Data Analysis and Management Project
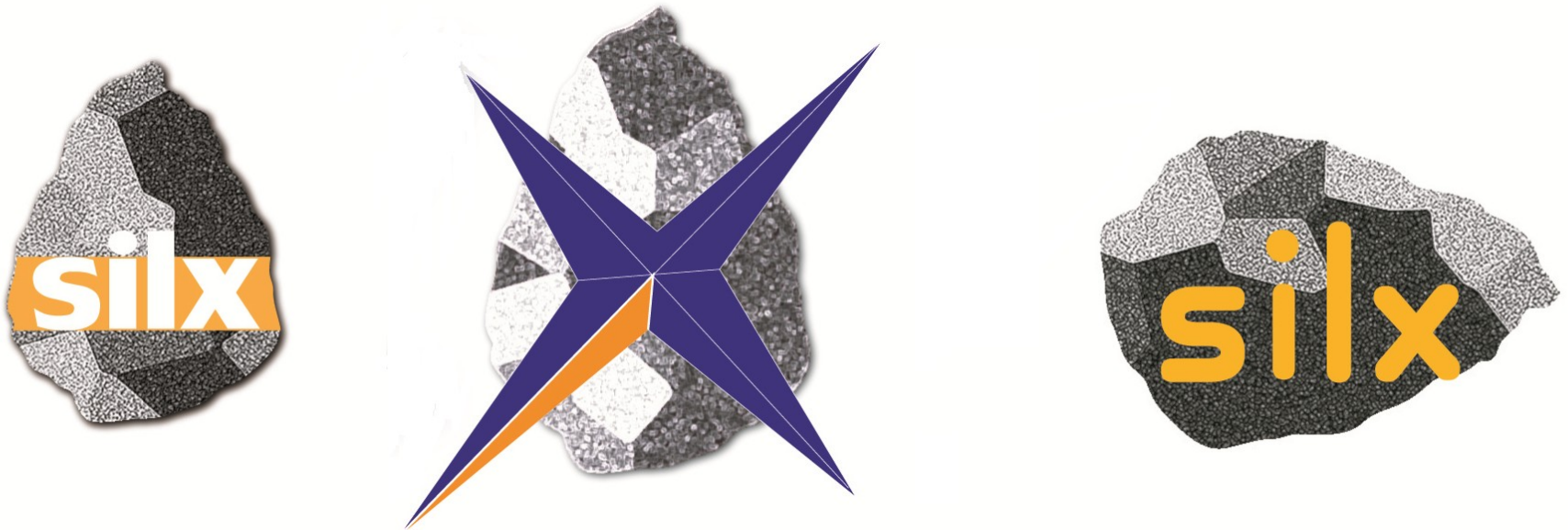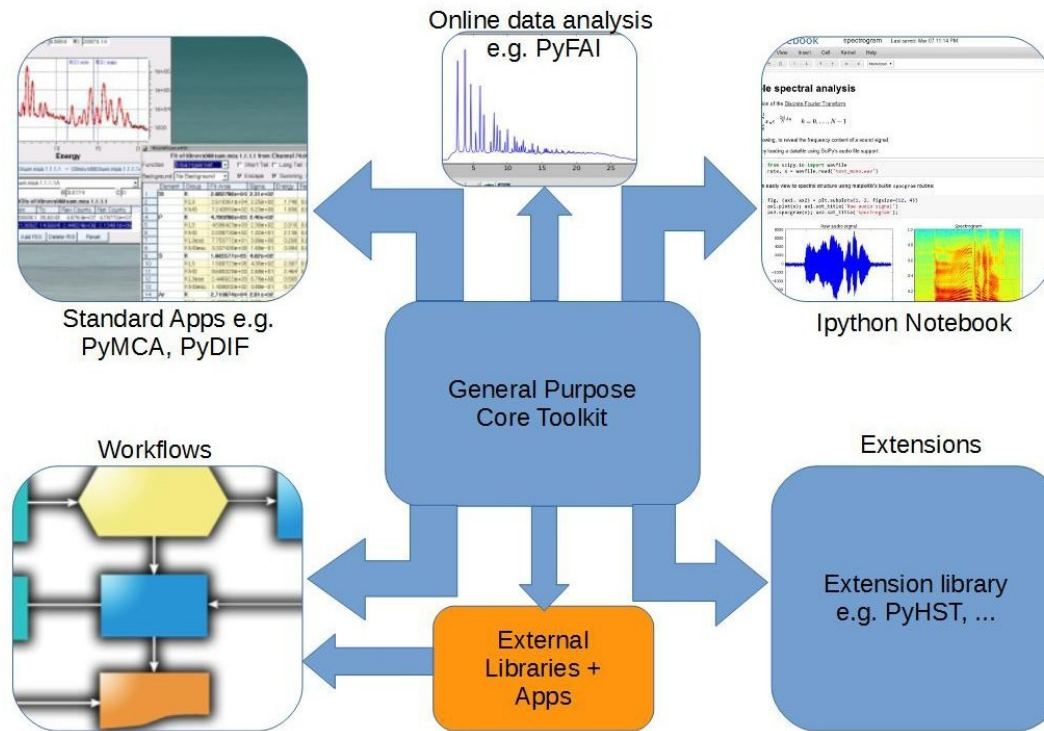# The silx library: Plotting

This Talk

- Introduction

- Objectives

- Current Status

- Discussion

Online data analysis e.g. PyFAI

Standard Apps e.g. PyMCA, PyDIF

Ipython Notebook

General Purpose Core Toolkit

Workflows

Extensions

External Libraries + Apps

Extension library e.g. PyHST, ...

- Provide, document and maintain a set of tools for software development
- Train staff and users on their use
- Simple and accessible to scientists

Data Visualization: Plot 1D and 2D

- Provide common set of tools for 0D, 1D and 2D visualization

- Capitalize effort

  - New features available to everybody
  - Common maintenance

- Improved user experience

Objective of this Meeting

- Figure out big mistakes in current approaches

  - At API level

  - At implementation level

- Identify needs

- Easy to use
- Documented
- Adapted to interactive and non interactive use
- Visualization of huge images
- Visualization of scatter plots, curves, images, polygons on same plot
- Possibility to extend plot functionality via plugins
- Programmable callback following plot interaction
- Bookkeeping of different types of elements in the plot
- Handling of linear and logarithmic axes as well as multiple axes
- Handling of pure visualization, interaction and drawing modes
- Independence of GUI toolkit (no dependence on Qt or whatever)
- Multiple backends supported
- Extensibility warranted via addItem

Consider it a base for a widget library

- Simpler than matplotlib : same call for line plot, scatter plot, ….

- Faster

    - Faster colormap calculation

    - Improved large image visualization (even using matplotlib!!)

    - Can use OpenGL as alternative

- Easier interaction handling

- A lot of us are using matplotlib, but there is no capitalization of efforts.

Plane Crystal (6)

Plots | Output

Plotting Style

Select level of Plotting   Preview

X,Z | X',Z' | X,X' | Z,Z' | Energy | Footprint

Optical Element Orientation

Source Plane Distance [cm]   0.0

Image Plane Distance [cm]   0.0

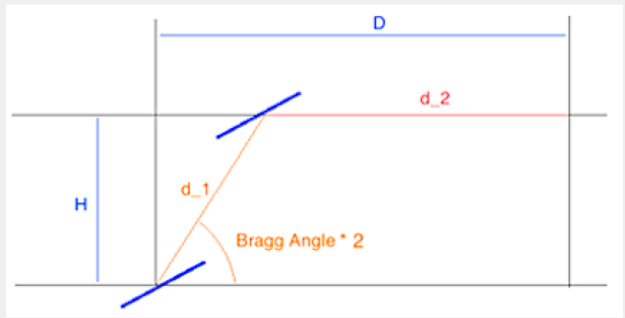Incident Angle respect to the normal [deg]   76.379

... or with respect to the surface [mrad]   237.74

Reflection Angle respect to the normal [deg]   87.977

... or with respect to the surface [mrad]   35.3

O.E. Orientation Angle [deg]   0

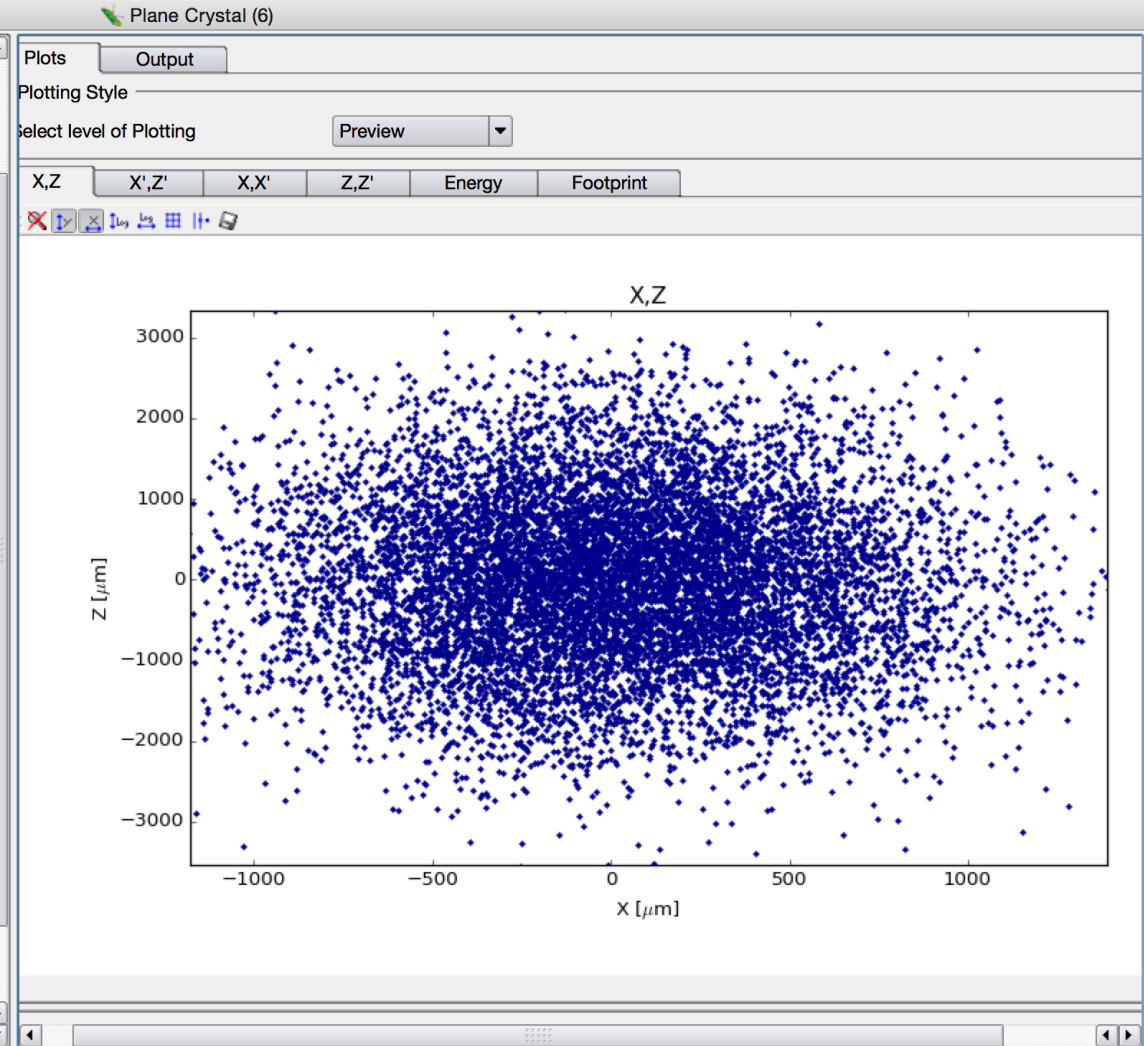Basic Setting | Advanced Setting | D.C.M. Utility

Optical Parameters

D

d_2

H

d_1

Bragg Angle * 2

H (Vertical Distance) [cm]   0.0

D (First Crystal to Next O.E.) [cm]   0.0

Bragg Angle [deg]   76.379   from O.E.

d_1 [cm]   0.0   set as S.P.   set as I.P.

X,Z

$Z\ [\mu m]$

$X\ [\mu m]$

Plane Crystal (6)

Output

...ts

...ting Style

...ct level of Plotting   Detailed Plot

...Z   X',Z'   X,X'   Z,Z'   Energy   Footprint

Energy

Number of Rays weighted by $\|\mathbf{E}_\sigma + \mathbf{E}_\pi\|^2$

400

350

300

250

200

150

100

50

23724.998 23724.999 23725.000 23725.001 23725.002 23725.003 23725.004

Energy [eV]

Info

Intensity   4480.916
Total Rays   100000
Total Good Rays   100000
Total Lost Rays   0
FWHM [eV]   0.0009

Optical Element Orientation

Source Plane Distance [cm]   0.0
Image Plane Distance [cm]   0.0
Incident Angle respect to the normal [deg]   76.379
... or with respect to the surface [mrad]   237.74
Reflection Angle respect to the normal [deg]   87.977
... or with respect to the surface [mrad]   35.3
O.E. Orientation Angle [deg]   0

Basic Setting   Advanced Setting   D.C.M. Utility

Optical Parameters

D

d_2

H

d_1

Bragg Angle * 2

H (Vertical Distance) [cm]   0.0
D (First Crystal to Next O.E.) [cm]   0.0

Bragg Angle [deg]   76.379   from O.E.

d_1 [cm]   0.0   set as S.P.   set as I.P.

Plane Crystal (6)

Plots Output

General Options

☒ Automatic Execution

Run Shadow/Trace   *Reset Fields*

Optical Element Orientation

Source Plane Distance [cm]	0.0
Image Plane Distance [cm]	0.0
Incident Angle respect to the normal [deg]	76.379
... or with respect to the surface [mrad]	237.74
Reflection Angle respect to the normal [deg]	87.977
... or with respect to the surface [mrad]	35.3
O.E. Orientation Angle [deg]	0

Basic Setting | Advanced Setting | D.C.M. Utility

Crystal | Dimensions

Diffraction Settings | Geometric Setting

Diffraction Parameters

Diffraction Geometry	Bragg
Diffraction Profile	Calculated
File with crystal parameters	Silicon220.dat ...
Auto setting	Yes
Units in use	eV
Set photon energy [eV]	23725.0

Plotting Style

Select level of Plotting   Detailed Plot

X,Z | X',Z' | X,X' | Z,Z' | Energy | Footprint

X,X'

X' [μrad]

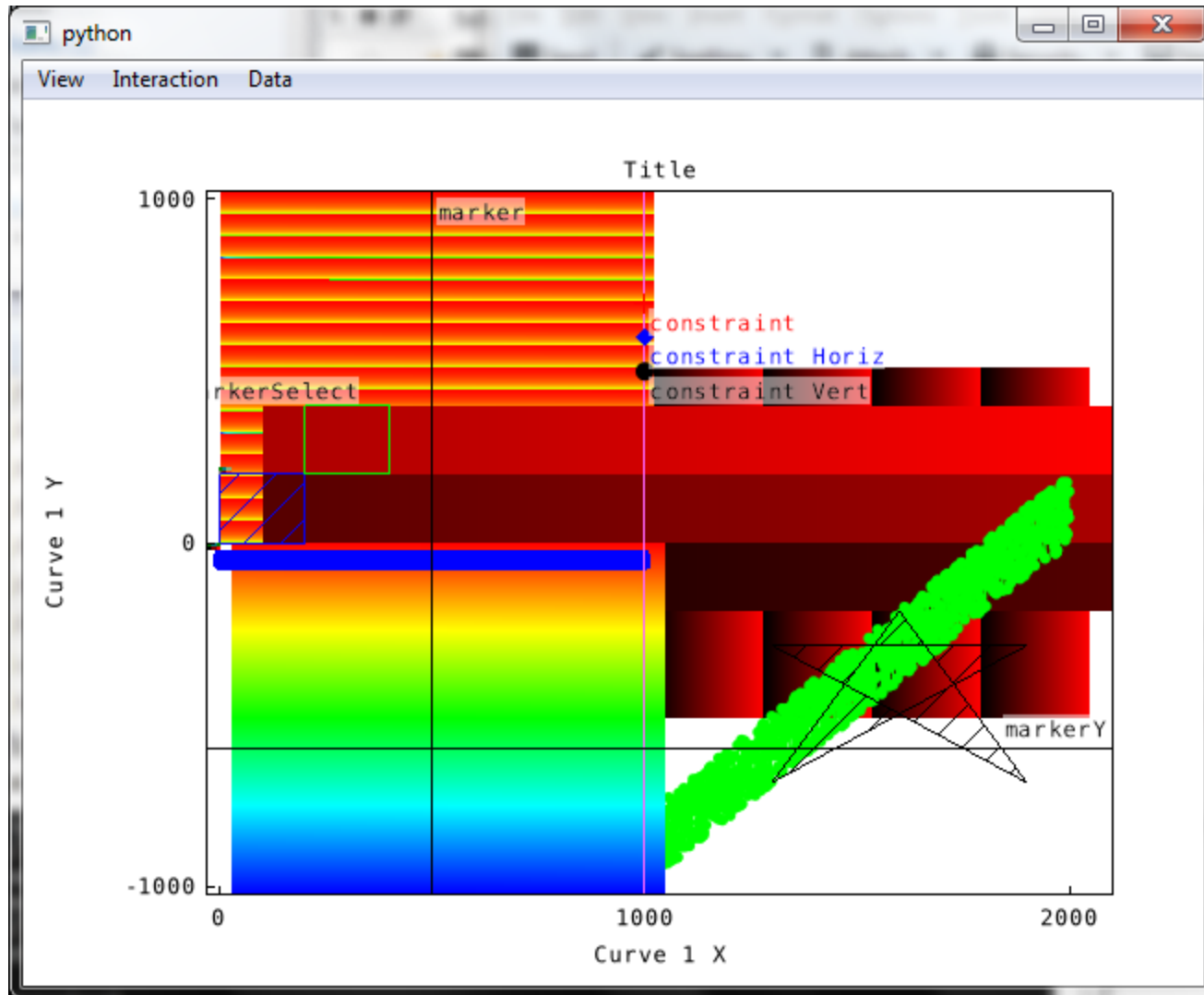X [μm]

Info

Intensity

Total Rays

Total Good Rays

Total Lost Rays

FWHM X [μm]

FWHM X' [μrad]

Known Issues: too smart backend

- It was considered desirable to allow the backend to be used directly

- Instead of that, a single entry point (the plot itself) would simplify development and maintenance because a maximum of features would be implemented at plot level
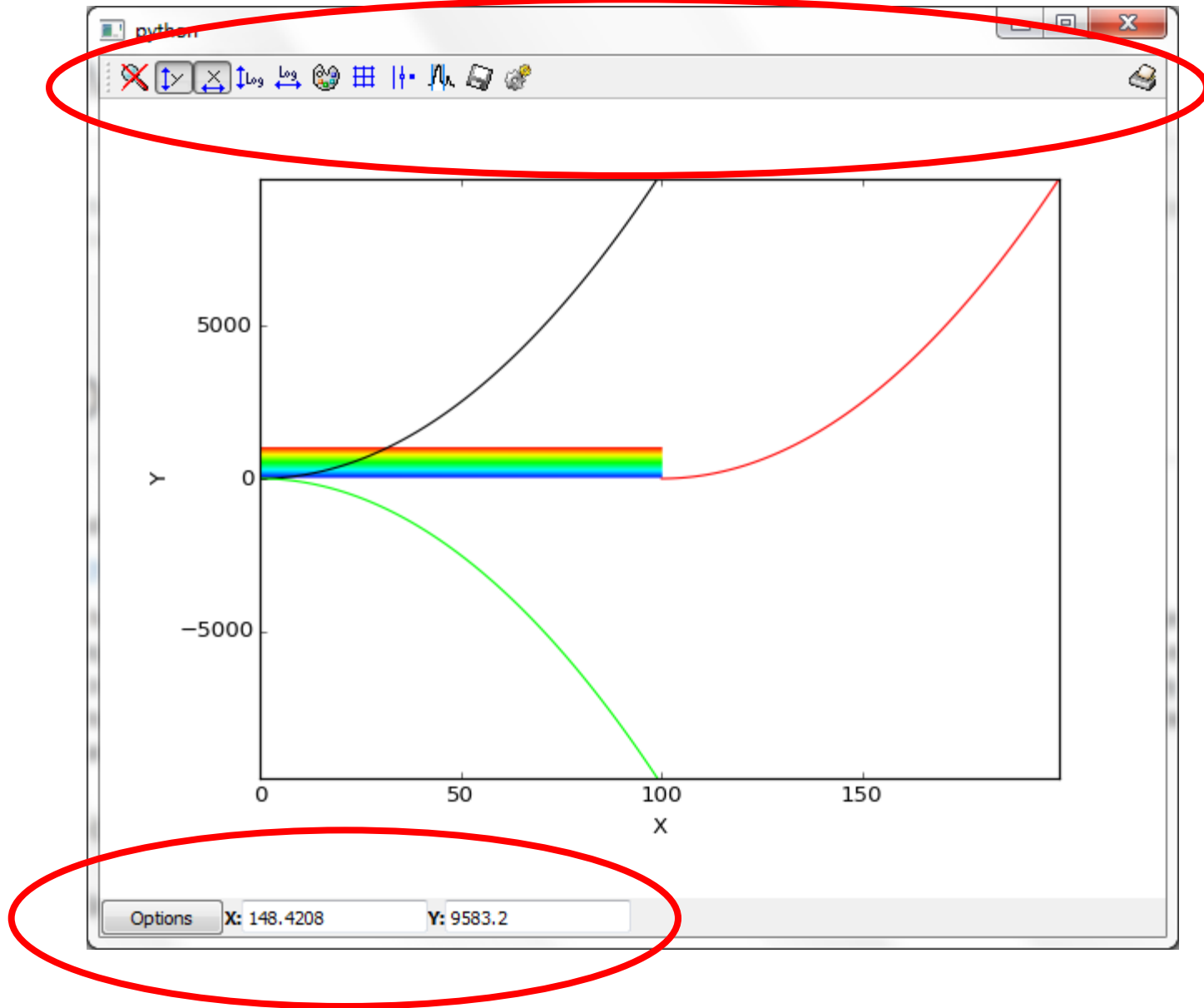
Known Issues: Missing Properties Access

- No documented way to access properties of objects in the plot

    - Partially a consequence of the "smart backend" issue

- Developers miss it

Current Implementation - I

- PlotWidget

  - Inherits the Plot API and QMainWindow

  - Provides a default implementation of the plot callback (emission a Qt signal) unless a different callback specified at instantiation time

  - Provides graph saving in different formats

  - Provides printing

  - Provides panning with arrow keys

Current Implementation - II

- PlotWindow

  - Inherits PlotWidget

  - Adds a configurable toolbar allowing access to a default implementation of common operations:

    - Axis scaling properties
    - Linear of Logarithmic axes
    - Aspect ratio handling
    - Colormap handling
    - Print configuration and preview

Known Issues: Poorly documented PlotWindow

- Partially on purpose

- Currently one decides the flavor of the PlotWindow at instantiation time just deciding the icons to be present

- Easy tailoring of the PlotWindow for specialized uses

- … but I do not know if that is everybody's taste

Current Developments: ImageView

- Default implementation for image visualization

- Optional Support of radar view and histograms

- Colormap handling

- Extraction of profiles

- Mask and ROI handling

- Distance measurements

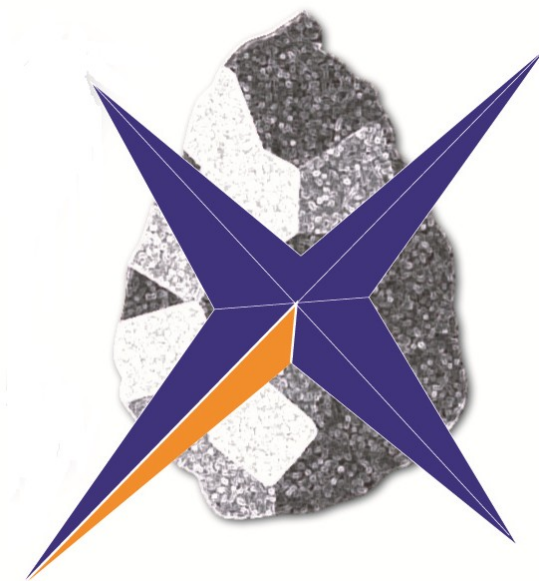- **Others????**

Some identified needs

- Provide support for different "more data than pixels" image visualization approaches (nearest, binned, blurred(?), …)

- More features imply more options: provide default and easy to customize choices

Discussion

Discussion – The logo

a   b   c

Discussion – Current API

- Do you see any major issue?

- What do you miss at API level?

Discussion – Current Implementation

- Besides need of documentation, do you see any major issue on providing access to common needs via keywords at instantiation time?

- What do you miss when visualizing 1D data (Newplot, PyMca, …)?

- What do you miss when visualizing 2D data (Oxidis, PyMca, …)?

- Do you need other 2D viewing approaches than nearest or binning?

- Have we totally forgotten something?