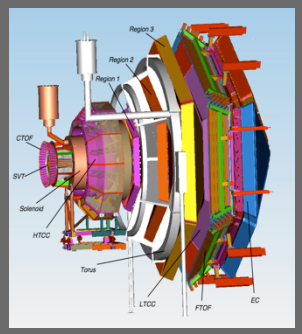
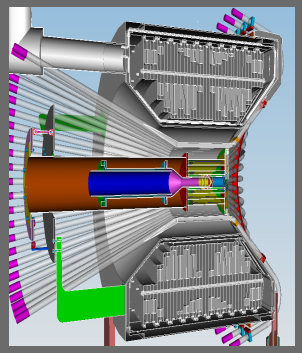
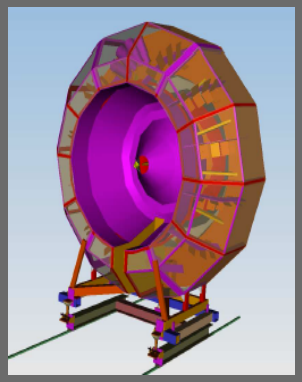
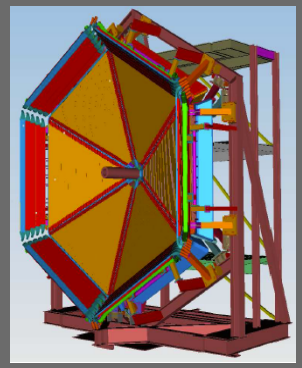


CLAS12 CalCom Status Update

CLAS Collaboration Meeting

November 2, 2016

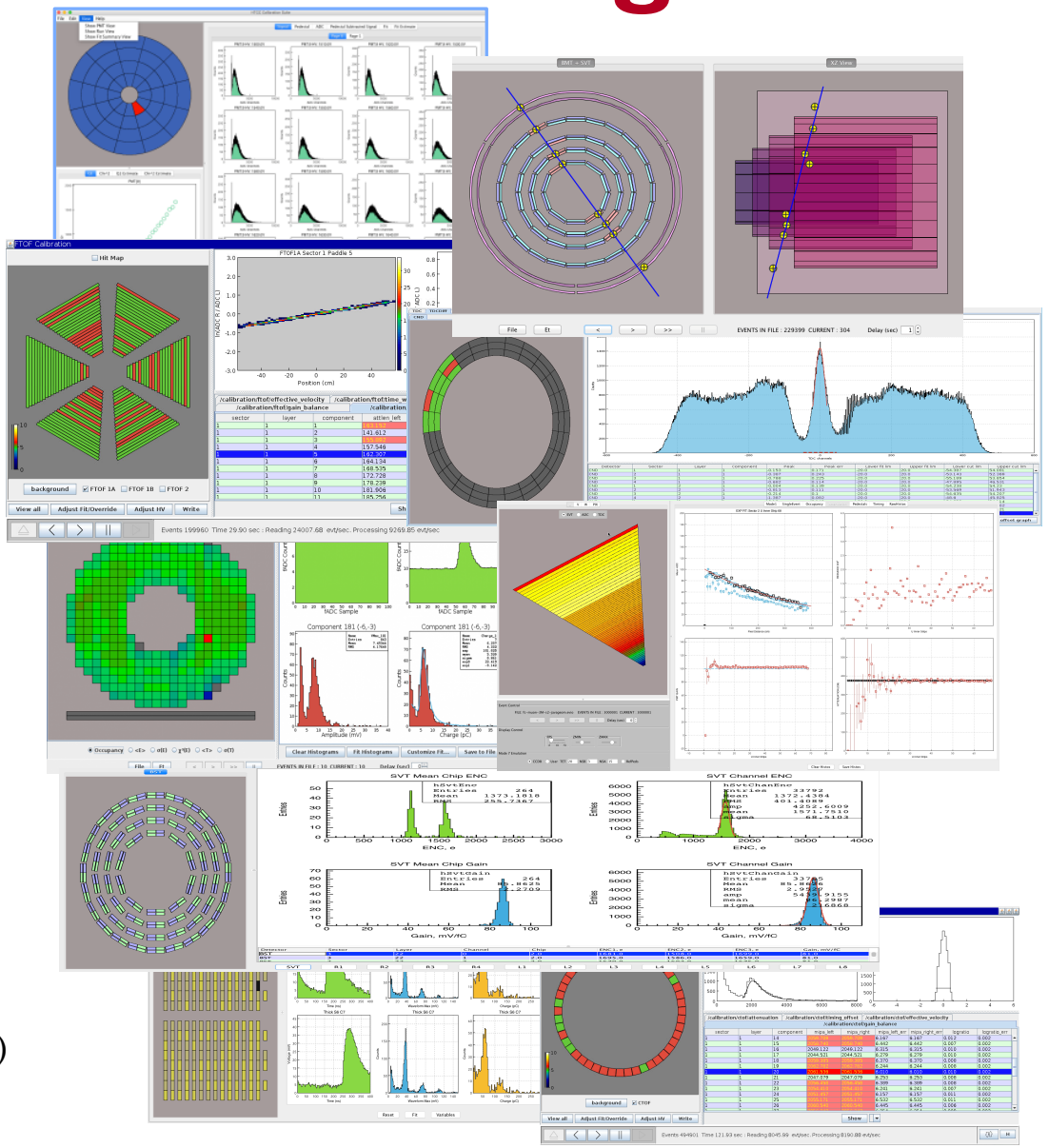
Outline

- Detector commissioning and calibration:
  - Status update and upcoming work for CLAS12 subsystems (EC-PCAL, FTOF, LTCC, HTCC, DC, SVT, MM, CTOF, CND, FT)
- Calibration Challenge
- Commissioning with Beam Plan
  - KPP run configuration
  - Simulation studies
  - Run plan

Calibration & Monitoring

Development of calibration and monitoring applications in an advanced stage for both baseline and ancillary CLAS12 subsystems:

- Calibration and monitoring software are based on COATJAVA
- Algorithm development supervised by the CLAS12 Calibration & Commissioning group (CALCOM)
- Implementation supervised by the software group
- Tests on both cosmic ray and simulated data
- Preparations for first Calibration Challenge (Dec. 2016) in progress



EC-PCAL (UVA/JLab)	MM (Saclay)
FTOF (Glasgow, Iowa, JLab)	SVT (JLab)
LTCC (Temple, JLab)	CTOF (Glasgow, JLab)
DC (Miss.,JLab)	CND (Orsay, Glasgow)
HTCC (FIU, UConn, JLab)	FT (INFN, Edinburgh)

ECMon

Monitoring and Calibration GUI

Current Features

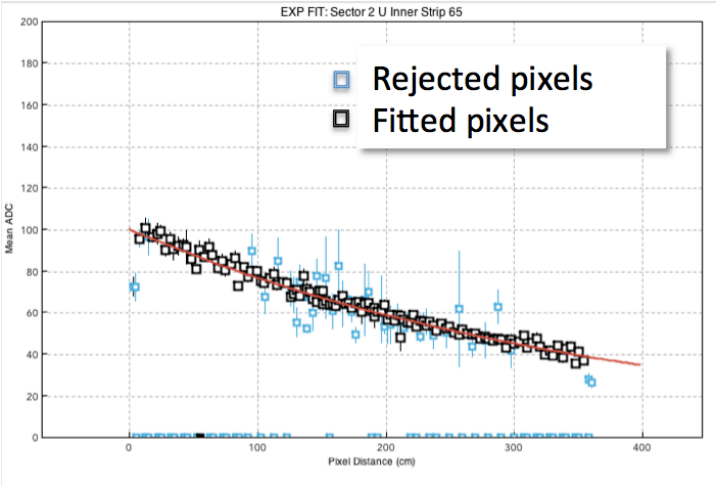
- Common JAVA framework for PCAL and EC.
- Pixels dynamically generated from geometry database.
- Mouse-over navigation of detector elements.
- Live updating of detector response and calibration results.

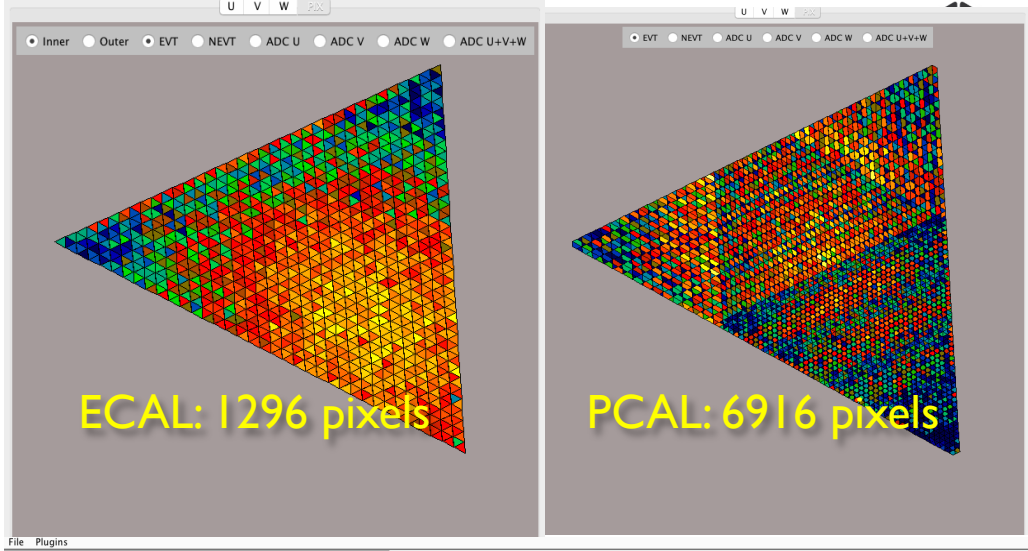
Monitoring

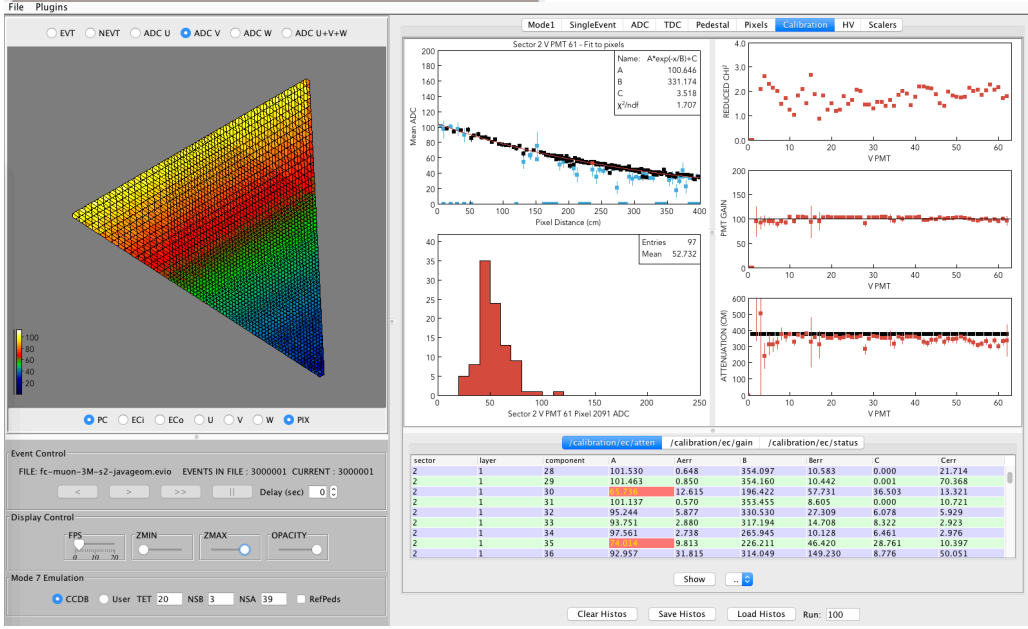
- Occupancy: strips, pixels, fADC and TDC data.
- fADC data: pulse shape, noise, fitter settings.
- Single event: visualize/analyze hits, peaks, clusters.
- Pedestals: offsets, noisy channels.
- EPICS data (scalers and HV) for status monitoring.

Calibration

- Single pixel filters for cosmic muon hits.
- Optimization of pixel selection (statistics, geometry).
- Fits to pixel data: PMT gains and light attenuation.
- Validation using GEMC simulations.





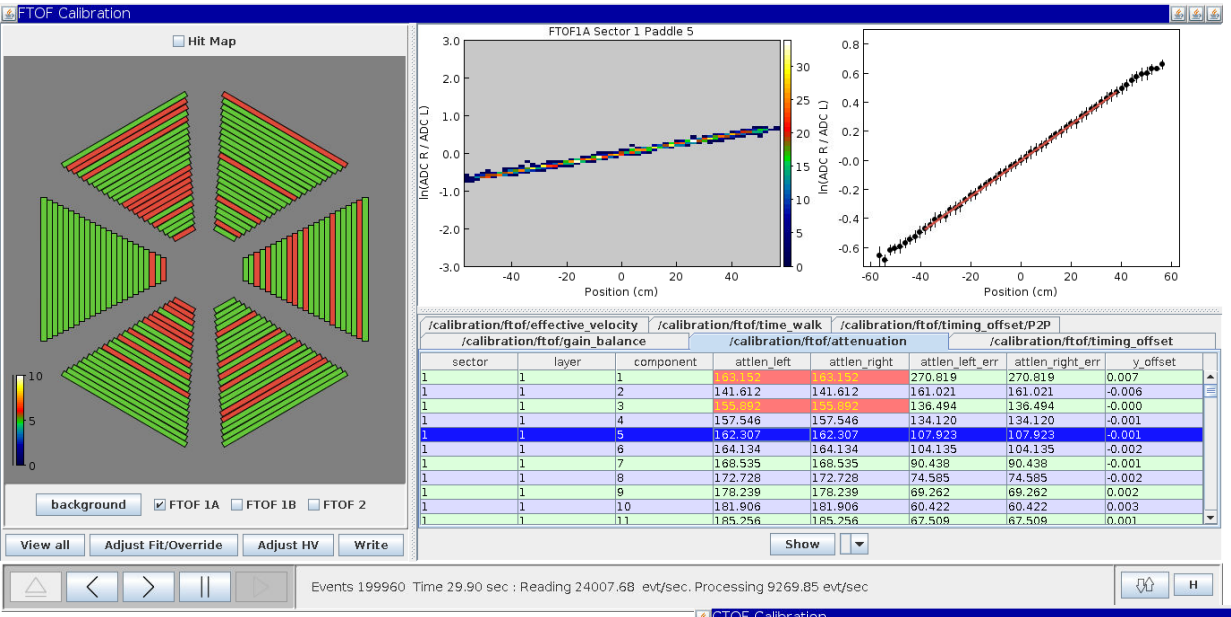


Further Development In Progress

- Energy cluster reconstruction and trigger debugging support.
- Energy calibration using physics data (e-, π^0, and MIP pions).
- Timing calibration (offsets, time-walk).
- EC, PCAL relative alignment using cosmic muon pixel tracks.

Work by C. Smith (JLab), N. Compton (Ohio), T. Chetry (Ohio)

FTOF and CTOF Calibration

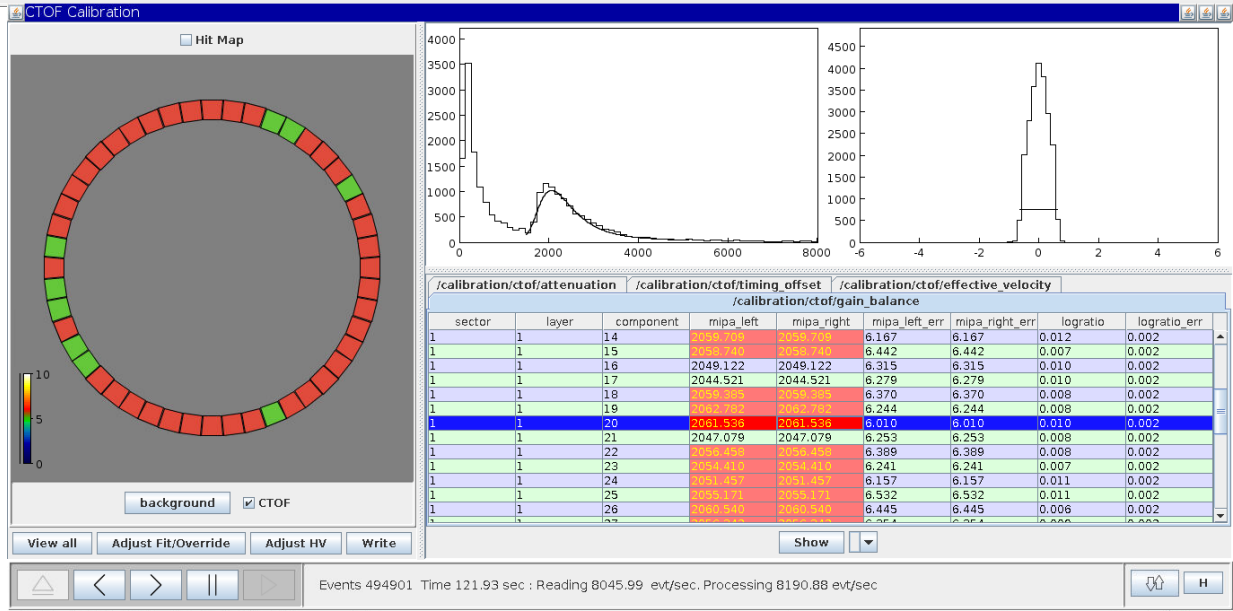


Work completed / in progress:

- Classes for each calibration step provide standard interface to generate constants
- HV, left-right timing, attenuation length tested with cosmic and GEMC data
- Effective velocity and time walk – testing done with GEMC data

Work planned:

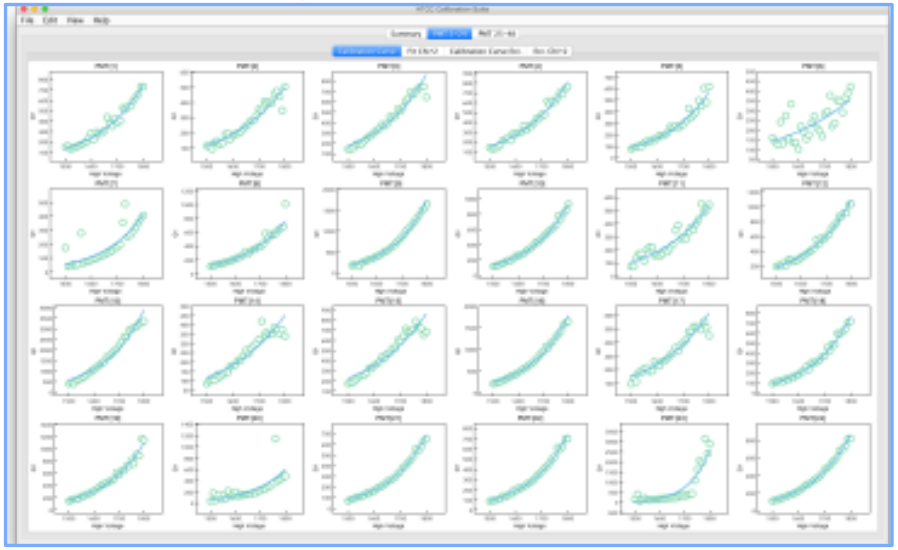
- Further testing with GEMC data
- Paddle to paddle offsets
- Documentation

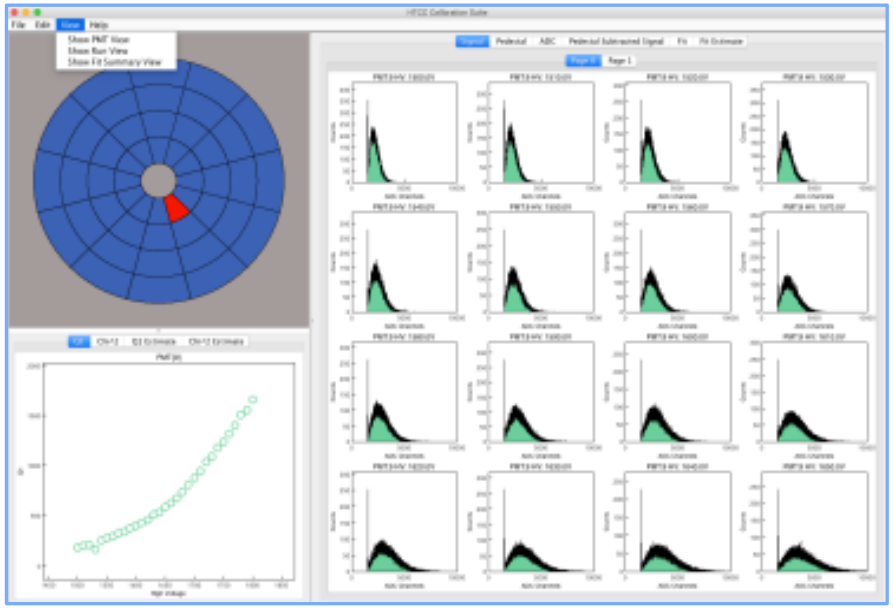


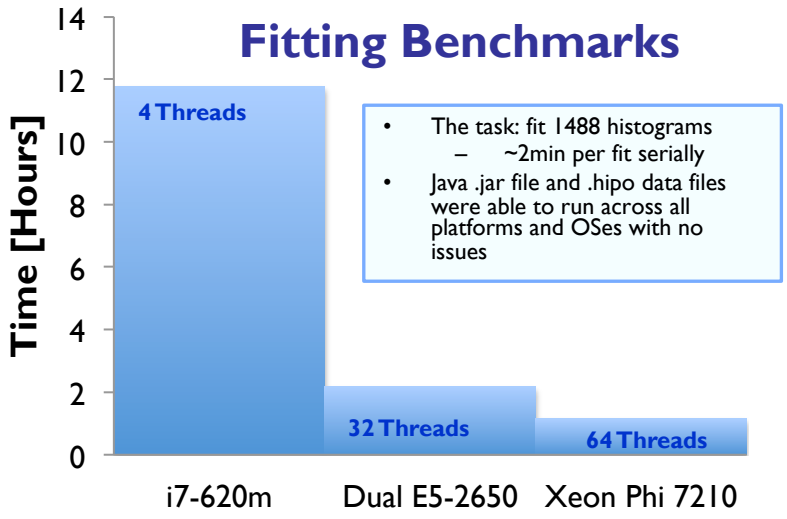
L. Clark (Glasgow)

HTCC Gain Matching

- The Calibration Suite for the HTCC is written using Common Tools provided by the CLAS12 Software group
- The Suite is multithreaded and object oriented
- The object oriented design of this software will save time
- Due to the design, it could be adapted to detector systems that find the SPE peak position in other ways (e.g. LTCC)



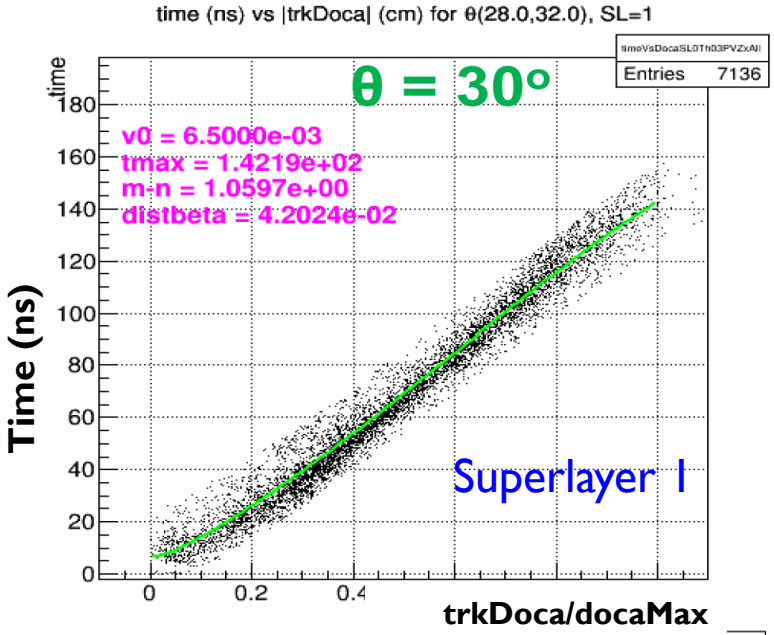


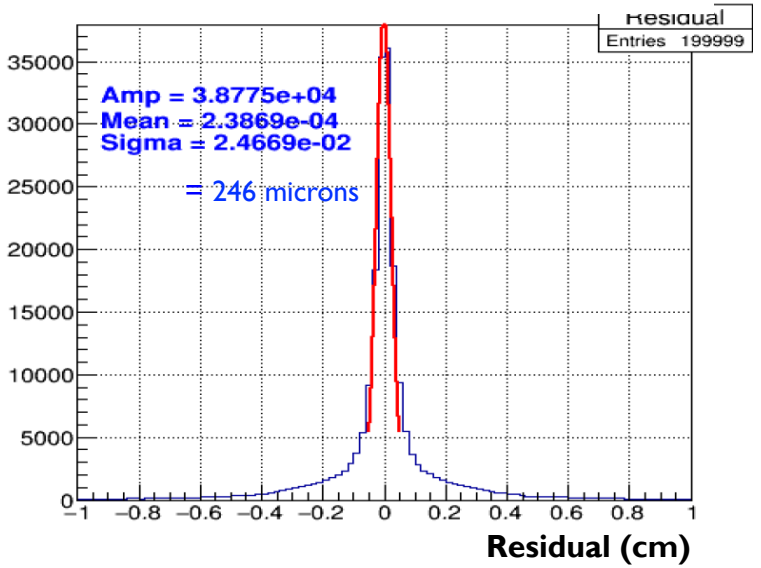


Work by Y. Sharabian (JLab), N. Markov (UConn), W. Phelps (FIU)

DC Calibration Status

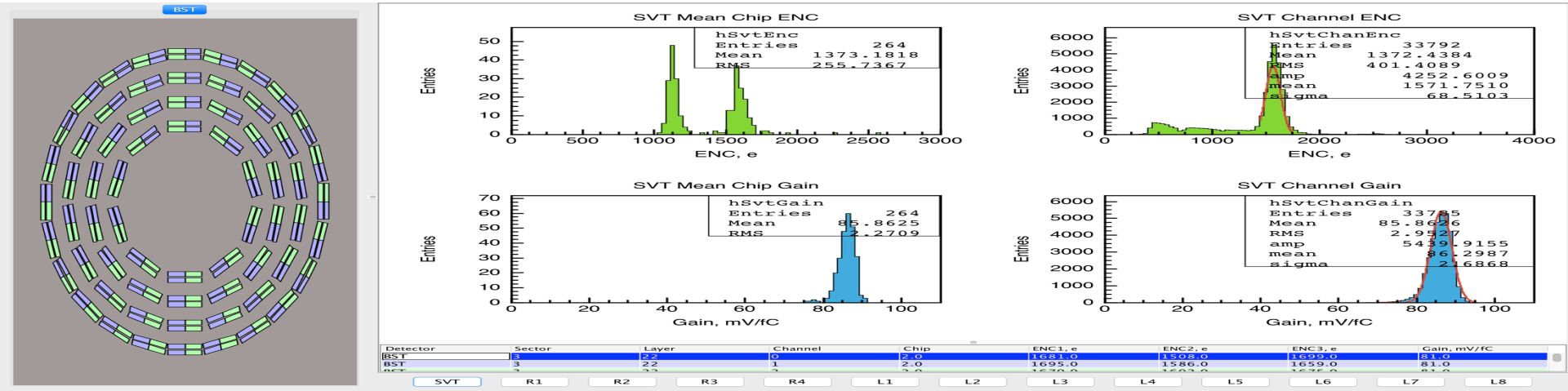
- Time-to-distance calibration program written (in ROOT) and tested on cosmic data available from one R1 chamber.
- To be done: a GUI-driven automated suite:
  - Java version of the time-to-distance minimization routine to calibrate the parameters (In Progress).
  - GUI using common tools (Started)
  - Putting together various components:
    - Decoder (Done)
    - Time Delay Corrections (Done)
    - Reconstruction (Done)
    - Minimizer (Underway)
    - Writer of results to CCDB





K. Adhikari (Mississippi), M. Mestayer (JLab)

SVT Calibration Suite

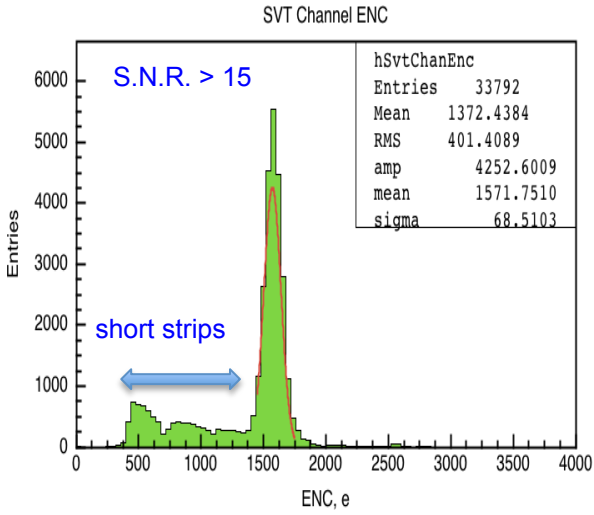


Detector	Sector	Layer	Channel	Chip	ENC1, e	ENC2, e	ENC3, e	Gain, mV/fC
BST	3	22	0	2.0	1681.0	1508.0	1699.0	81.0
BST	3	22	1	2.0	1695.0	1586.0	1659.0	81.0
BST	3	22	2	2.0	1679.0	1602.0	1675.0	81.0
BST	3	22	3	2.0	1679.0	1583.0	1652.0	81.0

Work in progress:

- Creating CCDB tables
- Porting to COATJAVA 3.0

1 SVT Calibration
- 1.1 Noise and gain measurement
- 1.2 Digital tests
  - 1.2.1 Module communication
  - 1.2.2 Channel masking
  - 1.2.3 Front-end calibration
- 1.3 Calibration procedure
  - 1.3.1 Scan production
- 1.4 Calibration suite
  - 1.4.1 Calibration data
  - 1.4.2 Calibration GUI



https://clasweb.jlab.org/wiki/index.php/Calibration

CND Calibration Suite

- COATJAVA 2.4 based suite nearly complete - will be updated for use with 3.0 when required
- Developed with cosmic data → some small changes will be required for GEMC data testing (plans in place for this)
- CND group will fully test suite using initial documentation as part of an iterative suite improvement process

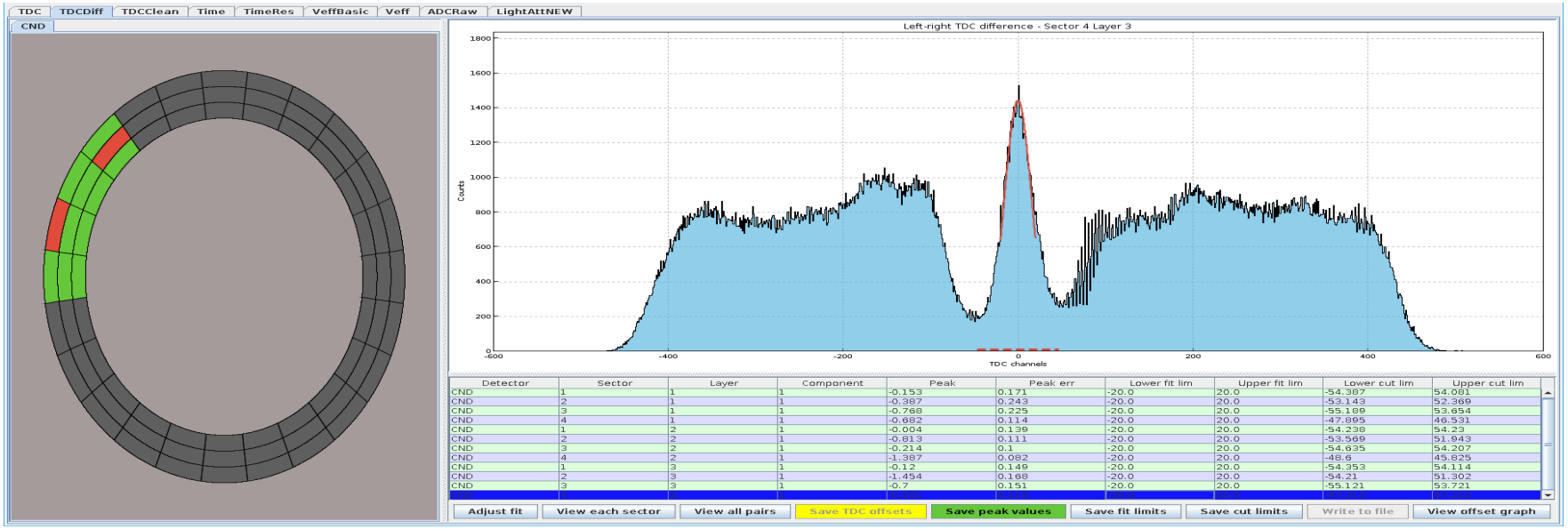
Complete:

- timing offset correction
- noise removal
- time resolution
- effective velocity

In progress:

- light attenuation (80%)
- energy calibration (initial work will be imported then optimized)

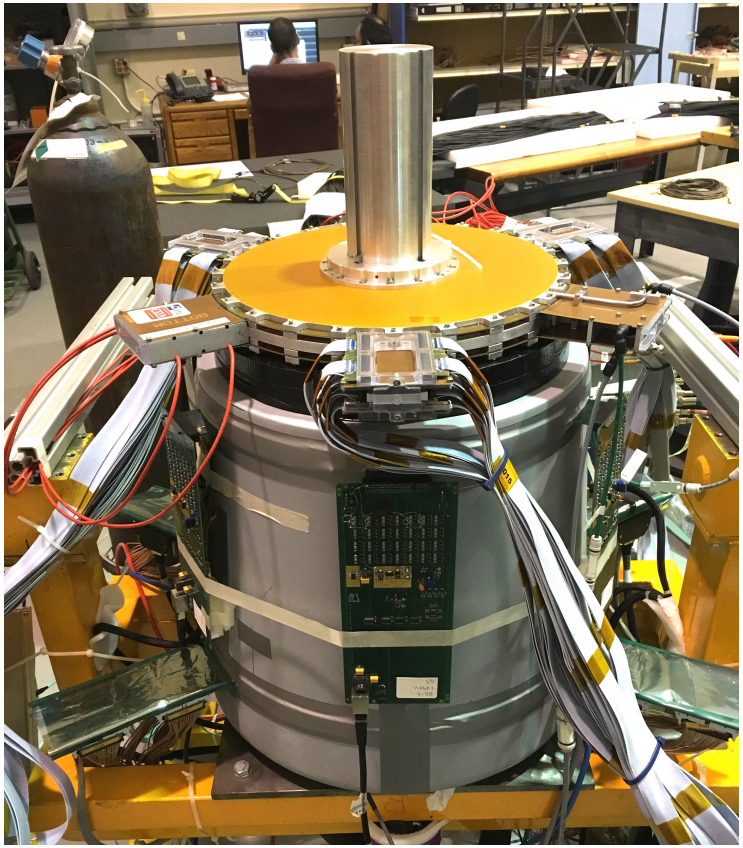
G. Murdoch (Glasgow)



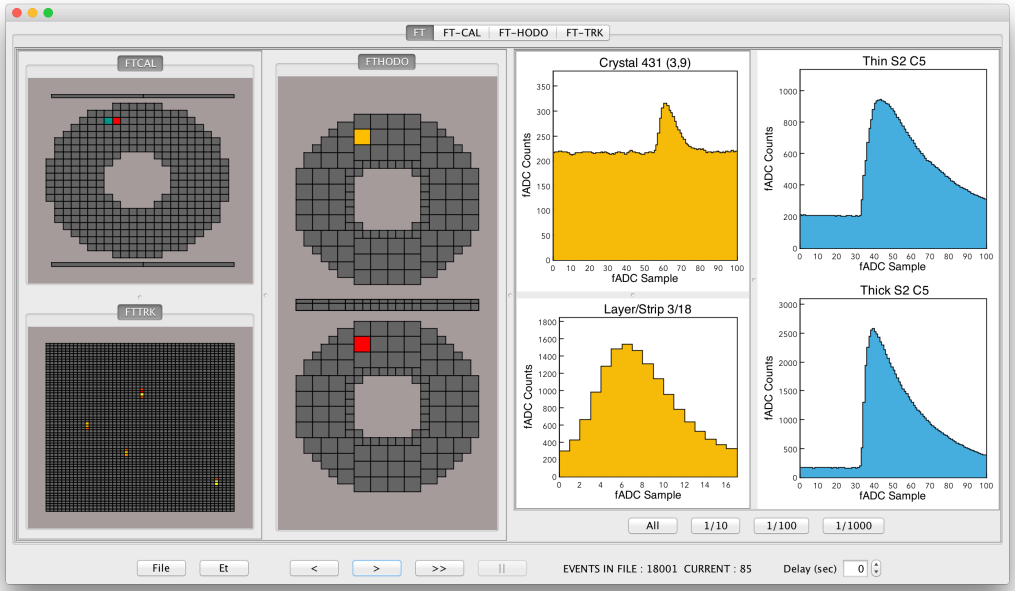
Forward Tagger

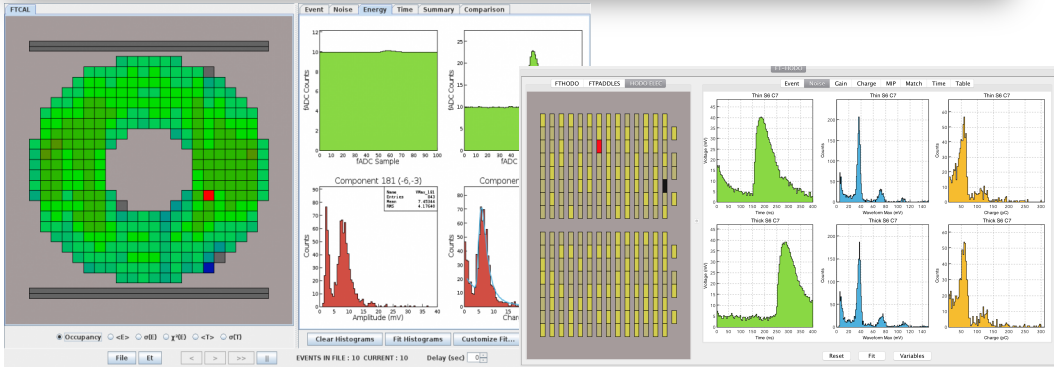
INFN – Genova, Edinburgh U., CEA-Saclay

System checkout and commissioning with cosmic rays



Combined Cal+Hodo+Trk monitoring GUI



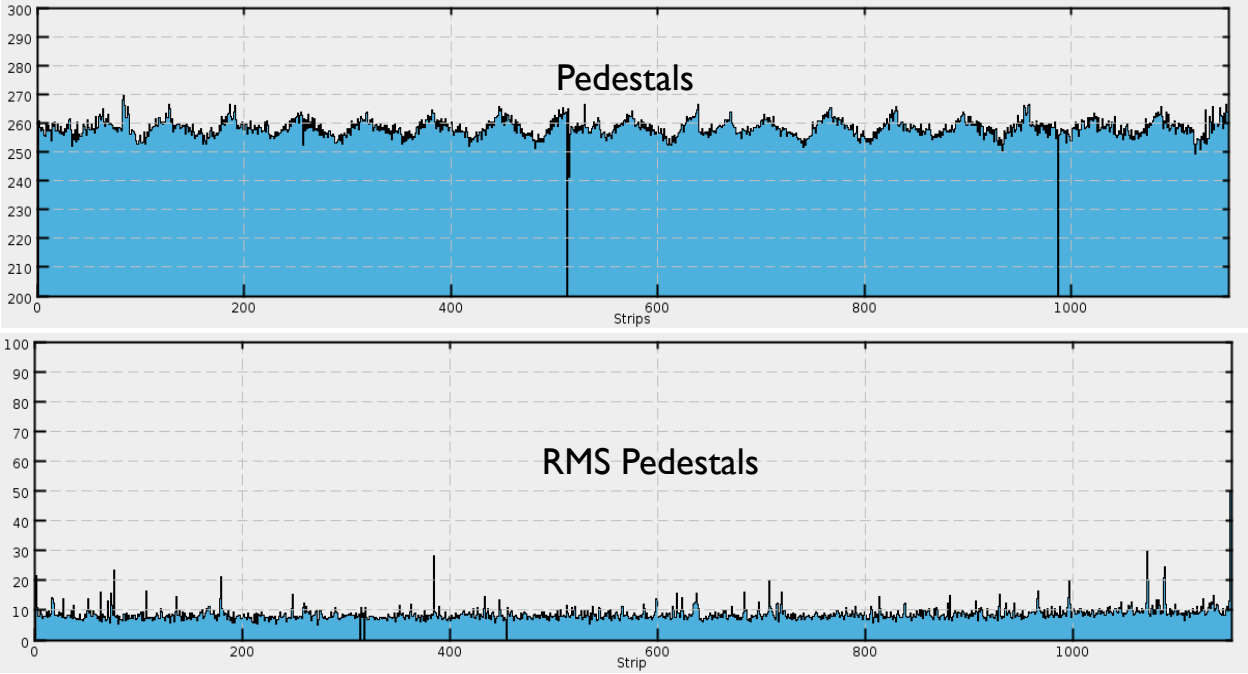


Now upgrading to COATJAVA 3.0

MVT Calibration Status

1) Low-level calibration procedure developed that needs to be incorporated in the calibration suite:

- Extract and store pedestals and RMS pedestals.
- Store time resolution and sampling constants (number of samples, rate).

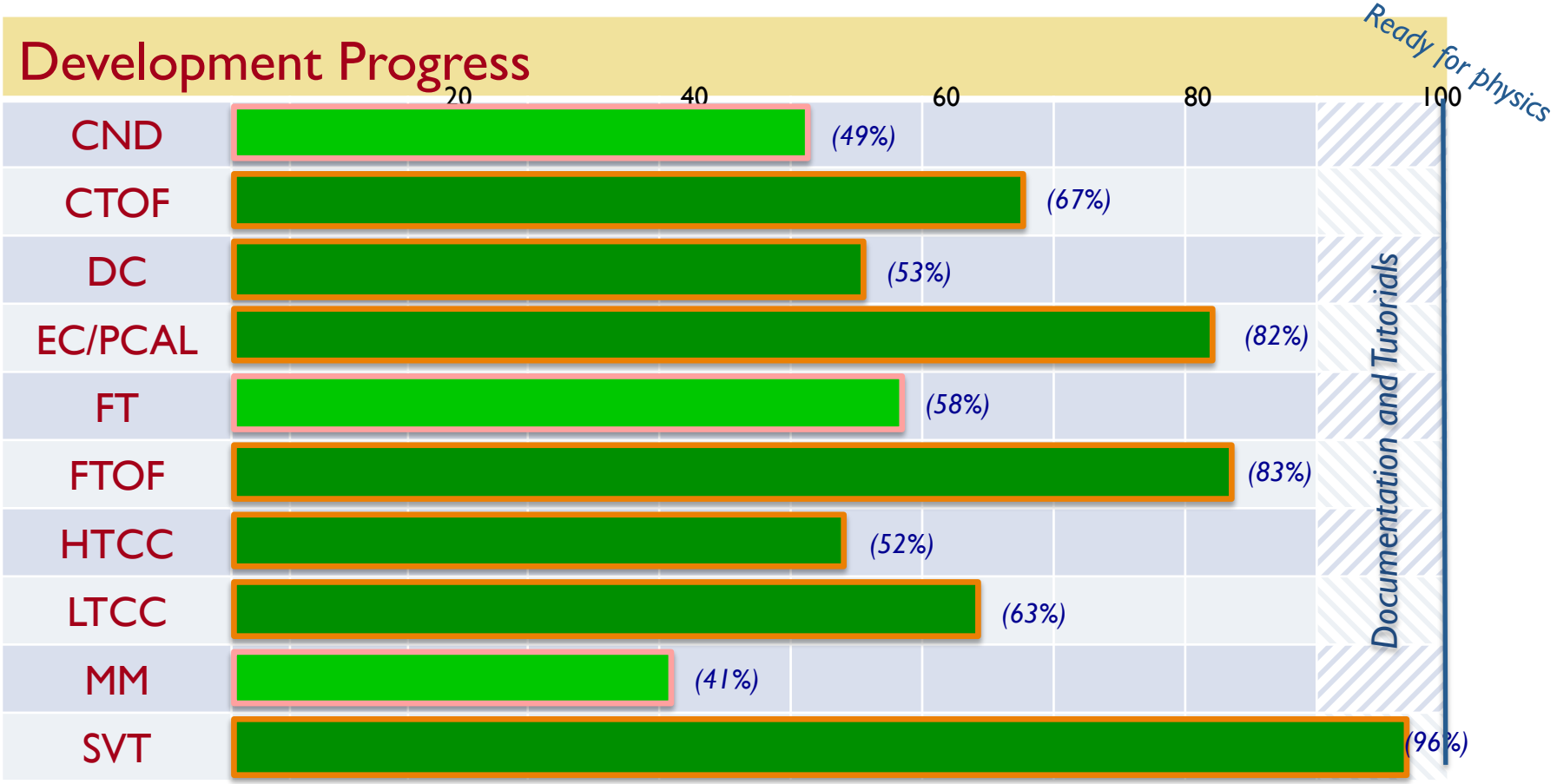


2) Need now to implement the high-level calibration code that consists of:

- Computing and correcting for Lorentz angle in the reconstruction.
- Storing masks for dead/noisy strips in the database.

CEA - Saclay

Calibration Tools



Status: ***Now ready for Feb. 17 KPP***

Timeline: *I) December 12-16, 2016: Calibration challenge*

II) Beginning 2017: Document and tutorials

III) June 2017: ready for physics (First experiment in Fall 2017)

Calibration Challenge

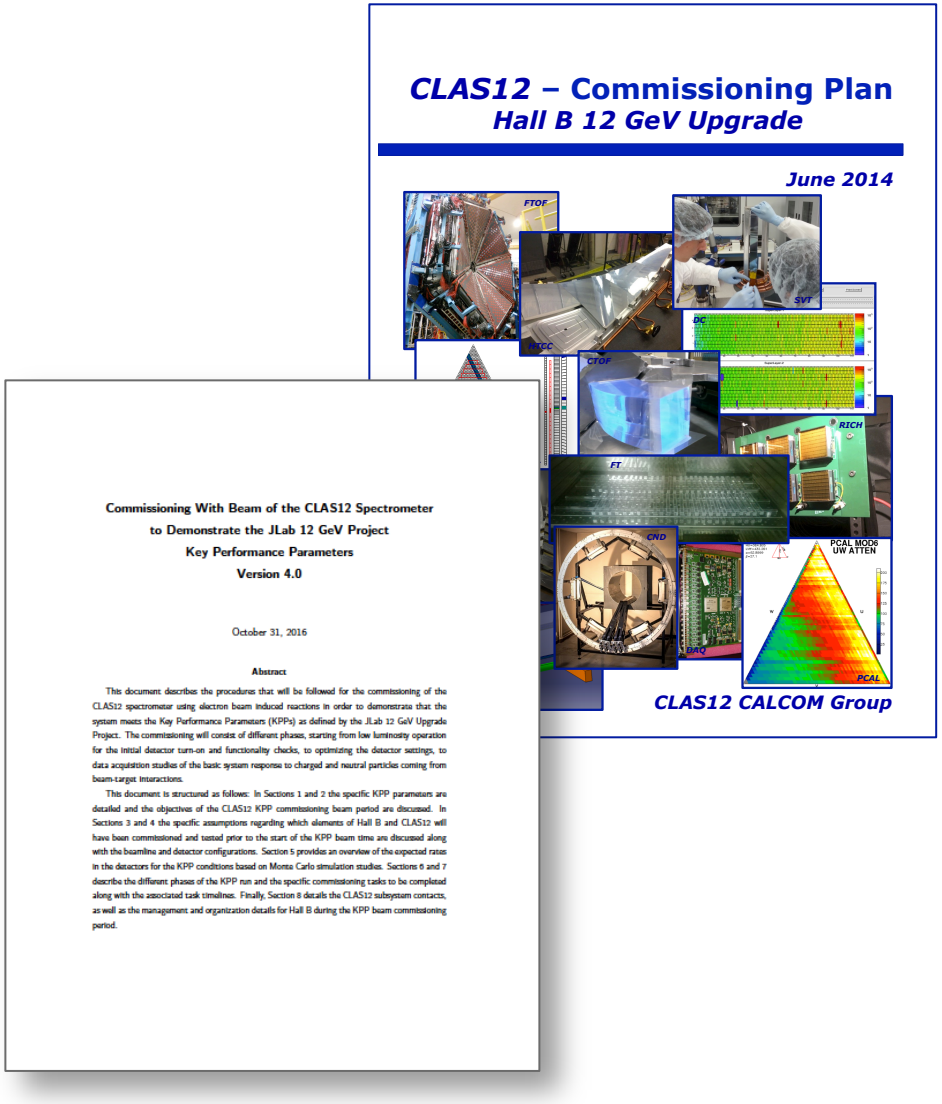
Test of the full calibration procedure:

- Generate pseudo-data with "wrong" calibration constants
- Run calibrations for all systems in appropriate sequence
- Extract calibration constants and save them to DB
- Evaluate calibration quality by:
  - looking at monitoring plots
  - comparing reconstruction output with extracted and original constants

- Who:
  - Analysis Coordinator
  - Calibrator team
  - DB manager
  - "Chef" for data processing
- When:
  - December 12-19 2016 (1 week time)
- How:
  - Generate pseudo-data with Pythia and full luminosity background
  - 1 shift (8 h) worth of data
  - Daily meetings and milestones for coordination and progress tracking

CLAS12 KPP Run

- New plan based on updated (still to be confirmed) schedule and detector configuration
  - 6.4 GeV
  - No solenoid
  - Solid (C12) target mounted on harp ladder
  - Focused on forward detectors
  - Partial installation of central detectors
  - Low luminosity: 10^{32}-10^{33} $cm^{-2}s^{-1}$
  - Few days of running



https://www.jlab.org/Hall-B/calcom/cwb-kpp.pdf

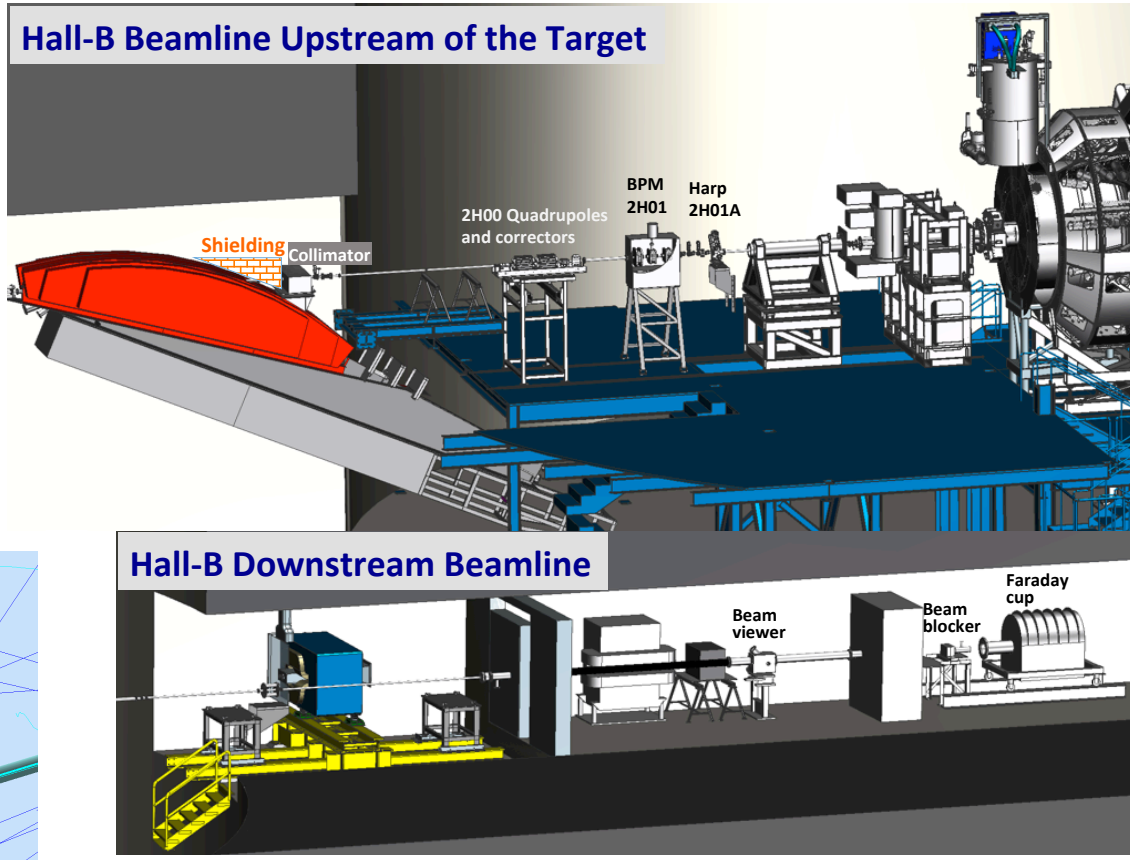
Latest version of KPP

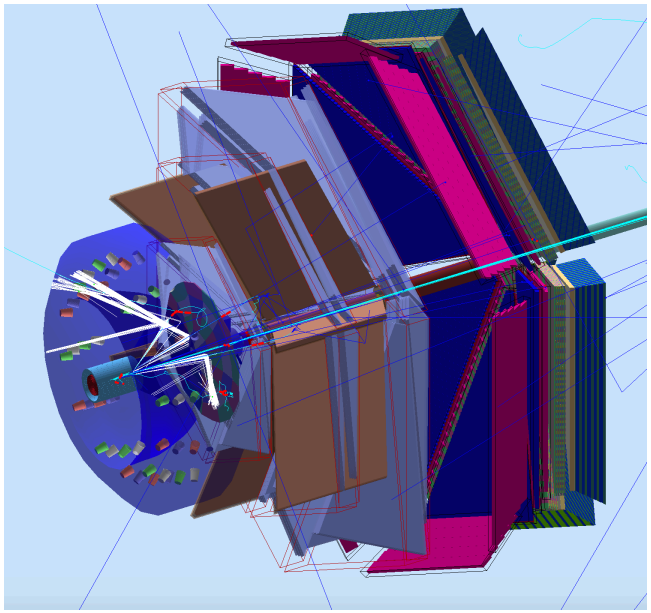
Detector operational: events recorded with a > 2 nA electron beam at > 6 GeV beam energy (3 pass)

1. Detector running for 8 hours recording data from all subsystems.
2. Screenshots of beam status and/or accelerator e-logs entries demonstrating electron beam current, beam energy, and beam profiles.
3. Plots showing relative timing of calorimetry, time-of-flight, and Cerenkov detectors.
4. Event displays showing correlated particle hits in the forward detectors.
5. Plots of particle trajectories showing target position.
6. Particle identification plots using signals from calorimetry and Cerenkov detectors.

KPP Beam & Target Configuration

- Beam:
  - 6.4 GeV
  - Few nA current
  - New configuration for beam tuning
- Target:
  - Carbon wire (few hundred microns) mounted on harp ladder



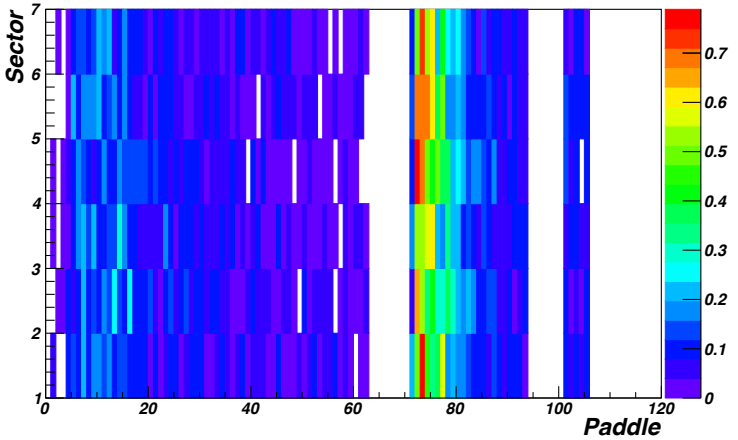


GEMC event at 10^{33} $cm^{-2}s^{-1}$ luminosity:
- 260 um carbon target in vacuum
- 5 nA beam current

Background Rates

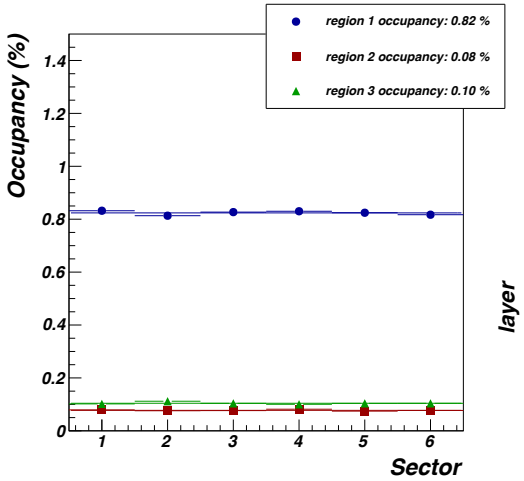
GEMC simulations in progress to:

- Optimize the KPP configuration (target, trigger,…)
- Determine the maximum luminosity
- Estimate beam time needed to make KPP plots with adequate statistics



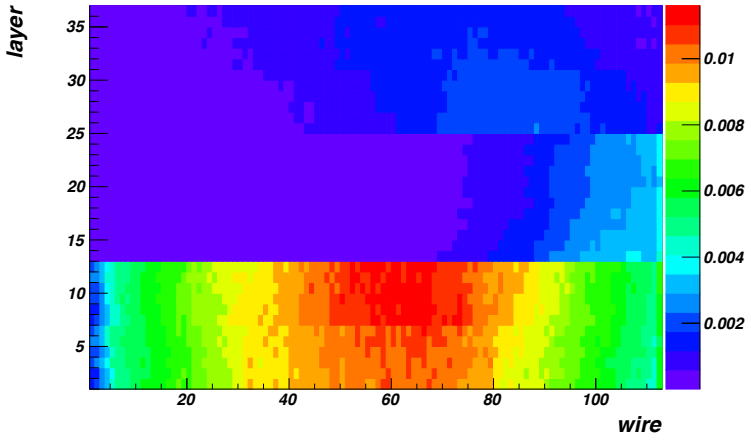
FTOF rates (kHz)

$L = 10^{33}\ cm^{-2}s^{-1}$

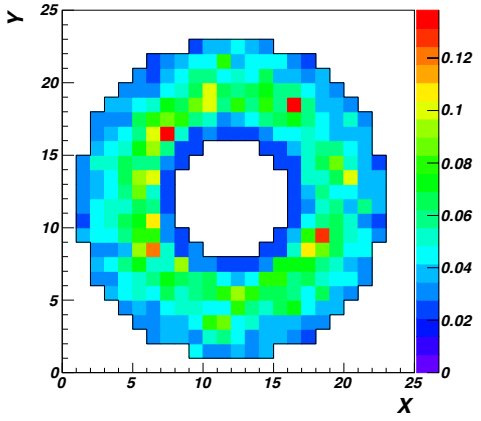


DC region average occupancy

DC occupancy map



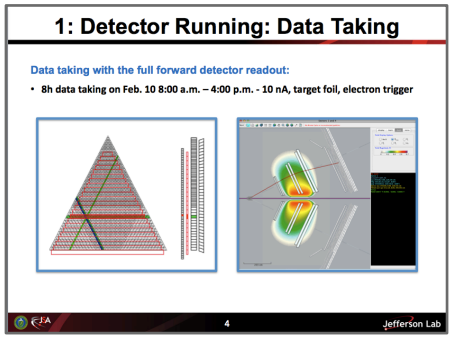
FTCal radiation dose

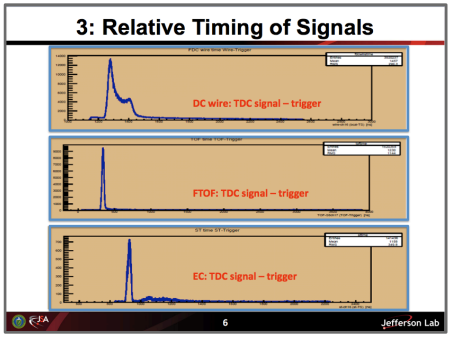


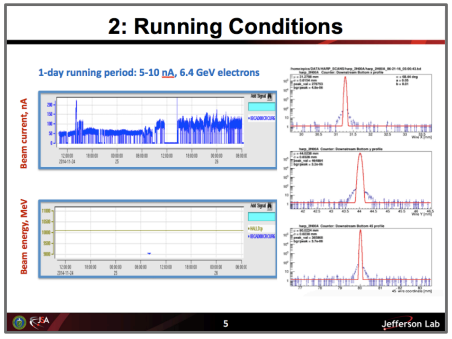
KPP CWB Schedule

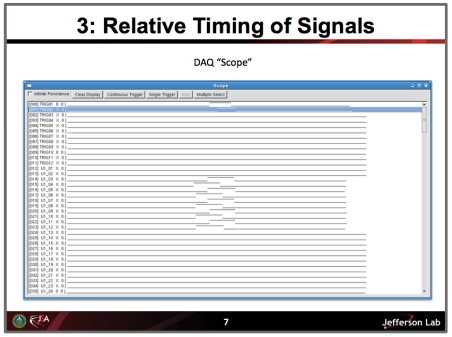
Shift #1		Shift #2	
Shift 1A: - Final beam tune verifications - Detector turn-on A - DAQ studies	Shift 1B: - Detector turn-on B - DAQ studies - Trigger studies - Hall B access	Shift 2A: - Detector readout optimization - DAQ studies - Trigger studies	Shift 2B: - Detector readout optimization - DAQ studies - Trigger studies - Hall B access
Shift #3		**Shift #4**	
Shift 3A: - DAQ run #1	Shift 3B: - DAQ run #2 - Hall B access	Shift 4A: - DAQ run #3	Shift 4B: - DAQ run #4 - Hall B access
Shift #5		**Shift #6**	
Shift 5A: - DAQ run #5 (if necessary)	Shift 5B: - DAQ run #6 (if necessary)	Shift 6A: - Contingency (if necessary)	Shift 6B: - Contingency (if necessary)

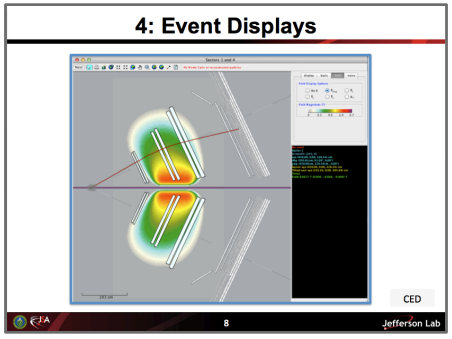
KPP template

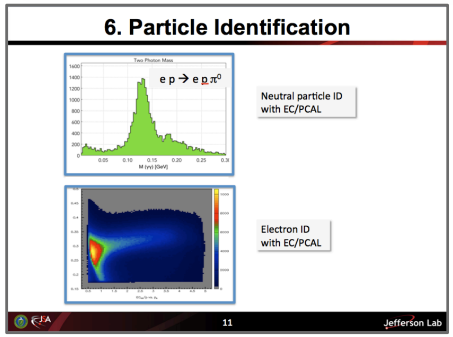


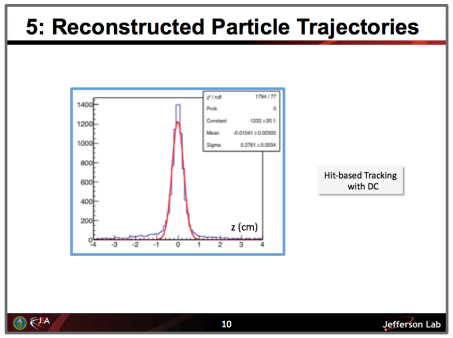












Summary

- Detector commissioning and calibration
  - Calibration suites under development and continuous progress for all systems
  - Close collaboration with software group
  - Intense use of common tools
  - Now ready for KPP
- Calibration Challenge in December 2016
- Commissioning With Beam (CWB)
  - New plan in preparation based on revised schedule and detector configuration
  - Rates studies
  - Run plan
  - KPP plot template