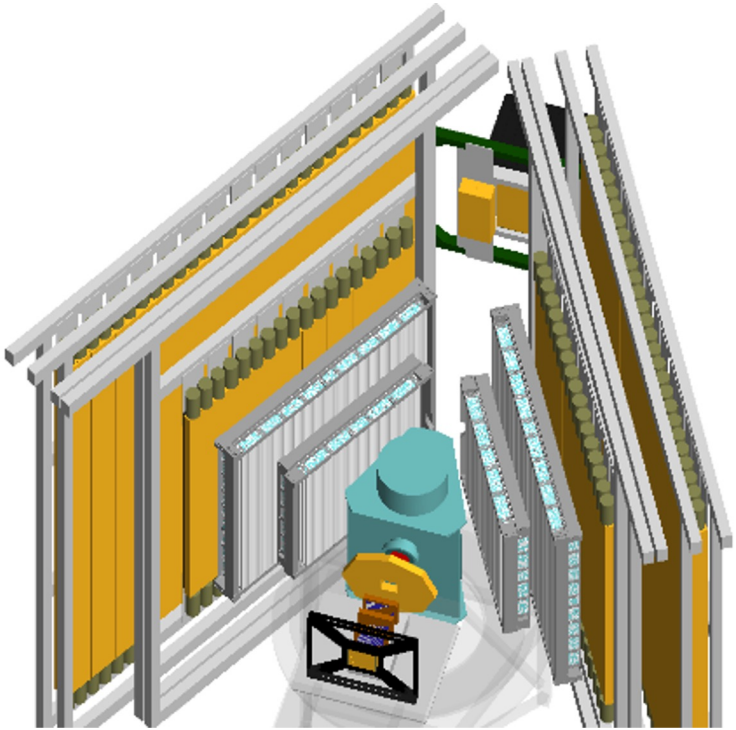
MUSE: Equipment Status



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Villigen, Switzerland
5 February 2024

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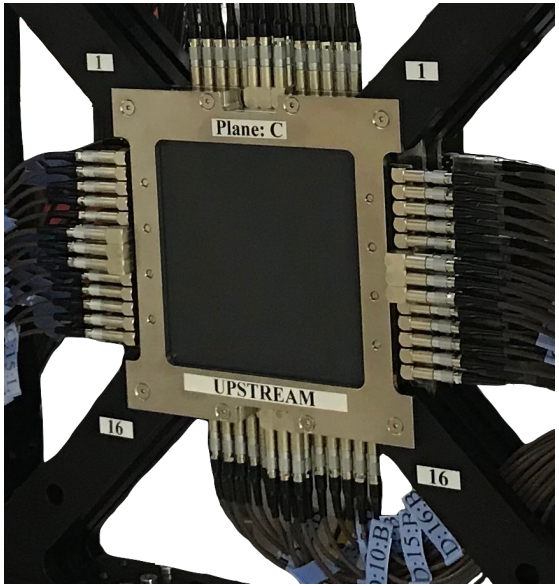
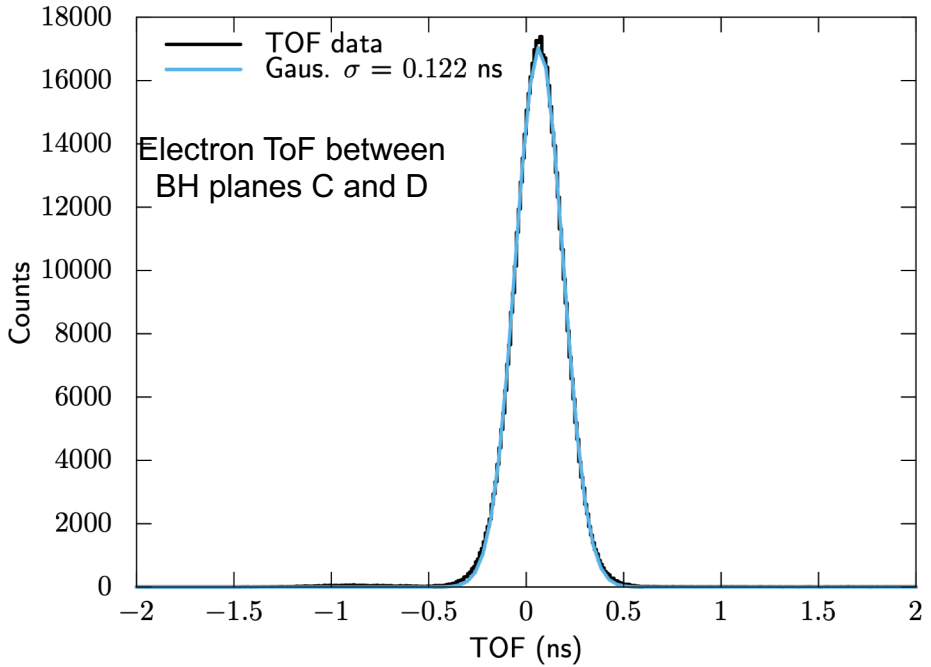
Beam Hodoscopes—BH

- First element which beam encounters in MUSE
- Essential element in ToF

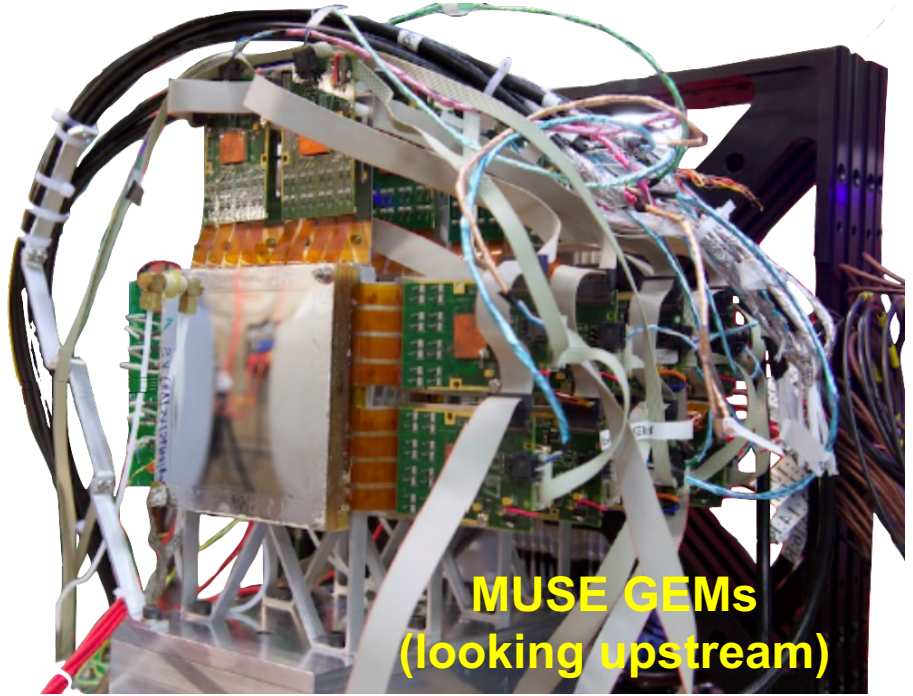




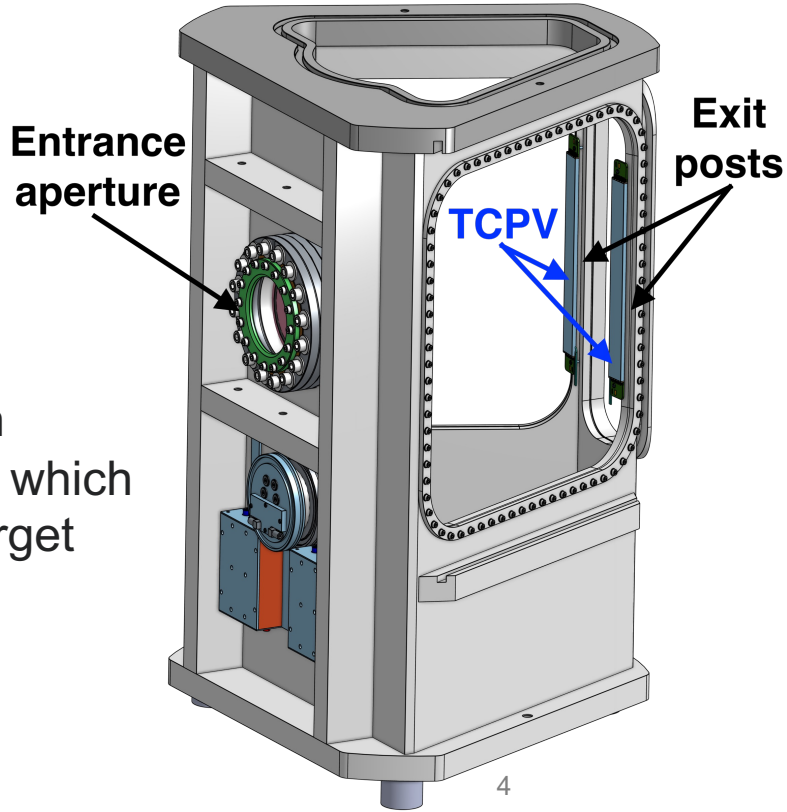
- Excellent ToF resolution $\sigma_{\Delta T} = \sqrt{\sigma_A^2 + \sigma_B^2} = 122$ ps
  - $\sigma_T = \frac{1}{\sqrt{2}}\, 122 \approx 86$ ps
- Larger currents in some BH SiPMs
  - Likely due to radiation damage
  - Discussion of replacement of SiPMs

GEMs

- GEM Readout
  - Front end code improvements
  - 160 μs 6-frame and less than 100 μs 3-frame
- Lost 1 GEM readout in Nov/Dec
  - CF card was corrupted
    - Short term—replaced CF card
    - Long term—considering network boot
  - Vulom-4b board issues
    - Purchase of spare Vulom-4b in progress
  - This was possibly caused by an unplanned power outage.



Target Chamber Post Veto—TCPV



Significant DAQ bandwidth spent in recording particles which scatter from the target posts

Target Chamber Post Veto—TCPV

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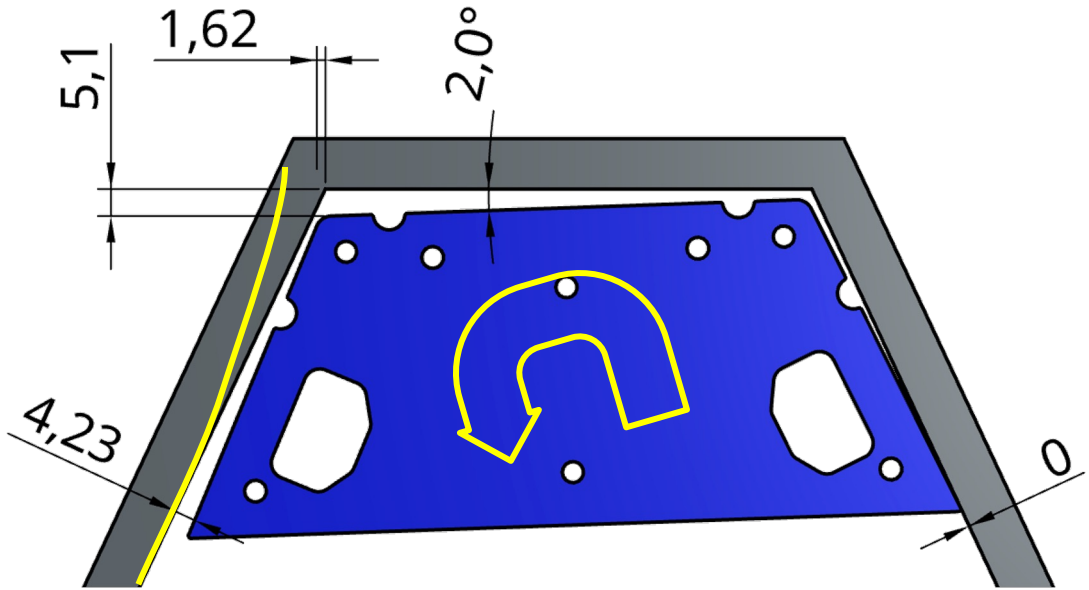


Target Chamber Post Veto—TCPV

Initial installation stability

- Vacuum chamber pump down caused slight flex in target posts.
- “Chair” slid slightly upstream and rotated
- TCPV damaged

- Received immediate attention from *PSI Detectors, Irradiation and Applied Particle Physics Group* to aid in repair.
- Designed fixed table and better mounting not susceptible to this flex.

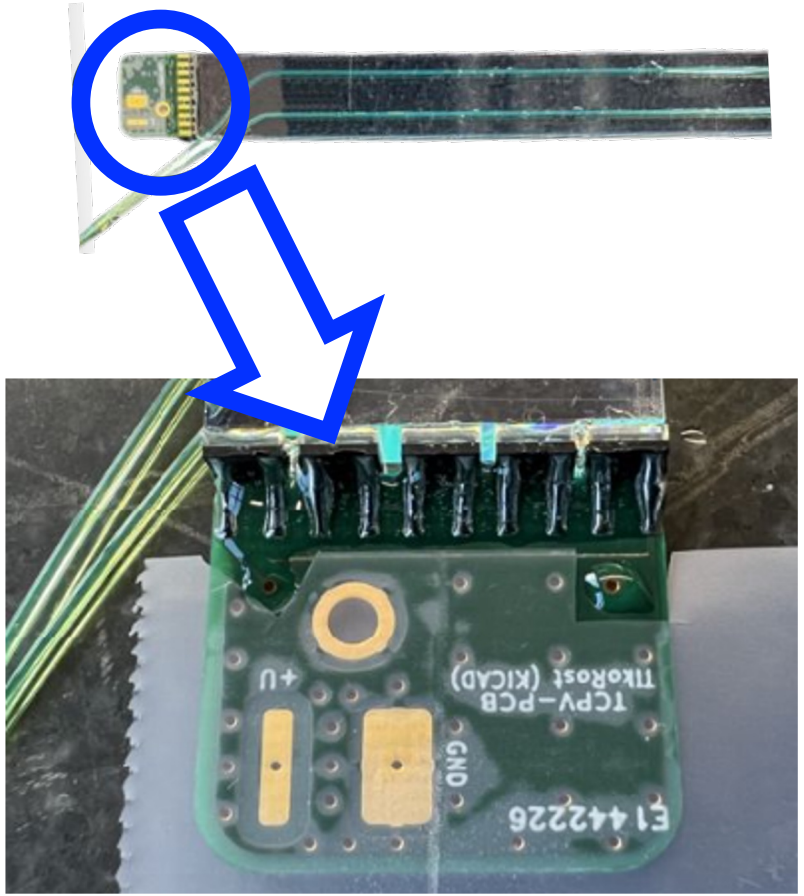
Target Chamber Post Veto—TCPV

Readout

TCPV with WLS lowers background trigger rate, but more improvement possible

TCPV may be read in two ways

1. Wavelength shifting fibers (WLS) to SiPMs outside of the vacuum chamber
2. SiPMs in-chamber directly attached to TCPV



Questions of relative efficiency:

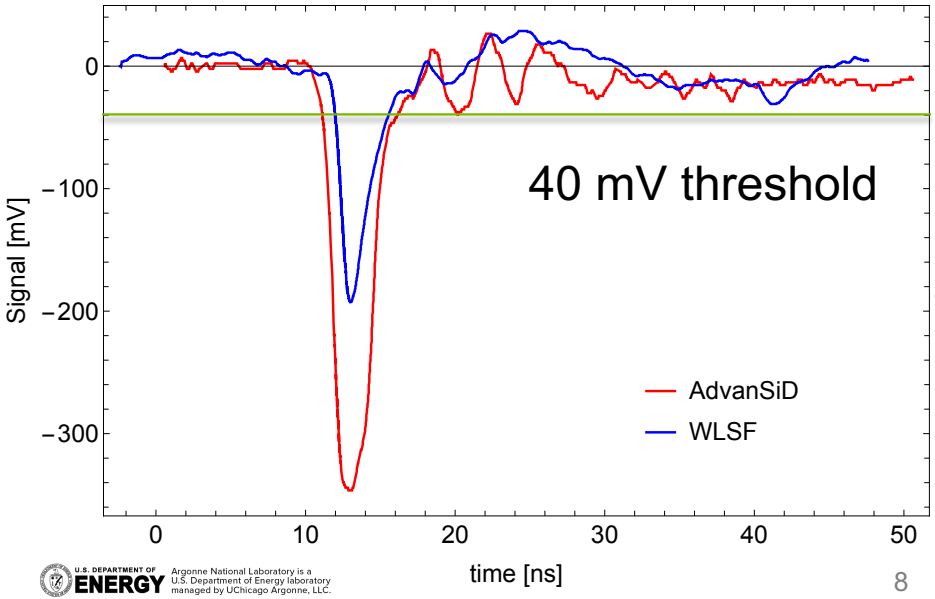
- Light collection
- Long decay constant of WLS broadens signal.

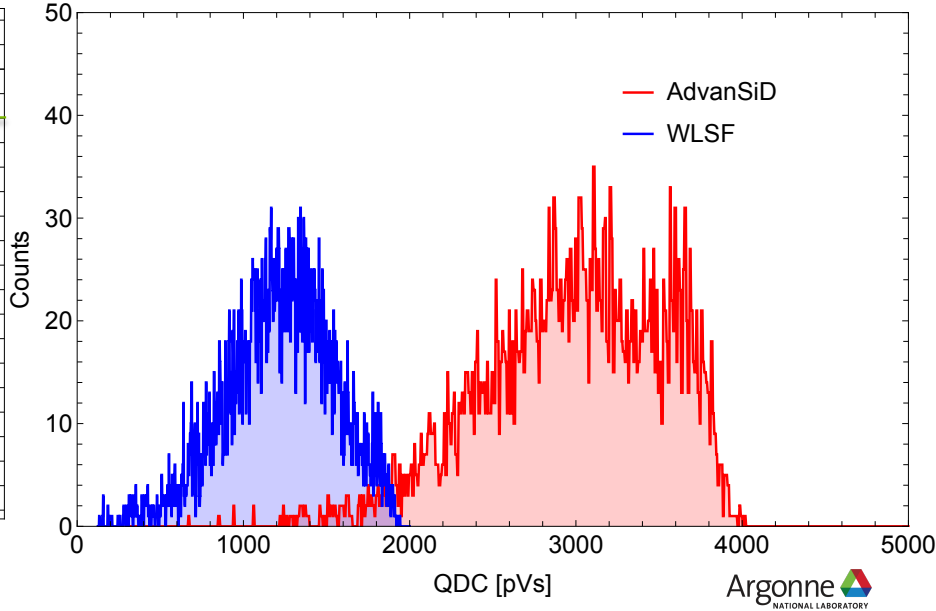
Study with no H_2 in the target chamber

TARGET CHAMBER POST VETO—TCPV

WLS vs internal SiPM

- Internal SiPM clearly has more easily discriminated (larger) signal.
- MUSE is evaluating the relative veto performance of the two readout methods and the safety of in-chamber SiPM readout.



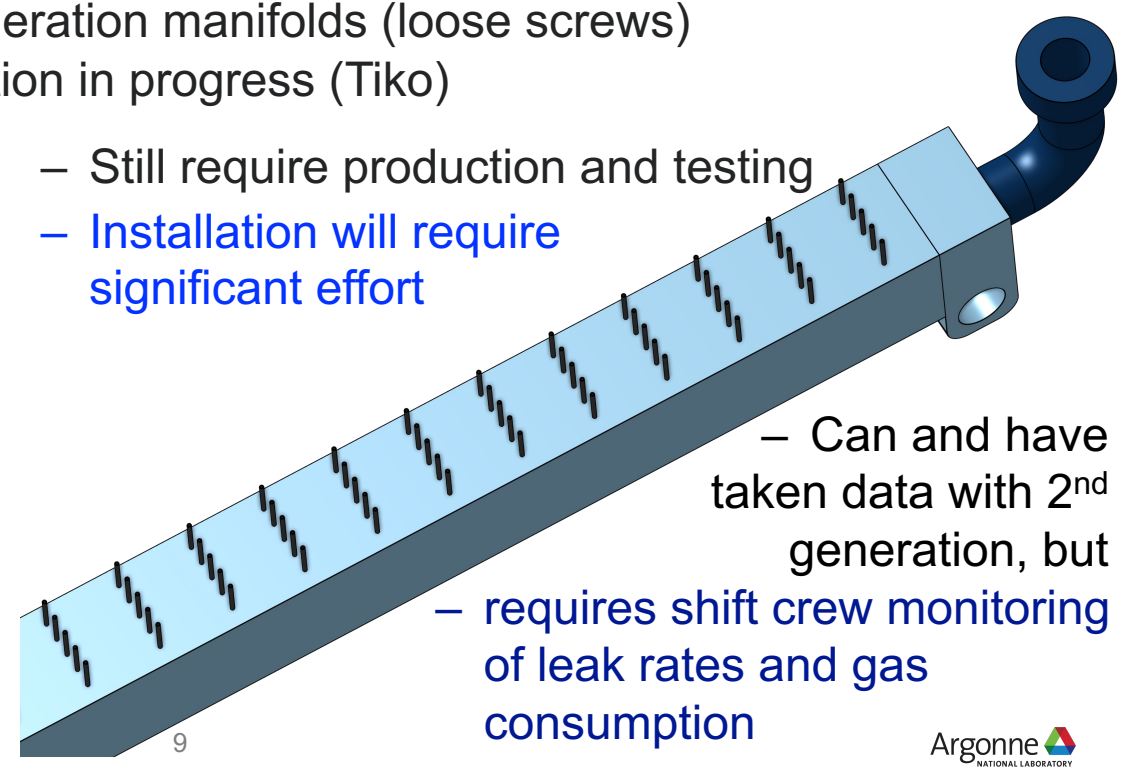


STRAW TUBE TRACKER—STT

In general, quite stable and reliable

- Gas Distribution System
  - Recurring issues with 2nd generation manifolds (loose screws)
  - 3rd generation design/production in progress (Tiko)

- Still require production and testing
- Installation will require significant effort



- Can and have taken data with 2nd generation, but
- requires shift crew monitoring of leak rates and gas consumption

Straw Tube Tracker—STT

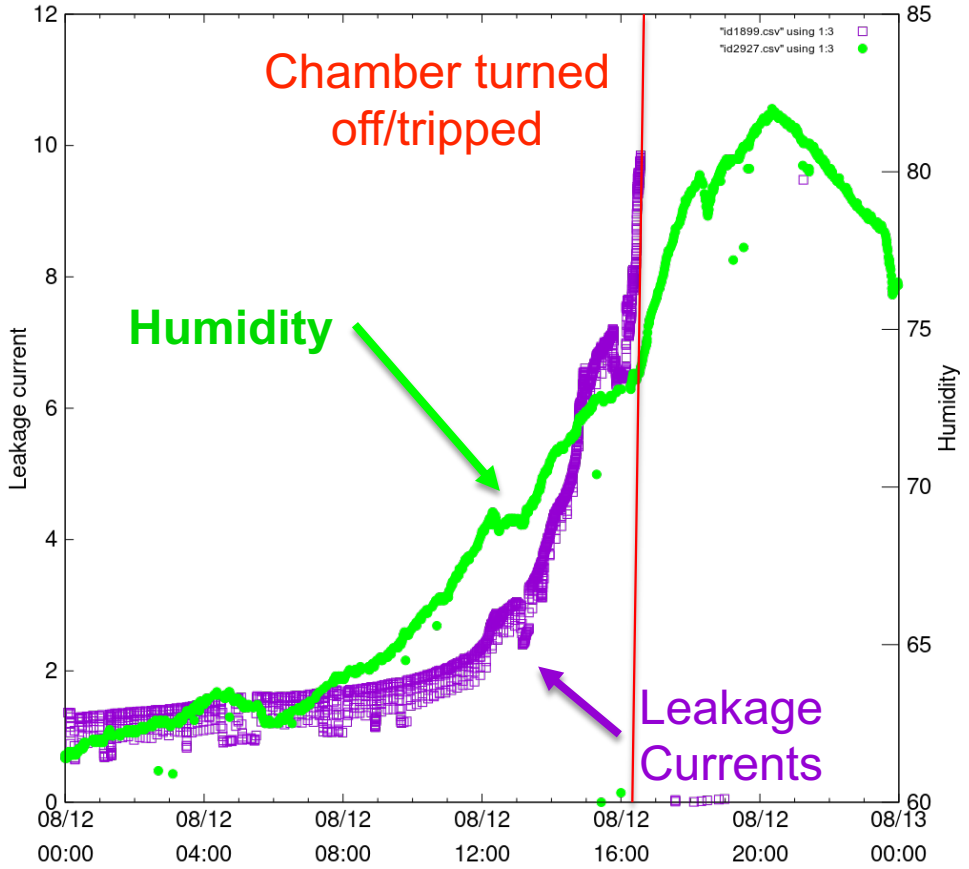
Humidity issues

You may remember that last summer was hot and humid at PSI

- Summer Humidity Issues
  - High humidity ⇒ Larger leakage currents

Right shows one (well chosen) 12 hr period as an illustration

- Humidity as measured on platform, but away from dehumidifiers

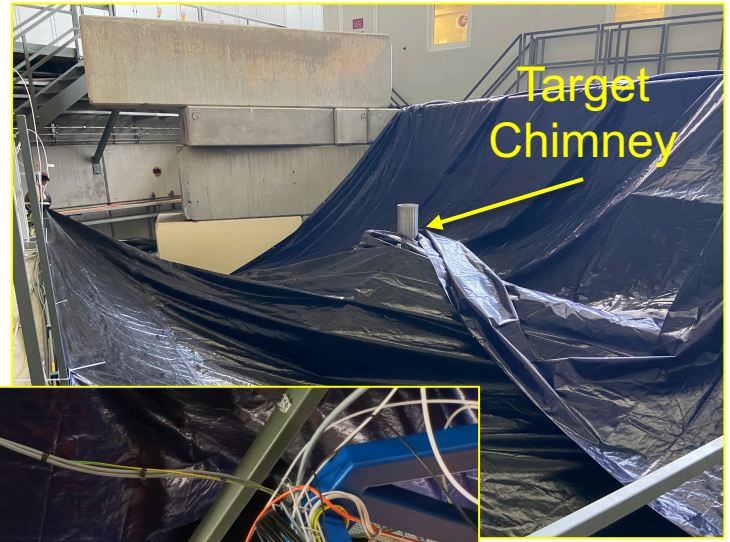


Straw Tube Tracker—STT

Humidity issues

You may remember that last summer was hot and humid at PSI

- Summer Humidity Issues
  - High humidity ⇒ Larger leak currents
  - Solutions
    - Dehumidifiers
    - Tent over area to keep dehumidified air in PiM1



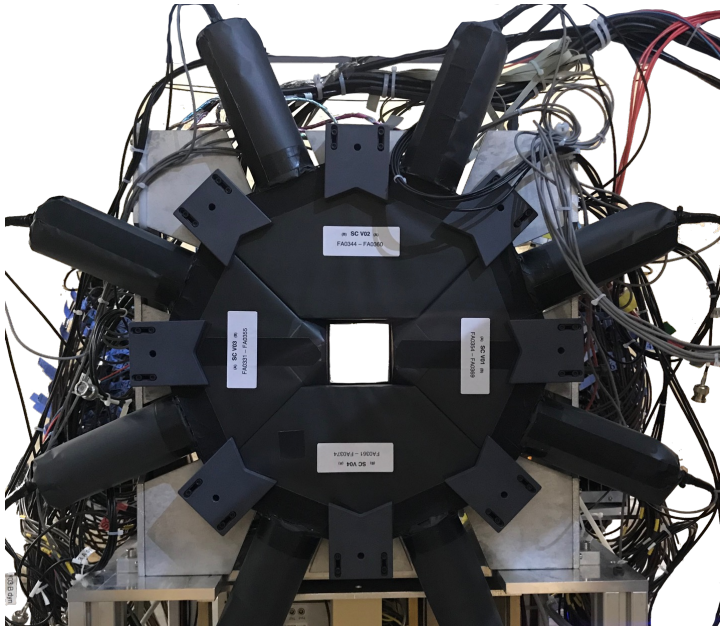
Scattered Particle Scintillators—SPS

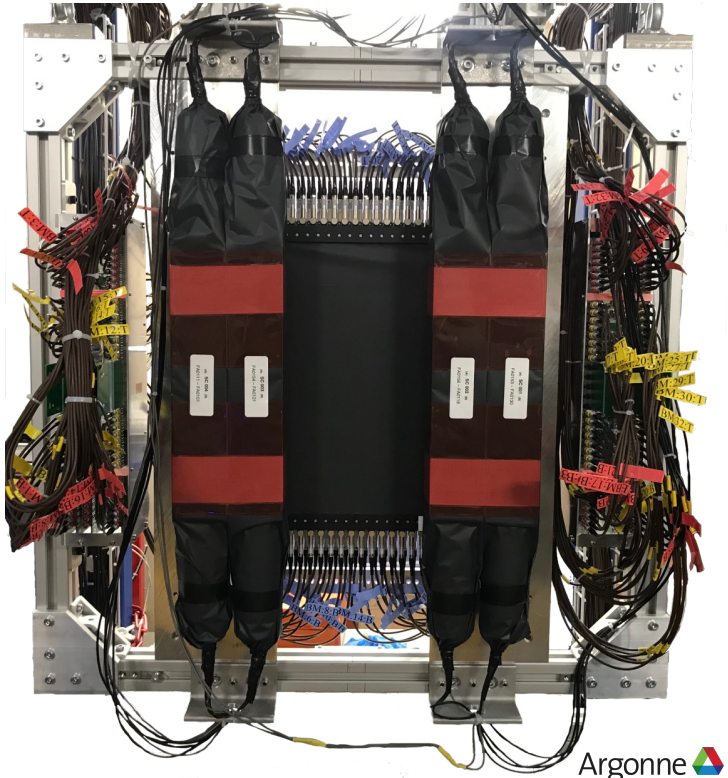
Only one significant issue:

- Scintillator glue joints breaking
  - slight stress over long period of time
  - stress during move in/out operations
  - Monitored on run-to-run basis
    - Light yield losses compensated by increasing HV and lowering threshold
  - Repairs during downtimes

Beam Veto (BV), Beam Counters (BC), and Calorimeter (Calo)

- Performed up to spec.
- Calorimeter paper drafted.





DAQ and Computer Storage

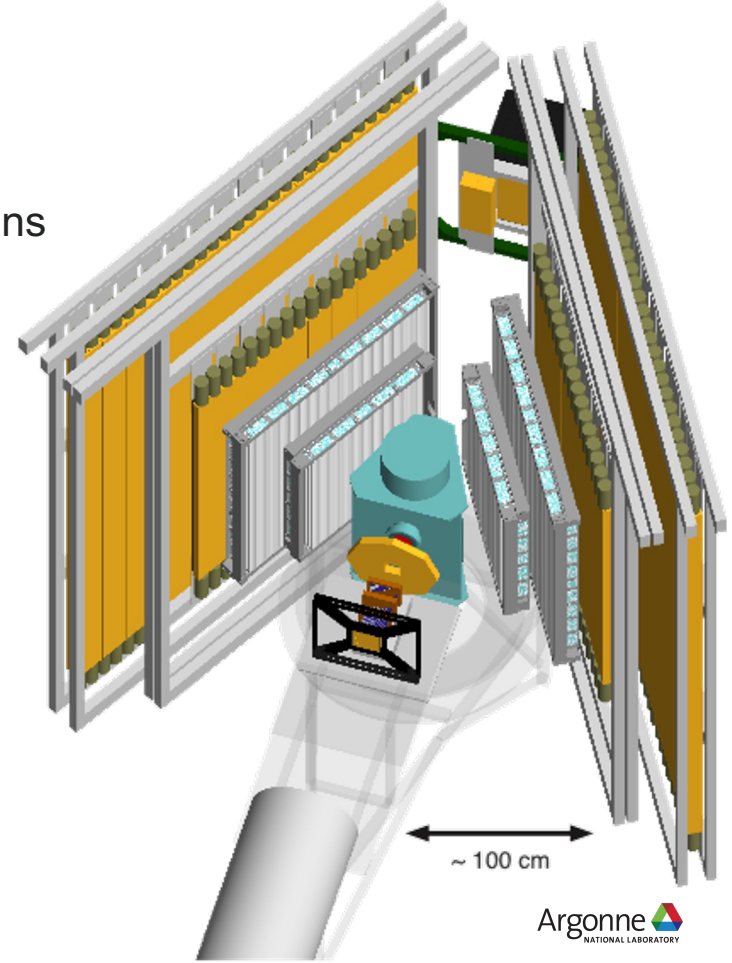
- Storage upgrade
  - Main data server currently at 665 TB
  - Additional disks can bring this up to 1.2 PB

- Raw data are backed up offsite at Argonne.
  - Thanks to Simon Gregor (PSI) for assistance with Globus access at PSI.

Detector Status

Ready to go

- No issues with most of the detector
- Other issues have been addressed or we have action plans
  - BH
    - ✓ Rad Damage*
  - TCPV
    - ✓ Installation
    - ✓ WLS vs in-chamber readout*
  - GEM
    - ✓ Dead Time
    - ✓ Vulom/CF card
  - STT
    - ✓ Humidity
    - ✓ Gas manifolds*
  - SPS
    - ✓ Glue Joints*



* Still to be fully evaluated or implemented