HDF5 Explorer

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Analysis & Applications

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Outline

- Introduction
- HDF5 Explorer package
- 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 libs:
  - h5py – for access to hdf5 data,
  - matplotlib – for graphics,
  - PyQt4 – for GUI.

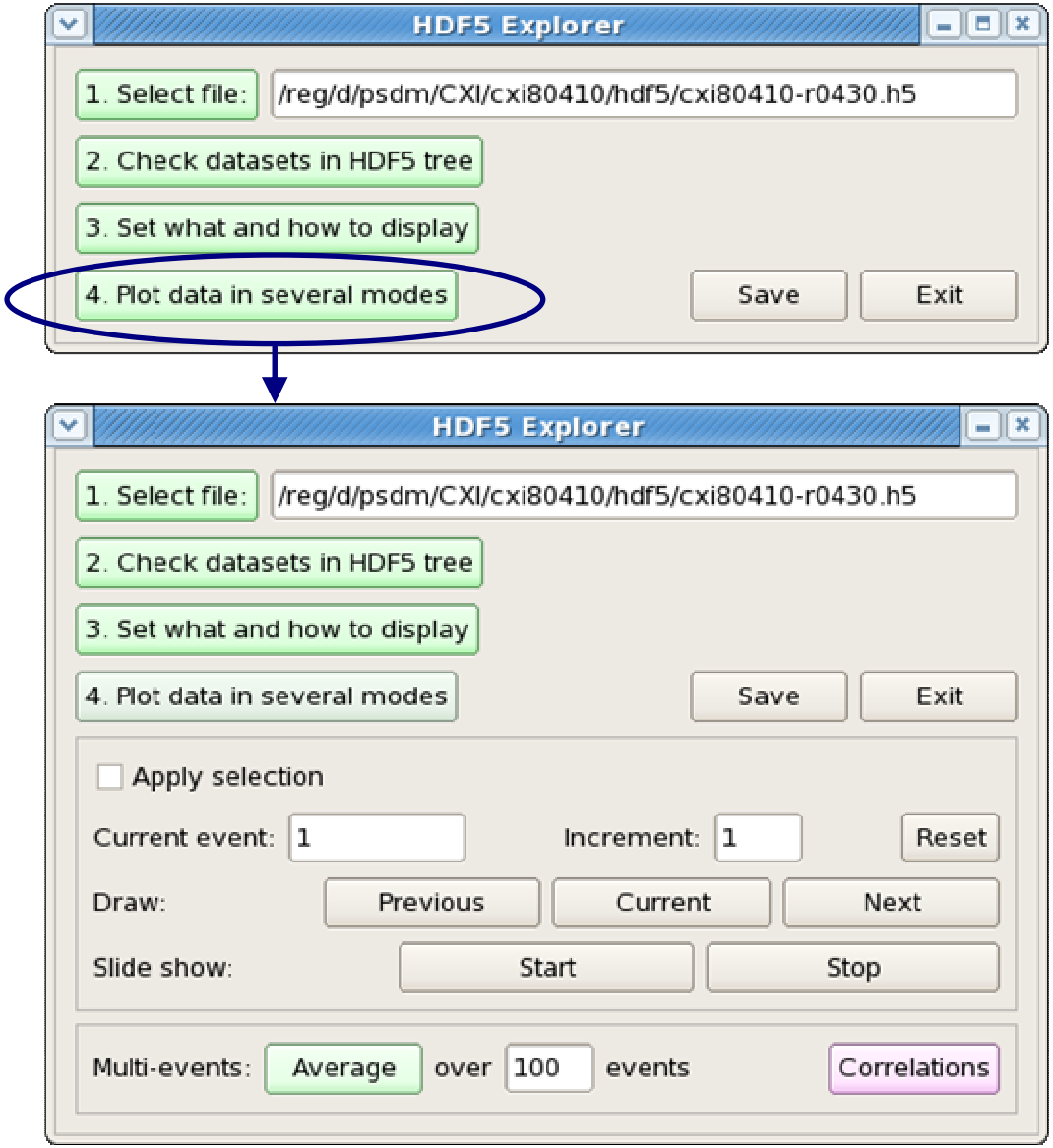
HDF5 Explorer package

- Package name: HDF5Explorer
- Documentation:
  https://confluence.slac.stanford.edu/display/PCDS/HDF5+Explorer
- To run this program use command on psana

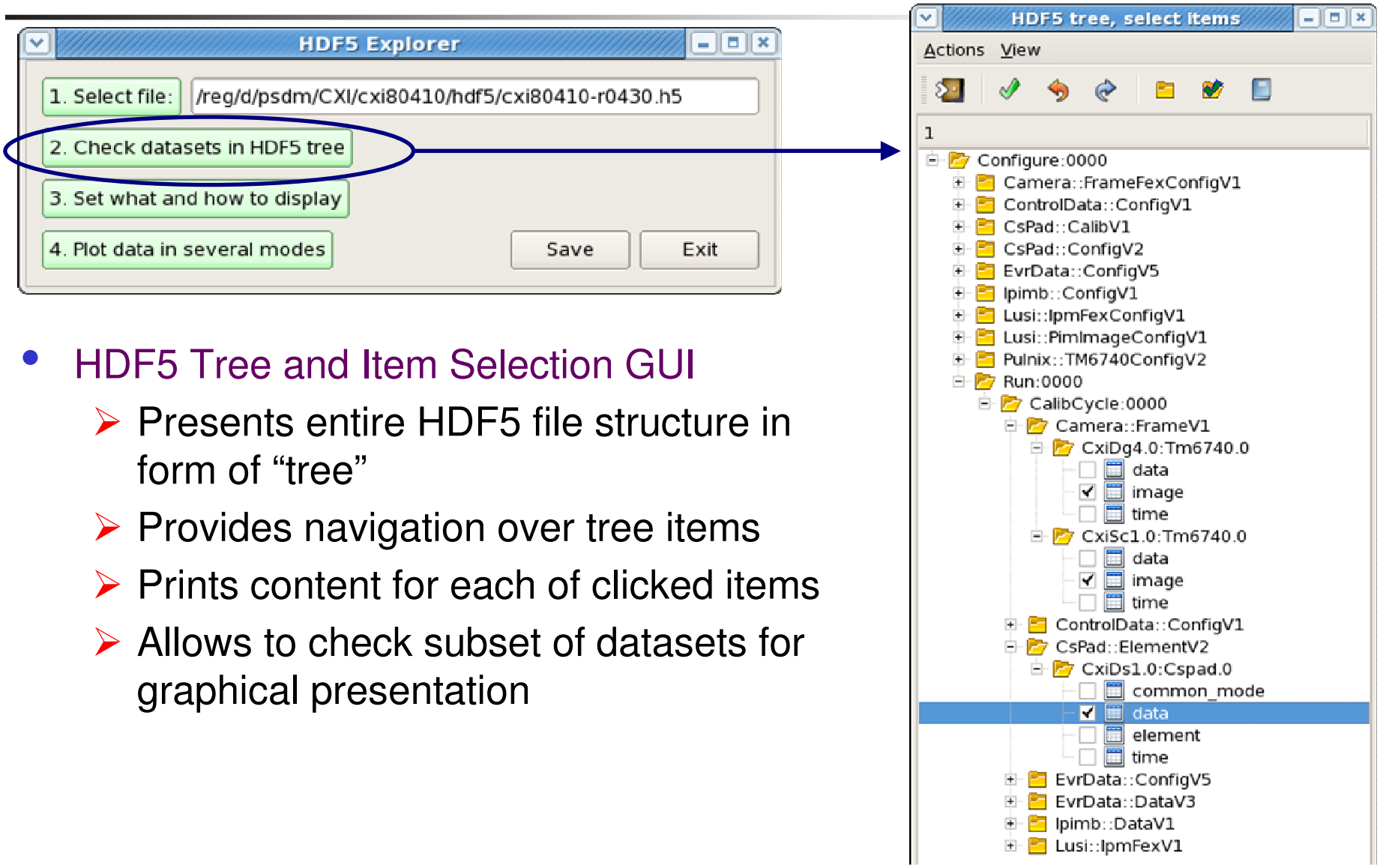
  [for now one need to create release and add package]
  - hdf5explorer
- Control GUI is split for three windows:
  - HDF5 Explorer or Main GUI
  - HDF5 Tree and Item Selection GUI
  - What and how to display GUI
    - Sub-GUIs for parameter settings.

Main GUI

- Main GUI has 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
- Long version contains “player” buttuns for immediate drawing.

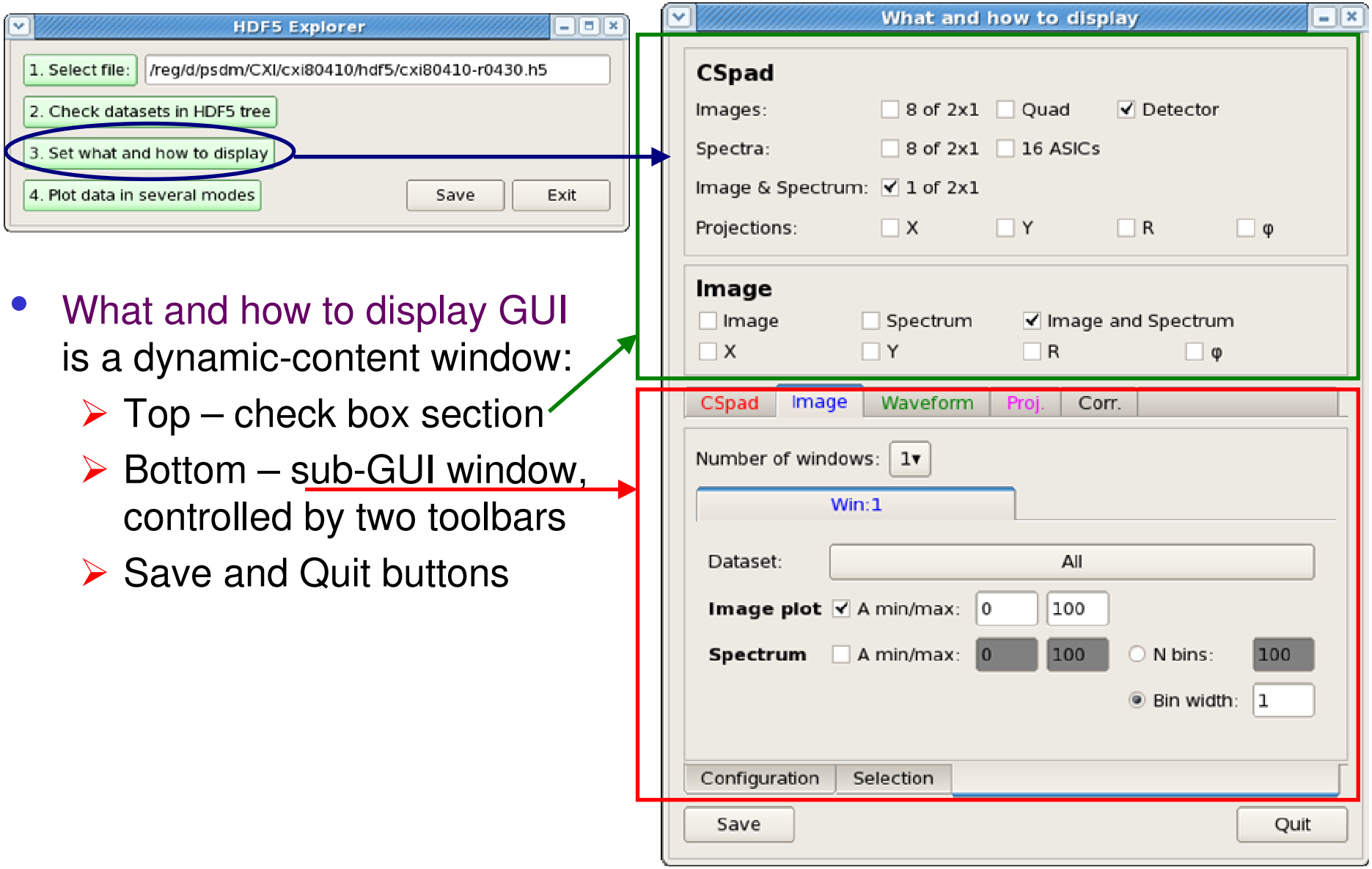


HDF5 Tree and Item Selection GUI



- HDF5 Tree and Item Selection GUI
  - Presents entire HDF5 file structure in form of “tree”
  - Provides navigation over tree items
  - Prints content for each of clicked items
  - Allows to check subset of datasets for graphical presentation

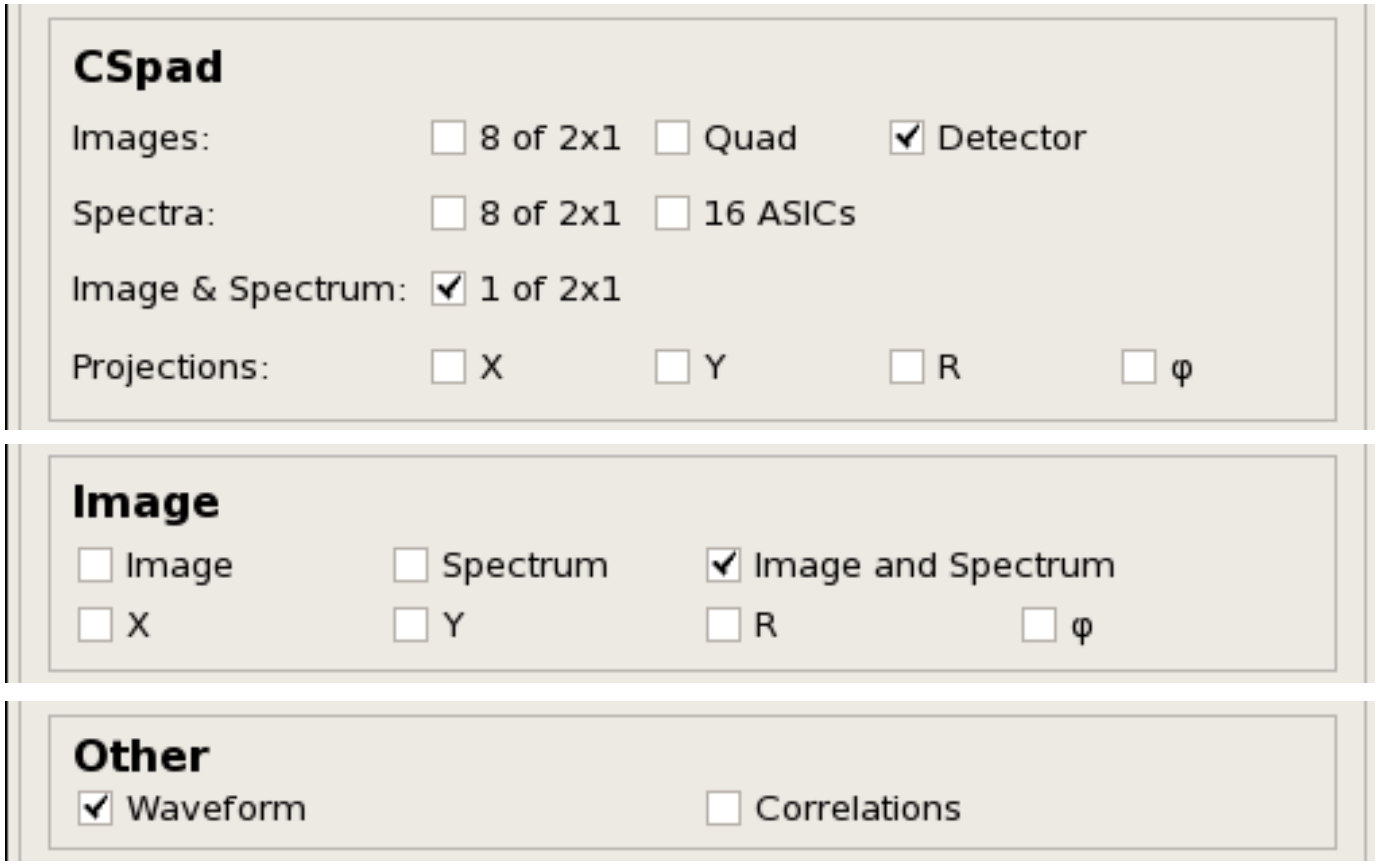
What and how to display GUI



- What and how to display GUI is a dynamic-content window:
  - Top – check box section
  - Bottom – sub-GUI window, controlled by two toolbars
  - Save and Quit buttons

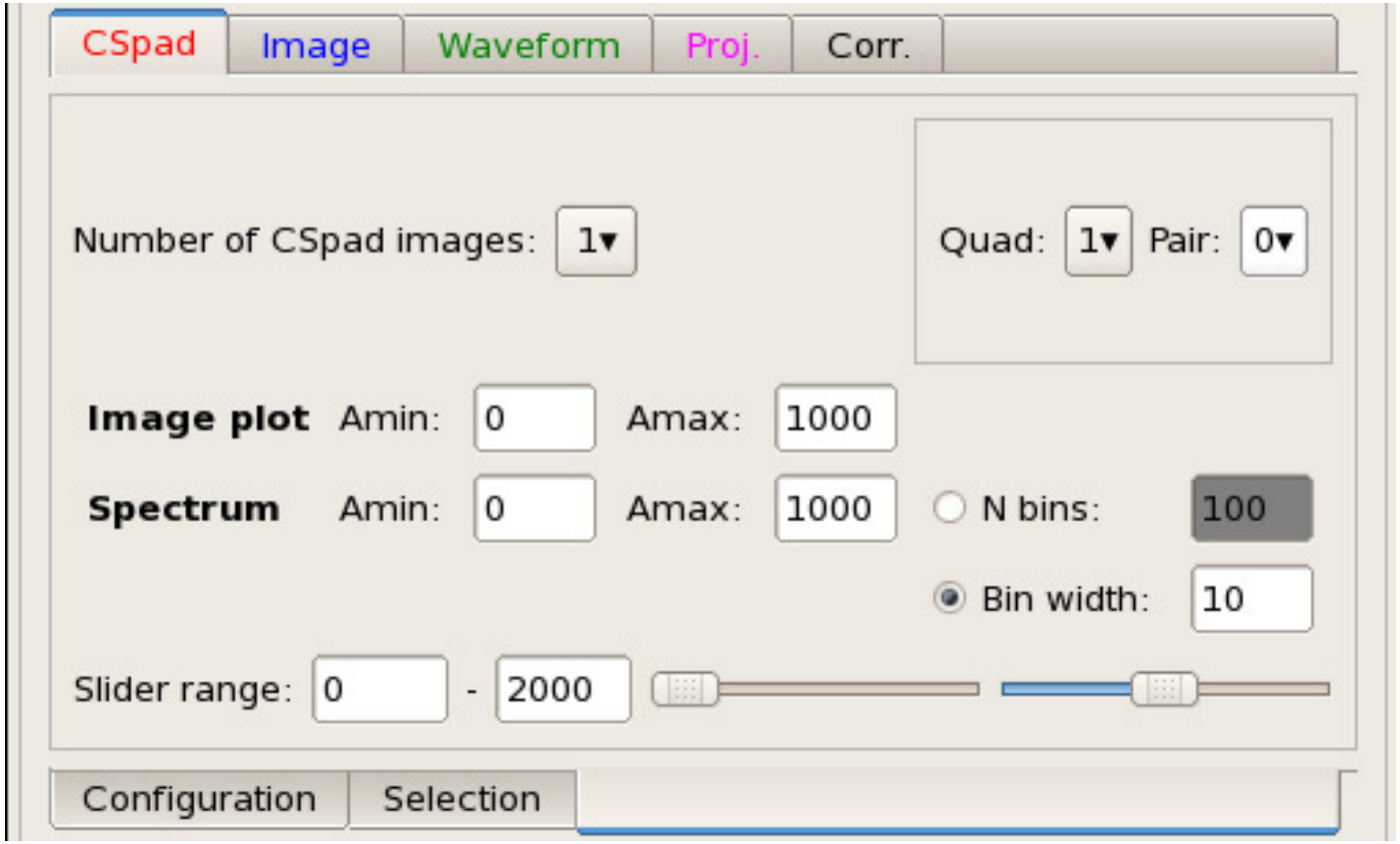
Check box sections

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



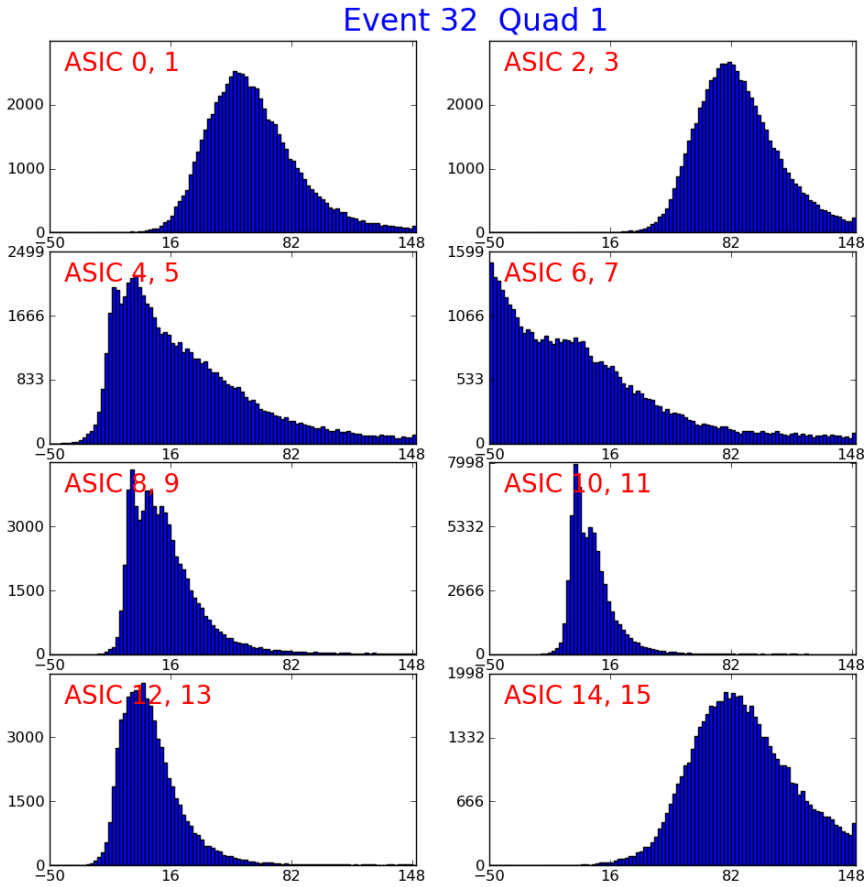
CSpad parameters sub-GUI

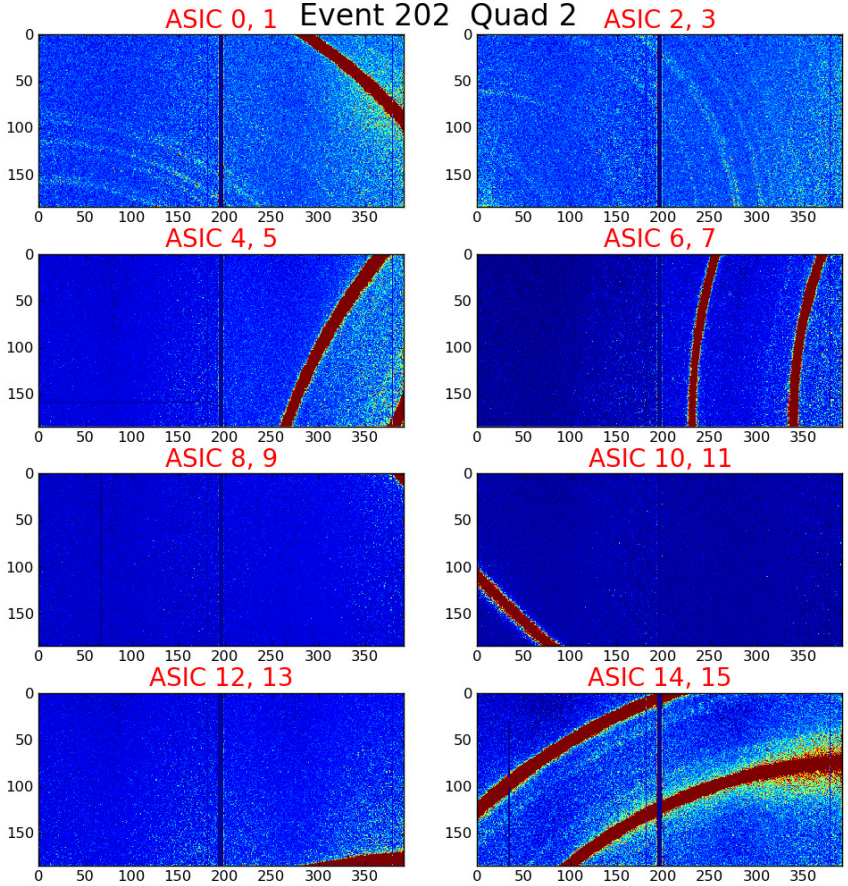
- CSpad sub-GUI is activated by checkbox or tabbar
- Allows to set parameters for CSpad plots



CSpad plots (1)

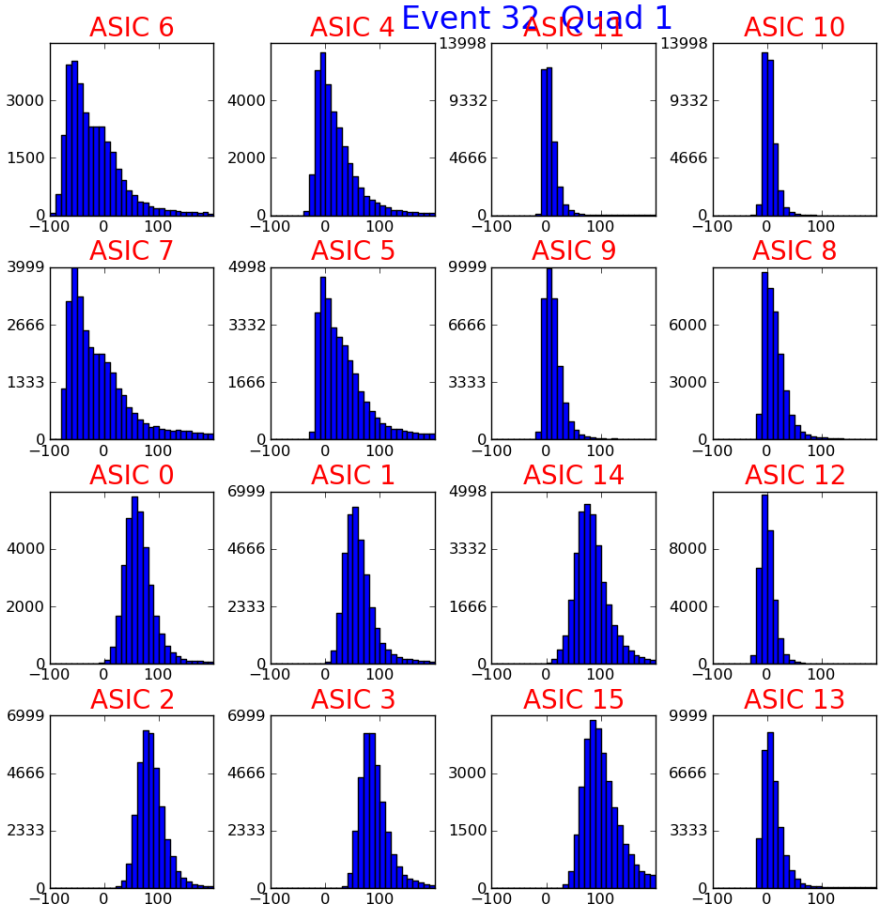
- Spectra of 2x1 sensors
- Images of 2x1 sensors

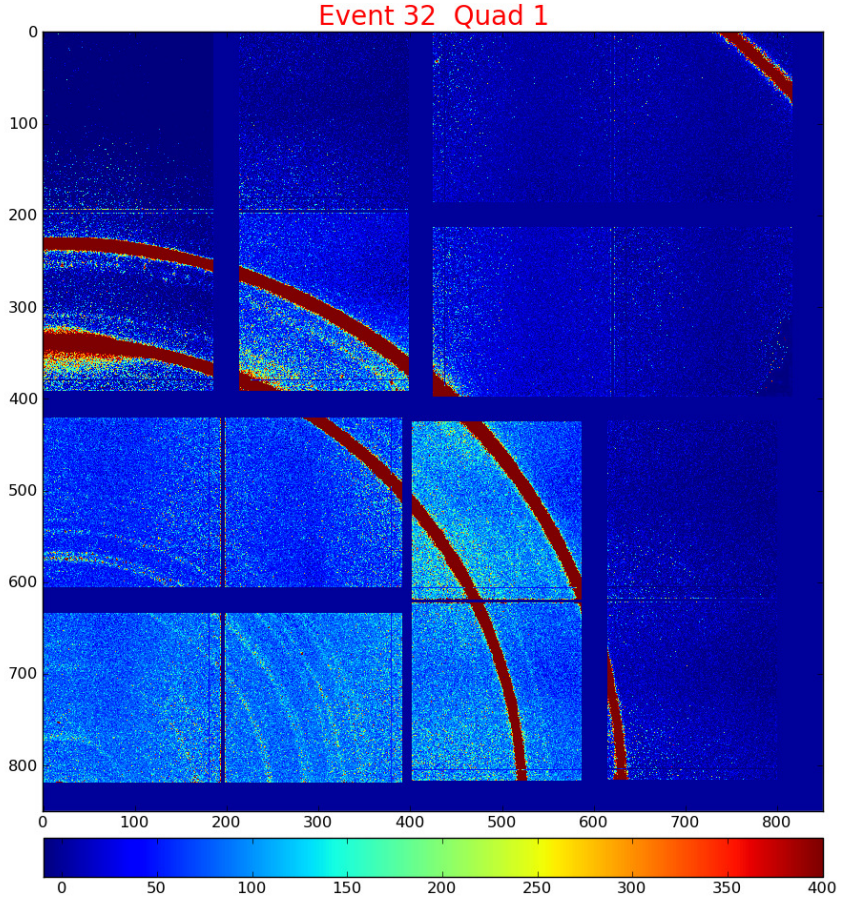




CSpad plots (2)

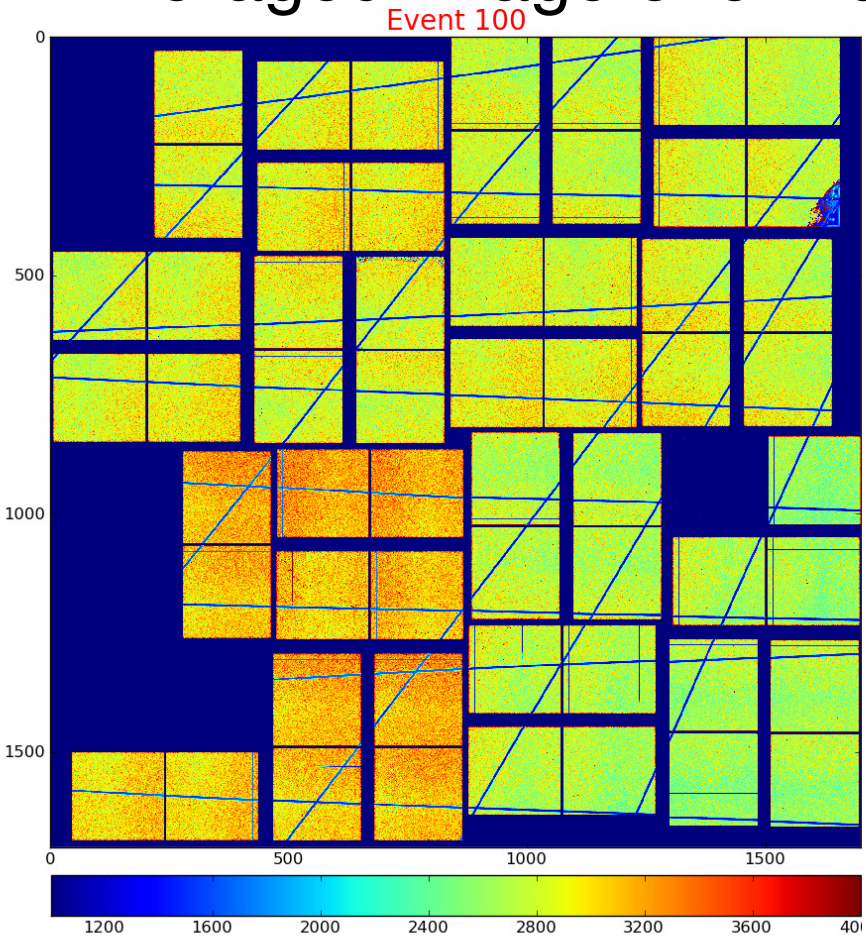
- Spectra of ASICs – position-vise numeration for quad
- Image of quad

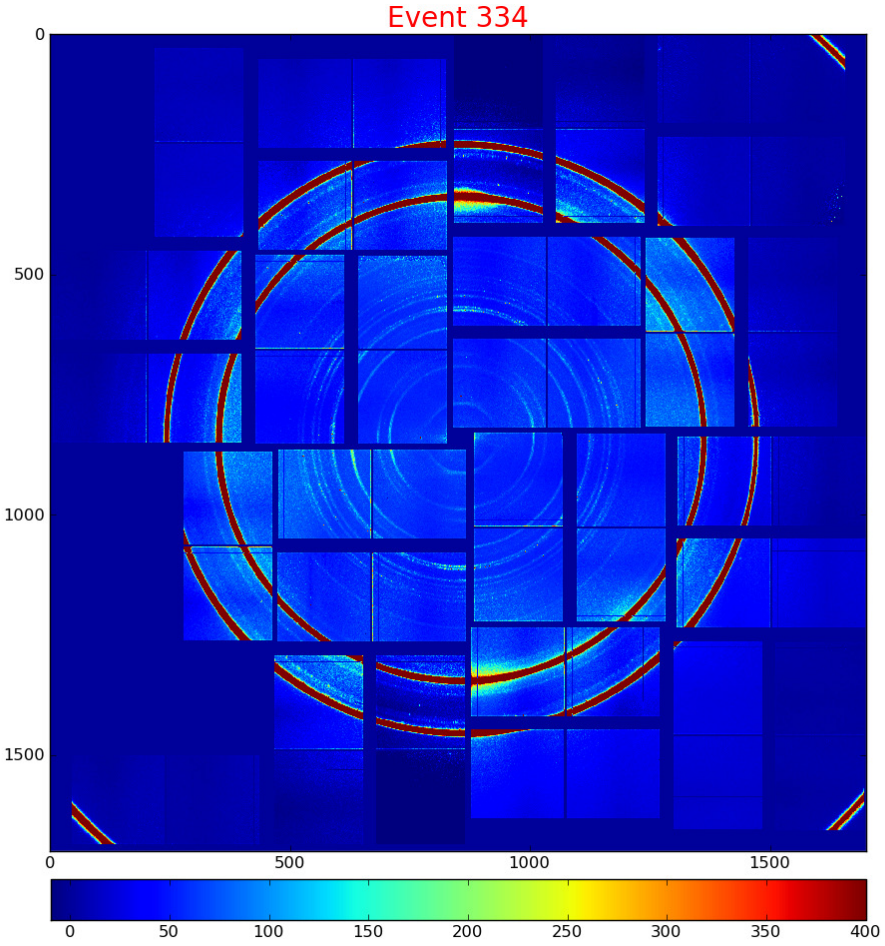




CSpad plots (3)

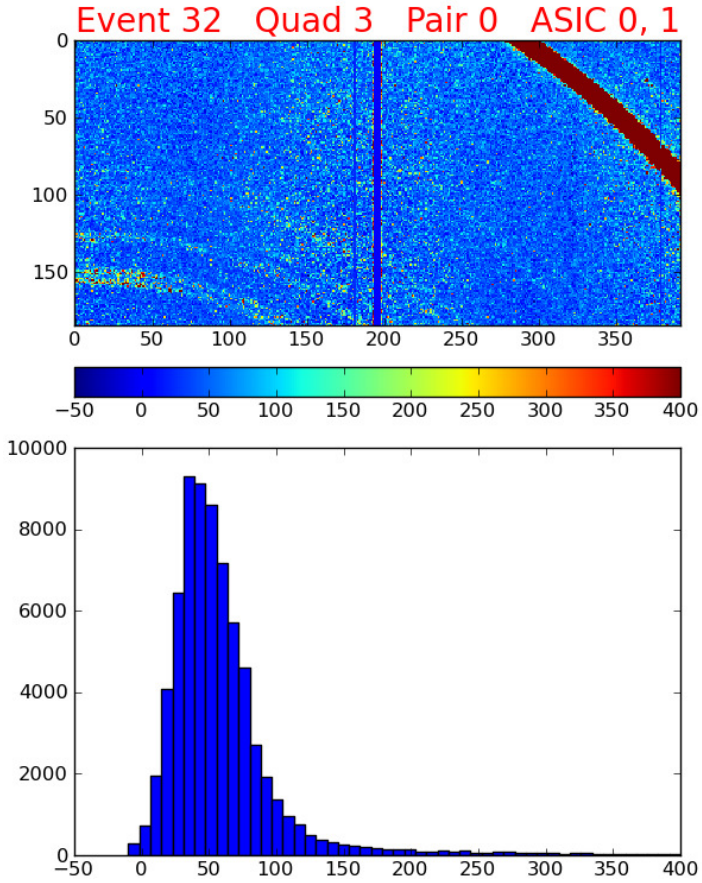
- Image of the CSpad detector
- Averaged image over 100 events

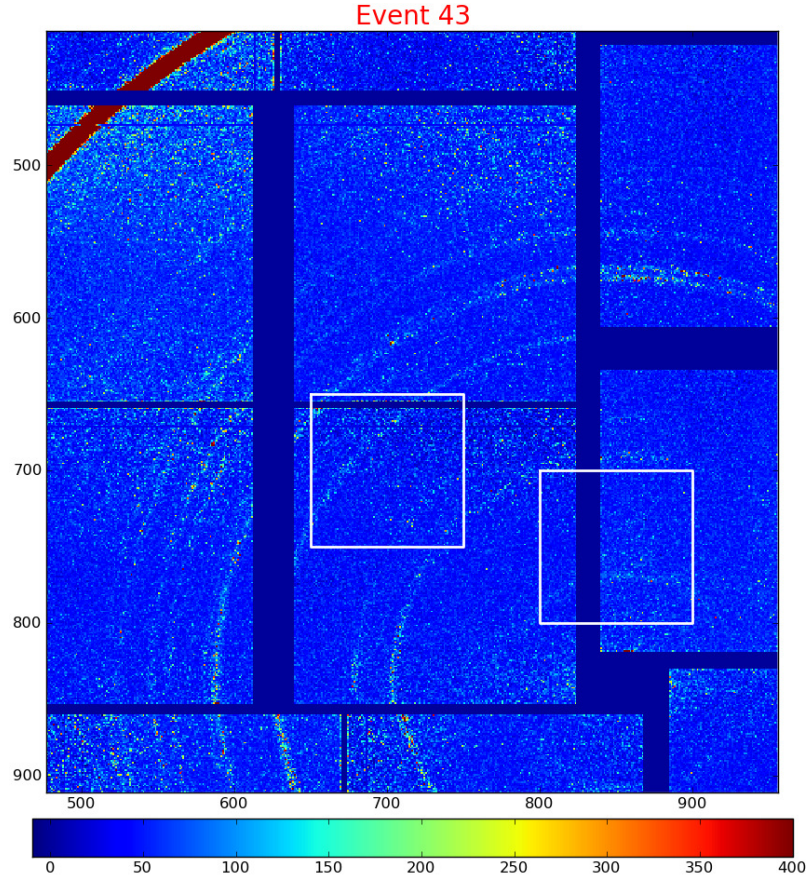




CSpad plots (4)

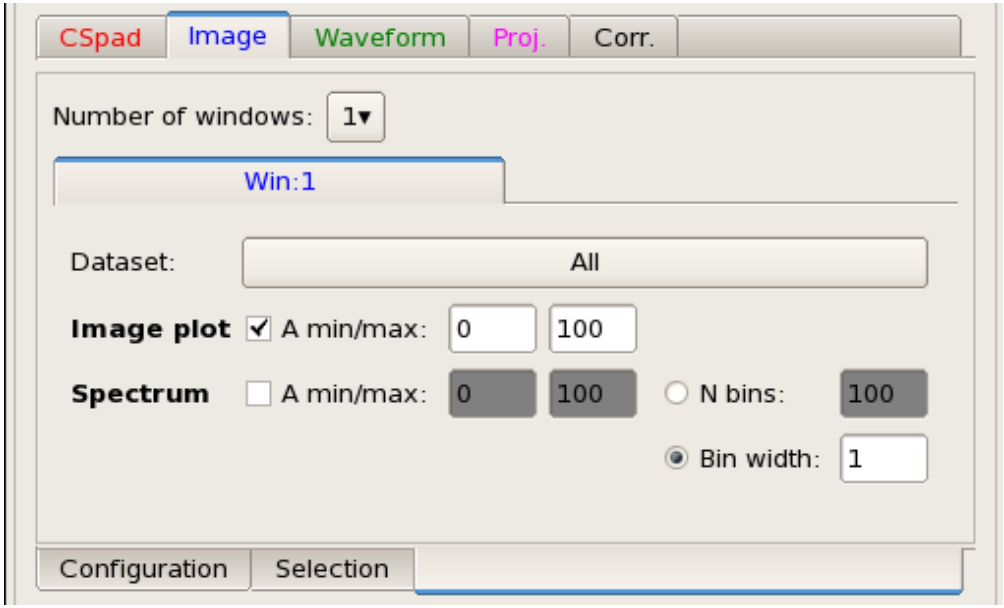
- Combined image and spectrum of 2x1
- Zoomed-in image of the CSpad with selection boxes

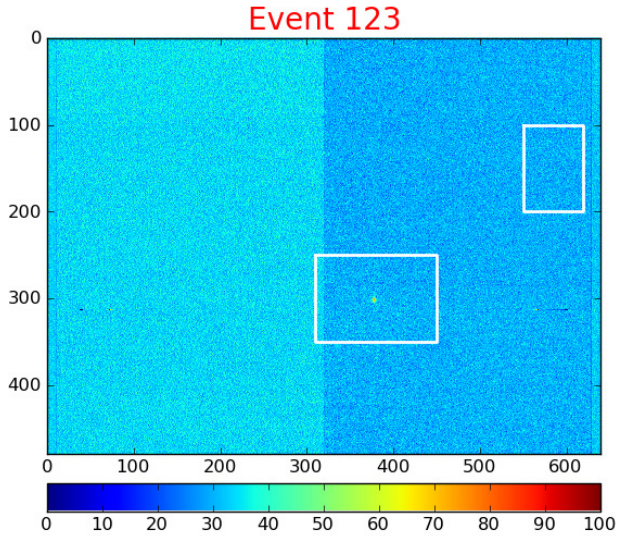


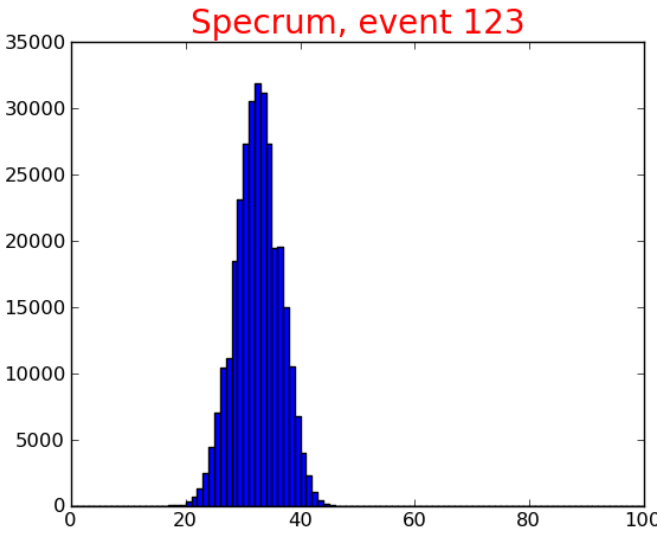


Camera image sub-GUI

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

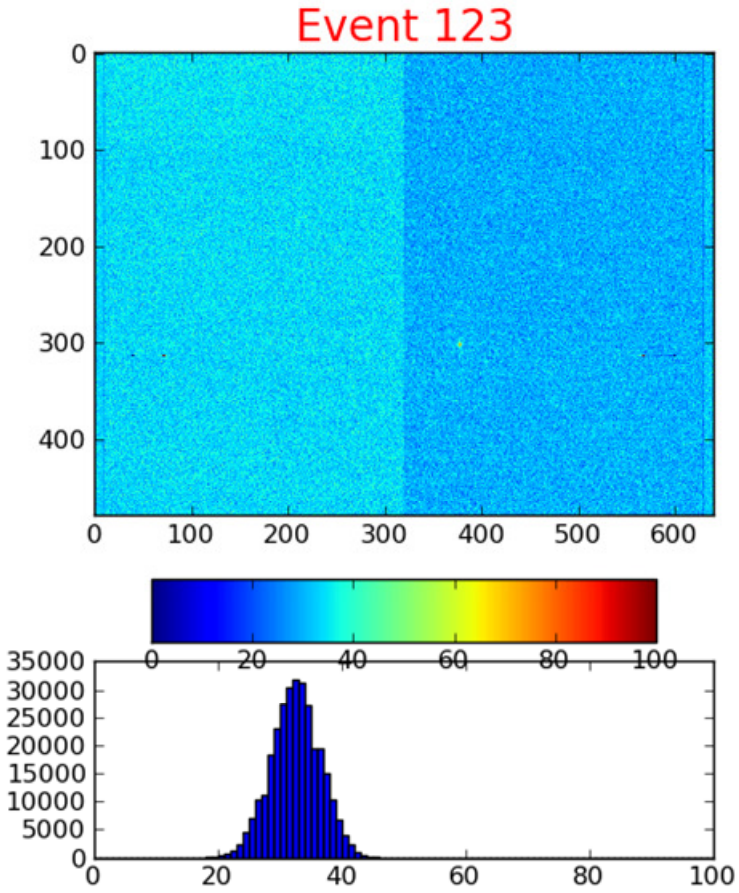


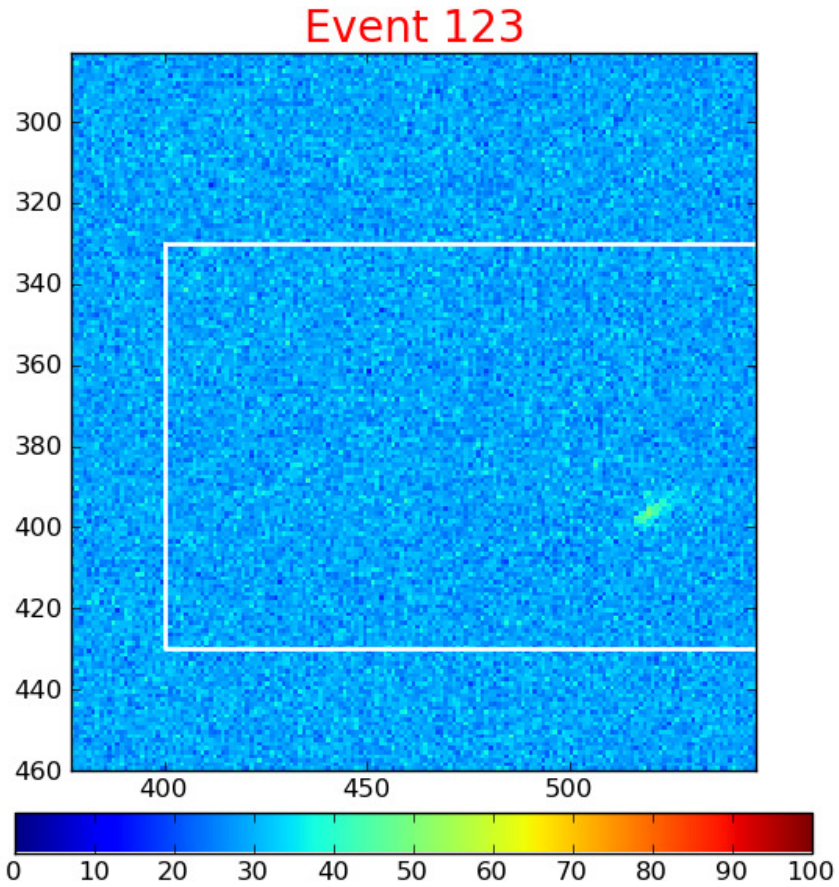




More plots for camera image

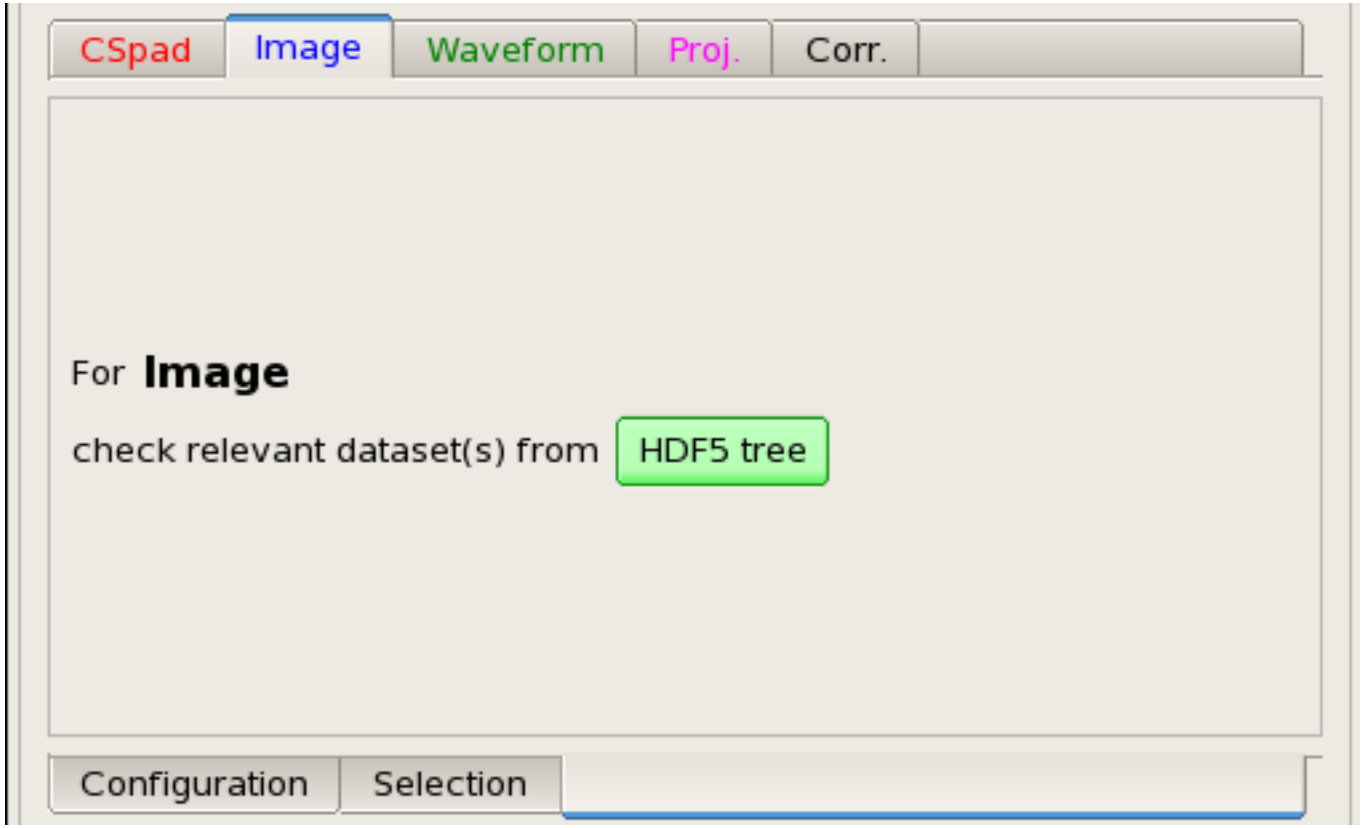
- Combined camera image and spectrum
- Zoomed-in camera image





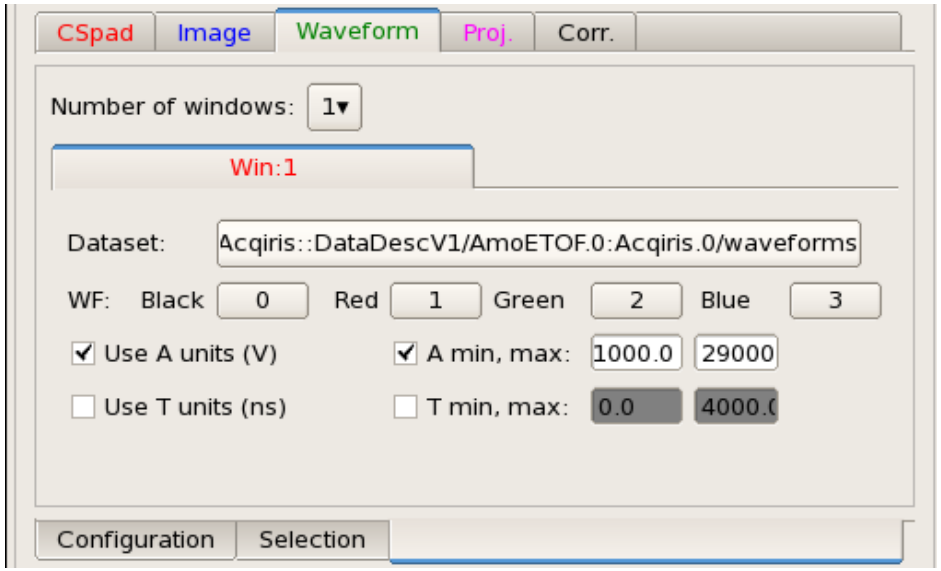
If dataset is not checked…

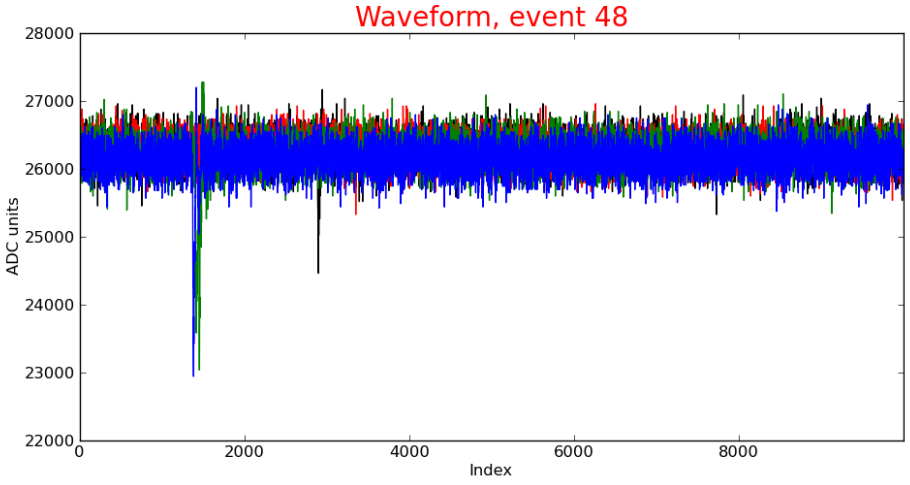
- Program advices to check it in HDF5 three:

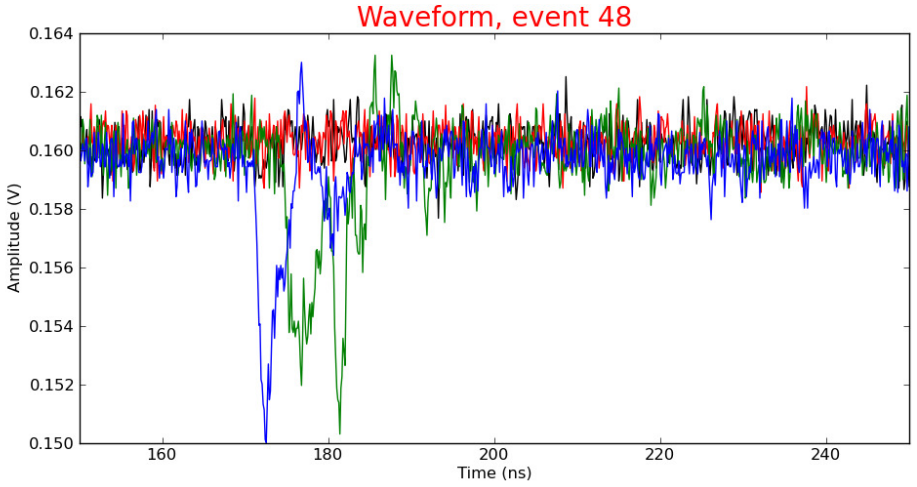


Waveform sub-GUI

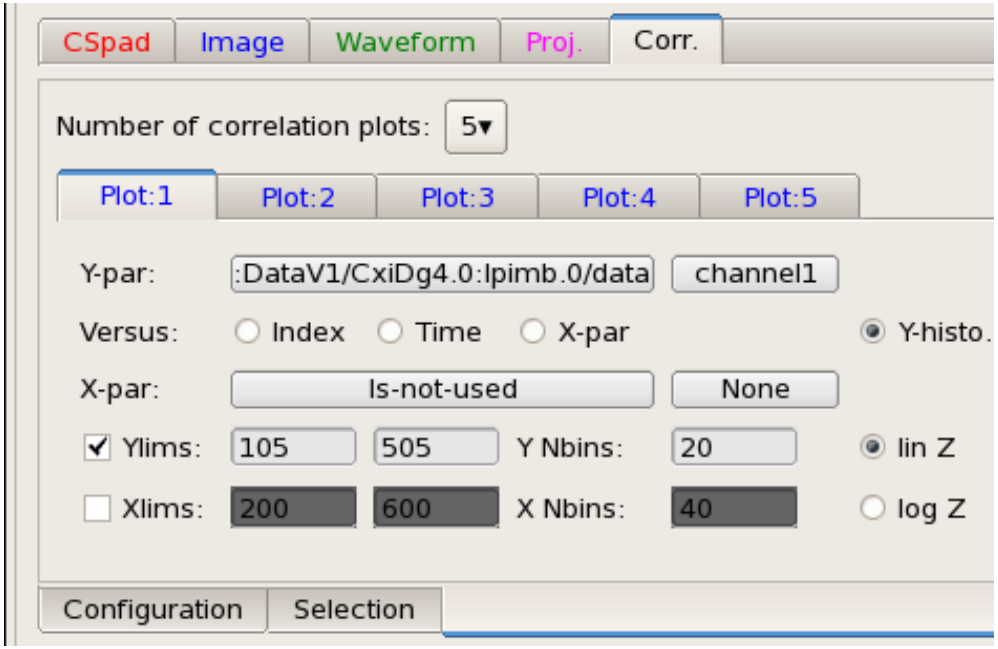
- One dataset per window
- 4 waveforms of different colors per window
- Auto/manual limits
- On/Off units

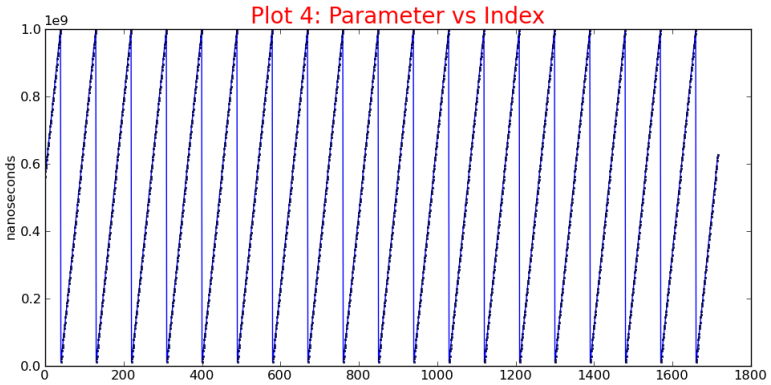


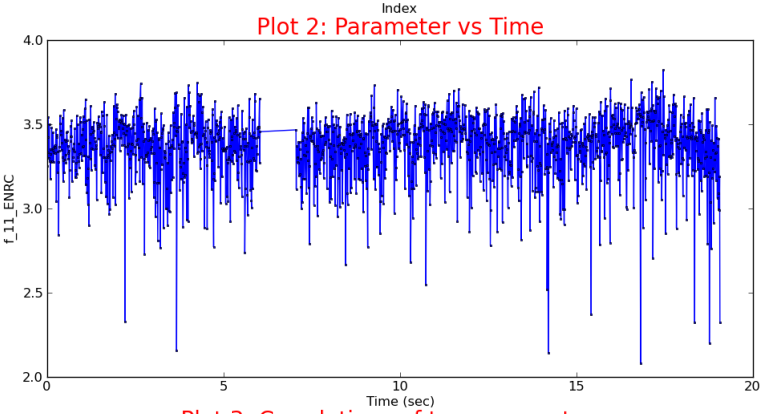


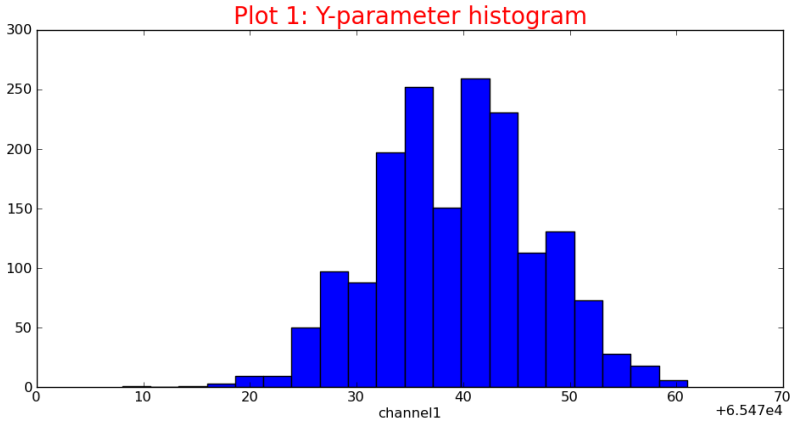


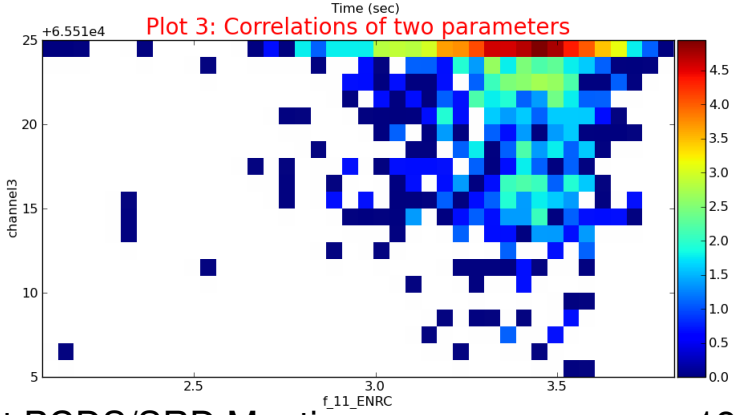
“Correlation” sub-GUI





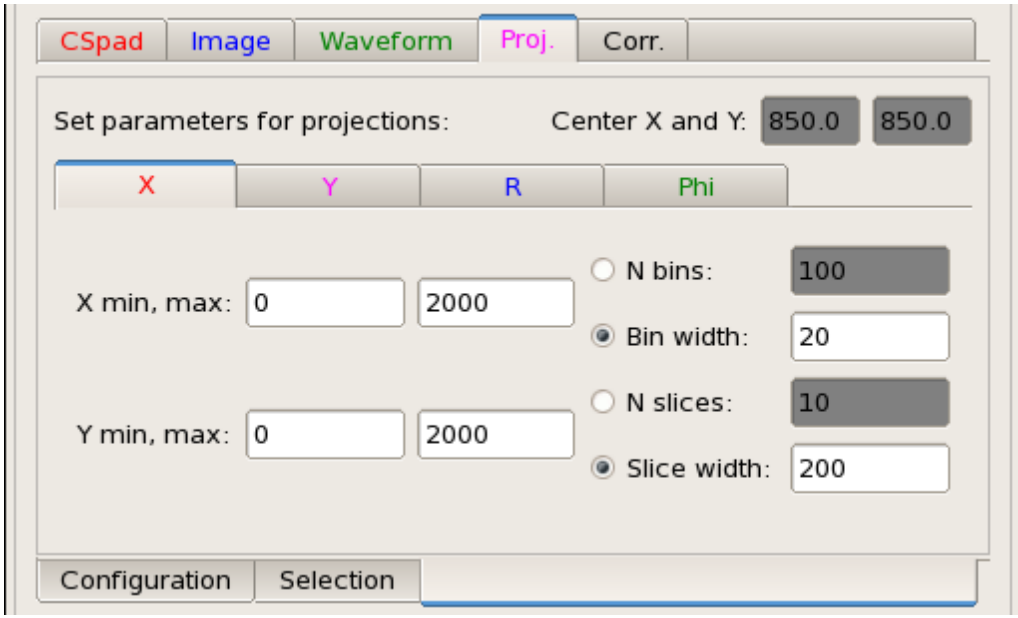


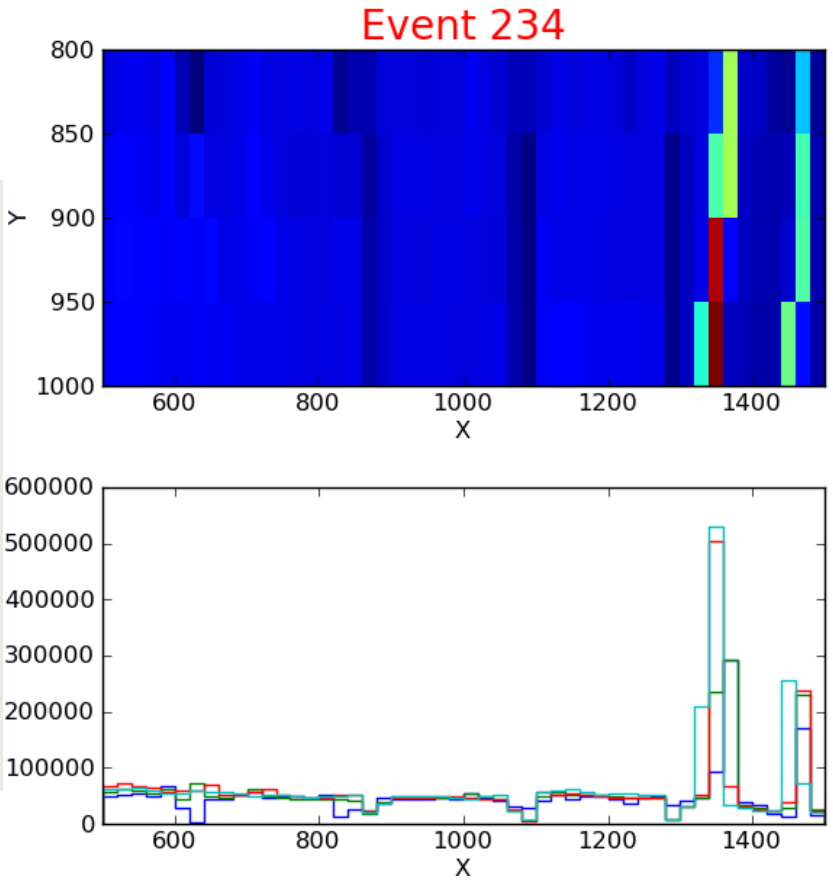




X-projection sub-GUI and plot

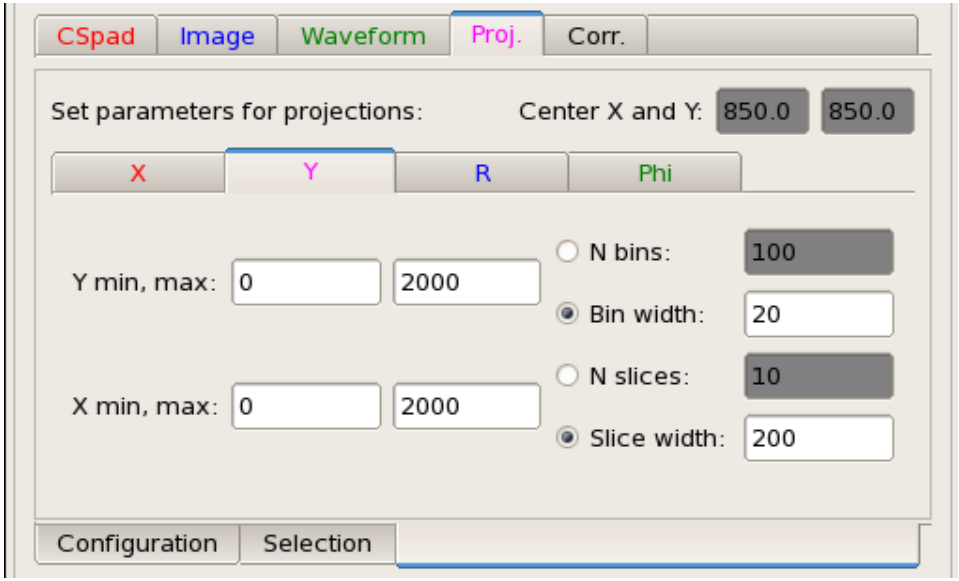
- Histograms in X
- For slices in Y

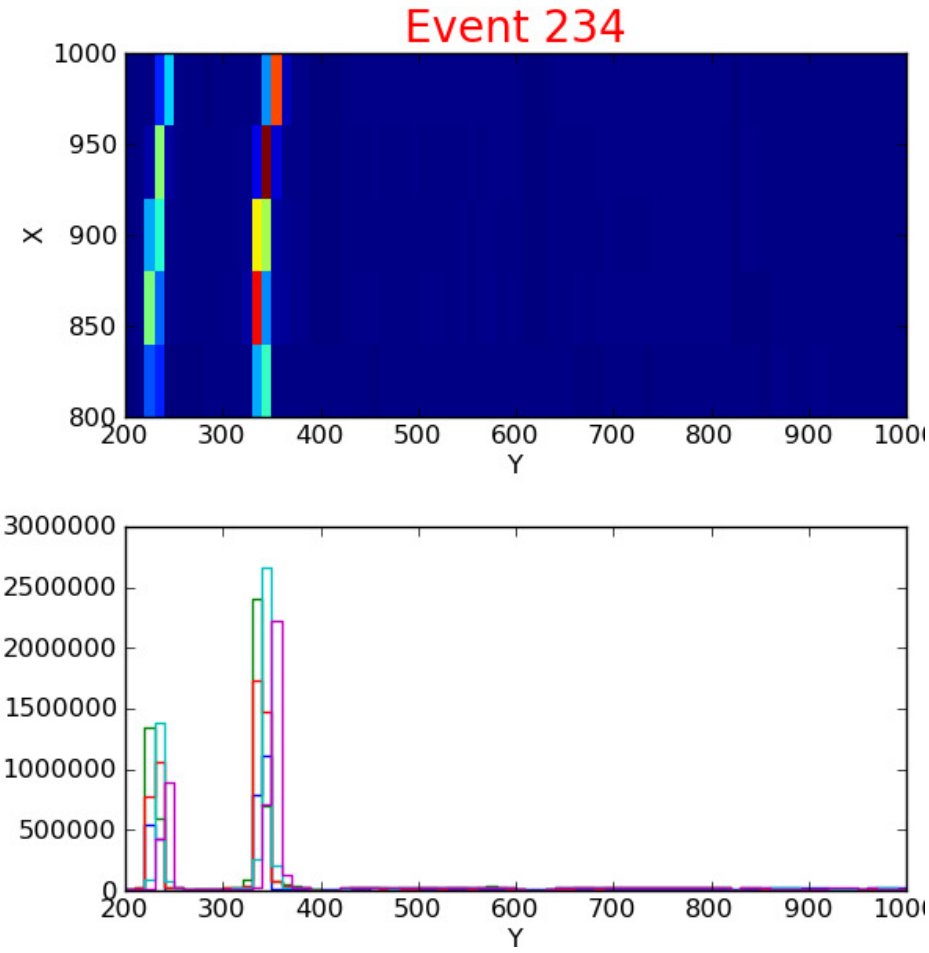




Y-projection sub-GUI and plot

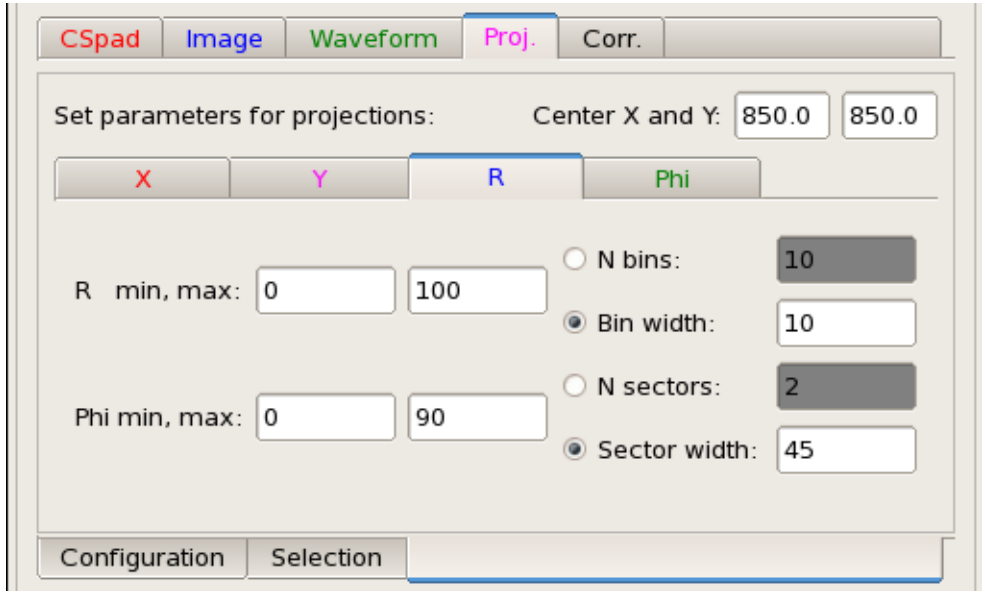
- Histograms in Y
- For slices in X

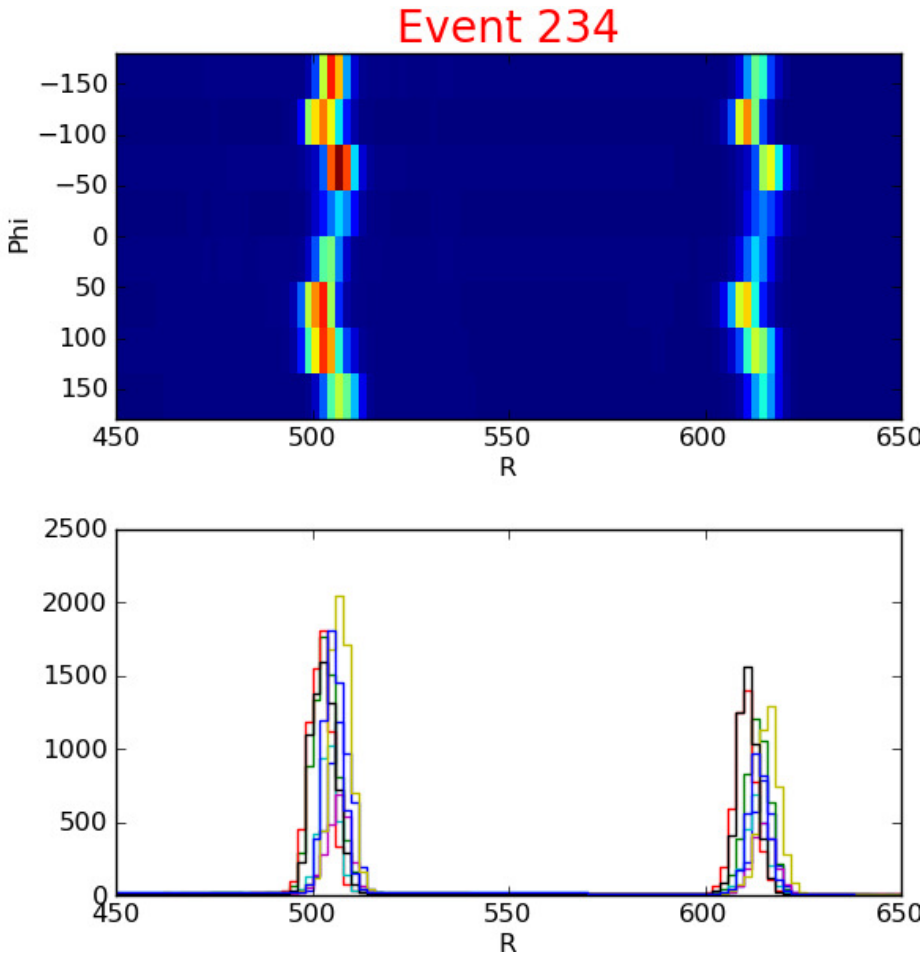




R-projection sub-GUI and plot

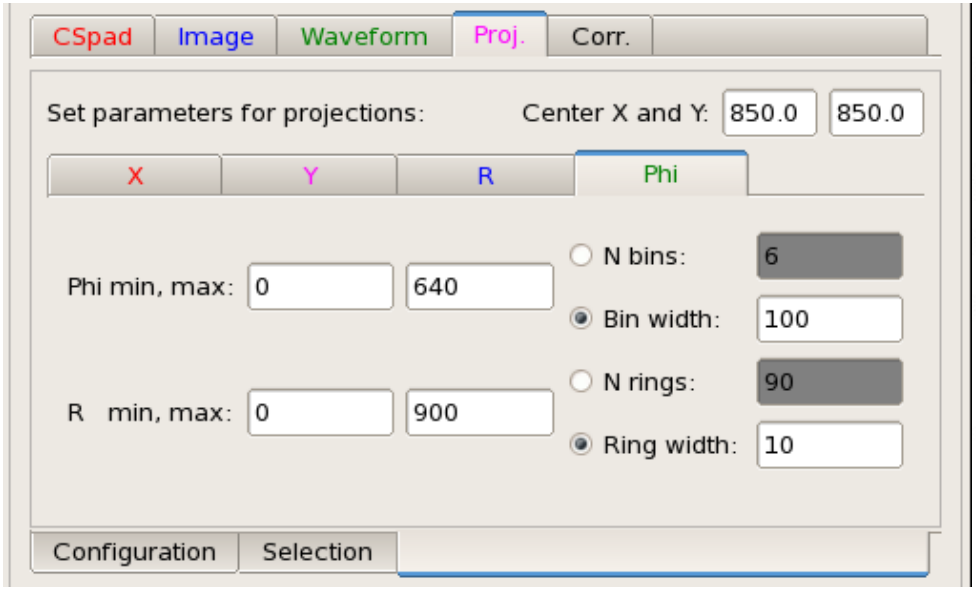
- Histograms in R
- For sectors in Phi
- Needs in center coord.

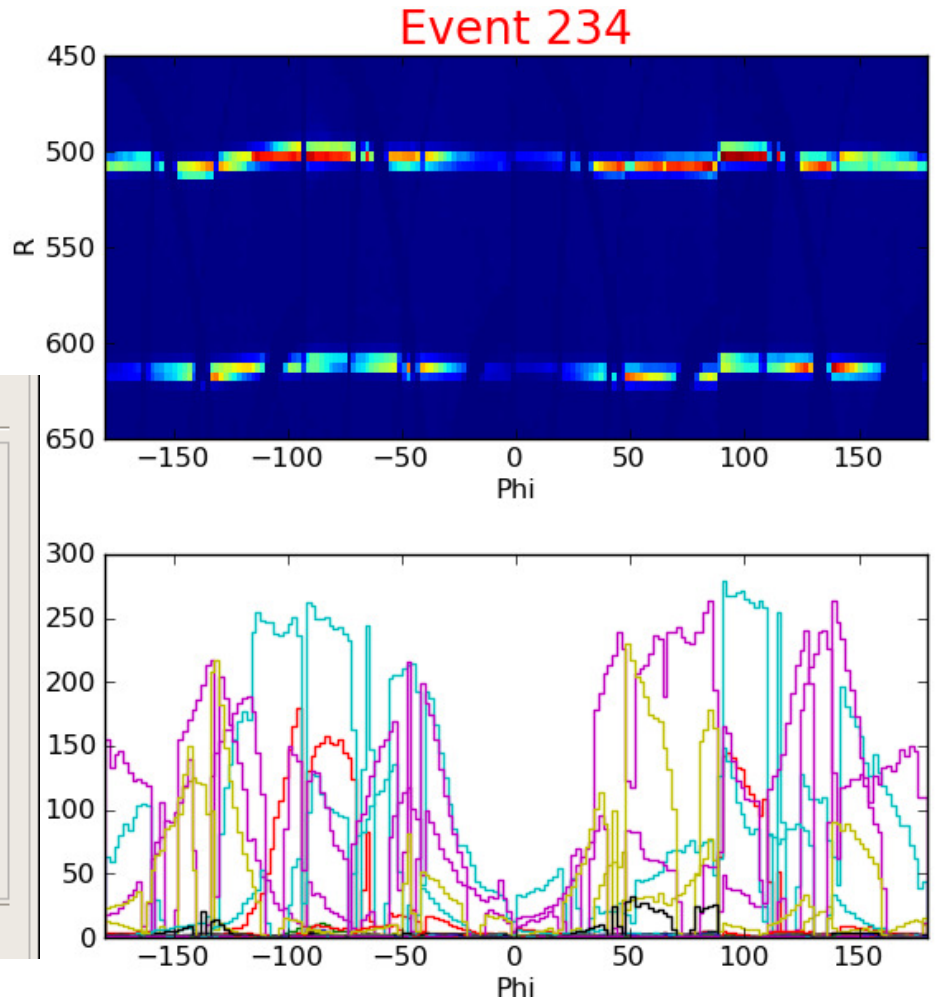




Rhi - projection sub-GUI and plot

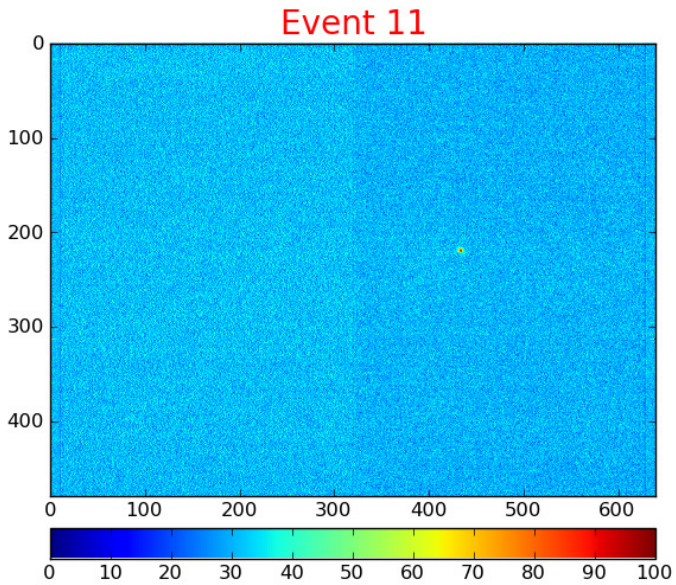
- Histograms in Phi
- For rings in R
- Needs in center coord.

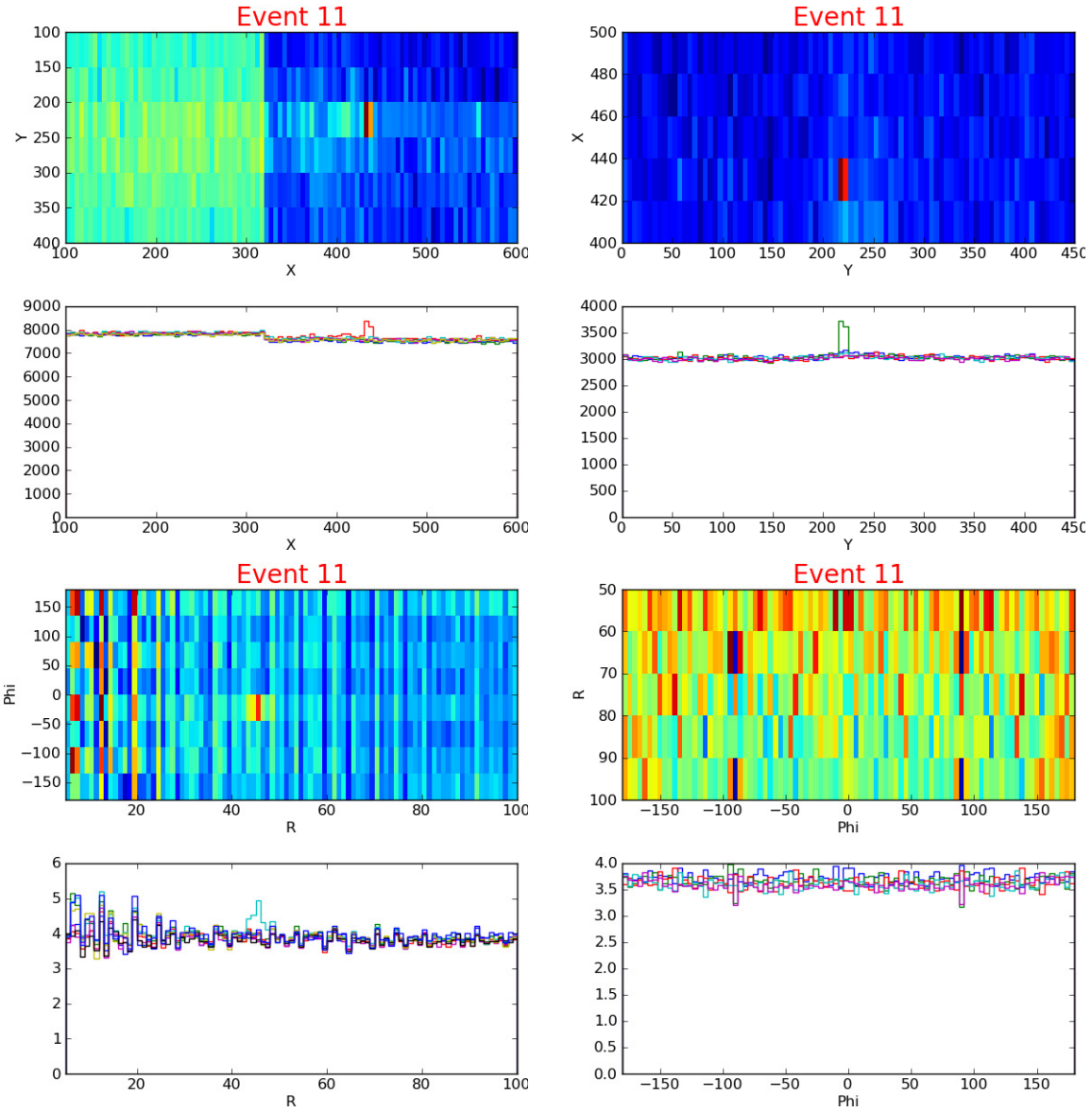




Projections for camera image

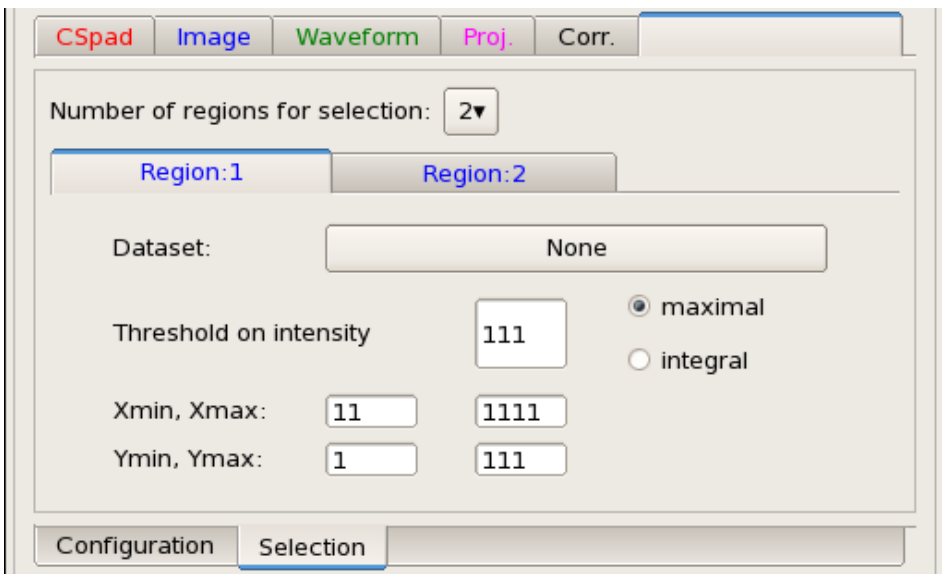
- Use the same GUI
- X, Y, R, Phi projections of the camera image

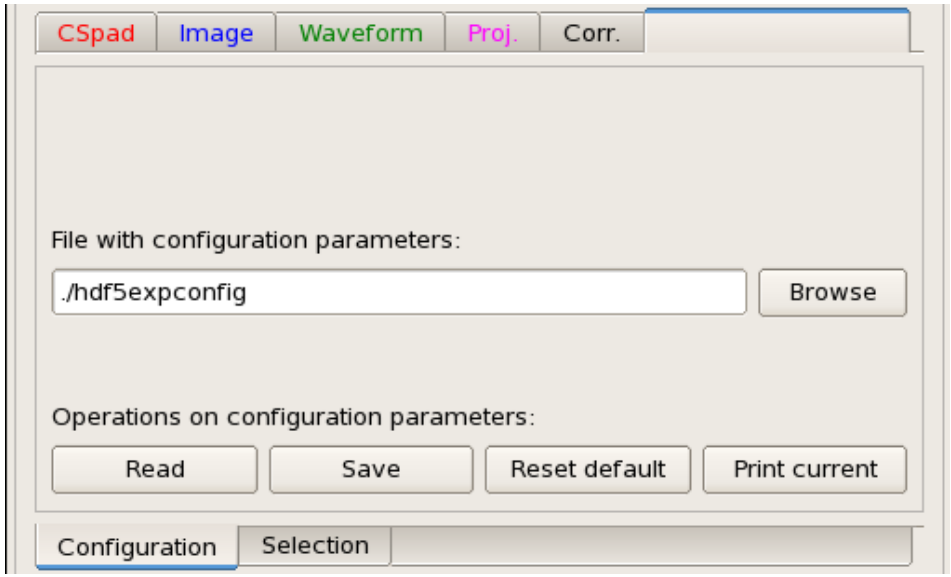




Selection and Configuration sub-GUIs

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





Summary

- HDF5 Explorer allows to look at data saved in HDF5 files.
- Program control is performed through the GUI.
- Interface is quite intuitive, instruction available in confluence.
- Graphics is specially designed for LCLS tools.
  - 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.
- Feedback is appreciated