Experiment Control and Analysis for High-Resolution Tomography

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Introduction

Experiment control software for X-ray Computed Tomography (XCT).

XCT is a powerful technique for imaging 3D structures at the micro- and nano-levels.

Faster detector and added complexity because of experimental components requires use of automated software.

Rich feature set with the ability to control complete experimental workflow, i.e., from acquisition to analysis.
Outline

Features
System Architecture
Reconstruction Pipeline
Automation
Features - Overview

- Histogram and Color Transfer Function
- Offline Data View
- Live Acquisition
- Acquisition Settings
- Image Annotation
- Area Detector IOC settings
Features - Data Browser
Features - Annotations
Features - Tomography Scan
Features - Calibration
Features - Configurability

Detectors

Calibration Widgets
### Architecture Overview

<table>
<thead>
<tr>
<th>Tomography Experiment Control Software</th>
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<tr>
<td>Qt</td>
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<td>EPICS CA</td>
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</table>

GStar - A widget library based on Qt\(^1\) provides EPICS aware widgets

SStar - A C++ wrapper around EPICS channel access API\(^2\), \(^3\), provides the core scanning functionality

DStar - Provides single interface to different data format libraries such as HDF5\(^4\)

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Reconstruction Pipeline

1. Control IOCs

2. Save to HDF5 file

3. Transfer

4. Launch reconstruction

5. Save results into original HDF5 file


Experiment Control and Analysis for High-Resolution Tomography - ICALEPCS 2013
Analysis Automation

A thin wrapper around user process

A common data format

Client starts the pipeline analysis by constructing a JMS message containing

input data\(^1,2\) - A HDF5 file with input parameters e.g. location of Hadoop file to process

route - specify individual processing step

Next stage is triggered by passing a JMS\(^3\) message between the current and the next stage

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3. Apache ActiveMQ, [http://activemq.apache.org](http://activemq.apache.org) based implementation of JMS standard is used.

Effective end-to-end management of data acquisition and analysis for XPCS - ICALEPCS 2013
Conclusion

Feature rich and configurable control software

Being used at newly upgraded nano-tomography station at APS 32-ID beamline

Integration of the software with reconstruction application lowers the turn-around time between acquisition and analysis

Maximize utilization of the equipment and beam time

Available at:

https://subversion.xor.aps.anl.gov/TXM/trunk/
Thanks

Questions?