# CalCom Activity Report

## CLAS Collaboration Meeting

### June 14, 2017
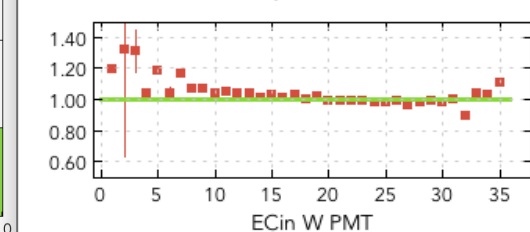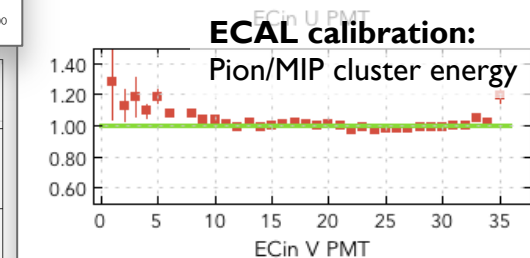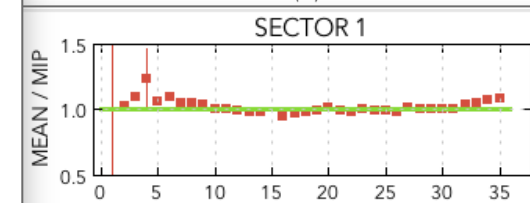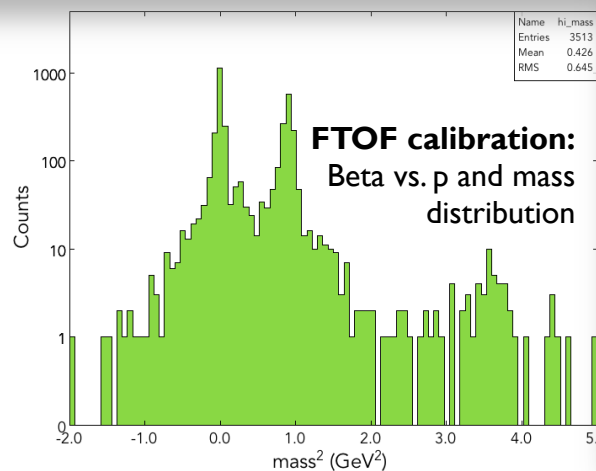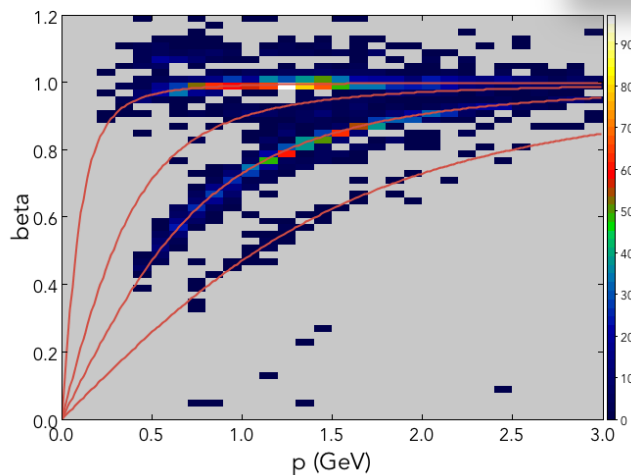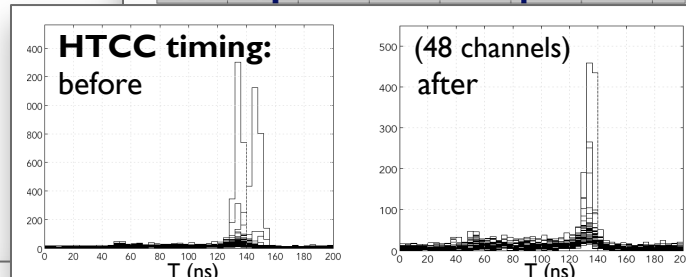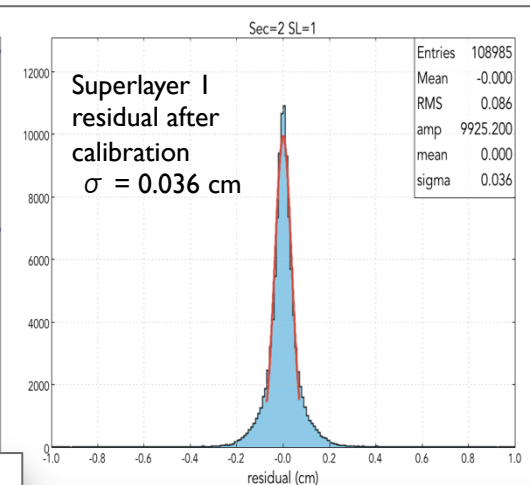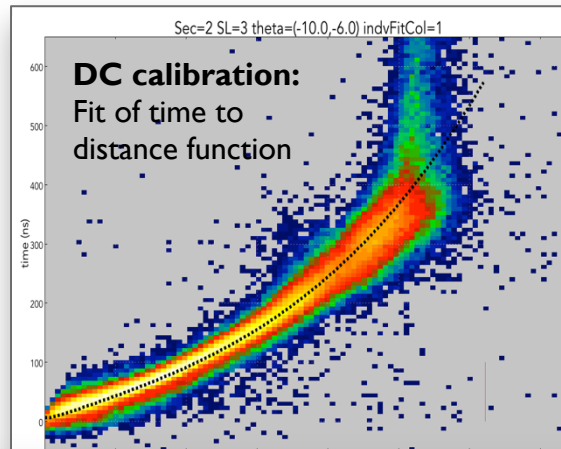
# Outline

- KPP data calibrations

- Calibration and monitoring suites development

- Plans for the next months

Check presentations in yesterday First Experiment Workshop for more details

# Calibration of KPP Data

- Continuous progress on KPP data calibration for all detectors:
  - ECAL cosmic gain calibration cross checked with pions, timing calibration started
  - Full calibration of FTOF done, improvements to reach ultimate resolution in progress
  - DC calibration step sequence developed and implemented, now under test
  - HTCC calibration extended to include timing



**DC calibration:** Fit of time to distance function

Sec=2 SL=3 theta=(-10.0,-6.0) indvFitCol=1

Sec=2 SL=1

Superlayer 1 residual after calibration
$\sigma = 0.036$ cm

| Entries | 108985 |
| Mean | -0.000 |
| RMS | 0.086 |
| amp | 9925.200 |
| mean | 0.000 |
| sigma | 0.036 |

**HTCC timing:** before

(48 channels) after

**FTOF calibration:** Beta vs. p and mass distribution

| Name | hi_mass |
| Entries | 3513 |
| Mean | 0.426 |
| RMS | 0.645 |

**ECAL calibration:** Pion/MIP cluster energy

SECTOR 1

ECin U PMT

ECin V PMT

ECin W PMT

# ECAL: Calibration and Monitoring Suite

## ECMON:
- Combined calibration and monitoring suite
- Latest developments:
  - Timing calibration development started (Josh, Andrey).
  - EVIO/ET to HIPO decoding implemented in GUI to save time and conserve disk space for cosmic runs.
  - Common visualization of FADC, TDC timing to better understand backgrounds, multi-hits, threshold settings.
  - CCDB Status tables to record run-dependent occupancy issues (ADC, TDC, CABLE, HV, NOISE).
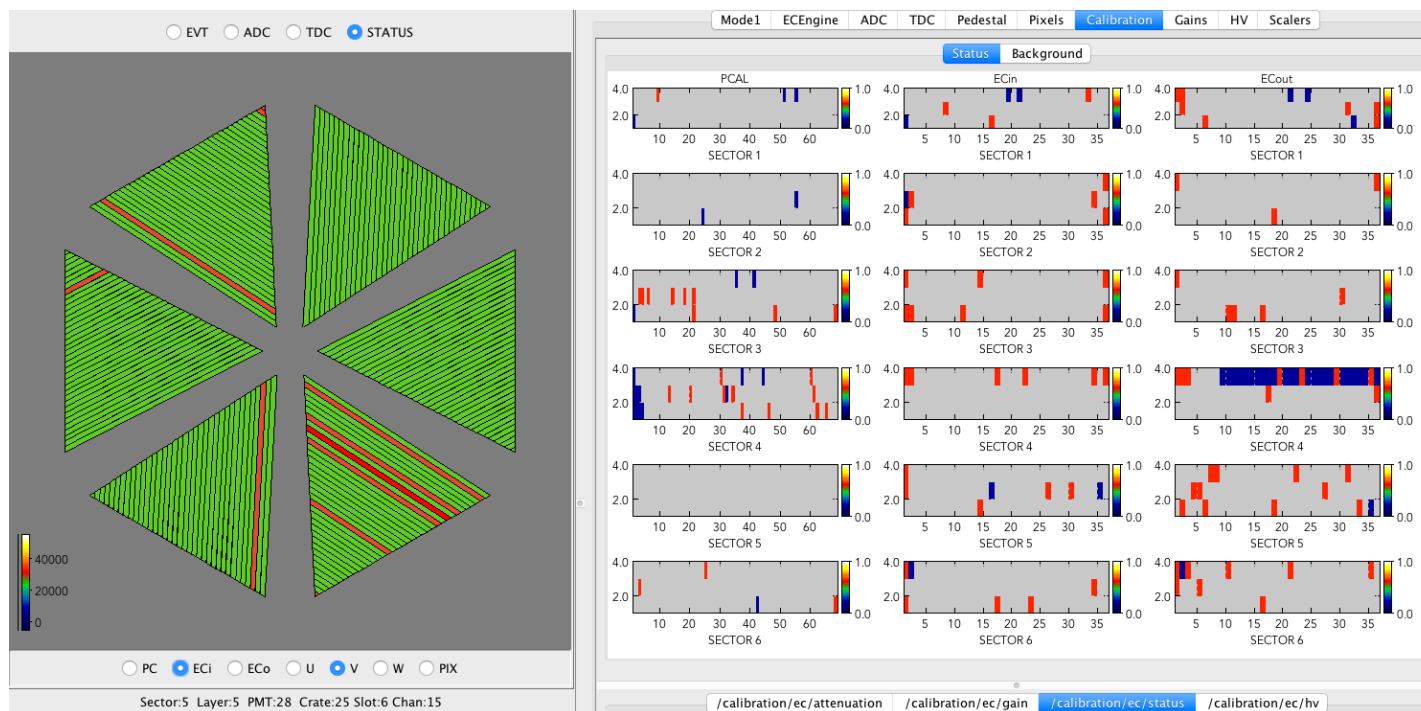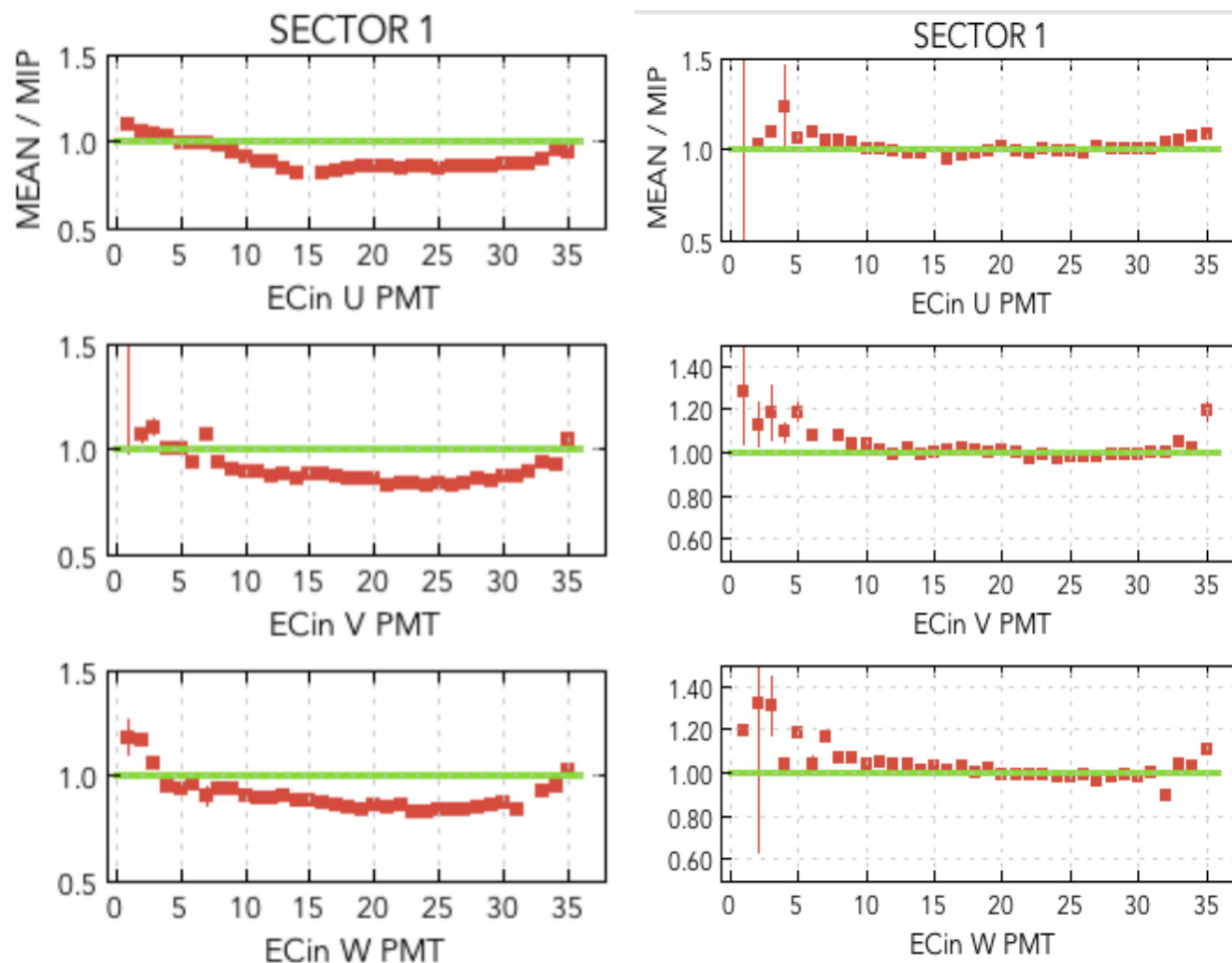
# ECAL: KPP Calibration

**Pion MIP cluster energies**
Pass 4 (left) Pass 5 (right)

## KPP Calibration

- Pass 5 constants (atten/gain) EC Sector 1.
- Pion/muon MIP calibrations mostly consistent but need to check with cut on tracking momentum.

# ECAL:Trigger

## Trigger Development

- New EC and PCAL pixel-based VTP triggers increase efficiency and reduce data rate for cosmic runs.
- Debugging of PCAL cluster trigger underway (Sergey, Ben).
- Attenuation correction in PCAL trigger essential due to lack of Dalitz compensation in simple U+V+W energy sum



PCAL PIXELS

U+V+W raw energy sum

EC PIXELS

U+V+W raw energy sum
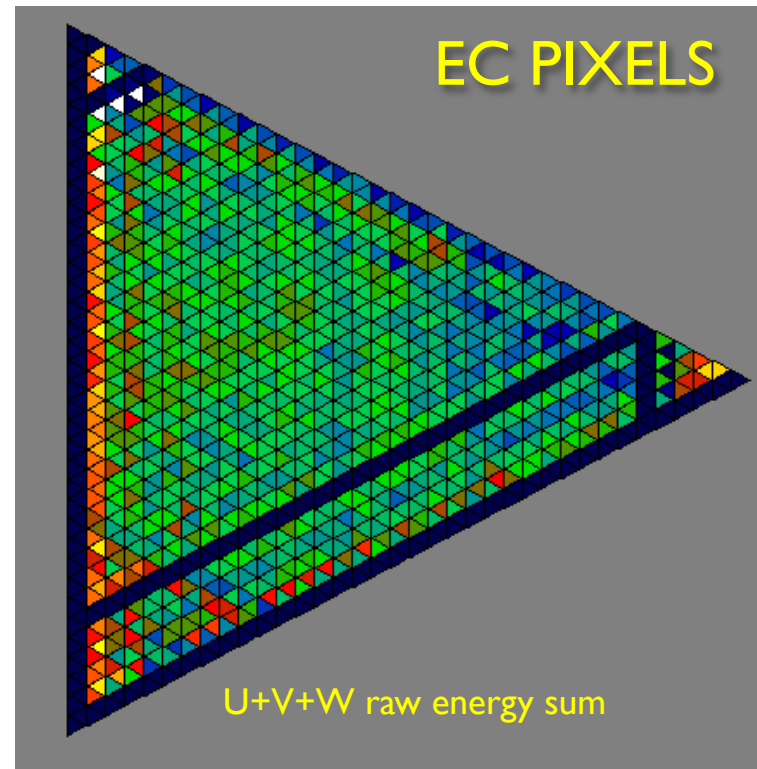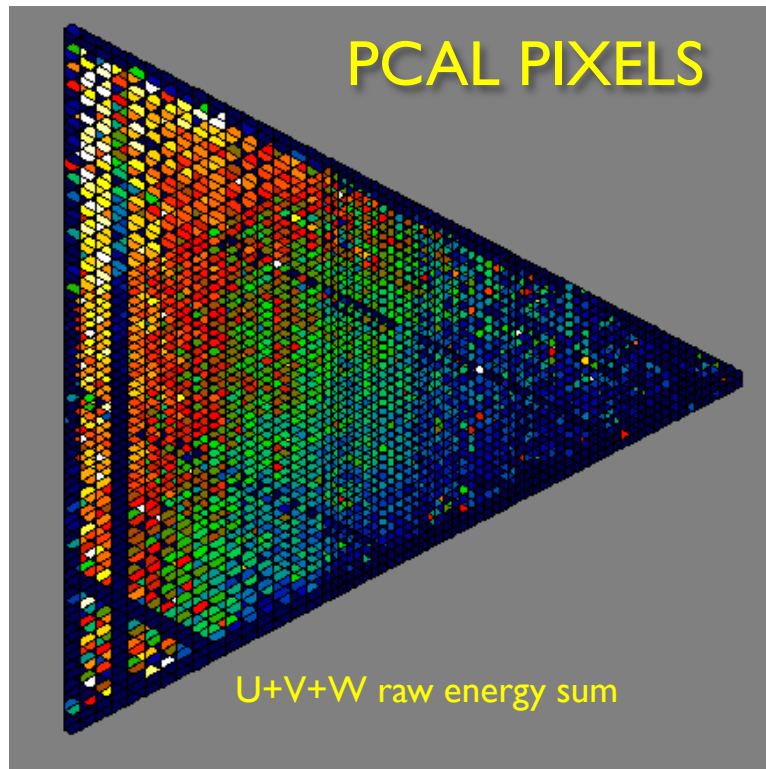
# FTOF Calibration

| HV/Gain Calibration | |
|---|---|
| Step # | Action |
| ✔ 1 | Gain Calibration |
| **Timing Calibration** | |
| ✔ 1 | PMT Timing Diff. |
| ✔ 2 | Attenuation Length |
| ✔ 3 | Effective Velocity |
| ✔ 4 | Time-Walk |
| ✔ 5 | P2P |
| ✔ 6 | RF Offset |

While the KPP data is limited (low statistics, S2 only), it has allowed for important developments and verifications related to the FTOF calibrations
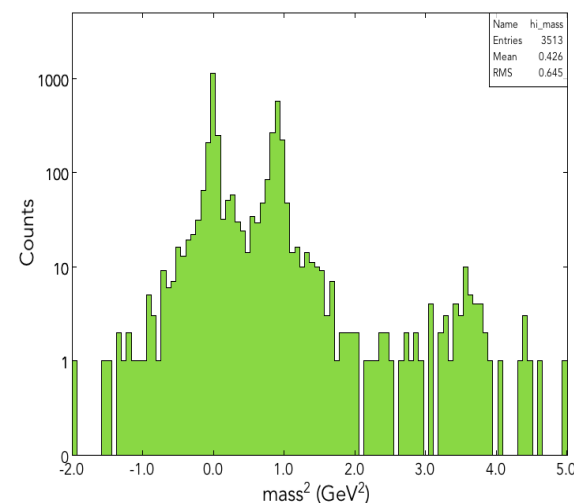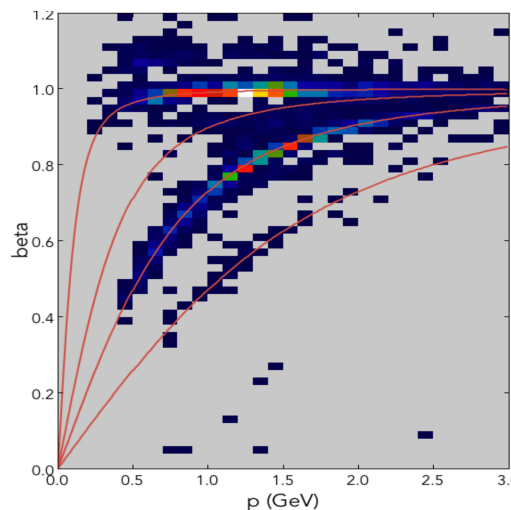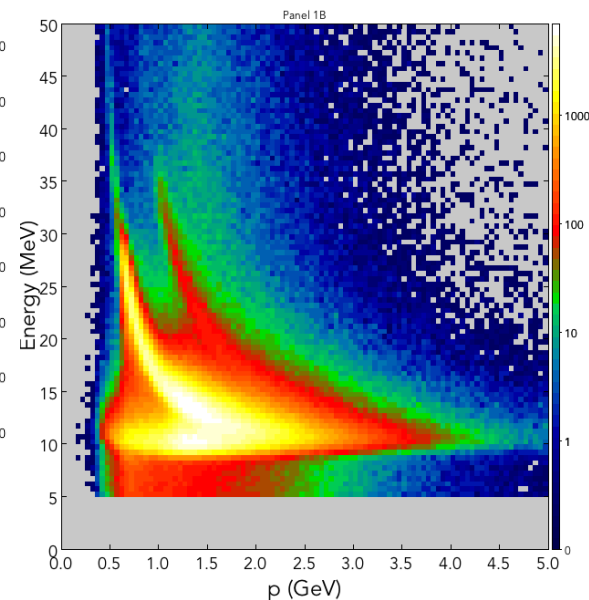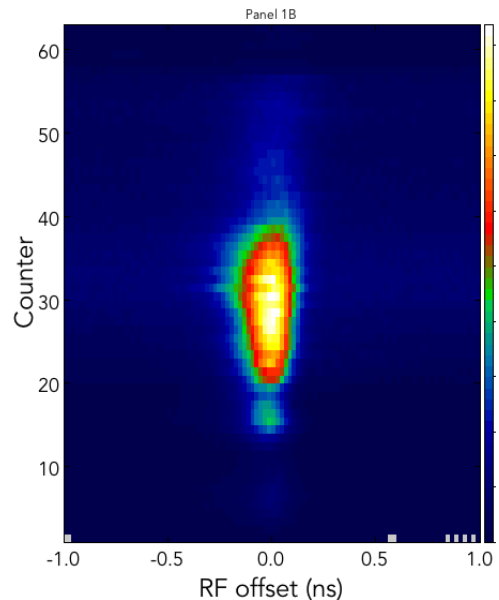
# FTOF Calibration

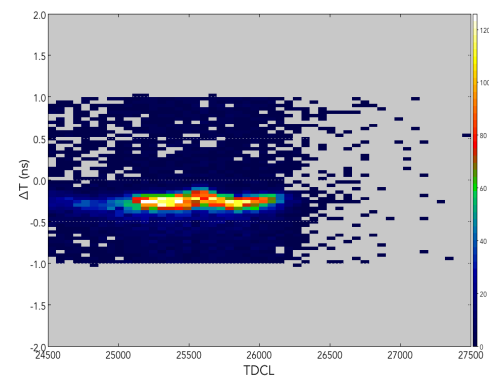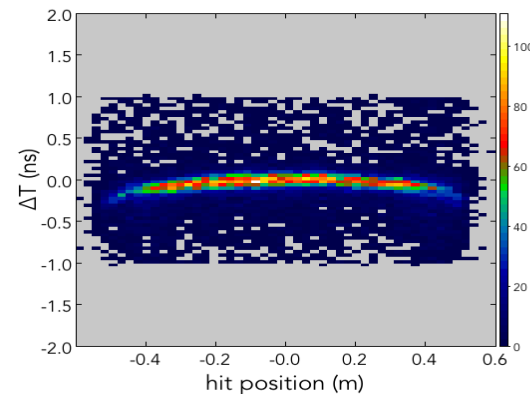## Resolution after calibration better than 100 ps
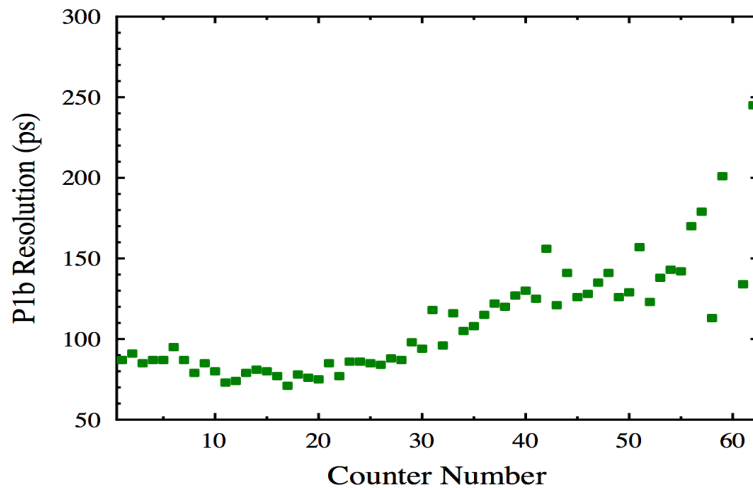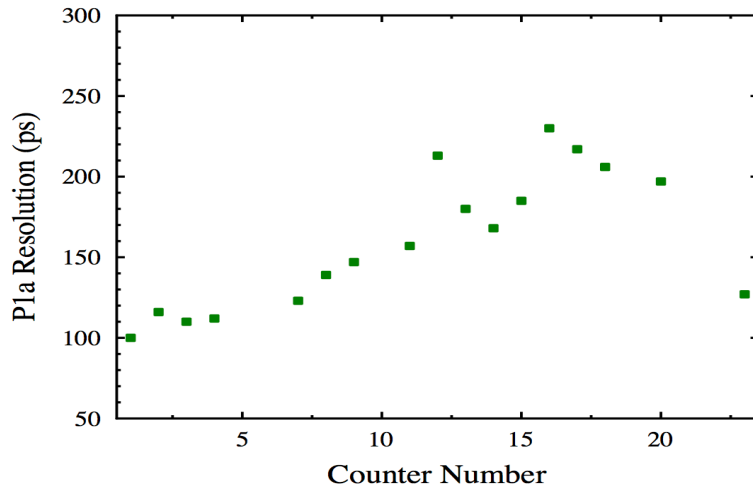


Counter timing resolutions still higher than values determined from cosmic ray bench tests:

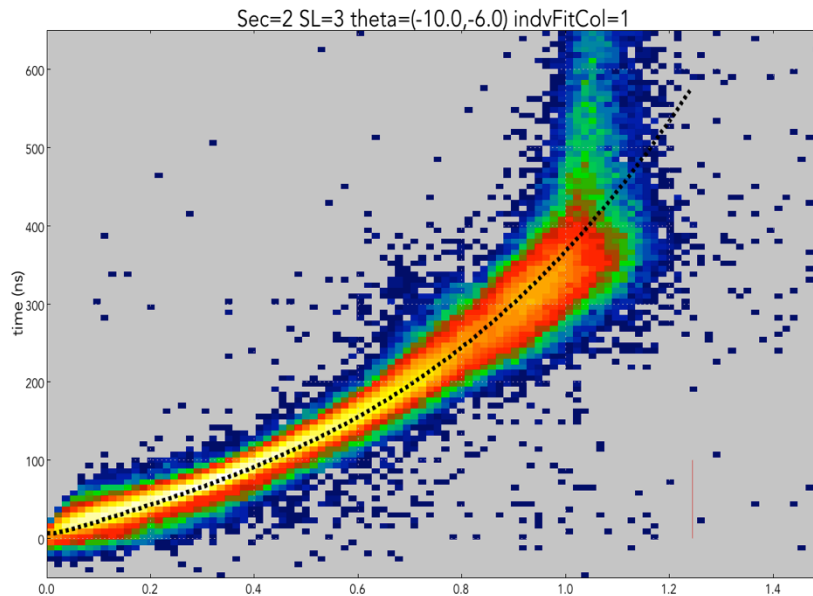- *P1a: 80 – 150 ps*
- *P1b: 30 – 80 ps*

Extracted values still limited by:

- *TW corrections*
  - *Position-dependent TW*
- *TDC calibrations*
- *TDC non-linearities*
- *Non-optimized tracking*
- *Geometry offsets*

# DC Calibration

- A GUI driven Calibration Suite has been developed
- First few iterations of time-to-distance fits have given improved resolutions, but further fine tuning of parameters seems necessary (as the results are not consistently better yet)



Screenshot of "Fit Control" panel

# DC Calibration



**Before Calibration** →

**After Calibration** →

cm
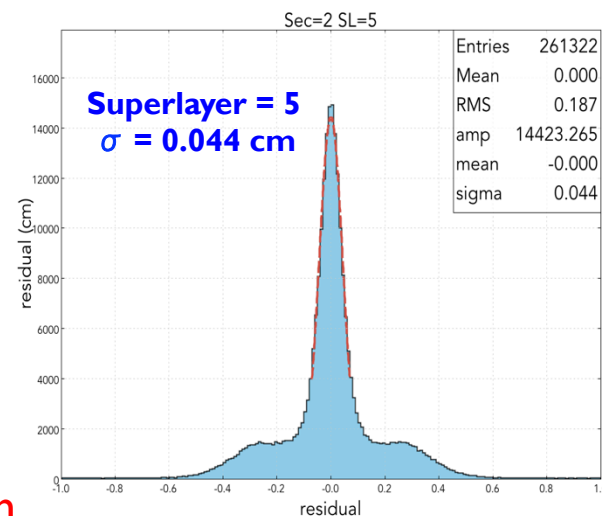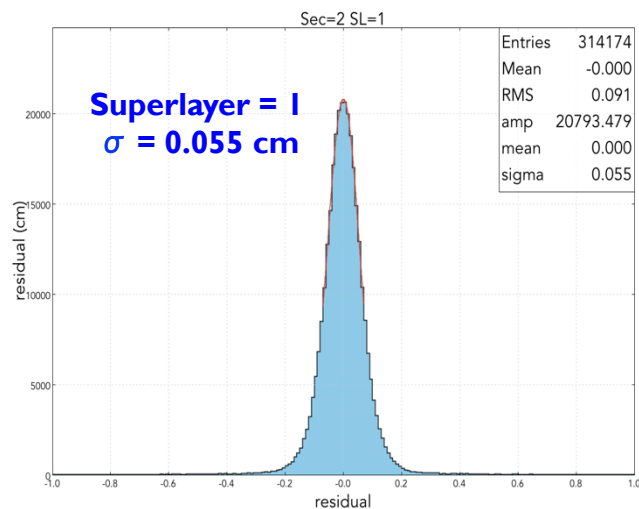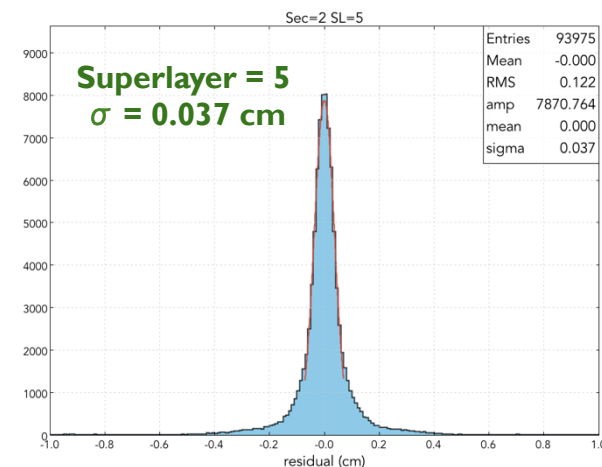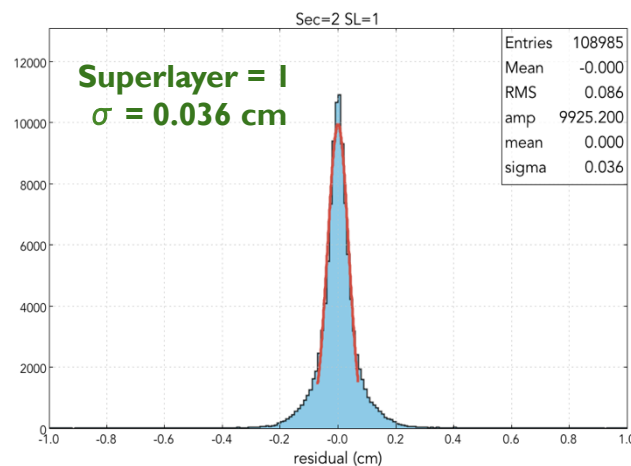
# HTCC:Timing Calibration

- if $|T_1 - T_2| > T_{thr}$ hits from the same events can be identified as belonging to different events hence cluster is not reconstructed properly

**Using LED data:**

R1HS1     Tmax = 68

$\triangle T = 12$ ns

R1HS2     Tmax = 71
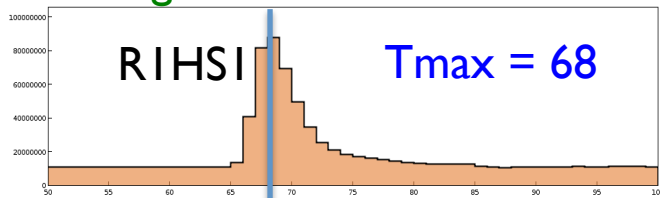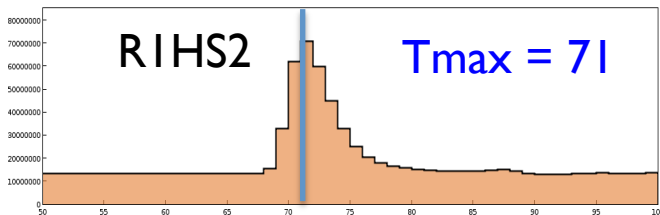
- Corrections for each channel were introduced and uploaded to *ccdb*
- Cluster reconstruction algorithm corrects timing for each channel

To PMT 1     To PMT 2

$T_1$     $T_2$

| Before correction | After Correction |
|---|---|

Timing is better aligned

Timing of 48 channels     Timing of 48 channels

T, ns     T, ns

Number of multiple hits events increased

N hits     N hits
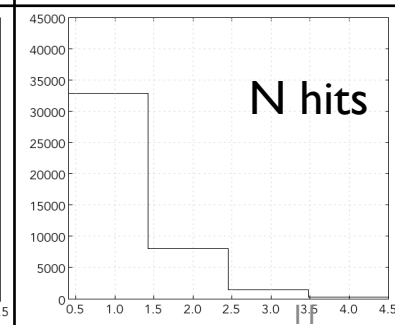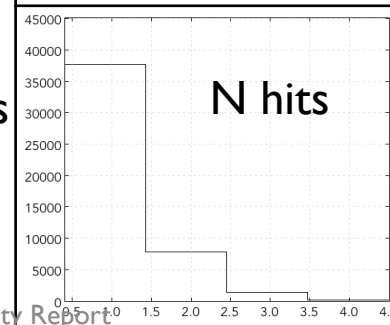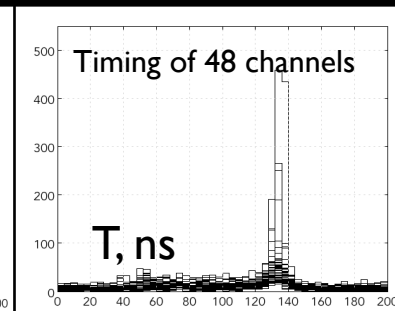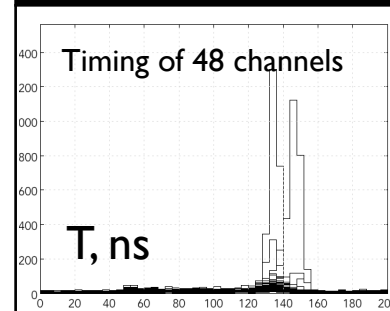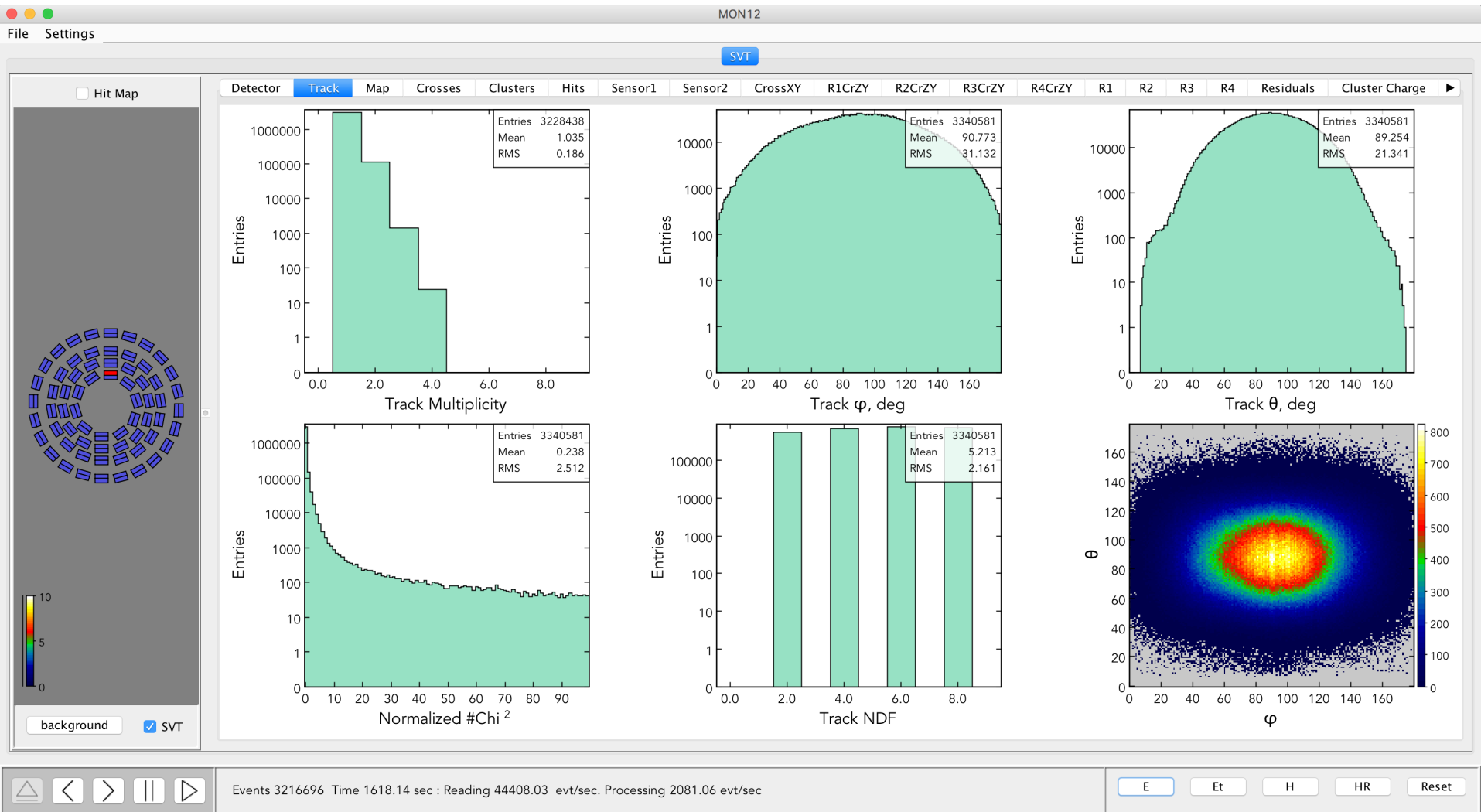
# SVT Monitoring

# CVT in CED
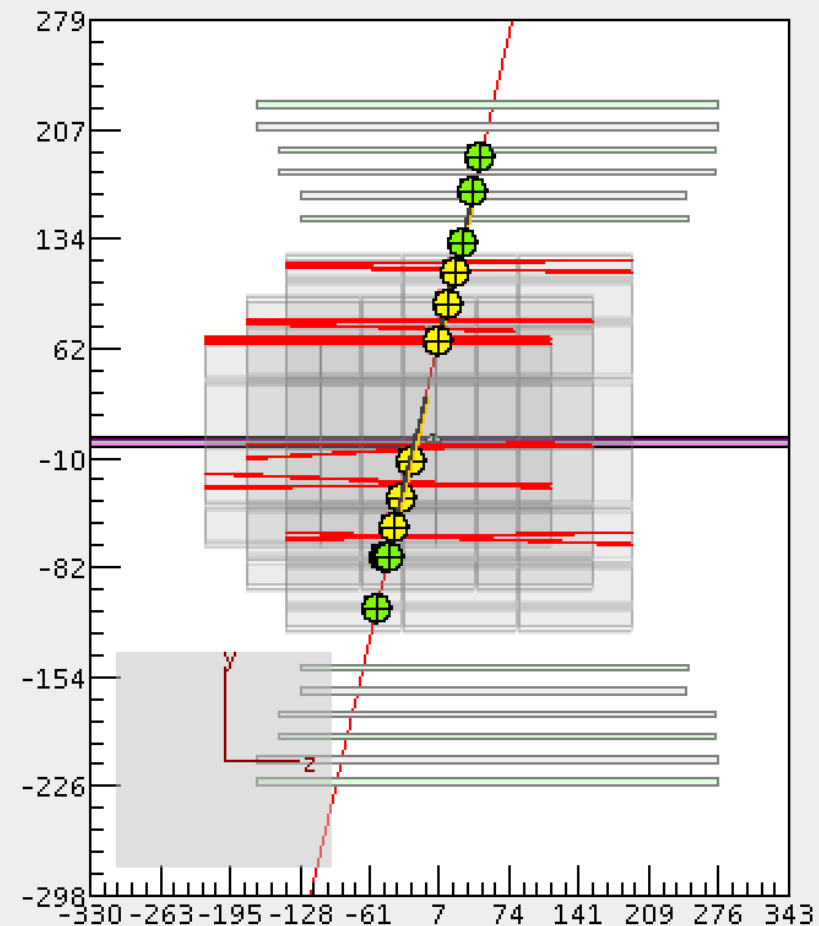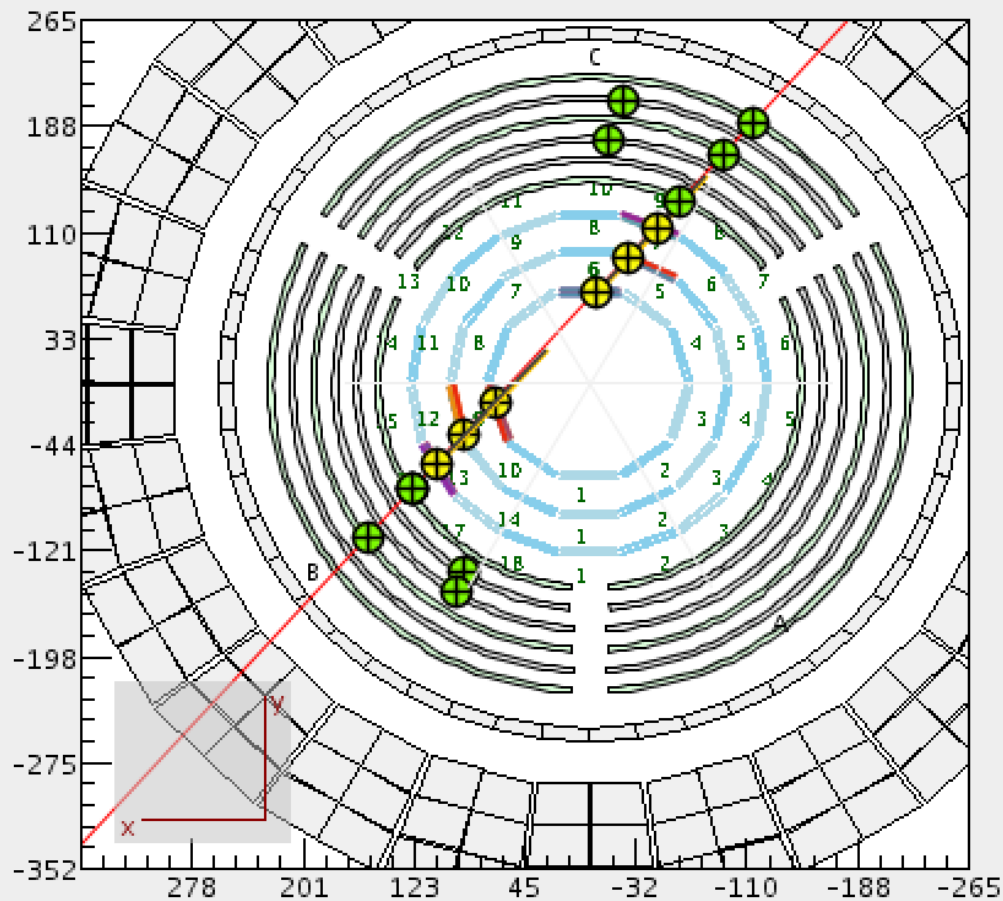
# MVT Monitoring

**Latest developments:**
- Micromegas data can be now decoded in latest COATJAVA
- Monitoring and calibration code developed in COATJAVA 2.4 being moved to MON12 framework

**Status:**
- Micromegas turned on last Friday
- Already taking cosmic data with new translation tables. (cf hitmap on the right)

**Work plan:**
- Finish implementing monitoring/ calibration codes under latest COATJAVA over the 2-3 next weeks will be to finish
- Test different approaches to measure the Lorentz angle in GEMC
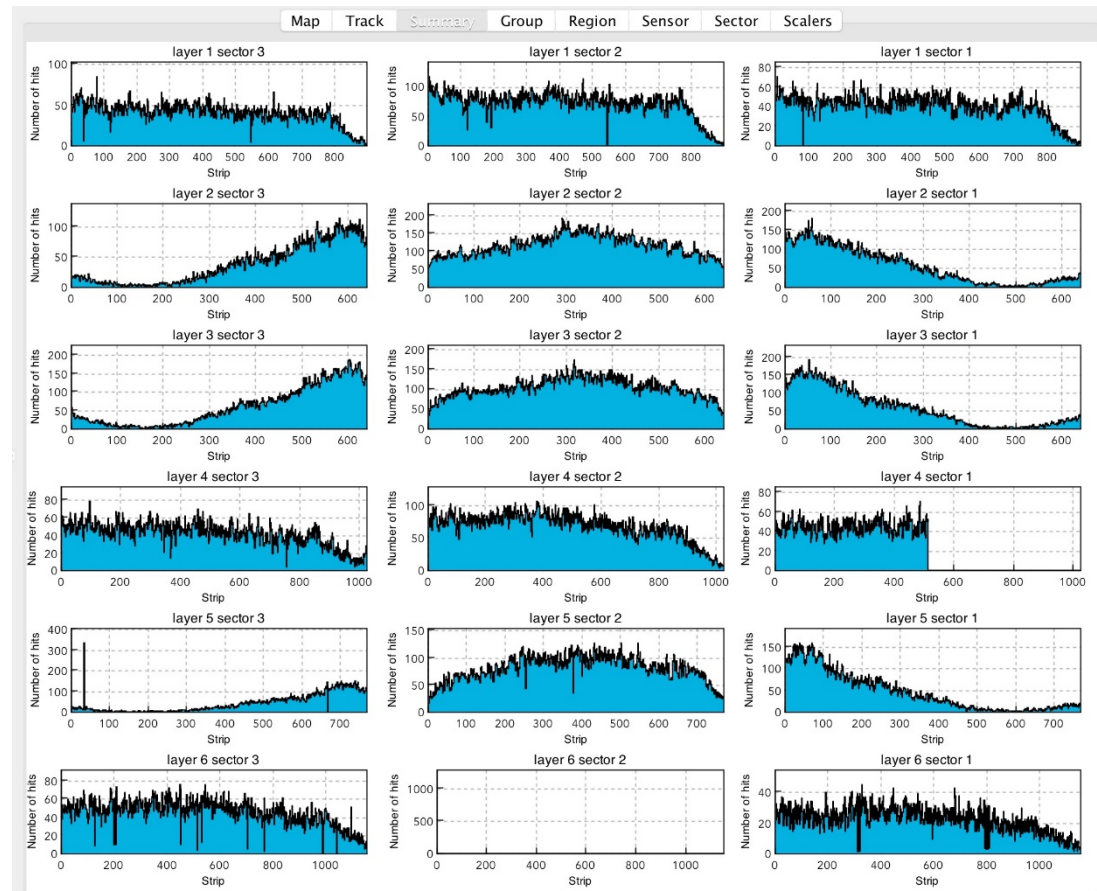
# Overall Status

| System | Status | Developers |
|--------|--------|------------|
| DC | T0 completed, Alpha version of calibration suite, monitoring suite done debugging of time-to-distance calibration in progress, kpp calibration in progress, documentation and tutorial to be done | Krishna, Mac, Olga, Daniel, Michael, Latiful |
| ECAL | energy calibration based on cosmics and pions (KPP) done, time calibration development started, documentation and tutorial to be done | Cole, Josh, Andrey |
| FTOF | first iteration of full calibration complete including P2P, refinement of TW in progress, KPP calibration in progress, documentation complete, tutorial to be done | Louise, Dan, Ralf, Raffaella |
| HTCC | SPE calibration completed, first iteration of time calibration done, algorithm improvement in progress, documentation and tutorial to be done | Nick, Will, Youri |
| LTCC | first order gain matching done, waiting on calibration data, software development in progress, documentation and tutorial to be done | Mauri, Sylvester, Mike, Burcu |
| FT | algorithm development complete, first tests on cosmics and mc data, software development in progress, documentation and tutorial to be done | Marco, Raffaella, Nick Z. |
| SVT | algorithm developed, implemented and tested, documentation complete, tutorial to be done | Yuri |
| MM | algorithm development complete, software development in progress, documentation and tutorial to be done | Maxime, Guillaume |
| CTOF | initial algorithms developed and implemented, first tests on KPP and MC data, code optimization in progress, documentation in progress, tutorial to be done | Louise, Dan, Ralf, Raffaella |
| CND | initial algorithms developed and implemented, first tests on cosmic and MC data, code optimization in progress, documentation and tutorial to be done | Gavin, Daria, Silvia |
| RICH | SPE calibration developed, implemented and tested, timing calibration to be implemented in the framework, documentation and tutorial to be done | Ilaria, Matteo, Valery, Andrey, Marco, Andrew |

# Work Plan for Next Months

- Continue calibration of KPP data for detailed understanding of detector behavior

- Use MC data to continue/complete Central Detector calibration procedure

- Complete calibration and monitoring suite development with release of beta versions
  - Calibration suites tested by "non-developers"
  - Source code moved to clas12-offline repository
  - Train potential calibrators

- Organize calibration challenge (end of July/beginning of August)

- Develop commissioning plan for Engineering Run

- Setup calibration team for the Fall Run