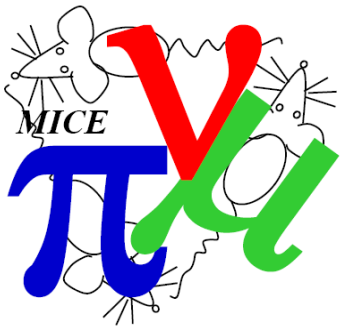


University of Glasgow

Detector Commissioning

MICE CM42

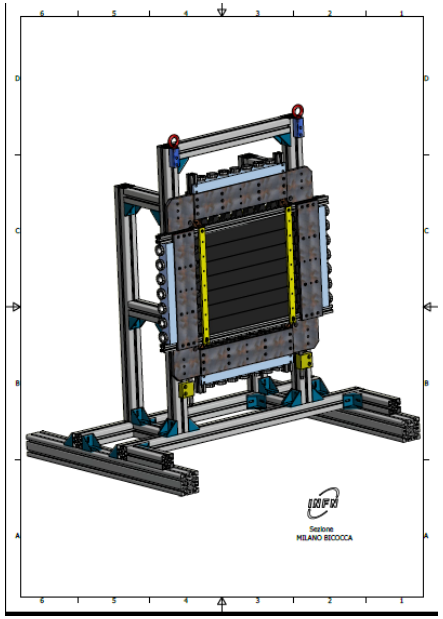
RAL, 23 June 2014

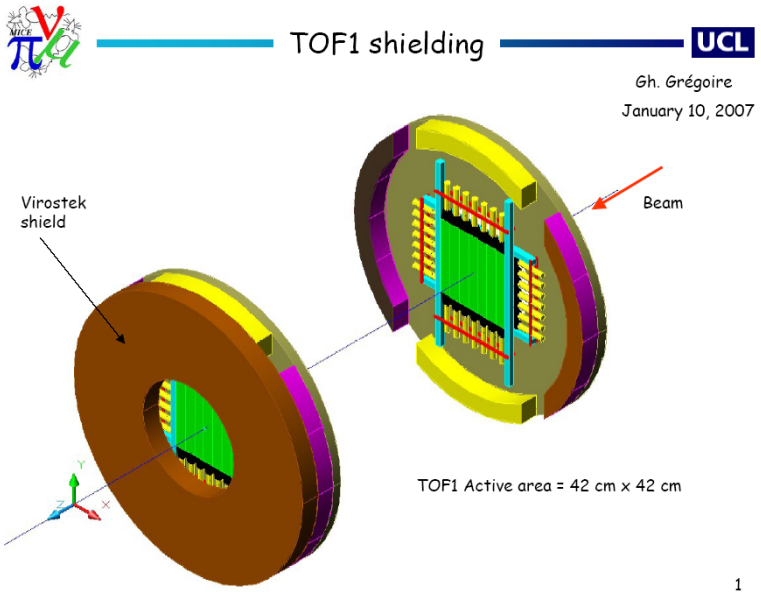
Paul Soler

TOF

- Local B-field shield for TOF1 fitted in Nov. 2014
  - Box shield with ARMCO

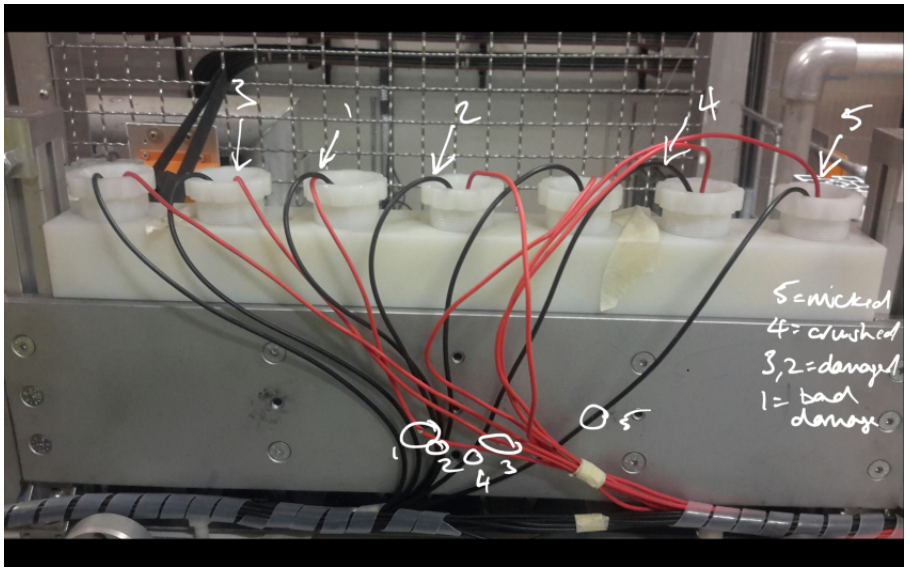
Bonesini





Readiness TOF

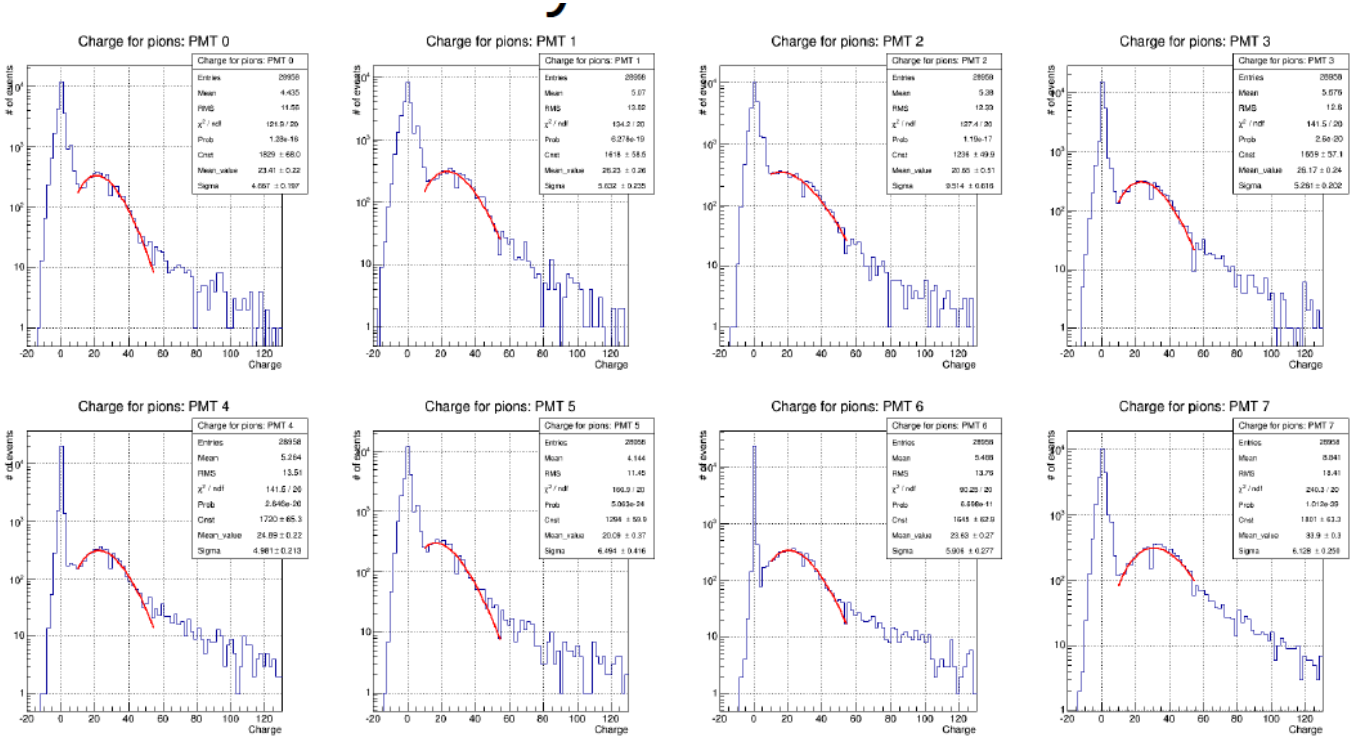
- TOF system (TOF0,TOF1,TOF2) working smoothly since 2009: no foreseen problems for STEP IV
- Need to monitor presence fringe fields from solenoids
- One PMT found broken after TOF1 shielding operation
- During installation of PRY and installation of tracker, some cables were damaged and had to be fixed



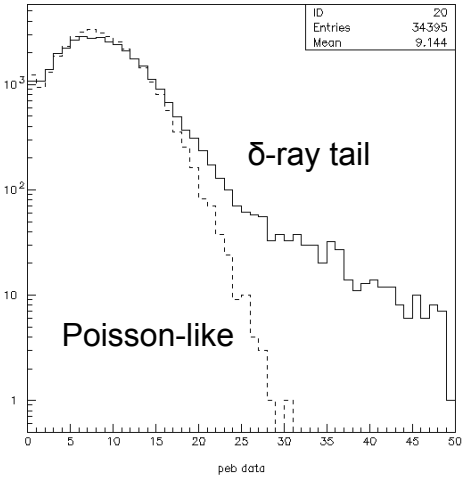
Bonesini

CKOV

- Calibration 1 PE distributions as function HV



Cremaldi, Hanlet, Rajaram, Kaplan



- Photoelectron modelling to finalise digitisation
  - Include Cherenkov, Poisson smearing, δ-rays, and pedestal noise – see Lucien's talk

CKOV

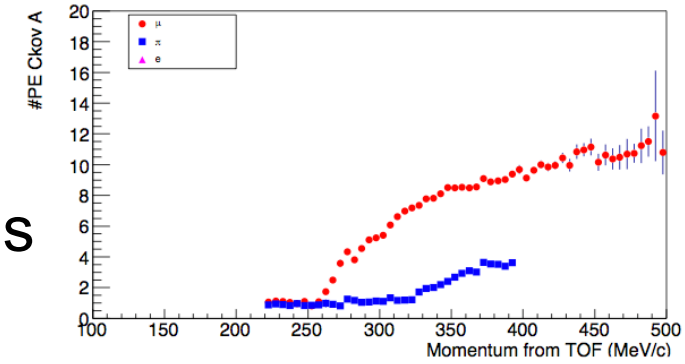
- Further steps in commissioning:
  - Verify gains of CKOV channels after first HV scans
  - Perform a mini-HV Scan with new CAEN SY4527 +HV module
  - Check aerogel Cherenkov thesholds
  - Has aerogel density changed?
    - Shift in threshold to lower momenta.

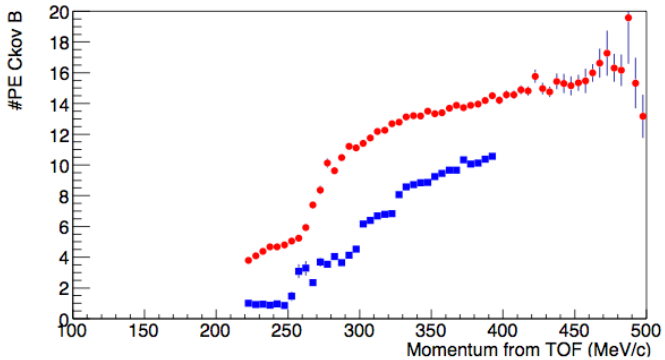
      muon pion

      P_{th_a} = 260 MeV/c, 325 MeV/c

      P_{th_b} = 190 MeV/c, 260 MeV/c
    - This corresponds to a change in index

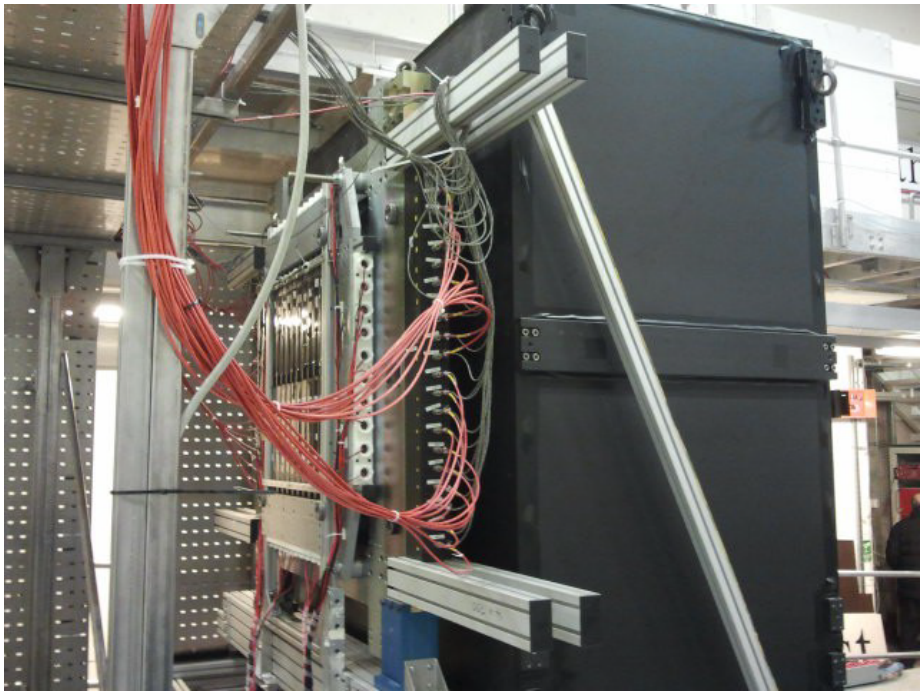
      n_a: 1.07 ➔ 1.09 n_b: 1.12 ➔ 1.14
  - Dedicated momentum scans, with extra low and high momentum runs

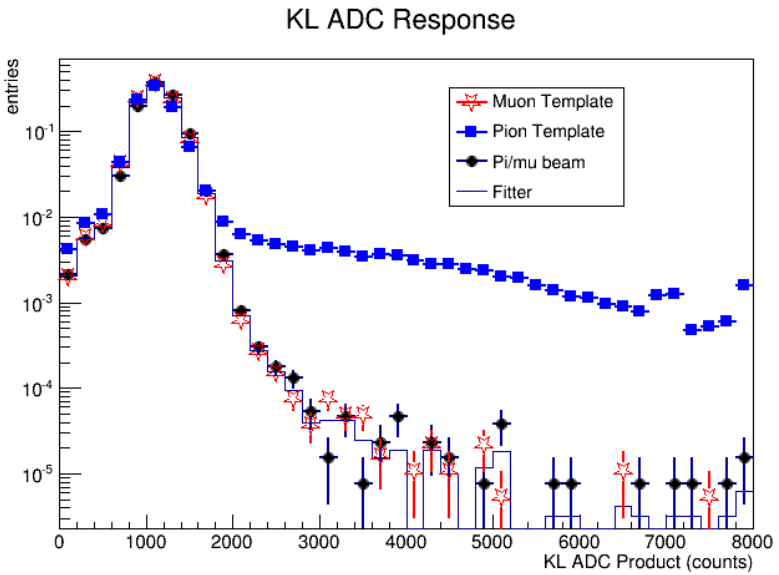




KL

- Remaining hardware: **Orestano/Tortora**
  - Move to its final Step IV position after PRY installation during shutdown week in July
  - Detector has been working well and was used in pion contamination paper





KL

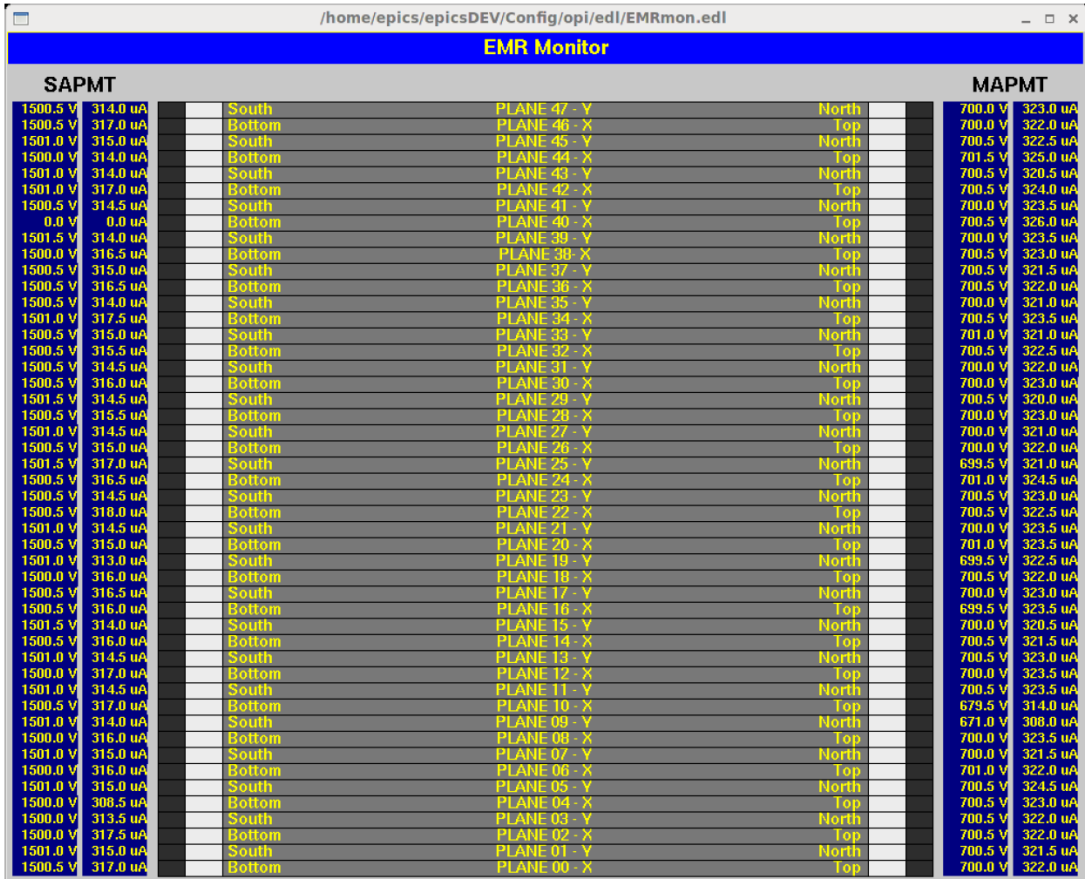
- Commissioning KL: **Orestano/Tortora**
  - No updates with respect to past CMs
  - Need to collect statistics on all slabs, check all PMTs are alive, check beam profile, check equalisation of gains
  - To collect enough statistics might need local trigger (TOF2) possibly also for cosmics
  - New calibrations to be carried out after movement of KL
  - Currently issues with recent MAUS version in decoding – hope to be able to check things soon
  - Need to revisit the shifter documentation (no significative change expected but need to be here to properly revise it – July 13-19)

EMR

- October 2014: **Drielsma**
  - EMR hardware extensively upgraded: new Hamamatsu R6427 PMTs, new rack, AC fan system, remote controlled AC power supply, HV PSU (PMTs), LV PSU, new VME and NIM crates
- Other issues fixed since October 2014:
  - 1 VHDC fails to configure FEBs, HV PSU did not start, LED not working (LV PSU changed), cosmic DAQ code bugs, two noisy FE boards, one single-anode PMT faulty and fixed

EMR

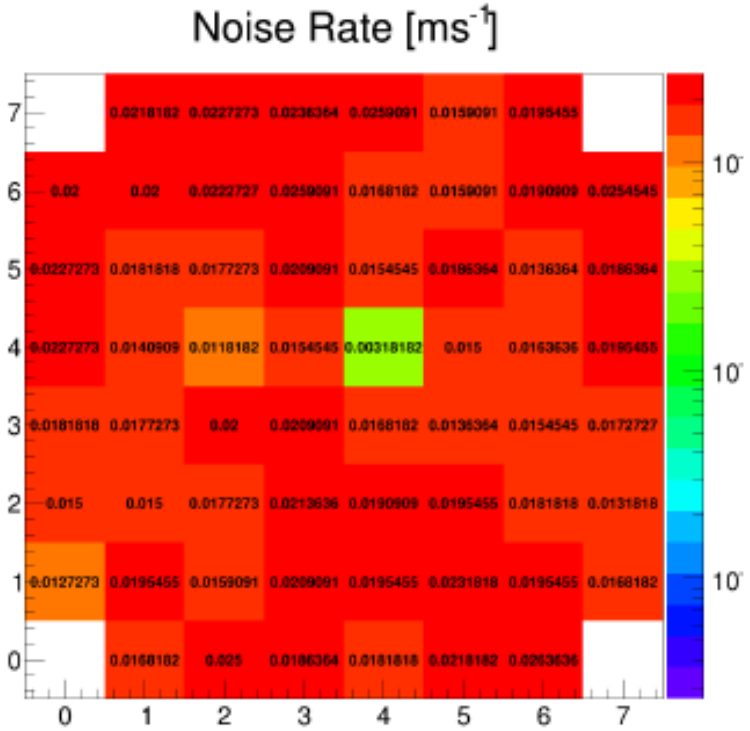
- Other issues fixed since October 2014:
  - HV PSU: 48 channels for SAPMTs (1500 V) and 48 channels for MAPMTs (700 V) remotely controlled

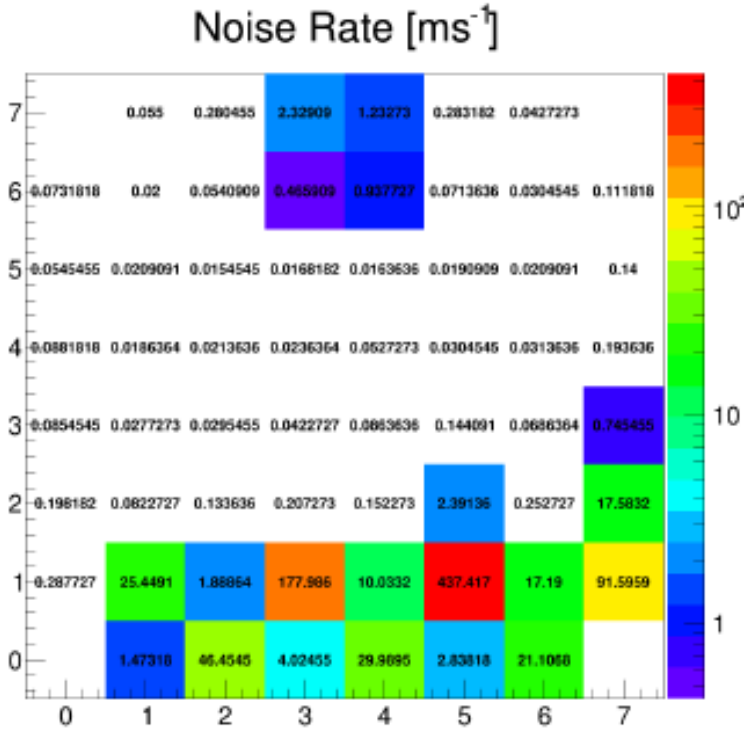


Drielsma, Hanlet

EMR

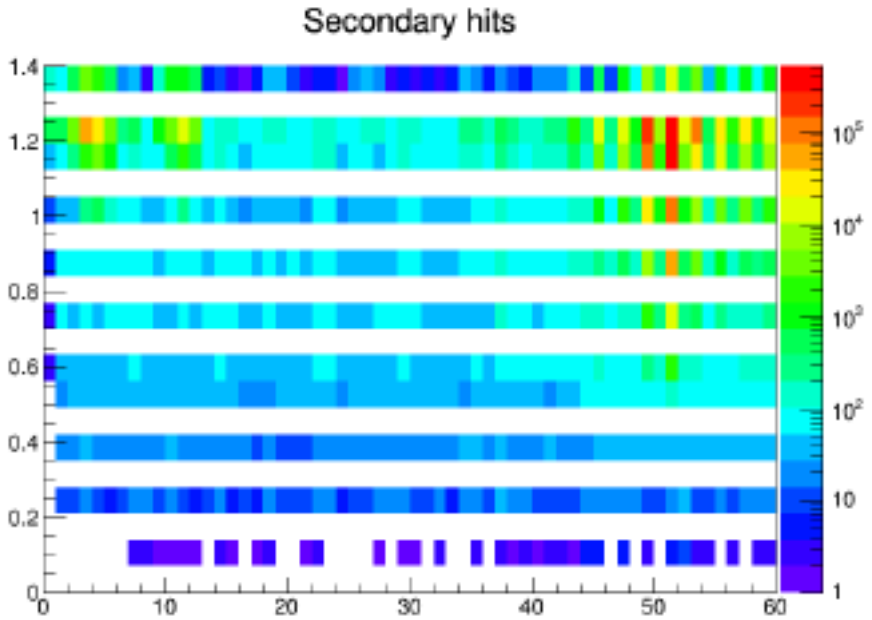
- Noise in SAPMTs: **Drielsma**
  - 39 planes with vey little noise (< 1 ms^{-1})
  - 7 somewhat noisy planes (< 100 ms^{-1})
  - 2 very noisy planes (> 100 ms^{-1})



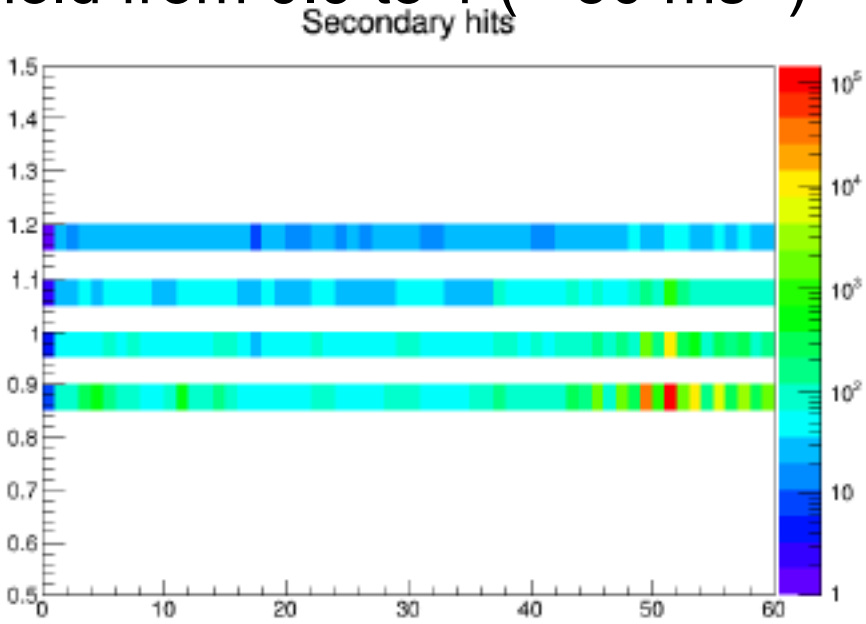


EMR

- Noise in SAPMTs: **Drielsma**
  - Reduce gain of noisy MAROC channels ~0.75 (< 50 ms^{-1})
  - Increase discriminator threshold from 0.9 to 1 (< 50 ms^{-1})



Reduction gain

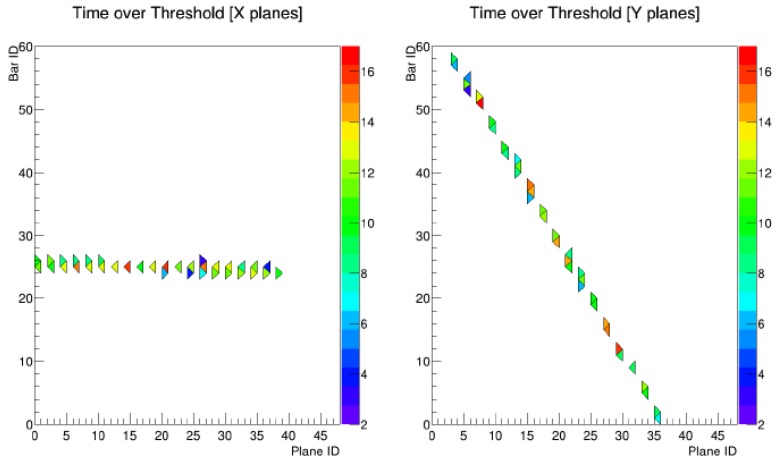


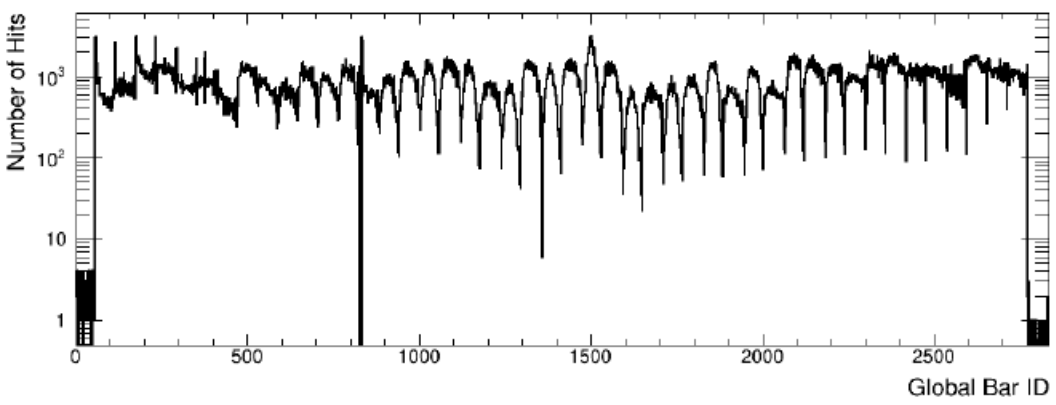
Increase threshold

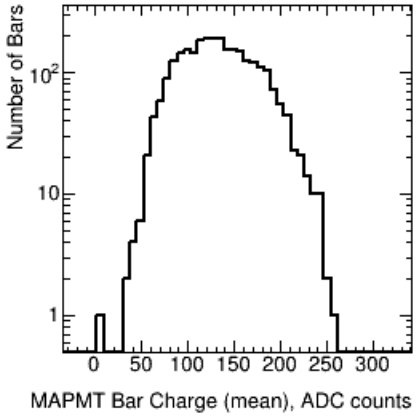
  - Origin noise unclear (FEB, MAPMT?): noise does not overflow DBB buffer at the moment by reducing gain

EMR

- EMR charge calibration: **Drielsma**
  - Require ~300k cosmics (~2-3 days)
  - Measure mean charge $\overline{Q}_{ij}$ and correction factor: $\varepsilon_{ij} = \frac{\overline{Q}_{ij}}{\overline{Q}}$
  - Will require new calibrations after EMR movement in July







EMR

EMR status summary

Drielsma

EMR hardware upgrade **completed** and **commissioned**

- SAPMT commissioned, 48 of them working and efficient (✓)
- HVPSU → fully operational, first control interface produced (✓)
- 2 LVPSUs → fully functional and in final state (✓)
- CAEN VME crate → functional (✓)

EMR software

- Completely functional MC and reconstruction (new data structure)

Outstanding tasks

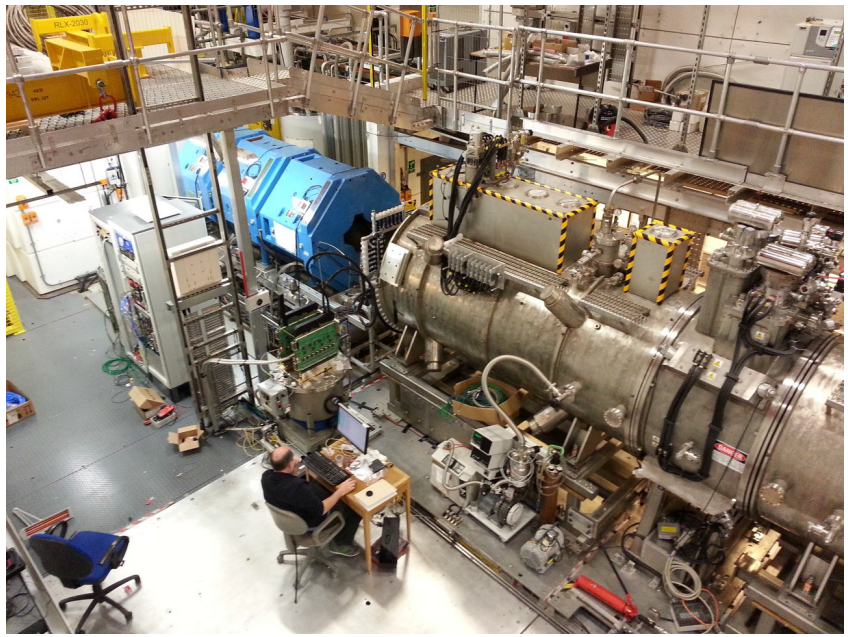
- Investigate the MAROC on the FEBs further (✗)
- Try replacing the MAPMTs on the noisy plane (✗)
- Produce a reducer and data quality flags (✗)
- Calibrate the detector and output the ϵ_{ij} (1 or 2 week(s) in August)

Ready for Step IV

Tracker

- Status at CM41:
  - Four cold cryostats
  - Faulty PSU on Downstream
  - Noise on all channels, above
  - Triggered and read out noise
  - Displayed plots on Online
  - Unpacking with MAUS was problematic
  - Internal LED was tested with waveguide
  - New trigger interface started but incomplete
  - Controls and Monitoring was overly complex, slow & prone to crashing

Overton



Tracker

- Progress since CM41: **Overton**
  - Faulty PSU on Downstream Tracker: loose fuse in the PSU to backplane connections.
  - Noise on all channels, above what was expected:
    - Experimented with a number of grounding schemes
    - Integration gate reduced from 200ns to 180ns (now 190ns on board)
  - Number of boards were diagnosed with faults and swapped: invalidated calibrations from Lab 7 cosmics
  - Controls and Monitoring:
    - Improved code exception safety to prevent common crashes
    - Extended functionality with a new derived class, which wrapped and used the original code base
    - Wrapped hardware Interface code with a new EPICS IOC.

Tracker

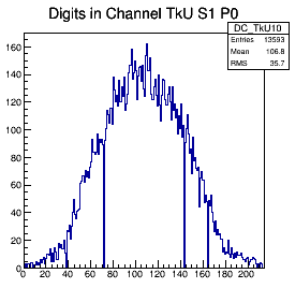
- Progress since CM41: **Overton**
  - Trigger Integration:
    - Yordan reviewed modifications and implemented in firmware
    - Tested during Mock Data Run 3 (MDR3) but issues found
    - Fixed post MDR3, in a two day post MDR3 debugging period.
  - Unpacking issues:
    - Good progress on unpacking from MDR3
    - Data quality issues caused unpacking exceptions
    - Following getting good data from the upstream tracker, data was read correctly into MAUS

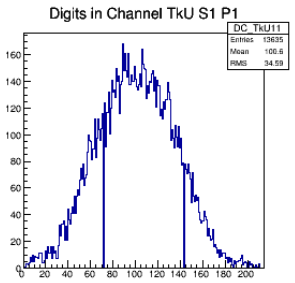
Tracker

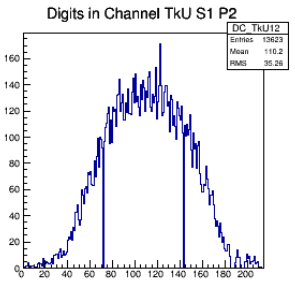
- Week 1 (1 June): **Overton**
  - Bias calibrations on the upstream tracker (with external pulser)
  - Connected waveguides
  - Bias calibrations on downstream tracker
  - First pass timing using upstream tracker and TOF0
  - Timed in upstream internal LED system
- Week 2 (8 June):
  - Replaced boards with readout issues on Cryo4, updated firmware, and ran calibration scripts
  - Moved external LED pulser around to complete calibrations
  - Attached downstream waveguides
  - Looked at internal LED on downstream
- Week 3 (15 June):
  - TOF1 for trigger: retimed to a pion beam @ TOF1
  - Connected upstream tracker and saw digits
  - Connected downstream tracker: GeoIDs were wrong, fixed.
  - Saw Digits!

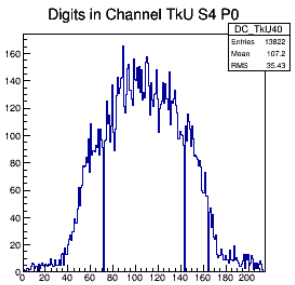
Tracker

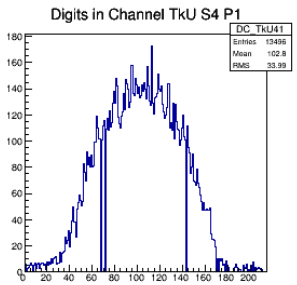
- Upstream tracker hits: **Heidt**

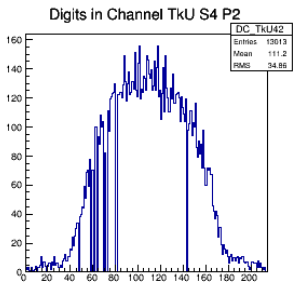


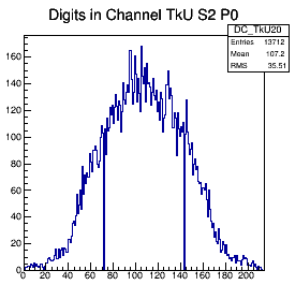


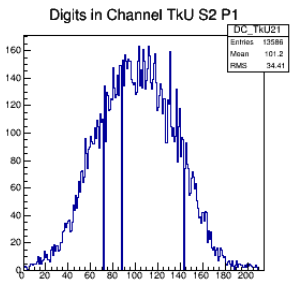


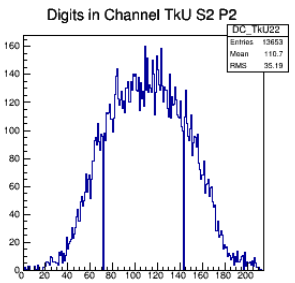


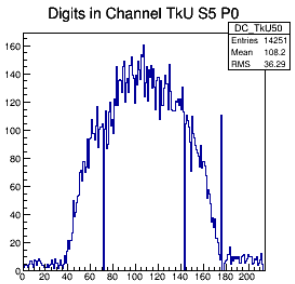


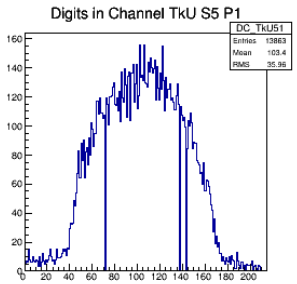


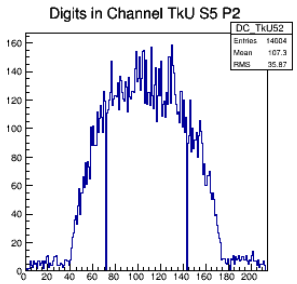


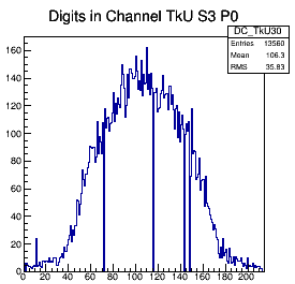


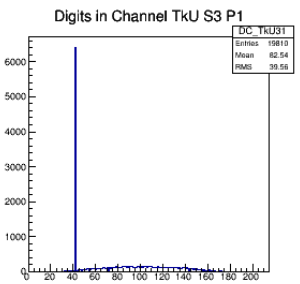


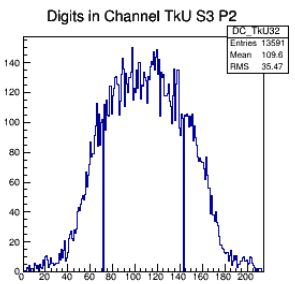






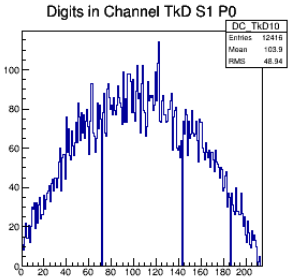


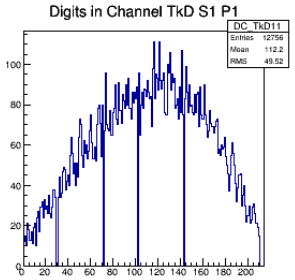


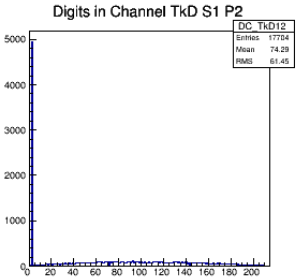


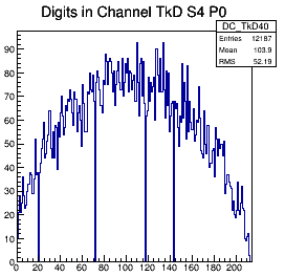
Tracker

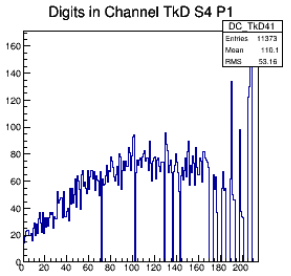
- Downstream tracker hits: **Heidt**

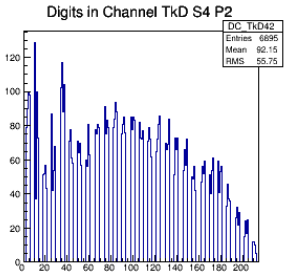


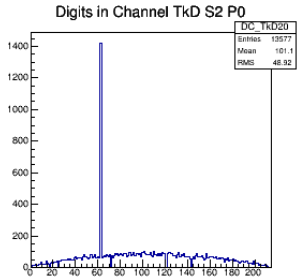


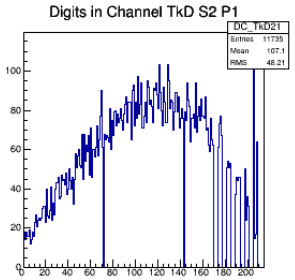


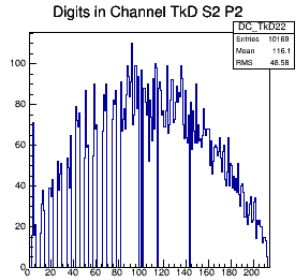


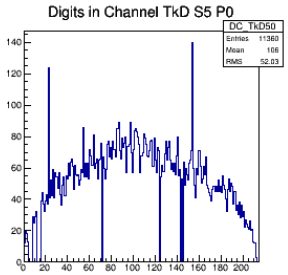


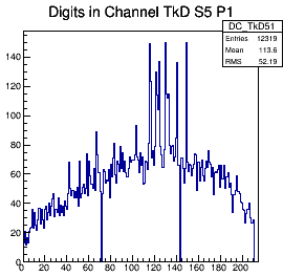


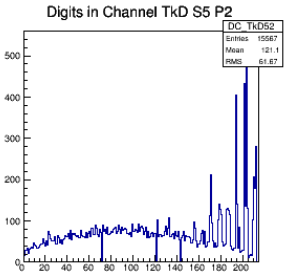


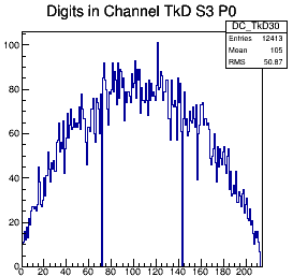


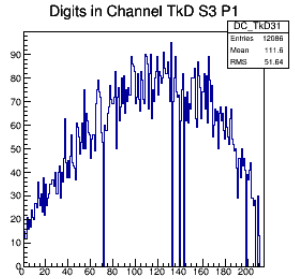


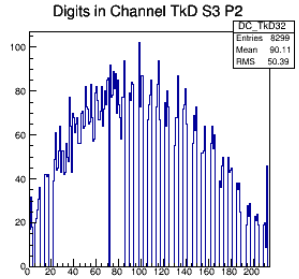






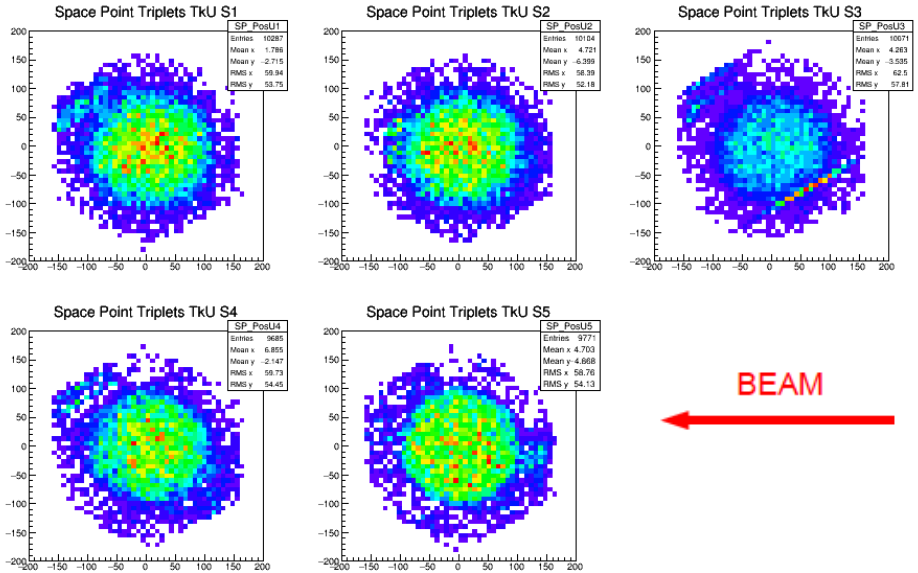




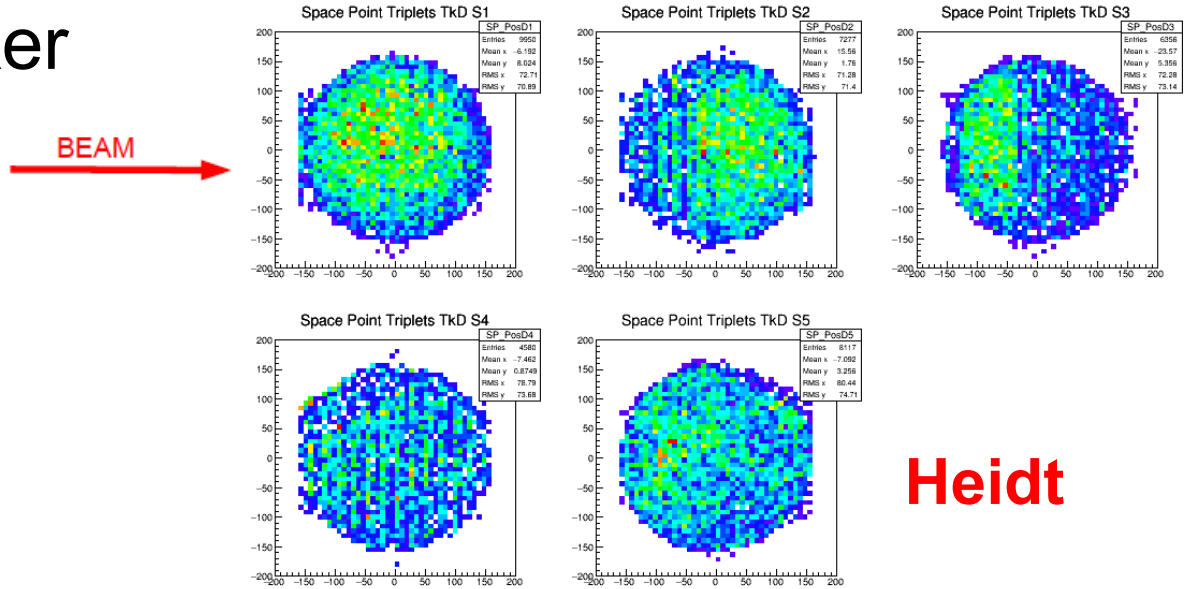


Tracker

- Upstream tracker triplets:



- Downstream tracker triplets:



Heidt

Tracker

Overton

- Issues remaining:
  - Upstream in pretty good shape
  - Downstream has known issues:
    - Two banks (256 channels) have readout problems
    - Station 4 probably has mapping or readout issues
  - Timing needs to improve to increase space point finding efficiency
- Plans:
  - Fix readout issues on the two bad banks.
  - Understand/fix issues with station 4
  - Re-check calibration
  - Careful timing studies...
  - Efficiency studies along the way...