Calibrations valid from 45 to 7000 keV.
- Calibrations accurate to within a few percent.
- Calibrations accurate at any angle from detector, not just on detector axis line.
- Operates with any size or type of Germanium detector which has been characterized by Canberra.
- Ideal for In-Situ or Waste Assay applications, where large and various sample types are often encountered.
- Includes predefined geometry templates for twenty common container shapes and sample distributions.
- Only a few physical sample parameters (e.g. size, distance from detector, etc.) are needed to tailor a template to a sample.
- User-defined templates containing all static information about a sample may be saved and easily be recalled.
- Ability to vary assumed sample characteristics (e.g. density, container wall thickness, etc.) makes it ideal for "What if...?" analyses.
- Resulting calibrations may be stored, recalled, and used just like those generated by traditional calibration techniques.
- Multi-Efficiency program allows creation of compound efficiencies for multiple detectors, multiple locations or multiple sources.

- Includes library of common materials and tools to create new materials.
- Works with cylindrical collimators with conical holes, and rectangular collimators with trapezoidal holes.
- Includes predefined collimator entries for ISOCS Shield.

### S574 Genie 2000 LabSOCS Laboratory Calibration Software

- No radioactive sources needed for accurate efficiency calibrations.
- Works over a wide range of geometries.
- Calibrations valid from zero distance out to 500 meters.
- Calibrations valid from 50 keV to 7000 keV.
- Calibrations accurate to within a few percent.
- Calibrations accurate at any angle from detector, not just on centerline.
- Eliminates the cost of purchasing radioactive standards, creating custom distributions, and radioactive waste disposal.
- Results are available within a few seconds.
- Operates with any size or type of germanium detector which has been characterized by Canberra.
- Optimized for laboratory applications where complex shaped containers are used repetitively.
- Includes predefined geometry templates for common laboratory container shapes.
- Includes library of common commercially available containers, and tools for the user to create new containers.
- Includes library of common matrix/absorber materials and tools to create new materials.
- Custom templates can be provided to meet special application needs.
- Sample size can be point-like, or up to 500 meters in size.
- Easy to use fill-in-the blank operator interface.
- Ability to vary assumed sample characteristics (e.g. density, container wall thickness, etc.) makes it ideal for “What if...?” analyses.
- Resulting calibrations may be stored, recalled, and used just like those generated by traditional calibration.

# Typographic Conventions

The following typographic conventions are used throughout this manual:

## Key Names

This manual shows the names of the keyboard keys as they usually appear on a keyboard and are seen in small capital letters (for example, ESC, ENTER, CTRL).

## Key Sequences

If a comma ( , ) separates the names of the keys, this means they must be pressed in sequence. For example, “Press ALT, SPACEBAR” means that you should press ALT and release it, then press and release the SPACEBAR.

## Key Combinations

A plus sign (+) between two key names means that these keys must be pressed at the same time. For example, “Press ALT+ESC” means that you should press the ALT key and hold it down while you press the ESC key.

## Windows Commands

Windows commands are shown in bold type (**Edit**).

## User Entries

Text you are expected to type in is shown in *Courier* (typewriter style) type.

## Titles

Titles of books and of manual chapters are shown in *italics*; titles of manual sections are enclosed in “quotes”.

# Keyboard Access

The Genie 2000 programs, like any 32-bit Windows programs, can be used with or without a mouse. If you aren't using a mouse with your system, the keyboard conventions listed in this section will allow you to operate Genie 2000 programs from your computer's keyboard.

## Accelerator Keys

### Right Arrow

Move the channel cursor to the right

**Left Arrow**

Move the channel cursor to the left

**Up Arrow**

Increment the display VFS

**Down Arrow**

Decrement the display VFS

**Ctrl + Ins**

Create a ROI at the cursor

**Ins**

Create a ROI between the markers

**Del**

Delete the ROI between the markers

**+**

Index markers right to the next ROI

**-**

Index marker left to the previous ROI

**PgUp**

Display the previous Info page.

**PgDn**

Display the next Info page.

**F4**

Toggle Acquire on and off

**F5**

Toggle Autoscale on and off

**F6**

Select the next Datasource

**Shift+F6**

Select the previous Datasource

**F7**

Select the next Memory Group

**Shift+F7**

Select the previous Memory Group

**F8**

Toggle Expand on and off

**Ctrl+C**

Copy the spectrum window to the clipboard

**Ctrl+L**

Move the Left Marker to the cursor channel

**Ctrl+R**

Move the Right Marker to the cursor channel

**Ctrl+M**

Move both markers into the expand region

**Ctrl+Right Arrow**

Move expand window to the right

**Ctrl+Left Arrow**

Move expand window to the left

**Ctrl+Up Arrow**

Move expand window up

**Ctrl+Down Arrow**

Move expand window down

**Alt+Right Arrow**

Increase the width of the expand window

**Alt+Left Arrow**

Decrease the width of the expand window

**Alt+Up Arrow**

Increase the height of the expand window

**Alt+Down Arrow**

Decrease the height of the expand window

**Shift+Up Arrow**

Move the compare spectrum up

**Shift+Down Arrow**

Move the compare spectrum down

## Help Keys

**F1**

Get help

**Alt+F4**

Close the help window

## System Keys

**Alt+Tab**

Switch to the next windowed program

**Ctrl+Alt+Del**

Switch to the Task List

## Window Keys

**F10**

Go to/from the action bar

**Arrow keys**

Move among choices

**Esc**

Cancel a pull-down or the system menu

**PgUp**

Scroll the contents of the window up one page



**PgDn**

Scroll the contents of the window down one page

**Underlined letter**

Move among the choices on the action bar and pull-downs

**Alt**

Go to/from the action bar

**Alt+F4**

Close the window

**Ctrl+PgDn**

Scroll the contents of the window right one page

**Ctrl+PgUp**

Scroll the contents of the window left one page

**Alt+Spacebar**

Go to the system menu

## Pop-Up Window Keys

**Enter**

Complete the pop-up window

**Esc**

Cancel the pop-up window

**Spacebar**

Set a check box on/off or perform the task described on the select pushbutton

**Tab**

Move to the next entry field or check box

## Editing Keys

**Backspace (left arrow delete)**

Delete the character to the left of the cursor

**Del**

Delete the character to the right of the cursor

**End or Ctrl+Right Arrow key**

Move to the end of a field

**Home or Ctrl+Left Arrow key**

Move to the beginning of a field

## 2. MCA Input Definition

---

The first step in using your Genie 2000 system is to create at least one MCA Input Definition (MID) so the system knows what kind of MCA is installed in or connected to your system.

This chapter demonstrates how to create the definition with both the MID Wizard and the MID Editor, using the DSA-2000 MCA as an example. Instructions for setting up your MCA will be found in its user's manual.

For most systems, you'll use the MID Wizard to help you set up your Input Definition quickly and easily. But if your Input Definition is more complex than the MID Wizard was designed to handle, you'll have to create your definition in the MID Editor, which is covered in detail starting on page 21.

For System 100 and AccuSpec MCAs, refer to the *Historical Canberra MCAs.pdf* file on your Genie 2000 CD-ROM. For AIM MCAs, refer to the Model 556A User's Manual.

Note: When you open the MID editor on a remote VDM server while it's in use, Genie 2000 will prevent certain operations with the VDM.

### The InSpector 2000 Simulator

Genie 2000 V2.1 and later includes InSpector 2000 Simulator, software designed as a tutorial for, or a demonstration of, Genie 2000, without the need for an actual MCA, a detector, and associated front-end electronics. The Simulator mimics a fully functioning InSpector 2000 and works within Genie 2000 as though it were an actual MCA, with working Adjust Controls and simulated data acquisition.

For more information on the Simulator, please refer to Appendix E, *The InSpector 2000 Simulator*.

### The MID Wizard

To use the MID Wizard, open the Genie 2000 folder and select the MID Wizard icon to start the definition process.

#### Restrictions

The Wizard does not support:

- Definition of multiplexer (MXR) inputs. This includes devices such as the Alpha Analyst.
- Configuration of remote VDMs.

For these situations, you must use the MID Editor (page 21).

## Using the Wizard

To use the MID Wizard, open the Genie 2000 folder and select the MID Wizard icon to see the Step 1 screen.

Note: The screens shown here are examples; the screens you see may vary, depending on the MCA type you specify.

### Step 1

The first screen (Figure 2) lets you select the MCA you're creating the definition for. Click on the '+' next to the "Network MCAs" board type, choose DSA-2000, then click the Next button.

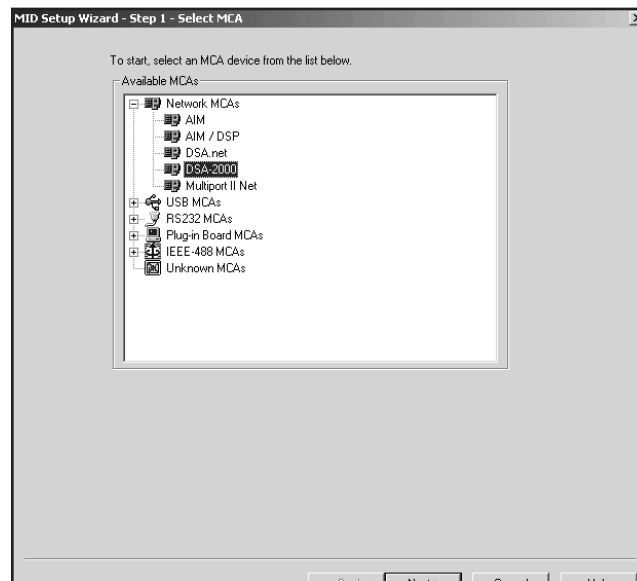
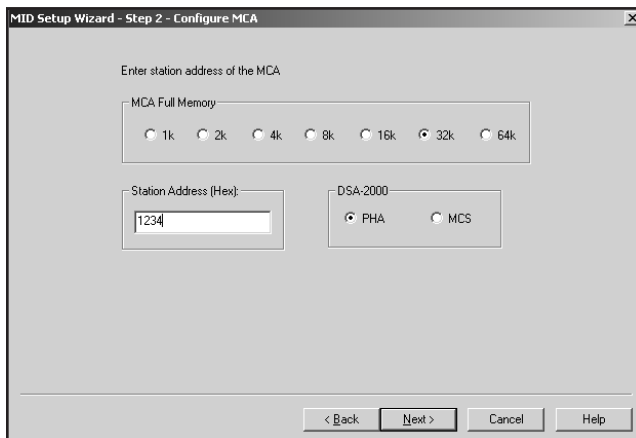


Figure 2 Step 1

## Step 2

The Step 2 screen (Figure 3) will ask you to define the MCA's Full Memory size, Station address, and the acquisition mode, PHA or MCS.



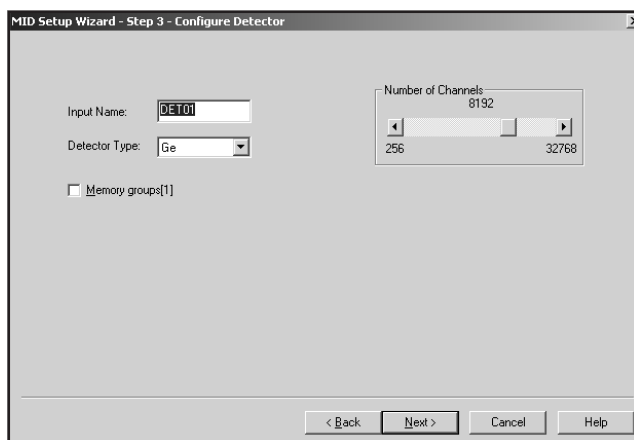
The screenshot shows a dialog box titled "MID Setup Wizard - Step 2 - Configure MCA". It contains the following fields and controls:

- Text label: "Enter station address of the MCA"
- Section: "MCA Full Memory" with radio buttons for 1k, 2k, 4k, 8k, 16k, 32k, and 64k. The 32k option is selected.
- Text input field: "Station Address (Hex):" containing the value "1234".
- Section: "DSA:2000" with radio buttons for PHA and MCS. The PHA option is selected.
- Buttons at the bottom: "< Back", "Next >", "Cancel", and "Help".

Figure 3 Step 2

## Step 3

The Step 3 screen (Figure 4) asks for an Input Name, Memory Groups, Number of Channels and Detector Type (this parameter is described in detail on page 35).



The screenshot shows a dialog box titled "MID Setup Wizard - Step 3 - Configure Detector". It contains the following fields and controls:

- Text input field: "Input Name:" containing the value "DET01".
- Text input field: "Detector Type:" with a dropdown menu showing "Ge".
- Text input field: "Number of Channels:" with a value of 8192 and a range from 256 to 32768.
- Text input field: "Memory groups[1]" with an unchecked checkbox.
- Buttons at the bottom: "< Back", "Next >", "Cancel", and "Help".

Figure 4 Step 3

## MCA Input Definition

You can change the default Input Name if you like, but if the field is empty, you won't be able to go to the next screen

With the Memory Groups box selected, the full memory can be divided into two or more memory groups. The number of groups depends on the Number of Channels setting.

### Steps 4 and 5

Steps 4 and 5 are not used in setting up the DSA-2000.

### Step 6

The Step 6 screen in Figure 5 asks you to define the high voltage power supply's Range, Voltage Limit and working Voltage.

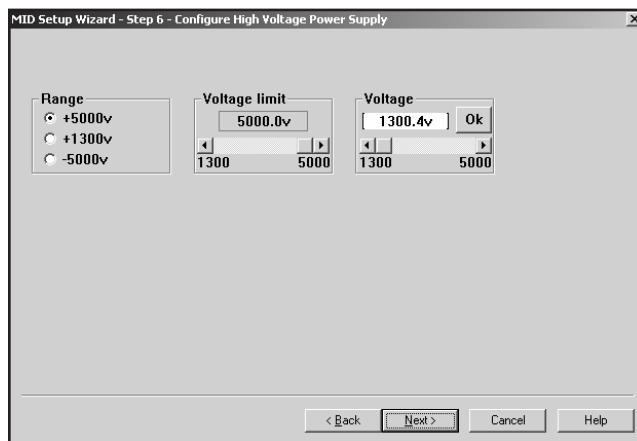


Figure 5 Step 6

### Step 7

The Step 7 screen in Figure 6 displays a summary of the current MCA's configuration for review and lets you enter the name of the MID file that the configuration is to be saved to.

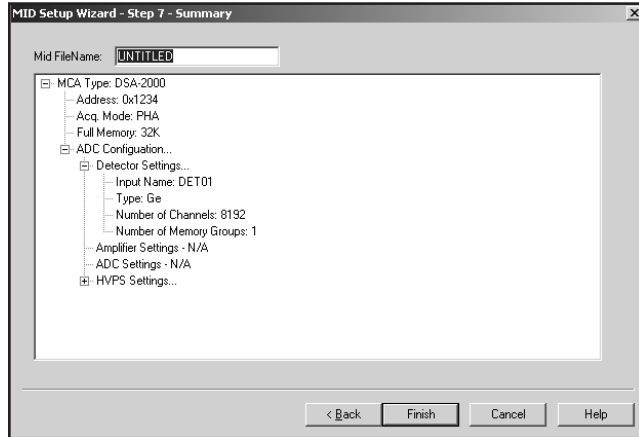


Figure 6 Step 7

### Ending the Definition

To complete your Input Definition, select **Finish**. The input you just defined will be stored as an MID file, using the name you specified in Step 7. The new MID file will automatically be loaded into the MCA Runtime Configuration Database (described on page 38).

When you select **Finish**, you will be asked if you would like to define another input. Answering No will close the Wizard.

The Step 7 Input Name defaults to UNTITLED, which you'll probably want to change to something more meaningful. If the name you enter is the same as that of an existing MID file, the system will ask if you want to overwrite the existing file.

## The MCA Input Definition Editor

In addition to using the MID Editor to create a new input definition (MID File), it's used to edit an existing MID File. For instance, you might want to:

- Change the default settings for any of your MCA's programmable components
- Replace a manual HVPS with a programmable HVPS and select its default settings.

## Basic Concepts

We'll begin with some basic concepts that are important to understand before actually getting into the details of how you define your system's MCAs.

### Multiple MCA Configurations

Since MCA definitions are saved in disk files, you can have as many definitions as you like. For example, you might have one MCA defined as an 1K Sodium Iodide Spectroscopy MCA in one file and another as a 2K Sodium Iodide Spectroscopy MCA in another file. Before you start an experiment you simply pick the configuration you want to use.

Because an MCA definition file can include any or all of the MCAs that are available to your system, you can use more than one MCA at a time. However, each MCA can be included only once in a given definition file and each MCA in that file must have a unique name.

### Using the MCA Definition Files

To use an MCA Definition, you must first have saved the definition to disk as a file. Once you've done that, all you have to do is load that file into the VDM's internal MCA Runtime Configuration Database. From that point on, all MCA operations will use the configuration information that was stored in the Definition File. To change to a new configuration, all you have to do is replace the database's contents with a new file.

## Starting the MCA Input Definition (MID) Editor

Start the MID Editor by double clicking on its icon in the Genie 2000 Program Group. The result will be the application window shown in Figure 7.

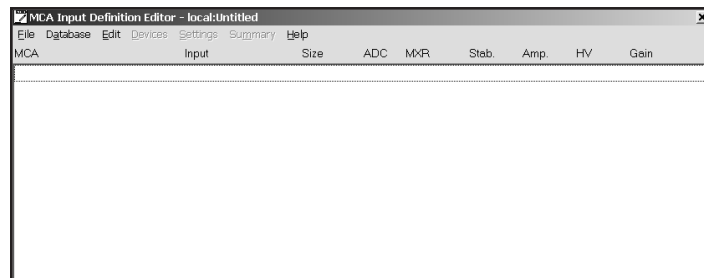


Figure 7 The MID Editor Window



Note that the phrase “local:Untitled” in the title bar, means that the MID Editor is connected to the local VDM and that no file is currently open; this is the default condition in a non-networked environment.

## Building an MCA Definition

In creating an MCA Input Definition, you’ll use the MID Editor’s:

- **Devices Menu** to select the MCA and its front-end components: amplifier, ADC, HVPS, and so forth.
- **Settings Menu** to define the operating characteristics and modes for each MCA and its front-end components.

In this section we’ll explain how to add (and delete) the MID editor’s MCA entries and will explain what the definition entry consists of. The next section, Defining an MCA on page 26, explains how to create an Input Definition for a DSA-2000 MCA.

The remainder of this chapter discusses how the definition is saved to a disk file, how a definition can be edited, and how to use a definition by loading the file into the MCA Runtime Configuration Database.

## Adding an MCA

The Edit menu, shown in Figure 8, is used to add an MCA to or delete an MCA from an MCA Input Definition.



Figure 8 The Edit Menu

To add an MCA, select the **Add MCA** command in the **Edit** menu. You'll see the "Add MCAs to Definition Table" Dialog Box (Figure 9).

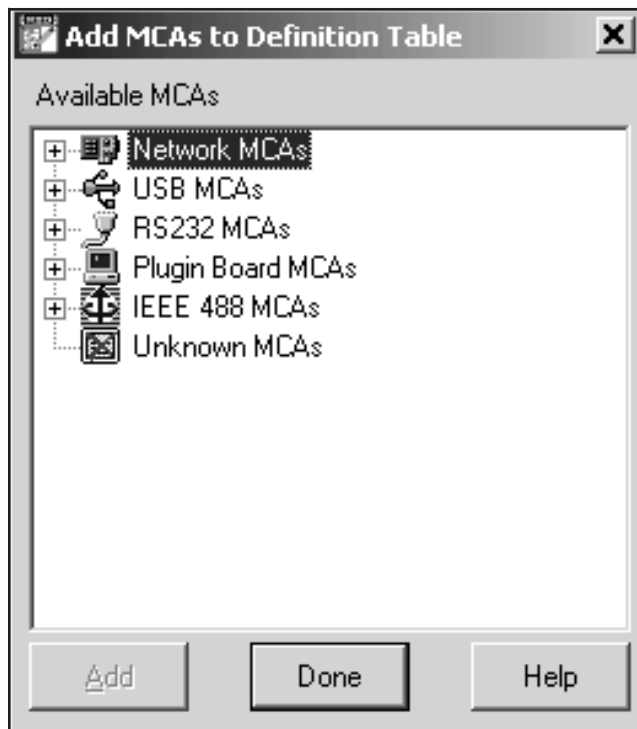


Figure 9 The Add MCA Dialog

This typical Add MCA tree view shows the MCAs grouped by MCA type. Clicking on the '+' next to a MCA type lets you choose a specific MCA.

You can add as many MCAs to the definition as are necessary for your system by highlighting one or more MCAs and clicking the **Add** button to add them to the MCA Definition Table. When you've finished adding MCAs, click on the **Done** button.

Please remember that this display, as well as many others in this chapter, are examples of what you might see; your display will probably differ.

## Interpreting the Definition Entry

As you can see in Figure 10, adding MCAs puts more than just the name of the MCA in the definition table. Note the letter following the unit number in some of the Definition Table items: **M** for a manually controlled unit, and **P** for a programmable unit.

MCA	Input	Size	ADC	MXR	Stab.	Amp.	HV	Gain
DSA-2000	DSA-2000	16384			1P		1P	1P
Series 5002	DET42	2048	1P			1P	1M	
AIM	DET23	8192	1M			1M	1P	

Figure 10 An MCA Has Been Added to the Table

### MCA

This is the type of MCA device being used for this particular entry in the table.

### Input

This is the name that will be used to refer to this specific hardware entry in the table. The MID Editor automatically assigns these names sequentially as **DET $nn$** , starting with  $nn=01$ . You can easily edit this assignment to an input name of your choice.

### Size

This shows the number of data channels assigned to this input.

### Gain

This column describes the DSP Gain device associated with the DSA-2000.

### Other Entries

All of the other entries, ADC, MXR, Stab, Amp and HV, tell you whether that kind of component is assigned to the MCA and if it's Manual or Programmable.

## Deleting an MCA

If you want to remove an MCA that you have added to the definition, you can do it easily by:

## MCA Input Definition

1. Selecting the table entry you want to delete.
2. Clicking on the **Delete MCA** command in the **Edit** menu to see the Dialog Box in Figure 11. Click on **OK** to remove the entry.

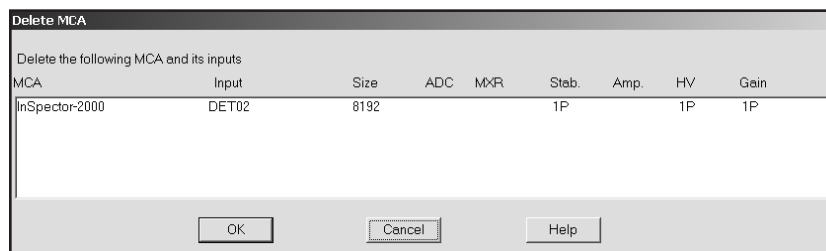


Figure 11 The Delete MCA Dialog

## Defining an MCA

This section discusses setting up a DSA-2000 MCA, which has a fully programmable front end. That is, its DSP Gain, DSP Filter, Digital Stabilizer, MCS and High Voltage Power Supply are all controlled from the host computer rather than manually with front panel knobs and switches. To begin, click on the MCA entry in the Definition Table that you want to set up.

## Devices

The **Devices** menu, shown in Figure 12, sets the parameters for the MCA and associated devices. Some Devices are disabled (grayed out) because they aren't used with your MCA.



Figure 12 The Devices Menu

**MCA**

Selecting the **MCA** command in the **Devices** menu pops up the Dialog Box shown in Figure 13, which lets you set the Ethernet address for the DSA-2000 and select the type of input.

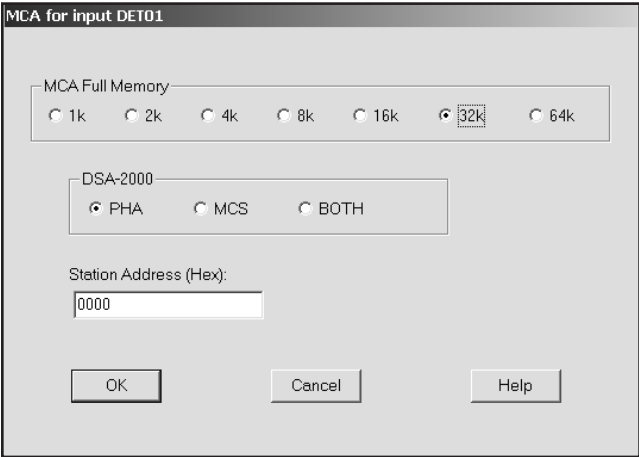


Figure 13 The MCA Device Setup Dialog

- **MCA Full Memory** selects the DSA-2000's full memory size.
- **Station Address** specifies the network address for communicating with the module.
- **DSA-2000** selects the DSA-2000's input type.

## Sample Changer

The Sample Changer screen in Figure 14 lets you disable the sample changer interface, (None), Gamma Analyst, or enable the Internal Changer interface.

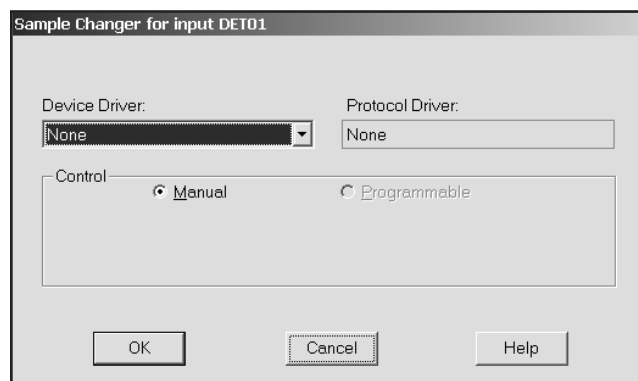


Figure 14 The Sample Changer Controls

## Stabilizer, High Voltage, DSP Gain and DSP Filter

If any of these are available for your MCA, you'll select either manual device or programmable device here. For the DSA-2000, these components are already selected, so these screens are used for general information.

## The Settings

The following section describes those parameters for the DSA-2000 that can be accessed from the MID Editor via the Settings menu (Figure 15).



Figure 15 The Settings Menu

### MCA Settings

For the DSA-2000, “This device has no adjustable controls”, so there’s nothing to do here.

### Stabilizer Settings

The Stabilizer maintains the stability of high resolution spectroscopy in applications involving long count times or high count rates.

Selecting the **Stabilizer** command displays the Dialog Box shown in Figure 16.

**Note** This window’s initial focus is on the **Cancel** button; pressing the keyboard’s ENTER key after making changes in this dialog box will cancel the changes. Be sure to click on the **OK** button to accept the changes.

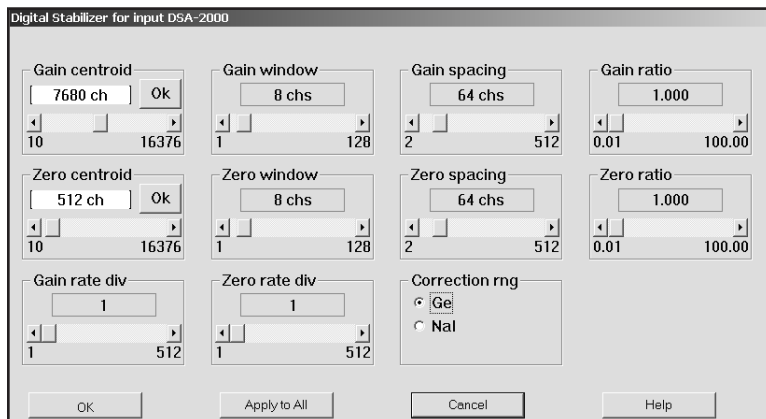


Figure 16 The Stabilizer Setting

Select the:

- **Gain Centroid** (in channels) of the reference peak at the high end of the spectrum for gain stabilization,
- **Gain Window** width (in channels) of the upper and lower sampling windows on either side of the gain reference peak,
- **Gain Spacing** (in channels) between the upper and lower sampling windows,
- **Gain Ratio** value (the ratio to maintain between the two gain windows),
- **Zero Centroid** (in channels) of the reference peak at the low end of the spectrum,
- **Zero Window** (in channels) of the upper and lower sampling windows on either side of the zero reference peak.
- **Zero Spacing** (in channels) between the upper and lower sampling windows,
- **Zero Ratio**, the ratio to maintain between the two zero windows,
- **Gain Rate Divisor**, the count rate dividers at the input to the Gain correction register,
- **Zero Rate Divisor**, the count rate dividers at the input to the Zero intercept correction register,



- **Correction Range**, the Gain Correction range to correct for drift.

## High Voltage Settings

The **High Voltage** command, shown in Figure 17, adjusts the High Voltage Power Supply (HVPS).

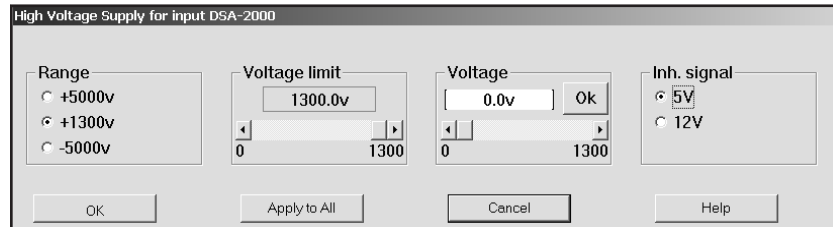


Figure 17 The High Voltage Settings

Note: This window's initial focus is on the **Cancel** button; pressing the keyboard's ENTER key after making changes in this dialog box will cancel the changes. Be sure to click on the **OK** button to accept the changes.

Select the:

- **Range** must be set *before* the Voltage Limit or Voltage Control is adjusted. It sets the HV Power Supply's absolute voltage limit.
- **Voltage limit** establishes the HVPS's maximum output voltage within the selected range.
- **Voltage** sets the output of the HVPS between the Voltage Limit's minimum and maximum settings.
- **Inh. Signal** sets the pull-up voltage of the HV INH connector.

## DSP Gain Settings

The DSP Gain settings screen (Figure 18) has three Gain controls. The combination of Coarse and Fine Gain sets the overall system gain to match the requirements of the detector and energy application; overall gain is continuously variable from x2.0 to x1536. The Fine Gain factor is dependent on the Super-Fine Gain (SFG) value. With the SFG set to  $0.0000e^{-2}$ , the Fine Gain covers a range of x0.4 to x1.6. The SFG value adds to the Fine Gain factor and covers a range of  $0.0000e^{-2}$  to  $3.0000e^{-2}$ .

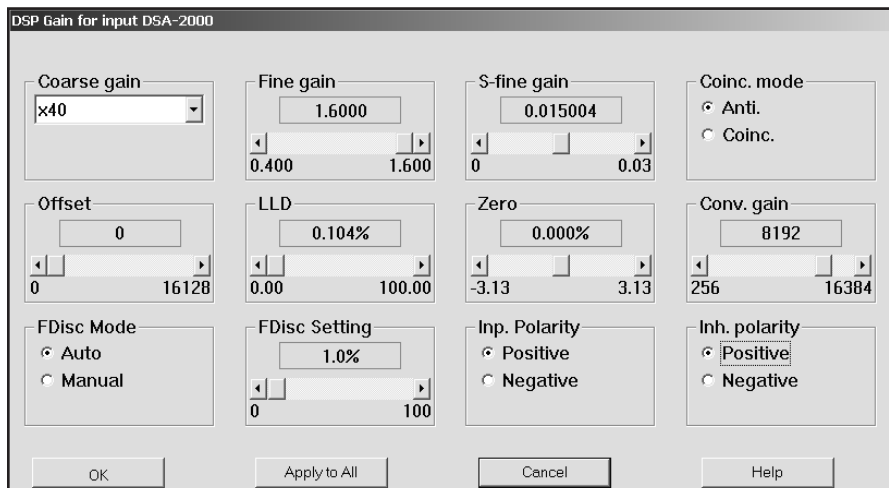


Figure 18 The DSP Gain Settings

Select the:

- **Coinc Mode** sets the devices gating mode (COINCidence or ANTIcoincidence).
- **Offset** sets the devices digital offset in channels.
- **LLD** sets the devices Lower Level Discriminator (LLD) as a percentage of the ADC's full scale.
- **Zero** sets the device's zero intercept as a percentage of the device's full scale.
- **Conv. Gain** sets the device's conversion gain.
- **FDisc Mode** sets the device's Fast Discriminator threshold mode. AUTO allows the threshold to be optimized automatically above the system noise level; MANUAL allows the threshold to be manually adjusted.
- **FDisc Setting** sets the device's Fast Discriminator threshold level.
- **Inp. Polarity** sets the device's Input signal polarity.
- **Inh. Polarity** sets the device's Inhibit signal polarity to either Positive or Negative.

## DSP Filter Settings

The DSP Filter settings screen (Figure 19) for the DSA-2000 contains the following controls.

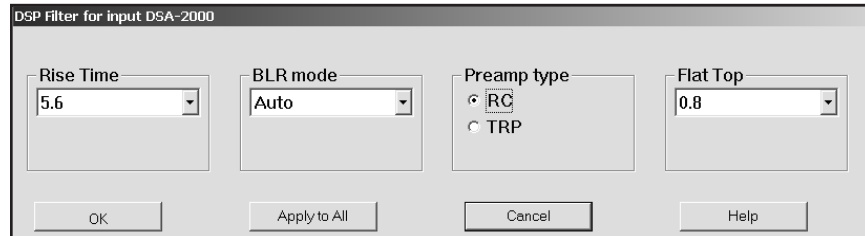


Figure 19 The DSP Filter Settings

Select the:

- **Rise Time** sets the rise time and fall time of the digital filter time response.
- **BLR Mode** sets the baseline restorer mode.
- **Preamp Type** selects the Preamplifier type as either TRP or RC.
- **Flat Top** sets the flat top portion of the digital filter time response.

## MCS Settings

If you chose either MCS or Both in the **Devices | MCA** menu (page 27), you'll select the MCS Disc Mode in Figure 20.

**Note:** This window's initial focus is on the **Cancel** button; pressing the keyboard's ENTER key after making changes in this dialog box will cancel the changes. Be sure to click on **OK** to accept the changes.

- **Disc Mode** establishes the MCS mode to be used.

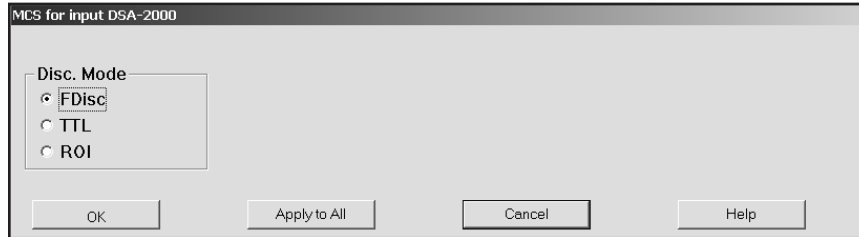


Figure 20 Choosing the MCS Disc Mode

## Input Settings

The **Input** command is used to change the name of the Input and set up the structure of its memory via the Dialog Box shown in Figure 21. These commands are not available in the Acquisition and Analysis application.

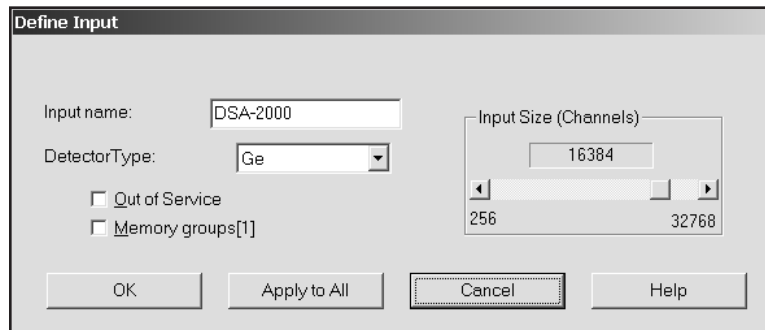


Figure 21 The Define Input Dialog

Note: This window's initial focus is on the **Cancel** button; pressing the keyboard's ENTER key after making changes in this dialog box will cancel the changes. Be sure to click on the **OK** button to accept the changes.

- **Input Name** lets you change the default detector name.

- **Detector Type** configures the default display and analysis parameters for the most commonly used detectors. If your detector type is not displayed, select the type that most closely matches your detector configuration. Analysis and display parameters can then be tailored to meet your specific configuration requirements.
- **Input Size** changes the number of channels assigned in the **Devices | MCA** menu.
- **Out of Service** lets you make this Input temporarily unavailable.
- **Memory Groups** allows you to define a multi-memory group input.

## Saving the Input Definition

After completing the definition, use the Editor's File | Save command to save the definition so that it can be loaded into the MCA Runtime Configuration Database for use. See "Loading and Unloading Definitions" on page 38.

To remind you to save a changed definition, you'll see an asterisk (\*) next to the name of the current definition in the Title Bar.



**CAUTION** If you change an existing Input Definition, saving it will clear the Acquisition Start time. You will be asked to retain the existing energy calibration information.

### The File Descriptor

When a Definition is saved for the first time, the Save As dialog (Figure 22) includes a File Descriptor field which lets you add a 32-character description to your file, making it easier to locate when you want to use it again.

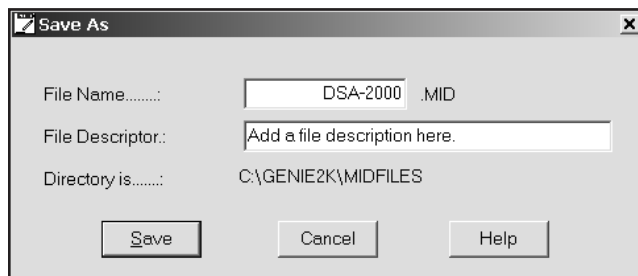


Figure 22 The Save As Dialog

## Changing the Summary View

Before going on to see how to edit an existing Input Definition Table, one that you've built previously and saved to disk, there's one more menu to look at. This is the Summary menu, which is shown in Figure 23.

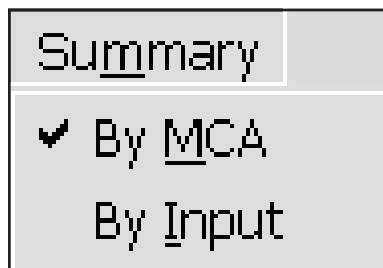


Figure 23 The Summary Menu

The **Summary** menu has two commands: **By MCA** and **By Input**, which change the order in which the information in the Input Definition Table is displayed. By MCA means that the first column of the table will display the MCA type that is being used for each entry. If you choose By Input, the MCA and Input columns will be reversed in the display and the Inputs will be sorted alphabetically.

You can choose either method, but in the case of systems with a large number of inputs, "By Input" is an easier display to understand than "By MCA".

## Editing an MCA Definition

To edit an MCA Definition, use the MID Editor's **File | Open** command to select the file and open it in the editor.

### Editing a File in the MCA Runtime Configuration Database

If the Definition you want to edit has been loaded into the MCA Runtime Configuration Database, it must first be unloaded before it can be opened in the editor. See "Unloading the Definition" on page 40 for instructions.

## Viewing the File Details

If you're not sure which file you want to edit, select a file, then click on the **Info** button to see further information about the file, as shown in Figure 24.

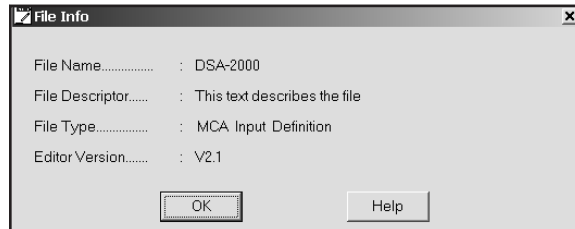


Figure 24 The File Info Display

The key piece of information here is the File Descriptor, which you added when the file was first saved. This should help you decide if the file you selected is the one you want to edit.

## Editing the Definition

All of the menus and commands available for defining an MCA are also used for editing a definition. Just select the entry you want to change and apply the commands as before, then **Save** the Definition file.

## The New Command

If you want to create a totally new MCA Definition, the **File** menu's **New** command clears the definition table so you can begin a new definition.

Because New is a destructive operation, selecting it will cause the program to ask for a confirmation in one of two ways:

- If the Definition currently being displayed has not been changed since it was last saved (no asterisk in the Title Bar), you will be asked if you want to erase the current Definition. Click on **OK** to erase it, or **Cancel** to return to the Input Definition Editor.
- If the Definition currently being displayed has been changed but not saved, you will be given a chance to save it.

## The Input Definition Report

The **File** menu's **Report** command always saves to a disk file, but if you click on **Yes** in the dialog box that pops up, you can send the report to a disk file *and* print the report as well. Click on **No** to save it to a disk file without printing the report.

## Using MCA Definition Tables

The whole purpose behind building MCA Input Definitions is to let Genie 2000 know the number and types of MCAs you'll be using with your system. You do this by loading one or more MCA Definition Files into the MCA Runtime Configuration Database.

This database is shared by all of the programs that make up the Genie 2000 software package, and is used by those programs to gain access to the actual MCA hardware in your system. In this section we'll take a look at the procedures used for setting up that database.

## Viewing the Current Database

To view the current contents of the database, click on the **Database** menu's **View** command, which will pop up the display shown in Figure 25. If you click on a line in the list, you can use the Device and Settings menus to look at details of that definition. Click on **OK** to close the View window.

MCA	Input	Size	ADC	MxR	Stob	Amp.	HV	Gain
DSA-2000	DSA-2000	16384			1P		1P	1P
InSpector-2000	I2KUSB	4096			1P		1P	1P

Figure 25 Viewing the Database

## Loading and Unloading Definitions

The Load/Unload functions will be disabled while any Acquisition and Analysis applications are running and have open datasources. This prevents one user from altering the runtime database while another user is accessing it.



Before you can use a Definition, whether created with the MID Wizard or with the MID Editor, it must be loaded into the MCA Runtime Configuration Database (described on page 38)

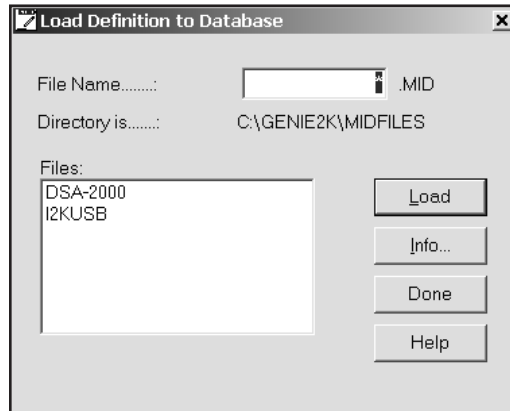


Figure 26 The Load To Dialog

### Wizard Definitions

An MCA Definition created with the MID Wizard will automatically be loaded into the MCA Runtime Configuration Database when you finish the definition. You don't need to do anything more.

### Editor Definitions

If you created or edited the MCA Definition with the MID Editor, you'll have to manually load the saved file into the database yourself. The next section tells you how.

## Loading the Definition

Use the **Load to** command (Figure 26) to choose the Definition to be added to the database.

### Loading Multiple Definitions

Though you will usually use only one definition at a time, there may be times when you want to load more than one definition. To do this, be sure that the Input name in each of the Definition Files is unique.

If you try to load an Input Definition which contains a duplicate Input name, you'll see an error message telling you that the requested Definition can't be loaded.

## Unloading the Definition

Though some of the programmable front end controls, such as ADC Gain or Amplifier Gain, are initially set with the MCA Input Definition Editor, many may also be adjusted in the Acquisition and Analysis application while you're collecting data. These adjustments can be stored in the database (with File | Save), and when you Unload the database, are saved in an Input Definition File for future sessions.

### The Unload Process

To unload a Database, click on the **Database** menu's **Unload from** command, which will bring up the Dialog Box shown in Figure 27. If several choices are listed, there are multiple definitions in the database.

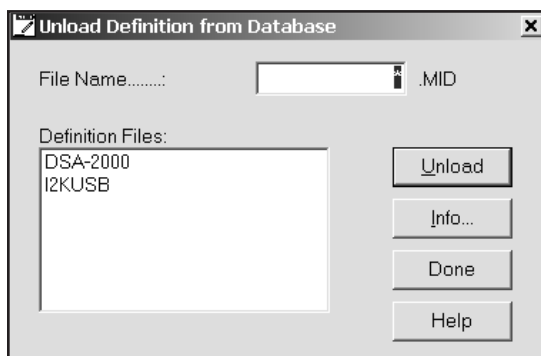


Figure 27 The Unload Dialog

Click on the one you want to unload, then click on the **Unload from** button. Note that this menu item is disabled if the MCA Runtime Configuration Database is currently being used by another application.

## 3. Gamma Acquisition and Analysis

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This operations reference for both the basic Model S500/502/504 Basic Spectroscopy Software and the Model S501 Gamma Analysis Option, lists all of their commands and functions by menu and submenu.

For a description of the application's user interface, please refer to *The Genie 2000 Tutorials Manual*.

### File Menu

The **File** menu lets you open, close or save a datasource, save it under another name (save as), print or copy a plot of the current spectrum, print the contents of the Report Window, open, save or delete workspace files, and exit the program.

### Open Datasource

The **Open Datasource** command displays a dialog (Figure 28) that allows you to open a datasource.

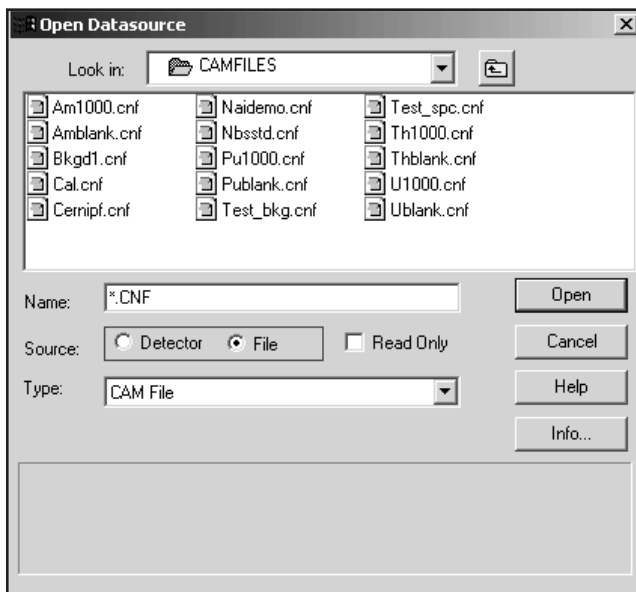


Figure 28 The Open Datasource Dialog

### Datasource

When the **Detector** button is selected, the “Node is” dropdown will list all the available local and remote VDMs. The list box will show all of the currently selected nodes’ defined input names. If the datasource is a multiple memory group detector, you can display any of the groups by typing its name into the edit box. For example: MULTIPLE(3:4).

When the **File** button is selected, the “Look in” dropdown will list all the available drives. The list box will show all of the files and directories in the current directory. The file name can be typed into the **Name** edit box or it can be selected from the list box.

### Type

When the **File** button is selected, the “Type” dropdown will list the file format types you can open.

- When opened, a file with a format other than other than a CAM will automatically be converted to a CAM file of the same name, with a .CNF file extension.

Note: For the file conversion routine to work properly, the correct file type must be selected before opening the file.

- If any critical parameters are not available in the selected file, appropriate default values will be provided during conversion.
- The converted file will be stored in the same directory as the original file.
- Old files of the same name as the intended output file name will have their extension changed to \*.b?? where the question marks will be replaced with an integer.
- The original file will be retained in its native format.
- The converted file will be opened by the application.

The supported file types are:

CAM	Oxford	AccuSpec	InterWinner (v 4.1 Unpacked)
S100 File	Ortec-GammaVision	Silena	Aptec PCMCA (v 6.31-7.02)
EasySpec	Intertechnique	Nucleus	
Ortec-ADCAM	Sampo 90	PC-Toolkit	
Gamma-AT	IEC 1455	Spectran-AT	

### The Info Button

Click the **Info** button (Figure 28) to display information about the currently selected CAM File datasource.

### Close

Selecting **Close** lets you close the current datasource. If the open datasource has been changed but not saved, you will be asked if you want to save it.

### Save

**Save** allows you to save the datasource, with all related information, to its original location.

### Save as

**Save as** displays a dialog box (Figure 29) that prompts you for a file name to save the current datasource to.

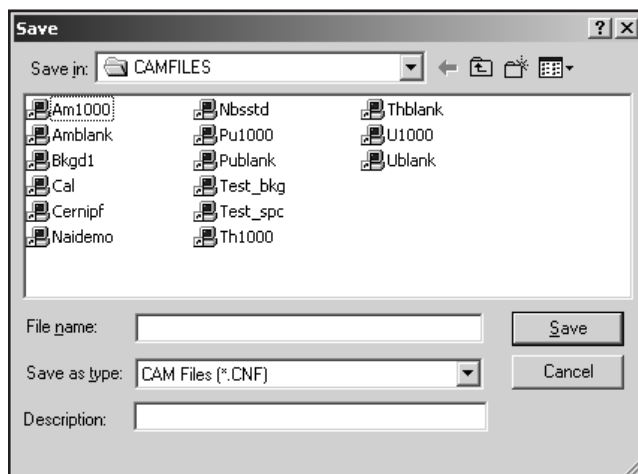


Figure 29 The Save As Dialog

The file types supported by this operation are:

- CAM files (.CNF)
- Toolkit files (.TKA)
- IEC1455 files (.IEC)

The **Description** text field lets you add a file description of up to 32 characters to be saved with the file. This information, which you'll see in the File Descriptor field in the Open Datasource dialog box (Figure 28), makes it easier to identify this specific data file.

## Data Plot

The **Data Plot** command sends a plot of the data in the spectral display to the printer device.

### Customizing Your Plot

You can choose one of four plot styles, any of three customization check boxes and either a range of channels or the full spectrum (Figure 30). Selecting any checkbox will preview that selection on the four sample plots.

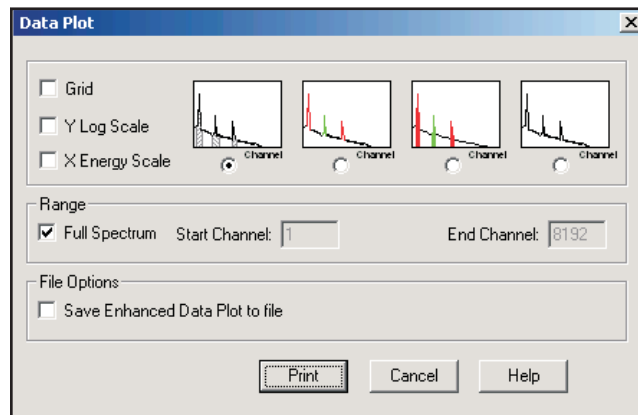


Figure 30 The Data Plot Dialog

### Plot Styles

Although any style will work well with any printer, Styles 2 and 3 are intended for color printers and Styles 1 and 4 are intended for black and white printers.

1. Solid black spectrum line; ROIs filled with hatching.
2. Solid black spectrum line; ROIs outlined in color.
3. Solid black spectrum line; ROIs filled with colors.
4. Solid black spectrum line.

### Grid

Check the **Grid** box to add X and Y grid lines to the plot. The grid is printed as shown, with dotted lines.

### Y Log Scale

Check the **Y Log Scale** box to change the Y-axis scale from linear to log. The maximum number of counts is determined automatically.

### X Energy Scale

Check the **X Energy Scale** box to change the X-axis scale from channels to energy.

### Range

The entire spectrum will be plotted if the **Full Spectrum** box is checked. If the box is not checked, a range of channels can be plotted. If an illegal value is entered into either of the channel boxes, the word "Error" will replace the illegal value in the box.

### Save Enhanced Data Plot to File

Check the Save Enhanced Data Plot to File box to save the current spectrum as a JPG graphics file to the Genie2K\RepFiles directory. The file will be named for the current datasource as `EDP_DatasourceName.jpg`. This file is in addition to the report printed to device selected in the Print dialog.

### Print

When all parameters have been chosen, click **Print** to bring up the printer selection dialog.

### Plot to Clipboard

The **Plot to Clipboard** command copies the current spectral display (including expand window, cursors, markers) to the Windows clipboard as a bitmap. This image may then be pasted into other applications such as word processors or paint programs. This command can also be executed with CTRL+C.

### Print Report Window

Selecting **Print Report Window** will print the contents of the Report Window (page 210) to the Windows default printer.

### Export Report to PDF

The **Export Report to PDF** command creates a PDF file of the contents of the Report Window (page 210). The standard Save As dialog lets you choose the folder to store the file in.

## Export Data Plot to PDF

The **Export Data Plot to PDF** command uses the JPG file generated with the “Save Enhanced Data Plot to File” command (page 45) to create a PDF named `EDP_DataSourceName.pdf`. The PDF is stored in the `Genie2K\RepFiles` directory.

## Open Workspace

The Workspace function lets you save and restore the current Gamma Acquisition and Analysis (GAA) settings to a “Workspace” file. A workspace file contains the specific datasources (detectors and/or spectrum files) that will be loaded, which datasource will be the currently displayed datasource, and other display settings.

Select **Open Workspace** (Figure 31) to open a workspace file, which will set up the Gamma Acquisition and Analysis (GAA) window. See “Workspace Files” on page 318 for a detailed description of a workspace file.

Or, in Windows Explorer, you can navigate to `C:\Genie2k\CAMfiles` and click on a Gamma Workspace (GWS) file to automatically start the GAA application and load the selected workspace file.

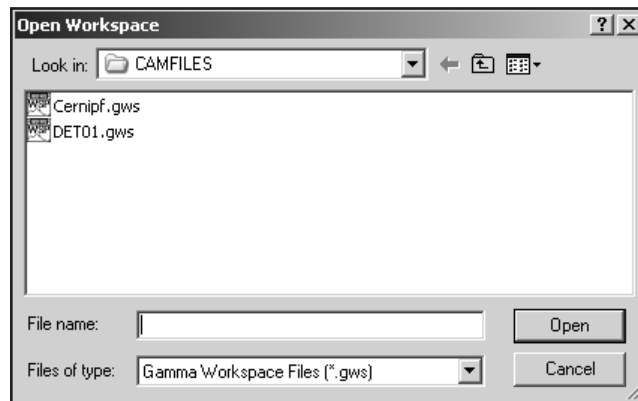


Figure 31 The Open Workspace Dialog

## Save Workspace

Select **Save Workspace** to save the current workspace file. If the workspace file already exists, you will be asked to confirm that you want to overwrite it.



## Delete Workspace

Select **Delete Workspace** to delete the selected workspace file. You will be asked for confirmation before the file is deleted.

## Exit

Select **Exit** to close Genie 2000. If you have an open but unsaved datasource, you will be asked if you want to save it.

## MCA Menu

The **MCA** menu, which is available only when the currently selected datasource is a Detector Input, contains the set of operations to be performed on the MCA and electronic front-end hardware.

### Acquire Start

Select **Acquire start** or press the F4 key to initiate data acquisition on the current datasource. This command is disabled for datasources that are already acquiring data.

### Acquire Stop

Select **Acquire stop** or press the F4 key to issue an unconditional Stop command to a currently collecting datasource.

## Acquire Setup

Selecting **Acquire setup** displays a dialog box (Figure 32) which allows you to define default acquisition parameters to be used when starting data collection on hardware datasources.

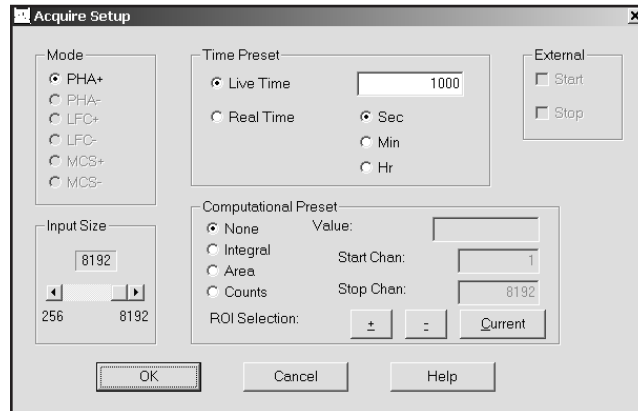


Figure 32 PHA Acquire Setup

### Mode

The available acquisition modes depend on the MCA being used and the time and computational preset options depend on the current acquisition mode.

- The PHA and LFC modes support time and computational presets, Input Size and External Start/Stop.
- The MCS mode supports MCS Preset, Input Size and External Start/Stop.

### Input Size

Input Size is available only when the MCA is defined as PHA or MCS mode.

The **Input Size** control lets you alter the displayed size of the input of the current detector input, and what is saved to a disk file. It does not change the input size in the detector input definition.

### External Start/Stop

External Start/Stop is available when the MCA is defined as PHA mode or as MCS mode.

These controls are enabled when using a hardware datasource which supports using an external trigger to start acquisition. For example, if external start is enabled and OK is selected, acquisition will not start until the external trigger is received.

## MCS Preset

The MCS Preset is available only when the MCA is defined as MCS mode.

**Sweep count** selects the number of sweeps to be performed during MCS data acquisition. Dwell time is set in MCS Adjust (refer to “MCS” on page 58).

## Time Preset

Time Preset is available only when the MCA is defined as PHA or LFC mode.

**Live Time** can be preset for the current hardware datasource in the specified number of **Seconds**, **Minutes** or **Hr** (hours). Live time is mutually exclusive with real time, but can be combined with any one computational preset.

**Real Time** can be preset for the current hardware datasource in the specified number of **Seconds**, **Minutes** or **Hr** (hours). Real time is mutually exclusive with live time, but can be combined with any one computational preset.

## Computational Presets

The Computational Presets are available only when the MCA is defined as PHA mode or LFC mode.

These presets stop acquisition when a computed value you specify is reached. When a computational preset is defined, the chosen time preset is still active. The acquire stop command is issued by the preset that is reached first. If you want to use a computational preset alone, set the time preset to a very large value, such as 9000 hours. This insures that the computational preset will be reached first.

Computational Presets are mutually exclusive with each other, but any one can be combined with either a live time or real time preset.

### None

Selecting None disables all computational presets. Only the time preset will be used.

### Integral, Area and Counts

Each of the three computational presets: **Integral**, **Area** and **Counts**, applies to a specified ROI.

To use any computational preset, you must specify its **Value**, the ROI's **Start Channel** and its **Stop Channel**. The Start and Stop Channel values will default to the current computational preset if there is one, otherwise the Start value will be 1 and the Stop value will be the spectrum's highest channel number.

### ROI Selection

You can enter the Start and Stop limits manually or by using the **Current** button in ROI Selection or the **+** and **-** buttons to move to the next ROI. These functions automatically replace the limits with the current ROI's start and stop channels.

### Clear

There are two options for clearing the spectral display:

- Select **Data** to remove all spectral data, including the time information in channels one and two, from the display.
- Select **Data & ROIs** to remove data, time, and all ROIs from the display.

### Adjust

**Adjust** allows you to adjust the controls of the current hardware datasource's programmable front-end electronics. This section shows typical adjust screens, but only those which are applicable to the current datasource will be available to you and the controls they show will not necessarily be those shown in the illustrations.

As adjustments are made in the dialog box, the new values are sent to the hardware. To save the adjustments to the datasource's CAM file, use the **File | Save** command so that the next time this datasource is selected, the proper setting will be loaded into the MCA.

The **Next** and **Prev(ious)** buttons at the left side of the dialog box are used to move to the next (or previous) "page" of the controls when there are more control elements than will fit in the basic box.

## ADC

Click on the **ADC** button to see the dialog box in Figure 33, which shows a typical ADC adjust screen. The controls you see on your adjust screen may vary, depending on which ADC you assigned to this datasource.

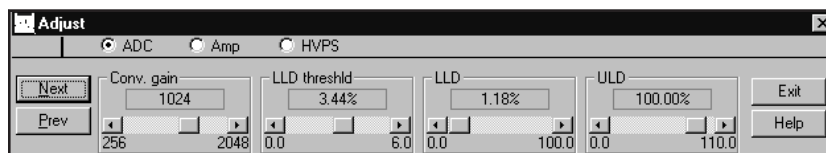


Figure 33 Typical ADC Adjust Dialog

### Conv. Gain

Clicking either on the arrows at the ends of the Scroll Bar or in the area to either side of the Scroll Bar's "Slider" will change the gain by a factor of two over the control's range of 256 channels to the maximum number of channels supported by the MCA.

### LLD Threshold

The window between the ULD setting and the sum of the LLD and LLD Threshold settings limits the energy range considered by the ADC.

### LLD

The ADC's Lower Level Discriminator (LLD) can be set as a percentage of the ADC's full scale input.

### ULD

The ADC's Upper Level Discriminator (ULD) can be set as a percentage of the ADC's full scale input.

The window between the LLD and ULD settings is used as a "filter" to limit the energy range to be considered by the ADC. Only signals within this window will be converted.

### Zero

The ADC's Zero is factory set for each conversion gain, so that a Zero setting of 0% corresponds to zero intercept (zero energy input stores in channel 3, the first channel used for spectral data storage) for that conversion gain. The Zero control can be used to change the zero intercept to another channel.

## Offset

The ADC's Digital Offset shifts the memory assignment of the ADC's conversions. With no (zero) offset, the ADC's channel numbers are the same as the memory assignment's channel numbers. For example, if the Gain is programmed to 8192 and the memory assignment is only 4096, an Offset of zero will allow only the lower half of the full-scale conversions to be stored. But if the Offset were set to 4096, channel 4096 of the ADC would be shifted down to correspond to channel zero of the memory. This offset would allow the upper half of the full-scale conversions to be stored in the assigned MCA memory.

## Stabilizer

Click on the **Stab.** button to see the Stabilizer Gain dialog box in Figure 34, which shows a typical stabilizer adjust screen. The controls you see on your adjust screen may vary, depending on which stabilizer you assigned to this datasource.

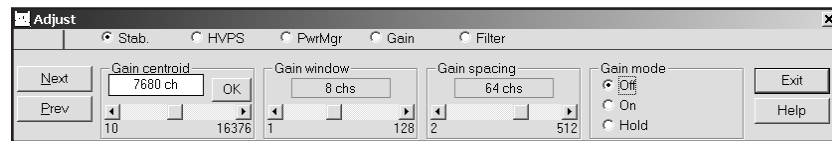


Figure 34 Typical Stabilizer Adjust Dialog

Figure 35 shows the relationship between several of the Stabilizer's functions.

After setting the Stabilizer's controls, perform a **File | Save** so that the next time this datasource is selected, the proper setting will be loaded into the MCA.

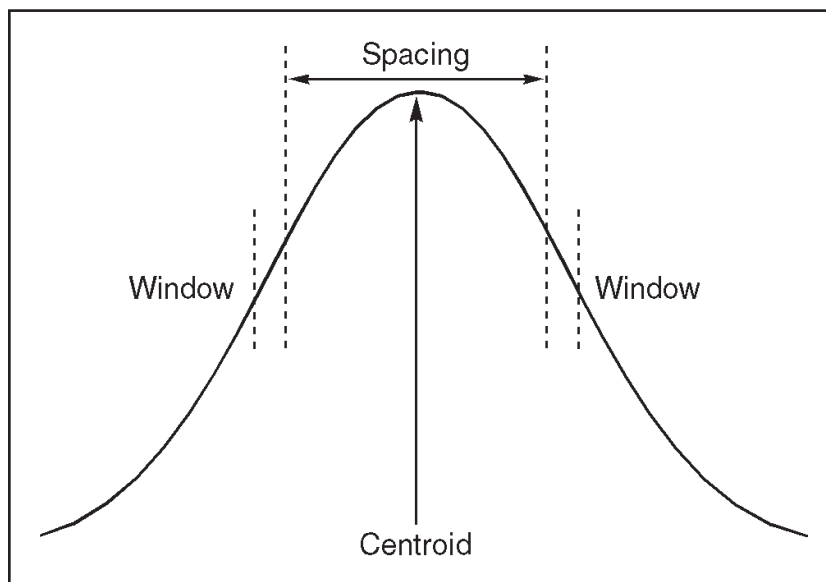


Figure 35 Relationship Between Stabilizer Functions

### Gain Centroid

This control sets the reference channel at the high end of the spectrum for gain stabilization, since gain drift is more pronounced in the upper channels. The centroid's channel number can also be typed in from the keyboard, then accepted with the Ok button within the control. To allow the stabilizer to correct for gain drift, the count rate in the gain reference peak must be significantly higher than the count rate in the background.

### Zero Centroid

This control sets the reference channel at the low end of the spectrum for zero intercept stabilization, which prevents interference from the effects of gain drift. The centroid's channel number can also be typed in from the keyboard, then accepted with the Ok button within the control. To allow the stabilizer to correct for zero drift, the count rate in the zero reference peak must be significantly higher than the count rate in the background.

### Gain and Zero Window Controls

These controls set the width (in channels) of the upper and lower sampling windows for each Mode. The operation of the stabilizer depends on measuring the count rate in these two windows, detecting a difference, then providing a correction to equalize count rates.

### Gain and Zero Spacing Controls

These two controls set the spacing (in channels) between the upper and lower sampling windows for each Mode. The windows should be placed so that a shift in the reference peak reflects a significant change in count rate through the windows. For broad peaks, the spacing should be set so that the windows edges are not on the flat part of the peak.

### Gain and Zero Mode Controls

The Stabilizer's Gain and Zero, or both, can be set to Off, On or Hold.

If the drift in either mode (zero or gain) exceeds the Correction Range, the overrange flag will be set and that mode will be changed to *hold*. Set that mode to *off* to clear the overrange flag, then correct the cause of the excessive drift before returning the mode to *on*.

**On** enables stabilization for the specified mode, allowing the Stabilizer to compare the incoming data to the Mode's Centroid and Window settings, then compensate for data below (or above) the Centroid.

**Off** disables stabilization for the specified mode and sets the correction adjustment to zero and clears the overrange flag if it was set.

**Hold** disables stabilization for the specified mode, but maintains the current correction adjustment at the Stabilizer's output.

## Amplifier

Click on the **Amp** button to see the dialog box in Figure 36, which shows a typical adjust screen for a programmable amplifier. The controls you see on your adjust screen may vary, depending on which amplifier you assigned to this datasource. Click on the **Next** button to see the PUR and Pole/Zero controls.

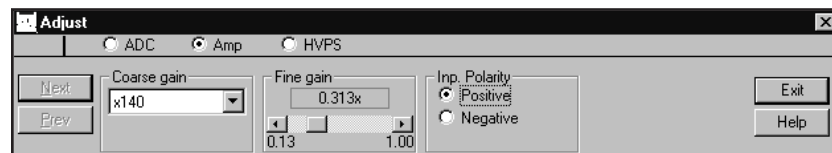


Figure 36 Typical Amplifier Adjust Dialog



### Coarse Gain

The Amplifier's Coarse gain setting is selected from the drop down list. For most configurations, it's best to choose the highest Coarse Gain which, combined with the Fine and S-Fine Gains, will produce the total desired gain.

### Fine Gain and S-fine Gain

The Fine Gain and Super Fine Gain controls are set with their Scroll Bars.

### Shaping Mode

This control sets the amplifier's shaping time constant for use with different detectors.

### PUR

This control, turns the amplifier's Pileup Rejector (PUR) **On** or **Off**. When PUR is *on*, a Live Time correction is performed for pulses that are piled up. A procedure for adjusting the Pileup Rejector for optimum performance is described in "Adjusting the PUR/LTC" on page 323.

### BLR Mode

The BLR (baseline restorer) control's Asymmetrical mode normally offers superior high count rate performance for high resolution Ge spectroscopy. The Symmetrical mode is used on Ge systems with high noise levels, scintillation and proportional detectors, and Si systems.

The Symmetrical mode should always be used for detector systems which exhibit baseline discontinuities resulting from excessive noise and/or high voltage effects, preamp reset pulses and preamp secondary time constants. Secondary preamp fall time constants result in unipolar output undershoots making it difficult to optimize the amplifier preamp matching.

### Pole/Zero

The amplifier's pole/zero, which must be changed whenever the Amplifier's Shaping is changed or a different detector is used, can be adjusted automatically or manually.

**Auto P/Z:** Click on **Start** to start the amplifier's automatic pole/zero optimization process, which is required before acquiring spectra with RC-type preamps.

For auto pole/zero to function properly, the incoming counts should be between 25% and 100% of full scale. For a 0-2 MeV setup, this generally means that at 500 keV or higher, the incoming count rate in this window should be greater than 100 cps. The maximum count rate over the full ADC range should be < 2 kcps. If the pole/zero fails to converge, check for the proper count rate.

The pole/zero adjustment will be more accurate if the spectrum contains a significant count rate above 70% of full scale.

After adjusting the pole/zero, you can see the current pole/zero setting by selecting a different Adjust screen, such as ADC, then reselecting Amp. This will update the number above the slider control. If, after performing an Auto P/Z and refreshing the screen, the setting has changed significantly, try to do another Auto P/Z cycle; the P/Z circuits may need more time to find the optimum setting.

**Manual P/Z:** In some situations the auto pole/zero may fail to converge to an optimal value, so a slider control is provided which allows you to manually adjust the pole/zero setting. The adjustment procedure is described in detail in the “Manual Pole/Zero” on page 324.

### TRP Preamps

When a Transistor Reset Preamp (TRP) is used, the pole/zero is fixed (at 0), but you may have to make an adjustment on the TRP preamp so that the amplifier and ADC are gated off during the preamp’s reset time. This procedure is described in the “Adjusting the TRP Reset Pulse” on page 327.

### High Voltage

Click on the **HVPS** button to see the dialog box in Figure 37, which shows a typical HVPS adjust screen. The controls you see on your adjust screen may vary, depending on which HVPS you assigned to this datasource.

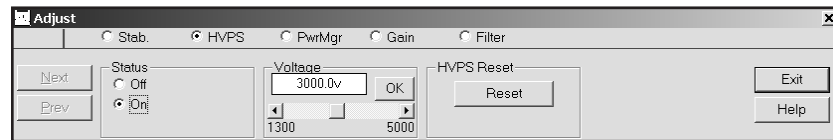


Figure 37 Typical High Voltage Adjust Dialog

### Voltage

The **Voltage** scroll bar sets the output of the HVPS between the minimum and maximum settings of the Voltage Limit control set in the MID Editor. The voltage can also be typed in from the keyboard, then accepted with the Ok button within the control.

### Status

If the Power Manager, described in the next section, is in the Battery Full mode or the AC Full mode, you can turn the HVPS **On** or **Off**. In the Battery Save mode, you can set the HVPS to **Armed** or **Off**. If Armed is selected, the HVPS will be automatically turned on when acquisition starts.

### HVPS Reset

The HVPS is turned Off when a fault caused by an overload or an Inhibit occurs with an InSpector HVPS. After the fault condition has been cleared, click on **HVPS Reset** to reset the HVPS, then turn it On again with the Status control.

### Clear Ov/In Latches

When a fault caused by an overload or an inhibit occurs with an ICB HVPS, its Overload and Inhibit latches are set. After the fault condition has been cleared, click on **Clear Ov/In Latches** to reset the latches.

## Power Manager

Click on the **PwrMgr** button to see the dialog box in Figure 38, which shows a typical power manager adjust screen. The controls you see on your adjust screen may vary, depending on which power manager you assigned to this datasource.

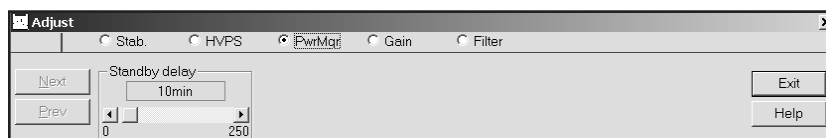


Figure 38 Typical Power Manager Adjust Dialog

### Power Mode

Click on a **Power mode** button to select one of the device's power modes.

The **Battery Full** mode keeps the system electronics on at all times using power from the device's batteries.

The **Battery Save** mode minimizes battery drain by turning off some of the device's circuits whenever possible. When data acquisition is initiated, the system changes to the Battery Full mode and data acquisition begins after the Acquisition Delay time has elapsed, which allows time for the high voltage to reach its preset value and for the internal electronics to become thermally stable. When acquisition is finished, the system returns to the Battery Save mode.

In the **AC Full** mode, the device operates from battery port A. If the AC Power Adapter is connected to this port, it will supply power to the device. The AC Adapter's User's Manual tells you how to connect it to the battery port with the supplied connecting cable. If ac power is lost, the Power Manager will

automatically switch to port B, allowing its battery to continue supplying power. When ac power is restored, the Power Manager will switch back to port A.

### Acq. Delay

The **Acq. Delay** control (enabled only in the Battery Save mode) sets a delay time which holds off actual data acquisition until the high voltage has reached its preset value and the internal electronics are thermally stable. A minimum delay of one minute is provided to allow the high voltage to increase to its preset value and the internal electronics to warm up. The internal electronics will stabilize to within 0.1% of their final settings in less than five minutes.

### Standby Delay

The **Standby delay** control (enabled only in the Battery Save mode) sets the amount of time that the system can remain idle (neither acquiring data nor communicating with the host computer) before it automatically changes to Standby. In Standby, all electronics except the Power Manager are shut down until the next command is received from the host. A setting of 0 minutes will prevent the device from switching to Standby.

## MCS

The MCS Adjust (Figure 39) allows you to set parameters such as Dwell time, Mode and ROI limits for the MCS device. The controls you see on your adjust screen may vary, depending on which MCS you assign to this datasource.

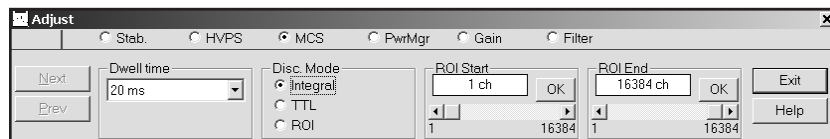


Figure 39 MCS Adjust Dialog

### Dwell Range

Choose seconds, milliseconds, or microseconds as the Range for the dwell time.

### Dwell Value

Sets the dwell-time, within the selected Range.

**Disc. Mode**

This can be TTL, FDisc or ROI. TTL picks up the signals to be counted from the external connector; FDisc sees any counts converted by the DSP; ROI counts only those events in a limited Region of Interest.

For the AccuSpec FMS board there is a special mode of operation that emulates PHA acquisition. For this detector, PHA replaces FDisc as a possible mode, and the following controls (to support “pseudo-PHA”) appear:

**Scan Window**

The percent of the start/end window used to set the discriminator ROI.

**Scan Start**

Percent of full scale where the scan for PHA data will start.

**Scan End**

Percent of full scale where the scan for PHA data will end.

**Set ROI**

The FMS board uses SCA LLD and ULD (as percent of full scale) instead of ROI Start and End. This button picks up the current Left and Right Marker positions and sets those values from them. Those settings will then be used for any subsequent ROI-mode acquisition.

**Pseudo-PHA**

Pseudo-PHA collects a pseudo spectrum to be used for defined discrimination window used during ROI mode of MCS. When you select PHA mode and then Start Acquire, the values for scan window, scan start, and scan end will be used as follows:

- With a fixed dwell time (2 ms).
- The discrimination ROI is set to the scan window, limited by (and scaled to) the scan start and scan end.
- That “scan window” moves across the spectrum, synchronized with the dwell time.

When collect ends, either by preset (sweeps) reached or manual Stop, you can place the Left and Right markers on either side of the peak of interest, and then use the **Set ROI** button to pick up those positions and (using the values of scan start and end) convert those positions into a discrimination ROIs (SCA LLD and SCA ULD) that will be used for subsequent MCS acquisition. Or you can try again, moving your scan start and/or scan end *in* so that the board will see a smaller part of the full scale allowing you to get better resolution.

## Status

Selecting **Status** shows a Hardware Status Report for all devices (MCA and programmable front-end electronics) associated with the current hardware datasource. Figure 40 shows a typical Status Report, which includes device type, serial number, and any programmable settings that are obtainable from each device. An asterisk next to the parameter means that an unexpected setting was read from the device.

Though the majority of the entries in the Status Report are direct reflections of the MCA Input Definition Editor settings or the spectral display Adjust settings, a few of them are explained in greater detail in the “Status Screen Entries” on page 328.

The **Update** button sends all programmable parameters to the devices and verifies them, updates the Status Screen. If the display’s Status field had been changed to red because an error was detected on the datasource, the field will be changed to white if the reported error has been corrected (remember that a datasource includes an MCA and various front-end devices). You’ll find more information on possible errors in “Genie 2000 Input Datasource Errors” in the *Error Codes* chapter in the *Genie 2000 Customization Tools Manual*.

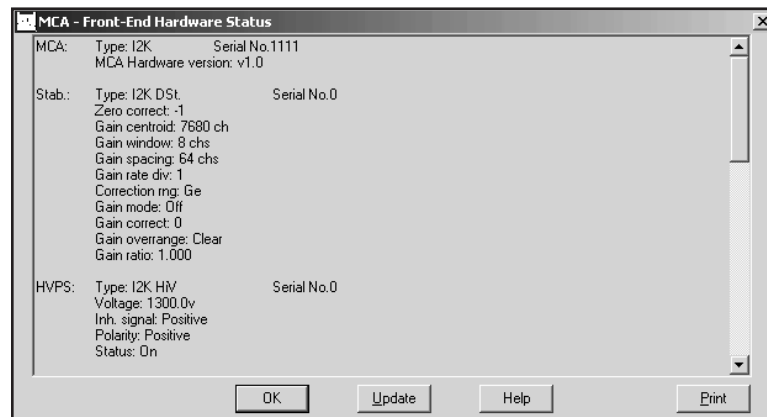


Figure 40 Typical Status Report

## Advance

Selecting **Advance** issues an advance command to a sample changer assigned to the current hardware datasource. If this datasource does not have a sample changer assigned to it in the MID configuration file, the command will not be issued.

## Load

If you are displaying a Detector (hardware) datasource and you have at least one CAM File datasource open, you can copy spectral data and energy calibration information from the selected CAM File datasource to the Detector datasource.

Selecting **Load** displays the dialog box in Figure 41. Use the “Load from:” list box to choose one of the open CAM File datasources. If you want to copy the energy calibration information as well, select the “Include Energy Calibration” check box.



Figure 41 Load From a Datasource

## Calibrate Menu

The **Calibrate** menu provides several options for calibrating the energy and efficiency of the datasource, graphically displaying the calibration, setting preferences for the calibration, and loading and storing calibration files.

## Setup

**Setup** displays a dialog screen (Figure 42) which allows you to select preferences and calibration settings to be used throughout the calibration and analysis processes.

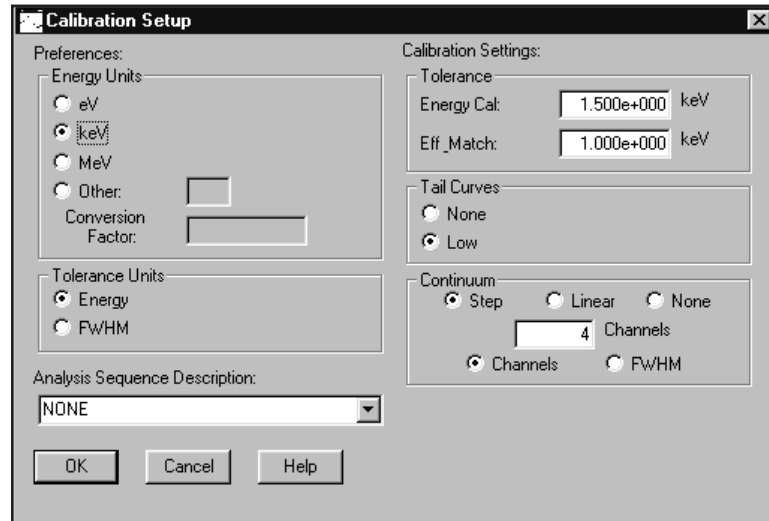


Figure 42 Calibration Setup

### Preferences

**Energy Units:** Though energies are stored in keV, you can change how energy units are shown in the display's dialog boxes and in reports: eV, keV, MeV or Other.

The proper Conversion Factor for "other" units is defined as the number of keV units equal to 1 "other unit". For example, the conversion factor for MeV would be 1000 because there are 1000 keV units in 1 MeV.

**Tolerance Units:** For the units to be used for entering tolerances, chose either Energy (a constant energy value across the spectrum) or FWHM (the energy varies according to the FWHM calibration).

### Calibration Settings

**Tolerance:** Energy Calibration and Peak Match values can be set in terms of energy (in the selected energy units) or FWHM.

Energy Calibration Tolerance is used during energy calibration in matching spectrum peaks to the current populated list, plus or minus the tolerance value.



Efficiency Match Tolerance is used during efficiency calibration to match calculated peaks with the peaks in the specified certificate file, plus or minus the tolerance value. It is also used to match energies and peaks during later analysis.

**Tail curves:** None or Low. A germanium detector (for instance) tends to exhibit tailing on the low energy side of its peaks, so you'd normally choose Low to take this into account during calibration. None is usually appropriate for NaI spectra.

**Continuum:** Linear, Step, None. You can establish the continuum by selecting either a Linear function or a Step function. The **Linear** function is adequate when the continuum is relatively flat. It is a simple, straightforward equation that estimates the continuum under the peaks as a trapezoid. The **Step** function should be chosen if there are any regions in the spectrum where the continuum is significantly higher on the left side of a peak region than on the right side. This function automatically reduces to a flat line when the continuum is flat. **None** is typically used only with Alpha spectra.

The value in the **Channels text box** establishes the continuum under the peak ROIs. If you have two peaks that are close together, reducing the number of continuum channels may give better results. If you have poor peak statistics and there are no other peaks nearby, increasing the number of continuum channels establishes the continuum more accurately but makes it more likely that close lying peaks will be considered as a multiplet instead of as a singlet.

FWHM or Channels. Choose **FWHM** to let the continuum vary according to the shape calibration. Choose **Channels** to keep the continuum fixed across the spectrum. The specified number of FWHMs or the specified number of continuum channels will be used on both sides of the peak to establish the continuum under the peak ROIs.

If you plan to use either the Cursor or the Marker method and the calibration peaks are very close to other peaks, you should set the continuum mode to Channels and set the value in the Channels text box to a small number. The Cursor and Marker methods *do not* use the expected FWHM information, even when it is available. If you plan to use the Auto button, you may set the continuum mode to FWHM. If you plan to use a mixture of both modes, both parameters should be set appropriately.

### Analysis Sequence Description

The Analysis Sequence Description dropdown is a list of the currently defined analysis sequence on your system. Selecting one of the sequences will direct efficiency calibration to execute the peak locate and peak area engines of the selected sequence when the Auto button is pressed. The default selection is **NONE**.

## Energy Only Calibration

The standard energy calibration includes low-tail and FWHM values. For a simpler energy calibration, this function (Figure 43) allows you to enter the calibration using only energy/channel pairs, either by the Cursor Method or the Manual Method. If only one energy/channel pair is entered, a second pair will automatically be generated as <energy/channel, 1> when you exit the dialog with an **OK**.

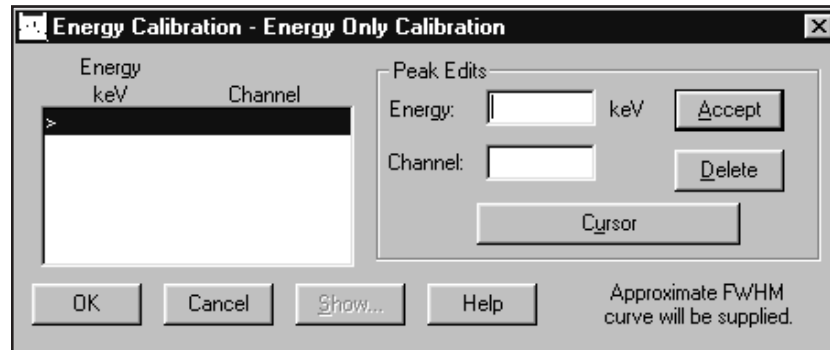


Figure 43 Energy Only Calibration

### Manual Method

To add an entry to the list box, type an energy value into the Energy text box and the corresponding channel number in the Channel text box, then select **Accept**. You can add these energy/channel pairs in any order; they will always be displayed in ascending energy order.

### Cursor Method

To use this method, there must be a spectrum in the Spectral Display area and its cursor must be on the peak that is being used for calibration.

Select the **Cursor** button to add the window's cursor channel position to the Channel text box. Now enter an energy value in the Energy text box and press **Accept** to add the data to the list box.

### Show

This function is available only when at least two energy/channel pairs have been entered, either by you or by the system. When you select the **Show** button, the energy calibration curve will be displayed as a graph. Please refer to "Energy Show" on page 74 for a complete discussion and an illustration of this function.

## Delete

To remove a line and its values from the list box, highlight the line, then select the **Delete** button.

## Energy Coefficients

Selecting **Energy Coefficients** displays a dialog box (Figure 44) which allows you to edit or manually enter known energy calibration coefficients for the energy vs. channel, FWHM vs. energy, and tail vs. energy curves.

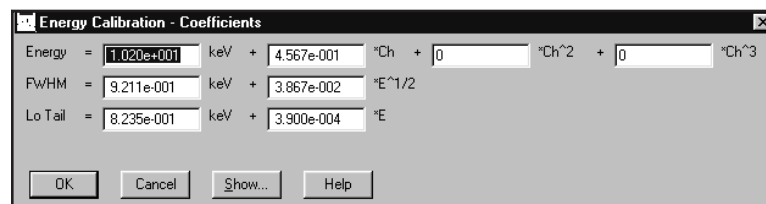


Figure 44 The Energy Coefficients Dialog

If you edit an existing calibration curve, any points previously used to generate that curve will be deleted and will not be available for further Populate operations on the current datasource.

## Show Button

Select the **Show** button to display the energy calibration curve as a graph. Please refer to “Energy Show” on page 74 for a complete discussion and an illustration of this function.

## Energy Full

When you select **Energy Full**, its menu lets you choose how energies are to be entered for spectrum calibration:

- By Certificate File, which allows you to select a certificate file containing the energies.
- By Nuclide List, which allows you to select a list of nuclides and their energies from a specified library.
- By Calibration File, which allows you to select a calibration file defining the list of energies.

- By Entry, which lets you manually enter each energy, its channel number, and its FWHM and Low Tail values.

## By Certificate File

Calibrating **By Certificate File** lets you choose either of two types of a certificate file (Figure 45) as a source of calibration energies: full or partial. The partial certificate file (.CTP) is similar to the full certificate file (.CTF), lacking only the assay date and time and the activity units for each nuclide. See “Save as Certificate” on page 67 for more information.

When you have highlighted the certificate file name you want to use, you can either select **Info** to see more information on the file, or select **OK** to load the file’s energy data into the energy line editor.

## Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite energy file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer “yes”, it will tell you each time it finds a duplicate entry.

## Editing the List

When you open the file, you’ll see the “Energy Calibration – Full” screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to “Energy Calibration – Full” on page 71 for an illustration and explanation of this screen.

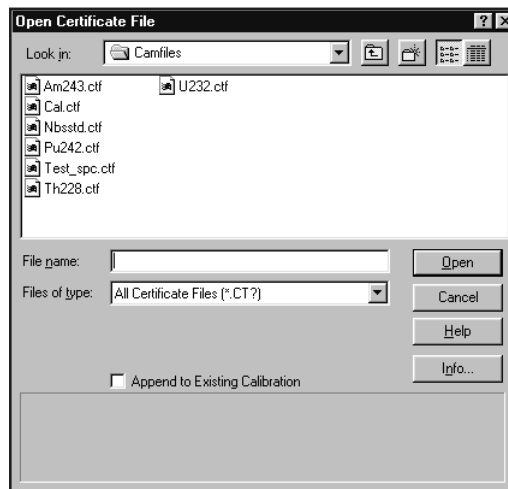


Figure 45 Calibrate by Certificate File

## By Nuclide List

Calibrating **By Nuclide List** lets you choose a nuclide list (Figure 46) as a source of nuclide lines. You can either accept the displayed nuclide Library (NLB) file or use the Select button to choose another one.

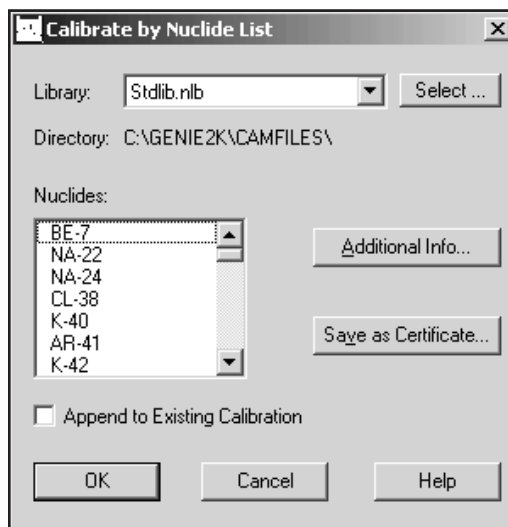


Figure 46 Calibrate by Nuclide List

### Save as Certificate

If you highlight one or more nuclides, then choose **Save as Certificate** you'll create a "partial" certificate file (.CTP) which can be used for energy calibration.

This certificate file is similar to the "full" certificate file (.CTF) created in the Certificate File Editor (page 234), lacking only the assay date and time and the activity units for each nuclide.

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite energy file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer "yes", it will tell you each time it finds a duplicate entry.

You can select **OK** to save this limited data as a "partial" certificate file. If you want to add the missing information, making this a "full" certificate file, highlight one or more nuclides, then choose **Additional Info** to enter the additional data.

### Additional Nuclide Information

In addition to entering the nuclide's assay date and time and its activity units, this screen (Figure 47) lets you enter the percent uncertainty and change the activity units.

Figure 47 Additional Nuclide Information

**General Information:** These text boxes let you enter or change assay date and time and the activity units.

The **Assay Date** is the date and time when the source was measured (you must enter both).

Though **Activity Units** defaults to  $\mu\text{Ci}$ , you can choose another unit for reporting nuclide activities. The **Conversion Factor** defaults to the proper value for converting Bq to  $\mu\text{Ci}$ . If you choose the last item in the Activity Unit list,  $\langle \rangle$ , you can type in the name of any other unit, then enter the Conversion Factor that will convert your units to  $\mu\text{Ci}$ .

**Nuclides:** Highlight a nuclide in the list box to enter or edit its Activity and Percent Uncertainty data. When you've finished editing that nuclide, select **Change**. This will copy the data to the list file and move the highlight to the next nuclide.

When you've finished, select **OK** to save this as a "full" (.CTF) certificate file and return to the Calibrate by Nuclide List screen. You'll see that all nuclides which have Additional Nuclide Information added are marked by a double asterisk (\*\*).

If you are satisfied that all data in the Calibrate by Nuclide List screen is correct, you can select this screen's **OK** to load the file into the energy line editor.

### Editing the List

When you select **OK**, you'll see the "Energy Calibration – Full" screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Energy Calibration – Full" on page 71 for an illustration and explanation of this screen.

### By Calibration File

Choosing to calibrate **By Calibration File** displays a dialog box (Figure 48) which lets you select a Calibration File defining the list of energy/channel pairs to be used for calibration. The **Info** button displays descriptive information for the selected file.

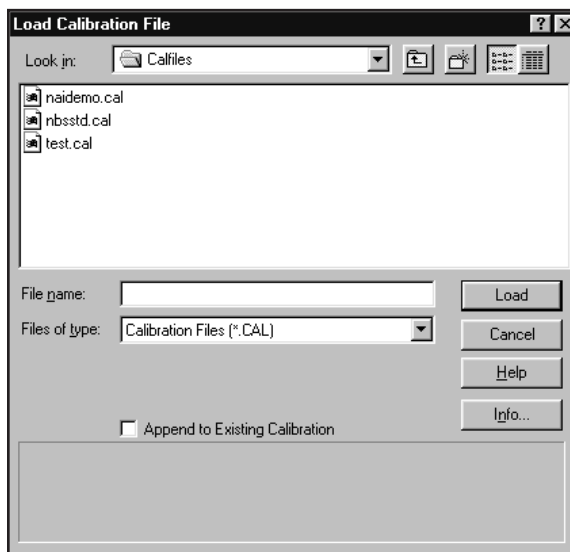


Figure 48 Calibrate by Calibration File

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite energy file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer "yes", it will tell you each time it finds a duplicate entry.

### Editing the List

When you open the file, you'll see the "Energy Calibration – Full" screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Energy Calibration – Full" on page 71 for an illustration and explanation of this screen.

### Info

The **Info** button displays descriptive information for the selected file.

### By Entry

Choosing to calibrate **By Entry** displays a dialog box (Figure 49) which lets you manually enter energy/channel pairs to be used in generating the energy calibration coefficients for the energy vs. channel equation.

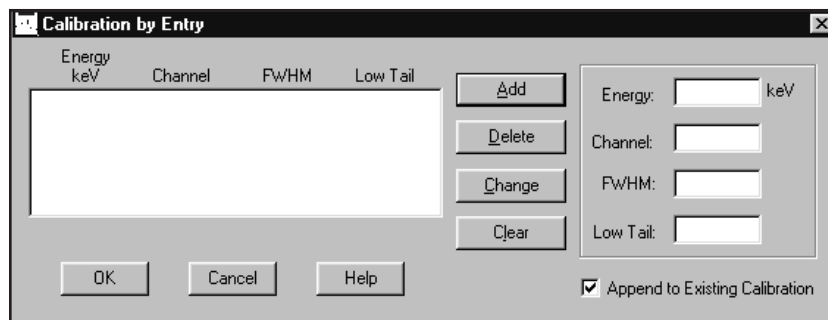


Figure 49 Calibrate by Entry

You must also manually enter FWHM values to be used in generating the shape calibration coefficients for the FWHM vs. energy equations.

If Low Tail Curve was selected in Calibration Setup (page 62), you are also allowed to manually enter Low Tail values to be used in generating the shape calibration coefficients for the Low Tail vs. Energy equations.

### Add Button

To create an entry in the list box, type an energy value into the Energy text box, then the corresponding channel number, FWHM value (in channels), and Tail value (in channels) in their text boxes. When the values have been entered, select **Add**. You can add these energy/channel pairs in any order; they will always be displayed in ascending energy order.



### Delete Button

To remove a line and all its values from the list box, highlight the line, then select the **Delete** button.

### Change Button

To change any of the values for a line, highlight the line, edit any of the values, then select the **Change** button to move the changes to the list box.

### Clear Button

Instead of editing the values one by one, you can remove all values from the text boxes for the highlighted line by selecting the **Clear** button. This will clear all entries at the once.

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite energy file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer “yes”, it will tell you each time it finds a duplicate entry.

### Editing the List

When you select **OK**, you’ll see the “Energy Calibration – Full” screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to “Energy Calibration – Full” on page 71 for an illustration and explanation of this screen.

## Energy Calibration – Full

The **Energy Calibration – Full** dialog (Figure 50) allows you to mark calibration peaks in a reference spectrum, then calculate the energy vs. channel, FWHM vs. energy, and tail vs. energy curves. You can enter Calibration peaks into the list box by the Cursor Method or the Marker Method, described in the following subsections.

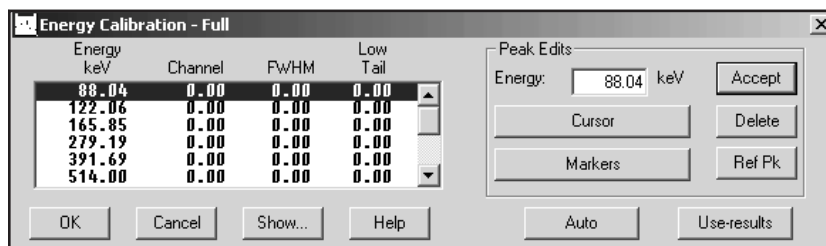


Figure 50 The Energy Calibration – Full Dialog

### Peak Edits

In the Peak Edits box, you'll see the **Cursor** button, used with the Cursor Method, the **Markers** button, used with the Marker Method, and the **Accept** button, used with both methods, to add the entry in the Energy text box to the list box. The **Delete** button deletes the highlighted entry from the list box. You'll also see the **Ref Pk** button, which selects/deselects the currently highlighted entry in the list box as the reference peak.

Only one peak, from a pulser for instance, may be assigned as a reference peak. The reference peak will not be used during the calculation of the calibration coefficients.

### Cursor Method

To use the Cursor Method, there must be a spectrum in the Spectral Display area and its cursor must be on the peak that is being used for calibration.

Select the **Cursor** button to use the spectrum's cursor channel position to determine an approximate FWHM in order to establish a computed (as opposed to displayed) ROI and attempt to fit the peak. The computed peak centroid, computed FWHM, and tail values will be calculated and displayed in the list box.

Now enter an energy value in the Energy text box and choose **Accept** to add the data to the highlighted list box entry.

Note that because the Cursor Method uses a relatively unsophisticated routine to determine ROI limits, it is not the best choice in certain calibrations, such as for NaI spectra. The Marker Method is recommended for NaI spectra.

### Marker Method

To use the Marker Method, there must be a spectrum in the Spectral Display area and its markers must be around the peak that is being used for calibration.

Select the **Markers** button to use the spectrum's markers to establish an ROI and attempt to fit the peak. The computed peak centroid, computed FWHM, and tail values will be calculated and displayed in the list box.

Now enter an energy value in the Energy text box and choose **Accept** to add the data to the highlighted list box entry.

The Marker Method is recommended for spectra where there are other peaks close to the calibration peak or when calibrating NaI spectra.

### Auto Button

The **Auto** button performs an automatic Peak Locate on the reference spectrum. The list box is then populated with the energies found in both the populate file and the reference spectrum, with their associated channel values.

### Use-Results Button

The **Use-results** button will retrieve energy/channel/FWHM/tail results directly from the current datasource and populate the list box. This button will be disabled if peak area analysis results are not present.

### Show Button

Select the **Show** button to display the energy calibration curve as a graph. Please refer to “Energy Show” on page 74 for a complete discussion and an illustration of this function.

## Energy Recalibration

Selecting **Energy recalibration** displays a dialog box (Figure 51) which lets you recompute the energy vs. channel calibration curve. Shape calibrations (FWHM and Low Tail) are not affected by this command; note that the FWHM/energy and Low Tail/energy pairs used by the shape calibration curves are zeroed out.

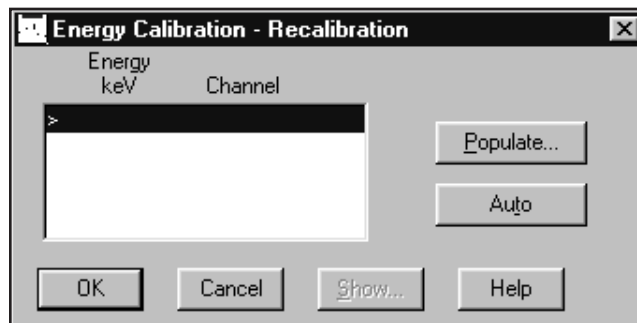


Figure 51 The Energy Recal Dialog

### Populate

The **Populate** button invokes a dialog screen, similar to the one in Figure 52, which allows you to populate the list box with the energies from the current datasource, a certificate file, or a previously stored calibration file.

If the certificate or calibration population option is invoked when the list box already contains energies, there may be a duplication of energy entries. If a duplicate is found, you will be asked if you want to replace the existing energy entry.

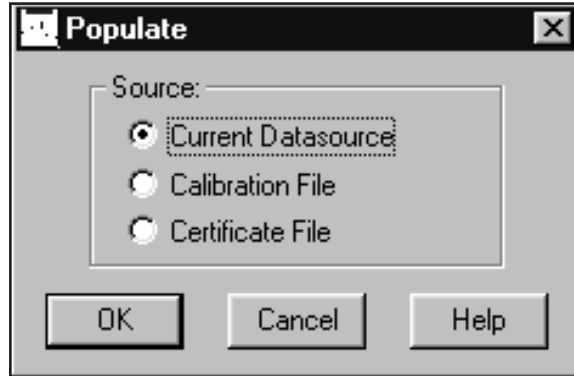


Figure 52 The Populate Screen

### Auto

The **Auto** button performs an automatic peak locate on the reference spectrum. The list box is then populated with those energies found in both the populate file and the reference spectrum with their associated channel values.

### Show Button

Select the **Show** button to display the energy calibration curve as a graph. Please refer to “Energy Show” on page 74 for a complete discussion and an illustration of this function.

## Energy Show

Selecting the Energy Show menu item (or the **Show** button on some screens) will display the calculated energy calibration curve as a graph, as seen in Figure 53. You can select the **Energy** button to show the energy curve or you can select the **Shape** button to show the FWHM and Low Tail curves

The Show Energy Calibration Curves display contains a Peak text box so that you can eliminate outlying peaks one at a time. Enter the number of the peak to be dropped, then select **Drop Pk**. The peak will be deleted from the list and both the curve and the equation will be regenerated. You may repeat Drop Peak until satisfactory results are obtained but you can't reduce the number of data points to less than two.

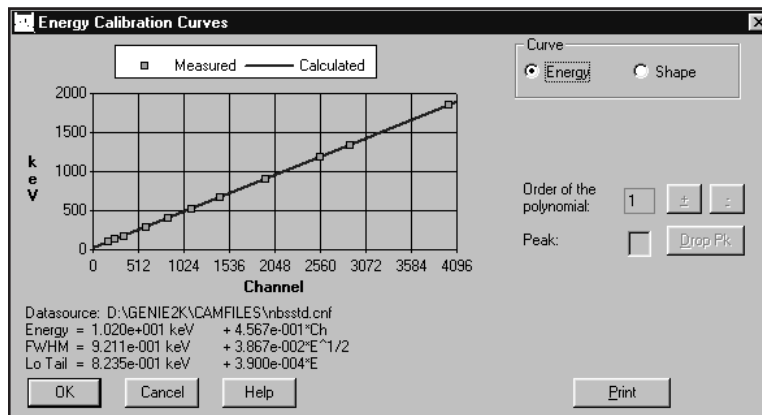


Figure 53 A Typical Energy Show Display

Note that the “Order of the polynomial” is limited by the number of data points present. For instance, at least two points are required for a first order curve and at least four points are required for a third order curve.

The “Order of the polynomial” field is enabled for the energy curve only. Click on the ‘+’ (‘-’) button to increase (decrease) the order value.

Select the **Print** button to send an output of the currently displayed curve(s) to the default print queue.

## Peak-to-Total Calibration

A Peak-to-Total efficiency calibration is required before you can use Canberra’s patented Cascade Summing Correction algorithms<sup>1</sup> (refer to “Using Cascade Correction” on page 249).

### Guidelines for Improving Accuracy

The following are provided as guidelines for performing an accurate Peak-to-Total (P/T) calibration.

1. US Patent 6,225,634.

### Calibration Sources

In order to carry out a P/T calibration we recommend a set of low cost point sources with the following nuclides:  $^{109}\text{Cd}$ ,  $^{57}\text{Co}$ ,  $^{113}\text{Sn}$ ,  $^{137}\text{Cs}$ ,  $^{54}\text{Mn}$  and  $^{65}\text{Zn}$ . The Model S-PTC P/T Calibration Source Set, available from Canberra, is a convenient set of radioactive sources suitable for the P/T calibration of any detector.

Note that the peak-to-total ratios at  $^{109}\text{Cd}$  (88 keV) and  $^{113}\text{Sn}$  (392 keV) gamma ray energies could be inaccurate because of X-ray contributions to the total counts in these spectra. To filter out the X rays, either a thin absorber foil may be placed between the source and the detector, or the Extrapolation Channel parameter (page 78) may be used to cut off the X ray and noise contributions to the total.

### Background Compensation

When the ambient background in the counting area is not negligible, it is recommended that a background spectrum be acquired, and used while performing the P/T calibration.

### Calibration Curve Fitting

The cascade summing correction factors obtained using Genie 2000 software could be in serious error if you're not careful in fitting the P/T calibration curve. The error due to extrapolating the curve beyond the last empirical P/T data point could be significant. To avoid this, it is highly recommended that a dual-curve fit with a crossover energy of 122 keV ( $^{57}\text{Co}$ ) be used. It is further recommended that the default order of 2 be used for the high energy polynomial. This would provide a linear and a predictable extrapolation in the log-log scale.

Keeping the above in mind, you can correctly use the Peak-to-Total Calibration procedure described in the following sections.

## Setting up a Peak-to-Total Calibration

Selecting the **Peak-to-Total** command opens the dialog box shown in Figure 54.

### Selecting the Calibration Spectra

The first step is to select the spectra that will be used for the Peak-to-Total (P/T) calibration. These spectra must each have been generated by a single line nuclide (or a nuclide which does not give rise to coincidence summing effects), and have these characteristics:

- The files must all be stored in the same subdirectory on your hard drive or network.
- The files must all be of the same size (e.g. 4K channels, 8K channels, etc.).
- The files must all be Energy Calibrated, though they're not required to have the same energy calibration.

- All spectra used for the P/T calibration, including the optional background file, must be acquired under similar conditions (geometry, background, etc.).

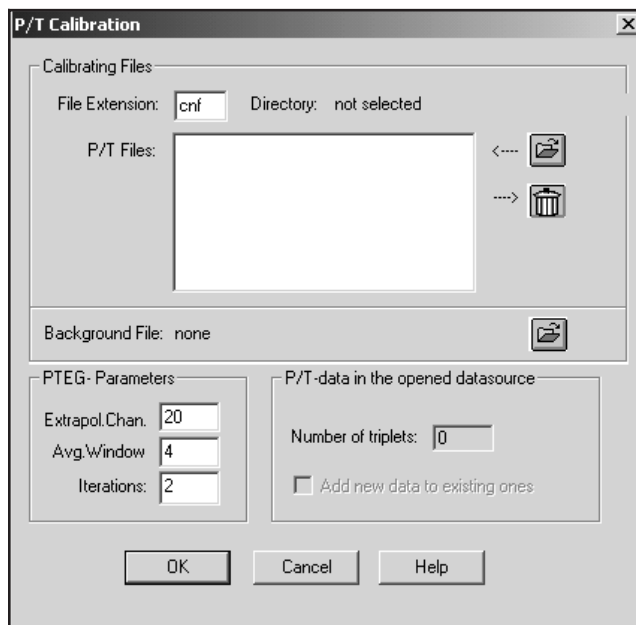


Figure 54 The Peak-to-Total Dialog

To select the spectra, click the File Folder button (uppermost button on the right) to navigate to the directory where the P/T calibration files are stored. Hold down the CTRL key and select as many files as you want to work on, then select **Open**.

The list of selected files will be displayed in the P/T Files box (Figure 55). If you don't want to use one of the files, it can be removed by selecting it, then clicking on the Garbage Can button (just below the File Folder button).

### Selecting the Background Spectrum

It is recommended that a background spectrum be selected for subtraction during the P/T calibration process. Click the File Folder button to the right of Background File field to select this file.

**Note:** The background file must be the same size (number of channels) as the calibration files and must be energy calibrated.

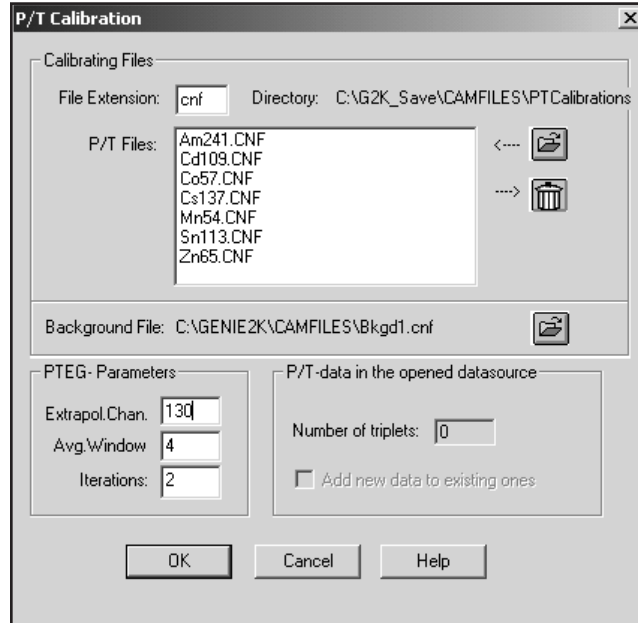


Figure 55 The Selected Spectra

### PTEG Parameters

The defaults for the three PTEG parameters are best for most situations, but may be changed if necessary.

#### Extrapol. Chan.

This parameter defines a lower limit (LLD) channel for the P/T calibration spectra. Spectral data below the extrapolation channel are replaced by a computed (predicted) value. Use this lower limit adjustment to discard unwanted low energy content (i.e. noise, etc.).

#### Avg. Window

The average window width to be used during peak analysis. This parameter sets the number of channels to the left and right of the extrapolation channel, and is used to determine the average count to be placed in all channels from zero to the Extrapolation Channel.

#### Iterations

This parameter displays the maximum number of iterations being used to correct for side-peaks on the P/T ratio during calibration. Ten iterations are more than sufficient to insure convergence to within 0.1%.



### Peak-to-Total Data in the Opened Datasource

The **Number of triplets** (energy/efficiency/error) used will be displayed if the datasource is already P/T calibrated and **Add new data to existing ones** will be enabled. Select the checkbox to add the new data to be incorporated into the existing P/T calibration. Deselect it to replace the existing P/T calibration.

### Performing the Peak-to-Total Calibration

After you've entered all of the parameters, click on **OK** to perform the calibration. While the calibration is being performed, an "in progress" message is displayed. Figure 56 shows the calibration results.

Energy keV	P/T	Error (%)	Cross
59.2	0.421	0.215	
87.6	0.309	0.492	
121.6	0.626	0.096	
391.3	0.257	0.207	
661.4	0.202	0.149	
834.6	0.177	0.179	
1115.4	0.117	0.336	

Figure 56 The P/T Calibration Results

### Editing the Peak-to-Total Calibration Results

Figure 56 shows how the results of the P/T calibration can be reviewed and edited as needed. At this stage of the process, the effect of the side-peaks on the P/T ratios for  $^{57}\text{Co}$ ,  $^{113}\text{Sn}$ , and  $^{65}\text{Zn}$  has not yet been corrected. The displayed P/T ratios shown are therefore still uncorrected values.

Click on either the **Show** or **OK** button to correct for the effect of the side peaks, using the selected number of **Iterations**.

#### Editing an Entry

To edit an entry, highlight it to transfer its data into the **Peak Edits** text entry fields. Make any needed edits, then click on the **Accept** button to store the revisions.

#### Deleting an Entry

Select an entry, then click on the **Delete** button.

Note: There is no confirmation dialog; the peak and its data will be removed from the list and cannot be recovered.

### Adding a New Entry

To add a new entry to the list:

1. Click on **New Record** to clear the Peak Edit fields.
2. Enter the new entry's values into the appropriate fields.
3. Click on **Accept** to insert the new entry into the list.

### Establishing a Crossover Energy

For fitting the peak-to-total calibration curve, it is recommended that a dual polynomial curve fit be used. To do this, a crossover energy must be specified. The recommended crossover energy is 122 keV.

Click the **Cross-over** button to select the currently highlighted entry in the list box as the crossover energy point. Only one crossover point may be assigned. The selection of a crossover energy point indicates that two curves will be generated for the dual polynomial curve. If no crossover energy point is selected, a single curve will be generated.

The result of doing this can be seen in Figure 57. Note that at least two data points must exist on each side of the crossover energy point for dual curves to be generated.

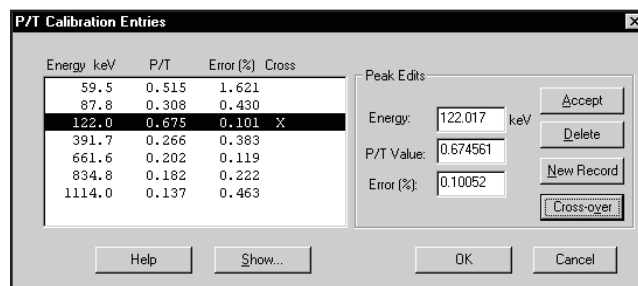


Figure 57 A Crossover Peak has Been Selected

Clicking either **Show** or **OK** starts the correction, with the software performing the iterations to correct the peak-to-total ratios for the effect of the side-peaks. If you click the **List Pks** button in the Show display (Figure 58), you'll see the iterated or final values of the peak-to-total ratios.

## Peak-to-Total Show

Select the **Show** button to display the Peak-to-Total calibration curve as a graph (Figure 58). Please refer to "Efficiency Show" on page 97 for a complete discussion of this function.

Note that the default order for the polynomial is 2 for both the low energy and high energy curves. The order of the polynomial settings can be changed up (+) or down (-) as required.

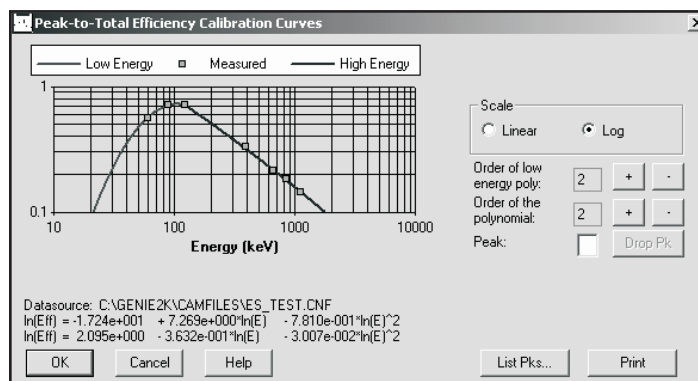


Figure 58 Show the Peak-to-Total Calibration

## List Peaks

Select the **List Pks** button to display a list of the peaks used in the calibration, as shown in Figure 59. The calculated vs. measured P/T ratios are listed to show how accurately the curve follows the measured points. Note that the input P/T ratios used have been corrected for the effect of side peaks.

You can leave the list on screen while working in the Peak-to-Total Show dialog box so that you can see the results of changing the graph's Scale.

Pk/Index	X-Value (keV)	Calculated P/T Ratio	Measured P/T Ratio	Measured Error (%)	Deviation (%)
1	59.72	0.70396	0.70396	0.36	0.00
2	88.21	0.71089	0.71089	0.35	0.00
3	122.18	0.70494	0.70401	0.10	0.13
4	391.77	0.43746	0.44568	0.15	-1.84

Figure 59 The Peak-to-Total List Peaks Dialog

## Efficiency

When you select **Efficiency**, you be asked to choose a method for entering the energies for spectrum calibration:

- By Certificate File, which allows you to select a certificate file containing the energies (page 82).
- By Nuclide List, which allows you to select a list of nuclides and their energies from a specified library (page 83).
- By Calibration File, which allows you to select a calibration file defining the list of energies (page 86).
- By Entry, which lets you manually enter each energy and its Efficiency and %Error values (page 87).
- By ISOCS/LabSOCS, which lets you use an efficiency file generated by the optional ISOCS or the LabSOCS software (page 88).

### By Certificate File

Calibrating **By Certificate File** lets you choose a certificate file (Figure 60) as a source of calibration energies and their efficiencies. When you have highlighted the certificate file name you want to use, you can select either **Info** to see more information on the file, or **OK** to load the file into the energy line editor.

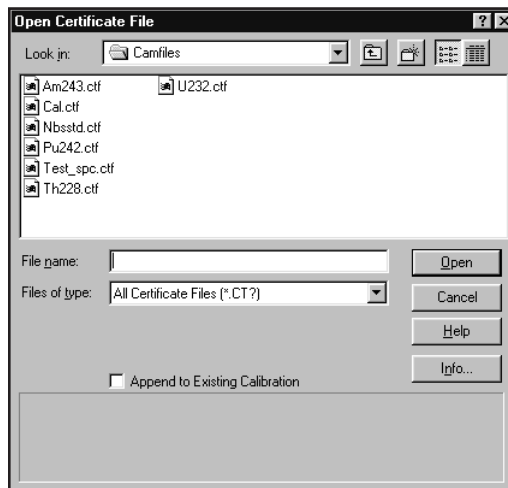


Figure 60 Calibrate by Certificate File

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite efficiency file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to overwrite the existing energy each time it finds a duplicate entry.

### Editing the List

When you open the file, you'll see the Efficiency Calibration screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Performing the Efficiency Calibration" on page 93 for an illustration and explanation of this screen.

### By Nuclide List

Calibrating **By Nuclide List** lets you choose a nuclide list (Figure 61) as a source of nuclide lines. You can accept all nuclides in the list by choosing **OK** to move to the Efficiency Calibration screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Performing the Efficiency Calibration" on page 93 for an illustration and explanation of this screen.

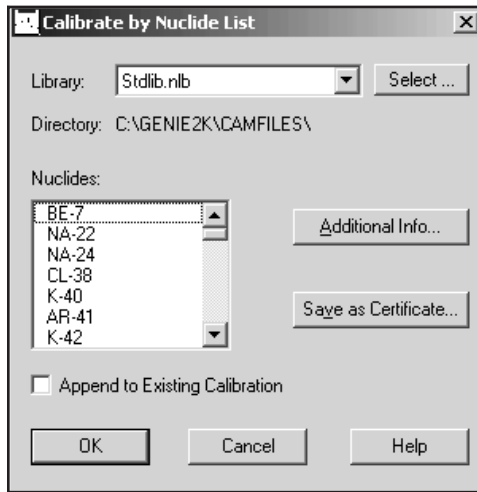


Figure 61 Calibrate by Nuclide List

### Save as Certificate

If you highlight one or more nuclides, then choose **Save as Certificate**, you'll create a "partial" certificate file (.CTP), which is similar to the "full" certificate file (.CTF) created in the Certificate File Editor, lacking only the assay date and time and the activity units for each nuclide.

To save this as a "full" certificate file (to use for efficiency calibration), you'll have to add the missing information. Highlight one or more nuclides, then choose **Additional Info** to enter the additional information.

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite efficiency file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer "yes", it will tell you each time it finds a duplicate entry.

### Additional Nuclide Information

In addition to entering the nuclide's assay date and time and its activity units, the screen in Figure 62 lets you enter the percent uncertainty and change the activity units.

Figure 62 Editing Additional Nuclide Information

**General Information:** These text boxes let you enter or change assay date and time and the activity units.

The **Assay Date** is the date and time at which the source was measured (you must enter both).

Though **Activity Units** defaults to  $\mu\text{Ci}$ , you can choose another unit for reporting nuclide activities. Since the activities are stored in microcuries, the **Conversion Factor** defaults to the proper value for converting microcuries to other units. If you choose  $< >$ , you can type in the name of an Activity Unit not shown in the list, then enter the Conversion Factor that will convert your units to  $\mu\text{Ci}$ .

**Nuclides:** Highlight a nuclide in the list box to enter or edit its Activity and Percent Uncertainty data. When you've finished editing that nuclide, select **Change**. This will copy the data to the list file and move the highlight to the next nuclide.

When you've finished, select **OK** to save this as a "full" (.CTF) certificate file and return to the Calibrate by Nuclide List screen. You'll see that all nuclides which have Additional Nuclide Information added are marked by a double asterisk (\*\*).

If you are satisfied that all data in the Calibrate by Nuclide List screen is correct, you can select this screen's **OK** to load the file into the energy line editor.

### Editing the List

When you select **OK**, you'll see the Efficiency Calibration screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Performing the Efficiency Calibration" on page 93 for an illustration and explanation of this screen.

### By Calibration File

Choosing to calibrate **By Calibration File** displays a dialog box (Figure 63) which lets you select a Calibration File defining the list of energy/efficiency/error triplets to be used for calibration. The **Info** button displays descriptive information for the selected file.



Figure 63 Calibrate by Calibration File

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite efficiency file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer "yes", it will tell you each time it finds a duplicate entry.

### Editing the List

When you open the file, you'll see the Efficiency Calibration screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to "Performing the Efficiency Calibration" on page 93 for an illustration and explanation of this screen.



## By Entry

Choosing to calibrate **By Entry** displays a dialog box (Figure 64) which lets you manually enter energy, efficiency and percent error values to be used in generating the efficiency calibration. Note that you can use up to 20 calibration data sets for calibration; any more than that will be ignored.

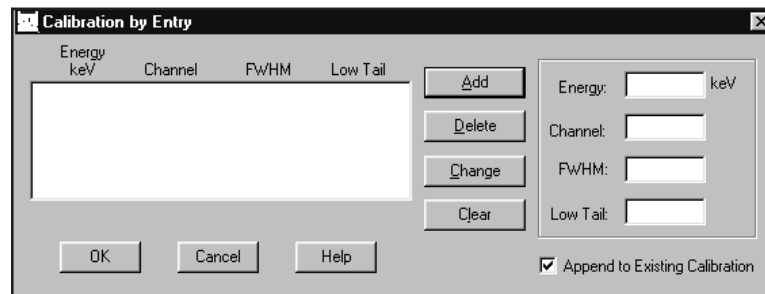


Figure 64 Calibrate by Entry

### Add Button

To create an entry in the list box, type an energy value in the Energy text box, then the corresponding Efficiency and Percent Error values in their text boxes. When the values have been entered, select **Add**. You can add these values in any order; they will always be displayed in ascending energy order.

### Delete Button

To remove a line and all its values from the list box, highlight the line, then select the **Delete** button.

### Change Button

To change any of the values for a line, highlight the line, edit any of the values, then select the **Change** button to move the changes to the list box.

### Clear Button

Instead of editing the values one by one, you can remove all values from the text boxes for the highlighted line by selecting the **Clear** button. This will clear all entries at the once.

### Append to Existing Calibration

When adding energy points to the current datasource from a file, such as in constructing a composite efficiency file, there may be common energy points in the two files. If the **Append to Existing Calibration** checkbox is selected, the system will ask if you want to append to the existing calibration. If you answer “yes”, it will tell you each time it finds a duplicate entry.

### Editing the List

When you open the file, you’ll see the Efficiency Calibration screen, which allows you to examine and, if necessary, edit the data in any of the lines. Please refer to “Performing the Efficiency Calibration” on page 93 for an illustration and explanation of this screen.

### By ISOCS/LabSOCS

This calibration method is available only on systems with Model S573 ISOCS or Model S574 LabSOCS installed. If neither ISOCS nor LabSOCS is installed on your system, this command will be grayed out.

Choose **Calibrate | Efficiency | By ISOCS/LabSOCS** to see the dialog box shown in Figure 65. The **Run Geometry Composer** button launches the Geometry Composer application described in Chapter 8.

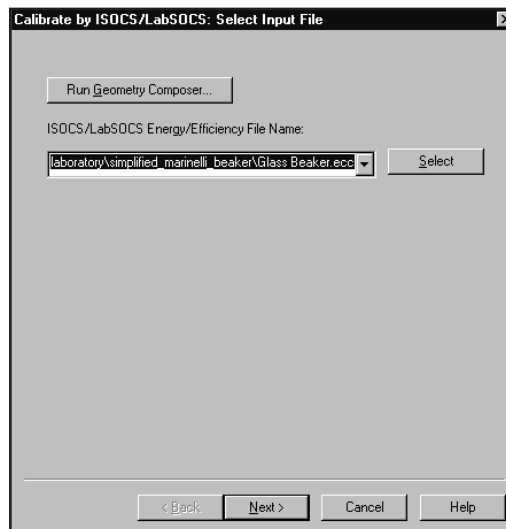


Figure 65 The ISOCS Efficiency Calibration Dialog

### Selecting the Input File

Assuming that you are going to use an existing set of LabSOCS/ISOCS data points, the next step is to specify which set of efficiency data points (the .ECC file) you want to use.

- If the Geometry Composer or the calibration process has recently used the file, it can be selected from the list in the **File Name** field.
- If it is not in the list, click on the **Select** button to browse to the desired directory and file. LabSOCS output files are usually stored in the following path:

Genie2K\isocs\data\Geometry\Laboratory\Template\_Name

Where Template\_Name is the subdirectory for the files associated with a given template.

When the file has been selected, click on **Next**.

### Run Geometry Composer

If you need to create a new geometry definition (.ECC) file (“Creating a Geometry Definition” on page 252) or edit an existing one (“Editing a Geometry Definition” on page 261), click on the **Run Geometry Composer** button to open the Composer.

### Selecting an Efficiency Factor

The dialog in Figure 66 lets you select the desired efficiency calibration type. For ‘traditional’ calibrations, select Efficiency and the results will be calculated in Activity. To convert to concentration, the activity can be divided by the mass in the Genie Report template. Alternatively, if you want to compute the Activity per mass (gram) directly, select Efficiency\*Mass. Other options are Efficiency\*Length and Efficiency\*Area. Other options are Efficiency\*Length and Efficiency\*Area.

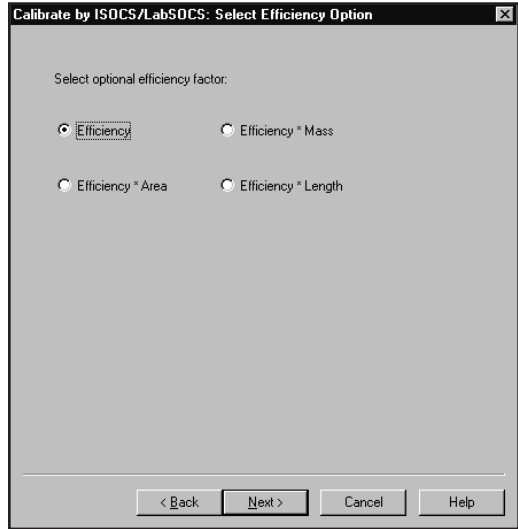


Figure 66 Select Efficiency Factor

When you've selected an efficiency type, click on **Next**. The calibration information will be presented as in Figure 67.

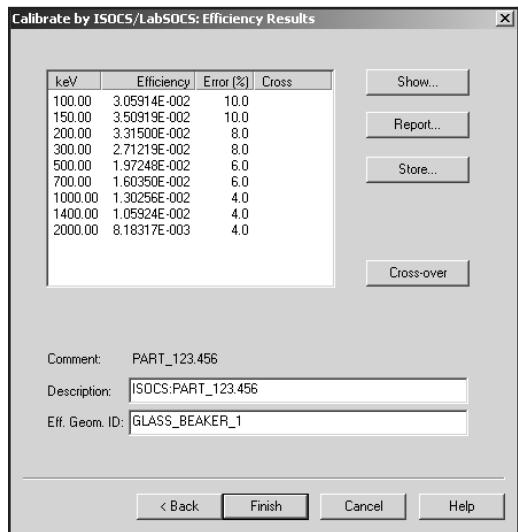


Figure 67 Results of an Efficiency Calibration

If you have selected an Efficiency\*Mass, Efficiency\*Length or Efficiency\*Area calibration type, the screen shown in Figure 68 will be displayed. Check the default value for the mass (or length, area) and correct it to the appropriate value, if needed. Press the **Recalculate** button to see the new values.

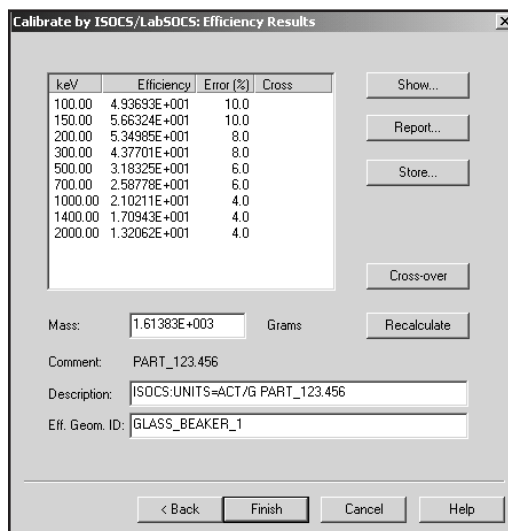


Figure 68 Results of an Efficiency\*Mass Calibration

For a discussion on how the mass, area and length of the various geometry definitions impact the analysis results, refer to the *LabSOCS/ISOCS Technical Notes* chapter in the *Genie 2000 Customization Tools Manual*.

## Efficiency Results

The list box shows the efficiency calculated for each of the energy points.

**Show**

Select the **Show** button to view the calibration graphically, as shown in Figure 69. Please refer to “Efficiency Show” on page 97 for a complete discussion of this function.

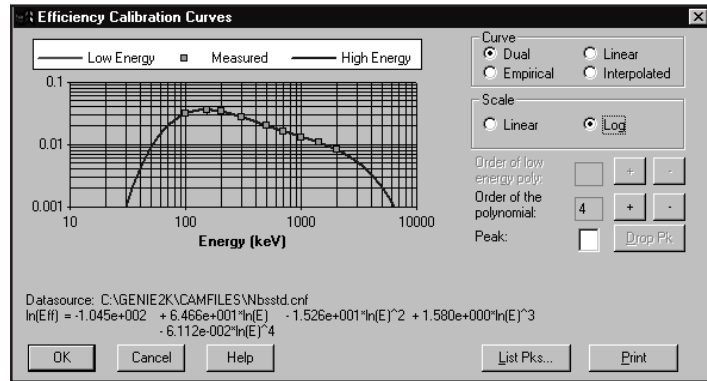


Figure 69 Show ISOCS Efficiency Calibration

**Report**

Select the **Report** button in Figure 67 to display the complete calibration report shown in Figure 70.

**Store**

To save the calibration results for later use, select the **Store** button in Figure 67 (page 90).

**Cross-over**

Select the **Cross-over** button in the Show screen to select the currently highlighted entry in the list box as the crossover energy, the point where the low energy curve and the high energy curve intersect. Only one point may be assigned.

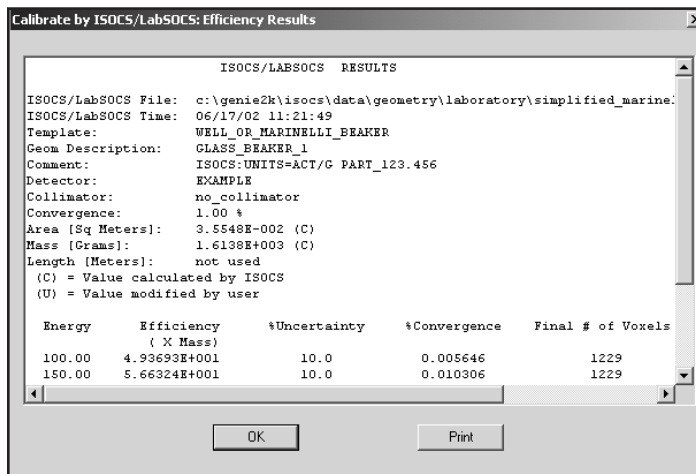


Figure 70 The Efficiency Calibration Report

The selection of a crossover energy point indicates that two curves will be generated for the dual polynomial curve. If no crossover energy point is selected, a single curve will be generated. Note that at least two data points must exist on each side of the crossover energy point for dual curves to be generated.

### Print

Select the **Print** button in Figure 70 to send a copy of the report to the default print queue. Select **OK** to return to the Efficiency Results screen (Figure 67 on page 90).

### Using the Calibration

Select the **Finish** button, which will then load this newly created efficiency calibration into the currently open datasource. If the calibration was **Stored** then you can also use the **Calibrate | Load** or the **Calibrate | Efficiency | By Calibration File** command to load the file you just created.

## Performing the Efficiency Calibration

The Efficiency Calibration screen (Figure 71) will be seen only after you've completed all steps for the method you chose on page 82: Certificate File, Nuclide List, Calibration File or Entry.

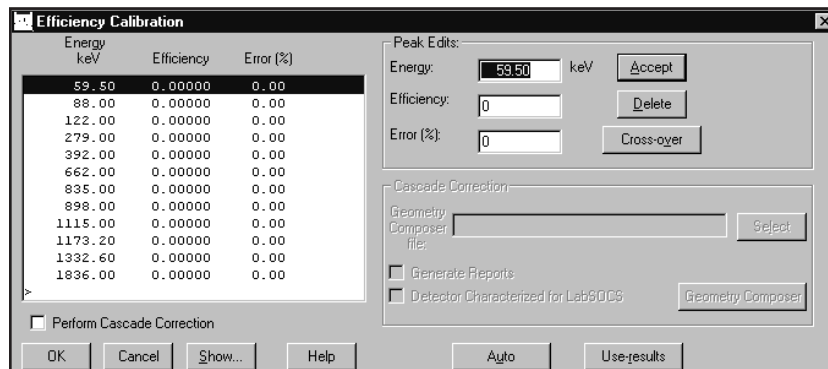


Figure 71 Efficiency Calibration

## Peak Edits

Peak Edits lets you enter **Energy**, **Efficiency**, and **Error (%)** data by hand. You can use up to 45 calibration data sets for calibration; any more than that will be ignored.

Since Efficiency Calibration always executes the Peak Locate and Peak Area phases, you should first choose the phases you want to use from the Analyze Menu (“Peak Locate” on page 133 and “Peak Area” on page 146).

If you don’t specify the phase, Efficiency Calibration will use the first Peak Locate and Peak Area algorithms it finds in the spectroscopy application’s AEF file (which may not always be the ones you want to use). Note that these choices apply to all open datasources.

## Accept

The **Accept** button verifies the entered values and displays them in the list box.

## Delete

The **Delete** button is used to delete the highlighted entry from the list box.

## Cross-over

The **Cross-over** button selects/deselects the currently highlighted entry in the list box as the crossover energy point. Only one crossover point may be assigned. The selection of a crossover energy point indicates that two curves will be generated for the dual polynomial curve. If no crossover energy point is selected, a single curve will be generated. Note that at least two data points must exist on each side of the crossover energy point for dual curves to be generated.



## Cascade Correction

These controls enable Genie 2000's Cascade Correction routines.

### Geometry Composer File

Select the Geometry Composer (.GIS) file associated with the geometry used to acquire this data.

### Generate Reports

Select the Generate Reports checkbox to output the reports generated by the analysis algorithms.

### Detector Characterized for LabSOCS

Select this checkbox if the detector being calibrated was characterized by Canberra.

### Geometry Composer

If there is no geometry (.GIS) file for the geometry used to acquire this data, select the **Geometry Composer** to launch the Geometry Composer application described in Chapter 8.

## Perform Cascade Correction

Selecting this checkbox enables the "Cascade Correction" group box and performs additional processing when the Auto button is selected. This produces an efficiency calibration that is free from cascade summing effects. This is necessary to get valid results from the Cascade Correction feature of the NID with Interference Correction algorithm (page 163). For information on performing the correction, refer to Appendix D, *Correcting for Cascade Summing*.

## Auto

If population was done from a certificate file, the **Auto** button will perform a peak locate with area analysis for each peak in the current datasource. The list box is then populated with the peak areas in the datasource that match those in the certificate file.

If the "Perform Cascade Correction" checkbox has been selected, additional processing will take place and the list box will be populated with the corrected results. For information, refer to Appendix D, *Correcting for Cascade Summing*.

Note that the peak locate and peak area analysis algorithms are determined by the Analysis Sequence Description selected in the Calibration Setup Dialog (page 63). If "NONE" was selected, the algorithms will default to the ones last chosen from the Analyze Menu.



**CAUTION** Analysis sequence (.ASF) files contain their own algorithm definitions. It is your responsibility to ensure that the algorithms called in these sequences are the same as the algorithms used for efficiency calibration. Failure to do so may greatly affect the accuracy of the results.

## Use-results

The **Use-results** button will retrieve peak analysis results directly from the current datasource and populate the list box. This button will not be enabled if peak area analysis results are not present in the datasource.

## Show

Select the **Show** button to display the efficiency calibration curve as a graph. Please refer to “Efficiency Show” on page 97 for a complete discussion and an illustration of this function.

## Supported Curves

All supported efficiency curves will be generated so that any one can be used for later analysis. The supported curves are:

- Dual Polynomial, using  $\ln()$  of energies for low and high curve on each side of a crossover point. A minimum of 2<sup>nd</sup> order (ln-ln) polynomial is allowed, and
  - ▶ For Dual in the single-curve mode and for the high energy curve in the two-curve mode, a maximum of 9<sup>th</sup> order (ln-ln) polynomial is allowed.
  - ▶ For the low energy curve in the two-curve mode, a maximum of 5<sup>th</sup> order (ln-ln) polynomial is allowed.
- Linear Polynomial, using linear  $1/E$  coefficients. A minimum of 2<sup>nd</sup> order and a maximum of 9<sup>th</sup> order polynomial are allowed.
- Empirical Polynomial, using  $\ln()$  of scaling-factor/ $E$  coefficients. A minimum of 2<sup>nd</sup> order and a maximum of 5<sup>th</sup> order polynomial are allowed.
- Interpolated, using a straight-line interpolation in the ln-ln domain.

The default order of the polynomial ( $n$ ) for both the high-energy and low-energy curves will be determined as follows:

- $n = 5$  for ten or more calibration points.
- $n = 4$  for eight or nine calibration points.
- $n = 3$  for six or seven calibration points.
- $n = 2$  for three to five calibration points.

Once an order has been determined by the program or has been adjusted in the Show screen, that order will be used as the default for future calibrations.

## Efficiency Show

Selecting the **Efficiency Show** menu item (or the **Show** button on some screens) will display the efficiency calibration as a graph (Figure 72).

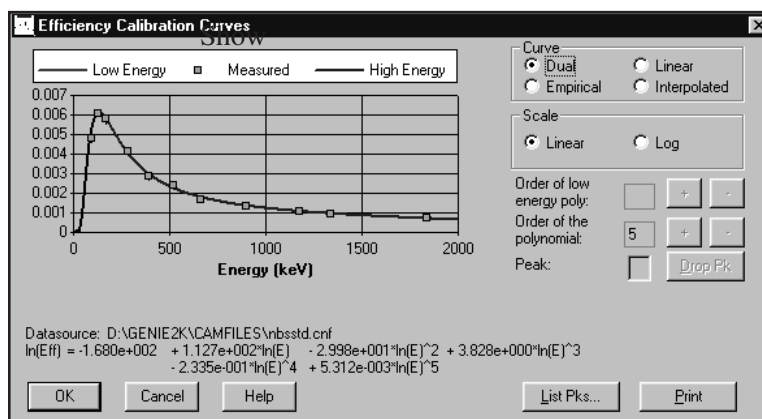


Figure 72 Show Efficiency Calibration

You can choose which curve to display (Dual, Empirical, Linear or Interpolated) in the Curve box and the scale of the graph (Linear or Log/Log) in the Scale box.

The order of the polynomial settings can be changed up (+) or down (-) as required. The “Order of the low polynomial” will be enabled for use only if Dual curve has been chosen and a low-energy curve is present.

Note that when a crossover point is specified, the low energy curve can only be adjusted up to a 5th order polynomial. The high energy curve can be adjusted up to a 9th order polynomial.

### Peak Text Box

The Peak text box lets you eliminate outlying peaks one at a time. Enter the number of the peak to be dropped, then select **Drop Pk**. The peak will be deleted from the list and both the curve and the equation will be regenerated. You may repeat Drop Peak until satisfactory results are obtained but you can’t reduce the number of data points to less than three (or five if a crossover peak for Dual Polynomial was specified).

### List Peaks Button

Select the **List Pks** button to display a list of the peaks used in the calibration, as shown in Figure 73. The measured vs. calculated efficiencies are listed to show how accurately the curve follows the measured points.

Pk/Index	X-Value (keV)	Calculated Efficiency	Measured Efficiency	Measured Error (%)	Deviation (%)
1	88.04	0.00480	0.00478	5.23	0.45
2	122.06	0.00607	0.00610	2.78	-0.49
3	165.85	0.00587	0.00578	4.97	1.66
4	279.19	0.00408	0.00409	3.43	-0.33

Figure 73 The List Peaks Dialog

You can leave the list on screen while working in the Show Efficiency Calibration Curve dialog box so that you can easily change the graph's scale, change curve type, change the order of the polynomial or drop peaks. If you highlight a peak in the List Peaks box, its number will automatically be placed in the Peak text box so that you can easily drop it.

### Print

Select the **Print** button to send an output of the currently displayed curve(s) to the default print queue.

## Gain Evaluator

The Gain Evaluator (Figure 74), which can be used with both file datasources and detector datasources, does not perform any hardware adjustments. Instead, it allows you to analyze the quality of the current datasource energy calibration and gain settings, to assess the impact on NID analysis, and to make corrective data adjustments, including file gain adjustments and saving the calculated energy calibration.

The specified datasource must already contain a spectrum acquired from a source with known true energies. When the Evaluator window opens, the evaluation results are populated using the datasource NID analysis results for true energies and the current peak search results for found energies.

The Gain Evaluator and Auto Gain Adjust functions primarily correct and assess gain shift (errors in the slope term of the initial energy calibration). Though some error in the initial equation's other calibration terms (zero/intercept and quadratic/higher order) can be accommodated, you should ensure that these other terms are reasonably accurate to obtain the most stable, reliable results.

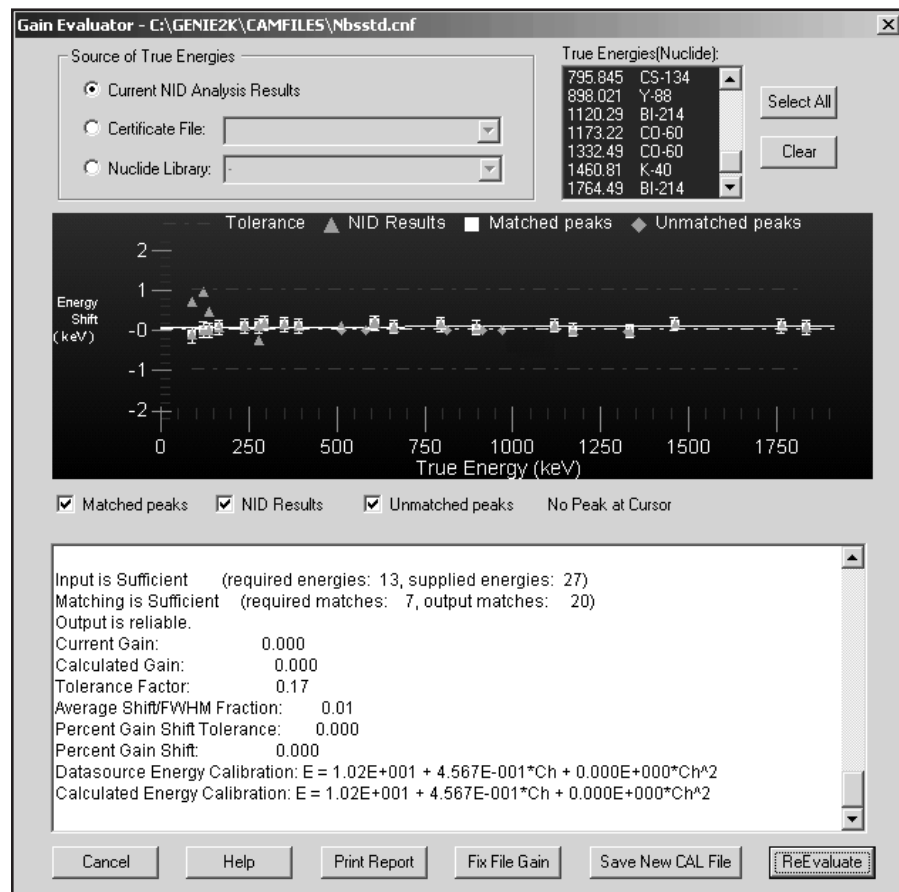


Figure 74 Gain Evaluator Dialog

## Zooming in on the Data

To magnify an area of interest in the data plot, click and drag to draw a rectangle around the area. When you release the mouse button, the plot will redraw itself to magnify the data (zoom in on) the area of interest. You can continue to zoom in by drawing the rectangle around smaller areas of the expanded data.

### **Undo Zoom**

To return to a full screen data plot, right click on the plot, then select the Undo Zoom command.

## **Context Menu**

Right-clicking on the data plot brings up a Context Menu of items for rendering the data (Figure 75).

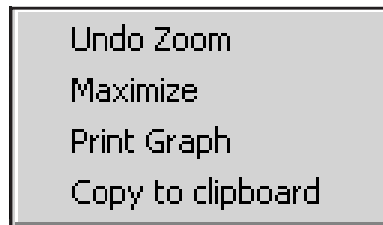


Figure 75 Context Menu

### **Undo Zoom**

The Undo Zoom command will undo all levels of zoom at once and return to the normal data plot.

### **Maximize**

The Maximize command expands the data plot to full screen. Press your keyboard's ESC key to close the maximized display window.

### **Print Graph**

The Print Graph command prints the data plot to the system's current print device.

### **Copy to Clipboard**

The Copy to Clipboard command copies the data plot to the clipboard as a graphic, suitable for pasting into presentation software or a word processor.

## **Interactive vs. ASF Evaluation**

The Gain Evaluator can be run interactively or as a part of an analysis sequence. In the interactive mode, you can select any or all of the energies in the True Energies list box. When used as a step in an Analysis Sequence File, energies can't be selected; the routine will use all of the energies in the specified Source of True Energies.

## Source of True Energies

Select the source of energies to be used in performing the Gain Evaluation.

- The Current NID Analysis Results
- A Certificate File
- A Nuclide Library File

Ideally, the source of true energies should list energies that correspond to all of the found peaks and no more. However, to get reliable results and avoid excessive computational time, the number of input true energies should be no greater than twice the number of found energies (and contain energies that actually correspond to most of the found peaks).

The routine can't resolve more than one nuclide at the same energy in the source of true energies, so matches will not be made at any true energy that is repeated. Best results will be obtained if all of the input true energies have a relative separation of at least several FWHM. It is also desirable to have peaks that span the full range of the spectrum.

### Current NID Analysis Results

Select the **Current NID Analysis Results** button to specify the Nuclide ID analysis of the current spectrum as the source of true energies.

Using the current NID analysis results as the source of true energies will be successful only if any gain shift was small enough to be accommodated by the NID energy tolerance during analysis.

Unexpected or low quality NID analysis results may indicate an excessive gain shift that would be better evaluated using a different source of true energies. In this case, selecting only expected nuclide energies from a nuclide library or certificate file is recommended (perhaps requiring some trial and error experimentation).

### Certificate File

Select the **Certificate File** button to specify a certificate (CTF) file as the source of true energies.

A certificate file is typically used when the NID analysis results are unavailable or are suspect, and there is some *a priori* knowledge about the measured source that is already documented in the certificate file.

### Nuclide Library

Select the **Nuclide Library** button to specify a nuclide (NLB) library as the source of true energies.

A nuclide library is typically used when the NID analysis results are unavailable or are suspect, and there may or may not be some *a priori* knowledge about the measured source.

Iteratively selecting likely nuclides and assessing the results until good matches are achieved can sometimes be a successful strategy for empirically determining what nuclide(s) are evident in the spectrum even when excessive gain shift precludes successful NID analysis.

### True Energies (Nuclide)

The True Energies list box lists the energies and their associated nuclides in the Source of True Energies you selected. By default, all of the energies from the NID Analysis Results or from a Certificate File are initially selected; none of the energies from a Nuclide Library are initially selected.

- The **Select All** button selects all of the listed energies.
- The **Clear** button deselects all of the listed energies.
- Click on a single energy to select or deselect it.

### The Data Plot




Data points for selected energies are displayed and plotted as True Energy (X-axis) vs. Energy Shift (Y-axis). The energy shift plotted at each matched true energy is the difference between the true energy and the corresponding matched found energy.

The solid line represents the fit to the data points and the dashed lines above and below it represent the Eff. Match Tolerance set in Calibration Setup (page 62).

If the solid line is sloped, gain has shifted. If the solid line doesn't pass through the origin, zero has shifted. A perfect energy calibration will have a flat, horizontal line passing through the origin.

### Matched Peaks, NID Results and Unmatched Peaks

Each of the data plot's flags is enabled/disabled via the checkboxes below the plot (Figure 76). Checking a box places its flag at relevant locations in the data plot and displays its indicator at the top of the plot.

- A blue triangle  indicates NID Results.
- A white square  indicates Matched Peaks.
- A green diamond  indicates Unmatched Peaks.



### No Peak at Cursor

When the mouse cursor is not over a peak in the data plot, No Peak at Cursor is displayed below the plot (Figure 74 on page 99).

### Peak at Cursor

When the mouse cursor is over a peak, it will change to a + and the No Peak label will change to the peak's true energy and the amount of shift of that energy away from a perfect energy calibration (Figure 76).

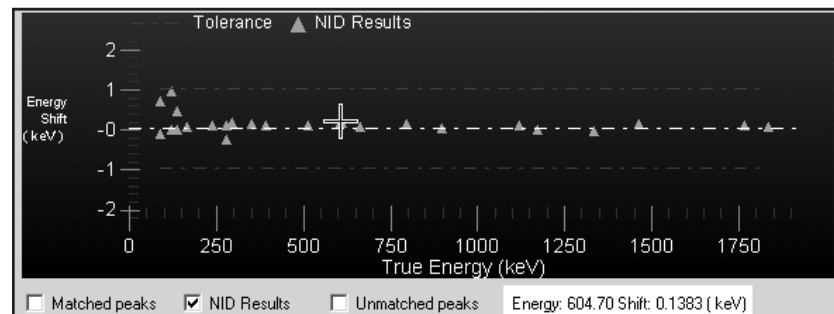


Figure 76 Peak Data Displayed

### Data Text Box

The Data Text Box shows the data similar to the Auto Gain Adjust dialog's Data Text Box (page 111). These evaluation results are concatenated with any previous results during the current session.

Key data to focus on includes the reported reliability of the results, evaluated percent gain shift and corresponding shift/FWHM fraction. Review the table of energy matches to assess whether the match results and evaluated gain shift seem logical. The shift/FWHM fraction(s) provide an indication of whether NID analysis should be successful, given the NID energy tolerance used for the analysis (when specified as FWHM).

### Fix File Gain

Click the **Fix File Gain** button (enabled only for file datasources) to execute a File Gain Adjustment (page 113) with the calculated energy calibration as the goal energy calibration.

This causes a rebinning of the spectrum to make the current energy calibration valid and should be performed only when the evaluated gain shift is deemed excessive. Alternatively, the datasource can be recalibrated outside of the Gain Evaluator (perhaps aided by Save New CAL File, below). In either case, the altered datasource would require a new analysis that reflects the changes. Detector datasources can be corrected via recalibration (see Save New CAL File) or gain adjustment via Auto Gain Adjust (page 104).

### Save New CAL File

Click the **Save New CAL File** button to save the calculated energy calibration in a new calibration (CAL) file.

This saved CAL file can then be loaded, outside of the Gain Evaluator, to establish a new, corrected energy calibration for the datasource (and perhaps other datasources known to have the same energy calibration/gain shift). Alternatively, the datasource can be rebinned to make the current energy calibration valid using Fix File Gain, above. In either case, the altered datasource would require a new analysis that reflects the changes.

### ReEvaluate

Click the **ReEvaluate** button to perform another evaluation on the current datasource using the selected energies. The results will be displayed in the plot and the Data Text Box.

Since the interactive version of the Gain Evaluator initializes with the current NID analysis results, when available, using a different or altered source of true energies requires a re-evaluation.

### Auto Gain Adjust

When the gain of a measurement system changes between the energy calibration acquisition and other acquisitions, the energy calibration becomes inaccurate for the other acquisitions. This suite of gain adjustment utilities provides the ability to assess the magnitude and importance of gain shifts for all datasources (Gain Evaluator) and to fix the gain shift for active detectors (Auto Gain Adjust) and saved files (File Gain Adjust).

The routine collects a spectrum, analyzes it for peaks, compares the energy at which each peak is observed against the “true” energy in a certificate file, then derives the actual energy calibration equation. Differences between actual and desired energy calibrations drive the hardware adjustments.

The Auto Gain Adjust and Gain Evaluator functions primarily correct and assess gain shift (errors in the slope term of the initial energy calibration). Though some error in the initial equation's other calibration terms (zero/intercept and quadratic/higher order) can be accommodated, you should ensure that these other terms are reasonably accurate to obtain the most stable, reliable results.

**The AGA Routine**

1. Acquires a spectrum for the specified preset live time.
2. Performs a peak search using the specified ASF algorithm.
3. Matches the found peak energies to the energies in the specified certificate. A weighted average gain correction factor (and possibly a zero correction) is calculated.
  - If the average gain correction factor satisfies the specified Percent Gain Shift Tolerance, adjustment is complete (specifying double convergence requires this to occur twice successively).
  - If the average gain correction factor does not satisfy the specified Percent Gain Shift Tolerance, the gain (and possibly the zero) is adjusted appropriately.
4. Clears the spectrum.
5. These steps are repeated until one of the following occurs:
  - The routine completes successfully.
  - The specified maximum number of iterations is reached.
  - An acquisition is manually aborted.

## Setting Up AGA

The Auto Gain Adjust Setup screen is used to select the parameters to be used by the routine (Figure 77).

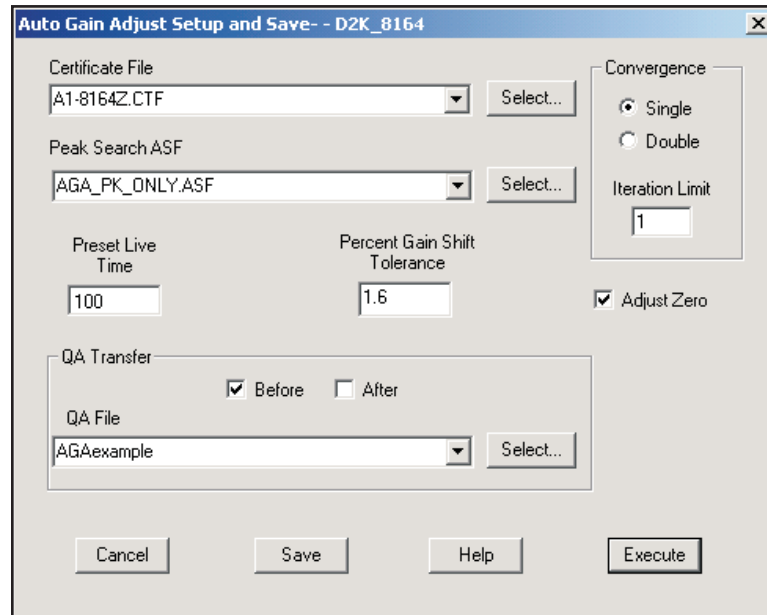


Figure 77 Auto Gain Adjust Dialog

## Certificate File

Selects the Certificate File (CTF) to be used for the gain adjustment calculations. The certificate file contains the energies and emission rates of the calibration source. If the detector datasource is efficiency corrected by the specified Peak Search ASF, the emission rate data will be used as an aid in properly matching true energies with found peaks.

Successful gain adjustment requires that the true energies listed in the specified certificate file correlate to at least half of the peaks found by the specified peak search ASF.

Successful ADC zero adjustment requires that at least one low energy (less than 1/3 that of the highest certificate energy) in the certificate file be matched with a found peak. In addition, the ADC must allow computer-controlled adjustments and its zero adjustment must have been specified during setup. Otherwise, only the gain will be adjusted.

Ideally, the certificate file should list only those energies that correspond to all of the found peaks. However, the number of input true energies must be no more than twice the number of found energies and contain energies that actually correspond to most of the found peaks.

If the number of input true energies is more than twice the number of found peak energies, peak matching and gain adjustment will fail.

The routine can't resolve more than one nuclide at the same energy in the source of true energies, so matches will not be made at any true energy that is repeated. Best results will be obtained if all of the input true energies have a relative separation of at least several FWHM. It is also desirable to have peaks that span the full range of the spectrum.

## Peak Search ASF

Selects the Analysis Sequence (ASF) file to be used for the gain adjustment calculations. For successful execution of AGA, the selected sequence must include at least a peak locate step and a peak area step, such as `Peak_sho.asf`, installed with Genie 2000.

Ensure that the peak search parameters are optimized to locate those peaks that correspond to the true energies in the specified certificate file while locating as few extraneous peaks as possible.

If the specified ASF includes an efficiency correction (which requires the detector to be efficiency calibrated to the source specified in the certificate file), the emission rate information is used with measured count rate data to help match found peaks to certificate lines. Otherwise, only the energy information is used for matching.

## Single/Double Convergence

Select either **Single** or **Double** convergence to determine whether the routine completes successfully after getting the average gain correction factor to satisfy the specified Percent Gain Shift Tolerance either once or twice, successively. Double convergence may minimize any possible overshoot or undershoot bias, but requires more iterations.

## Iteration Limit

Specify the maximum number of iterations that can be performed. If convergence is not obtained before the specified limit is reached, the algorithm will stop with an error. The typical number of iterations required to reach convergence depends on the Preset Live Time as compared to the source intensity and the Percent Gain Shift Tolerance. Reasonable settings usually result in convergence within 3 iterations, so 5 might be a typical Iteration Limit setting.

### **Preset Live Time**

Select the live time in seconds that each iteration's data acquisition is to be performed. This acquisition time should be long enough to provide adequate statistics for a successful peak search analysis.

The acquisition time may typically range from 10 seconds to several minutes, depending on the source intensity and desired Percent Gain Shift Tolerance. A typical button source in the 37 Bq (1  $\mu$ Ci) range placed at the detector will probably provide sufficient counts (depending on branching ratios) after about 30 seconds. Optimizing the Preset Live Time may initially require some experimentation.

### **Percent Gain Shift Tolerance**

The Percent Gain Shift Tolerance is the percent deviation that the average gain correction factor can deviate from unity after a successful gain adjustment.

Given sufficient acquisition time to adequately determine peak centroids, a Percent Gain Shift Tolerance of 1% or less for high resolution (HPGe) detectors and perhaps up to several percent for low resolution (NaI) detectors is usually a good starting point. Optimizing the Percent Gain Shift Tolerance in conjunction with the Preset Live Time may initially require some experimentation.

### **Adjust Zero**

Check the Adjust Zero box to cause the ADC zero to be adjusted after each iteration. The checkbox is enabled only when the ADC allows computer-controlled zero adjustments. A zero adjustment cannot be performed unless the lowest matched energy is less than 1/3 of the highest matched energy.

Note: A shift in zero tends to be much less likely than a shift in gain. Unless a zero shift is suspected, it is recommended that Adjust Zero not be specified.

### **QA Transfer Before/After**

Check the Before box to transfer data from the first iteration to the specified QA File. Check the After box to transfer data from the successfully completed iteration to the specified QA File. You may check either box or both boxes.

Specifying the Before box allows tracking the amount of pre-correction gain shift with the first iteration. Specifying the After box allows tracking any residual, post-correction gain shift with the successfully completed iteration. Specifying both allows tracking of the amount of correction actually applied.

### QA File

Enabled only if the Model S505 Quality Assurance Software is installed on your system. Use this field to Browse for the QA file to which the adjustment data is to be transferred. This file determines which CAM parameters are extracted from the datasource for archiving. For more information, please refer to the *Model S505 Quality Assurance Software User's Manual*.

### Execute

When you click the **Execute** button, you'll be told that executing this routine will overwrite your existing certificate file data with the data in the specified certificate file. When you click **OK**, the routine will start and the Auto Gain Adjust Status window (page 109) will open.

Note: The routine can usually determine which amplifier you're using. If it can't, you'll be asked to specify the amplifier type.

### Save

After executing the AGA routine, click the **Save** button to save the current parameters, both current setup parameters and any adjusted hardware settings, to the current detector's MID file.

Any adjustment already made will be retained only after saving. Canceling or closing the dialog without saving will cause hardware settings to revert to their original values.

### Cancel

If the current parameters have not yet been Saved, clicking the **Cancel** button will reset all parameters to their initial values, and close the dialog.

## Auto Gain Adjust Status

The Auto Gain Adjust Status window (Figure 78) shows you a live-time update of the gain adjustment while it's in progress. Analysis results from each iteration/acquisition are listed in order in the Data Text Box in the lower half of the window. If you would like a record of the contents of the Data Text Box (described on page 111), click the **Print Report Now** button.

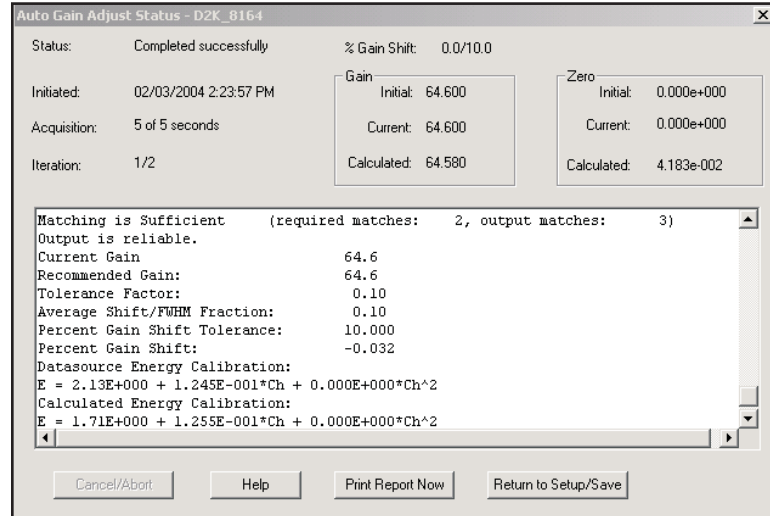


Figure 78 Auto Gain Adjust Status

### Cancel/Abort

Clicking the **Cancel/Abort** button, enabled only if a gain adjustment is in progress, stops the routine and returns to the setup dialog. Any adjustment already performed will only be retained after saving. Canceling or closing the setup dialog without saving will cause hardware settings to revert to their original values.

### Print Report Now

Only the data from the last iteration is saved to the datasource after leaving the AGA Status window; data from previous iterations is not retained.

To create a record of all iterations, click the **Print Report Now** button.

### Return to Setup/Save

Click the **Return to Setup/Save** button, enabled only when a gain adjustment is *not* in progress, to Return to the AGA setup screen, where you can Save the current settings and parameters. Adjustments are retained only when the Save button in the setup screen is clicked.

### General Information

The upper part of the AGA Status screen displays general information about the current AGA session.



**Status** – current status may be In Progress, Completed Successfully or Failed (iteration limit reached or communication failure).

**Initiated** – the date and time when the adjustment was started.

**Acquisition** – the current live time and preset.

**Iteration** – the current iteration and iteration limit.

**% Gain Shift** – the current percent gain shift and percent gain shift tolerance.

### **Gain**

**Initial** – the amplifier gain before any adjustments are made; not changed by AGA.

**Current** – the gain which was used to acquire the data displayed in the report; changes with each iteration.

**Calculated** – the gain to be used on the next iteration; changes with each iteration.

### **Zero**

**Initial** – the ADC zero before any adjustments are made; not changed by AGA.

**Current** – the ADC zero value which was used to acquire the data displayed in the report; changes with each iteration.

**Calculated** – the ADC zero value to be used on the next iteration; changes with each iteration.

## **Data Text Box**

The text box in the lower half of the AGA Status screen (Figure 78) displays the concatenated data from all iterations as tabular data and gain adjustment data.

### **Tabular Data**

- True and Found energies in the first two columns, with unmatched energies indicated by dashes.
- Matches are aligned, showing the resulting gain Correction Factor in the third column.
- The fourth column lists the ratio of the energy shift, calculated from the evaluated energy calibration versus the current energy calibration, to the local FWHM.

### **Gain Adjustment Data**

**Input** is considered sufficient if the number of supplied true lines is at least half the number of found peaks. This makes it likely that the true pattern will be dominant, reducing the chances of false matches.

**Matching** is considered sufficient when the number of peak-line matches is considered statistically significant. Statistical significance is determined when the number of successful matches compared to the number of possible matches (true energies supplied) exceeds that expected for a normal distribution within the determined number of standard deviations. The determined number of standard deviations is provided by the listed Tolerance Factor. The required threshold for statistical significance has a maximum of 0.75 to allow for up to 25% spurious input true energy lines.

**Output** is considered reliable when both the Input and Matching are sufficient. Reliability must be established before Auto Gain Adjust performs any hardware adjustments in a given iteration.

**Tolerance Factor** is the minimum number of standard deviations of the energy uncertainties required to obtain the maximum number of unambiguous peak-line matches. The higher the tolerance factor (the greater the number of standard deviations) required for the matches, the less stringent the matching process and the more likely that inappropriate matches might be made and therefore the more restrictive the criteria to consider Matching sufficient.

**Average Shift/FWHM Fraction** gives the average from all of the listed energies and indicates the required NID Tolerance (FWHM) to be able to perform a successful NID analysis. While this gives the average value for all of the found energies as a general characteristic, the individual values given for each line in the tabular data indicate which lines in particular might have trouble being properly identified via NID analysis.

**Percent Gain Shift Tolerance** is the measured Percent Gain Shift that must be attained to have a status of Completed Successfully. The measured shift must be less than the tolerance value.

**Percent Gain Shift** is calculated from the weighted average of all of the correction factors of the listed matches and indicates how much gain has shifted. Each correction factor is weighted according to respective uncertainties.

**Datasource Energy Calibration** indicates the current energy calibration equation.

**Calculated Energy Calibration** is determined using the true energies and their matched peak channels. The current energy calibration quadratic term, if any, is kept constant during the fit.

## File Gain Adjust

File Gain Adjust (Figure 79) is available only for file datasources. Executing this routine shifts the current file's spectral data so that it matches the specified "goal" energy calibration instead of the current energy calibration. File Gain Adjustment makes it easier to add, strip or compare spectra.

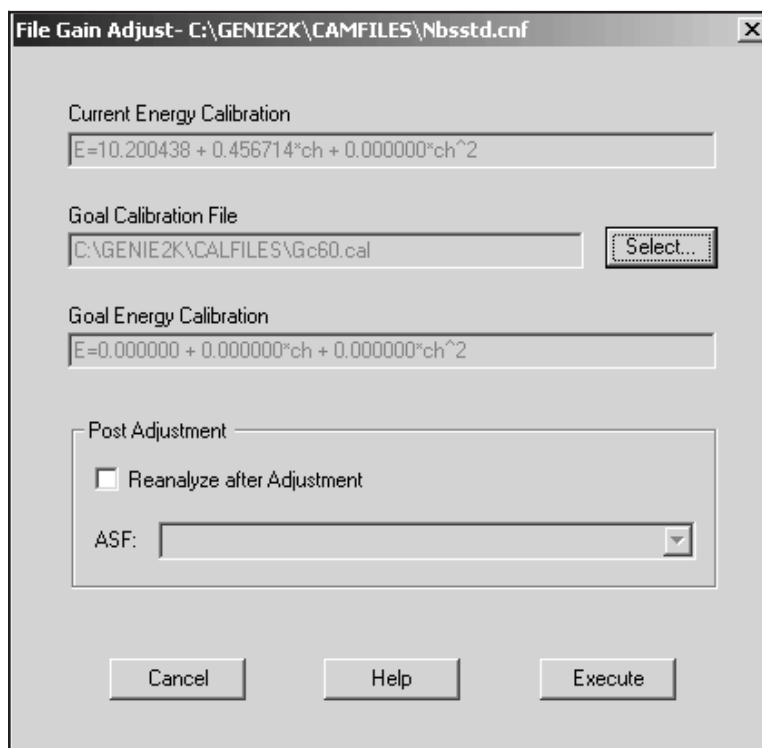


Figure 79 The File Gain Adjust Dialog

### Current Energy Calibration

This box displays the energy calibration equation of the current datasource.

### Goal Calibration File

Browse for the CNF file or CAL file containing the calibration equation which you want to match the current data source's equation to.

### Goal Energy Calibration

When the Goal Calibration File has been specified, this box will display the file's energy calibration equation.

## Reanalyze After Adjustment

Check this box to reanalyze the current datasource, using the specified ASF file, after the adjustment has changed the spectrum. Reanalysis is recommended because the current analysis results may not be accurate for the altered spectrum.

### ASF

Specify the ASF file you want to use for the Reanalyze After Adjustment selection.

## Load

Selecting **Load** displays a dialog which lets you load a previously stored calibration file (.CAL) into the current datasource (Figure 80). You can load any combination of the Energy/Shape, Efficiency or Peak-to-Total calibration data by checking the corresponding checkboxes.

The **Info** button displays a dialog box which shows descriptive information for the currently selected file, provided such information was entered when storing the calibration file.

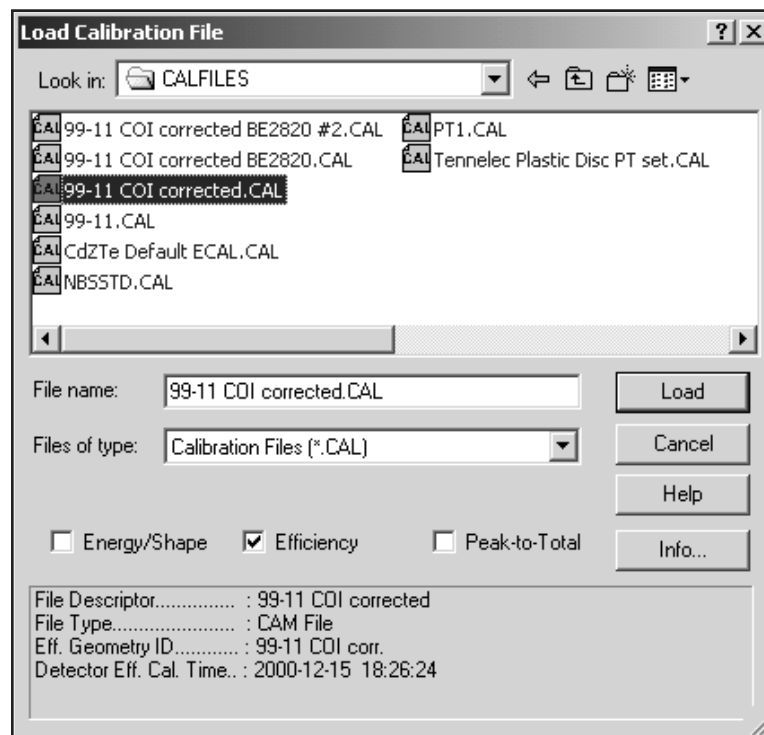


Figure 80 Load Calibration File Dialog

## Store

Selecting **Store** displays a dialog screen which prompts you to save the current calibration into a .CAL file (Figure 81). This file can later be retrieved through **Calibrate | Load**. An Efficiency Geometry ID is required and must be entered. You can enter an optional Calibration Description to be saved with the file.

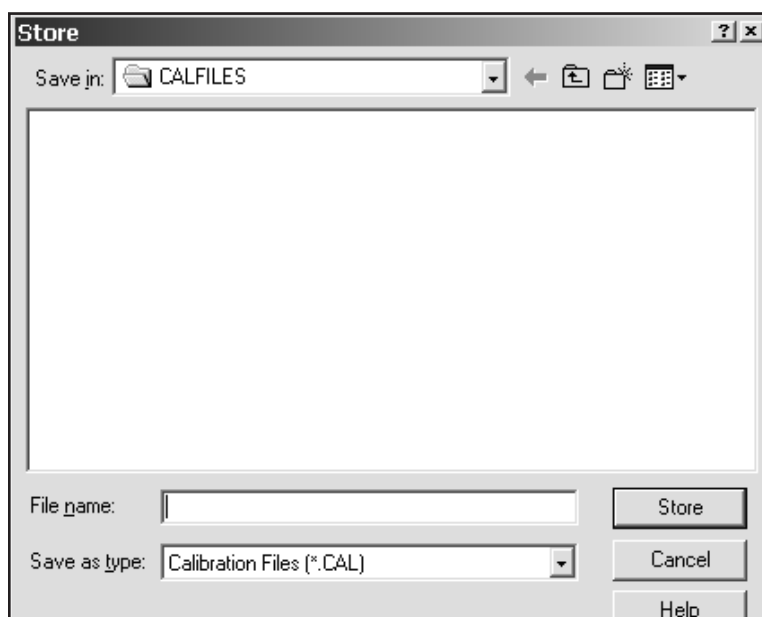


Figure 81 Store Calibration Dialog

## Display Menu

The **Display** menu contains several functions for the data display: Expand, Scale, Compare, ROIs, and Preferences.

### Expand

The expanded display, shown in Figure 82, is a split-screen display, with the whole spectrum in the lower half of the display and the expanded portion in the upper half.

The upper and lower half of the window can be resized by moving the splitter bar between the upper and lower halves. Note that Expand and Compare (page 117) can be enabled simultaneously.

### Expand On

The Expand mode can easily be turned on by clicking on the Control Panel's **Expand On** button or by pressing the F8 key.

### Expand Off

The Expand mode can easily be turned off by clicking on the Control Panel's **Expand Off** button or by pressing the F8 key.

### The Expanded Spectrum

The expanded half of the display is the data inside the rectangle in the lower half of the display.

The focus of the expanded display, the rectangle, can be moved through the spectrum by putting the mouse pointer inside the rectangle, then clicking and dragging it to a new location. The data shown in the expanded half of the display will track the moving rectangle.

### Resizing the Rectangle

The rectangle can be resized by moving the mouse pointer to any side of the rectangle so that the pointer changes to a two-headed arrow. Click the mouse button and drag the rectangle's side to a new height or width.

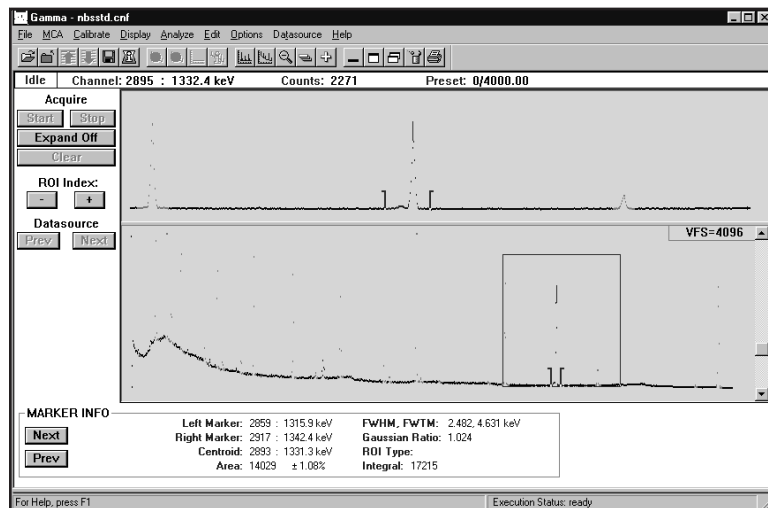


Figure 82 A Typical Expanded Display

### Rescaling With the Rectangle

Changing the height of the rectangle will automatically rescale the expanded display to accommodate the data in the rectangle. The normal (unexpanded) display's VFS will not change.

Pressing CTRL+M on the keyboard will move the markers to the sides of the rectangle in the lower half and to either end of the expanded region in the upper half.

## Scale

The Scale menu lets you select the method of setting the display's vertical full scale (auto or manual) and the scale type (linear or log). The scale type you choose can be saved as a permanent setting; see "Display Preferences | Save" on page 120.

### Manual

**Manual** lets you adjust the display's vertical full scale, either by using a mouse to change the scroll bar at the right side of the spectrum display or by pressing the keyboard's up arrow or down arrow key. Pressing the F5 key will toggle between Manual and Auto.

### Auto

Selecting **Auto** lets the program automatically set the display's vertical full scale (VFS). As the spectrum grows, the VFS is automatically reset to show all of the data. Pressing the F5 key will toggle between Auto and Manual.

Note that if you use the scroll bar while Auto is enabled, the program will change the scale mode to Manual.

### Linear

**Linear** defines the vertical scale of the display as a linear scale.

### Log

**Log** defines the vertical scale of the display as a logarithmic scale.

## Compare

The Compare command lets you turn the compare function on or off and, when on, lets you position the compare spectrum by specifying its vertical full scale (VFS).

## On

Selecting **On** displays a dialog box (Figure 83) which allows you to visually compare the current (reference) spectrum with spectral data from another open datasource. This function is not available if only one datasource is open. Note that Compare and Expand (page 115) can be enabled simultaneously.

The spectrum selected for compare will automatically be energy normalized to the reference spectrum. That is, the compare spectrum's energies will be aligned with the same energies in the reference spectrum.

Once the compare datasource is selected, you'll see the compare spectrum displayed in the currently selected compare spectrum color ("Display Preferences" on page 120) just above the reference spectrum.

If you change the reference datasource by selecting a different spectrum, the Marker Info status page information changes accordingly. Only one energy calibration (that of the reference spectrum) is meaningful for the set of compared spectra.

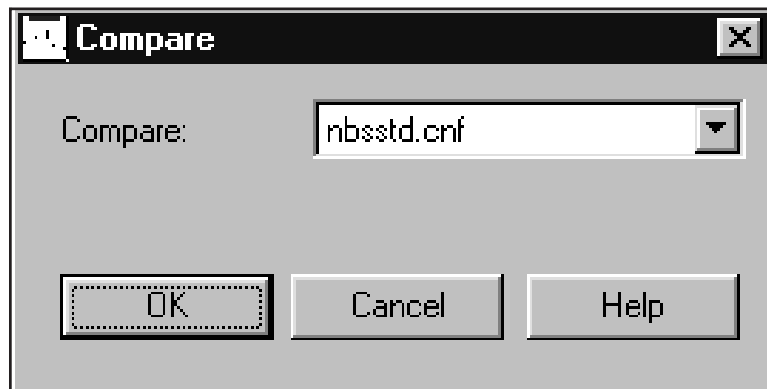


Figure 83 The Compare Dialog

### Move the Compare Spectrum

When Compare has been turned on, you can move the compare spectrum by clicking on the VFS box in the upper right-hand corner of the display window (the VFS box will change to the color of the compare spectrum) or by selecting **Display | Compare VFS**. The mouse cursor will change to a solid double-headed vertical arrow. Use the mouse or the cursor keys to position the compare spectrum anywhere within the spectral display.



When the compare spectrum is enabled, the VFS scroll bar controls the compare spectrum's scale. With the reference spectrum enabled (VFS box returned to its original color), the VFS scroll bar controls the reference spectrum's scale.

## Off

Select **Off** to disable the compare mode and return to the current display mode, normal or expanded, whichever was in effect before Compare was turned on.

## VFS

When Compare has been turned on, selecting **VFS** will let you position the compare spectrum vertically within the spectral display as described in "Move the Compare Spectrum" on page 118. It also allows independent VFS control of the compare spectrum.

## ROIs

The choices offered by the ROI menu are: Add or Delete an ROI, Clear All ROIs, and Load or Store an ROI file.

### Add ROIs

Select **Add ROIs** or press the keyboard's **INS** key to enter an ROI between the current marker positions. The ROI will be of the current ROI type as defined in the Preferences dialog (page 120).

### Auto ROI

Select **Auto ROI** or press the keyboard's **Ctrl+Ins** to add an ROI at the current cursor position. The ROI's width will be determined by the current energy and shape calibration. The left channel will be 2 FWHM and 1 Low Tail to the left of the cursor. The right channel will be 2 FWHM to the right of the cursor. The ROI will be of the current ROI type defined in the Preference's dialog (page 120).

### Delete ROIs

Select **Delete ROIs** or press the keyboard's **DEL** key to delete the ROI between the markers. The item is disabled if the markers are not positioned at the limits of a previously defined ROI.

### Clear All

Selecting the **Clear All** command clears all ROIs in the current database.

## Load

Selecting **Load** displays a dialog box which lets you select a datasource whose ROIs are to be loaded into the current datasource. These ROIs will replace the currently defined ROIs, if there are any. Select the “By Energy” check box to load ROIs by energy. This will attempt to use the energies stored in the ROI file rather than the channel values. If the check box is not selected or those values are not defined, then the ROIs will be loaded by channel value. Note that only ROI files stored using **Store ROIs** will contain energy values.

## Store

Selecting **Store** displays a dialog which lets you select the name of a datasource which will be used to store the currently defined ROIs. Note that ROI files created using **Store ROIs** will now store ROIs by energy and channel. This allows you to load ROIs using the energy values if so desired.

## Display Preferences

Select **Preferences** to reconfigure the display with your own settings (Figure 84).

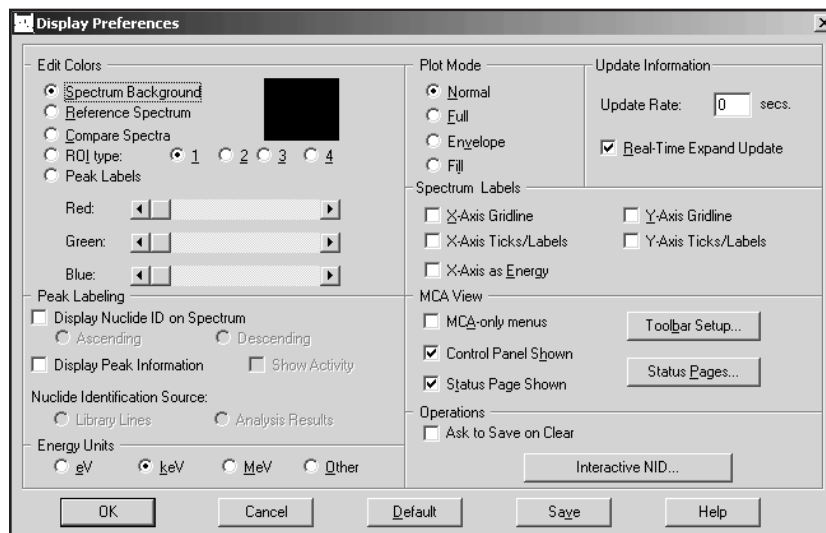


Figure 84 Display Preferences Dialog

## Save

You can **Save** these preferences so that your display will always be set the way you want it to be. In addition to the settings shown on this screen, selecting Save will save the display’s Scale Type (page 117), the chosen Status Pages (page 126), and the Report Window’s size (page 210).

**OK**

Selecting **OK** will use the settings only during the current session; they will *not* be saved for future use.

**Default**

The **Default** button resets all parameters to the factory default state.

**Edit Colors**

You can change the displayed colors for the:

- Spectrum background
- Reference Spectrum
- Compare Spectra
- ROI type
- Peak Labels

**ROI Type**

Selecting an ROI type by number allows you to select both the color of each type and the type itself. For instance, selecting type 3 means that all of the ROIs you enter from now on will be known as type 3. You may use any combination of the four types and colors for ROIs which you add to the spectrum.

Note that the Peak Area Analysis algorithm sets regions around the peaks when it is run. If you selected “Show ROIs in MCA View” in the algorithm’s dialog box, these ROIs will replace the currently displayed ROIs. The type and color of each of these ROIs depends on the Peak Area Analysis algorithm used. “Peak Area” on page 146 discusses the Peak Area routines and describes how they use ROI colors.

**Peak Labeling**

You can add two kinds of peak information to the spectral display:

- The **Nuclide ID** labels for identified ROIs are derived from the chosen Nuclide Identification Source (page 123).
- The **Peak Information** bubble, which can be seen only when the spectrum cursor is in an ROI.

**Label Color**

In Edit Colors, select Peak Labels to assign a color to the Nuclide ID label’s text and the Peak Information bubble’s text.

### Display Nuclide ID on Spectrum

Check the Display Nuclide ID on Spectrum checkbox to add a Nuclide ID label above every identified peak. Multiple labels will be attached to a peak if more than one nuclide can be associated with that peak.

Note: When data acquisition is active, the label will appear only at the peak cursor.

Figure 85 shows Nuclide ID labels on the peaks and Peak Information data for the second  $^{60}\text{Co}$  peak in an NBS Standard spectrum.

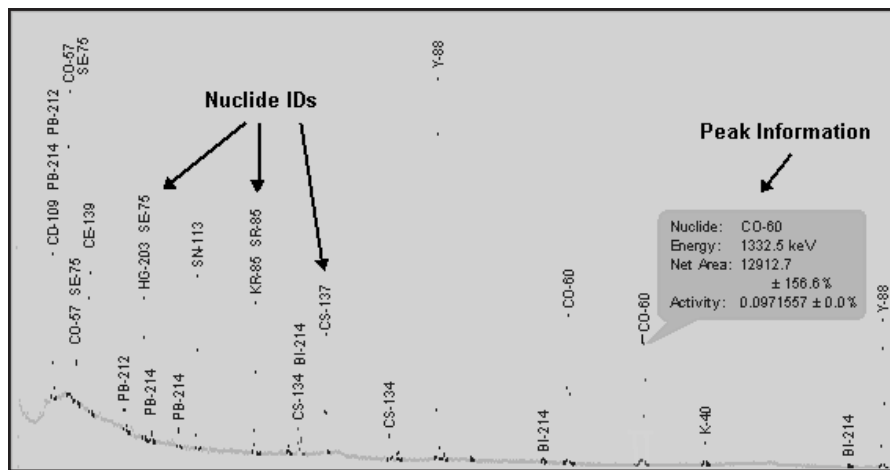


Figure 85 Nuclide IDs and  $^{60}\text{Co}$  Peak Information

#### Ascending

Choose **Ascending** to show Nuclide ID labels with their text oriented bottom-to-top.

#### Descending

Choose **Descending** to show Nuclide ID labels with their text oriented top-to-bottom.

### Display Peak Information

When Display Peak Information is checked, moving the mouse cursor over an identified peak will display the peak's Nuclide ID, Energy, Net Area with percent error and Activity (optional) in a bubble (Figure 85). If the Show Activity checkbox (below) is checked, the peak's activity will also be displayed.

- The Energy Units (page 123) displayed in the bubble are those specified for the entire system.

- The activity units displayed in the bubble are chosen in Interactive NID (page 129) in the Display Preferences dialog. The activity value will be correctly displayed for the selected unit but the unit itself is not displayed.

The two Nuclide Identification Source radio buttons are enabled only if one of the Peak Labeling checkboxes is checked.

### Library Lines

Choose the Library Lines button to display peak bubble information from the Nuclide Library chosen in Interactive NID setup (page 129). When you use Library Lines, the bubble's Activity values will be estimated.

### Analysis Results

Choose the Analysis Results button to display the Activity from the current NID results for this datasource.

### Show Activity

Check Show Activity to add activity data with percent error to the Peak Information bubble (Figure 85). This checkbox is enabled only if Display Peak Information is checked.

## Energy Units

Select the **Energy Units** to be used for reporting energy in the display. Select Other to use the calibration units and conversion factor stored in the current datasource.

## Plot Mode

**Normal** shows a maximum of 1024 data points. For example, in a 4K spectrum, the plot routine considers groups of four channels at a time and displays the channel in each group which has the highest number of counts. Note that for spectra with more than 1024 channels, selecting Full will slow down the display update rate.

- **Full** shows a data point for every channel in the spectrum being viewed.
- **Envelope** shows the normal plot with the data points connected.
- **Fill** shows the envelope plot with a color fill of the data.

## Update Information

The **Update Rate** can be set for the number of seconds between screen updates of spectral data during data acquisition. The range is 0 (as quickly as possible) to 60 seconds, with the actual rate affected by how busy the processor is at the end of any given update interval. A value of 3 to 5 is usually best, allowing an operator's key presses or mouse movements to be serviced promptly.

### **Real-Time Expand Update**

If the **Real-Time Expand Update** checkbox is selected, the expand window will refresh as the expand rectangle is moved in the main spectral display. If the box is not checked the expand window does not update until the mouse movement is complete.

### **Spectrum Labels**

These selections let you add x- and y-axis gridlines to the spectral display and tickmarks to the x- and y-axes of the display.

#### **X-Axis Ticks/Labels**

Selecting **X-Axis Ticks/Labels** creates X-Axis labels on the spectrum display. These may be displayed in terms of Channel or Energy. See **X-Axis as Energy**.

#### **X-Axis Gridline**

Selecting **X-Axis Gridline** creates X-Axis gridlines on the spectrum display.

#### **Y-Axis Ticks/Labels**

Selecting **Y-Axis Ticks/Labels** creates Y-Axis labels on the spectrum display.

#### **Y-Axis Gridline**

Selecting **Y-Axis Gridline** creates Y-Axis gridlines on the spectrum display.

#### **X-Axis as Energy**

Selecting **X-Axis as Energy** displays X-Axis labels in terms of energy. If this is not selected, the X-Axis will be displayed in terms of channel.

### **MCA View**

The MCA View selections let you modify the appearance of the application's interface and select the data it displays.

#### **MCA-Only Menus**

Select the **MCA-only menus** checkbox to remove the Analyze menu from the application's menu bar and the Efficiency items from the Calibrate menu.

#### **Control Panel Shown**

Removing the check from the **Control Panel** checkbox will remove the Control Panel from the display, leaving more room for the spectrum

## Toolbar Setup

The Toolbar Setup dialog screen (Figure 86) allows you to tailor the display of the Acquisition and Analysis toolbars. The dialog is divided into three panes: Toolbars, Commands, and Customize Buttons.

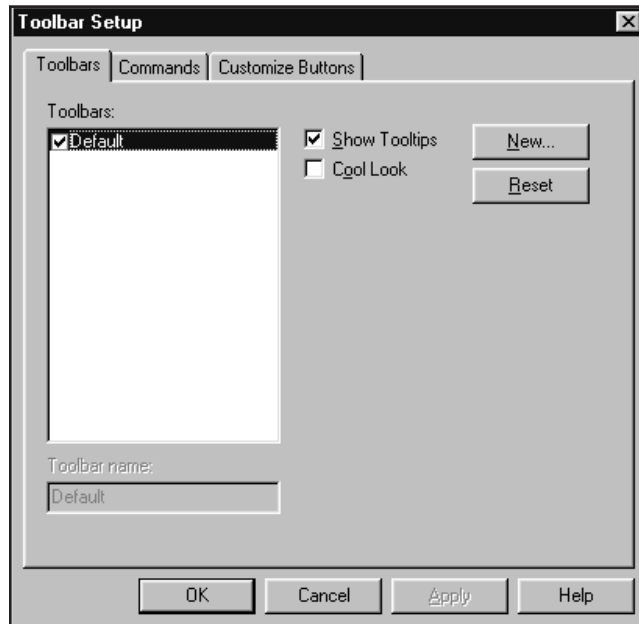


Figure 86 Toolbar Setup Dialog

The Toolbars pane allows you to create, rename, and delete toolbars:

- To create a new toolbar, select the **New** button. This will prompt you to input a name for the toolbar. The new toolbar will initially be empty.
- To rename a toolbar, highlight it in the list and edit the name in the edit box below the list.
- To delete a toolbar, highlight it in the list and select the **Delete** button.

You may also enable/disable the Tooltips and Cool Look features of the toolbar.

The Commands pane allows you to customize the command buttons that will appear on your toolbars. The list on the left contains a variety of categories of commands organized in a similar fashion as the main menu. Selecting a category will change the command buttons that appear in the Button area of the pane. Selecting a command button will show that button's description in the Description field. To modify the toolbars:

- To add a command button to a tool bar, select the button you want to add from the Buttons area of the pane. Then, hold the left mouse button down, drag the command button to the exact place on your toolbar you wish to place it. Then release the left mouse button.
- To remove a command button from a toolbar, select the button from the toolbar and drag it off the toolbar. Then release the left mouse button.
- To add a separator between command buttons on your toolbar, select the command button you wish to have on the right of the separator and drag it slightly to the right.

The Customize Button pane allows you to associate certain command buttons with Analysis Sequences and Executable programs. There are 10 special "Analysis" buttons and 10 special "Executable" buttons. These can be added to any toolbar from the Commands pane. Then, using the Customize Buttons pane, select the appropriate item from a list box and:

- To change an Analysis Sequence button select the sequence from the drop-down Analysis Sequence combo box.
- To change an Executable button edit the command line in the Executable edit field. To browse for a specific program use the Browse button.

Select **OK** from the dialog will confirm all changes. **Cancel** will discard all changes. The settings only be permanently saved if the **Save** button is selected in Display Preferences. Otherwise the toolbars will return to the last saved state upon the next invocation of the Acquisition and Analysis window.

### Status Page Shown

Unchecking the Status Page Shown checkbox removes the Status Page from the display, leaving more room for the spectrum

Checking the Status Page Shown checkbox lets you click the **Status Pages** button to choose which pages will be displayed (Figure 87).



The Status Pages you choose can be saved as a permanent setting; see “Display Preferences | Save” on page 120.

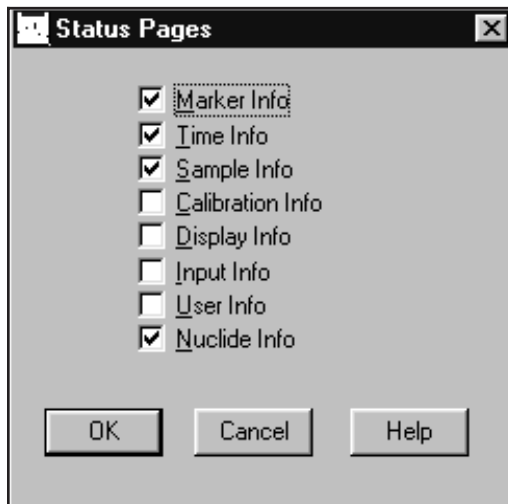


Figure 87 Selecting the Status Pages

Note that some of the data shown on the Status Pages is the result of a rough calculation for the region between the markers. This means that this displayed data may not agree with the data you see in a report generated by your analysis application.

**Marker Info**

The **Marker Info** status page includes data related to the current Region of Interest (ROI): left and right marker channel and energy, centroid channel and energy, area and percent error, FWHM and FWTM, Gaussian ratio, ROI type, and integral.

The calculated values centroid, area, percent error, FWHM, FWTM, and Gaussian ratio are computed only when the size of the current ROI meets the following criteria:

Number of Spectral Data Channels	Size of ROI
256	≤ 256
512–2048	≤ 512
> 2048	≤ 1024

### **Time Info**

The **Time Info** status page includes: acquire start time, dead time percentage, computational preset region, elapsed and preset values for the live time, real time, and computational presets.

### **Sample Info**

The **Sample Info** status page includes sample-related information: Title, ID, sample type, quantity and units, sample geometry, geometry id, and buildup type.

### **Calibration Info**

The **Calibration Info** status page includes energy and shape calibration information: energy equation, FWHM equation, low tail equation and efficiency/error at cursor position.

### **Display Info**

The **Display Info** status page includes data related to the current display window and the current ROI defined by the markers: the display window's start and end channels and their energies, and the display VFS. The current ROI's width, net cps, and total cps are also shown.

If Expand is on, the display window data is for the expanded window. If Compare is on and the compare spectrum is currently selected, the data is for the compare spectrum.

### **Input Info**

The **Input Info** status page includes data related to the configuration of the currently open input: number of channels, acquisition mode, and the type of MCA, Amp, ADC, and HVPS.

### **User Info**

The **User Info** status page includes six extra CAM parameters which can be used for special purposes: CAM\_T\_DISSTR1 through CAM\_T\_DISSTR6. If none of these CAM parameters have been defined, this screen will be blank.

### **Nuclide Info**

The **Nuclide Info** status page includes estimated nuclide information for the current cursor channel: Nuclide, Energy, Half-life and Percent Yield. If the cursor is within an ROI then the FWHM, Area, and estimated Activity is also displayed.

## **Operations**

If **Ask to Save on Clear** is enabled, you'll be asked to save changes when clearing a detector's spectrum. If this option is disabled then the clear will be done unconditionally.

## Interactive NID

The Interactive NID Setup dialog (Figure 88) lets you choose the nuclide library to be used for the Nuclide Identification Source (page 123), as well as setting the tolerance for searching that library, and the activity units to be used in the Peak Information window.

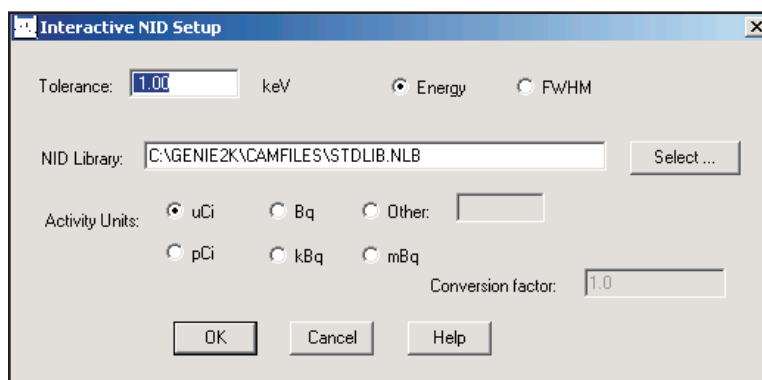


Figure 88 The Interactive NID Setup

### Tolerance

This is used to specify the value to be used in deciding if an energy line in the given library matches the peak being searched for.

### Energy/FWHM

The energy units for the Peak Match Tolerance value. Choose **Energy** for a fixed tolerance or **FWHM** for a variable tolerance.

### Peak Match

Enter the Tolerance value for peak matching. If you choose **Energy Units**, enter the value in keV. If you choose variable, the tolerance becomes the number entered multiplied by the FWHM calculated at the energy of the peak.

### NID Library

Select the default Nuclide Library to be used when Library Lines is used for the Nuclide Identification Source (page 123).

### Activity Units

The selected **Activity Unit** determines the activity units used for reporting in the Peak Information window. When you choose one of the standard activity units ( $\mu\text{Ci}$ ,  $\text{pCi}$ ,  $\text{Bq}$ ,  $\text{kBq}$ ,  $\text{mBq}$ ), the correct Conversion Factor, referenced to 1  $\mu\text{Ci}$ , is automatically supplied.

If none of the standard units is acceptable, select **Other**, then type a label in the text box and enter the unit's **Conversion Factor**.

## Analyze Menu

The **Analyze** menu lets you select and execute or abort (stop) a single analysis phase, such as "Acquisition", or a predefined sequence of analysis phases. A phase includes all of the parameters the needed for its successful execution. A sequence is a list of phases, including the algorithms for a given phase, processing parameters required for each algorithm, and so forth, needed to perform a given set of analyses and generate reports.

For information on creating or editing a sequence, refer to "Analysis Sequence" on page 198.

## Execute Sequence

Select **Analyze | Execute Sequence** to see a menu of all currently defined analysis sequences on your system. Figure 89 shows the Execute Sequence Menu. Selecting one of the sequences will execute it.

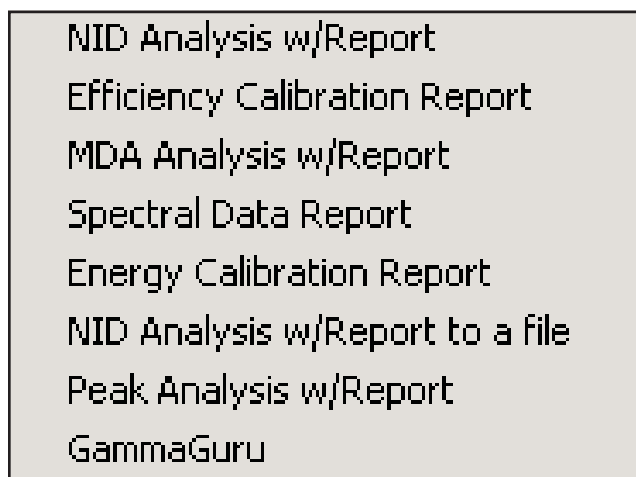


Figure 89 The Execute Sequence Menu

## Abort Sequence

Selecting **Abort Sequence** allows you to abort execution of the current sequence. Note that the sequence may not stop immediately; it will continue until the analysis step already in progress has finished.

## Analysis Phase Selection

The Analyze menu lists the analysis phases for the S500 Basic Spectroscopy Software and those associated with the Genie 2000 options installed on your system. Each item in the menu lets you select an algorithm to associate with the selected phase, then assign and save the algorithm's parameters, execute the algorithm, or do both.

The following sections discuss each of the phases, their algorithms and the required parameters. For more detailed information on the algorithms, refer to the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

### OK

Selecting **OK** in the algorithm's setup screen saves the setup parameters you selected, but does not execute the algorithm.

### Execute

Selecting **Execute** starts the algorithm using the defined parameters.

## Acquisition

The Acquire Setup dialog box (Figure 90) allows you to define default acquisition parameters to be used when starting data collection on hardware datasources.

## Time Preset

You can set the **Live Time** or **Real Time** preset for the current hardware datasource in seconds, minutes or hours. Live Time and Real time are mutually exclusive, but either time preset can be combined with any one computational preset (see next subsection).

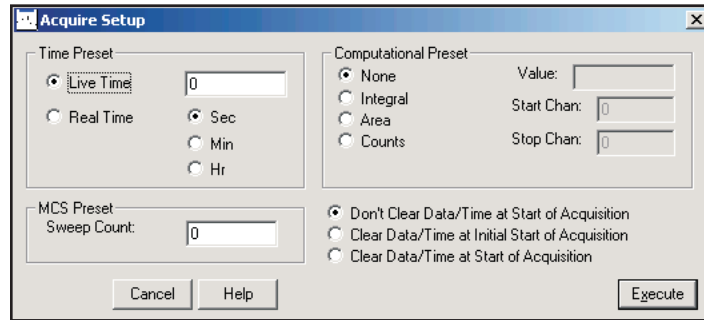


Figure 90 The Acquire Setup

## Computational Presets

These presets stop acquisition when a computed value you specify is reached. When a computational preset is defined, the chosen time preset is still active. The acquire stop command is issued by the preset that is reached first. If you want to use a computational preset alone, set the time preset to a very large value, such as 9000 hours. This insures that the computational preset will be reached first.

Each of the three computational presets is mutually exclusive, but any one of them can be combined with either time preset.

- **None** disables computational presets and uses only a time preset.
- **Integral** is a preset for the integral of any one ROI. The integral's Value and the ROI's Start and Stop Channels must be specified.
- **Area** is a preset for the area of any one ROI. The area's Value and the ROI's Start and Stop Channels must be specified.
- **Counts** is a preset for the total counts (Value) in any one channel within the range specified by the Start Channel and Stop Channel.

### MCS Preset

**Sweep Count** selects the number of sweeps to be made during multichannel scaling data acquisition. Both Time and MCS Presets can be set here, but which is used depends on the Mode Setup of the hardware input you acquire data from.

### Clear Data/Time

Select the Don't Clear Data/Time at Start of Acquisition button to leave the data and time unchanged when acquisition starts in the current session.

Select the Clear Data/Time at Start of Acquisition button to clear data and time at every start of acquisition in the current session.

Select the Clear Data/Time at Initial Start of Acquisition button to automatically clear data and time at the first start of acquisition in the current session.

## Peak Locate

The Peak Locate phase contains the algorithms which locate the peaks of interest in the spectrum. In addition to the usual library locate parameters, there are several occasionally useful "More Peak Locate Parameters" starting on page 137.

### Unidentified Second Difference

The generalized second difference method (Figure 91) locates all peaks in the **Search Region** that are significantly above the continuum, as described in the "Generalized Second Difference Method" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

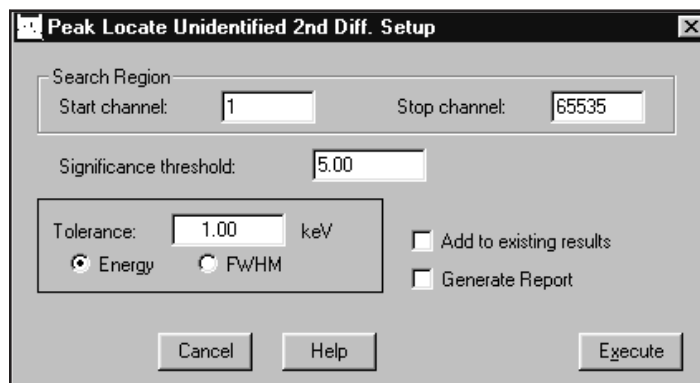


Figure 91 Second Difference Peak Locate Setup

### Search Region

The search will be performed on the region between the Start and Stop Channels.

### Significance Threshold

The second difference algorithm automatically calculates a significance value for each peak it considers. The larger the peak with respect to the continuum that it rests on, the larger the significance value.

Only peaks that exceed the **Significance Threshold** will be accepted as valid. For less sensitivity, for example to pick out just the large peaks for calibration, the Significance Threshold can be raised. For more sensitivity, the significance limit may be lowered. However, experience has shown that threshold values below 3.00 produce increasing numbers of false peaks.

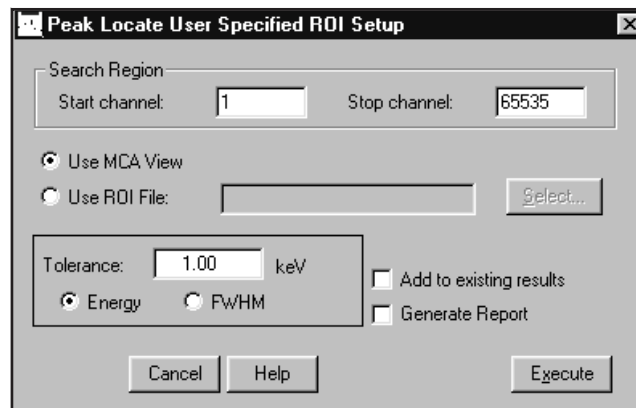


Figure 92 The User Specified Peak Locate Setup

### Add to Existing Results and Tolerance

If the **Add to existing results** box is checked, each found peak will be compared with peaks listed in the peak results table. A found peak that is closer to an existing peak than the specified **Tolerance** value (either fixed Energy or variable FWHM) is assumed to be the listed peak and will be discarded. A found peak that is farther away from an existing peak than the specified tolerance is considered to be a separate peak and will be merged with the existing peak results table. If the “Add to existing results” box is *not* checked, the current peak results table will be replaced by this search.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.



## User Specified

This method, using the parameters in Figure 92, calculates the centroid for each peak displayed in the Search Region, as described in the “User Specified Peak Locate” section of the “Algorithms” chapter in the *Genie 2000 Customization Tools Manual*.

### Search Region

The search will be performed on the region between the Start and Stop Channels.

### Use MCA View

Select this button to perform the Peak Locate using the ROIs displayed in the spectral display.

### Use ROI File

Select this button to use an ROI file for Peak Locate. Enter the name of the file in the Use ROI File text box or click on **Select** and choose a file from the file open dialog box.

### Add to Existing Results and Tolerance

If the **Add to existing results** box is checked, each found peak will be compared with peaks listed in the peak results table. A found peak that is closer to an existing peak than the specified **Tolerance** value (either fixed Energy or variable FWHM) is assumed to be the listed peak and will be discarded. A found peak that is farther away from an existing peak than the specified tolerance is considered to be a separate peak and will be merged with the existing peak results table. If the “Add to existing results” box is *not* checked, the current peak results table will be replaced by this search.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.

## Library Locate (Gamma-M)

The Gamma-M Library Peak Locate setup screen is shown in Figure 93. The analysis will include the library energies included within the Search Region or that are equal to either region limit. The current energy calibration will be used to determine whether a library peak falls within the Search Region.

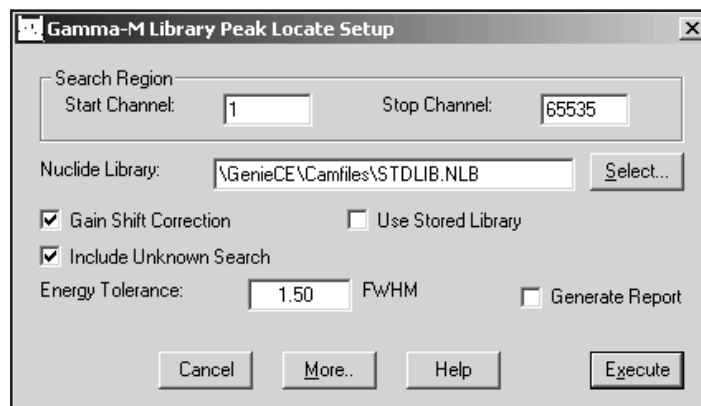


Figure 93 The Gamma-M Library Locate Setup

### Search Region

The search will be performed on the region between the Start and Stop Channels.

### Nuclide Library

The library (NLB) file shown in the Nuclide Library text box is used in this phase's calculations and is stored in the current datasource when the phase is Executed. This lets you use a fixed reference for future calculations. See also Use Stored Library, below.

To use a different library, click Select before Executing the phase and choose a library file. When the phase is Executed, the selected library will replace the library in the current datasource.

### Use Stored Library

If the Use Stored Library checkbox is checked, the library stored in the current datasource will be used when the phase is Executed. If it is *not* checked, the Selected Nuclide Library will be used when the phase is Executed and will replace the library in the current datasource.

### Gain Shift Correction

Gain Shift Correction is a technique for moving the peaks so that their centroids are correctly placed. It is normally enabled (checked) because NaI peaks, in particular, tend to shift from their original calibrated positions as a function of temperature.

### Include Unknown Search

Peaks found by the Unknown Search algorithm that are farther away from existing library locations than the Energy Tolerance are treated as separate peaks. Peaks that are closer to the existing library locations than the Energy Tolerance are assumed to be the library peaks already assigned. The Library Locate will be followed by the Unknown Locate, which is governed by the Search Region.

The Energy Tolerance value, which is accessible only if the Include Unknown Search box is checked, specifies the Energy Tolerance as a full width at half maximum (FWHM) multiplier. This determines whether a peak found during the Unknown Locate is one of the peaks already assigned during the Library Locate.

### More Peak Locate Parameters

Selecting the **More** button brings up the screen in Figure 94, which lets you set several other parameters affecting Gamma-M Library Peak Locate. The description of each parameter lists the default value for both Ge and NaI detectors.

Section	Parameter	Value
Window Settings	Area	2.5
	Interference	3
	Overlap	0.3
Gain Correction	Max Nbr. Gain Passes	10
	Reject Gain Factor	0.0001
Reject Factors	Variance	0
	Background	0
	Nbr. Bkgnd Terms	2
Reject MDA	Sigma	2.5
	Constant	3

Figure 94 The Peak Locate “More” Setup Showing Ge Detector Defaults

### Window Settings

**Area** specifies the FWHM multiplier which establishes the left and right ROI limits around the peaks for a fit to determine whether the peak is present in the spectrum. Default: 2.5 for Ge; 1 for NaI.

**Interference** specifies the FWHM multiplier which establishes the limit beyond which two adjacent peaks are no longer considered to interfere with each other when determining whether a peak is present. Default: 3 for Ge; 1.5 for NaI.

**Overlap** specifies the FWHM multiplier which establishes the limit below which two adjacent peaks are considered as one; that is, one of the two peaks is deleted. Default: 0.3 for both Ge and NaI.

### Reject Factors

**Variance** specifies the peak height variance rejection factor. Only peaks whose height is larger than this factor times the uncertainty of the height (at 1 sigma) will be accepted as valid peaks. Default: 0 for Ge; 1 for NaI.

**Background** specifies the peak rejection factor based on the height of the background. Only peaks whose square of the height is larger than this factor times the height of the background will be accepted as valid peaks. Default: 0 for Ge; 1 for NaI.

**Number of Background Terms** defines whether the fits are to be made with an added constant or linear continuum. 0 means that no additional continuum term will be used, 1 means that only a constant continuum will be used, and 2 means that a linear continuum will be used. Default: 2 for both Ge and NaI.

### Gain Correction

The Gain Shift Correction check box on the Gamma-M Library Peak Locate Setup screen must be checked for these parameters to be used in the calculations.

**Maximum Number of Gain Passes** is used to specify the maximum number of iterations allowed for peak fitting with automatic gain correction. Default: 10 for both.

**Reject Gain Factor** specifies the convergence criterion. When consecutive iterations produce a change in the chi-square less than this value, convergence has been achieved. Default: 0.0001 for Ge; 0.005 for NaI.

### Reject MDA

**Sigma** specifies the multiplier of the MDA equation used to accept or reject a library peak in the spectrum. Default: 2.5 for both Ge and NaI.

**Constant** specifies the constant term of the MDA equation used to accept or reject a library peak in the spectrum. Default: 3 for both Ge and NaI.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

## Library Locate (Simple)

The Simple Library Peak Locate setup screen is shown in Figure 95. The analysis will include the library energies included within the Search Region or that are equal to either region limit. The current energy calibration will be used to determine whether a library peak falls within the Search Region.

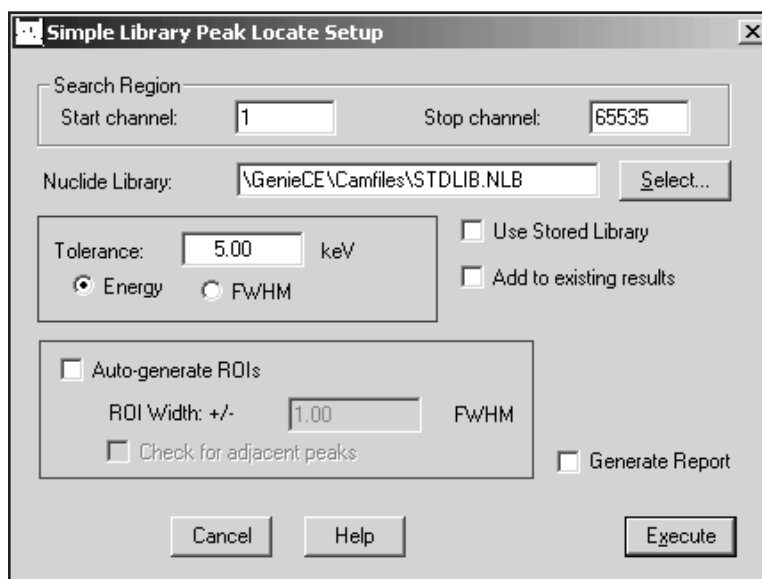


Figure 95 The Simple Library Locate Setup

### Search Region

The search will be performed on the region between the Start and Stop Channels.

### Nuclide Library

The library (NLB) file shown in the Nuclide Library text box is used in this phase's calculations and is stored in the current datasource when the phase is Executed. This lets you use a fixed reference for future calculations. See also Use Stored Library, below.

To use a different library, click Select before Executing the phase and choose a library file. When the phase is Executed, the selected library will replace the library in the current datasource.

### **Use Stored Library**

If the Use Stored Library checkbox is checked, the library stored in the current datasource will be used when the phase is Executed. If it is *not* checked, the Selected Nuclide Library will be used when the phase is Executed and will replace the library in the current datasource.

### **Add to Existing Results and Tolerance**

If the “Add to existing results” box is checked, peaks outside the specified Tolerance (either fixed Energy or variable FWHM) of a peak in the datasource’s peak results table will be added to the table. Peaks within the Tolerance of an existing peak will not be added.

If the “Add to existing results” box is *not* checked, the current peak results table will be replaced by this search.

### **Generate Report**

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.

### **Auto Generate ROIs**

If this option is selected, then the peak locate engine will automatically generate ROIs based on the FWHM calibration. The user can also specify a multiplier to be applied to the ROI width. In addition, an option for checking for adjacent peaks can be enabled – this will flag any peak ROI that may be affected by an adjacent peak.

## VMS Standard Peak Search

The VMS Standard Peak Search (Figure 96) is taken from the Genie-VMS application as an optional Peak Locate/Analysis engine. It locates all peaks in the search region whose significance is above the Peak Search Sensitivity threshold. A second difference method locates the peaks above the sensitivity threshold, which are then fitted using a pure Gaussian fit routine.

The screenshot shows a dialog box titled "VMS Standard Peak Search Parameters". It contains the following fields and options:

- Peak Search Start Channel: 1
- Peak Search End Channel: 4096
- Peak Search Sensitivity: 5.00
- Gaussian Sensitivity: 10.00
- Maximum Number of Iterations: 10
- FWHM Based Rejection
- FWHM Rejection Ratio: 1.00
- Fit Singlets
- Show Regions of Interest
- Critical Level Test
- Use Fixed FWHM
- Generate Report

Buttons at the bottom: Cancel, Help, Execute.

Figure 96 VMS Standard Peak Search Setup

### Peak Search Start / End Channel

The peak search will be performed on the region between the Peak Search Start and End Channels.

### Peak Search Sensitivity

The Sensitivity Threshold (i.e., the number of standard deviations above background a feature must be to be considered a peak) controls the sensitivity of the peak locating algorithm. For example, if the sensitivity is set to 5, and the average background in a region is 10 000 counts, any feature with a height smaller than about 500 counts above background will be ignored. (One standard deviation of 10 000 is 100.) Typically, the sensitivity should be between 3 and 10.

### Gaussian Sensitivity

The Gaussian Sensitivity determines how near to a pure Gaussian shape peaks should be. Low settings (5-10) cause the peak fitting algorithm to expect cleanly shaped peaks. Higher settings (15-20) provide the algorithm more latitude in working with poorly shaped peaks. If multiplets are not being found where they should be, the value of the Gaussian Sensitivity should be decreased.

### Maximum Number of Iterations

This value is the maximum number of iterations the peak search will perform when fitting a Gaussian function to a multiplet. The minimum value is 0; a reasonable value is 10.

### FWHM Based Rejection

If the FWHM Based Rejection checkbox is enabled, the standard peak search function will reject singlet peaks whose (measured FWHM) / (expected FWHM) ratio is less than the **FWHM Rejection Ratio** setting. This option is very useful if you typically analyze spectra at low sensitivities (e.g. less than 3).

### FWHM Rejection Ratio

This value specifies the minimum valid (measured FWHM) / (expected FWHM) ratio that will be accepted for a singlet peak. If the ratio for a peak is less than this value the peak will be rejected. This parameter is used only if the **FWHM Based Rejection** function is enabled. Minimum value is 0; maximum value is 1.0.

### Fit Singlets

Fit Singlets controls singlet peak analysis. If the checkbox is enabled, singlet peaks are fitted to a single peak Gaussian function, otherwise singlet values are calculated by the total peak area method.

### Show Regions of Interest

If the Show Regions of Interest checkbox is checked, the ROIs calculated during the area analysis are copied to the “display ROIs” section of the datasource, thus causing the ROIs to appear in the MCA View/Control window.

The ROI color conventions are:

- Color 1: Singlet peaks
- Color 2: Multiplet peaks
- Color 3: Not used
- Color 4: Not used

Any previously displayed ROIs are cleared before generating the new ROI list.

### Critical Level Test

If this checkbox is enabled, any corrected peak that has a net area less than  $k$  times the uncertainty of the background will be discarded, where  $k$  is the Confidence Factor set in either the Nuclide Identification setup (page 163) or the Detection Limits setup (page 182).



### Use Fixed FWHM

If the Use Fixed FWHM checkbox is enabled, the FWHM of peaks in a region will be held fixed to their calibration value. Otherwise they will be allowed to freely vary during the fitting process. Note that this parameter only applies to singlets if the **Fit Singlets** checkbox is enabled, or when analyzing multiplets.

### Generate Report

When this checkbox is enabled, a predefined report is generated in the Report Window (page 210) upon successful completion of the analysis phase execution.

## Library Correlation NID

The Library Correlation NID algorithm<sup>2</sup> (Figure 97) needs a spectrum with relatively accurate energy, shape and efficiency calibrations to identify nuclides. If the spectral area is statistically significant and the distribution of the area is sufficiently similar to the expected shape as defined by user-specified parameters, the nuclide is identified.

The screenshot shows the 'Correlation NID Peak Locate Setup' dialog box with the following settings:

- NID Library: C:\GENIE2K\CAMFILES\STD.LIB.NLB
- Shape Correlation Threshold (0-1): 0.8
- Sensitivity Threshold (0-100): 5
- Calibration Compensation:
  - % Gain Shift Tolerance: 5
  - % Shape Error Tolerance: 30
  - Shielding Tolerance (cm Fe): 1
- Background Compensation:
  - Use background compensation:
  - Background: [Empty field]
- Tolerance: 1.00 keV (Energy selected)
- Retain Calibration Compensations:
- Add to existing results:
- Generate Report:

Figure 97 Library Correlation NID Setup

2. Patent pending.

### **NID Library**

The NID Library NLB file you select should include the nuclides likely to be present in the spectrum, especially those nuclides of interest and any that might be sources of interference.

The ANSI\_GammaGuru.NLB library, included with Genie 2000, is recommended for security applications, with nuclides defined per ANSI standard N42.34 (Performance Criteria for Hand-held Instruments for the Detection and Identification of Radionuclides).

### **Shape Correlation Threshold (0-1)**

The Shape Correlation Threshold is a value between 0.00 and 1.00 that determines the required correlation coefficient value to become an identified nuclide. A value of 0.00 indicates no correlation and a value of 1.00 indicates a perfect correlation. The recommended setting is 0.80. Lower values are less selective and higher values are more selective. After running this analysis phase, the listed output ID Confidence represents the calculated correlation for each identified nuclide.

When all of the candidate nuclides have been fitted and all of the other candidate nuclides have been subtracted from the peak spectrum, each candidate nuclide is tested for identification. Identification testing includes verifying the post-fit Critical Ratio Limit is exceeded and evaluating whether the shape of the attributed spectrum area sufficiently matches the expected shape, as defined by the Analysis Library and calibrations. The shape testing is done by calculating the normalized cross-correlation between the attributed spectrum area and the expected theoretical nuclide shape.

### **Sensitivity Threshold (%)**

The Sensitivity Threshold value determines the significance of a given nuclide (percent of the peak spectrum) required for that peak to become either a candidate or identified nuclide. Only those nuclides that have optimized significances at or above the specified Sensitivity Threshold can be considered for identification.

The recommended Sensitivity Threshold setting is 5. A lower setting produces a more thorough examination of the library but takes more time. With a higher setting, the library examination is faster, but is less thorough.

### **Gain Shift Tolerance (%)**

The Gain Shift Tolerance value determines how much gain shift the analysis will allow when considering and fitting nuclides. It should be set high enough to accommodate the system's gain variability but not so high as to needlessly increase analysis time. A typical setting ranges from 0 to 10%, with a recommended setting of 5%.

**Shape Error Tolerance (%)**

The Shape Error Tolerance controls the range of shape error the analysis will allow when fitting candidate nuclides. It should be set high enough to accommodate the system's gain variability but not so high as to needlessly increase analysis time. Typical values range from 0 to 50%, with a recommended setting of 30%.

**Shielding Tolerance (cm Fe)**

The Shielding Tolerance value determines the maximum effective iron absorber thickness as an additional attenuator during fitting. It should be set high enough to accommodate the system's gain variability but not so high as to needlessly increase analysis time. Typical values range from 0 to 10, with a recommended setting of 1.

**Use Background Compensation**

Check this box to enable background compensation during peak locate processing using the selected Background CNF file. The background spectrum must have the same number of channels as the analysis spectrum, and their energy calibration slope terms must be within the specified Gain Shift Tolerance.

**Tolerance**

The Tolerance value is used when adding new search results to existing peak records. Select Energy to allow the Tolerance to be specified in units of energy (keV) or select FWHM to allow specification in units of full width at half maximum. Only peaks with energies not within this Tolerance of existing peak records will be added as new peaks.

**Add to Existing Results**

If the Add to existing results box is checked, each found peak will be compared with peaks listed in the peak results table. A found peak that is closer to an existing peak than the specified Tolerance value is assumed to be the listed peak and will be discarded. A found peak that is farther away from an existing peak than the specified tolerance is considered to be a separate peak and will be merged with the existing peak results table.

If the Add to existing results box is *not* checked, the current peak results table will be replaced by the results of this search.

**Retain Calibration Compensation**

If the Retain Calibration Compensation checkbox is checked, the optimized energy and FWHM calibration slope terms will be saved with the file.

If the checkbox is *not* checked, these values will still be optimized and reported in accordance with the specified tolerances, but will not be saved; the original values will be retained.

## Generate Report

If the Generate Report box is checked, a report will be generated when this phase is executed and will be displayed in the application's report window.

## Peak Area

The peak area phase contains the algorithms to calculate the net peak areas of all peaks found by the peak locate phase (independent of the peak locate method).

## Sum/Non-Linear Least Squares Fit Peak Area

Selecting Sum/Non-Linear LSQ Fit brings up the setup screen shown in Figure 98.

The Peak Area Non-Linear Least Squares Fit algorithm calculates peak areas of multiplets using the fitting method described in the "Peak Area for Multiplets" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

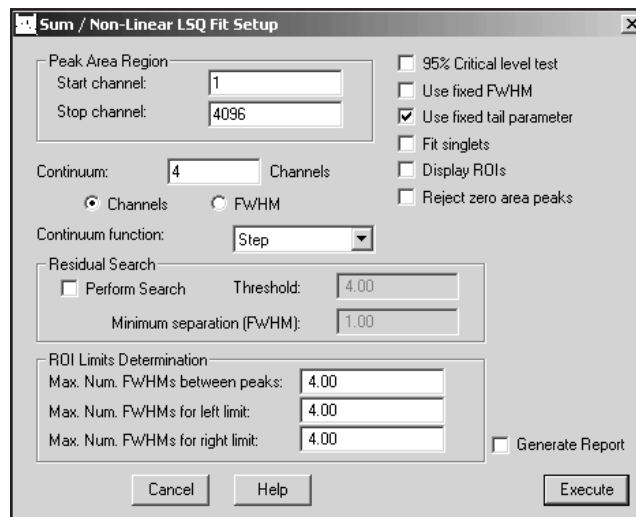


Figure 98 The Sum/Non-Linear LSQ Fit Setup

It normally calculates the peak areas of single peaks using a summation method (described in the "Peak Area for Single Peaks" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools manual*), but you can choose the peak fitting method instead.

This method also automatically determines the region-of-interest (ROI) around each peak found by the peak locate method in use. Peaks that are close to each other are automatically grouped into multiplet ROIs and analyzed as multiplets. The method of determining the ROIs is described in more detail in the “Determination of Peak Region Limits” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

If the peak locate results already contain ROI definitions, such as after a User Specified Peak Locate, these ROIs will be used without changes. No multiplet analysis will be performed. If the peak locate results do not contain ROI definitions (that is, they include peak centroids only) the ROI limits will be calculated automatically.

### Peak Area Region

You can limit the region to be searched by specifying the Start and Stop channels.

### Continuum

Selecting the Channels button fixes the number of continuum channels added to each ROI throughout the spectrum at the value entered in the text box. For most spectra, especially those acquired with a sodium iodide detector, it's usually better to select the FWHM button so that the continuum channels are added as a function of each peak's FWHM. The channels/FWHM parameter and its value can also be specified in “Continuum” in **Calibrate | Setup** on page 62). If you have two peaks that are close together, reducing the number of continuum channels may give better results. If you have poor peak statistics and there are no other peaks nearby, increasing the number of continuum channels establishes the continuum more accurately but makes it more likely that close lying peaks will be considered as a multiplet instead of as a singlet.

### Continuum Function

You can establish the continuum of a spectrum by selecting either a Linear function or a Step function. The Linear function is adequate when the spectrum's continuum is relatively flat. It is a simple, straightforward equation that estimates the continuum under the peaks as a trapezoid. The Step function should be chosen if there are any regions in the spectrum where the continuum is significantly higher on the left side of a peak region than on the right side; this function automatically reduces to a flat line if the continuum is flat. None is normally not used with Gamma spectra; it is typically used only with Alpha spectra. This parameter can also be specified in “Continuum” in **Calibrate | Setup** on page 62.

### 95% Critical Level Test

If the 95% Critical Level test is enabled, the net peak area of a singlet is examined to see if it exceeds the 95% Critical Level value as described in the “Critical Level Testing” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

Peaks that do not pass this test will be deleted from the peak results table. If the Critical Level test is not enabled, all peak areas are accepted regardless of their size, even negative areas.

### Fixed Parameters

Selecting the Fixed FWHM Parameter or Fixed Tail Parameter check box causes the chosen parameter(s) to be used for all multiplet peaks instead of allowing the value to vary for best fit. If either of these check boxes is not checked, the specified parameter will be allowed to vary.

### Fit Singlets

Normally, the Peak Area routine fits only multiplet peaks, but if you check the Fit Singlets check box, singlets will also be fitted, rather than calculated using the summation method.

### Display ROIs

If the “Display ROIs” check box is checked, the ROIs resulting from the analysis will be copied to the Display ROIs block in the datasource.

The ROI color conventions are:

- Color 1: Singlet peaks
- Color 2: Multiplet peaks
- Color 3: Not used
- Color 4: Not used

### Reject Zero Area Peaks

If the “Reject zero area peaks” check box is checked, any peaks with negative or zero peak areas will be deleted from the peak results table.

### Residual Search

When the Perform Search checkbox is selected, the algorithm will examine the current datasource’s ROIs for “hidden” components in a peak region, those that would otherwise not be found by the Peak Locate algorithm. A new peak will be added at the highest residual which is separated from the nearest established peak by at least the specified Minimum Separation (in FWHM) and the limits for that ROI will be re-established. This process will be repeated until there are no more peaks to be added. In most situations, the residual search works best when the Fixed FWHM, Fixed Tail and Fit Singlets check boxes are selected.

### ROI Limits Determination

The Sum/Non-Linear LSQ peak area calculations rely on these three parameters in determining whether multiplets are to be included in an ROI. Peaks that are no farther apart than the Maximum Number of FWHMs Between Peaks are seen as part of a multiplet and will be included in the ROI.

The calculation of the left and right ROI boundaries is influenced by the Maximum Number of FWHMs for Left (Right) Limit values. The ROI will not be extended beyond these limits even if the data has not leveled out.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

### Library (Gamma-M)

The Gamma-M Library Peak Area algorithms include steps for defining the background continuum using the erosion technique, as well as calculating the peak areas and their uncertainties. The Gamma-M Library Peak Area setup screen is shown in Figure 99.

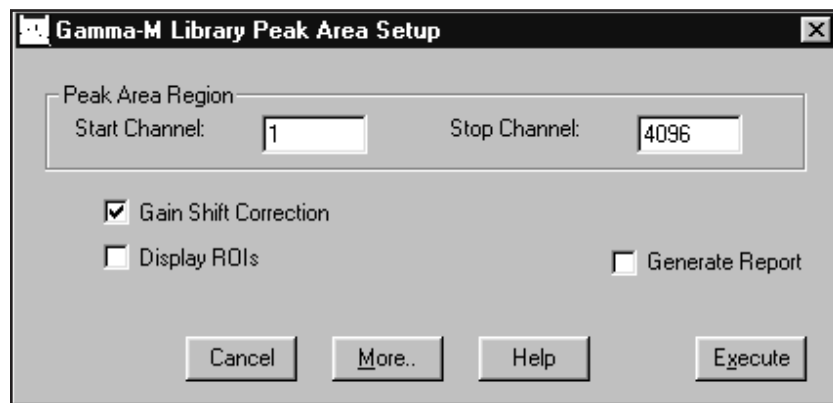


Figure 99 The Gamma-M Library Peak Area Setup

### Peak Area Region

The analysis will include the energies included within the Peak Area Region or that are equal to either limit. The current peak locate table will be used to determine whether a peak falls within the specified Region.

### Gain Shift Correction

Gain Shift Correction is a technique for moving the peaks so that their centroids are correctly placed. It is normally enabled (checked) because NaI peaks, in particular, tend to shift from their original calibrated positions as a function of temperature.

### Display ROIs

If the “Display ROIs” check box is checked, the ROIs resulting from the analysis will be copied to the Display ROIs block in the datasource.

The ROI color conventions are:

- Color 1: Non-interfered library peaks.
- Color 2: Non-interfered unknown peaks.
- Color 3: Interfered library peaks.
- Color 4: Interfered unknown peaks.

## More Peak Area Parameters

Selecting the **More** button brings up the screen in Figure 100, which lets you set several other parameters affecting Library Peak Area. The description of each parameter lists the default value for both Ge and NaI detectors.

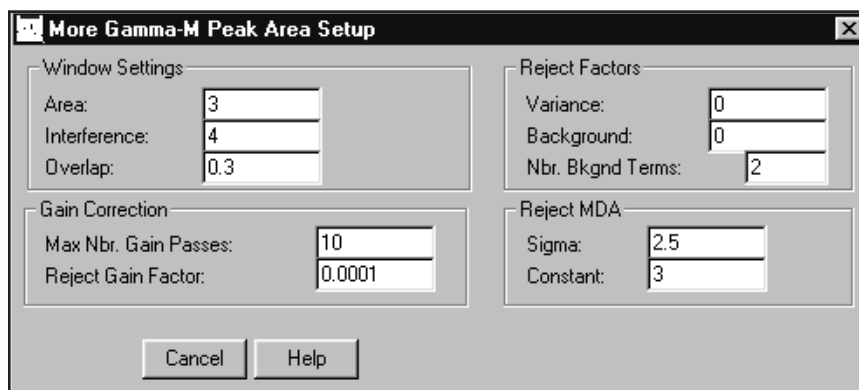


Figure 100 The Peak Area “More” Setup Showing Ge Detector Defaults

### Window Settings

**Area** specifies the FWHM multiplier to establish the left and right ROI limit around the peaks for a fit to calculate the peak area. Default: 3 for Ge; 1.5 for NaI.

**Interference** specifies the FWHM multiplier to establish the limit beyond which two adjacent peaks are no longer considered to interfere with each other for the purpose of determining their areas. Default: 4 for Ge; 2.5 for NaI.

**Overlap** specifies the FWHM multiplier to establish the limit below which two adjacent peaks are considered as one; that is, one of the two peaks is deleted. Default: 0.3 for both Ge and NaI.

### Reject Factors

**Variance** specifies the area variance rejection factor. Only peaks whose area is larger than this factor times the uncertainty of the area (at 1 sigma) will be accepted as valid peaks. Default: 0 for Ge; 1 for NaI.



**Background** specifies the peak rejection factor based on the area of the background. Only peaks whose square of the area is larger than this factor times the area of the background will be accepted as valid peaks. Default: 0 for Ge; 1 for NaI.

**Number of Background Terms** defines whether the fits are to be made with an added constant or linear continuum. 0 means that no additional continuum term will be used. 1 means that only a constant continuum will be used, and 2 means that a linear continuum will be used. Default: 2 for both Ge and NaI.

### Gain Correction

The Gain Shift Correction check box on the Gamma-M Library Peak Area Setup screen must be checked for these parameters to be used in the calculations.

**Maximum Number of Gain Passes** specifies the maximum number of iterations allowed for the fits with the automatic gain correction. Default: 10 for both Ge and NaI.

**Reject Gain Factor** specifies the convergence criterion. When consecutive iterations produce a change in the chi-square less than this value, a convergence has been achieved. Default: 0.0001 for Ge; 0.005 for NaI.

### Reject MDA

**Sigma** specifies the multiplier of the MDA equation used to accept or reject a peak area in the spectrum. Default: 2.5 for both Ge and NaI.

**Constant** specifies the constant term of the MDA equation used to accept or reject a peak area in the spectrum. Default: 3 for both Ge and NaI.

## Area Correction

(S501 Gamma Option) The area correction phase contains algorithms to correct the net peak areas before further calculations are made. You can choose either Standard Background Subtract or Reference Peak Correction with or without Background Subtract.

### Standard Background Subtract

(S501 Gamma Option) The Standard Background Subtract algorithm (Figure 101) allows you to subtract background peak areas from matching peak areas in the current datasource as described in the “Subtraction of Peak Environmental Background” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

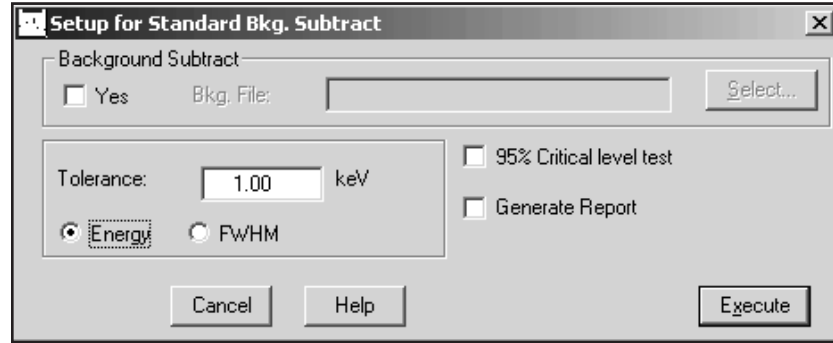


Figure 101 The Standard Background Subtract Setup

### Background Subtract

To perform background subtraction, enable the Yes checkbox, then Select the background (CNF) file.

Note: Do not enter a file name when using one of Canberra's automatic applications, such as PROcount. They use a specific background file. See the application's user's manual for more specific information.

### Tolerance

Enter a tolerance value (either fixed Energy or variable FWHM) to define how large a difference can be allowed between a peak in the current datasource and a peak in the background datasource and still be considered the same peak.

The tolerance value can also be specified from within Calibration Setup (page 62) as Peak Match Tolerance.

### 95% Critical Level Test

The 95% Critical Level test may be enabled or disabled for this phase of the calculations. If the test is enabled, the net peak area of a singlet after the background subtract must exceed the 95% Critical Level value as described in the "Critical Level Testing" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

If the Critical Level test is not enabled, all peaks are retained even if their areas are zero or negative after the background subtract.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

## Reference Peak Correction

(S501 Gamma Option) The Reference Peak Correction algorithm (Figure 102) uses a reference peak of a known count rate to normalize the areas of all other peaks in the spectrum. The reference source can be either an electronic pulser or an external stationary source.

Figure 102 The Reference Peak Correction Setup

If both a reference peak correction and an environmental background subtract are to be applied, the reference peak correction must always be applied first. Therefore, this algorithm provides both of these corrections in the proper order as described in the “Reference Peak Correction” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

### Reference Peak

The Reference Rate in counts per second is the emission rate of the reference source at the reference energy. The Reference Energy is the energy of the reference peak. Enter the Uncertainty of the reference peak in counts per second.

### Peak Match Tolerance

Enter the Peak Match Tolerance value either in energy or in FWHM units to define how large a difference to allow between a peak in the current spectrum and a peak in the background spectrum and still be considered the same peak.

### Reference Source

You can choose either a Stationary reference source or a Pulser. For a stationary source, the Reference Date is the date and time at which the source was measured.

Enter the Half Life of the nuclide which caused the reference peak. and choose the half-life's time units: **Years**, **Days**, **Hours**, **Minutes** or **Seconds**.

### Background Subtract

To perform background subtraction, enable the Yes checkbox. then Select the background (CNF) file.

## Efficiency Correction

(S501 Gamma Option) The efficiency correction phase includes two methods: Standard Efficiency Correction, which uses the previously established efficiency calibration for its calculations, and ISOCS Efficiency Correction, which uses mathematical calibrations to directly calculate efficiencies.

### Standard Efficiency Correction

(S501 Gamma Option) The Standard Efficiency Correction phase uses the previously established efficiency calibration to calculate and apply respective efficiencies and calculated net areas to each found peak (Figure 103). You can select one of four correction modes from the drop down list: Dual, Linear, Empirical or Interpolated (Figure 103).

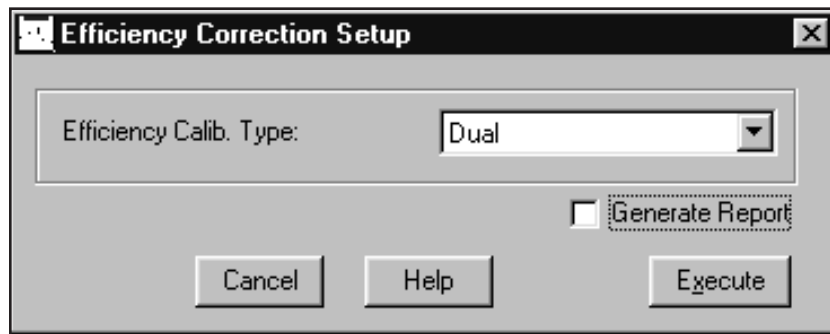


Figure 103 The Standard Efficiency Correction Setup

### Dual

The Dual Mode calculates the efficiency at each peak energy using the Dual efficiency curve described in the “Efficiency Correction Using the Dual Curve” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

**Linear**

The Linear Mode calculates the efficiency at each peak energy using the Linear efficiency curve described in the “Efficiency Correction Using the Linear Curve” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

**Empirical**

The Empirical Mode calculates the efficiency at each peak energy using the Empirical efficiency curve described in the “Efficiency Correction Using the Empirical Curve” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

**Interpolated**

The Interpolated Mode calculates the efficiency using a straight-line interpolation (in the In-In domain) between the two points on either side of the requested energy. If the energy is outside the range of calibration points, the nearest point is used.

**Generate Report**

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.

**ISOCS Efficiency Correction**

(S501 Gamma Option) The ISOCS Efficiency Correction phase (Figure 104) uses mathematical calibrations to directly calculate efficiencies for found peak energies. This direct efficiency correction lets you modify parameters in a geometry template during analysis, not only speeding analysis of multiple samples with varying parameters (i.e., Marinelli beakers with changes in fill height or mass), but letting you quickly optimize measurement geometries by experimentation and feedback.

For a discussion of how these factors are calculated, refer to the “LabSOCS/ISOCS Technical Notes” appendix in the *ISOCS (LabSOCS) User’s Manual*.

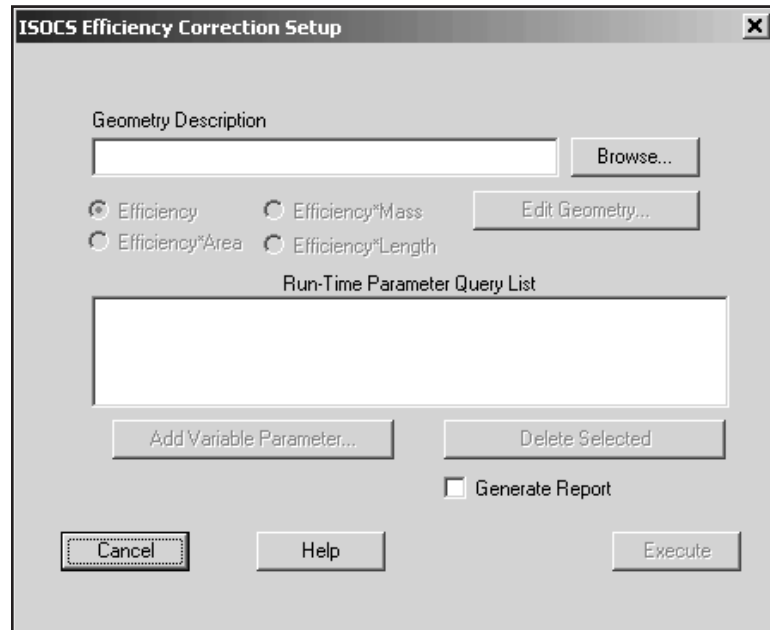


Figure 104 The ISOCS Efficiency Correction Setup

### Geometry Description

Use the Browse button to select a cam file (CNF), an analysis file (ASF), a calibration file (CAL), or a geometry file (GEO). When you click Open, the file's description will appear in the Geometry Description text box.

Note: This file will replace the geometry data, if any, stored in the current database.

### Edit Geometry

Click the Edit Geometry button to open the Geometry Composer with the selected file's Geometry Composer Report loaded. Refer to Chapter 8, "Using the Geometry Composer" for a discussion of geometry file editing.

### Efficiency Factor Buttons

For 'traditional' calibrations, select Efficiency and the results will be calculated in Activity. To convert to concentration, the activity can be divided by the mass in the Genie Report template. Alternatively, if you want to compute the Activity per mass (gram) directly, select Efficiency\*Mass. Other options are Efficiency\*Length and Efficiency\*Area.

### Add Variable Parameter

Click the Add Variable Parameter button to open the selected template file in the Template Editor (Figure 105).

LabSOCS, Template: SIMPLIFIED\_BEAKER

Delete Help

Detector and End-Cap: Dia=45mm\_Coaxial  
 Select Detector

Geometry Information  
 Description: Factory\_Test\_Wineglass  
 Comment: Enjoy\_your\_new\_software

Set Sample via:  
 Dimensions  
 Volume, ml  Weight, g

Geometry Elements		Dimensions				
#	Description	d.1	d.2	d.3	d.4	d.5
1	Beaker	0	0	0	0	
2	Sample	5.0000				0
3	Absorber1	0.3				
4	Absorber2	0				
5	Source-Detector	10				

Density and Material	
g/cm3	Material
0	none
1	water
1.2	plexigls
0	none

Select from List

- 304ss
- acrylic
- aluminum
- cellulos
- concrete
- copper
- csteel
- dirt1
- dirt2
- dirt3
- dirt4
- dryair
- drydirt
- epoxy
- germanum
- glass
- hdepoxy
- hpolyeth
- iron

Buttons: OK, Cancel, Help, Show Template

Figure 105 Template Editor with Parameters Selected

Geometry template parameters which are not available for run-time definition will be grayed out.

Double clicking on an available parameter field opens a “Comment” box (Figure 106), letting you enter text to identify the parameter at run time. When you OK the comment, you’ll see the chosen field marked in blue, indicating that it has been selected for runtime definition.

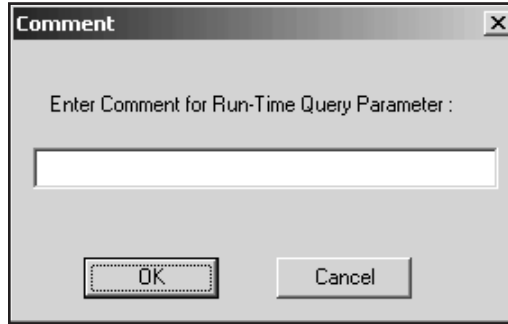


Figure 106 The Comment Box

Create all Variable Parameters that might be redefined at runtime, then click the Editor's OK button. In the Setup screen (Figure 107), the parameters will be seen in the Run-Time Parameter Query List, identified by their comments.

Note: Completed comments cannot be edited. If you want to change the comment, you'll have to delete that parameter then recreate it.

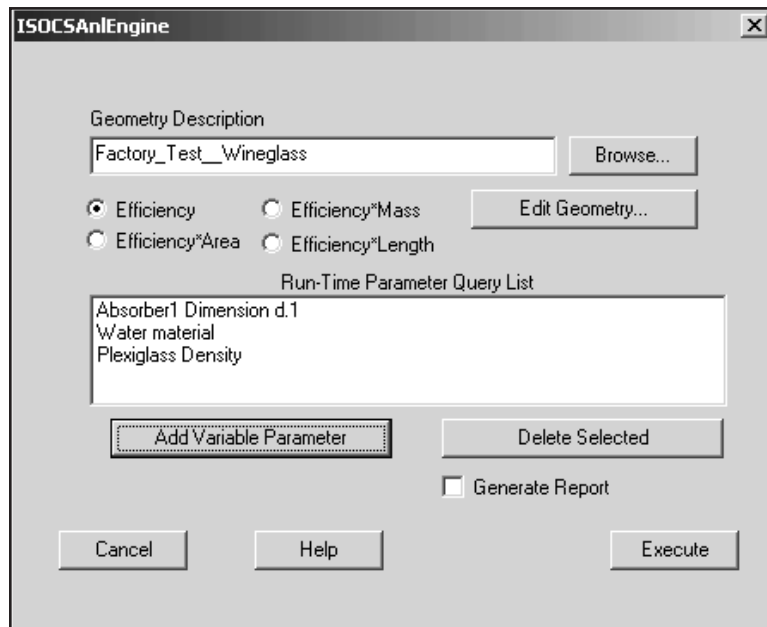


Figure 107 Several Comments Added



### Delete Selected

To delete a run-time parameter from the list, highlight its comment, then click the Delete Selected button. The parameter will be deleted from the list and the blue highlight will be removed from the template's parameter field.

### Run-Time Parameter Query List

The Run-Time Parameter Query List contains parameters defined by the Add Variable Parameter function, each identified by its comment.

### Generate Report

If the Generate Report box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

### Execute

Clicking the Execute button opens the run-time file (Figure 108). The default value of each run-time parameter is shown in blue and is followed by the parameter's comment.

You can modify the default value or accept it unchanged. When you've completed your run-time edits, click the template's OK button.

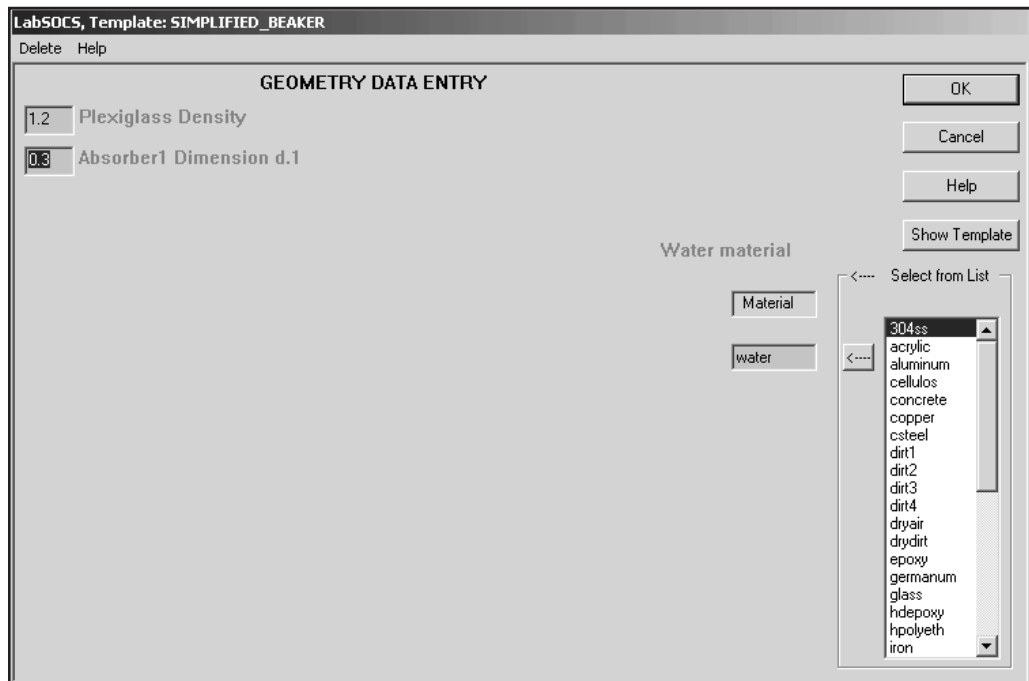


Figure 108 Sample Parameters in the Run-Time File

### Show Template

Click the Template Editor's Show Template button to see a drawing of the geometry, showing the elements and relationships of the current geometry.

## Nuclide Identification

The nuclide identification step contains the algorithms to perform the nuclide identification and activity calculations.

Note that the MDA Confidence Factor is used both here and in the Detection Limits algorithm (page 182). If the Confidence Factor is changed here, the Detection Limit calculations are affected too, unless the factor is changed again in the MDA Setup screens *before* performing its calculation. In either case, VMS Standard Peak Search (page 141) will be affected by any change in the Confidence Factor if its Critical Level test is enabled.

### Tentative NID

The Tentative Nuclide Identification (NID) algorithm (Figure 109) will generate a tentative nuclide identification. The algorithm looks at each of the peaks established by the Peak Area step of the analysis, and attempts to find a match in the specified nuclide library. It uses the specified tolerance to perform the search; all nuclides that satisfy that tolerance are recorded for reporting. The nearest match will be reported first, followed by any 'more distant' matches in order.

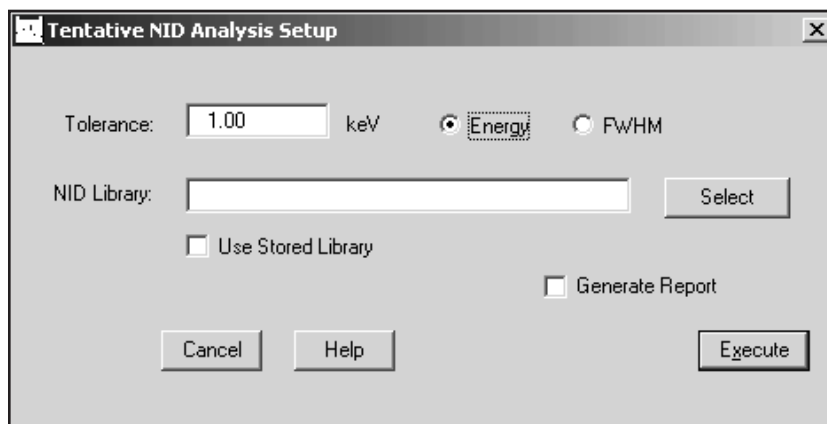


Figure 109 The Tentative NID Analysis Setup

**Tolerance**

This is used to specify what value is to be used to decide if an energy line in the given library matches the peak being searched for. The tolerance can be a fixed energy (in keV), or variable. If you choose variable (FWHM) the tolerance becomes the number entered multiplied by FWHM calculated at the energy of the peak.

**NID Library**

The library (NLB) file shown in the NID Library text box is used in this phase's calculations and is stored in the current datasource when the phase is Executed. This lets you use a fixed reference for future calculations. See also Use Stored Library, below.

To use a different library, click Select before Executing the phase and choose a library file. When the phase is Executed, the selected library will replace the library in the current datasource.

**Use Stored Library**

If the Use Stored Library checkbox is checked, the library stored in the current datasource will be used when the phase is Executed. If it is *not* checked, the Selected Nuclide Library will be used when the phase is Executed and will replace the library in the current datasource.

**Generate Report**

If checked, a report will automatically be generated and displayed in the report window after the analysis has executed.

**NID**

(S501 Gamma Option) If the current spectrum already includes peak area and efficiency correction results, the Nuclide Identification (NID) algorithm (Figure 110) identifies the spectrum's nuclides, as described in the "Basic Calculations" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

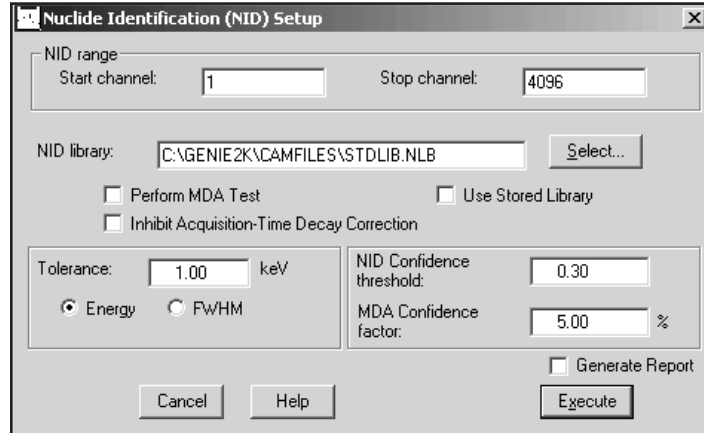


Figure 110 The NID Setup

### NID Range

The identification is limited to the specified NID Range; only peaks within those limits will be considered for identification. Note that though the stop channel initially defaults to a large value, the algorithm will only search to the spectrum's highest channel.

### NID Library

The library (NLB) file shown in the NID Library text box is used in this phase's calculations and is stored in the current datasource when the phase is Executed. This lets you use a fixed reference for future calculations. See also Use Stored Library, below.

To use a different library, click Select before Executing the phase and choose a library file. When the phase is Executed, the selected library will replace the library in the current datasource.

### Use Stored Library

If the Use Stored Library checkbox is checked, the library stored in the current datasource will be used when the phase is Executed. If it is *not* checked, the Selected Nuclide Library will be used when the phase is Executed and will replace the library in the current datasource.

### Perform MDA Test

The Perform MDA Test is most useful in cases where a nuclide has many peaks with small branching ratios that would result in peaks that are below the MDA level, such as in most low activity samples. Enabling this function will ignore small peaks when calculating the identification confidence so that expected peaks below the MDA will not penalize the confidence test results.

### Inhibit Acquisition-Time Decay Correction

If this option is checked, decay correction will not be performed during the count time. Decay correction will still be performed for wait time (the time between sample time and the start of the count) and for build up time (the time the sample is building up on a filter), if any.

Note: Decay correction in Genie 2000 is limited to  $\pm 66$  half lives.

### Tolerance

You must set the tolerance in either energy or FWHM units (this value can also be specified as Eff & Match Tolerance in **Calibration | Setup** on page 62).

### NID Confidence Threshold

The NID Confidence Threshold is used to accept or reject peaks for identification; this parameter's range is 0 (low) to 1 (high).

### MDA Confidence Factor

In the standard NID, the MDA Confidence Factor is used as the designated MDA confidence during the MDA test only if Perform MDA Test is enabled.

Note that the MDA Confidence Factor is used both here and in the Detection Limits algorithm (page 182). If the Confidence Factor is changed here, the Detection Limits calculations are affected too, unless the factor is changed again in the Detection Limits Setup screen *before* performing its calculation. In addition, the VMS Standard Peak Search (page 141) will be affected by any change in the Confidence Factor if its Critical Level test is enabled.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

### NID with Interference Correction

(S501 Gamma Option) If the current spectrum already includes peak area and efficiency correction results, the Nuclide Identification with Interference Correction algorithm (Figure ) identifies the spectrum's nuclides and automatically performs an interference correction and weighted mean calculation on them, as described in the "Basic Calculations" and "Activity Corrections" sections of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

### NID Range

The identification is limited to the specified NID Range; only peaks within those limits will be considered for identification. Note that though the stop channel initially defaults to a large value, the algorithm will only search to the spectrum's highest channel.

### **NID Library**

The library (NLB) file shown in the NID Library text box is used in this phase's calculations and is stored in the current datasource when the phase is Executed. This lets you use a fixed reference for future calculations. See also Use Stored Library, below.

To use a different library, click Select before Executing the phase and choose a library file. When the phase is Executed, the selected library will replace the library in the current datasource.

### **Use Stored Library**

If the Use Stored Library box is checked, the library stored in the current datasource will be used when the phase is Executed. If it is *not* checked, the Selected Nuclide Library will be used when the phase is Executed and will replace the library in the current datasource.

### **Perform MDA Test**

The **Perform MDA Test** is most useful in cases where a nuclide has many peaks with small branching ratios that would result in peaks that are below the MDA level, such as in most low activity samples. Enabling this function will ignore small peaks when calculating the identification confidence so that expected peaks below the MDA will not penalize the confidence test results.

### **Inhibit Acq-Time Decay Correction**

If this option is checked, decay correction will not be performed during the count time. Decay correction will still be performed for wait time (the time between sample time and the start of the count) and for build up time (the time the sample is building up on a filter), if any.

Note: Decay correction in Genie 2000 is limited to  $\pm 66$  half lives.

### **Tolerance**

This is the tolerance value used when matching peaks between the currently opened datasource and the specified nuclide library. You can choose to enter this in Energy (a constant energy value across the spectrum), or in FWHM (the energy varies according to the FWHM calibration).

### **NID Confidence Threshold**

This is the confidence value used to accept or reject candidate peaks for identification; this value has a range of 0 (low) to 1 (high).

### MDA Confidence Factor

The MDA Confidence factor for NID with Interference Correction is the same that used for standard NID, except that there is an added function. This factor governs the allowed uncertainty of the activity results, which must exceed its own uncertainty times a factor related to the MDA Confidence Factor. The smaller the MDA Confidence Factor, the larger the multiplier.

Note: The MDA Confidence factor is applied only if the 95% Critical Level test is enabled in Sum Non/Linear LSQ Fit Peak Area (page 146), VMS Standard Peak Search (page 141), or Standard Background Subtract (page 151).

### Cascade Correction

Canberra's patented Cascade Summing Correction algorithms<sup>3</sup> let you correct nuclide activities for losses or gains due to the cascade summing effect of gamma rays. Cascade Correction can be enabled/disabled here, in the NID with Interference Correction dialog.

For information on setting up and using Cascade Correction, please refer to Chapter 7, *Using Cascade Correction* on page 249.

For cascade correction to work, the gamma ray spectrum must include a valid peak-to-total calibration and a valid efficiency calibration that is free from cascade summing effects. Refer to Appendix D, *Correcting an Efficiency Calibration for Cascade Summing*, on page 330 for details on correcting an empirical efficiency calibration.

In addition, to be properly associated with a nuclide in the cascade summing library, the entries in the NID library must follow the naming convention XX-AAA[m], where XX is the element name, AAA is the mass number, and m is an optional letter indicating decay from a metastable state (for example: Bi-212 or Te-131m). For a complete list of available nuclides, refer to *Genie 2000 Coincidence Summing Library.pdf*, either on your Genie 2000 CD-ROM or, if documentation was installed on your PC, in its Genie2K\pdfs\docs folder.

Other components that are necessary for running the cascade correction are the **Coincidence library** and a **Geometry file** that contains the source-detector geometry information for the given measurement.

If the Perform Cascade Correction box is checked, cascade correction will be performed when the Execute button is pressed.

---

3. US Patent 6,225,634.

### Generate Report

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application's report window.

## Parent-Daughter Correction

(S501 Gamma Option) Except for "Generate Report", there are no setup parameters for the Parent-Daughter Correction algorithm (Figure 111).

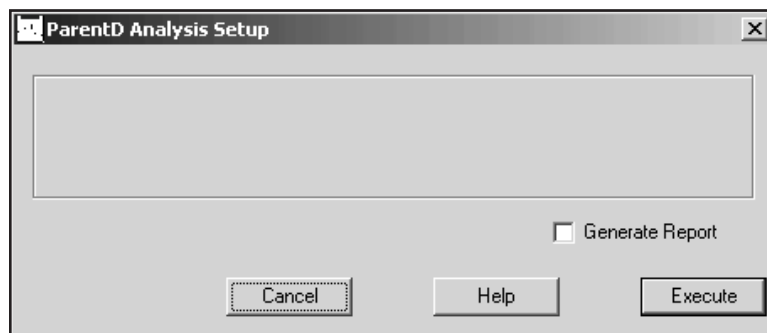


Figure 111 Parent-Daughter Correction Setup

The Parent-Daughter Correction algorithm loops through the identified nuclides in the datasource, searching for nuclides in parent-daughter pairs. It performs corrections to the activities of the daughter nuclides (where appropriate) to account for possible feeding from a parent nuclide. The algorithm only treats parent-daughter pairs. It does not handle multiple generation (e.g. parent-daughter-granddaughter) nuclide chains.

**Note:** You must execute the "NID plus Interference Correction" analysis step on the datasource before executing this algorithm. The NID plus Interference Correction step calculates the activity of each identified nuclide at the Sample Time by treating it as a standalone decay. That is, it does not account for parental feeding.

The definition of the parent or daughter for a given nuclide is established in the nuclide library (NLB) file used in the NID plus Interference Correction step. These definitions are editable in the Nuclide Library Editor (see "The Optional Nuclide Data" on page 217). Note that while defining a parent-daughter relationship you must specify the Decay Ratio (the fractional probability for the parent to decay into the daughter) and the Error in the Decay Ratio while editing the *daughter* nuclide.



The Parent-Daughter Correction algorithm first examines each nuclide as a potential daughter. If the nuclide has a parent defined in the nuclide library and the parent was found in the datasource, the nuclide's activity at the Sample Time is corrected for feeding from the parent.

The algorithm then makes a second pass through the list of identified nuclides, this time examining each as a potential parent. If the nuclide has a daughter defined in the nuclide library but the daughter was *not* found in the datasource, an activity record is created for the daughter and its activity is calculated (assuming 0 for the uncorrected activity) and stored.

The mathematical expressions used for the corrected activities and their uncertainties are given in the "Parent-Daughter Correction" section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

### Generate Report

If the **Generate Report** checkbox is checked, a report will automatically be generated and displayed in the report window after the analysis has executed. In this report, if a nuclide's activity has been corrected by the Parent-Daughter Correction algorithm, it is flagged with a special symbol in the left-hand margin.

## Interactive Analysis

(S501 Gamma Analysis) Interactive Analysis uses visual feedback for reviewing and refining spectra. When you launch it, Interactive Analysis loads the data and analysis results stored in the current datasource.

Interactive Analysis lets you examine the peak analysis results for multiplet peaks, peaks not found to be statistically significant, etc., and influence the calculation of individual peak areas by interactively adding, editing, and deleting peaks and peak regions, and by interactively modifying nuclide activities.

### The Parts of the Display

The Interactive Analysis display (Figure 112) is described on the pages listed in the Display Part table on the next page.

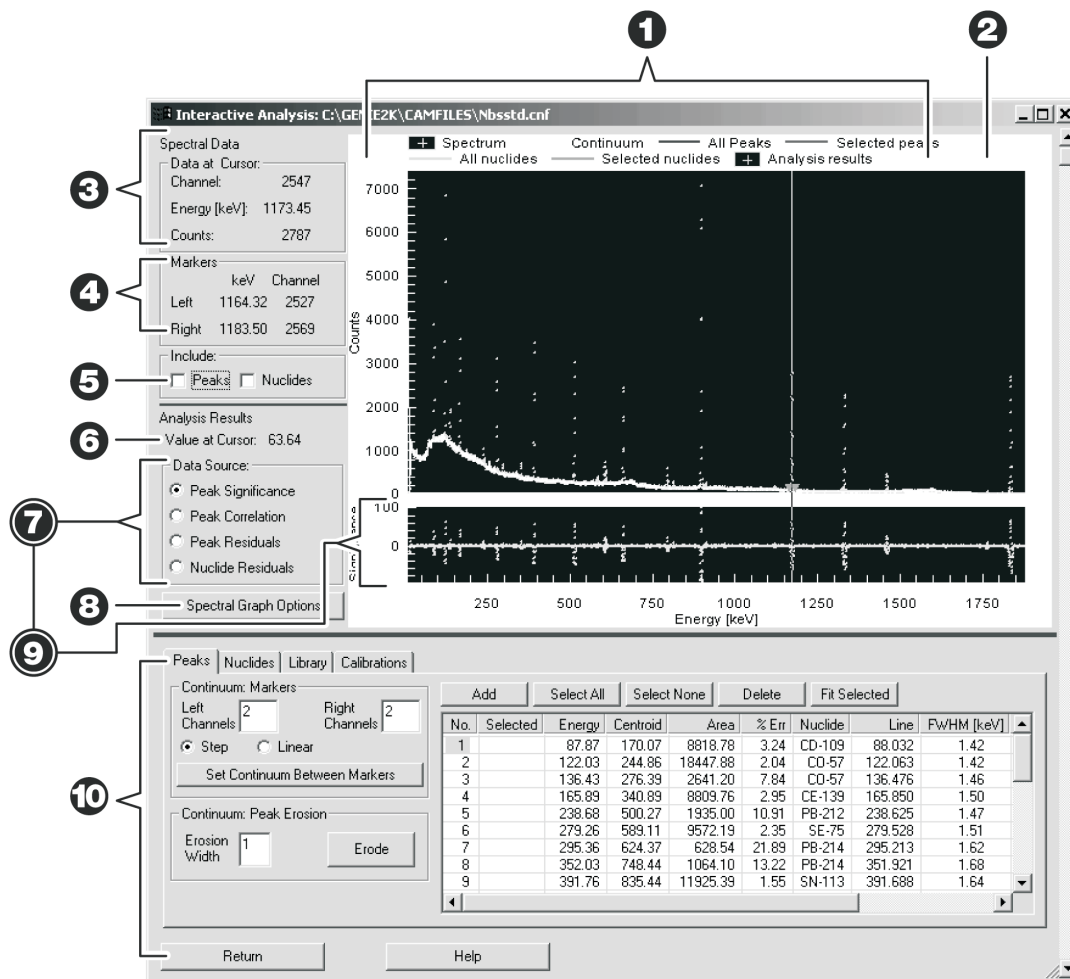


Figure 112 The Interactive Analysis Display

Display Part	Page
① The Legend . . . . .	169
② The Spectral Plot . . . . .	169
③ Data at Cursor. . . . .	170
④ Markers . . . . .	170
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⑧ Spectral Graph Options . . . . .	172
⑨ Analysis Results Plot . . . . .	171
⑩ Tabular Data . . . . .	174

## The Legend

The legend at the top of the screen displays the Plot Method, Style and Color selected in Spectral Graph Colors (page 173) for:

- The Spectrum
- The Analysis Results
- The Continuum
- All Peaks
- Selected Peaks
- All Nuclides
- Selected Nuclides

## Spectral Plot

The upper, spectral plot, window shows the spectrum with a Spectrum Cursor and a pair of Spectrum Markers. Data at Cursor and Markers position are shown to the left of the Spectral Plot.

### Y-Axis Scale

The spectral plot's Y-Axis may be labeled either as a power of ten ( $10^3$ ) or as an exponential value, represented by one of the following letters:

p = 1.0e-12  
n = 1.0e-9  
u = 1.0e-6  
m = 1.0e-3  
k = 1.0e3  
M = 1.0e6  
G = 1.0e9  
T = 1.0e12

### Current Cursor Location

The current location of the spectrum's cursor is marked by a vertical line passing through the both the Spectral Graph and the Analysis Results Graph (Figure 112). The initial cursor position, when IA is first opened, duplicates the position of the spectrum cursor in Genie 2000.

### Moving the Cursor

To move the spectrum's cursor to another location, place the mouse cursor on any data on the Spectral Graph or Analysis Results Graph (the mouse cursor will change to a hand), click and drag the spectrum's cursor.

To move the cursor a few channels at a time, use the keyboard's left and right arrow keys. Pressing an arrow key once will move the spectrum cursor one channel. Pressing and holding an arrow key will scan the spectrum cursor through the spectrum.

### Zooming In on the Data

To magnify the data in an area of interest, click and drag to draw a rectangle around an area of the Spectral Graph alone or of the Spectral Graph and the Analysis Results Graph together. When you release the mouse button, the graph will redraw itself to magnify the area of interest.

### Multiple Levels of Zoom In

You can continue to zoom in by drawing the rectangle around successively smaller areas of the expanded data.

### Undo Zoom

To return to the full display, right click on the background and select **Undo Zoom** from the right-click menu. This will undo all levels of zoom at once.

### Data at Cursor

These three data fields show the **Channel** number, **Energy** and number of **Counts** at the cursor's current location in the Spectral Plot.

### Markers

The spectrum Markers, a pair of downward pointing triangles, can be used to define an area of interest (Figure 112). Click and drag a marker to move it to a new location.

Note: When Interactive Analysis is first opened, the initial position of the Markers is the same as their position in Genie 2000's Gamma Analysis window.

You can also use the keyboard's CTRL-L to move the Left marker, or CTRL-R to move the Right marker, to the cursor's current location.

### Include

Check either or both of the Peaks and Nuclides boxes to overlay the Spectral Plot with the selected data.

### Peaks

Checking the **Peaks** checkbox highlights all peaks selected in the Peaks Table (page 174). The peaks are marked with the Selected Peaks color chosen in Spectral Graph Options (page 172). All other peaks are marked with the All Peaks color.

The All Peaks array is the summation of the continuum array with theoretical Gaussian representations of all peaks currently in the peak search results, reflecting the location, shape and area of the peaks in the Data Section. The Selected Peaks array is the summation of the continuum array with theoretical Gaussian representations of the peaks currently selected in the Peaks Table.

## Nuclides

Checking the **Nuclides** checkbox highlights the single nuclide selected in the Nuclides Table (page 176). The nuclide is marked with the Selected Nuclides color chosen in Spectral Graph Options (page 172). All other nuclides are marked with the All Nuclides color.

The All Nuclides array is the summation of the continuum array with theoretical Gaussian representations of the summation of all of the nuclide arrays currently in the nuclide results, with shapes determined from library, calibration and NID results data. The Selected Nuclides array is the summation of the continuum array with theoretical Gaussian representations of the array containing the single nuclide selected in the Nuclides Table.

## Analysis Results – Data Source and Plot

Select one of the **Data Source** buttons to choose the type of data to be displayed in the **Analysis Results Plot**. The data in the Analysis Results plot correspond to the horizontal region of the spectrum in the Spectral Plot.

## Value at Cursor

This field shows the value at the cursor in the Analysis Results plot.

## Peak Significance

Selecting **Peak Significance** shows the negative of the peak significance data resulting from an Unidentified Second Difference analysis of the spectrum. The negative is used to make it easier to visually correlate the spectral peaks with their significance; a large significance indicates a peak.

## Peak Correlation

Selecting **Peak Correlation** shows normalized peak correlation coefficient data resulting from a shape correlation analysis of the measured spectrum. A large correlation indicates a peak.

### Peak Residuals

Selecting **Peak Residuals** shows the difference in counts between the current peak results (All Peaks) and the measured spectrum.

### Nuclide Residuals

Selecting **Nuclide Residuals** shows the difference in counts between the current nuclide results (All Nuclides) and the measured spectrum.

### Residuals Scaling

The residuals in each channel are scaled by the uncertainty in the spectrum at that channel.  $(\text{Measured Value} - \text{Theoretical Value}) / (\sqrt{(\text{Measured Value})})$

## Spectral Graph Options

Select the **Spectral Graph Options** button to see the Display Properties dialog (Figure 113), or right click on the Spectral Data graph to see a context menu (Figure 114) listing the data rendering options.

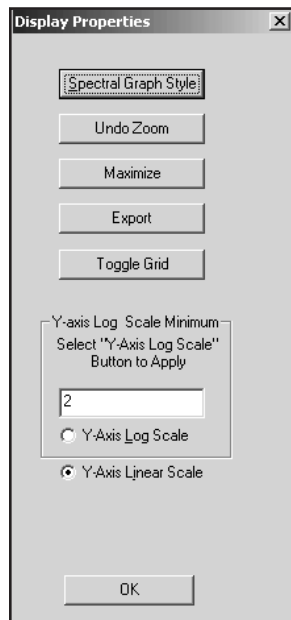


Figure 113 Display Properties Dialog

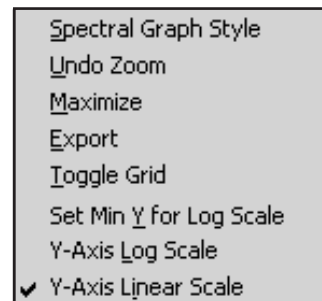


Figure 114 Spectral Graph Context Menu

## Spectral Graph Style

Selecting **Spectral Graph Style** opens a dialog box (Figure 115) which lets you choose how to render each Data class's Plot Method, Style, Color and Point Size.

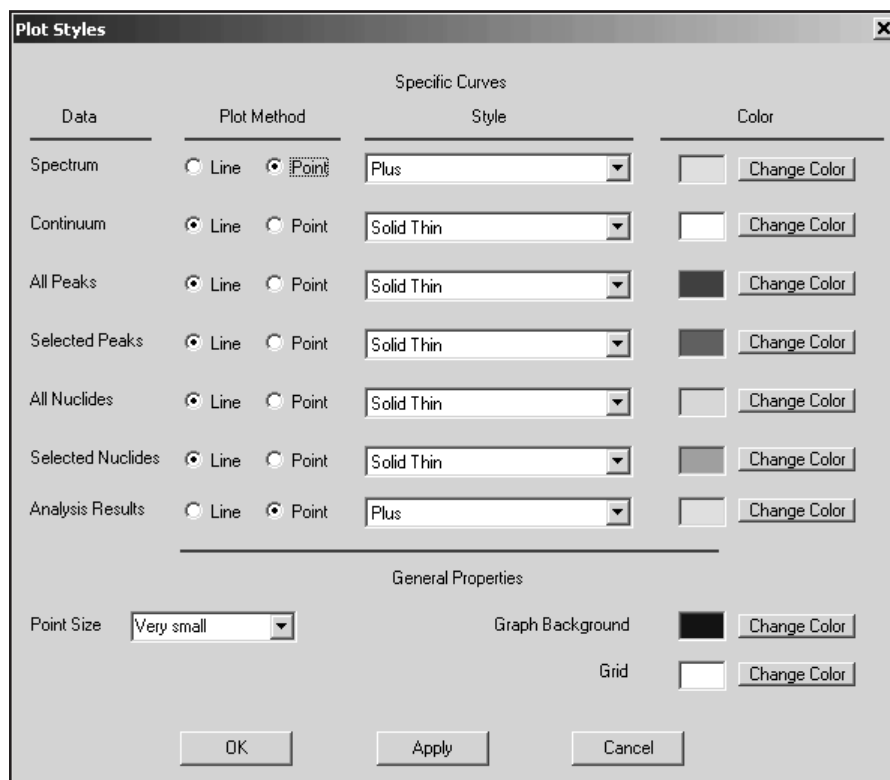


Figure 115 The Spectral Graph Style Dialog

## Undo Zoom

You can use the **Undo Zoom** command to undo all levels of zoom at once and return to the full spectrum display.

## Maximize

Expands the graphical display to full screen. Press your keyboard's ESC key to close the maximized display window.

## Export

The Export dialog lets you export the data as a bitmap or as (ASCII) Text/Data Only. The **Export Destination** can be the Clipboard, a file, or for a bitmap, the system print device.

**Toggle Grid**

Enables or disables the grid overlaid on both the Spectral and Analysis Results plots.

**Y-Axis Log Scale**

Displays the spectral plot's data logarithmically.

**Y-Axis Linear Scale**

Displays both plots' data linearly.

**Set Min Y for Log Scale**

There are two ways to set the Y-Axis' minimum value for log scale.

- In the Display Properties Dialog, click on the "Y-Axis Log Scale" radio button, enter the value, then click the Log Scale button again to enable Log Scale.
- In the Spectral Graph Context Menu, click on "Set Min Y for Log Scale" and enter the value in its dialog box. When you click on "OK" in that dialog box, the Y-axis is set to log mode and the minimum value is applied.

Note: The spectral plot's Y-Axis is labeled in one of two ways. See "Y-Axis Scale" (page 169) for details.

**Tabular Data**

The Tabular Data section provides a direct, interactive interface with the current data displayed in several tables.

**Peaks Table**

The Peaks Table (Figure 116) displays editable Peak search results. Click on a field to manually edit its data. Clicking on nuclide field or a line field opens a dialog which lets you select data from the current library.

No.	Selected	Energy	Centroid	Area	% Err	Nuclide	Line	FWHM [keV]
13		609.45	1312.10	1104.65	5.91	Bi-214	609.312	1.62
14		661.69	1426.48	9384.88	1.87	CS-137	661.650	1.85
15		795.95	1720.45	1875.19	5.32	CS-134	795.845	1.73
16		814.01	1759.98	687.63	13.23			1.93
17		898.04	1943.96	33469.09	0.73	Y-88	898.021	2.02
18		911.35	1973.11	436.47	18.76			1.61
19		968.81	2098.93	229.95	30.31			2.26
20		1120.37	2430.77	261.10	24.13	Bi-214	1120.287	2.28
21	X	1173.20	2546.44	14837.38	1.26	CO-60	1173.216	2.24

Figure 116 The Peaks Table



If the Include Peaks checkbox on the IA screen is checked, the peaks selected here are marked in the Spectral Plot with the current Style and Color for Selected Peaks (page 173). Multiple peaks can be selected by holding down the keyboard's control key as you click each peak's number.

### Continuum Markers

The continuum can be established either by using the Continuum Markers or by Peak Erosion. For Continuum Markers, you can select the number of channels to average outside of the markers and the type of function to set between the markers, linear or step. For Peak Erosion, you can select the erosion width parameter.

### Left Channels and Right Channels

The number of channels to average to the left and right of the markers to establish the local background are specified in the Left Channels and Right Channels text boxes.

### Set Continuum Between Markers

These controls let you specify the number of channels (typically 2) to be used for the left and right background and whether the continuum between the backgrounds is **Linear** or **Step**.

When the **Set Continuum Between Markers** button is selected, the Continuum between the two Spectrum Markers (page 170) is changed to best transition between the specified backgrounds. The rest of the continuum is unchanged.

### Continuum Peak Erosion

Selecting the **Erode** button causes the continuum to be established by estimating the baseline through iteratively filtering the spectrum to remove features that resemble peaks according to the current shape calibration. The width of the filter is a function of the local peak width times the specified **Erosion Width** (typically 1) and is reduced at each iteration. The entire continuum is changed.

### Add

Selecting the **Add** button creates a new peak search results record with the centroid located at the current spectral cursor location.

### Select All

Selects all peak search records in the Peaks table.

### Select None

Deselects all selected peak search records in the Peaks table.

### Delete

Deletes all selected peak search records.

### Fit Selected

The **Fit Selected** button opens the Sum/Non-Linear LSQ Fit dialog (page 146) to specify how the currently selected peak search records are to be optimized when executed. The fitting will optimize those peak parameters (centroid, amplitude/area, FWHM, and low tail) that are selected to best fit the spectral data above the established continuum. If the associated nuclide has activity, the efficiency will be entered automatically. Select the **OK** button to run the Fit analysis. The peak search data for the selected peak records will be modified.

### Nuclides Table

The NID results (Figure 117) can be reviewed, activities can be modified, and NID analyses can be performed, for a selected nuclide's peak. Identified nuclides are marked with an X in the line's ID Status cell. The nuclide ID Status can be edited to mark a nuclide as identified or to remove the identified indicator. The ID Status and Activity fields can be edited manually (constrained to positive values).

No.	ID Status	Nuclide	Activity [uCi]	Uncert. [%]	Confidence	Correlation	Significance
1		BE-7	0.000	0.00	0.000	0.000	0.000
2		NA-22	0.000	0.00	0.000	0.000	0.000
3		NA-24	0.000	0.00	0.000	0.000	0.000
4		CL-38	0.000	0.00	0.000	0.000	0.000
5	X	K-40	0.182	4.48	0.998	0.000	0.000
6		AR-41	0.000	0.00	0.000	0.000	0.000
7		K-42	0.000	0.00	0.000	0.000	0.000
8		SC-46	0.000	0.00	0.000	0.000	0.000
9		CR-51	0.000	0.00	0.000	0.000	0.000
10		MN-54	0.000	0.00	0.000	0.000	0.000
11		MN-56	0.000	0.00	0.000	0.000	0.000
12	X	CO-57	0.029	3.59	0.999	0.000	0.000
13		CO-58	0.000	0.00	0.000	0.000	0.000

Figure 117 The Nuclides Table

Changing any activity triggers an update of the arrays shown in the Display section (NID results arrays and residuals). If the Include Nuclides checkbox is checked, the nuclide you selected is marked in the Spectral Plot with the current Style and Color for Selected Nuclides (page 173). When a nuclide is modified, its ID Status is automatically marked with an X (identified).

### Tentative NID

The **Tentative NID** button opens the Tentative NID Analysis dialog (page 160) and performs the analysis.

**NID (Interf. Corr.)**

The **NID (Interf. Corr.)** button opens the NID with Interference Correction dialog (page 163) and performs the analysis.

**Correlation NID**

The **Correlation NID** button opens the Library Correlation NID dialog (page 143) and performs the analysis.

Note: The Tentative NID and NID with Interference Correction analyses modify only nuclide results. The Correlation NID modifies the energy and FWHM calibrations, the peak results, and the nuclide results.

**Library Table**

The Library Table (Figure 118) lets you review the current library's data. A new library can be loaded via the **Load** button. Clicking the **Edit** button will launch the Nuclide Library Editor, allowing you to edit the current library. Loading or Editing will reset the Nuclides results. The current library can be saved with the same or a different file name via the **Save** button.

Nuclides				Lines		
No.	Name	Type	Half Life	No.	Energy [keV]	Abundance [%]
1	BE-7	activation	7.7e+004 M	1	1368.53	99.999
2	NA-22	activation	1.4e+006 M	2	2754.09	99.862
3	NA-24	activation	15 H			
4	CL-38		37 M			
5	K-40	natural	1.3e+009 Y			
6	AR-41	activation	1.8 H			
7	K-42		7.4e+002 M			

Figure 118 The Library Table

**Calibrations Table**

The Calibrations Table (Figure 119) lets you review the selected calibration type. The calibrations graph shows the calibration curve. You can choose from **Efficiency**, **Energy**, **FWHM** and **Low Tail** calibration types. For some calibrations, a different **Curve Type** can be selected for display.

### Order of the Polynomial

If you select Dual Efficiency calibration, you'll be able to set the Order of the Polynomial for each of the two calibration curves. The **Set Crossover** button opens a dialog which lets you set the crossover point between the two curves. The crossover point is listed in the table along with the coefficients.

For any other Efficiency Curve (except Interpolated) and for the energy calibration, you'll be able to set the single Order of the Polynomial for that curve.

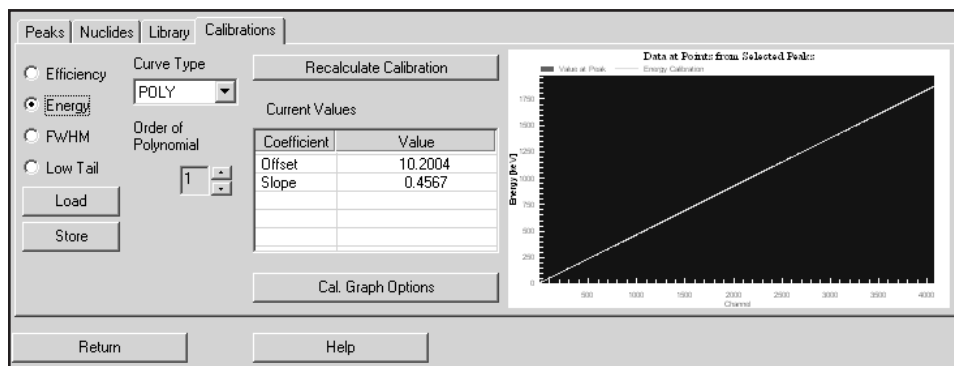


Figure 119 The Calibrations Table

### Recalculate Calibration

The **Recalculate Calibration** button will modify the currently selected calibration equation by automatically optimizing the coefficient values to best match the data points currently selected in the Peaks results. This resets the Nuclides results and appropriately alters Peak results to match the new calibration.

You can also apply changes to the order of the polynomial. For all calibration types except Efficiency, you can also select a particular coefficient in the table of coefficients and fit only that coefficient.

Note: For all calibration types except Efficiency, you can manually change a coefficient. This is useful, for example, if you wish to experiment with a change in the slope of the energy calibration curve.

### Load/Store

A new calibration (CAL) file can be loaded via the **Load** button or saved via the **Store** button.

## Calibration Graph Options

Select the **Cal. Graph Options** button to see the Display Properties dialog (Figure 120), or right click on the Calibration Graph to see a context menu (Figure 121) listing the data rendering options.

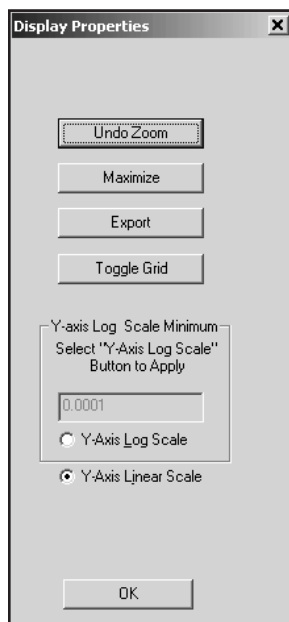


Figure 120 Display Properties Dialog

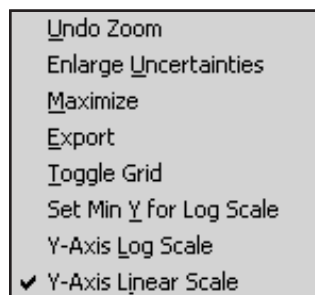


Figure 121 Calibration Graph Context Menu

## Calibration Graph Colors and Style

The Calibration Graph's colors and style are chosen in Spectral Graph Style (page 173). The calibration curve uses the color chosen for "Spectrum" and the plotted points use the color chosen for "Selected Peaks".

## Zooming In

To magnify an area of interest in the Calibrations graph, click and drag to draw a rectangle around the area. When you release the mouse button, the Calibrations graph will redraw itself to magnify the data (zoom in) in the area of interest.

You can continue to zoom in by drawing the rectangle around each successively smaller area of expanded data.

Use the Undo Zoom command to return to the full Calibrations graph.

### **Undo Zoom**

The **Undo Zoom** command will undo all levels of zoom and return to the full graph.

### **Enlarge Uncertainties**

If the calibration graph's uncertainty bars are difficult to see, the Enlarge Uncertainties property will make the bars ten times larger (Figure 122).

Note: This context menu item does not appear in the Calibration Graph Options dialog.

### **Maximize**

Expands the graphical display to full screen. Press your keyboard's ESC key to close the maximized display window.

### **Export**

The Export dialog lets you export the data as a bitmap or as (ASCII) Text/Data Only.

The **Export Destination** can be the Clipboard, a file, or for a bitmap, the system print device.

### **Toggle Grid**

Adds or removes a grid overlaid on the calibration plot.

### **Y-Axis Log Scale**

Displays the calibration plot's data logarithmically.

### **Y-Axis Linear Scale**

Displays the calibration plot's data linearly.

### **Set Min Y for Log Scale**

There are two ways to set the Y-Axis' minimum value for log scale.

- In the Display Properties Dialog, click on the "Y-Axis Log Scale" radio button, enter the value, then click the Log Scale button again to enable Log Scale.
- In the Spectral Graph Context Menu, click on "Set Min Y for Log Scale" and enter the value in its dialog box. When you click on "OK" in that dialog box, the Y-axis is set to log mode and the minimum value is applied.

Note: The calibration plot's Y-Axis is labeled in one of two ways. See "Y-Axis Scale" (page 169) for details.

## The Calibration Graph

The Calibrations Graph uses the selected calibration type to generate a calibration curve for the peaks selected in the Peaks Table (page 174).

The graph also shows points corresponding to the calibration value of the selected peaks as a horizontal line, and the uncertainty in the calibration as a vertical bar through the horizontal line.

If the uncertainty bars are difficult to see, use the “Enlarge Uncertainties” property (page 180) to make the bars ten times larger (Figure 122).

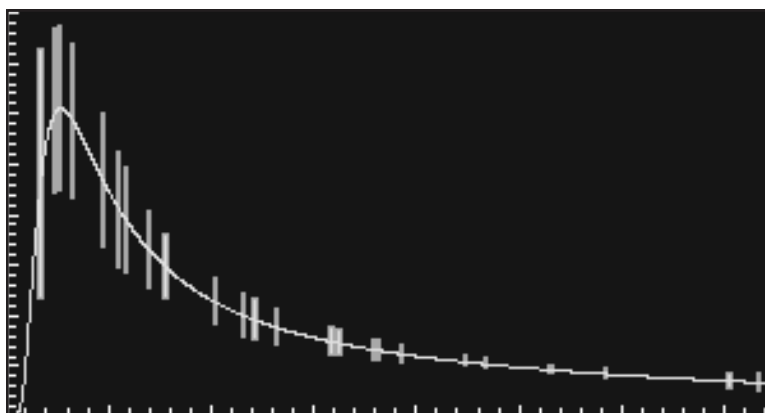


Figure 122 Enlarged Uncertainty Bars

## Return

Select **Return** to close the Interactive Analysis dialog and return to Genie 2000.

Note: Changes to the data made during Interactive Analysis are written to a temporary copy of the current datasource. The temporary file's data can be written to the datasource when the datasource is saved in Genie 2000.

Plotting preferences, set in Spectral Graph Style (page 173), are stored with Genie 2000's Display Preferences.

## Detection Limits

(S501 Gamma Option) The Detection Limits step contains the algorithms to perform MDA or KTA MDA (used for German regulatory compliance) and LLD calculations. If applied to a spectrum collected with a blank sample or in an empty shield, the Detection Limits calculation is equivalent to an LLD calculation.

The MDA algorithm (Figure 123) calculates the MDA values for all the nuclides as described in the “MDA Calculations” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

Figure 123 Detection Limit Setup

### Confidence Factor

The MDA Setup screen lets you select the MDA Confidence Factor, which can be set to any value between 0.1% (high) and 40% (low) for calculating detection limit values. For instance, to use the NRC 95% confidence factor, you would enter 5.00% here.

Note that the MDA Confidence Factor is used both here and in the Nuclide Identification algorithm (page 163). If the Confidence Factor is changed here, the Nuclide Identification calculations are affected too, unless the factor is changed again in the Nuclide Identification Setup *before* performing its calculation. In either case, VMS Standard Peak Search (page 141) will also be affected by any change in the Confidence Factor if its Critical Level test is enabled.



## Perform Variable ROI Width

Selecting this checkbox extends the MDA ROI to the left and right of the expected location of the energy line by the number of expected FWHMs entered in the ROI Width text box. If not selected, 4.0 FWHM will be used for Currie MDA calculations or 1.25 FWHM for KTA MDA calculations.

### ROI Width

This parameter establishes the width of the ROI as plus and minus the specified number of FWHMs from the expected location of an unidentified peak. The minimum setting is 0.8 FWHM.

## Use Variable MDA Constants

Selecting this allows the user to specify the values for the Add Constant and the Multiplier used in the MDA calculations, as described in the “Currie MDA” section or the “KTA MDA” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

If the checkbox is not selected, the “normal” equation of  $L_D = k^2 + 2L_C$  is used. At the typical 95% confidence level the “normal” equation is equivalent to specifying 2.71 for the Add Constant and 3.29 for the Multiplier.

### Add Constant

This parameter specifies the Add Constant used in the MDA calculation if the “Use Variable MDA Constants” option has been checked.

### Multiplier

This parameter specifies the Multiplier used in the MDA calculation if the “Use Variable MDA Constants” option has been checked.

## Cascade Correction

When a Cascade Correction is applied to the data in an NID step performed before the MDA step, the MDA algorithm will take the cascade corrected results into account.

If Cascade Correction was performed in the NID step, the resulting cascade correction parameters will be displayed here. The names of the Coincidence Library (not editable) and Geometry Composer GIS files will be displayed and the Perform Cascade Correction checkbox will be enabled.

## Generate Report

If the Generate Report box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.

## Post NID Processing

The **Post NID Processing** menu item allows you to run the Line Activity Consistency Evaluator, perform Action Level Calculations, or run the Genie Script Engine.

### LACE (Line Activity Consistency Evaluator)

LACE is used only after NID analysis, as it requires the quantitative output from such analysis. Data can be post-NID processed by LACE as a component of an analysis sequence, as shown in Figure 124, or manually via the Post NID Processing sub-menu of the Analyze menu.

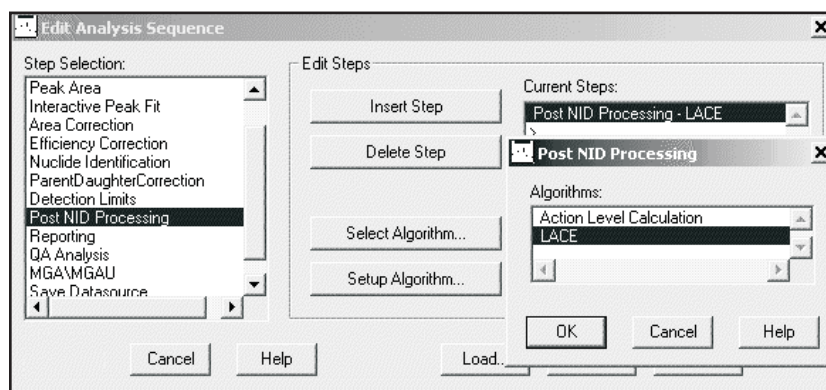


Figure 124 Adding LACE to an Analysis Sequence

For additional information on how LACE operates, refer to Appendix F, *Line Activity Consistency Evaluator*.

Figure 125 shows the output options available after analysis is performed by the LACE algorithm during manual initiation. The results can be displayed as a plot on a screen window and/or printed via a report template.

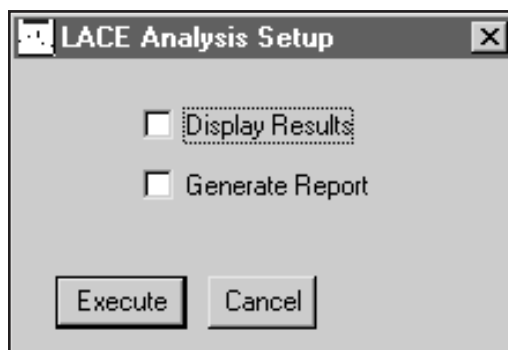


Figure 125 LACE Analysis Setup Screen

If no output option is selected, the processed data is available for future output from the datasource CAM parameters designated for storing LACE results, specified in the *CAM Files* chapter in the *Genie 2000 Customization Tools Manual*. LACE can also be launched as an executable separate from the Genie MCA for the purpose of opening and viewing results from datasources that have already been processed by the LACE analysis algorithm. Refer to “Launching the Viewer” on page 352 for more details.

When setting up an analysis sequence containing the LACE analysis, you can choose to **Display Results** as a plot or **Generate Report** as a printout. If desired, a separate report step can be inserted with the option of a LACE template.

When a datasource is processed by the LACE algorithm with the Display Results option selected, the window shown in Figure 126 appears. The graph shows the data points and curve for a single calculated equation. The nuclide list (to the right of the graph) lists all nuclides in the datasource. Clicking on a nuclide name will select the nuclide for display. Clicking on **Next** or **Previous** buttons will select the next or previous nuclide name in the list. The **Weighted Mean** or **Key Line** curve, whichever button is selected, will be displayed along with the data points defined by the Energy/Ratio pairs, where the Ratio is the Weighted Mean or Key Line ratio. The error bars are the calculated ratio uncertainties.

The equation defining the displayed curve is shown just below the graph. This equation corresponds to the selected Ratio type. The screen controls are defined below:

### Ratio

The weighted mean ratios are ratios of each line activity to the weighted mean of the nuclide activity as calculated during NID with interference correction analysis. Weighted mean ratios are only available if NID with interference correction was performed on the datasource. The key line ratios are ratios of each line activity to the activity of the key line for the nuclide. For key line ratios, available nuclides are only those that had the activity determined for the key line specified in the library file used for the NID analysis. Key line designation can be added or changed by editing the library file and reperforming the NID and LACE analyses.

### Y Scale

Includes edit boxes for specifying the Y-axis limits for viewing. Clicking Auto allows LACE to calculate limits based on the data points for the displayed nuclide.

### X Scale

Includes edit boxes for specifying the X-axis limits for viewing. Clicking Auto allows LACE to calculate limits based on the data points for the displayed nuclide.

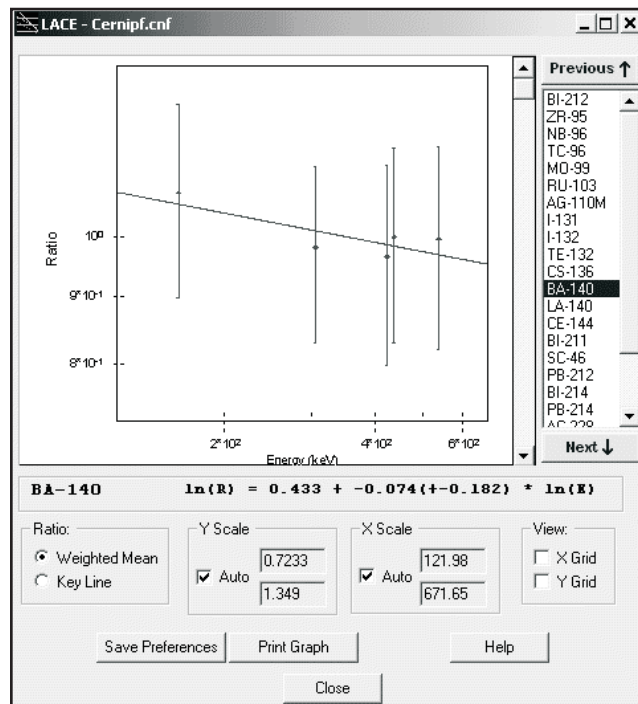


Figure 126 LACE Screen Plot for the Display Results Output

**View**

When checked LACE displays X and/or Y grid lines on the graph.

**Save Preferences**

Saves the default ratio and coordinate scaling parameters to those currently selected.

**Print Graph**

Prints a hard-copy of the graph.

Interpretation of the displayed data includes finding outliers and whether the trend of the lines is reflected in the slope of the fit or exhibits any concavity, as well as the magnitude and direction of the slope.

**Action Level Calculation**

(S501 Gamma Option) The Action Level Calculations (Figure 128) are performed on both identified and unidentified nuclides and will total the number of identified nuclides and unidentified peaks. These functions are described in the “Post-NID Processing Algorithms” section of the “Algorithms” chapter in the *Genie 2000 Customization Tools Manual*.

**Sum Action Level 1**

Specifies Alarm Limits 1 and 2 for the sum of Action Level 1 values for all nuclides.

**Sum Action Level 2**

Specifies Alarm Limits 1 and 2 for the sum of Action Level 2 values for all nuclides.

**Use MDA Values**

When this checkbox is selected, the action level calculation will include MDA values for those nuclides that were not identified, and therefore had no activity values calculated. If not selected, the action level calculations will not include those nuclides for which no activity was found.

**Use Upper Level Values**

When this checkbox is selected, the activity plus its error or the MDA value plus its error will be used as the upper bound value for the action level calculation. If not selected, action level calculations will simply use activity or MDA values.

**Generate Report**

If the **Generate Report** box is checked, a predefined report will be generated when this phase is executed and will be displayed in the application’s report window.

## Script Engine

The Script Engine Setup (Figure 127) lets you specify a Visual Basic® or Java® script to execute on the currently opened datasource. This lets you perform custom operations within the Genie 2000 Acquisition and Analysis environment.

All scripts must be located in the \Genie2k\Scripts folder. By default, CAMDatasource methods and properties should be used within the script.

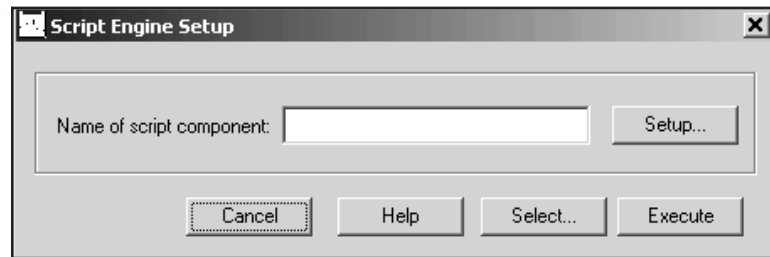


Figure 127 Script Engine Setup

### Name of Script Component

Use the Select button to choose the script to be executed or type in the script's name and extension, up to 32 characters. Do not include the path.

### Select

The Select button opens a list of all script files in Genie2k's Scripts folder so you can choose a script by file name.

### Setup and Execute Buttons

The Setup and Execute buttons must be included as functions in the script being executed, otherwise the buttons do nothing.

### Running the Example Script

The example script, \Genie2k\Scripts\GenieScriptEngine.wsc, is a text file included with the Genie 2000 distribution and installed in the \Genie2k\Scripts folder. To run the script:

- Open a spectrum file in the Gamma application.
- Select Analyze | Post NID Processing | Script Engine.

- Enter the script's name in the Name of Script Component text box (Figure 127).
- Press the **Setup** button, enter sample quantity conversion factor, for instance 24.
- Press the **Execute** button to pass the conversion factor to the CAM parameter specified in the script.

To see the result, open the Edit | Sample Info screen. Its Quantity field should contain 24. If you save the file, the new value will be saved with the spectrum.

## Gain Evaluator

The Gain Evaluator, which can be used with both file datasources and detector datasources, does not perform any hardware adjustments. Instead, it allows you to analyze the quality of the current datasource energy calibration and gain settings, assess the impact on NID analysis, and make corrective data adjustments, including file gain adjustments and saving the calculated energy calibration.

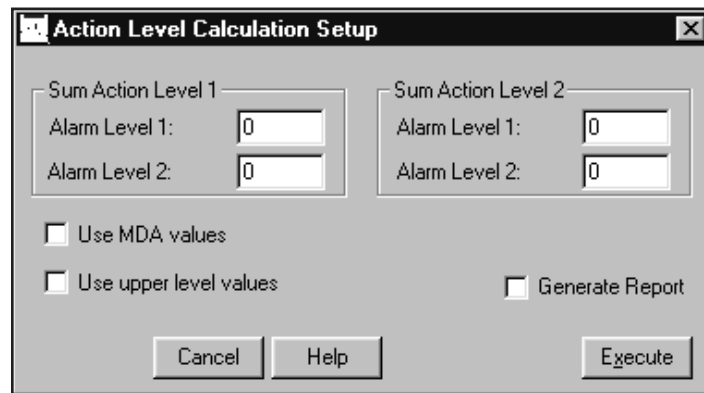


Figure 128 The Action Level Calculation Setup

Gain Evaluator Setup (Figure 129) asks you to specify the actual (true) energies expected to occur in the spectrum by selecting lines from the current NID results, a certificate file or a nuclide library file. These true energies are matched to peaks found in the resident peak search analysis results.

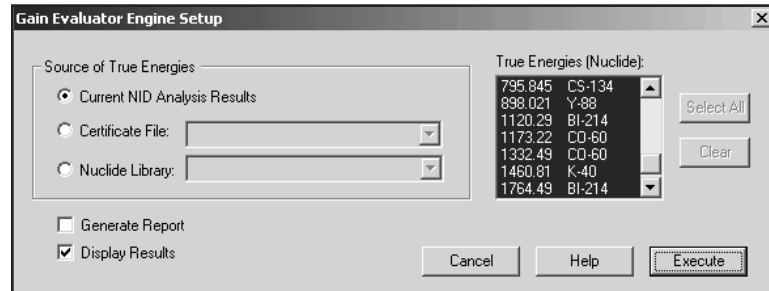


Figure 129 Gain Evaluator Setup

Output includes the reliability of the peak matching, the percent gain shift, and the resulting energy shift in each found peak as a fraction of the local peak width.

The specified datasource must already contain a spectrum acquired from a source with known true energies.

**Note:** Use generic nuclide libraries with caution since extraneous true energies can result in unreliable results and excessive calculation time. Use of a source-specific certificate file or nuclide library is recommended.

### Source of True Energies

Select the source of energies to be used in performing the Gain Evaluation. All of the energies listed in the specified source will be used.

- The Current NID Analysis Results
- A Certificate File
- A Nuclide Library File

### Current NID Analysis Results

Select the **Current NID Analysis Results** button to specify the Nuclide ID analysis results of the current spectrum as the source of true energies.



**Certificate File**

Select the **Certificate File** button to specify a certificate (CTF) file as the source of true energies.

**Nuclide Library**

Select the **Nuclide Library** button to specify a nuclide (NLB) library as the source of true energies.

**Display Results**

Select the Display Results button to open the Gain Evaluator display (Figure 74 on page 99), showing the results of the gain evaluation.

**Generate Report**

Select the **Generate Report** button to generate a report containing a table of data for all true and all found energies, all matched energies and all found energies, and a summary of the analysis results.

## Reporting

The reporting phase contains standard routines to output analysis results and other information contained in the datasource as well as a routine for printing spectra.

### Standard

The functions of the Standard reporting dialog are explained in the following paragraphs. The Genie 2000 Report System, including how to create your own templates, is covered in detail in the *Report Module and Template Files* chapter in the *Genie 2000 Customization Tools Manual*.

### Template Name and Section Name

To output the analysis results, choose both a Template Name and a Section Name within that file, as shown in Figure 130 (note that a section named <all> is available if you want to use the entire template file).

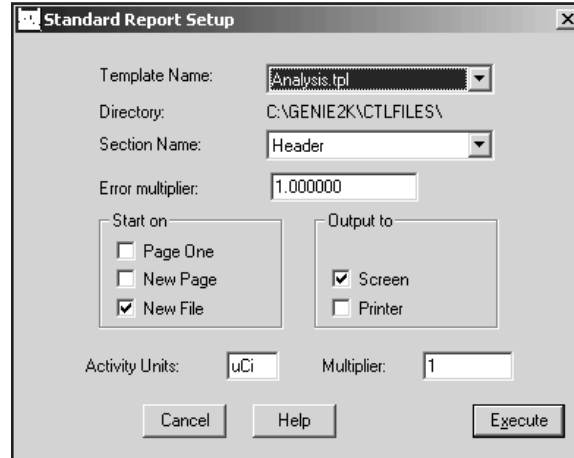


Figure 130 The Standard Report Setup

### Error Multiplier

Though uncertainty values are always calculated and stored at 1 sigma, errors can be reported at a different sigma level by entering a specific Error Multiplier here. For instance, if you'd like errors to be reported at 3 sigma, type in 3 as the Error Multiplier.

### Start On

You should check one of the boxes in the “Start on” section:

- **Page One** means that the first page of the next report section will be numbered as one.
- **New page** means that the new results will be appended to existing results and start on a new page.
- **New file** means that any previous report file (spectrum file name with an extension of .RPT) will be overwritten; if this box is *not* checked, the data will be appended to the existing file.

### Output To

- If the Screen checkbox is checked, the current report section is displayed on the system's screen.
- If the Printer checkbox is checked, the entire report is sent to the system's printer.

Note: A report is always saved to `?:\GENIE2K\REPPFILES\name.RPT`, where *name* is the name of the datasource being reported on.

### Activity Units and Multiplier

Activity Units is normally  $\mu\text{Ci}$ ; if you want to use another unit for reporting nuclide activities, enter that unit here. Since the activities are stored in microcuries, you'll have to enter a factor to convert microcuries to your units (if you want to use Bq, for instance, enter 37000 here).

### Print Spectrum

The Print Spectrum dialog (Figure 131) lets you set the parameters that control the way a hard copy printout of the spectrum will appear.

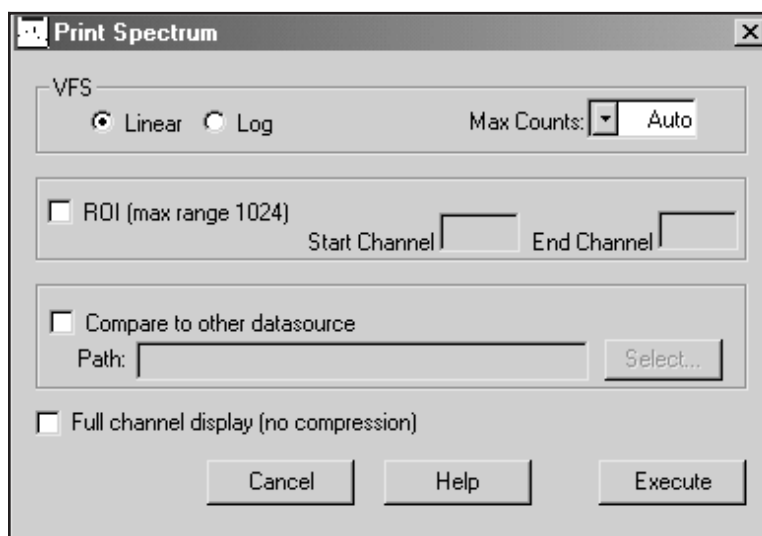


Figure 131 The Print Spectrum Dialog

#### VFS

Choose either Linear or Log for the vertical full scale of the graph.

#### Max Counts

The maximum number of counts can either be determined automatically or chosen by the user from the drop-down list. This maximum must be determined automatically if a second spectrum is to be overlaid (for comparison purposes).

## ROI

To print only a part of the spectrum, check “ROI”, then enter the region’s starting and ending channel numbers. The starting channel must be at least 1. The maximum number of ROI channels that can be printed is 1024.

## Compare to Other Datasource

To overlay your current spectrum with that of a second datasource, check “Compare to other datasource” and specify the datasource:

- Choose the datasource with the **Select** button.
- Type in the fully specified datasource path for any CNF CAM file.  
For example – C:\genie2k\camfiles\Nbsstd.cnf
- Type in any detector name, prefixing it with “DET:”.  
For example – DET:DET1 or \\HOTLAB1\DET:Ge2

Note that since the vertical scale should be automatically determined for printed comparisons, “Auto” must be selected in the VFS “Max Counts” box.

## Full Channel Display

The normal method of spectrum plotting compresses adjacent channels to simplify the graph. Check the “Full channel display” box to display a data point for every channel in the range of channels being plotted. This option is only effective for a range of more than 1024 channels.

## QA Analysis

(S505 QA Software) There are two QA Analysis commands. One, QA Transfer, to transfer data to a selected QA File and another, QA Analyze, to specify options for reporting a selected QA File.

### QA Transfer

**Select** an existing QA (QAF) file to save the QA Analyze data to, then click **Execute** to save the current datasource’s data to the Selected QA file.

### QA Analyze

QA Analyze lets you choose report generation options for the selected QA (QAF) file.

#### Select

The QA file from the most recent **QA Transfer** command will be shown in the text box; use the Select button to choose another.

## Report Selection

Choose which type of report you want to generate: a Last Measurement Report, a Full Report or None.

Select **Last Measurement** to generate a Last Measurement Report for each of the parameter definitions. This analysis compares the most recent measurement to all earlier measurements for that parameter on file.

Select **Full** to generate a Full Report: All of the measurements for each of the parameters defined.

Select **None** to analyze the data, performing limit checks, for example, and store the results in the QA file selected by the QA Transfer command (page 194) without generating a report.

## Start On

- **Page One** means that the first page of the next report section will be numbered as one.
- **New page** means that the new results will be appended to existing results and start on a new page.
- **New file** means that any previous report file (spectrum file name with an extension of .RPT) will be overwritten; if this box is *not* checked, the data will be appended to the existing file.

## Output To

- If the Screen checkbox is checked, the current report section is displayed on the system's screen.
- If the Printer checkbox is checked, the entire report is sent to the system's printer.

Note: A report is always saved to ?:\GENIE2K\REPPFILES\*name*.RPT, where *name* is the name of the datasource being reported on.

## Save Datasource

This phase specifies the save location for an open datasource. If the phase is invoked from the **Analyze** menu, the save will occur immediately after you click the **Execute** button.

Note: Although analysis sequences can be executed in a command line environment using REXX or ANALYZE.EXE directly, the Save Datasource step will only work in that environment if automatic file naming has been enabled in the Sequence Preferences dialog on page 202.

In an Analysis Sequence File, the phase can appear more than once as a step. The Save Datasource window in Figure 132 will appear, once for each step, when the sequence begins execution.

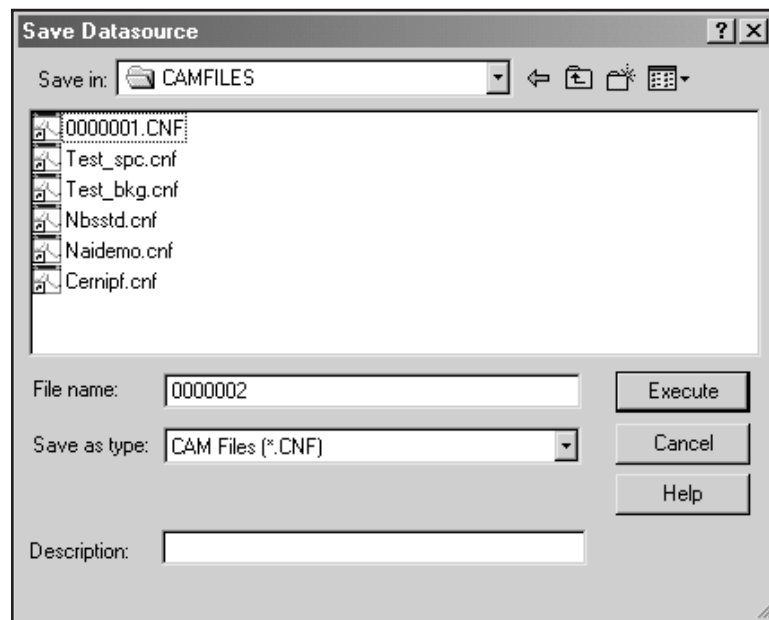


Figure 132 Save Datasource Dialog

This lets you specify the save parameters separately for each instance of the step. The save parameters you specify for each instance will be used when that instance is executed in the sequence.

### Save as Type

The “Save as type” box lets you select the file format you want to save as: CAM (.CNF), Toolkit (.TKA), or IEC455 (.IEC). If you type in the file name without an extension, the selected “Save as type” extension will automatically be appended.

To save a file with an extension other than those associated with the file filters, type the file name and extension, surrounded by double quotes (“filename.abc”), into the “Save as type” box.

## Description

For CAM files, you can enter an optional description of up to 32 characters.

## Edit Menu

The **Edit** Menu allows you to enter and edit Sample Information, define and edit Analysis Sequences.

## Sample Info

**Sample info** presents you with a dialog screen (Figure 133) for entering sample information for the current datasource.

Figure 133 Editing Sample Information

### The Text Fields

The text fields allow you to enter descriptive data for your sample. You can enter up to 64 characters in the Sample Title field and all four of the Sample Description fields. You can enter up to 16 characters in the Sample ID, Type, and Sample Geometry fields and up to 24 characters in the Collector Name field.

### The Information Fields

The information fields let you enter the Sample ID, Type, sample Quantity, its Uncertainty and Units, the Sample Geometry and the user-defined percent Random Error and percent Systematic Error, all of which are used in calculating the uncertainty for the nuclide line activity, as described in the “Basic Calculations” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

### **Buildup Type**

Selecting **None** will allow entry of the Sample Date and time; that is, the time you collected the sample. The Begin Date is not available for this Type.

Selecting **Deposition** or **Irradiation** lets you enter the Begin Date and time and End Date and time for your sample's deposition or irradiation time.

### **Load Cal**

The **Load Cal** button lets you load a calibration file (.CAL) into the datasource. You have the option of loading the source's Energy/Shape calibration, Efficiency calibration, or both. The **Info** button displays a dialog box which shows descriptive information for the currently selected file, if any is available.

### **More**

The **More** button will not be seen on the Edit Sample Information screen unless the GAAINFO.FDS file is present in the directory defined by the environment variable EXEFILES (refer to "Genie 2000 Environment Settings" on page 310 for more information on environment variables).

When the **More** button is present, it lets you define or customize a dialog which allows editing of additional sample information parameters. Only CAM sample class parameters are supported by this mechanism.

Note: If an .FDS file is defined that contains sample parameters already present on the main edit sample information dialog, any value entries for those duplicate parameters will be overridden by values entered in the main dialog screen.

## **Analysis Sequence**

The **Analysis Sequence** command allows you to create or edit analysis sequences that you can use to automatically analyze your spectra (Figure 134).



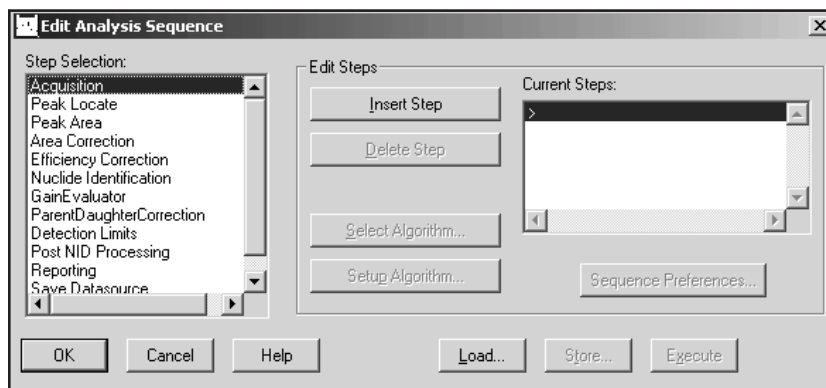


Figure 134 The Edit Analysis Sequence Dialog

### Sizing the Window

The Editor's window defaults to a minimum size, but can easily be dragged to a larger size.

In the Algorithms and Current Steps lists, you'll see some steps with an asterisk before their names, such as "\*Reporting – Standard". These steps have parameters that control how the sequence's output will be presented.

Note: An Analysis Sequence file can also be created or edited with the standalone Analysis Sequence Editor, which is described in detail in Chapter 6, "Using the Analysis Sequence Editor".

### Unique Parameters

Note that the steps listed in the following table have parameters that can be defined uniquely each time they occur in a sequence.

Step	Parameters
Peak Locate and Peak Area	Start channel and Stop channel
Save Datasource	File name, Save as type and Description
Report	All parameters other than Activity Units and Multiplier

### Common Parameters

All other sequence step parameters are “common”; they cannot be specified independently. If there are multiple instances of one of these steps in a sequence, all instances of that step will have the same parameters.

### Insert Step

To add a step to the sequence, highlight a step in the Step Selection list box, then click on the **Insert Step** button. The step will be added to the Current Steps list.

### Delete Step

To remove a step from the sequence, highlight the step in the Current Steps list that you want to remove, then click on the **Delete Step** button.

### Select Algorithm

To choose an algorithm for the current step, press the **Select Algorithm** button. For instance, if you had inserted and highlighted the Peak Locate phase step, pressing the Select Algorithm button would bring up a window similar to Figure 135, which shows the Peak Locate phase’s algorithms. To associate one of the algorithms with the phase, highlight the algorithm then press **OK** to save the association.

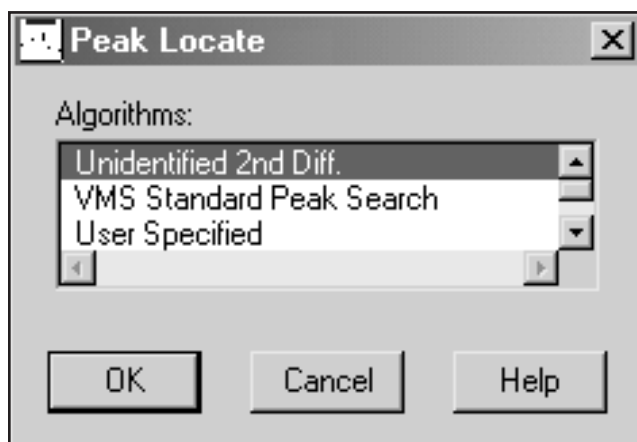


Figure 135 Selecting an Algorithm

## Set Up Algorithm

After you have associated an algorithm with the phase, press the **Setup Algorithm** button and verify or change the algorithm's parameters. The setup screens and parameter choices for each of the analysis phases are described in detail in "Analyze Menu", starting on page 130.

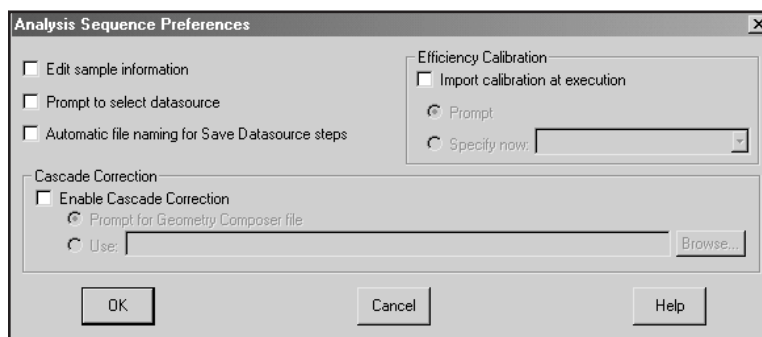


Figure 136 Analysis Sequence Preferences

## Sequence Preferences

After you have begun editing an analysis sequence, press the Sequence Preferences button to set a group of preferences for that sequence (Figure 136).

### Edit Sample Information

If the "Edit sample information" box is checked, you will be prompted to edit Sample Information (page 197) when the sequence begins execution. If the box is not checked, there will be no prompt.

**Note:** No prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX, regardless of this preference setting.

### Prompt to Select Datasource

If you check the "Prompt to select datasource" box, you'll be prompted to choose a datasource when the sequence begins execution. If the box is not checked, the analysis sequence will use the detector or file datasource that is open and active when the analysis sequence is run.

**Note:** No prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX, regardless of this preference setting.

### Automatic File Naming

Check the “Automatic file naming” box to cause the system to automatically create a new file name each time the Save Datasource step is executed. The files are saved in the standard CAMFILES subdirectory and are named sequentially. If the box is not checked, you will have to specify a file name when the sequence is run.

The first time this function is executed, the file will be named “00000001.CNF” and the counter will be incremented by one. When the counter reaches  $10^8$ , it will reset to 1.

Note: This preference must be enabled for any sequence that includes a Save Datasource step and that will be executed in a command line environment using ANALYZE.EXE or REXX directly.

### Efficiency Calibration

Check the “Import calibration at execution” box to indicate that an efficiency calibration should be imported at execution. If the box is not checked, the calibration in the datasource being analyzed will be used.

Notes: No calibration selection prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX.

When an efficiency calibration that includes the specification of a GIS file is imported during an analysis sequence, this specification will be overridden if a .GIS file is also specified in either the Sequence Preferences settings or the NID with Interference Correction algorithm settings.

### Prompt

If “Prompt” is selected, you will be asked to specify the calibration when the analysis sequence starts to run.

### Specify Now

If “Specify now” is selected, you’ll choose the calibration file now instead of at execution time. The drop-down list shows the efficiency geometry identifier of each .CAL calibration file found in the CALFILES directory.

If a calibration file does not specify an efficiency geometry identifier, the list will display the file name (truncated if necessary) enclosed in parentheses. Note that the efficiency geometry identifier can be set via **Calibrate | Store** menu selection.

### Cascade Correction

To enable cascade correction, mark the checkbox. The currently specified .GIS Geometry Composer file is displayed.

Note: When an efficiency calibration that includes the specification of a .GIS file is imported during an analysis sequence, this specification will be overridden if a .GIS file is also specified in either the Sequence Preferences settings or the NID with Interference Correction algorithm settings.

### Prompt for Geometry Composer File

If “Prompt for Geometry Composer File” is selected, you will be asked to specify the calibration when the analysis sequence starts to run.

Note: No file selection prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX.

### Use

If “Use” is selected, you’ll choose the indicated file now instead of at execution time.

Note: This setting will overwrite any existing .GIS file specification in interference-corrected nuclide identification steps. Similarly, specifying a .GIS file in such a step after choosing one in the Analysis Sequence Preferences window will overwrite the preference setting. (Both methods control the same property.)

## Load

**Load** (Figure 137) lets you load a defined sequence, populating the Current Steps list box with the sequence’s steps and loading their associated setup parameters.

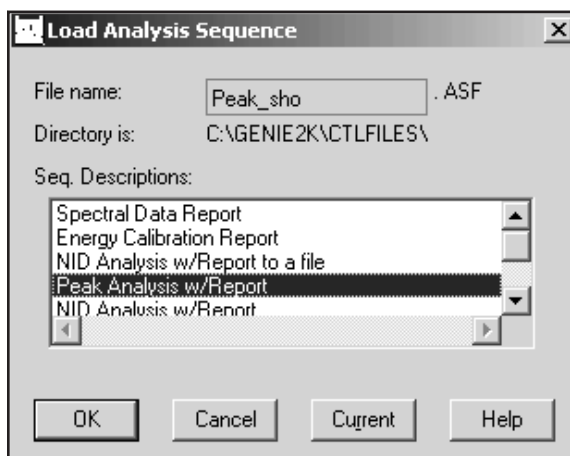


Figure 137 Loading a Sequence

### **OK**

Selecting **OK** loads the sequence highlighted in the Seq. Descriptions list.

### **Current**

Selecting **Current** loads the steps from the last sequence file executed in this session, or if no sequence has been executed, the sequence stored in the current datasource.

### **Store**

Store allows you to save the currently defined analysis sequence as a file. These files will appear in both the Analyze menu and the Load screen's sequence descriptions.

### **Execute**

The **Execute** button executes the currently defined analysis sequence, which is the sequence of steps listed in the Current Steps list box.

## **Options Menu**

The **Options** Menu lets you Change the Operator's Name, perform Strip and Smooth, and work with the Report Window.

### **Change Operator Name**

Selecting **Change Operator Name** lets you enter or edit an operator name. This name will be stored in all currently opened datasources whenever various phases of analysis and calibration are performed.

### **Interactive NID**

The Interactive Nuclide Identification (NID) option (Figure 138) brings up a modeless dialog, allowing you to see a graphical connection between the location of the spectrum cursor and the nuclides in a library.

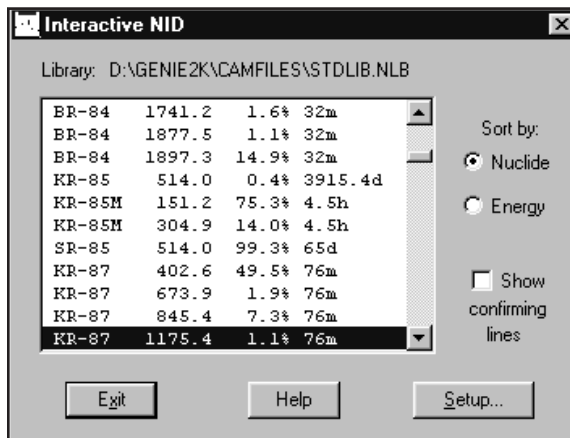


Figure 138 The Interactive NID Dialog

As you move the cursor in the spectrum window, Interactive NID will attempt to find the closest matching line (within tolerance) in the nuclide library and select that line in the list box. Alternatively, you may select a line in the list box and this will automatically move the spectrum cursor (if possible) to that energy.

The nuclide information for the currently selected line will also be displayed in the Nuclide Info status page. If the cursor is within an ROI, an activity will be calculated using the current efficiency calibration and displayed in that page.

### Sort By Nuclide or Energy

The list can be sorted either by nuclide name, or by line energy. Use these radio buttons to toggle between the two modes.

### Show Confirming Lines

If the Confirming Lines box is checked, the energies of any other lines for the selected nuclide will be marked in the spectrum window.

### Setup

The Setup button lets you change the Interactive NID preferences. This includes nuclide library, tolerance, and activity units.

## Geometry Composer

This menu entry will be available only if the S501 Gamma Analysis, S573 ISOCS or S574 LabSOCS application option is installed on your system. Refer to Chapter 8, *Using the Geometry Composer*, for details.

## Strip

The **Strip** command (Figure 139), lets you choose the Background Datasource, multiplied by the selected factor, to be subtracted from the Current Datasource, channel by channel.

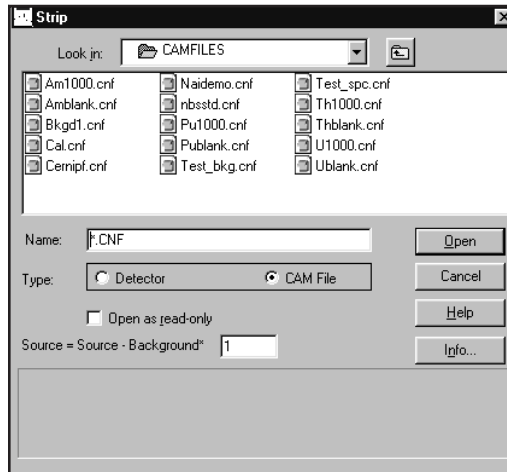


Figure 139 The Strip Dialog

### Source = Source Background

Enter the factor to multiply the Background Datasource by.

### Background Datasource

Click on one of the Source buttons, then select a **CAM File** or a **Detector** from the list box to start the strip function.

## Smooth

Choosing **Smooth** (Figure 140) lets you smooth the current datasource to decrease or eliminate random data fluctuations. You can choose one of six weighted-average smoothing algorithms, from 3 point to 13 point.



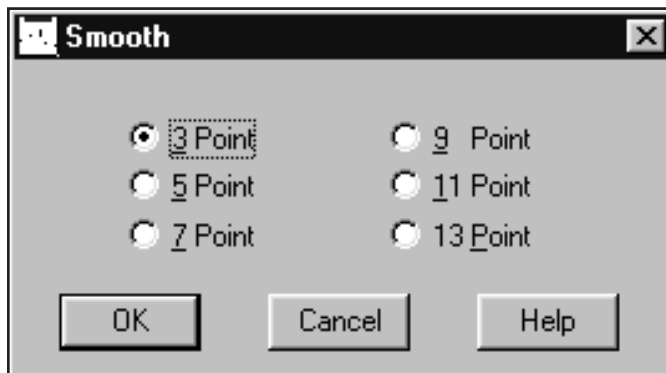


Figure 140 The Smooth Dialog

### How Smoothing Works

As an example of how smoothing works, let's consider **3 Point** smoothing, which weight-averages three channels at a time: the current channel and one channel to either side. The weighted-average value is placed in the current channel, then the algorithm moves on to the next channel, repeating the process until the entire spectrum has been smoothed.

## Datasource Overview

The three Datasource Overviews display a brief summary of the Acquisition, Analysis and Calibration parameters stored in the current datasource.

### Acquisition Data

The Acquisition Data view (Figure 141), summarizing data about the datasource acquisition, shows the datasource's name and detailed input information.

#### Datasource Name

File datasources will be listed as Path\FileName.

MCA datasources will be listed as Detector: <MID input name>.

#### Input Information

This information describes the physical device used to acquire the datasource. The information is also available on the "Input Info" Status Page (page 128). If the data is not present, the field will be blank.

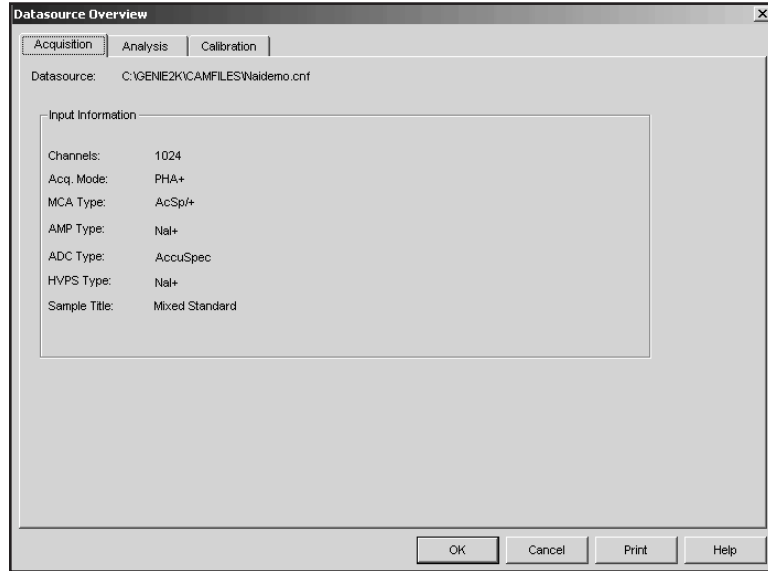


Figure 141 Acquisition Overview

### Analysis Data

The Analysis Data view (Figure 142) summarizes data about the analysis that has been applied to the datasource. The algorithms used for that step will also be identified. If an Analysis Sequence has been stored in the datasource, the steps will be displayed. A list of files that will be or have been used for an analysis step will also be displayed.

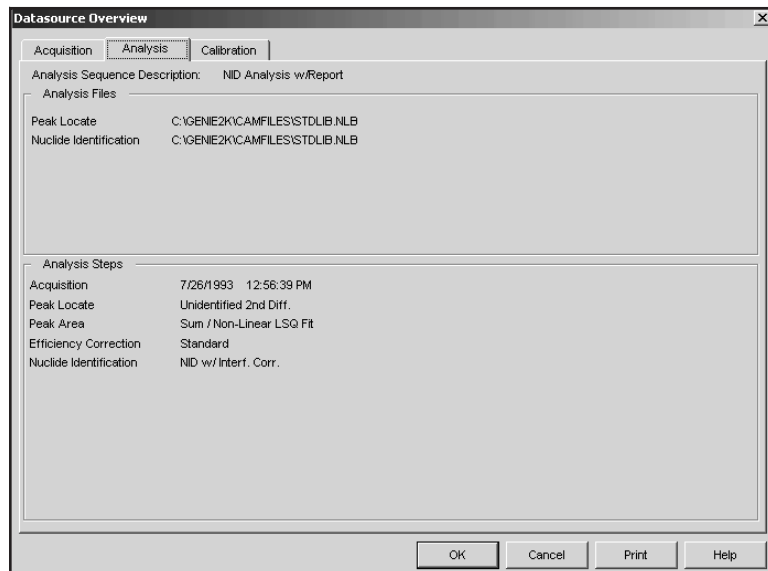


Figure 142 Analysis Overview

## Analysis Sequence Description

Analysis Sequence Description data names the analysis sequence file (ASF) used to analyze the spectrum. If no sequence file was executed, the Description will be blank.

## Analysis Files

Any additional files used to perform analysis steps, such as NLB and CNF files, will be listed here.

Note: An entry in the Analysis Files section does not necessarily mean that the step has been performed on the datasource.

## Analysis Steps

The Analysis Steps section lists the analysis steps performed on the datasource. The list of steps is derived from an Analysis Sequence File (ASF), selections from the Analyze menu, or both. A grayed-out algorithm name indicates that analysis step has not been executed.

## Calibration Data

The Calibration Data view (Figure 143) displays the current energy and efficiency calibration data for the foreground datasource.

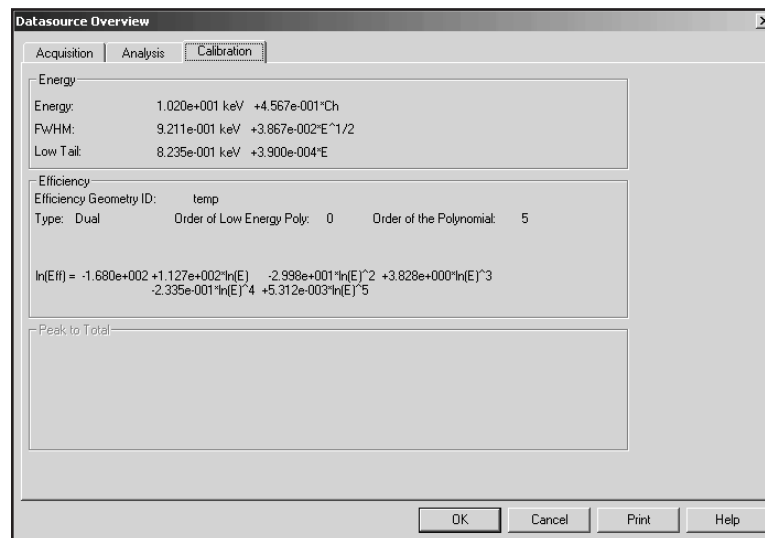


Figure 143 Calibration Overview

### **Energy**

The Energy data includes the energy, FWHM and Low Tail equations.

### **Efficiency**

The Efficiency data includes the efficiency equation, model (type), and the order of both the low energy peak and the polynomial.

### **Peak to Total**

The Peak-to-Total data includes the peak to total calibration equations, the order of the low energy peak and order of the polynomial.

## **Report Window**

The Report Window menu item lets you work with the window's contents and control the window's size. The window size you choose can be saved as a permanent setting with the Display Preferences | Save command (page 120).

You can create a PDF file of the Report Window's contents with the File | Export Report to PDF command (page 45).

### **Copy Highlighted to Clipboard**

This command copies the highlighted contents of the Report Window to the system clipboard so you can paste the data in another application, such as a word processor or a presentation program.

### **Copy Contents to Clipboard**

This command copies the entire contents of the Report Window to the system clipboard.

### **Clear Contents**

Selecting this command will remove all data from the Report Window.

### **Load Existing Report**

This command loads a selected RPT file into the Report Window. If there is already a report in the window, the loaded file will overwrite it. Execution of this command requires that the Report Window not be minimized.

### **Default Size**

If you have changed the size of the Report Window, either by dragging a window border or by using one of the sizing commands in this menu, this command will return the window to its default size.

**Maximize**

The Maximize command will enlarge the Report Window to full screen, allowing you to read the data more easily.

**Minimize**

This command removes the Report Window from the display and maximizes the spectral display.

**Datasource Menu**

The **Datasource** menu doesn't appear in the Menu Bar until at least one datasource has been opened. It can show up to eight datasource file names. If more than eight datasources are currently open, the "More" item will be added to the menu. Selecting **More** brings up a list of all open datasources, letting you choose the one of interest (Figure 144). The maximum number of datasources which can be open at one time is 48.

When one of the datasource file names is selected, the spectral display area changes to show the selected datasource.

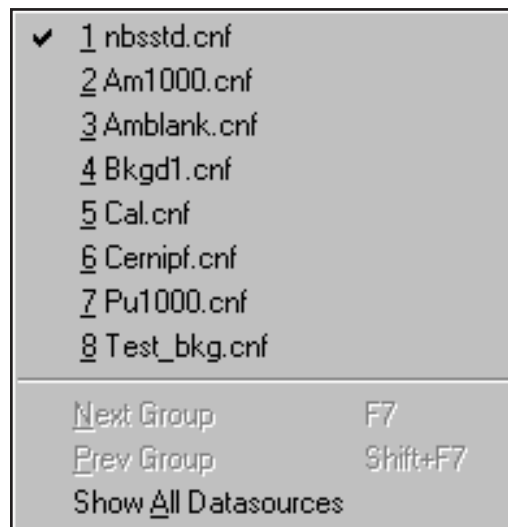


Figure 144 The Datasource Menu

**Next Group**

Select **Next Group** to index to and display the next memory group. This menu item is available only if the datasource is a multi-memory group input.

For example, if you open a Detector Input called MULTI(1:4), the spectral displays will display the first memory group. Selecting **Next Group** will display memory group 2 and the Title Bar will show MULTI(2:4), and so on.

### Previous Group

The **Prev Group** menu item, which is available only if the datasource is a multi-memory group input, indexes to and displays the previous memory group.

For example, if you open a Detector Input called MULTI(1:4), the spectral displays will display the first memory group. Selecting **Prev Group** will display memory group 4 and the Title Bar will show MULTI(4:4), and so on.

### Show All Datasources

**Show All Datasources** is available only if more than one datasource is open. Selecting it will simultaneously display up to eight open datasources. The name of each datasource will be shown in the top right corner of the datasource's display. The acquisition status of each hardware datasource will be shown in the top left corner.

You can list the next set of eight either by pressing the keyboard's F6 key (next datasource) or by selecting the Datasource | More menu item and choosing any of the open datasources.

When displaying multiple datasources, the current datasource has a heavy border around its display and its name is displayed in the Title Bar.

Single click on any one of the display areas to make it the current datasource. Double click on any one of the display areas to make that datasource a full screen display.

## 4. Using the Nuclide Library Editor

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Included with the Genie 2000 Basic Spectroscopy software is an editor for creating and maintaining the nuclide libraries that are used for both qualitative and quantitative radionuclide analysis. In this chapter we'll take a look at how to use that editor to modify existing and create new nuclide libraries.

### Getting Started

To start the Editor, double click on its icon in the Genie 2000 folder. This will start the program and will bring up the Dialog Box shown in Figure 145.

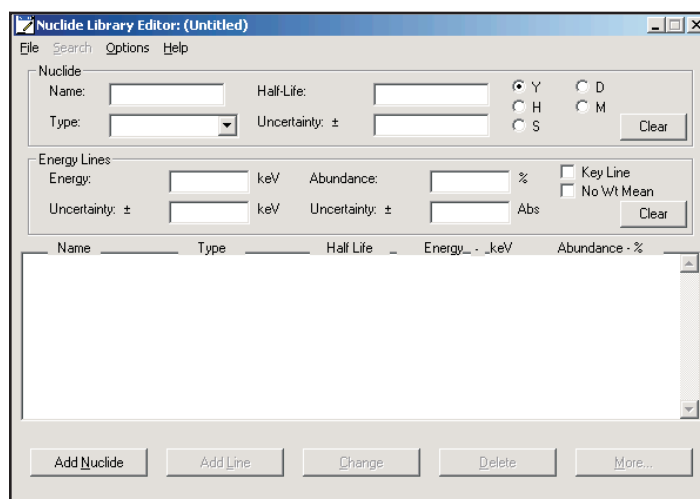


Figure 145 The Nuclide Library Editor

### Sizing the Window

The Editor's window defaults to a minimum size, but can easily be dragged to a larger size.

## Editing a Nuclide Library

Genie 2000 includes a Standard Nuclide Library, a NaI Detector (example) Library, a Demo Nuclide Library and four Master Libraries. The Demo Nuclide Library, DEMOLIB.NLB (Table 1), contains 17 nuclides and 60 lines. The “No MDA” flag (page 218) is not set for any of the nuclides in the Demo Nuclide Library.

The Standard Nuclide Library STDLIB.NLB contains 109 nuclides and 511 lines; the “No MDA” flag is set for all nuclides *except* those listed in the Demo Nuclide Library.

Table 1 The Demo Nuclide Library

K-40	Co-57	Co-60	Se-75	Sr-85
Y-88	Cd-109	Sn-113	Cs-134	Cs-137
Cs-138	Ce-139	Hg-203	Kr-85	Sc-46
Sc-46	Pb-214			

The four Master Libraries are included to help you build tailored libraries for specific situations. For more information on these libraries, their origin and their use, refer to “The Master Libraries” on page 232.

We’ll edit the Demo Nuclide Library to see how to use the Nuclide Library Editor.

## Opening a Nuclide Library

The **Open** command in the **File** menu is used to select a file for editing. From the standard File Open dialog box, open the file DEMOLIB.NLB. This will result in a screen like the one in Figure 146. The first nuclide – K-40 – is selected for editing.



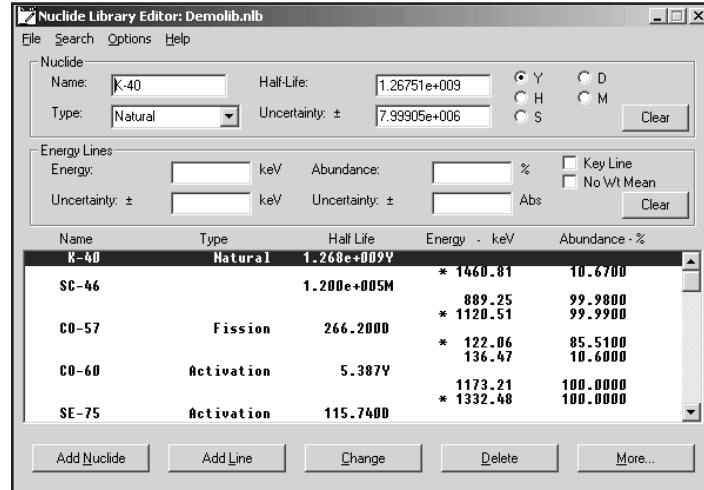


Figure 146 A Library Opened for Editing

## The Nuclide Data

For each radionuclide in the library, there is both a basic set of data that must be present plus optional sets of permissible limit data: MPC Values, Effl./DAC Values, Action Level / Derived Parameter Values, Nuclide Constants, and More.

In addition, there are editing buttons that are used to deal with nuclide entries as a whole (as opposed to operating on just one energy line of a nuclide).

## Master Buttons

There are five buttons at the bottom of the screen which affect the entire window.

### Add Nuclide

To add a new nuclide to the library, edit the nuclide data as above, then click on the **Add Nuclide** button. This will position the nuclide in the library so that the library remains sorted by mass number and nuclide name.

### Change

Once you've made all your edits to an existing nuclide entry, clicking on the **Change** button will update the entry in the list with the values from the edit fields.

### Delete

To delete a nuclide from the library, select it by clicking on it, then click on the **Delete** button. This pops up a query box to confirm the deletion.

## **Nuclide**

The first entry for each nuclide in the library is general information about the nuclide itself, basic data and energy lines.

### **Name**

This is an eight-character field that is used for the name of the nuclide.

### **Type**

This is a 16-character field that can be used to enter a type or classification for the nuclide if you like.

### **Half-Life**

Enter the nuclide's half-life in this field, then choose the time units: Years, Days, Hours, Minutes, or Seconds.

### **Uncertainty**

This is the uncertainty in the half-life, expressed in the same time units as the half-life.

### **Clear**

This button deletes all data from the Nuclide fields so new values can be entered.

## **Energy Lines**

There will be one or more Energy Line entries for each Energy Line that you want to have associated with the current Nuclide.

### **Energy and its Uncertainty**

This is the energy of the line in the units specified and the uncertainty in the energy, expressed in the same units as the energy.

### **Abundance and its Uncertainty**

This is the percentage of the total events emitted by the nuclide at this particular energy and the uncertainty in its abundance, expressed in absolute terms.

### **Key Line**

Check this box to select the current line as the nuclide's "Key Line". It's used for reporting purposes, and is normally selected for the highest abundance line for a nuclide with multiple lines.

### **No Wt Mean**

Check this box to disable use of this line in weighted activity calculations. If the box is not checked, the energy line will be used in the calculations.

**Clear**

This button deletes all data from the Energy Line fields so new values can be entered.

**More**

Clicking on the **More** button pops up the Dialog Box shown in Figure 147, which is used to add optional nuclide data related to decay chain information, Parent/Daughter information, Health Physics analyses and more.

**Additional Nuclide Parameters for K-40**

Abundance Limit:       Mass Factor:  g / uCi

Average Gamma:  MeV      Equiv. Factor:

Average Beta:  MeV       No MDA       No EBAR

MDA to be met:  uCi / unit

Decay Chain

Parent:       Parent-Daughter Decay Ratio:

Daughter:       Error on Decay Ratio:

Figure 147 The Optional Data Dialog

**Abundance Limit**

This field is reserved for future use.

**Average Gamma**

This is the average gamma energy that is emitted by this nuclide.

**Average Beta**

This is the average beta energy that is emitted for this nuclide.

**MDA to be Met**

The value entered here is used by the MDAPRESET Job Function, which is described in section with that title in the *Batch Procedure Reference* chapter of the *Model S561 Batch Tools Support Reference Manual*.

### **Mass Factor**

This factor, in g/μCi, converts activity (μCi) to mass (grams) for the selected nuclide.

### **Equiv. Factor**

This field is used for <sup>131</sup>I or <sup>137</sup>Cs equivalency calculations.

### **No MDA**

If this check box is selected, the “No MDA” flag will be set and this nuclide will not be included in any Minimum Detectable Activity calculations that are performed.

### **No EBAR**

If this check box is selected, this nuclide will not be included in any EBAR calculations that are made.

## **Decay Chain**

These fields specify the parent and daughter nuclides, if any, of the current nuclide. They are used by Genie 2000's Parent-Daughter function.

### **Parent**

Select the appropriate Parent nuclide from the drop down list.

### **Daughter**

Select the appropriate Daughter nuclide from the drop down list.

### **Parent-Daughter Decay Ratio**

The **Parent-Daughter Decay Ratio** specifies the parent nuclide's fractional decay probability of decaying into the current nuclide. Note that this is an absolute fraction, not a percentage.

### **Error on Decay Ratio**

Enter the value of the decay ratio's error here.

## **The Energy Line Data**

In addition to the general nuclide data, each library entry also contains one or more Energy Line entries. There will be one such entry for each Energy Line that you want to have associated with that nuclide.

## Editing an Energy Line Entry

To edit a nuclide's data, double click on its line. This will copy its parameters into the Energy Line edit area, as shown in Figure 148.

The screenshot shows the 'Nuclide Library Editor: Stdlib.nlb' window. The 'Nuclide' section has fields for Name (K-40), Type (natural), Half-Life (1.277e+009), and Uncertainty (8e+006). The 'Energy Lines' section has fields for Energy (1460.810 keV), Abundance (10.67%), and Uncertainty (0.000000 keV). A table below lists energy lines for K-40, AR-41, and K-42. The K-40 line is highlighted, and its data is reflected in the edit fields above. The 'Key Line' checkbox is checked, and the 'No Wt Mean' checkbox is unchecked.

Name	Type	Half Life	Energy - keV	Abundance - %
K-40	natural	1.277E+009Y	* 1460.81	10.6700
AR-41	activation	1.827H	* 1293.64	99.1600
K-42		741.600M	* 1524.66	17.9000

Figure 148 Editing Energy Line Data

1. **Energy.** This is the energy of the line. In this case the energy is displayed in keV.
2. **Uncertainty.** This is the uncertainty in the energy, expressed in the same units as the energy.
3. **Abundance.** This is the percentage of the total events emitted by the nuclide at this particular energy. Abundance is also called branching ratio or yield in the literature.
4. **Uncertainty.** This is the uncertainty in the abundance, expressed in Absolute terms. For example: The abundance is  $10.67 \pm 0.11\%$  in Figure 148.
5. **Key Line.** This check box is used to select or deselect this line as the “Key Line” for the nuclide. It is used for reporting purposes, and is normally selected for the highest abundance line for a nuclide with multiple lines.
6. **No Wt Mean.** Check the No Weighted Mean checkbox if you want to omit this line from the weighted mean activity calculations, as described in the “Activity Corrections” section of the *Algorithms* chapter in the *Genie 2000 Customization Tools Manual*.

Once you've made all your edits to an Energy Line, click the **Change** button at the bottom of the screen to update the entry in the list with your new values.

### Adding an Energy Line

To add a new line to the nuclide, edit the line data as above, then click on the **Add Line** button. This will add the line in its proper energy position in the list of lines for the nuclide.

### Deleting a Line

To delete a line from a nuclide, select it by clicking on it, then click on the **Delete** button. There is no confirmation query, so make sure you have selected the correct line before clicking on Delete.

## The Options Menu

The Options Menu contains several commands that can be used to further tailor the Nuclide Library.

### Extract

This command lets you extract nuclides and their associated energy lines and information from an existing nuclide library file.

Select **Extract**, then click on **Open** and double click on a nuclide library name in the Files list box. The Extract Library Nuclides list box will be populated with the nuclides from the selected library, as seen in Figure 149.

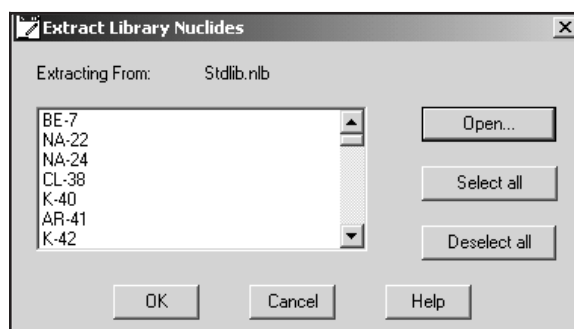


Figure 149 The Extract List Has Been Populated

Single nuclides can be extracted simply by clicking on the nuclide name in the list box, or click on **Select all** to extract all lines.

## Energy Units

Though energies are stored in keV, the **Energy Units** command can change how energy units are shown in the editor's dialog boxes and in reports. The dialog box in Figure 150 allows you to select which energy units you want to display: **eV**, **keV**, **MeV**, or **Other**.

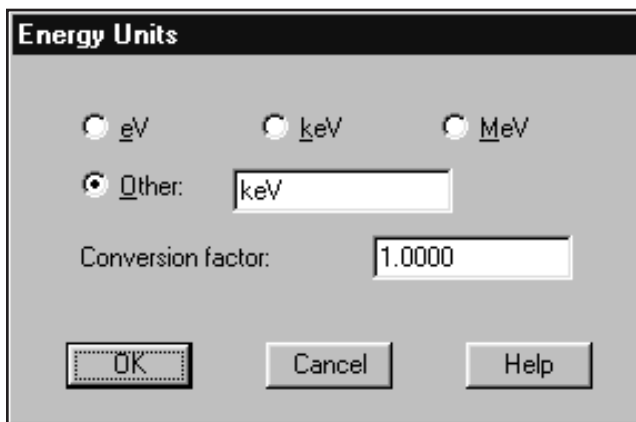


Figure 150 Energy Units Dialog

The proper Conversion Factor for “other” units is defined as the number of keV units equal to 1 “other unit”. For example, the conversion factor for MeV would be 1000 because there are 1000 keV units in 1 MeV.

## MPC Units

To set the MPC units, click on **MPC Units** in the Option Menu. You'll see the dialog box shown in Figure 151, where you can select the MPC Activity Units ( $\mu\text{Ci}$  or Bq) for the library and the Volume Units ( $\text{cm}^3$ ,  $\text{m}^3$ , ml or l) for each of the MPC limit variables in the library.

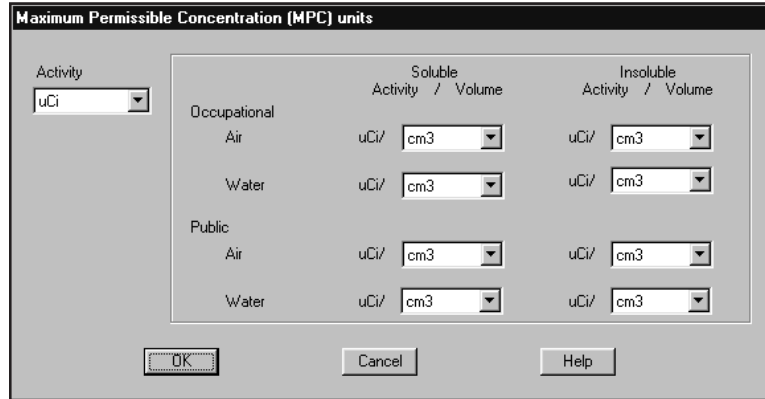


Figure 151 The MPC Units Dialog

Drop down lists are used for the selection. For each item you want to change, click on the Down Arrow, then click on your choice from the list.

## MPC Values

This command is used to set the MPC values for the currently selected radionuclide. Click on **MPC Values** in the Option Menu to see the dialog box shown in Figure 152. Now you can set values for each of the eight Maximum Permissible Concentration limits. The units for these MPC values are the ones set under MPC Units in the Options menu (page 221).

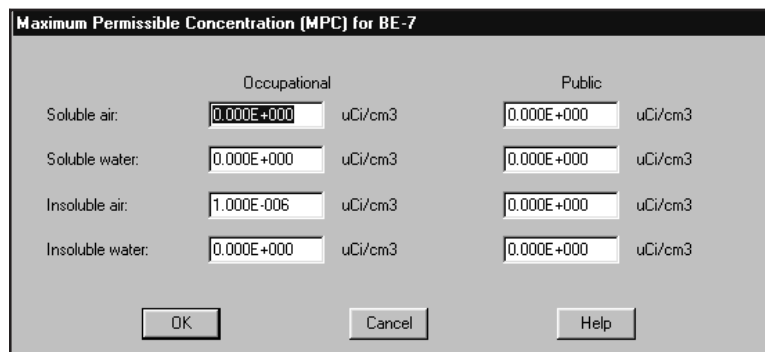


Figure 152 The MPC Values Dialog



## MPC Concentration Limits

Use this dialog to enter Concentration Limits for the nuclide and type selected in the main editor window (see Figure 146). The Maximum Permissible Concentration Classification Limits entered here apply only to the selected type. You can enter limit values in only one of the dialog's sections.

Maximum Permissible Concentration (MPC) for K-40

Enter the concentration limit(s) for the nuclide into one and only one of the sections below

Table 1 - Alpha Emitting Transuranic with half-life greater than 5 years  
Concentration limit:  nCi/g

Table 1 - Nuclide with limit in mass units  
Concentration limit:  nCi/g

Table 1 - Nuclide  
Concentration limit:  Ci/m<sup>3</sup>

Table 2 - Nuclide with Class A, B and C limits  
Class A - Concentration limit:  Ci/m<sup>3</sup>  
Class B - Concentration limit:  Ci/m<sup>3</sup>  
Class C - Concentration limit:  Ci/m<sup>3</sup>

Table 2 - Nuclide without Class B and C limits and a half-life less than 5 years  
Concentration limit:  Ci/m<sup>3</sup>

Table 2 - Nuclide without Class B and C limits and a half-life greater than 5 years  
Concentration limit:  Ci/m<sup>3</sup>

OK Cancel Help

Figure 153 Maximum Permissible Concentration

## Effl./DAC Units

This command is used to set the Effluent and DAC limit units. Click on **Effl./DAC Units** in the Option Menu to see the dialog box shown in Figure 154. Now you can set the Effluent and DAC limit Activity Units ( $\mu\text{Ci}$  or  $\text{Bq}$ ) for the library and the volume units ( $\text{cm}^3$ ,  $\text{m}^3$ ,  $\text{ml}$ ,  $\text{l}$ ) for each of the Effluent and DAC limit variables in the library.

Drop down lists are used for the selection. For each item you want to change, click on the Down Arrow, then click on your choice from the list.

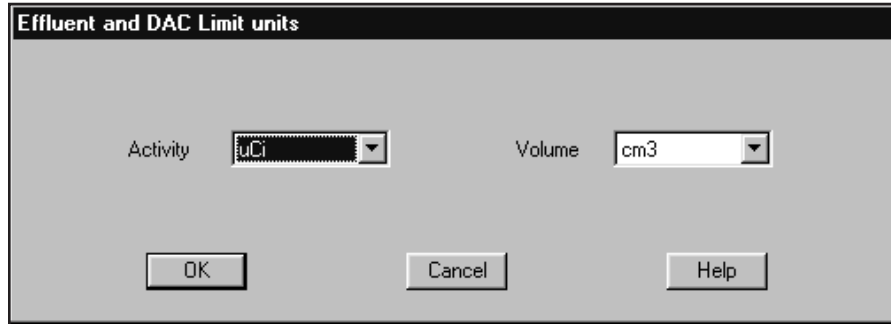


Figure 154 Effluent and DAC Limit Units Dialog

## Effl./DAC Values

This command sets the Effluent and DAC limit values for the currently selected radionuclide. Click on **Effl./DAC Values** in the Option Menu to see the dialog box shown in Figure 155.

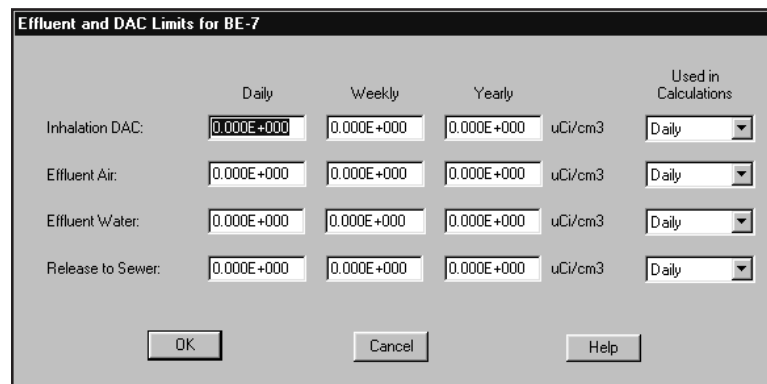


Figure 155 The Effluent/DAC Values Dialog

Now you can set values for each of the four Effluent and DAC limits for regulation 10CFR20. The units for these Effluent and DAC values are the ones set under Effl./DAC Units in the Options menu (page 223).

## Action Level/Derived Units

To set the Action Level values, open a library file, then choose this command to specify the unit for either or both of the Action Levels (Figure 156). Because activities are stored in microcuries, you'll have to enter a Conversion Factor to convert microcuries to your unit. The conversion factor must include any necessary mass (or volume) conversion, as might happen if Concentration is selected and its unit is different from that of the current sample.

The screenshot shows a dialog box titled "Action Level / Derived Units". It is divided into two main sections, "Action Level 1" and "Action Level 2".

- Action Level 1:**
  - Units:
  - Conversion Factor:
  - Activity:
  - Concentration:
- Action Level 2:**
  - Units:
  - Conversion Factor:
  - Activity:
  - Concentration:

At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

Figure 156 The Action Levels Unit Dialog

### Activity vs. Concentration

Select Activity if the action level is to be based on total activity (such as  $\mu\text{Ci}$ ) or Concentration if the action level is to be based on activity per unit quantity (such as  $\text{Bq/kg}$ ).

### Examples

Example 1: If the Action Level 1 Unit is microcuries and it is activity based, Conversion Factor 1 *must* be set to 1.

Example 2: If the Action Level 2 Unit is Bq/kg, it is concentration based, and sample quantity values have been entered in grams (g), the Conversion Factor 2 is  $0.000027/0.001$  or  $0.027$ .

## Action Level/Derived Values

With a nuclide library open and appropriate Action Level Units defined, the dialog box shown in Figure 157 will let you set the Derived Nuclide parameters and Action Levels for a nuclide. Note that the Action Level units displayed are those which were defined in “Action Level Units” on page 225).

The dialog box is titled "Action Level / Derived Values for NA-24". It contains two main sections: "Derived Nuclide" and "Action Levels".

**Derived Nuclide:**

- Observed Nuclide: [Dropdown menu]
- Adj. Factor - Offset: [0]
- Adj. Factor - Gain: [0]
- Adj. Factor - Quadratic: [0]
- Error Adj. Factor: [0]

**Action Levels:**

- Level 1: [0] uCi
- Level 2: [0] Bq/kg

Buttons: OK, Cancel, Help

Figure 157 The Action Level Values Dialog

### Derived Nuclide

An observed nuclide, which represents the nuclide from which activity data will be derived, must be specified. The “Observed Nuclide” drop down list lets you choose a nuclide from the current library.

For the Derived Nuclide calculation, four factors are required. The first three factors, Adj. Factor – Offset, Adj. Factor – Gain, and Adj. Factor – Quadratic, are coefficients from an efficiency curve fitted through a set of data representing “observed vs. derived” activity pairs.

To find the values for the three Adjust Factors, use your spectroscopy application’s Efficiency Calibration window to enter each derived nuclide’s Energy and Efficiency values from your own data table (you don’t need to enter the percent error value and you *must not* select a Crossover Energy).

When you have finished entering your data, press the Show button to see the curve generated from your data (the Dual button at the top of the Show screen should be selected). At the bottom of the Show screen you'll see the calibration equation. The equation's first three terms, left to right, are the Offset, Gain and Quadratic Adjust Factors.

The Error Adjust Factor is taken from the Show screen's List Peaks dialog box. It is the larger of: the largest Measured Error *or* the Deviation (the maximum difference between the known and fitted values).

### Action Level

The two values required for the Action Level calculation are the levels that nuclide activity (or concentration) can be tested against. These values are typically application-specific, such as MPBB or ALI values for Whole Body Counting or release levels for Q2 users.

## Nuclide Constants

The Nuclide Constants dialog (Figure 158) lets you enter optional information for the library's current (highlighted) nuclide.

**Nuclide Constants for K-40**

TMU Constants

Include in TMU       Use as Fiducial Nuclide

Include in TRU Activity       Include in Alpha Activity       Use Isotopic Ratio

Pu239 Equivalent Activity:  Ci / Ci      FGE:  g / g

Specific Power:  w / g      Activity:  g / uCi

Activity Limit:  Ci

OK      Cancel      Help

Figure 158 Nuclide Constants

### Include in TMU

Check this box to include the current nuclide in the Total Measurement Uncertainty (TMU) calculation.

### **Use as Fiducial Nuclide**

Check this box to use the current nuclide as the Fiducial Nuclide, the one providing the reference activity from which activities are calculated for nuclides that have the Use Isotopic Ratio checkbox enabled.

Only one nuclide in the library can be the Fiducial Nuclide.

### **Include in TRU Activity**

Check this box to include the current nuclide in the TransUranic (TRU) activity calculation.

### **Include in Alpha Activity**

Check this box to include the current nuclide in the Alpha Activity calculation.

### **Use Isotopic Ratio**

Check this box to indicate that the activity for the current nuclide should be calculated based on the activity of the Fiducial Nuclide.

### **Pu-239 Equivalent Activity**

The Pu-239 Equivalent Activity factor, in Ci/Ci, is used to convert the current nuclide's activity to "Pu-239 Equivalent Activity" for reporting under the DOE WIPP-WAC (see DOE/WIPP Transuranic Waste Acceptance Criteria, Appendix B).

### **FGE**

The FGE factor, in g/g, is used to convert the current nuclide's mass to its equivalent <sup>239</sup>Pu mass.

### **Specific Power**

The Specific Power factor, in watts/g is used to convert the current nuclide's mass into decay heat.

### **Activity**

The Activity factor, in g/activity-unit, is used to convert the current nuclide's activity to mass.

### **Activity Limit**

The Activity Limit is the shipping limit, in Ci, for the current nuclide. The limit for each nuclide is given in 49 CFR 173.435.

## Preferences

The Preferences dialog (Figure 159) lets you choose  $\mu\text{Ci}$  or Bq as the Editor's default Activity Units.

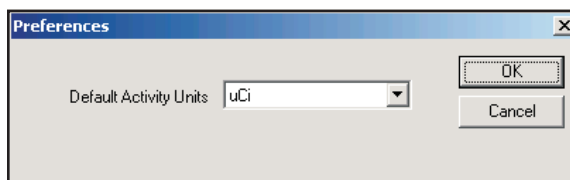


Figure 159 The Preferences Dialog

## The Search Menu

To aid you in locating specific entries in a large library, the Search menu contains the commands Find Name, Find Energy and Find Mass Number.

### Find Name

Click on **Find Name** to see the dialog box in Figure 160, which is used to search the library for a specific nuclide name. Type the name (full or partial) into the **Name** text input, then click on the **First** button.

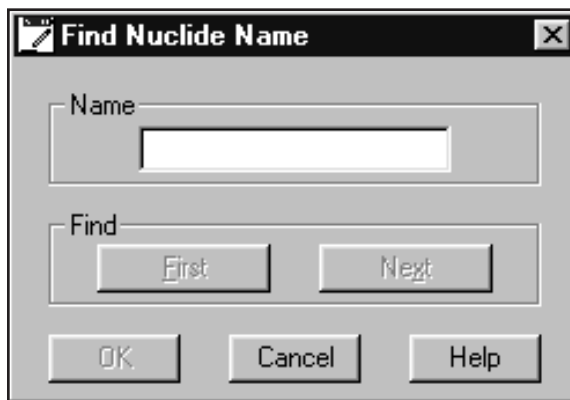


Figure 160 The Find Name Dialog

The library will be searched until either the name is matched or the end is reached. If the end is reached, a message will tell that there was no match. When a matching entry is found the search will stop and the nuclide will be selected for editing.

To search for the next entry that matches the search criterion, click on the **Next** button.

The name you entered is compared to each name in the library, starting with the first character of the nuclide name and stopping when the last character in the “search for” name has been used. If all of the characters up to that point match, a match is declared to have been found. Because of this, partial searches are very easy to make.

For example, a search for “CO” will match any Cobalt entry, or searching for “S” will find any nuclide name beginning with the that letter.

If you want to leave the last entry you found selected for editing, click on **OK**. Click on **Cancel** to restore the name selected before you brought up Find.

## Find Energy

The **Find Energy** command uses the dialog box in Figure 161.

Once you’ve entered the energy (and changed the tolerance, if you like), click on the **First** button. The library will be searched until either the energy is matched, plus or minus the specified tolerance, or the end is reached. If the end is reached, a message will tell you that there was no match. When a matching entry is found the search will stop and the energy line will be selected for editing.

To search for the next entry that matches the search criterion, click on the **Next** button.

If you want to leave the last entry you found selected for editing, click on **OK**. Click on **Cancel** to restore the name selected before you brought up Find.



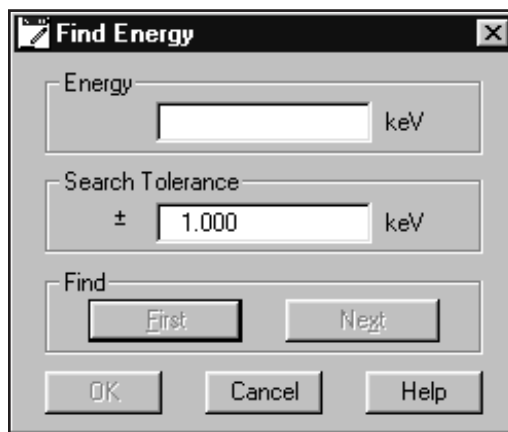


Figure 161 The Find Energy Dialog

## Find Mass Number

The **Find Mass Number** command uses the dialog box in Figure 162 to locate a specific mass number in the library. It searches for the value you enter in the Mass Number text box.

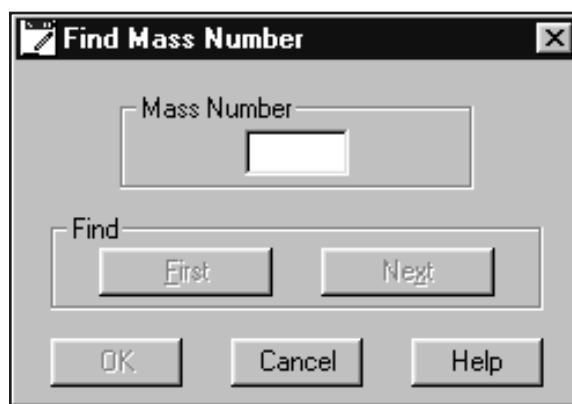


Figure 162 The Find Mass Number Dialog

Once you've entered the mass number, click on the **First** button. The library will be searched until either the mass number is matched or the end is reached. If the end is reached, a message will tell that there was no match. When a matching entry is found the search will stop and the nuclide will be selected for editing.

To search for the next entry that matches the search criterion, click on the **Next** button.

If you want to leave the last entry you found selected for editing, click on **OK**. Click on **Cancel** to restore the name selected before you brought up Find.

## The File Menu

The file menu lets you: Start a New library; Open, Save or Save as, a file; print the file as a Report; or Exit the editor.

### Creating a New Library

The **File** menu's **New** command erases the current Library from the editing window, allowing you to enter a new Library.

### Saving the Library

The File Menu offers the **Save** command for saving the file under the same name and the **Save as** command for saving the file under a different name.

### Printing the Library

To create both a text file and a printout of the current Library's contents, click on **File | Report**, then click on **Yes**. If you click on **No**, only the text file will be created and saved. The default save path is C:\GENIE2K\REPFILS\*name*.RPT, where *name* is the name of the library being printed.

### Exiting the Editor

When you are finished with the editor, click on the **Exit** command in the File menu to close it.

## The Master Libraries

To help you build tailored libraries, Genie 2000 is shipped with a set of four master libraries, containing about 800 nuclides and 31 000 energy lines, obtained from the NUDAT database maintained by the National Nuclear Data Center of the Brookhaven National Laboratory. These master libraries, named A\_G.NLB, H\_O.NLB, P\_R.NLB, S\_S.NLB, T\_T.NLB and U\_Z.NLB, contain nuclides with names starting with letters in each file's name.

The Master Libraries include these 10CFR20 Appendix B parameters: DAC, Effluent Concentrations and Release to Sewers values; class has been set to most restrictive non-zero D, W, Y category.

For practical reasons, the NUDAT data has been somewhat reduced by including only:

- Gamma data
- Gamma energies greater than 50 keV
- Nuclides with half-lives greater than three minutes
- Energy lines with branching ratios greater than 0.1%

To copy nuclide data from one of these libraries into the current library, choose **Options | Extract**, open one of these master libraries, then select the nuclides of interest to copy from the master library to the current library. Further editing may then be done within the current library as desired.

More nuclides may be added to the current library with additional extracts from the same master library or from another master library. Be sure to Save the current library after completing the edits.

## 5. Using the Certificate File Editor

Certificate Files greatly simplify the calibration process. Those files, which are basically disk copies of the data sheets for your calibration sources, are created and maintained by the Certificate File Editor program included with the Genie 2000 Basic Spectroscopy software.

### Getting Started

To start the Editor, double click on its icon in the Genie 2000 folder. When you do that, you'll see the dialog box in Figure 163.

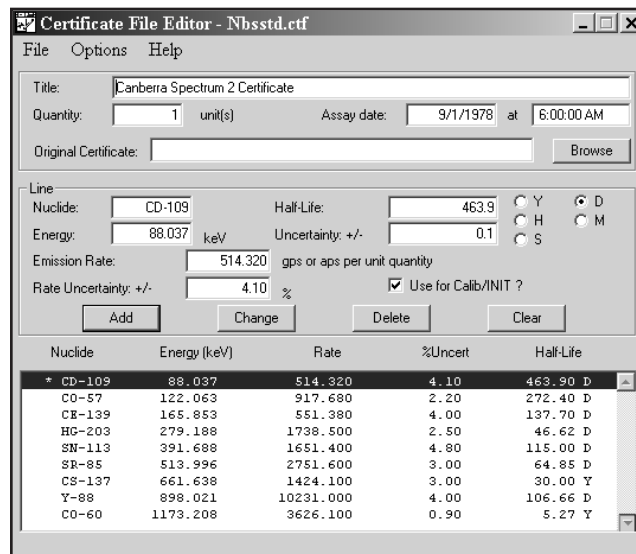


Figure 163 The Certificate File Editor

### Sizing the Window

The Editor's window defaults to a minimum size, but can easily be dragged to a larger size.

## The Options Menu

The Options menu has three commands that can be used to further tailor the Certificate File: Library Extract, Certificate Extract, and Energy.

### Library Extract

This command lets you extract energy lines and their associated information from one or more existing nuclide library files (.NLB). You can extract energy lines from multiple nuclide libraries at any point while editing the current certificate file.

Select **Library Extract**, then double click on the name of a nuclide library in the Files list box. All of the selected library's nuclides will be listed in the Extract Library Nuclides list box, as seen in Figure 164. Specify your library's activity units from the list in the Activity Units drop down list box.

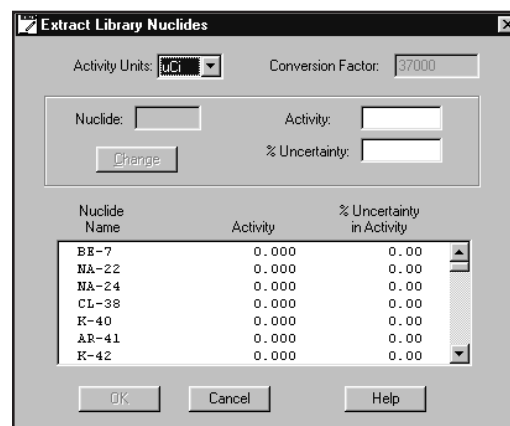


Figure 164 Extracting Nuclides From a Library

If your library uses activity units other than curies or becquerels, you'll have to convert its units to becquerels. Choose "<>" from the Activity Units list box, then type the appropriate conversion factor into the Conversion Factor text box. The conversion factor is the number of becquerels in each <> unit.

Select the nuclides you want to include by clicking on them one at a time in the list box. The activity of each nuclide (in the selected units) must be entered in the edit box provided; any uncertainty should also be entered. When data has been entered in all of the edit boxes, click on the **Change** button to update the list box.

When all the nuclides to be extracted have had activities entered, click on **OK**. This will make entries in the certificate file for all of the energy lines of the selected nuclides. The emission rate for a line will be calculated from the activity and the abundance of that line from the library file.

## Certificate Extract

This command lets you extract energy lines and their associated information from one or more existing certificate files (.CTF). You can extract energy lines from multiple certificate files at any point while editing the current certificate file.

Select **Certificate Extract**, then click on **Open** and double click on a certificate file name in the Files list box. The Extract Certificate Nuclides list box will be populated with the energy lines from the selected certificate file, as seen in Figure 165.

Selected energy lines can be extracted simply by clicking on those lines in the list box, or click on **Select all** to extract all lines.

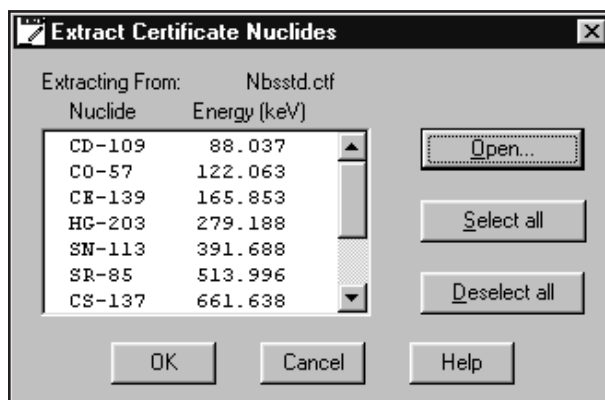


Figure 165 Extracting Nuclides From a Certificate

## Energy Units

Though energies are stored in keV, the **Energy Units** command can change how energy units are shown in the editor's dialog boxes and in reports. The Dialog Box in Figure 166, allows you to select which energy units you want to display: **eV**, **keV**, **MeV**, or **Other**.

The proper Conversion Factor for "other" units is defined as the number of keV units equal to 1 "other unit". For example, the conversion factor for MeV would be 1000 because there are 1000 keV units in 1 MeV.

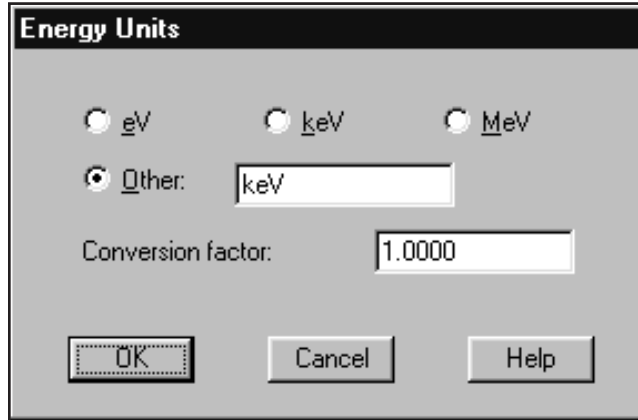


Figure 166 Selecting the Energy Units

## Editing a Certificate File

The easiest way to see how the Certificate File Editor works is to edit an existing file.

### Opening a Certificate File

Select the **File | Open** command to load a Certificate File, then select the NBSSTD.CTF file. The result will be the screen in Figure 167.

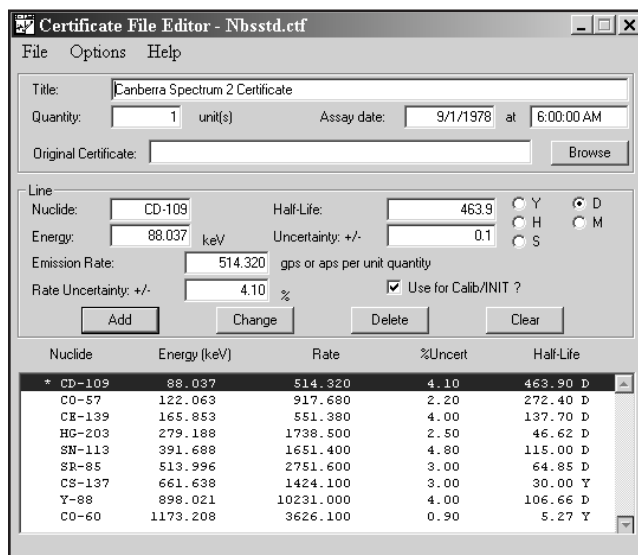


Figure 167 Editing a Certificate File

## The Header Data

At the top of the screen are the Title, Quantity, Assay Date and Original Certificate, which are used as follows:

### Title

The title you enter here will be used when a report is printed.

### Quantity

This is the size (volume or mass) of the standard used in efficiency calculations. If the activity of a standard source is known to be the total activity content of the standard, enter 1 in the Quantity field. For example, if a 5 mL standard sample is known to contain 1  $\mu\text{Ci}$  of  $^{60}\text{Co}$ , the Quantity should be entered as 1, and the activity as 1  $\mu\text{Ci}$  (or the equivalent emission rate in gammas or alphas per second).

If the activity of a standard source is known to be an activity concentration, enter the real standard quantity in the Quantity field. For example, if a 5 mL standard sample is known to contain 0.2  $\mu\text{Ci/mL}$  of  $^{60}\text{Co}$ , the Quantity should be entered as 5, and the activity as 0.2  $\mu\text{Ci/mL}$  (or the equivalent emission rate in gammas or alphas per second per unit volume).

Either mode of describing the activity content of the standard source is correct. Note, however, that if the Sample Quantity<sup>1</sup> is entered as the real quantity (5 mL), an analysis of both of these examples will report the  $^{60}\text{Co}$  activity to be 0.2  $\mu\text{Ci/mL}$ . If an analysis of the calibration spectrum is to yield an activity report of 1  $\mu\text{Ci/each}$ , the sample quantity must be entered as 1 each.

### Assay Date

The assay date and time, which are used for an Efficiency Calibration decay correction, can be found on the data sheet that came with the source.

### Original Certificate

This field lets you link a scanned copy (BMP or JPG) of the original calibration certificate to the current CTF file.

To view this bitmap copy of the original certificate, select the File | View Original Certificate menu option.

---

1. The Sample Quantity is entered by way of the Edit | Sample info dialog in the Acquisition and Analysis application.



## The Line Data

At the bottom of the screen is a List Box that is used to scroll through the contents of the Certificate File. Above the List Box are the edit fields for the currently selected file entry (the one shown in reverse type).

### Selecting an Entry to Edit

Each entry describes a single line in the calibration source spectrum. When you click on the line you want to edit, the edit fields will be loaded with the data from the selected entry.

### Editing the Line Data

The fields in the entry are used as follows:

1. **Nuclide.** This is the name of the radionuclide that caused this particular line, and can be any text string of your choice up to a total of eight characters.
2. **Energy.** The photopeak energy of the line, in keV, is shown here.
3. **Emission Rate.** This is the number of gammas per second (gps) or alphas per second (aps) that this line was emitting at the time the source was originally assayed.
4. **Rate Uncertainty.** The uncertainty in the assayed emission rate, expressed as a percent, is displayed here.
5. **Half-Life.** This is the half-life of the nuclide, which can be expressed in **Years, Days, Hours, Minutes, or Seconds**. The unit should be chosen *before* entering the half-life value.
6. **Uncertainty.** This is the uncertainty of that half-life, expressed in the same units as the half-life. For example, in Figure 167 the data shown would be read as “The half-life is 463.9 Days plus or minus 0.1 Days”.
7. **Use for Calib/INIT?** This option is used only when performing an Energy Calibration with Genie 2000’s batch commands. Selecting this option for a peak tells the Batch Calibration that the peak is to be used for performing an Initial Energy Calibration before doing a complete calibration. Normally only the first (lowest energy) and last (highest energy) peaks would have this option enabled. For further details, refer to the “ECAL” section of the *Batch Procedure Reference* chapter in the *Model S561 Batch Tools Support Reference Manual*.

### Clear

The **Clear** button clears the list box so that new values can be entered without having to delete the box’s contents first.

### Updating the Line

Once you've made any needed changes, click on the **Change** button to transfer the new parameters into the List Entry for the line.

### Adding a New Line

To add a new line to the list, first use the above editing procedure to alter an existing entry to look like the new one you want to add. When you're finished with the edits, click on the **Add** button instead of the Change button. Since the list is sorted by ascending energy, the new entry will automatically appear in its correct location in the list.

### Deleting an Entry

To remove an entry from the list, click on it to select it, then click on the **Delete** button.

## The File Menu

The file menu lets you: Open, Save or Save as a file, print the file as a Report, start a New file, or Exit the editor.

### Saving the Certificate File

Once you've edited the file you have to save it with either the **Save** or **Save as** command before it can be used.

### Printing the Certificate File

Use the File | Report command to print a disk file and a hard copy report of the current Certificate File. Click on **Yes** to send the report to a disk file and print the report, or **No** to send the report to the disk file only.

### Creating a New Certificate File

The **File** menu's **New** command erases the current Certificate File from the editing window, allowing you to enter a completely new Certificate File.

### Viewing the Original Certificate

If you have attached a bitmap copy of the original certificate file to a CTF file (page 238), you can view it with the View Original Certificate command.

## Exiting the Editor

When you are finished with the editor, click on the **Exit** command in the File menu to close it.

## 6. Using the Analysis Sequence Editor

---

Genie 2000 includes an Analysis Sequence Editor that allows you to create or edit analysis sequences that you can use to automatically analyze your spectra.

### Launching the Editor

To launch the editor, type ASE at the command line.<sup>1</sup> When you press ENTER, you'll see a window similar to the one in Figure 168.

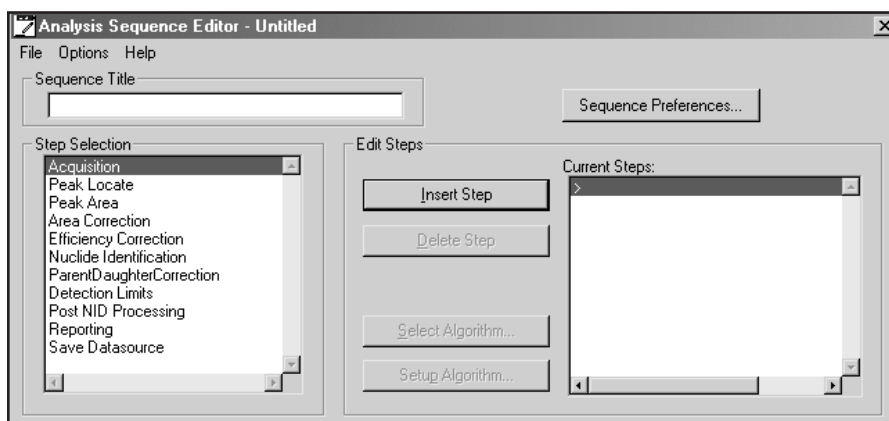


Figure 168 The Analysis Sequence Editor Window

You can also start the editor with an ASF file loaded by typing, for instance:

```
ASE <filepath>\MDA_sho.asf
```

Or you can launch the editor, then use the **File | Open** command to open an existing ASF file for editing.

---

1. See the “Batch Procedure Reference” chapter of the *Model S561 Batch Tools Support Reference Manual* for details of the ASE command.

Figure 169 shows the editor with MDA\_sho.asf loaded. In the Algorithms and Current Steps lists, you'll see some steps with an asterisk before their names, such as “\*Reporting – Standard”. These steps have parameters that control how the sequence's output will be presented.

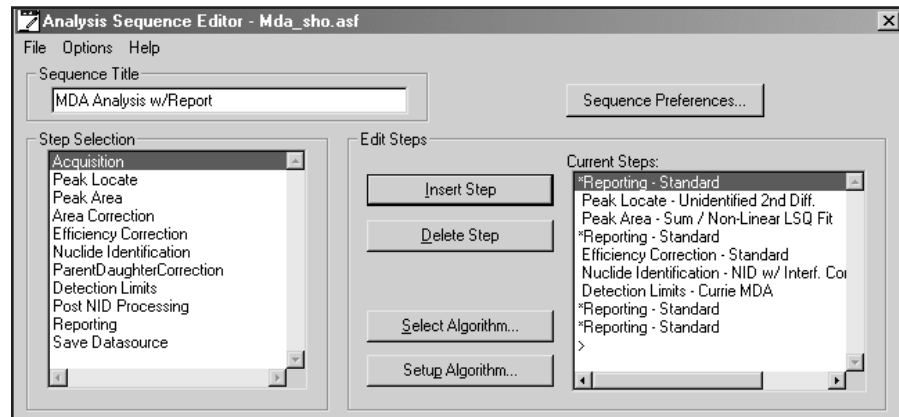


Figure 169 An ASF File Opened for Editing

## Editing a Sequence File

The editor allows you to create a new sequence, change an existing sequence's list of steps or edit any of the steps, by:

- Inserting or deleting steps
- Selecting the proper algorithm for each step
- Setting the parameters for each algorithm
- Editing the parameters for a step

In addition, you can set a number of parameters separately for each analysis sequence.

### Unique Parameters

Note that the steps listed in the following table have parameters that can be defined uniquely each time they occur in a sequence.

Step	Parameters
Peak Locate and Peak Area	Start channel and Stop channel
Save Datasource	File name, Save as type and Description
Report	All parameters other than Activity Units and Multiplier

### Common Parameters

All other sequence step parameters are “common”; they *cannot* be specified independently. If there are multiple instances of one of these steps in a sequence, all instances of that step will have the same parameters.

### Insert Step

To add a step to the sequence, highlight a step in the Step Selection list box, then press the **Insert Step** button. The step will be added to the Current Steps list.

### Delete Step

To remove a step from the sequence, highlight the step in the Current Steps list that you want to remove, then press the **Delete Step** button.

### Select Algorithm

To choose an algorithm for the Current Step, press the **Select Algorithm** button. For instance, if you had inserted and highlighted the Peak Locate phase step, pressing the Select Algorithm button would bring up the window in Figure 170, which shows the algorithms available for the Peak Locate phase. To associate one of the algorithms with the phase, highlight the algorithm then press **OK** to save the association.

The available analysis phases and algorithms are slightly different for the Alpha Spectroscopy Analysis option and the Gamma Spectroscopy Analysis option. The setup screens and parameter choices for each of the analysis phases are described in detail in “Analyze Menu” of this manual, starting on page 130, or in the “Analyze Menu” section of the *Model S509 Alpha Spectroscopy User’s Manual*.

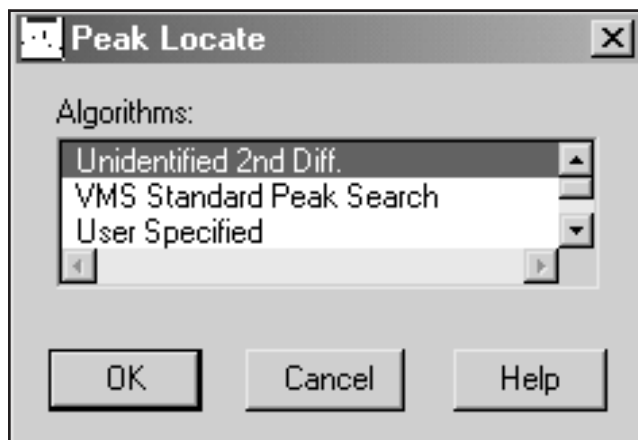


Figure 170 Selecting a Peak Locate Analysis Phase

## Setup Algorithm

After you have associated an algorithm with the phase, highlight the step and press the **Setup Algorithm** button (or double click on the step). Now you can verify or change the algorithm's parameters.

## Sequence Preferences

After you have begun editing an analysis sequence, you can set a group of preferences for that sequence via the **Sequence Preferences** button (Figure 171).

## Edit Sample Information

If the "Edit sample information" box is checked, you will be prompted to edit sample information when the sequence begins execution. If the box is not checked, there will be no prompt.

**Note:** These settings are not stored in the ASF. They apply only to the specified sequence when run in the current session of Genie 2000. No prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX, regardless of this preference setting.

## Prompt to Select Datasource

If you check the "Prompt to select datasource" box, you'll be prompted to choose a datasource when the sequence begins execution. If the box is not checked, the analysis sequence will use the detector or file datasource that is open and active when the analysis sequence is run.

Note: No prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX, regardless of this preference setting.

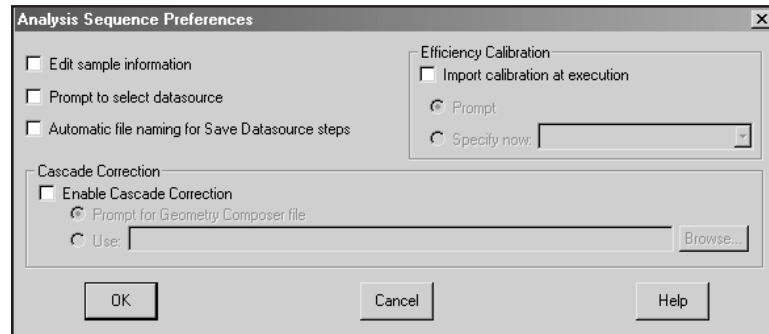


Figure 171 Analysis Sequence Preferences

### Automatic File Naming

Check the “Automatic file naming” box to cause the system to automatically create a new file name each time the Save Datasource step is executed. The files are saved in the standard CAMFILES subdirectory and are named sequentially. If the box is not checked, you will have to specify a file name when the sequence is run.

The first time this function is executed, the file will be named “00000001.CNF” and the counter will be incremented by one. When the counter reaches  $10^8$ , it will reset to 1.

Note: This preference must be enabled for any sequence that includes a Save Datasource step and that will be executed in a command line environment using ANALYZE.EXE or REXX directly.

### Efficiency Calibration

Check the “Import calibration at execution” box to indicate that an efficiency calibration should be imported at execution. If the box is not checked, the calibration in the datasource being analyzed will be used.

Notes: No calibration selection prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX.



When an efficiency calibration that includes the specification of a .GIS file is imported during an analysis sequence, this specification will be overridden if a .GIS file is also specified in either the Sequence Preferences settings or the NID with Interference Correction algorithm settings.

### **Prompt**

If “Prompt” is selected, you will be asked to specify the calibration when the analysis sequence starts to run.

### **Specify Now**

If “Specify now” is selected, you’ll choose the calibration file now instead of at execution time. The drop-down list shows the efficiency geometry identifier of each .CAL calibration file found in the CALFILES directory. If any calibration file does not have an efficiency geometry identifier specified, the list will display the file name (truncated if necessary) enclosed in parentheses. Note that the efficiency geometry identifier can be set via the **Store...** option in the **Calibrate** menu.

### **Cascade Correction**

To enable cascade correction, mark the checkbox. The currently specified .GIS Geometry Composer file is displayed.

**Note:** When an efficiency calibration that includes the specification of a .GIS file is imported during an analysis sequence, this specification will be overridden if a .GIS file is also specified in either the Sequence Preferences settings or the NID with Interference Correction algorithm settings.

### **Prompt for Geometry Composer File**

If “Prompt for Geometry Composer File” is selected, you will be asked to specify the calibration when the analysis sequence starts to run.

**Note:** No file selection prompt will be issued if the analysis sequence is executed in a command line environment using ANALYZE.EXE directly or via REXX.

### **Use**

If “Use” is selected, you’ll choose the indicated file now instead of at execution time.

**Note:** This setting will overwrite any existing .GIS file specification in interference-corrected nuclide identification steps. Similarly, specifying a .GIS file in such a step after choosing one in the Analysis Sequence Preferences window will overwrite the preference setting. (Both methods control the same property.)

## Options Menu

Though energies are stored in keV, the **Energy Units** command can change how energy units are shown in the editor's dialog boxes and in reports. The Dialog Box in Figure , allows you to select which energy units you want to display: **eV**, **keV**, **MeV**, or **Other**.

The proper Conversion Factor for "other" units is defined as the number of keV units equal to 1 "other unit". For example, the conversion factor for MeV would be 1000 because there are 1000 keV units in 1 MeV.

## Saving a New Sequence File

The **File | Save as** command lets you save a new sequence file with a Description as shown in Figure 172. The Description is displayed in the editor's Sequence Title field the next time you open the file.

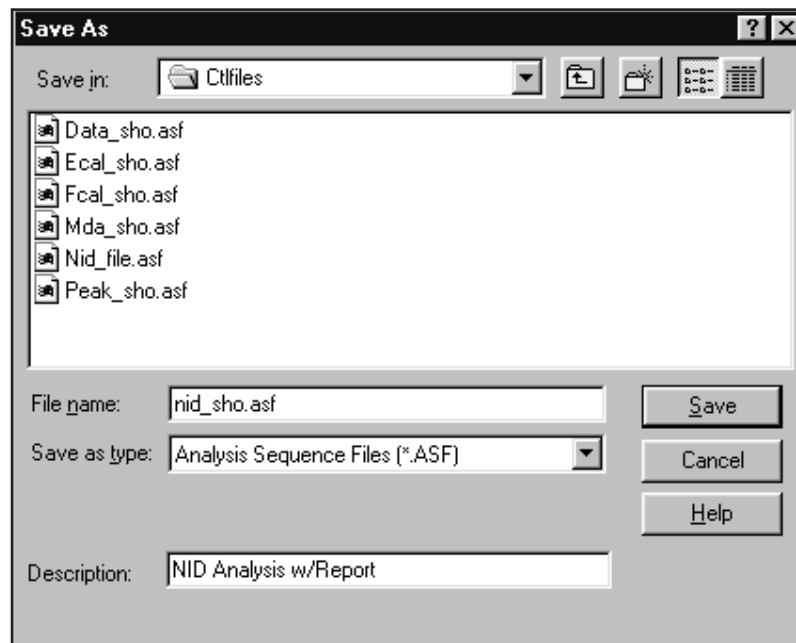


Figure 172 Save As with a Description

## 7. Using Cascade Correction

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Canberra's patented Cascade Summing Correction algorithms<sup>1</sup>, included in Genie 2000 software, lets you more accurately determine the activities of radionuclides that exhibit cascade summing effects, such as <sup>88</sup>Y, <sup>60</sup>Co and <sup>152</sup>Eu.

### Prerequisites

Before you execute a Cascade Correction analysis, you must have performed these steps:

1. Install the Model S501 Genie 2000 Gamma Analysis Option software, if that has not already been done.
2. Energy calibrate the detector to be used, as described in “Calibrate” on page 61.
3. Create a Geometry Description for the sample analysis configuration that will be used, as described in Chapter 8, *Using the Geometry Composer*, on page 251.
4. Perform a Peak-to-Total Calibration for that geometry, as described in “Peak-to-Total” on page 75.
5. Perform an Efficiency Calibration for that geometry as described in “Efficiency” on page 82.



**CAUTION** If you performed a source-based (empirical) efficiency calibration, and your calibration source includes nuclides which give rise to cascade summing (e.g. <sup>88</sup>Y, <sup>60</sup>Co, <sup>152</sup>Eu), you should refer to Appendix D, *Correcting an Efficiency Calibration for Cascade Summing*, on page 330.

Note: Calibrations performed by the optional Model S573 ISOCS or Model S574 LabSOCS applications do not suffer from cascade summing effects and therefore do not need to be corrected as described in Appendix D.

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1. US Patent 6,225,634.

## Performing the Analysis

Once the prerequisites have been met, you are ready to use Cascade Summing Correction in your analyses. The details on the procedure can be found in the “NID with Interference Correction” on page 163.

As you perform the procedure outlined there, you will find a reference to the Coincidence Library used for the Cascade Summing Correction calculations. The library includes:

- Nuclides and gamma lines that are affected by cascade summing, as well as those that are free from the effect.
- Decay parameters such as branching ratio, internal conversion correction factors, and absolute yield percentages for nuclides and gamma lines that are affected by cascade summing.
- Although this library is not user editable, it is quite comprehensive. The library's data were obtained from the NuDat online database (<http://www.nndc.bnl.gov/nndc/nudat>) at the National Nuclear Data Center. Since the NuDat data is revised continuously and Canberra's Cascade Summing Correction Library is revised only occasionally, some of the library's data may vary slightly from the current NuDat data.

A complete list of available nuclides and associated gamma-ray energies is provided in *Genie 2000 Coincidence Summing Library.pdf*, either on your Genie 2000 CD-ROM or, if documentation was installed on your PC, in its `Genie2K\pdfs\docs` folder.

In order to make a positive correlation, the nuclides in the NID library must have the same name as those listed in the Library PDF. The gamma-ray energies do not have to match precisely, but rather agree within the Tolerance defined in the “NID plus Interference Correction Setup” window. In addition, it is not necessary that all the gamma rays in the Coincidence library be listed in the NID library, nor that the NID library be limited to those in the Coincidence library. The proper correction will still be applied for the cases listed.

Notes: Cascade summing with x-rays resulting from internal conversion or electron capture are not considered.

The 1274 keV gamma ray in  $^{22}\text{Na}$  is corrected for coincidence summing with 511 keV gamma rays resulting from positron annihilation, assuming that the annihilation takes place at the decay source. This is the only case in which cascade summing with 511 keV gamma rays from positron annihilation is considered.

## 8. Using the Geometry Composer

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The information developed by the Geometry Composer is used by Canberra's patented Cascade Summing Correction algorithms<sup>1</sup> and the Models S573 ISOCS and S574 LabSOCS software.

The Composer helps you define sample geometries for HPGe gamma spectroscopy analysis. You can use one of eight sample templates, or customize your own template, to define sample geometries. For each geometry that is defined, you specify:

- The size and shape of the sample and its container.
- The materials from which they are made.
- The type of the detector that will be used for the analysis of this sample.

### Starting the Composer

Before you can run the Geometry Composer, you'll have to open a datasource. When the datasource has been opened, select **Options | Geometry Composer**. This brings up the Geometry Composer screen in Figure 173. Many of the Composer's menu commands are available as buttons in the toolbar at the top of the screen.

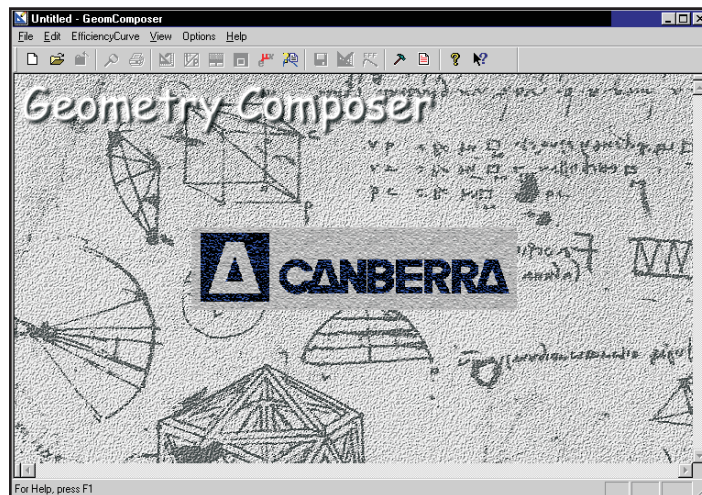


Figure 173 The Geometry Composer

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1. US Patent 6,225,634.

## Creating a Geometry Definition

The next step is to create a new geometry definition. This is done by selecting the **File | New** command or the icon, which pops up the dialog box in Figure 174.

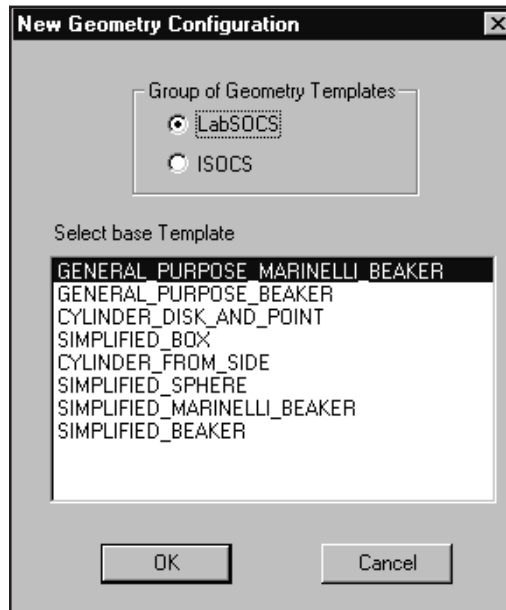


Figure 174 Selecting the Geometry Template

## Selecting the Geometry Template

Select one of the **Group of Geometry Templates** buttons to enable the set of template definitions you'll use. Which buttons are enabled depends on the software options installed on your system (S501 Gamma Analysis, S574 LabSOCS or S573 ISOCS).

The **Select Base Template** list shows the definitions available in the chosen group. Click on the description which most closely matches the geometry you want to define (Simplified Marinelli Beaker for this example), then click on **OK**. The result will be the display shown in Figure 175.

For a detailed description of the available templates, refer to the *Standard LabSOCS Template Drawings* chapter in the *Genie 2000 Customization Tools Manual*.

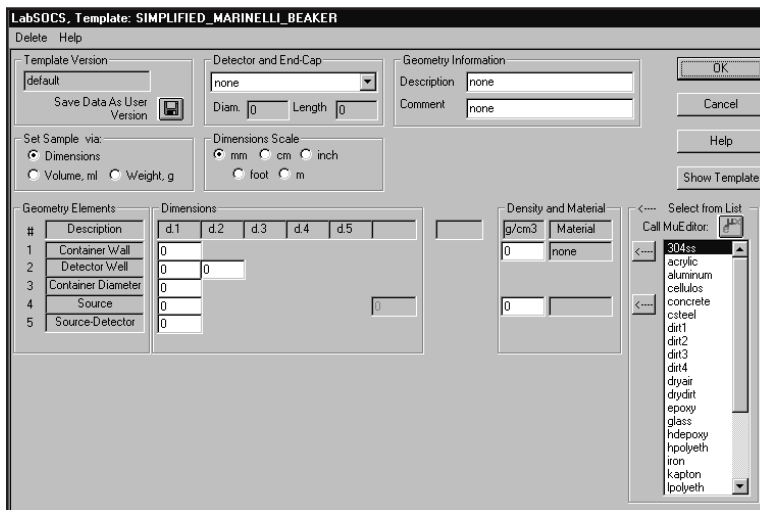


Figure 175 Editing the Sample and Detector Dimensions

## Editing the Detector and Sample Dimensions

The next step is to modify the selected geometry template to match the specific detector, container, and sample that will make up this geometry.

### Template Version

The template version you selected is shown here ('default' in this case).

### Detector and End Cap

For the most accurate efficiency calibration and for cascade summing results, the HPGe detector being used in this geometry definition should have been characterized for LabSOCS/ISOCS at the factory. If that option has been purchased, and if the detector characterization file has been installed, the detector's serial number will appear in the drop down list. Selecting it will automatically insert its dimensions into the "Diam." and "Length" parameters.



**CAUTION** If you have LabSOCS or ISOCS installed, do not use the generic characterizations for Coaxial or Planar detectors for efficiency calibrations; they are not suitable for that purpose. Nor should you use the 'Example' detector; it's used only for testing and training.

For accurate efficiency calibration results, you must use the specific characterization file supplied for your particular detector.

The generic characterizations are used only by Cascade Correction users who do not have LabSOCS or ISOCS software, and thus do not have their individual detectors characterized.

- Coaxial Detectors (GC, GX, GR, etc.):**  
 Select the detector named “Dia=nn..\_Coaxial”, where **nn** is the diameter (in mm) which most closely matches the (germanium crystal) diameter of the actual detector. Consult your detector’s specification sheet to obtain this information.
- Planar Detectors (BEGe, etc.):**  
 Select the detector named “Dia=nn..\_Planar”, where **nn** is the diameter (in mm) which most closely matches the (germanium crystal) diameter of the actual detector. Consult your detector’s specification sheet to obtain this information.

Using this method, a bias in the cascade summing correction factor of less than  $\pm 15\%$  can be expected. For greater detail on the correction factor, refer to the *Selecting an ISOCS Detector Characterization* chapter in the *Genie 2000 Customization Tools Manual*.

Figure 176 shows the result of selecting a characterized detector named “Example”.

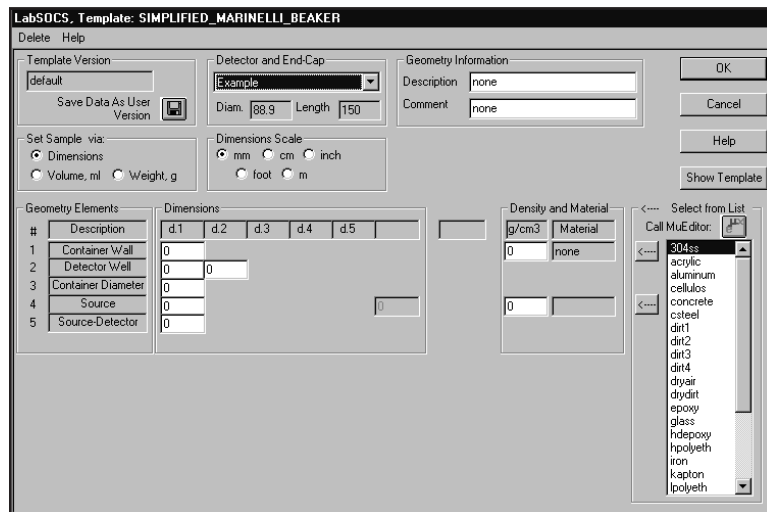


Figure 176 The Detector Has Been Selected



## Geometry Information

The definition of the geometry starts with its Description and an optional descriptive Comment. Since Genie uses the Description as the File ID, and the Comment as the File Descriptor, these should be selected to uniquely identify the geometry so that when the calibration file is retrieved, it can be shown to be the proper one.

## Density and Material

Enter the density and material of the sample (source). They are used by the calibration process to correct for factors such as attenuation due to sample and container wall composition.

The list at the right of the dialog box is used to specify the material used for the container and source. Double-click on a material to display its name, default density, chemical composition, and mass attenuation coefficients (Figure 177).

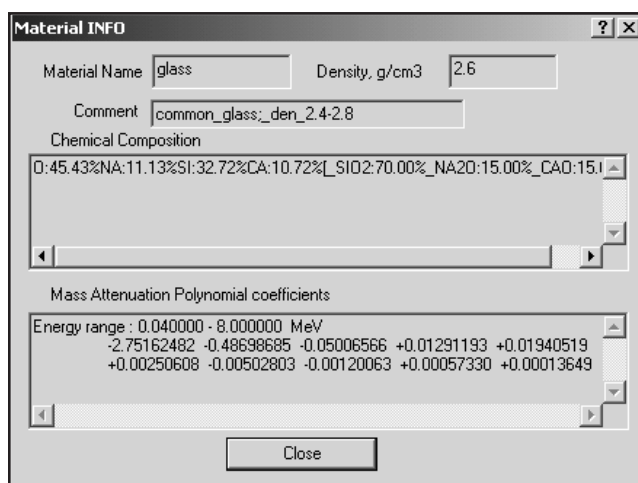


Figure 177 Displaying the Material Parameters

To modify these parameters, or to add further materials to the library, click on the **Call MuEditor** button directly above the material list. This will launch the Materials Library Editor (described on page 265).

To specify the material for the container, click on its name in the list (e.g. glass), then click on the upper arrow ( $\Leftarrow$ ) to copy that choice and its density to the Container Wall Density and Material fields. Next, click on the sample material (e.g. water), then click on the lower arrow ( $\Leftarrow$ ) to copy that data to the Source Density and Material fields. In Figure 178 glass was selected for the beaker and water for the sample.

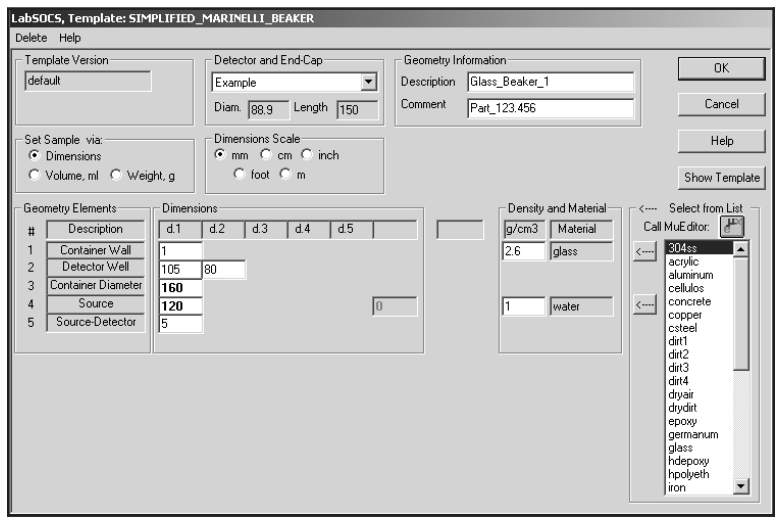


Figure 178 Add Geometry Information

The density values from the Materials Library entries for the selected materials are automatically inserted into the Geometry Description. If necessary, the density can be edited to better fit the sample.



**CAUTION** Carefully review the default density to assure that it is appropriate for the actual material used.

### Set Sample Via

By default, the Geometry Composer bases its calculations on the sample's Dimensions. Click on Volume or Weight to select another basis for the calculations.

The selected basis is inserted into the Dimensions table and an entry box for its value is enabled. Once the dimensions of the sample and its container have been entered (see "Sample Dimensions", below), the value for the volume or weight is set automatically based on the container dimensions and the sample density previously entered in the Density and Material section of the window.

### Dimensions Scale

All dimensions default to the unit selected in "Default Parameters for New Geometries" on page 274. Use the buttons here in Dimensions Scale to select another unit. Note that the units selected apply to the dimensions for both the detector and the sample.



**CAUTION** Changing units during data entry will convert all existing entries to the new units.

### Sample Dimensions

The Dimensions table in the middle of the window is used to enter the dimensions of the sample and its container. There is one row in the table for each element in the definition of the geometry and one or more columns of data.

### Show Template

Click on the **Show Template** button to see a drawing like the one in Figure 179, showing the elements and relationships of the geometry currently being defined.

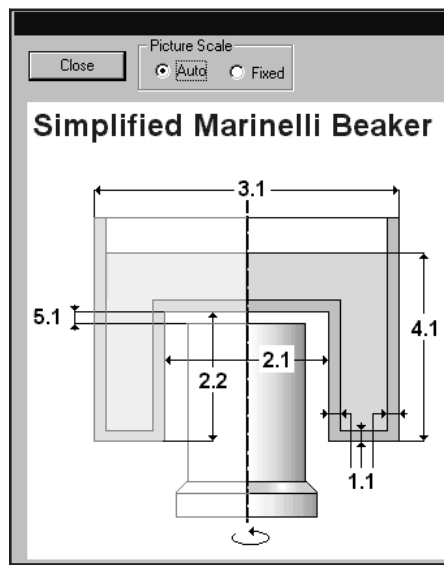


Figure 179 Displaying a Geometry Template

The numbers in the drawing correspond to the row and column position of the element in the sample Dimensions table. For example, the value for the dimension labeled 2.1 - the diameter of the detector well - is entered into Row 2 (Detector Well), Column d.1.

### Auto and Fixed

The two Picture Scale buttons in Figure 179 are used to resize the window for easier viewing. Use the **Close** button to exit the viewer.

Notes: A Source-to-Detector distance of 0 mm is permitted; for example, when the source is resting directly on the detector end-cap.

For geometries where it is physically appropriate, additional Source-to-Detector data fields for parameters such as source orientation relative to the detector's axis will be found. Refer to the descriptions of the various template descriptions in the *Standard LabSOCS Template Drawings* chapter in the *Genie 2000 Customization Tools Manual* for further details.

### Save Data As User Version

You can save a partial description as a custom template for future use. For example, if you will be using several different Marinelli Beakers for sample assay, you may wish to save a partial definition now in order to reduce geometry definition time in the future.

Click on the **Save Data As User Version** button in the upper left corner of the screen in Figure 176 (page 254) to save the partial template.

Note: A User-defined Template should only be saved with those parameter values which will be constant from one geometry to the next, because those values can't be edited when that User-defined Template is used as the basis for a new geometry definition.

You'll now see Figure 180, where you should change "untitled" to an appropriate name for the new template, then click **Add** to add the new definition to the list of available template definitions.

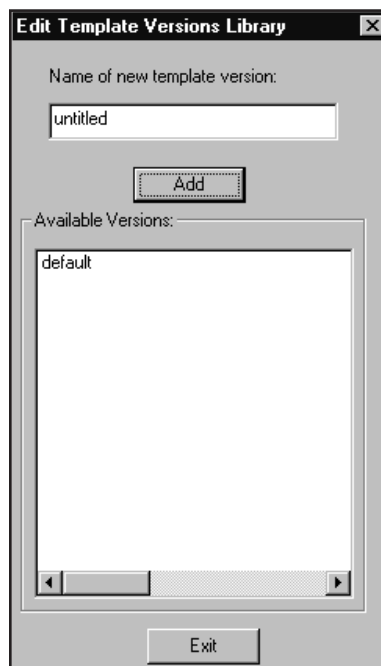


Figure 180 Saving a User Template

### Selecting a User Defined Template

To define a geometry based on any partial template you have saved:

1. Select **File | New**.
2. Select the same generic definition used previously (in this example, Simplified Marinelli Beaker), then click on **OK**.
3. This will display the dialog shown in Figure 181, where you can select the custom definition you just saved as your base template, then continue as described in "Detector and End Cap" on page 253.

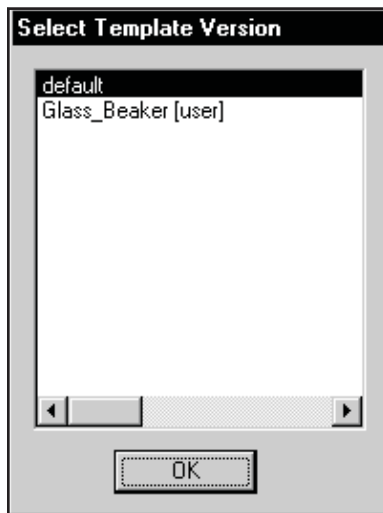


Figure 181 Selecting a User-defined Template.

## Verifying the Geometry Definition

When you've completed the geometry definition, click on **OK**. The Composer will verify the definition and, if a potential problem is found, display an error message. If the definition is valid, you'll see a report like the one in Figure 182.

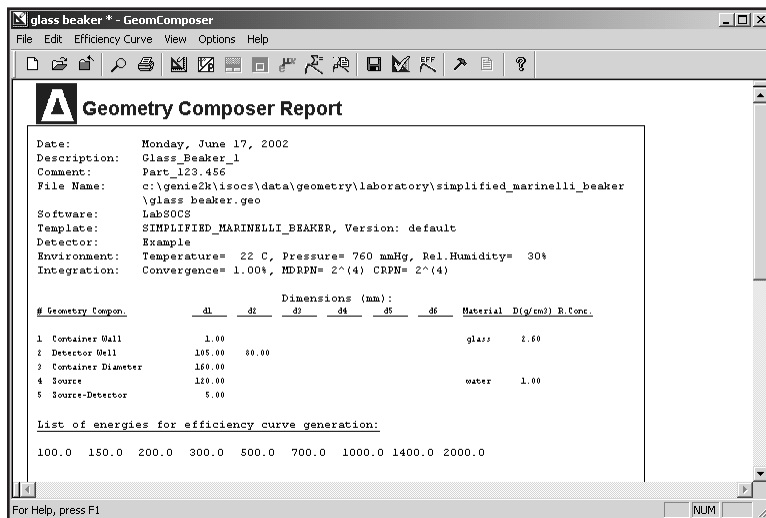


Figure 182 The Geometry Composer Report

Note: If you open an existing definition in the Geometry Composer, you'll immediately see the Geometry Composer Report for that definition.

## Editing a Geometry Definition

If need to change any of the parameters shown in the report, select **Edit | Dimensions and Detector** to open the editing window (Figure 175 on page 253).

## Editing the Sample Environment

In the LabSOCS/ISOCS efficiency calibration process, air fills all undefined spaces between the sample and the detector. In order to correctly calculate the attenuation of the air, you'll have to define three environmental (ambient) parameters.

To edit these parameters, temperature, pressure and relative humidity, select **Edit | Environment**. You'll see the dialog box in Figure 183.

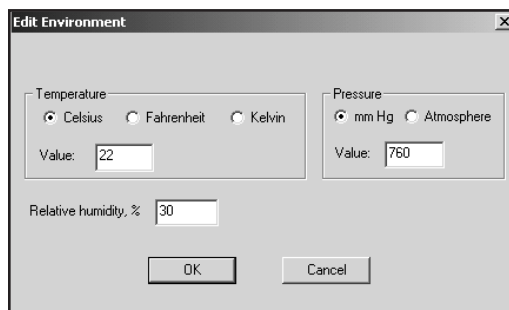


Figure 183 The Edit Environment Dialog

Note: These edits affect only the current geometry. You can change the defaults for all future geometries under “Default Parameters for New Geometry” in the Options menu (page 274).

## Editing the Efficiency Parameters

If you need to modify the Convergence, Maximum Detector Reference Point Number (MDRPN), Energies, and Error Values used in the LabSOCS/ISOCS efficiency calibration process, select the command **Efficiency Parameters for this Geometry** from the **Edit** menu, which opens the dialog box shown in Figure 184.

Note: These edits affect only the current geometry. You can change the defaults for all future geometries under “Setting the Default Parameters for New Geometry” in the Options menu (page 274).

Since editing and using these parameters is beyond the scope of this chapter, only an overview of parameter use and editing functions will be presented here. For an in-depth discussion of how the Convergence and MDRPN parameters affect the calibration process, refer to the *LabSOCS/ISOCS Technical Notes* chapter in the *Genie 2000 Customization Tools Manual*.

## Editing the Energy List

Select the Energy List tab in Figure 184 to activate the Energy List Editor. This editor allows you to define the energies for which efficiencies will be calculated. This feature may be used to establish properly spaced efficiency values for the desired energy range.

Figure 184 shows that the default energy list covers the 100 to 2000 keV range. The error values listed are the estimated uncertainty error values for each energy based on LabSOCS/ISOCS validation testing.

### Deleting an Energy from the List

Select the energy line to be deleted, then click on **Remove**.

### Adding an Energy to the List

Type the new energy value into the “Energy, keV” field and its associated uncertainty into the “Error, %” field, then click on **Add**. The new line will be added to the list.

### Restoring the Default Values

To restore the Energy List defaults in Figure 184, click on **Use Default Energies**.

### Load Energy List

Use this button to load a previously saved list of energies, replacing the current one.

### Save Energy List

This button is used to save a custom list of energies for later use



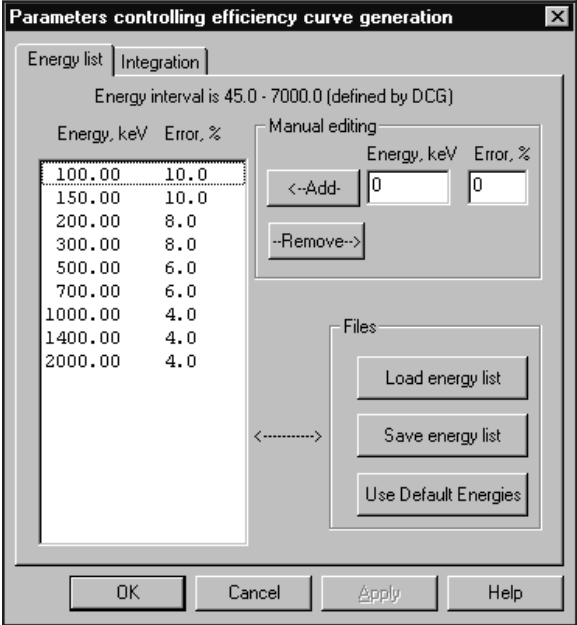


Figure 184 The Energy List Dialog

### Changing the Integration Settings

Selecting the **Integration** tab in Figure 184 brings up the dialog box in Figure 185, which is used to change the integration settings for efficiency calculation. For a discussion on how these parameters affect the efficiency calculation, refer to the *ISOCS Technical Notes* chapter in the *Genie 2000 Customization Tools Manual*.

#### Convergence %

This parameter defines the maximum acceptable deviation in the results of the efficiency calibration calculations. The default value of 1% typically yields the best trade-off between accuracy and computation time.

#### MDRPN

The Use MDRPN option (Maximum Detector Reference Point Number) should always be checked (default) to enable a process that increases the accuracy of the LabSOCS/ISOCS computations for close-detector geometries.

A Value of 4 has been found to be the optimum for most applications. Accordingly, this value will be used in the calculations if the “Use MDRPN defined for detector” check box is enabled.

### Show Progress Bar

Select Yes to enable display of the Progress Bar during the Efficiency Calibration Calculation.

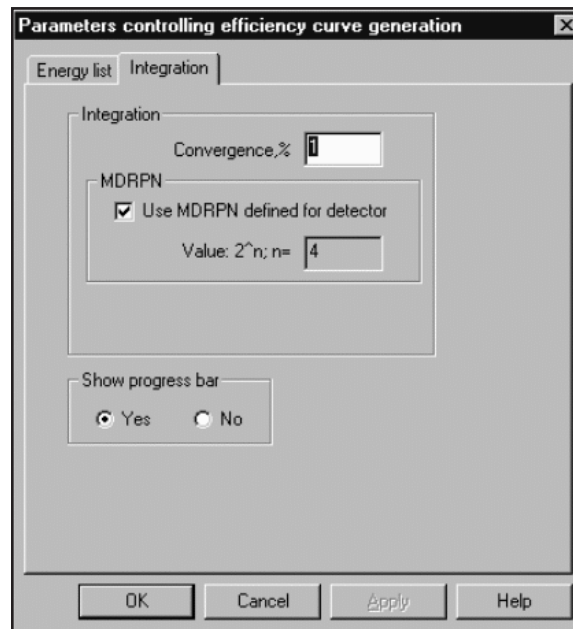


Figure 185 The Integration Settings Tab

## Checking the Geometry's Validity

Once you have completed making all necessary changes to your definition, you should again have it tested to insure that is valid for later use by the calibration and analysis procedures.

To do that, select **Efficiency Curve | Check Geometry Validity** to perform a more extensive validation of the geometry definition than the automatic validity check made when you exit the geometry definition window.

## Saving the Definition

Once you are satisfied that all of the parameters are correct, you must do a **File | Save As** to save the definition before going on to perform a LabSOCS/ISOCS efficiency calibration.

Note: This will generate two files: a .GEO file and a .GIS file. Each contains the same information, but in two different formats for different sections of the software. To avoid confusion, they should always be treated - deleted, re-named, etc. - as a two-part set.

## Generating an Efficiency Curve

This function is available only if LabSOCS/ISOCS is installed.

First make sure that you have already saved your newly created or modified Geometry Definition. Then select **Efficiency Curve | Generate Efficiency Data Points** to calculate the efficiency curve for the defined geometry. This process creates an .ECC file in a subdirectory defined by the geometry template chosen.

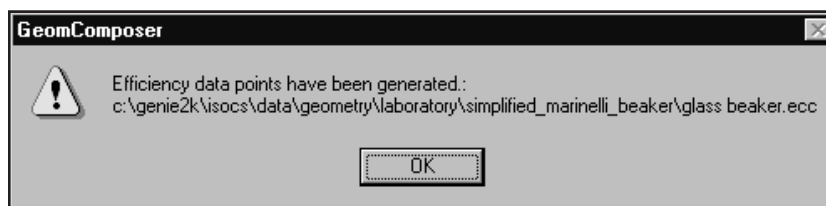


Figure 186 The Data Points Have Been Generated

A progress report is displayed during this process, and the message in Figure 186 is displayed when it is complete. Note that the full path to .ECC file that was generated is shown.

To use the completed calibration, see “By LabSOCS/ISOCS” on page 88 and select the \*.ecc file you have just created. Refer to Calibration by LabSOCS/ISOCS (page 88) for the rest of the process. Closing the Geometry Composer returns you to the screen shown in Figure 65 (page 88).

## The Materials Library Editor

The **Edit | Materials Library** command is used to edit the library containing the material choices and characteristics used to specify the composition of the sample and its container. Selecting it opens the library editing window shown in Figure 187.

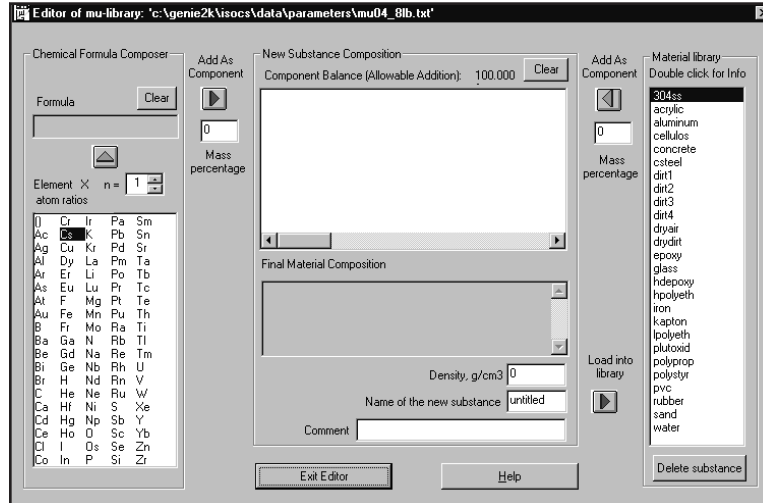


Figure 187 The Materials Library Editor

## The Nature of a Library Entry

The uses of the library's editing tools can be better understood by examining the makeup of a Materials Library entry. For example, to view data for "concrete", double click on its name in the Material Library list on the right side of the window. The result will look like Figure 188.

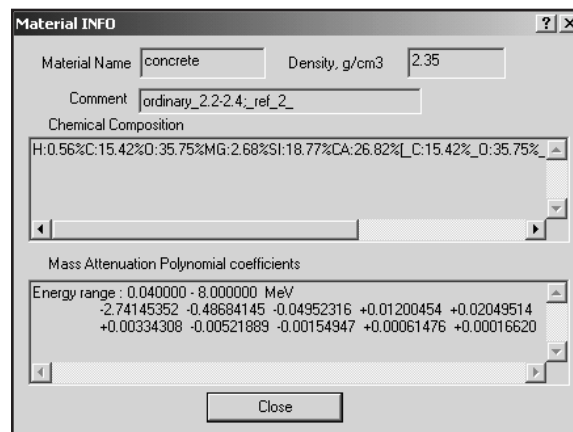
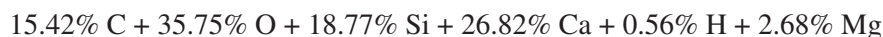


Figure 188 The Library Entry for Concrete

You'll see the name of the material and its density, any comments, the chemical composition of the material, and the coefficients used to correct for the material's radiation attenuation. These parameters cannot be modified from this display; it is for information purposes only.

The Chemical Composition of this compound, shown in Figure 188, is interpreted as:



The total may not always be 100% because of rounding errors.

## Defining New Materials

There are three ways that new materials can be defined:

- By defining a completely new material.
- By basing the new material on an existing definition.
- By combining two or more existing materials into a new one.

The left side of the Material Editor window is used for the definition of a new material. To illustrate how the process, the definition of a new material called "bronze" will be entered. Bronze is composed of 90% Copper and 10% Tin, by weight. The procedure is as follows:

1. Select copper (Cu) from the list of elements at the left.
2. Insure that the **n=** field shows a value of 1.
3. Click on the ▲ button above the list to copy the Cu entry from the list to the Formula box (the button is green, indicating that it's enabled; red buttons are disabled.)
4. Enter the value "90" in the left-hand Mass Percentage field.
5. Click on the "Add As Component" button (▶) directly above that field.

The result will be a display like the one in Figure 189. The New Substance Composition indicates that we just entered a component that will make up 90% of the mass of our new material, and that component consists of pure (100%) copper. Note the line directly above this field, which tells us we still have 10% of the material's composition left to be defined.

## Using the Geometry Composer

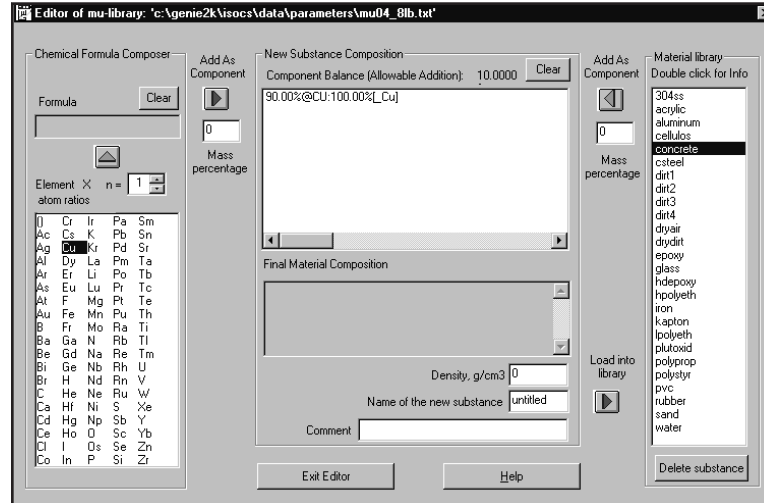


Figure 189 The Copper Component Has Been Added

The same basic procedure is then used for entering the tin component, using Sn for the Element and 10% for the Mass Percentage. After doing that, the window will look like the one in Figure 190. With 100% of the material defined, the Arrow Buttons we have been using have turned red.

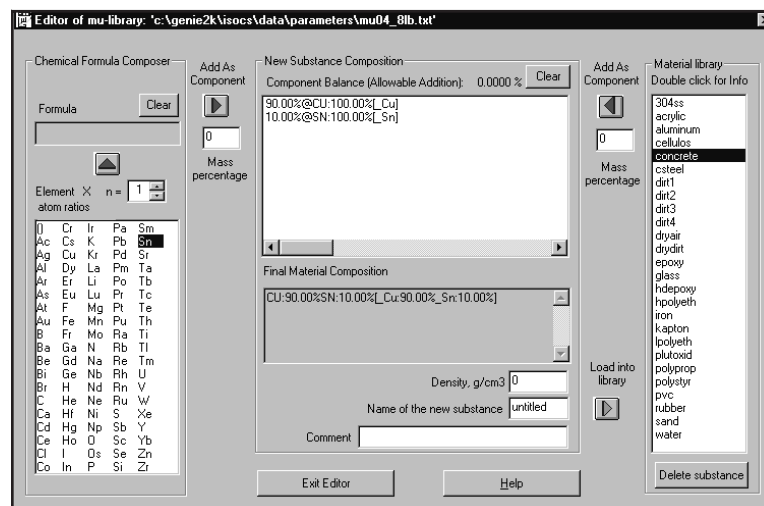


Figure 190 The Tin Component Has Been Added

## Saving the Definition

There are two or three more data entries to make before the definition is complete (see Figure 191):

- **Density** of the material in  $\text{g/cm}^3$ .
- The **Name of the New Substance** (8 characters, maximum).
- An optional **Comment** (32 characters, maximum).

Once you've done this, the new material can be added to the Material Library by simply clicking on the **Load into Library** button (▶). A message will be displayed to let you know the entry was successful. Click on OK to acknowledge it, and “bronze” will be found in its correct alphabetical position in the Material List.



**CAUTION** Load the definition into the Library *before* exiting the editor or the definition will be lost.

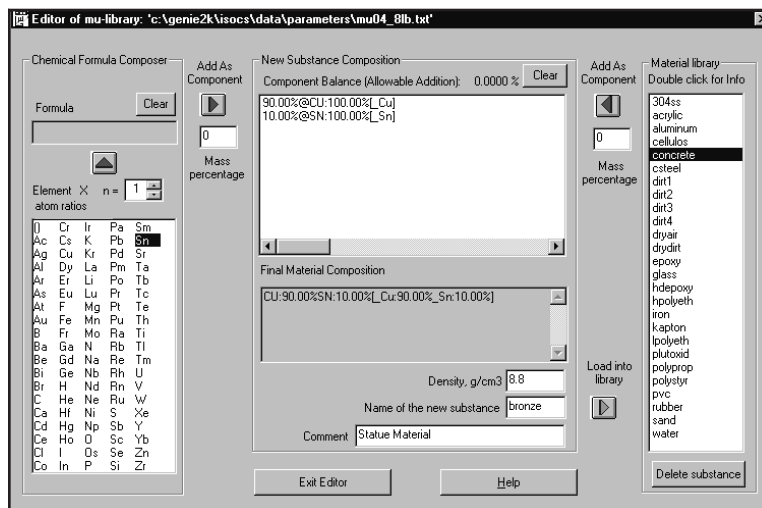


Figure 191 The Completed Definition

## Correcting Data Entry Errors

In the Material Editor's window you'll notice two Clear buttons, one at the top of the Chemical Formula Composer and one in the New Substance Composition. These allow you to delete the current contents of these fields and enter new values.

## Basing a New Material on an Existing Definition

To illustrate how this is done we will take the definition of a material called “dirt1”, add some water to it, and save it as “mud1”. Assuming a three parts “dirt1” to one part water, the process is as follows:

1. Click on “dirt1” in the Material Library.
2. Enter 75 into the right-hand Mass Percentage field.
3. Click on the green “Add as Component” button (◀) directly above that field.

The result can be seen in the New Substance Composition window of Figure 192, which indicates that 75% of our new material is composed of the elements which make up “dirt1”.

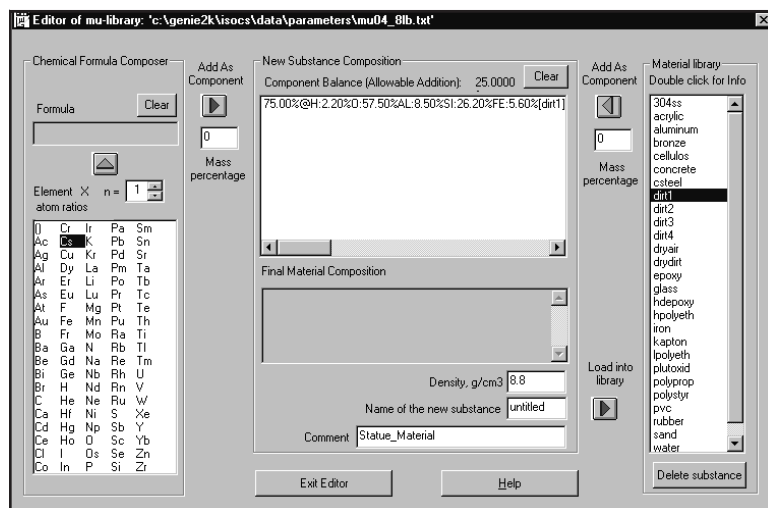


Figure 192 Dirt1 Has been Added

Next we have to add some water, using the Chemical Formula Composer on the left side of the window:

1. Click on the element H.
2. Enter 2 in the **n=** field, indicating 2 atoms of hydrogen.



3. Click on the green ▲ button above the list to copy the H element from the list to the Formula box.
4. Click on the element O.
5. Insure that **n=** shows a value of 1, indicating 1 atom of Oxygen.
6. Click on the green ▲ button to complete the formula for water (H<sub>2</sub>O will be seen in the Formula text box).
7. Type 25 into the left Mass Percentage field, then click on the Add As Component button (▶) directly above it, to add the water to the dirt.

To complete the definition of “mud”, enter the density, name, and comments as we did for “bronze” (on page 269). Now click on the **Load into Library** button (▶) to add “mud” to the Material Library.

Alternatively, you could have simply used the “Water” already defined in the materials library for the remaining 25%.

## Combining Existing Materials to Make a New One

Since “water” and “dirt1” are already in the Material Library, we could have made our “mud1” by simply combining them. This is done by:

1. Selecting “dirt1”, entering 75 as its Mass Percentage and clicking on the right-hand Add as Component button.
2. Repeat that process for “water”, using 25 as its Mass Percentage.
3. Enter the new name, density, and comments, click on **Load into Library**, and the definition is complete.

Any of these three techniques make it very easy to define a custom Material Library tailored to the specific needs of your laboratory.

## Deleting a Material Library Entry

To delete an entry from the library, select it in the list, then click on the **Delete Substance** button. If the entry is part of another definition, the deletion will not be allowed. For example, “dirt1” cannot be deleted as long as the just created “mud1” still exists.

## View Menu

The View menu's commands are used to customize the display. For instance, turning off the Toolbar and the Status Bar will make the display area larger and the Split command lets you display up to four geometries at a time.

## Toolbar

When checked, the toolbar is displayed just below the Geometry Composer's menu bar.

## Status Bar

When checked, the status bar is displayed below the bottom scroll bar in the Geometry Composer.

## Split

When checked, the Split display function is enabled as shown in Figure 193. You can change the split at any time by dragging the gray lines to create two or four "panes" of any size.

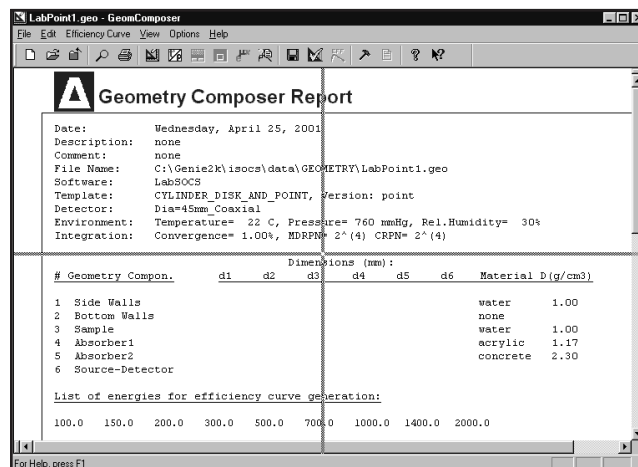


Figure 193 The Initial Split Window

To return to a single-pane display from a four-pane display, drag the gray lines to a corner of the display. From a two-pane display, drag the single gray line to the side of the display.

## Option Menu

The Options menu contains commands that are used to establish the default operating preferences and parameters used by the Geometry Composer.

Note: The Geometry Composer's default configuration parameters are suitable for most uses and do not normally need to be altered.

## Configuration

Select **Options | Configuration** to display the dialog box in Figure 194. The current Version Numbers and Dates of the program's software modules are displayed. These will be helpful to Canberra's service personnel for troubleshooting purposes. Click on the **Update Configuration** button to ensure that the most current information is being displayed.

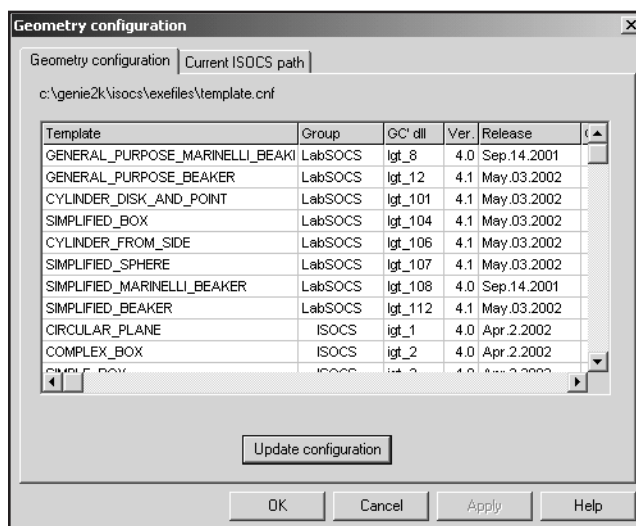


Figure 194 The Geometry Configuration Tab

The **Current LabSOCS/ISOCS Path** tab displays the complete path to all of the data files used by the software (Figure 195).

If you use a different file structure, you can change the data by double-clicking on a path description, then selecting a new path via the dialog box that is displayed.

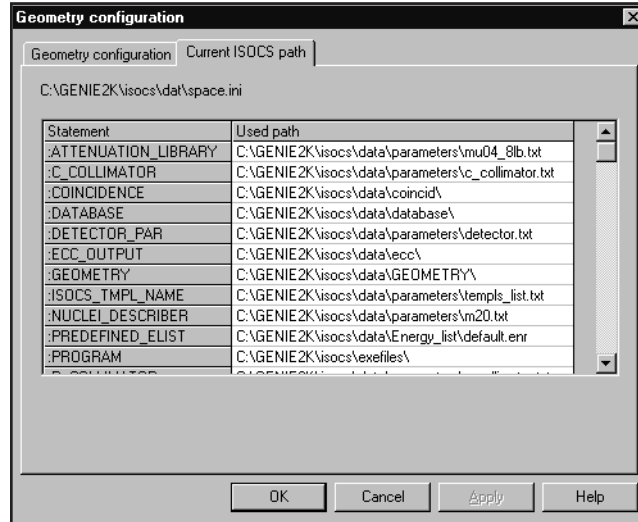


Figure 195 The Current ISOCS Path Tab



**CAUTION** An incorrectly set path can cause the system to stop functioning.

## Default Parameters for New Geometries

Select **Options | Default Parameters** to establish default values for some of the parameters used when creating a new geometry. This command is not available if a geometry definition is open in the Composer.

### Preferences

The **Preferences** tab (Figure 196) is used to establish the defaults used for the sample, container, and environmental measurement units. Note that the choices made here are simply setting the defaults that will be displayed when a new geometry definition is created. The defaults may be changed as needed when a geometry is defined.

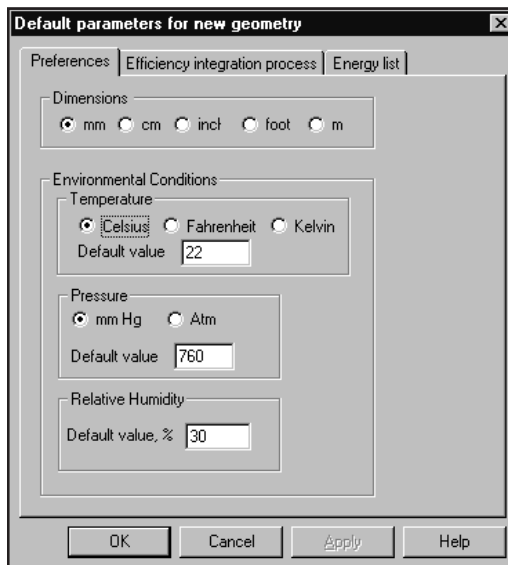


Figure 196 Setting the Default Parameters

### Efficiency Integration Process Tab

The **Efficiency Integration Process** tab (Figure 197) is used to set default parameters for the efficiency calculation. The Use MDRPN box should be checked for accurate computations when the sample or absorber is close to the detector.

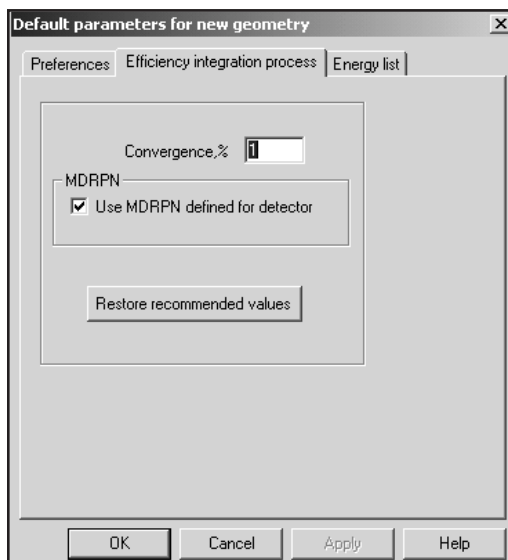


Figure 197 The Integration Defaults

The CRPN parameter shown below this check box is relevant only for collimator calibrations within ISOCS; for LabSOCS the CRPN setup can be ignored.

For further information on these parameters refer to “Changing the Integration Settings” on page 263 and to the *LabSOCS/ISOCS Technical Notes* chapter in the *Genie 2000 Customization Tools Manual*. The default values may be re-established by clicking on the **Restore Recommended Values** button.

### Energy List

The Energy List tab (Figure 198) is used to establish the default energies and uncertainties that will be used for calibrating a new geometry definition.

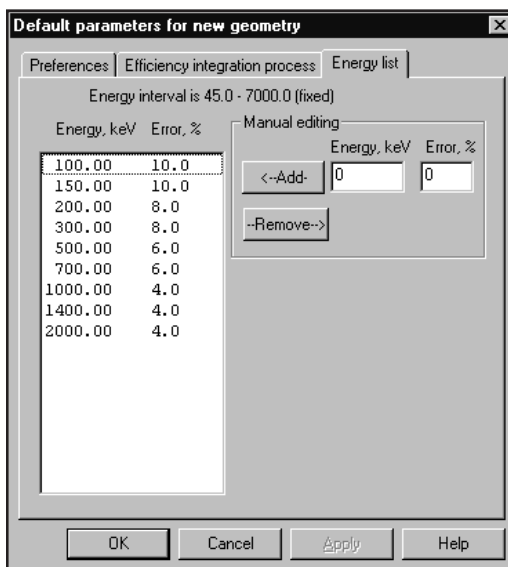


Figure 198 The Energy List Tab

- Delete an Energy: Select the energy line to be deleted, then click on the **Remove** button.
- Add an Energy: Type the new energy value into the **Energy, keV** field and its associated uncertainty into the **Error, %** field, then click on the **Add** button. The new line will be inserted into the list.

Refer to the ISOCS Validation Documentation for guidance as to the estimated accuracy of the ISOCS/LabSOCS calibration methodology, or use values determined locally. Enter the estimated 1 sd value in %.

## Deleting a Geometry Definition

To delete a definition that is no longer needed:

1. Select Open from the File menu.
2. Locate the definition to be deleted.
3. Right click on the name of the definition, and select Delete from the list of commands that is displayed.
4. Click on Yes in the confirmation dialog that is displayed.
5. Click on Cancel to close the Open command dialog box.

## 9. DataSource Preview

---

DataSource Preview lets you preview Genie 2000 spectrum (CNF) files using Windows Explorer without having to open the file in an MCA view. Preview uses a directory configurable Javascript® in conjunction with Genie 2000 components.

- You can configure any directory to use this function.
- When the function is enabled, you can only preview the datasource. The preview can be disabled, allowing you to move or copy files.
- When a datasource is opened for preview, you cannot open it in an MCA view.
- This function is not supported under Windows NT.

### Requirements

The Datasource Preview function requires that three conditions be met:

- Your operating system must be Windows 2000 SP2 or later, or Windows XP SP1 or later.
- After installing Genie 2000, you must reboot for Datasource Preview to work.
- Screen Resolution must be 1024 by 768 pixels, minimum.

## Enabling Datasource Preview

If the following settings are not enabled after you've installed Genie 2000 and rebooted, they must be configured manually.

### The Active Desktop

First, you'll have to enable the Active Desktop feature of Windows Explorer.

#### Windows 2000

In Windows 2000, select Tools | Folder Options | Web View | Enable Web content in folders.

#### Windows XP

In Windows XP, select Tools | Folder Options | Tasks | Show common tasks in folders.



## Customizing the Datasource Folder

Next, you'll have to customize the folder where the datasource files are stored. If you performed a Standard Genie 2000 Installation, the files are in C:\GENIE2K\CAMFILES.

### Windows 2000

For Windows 2000:

- Find and select the directory containing the datasource files.
- Click View | Customize This Folder. This opens the Customize This Folder Wizard.
- Click Next.
- In the next dialog box, select Customize | “Choose or Edit an HTML template for this folder”, then click Next.
- In the next dialog box, select Current, then click Next.
- At this point, the Folder.htt file will be launched in Notepad.



**CAUTION:** DO NOT edit this file.

- Close Notepad, then click Finish in the Wizard.

### Windows XP

For Windows XP:

- Find and select the directory containing the datasource files.
- Click View | Customize This Folder.
- In the dropdown box, choose Use existing customization template.
- If you want to apply this template to all the subfolders check the “Also apply this template to all subfolders” checkbox.
- Click OK.

The first time the datasource folder is opened in Windows XP, you'll see the message that “The file or folder you are opening contains Web content that may be unsafe...”

Click the message's **Yes** button to allow the datasource preview to run.

If datasource preview does not work under Windows XP after you've installed Genie 2000 and rebooted, check the following:

- Click View | Customize This Folder.
- In the dropdown box make sure "Use existing customization template" is selected. If it isn't, select it, then click OK.

### Using a Different Directory

Any directory can use this feature. To enable another directory, do the following.

- Using the Control Panel Folder options, enable the showing of hidden and system files.
- Navigate to the datasource directory (\GENIE2K\CAMFILES) and copy the Desktop.ini file and the "Folder Settings" folder to the target directory, the one you want to enable for datasource previewing.
- Open a Command Window and navigate to the target directory.
- The target directory's system attribute must be set to 'true'. At the command prompt, type:  

```
attrib +s directoryname.
```

Where 'directoryname' is the name of the target directory. Be sure to include the '.' following the directoryname.

- Perform the configuration steps listed above for your operating system.

## Working With the Preview

When the datasource directory is opened, datasource preview is enabled by default. Select a datasource, such as `Nbsstd.cnf`, to display it (Figure 199).

**Note:** The preview function needs enough space to display the datasource's spectrum. If the Explorer is not maximized, you may not see the spectrum; stretch the Explorer horizontally until the spectrum is displayed.

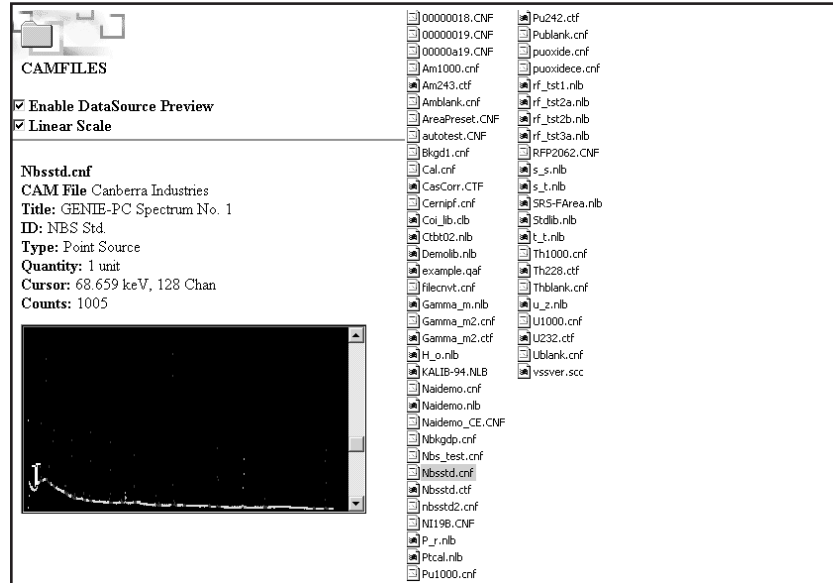


Figure 199 Previewing Nbsstd.cnf

### Copying a File In the Preview Mode

Unchecking the Enable DataSource Preview checkbox will allow you to safely copy the currently selected file.



**CAUTION** Attempting to copy a file with Enable DataSource Preview checked can cause unexpected results.

### Scale

Click the Linear Scale checkbox to toggle the preview's vertical full scale between linear and log.

### Cursor / Counts

You can use the standard Genie 2000 controls to move the cursor and the region markers through the spectrum. The Cursor and Counts fields above the spectrum will be updated to reflect the cursor's current position.

# A. Software Installation

---

Because of the flexibility of the Genie 2000 system, there are many aspects to system installation and setup. The applicability of these various aspects is a function of the individual installation, its desired capability, its hardware, and so forth.

This appendix serves as a guide to the installation process, directing you to the related information in this manual as required.

## Factory Assembled Systems

For complete systems provided by Canberra, the hardware and software have been installed and tested at the factory. After setting up the system, go to Chapter 2, *MCA Input Definition*. Preliminary configuration of inputs will have been done at the factory for testing, but you will probably want to change some of the initial definition (for example, the detector names) for your own operation.

## Doing it Yourself

If you are putting the system together yourself, Canberra recommends that you follow the sequence presented here.

## Basic System Requirements

Successful installation and operation of Genie 2000 software requires at a minimum:

Computer: Industry standard computer with a Pentium®-233 processor and CD-ROM drive is required.

Operating Systems: Windows XP, or  
Windows 2000, Service Pack 3, or  
Windows NT® V4.0, Service Pack 6A.

Note: Internet Explorer V6 or above is required for all operating systems.

RAM: A minimum of 64 MB (Windows NT/2000) or 128 MB (Windows XP) is recommended, but in the Genie 2000 environment more memory will generally improve performance.

Hard Disk: 100 MB free disk space for Genie 2000 software and sample data file storage.<sup>1</sup>

---

1. Due to extensible nature of the CAM file system, you can expect data files, including all parameters, analysis results, library information and calibrations, to average 80-100 KB each.

- Display: VGA color, 800 x 600 resolution, minimum; 1024 x 768 recommended.
- Security Key: The security key supplied with the Genie 2000 software must be connected to either a USB port or a parallel port.<sup>2</sup>

1. Referring to “Installing Windows” on page 283, install the appropriate Windows operating system.
2. Install MCA hardware and any network hardware. Refer to the hardware user’s manual for installation instructions. For the System 100 and AccuSpec MCAs, refer to the “Hardware Installation” chapter of the *Historical Canberra MCAs.pdf* file on your Genie 2000 CD-ROM or if installed, in your `Genie2K\pdfs\docs` folder.
3. Referring to “Installing Genie 2000” on page 284, install the Basic Spectroscopy Software.
4. Referring to “Installing TCP/IP Components” on page 288, install the required TCP/IP network software components.
5. To install any Genie 2000 software options, refer to “Installing Optional Software” on page 288.
6. Additional information on customizing Windows for running Genie 2000, which is not required by most users, can be found in Appendix B, *Genie 2000 Configuration*.
7. To set up your MCA Input Definitions, use the MID Wizard or MID Editor, both described in Chapter 2, *MCA Input Definition*.

## Installing Windows

Windows must be installed on the hard drive; refer to the appropriate Windows manuals for complete instructions. Please follow these guidelines when installing Windows on your system.

1. You’ll need approximately 550 MB (Windows NT/2000) or 1.5 GB (Windows XP) of free space on your hard disk for the complete Windows installation.

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2. If you are using parallel port key, you can still use the port for most peripherals, but not for control of the Model 8224 Multiplexer.

2. Remove all Canberra PC-board acquisition devices prior to the installation of Windows NT/2000/XP. Windows NT/2000/XP supports Plug-n-Play, which will automatically detect hardware during installation and attempt to install the proper support. Canberra's PC-board acquisition devices do not support Plug-n-Play and may cause detection problems if plugged in during Windows installation.

## Installing Genie Software

This section describes installing the Genie 2000 Basic Spectroscopy and optional software from the distribution CD. Please note that this installation requires 50 to 90 MB of free space on your hard disk, depending on options selected. Note also that Administrator privilege is required under Windows NT/2000/XP to perform the installation since edits to the registry are made.

Notes: Canberra recommends that Genie-2000 software be operated using the local system administrator account. If however, you opt to run Genie-2000 from a non-privileged account, you must manually change the permission and security setting in the Genie2K directory tree and their files. Not doing so will produce unreliable results.

It is also recommended that the Windows XP "Switch Users" function be disabled to prevent simultaneous access to common Genie-2000 files. The System Administrators Control Panel can be used to disable this feature. Refer to the Windows XP online help for additional information on how to disable this feature.

### Update Procedure

Before performing a software installation or upgrade, it's highly recommended that you make a complete backup of all of your Genie 2000 directories. If this is not practical, you should at least copy any \*.ASF, \*.TPL or \*.NLB files that you modified (but that still use the default file names) to a disk or to a temporary directory to be sure that the software installation procedure does not overwrite them with default files. After the installation is complete, these files can be restored to their original directories.

### Release Notes

During installation of each software option, a Release Notes file containing information on the current version of the software, is copied to the GENIE2K directory on your hard disk. It is worthwhile to read this text (ASCII) file, which has a general file name of G2K\*.TXT, directly from the installation CD *before* installing the software, to see if there is any variation in the installation procedure.

### Starting the Installation

1. If you are installing this software as an upgrade from a previous version, make sure that no Genie 2000 software programs, such as the VDM, are running.
2. Insert the CD into the CD-ROM drive.
3. Click **Start | Run** and type `? : \setup`, where ? is your CD drive, then click **OK**.
4. The setup screen (Figure 200) offers several Genie 2000 options. In addition to installing the software, you can read the Release Notes, install Acrobat® Reader® and review the *Genie 2000 Tutorials Manual*, the *Genie 2000 Operations Manual*, and the *Genie 2000 Customization Tools Manual*.

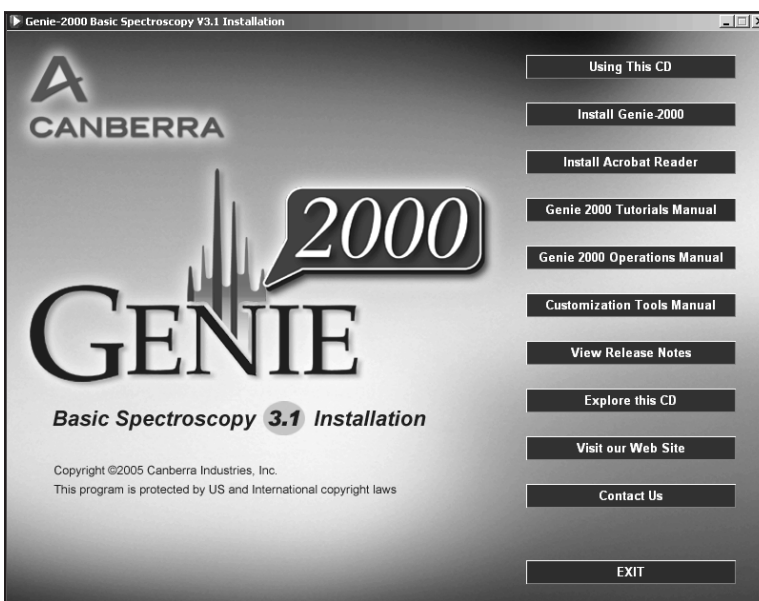


Figure 200 The Genie 2000 Installation Screen

## Installing Genie 2000



**CAUTION** Windows Scripting Host, one of the components being installed with Genie, may ask you to reboot when its installation is complete. If this happens, select **No**. You should allow the Genie 2000 installation to finish before you reboot.

1. To install the software, select the **Install Genie-2000** button.
2. You'll be asked to select the language for this installation (Figure 201).



Figure 201 Select the Language

3. Follow the instructions on the next few screens. When you're asked to select the Installation Type (Figure 202), accept the default selection, **Install Genie 2000 S500/S502 Basic Spectroscopy**. The other option, "Install Genie 2000 S504 Basic Spectroscopy", is used only with Genie supported InSpector-type MCAs.

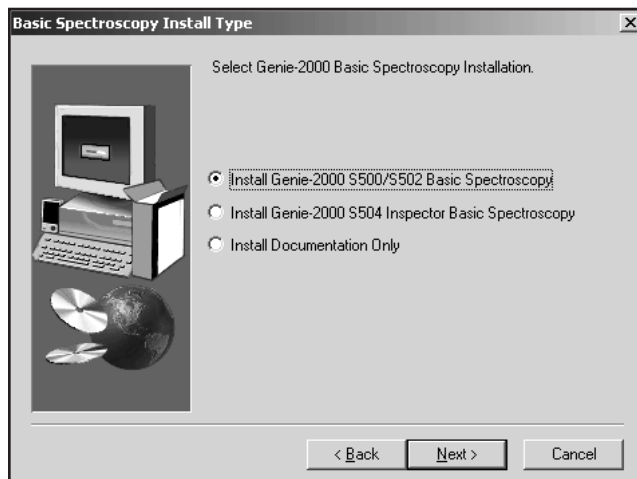


Figure 202 Selecting the Installation Type



4. Setup will now ask if you want to install the Genie 2000 documentation (about 30 MB of PDF files) directly on your hard drive.
5. Next, setup will ask if you would like to install Acrobat Reader. You can also install the Reader by clicking its button on the setup screen.
6. Finally, you will be asked to choose between Standard Installation and Custom Installation, as described in the following two sections.

## Standard Installation

This is the choice that most people will use. The Genie 2000 application is installed with predefined defaults – no further user selections are required.

Select the Standard button, then click **Next**. The application will now be installed. When the installation is complete, some final instructions will be displayed.

## Custom Installation

The components that comprise the Genie 2000 application are installed in sub-directories in the installation directory specified earlier in the procedure. If these default sub-directories are not acceptable for a particular installation you can change the location (directory) where these components are installed.

In addition, Setup allows you to modify the values of the following environment settings: SAD\_TIMEOUT, DS\_LOGON, PSET\_DELAY, ADVISE\_HOLD and HDW\_STATUS. See Appendix B, *Genie 2000 Configuration*, for a description of these settings.

1. Select the Custom button, then click **Next** or press the ENTER key.
2. A dialog box will appear. Select the components whose directories you want to change. When you have made all your selections click **Next** or press the ENTER key.
3. For each component selected, a dialog box will prompt you to enter the drive and directory in which to install the component. Change the drive/directory as necessary and click **Next** or press ENTER. After all selected components are complete the application will be installed.
4. After installing the application, Setup will display each of the above mentioned environment settings. You may keep the default settings or modify the settings. Setup will run through the final installation steps.
5. When the installation is complete, some final instructions will be displayed.

## Installing Optional Software

To install another Genie 2000 program, put its CD into the CD-ROM drive, then:

1. Click **Start | Run** and type `? : \setup`, where ? is your CD drive, then click **OK**.
2. Follow the instructions presented on the screen.
3. If the instructions on the screen tell you to reboot your system and you are installing several options, you can install all of them before rebooting.

## Completing the Installation

After installing all the software:

- Install and configure the TCP/IP network components (page 288).
- Install the AIM system drivers, if required (page 304).
- The security key supplied with the Genie 2000 software must be connected to either a USB port or a parallel port. The Models S500 and S502 Genie 2000 software will not operate without this key.
- You might want to have a shortcut to the Genie 2000 folder on your desktop (page 307).

## Installing TCP/IP Network Components

The TCP/IP network protocol is a standard component of the Windows operating system environments. The Genie 2000 software is a client/server architecture; communications between the client and server components is through Windows sockets using the TCP/IP protocol.

**Note:** Genie-2000 assumes that a network interface is installed in the local PC. If you do not have a network interface in a Windows 2000 or Windows XP PC, refer to the procedures in “Non-Network VDM Configuration” on page 298.

## Windows NT/2000/XP TCP/IP Setup

The following steps should be performed to ensure proper setup of TCP/IP for use by Genie 2000 under Windows NT/2000/XP. If remote VDM access is required, either by this computer or by another remote computer to this computer's VDM, some additional steps may be required; these are described in "Additional Setup Steps for Remote VDM Access" on page 292.

1. To determine if TCP/IP is already installed on your computer, right click on the Network Neighborhood icon, select Properties, then select the Configuration tab.

If you see TCP/IP in the Configuration list (Figure 203), it is installed and no further action is required. Click on Cancel to exit the Network window without making any changes.

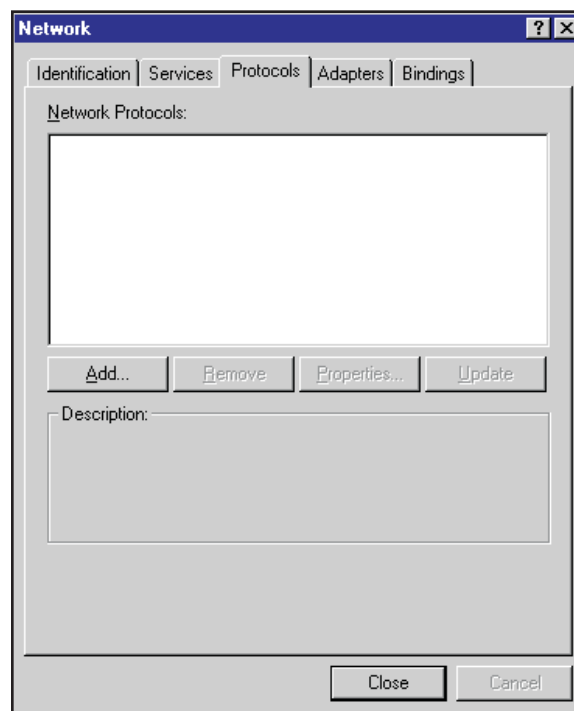


Figure 203 Network Protocol Screen

2. Only two network components require installation for Genie 2000. First, a network adapter must be added. If your computer does not contain a network adapter card, then an MS Loopback Adapter must be added. Click on the

Adapters notebook tab (this brings up the Network Adapters selection page); click on the **Add** button to bring up the dialog in Figure 204.

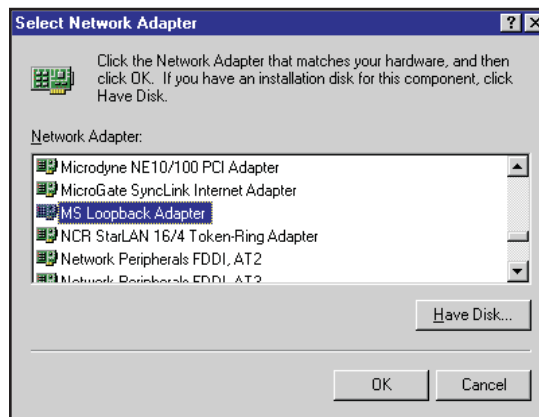


Figure 204 Select Network Adapter

Select the appropriate vendor and network adapter card to match the one in your machine. If none is present, then select the MS Loopback Adapter entry in the Network Adapters list. Choose **OK** to add the selected adapter. You will be prompted for your Windows NT/2000/XP installation disks (CD-ROM) in order to copy the required files for the selected network adapter (note that on some pre-loaded systems, the Windows NT/2000/XP distribution is installed on the hard disk partition containing Windows NT/2000/XP).

3. It is now time to add the TCP/IP protocol. Select the Protocols notebook tab on the Network Settings screen and press the **Add** button to bring up the Select Network Component Protocol dialog (Figure 205).

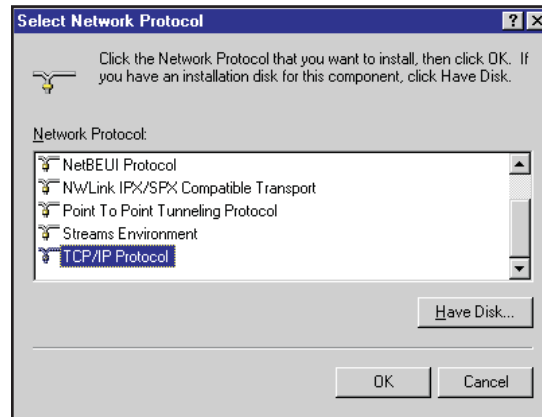


Figure 205 Select Network Protocol

Highlight the TCP/IP Protocol from the Network Protocol list and press **OK** to add. You will be prompted for your Windows NT/2000/XP installation disks (CD-ROM) in order to copy the required files for the selected network adapter (note that on some pre-loaded systems, the Windows NT/2000/XP distribution is installed on the hard disk partition containing Windows NT/2000/XP).

4. If remote VDM access is required, then proceed to "Additional Setup Steps for Remote VDM Access" on page 292.
5. Press the Close pushbutton to exit the Network setting dialog. At this time you will be prompted (via a dialog shown in Figure 206) for setup of TCP/IP properties.

On this dialog, an IP address and subnet mask must be specified. Since the loopback adapter has been selected (i.e. restricting TCP/IP communications to local only), then any legal IP address and subnet mask may be specified (e.g. 200.200.200.1 for IP address and a subnet mask of 255.255.255.0). Note that with this type of setup, Genie 2000 will use the standard loopback

IP address, 127.0.0.1, and not the one specified in this dialog. Press **OK** to complete the setup.

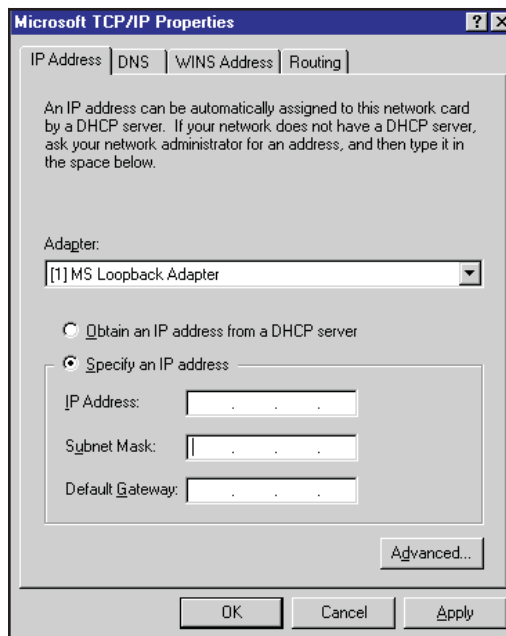


Figure 206 Microsoft TCP/IP Properties

6. When all required files have been copied and the installation is complete, you will be reminded to reboot your system to complete the installation process and will be given the option of restarting your computer immediately.

### Additional Steps for Remote VDM Access

If access to this computer's VDM is required from another remote computer, then this computer must identify itself via a unique computer name. If, after setting up your remote VDM access, you have persistent problems in establishing client connections to the VDM, refer to "Additional TCP/IP Installation Tips" on page 296.

To set up remote VDM access, perform the following steps:

1. The name of this computer must be defined via the Network Settings applet. To do this, click on the Identification notebook tab which brings up a dialog box.

Click the **Change** button to enter the Computer Name (Figure 207), which must be unique and is limited to 8 characters, maximum. It can include letters, numbers, hyphens and underlines (spaces are not allowed).

The Workgroup field is not used by Genie 2000. It is typically used in a larger network to help partition it and its users into logical domains.

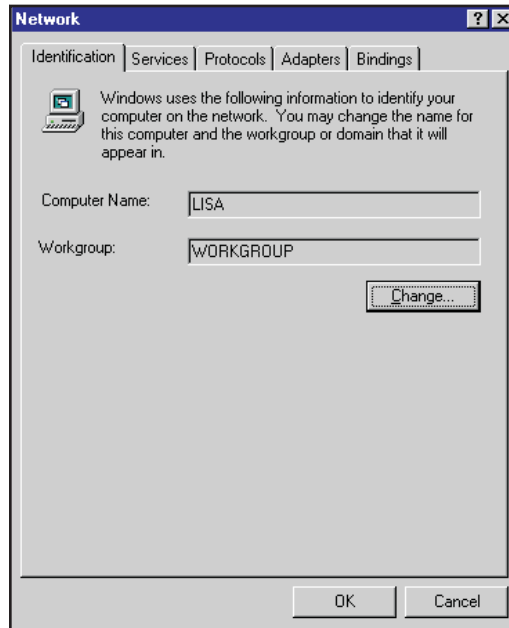


Figure 207 Computer Name Identification

2. Click the **Close** button to exit the Network setting dialog. You'll be prompted (via the dialog in Figure 208) to set up the TCP/IP properties.

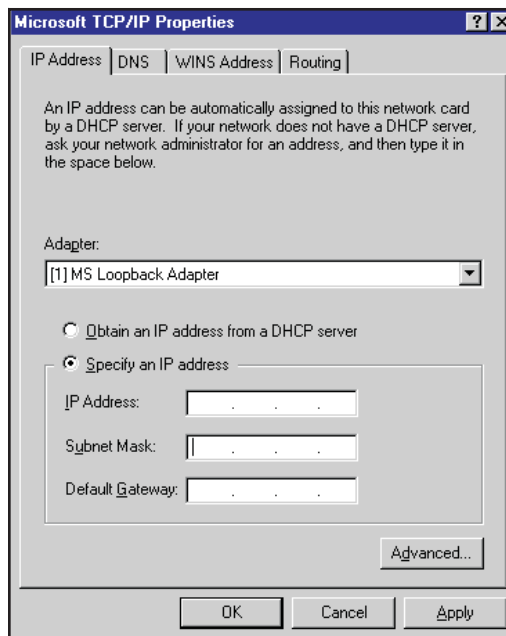


Figure 208 TCP/IP Properties Screen

An IP address must be defined for this computer so it can be associated with the previously entered computer name (this is how computers and applications communicate with each other using TCP/IP; the computer name is translated into an IP address). Either select the “Specify an IP address” radio button and enter in a valid IP address and subnet mask (e.g. IP address of 200.200.200.1 and a subnet mask of 255.255.255.0) or select the “Obtain an IP address automatically” radio button if this computer resides on a network that uses TCP/IP and employs dynamic IP addressing.

It is recommended that you contact your network administrator for guidance in setting up this portion of TCP/IP since IP addresses must be unique on a network. Select **OK** when setup of TCP/IP properties is complete.

3. When all required files have been copied and the installation is complete, you will be reminded to reboot your system to complete the installation process and will be given the option of restarting your computer immediately. Select No to the restart computer question since some additional setup steps are still required.



- The Genie 2000 Network Configuration File (as pointed to by the environment variable CINETCFG; typically named G2K\_VDM.NCF) must be edited as follows:

Edit the first line of this file to remove the text LOCAL as shown below (this indicates that the computer name/IP address information is defined via the network settings information and not defaulted to Local / 127.0.0.1):

**Original:**

```
1 -\local
1B-\pipe\datasrce
1C-\pipe\configur
```

**Edited:**

```
1 -\
1B-\pipe\datasrce
1C-\pipe\configur
```

If access to another computers VDM is required from this computer, perform the following steps:

- The Genie 2000 Network Configuration File (as pointed to by the environment variable CINETCFG) must be edited as follows:

Edit additional lines (after the first three lines) into the file as follows (this example assumes a remote computer name of NODE1):

**Original:**

```
1 -\local
1B-\pipe\datasrce
1C-\pipe\configur
```

**Edited:**

```
1 -\
1B-\pipe\datasrce
1C-\pipe\configur
1M-\\node1\pipe\datasrce
1C-\\node1\pipe\configur
```

Add additional lines as required to define subsequent remote computers.

2. Assuming your network does not use DNS, WINS or dynamic IP addressing, then one additional Windows NT/2000/XP TCP/IP file requires editing in order for this computer to resolve the remote computer name to an IP address. This file is named **HOSTS** and must be located in the WINNT\SYSTEM32\DRIVERS\ETC directory. A sample file named **HOSTS**, located in the aforementioned directory, can be used as the template for creating this file. Computer name and IP address entries must be made to this file so this computer can access the remote computer running the VDM. An example file is shown below with edits for the remote computer name NODE1.

```
# Copyright (c) 1993-1995 Microsoft
# Corp.
#
# This is a sample HOSTS file used by
# Microsoft TCP/IP for Windows/NT
#
# This file contains the mappings of
# IP addresses to host names. Each
# entry should be kept on an individual
# line. The IP address should
# be placed in first column followed
# by the corresponding host name.
# The IP address and the host name
# should be separated by at least one
# space.
#
# Additionally, comments (such as
# these) may be inserted on individual
# lines or following the machine name
# denoted by a # symbol.
#
# For example:
#
# 102.54.94.97 rhino.acme.com # source server
# 38.25.63.10 x.acme.com # x client host

127.0.0.1 localhost
200.200.200.5 node1 # Node 1 IP address
```

## Additional TCP/IP Installation Tips

Genie 2000 uses (by default) the port numbers 1200, 1300, and 2000 when creating socket connections for client/server communications. These are in the range of “user defined” services as specified by the TCP/IP standard. It is possible that these may be defined by another application on your computer, causing conflicts with Genie 2000. If problems persist in establishing client connections to the VDM, this may be a possible cause of the problems. To verify, examine the file WINNT\SYSTEM32\DRIVERS\ETC\SERVICES, as shown below.

```

# Copyright (c) 1993-1995 Microsoft Corp.
#
# This file contains port numbers for
# well-known services as defined by
# RFC 1060 (Assigned Numbers).
#
# Format:
#
# <service name> <port number>/
#   <protocol> [aliases...] [#comment>]

```

echo	7/tcp	
echo	7/udp	
discard	9/tcp	sink null
discard	9/udp	sink null
systat	11/tcp	
systat	11/tcp	users
daytime	13/tcp	
daytime	13/udp	
netstat	15/tcp	
	.	
	.	
	.	
kpop	1109/tcp	# Pop with Kerberos
phone	1167/udp	
ingreslock	1524/tcp	
maze	1666/udp	
nfs	2049/udp	# sun nfs.
	.	
	.	
	.	

Check to see if any one of the default Genie 2000 port numbers is defined. If so, then edits must be made to this file as follows:

```

Datasrce      nnnn/tcp      # VDM datasource connection
Advise       nnnn/tcp      # VDM advise connection
Configur     nnnn/tcp      # VDM configuration connec-
tion

```

where nnnn is an undefined port number.

If a Dialup Adapter is used for binding the TCP/IP protocol stack, it is possible that your Windows system is set up to “Connect to the Internet as needed”. This feature

will instruct the system to prompt you for an Internet connection whenever a Genie 2000 client application connects to the VDM.

To disable this behavior, bring up the Internet settings applet from within the Control Panel. Use the Connections notebook tab (as shown in Figure 209) and uncheck the checkbox labeled “Connect to the Internet as needed”; click on **OK** to save this settings change.

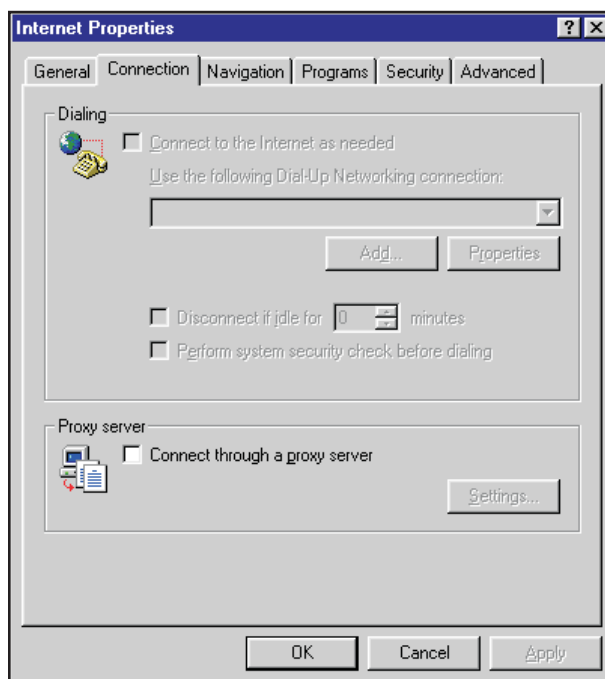


Figure 209 Connect to Internet

## Non-Network VDM Configuration

This section provides procedures for VDM configuration of a non-network Windows 2000 or Windows XP system.

### Windows 2000 Setup

This procedure supersedes the TCP/IP configuration procedure for Windows 2000 installations that do not contain a network adapter.

Communication to the Virtual Data Manager (VDM) is performed using the TCP/IP network protocol stack. With Windows 2000 installations, the configuration of this protocol differs somewhat from the Windows-NT installations when network adapter is not resident in the computer. Follow the steps outlined below to configure the TCP/IP protocol stack.

1. Connect the Genie hardware key to the local parallel port.
2. Log in to a local Administrator account.
3. Click **Start | Setting**. Click on the **Network and Dialup Connections**.
4. Double click on “Make New Connection”. This will launch the Network Connection Wizard. Click on **Next** to continue
5. Select *Connect to a Private Network through the Internet* as shown in Figure 210. Click on **Next**.

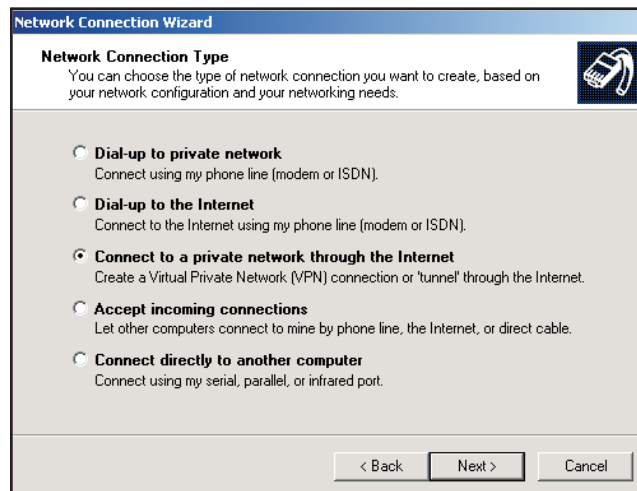


Figure 210 Selecting the Network Connection Type

6. Select *Do Not Dial the Initial Connection* as shown in Figure 211. Click **Next**.



Figure 211 Connecting to the Public Network

7. Enter a Host IP of 100.0.0.1 as shown in Figure 212. Click on **Next**.
8. Select "All Users".
9. When prompted to Connect, select Cancel.

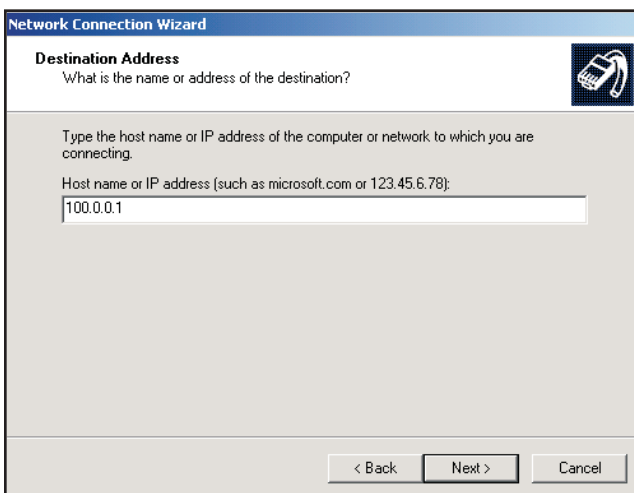


Figure 212 Entering the IP Address

## Windows XP Setup

This procedure supercedes the TCP/IP configuration procedure for Windows XP installations that do not contain a network adapter.

Communication to the Virtual Data Manager (VDM) is performed using the TCP/IP network protocol stack. With Windows-2000 installations, the configuration of this protocol differs somewhat from the Windows-NT installations when network adapter is not resident in the computer. Follow the steps outlined below to configure the TCP/IP protocol stack.

1. Connect the Genie hardware key to the local parallel port.
2. Log in to a local Administrator account.
3. Click on **Start | Settings** then **Network** and right click on “Network”.
4. This will launch the New Network Connection Wizard. Click **Next** to continue.
5. Select “Setup and Advanced Network Connection” as shown in Figure 213. Click on **Next**.

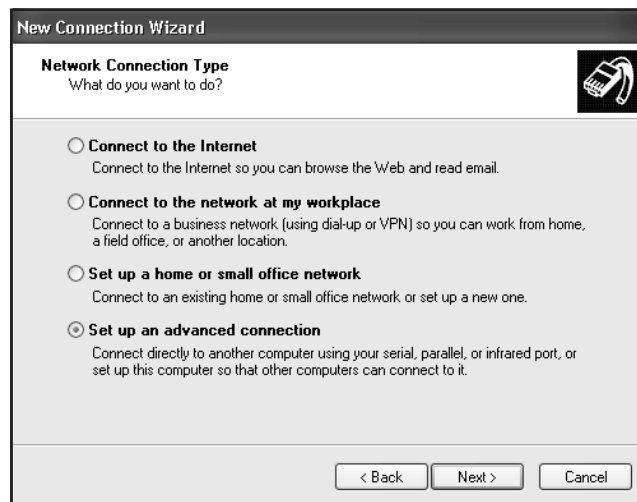


Figure 213 Selecting the Network Connection Type

6. Do not configure any connection devices if this is a stand-alone system. See Figure 214. Click on **Next**.

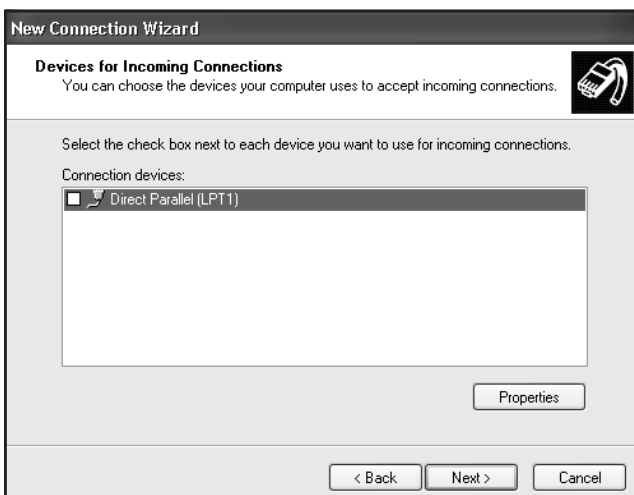


Figure 214 Selecting Devices for Incoming Connection

7. Select "Allow Virtual Private Connections" as shown in Figure 215. Click on **Next**.

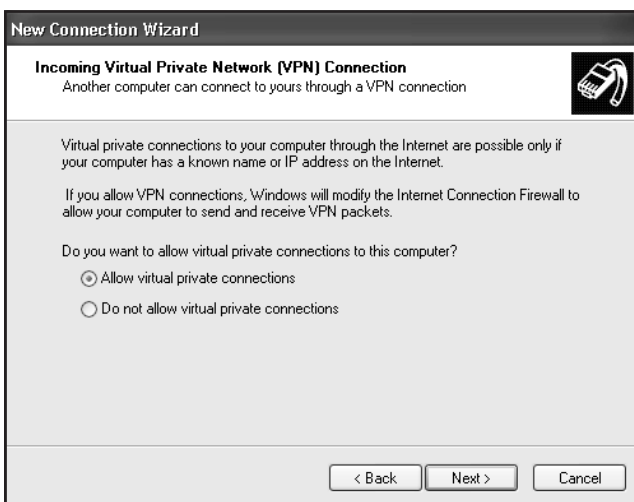


Figure 215 Selecting the VPN Connection



8. Select all users you wish to have access rights to the network. At a minimum, the Local Administrator must have network rights assigned. Click on **Next**.
9. Add the network protocols to the network. TCP/IP must be added at this time if not already in the protocol list. See Figure 216. Click on **Next**.

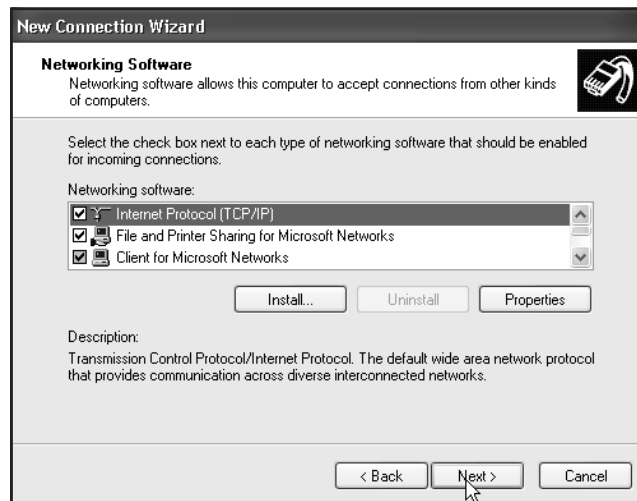


Figure 216 Selecting the Network Software

10. Configure a range of IP addresses allowed to access the system. A minimum range must be assigned as shown in Figure 217. Click **OK**.

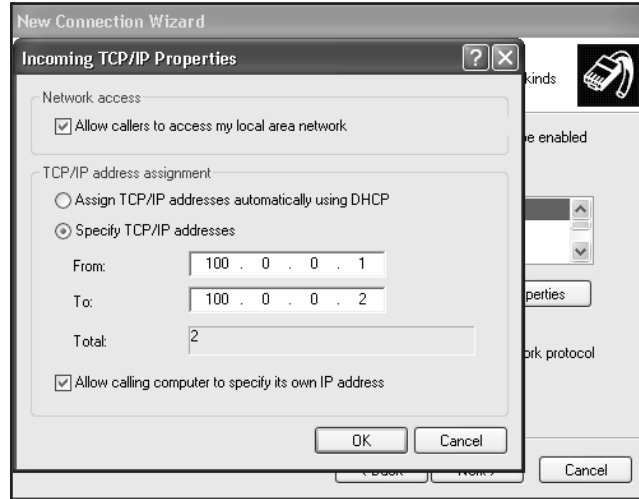


Figure 217 Adding the Network Protocol

11. Click **Next** and restart your system. When the system is restarted, verify the VDM starts correctly by simply opening a hardware or software datasource.

## Installing AIM Device Drivers

In order to communicate with an AIM acquisition device under Genie 2000, a special protocol stack must be installed.

- The Windows NT AIM setup is described on page 305
- The Windows 2000/XP AIM setup is described on page 305.

For CD-ROM distributions, the following table shows the CD-ROM location of the AIM drivers for each operating system.

<b>Operating System</b>	<b>Directory</b>
Windows NT	NT
Windows 2000	2000_XP
Windows XP	2000_XP

## Windows NT Setup

The following steps should be followed to ensure proper setup of the AIM protocol stack under Windows NT:

1. Launch the Network applet (via the Control Panel).
2. Click on the Protocols notebook tab and then press the Add pushbutton.
3. Click on the Have Disk pushbutton.
4. Make sure the CD is still loaded in the CD-ROM drive. Select the directory (?:\Bin\G2KVx.x\NT) having the required Windows NT AIM driver, where ? is your CD-ROM drive and x.x is the version of Genie being installed.
4. Click **OK**.
5. A dialog box will appear having the following entry: Canberra 802.3 SNAP Protocol driver V1.0; click **OK** to accept this protocol.
6. Make sure that the Canberra 802.3 SNAP Protocol is bound to the correct Ethernet adapter (this is not an issue if you have only one Ethernet adapter in your computer). If multiple adapters are present, the adapter binding can be determined from the Bindings dialog. The name of the protocol can be clicked on which brings up a list of adapters it is bound to. Highlight the adapter(s) which do not require the Canberra 802.3 protocol driver and click on Disable. Click on Close to save these new bindings.
7. Exit the Network settings dialog by clicking on **OK** (follow the prompts for your Windows distribution and reboot your system.)

## Windows 2000/XP Setup

The following steps should be followed to ensure proper setup of the AIM protocol stack under Windows 2000/XP:

1. Launch the Network and Dial-up Connections applet for Windows 2000 or the Network Connections applet for Windows XP (via the Control Panel).
2. Right click on the Local Area Connection icon and click Properties.
3. Click the Install pushbutton on the Local Area Connection Properties window.
4. Highlight Protocol and then click the Add pushbutton.

5. Click on the Have Disk pushbutton.
6. Make sure the CD is still loaded in the CD-ROM drive. Click the Browse pushbutton to select the directory (?:\Bin\G2KVx.x\2000\_XP) having the required Windows 2000/XP AIM drivers, where ? is your CD-ROM drive and x.x is the version of Genie being installed.
7. Click **OK**.
8. A dialog box will appear having the following entry: Canberra NDIS 5.0 SNAP Protocol driver; click **OK** to accept this protocol.
9. Make sure that the Canberra NDIS 5.0 SNAP Protocol is bound to the correct Ethernet adapter (this is not an issue if you have only one Ethernet adapter in your computer). If multiple adapters are present, the adapter binding can be determined from the Bindings dialog. The name of the protocol can be clicked on which brings up a list of adapters it is bound to. Highlight the adapter(s) which do not require the Canberra NDIS 5.0 SNAP Protocol driver and click on Disable. Click on Close to save these new bindings.
10. Exit the Local Area Connection Properties dialog by clicking Close (follow the prompts for your Windows distribution and reboot your system).

## Installing the USB Driver

In order to communicate with Canberra's USB enabled devices (MCAs), a special driver must be installed. Follow these steps to install the USB driver.

1. Plug the MCA into the USB port.
2. Windows will prompt you for the USB driver diskette.
3. Insert the Genie 2000 CD into the CD ROM drive.
4. Specify the folder for your MCA:
  - CIUsb folder for the InInspector 2000, DSA-1000 and Multiport II MCAs.
  - EagleUSB folder for the Eagle Plus MCA.
  - UniSpec folder for the UniSpec MCAs.
5. Click **OK**. It's not necessary to reboot when installation is complete.

## Installation of the PCI MCA Driver

Windows 2000 and XP are “Plug and Play” operating systems. Therefore, after a PCI MCA (i.e. ASA-100) is installed in the system and the system is restarted, the operating system will automatically detect the presence of the MCA and prompt the user to navigate to a directory that contains the Canberra PCI driver.

The directory will be found on your distribution media in an operating system-specific directory `?:\Bin\G2KVx.x\CIPCI\PLx\WinNT_2000`, where `?` is your CD-ROM drive and `x.x` is the version of Genie being installed.

Note however, that Windows XP uses the same driver as the Window NT and 2000 operating system. During the installation of the PCI driver on a Window-XP system, the operating system will inform the user that the Canberra MCA is not a certified Window device. Select **Continue** to complete the installation of the PCI driver.

Windows-NT does not require any additional operation. The PCI driver will be installed during installation of Genie-2000 regardless whether the PCI device is present or not.

## Installing the Security Key

The security key supplied with the Genie 2000 software must be connected to either a USB port or a parallel port. The Models S500 and S502 Genie 2000 software will not operate without this key.

## Creating a Shortcut on Your Desktop

After software installation, you can use this method to create a shortcut to any Genie 2000 program on Windows 2000 or Windows XP.<sup>3</sup>

1. Click on **Start Menu**.
2. Click on **Programs**.
3. Click on **Genie-2000**.
4. Using the secondary (usually the right) mouse button, click on the desired program, such as “Gamma Acquisition & Analysis”.

---

3. Windows NT uses a different method; refer to Windows NT Help for details.

5. Using the primary (left) mouse button, click on **Send To**.
6. Click on **Desktop** (create shortcut).

The newly created shortcut will appear on your Windows desktop. You can move this shortcut icon anywhere on the desktop and, if you like, you can rename it.

## Starting the Virtual Data Manager

All Genie 2000 programs require the Virtual Data Manager (VDM) program to be running before they can be started. If the VDM is not already running when an application is launched, it will be started automatically. This may cause a brief delay when launching an application.

## System Power Options

All supported Windows operating systems provide the ability to put your computer in a “sleep” state when it’s not being used.



**CAUTION** System Standby in your computer’s Power Options should be set to “Never”.

Allowing your computer to power down during Genie 2000 operation will cause unreliable communications with the Genie VDM and cause undesirable results.

## Starting Genie 2000

There are several ways to start Genie 2000:

- Click on the shortcut created in “Creating a Shortcut to Genie 2000” (page 307).
- Choose **Start | Programs | GENIE-2000 | “your program”**, where “your program” might be Gamma Acquisition and Analysis.
- In a Command Line window
  - For Gamma Acquisition and Analysis type  
MVCG.exe

- For Alpha Acquisition and Analysis type  
MVCA.exe
- You can automatically open a datasource file at the same time. For instance, type  
MVCG.exe C:\GENIE2K\CAMFILES\Nbsstd.cnf

## Uninstalling the Genie Software

Note: The Genie 2000 software components must be uninstalled in the order in which they were installed to ensure that all modified Genie 2000 and system files are returned to their proper state.

To uninstall all or part of the Genie 2000 software:

1. Click on Start Menu.
2. Select Settings.
3. Select Control Panel.
4. Select the Add/Remove Programs icon.
5. In the scroll-down list of programs in the Install/Uninstall pane, highlight the Genie 2000 component(s) you want to uninstall.
6. Select the **Add/Remove** button to remove the highlighted items.

## B. Genie 2000 Configuration

---

Though most users won't need to customize their Genie 2000 setup, the information in this chapter is useful for configuring Genie 2000 for specific situations.

### Genie 2000 Environment Settings

Starting with V1.2, Genie 2000 stores all its environment settings in the registry (as opposed to defining environment variables via SET statements in AUTOEXEC.BAT). The registry key location of these settings will be:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Canberra Industries, Inc.\  
Genie 2000 Environment
```

The software installation scripts for Genie 2000 now perform just two modifications to the AUTOEXEC.BAT file:

1. Modifications as required to the PATH environment variable.
2. On upgrades from V1.0/V1.1 systems, all Genie 2000 environment definitions are removed.

A special batch file, GENIE2K.BAT, containing all environment variables will be created in the GENIE2K\EXEFILES directory during Genie 2000 software installation. This file can be executed to recreate the full set of Genie 2000 environment variable definitions, if necessary.

Note that Genie 2000 environment settings can be altered in one of two ways after installation:

1. Using the Windows registry editor, REGEDIT, you can select and modify the appropriate Genie 2000 setting.
2. A registry setting can be overridden by defining the corresponding environment variable in AUTOEXEC.BAT. For instance, if you would like to override the default report format setting of WYSIWYG, you can add the following line to AUTOEXEC.BAT:

```
SET RPTFORMAT=DRAFT
```



**CAUTION** Use extreme caution if you elect to modify settings using REGEDIT; any erroneous edits/deletions can result in problems when running your Windows environment.

The following is a list of the various environment settings that are defined in the registry. Each of the setting descriptions is followed by its default value during installation.

CINETCFG Fully specified pathname of Network Configuration File.

SET CINETCFG=C:\GENIE2K\CTLFILES\G2K\_VDM.NCF

CAMFILES Pathname used for storing CAM (.CNF), Certificate (.CTF), Workspace (.WSP) and Nuclide Library (.NLB) files.

SET CAMFILES=C:\GENIE2K\CAMFILES

VDM\$TEMPS Pathname which the VDM will use to manage temporary files.

SET VDM\$TEMPS=C:\GENIE2K\VDMTEMP

EXEFILES Pathname where all Genie 2000 .EXE and .DLL files are stored.

SET EXEFILES=C:\GENIE2K\EXEFILES

GENIE2K Pathname defining the root directory in which Genie 2000 was installed.

SET GENIE2K=C:\GENIE2K

MCA\$DRIVERS Pathname which the VDM will search for Programmable Device Driver (.DRD) files.

SET MCA\$DRIVERS=C:\GENIE2K\DRIVERS

ASEQFILES Pathname which the Acquisition and Analysis applications will search for Analysis Sequence (.ASF) files so that the Analyze menu can be populated with a list of predefined sequences; the Edit Current Sequence menu will also use this when opening and saving analysis sequence files.

SET ASEQFILES=C:\GENIE2K\CTLFILES

MCA\$DEFINES Pathname used by the VDM for managing MCA Input Definition (.MID) files and MCA Configuration Files.

SET MCA\$DEFINES=C:\GENIE2K\MIDFILES

RTPLFILES Pathname which the Acquisition and Analysis applications will search for Report Template (.TPL) files when displaying the setup dialog for the standard report module.

SET RTPLFILES=C:\GENIE2K\CTLFILES

REPFILLES Pathname used by the standard report module when creating report (.RPT) disk files.

SET REPFILLES=C:\GENIE2K\REPFILLES

GAMMAAEF Fully specified pathname of the Analysis Module File used by the Gamma Acquisition and Analysis window.

SET GAMMAAEF=C:\GENIE2K\CTLFILES\GAMMA32.AEF

OS2FCTSFILE Fully specified pathname of the Genie 2000 Job Functions File used by REXXFCTS job command to register functions with the REXX language environment.

SET OS2FCTSFILE=C:\GENIE2K\CTLFILES\REXXFC32.DAT

CAMDB Fully specified pathname of the CAM schema file.

SET CAMDB=C:\GENIE2K\CTLFILES\CAMDB.DAT

CALFILES Pathname which the Acquisition and Analysis windows use to manage calibration files (for LOAD and STORE).

SET CALFILES=C:\GENIE2K\CALFILES

CIJOBHELP Pathname which the various Genie 2000 job commands will search for HELP files.

SET CIJOBHELP=C:\GENIE2K\JOBHELP

SAD\_TIMEOUT Timeout value (in tenths of a second) used internally by applications during its handling of communications with the VDM. This value may need to be increased based on the actual communications throughput of your system.

SET SAD\_TIMEOUT=300

DS\_LOGON Timeout value (in tenths of a second) used internally by the VDM during its handling of the create/logon process.

SET DS\_LOGON=50

PSET\_DELAY            Timeout value (in milliseconds) used by the VDM to control the cycle time of the preset checking thread.

SET PSET\_DELAY=31

ADVISE\_HOLD           Timeout value (in milliseconds) used by the VDM to control the cycle time of the advice-handling checking thread.

SET ADVISE\_HOLD=31

HDW\_STATUS            Timeout value (in milliseconds) used by the VDM to control the cycle time of the hardware status checking thread.

SET HDW\_STATUS=5000

MVCPREFS              Fully specified pathname of the preferences file used by the Acquisition and Analysis applications.

SET MVCPREFS=C:\GENIE2K\CTLFILES\MVCPREFS.INI

GENIE2K\_VERSION      Version number of the currently installed Basic Spectroscopy Software. This environment variable *must not* be edited in any way since it is checked by the optional Genie 2000 software packages during their installation.

RPTFORMAT             This setting, which is *not* written to the registry during software installation, specifies how reports are to be sent to the printer device. If your system needs this setting, you must add it to the registry (or add the environment definition to AUTOEXEC.BAT).

WYSIWYG (default value if setting is not defined) specifies that the report system is to send all data to the printer device through the printer drivers.

DRAFT specifies that the report system is to send all data to the printer device in “draft mode” (if supported by the printer). This means that all Windows printer driver settings are overridden and that the local printer settings are used.

SET RPTFORMAT=WYSIWYG

AIMPROTO\_RETRIES     This setting, which is not written to the registry during software installation, specifies the number of retries attempted by the AIM driver when it encounters an Ethernet communications error. The default value for this setting, if not defined, is 3. This setting may need to be increased on Ethernet networks that contain heavy traffic.

SPACE This is a fully specified pathname, pointing to the location of the ISOCS/LabSOCS SPACE.INI file.

SET SPACE=C:\GENIE2K\ISOCS\DATA

ISOCS\_HOME This is a fully specified pathname, pointing to the root ISOCS directory.

SET ISOCS\_HOME=C:\GENIE2K\

ASEQNUM This is the name of the last file stored by an Analysis Sequence file save. Used only if the Automatic File Naming feature has been turned on.

SET ASEQNUM=<value>  
where <value>=00000001-99999999

## File Formats

The Genie 2000 Report Template files, Analysis Engine files, Network Configuration file and Workspace files can be configured to your own requirements with the information in this part of the manual.

### Report Template Files

Report Template Files are ASCII files that govern the content and format of report data as generated by the Acquisition and Analysis windows as well as the Report job command (the location of these files is defined by the environment variable RTPLFILES, which is described on page 312). Please refer to the *Report Module and Template Files* chapter in the *Genie 2000 Customization Tools Manual* for details of file content and syntax.

### Analysis Engine Files

The Analysis Engine File (AEF) is an ASCII file (using '\$' as the delimiter) which contains a table that defines analysis phases, a list of descriptions for the engines supported by a phase, and their operating-system dependent command line and resource file name. There is only one AEF per client node (the file name is defined by the Genie 2000 environment variable GAMMAAEF); this file will be updated automatically during installation of Genie 2000 analysis package options. This file can also be edited to add user-defined sections (phases and engines). The format of an AEF is as follows:

#### **PHASE (Max. 24 chars.)**

The name of the analysis phase. This list of phases is used to construct the Manual menu in the Gamma Analysis application. Note that multiple engines can be defined for a given phase; the phase name only appears once in the menu.

**PHASE TYPE (Max. 3 chars.)**

The analysis phase type is used by applications that need to determine what particular engine to execute for a given phase of analysis (that is, efficiency calibration in batch will automatically execute a peak locate and peak analysis engine during its operation). Types 1-499 are reserved for internal Canberra use.

**DESCRIPTION (Max. 24 chars.)**

The descriptive name of an analysis engine. This name is used by the Gamma Analysis application when listing the various engines available for a given phase (i.e. the contents of the Algorithms list box within the Algorithm Selection dialog box).

**ENGINE (Max. 16 chars.)**

This field represents the generic (language independent) name of the engine for a particular phase. It is this field that is stored in the Analysis Control block CAM record structure to define the analysis sequence.

**TYPE (Max. 1 char.)**

The engine types are:

- **Type 1:** Analysis Engine (subroutine) – uses predefined common CAM parameters
- **Type 2:** Analysis Engine (subroutine) – uses both predefined common CAM parameters and optional parameters from the ‘analysis sequence’ record structure within the Analysis Control Parameters block.
- **Type 3:** Report Engine (subroutine) – uses both predefined common CAM parameters and optional parameters from the analysis sequence record structure within the Analysis Control Parameters block.

**LOCATION (Max. 64 chars.)**

This is the engine location. The portion of the line preceding the ‘!’ is the name of the system dependent DLL (Windows) that contains the engine. The name of the entry point for the engine follows the ‘!’.

As mentioned above, there are different types of engines. They can make use of a step number passed to them as follows:

- **Type 1** entries in the AEF are restricted to using common CAM parameters only (this implies that when these entries are used as part of an analysis sequence, one common set of parameters are used for multiple invocations).
- **Type 2/3** entries in the AEF have additional flexibility in that they determine the source of required input parameters based on how they are invoked. Specifically, a Type 2/3 entry that is invoked from the Manual menu, will be

called with the step number parameter being zero (0). This instructs the entry to read its required input parameters from the appropriate common CAM parameters section. If a Type 2/3 entry is invoked as part of an analysis sequence (through the Analyze menu), then its step number parameter will be non-zero and indicate the record number from within the Analysis Control Block from which it will read its required input parameters.

**RESOURCE (Max. 64 chars.)**

This is the engine setup screen location. The portion of the line preceding the ‘!’ is the name of the DLL (Windows) which contains the setup screen dialog procedure and resource; it is system dependent. The name of the entry point for the setup screen function follows the ‘!’.

**TEMPLATE NAME (Max. 12 chars.)**

This is the name of the default report template used by the engine when “generate report” is selected.

**SECTION NAME (Max. 8 chars.)**

This is the name of the default report section used by the engine when “generate report” is selected.

**A Typical AEF Record**

A typical record in the AEF would look like this:

```
Peak Analysis$2$Simple$PSSIMP$1$  
C:\DLL\PSSIMP.DLL!PSSIMP$  
C:\DLL\PSSRES.DLL!PSSPROC$  
ANALYSIS.TPL!PeakAnalysis
```

## Genie 2000 Network Configuration File

A Network Configuration File is required on all computer nodes that are running the Genie 2000 software environment (the name and location of the file is defined by the environment variable CINETCFG as described in “Genie 2000 Environment Variables” on page 310. This file defines both the location and the functions of the Virtual Data Managers (VDMs) that the client node has access to.

**Example**

This example of a typical Network Configuration File is followed by a detailed explanation of format and content.

```
1 -\Local  
1F-\pipe\datasrce  
1M-\node1\pipe\datasrce  
1C-\node1\pipe\configur
```

1M-\\node2\pipe\datasrce  
 1C-\\node2\pipe\configur

The format of a Network Configuration record is:

- **Node System Type (1 char.):** Specify type 1 for Intel nodes.
- **VDM Type Code (1 char.):** Type code as follows:

<b>M:</b>	VDM supports hardware control access
<b>F:</b>	VDM supports file access
<b>B:</b>	VDM supports both hardware control and file access
<b>C:</b>	VDM supports hardware configuration access

- **VDM Connection Identifier:** This identifier must be in the form of [\\nodename]\pipe\pipeid where:

<b>\\Nodename</b>	Optional identifier which is the name of the remote node; the \\ are required.
<b>\pipe</b>	Required text for connection identifier.
<b>pipeid</b>	Actual name of the connection; <i>must</i> be either DATASRCE for M, F, or B type VDMs or CONFIGUR for C type VDMs.

The first record of this file indicates whether “local only” TCP/IP or “network” TCP/IP connections are allowed. If the first line contains Local as the entry, then a loopback IP address is used for socket connections. If the first line contains anything other than local, the computer name/IP address is defined via the system network settings.

Given the above explanation of the file format, the example file defines the following information:

- The local node is named LOCAL and is an Intel node.
- There is a local VDM which support access to files only.
- There are two remote VDM’s (on nodes NODE1 and NODE2) which support both control access and configuration of hardware.

Please be aware that F and B type VDMs are only supported locally; they *cannot* be a remote node.

Note also that a default Network Configuration File (named G2K\_VDM.NCF) is automatically installed with the Genie 2000 software; this file is configured to allow access to a local VDM for both file/MCA and MCA configuration operations.

## Workspace Files

The workspace function allows you to save a specific configuration within the Gamma Acquisition and Analysis (GAA) and Alpha Acquisition and Analysis (AAA) packages. For example, if you have a four detector system, a workspace file can be created that allows you to open all datasources (detectors) at once by selecting the saved workspace file from the menu selection.

Workspace files are created when a current Acquisition and Analysis configuration is saved to a workspace file. A workspace file normally never needs to be edited, but the following information is provided in case a workspace file needs to be created or edited outside Acquisition and Analysis.

Workspace files are ASCII files written in a .INI file format. These files control the datasource(s) opened and the display options selected by the Acquisition and Analysis windows when a workspace file is loaded. These files have a .GWS file extension for mvcg.exe (Gamma) and a .AWS file extension for mvca.exe (Alpha).

INI files, or profile files as they are sometimes called, have a standard format: Each file is divided into sections. Each section is marked by a name of the section in brackets, i.e. [section name]. Within each section, entries are formed of two parts separated by an equal sign. The first part is the key name or entry name. The second part is the string for the key value, i.e. key name = string key value. The workspace file follows this format

### [Datasource]

This section contains key information about the datasource sections to follow, the show all display option, and the datasource that was being displayed.

#### **ShowAll=1(On) / 0(Off)**

This key name/value pair represents a on/off switch for the Show All datasource display option. A 1 represents a On value and a 0 is Off, i.e. ShowAll=0. See "Show All Datasources" on page 212 for more detail.

#### **CurrentDS=datasource file name or Detector name**

The datasource name (CurrentDS) should contain the name of the datasource to be opened when the workspace file is loaded. The name can be either a detector name or a fully qualified CAM file name, i.e.

CurrentDS=C:\GENIE2K\CAMFILES\Naidemo.cnf.



**OpenNames=DSn, ...**

This key name/value pair contains information about the names of the datasource sections to follow. The value is a comma delimited list of strings used to uniquely identify the section names for datasource information. Each string is made up of a “DS” string and a unique number i.e. OpenNames=DS1,DS2.

**[DataSource.DSx]**

This section is used to specify information for a given datasource, including the datasource name, the type of datasource and whether the datasource is to be opened as read-only. There should be a section like this for each name in the OpenNames section list.

**DSName=datasource file name or Detector name**

The datasource name (DSName) should contain the name of the datasource to be opened when the workspace file is loaded. The name can be either a detector name or a qualified CAM file name, i.e. DSName=C:\GENIE2K\CAMFILES\Naidemo.cnf.

**ROIName=roi file name**

The fully qualified name of the ROI file associated with the current datasource.

**DSCType= 769(Detector) / 1(NativeSpect file)**

Currently there are two types of datasources, a detector or a file. If the datasource is a detector, then type value should be 769. If the datasource is a file, then type value should be 1.

**DSServerType=x**

DSServerType indicates VDM type, where x =

M – the VDM supports hardware control access.

F – the VDM supports file access.

B – the VDM supports both hardware control and file access.

**DSServerName=\pipe\datasrce**

The DSServerName specifies the path to the datasource.

**DSReadOnly=1(On) / 0(Off)**

This value is the flag to open that datasource as read only or not. A 1 means On (open as read only) and 0 means Off (open as read/write).

**[Display]**

This section contains the available Acquisition and Analysis datasource display options. Each key name corresponds to a display option that affects how the datasource data is viewed. All the key values, except for CompareDS, are On/Off values, 1 for On and 0 for Off.

**ScaleIsAuto=1(On) / 0(Off)**

Set ScaleIsAuto=1 to change the display’s vertical full scale (VFS) automatically.  
Set ScaleIsAuto=0 to require that the VFS be set manually (page 117).

**ScaleIsLinear=1(On) / 0(Off)**

Set ScaleIsLinear=1 to define the display's scale as Linear.

Set ScaleIsLinear=0 to define the display's scale as Log (page 117).

**Expand=1(On) / 0(Off)**

Set Expand=1 to change the display mode to expanded.

Set Expand=0 to restore the display mode to normal (page 115).

**Compare=1(On) / 0(Off)**

Set Compare=1 to turn the compare function On.

Set Compare=0 to turn the compare function Off (page 117).

**CompareDS=datasource file name or Detector name**

The CompareDS key value should contain the name of the datasource to be used to compare with the other loaded datasources. The name can be either a detector name or a fully qualified CAM file name, i.e. Com-

pareDS=C:\GENIE2K\CAMFILES\Naidemo.cnf.

## Genie 2000 Font Customization

It's possible to customize fonts used in selected portions of Genie 2000 by creating an file named G2K FONTS.INI in the GENIE2K\CTLFILERS directory.

- A section is required in the INI file for each font you want to customize.
- Sections that are not being customized are not required in the INI file.
- The valid section names and their uses are listed below.

**[MVC Report]**

Report window (within the Gamma/Alpha Acquisition and Analysis windows and the QA Editor window).

**[MVC Status Bar]**

Status bars within the Gamma/Alpha Acquisition and Analysis windows.

**[MVC Status Pages]**

Status pages within the Gamma/Alpha Acquisition and Analysis windows.

**[MVC Lists]**

Owner drawn listboxes (such as those within the various calibration screens, QA editor screens, etc.).

**[GBT View]**

Graphical Batch Tools reporting window (GBT main screen and GBT\_VIEW window).

**[Cfed List]**

Certificate Editor listboxes.

**[Nuclib List]**

Nuclide Library Editor listboxes.

**[Reporter]**

Reports directed to a printer.

**[QA Edit]**

Quality Assurance Editor data entry fields.

**[QA Lists]**

Quality Assurance list boxes.

**[Peak Label]**

Peak labels in the spectrum. Large font sizes are not recommended for this section.

**[Peak Information]**

Peak information in the spectrum. Large font sizes are not recommended for this section.

**Example Section**

This [MVC Report] example illustrates all the available customization options. Specifying these values in the INI file will customize the MVC Report Window text as 9 point Bold Courier New.

```
[MVC Report]
Point=9
Facename=Courier New
Italic=0
Bold=1
Underline=0
Strikeout=0
FixedWidth=1
```

```
Charset=0
```

Though this example shows all options, only the options you want to change need to be specified in the INI file. Values that are not being changed can be omitted.

### Option Values

The valid values for each of the customization options are listed below:

```
Point=6,7,8,9,  
Facename=Courier New, MS Sans Serif,  
Italic=0 or 1  
Bold=0 or 1  
Underline=0 or 1  
Strikeout=0 or 1  
FixedWidth=0 or 1  
  
Charset=0 (ANSI), 1 (Default), 204 (Russian), 136  
(CHINESEBIG5), 255 (OEM)
```

Facename can be any valid font facename currently installed in the system. Valid point sizes are determined based upon the font selected. Most fonts support a range from 6 to 72.

## Sample Files

A number of sample files are automatically installed with the Basic Spectroscopy software:

- Spectral data files, gamma and alpha (.CNF)
- Certificate file (.CTF)
- Nuclide library files (.NLB)
- Analysis sequence files (.ASF)
- Report template files (.TPL)
- Batch procedure files (.REX)

## C. Technical Information

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This appendix contains instructions on adjusting the PUR/LTC, performing a manual pole/zero for an amplifier, adjusting a TRP preamp's reset pulse width and additional information on some of Status Screen's entries.

### Adjusting the PUR/LTC

To achieve the highest performance of your amplifier's Live Time Corrector, it may be necessary to adjust the ADC's LLD control. This adjustment must be made after the amplifier and ADC have been set to process the energy range of interest.

To make the adjustment, two radioactive sources with high activity are required: Source A with an energy peak in the upper part of the desired spectrum and Source B, a high activity source with an energy peak in the lower part of the spectrum. The following LTC optimizing process assumes that Source A is  $^{60}\text{Co}$  and Source B is  $^{137}\text{Cs}$ . The 1173.2 keV peak of  $^{60}\text{Co}$  will be used as a reference. The upper peak, at 1332.5 keV, is not a good choice because a sum peak of  $^{137}\text{Cs}$  at  $2 \times 661.6 = 1323.2$  keV would interfere with the measurement.

1. Put Source A near the detector so that the total count rate from this source is  $< 5$  kcps.
2. Set the LLD for a low value so that only energy above the noise level is acquired.
3. Enter an ROI about the reference peak and, with PUR *enabled*, acquire data until there are  $\approx 30$  kcounts in the peak area.
4. Clear the data from the spectrum, then put Source B near the detector. Adjust the total count rate to be the maximum expected in the course of normal measurements. Repeat the acquisition, stopping when the area of the reference peak reaches 30 kcounts.
5. Compare the count rates (Peak Area divided by the Elapsed Live Time) of Steps 3 and 4. If they are within several percent of each other, the LLD is properly adjusted.
6. If you feel improvement is desirable, adjust the LLD about 1% or 2% higher.
7. Repeat Steps 3 through 6 until an optimum setting has been achieved.

## Manual Pole/Zero

At high count rates, the pole/zero adjustment is extremely critical for maintaining good resolution and low peak shift. Figure 218 shows how misadjustment will affect peak shape and resolution.

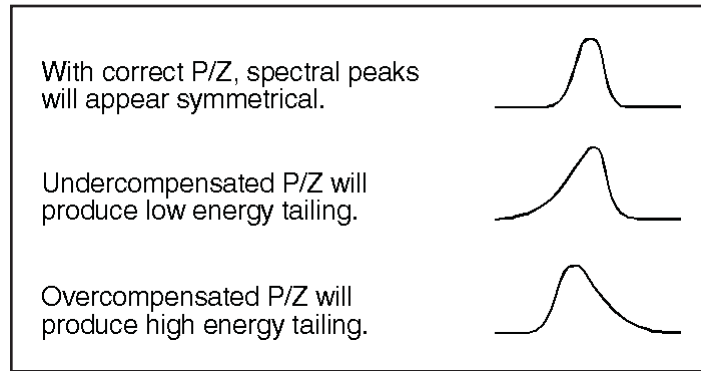


Figure 218 The Effect of Pole/Zero on a Spectral Peak

For a precise and optimum setting of the pole/zero, a scope vertical sensitivity of 50 mV/div should be used. However, most scopes will overload for a 7 V input signal when the vertical sensitivity is set for 50 mV/div. Overloading the scope input will distort the signals' recovery to the baseline.

Thus, the pole/zero will be incorrectly adjusted resulting in a loss of resolution at high count rates.<sup>1</sup>

When performing the manual pole/zero, set the scope vertical sensitivity to 50 mV/div, clamping the signal with the clamp box or the equivalent. The AMP signal will now be clamped, eliminating potential scope overload allowing precise pole/zero adjustment.

---

1. The Model LB1502 Schottky Clamp Box is available from Canberra to prevent this problem. The Schottky clamp is built into the Model 1510 Intergrated Signal Processor and Models 2025 and 2026 Spectroscopy Amplifiers.

**Pole/Zero Using a Ge Detector and a  $^{60}\text{Co}$  Source**

Adjust the position of the source so that the count rate is between 2 kcps and 25 kcps. While observing the signal at the amplifier's output connector, adjust the pole/zero control so that the trailing edge of the unipolar pulse returns to the baseline with no overshoots or undershoots, as shown in Figures 219, 220 and 221.

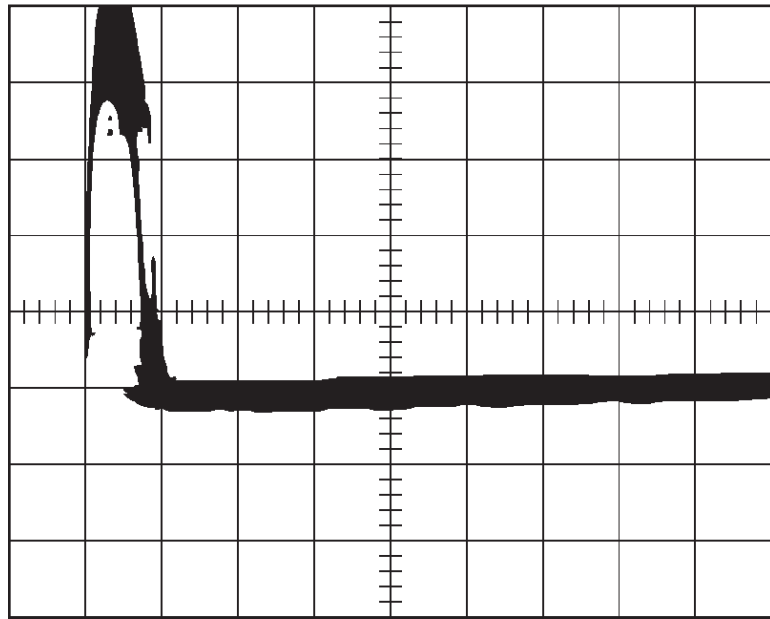


Figure 219 Correctly Adjusted Pole/Zero

Some amplifier shapings may exhibit small undershoots. These arise primarily from amplifier shaping component tolerances and secondary time constants associated with the detector/preamp system. If an undershoot is present and is less than 20 mV, its impact on performance is insignificant. However, these small shaping undershoots should not be confused with pole/zero misadjustment undershoots which exhibit a much longer time constant and have a larger performance impact.

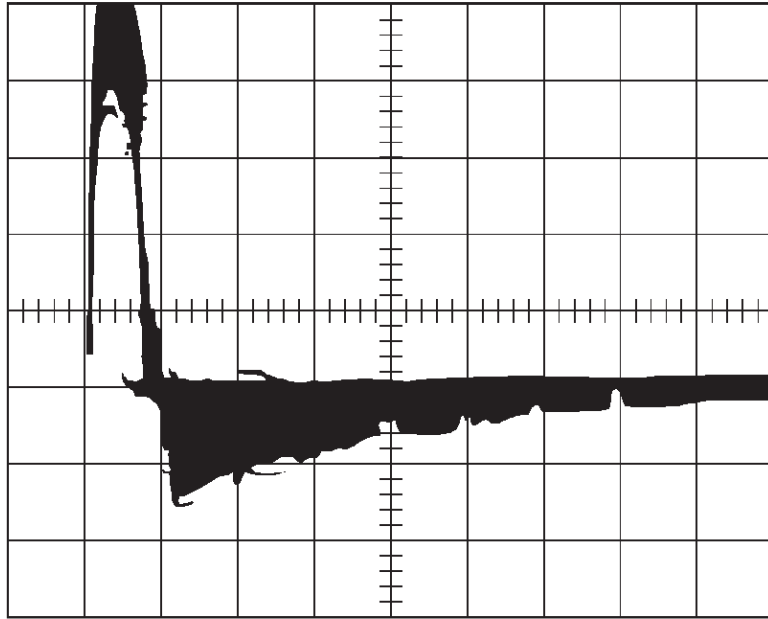


Figure 220 Undercompensated Pole/Zero

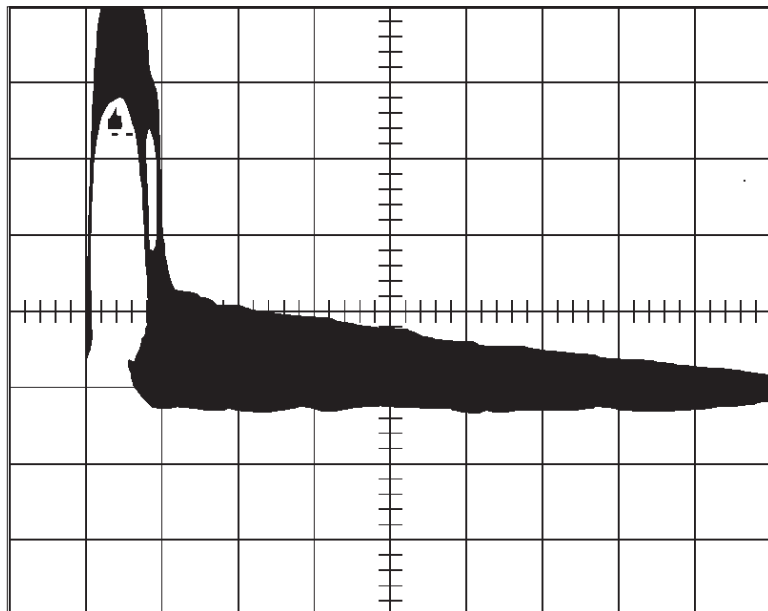


Figure 221 Overcompensated Pole/Zero



## Adjusting the TRP Reset Pulse

When a Transistor Reset Preamp (TRP) is used, its Reset output is connected to the amplifier's Inhibit input and the pole/zero is fixed at 0. For proper operation, you'll have to make an adjustment on the TRP preamp so that the amplifier and ADC are gated off during the preamp's reset time.

The adjustment is made with an oscilloscope connected to the amplifier's output<sup>2</sup> Trigger the scope on the leading edge of the Reset pulse and adjust its width so that it returns to its baseline *after* the amplifier's output returns to within 2 mV of the baseline, as shown in Figures 222 and 223.

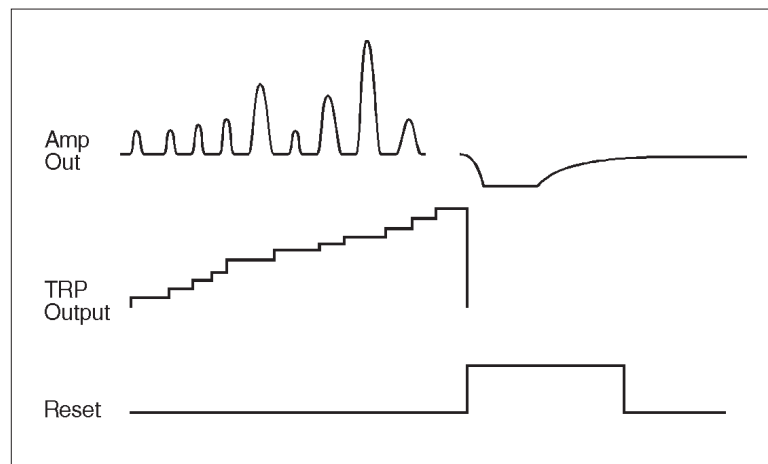


Figure 222 Amp, TRP, and Reset Signals Compared

2. The Model LB1502 Schottky Clamp Box is available from Canberra. The Schottky clamp is built into the Model 1510 Intergrated Signal Processor and Models 2025 and 2026 Spectroscopy Amplifiers.

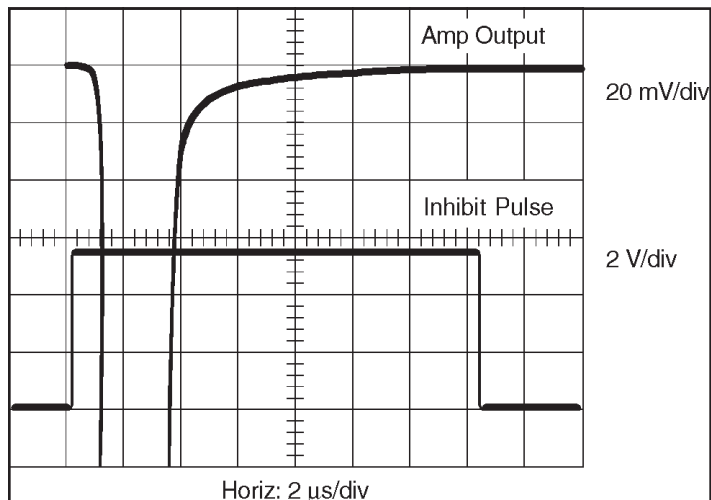


Figure 223 Setting the TRP Inhibit Pulse Width

## Status Screen Entries

Though the majority of the entries in the Status Report are direct reflections of the MCA Input Definition Editor settings or the Analysis and Acquisition application's Adjust settings, a few of them are explained in greater detail here.

### Stabilizer

This section refers to adjustments for the InSpector MCA only. The Zero and Gain correction values are the numbers representing the amount of correction made to the ADC. The range of correction is 0 to 4095, with 2048 representing *no* correction. If data drift causes either the Gain or the Zero correction to reach the limit of 0 or 4095, that stabilizer function will be changed to Hold and an overrange error flag will be set. To clear the flag, set that function to *off* to clear the overrange flag (and set the value to 2048), then correct the cause of the excessive drift before returning the mode to *on*.

### Power Manager

This section refers to adjustments for the InSpector MCA only.

#### Battery A and B Status

Bat A (or B) Status is reported as:

Good, when the battery voltage is  $> 5.8 \text{ V}$

Low, when the battery voltage is  $\leq 5.8 \text{ V}$

Discharged, when the battery voltage is  $\leq 5.5 \text{ V}$

When the Power Manager detects a “Discharged” battery, it will no longer use that battery port until the battery is removed (voltage detected as  $\leq 0.5$  V) and replaced with a battery with a voltage  $> 5.5$  V. The Power Manager specifically looks for the battery to be removed because an unloaded battery will recover some of its voltage but will not have enough capacity to support a load for more than a few seconds.

### **Batteries**

The line labeled “Batteries” shows the status of the InSpector’s batteries.

If this line reads “Warning”, you have only a few minutes of power left before the InSpector shuts down.

“Good” means that at least one battery’s voltage is  $> 5.8$  V.

“Warning” means that the voltage of both batteries, or just one if only one is connected, is  $\leq 5.8$  V.

### **RAM Batt Back**

The “RAM Batt Back” line shows the condition of the internal lithium battery used for maintaining data in the spectrum memory when the InSpector’s power switch is turned off. This battery, with an operating life of at least five years, is in a socket on the InSpector’s MCA Board. When its status changes from “Good” to “Disc” (discharged), replace it with a Panasonic CR2025 battery, or equivalent.

### **$\pm 12$ V Fault**

The  $\pm 12$  V Fault status tells you that because there is an overload on the +12 V or –12 V power supply, the Power Manager has put the supply into a Power Save condition. The most likely cause of this is that the preamplifier connected to the rear panel Preamp connector requires more power than the InSpector can supply. The proper remedial action is to disconnect the preamplifier’s power cable and change the power mode to Battery Full or AC Full. If successful, the fault will be cleared.

## D. Correcting for Cascade Summing

---

In gamma-ray counting laboratories, it is a common practice to use mixed gamma-ray standard sources for performing an empirical efficiency calibration of the detector. Nuclides such as  $^{60}\text{Co}$  and  $^{88}\text{Y}$  are almost invariably present in these mixed standards. This is because, the gamma rays emitted by  $^{60}\text{Co}$  and  $^{88}\text{Y}$  can be used to extend the efficiency calibration up to an energy of 1836 keV.  $^{152}\text{Eu}$  may also be used due to its multiple energies and long half-life.

Note: If a mathematical efficiency calibration method such as Model S573 ISOCS or Model S574 LabSOCS is used instead of a source-based method, the problem of having to correct the efficiency calibration for cascade summing effects will not arise. LabSOCS and ISOCS users can therefore ignore this chapter.

### Why Efficiency Calibration Correction is Needed

Unfortunately, the gamma rays emitted by  $^{60}\text{Co}$ ,  $^{88}\text{Y}$ , or even  $^{152}\text{Eu}$ , are affected by the phenomenon of cascade summing. As a result, counts are lost from the full energy peaks of these nuclides, and smaller detection efficiency will be measured at the gamma-ray energies.

An efficiency calibration performed using such data points affected by cascade summing will, therefore, be in error. The magnitude of the error depends on the source-detector counting geometry. The closer the source is to the detector, the larger the error due to cascade summing. Also, the larger the detector size, the larger will be the error due to cascade summing.

Efficiency errors of 10-30% are not uncommon in such scenarios. It is therefore necessary to correct the empirical efficiency calibration for cascade summing losses (or gains) to obtain the true efficiency. The next section, "Correcting the Calibration" describes the procedure for correcting the efficiency calibration.

### Correcting the Calibration

This procedure assumes that a spectrum has been acquired using a mixed gamma ray standard source, and that it has been energy and shape calibrated. The mixed gamma ray standard is assumed to contain nuclides that are affected by cascade summing. It is further assumed that a peak analysis has been performed on the spectrum, including an optional background correction.

1. Perform a Peak-to-Total Calibration for the detector, as described in “Peak-to-Total” on page 75. Alternatively, you can load a Peak-to-Total calibration file previously created for that detector.
2. Select **Calibrate | Efficiency | By Certificate File**. Select the source certificate file for the gamma ray standard.
3. Select the Perform Cascade Correction checkbox (Figure 224). If any of the prerequisites have not been met, an appropriate error message will be displayed. The checkbox will be disabled and you must exit the dialog to correct the deficiency. Otherwise, the Cascade Correction group box will be enabled.

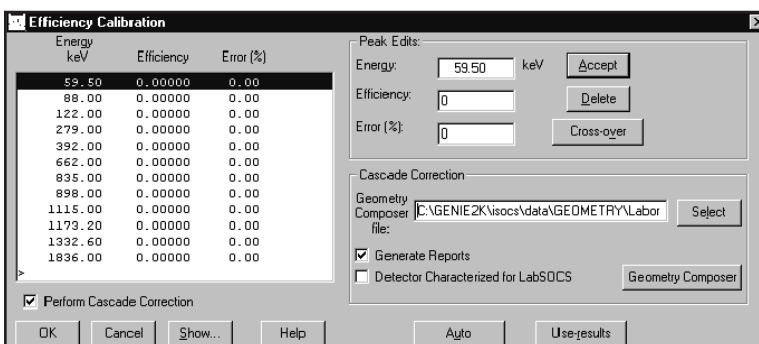


Figure 224 Enabling Cascade Correction

4. Select the geometry description (.GIS) file to be used for this calibration. If a file does not exist, select the **Geometry Composer** button. This will start the Geometry Composer application, where you can create and save a geometry description file. The newly created file must then be selected.

If your HPGe detector is not characterized for LabSOCS/ISOCS, you should select the closest generic detector characterization while editing the Geometry Composer parameters. For more information, refer to the *Selecting a Generic LabSOCS Detector Characterization*, appendix in the *Genie 2000 Customization Tools Manual*.

5. The Generate Reports checkbox determines if the analysis algorithms will output their standard reports.
6. Select the Detector Characterized for LabSOCS checkbox if Canberra has characterized the detector being calibrated. This will add a 5% systematic

error to the certificate file uncertainty (Error % triplet) of all affected nuclides. If the detector has not been characterized, a 10% systematic error will be added if the nuclide is  $^{60}\text{Co}$  or  $^{88}\text{Y}$  and a 15% systematic error will be added to any other affected nuclide's uncertainty.

7. The **Auto** button will now perform all the steps necessary to correct the calibration for Cascade Summing. The status bar at the bottom of the Gamma Acquisition and Analysis (GAA) window will show the stages being executed.
  - a. First, a peak locate with area analysis will be done using the sequence selected from the Calibration | Setup dialog. If "NONE" was selected, the algorithms will default to the ones last chosen from the Analyze Menu.
  - b. The Standard Efficiency Correction algorithm will be executed and a report generated in the GAA's report window. It is not necessary to preset parameters for this step.
  - c. Nuclide Identification will take place using the NID with Interference Correction algorithm. The NID parameters used should be set up from the Analysis | Nuclide Identification | NID w/Interf. Corr. menu before performing this process. A report will be generated in the GAA's report window.
  - d. The energy lines in the certificate file will be compared to the results of the NID process. When a match is found, the efficiency will be divided by the Coincidence Correction factor calculated during the NID process. The certificate's error will be adjusted as described in step 5. An asterisk (\*) will be displayed to the right of any line that has been adjusted.
8. Click on the **Show** button to display the calculated calibration curve. Select the appropriate polynomial fit to the efficiency data points. Click on the **OK** button when you are done.
9. In the Efficiency Calibration window click on the **OK** button to accept the calibration. The empirical efficiency calibration has been corrected for the effect of cascade summing and should now closely represent the true efficiency. Use the **Calibrate | Store** function to save your corrected efficiency calibration as required.

## E. The InSpector 2000 Simulator

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Genie 2000 V2.1 and later includes the InSpector 2000 Simulator, software which approximates many of the functions of a real InSpector 2000. It is designed to be used as a tutorial for and demonstration of Genie 2000, without the need for an actual MCA, a detector, and associated front-end electronics. This appendix describes the InSpector 2000 functions which are available in the Simulator.

### MID Definition

The Simulator is definable as a standard MCA, therefore an MID file definition must be created for it. It is listed as one of the MCAs in the MID Editor's MCA list. The MID Editor's screens are the same as those for an InSpector 2000 – USB device. There are a few points to remember when creating the MID definition for the InSpector 2000 Simulator:

- The Simulator's serial number can be any positive decimal number. The serial number for a real InSpector 2000 is a hexadecimal number.
- The MID Editor's input definition screen contains the selection for Detector Type. This selection will determine the type of spectrum (Germanium, NaI or Alpha) displayed during acquisition. This is explained in more detail in "Spectrum Simulation" on page 334.
- The Simulator's High Voltage Range (High Voltage settings screen) must be set. Unlike the real InSpector 2000, the Simulator does not support negative voltages.

When the MID definition has been saved, the Simulator can be opened in the Acquisition and Analysis application.

Note: A maximum of 48 Simulators may be defined, but only 32 can be opened concurrently in the Acquisition and Analysis application. Each Simulator must have a unique Serial Number defined.

## Acquisition and Analysis

Within the Acquisition and Analysis application, the Simulator will closely approximate an actual InSpector 2000 device. All of the adjust controls are included; their values will be correctly reported in the Status window and will be saved to (and reloaded from) the device definition file. Many of the adjust control settings will affect the simulated spectrum. For example, modifying the Coarse or Fine Gain will cause a shift in the spectrum, as would be true for a real device. The method for generating the simulated spectrum is discussed in “Spectrum Simulation” on page 334.

### Spectrum Simulation

The basis for all of the Simulator’s functionality is the “Template” file, a CAM file containing an actual spectrum. Any CAM file can be used, and the behavior of the Simulator, especially the simulated spectrum, will match that of the template file. As a result, any real spectrum can be simulated. Each of the following sections further describes how the template file contributes to the simulation.

The Simulator will always reproduce the spectrum of its template file. Genie 2000 installation provides an NaI template file (**SimNai.cnf**), a Ge template file (**SimGe.cnf**) and an Alpha template file (**SimAlpha.cnf**). In addition, any number of custom template files may be used, which must be actual CAM files containing real spectral data. Before opening the default template, the Simulator will search for a file with the name **Sim#.cnf**, where # is the Simulator’s serial number. In this way every Simulator can have a unique template file. If this template file is not found the default template file is used.

Note: All template files must reside in the Genie2k\Ctlfiles folder.

A Simulator device defined with two memory groups can have a separate template file for each memory group, using the name **Sim#m.cnf**, where *m* is ‘A’ or ‘B’, corresponding to memory groups 1 and 2, respectively.

Therefore, the Simulator searches for template files in the following order:

1. **Sim#m.cnf**                      Devices with two memory groups.
2. **Sim#.cnf**                      Devices with no memory groups defined.
3. **SimNai.cnf, SimGe.cnf**  
    or **SimAlpha.cnf**              Default templates.



In addition to a real spectrum, each template file must also have these three CAM parameters defined: CAM\_F\_VOLTAGE, CAM\_F\_AMPGAIN and CAM\_F\_LLD<sup>1</sup>.

The first two, CAM\_F\_VOLTAGE and CAM\_F\_AMPGAIN are especially critical. Since the spectrum is affected by changes in the voltage level (NaI mostly) and Amp Gain, these settings are read from the template files as baseline values – the spectrum will be adjusted according to the difference between these baseline values and the Adjust Control settings during acquisition. CAM\_F\_LLD is used as the LLD setting when “LLD Mode” is set to “Auto”. Baseline values are discussed in detail in several of the following sections.

## PHA Mode

The template file is the basic for the spectrum generated for a particular Simulator device. The total counts in the template spectrum (the Integral) is calculated when the template spectrum is read. The resulting spectrum will produce approximately the same number of counts per second as the template spectrum.

The elapsed times are also read from the template CAM file, which will be used to generate correct spectrum activity (i.e., counts per second) and correct dead time display. Note that in all of the spectrum and dead-time generation there is some randomness added to enhance realism.

## MCS Mode

Spectrum generation for MCS mode is implemented simply to give some facsimile of results. The Integral and ROI Modes use the same template spectrum as the PHA mode. The activity of the template spectrum is used in MCS mode to generate the correct number of events per unit time.

Integral Mode uses the entire template spectrum to calculate activity, and ROI mode uses the channels specified between ROI Start and ROI End. In TTL mode, a spectrum is created with a few modest peaks to show a different effect, but is not intended to depict realistic results.

## Percent Dead Time

The elapsed real and live times are read from the template file and the percent live time is calculated, which is then used to calculate live time, as percentage of real time, during acquire. A small amount of randomness is added to give a more realistic appearance. The percent dead time will fluctuate slightly during acquire, as would be expected with an actual device.

---

1. These parameters are normally stored as part of a saved CAM file. If the parameters are not present in the file, the Pars.exe utility shipped with Genie 2000 can be used to set values for these parameters.

## Amp Gain

Amp Gain is one of several settings that affect the generated spectrum. When the template file is read, the composite amp gain – the product of coarse gain, fine gain and super fine gain – is also read (CAM parameter CAM\_F\_AMPAIN). This is used as the baseline amp gain. The ratio of the current composite amp gain (as defined by the current Amp Gain settings) to the baseline is calculated, and the spectrum is shifted up/down according to this ratio. This allows for the dynamic shift in spectrum in response to change in gain, which is the behavior expected in a real device.

If the current Amp Gain setting equals the baseline value then the ratio equals 1.0 and the spectrum will not be shifted at all – thus the reason for the term “baseline” value.

## LLD

The LLD value is used to clip the lower end of the spectrum as in a real device. If LLD Mode is set to Manual, the current LLD setting is used. If LLD Mode is Auto, the LLD value from the template file (CAM parameter CAM\_F\_LLD) is used. The purpose for this behavior of LLD Auto Mode is simply to give the user different feedback based on different adjust control settings.

## Voltage

The voltage status (On/Off) and voltage level are maintained and used by the Simulator. For NaI detectors, the energy input from the detector varies exponentially with the voltage level setting. Accordingly, the Simulator reads the “baseline” voltage level from the template file (CAM parameter CAM\_F\_VOLTAGE), and shifts the spectrum up/down with respect to the difference between the current (via adjust control setting) and baseline voltage levels.

The Ge spectrum does not respond to the voltage level as the NaI spectrum does. The only requirements for germanium are that the voltage level  $\geq 1300$  V and that the HVPS be On.

Finally, when voltage is turned on or off or when voltage level is adjusted, the Simulator will wait for a period of time to simulate the voltage ramping process. Gamma Analysis will display the “Wait” message in the adjust control window. As with an actual device, the wait time is proportional to the change in voltage.

## Digital Stabilizer

The Digital Stabilizer adjusts the spectrum up or down in order to maintain the specified Gain Ratio at the Centroid. Every five seconds (actually five times the Gain Rate Divisor set in MID), the stabilizer samples the spectrum windows as defined by the Gain Centroid, Gain Window and Gain Spacing controls, and calculates the ratio of events (counts) in the two windows. It then adjusts the spectrum's stabilizer gain up or down accordingly. It continues adjustments until this ratio is equivalent to the specified Gain Ratio. If the Gain Factor should, over significant time, fall outside of the allowable 10% or 1% range, then a fault is triggered. The fault is cleared only when the stabilizer is turned off.

If Gain Mode is set to Hold, the stabilizer will maintain the current stabilizer gain. If the stabilizer is turned off, the gain is reset to 1.0 and therefore has no effect on the spectrum.

Note that since the spectrum is not affected by thermal effects in hardware components as would a real InSpector 2000, the only way to test the Stabilizer, for training purposes for instance, would be to manually change the Amp Gain or Voltage slightly during acquisition.

## Filter, Digital Oscilloscope and Pole/Zero

The Simulator supports the Digital Oscilloscope, Pole/Zero Assistant, and the Filter settings Rise Time and Flat Top. The Simulator creates an approximate trapezoidal pulse from the current Rise Time and Flat Top settings. It uses the Pole/Zero setting to adjust the overshoot or undershoot relative to baseline of the pulse's trailing edge. It also uses the energies of the simulated spectrum "events" to adjust the height of each pulse. Therefore, as the Amp Gain and Voltage are changed, the average height of the pulses will change accordingly. All the Oscilloscope controls, "Vertical Scale", "Smoothing Factor" etc., affect the displayed pulse appropriately.

When the voltage goes too low to generate a valid spectrum, the message "Count rate too low" is flashed on the Oscilloscope. Likewise, an FDisc Setting of 0.0 will cause a "Count rate too high" message to be displayed.

The Filter and Pole/Zero settings do not affect the spectrum, as they would in a real device.

## Other MID and Adjust Controls

The MID and Adjust Control settings which have not been specifically mentioned generally fall into one of three categories, and are summarized in the following table.

- Settings which can be written to the device and read back (for display in Status Screen only), but have no corresponding "simulation" or effect on the

spectrum. Examples of these settings include **LT Trim**, **LTC Mode** and **Standby Delay** in the Power Manager.

- Settings which are read-only, which would normally come from a real hardware device. These are for display only. One such example is the **Battery Voltage**. For these a reasonable value is assumed.
- Settings, such as the various polarities, which are MID settings only (not contained in the Adjust Windows in Gamma) and are used only for verification purposes. These may in some cases cause certain faults. Some polarity values are set to a predetermined value.

<b>HVPS</b>	Reset	This is implemented, but currently there is no method to cause a voltage fault.
	Inhibit Signal Polarity	
	Polarity	
<b>Power Manager</b>	Standby Delay	
<b>Gain</b>	PUR Guard	
	FDisc Setting	
	FDisc Mode (Auto)	
	Input Polarity	
	Inhibit Polarity	
	Inhibit Mode	
	Inhibit Setting	
	ICR	
	Gain Attenuator	
	LT Trim	
	LTC Mode	
	LLD Mode (Auto)	This is used (see LLD section) but does not simulate an actual Auto Mode
<b>Filter</b>	BLR mode	
	FDisc Shaping	
	Preamp Type	
	Trigger Select (Inhibit)	

## F. Line Activity Consistency Evaluator

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The activities calculated for all associated energies (line activities) for a given multi-line radionuclide should be the same, within statistical variation. The Line Activity Consistency Evaluator (LACE) facilitates analysis of this characteristic and helps in assessing how to improve the gamma analysis. LACE first searches the analysis file for nuclides with multiple gamma lines (e.g.,  $^{60}\text{Co}$ ,  $^{134}\text{Cs}$ ,  $^{152}\text{Eu}$ ,  $^{59}\text{Fe}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ +equilibrium progeny,  $^{226}\text{Ra}$ +equilibrium progeny,  $^{232}\text{Th}$ +equilibrium progeny).

For each of these multi-line nuclides, the ratios between each line activity and a reference activity (weighted mean and key line) are calculated. The energy vs. line activity ratios are then plotted on a log-log scale, showing the best weighted linear fit to the data. The activity ratios are used rather than absolute activities to enable consistent, relative scaling.

When the same activity is determined at all energies, the fitted slope would be zero with all activity ratios being unity. However, if line activities differ, there could be a variety of causes for the discrepancy:

- Statistical variation allows for about 32% of all normally distributed data to fall outside of the one standard deviation error bars that are plotted. Note that since this is a ratio, there are two statistical uncertainties involved, but points well outside the line with small uncertainties are likely to have other causes.
- If a single data point is too high or low, there are several possible causes:
  - ▶ Incorrect peak fit – use Interactive Peak Fit (IPF) to resolve poor multiplet deconvolution or bad FWHM calibration
  - ▶ Wrong background, possibly caused by another peak or Compton edge very close
  - ▶ Part or all of this peak belongs to another nuclide, data point will always be high due to poor energy calibration, unresolved multiplet or because this line is part of an interference set

Note: interference correction improves the weighted mean activity but does not change the line activity that is used in LACE. So if that line is part of an interference correction set, and the other nuclide has no real activity, the data point will be high.

  - ▶ Gamma abundance wrong – review library
- If points trend together, but not in a straight and level line this is because efficiency calibration doesn't match sample

You should first investigate the causes of individual peak errors, fixing those which cause errors in the nuclide activity. Where the line activity ratios indicate a statistically discernable trend with energy, LACE can assist you to qualitatively evaluate the correlation between the efficiency calibration and the sample emission rate. The shape of the LACE curve can help determine the type and general magnitude of discrepancy between the efficiency calibration and the measured sample.

When LACE shows a discrepancy between the efficiency calibration and the results for a given sample measurement, you can improve the correlation and enhance accuracy by either performing a new calibration that better matches the sample measurement or changing the sample conditions to better match the existing calibration. When a sourceless efficiency calibration (ISOCS/LabSOCS) is used, the efficiency calibration parameters can be quickly altered until a match is achieved. In either case, the LACE output must be properly interpreted to direct required changes.

## LACE Analysis

A variety of parameters must be considered when investigating possible discrepancies between an efficiency calibration and the actual conditions during sample measurement. These parameters include the dimensions, densities and materials used for both the source matrix and absorbers between the source and detector, as well as the distance between the source and detector. While it is possible that multiple parameters may have discrepancies confounding the analysis, it is likely that the scope of analysis can be limited by understanding which parameters might not be well known. Therefore, it is worthwhile isolating and investigating the effect of individual parameter discrepancies.

Figures 225 through 231 each address a different parameter, showing the effects of a range of discrepancies for analyzing a simulated measurement. Each figure addresses changes to only one parameter of the measured sample, keeping all of the other parameters at nominal values. These nominal values are:

- Source matrix thickness: 5 cm
- Source matrix material: aluminum
- Source matrix density: 2.7 g/cm<sup>3</sup>
- Absorber thickness: 1 cm
- Absorber material: aluminum
- Absorber density: 2.7 g/cm<sup>3</sup>

- Source-detector distance: 10 cm

Each figure includes the reference nominal case with variations above and below to show the resulting trends. The energy range is 45–7000 keV and the activity ratios reference the weighted mean activity.

Figure 225 shows how the activity ratio changes when the sample matrix thickness is different from the calibration matrix thickness of 5 cm. A negative slope indicates that the measured sample matrix thickness is less than the calibration matrix thickness, while a positive slope indicates that the measured sample matrix thickness is greater than the calibration matrix thickness.

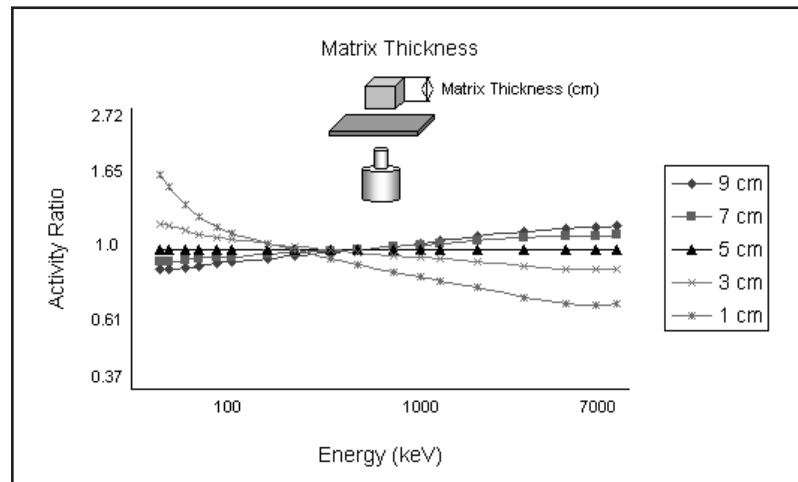


Figure 225 Simulating Discrepancies in Matrix Thickness

Figure 226 shows how the activity ratio changes when the sample matrix density is different from the calibration matrix density of 2.7 g/cm<sup>3</sup>. A negative slope indicates that the measured sample matrix density is less than the calibration matrix density, while a positive slope indicates that the measured sample matrix density is greater than the calibration matrix density.



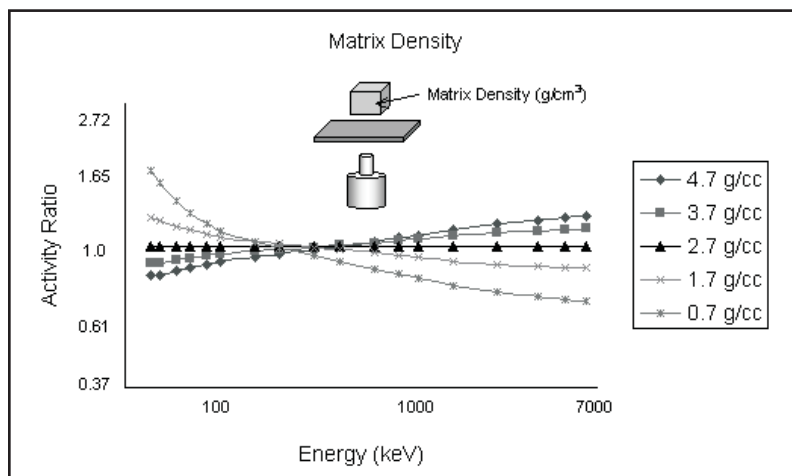


Figure 226 Simulating Discrepancies in Matrix Density

Figure 227 shows how the activity ratio changes when the sample absorber thickness is different from the calibration absorber thickness of 1 cm. A negative slope indicates that the measured sample absorber thickness is less than the calibration absorber thickness, while a positive slope indicates that the measured sample absorber thickness is greater than the calibration absorber thickness.

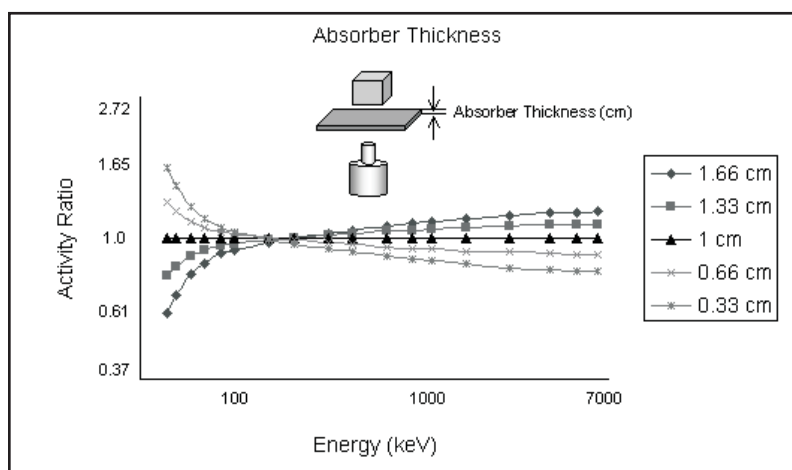


Figure 227 Simulating Discrepancies in Absorber Thickness

Figure 228 shows how the activity ratio changes when the sample absorber density is different from the calibration absorber density of 2.7 g/cm<sup>3</sup>. A negative slope indicates that the measured sample absorber density is less than the calibration absorber density, while a positive slope indicates that the measured sample absorber density is greater than the calibration absorber density.

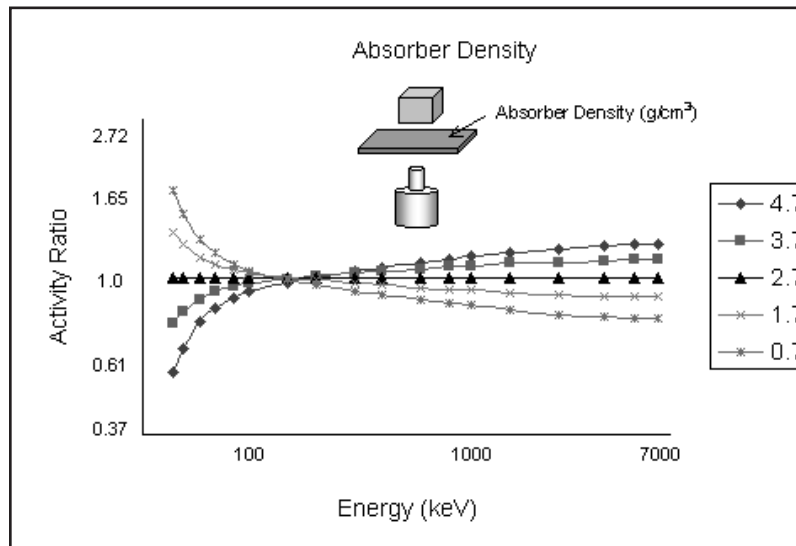


Figure 228 Simulating Discrepancies in Absorber Density

Figure 229 shows how the activity ratio changes when the sample matrix material type is different from the calibration matrix material type of aluminum. Upward concavity indicates that the measured sample matrix material type has a lower atomic number than the calibration matrix material type, while downward concavity indicates that the measured sample matrix material type has a higher atomic number than the calibration matrix material type.

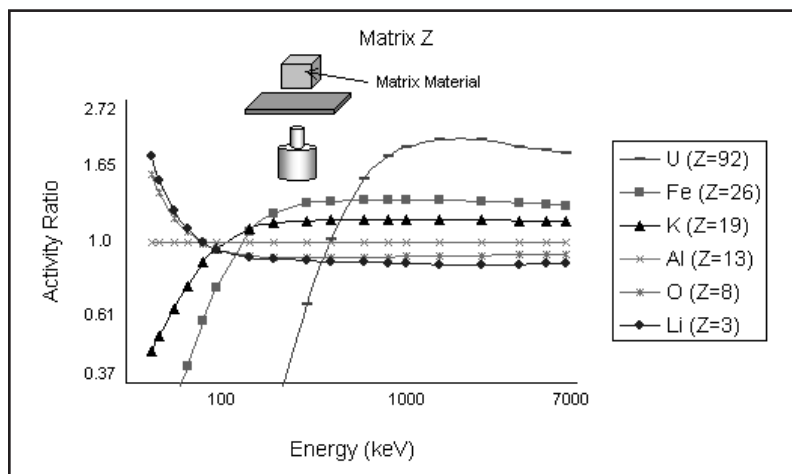


Figure 229 Simulating Discrepancies in Matrix Material Type

Figure 230 shows how the activity ratio changes when the sample absorber material type is different from the calibration absorber material type of aluminum. Upward concavity indicates that the measured sample absorber material type has a lower atomic number than the calibration absorber material type, while downward concavity indicates that the measured sample absorber material type has a higher atomic number than the calibration absorber material type.

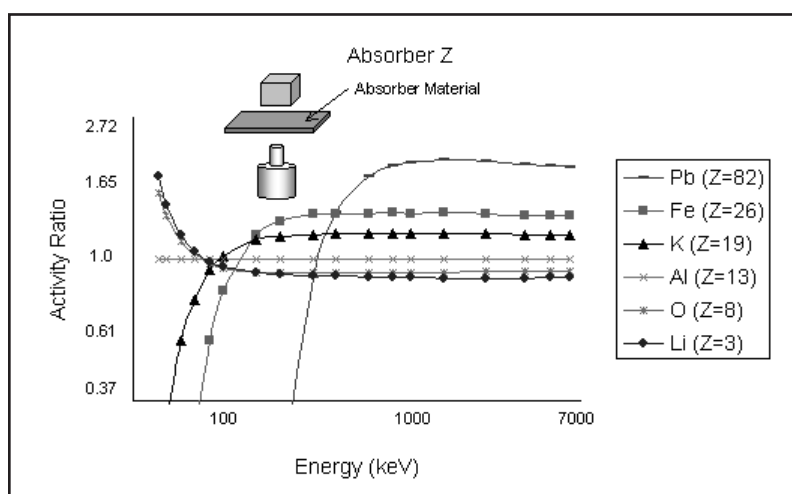


Figure 230 Simulating Discrepancies in Absorber Material Type

Figure 231 shows how the activity ratio changes when the sample source-detector distance is different from the calibration source-detector distance of 10 cm. A LACE analysis is not very sensitive to this discrepancy. In general, changes in geometry affect all energies equally.

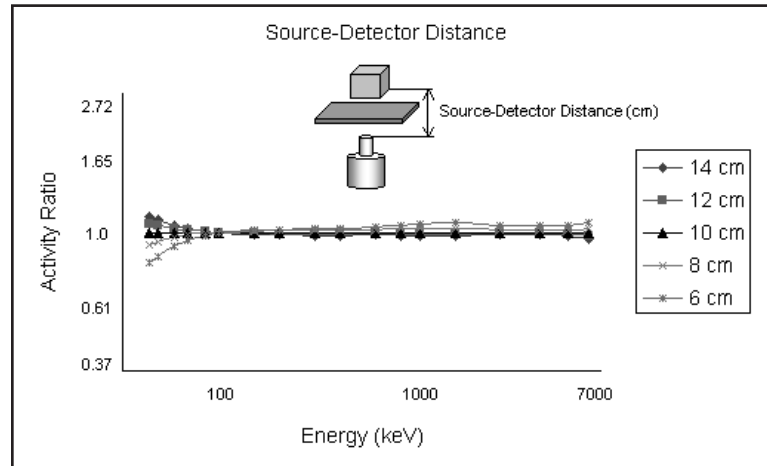


Figure 231 Simulating Discrepancies in Source-Detector Distance

In general, a negative slope indicates that the material attenuation accounted for in the efficiency calibration is greater than that of the measured sample while a positive slope indicates that the material attenuation accounted for in the efficiency calibration is less than that of the measured sample. Excessive concavity can indicate a significant difference in the atomic number between the efficiency calibration and the measured sample. Upward concavity indicates that the efficiency calibration has a higher atomic number than the measured sample while a downward concavity indicates that the efficiency calibration has a lower atomic number than the measured sample.

### LACE Example

To illustrate how LACE could be used with an actual measurement, a 20 mL scintillation vial containing an epoxy matrix with a  $^{152}\text{Eu}$  source and an intervening thin (1.63 mm) copper absorber was measured. Using these nominal parameters, a LabSOCS efficiency calibration was calculated and the LACE results are shown in Figure 232. The relatively flat curve (slope:  $0.005 \pm 0.030$ ) indicates a reasonably good match between the efficiency calibration and sample. However, the effects of a mismatch between the calibration and sample for certain parameters can be seen in subsequent figures.

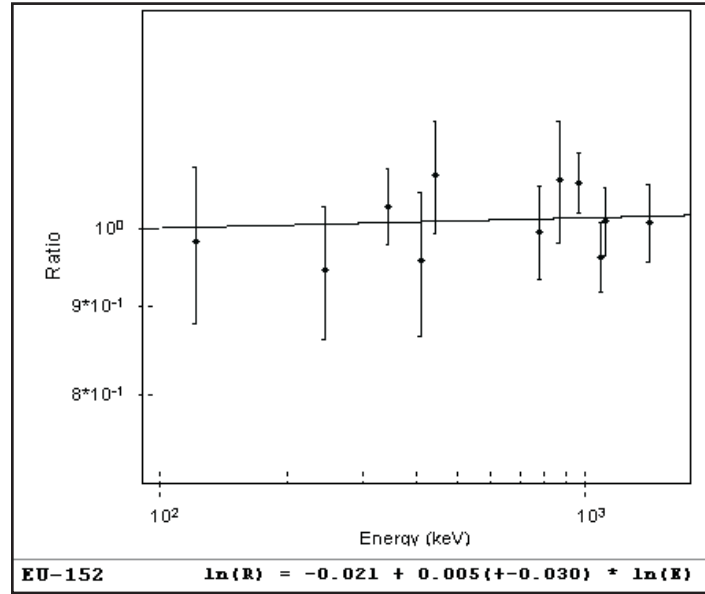


Figure 232 LACE Results with Nominal Parameters

Figures 233 and 234 show the effect of halving (to 0.815 mm) and doubling (to 3.26 mm) the nominal absorber thickness of 1.63 mm in the calibration. Positive slope indicates the absorber thickness is lower in the calibration than in the sample while negative slope indicates the absorber thickness is higher in the calibration than in the sample.

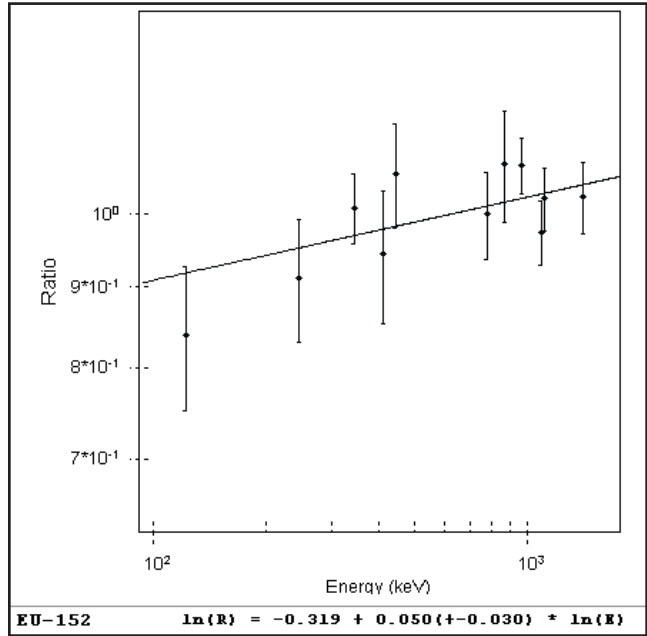


Figure 233 LACE Result with Absorber Thickness Halved

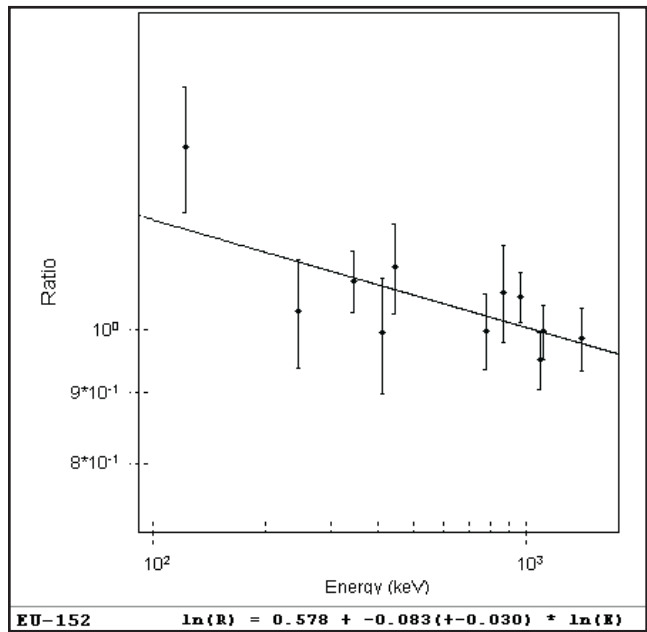


Figure 234 LACE Result with Absorber Thickness Doubled

Figures 235 and 236 show the effect of halving (to 0.575 g/cm<sup>3</sup>) and doubling (to 2.30 g/cm<sup>3</sup>) the nominal matrix density of 1.15 g/cm<sup>3</sup> in the calibration. Positive slope indicates the matrix density is lower in the calibration than in the sample while negative slope indicates the matrix density is higher in the calibration than in the sample.

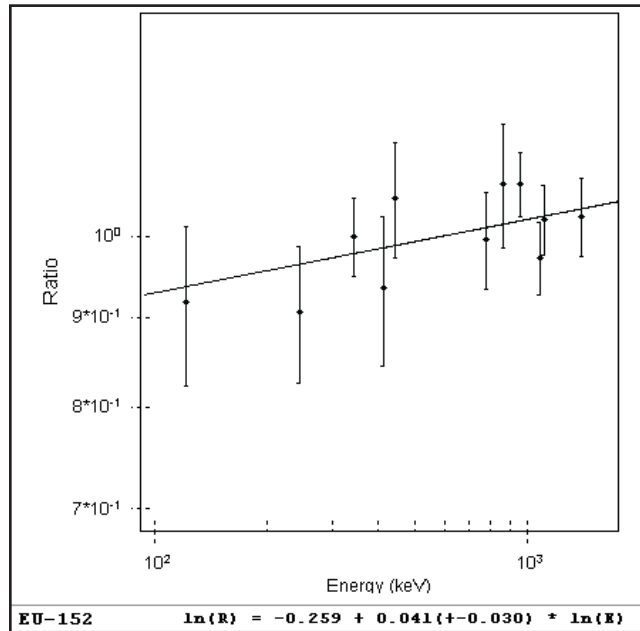


Figure 235 LACE Result with Matrix Density Halved

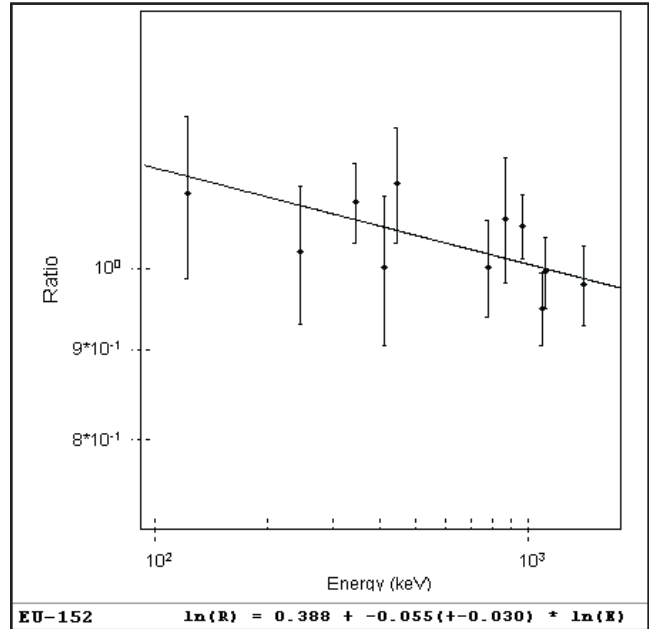


Figure 236 LACE Result with Matrix Density Doubled

Finally, Figures 237 and 238 show the effect of using much lower (aluminum) and higher (cadmium) atomic mass metals (but at the same nominal density) for the copper absorber in the calibration. Downward concavity indicates the absorber atomic number is lower in the calibration than in the sample while upward concavity indicates the absorber atomic number is higher in the calibration than in the sample.



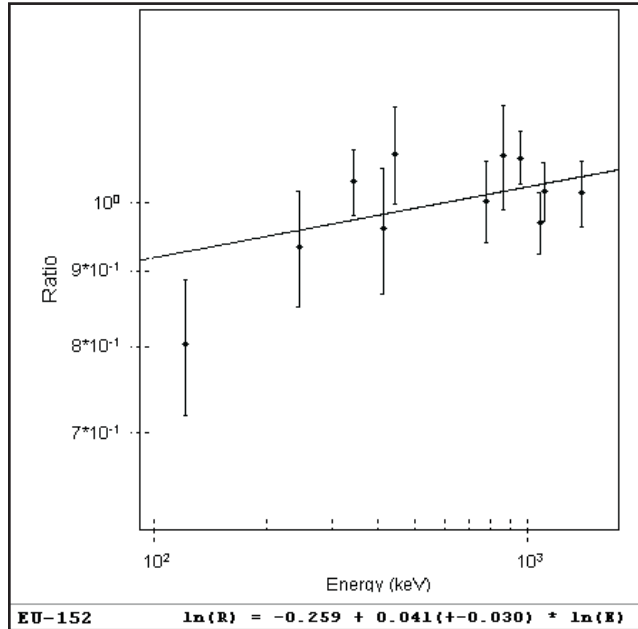


Figure 237 LACE Result with Absorber Changed to Aluminum

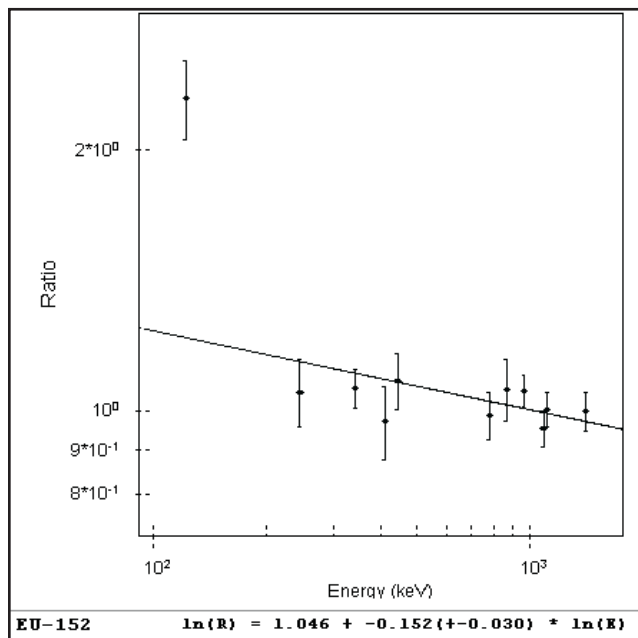


Figure 238 LACE Result with Absorber Changed to Cadmium

To enhance the range and power of a LACE analysis, it is possible to combine different nuclides if they are related and the relative abundances are known. For instance, radium, thorium, and  $^{238}\text{U}$  can be combined with respective progeny nuclides when they are in secular equilibrium. In addition, nuclides that are always found in the same ratio can be combined, such as  $^{235}\text{U}$  and  $^{238}\text{U}$  in natural uranium. Implementing these composite nuclides for LACE analysis requires that such composite nuclides be defined (via the Nuclide Library Editor) in the library used for the NID processing, with appropriately modified gamma abundances.

If a problem with a gamma analysis is found using LACE analysis, fix the problem and then reanalyze. Such fixes may include using Interactive Peak Fit to optimize peak areas, correcting inaccurate energy and/or FWHM calibrations, and examining library files referenced for proper gamma abundances. Finally, change the measured sample and/or the efficiency calibration so that they are more closely matched, as directed by the LACE analysis. While possible with standard (source-based) efficiency calibrations, changing the efficiency calibration is most easily implemented using a sourceless (ISOCS/LabSOCS) calibration. LACE and ISOCS/LabSOCS synergistically combine to become a powerful tool in determining the physical characteristics of a sample with uncertain parameters.

## Launching the Viewer

Genie 2000 includes an LACE viewer that allows you to view LACE analysis results for datasource files that already have been processed by the LACE algorithm.

To launch the viewer double click on the LACE application in the directory EXEFILES or type `LACE` at the command line.

When you press `ENTER`, you'll see a window similar to the one in Figure 239.

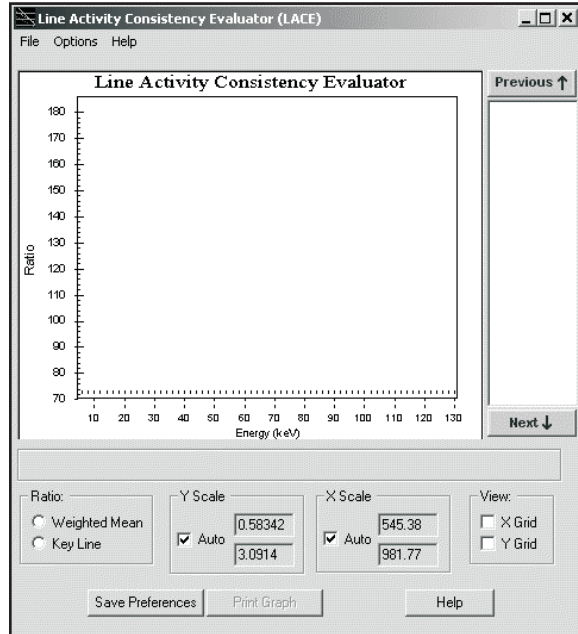


Figure 239 The LACE Viewer

The LACE viewer can only be used to view files that already have been processed by the LACE algorithm in Genie.. Once this is done you can also start the viewer with a file loaded by typing, for instance:

```
lace c:\genie2k\camfiles\nbsstd.cnf
```

Or you can launch the editor, then use the **File | Open** command to open an existing LACE processed file for viewing. Figure 240 shows the viewer with a file loaded.

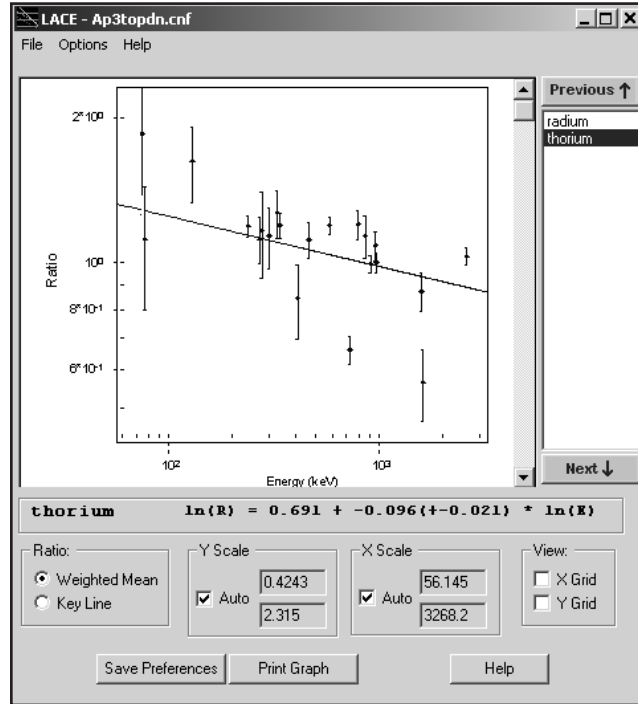


Figure 240 A File Opened for Viewing

The graph shows the data points and curve for a single calculated equation. The nuclide list (to the right of the graph) lists all nuclides in the datasource. Clicking on a nuclide name will select the nuclide for display. Clicking on **Next** or **Previous** buttons will select the next or previous nuclide name in the list. The **Weighted Mean** or **Key Line** curve, whichever button is selected, will be displayed along with the data points defined by the Energy/Ratio pairs, where the Ratio is the Weighted Mean or Key Line ratio. The error bars are the calculated ratio uncertainties.

The equation defining the displayed curve is shown just below the graph. This equation corresponds to the selected Ratio type. The screen controls are defined below:

### Ratio

Select Weighted Mean or Key Line curve for display. The Weighted Mean button is disabled if NID w/Interf Correction was not run on this datasource.

### Y Scale

Includes edit boxes for specifying the Y-axis limits for viewing. Clicking **Auto** allows LACE to calculate limits based on the data points for the displayed nuclide.

### X Scale

Includes edit boxes for specifying the X-axis limits for viewing. Clicking **Auto** allows LACE to calculate limits based on the data points for the displayed nuclide.

### View

When checked LACE displays X and/or Y grid lines on the graph.

### Save Preferences

Saves the user options/preferences (Ratio, X Scale, Y Scale and View) to the registry, which are then reloaded when LACE is later run again. These settings will be stored in registry location:

“HKEY\_LOCAL\_MACHINE\SOFTWARE\Canberra Industries, Inc.\LACE\Preferences”.

### Print Graph

Prints a hard-copy of the graph.

When you change the graph’s Y scale limits so that one or more points fall outside those limits, those “outlying” points will be plotted along the edge of the graph in order to show their existence. The graph shown in Figure 241 shows an “outlying” point at the top edge.

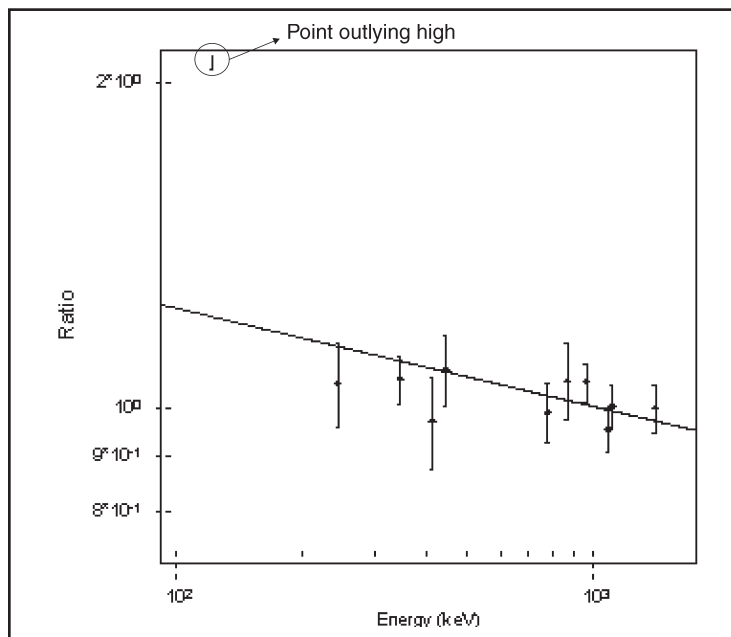


Figure 241 Changing the Graph's Y Scale Limits

As mentioned previously, the File and Option menus are displayed only when LACE is executed manually, i.e. not automatically by LACE itself. The menu options are described below.

### **File Menu**

Select **Open** to open a CAM file for viewing. **Close** will close the currently opened file. **Exit** will quit the LACE.

### **Options Menu**

#### **Auto Size**

Selecting this option will cause the graph to grow/shrink in proportion to the Viewer window. Controls maintain their positions relative to the Viewer window so that they are always visible. Disabling Auto Size will cause the graph and other controls to maintain their current size and position.

#### **Color**

The colors of the various graph elements; background, label, data points and curve can be changed.

## **LACE Report**

Below is a sample report generated by the LACE using `Lace.tpl`.

Note that all “identified” nuclides are listed in the report. Nuclides which are rejected because of single-line or no key line will appear anyway - the rejection criteria is evident from the report.

```
*****
*
**** LINE ACTIVITY CONSISTENCY EVALUATOR ****
*****
*
```

```
=====
Analysis using Weighted Mean Activities
=====
```

Filename: C:\GENIE2K\CAMFILES\AP3TOPDN.CNF

Equation used to calculate plot:  $\ln(\text{Ratio}) = A + B \cdot \ln(\text{Energy})$   
 where: Ratio = Activity / WM Activity

Notes:

\* All uncertainties quoted at 1.00 sigma

Nuclide Name	Energy (keV)	Activity (uCi/Unit)	Activity %Uncert*	WM Activ [%Uncert]	Ratio[%Uncert]	A	B [uncert]
ANNIH	511.0	5.42E-007	4.895				
radium	74.8	1.13E-005	31.849	1.99E-006	5.702[31.915]	1.72	-0.254
	77.1	7.44E-006	28.537	[ 2.049]	3.737[28.610]		[ 0.030]
	186.0	4.89E-006	14.700		2.460[14.842]		
	242.0	4.01E-006	7.732		2.014[ 7.999]		
	295.2	2.04E-006	6.310		1.028[ 6.635]		
	352.0	1.97E-006	4.947		0.988[ 5.355]		
	609.3	2.18E-006	4.070		1.094[ 4.557]		
	768.4	1.90E-006	12.520		0.956[12.687]		
	1120.3	1.85E-006	5.874		0.932[ 6.221]		
	1238.1	2.22E-006	9.690		1.116[ 9.904]		
	1377.7	1.33E-006	16.633		0.666[16.759]		
1764.5	1.91E-006	5.331		0.958[ 5.712]			
2204.2	1.29E-006	13.929		0.648[14.079]			

# Line Activity Consistency Evaluator

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LACE - Weighted Mean Results

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Nuclide Name	Energy (keV)	Activity (uCi/Unit)	Activity %Uncert*	WM Activ [%Uncert]	Ratio[%Uncert]	A	B [uncert]
thorium	74.9	7.46E-006	32.015	4.03E-006	1.852[32.044]	0.69	-0.096 [ 0.021]
	77.1	4.51E-006	28.593	[ 1.351]	1.120[28.625]		
	129.1	6.54E-006	17.861		1.624[17.912]		
	238.6	4.80E-006	5.054		1.191[ 5.232]		
	270.2	4.51E-006	10.992		1.119[11.075]		
	277.4	4.70E-006	20.131		1.166[20.176]		
	300.1	4.58E-006	14.530		1.136[14.593]		
	328.0	5.11E-006	11.137		1.269[11.219]		
	338.3	4.82E-006	5.859		1.196[ 6.013]		
	409.5	3.40E-006	17.548		0.844[17.600]		
	463.0	4.50E-006	8.364		1.115[ 8.472]		
	583.2	4.81E-006	3.848		1.194[ 4.078]		
	727.2	2.66E-006	6.340		0.660[ 6.482]		
	794.9	4.85E-006	6.788		1.202[ 6.921]		
	860.5	4.57E-006	10.129		1.135[10.218]		
	911.1	4.01E-006	4.013		0.994[ 4.235]		
	964.8	4.38E-006	6.815		1.086[ 6.948]		
	969.0	4.04E-006	4.388		1.002[ 4.592]		
	1587.9	3.51E-006	9.023		0.871[ 9.123]		
	1620.6	2.28E-006	16.919		0.566[16.972]		
2614.5	4.15E-006	3.895		1.030[ 4.123]			
K-40	1460.8	1.76E-005	2.812				



\*\*\*\*\*  
 \*  
 \*\*\*\* LINE ACTIVITY CONSISTENCY EVALUATOR \*\*\*\*  
 \*\*\*\*\*  
 \*

=====  
 Analysis using Key Line Activities  
 =====

Filename: C:\GENIE2K\CAMFILES\AP3TOPDN.CNF

Equation used to calculate plot:  $\ln(\text{Ratio}) = A + B \cdot \ln(\text{Energy})$

where: Ratio = Activity/KL Activity

Notes:

^ Denotes Key Line energy

\* All uncertainties quoted at 1.00 sigma

Nuclide	Energy (keV)	Activity (uCi/Unit)	Activity %Uncert*	Ratio[%Uncert]	A	B [uncert]
ANNIH	511.0	^ 5.42E-007	4.895			
radium	74.8	1.13E-005	31.849	5.213[32.108]	1.81	-0.281 [ 0.033]
	77.1	7.44E-006	28.537	3.417[28.826]		
	186.0	4.89E-006	14.700	2.249[15.253]		
	242.0	4.01E-006	7.732	1.841[ 8.738]		
	295.2	2.04E-006	6.310	0.940[ 7.509]		
	352.0	1.97E-006	4.947	0.904[ 6.406]		
	609.3	^ 2.18E-006	4.070	1.000[ 5.756]		
	768.4	1.90E-006	12.520	0.874[13.165]		
	1120.3	1.85E-006	5.874	0.852[ 7.146]		
	1238.1	2.22E-006	9.690	1.020[10.510]		
1377.7	1.33E-006	16.633	0.609[17.124]			
1764.5	1.91E-006	5.331	0.876[ 6.708]			
2204.2	1.29E-006	13.929	0.592[14.511]			

# Line Activity Consistency Evaluator

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LACE - Key Line Results

Page 2

Nuclide	Energy (keV)	Activity (uCi/Unit)	Activity %Uncert*	Ratio[%Uncert]	A	B [uncert]
Thorium	74.9	7.46E-006	32.015	1.864[32.266]	0.77	-0.108 [ 0.026]
	77.1	4.51E-006	28.593	1.127[28.873]		
	129.1	6.54E-006	17.861	1.634[18.306]		
	238.6	4.80E-006	5.054	1.198[ 6.454]		
	270.2	4.51E-006	10.992	1.126[11.702]		
	277.4	4.70E-006	20.131	1.174[20.527]		
	300.1	4.58E-006	14.530	1.143[15.074]		
	328.0	5.11E-006	11.137	1.277[11.838]		
	338.3	4.82E-006	5.859	1.204[ 7.102]		
	409.5	3.40E-006	17.548	0.850[18.001]		
	463.0	4.50E-006	8.364	1.122[ 9.277]		
	583.2	4.81E-006	3.848	1.202[ 5.560]		
	727.2	2.66E-006	6.340	0.664[ 7.504]		
	794.9	4.85E-006	6.788	1.210[ 7.886]		
	860.5	4.57E-006	10.129	1.142[10.895]		
	911.1	^4.01E-006	4.013	1.000[ 5.676]		
	964.8	4.38E-006	6.815	1.093[ 7.909]		
	969.0	4.04E-006	4.388	1.008[ 5.947]		
	1587.9	3.51E-006	9.023	0.877[ 9.875]		
	1620.6	2.28E-006	16.919	0.569[17.388]		
2614.5	4.15E-006	3.895	1.037[ 5.593]			
K-40	1460.8	^1.76E-005	2.812			

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## Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

### LIMITATIONS

EXCEPT AS SET FORTH HEREIN, NO OTHER WARRANTIES OR REMEDIES, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESSED, IMPLIED (INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) OR OTHERWISE, SHALL APPLY. IN NO EVENT SHALL CANBERRA HAVE ANY LIABILITY FOR ANY SPECIAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, WHETHER AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE. REPAIR OR REPLACEMENT OF THE SOFTWARE OR EQUIPMENT DURING THE APPLICABLE WARRANTY PERIOD AT CANBERRA'S COST, OR, IN THE CASE OF DEFECTIVE SERVICES, REPERFORMANCE AT CANBERRA'S COST, IS YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY.

### EXCLUSIONS

Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

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