Forward Tagger Status

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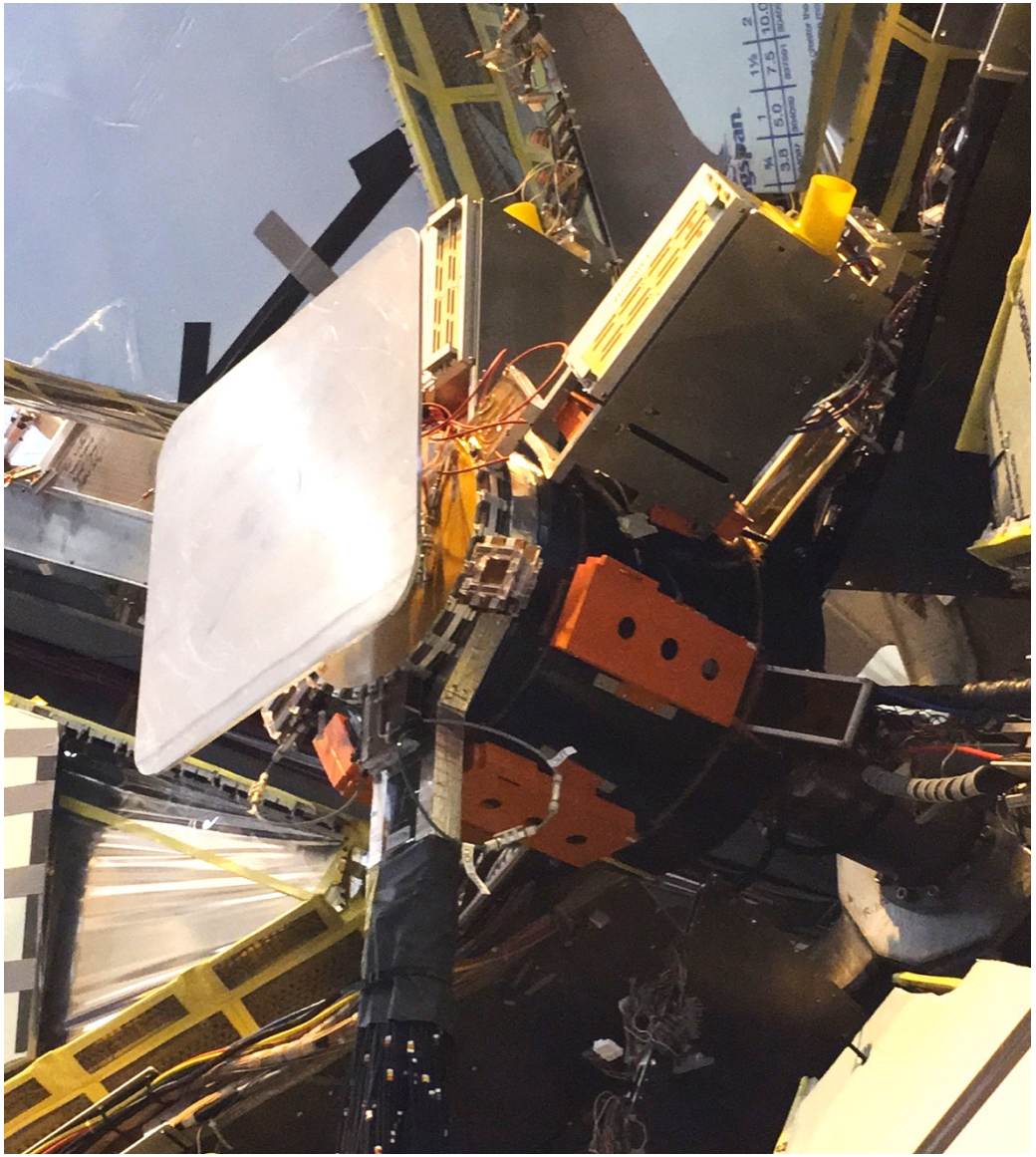
On behalf of the FT team
CLAS12 First Experiment Workshop
March 6th, 2018

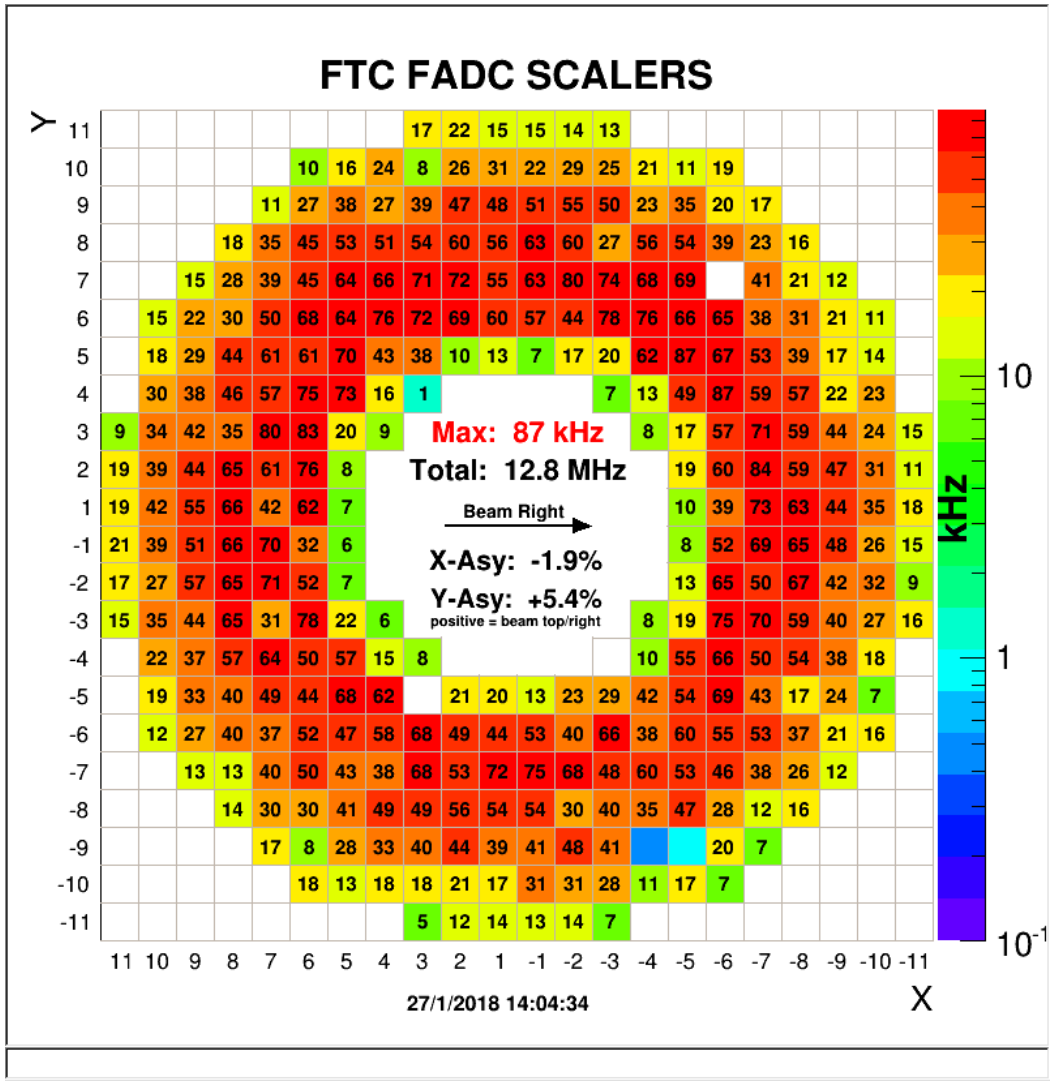
FT Status

All three detectors fully operational

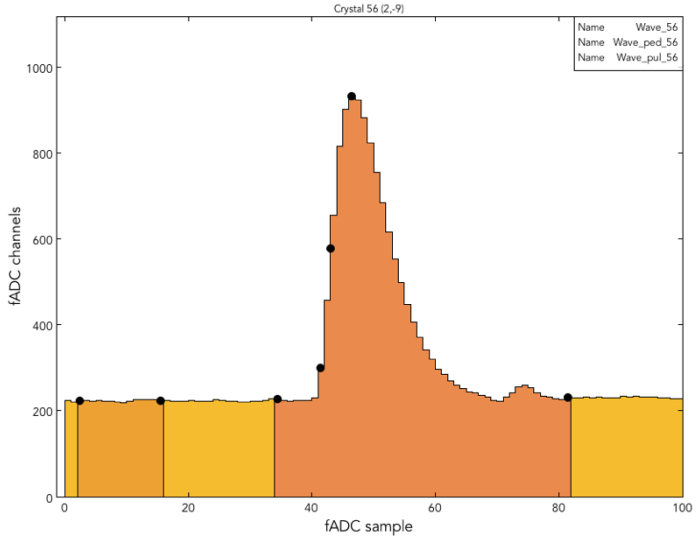
- **Calorimeter**:
  - Cooking circuit leak developed in December repaired early January
  - Calorimeter operated at 20 C
  - In data taking mode since beginning of January run
  - Readout settings optimized
  - Cluster trigger commissioned and now in use
- **Hodoscope**:
  - Detector fully operational
  - HV and Readout settings optimized
  - SiPM gains dependence on luminosity detected and corrected for (room for hardware improvement)
- **Tracker**:
  - Gas leak detected in one of the two detectors in December
  - Detector replaced with spare early January
  - Full tracker, 2 double-layer detectors in operation with only few noisy channels
  - HV and readout settings optimized
  - One gas flowmeter to be replaced after the run



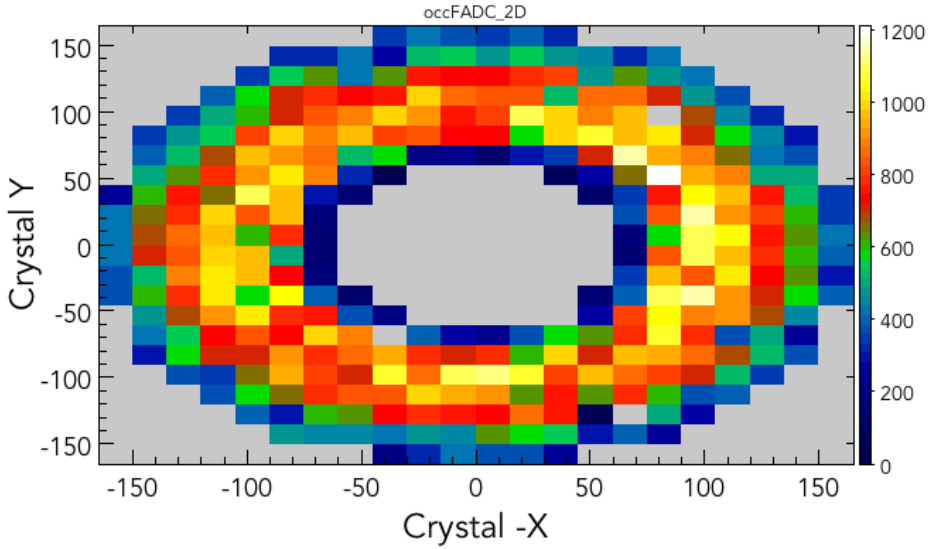
FT Calorimeter readout parameters

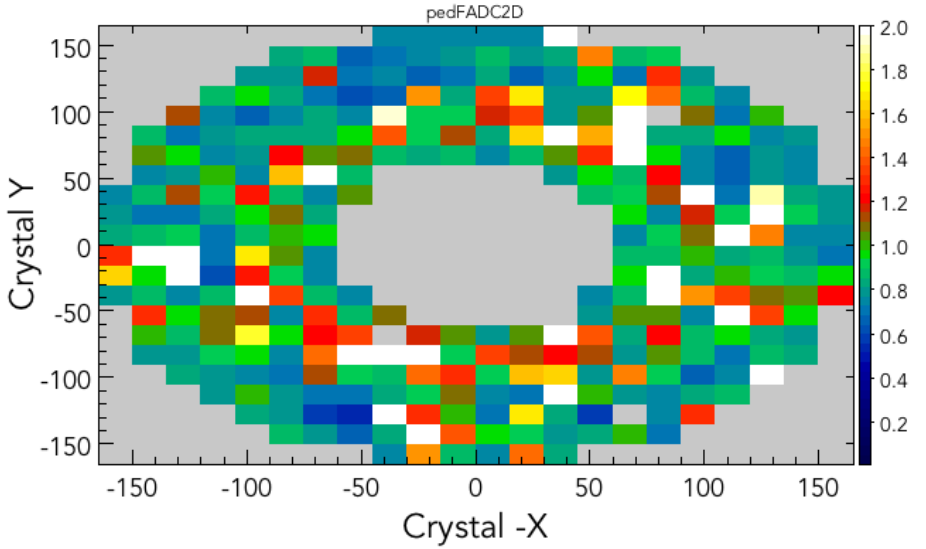


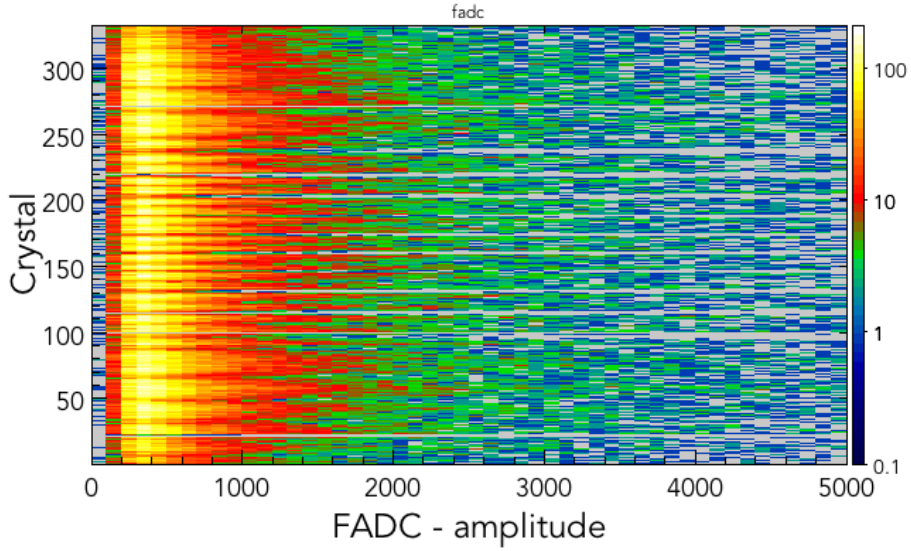
- HV: voltages sets by design for LAAPD gain of 150
- TET: set to 15 since 2/1, corresponding to ~12 MeV (10 MeV by design)
- NSB, NSA: 20 ns,120 ns in both offline and online
- Windows offsets adjusted (FADCs/VTP)
- Window width: 400 ns
- 6 dead channels, 3 reparable

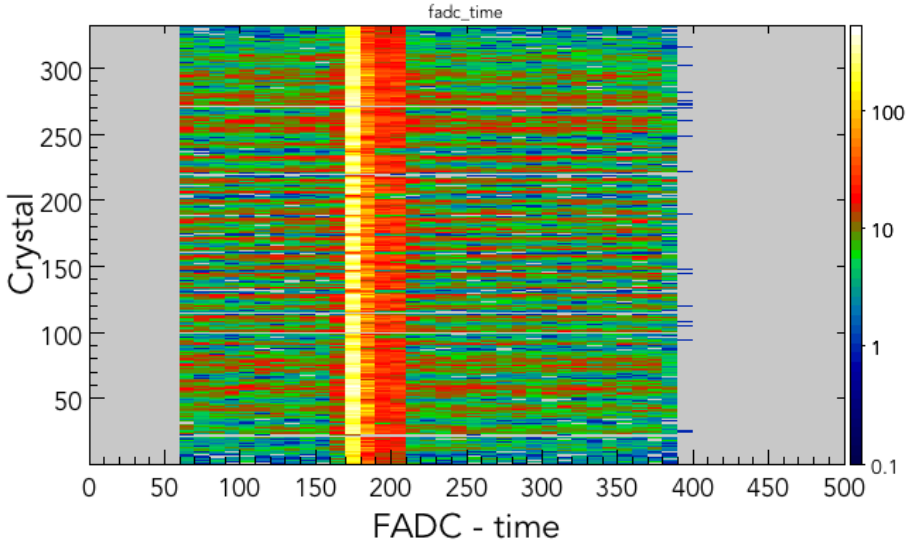


FT Calorimeter readout parameters

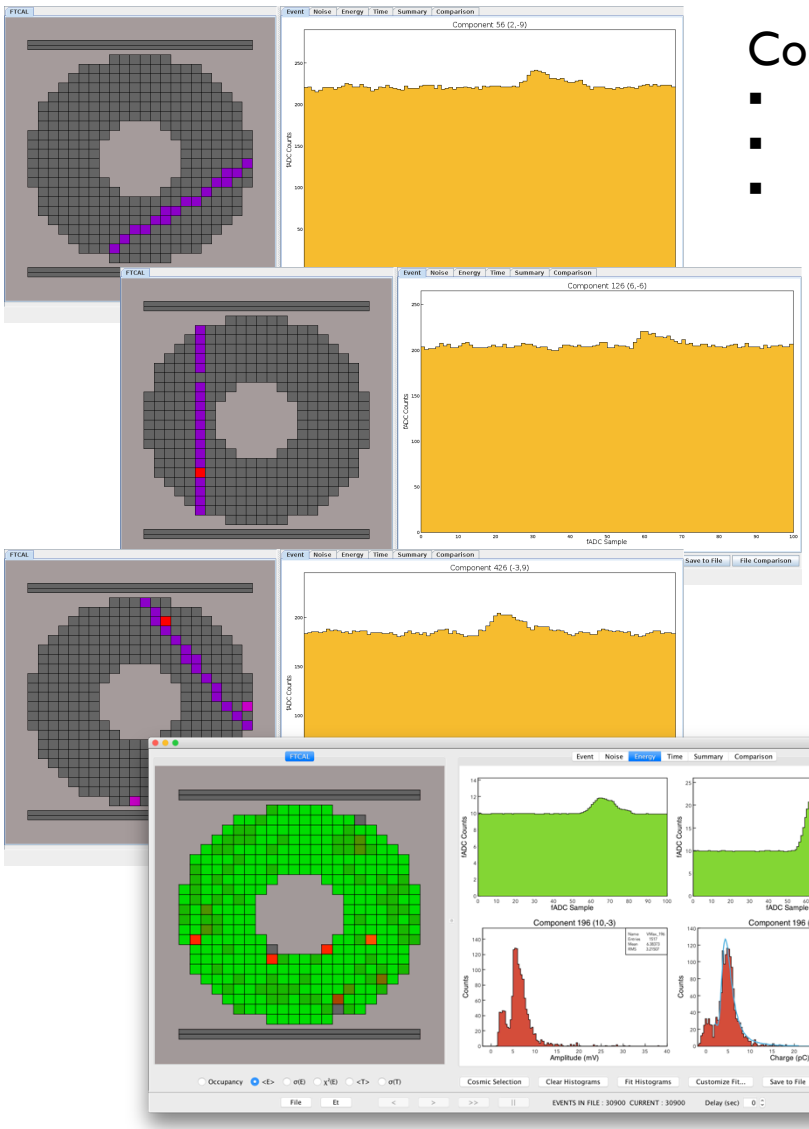








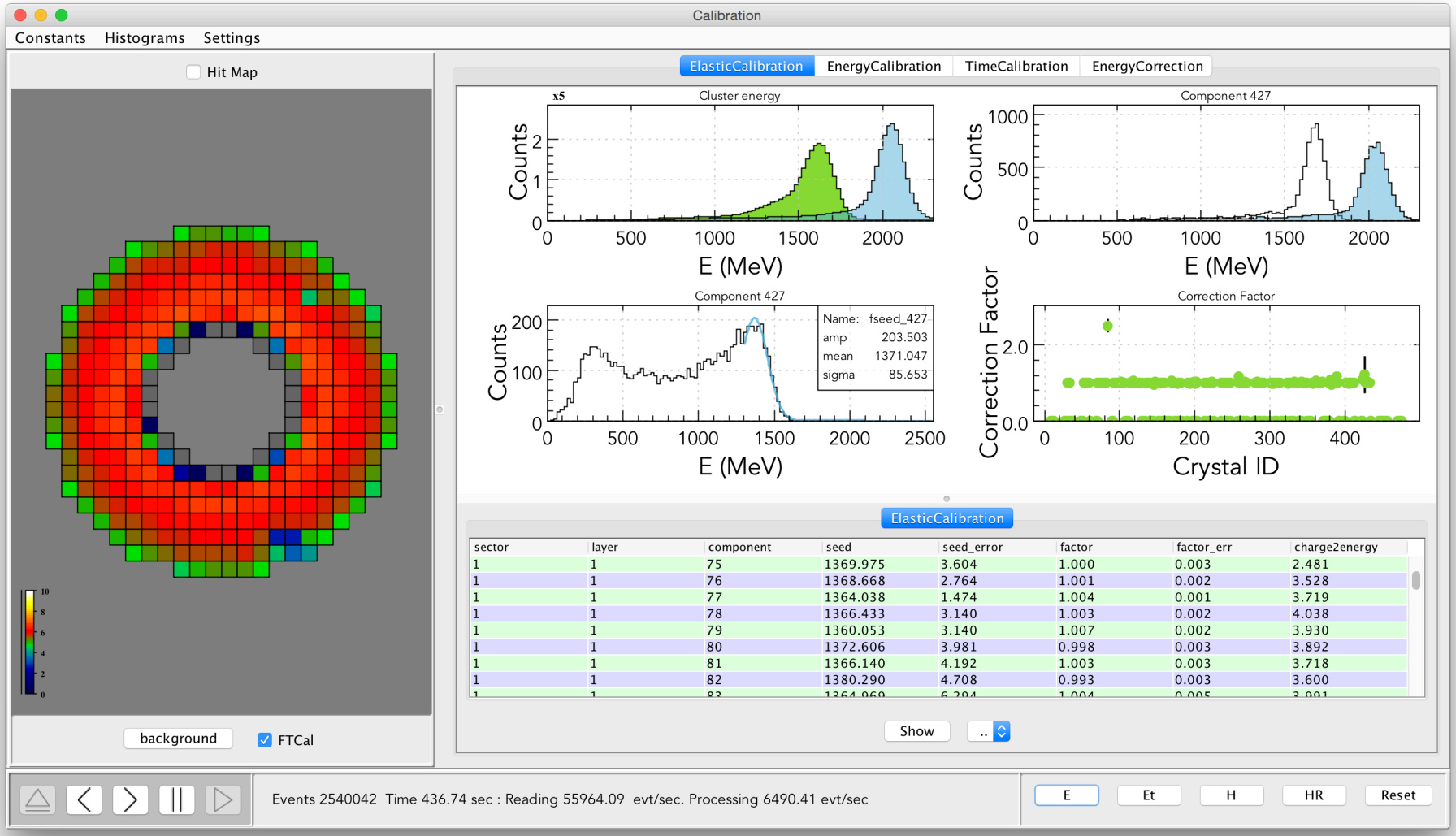
FT Calorimeter cosmic calibrations



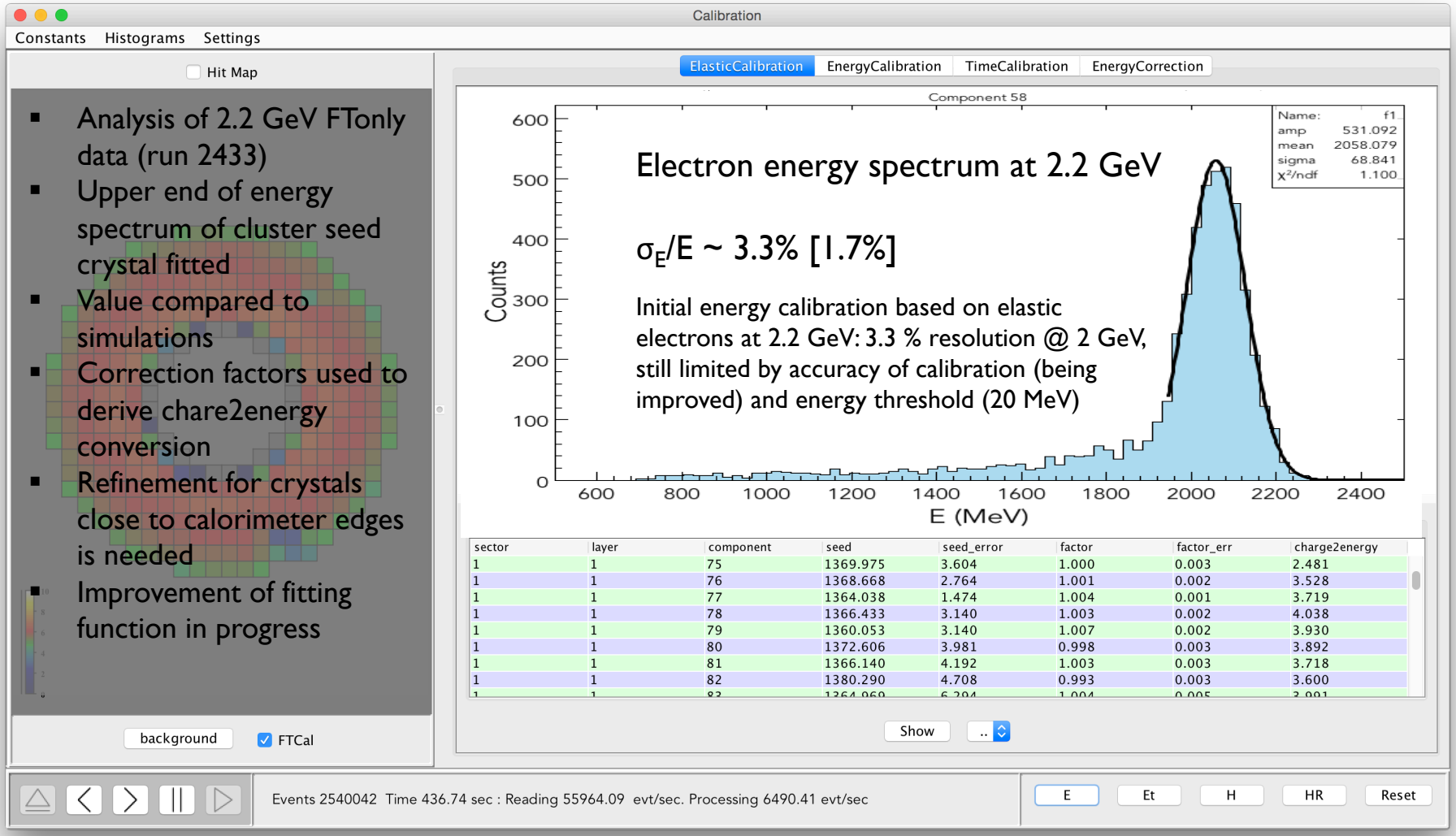
Cosmic data taking with FT-Cal:

- FT-Cal self trigger based on OR of fADCs majority signal
- Noise level fully consistent with EEL measurements
- FT-Cal response as expected

FT Calorimeter elastic calibrations

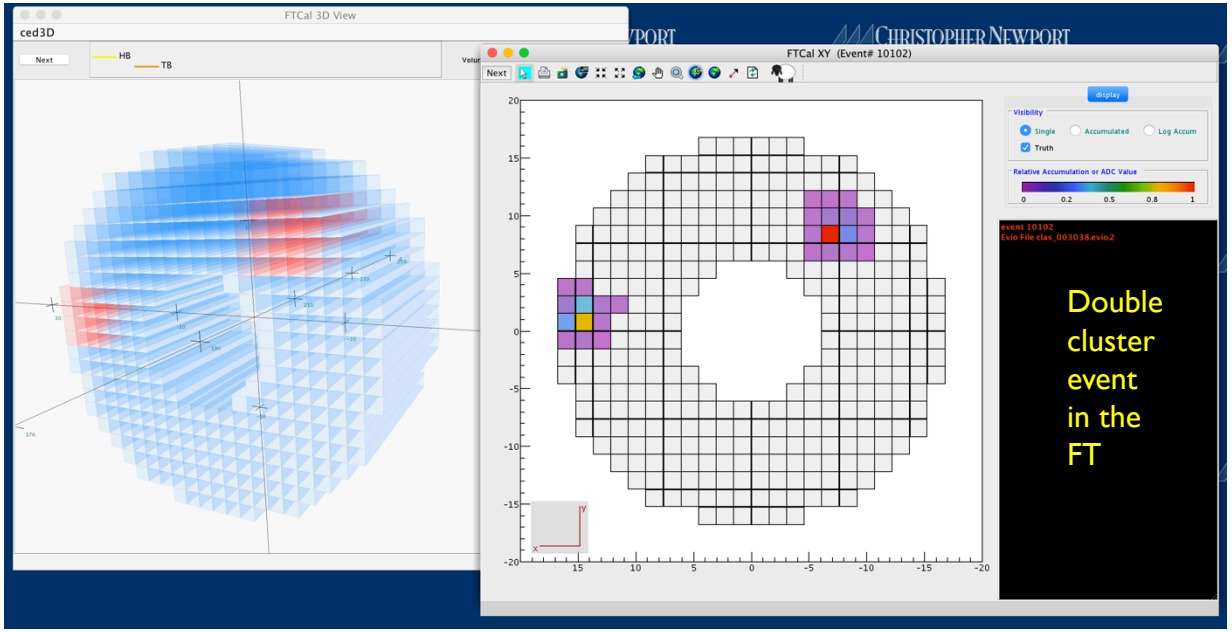


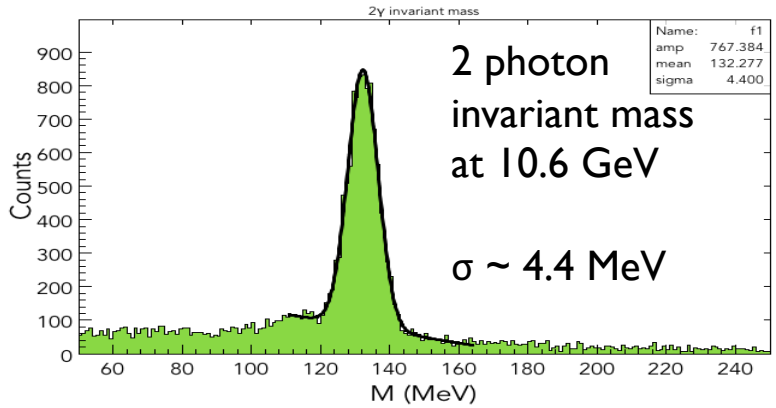
FT Calorimeter elastic calibrations



Constants in CCDB, in use (online/offline) since 2/20

FT Calorimeter: pi0 reconstruction





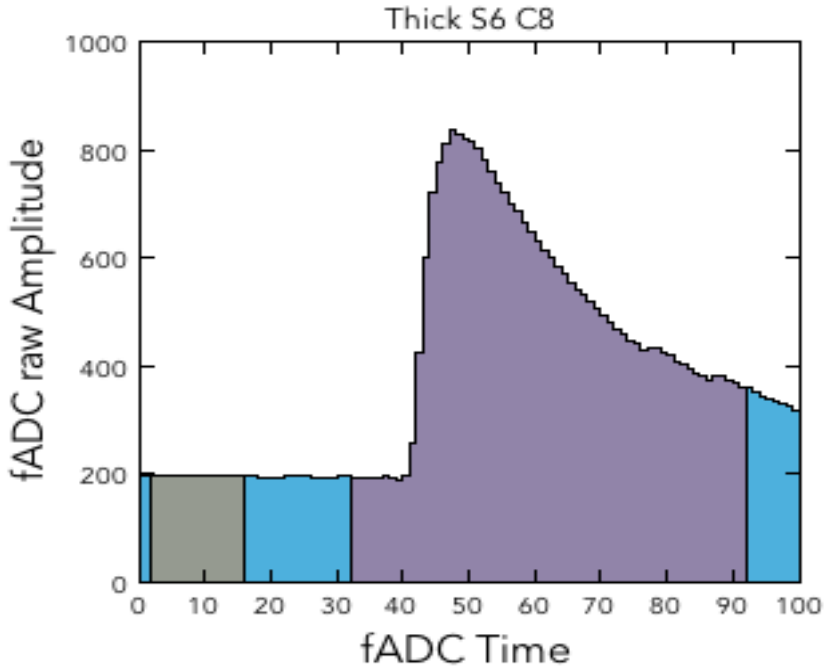
Elastic electron calibration constants presently applied to all runs since 2284 (beginning of 2.2 GeV)

Effect of new calibration tested at 10.6 GeV looking at pi0 reconstruction

2 photon events selected from FT trigger events

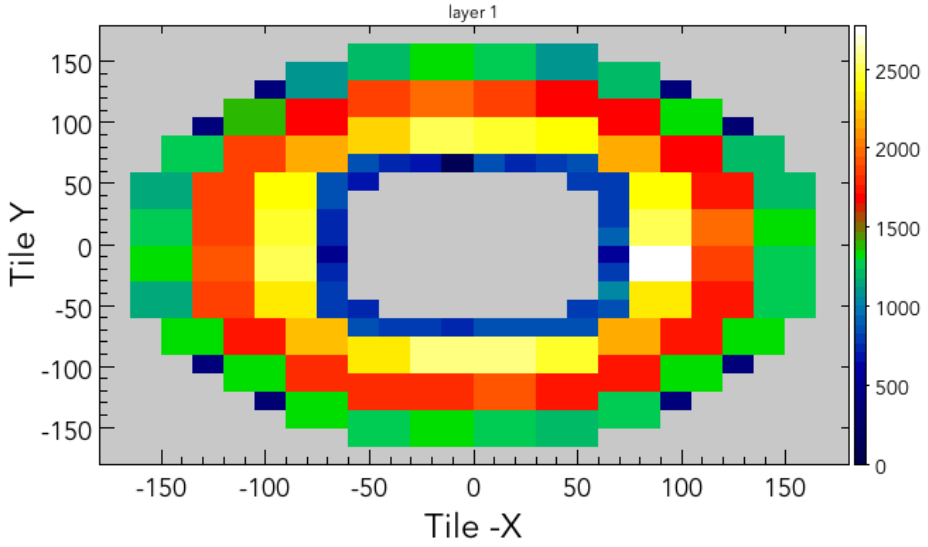
Hodoscope used as a veto to exclude charge particle clusters

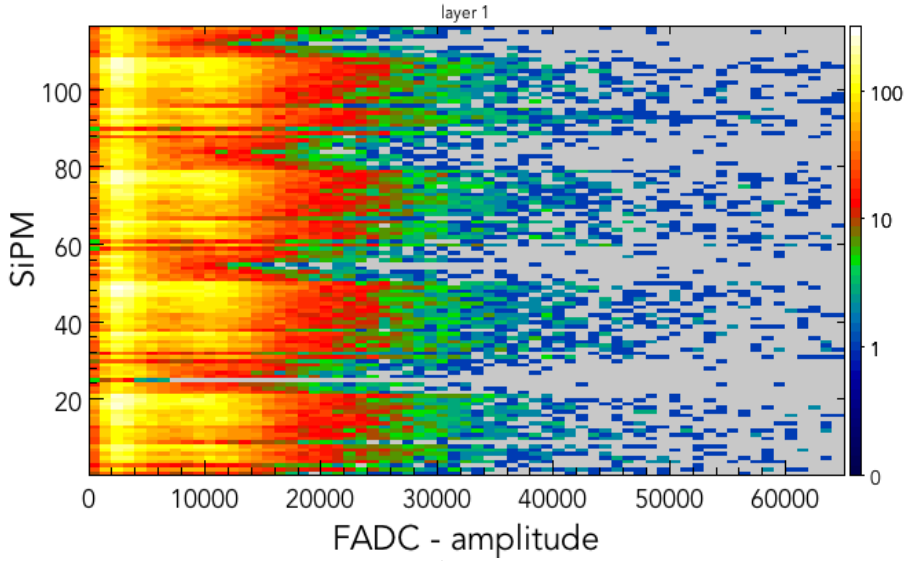
FT hodoscope HV and Readout settings

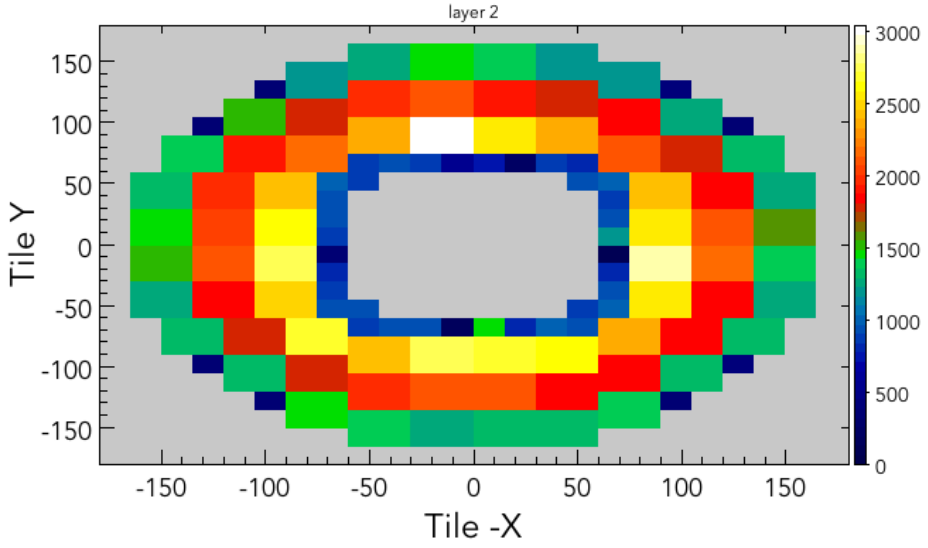


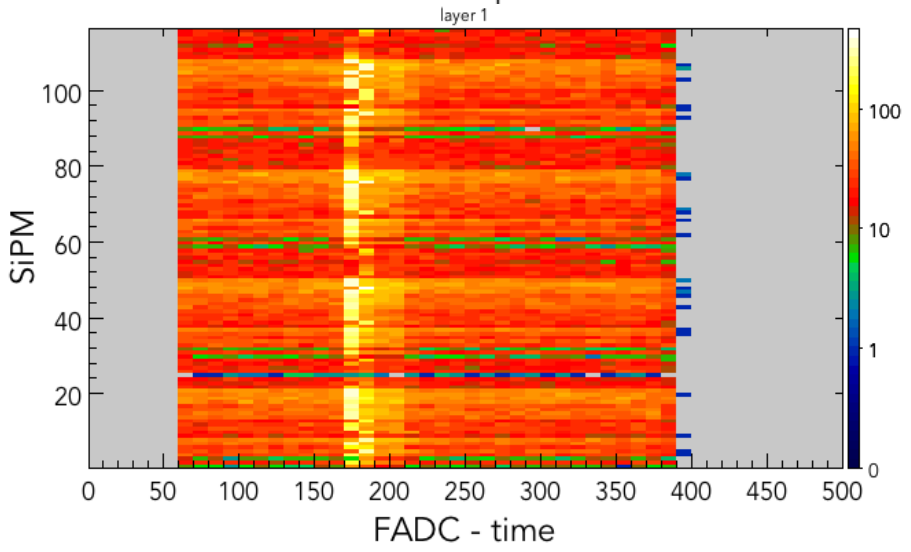
- HV: gain matching base on MIPs, final value selected to have acceptable currents at full luminosity
- TET: set to 50 since 2/1, corresponding to ~5 photoelectrons, good noise suppression while preserving small signals
- NSB, NSA:
  - Online: 10 ns, 50 ns to get the peak height
  - Offline: 16 ns, 200 to integrate full pulse for charge determination
- Windows offsets adjusted
- Window width: 400 ns
- All channel operational

FT hodoscope HV and Readout settings

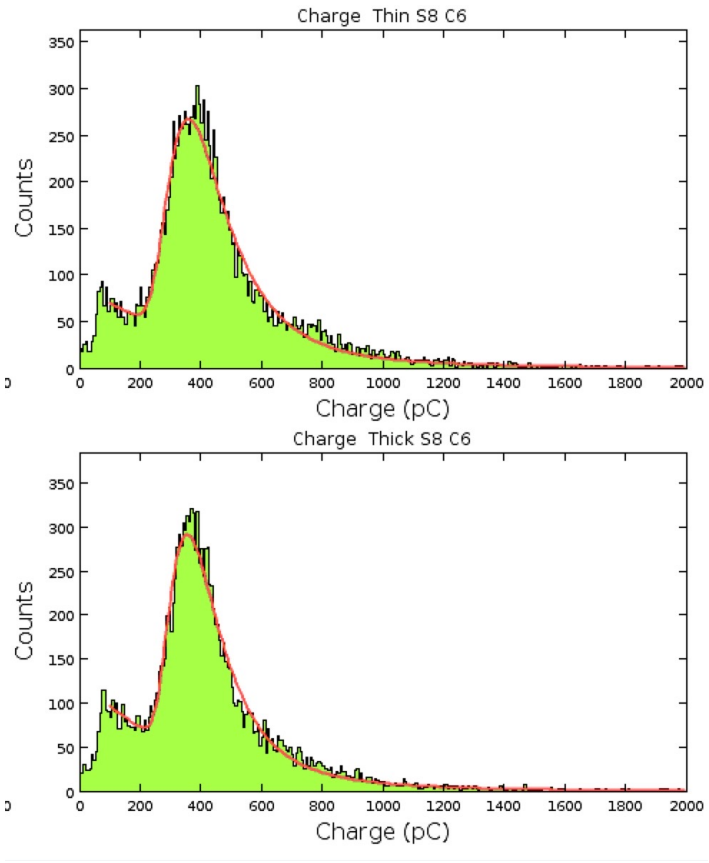


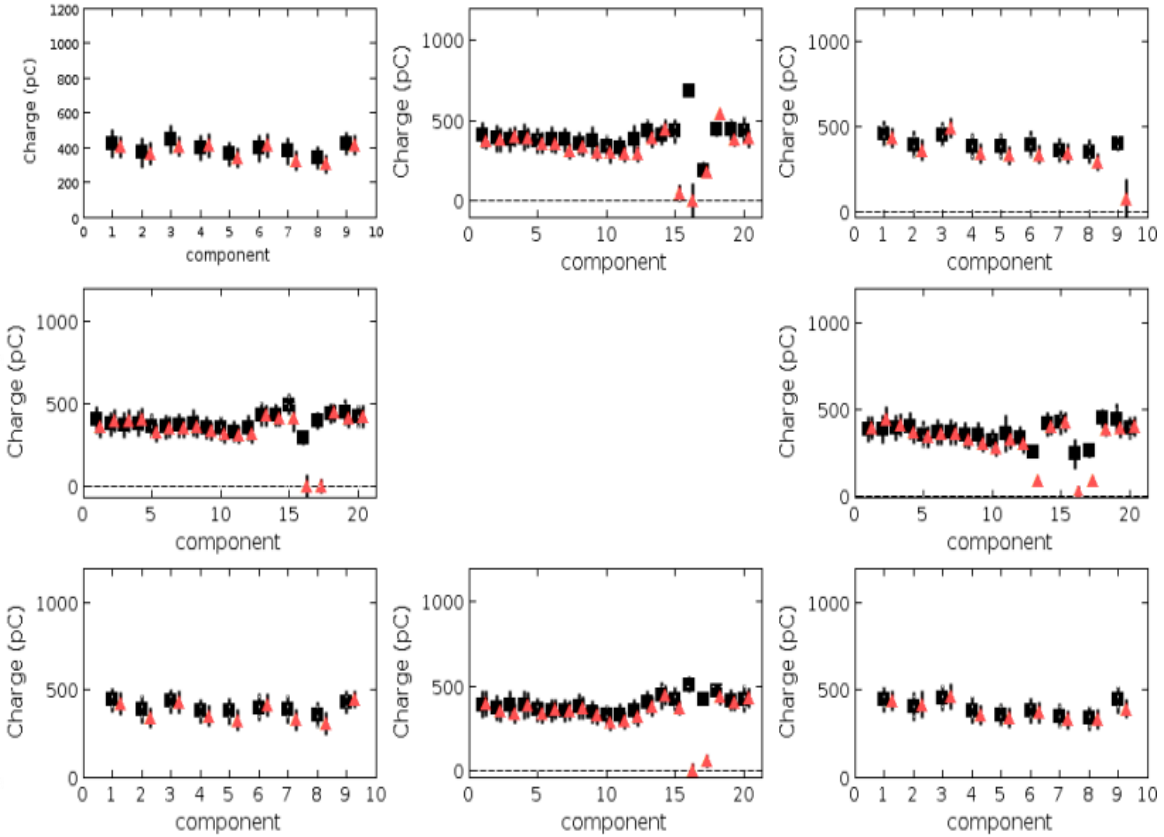






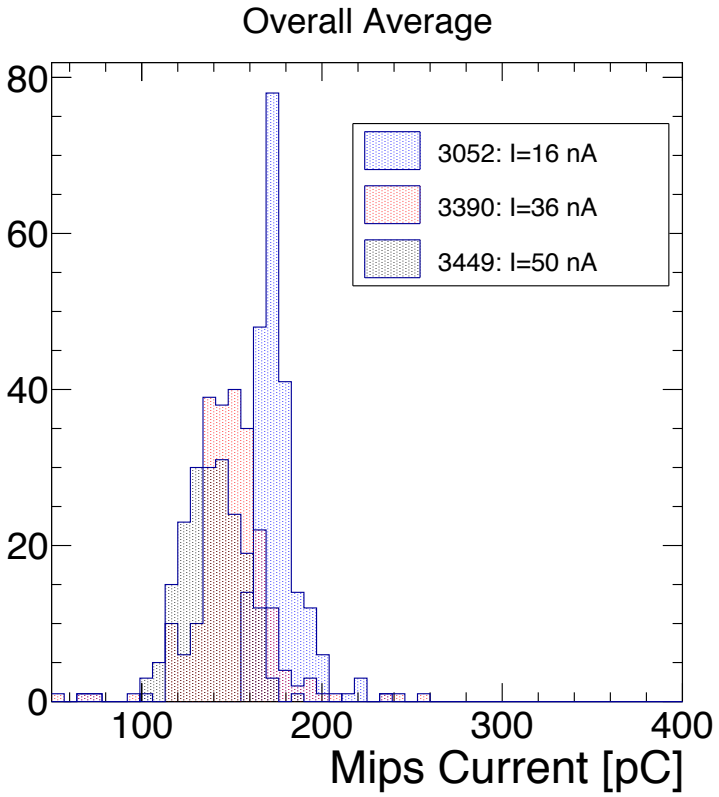
FT hodoscope calibration

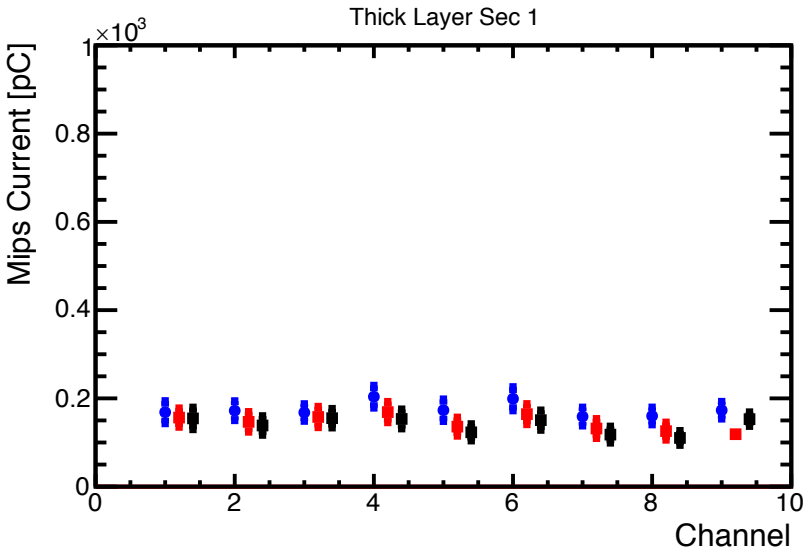


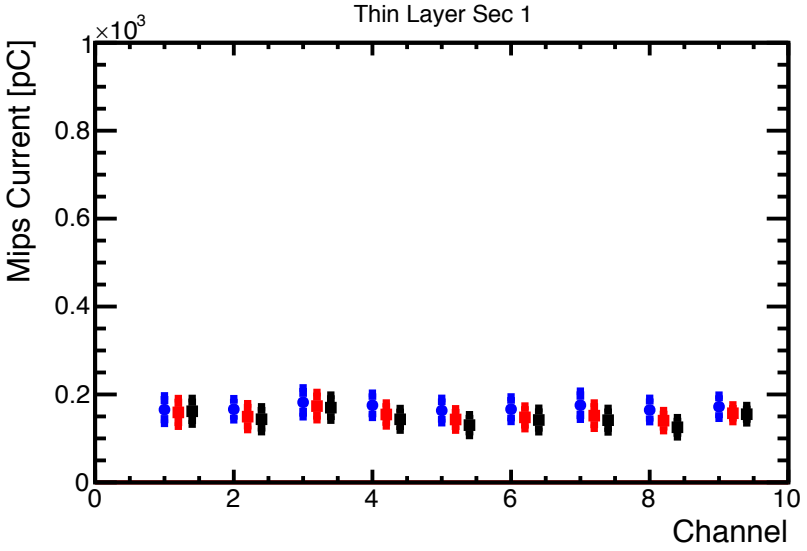


- Charged particles selected by requiring hits in matching tiles
- Charge distribution fitted with a Landau + exponential function to extract the peak position
- Analysis done with both nsa/nsb for offline (CCDB) and online (trigger gains)

FT hodoscope calibration

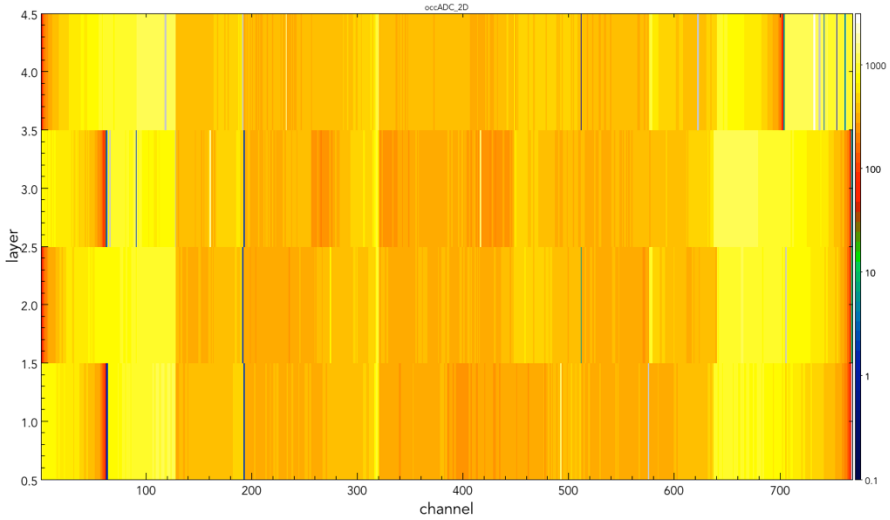






- Reduction of MIP signal observed for increasing luminosity, due to the sizeable current across the SiPM polarization circuit (induced by converted scintillation light!)
- Calibration has to be performed for each luminosity setting

FT tracker HV and readout settings

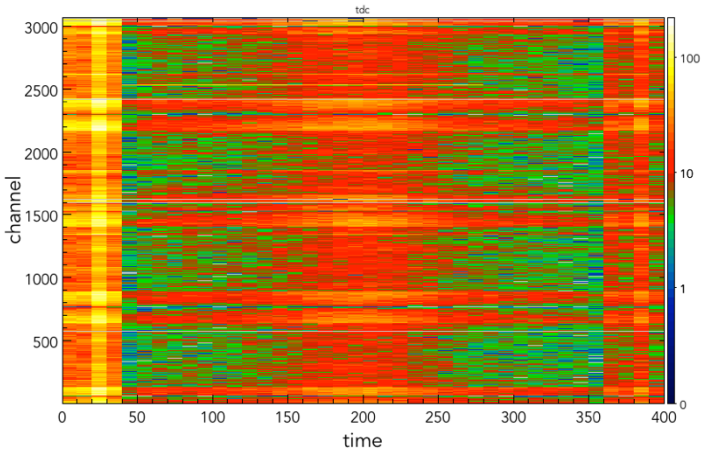


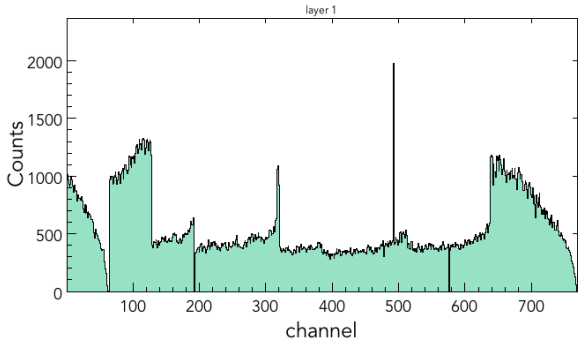
Almost 100% channels operational:

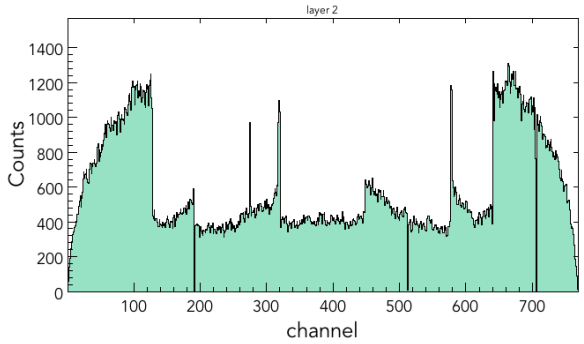
- Few dead channels
- Few noisy channels

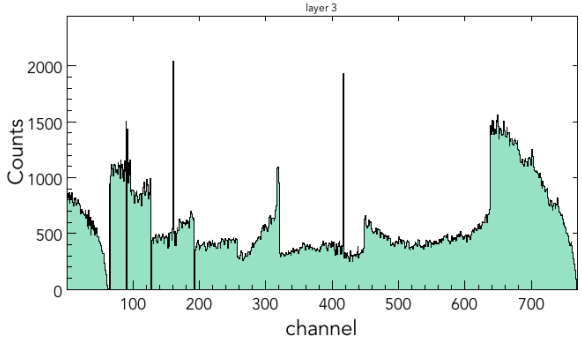
Occupancy plots indicate issues with translation table that needs to be corrected

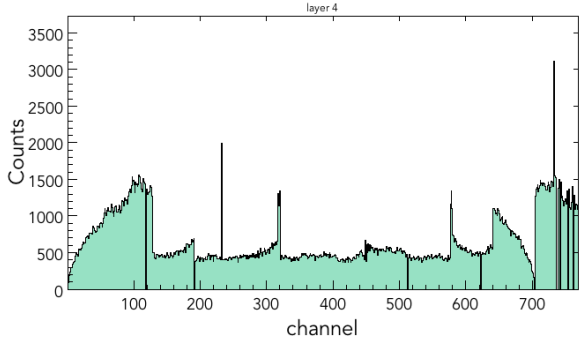
Readout window offset optimized





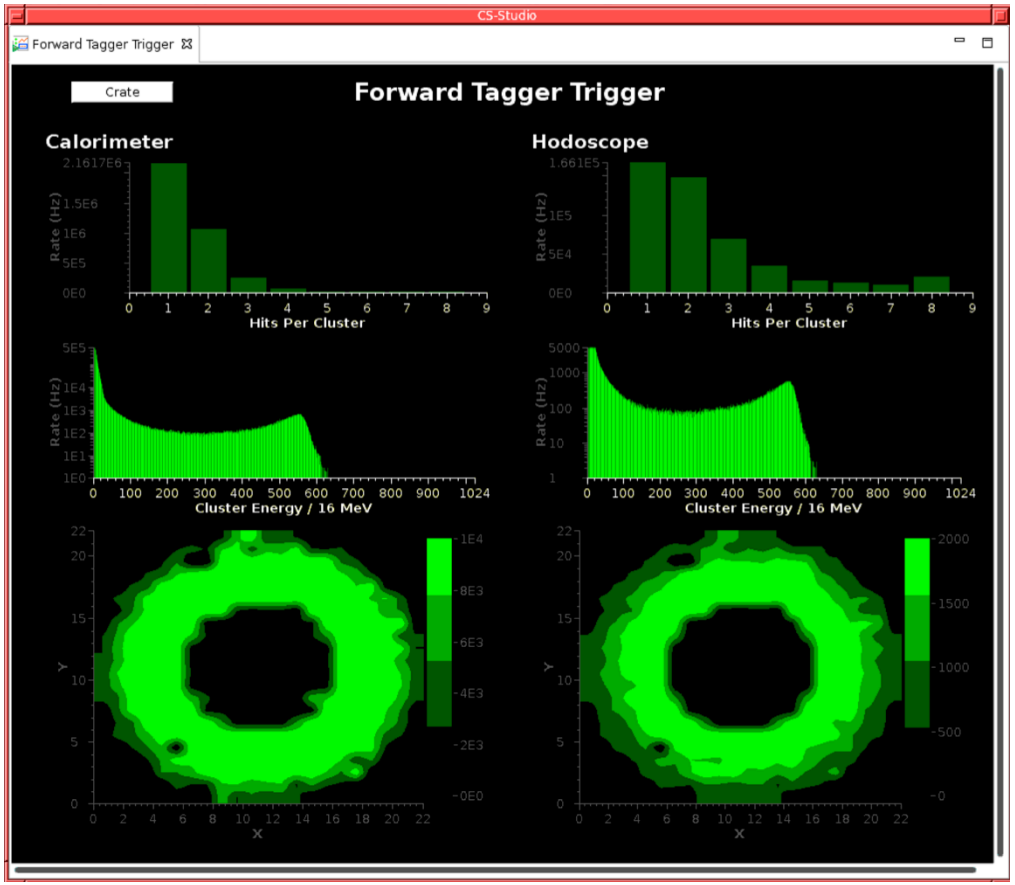






FT Trigger

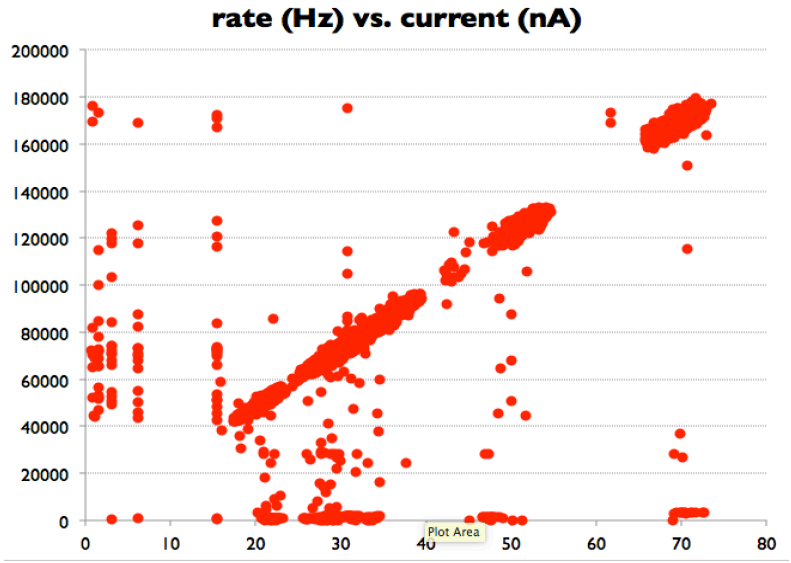
- FTCal trigger operational:
  - Clustering in 3x3 matrix, with selection of seed energy and cluster size
  - New fADC gains based on elastic electron calibration at 2.2 GeV
  - Selected cluster energy range: 300-4000 MeV
  - Check trigger: 100-10000 MeV
- FTHodo trigger operational:
  - Hits in the two layers matching the FTCal cluster position
  - New fADC gains based on MIPs calibration
  - Selected threshold: 0.25 MIP
  - Need to retune gains at the final luminosity

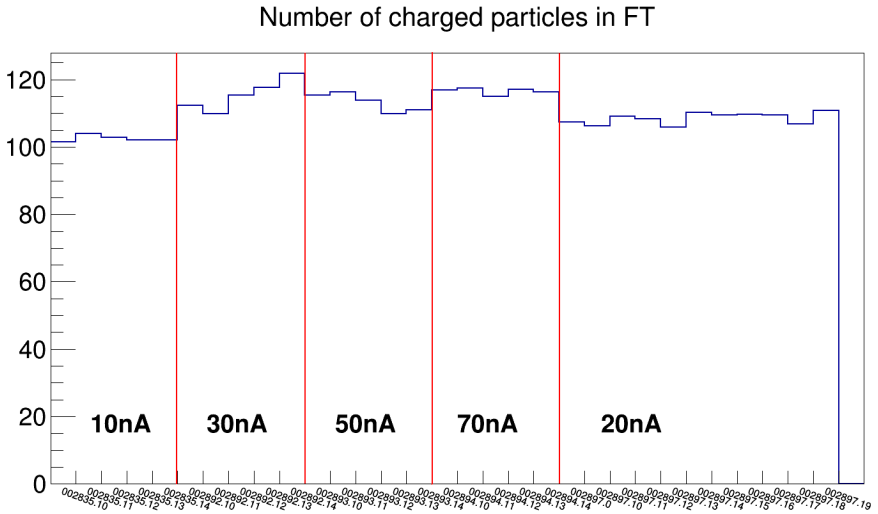


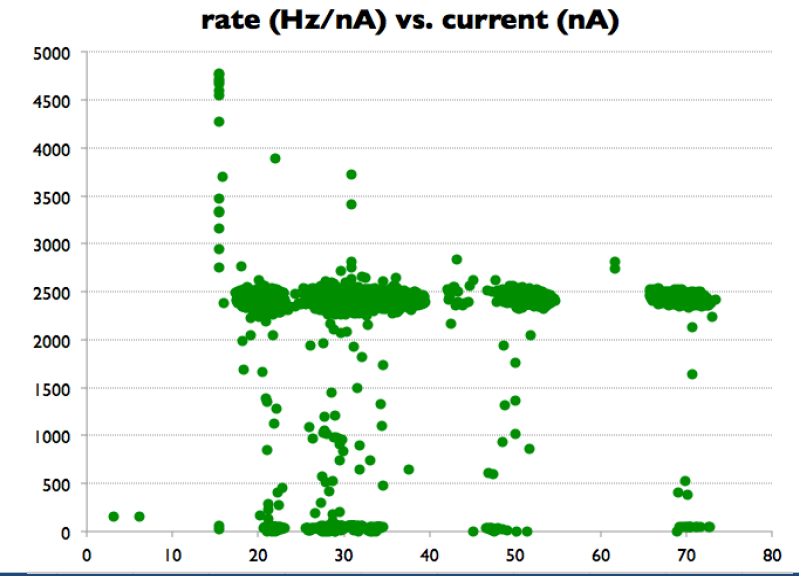
FT L1 trigger fully debugged (data / firmware simulations). Efficiency higher than 99% over full energy range.

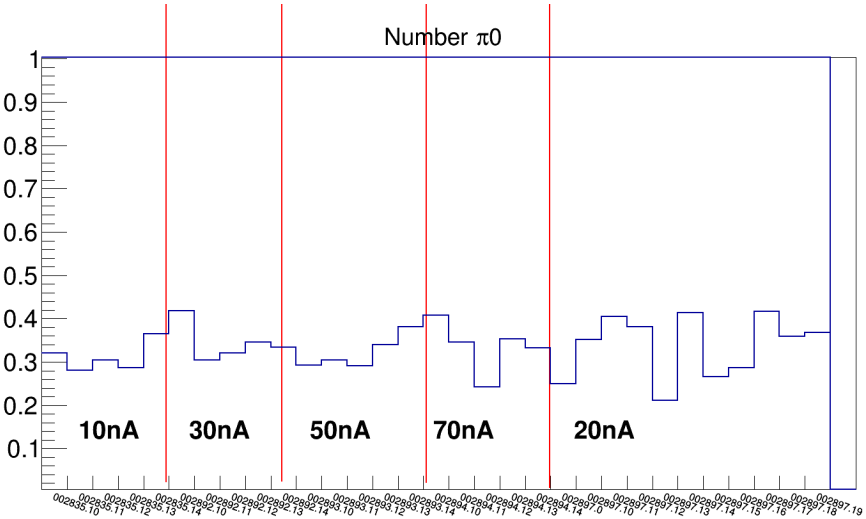
Thanks for your attention

FT performance vs. luminosity









FT tracker HV and readout settings

HV scan performed at different luminosities

Cluster Multiplicity dependence on HV used to to identify optimal settings

Conditions:

- 10.6 GeV
- 5 to 70 nA
- electron trigger and only electron trigger bits
- Premix gas flow set at 3 L/h