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BRUKER

ARTAX

User Manual

Innovation with Integrity

Handheld XRF

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Table of Contents

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1 Introduction

Description

Artax is a program developed to work with S1 TITAN, TRACER 5, and CTX instruments to –

- Control system components.
- Acquire measurement data.
- Analyze measurement data.

Analyzing data

Measured data can be analyzed by –

- Spectra correction (Escape, Shelf, Background).
- Qualitative analysis.
- Calculation of the spectral line intensities by deconvolution.

Contacting Bruker

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Kennewick, WA 99336 USA

1.1 Installation

Hardware requirements

To use Artax, a PC with Windows 7, 8.1 or 10 operating system and a USB port is required.

Instructions

To install Artax –

Step	Action
1	Insert the USB flash drive.
2	Navigate to the USB drive (part number 160.0211).
3	Double-click Artax – 8-4xx.exe and follow the directions on the screen.

1.2 Program Start

Description

This section describes how to start Artax and connect to an instrument.

Note: A default printer must be accessible or Artax may not start correctly.

Logging in

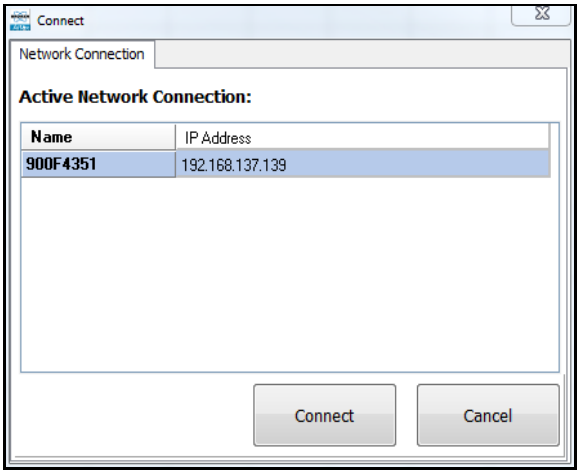
To log into Artax –

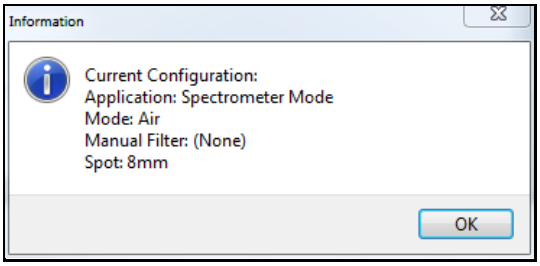
Step	Action	Result
1	On the computer, start Artax by double-clicking the icon.	The **Password** dialog box is displayed.
2	Enter a **User** name (test) and **Password** (test), and press Enter or click **Ok**.	The **Artax** window is displayed and **OFF-LINE** is displayed in the status bar at the bottom.

Connecting to an instrument

To connect to an instrument –

Step	Action	Result
1	Power on the PC and the instrument.	
2	Connect the instrument to the PC with a USB cable (Bruker part number 160.0012) or through Wi-Fi. To enable USB or set up the Wi-Fi, see the *Supervisor Manual*, Bruker document 030.0113.	
3	From the **Artax** window, click **Device** (left side of menu bar).	The dropdown menu is displayed.
4	Click **Connect**.	The **Connect** dialog box is displayed.
5	Click the instrument name and **Connect**.	For the TRACER 5, the **Information** popup with instrument information is displayed.
6	For the TRACER 5, click **OK**.	Both dialog boxes are removed. Below the Artax toolbar, as data is retrieved from the instrument, a colored bar is displayed: first yellow, then orange, and finally green. **ON-LINE** is displayed in the status bar at the bottom. Artax logs into the instrument and the **Ready to Test** screen is displayed there.





Failure to connect

If Artax is unable to connect to the instrument, either **Error transmission to device** or **Time out** is displayed. Click **OK**.

Artax cannot connect with an instrument if –

- The instrument is not powered on and logged into.
- The USB connection cable between the computer and instrument is not plugged in.
- The computer hardware or the instrument has a malfunction.

2 User Interface

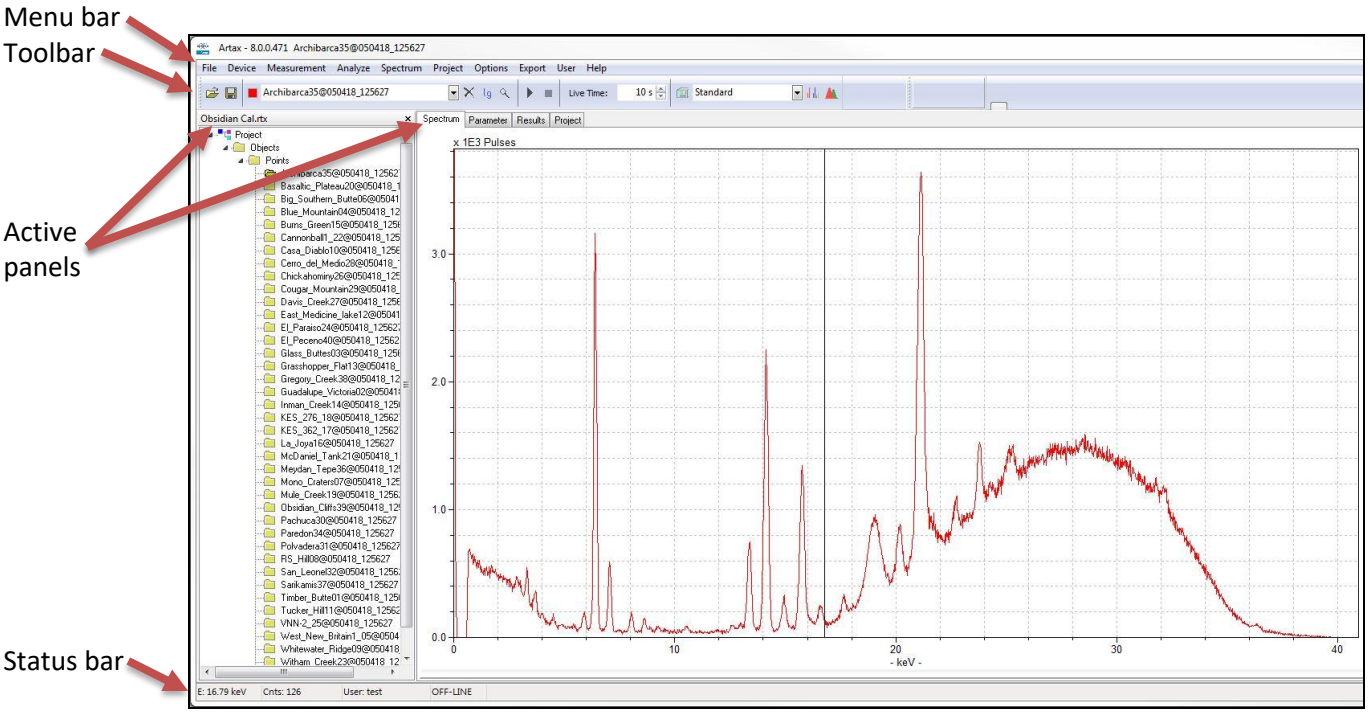
Description

This section describes the organization of Artax options.

Window structure

The Artax program window contains the –

- Menu bar.
- Toolbar.
- Active panels.
- Status bar.



2.1 Menu Structure

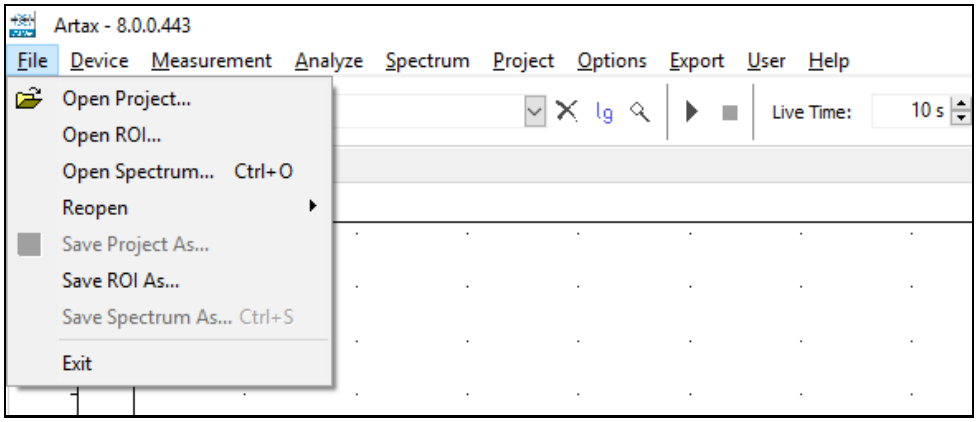
Description

The Artax menu bar contains **File**, **Device**, **Measurement**, **Analyze**, **Spectrum**, **Project**, **Options**, **Export**, **User**, and **Help**. Their submenus are described below.

2.1.1 File Menu

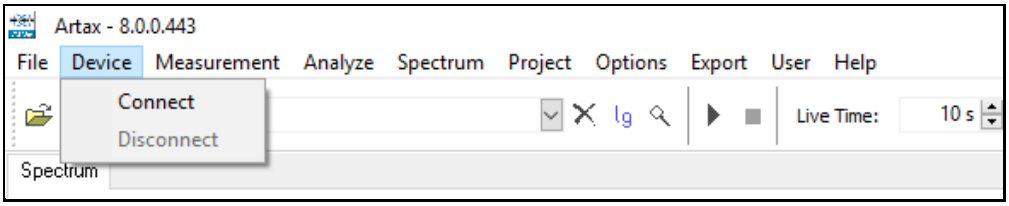
Description

This section describes options found under **File** in the menu bar. Note that during a measurement these options are not available.



Option	Description
Open Project, Open ROI, Open Spectrum	Opens a dialog box through which a project, ROI (region of interest), or spectrum/spectra can be selected and opened. The most recent directory and files are listed.
Reopen	Displays a list of the last modified spectra or project files. Click to open the file. The submenu option **Clear** deletes all listed items.
Save Project As, Save ROI As, Save Spectrum As	Opens a dialog box through which a file can be saved. The most recent directory and files are listed.
Exit	Closes Artax. If an assay is in process, the assay is stopped. The message **Project was changed! Exit Program?** is displayed if either of the following are unsaved – • A modified open project. • Measurement spectra in the Spectrum panel.

2.1.2 Device Menu

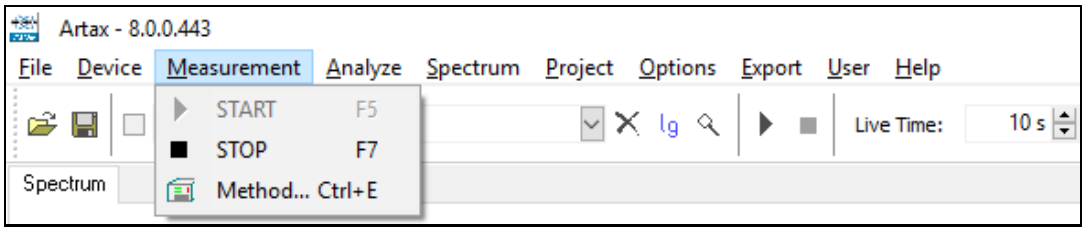


Description

This section describes options found under **Device** in the menu bar.

Option	Description
Connect	Once the PC is physically connected to an instrument via USB cable or Wi-Fi, displays the **Connect** dialog box through which Artax connects via software. See **Program Start** on page 5.
Disconnect	Disconnects Artax from an instrument.

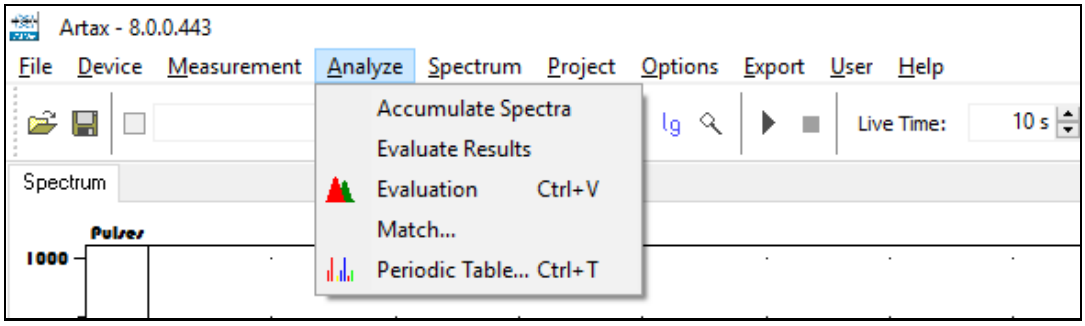
2.1.3 Measurement Menu



Description This section describes options found under **Measurement** in the menu bar.

Option	Description
Start	If the PC is connected to the instrument, starts a measurement.
Stop	During a measurement, stops a measurement.
Method	Opens the **Method Editor** dialog box through which methods can be selected, added, replaced, and removed. See **Working with Methods** on page 39.

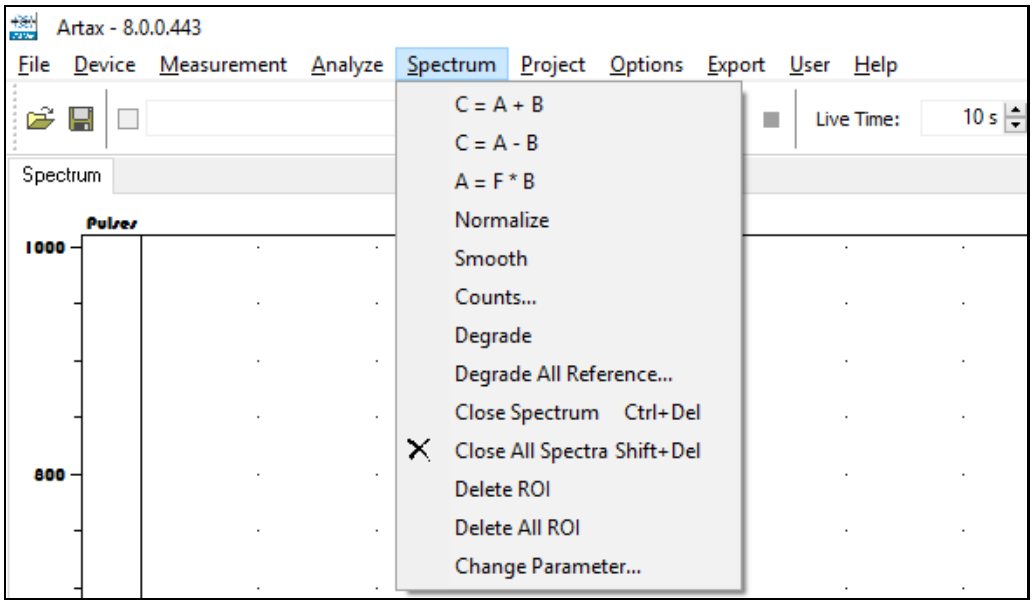
2.1.4 Analyze Menu



Description This section describes options found under **Analyze** in the menu bar.

Option	Description
Accumulate Spectra	Sums – • Channels using all spectra of one selected node within a project data file. • Real and live measuring times. A new node, **Accu_Points** or **Accu_Spectra**, is added to the project.
Evaluate Results	Calculates the net intensities via deconvolution for all spectra within one selected node of a project file.
Evaluation	Calculates net intensities using selected deconvolution method.
Match	Opens the **Match** dialog box through which a spectrum can be compared with saved spectra. See **Comparing Spectra** on page 47.
Periodic Table	If a spectrum is open, displays the **Periodic Table of the Elements** dialog box. See **Qualitative Analysis** on page 49.

2.1.5 *Spectrum Menu*

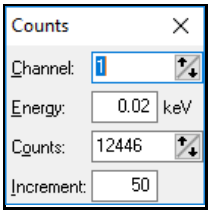


Description

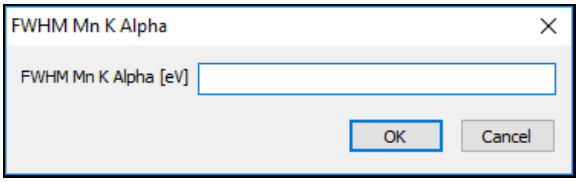
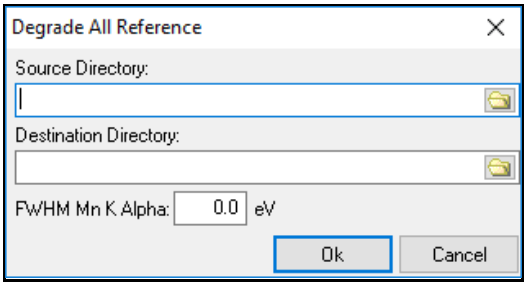
This section describes options found under **Spectrum** in the menu bar. The functions of the **Spectrum** menu, except **Delete All ROI**, are not available during measurements.

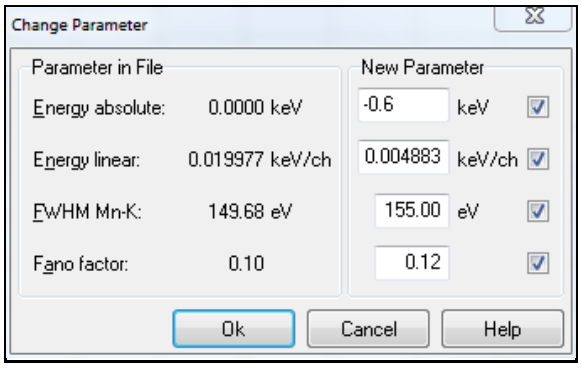
The *active spectrum* is the currently selected spectrum that can be analyzed. See **Working with Spectra** on page 23.

When measurements are taken, spectra are added, or spectra are subtracted, newly created files are given the temporary names of Measured_n, Add_n, and Sub_n, respectively.

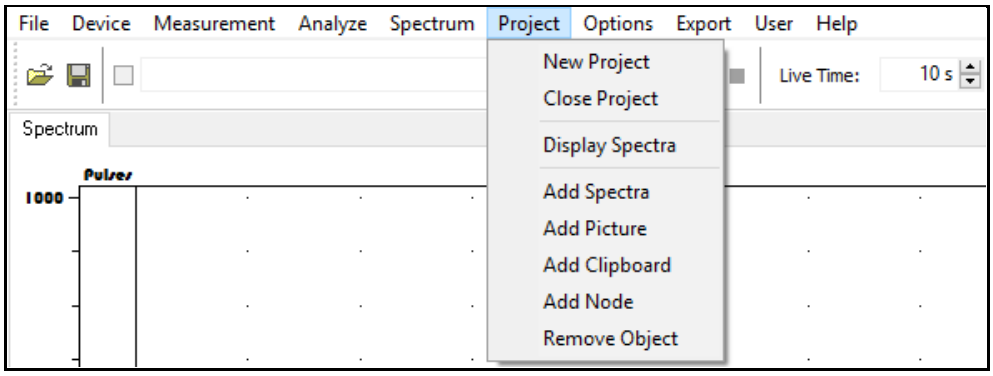
Option	Description
C = A + B	Displays **Select Spectra** dialog box to indicate two spectra to add. See **Adding and Subtracting Spectra** on page 45.
C = A - B	Displays **Select Spectra** dialog box to indicate a spectrum to subtract from another. See **Addition and Subtraction of Spectra** on page 45.
A = F * A	Displays **Factor for multiplication** dialog box to enter a multiplication factor to scale the active spectrum. See **Scaling a Spectrum** on page 46.
Normalize	Scales all displayed spectra to the active spectrum to the channel at the cursor location.
Smooth	Smooths the active spectrum via a polynomial filter of second order. Smoothed values replace original data.
Counts	Opens the **Counts** dialog box. The cursor can be moved one channel at a time and the counts in a channel can be changed. It also displays the energy and counts of the current channel. 

Description, cont.

Option	Description
Degrade	Opens the **FWHM Mn K Alpha** dialog box to increases the full width at half maximum (FWHM) of each line of a spectrum. 
Degrade All Reference	Opens the **Degrade All Reference** dialog box though which the source and destination folder can be entered. Specify resolution (FWHM). Degrades all .spx spectra to the resolution specified and stores them in the destination folder. 
Close Spectrum	Closes the active spectrum.
Close All Spectra	Closes all open spectra.
Delete ROI	Removes the selected ROI.
Delete All ROI	Removes all ROIs.
Change Parameter	Not currently supported and may give incorrect results.



2.1.6 Project Menu

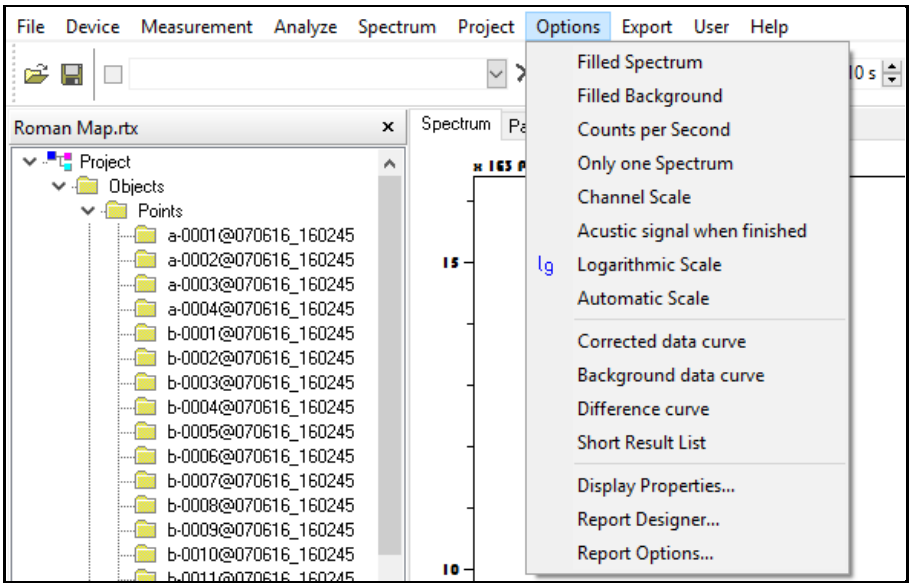


Description

This section describes options found under **Project** in the menu bar when the project nodes panel on the left of the window is right clicked.

Option	Description
New Project	Creates a new project.
Close Project	Closes a project. ***Note***: this option does not save changes.
Display Spectra	Displays all spectra of the selected node, unless **Options** -> **Only one Spectrum** is checked.
Add Spectra	Adds all displayed spectra to the project.
Add Picture	Not currently available.
Add Clipboard	Adds objects on the clipboard to the project.
Add Node	Adds to the project a node.
Remove Object	Removes the selected object from the project.

2.1.7 Options Menu

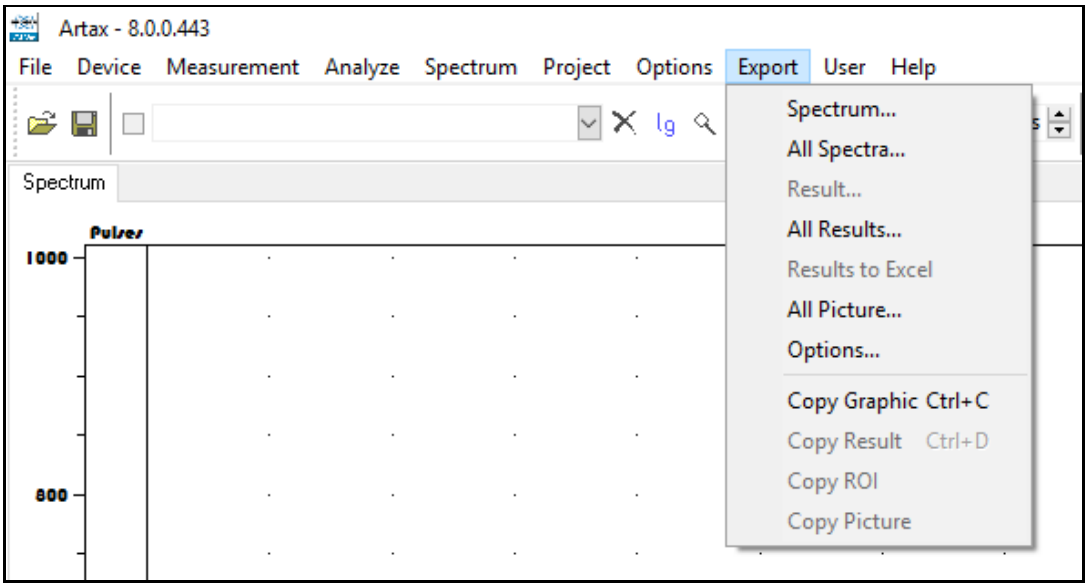


Description

This section describes options found under **Options** in the menu bar and when the Spectrum panel is right clicked.

Option	Description when checked
Filled Spectrum	Displays a colored area under the line plot.
Filled Background	Displays a colored area under the background radiation curve. Do not set both the spectrum and background to **Filled**. The area plot of the filled spectrum would occlude the area plot of the background.
Counts per Second	Displays the Y-axis scale's units in counts per second.
Only one Spectrum	Displays only one spectrum. If a new measurement is started or if a new spectrum data file is opened, the Spectrum panel is cleared.
Channel Scale	Displays the X-axis scale's units in channels.
Acoustic signal when finished	Not currently available.
Logarithmic Scale	Displays Y-axis values as a logarithmic scale.
Automatic Scale	During a measurement, adjusts the scale to the maximum amplitude in the active spectrum, excluding the zero peak.
Corrected data curve	Displays a data curve corrected for escape peaks and sum peaks. Corrects only a data curve placed within a project.
Background data curve	Displays the background data curve.
Difference curve	Displays the difference between the original spectrum and the deconvoluted spectrum.
Short Result List	Displays the shortened intensity list of deconvolution results to the right of the spectrum.
Display Properties	Opens the **Display Properties** dialog box which defines how spectra are displayed. See **Display Options** on page 25.
Report Designer	Not currently available.
Report Options	Not currently available.

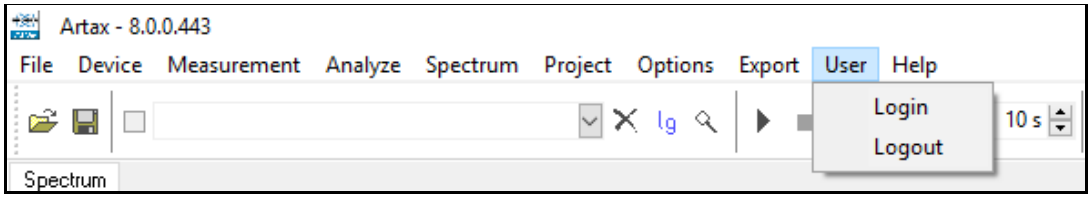
2.1.8 Export Menu



Description This section describes options found under **Export** in the menu bar.

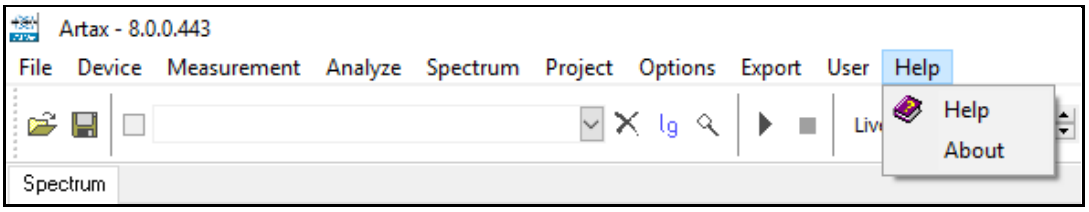
Option	Description
Spectrum	Exports spectrum data as a text file (.txt).
All Spectra	Exports all spectra contained in a node as a text file.
Result	Exports deconvolution results as a text file.
All Results	Exports all results contained in a node as a text file.
Results to Excel	For each analyzed element, exports the results of a line-scan or mapping to an .xlsx file that can be opened by Microsoft Excel.
All Picture	Not currently available.
Options	Opens the **Export Options** dialog box which controls what is included in the text file created from **Export** options **Spectrum** through **Results to Excel**.
Copy Graphic	<table><tr><th>Active Tab</th><th>Exports to the Windows Clipboard</th></tr><tr><td>Spectrum</td><td>Spectra displayed in the Spectrum panel.</td></tr><tr><td>Mapping Results</td><td>Not currently available.</td></tr></table>
Copy Result	Copy results in table format. <table><tr><th>Active Tab</th><th>Exports to the Windows Clipboard</th></tr><tr><td>Spectrum</td><td>Summary of the deconvolution results.</td></tr><tr><td>Results</td><td>Short result list.</td></tr><tr><td>Mapping Results</td><td>Not currently available.</td></tr><tr><td>Match Results</td><td>Results table.</td></tr></table>
Copy ROI	Exports the ROI calculation results to the Windows clipboard.
Copy Picture	Not currently available.

2.1.9 User Menu



Description Options under **User** are not currently applicable.

2.1.10 Help Menu



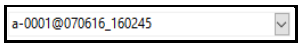
Description This section describes options found under **Help** in the menu bar.

Option	Description
Help	Currently, this *Artax User Manual* contains the most updated material. Do not use the **Help** option.
About	Displays Artax version and copyright information. To remove it, press Esc on the keyboard or click the message.

2.2 Toolbar Structure

Description The toolbar displays icons to easily access commonly used options.

Icons Note that icons, except for the stop icon, are not available during a measurement.

<table>
<tr><th>Icon</th><th>Description</th></tr>
<tr><td>  </td><td>Opens the Open Project dialog box through which a project can be selected and opened. The most recent directory and files are listed.</td></tr>
<tr><td>  </td><td>Opens the Save Project dialog box through which a project can be saved. The most recent directory and files are listed.</td></tr>
<tr><td> 
</td><td>Displays the name of the active spectrum. To activate a different spectrum from currently open spectra, click the down pointing caret and click a spectrum name. That spectrum is now active and its name is displayed in the field.</td></tr>
<tr><td>  </td><td>Removes all spectra from the Spectrum panel.</td></tr>
<tr><td> 
</td><td>Switches the Y-axis between linear and logarithmic scale.</td></tr>
<tr><td>  </td><td>Activates zoom mode. To zoom in on part of a spectrum –
<table>
<tr><th>Step</th><th>Action</th><th>Result</th></tr>
<tr><td>1</td><td>Click the zoom icon and move the mouse cursor to the Spectrum panel.</td><td>The mouse cursor displays as a magnifying glass.</td></tr>
<tr><td>2</td><td>Left click, drag to define a rectangle, and release.</td><td>The area within the rectangle is enlarged to fill the Spectrum panel and the mouse cursor reverts to an arrow.</td></tr>
</table></td></tr>
<tr><td>  </td><td>If the PC is connected to the instrument, starts a measurement.</td></tr>
<tr><td>  </td><td>Stops a measurement.</td></tr>
<tr><td> 
</td><td>Determines the length in seconds of a measurement. To change the duration, click the up pointing or down pointing triangles.</td></tr>
<tr><td>  </td><td>Opens the Method Editor dialog box through which methods can be selected, added, replaced, or removed. See Working with Methods on page 39.</td></tr>
<tr><td> 
</td><td>Lists available methods. A method name may be typed in the field.</td></tr>
</table>

Icons, cont.

Icon	Description
	Displays the **Periodic Table of the Elements** dialog box. See **Qualitative Analysis** on page 49.
	Deconvolutes the active spectrum and calculates element intensities.

Radiation icons

During a measurement, two radiation warning icons are displayed in the toolbar –  and  .

3 Working with Projects

Description

Spectra and analysis results are saved in project files and are automatically created when a measurement is performed through Artax. A project file can contain –

- Several spectra.
- Images.
- Analysis result sets.
- Results of deconvolution images.
- Comments.

3.1 Opening a Project

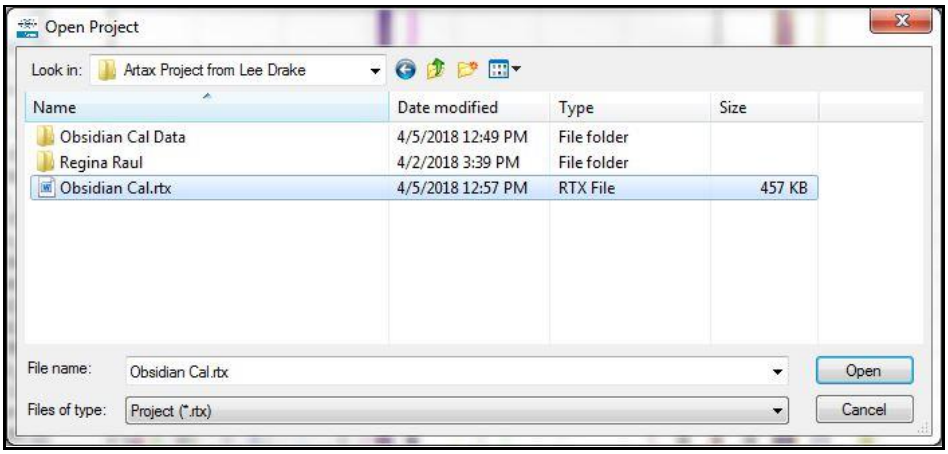
Description

An existing project can be opened and analyzed. A project can contain spectra, ROI (region of interest), and calculation results.

Opening a project

To open a project –

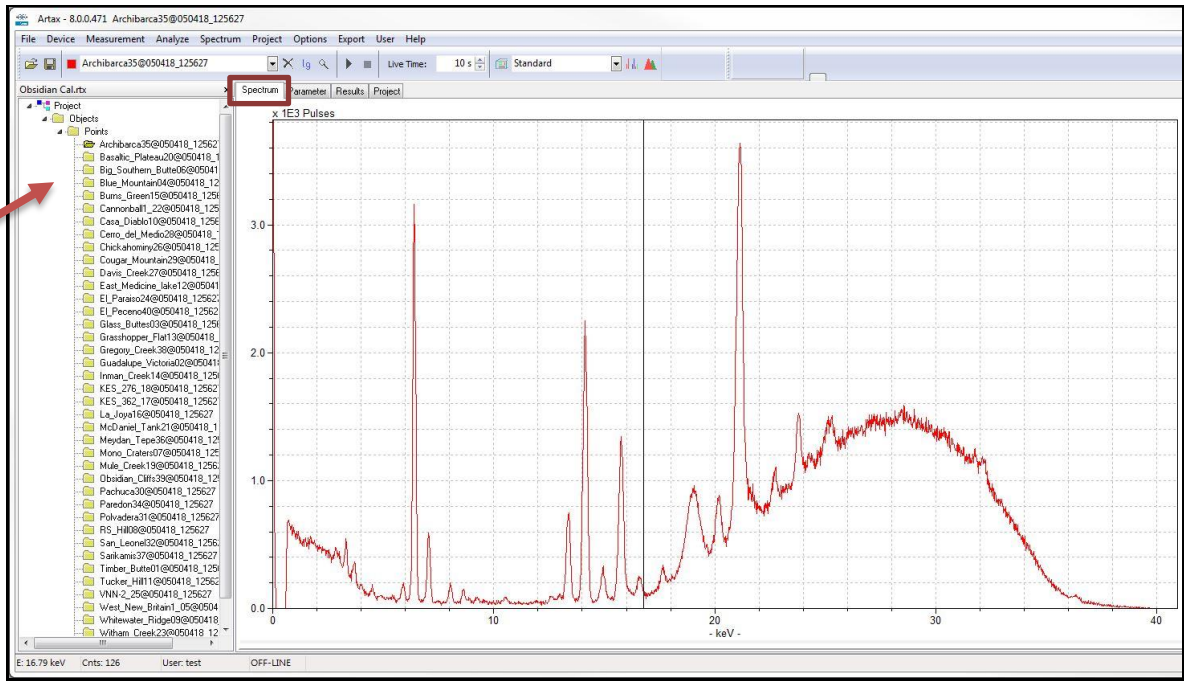
Step	Action	Result
1	Click **File**.	A dropdown list is displayed.
2	Click **Open Project**. ***Note***: if a project is already open, clicking **Open Project** will close it without saving changes.	The **Open Project** dialog box is displayed.



3	Click the down pointing triangle of the **Look in** field.	A dropdown list of folders is displayed.
4	Navigate the list and click a folder.	The node is displayed in the **Name** column.
5	Double-click the project name.	The project nodes panel is opened on the left with nodes listed in a tree. Available tabs are displayed above the main panel. The display in the main panel depends on which tab is active. For information on tabs, see **Tabs** on page 19.

Displaying a spectrum

To display a spectrum, click its name in the node tree and click the **Spectrum** tab.



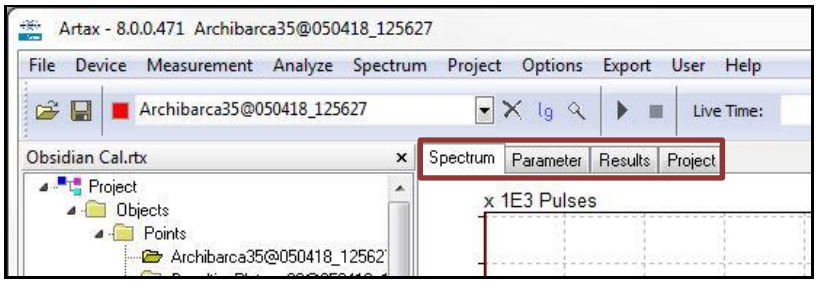
Editing a node name

To edit a node name, click it once to select it, then slowly click it again. The name changes to an editable field. Note that the names “Project” and “Objects” cannot be changed.

3.2 Tabs

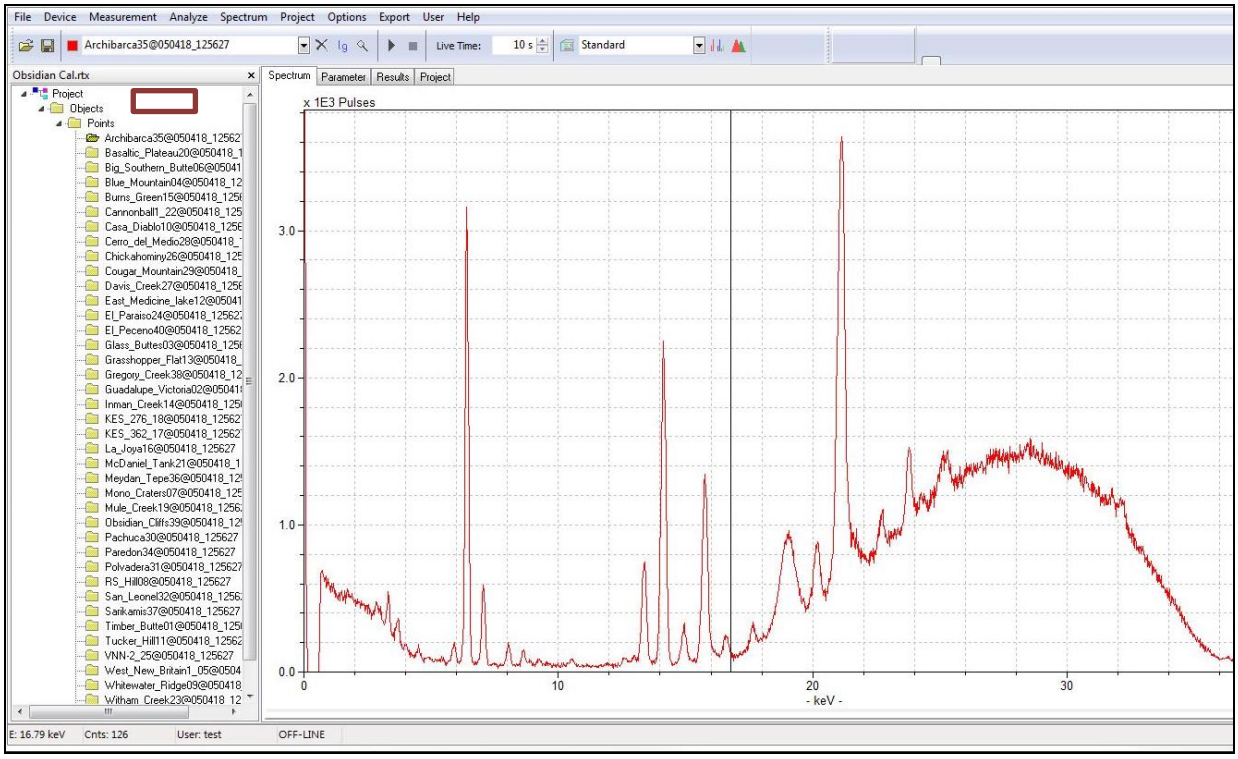
Description

Various tabs, visible under the toolbar and to the right of the project nodes panel, display specific panels.

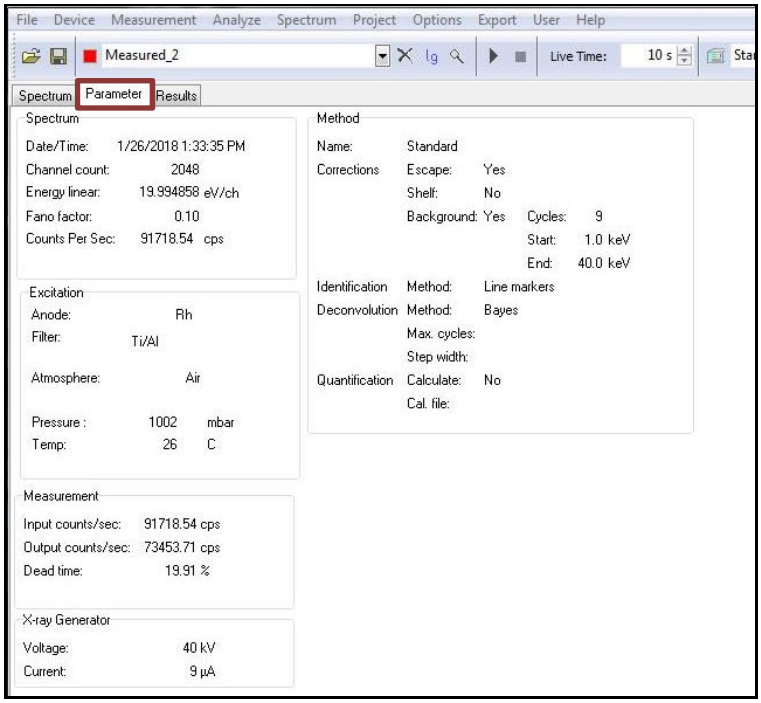


Tabs

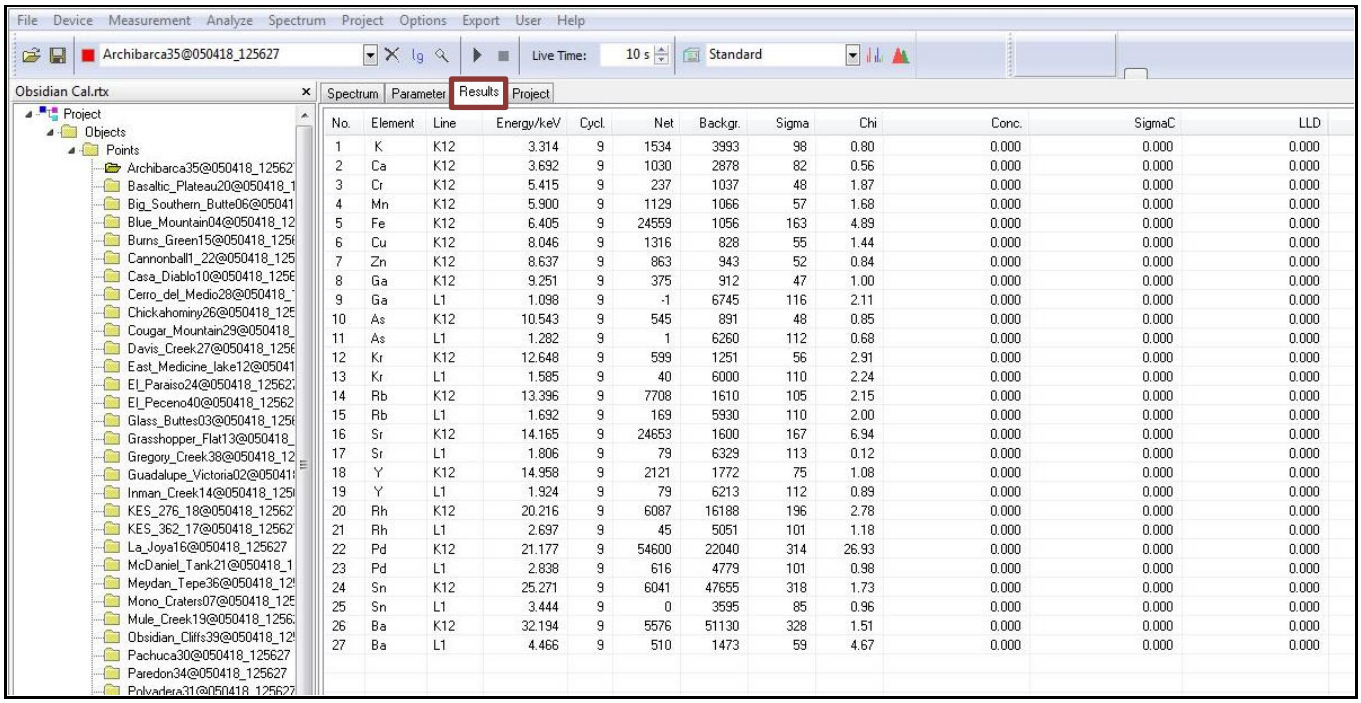
Tab	Displays	When Visible	Reference
Spectrum	Spectra, a shortened results table of the Bayes deconvolution, and an ROI table, depending on options selected under **Options**.	Always.	**Working with Spectra**, page 23.
Parameter	Parameters of an individual spectrum.	After starting a measurement or after displaying a spectrum.	**Spectra Parameters**, page 35.
Results	Complete Bayes-deconvolution table of results.	After executing a deconvolution or after displaying a spectrum containing results.	**Deconvolution**, page 51.
Project	**User** - Name of the user under whose login the project was created. **Comment** - Provides the ability to enter text. To save changes, save the project.	After loading a project file.	**Creating a Project**, page 22.



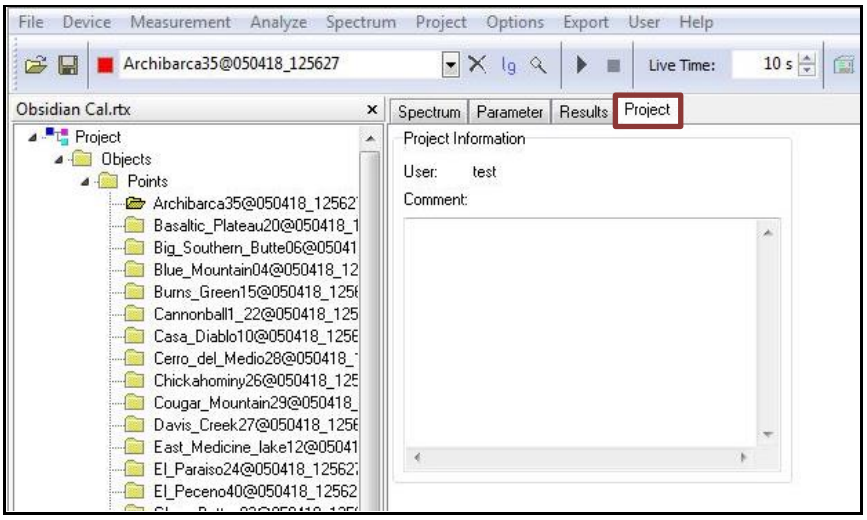
Spectrum panel



Parameter panel



Results panel



Project panel

3.3 Creating a Project

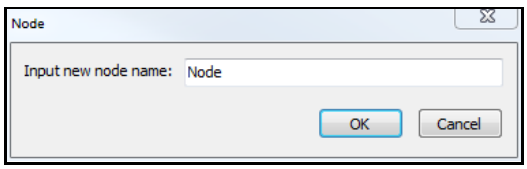
Description

A project is a collection of measurement spectra. A project can be created before taking measurements and after.

After measurements

***To create a project* after *taking measurements* –**

Step	Action	Result
1	Open spectra or take measurements to be included in the new project.	
2	Click **Project**.	A dropdown list is displayed.
3	Click **New Project**.	The project nodes panel is labeled **New project**.
4	In the project nodes panel, click to highlight **Objects**.	
5	Click **Project** from the menu bar and **Add Node**.	The **Node** dialog box is displayed.
6	Enter a node name and click **OK**.	The dialog box is removed and the new node is listed under **Objects** node of the nodes panel.
7	Double click **Objects** and click a node name.	The name is highlighted.
8	Click **Project** from the menu bar and **Add Spectra**.	All open spectra are added to the new project.



Before measurements

To create a project* before *taking measurements, follow the steps in the preceding table except move step 1 to right after step 3, then resume with step 4.

3.4 Copying and Saving

Copying

To copy a node to a different object or under another node, click the node to be copied, drag, and drop it on top of the name of the object or node under which it will go.

Saving

To save spectra within projects, click **File** -> **Save Project As**.

Note: using the **Open Project** or **Exit** option under **File** will not save changes. There is also no message to confirm closing a file without saving.

4 Working with Spectra

Description

This section describes types of spectra, and how to display and manipulate them in the Spectrum panel. ***To display the Spectrum panel***, select the **Spectrum** tab. Each displayed spectrum has an assigned color.

Note that when a large number of spectra are displayed, the general view worsens and performance slows.

For a description of tabs and their panels, see **Tabs** on page 19.

Spectra types

For every measured or imported spectrum displayed, four spectra are managed within Artax –

Spectrum Type	Description
Original data	Data from a measurement of a sample.
Corrected spectrum	The spectrum with the background subtracted.
Calculated background count rate	The background data curve.
Recalculated spectrum from the deconvolution procedure.	See **Deconvolution** on page 51.

Assay result lines

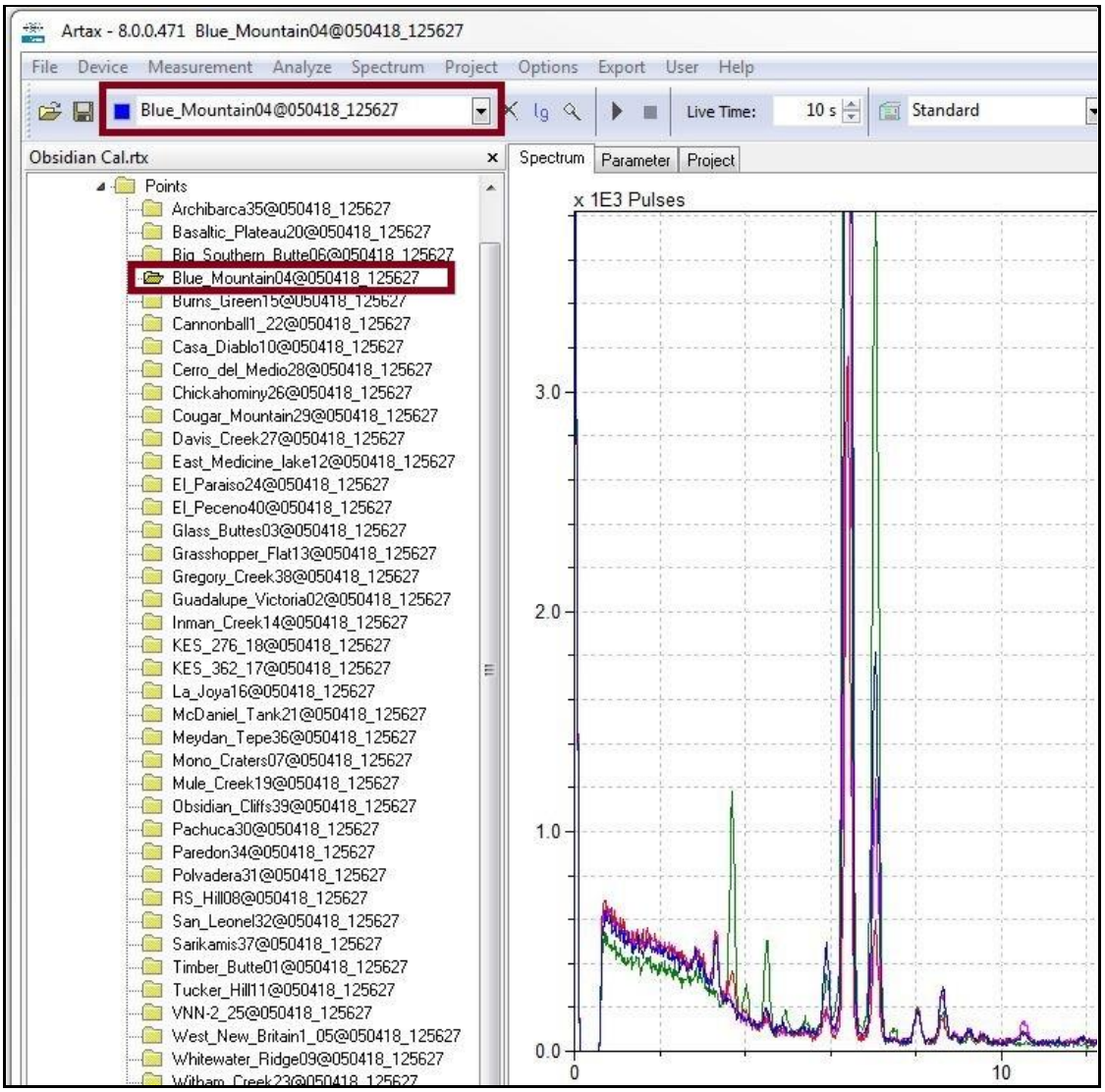
If assay results are saved with the spectrum, then the lines of the analyzed elements are displayed on the Spectrum panel. See **Qualitative Analysis** on page 49.

4.1 Active Spectrum

Active spectrum

The active spectrum is the currently selected spectrum that can be analyzed.

- It is brought to the top of all other displayed spectra.
- Its name is displayed in the toolbar field.
- Its color is indicated in a box to the left of the name in the toolbar field.
- Its name in the project nodes panel is highlighted.



Selecting a spectrum

To make a spectrum active –

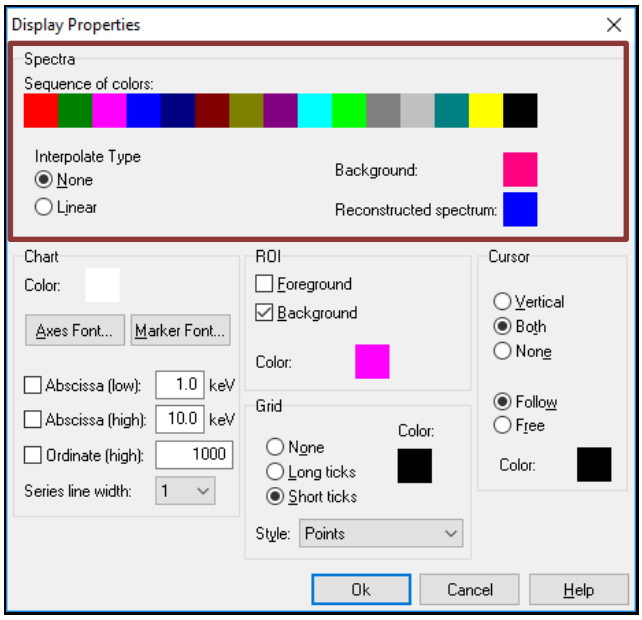
Step	Action	Result
1	Click the down pointing triangle on the left field in the toolbar.	A dropdown list is displayed.
2	Click a spectrum name.	The selected spectrum is active.

OR click the spectrum name in the project nodes panel.

4.2 Display Options

Description — What is displayed in the Spectrum panel depends on options selected under **Options** -> **Display Properties**.

Spectra frame — Options in the **Spectra** frame affect how spectra are displayed.

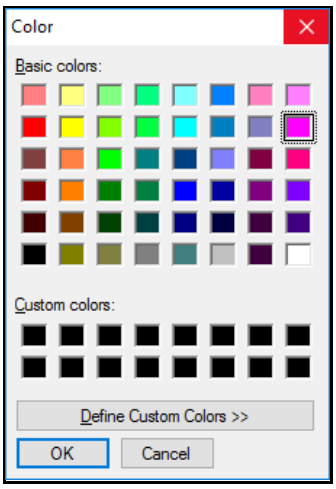


Option	Description
Sequence of colors	As each spectrum opens it is assigned a color according to the sequence defined here. ***To change a color box***, click it. The **Color** dialog box is displayed. Click a color and **OK**. The selected color box reflects the choice. ***To change the order of colors***, hold the Alt key, click and drag a color box to a new location, and release. The two boxes are exchanged.
Interpolate Type	**None** – Displays the spectrum with constant count rate across the width of the channel. **Linear** – The spectrum curve is linearly interpolated between channels.
Background box	Color of the background curve.
Reconstructed spectrum box	Color of the reconstructed spectrum after deconvolution.

Customizing colors

The **Color** dialog box provides the option to create custom colors. ***To create a custom color –***

Step	Action	Result
1	From the **Display Properties** dialog box, click a color box.	The **Color** dialog box is displayed.
2	Click **Define Custom Colors**.	The dialog box expands.
3	Select a color by clicking in the color gradient or editing the values in the numeric fields.	The **Color** box and numeric fields reflect the color choice.
4	On the right side of the dialog box, slide the left pointing triangle up or down as needed.	The **Color** box and numeric fields reflect the color choice.
5	Click **Add to Custom Colors**.	The custom color is displayed with the **Custom colors** on the lower left side of the dialog box.
6	Click the custom color to apply to the previously-selected **Display Properties** option and click **OK**.	The **Color** dialog box is removed and the previously-selected **Display Properties** option color box reflects the change.



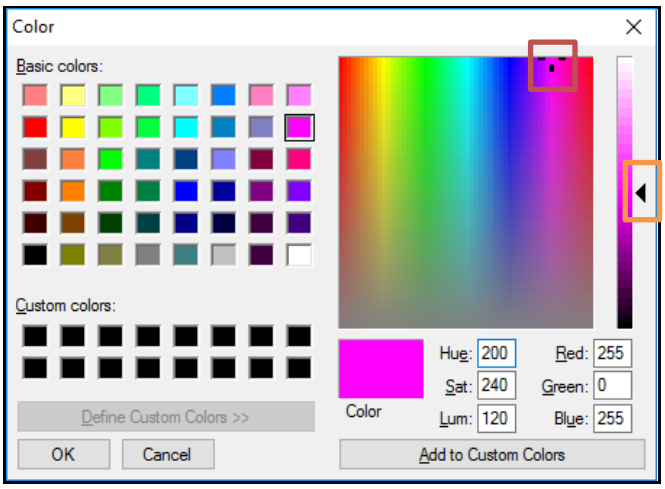
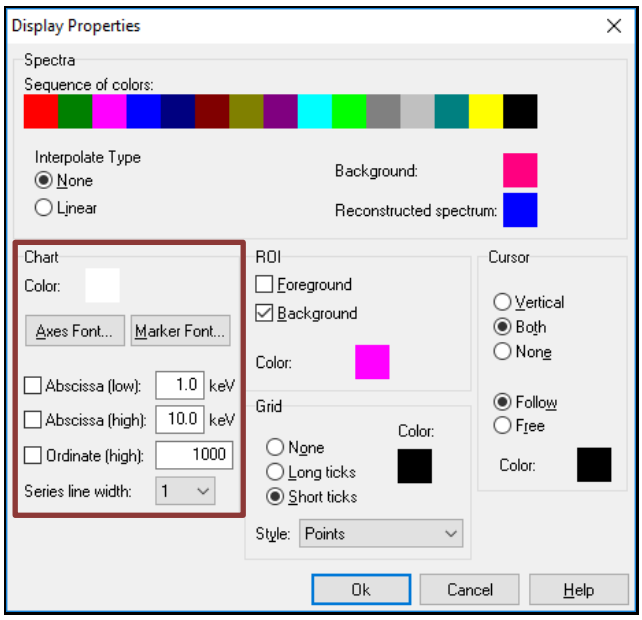


Chart frame

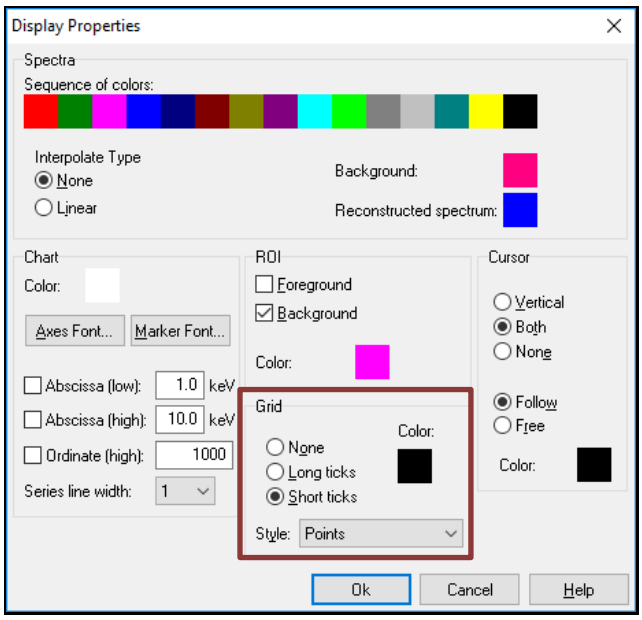
Options in the **Chart** frame affect what is displayed in the Spectrum panel.



Option	Description
Color box	Displays the **Color** dialog box. ***To change the chart background color***, click the color box, click a color on the displayed **Color** dialog box and click **OK**, and click **OK** on the **Display Properties** dialog box.
Axes Font	Displays the **Font** dialog box. ***To alter the text format of* axes markers**, click desired options and **OK**.
Marker Font	See Axes Font above.
Abscissa (low) This option, with the following two, define spectrum panel boundaries; how much of the spectrum is displayed.	Displays the field value as the *smallest* value of the *energy* scale. 1. Open a spectrum. 2. Open **Display Properties** and check the **Abscissa (low)** box. 3. Change the value and click **OK**. 4. Execute the change by double clicking the spectrum panel.
Abscissa (high)	Displays the field value as the *highest* value of the *energy* scale. See the steps for **Abscissa (low)**.
Ordinate (high)	Displays the field value as the *highest* value of the *impulse* scale. See the steps for **Abscissa (low)**.
Series line width	Defines the line weight of all displayed spectra.

Grid frame

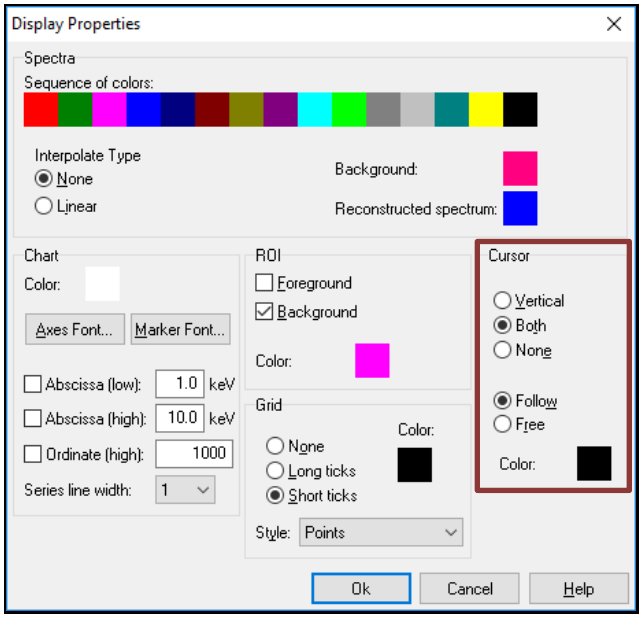
Options in the **Grid** frame affect how the grid of the spectra is displayed.



Option	Description
None	No grid is visible.
Long ticks	Tick marks are visible where axes are labeled.
Short ticks	Tick marks are visible at axis marks.
Style	Displays a dropdown list of line style options: points, dot lines, horizontal dot lines, horizontal lines, lines, points, vertical dot lines, and vertical lines.
Color box	Displays the **Color** dialog box. ***To change the grid color***, click a color and **OK**.

Cursor frame

Options in the **Cursor** frame affect how the cursor is displayed.



Option	Description
Vertical	Vertical bar cursor.
Both	Vertical bar and horizontal bar cursor.
None	No cursor.
Follow	When **Both** is selected and the cursor is moved, the horizontal bar follows the active spectrum curve.
Free	When **Both** is selected and the cursor is moved, the horizontal bar moves independently of the spectrum.
Color box	Displays the **Color** dialog box. ***To change the cursor color***, click a color and **OK**.

4.3 Manipulating a Spectrum

Description

To better view spectrum details, use the following commands.

Mouse and keyboard commands

Command	Mouse	Keyboard
Move cursor	Left button click or drag	Left/right arrow
Compress and stretch vertically	Ctrl + Left button OR Left of the Y-axis, left button	Page up/down or arrow up/down
Compress and stretch horizontally	Ctrl + Left button	Ctrl + left/right arrow
Move horizontally	Below the X-axis, left button	Alt + left/right arrow
Move to the beginning		Home
Move to the end		End
Return to original display	Left button double-click	

Zooming

To zoom in on part of a spectrum –

Step	Action	Result
1	Click the zoom icon,  , and move the mouse cursor to the Spectrum panel.	The mouse cursor displays as a magnifying glass.
2	Left click, drag to define a rectangle, and release.	The area within the rectangle is enlarged to fill the Spectrum panel and the mouse cursor reverts to an arrow.
3	***To restore the display***, double-click in the Spectrum panel.	The spectrum is restored to its original display.

4.4 Status Bar

Description

The status bar at the bottom of the window displays the values for the point the cursor intersects an active spectrum.

Placing the cursor

To place the cursor on a specific point on a spectrum –

Position the mouse cursor and left click, *OR* left click and drag the cursor, *OR* use the left/right arrow keyboard keys.	A vertical line intersecting the spectrum is displayed and data relevant to the intersection point is reflected in the status bar. See below.

If **Options** -> **Channel Scale** is selected, the cursor can be placed only onto existing data points.

Status bar fields

The status bar displays the following conditional fields and information –

Field	When Displayed	Description
E	**Options** -> **Channel Scale** is *off*.	Energy in keV.
Ch	**Options** -> **Channel Scale** is *on*.	Channel number (0-2048).
Cnts	**Options** -> **Counts Per Second** is *off*.	Count in the channel.
R	**Options** -> **Counts Per Second** is *on*.	Counts per second (rate).
User	Always.	Identification of logged in user.
READY	The PC is connected to an instrument.	The connection between the PC and the instrument is detected.
OFF-LINE	The PC is not connected to an instrument.	No connection between the PC and the instrument is detected.

5 Regions of Interest (ROIs)

Description

An ROI displays, in the ROI panel, the area under a curve between ROI boundaries. Multiple ROIs are defined in a single spectrum but apply to all spectra in the project. With ROIs, portions of the spectrum for the calculation of peak intensities can be defined.

Defining an ROI

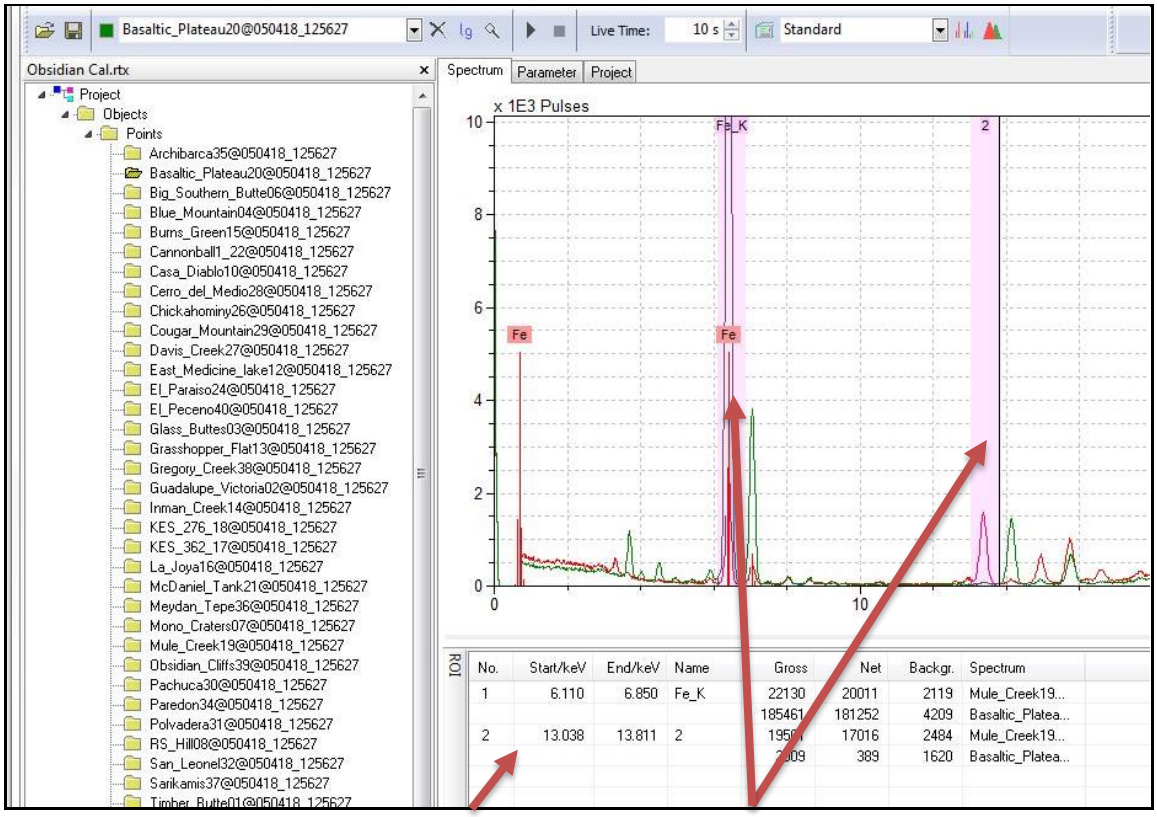
To define an ROI –

Step	Action	Result
1	Position the mouse cursor at the left edge of the region to be defined.	
2	a) Press and hold the Shift key, b) left click and hold, c) drag to the opposite edge of the region to be defined, d) and release.	During the operation, the cursor displays as a short vertical line with **ROI** beneath.

Adjusting an ROI

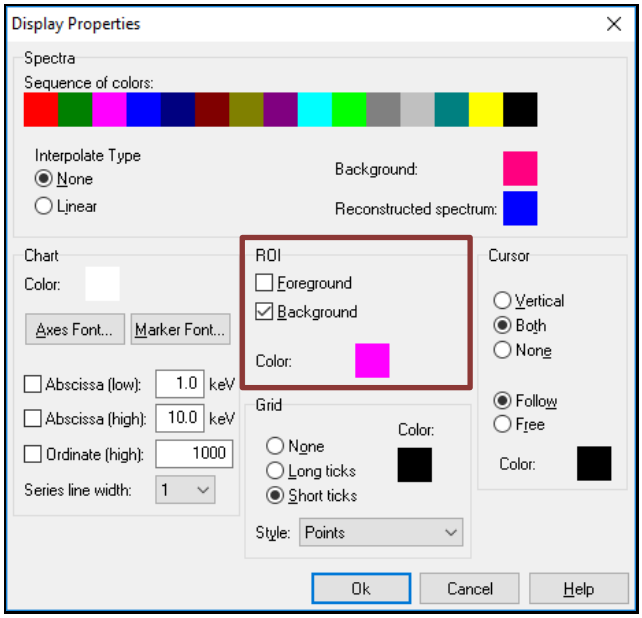
To adjust left and right edges of an ROI –

Step	Action	Result
1	Press and hold the Shift key and move the mouse cursor over an ROI edge.	The ROI cursor gains left and right pointing arrows.
2	Continue to hold the Shift key, left click and hold the mouse, drag, and release.	The ROI edge moves accordingly.



ROI display

How an ROI is displayed depends on options selected under **Options** in the menu bar, **Display Properties**, **ROI** frame.



Option	Description
Foreground	Not currently available.
Background	ROIs are displayed as shaded areas, each labeled with a name. The shade color is determined by the **Color** box.
Color box	Displays the **Color** dialog box. ***To change the color for new ROIs***, click a color and **OK**. For details, see **Display Options** on page 25. This does not change the color of existing ROIs.

ROI panel

At the bottom of the window, the ROI panel is displayed. It contains data for all ROIs in the active spectrum. When a different spectrum is made active, the ROIs stay the same, but the data in the ROI panel are recalculated.

Field	Description
No.	Consecutive number based on creation order.
Start/keV	Beginning of the ROI.
End/keV	End of the ROI.
Name	If labeled through the periodic table, a number or element line name.
Gross	Calculated count rate.
Net	Gross minus background count rate.
Backgr.	Background count rate.
Spectrum	Names of spectra containing ROIs.

Copying

To copy data from the ROI panel to the Windows clipboard –
From the menu bar, click **Export** -> **Copy ROI**.
OR
Right click in the ROI panel and left-click **Copy ROI**.

Naming

ROIs are numbered consecutively, 1 to N. If elements are labeled on the spectrum, then the ROI is assigned a standard name of the element symbol and line type (e.g., Cu_K).

Renaming

To rename an ROI –

Step	Action	Result
1	In the ROI panel, click an ROI.	The row is highlighted.
2	Click **Name**.	The **ROI Name** dialog box is displayed.
3	Enter a new name and press Enter or click **OK**.	The dialog box is removed and the name in the ROI panel reflects the change.

Deleting

To delete a single ROI using the Spectrum panel –

Step	Action	Result
1	In the Spectrum panel, double-click inside an ROI. (If spectra are expanded, first double-click to resize the display.)	The ROI is bordered by dashed lines.
2	Press Delete on the keyboard.	The ROI is removed from the Spectrum panel and the ROI panel.

To delete a single ROI using the* ROI *panel –

Step	Action	Result
1	In the ROI panel, click an ROI.	The ROI is highlighted.
2	From the menu bar, click **Spectrum**. *OR* Right click the ROI in the ROI panel.	A dropdown list is displayed.
3	Click **Delete ROI**.	The ROI is removed from the Spectrum panel and the ROI panel.

To delete all ROIs –

Step	Action	Result
1	From the menu bar, click **Spectrum**. *OR* Right click in the ROI panel.	A dropdown list is displayed.
2	Click **Delete All ROI**.	All ROIs are removed from the Spectrum panel and the ROI panel.

Saving

To save an ROI –

Step	Action	Result
1	From the menu bar, click **File**.	A dropdown list is displayed.
2	Click **Save ROI As**.	The **Save ROI List** dialog box is displayed.
3	***To select a folder***, click in the **Save in** field.	A dropdown list is displayed.
4	Click the desired folder.	Folders and files contained in the selected folder are displayed.
5	Enter a name in the **File name** field and click **Save** or press Enter.	The ROIs are saved in a file and the dialog box is removed.

Opening

To open a saved ROI file –

Step	Action	Result
1	From the menu bar, click **File**.	A dropdown list is displayed.
2	Click **Open ROI**.	The **Open ROI List** dialog box is displayed.
3	In the **Look in** field, click the down pointing triangle to navigate to the desired folder.	The desired file is listed in the **Name** field.
4	Double-click the file name. *OR* Click the file name and click **Open** or press the Enter key.	ROIs from the file are added to the Spectrum panel and the ROI panel.

6 Spectra Parameters

Description

The Parameter panel, visible when the **Parameter** tab is selected, displays measurement parameters for the active spectrum.

Spectrum parameters

Field	Description
Date/Time	Date and time the measurement started. Format depends on operating system settings.
Channel count	Number of channels in the spectrum.
Energy linear	The linear parameter A of the Energy-to-channel equation (E=A*x+B).
Fano factor	Describes the fluctuation of the primary ionization at the detector.
Counts Per Sec	Counts per second over the entire spectrum.

Excitation parameters

Field	Description
Anode	Anode material of the X-ray tube.
Filter	Filter material.
Atmosphere	Milieu of the measuring chamber: air, He, or vacuum.
Pressure	Pressure in the measuring chamber in mbar.
Temp	Temperature in Celsius of the measuring chamber.

Measurement parameters

Field	Description
Input counts/sec	All counts, including valid, double, escape, and more.
Output counts/sec	Only valid counts.
Dead time	Percent of time counting rejected invalid counts.

X-ray Generator parameters

Field	Description
Voltage	High voltage of X-ray tube.
Current	X-ray tube current.

Method parameters

These values are set in the **Method Editor**. See **Working with Methods** on page 39.

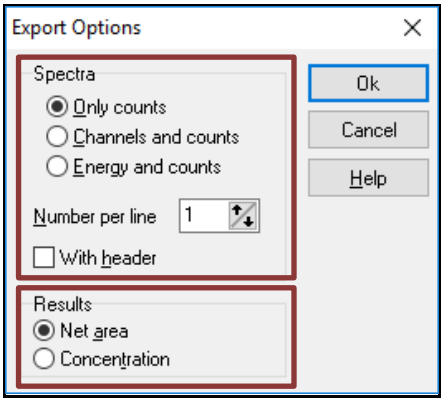
7 Exporting

Description

Measurement data can be exported for further analysis to standard programs (e.g., Microsoft Excel) and other evaluation software.

Settings

To define what data is exported, check settings in the **Export Options** dialog box, under **Export** -> **Options**.



Spectra frame

Option	Description
Only counts	Only recorded pulse counts.
Channels and counts	Channel numbers and recorded pulse counts.
Energy and counts	Energy values and recorded pulse counts.
Number per Line	Number of measurements per line of text.
With header	Measurements are preceded by the eV/channel and zero offset. Exported spectra files (.txt files) can be reimported, if **With Header** was checked when they were exported. ***To import***, use **File -> Open Spectrum…**.

Results frame

Option	Description
Net area	Calculated net intensities.
Concentration	Not currently available.

Active spectrum data

To export original measurements of the active spectrum –

Step	Action	Result
1	From the menu bar, click **Export** -> **Spectrum**.	The **Save Spectrum as ANSI File** dialog box is displayed.
2	Navigate the **Save in** field to locate the folder to export to.	The folder name is displayed in the **Save in** field.
3	Provide a name in the **File name** field and click **Save**.	Spectrum data, as specified in **Export Options** dialog box, are saved in a file in the selected folder.

All spectra data

To export all spectra from a project node as text files –

Step	Action	Result
1	Select a spectrum or node from the project nodes panel.	Spectra are displayed.
2	Click **Export** -> **All Spectra**.	The **Save Spectra from Node as ANSI File** dialog box is displayed.
3	Navigate the **Save in** field to locate the folder to export to. The original file path is recommended.	The folder name is displayed in the **Save in** field.
4	Provide a name in the **File name** field and click **Save**. That name is used as a prefix for each created file. The original file name with extension .txt is recommended.	Each spectrum's data are saved in an individual file in the selected folder.

Current results

To export results of the deconvolution and intensities (counts) of the active spectrum –

Step	Action	Result
1	Click **Export** -> **Result**.	The **Save Results as ANSI File** dialog box is displayed.
2	Navigate the **Save in** field to locate the folder to export to.	The folder name is displayed in the **Save in** field.
3	Provide a name in the **File name** field and click **Save**.	Data, as specified in **Export Options** dialog box, are saved in a file in the selected folder.

All results

To export all results from a project file node to a text file in .csv format –

Step	Action	Result
1	Select a spectrum or node from the project nodes panel.	Spectra are displayed.
2	Click **Export** -> **All Results**.	The **Save Results from Node as ANSI File** dialog box is displayed.
3	Navigate the **Save in** field to locate the folder to export to. The original file path is recommended.	The folder name is displayed in the **Save in** field.
4	Provide a name in the **File name** field. The original file name with extension .csv is recommended.	Data, as specified in **Export Options** dialog box, are saved in a file in the selected folder.

To Excel

To export all results from a project file node to an Excel file –

Step	Action	Result
1	Select a spectrum or node from the project nodes panel.	Spectra are displayed.
2	Identify element lines in the spectra using **Auto Ident** in the **Periodic Table of the Elements**. See **Qualitative Analysis** on page 49.	Element peaks are identified.
3	Click **Analyze -> Evaluate Results**. The more spectra to analyze, the longer the analysis.	The intensities of the selected lines for all spectra are determined and stored in memory. A progress bar may be displayed.
4	Click **Export -> Results to Excel**.	The **Save As** dialog box is displayed.
5	Provide a file name with an .xlsx extension and click **Save**.	The dialog box is removed and the results are saved as an Excel file.

8 Working with Methods

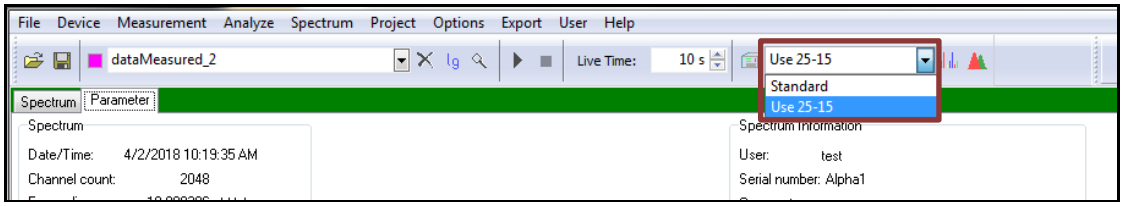
Description

Parameters for measuring and evaluating spectra data are specified within one method. An unrestricted number of methods, classified by name, can be saved.

Selecting a method

To select a different method –

Step	Action	Result
1	Click the down pointing triangle to the right of the **Edit methods** icon ( ).	A dropdown list of method names is displayed.
2	Click a method name.	The list is removed, the selected method name is displayed in the field, and relevant parameters are updated.

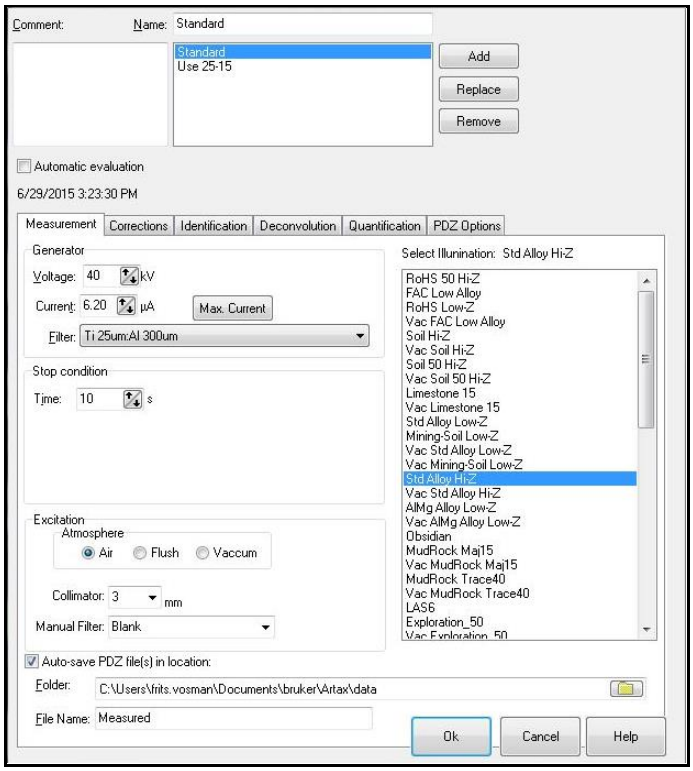


8.1 Method Editor

Description

The **Method Editor** is a dialog box for creating new methods and editing existing ones.

To display the Method Editor, click the **Edit methods** icon ( ) from the toolbar OR, from the menu bar, click **Measurement** -> **Method**. ***To access different panels***, click the appropriate tab.

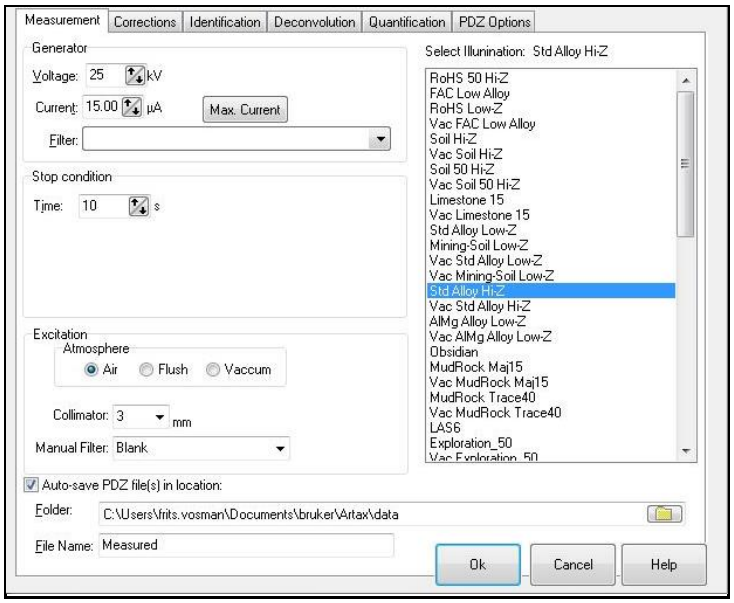


General fields

Option	Description
Comment	Comments entered for the currently selected method. When the method name is displayed in the toolbar method box and the mouse cursor hovers over the name, text previously entered in this **Comment** field is displayed.
Name	Currently selected method.
Add	***To add a new method***, enter a unique name in the **Name** field and click **Add**. The new name is displayed in the list box.
Replace	***To change parameters of the selected method***, click the method name, edit field values, and click **Replace**.
Remove	Deletes the selected method.
Automatic evaluation	When a measurement completes, deconvolution (blue curve on the Spectrum panel) and intensities (data displayed on the Results panel) are calculated. Detected elements are labeled and saved with the spectrum. The Bayesian deconvolution curve automatically changes when a new element is added or subtracted via the periodic table. See **Qualitative Analysis** on page 49. This option is available if the following are selected – • Under the **Deconvolution** tab, **Bayes** *OR* **Profile bayes** (**normal Fit**) *AND* • Under the **Identification** tab, **Line markers** *OR* **Automatic**. Note: Intensities results are displayed in the Results panel only if the spectrum is in a project.
Data and time	The date and time of the last method modification.
Ok	Stores all changes in the database.

8.2 Measurement Panel

Description



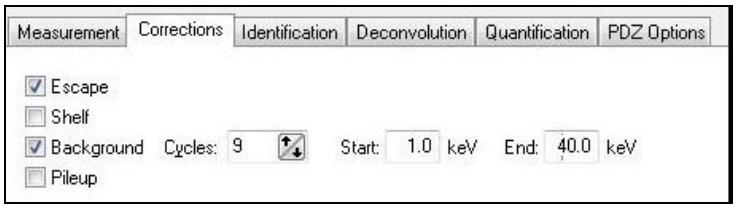
Option	Description
Voltage	X-ray tube voltage.
Current	X-ray tube current.
Max. Current	When clicked, displays in the **Current** field the maximum current possible at the voltage setting.
Filter	A dropdown list of possible material filters.
Time	Duration of a measurement.
Select Illumination	From the list of available illuminations, select one as a starting point.
Auto-save PDZ file(s) in location	When this box is checked, saves the .pdz file in the folder or file specified in the boxes below.
Folder	Folder in which the PDZ file is saved.
File Name	PDZ file name with _n.pdz automatically appended, where n is a unique number. The default name is Measured.

TRACER 5 options

When connected to a TRACER 5, the following additional options are available.

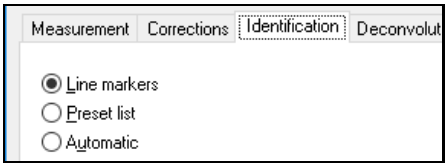
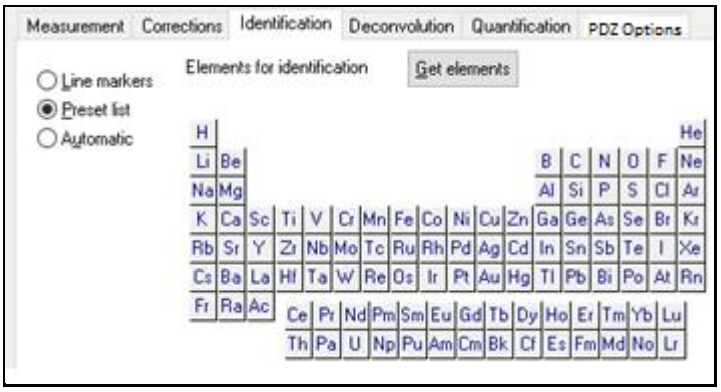
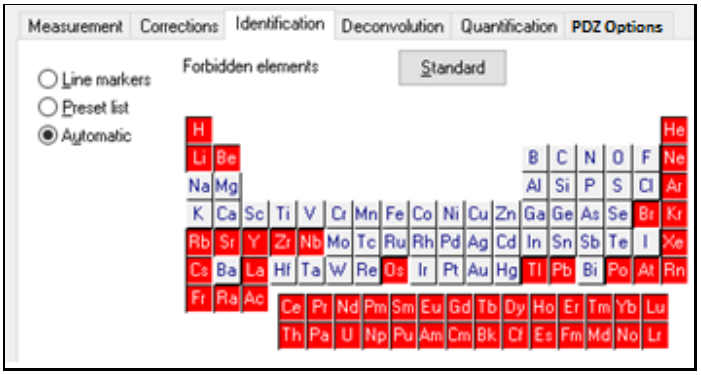
Option	Description
Atmosphere	Atmospheric measurement environments: **Air** – Ambient atmosphere. **Vacuum** – setting for use with a vacuum pump to eliminate air between the sample and detector. **Flush** – setting for use with a Helium, or other gas, flush to replace air between the sample and detector.
Collimator	Collimators that can be manually installed.
Manual filter	Filters that can be manually installed.

8.3 Corrections Panel

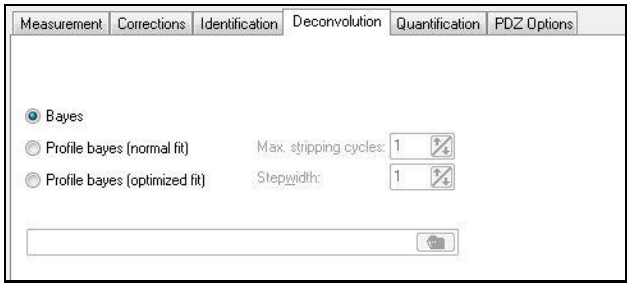


Option	Description
Escape	Corrects the spectrum for escape peaks.
Shelf	Corrects the spectrum for background signals in the lower energy range (Shelf).
Background	Corrects the background.
Pileup	Ignores sum peaks.
Cycles	For background, tunes background calculations.
Start	For background, lowest energy boundary for correction.
End	For background, highest energy boundary for correction.

8.4 Identification Panel

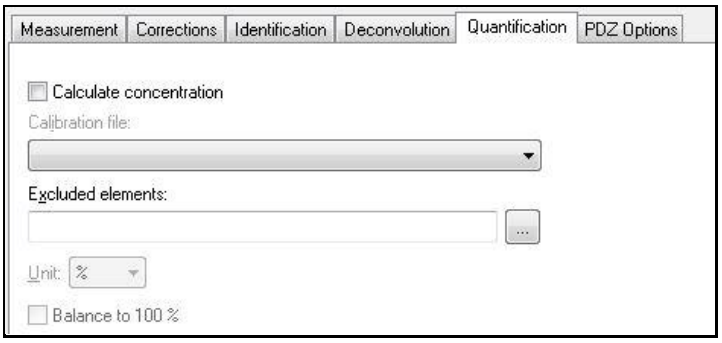
Method Name	Description
Line markers	Measured elements within the spectrum must be identified via the **Periodic Table of the Elements** dialog box, via the toolbar icon ( ) or **Analyze** -> **Periodic Table**. See **Qualitative Analysis** on page 49. 
Preset list	This option is recommended when the collected spectra are known to contain certain elements. ***To select required elements***, click element buttons on the periodic table. ***To add elements to the periodic table from the active spectrum***, if the elements there are labeled, click **Get Elements**. 
Automatic	Identifies elements within the spectrum. ***To exclude elements known to not be present***, click element buttons on the periodic table.  ***To exclude elements impossible to measure or rare***, click **Standard**.

8.5 Deconvolution Panel

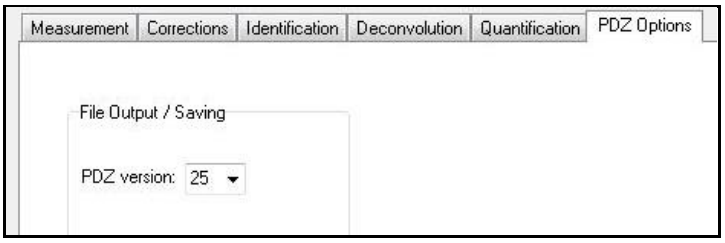
Option	Description
Bayes	Performs Bayesian deconvolution of spectrum. 
Profile bayes (normal fit)	Not currently available.
Profile bayes (optimized fit)	Not currently available.

8.6 Qualification Panel

Not currently available.



8.7 PDZ Options Panel



The PDZ version can be **24** or **25**.

9 Spectra Processing

Description — Spectra can be added, subtracted, scaled, compared, and saved.

Saving — New spectra can be saved as part of a project or as an individual spectrum. Be sure to use a new file name so another file is not overwritten.

To add a new spectrum to the current project, click **Project** -> **Add Spectra**.

To save a new spectrum as an individual spectrum rather than part of a project, click **File** -> **Save Spectrum As**.

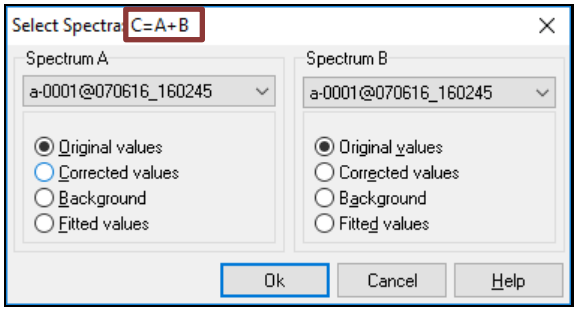
9.1 Adding and Subtracting Spectra

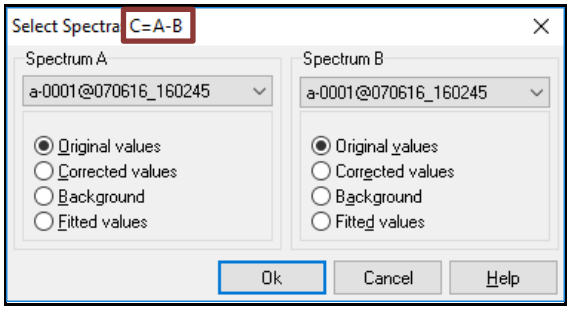
Description — Two spectra can be added, or one spectrum subtracted from another.

Adding or subtracting

To add two spectra or subtract one spectrum from another –

Step	Action	Result
1	Open two or more spectra.	
2	From the menu bar, click **Spectrum** -> **C = A + B** *OR* **C = A - B**.	The **Select Spectra** dialog box is displayed.
3	Under **Spectrum A**, click the down pointing caret to display a list of open spectra and click a spectrum name. Parameter values from spectrum A will apply to the new spectrum.	The list is removed and the selected spectrum name is displayed in the box.
4	Under **Spectrum A**, select the appropriate option to be added or subtracted. **Original values** – The original spectrum. **Corrected values** – After the background is subtracted. **Background** – Just the background. **Fitted values** – The deconvoluted spectrum.	
5	Under **Spectrum B**, click the down pointing caret to display a list of open spectra and click a spectrum name.	The list is removed and the selected spectrum name is displayed in the box.
6	Under **Spectrum B**, select an appropriate option and click **Ok**.	The dialog box is removed; the Spectrum panel displays the new spectrum, **Add_n** or **Sub_n** (n being a consecutive number); and the toolbar indicates that it is the active spectrum.



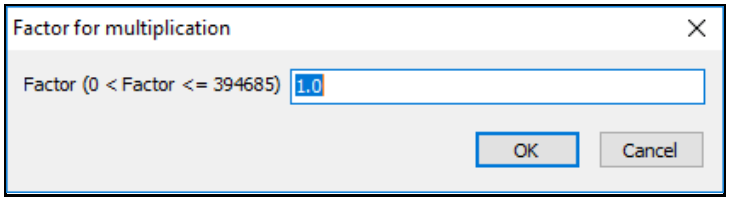


9.2 Scaling a Spectrum

Description — Scaling is multiplying the pulse counts, which affects the vertical scale.

Scaling — ***To scale the active spectrum –***

Step	Action	Result
1	Click **Spectrum** -> **A = F * A**.	The **Factor for multiplication** dialog box is displayed.
2	Type a scaling factor and click **OK**.	All pulse counts and measurement times of the active spectrum are multiplied by the entered factor.



Normalizing — This type of scaling –

- At the spectrum cursor location, gives all open spectra the same value as the active spectrum.
- Recalculates all open spectra by the scaling factor determined by the relation of the pulse counts at the spectrum cursor.

To normalize all spectra in the Spectrum panel to the active spectrum, place the spectrum cursor at the desired location and click **Spectrum** -> **Normalize**. Open spectra are scaled accordingly.

9.3 Comparing Spectra

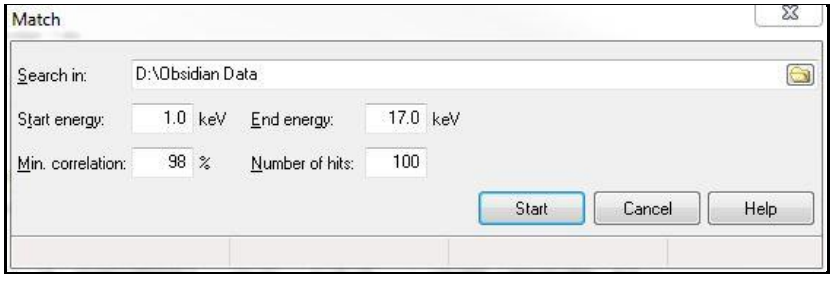
Description

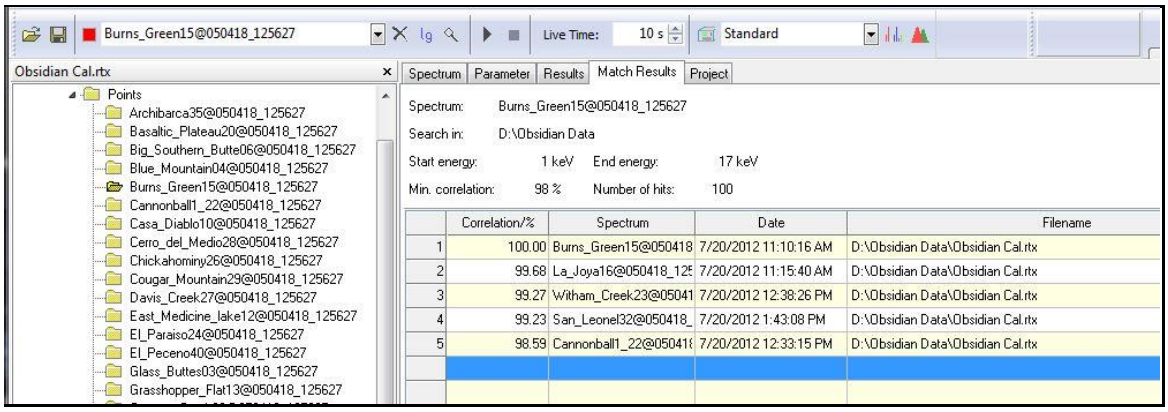
An unknown spectrum can be identified by making it the active spectrum and comparing it to known spectra in project files. The comparison calculates matches in percent.

Searching for matches

To search for matches with the active spectrum –

Step	Action	Result
1	From the menu bar, click **Analyze** -> **Match**.	The **Match** dialog box is displayed.
2	***To select a directory in which to search for matching spectra***, click the folder icon to the right of the **Search in** field.	The **Browse For Folder** dialog box is displayed.
3	Navigate and select the desired folder, then click **OK**.	The directory name is displayed in the **Search in** field.
4	In the **Start energy** field, specify the lower boundary of the energy range in which to compare the spectra.	The field reflects the change.
5	In the **End Energy** field, specify the upper boundary of the energy range in which to compare the spectra.	The field reflects the change.
6	In the **Min. correlation** field, specify the minimum percent of matching concentrations for spectra to be a match.	The field reflects the change.
7	In the **Number of hits** field, specify the maximum number of matches displayed.	The field reflects the change.
8	Click **Start**.	The status bar of the dialog box displays the number of files found, the number spectra being compared, and the count of matches found so far. When the comparisons end, the dialog box is removed. If matches were found, the Match Results panel is displayed.





Match Results panel

The Match Results panel displays the following columns –

Column Name	Description
Correlation/%	Closeness of match in percent.
Spectrum	Spectrum name.
Date	Date and time the spectrum was recorded.
Filename	Directory and filename of the project file or of the individual spectrum file.

Active match

To select a spectrum match to be active, double click its row in the Match Results panel. The Spectrum panel is displayed and the selected spectrum is active.

Removing the panel

The Match Results panel remains available until –

A comparison is executed that results in zero hits.

OR

Artax is exited.

10 Qualitative Analysis

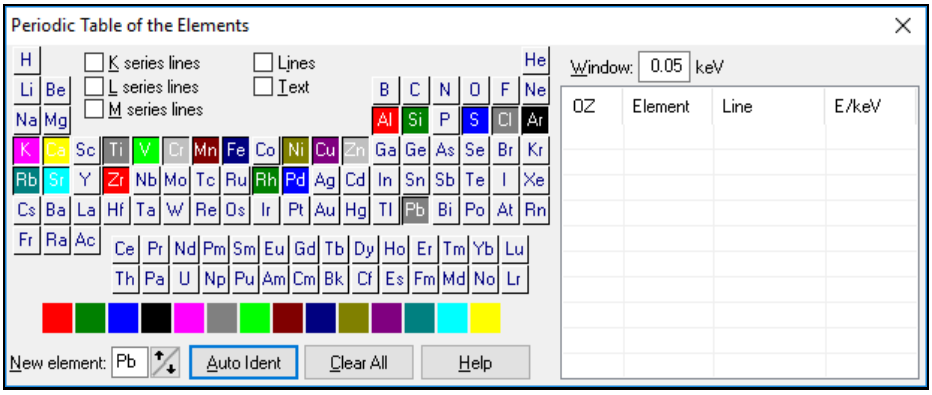
Description

Elements to be charted in the Spectrum panel can be specified from the **Periodic Table of the Elements**, which is a dialog box accessible by clicking –

The toolbar icon ( ).

OR

The menu bar option **Analyze** -> **Periodic Table**.



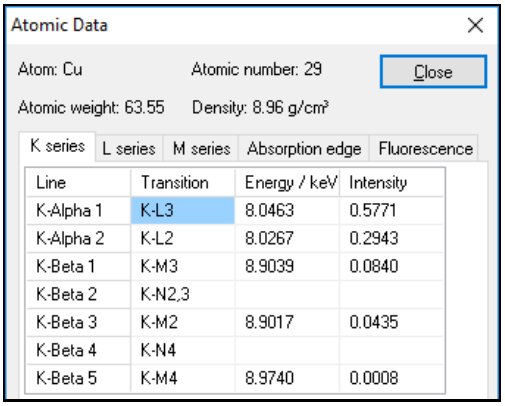
10.1 Display Options

Element name and number

Element buttons are displayed in periodic table format. ***To display an element button's element name and atomic number***, hover the mouse cursor over it.

Element details

To display details of a specific element, right click the element button. The **Atomic Data** box is displayed, which contains atomic mass, density, line series energies, and more.



Spectrum display options

Depending on boxes checked on the **Periodic Table**, the Spectrum display can include –

- Lines indicating K, L, and/or M series points.
- Flags, with the element symbol and color corresponding to the color of the element button, indicating K, L, and/or M series points.

<table>
<tr><th>Option</th><th>Description</th></tr>
<tr><td>K series lines
L series lines
M series lines</td><td>Displays the spectrum K, L, and/or M series lines and/or text for each element highlighted on the Periodic Table, if the Lines box and/or Text box are checked.</td></tr>
<tr><td>Lines</td><td>Displays, with vertical lines, the K, L, and/or M points for each element highlighted on the Periodic Table, if the respective series line boxes are checked.</td></tr>
<tr><td>Text</td><td>Displays, with colored flags indicating the element, the K, L, and/or M points for each element highlighted on the Periodic Table, if the respective series line boxes are checked.</td></tr>
<tr><td>Color</td><td>Changes the color of the –
Element button in the Periodic Table.
Element flag and element line on the Spectrum panel.
To change the color –
Left click and drag a color box from the dialog box and drop it over an element button.
OR
Select an element button and press Enter twice repeatedly to scroll through color options.
New color assignments remain while the program runs. They cannot be saved.</td></tr>
<tr><td>New element</td><td>To activate a new element –
Type the element symbol in this field and press Enter.
OR click the up arrow or down arrow to scroll through the elements.
OR left click an element button.</td></tr>
<tr><td>New element arrows</td><td>Incrementally selects elements up or down from the selected element button.</td></tr>
<tr><td>Auto Ident</td><td>Depending on checked box options, automatically identifies –
In the Periodic Table, elements of the active spectrum.
In the Spectrum panel, element series lines.
In the Spectrum panel, elements symbols associated with series lines.
Careful verification of automatic results is recommended.
To select elements individually, click an element button. To unselect, click again.</td></tr>
<tr><td>Clear All</td><td>Removes from the –
Spectrum panel all element labeling.
Periodic Table all activated element buttons.</td></tr>
<tr><td>Window</td><td>Lists possible elements according to data at the spectrum cursor location.
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>keV</td><td>Adjustable bandwidth for recognizing a line along the X-axis.
The default is 0.05 keV.</td></tr>
<tr><td>OZ</td><td>Atomic number.</td></tr>
<tr><td>Element</td><td>Symbol of the elements detected at that point.</td></tr>
<tr><td>Line</td><td>Emission line series type.</td></tr>
<tr><td>E/keV</td><td>Energy in keV.</td></tr>
</table>
If Profile bayes is chosen as the deconvolution method, the list of possible elements is further restricted based on the included profile files. Element symbols with no corresponding reference data are underlined.</td></tr>
</table>

10.2 Deconvolution

Description

From an existing spectrum, deconvolution creates a model spectrum defined by only elements selected on the **Periodic Table of the Elements** dialog box.

The deconvolution process depends on –

- The method selected in the **Method Editor** dialog box, under the **Identification** tab.
- Availability of other spectra results.

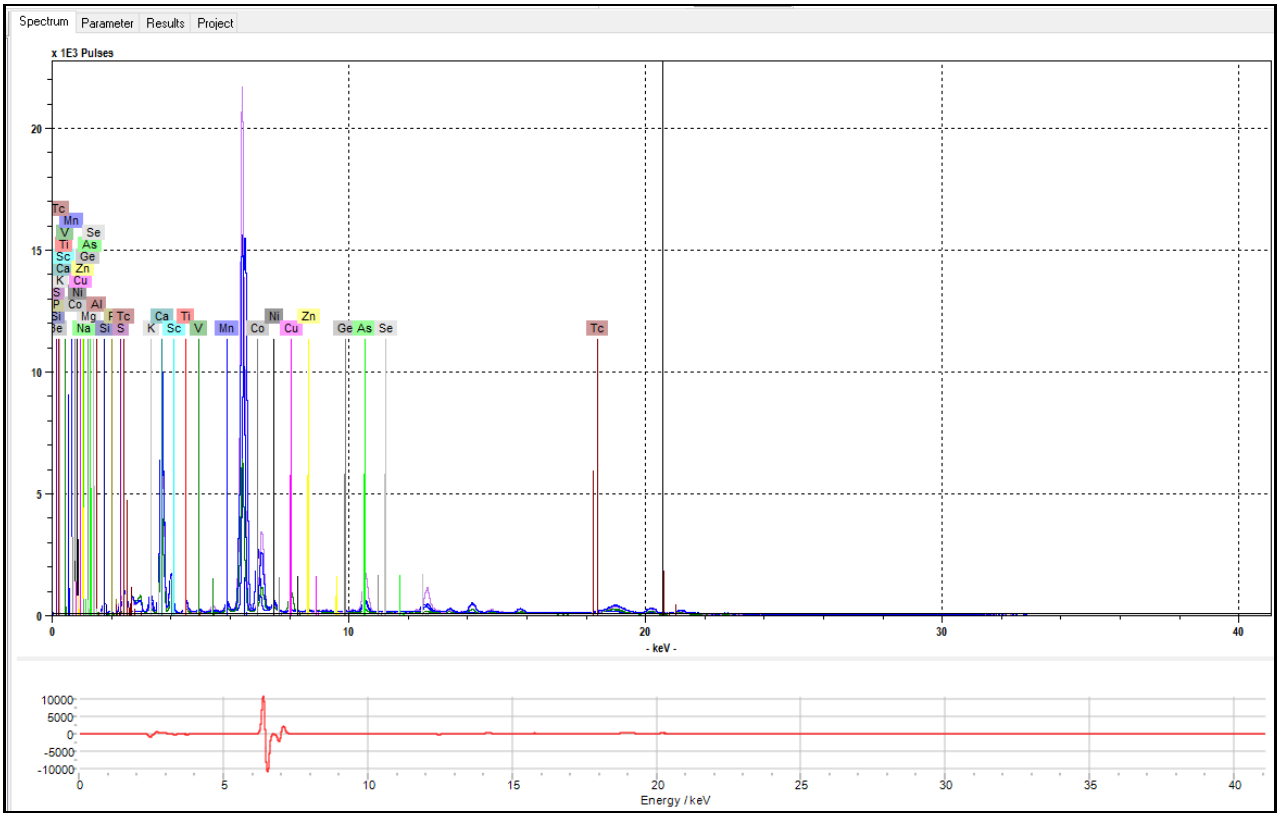
Corrected raw counts

To determine corrected raw counts of the active spectrum via deconvolution –

Step	Action	Result
1	Display element labels and series lines on the active spectrum.	
2	Click  on the toolbar or **Analyze** -> **Evaluation** on the menu bar.	The deconvolution curve (default blue) is displayed in the Spectrum panel and the method data and results are temporarily stored in memory.
3	***To permanently save changes***, use **File** -> **Save Spectrum As** or add the spectrum to a project file and use **File** -> **Save Project As**.	

Differences

To display the difference between original values and deconvolution values, from the menu bar click **Options** -> **Difference curve**. Results are displayed in a panel below the Spectrum panel.



Appendix A: Registry Database

Description

Artax uses the registry database of the operating system intensively to store the position of all windows and dialog boxes and their display parameters. The information is in the registration key HKEY_CURRENT_USER/Software/ Bruker/ARTAX.

Individual's data

If several users are registered within the operating system, an individual's data is also stored in the registry. This data is not automatically available after installation of the software or registration of new users.

System parameters and methods

Instrument system parameters and available methods are store in the directory **C:\Program Files (x86)\Bruker\Artax\settings\Spectra** with the following naming convention:

Data Type	Storage File Name
Instrument system parameters	program name.ini
Available methods	program name.mth