Engineering Run Overview

N. Baltzell

March 6, 2018

7th 1st Experiment Workshop

Ultimate Goals

- Understand detector response vs simulation
- Study acceptance/rates for different particle types and final states
- Study & optimize reconstruction for Forward and Central detectors
- Calibrate subsystems for different configurations
- Characterize CLAS12 resolution function
- Measure cross sections for well known processes
- Document studies via CLAS12-Notes

Dedicated Studies

- Beamline commissioning
  - beam tuning, harps/rates, FSD, SLM, Fcup attenuation, Moller polarimeter, …
- Configuration Scans
  - Luminosity
  - Solenoid / Torus fields
  - FT-On/Off configurations
  - Feedback
    - rates compared to MC
    - normalized rates (e.g. tracks per electron, electrons per luminosity)
    - impact on PMT operations
    - acceptance impact
- Hardware setting optimzations
  - readout windows, thresholds, pulse integration ranges, high voltage
- Calibration data
  - different torus/solenoid fields and polarity
  - low/high luminosity
  - two beam energies, 2.2 and 10.6 GeV
  - no-field for alignment
- Trigger commissioning, validation, optimization

Organization

Run Dates: December 11, 2017 – January 28, 2018
Run Coordinators: D. Carman, R. De Vita
Run Wiki: https://wiki.jlab.org/clas12-run/index.php/Engineering_Run
Analysis Wiki: https://clasweb.jlab.org/wiki/index.php/Engineering_Run_Analysis

Offline Team

Role	People
Analysis Coordinator	N. Baltzell, R. De Vita
Data Chef	F.X. Girod, N. Harrison
Database Manager	H. Avakian

Reaction	People
Inclusive electron	N. Markov
Elastic	M. Osipenko, R. De Vita
2-π	E. Golovach, OHIO (TBC)
BH/DVCS	FX. Girod
$K^+\Lambda$	D.S. Carman, E. Golovach
$\pi^+ n$	
$\pi^0 p$	A. Kim
e^+e^-	J. Newton

Detector	People
CND	P. Chatagnon, D. Sokhan, S. Niccolai
CTOF	D.S. Carman, L. Clark
DC	L. Kabir
ECAL	C. Smith, J. A. Tan
FT	S. Adhikari, A. Celentano, L. Lanza, A. Thornton
FTOF	D.S. Carman, L. Clark
HTCC	N. Markov
LTCC	B. Duran, M. Ungaro
MVT	G. Christiaens, M. Defurne
RICH	A. Kim, M. Turisini
SVT	Y. Gotra

Coordinator: organize group, select runs for processing, reviewing the calibration results, organize daily meetings and ccdb updates

Chef: organize data processing and associated scripts, offline shift takers processing data (temporary until dedicated fam ready)

Calibrators: perform and optimize calibrations, report results

Daily 10:00 meetings in couning house upstairs meeting room

Dedicated Runs

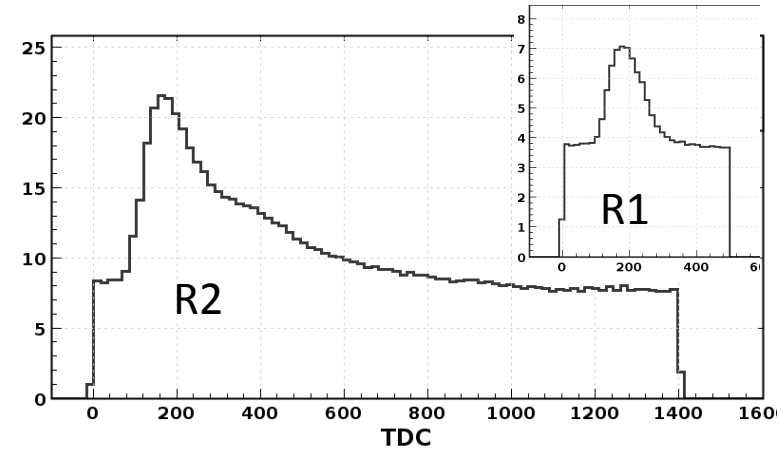
Description	Run #	Dates	Notes
Luminosity Scans	2088, 2103-2106, 2128-2129, 2324, 2711	12/17, 12/17, 12/17, 1/14, 1/27-28	Random/Electron triggers ; up to 75/125 nA ; FToff/FTon
Solenoid Scans	2228-2229, 2349-2350	12/21, 1/14	FTon, FToff
Torus Scans			+/-85,100% In- and Out-bending at 10.6 GeV ; +/-60-100% at 2.2 GeV
DCHV Scans	2014-2032, 2175-2187, 2578-2580, 2959-2968, 2993-2997	12/15, 12/19^*, 1/25, 2/5, 2/5	(^ lower HV settings) (* MVT HV scans included)
TOF	2736-2739		CTOF/FTOF Threshold scans
RICH	2308-2315 & 2321-2323, 2329-2341, 2727-2733, 2754-2759, 2784-2793, 2827-2831	1/14, 1/14, 1/25 1/29, 1/30, 1/31	time delays, trigger latency, HV/thresh, *,*, *
Forward Tagger	2425-2426, 2829-2843, 2892-2897, 2945-2948, 2971-2972	1/18, 2/1-2/3	trigger, FTC thresh and FTH HV, luminosity scan, trigger, FTH HV
Micro Megas	2175-2187, 2943- 2944	12/19, 2/2	HV scans
Moller, Trigger Tunings, etc			

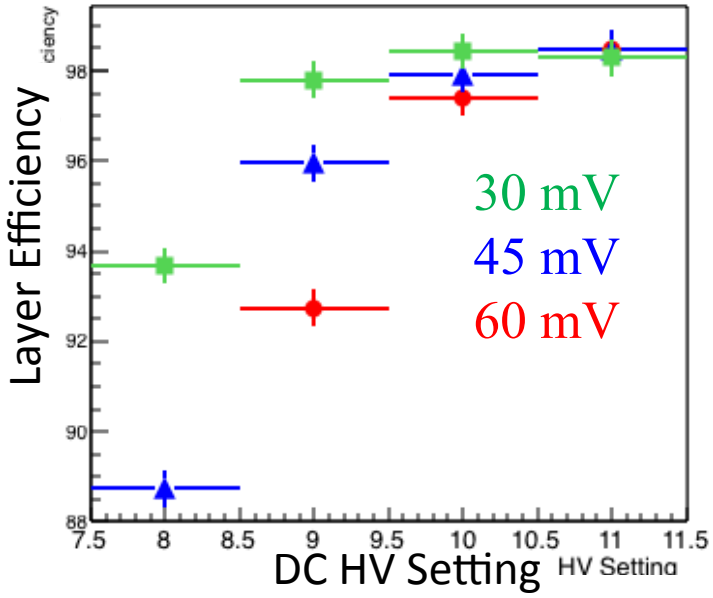
Calibration Runs

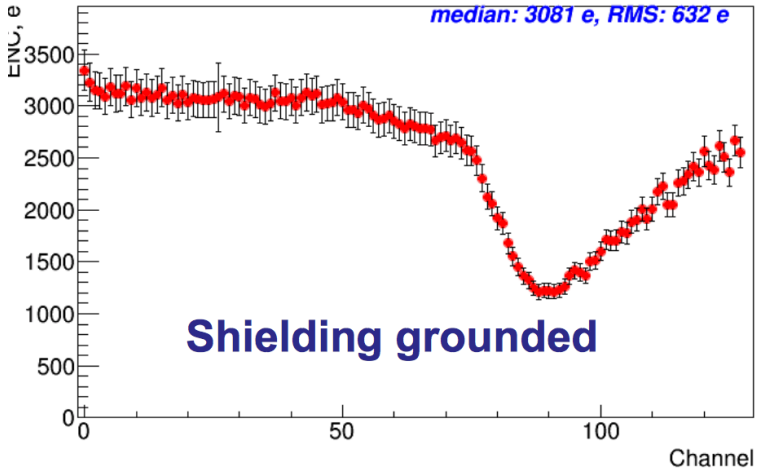
Description	Run #	Dates	Notes
10.6 GeV, FToff	2325-2327, 2346-2350	1/14, 1/15	25-125 nA, Inbending
10.6 GeV, FTon		December	5-50 nA, Inbending
10.6 GeV, FToff		December	5-30 nA, Outbending
10.6 GeV, FTon	2711-2722	1/27-1/28	5-75 nA, many at low luminosity, Inbending
2.2 GeV, FTon		Mid-Late January	Various torus/solenoid combinations at 60% and 100% and both polarities
ECAL	2316-2319	1/14	dedicated configuration for ECAL calibration
Alignment / Empty Target	2467, 2443, 2449	1/20, 1/19, 1/19	0/0 torus/solenoid empty, 0/60% LH2, , 0/60% empty

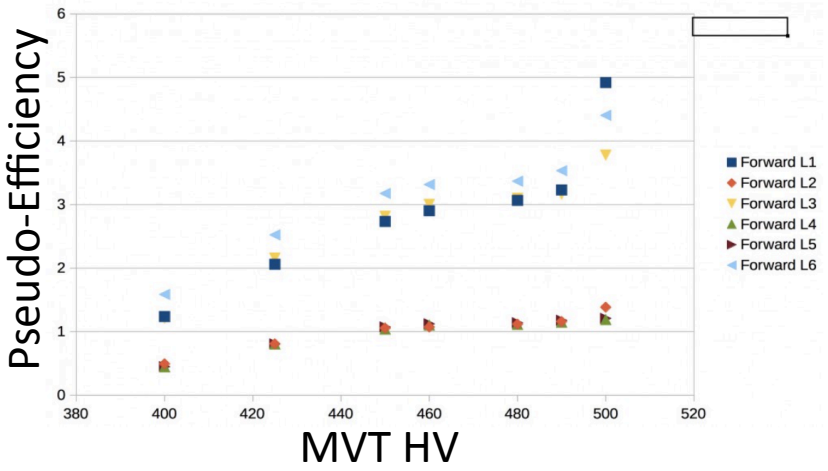
Hardware Settings Examples

Scan thresholds and high voltage settings, efficiency plateaus. Tune readout windows and latency, and offline time cuts, integration windows. Various opportunistic non-beam studies for DC and SVT to accommodate new noise effects.

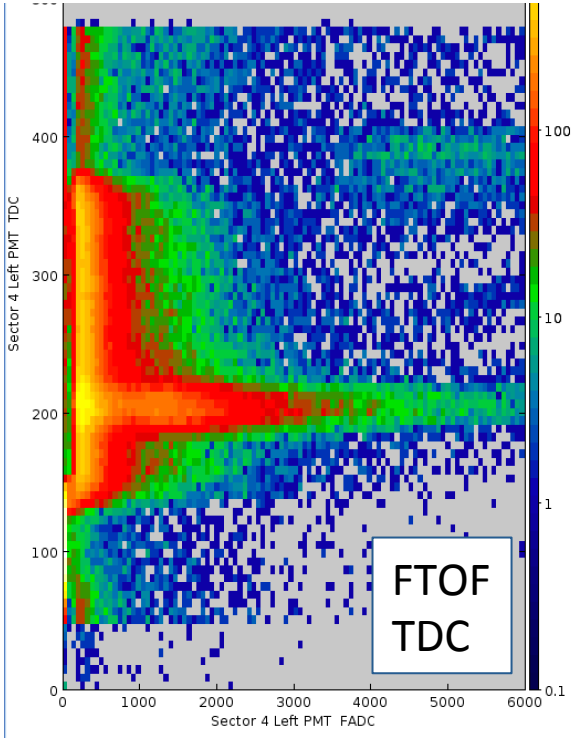








Hardware Settings Examples



Readout windows, trigger integration ranges optimized similarly for all PMT-based detectors. Loose enough to accommodate all trigger types.

FADC250 Settings for PMT-Based Detectors			
System	NSB	NSA	Threshold
EC	12	60	30, 60 (~1.5 MeV)
PCAL	12	156	60 (~1.5 MeV)
FTOF	8	28	60 (~1 MeV)
CTOF	12	60	60 (~0.5 MeV)
CND	12	60	60 (~1 MeV)

NSB/A: FADC number of samples Before/After pulse

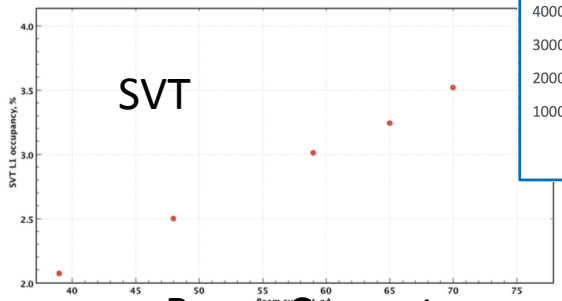
TDC1190 Settings for PMT-Based Detectors	
TDC readout window	500 ns

Luminosity Scans, Rate/Occupancy Studies

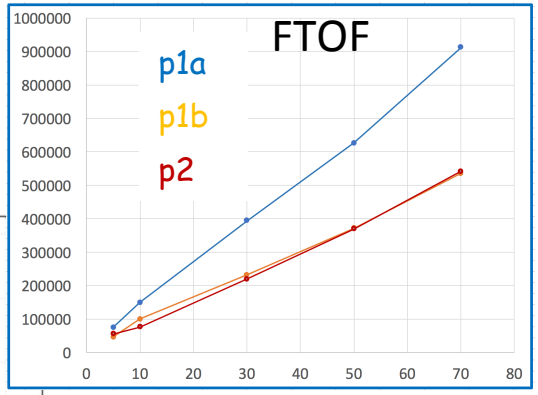
Rates and occupancies compare well with simulation (accounting for slightly different settings, e.g. window sizes, thresholds) and scale linearly with current. Used online slow controls scalers / ced / for many detectors.

DC Occupancies

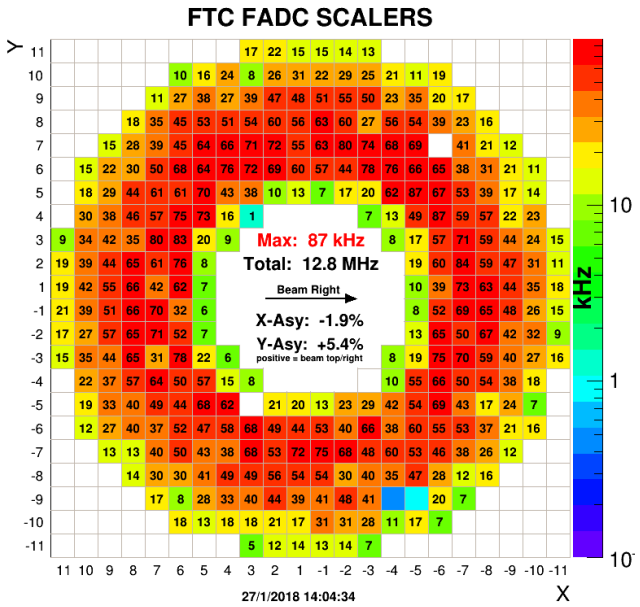
	Data (measured)	Data (rescaled)	GEMC
R1	1.7 %	1.7 %	1.12 %
R2	0.6 %	0.3 %	0.44 %
R3	1.4 %	0.9 %	0.73 %

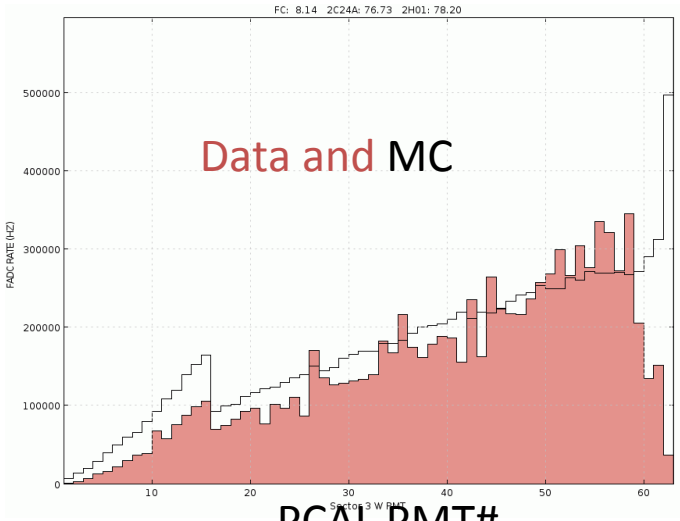


Beam Current



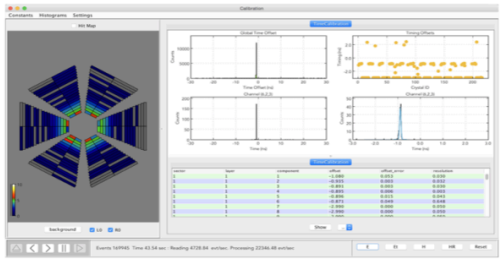
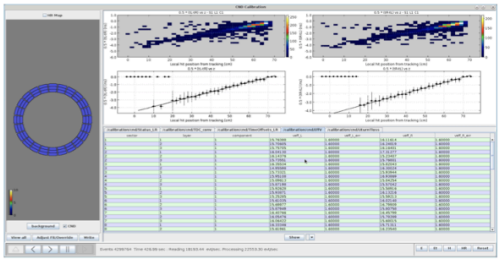
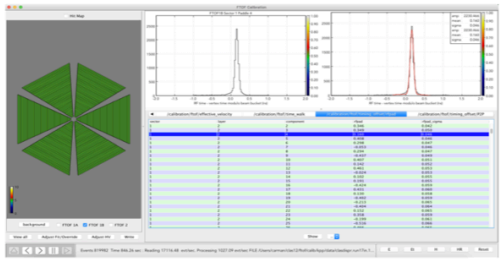
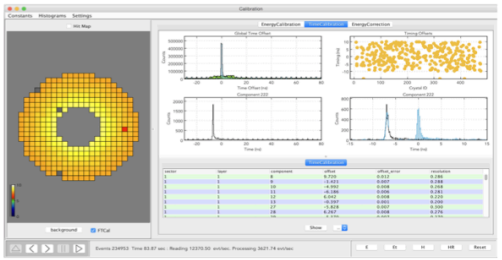
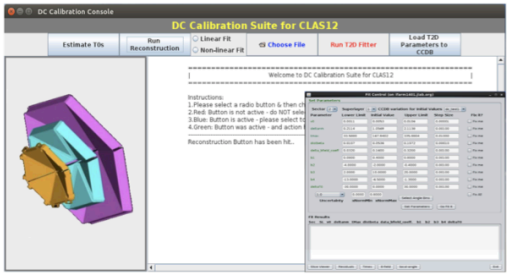
Beam Current

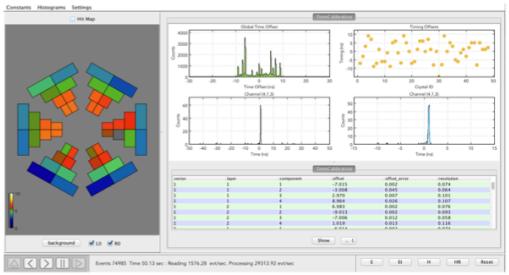
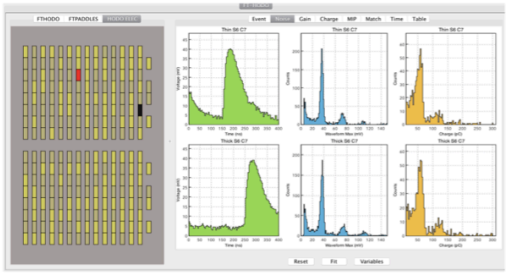
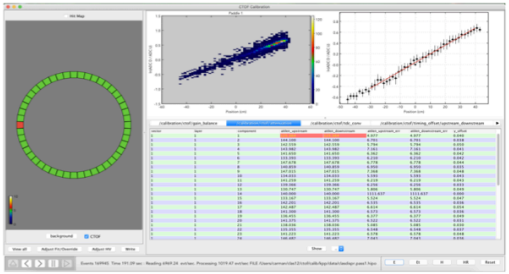




PCAL PMT#

Calibrations

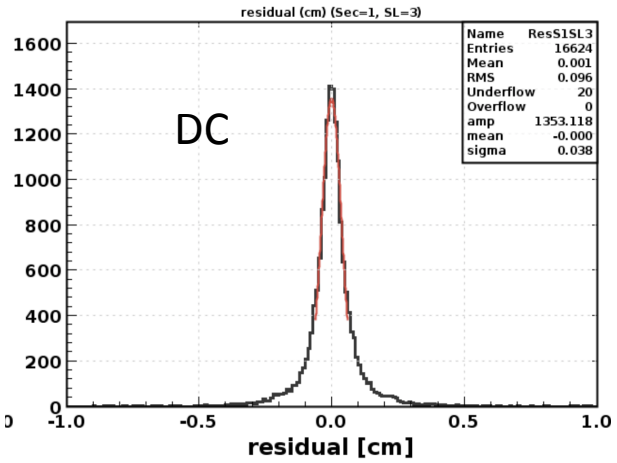
Subsystem calibration and commissioning studies well underway for different field and luminosity conditions for:

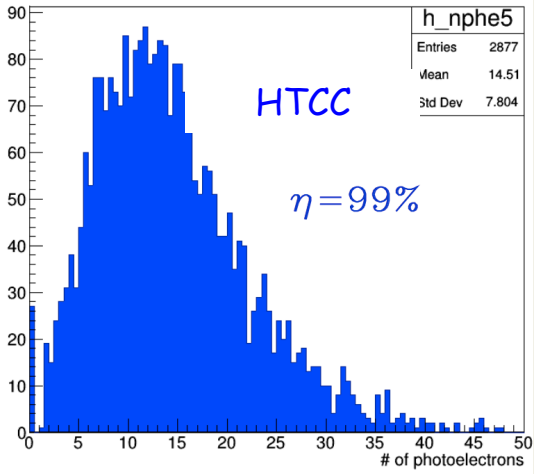
- 2.2 GeV
- 10.6 GeV

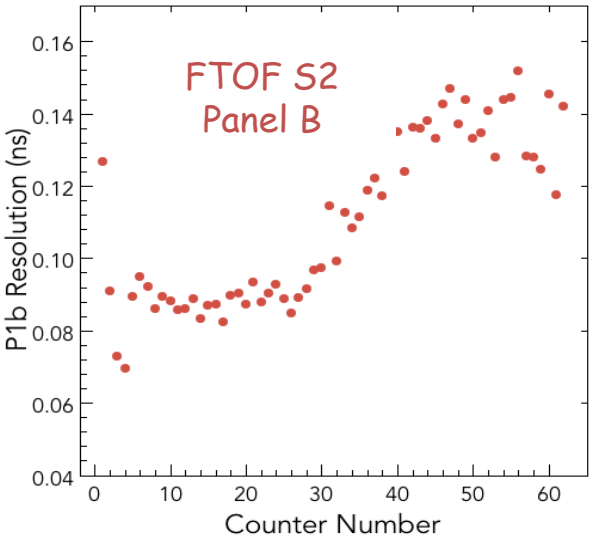
for

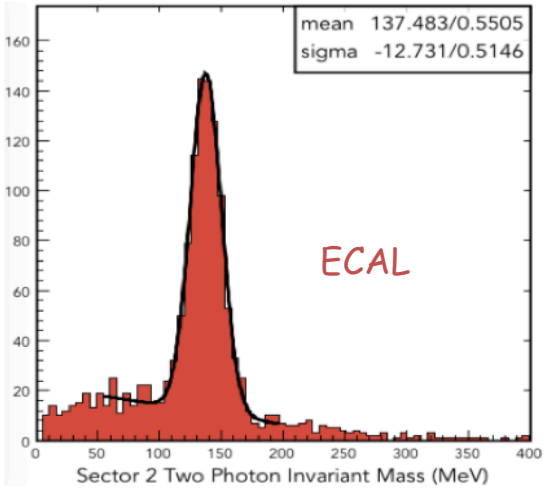
- CND
- CTOF
- DC
- ECAL
- FT (Hodo, Trk, Cal)
- FTOF
- HTCC
- LTCC
- MM (FMT, BMT)
- RICH
- SVT

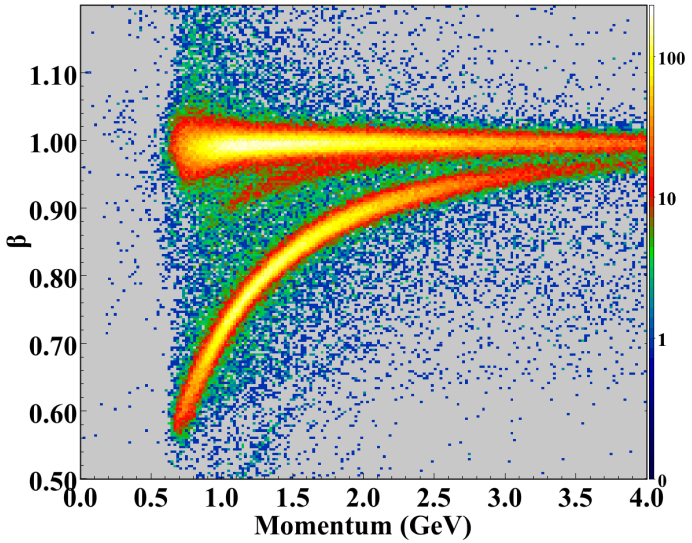
Some Calibration Results

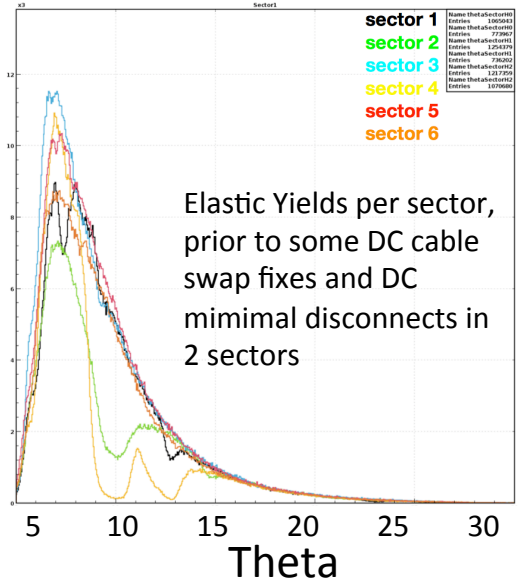












Conclusion

- Analysis of luminosity and field scans for understanding backgrounds
- Detector performance studies for different fields and luminosity in progress
- Partial calibration performed in semi-real time (DC, FTOF, CTOF, HTCC, FTCal, FTHodo, CND, ...)
- Work continuing under supervision of CalCom group (Friday meetings)
- Calibration work presently focused on RG-A data to provide feedback to data taking and support first analyses
- See the many, many talks today for details on each subsystem, topic, study … !