

Tracker update

D Adey

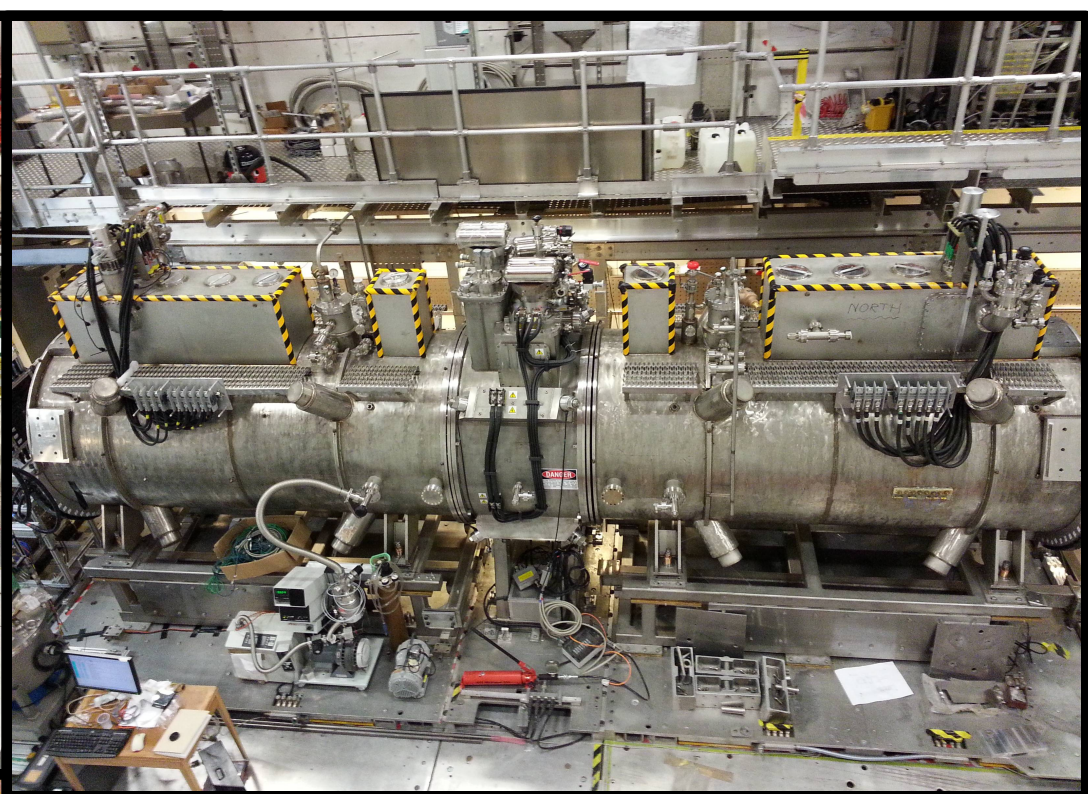
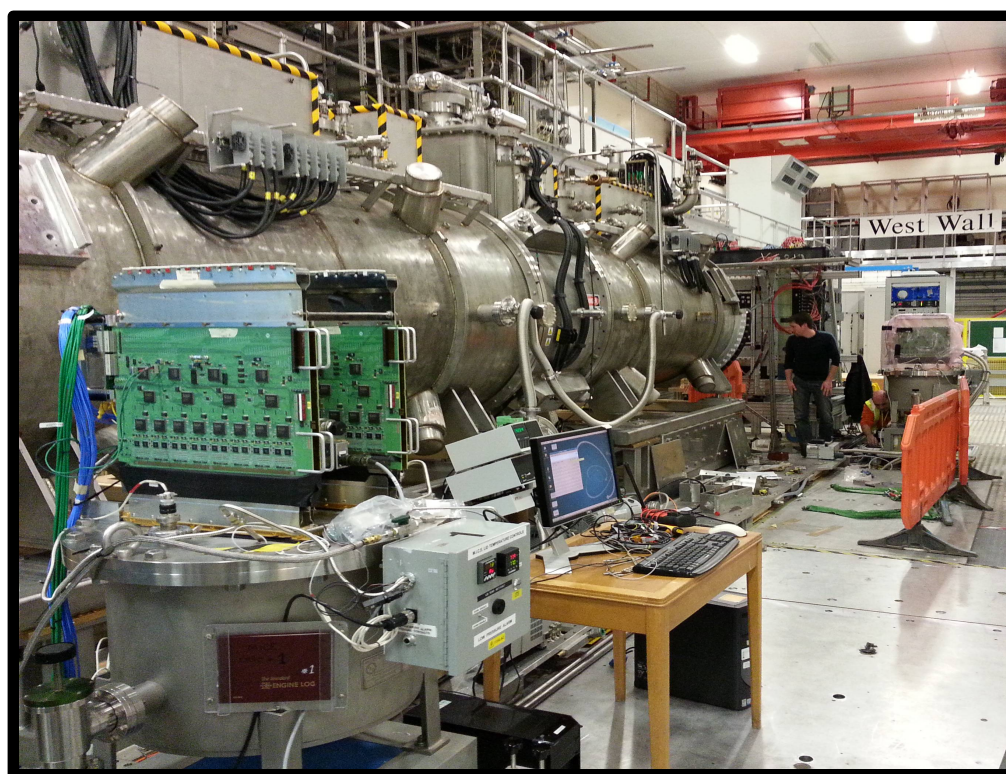
MICE VC

11th December

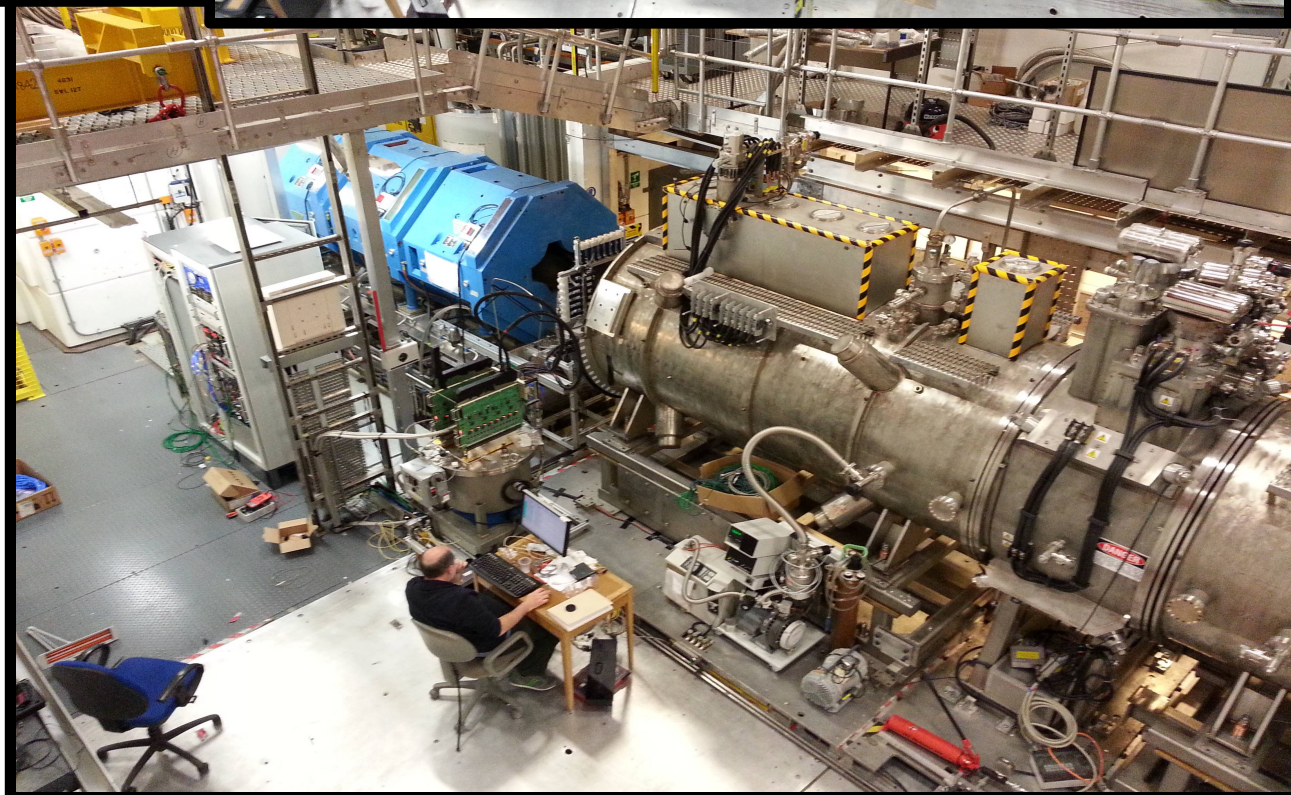
adey@fnal.gov

September equipment tests

- Check Wiener power supplies – one faulty repaired by vendor, spare ordered
- Vacuum turbo pumps idle for >1 year, but inspected by vendor
- Readout electronics full QA, not-insignificant selection of bad chips discovered (broken TriPt, FPGA) – full set of spares (16 AFE boards) removed from D0 in addition to 8 spares at RAL
- Other spares (VME buffers, bayonets) also found/acquired



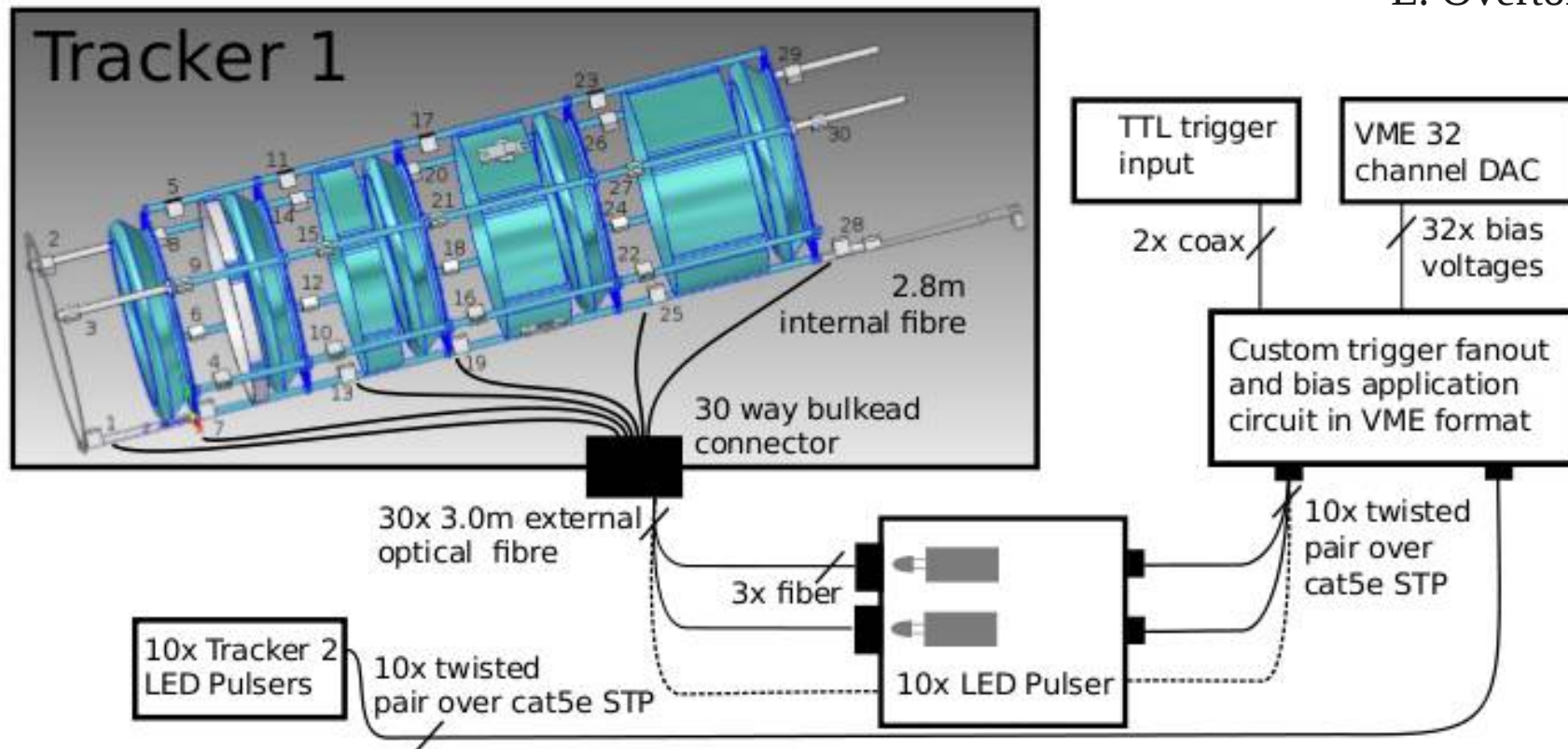
- C MacWaters installed and prepared all four cryostats, compressors, vacuum systems and electronics
- A Bross, P Rubinov, E Overton, D Adey at RAL 11/17-11/26
- Upstream cryostats cabled
- External LED on Cryo 1
- Waveguides for station 1 split on Cryos 1+2



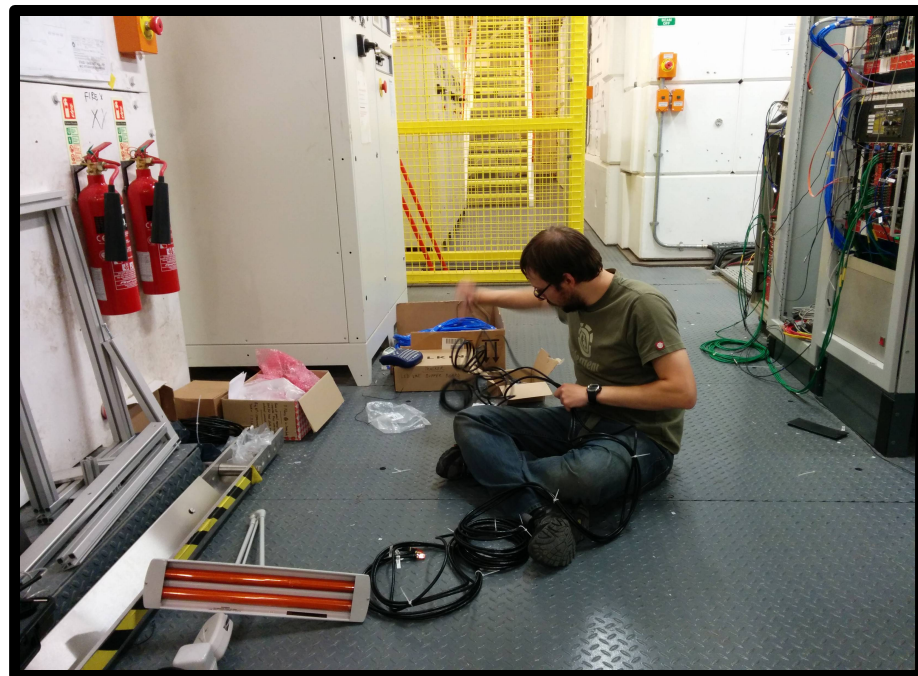
November installation and tests

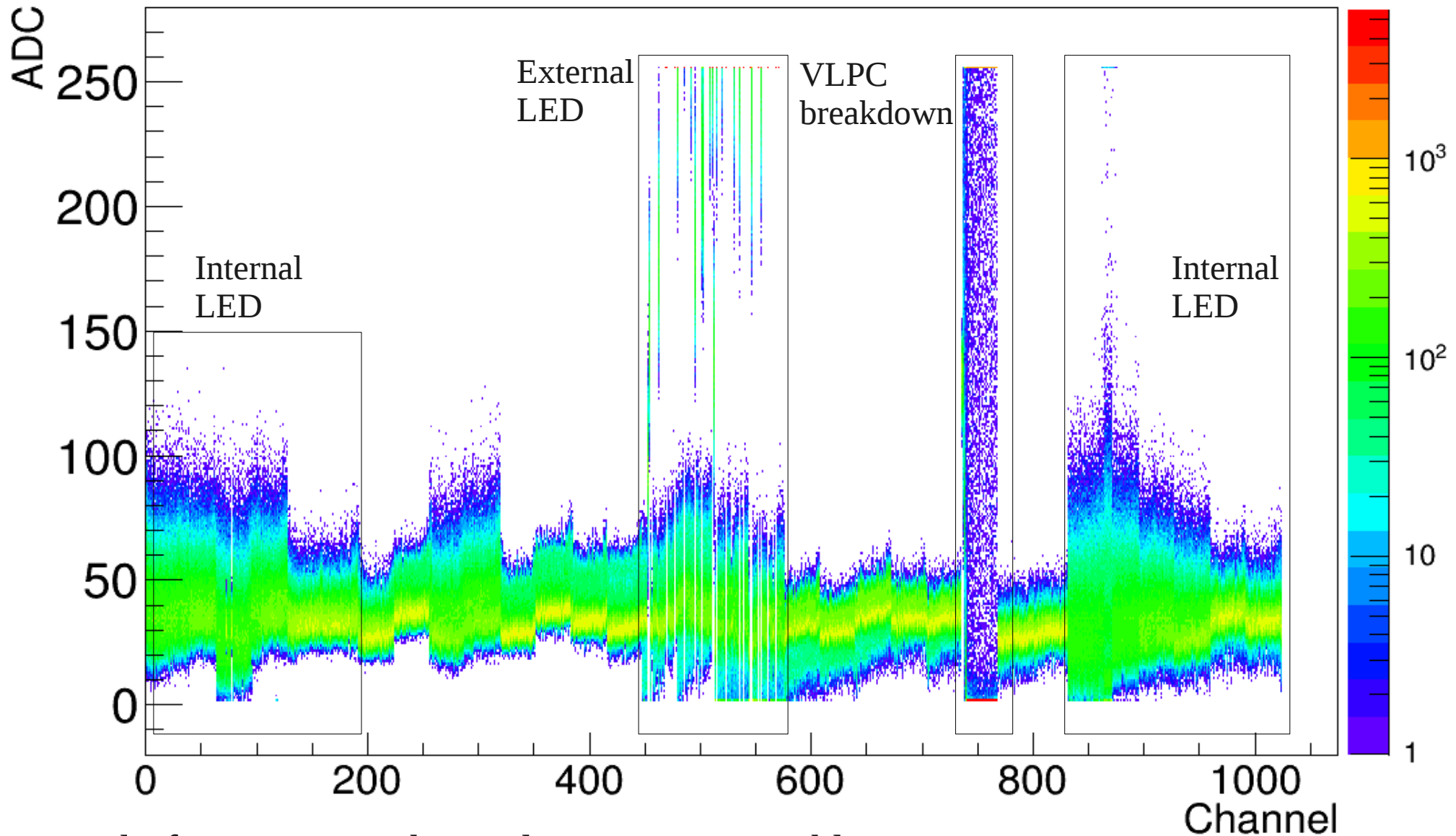
- All four cryostats installed
- Vacuum pump-down mostly successful, some variations between cryostats but at specification
- Compressors installed in original magnetic field mitigation locations – 20-30m hoses to cryocoolers
- Plan – verify cooldown and performance of VLPCs; integrate new trigger logic; install and inspect internal LED; update and replace with D0 spares

- The test did not go as productively as previous tests
- Temperature monitoring and control units failed/lost calibration/behaved randomly
- Essential computer hardware failed
- Cryostats failed to reach design temperature of $\sim 6\text{K}$ – temperature at VLPCs measured as $9.5\text{-}10.5\text{K}$
- Upstream cryostats (with untested 30m hoses) $\sim 1\text{K}$ warmer than (used) downstream 20m hoses
- Hoses alone would not explain temperature rise
- High temperature made VLPCs very noisy and



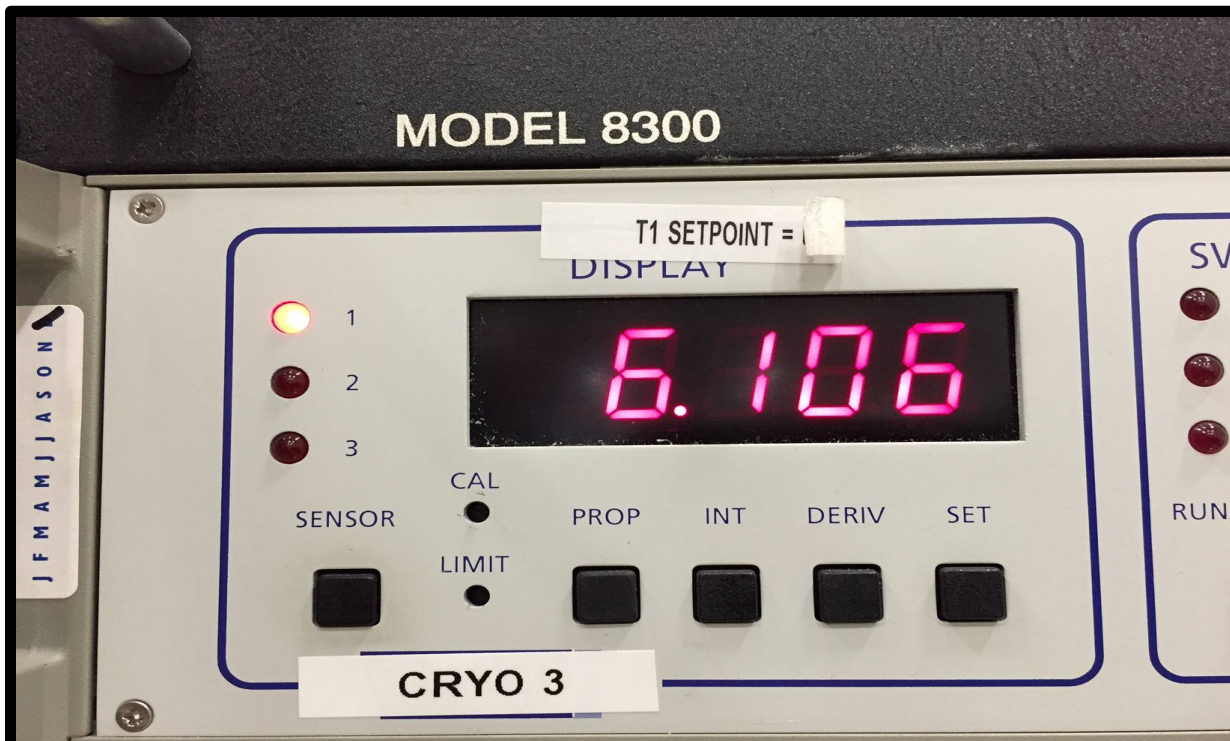
- Drive Kapustinsky pulser externally to tracker and feed fibers through spare waveguide connector
- Illuminate 3 fiber-LEDs on each face of each of the 5 tracker stations
- High T/noise conditions of VLPC made observing signal difficult
- Output of fibers at connection to tracker visible by eye



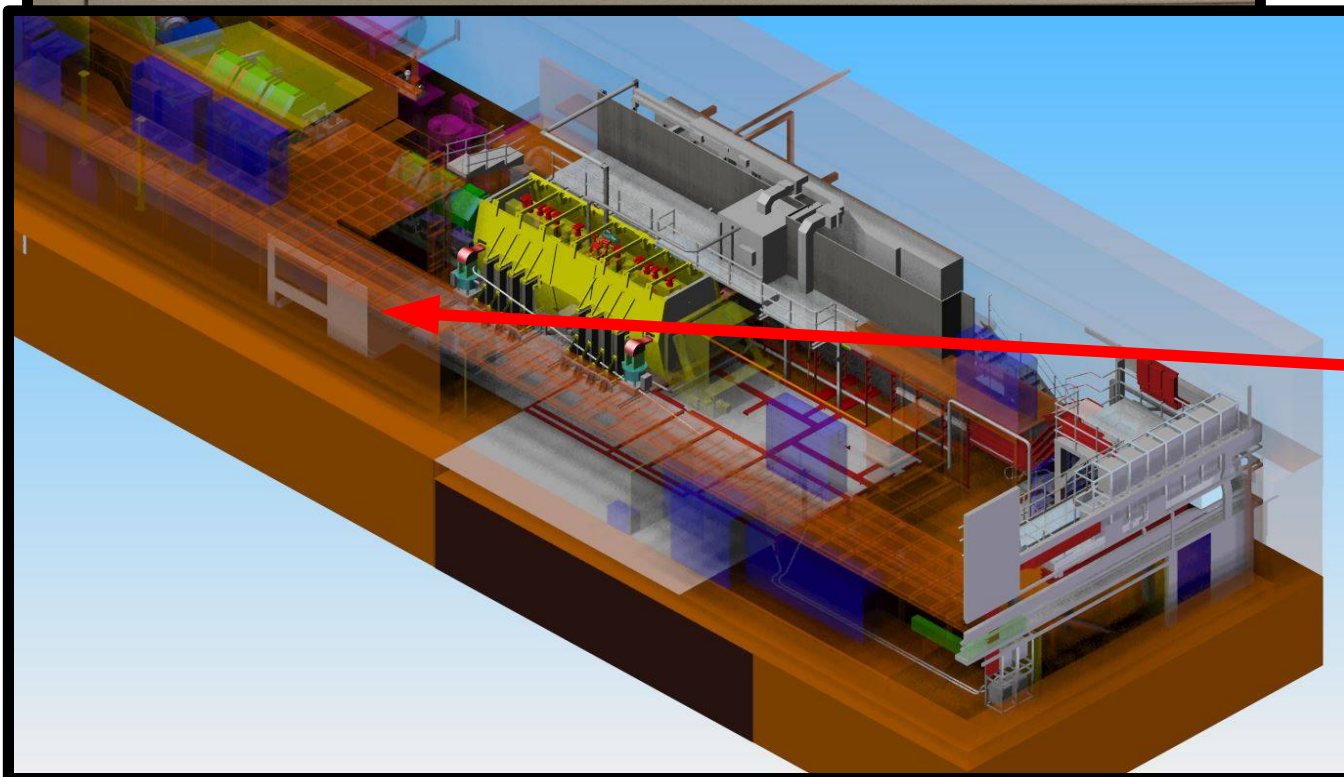


- Light from Kapustinsky pulsers was not visible
- Longer pulse LED applied to internal fibers was visible, but obscured by noise from high temperature (over biased) environment
- Issue with system probably lies in limited pulse length (2.5ns) – modifications may mitigate problem

C. Macwaters



“After only 1.5 days the new cleaned out cold head for compressor 3 has the cryostat down to $T_1=6.1\text{K}$. This is nearly 1K lower than it originally achieved after running a week.”

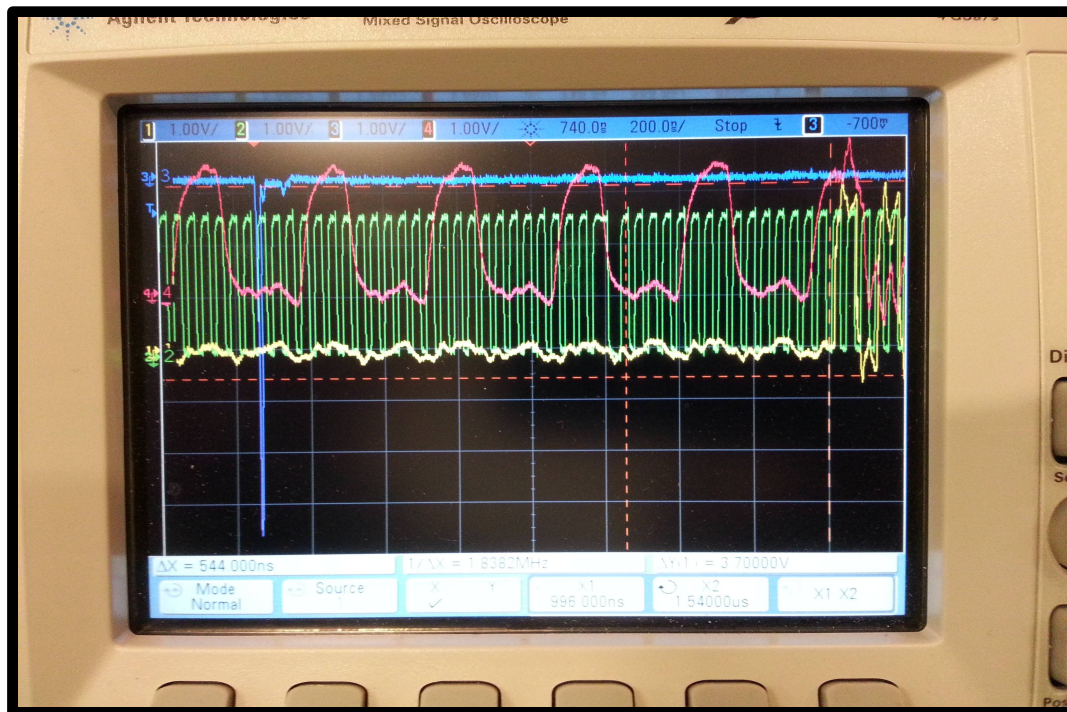
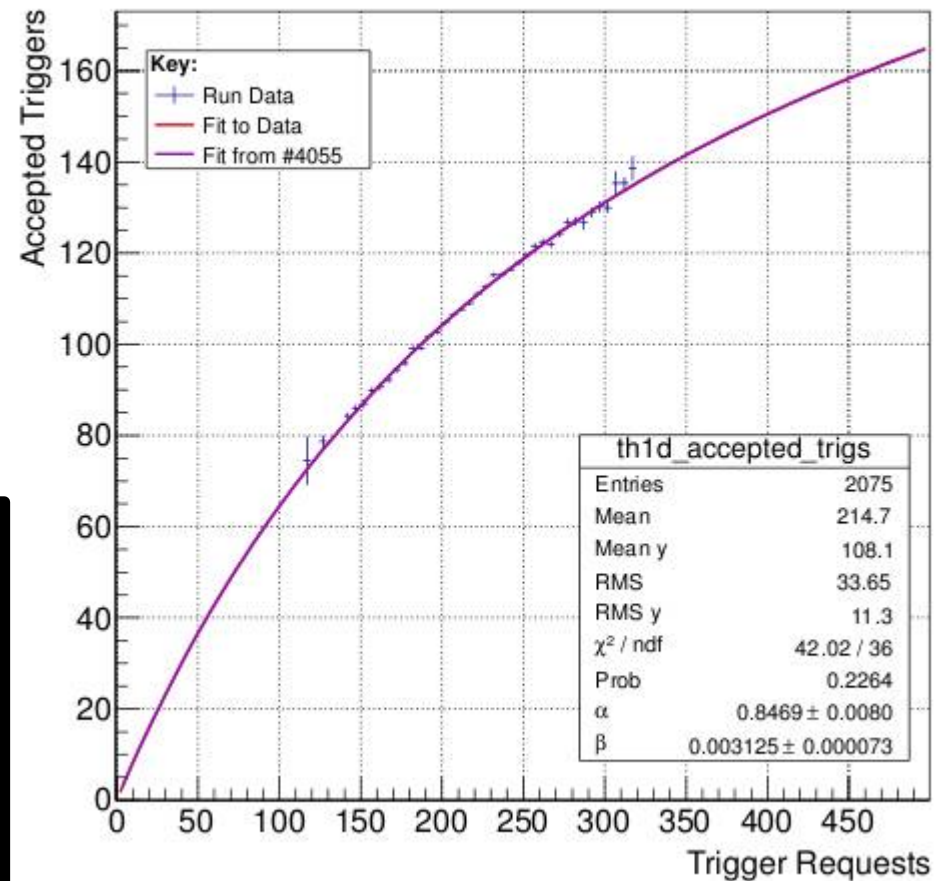


With PRY compressors no-longer need to be so far from cryostats

Movement of upstream compressors into trench – reduce hose length

- Serial ADC digitization generates a 5.7 microsecond dead time which is the primary dead time of MICE
- Action from MPB to increase data-rate as much as possible
- May involve discarding analogue and time information from the trackers
- Possible development and implementation Jan 2015

Trigger Acceptance for Run #4055

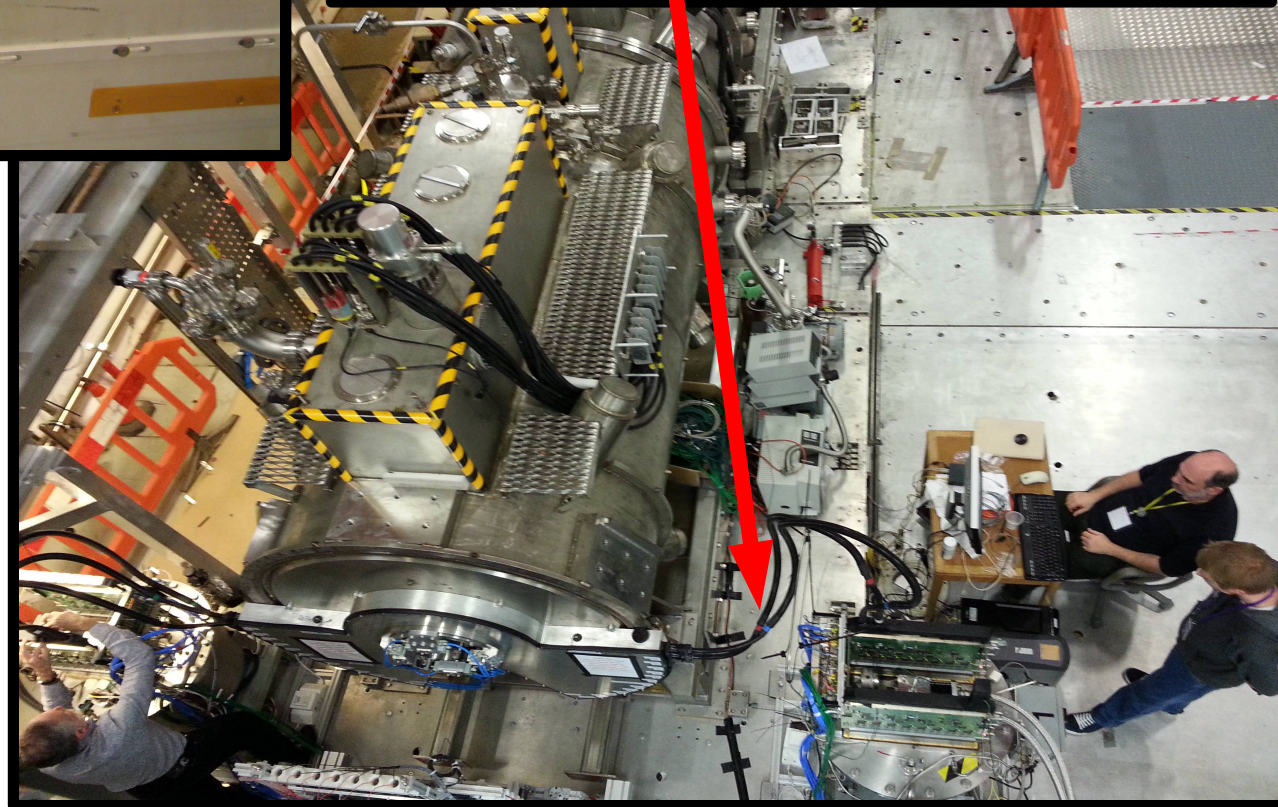
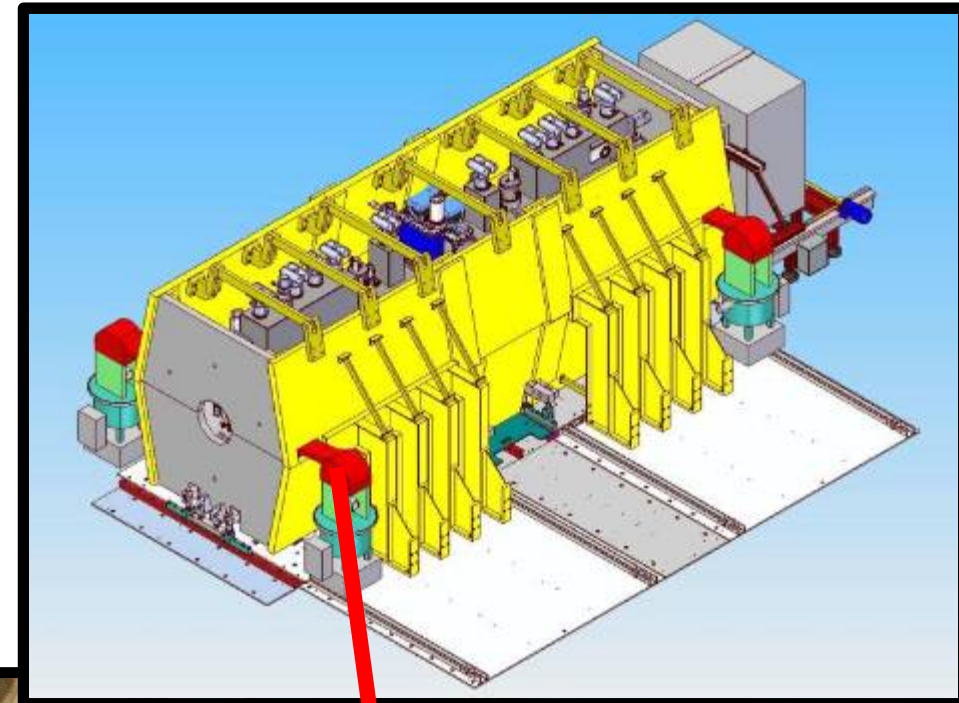
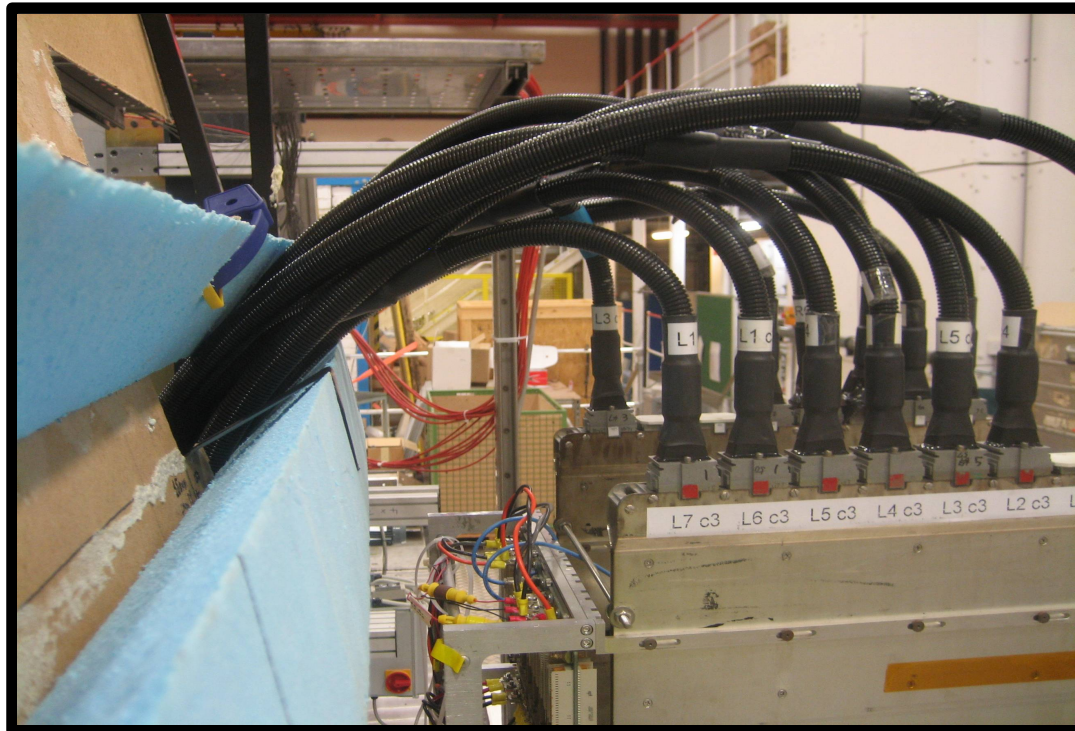


Summary

- Construction and installation is effectively complete
- Issues with temperature from November look solved with purge/compressor move – problems with readout and observation of signal are not a concern given high T
- Final integration and commissioning in the first half of 2015
- Tracker must move from “working” to “precision” detector in the MICE environment (RF timing, local noise, global detector framework), especially detailed understanding and treatment of position within the magnetic field
- First beam considered for April, but operations and hall constraints to be defined

Backup

PRY and trackers

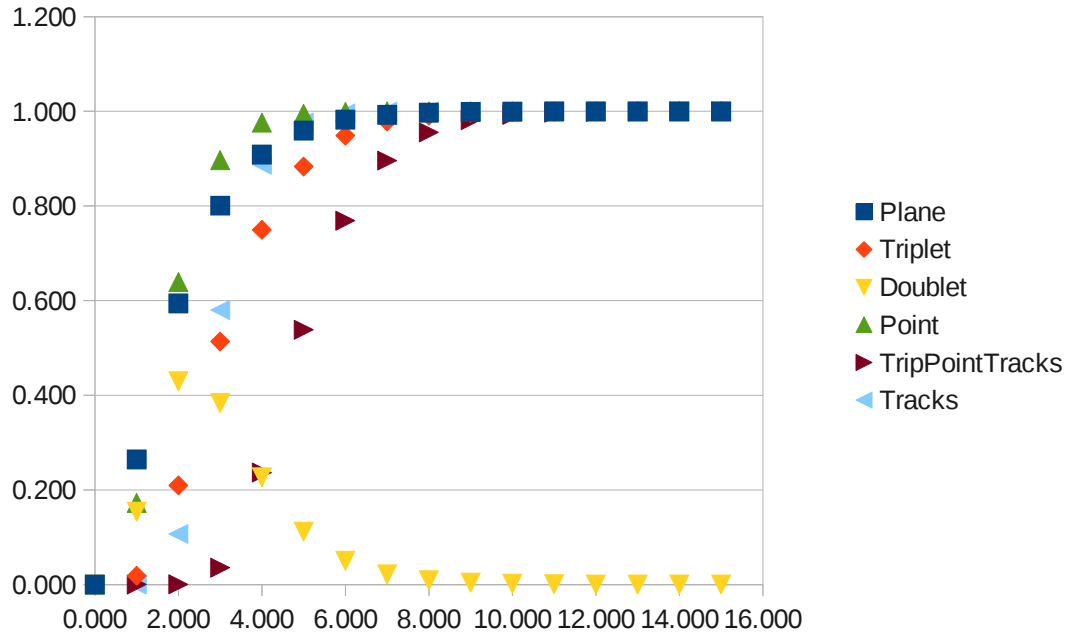


- Routing of waveguides through PRY will prove challenging
- Mock-up shows it is possible in principle

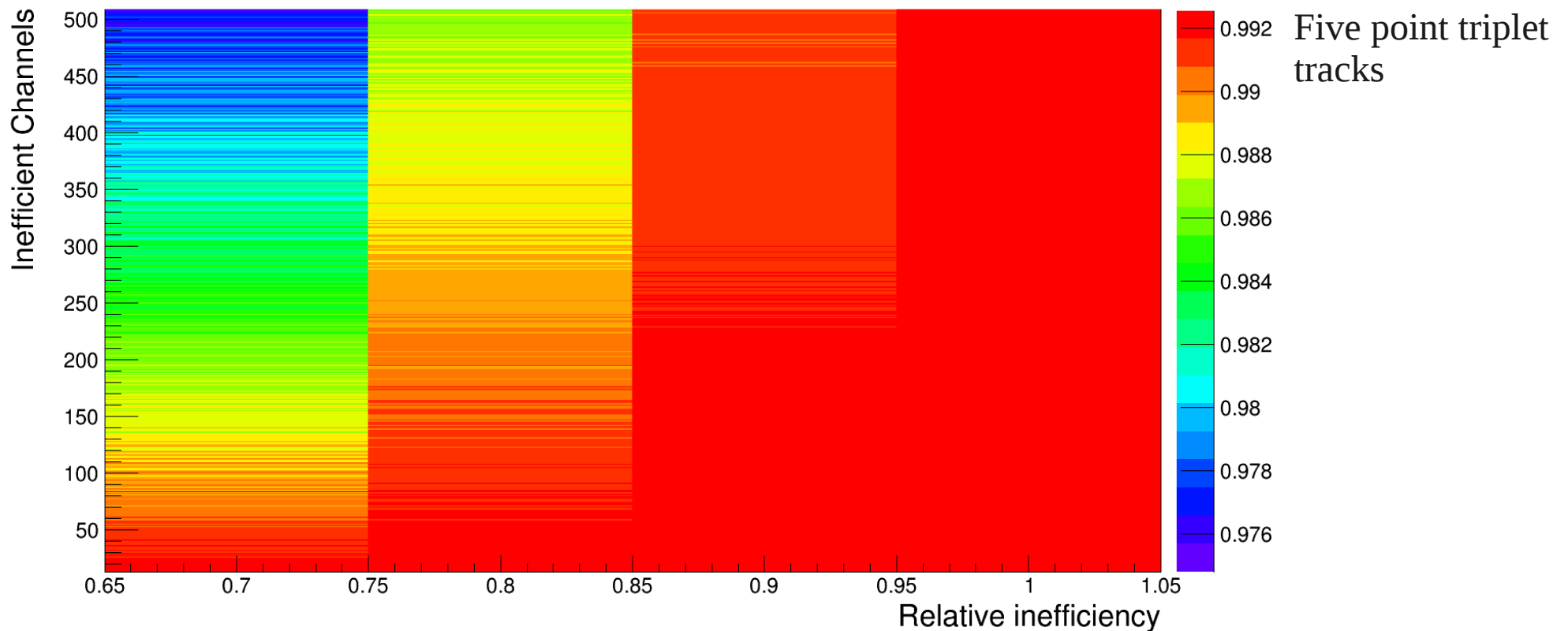
Commissioning

- Everything must work – cryo/vacuum systems, readout electronics, power supplies, waveguides, LEDs, software for as installed trackers
- Integrate with final trigger/DAQ systems – **Jan 15**
- Ensure timing with ISIS 3MHz RF cycle is understood at an acceptable level (aim for 0.01%) - **First beam (April 15?)**
- Understand relative efficiency of each tracker – **First beam**
- Know the alignment of trackers in the global coordinate system – **First beam with and without field**
- Mock data run in January is goal for integration. Alignment and other commissioning will require beam

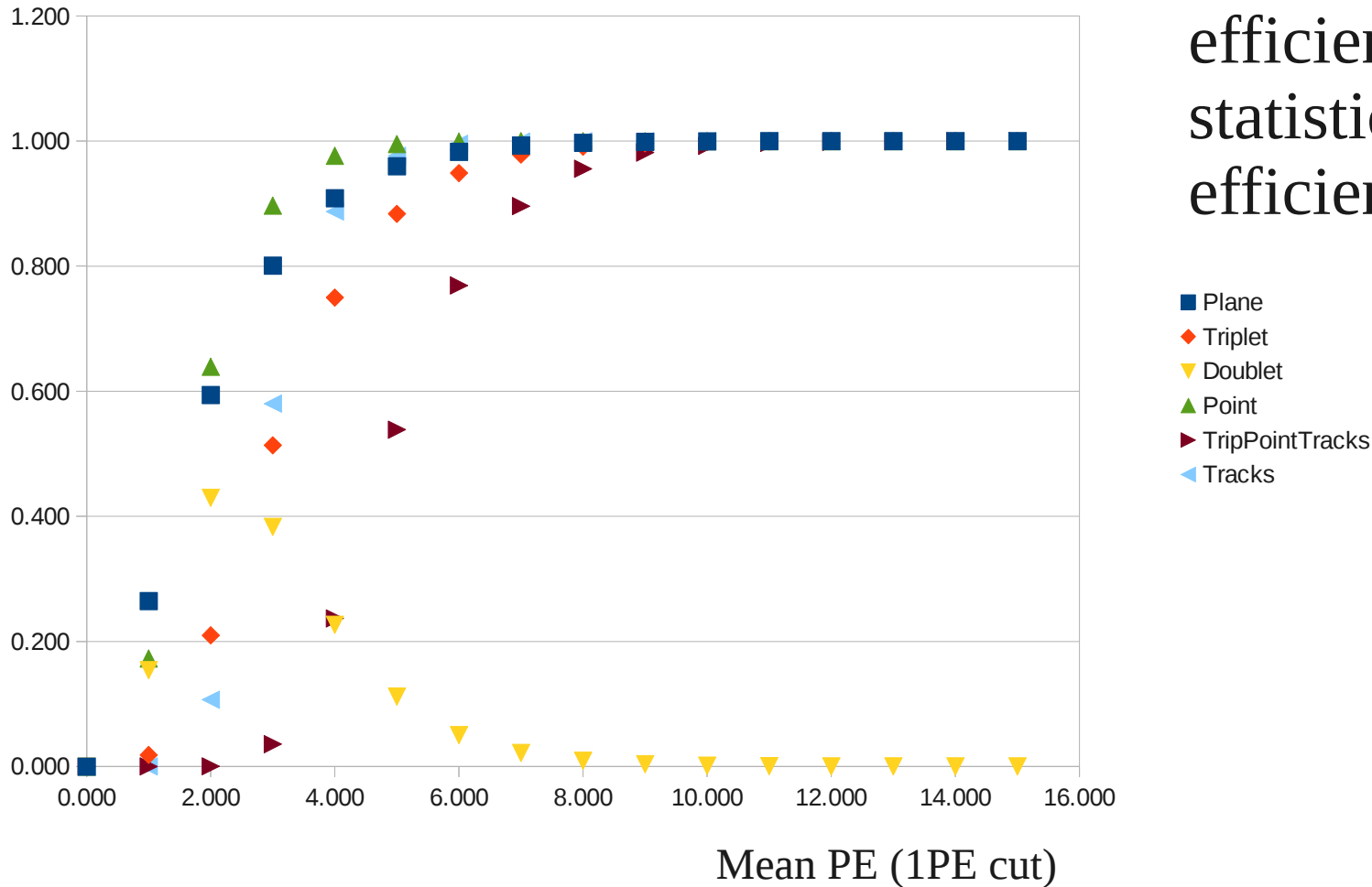
Efficiency



- Unexpected loss in efficiency is not critical problem for trackers (high light yield, degeneracy in channels)
- Important to understand for analysis of transmission etc.
- Combination of beam and internal LED



- First consider uniform efficiency and statistical behavior of efficiency



- Assumes binomial hit efficiency (OK)
- Poisson light yield (Not OK) - Saying “10PE mean light yield gives 99.9% plane efficiency” is not correct
- Re-treat as binomial problem with high k, n, p ?
- Re-evaluate linear ADC-PE conversion to accommodate gain dispersion?
Dispersion is an issue when cut is made at mean ADC of 1PE peak

3m Optical fibres
to tracker
bulkead. 30 total

LED pulser box

TTL trigger input

?m cat5e STP

VME Buffer Board

