# XTC Explorer Tutorial


- Introduction
- Set up environment
- Exercise 1: Start xtcexplorer and select the XTC file
- Exercise 2: Explore XTC file content and make configuration file
- Exercise 3: Run pyana with existing configuration file from command line
- Currently implemented pyana/psana modules
- What to use pyana or psana?
- References


## Introduction

XTC Explorer is a GUI-based tool to explore interactively the XTC data files;

This application opens a Python GUI which helps to prepare configuration file for **pyana** or **psana** and launch it. The **pyana** or **psana** framework modules access, accumulate, and plot data from XTC file.

- Data is extracted using the LCLS framework pyana or psana.
- GUI is implemented on PyQt,
- visualization of data uses matplotlib,
- data processing algorithms are accelerated by NumPy and SciPy libraries.

Based on selections made in the GUI, xtcexplorer writes out pyana configuration files with names xb_pyana_XXXX.cfg, where XXXX is a random four-digit number. You can use them to run pyana directly from the command line. But they accumulate, so you might want to remove these regularly...

Naming conventions:

- project name: **XTC Explorer**
- package name: **XtcExplorer**
- executable name: xtcexplorer

Authors:

- Ingrid Ofter - implemented everything for **pyana**
- Joseph Barrera - began to add option to run python modules on **psana**
- Andy Salnikov - latest maintenance, fixing bugs, complete integration with **psana**.

Latest tags:
2012-Aug-20 ofte V00-01-37
...
2013-Mar-14 salnikov V00-03-00

This tutorial follows to the Manual XTC Explorer - Old, shows how to set up environment, start **xtcexplorer**, explore content of the xtc file, interactively create/edit configuration file for pyana/psana, run it interactively and in the command line, etc.

## Set up environment

- See for details Analysis Workbook. Account Setup
- Log onto any machine of the interactive pools **psananeh** (for AMO, XPP, SXR data) or **psanafeh** (for XCS, CXI, MEC data):

```
ssh -Y pslogin
ssh psananeh
or
ssh psanafeh
```

- Once per session execute one of the following scripts
  - for **bash** shell:

    ```
    . /reg/g/psdm/etc/sit_env.sh
    ```

  - or for **csh** shell:

    ```
    source /reg/g/psdm/etc/sit_env.csh
    ```

- You should always run this application from your own release working directory:

  ```
  newrel ana-current my_tutorial_release;
  cd my_tutorial_release;
  sit_setup;
  ```

  At this point you are ready to go.

Optional: if something need to be changed in code, check out the latest version of package and "compile":

```
addpkg XtcExplorer HEAD
scons
```

# Exercise 1: Start xtcexplorer and select the XTC file

Application GUI can be started by the command

```
xtcexplorer
```

To proceed the xtc file name should be pointed using one of four methods:

1. use command line parameter

   ```
   xtcexplorer /reg/d/psdm/XPP/xpptut13/xtc/e308-r0008-*.xtc
   or
   xtcexplorer /reg/d/psdm/SXR/sxrtut13/xtc/e306-r0366-*.xtc
   ```

2. use Instrument-Experiment-Run number-Load buttons in GUI
3. use file browser
4. type-in the file name
   Once a file or more has been connected, another GUI will pop up (possibly after a short delay while the file(s) content is being investigated). This GUI displays information about the file content and help with further processing of the data in pyana.

# Exercise 2: Explore XTC file content and make configuration file

In the **Psana Control Center** window

- set desired parameters in section **General Settings**
- in the left panel check detectors which you want to monitor, for example
  ✅ EBeam
  ✅ FEEGasDetEnergy
  ✅ XppGon-0|Cspad2x2-1

  > ⚠️ In case of selection
  > ✅ Epics Process Variables
  > separate window **Available Epics PVs** will show up. Desired PVs need to be checked.

Click on **Write configuration to file** button.
After that the configuration file with name **xb_pyana_XXXX.cfg** is ready and can be edited clicking on **Edit configuration to file** or executed

- click on button **Run pyana** or **Run psana** and confirm in the pop-up box that you want to run command line like

  ```
  pyana -c xb_pyana_XXXX.cfg
  ```

  ✅ Ok
  and enjoy observing your data in plots

# Exercise 3: Run pyana with existing configuration file from command line

Use `ls` command, select one of existing configuration files created by the **xtcexplorer** in current directory and run psana/pyana by the command line:

```
pyana -c xb_pyana_XXXX.cfg
```

observe the same results as in Exercise 2.

# Currently implemented pyana/psana modules

| Framework module name | Functionality |
|---|---|
| XtcExplorer/src/pyana_bld.py | display of Beam-line data |
| XtcExplorer/src/pyana_epics.py | display of Epics PV data |
| XtcExplorer/src/pyana_scan.py | display of motor scan data |
| XtcExplorer/src/pyana_encoder.py | display of encoder data |
| XtcExplorer/src/pyana_ipimb.py | display of diode data from IPIMB and PIM |
| XtcExplorer/src/pyana_waveform.py | display of waveform data |
| XtcExplorer/src/pyana_image.py | display of camera image data |
| XtcExplorer/src/pyana_plotter.py | plotter module to control the event display |

These modules can be used in configuration file with parameters described in XTC Explorer - Old#The pyana modules.

# What to use pyana or psana?

Now you are familiar with general concept of how to launch pyana or psana in the **xtcexplorer** or command line for existing modules. But you need in more data processing and would like to get data in your code in the framework module. What framework should you prefer **pyana** or **psana**?

- We strongly encourage people to use **psana**, which covers everything what is available in **pyana** and has more features, which are not available in **pyana**.
- **Pyana** still works in `ana-0.9.15` release. Upcoming modifications in pdsdata may force to drop further maintenance of **pyana**.
- **psana** is going to be supported in future for both C++ and Python modules for batch and interactive mode.

Framework interfaces in **pyana** and **psana** modules are slightly different, that is explained in
Migration from pyana to psana

> ⚠ **psana** should be your preferable choise!

# References

XTC Explorer - Old
HDF5 Explorer - Old
Pyana User Manual
Migration from pyana to psana

Python
PyQt
matplotlib
NumPy
SciPy