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Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

SBN-FD CRT Status

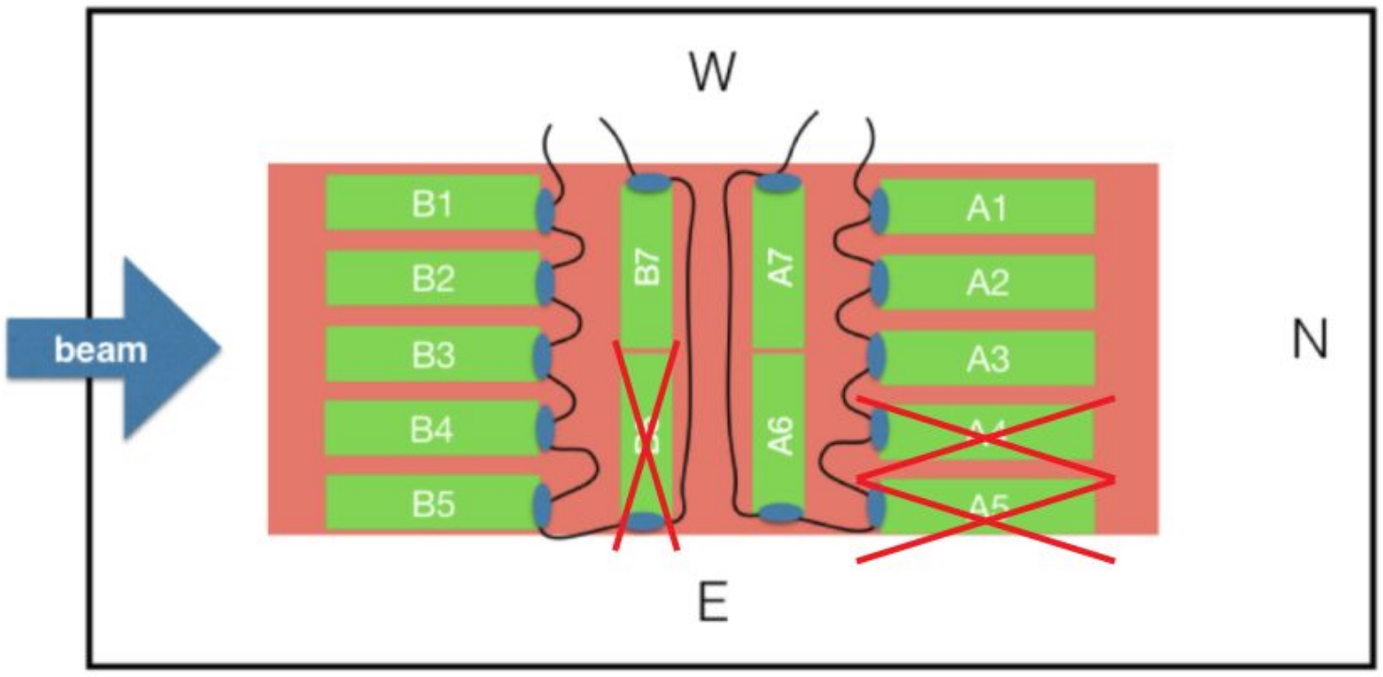
Minerba Betancourt and Umut Kose, Fermilab and CERN for the CRT group

19 November 2019

Bottom CRT

Damaged PMT Boards

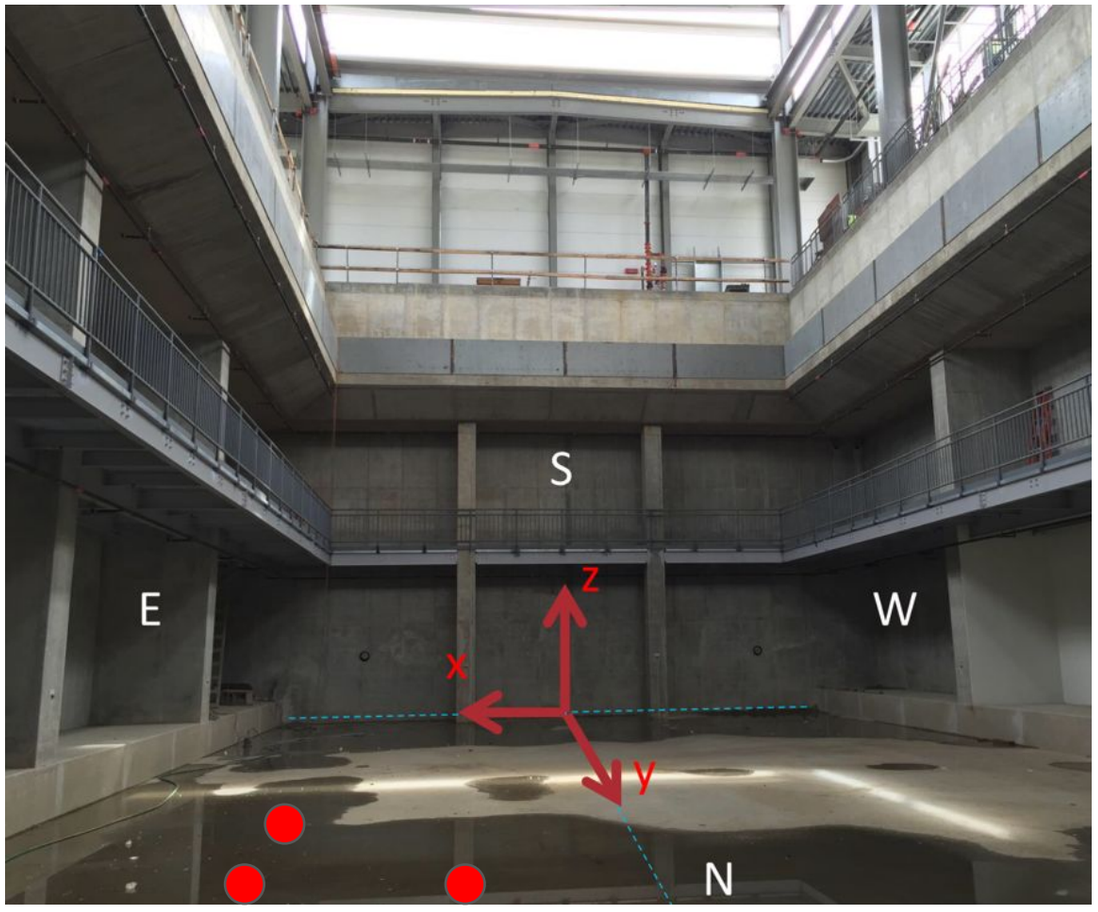
- B6 was accessible enough to replace, but side CRT foundations and cryostat feet were in the way of A4 and A5
- I knew those boards were damaged because they were drawing no current from the low voltage supply



Location of the Boards

Uneven Ground in FD Building

Here is a picture of the building before anything was installed. The pool of water shown in this picture match perfectly with the location of the PMT boards that were damaged and needed to be repaired



Locations of damaged boards

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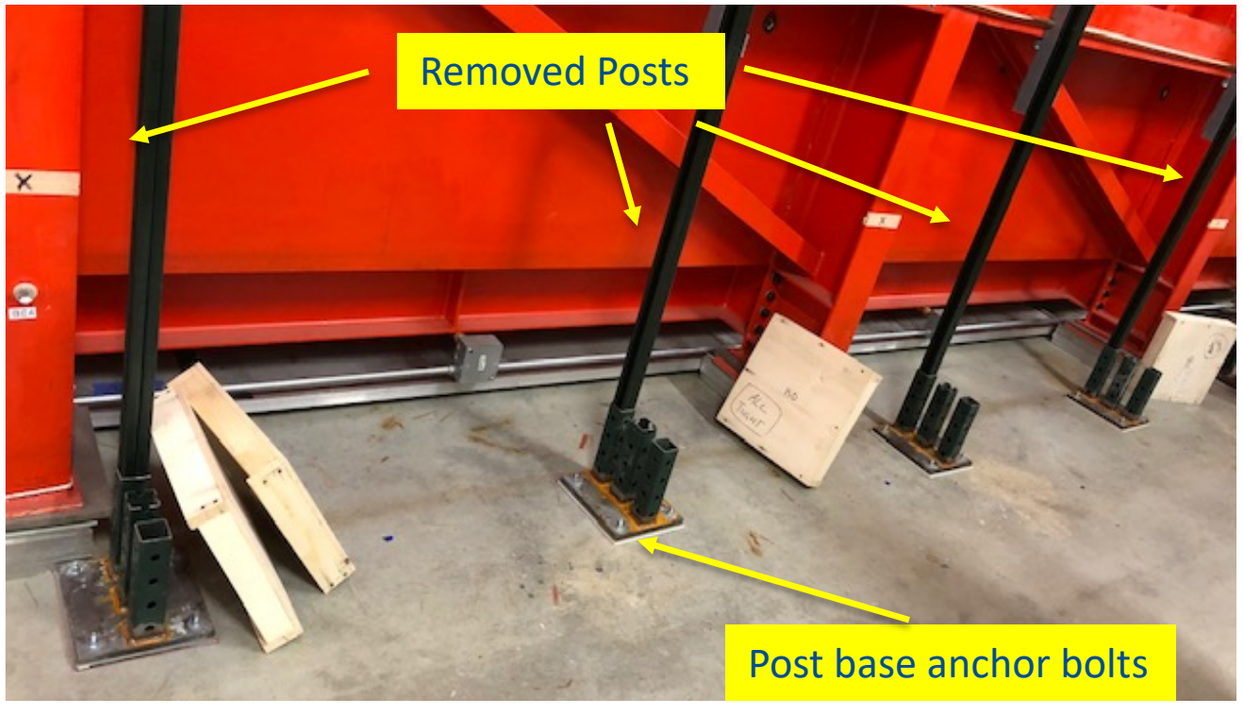
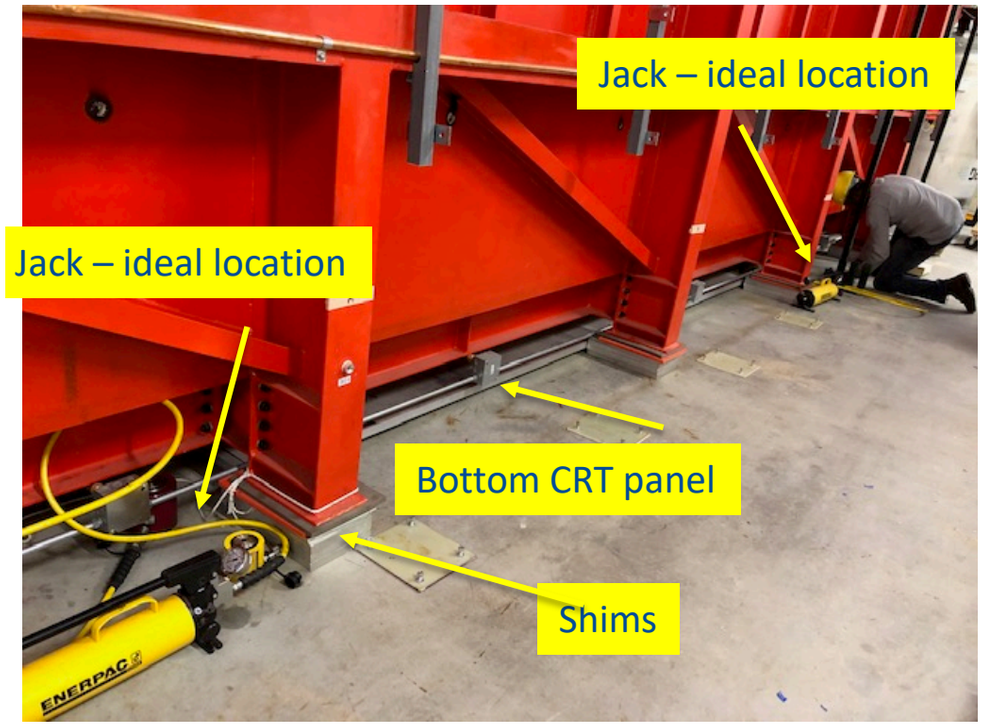
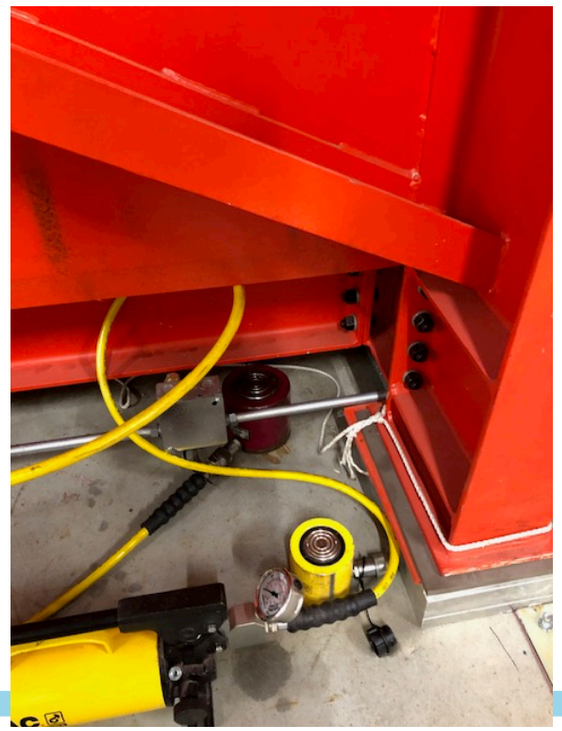
Preparation







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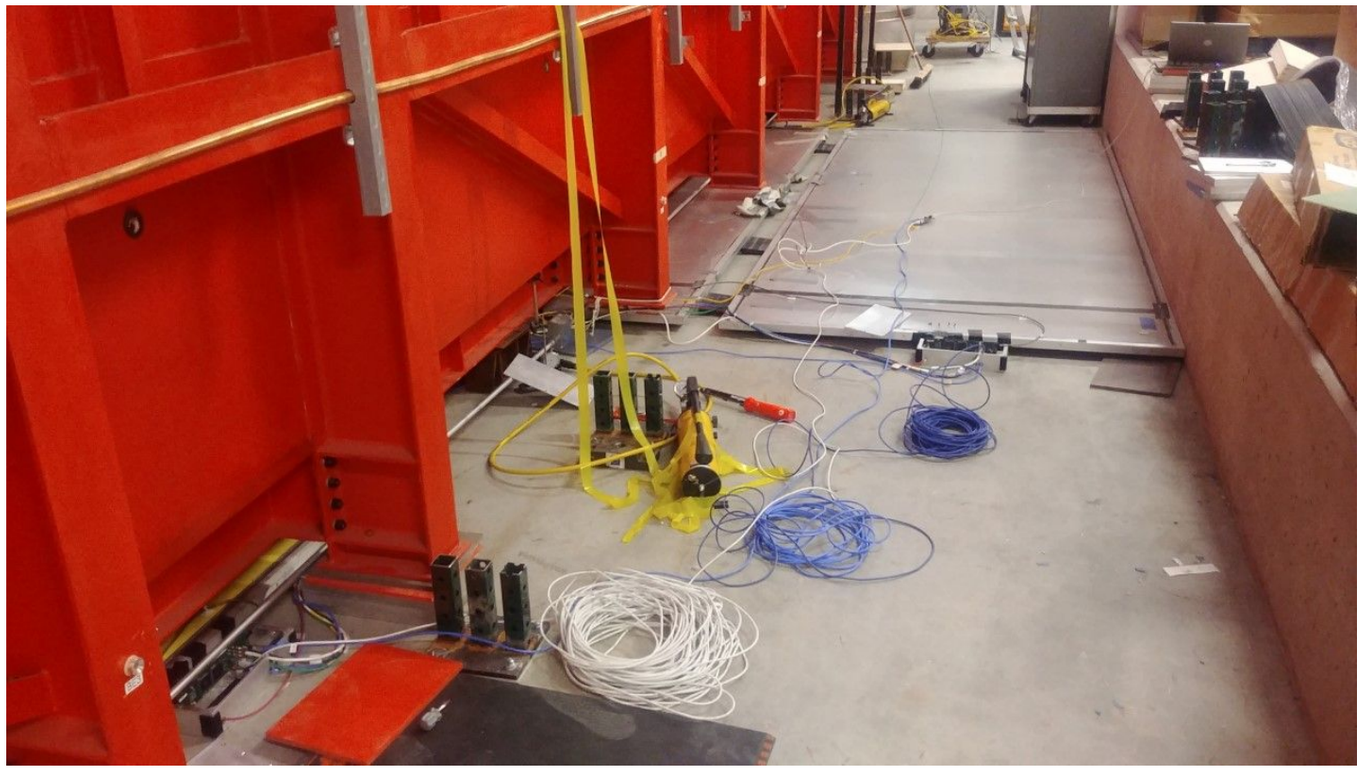
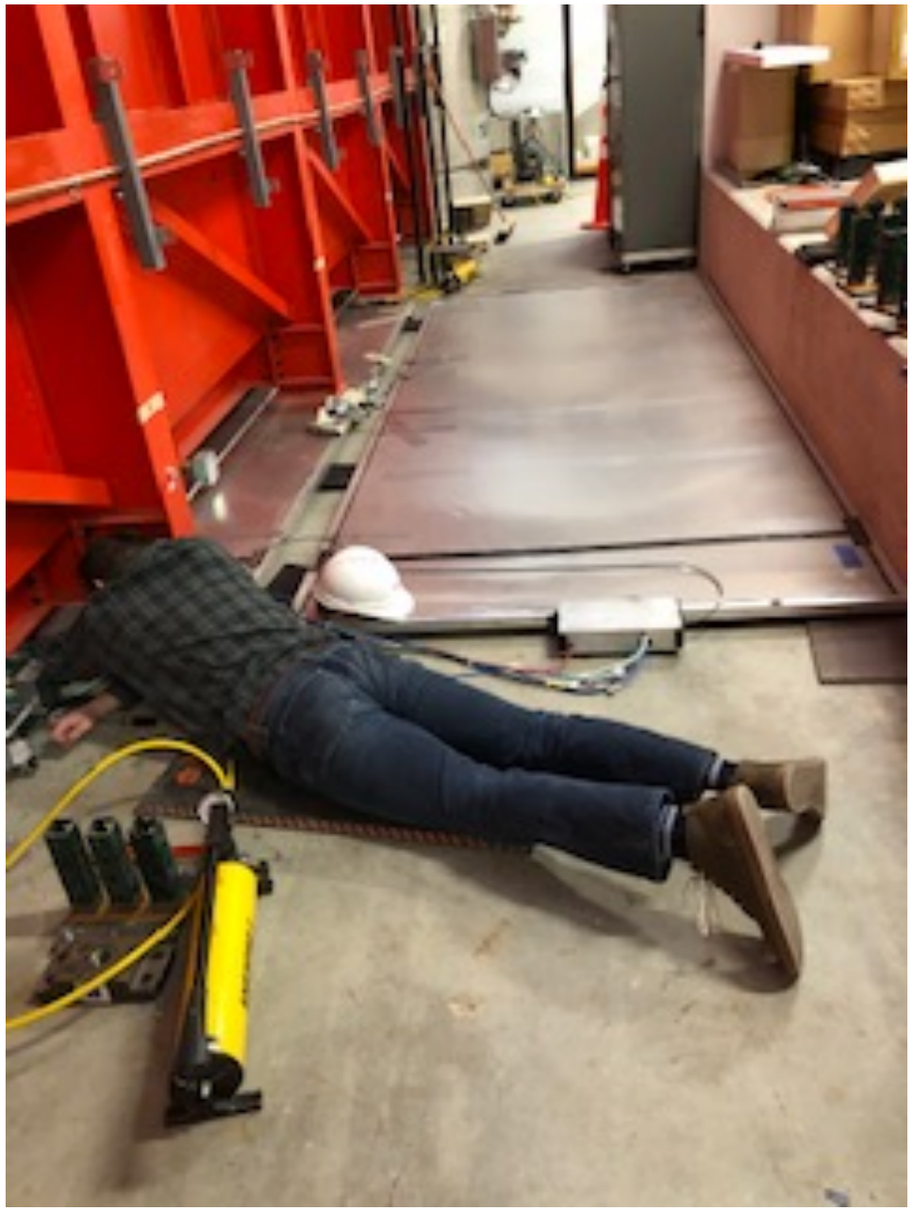
Replacement Procedure

- Detailed procedure the work plan for the replacement of the boards at sbn-db 15315
- Use two 50 ton hydraulic jacks to raise cryostat enough to remove shims underneath feet
- Rest the raised cryostat on metal blocks+shims to keep it elevated
- Push row of the modules from far end of cryostat to access the two damaged modules
- Replace PMT boards
- Test all connections on the replaced boards individually
  - High voltage, low voltage, clock, sync, trigger, data
- Test DAQ with daisy chain full daisy chain
- Push modules back underneath the cryostat
- Test DAQ again to make sure no cables were damaged in the move
- Many thanks to Ryan, Cat, Peter, Chris, Kelly, Claudio, Umut, Dimitar and Fermilab's techs

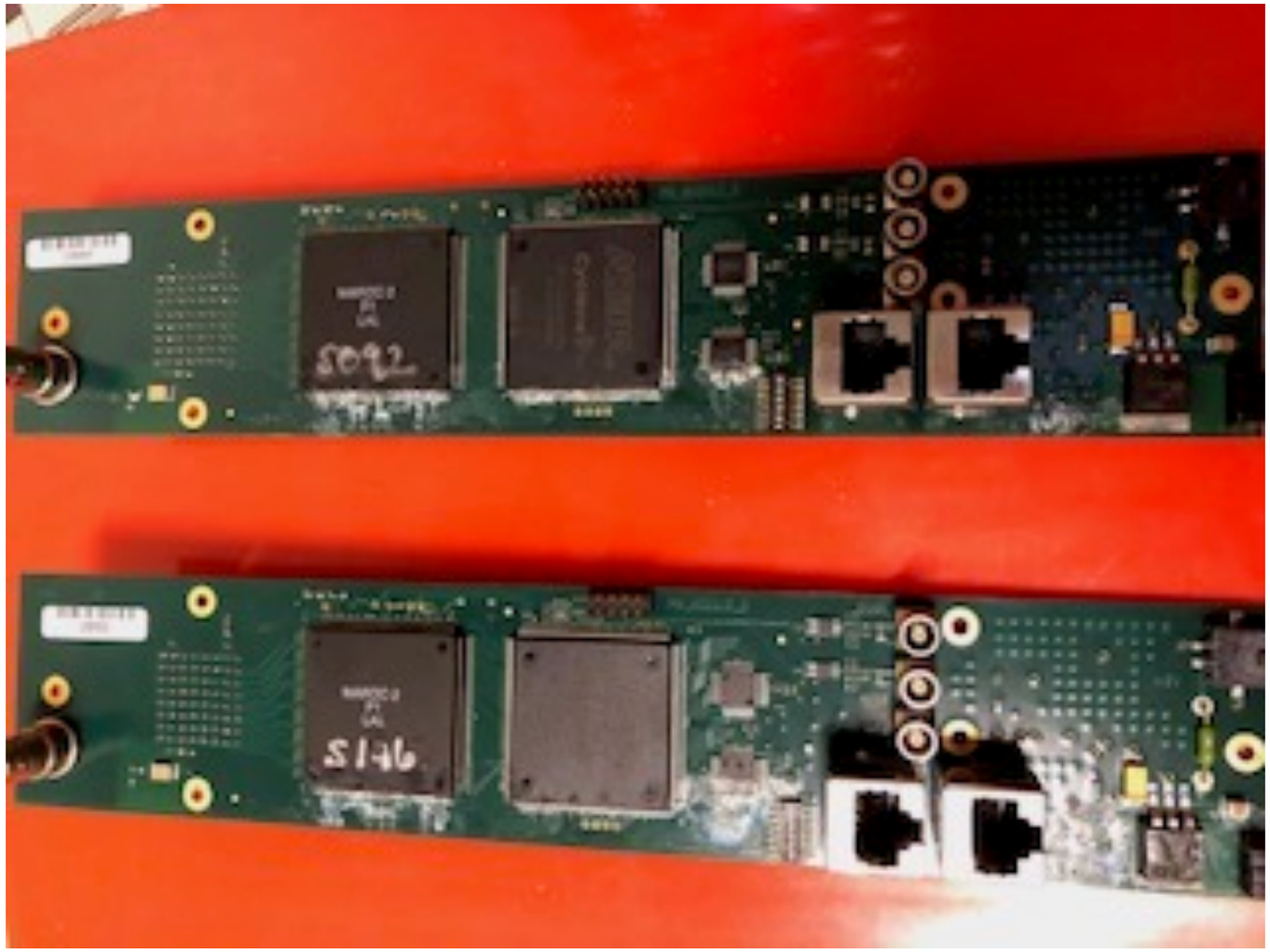
Raised Cryostat w/o Feet or Side CRT Supports

Ryan Replacing the Boards





Pictures of Damaged Boards



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PMT Board Testing

- Test current draw on the replaced boards
  - Good current draw is 0.3 A
  - Bad currents were 0.0-0.1
- Take board out of the daisy chain and test it with the DAQ
  - Disconnect CAT6 data cables and cable them directly to USB readout board
  - Check that the baselines looked good

Side CRT

- Excellent progress this past month
  - Performed a successfully CRT VST with 1 FEB
  - All the components for the side CRT at north wall has been installed
  - We are ready to start the commissioning

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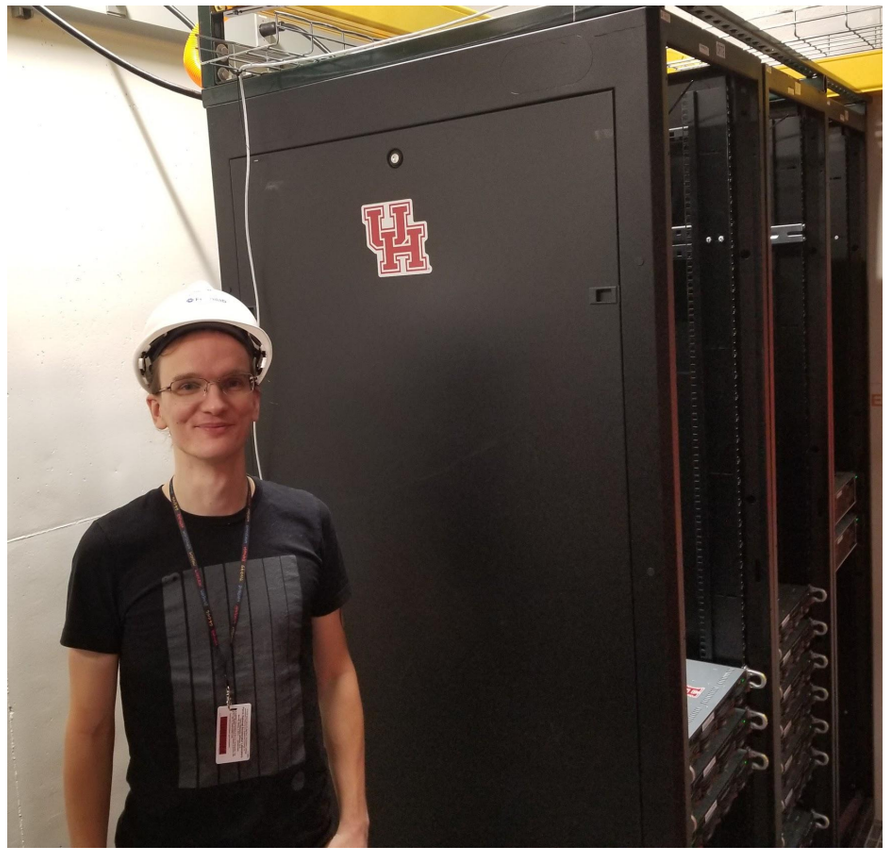
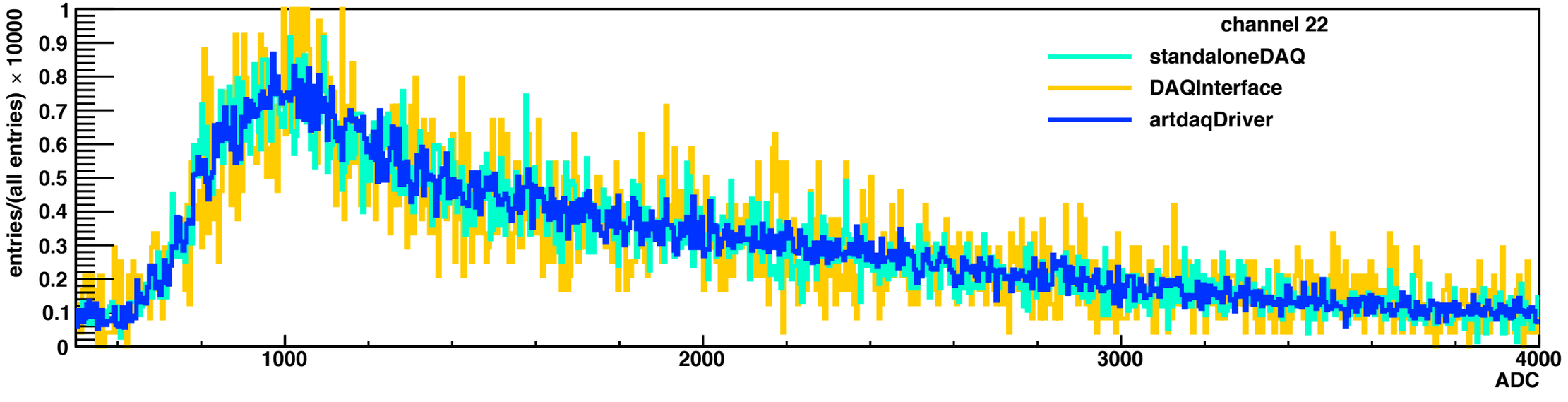
CRT Vertical Slice Test

- Mounted FEB, routed power and Ethernet cables, mounted optical readout and cables

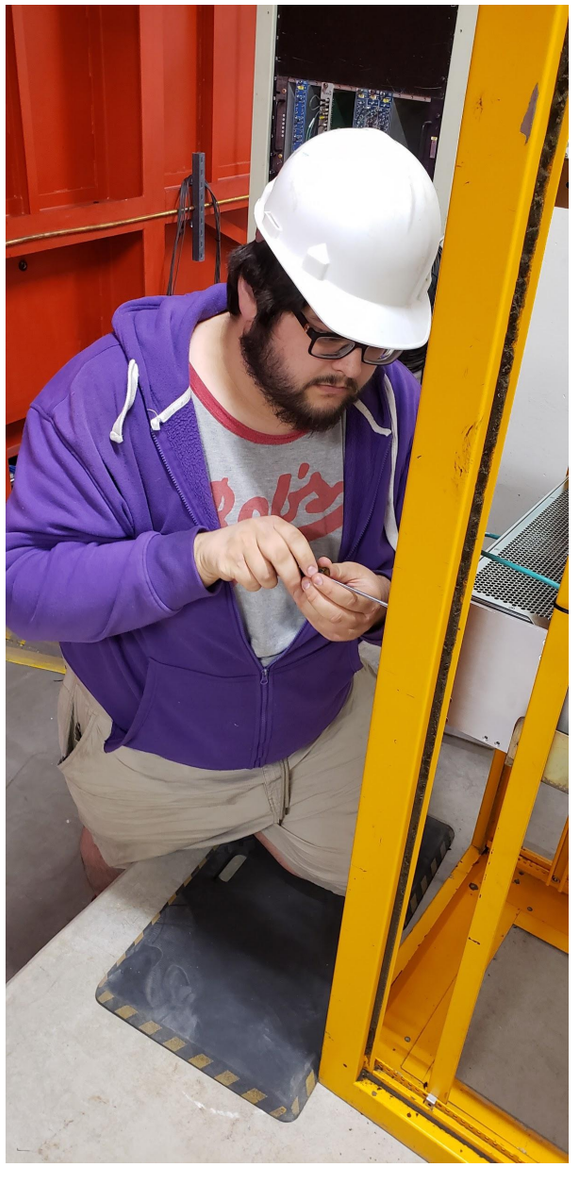


- Tested the readout using standalone DAQ, artdaqDriver and DAQInterface, more details at 15063 and 15495



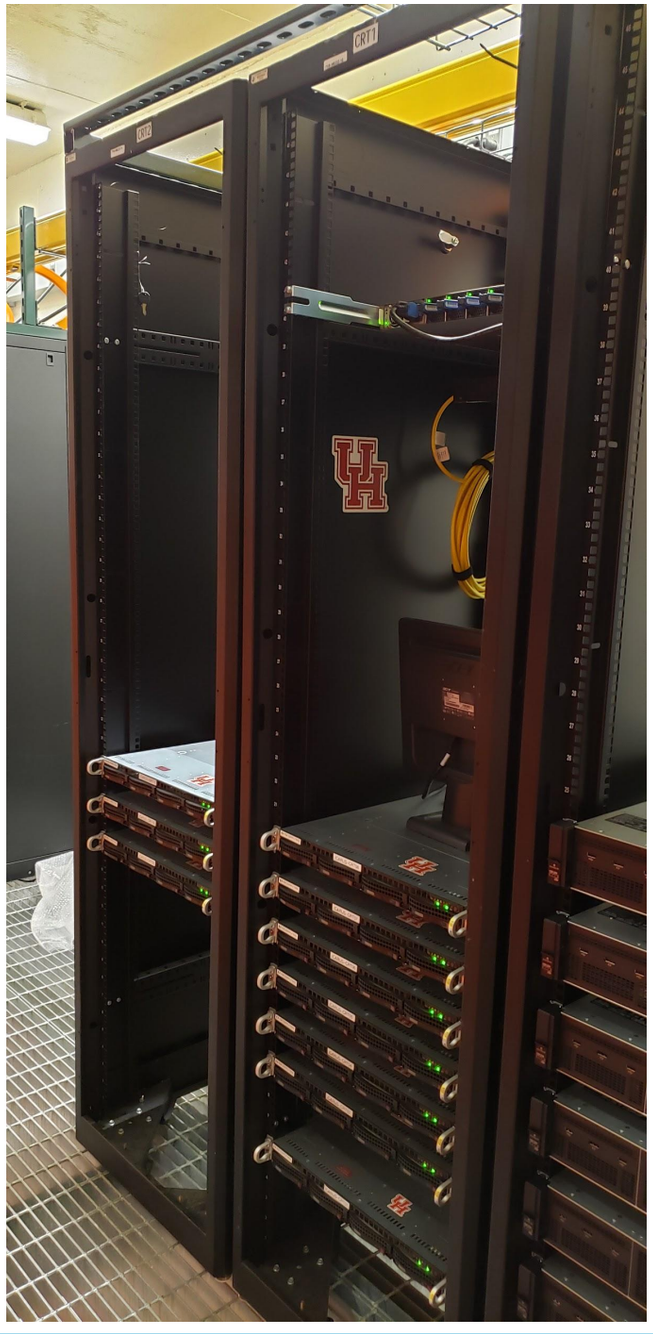
Installation at the North Wall

- Readout, FEBs, power distribution, cables has been installed
- Rack has been installed
- Many thanks to Chris, Tyler, Tom, Vittorio, Antoni, Bishu, Francesco, Cat, Linda, Geoff, Donatella, Skippy and Fermilab's technician



Servers Racks Ready

Two racks with ten production DAQ servers from University of Houston installed



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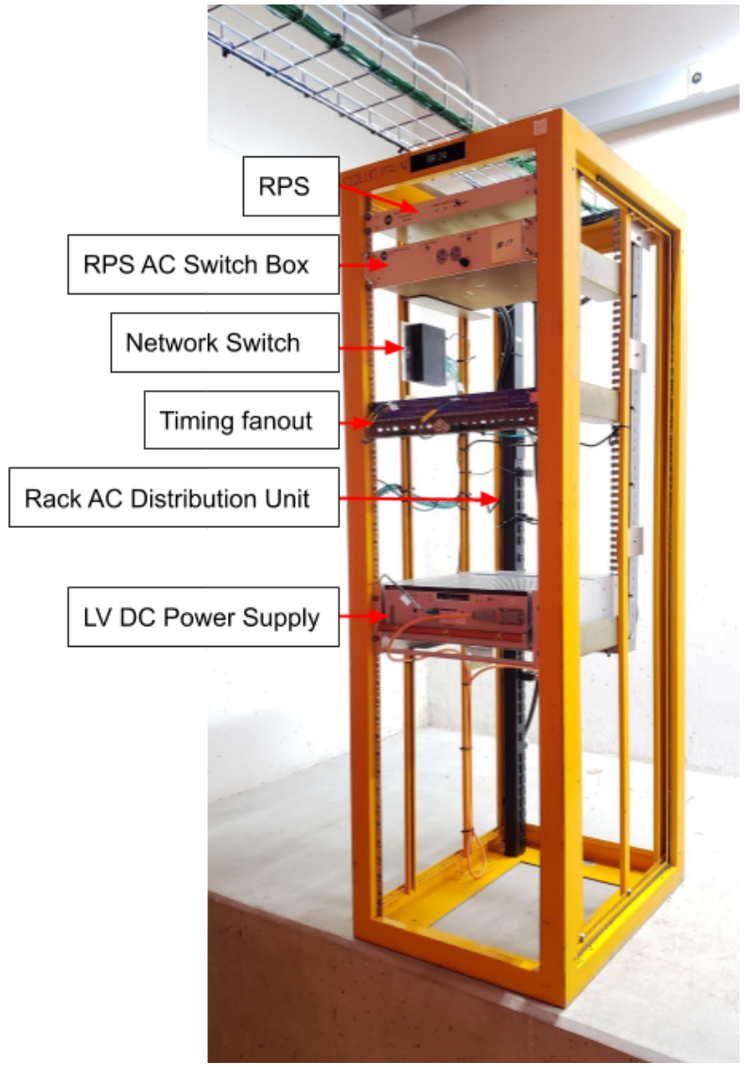
Racks Ready

We are now ORC approved, doc-db 15372
Many thanks to Linda for helping us to prepare everything
Procedure for testing the components of the rack at doc-db 15489
RPS and smoke sensor tested last Friday
Wiener PS configured and tested yesterday
Testing the PPS



Ongoing Effort and Next

- Side CRT:
  - We will start with the standalone DAQ
  - Run with production DAQ
  - Need to understand noise rates and study possible sources
  - Setting up the online monitoring, testing initial metrics: T0, T1, Max ADC value per fragment, baseline noise per fragment, number of events per CRT board
  - Setup the control room to monitor north wall side CRT
  - Setup the slow control for CRT
  - Continue the installation of the side CRT support
- Bottom CRT:
  - Ryan is setting the production bottom CRT rack, route the cables using proper cable tray and proper cable cover
  - Setup the artDAQ framework

Back Slide

Online Monitoring System CRT

- Metrics added thus far:
  - T zero
  - T one
  - Max ADC value per Fragment
  - Baseline noise per fragment
  - Number of events per CRT board
- Metrics we want to add:
  - Number of events **per channel**
  - ADC **per channel**
  - Heat map of the hits
  - Calibration failure flag
  - Gain over time
  - Temperature near front end board
  - Long term check for noise increase (magic doesn't always work)