Fermilab

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

AEM Update

Chris Polly

29 June 2015

Muon g-2

Good two years for g-2

- Moved ring from BNL two summers ago
- Started ring installation in new building last summer

CD 2/3 Review July 2014

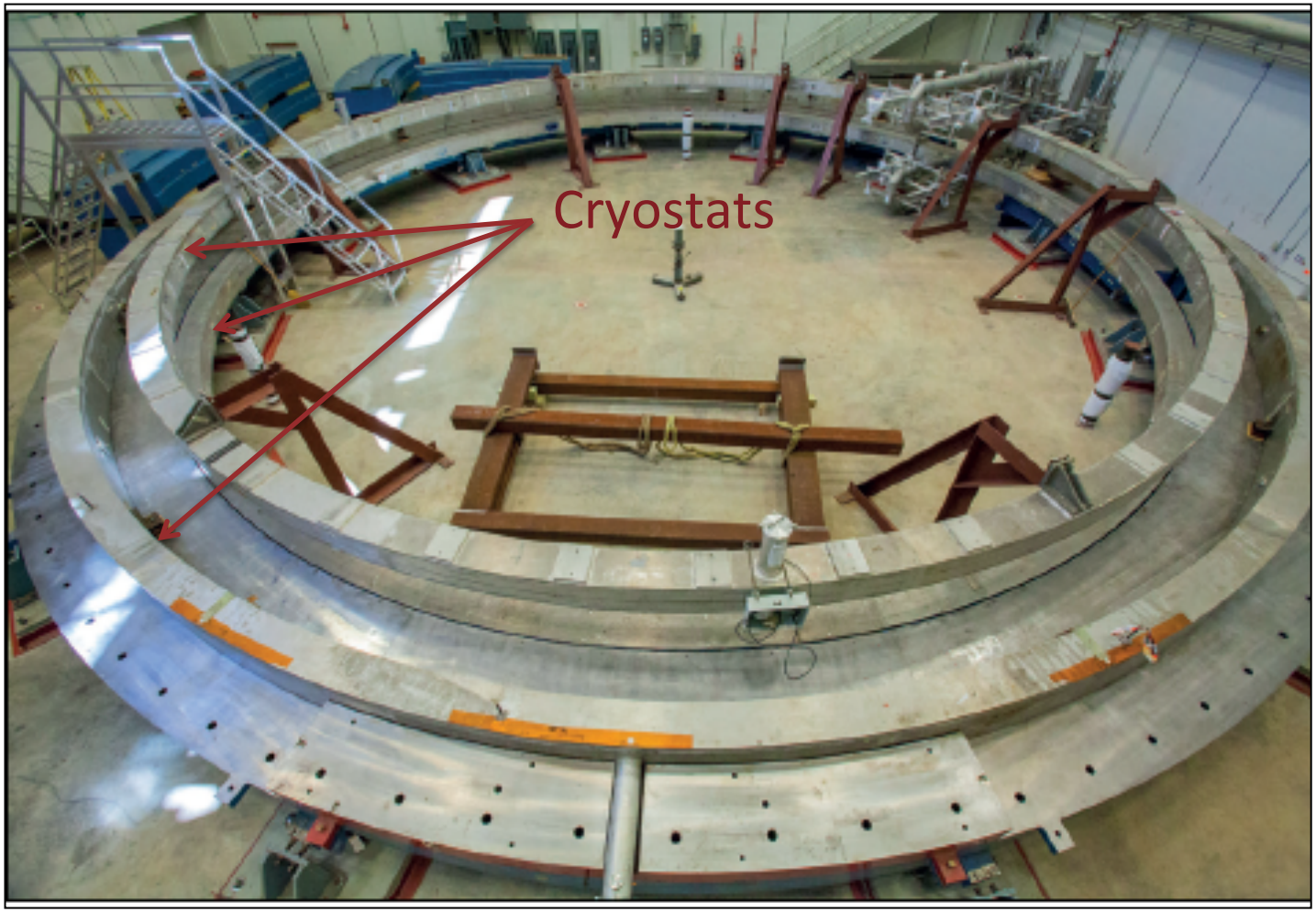
- Held a CD-2/3 review last July
  - Requested full approval, construction start for all areas of project
  - OHEP decided it would be best if we could limit spending as much as possible until the ring cold test could be completed
  - Risk mitigation strategy to not baseline -- ring had not been operational since 2001 → high-impact, low-probability risk

5.0 Project Management

11) *The Project and the laboratory should make every effort to accomplish a timely cold test of the ring.*

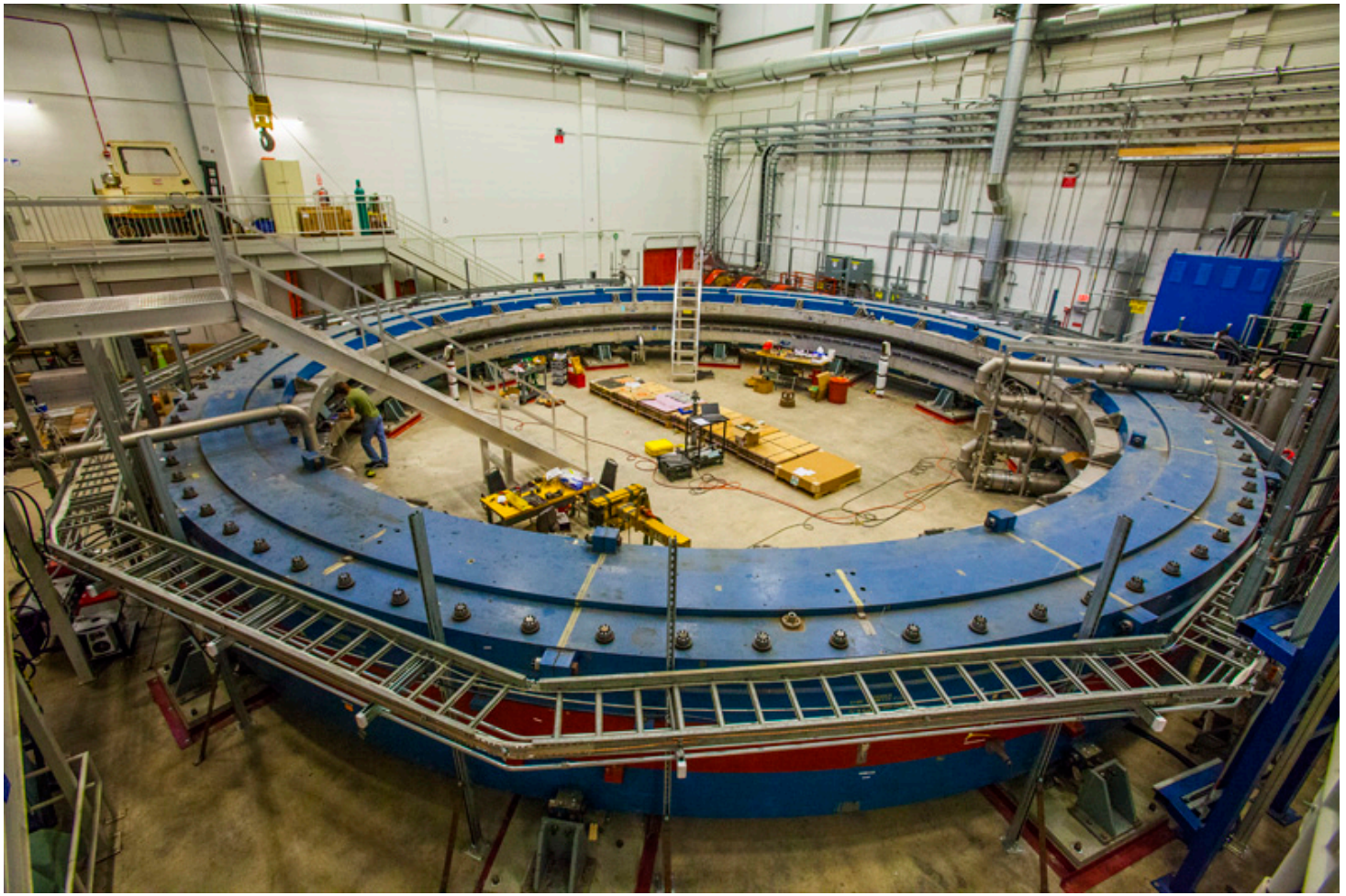
- Special authorizations
  - Permission to continue with any remaining design
  - $2.7M to get ring cold & powered
  - $2.8M for general accelerator work

Storage ring progress



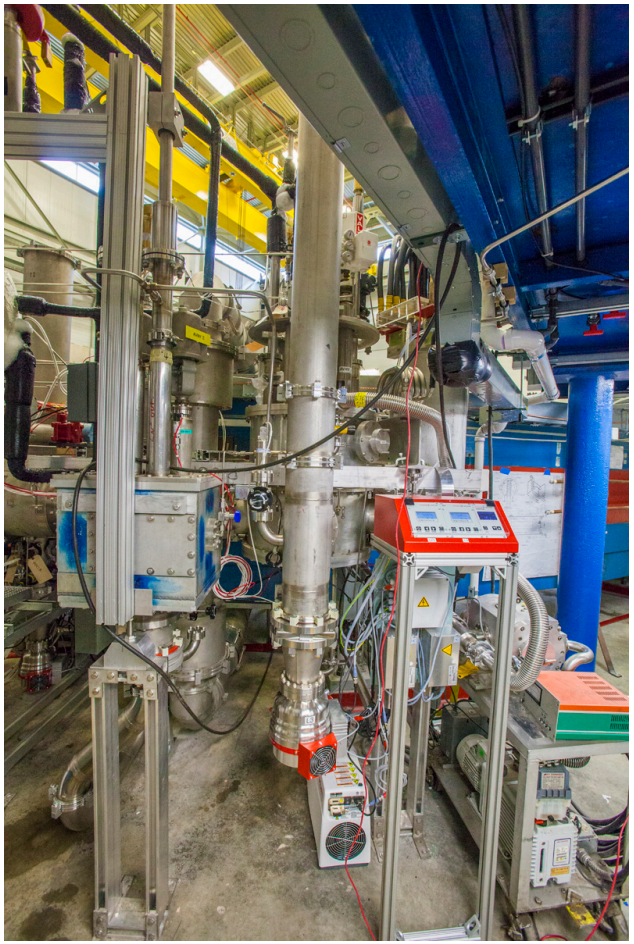
- Picture shortly after rings moved into building (last July)

Storage ring progress



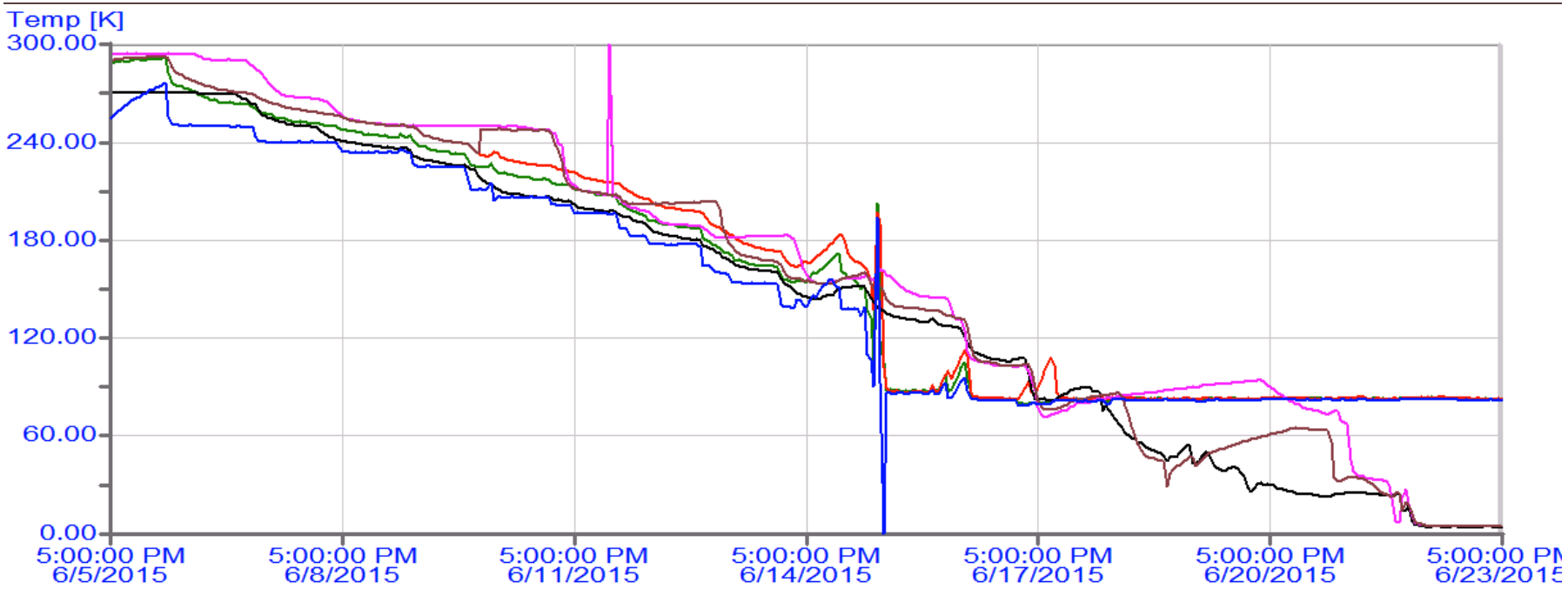
- Picture after yoke assembly completed

Storage ring progress



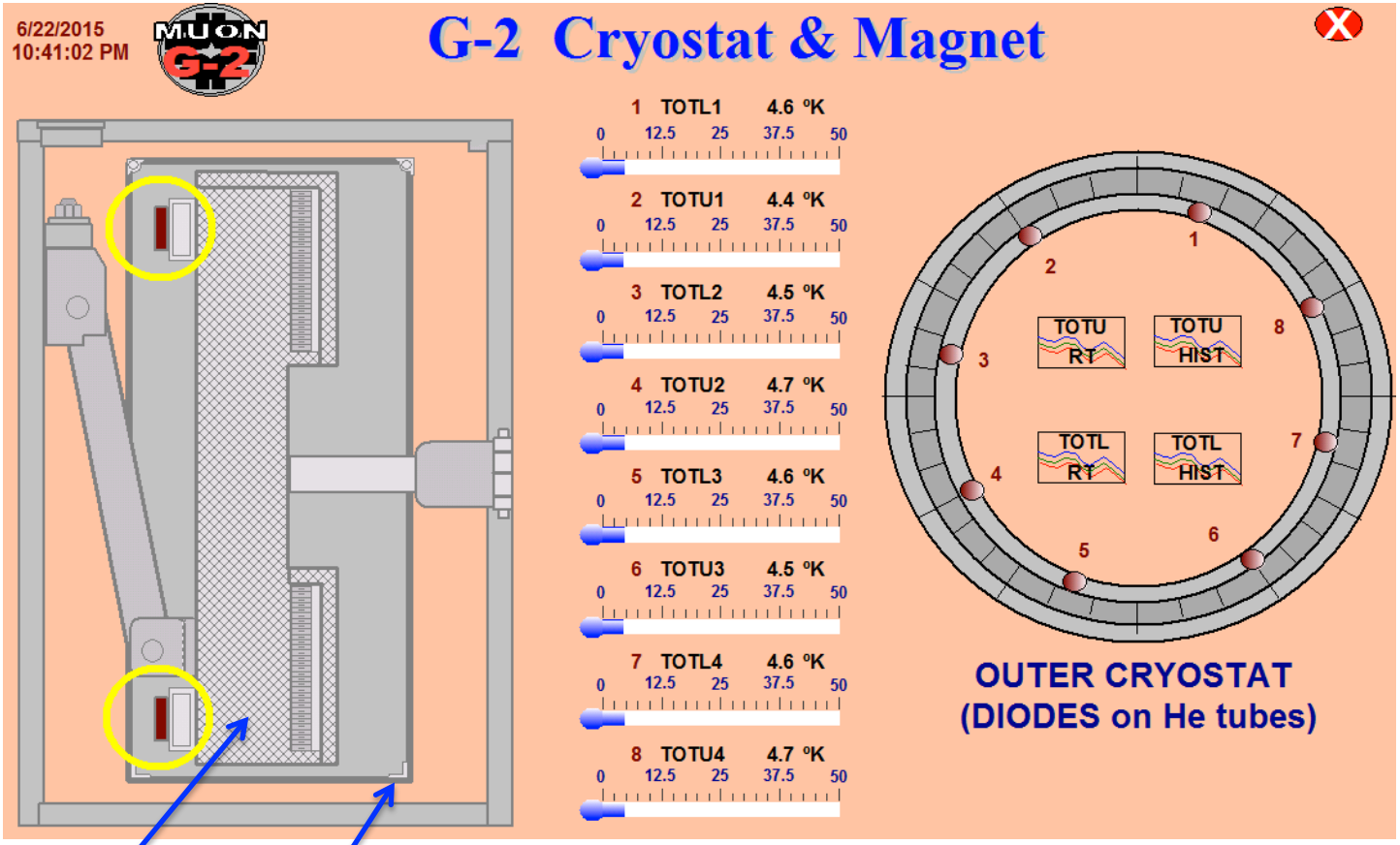
- Enormous amount of work led by Hogan Nguyen
  - Project engineers Del Allspach (ME), Steve Chappa (EE), Dan Markley (Controls)
  - Lead technician Kelly Hardin, Alignment Horst Friedsam
- ✔ 650 tons of yoke steel installed to 125 micron precision
- ✔ Strict alignment tolerances met for coils and poles (poles <25 micron average)
- ✔ Superconducting interconnect rewelded, corroded lead box refurbished
- ✔ Delivery systems for LCW and cryogens (He and N2) that required several FTE*years of very careful pipework
- ✔ Refurbishment/replacement of dozens of valves and seals
- ✔ Leak checking and installation of all new vacuum system achieving vacuum 10e-7 Torr vacuum
- ✔ Refurbishment of Bruker PS and trip cabinet, new quench protection system
- ✔ New PLC and controls system with >500 instruments read-out, dozens of controls, logic programming, & interactive iFix GUI
- ✔ Plans reviewed every step of the way to ensure safe operation
- ✔ Even the infamous BNL cold leak was repaired. The ring is in better condition than it ever has been!

Cool-down



- Cool-down started June 6 – completed in 17 days
- Few leaks had to be fixed along way – overall very smooth
  - g-2/Mu2e Cryo plant started right up and ran well

Snapshot of outer mandrel temps

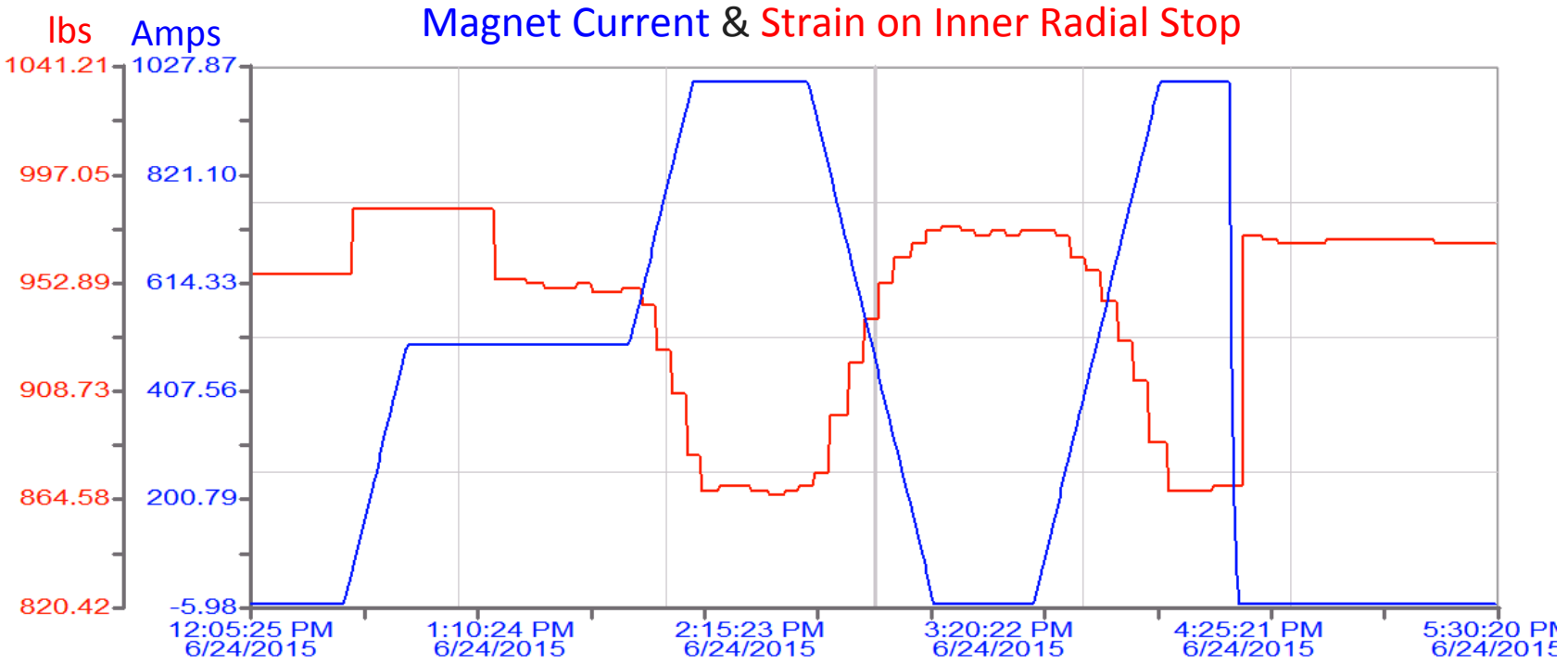


Mandrel (He)

Shield (N2)

- With magnet at operating temperatures, resistivity was checked, power tests started last week

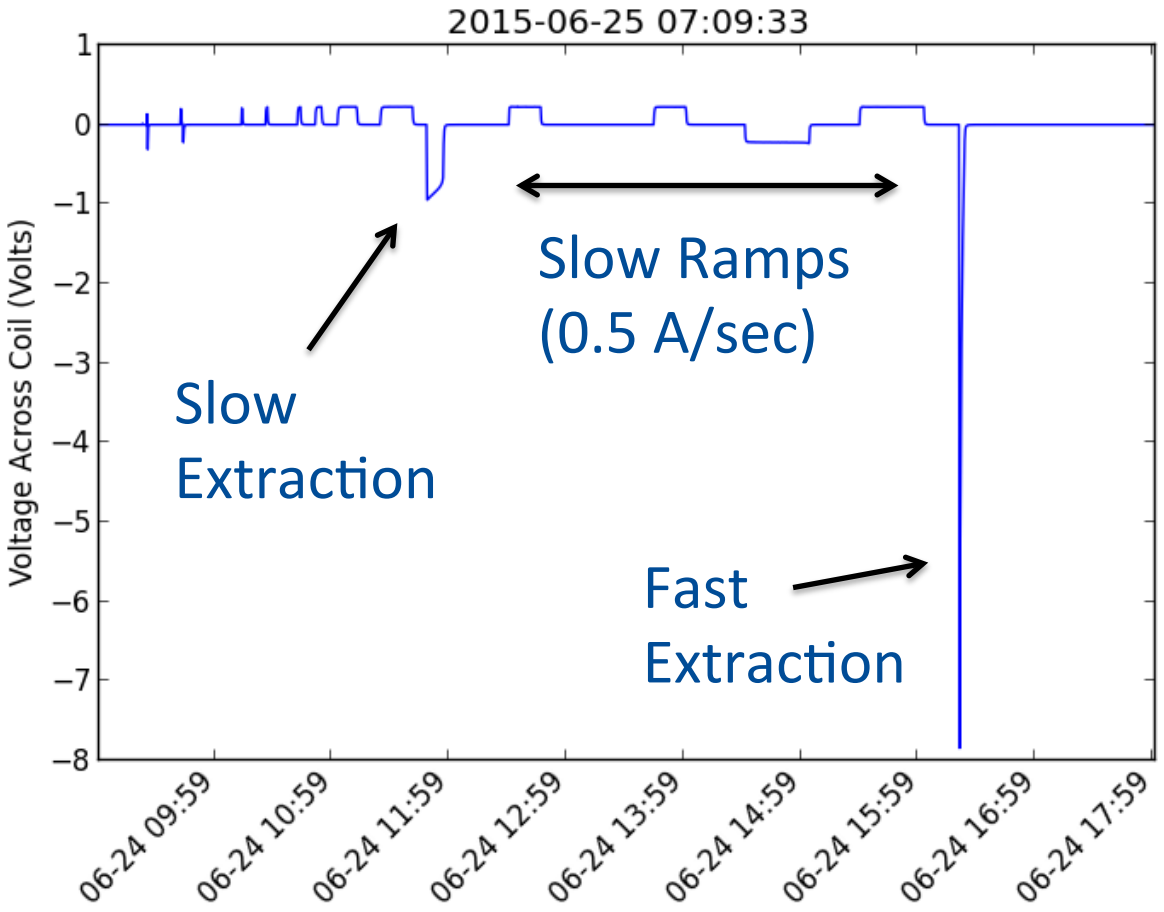
Power tests



- Initial power tests at 1000 Amps
  - Fast extraction and slow extraction testing
  - Strain gauge from radial stop on outer coil shown
- Have now tested to 3000 Amps (5200A is operating)

Voltage drop on coils

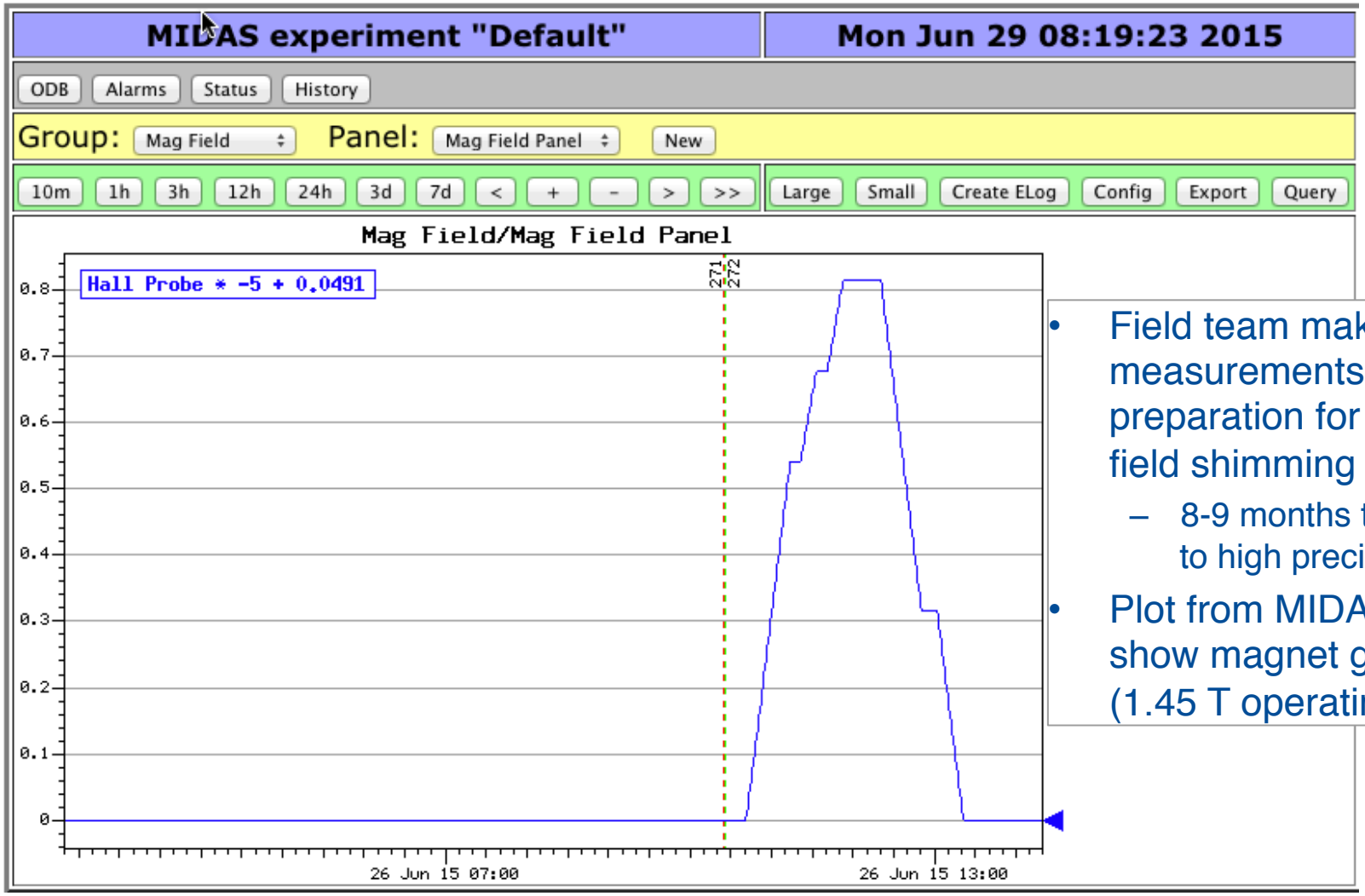
Coil Voltage



Coil Voltages
In excellent
agreement
With Model.

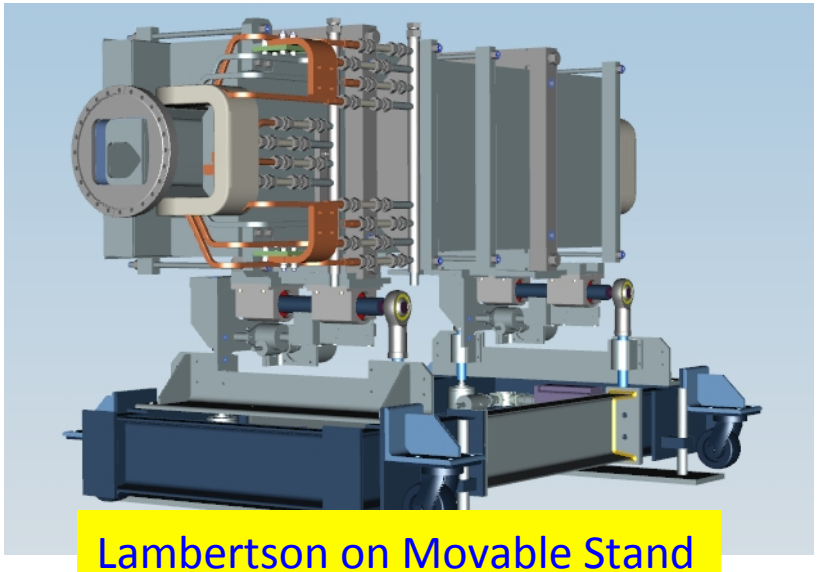
Cold mass
Temperature
Reached 16 K
During Fast
extraction
(model predicted
17K)

Magnetic field measurement

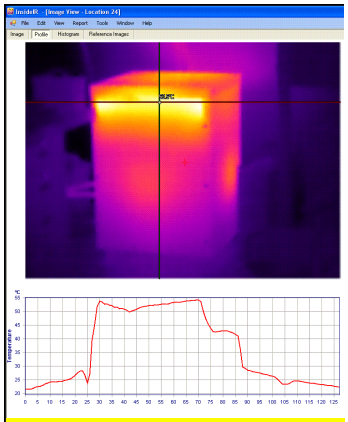


- Field team making B field measurements in preparation for starting field shimming
  - 8-9 months to shim field to high precision
- Plot from MIDAS DAQ show magnet gap at 0.84T (1.45 T operating)

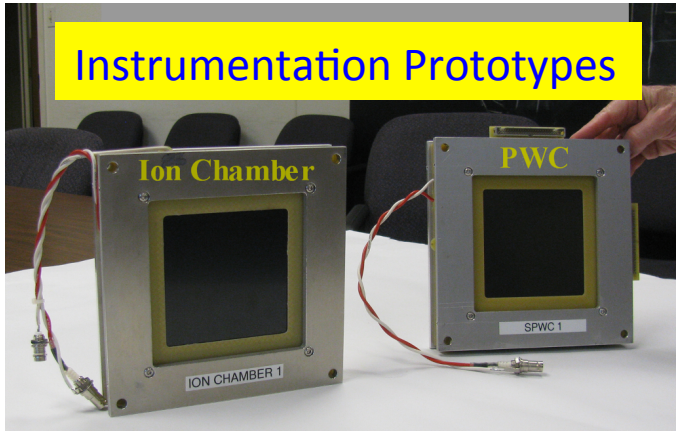
Final design - Accelerator



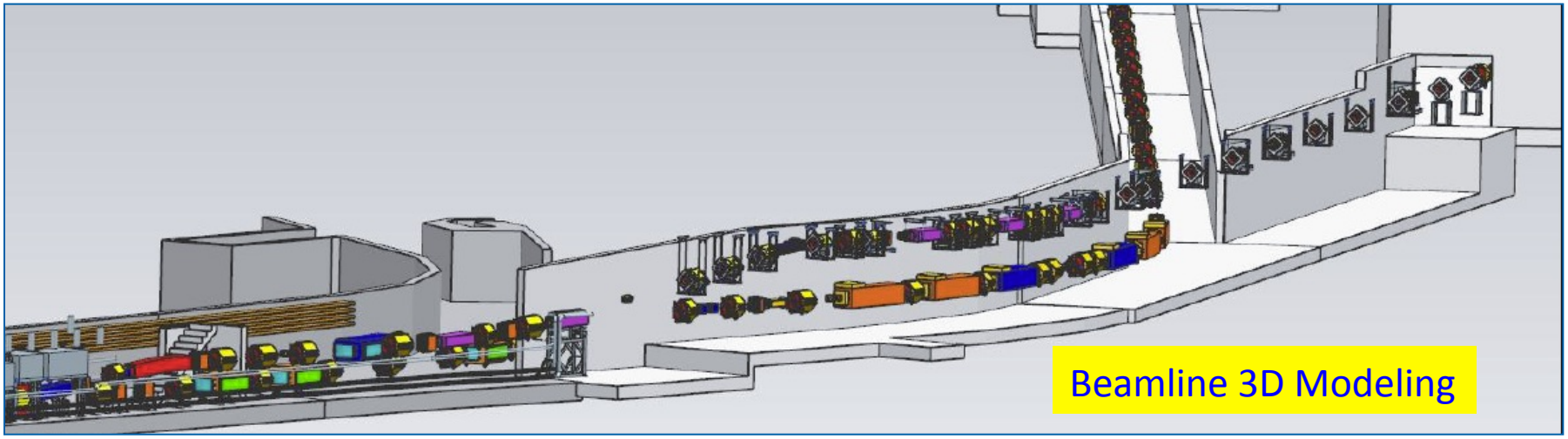
Lambertson on Movable Stand



Lens PS Testing

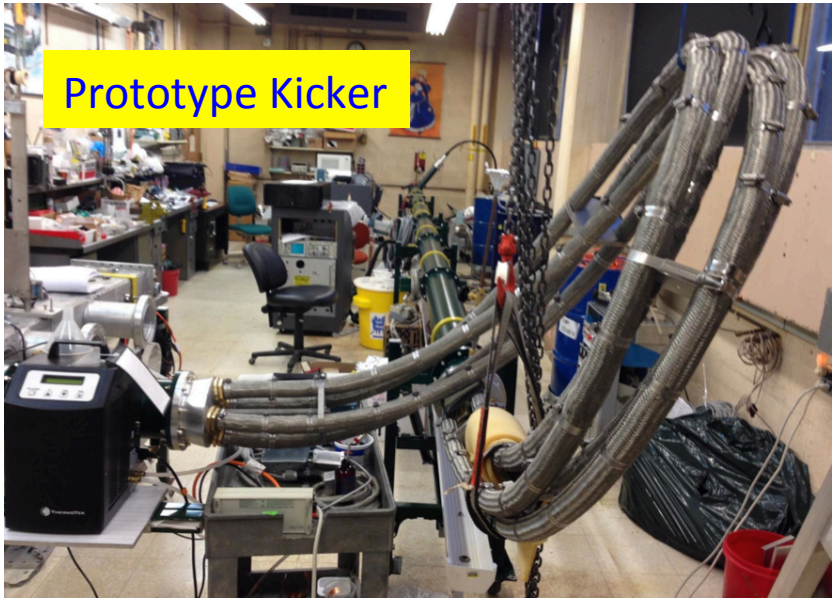


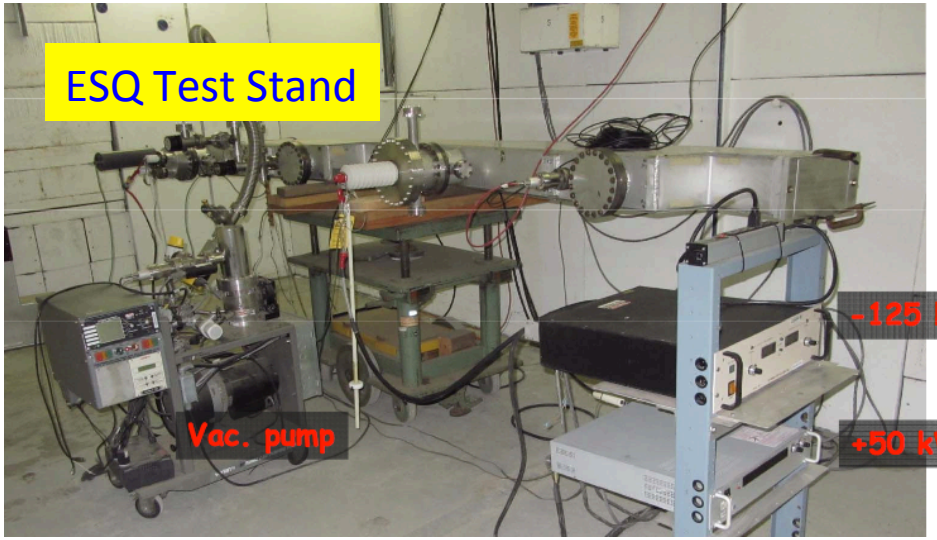
Instrumentation Prototypes

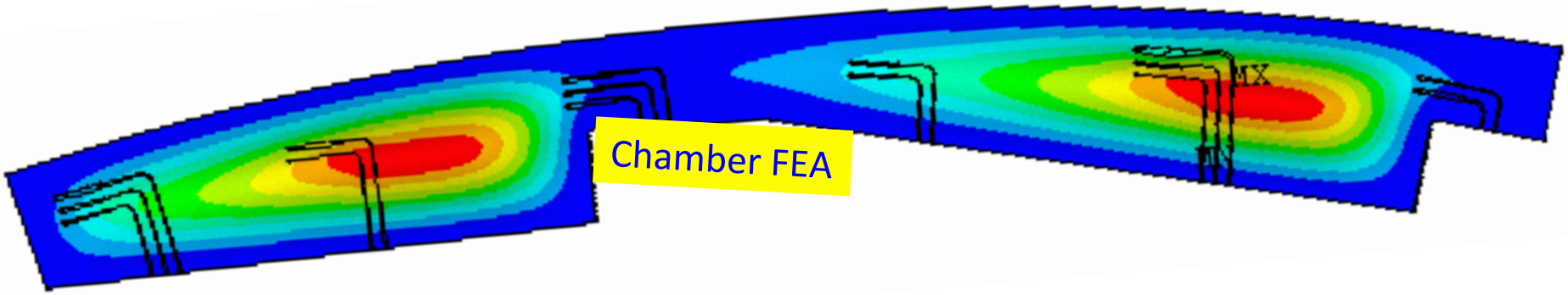


Beamline 3D Modeling

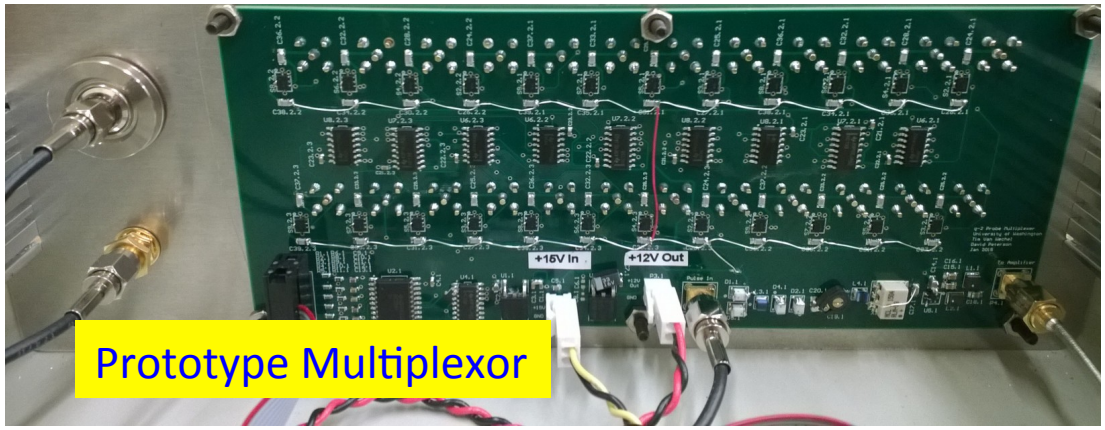
Final design - Ring

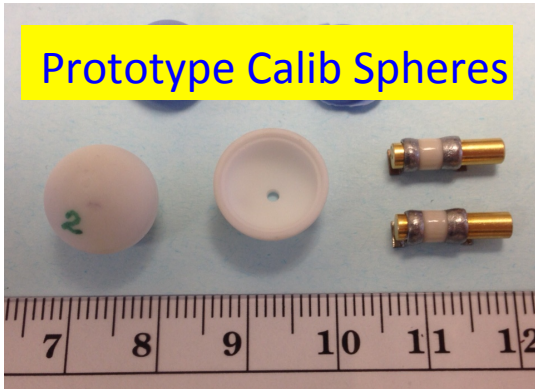


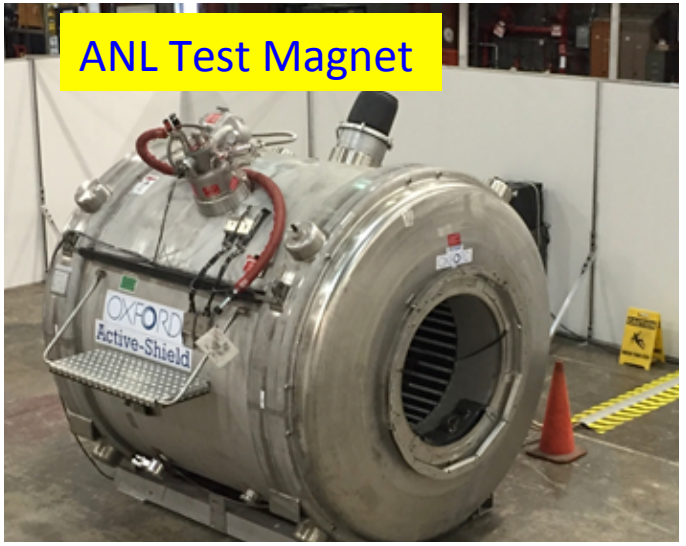


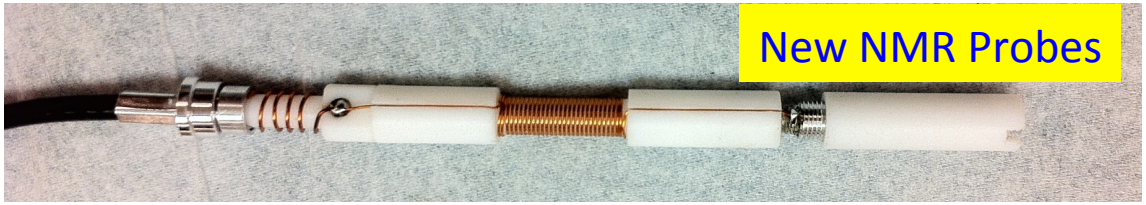


Final design – Magnetic Field

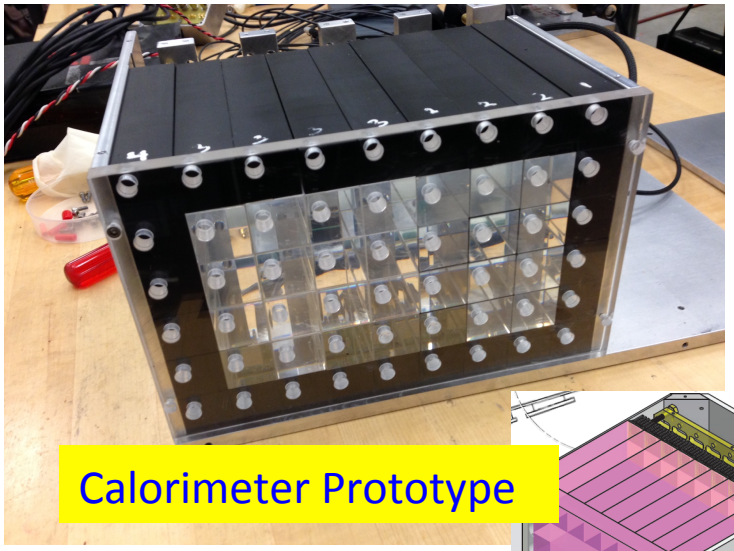




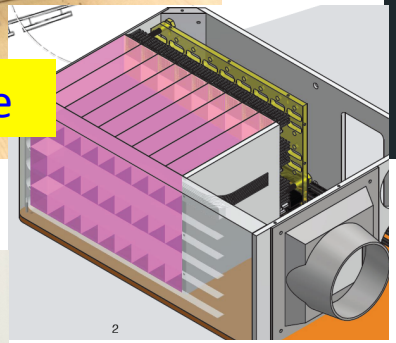


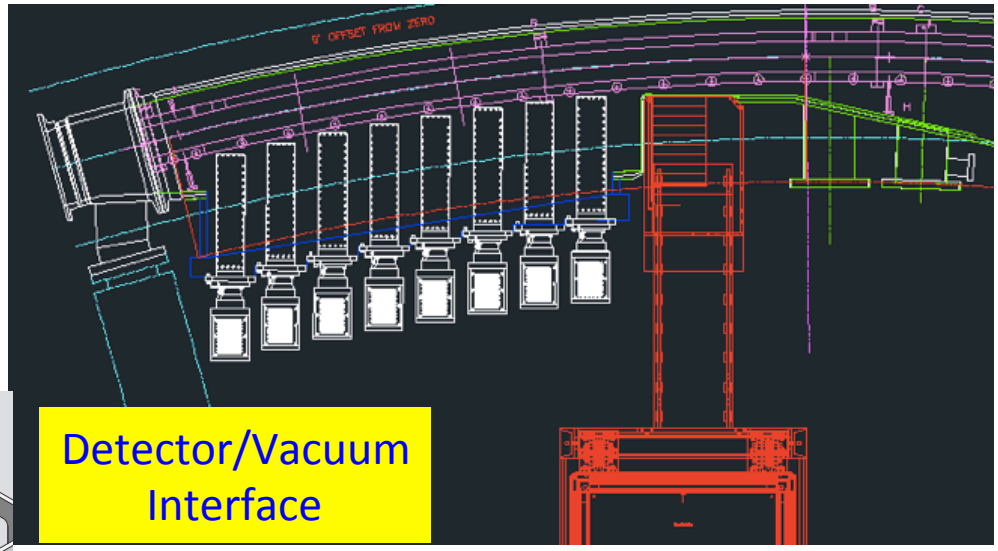


Final design - Detector

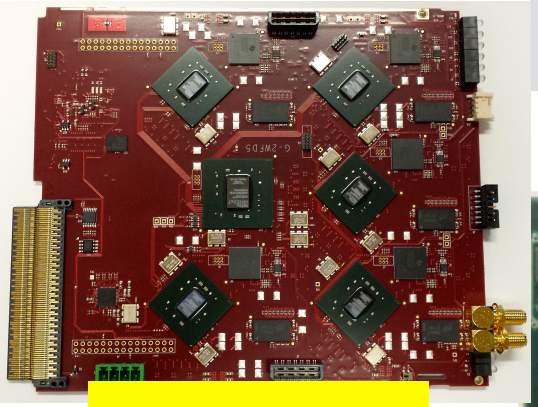


Calorimeter Prototype

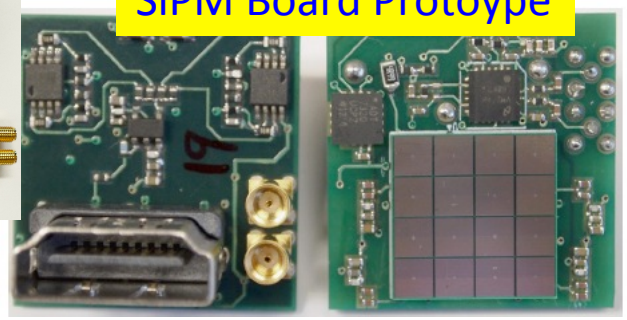




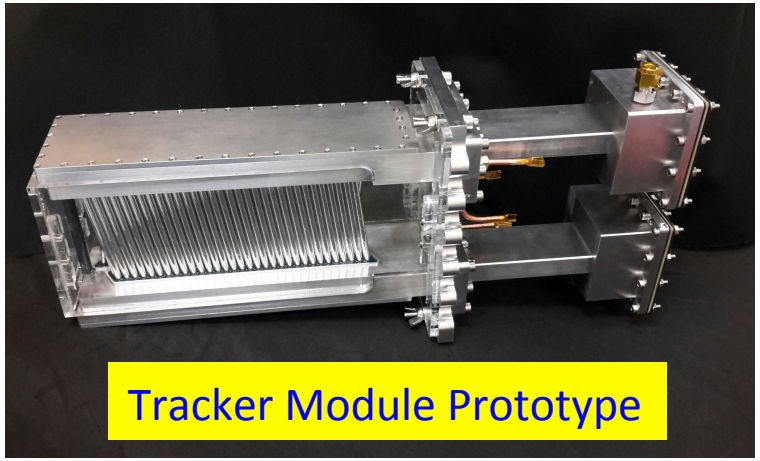
Detector/Vacuum Interface



800 MSPS WFD



SiPM Board Protoype



Tracker Module Prototype

Conclusion

- CD-2/3 Follow-up review held last week (June 25-26)
  - Committee was very happy to see the storage ring was at operating temperatures and vacuums, 60% of the way to full current
- We will continue to push forward with careful testing at each stage
  - Aiming for full power demonstration by end of week
- Anticipate getting the ESAAB approval to start construction for rest of the experiment in July

Add CD-Milestones (point about critical path-acc, float to CD-4