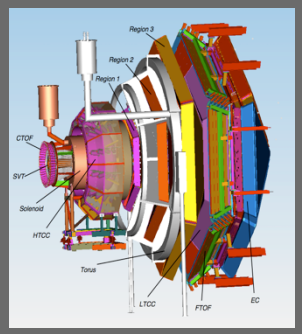
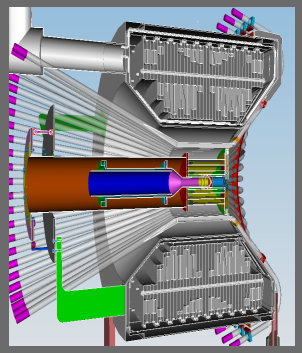
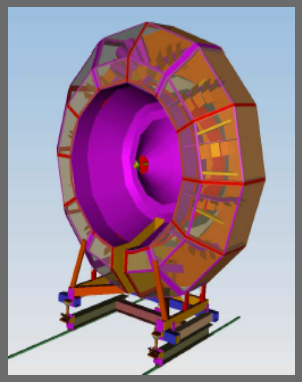
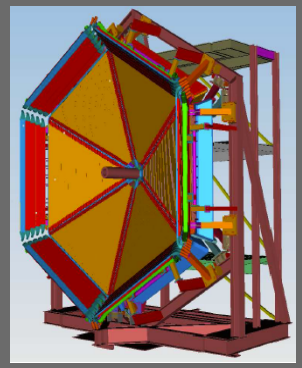


CLAS12 CalCom Status Update

CLAS Collaboration Meeting

June 16, 2016

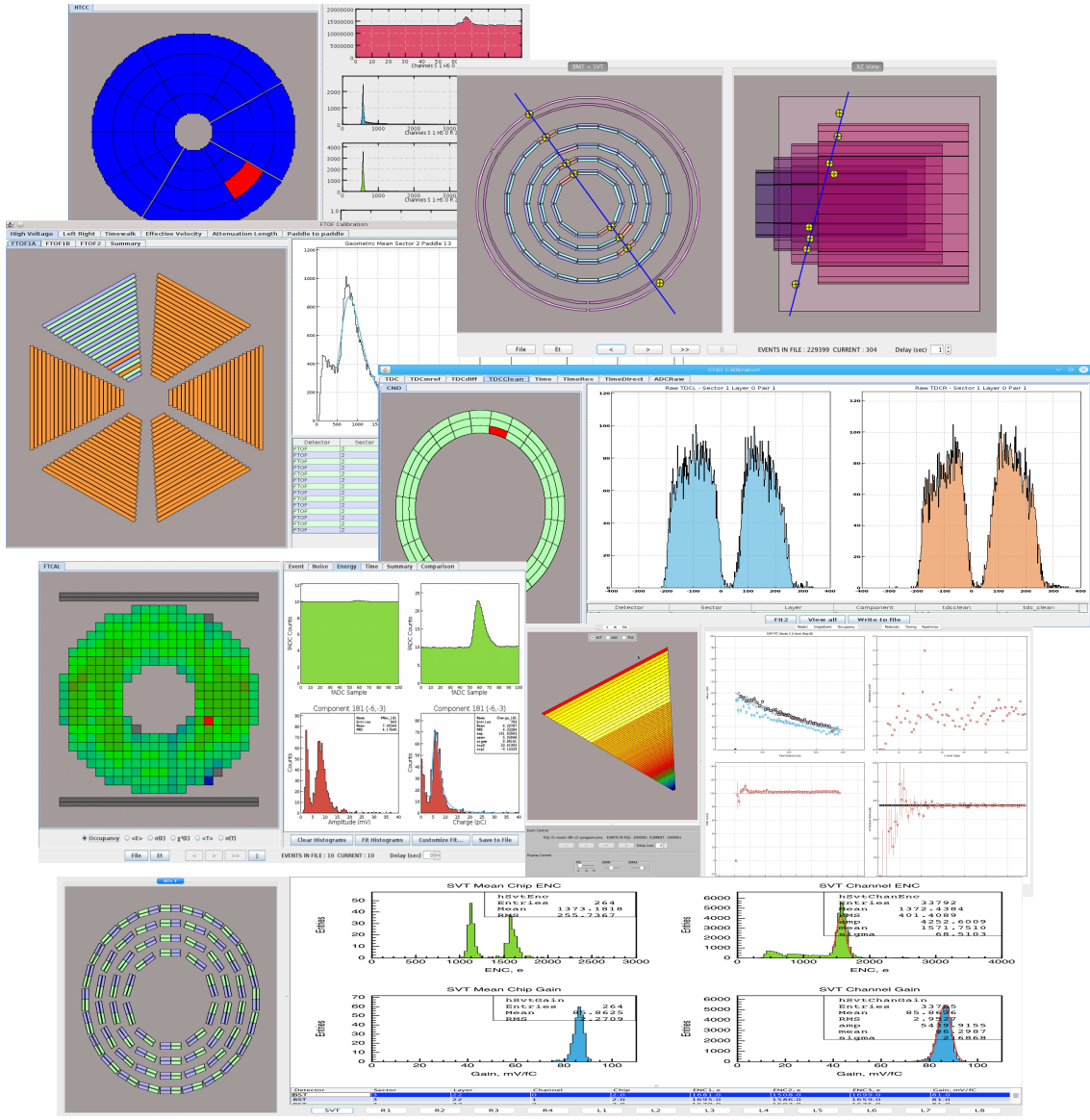
Outline

- Detector commissioning and calibration:
  - Status update and upcoming work for CLAS12 subsystems (EC-PCAL, FTOF, LTCC/HTCC, DC, SVT, MM, CTOF, CND, FT)
- Commissioning with Beam Plan
  - KPP run configuration
  - Expected rates
  - Work plan

Detector Calibrations

Commissioning and calibration in progress for all subsystems:

- EC/PCal: algorithm and software implementation in very advanced stage; detailed validation with GEMC data
- FTOF: calibration suite almost ready; next: documentation and tutorials
- LTCC: system checkout and SPE calibration in progress; calibration suite development started
- DC: development in progress, presently focused on time-to-distance parameterization
- FT: monitoring/calibration GUIs under development; cosmic ray calibration suite in final stage
- HTCC: calibration suite under development; SPE calibration algorithm in advance stage
- SVT: calibration suite almost ready; next: documentation and tutorials
- MM: algorithms exist, presently being ported to Java
- CTOF: calibration suite to be developed based on FTOF suite
- CND: development of monitoring/calibration GUI in progress based on FT/FTOF ones
- RICH: development started



EC-PCal

ECMon: Monitoring and Calibration GUI

Current Features

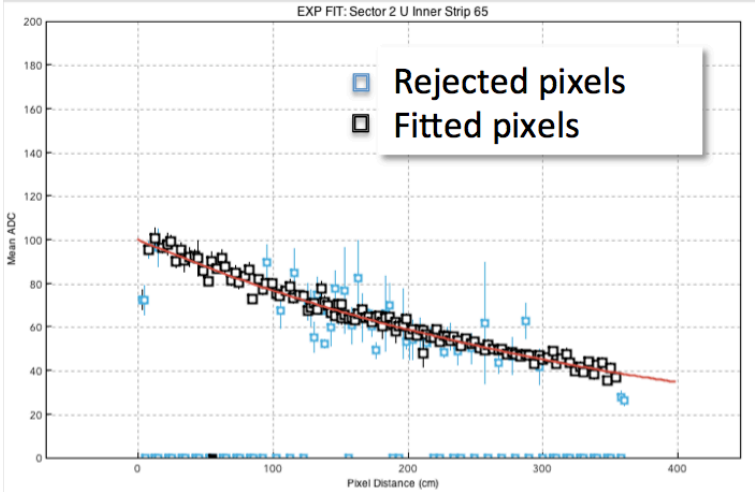
- Common framework for EC and PCAL.
- Pixels dynamically generated from geometry database.
- Mouse-over navigation of detector elements.
- Live updating of detector response and calibration results.

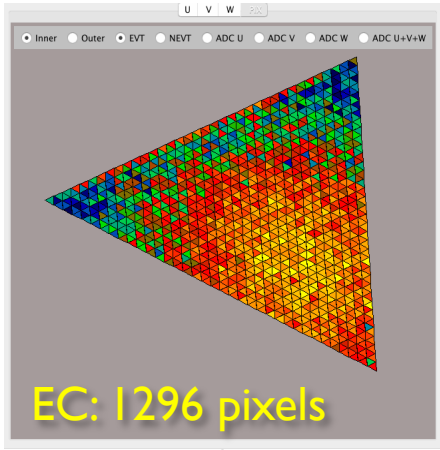
Monitoring

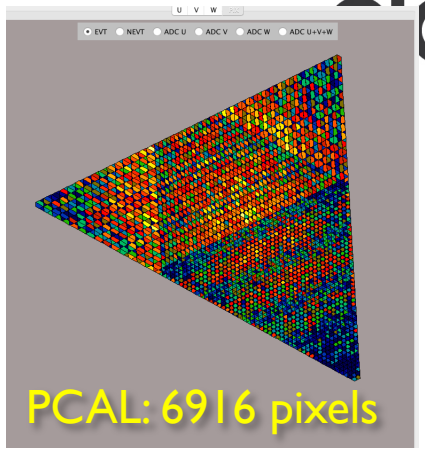
- Occupancy: strips, pixels, fADC and TDC data.
- fADC data: pulse shape, noise, fitter settings.
- Single event: visualize hits and showers.
- Pedestals: event-by-event, noisy channels.

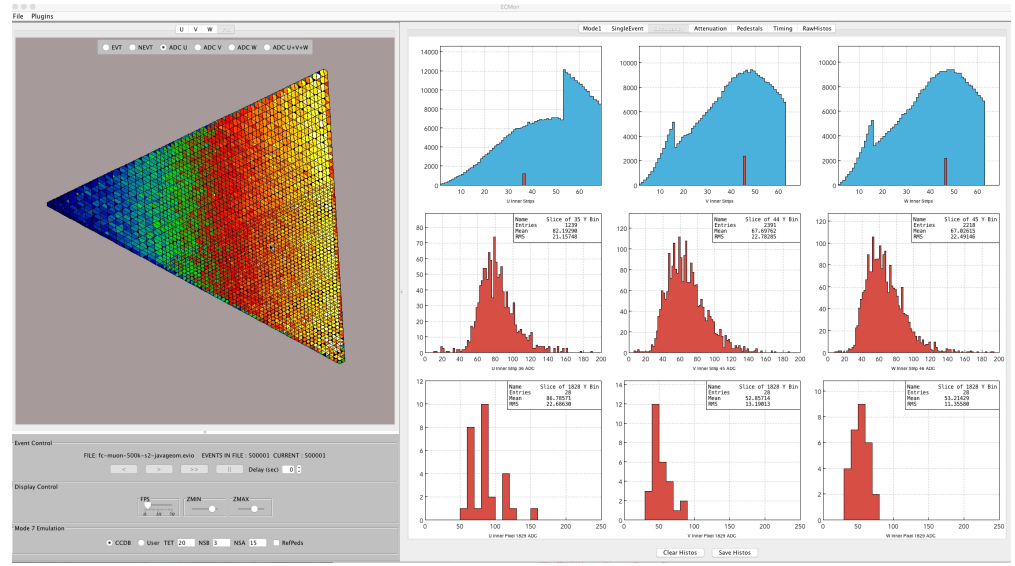
Calibration

- GUI isolates single pixel cosmic muon hits (Dalitz).
- Optimization of pixel selection (statistics, geometry).
- Fits to pixel data: PMT gains and light attenuation.
- Validation using GEMC simulations.









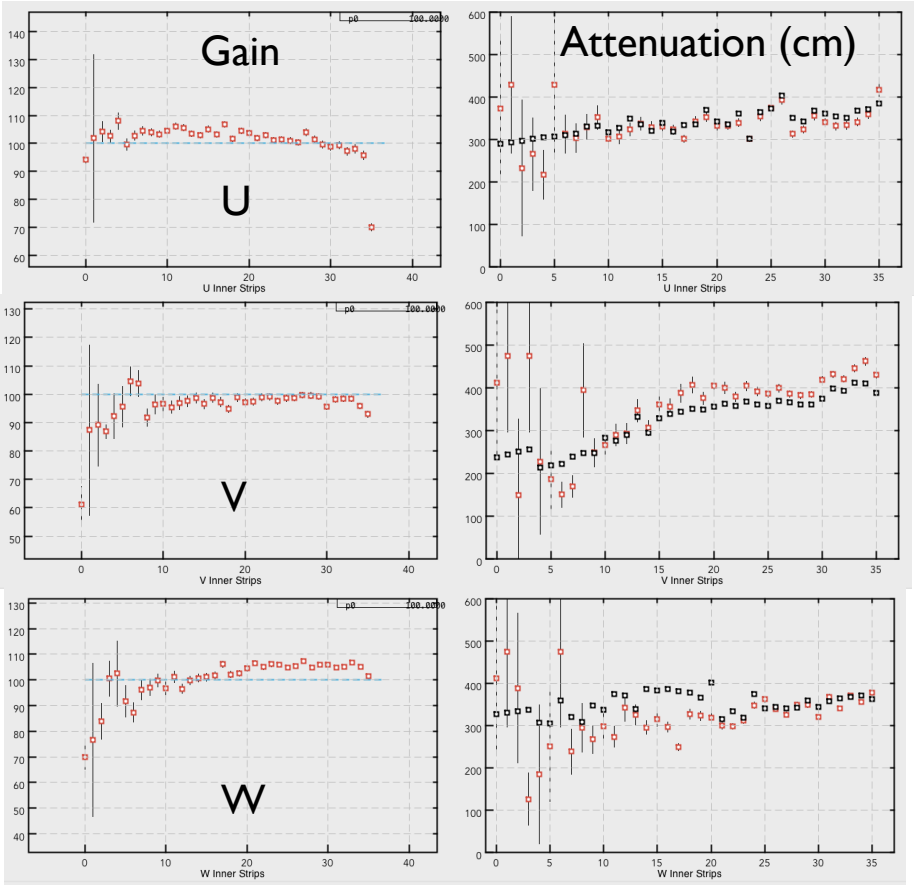
Further Development

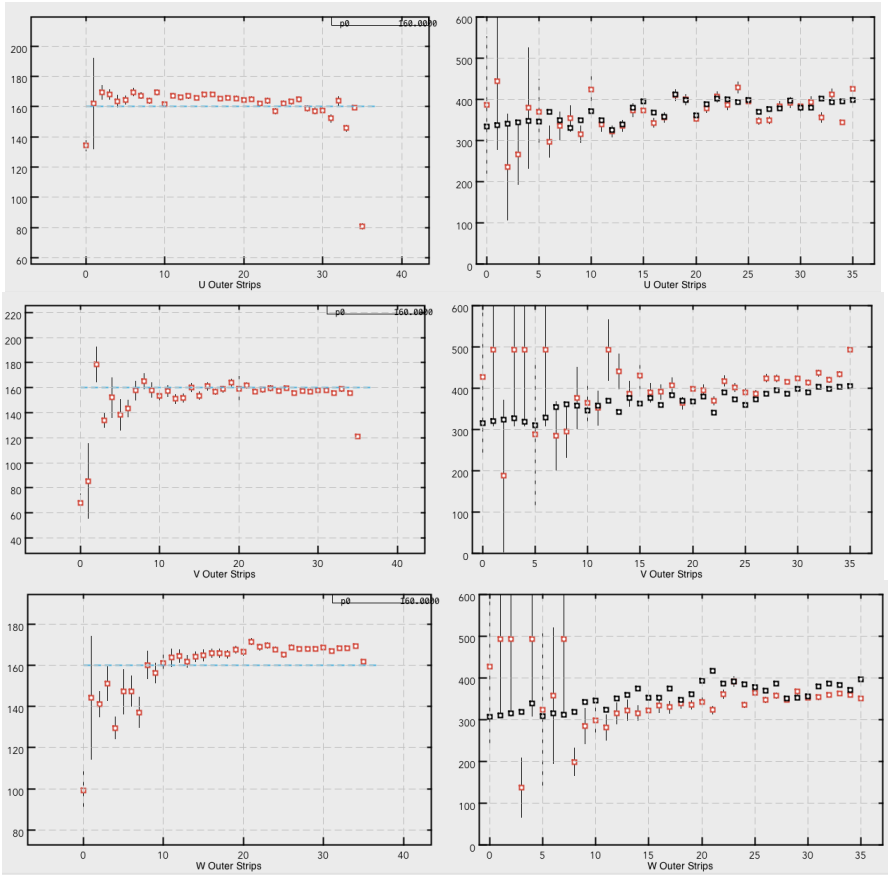
- Incorporate EPICS data (scalers and HV) for status monitoring.
- Energy cluster reconstruction and trigger debugging support.
- Energy calibration using physics data (e-, π^0, and MIP pions).
- Timing calibration (offsets, time-walk).
- EC, PCAL relative alignment using cosmic muon pixel events.

EC/PCal

Validation of MIP Calibration Algorithm

- Expected MIP
- GEMC attenuation
- ECMon fit to simulated data





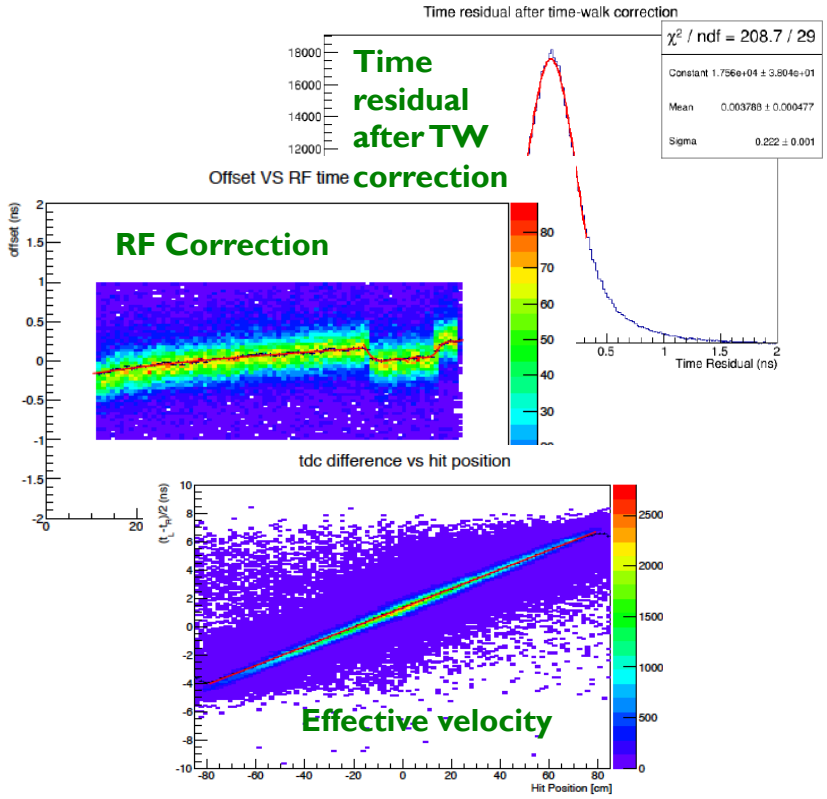
EC Inner

EC Outer

FTOF

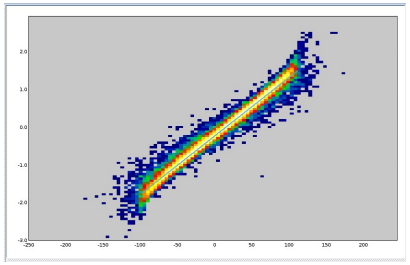
Algorithms for different calibration steps finalized and tested on CLAS data (H. Lu):

- …
- Time-walk correction
- Effective velocity
- RF correction
- Paddle to Paddle

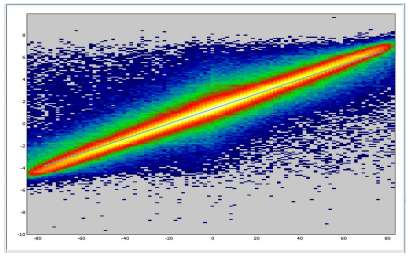


Implementation in java calibration suite close to completion (L. Clark)

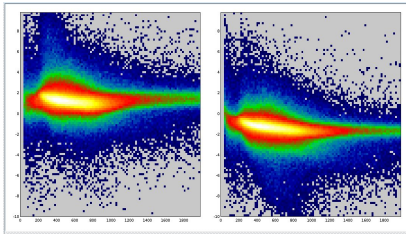
Attenuation Length



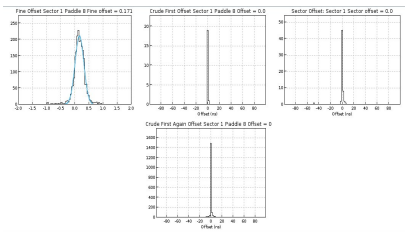
Effective Velocity



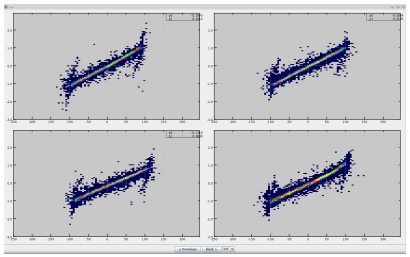
Timewalk



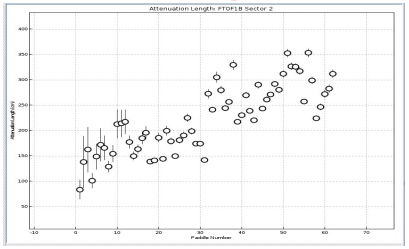
Paddle to paddle



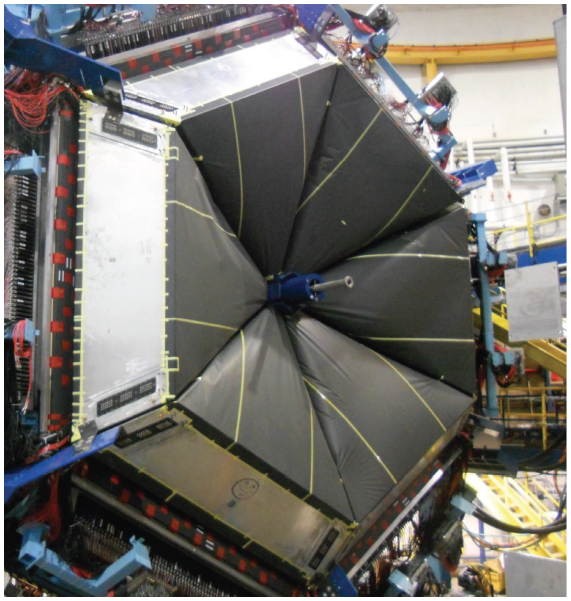
Multiple plot view

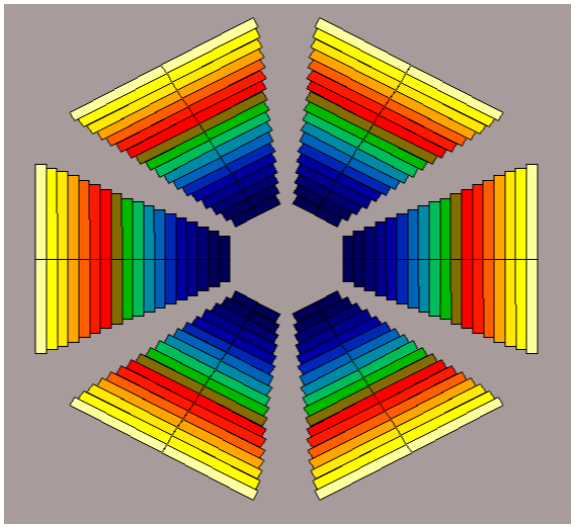


Summary view



LTCC

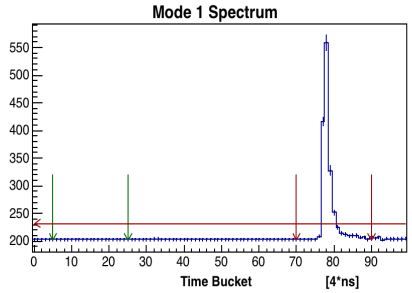


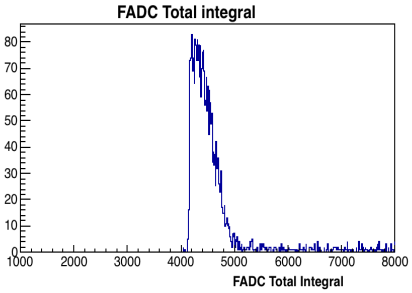


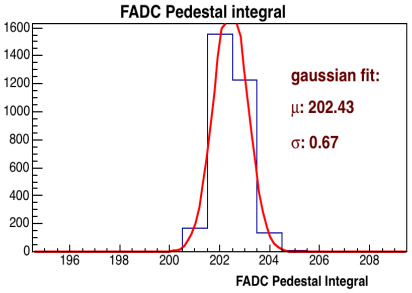
Monitoring GUI under development

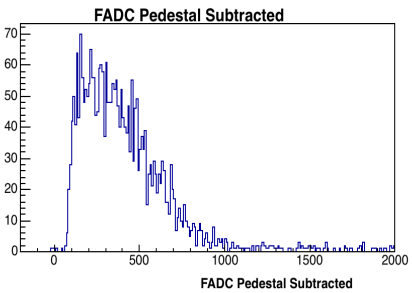
SPE analysis from fADC mode 1 data

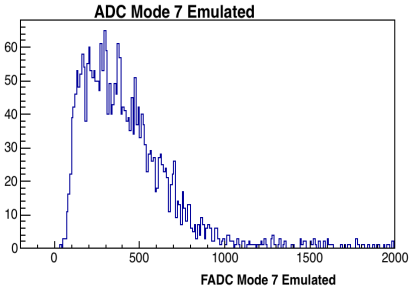
Sector 1 Channel 1 Left











Number of hits: 3103

Pedestal: 202.4

Pedestal min t: 5

Pedestal max t: 25

Signal min t:70

Signal max t:90

Mode 7 Emulation Threshold: 30

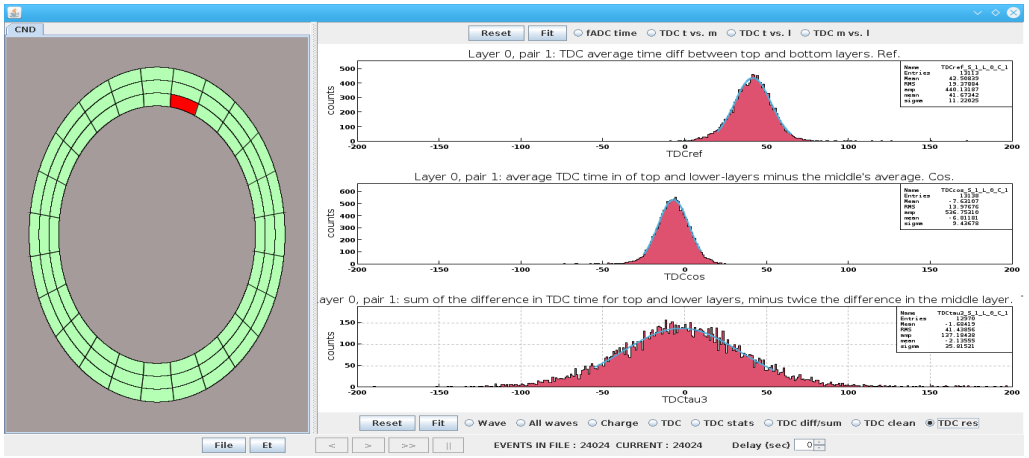
CND Comm. & Calibration

Monitoring GUI:

→ Developed March-April 2016 for new cosmic tests at JLab

→ Based on FT Viewer Module code [Raffaella De Vita, Gary Smith, Erica Fanchini]

→ Status: 80%



Calibration GUI:

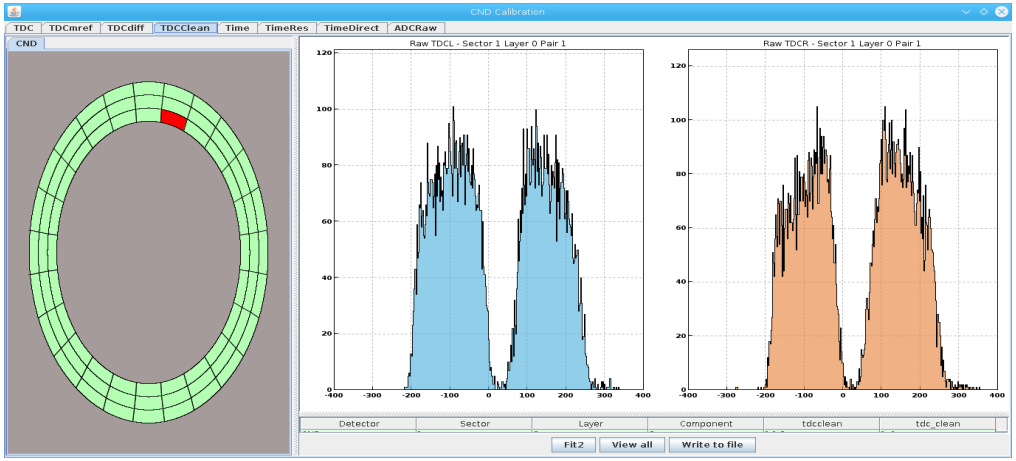
→ Started developing in May 2016

→ Based on FTOF calibration code [Louise Clark]

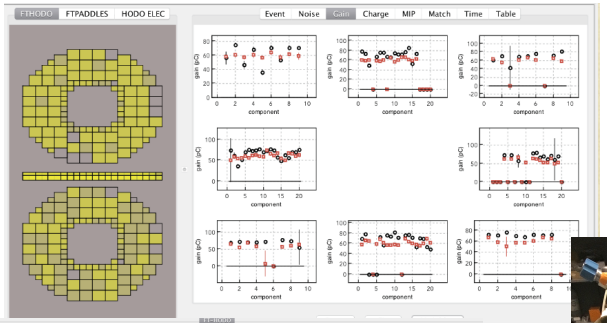
→ Status: 30%

- → Still to implement ROOT macros into framework
- → Fix some display issues, use of constants table, reading/writing of constants

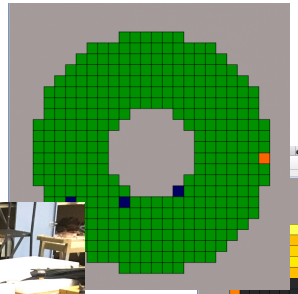
All common tools required exist



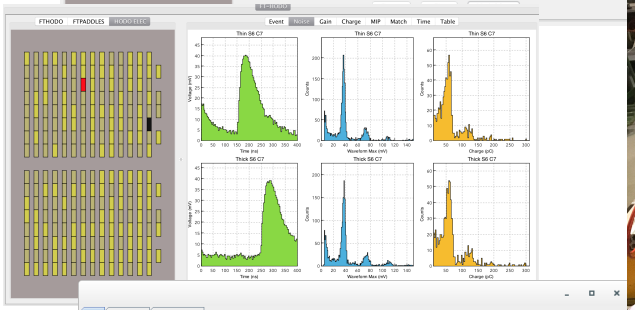
Forward Tagger

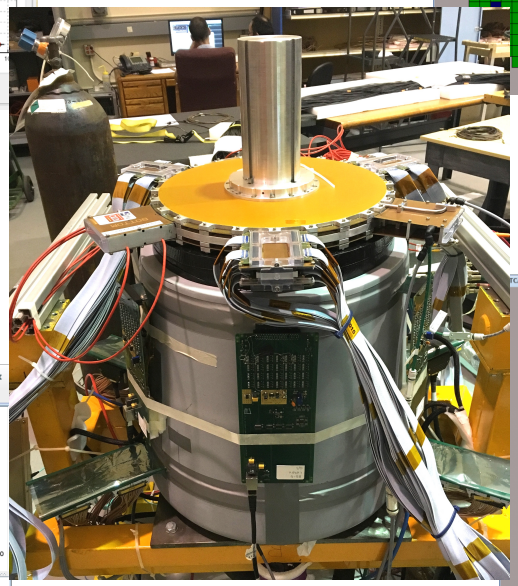


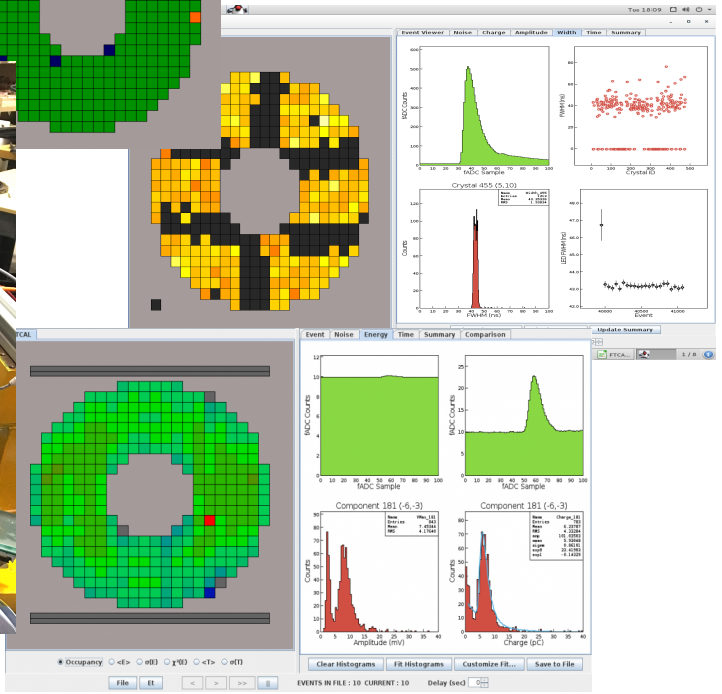
System checkout and commissioning with cosmic rays

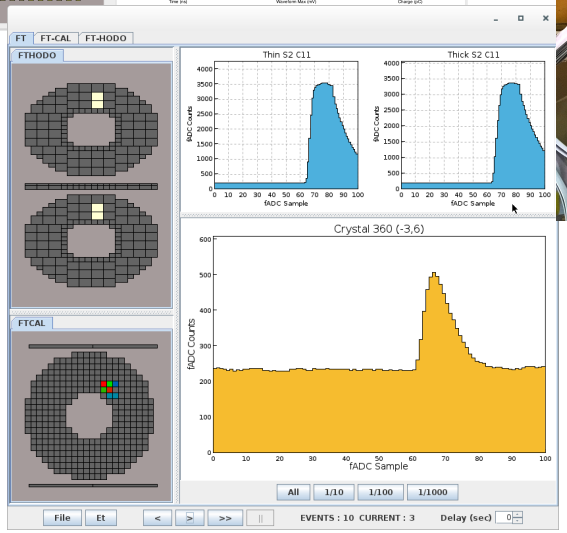


Channel status based on noise measurement









Combined Cal+Hodo monitoring GUI

Absolute energy calibration based on MIPs peak

Calibration and Monitoring GUIs will now be extended to include the MM Tracker

Calibration Progress Tracking

FTOF Calibration Timeline

Task	Subtask	Item	Start Date	End Date	Resources	% of Completion	Status (on schedule/ delayed, ...)
CCDB	FTOF tables	table definition (document)	1-Feb-16	4-Mar-16	D.S. Carman, H. Lu	100	
		table creation	15-Feb-16	4-Mar-16	C. Smith	100	
		fill tables w nominal values	15-Feb-16	11-Mar-16	D.S. Carman, C. Smith	100	
Calibration Algorithm and Suite Development	FTOF calibration suite	algorithm development	1-Jan-14	15-Apr-16	D.S. Carman, H. Lu, L. Clark	85	on schedule
		c++ suite development	1-Jan-14	30-Apr-16	H. Lu, D.S. Carman	85	on schedule
		c++ suite tests (g14 data)	1-Jan-14	30-Apr-16	H. Lu	75	on schedule
		java suite development	1-Apr-15	31-May-16	L. Clark, G. Gavalian, D.S. Carman	35	on schedule
		Java suite tests (cosmics)	15-Jan-16	30-Apr-16	L. Clark, G. Gavalian, D.S. Carman	30	on schedule
		java suite tests (GEMC)	1-Apr-16	31-May-16	L. Clark, G. Gavalian, M. Ungaro	10	now underway
		java suite documentation	30-Apr-16	31-Jul-16	L. Clark, H. Lu, D.S. Carman	0	
		Java suite tutorials	15-May-16	31-Aug-16	L. Clark, D.S. Carman	0	
	FTOF cosmic ray calibration	algorithm development			D.S. Carman	100	
		FORTRAN, PAW tool implementation			D.S. Carman	100	
Monitoring	FTOF monitoring	observables definition	1-May-16	15-Jun-16	D.S. Carman	0	
		java tool implementation		31-May-16	G. Gavalian	20	on schedule
		documentation	1-Jun-16	30-Sep-16	D.S. Carman, G. Gavalian	0	
		slow controls		01-Jun-16	N. Baltzell, K. Livingston	60	on schedule
Last Updated: April 7, 2016							

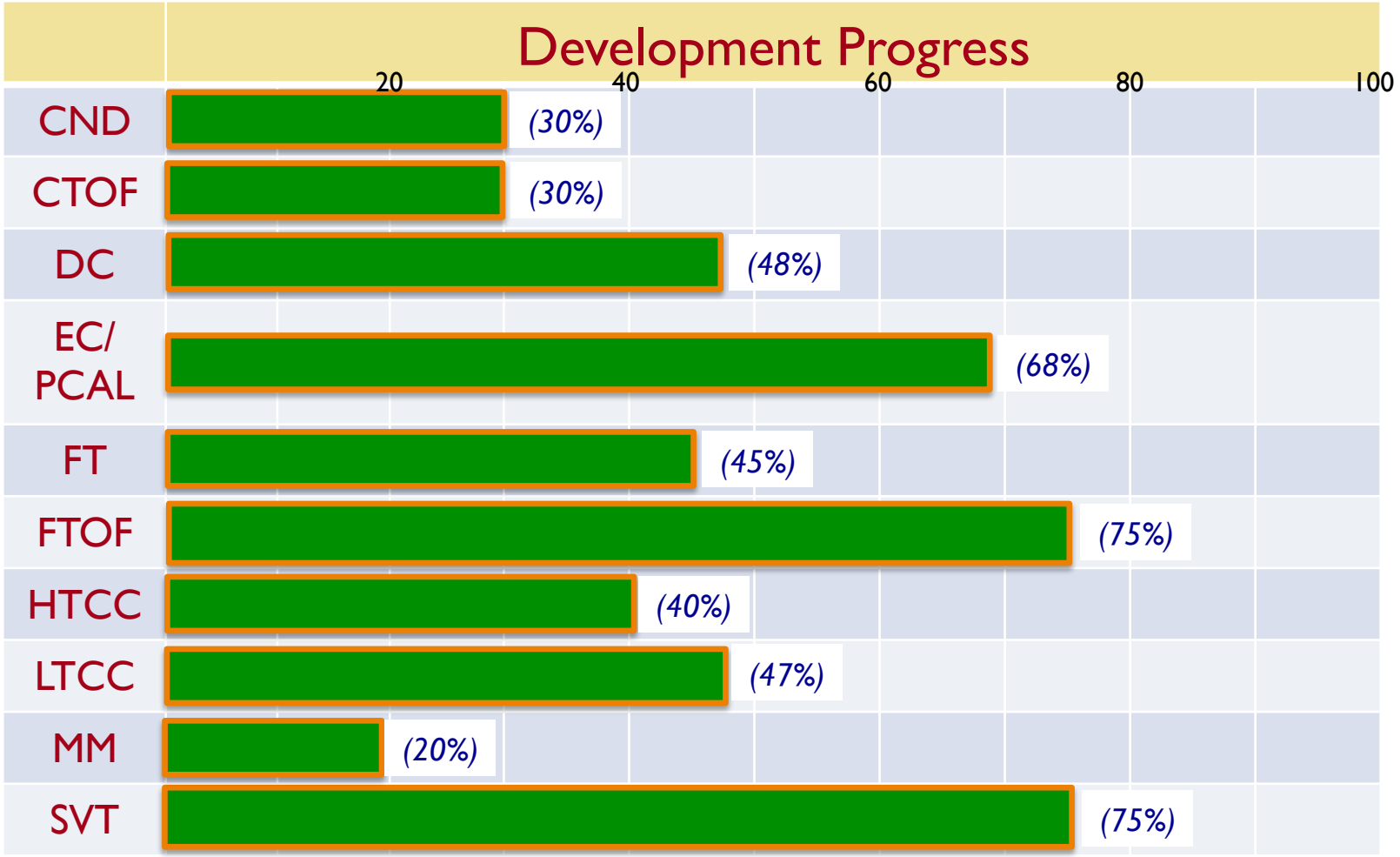
- Tracking of calibration suite development:

CND, CTOF, DC, EC/PCAL, FT, FTOF, HTCC, LTCC,MM, SVT

(updated every month)

Calibration Progress

(including documentation and tutorials)



Timeline:

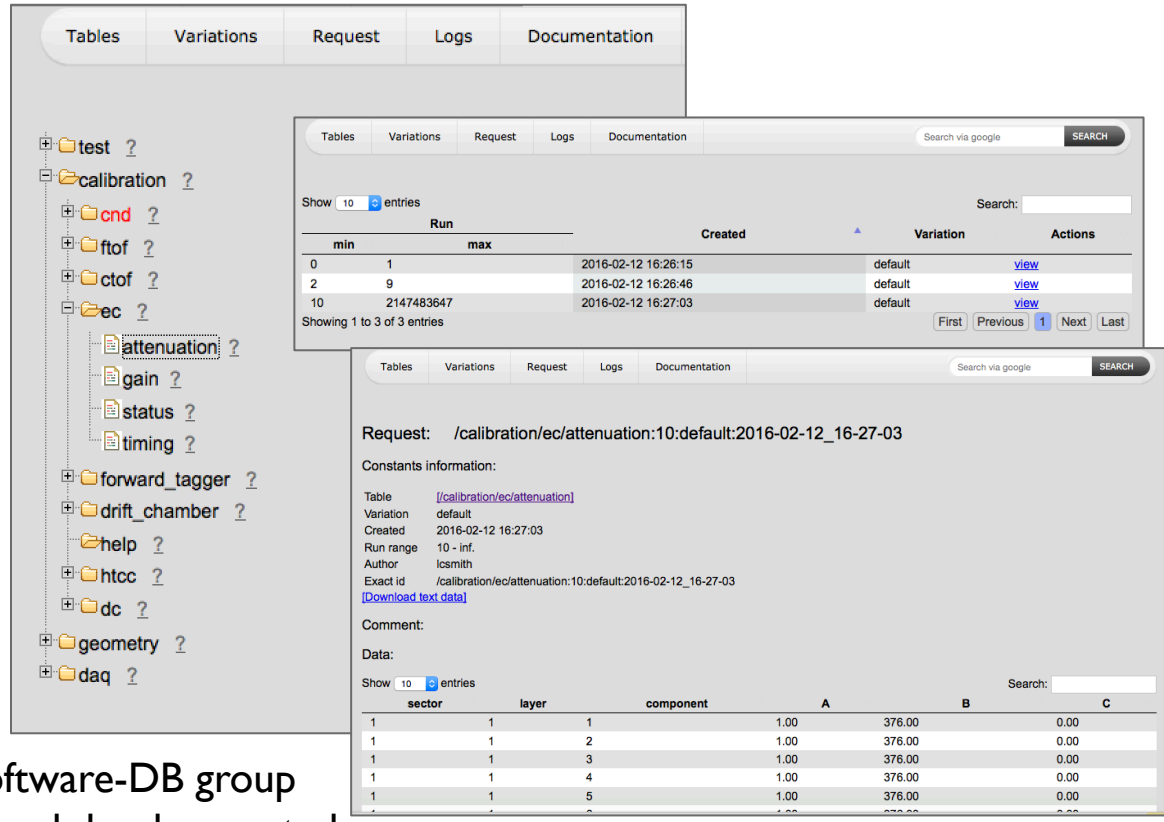
I) Suite β-versions – Fall 2016

II) Document and tutorials – End 2016

III) MC data calibrations – Begin 2017

Calibration Constants DB

- CCDB: Hall-D calibration constants database based on mysql set of tables (M. Ito, D. Romanov)
- Used for:
  - Geometry
  - Calibration constants
  - fADC parameters
  - Translation tables
- Allows to set run ranges and "variations"



- Joint meetings between CalCom-Software-DB group (Harut & Bryan) to discuss policies and development plan
- Short-term CCDB usage policies for (expert) calibrators defined: https://clasweb.jlab.org/wiki/images/4/4f/Ccdb_tables_V5.pdf
- Scripts for long-term CCDB usage needed

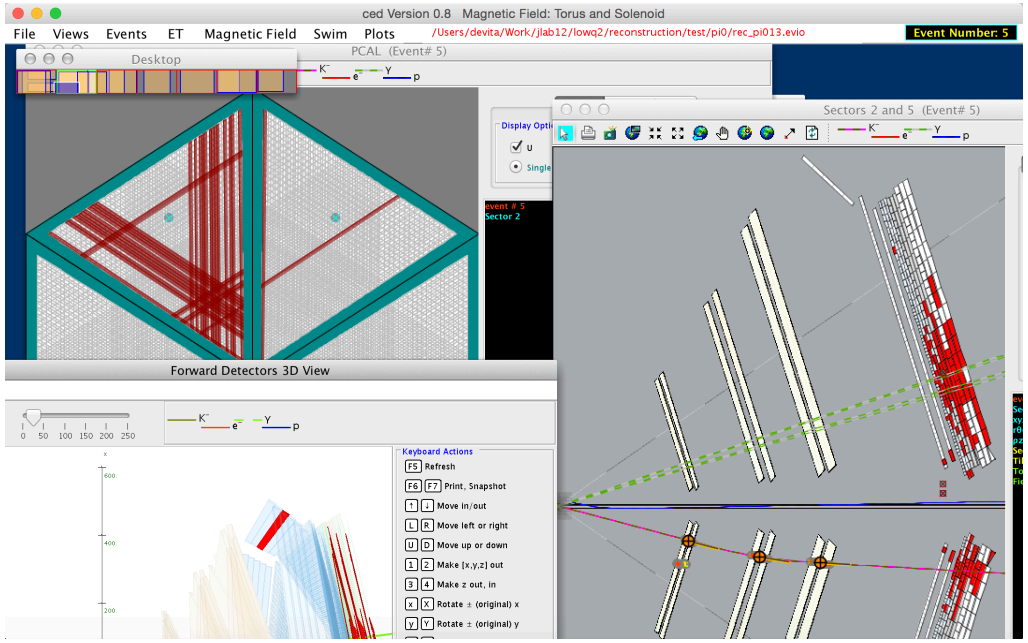
https://clasweb.jlab.org/cgi-bin/ccdb/objects

mysql server host: clasdb.jlab.org
user: clas12reader
database: clas12

CLAS12 Monitoring

Discussion on organization of general monitoring tools for usage in the counting house started:

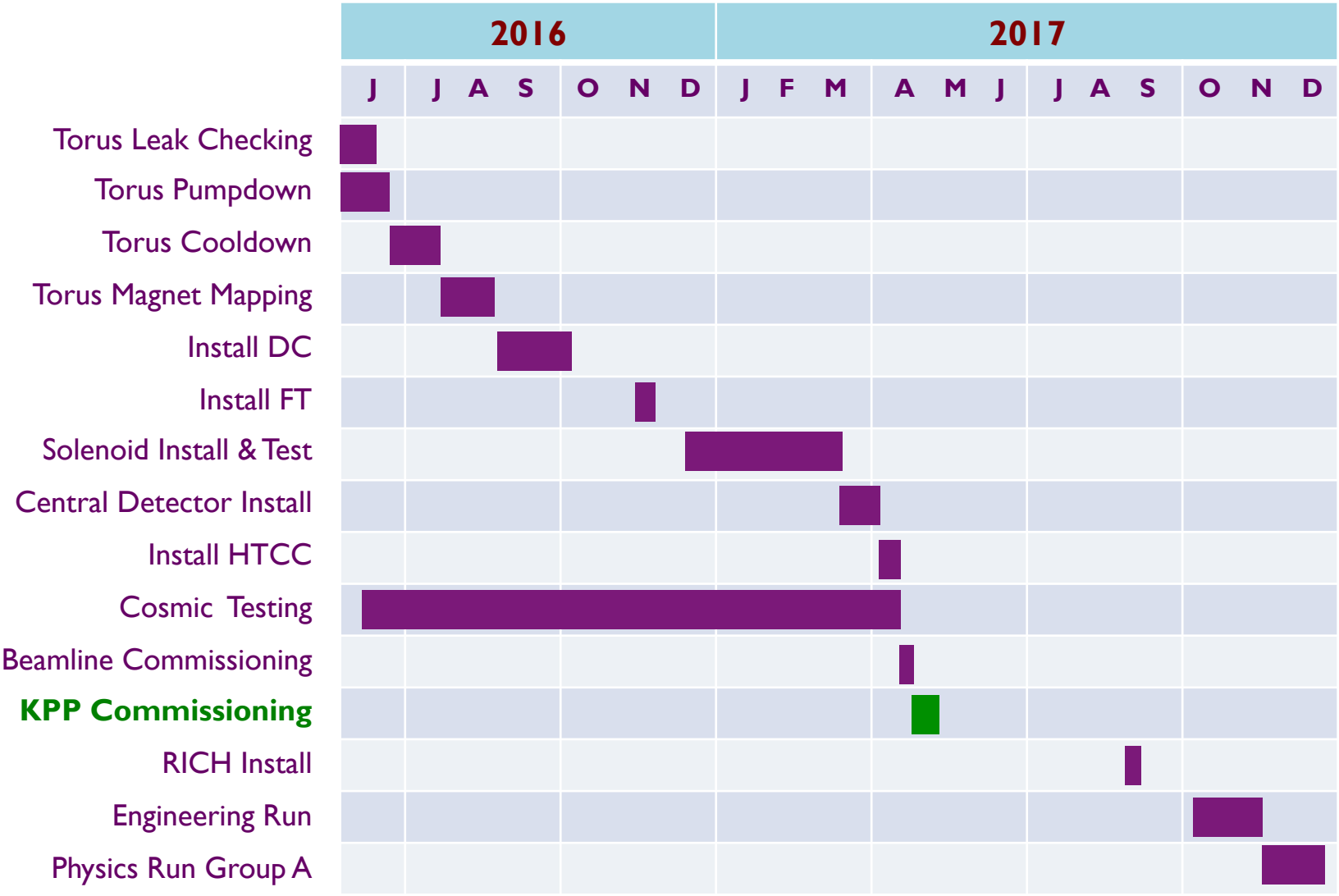
- Provide similar information/functionality as we had in CLAS but with renewed/ reorganized/unified framework
- Provide global and easy to understand view of detector status for shift takers
- New features:
  - Simple detector status information (e.g. total occupancy, …) for alarm definition
  - Access to more detailed information for debugging if issue is detected
  - Automatized comparison of online histograms to reference to detect issues and give alarms
  - Detector specific monitoring apps loaded as plugins for maximum flexibility
  - Possibility to mask known problematic channels
  - Possibility to run from ET or file
  - Save relevant info to MYA DB and data stream (histograms too)



In CLAS12:

- Scaler info
- Event Display: CED
- Raw data info: MONB
- Fast reconstruction
- RECSIS-Online

CLAS12 KPP Run



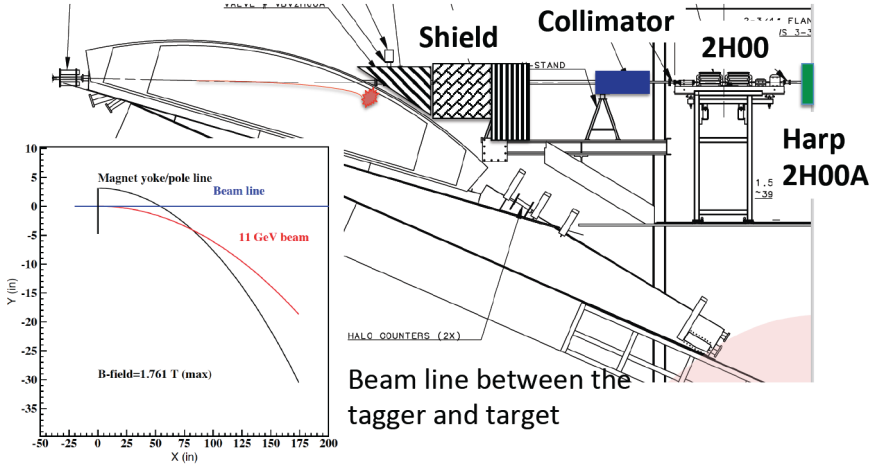
Latest version of KPP
(from Glenn's talk)

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

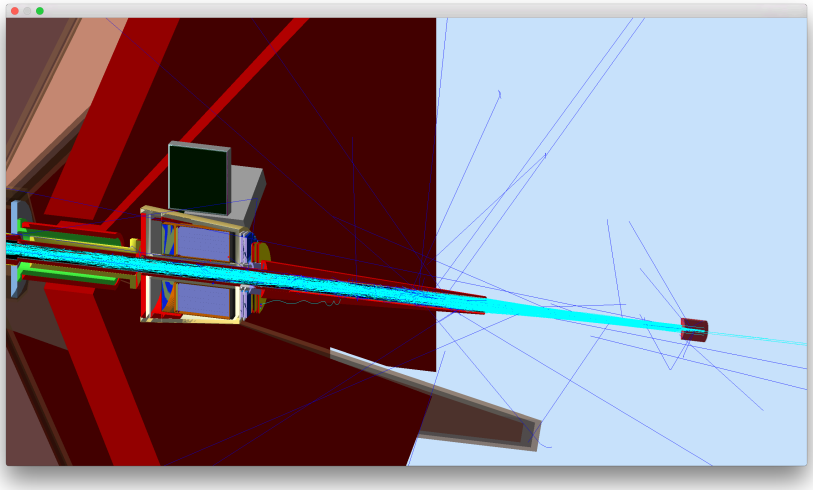
1. Detector running for 8 hours recording data from all subsystems.
2. Screenshots of beam status and/or accelerator e-logs entries demonstrating electron beam current, beam energy, and beam profiles.
3. Plots showing relative timing of calorimetry, time-of-flight, and Cerenkov detectors.
4. Event displays 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 & Detector Configuration

- Beam: 6.6 GeV (TBC) electron beam
  - Energy has to be higher than 6 GeV
  - Max energy for tagger dump 6.2 GeV
  - E > 6.2 GeV requires new beam dump scheme also needed for 11 GeV
- Target: use empty target cell
  - 30 μm aluminum window equivalent to thin target
  - Leaves the possibility of quick change to full LH2 target
- Detector:
  - All baseline detectors
  - 4-layer SVT + MM in B2 configuration (FMT + 2-layer BMT)
  - CND
  - FT



Beam line between the tagger and target

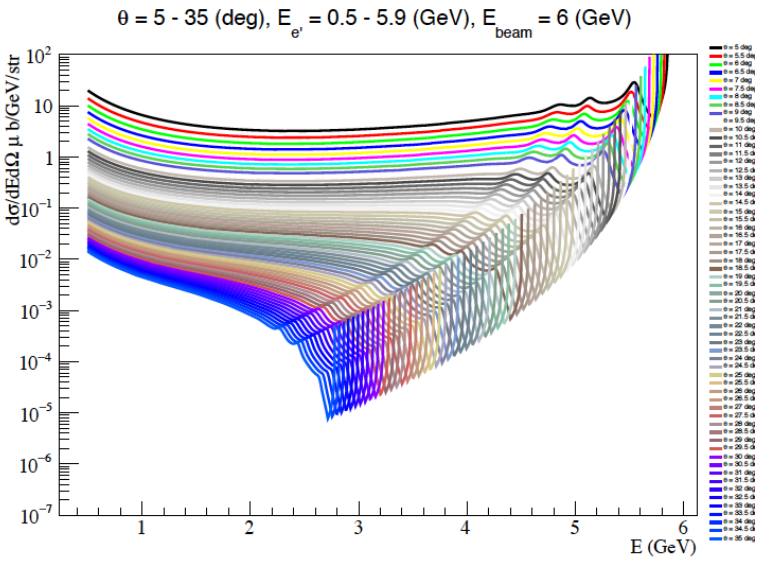


Expected Rates

Estimates of particle rates based on different event generators (S. Pisano)

- Inclusive (M. Sargsian, CLAS-Note 92-018)
- Semi-inclusive (CLASDIS)

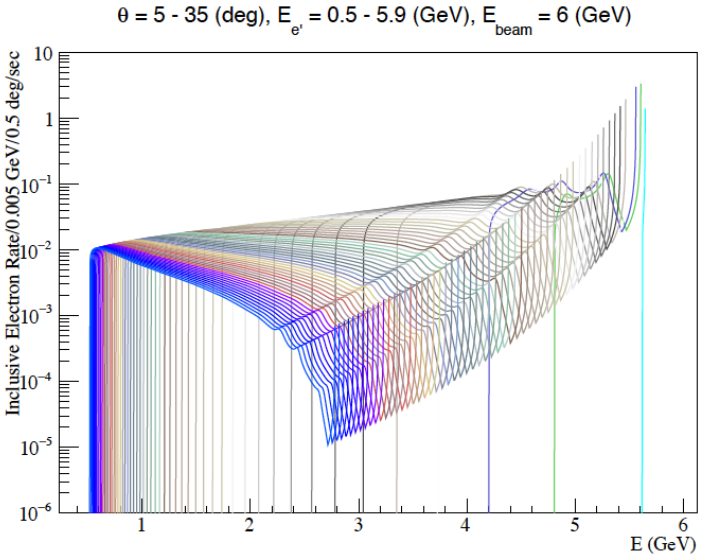
using both fastmc and full sim+rec chain, for different energies and magnetic field values



Expected inclusive electron rate at 10^{34} $cm^{-2}s^{-1}$ luminosity (7-8 nA on 5 cm LH2 target):

~ 5 kHz

- consistent with CLAS 6 GeV data
- corresponding rate on empty target ~ 100 Hz

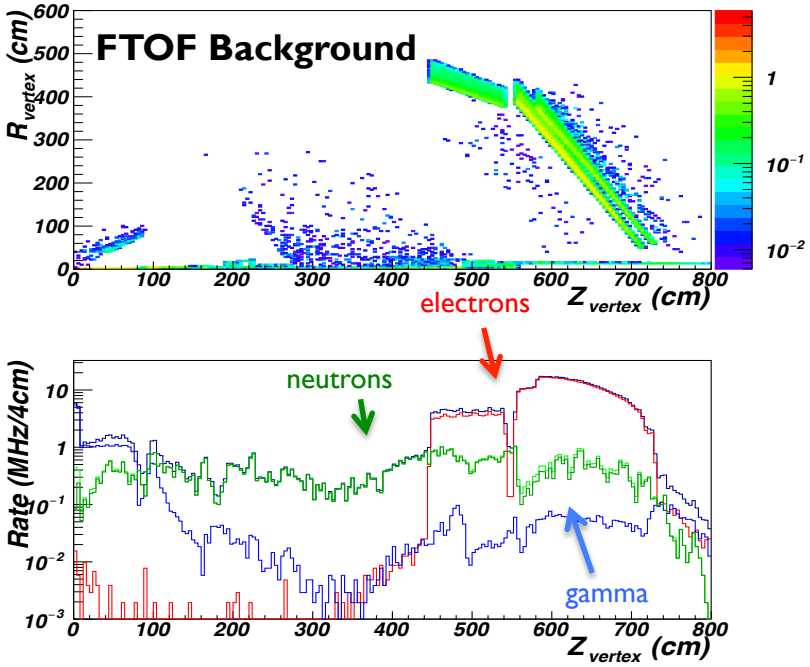


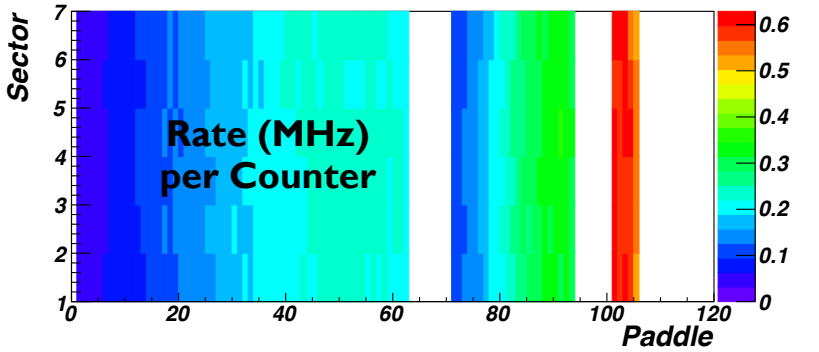
Background Rates

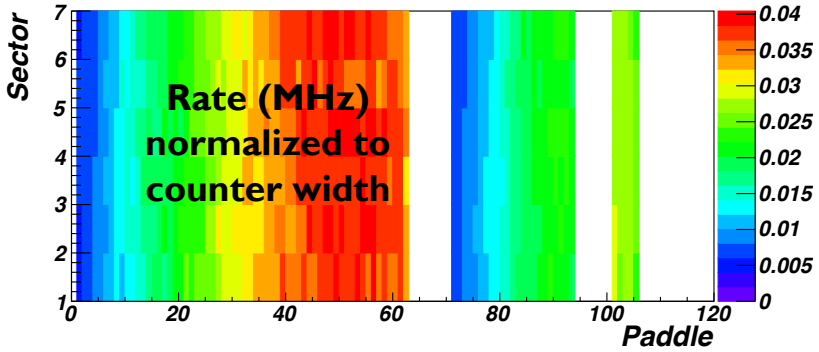
Detailed studies for 11 GeV already done:

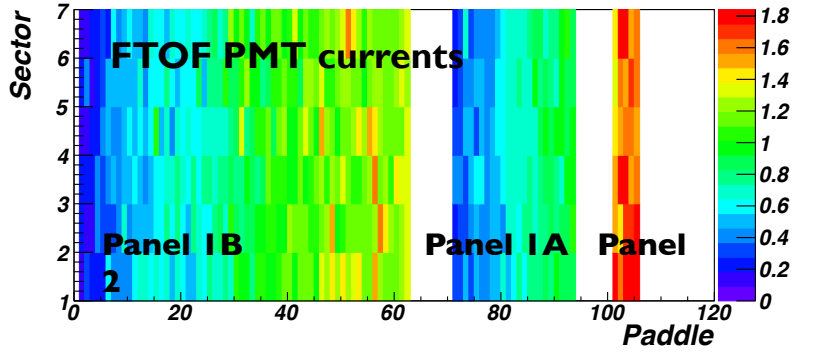
- DC occupancies
- Rates and PMT currents
- Radiation doses

Will be extended to 6.X GeV to have reference values for the KPP run



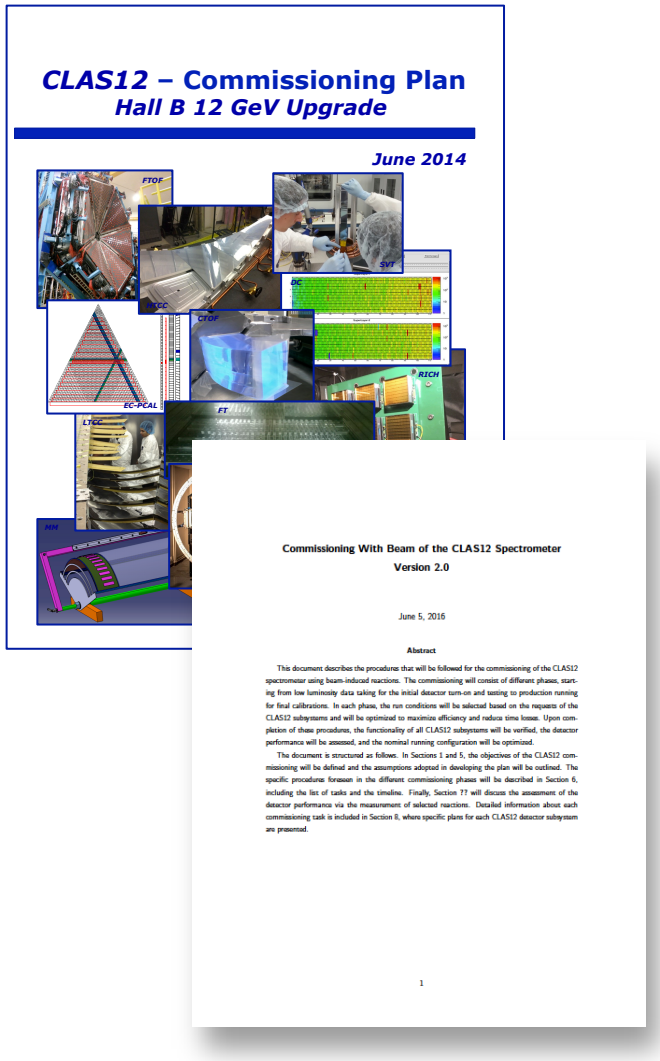






KPP Run Plan

- Establish beam to Faraday Cup
- Detector functionality checks:
  - measure of noise and rates for different detectors (first focus on forward detectors → trigger)
  - check DAQ functionality
  - setup and checkout trigger
- Optimize beam condition (current) and detector settings (thresholds, acquisition windows, delays,…)
- KPP studies:
  - CED snapshots of tracks with correlated hits in FD
  - reconstruct tracks (HTB) and get vertex distribution
  - time correlations of FD
  - PID from calorimeters
  - time correlation of FD and CD
  - take data to do timing calibrations



Summary

- Detector commissioning and calibration
  - Calibration suite under development and continuous progresses for all systems
  - Close collaboration with software group
  - Intense use of common tools
  - Aiming at first version of calibration suites by Fall
  - MC calibration "challenge" by end 2016/begin 2017

- Commissioning With Beam (CWB)
  - Beam and detector configuration being finalized
  - Preparation studies
    - Evaluation of particle rates at 6.X GeV
    - Simulation of detector backgrounds
  - Focus of next months:
    - Simulation studies for KPP achievement