ORTEC®

ORTEC MCB *CONNECTIONS-32*
Hardware Property Dialogs Manual

Software Version 6.04

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Manual Revision C

Advanced Measurement Technology, Inc.

a/k/a/ ORTEC®, a subsidiary of AMETEK®, Inc.

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NOTE!

We assume that you are thoroughly familiar with 32-bit Microsoft® Windows® usage and terminology. If you are not fully acquainted with the Windows environment, including the use of the mouse, ***we strongly urge you to read the Microsoft documentation supplied with your Windows software and familiarize yourself with a few simple applications before proceeding.***

The convention used in this manual to represent actual keys pressed is to enclose the key label within angle brackets; for example, **<F1>**. For key combinations, the key labels are joined by a + within the angle brackets; for example, **<Alt + 2>**.

1. INTRODUCTION

This reference manual contains the information you will need to set up your ORTEC multichannel buffers (MCBs) for data acquisition in ***CONNECTIONS-32*** programs such as MAESTRO®-32, GammaVision®-32, Renaissance®-32, ScintiVision™-32, ISOTOPIC-32, and AlphaVision®-32.[1] Use this manual in conjunction with the user manuals for your particular ***CONNECTIONS*** application and hardware.

The individual application software manuals contain the MCB Property dialogs for the one or two MCBs most commonly used with that application. However, all ***CONNECTIONS-32*** applications can use any of our more than 35 ***CONNECTIONS-32*** MCBs, therefore, this reference manual is intended to provide complete acquisition-setup information for all supported MCBs in production at the time this manual was published.

In addition to the MCB Properties setup information that comprises most of this manual, Chapter 2 contains general information on adding new ***CONNECTIONS-32*** software and hardware to your system, including driver updates that enable you to use our newest instruments. In addition, Chapter 2 tells how to select the proper network protocol for using ***CONNECTIONS*** systems over a network and how to build the master list of MCBs available to your PC, from which you can then select the specific MCBs to be used in your application.

1.1. Setting the Data Acquisition Parameters

The MCB properties are generally set in a dialog with multiple tabs, as shown in Fig. 1. The number of tabs and the contents of the tabs are controlled by the capabilities of both the MCB and the application program. The MCBs have a feature status which the *CONNECTIONS* software reads. Only those features supported by the hardware (such as high-voltage polarity) are shown. The application software can suppress or add tabs. Support for the MDA preset depends on the application. Chapter 3 shows the basic Properties dialogs; the common variations are described.

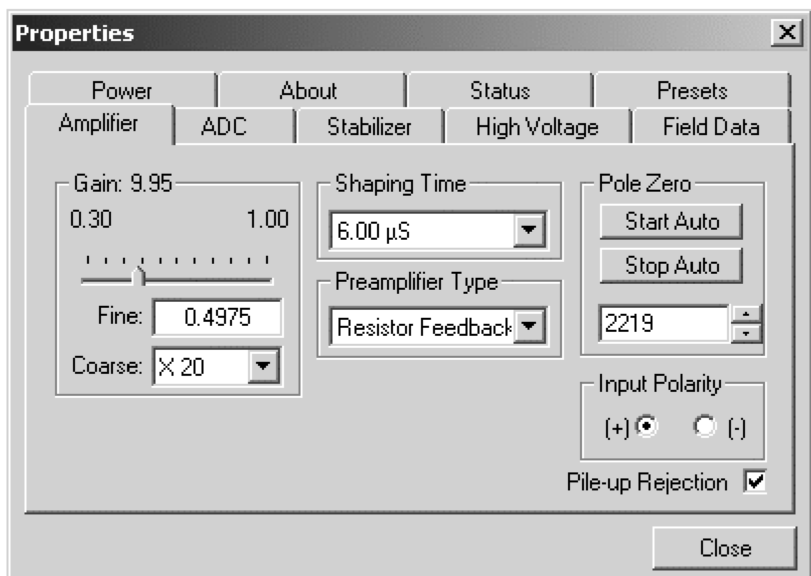


Fig. 1. Example Properties Dialog.

[1]For the purposes of this manual, when we refer to MAESTRO, we intend it as a generic reference to your particular ORTEC ***CONNECTIONS-32*** application software.

To use this manual for setting your MCB properties, simply find your instrument's setup section in the table of contents or index, click on **Acquire/MCB Properties...**, move from tab to tab and set your hardware parameters, then click on **Close** — it's that easy.

Note that as you enter characters in the data-entry fields, the characters will be underlined until you move to another field or until 5 seconds have lapsed since a character was last entered. During the time the entry is underlined, no other program or PC on the network can modify this value.

1.2. *CONNECTIONS* Programmer's Toolkit

Most users communicate with their MCBs through ORTEC software applications such as MAESTRO, so direct interaction with the ***CONNECTIONS*** software layer[2] is not necessary. However, we offer the ***CONNECTIONS*** Programmer's Toolkit with Microsoft ActiveX® Controls (A11-B32) for those who wish to write customized applications in Microsoft Visual Basic®, Microsoft Visual C++®, and National Instruments LabVIEW® that directly control ORTEC MCBs.

[2]Also called the Universal Multichannel Buffer Interface or UMCBI.

2. SOFTWARE INSTALLATION AND CONFIGURATION

This chapter discusses the general workflow for installing ***CONNECTIONS-32*** software and hardware, including:

- Choosing the correct protocol for communicating with ORTEC MCBs over a network.
- Adding new ***CONNECTIONS-32*** software, hardware, and driver updates to your system.
- Building the Master Instrument List from which you will select the MCBs to be used by your application(s).

Note that as of September 2004, ORTEC has discontinued support for Windows 95, the original release of Windows 98 (as distinguished from Windows 98 Second Edition, which is still supported), and NT. ORTEC gives no assurance that our new CONNECTIONS-32 software or hardware will install and/or function correctly on PCs using these operating systems.

Appendix A contains additional setup and configuration notes for special cases including some laptops and older PCs; and, for older systems, the network protocol setup for Windows NT (Windows 95 setup is the same as setup for Windows 98 SE; see Section 2.1.1).

2.1. Setting Up the Network Protocol

This section describes how to select the right Windows 98 SE, 2000, and XP protocols for ***CONNECTIONS-32*** operation on a network. ORTEC *CONNECTIONS* software will use all of the network "languages" — called *protocols* — supported by 32-bit Windows. If multiple protocols are installed on the various PCs in the network, only those PCs with compatible protocols will be able to communicate with one another. No special settings are required in that case. However, *CONNECTIONS* products with built-in Ethernet adapters, such as the DSPEC Plus™, DSPEC®, ORSIM™ II or III, OCTÊTE Plus™, 919E, 920E, 921E, MatchMaker™, and 92X-II, communicate directly with the PCs on the network. The PCs and these "direct-connect" units must "speak the same language" (i.e., use the same protocol) in order to understand each other. If you are connected to instruments via a network and one or more of the MCBs on the network has a built-in Ethernet adapter, the network default protocol must be set to the following protocols on all PCs that use *CONNECTIONS* hardware:

- **Windows 98 SE** IPX/SPX Compatible Transport with NetBIOS (page 4)
- **Windows 2000** NWLink IPX/SPX/NetBIOS Compatible Transport Protocol (page 7)
- **Windows XP** NWLink IPX/SPX/NetBIOS Compatible Transport Protocol (page 11)

In addition, in a network that has both 16-bit (e.g., Windows 3.x) and 32-bit Windows systems on it, the 32-bit systems must use the IPX/SPX protocol before they can communicate with any 16-bit system.

2.1.1. Windows 98 SE Network Setup

To use direct-connect MCBs, Windows 98 SE must use the **IPX/SPX Compatible Transport with NetBIOS** protocol. As noted above, systems without any direct-connect Ethernet devices can use any protocol.

To check to see if the IPX/SPX protocol is installed, add it, or set it as the default, click on **Start** from the Windows Taskbar. Next select **Settings**, then **Control Panel** as shown in Fig. 2.

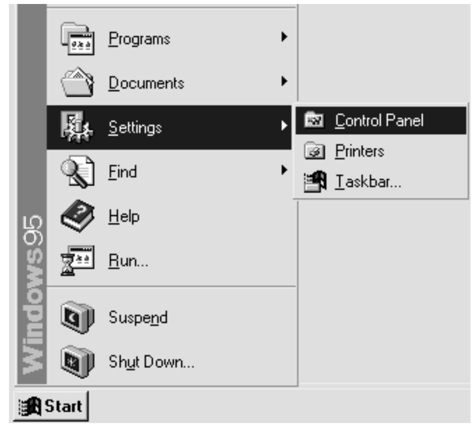
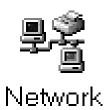


Fig. 2. Starting the Control Panel.



When the Control Panel opens, double-click on the **Network** icon to open the Network dialog (Fig. 3).

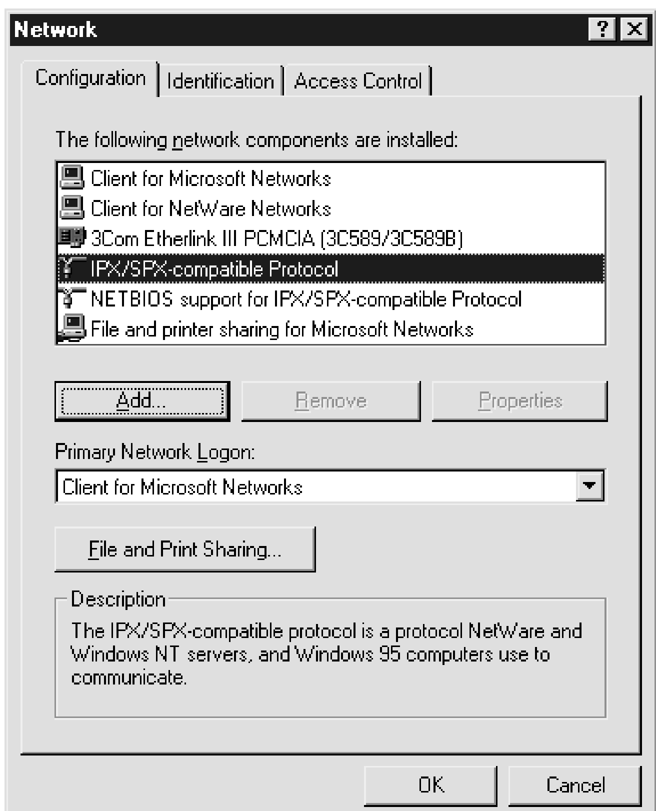


Fig. 3. The Network Dialog.

2.1.1.1. Adapter

Make sure the Ethernet adapter is on the list of installed components. If not, it must be added.

To add the Ethernet adapter to the list, click on the **Add...** button. This will open the Select Network Component Type dialog (Fig. 4). Select **Adapter** and click on **Add...**. Add the adapter according to the hardware instructions. When adapter setup is complete, click on **OK** to return to the Network dialog.

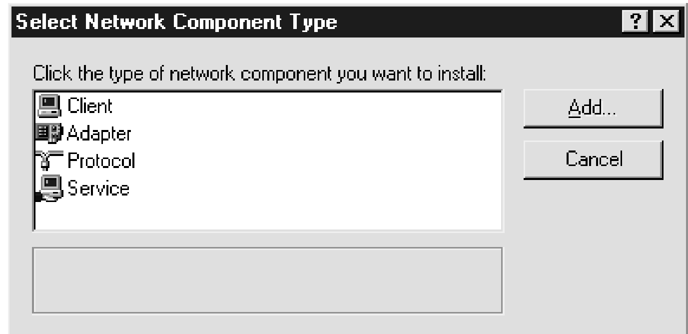


Fig. 4. Select Network Component.

2.1.1.2. Protocol

If **IPX/SPX-compatible Protocol** is not listed, it needs to be added. To do so, click on **Add...**. This will again open the Select Network Component Type dialog. Click on **Protocol** and click on **Add...**. The Select Network Protocol dialog (Fig. 5) will open.

Under **Manufacturers**, click on **Microsoft**. Under **Network Protocols**, click on **IPX/SPX-compatible Protocol**. Click **OK** to add the protocol to the list and return to the Network dialog.

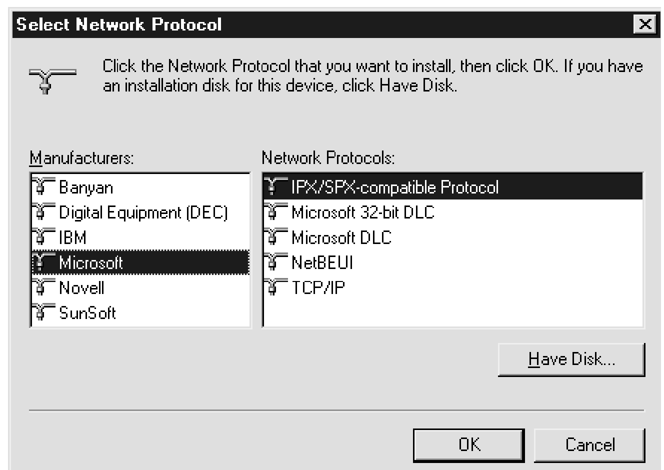


Fig. 5. Select IPX/SPX-Compatible Protocol.

On the Network dialog, click once on **IPX/SPX-compatible Protocol** to highlight it, then click on **Properties**. This will open the IPX/SPX-compatible Protocol Properties dialog shown in Fig. 6. Click on the **NetBIOS** tab, then check the option **I want to enable NetBIOS over IPX/SPX**.

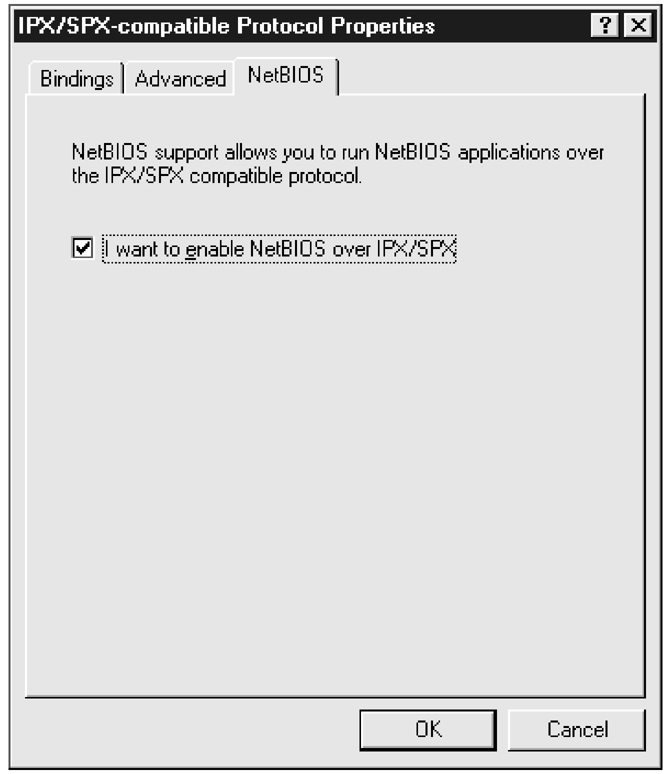


Fig. 6. Enable NetBIOS over IPX/SPX.

Next, click on the Advanced tab as shown in Fig. 7. In the **Property:** box, click once to select **Frame Type**. Open the **Value:** field pull-down list (double-click on the field or click once on the down arrow) and select **Ethernet 802.3**. Check the option **Set this protocol to be the default protocol**. Click on **OK** to return to the Network dialog (Fig. 3).

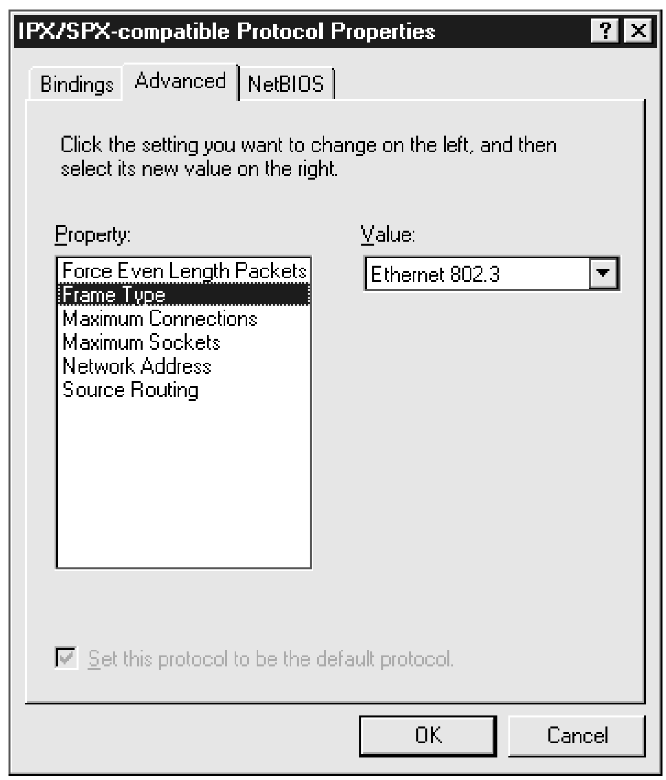


Fig. 7. Advanced Protocol Setup.

2.1.1.3. Network Client

If **Client for Microsoft Networks** is not on the list of currently installed network components, click on **Add...** to open the Select Network Component Type dialog. Select **Client** and click on **Add...** to open the Select Network Client dialog (Fig. 8).

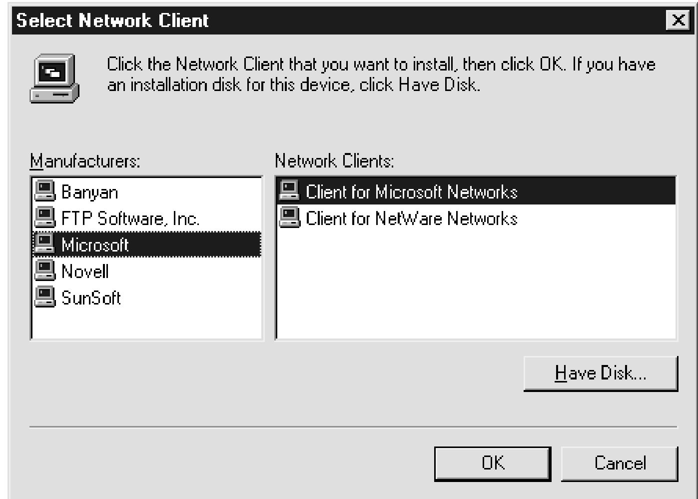


Fig. 8. Select Client for Microsoft Networks.

Click on **Microsoft** in the list of **Manufacturers**, and **Client for Microsoft Networks** under **Network Clients**. Next, click on **OK** to return to the Select Network Client dialog. Finally, click on **Add** to finish the operation and return to the Network dialog.

Click **OK** again to close the Network dialog and finish the operation. If changes were made, you must restart the PC so the changes will be applied to Windows. This is necessary before direct-connect MCBs can be used.

2.1.2. Windows 2000 Setup

To determine whether the NWLink IPX/SPX/NetBIOS Compatible Transport Protocol is installed, to add it, or to select it as the default, go to the Taskbar and click on **Start/Settings/Network and Dial-up Connection** as shown in Fig. 9. This will open the Network and Dial-up Connections dialog shown in Fig. 10.

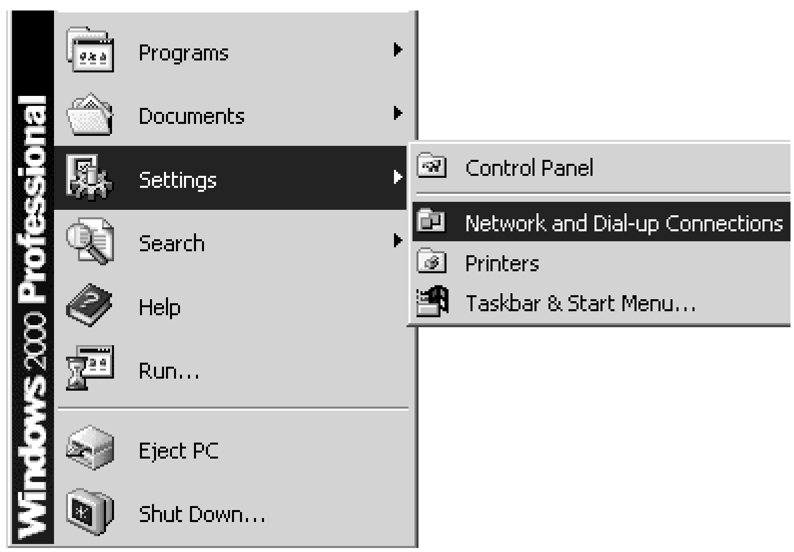


Fig. 9. Starting Network and Dial-up Connection..

This dialog displays the existing connections. If no network entry is shown, install the hardware and follow the instructions for new hardware, then return to this screen.

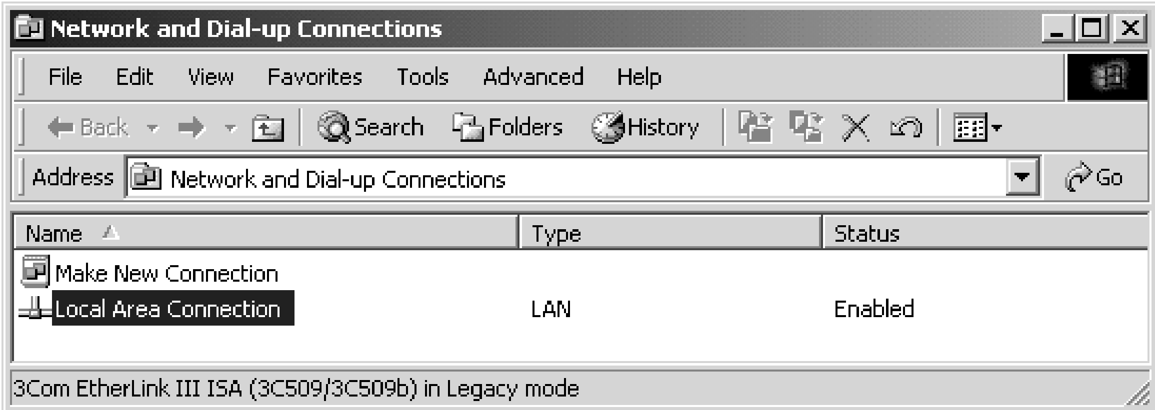


Fig. 10. Network and Dial-up Connections.

Double-click on the **Local Area Connection** entry to display the status dialog as shown in Fig.11.

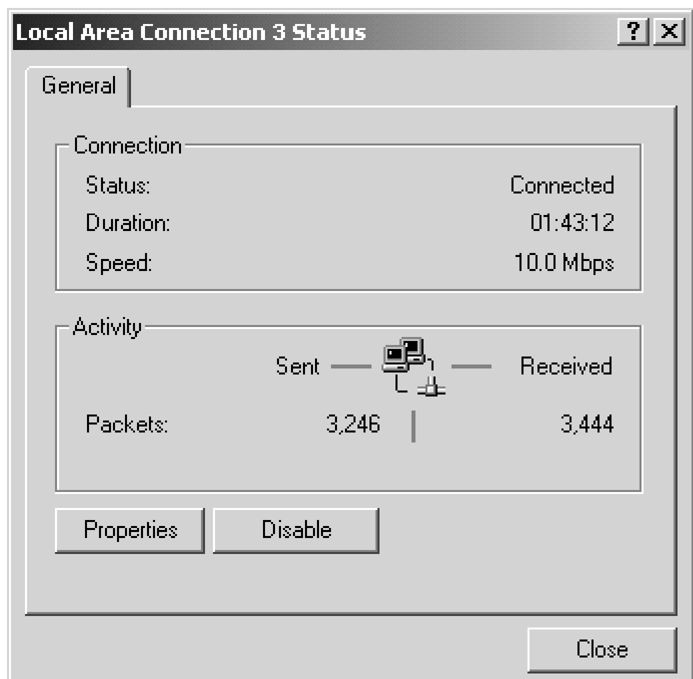


Fig. 11. LAN Connection.

Click on the **Properties** button to open the Local Area Connection Properties dialog shown in Fig. 12.

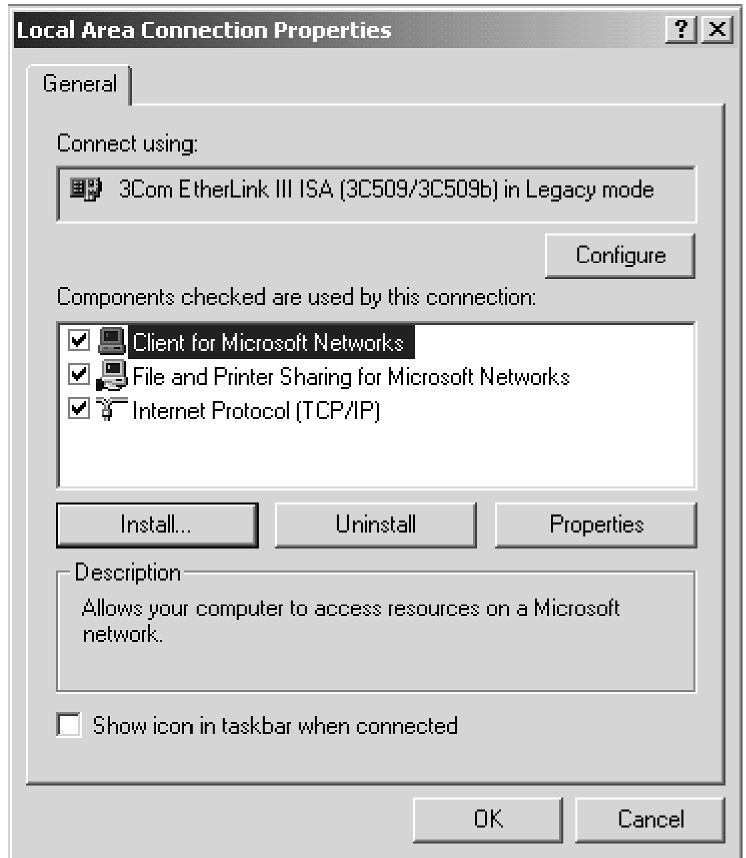


Fig. 12. LAN Properties.

To add the **NWLink IPX/SPX/NetBIOS Compatible Transport Protocol**, click on the **Install...** button. This will open the Select Network Component Type dialog (Fig. 13). Click on **Protocol** to display the Select Network Protocol dialog shown in Fig. 14.

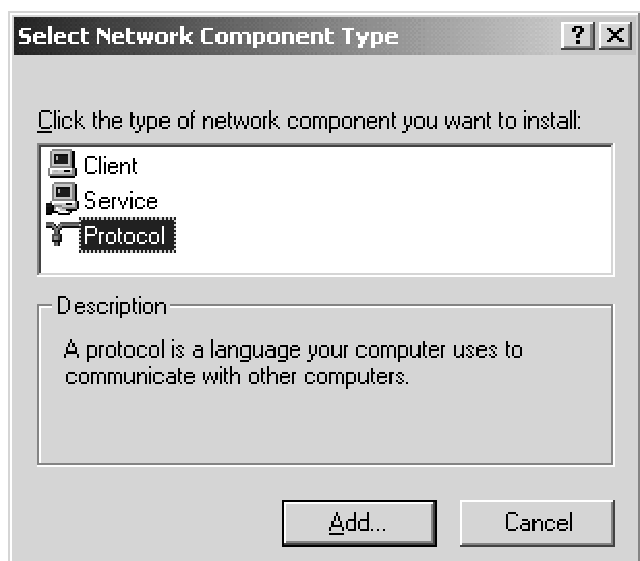


Fig. 13. Add a New Protocol.

Click on **NWLink IPX/SPX/ NetBIOS Compatible Transport Protocol**, then click on **OK** to return to the Local Area Connection Properties dialog. (Fig. 15).

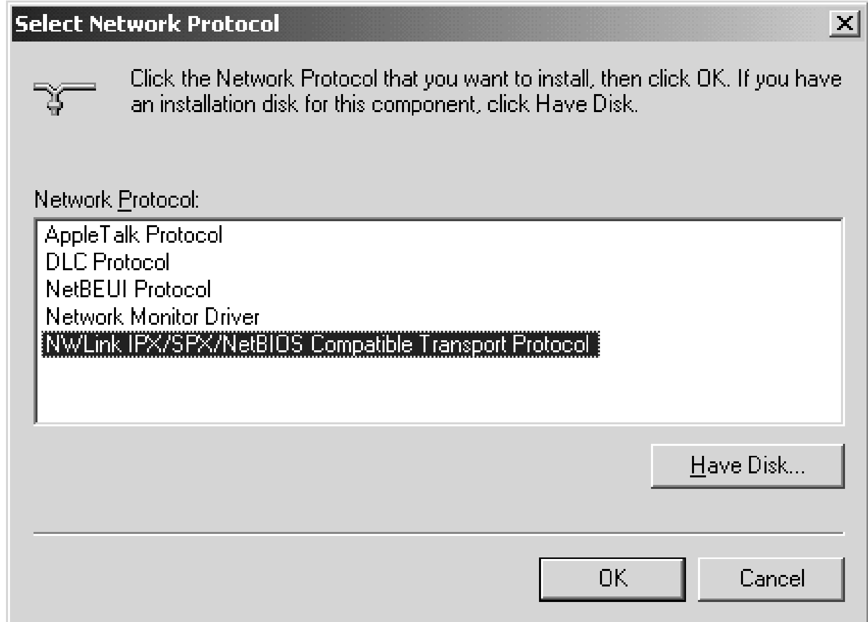


Fig. 14. Choose the Protocol.

Select **NWLINK IPX...** as shown, then click on **Properties** to open the dialog shown in Fig. 16.

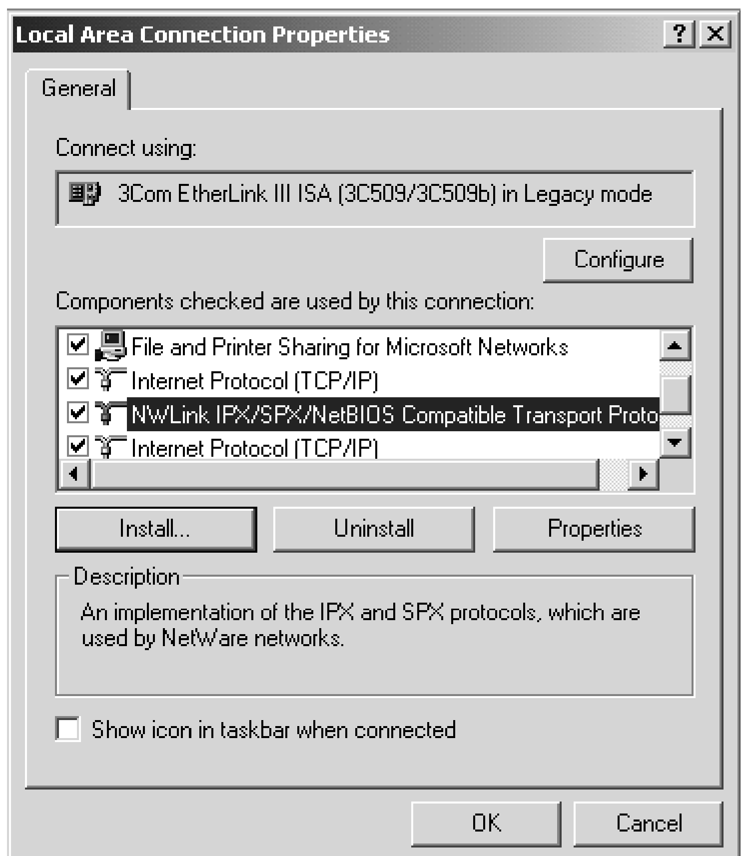


Fig. 15. LAN Properties.

Set the **Frame type** to 802.3 as shown, then click on **OK** and return to the Windows desktop.

NOTE Should you experience difficulties communicating with network MCBs, return to this dialog and make sure the **Frame type** setting was saved.

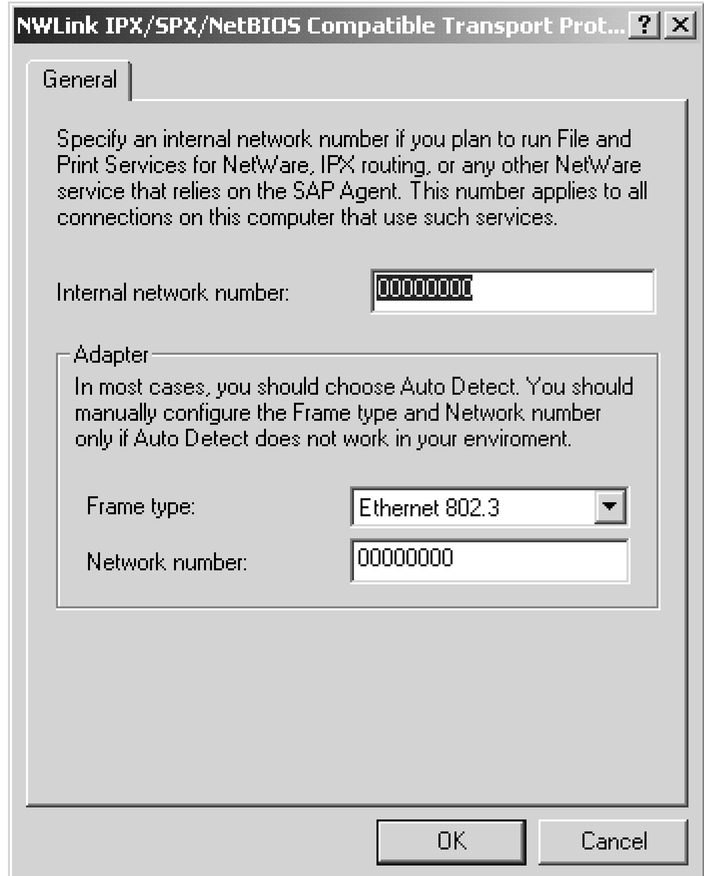


Fig. 16. Choose the Correct Frame Type.

2.1.3. Windows XP Setup

To determine whether the NWLink IPX/SPX/NetBIOS Compatible Transport Protocol is installed, to add it, or to select it as the default, go to the Taskbar and click on **Start**, then **Control Panel**. In the Control Panel under “Pick a Category,” choose **Network and Internet Connections** (Fig. 17).

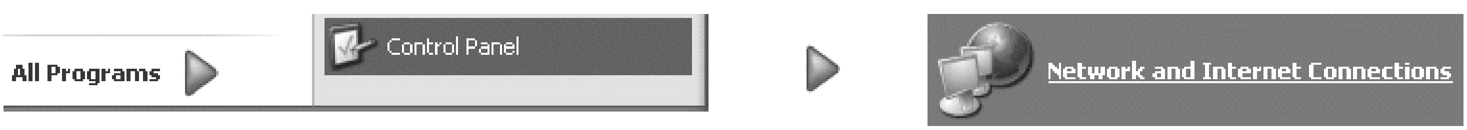


Fig. 17. Opening the Control Panel, then Network and Internet Connections.

Under “Pick a Control Panel Icon,” click on **Network Connections** (Fig. 18). This will display the **LAN or High-Speed Internet** connections, as shown in Fig. 19.

Fig. 18. Network Connections.

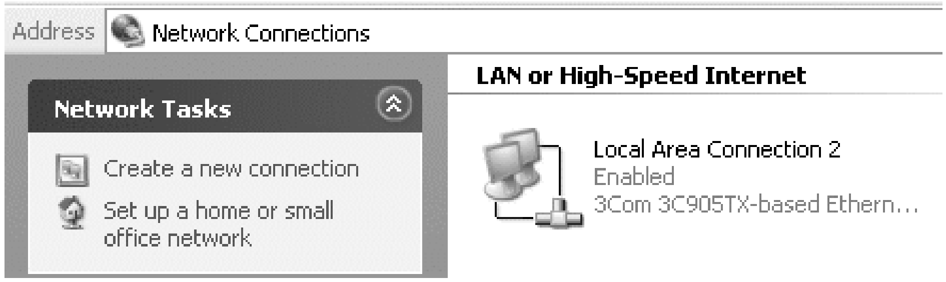


Fig. 19. Existing Network Connections.

If no network entry is shown, install the hardware and follow the instructions for new hardware, then return to this screen.

Double-click on the existing LAN entry to display the status dialog shown in Fig. 20. Click on **Properties** to open the LAN properties dialog (Fig. 21).

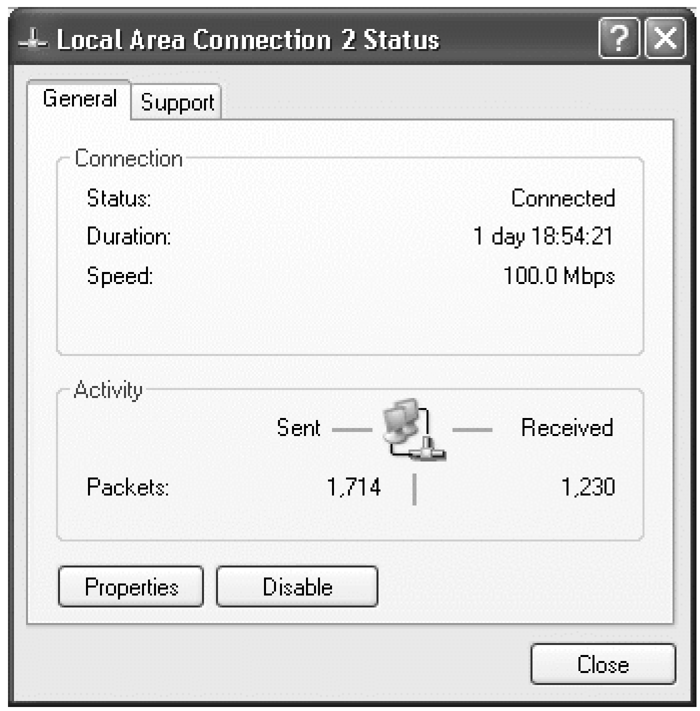


Fig. 20. LAN Connection Status.

To add the **NWLink IPX/SPX/NetBIOS Compatible Transport Protocol**, click on the **Install...** button. This will open the Select Network Component Type dialog (Fig. 22).

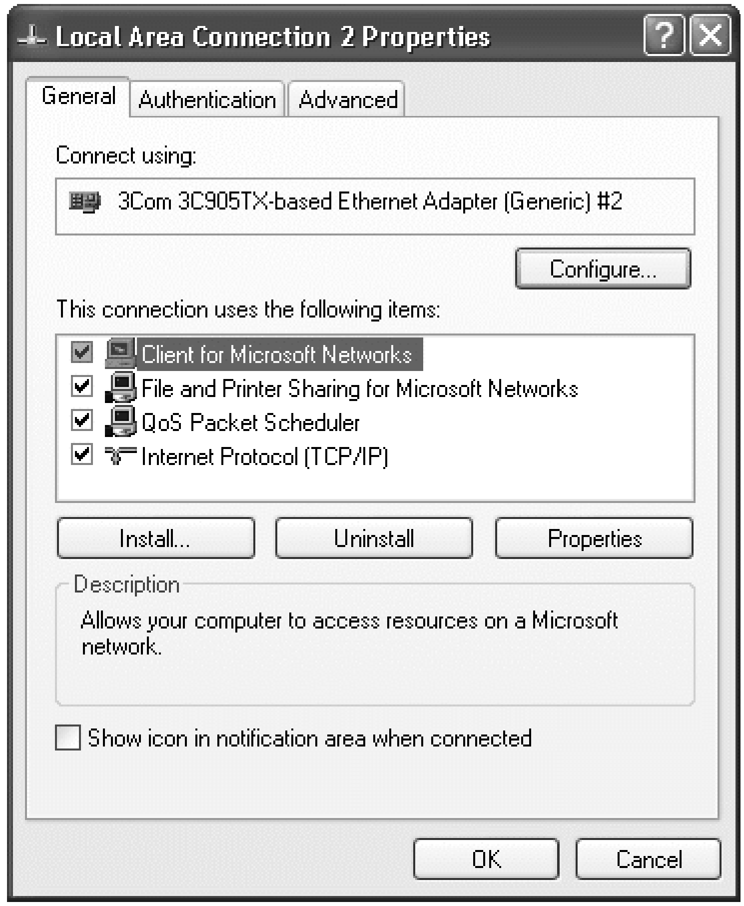


Fig. 21. LAN Properties.

Click on **Protocol** to display the Select Network Protocol dialog shown in Fig. 23.

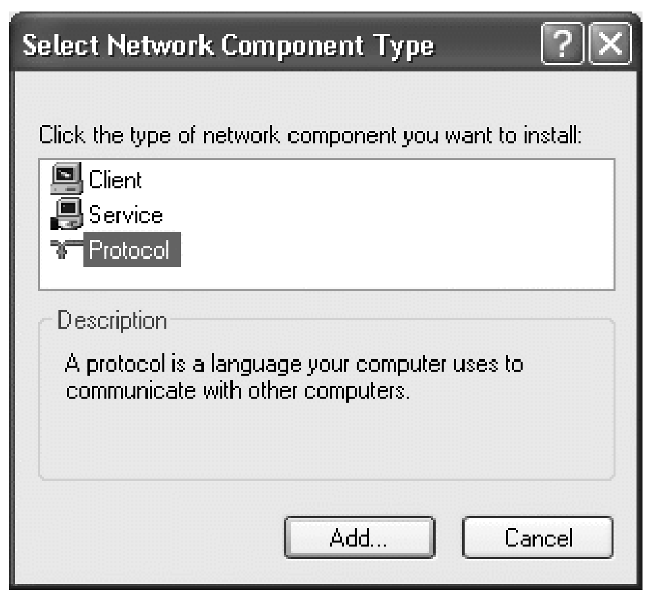


Fig. 22. Add a New Protocol.

Click on **NWLink IPX/SPX/ NetBIOS Compatible Transport Protocol**, then click on **OK** to return to the Local Area Connection Properties dialog (Fig. 24).

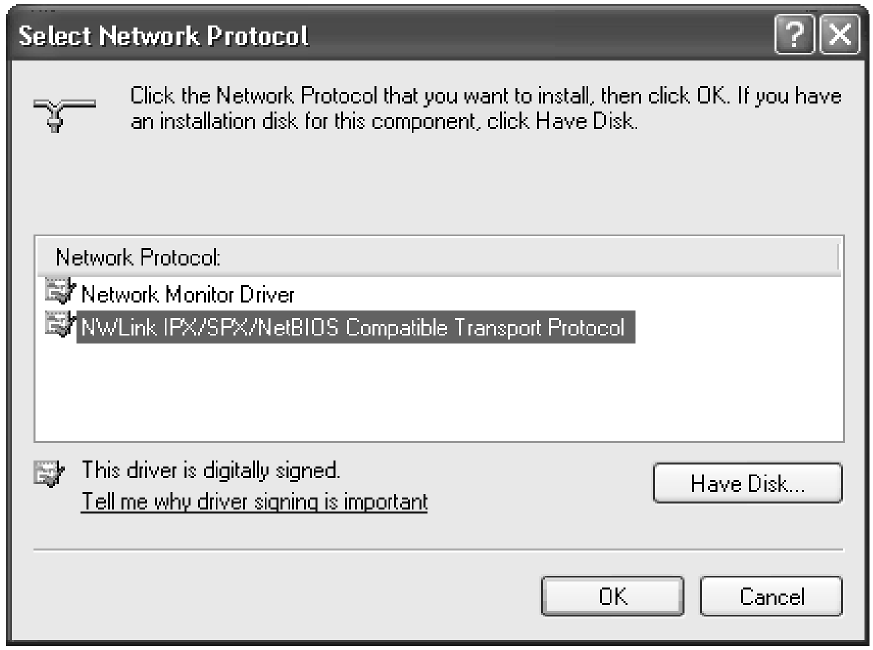


Fig. 23. Choose the Correct Protocol.

Select **NWLINK IPX...** as shown, then click on **Properties** to open the dialog shown in Fig. 25.

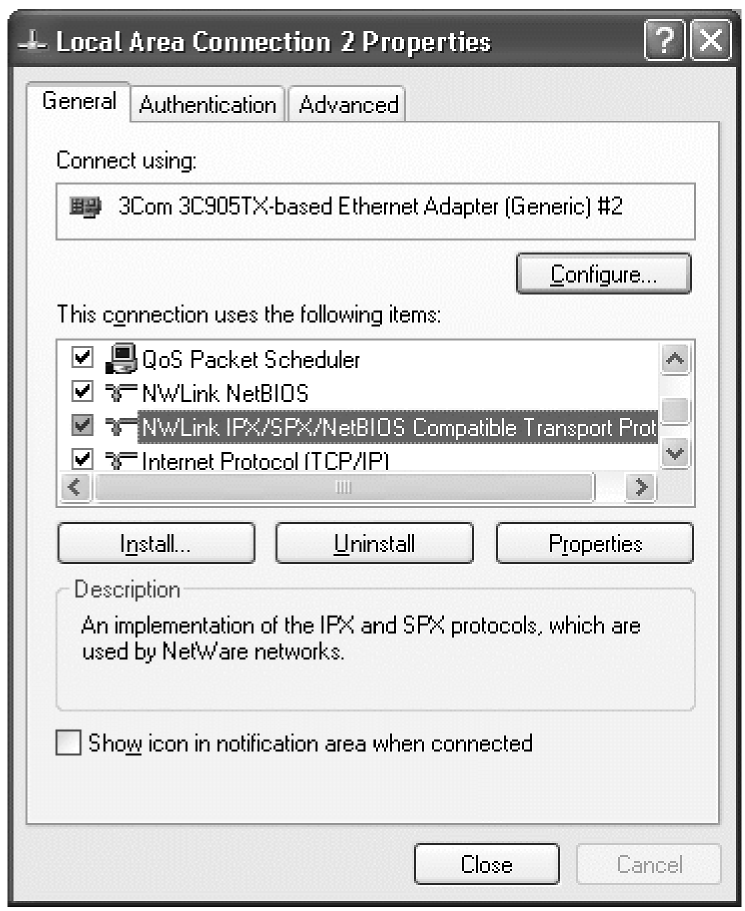


Fig. 24. LAN Properties.

Set the **Frame type** to 802.3 as shown, then click on **OK**, **Close**, and **Close** to return to the Windows desktop.

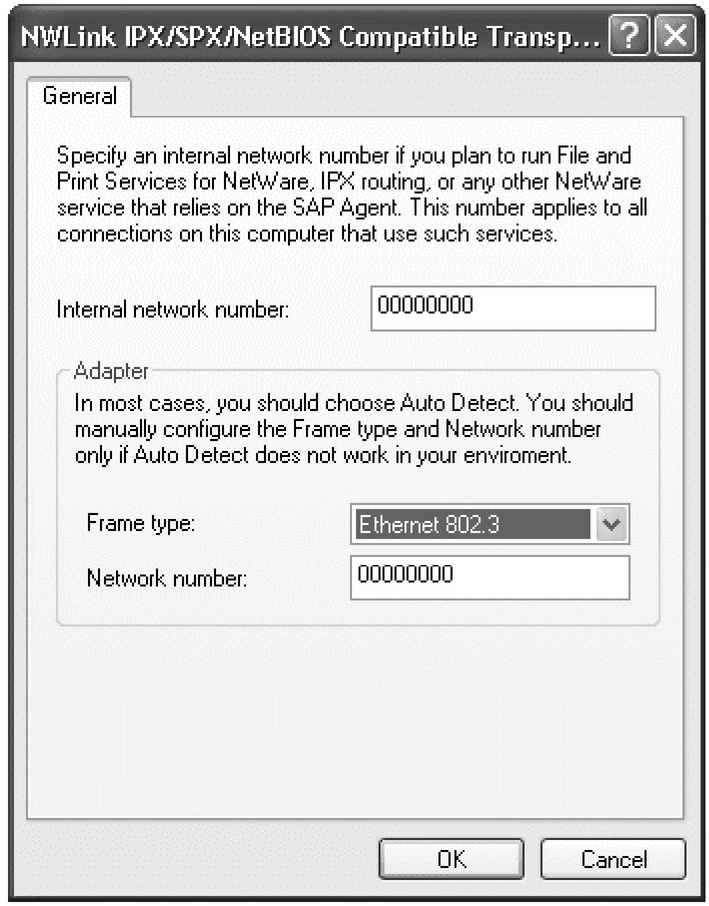


Fig. 25. Choose the Correct Frame Type.

2.2. Adding New *CONNECTIONS-32* Software, Hardware, and Driver Updates to Your System

The instructions in this section are generalized and will apply in most cases. However, to guarantee best results, use the installation instructions provided with your software or hardware product.

NOTE For systems using Windows 2000 or XP, ORTEC ***CONNECTIONS-32*** software products are designed to operate correctly only for users with full Administrator privileges. Limiting user privileges could cause unexpected results.

2.2.1. Installing a New Software Application

1. Insert the application CD. If it does not autorun, go to the Windows Taskbar and click on **Start**, then **Run...**. In the Run dialog, enter **D:\disk1\setup.exe** or the path provided in the software user's manual (use your CD-ROM drive designator), then click on **OK**. This will start the installation wizard. Click on **Next** and follow the wizard prompts.

2. If your new software is accompanied by a ***CONNECTIONS-32*** Driver Update Kit (Part No. 797230), skip to Step 5 for now. You will be directed later to return to this section to select your instrument drivers.

   If your new software application *is not accompanied by a Driver Update Kit*, the application is already using the most current ***CONNECTIONS-32*** driver. In this case, you will proceed with instrument setup now; go to Step 3.

3. On the Instrument Setup page, mark the checkbox(es) that corresponds to the instrument(s) physically attached to your PC; an example Instrument Setup dialog is shown in Fig. 26. To see more information on each instrument family, click on the family name and read the corresponding **Item Description** on the right side of the dialog.

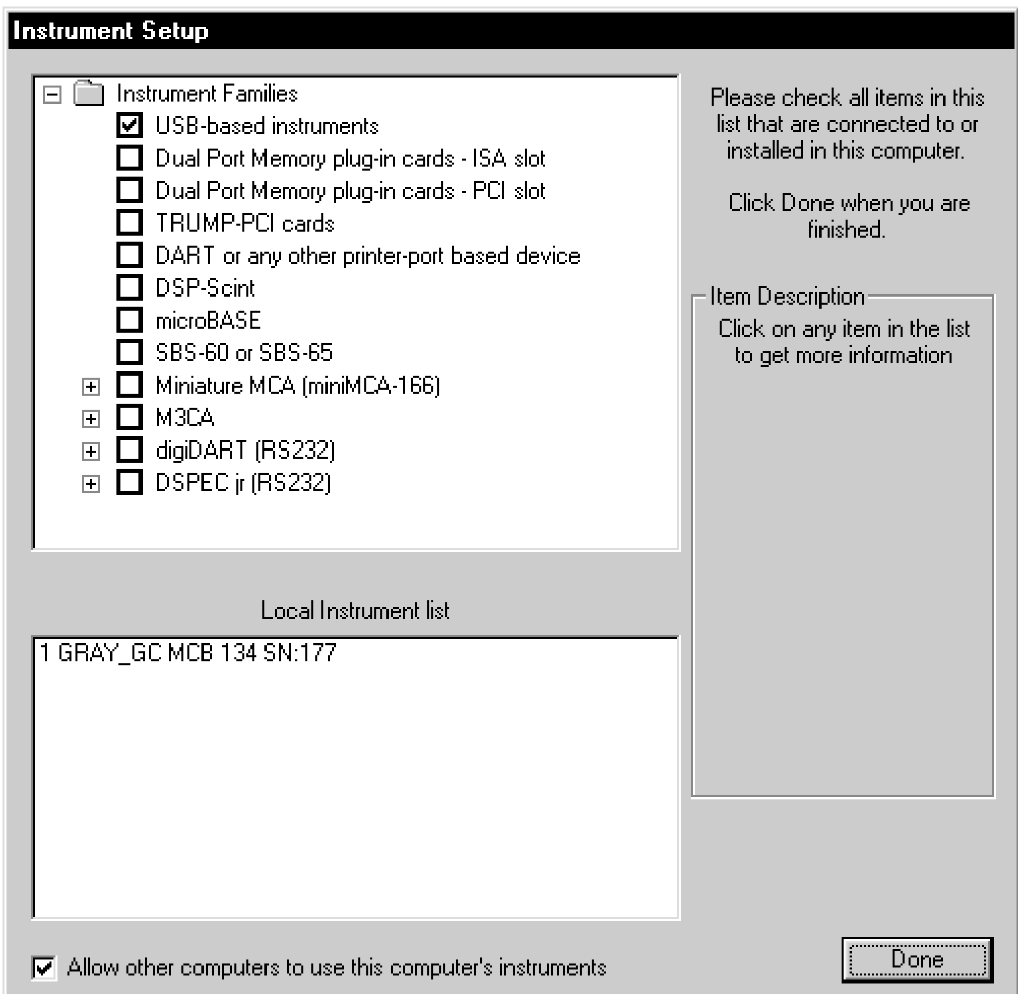


Fig. 26. Choose the Interface for Your Instruments.

If you already have an ORTEC ***CONNECTIONS-32*** application installed on this PC, you probably already have ORTEC ***CONNECTIONS-32*** instruments attached to it. If so, they will be included on the **Local Instrument List** at the bottom of the dialog, along with any new instruments. Existing instruments (those previously configured before this installation) do not have to be powered on during this part of the installation procedure.

4. If you want other computers in a network to be able to use your MCBs, leave the **Allow other computers to use this computer's instruments** marked so the MCB Server program will be installed. Most users will leave this box marked for maximum flexibility.

NOTE If your PC uses Windows XP and you wish to use or share ORTEC MCBs across a network, ***be sure to read Section 2.2.3***.

5. Click on **Done**.

If your PC is operating under Windows 2000 or XP, the installation wizard will resume copying files.

If your PC uses Windows 98 SE, there are two additional dialogs that might be displayed. The first, shown in Fig. 27, might ask you to insert the "ORTEC ***CONNECTIONS-32*** Driver Update CD". *Ignore this message* and click on **OK**.

Fig. 27. Window Menu.

The second additional dialog could request a specific file (see the example in Fig. 28). Browse to the **`c:\Program Files\ Common Files\ORTEC Shared\UMCBI`** folder (*not to the update CD*), then click on **OK**. The installation wizard will resume copying files.

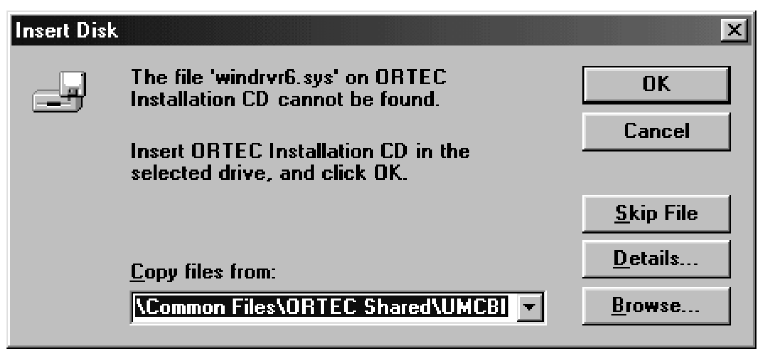


Fig. 28. Window Menu.

6. At the end of the wizard, restart the PC to complete software installation. Upon restart, remove the update CD from the drive.

7. After all processing for new plug-and-play devices has finished, you will be ready to configure the MCBs in your system. Connect and power on all local and network ORTEC instruments that you wish to use, as well as their associated PCs. Otherwise, the software will not detect them during installation. Any instruments not detected can be configured at a later time.

8. If any of the components on the network is a DSPEC Plus™, ORSIM™ II or III, MatchMaker, DSPEC®, 92X-II, 919E, 920E, 921E, or other module that uses an Ethernet connection, the network default protocol must be set to the **IPX/SPX Compatible Transport with NetBIOS** selection on all PCs that use *CONNECTIONS* hardware. For instructions on making this the default, see the network protocol setup discussion in Section 2.1.

9. To start the MCB Configuration program on your PC, click on **Start**, **Programs**, [the name of your application], and **MCB Configuration**. Alternatively, you can go to **`c:\Program Files\Common Files\ORTEC Shared\Umcbi`** and run **`MCBCON32.EXE`**.

   The MCB Configuration program will locate all of the (powered-on) ORTEC MCBs attached to the local PC and to (powered-on) network PCs, display the list of instruments found, allow you to enter customized instrument numbers and descriptions, and optionally write this configuration to those other network PCs. See Section 2.3 for instructions on customizing instrument numbers and descriptions. *If this is the first time you have installed ORTEC software on your system, be sure to read the information on initial system configuration in Section 2.3.*

If you *did not* receive a ***CONNECTIONS-32*** Driver Update Kit (Part No. 797230), your system is now ready to use. If you received the driver update kit, go to Section 2.2.2.

NOTE You can enable other device drivers later with the Windows **Add/Remove Programs** utility on the Control Panel. Select **Connections 32** from the program list, choose **Add/Remove**, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog so you can mark or unmark the driver checkboxes as needed, after which you must re-run the MCB Configuration program as described above.

2.2.2. Installing a *CONNECTIONS-32* Driver Update Kit Included with an ORTEC Software or Hardware Product

This section assumes that an ORTEC software application is already installed on your PC; if not, begin with Section 2.2.1. If you have received a ***CONNECTIONS-32*** Driver Update Kit, it is because:

- ORTEC has updated the ***CONNECTIONS-32*** driver since the release date of the ORTEC software product(s) you installed in Section 2.2.1.

  or

- You have purchased a recently released ORTEC ***CONNECTIONS-32*** MCB that requires the installation of a ***CONNECTIONS-32*** driver update before you can access your new instrument with ORTEC software applications.

To install the ***CONNECTIONS-32*** Driver Update:

1. Insert the ***CONNECTIONS-32*** Driver Update CD, then go to the Windows Taskbar and click on **Start**, and **Run...**. In the Run dialog, enter **D:\ConnectionsSetup.exe** (use your CD-ROM drive designator), then click on **OK**. This will start the installation wizard. Click on **Next** and follow the wizard prompts.

2. Return to Step 3 in Section 2.2.1 and follow the instrument setup and subsequent software installation steps.

After completion of the wizard, restart, and MCB configuration steps described in the preceding section, your system will be ready to use.

2.2.3. If You Have Windows XP Service Pack 2 and Wish to Share Your Local ORTEC MCBs Across a Network

NOTE If you do not have instruments connected directly to your PC or do not wish to share your instruments, this section does not apply to you.

If you have installed Windows XP Service Pack 2 and have fully enabled the Windows Firewall, as recommended mby Microsoft, the default firewall settings will prevent other computers from accessing the ***CONNECTIONS-32*** MCBs connected directly to your PC. To share your locally connected ORTEC instruments across a network, you must enable **File and Printer Sharing** on the Windows Firewall Exceptions list. To do this:

1. From the Windows Control Panel, access the **Windows Firewall** entry. Depending on the appearance of your Control Panel, there are two ways to do this. Either open the **Windows Firewall** item (if displayed); or open the **Network Connections** item then choose **Change Windows Firewall Settings**, as illustrated in Fig. 29. This will open the Windows Firewall dialog.

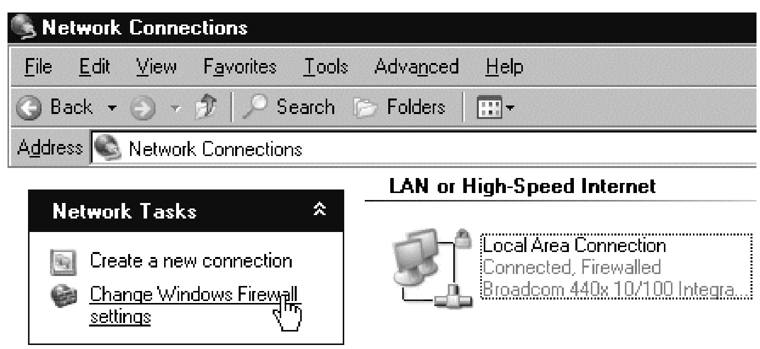


Fig. 29. Change the Firewall Settings.

2. Go to the Exceptions tab, then click to mark the **File and Printer Sharing** checkbox (Fig. 30).

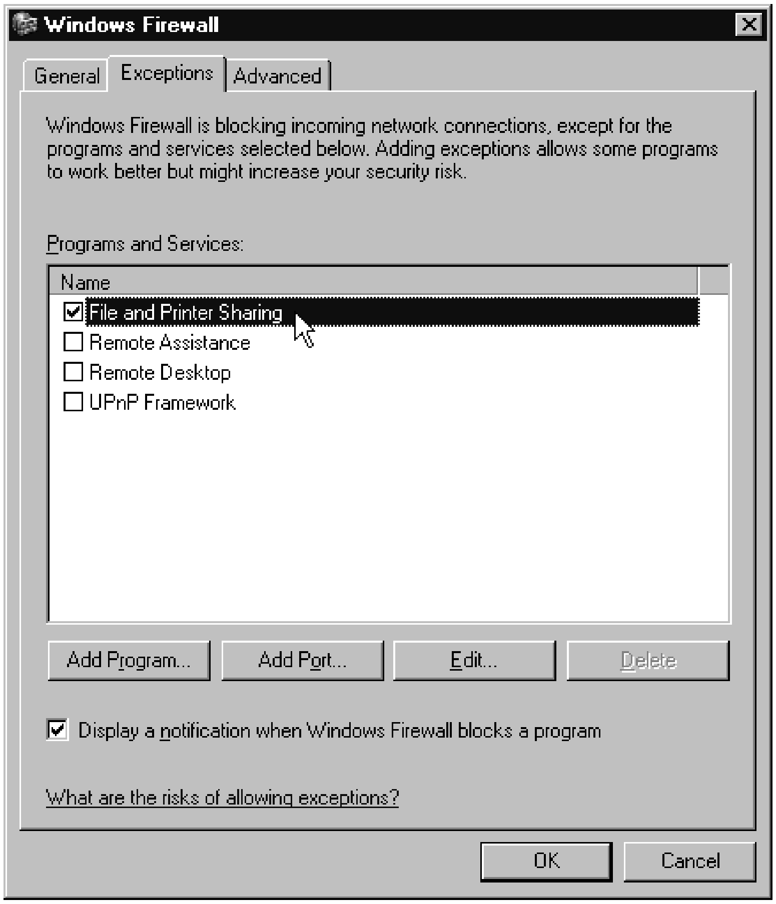


Fig. 30. Turn on File and Printer Sharing.

NOTE This affects only the ability of other users on your network to access your MCBs. You are *not required* to turn on **File and Printer Sharing** in order to access networked MCBs (as long as those PCs are configured to grant remote access).

3. To learn more about exceptions to the Windows Firewall, click on the **What are the risks of allowing exceptions** link at the bottom of the dialog.

4. Click on **OK** to close the dialog. No restart is required.

2.3. Configuration of the Master MCB List

The initial master list of MCBs available to the ORTEC programs on your PC is determined by the MCB Configuration program, which you run as part of software installation or update, or after installing a new MCB. piece of hardware (see Section 2.2).

When MCB Configuration runs, it searches the PC and the network (if any) for MCBs, then displays a master list of the instruments found (Fig. 31).

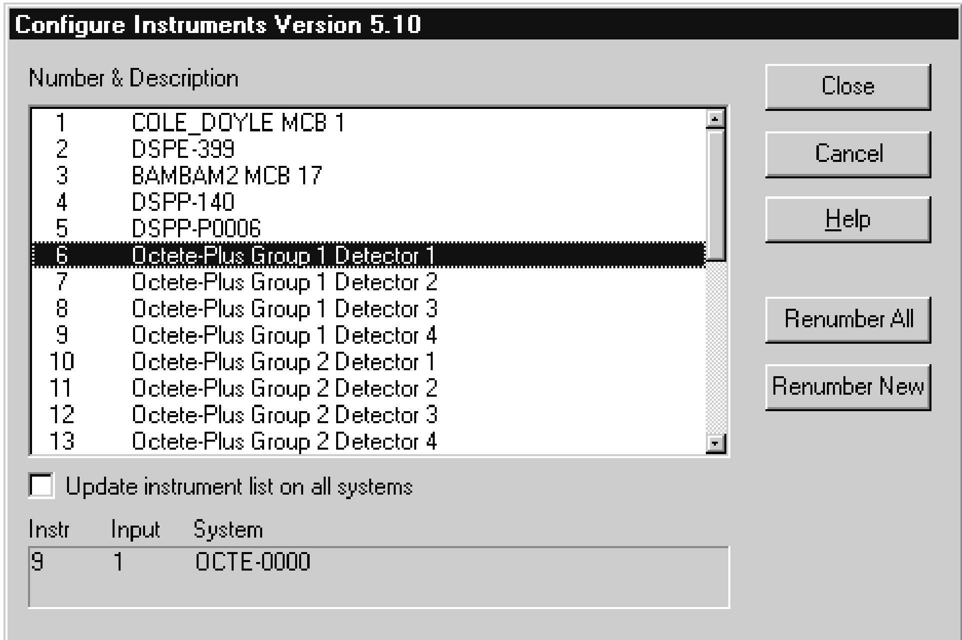


Fig. 31. MCB Numbering.

Note that you can change the instrument numbers and descriptions at any time by double-clicking on an instrument entry in the Configure Instruments dialog. This will open the Change Description or ID dialog (Fig. 32). It shows the physical detector location (read-only) and allows you to change the **ID** and **Description**. Make the desired changes and click on **Close**.

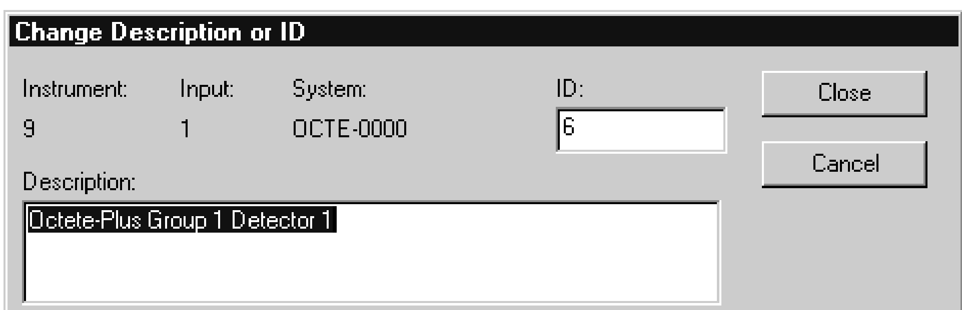


Fig. 32. Change MCB Number or Description.

If you or another user have already assigned a description to a particular instrument, you can restore the default description by deleting the entry in the **Description** field. Then, the next time you run MCB Configuration (see Section 2.4), the default description will be displayed.

When MCB Configuration runs, the resulting MCB configuration list is normally broadcast to all PCs on the network. If you do not want to broadcast the results, unmark the **Update detector list on all systems** checkbox under the instrument list (see Fig. 31) so the configuration will be saved only to the local PC.

The first time the system is configured, Fig. 33 will be displayed to remind you that all new instruments must be assigned a unique, *non-zero* ID number.

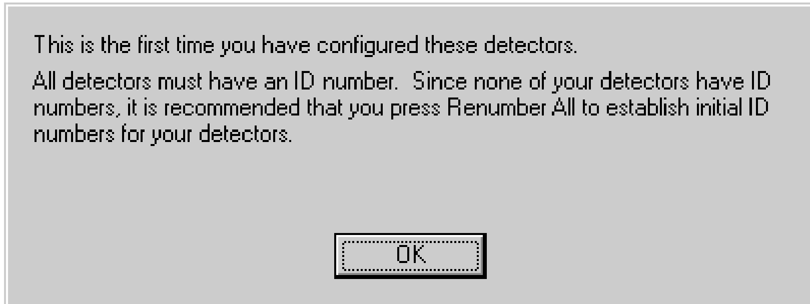


Fig. 33. MCB Numbering First Time.

You can change all the instrument numbers by clicking on **Renumber All** to assign new numbers in sequence; or click on **Renumber New** to renumber just the new instruments. Figure 34 will be displayed if the list is a mixture of old and new numbers.

NOTE Remember that some applications use the instrument number to refer to a specific MCB or device (e.g., the **.JOB** file command SET_DETECTOR 5). Therefore, you might want to subsequently avoid changing its ***number*** so all defined processes will still operate. See your application software manual for additional information.

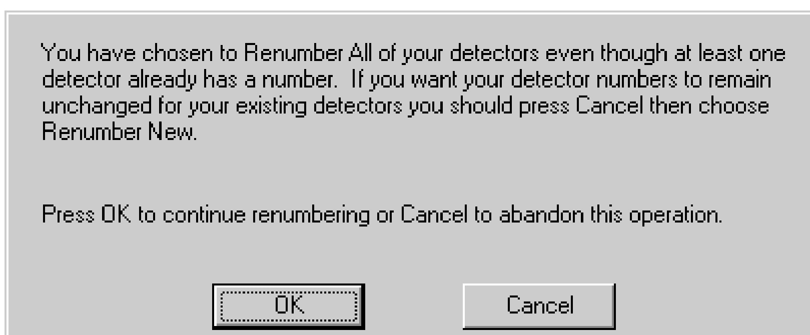


Fig. 34. Renumbering Warning.

Click on the **Help** button on the Configure Instruments dialog to display a detailed help screen.

When you have completed all changes to the instrument list, click on **Close** to close the Configure Instruments dialog. At this point, MAESTRO and other ***CONNECTIONS*** applications can be run on any PC, and the MCB pick list for each program on each PC can be tailored to a specific list of instruments.

2.4. Re-Running the MCB Configuration Program to Update the Master Instrument List

When an MCB is added to the system, or if you change total memory size and number of segments for a multi-input MCB such as the Model 920 or a member of the OCTÊTE instrument family, you can't communicate with the new input(s) until you have (1) enabled its ***CONNECTIONS-32*** driver, if the appropriate driver is not already active; and (2) re-run the MCB Configuration program to add the new device to the Master Instrument List. To do this:

Open the Windows **Add/Remove Programs** utility on the Control Panel. Select **Connections 32** from the program list, choose **Add/Remove**, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog (Fig. 26) so you can mark or unmark the driver checkboxes as needed. Close the dialog, then re-run the MCB Configuration program according to the instructions beginning on page 16.

2.5. Detector Security

If your application supports detector locking and unlocking, you can assign a password to protect Detectors from destructive access. Once a password is set, no application can start, stop, clear, change presets, change ROIs, or perform any command that affects the data in the detector if the password is not known (however, in most cases, the current spectrum and settings for the locked device can be viewed read-only). The password is required for any access, even on a network. This includes changing instrument descriptions and IDs with the MCB Configuration program.

3. MCB PROPERTIES DIALOGS

3.1. Introduction

ORTEC ***CONNECTIONS-32*** applications now use a uniform data-acquisition setup dialog called Properties. The Properties dialog opens when you select the appropriate command in the application. This chapter covers the Properties dialog for all ***CONNECTIONS***-compliant MCBs. Depending on the currently selected MCB, the Properties dialog displays several tabs of hardware controls including ADC setup parameters, acquisition presets, high-voltage controls, amplifier gain adjustments, gain and zero stabilizers, pole-zero and other shaping controls, and access to the InSight™ Virtual Oscilloscope. The Status tab for certain MCBs monitors conditions such as alpha chamber pressure, detector status, and charge remaining on batteries. In addition, portable MCBs have a Field Data tab that provides information about the number of spectra currently stored in memory, and some support an in-field Nuclide Report (see Section 3.9).

The following MCBs are listed with the newest first. Use the table of contents or index to find the setup section for your MCB, move from tab to tab and set your hardware parameters, then click on **Close**. Note that as you enter characters in the data-entry fields, the characters will be underlined until you move to another field or until 5 seconds have lapsed since a character was last entered. During the time the entry is underlined, no other program or PC on the network can modify this value.

3.2. MCB Properties Dialogs

3.2.1. trans-SPEC

3.2.1.1. Amplifier

Figure 35 shows the Amplifier tab. This tab displays the controls for the **Coarse** and **Fine Gain**.

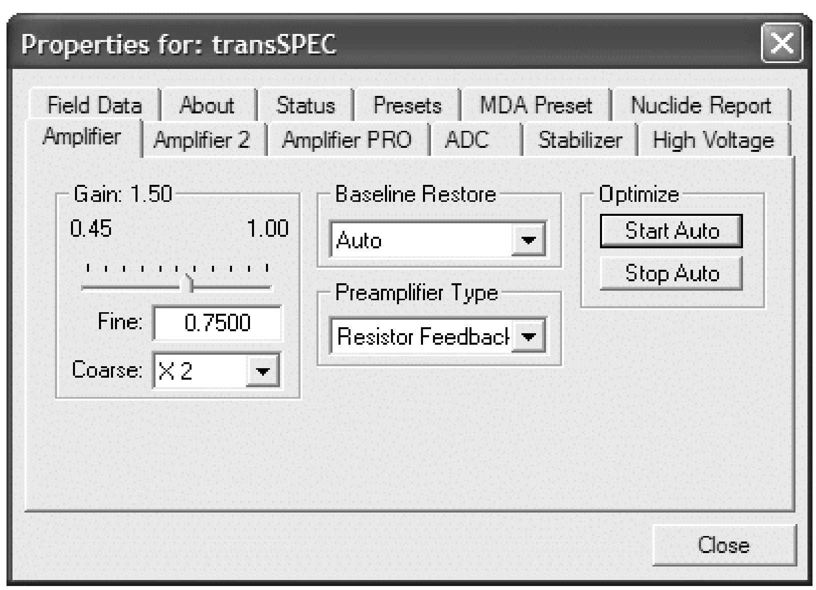


Fig. 35. trans-SPEC Amplifier Tab.

3.2.1.2. Amplifier 2

Figure 36 shows the Amplifier 2 tab, which displays the trans-SPEC **Rise Time** and (fixed) **Flattop Width** settings. You can also use the **InSight** Virtual Oscilloscope mode (see Section 3.3) to view the digital signal processor's actual sampled waveform on a reference graticule.

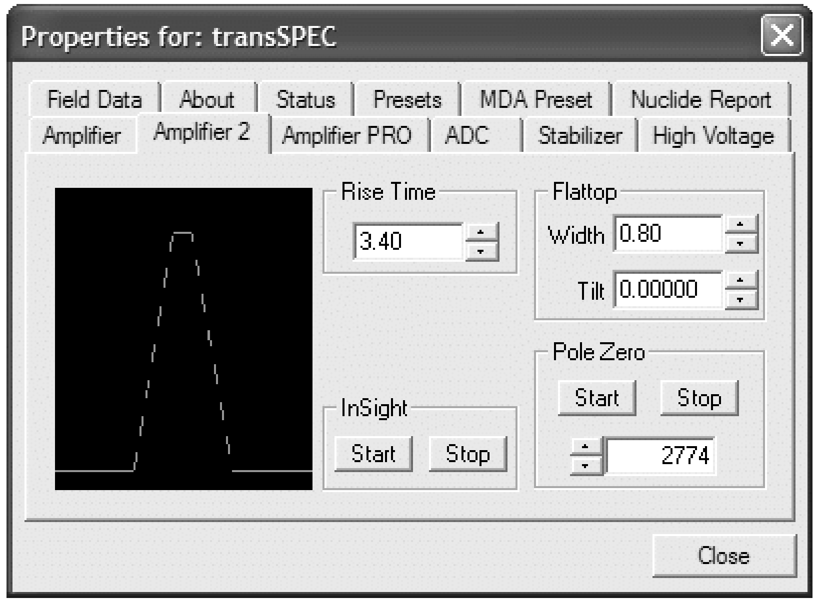


Fig. 36. trans-SPEC Amplifier 2 Tab.

3.2.1.3. Amplifier PRO

Figure 37 shows the Amplifier PRO tab, which contains the **Low Frequency Rejector** (LFR) filter control.[3] This control is always on and cannot be changed.

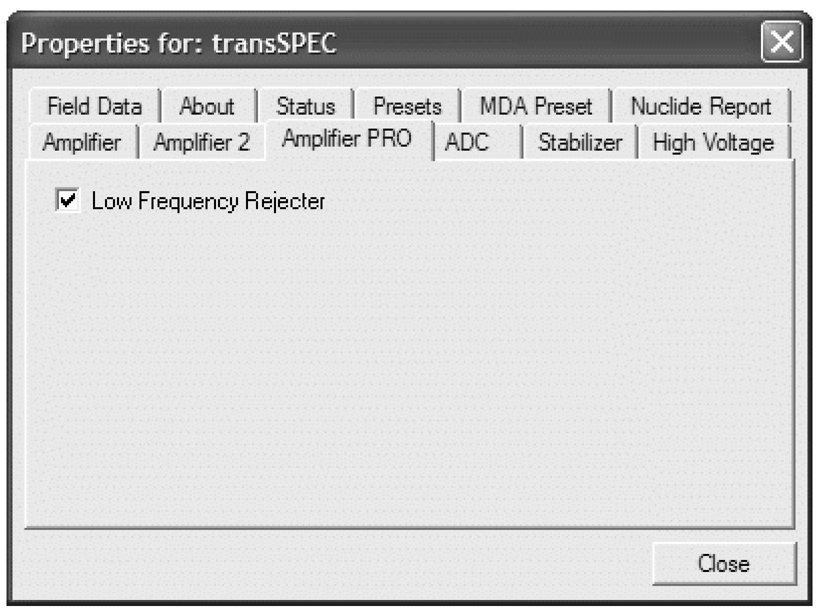


Fig. 37. trans-SPEC Amplifier PRO Tab.

[3]Patent pending.

3.2.1.4. ADC

This tab (Fig. 38) allows you to view the conversion gain, lower- and upper-level discriminator settings; and monitor the current real time, live time, and count rate. The trans-SPEC operates at a fixed conversion gain of 32768 channels, and the LLD and ULD cannot be adjusted.

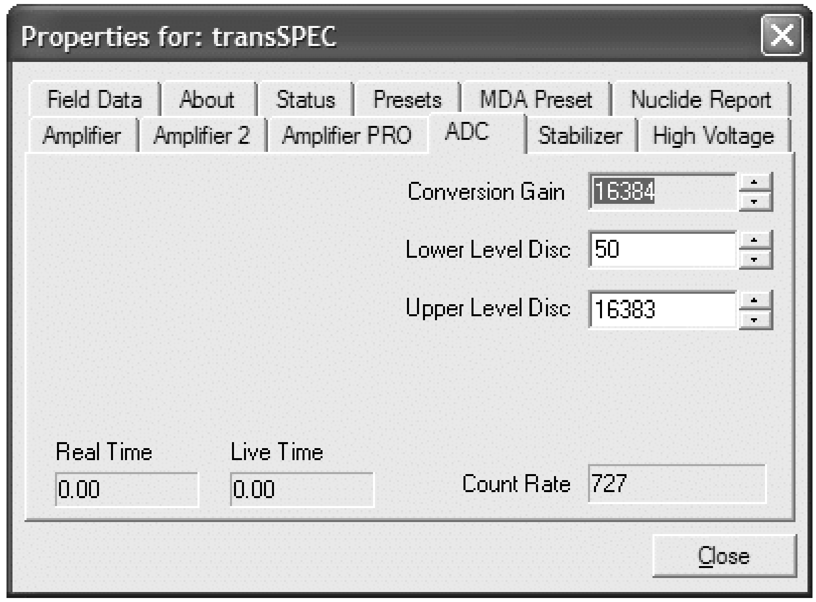


Fig. 38. trans-SPEC ADC Tab.

3.2.1.5. Stabilizer

The trans-SPEC has both a gain stabilizer and a zero stabilizer.

The Stabilizer tab (Fig. 39) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Cha**nnel and **Width** fields show the peak currently used for stabilization.

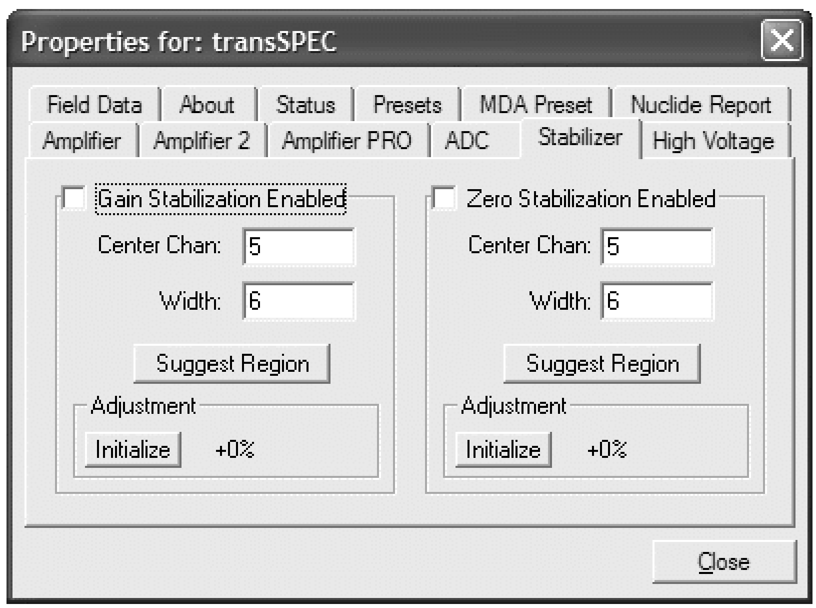


Fig. 39. trans-SPEC Stabilizer Tab.

To enable the stabilizer, enter the **Center Cha**nnel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Cha**nnel and **Width** cannot be changed.

3.2.1.6. High Voltage

Figure 40 shows the High Voltage tab, which allows you to monitor the **Actual** bias. You cannot adjust the bias voltage or turn it on and off; these functions are factory set. The **Shutdown** is fixed as **SMART** (for more information on SMART-1, see the ORTEC catalog or visit www.ortec-online.com) and cannot be changed.

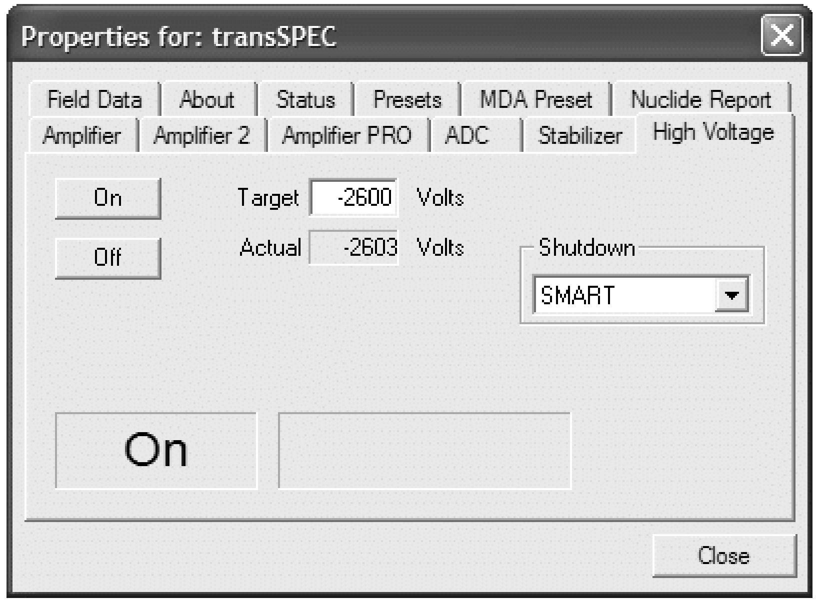


Fig. 40. trans-SPEC High Voltage Tab.

3.2.1.7. Field Data

This tab (Fig. 41) is used to view the trans-SPEC spectra collected in Field Mode, that is, in remote mode, detached from a PC. The trans-SPEC is always in Field Mode when disconnected from the PC. The spectrum can then be viewed as the "active" spectrum in the trans-SPEC.

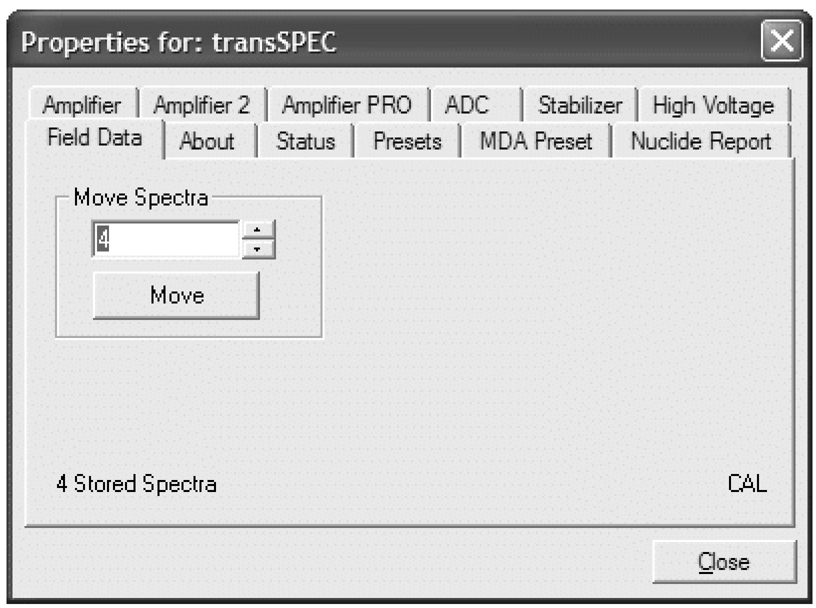


Fig. 41. trans-SPEC Field Data Tab.

The active spectrum is the spectrum where the new data are collected. The current active spectrum is lost. The lower left of the tab shows the total number of spectra (not counting the active spectrum) stored in the trans-SPEC memory. The spectrum ID of the active spectrum is shown in the lower right. The spectrum ID is the eight-character alphanumeric value stored with the spectrum. The stored spectra cannot be viewed or stored in the PC until they are moved to the active spectrum position. To move a spectrum from the stored memory to the active memory, enter the spectrum number and click on **Move**. Use the up/down arrow buttons to scroll through the list of spectra. The label on the lower right does not update until a spectrum is moved. The numbers are the same as the numbers shown on the trans-SPEC display in the stored spectrum list. Note that this only moves the spectrum inside the trans-SPEC. To save the current active spectrum to the PC disk, use the **File/Save** commands in the application. The **Acquire/Download Spectra** command can also be used to download all the stored spectra and save them to disk automatically. They can then be viewed in a buffer window.

3.2.1.8. About

This tab (Fig. 42) displays hardware and firmware information about the trans-SPEC as well as the data **Acquisition Start Time (Sample** description is not used). In addition, the **Access** field shows whether the Detector is currently locked with a password; **Read/Write** indicates that the Detector is unlocked and **Read Only** means it is locked.

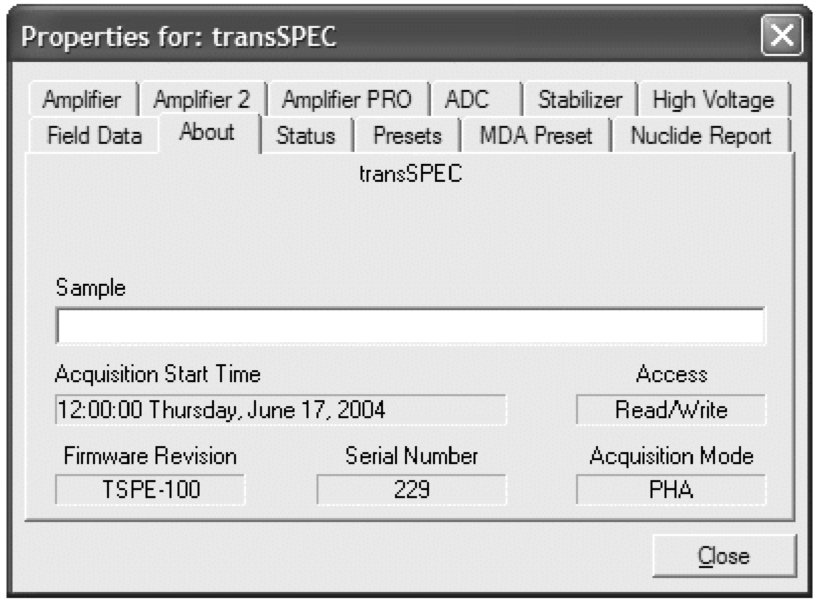


Fig. 42. trans-SPEC About Tab.

3.2.1.9. Status

Figure 43 shows the Status tab. Nine parameters are continuously monitored in real time.

Satisfactory status is reported as **OK** or a numerical value. A failure is reported as **ERR** or a descriptive message. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab. You can change the selected parameters at any time.

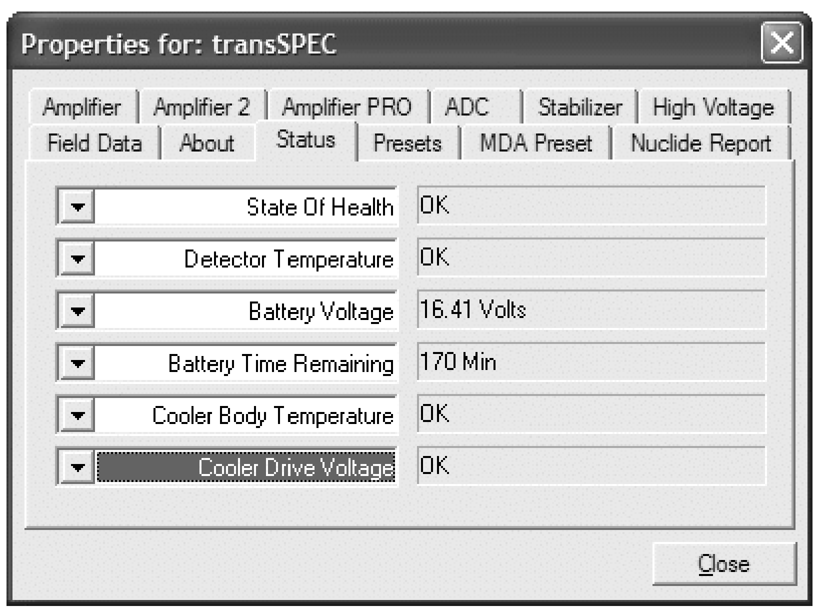


Fig. 43. trans-SPEC Status Tab.

The monitored parameters are:

- Detector **State of Health** — reported as **OK** or **ERR**.
- **Detector Temperature** — reported as **OK** or **ERR**.
- **Battery Voltage** — reported in volts.
- **Battery Time Remaining** — in minutes.
- **Cooler Body Temperature** — **OK** or **ERR**.
- **Cooler Drive Voltage** — **OK** or **ERR**.
- **Cold-Tip Temperature** — **OK or ERR**.
- **HV Bias** — in volts.

To resolve status problems, refer to the troubleshooting list in the hardware manual. For further assistance, contact your ORTEC representative or our Global Service Center.

3.2.1.10. Presets

Figure 44 shows the Presets tab. The presets can only be set when the trans-SPEC is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

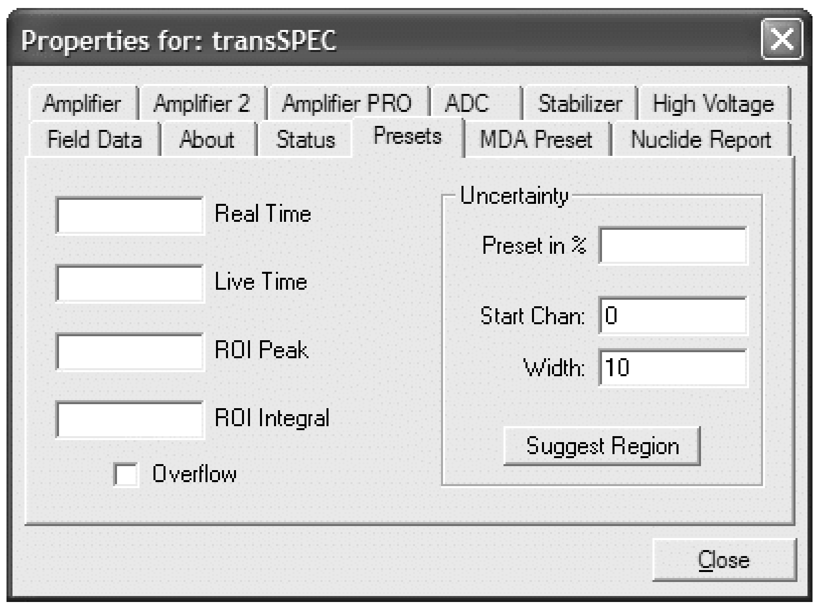


Fig. 44. trans-SPEC Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. Real time means elapsed time or clock time. Live time refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the dead time (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.1.11. MDA Preset

The MDA preset (Fig. 45) can monitor up to 20 nuclides at one time, and stops data collection when the values of the *minimum detectable activity* (MDA) for all of the user-specified MDA nuclides reach the needed value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the “Analysis Methods” chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

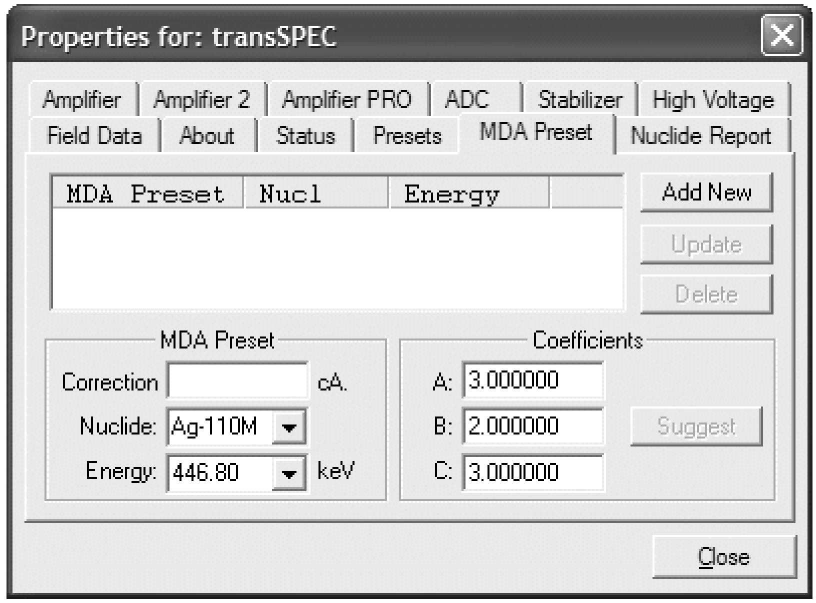


Fig. 45. trans-SPEC MDA Preset Tab.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the MCB is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.1.12. Nuclide Report

Figure 46 shows the Nuclide Report tab. The Nuclide Report displays the activity of up to 9 user-selected peaks. Once the report is set up you can view the Nuclide Report at any time on the trans-SPEC display. The peak area calculations in the hardware use the same methods as the MAESTRO **Peak Info** calculation (see Section 3.7), so the Nuclide Report display is the same as the **Peak Info** display on the selected peak in the spectra stored in the PC. The calculated value is computed by multiplying the net peak count rate by a user-defined constant. If the constant

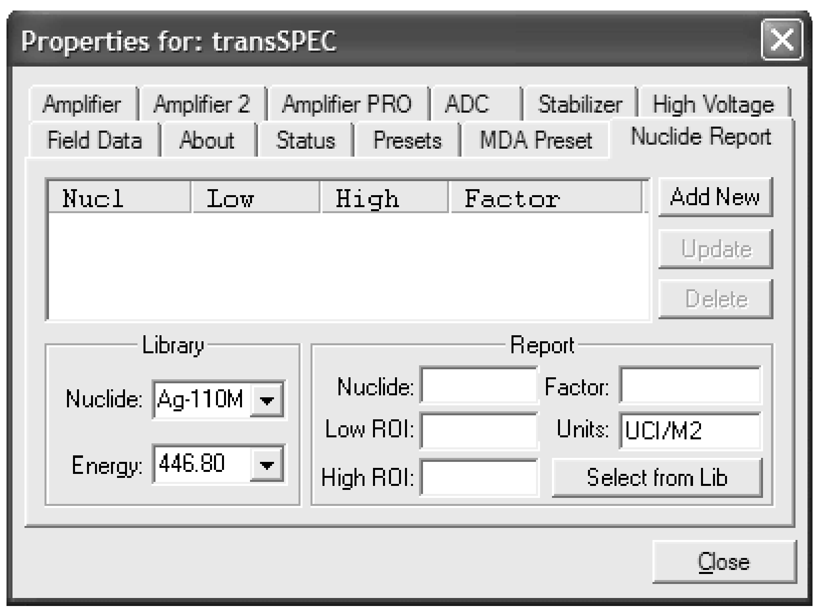


Fig. 46. trans-SPEC Nuclide Report Tab.

includes the efficiency and branching ratio, the displayed value is the activity. You enter the nuclide label and the activity units.

The report format and calculations are discussed in detail in Section 3.9.

Add New

Manual Add

Nuclides can be added to the list using the library to assist in the region definition or manually. To add a nuclide manually, enter the nuclide name, ROI start and end channels, multiplicative factor and units in the Report section. Now press **Add New** to add this nuclide to the list. The units need only be entered once, since they are the same for all nuclides in the table.

Library Add

To use the library to aid in the definition, select the nuclide from the library nuclide drop down list. Now select the gamma-ray energy from the Energy drop down list. This defines what gamma ray to use. Now Press the **Select from Lib** button in the Report section. This will update all the entries in this section and show (as a yellow band) the region to be used in both the expanded spectrum and the full window. Now press **Add New** to add this nuclide to the list.

Edit

To change any of the current nuclides, select the nuclide in the list (use the scroll bars if needed). This will show the current settings for this nuclide. Make any changes needed. Any or all of the entries can be changed. When finished with the changes, click on **Update**.

Delete

To remove an entry, select the entry and press **Delete**.

When you close the Properties dialog, all the values entered are written to the trans-SPEC and are used when you view the Nuclide Report on the trans-SPEC display.

3.2.2. Detective-EX

3.2.2.1. Amplifier

Figure 47 shows the Amplifier tab. This tab displays the controls for the **Coarse** and **Fine Gain**, which are factory preset and cannot be changed. The fine gain is changed when the recalibration is redone.

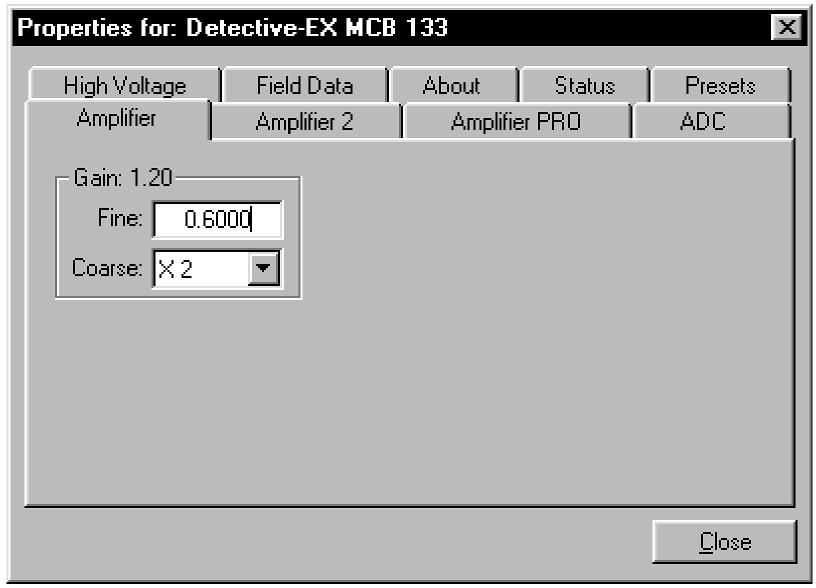


Fig. 47. Detective-EX Amplifier Tab.

3.2.2.2. Amplifier 2

Figure 48 shows the Amplifier 2 tab, which displays the Detective-EX fixed **Rise Time** and **Flattop Width** settings. You can also use the **InSight** Virtual Oscilloscope mode (see Section 3.3) to view the digital signal processor's actual sampled waveform on a reference graticule; however, the shaping settings cannot be adjusted.

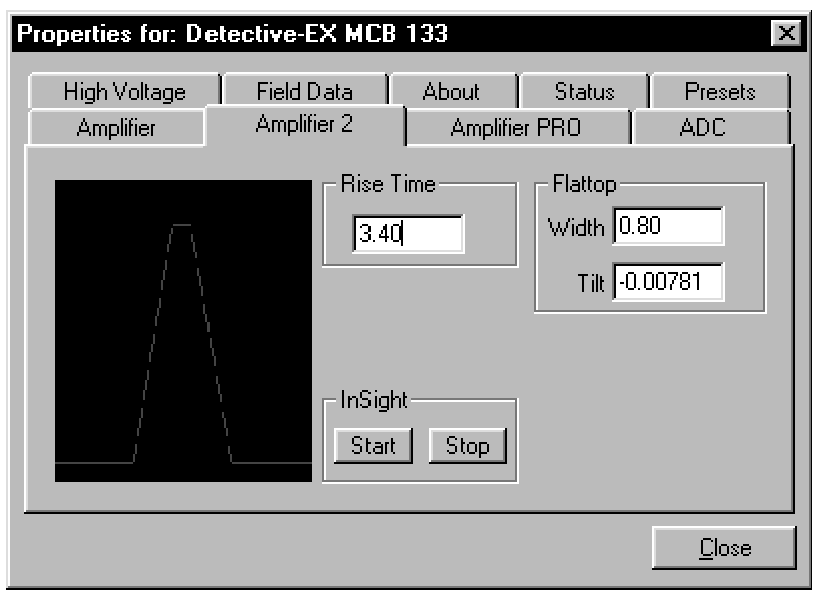


Fig. 48. Detective-EX Amplifier 2 Tab.

3.2.2.3. Amplifier PRO

Figure 49 shows the Amplifier PRO tab, which contains the **Low Frequency Rejector** (LFR) filter control.[3] This control is always on and cannot be changed.

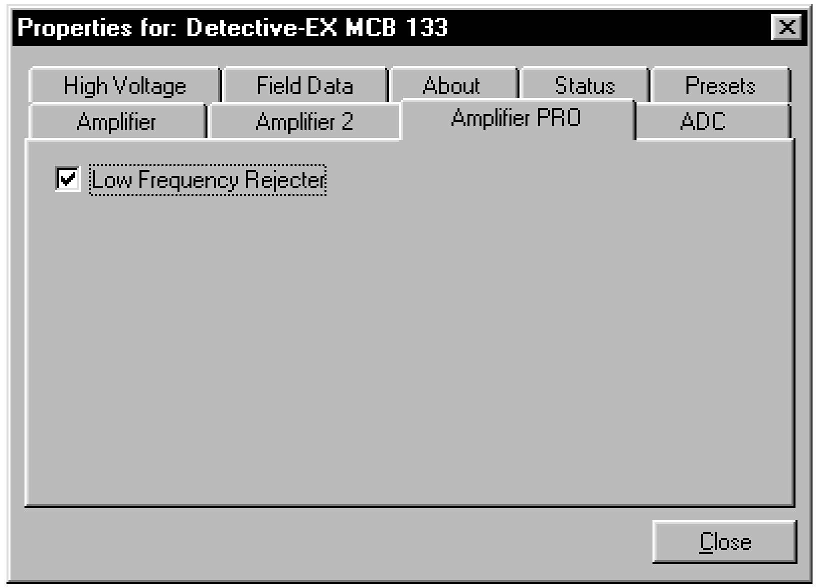


Fig. 49. Detective-EX Amplifier PRO Tab.

3.2.2.4. ADC

This tab (Fig. 50) allows you to view the conversion gain, lower- and upper-level discriminator settings; and monitor the current real time, live time, and count rate. The Detective-EX operates at a fixed conversion gain of 8192 channels, and the LLD and ULD cannot be adjusted.

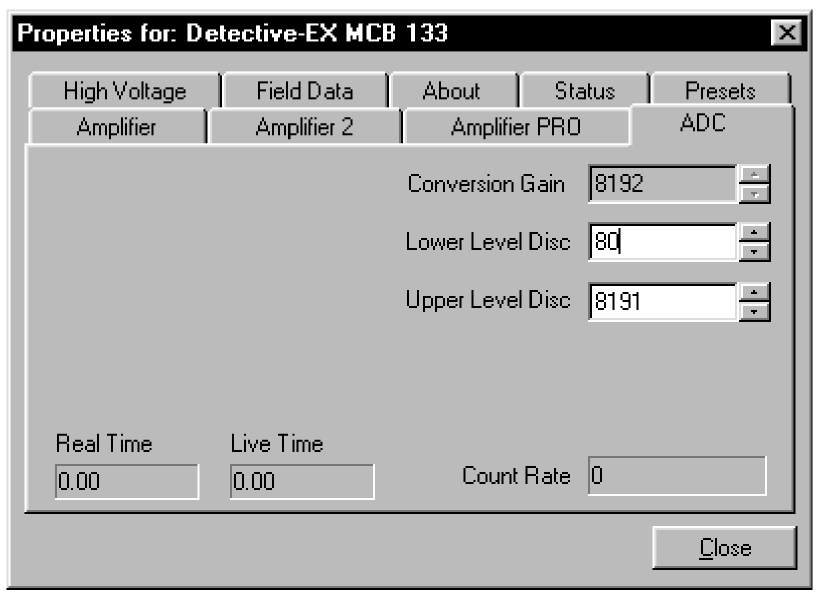


Fig. 50. Detective-EX ADC Tab.

3.2.2.5. High Voltage

Figure 51 shows the High Voltage tab, which allows you to monitor the **Actual** bias. You cannot adjust the bias voltage or turn it on and off; these functions are factory set.

The **Shutdown** is fixed as **SMART** (a reference to the Detective-EX SMART-1™ detector technology; for more information on SMART-1, see the ORTEC catalog or visit www.ortec-online.com) and cannot be changed.

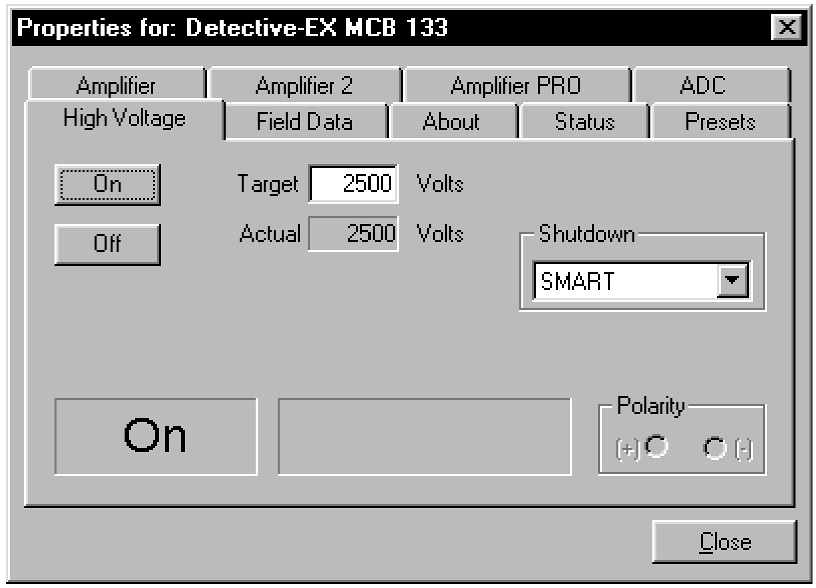


Fig. 51. Detective-EX High Voltage Tab.

3.2.2.6. Field Data

This tab is not used because there are no spectra stored in the MCB memory.

3.2.2.7. About

This tab (Fig. 52) displays hardware and firmware information about the Detective-EX as well as the data **Acquisition Start Time** (**Sample** description is not used). In addition, the **Access** field shows whether the Detector is currently locked with a password; **Read/Write** indicates that the Detector is unlocked and **Read Only** means it is locked.

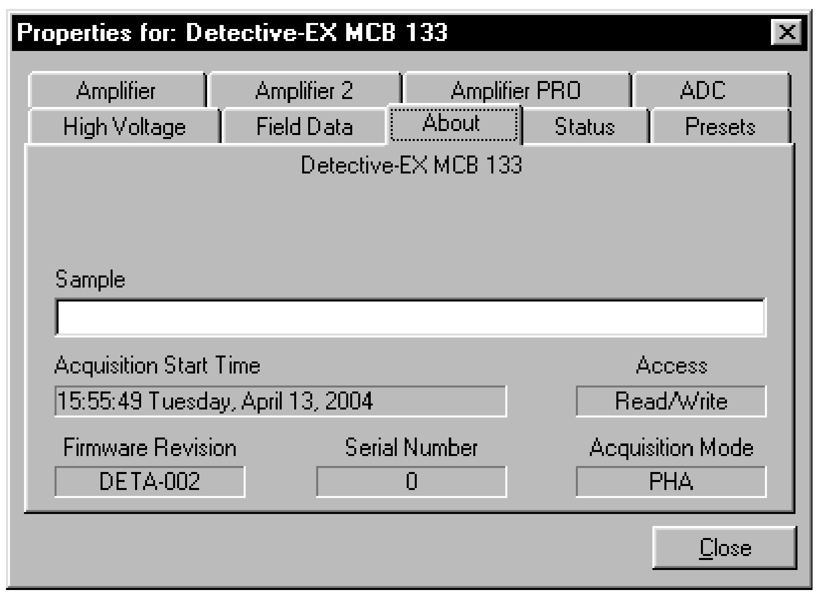


Fig. 52. Detective-EX About Tab.

3.2.2.8. Status

Figure 53 shows the Status tab. Nine parameters are continuously monitored in real time. Satisfactory status is reported as **OK** or as a numerical value. A failure is reported as **ERR** or a descriptive message. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab. You can change the selected parameters at any time.

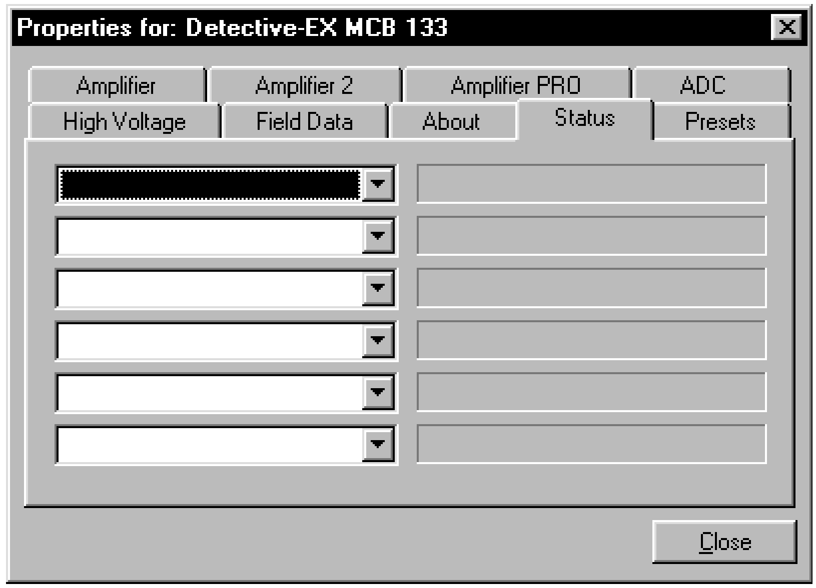


Fig. 53. Detective-EX Status Tab.

The monitored parameters are:

- Detector **State of Health** — reported as **OK** or **ERR**.
- **Gamma Dose Rate** — reported in mrem/h or µSv/h, depending on user-selected dose units and indicating whether this reading was made with the detector (**Ge** for low dose rates) or the Geiger-Müller tube (**GM** for high dose rates); see the hardware manual for discussion of the two dose-rate meters.
- **Detector Temperature** — reported as **OK** or **ERR**.
- **Battery Voltage** — reported in volts.
- **Battery Time Remaining** — in minutes.
- **Cooler Body Temperature** — **OK** or **ERR**.
- **Cooler Drive Voltage** — **OK** or **ERR**.
- **Cold-Tip Temperature** — **OK** or **ERR**.
- **HV Bias** — in volts.

To resolve status problems, refer to the troubleshooting list in the hardware manual.

3.2.2.9. Presets

Figure 54 shows the Presets tab. The presets can only be set when the Detective-EX is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

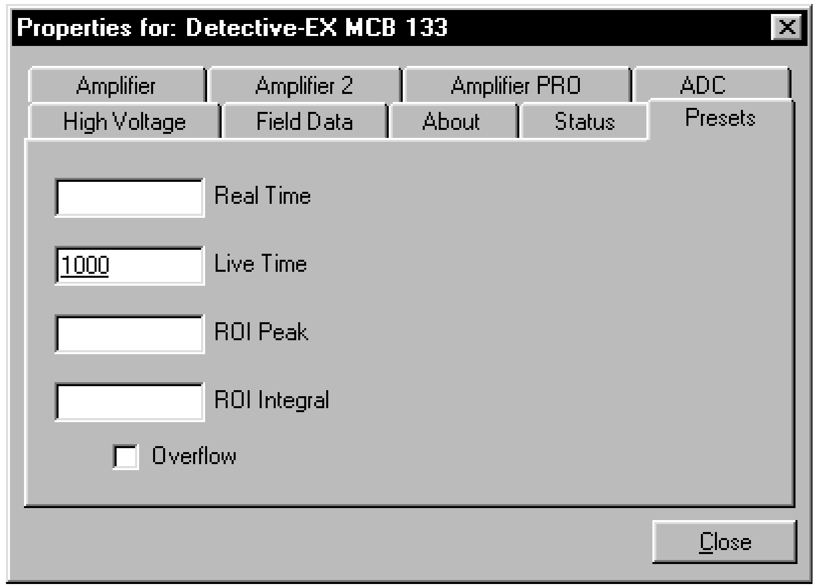


Fig. 54. Detective-EX Presets Tab.

NOTE The presets on this tab do not affect the Detective-EX when the instrument is operating in standalone configuration (disconnected from the PC). When operating as a standalone identifier all presets are cleared. When the **Identify** button is pressed, the Detective-EX will always continue to take data until the **Stop** button is pressed.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. Real time means elapsed time or clock time. Live time refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the dead time (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.3. Detective

3.2.3.1. Amplifier

Figure 55 shows the Amplifier tab. This tab displays the controls for the **Coarse** and **Fine Gain**, which are factory preset and cannot be changed.

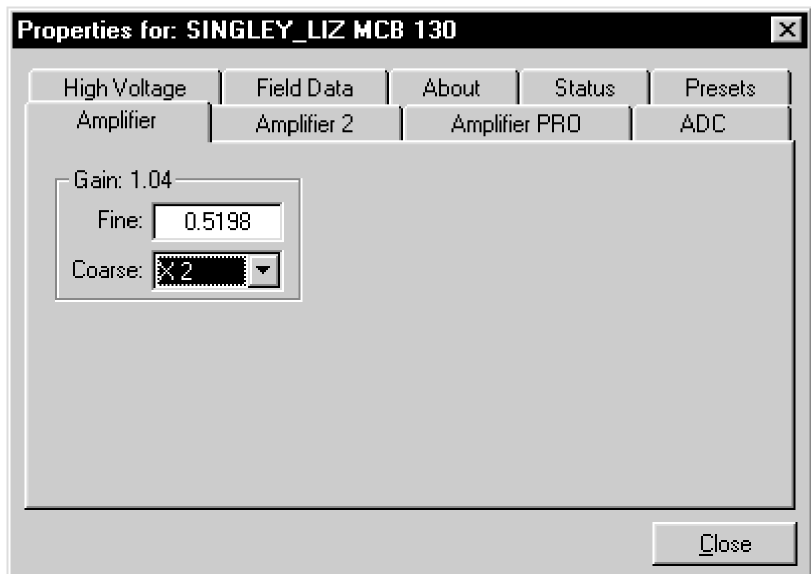


Fig. 55. Detective Amplifier Tab.

3.2.3.2. Amplifier 2

Figure 56 shows the Amplifier 2 tab, which displays the Detective's fixed **Rise Time** and **Flattop Width** settings. You can also use the **InSight** Virtual Oscilloscope mode (see Section 3.3) to view the digital signal processor's actual sampled waveform on a reference graticule; however, the shaping settings cannot be adjusted.

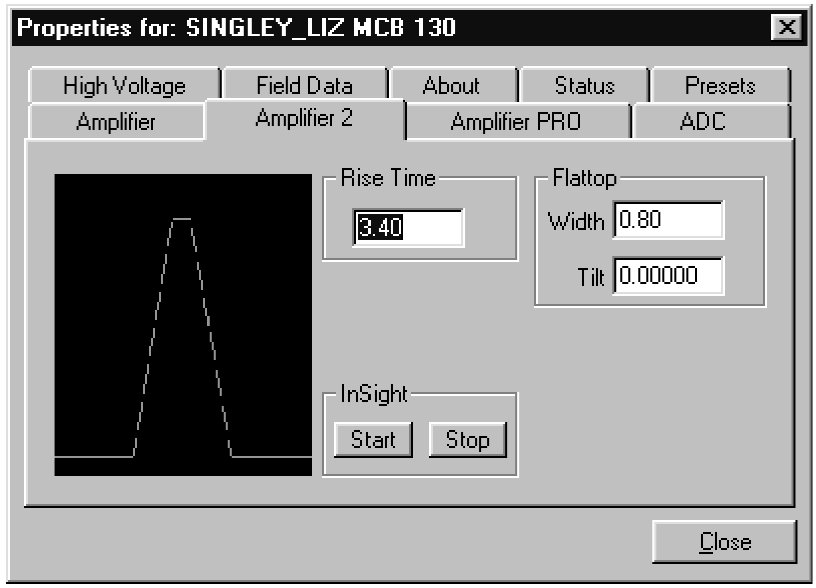


Fig. 56. Detective Amplifier 2 Tab.

3.2.3.3. Amplifier PRO

Figure 57 shows the Amplifier PRO tab, which contains the **Low Frequency Rejector** (LFR) filter control. This control is always on and cannot be changed.

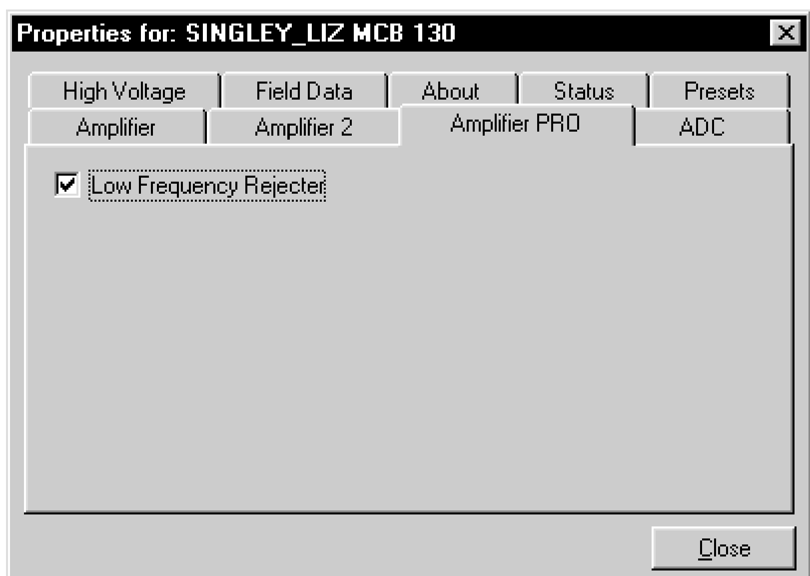


Fig. 57. Detective Amplifier PRO Tab.

3.2.3.4. ADC

This tab (Fig. 58) allows you to view the conversion gain, lower- and upper-level discriminator settings; and monitor the current real time, live time, and count rate. The Detective operates at a fixed conversion gain of 8192 channels, and the LLD and ULD cannot be adjusted.

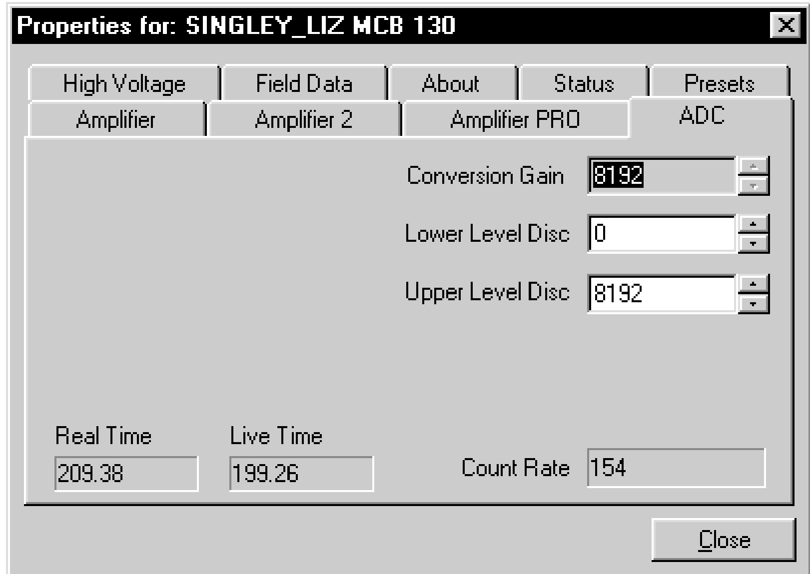


Fig. 58. Detective ADC Tab.

3.2.3.5. High Voltage

Figure 59 shows the High Voltage tab, which allows you to monitor the **Actual** bias. You cannot adjust the bias voltage or turn it on and off; these functions are factory set.

The **Shutdown** is fixed as **SMART** (a reference to the Detective's SMART-1™ detector technology; for more information on SMART-1, see the ORTEC catalog or visit www.ortec-online.com) and cannot be changed.

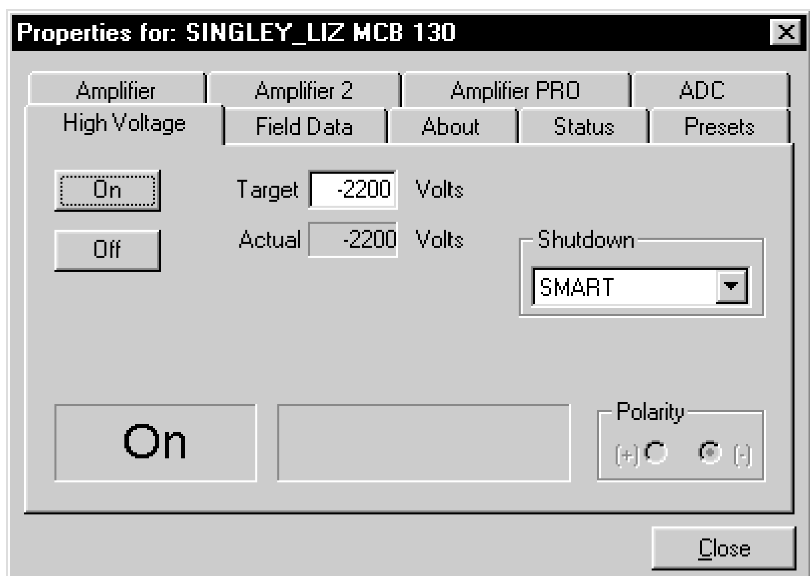


Fig. 59. Detective High Voltage Tab.

3.2.3.6. Field Data

Use this tab (Fig. 60) to view and/or save the spectra in the Detective's live- and stored-spectrum memory. When you connect to the PC, start MAESTRO or another ORTEC application, and select the Detective from the detector droplist within the software, the spectrum in the Detective's live-spectrum memory will be displayed. *If you do not save this spectrum, it will be lost* (overwritten) when you start the next data acquisition within the software application or use the **Move** button to read a spectrum from the Detective's stored-spectrum memory to the live-spectrum memory.

NOTE Moving and viewing *stored* spectra does not erase or overwrite these spectra. They are retained in the Detective memory until you delete them with the **Erase All Stored Spectra** command under the Detective's Administrative Menu, as described in the Detective Administrator's manual.

The lower left of the tab shows the total number of spectra (not counting the current live spectrum) stored in the Detective memory. The spectrum ID of the active spectrum is shown in the lower right (either **IDENT** or **SEARCH**). The spectrum ID is the eight-character alphanumeric value assigned by the Detective when you store the spectrum (see the Detective Administrator's Manual for more information on this format).

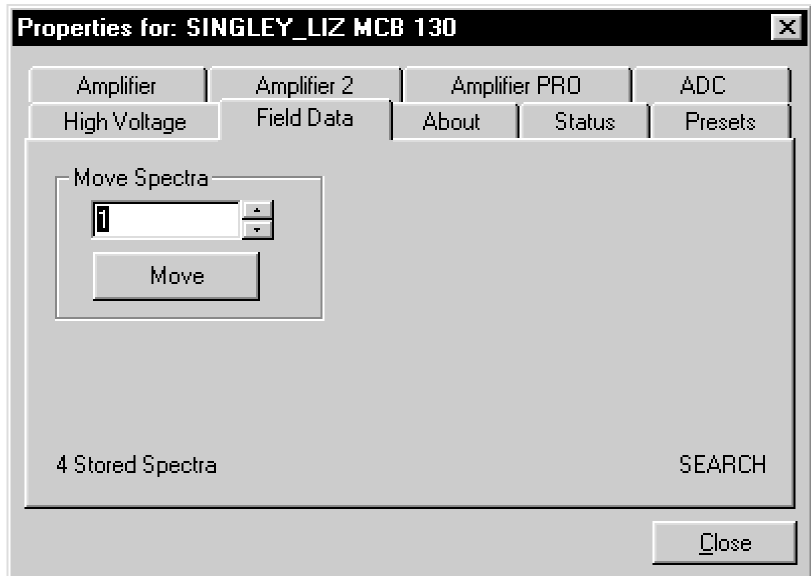


Fig. 60. Detective Field Mode Spectrum Tab.

There are two ways to store a Detective spectrum on disk. The first is to use the **Move** button to read one or more spectra, one-at-a-time, into MAESTRO or other application buffer windows (after which you can save them to individual disk files). The other is to download all stored spectra in a single operation using the **Acquire/Download Spectra** command, after which you can view them in buffer windows within your ORTEC ***CONNECTIONS*** application.

To move a spectrum from the stored memory to the active memory, enter the spectrum number or use the up/down arrow buttons to scroll through the list of spectra. When the correct spectrum number is displayed, click on **Move**. The spectrum ID in the lower right will not update until a spectrum is moved. *Note that this only moves the spectrum inside the Detective memory*. To save the current active spectrum to the PC disk, use the **File/Save** commands in the software application.

3.2.3.7. About

This tab (Fig. 61) displays hardware and firmware information about the Detective as well as the data **Acquisition Start Time** (**Sample** description is not used). In addition, the **Access** field shows whether the Detector is currently locked with a password; **Read/Write** indicates that the Detector is unlocked and **Read Only** means it is locked.

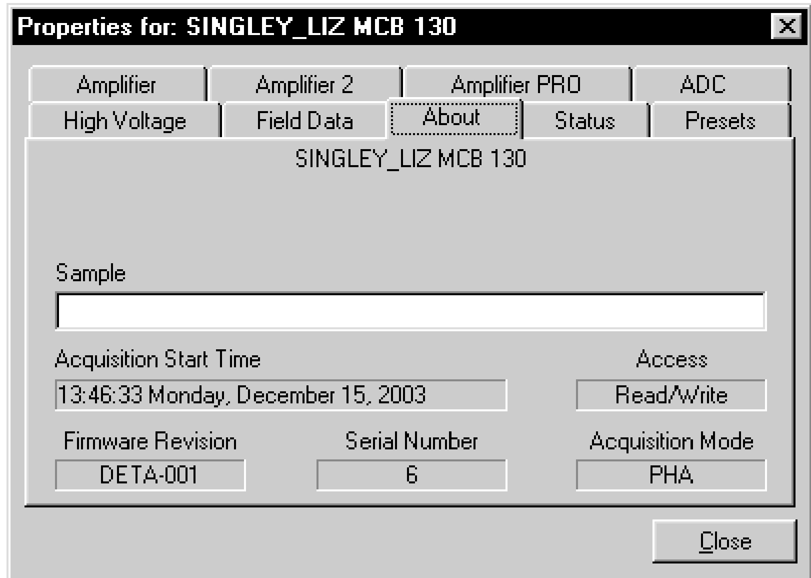


Fig. 61. Detective About Tab.

3.2.3.8. Status

Figure 62 shows the Status tab. Nine parameters are continuously monitored in real time. Satisfactory status is reported as **OK** or a numerical value. A failure is reported as **ERR** or a descriptive message. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab. You can change the selected parameters at any time.

The monitored parameters are:

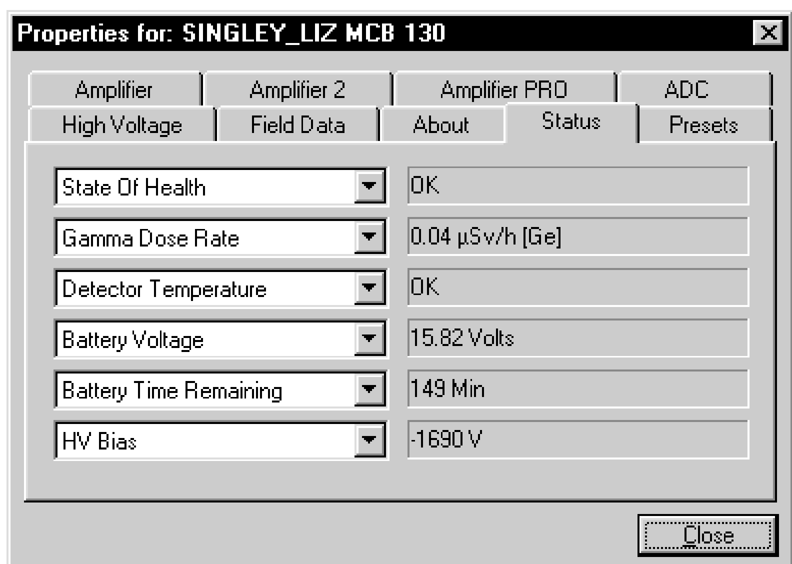


Fig. 62. Detective Status Tab.

- Detector **State of Health** — reported as **OK** or **ERR**.

- **Gamma Dose Rate** — reported in mrem/h or µSv/h, depending on user-selected dose units (see the Detective Operator Manual) and indicating whether this reading was made with the detector (**Ge** for low dose rates) or the Geiger-Müller tube (**GM** for high dose rates); see **Gamma Dose-Rate Determination** in the Detective Operator Manual for further discussion of the two dose-rate meters.

- **Detector Temperature** — reported as **OK** or **ERR**.

- **Battery Voltage** — reported in volts.
- **Battery Time Remaining** — in minutes.
- **Cooler Body Temperature** — `OK` or `ERR`.
- **Cooler Drive Voltage** — `OK` or `ERR`.
- **Cold-Tip Temperature** — `OK` or `ERR`.
- **HV Bias** — in volts.

To resolve status problems, refer to the troubleshooting list in the hardware manual.

3.2.3.9. Presets

Figure 63 shows the Presets tab. The presets can only be set when the Detective is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

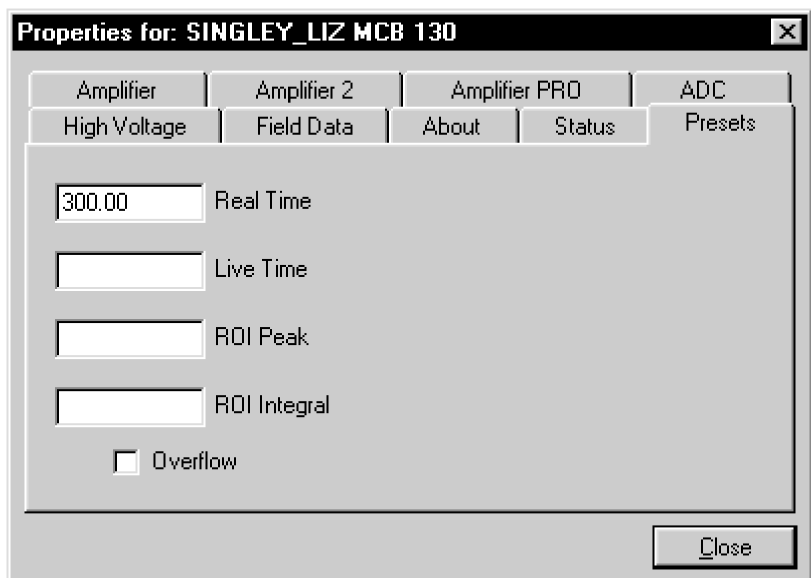


Fig. 63. Detective Presets Tab.

NOTE The presets on this tab do not affect the Detective when the instrument is operating in standalone configuration (disconnected from the PC). When operating as a standalone identifier and the **ID** button is pressed, the Detective will always continue to take data until the **Stop** button is pressed.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.4. DSPEC Pro

3.2.4.1. Amplifier

Figure 64 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Optimize**.

NOTE Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button. The changes you make on most property tabs *take place immediately*. There is no cancel or undo for these dialogs.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 32.

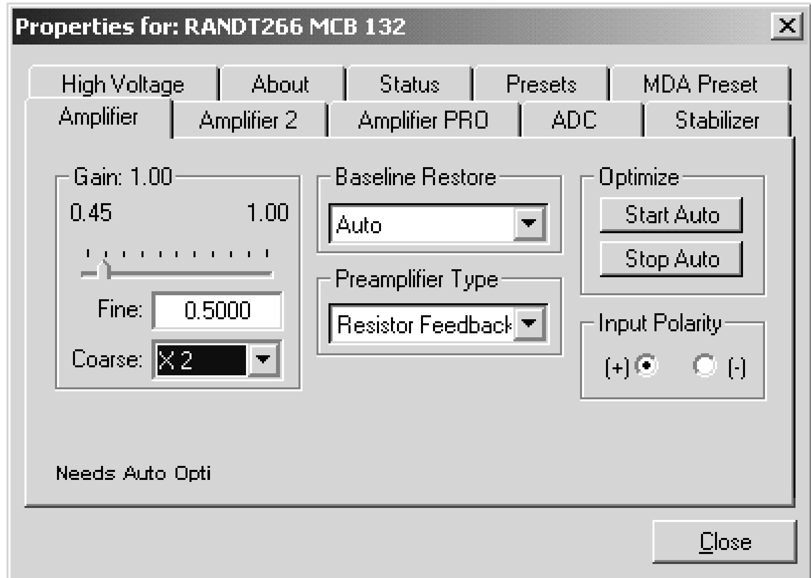


Fig. 64. DSPEC Pro Amplifier Tab.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise from dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC Pro even when the power is off. The time constant can be manually set on the InSight display (see Section 3.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the germanium detector being used.

[4]Patent number 5,912,825.

Optimize

The DSPEC Pro is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** (optimize) button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC Pro, the optimize button does not perform the pole zero.

As with any system, the DSPEC Pro should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the DSPEC Pro must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC Pro front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC Pro at this time and, if the DSPEC Pro is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC Pro is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC Pro, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if you change the flattop width.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape may not change enough for you to see. (In this situation, you also may not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

Figure 65 shows the Amplifier 2 tab, which accesses the advanced DSPEC Pro shaping controls including the InSight Virtual Oscilloscope mode (which is discussed in Section 3.3).

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. The value of the rise time parameter in the DSPEC Pro is roughly equivalent

[5]Patent number 5,372,363

[6]Patent number 5,821,533.

to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC Pro value of 12 µs corresponds to 6 µs in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

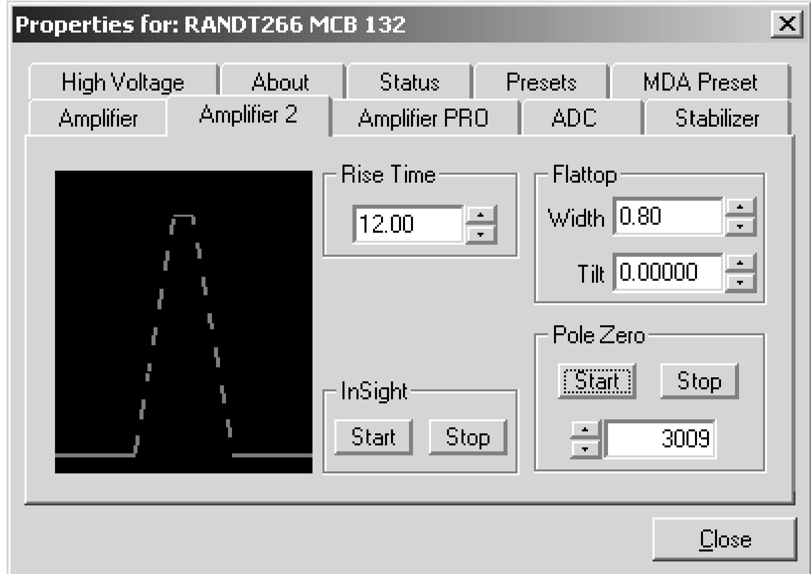


Fig. 65. DSPEC Pro Amplifier 2 Tab.

Use the up/down arrows to adjust the **Rise Time** within the range of 0.8 to 23.0 µs. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC Pro firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **Insight** section on the Amplifier 2 tab and click on **Start**. The InSight mode is discussed in more detail in Section 3.3.section.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top may be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the “flatness” of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \textit{Rise Time}) + (2 \times \textit{Flattop Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user may wish to return to **MCB Properties...** and click on the **Insight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

3.2.4.2. Amplifier PRO

This tab (Fig. 66) contains the controls for the **Low Frequency Rejector** (LFR) filter,[3] **Resolution Enhancer**, and **Enhanced Throughput Mode**. To enable a particular feature, mark the corresponding checkbox. Any or all of these features can be used at one time, however, the LFR and enhanced throughput modes must be set up before the resolution enhancer is configured, as discussed below. Note that once an MCB is "trained" for the **Resolution Enhancer** (see the following section), it must be "retrained" if any settings are changed that can affect peak shape or position (e.g., bias, gain, rise time, flattop, PZ).

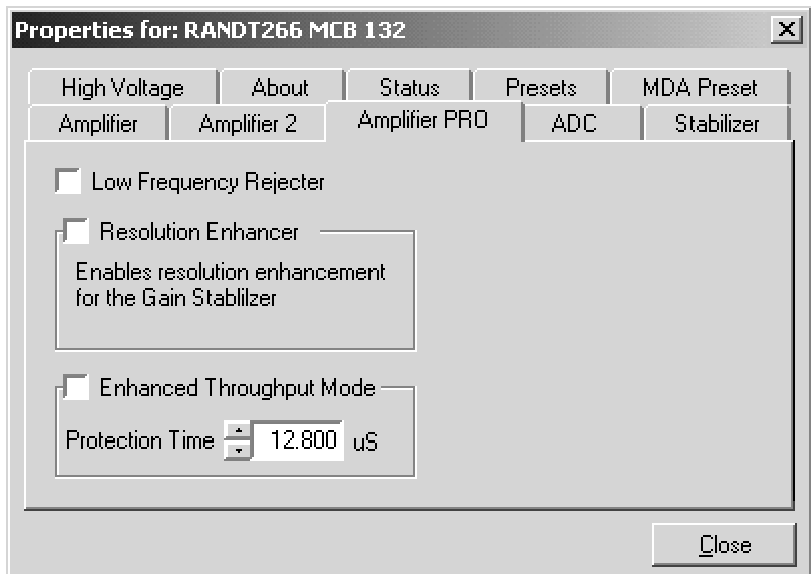


Fig. 66. DSPEC Pro Amplifier PRO Tab.

Low Frequency Rejector — This feature is discussed in detail in the DSPEC Pro hardware manual. You *cannot* optimize or pole-zero the DSPEC Pro while in LFR mode. The **Optimize** feature should be used with the LFR filter *off*. Subsequent measurements can then be taken with the LFR filter on. Also, LFR mode affects the available range of protection times in **Enhanced Throughput Mode**, as discussed in the next paragraph.

Enhanced Throughput Mode — See the hardware manual for a discussion of this feature. The valid **Protection Time** settings, in 25-ns increments, are:

- LFR mode off 1.1 µs to 48.4 µs
- LFR mode on 3.0 µs to 145.2 µs

Turning on this feature automatically sets the minimum protection time (highest throughput rate) based on your current **Rise Time** and **Flattop** settings, however, you can adjust this value at any time. Each time you change the rise time or flattop, the DSPEC Pro will automatically set itself to the new minimum protection time.

"Training" the Resolution Enhancer

The resolution enhancer can help alleviate the low-side peak tailing that results from increased charge trapping; see the discussion in the DSPEC Pro hardware manual. This function will *not* improve low resolution due to other causes (and might exacerbate the problem).

1. Set the bias, gain, rise time, flattop, and PZ as you would for data collection.

2. If you wish to use LFR Mode, turn it on.

3. If you wish to use Enhanced Throughput Mode, turn it on and either accept the automatically calculated, highest-throughput protection time, based on the current rise time and flattop; or enter the desired setting. (The latter might require one or more data acquisitions. When finished, proceed to Step 4).

4. Clear the MCB and acquire a well-isolated peak.

5. You will now use the gain stabilization section of the Stabilizer tab to configure the resolution enhancer. (The gain stabilizer and resolution are somewhat similar in function, and only one of these features can be used at a time.) Enter the **Center** channel and **Width** of the peak acquired in Step 4; the maximum **Width** is 255 channels. If you wish, use the **Suggest** button.

6. If you have already used the resolution enhancer, you can either use the previously established settings (which will go into effect when you turn on the enhancer in Step 7), or click on **Initialize** to clear all settings. Initialization does not change the current **Center** channel and **Width**.

7. Return to the PRO tab and turn on the resolution enhancer.

8. Clear the MCB, re-start acquisition, and monitor the FWHM of the target peak until it no longer changes. Typically, the more charge trapping exhibited by the detector, the longer the data collection time.

9. When you are satisfied that the FWHM has reached the best possible value, clear the MCB and collect another spectrum for confirmation.

10. At this point, the resolution enhancer is now "trained" for the current peak shape parameters and can be turned off. (You can leave it on, if you wish, but you might notice some peak broadening.)

11. If you change any parameters that affect peak position and/or shape, you must repeat this "training" procedure.

3.2.4.3. ADC

This tab (Fig. 67) contains the **Gate**, **ZDT Mode**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 ns beyond peak detect (peak maximum).

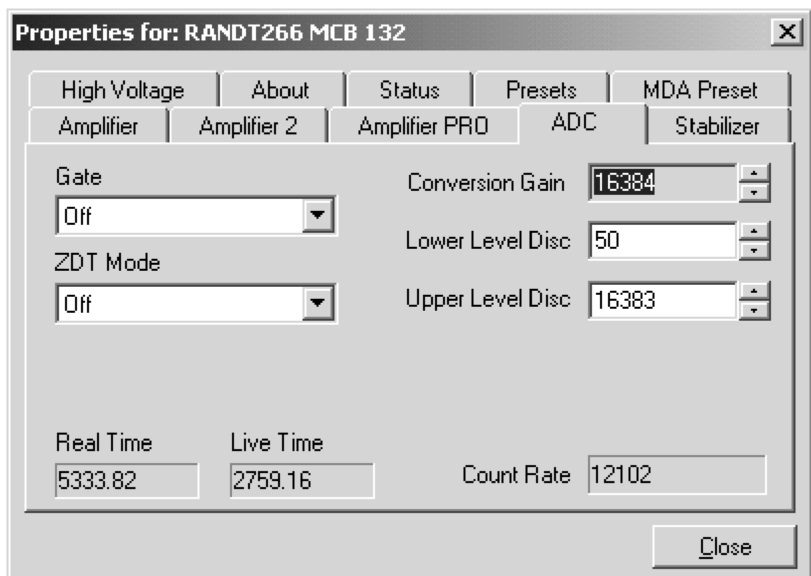


Fig. 67. DSPEC Pro ADC Tab.

ZDT Mode

Use this droplist to choose the **ZDT Mode** to be used for collecting the zero dead time (corrected) spectrum (see Section 3.6). The three modes are **Off** (LTC only), **NORM_CORR** (LTC and ZDT), and **CORR_ERR** (ERR and ZDT). If one of the ZDT modes is selected, both spectra are stored in the same spectrum (**.SPC**) file. If you do not need the ZDT spectrum, you should select **Off**.

In *CONNECTIONS* applications, the display can show either of the two spectra. Use **<F3>** or **Acquire/ ZDT Display Select** to toggle the display between the two spectra. In the Compare mode, **<F3>** switches both spectra to the other type and **<Shift+F3>** switches only the compare spectrum. This allows you to make all types of comparisons.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048). The up/down arrow buttons step through the valid settings for the DSPEC Pro.

Upper- and Lower-Level Discriminators

In the DSPEC Pro, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

3.2.4.4. Stabilizer

The DSPEC Pro has both a gain stabilizer and a zero stabilizer. The Stabilizer tab (Fig. 68) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

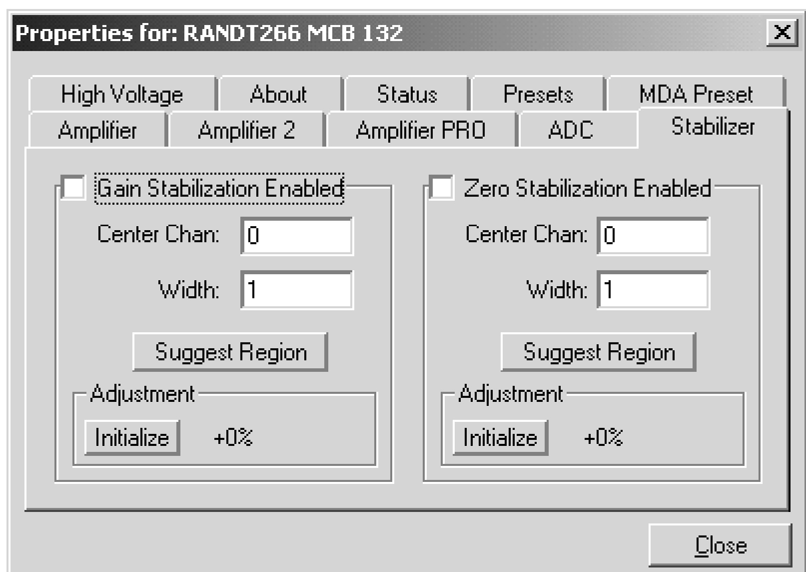


Fig. 68. DSPEC Pro Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.4.5. High Voltage

Figure 69 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; and choose the **Shutdown** mode. The polarity is set in the DIM module.

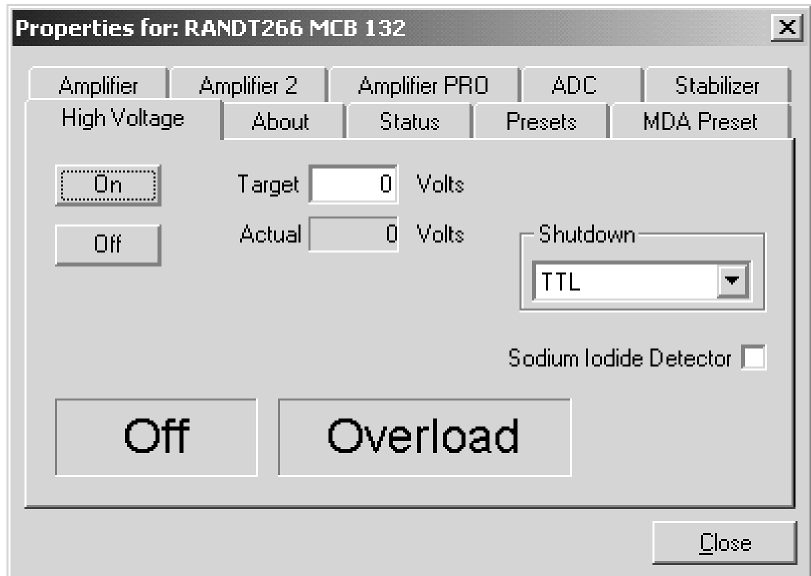


Fig. 69. DSPEC Pro High Voltage Tab.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be **ORTEC**, **TTL**, or **SMART**. The **ORTEC** mode is used for all ORTEC detectors except SMART-1 detectors. Use the **SMART** option for those detectors. Check with the detector manufacturer for other detectors. The **TTL** mode is used for most non-ORTEC detectors.

The high voltage in the DSPEC Pro is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

To use a **Sodium Iodide Detector**, mark the checkbox. This changes the gain and zero stabilizers to operate in a faster mode. For the DIM-296, the HV is controlled by the adjustment in the Model 296 and not here.

3.2.4.6. About

This tab (Fig. 70) displays hardware and firmware information about the currently selected DSPEC Pro as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password; **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

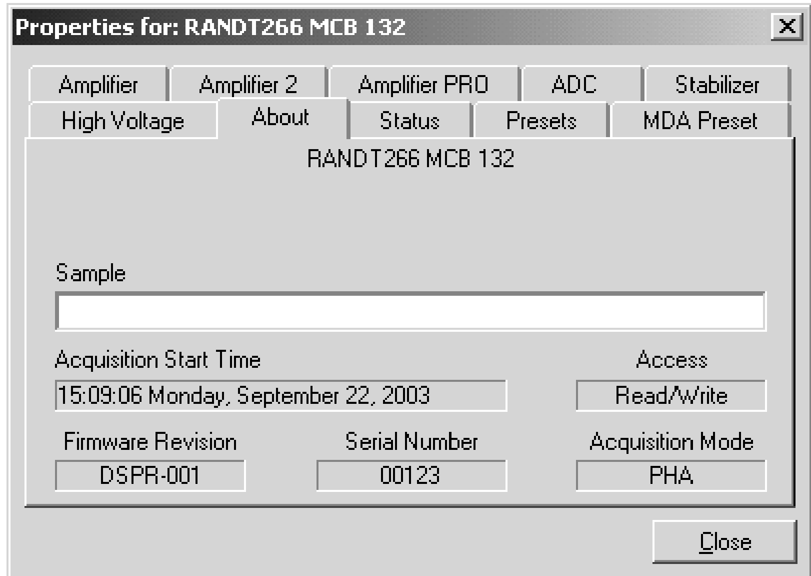


Fig. 70. DSPEC Pro About Tab.

3.2.4.7. Status

Figure 71 shows the Status tab. There are 21 values monitored at all times. You can select any six of these to be displayed simultaneously on the Status tab. The parameters you choose can be changed at any time, so you can view them as needed. Two types of values are presented: **OK** or **ERR**, and numeric value. The state-of-health (SOH) parameters are all **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the DSPEC Pro. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they show **N/A**.

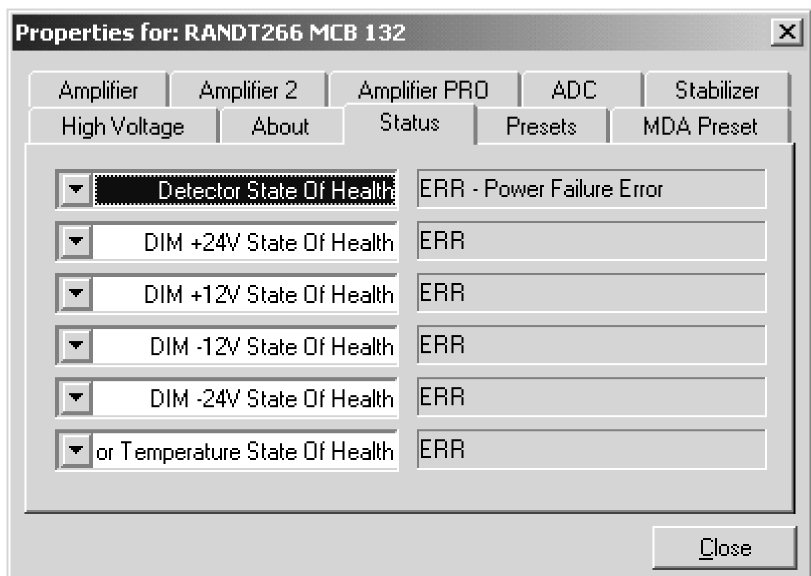


Fig. 71. DSPEC Pro Status Tab.

The parameters displayed are:

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health
This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health
This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health
This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health
This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health
This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health
This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health
This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts
This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts
This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts
This is the current value of the -12 volt supply in the DIM as delivered to the detector.

−24 volts
This is the current value of the -24 volt supply in the DIM as delivered to the detector.

High Voltage
This is the current value of the high voltage bias supply in the DIM as delivered to the detector.

Detector temperature
This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature
This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage
This is not used in the DSPEC Pro.

Battery % full
This is not used in the DSPEC Pro.

Battery time remaining
This is not used in the DSPEC Pro.

3.2.4.8. Presets

Figure 72 shows the Presets tab. MDA presets are shown on a separate tab.

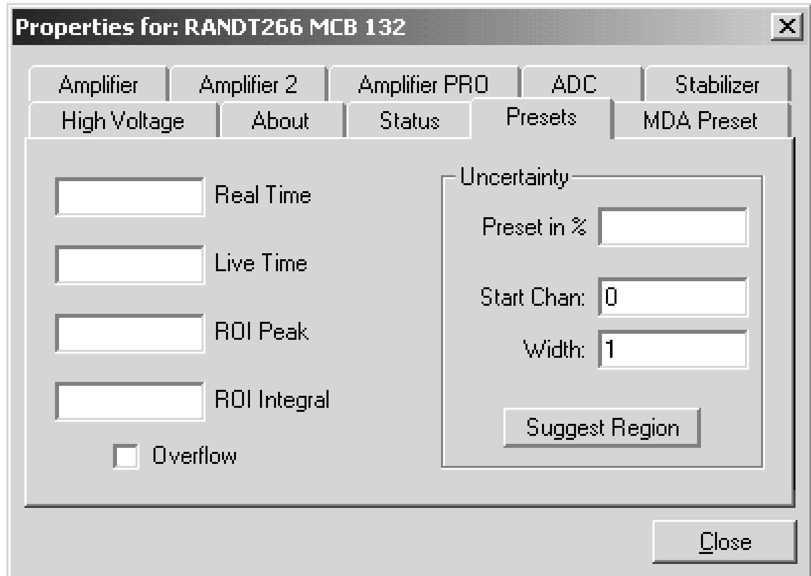


Fig. 72. DSPEC Pro Presets Tab.

The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample may be lower than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command (see Section 3.7).

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.4.9. MDA Preset

The MDA preset (Fig. 73) can monitor up to 20 nuclides at one time, and stops data collection when the values of the *minimum detectable activity* (MDA) for all of the user-specified MDA nuclides reach the needed value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a+\sqrt{b+c*Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*.

The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the MCB is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

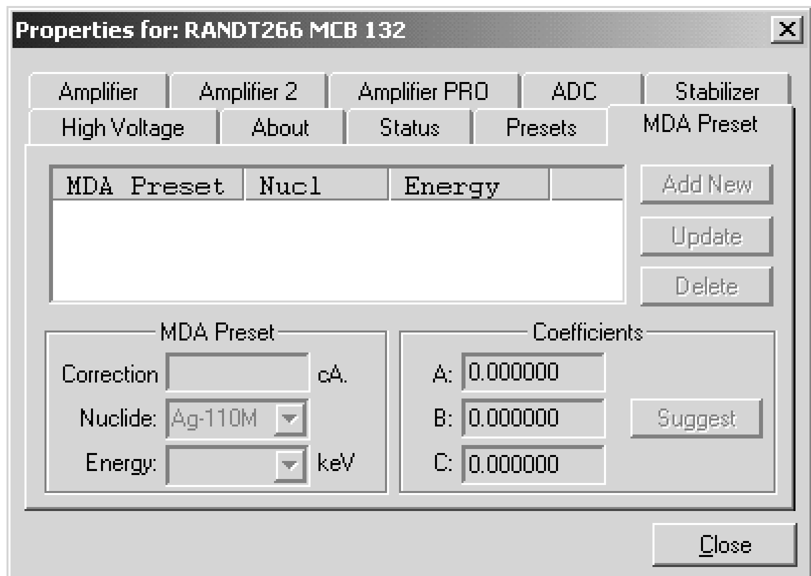


Fig. 73. DSPEC Pro MDA Preset Tab.

3.2.5. DSPEC jr 2.0

3.2.5.1. Amplifier

Figure 74 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Optimize**.

NOTE Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button. The changes you make on most property tabs *take place immediately*. There is no cancel or undo for these dialogs.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 32.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

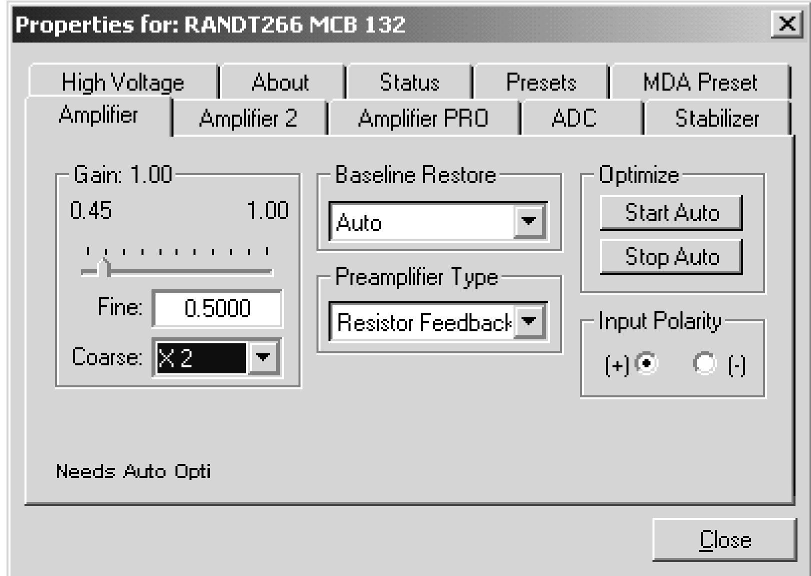


Fig. 74. DSPEC jr 2.0 Amplifier Tab.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise from dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC jr 2.0 even when the power is off. The time constant can be manually set on the InSight display (see Section 3.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the germanium detector being used.

Optimize

The DSPEC jr 2.0 is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** (optimize) button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC jr 2.0, the optimize button does not perform the pole zero.

As with any system, the DSPEC jr 2.0 should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the DSPEC jr 2.0 must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC jr 2.0 front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC jr 2.0 at this time and, if the DSPEC jr 2.0 is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC jr 2.0 is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC jr 2.0, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if you change the flattop width.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape may not change enough for you to see. (In this situation, you also may not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

3.2.5.2. Amplifier 2

Figure 75 shows the Amplifier 2 tab, which accesses the advanced DSPEC jr 2.0 shaping controls including the InSight Virtual Oscilloscope mode (see Section 3.3).

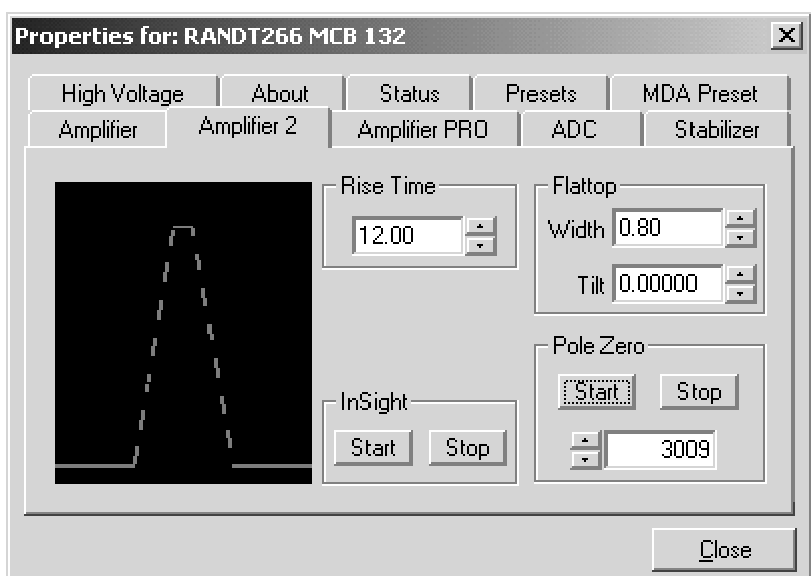


Fig. 75. DSPEC jr 2.0 Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. The value of the rise time parameter in the DSPEC jr 2.0 is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC jr 2.0 value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the **Rise Time** within the range of 0.8 to 23.0 µs. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC jr 2.0 firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **Insight** section on the Amplifier 2 tab and click on **Start**. The InSight mode is discussed in more detail in the following section.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top may be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \mathit{Rise\ Time}) + (2 \times \mathit{Flattop\ Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user may wish to return to **MCB Properties...** and click on the **Insight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

3.2.5.3. Amplifier PRO

This tab (Fig. 76) contains the LFR filter control,[3] which is discussed in detail in the hardware manual. To enable **Low Frequency Rejector** mode, mark the checkbox. Unmark the checkbox to turn off the LFR filter.

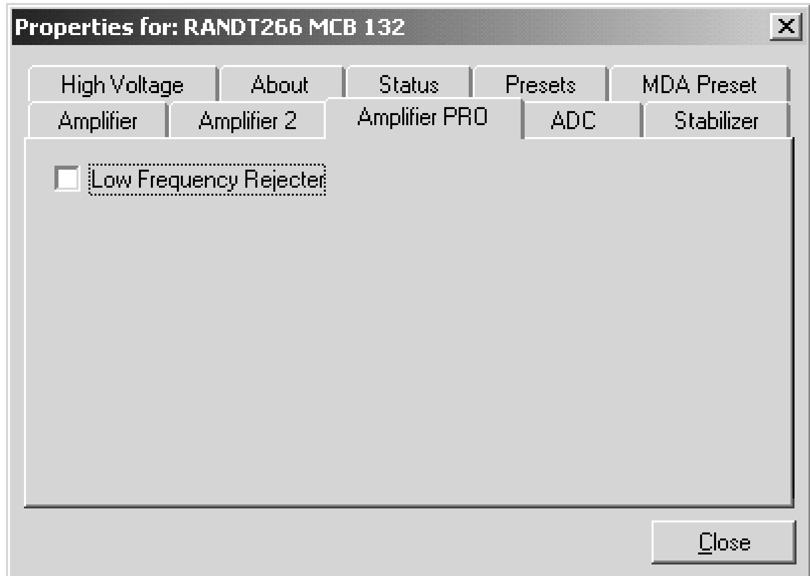


Fig. 76. DSPEC jr 2.0 ADC Tab.

NOTE You *cannot* optimize or pole-zero the DSPEC jr 2.0 while in LFR mode. The Optimize feature should be used with the LFR filter off. Subsequent measurements can then be taken with the LFR filter on.

3.2.5.4. ADC

This tab (Fig. 77) contains the **Gate**, **ZDT Mode**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

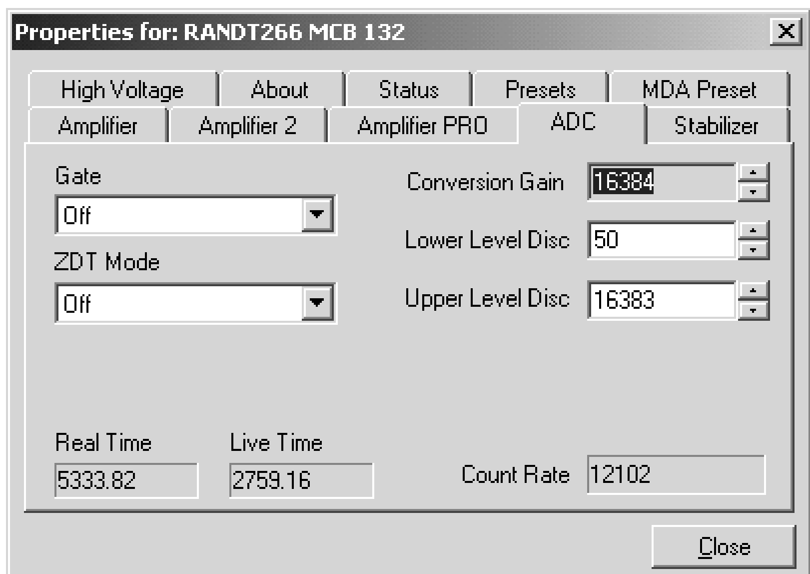


Fig. 77. DSPEC jr 2.0 ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 ns beyond peak detect (peak maximum).

ZDT Mode

Use this droplist to choose the **ZDT Mode** to be used for collecting the zero dead time (corrected) spectrum (see Section 3.6). The three modes are **Off** (LTC only), **NORM_CORR** (LTC and ZDT), and **CORR_ERR** (ERR and ZDT). If one of the ZDT modes is selected, both spectra are stored in the same spectrum (`.SPC`) file. If you do not need the ZDT spectrum, you should select **Off**.

In ***CONNECTIONS*** applications, the display can show either of the two spectra. Use **<F3>** or **Acquire/ ZDT Display Select** to toggle the display between the two spectra. In the Compare mode, **<F3>** switches both spectra to the other type and **<Shift+F3>** switches only the compare spectrum. This allows you to make all types of comparisons.

Conversion Gain

The **Conversion Gain** sets the maxi-mum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048). The up/down arrow buttons step through the valid settings for the DSPEC jr 2.0.

Upper- and Lower-Level Discriminators

In the DSPEC jr 2.0, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

3.2.5.5. Stabilizer

The DSPEC jr 2.0 has both a gain stabilizer and a zero stabilizer. The Stabilizer tab (Fig. 78) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function

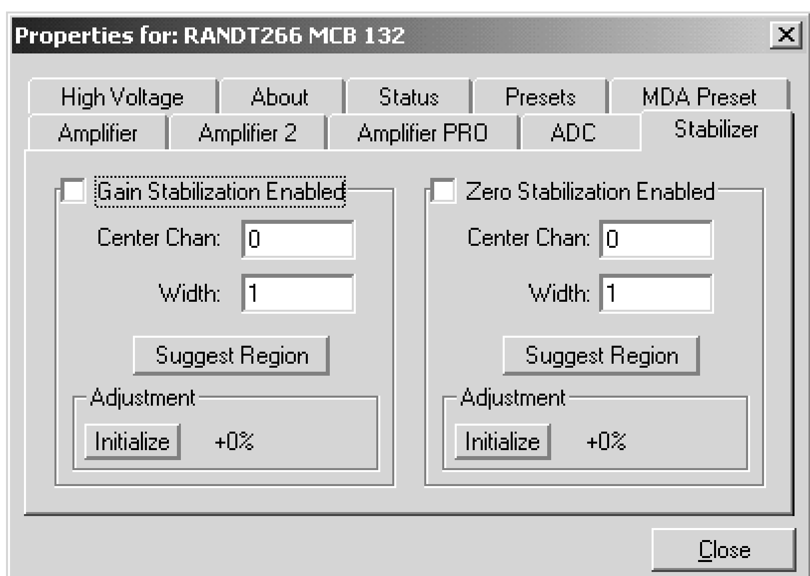


Fig. 78. DSPEC jr 2.0 Stabilizer Tab.

— when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.5.6. High Voltage

Figure 79 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; and choose the **Shutdown** mode. The polarity is set in the DIM module.

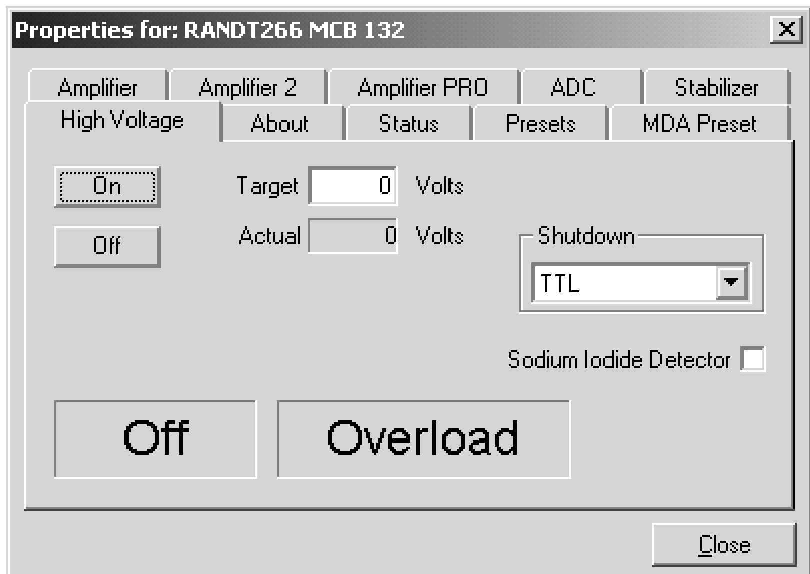


Fig. 79. DSPEC jr 2.0 High Voltage Tab.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be ORTEC, TTL or SMART. The ORTEC mode is used for all ORTEC detectors except SMART-1 detectors. Use the SMART option for those detectors. Check with the detector manufacturer for other detectors. The TTL mode is used for most non-ORTEC detectors.

The high voltage in the DSPEC jr 2.0 is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

To use a **Sodium Iodide Detector**, mark the checkbox. This changes the gain and zero stabilizers to operate in a faster mode.” For the DIM-296, the HV is controlled by the adjustment in the Model 296 and not here.

3.2.5.7. About

This tab (Fig. 80) displays hardware and firmware information about the currently selected DSPEC jr 2.0, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password; **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

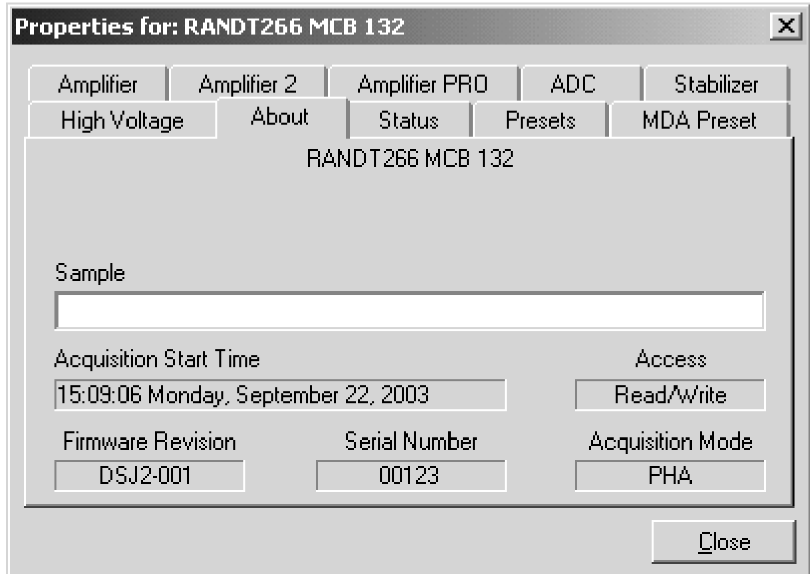


Fig. 80. DSPEC jr 2.0 About Tab.

3.2.5.8. Status

Figure 81 shows the Status tab. There are 21 values monitored at all times. You can select any six of these to be displayed simultaneously on the Status tab. You would normally pick the six that are most important to you. The values you select can be changed at any time, so you can view any of them as needed. Two types of values are presented: **OK** or **ERR**, and numeric value. The state-of-health (SOH) are all **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the DSPEC jr 2.0. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they show **N/A**.

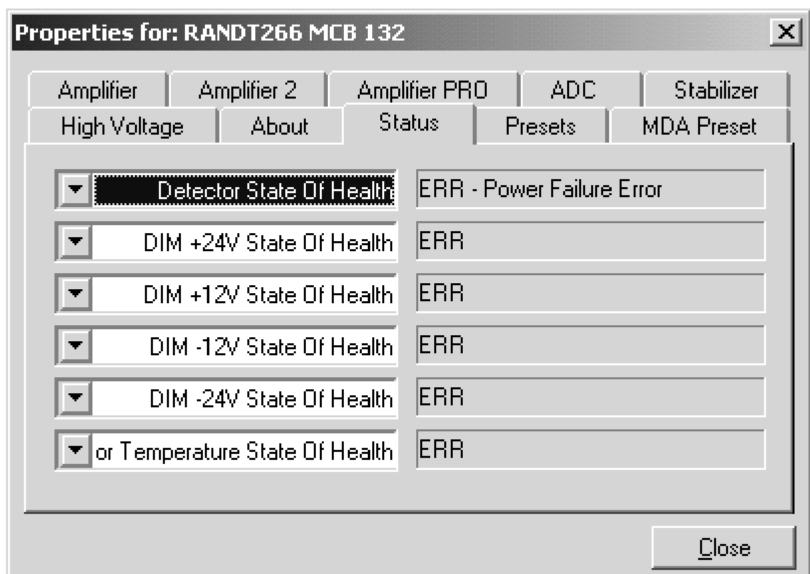


Fig. 81. DSPEC jr 2.0 Status Tab.

The parameters displayed are:

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health
This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health
This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health
This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health
This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health
This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health
This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the -12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the -24 volt supply in the DIM as delivered to the detector.

High Voltage

This is the current value of the high voltage bias supply in the DIM as delivered to the detector.

Detector temperature

This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature

This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage

This is not used in the DSPEC jr 2.0.

Battery % full

This is not used in the DSPEC jr 2.0.

Battery time remaining

This is not used in the DSPEC jr 2.0.

3.2.5.9. Presets

Figure 82 shows the Presets tab. MDA presets are shown on a separate tab. The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To

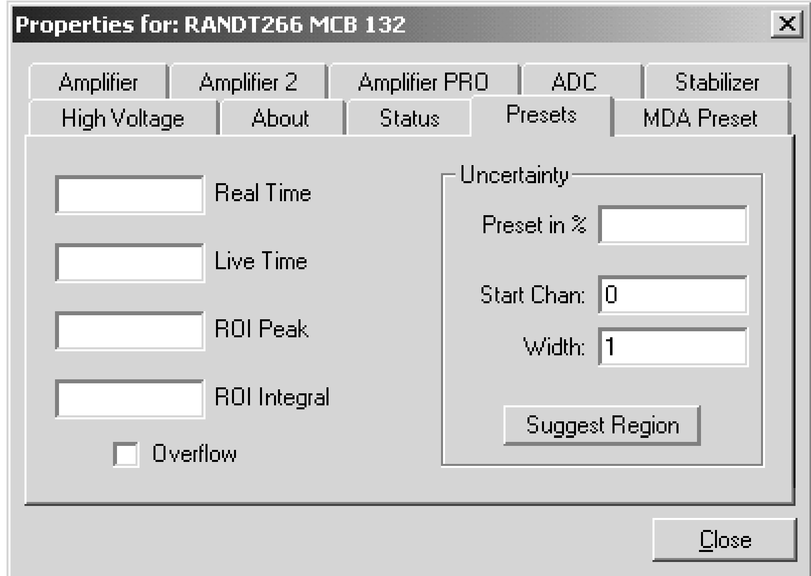


Fig. 82. DSPEC jr 2.0 Presets Tab.

disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample may be lower than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command (see Section 3.7).

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.5.10. MDA Preset

The MDA preset (Fig. 83) can monitor up to 20 nuclides at one time, and stops data collection when the values of the *minimum detectable activity* (MDA) for all of the user-specified MDA nuclides reach the needed value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

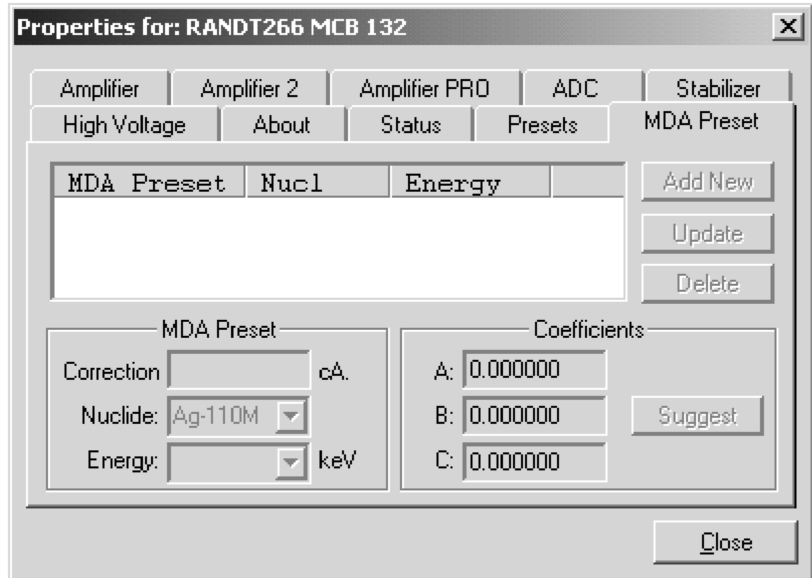


Fig. 83. DSPEC jr 2.0 MDA Preset Tab.

If the application supports efficiency calibration and the MCB is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.6. digiBASE

3.2.6.1. Amplifier

Figure 84 shows the Amplifier tab. This tab contains the controls for **Gain** and **Shaping Time**.

Set the amplifier coarse gain by setting the gain jumper described in the hardware manual to 1, 3, or 9, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.4 to 1.2. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.4 to 10.8.

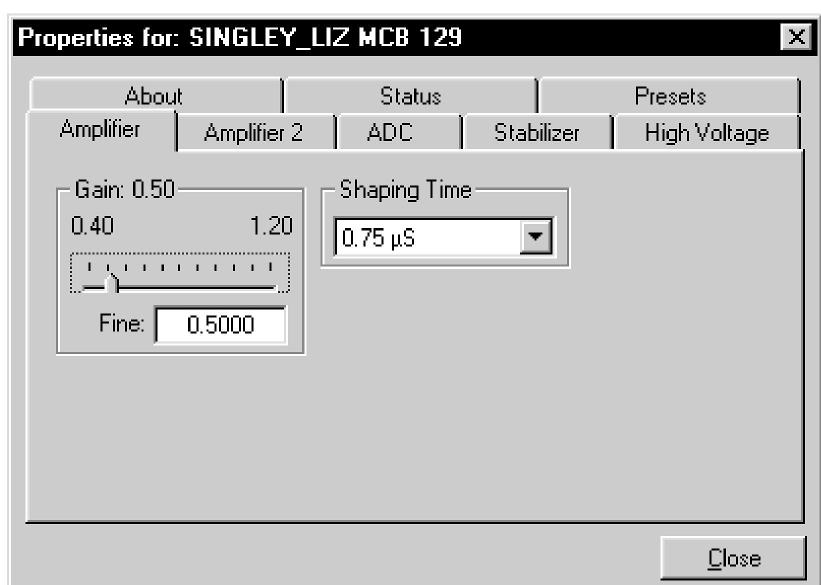


Fig. 84. digiBASE Amplifier Tab.

In almost all cases, the default **Shaping Time**, 0.75 µs, is the preferred setting. However, the digiBASE supports shaping times from 0.75 µs to 2 µs in steps of 0.25 µs.

3.2.6.2. Amplifier 2

Figure 85 shows the Amplifier 2 tab, which accesses the InSight Virtual Oscilloscope mode (see Section 3.3). For the more advanced user, the InSight mode allows you to directly the digiBASE's advanced shaping parameters and adjust them interactively while collecting live data. To access the InSight mode, click on **Start**.

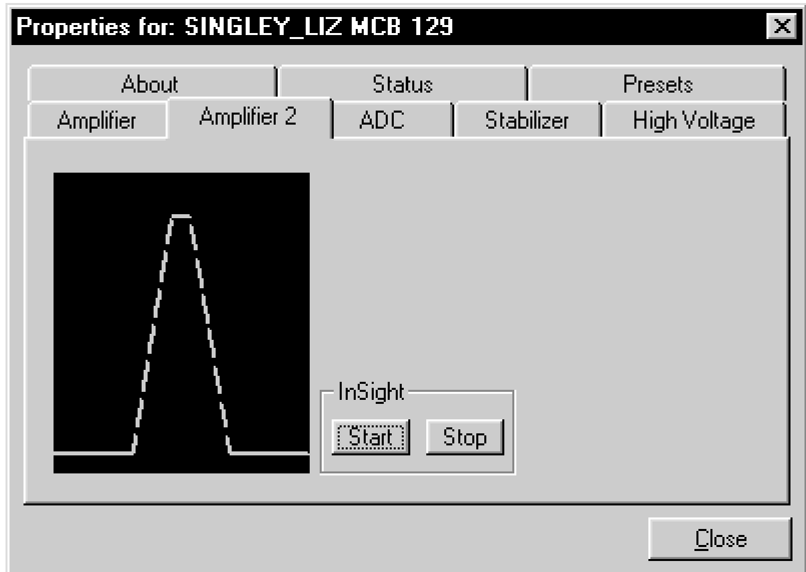


Fig. 85. digiBASE Amplifier 2 Tab.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data. Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and switch to the Insight mode to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

3.2.6.3. ADC

This tab (Fig. 86) contains the **Gate**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

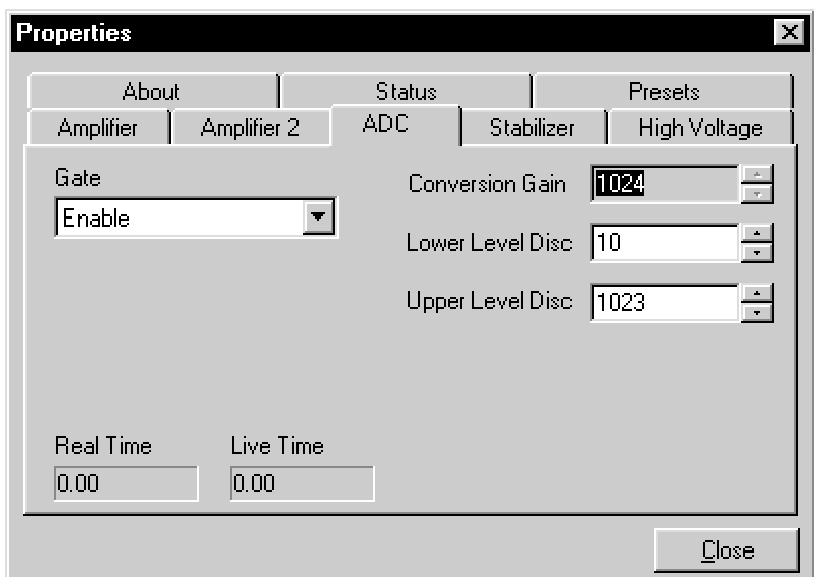


Fig. 86. digiBASE ADC Tab.

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed).

When the **Gate** is set to **Enable**, if the ENABLE INPUT is low (<0.8V), real time, live time, and data acquisition are stopped. When the ENABLE INPUT is left open or forced high (>2.0V), real time, live time, and data acquisition are enabled.

If set to **Coincidence**, when the ENABLE INPUT is low, real time and live time operate normally, but no counts are stored in memory. If the ENABLE INPUT is high, normal acquisition occurs.

If set to **Event**, rising edges are counted by a 32-bit event counter. The contents of this counter can be monitored in the **Enable Counter** field on the Status tab (Section 3.2.6.7). The input impedance is 5-kΩ to +3.3V, protected to ±10 V.

The digiBASE operates at a **Conversion Gain** of 1024 only.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

3.2.6.4. Stabilizer

The digiBASE has both a gain stabilizer and a zero stabilizer; their operation is discussed in more detail in Sections 3.4 and 3.5.

The Stabilizer tab (Fig. 87) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

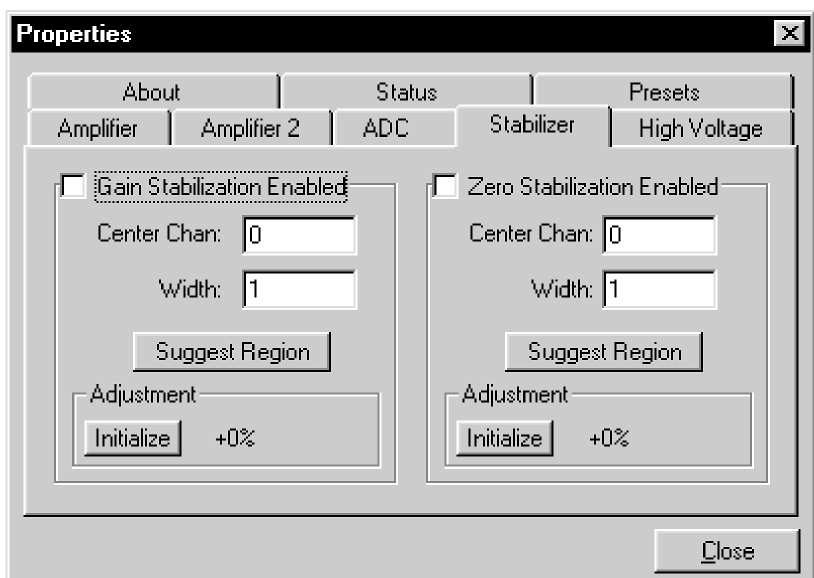


Fig. 87. digiBASE Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.6.5. High Voltage

Figure 88 shows the High Voltage tab, which allows you to turn the high voltage on or off; and set and monitor the voltage.

Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

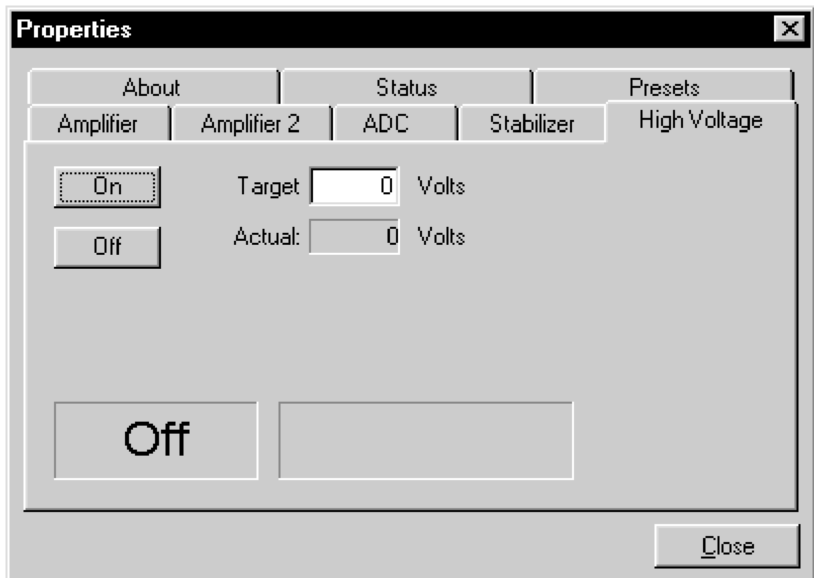


Fig. 88. digiBASE High Voltage Tab.

3.2.6.6. About

This tab (Fig. 89) displays hardware and firmware information about the currently selected DSPEC Plus as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password. **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

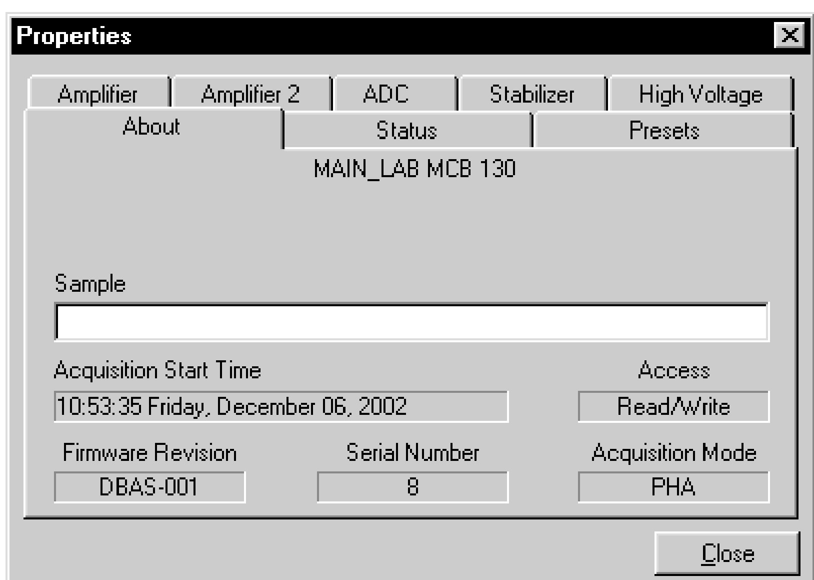


Fig. 89. digiBASE About Tab.

3.2.6.7. Status

Figure 90 shows the Status tab. The **Aux0** and **Aux1** counters are reserved for future use. The **Enable Counter** functions when the **Gate** function on the ADC tab is set to **Event** and the digiBASE is actively acquiring data in a spectrum. Under these conditions, the **Enable Counter** accrues the number of events at the ENABLE INPUT since the **Start** command was issued. To clear this counter, click on the **Clear Spectrum** button on the application toolbar or issue **Acquire/ Clear**.

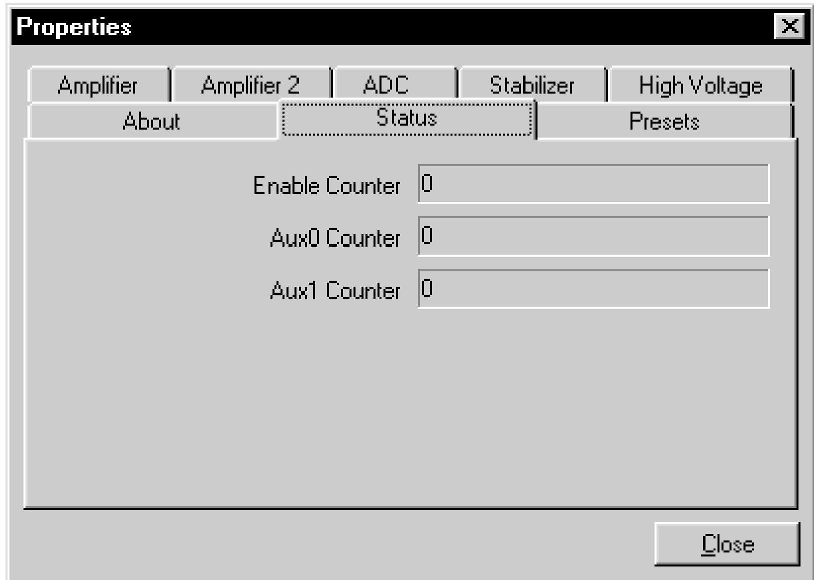


Fig. 90. digiBASE Status Tab.

3.2.6.8. Presets

Figure 91 shows the Presets tab. The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use either or both presets at one time. To disable a preset, enter a value of zero. If you disable both presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting.

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

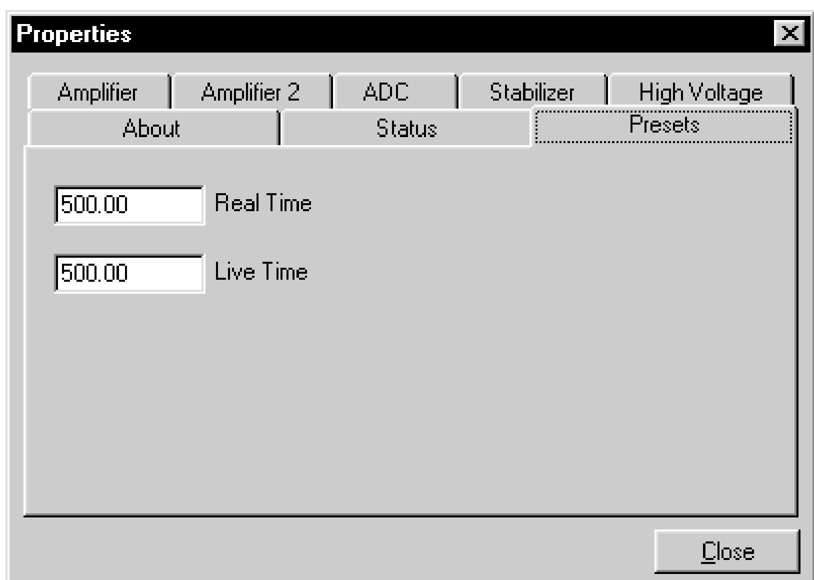


Fig. 91. digiBASE: The Presets Tab.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

3.2.7. DSP-Scint

3.2.7.1. Amplifier

Figure 92 shows the Amplifier tab, which contains the **Gain** control.

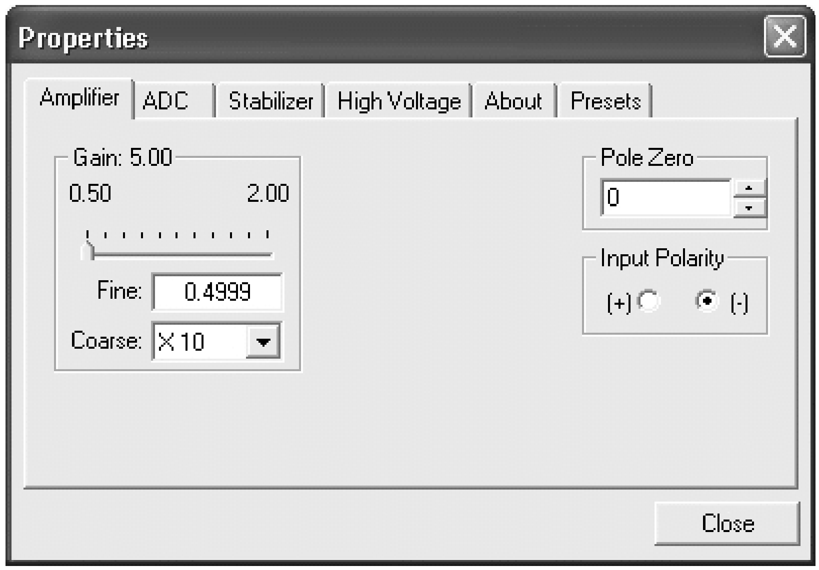


Fig. 92. DSP-Scint Amplifier Tab.

Set the amplifier coarse gain by selecting from the **Coarse** droplist (5× to 910×), then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.5 to 2.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 2.5 to 1820.

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, preamplifiers used with NaI(Tl) detectors have a negative signal. Occasionally, a preamplifier with a positive output polarity might be encountered; check the specifications for the PMT base and preamplifier you have chosen.

Pole Zero Adjustment

To maintain optimum energy resolution and peak position stability to high counting rates, it is important to enter the correct value for the pole-zero cancellation. As a starting point, use the exponential decay time constant that is appropriate for the preamplifier supplying the signal to the DSP-Scint input. This initial value can be obtained from the preamplifier manufacturer's data sheet, or by measuring the exponential decay time constant of the preamplifier output with an oscilloscope. The exponential decay time constant is the time taken for the pulse at the preamplifier output to decay to $1/e = 0.368$ of its initial value. This known or measured value for the decay time constant must be converted to the corresponding pole-zero value to be entered in the **Pole Zero** field. Compute the value to be entered from the following equation:

$$\textbf{\textit{Pole Zero}} = 42.53 * \tau - 158.44$$

where τ is the exponential decay time constant in microseconds.

Enter a number between 0 and 4095, which will correspond to decay time constants from 3.725 µs to 100 µs according to the relationship:

$$\tau = 0.02351 * \textbf{\textit{Pole Zero}} + 3.725$$

Example: For a typical 50-µs decay time constant, you will enter the number 1968.

To make a fine adjustment of the **Pole Zero** setting:

1. Use a radioactive source that produces a well-defined peak near the upper limits of the energy spectrum. At low counting rates, note the symmetry of the peak.

2. Move the source closer to the detector to achieve much higher counting rates. If the peak maintains the symmetry observed at low counting rates no further adjustment of the **Pole Zero** is needed. If high counting rates generate a tail on the high energy side of the peak, slightly decrease the pole-zero value until the tail disappears. If high counting rates generate a tail on the low-energy side of the peak, slightly increase the pole-zero value until the tail disappears.

3. Make a final adjustment to balance the symmetry of the peak as closely as possible to the symmetry observed at low counting rates. This will result in the optimum pole-zero adjustment.

3.2.7.2. ADC

This tab (Fig. 93) contains the **Gate**, **Conversion Gain**, and **Lower Level** and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

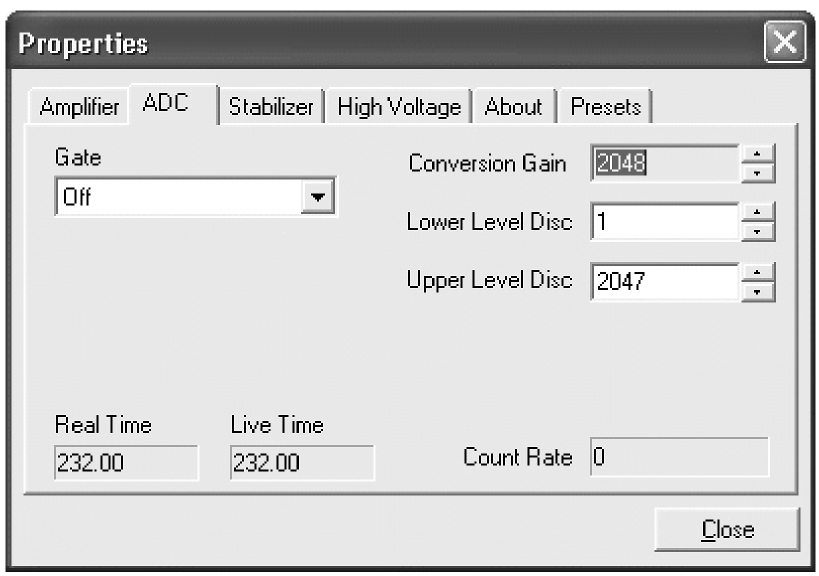


Fig. 93. DSP-Scint ADC Tab.

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed). In **Coincidence** mode, a gating input signal *must be* present at the proper time for the conversion of the event. In **Anticoincidence** mode, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 ns beyond peak detect (peak maximum).

NOTE The DSP-Scint ensures that the minimum length of the gating signal is 4 µs.

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 2048, the energy scale will be divided into 2048 channels. The conversion gain is entered in powers of 2 (e.g., 2048, 1024, 512, 256). The up/down arrow buttons step through the valid settings.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This establishes a lower-level cutoff, by channel number, for ADC conversions. Set this level low enough to see the lowest-energy feature of interest. However, avoid setting it so low that it generates a high dead time by accepting noise. The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for storage.

3.2.7.3. Stabilizer

The Stabilizer tab (Fig. 94) shows the current value for the gain stabilizer. The value in the **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

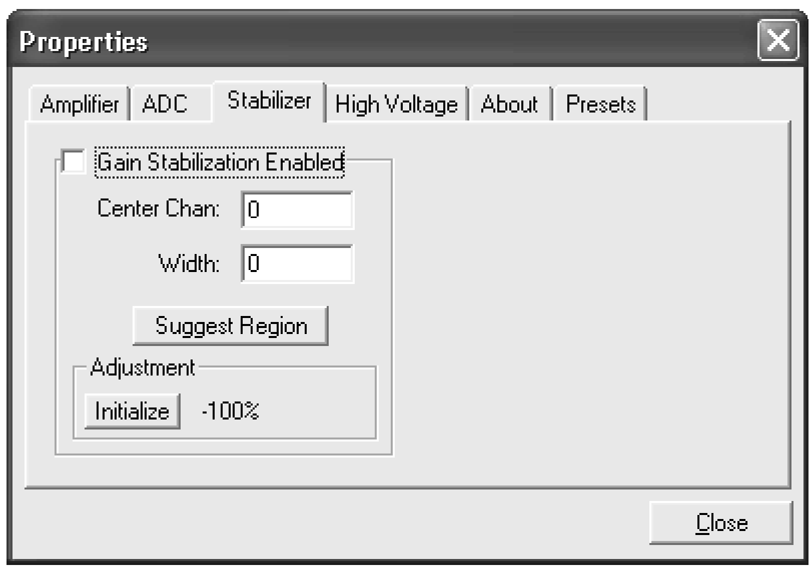


Fig. 94. DSP-Scint Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. The center channel is the marker channel and the width is 4 times the FWHM at this energy. Now click on the **Gain Stabilization Enabled** checkbox to turn the stabilizer on. The stabilizer will stay enabled, even if the power is turned off, until changed in this dialog. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.7.4. High Voltage

Figure 95 shows the High Voltage tab, which allows you to turn the high voltage on or off. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

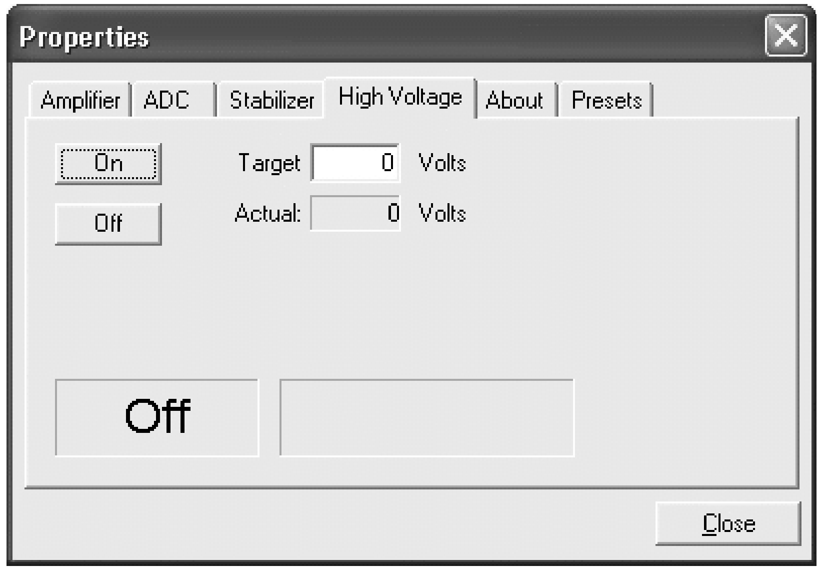


Fig. 95. DSP-Scint High Voltage Tab.

3.2.7.5. About

This tab (Fig. 96) displays hardware and firmware information about the currently selected DSP-Scint as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password. **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

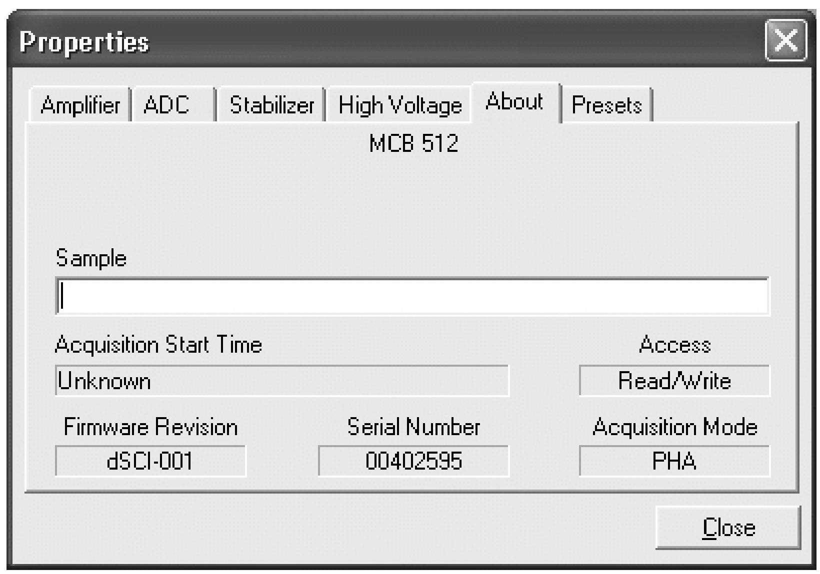


Fig. 96. DSP-Scint About Tab.

3.2.7.6. Presets

Figure 97 shows the Presets tab. A preset can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive).

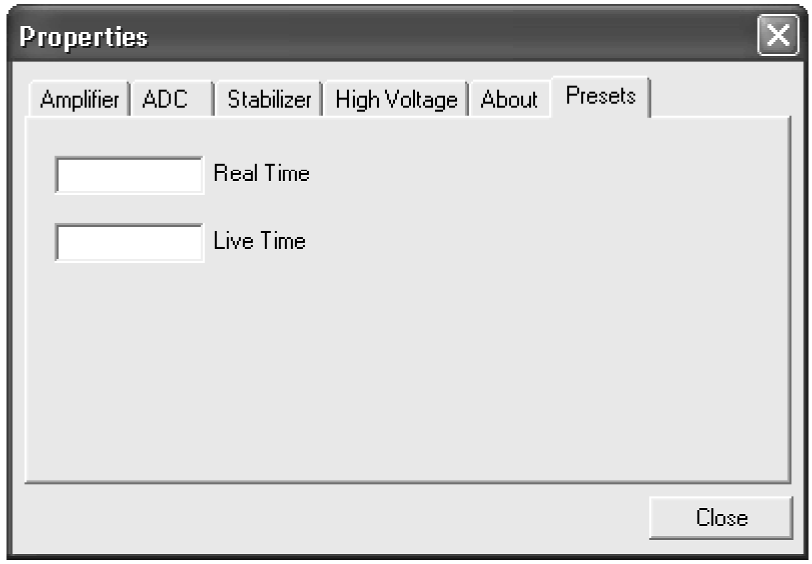


Fig. 97. DSP-Scint Presets Tab.

Enter either the **Real Time** or **Live Time** preset in units of seconds and fractions of a second. This value is stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

To disable a preset, enter a value of zero. If both presets are disabled, data acquisition will continue until manually stopped. The values of all presets for the currently selected Detector are shown on the application's Status Sidebar.

3.2.8. microBASE

3.2.8.1. Amplifier

Figure 98 shows the Amplifier tab, which contains the **Gain** control.

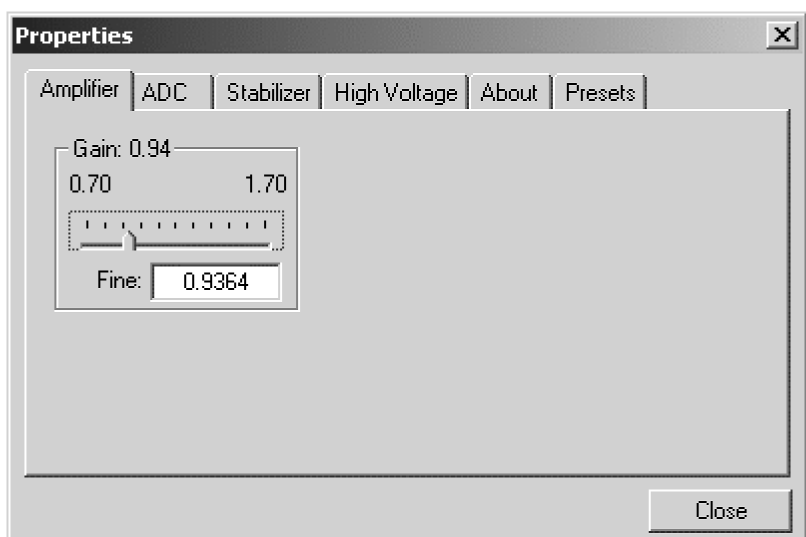


Fig. 98. microBASE Amplifier Tab.

The amplifier coarse gain is automatically set by the PMT being used. This tab allows you to adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.7224 to 1.625. The resulting effective gain is shown at the top of the **Gain** section and depends on the PMT.

For NaI detectors, the observed spectrum gain depends in part on the detector/PMT pair and will vary depending on the individual components. If necessary, the gain can also be adjusted by varying the HV applied to the PMT. In some cases, the HV will have to be adjusted to set the spectrum gain to the desired level.

3.2.8.2. ADC

This tab (Fig. 99) contains the **Lower Level** and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for storage.

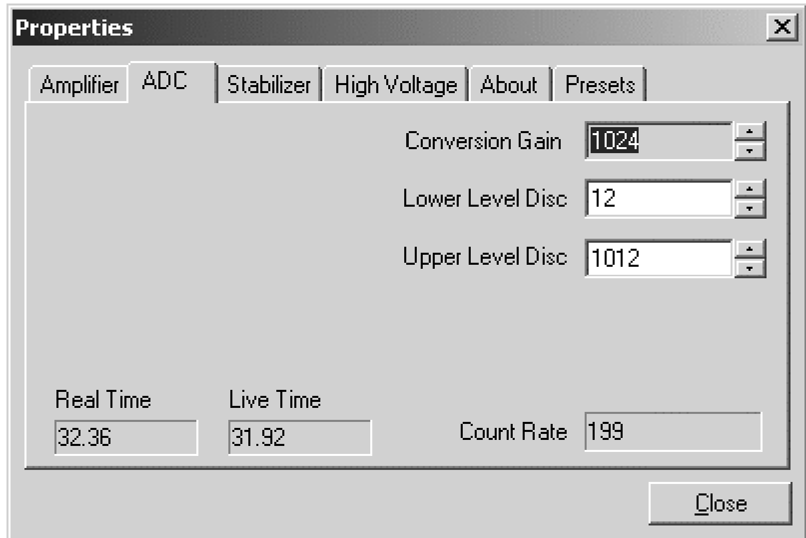


Fig. 99. microBASE ADC Tab.

3.2.8.3. Stabilizer

The Stabilizer tab (Fig. 100) shows the current value for the gain stabilizer. The value in the **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

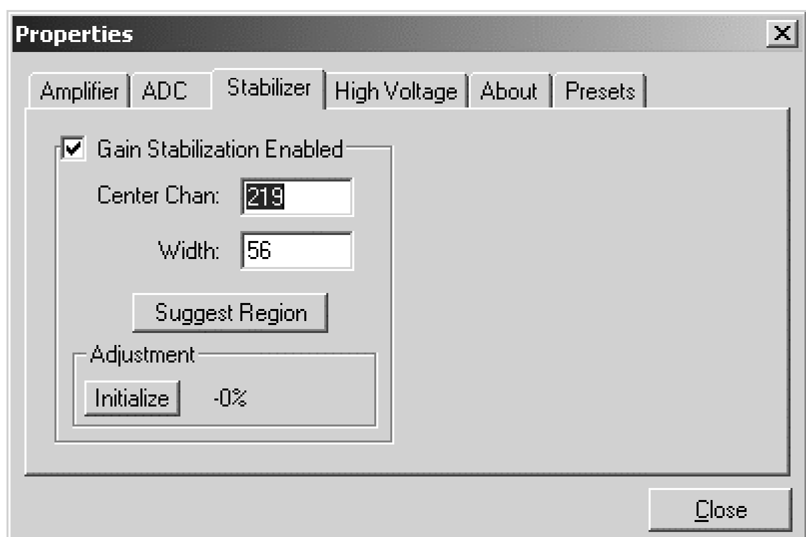


Fig. 100. microBASE Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the **Gain Stabilization Enabled** checkbox to turn the stabilizer on. The stabilizer will stay enabled, even if the power is turned off, until changed in this dialog. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.8.4. High Voltage

Figure 101 shows the High Voltage tab, which allows you to turn the high voltage on or off. The maximum voltage for the microBASE is +1200 V.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

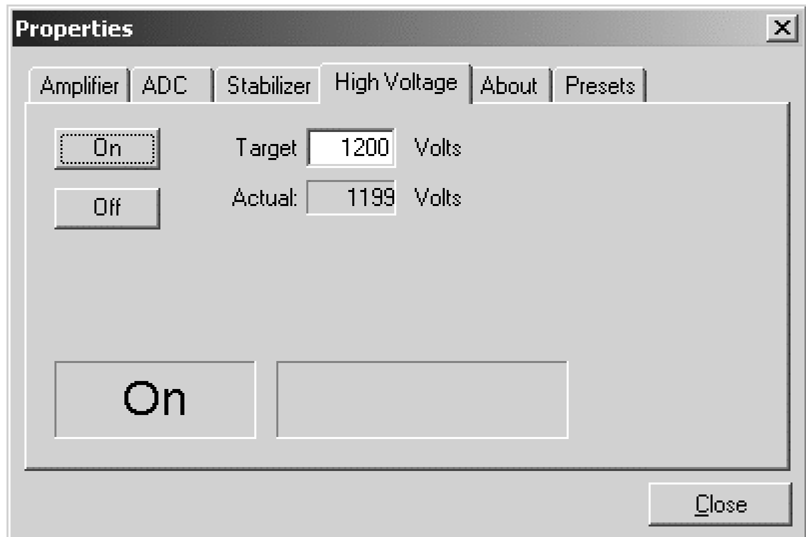


Fig. 101. microBASE High Voltage Tab.

3.2.8.5. About

This tab (Fig. 102) displays hardware and firmware information about the currently selected microBASE as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password. **Read/Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

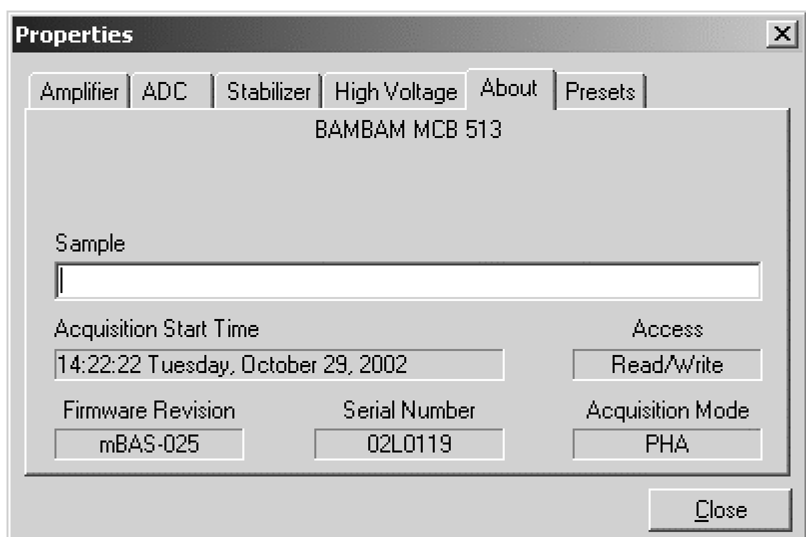


Fig. 102. microBASE About Tab.

3.2.8.6. Presets

Figure 103 shows the Presets tab. A preset can only be set on a Detector that is not acquiring data (during acquisition the preset fields are inactive/gray).

Enter either the **Real Time** or **Live Time** preset in units of seconds and fractions of a second. This value is stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

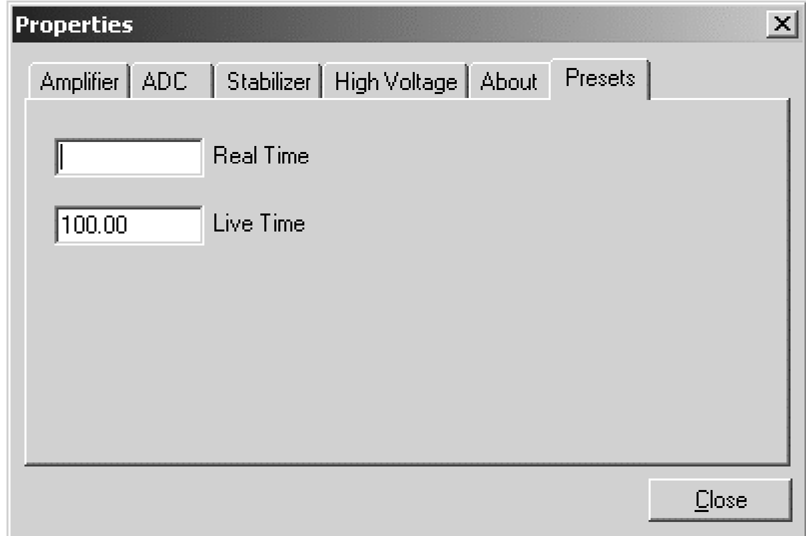


Fig. 103. microBASE Presets Tab.

To disable a preset, enter a value of zero. If both presets are disabled, data acquisition will continue until manually stopped. The values of all presets for the currently selected Detector are shown on the application's Status Sidebar.

3.2.9. DSPEC jr

3.2.9.1. Amplifier

Figure 104 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Optimize**. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button.

NOTE The changes you make on most property tabs *take place immediately*. There is no cancel or undo for these dialogs.

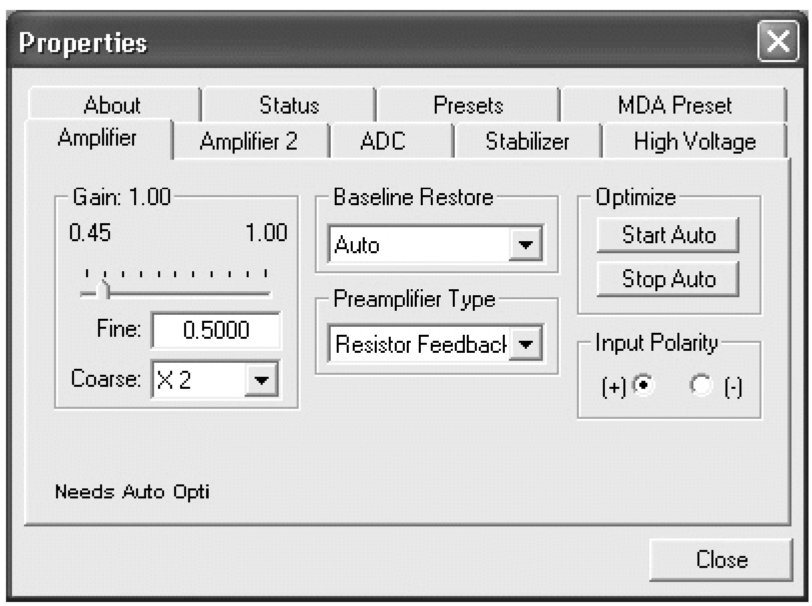


Fig. 104. DSPEC jr Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 100.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC jr even when the power is off. The time constant can be manually set on the InSight display (see Section 3.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the germanium detector being used.

Optimize

The DSPEC jr is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** optimization button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC jr, the **Start Auto** button does not perform the pole zero.

As with any system, the DSPEC jr should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the DSPEC jr must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC jr front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC jr at this time and, if the DSPEC jr is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC jr is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC jr, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if the flattop width is changed.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape might not change enough for you to see. (In this situation, you also might not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

3.2.9.2. Amplifier 2

Figure 105 shows the Amplifier 2 tab, which accesses the advanced DSPEC jr shaping controls including the InSight Virtual Oscilloscope mode, which is discussed in Section 3.3.

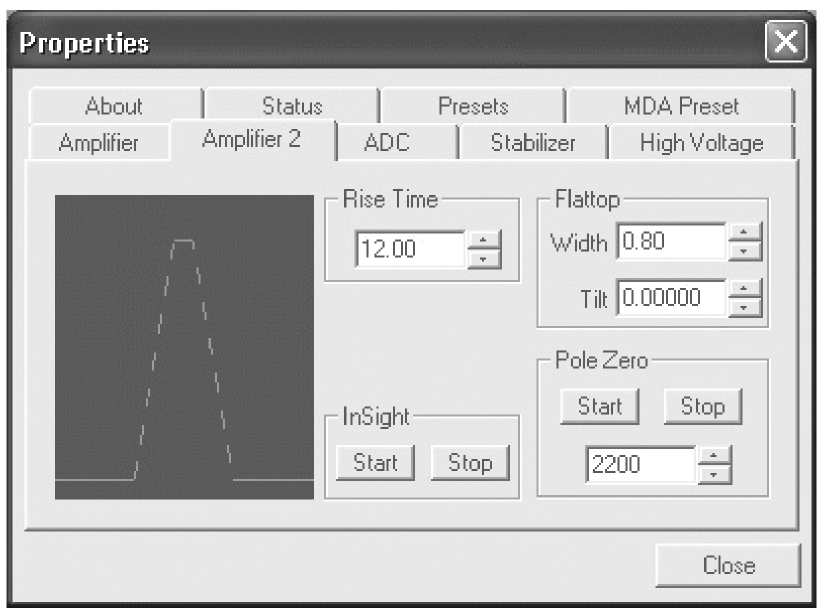


Fig. 105. DSPEC jr Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. Section 3.8 discusses this tradeoff and contains a guide to choosing rise time according to count rate. The value of the rise time parameter in the DSPEC jr is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC jr value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the rise time within the range of 0.2 to 23.0. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC jr firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **InSight** section on the Amplifier 2 tab and click on **Start**.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top can be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \mathit{Rise\ Time}) + (2 \times \mathit{Flattop\ Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and click on the **InSight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well. Section 3.3 provides detailed instructions on using the InSight mode.

3.2.9.3. ADC

This tab (Fig. 106) contains the **Gate**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048). The up/down arrow buttons step through the valid settings for the DSPEC jr.

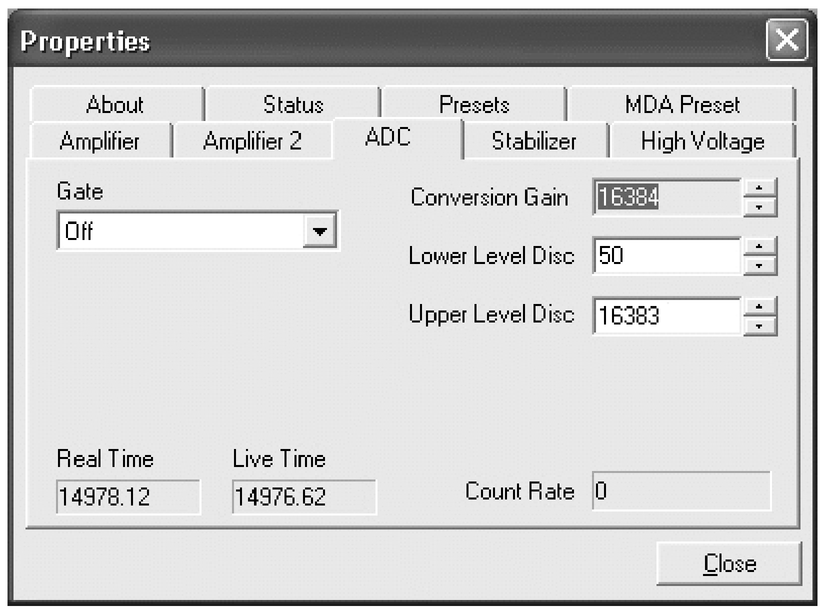


Fig. 106. DSPEC jr ADC Tab.

Upper- and Lower-Level Discriminators

In the DSPEC jr, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for storage.

3.2.9.4. Stabilizer

The DSPEC jr has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively. See also **Sodium Iodide Detector** (page 89) on the High Voltage tab.

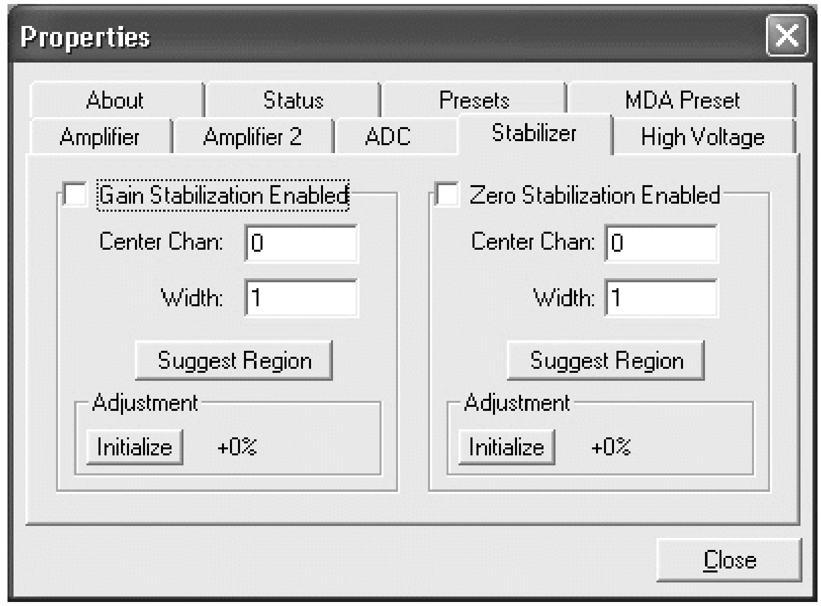


Fig. 107. DSPEC jr Stabilizer Tab.

The Stabilizer tab (Fig. 107) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.9.5. High Voltage

Figure 108 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; and choose the **Shutdown** mode. The polarity is set in the DIM module.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be **ORTEC**, **TTL** or **SMART**. The **ORTEC** mode is used for all ORTEC detectors except SMART-1 detectors; use the **SMART** option for those detectors. Check with

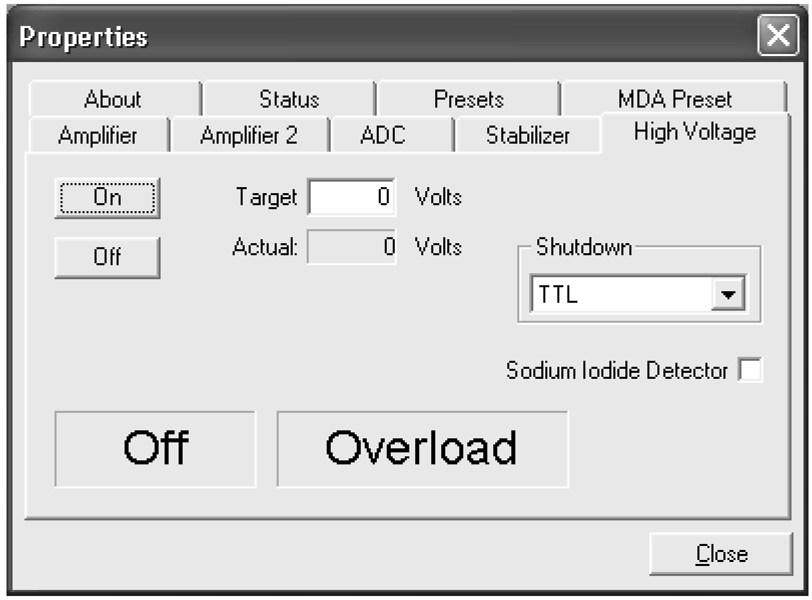


Fig. 108. DSPEC jr High Voltage Tab.

the detector manufacturer for other detectors. The **TTL** mode is used for most non-ORTEC detectors.

The high voltage in the DSPEC jr is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

To use a **Sodium Iodide Detector**, mark the checkbox. This changes the gain and zero stabilizers to operate in a faster mode. For the DIM-296, the HV is controlled by the adjustment in the Model 296 and not here.

3.2.9.6. About

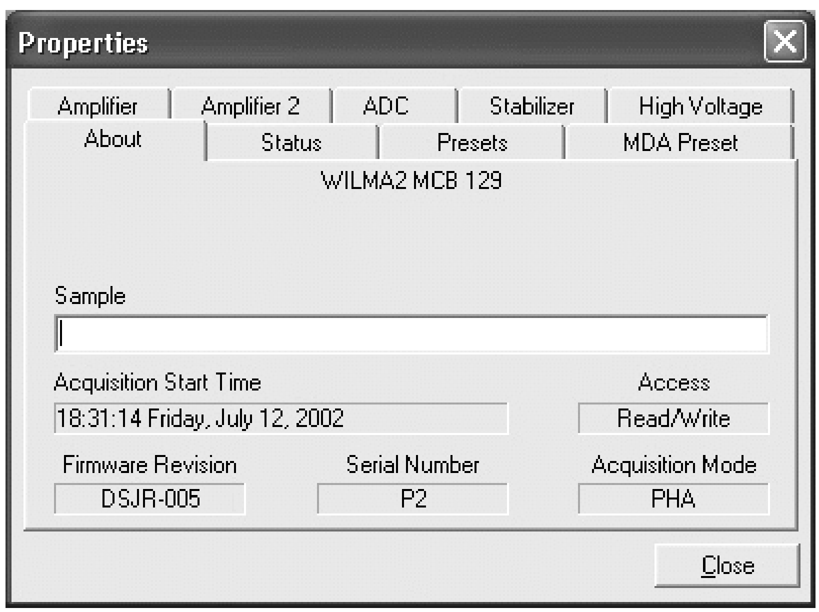


Fig. 109. DSPEC jr About Tab.

This tab (Fig. 109) displays hardware and firmware information about the currently selected DSPEC jr as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

3.2.9.7. Status

Figure 110 shows the Status tab. Twenty-one parameters are monitored at all times. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab (normally these would be the six that are most important to you). The items you select can be changed at any time.

Two types of status responses are displayed: **OK** or **ERR**, and a numeric value. The state-of-health (SOH) parameters all respond with **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the DSPEC jr. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they respond with **N/A**.

The parameters are:

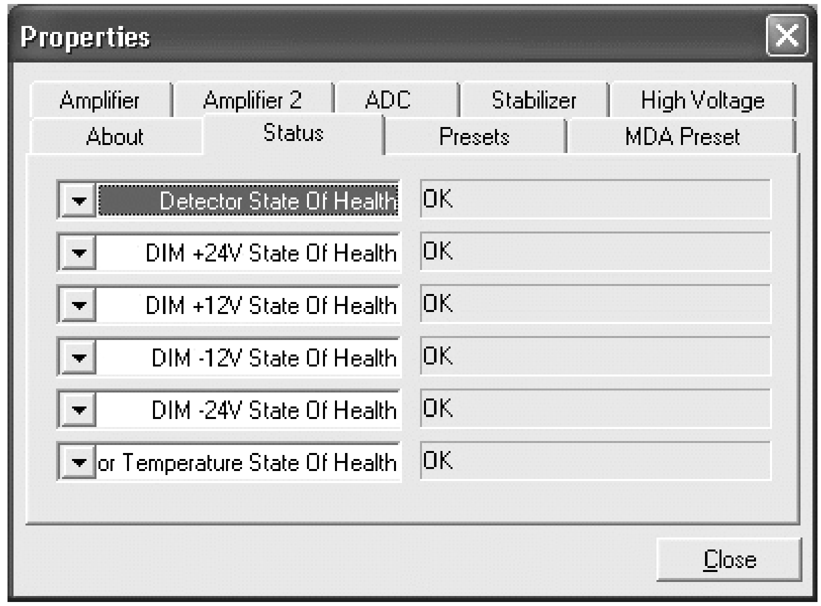


Fig. 110. DSPEC jr Status Tab.

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health
This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health
This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health

This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health

This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health

This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health

This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the −12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the −24 volt supply in the DIM as delivered to the detector.

High Voltage

This is the current value of the high voltage bias supply in the DIM as delivered to the detector.

Detector temperature

This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature

This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage

This is not used in the DSPEC jr.

Battery % full

This is not used in the DSPEC jr.

Battery time remaining

This is not used in the DSPEC jr.

3.2.9.8. Presets

Figure 111 shows the Presets tab. MDA presets are shown on a separate tab.

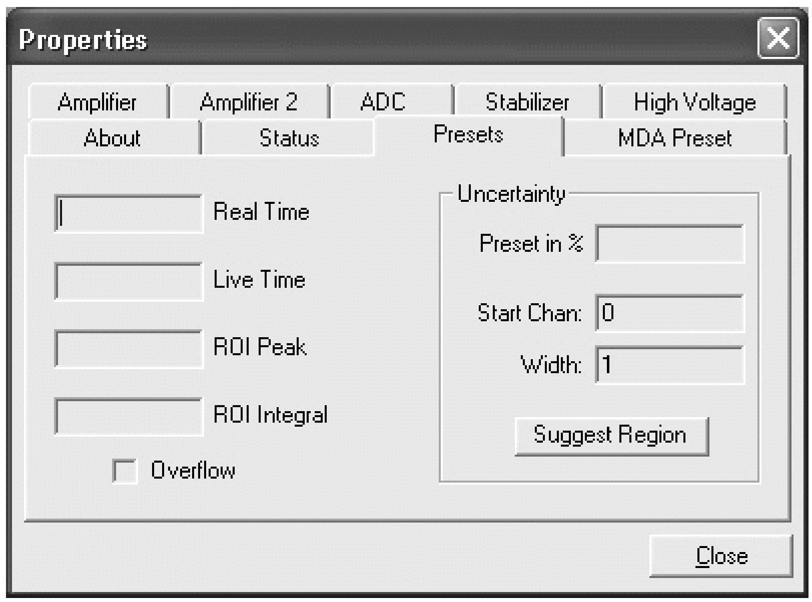


Fig. 111. DSPEC jr Presets Tab.

The presets can only be set on an MCB that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value. This has no function if no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be lower than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

3.2.9.9. MDA Preset

The MDA preset (Fig. 112) can monitor up to 20 nuclides at one time, and stops data collection when the minimum detectable activity for each of the user-specified MDA nuclides reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual, and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

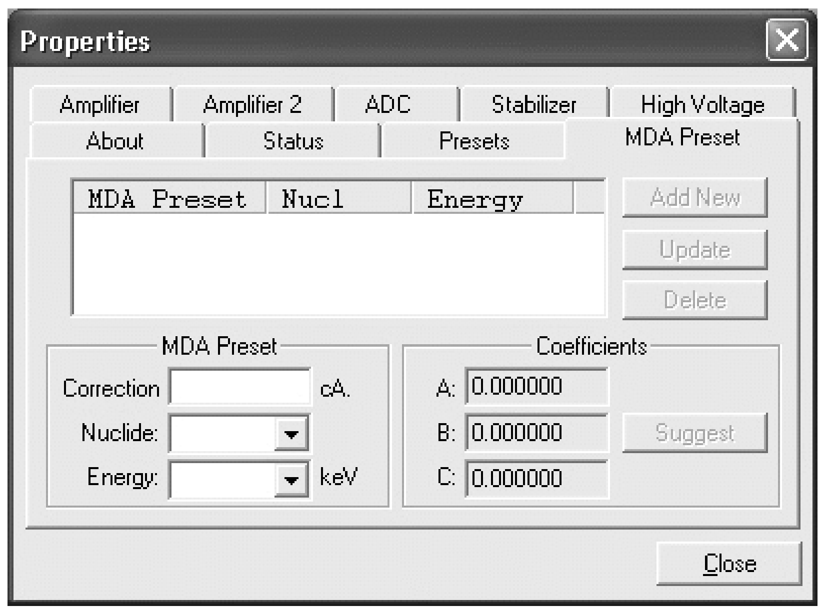


Fig. 112. DSPEC jr MDA Preset Tab.

If the application supports efficiency calibration and the MCB is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction**

factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.10. digiDART

3.2.10.1. Amplifier

Figure 113 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and optimization. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog.*

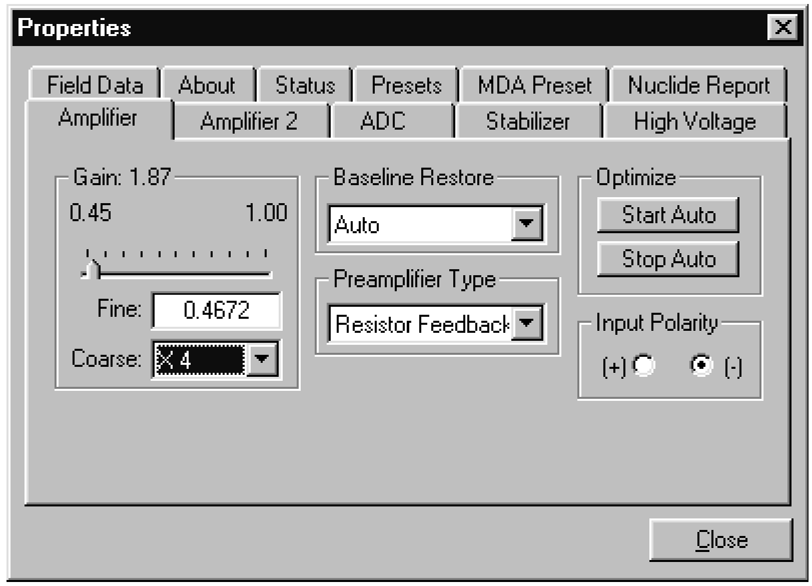


Fig. 113. digiDART Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 100.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (auto, fast, or slow) are saved in the digiDART even when the power is off. The time constant can be manually set on the InSight display (see Section 3.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the type of germanium detector being used.

Optimize

The digiDART is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** optimization button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this digiDART, the **Start Auto** button does not perform the pole zero.

As with any system, the digiDART should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the digiDART must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the digiDART front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the digiDART at this time and, if the digiDART is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the digiDART is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the digiDART, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if the flattop width is changed.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape might not change enough for you to see. (In this situation, you also might not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

3.2.10.2. Amplifier 2

Figure 114 shows the Amplifier 2 tab, which accesses the advanced digiDART shaping controls including the InSight Virtual Oscilloscope mode, which is discussed in Section 3.3.

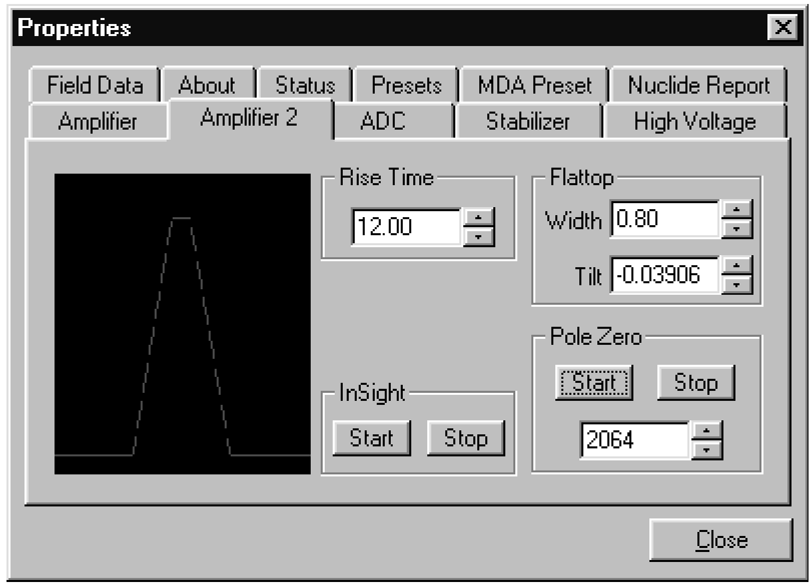


Fig. 114. digiDART Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. Section 3.8 discusses this tradeoff and contains a guide to choosing rise time according to count rate. The value of the rise time parameter in the digiDART is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a digiDART value of 12 µs corresponds to 6 µs in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the rise time within the range of 0.2 to 23.0. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the digiDART firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **InSight** section on the Amplifier 2 tab and click on **Start**.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top can be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \textit{Rise Time}) + (2 \times \textit{Flattop Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and click on the **InSight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well. Section 3.3 provides detailed instructions on using the InSight mode.

3.2.10.3. ADC

This tab (Fig. 115) contains the **Gate**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

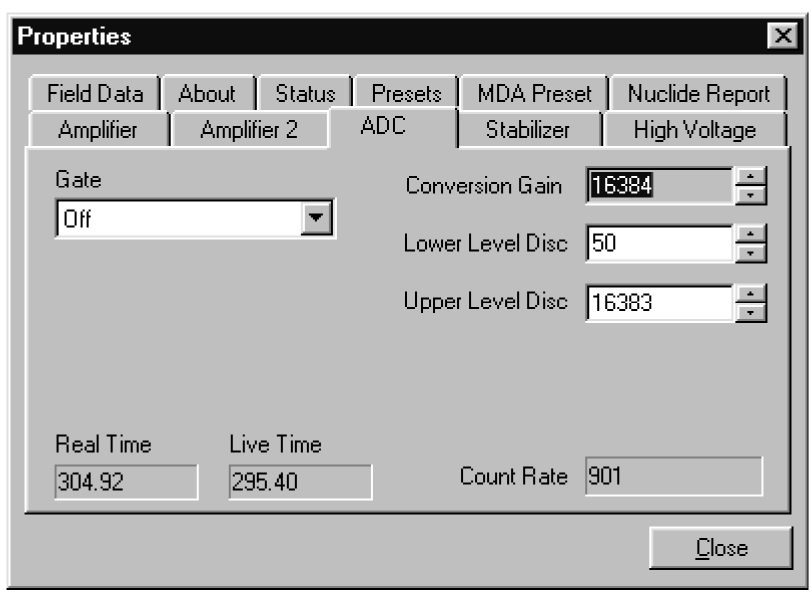


Fig. 115. digiDART ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings for the digiDART.

Upper- and Lower-Level Discriminators

In the digiDART, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

3.2.10.4. Stabilizer

The digiDART has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 116) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

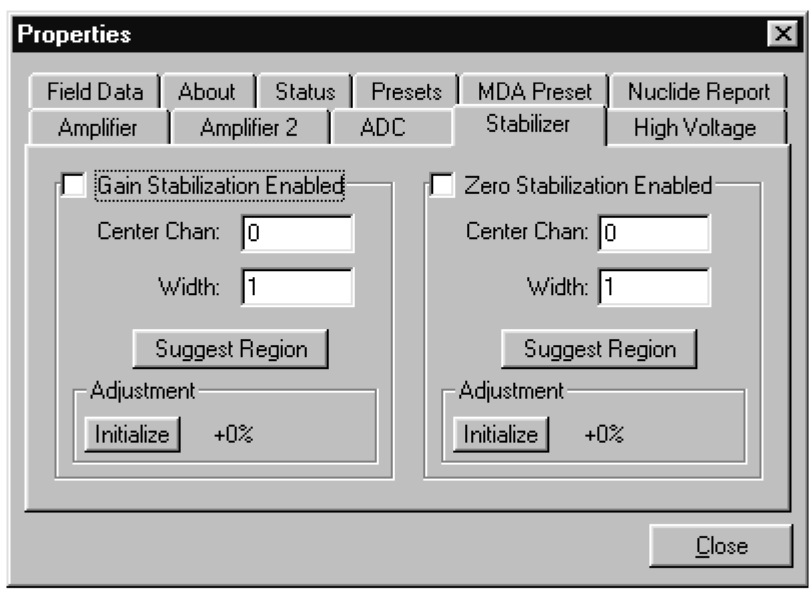


Fig. 116. digiDART Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.10.5. High Voltage

Figure 117 shows the High Voltage tab, which allows you to turn the high voltage on or off, set and monitor the voltage, and choose the **ShutDown** mode.

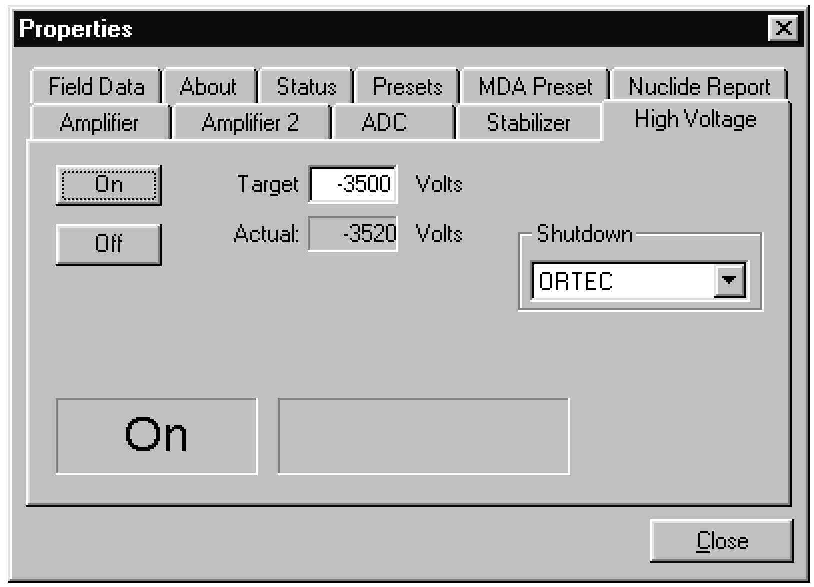


Fig. 117. digiDART High Voltage Tab.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be **ORTEC**, **TTL** or **SMART**. The **ORTEC** mode is used for all **ORTEC** detectors except SMART-1 detectors; use the SMART option for those detectors. Check with the detector manufacturer for other detectors. The **TTL** mode is used for most non-ORTEC detectors.

The high voltage in the digiDART is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

3.2.10.6. Field Data

This tab (Fig. 118) is used to view the digiDART spectra collected in Field Mode, that is, in remote mode, detached from a PC. The digiDART is always in Field Mode when disconnected from the PC. The spectrum can then be viewed as the "active" spectrum in the digiDART. The active spectrum is the spectrum where the new data are collected. The current active spectrum is lost.

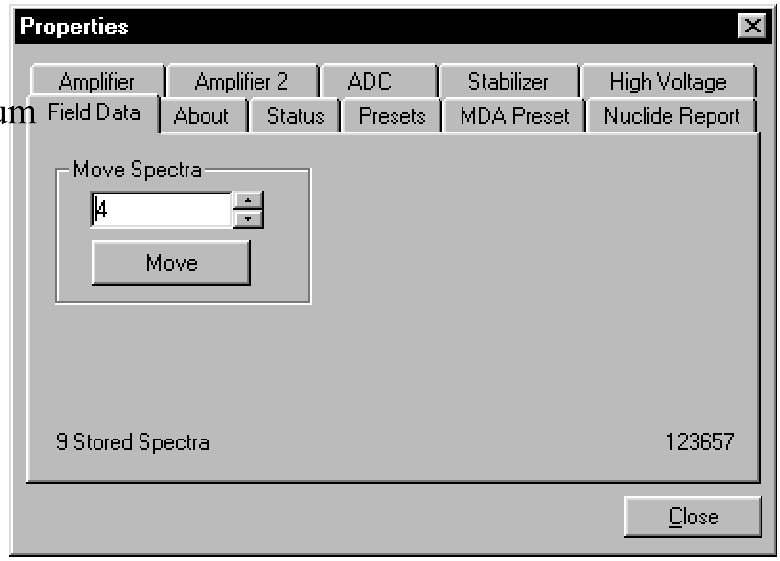


Fig. 118. The digiDART Field Mode Spectrum Tab.

The lower left of the tab shows the total number of spectra (not counting the active spectrum) stored in the digiDART memory. The spectrum ID of the active spectrum is shown in the lower right. The spectrum ID is the eight-character alphanumeric value stored with the spectrum. The stored spectra cannot be viewed or stored in the PC until they are moved to the active spectrum position.

To move a spectrum from the stored memory to the active memory, enter the spectrum number and click on **Move**. Use the up/down arrow buttons to scroll through the list of spectra. The label on the lower right does not update until a spectrum is moved. The numbers are the same as the numbers shown on the digiDART display in the stored spectrum list. Note that this only moves the spectrum inside the digiDART. To save the current active spectrum to the PC disk, use the **File/Save** commands in the application.

The **Acquire/Download Spectra** command can also be used to download all the stored spectra and save them to disk automatically. They can then be viewed in a buffer window.

3.2.10.7. About

This tab (Fig. 119) displays hardware and firmware information about the currently selected digiDART as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

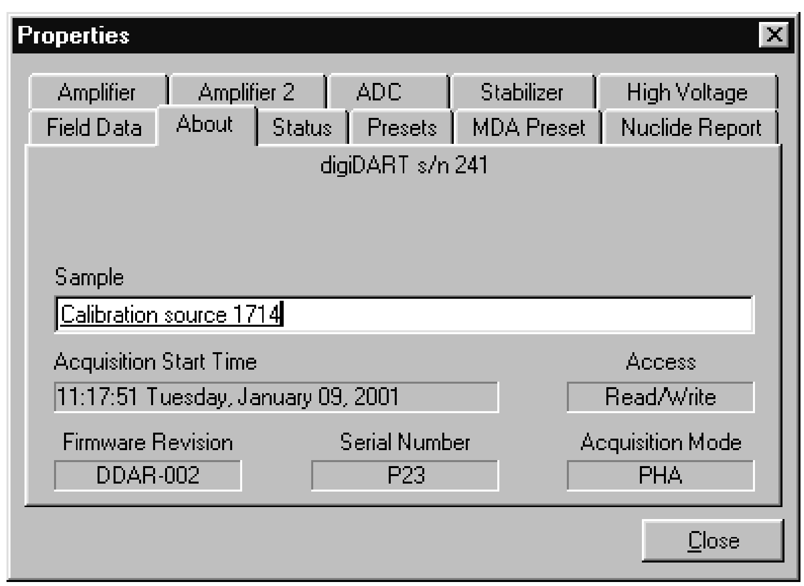


Fig. 119. digiDART About Tab.

3.2.10.8. Status

Figure 120 shows the Status tab. Twenty-one parameters are monitored at all times. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab (normally these would be the six that are most important to you). The items you select can be changed at any time.

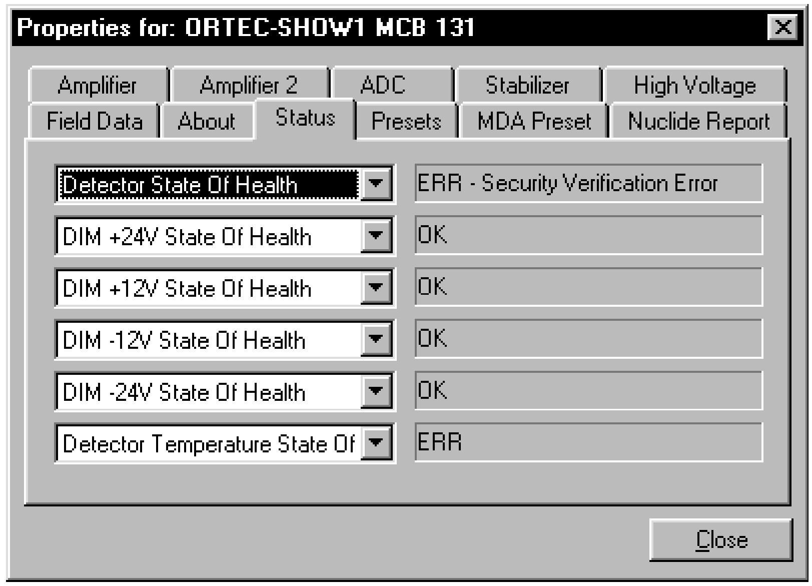


Fig. 120. digiDART Status Tab.

Two types of status responses are displayed: **OK** or **ERR**, and a numeric value. The state-of-health (SOH) parameters all respond with **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the digiDART. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they respond with **N/A**.

The parameters are:

Detector State of Health
This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health
This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health
This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health
This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health

This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health

This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health

This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health

This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health

This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health

This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the −12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the −24 volt supply in the DIM as delivered to the detector.

High Voltage
This is the current value of the high-voltage bias supply in the DIM as delivered to the detector.

Detector temperature
This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature
This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage
This is the present voltage of the internal battery.

Battery % full
This is an estimate of the amount of power remaining in the battery.

Battery time remaining
This is an estimate of the time remaining when using the internal battery and the digiDART operating in the present mode.

3.2.10.9. Presets

Figure 121 shows the Presets tab. MDA presets are shown on a separate tab.

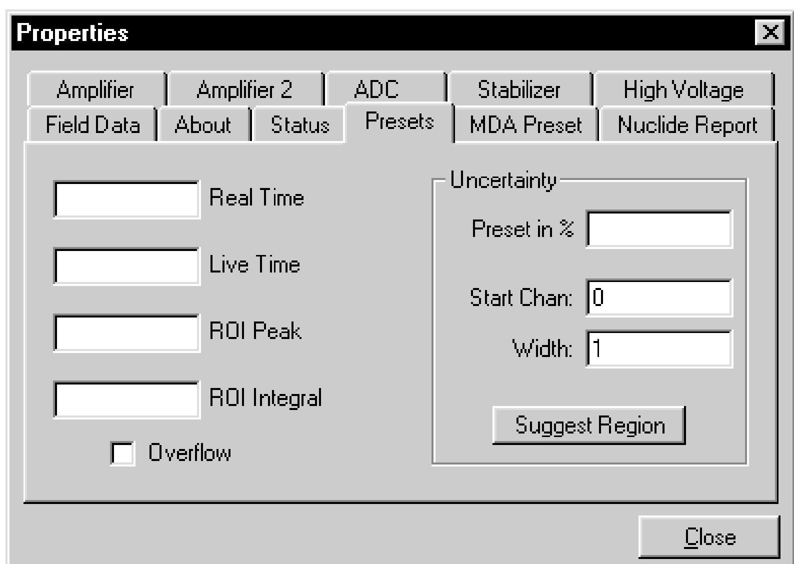


Fig. 121. digiDART Presets Tab.

The presets can only be set on an MCB that is *not* acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds 2^{31}-1 (over 2×10^9) counts.

3.2.10.10. MDA Preset

The MDA preset (Fig. 122) can monitor up to 20 nuclides at one time, and stops data collection when the minimum detectable activity for each of the user-specified MDA nuclides reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

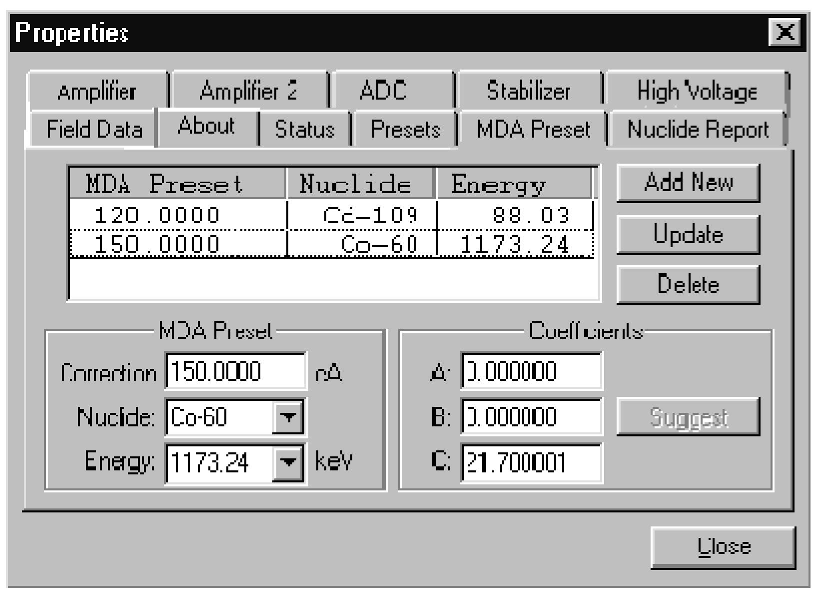


Fig. 122. digiDART MDA Preset Tab.

If the application supports efficiency calibration and the digiDART is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.10.11. Nuclide Report

Figure 123 shows the Nuclide Report tab. The Nuclide Report displays the activity of up to 9 user-selected peaks. Once the report is set up you can view the Nuclide Report at any time on the digiDART display. The peak area calculations in the hardware use the same methods as the MAESTRO **Peak Info** calculation (see Section 3.7), so the Nuclide Report display is the same as the **Peak Info** display on the selected peak in the spectra stored in the PC. The calculated value is computed by multiplying the net peak count rate by a user-defined constant. If the constant includes the efficiency and branching ratio, the displayed value is the activity. You enter the nuclide label and the activity units.

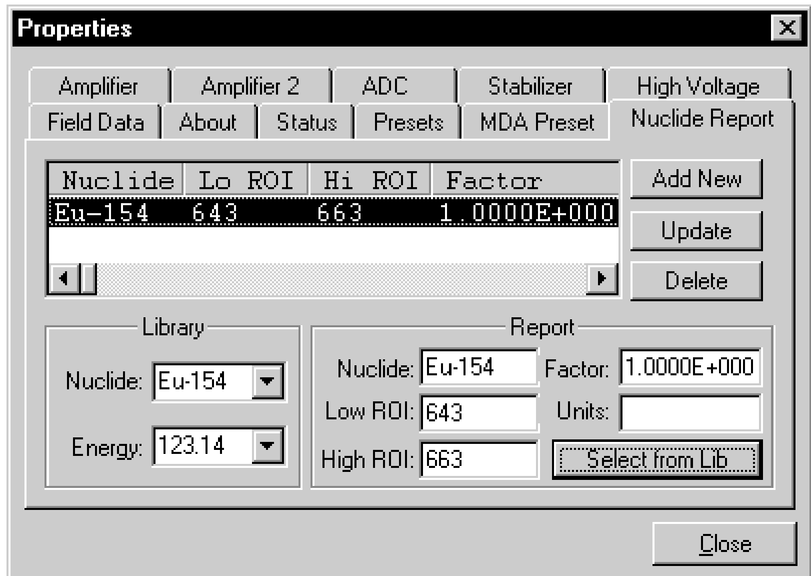


Fig. 123. digiDART Nuclide Report Tab.

The report format and calculations are discussed in detail in Section 3.9.

Add New

Manual Add

Nuclides can be added to the list using the library to assist in the region definition or manually. To add a nuclide manually, enter the nuclide name, ROI start and end channels, multiplicative factor and units in the Report section. Now press **Add New** to add this nuclide to the list. The units need only be entered once, since they are the same for all nuclides in the table.

Library Add

To use the library to aid in the definition, select the nuclide from the library nuclide drop down list. Now select the gamma-ray energy from the Energy drop down list. This defines what gamma ray to use. Now Press the **Select from Lib** button in the Report section. This will update all the entries in this section and show (as a yellow band) the region to be used in both the expanded spectrum and the full window. Now press **Add New** to add this nuclide to the list.

Edit

To change any of the current nuclides, select the nuclide in the list (use the scroll bars if needed). This will show the current settings for this nuclide. Make any changes needed. Any or all of the entries can be changed. When finished with the changes, click on **Update**.

Delete

To remove an entry, select the entry and press **Delete**.

When you close the Properties dialog, all the values entered are written to the digiDART and are used when you view the Nuclide Report on the digiDART display.

3.2.11. DSPEC Plus

3.2.11.1. Amplifier

Figure 124 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and optimization. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

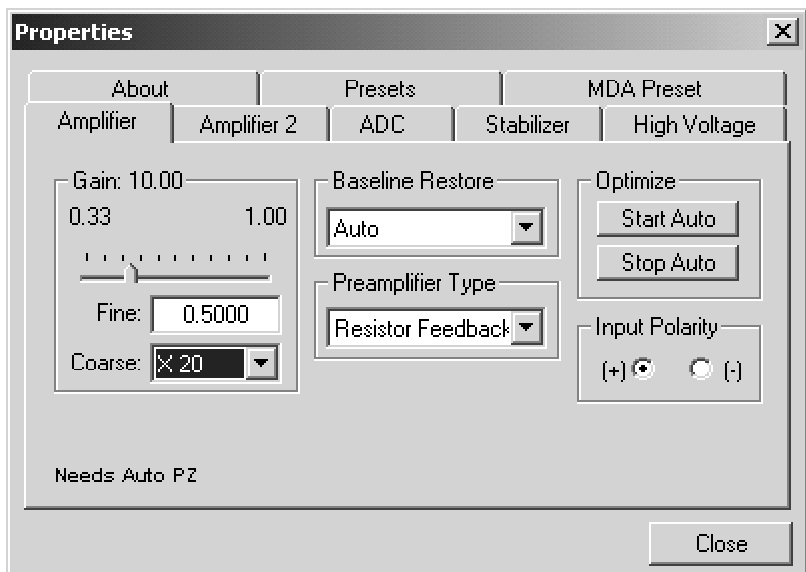


Fig. 124. DSPEC Plus Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.33 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.33 to 100.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC Plus even when the power is off. The time constant can be manually set on the InSight display (see Section 3.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the type of germanium detector being used.

Optimize

The DSPEC Plus is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** optimization button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC Plus, the **Start Auto** button does not perform the pole zero.

As with any system, the DSPEC Plus should be optimized any time the detector is replaced or if the flattop width or cusp parameter is changed. For optimization to take place, the DSPEC Plus must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC Plus front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC Plus at this time and, if the DSPEC Plus is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC Plus is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC Plus, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if the flattop width or the cusp settings are changed.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape might not change enough for you to see. (In this situation, you also might not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

3.2.11.2. Amplifier 2

Figure 125 shows the Amplifier 2 tab, which accesses the advanced DSPEC Plus shaping controls including the InSight Virtual Oscilloscope mode (see Section 3.3).

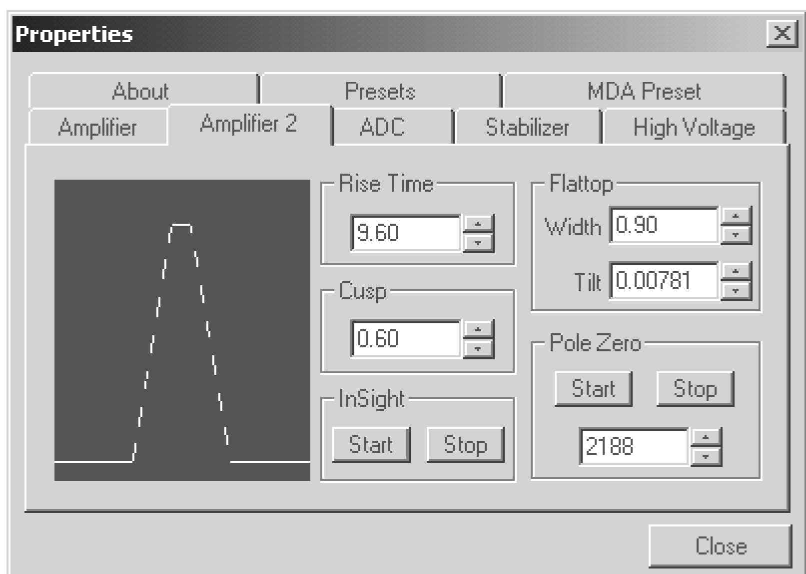


Fig. 125. DSPEC Plus Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. Section 3.8 discusses this tradeoff and contains a guide to choosing rise time according to count rate. The value of the rise time parameter in the DSPEC Plus is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC Plus value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the rise time within the range of 0.2 to 23.0. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC Plus firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **InSight** section on the Amplifier 2 tab and click on **Start**.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of the actual pulse shape, only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top can be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** and **Cusp** values are for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically. The **Cusp** value controls the curvature of the "sides" with larger values (approaching 1.00) giving a nearly straight-line shape for the rise and fall. The cusp value can range from 0.99 to 0.5. Under normal conditions, the cusp value will be in the upper part of the range.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 µs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and click on the **InSight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well. Section 3.3 provides detailed instructions on using the InSight mode.

3.2.11.3. ADC

This tab (Fig. 126) contains the **Gate**, **ZDT Mode**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

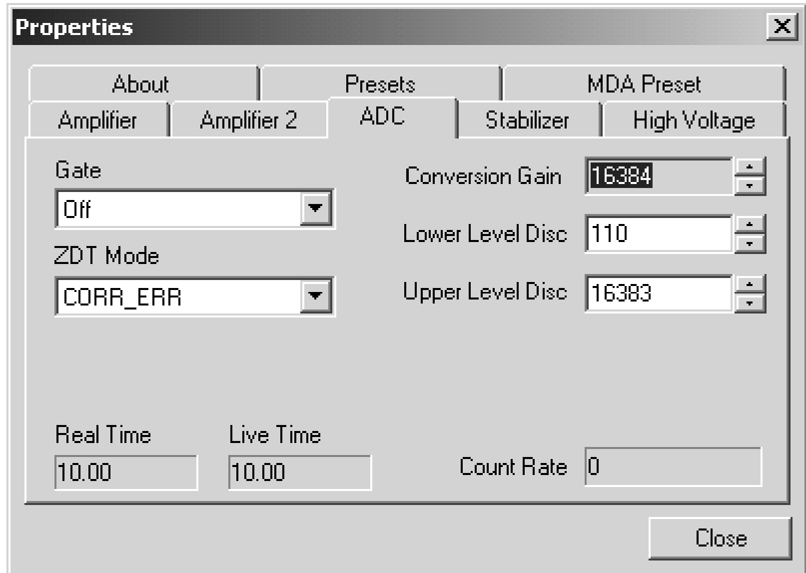


Fig. 126. DSPEC Plus ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

ZDT Mode

Use this droplist to choose the **ZDT Mode** to be used for collecting the zero dead time (corrected) spectrum (see Section 3.6). The three modes are **Off** (LTC only), **NORM_CORR** (LTC and ZDT), and **CORR_ERR** (ERR and ZDT). If one of the ZDT modes is selected, both spectra are stored in the same spectrum (`.SPC`) file. If you do not need the ZDT spectrum, you should select **Off**.

In ***CONNECTIONS*** applications, the display can show either of the two spectra. Use **<F3>** or **Acquire/ ZDT Display Select** to toggle the display between the two spectra. In the Compare mode, **<F3>** switches both spectra to the other type and **<Shift+F3>** switches only the compare spectrum. This allows you to make all types of comparisons.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings for the DSPEC Plus.

Upper- and Lower-Level Discriminators

In the DSPEC Plus the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

Stabilizer

The DSPEC Plus has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 127) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

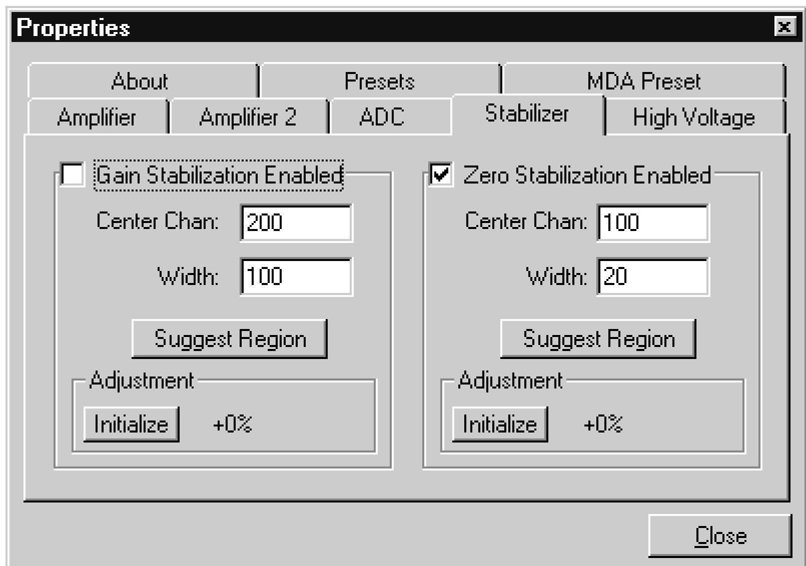


Fig. 127. DSPEC Plus Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.11.4. High Voltage

Figure 128 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; select the **Polarity**; and choose the **ShutDown** mode.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The **Polarity** selection determines which of the two rear-panel HV connectors have power. The blue or negative connector only has high voltage when **(−)** is selected, and the red or positive connector only has high voltage when **(+)** is selected. Choose the **Polarity** with the **(+)** and **(−)** radio buttons (the high voltage is disabled when the polarity is being changed).

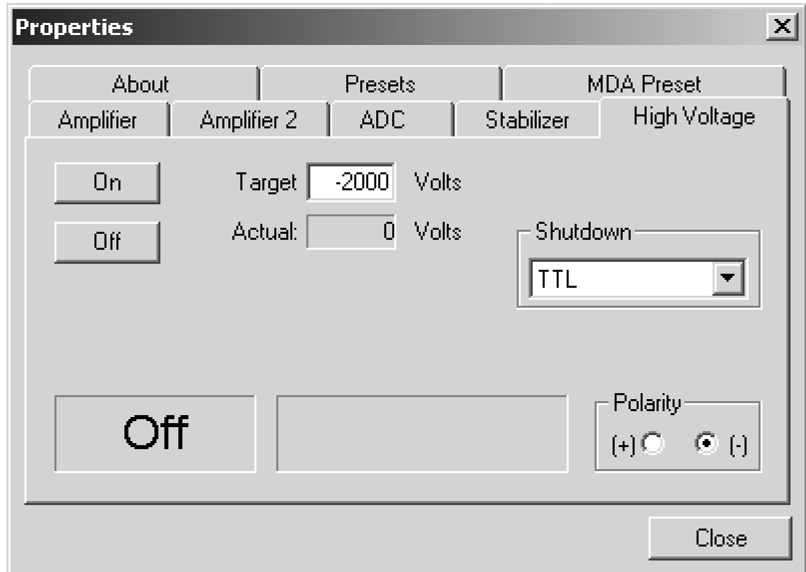


Fig. 128. DSPEC Plus High Voltage Tab.

3.2.11.5. About

This tab (Fig. 129) displays hardware and firmware information about the currently selected DSPEC Plus as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

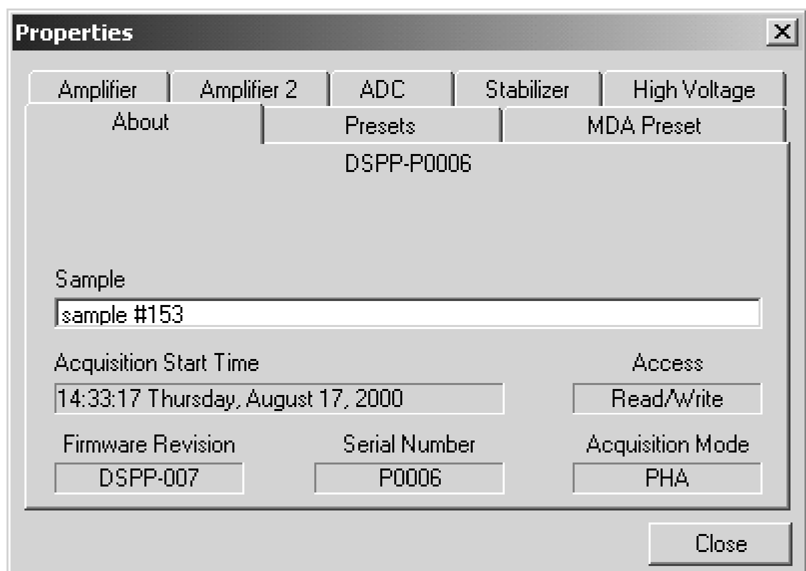


Fig. 129. DSPEC Plus About Tab.

3.2.11.6. Presets

Figure 130 shows the Presets tab. MDA presets are shown on a separate tab.

The presets can only be set on an MCB that is *not* acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

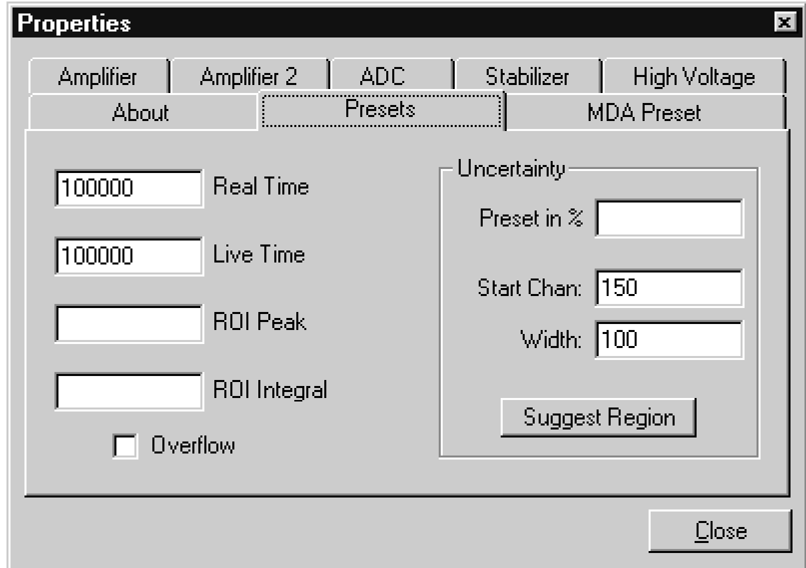


Fig. 130. DSPEC Plus Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.11.7. MDA Preset

The MDA preset (Fig. 131) can monitor up to 20 nuclides at one time, and stops data collection when the minimum detectable activity for each of the user-specified MDA nuclides reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a+\sqrt{b+c*Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

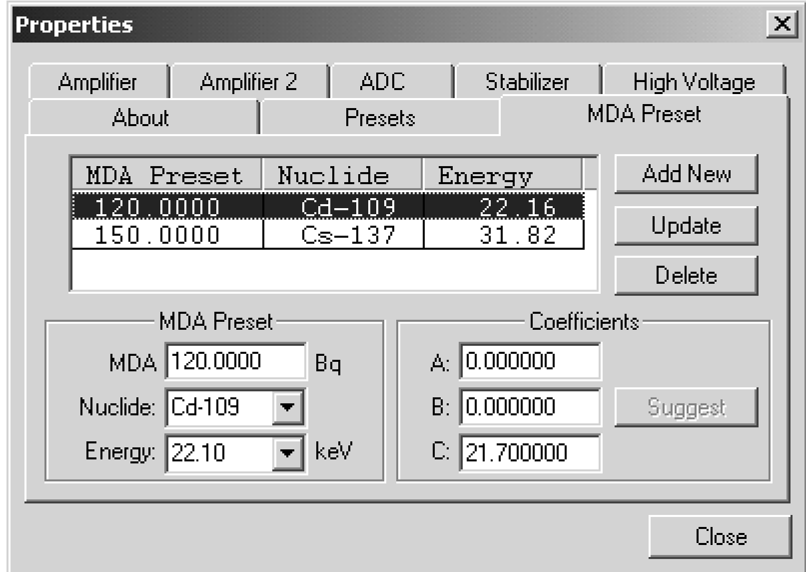


Fig. 131. DSPEC Plus MDA Preset Tab.

If the application supports efficiency calibration and the DSPEC Plus is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.12. DSPEC

3.2.12.1. Amplifier

Figure 132 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and optimization. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

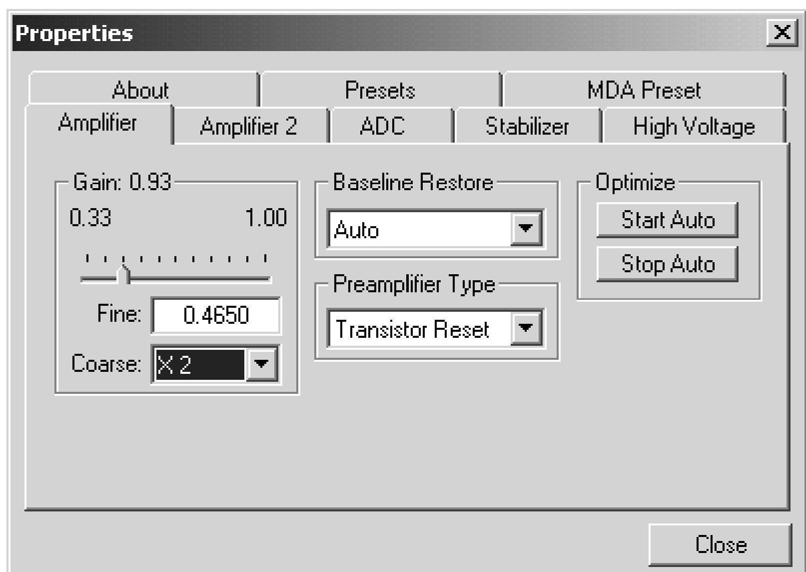


Fig. 132. DSPEC Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.33 to 0.99. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.33 to 99.99.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto**, **Fast**, or **Slow**) are saved in the DSPEC even when the power is off.

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 200). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 227). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type

Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the type of germanium detector being used.

Optimize

The DSPEC is equipped with both automatic pole-zero logic[5] and automatic flattop logic.[6] The **Start Auto** (optimize) button uses these features to automatically choose the best pole-zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC, the optimization buttons do not perform the pole zero.

As with any system, the DSPEC should be optimized any time the detector is replaced or if the flattop width or cusp parameter is changed. For optimization to take place, the DSPEC must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto** (optimize). This optimize command is sent to the DSPEC and, if the DSPEC is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeps stop.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC is cycled through all the rise time values for the determination of the optimum tilt values. As all of the values for all the combinations are maintained in the DSPEC, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if the flattop width or the cusp settings are changed.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape might not change enough for you to see. (In this situation, you also might not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

3.2.12.2. Amplifier 2

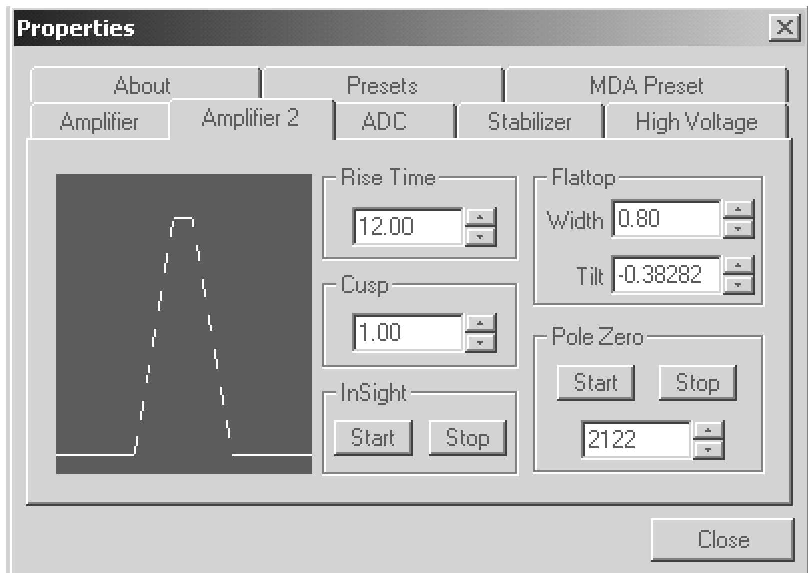


Fig. 133. DSPEC Amplifier 2 Tab.

Figure 133 shows the Amplifier 2 tab, which accesses the advanced DSPEC resolution, throughput, and shaping controls including the InSight Virtual Oscilloscope mode (see Section 3.3).

The **Rise Time** field allows you to precisely control the tradeoff between resolution and throughput. Section 3.8 discusses this tradeoff and contains a guide to choosing rise time according to count rate. The value of the rise time parameter in the DSPEC is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the rise time within the range of 0.8 to 25.6. After all the controls have been adjusted, go to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **InSight** section of the tab and click on **Start**.

Note that the Amplifier 2 tab graphically presents a *modeled shape*. This is *not* a sampled waveform of actual pulse shape(s), only a model based on the current parameters. The modeled shape is nominally a quasi-trapezoid whose sides and top can be adjusted by the controls in this dialog. While a particular control is being adjusted, the model is updated to represent the changes made.

The **Rise Time** and **Cusp** values are for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically. The **Cusp** value controls the curvature of the "sides" with larger values (approaching 1.00) giving a nearly straight-line shape for the rise and fall. The cusp value can range from 0.99 to 0.5. Under normal conditions, the cusp value will be in the upper part of the range.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.8 to 2.4 μs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The **Pole Zero Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The **Pole Zero Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to select **MCB Properties...** and click on the **InSight Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well. Section 3.3 provides detailed instructions on using the InSight mode.

3.2.12.3. ADC

This tab (Fig. 134) contains the **Gate**, **Conversion Gain**, and **Lower Level Disc**riminator controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a

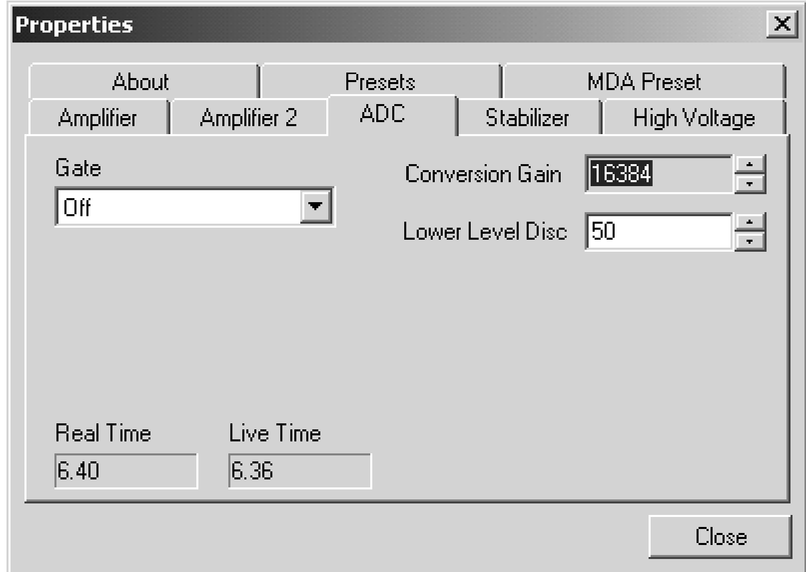


Fig. 134. DSPEC ADC Tab.

gating input signal *must be* present at the proper time for the conversion of the event; in **Anti-coincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings for the DSPEC.

Lower-Level Discriminator

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. In the DSPEC this is under computer control; in older systems it was implemented via a hardware potentiometer adjustment. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is then not unproductively occupied processing noise pulses.

3.2.12.4. Stabilizer

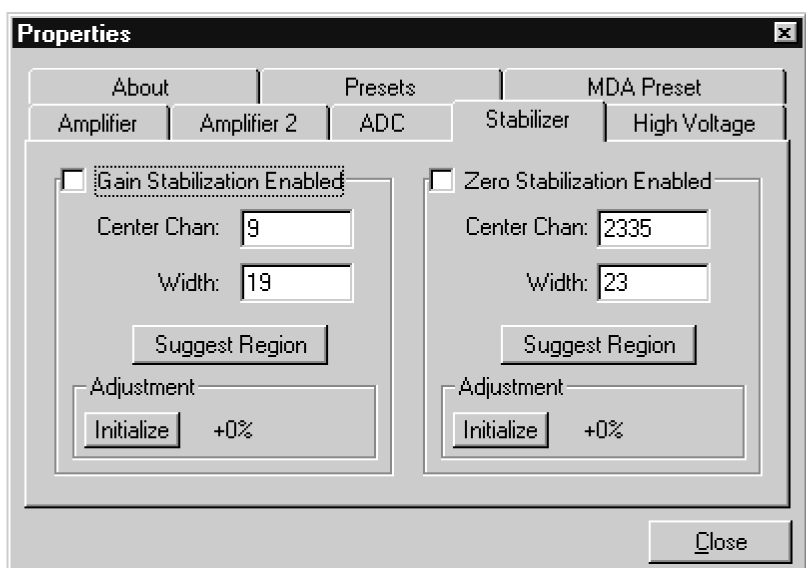


Fig. 135. DSPEC Stabilizer Tab.

The DSPEC has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 135) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.12.5. High Voltage

Figure 136 shows the High Voltage tab. The **On** and **Off** buttons apply and remove the high voltage. This function is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. The **Target** voltage level is displayed on this tab but cannot be modified from the dialog. It is controlled by the hardware and can be adjusted by a rear-panel potentiometer. High-voltage polarity is set with an internal jumper. See the DSPEC hardware manual for more information.

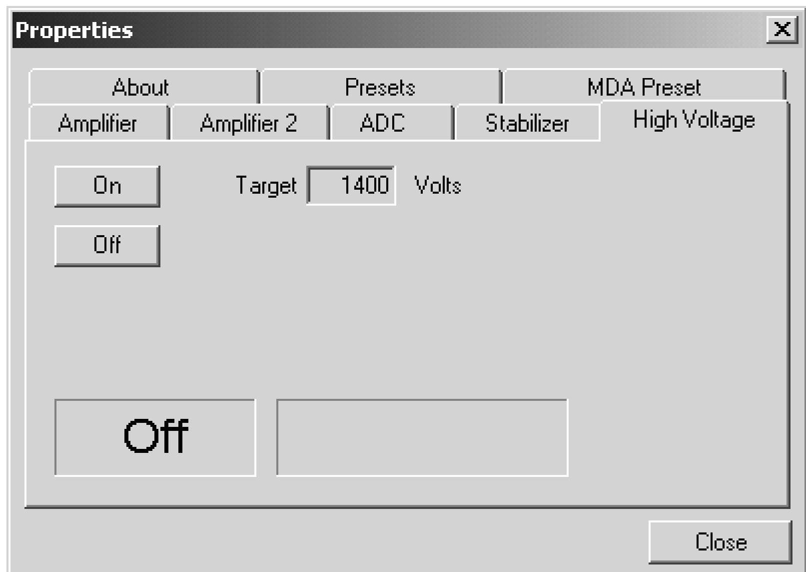


Fig. 136. DSPEC High Voltage Tab.

3.2.12.6. About

This tab (Fig. 137) displays hardware and firmware information about the currently selected DSPEC, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

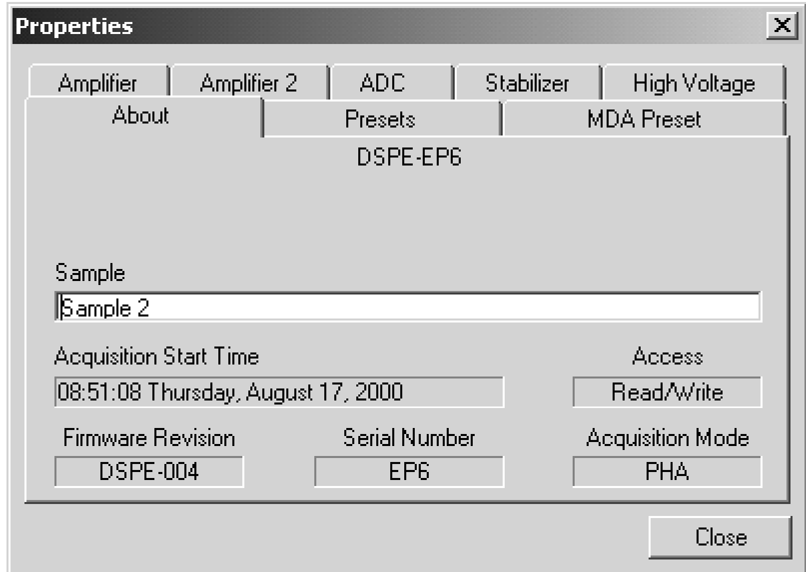


Fig. 137. DSPEC About Tab.

3.2.12.7. Presets

Figure 138 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance the **ROI Peak** preset can be viewed as a "safety valve."

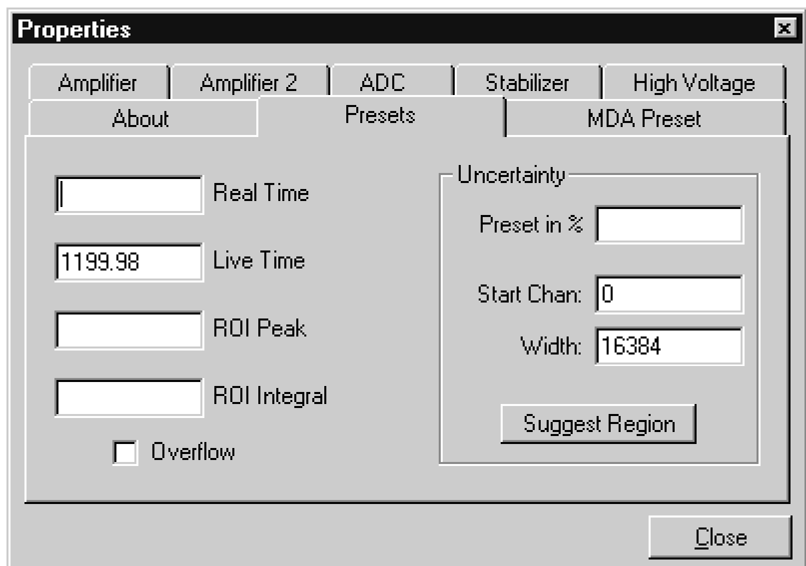


Fig. 138. DSPEC Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.12.8. MDA Preset

The MDA preset (Fig. 139) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the “Analysis Methods” chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

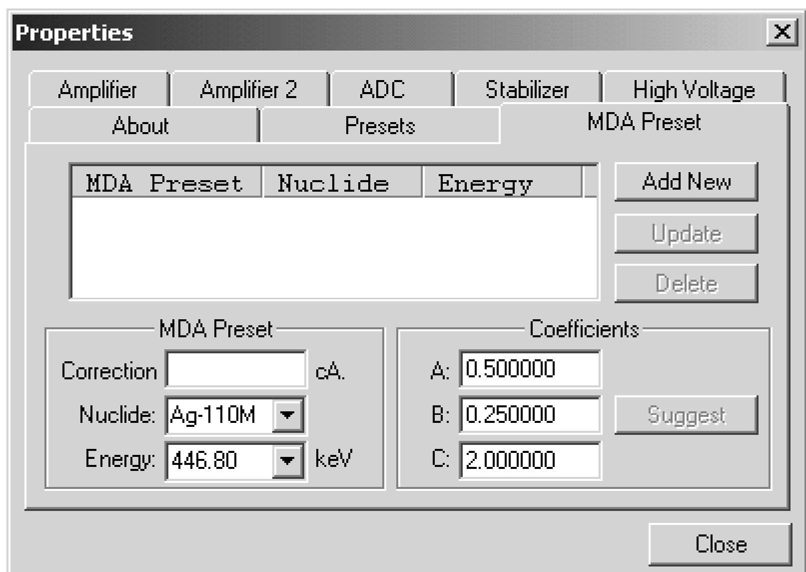


Fig. 139. DSPEC MDA Preset Tab.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the DSPEC is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction**

factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.13. 92X-II

3.2.13.1. Amplifier

Figure 140 shows the Amplifier tab. This tab contains the controls for **Gain**, **Shaping Time**, **Preamplifier Type**, and **Pole Zero**. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (pole zero) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog.*

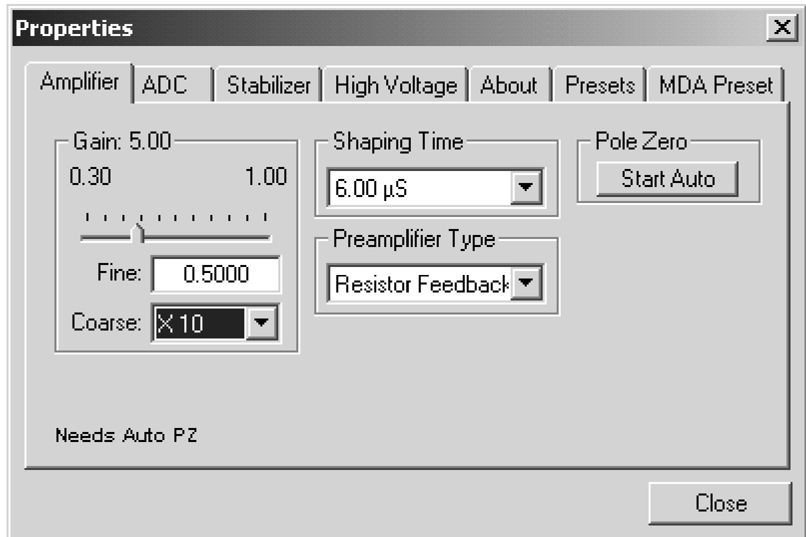


Fig. 140. 92X-II Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.3 to 1.0. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 3.0 to 1000.0.

Shaping Time

Use the **Shaping Time** droplist to select the 92X-II amplifier pulse shaping-time constant. The displayed values are the values available for this 92X-II. The selections are 2 µs and 6 µs.

Preamplifier Type and Pole Zero

The **Preamplifier Type** section lets you choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. The 92X-II amplifier is equipped with an automatic pole-zero circuit. If **Transistor Reset Preamplifier** is selected for this 92X-II, the pole zero is not needed.

When the **Resistive Feedback** option is selected, you must set the pole zero. To do this, go to the **Pole Zero** section of the dialog and click on **Start Auto**. If the 92X-II is able to start the pole-zero, a series of short beeps will sound, indicating that the pole zero is in progress. When the pole zeroing is finished, the beeps will stop.

As with any system, the amplifier should be pole zeroed any time the detector is changed or the shaping time of the amplifier is changed. Pole-zeroing requires the amplifier to be amplifying pulses. The detector should be connected in the final configuration before pole zeroing is started. There should be a radioactive source near the detector so that the count rate will be high enough (about 5 to 10% dead time) to accomplish the pole zero in the proper time.

Without an oscilloscope connected to the amplifier output to display the pulse shape, the effect of the pole zero operation is not always easy to see. The most common effect of an incorrect pole-zero setting is tailing on the peak shape in the spectrum. Here, tailing refers to abnormally high counts on either side of the peak. If the amplifier was close to the proper pole zero setting before the operation, the spectrum peak shape might not change enough to be seen.

3.2.13.2. ADC

This tab (Fig. 141) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

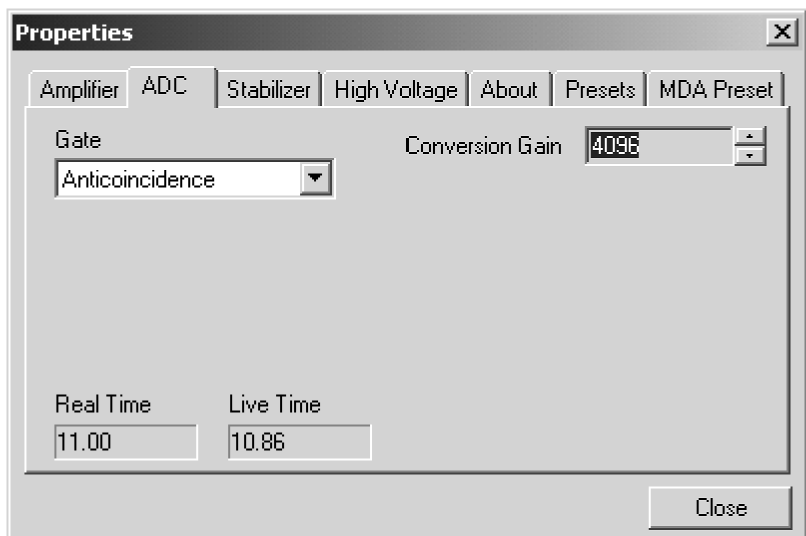


Fig. 141. 92X-II ADC Tab.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

3.2.13.3. Stabilizer

The 92X-II has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 142) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

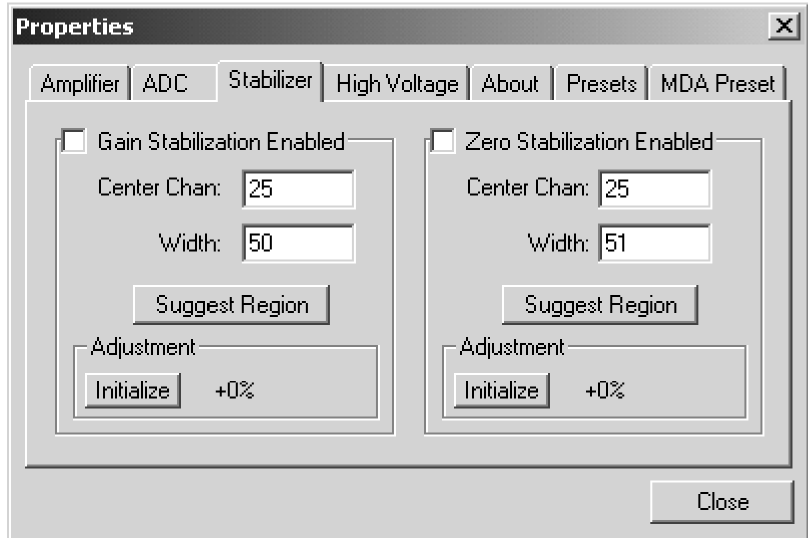


Fig. 142. 92X-II Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

High Voltage

Figure 143 shows the High Voltage tab. The **On** and **Off** buttons apply and remove the high voltage. This function is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. The **Target** voltage level is displayed on this tab but cannot be modified from the dialog. It is controlled by the hardware and is adjusted by a rear-panel potentiometer. High-voltage polarity is set with an internal jumper. See the hardware manual for more information.

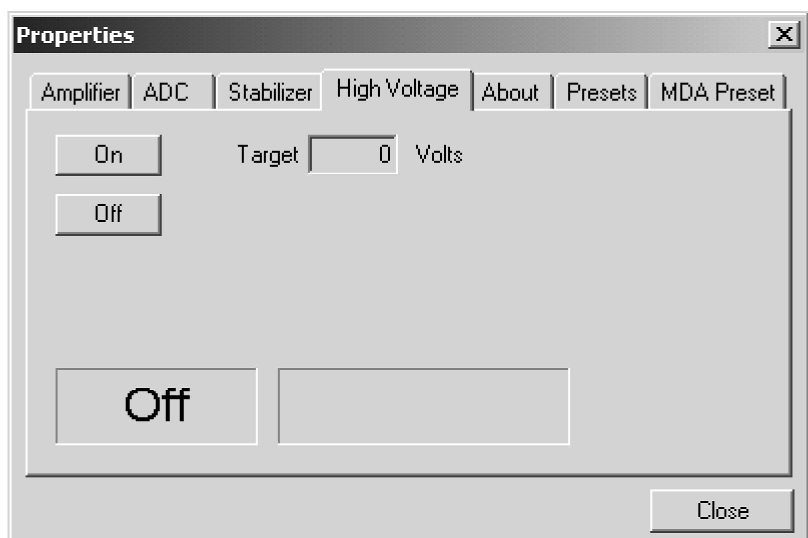


Fig. 143. 92X-II High Voltage Tab.

3.2.13.4. About

This tab (Fig. 144) displays hardware and firmware information about the currently selected 92X-II, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/ Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

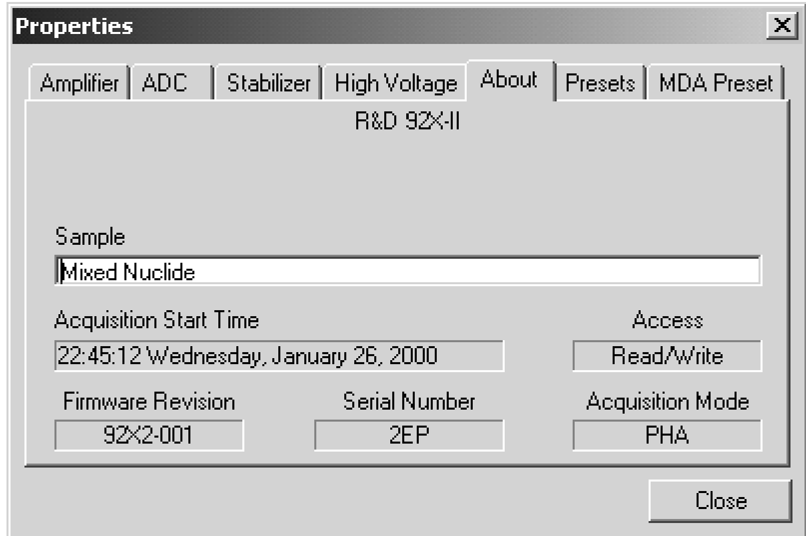


Fig. 144. 92X-II About Tab.

3.2.13.5. Presets

Figure 145 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

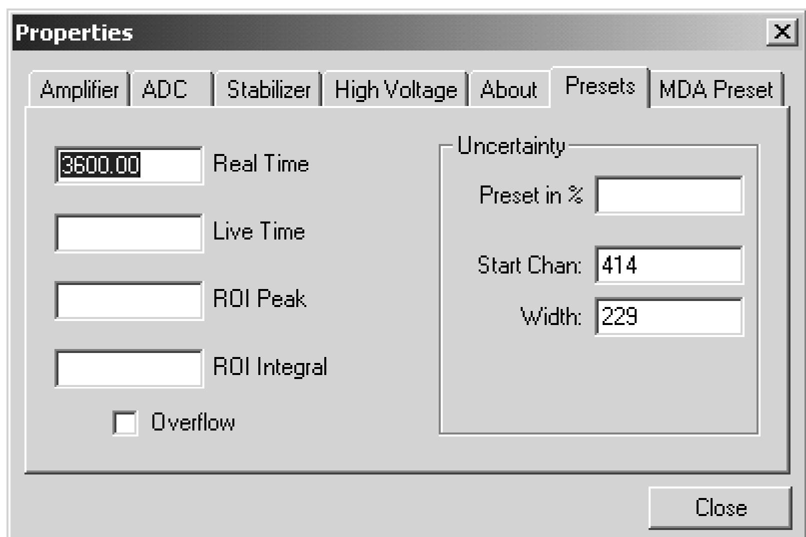


Fig. 145. 92X-II Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.13.6. MDA Preset

The MDA preset (Fig. 146) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the “Analysis Methods” chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

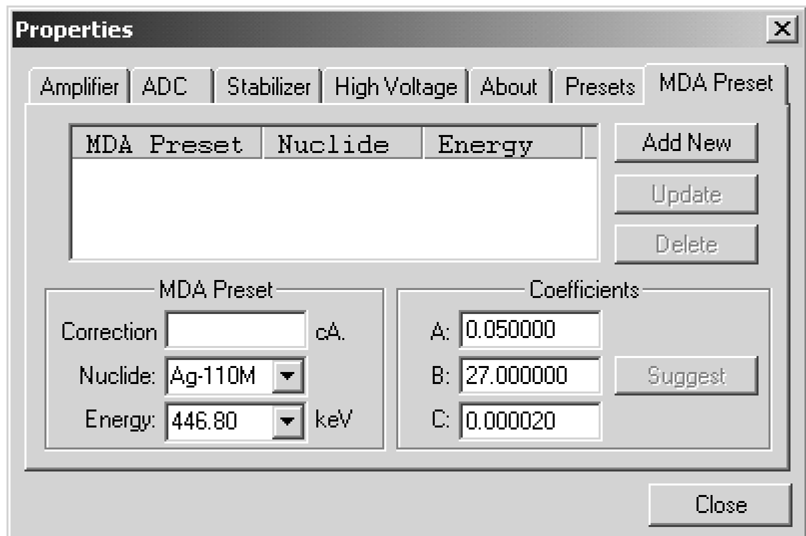


Fig. 146. 92X-II MDA Preset Tab.

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the 92X-II is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction**

factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.14. DART

3.2.14.1. Amplifier

Figure 147 shows the Amplifier tab. This tab contains the controls for **Gain**, **Shaping Time**, **Preamplifier Type**, **Pole Zero**, **Input Polarity**, and **Pileup Rejection**. Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (pole zero) button.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

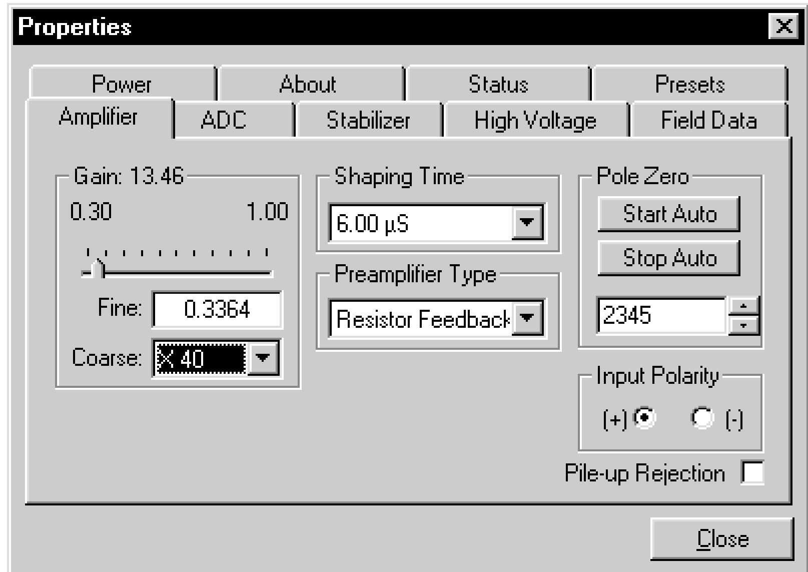


Fig. 147. DART Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.3 to 1.0. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 3.0 to 1000.0.

Shaping Time

Use the **Shaping Time** droplist to select the DART amplifier pulse shaping-time constant. The displayed values are the values available for this DART. The selections are usually either 1 and 6 µs, or 1 and 2 µs.

Preamplifier Type and Pole Zero

The **Preamplifier Type** section lets you choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. The DART amplifier is equipped with an automatic pole-zero circuit. If **Transistor Reset** is selected for this DART, the pole zero is not needed.

When the **Resistive Feedback** option is selected, you must set the pole zero. To do this, go to the **Pole Zero** section of the dialog and click on **Start Auto**. The pole-zero command will be sent to the DART and if the DART is able to start the pole-zero, a series of short beeps will sound to indicate that the pole zero is in progress. When the pole zeroing is finished, the beeps will stop.

As with any system, the amplifier should be pole zeroed any time the detector is changed or the shaping time of the amplifier is changed. Pole-zeroing requires the amplifier to be amplifying pulses. The detector should be connected in the final configuration before pole zeroing is started. There should be a radioactive source near the detector so that the count rate will be high enough (about 5 to 10% dead time) to accomplish the pole zero in the proper time. If the detector does not pole zero in a few minutes, there might be some problem with the detector or cables. Click on **Stop Auto** to halt the pole-zeroing operation.

By entering a value in the **Pole Zero** field, you can set the pole-zero value to any value you wish much the same as with the old-fashioned screwdriver potentiometer, but with much greater reproducibility. The setting has no units. This gives you the ability to exactly set the pole zero for any detector to the value used previously, ensuring data quality and reproducibility.

Without an oscilloscope connected to the amplifier output to display the pulse shape, the effect of the pole zero operation is not always easy to see. The most common effect of an incorrect pole-zero setting is tailing on the peak shape in the spectrum. Here, tailing refers to abnormally high counts on either side of the peak. If the amplifier was close to the proper pole zero setting before the operation, the spectrum peak shape might not change enough to be seen.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Pileup Rejection

Pileup Rejection (PUR) is used to reject overlapping pulses, improving the peak shape. This checkbox allows you to disable the PUR. This feature is normally enabled and is only turned off for special detectors.

3.2.14.2. ADC

This tab (Fig. 148) contains the **Gate**, **Conversion Gain**, **Lower Level Disc**rim-inator, **Upper Level Disc**riminator and **Zero Adjustment** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum). An external oscilloscope is needed to check this timing.

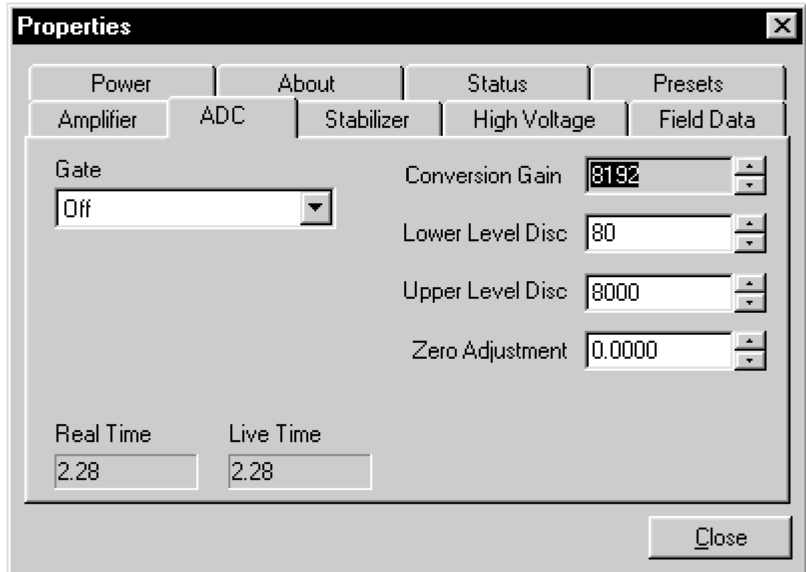


Fig. 148. DART ADC Tab.

Conversion Gain

If set to 8192, the energy scale will be divided into 8192 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

Upper- and Lower-Level Discriminators

In the DART the lower- and upper-level discriminators are under computer control.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

The lower- and upper-level discriminators are used in the multichannel scaler (MCS) mode as the single-channel-analyzer settings. Only the pulses between these two settings will be counted in the MCS spectrum. (See the DART-MCS [A71-B32] *Software User's Manual*.)

Zero Adjustment

The **Zero Adjustment** is used to set the dc offset voltage on the preamplifier input. The control ranges plus and minus, with 2048 being 0 V offset. The setting is normally 0 V or slightly negative. Setting the value too far in the positive direction (above 2048) can cause “lock-up” by putting the input value above the pulse reset discriminator value. A lock-up has occurred if the live time stops and the real time continues to count. The full range of offset is ±125 mV. Therefore, a setting of 3100 corresponds to a zero offset of +64.2 mV.

3.2.14.3. Stabilizer

The DART has both a gain stabilizer and a zero stabilizer. These are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 149) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

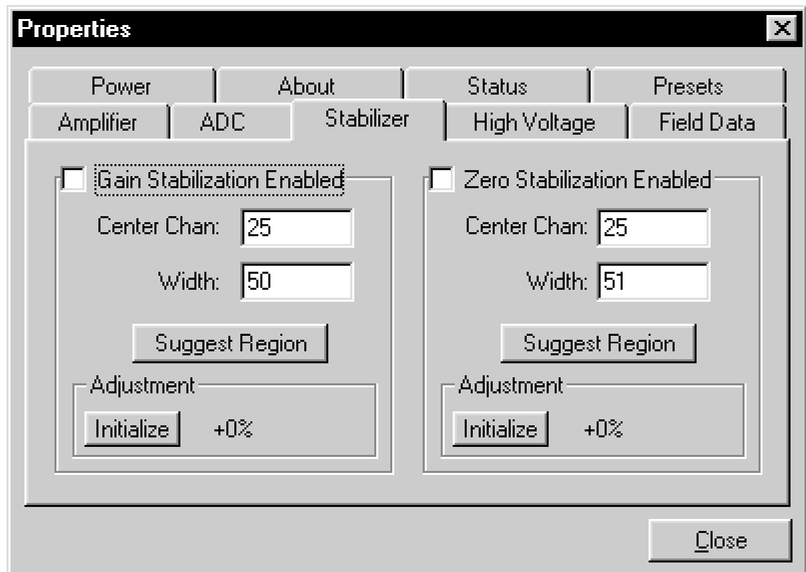


Fig. 149. DART Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

If the **Sodium Iodide Detector** box is marked on the High Voltage tab, the gain stabilizer adjusts the amplifier fine gain. For germanium detectors the amplifier superfine gain is adjusted.

3.2.14.4. High Voltage

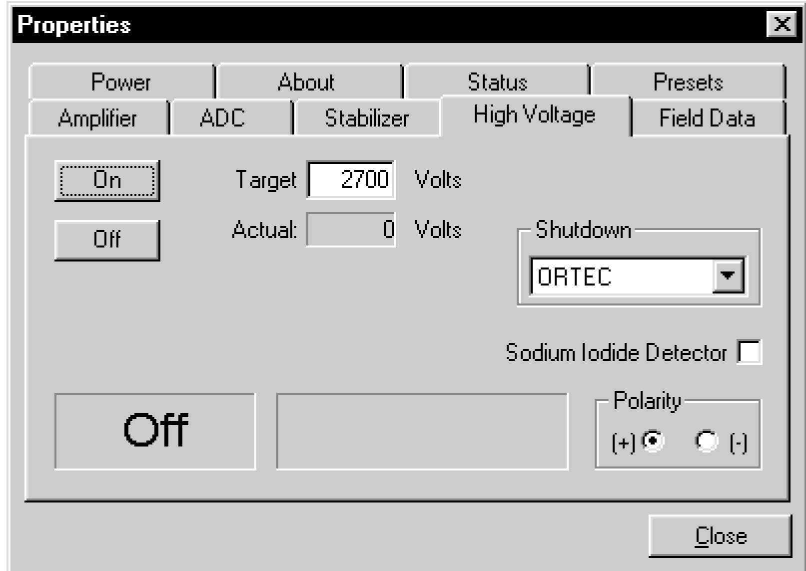


Fig. 150. DART High Voltage Tab.

Figure 150 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; select the **Polarity**; choose the **Shutdown** mode, and indicate whether this is a **Sodium Iodide Detector**.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. The limit is ±5000 for Ge detectors and ±1500 for NaI detectors. Click the **Off** button to turn off the high voltage.

Choose the **Polarity** with the **(+)** and **(−)** radio buttons (the high voltage is disabled when you change the polarity). In NaI mode, this selection is disabled.

3.2.14.5. Field Data

This tab (see Fig. 151) is used to **Enter** and **Exit** the Field Mode (remote operation detached from a PC) or to view the DART spectra collected in field mode. The DART can only be set in Field Mode by clicking on the **Enter** button on this tab, and remains in Field Mode unit you return to this tab and click on **Exit**. It cannot be removed from Field Mode when disconnected from the PC. The spectrum can then be viewed in the application as the “active” spectrum in the DART. The active spectrum is the spectrum where the new data are collected. The current active spectrum is lost.

When the DART is in field mode, the spectrum is collected in the active spectrum position until the preset is met, then it is stored as the *next stored spectrum*. The DART waits until the next trigger and then starts the collection of the new spectrum. The trigger is either the trigger signal on the back of the DART or input from the barcode reader connected to the DART.

NOTE If the DART is in field mode and you attempt to access it within a ***CONNECTIONS*** application, the following message will be displayed at the bottom of the program window: “**Start [or Stop] Error: Not Allowed During Current Mode**.” Go to the Field Data tab and exit field mode.

The lower left of the tab shows the total number of spectra (not counting the active spectrum) stored in the DART memory. The spectrum ID of the active spectrum is shown in the lower right. The stored spectra cannot be viewed or stored on the PC until they are moved to the active spectrum position.

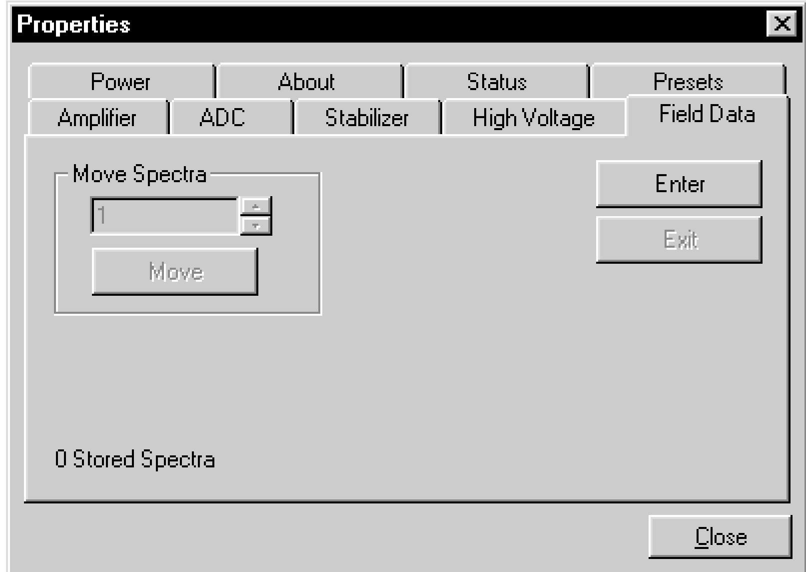


Fig. 151. DART Field Mode Tab.

To move a spectrum from the stored memory to the active memory, enter the spectrum number and click on **Move**. Use the up/down arrow buttons to scroll through the list of spectra. The label on the lower right does not update until a spectrum is moved. Note that this only moves the spectrum inside the DART. To save the stored spectrum to the PC disk, move it to the active position and use the **File/Save** commands in your application.

Use the **Acquire/Download Spectra...** command to download all the stored spectra and save them to disk automatically. They can then be viewed in a buffer window.

3.2.14.6. Power

The Power tab is shown in Fig. 152. This tab displays information about the DART's current power source, its power mode, and voltage of the two batteries. The power **Source** can be **Battery 1**, **Battery 2**, or **External**. The DART internal hardware automatically switches from a discharged battery to the good battery. The discharged battery can then be replaced without turning off the power or stopping operation.

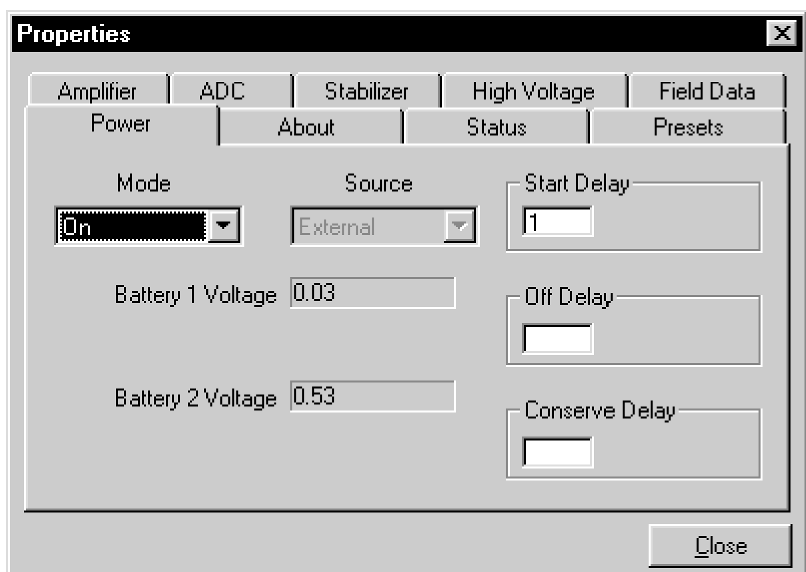


Fig. 152. DART Power Tab.

DART's advanced power management allows you to set the unit for automatic shutdown when it is not being used. The power **Mode** droplist lets you manually switch the DART between the always-**On** and **Conserve** modes. Use the delay fields to set the time delays, from 0 to 65535 seconds, before the unit switches to Conserve mode or to complete power-off.

In the example shown, the DART will go from **On** mode to **Conserve** mode 100 seconds after the last command, when not in active data-acquisition mode. It will then power off 600 seconds later if no commands are sent to it.

Start Delay is used in Field Mode and is the wait time between the barcode reading and the start of the data acquisition.

3.2.14.7. About

This tab (Fig. 153) displays hardware and firmware information about the currently selected DART as well as the data **Acquisition Start Time** and **Sample** description. The **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

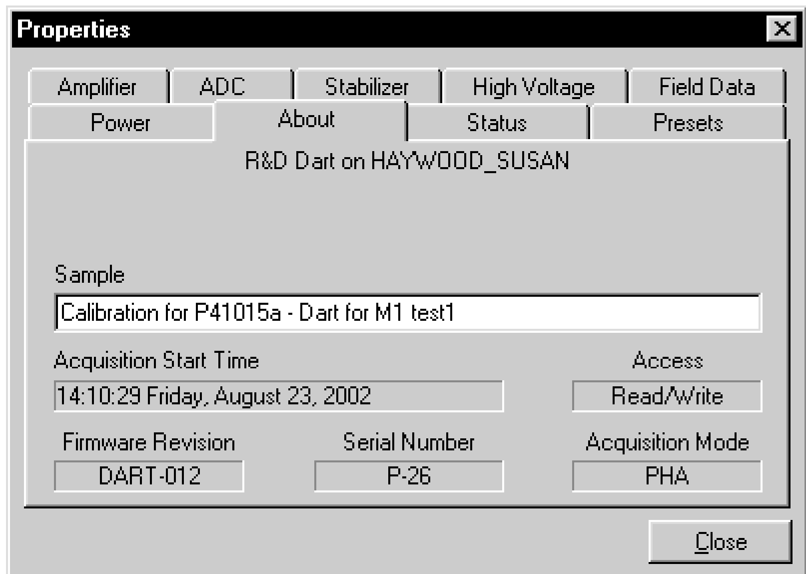


Fig. 153. DART About Tab.

This screen displays the DART's serial number; all DARTs have a unique serial number which is read by the software and stored in the spectrum file for verification of the spectrum. The PC to which the DART is attached is shown at the top of the dialog.

3.2.14.8. Status

The DART can monitor a thermistor, usually located on a NaI detector. The **Thermistor** reading shown on the Status tab (Fig. 154) is in ohms. This can be used by other programs to monitor the gain of the photomultiplier tube.

3.2.14.9. Presets

Figure 155 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. Use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

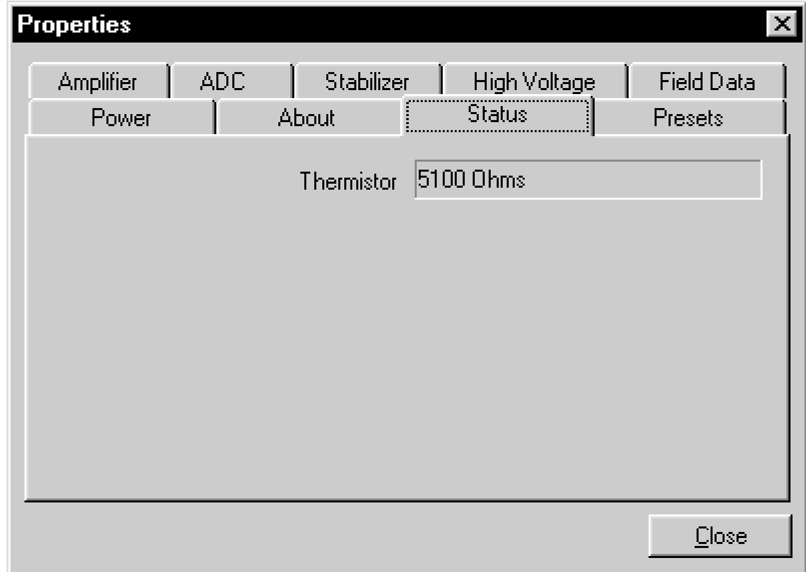


Fig. 154. DART Status Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

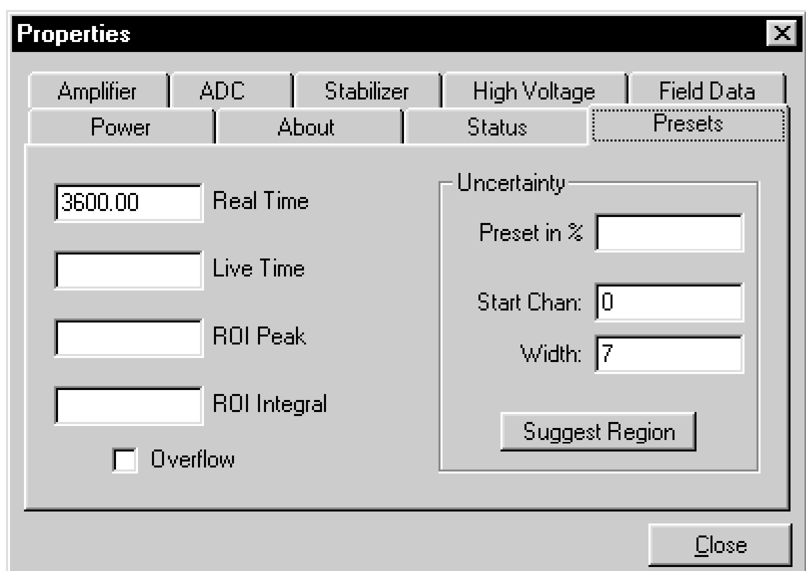


Fig. 155. DART Presets Tab.

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any

ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.15. 92X, NOMAD, and NOMAD Plus

3.2.15.1. Amplifier

Figure 156 shows the Amplifier tab. This tab contains the controls for **Gain**, **Shaping Time**, **Preamplifier Type**, and **Pole Zero**. The **Start Auto** (pole zero) buttons should only be clicked *after* all of the controls on the tabs have been set.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.4 to 1.0000. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 4.0 to 1000.0.

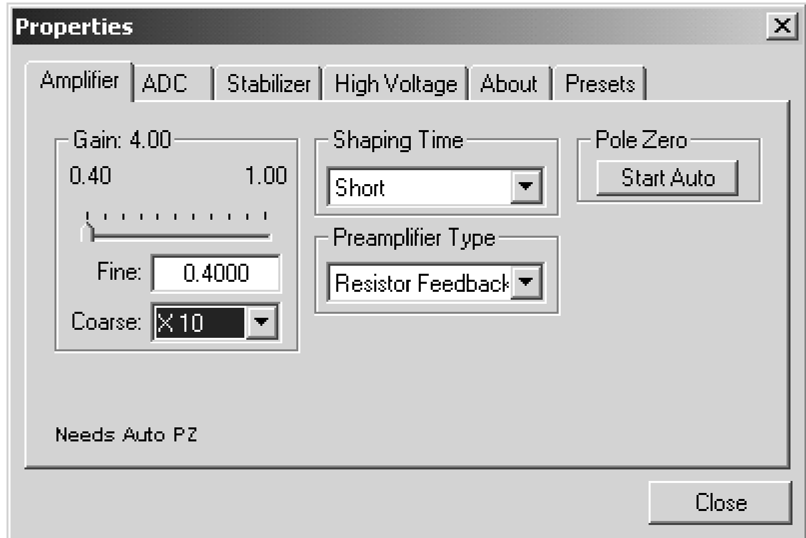


Fig. 156. 92X, NOMAD, NOMAD Plus Amplifier Tab.

Shaping Time

Use the **Shaping Time** droplist to select the amplifier pulse shaping-time constant. The available values, **Short** and **Long**, cover the time constants needed for high count-rate and high-resolution systems.

Preamplifier Type and Pole Zero

The **Preamplifier Type** section lets you choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. The MCB amplifier is equipped with an automatic pole-zero circuit. If **Transistor Reset Preamplifier** is selected for this MCB, the pole zero is not needed.

When the **Resistive Feedback** option is selected, you must set the pole zero. To do this, go to the **Pole Zero** section of the dialog and click on **Start Auto**. The pole-zero command will be sent to the MCB. If the instrument is able to start the pole-zero, a series of short beeps will sound to indicate that the pole zero is in progress. When the pole zeroing is finished, the beeping stops.

As with any system, the amplifier should be pole zeroed any time the detector is changed or the shaping time of the amplifier is changed. Pole-zeroing requires the amplifier to be amplifying pulses. The detector should be connected in the final configuration before pole zeroing is started. There should be a radioactive source near the detector so that the count rate will be high enough (about 5 to 10% dead time) to accomplish the pole zero in the proper time.

Without an oscilloscope connected to the amplifier output to display the pulse shape, the effect of the pole zero operation is not always easy to see. The most common effect of an incorrect pole-zero setting is tailing on the peak shape in the spectrum. Here, tailing refers to abnormally high counts on either side of the peak. If the amplifier was close to the proper pole zero setting before the operation, the spectrum peak shape might not change enough to be seen.

3.2.15.2. ADC

This tab (Fig. 157) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

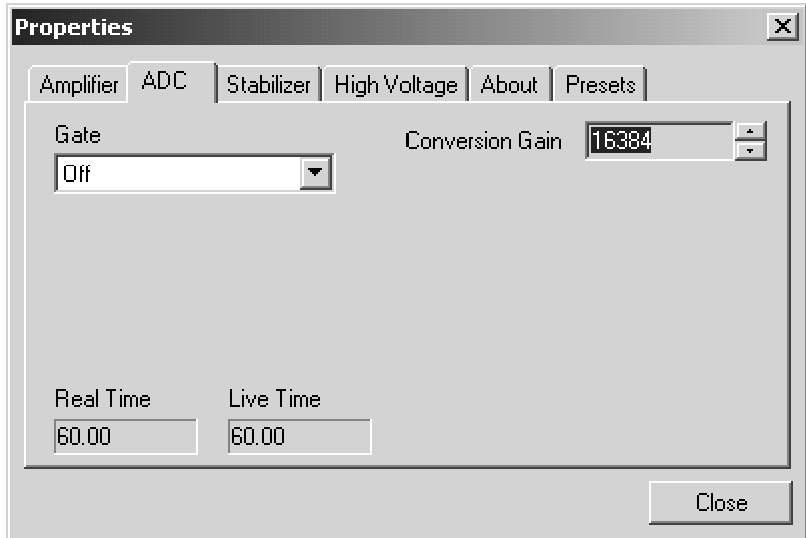


Fig. 157. 92X, NOMAD, NOMAD Plus ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

3.2.15.3. Stabilizer

The 92X, NOMAD, and NOMAD Plus have both a gain stabilizer and a zero stabilizer. Gain and zero stabilization are discussed in detail in Sections 3.4 and 3.5, respectively.

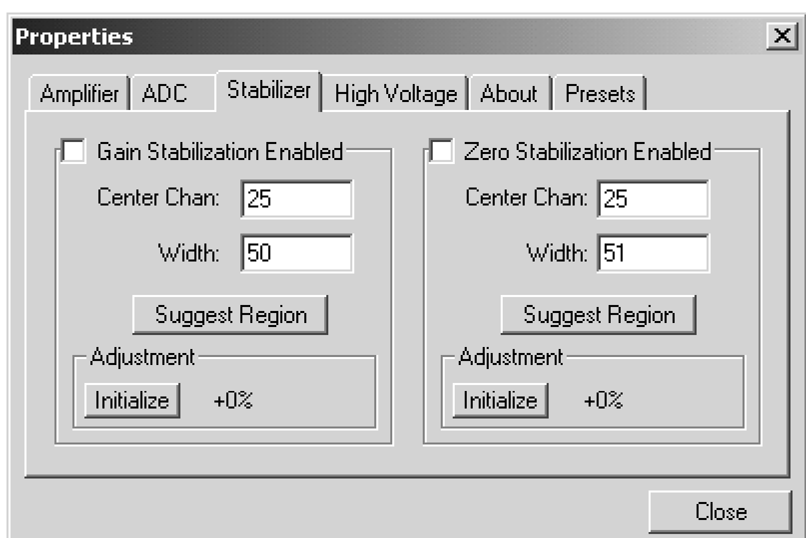


Fig. 158. 92X, NOMAD, NOMAD Plus Stabilizer Tab.

The Stabilizer tab (Fig. 158) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.15.4. High Voltage

Figure 159 shows the High Voltage tab. The **On** and **Off** buttons apply and remove the high voltage. This function is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. The **Target** voltage level is displayed on this tab but cannot be modified from the dialog. It is controlled by the hardware and can be adjusted by a rear-panel potentiometer. High-voltage polarity is set with an internal jumper. See the MCB hardware manual for more information.

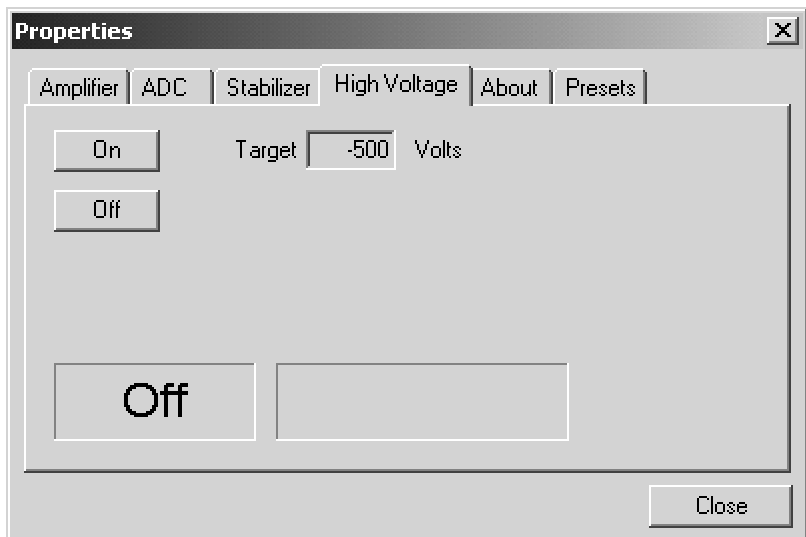


Fig. 159. 92X, NOMAD, NOMAD Plus High Voltage Tab.

3.2.15.5. About

This tab (Fig. 160) displays hardware and firmware information about the currently selected 92X, NOMAD, or NOMAD Plus, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

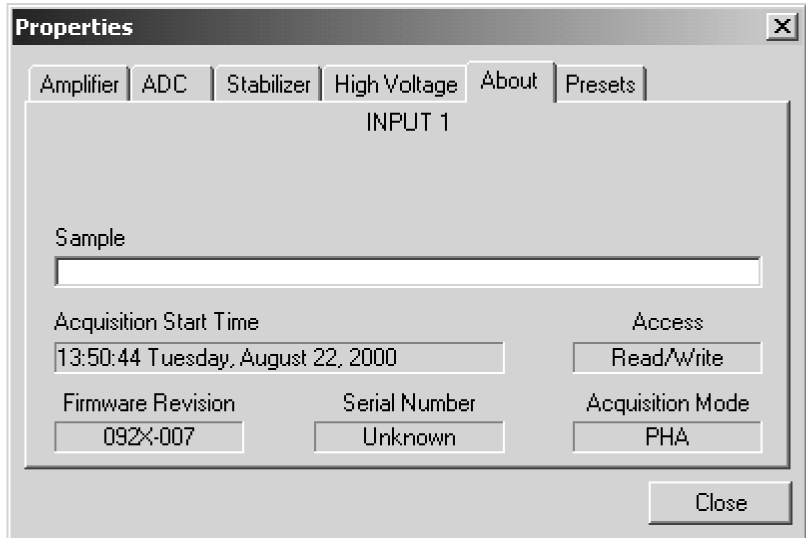


Fig. 160. 92X, NOMAD, NOMAD Plus About Tab.

3.2.15.6. Presets

Figure 161 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

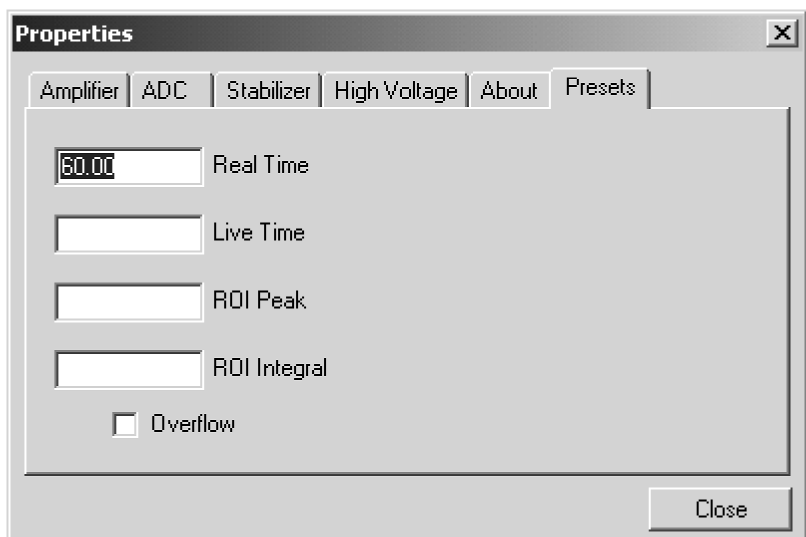


Fig. 161. 92X, NOMAD, NOMAD Plus Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.16. MatchMaker ADC Interface

3.2.16.1. ADC

The MatchMaker ADC interface is used to interface standalone ADCs from different manufacturers to the ***CONNECTIONS-32*** software. The ADC tab (Fig. 162) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

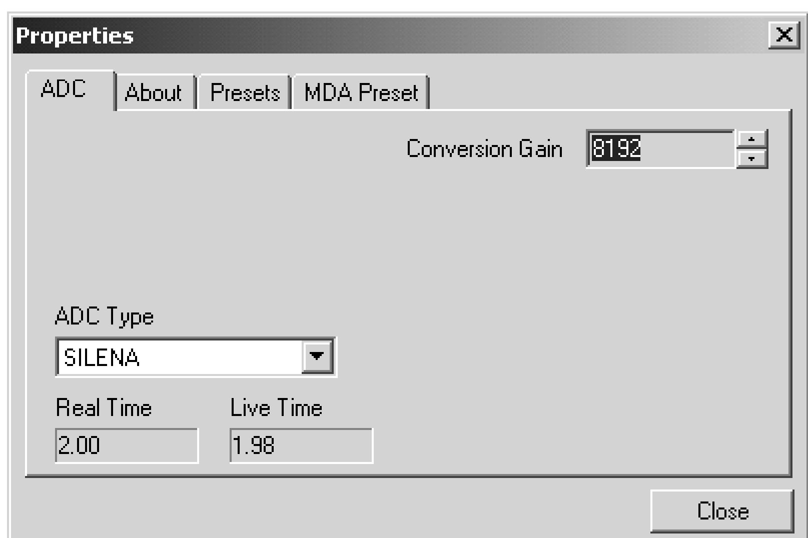


Fig. 162 . MatchMaker ADC Tab.

The **Conversion Gain** set here is the number of channels that will be displayed when this ADC is selected. It is also the number of channels stored in the spectrum on disk. Normally this is set to the ADC conversion gain selected in the hardware unit, but can be different depending on the options available in the ADC hardware itself.

The **ADC Type** can be (1) ORTEC, (2) Canberra 26-pin, (3) Canberra 34-pin (including the S100), or (4) Silena. For these ADCs, all of the controls (such as conversion gain or amplifier settings) are in the hardware.

3.2.16.2. About

This tab (Fig. 163) displays hardware and firmware information about the currently selected MatchMaker, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MatchMaker is currently locked with a password. **Read/Write** indicates that it is unlocked; **Read Only** means it is locked.

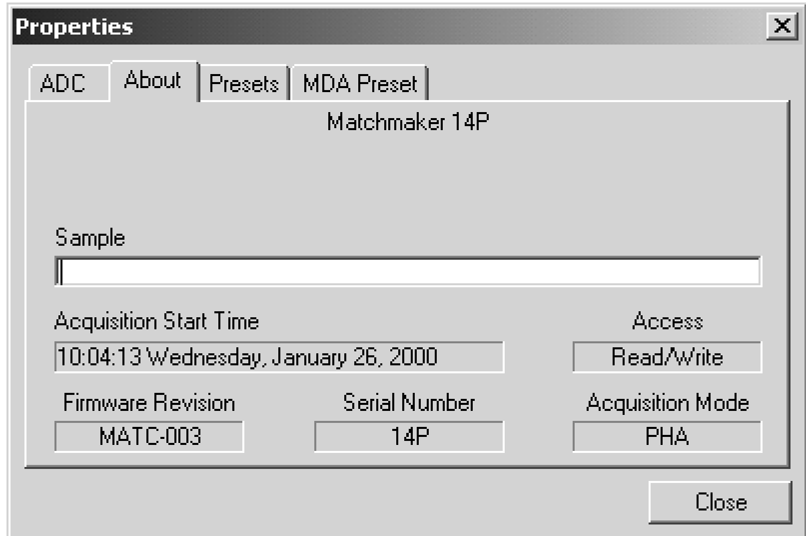


Fig. 163. MatchMaker About Tab.

3.2.16.3. Presets

Figure 164 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be

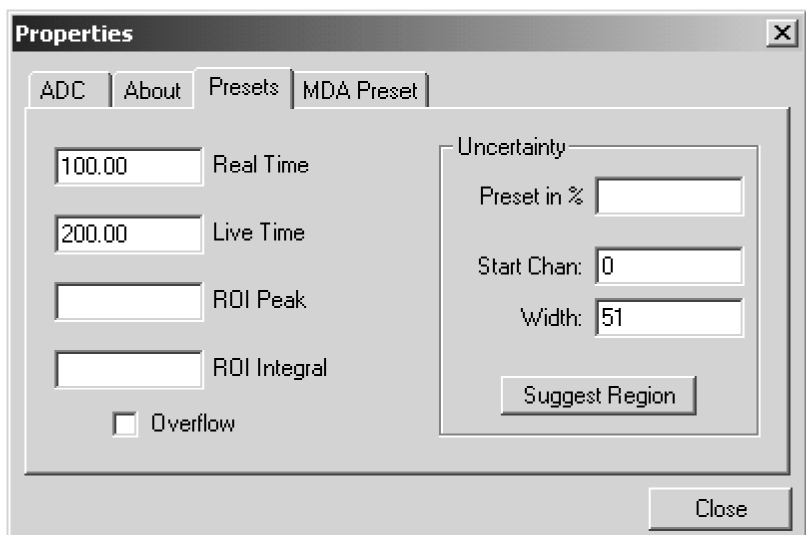


Fig. 164. MatchMaker Presets Tab.

counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

3.2.16.4. MDA Preset

The MDA preset (Fig. 165) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the “Analysis Methods” chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

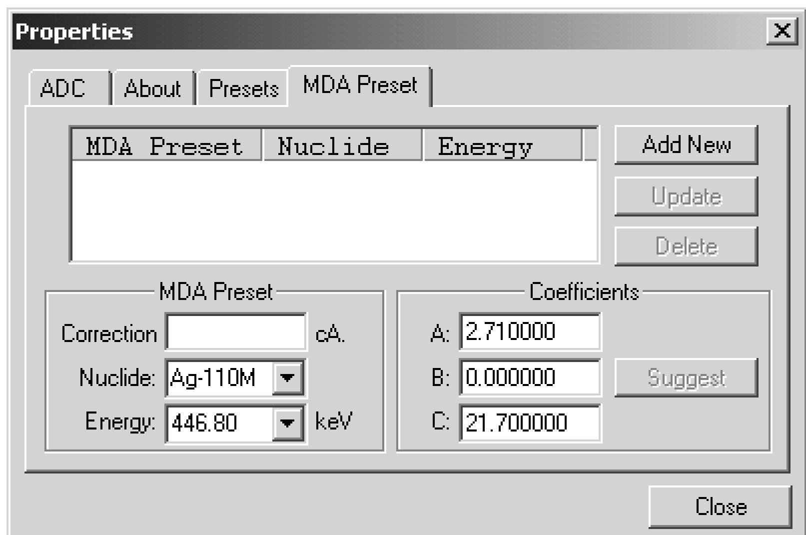


Fig. 165. MatchMaker MDA Preset Tab.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the MatchMaker is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction**

factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.17. 919 and 919E

The Model 919E has more features than the 919, as explained beginning in Section 3.2.17.6.

3.2.17.1. ADC

This tab (Fig. 166) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

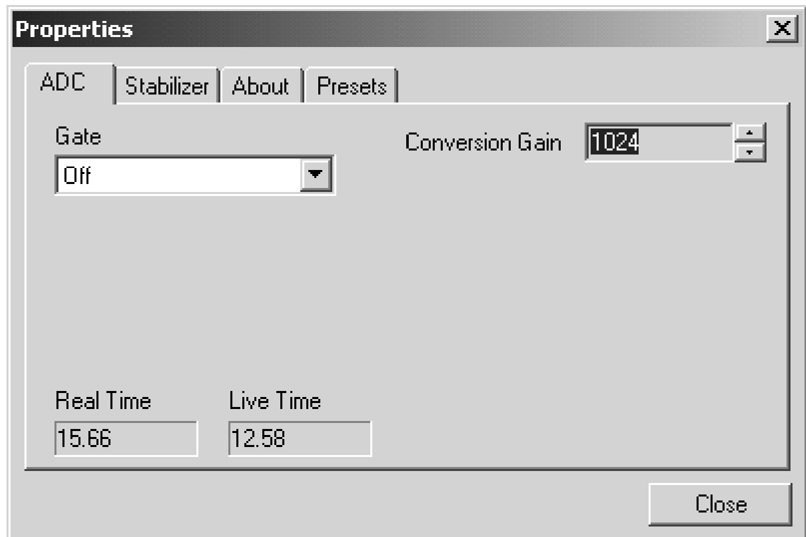


Fig. 166. 919 and 919E ADC Tab.

3.2.17.2. Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

3.2.17.3. Stabilizer

The 919 and 919E have both a gain stabilizer and a zero stabilizer on input 1 only. Gain and zero stabilization are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 167) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

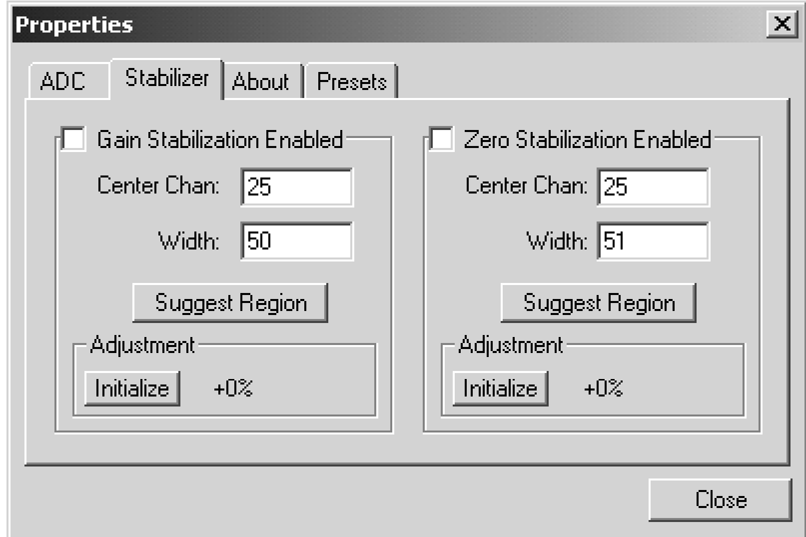


Fig. 167. 919 and 919E Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. Ifthe marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.17.4. About

This tab (Fig. 168) displays hardware and firmware information about the currently selected 919 or 919E, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/ Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

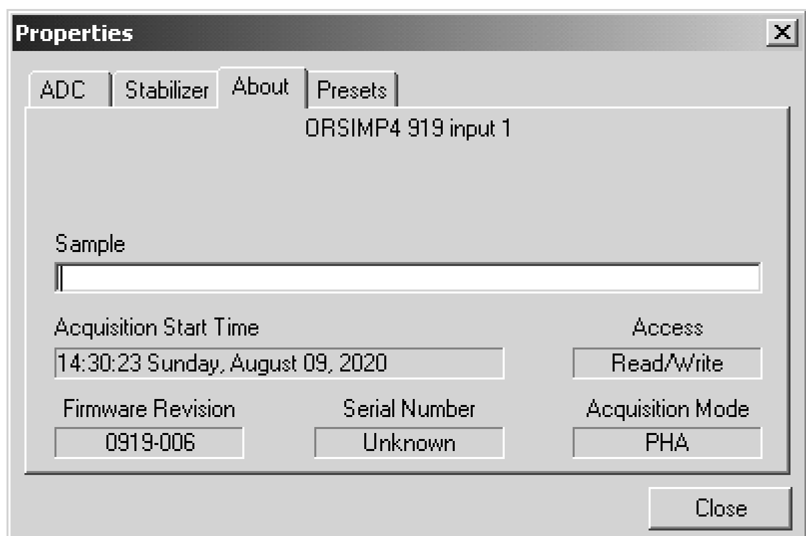


Fig. 168. 919 and 919E About Tab.

3.2.17.5. Presets

Figure 169 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of

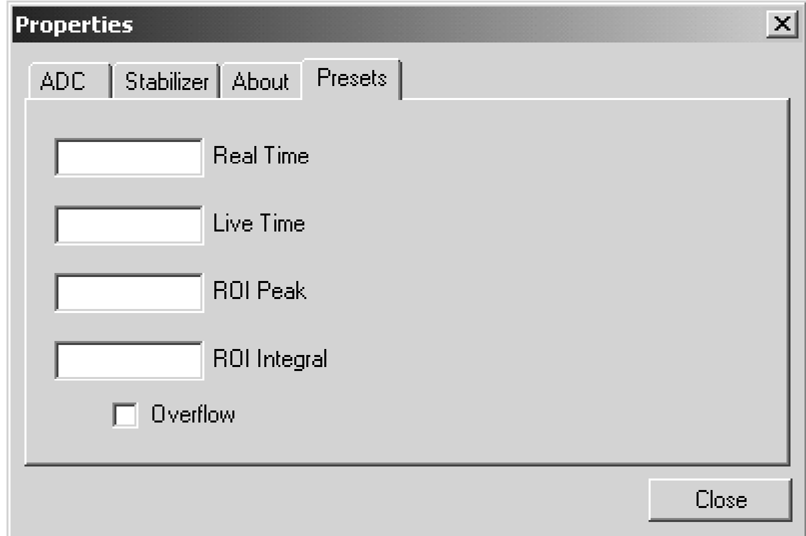


Fig. 169. 919 Presets Tab.

widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

3.2.17.6. 919E: Uncertainty Preset

The 919E includes an **Uncertainty** preset on the Presets tab (see Fig. 164, page 146, for an example of this preset's data fields). The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

3.2.17.7. 919E: MDA Preset Tab

The MDA preset (Fig. 170) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

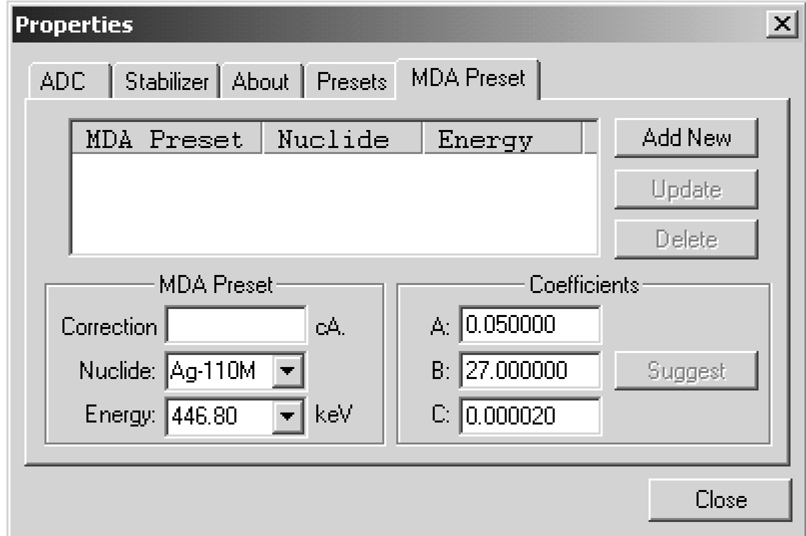


Fig. 170. 919E MDA Preset Tab.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the 919E is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.18. 921 and 921E

The Model 921E has more features than the 921, as explained beginning in Section 3.2.18.5.

3.2.18.1. ADC

This tab (Fig. 171) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

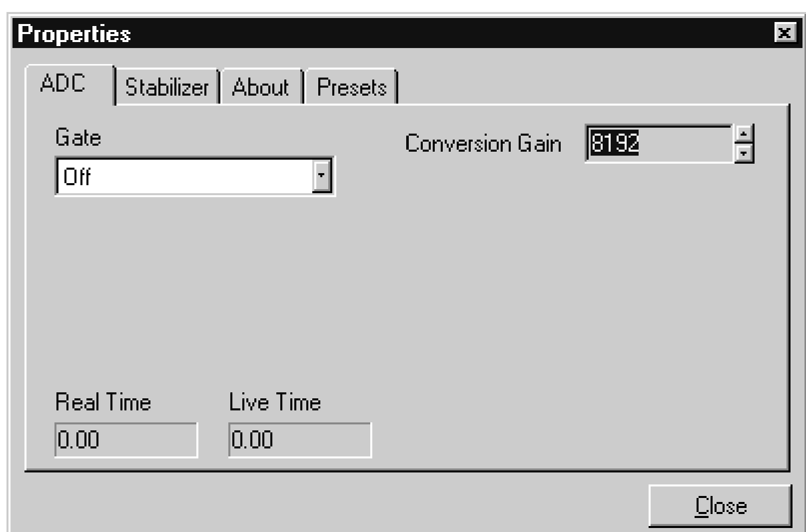


Fig. 171. 921 and 921E ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

3.2.18.2. Stabilizer

The 921 and 921E have both a gain stabilizer and a zero stabilizer. Gain and zero stabilization are discussed in detail in Sections 3.4 and 3.5, respectively.

The Stabilizer tab (Fig. 172) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

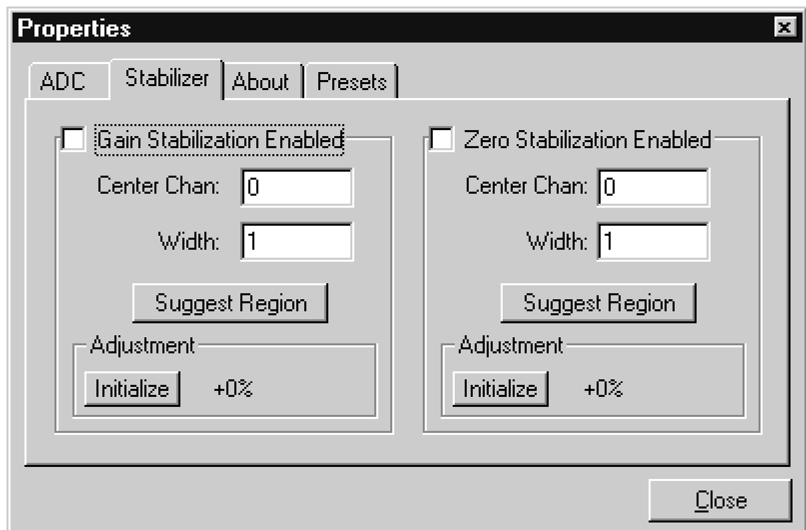


Fig. 172. 921 and 921E Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.18.3. About

This tab (Fig. 173) displays hardware and firmware information about the currently selected 921 or 921E, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

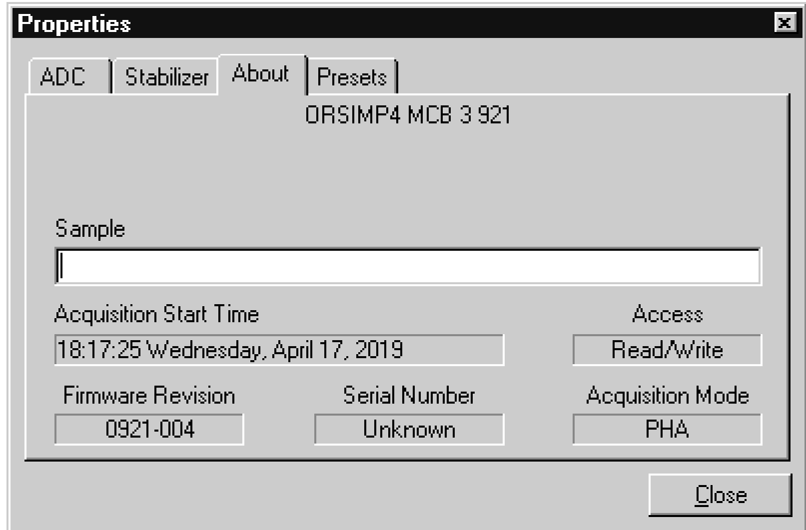


Fig. 173. 921 and 921E About Tab.

3.2.18.4. Presets

Figure 174 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

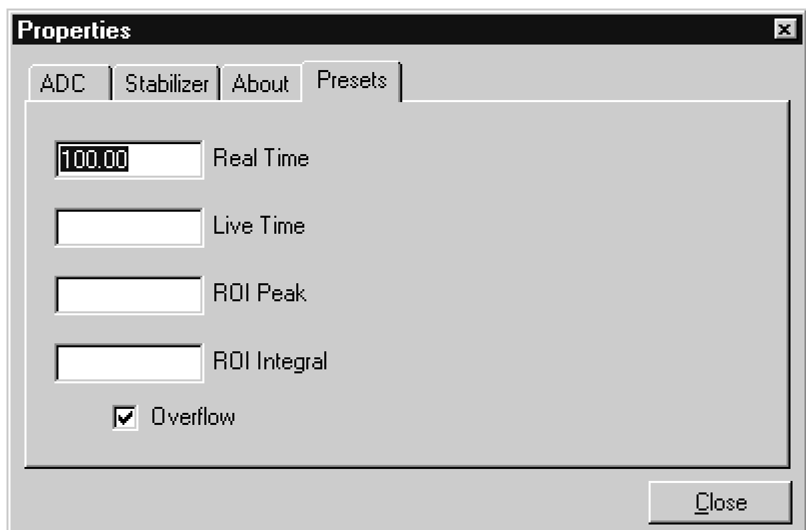


Fig. 174. 921 and 921E Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.18.5. 921E: Uncertainty Preset

The 921E includes an **Uncertainty** preset on the Presets tab (see Fig. 164, page 146, for an example of this preset's data fields). The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

3.2.18.6. 921E: MDA Preset

The MDA preset (Fig. 175) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

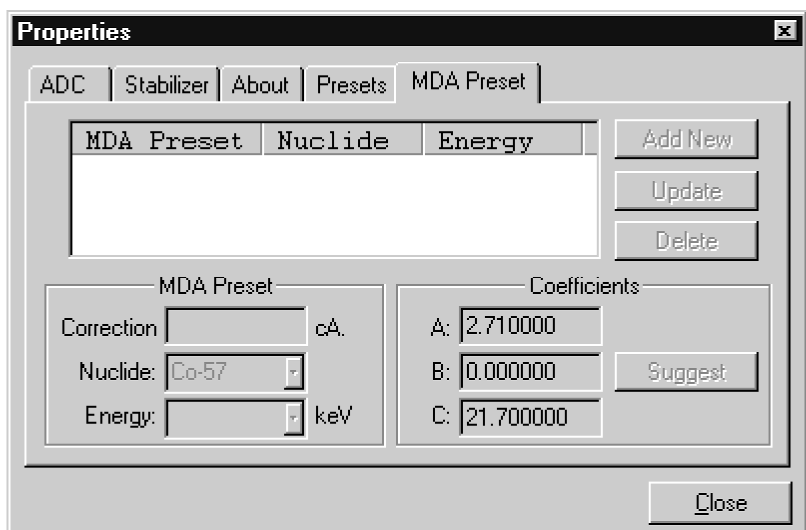


Fig. 175. 921E MDA Preset Tab.

If the application supports efficiency calibration and the 921E is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.19. TRUMP-PCI

3.2.19.1. ADC

This tab (Fig. 176) contains the **Gate**, **Conversion Gain**, **Lower Level Disc**riminator, **Upper Level Disc**riminator and **Zero Adjustment** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

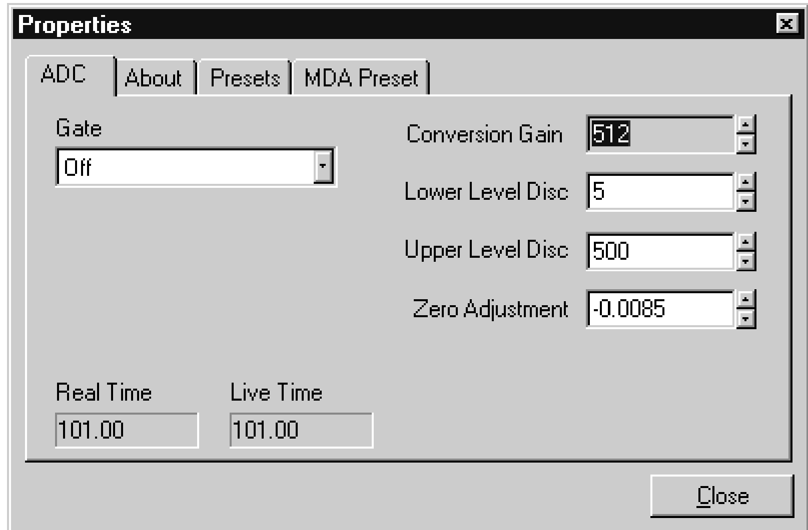


Fig. 176. TRUMP-PCI ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum). An external oscilloscope is needed to check this timing.

Conversion Gain

If set to 8192, the energy scale will be divided into 8192 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the instrument's valid settings.

Upper- and Lower-Level Discriminators

In the TRUMP-PCI the lower- and upper-level discriminators are under computer control.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

Zero Adjustment

The **Zero Adjustment** is used to set the dc offset voltage on the preamplifier input. The control ranges plus and minus, with 2048 being 0 V offset. The setting is normally 0 V or slightly negative. Setting the value too far in the positive direction (above 2048) can cause "lock-up" by putting the input value above the pulse reset discriminator value. A lock-up has occurred if the live time stops and the real time continues to count. The full range of offset is ±125 mV. Therefore, a setting of 3100 corresponds to a zero offset of +64.2 mV.

3.2.19.2. About

This tab (Fig. 177) displays hardware and firmware information about the currently selected TRUMP-PCI as well as the data **Acquisition Start Time** and **Sample** description. The **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

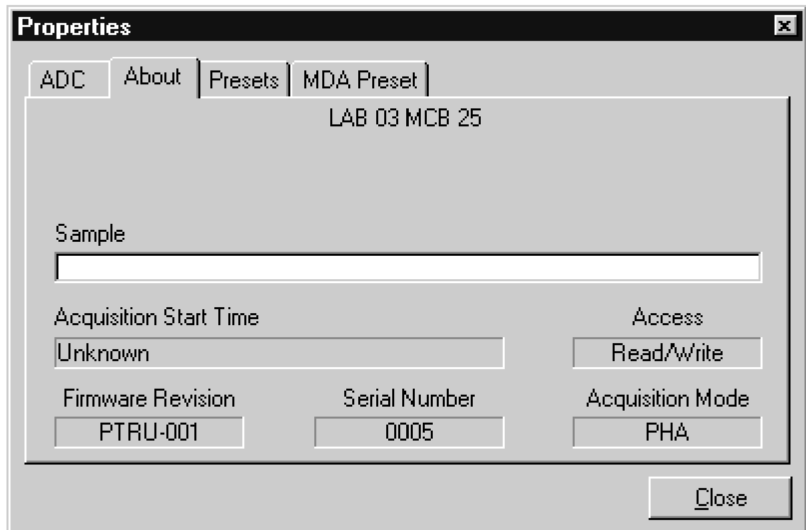


Fig. 177. TRUMP-PCI About Tab.

This screen displays the TRUMP-PCI's serial number; all TRUMP-PCIs have a unique serial number which is read by the software and stored in the spectrum file for verification of the spectrum. The PC to which the TRUMP-PCI is attached is shown at the top of the dialog.

3.2.19.3. Presets

Figure 178 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

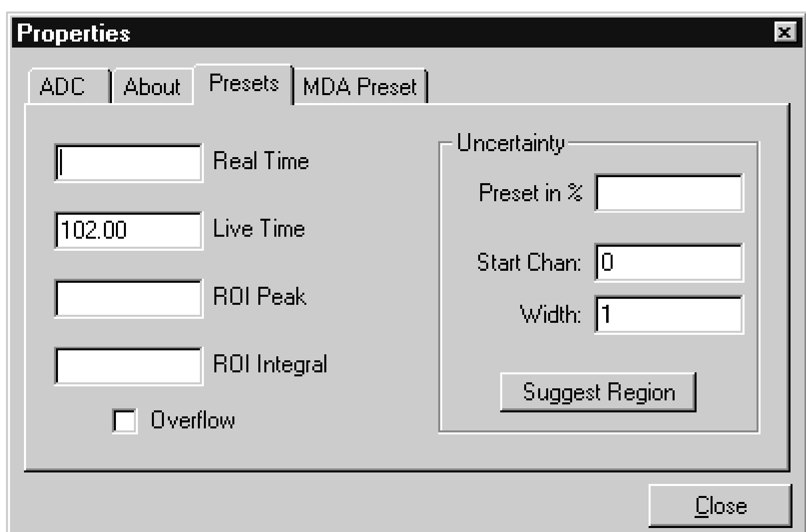


Fig. 178. TRUMP-PCI Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.19.4. MDA Preset

The MDA preset (Fig. 179) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

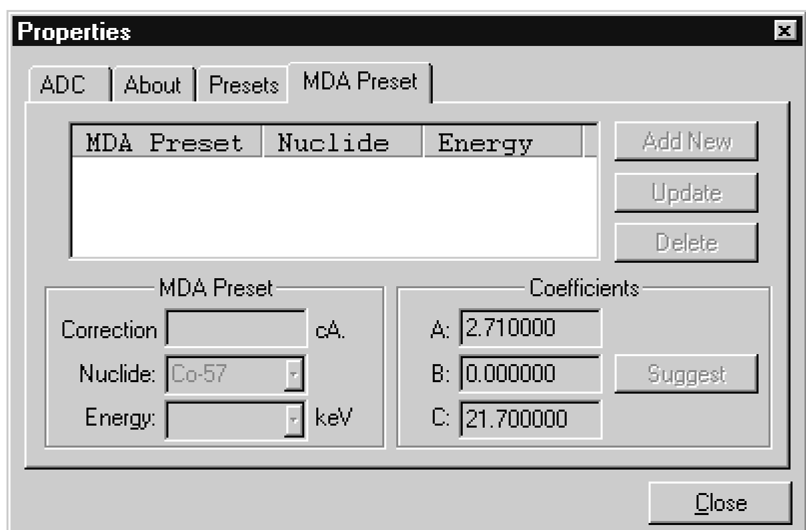


Fig. 179. TRUMP-PCI MDA Preset Tab.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the TRUMP-PCI is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.20. TRUMP and 926

3.2.20.1. ADC

This tab (Fig. 180) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

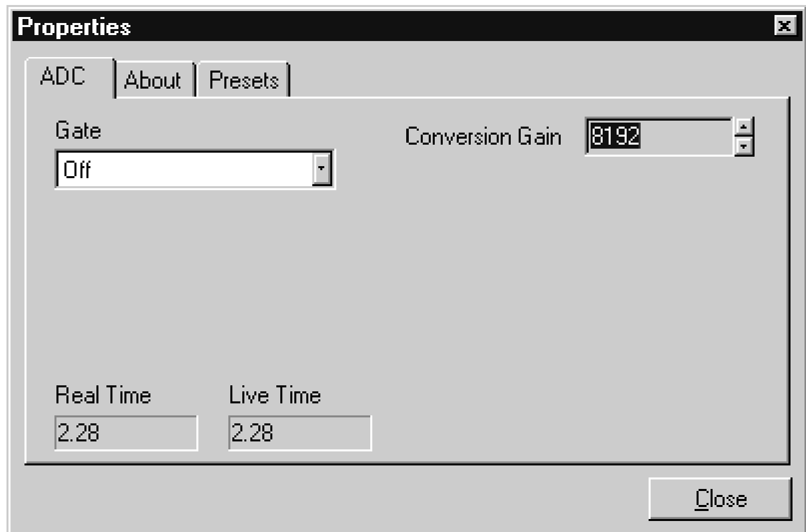


Fig. 180. TRUMP and 926 ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 8192, the energy scale will be divided into 8192 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048, ...). The up/down arrow buttons step through the valid settings.

3.2.20.2. About

This tab (Fig. 181) displays hardware and firmware information about the currently selected TRUMP or 926, as well as the data **Acquisition Start Time** and **Sample** description.

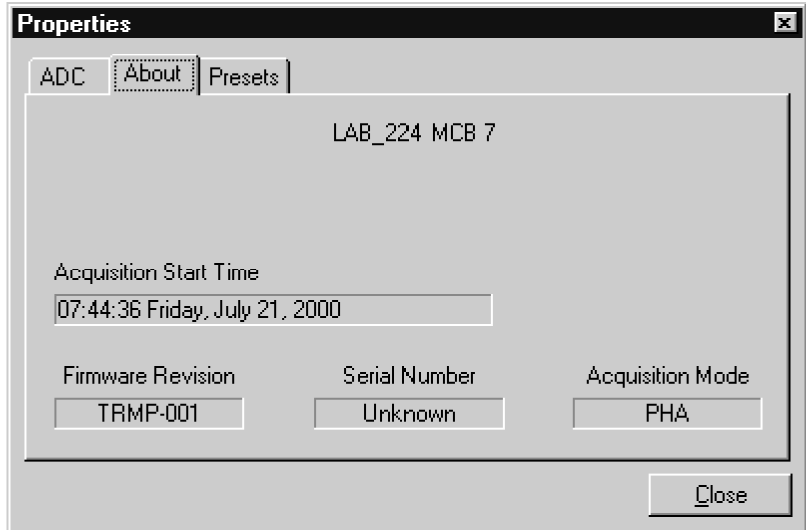


Fig. 181. TRUMP and 926 About Tab.

3.2.20.3. Presets

Figure 182 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

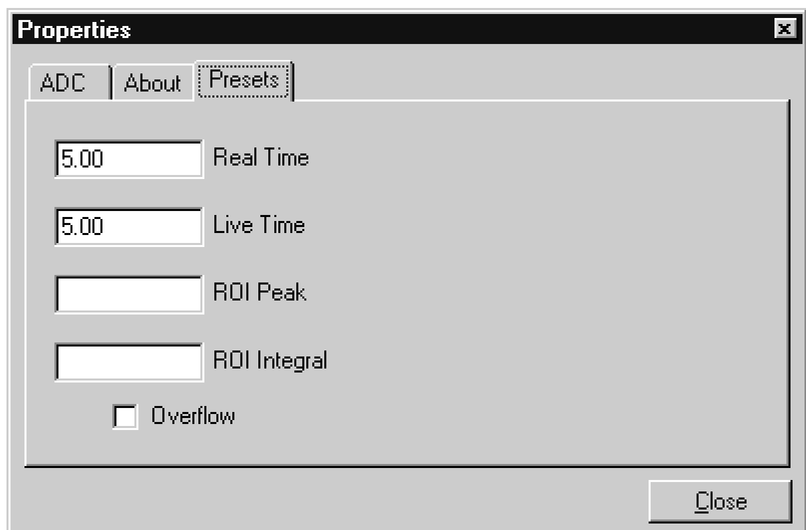


Fig. 182. TRUMP and 926 Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.21. 918

3.2.21.1. ADC

The 918 does not have computer-adjustable ADC controls. The current instrument's real time and live time are monitored at the bottom of the ADC tab (Fig. 183).

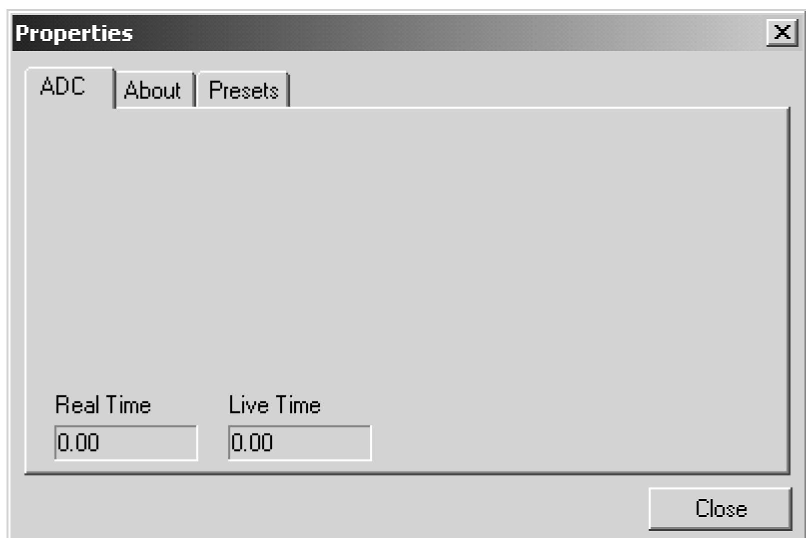


Fig. 183. 918 ADC Tab.

3.2.21.2. About

This tab (Fig. 184) displays hardware and firmware information about the currently selected 918, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

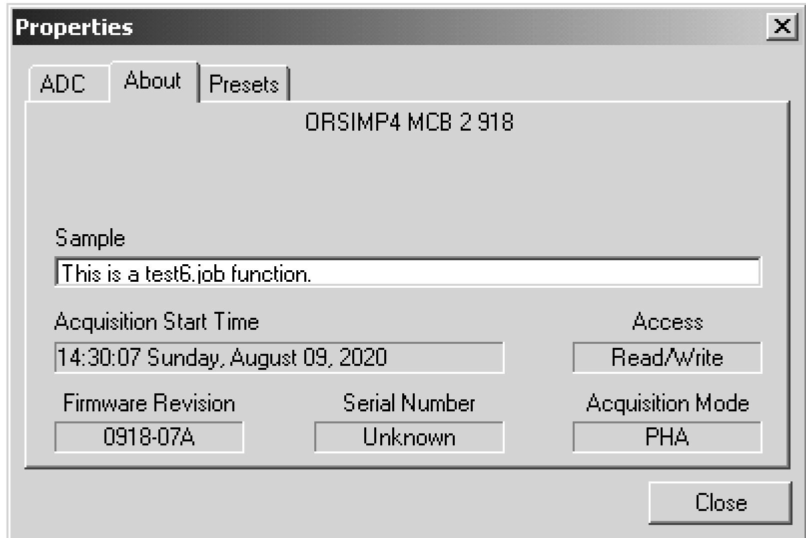


Fig. 184. 918 About Tab.

3.2.21.3. Presets

Figure 185 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

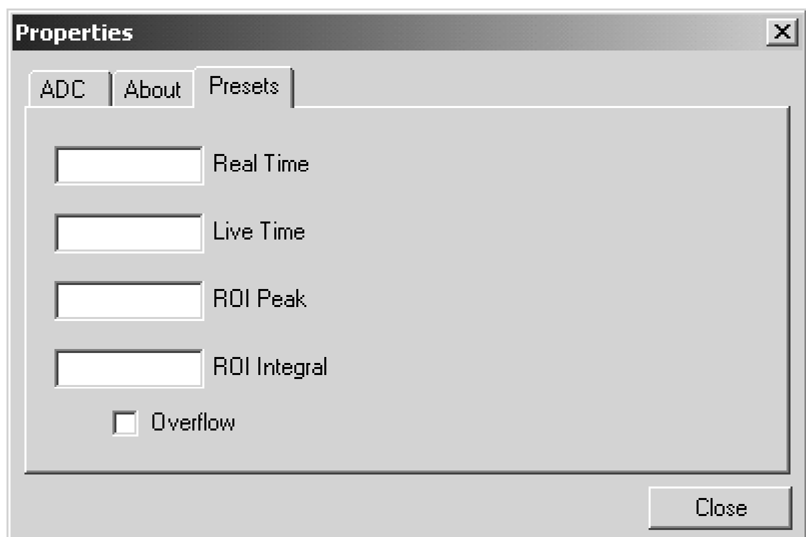


Fig. 185. 918 Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

3.2.22. 916, 916A, ACE, and Spectrum ACE

3.2.22.1. ADC

This tab (Fig. 186) contains the **Conversion Gain** control. In addition, the current real time and live time are monitored at the bottom of the dialog.

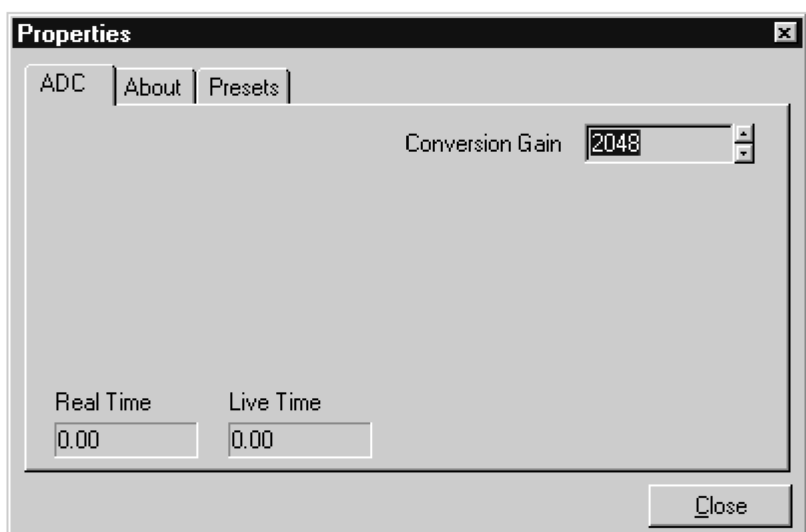


Fig. 186. 916, 916A, ACE, and Spectrum ACE ADC Tab.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 2048, the energy scale will be divided into 2048 channels. The conversion gain is entered in powers of 2 (e.g., 2048, 1024, 512, ...). The up/down arrow buttons step through the valid settings for each instrument type.

3.2.22.2. About

This tab (Fig. 187) displays hardware and firmware information about the currently selected instrument, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/ Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

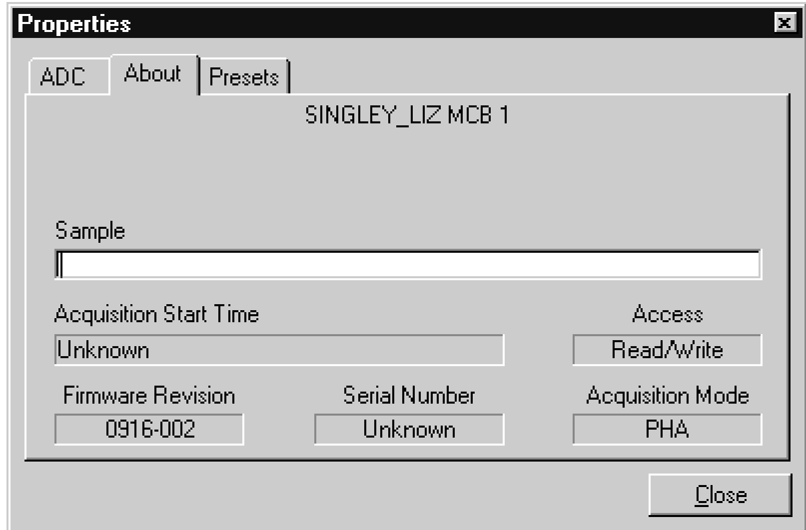


Fig. 187. 916, 916A, ACE, and Spectrum ACE About Tab.

3.2.22.3. Presets

Figure 188 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

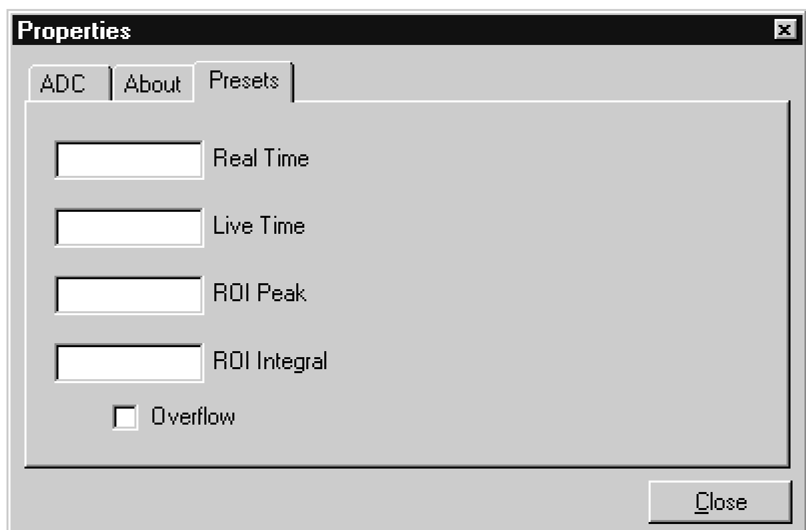


Fig. 188. 916, 916A, ACE, and Spectrum ACE Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.23. 917

3.2.23.1. ADC

The 917 does not have computer-adjustable ADC controls. The current instrument's real time and live time are monitored at the bottom of the ADC tab (Fig. 189).

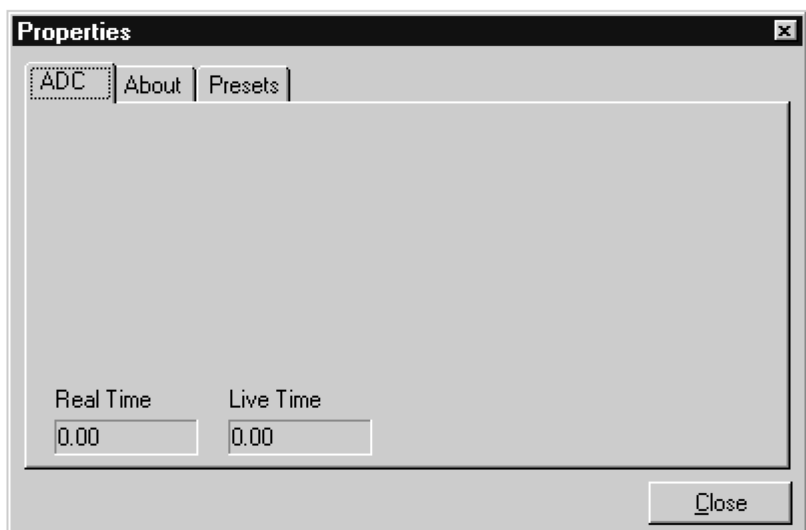


Fig. 189. 917 ADC Tab.

3.2.23.2. About

This tab (Fig. 190) displays hardware and firmware information about the currently selected 917, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

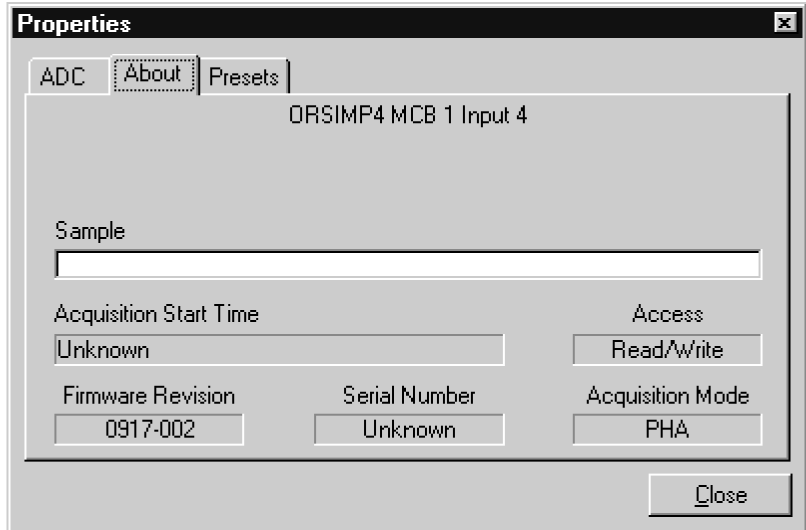


Fig. 190. 917 About Tab.

3.2.23.3. Presets

Figure 191 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

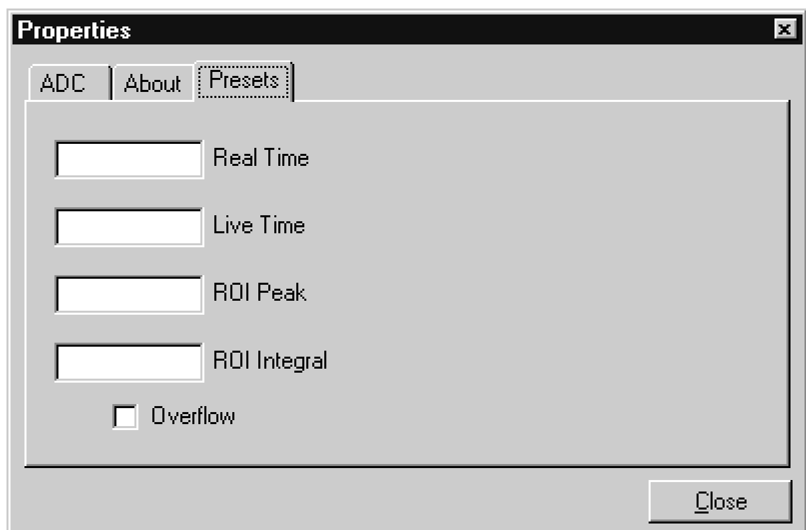


Fig. 191. 917 Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.24. MicroNOMAD

3.2.24.1. Amplifier

Figure 192 shows the Amplifier tab, which contains the **Gain** control.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

Gain

Set the amplifier **Gain** with the horizontal slider bar or the edit box, in the range of 5.00 to 25.00. The resulting effective gain is shown at the top of the **Gain** section.

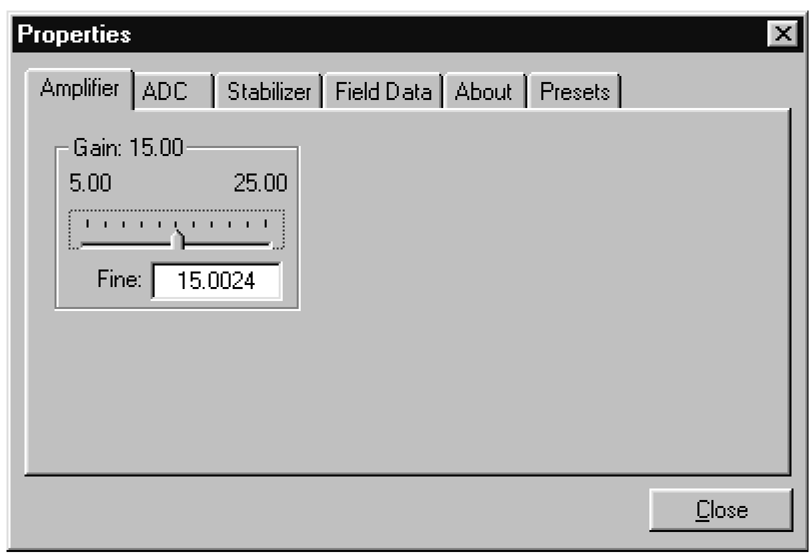


Fig. 192. MicroNOMAD Amplifier Tab.

3.2.24.2. ADC

This tab (Fig. 193) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

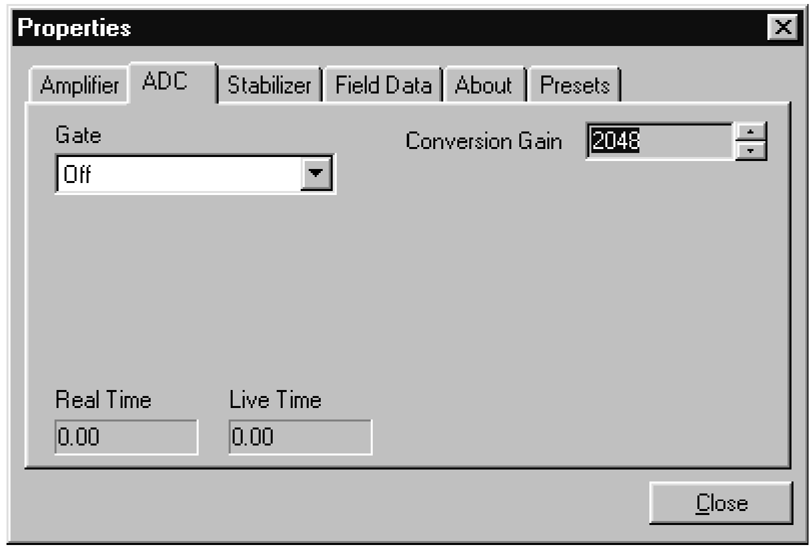


Fig. 193. MicroNOMAD ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

NOTE The **Gate** should be left **Off** because the MicroNOMAD gate control input is normally not accessible.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 2048, the energy scale will be divided into 2048 channels. The conversion gain is entered in powers of 2 (e.g., 2048, 1024, 512, ...). The up/down arrow buttons step through the valid settings for the MicroNOMAD.

3.2.24.3. Stabilizer

The MicroNOMAD has a gain stabilizer. Gain stabilization is discussed in detail in Section 3.4.

The Stabilizer tab (Fig. 194) shows the current gain stabilizer setting. The value in the **Adjustment** section shows how much adjustment is currently applied. The **Initialize** button sets the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

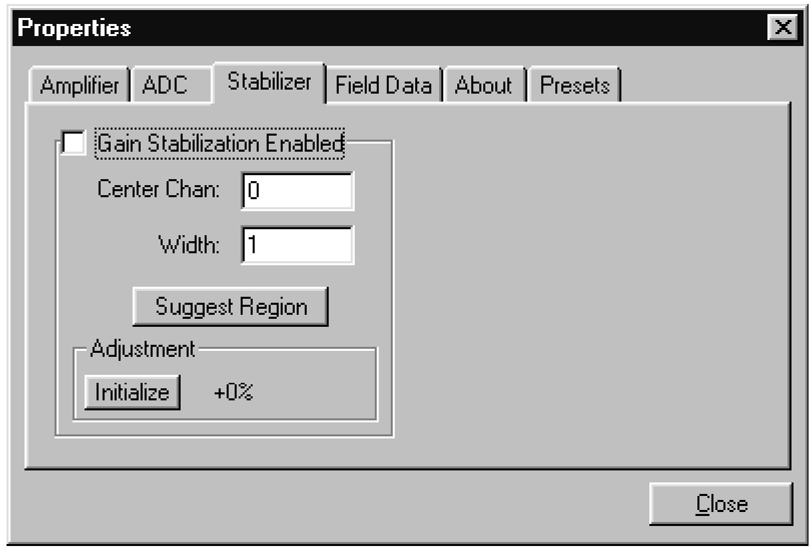


Fig. 194. MicroNOMAD Stabilizer Tab.

3.2.24.4. Field Data

This tab (Fig. 195) is used to **Enter** and **Exit** the Field Mode (remote operation detached from a PC) or to view the MicroNOMAD spectra collected in field mode. The MicroNOMAD can only be set in Field Mode by clicking on the **Enter** button on this tab, and remains in Field Mode unit you return to this tab and click on **Exit**. It cannot be removed from Field Mode when disconnected from the PC. The spectrum can then be viewed in the application as the "active" spectrum in the MCB. The active spectrum is the spectrum where the new data are collected. The current active spectrum is lost.

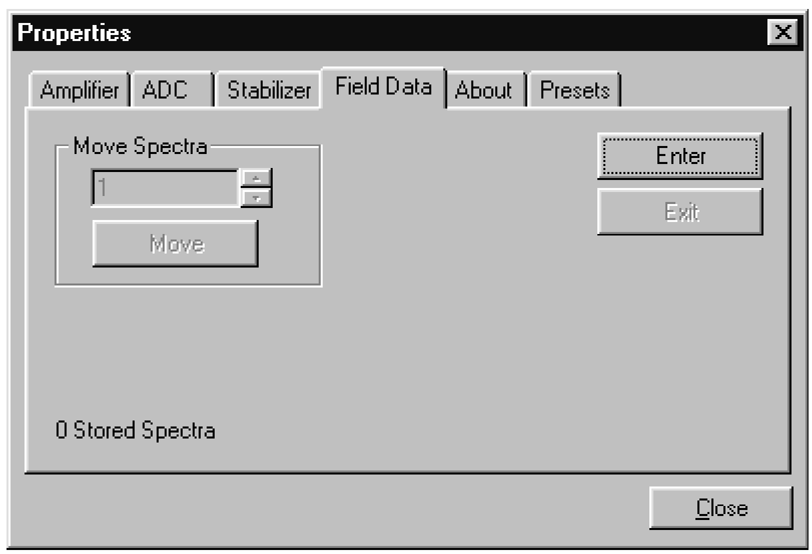


Fig. 195. MicroNOMAD Field Data Tab.

When the MicroNOMAD is in field mode, the spectrum is collected in the active spectrum position until the preset is met and then it is stored as the *next stored spectrum*. The microNOMAD waits until the next trigger and then starts the collection of the new spectrum.

NOTE If the MicroNOMAD is in field mode and you attempt to access it within a *CONNECTIONS* application, the following message will be displayed at the bottom of the program window: “**Start [or Stop] Error: Not Allowed During Current Mode**.” Go to the Field Data tab to exit field mode.

The lower left of the tab shows the total number of spectra (not counting the active spectrum) stored in the MicroNOMAD memory. The spectrum ID of the active spectrum is shown in the lower right. The stored spectra cannot be viewed or stored in the computer until they are moved to the active spectrum position.

To move a spectrum from the stored memory to the active memory, enter the spectrum number and click on **Move**. Use the up/down arrow buttons to scroll through the list of spectra. The label on the lower right does not update until a spectrum is moved. Note that this only moves the spectrum inside the MicroNOMAD. To save the stored spectrum to the PC disk, move it to the active position and use the **File/Save** commands in your application.

Use the **Acquire/Download Spectra...** command to download all the stored spectra and save them to disk automatically. They can then be viewed in a buffer window.

3.2.24.5. About

This tab (Fig. 196) displays hardware and firmware information about the currently selected MicroNOMAD, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

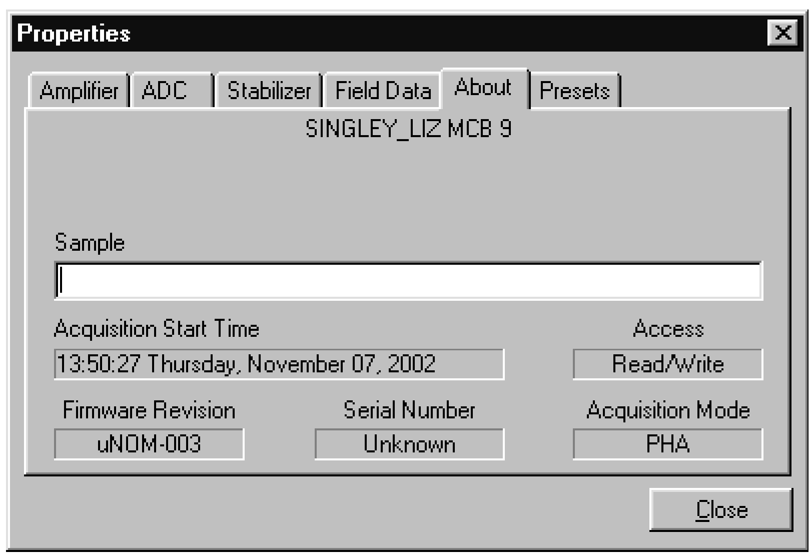


Fig. 196. MicroNOMAD About Tab.

3.2.24.6. Presets

Figure 197 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of

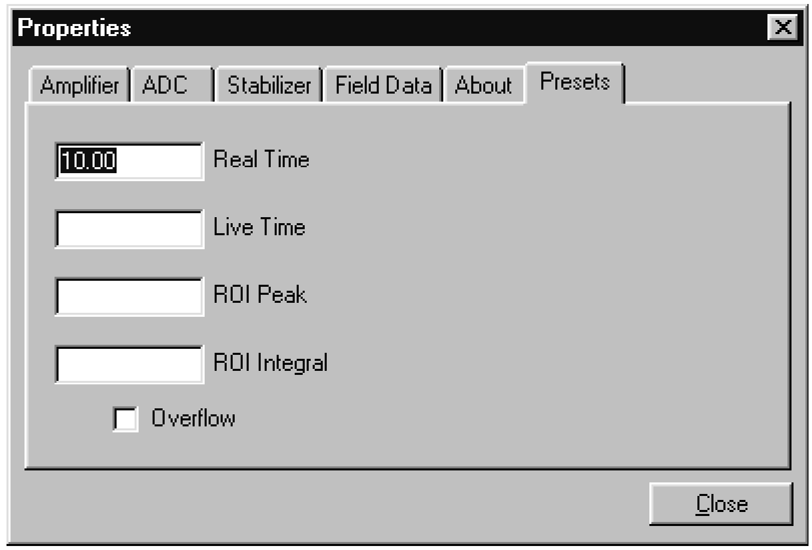


Fig. 197. MicroNOMAD Presets Tab.

widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.25. MicroACE

3.2.25.1. Amplifier

Figure 198 shows the Amplifier tab. This tab contains the fine **Gain** control.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog.*

Adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 5.00 to 25.00.

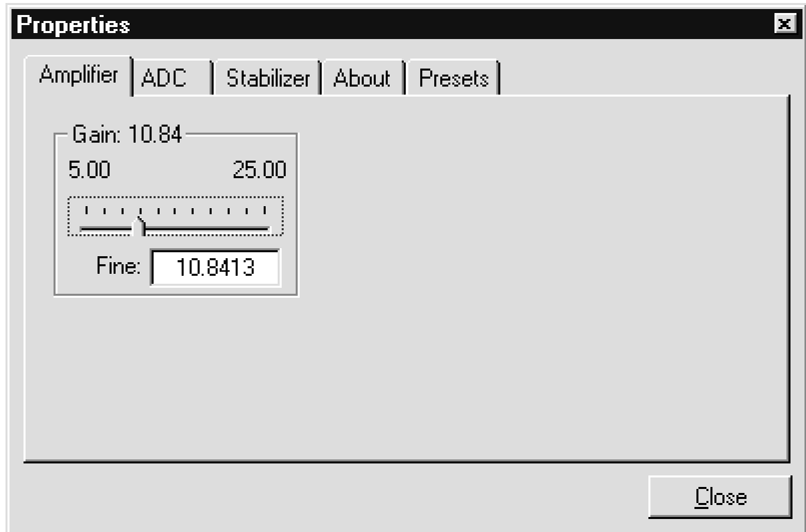


Fig. 198. MicroACE Amplifier Tab.

3.2.25.2. ADC

This tab (Fig. 199) contains the **Gate** and **Conversion Gain** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

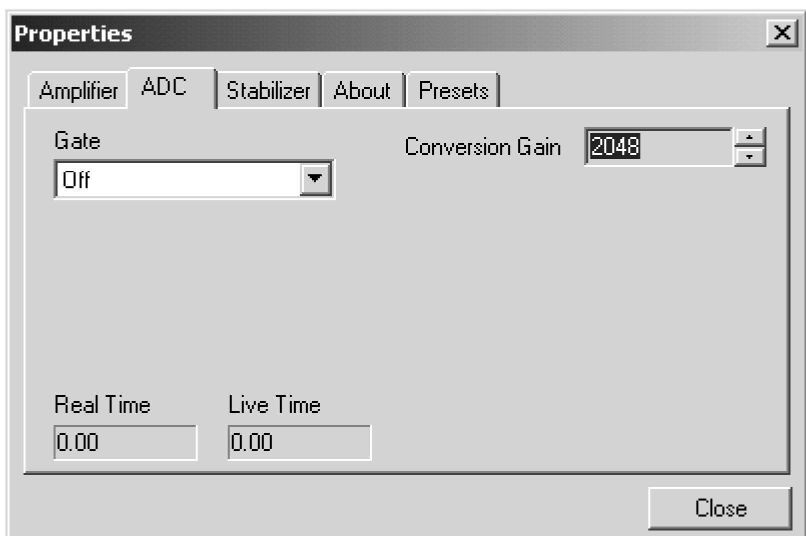


Fig. 199. MicroACE ADC Tab.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 2048, the energy scale will be divided into 2048 channels. The conversion gain is entered in powers of 2 (e.g., 2048, 1024, 512). The up/down arrow buttons step through the valid settings.

3.2.25.3. Stabilizer

The MicroACE has a gain stabilizer; gain stabilization is discussed in detail in Section 3.4.

The Stabilizer tab (Fig. 200) shows the current values for the stabilizer. The value in the **Adjustment** section shows how much adjustment is currently applied. The **Initialize** button sets the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

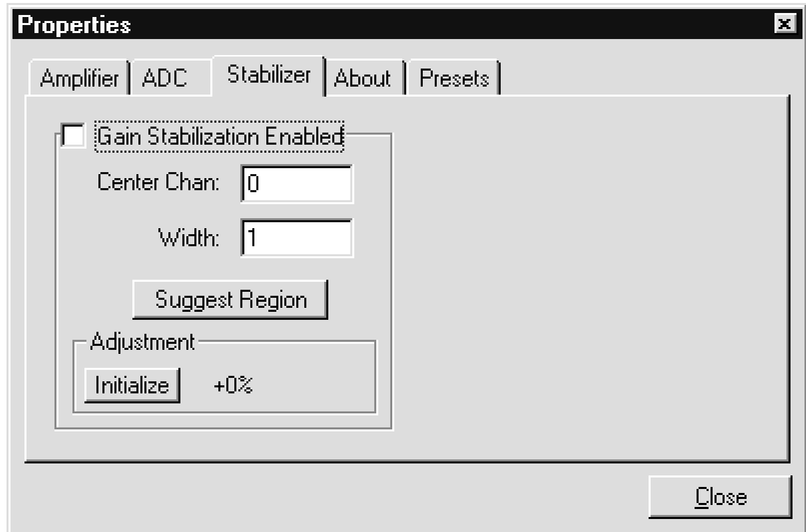


Fig. 200. MicroACE Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.25.4. About

This tab (Fig. 201) displays hardware and firmware information about the currently selected MicroACE, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

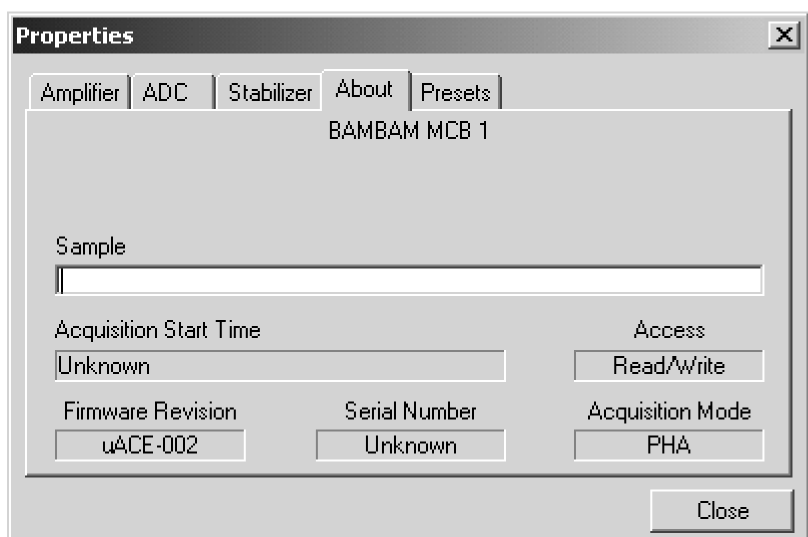


Fig. 201. MicroACE About Tab.

3.2.25.5. Presets

Figure 202 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

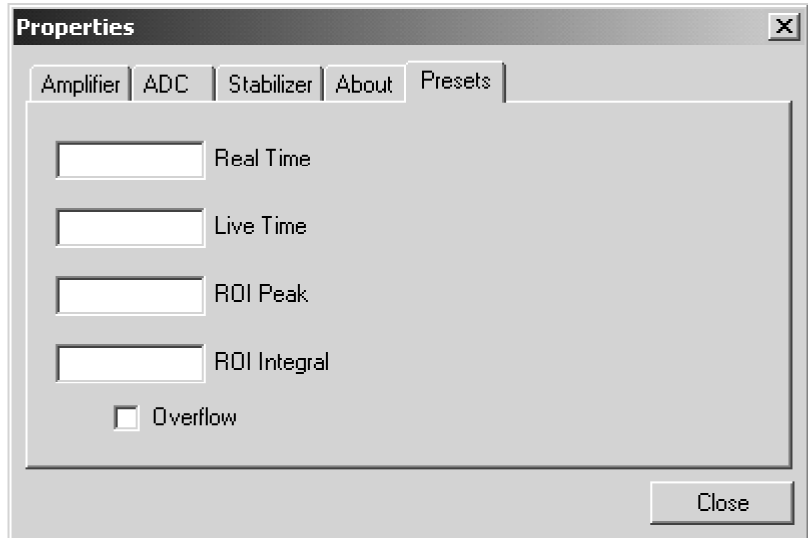


Fig. 202. MicroACE Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.26. 920 and 920E

The Model 919E has more features than the 919, as explained beginning in Section 3.2.26.4.

3.2.26.1. ADC

This tab (Fig. 203) contains the **Gate**, **Conversion Gain** and **Digital Offset** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

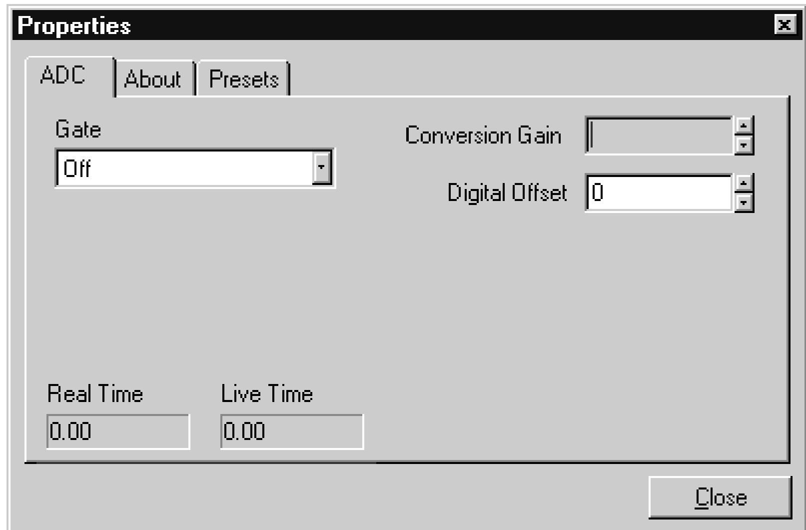


Fig. 203. 920 and 920E ADC Tab.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum).

Conversion Gain and Digital Offset

The **Digital Offset** and **Conversion Gain** are used to control the starting energy and energy range of the spectrum collected. In many cases the low-energy portion of the spectrum contains no data of interest and can be discarded. The 920 and 920E use digital offset in the MCB to accomplish this. The conversion gain is the number of channels corresponding to a full-scale input of 10 V. In the 920 and 920E, the amplifier gain is set at the factory so that a 10-MeV alpha particle corresponds to a 10-V output. All amplifier connections are internal to the system.

Table 1 shows the offset and gain settings, with the spectrum size[7] set to 512 channels, for some commonly used spectrum energy ranges. The energy range can be the same for all inputs, different for all inputs, or any combination in between. Each input has its own energy calibration in the system. These are only examples; any other combination can be used.

Table 1. Offset and Conversion Gain Settings.

Starting Energy (MeV)	Ending Energy (MeV)	Offset	Conversion Gain
3.0	5.5	600	2048
3.0	8.0	300	1024
4.0	6.5	800	2048
4.0	9.0	400	1024
5.0	7.5	1000	2048
6.0	8.5	1200	2048
Spectrum size is 512 channels.			

3.2.26.2. About

This tab (Fig. 204) displays hardware and firmware information about the currently selected 920 or 920E, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

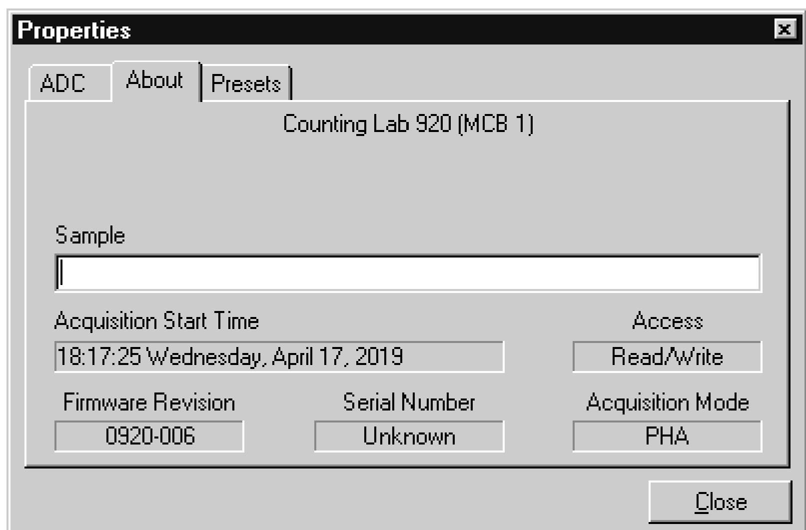


Fig. 204. 920 and 920E About Tab.

3.2.26.3. Presets

Figure 205 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter

[7] The total memory size and number of segments in the 920 and 920E can be changed. See the hardware manual and the SET920 program for details. After any changes to these settings, you must run the MCB Configuration program to register the changes (see Section 2.4).

a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

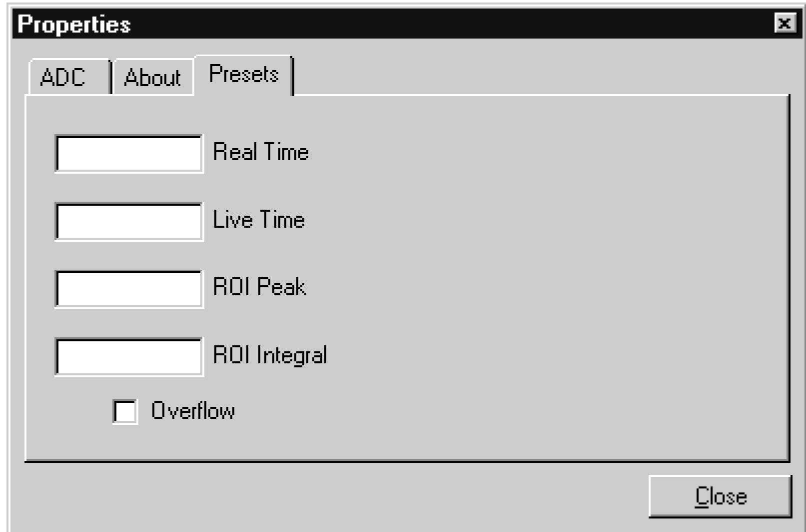


Fig. 205. 920 and 920E Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.26.4. 920E: Uncertainty Preset

The 920E includes an **Uncertainty** preset on the Presets tab (see Fig. 164, page 146, for an example of this preset's data fields). The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

3.2.26.5. 920E: MDA Preset

The MDA preset (Fig. 206) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a+\sqrt{b+c*Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*.

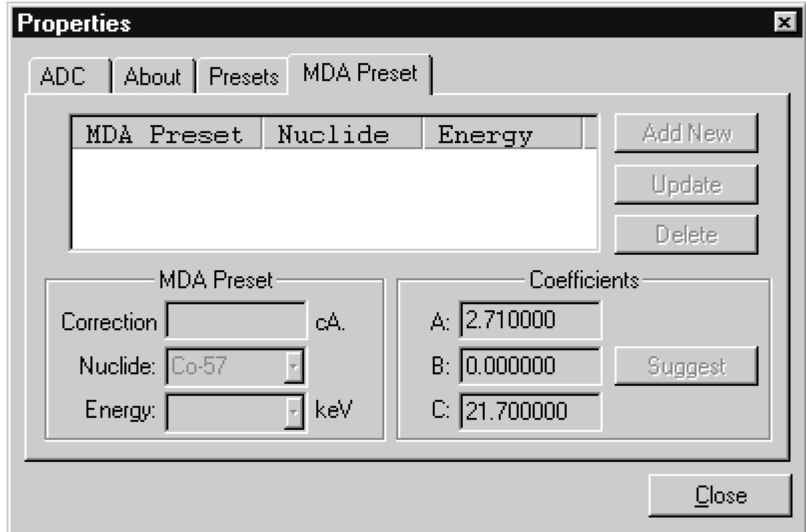


Fig. 206. 920E MDA Preset Tab.

The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

If the application supports efficiency calibration and the 920E is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.27. OCTÊTE PC and OCTÊTE Plus

The OCTÊTE Plus has more features than the OCTÊTE PC, as explained beginning in Section 3.2.27.6.

3.2.27.1. ADC

This tab (Fig. 207) contains the **Gate**, **Conversion Gain**, and **Digital Offset** controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

Gate

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 nanoseconds beyond peak detect (peak maximum). An external oscilloscope is needed to check this timing.

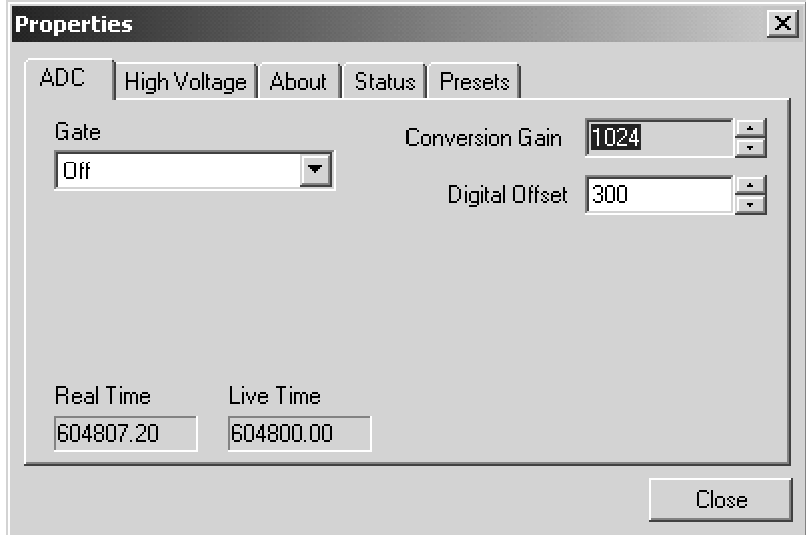


Fig. 207. OCTÊTE PC and OCTÊTE Plus ADC Tab.

Conversion Gain and Digital Offset

The **Digital Offset** and **Conversion Gain** are used to control the starting energy and energy range of the spectrum collected. In many cases the low-energy portion of the spectrum contains no data of interest and can be discarded. The OCTÊTE PC uses digital offset in the MCB to accomplish this. The conversion gain is the number of channels corresponding to a full-scale input of 10 V. In the OCTÊTE PC, the amplifier gain is set at the factory so that a 10-MeV alpha particle corresponds to a 10-V output. All amplifier connections are internal to the system.[8]

Table 2 shows the offset and gain settings, with the spectrum size set to 512 channels, for some commonly used spectrum energy ranges. The energy range can be the same for all inputs, different for all inputs, or any combination in between. Each input has its own energy calibration in the system. These are only examples; any other combination can be used.

Table 2. Offset and Conversion Gain Settings.

Starting Energy (MeV)	Ending Energy (MeV)	Offset	Conversion Gain
3.0	5.5	600	2048
3.0	8.0	300	1024
4.0	6.5	800	2048
4.0	9.0	400	1024
5.0	7.5	1000	2048
6.0	8.5	1200	2048
Spectrum size is 512 channels.			

3.2.27.2. High Voltage

Figure 208 shows the High Voltage tab, which allows you to turn the MCB bias on or off, and monitor the MCB voltage (**Actual**) and leakage **Current**.

[8]To change the total memory size or enable the second set of eight inputs in the OCTÊTE Plus, see the hardware manual and the SET920 program for details. After any changes to these settings, you must run the MCB Configuration program to register the changes (see Section 2.4).

The OCTÊTE PC has a rear-panel Vacuum/Bias Interlock switch that can disabled the bias when chamber pressure rises above the cutoff value. When the cutoff value is exceeded and the interlock shuts off the bias, the dialog's **On** button remains in the on (depressed) position. In this condition, bias will be automatically reapplied when the vacuum improves sufficiently or the interlock switch is set to off.

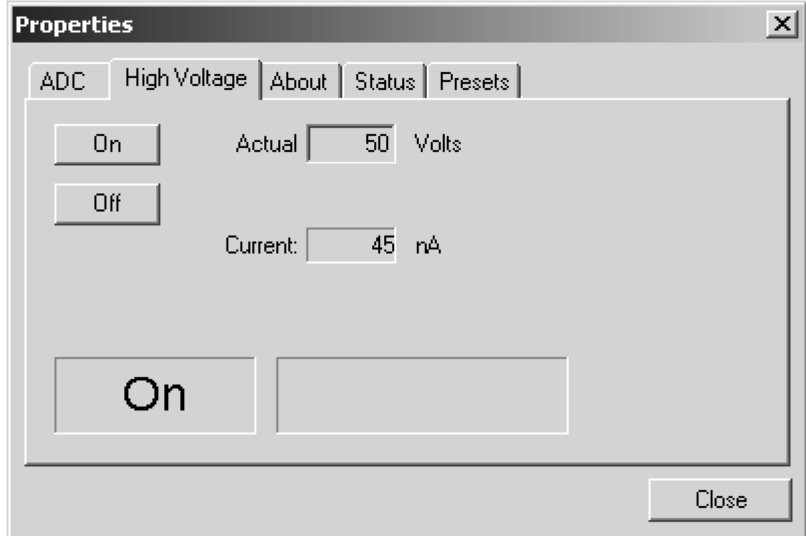


Fig. 208. OCTÊTE PC and OCTÊTE Plus High Voltage Tab.

When the bias is on, the detector leakage current is shown in the **Current** field. The leakage current is detector dependent and will be near zero when the bias is turned off.

While the Properties dialog is open, the computer monitors the OCTÊTE PC in real time, continuously updating the **Actual** voltage, leakage **Current**, and chamber pressure information.

3.2.27.3. About

This tab (Fig. 209) displays hardware and firmware information about the currently selected OCTÊTE as well as the data **Acquisition Start Time** and **Sample** description. The **Access** field shows whether the MCB is currently locked with a password. **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

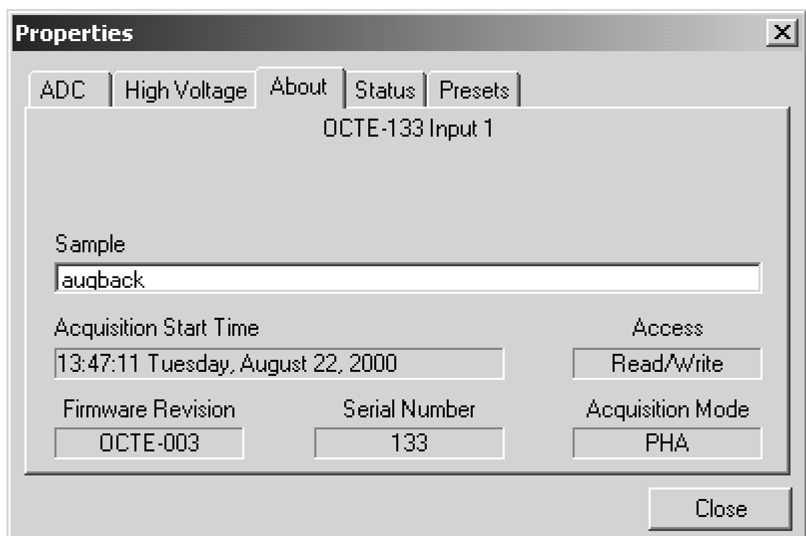


Fig. 209. OCTÊTE PC and OCTÊTE Plus About Tab.

This screen displays the OCTÊTE's serial number; all OCTÊTEs have a unique serial number which is read by the software and stored in the spectrum file for verification of the spectrum. The OCTÊTE input currently being monitored is shown at the top of the dialog.

3.2.27.4. Status

The Status tab (Fig. 210) monitors the currently selected OCTÊTE chamber's pressure. Chamber pressure is displayed in millitorr (mT). If the pressure is above the range of the vacuum gauge (about 1000 mT), the **Vacuum** is displayed as **OVER**.

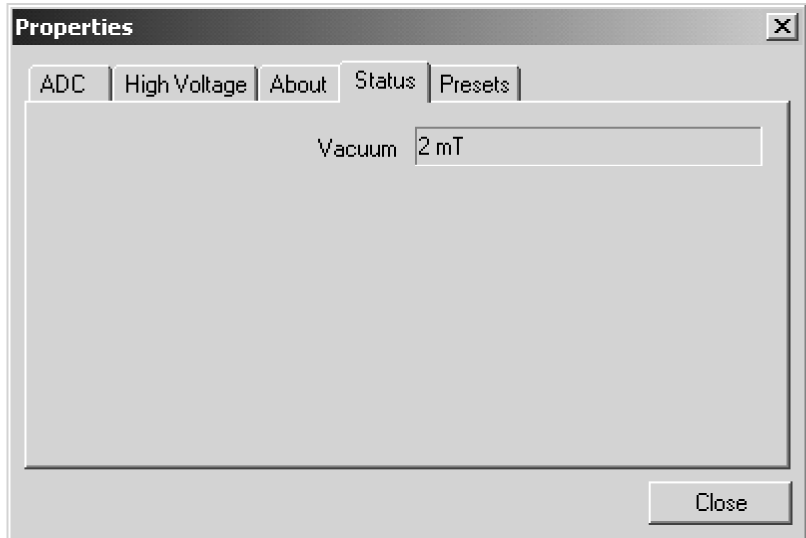


Fig. 210. OCTÊTE PC and OCTÊTE Plus Status Tab.

The cutoff pressure can be set to either 100 mT or 500 mT (see the hardware manual for the factory setting and how to change it). The vacuum is controlled by the valve on the front of the unit. The computer continuously monitors the vacuum whenever this dialog is open.

3.2.27.5. Presets

Figure 211 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

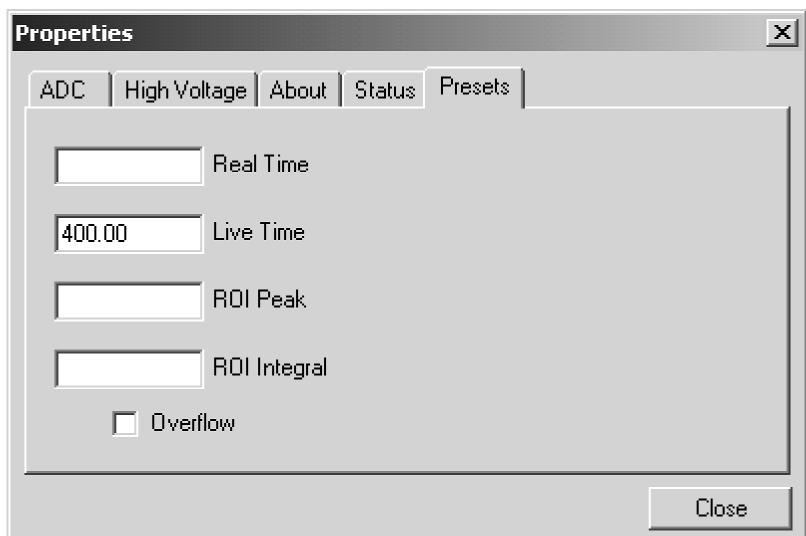


Fig. 211. OCTÊTE Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

3.2.27.6. OCTÊTE Plus: Uncertainty Preset

The OCTÊTE Plus includes an **Uncertainty** preset on the Presets tab (see Fig. 164, page 146, for an example of this preset's data fields). The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample might be better than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM. The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, which is discussed in Section 3.7. Note that the **Suggest Region** button is not displayed during data acquisition.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^9) counts.

3.2.27.7. OCTÊTE Plus: MDA Preset

The MDA preset (Fig. 212) stops data collection when the minimum detectable activity for a single user-specified MDA nuclide reaches the designated value. The MDA preset is implemented in the hardware. The formulas for the MDA are given in various textbooks and in the "Analysis Methods" chapter in the GammaVision user manual and can be generally represented as follows:

$$MDA = \frac{a+\sqrt{b+c*Counts}}{Live\ time * Eff * Yield}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from the calibration. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, *Eff*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers. If the application, such as GammaVision, supports MDA calculations, you can click on the **Suggest** button to enter (from an internal table) the values for the MDA type selected. The MDA type should be chosen before the preset is selected here.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

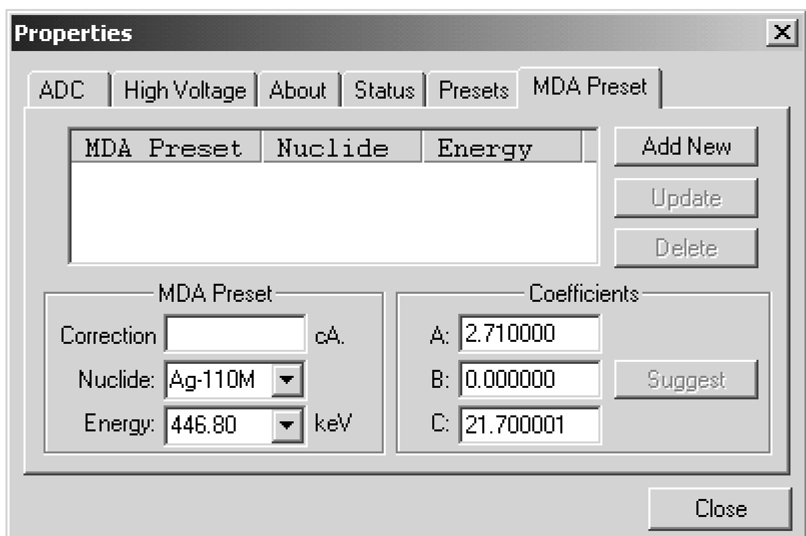


Fig. 212. OCTÊTE Plus MDA Preset Tab.

If the application supports efficiency calibration and the OCTÊTE Plus is efficiency calibrated, the **MDA** is entered in the units selected in the application. If the unit is not efficiency calibrated (e.g., in MAESTRO, which does not support efficiency calibration), the **MDA** field is labeled **Correction**, the efficiency (*Eff*) is set to 1.0 and the preset operates as before. If the **Correction** factor is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

3.2.28. M³CA

3.2.28.1. Amplifier

Figure 213 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Pileup Rejection**.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog.*

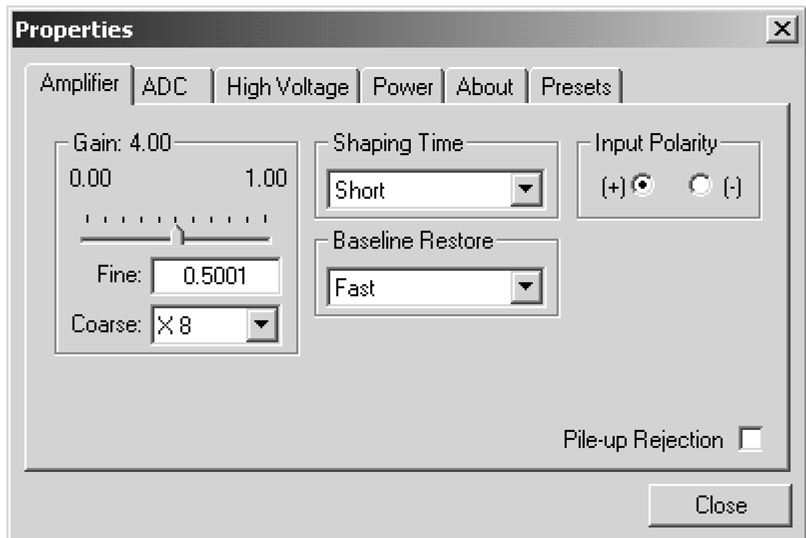


Fig. 213. M³CA Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.00 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.00 to 64.00.

Shaping Time

Use the **Shaping Time** droplist to select the amplifier pulse shaping-time constant. The available values, **Short** and **Long**, cover the time constants needed for high-count-rate and high-resolution systems.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[4] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (**Auto, Fast, or Slow**) are saved in the M^{3}CA even when the power is off.

Pileup Rejection

Pileup Rejection (PUR) is used to reject overlapping pulses, improving the peak shape. This checkbox allows you to disable the PUR. This feature is normally enabled and is only turned off for special detectors.

3.2.28.2. ADC

This tab (Fig. 214) contains the **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

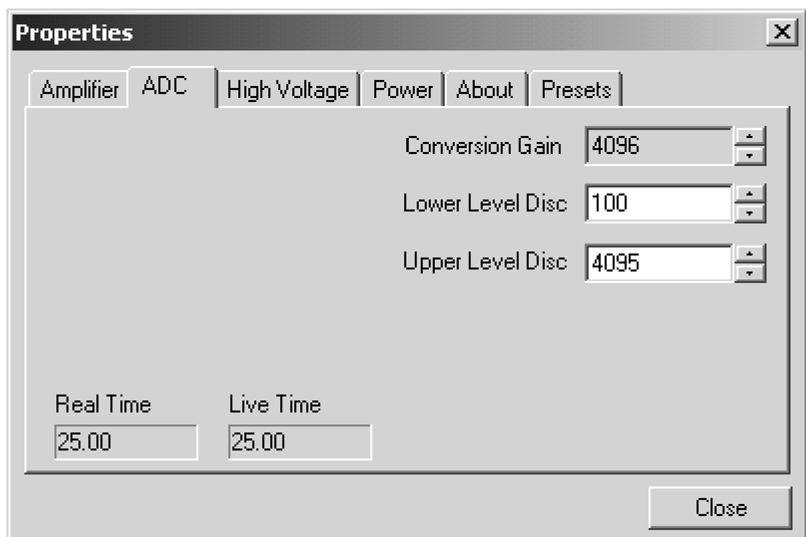


Fig. 214. M^{3}CA ADC Tab.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 4096, the energy scale will be divided into 4096 channels. The conversion gain is entered in powers of 2 (e.g., 4096, 2048, 1024, ...). The up/down arrow buttons step through the valid settings for the M^{3}CA.

Upper- and Lower-Level Discriminators

In the M^{3}CA the lower- and upper-level discriminators are under computer control.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

3.2.28.3. High Voltage

Figure 215 shows the High Voltage tab, which allows you to turn the high voltage on or off, set and monitor the voltage, and select the **Polarity**.

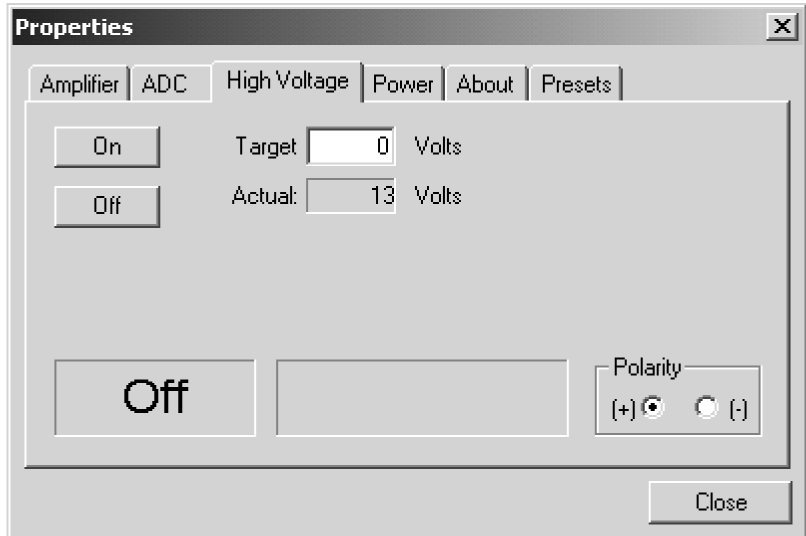


Fig. 215. M³CA High Voltage Tab.

Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage. The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it.

The **Polarity** selection determines the output polarity on the rear-panel connector.

3.2.28.4. Power

The Power tab is shown in Fig. 216. This tab displays information about the M³CA's current power source and the battery voltage. The power **Source**s are **Battery 1** or **External**.

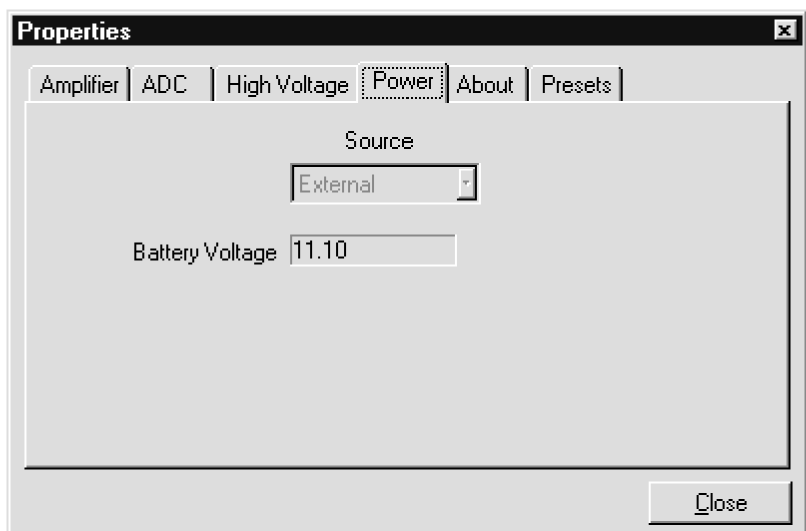


Fig. 216. M³CA Power Tab.

3.2.28.5. About

This tab (Fig. 217) displays hardware and firmware information about the currently selected M^{3}CA as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password. **Read/ Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

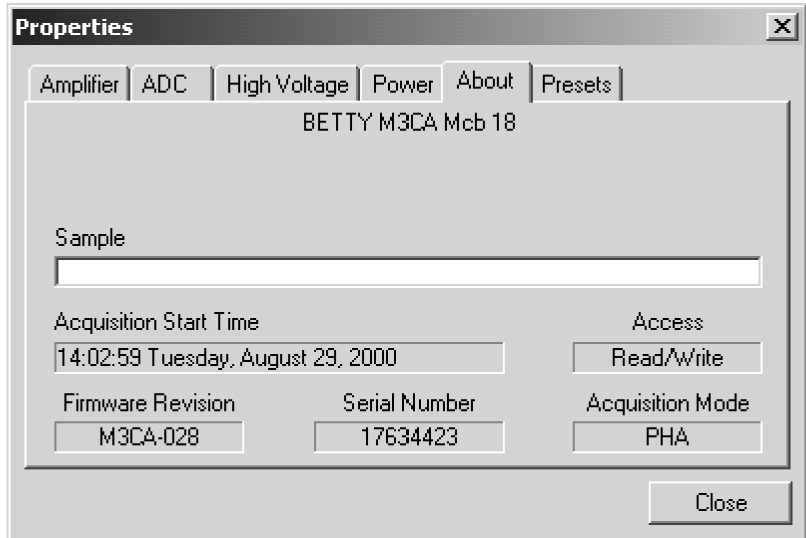


Fig. 217. M^{3}CA About Tab.

3.2.28.6. Presets

Figure 218 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

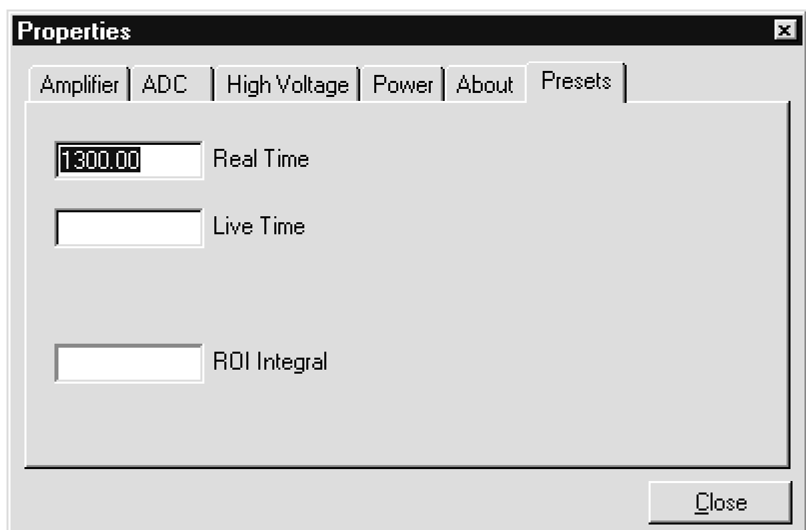


Fig. 218. M^{3}CA Presets Tab.

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

The ROI Integral preset operates differently than in ORTEC MCBs. In the M^3CA, this preset is maintained separately for each distinct ROI. Up to 29 ROIs can be marked. When the integral of all counts in any single region reaches the preset value, acquisition is stopped. Note, however, that this "variable-integral-count" feature can only be activated by issuing the SEND_MESSAGE command as part of a `.JOB` file. The M^3CA hardware manual contains the necessary command details. Entering an **ROI Integral** preset on the **Acquisition Presets** dialog sets the preset *the same for all regions*.

3.2.29. MiniMCA-166 Portable MCA

3.2.29.1. Amplifier

Figure 219 shows the Amplifier tab. This tab contains the controls for **Gain**, **Shaping Time**, **Pole Zero**, **Input Polarity**, and **Pileup Rejection**.

NOTE The changes you make on this tab ***take place immediately***. *There is no cancel or undo for this dialog*.

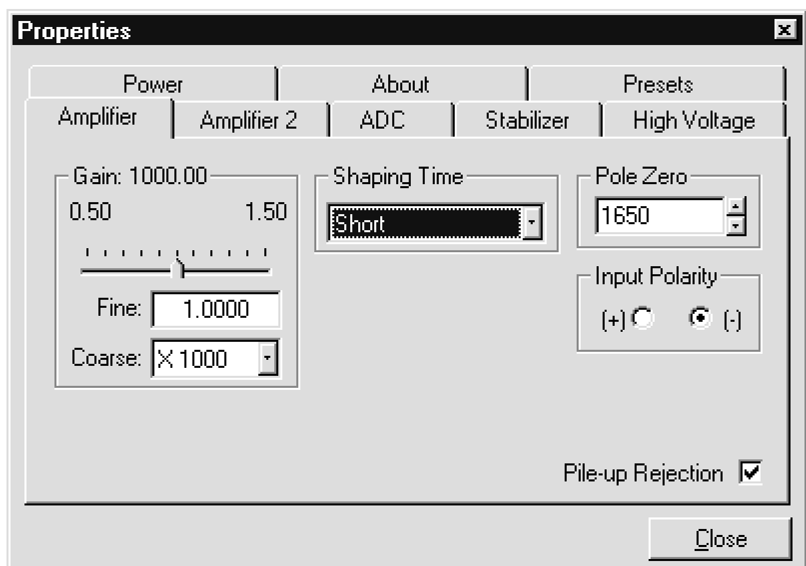


Fig. 219. MiniMCA-166 Amplifier Tab.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.5 to 1.50. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 1.0 to 1000.0.

Shaping Time

Use the **Shaping Time** droplist to select the amplifier pulse shaping-time constant. The available values, **Short** and **Long**, cover the time constants needed for high count-rate and high-resolution systems. See the hardware manual for the specific time constants used.

Input Polarity

The **Input Polarity** radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Pole Zero

This field allows you to set the **Pole Zero** to any value you wish much the same as with the old-fashioned screwdriver potentiometer, but with much greater reproducibility. This gives you the ability to exactly set the pole zero for any detector to the value used previously, ensuring data quality and reproducibility. To see if the pole zero is correctly set, collect a spectrum and observe the peak shape. When the high-energy side is Gaussian and the width is minimized, the pole zero is correct.

Without an oscilloscope connected to the amplifier output to display the pulse shape, the effect of the pole zero operation is not always easy to see. The most common effect of an incorrect pole-zero setting is tailing on the peak shape in the spectrum. Here, tailing refers to abnormally high counts on either side of the peak. If the amplifier was close to the proper pole zero setting before the operation, the spectrum peak shape might not change enough to be seen.

Pileup Rejection

Pileup Rejection (PUR) is used to reject overlapping pulses, improving the peak shape. This checkbox allows you to disable the PUR. This feature is normally enabled and is only turned off for special detectors.

3.2.29.2. Amplifier 2

The Amplifier 2 tab (Fig. 220) contains the **Signal Routing** and **Analog Threshold** controls.

The **Signal Routing** droplist allows you to route the detector input signal directly to the ADC as positive (**Direct [0 to +3V]**), negative (**Direct [0 to −3V]**), or **Through Amplifier**.

The **Analog Threshold** can be 2–60% of full scale. Pulses below the threshold do not contribute to ADC dead time.

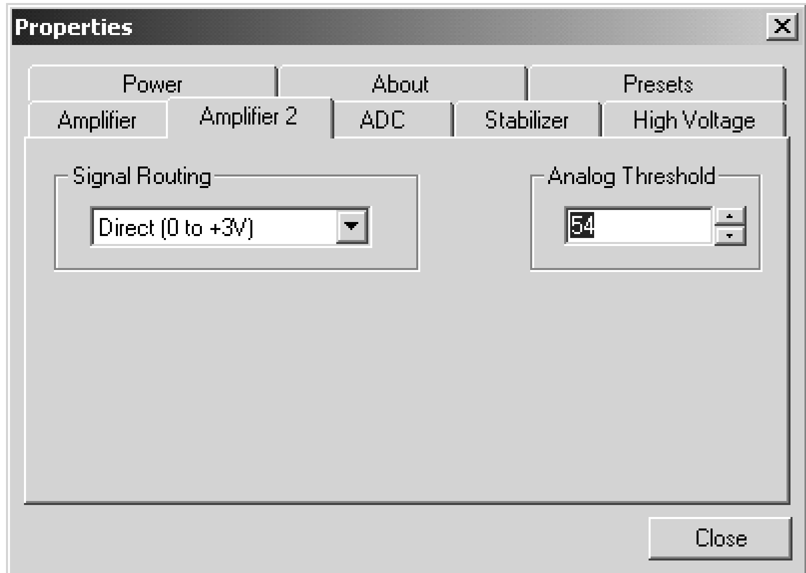


Fig. 220. MiniMCA-166 Amplifier 2 Tab.

3.2.29.3. ADC

This tab (Fig. 221)contains the **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

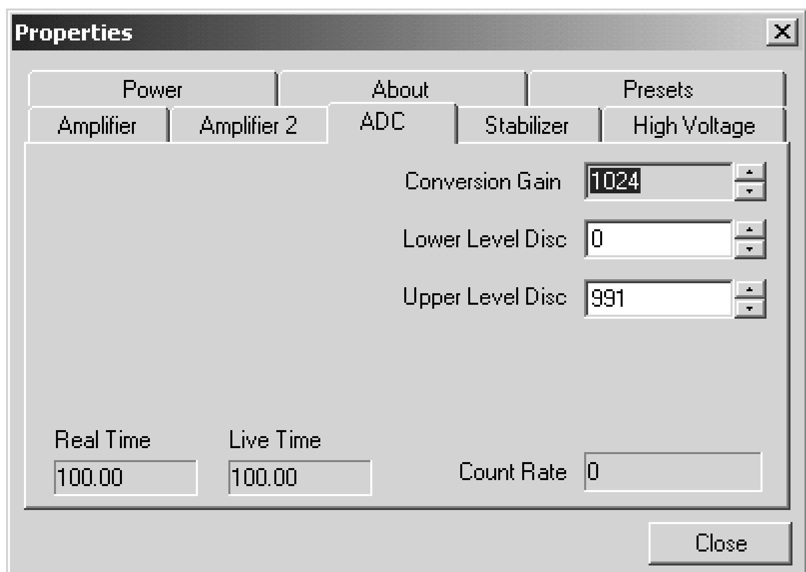


Fig. 221. MiniMCA-166 ADC Tab.

Conversion Gain

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 4096, the energy scale will be divided into 4096 channels. The conversion gain is entered in powers of 2 (e.g., 4096, 2048, 1024, ...). The up/down arrow buttons step through the valid settings.

Upper- and Lower-Level Discriminators

In the MiniMCA-166 the lower- and upper-level discriminators are under computer control.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff, by channel number, for ADC conversions. Setting that level above random noise increases useful throughput because the MCB is not unproductively occupied processing noise pulses.

The **Upper Level Discr**iminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff, by channel number, for ADC conversions.

3.2.29.4. Stabilizer

The Stabilizer tab (Fig. 222) allows you to control the MiniMCA-166 gain stabilizer. Gain stabilization is discussed in detail in Section 3.4.

The value in the **Adjustment** section shows how much adjustment is currently applied. The **Initialize** button sets the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

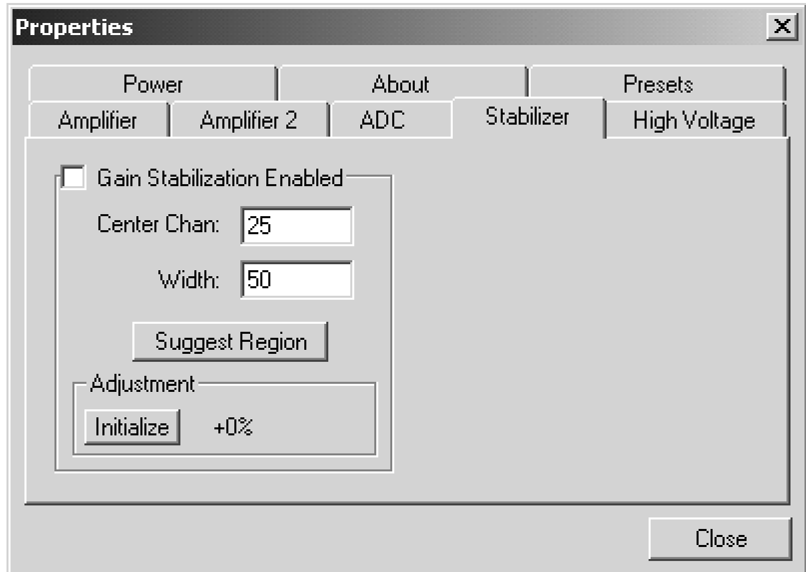


Fig. 222. MiniMCA-166 Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay active even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

3.2.29.5. High Voltage

Figure 223 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage, monitor the leakage **Current**, show the **Polarity**, and select the **Shutdown** mode.

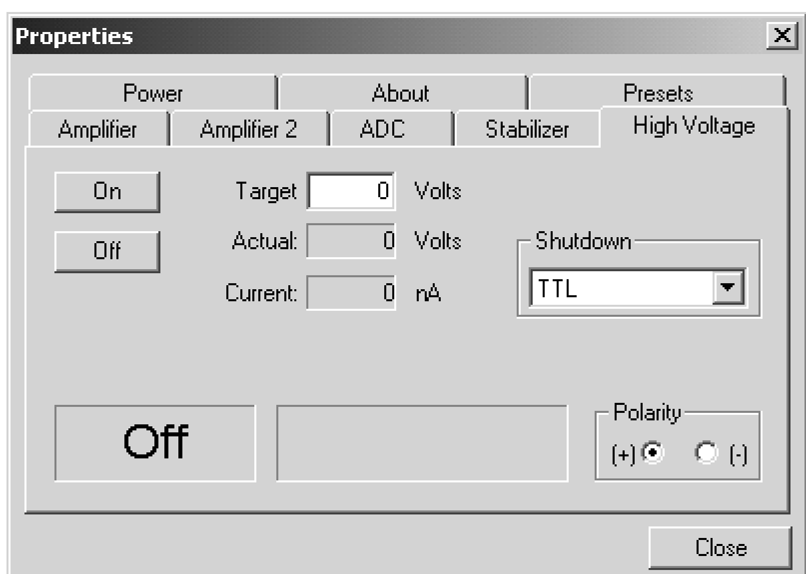


Fig. 223. MiniMCA-166 High Voltage Tab.

Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The **Polarity** selection is an indicator. To change polarity, see the hardware manual.

3.2.29.6. Power

The Power tab (Fig. 224) displays the MiniMCA-166's current battery voltage.

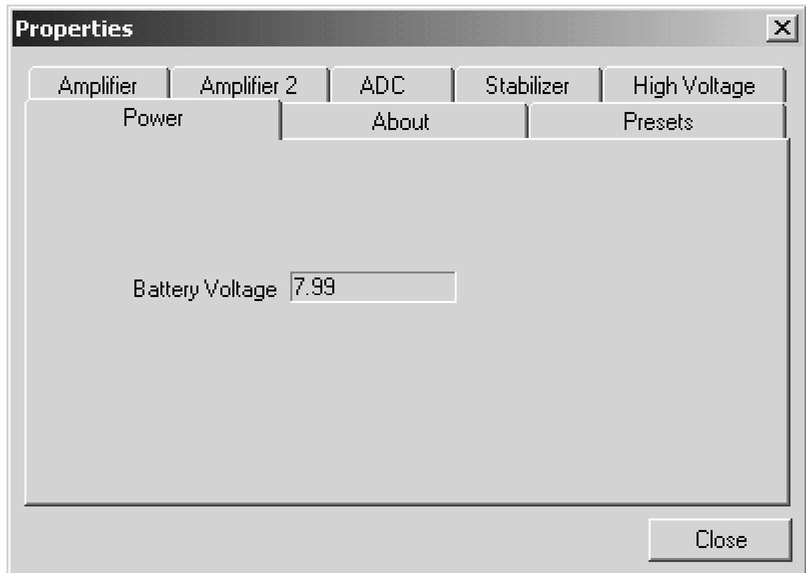


Fig. 224. MiniMCA-166 Power Tab.

3.2.29.7. About

This tab (Fig. 225) displays hardware and firmware information about the currently selected MiniMCA-166, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the MCB is currently locked with a password; **Read/Write** indicates that the MCB is unlocked; **Read Only** means it is locked.

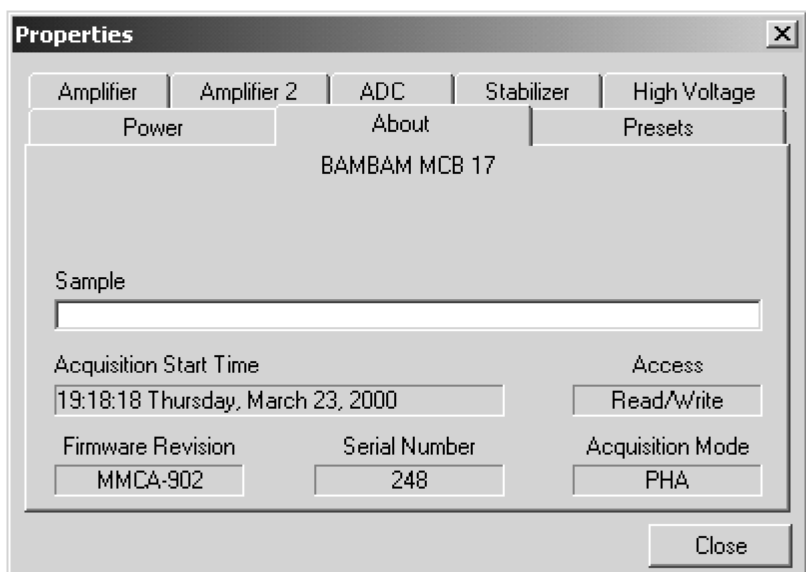


Fig. 225. MiniMCA-166 About Tab.

3.2.29.8. Presets

Figure 226 shows the Presets tab. The presets can only be set on an MCB that is *not* acquiring data. You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

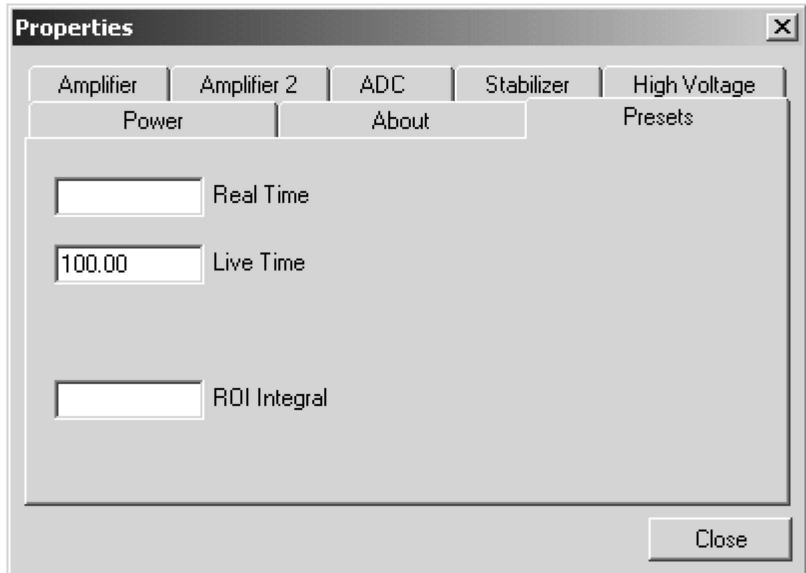


Fig. 226. MiniMCA-166 Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Integral** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI total count. In this circumstance, the **ROI Integral** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value, unless no ROIs are marked in the MCB.

3.3. Using the InSight Virtual Oscilloscope

To assist in setting up ORTEC digital MCBs, advanced users can return to the Amplifier 2 tab under **Acquire/MCB Properties...**, go to the **InSight** section, and click on the **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that the settings are correct. The InSight display (Fig. 227) shows the actual sampled waveform in the digital processing units on a reference graticule. The Properties dialog remains active and can be used to change settings as you view the pulses. Because none of the traditional analog signals are available in digital spectrometers such as our DSPEC Pro, DSPEC jr 2.0, DSPEC jr, digiDART, this mode is the only way to display the equivalent amplifier output pulse. Note that at the bottom of the window the marker channel is displayed in units of time.

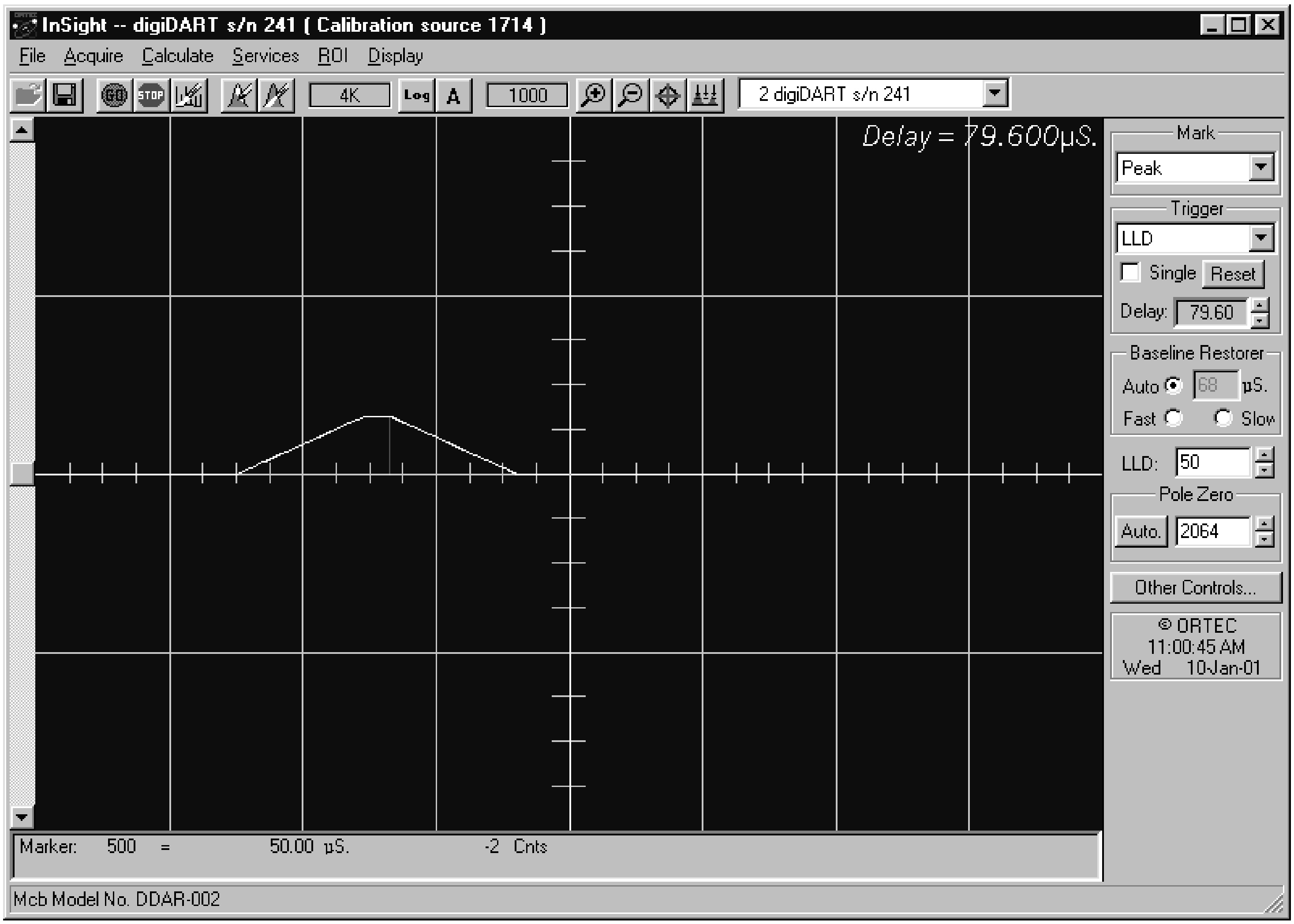


Fig. 227. digiDART InSight Mode.

The display can be switched from the current Detector to another Detector or buffer window. The other Detector will be displayed in its most recent mode (pulse-height analysis [PHA] or InSight). Buffer windows are always in PHA mode. When you return to the current MCB, the display will return to the InSight mode. This also holds true if you exit the application while in InSight mode; on next startup, this MCB will still be in InSight mode.

3.3.1. Exiting InSight

To exit the InSight mode and return to the PHA display, press **<Esc>** or go to the **InSight** section on the Amplifier 2 tab and click on **Stop**. The PHA mode is set to STOP when you enter the InSight mode.

3.3.2. InSight Controls

The Status Sidebar changes from the PHA mode controls to the InSight controls for adjusting the peak display. On the left is a vertical scrollbar for adjusting the vertical offset of the waveform. The value of the offset is shown on the display. Double-clicking the mouse in the scrollbar will set the vertical offset to the vertical value of the channel at the marker position. This lets you conveniently zoom in on a particular part of the waveform (such as the tail for pole-zeroing).

In the **Auto** trigger mode, the display is updated every time a new pulse exceeds the trigger level. To keep a single pulse displayed, select **Single**. Click on **Reset** to refresh the display to see the next pulse. There will usually be one or two pulses in the “pipeline” that will be displayed before any change entered will be seen. If the trigger is turned off, the display will be redrawn periodically, even if no pulse is there.

The **Delay** setting is the time delay between the pulse shown on the display and the trigger level crossing. The value of the time delay is shown on the display.

3.3.3. The InSight Display

Just as for the PHA mode display, the vertical scale can be adjusted with the vertical adjustments. The display can be set to Log mode, but the peak shapes do not have a familiar shape in this display. The Auto mode will adjust the vertical scale for each pulse. The pulse is shown before the amplifier gain has been applied, so the relation between channel number and pulse height is not fixed.

The horizontal scale extends from 16 to 256 channels. The display is expanded around the marker position which means that in some cases the peak will disappear from the display when it is expanded.

The display can be switched from the MCB to another detector or the buffer. In this case the other detector will be shown in the mode selected for it. The buffer will always be shown in PHA mode. The display will return to the InSight mode when you return to the first MCB. If you exit the program with the MCB in InSight mode, it will be in InSight mode on the next startup.

The display can include a **Mark** to indicate one of the other signals shown in Fig. 228. The Mark is a solid-color region displayed similarly to that of an ROI in the spectrum. This Mark can be used to set the timing for the gate pulse. It can also be used to set the shaping times and flattop parameters to get the best performance.

Fig. 228. Mark Display Selection.

For example, suppose you want to get the best resolution at the highest throughput possible. By viewing the pulses and the pileup reject marker, you can increase or decrease the rise time to obtain a minimum of pileup reject pulses.

Mark Types — For the **Mark,** choose either "points" or "filled" (to the zero line) display. This is controlled by the selection in the **Display/Preferences** menu item. That choice does not affect the PHA mode choice. The colors are the same as for the PHA mode. (Not all DSP MCBs support all Marks.)

- **None** — No channels are marked in the display.
- **PileUpReject** — The region marked indicates when the PUR circuit has detected pileup and is rejecting the marked pulses.
- **NegBLDisc** — This shows when the negative baseline discriminator has been triggered. Typically this signal only marks the TRP reset pulse. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.
- **BaseLineR** — This shows when the baseline restorer is actively restoring the baseline.
- **PosBLDisc** — This shows when the positive baseline discriminator has been triggered. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.
- **Busy** — When the MCB busy signal is active, **Busy** shows in the **Mark** box. It represents the dead time.

- **Gate** This shows when the gate signal is present on the gate input connector. If the **Gate** mode on the ADC tab (see Fig. 115) is set to **Off**, then all regions are marked. If the mode is set to **Coincidence**, then the marked region must overlap the pulse peak (that is, must start before the beginning of the flattop and stop after the end of the flattop) for the pulse to be counted. If the mode is set to **Anticoincidence**, then the marked region will show the pulses that are accepted. That is, the rejected peaks will not be marked. Simply put, in all modes the accepted peaks are marked.

- **Peak** This is the peak detect pulse. It indicates when the peak detect circuit has detected a valid pulse. The Mark occurs about 1.5 μs after the pulse maximum on the display.

3.3.4. Shaping Parameter Controls

On the lower right of the InSight sidebar are the shaping parameter controls. The controls are split into two groups, and the **other controls...** button switches between them. (Not all DSP MCBs support all controls.)

One group includes **Rise Time**, **Flattop**, **Tilt**, and the **Optimize** button. The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (for the adjustment range, see the Amplifier 2 tab for this MCB). The **Tilt** adjustment varies the slope of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, **Optimize** can set the tilt value automatically. This value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The **Optimize** button also automatically adjusts the pole-zero setting.

3.4. Gain Stabilization

ORTEC gain stabilizers require a peak in the spectrum to monitor the changes in the gain of the system amplifier. The gain stabilizer controls the amplification factor of a separate amplifier so that the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is:

$$Channel\ number = Intercept + Gain * pulse\ height \tag{3}$$

where:

Intercept = The channel number of the zero-height input pulse
Gain = The relation between pulse height and channel number (slope of the curve)

Changes in either the intercept or gain can affect the positions of all the peaks in the spectrum. When used with the zero stabilizer, both the zero intercept and the gain (slope) will be monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be made symmetrically about the center of a peak with reasonably good count rate in the higher channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the **Peak** command so that peak count preset can be used on another peak.

The coarse and fine gains should be set to the desired values, both stabilizers initialized, and the pole zero triggered before setting either stabilization peak. For example, on the 92X this is done in the Amplifier tab; on the Model 919 it is done externally.

The **Initialize** dialog button sets the gain on the stabilization amplifier to its midpoint (that is, halfway between minimum gain and maximum gain). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process. If the peak is moved by this command, use the amplifier fine-gain control (the Amplifier tab or hot keys) to move the peak to the desired channel.

When starting a new system, the zero-initialize command should also be given before starting the gain stabilization.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Gain Stabilizer Enabled** checkbox enables or disables the gain stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

3.5. Zero Stabilization

Zero stabilization enables you to control the zero-level (or offset) stabilizer on MCBs so equipped. The zero-level stabilizer uses a peak in the spectrum to monitor the changes in the zero level of the system amplifier. The zero stabilizer controls the offset bias level so the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is as in **Eq. 3**.

Changes in either the zero intercept or gain can affect the positions of all the peaks in the spectrum. When used with the gain stabilizer, both the zero intercept and the gain (slope) are monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be set symmetrically about the center of a peak with reasonably good count rate in the lower channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the PEAK command so that peak count preset can be used on another peak.

The zero stabilization dialog **Initialize** button sets the zero offset to its midpoint (that is, halfway between minimum offset and maximum offset). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Zero Stabilizer Enabled** checkbox enables or disables the zero stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

3.6. ZDT Mode

An extended live-time clock increases the collection time (real time) of the acquisition to correct for input pulse train losses incurred during acquisition due to system dead time. This corrected time value, known as the "live time," is then used to determine the net peak count rates necessary to determine nuclide activities. As an example, consider the case where the spectrometry amplifier and ADC are 25% dead during the acquisition. If a live-time preset of 100 seconds is selected, the spectrometer counts for a total of 133.33 seconds (real time). The extra 33.33 seconds make up for the gamma rays lost due to system-busy time. The total counts in a peak can then be divided by 100 to determine the number of gamma rays per second recorded in the spectrum.

Unfortunately, extending the counting time to make up for losses due to system-busy results in an incorrect result *if the gamma-ray flux is changing as a function of time*. If an isotope with a very short half-life is placed in front of the detector, the spectrometer might start out with a very high dead time, but the isotope will decay during the count and there will be no dead time. If the spectrometer extends the counting time to make up for the lost counts, it will no longer be counting the same source as when the losses occurred. As a result, the number of counts in the peak will not be correct.

When the MCB operates in ZDT[9] mode, it adjusts for the dead-time losses by taking very short acquisitions and applying a correction in ***real time*** — that is, as the data are coming in — to the number of counts in the spectrum. This technique allows the gamma-ray flux to change while the acquisition is in progress, yet the total counts recorded in each of the peaks are correct. The resulting spectrum has no dead time at all — in ZDT mode, the *data* are corrected, not the acquisition time. Thus, the net counts in a peak are divided by the real time to determine the count rate.

ZDT mode has a unique feature in that it can store both the corrected spectrum and the uncorrected spectrum, or the corrected spectrum and the uncertainty spectrum.

The uncorrected spectrum (also called the live-time-corrected [LTC] spectrum) can be used to determine exactly how many pulses at any energy were processed by the spectrometer. The corrected spectrum gives the best estimate of the total counts that would have been in the peak if the system were free of dead-time effects. The uncertainty spectrum can be used to calculate the counting uncertainty, channel by channel, in the corrected spectrum.

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[9]Patent number 6,327,549.

NOTE When the spectrometer is placed in ZDT mode, the throughput of the instrument is reduced somewhat as extra processing must be done on the spectrum; therefore, if the gamma-ray flux is not changing as a function of time, but absolute highest throughput is desirable, you might wish to store only the LTC spectrum in the DSPEC Plus memory.

When ZDT counting is enabled (in mode 0; **ZDT Mode** field set to **NORM_CORR** on the ADC tab), the two spectra stored are the LTC spectrum (live time and real time with dead-time losses) and the spectrum corrected for the dead-time losses (real time only). Unfortunately, in the analysis of the ZDT spectrum, the uncertainty of the measurement cannot be determined using either spectrum.

In the second ZDT mode (**ZDT Mode** field set to **CORR_ERR** on the ADC tab), the estimation of the statistical uncertainty is stored in place of the LTC spectrum, and is referred to as the *error spectrum* (ERR). In this mode, the corrected spectrum is used to measure the counts in a peak, and the error spectrum is used to determine the uncertainty of the measurement made in the corrected spectrum. Table 3 shows which spectra are collected in the three possible modes.

For example, if the area of a peak is measured in the corrected spectrum by summing channels 1000 to 1100, the variance of the measurement can be determined by summing the counts in channels 1000 to 1100 in the error spectrum. Or, shown another way, the counts in channel i can be expressed as $N(i) \pm \sqrt{V(i)}$ with a 1-sigma confidence limit, where N is the corrected spectral data and V is the variance (error) spectral data.

Table 3. ZDT Modes.

Mode	Uncorrected Spectrum	ZDT Corrected Spectrum	ZDT Error Spectrum
ZDT Disabled	Yes	No	No
ZDT–LTC Mode	Yes	Yes	No
ZDT–ERR Mode	No	Yes	Yes

3.7. The MAESTRO Peak Info Calculation

A number of ORTEC MCBs support an uncertainty preset, which requires that you select a peak. This peak can be defined by (1) entering the start channel and peak width for the peak of interest; or (2) marking the peak of interest as an ROI, positioning the marker in the ROI, and clicking on the **Suggest Region** button. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command, as described below.

The background on the low channel side of the peak is the average of the first three channels of the ROI (see Fig. 229).

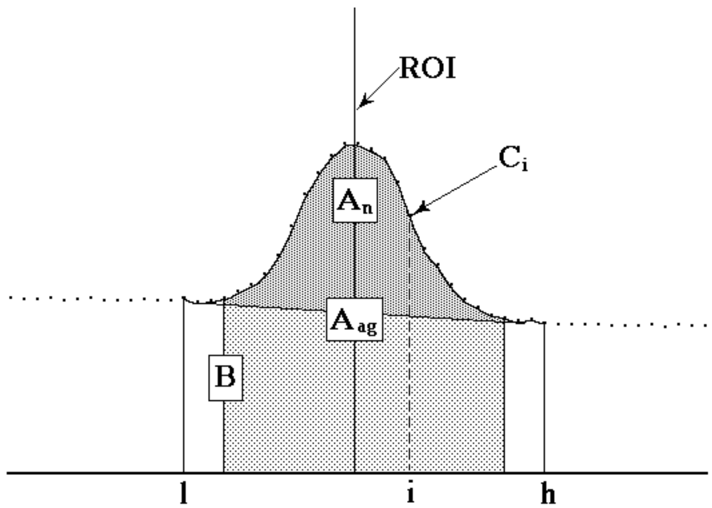


Fig. 229. Background Calculation Details.

The channel number for this background point is the middle channel of the three points. The background on the high channel side of the peak is the average of the last three channels of the ROI. The channel number for this background point is also the middle channel of the three points. These two points on each side of the peak form the end points of the straight-line background.

The background is given by the following:

$$B = \left(\sum_{i=l}^{l+2} C_i + \sum_{i=h-2}^{h} C_i \right) \frac{h - l + 1}{6} \tag{4}$$

where:

B	=	the background area
l	=	the ROI low limit
h	=	the ROI high limit
C_i	=	the contents of channel i
6	=	the number of data channels used (three on each end)

The gross area is the sum of all the channels marked by the ROI according to the following:

$$A_g = \sum_{i=l}^{h} C_i \tag{5}$$

where:

A_g = the gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The adjusted gross area is the sum of all the channels marked by the ROI but not used in the background according to the following:

$$A_{ag} = \sum_{i=l+3}^{h-3} C_i \tag{6}$$

where:

A_{ag} = the adjusted gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The net area is the adjusted gross area minus the adjusted calculated background, as follows:

$$A_n = A_{ag} - \frac{B\,(h-l-5)}{(h-l+1)} \tag{7}$$

The uncertainty in the net area is the square root of the sum of the squares of the uncertainty in the adjusted gross area and the weighted error of the adjusted background. The background uncertainty is weighted by the ratio of the adjusted peak width to the number of channels used to calculate the adjusted background. Therefore, net peak-area uncertainty is given by:

$$\sigma_{An} = \sqrt{A_{ag} + B\left(\frac{h-l-5}{6}\right)\left(\frac{h-l-5}{h-l+1}\right)} \tag{8}$$

where:

A_{ag}	=	the adjusted gross area
A_n	=	the net area
B	=	the background area
l	=	the ROI low limit
h	=	the ROI high limit

3.8. Setting the Rise Time in Digital MCBs

To achieve the best results for your application, when using a digital spectrometer, such as the DSPEC jr, digiDART, DSPEC Plus, or DSPEC, we recommend that you set the rise time of the pulses being processed by the digital filter.

The pulse rise time (and also fall time) is based on the time required for each pulse to reach its peak value. This "peaking time" is about twice that indicated by the conventional time constants displayed on the front panel of commercial analog amplifiers. For example, germanium detectors are often specified at a 6-µs time constant; this setting is equivalent to 12-µs peaking (rise) time in our digital spectrometers.

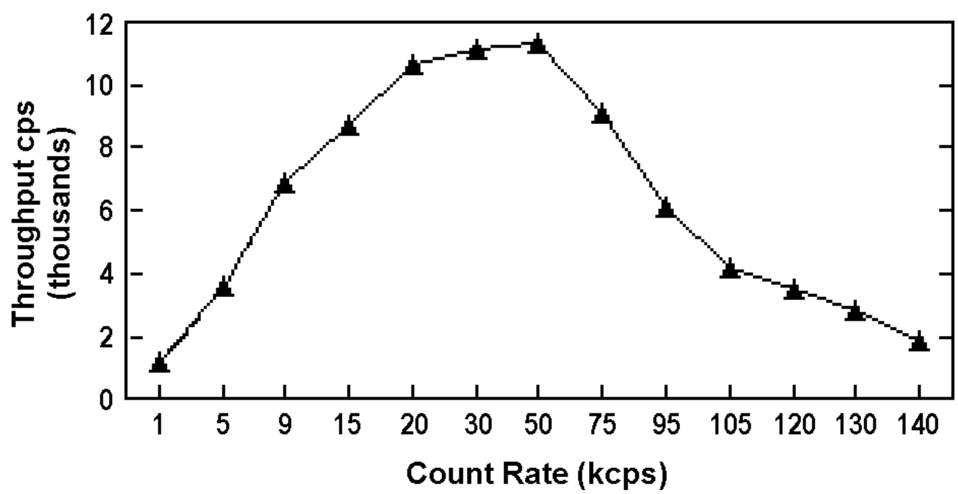


Fig. 230. An Example of the Tradeoff Between Throughput and Count Rate.

Up to some value of rise time, one can expect improved resolution with increasing rise time; there will, however, be a tradeoff in maximum throughput to memory. Figure 230 illustrates an example of this tradeoff. ORTEC digital spectrometers operate well above the peak of the throughput curve. Operating there allows these instruments to handle an even higher rate of incoming counts, but with less data into memory and, therefore, longer counting time to the same detection limit. It is possible to move the peak of the curve to the right (more counts to memory with higher input count rate) by reducing the pulse rise (and fall) time, thereby trading off resolution for maximum count rate.

Table 1 is a guide to choosing a count rate that will ensure that the most efficient operation of your digital spectrometer over the range of anticipated input count rates for your application — that is, at or below the throughput peak — while achieving the best resolution obtainable from the detector consistent with that requirement. Enter the rise time that best matches your dynamic range of count rate (note that the available rise-time settings will vary by instrument; this chart is a general guide only).

Table 4. Rise Time Selection Guide.

Input Count Rate Dynamic Range	Maximum Throughput	Rise Time (μs)
0--->20000	9000	12
0--->50000	12500	8
0--->75000	23500	4
0--->100000	37000	2.4
0--->150000	50000	1.6
0--->200k	70000	0.8
0--->220k	85000	0.6
0--->250k	100000	0.4
0--->300k	120000	0.2

The longest rise time shown in the table is 12 μs, even though some digital instruments can be set for rise times as long as 23 μs. If throughput is not an issue because all samples are low rate, increasing the rise time beyond 12 μs might achieve a small improvement in resolution. For planar detectors, such as ORTEC's GLP, Si(Li), IGLET, and IGLET-X Series, operating at longer rise times frequently gives improved resolution.

3.9. The Nuclide Report

The Nuclide Report displays the activity of up to nine user-selected peaks. Fig. 231 shows a typical Nuclide Report tab. Once the report is set up, you can view the Nuclide Report at any time on the display of supported MCBs. The peak area calculations in the hardware use the same methods as the MAESTRO **Peak Info** calculation described in Section 3.7, so the Nuclide Report display is the same as the **Peak Info** display on the selected peak in the spectra stored in the PC. The calculated value is computed by multiplying the net peak count rate by a user-defined constant. If the constant includes the efficiency and branching ratio, the displayed value is the activity. You enter the nuclide label and the activity units.

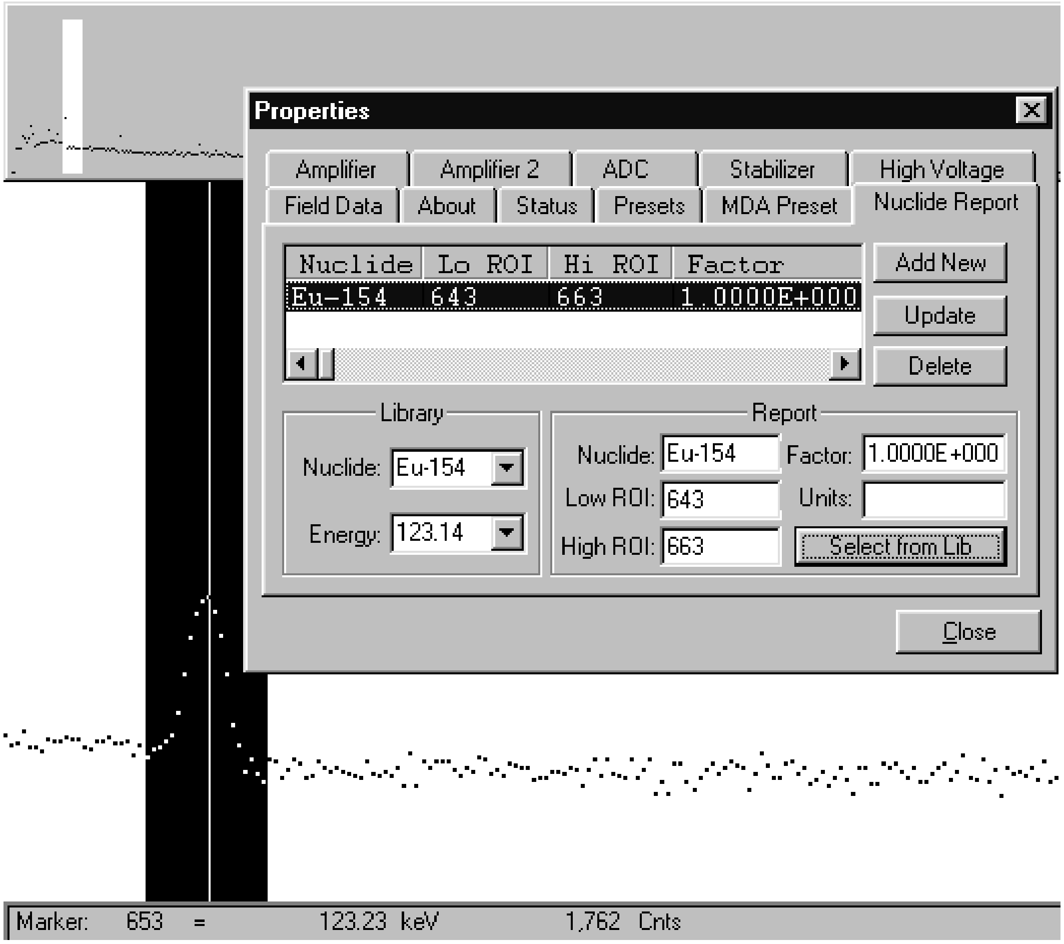


Fig. 231. Typical Nuclide Report Setup Tab.

3.9.1. Format

The report has this format:

Nuclide	keV	uCi/m2	±%
CO-60	1332.5	1.21E+01	10.2
CO-60	1173.2	1.09E+01	12.3
CO-57	122.1	1.48E+00	86.2

3.9.2. Calculations

These are the calculations used to generate the **Activity**, **Uncertainty**, and **Peak** values for the Nuclide Report.

3.9.2.1. Activity

Activity is calculated as follows:

$$Activity = \frac{NetCounts \cdot NucCoef}{LiveTime}$$

where:

NucCoef is normally the inverse of the product of the efficiency and the branching ratio. Note that the efficiency is the absolute counting efficiency for the source-detector geometry being used. Thus, in order to get meaningful activity results, as in any counting situation, you need to have efficiency factors which are appropriate to the actual counting geometry. If *NucCoef* is set to 1, you will get peak count rate on the display.

LiveTime is the current live time.

NetCounts is computed with the following equation:

$$NetCounts = GrossCounts - Background$$

GrossCounts is the sum of the counts in the ROI, excluding the first and last 3 channels of the ROI.

Background is:

$$Background = \frac{AvgCount\ first\ 3\ chan + AvgCount\ last\ 3\ chan}{2} \cdot ROIWidth$$

ROIWidth is:

$$ROIWidth = EndChannel - StartChannel + 1 - 6$$

3.9.2.2. Uncertainty

Uncertainty (in percent) is calculated as follows:

$$Uncertainty = \frac{\sqrt{GrossCounts + Background \cdot \frac{ROIWidth}{6}}}{NetCounts} * 100$$

3.9.2.3. Peak

Peak is the position of the maximum count and is computed with the following equation:

$$Peak = MaximumROIChan * EnergySlope + EnergyIntercept$$

where:

MaximumROIChan is the channel in the ROI with the most counts. If there are no data, the center channel of the ROI is used.

EnergySlope and *EnergyIntercept* are the energy calibration values as entered on the MCB keypad or by software. If the values are not present, the result is given in channels.

APPENDIX A. ADDITIONAL CONFIGURATION INFORMATION

A.1. Operating *CONNECTIONS* Software on a Network

MAESTRO and other ***CONNECTIONS*** software operates the same for local MCBs (those connected directly to the PC running MAESTRO) and for remote MCBs connected by Ethernet (those connected to PCs other than the local PC running MAESTRO), as illustrated in Fig. 232.

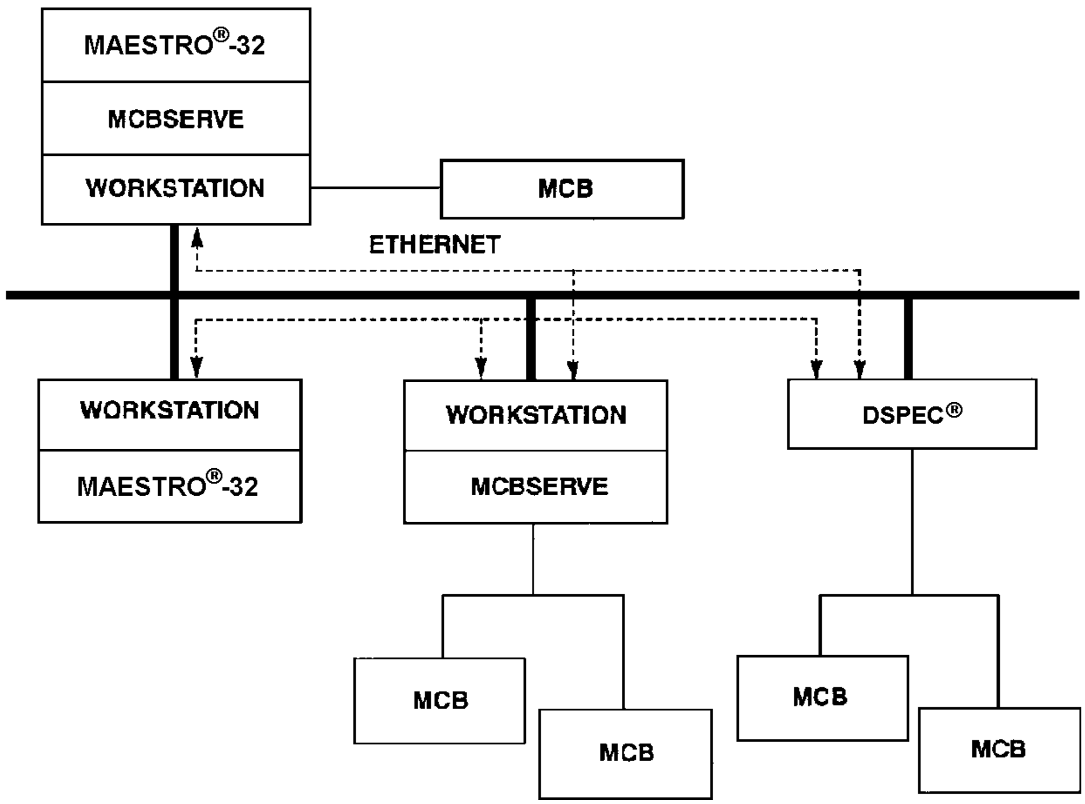


Fig. 232. Example Network Setup.

Each time ***CONNECTIONS*** software is installed on a PC in the network, and the network is connected and operational, the MCB Configuration program will find all the MCBs attached to PCs on which the MCB Server program is running. It will then build a Master Instrument List, update the local PC's MCB pick list so that is identical to the Master Instrument List, and, optionally, broadcast the new Master Instrument List to all PCs that are connected to the network and currently running MCB Server.

At this point, your ***CONNECTIONS*** program is ready to use. The MCB pick list for each ***CONNECTIONS*** program on each PC in the system can be tailored to a specific list of MCBs.

A.2. Port 292 or Page D Conflict

In some PCs and laptops, output port 292Hex is used for a system-reset (reboot) signal. In some PCs, memory page D is not available. These two conditions conflict with the use of an ISA Dual-Port Memory card. Therefore, the ISA version of the DPM card cannot be used in PCs that use port 292 or page D. Symptoms of this conflict include system failure or spontaneous rebooting each time you attempt to start a ***CONNECTIONS-32*** program. *This problem does not affect PCI cards.*

To remedy this problem, go to the Windows Control Panel, then Add/Remove Programs, select **Connections 32**, and click on the **Add/Remove** button. When the ***CONNECTIONS-32*** wizard starts, select **Modify**, unmark the entry for the DPM-ISA card, then click on **Close**. If a restart is required, a message box will tell you to do so. For further assistance, contact your ORTEC representative or our Global Service Center.

A.3. MCBLOC32.INI

The **`MCBLOC32.INI`** file controls the interfaces that are used to communicate with the MCBs attached to your PC. The settings in this file are determined by the choices you make in the install wizard and do not affect other MCBs connected via a network. Ethernet communication is always enabled, so **`MCBLOC32.INI`** does not contain entries for MCBs with built-in Ethernet adapters, such as the DSPEC and ORSIM III.

For ***CONNECTIONS-32*** applications installed or upgraded beginning in August 2004, ***you should not change the contents of the MCBLOC32.INI file*** as was described in earlier revisions of this manual. Instead, go to the Windows Control Panel, then **Add/Remove Programs**, select **Connections 32**, click on the **Add/Remove** button, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog (Fig. 26) so you can mark or unmark the driver checkboxes as needed, close the dialog, then run the MCB Configuration program, according to the instructions beginning on page 16. If a restart is required, a message box will tell you to do so. For further assistance, contact your ORTEC representative or our Global Service Center.

A.4. Legacy Network Protocol Setup: Windows NT v4.x

As noted in the introduction to Chapter 2, ORTEC no longer supports Windows NT. This section is included for users operating older *CONNECTIONS* hardware and software.

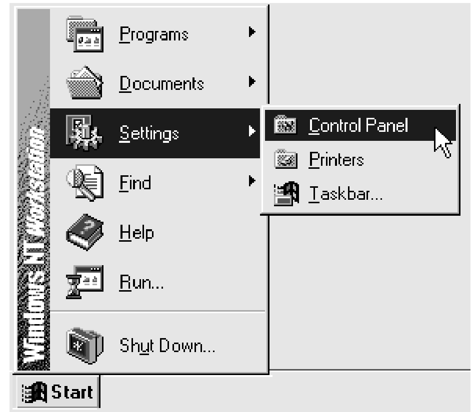
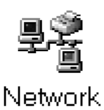


Fig. 233. Starting the Control Panel.

To use direct-connect MCBs, Windows NT V4.x must use the **NWLink IPX/SPX Compatible Transport** protocol. As noted above, systems without any direct-connect Ethernet devices can use any protocol.

To check to see if the NWLink IPX/SPX Compatible Transport protocol is installed, to add it, or to select it as the default, click on **Start** from the Windows Taskbar. Next select **Settings**, then **Control Panel** as shown in Fig. 233.



When the Control Panel opens, double-click on the **Network** icon. This will open the Network dialog to the Identification tab.

A.4.1. Adapter

If no adapter is shown, it needs to be added. Click on the **Add...** button and follow the hardware instructions for adding the proper adapter. When adapter setup is complete, click on **OK** to return to the Network dialog.

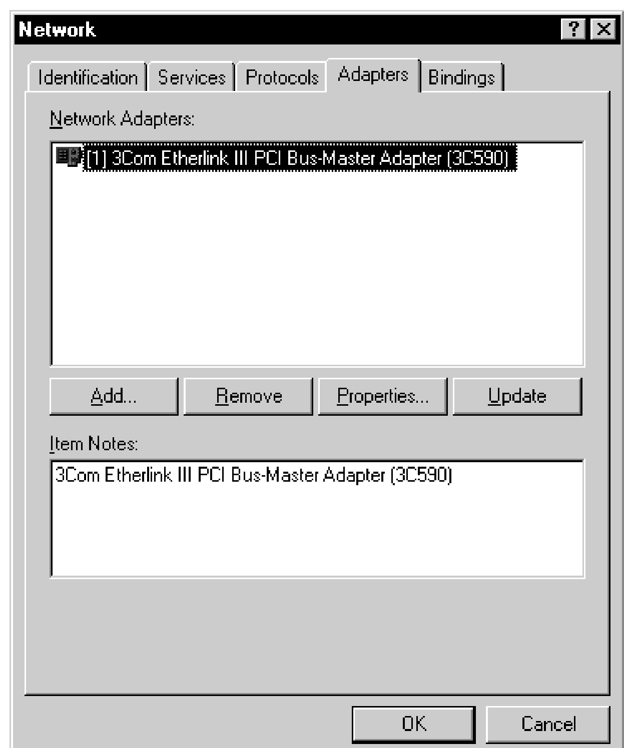


Fig. 234. The Network Dialog, Adapter Tab.

A.4.2. Protocol

On the Network dialog, click on the Protocols tab to open the dialog shown in Fig. 235. If the **NWLink IPX/SPX Compatible Transport** or **NWLink NetBIOS** protocol is not listed, it needs to be added.

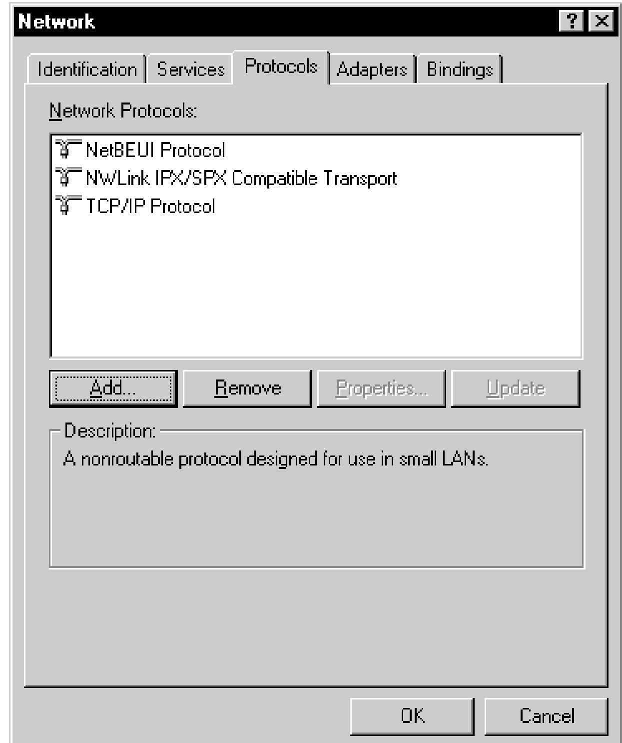


Fig. 235. The Network Dialog, Protocols Tab.

To add the **NWLink IPX/SPX Compatible Transport** protocol to the list, click on **Add...** to display the Select Network Protocol dialog shown in Fig. 236. Click on **NWLink IPX/SPX Compatible Transport**, then click on **OK** to return to the Network dialog.

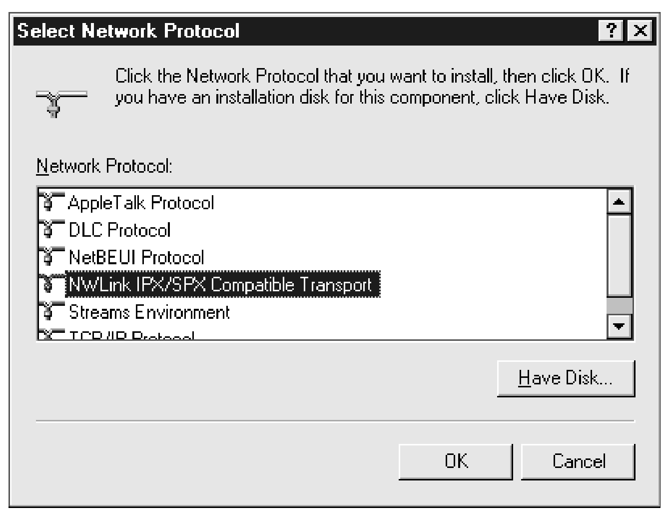


Fig. 236. Select IPX/SPX Protocol.

On the Network dialog, click once on **NWLink IPX/SPX Compatible Transport,** then on **Configure...** to open a dialog similar to the one in Fig. 237.

Open the **Adapter** pull-down list (double-click in the field or click once on the down arrow) and select the adapter to be used. Normally there will only be one adapter on the system. Next select the **Frame Type** pull-down list and click on **Ethernet 802.3**. The **Internal Network Number** should be left at the default value. To complete this step and return to the Network dialog, click on **OK**.

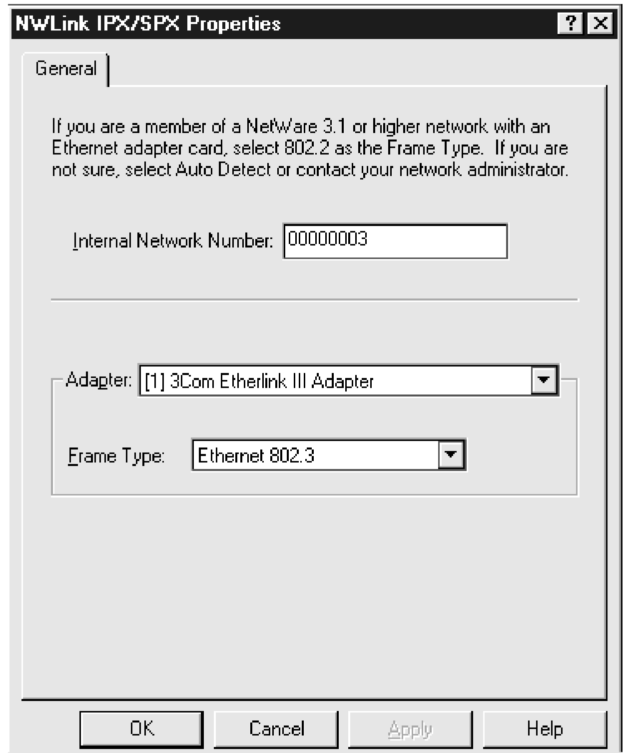


Fig. 237. Select Ethernet 802.3 Frame Type.

A.4.2.1. Services

Click on the Services tab to display the dialog shown in Fig. 238.

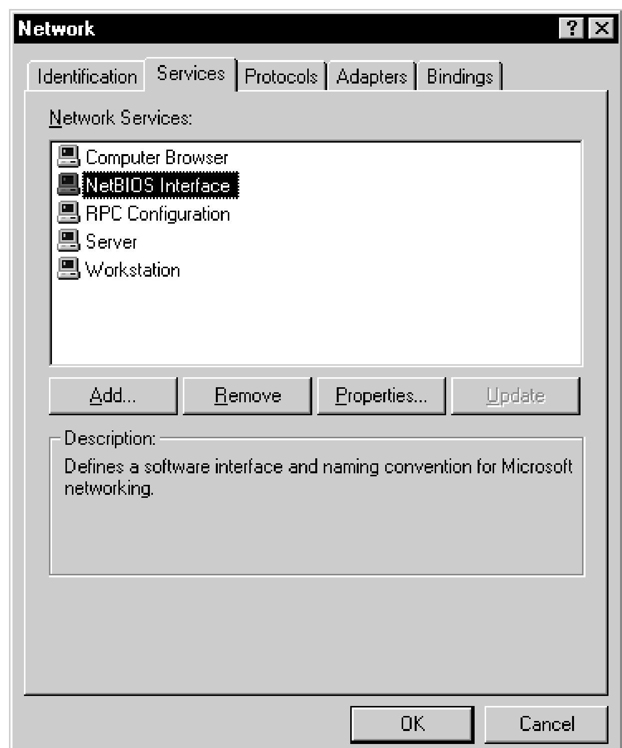


Fig. 238. The Network Dialog, Services Tab.

If **NetBIOS Interface** is not shown, it should be added. To do this, click on **Add...** to display the Select Network Service dialog (see Fig. 239).

Click once on **NetBIOS Interface** to highlight it, then click on **OK** to add the service and return to the Network dialog.

Click **OK** again to close the Network dialog and finish the operation. If you changed any of the settings, you must restart the PC so the changes will be applied to Windows. This is necessary before direct-connect devices can be used.

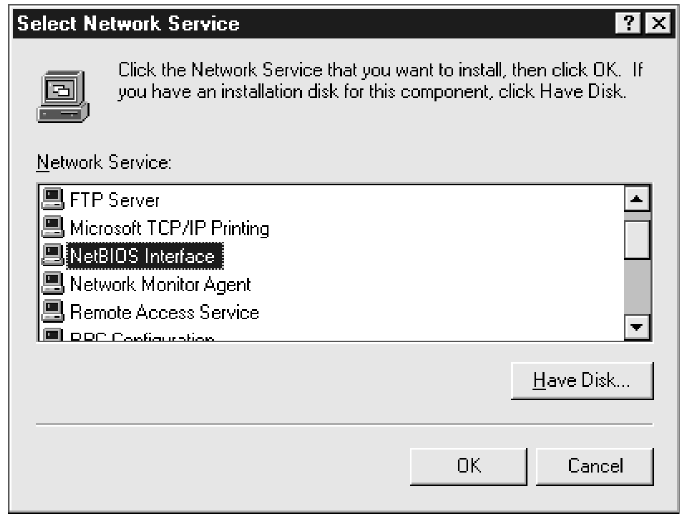


Fig. 239. Select NetBIOS Interface.

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