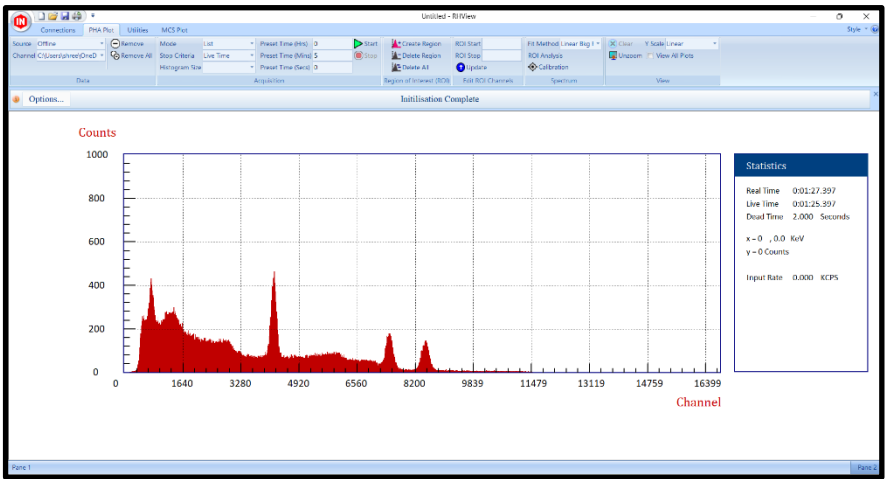
Rev. 0 - 13 May 2025

RHView

Spectrum Acquisition Software for CAEN Red Eagle and Hawkeye



Purpose of this User Manual

This User Manual contains the full description of This User's Manual contains the full description of the RHView, Spectrum Acquisition Software for Red Eagle and Hawkeye.

Change Document Record

Date	Rev.	Changes
13 May 2025	0	First release

Symbols, Abbreviated Terms and Notations

MCA	Multichannel Analyser
MCS	Multichannel Scaler
HV	High Voltage Supply
USB	Universal Serial Bus
ROI	Region of Interest
mS	Milli Seconds
uS	Micro Seconds
nS	Nano Seconds
CPS	Counts per second

Reference Document

[RD1] Red Eagle, Digital Multichannel Analyzer, Data Sheet, User's Manual

[RD2] HawkEye, MCA Tube Base for Gamma Ray Spectroscopy, Data Sheet, User's Manual

All CAEN documents can be downloaded at:

https://www.caen.it/support-services/documentation-area/ (**login required**)

https://www.caen-india.in/products

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Limitation of Responsibility

If the warnings contained in this manual are not followed, CAEN will not be responsible for damage caused by improper use of the device. The manufacturer declines all responsibility for damage resulting from failure to comply with the instructions for use of the product. The equipment must be used as described in the user manual, with particular regard to the intended use, using only accessories as specified by the manufacturer. No modification or repair can be performed.

Disclaimer

The information contained herein has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies. CAEN SpA and CAEN India reserve the right to modify its products specifications without giving any notice; for up to date information please visit **www.caen.it**.

Made in Italy

We remark that all our boards have been designed and assembled in Italy. In a challenging environment where a competitive edge is often obtained at the cost of lower wages and declining working conditions, we proudly acknowledge that all those who participated in the production and distribution process of our devices were reasonably paid and worked in a safe environment (this is true for the boards marked "MADE IN ITALY", while we cannot guarantee for third-party manufactures).

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1 Introduction

RHView is an application that allows you to acquire gamma ray spectrum using Red Eagle or HawkEye.

Operation with Red Eagle or HawkEye can be controlled via USB or Ethernet.

It is possible to connect multiple units of Hawkeye or Red Eagle with diffent device address. Maximum 20 units can be controlled with this initial version.

This software has many features like spectrum acquisition control, spectrum storage and display in file format, spectrum calibration, spectrum analysis, report, printing.

Additional features include HV control.

Software supports offline spectrum acquisition. User can disconnect PC communication link after starting acquisition. Acquisition will continue in the unit. This feature is useful when preset time is very long.

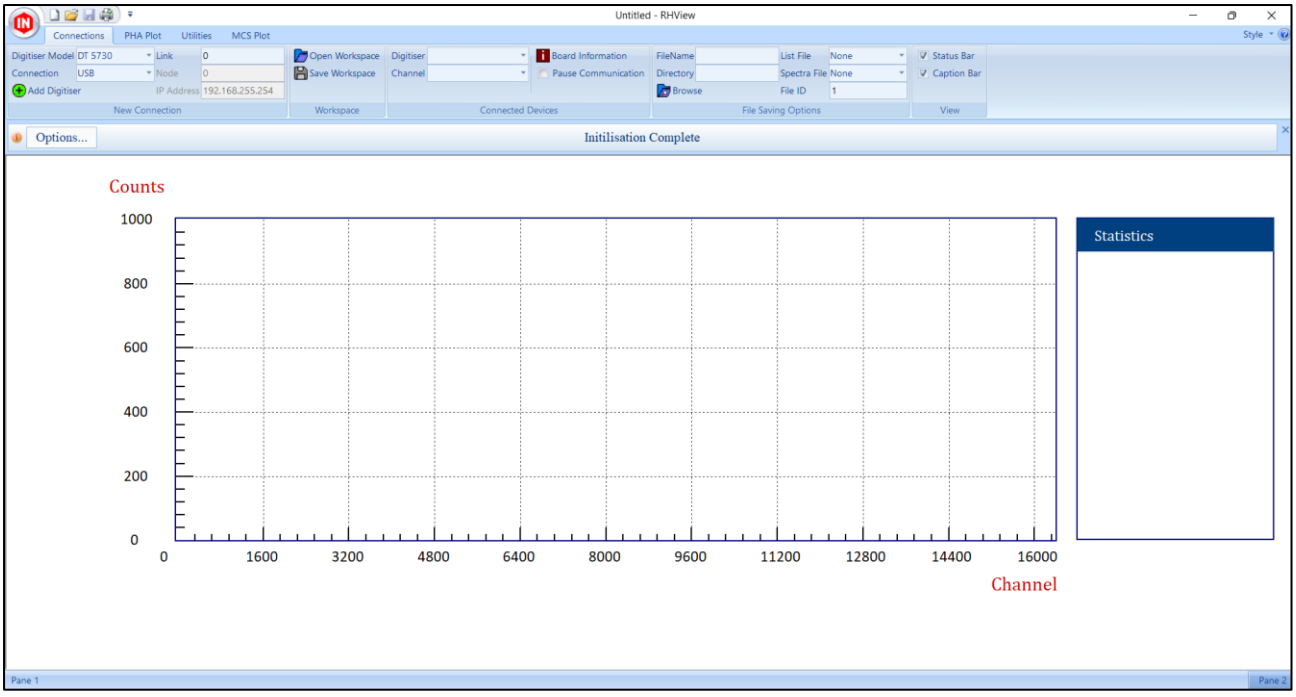


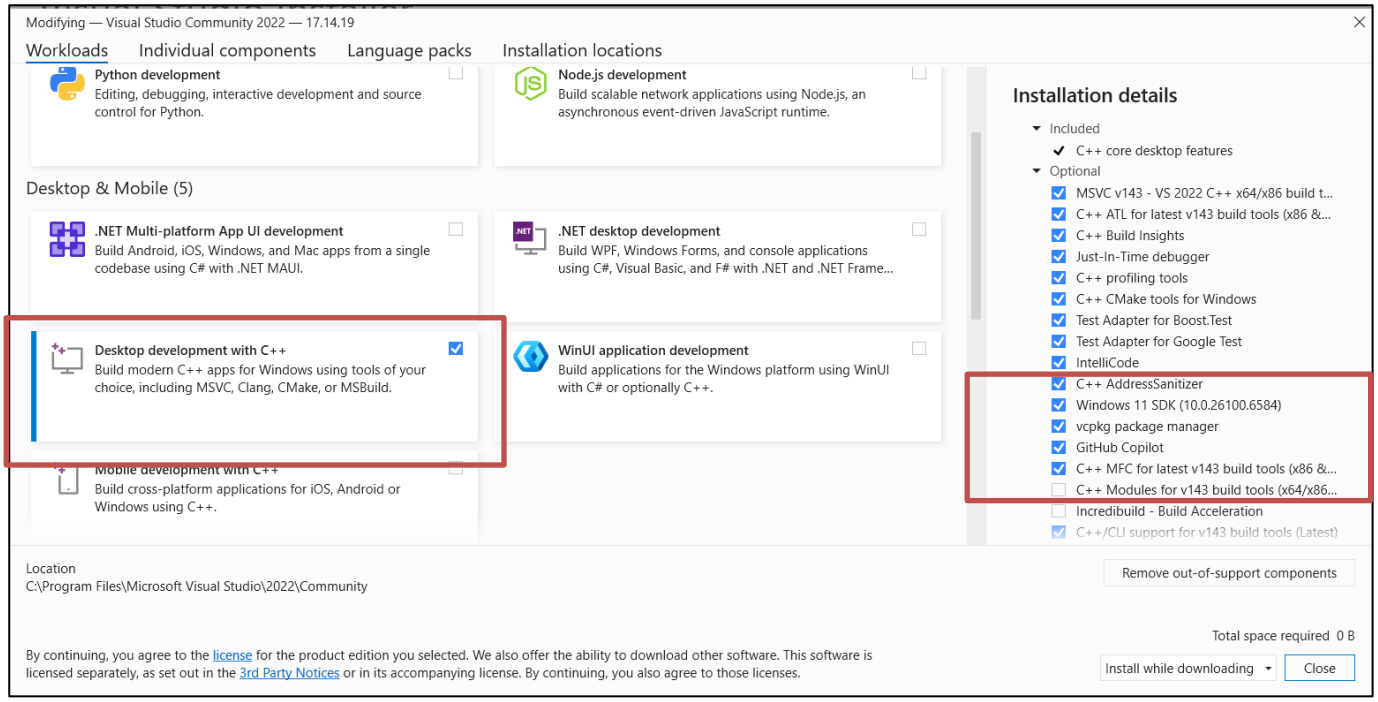
Figure 1 : RH View Main Screen

System requirements

1. The host PC shall run Windows 10 or higher.
2. ROOT, CERN, Version 6.34.02 (No other version will be compatible with this package).
3. ROOT libraries require C++ development environment. So in some cases, Visual Studio Community edition may be required to be installed, if ROOT application fails to launch. Link to install Community edition is given here. Add "**Desktop**

Development with c++" option. Select "**C++ MFC for latest v143 build tools….". Also** select **Windows 11 SDK (10.0.26100.xxxx)** and complete the installation. Community version is license free.

Visual Studio 2022 Community Edition – Download Latest Free Version



2 Installation

Download and launch the “RHView.msi” setup file supported by Windows 10 or higher operating system and follow the installation wizard instructions.

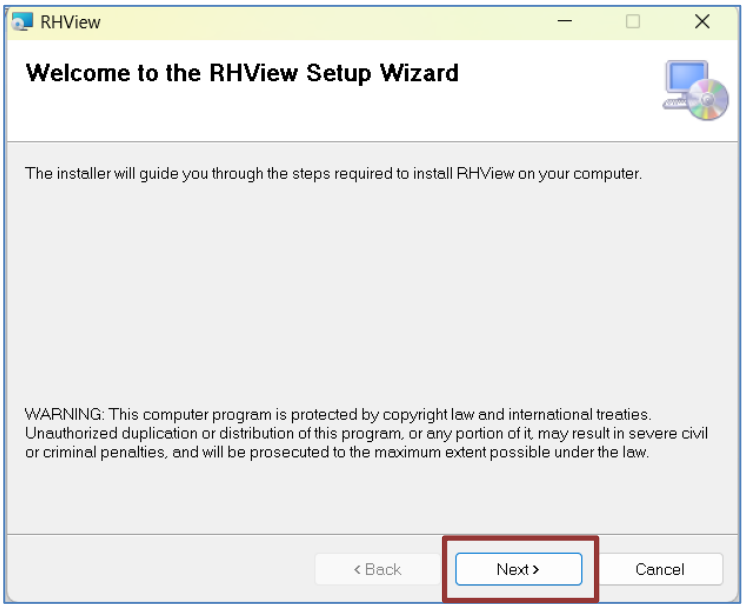
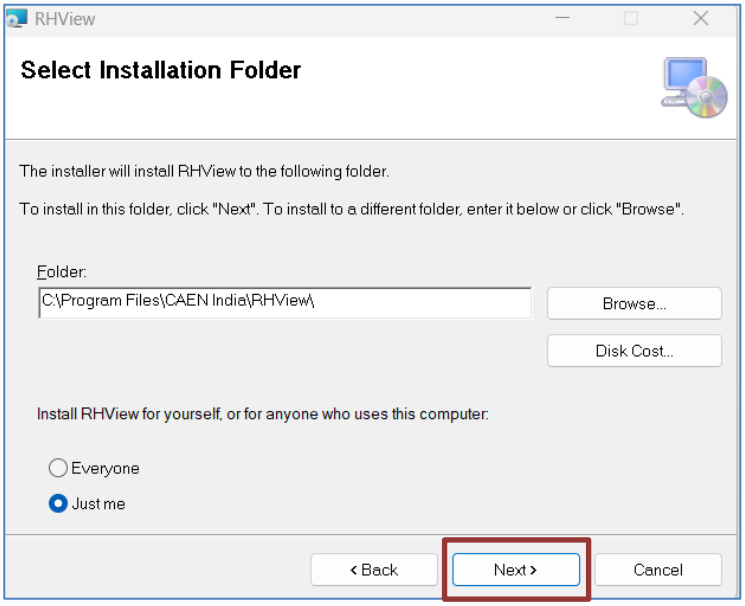
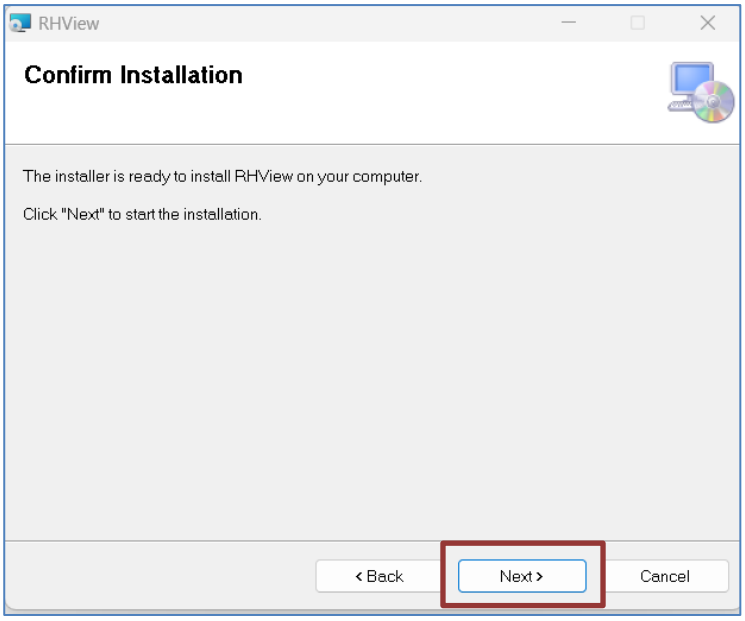


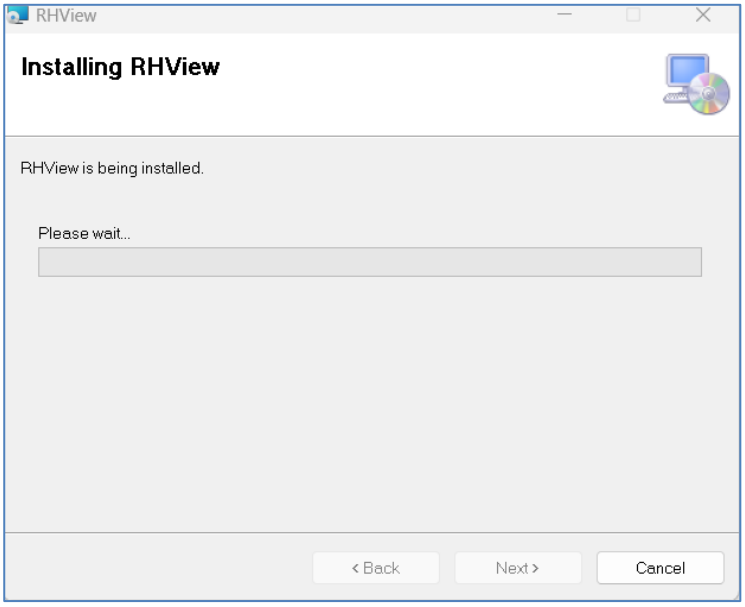
Figure 2 : Installation Wizard

Click “Next” Button on Welcome screen.



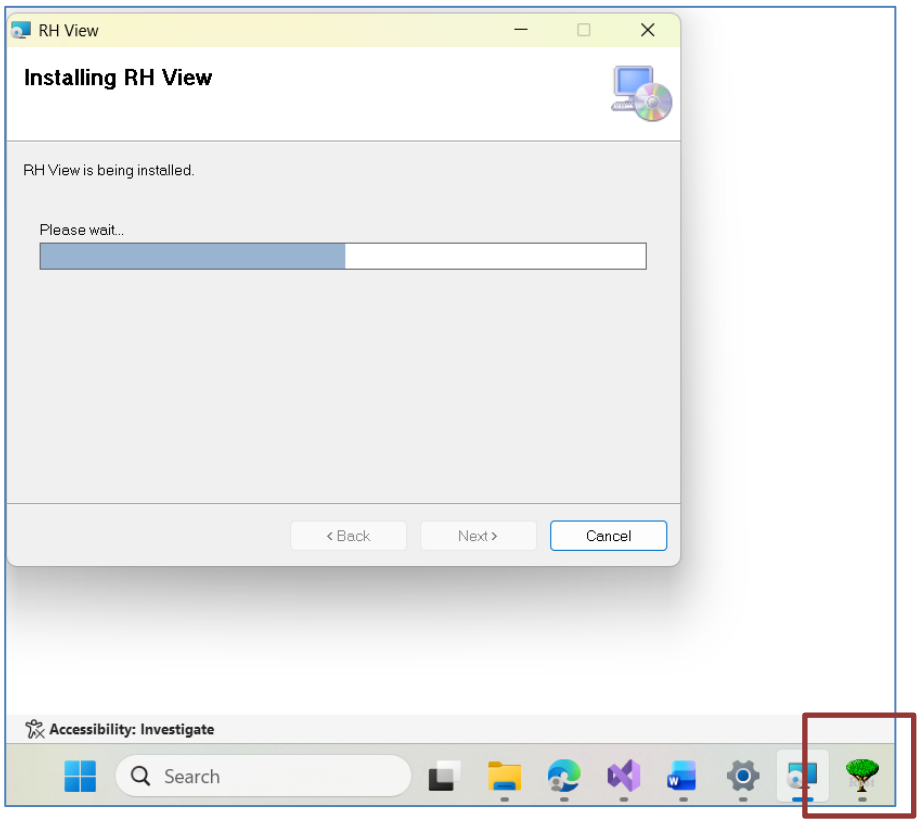


Click “Next” button to proceed.



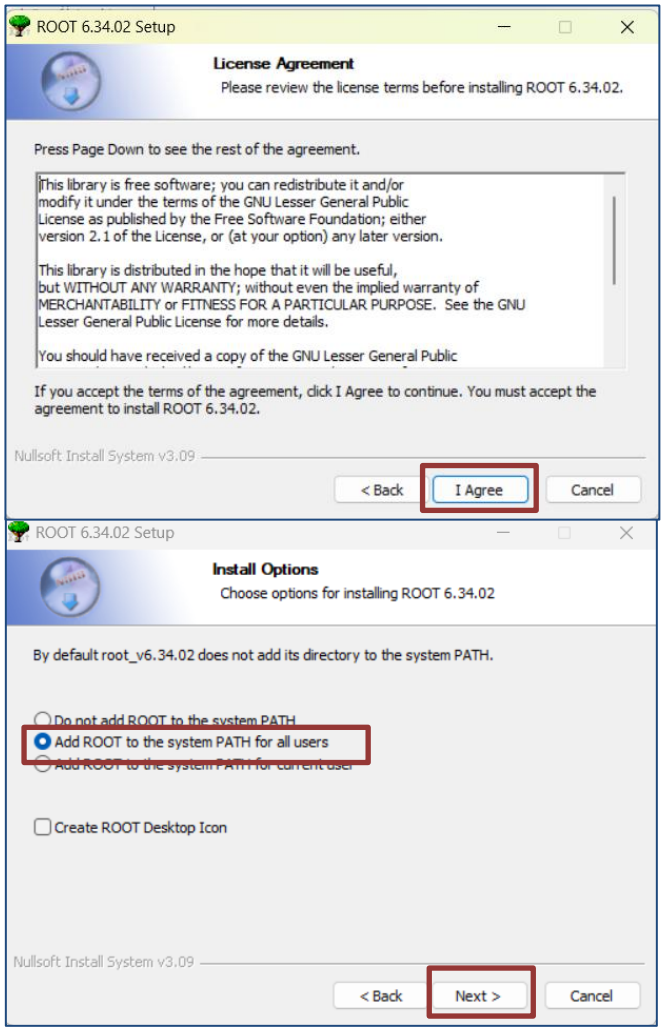
Installation will start.

Allow User Access Control to make changes to your local disk. Setup starts copying files to the disk. After this, it will automatically start installing **“ROOT” libraries** on the disk. ROOT installer will be in a minimized mode. Click on ROOT icon on the task bar. Maximise it and start installing.

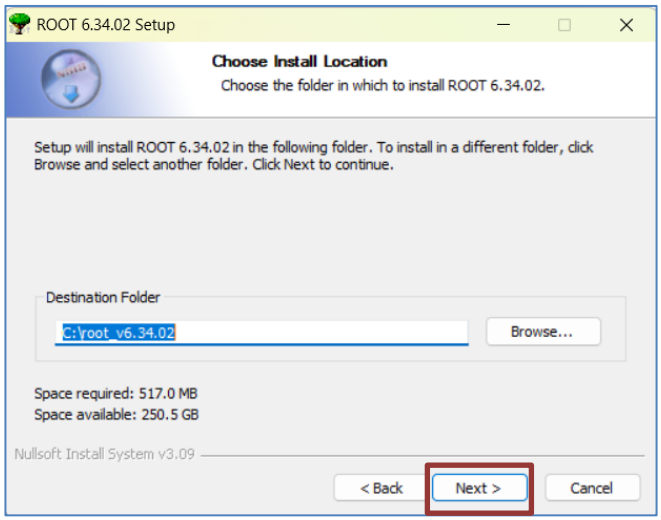


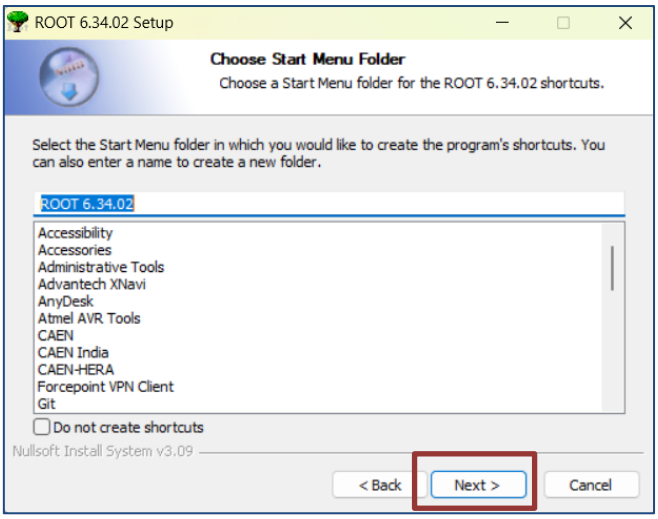
ROOT Installation

Images are for representation only.

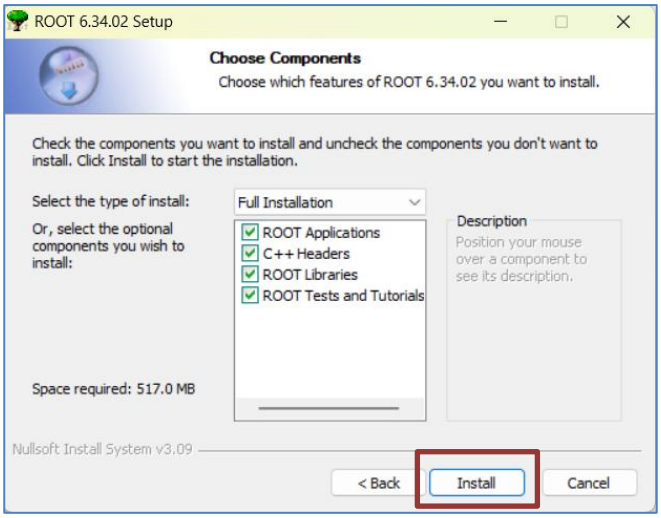


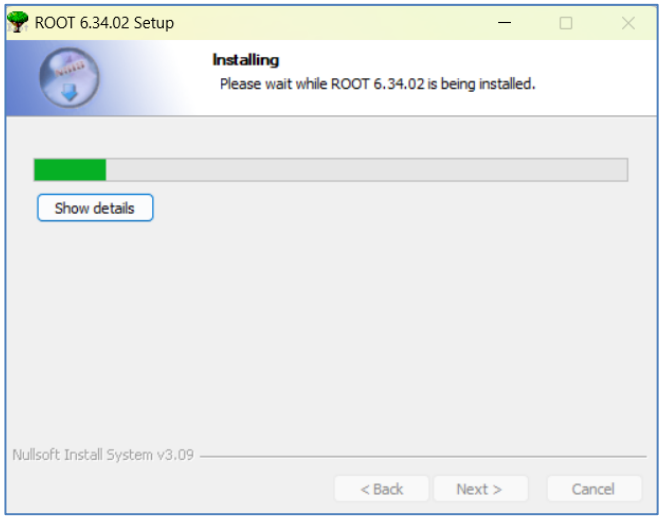
Select option "**Add ROOT to the system PATH for all users**."

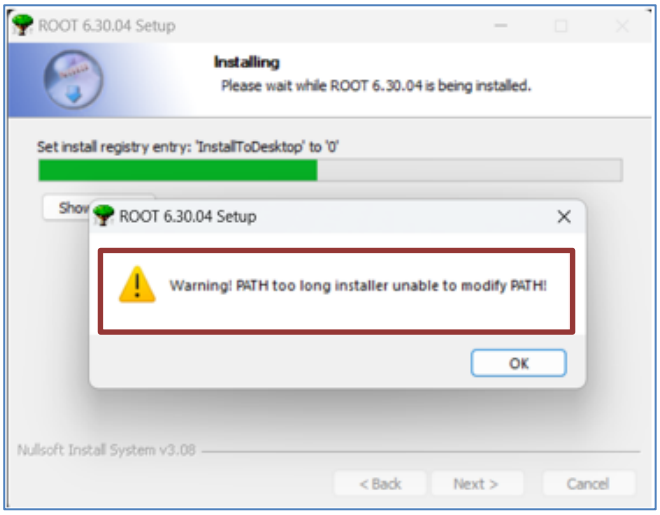




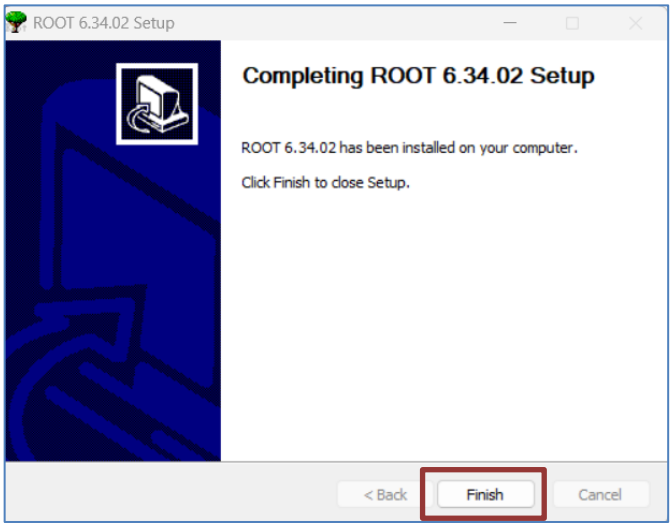
Keep default destination folder, name for program menu and select full installation.





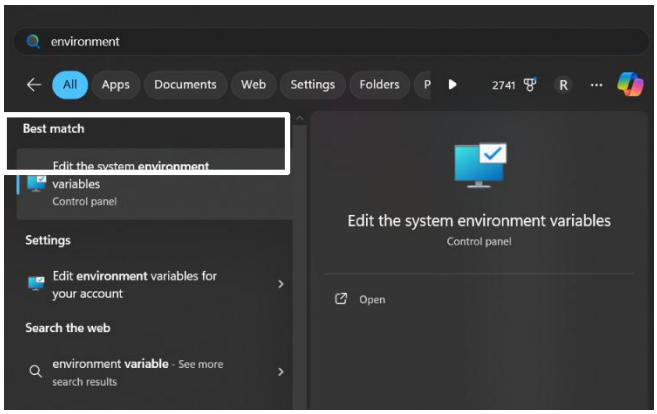


Warning may come while registering PATH with environment. If this warning comes, then manually register ROOT path with Windows. Procedure is explained on next page.

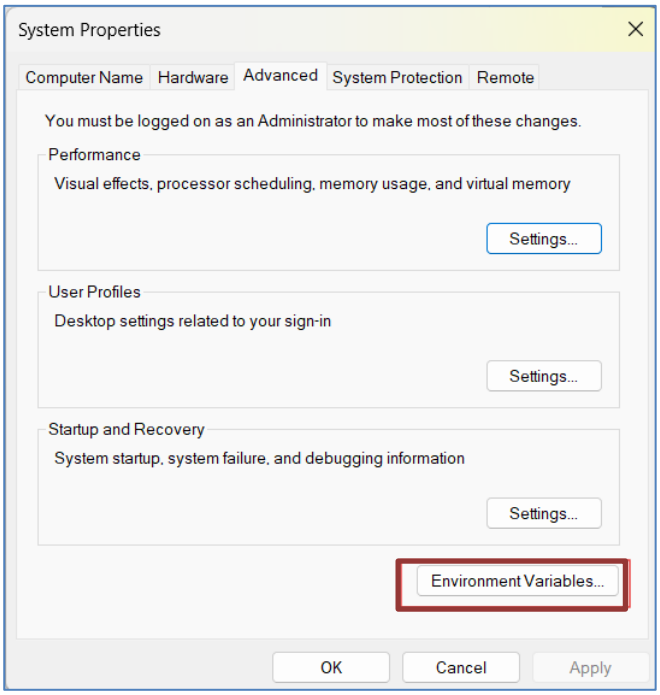


Click "**Finish**" to complete.

To register ROOT path with environment, search environment variables in search bar of windows.



Click on "**Edit the system environment variables**".



Click on "**Environment Variables**"

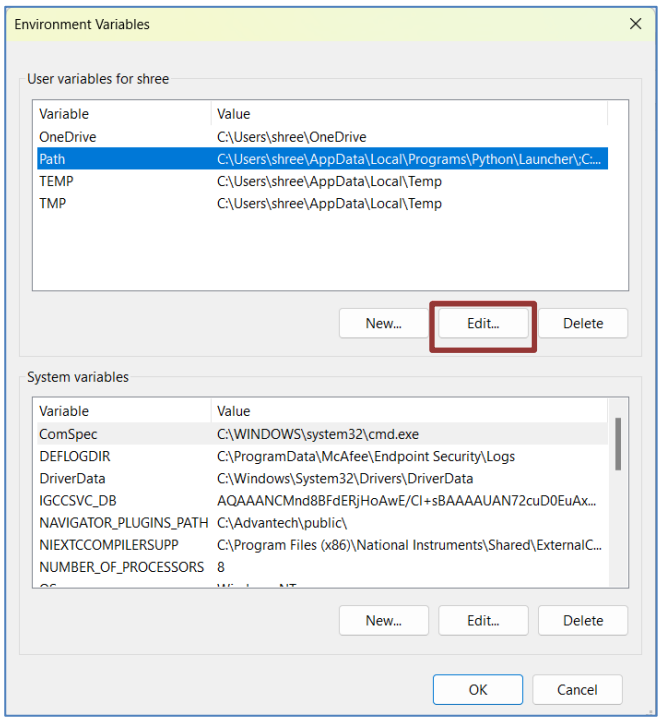
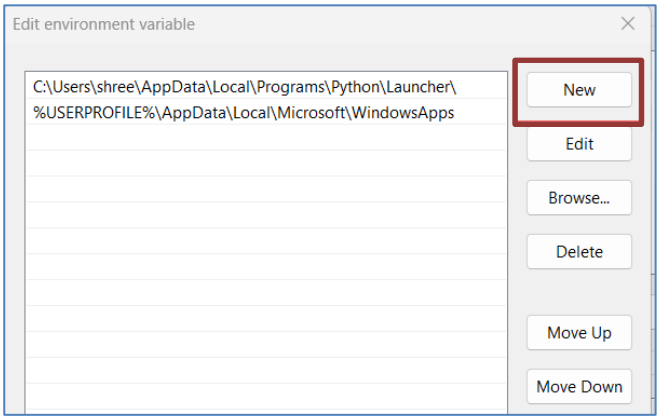
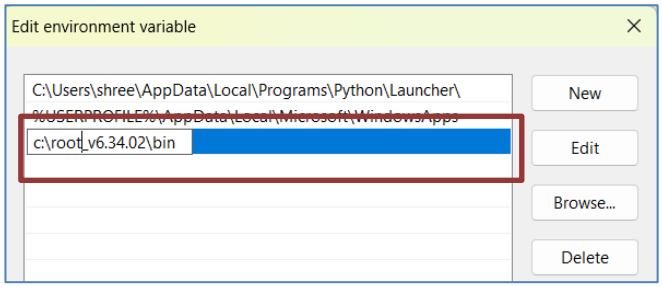


Figure 3 : Registration of ROOT path with environment

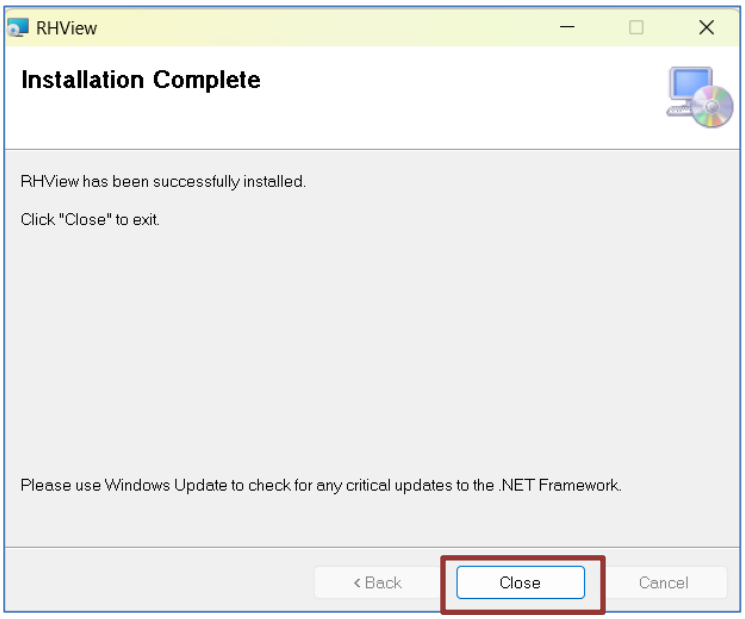
Select **PATH** and click on "**Edit**" button as shown in above picture.



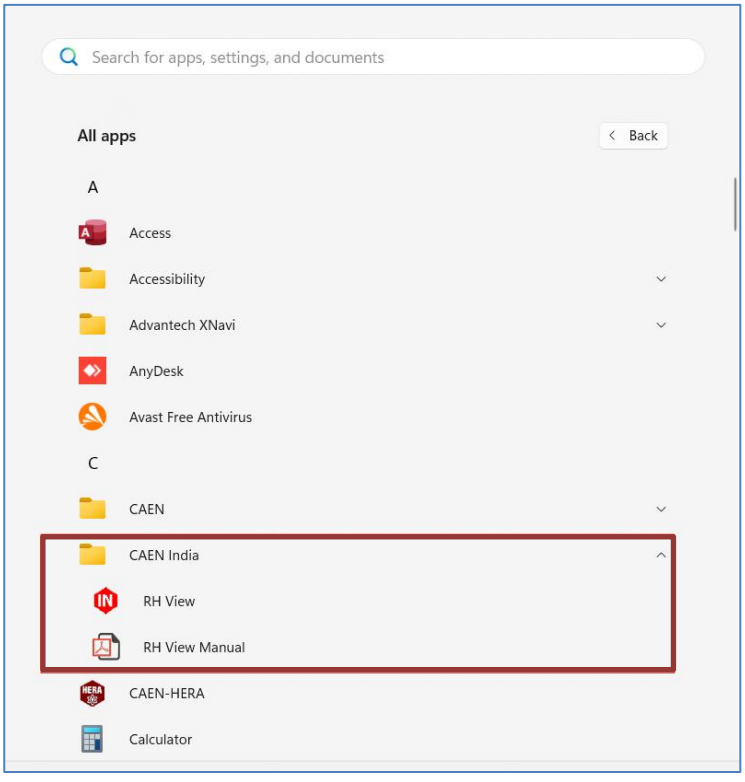
Click on "**New**" button as shown in above picture.



Enter new path as "**C:\root_v6.34.02\bin**"
Click "**OK**" on all subsequent screens to close them and complete installation.



Then installation will complete.

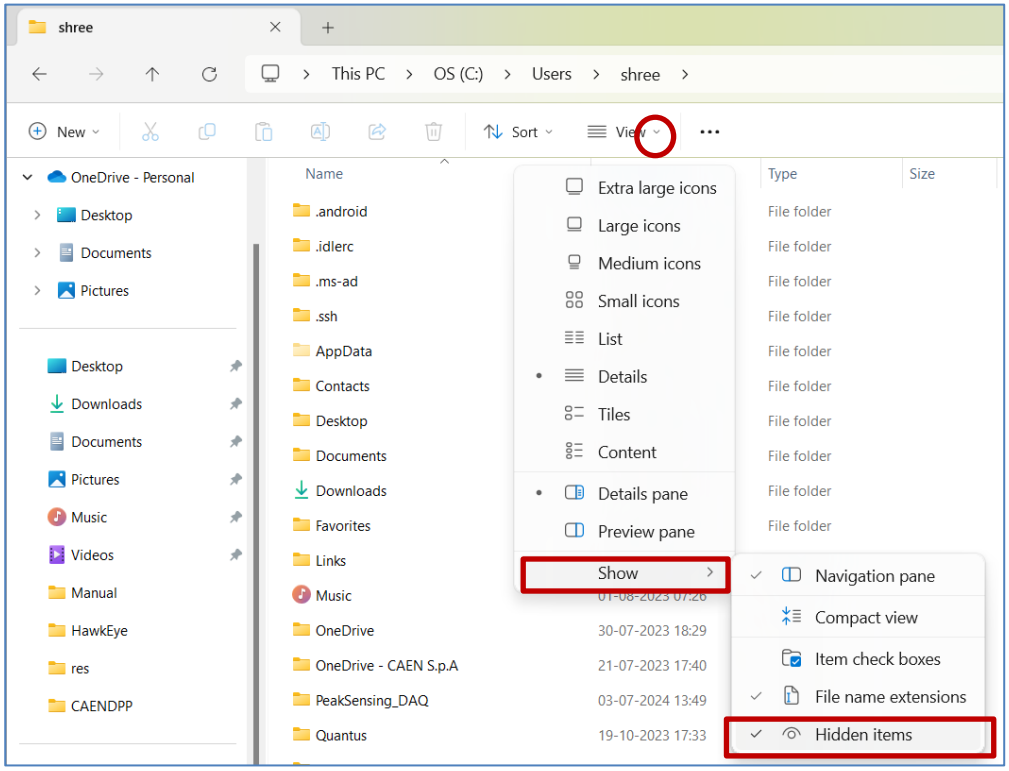


Short cut will be added to Program Menu as shown above.

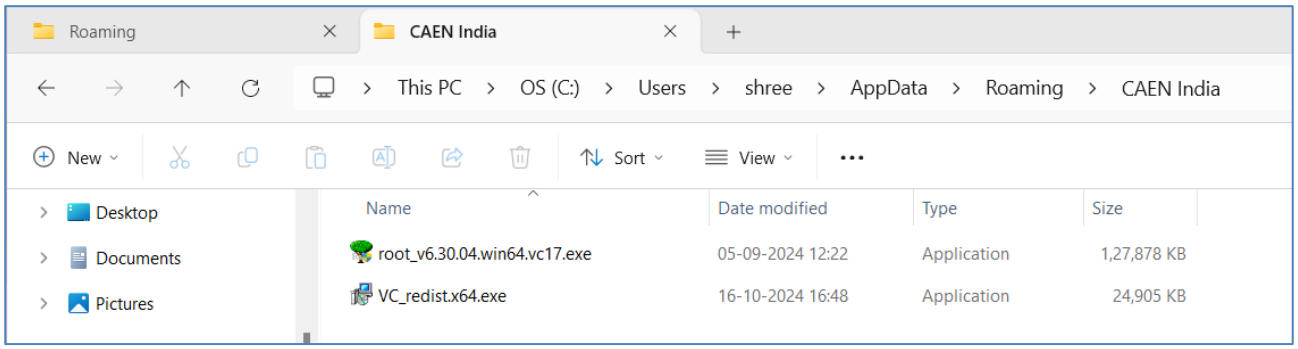
Before starting "**RH View"** application, make sure that following programs are installed on your laptop.

1. Root, Version 6.34.02
2. Windows 11 SDK, Version 10.0.26100.xxxx

Installation files for above programs will be available inside your App Data folder after installation of "RH View" program. AppData is hidden folder. To see the contents of this folder, select "**Hidden Items**" option as shown below.



If your login name is "ABC", then installation files will be available in folder "C: > Users > ABC > AppData > Roaming > CAEN India"



3 Hardware and Software Setup

Hardware setup, in case of HawkEye is very simple. Plug the detector, on 14 pin socket. Connect communication cable (USB or Ethernet) between HawkEye and PC. In case of wireless connection, plug wireless adapter provided with the unit into the USB socket. Press power switch and turn on the unit. HawkEye has internal battery. If battery voltage is low, connect the power cable and turn on mains supply. Refer "**HawkEye User Manual**", **Document no UM9761**, for battery status indication details.

In case of Red Eagle, external preamplifier is necessary. Connect high voltage supply output and low voltage supply (9 pin connector on rear panel) to the preamplifier. Connect signal output of preamplifier to Red Eagle signal input. Connect power cable and turn on the mains supply. Refer **"Red Eagle Quick Start Guide Instructions for use", Document no GD9792.**

Both HawkEye and Red Eagle have Power button. Press power button to start the unit.

USB Drivers

In case of Red Eagle or HawkEye, the miniUSB driver will be automatically installed when the board is connected to the computer for the first time. The device will be recognized under the "Device Manager" window among "Network adapters" as Remote NDIS Compatible Device.

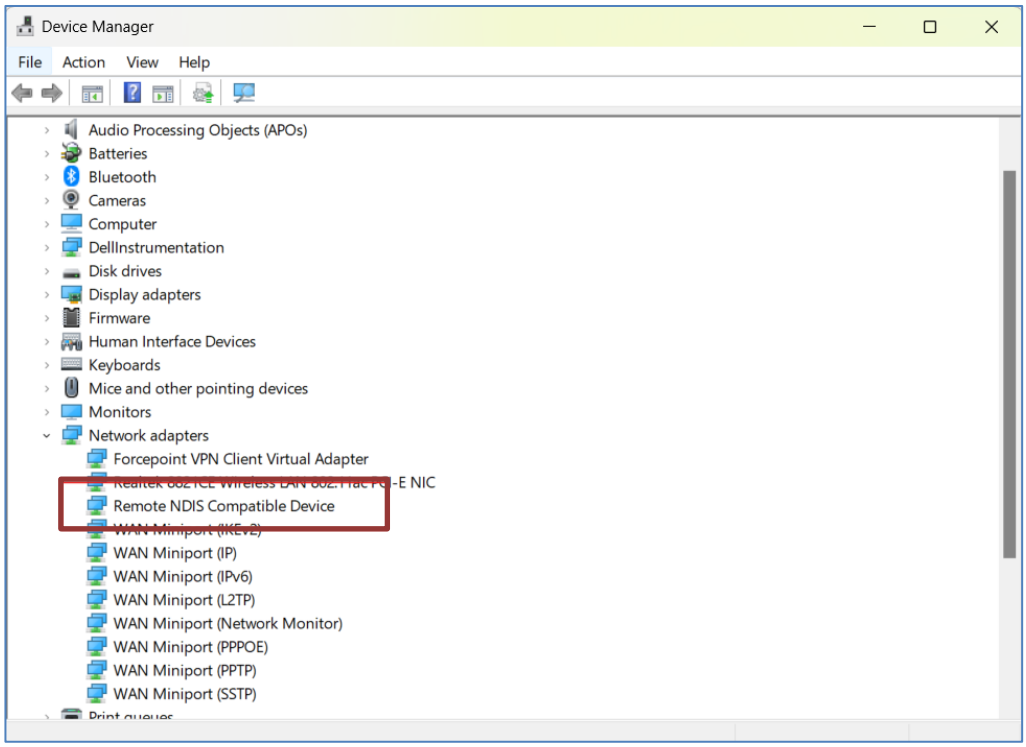


Figure 4 : MiniUSB Connection (Device Manager)

Ethernet Connection to the PC

1. Connect the Ethernet cable from unit to the PC.

2. Configure the Ethernet network of your PC.

a. Open the path: Control Panel ----> Network and Internet ----> Network and Sharing Center

b. Click on ”**Change adapter settings**”

c. Right click on the Ethernet icon and select ”**Properties**”, as in Fig. 5

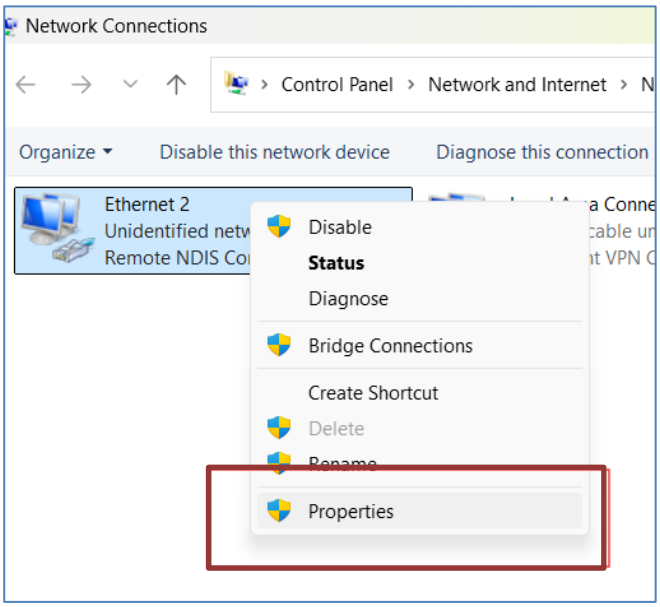


Figure 5 : Network Properties

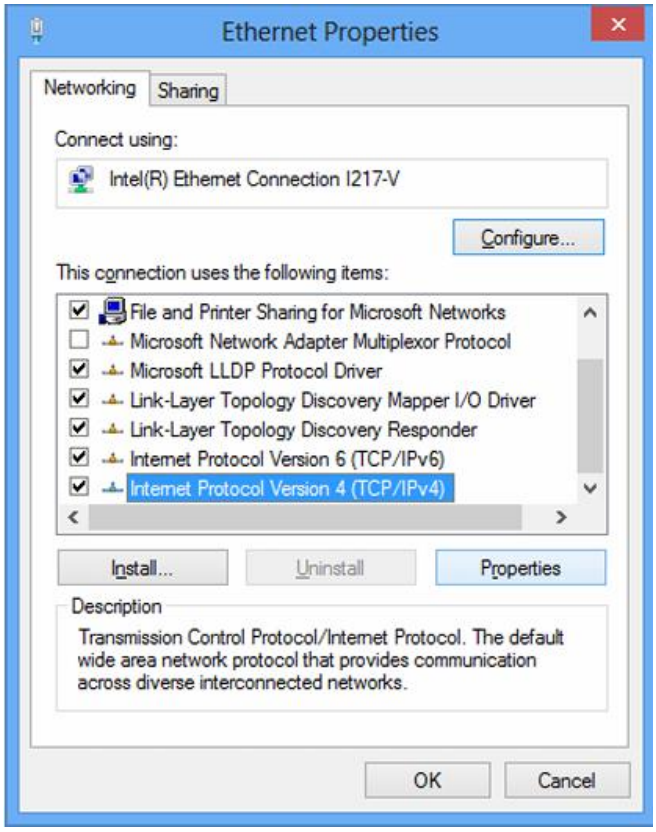


Figure 6 : Ethernet Connection Properties (Network and Sharing Center)

d. Click on ”Internet Protocol Version (TPC/IPv4)”, and select ”Properties”, as in Fig. 6

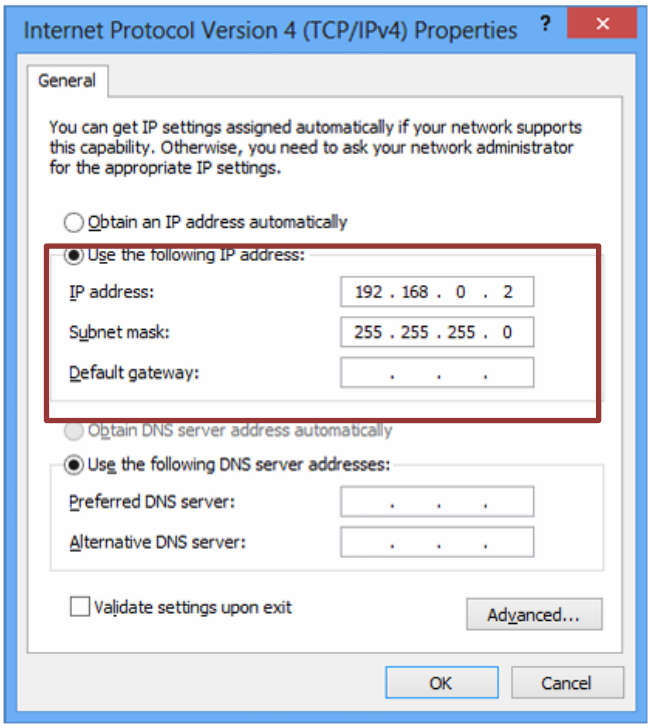


Figure 7 : Properties window of Internet Protocol Version (TCP/IPV4)

Enter IP address for PC. First three blocks of IP address must match the unit's address. Forth block should be different. For example, if IP address of unit is 192.168.0.1, then IP address of PC should be 192.168.0.xxx where xxx can have value between 2 and 255 (other than 1).

4 Description

New Workspace

This software saves all settings of board, ROI settings, Calibration constants and many other user selectable values in a file. This file is saved as a workspace. To begin with, it is necessary to create a connection to the unit using USB or other communication interface. The connection tab is visible on the main screen.

Select board model from the list. Select communication interface and enter corresponding parameters.

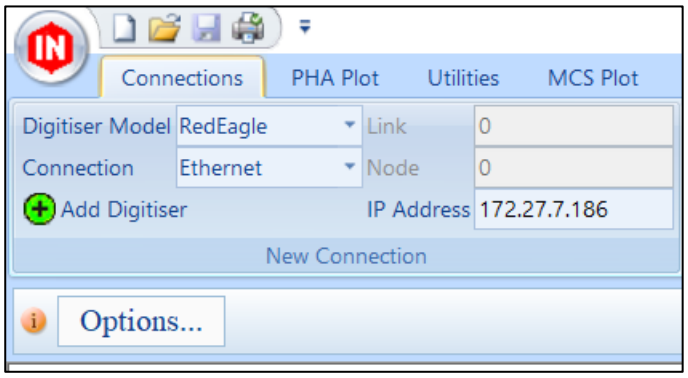


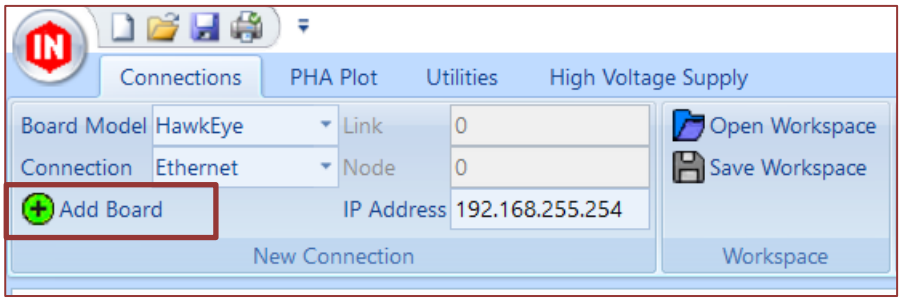
Figure 8 : New workspace and connection

Following table summerises the communication parameters.

Table 1 – Communication Details

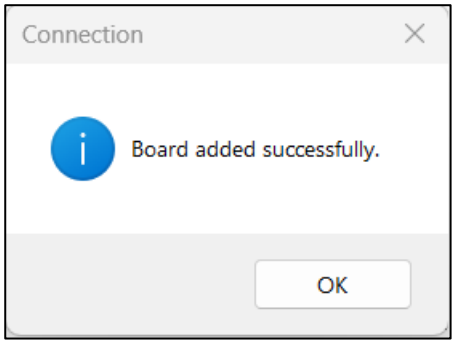
Model	Communication Type	Default Parameter
Red Eagle	Mini USB	Link = Not Applicable Node = Not Applicable Connection = Ethernet IP Address = 172.27.7.186 **(Verify address on LCD)**
	Ethernet	Link = Not Applicable Node = Not Applicable Connection = Ethernet IP Address = 172.16.0.2
HawkEye	Mini USB	Link = Not Applicable Node = Not Applicable Connection = Ethernet IP Address = 192.168.255.254
	Ethernet	Link = Not Applicable Node = Not Applicable Connection = Ethernet IP Address = 192.168.0.1

After connection details have been entered, click on **"Add Board"** button.

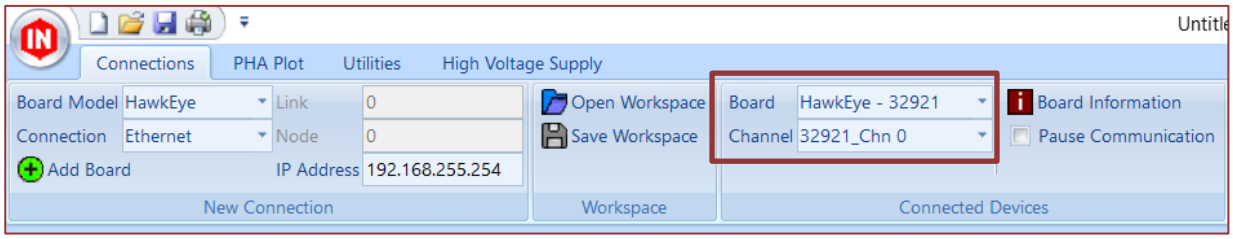


In case of failure, error message will appear.

On successful connection, message will be displayed on screen.



Connected unit serial number will be displayed on screen along with available channels.



Communication with board can be suspended using Pause Communication check box. If this box is checked, then the software will not communicate with the board. However, the board will continue to acquire spectrum if acquisition is started earlier.

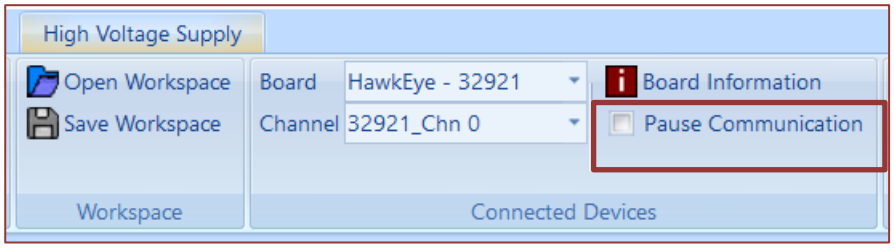
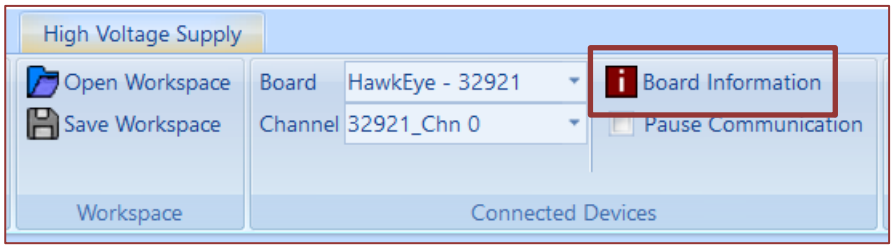


Figure 9 : Pause Communication

Information of the connected board can be retrieved by clicking "**Board Information**" button.



Information will be displayed on screen.

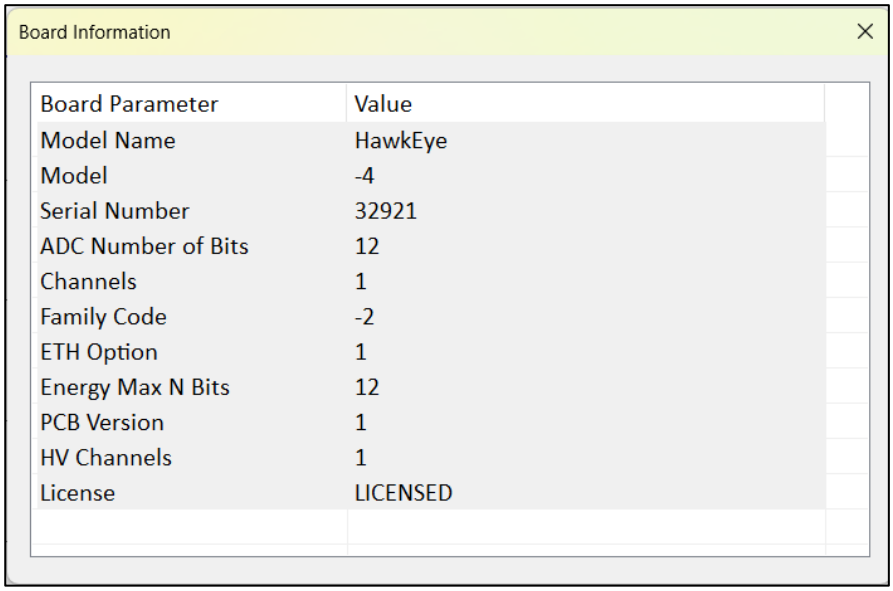


Figure 10 : Board Information

Save Workspace

After creating connection to the board, save the connection settings in workspace.

Click on "**Save Workspace**" button.

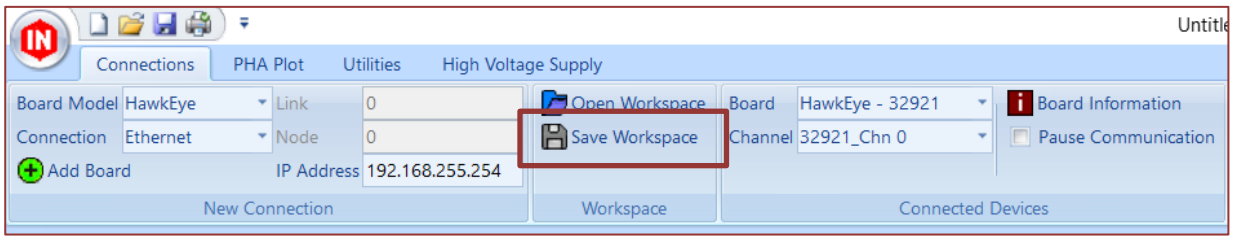
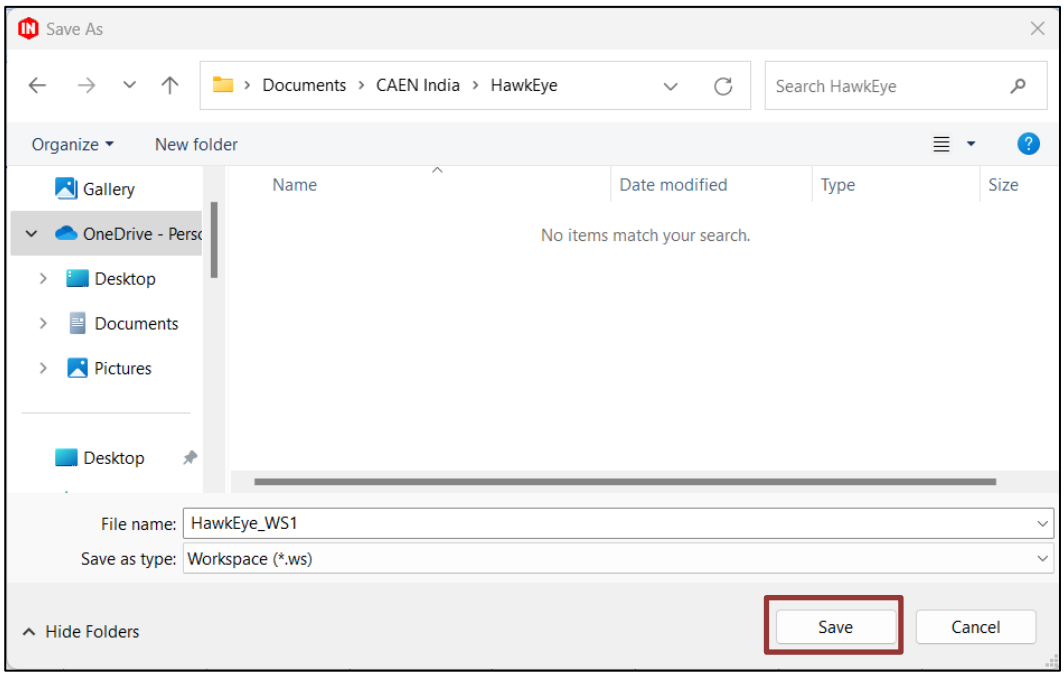


Figure 11 : Save Workspace

File dialog will open. Enter the required workspace name and select directory to save the workspace.



Click on "**Save**" botton to complete.

Open Workspace

Workspace file stores all the connection details along with board parameters. So next time you start the software, click on Open Workspace button. All previously connected boards will be connected again with same communication settings.

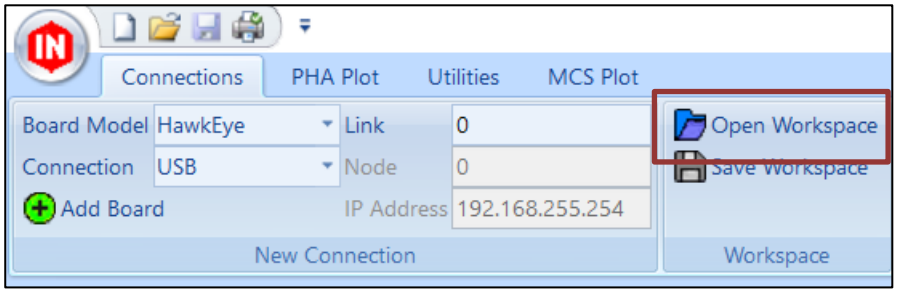
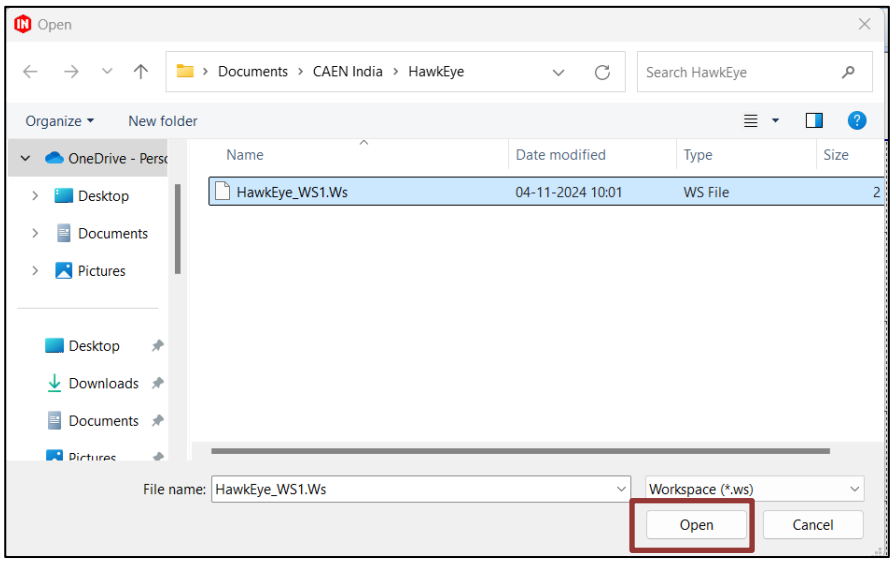


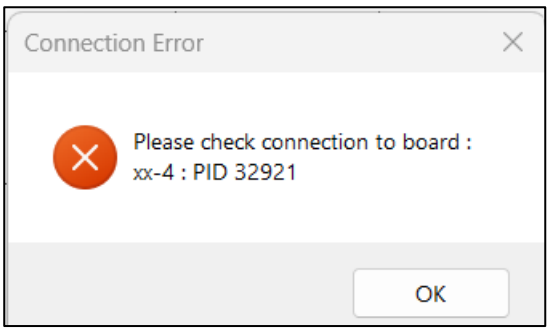
Figure 12 : Open Workspace

Click on "**Open Workspace**" button. File dialog will open.



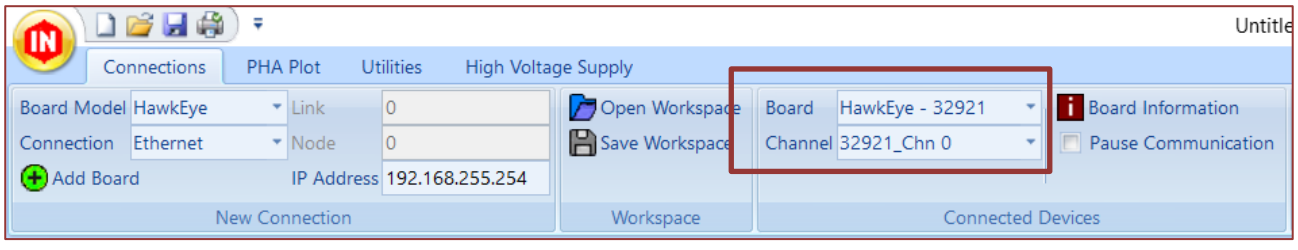
Select the workspace name and directory. Click on "**Open**" button to complete.

While opening the previous workspace, software checks the presence of previously connected boards. So, if the board is not connected, the software will display error message after scanning for a few seconds.



If the connections are successful, it will display board serial number in "Connected Devices" tab as shown here.

Please note that if the board is acquiring spectrum while opening workspace, connection error will come. In such cases, wait till the board completes acquisition. Then try to open the workspace again.



Also, the connection status will be displayed in Caption Bar.

High Voltage Supply Control

Click on "**High Voltage Supply**" tab to control high voltage supply.

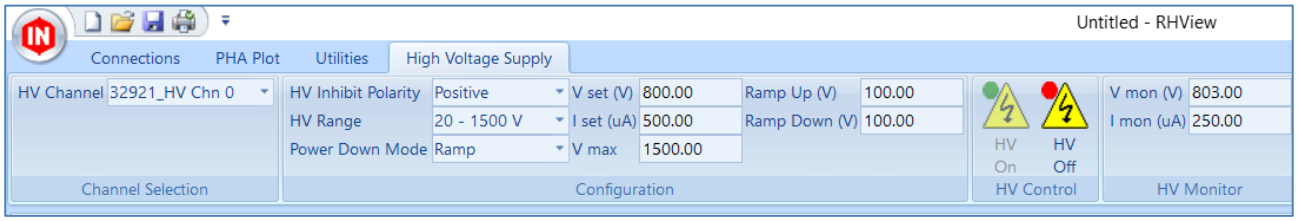
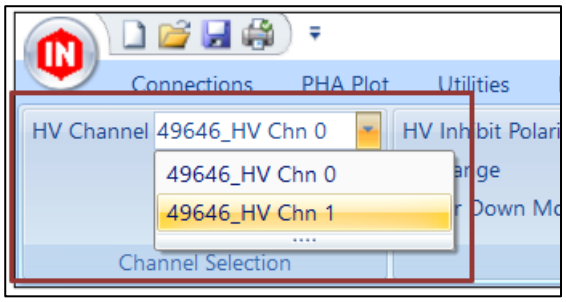
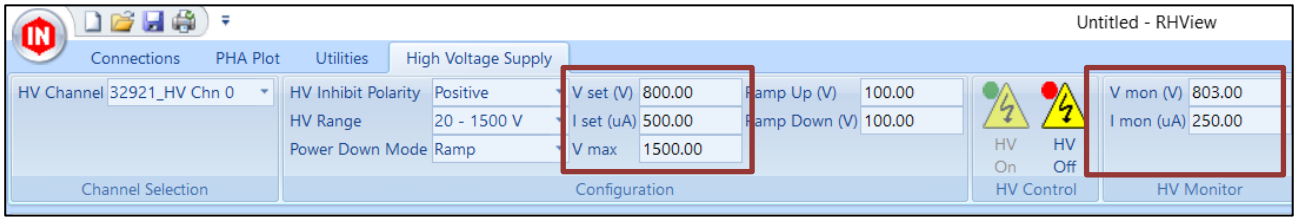


Figure 13 : High Voltage Supply Settings

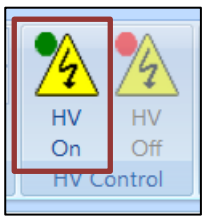
In channels selection group, select the required channel. Then enter the required channel settings in configuration group, Polarity, Range, Set values for voltage and current etc. Enter Ramp Up and Ramp Down value for high voltage supply.



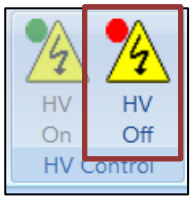
If the HV supply current, exceeds the set value of current, then HV supply output drops and limits voltage output sothat the current does not exceed the set value. Observe the image shown here which displays over current effect.

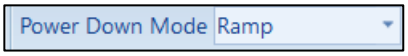


Turn on the HV supply by clicking "**HV On**" button. HV voltage output ramps up at rate entered by user. Please note that if this rate is zero, then output voltage will never rise to set value.

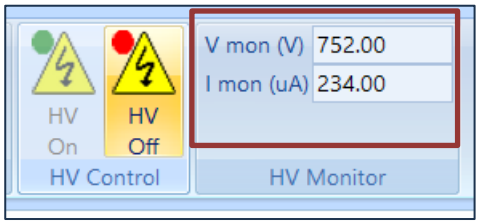


To turn off the HV supply output, click on "**HV Off**" button. Based on power down mode selection, HV supply output drops. When "**Power Down Mode**" is Ramp, high voltage output drops at the rate entered as "**Ramp Down**" value. When "**Power Down Mode**" is Kill, HV output drops to zero immediately.





Output voltage and current are displayed in "HV Monitor" group.



Configuration of Channel Settings

This software supports only Pulse Height Analysis. Energy histogram is displayed in PHA plot.

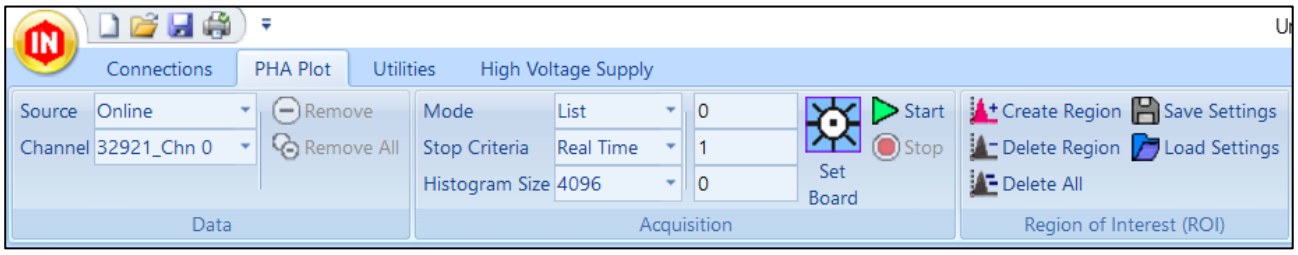
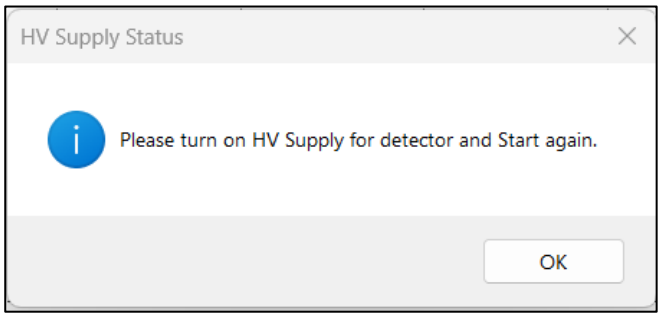


Figure 14 : PHA Plot and Spectrum Acquisition

In case of Red Eagle and Hawkeye models, if the high voltage supply is off, then warning message will be displayed on screen. Acquisition will never start if high voltage supply is off.



To acquire proper spectrum, it is necessary to set the board properly. Select **Wavefrom** mode in Acquisition group of PHA plot tab as shown in the figure below. Select **Manual** mode as Stop Criteria. Set required histogram size from dropdown list. Then click on "**Start**" button.

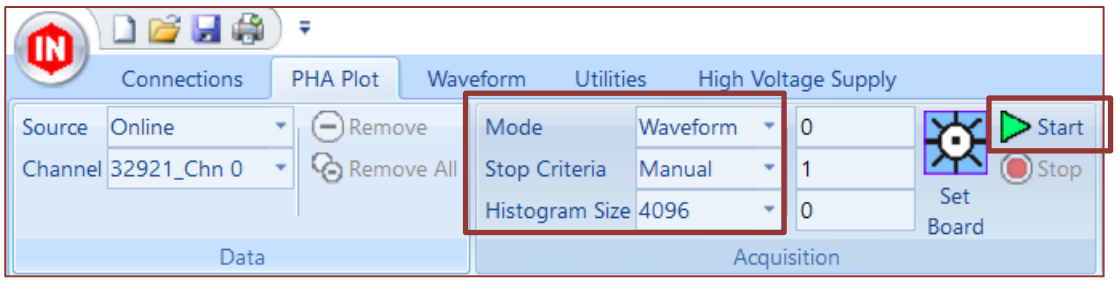


Figure 15 : Start Acquisition

Ckick on Waveform tab to observe board waveforms. Please note that Waveform tab is visible only when Waveform mode is selected while acquiring. In case of List mode, Waveform tab is hidden.

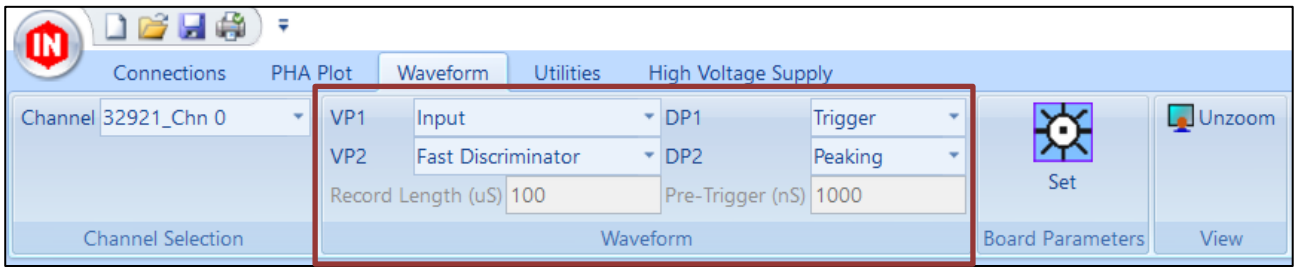


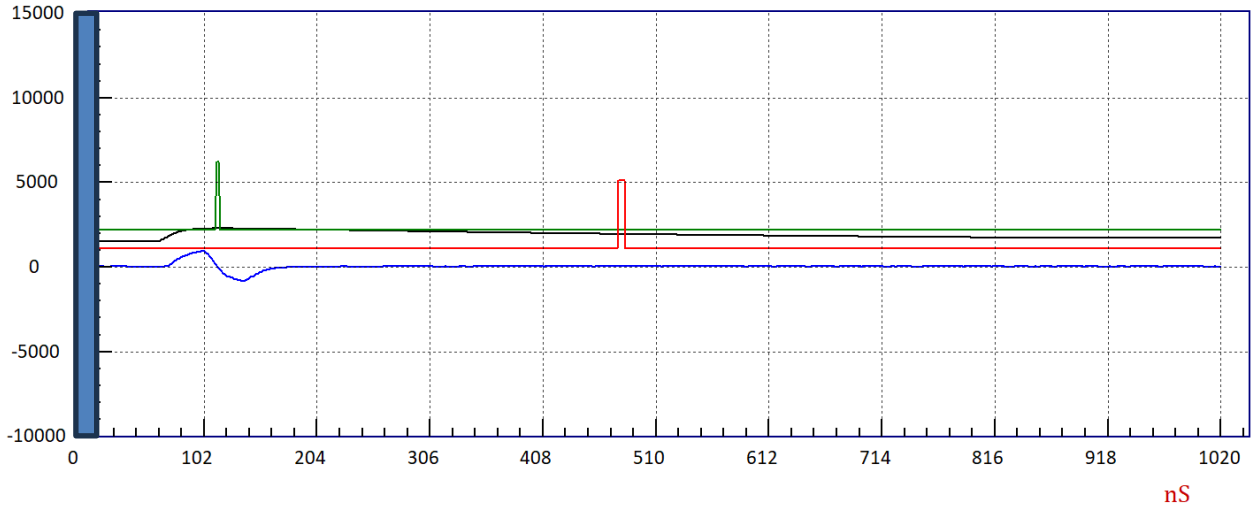
Figure 16 : Waveform Inspection

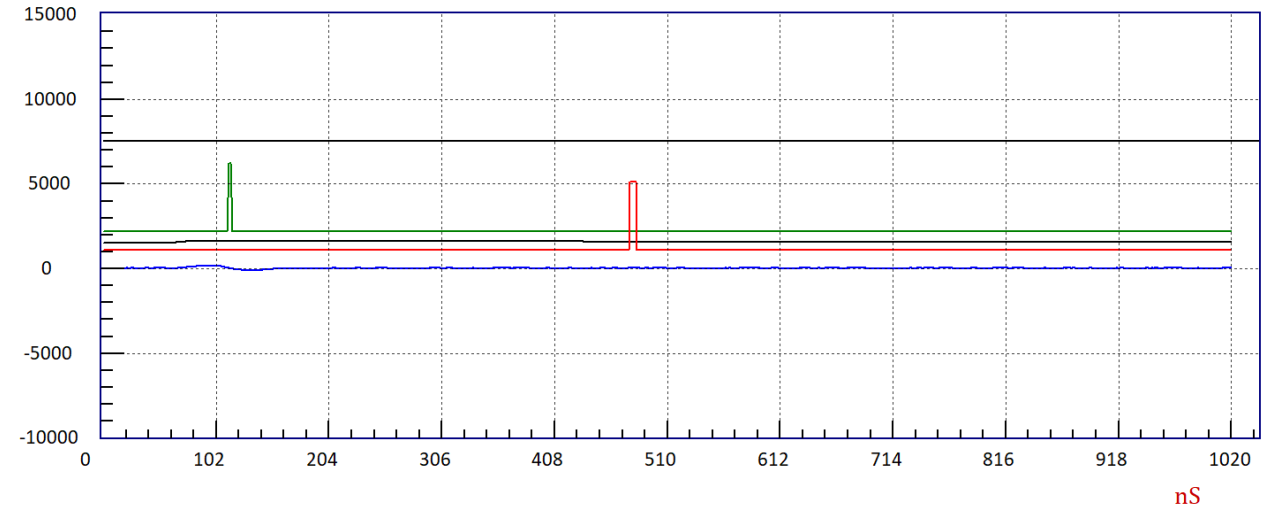
In case multiple channels, each channel is accessible through “Channel Selection” group on left side. Select required channel from the “Channel” list. It is possible to visualize a set of analog and digital traces. Start with the visualization of:

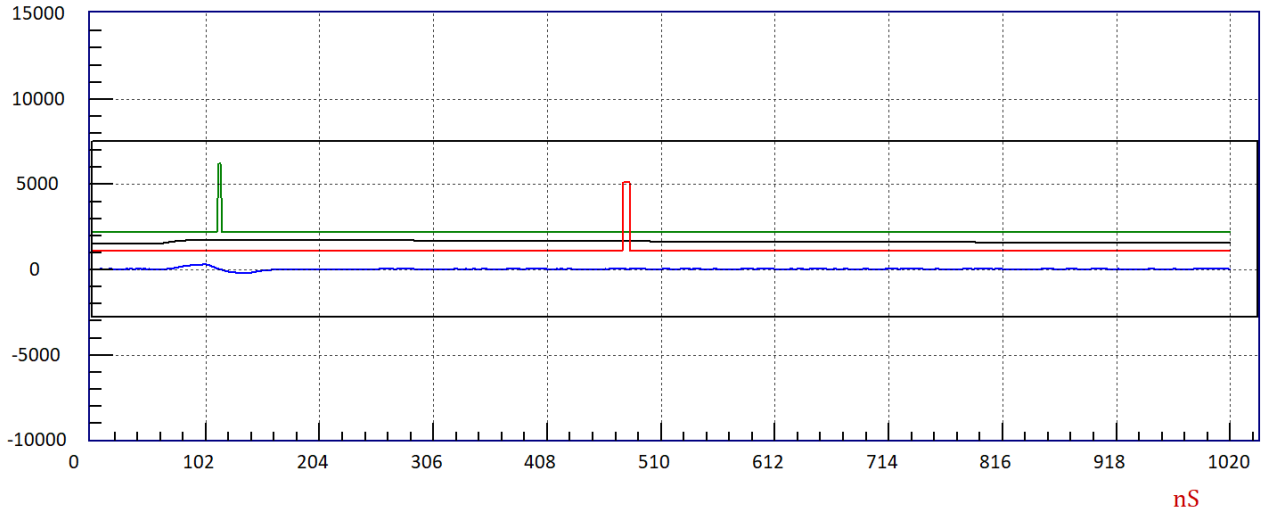
- “Input” as “VP 1” (Black color)
- “Fast Discriminator” as “VP 2” (Blue color)
- “Peaking” as “DP 1” (Red color)
- “Trigger” as “DP 2” (Green color)

Set Record Length and Pre-Trigger to get full view of the input signal. In case of Hawkeye, these two parameters are default. Hence, they can not be set.

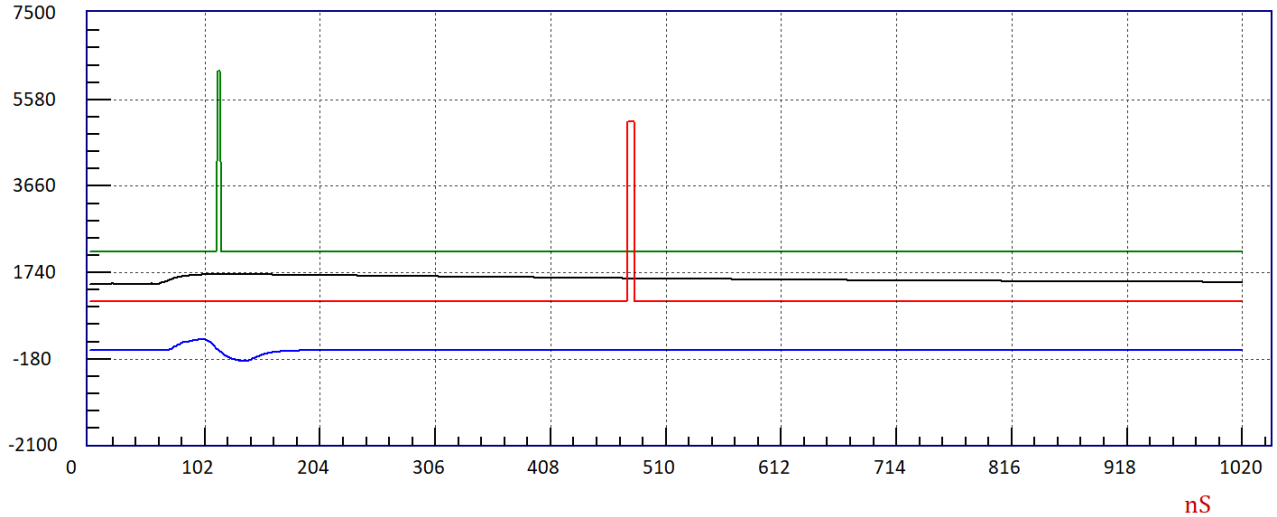
To get better view of the signal, zoom the required portion on screen using left click and drag mouse events. Keep left button pressed. Click on left side of the Y axis on screen to change y scale. Such portion is shown in blue color.



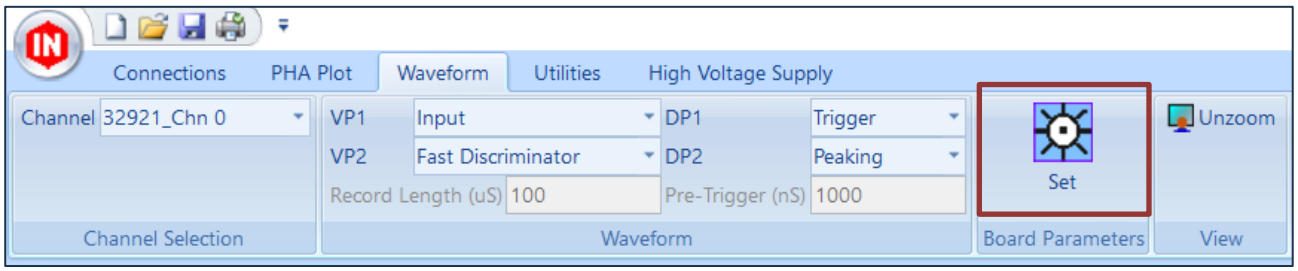




After selecting required portion, release the mouse button.



Now measure rise time of input signal and enter the value in board settings. Click on Set button to enter board settings.



Following screen appears.

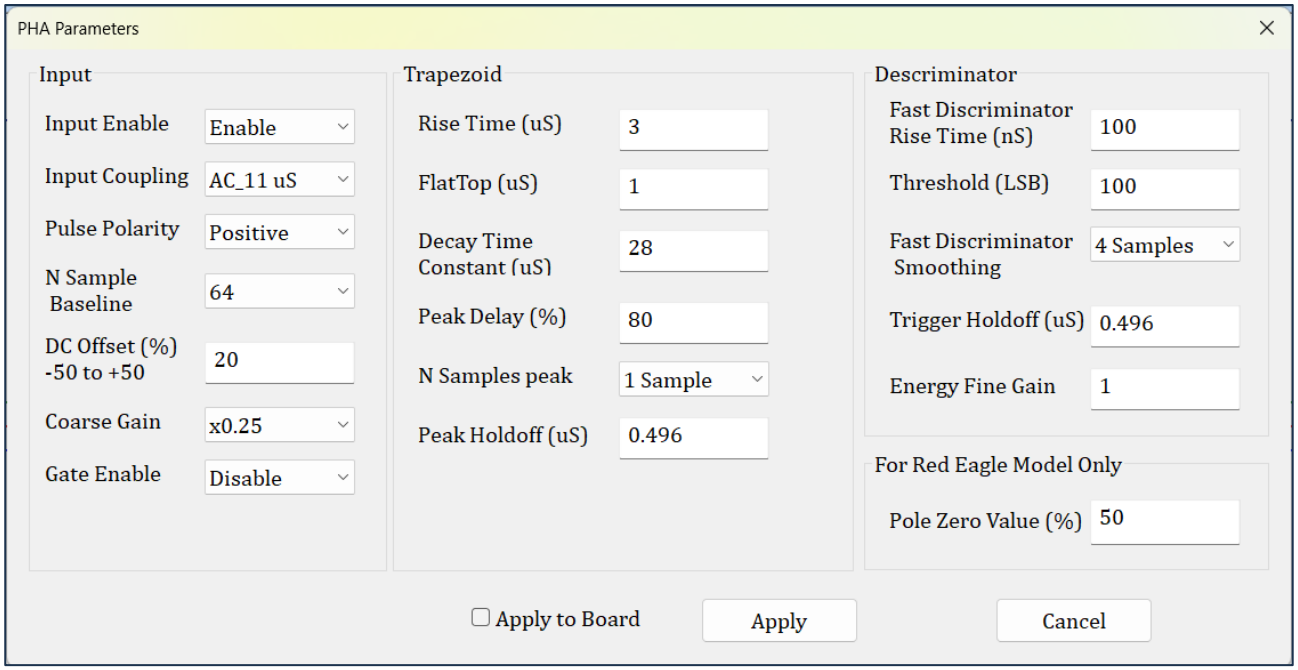


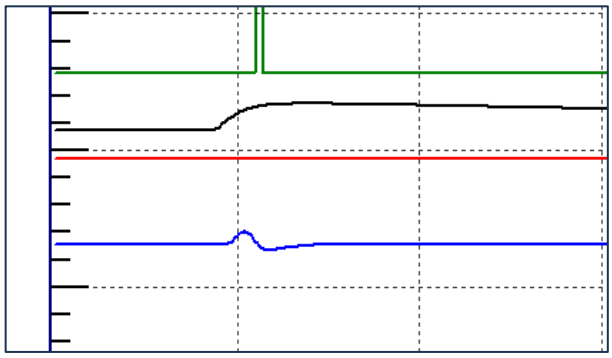
Figure 17 : Settings

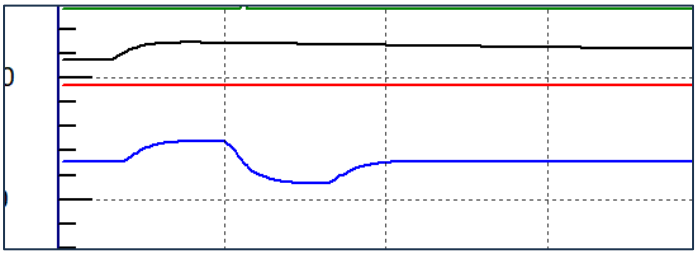
- Select Enable option for channel.
- Select polarity of input signal.
- Set DC offset for signal input. In case of Hawkeye, DC offset can not be set. It is always zero.
- Input coupling is applicable only in case of Red Eagle. Select required option of coupling.
- Enter Fast Discriminator Rise Time.
- Set the necessary gain value.
- Set Fast Discriminator smoothing factor to 4 or more

Click on "**Apply**" button to proceed. In case of multiple input channels, if same setting is to be applied, then click, "**Apply to Board**" check box and then click "**Apply**" button. Now observe the "Fast Discriminator" trace.

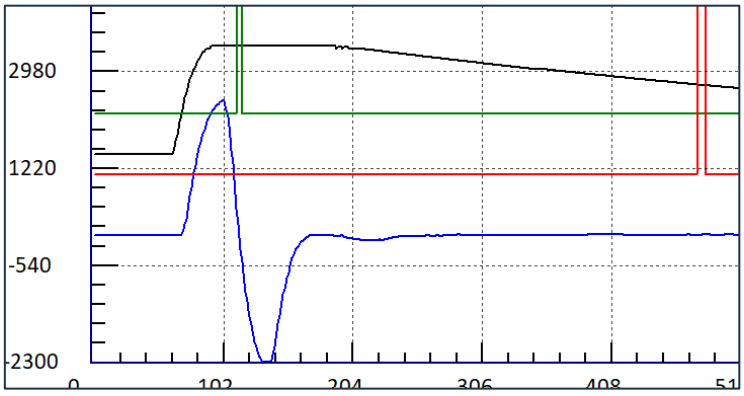
Set the "Fast Discriminator Rise Time" value to have the same height of "Fast Discriminator" signal and the input pulse. Try to avoid cases where the "Fast Discriminator Rise Time" is too short (the Fast Discriminator height will be less than the input) and where the "Input Rise Time" is too long,

which are represented in the following figure. On the left the value is underestimated, on the right it is overestimated.

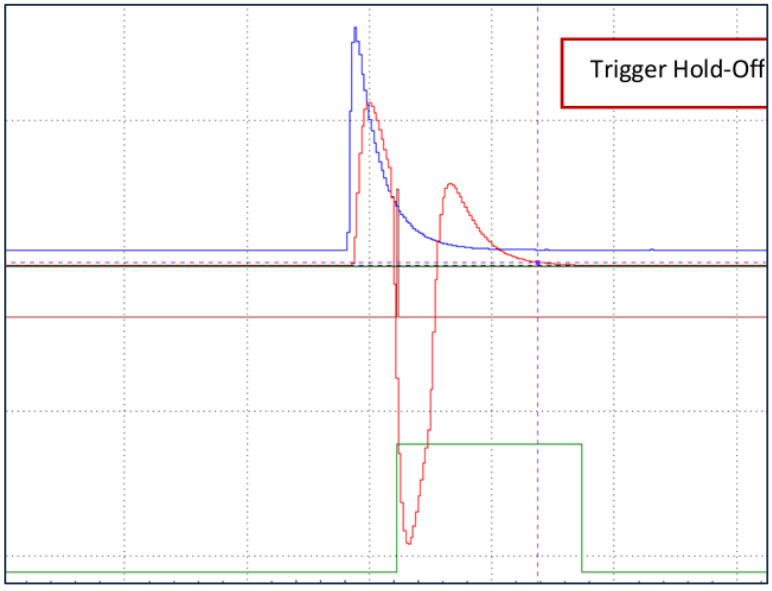




Correct value for input signal entered.



In case the “Fast Discriminator” signal shows an overshoot, set the “Trigger Hold-Off” value as long enough to eventually include the overshot inside it. The algorithm then inhibits any trigger occurring during the whole “Trigger Hold-Off” duration.



Next step is to set trapezoid filter.

How to set the Energy Filter

The precise configuration of the Energy Filter strongly affects the final resolution measurement; therefore it is very important to fine tuning the Energy Filter settings. The user must take care of:

• Checking that the trapezoid is correctly shaped;

• Evaluating the energy value (see the Peaking trace) in the flat top region of the trapezoid.

The two typical measurement setups that we are going to discuss are:

1. Low rate (up to few hundreds of Hz) and very high precision measurement;

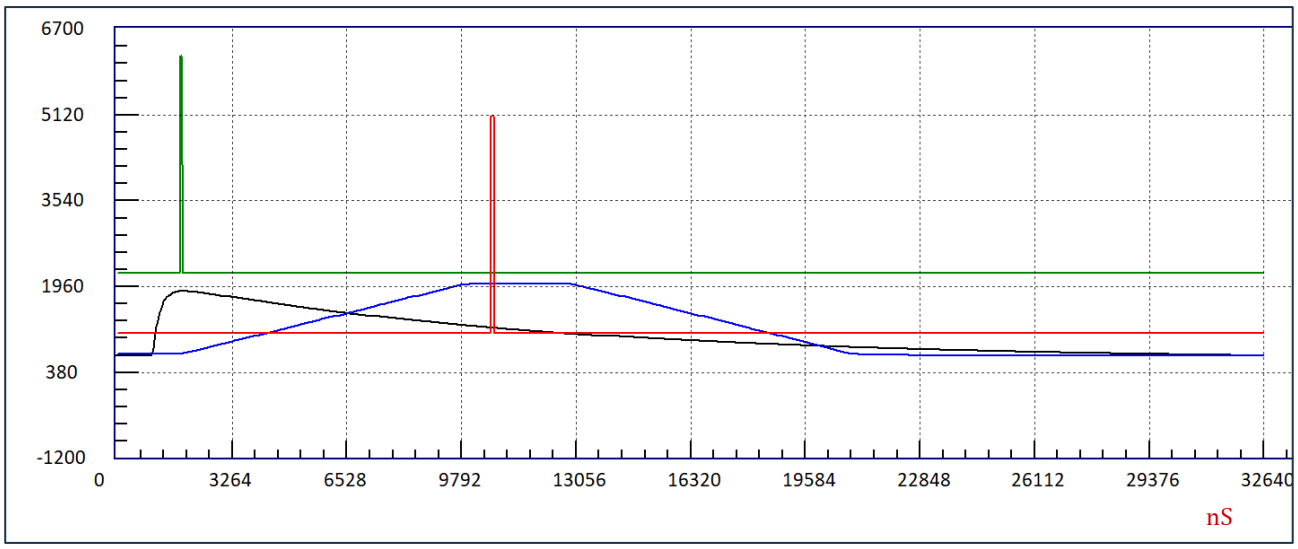
2. High rate (up to tens of kHz), where the result is a compromise between high resolution and dead-time.

Select now

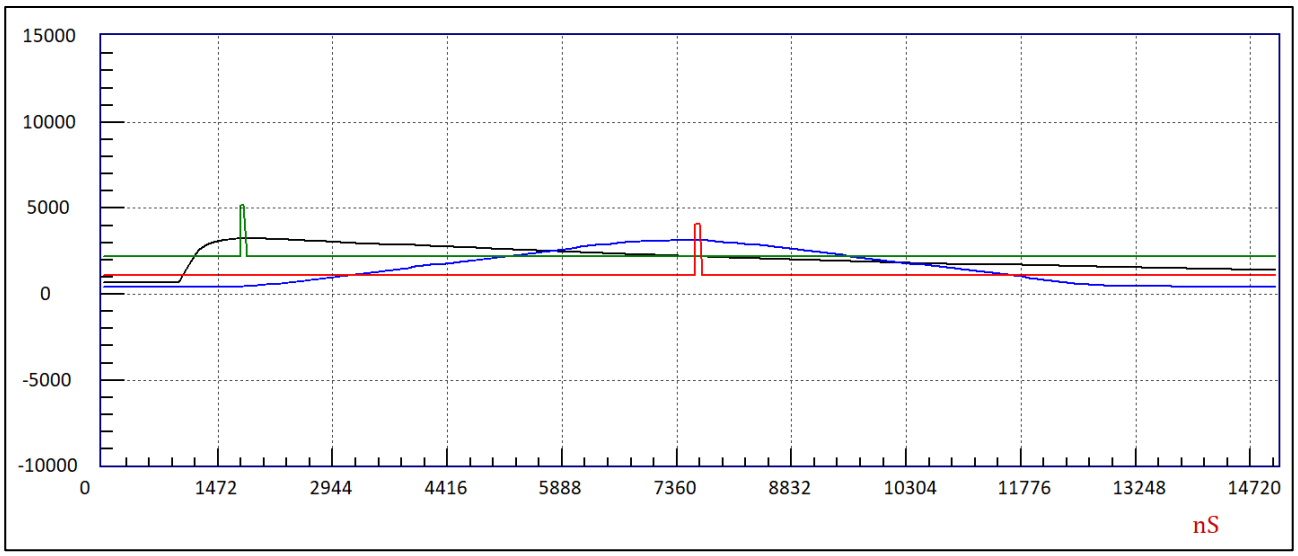
- "Input" as "VP 1"
- "Trapezoid-Baseline" as "VP 2"
- "Peaking" as "DP 1"
- "Trigger" as DP 2

The baseline of "Trapezoid - Baseline" trace should be at 0.

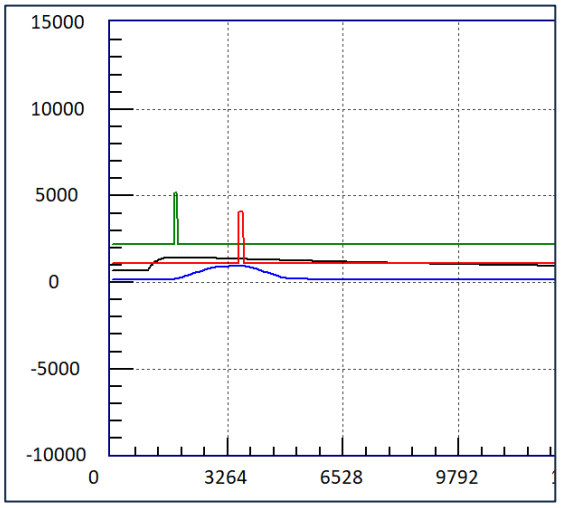
In the low-rate case, it is recommended to set a high value of "Trapezoid Rise Time", as for example 8 us. Considering it in the analogy of the analog chain, it corresponds to about 3 us of shaping time. Then set a value of "Trapezoid Flat Top" between 1-2 us, only check that the flat top region is really flat. Finally for very low rate set the maximum value of "Baseline Mean" (i.e. the number of samples for the baseline calculation), i.e. 1024.



Adjust – if necessary – the Peaking position (“Peak Delay”) and the number of samples (“Peak. Mean”) for the energy mean calculation.



In the high-rate case (tens of kCPS) it is recommended to set a lower value of “Trapezoid Rise Time”, as for example 3-4 us. For a rate greater than 20 kCPS it might be convenient to set “Trapezoid Rise Time” = 1 us. Set also “Trapezoid Flat Top” = 1 us, only check that the flat top region is really flat.



Adjust – if necessary – the Peaking position (“Peak Delay”) and the number of samples (“Peak. Mean”) for the energy mean calculation in the flat region.

Pole-Zero Adjustment

The pole-zero adjustment is very important for a correct evaluation of the trapezoid baseline and consequently for a correct evaluation of the energy value. The user must adjust the “Decay Time” according to the Pre-Amplifier decay time. Fine adjustments can be done looking at the zoom of the Trapezoid trace (or Trapezoid-Baseline) to have no undershoot nor overshoot. The two cases are shown in the following figure, where the Decay Time has been set too high giving an undershoot,

and the Decay Time has been set too low thus giving an overshoot. After setting correct trapezoid, unit will be ready for spectrum acquisition.

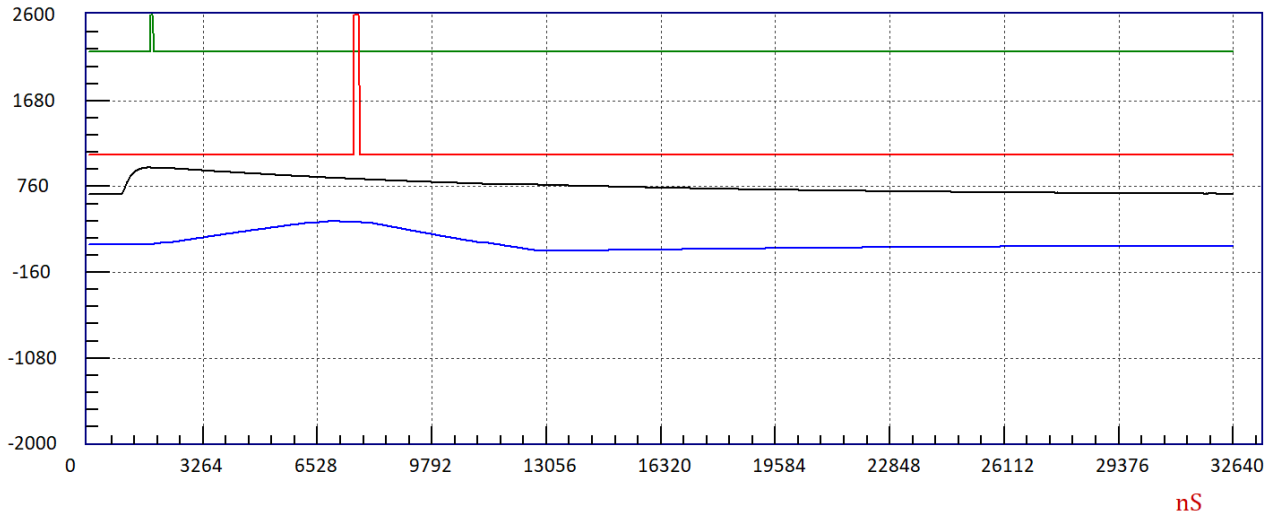


Figure 18 : Decay time, too high

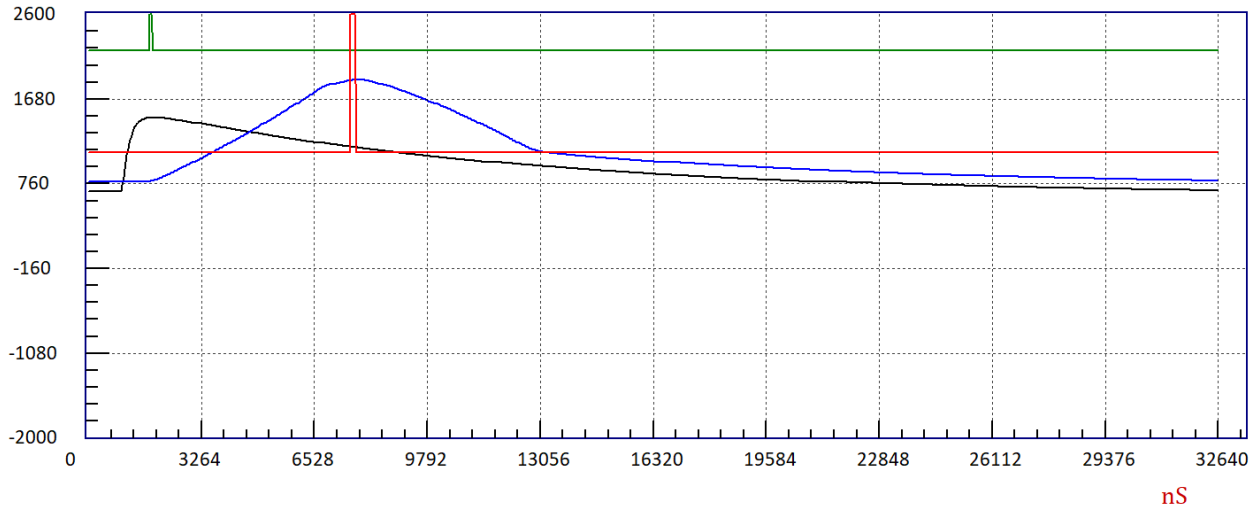


Figure 19 : Overshoot : Decay time, too low

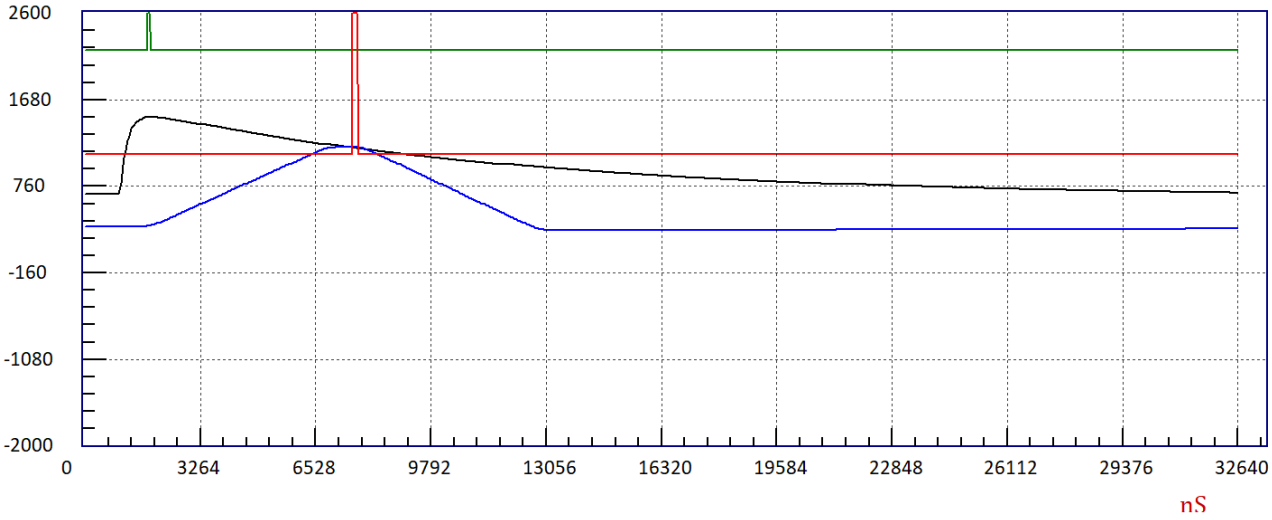
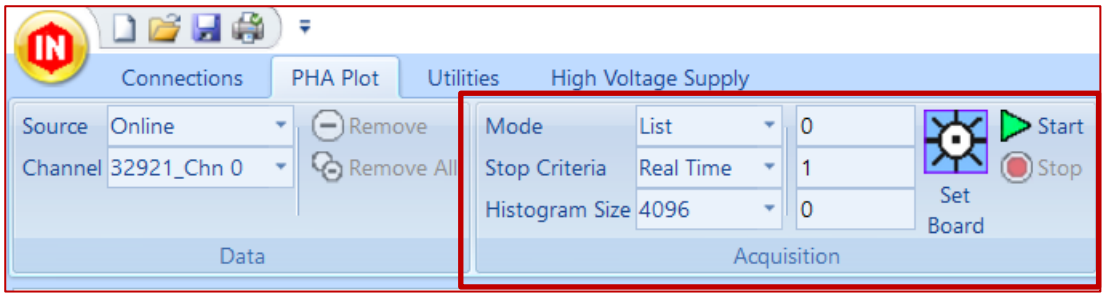


Figure 20 : Decay time, correctly compensated

Start and Stop Acquisition

Once you have configured the channel settings, switch to “List” mode of acquisition.



Set “Stop Criteria” as Real Time or Manual as per requirements. Set preset time in case of Real Time. Click on “Start” button to start spectrum acquisition. PHA plot will be visible on screen.

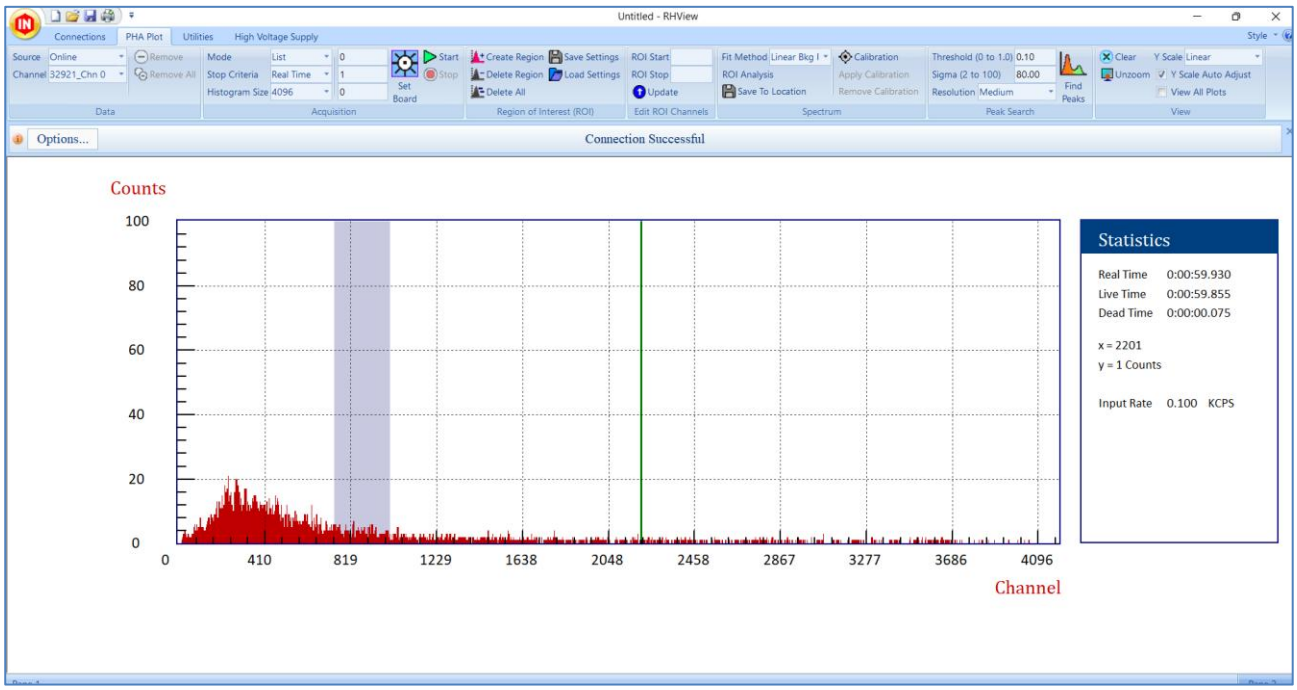
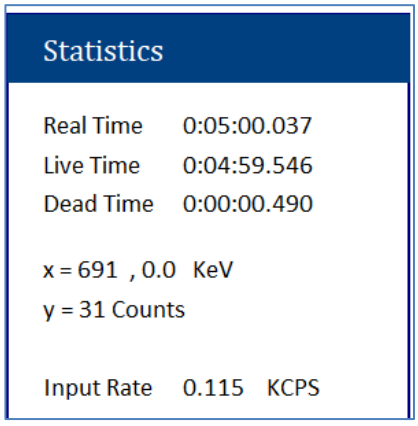
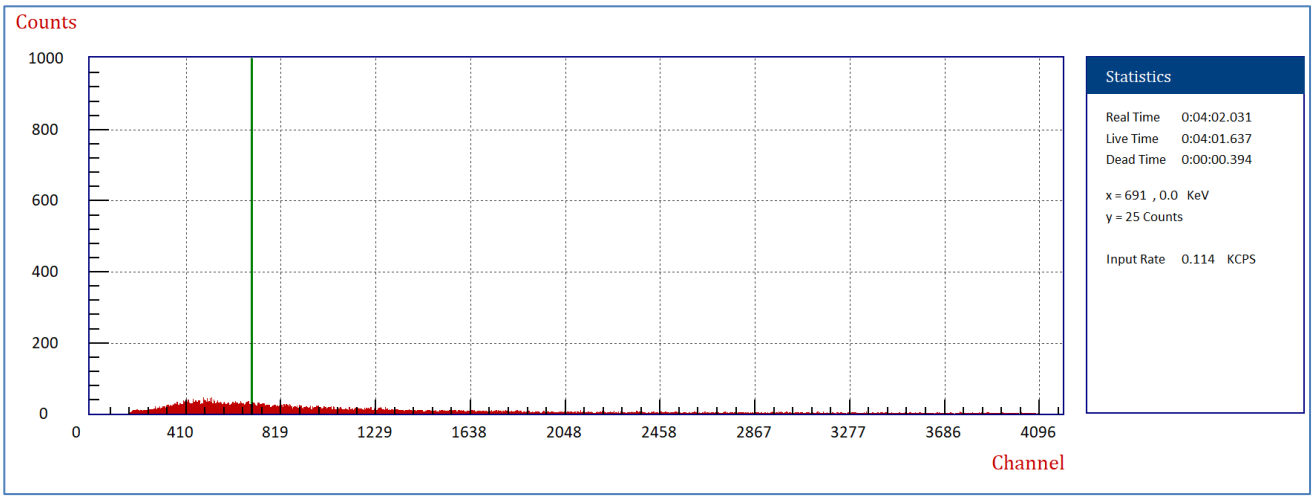


Figure 21 : Energy Spectrum



On right side of the screen, statistics for acquired spectrum are shown.

To change the cursor position, click left mouse button when mouse cursor position is over the required channel of the spectrum. Cursor will be displayed by Green color line over the spectrum.



Horizontal zooming of the spectrum.

Left Click in the area below X axis and drag the mouse. After reaching the required position, release mouse button.

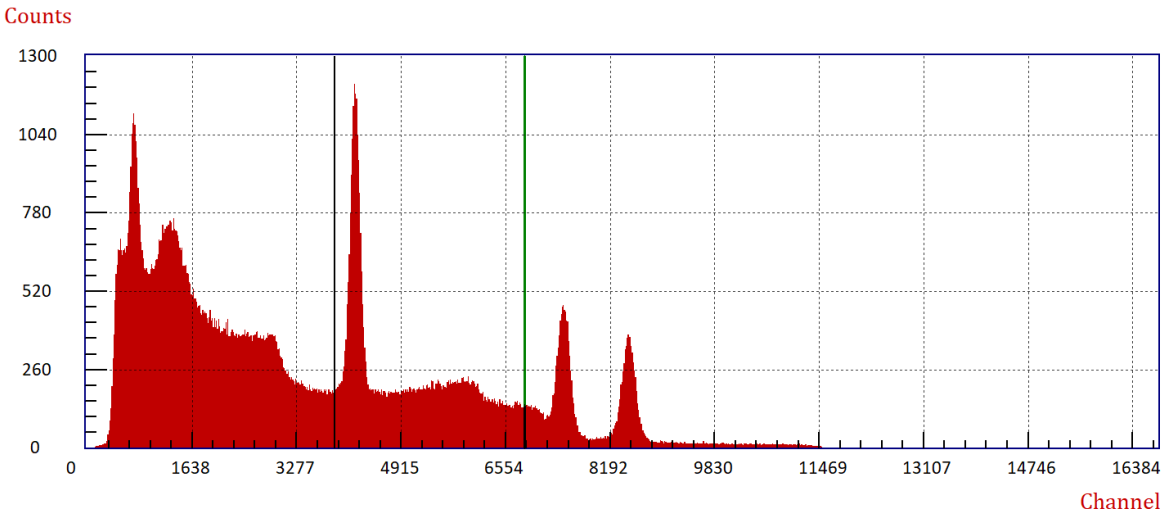
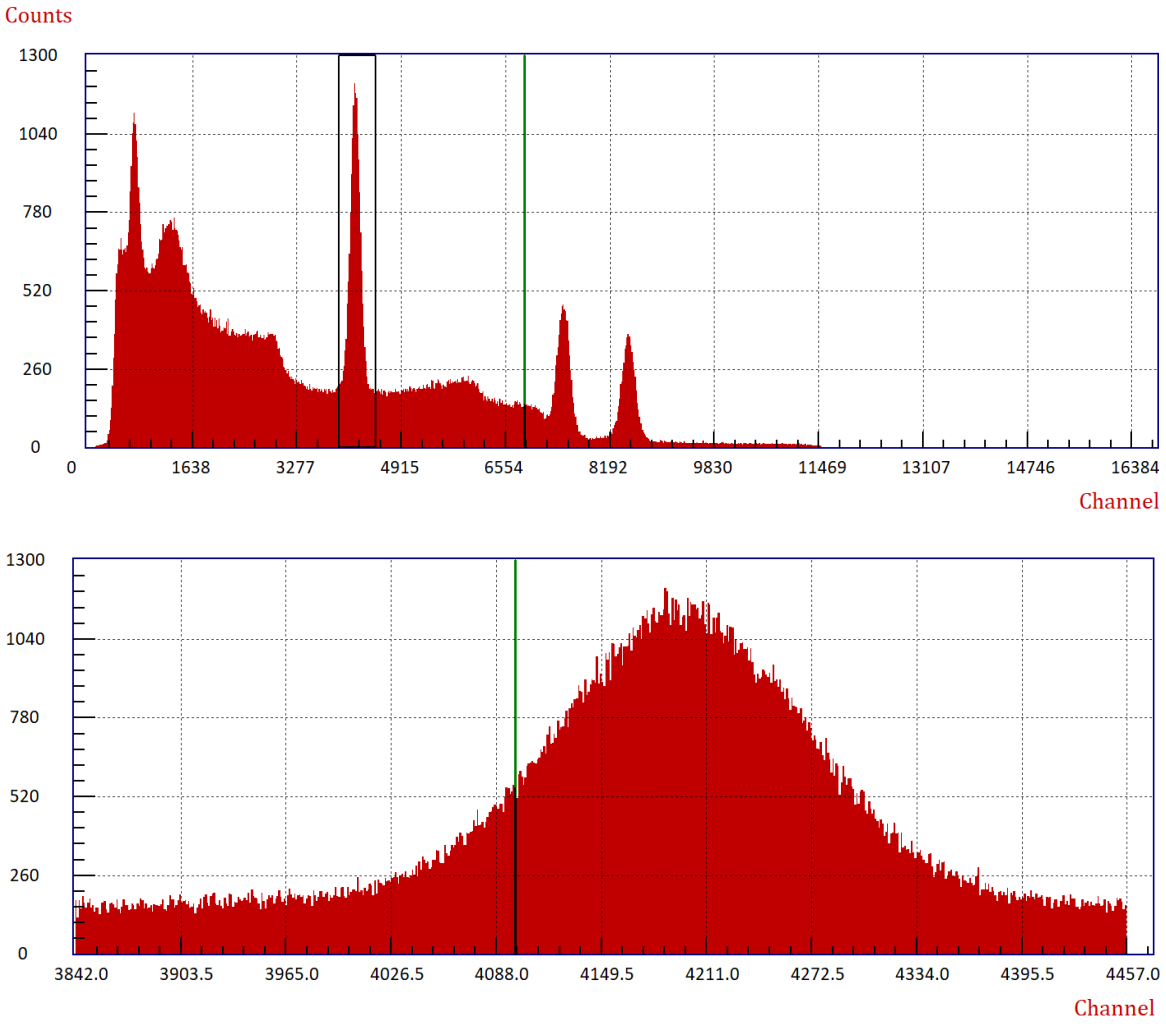


Figure 22 : Horizontal zooming



Vertical zooming of the spectrum.

Left Click in the area adjucent to left side of Y axis and drag the mouse. After reaching the required position, release mouse button.

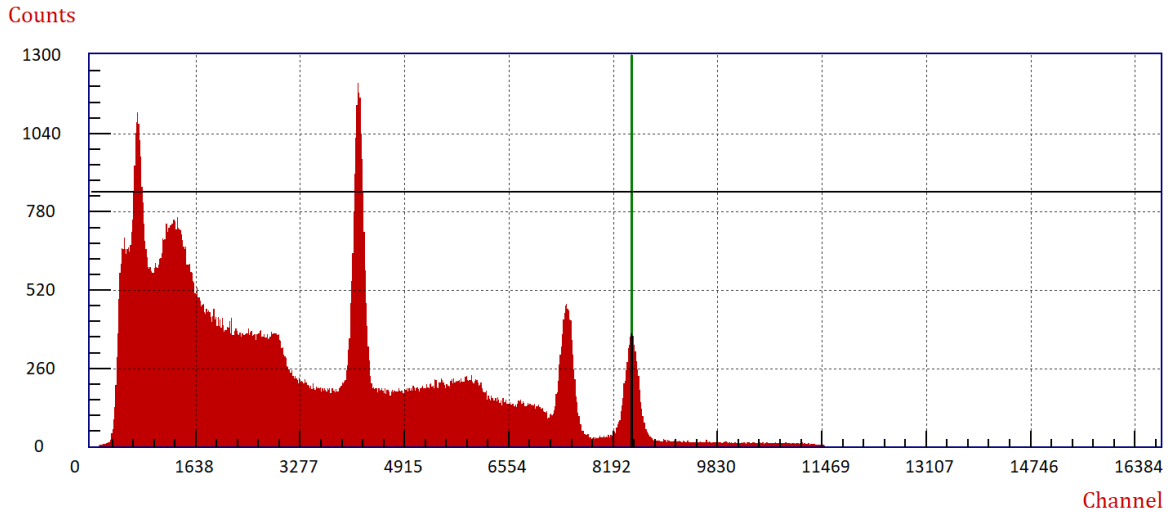
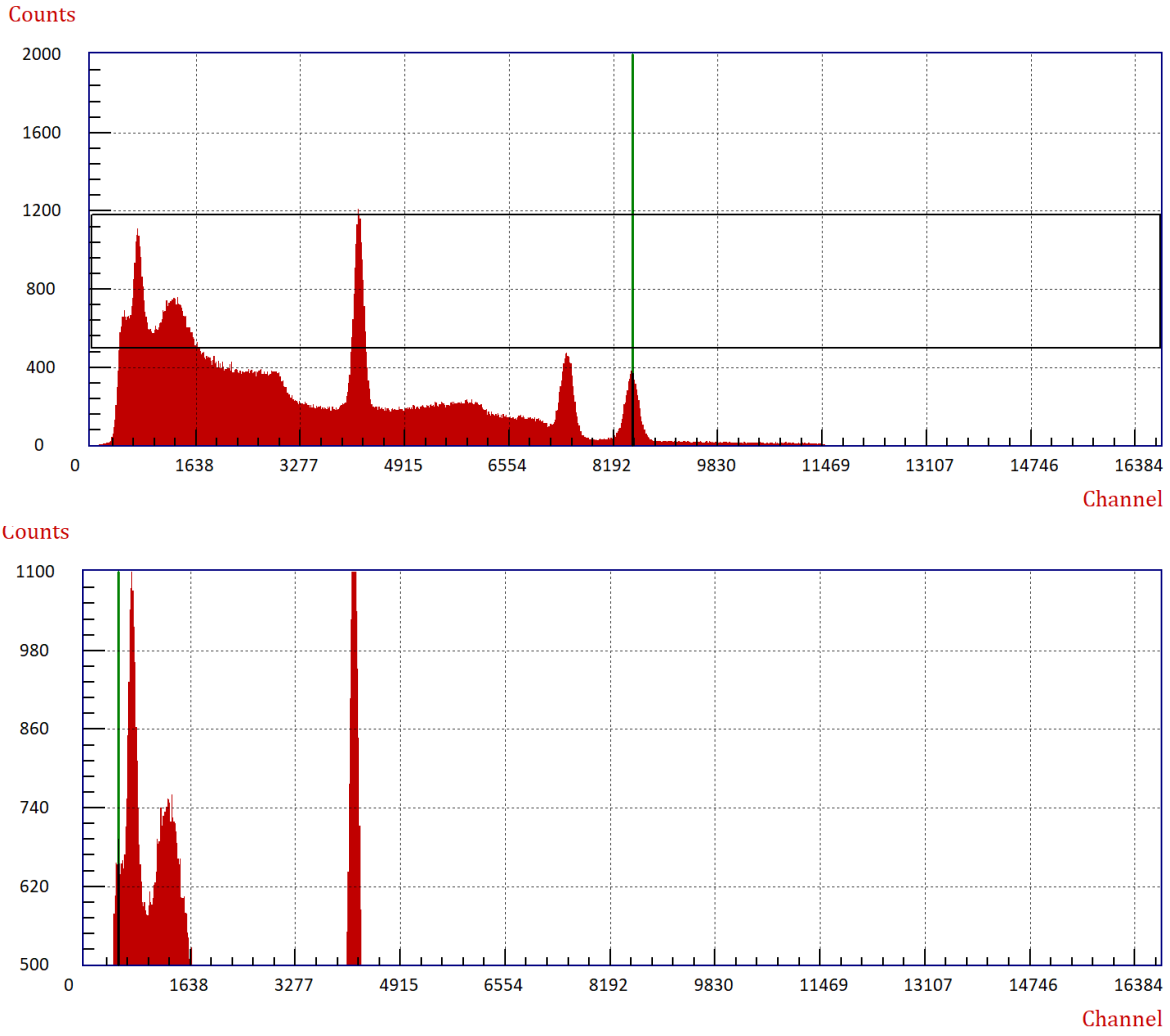
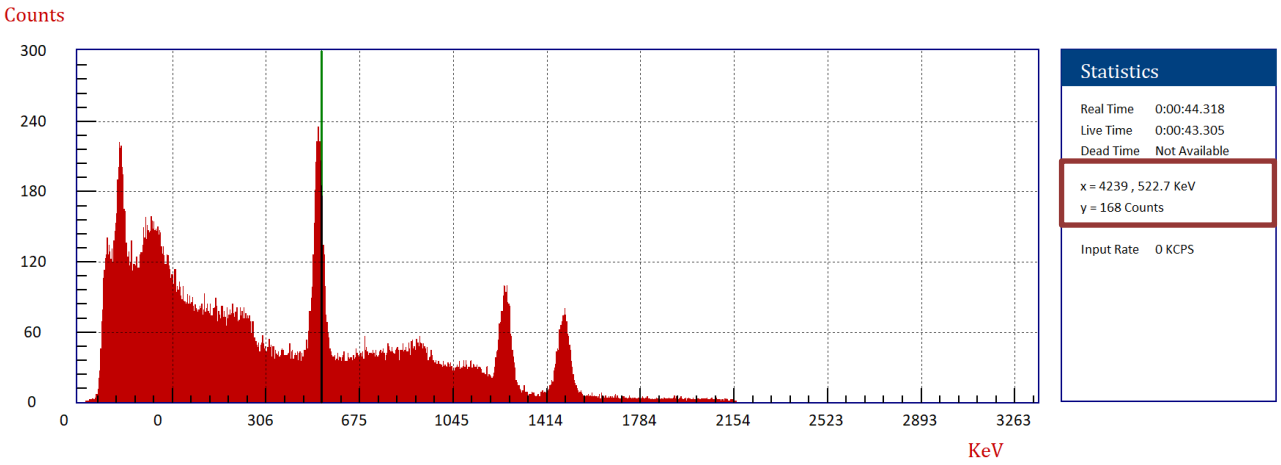


Figure 23 : Verticle zooming



Cursor Movement and Keyboard shortcuts

Cursor id displayed on screen by a green vertical line. Information related to cursor is displayed on right side of the screen.

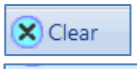


To change the cursor position, click Left mouse button inside the spectrum area. Cursor will be moved to channel on which mouse was clicked.

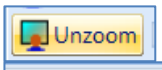
Use following keys to change cursor position.

LEFT ARROW KEY	:	Move cursor to left by 1 channel.
RIGHT ARRROW KEY	:	Move cursor to right by 1 channel
HOME KEY	:	Bring cursor to first channel which is displayed on screen
END KEY	:	Bring cursor to last channel which is displayed on screen
M or m	:	If cursor is already inside the region, then cursor will be moved to channel with highest counts inside region. If cursor is outside the region, then cursor will be moved to channel with highest counts on the right side.

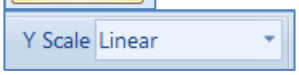
View Options



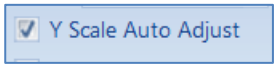
Click on Clear button to start acquisition all over again. This will clear all channel counts.



Click on Unzoom button to reset the spectrum display.

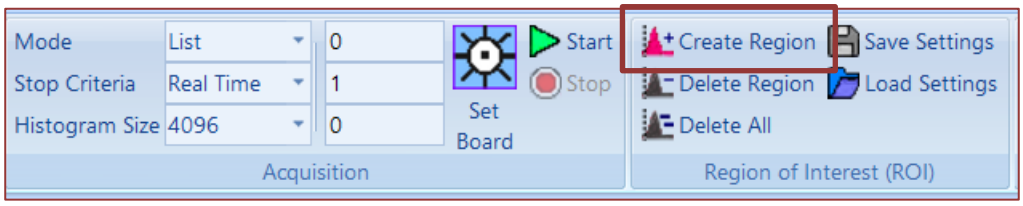


Choose linear or log scale option for vertical scale.

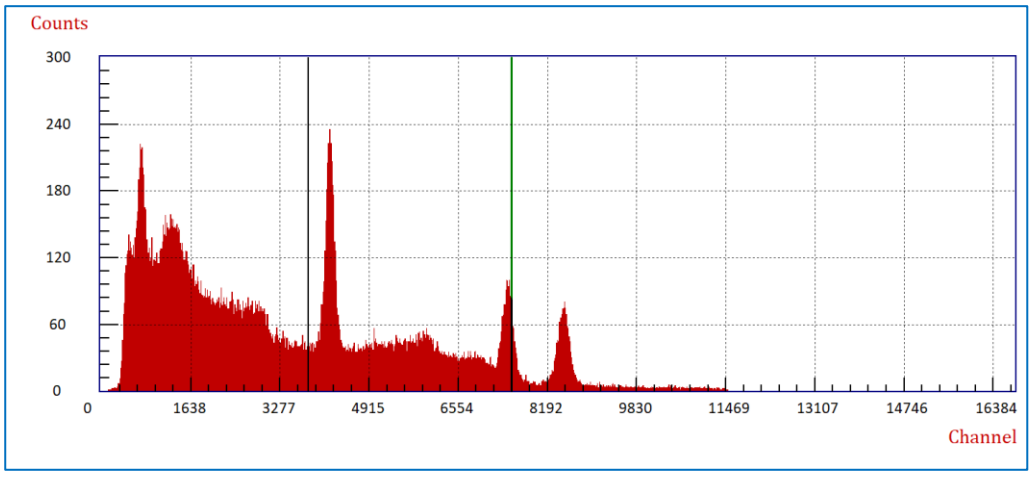


Auto scale adjustment for Y axis. By default, this option is enabled at start of acquisition.

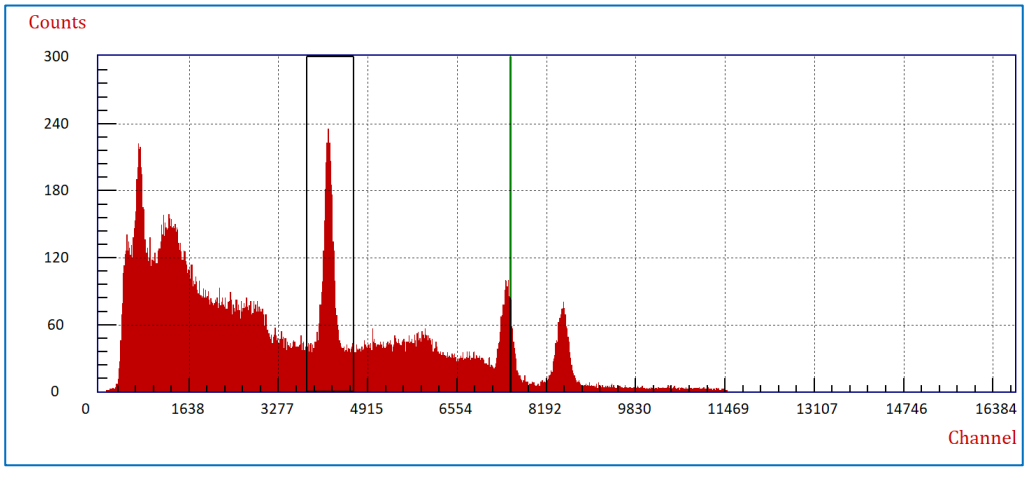
How to create “Region of Interest”



Click on “**Create Region**” button. Locate mouse cursor over the start channel of ROI. Click left button of the mouse and drag. Please note that mouse button should be clicked over the spectrum display area to create region.



Drag mouse cursor till end of ROI is reached. Then release left button.



Region will be displaed with highlighted background colour.

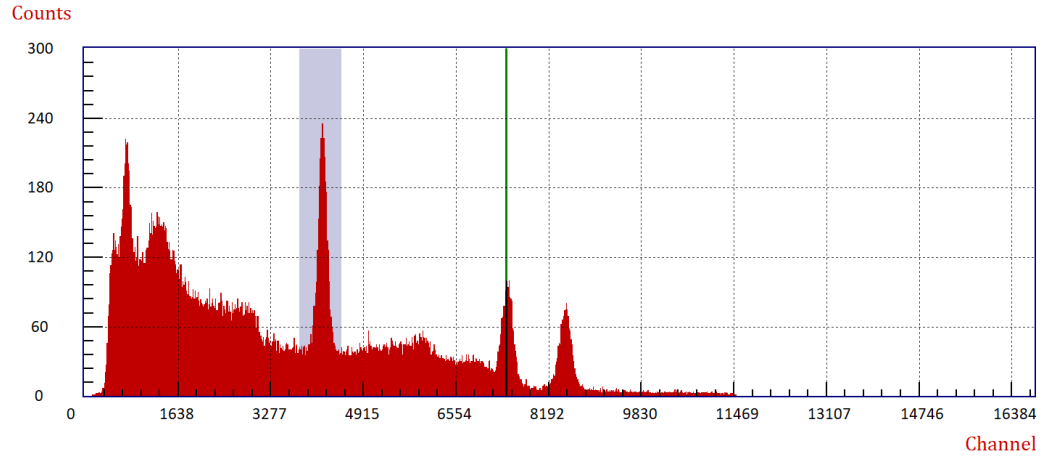
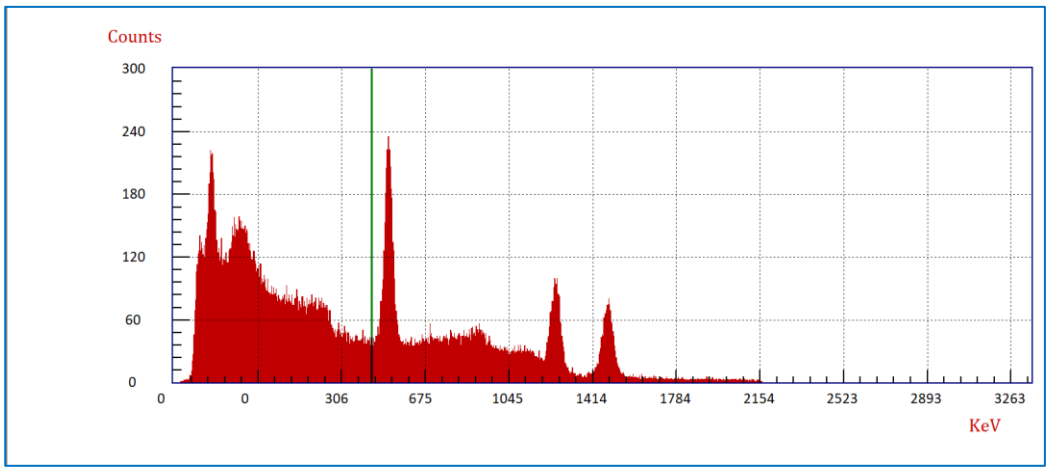
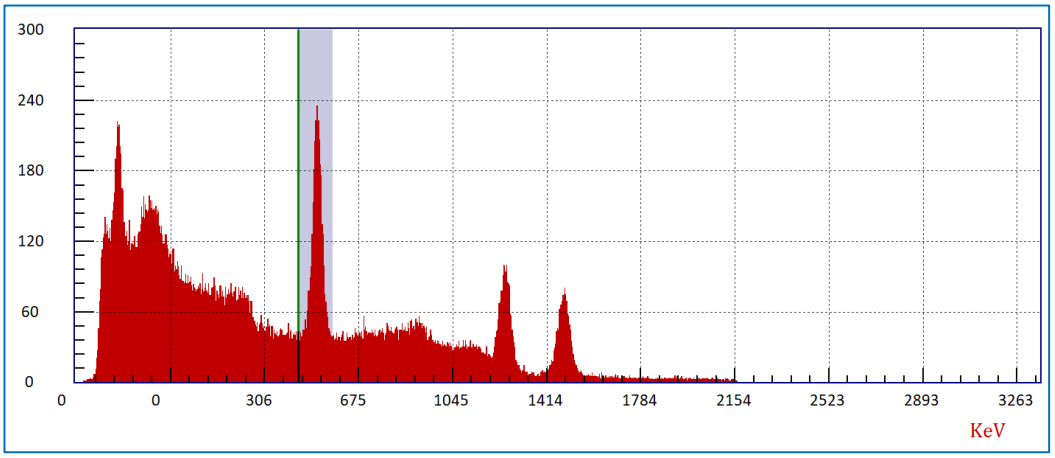


Figure 24 : Region of Interest

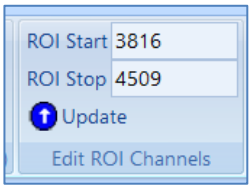
Another option to create region is to use **Mouse Double Click** event. Locate mouse over start channel and double click **Left mouse button**.



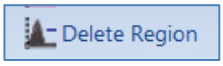
Locate mouse over end channel and double click **Left mouse button**. ROI will be marked.



Follow same procedure to create multiple regions. There is no limit over number of regions permitted. Similarly overlapping regions are also permitted.

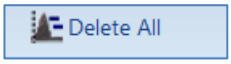


When cursor is positioned inside ROI, start and stop channels will be displayed in "Edit ROI" Channels group. To edit start and stop channels, enter required channel values in respective boxes and click on Update button. ROI will be modified to new values.



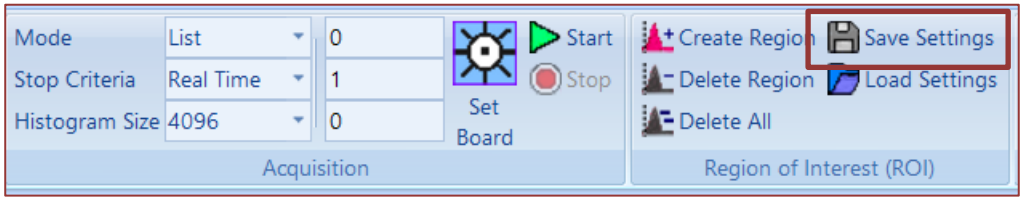
Use "**Delete Region**" button to delete single region. When this button is clicked, mouse cursor changes to

Now click left button inside the ROI. Selected ROI will be deleted.

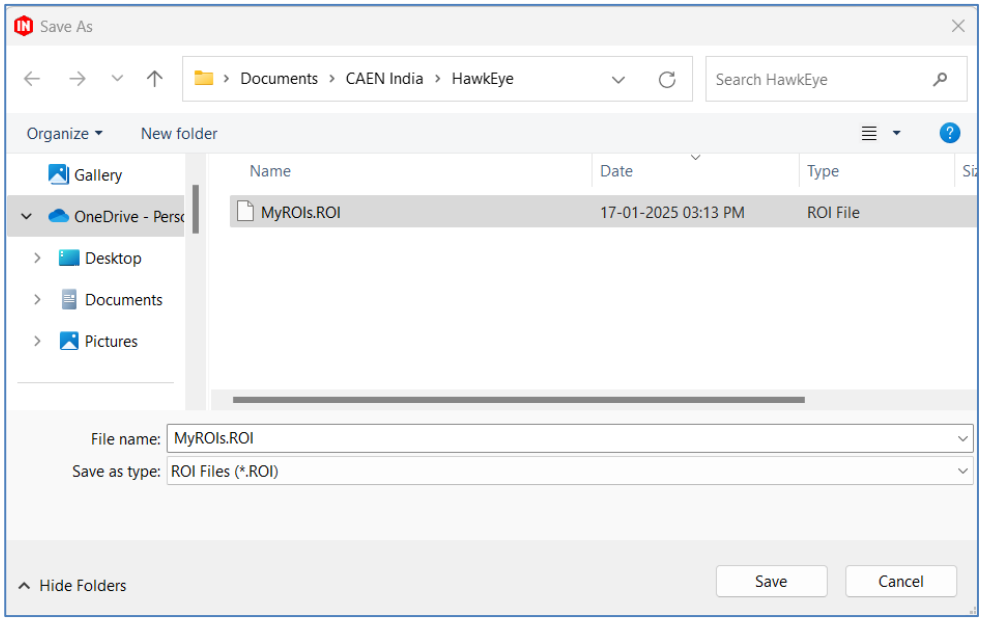


Use Delete All button to delete all ROIs at once.

To save all ROIs of all channels in a single file, click on "**Save Settings**" button.

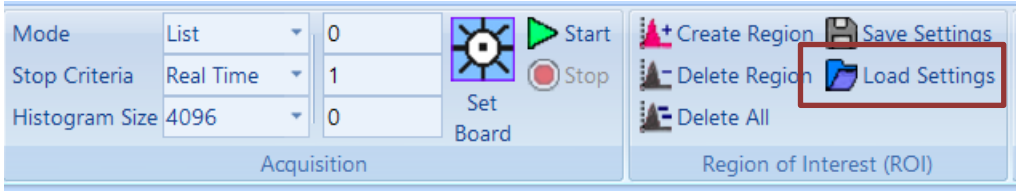


File Dialog will open.

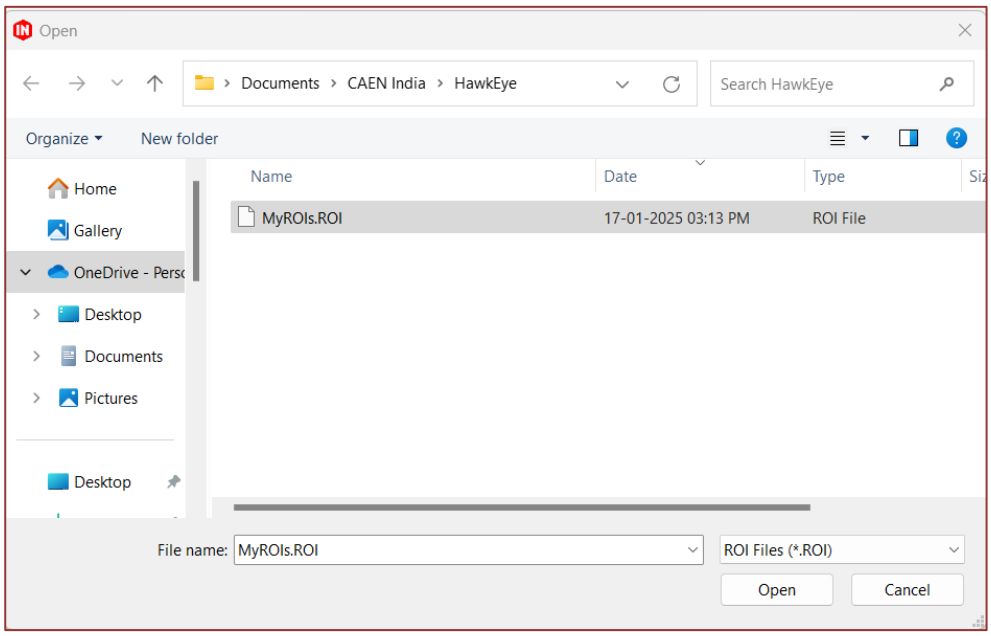


Enter file name and click on **Save** button to complete.

To load ROI settings from a file for all channels, click on "**Load Settings**" button.



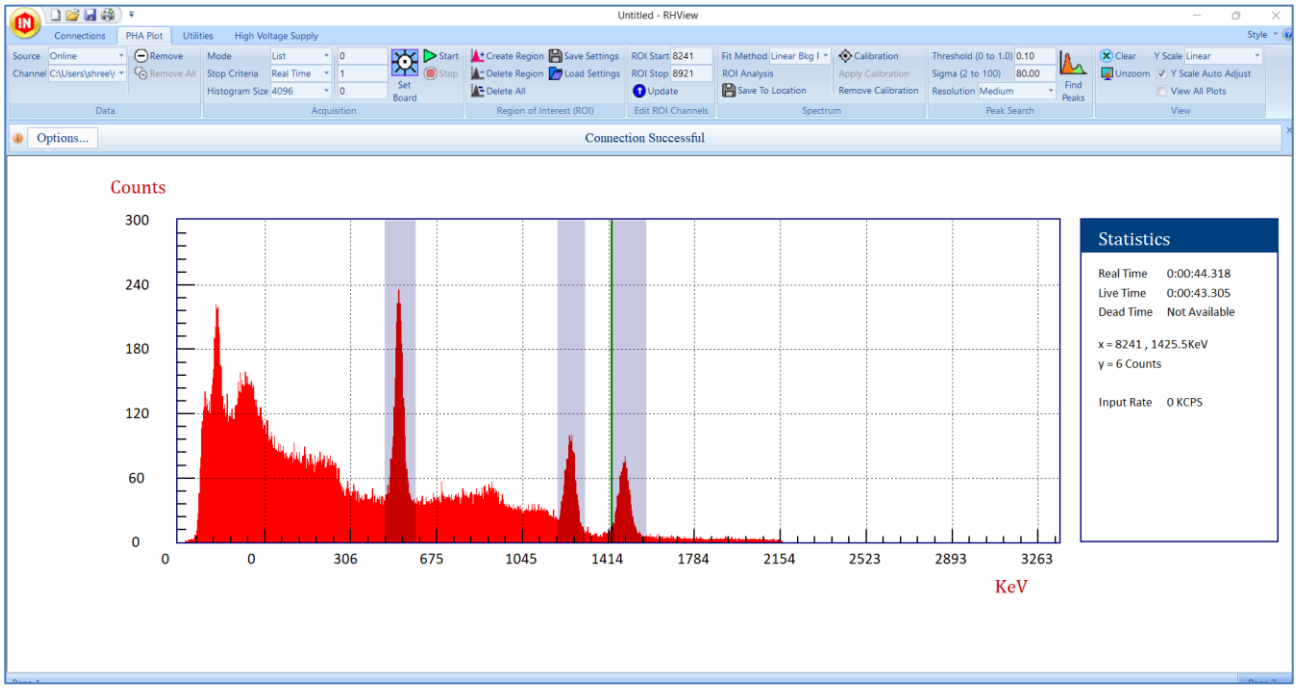
File Dialog will open.

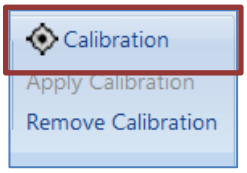


Select file and click on Open button. All ROI settings will be read from the file and applied on channels.

Energy Calibration

Create ROIs for Gamma peaks as shown in the figure below.





Click on "**Calibration**" button.

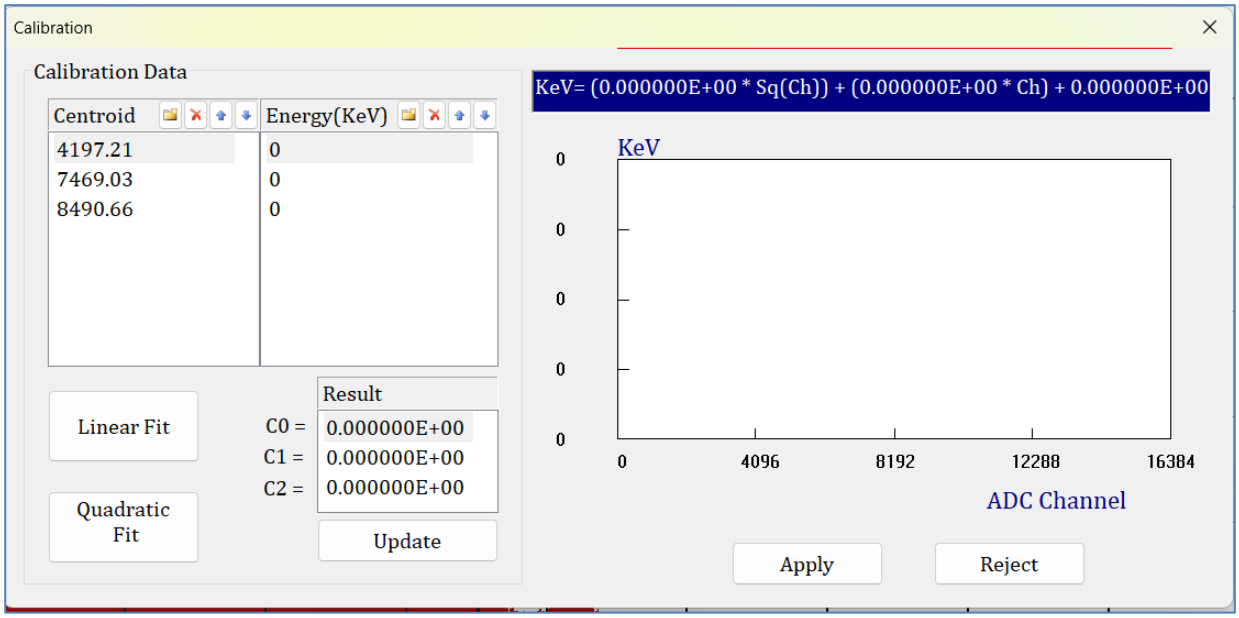
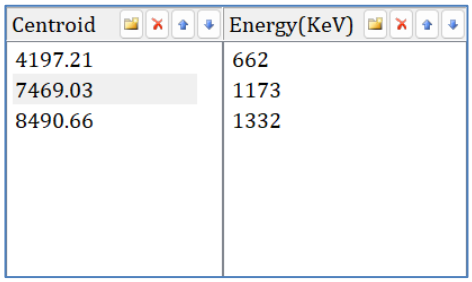
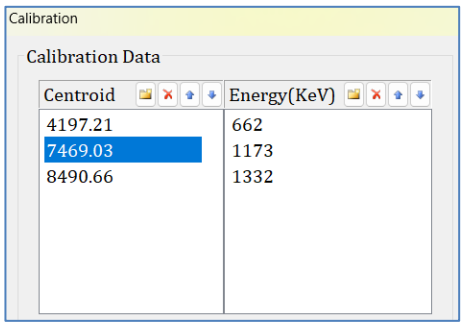


Figure 25 : Energy Calibration



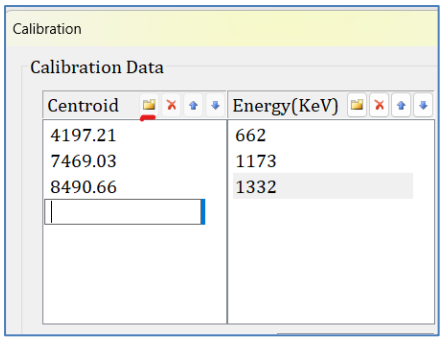
Calibration screen will pop up. Centroids of all ROIS will be displayed under "Centroid" column as shown in the figure. Enter the energy value for each centroid.

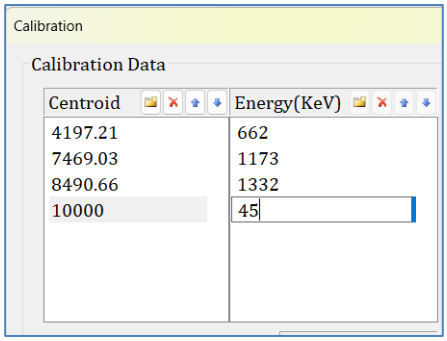


To remove centroid entry from the list, select the required entry and click on  button.

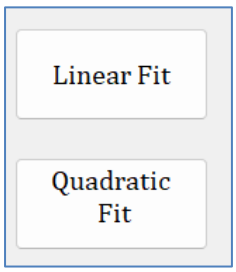
Selected entry will be removed from the list.

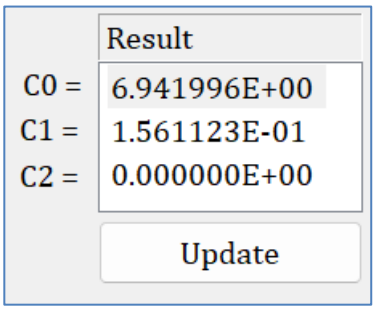
To add new entry into the list, click on  button. New entry will be added to the list. Enter Centroid and corresponding energy value.





Click on "**Linear Fit**" or "**Quadatic Fit**" button as per choice.





Calibration constants will be calculated and result will be displayed on screen. To edit any calibration constant, double it's value and change. Then click on "Update" button. New value will be taken for calibration.

After calibration, calibration equation will be displayed on right side, above the calibration curve.

Calibration curve will be displayed on right side of the screen.

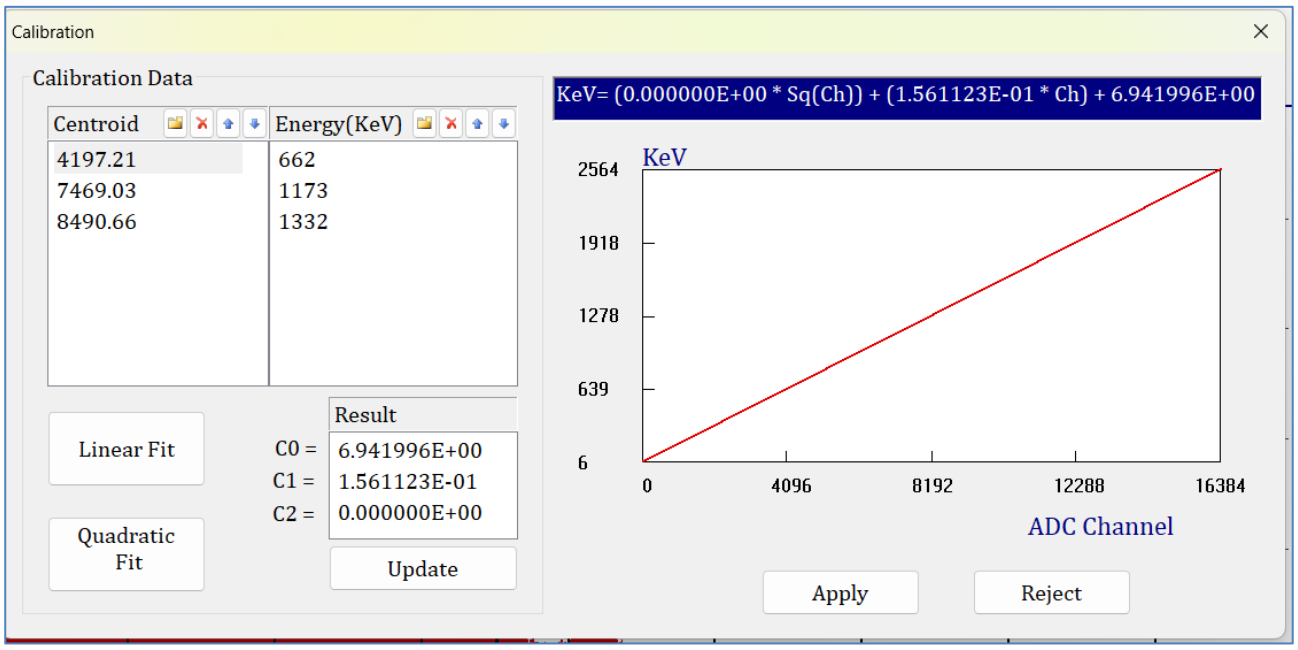
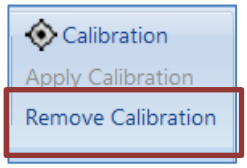


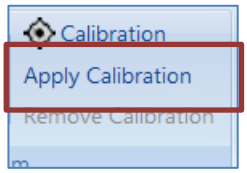
Figure 26 : Calibration curve

To accept the calibration curve, click on "**Apply**" button. Click "**Reject**" to discard the changes.



After calibration, X axis will be displayed in terms if KeV.

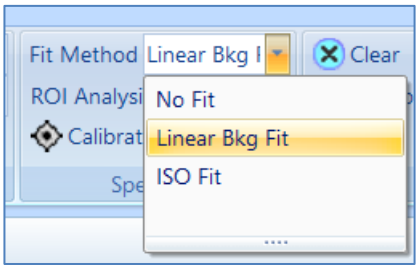
Due to any reason, if calibration is to be removed, then click on "**Remove Calibration**" button.

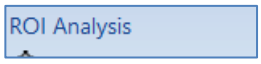


To re-apply calibration, click on "**Apply Calibration**" button.

ROI Analysis

After energy calibration, perform ROI analysis. Select curve fitting method or no fitting from the list.





Then click on "**ROI Analysis**" button.

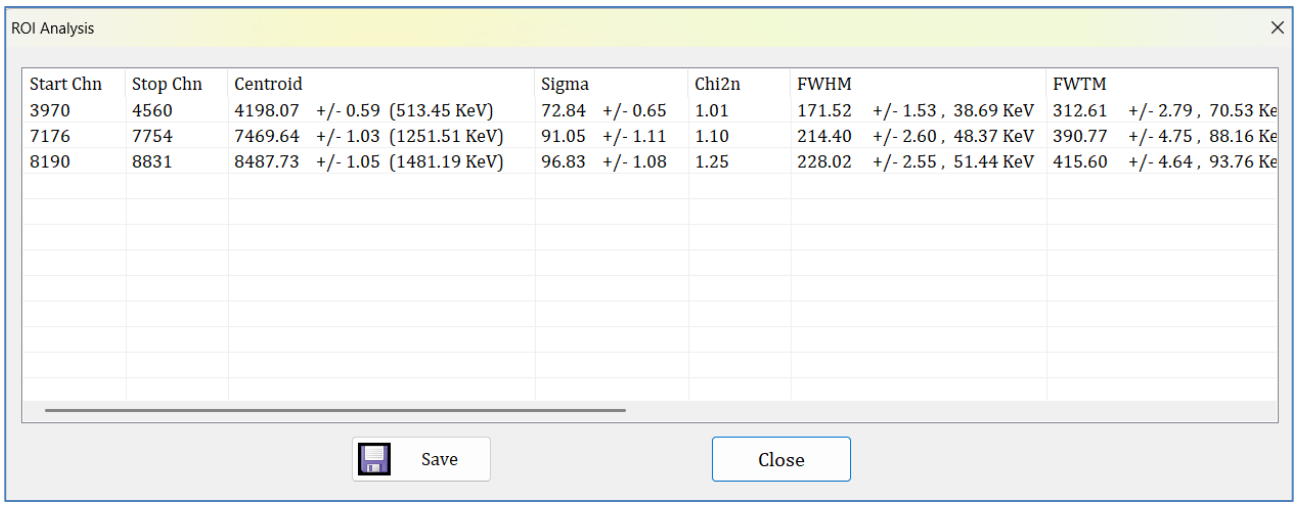
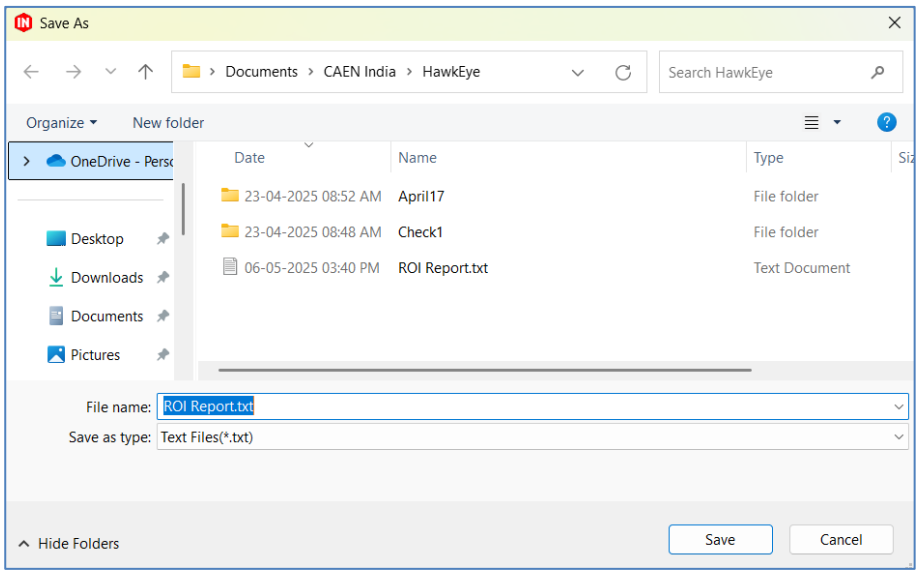


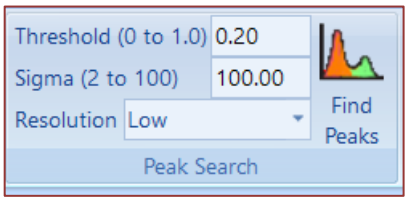
Figure 27 : ROI Analysis

To save the results in the text format, click on **Save** button. File dialog will appear on screen.



Enter the file name and click on **Save** button again to complete the file saving.

Peak Search using ROOT library



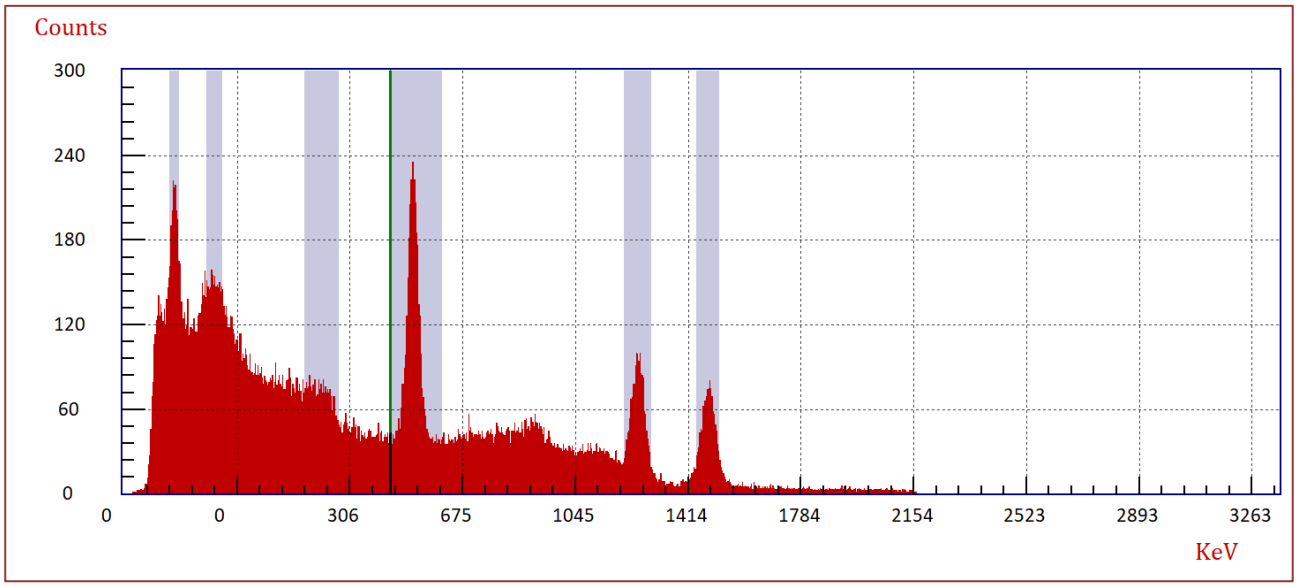
ROOT library is used to mark peaks automatically. Threshold and Sigma values decide the sensitivity of the algorithm.

Threshold : Peaks with amplitude less than threshold*highest_peak are discarded. Threshold value is set between 0 and 1.

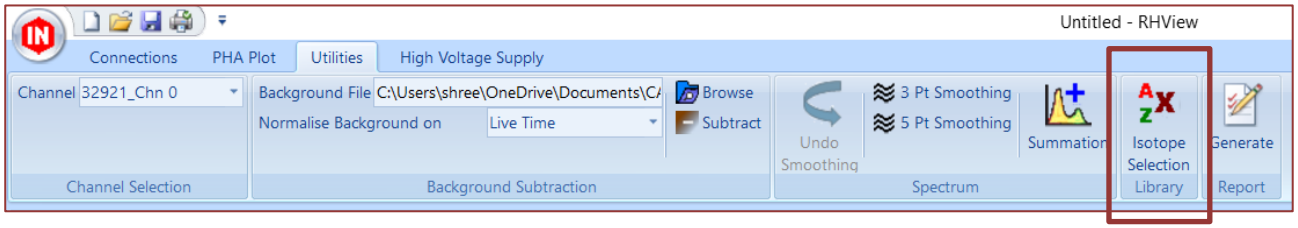
Sigma : Sigma of the searched peaks.

Resolution : Based on resolution of the detector, select Resolution option. Select Low if resolution is more than 6% @662 KeV. Select Medium if resolution is between 3 and 6% @ 662 KeV. Select High option if resolution is less than 3% @ 662KeV. Based of the selection, Threshold and Sigma take pre-defined values. User can overwrite the Threshold and Sigma values as per his choice.

After setting parameters, click on "**Find Peaks**" Peaks will be marked.



Isotope Selection Library



Click on “Utilities” tab. Then click on “**Isotope Selection**” group. Following screen will open.

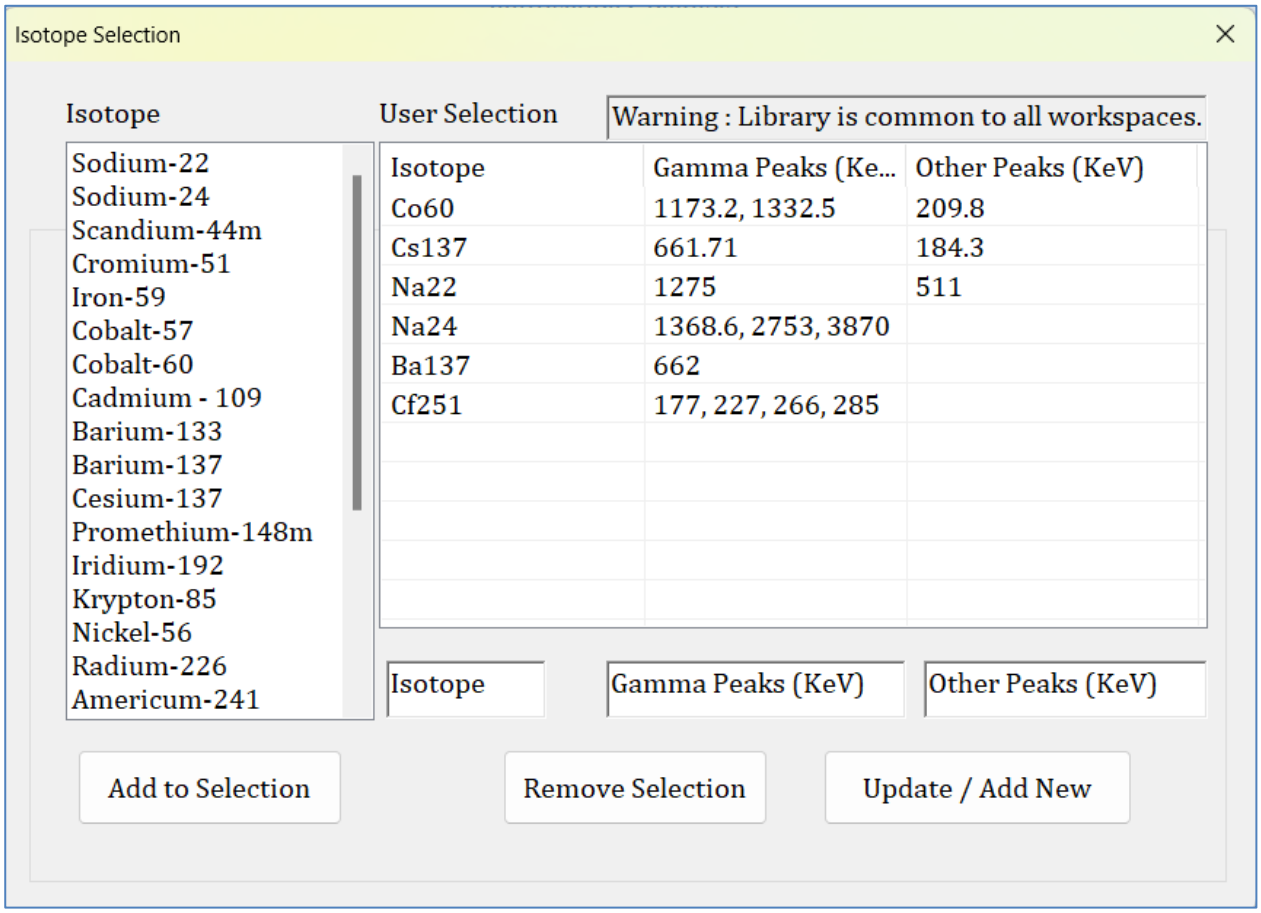
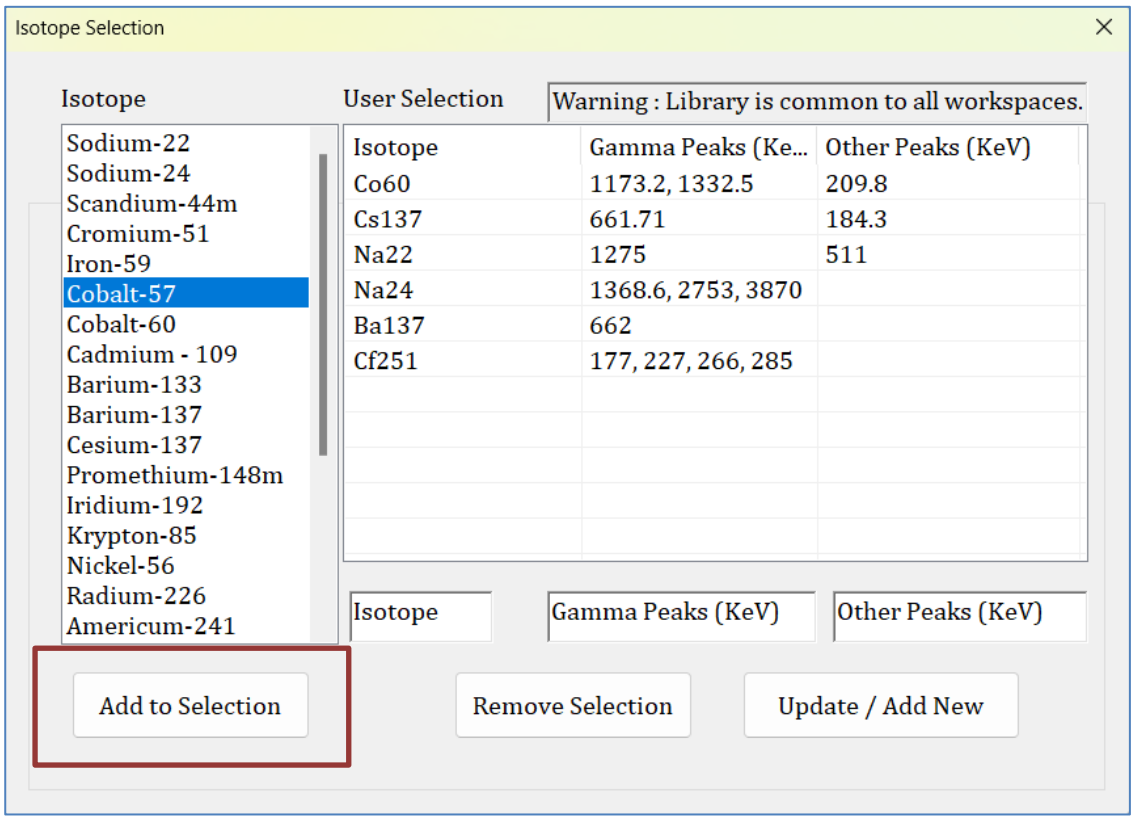
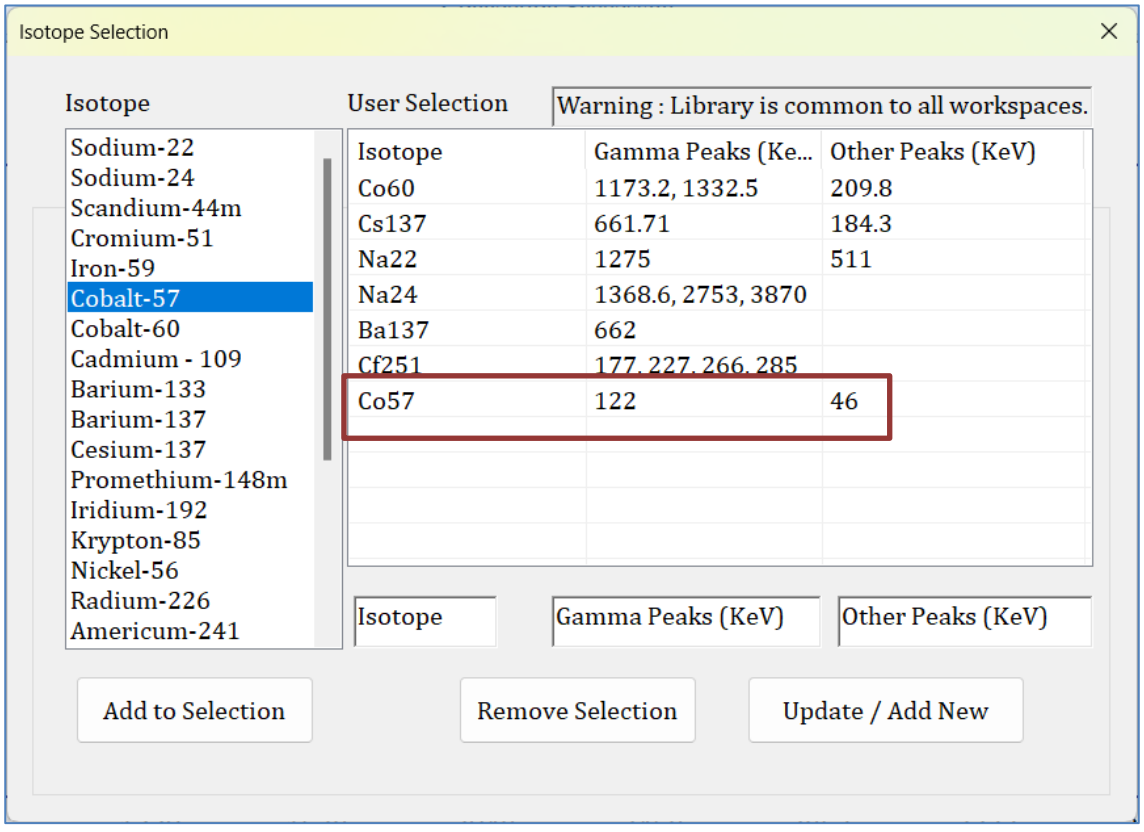


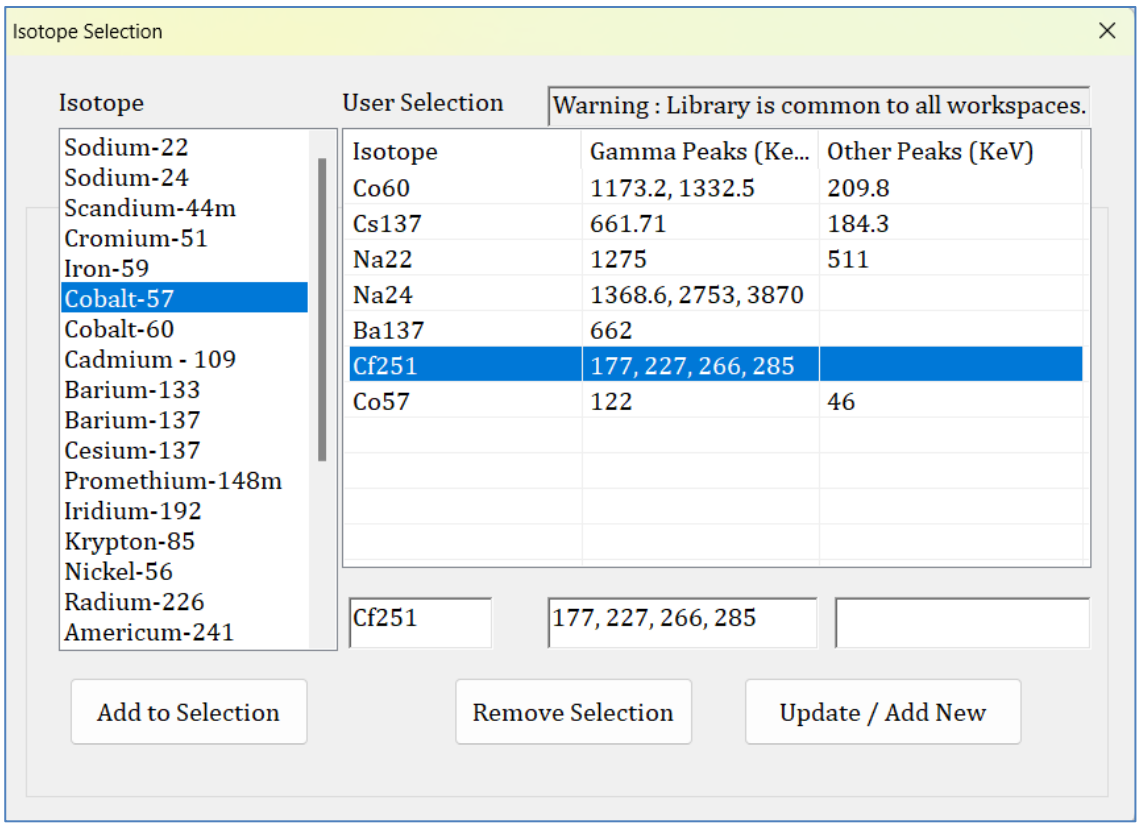
Figure 28 : Isotope Selection Library

On the left side of the screen, under “Isotope” list, commonly used isotopes are listed. To add any of the isotopes to user library, click on the name of the isotope and click “**Add to Selection**” button.

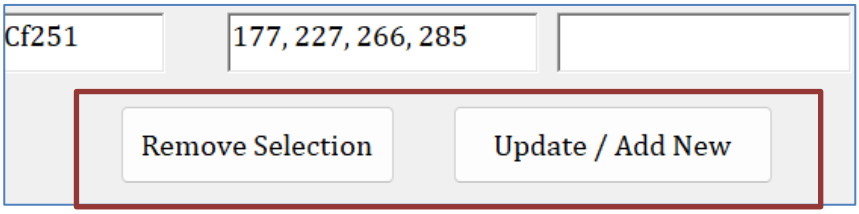

Isotope Selection
Isotope
User Selection
Warning : Library is common to all workspaces.
Sodium-22
Sodium-24
Scandium-44m
Cromium-51
Iron-59
Cobalt-57
Cobalt-60
Cadmium - 109
Barium-133
Barium-137
Cesium-137
Promethium-148m
Iridium-192
Krypton-85
Nickel-56
Radium-226
Americum-241
Isotope
Gamma Peaks (Ke...
Other Peaks (KeV)
Co60
1173.2, 1332.5
209.8
Cs137
661.71
184.3
Na22
1275
511
Na24
1368.6, 2753, 3870
Ba137
662
Cf251
177, 227, 266, 285
Isotope
Gamma Peaks (KeV)
Other Peaks (KeV)
Add to Selection
Remove Selection
Update / Add New


Isotope Selection
Isotope
User Selection
Warning : Library is common to all workspaces.
Sodium-22
Sodium-24
Scandium-44m
Cromium-51
Iron-59
Cobalt-57
Cobalt-60
Cadmium - 109
Barium-133
Barium-137
Cesium-137
Promethium-148m
Iridium-192
Krypton-85
Nickel-56
Radium-226
Americum-241
Isotope
Gamma Peaks (Ke...
Other Peaks (KeV)
Co60
1173.2, 1332.5
209.8
Cs137
661.71
184.3
Na22
1275
511
Na24
1368.6, 2753, 3870
Ba137
662
Cf251
177, 227, 266, 285
Co57
122
46
Isotope
Gamma Peaks (KeV)
Other Peaks (KeV)
Add to Selection
Remove Selection
Update / Add New

To edit details of any isotope from the user's list, click on the isotope entry in "User's Selection" list.



Details of the selected isotope will appear as shown in the below figure. To change the details, edit the values in the boxes and click on "Update / Add New" button. To remove the isotope from the list, click on "Remove Selection" button.



Each entry has details like Gamma Peaks and Other Peaks (energies). To accurately identify the isotope, enter energies of Compton, X ray peaks etc associated with the isotop in "Other Peaks" column.

Warning is displayed on top. User Library is common to all workspaces. So carefully edit the library selection.

Spectrum Smoothing

Smooting option is available in "**Utilities**" tab.

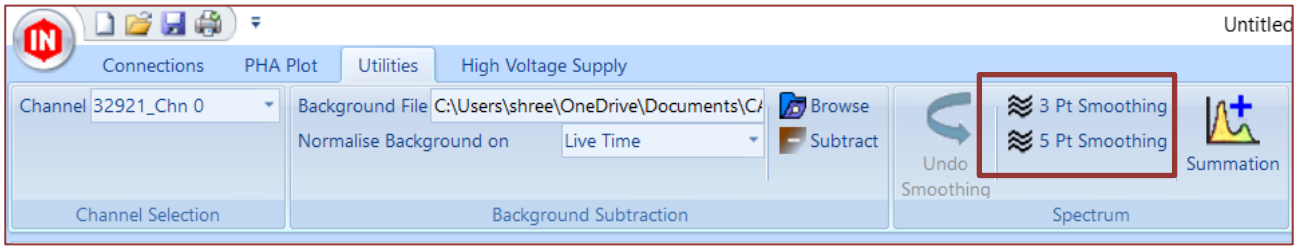


Figure 29 : Spectrum Smoothing

Smoothing can be done in two ways.

3 Point Smoothing : In three point smoothing, average of consequitive three points is taken.

Counts[x] = { Counts[x-1] + Counts [x] + Counts[x+1] } / 3.0

Where x represents the channel number.

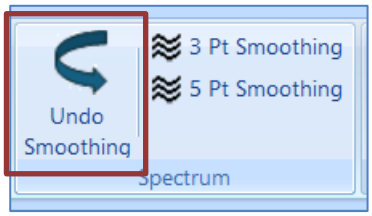
5 Point Smoothing : Five point smooting is weighted average. In five point smoothing, average of consequitive five points is taken.

Counts[x] ={ 10 x Counts[x-2] + 5 x Counts[x-1] + Counts [x] + 5 x Counts[x+1] + 10 x Counts[x+2]} / 15.0

Where x represents the channel number.

Remember to Pause Communication with the board if you are doing smoothing on Board channel.

Undo Smoothing :



Undo option is available to retrieve original spectrum back. **Undo** button will be enabled after smoothing function is used. If smoothing function is done multiple times on the same spectrum, then it is possible to Undo every step and go back upto original spectrum.

File Saving

Acquired spectrum will be saved automatically after preset time (or acquisition is stopped manually) if saving option is used. File saving option is available in “Connections” tab.

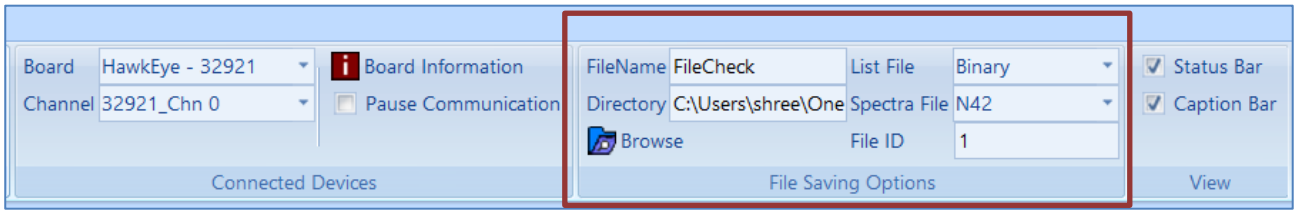
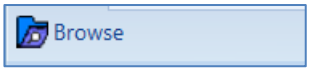
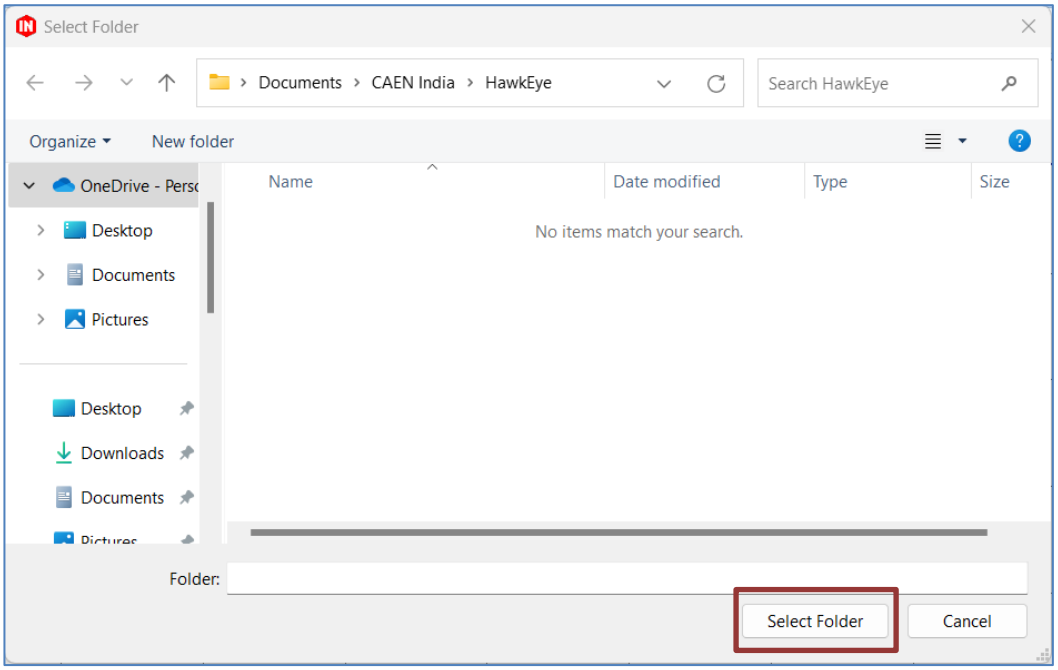
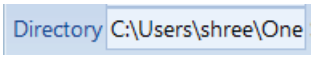


Figure 30 : File Saving

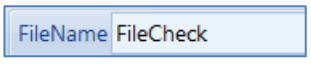


Click on browse button. Folder selection dialog will open. Browse to the required folder and click “Select Folder” button.

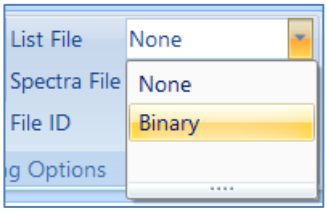




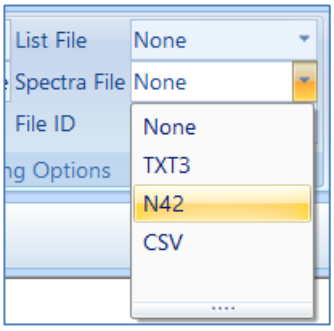
Selected folder path will appear in Directory box automatically.



Enter required file name.



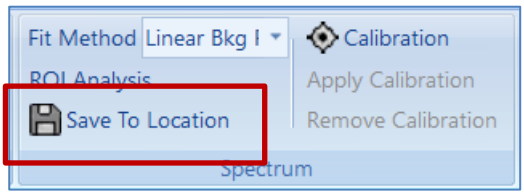
List file is a file which stores all events captured by board.



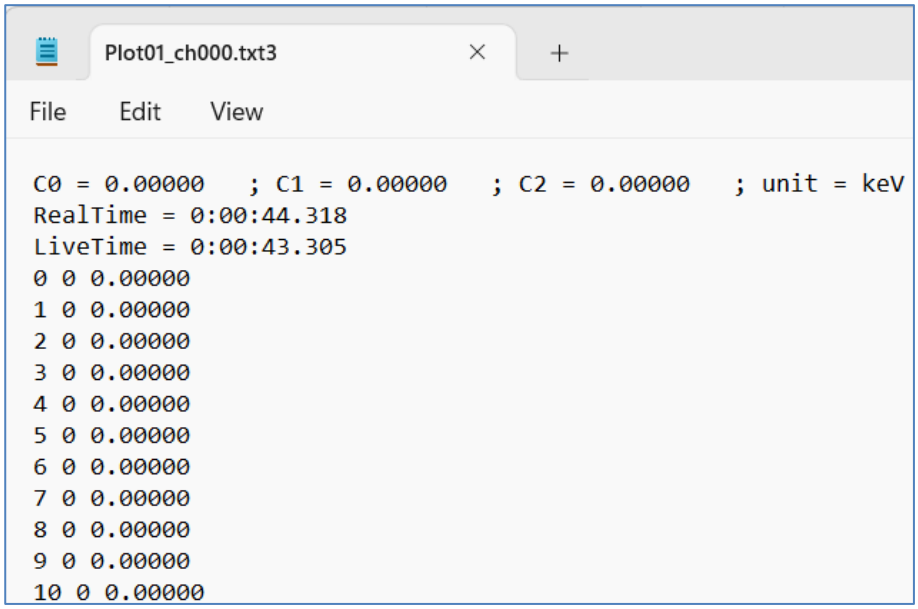
Spectrum can be saved in text or CSV or N42 format. Select required option here.

Files will not be saved on drive if “None” option is set.

If saving option is not set at the beginning of acquisition, then it is possible to save spectrum later. Click on “Save to Location” button to save spectrum.

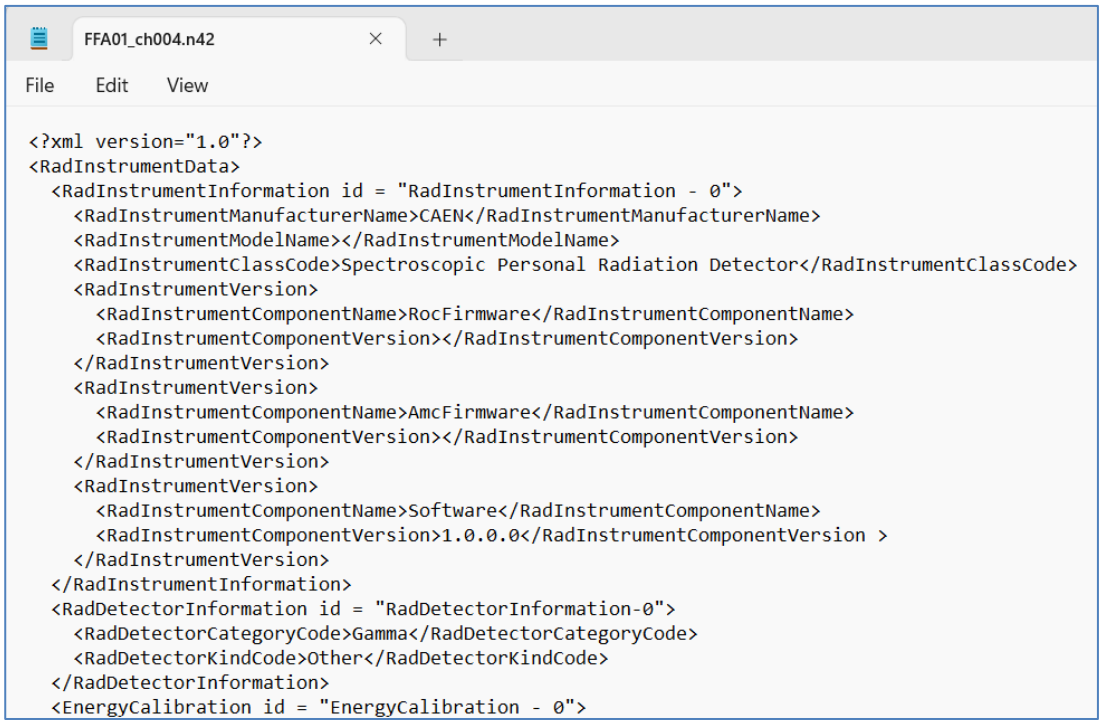


In txt3 format, channel data is saved in three columns, separated by ‘Space’ character. Column 1 is channel number, Column 2 is counts and Column 3 is energy value.



In CSV format, data will be stored with columns, separated by ‘Comma’ character.

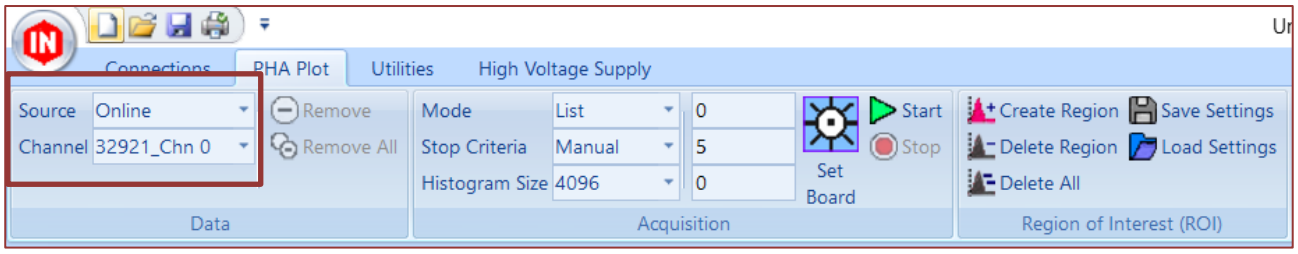
File saved in N42 format, can be opened in other softwares.



HawkEye and Red Eagle also support saving of data on board itself. Directory will be created on board with name matching the File Name and ID will be generated automatically. So board ID and File ID entered by user in “RHView” will not match if user changes FileID randomly. Data stored on board will be accessible through Web interface.

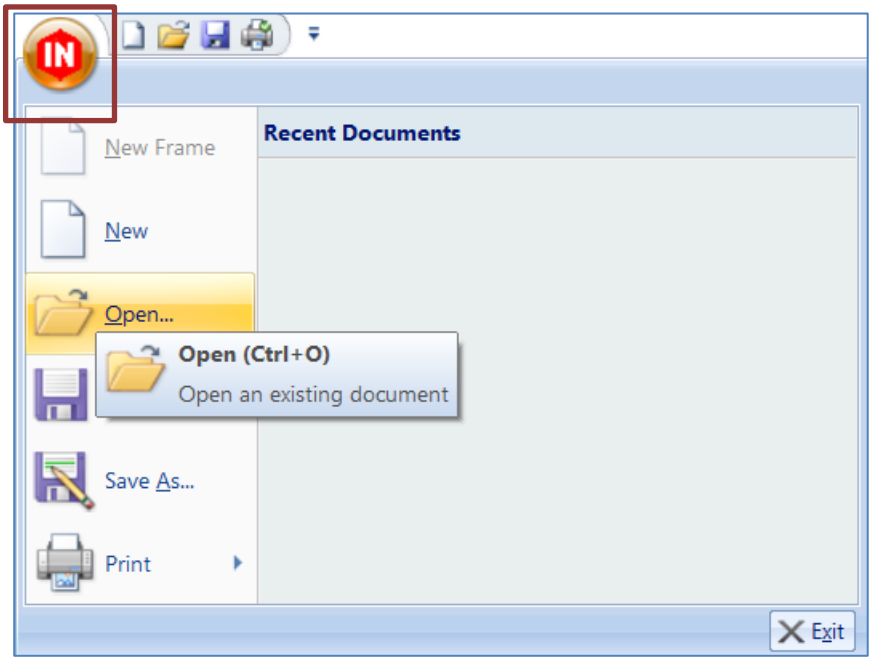
File Opening : Online Mode

There are two ways to open a stored file. First is to open file in a workspace. With opened workspace and board connected to the PC, data source is “Online” by default.

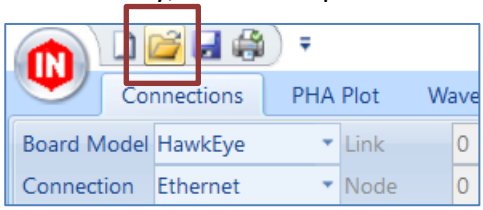


In this case, software continues to read data from board every second. When file is opened in Online mode, file is treated as a new board channel and file name will be displayed in Channel List.

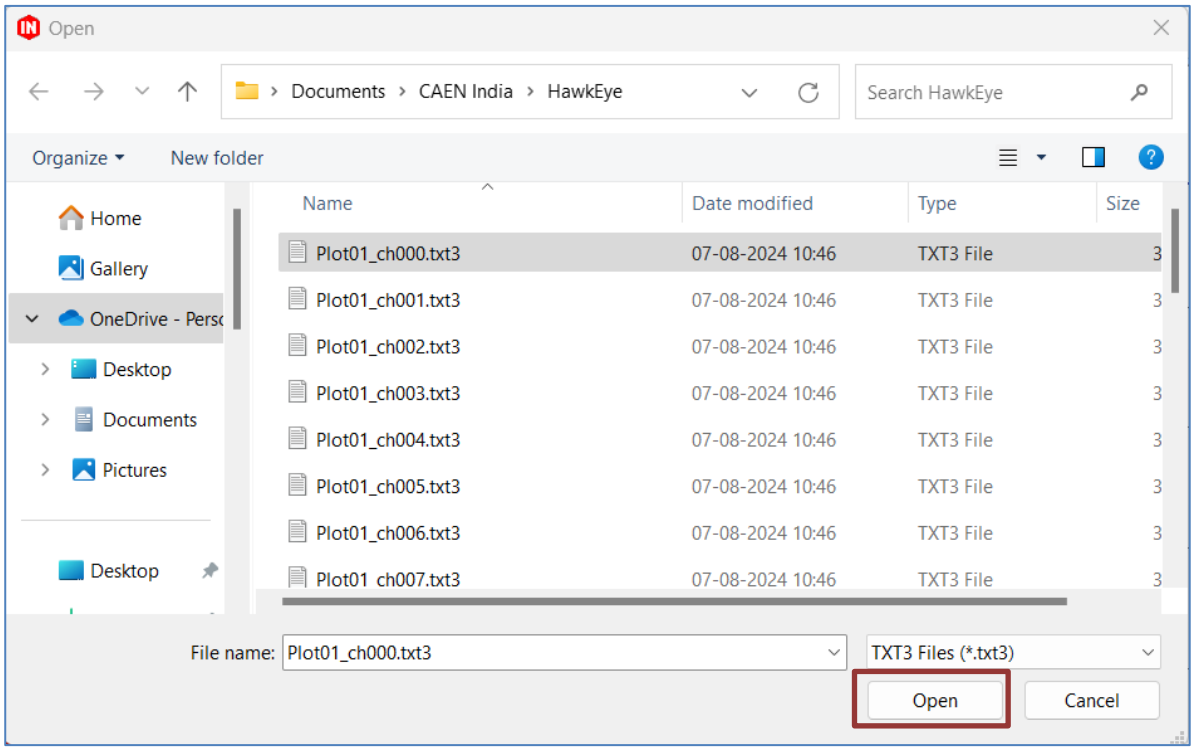
To open a file, click on application icon and click “Open”.



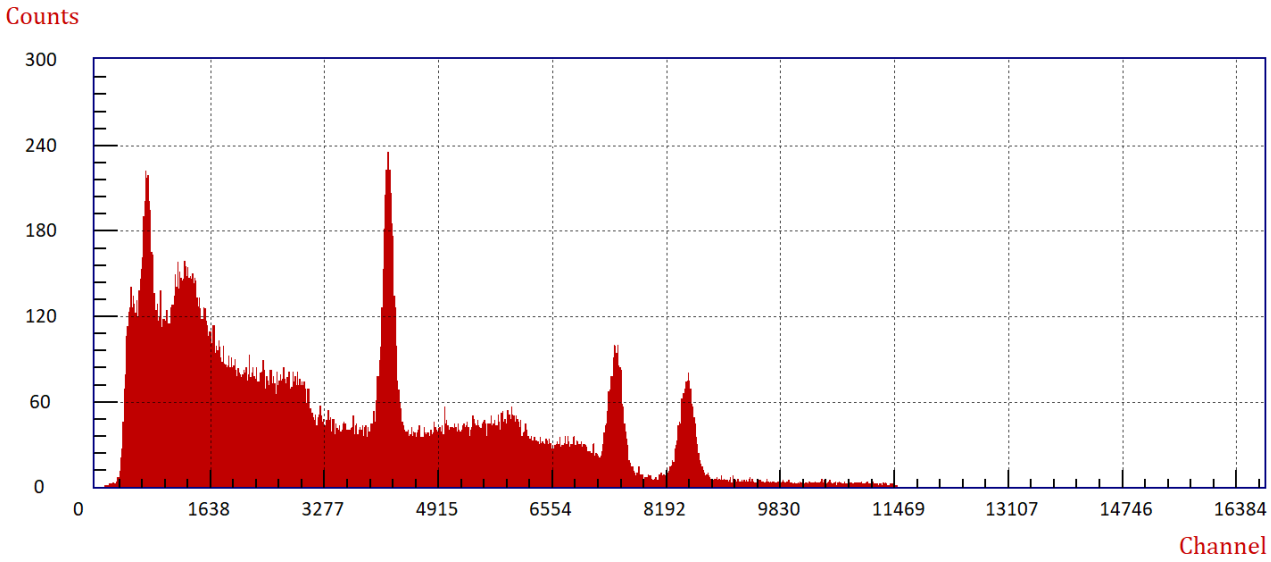
Alternatively, click on “Open” button in Quick Action Toolbar.



File dialog box will open. Browse to required directory and select file.

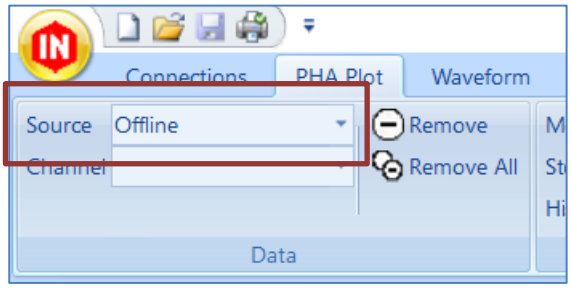


Click “Open” button to complete the file operation. Spectrum data stored in a file will appear on screen.

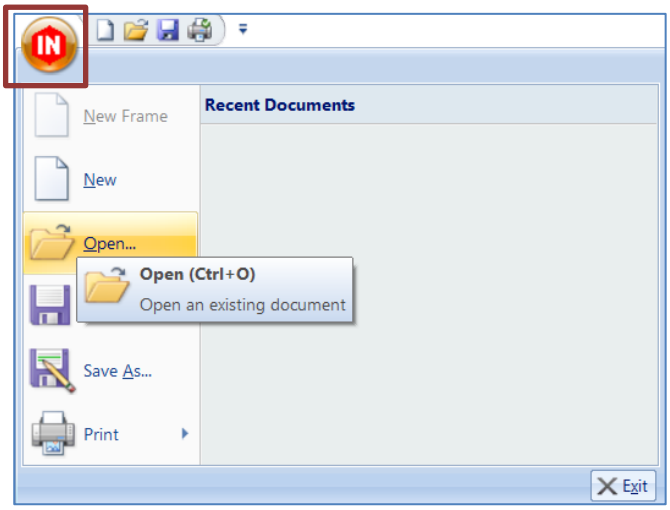


File Opening : Offline Mode

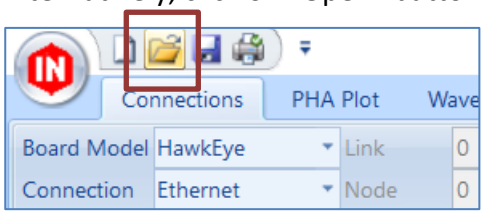
To open multiple files for comparison, use offline mode.



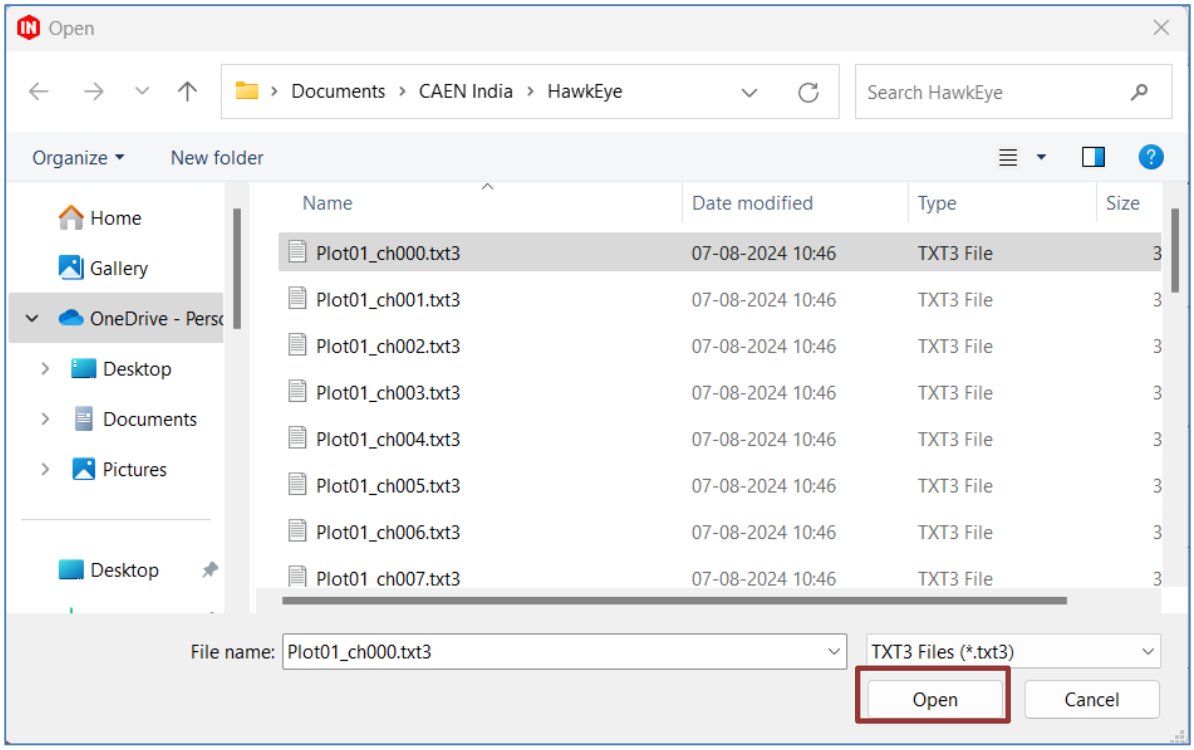
To open a file, click on application icon and click “Open”.



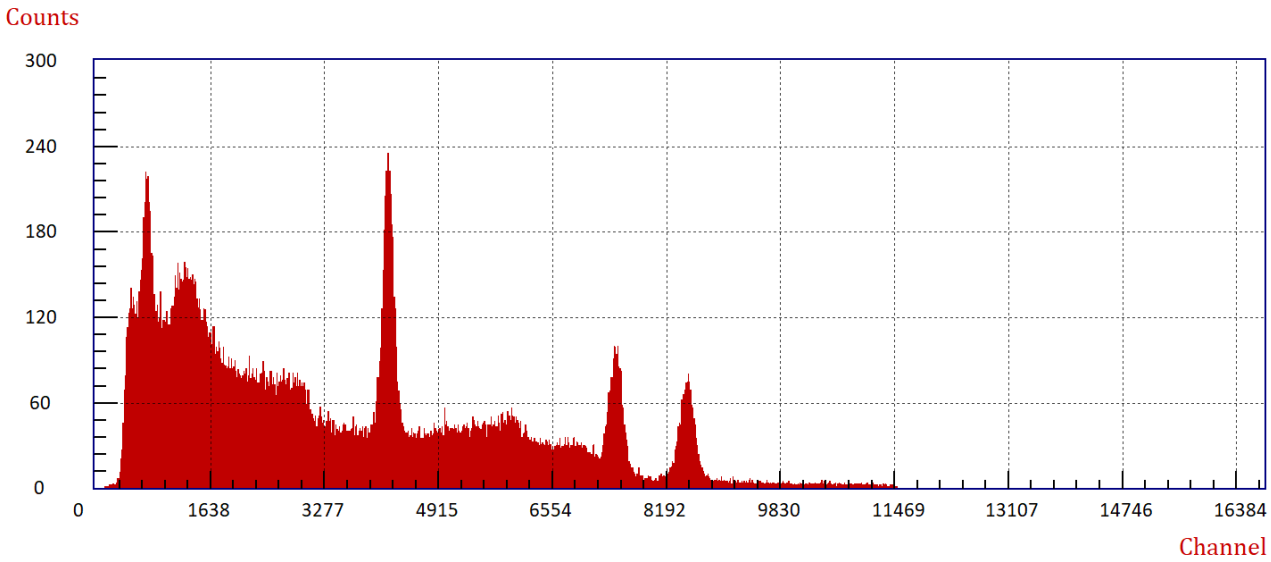
Alternatively, click on “Open” button in Quick Action Toolbar.



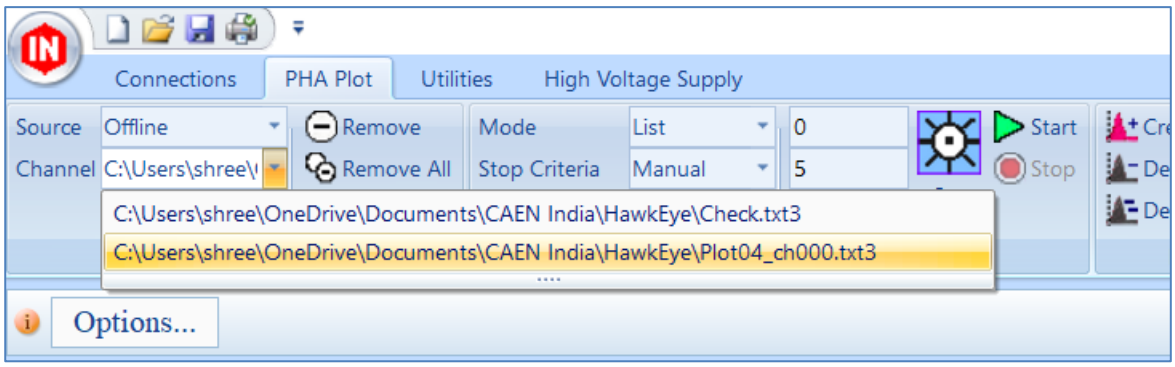
File dialog box will open. Browse to required directory and select file.



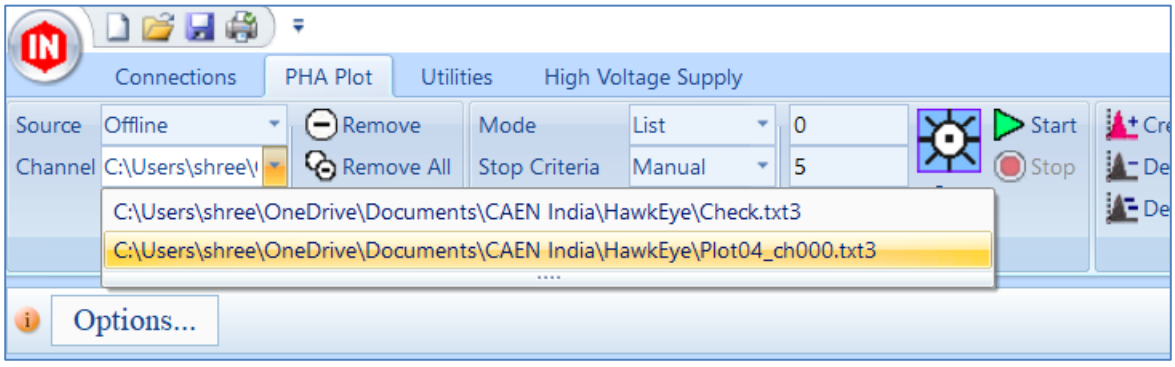
Click “Open” button to complete the file operation. Spectrum data stored in a file will appear on screen.

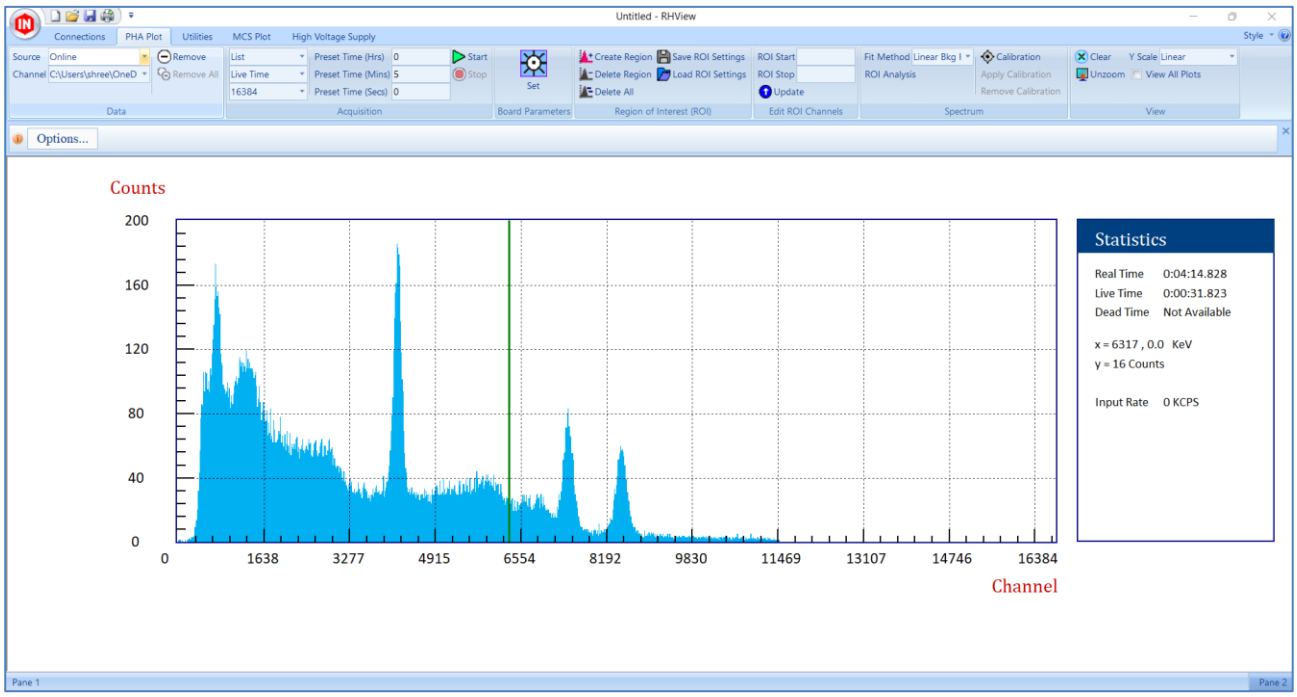


File name will appear “Channel” list.



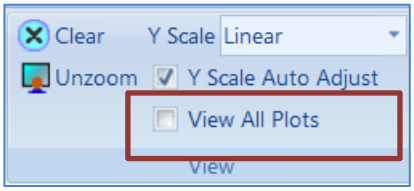
To open another file, following same procedure. After opening second file (or more files), each file data can be accessed through “Channel” selection list.





Multiple Spectrum Display

If board has more than one channels or if multiple files are opened in Offline mode, then it is possible to compare all spectrums visually. Overlapping display feature of this software makes it possible. Click on "**View All Plots**" option in "PHA" tab.



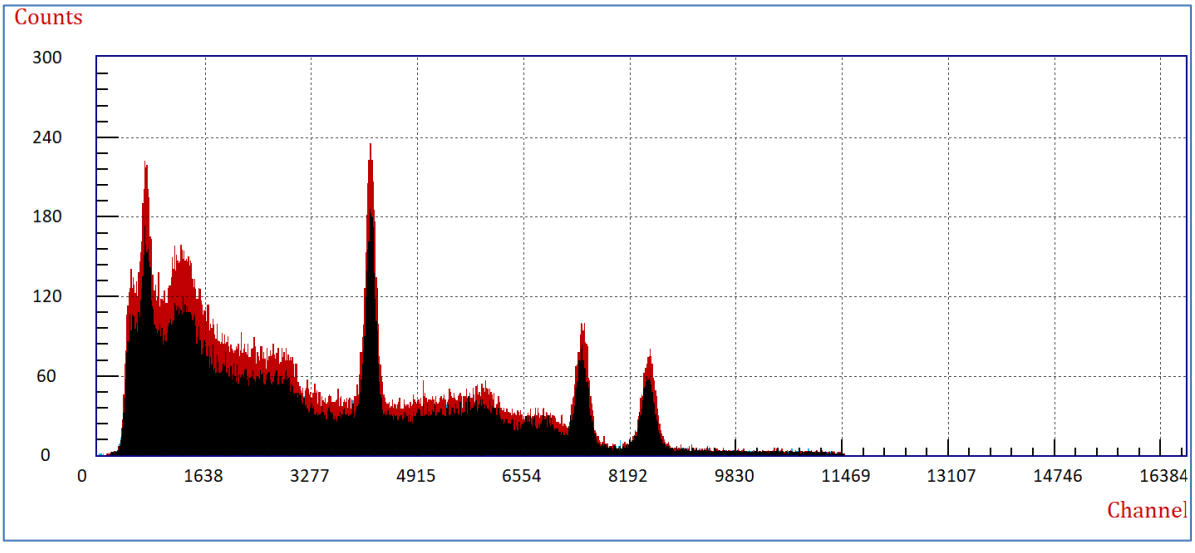
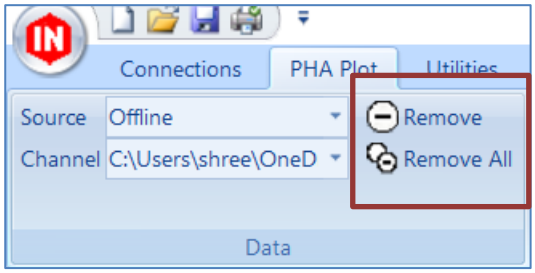


Figure 31 : Multiple Spectrum Display

To remove any of the opened file data from the list, select that in “Channel” list and then click “Remove” button.

Click “Remove All” button to remove all spectrums simultaneously.



Background Spectrum Subtraction.

To remove background spectrum from acquired spectrum, use “Background Subtraction” option.

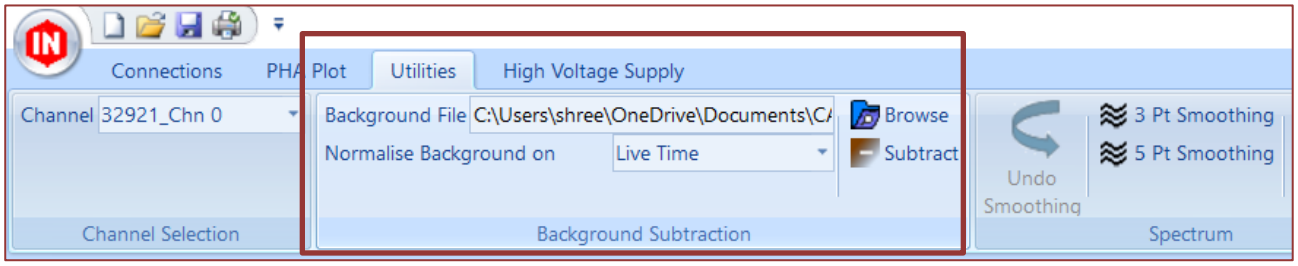
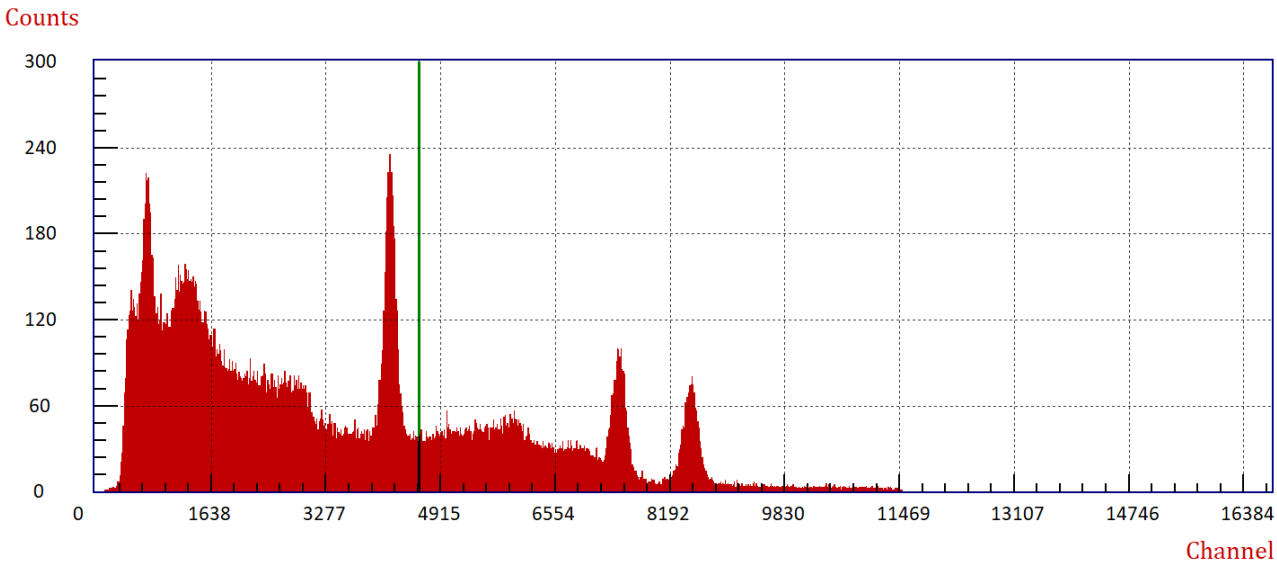


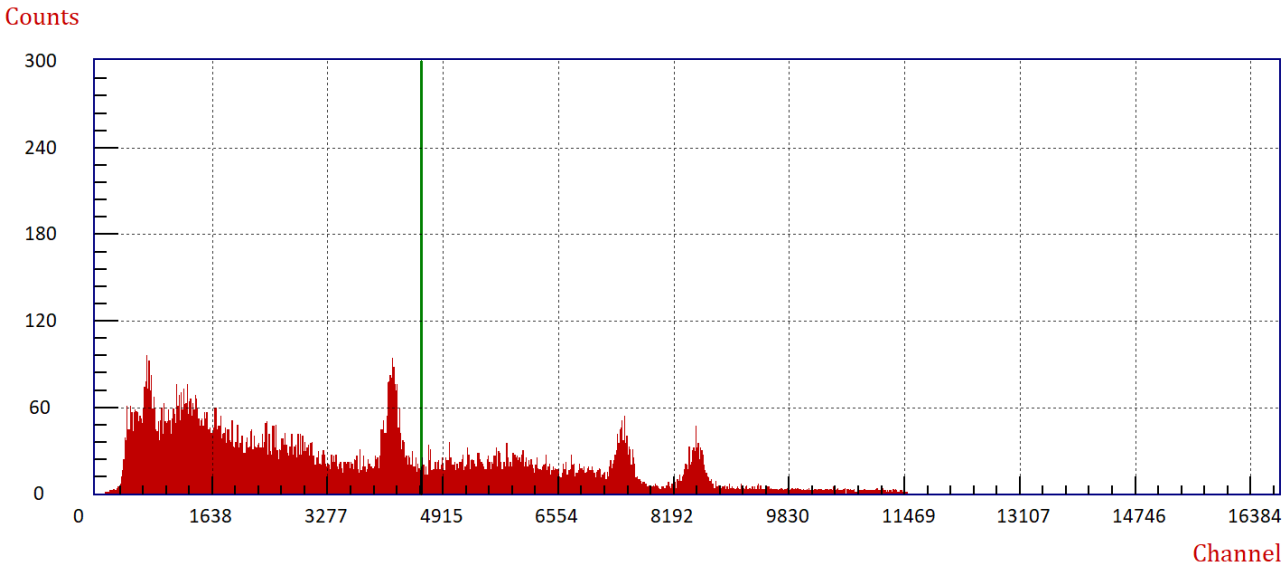
Figure 32 : Background Spectrum Subtraction

“Channel” list displays list of of acquired spectrum or spectrum opened from file. Enter background file path in “File” box or click “Browse” button to select file. Background is automatically normalised on Live Time or Gross Counts of the main spectrum. Select required option from the list and click “**Subtract**” button.

Remember to Pause Communication with the board if you are doing background subtraction on Board channel.



Spectrum before background subtraction.



Spectrum after background subtraction

Spectrum Summation

To add two or more spectrum, use Spectrum Summation. Open the required spectrum files or use board channels. Then click on **Summation** button.

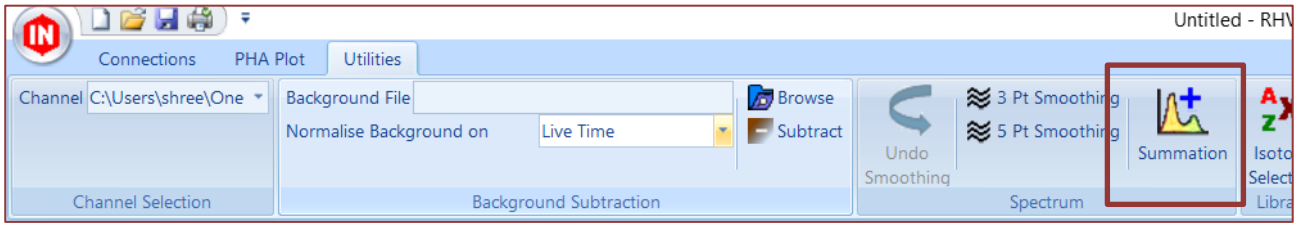
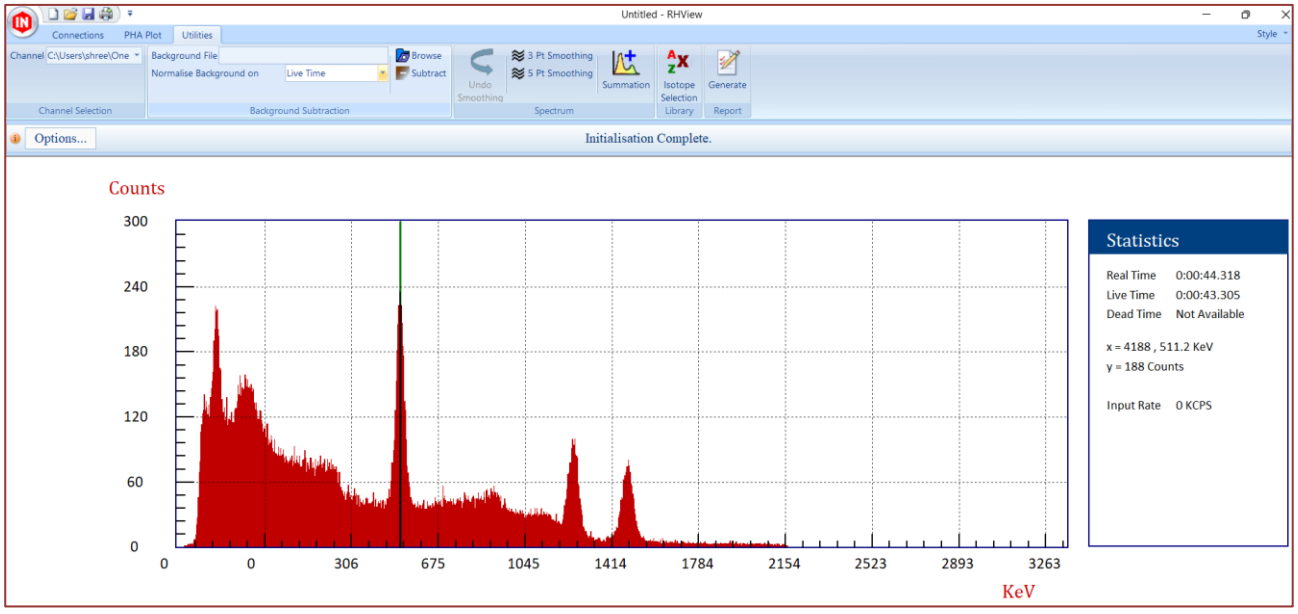
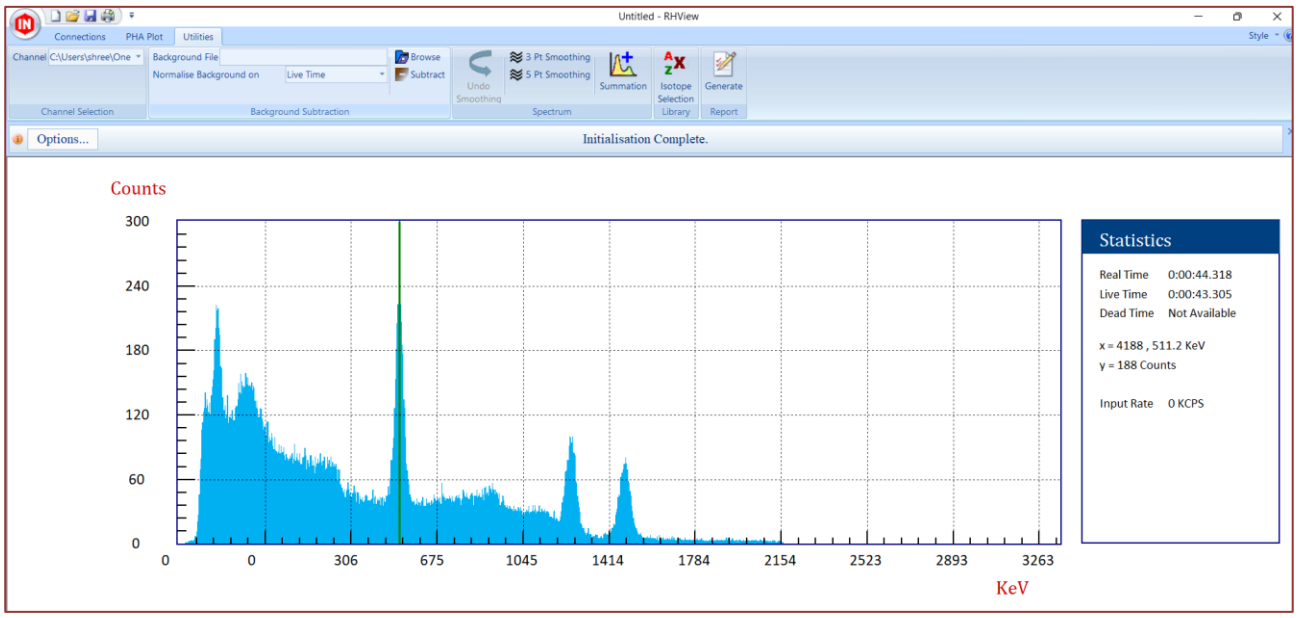


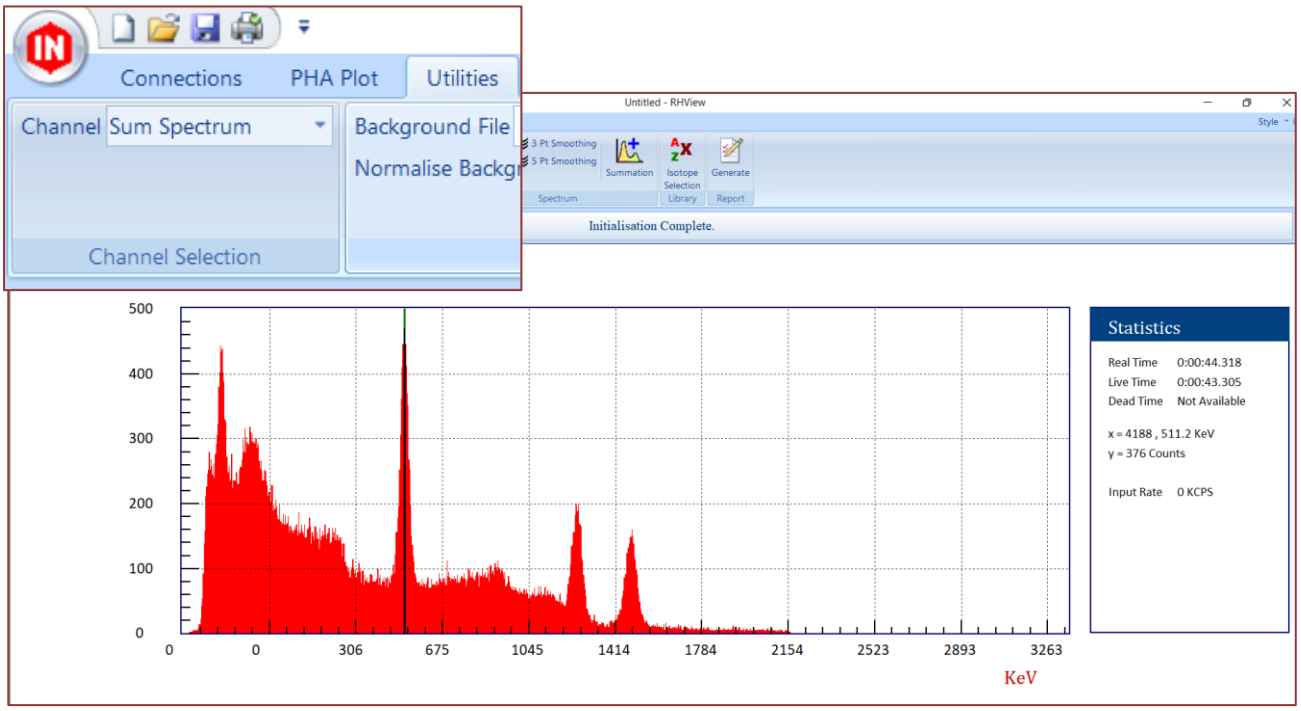
Figure 33 : Spectrum Summation

All the spectrum will be added together with reference to their energy values and will be displayed as **Sum Spectrum.** Two spectrums from file are displayed here.





When Spectrum Summation is performed by user, Sum Spectrum is displayed on screen automatically.



Report Generation

To generate report of acquired spectrum, click "**Report**" button in Utilities tab.

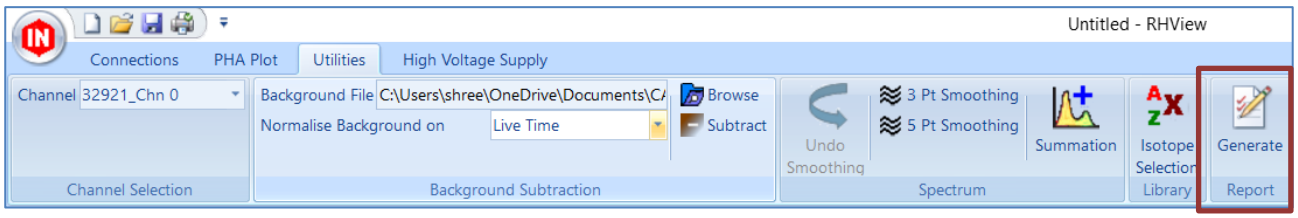
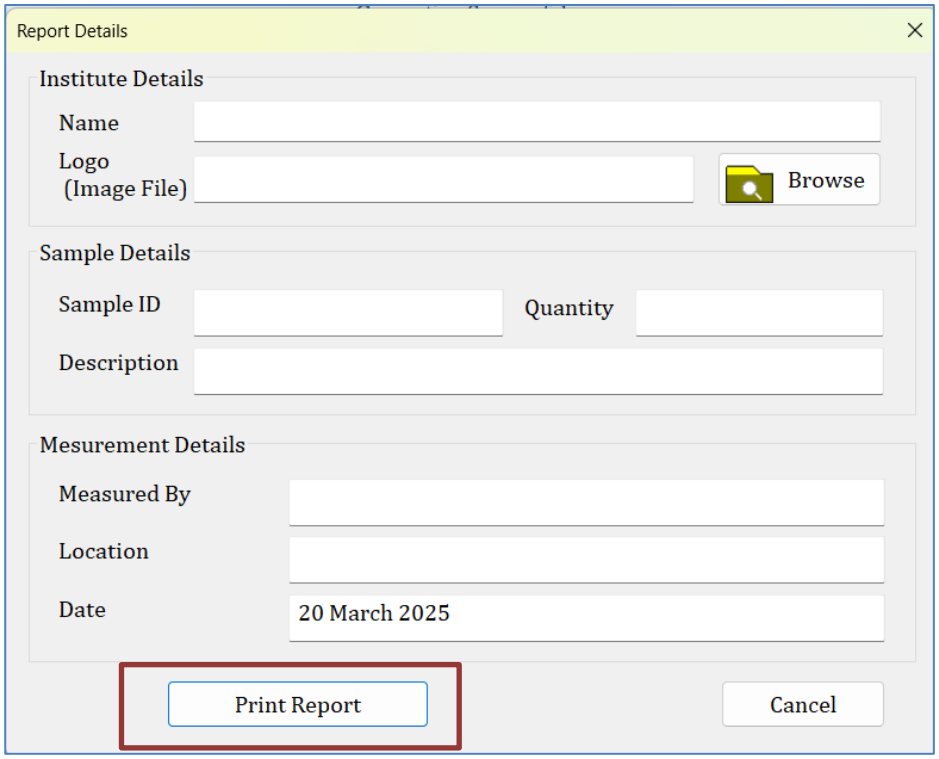


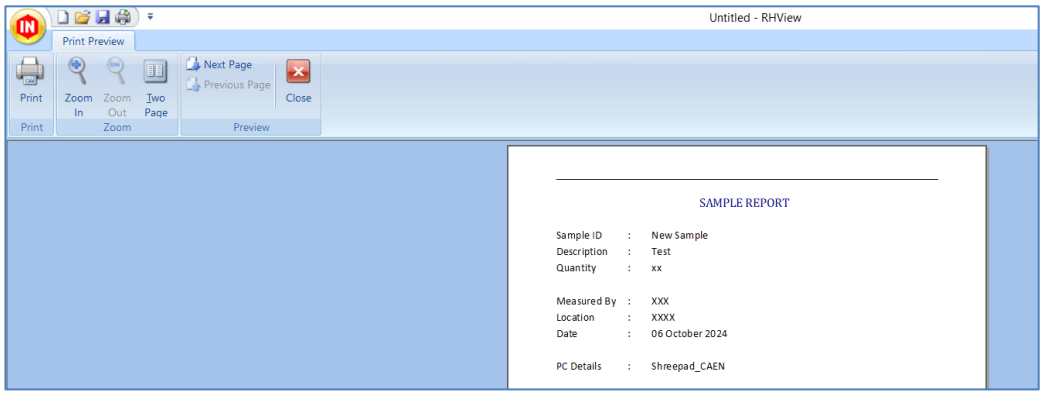
Figure 34 : Report Generation

Enter details of sample acquired as shown in picture. Click "**Print Report**" button.



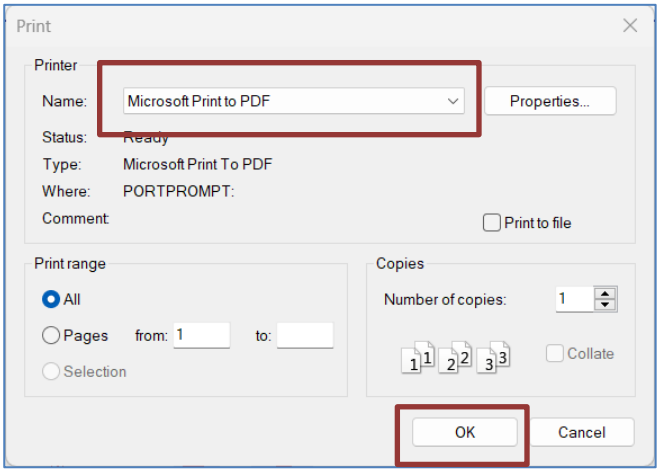
Enter the details of sample acquired as shown in the above picture. User can include his institute name and logo. Logo should be in jpg or bmp or ico format with at least 32 x 32 pixel size.

Report will appear in printable format.

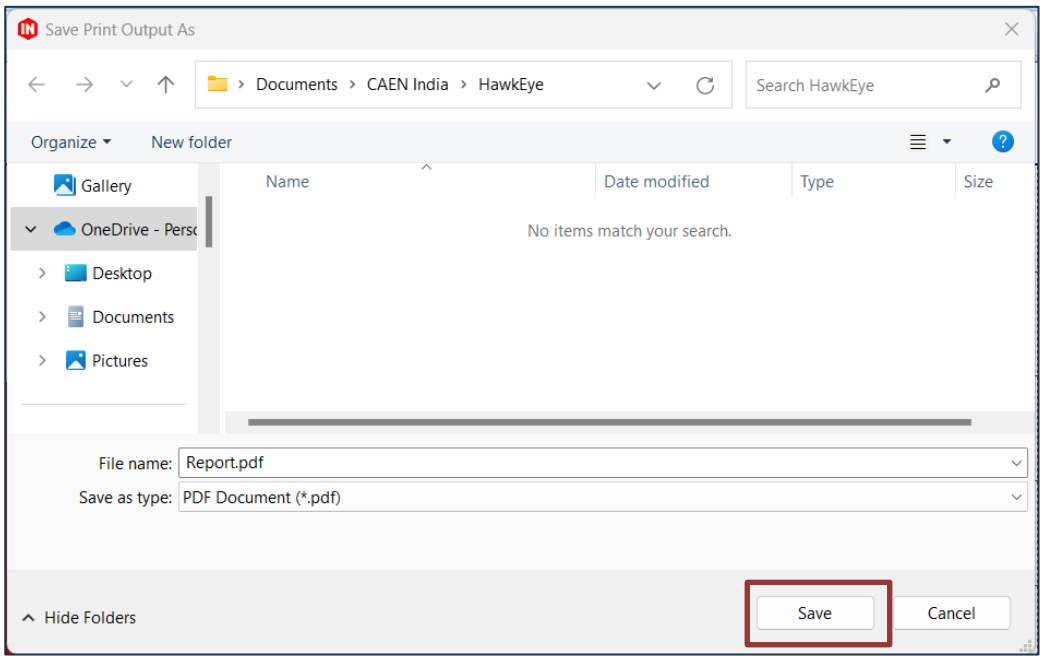


Use printer interface of windows to print the report. Select the printer's name and click "**OK**".

To save report in PDF format, use "Microsoft Print to PDF" printer and click "**OK**"

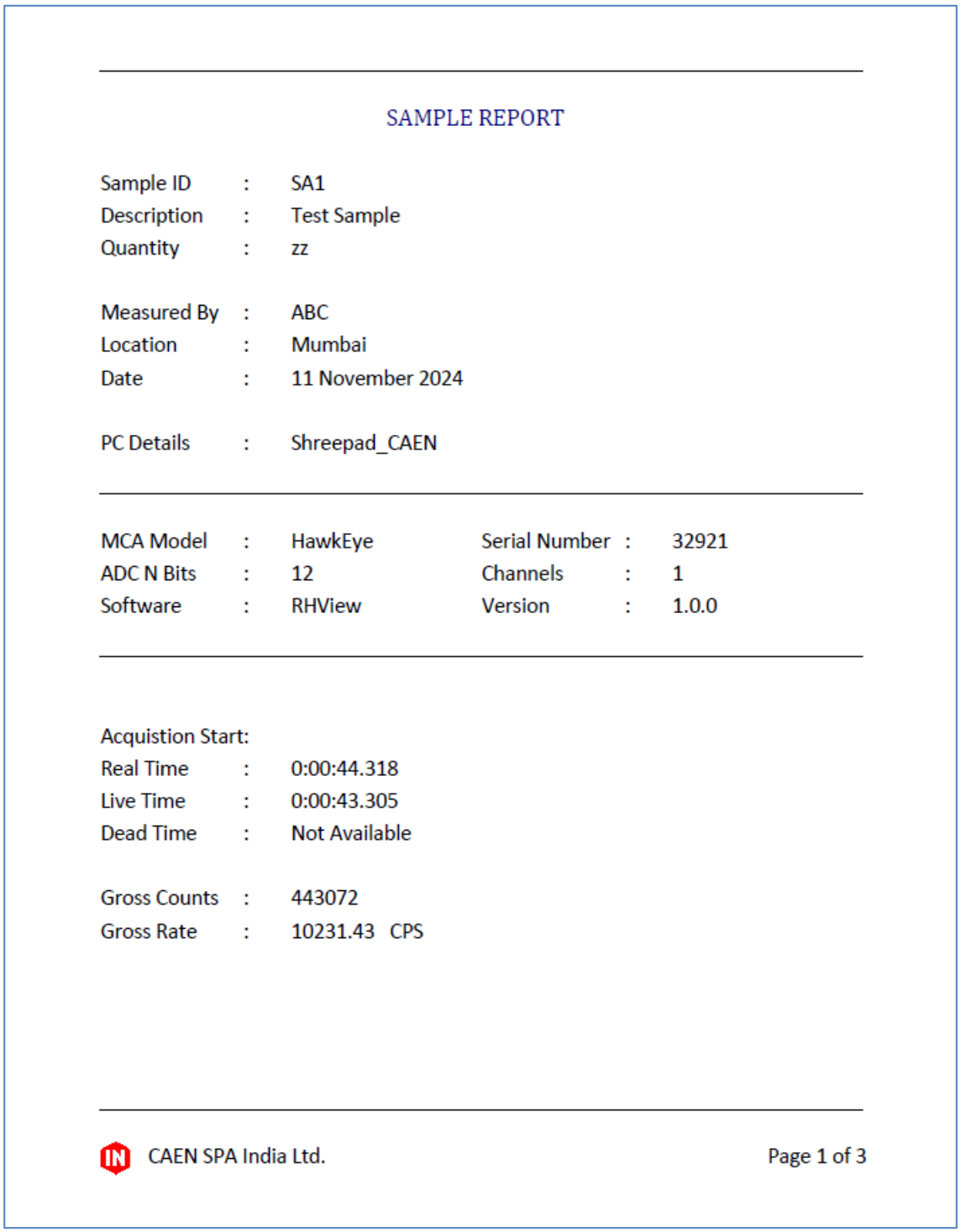


On next screen, enter the path to save report in PDF format.


Save Print Output As
Documents › CAEN India › HawkEye
Search HawkEye
Organize
New folder
Gallery
OneDrive - Perso
Desktop
Documents
Pictures
Name
Date modified
Type
Size
No items match your search.
File name: Report.pdf
Save as type: PDF Document (*.pdf)
Hide Folders
Save
Cancel

5 Report Formats

Spectrum analysis report has information about board, sample details, acquisition details etc. Sample report is shown here.



SAMPLE REPORT

Sample ID	:	SA1
Description	:	Test Sample
Quantity	:	zz
Measured By	:	ABC
Location	:	Mumbai
Date	:	11 November 2024
PC Details	:	Shreepad_CAEN

MCA Model	:	HawkEye	Serial Number	:	32921
ADC N Bits	:	12	Channels	:	1
Software	:	RHView	Version	:	1.0.0

Acquistion Start:

Real Time	:	0:00:44.318
Live Time	:	0:00:43.305
Dead Time	:	Not Available
Gross Counts	:	443072
Gross Rate	:	10231.43 CPS

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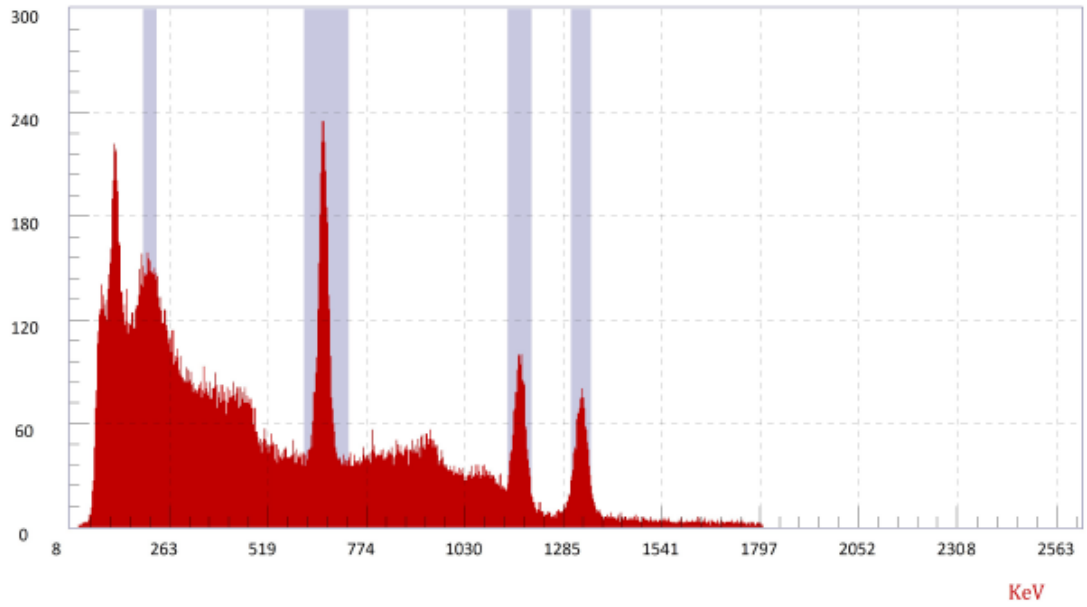
Figure 35 : Report (PHA Mode)



ROI # 1 Centroid : 4197.62 +/-0.55 (662.32 KeV)

Start Channel	:	3877	Stop Channel	:	4617
Resolution	:	4.15 +/-0.03 %	FWHM	:	27.15 KeV
Gross Counts	:	54738.16 +/- 233.96, (1264.01 CPS +/- 5.40 CPS)			
Background	:	21928.99 +/- 148.08, (506.38 CPS +/- 3.42 CPS)			
Net Counts	:	32809.17 +/- 181.13, (757.63 CPS +/- 4.18 CPS)			
Sigma	:	73.92 +/- 0.55 , (1.71 CPS +/- 0.01 CPS)			
Identified Isotope	:	Cs137			
Possible Isotope	:				

ROI # 2 Centroid : 1451.51 +/-30.46(233.94 KeV)

Start Channel	:	1192	Stop Channel	:	1421
Resolution	:	28.25 +/-28.10 %	FWHM	:	63.97 KeV
Gross Counts	:	29187.72 +/- 170.84, (674.00 CPS +/- 3.95 CPS)			
Background	:	8595.06 +/- 92.71, (198.48 CPS +/- 2.14 CPS)			
Net Counts	:	20592.66 +/- 143.50, (475.53 CPS +/- 3.31 CPS)			
Sigma	:	174.14 +/- 173.15, (4.02 CPS +/- 4.00 CPS)			
Identified Isotope	:	Co60(Asso. Peak)			
Possible Isotope	:				

ROI # 3 Centroid : 7467.60 +/-1.69 (1172.43 KeV)

Start Channel	:	7262	Stop Channel	:	7663
Resolution	:	3.00 +/-0.09 %	FWHM	:	34.92 KeV
Gross Counts	:	19488.38 +/- 139.60, (450.03 CPS +/- 3.22 CPS)			
Background	:	2478.32 +/- 49.78, (57.23 CPS +/- 1.15 CPS)			
Net Counts	:	17010.06 +/- 130.42, (392.80 CPS +/- 3.01 CPS)			
Sigma	:	95.07 +/- 2.82 , (2.20 CPS +/- 0.07 CPS)			
Identified Isotope	:	Co60			
Possible Isotope	:				

ROI # 4 Centroid : 8496.30 +/-3.14 (1332.91 KeV)

Start Channel	:	8317	Stop Channel	:	8652
Resolution	:	2.76 +/-0.18 %	FWHM	:	36.57 KeV
Gross Counts	:	14005.77 +/- 118.35, (323.42 CPS +/- 2.73 CPS)			
Background	:	156.98 +/- 12.53, (3.62 CPS +/- 0.29 CPS)			
Net Counts	:	13848.79 +/- 117.68, (319.80 CPS +/- 2.72 CPS)			
Sigma	:	99.54 +/- 6.61 , (2.30 CPS +/- 0.15 CPS)			
Identified Isotope	:	Co60			
Possible Isotope	:				

6 Standard Operating Procedure

Installation

1. Unpack the box.
2. Install RHView software on Laptop / PC
3. Connect board to Laptop or PC with USB or Ethernet cable.
4. For ethernet connection, setup IP address for PC. Refer section **Hardware and Software Setup**.
5. Start RHView Software and add connected board.
6. **Save workspace** on local drive.
7. In Hawkeye / Red Eagle models, go to **High Voltage Supply** section and set HV for PMT. Switch on HV supply.
8. Enter **file saving** option.
9. **Configure channel settings**
10. Set **energy filter**.
11. Keep standard gamma sources such as Cs137, Co60 or any other available source.
12. Set Stop Criteria and enter preset time. Start **acquiring spectrum**.
13. After completion of preset time, acquisition will stop automatically.
14. Set **Region of Interest**.
15. Set isotope library for **isotope identification**.
16. **Calibrate spectrum.**
17. Save workspace again.

Sample Counting

1. Remove all sources.
2. Start RHView Software.
3. **Open workspace** which is created earlier during installation.
4. In Hawkeye / Red Eagle models, go to **High Voltage Supply** section and set HV for PMT. Switch on HV supply.
5. Enter **file saving** option.
6. Set Stop Criteria and enter preset time. Start **acquiring spectrum**.
7. After completion of preset time, spectrum will be saved automatically. This spectrum is background spectrum of the set up.
8. Now keep the sample of interest.
9. Acquire the spectrum again.
10. Perform **background subtraction.**
11. **Generate report**.

7 Technical Support

To contact CAEN specialists for requests on the software, hardware, and board return and repair, it is necessary a MyCAEN+ account on www.caen.it:

https://www.caen.it/support-services/getting-started-with-mycaen-portal/

All the instructions for use the Support platform are in the document:

A paper copy of the document is delivered with CAEN boards.

The document is downloadable for free in PDF digital format at:

https://www.caen.it/wp-content/uploads/2022/11/Safety_information_Product_support_W.pdf

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