



HDF5 Explorer

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Outline

- Introduction
- HDF5Explorer package
- System of GUI & Example of plots
- Summary

Introduction

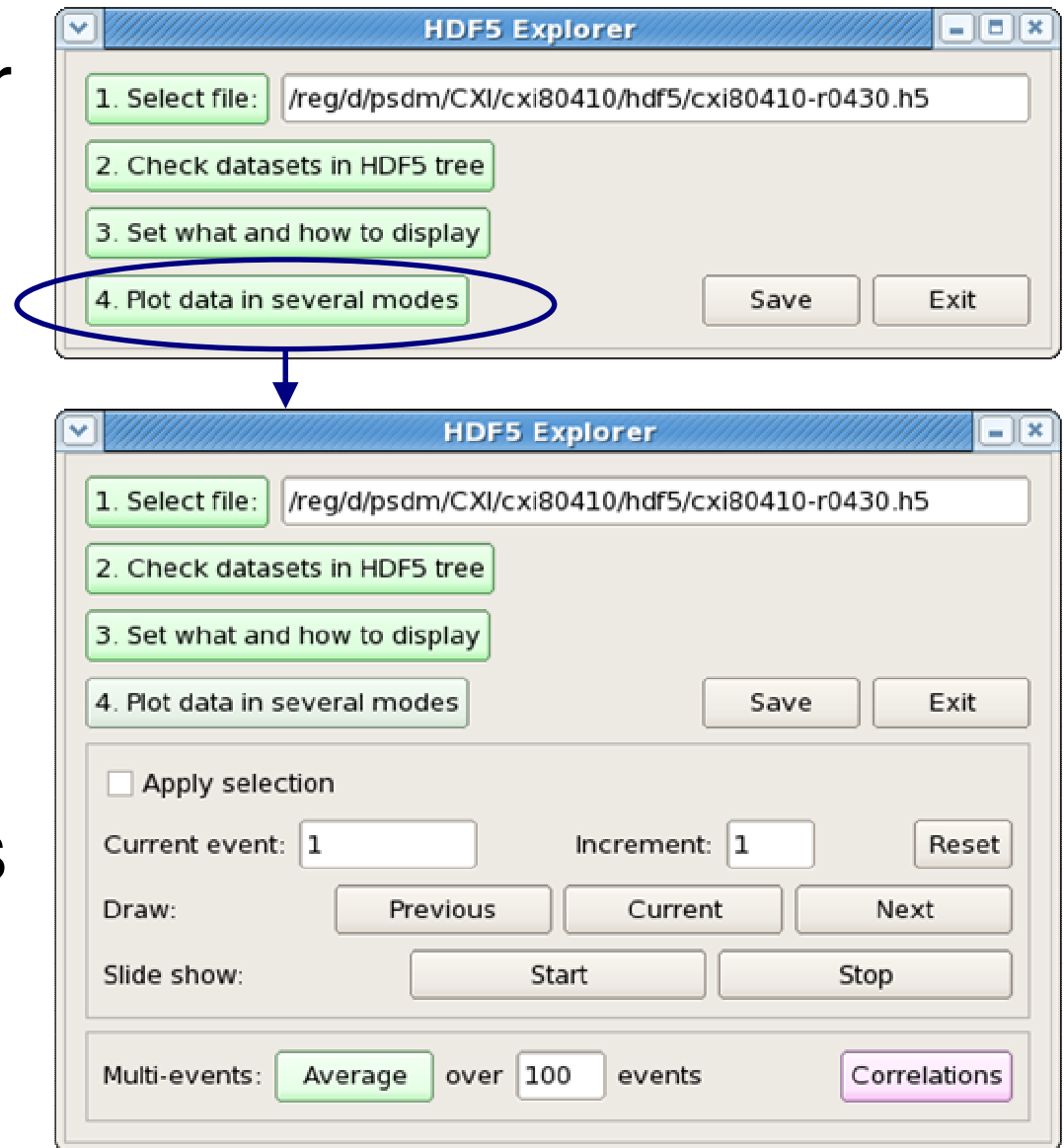
- LCLS users need in flexible interactive tool to look at data in XTC and HDF5 formats.
- I will discuss HDF5, Ingrid – XTC.
- Available external packages for HDF format:
 - HDFView (Java) does not work with LCLS images,
 - ViTables does not have any graphics (except GUI)Re-implementation assumes deep intervention in quite specific code.
- We decided to create our own package on Python, using h5py, matplotlib and PyQt4 libs.

HDF5 Explorer package

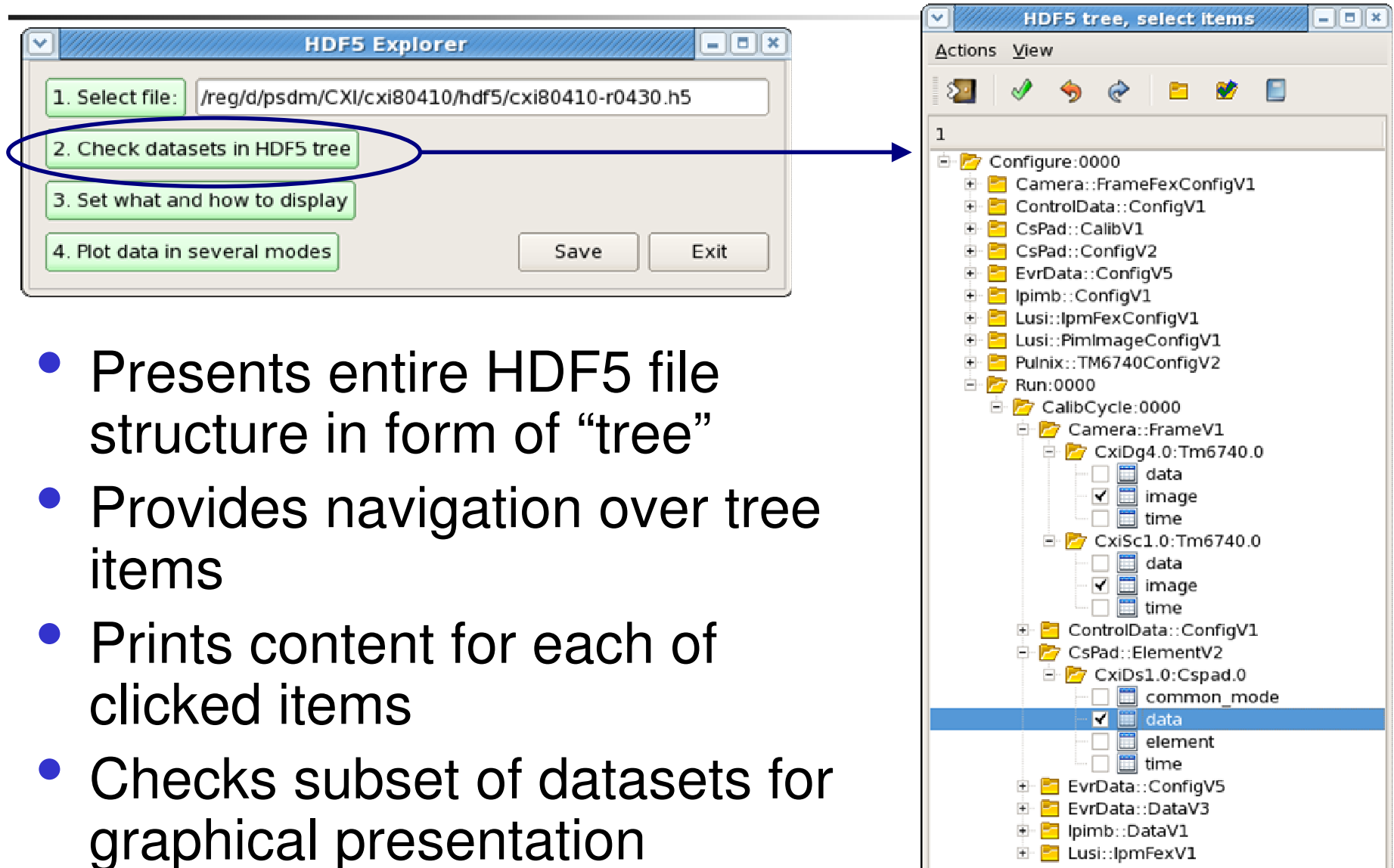
- Package name: HDF5Explorer
- Documentation:
<https://confluence.slac.stanford.edu/display/PCDS/HDF5+Explorer>
- To run this program use command on psana
 - [for now need to create release and add package]
 - hdf5explorer
- Three control GUIs:
 - HDF5 Explorer or Main GUI
 - HDF5 Tree and Item Selection GUI
 - What and how to display GUI
 - Sub-GUIs for parameter settings.

Main GUI

- Step-by-step order of buttons
- Color of button is changed when the step is passed
- Button 4: expands/collapses the Main GUI for long/short version



HDF5 Tree and Item Selection GUI



The image displays two windows from the HDF5 Explorer application. The left window, titled 'HDF5 Explorer', contains a workflow with four steps: '1. Select file:', '2. Check datasets in HDF5 tree', '3. Set what and how to display', and '4. Plot data in several modes'. Step 2 is circled in blue, and a blue arrow points from it to the right window. The right window, titled 'HDF5 tree, select items', shows a hierarchical tree of HDF5 datasets. The tree structure includes folders like 'Configure:0000', 'Run:0000', and 'CalibCycle:0000', with various sub-items such as 'Camera::FrameFexConfigV1', 'ControlData::ConfigV1', 'CsPad::CalibV1', 'CsPad::ConfigV2', 'EvrData::ConfigV5', 'Ipimb::ConfigV1', 'Lusi::lpmFexConfigV1', 'Lusi::PimImageConfigV1', 'Pulnix::TM6740ConfigV2', 'Camera::FrameV1', 'CxiDg4.0:Tm6740.0', 'CxiSc1.0:Tm6740.0', 'ControlData::ConfigV1', 'CsPad::ElementV2', 'CxiDs1.0:Cspad.0', 'EvrData::ConfigV5', 'EvrData::DataV3', 'Ipimb::DataV1', and 'Lusi::lpmFexV1'. The 'data' item under 'CxiDs1.0:Cspad.0' is selected and highlighted in blue.

- Presents entire HDF5 file structure in form of “tree”
- Provides navigation over tree items
- Prints content for each of clicked items
- Checks subset of datasets for graphical presentation

What and how to display GUI

The image shows two windows from a software application. The 'HDF5 Explorer' window on the left has a list of steps: '1. Select file:', '2. Check datasets in HDF5 tree', '3. Set what and how to display' (circled in blue), and '4. Plot data in several modes'. A blue arrow points from step 3 to the 'What and how to display' window. This second window has a green border and contains settings for 'CSpad' and 'Image' views. Below these is a red-bordered sub-GUI for 'Win:1' with various plot controls. A green arrow points from the 'Top - check box section' bullet to the top of the 'What and how to display' window. A red arrow points from the 'Bottom - sub-GUI window, controlled by two toolbars' bullet to the red-bordered sub-GUI. At the bottom of the 'HDF5 Explorer' window are 'Save' and 'Exit' buttons.

HDF5 Explorer

1. Select file: /reg/d/psdm/CXI/cxi80410/hdf5/cxi80410-r0430.h5
2. Check datasets in HDF5 tree
3. Set what and how to display
4. Plot data in several modes

Save Exit

What and how to display

CSpad

Images: ☐ 8 of 2x1 ☐ Quad ☒ Detector

Spectra: ☐ 8 of 2x1 ☐ 16 ASICs

Image & Spectrum: ☒ 1 of 2x1

Projections: ☐ X ☐ Y ☐ R ☐ ϕ

Image

☐ Image ☐ Spectrum ☒ Image and Spectrum

☐ X ☐ Y ☐ R ☐ ϕ

CSpad Image **Waveform** Proj. Corr.

Number of windows: 1

Win:1

Dataset: All

Image plot ☒ A min/max: 0 100

Spectrum ☐ A min/max: 0 100 ☐ N bins: 100

☒ Bin width: 1

Configuration Selection

Save Quit

- Dynamic-content GUI
- Top – check box section
- Bottom – sub-GUI window, controlled by two toolbars
- Save and Quit buttons

Check box sections GUI

- Top check box sections depend on selected datasets
- May have up to three check box sections:

The image shows a screenshot of a GUI with three distinct sections, each containing a title and several check boxes. The sections are stacked vertically and separated by thin lines.

CSpad

Images: ☐ 8 of 2x1 ☐ Quad ☒ Detector

Spectra: ☐ 8 of 2x1 ☐ 16 ASICs

Image & Spectrum: ☒ 1 of 2x1

Projections: ☐ X ☐ Y ☐ R ☐ ϕ

Image

☐ Image ☐ Spectrum ☒ Image and Spectrum

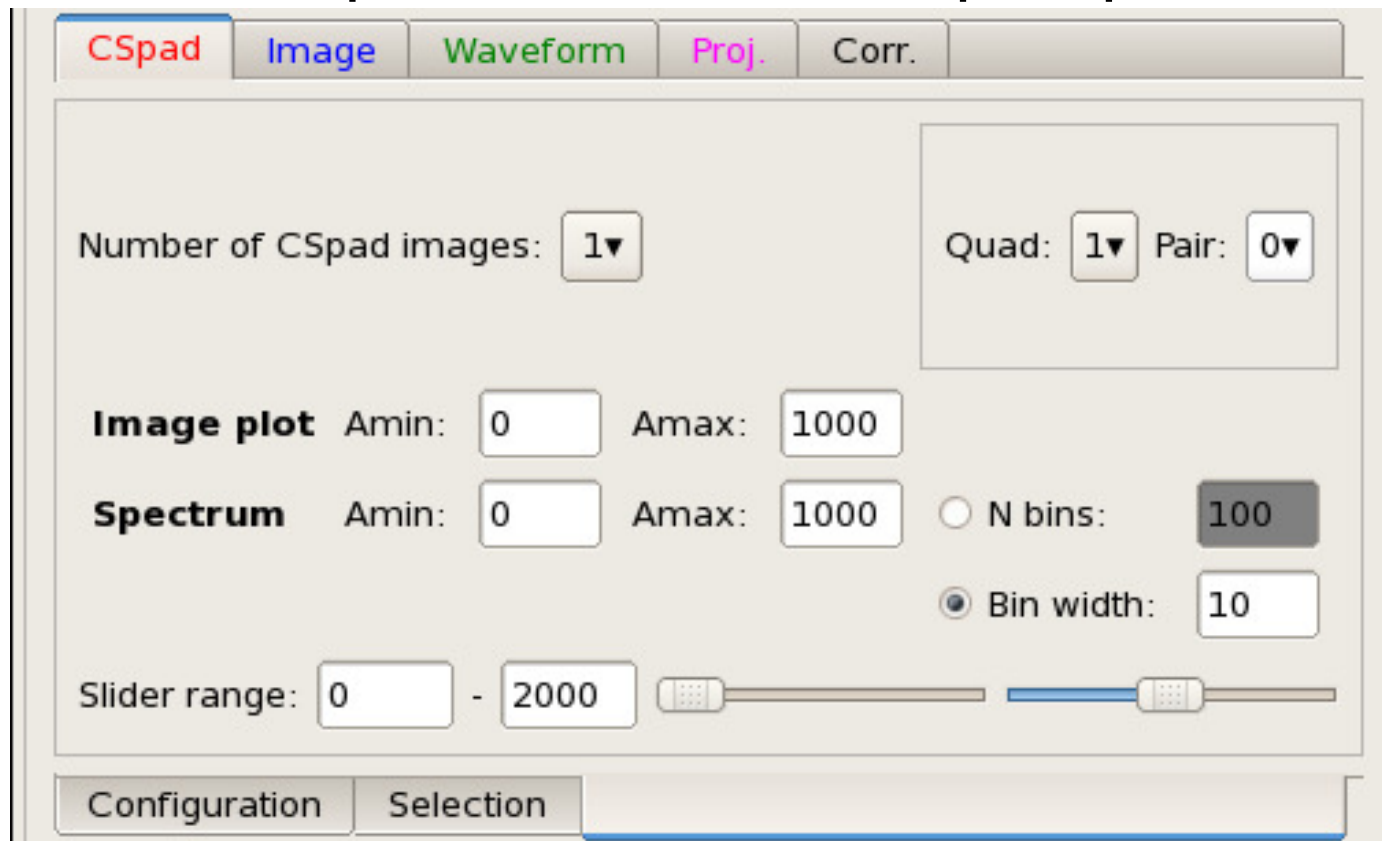
☐ X ☐ Y ☐ R ☐ ϕ

Other

☒ Waveform ☐ Correlations

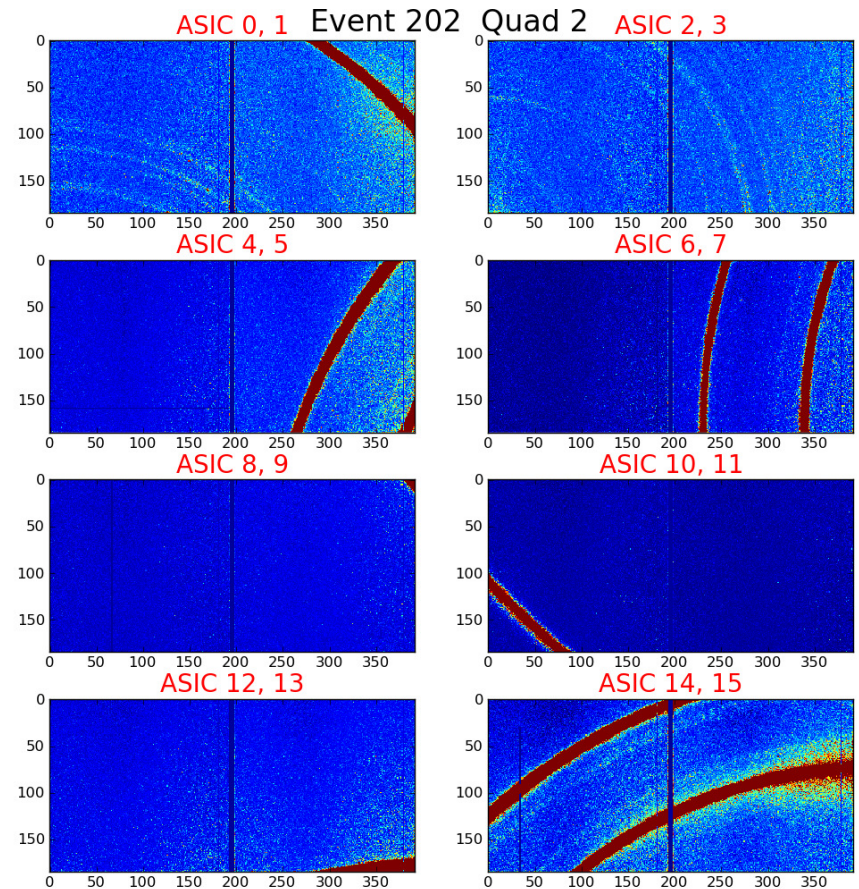
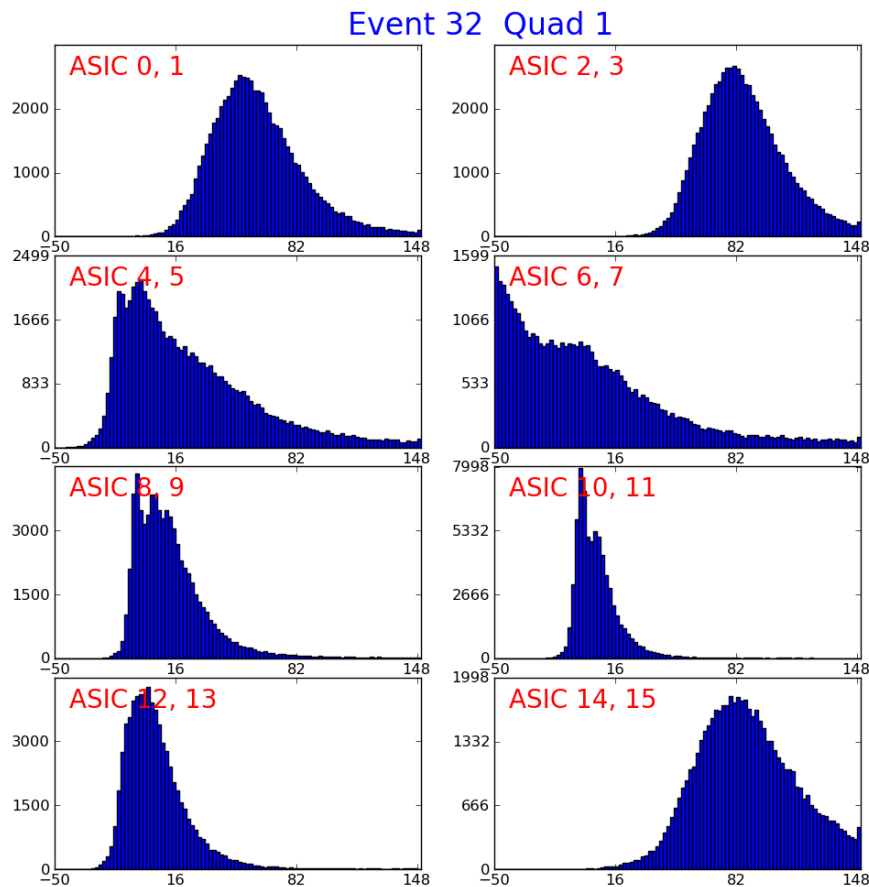
CSpad parameters sub-GUI

- CSpad sub-GUI is activated by checkbox or tabbar
- Allows to set parameters for CSpad plots



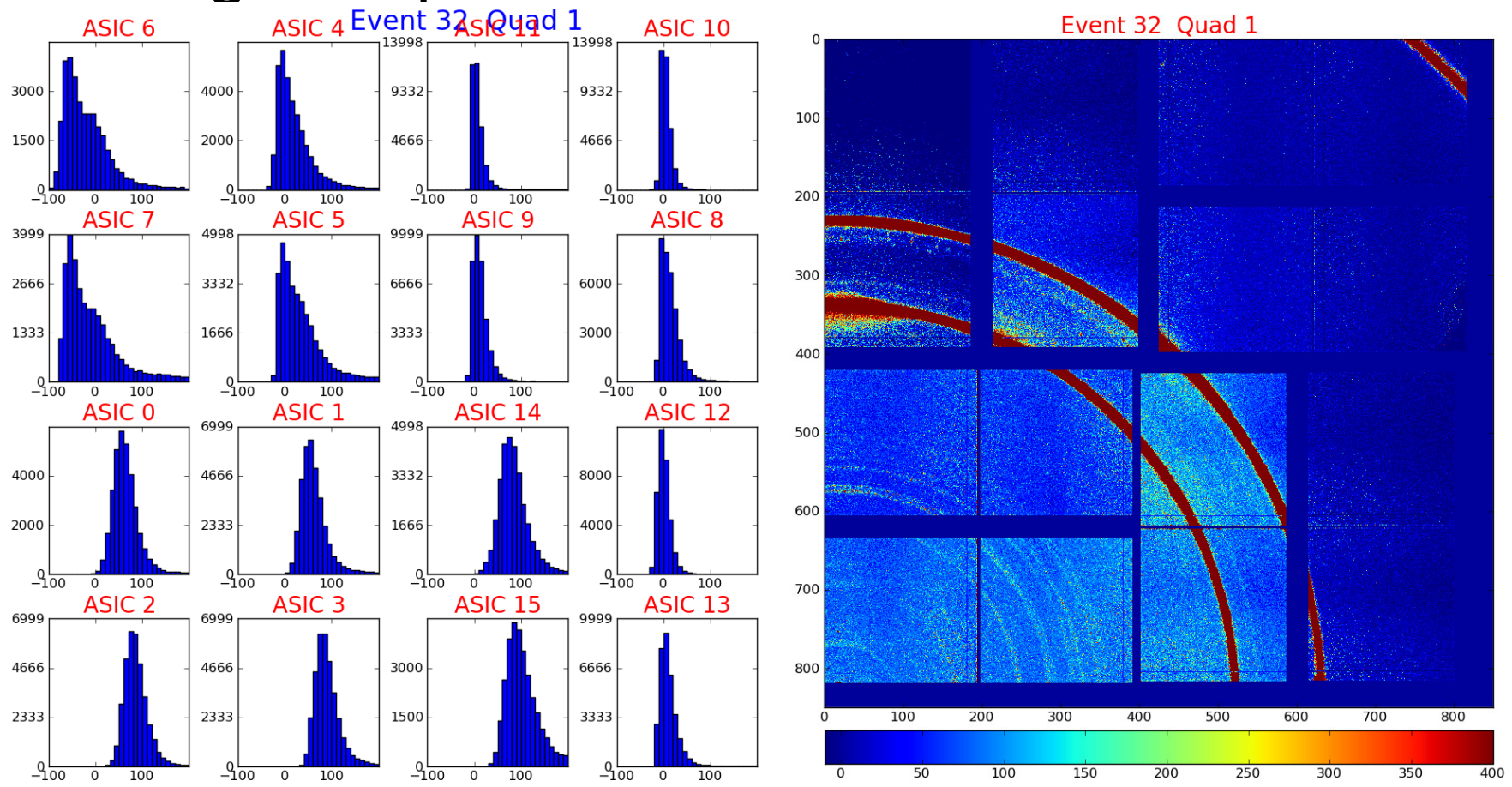
CSpad plots (1)

- Spectra of 2x1 sensors
- Images of 2x1 sensors



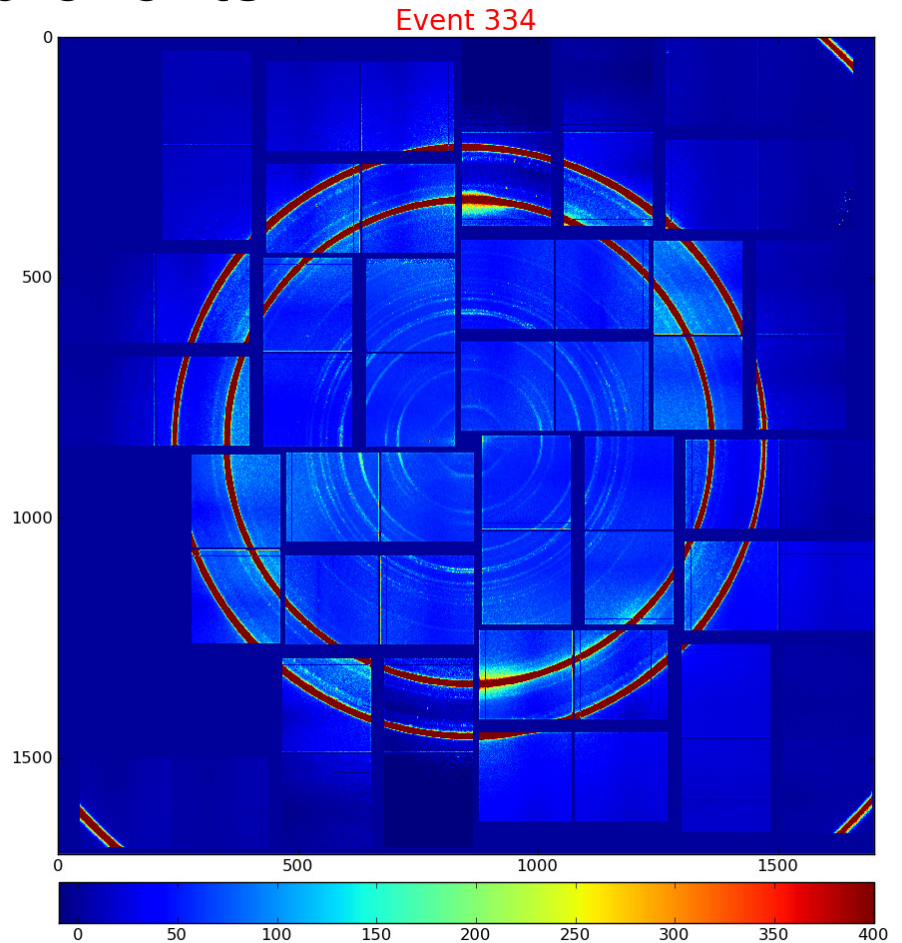
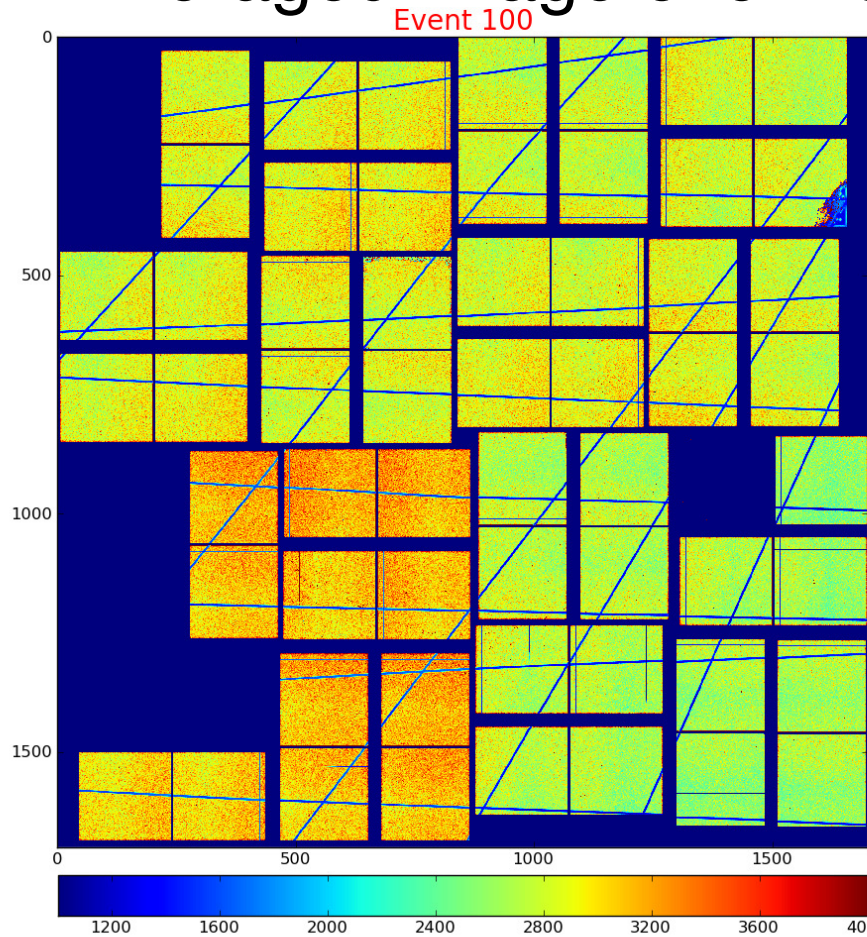
CSpad plots (2)

- Spectra of ASICs – numerated as in quad
- Image of quad



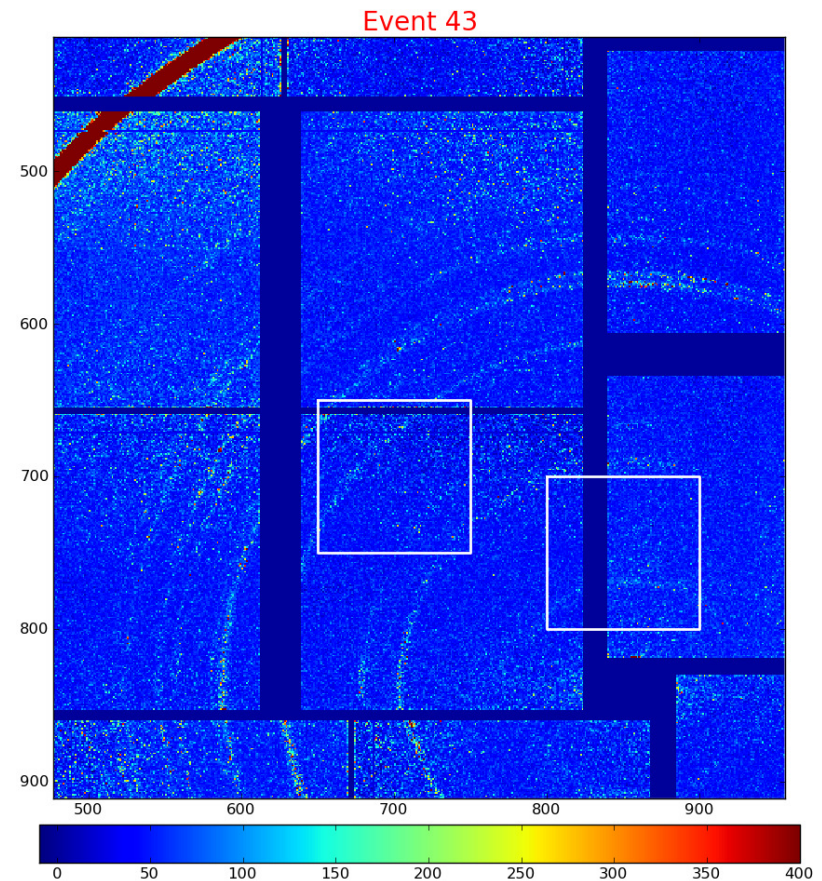
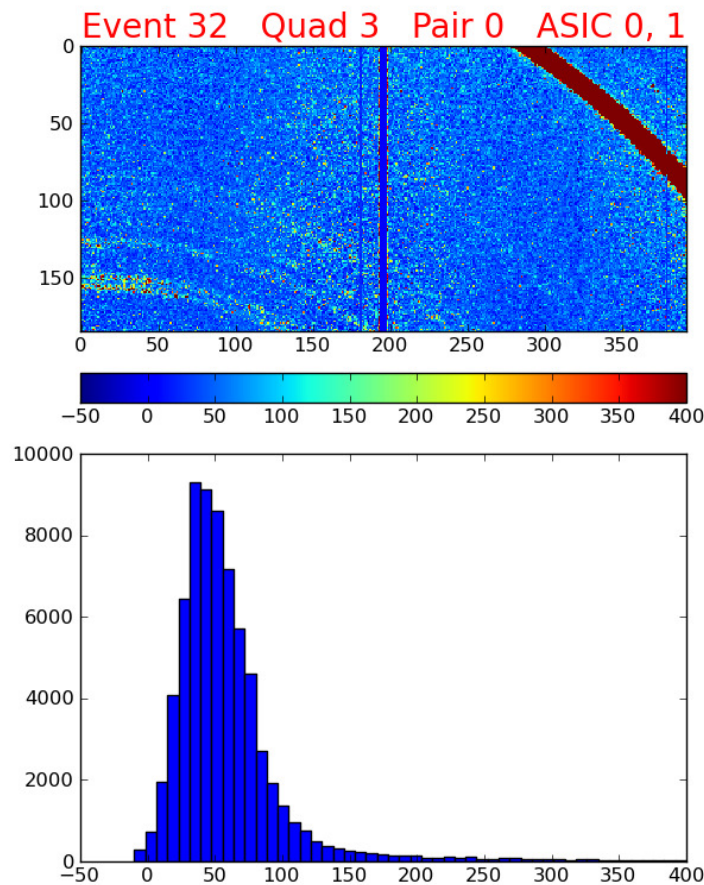
CSpad plots (3)

- Image of the CSpad detector
- Averaged image over 100 events



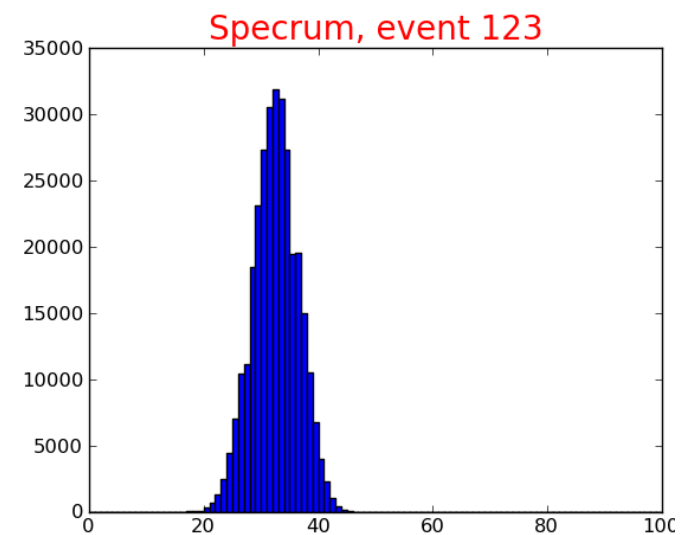
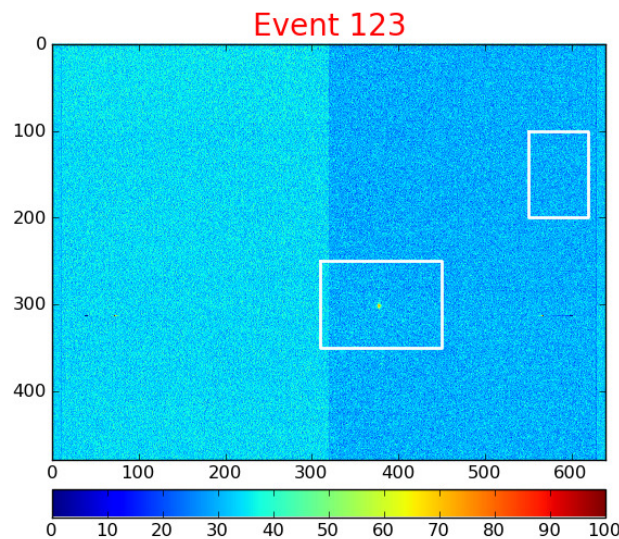
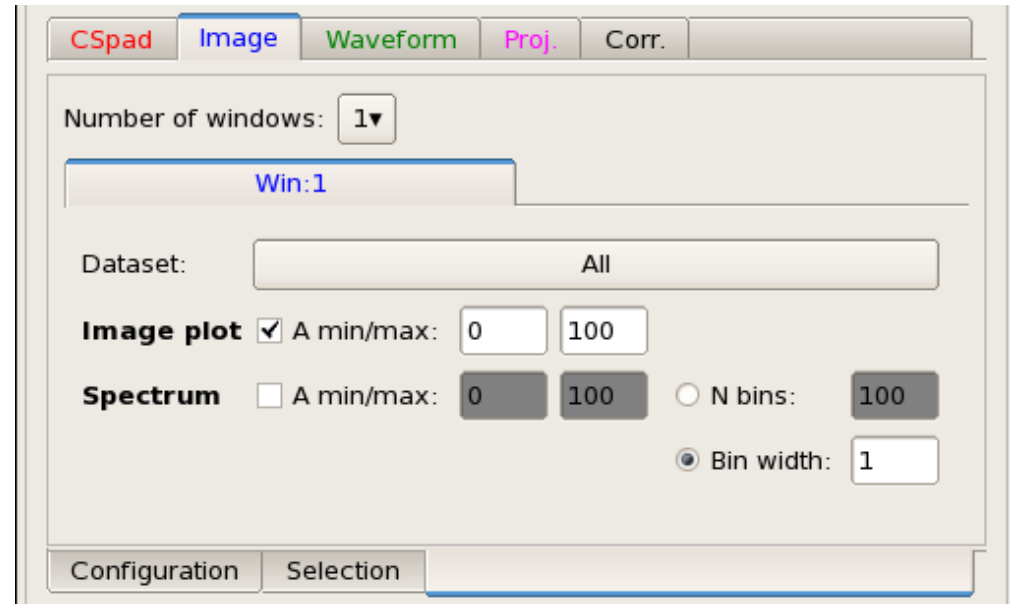
CSpad plots (4)

- Combined image and spectrum of 2x1
- Zoomed-in image of the CSpad with selection boxes



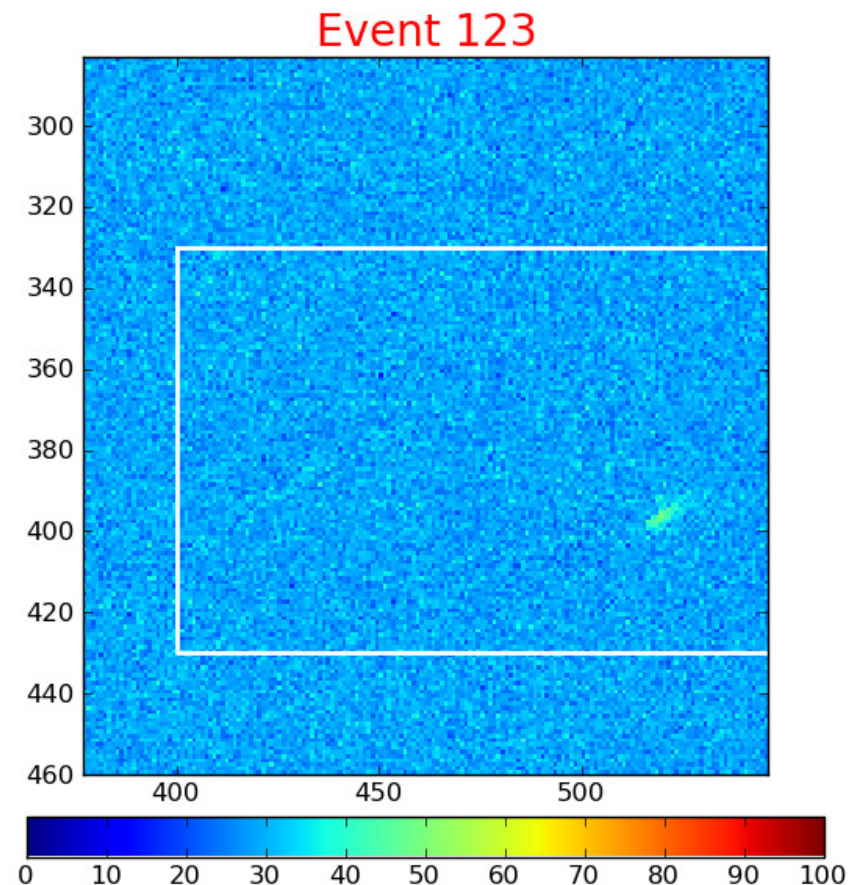
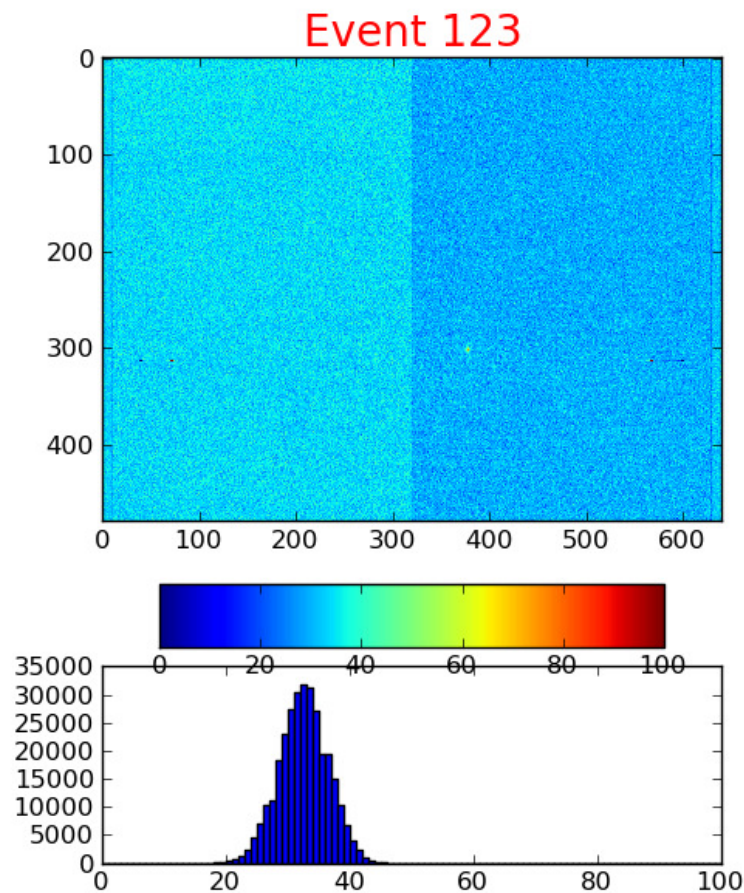
Camera image sub-GUI

- Image sub-GUI is activated by checkbox or tabbar
- Allows to set parameters for camera image plots



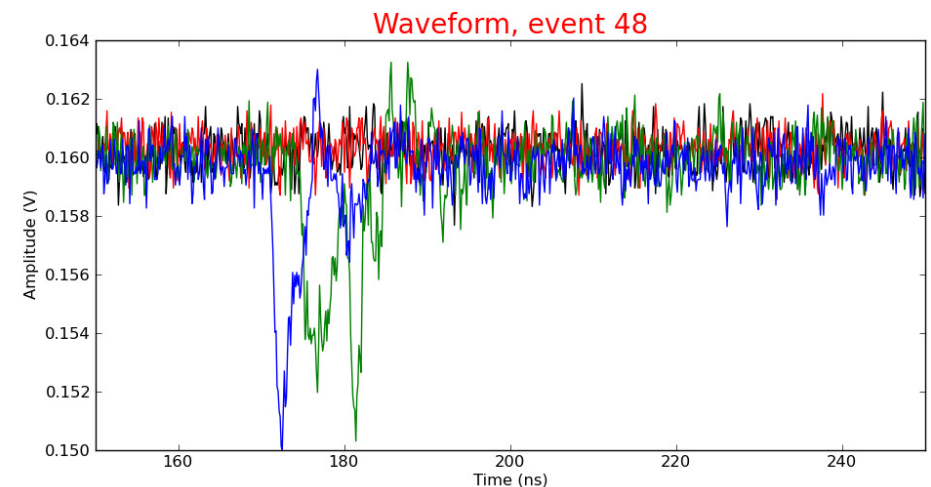
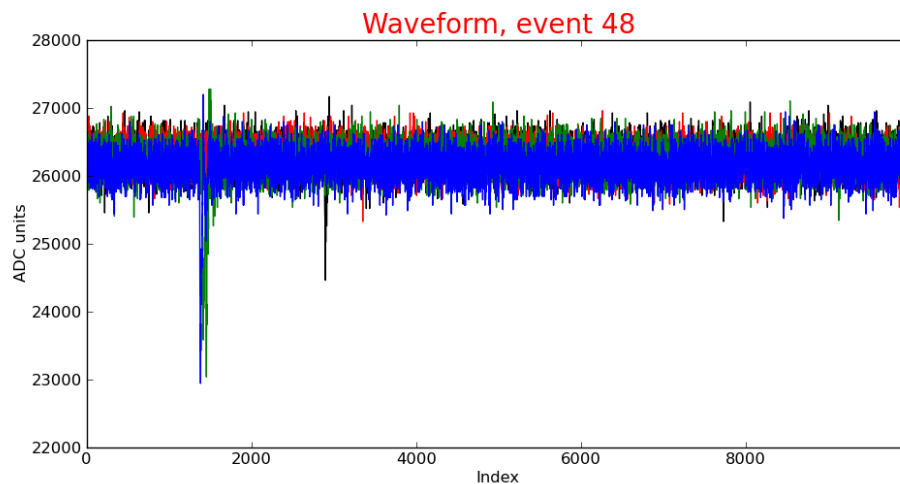
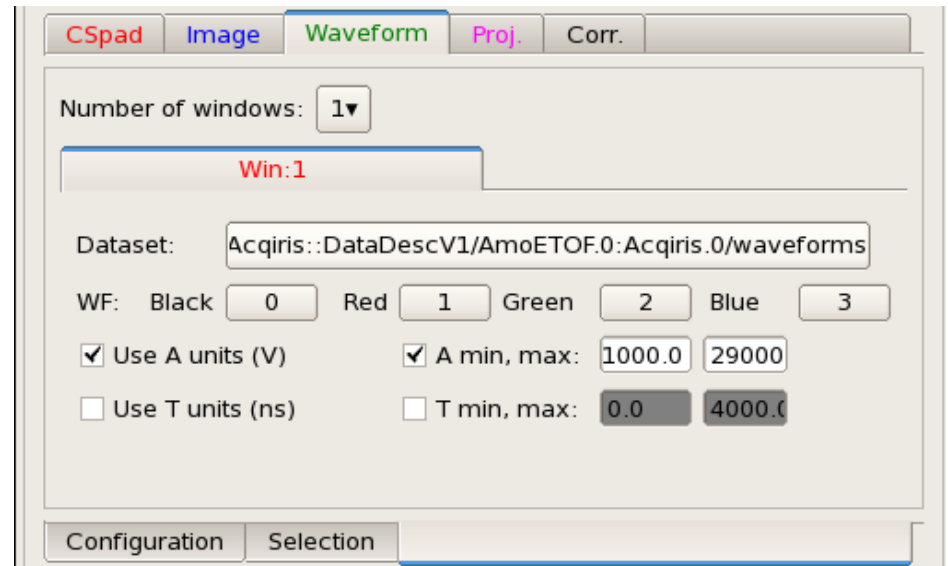
More plots for camera image

- Combined camera image and spectrum
- Zoomed-in camera image

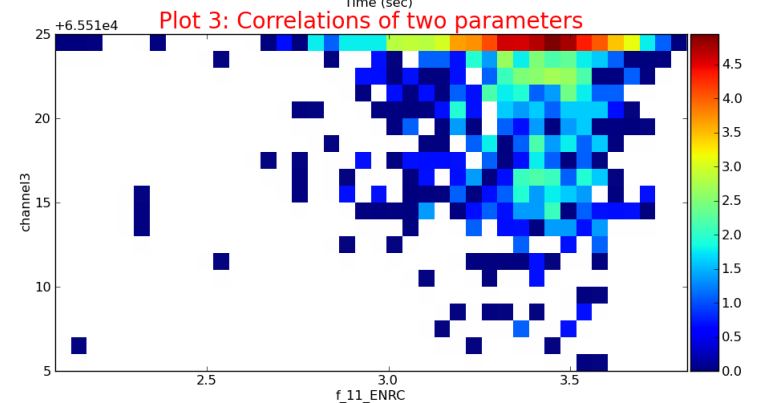
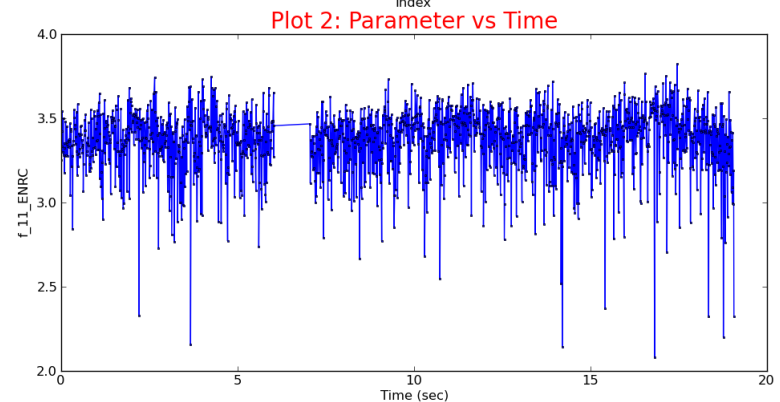
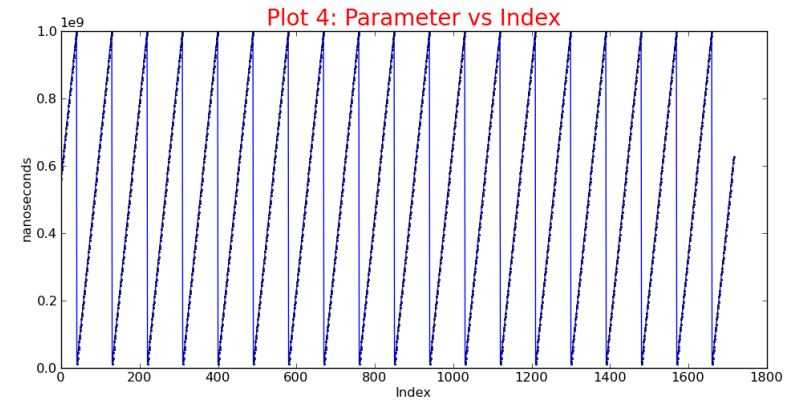
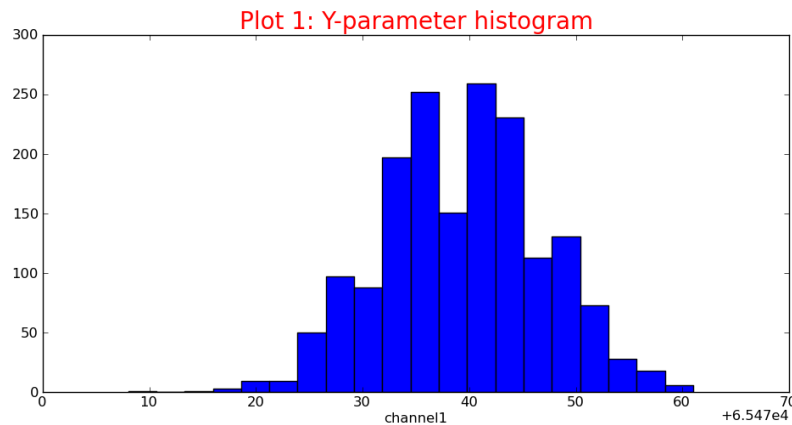
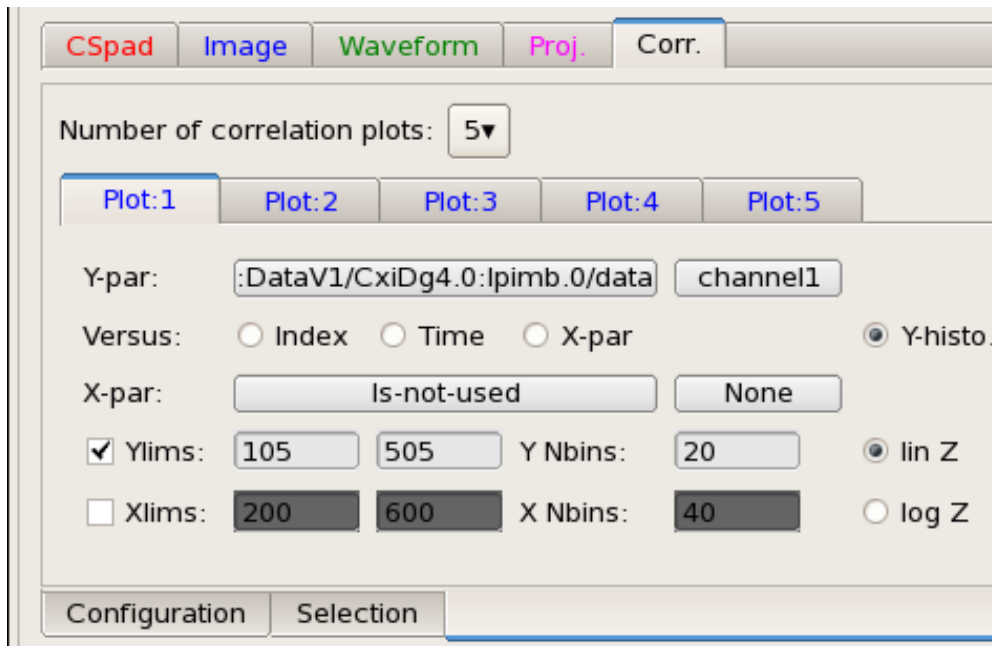


Waveform sub-GUI

- One dataset per window
- 4 waveforms of different colors per window
- Auto/manual limits
- On/Off units

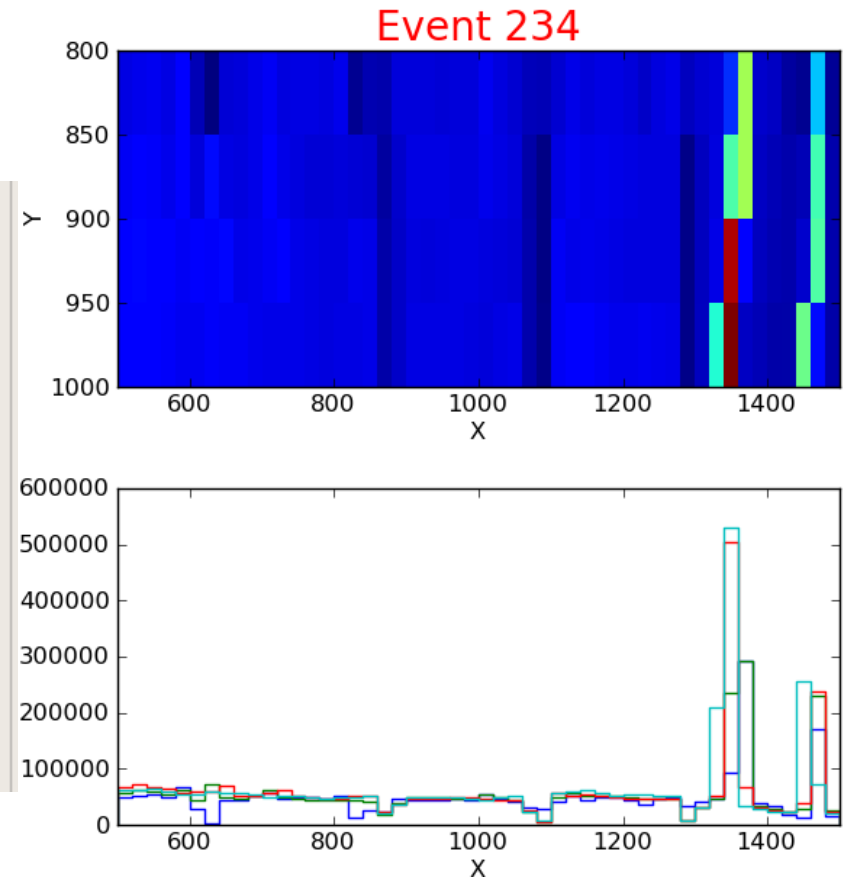
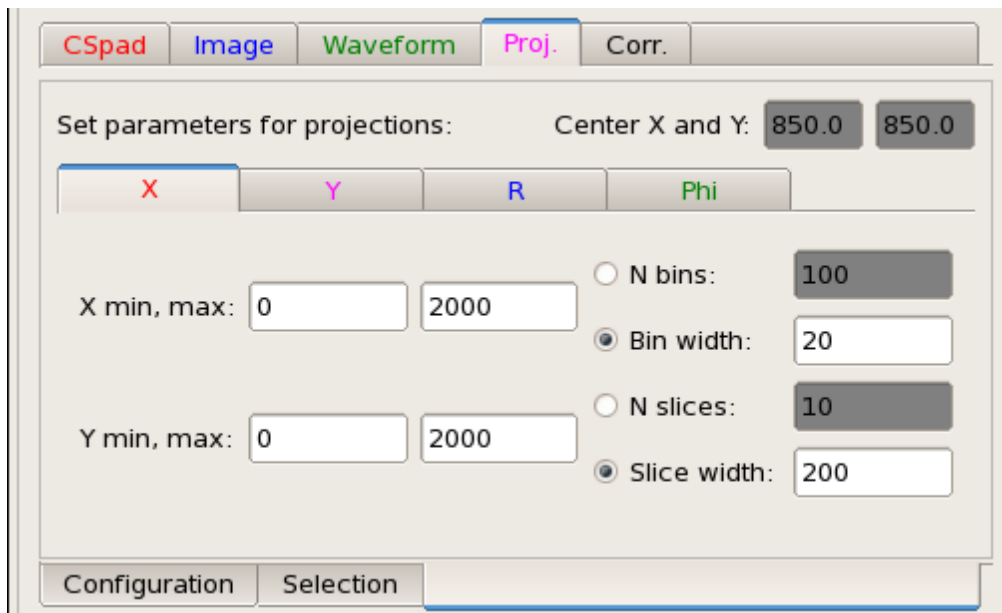


“Correlation” sub-GUI



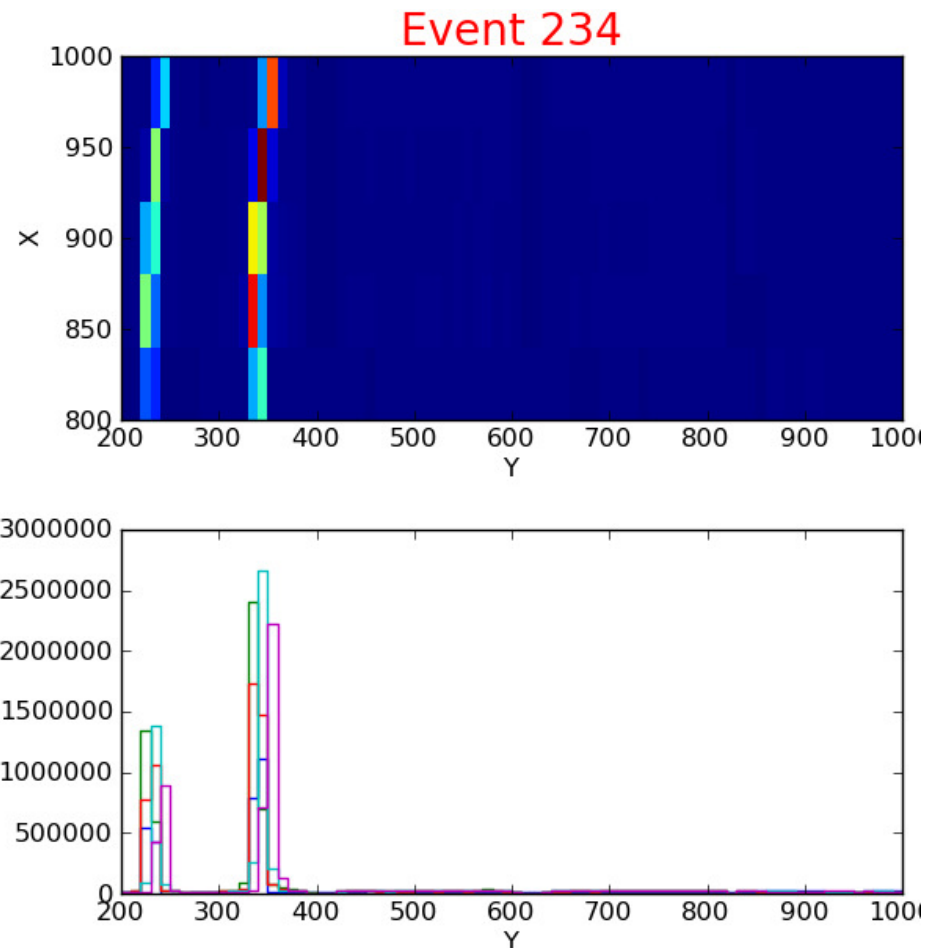
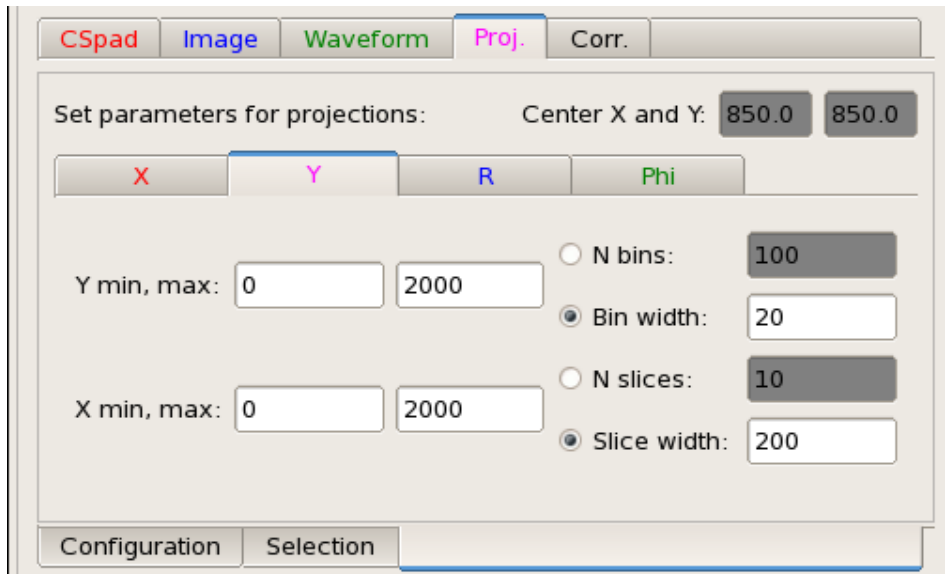
X-projection sub-GUI and plot

- Histograms in X
- For slices in Y



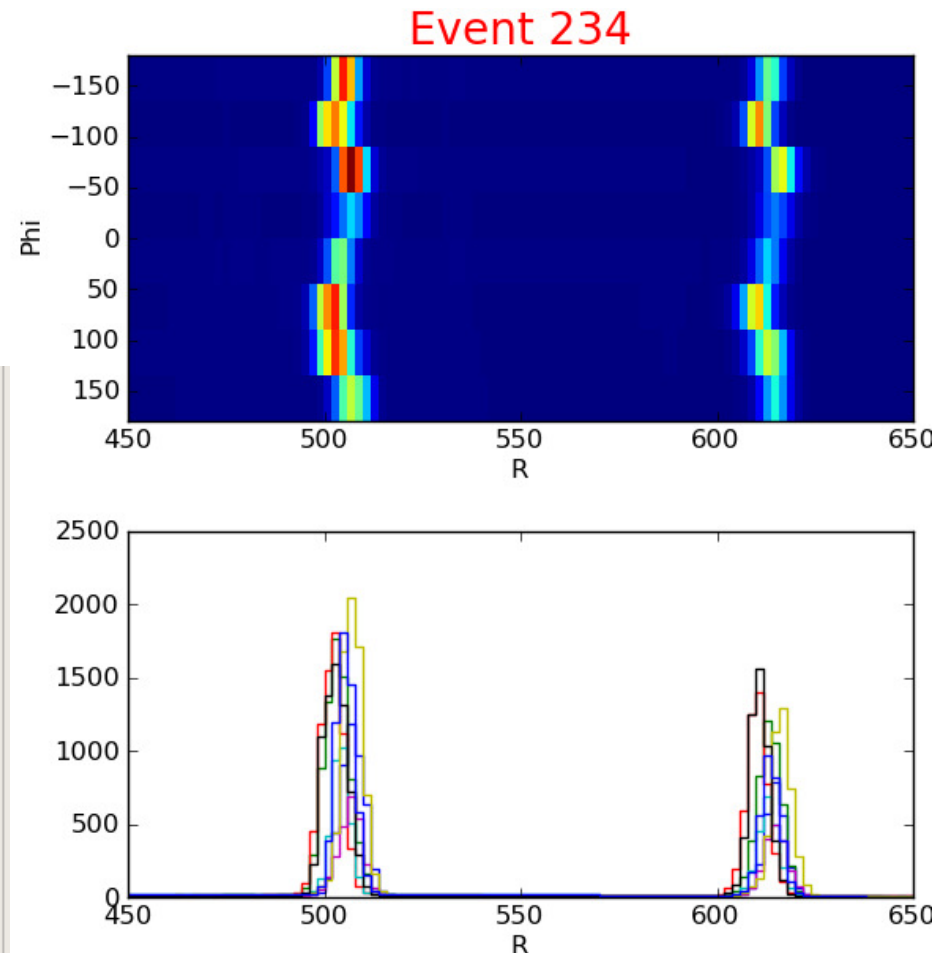
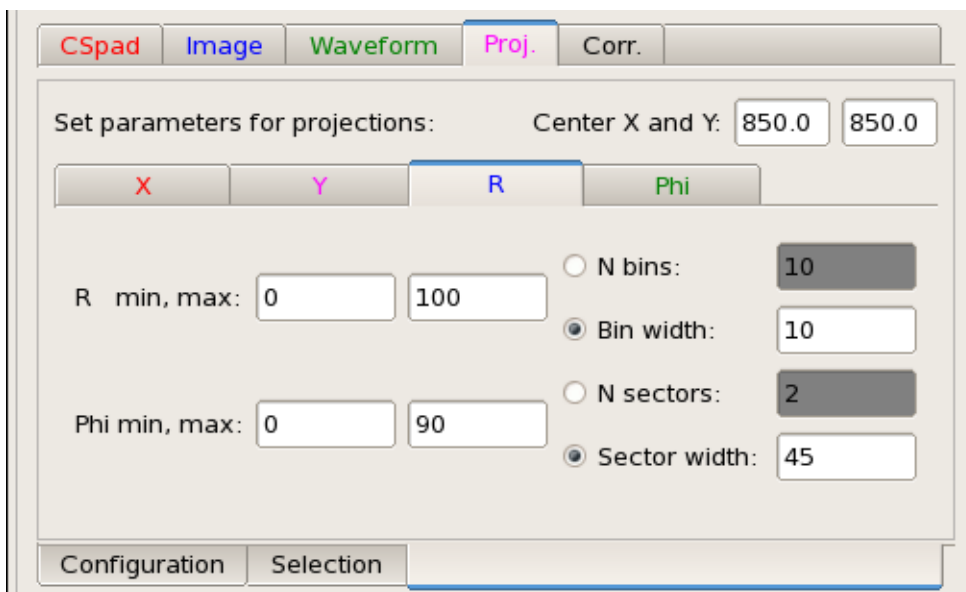
Y-projection sub-GUI and plot

- Histograms in Y
- For slices in X



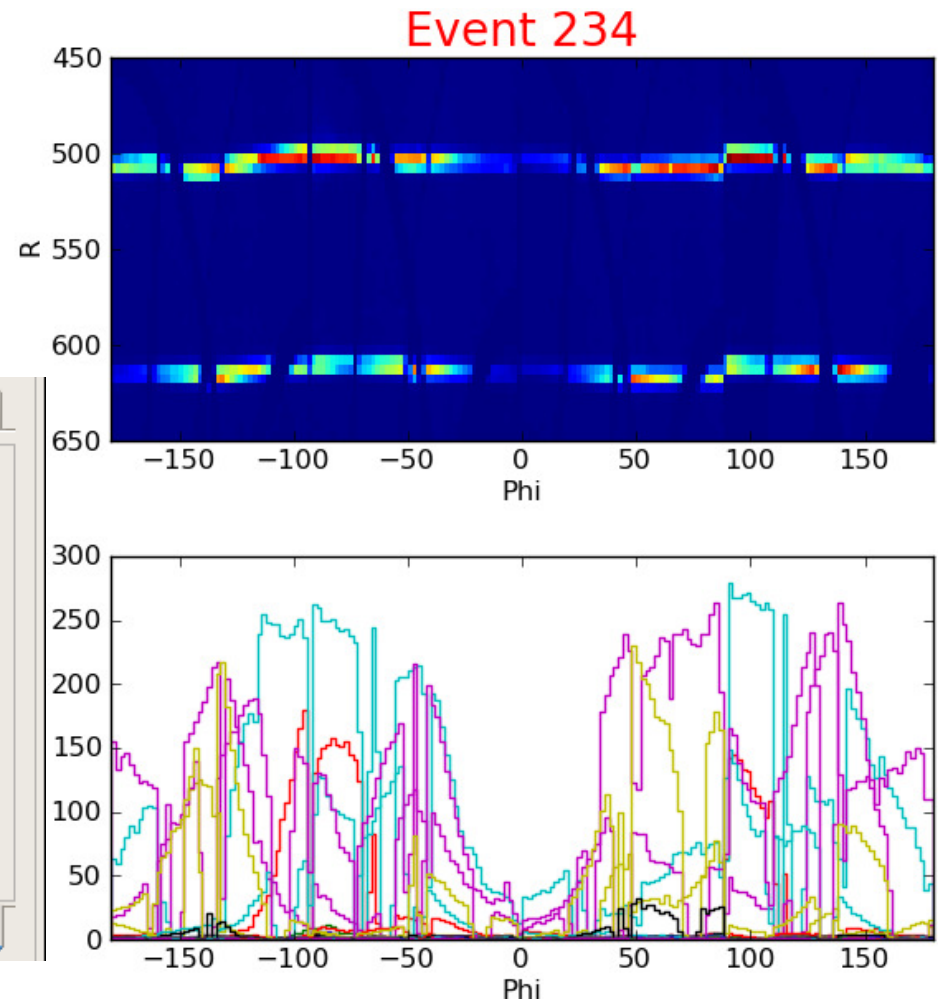
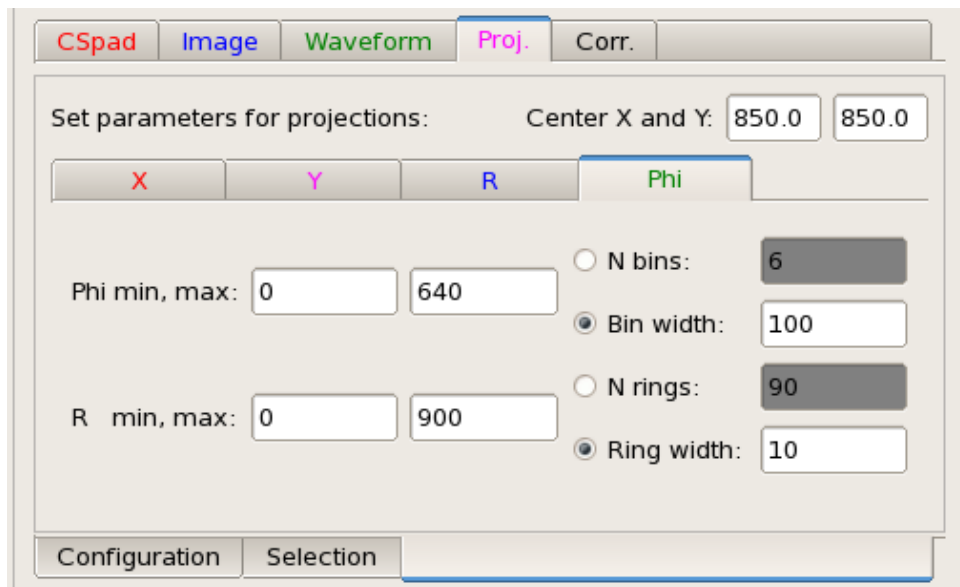
R-projection sub-GUI and plot

- Histograms in R
- For sectors in Phi
- Needs in center coord.



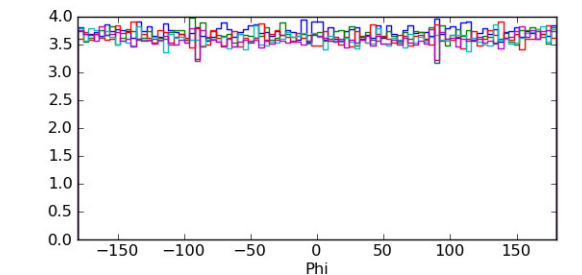
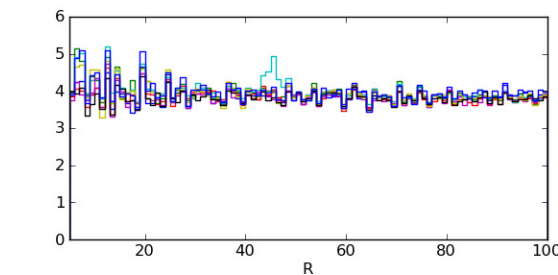
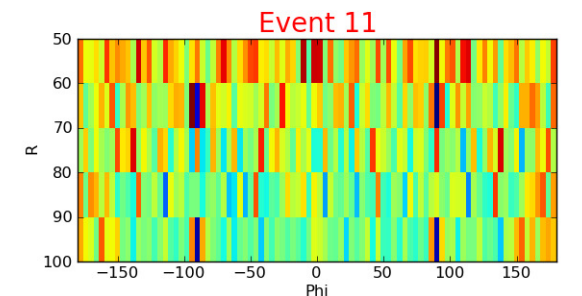
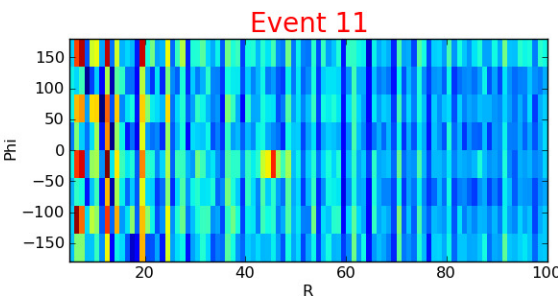
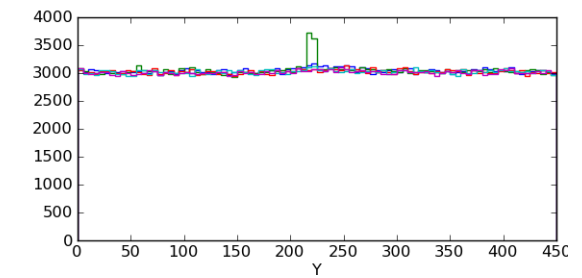
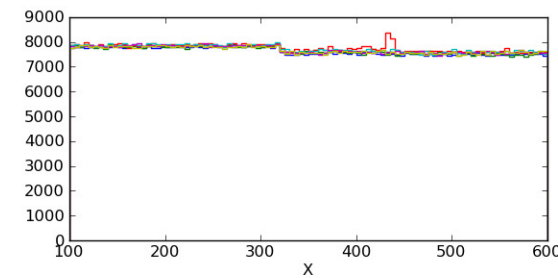
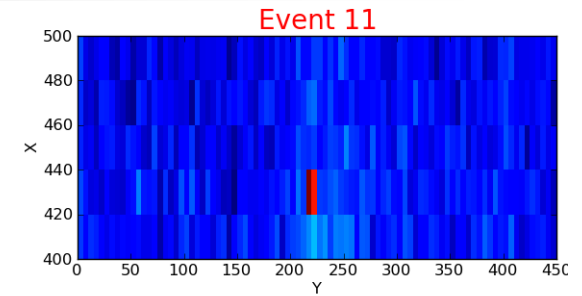
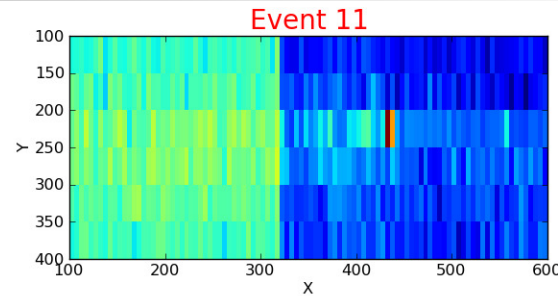
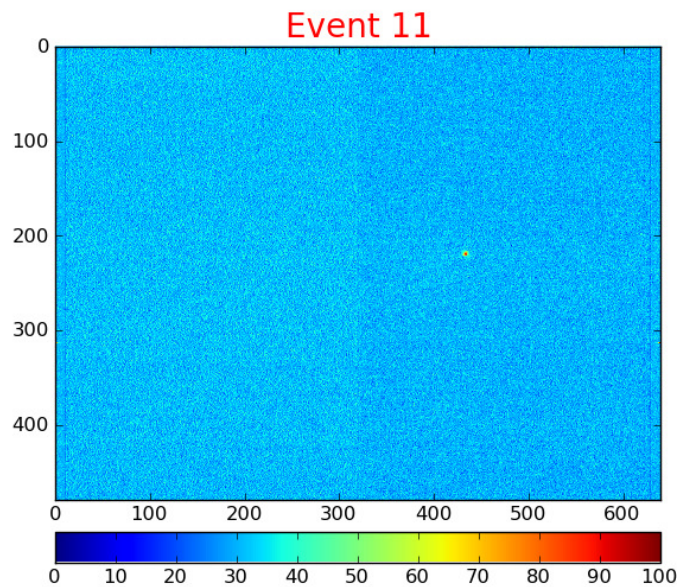
Rhi - projection sub-GUI and plot

- Histograms in Phi
- For rings in R
- Needs in center coord.



Projections for camera image

- Use the same GUI
- X, Y, R, Phi projections



Selection and Configuration sub-GUIs

- Selection GUI – set the image-window(s) parameters for threshold selection
- Configuration GUI – manipulates with configuration parameters for HDF5 Explorer

The Selection GUI is shown with tabs for CSpad, Image, Waveform, Proj., and Corr. The 'Image' tab is active. It features a 'Number of regions for selection' dropdown set to 2. Below this are two tabs for 'Region:1' and 'Region:2'. The 'Region:1' tab is selected, showing a 'Dataset' dropdown set to 'None'. Under 'Threshold on intensity', there is a text input field with '111' and two radio buttons: 'maximal' (selected) and 'integral'. Below these are input fields for 'Xmin, Xmax' (values: 11, 1111) and 'Ymin, Ymax' (values: 1, 111). At the bottom, there are tabs for 'Configuration' and 'Selection', with 'Selection' being the active tab.

The Configuration GUI is shown with tabs for CSpad, Image, Waveform, Proj., and Corr. The 'Image' tab is active. It features a 'File with configuration parameters:' label above a text input field containing './hdf5expconfig' and a 'Browse' button. Below this is a section labeled 'Operations on configuration parameters:' containing four buttons: 'Read', 'Save', 'Reset default', and 'Print current'. At the bottom, there are tabs for 'Configuration' and 'Selection', with 'Configuration' being the active tab.

Summary

- HDF5 Explorer allows to look at data saved in HDF5 files.
- Program control is performed through the GUIs.
- Interface is quite intuitive, instruction available in confluence.
 - Program allows to explore HDF5 tree and print info about its items' structure, data types etc.
 - Graphic plots are implemented for camera images, CSpad images, image projections, Acqiris waveforms, correlation plots for time-matched scalar-arrays etc.
- Your feedback will be appreciated