

Tracker Commissioning

On behalf on the tracker team:

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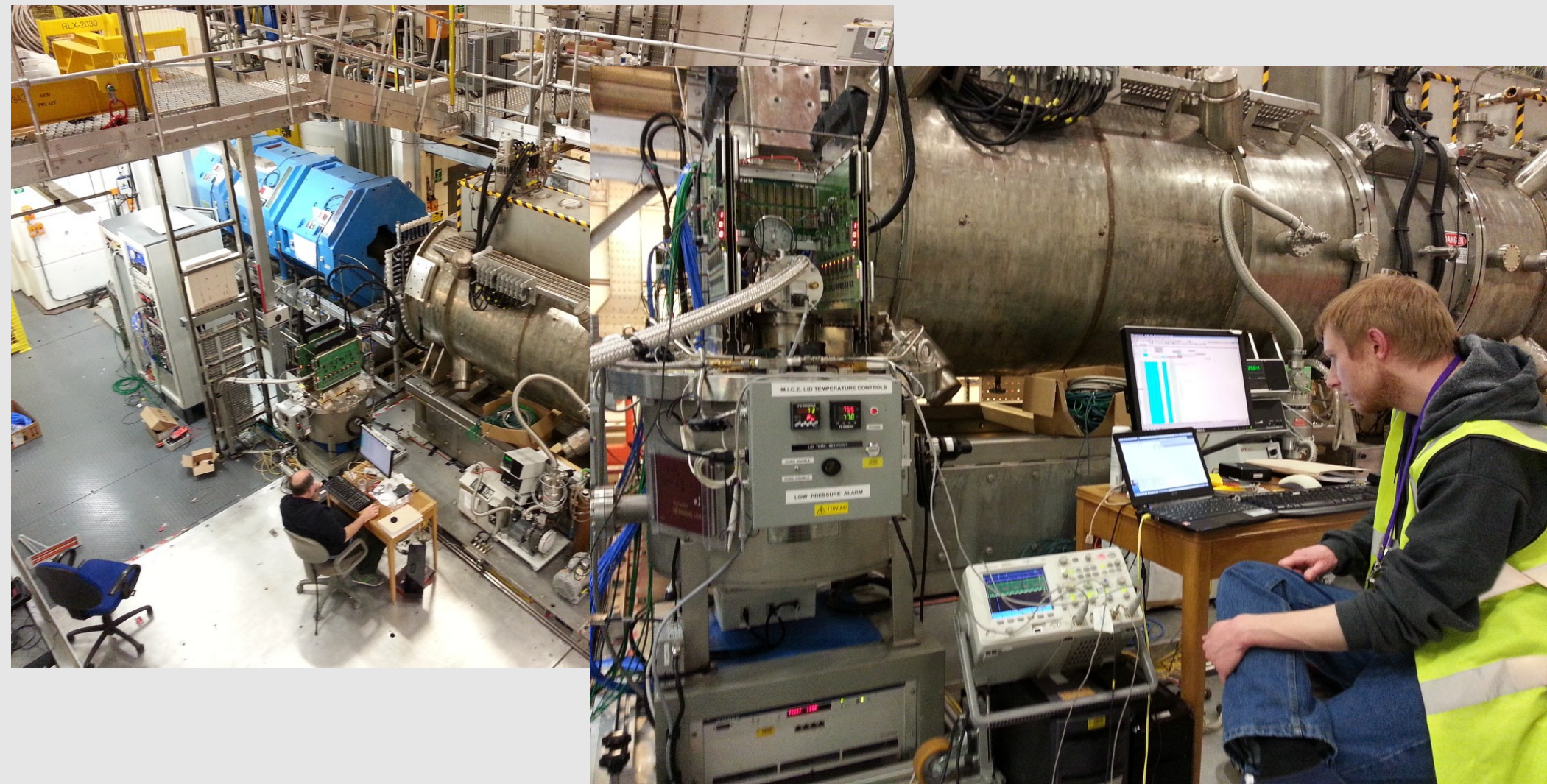
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Nov 2014

- Begun Operation in Hall
 - Cryostats hooked up to monitoring/interlocks/vacuum/helium.
 - Compressors hooked up to water/power/cryostats
 - Cryos 1,2 had long lines, did not attain <9K operational requirement.
- Cryostats 1 & 2 cabled for readout
- Cryostat 2 had a short to ground, found and solved.
- Issues with configuration S/W (no communication with cryos)
 - Reverted to use of excel calibration tool on aging windows pc.
- Timed in and observed external LED.
- Attempted to connect internal LED, however hot VLPC's required biasing low, and nothing was seen above the noise.

Nov 2014



MICE CM41

E. Overton

4/14

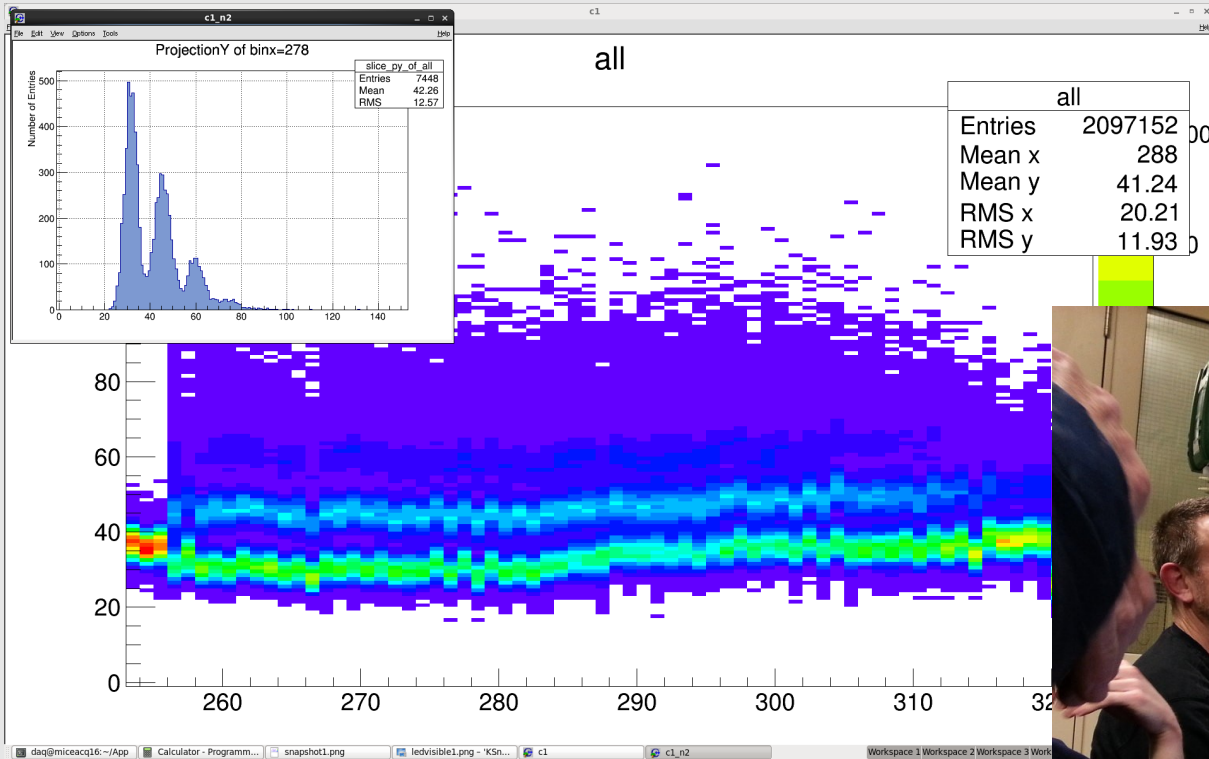
Nov 2014 – Jan 2015

- Cold-trapped cryo coolers to clean contamination from system.
- Shortened Cryo1,2 lines by moving Compressors.
- Debugged C&M S/W
 - Added a CAEN VME controller compatible interface, removes need for outdated SBS controller.

Jan 2015 - MDC

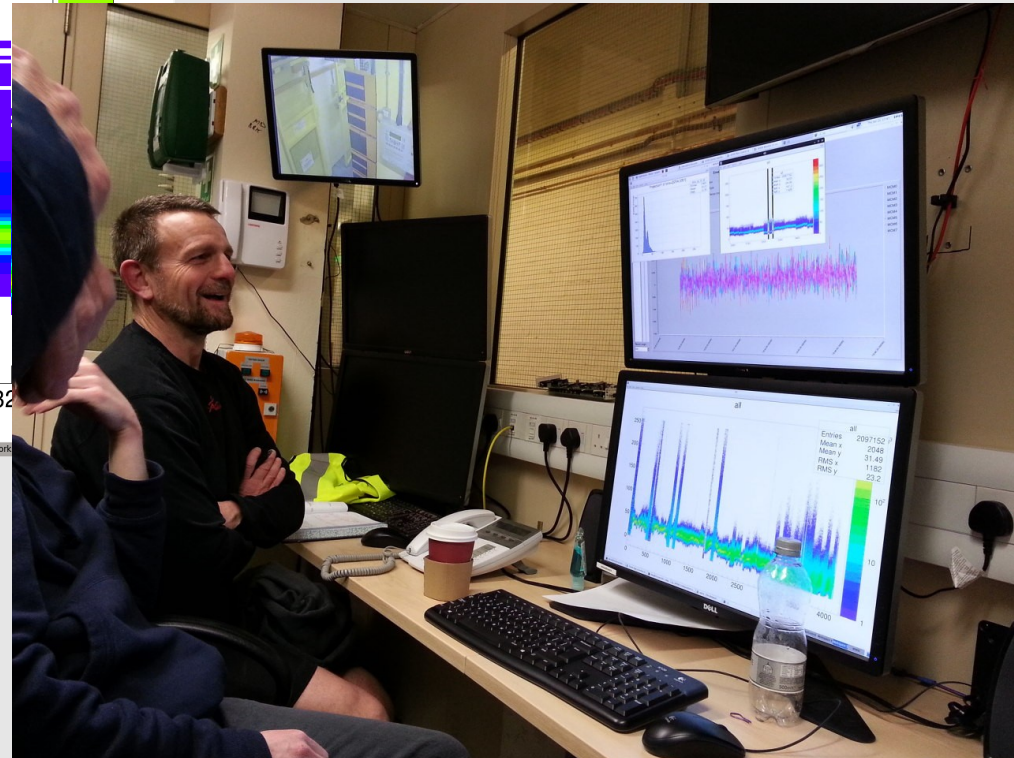
- Compressors moved and purged, delivering 4 cold cryostats (<6.5 K)
- Connected WG's on Down Stream Tracker
- Faulty PSU on DS Tracker → used US instead
- Had issues regulating VLPC temperature, bad calibration constants, finally resolved by end of week.
- Noise on upstream tracker electronics, unresolved.
- First Pass integration with DATE.
- Triggered and read out noise into data stream
- On-mon displayed some nice plots.
- On-rec not tested, Tracker Unpacking in MAUS is presently non-operable.
- After the MDC a single Waveguide was readout from the tracker with the internal LED...
- “New” trigger integration incomplete.

Jan 2015 - MDC



<<= Internal LED

Temperature Control &
Light leak observation =>>



Cryostats, Interlocks, Controls,

- Controls / Interlocks
 - Daresbury control racks currently in hall will be relocated to RR2.
 - Some detectors require installing for unattended running.
- Cryostat
 - Helium leaks on flex lines, cryo 2 notable, replacement flex is ready to be installed when convenient.
- Controls SW
 - Need Fully integrating with the MLCR systems.
 - Existing AFE Configuration/Monitoring code does not present ideal process variables.
 - => Extracting core functionality from the existing code, but adding to a new program.
- Grounding scheme being implemented with Daresbury to help with noise problems.
- Automated Calibration code needs interfacing with EPICS.

Preparing for Beam

The following list is the list containing the bare minimum for taking beam data, for Step IV a more thorough commissioning is required.

1) Clarify and fix noise issues [? days]

Noise issues were observed during the Mock data run, however these seem to have dissapeared... This needs understanding, otherwise will bite us!

2) Implement timing derived from the single station test [1 day]

Use the timing we used in 2012 as a starting point for finding the ISIS beam, then re-time in LED systems to this timing..

3) Perform Bias Calibrations [4 day]

David has written the calibration software, but this is the first time it is to be used properly.

4) Test New trigger [3 day]

FPGA Trigger now has an implementation of the necessary tracker veto (alive window), but with 10ns of jitter (on a 120ns gate, this is substantial). Needs testing and understanding.

5) External LED pulser test [3 day]

With the correctly biased VLPC's the external LED pulsers must be fired to verify the calibration and obtain gains for each channel.

6) Wave guide attachment, [4 days]

(possibly) **testing with internal LED** [1 day]

Timing in.. with Beam (first pass)

Once the system is wave guided and calibrated, we can then start looking for the beam.

- 1) Synchronise alive window to the trigger arrival.** [2hrs beam + on-mon]
Maximise accepted-triggers to trigger requests.
- 2) Verify timing of readout trigger and closing of integration gate.** [2hrs]
In the hall, with a scope.
- 3) Synchronously move the readout trigger and integration gate.** [4hrs beam + on-rec]
Looking for space points in the tracker, aiming to maximise:
Spacepoints in tracker / Spacepoint in TOF1 AND TOF2

At this point the first timing pass of the trackers will be complete.

NOTE: This will get data through the chain, giving users a good chance at using real tracker data. Probably 95%+ space point finding efficiency. Might help with alignment.

REQUIRES: Online monitoring + reconstruction for critical diagnostics.

ASSUMES: NOTHING goes wrong....

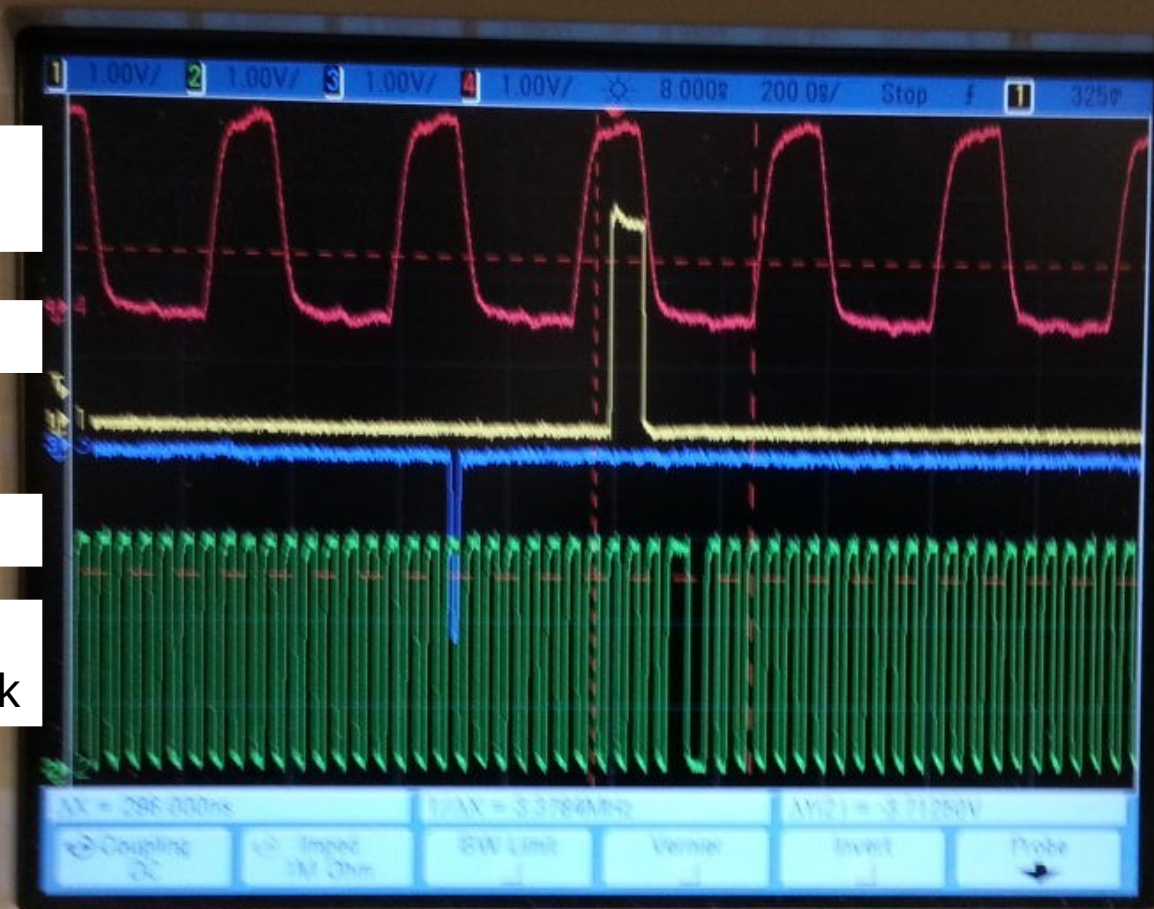
LED Timing Shot

Integration Gate

Trigger

LED Pulse

53MHz
Encoded Clock



Digital

Select

D15 Thru D0

Position

Commissioning Step IV

To produce the best possible data we must ensure that the tracker works efficiently, and does not introduce bias into our measurements. Much of this was already considered by David at CM40, little has changed.

1) Verification of space point finding efficiency against: [1 week beam]

- Time in spill
- TOF1-2 time
- Each station

2) Verification of particle-optical-readout path: [5 days LED + 2 day beam]

- Use the internal LED system to illuminate internal fibres and measure mean light yield. Need to understand/parametrise internal light distribution.
- Combine with beam data to obtain a full understanding.
- Use to generate a large statistics measurement of hit efficiency / MIP light yield

3) Discriminator only running mode (removes 5.7us dead time, and all light data):

- Develop Firmware/Readout/Unpacking.
- Calibrate.
- Repeat efficiency study with discriminators only.

Diagnostics for Step IV

Stealing Davids list from CM40:

- 1) Raw ADC/TDC for all electronics channels on each tracker - gives information about chip status and zero suppression – pure monitoring (no cabling or calibration)
- 2) Calibrated to PE for all electronics channels - gives information on VLPC performance (requires calibration)
- 3) PE for each fiber-channel - gives information on fiber performance
- 4) Hits / plane, space points / station - gives information about cabling, reconstruction efficiency. Also do function of (for comissioning):
 - 1) Time in spill
 - 2) TOF1-2
- 5) Spacepoints in tracker / Spacepoint in TOF1 AND TOF2
- 6) Event displays: x-y by station & the circle swirly-line plots Adam uses. Need to randomly select events or something.

Primary Goal

- Obtain a complete readout of a calibrated tracker, which has been partially timed into the Beam as part of the possible weekend running on 21st March onwards.
- From here, we can use data readout to:
 - Test unpacking/analysis codes
 - Develop tools for the proper commissioning
 - Spot the mistakes we made, so we can do it properly next time