

CLAS12 Software Organization and Documentation

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Jefferson Lab

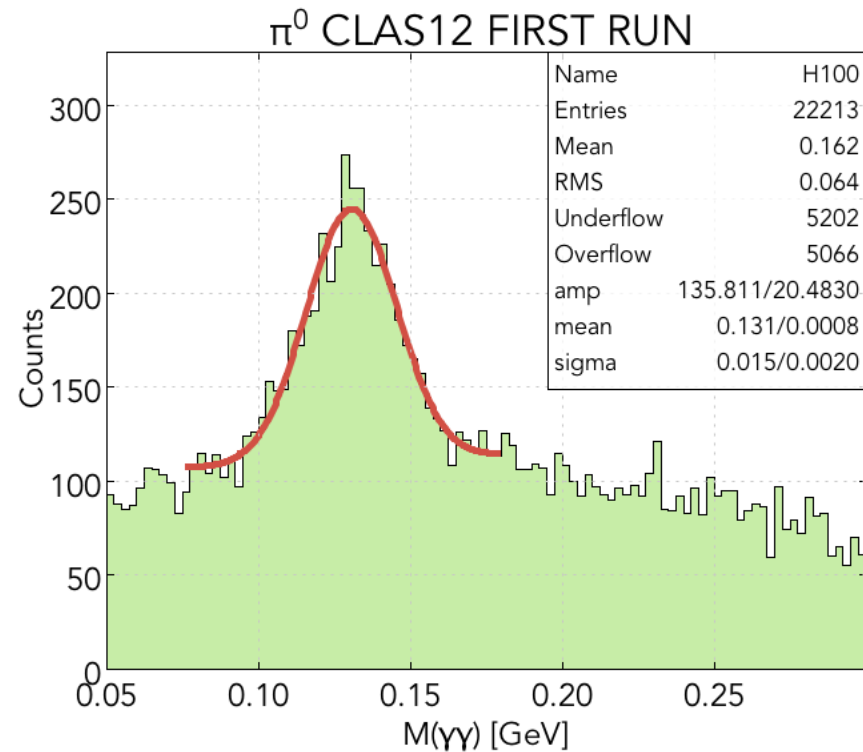
CLAS Collaboration Meeting
June 13, 2017
Jefferson Lab

Outline

- Current release
- Online software
- Simulations
- Common tools
- Reconstruction
- Data processing
- Summary

Current Release

- GEMC 4a.1.0
- COATJAVA 4a.6.0



2-photon invariant mass from KPP data (coatjava 4a.0.0)

Online Software

- CEBAF Online Data Acquisition (CODA)

Expert: Sergey Boyarinov

See talk later today (14:25)

* Great performance during KPP

- Slow Controls

Expert: Nathan Baltzell

See talk later today (14:10)

Simulations

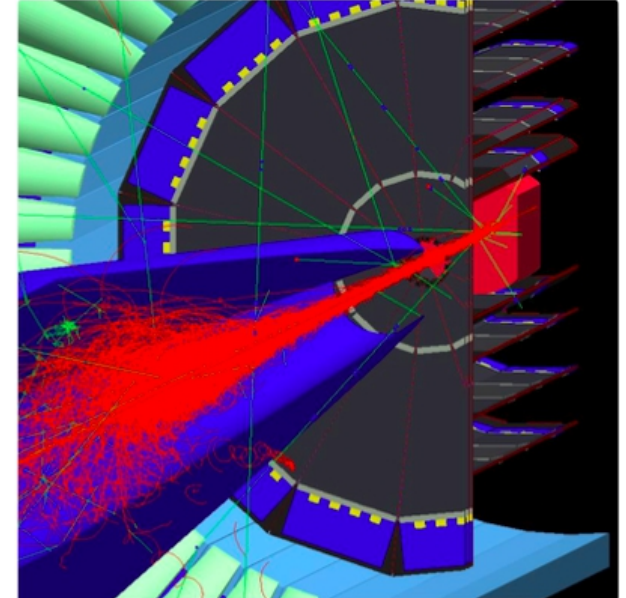
- GEant4 Monte Carlo (GEMC)

Expert: Maurizio Ungaro

Documentation: gemc.jlab.org

Source code and release tags: github.com/gemc

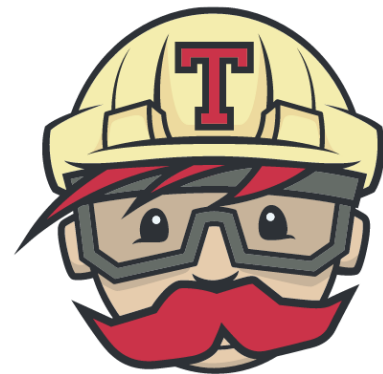
See talk later today (14:40)



* There will be a hands-on GEMC demo during the CLAS12 Software Tutorial (Friday at 14:00)

Common Tools

- Geometry, calibration, and run conditions databases – CCDB/RCDB
 - Hall-D development
 - Hall-B contact: Harut Avakian
 - Contains run number and variation dependence
 - sqlite versions available
- CLAS Offline Analysis Tools (COATJAVA) * Great performance during KPP
 - Allows for fast application development
 - Written in Java, version control by git
 - Contains I/O tools, plotting/fitting, geometry, and reco/calibration engines
 - Built with Maven build system
 - Unit tests and validation done by Travis CI
 - Documentation and downloads: <https://github.com/JeffersonLab/clas12-offline-software>



<> Code Issues 1 Pull requests 1 Projects 0 Wiki Settings Insights

CLAS12 Offline Software

Add topics History of all changes

Releases (downloads and notes)

1,191 commits

2 branches

9 releases

21 contributors

Branch: master

New pull request

Create new file

Upload files

Find file

Clone or download

Different branches for parallel development

zieglerv Merge branch 'master' of https://github.com/JeffersonLab/clas12-offli... Latest commit 9edb264 3 days ago

| | | |
|-----------------------|--|--------------|
| bin | added bin/ etc/ and lib/ directories | 3 months ago |
| common-tools | magfield computes greadients and ced displays | 3 days ago |
| docs | Updated documentation | 2 months ago |
| etc | fixed typo in EVENT.json | 6 days ago |
| external-dependencies | Minor dependency management change | 7 days ago |
| reconstruction | Merge branch 'master' of https://github.com/JeffersonLab/clas12-offli... | 3 days ago |
| validation | Updated yaml and unit-tests for new EB | 24 days ago |
| .gitignore | Cleanup | 7 days ago |
| .travis.yml | Updated unit tests | 2 months ago |
| README.md | Updated documentation | 4 days ago |
| build-coatjava.sh | Minor dependency management change | 7 days ago |
| pom.xml | fixed unstable build warnings by creating a local mvn repo to store t... | 2 months ago |













Source code

README.md

Current build status and link to Travis CI

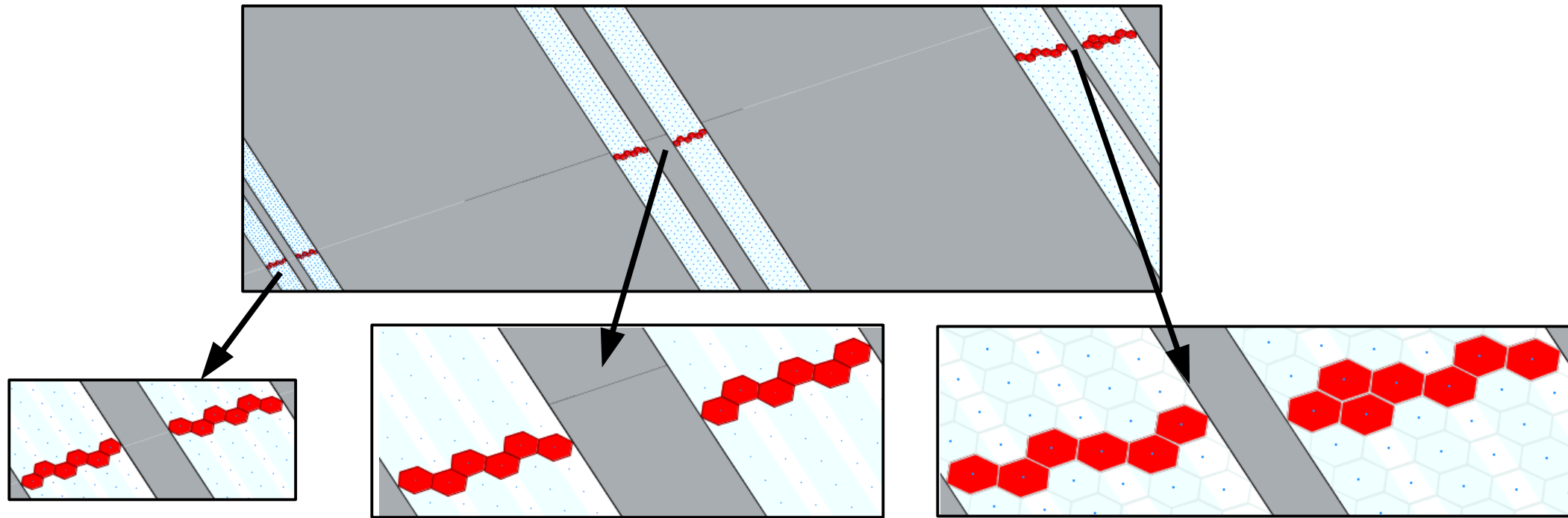
clas12-offline-software build passing

Current Branches Build History Pull Requests

| | | | |
|---|--|---|--------------------------------|
| ✓ 4a.6.0  Veronique Ziegler | Merge branch 'master' of https://github.com/ | 🔗 #222 passed  9edb264 | 🕒 4 min 12 sec 📅 3 days ago |
| ✓ master  Veronique Ziegler | Merge branch 'master' of https://github.com/ | 🔗 #221 passed  9edb264 | 🕒 9 min 50 sec 📅 3 days ago |
| ✓ master  David Heddle | magfield computes greadients and ced displa | 🔗 #220 passed  850d1ac | 🕒 8 min 31 sec 📅 3 days ago |
| ✓ master  David Heddle | removed suspect uberfast sin and cosine | 🔗 #219 passed  e0e4157 | 🕒 3 min 52 sec 📅 3 days ago |
| ! master  David Heddle | Bad ass testing of the mag field. Confident pr | 🔗 #217 errored  be6c519 | 🕒 1 min 7 sec 📅 4 days ago |
| ✓ master  Nathan Harrison | Updated documentation | 🔗 #216 passed  4584462 | 🕒 9 min 46 sec 📅 4 days ago |

DC Unit Test

* single simulated electron event with $p=2.5$ GeV, $\theta=25$ deg, $\phi=0$, torus=-1, solenoid=0



Unit test checks the following for HBT and TBT:

- has tracking bank
- tracking bank has 1 row
- the one track has charge -1
- p_x , p_y , p_z are close to the true values

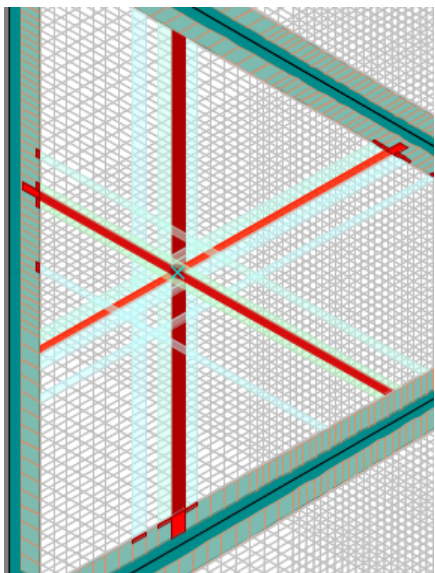
* These tests are run automatically by Travis CI after every build; returns a failure if tests don't pass



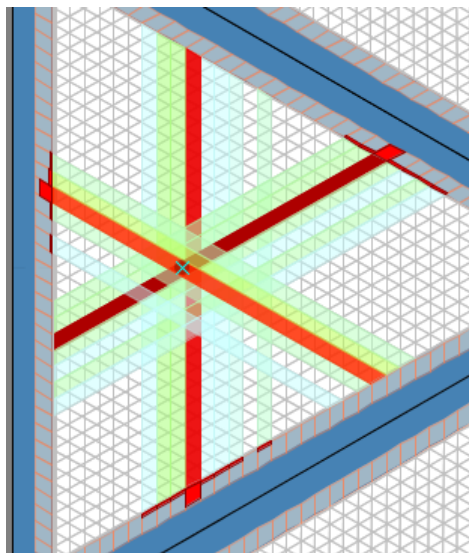
EC Unit Test

* single simulated photon event with $p=2.5$ GeV, $\theta=25$ deg, $\phi=0$, torus=-1, solenoid=0

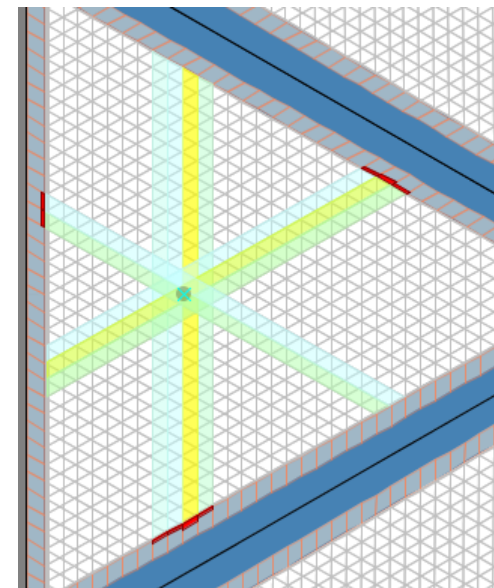
PCAL



EC inner



EC outer



Unit test checks the following using ECEngine and EBEngine:

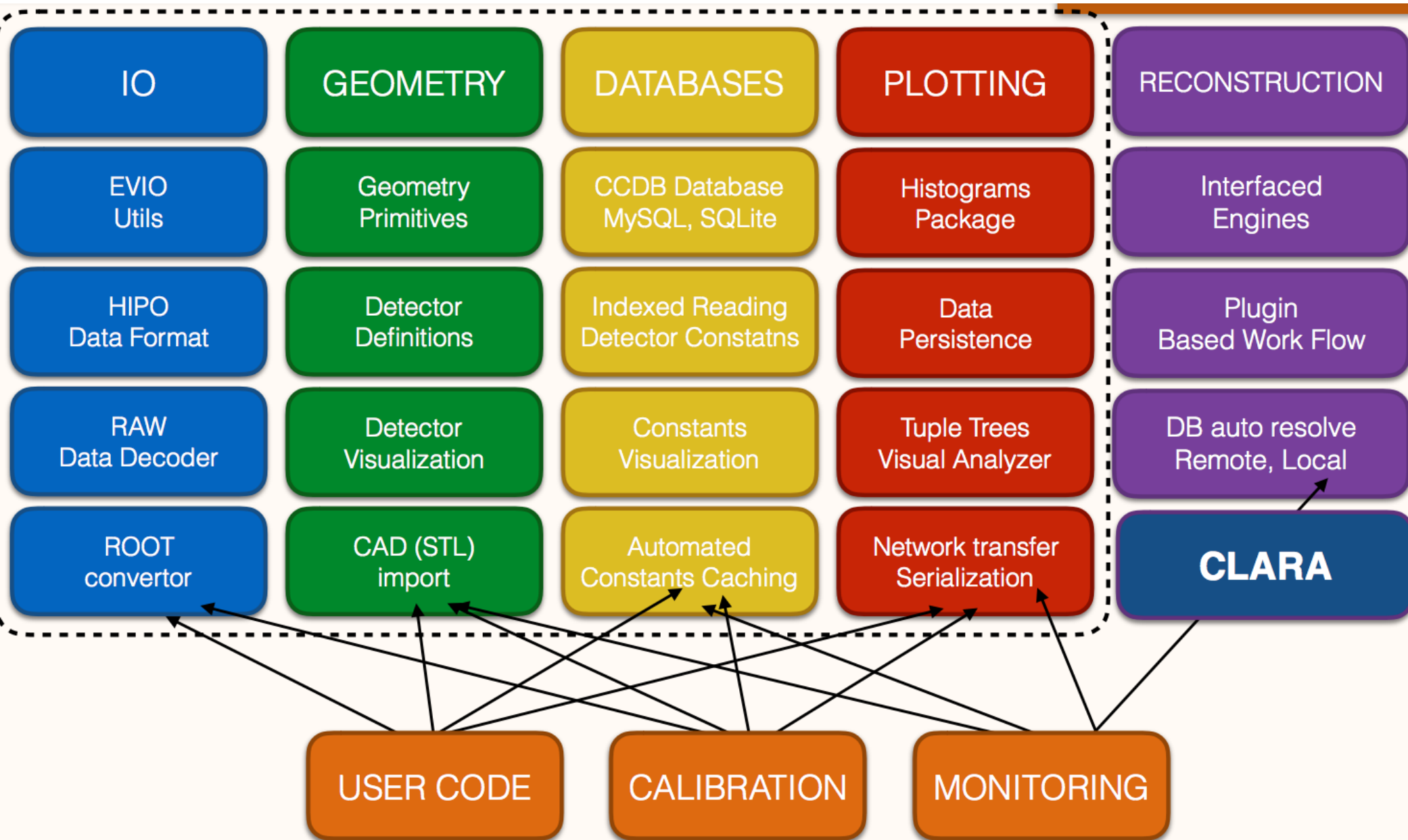
- has RECHB::Particle bank
- particle bank has 1 row w/ correct pid, px, py, pz
- has RECHB::Detector bank
- detector bank has 3 rows w/ correct detector/sector/layer/component

* These tests are run automatically by Travis CI after every build; returns a failure if tests don't pass



Common Tools

Software Structure



Common Tools

User Code

Detector Visualization

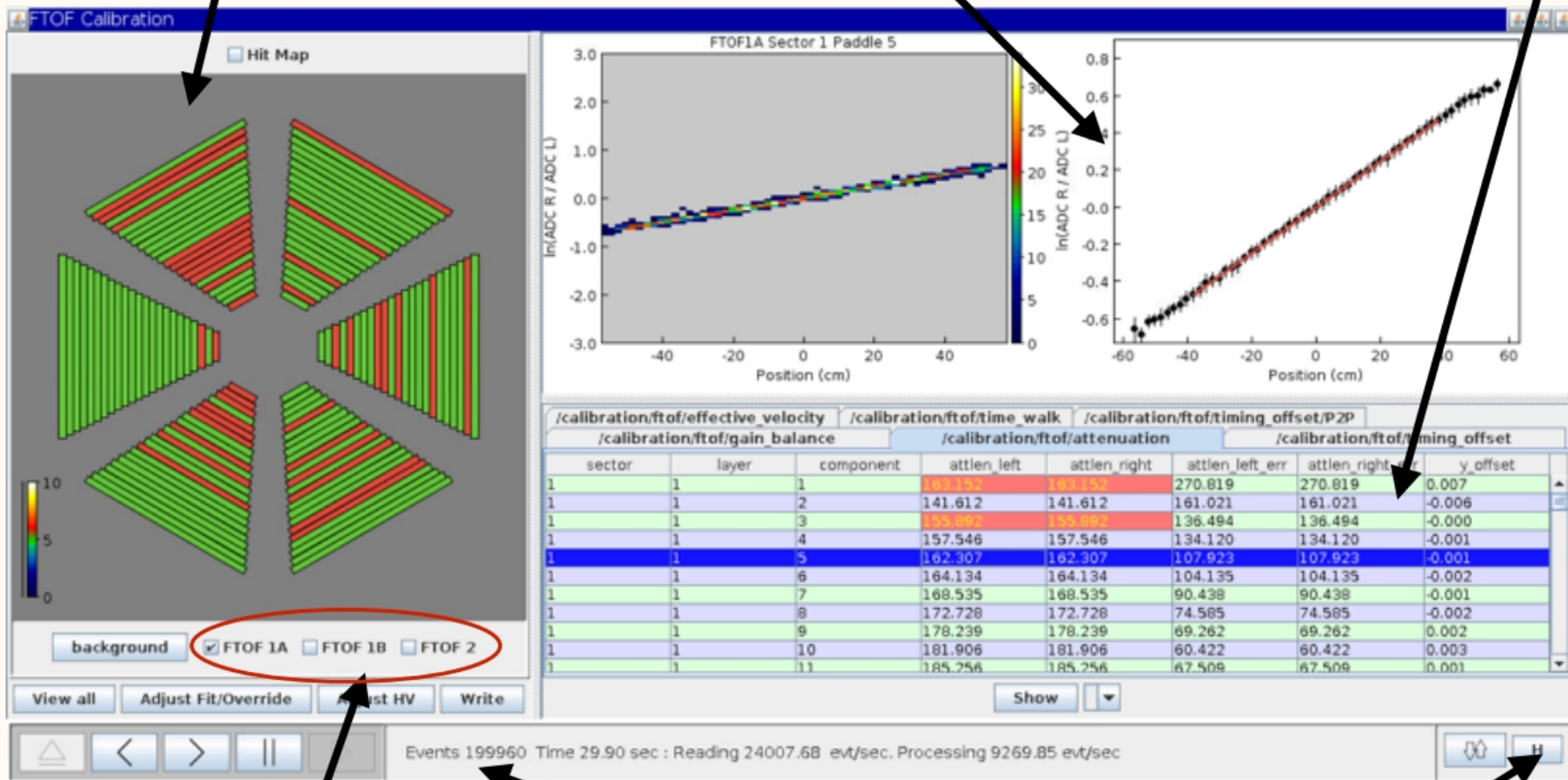
callback on clicks
coloring by occupancy

Data Canvas

callback for detector
callback for table

Database Table

component callback
constraint coloring
comparison utils



Detector Visualization
Layers

Event Processing Pane

event by event, or whole
opens: File, ET ring, CLOUD

Common Tools

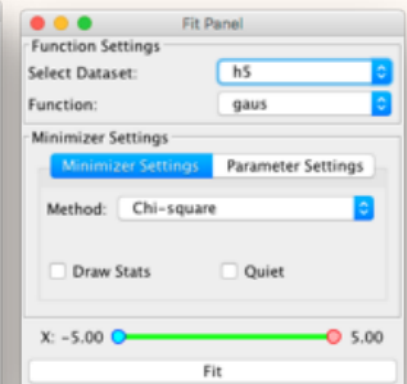
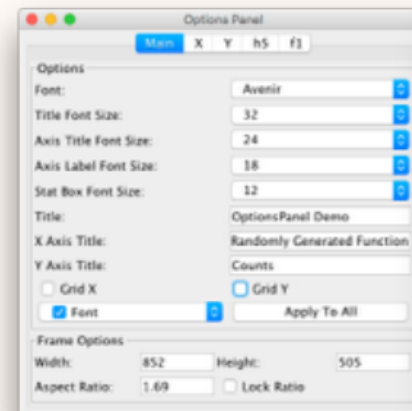
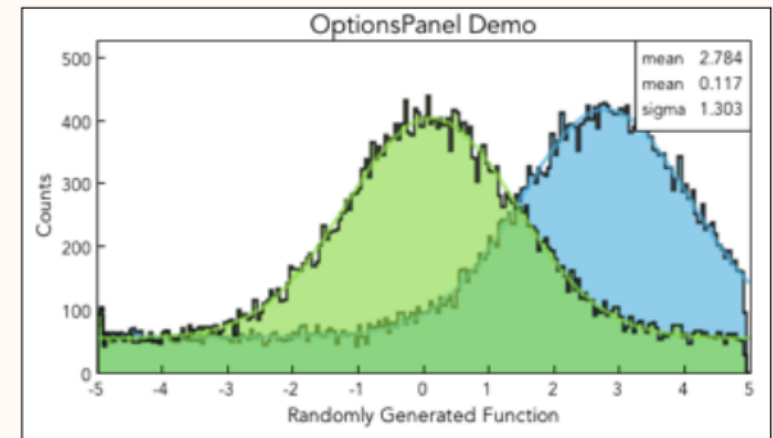
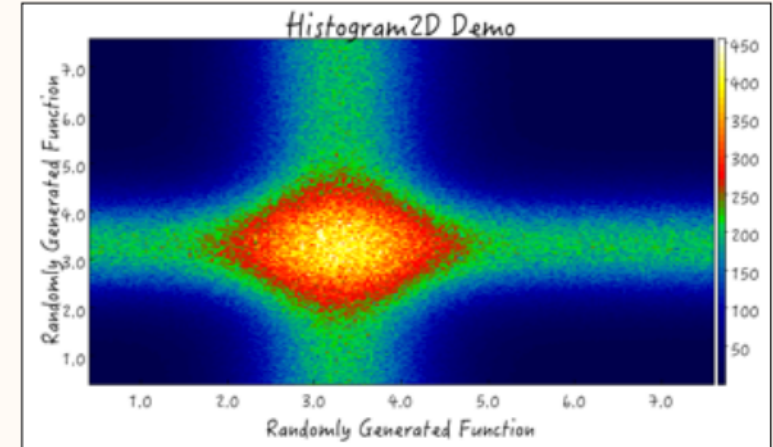
Development: G. Gavalian, W. Phelps

► Data Visualization Package:

- pure Java implementation of plotting
- histograms 1D, 2D and GraphErrors
- functions and MINUIT fitting
- interactive styles and property editors
- tuple tree implementation
- saves data to HIPO files (compressed)
- data serialization for network transfer

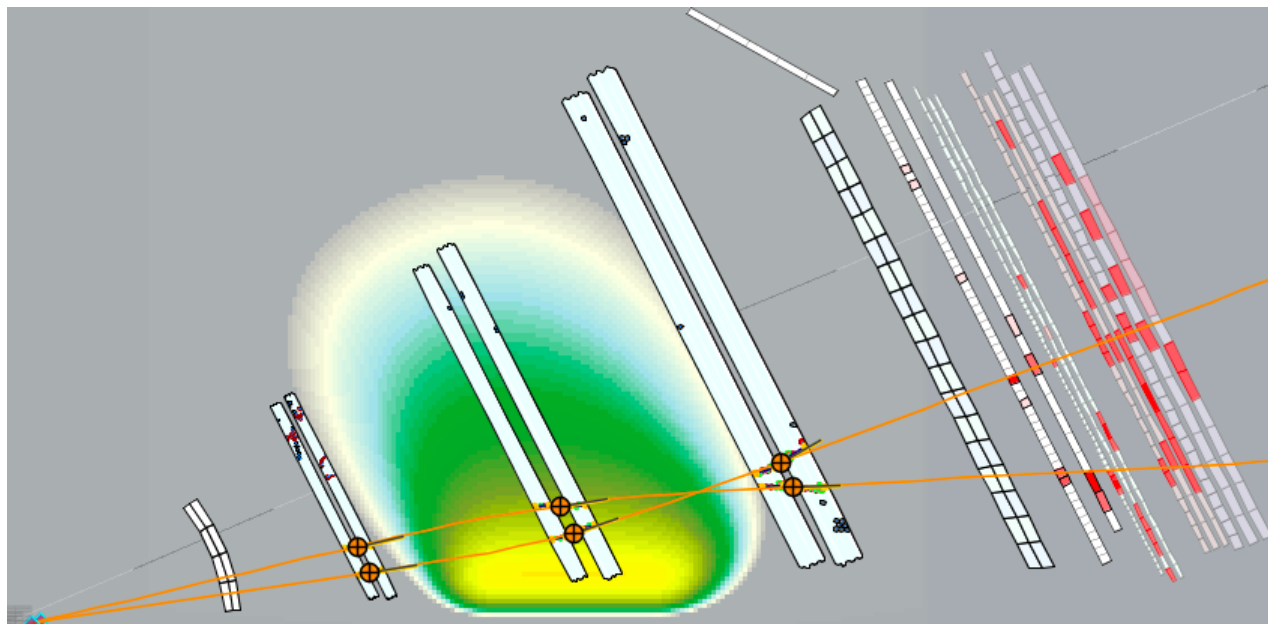
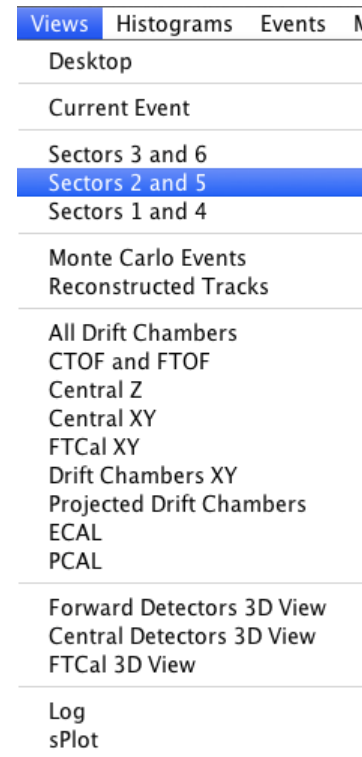
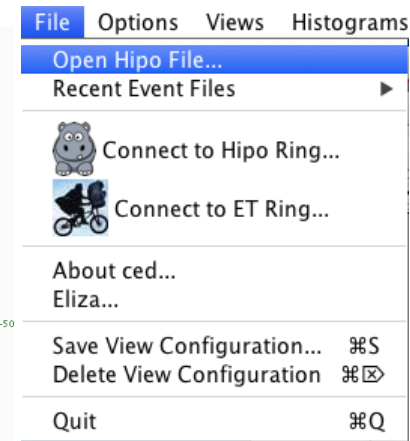
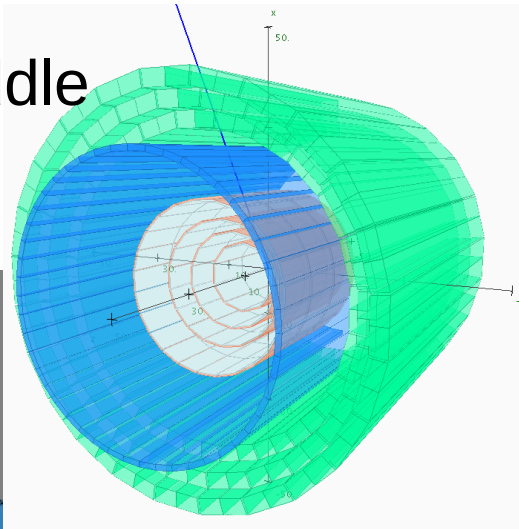
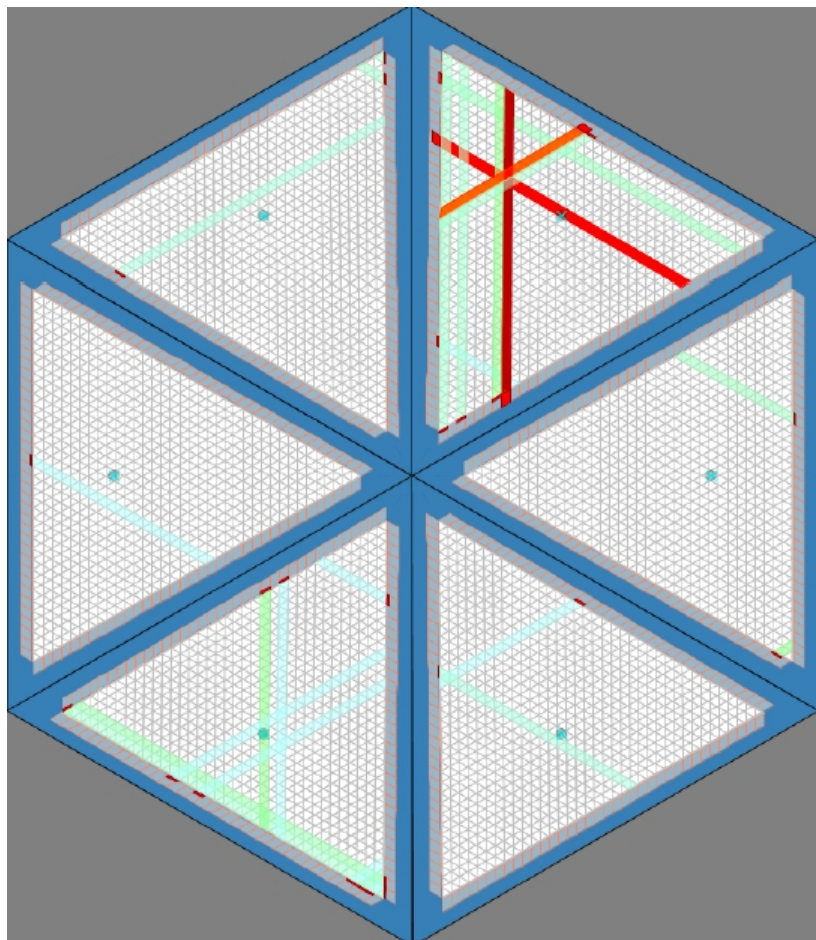
► Studio UI

- analysis studio for visual data analysis
- interactive fitting, custom function builder
- interactive data set comparison algorithms
- ASCII tuple import/export
- serialized data export with analysis procedure



Common Tools

- CLAS12 Event Display (ced)
Expert: Dave Heddle
Download: jlab.org/~heddle



Reconstruction

- Reconstruction code is written in Java and version controlled with git
- Reconstruction package comes with the COATJAVA download and includes:
 - Descriptors for data banks
 - Local copy of calibration database (sqlite)
 - Magnetic map definitions and swimmers
 - YAML file specifying different run configurations
- Can be run multi-threaded within the CLARA framework
- Many talks throughout the rest of today on the status of reconstruction for each detector sub-system

Data Processing

- CLAS12 Reconstruction and Analysis framework (CLARA)
 - Base on service oriented architecture
 - Services can be written in Java, C++, and Python
 - Efficiently runs CLAS12 reconstruction code multi-threaded
 - Expert: Vardan Gyurjyan
 - Documentation: claraweb.jlab.org

* There will be a hands-on demo of running reconstruction with CLARA during the CLAS12 Software Tutorial (Friday at 14:00)

Summary

- CLAS12 software has reached a high level of maturity and performed very well during the KPP run
- More in-depth talks on each software component will take place throughout the rest of today
- A 2-hour hands-on software tutorial will take place on Friday at 14:00 – input and requests are welcome!