DAQ Update - CM41

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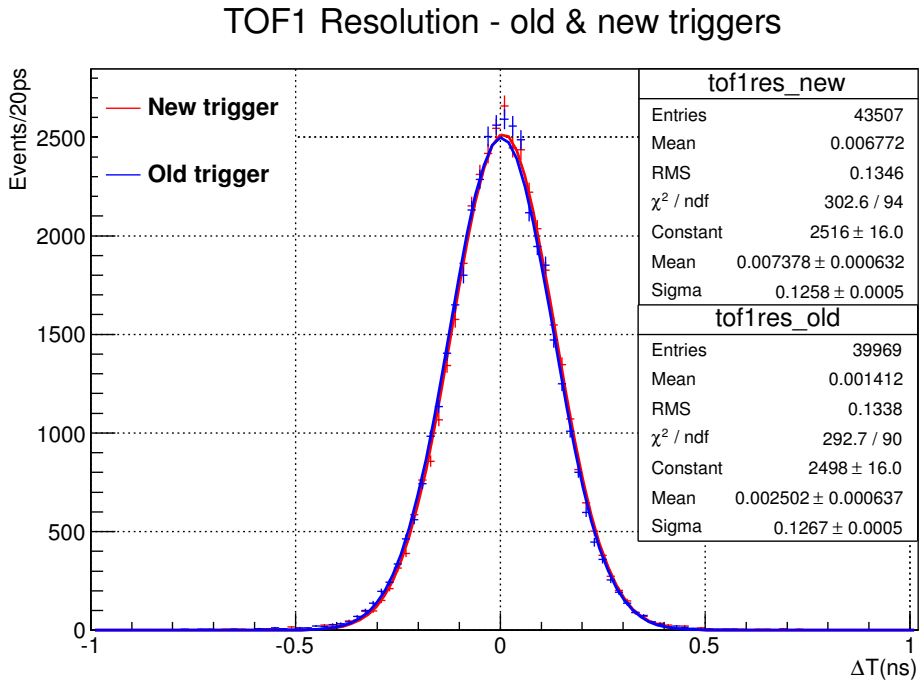
Final validation of the new Trigger system

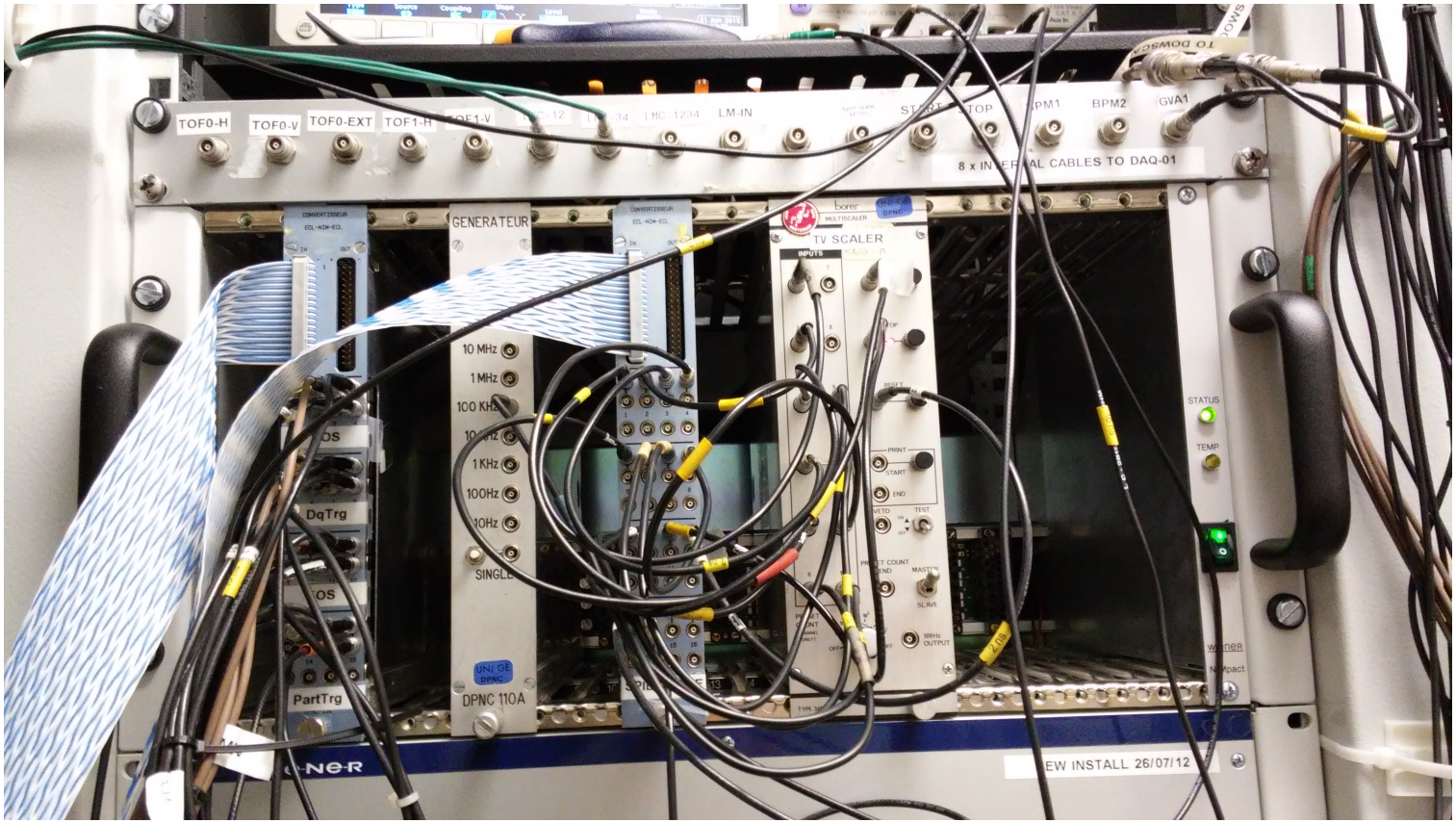


- The integration with the TOF detectors is validated systematically. This validation is very important because the TOF measurement depends strongly on the trigger.
- No difference in the performance of the TOF detectors was found when using the new trigger compared to what was obtained using the old trigger.

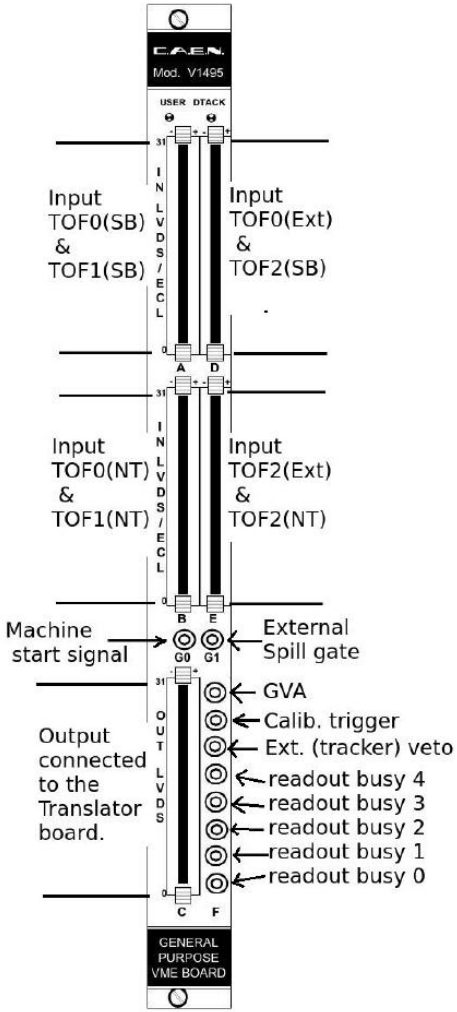
New Trigger

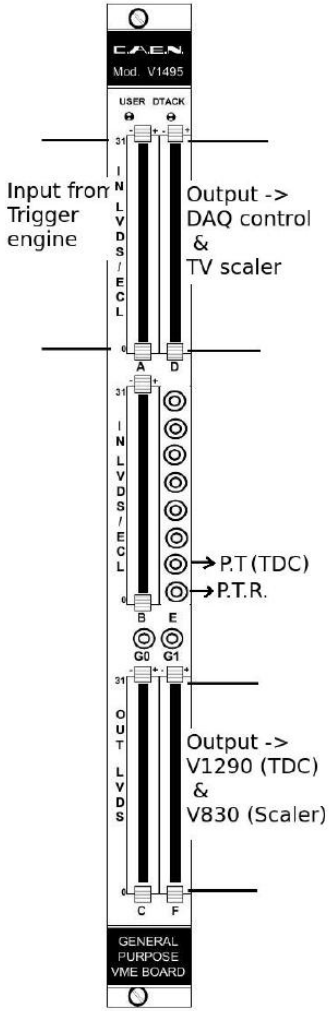
- An asynchronous external veto (tracker veto) has been implemented.
- The documentation of the new trigger is completed. It is available at: http://micewww.pp.rl.ac.uk/projects/online/wiki/DAQUserManuals
- The old trigger system is now dismounted.
- The new system has been routinely operated since April.

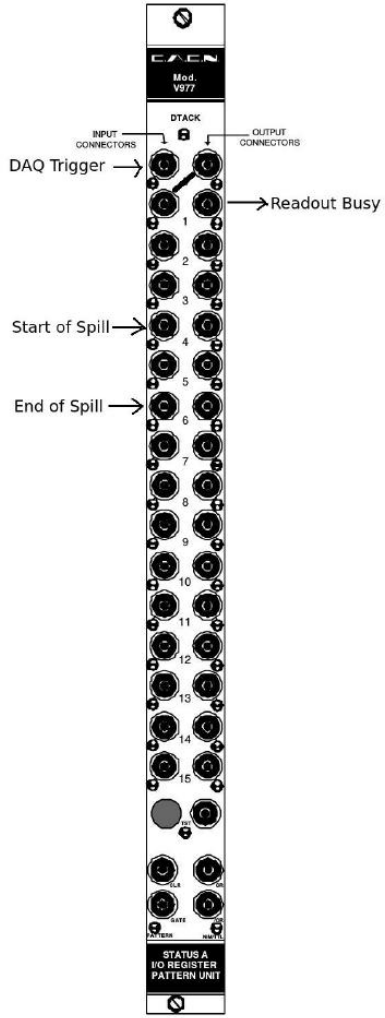
The new look of the MICE DAQ system



Now the cabling is simple and easy to understand.







Left: Trigger engine board connection scheme. Middle: Translator board connection scheme. Right: I/O connection scheme.

Data corruption protection

- The unpacking is now very well protected against the different forms of data corruption.
- Rhys works on an automated data quality checks and an interface between the Online Monitoring and EPICS. More details in his slides.
- The reason for the occasional trigger mismatches has been identified. We found an oscillating 6V channel of the Power supply of the old NIM crate. This is also the most probable explanation of the 10% inefficiency of the old trigger. The crate has been replaced.
- We still have a problem in the data coming from some of the tracker boards. More details in Ed's presentation.

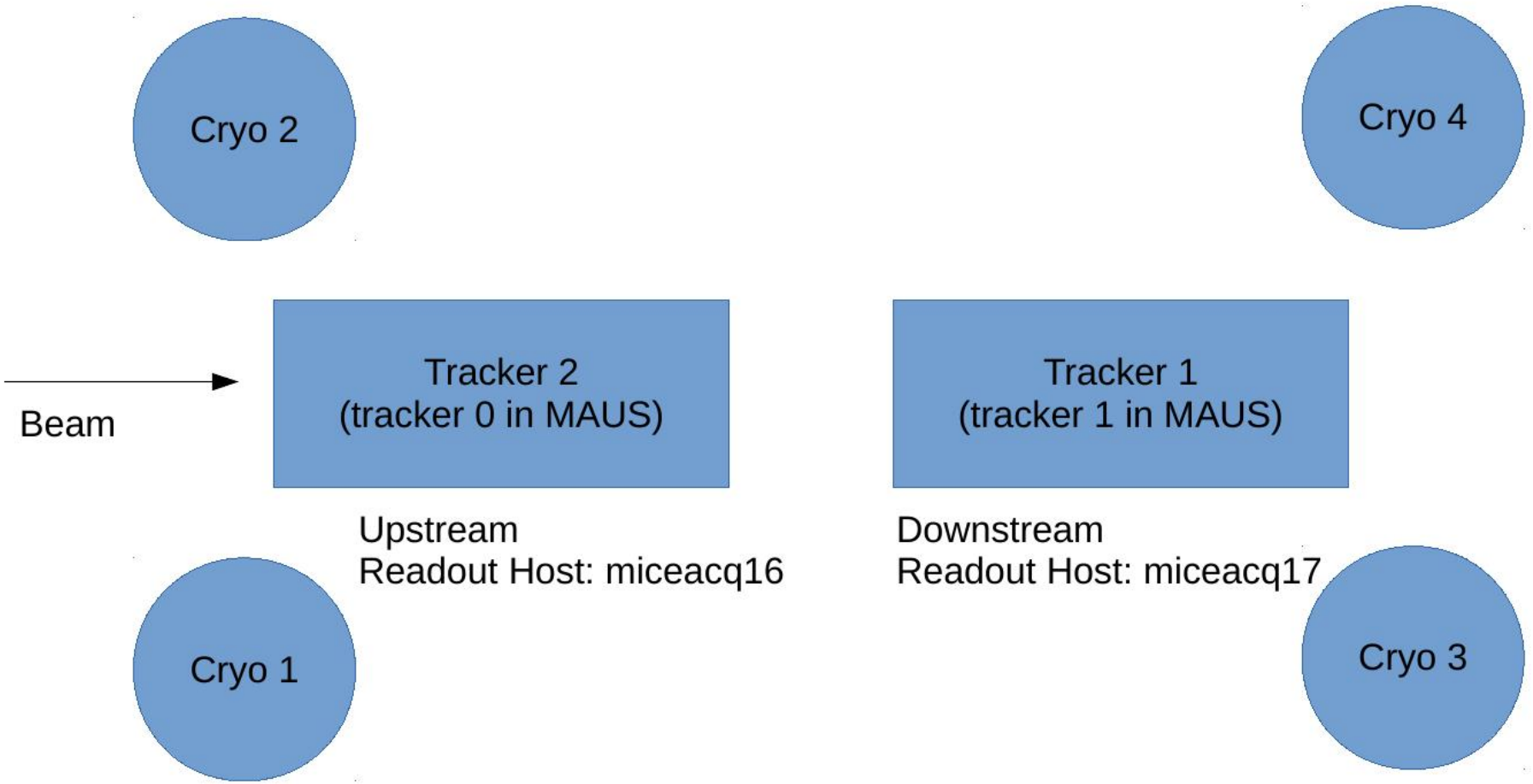
Software framework for fast data processing (mic11)

- MAUS is used as a third party. All original MAUS maps are used without changing anything.
- The data processing is driven by a bunch of classes written c++11.
- The code allows for a single-thread or a multi-thread processing.

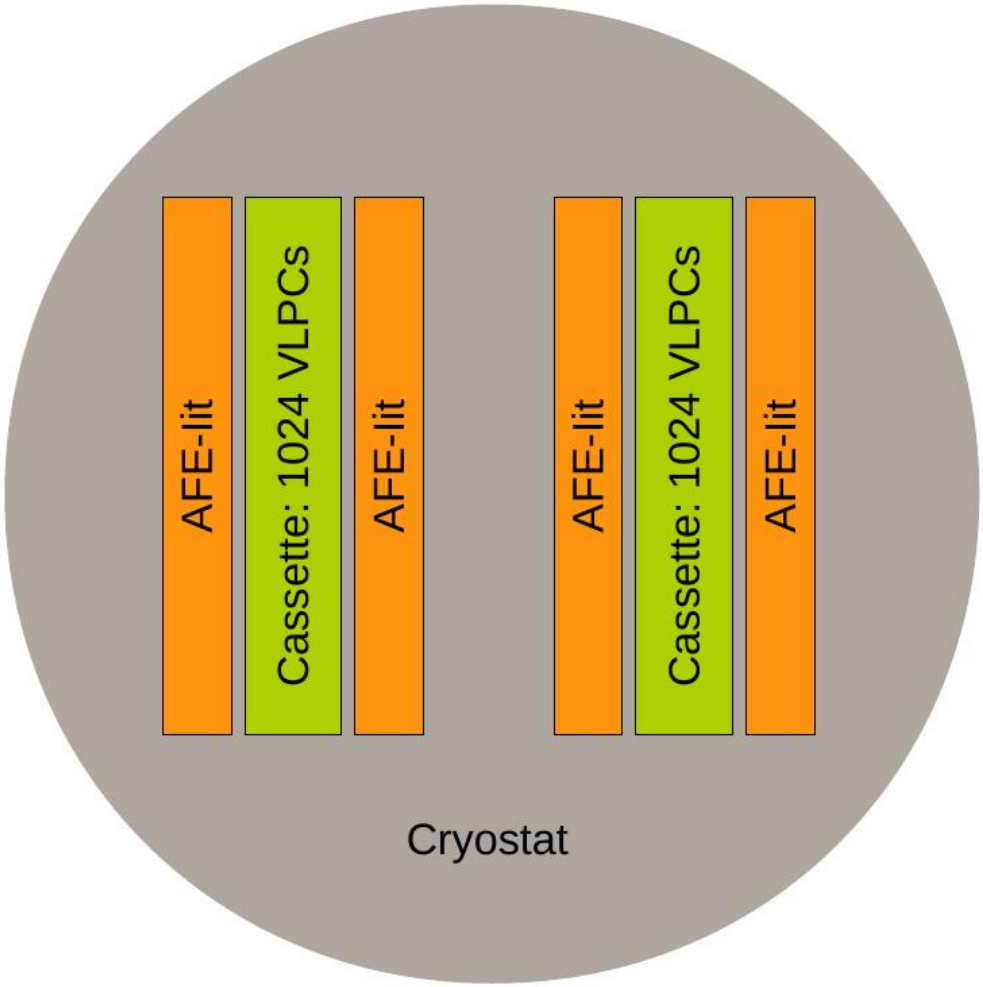
mic11 was very useful as un online tool:

- For quick look into the data and DAQ related debugging.
- For quick processing of new TOF calibrations.
- For developing a new MAUS code (InputDAQCpp....).

System Overview



System Schematic



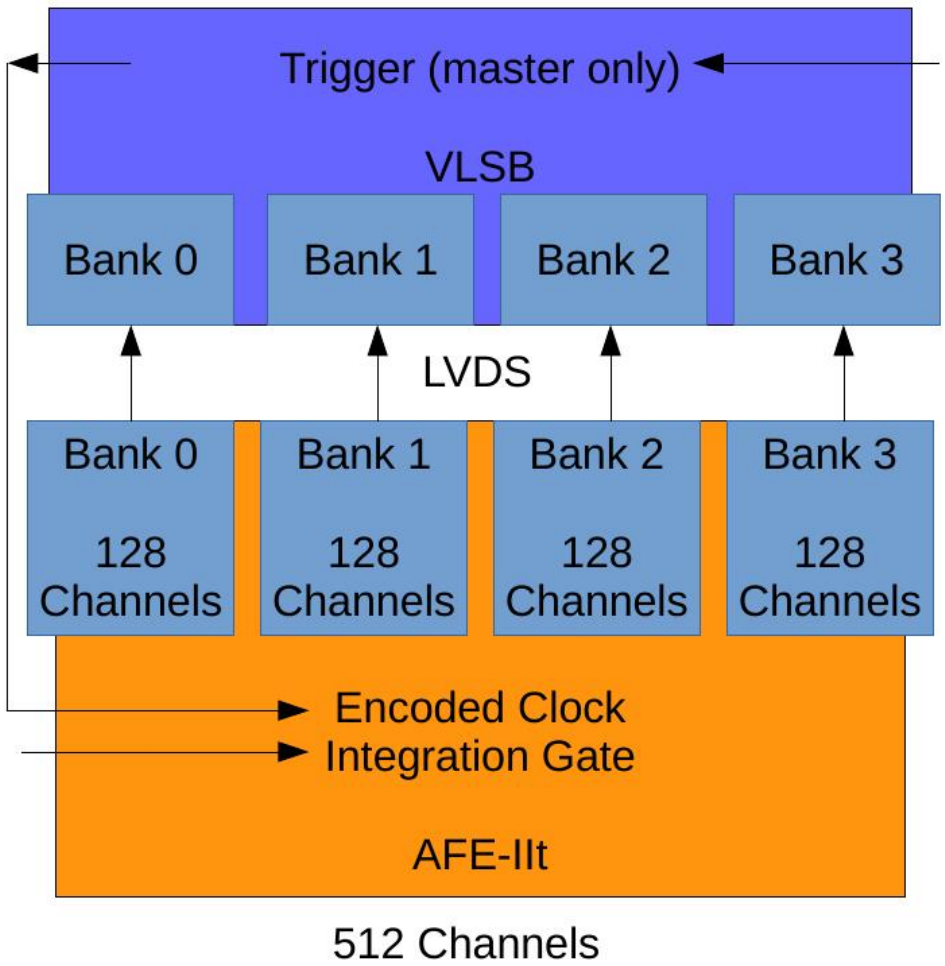
Each cryostat contains two “cassettes”,and has 2048 channels of readout

Each cassette contains 1024 VLPCs, which must be temperature regulated to 9.0K.

The VLPCs were fabricated in modules of 8.

Readout of each cassette is performed by two Analog Front End II with Timing (AFE-IIt) boards.

System Schematic



Each AFE has 512 channels and is responsible for digitising the charge and timing data.

Charge is Integrated over a period dictated by the Integration Gate. This data is stored in a analog pipeline.

A trigger (externally generated) is sent to one of the VLSB boards, where it is encoded and distributed to the AFE boards.

Upon receiving a trigger the AFE-Iit looks back in the analog pipeline and begins the digitisation process (5.7us dead time).

The 512 channels are divided into 128 channel banks. Data is sent from the AFE to the VLSB where it is buffered until the end of spill.

DATE Readout

- The two trackers are connected to two data acquisition machines:
  - Upstream = miceacq16, LDCID 3
  - Downstream = miceacq17, LDCID 4
- Integration with date was started in January.
- Thanks to yordans diligence in looking over the data in the unpacking a number of readout errors were spotted.
  - These were caused by mistakes in the wrapper layers.
  - These were fixed in the post MDR debug.
- When integrating with the downstream detector, the GEOID's for the equipment was set wrongly. This was spotted during beam running and fixed (although it did crash the code at first, and a quick cheap modification (hack) was put in place)
- DATE readout is now working for both detectors.

Hardware Status

- Upstream tracker is OK.
- Downstream tracker has issues on two banks, reading incorrect event numbers.
- Possible issues in readout of 4th station.
- Investigation of these issues is a priority
- Spares...
  - Need to perform an inventory of spares (with calibrations – few at present).
  - Need to setup onsite test stand.
  - Prepare spare boards, so hotswap is possible.

DAQ Code Changes

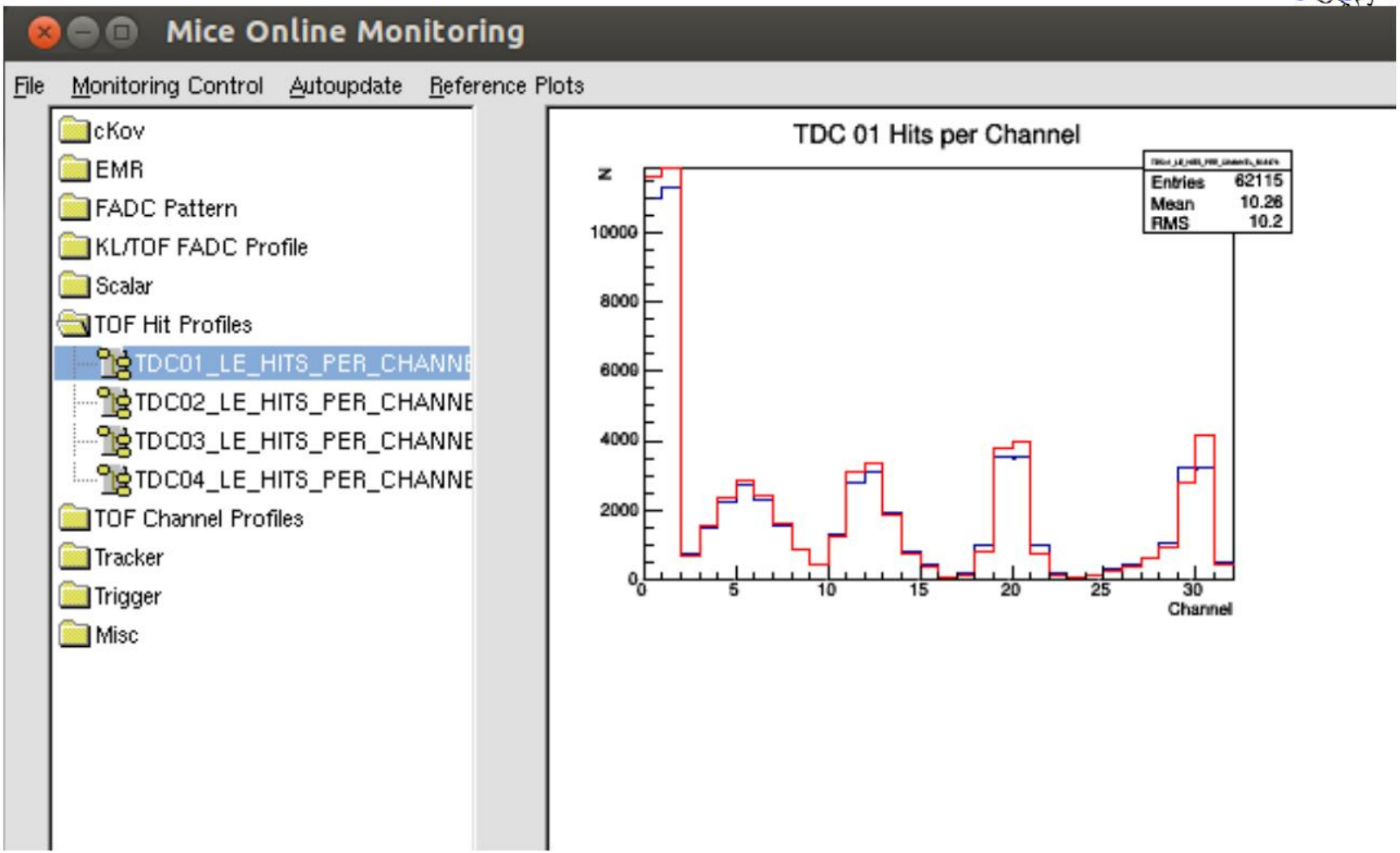
- The DAQ code at present is implemented in a complex library. (TrReadoutLib).
  - This has a large amount of superfluous readout machinery.
  - It is wrapped by two layers (MICE Daq Equipment) and DateReadout code.
  - These layers are difficult to follow, and tough to debug.
  - VME operations are not checked for success.
  - VME multiread is used, which claims to be “fast”, 3.2Mbyte/s. Will try using block transfers.
  - Errors are not reported back using the standard machinery set up in Mice Daq Equipment.
- Rewite is planned to address these issues.

General Updates

- Tracker Plots are now shown correctly in OnMon.
  - Previously wasn't getting correct boardID. Now fixed.
- Now using latest unpacking.
  - Fixed install scripts to reflect this.
- General GUI debugging.
  - Solved issues with communication between GUI and BG process.

Comparison

- Still persisting with the Chi2Test method
- Issues with making comparisons on every spill.
  - Too many histograms = slowdown
  - Resolve by comparing every 10 spills.
- Still many bugs to resolve.
  - Should be ready for early July.
- Now have an overlay of the reference data over the live data ready to view.
  - Long requested feature!


Mice Online Monitoring
File
Monitoring Control
Autoupdate
Reference Plots
cKov
EMR
FADC Pattern
KL/TOF FADC Profile
Scalar
TOF Hit Profiles
TDC01_LE_HITS_PER_CHANNE
TDC02_LE_HITS_PER_CHANNE
TDC03_LE_HITS_PER_CHANNE
TDC04_LE_HITS_PER_CHANNE
TOF Channel Profiles
Tracker
Trigger
Misc
TDC 01 Hits per Channel
Entries 62115
Mean 10.26
RMS 10.2
10000
8000
6000
4000
2000
0
0
5
10
15
20
25
30
Channel

Belgrade

- Team from Belgrade has offered to help with the Online Monitoring

- 2 main tasks assigned:

  - Simplify the communication between the GUI and BG process
  - Upload the plots generated by the OnMon to a webserver (similar to the OnRec).

  I'm sure they'll say hi!

Conclusion

- The FPGA-based trigger has been routinely operated since April.
- The old trigger system has been dismounted.
- The PID DAQ is in a good shape and is ready for Step IV.
- Integration of the trackers in the MLCR DAQ system is almost completed. Great job Ed!
- We still have an issue in one of the VLSBs (in two of the banks).
- Comparison Live data vs. Reference data is added to the OnMon.
- The interface between OnMon with EPICS is almost ready. This must be a top priority.