ECal Installation Update

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Jefferson Lab

Overview: Installation in Hall A

1656 channels

ECal infrastructure: platform, enclosure, racks, patch panels etc.

Supermodule stacking

Heating system

Cooling system

Commissioning with cosmics

DAQ system

Cabling in Hall A

Cabling infrastructure: cable trays, strain relief panels

PMT/mu-metal Installation

Before Installation in Hall A

Albert/Bogdan and the Yerevan group (Aram, Karen and Samvel) worked on preparing all the parts needed to put ECal together

They also provided support for ECal's installation in Hall A

Installation in Hall A

Hall A technical staff: Lawrence (work coordinator), Zak, Travis, Cody, Casey, Cason, Lars, Sam, Ellen

Target group: Dave Meekins, Stan, Paul, Mark

Hall A staff: Don, Jimmy, Simona, Chandan, Jiawan, Ibrahim

Users (mostly students): Deb, Arna, Mahmoud, Keagan, Ryan, Hem, Jhih-Ying, Kip, Oliver, Andrew, Ben, Logan, Keegan, Provakar, Anurunddha, Nunzio, Vicenzo, Prakash

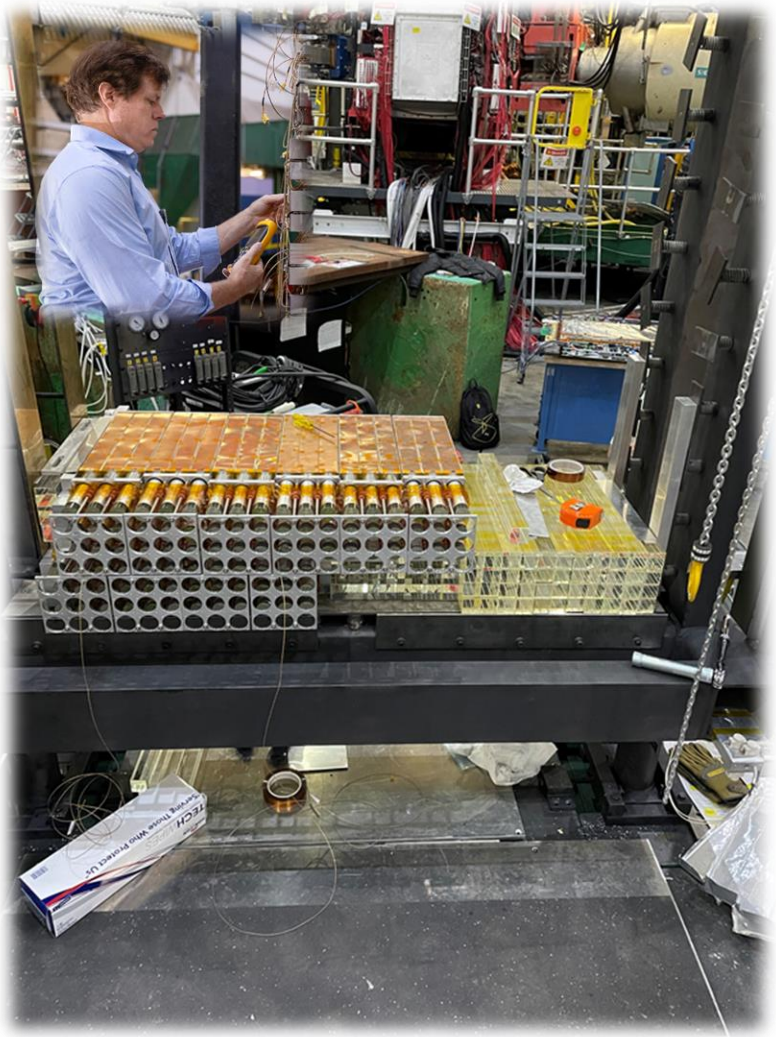
Hall A engineering and design group: Robin, Anthony, Derek, Chris

ECal Infrastructure

ECal platform, ECal enclosure, ECal frame, racks, patch panels, cable trays …

Supermodule Stacking

184 supermodules installed, one supermodule consists of 9 blocks/light guides/PMTs: 1656 detector channels



Heater System

→ Needed to maintain good transparency of calorimeter blocks to achieve the desired Ccal resolution

→ 48 heater zones and >200 thermocouples have been installed

→ Power connections to the zones are being completed and zone-by-zone testing is underway (heating each zone to 50-60 C)

→ DSG (Marc McMullen) took the lead on heater controls and monitoring

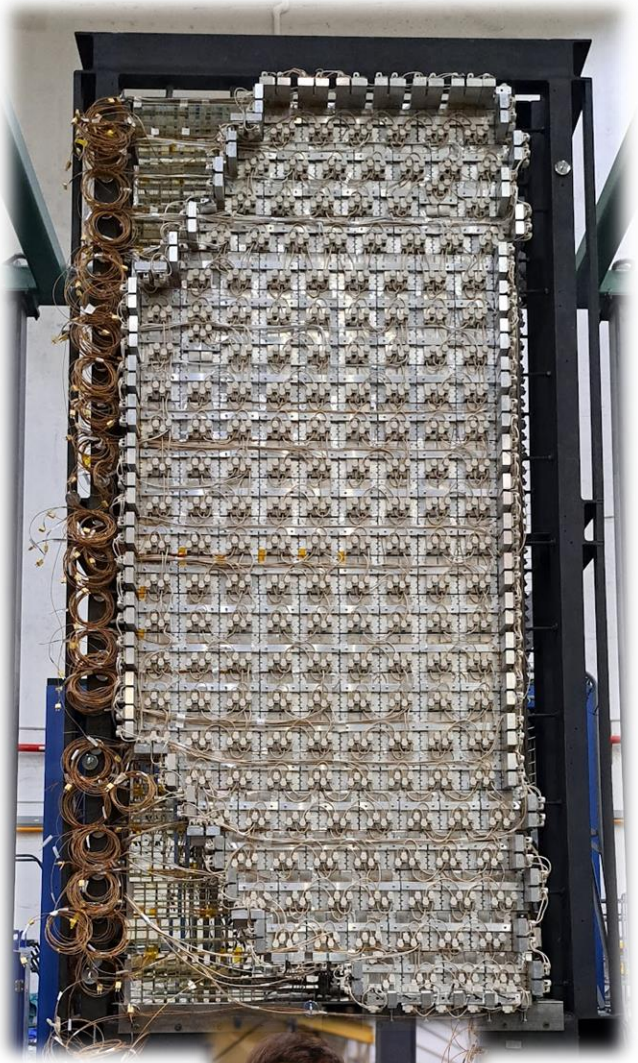
→ Developing a large scale control following the successful prototype model with each zone having its own set temperature and current to heaters adjusted by PID control loop

Slide from Don Jones

A heated detector prototype was tested in Hall A in 2023/2024

Don and Mark M. are almost done with having the heater system ready for a test with ECal (sometime next week?)

Don made ~ 1500 connections



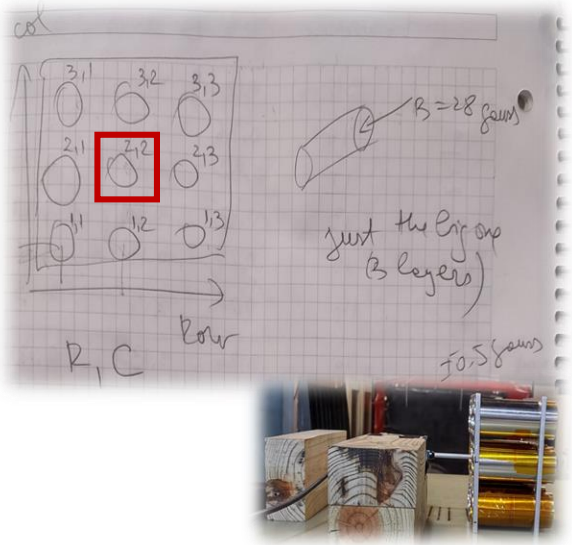
Cooling System

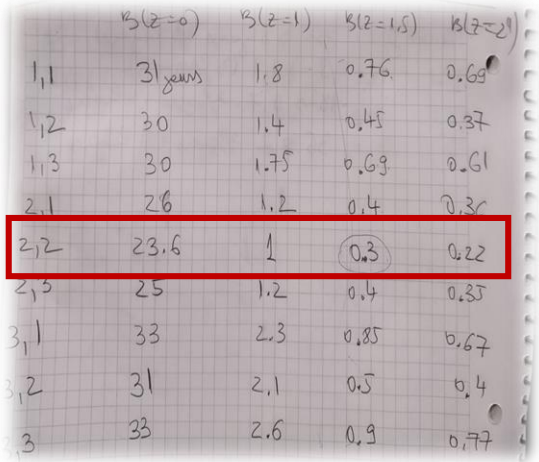
→ Needed to keep the temperature at the PMTs location under 50 C

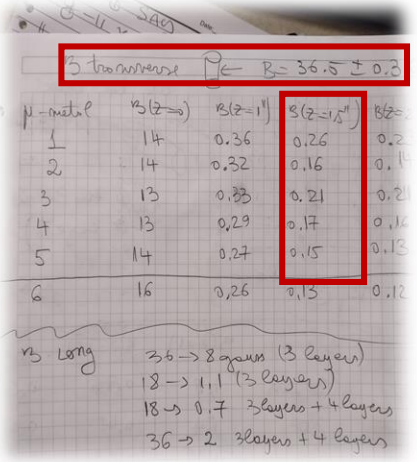
→ Air pumps under the ECal platform; pump control is manual, no feedback loop

PMT/mu-metal Installation: mu-metal Fabrication & PMT Testing

- Mu-metal shields: 4’’ long 18 mil thick (3 layers of 6 mil mu-metal) AND PMT window inserted 1.5 inch based on T and L mag field measurements







- Epas for mu-metal fab and PMT/divider/mu-metal unit testing in EEL 126

  Lots of people contributed:

  → **Keagan, Ryan**, **Chandan**, **Jhih-Ying**, **Mahmoud**, Deb, Don, Jimmy, Karen, Aram, Jerry, Simona

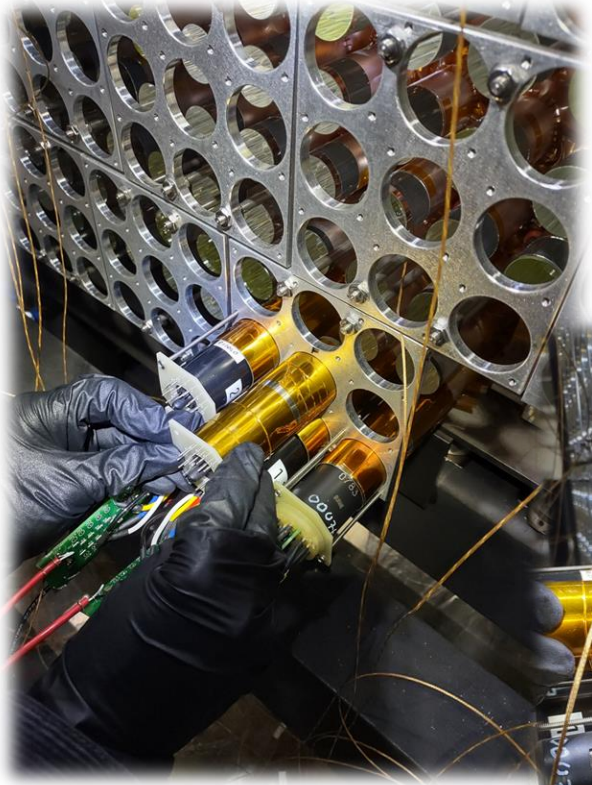
  → More than 1656 mu-metals rolled

  → More than 1656 PMTs/dividers tested

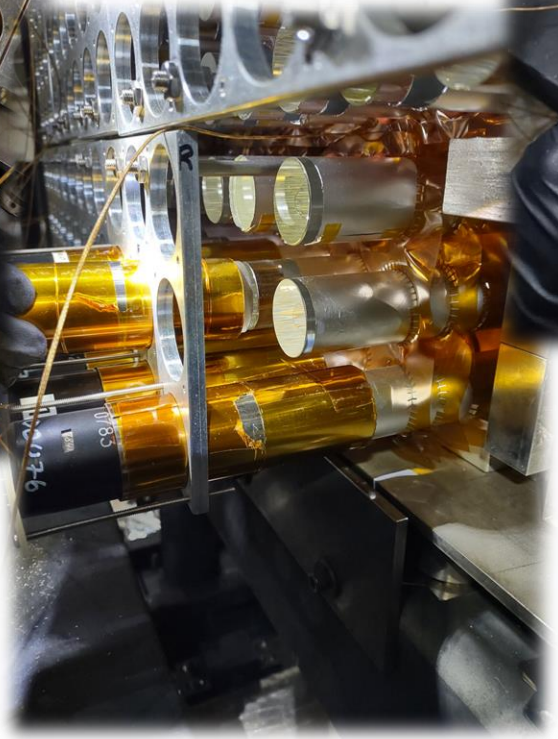
  → A lot cookie cutting (optical interface between light guide and PMT)

PMT/mu-metal Installation: Procedure

Needs to ensure good transmission between PMT and guide line through cookie



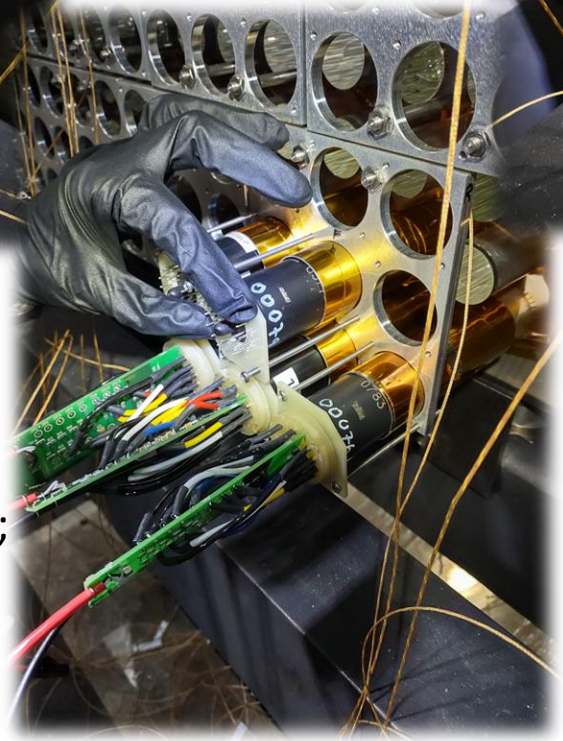
Inserting PMT through hole in the backplate



Aligning PMT/cookie to the lightguide

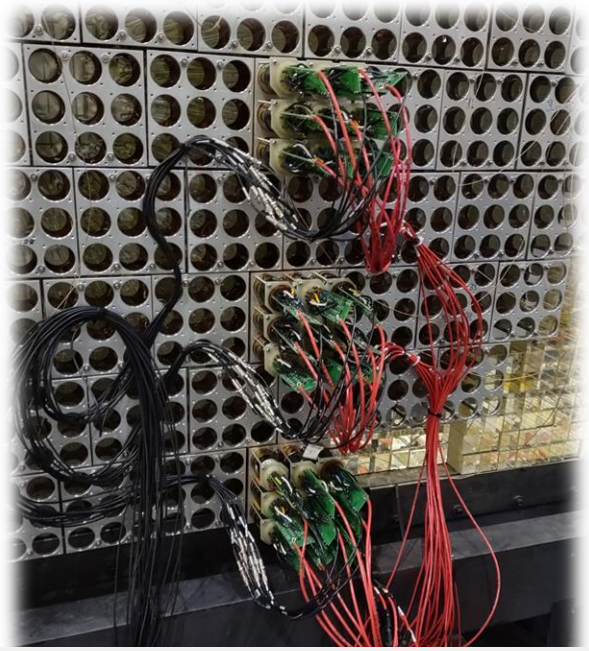
Placing the mu-metal for the PMT photocathode at the right depth – see silver line on the PMT; this must be done before putting in the screws

Putting in the screws by hand



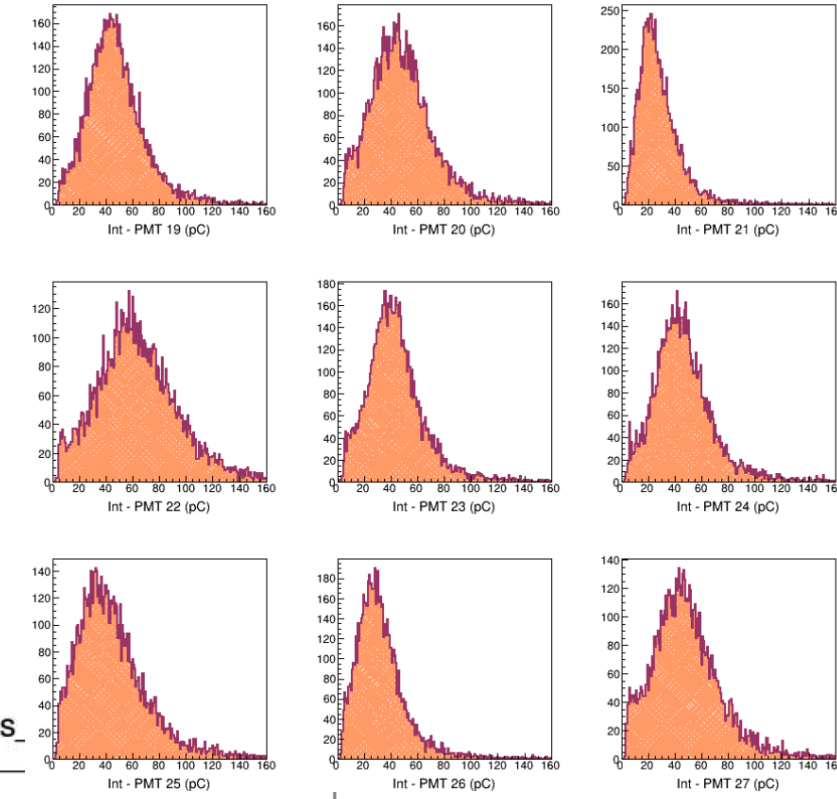
Using a torque screw driver: setting = 2

Cosmics Test during GeN-RP

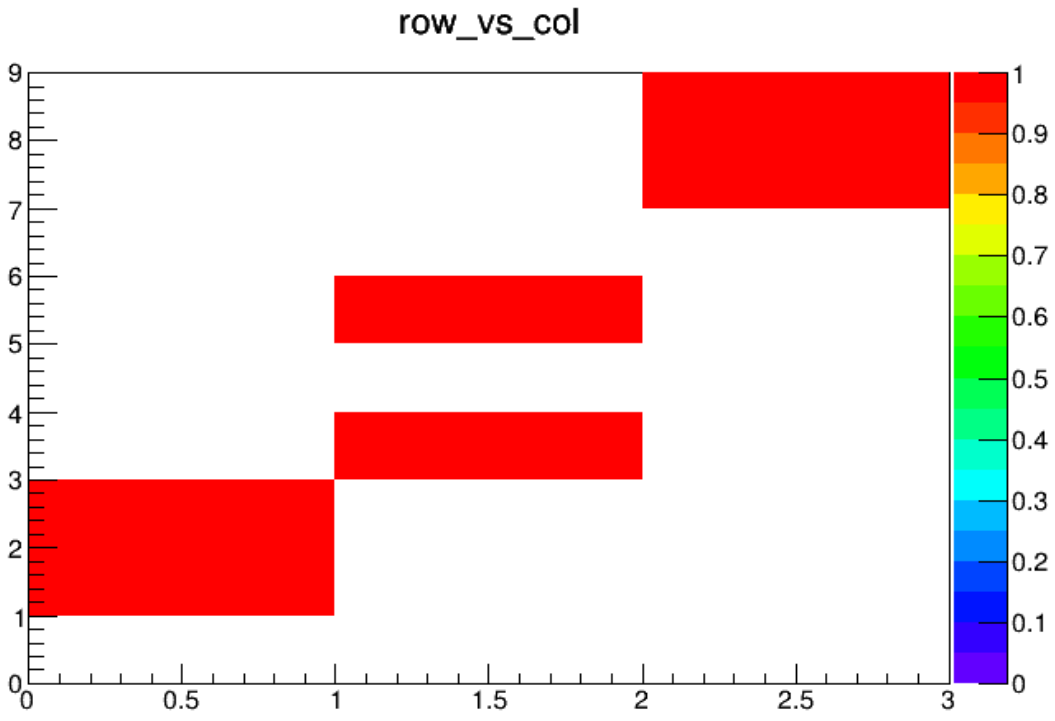


This was done to check the adequacy of the optical contact between PMT and light guide via cookie

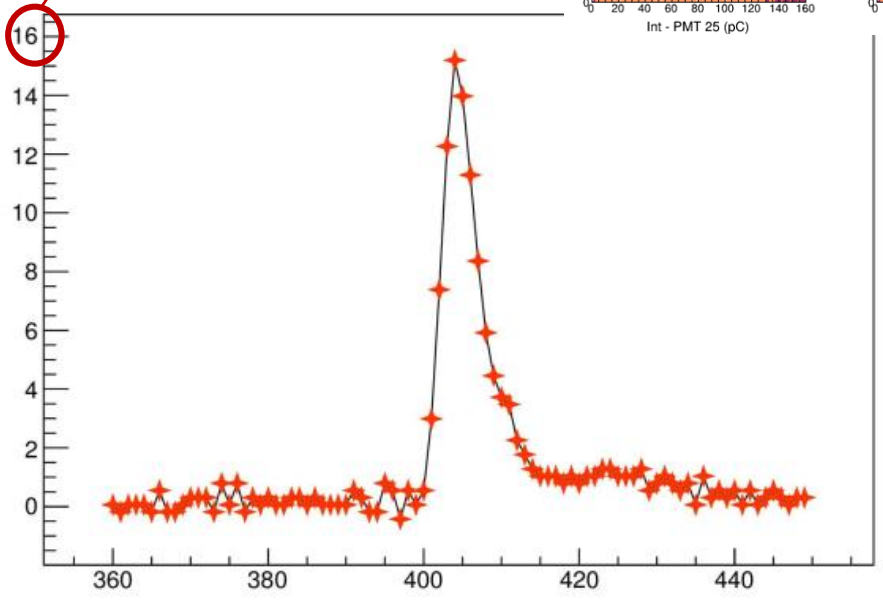
VTP-based trigger



ImageMagick: run_82_evnum_140_2d_ch_23.png



Amplitude in mV



I did this against Bogdan's wishes ☺

PMT/mu-metal Installation

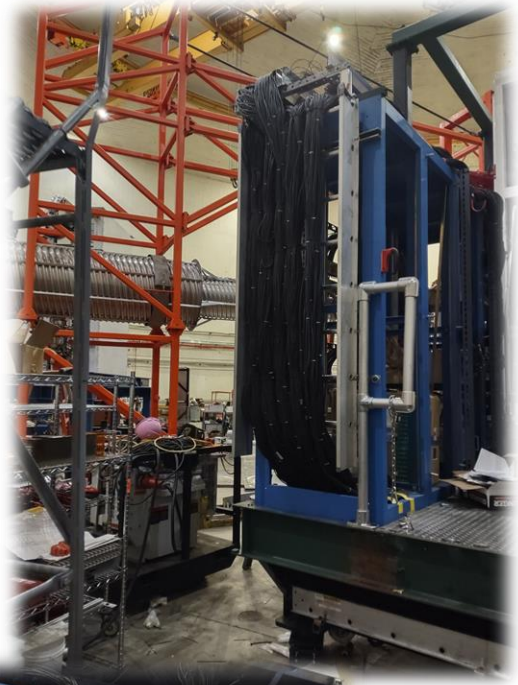
Except for the first two rows of SM which were installed by Jimmy (117 PMTs) – the rest of 1539 PMTs were installed by Deb, Mahmoud, Kip and Simona

Cabling Infrastructure: Cable Trays

Cable trays in the SBS bunker (DAQ)

Cable trays between SBS bunker and platform

Cable trays on the platform



Cabling Infrastructure: Strain Relief Panels

These have been installed at the back of ECal and they make the transition from the PMT dividers cables to the HV and signal cables that run to the patch panels and summing modules, respectively

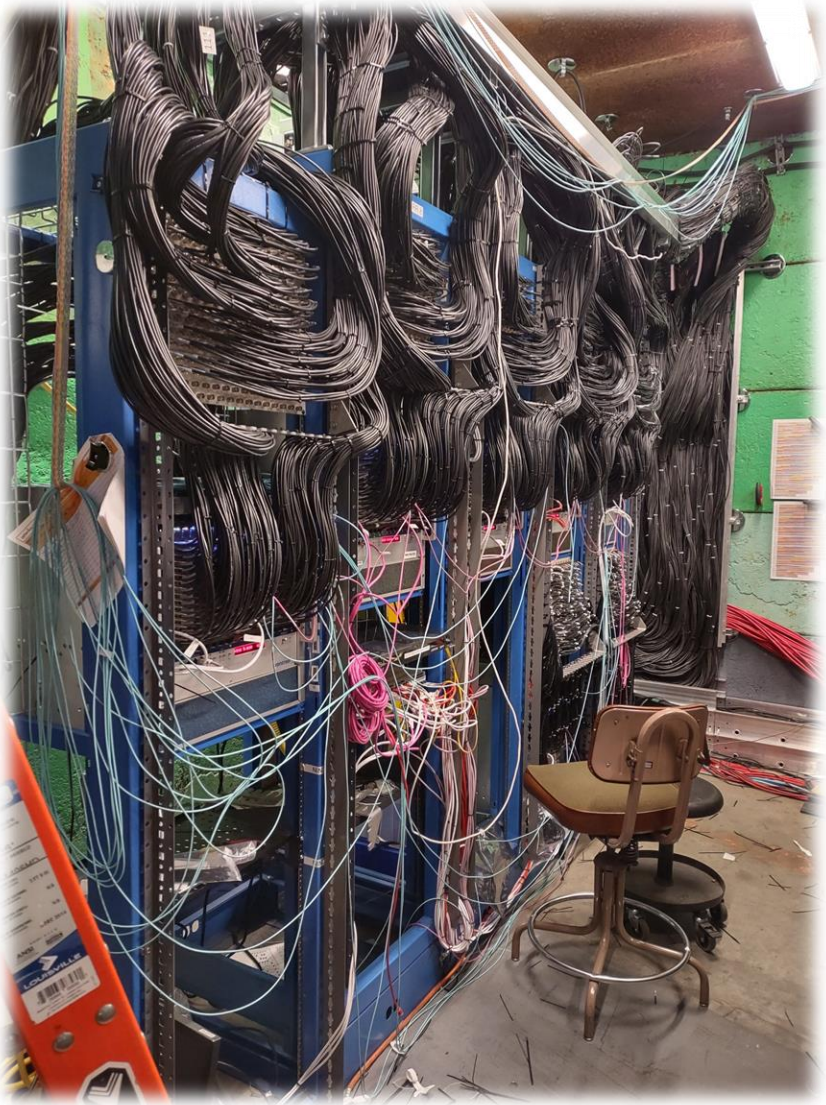
Cabled panels placed here
for transport to Hall A

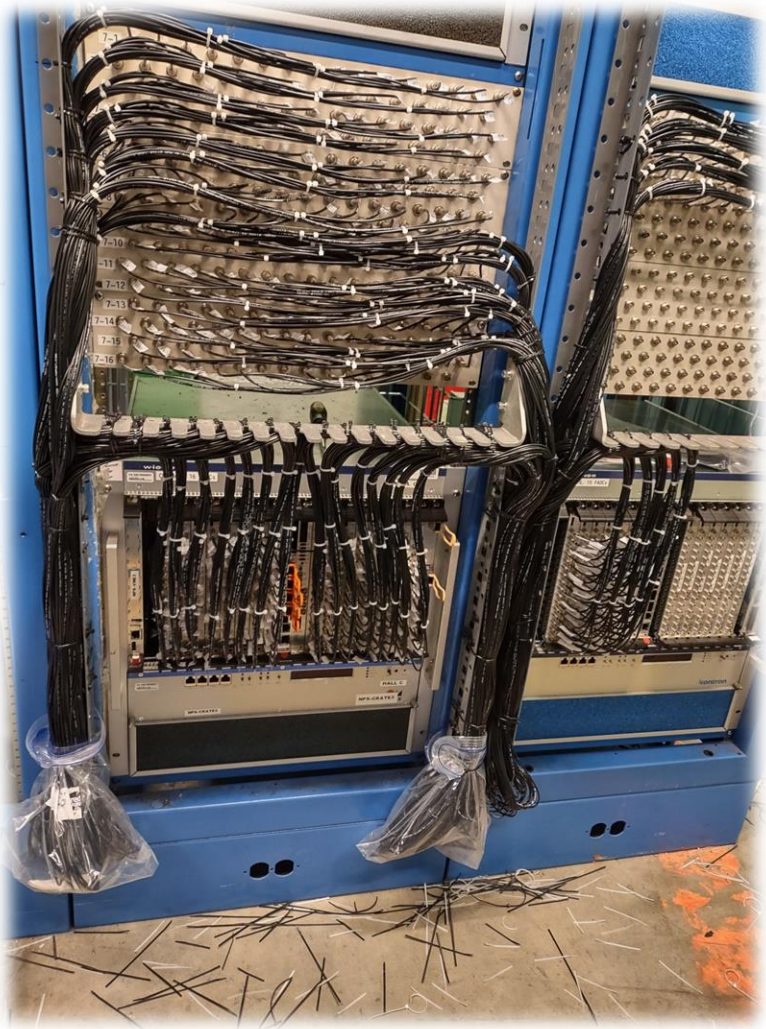
3312 connections had to be made

HV and Signal Cabling in Hall A

From FADCs to the DAQ Front Patch Panel in the SBS bunker: signal

Many thanks to **Deb** for doing more than half of this cabling

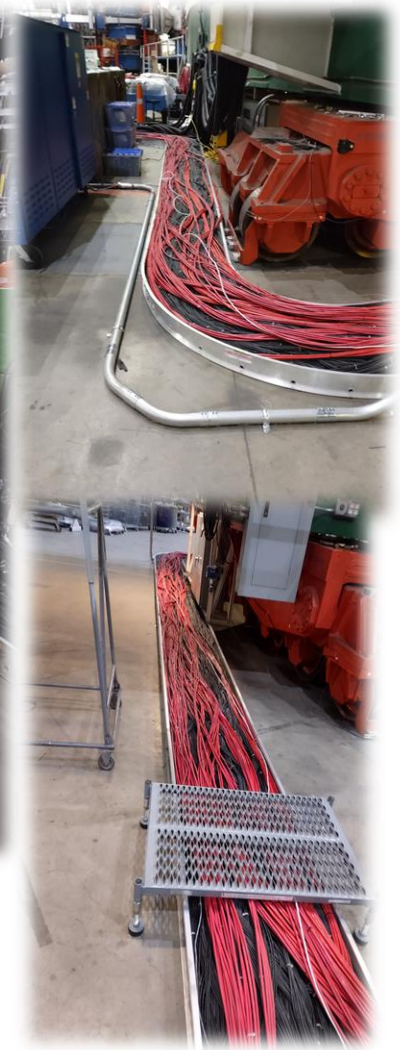




Deb ~ 2012 connections made
Simona ~ 1300 connections made

HV and Signal Cabling in Hall A

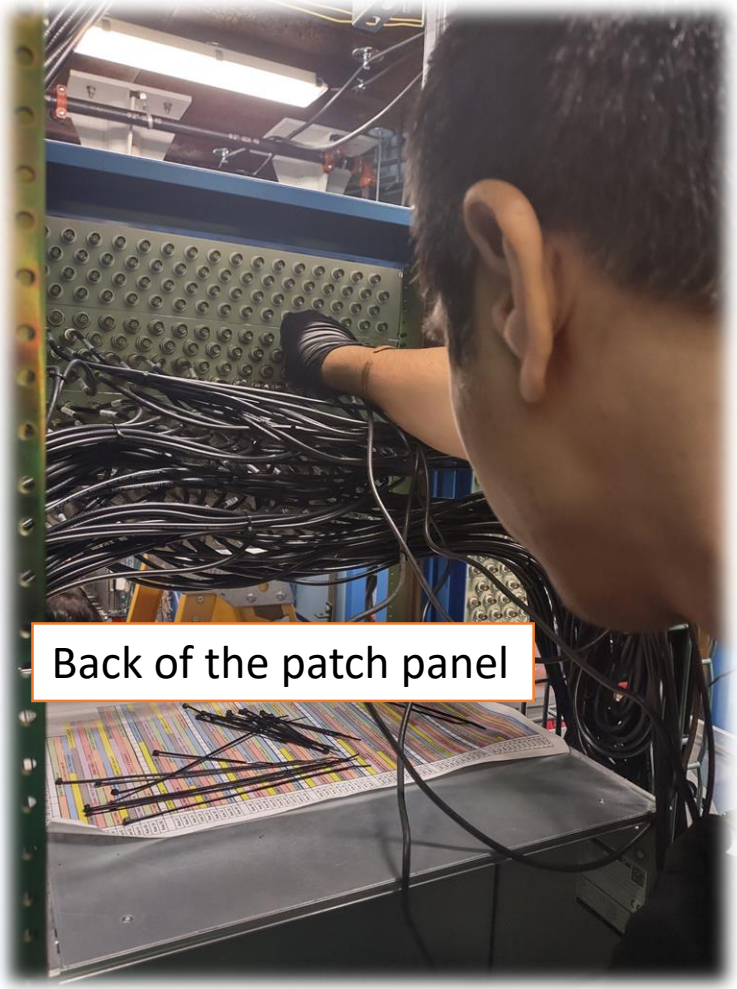
From Back of DAQ Patch Panel in the SBS bunker to the cable carts by the platform: signal



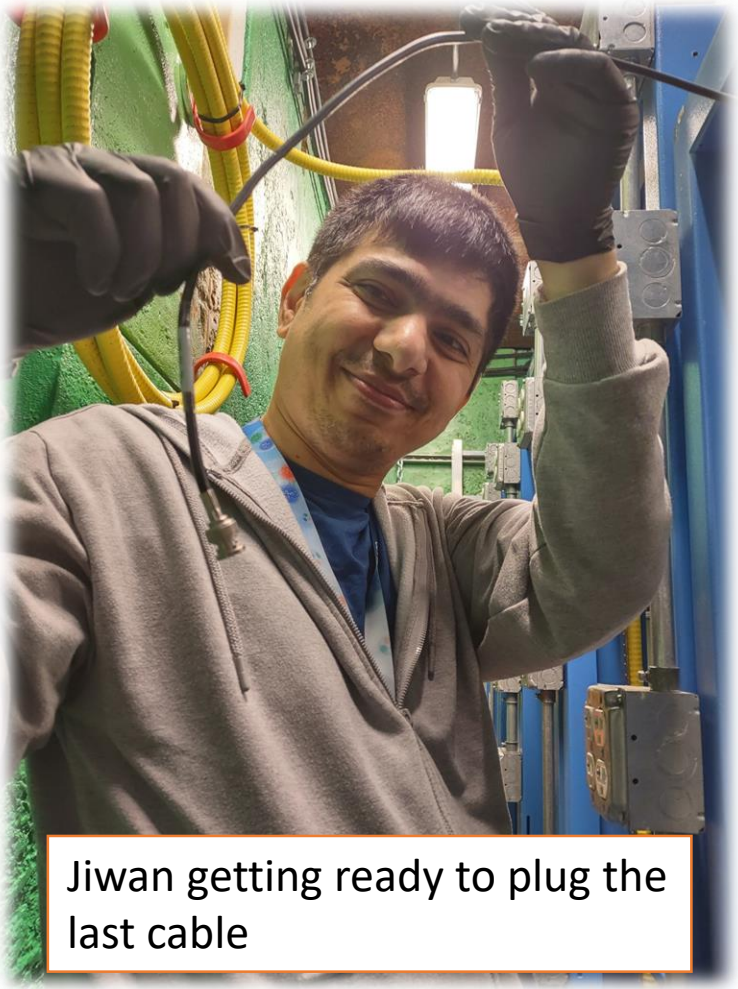
HV and Signal Cabling in Hall A

From Back of DAQ Patch Panel in the SBS bunker to the cable carts by the platform: signal

Jiwan made **1656 connections** at the back of the DAQ Patch panel in few weeks



Back of the patch panel



Jiwan getting ready to plug the last cable

HV and Signal Cabling in Hall A

From Back of DAQ Patch Panel in the SBS bunker to the cable carts by the platform: signal

This was made with love, light & larmes

HV and Signal Cabling in Hall A

From Back of DAQ Patch Panel in the SBS bunker to the cable carts by the platform: signal

HV and Signal Cabling in Hall A

Cabling on the platform: signal and HV

I worked with Chandan in the beginning to establish a procedure and work flow

Chandan then took over and made sure it got done quickly

HV and Signal Cabling in Hall A

Cabling on the side of platform: signal – beamline side

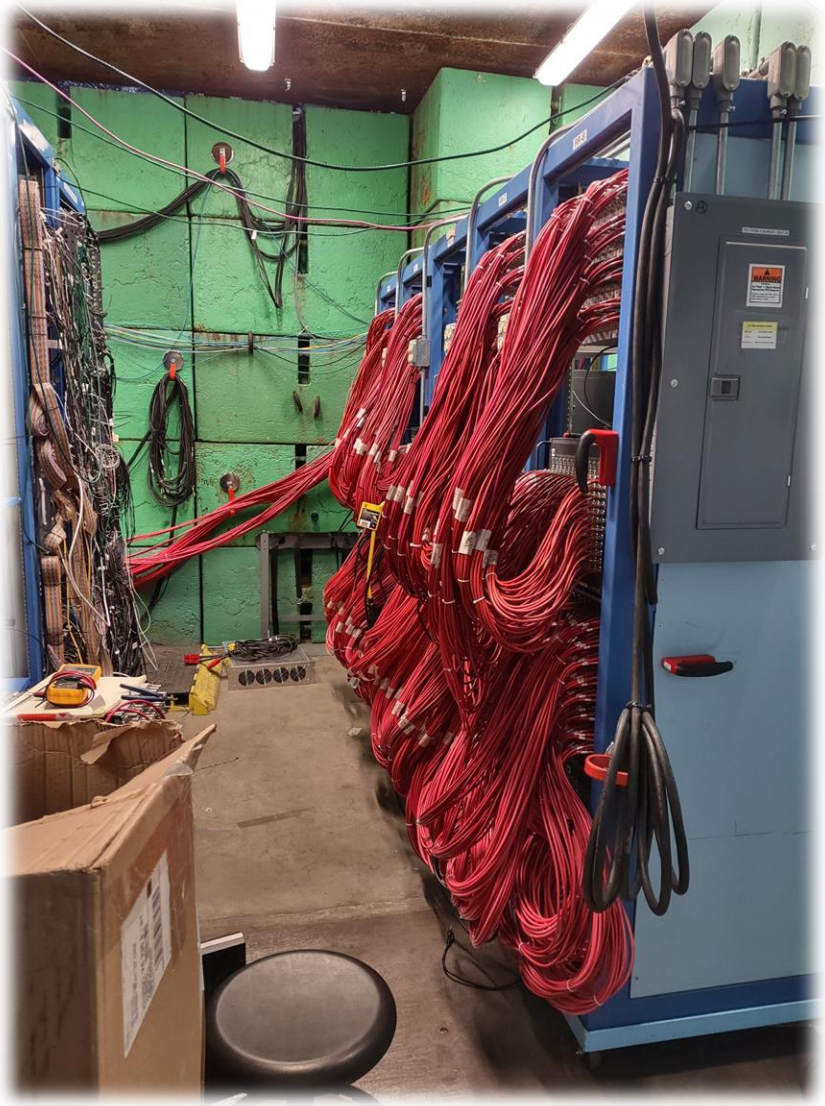
HV and Signal Cabling in Hall A

Cabling on the side of platform: signal – the other side

HV Cabling in Hall A

Jimmy set up all the rpis for the HV controls, installed the HV crates and cards and cabled them from front of patch panel to HV cards

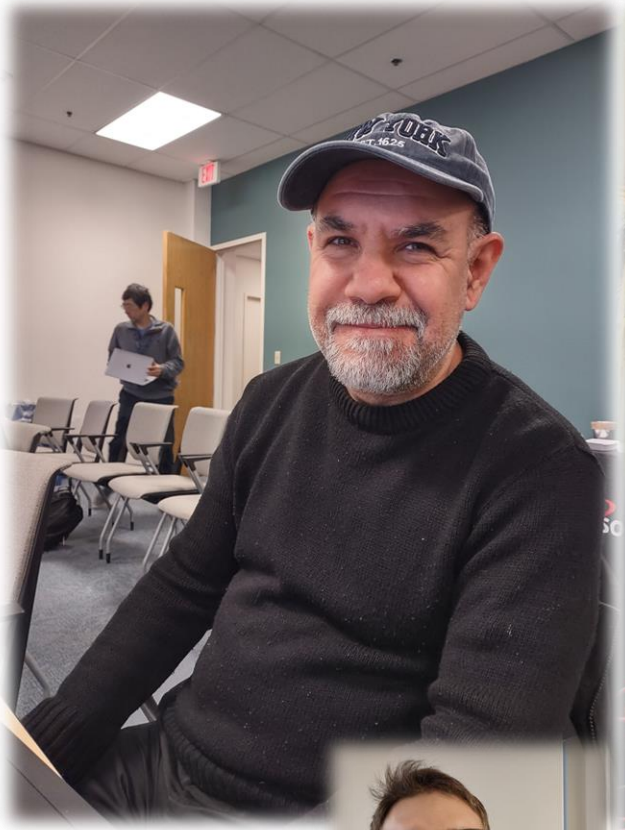
Jimmy made 3312 connections



Thanks to Kip for producing loadable files for the HV gui with proper Imon limits etc.

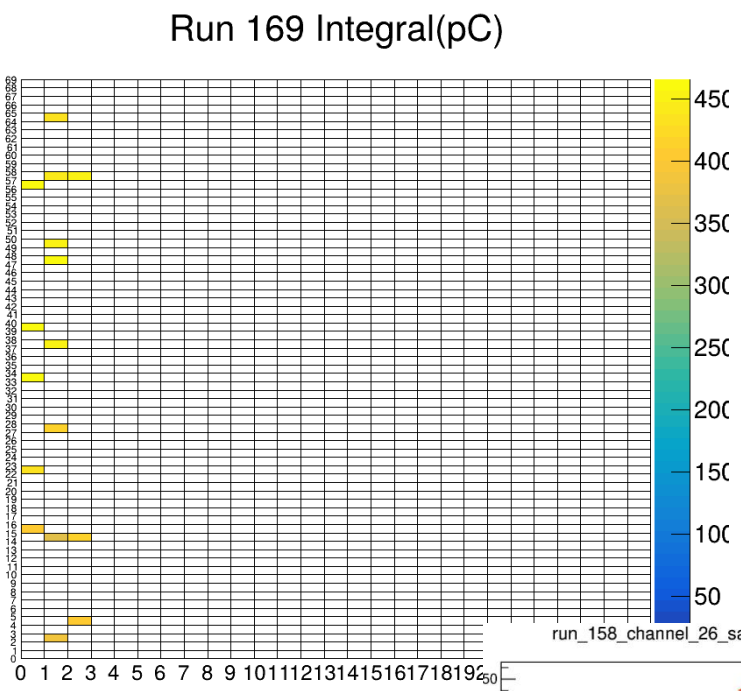
HV Cabling in Hall A

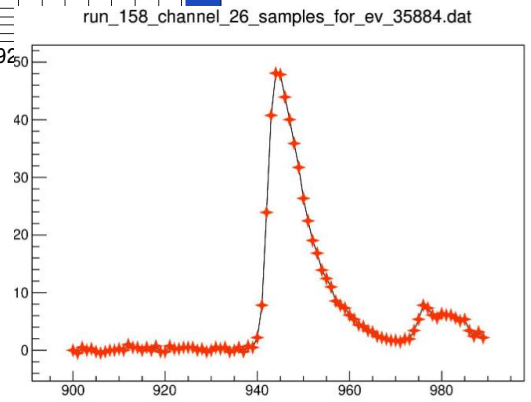
Running HV cables from SBS bunker to the platform via cable trays and carts



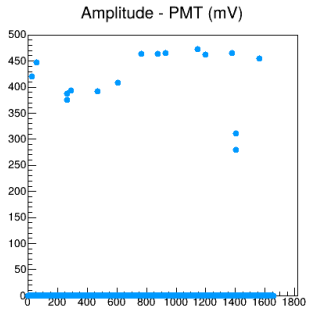
DAQ System

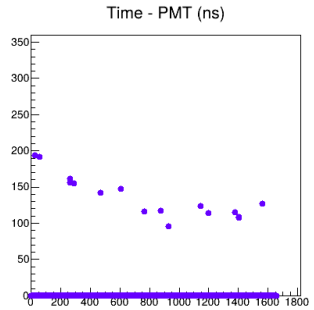
7 VXS crates with FADCs, VTPs, SDs and one SSP in crate 1
2 types of triggers available: cosmics and beam (cluster)
I exercised the cosmics trigger with pulsers last week

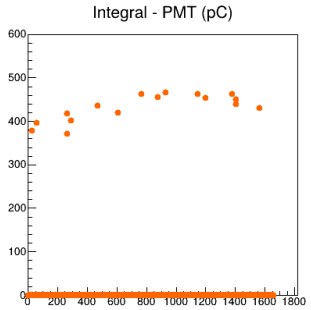


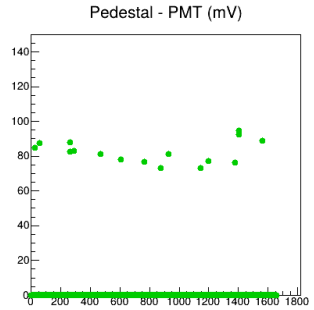


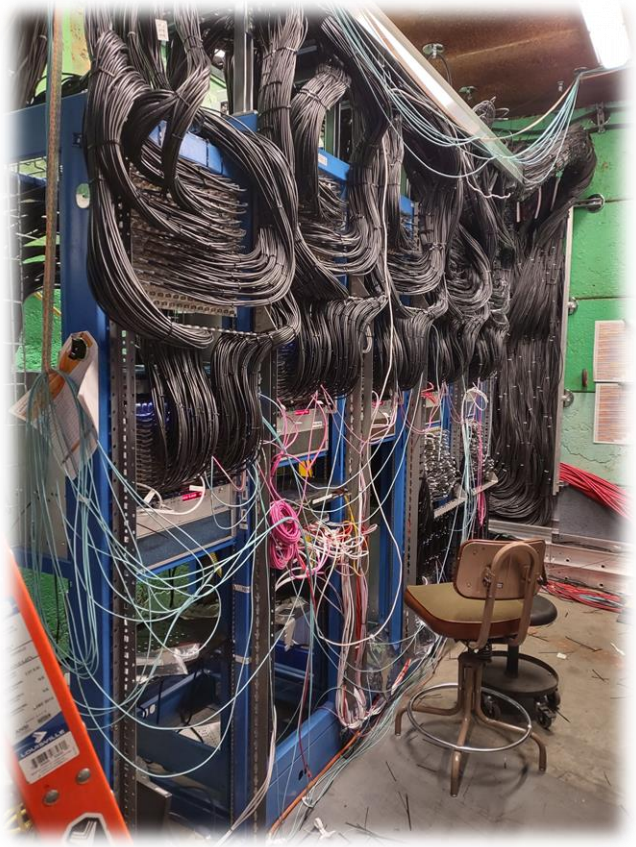
Plots by Jhih-Ying



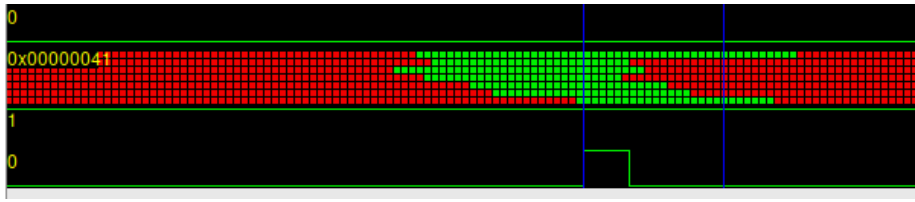








Ben, Alex, Hanjie: DAQ and VTP trigger setup



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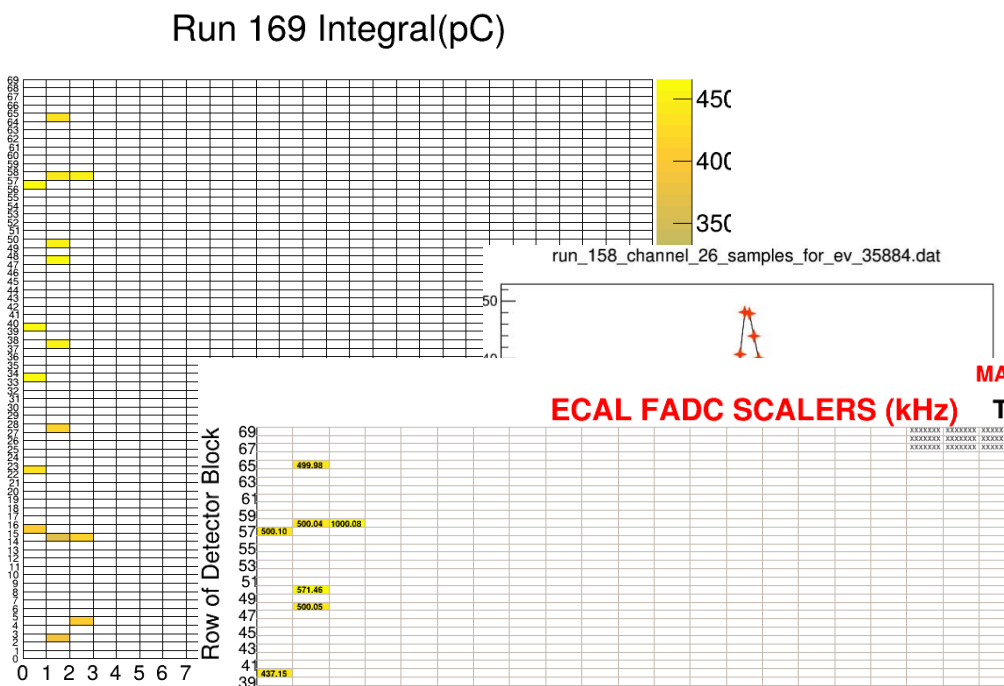

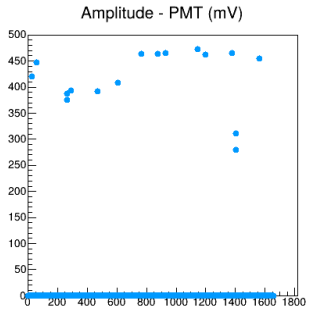

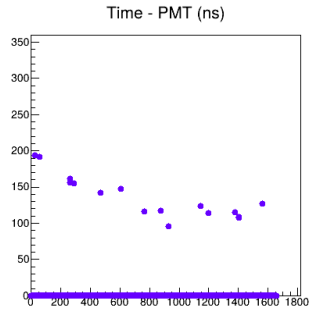

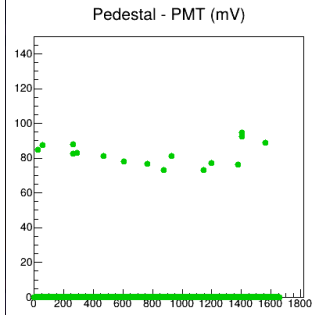

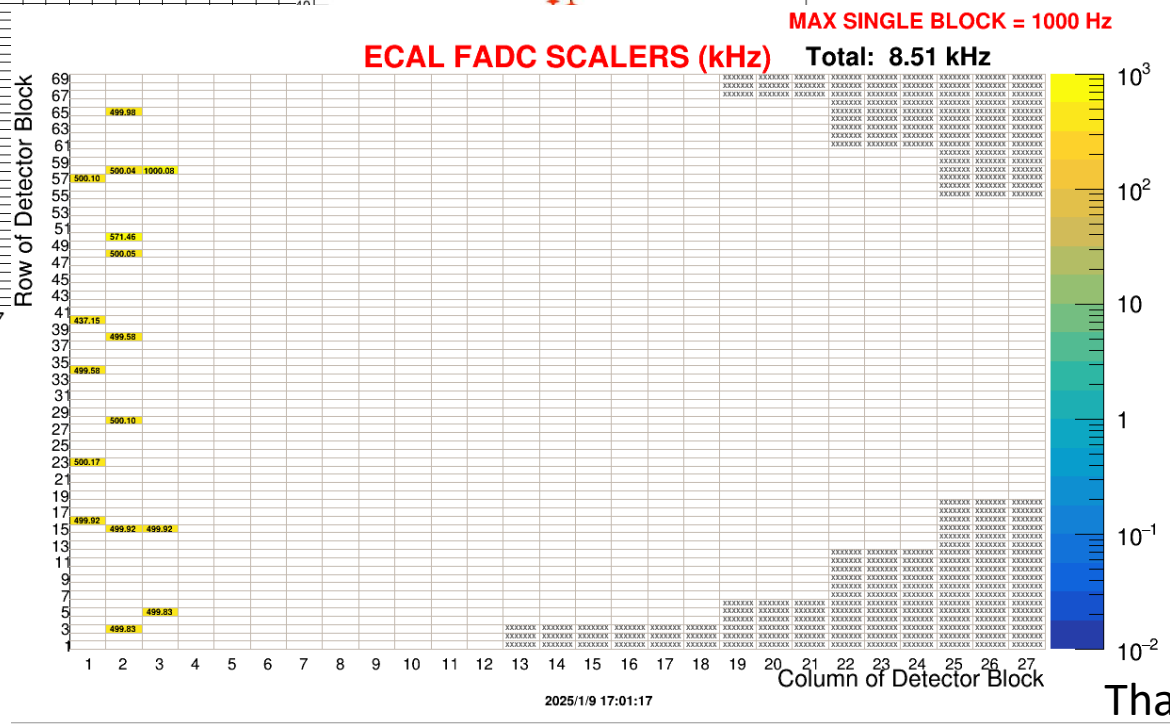

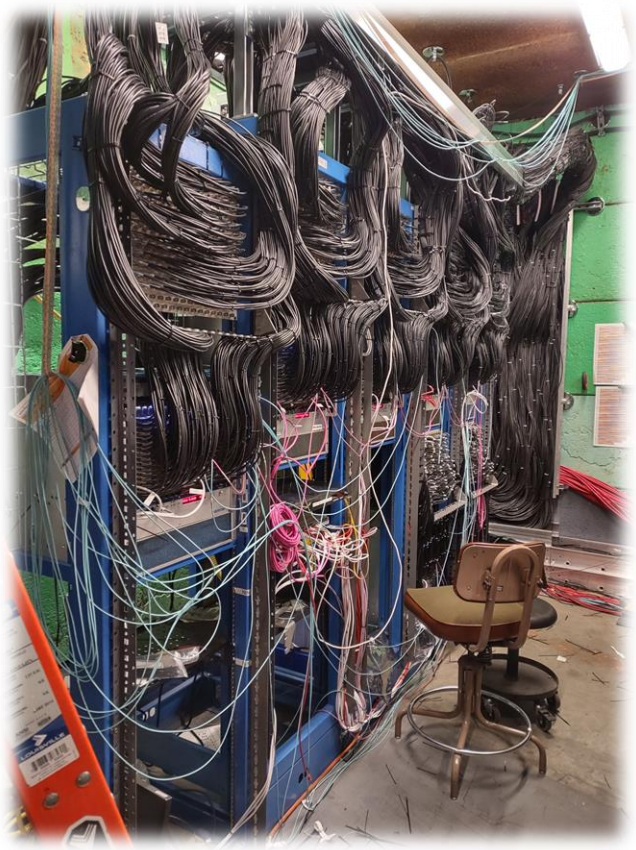

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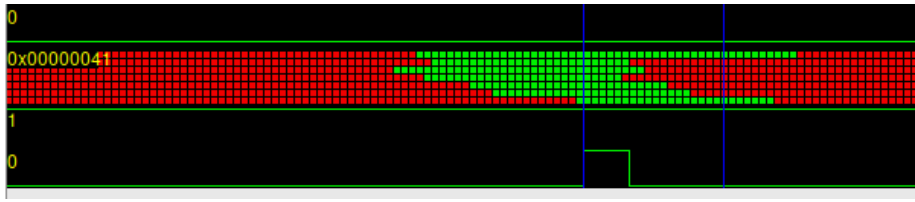

Thanks to Jiwan for getting the FADC scaler gui to work

Summary

ECal is ready for commissioning with cosmics:

→ Don and Jimmy finished installing the insulation blocks and got ECal light tight

→ The DAQ and cosmics trigger has been exercised and all the expert debugging codes/plots are available

→ My plan is to turn ECal HV ON and take a cosmics run triggering with a Ecal hit multiplicity of 1 per VXS crate, multiplicity of crates 1 as well; further track selection can be done in the offline analysis
This will map for us the good vs bad channels
Then we will take at list 3 runs at different HVs (1700, 1800, 1900 V) to do block/PMT gain matching (Kip is working on code for that)
I will install scin paddles to time in all the channels (cluster timing window +/-16 ns so we have to be pretty “timed in”)

→ Don will run the heater test

→ Ben will load the cluster trigger and we will give it a try

→ I expect ECal to be ready for beam ON TIME