2 - HOW TO USE THE SES SOFTWARE

Chapter Overview

Introduction

The SES software is a Windows-based application that manages most of the user interaction with the SCIENTA R4000 system. The SES software controls the analyser, and provides a plug-in interface for auxiliary equipment.

This chapter describes how to use the SES software, version 1.2.2.

This chapter

Section A – General Software Description

Introduction

This section describes the system requirements, the recommended access control set-up and how to get started in the software.

This section

System requirements

The SES software operates under Windows 2000 or Windows XP.

Access control

By default users will have full access to all parts of the software.

Windows accounts

In the case of a multi-user environment, the administrator in charge of the SCIENTA R4000 system should ensure that at least two Windows user accounts are set-up with different write permission restrictions.

The recommended files to write protect are shown in the table below:

	Write permission restriction	
	*Recommended**	*Optional***
User	Instrument.dat Dac.ini DCAM.ini	RunVar.dat
Administrator	none	none

*) Write permission restrictions to these files prevents the user from changing calibration parameters.

**) Write permission restriction to the RunVar.dat file prevents the user from changing the global detector settings and the Energy Offset. However, this will also mean that the user cannot use initial energy calibration or drift regions.

Note: if there are no write restrictions in place a user could accidentally change setup and calibration data, which in turn could affect the operability and performance of the instrument.

How to Get Started in the Software

Starting program

The SES program is started by double-clicking on its icon. A click sound from the High Voltage should be noticeable.

Check cables for low or high pass

The SES program begins with a pop-up window that reminds you to check cable connections for either Low Pass or High Pass.

For instructions on how to change the cables, see page 3-10.

Prior runs

If the SES program has inadvertently shut down during prior acquisition and there is still usable data in the work folder, a query to save the data to an experiment file before continuing is displayed.

Click Yes or No to continue.

Start guide

a. Experiments are defined and started from the Setup and Run commands in the Run menu (**Run → Setup** and **Run → Run**).

b. Energy calibration and lens deflection calibration are started by the Voltages command in the Calibration menu (**Calibration → Voltages**).

c. Global detector settings are defined through the Setup Global Detector command in the Setup menu (**Setup → Setup Global Detector**).

Before turning HV on

a. Make sure the pressure is below $1 \cdot 10^{-5}$ mbar.

b. Go to **Calibration → Voltages** to check that the running parameters are reasonable.

c. Go to Chapter 3, System Operation..

Section B – Main Menu

Introduction

This section gives an overview of the main menu commands.

This section

File Menu

File

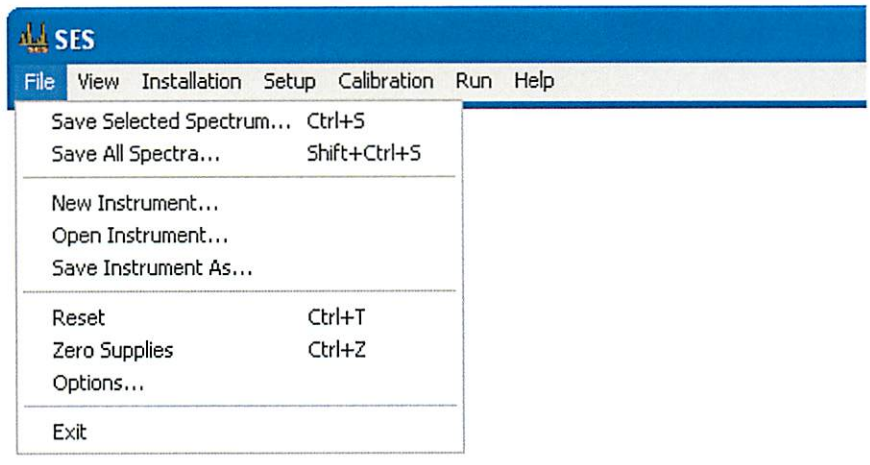

Figure 2-1. File Menu.

File menu commands

Save Selected Spectrum...	Save the currently selected spectrum.
Save All Spectra...	Save all spectra.
New Instrument...	Create a new instrument calibration file.
Open Instrument...	Open a different instrument calibration file.
Save Instrument As...	Save the currently open instrument calibration file under a different name.
Reset	Abort ongoing acquisition and send a reset to the supply and the detector hardware.
Zero Supplies	Set all supplies to zero voltage.
Options...	Open the SES Options Dialogue (page 2-70).
Exit	Close the SES program.

View Menu

View

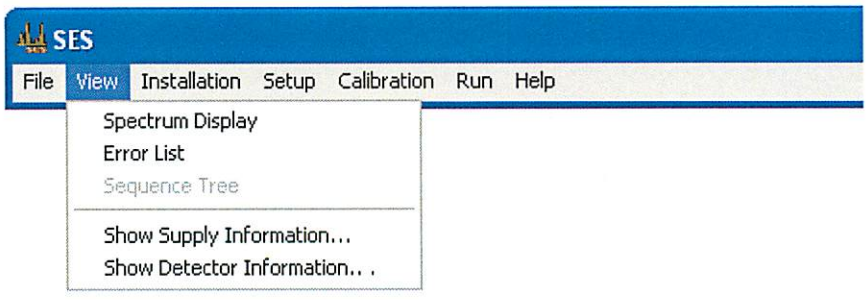

Figure 2-2. View Menu.

View menu commands

Spectrum Display	Show the spectrum display.
Error List	Show the error listing.
Sequence Tree	Show the sequence tree when the spectrum display is shown.
Show Supply Information...	Open the Supply Information (page 2-75).
Show Detector Information...	Open the Detector Information Window (page 2-76).

Installation Menu

Installation

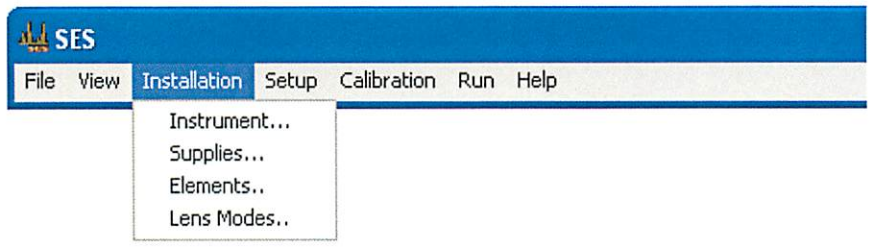

Figure 2-3. Installation Menu.

Installation menu commands

Instrument...	Open the Instrument Installation Dialogue (page 2-61).
Supplies...	Open the Supply Installation Dialogue (page 2-63).
Elements...	Open the Element Installation Dialogue (page 2-65).
Lens Modes...	Open the Lens Mode Installation Dialogue (page 2-67).

Note: the Installation menu commands should only be used by the system administrator.

Setup Menu

Setup

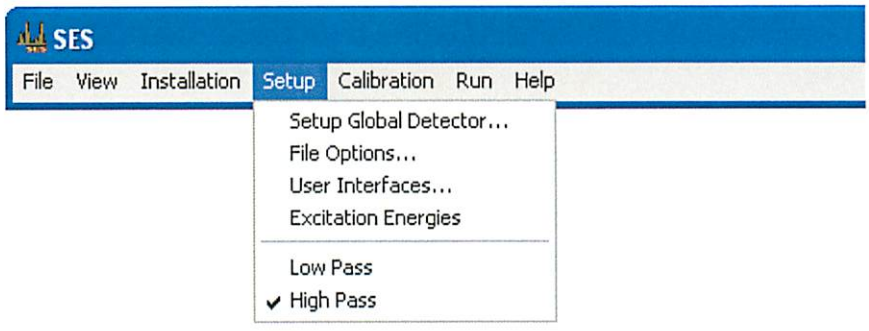

Figure 2-4. Setup Menu.

Setup menu commands

Setup Global Detector...	Open the Detector Setup Dialogue for global detector settings (page 2-15).
File Options...	Open the File Options Dialogue (page 2-21).
User Interfaces...	Open the User Interfaces Dialogue (page 2-23).
Excitation Energies...	Open the Excitation Energies Dialogue (page 2-24).
Low Pass, High Pass	Selects a set of elements depending on instrument for high or low pass energy ranges. (page 3-10).

Note: the user only has to use the Setup Global Detector and File Options commands. The remaining commands should only be used by the system administrator.

Calibration Menu

Calibration

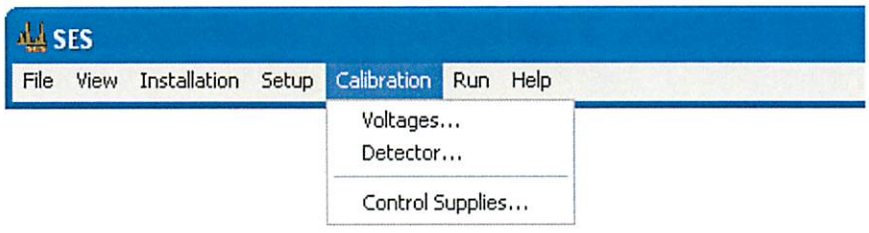

Figure 2-5. Calibration Menu.

Calibration menu commands

Voltages...	Open the Voltage Calibration Dialogue (page 2-27).
Detector...	Open the Detector Calibration Dialogue (page 2-35).
Control Supplies...	Open the Control Supplies Dialogue (page 2-38).

Note: the user only has to use the Voltages command in the Calibration menu. The remaining commands should only be used by the system administrator.

Run Menu

Run

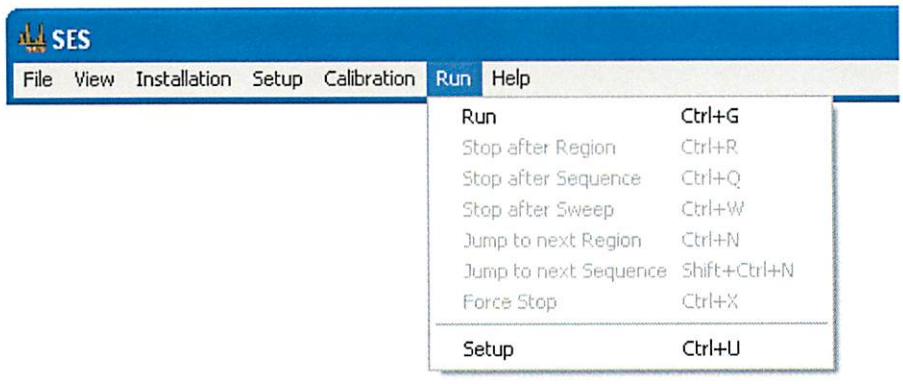

Figure 2-6. Run Menu.

Run menu commands

Run	Starts an acquisition with the current sequence and region settings.
Stop after Region	Stops the acquisition after the region has finished each of its sweeps.
Stop after Sequence	Stops the acquisition after the sequence has finished each of its regions.
Stop after Sweep	Stops the acquisition after the current sweep.
Jump to next Region	Finishes the acquisition of the current sweep, and starts the next region.
Jump to next Sequence	Finishes the current region, and starts the next sequence, only applicable when using multiple sequences (page 2-72).
Cancel Stop Request	Cancels the current stop request. This menu item appears only after one of the above stop requests has been issued.
Force Stop	Forces the current acquisition to stop immediately. Incomplete data from the current sweep is discarded, but data from earlier sweeps is kept.
Setup	Opens the Sequence List editor for acquisition setup (page 2-41).

Note 1: if the Autosave option is checked in the File Options Dialogue (page 2-21), all stop commands will save acquired data.

Note 2: if the Zero voltages option is checked in the Acquisition tab of the SES Options Dialogue (page 2-70), Force Stop works effectively as an emergency button, resetting all supplies to zero. This is useful when working with experiments which might damage the detector.

Help Menu

Help

Figure 2-7. Help menu.

Help menu command	
About SES...	Opens the About SES information window.

Section C – Setup Dialogues

Introduction

This section describes how to use the Setup dialogues.

This section

Detector Setup Dialogue

Description

The Setup Detector dialogue defines the active window of the detector and how this window is divided into slices for image acquisition.

Access

d. From the Setup menu select the Setup Global Detector command.
(Setup → Setup Global Detector)

e. From the Run menu select the Setup command.
In the Sequence Editor dialogue click the Setup Detector button.
(Run → Setup → Setup Detector)

f. From the Run menu select the Setup command.
In the Sequence Editor's Region frame click the New or Edit button. In the Region Editor's Detector frame check the Use Region Defined Detector box and then click the Setup button.
(Run → Setup → New/Edit → Use Region Defined Detector, Setup)

Detector setup

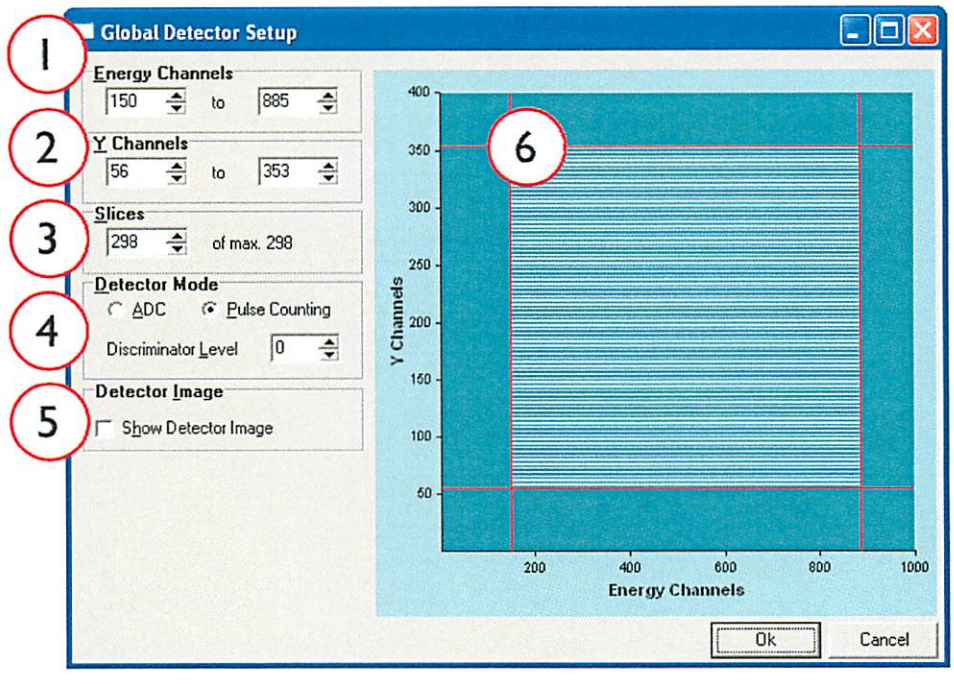

Figure 2-8. The Detector Setup dialogue for global settings.

Detector Setup Dialogue, Cont.

1. Energy channels

Energy Channels define the channel range in the energy direction of the detector.

Reducing the energy range to the central part of the detector mainly improves angular resolution.

Note: the channels can be changed either by the spin edit boxes, or by the range markers in the detector window.

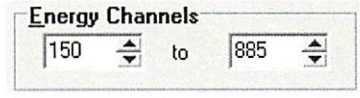

Figure 2-9. Detail of the Energy Channels frame.

2. Y channels

Y Channels define the channel range in the angular or spatial direction of the detector.

When only one slice is used, there are no restrictions on how to select the range of Y Channels.

Note: the channels can be changed either by the spin edit boxes, or by the range markers in the detector window.

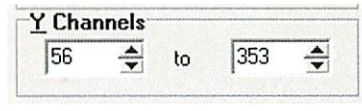

Figure 2-10. Detail of the Y Channels frame.

3. Slices

Slices define the number of partitions of equal height into which Y Channels should be divided.

Unless the detector system has only Energy Channels, the Y Channels can be divided into a number of Slices.

When only one slice is used, data is summed over all Y Channels and presented as a one dimensional spectrum in the energy dispersion direction.

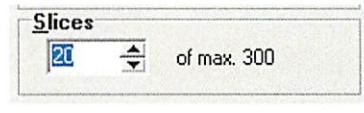

Figure 2-11. Detail of the Slices frame.

Continued

3. Slices *Cont.*

When more than one slice is used, data is instead presented either as:

- a one dimensional spectrum summed over all Y Channels as above,
- as several one dimensional spectra for each slice respectively, or
- as an image representation of the two dimensional spectrum.

Note: when choosing a value for Slices other than one, there are enforced restrictions on the range of Y Channels. The number of Y Channels must be an even multiple of the slices, and this is handled automatically by the Detector Setup dialogue. The spin edits and the range markers for Y Channels behave differently in this context.

4. Detector modes

Detector Mode defines whether the detector system should use Pulse Counting or ADC mode.

The detector systems based on the VG Scienta 7059 processor cards have two detector modes; ADC or Pulse Counting mode. Older detector systems may have either Pulse Counting mode, or no modes. Newer detector systems based on FireWire cameras have no modes.

4a. ADC mode

In ADC mode, which is the most commonly used mode, each camera pixel is counted as an event and added to the total intensity during a measurement. Noise reduction is performed before making the accumulation. Since one event often occupies more than one pixel, the Multiple Counting Factor is of importance.

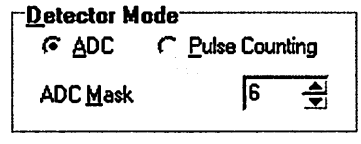

Figure 2-12. Detail of the Detector Mode frame for ADC mode. The ADC Mask control was used by older versions of the Detector library but is currently not active (the value is set up as a constant in another part of the software).

4b. Pulse Counting mode

Pulse Counting is only useful for very low intensities. The idea behind it is to replace an event containing several pixels distributed in a spot-like shape with a single pixel with intensity one. One such spot is considered to represent one electron hitting the MCP. If two such events occur close enough to make their two areas merge into one spot, the pulse counting algorithm will not be able to distinguish between them, and report only one pulse. It is therefore only viable when you are fairly certain that no events ever merge in the image, i.e. only when doing low intensity measurements.

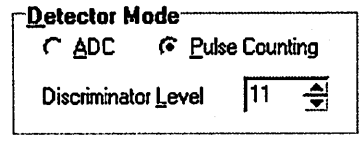

Figure 2-13. Detail of the Detector Mode frame for Pulse Counting mode. The Discriminator Level control was used by older versions of the Detector library but is currently not active (the value is set up as a constant in another part of the software).

5. Show detector image

Checking Show Detector Image displays a real time image of the detector. Controls for selecting acquisition parameters then become visible.

The acquisition parameters used for displaying the detector image are the same as in Voltage Calibration, except for the detector area settings. The full range of Energy Channels are used, and as many of the Y Channels as the choice of Slices allows, starting from one.

For 7059 detector systems the Data Bytes control will be visible. Selecting a lower value of Data Bytes significantly decreases the data transfer time, but will result in a much lower saturation rate.

Note: The Slices parameter in the Detector Image frame pertains to the acquisition of the detector image in this window only, and is not related to the parameter in the Slices frame.

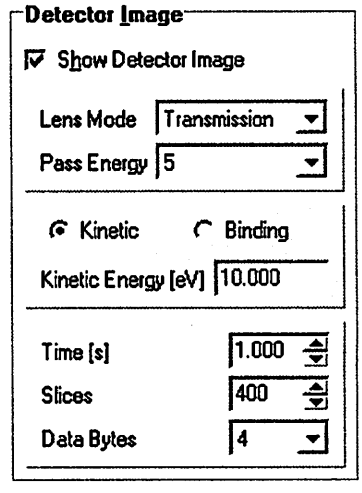

Figure 2-14. Detail of the Detector Image frame.

6. Detector range markers

The detector area used for acquisitions can be defined by dragging the range markers in the detector window.

Global and Local Detector Settings

Global detector settings

The detector settings are referred to as global when accessed from the:

g. Setup Global Detector command in the Setup menu, or

h. Setup command in the Run menu and then in the Sequence Editor clicking the Setup Detector button.

Global detector settings are used for all spectrum acquisitions that do not have individual or local detector settings. In addition, they are also used as a base for all dialogues in which data acquisition occurs.

Note: if the user does not have write permission to the RunVar.dat file, he will not be able to save changes made to the global detector settings.

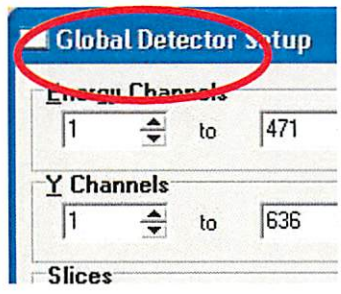

Figure 2-15. Detail of the Detector Setup dialogue for global settings.

Local detector settings

The detector settings are referred to as local when accessed from the Region Editor by checking the Use Region Defined Detector box and then clicking the corresponding Setup button.

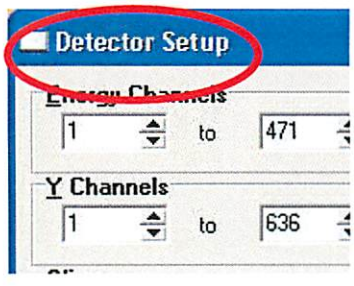

Figure 2-16. Detail of the Detector Setup dialogue for local settings.

File Options Dialogue

Description

The File Options dialogue is used for specifying available experiment file libraries and for defining parameters such as experiment file type, save directory and file naming method.

Access

i. From the Setup menu select the File Options command.
(**Setup → File Options**)

j. From the Run menu select the Setup command.
In the Sequence Editor dialogue click the File Options button.
(**Run → Setup → File Options**)

File options

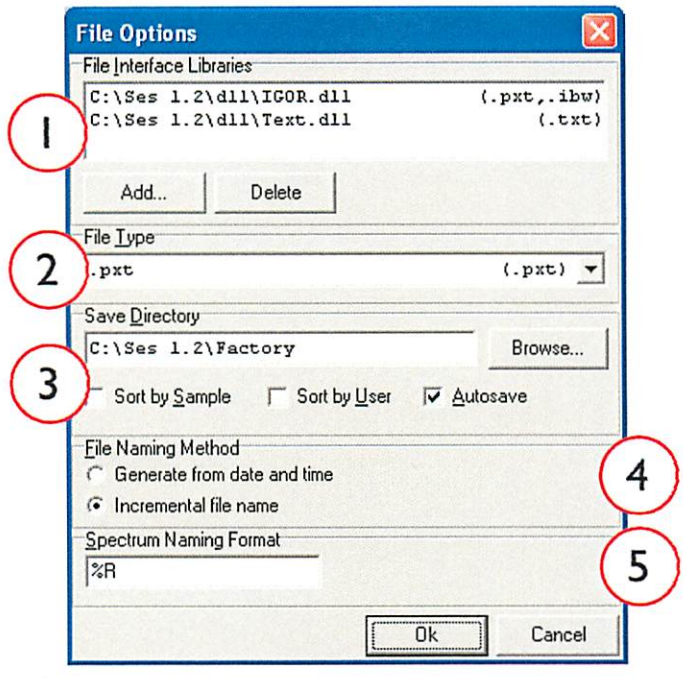

Figure 2-17. File Options dialogue.

1. Interface libraries

The File Interface Libraries box lists available experiment file libraries and their respective formats. Experiment file libraries can be added and deleted with the Add and Delete buttons respectively.

File Options Dialogue, Cont.

2. File type

The File Type box defines the file type used for saving experiment files. By default, three file types are available:

- Igor Packed Experiment Files (.pxt)
- Igor Binary Wave (.ibw)
- text file format (.txt)

3. Save directory

The Save Directory box defines the base directory and where to save experiment files.

- If the Sort by Sample or Sort by User boxes is checked, experiment files will be saved in subdirectories to the base directory based on the information in the Sample and User boxes in the Sequence Editor.
- If the Autosave box is checked, experiment data will be saved after each time that the sequence has completed an execution. Experiment data will then also be saved when the sequence is stopped by the user.

4. File naming method

File Naming Method defines whether experiment file names should be constructed from the date and time of the acquisition, or from an incremental number. The file names generated from date and time have the format **base-mmddhhnn.ext** while the file names generated from an incremental number have the format **base-xxx.ext**.

5. Spectrum naming format

The Spectrum Naming Format box defines how the spectra are named in the experiment files. There are three format parameters:

- %R represents the region name
- %F represents the experiment file name
- %N represents the incremental number or date and time of the experiment file name

Example: '%R_%N' would name the spectrum 'Region1_001' for a region with name 'Region1' and incremental number '001'.

User Interfaces Dialogue

Description

The User Interfaces dialogue is used to load and unload plugins or user interface libraries for auxiliary equipment, such as sample manipulator, monochromator, flood gun and ion gun. The currently loaded plugins are listed in the Loaded User Interfaces frame.

Access

From the Setup menu select the User Interfaces command.
(**Setup → User Interfaces**)

User interfaces

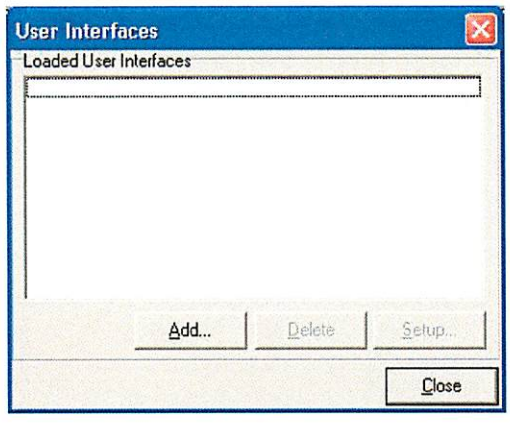

Figure 2-18. User Interfaces dialogue.

Note: this dialogue should only be used by the system administrator.

Add, delete, setup

- New plugins can be loaded by clicking the Add button and browse for the desired plugin.
- A plugin can be unloaded by selecting it in the list and clicking the Delete button.
- If the selected plugin has a setup dialogue, it can be opened by clicking the Setup button.

Excitation Energies Dialogue

Description

The Excitation Energies dialogue is used to define excitation energies, specify default excitation energy and to change the current excitation energy.

Access

From the Setup menu select the Excitation Energies command. (**Setup → Excitation Energies**)

Excitation energies

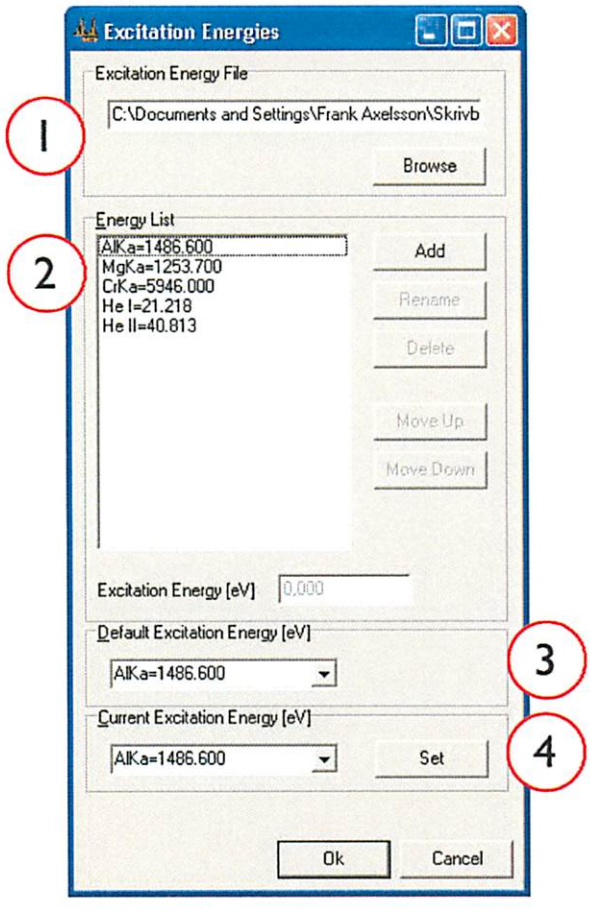

Figure 2-19. Excitation Energies dialogue.

Note: This dialogue should only be used by the system administrator.

Excitation Energies Dialogue, Cont.

1. Excitation energy file

The file where the defined excitation energies are stored is specified in the Excitation Energy File frame. A different file can be loaded by clicking the Browse button and browse for the desired file.

2. Energy list

1. New excitation energies can be defined by clicking the Add button.
   - The selected excitation energy can be renamed or deleted by clicking the Rename or Delete button respectively.
   - Excitation energies can be moved further up or down the list by clicking the Move Up or Move Down buttons.
   - The actual energy for the selected excitation energy can be changed in the Excitation Energy field.

3. Default excitation energy

The Default Excitation Energy frame specifies which excitation energy to use when creating new regions in the

The default excitation energy can be changed either by selecting a predefined energy from the drop-down list or by entering a new value.

4. Current excitation energy

The Current Excitation Energy frame specifies the excitation energy currently assigned to the instrument. The current excitation energy can be changed by either selecting one of the predefined excitation energies from the drop-down list or by entering a new value and clicking the Set button.

Note: if a monochromator plugin is loaded, the Current Excitation Energy frame will display the current photon energy of the monochromator. When the current excitation energy is changed, the new value is assigned to the monochromator.

Section D – Calibration Dialogues

Introduction

This section describes how to use Calibration dialogues.

This section

Voltage Calibration Dialogue

Description

The Voltage Calibration dialogue is mainly used for optimizing intensities by changing the Pass Energy and the lens deflection elements, calibrating the Energy Offset to compensate for drift, and general troubleshooting.

Access

From the Calibration menu select the Voltages command. (**Calibration → Voltages**)

Voltage calibration

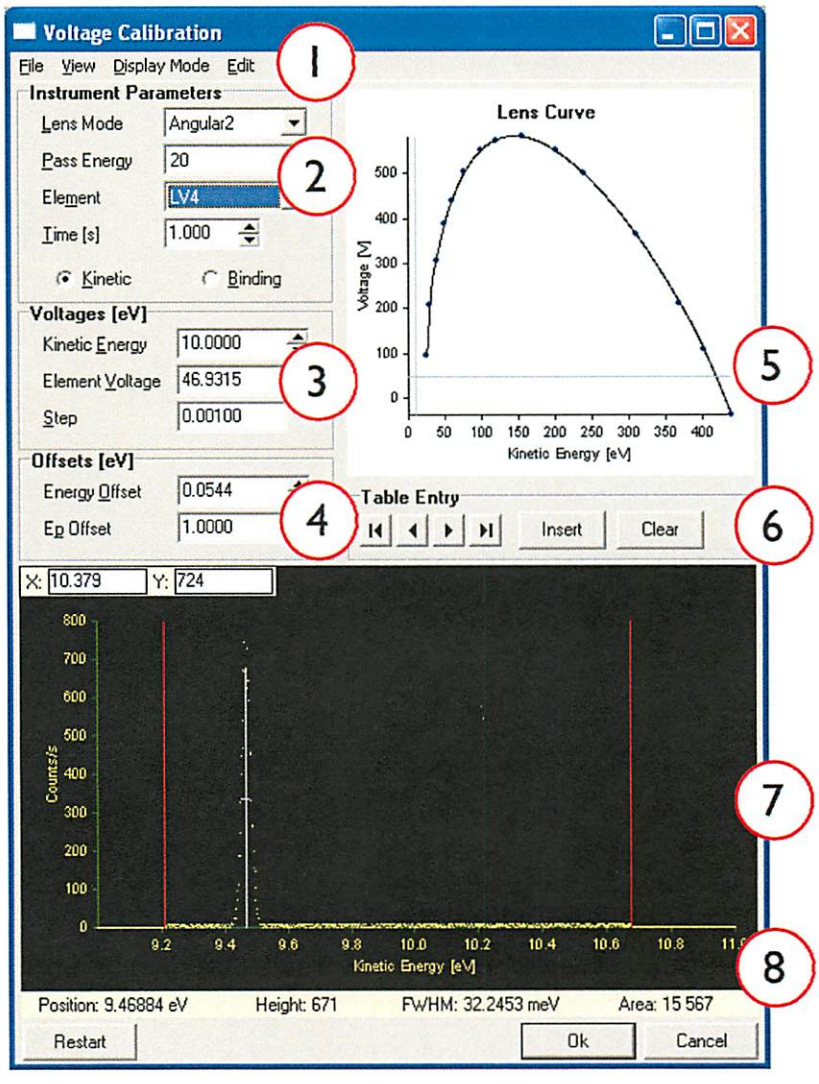

Figure 2-20. The Voltage Calibration dialogue.

Voltage Calibration Dialogue, Cont.

1. Voltage calibration menus

The menu bar in the Voltage Calibration dialogue includes File, View, Display Mode and Edit menus.

1a. File menu

The File menu is used for importing and exporting lens tables, and for exiting the Voltage Calibration dialogue.

Note: the user only has to use the Exit command in this menu. The remaining commands should only be used by the system administrator.

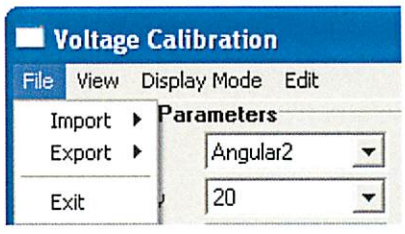

Figure 2-21. File Menu.

1b. View menu

The first four commands of the View menu open number display windows corresponding to data in the Peak Information bar.

The External Image command opens a window displaying an image representation of the spectrum. This command is available for Angular/Spatial and Spectrum Image acquisition modes (page 2-29).

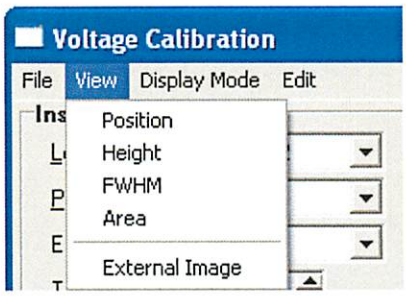

Figure 2-22. View Menu.

The Position, Height, FWHM and Area windows can be resized for viewing at a distance when performing optimization away from the computer.

Figure 2-23. The FWHM number display window.

1c. Display mode menu

The first three commands of the Display Mode menu represent different acquisition modes. The last two commands represent other aspects of data acquisition.

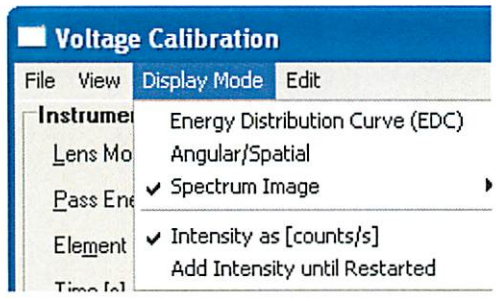

Figure 2-24. Display Mode menu.

Energy Distribution Curve	Corresponds to a one slice acquisition, presented as kinetic or binding energy vs. counts or count rate in the Spectrum Display.
Angular/Spatial	Corresponds to an acquisition using the maximum number of slices available for current selection of Y Channels in the global detector settings. The data is summed over all Energy Channels, and then presented as Y channel vs. counts or count rate in the Spectrum Display.
Spectrum Image	Corresponds to an acquisition using the maximum number of slices available for the current selection of Y Channels in the global detector settings. The data can be presented either as an image, or as kinetic or binding energy vs. counts or count rate for each slice individually, or summed over all slices. **Note:** the Spectrum Image item will have a submenu only if the detector system has a setting for Data Bytes (page 2-18).
Intensity as [counts/s]	If this command is checked, the intensity of the acquired data will be displayed as count rate, rather than as counts.
Add Intensity until Restarted	If this command is checked, the intensity of subsequent acquisitions are added until either the Restart button is clicked, or changes made to the acquisition parameters forces the acquisition to restart.

Voltage Calibration Dialogue, Cont.

1d. Edit menu

The Lens Table item opens the Edit Lens Tables dialogue for the currently selected Lens Mode and Pass Energy.

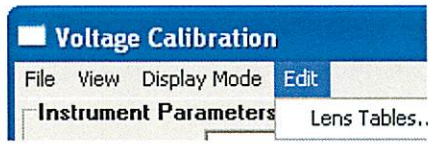

Figure 2-25. Edit menu.

Note: the user should not change the values in the Edit Lens Tables dialogue except for the lens deflection elements.

2. Instrument parameters

The Instrument Parameters frame specifies the setup of the continuous acquisition, as well as the current element selection.

When the Voltage Calibration dialogue is opened, it immediately starts a continuous fixed mode acquisition using default parameters. For the detector, it uses the full range of Energy Channels. It uses a Slices setting dependent on Display Mode and for the remaining parameters it uses values from the global detector settings.

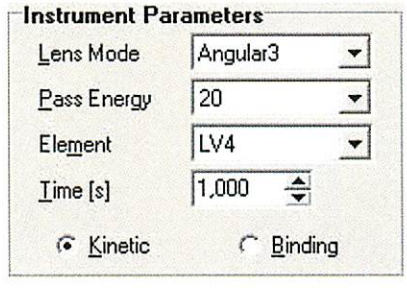

Figure 2-26. Instrument Parameters frame.

Note: if the user does not have write permission to Instrument.dat, changes can not be made to element voltages, including the lens deflection elements. Likewise, if the user does not have write permission to RunVar.dat, changes can not be made to Energy Offset.

3. Voltages

The Voltages frame specifies the current kinetic or binding energy and displays the voltage of the currently selected element.

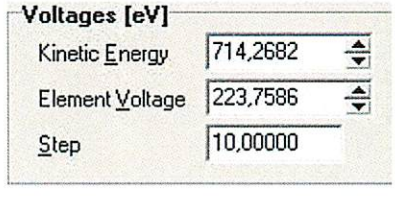

Figure 2-27. Voltages frame.

Voltage Calibration Dialogue, Cont.

4. Offsets

The Offsets frame specifies the Energy Offset of the analyser, and the pass energy offset for the currently selected pass energy.

The Ep Offset parameter is calibrated and should not be changed.

The Energy Offset parameter can be used to compensate for energy drift in the experiment setup, and it can also be used for defining the work function.

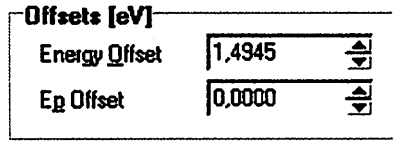

Figure 2-28. Offsets frame.

5. Lens curve

The Lens Curve graph displays the lens table for the currently selected Element, if it depends on kinetic energy.

6. Table entry

The Table Entry frame provides means to navigate through the discrete kinetic energy/voltage pairs of the lens table for the currently selected element, if it depends on kinetic energy.

7. Spectrum display

The Spectrum Display presents the spectrum of the current acquisition as a graph or as an image representation. (page 2-54)

8. Peak information

The information displayed in the Peak Information Bar of the Spectrum Display can be used when maximizing intensity and resolution for desired analyser settings.

How to Optimize the Lens Deflection Elements

Description

The two lens deflection elements called Up/Down and Left/Right can be used to optimize the sample position with regard to intensity or resolution.

Select element

Step 1

Select the lens deflection element that you wish to optimize in the Element box. The lens table for the element will become visible in the Lens Curve graph.

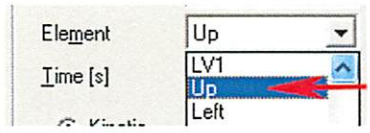

Figure 2-29. Element selection detail.

Adjust voltage

Step 2

Next, use the Element Voltage box to adjust the voltage for the lens deflection element while watching the Peak Information bar.

Figure 2-30. Element voltage detail.

Note: changing settings related to the acquisition will force it to restart, and the Element Voltage for the lens deflection element will revert back to its initial value. Refer to the How to Edit the Lens Tables on page 2-33 for instructions on how to save the new lens deflection voltages in the Lens Table.

Optimize

Step 3

When optimizing for intensity, watch for an increase in peak height or spectrum area; when optimizing for energy resolution, watch for a decrease in peak FWHM, while maintaining good peak height.

Note: instrument operation is best when the lens deflection elements are at 0 V. It is better to optimize the intensity by changing experiment geometry.

Peak information

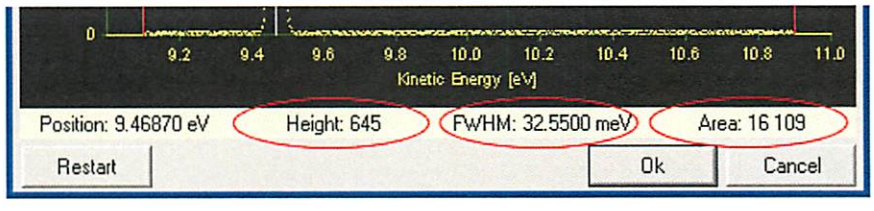

Figure 2-31. Detail of Peak Information bar showing important parameters when optimizing intensity and resolution.

How to Edit the Lens Tables

Description

When optimal voltages for a lens deflection element have been found, the lens table needs to be changed to reflect this. This can be carried out either by using the Table Entry frame or the Edit Lens Tables dialogue.

Note: users should never change the lens tables for elements other than the Up/Down and Left/Right lens deflection elements.

Using table entry

- **To change** the element voltage of a lens table point, navigate to it using the navigation buttons, and enter the desired value in the Element Voltage box.
- **To delete** a point, navigate to it and click the Delete button.
- **To insert** a new point at the current kinetic energy, enter the desired value in Element Voltage and click the Insert button.

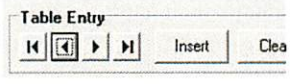

Figure 2-32. Detail of the navigation buttons in the Table Entry frame.

Using edit lens table

Open the Edit Lens Tables dialogue from the Edit menu.

- **To change** element voltage for a point, edit the cell in the Voltage column for the corresponding kinetic energy.
- **To delete** a point, select a cell in the Ek or Voltage column and press the Delete key.
- **To insert** a new point, select an empty cell in the Ek column, enter the desired kinetic energy for the point, press the Enter key and then edit the element voltage.

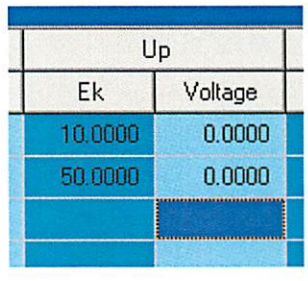

Figure 2-33. Detail of Edit Lens Tables dialogue showing the lens table for the Up lens deflection element.

Note: when using the Edit Lens Table a lens table must contain at least two points.

How to Edit the Lens Tables, Cont.

Saving lens table changes

After a lens table has been edited, changes should be saved by clicking the Ok button and confirming the changes.

Detector Calibration Dialogue

Description

The Detector Calibration dialogue is used to calibrate the basic energy and angular or spatial scales of the detector. It is also used to calibrate an energy correction curve compensating for non-linearities in the energy direction of the detector.

Access

From the Calibration menu select the Detector command.
(**Calibration → Detector**)

Detector calibration

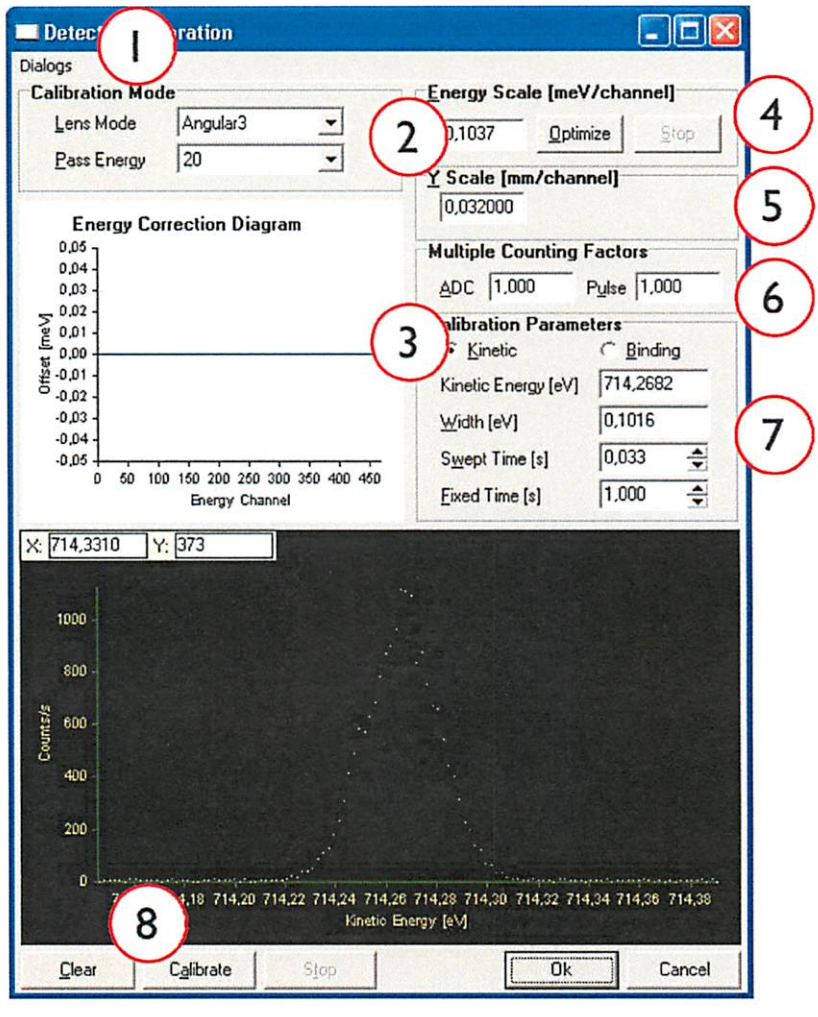

Figure 2-34. Detector Calibration dialogue.

Note: this dialogue should only be used by the system administrator.

Detector Calibration Dialogue, Cont.

1. Dialogs menu

- For the 7059 detector system, the Detector Linearity command is used to investigate the saturation level when using Pulse Counting mode and ADC Mode respectively (page 2-15).
- The Multiple Counting command is used to calibrate the multiple counting factor(s).

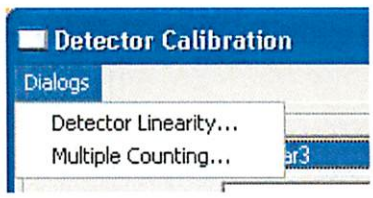

Figure 2-35. Detail of Dialogs menu.

2. Calibration mode

The basic acquisition parameters of the instrument are specified in the Calibration Mode frame.

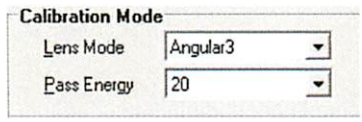

Figure 2-36. Detail of Calibration Mode frame.

3. Energy correction diagram

The Energy Correction Diagram displays the calibration curve for the current pass energy.

4. Energy scale

The Energy Scale frame specifies the basic energy scale of the detector. Basic energy scale calibration can be started by clicking the Optimize button and stopped by clicking the Stop button.

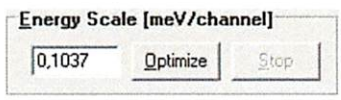

Figure 2-37. Detail of Energy Scale frame.

5. Y-scale

The Y-Scale frame specifies the basic angular or spatial scale of the detector.

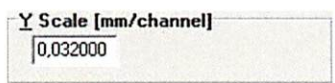

Figure 2-38. Detail of Y-Scale frame.

6. Multiple counting factors

The Multiple Counting Factors frame specifies the multiple counting factor(s) for the current pass energy.

Pulse Counting mode and ADC Mode (page 2-17) have separate multiple counting factors.

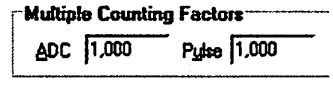

Figure 2-39. Detail of Multiple Counting Factors frame.

7. Calibration parameters

The Calibration Parameters frame specifies the instrument settings for the continuous acquisition, the basic energy scale calibration and calibration of the energy correction curve.

- The Kinetic and Binding buttons specify whether to use kinetic or binding energy for the energy scale.
- The Kinetic Energy box specifies the centre energy of the acquisitions. The Width field specifies the width of the energy window used for the sweeps when calibrating energy correction curves.
- The Swept Time box specifies the step time used for the sweeps when calibrating energy correction curves.
- The Fixed Time box specifies the acquisition time for the continuous acquisition and for the basic energy scale calibration.

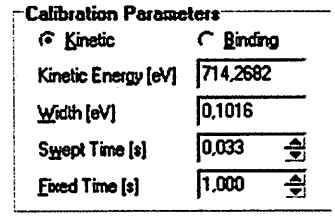

Figure 2-40. Detail of Calibration Parameters frame.

8. Energy correction curve

- The energy correction curve for the current pass energy can be cleared by clicking the Clear button.
- A new energy correction curve can be calibrated for the current pass energy by clicking the Calibrate button.

Control Supplies Dialogue

Description

The Control Supplies dialogue is used to display and change the voltages assigned to specific supplies. It is used solely for troubleshooting the operation of the supplies.

Access

From the Calibration menu select the Control Supplies command.
(**Calibration → Control Supplies**)

Control supplies

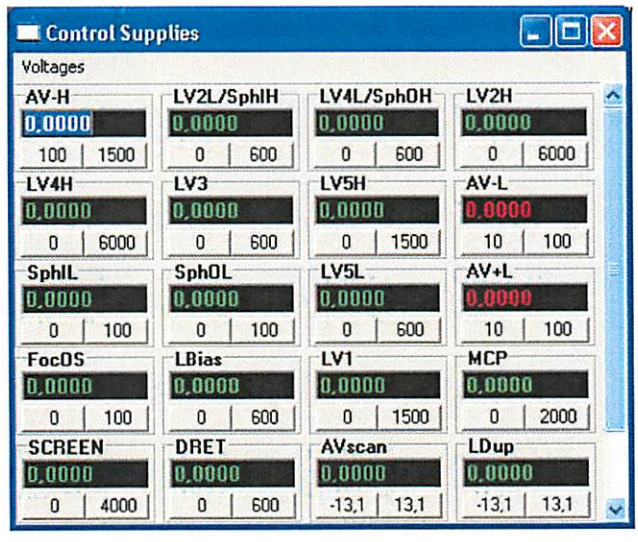

Figure 2-41. Example of Control Supplies dialogue.

Note 1: this dialogue should only be used by the system administrator.

Note 2: the zero value for high voltage supplies generally differ from 0 by a small amount.

Overview of control supplies dialogue

- The supply voltage indicators can be dragged and dropped to resemble the layout of the high voltage.
- If a supply is within its operational range, this is indicated by the green colour of the numbers in the voltage indicator. If it is outside its operational range, the colour will be red.
- A specific supply can be brought to its extreme max and min values by clicking the respective button at the bottom of the appropriate supply voltage indicator.

Continued

Control Supplies Dialogue, Cont.

Overview of control supplies dialogue

Cont.

- The voltage assigned to a specific supply can also be changed by entering a new value and pressing the Enter key.
- The Zero All command in the Voltages menu sets all supplies to their zero values.
- The Send Repeatedly command in the Voltages menu forces the assigned voltages to be sent to the supplies repeatedly with a 100 ms delay.

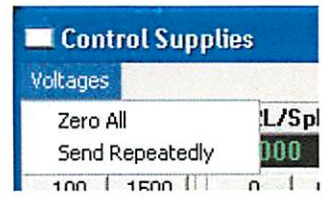

Figure 2-42. Detail of Voltages menu.

Section E – Run Dialogues

Introduction

This section describes how to use the Sequence and Region Editors, explains the Run Modes and how to compensate for energy drifts during data acquisition.

This section

Sequence List Editor

Description

The Sequence List Editor defines a batch of sequences to be run in an experiment, each with their own base file name and directory for storing the results.

Access

(**N.B.** The Sequence List Editor is only available after selecting "Use multiple sequences" from the Acquisition tab in the File/Options menu.) From the Run menu select the Setup command.
(**Run → Setup**)

Sequence List editor

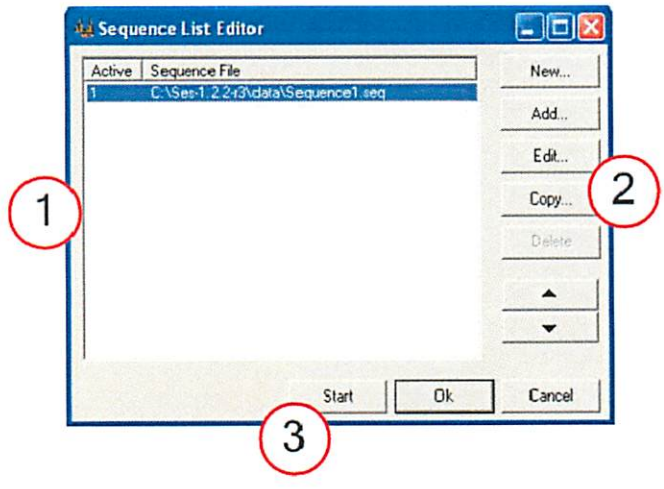

Figure 2-43. The Sequence List Editor.

1. Sequence List

Table showing the sequences to execute during a measurement. The leftmost column (titled "Active") shows the number of regions that are active in the sequence given in the rightmost column (titled "Sequence File").

2. Edit Buttons

The available buttons for editing the sequence list:

- The "New…" button creates a new sequence file and adds it to the end of the list.
- The "Add…" button enables you to add an existing sequence file to the list.
- The "Edit…" button opens the Sequence Editor for the currently selected sequence file.
- The "Copy…" button creates a copy of the selected group of sequences. Note that any manipulator settings present in the

source sequences need to be re-created in the target sequences. SES stores manipulator positions by index, which means that the copied sequence will point to the same manipulator position as the source sequence. Any change of manipulator position in one sequence will then automatically modify the position in the other sequence as well.

- The "Delete..." button deletes selected sequences from the list. It will not delete any files from the hard drive.
- The Up- and Down-arrow buttons moves selected sequences up or down the list.

---

3. Other buttons

The buttons on the bottom of the editor are:

- "Start" will start acquisition of the entire list. This is commonly called a batch mode acquisition. It executes the sequences from top to bottom in the Sequence List.
- "OK" will close the editor and accept the changes to the Sequence List. It does not have any effect on the Region list edited in the Sequence Editor or Region Editor.
- "Cancel" will close the editor and cancel the changes made to the Sequence List. It does not have any effect on the data edited in the Sequence Editor or Region Editor.

Sequence Editor

Description

The Sequence Editor defines the regions to be run in an experiment, which run mode to use and where to save resulting data.

Access

When using multiple sequences, this editor will open from the Sequence List Editor by either double-clicking on a sequence file, or by clicking on the "Edit…" button.

If "Use multiple sequences" has not been selected in the Acquisition tab in the File/Options… dialog, this editor will open when selecting Setup from the Run menu (**Run → Setup**).

Sequence editor

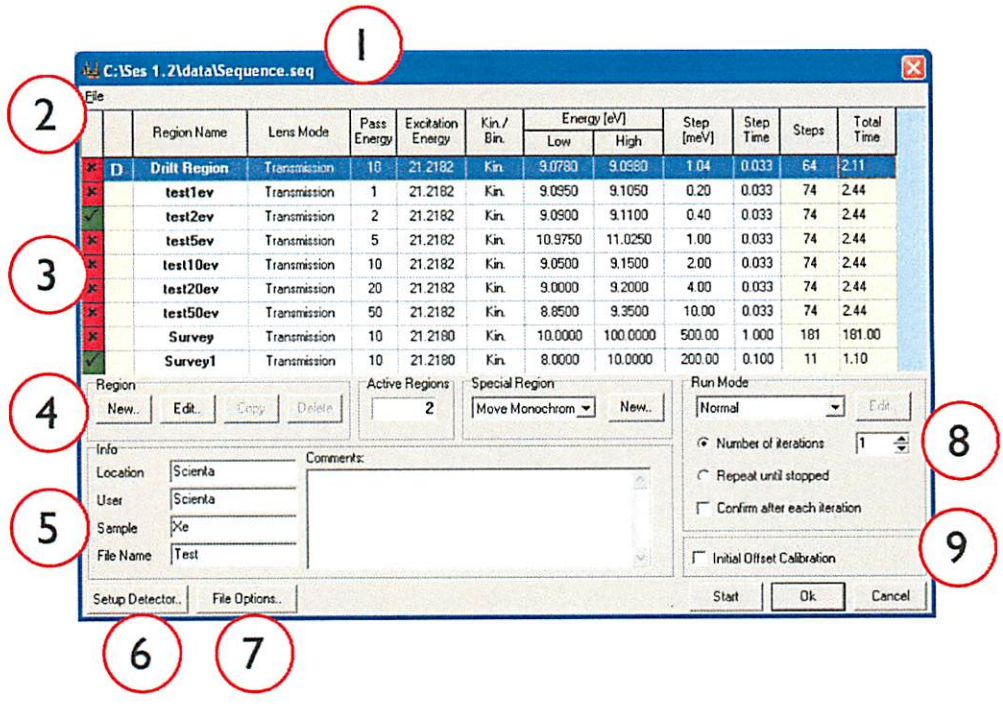

Figure 2-44. The Sequence Editor.

1. Title bar

Title bar displaying the currently loaded sequence file.

2. File menu

The File menu provides commands to open, save and create new sequences.

3. Acquisition regions

The regions marked as active will be executed sequentially when an experiment is started.

- **To activate a region**, click the centre of the cell of the first column so that it turns green and the ✓-symbol appears.
- **To deactivate a region**, click the cell so that it turns red and the ✗-symbol appears.

The number of activated regions is displayed in the Active Regions frame.

Note: the Total Time column displays the estimated time to complete one acquisition of the region. This includes the number of repetitions defined in the region in the calculation, but not analyser delays.

4. Region management

The Region frame contains four buttons for adding, editing, copying and deleting regions.

- **To create a new region**, click the New button.
- **To copy a region**, select the corresponding row in the region table and click the Copy button.
- **To delete a region**, select the corresponding row in the region table, and click the Delete button.
- **To edit a region**, either use the Region Editor or edit the cells in the region table directly. The Region Editor can be opened either through selecting the corresponding row in region table, and then clicking the Edit button, or by double clicking the row.

5. Experiment information

The Info frame allows for miscellaneous experiment information to be entered including the base file name for saving experiment data.

6. Global detector settings

Button for setting up the global detector settings. This button opens the same dialog as the Setup Global Detector command in the main Setup menu.

Sequence Editor, Cont.

7. Experiment file options

Button for setting up experiment file options. This button opens the same dialogue as the File Options command in the main Setup menu.

8. Run mode

The Run Mode frame defines how the software should perform the acquisitions and save the data (page 2-50).

9. Calibrate energy offset

Option for calibrating the Energy Offset before the actual experiment acquisition commences

Saving experiments

- With the exception of the File Name box, all information entered in the Info frame will be saved with the experiment. The text in the File Name box will be used as a base file name for the saved experiments.
- If the Sort by User option is checked in the File Setup dialogue, experiments will be saved in a subdirectory named as User.
- If the Sort by Sample option is checked in the File Setup dialogue, experiments will be saved in a subdirectory named as Sample.
- If both options are checked in the File Setup dialogue, experiments will be saved in subdirectories of the form \User\Sample.

Region Editor

Description

The Region Editor is used to define acquisition regions. The most basic settings for a region are lens mode, pass energy and energy range. In addition to this, there are more advanced settings, such as using a region specific detector setting and run mode.

Access

From the Run menu select the Setup command.
In the Sequence Editor, click the Edit command in the Region frame or double click a row in the regions table. (**Run → Setup → Edit**)

Region editor

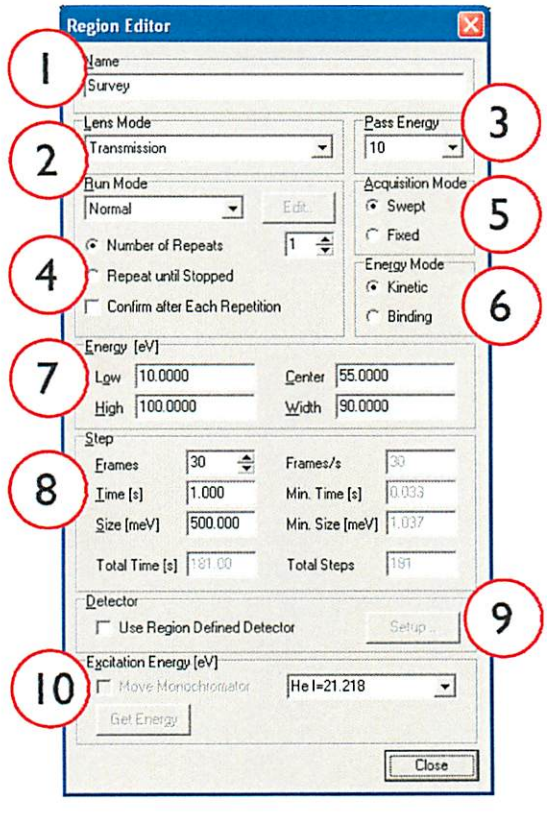

Figure 2-45. The Region Editor dialogue.

Note: changes made to a region in the Region Editor will be saved only when the sequence is saved in the Sequence Editor, either through the Save Sequence or Save Sequence As commands, or by clicking the Ok button. Likewise, to discard changes made to a region, the Cancel button must be clicked in the Sequence Editor.

Region Editor, Cont.

1. Name

Each region should have a unique name. If the region is not given a unique name, it will be changed to by the Sequence Editor when the Close button is clicked.

2. Lens mode

The Lens Mode box lists the lens modes available for the instrument.

3. Pass energy

The Pass Energy box lists the pass energies available for the selected lens mode. Choosing a higher pass energy results in higher intensity and a wider energy range, at the expense of energy resolution.

4. Run mode

The Run Mode frame defines how the software should perform the acquisitions and save the data (page 2-50). Note that this is different from the run mode defined in the Sequence Editor.

5. Acquisition mode

The Acquisition Mode frame defines whether the region should be measured using fixed mode or swept mode.

In fixed mode, the energy is kept fixed for the duration of the acquisition, so that a snapshot of the selected detector area is produced. The energy range is restricted by the energy width of the detector, which is typically about 10% of the pass energy.

In swept mode, the energy is incremented by the energy step, starting with the low energy. Each step in energy corresponds to one point of the spectrum, and each step in energy is also integrated over the selected area of the detector.

6. Energy mode

The Energy Mode frame defines whether binding energy or kinetic energy should be used for defining the low and high energies and for the energy scale of the spectrum.

7. Energy

The Energy frame defines the energy range of the region. It provides means of changing the energy range either by low and high energy, or by centre energy and energy width.

The values in the Energy frame are either in binding energy or kinetic energy, depending on the selected Energy Mode. If fixed acquisition mode is selected in Acquisition Mode, only the centre energy can be changed.

8. Step

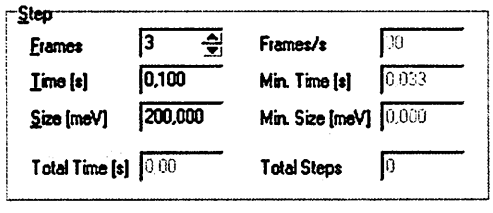

Figure 2-46. Detail of the Region Editor's Step frame.

The Step frame defines the step time and step size of the region.

- For detectors that have a fixed frame rate, such as CCD and FireWire cameras, both the Frames and the Time boxes can be used to select the desired step time. The step time defines the amount of time the detector should spend acquiring data for each energy step.
- For detectors with a fixed frame rate, the value in the Time box is always adjusted to define a whole number of frames.
- For swept mode acquisitions, the energy step defines the distance in energy between each point of the spectrum. The energy step in conjunction with the energy range defines the number of steps, and thus the number of spectrum points, of a swept mode acquisition.
- The Step frame displays frame rate for detectors with a fixed frame rate, minimum step time and minimum energy step for the selected pass energy. It also displays the total number of steps and estimated total time for one acquisition of the region.

9. Detector

The Detector frame defines the detector settings for the region.

- If the Use Region Defined Detector box is unchecked, the region will use the global detector settings.
- If the Use Region Defined Detector box is checked, it will use local detector settings specific to the region. The local detector settings can be changed by clicking the Setup button.

10. Excitation

The Excitation energy frame defines the excitation energy or photon energy for the region.

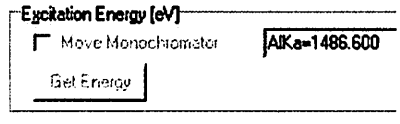

Figure 2-47. Detail of Region Editor's Excitation Energy frame.

- An excitation energy can be entered either by selecting one of the predefined energies, or by typing a new value in the excitation energy box.
- The predefined excitation energies and the default excitation energy for new regions can be modified in the Excitation Energies dialogue. This dialogue is accessed from the main Setup menu by selecting the Excitation Energies command.
- If a monochromator plugin is being used, the monochromator can be moved to the selected excitation energy by checking the Move Monochromator box. To use the current photon energy of the monochromator as the excitation energy for the region, click the Get Energy button.

Run Modes

Description

A run mode is a set of rules that defines how the SES should perform acquisitions and how it should save the data resulting from these acquisitions.

Access

Run modes are selected and configured in the Run Mode frames of the Sequence Editor and the Region Editor for the sequence and regions respectively.

Run mode

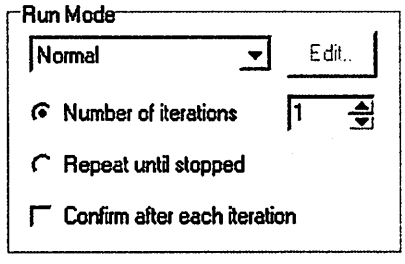

Figure 2-48. Detail of the Run Mode frame.

Run mode settings

SES comes with two built in run modes; Normal and Add Dimension. Each of these run modes can be selected and configured for the whole sequence and for each region individually.

- In the **Normal** run mode, consecutive acquisitions are summed together to yield higher intensity and a better signal to noise ratio.
- In the **Add Dimension** run mode, each consecutive acquisition is stored separately to form an extra dimension in the experiment file. If both the sequence and a region make use of the Add Dimension run mode, the result will be two extra dimensions in the experiment file.
- By selecting the **Number of iterations** option, the number of consecutive executions of the sequence or the region can be specified.
- By selecting the **Repeat until stopped** option the execution of the sequence or the region can be repeated indefinitely.
- If **Confirm after each iteration** is checked, a confirmation to continue will be displayed after each successful execution of the sequence or the region.

How to Compensate for Energy Drifts

Description

If the experiment setup is likely to experience an energy drift, the Initial Energy Calibration option can be used to change the Energy Offset to compensate for this prior to the acquisition.

Alternatively, if the energy drift is noticeable during the time frame of one or a few acquisitions, the Drift Region can be used to automatically compensate by adjusting the Energy Offset each iteration of the sequence. Both compensation methods will change the Energy Offset of the instrument.

How to perform initial energy calibration

Step 1

A reference spectrum with a characteristic with a well defined energy is necessary to perform the initial energy calibration.

To perform an initial energy calibration prior to an acquisition, check the Initial Energy Calibration box.

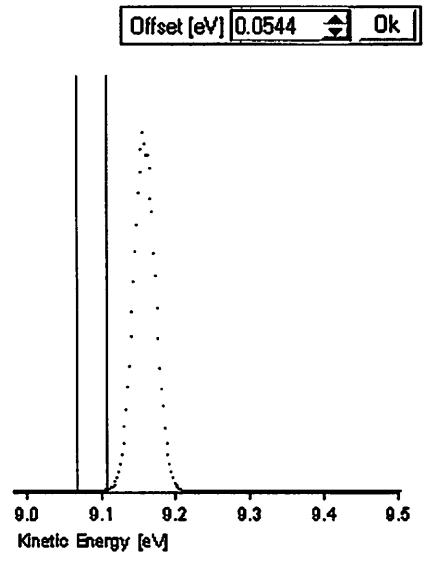

Figure 2-49. Detail of Offset Calibration.

Change region settings

Step 2

Change the pass energy and lens mode of the Drift Region to suitable values, and set its centre energy to that of the chosen characteristic. Before the acquisition is started, the offset calibration will be displayed in the spectrum display of the main window.

Adjust offset

Step 3

Adjust the value in the Offset box so that the centre of the chosen characteristic is located between the two vertical bars, and then click the Ok button.

How to Compensate for Energy Drifts, Cont.

How to setup the drift region

Step 1

As with the initial offset calibration, setup the Drift Region with suitable pass energy and lens mode, and an energy region which is centred on an UPS or XPS peak or a Fermi edge.

Enable drift region

Step 2

- Click the first column of the first row to enable the Drift Region.
- When an acquisition of the Drift Region is complete, the spectrum is correlated to that of the prior acquisition, and the Energy Offset is modified accordingly.
- The total drift since the acquisition started, and the drift between the last two acquisitions of the drift region can be observed in the spectrum display.

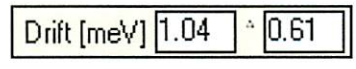

Figure 2-50 Drift Information detail.

Drift region

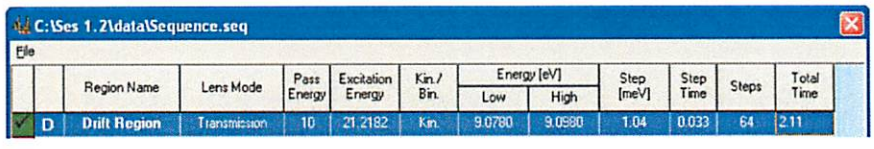

Figure 2-51. Drift Region centered around 9.088 eV.

Note: to use the Drift Region with a Fermi edge rather than an UPS or XPS peak, the Spectrum Type option must be set to Fermi edge in the Options dialogue.

Section F – Operations During Acquisition

Introduction

This section describes the operations and information during data acquisition.

This section

Operating the Spectrum Display

Description

The Spectrum Display is used to display acquired spectra, and can be configured to display data in several ways. During acquisition, it scales automatically to the acquired data, and it also has zooming capabilities and can display basic peak information.

Spectrum display

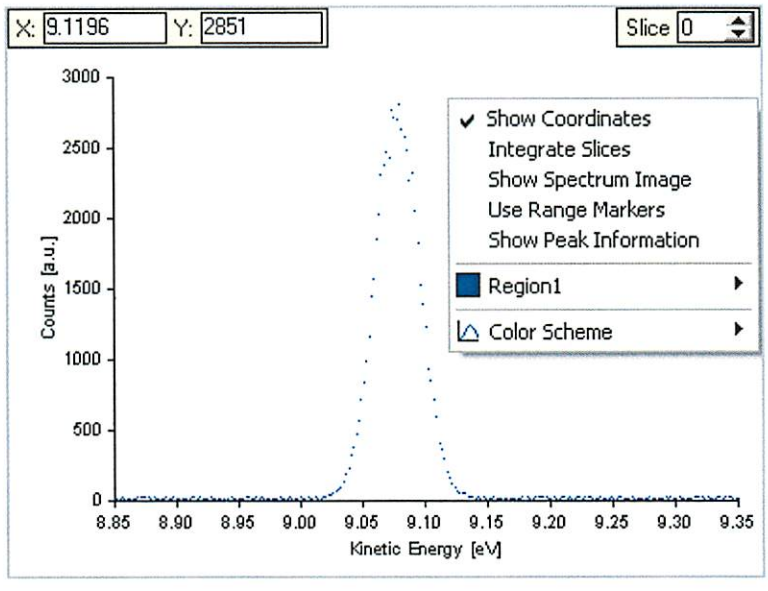

Figure 2-52. Spectrum Display displaying the first slice of a multiple slice spectrum.

Overview of the spectrum display menu

The Spectrum Display context menu is opened by right clicking in the spectrum area, and has the following commands:

- The Show Coordinates command specifies whether the information about the coordinates of the mouse pointer's current position should be displayed.
- The Integrate Slices command is only available with multiple slice spectra. If Integrate Slices is checked, the spectrum data for all slices will be summed and displayed as a single slice spectrum.
- The Show Spectrum Image command is only available with multiple slice spectra. If Show Spectrum Image is checked, the spectrum data will be displayed as an image representation of the spectrum.

Continued

Overview of the spectrum display menu

Cont.

Note: the Integrate Slices and Show Spectrum Image commands are mutually exclusive. By checking either one of them, the other will automatically be unchecked. If either one of them is checked the Slice box will not be visible.

- The Use Range Markers command specifies whether only data within the area of the range markers should be displayed.
- The Show Peak Information command specifies whether basic peak information should be displayed at the bottom of the spectrum display.
- The Region1 command is named after the region that is being displayed, and is only visible if the spectrum has as a graph. Its sub menu specifies whether the graph should be drawn using lines or points as well as the colour of the graph.
- The Colour Scheme item specifies what colours to use for the background of the spectrum display, as well as for the axes and the text. When selecting a colour scheme, the colour of the graph will be reset to the default value for that colour scheme.

Image representation

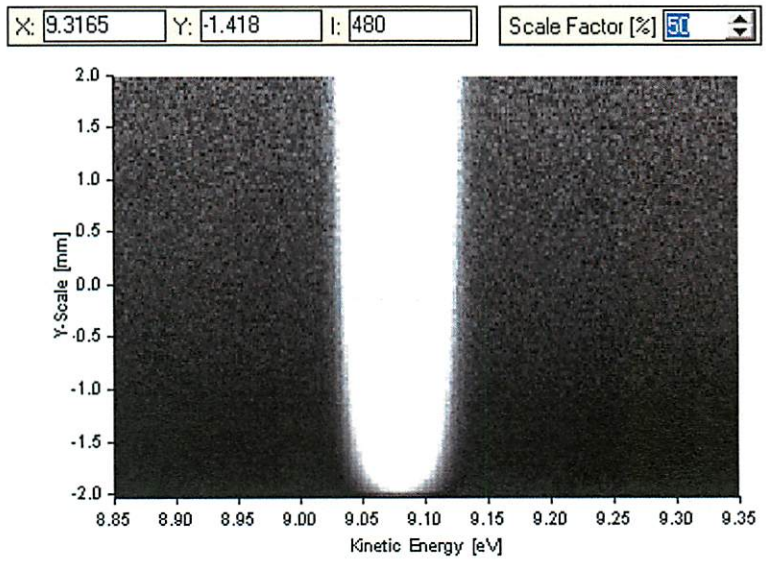

Figure 2-53. Image representation of a multiple slice spectrum.

Displaying spectra as images

When displaying the spectrum image, the Scale Factor box will be visible. The scale factor specifies how the body of the spectrum data should be scaled with respect to the maximum.

- Decreasing the Scale Factor yields more detail in the low intensity areas of the spectrum, such as noise.
- Increasing the Scale Factor yields more detail in the high intensity areas of the spectrum.

If the Show Coordinates item is checked, in addition to the position of the mouse pointer, the intensity of that position will also be displayed.

Note: when a large detector area with many slices is selected, this might result in a decreased sweep speed due to computer performance, but data is still collected correctly. For optimal performance, do not display the spectrum in image mode when acquiring swept spectra.

Range Markers and Peak Information

Range markers and peak info

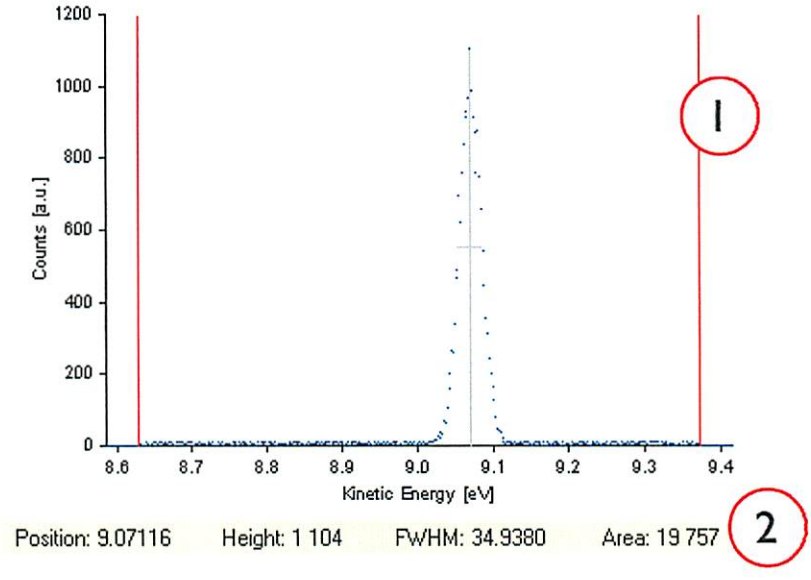

Figure 2-54. Range markers and peak information detail.

1. Range markers

The range markers are used to specify which energy range of the spectrum should be displayed and used for calculation of peak information. If a spectrum contains multiple peaks, peak information pertaining only to the highest peak is displayed.

Information about another peak can be gained by moving the range markers to include only that peak. By moving the range markers to include a certain region of interest, the area is calculated using data within the range markers only.

2. Peak information

The Peak Information bar displays information pertaining to the highest peak in the spectrum.

- Position describes the energy position of the highest point.
- Height describes the intensity of the highest point.
- FWHM describes the full width at half maximum of the peak.
- Area describes the total intensity over the whole spectrum.

The Sequence Tree

Description

The sequence tree keeps track of produced spectra during and after acquisition.

The sequence tree during acquisition

During acquisition the tree contains a list of all regions enabled for the acquisition, and displays icons whose colours specify the status of the region.

- If the icon is red, the region is currently being executed.
- If the icon is white, region has not yet been executed and there is no data to save.
- If the icon is green, the region has successfully been acquired and data has been saved.

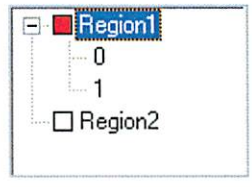

Figure 2-55. Sequence tree during acquisition.

The sequence tree after acquisition

After acquisition the spectra of the individual regions can be displayed by selecting the region in the sequence tree.

If the Add Dimension run mode is used, the individual spectra of the region can be displayed by selecting the relevant iteration count.

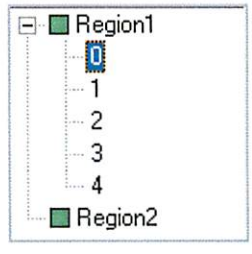

Figure 2-56. Sequence tree after acquisition.

The Status Bar

Description

The Status Bar of the main window displays information pertaining to the current acquisition. Depending on which options are checked in the Appearance tab of the Options dialogue, the appearance of the status bar will be different.

Status bar

Figure 2-57. Status bar detail displaying information for a region using the Add Dimension run mode with five iterations.

Overview of the status bar

1. Sweep displays the current and total number of additive iterations of the region.
2. Point displays the current and total non-additive iterations when using the Add Dimension run mode.
3. This field displays the name of the experiment file in which spectrum data is saved. If the Autosave option in the File Options dialogue is unchecked, the text "No Autosave." will be displayed.
4. This field displays the Lens Mode and Pass Energy of the acquisition.
5. This field displays the current Kinetic Energy of the analyser during acquisition.

Section G – Installations Dialogues

Introduction

This section describes the installation dialogues that are used for the initial setup of a new system.

This section

Instrument Installation Dialogue

Description

The Instrument Installation dialogue is used to change basic settings of the instrument, such as which detector and supply libraries to use.

Access

From the Installation menu select the Instrument command.
(**Installation → Instrument**)

Instrument installation

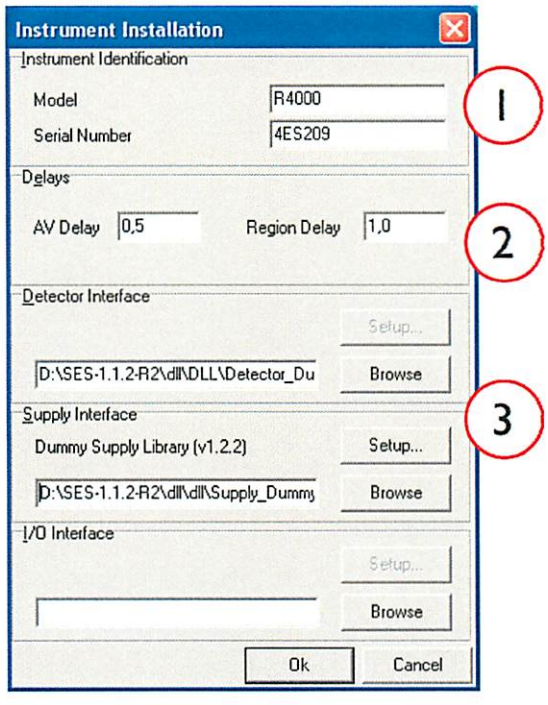

Figure 2-58. Instrument Installation dialogue.

Note 1: this dialogue should only be used by the system administrator.

Note 2: the I/O Interfaces which are currently supported are for output of the total spectrum signal only.

Instrument Installation Dialogue, Cont.

Overview of instrument installation dialogue

1. The Model and Serial Number fields specify the model and serial number of the instrument.
2. The AV Delay specifies the delay used when the voltage of a high voltage supply is changed. The Region Delay specifies the delay used between the regions in a sequence.
3. The Detector Interface, Supply Interface and I/O Interface frames specify which detector, supply and I/O libraries are used. Different libraries can be loaded by clicking the respective Browse button, and the setup dialogue for the respective libraries can be accessed through the Setup button.

Supply Installation Dialogue

Description

The Supply Installation dialogue is used to add and remove supplies, and to change their settings and calibration parameters.

Access

From the Installation menu select the Supply command.
(**Installation → Supply**)

Supply installation

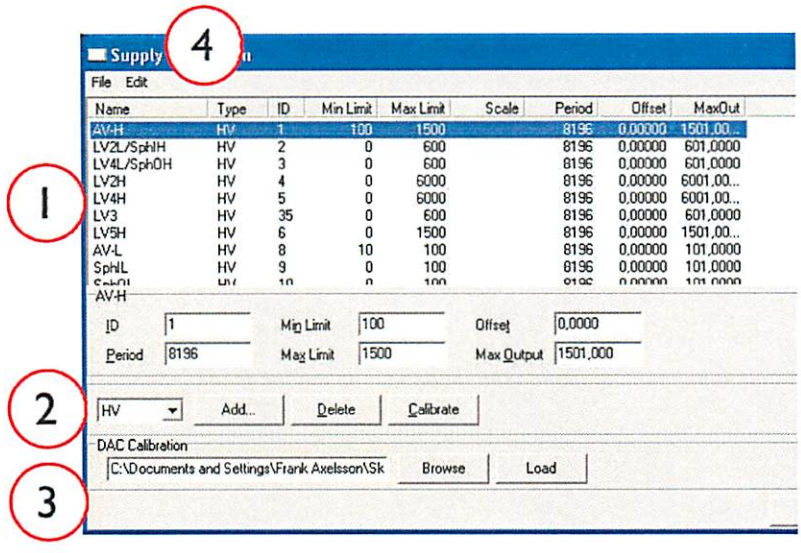

Figure 2-59. Supply Installation dialogue.

Note: this dialogue should only be used only by the system administrator.

Overview of supply installation dialogue

1. The supply list lists the supplies installed in the instrument. By selecting one specific supply, its calibration parameters and settings can be edited.
2. New supplies can be added by selecting the proper type and clicking the Add button. By clicking the Delete button, the selected supply is deleted. The calibration curve for a DAC can be viewed by selecting it in the supply list, and clicking the Calibrate button.

Continued

Supply Installation Dialogue, Cont.

Overview of supply installation dialogue
Cont.

1. The DAC Calibration frame specifies which DAC calibration-file is used. A new DAC calibration-file can be selected using the Browse button, and loaded using the Load button.
2. Settings for all supplies and the calibration parameters for high voltage supplies can be exported and imported using the **File → Export** and **File→ Import** commands respectively.

Element Installation Dialogue

Description

The Element Installation dialogue is used to add and remove element sets, add and remove elements in the element sets, link supplies to elements and link elements to each other.

Access

From the Installation menu select the Element command.
(**Installation → Element**)

Element installation

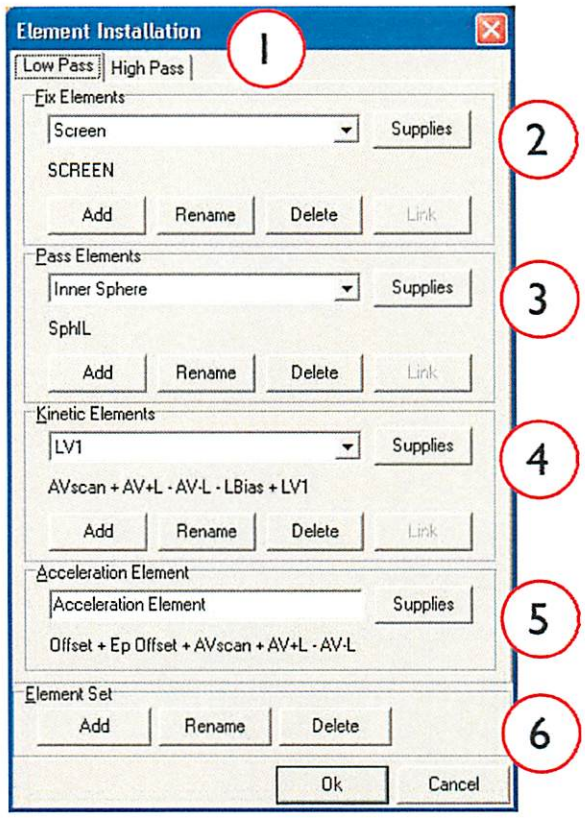

Figure 2-60. Element Installation dialogue.

Note: this dialogue should only be used only by the system administrator.

Overview of the element installation dialogue

1. The tabs specify the different element sets available to the instrument.
2. The Fix Elements frame defines elements which are neither dependent on pass energy nor kinetic energy.

Overview of the element installation dialogue

Cont.

3. The Pass Elements frame defines elements which are dependent on pass energy, but not kinetic energy.
4. The Kinetic Elements frame defines elements which are dependent on both pass energy and kinetic energy.

3. The Acceleration Element frame defines the acceleration element.

Elements in all the different frames described above (2-5) can be:

- Added by clicking the Add button.
- Deleted or renamed by clicking the Delete or Rename buttons.
- Linked to an element further up in the list by clicking the Link button.
- The supplies linked to a certain element can be changed by clicking the Supplies button

6. In the Element Set frame element sets can be added by clicking the Add button, or deleted or renamed by clicking the Delete or Rename buttons.

Lens Mode Installation Dialogue

Description

The Lens Mode dialogue is used to add and remove lens modes and to add and remove pass energies.

Access

From the Installation menu select the Lens Modes command. (**Installation → Lens Modes**)

Lens mode installation

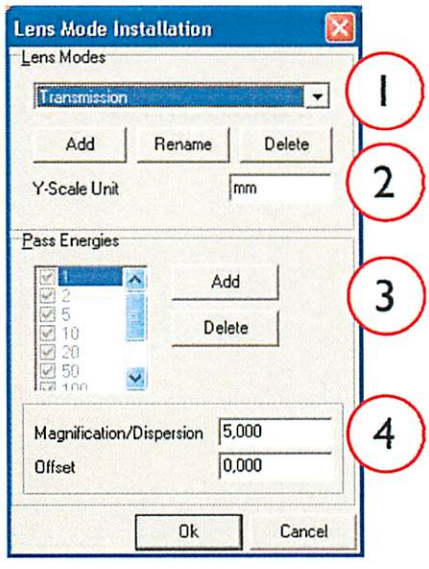

Figure 2-61. Lens Mode Installation dialogue.

Note 1: this dialogue should only be used by the system administrator.

Note 2: for the first lens mode, all pass energies must be activated.

Lens Mode Installation Dialogue, Cont.

Overview of the lens mode installation dialogue

1. Lens modes can be added by clicking the Add button in the Lens Mode frame. The selected lens mode can be deleted or renamed by clicking the Delete or Rename button respectively in the Lens Mode frame.
2. The Y-Scale Unit field specifies the dimensional unit used for the angular or spatial dimension.
3. The check list in the Pass Energies frame specifies the available pass energies for the selected lens mode. Pass energies can be added by clicking the Add button and the selected pass energy can be deleted by clicking the Delete button. For specific lens modes, a pass energy can be activated or deactivated by checking the appropriate entry in the check list.
4. The Magnification/Dispersion field specifies the dispersion for angular lens modes and the magnification for spatial lens modes for the selected pass energy. The Offset field specifies the angular or spatial scale offset for angular and spatial lens modes respectively for the selected pass energy.

Section H – SES Options and Information Dialogues

Introduction

This section describes how to customize the software appearance and information.

This section

SES Options Dialogue

Description

The SES Options dialogue is used to define general aspects of appearance and behaviour of the SES software. An important option in the Acquisition tab to consider is the choice to zero all supplies after a completed acquisition. This is useful when working with experiments which might damage the detector.

Access

From the File menu select the Options command. (**File → Option**)

Messages tab

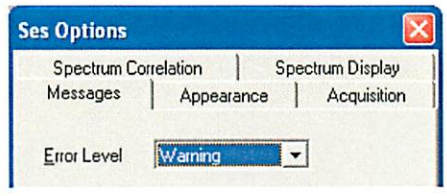

Figure 2-62. Messages tab.

Note: the Messages tab should only be used by the system administrator.

Appearance tab

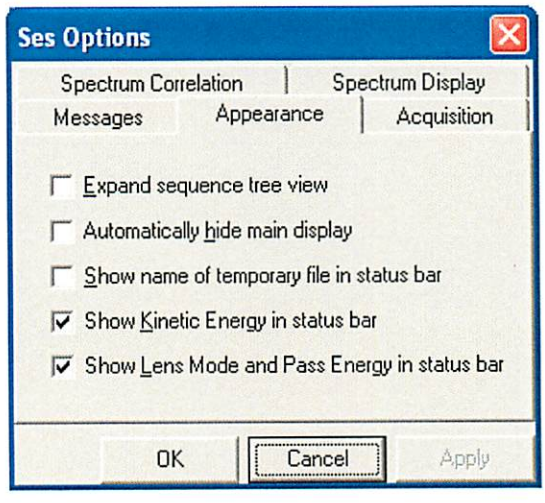

Figure 2-63. Appearance tab.

SES Options Dialogue, Cont.

Overview appearance tab

The Appearance tab contains general options for the appearance of the SES software. The administrator will setup these options.

- If the Expand sequence tree view option is checked, acquisitions using the Add Dimension run mode will be expanded automatically in the sequence tree view.
- If the Automatically hide main display option is checked, the main display will be hidden when an installation, setup or calibration dialogue is opened, leaving only the main menu of the SES main window visible.
- If the Show name of ... option is checked, the name of the temporary file stored in the work folder will be displayed in the status bar. This option is for advanced use.
- If the Show Kinetic Energy ... option is checked, the current kinetic energy of the analyser is displayed in the status bar during acquisition.
- If the Show Lens Mode ... option is checked, the current lens mode and pass energy is displayed in the status bar during acquisition.

Acquisition tab

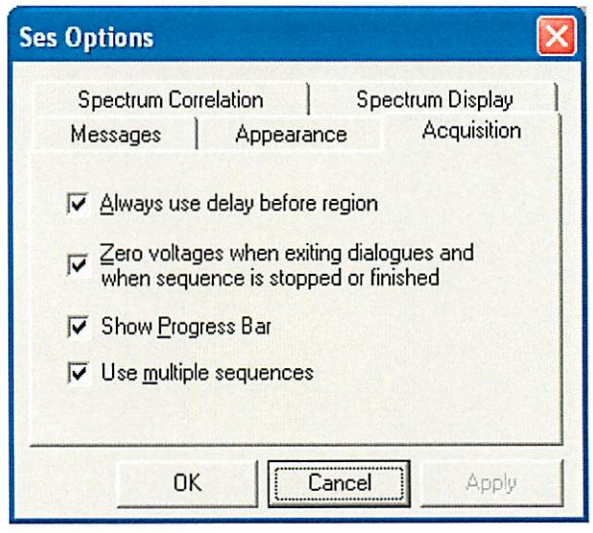

Figure 2-64. Acquisition tab.

Overview acquisition tab

The Acquisition tab contains options pertaining to acquisitions, and applies to the setup and calibration dialogues that have acquisition capabilities as well as experiment acquisitions. The administrator will setup these options.

- If the Always use delay … option is checked, a region delay of usually one second will always precede the execution of an acquisition even if the high voltage power supplies have not changed since the last acquisition.
- If the Zero voltages … option is checked, all supplies will be zeroed when a sequence is completed or stopped by the user, and when a calibration or setup dialogue with acquisition capabilities is closed. It is highly recommended that this option remains checked at all times, to minimize the risks of detector overload.
- If the Show Progress Bar option is checked a progress bar is displayed during swept mode acquisitions.
- If the Use multiple sequences option is checked, selecting Setup from the Run menu will result in the opening of a Sequence List Editor. This will enable a batch of sequences to run. If not checked, only the Sequence Editor will be used.

Spectrum correlation tab

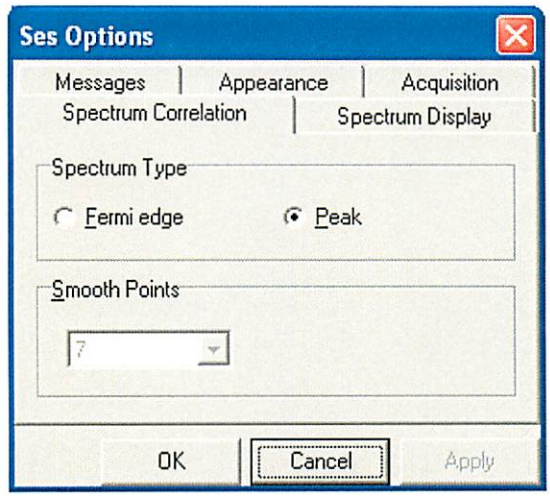

Figure 2-65. Spectrum Correlation tab.

Overview spectrum correlation tab

The Spectrum Correlation tab contains options pertaining to spectrum correlation. When using the Drift Region Spectrum, correlation is performed using Fast Fourier Transform routines for both XPS and UPS peaks, and Fermi edges.

- If the Peak option is selected, the spectra from the Drift Region will be assumed to contain an XPS or a UPS peak.
- If the Fermi edge option is selected, the spectra from the Drift Region will be assumed to contain a Fermi edge. The Drift Region spectra will then be smoothed and differentiated once using a Savitzky-Golay filter prior to correlation. The number of smooth points can be specified using the Smooth Points box.

Spectrum display tab

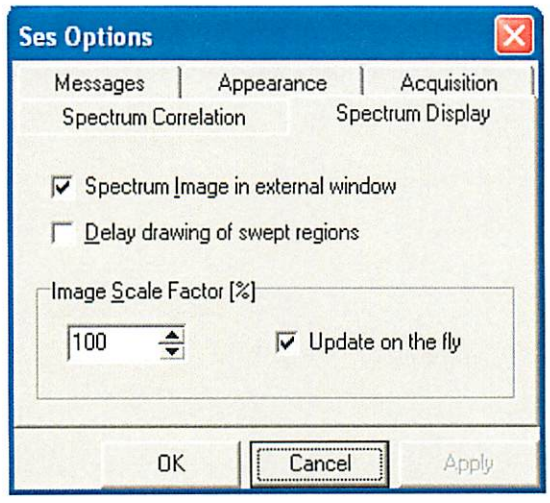

Figure 2-66. Spectrum Display tab.

Overview spectrum display tab

The Spectrum Display tab contains options pertaining to displaying spectra and in particular to displaying of image representations of spectra.

- If the Spectrum Image … option is checked, the image representation of a multiple slice acquisition will be displayed in an external window.
- If the Delay drawing … option is checked, the spectrum display in the SES main window delays displaying of an acquisition until data is available. This allows a completed spectrum to be viewed while the subsequent acquisition performs its preparation steps.
- The Image Scale Factor frame pertains to the external image in the SES main window and in the Voltage Calibration dialogue.
- If the Update on the fly option is checked, changes to the scale factor will immediately take effect.

Supply Information Window

Description

The Supply Information window is used to display the voltages assigned to specific supplies during instrument operation. This window is mainly used for troubleshooting. For instance, to check whether certain instrument settings brings any of the supplies out of range.

Access

From the main View menu select the Show Supply Information command. (**View → Show Supply Information**)

Supply information

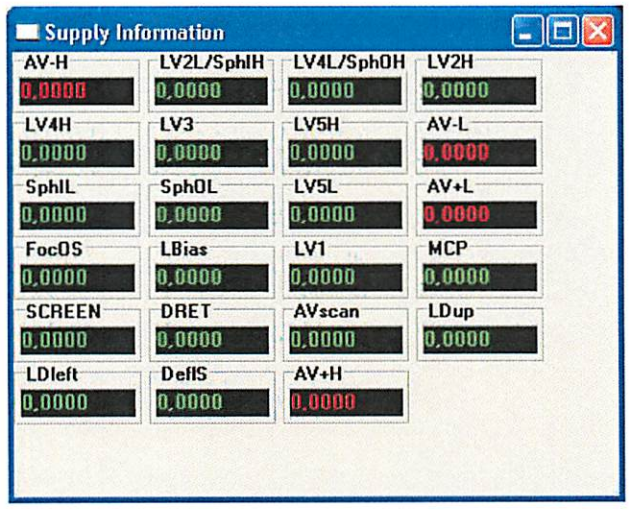

Figure 2-67. Supply Information window.

Note: this window should only be used by the system administrator.

Overview supply information window

The supply voltage indicators can be dragged and dropped to resemble the layout of the high voltage.

If a supply is within its operational range, this is indicated by the green colour of the numbers in the voltage indicator. If it is outside its operational range, the colour will be red.

Detector Information Window

Description

The Detector Information window is used to display the current detector settings. This dialogue can be used to verify that the correct detector settings for different regions in a sequence are selected.

Access

From the main View menu select the Show Detector Information command. (**View → Show Detector Information**)

Detector information

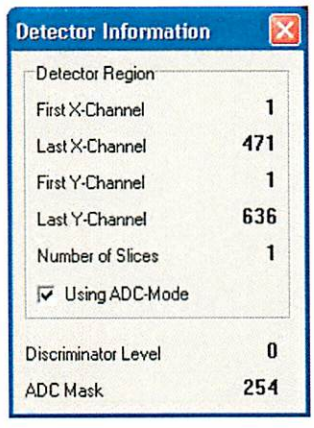

Figure 2-68. Detector Information window.

Section I – CCD Camera Software

Introduction

This section describes how to manage the settings for the CCD Camera.

This section

DCAM Detector Setup Dialogue

Description

The SCIENTA R4000 detection system is supplied with integrated CCD FireWire-camera software for data readout. The camera is connects to the computer via a USB 2.0 connection and uses a standard DCAM 1.3 protocol.

Access

From the Installation menu, select the Instrument command. In the Instrument Installation dialogue, click the Setup or Browse button in the Detector Interface frame.
(**Installation → Instrument → Detector Interface → Setup/Browse**).

DCAM detector setup

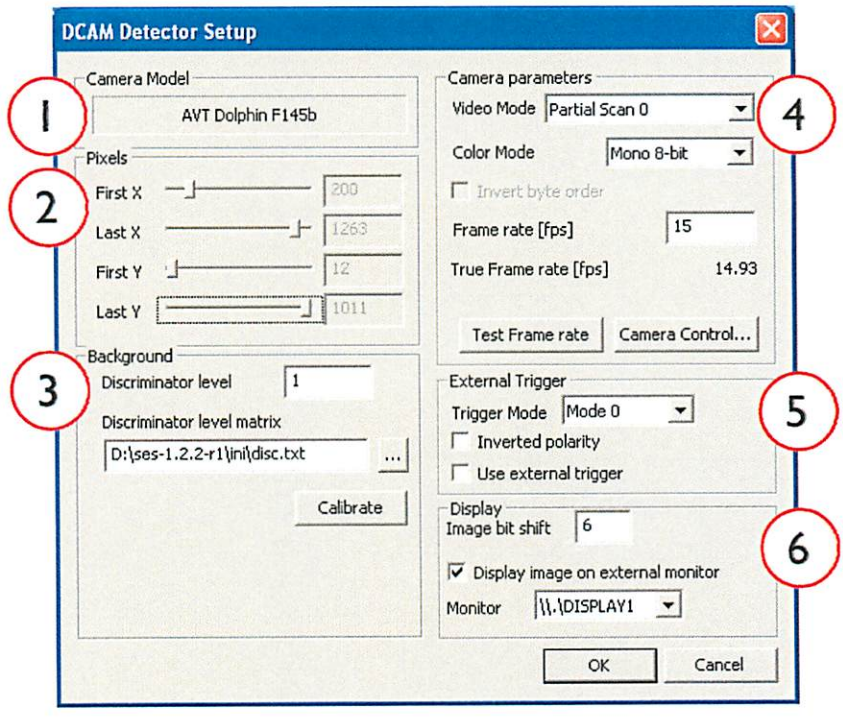

Figure 2-69. DCAM detector dialogue.

Note: all camera parameters have been set before delivery and normally should not be changed.

1. Camera model

The name of the DCAM camera model that is read from camera.

2. Pixels

The Pixels frame defines the used region of interest (ROI) of the camera.

3. Background

The Background frame contains three controls for handling background noise and hot pixels.

I. Discriminator Level
Describes the number of bits that should be removed to eliminate noise from the acquired images.

In ADC mode (page 2-17), a Discriminator Level of n removes the n lowest bits from lone non-zero pixels, but when a pixel is found to have one or more adjacent neighbours, the Discriminator Level is ignored for that pixel.

In Pulse Counting mode (page 2-17), a spot on the image can contain several pixels, and the Discriminator Level then describes the lowest accepted total intensity of that spot. If that intensity is below the Discriminator Level, it is not added by the pulse counting algorithm. Note that this constant is thus handled differently by the Pulse Counting mode compared to the Gray Scale mode.

II. Discr. Level Matrix
Defines a full path to a file containing a matrix where each element describes the value to be subtracted from each corresponding pixel in the acquired images. This matrix is mainly used to remove hot pixels.

Note: It is important to remember that the Discriminator Level Matrix is not the same as the Discriminator Level: The Discriminator Level is used as a bit mask and the Matrix performs a subtraction.

III. Calibrate
This button initiates a Discriminator Level Matrix creation that scans the camera CCD for hot pixels during a period of approximately 12 seconds. Before starting this calibration it is important to turn off the radiation source to make sure the camera sees only a black picture.

4. Camera parameters

The Camera Parameters frame provides the following options:

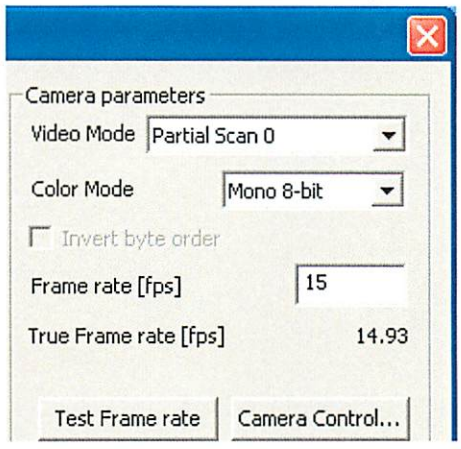

Figure 2-70. Camera Parameters frame.

Video mode	Shows list with all supported video modes of the camera.
Color mode	Shows the transferred bit depth of the camera image. The camera sets the true bit depth.
Invert bit order	Option available for some cameras that have an inverted bit order for 16-bit images.
Frame rate	Defines the true frame rate of the camera.
Test Frame Rate	Measures the frame rate of the camera. The test value should be close to the frame rate as set above.
Camera control	Brings up the options in the Camera Control Dialogue (page 2-82).

5. External trigger

Some cameras have the possibility to use an external trigger to set when the camera can acquire data. The settings and mode for this varies from camera to camera. Please check the separate camera manual for your specific camera.

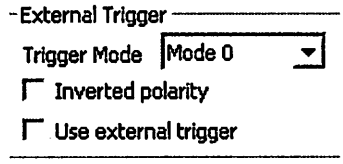

Figure 2-71. External Trigger frame.

6. Display

The Display frame handles options regarding how to display the image.

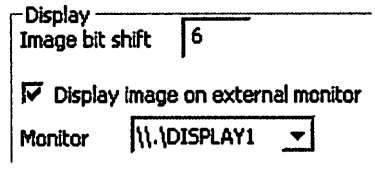

Figure 2-72. Display frame.

The following options are available:

- **Image bit shift** defines how the intensity of each pixel is shifted a number of pixels to increase the sensitivity.
- **Display Image on External Window Monitor** enables the real-time monitoring of the camera image.

  Note: real-time imaging might slow down quick sweeps on slow computers or computers with slow video cards. This slow down effect can be reduced by reducing the camera image window size.

- **Monitor** selects in which monitor to display image. If DISPLAY1 is selected, the image is displayed in a floating window. For all other monitors, the image will cover the whole screen.

Camera Control Dialogue

Description

The Camera Control dialogue provides a number of parameter options that control the camera lens.

Access

From the Installation menu, select the Instrument command. In the Instrument Installation dialogue, click the Setup or Browse button in the Detector Interface frame. In the Camera Parameters frame click the Camera Control button.
(**Installation → Instrument → Detector Interface → Setup/Browse → Camera Control**).

Camera control

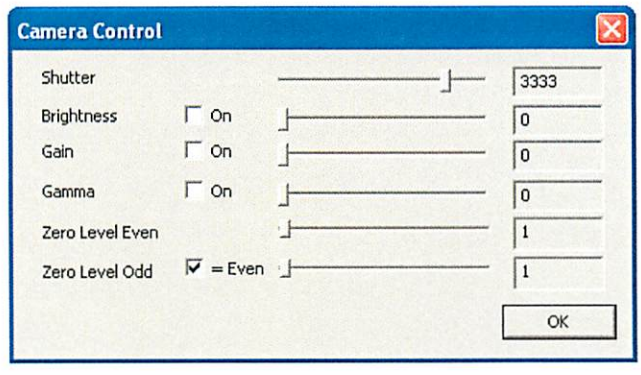

Figure 2-73. Camera Control dialogue.

Overview of camera control options

The Camera Control frame provides the following options:

Shutter	**value set in the camera shutter register. To see what exposure times this shutter value corresponds to; please refer to your camera manual for your specific camera. For most cameras the following formula can be used: Shutter value = 50.000/frame rate.**
Brightness	**value set in the camera brightness register.**
Gain	**value set in the camera gain register.**
Gamma	**value set in the camera gamma register.**
Zero level Even/Odd	**subtracts the value from the intensity of each pixel. This is only needed if it is impossible to move the noise level of the camera down to zero.**
Odd=	**in most cases the zero level of odd and**

Even	**even lines are the same.**