

DETECTOR

General

DETECTOR plugin is used to calibrate detectors for desired measurement mode. In the DETECTOR plugin one can simply with just a few mouse clicks perform detector specific calibration measurement, evaluate estimated data and apply new calibration settings to the detector. DETECTOR plugin provides a set of special calibration procedures for every detector type and model, for example resolution and zero offset determination, flood field determination etc.

Actually mounted detector will be automatically selected by the DETECTOR plugin. In case if the instrument has more than one detector mounted on multiple tracks one has to select desired detector name in the dropdown box as it shown in figure below.

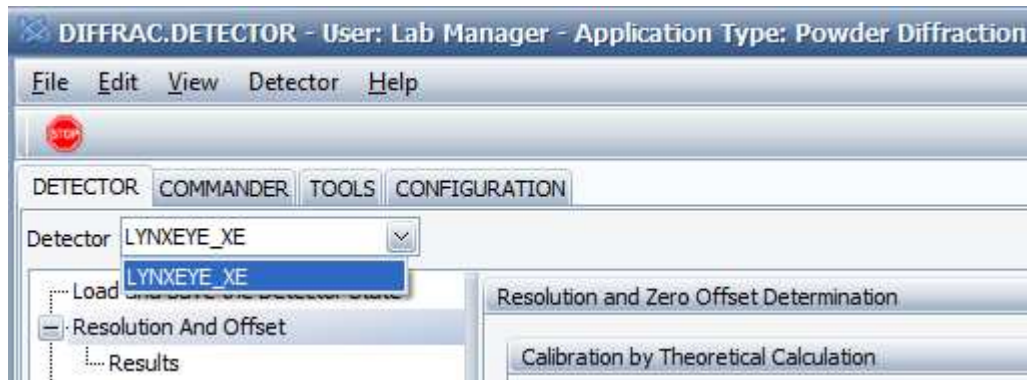


Fig. 1: Detector selection

In order to be able to make measurements with help of the DETECTOR plugin, one has to connect the DIFFRAC.SUITE to the measurement server and it presupposed that the Measurement Server has already obtained the control over the instrument.

Detector Menu

DETECTOR plugin has **Detector** menu at the top of the view.

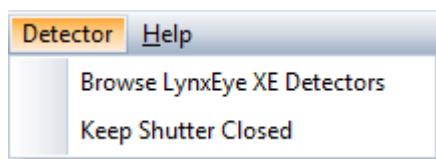


Fig. 2: Detector menu

Browse LYNXEYE XE detector

This opens a dialog to find a LYNXEYE XE detector in the local area network.

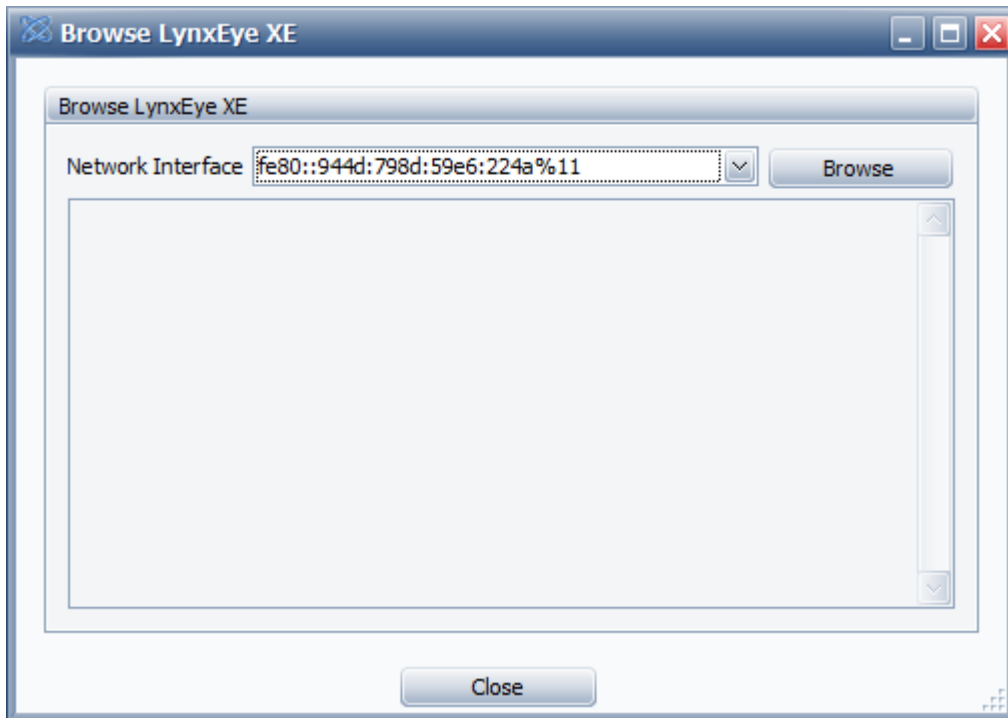


Fig. 3: Browse LYNXEYE XE detector dialog.

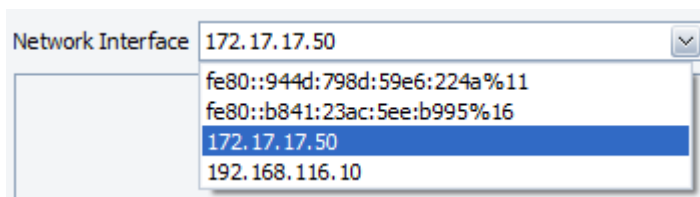


Fig. 4: Selecting Network Interface.

Select network interface (network adapter) in the drop down list box and click **Browse** button to find detector, as shown in the picture above.

When detector has been found its name, IP address and MAC address will be displayed.

Keep Shutter Close

This function can be applied only to 2D detectors.

1D Detector Calibration

Position sensitive detectors (1D detectors) like LYNXEYE XE, LYNXEYE, SSD160, VANTEC1 can be adjusted and calibrated with help of DETECTOR plugin.

Resolution and Zero Offset

Determination of the detector angular resolution (angular size of the single detector channel) and zero offset of the detector. This function supports LYNXEYE XE, LYNXEYE, SSD160 and VANTEC1 detectors.

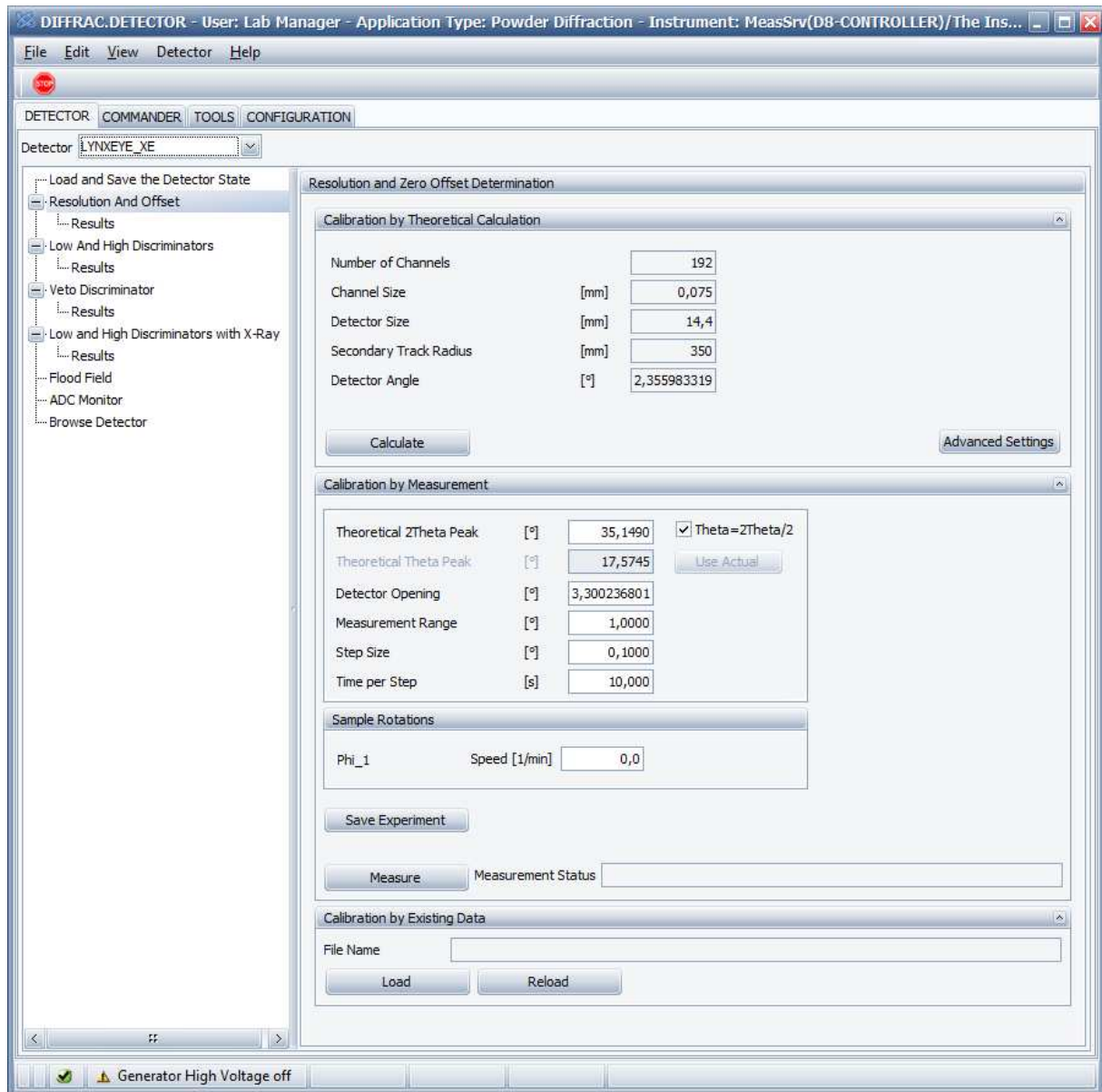


Fig. 5: Resolution And Offset.

Calibration by Theoretical Calculation

In order to get the calibration measurement succeeded one need to specify approximate values for the current detector resolution and zero offset. When even approximate values of the resolution and zero offset are unknown, one can calculate them theoretically with help of Calculate button.

The secondary track radius, total number of the detector channels and size of the single detector channel will be determined automatically by the DETECTOR plugin.

Calibration by Theoretical Calculation		
Number of Channels		192
Channel Size	[mm]	0,075
Detector Size	[mm]	14,4
Secondary Track Radius	[mm]	250
Detector Angle	[°]	3,296594350

Fig. 6: Calibration by Theoretical Calculation.

Advanced Settings Enables editing of the track radius, number of channels and size of the channel values.

By clicking a **Calculate** button, the view will be changed to the “Results” view as shown in figure below.

Quality of the Calibration		
<input checked="" type="radio"/> None		
Results		
Zero Offset	[°]	-1,64829717513988
Detector Resolution	[°]	0,0171887333382627
Standard Deviation		0
Number Of Points		0

Fig. 7: Results of the Resolution And Zero Offset Calculation.

“Quality of the Calibration” will stay unchanged in the case of theoretical calculation.

Zero Offset [°] **-1,64829717513988** displays calculated zero offset of the detector.

Detector Resolution [°] **0,0171887333382627** displays calculated resolution of the detector.

In order to apply calculated resolution and zero offset values to the instrument one has to click **Apply to Instrument** button. This will save the configuration with new values into database and into instrument, which requires restart of the instrument and reconnection of the DETECTOR plugin.

i NOTE

The LYNXEYE XE detector will immediately change the actual and configuration values for the instrument without restart of the instrument.

Calibration by Measurement

For the best angular resolution results one has to perform calibration measurement for the detector. When doing so the DETECTOR plugin will perform a set of fixed scans and after that calculate automatically the resolution and zero offset of the detector.

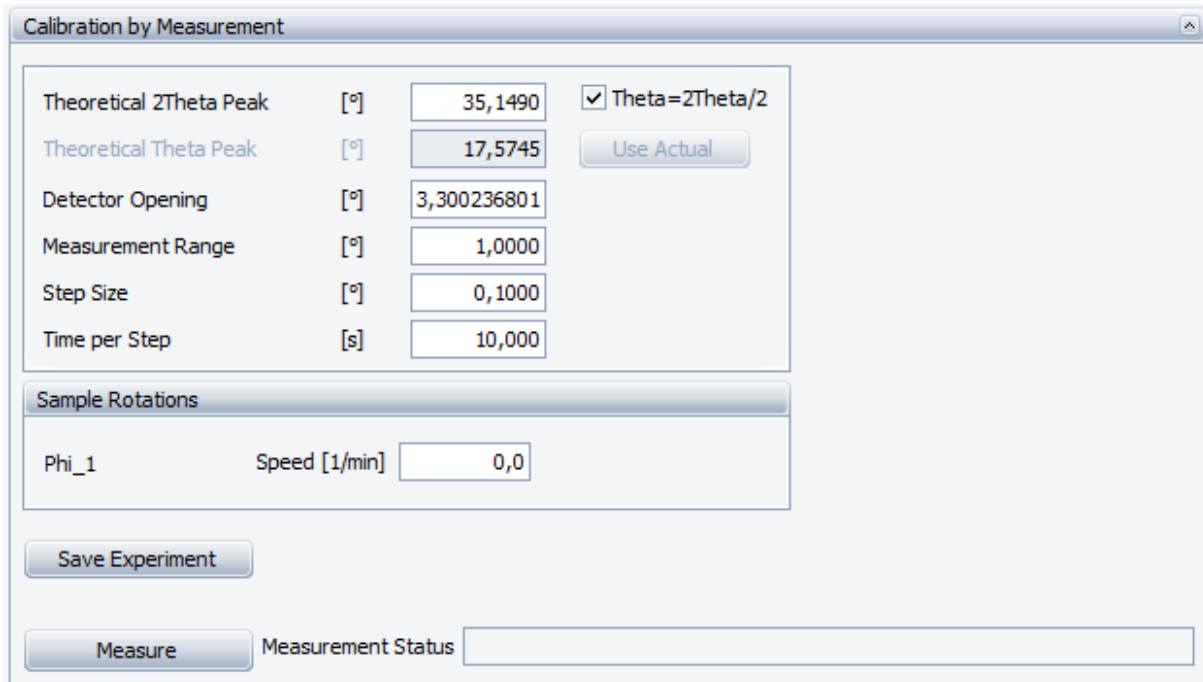


Fig. 8: Calibration by Measurement

Calibration measurement provides following options:

Theoretical 2Theta Peak [°]

Determines position of the two theta axis.

Theoretical Theta Peak [°]

Determines position of the theta axis.

Theta=2Theta/2

When checked, Theta value is set automatically to a half of 2Theta value. In order to specify user defined value, please, uncheck the box. Unchecking the box enables **Use Actual** button.

Copies actual position of the theta axis into Theoretical Theta Peak field.

Detector Opening [°]

Determines maximum detector opening. Measurement has to be started with maximum detector opening.

Measurement Range [°]

Determines range of the measurement. It should be less then maximum detector opening.

Step Size [°]

Determines increment of the detector position between two fixed scans.

Time per Step [s]

Determines measurement time for single fixed scan.

When instrument has a sample rotation axes, one can specify rotation speed for every axis.




Save Experiment Saves calibration experiment with specified parameters to file. One can start the saved “brml” file as a job with help of **Fehler! Verweisquelle konnte nicht gefunden werden.** plugin.

Measure Starts the calibration measurement, analyzes measured data and calculates resolution and zero offset values.

Parameter values for all other optics (e.g. variable slit size.), which are not displayed in the DETECTOR plugin could be set in the **Fehler! Verweisquelle konnte nicht gefunden werden.** or **Fehler! Verweisquelle konnte nicht gefunden werden.** plugins.

One can observe the progress of the calibration measurement in the **Fehler! Verweisquelle konnte nicht gefunden werden.** plugin.

 Aborts actually running calibration measurement started by DETECTOR plugin.

When calibration measurement has been finished the DETECTOR plugin will change automatically to the Results view.

Calibrate by Existing Data

One can analyze saved calibration data again by clicking **Load** button. In the upcoming file open dialog one can select “brml” file to analyze. DETECTOR plugin will change automatically to the Results window, which is described in the next section.

Reload Reloads selected “brml” file and determines resolution and zero offset for the detector again.

Results

The view of the **Results** of the resolution and zero offset calibration is shown in picture below.

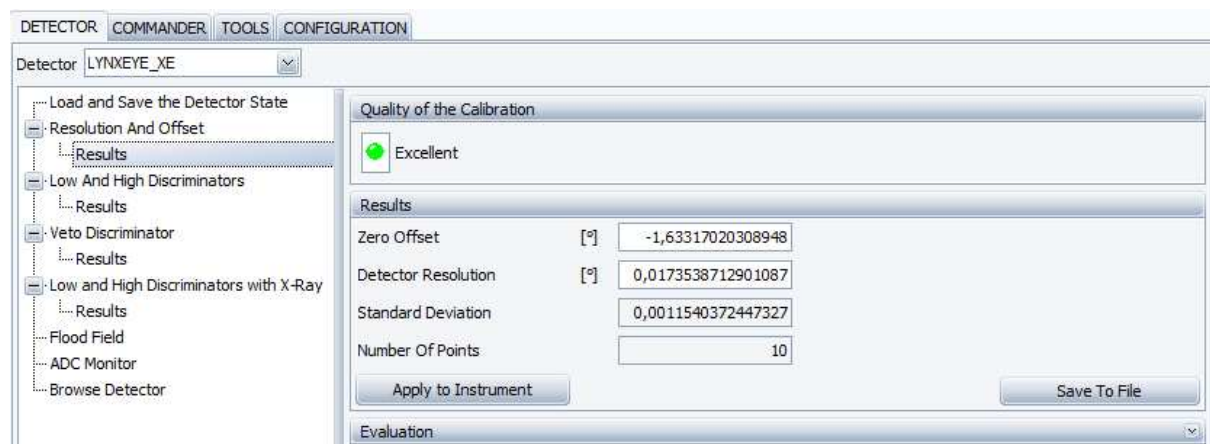






Fig. 9: Results of the Resolution and Zero Offset measurement

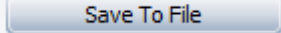
“Quality of the Calibration” field will be displayed at the top of the Results view and can take following values:

 **None** Calibration measurement has not been done.

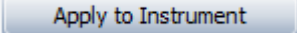
 **Not Satisfying** Quality of the calibration measurement is not satisfying.

 **Satisfying** Quality of the calibration is satisfying. Number of points ≥ 6 and standard deviation $< 1e-2$.

 **Excellent** Quality of the calibration is excellent. Number of points ≥ 10 and standard deviation $< 1.5e-3$.

 **Save To File** Saves measured calibration data to “brml” file. Saved file can be analyzed again in the “Calibrate by Existing Data” section.

In order to apply measured resolution and zero offset values to the instrument one has to click

 **Apply to Instrument** button. This will save the configuration with new values into instrument and into database, which requires restart of the instrument and reconnection of the DETECTOR plugin to the measurement server. Measurement server has also to be reconnected to the instrument.

 **NOTE**

The LYNXEYE XE detector will immediately change the actual and configuration values for the instrument without restart of the instrument.

LYNXEYE XE

Load and Save The Detector State

LYNXEYE XE detector can be used in few different modes (e.g. High Resolution or High Count Rate) moreover it could be used with different X-Ray tubes (e.g. Cu or Mo tubes). Detector requires a set of special calibrations to be done for every combination of tube and mode. Making a set of calibration once one can save the calibrated detector state to file. LYNXEYE XE detector allows to simply reload detector state from the file without restarting of the instrument, when using desired tube and mode combination again.

Load State To Detector

Loads all detector settings from file into detector. It does not need a restart of the instrument.

Save State To File

Saves all detector settings to file.

Low and High Discriminators

Performs trimming of the low and high discriminators with help of the internal simulated pulses without X-Ray beam.

Internal simulated pulses are used when trimming with help of X-Ray beam is not possible, in other cases trimming with the monochromatic X-Ray beam is recommended.

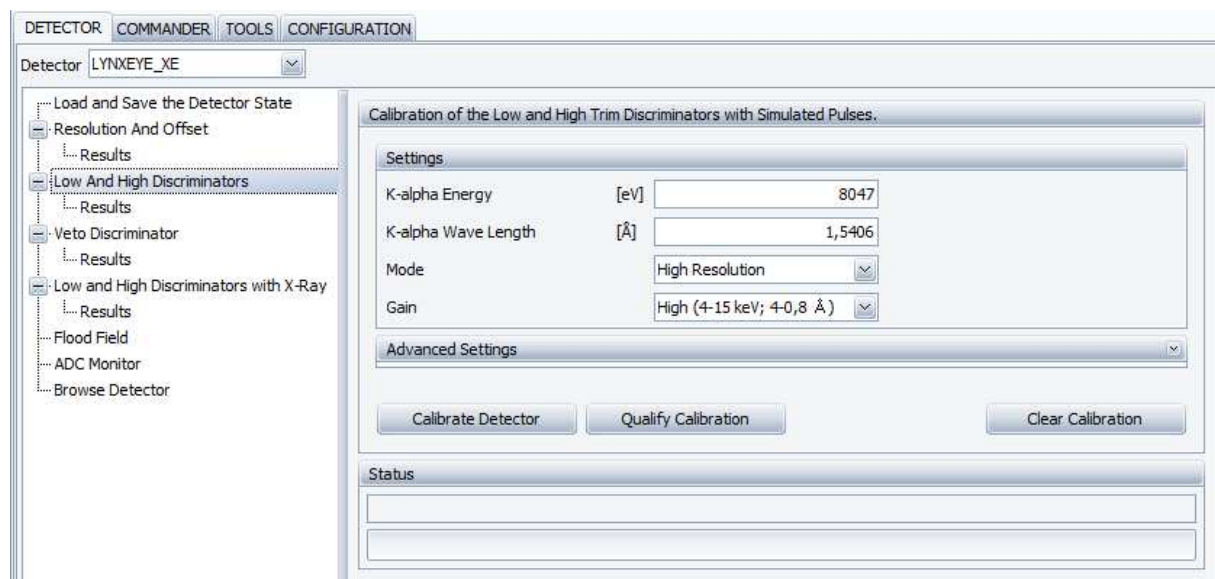


Fig. 10: Low and High Discriminators

The functions of all dialogs and buttons are identical to functions described in the **Low and High Discriminators with X-Ray** chapter.

Please refer to the **Low and High Discriminators with X-Ray** chapter for more information.

Veto Discriminator

LYNXEYE XE has a veto discriminator, which can discriminate signals, that come simultaneously in the neighbor channels. This normally happens when the same gamma quant deposits its energy in more than one channel.

The veto discriminator can be adjusted for every single detector channels in the **Veto Discriminator** section. Veto calibration will be done with the closed shutter.

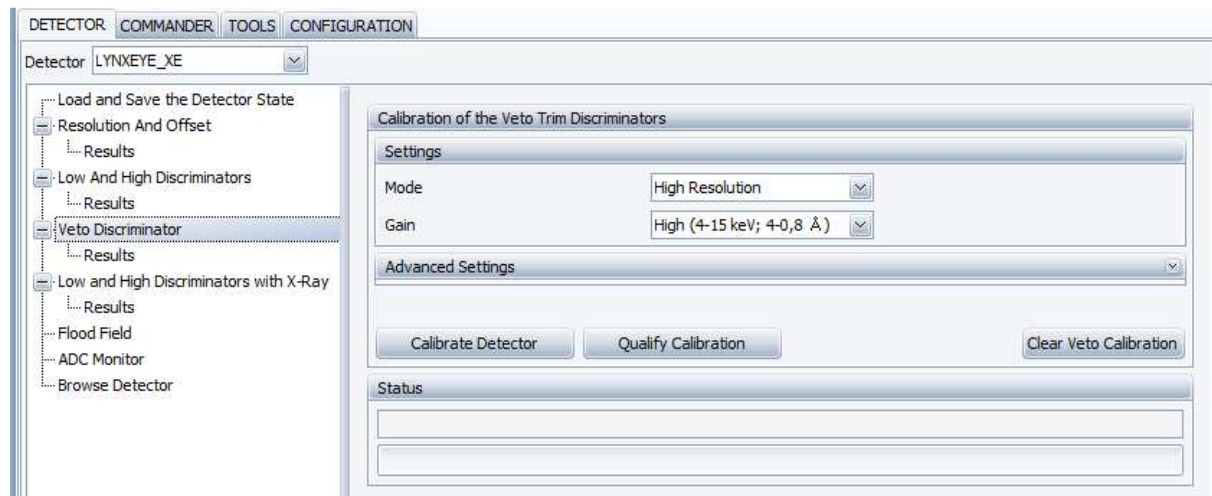


Fig. 11: Veto Discriminator

Veto trimming provides following options:

Mode Determines detector mode:

High Resolution applies settings for maximum energy resolution to the detector.

High Count Rate applies settings for maximum count rate to the detector.

Actual Settings is a user custom mode. Trimming will be performed with actual detector settings. actual detector settings can be set in the TOOLS plugin. It is recommended only for advanced users.

Gain Determines amplification gain of the detector.

Clears veto calibration of the detector.

Qualifies actual veto calibration of the detector. Actual settings of the detector will be not changed.

Starts calibration measurement and determines veto calibration for the detector. Calibration will be applied automatically to the detector. Actual and configuration values of the detector will be changed. Configuration with new values will be written into database. Instrument does not require restart or reconnect.

Status and progress of the detector calibration or qualification will be shown in the status display, see figure below.

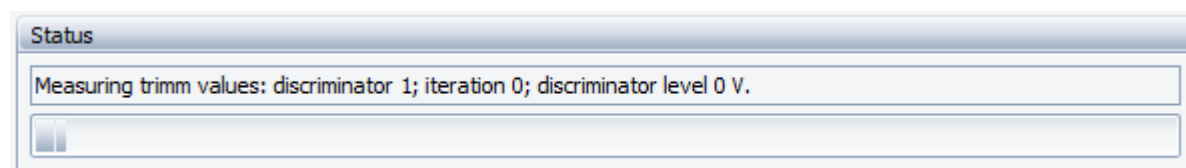


Fig. 12: Status and progress of the measurement.

When calibration or qualification measurement has been finished, the DETECTOR plugin will change automatically to the **Results** view.

One can abort actual measurement by clicking the  button in the toolbar menu at the top-left corner.

Results

View of the Results of the veto trimming calibration is shown in the figure below.


Quality of the Calibration		
 Excellent		
Veto		
	ASIC1	ASIC2
Mean value, V	0,0341670410160951	0,0344204008570174
Standard deviation, V	0,00113747498094702	0,00126981970871063
6Sigma width (99.7%), V	0,0113248498856821	0,0136189182522638

Fig. 13: Veto Trimming Results

Mean Value, V This is optimum value for the Veto Discriminator.

Standard Deviation, V Statistical deviation of the discriminator values for all channels.

6Sigma width, V Interval on the discriminator axis, which includes about 99,7 % of measured values for all channels, usually it is less than 1 LSB, which is 0,002 V for LYNXEYE XE.

Low and High Discriminators with X-Ray

LYNXEYE XE has high and low energy discriminators. For best energy discrimination results every detector channel has to be trimmed with help of monochromatic X-Ray beam.

LYNXEYE XE detector has to be set up for the calibration as it described in the detector manual.

View of the trimming of the low and high discriminators with help of X-Ray measurement is shown below.

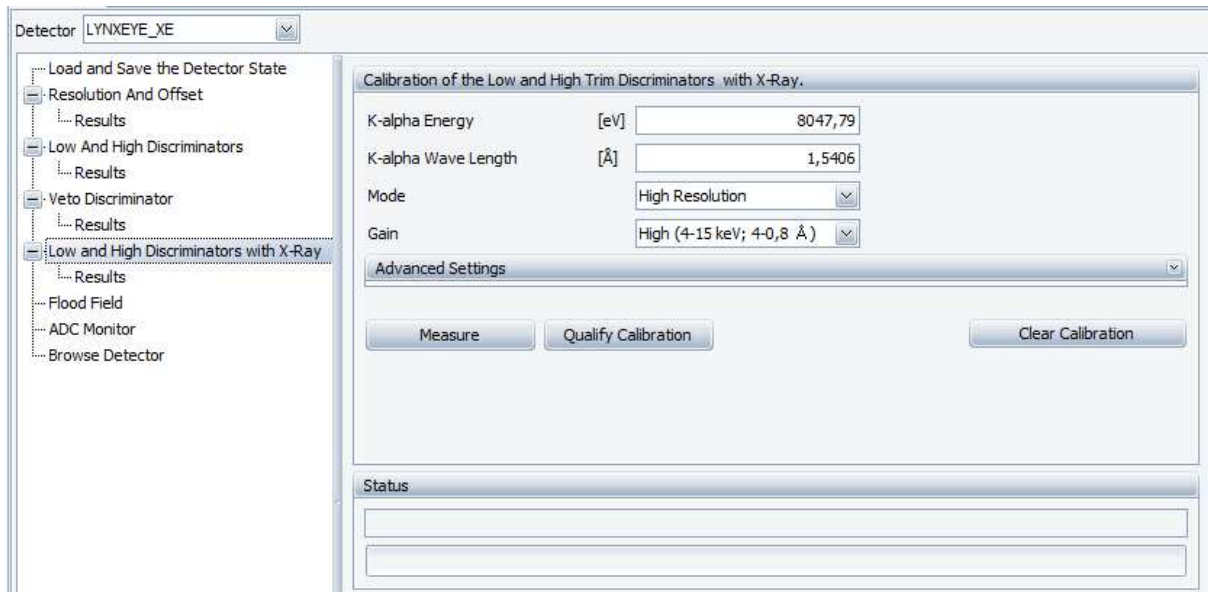


Fig. 14: Trimming with X-Ray

Trimming with X-Ray provides following options:

K-alpha Energy [eV] Determines energy of the X-Ray source. Actual value specified in the X-Ray tube will be automatically set into this field.

K-alpha Wave Length [Å] Determines wave length of the X-Ray source. Actual value specified in the X-Ray tube will be automatically set into this field.

Mode Determines detector mode:

High Resolution applies settings for maximum energy resolution to the detector.

High Count Rate applies settings for maximum count rate to the detector.

Actual Settings is a user custom mode. Trimming will be performed with actual detector settings. It is recommended only for advanced users.

Gain Determines amplification gain of the detector.

Clear Calibration Clears actual high and low discriminator trim values and correction values.

Qualify Calibration Qualifies quality of the actual trimming settings for the load and high discriminators. Detector settings will stay unchanged.

Measure Starts trimming measurement, determines trimming settings and applies them to the detector. Actual and configuration settings of the detector will be changed. Configuration with new settings will be written into database. At the end of the trimming the view will be changed to Results view.

Status and progress of the detector calibration or qualification will be shown in the status display, see figure below.

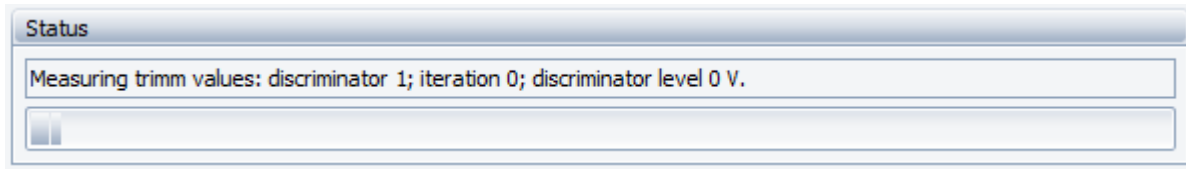


Fig. 15: Status and progress of the measurement.

One can abort actual measurement by clicking the  button in the toolbar menu at the top-left corner.

Results

Displays results of the calibration for low and high discriminators.

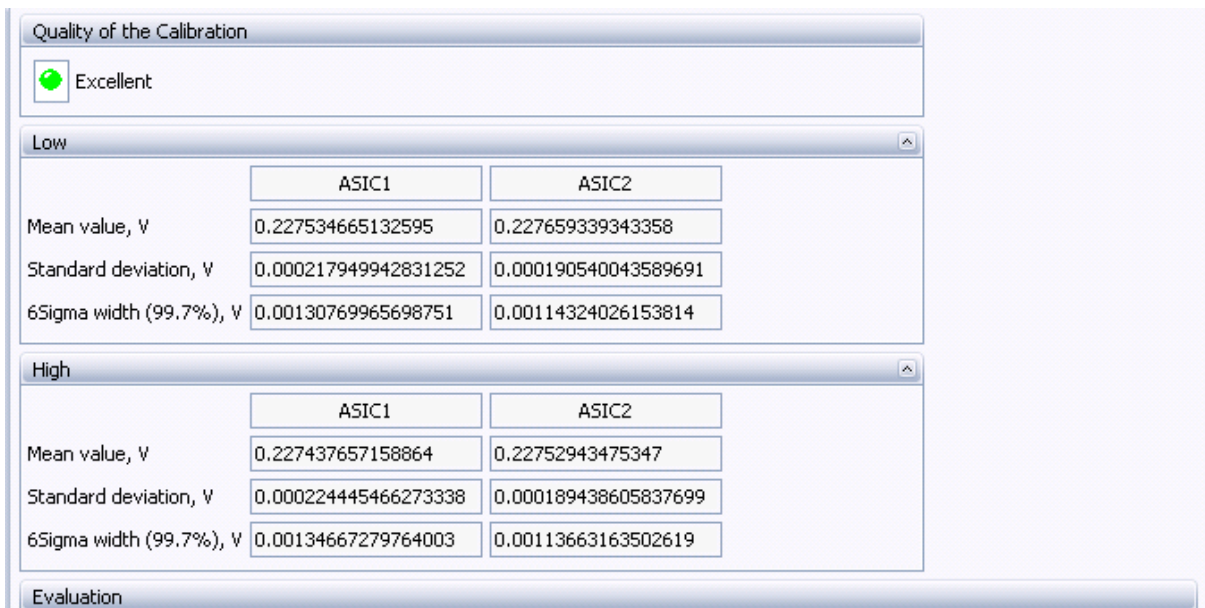
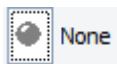


Fig. 16: Results of the calibration.

“Quality of the Calibration” can take following values:



None

Calibration measurement has not been done.



Not Satisfying

Quality of the calibration measurement is not satisfying.



Satisfying

Quality of the calibration is satisfying.



Excellent

Quality of the calibration is excellent.

Following statistical parameters will be displayed:

Mean Value, V Discriminator value, which corresponds to the energy of the X-Ray radiation used in the calibration.

Standard Deviation, V Statistical deviation of the discriminator values for all channels.

6Sigma width, V Interval on the discriminator axis, which includes about 99,7 % of measured values for all channels, usually it is less than 1 LSB, which is 0,002 V for LYNXEYE XE.

Flood Field

Flood field calibration equalizes sensitivity of detector channels by determining of linear coefficients for every channel.

Detector should be set up for the calibration as it described in the LYNXEYE XE detector manual.

The screenshot shows a software window titled "Flood Field Determination". Inside the window, there are two main sections. The top section contains a "Measure time" field with a unit "[s]" and a value of "10". Below it is a "Flood Corrections" field containing a list of 11 "1"s followed by an ellipsis "...". A "Measure and Set" button is located below these fields. The bottom section is titled "Status" and contains two empty text boxes.

Fig. 17: Flood Field Determination

Flood field determination provides following options:

Measure time [s] Specifies measurement time.

Flood Corrections Actual detector flood corrections.

Starts flood field calibration measurement. Coefficients will be automatically determined from the measured data and applied to instrument, actual and configuration values of the instrument will be changed. New configuration will be written into database.

Status bar at the bottom displays progress and status of the calibration measurement.

ADC Monitor

Monitors and records LYNXEYE XE detector properties (e.g. high voltage, ASIC temperature, etc.) over time.

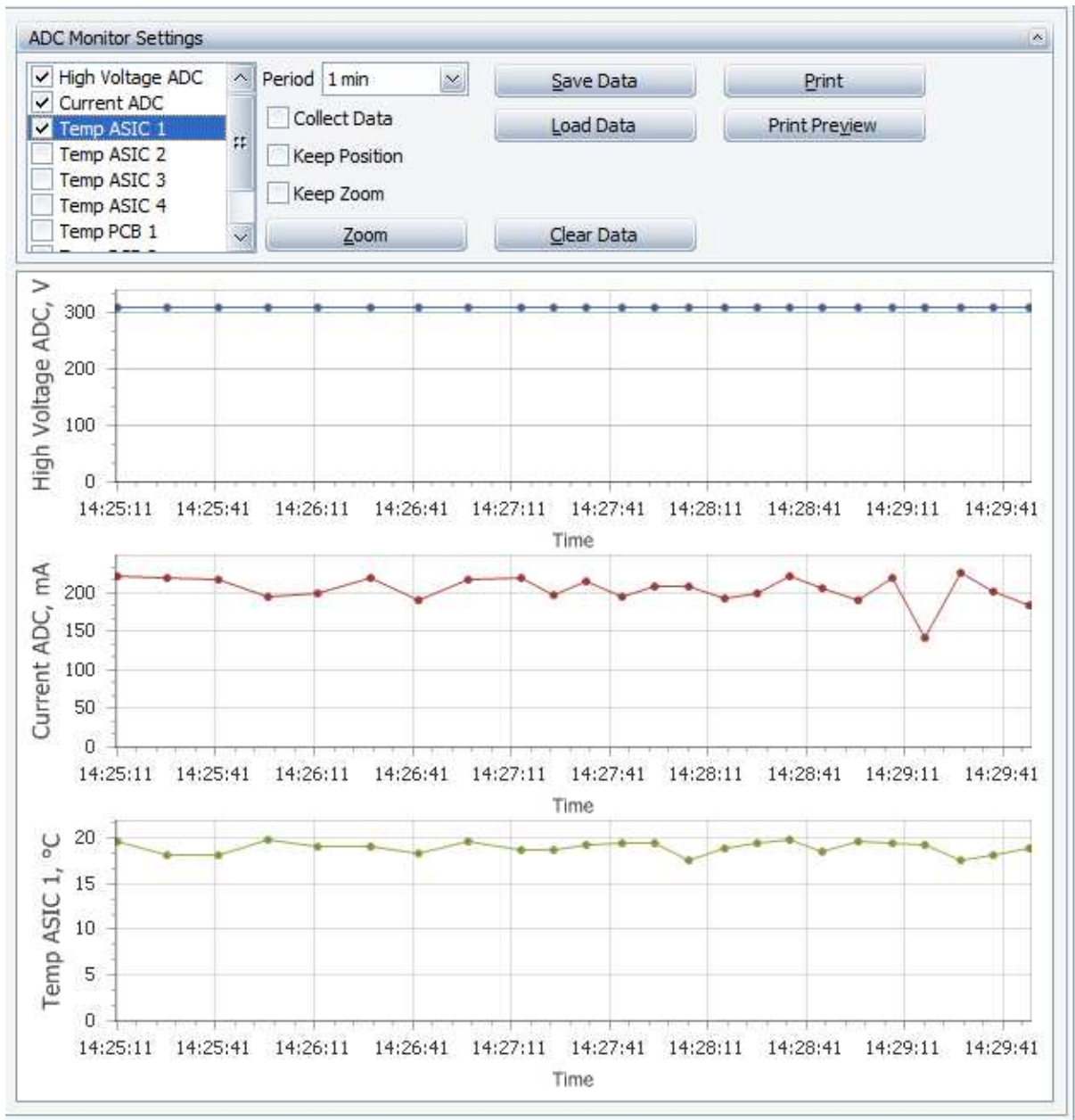


Fig. 18: ADC Monitor

In order to record detector data ensure that **Collect Data** check box is checked.

Select properties to be recorded by checking them in the list at the top left corner.

ADC monitor provides following options:

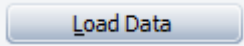
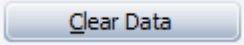
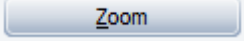
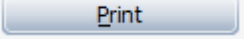
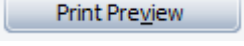
Collect Data Collects detector data (e.g. Temp ASIC 1, etc.) when checked.

Keep Position Keeps position of the chart when checked.

Keep Zoom Keeps zoom of the chart when checked.

Period Specifies data collection period.

Saves collected data to file with text based format.

	Loads data from file.
	Clears actual data.
	Specifies zoom – minimum and maximum values for the chart axes.
	Prints actual chart.
	Opens print preview dialog.

Detector Browse

Finds LYNXEYE XE detector in the local area network.

Select network interface (network adapter) in the drop down list box and click **Browse** button to find detector.

When detector has been found its name, IP address and MAC address will be displayed.

See more description in the **Browse LYNXEYE XE detector** section in the Detector Menu.