Muons report

Greg Rakness (FNAL)

Proton PMG / AEM

04-Apr-2024

https://indico.fnal.gov/event/63842/

Mu2e-docdb-48488-v2

Outline

- Muon g-2 experiment overview
- Mu2e experiment overview
- Muon Campus beam studies plan

Muon g-2 overview

- March: wrapped up magnet-off measurements, as planned
- Status: magnet dormant at room temperature
- 17-19 April: Muon g-2 collaboration meeting at ANL
  - Many analyses ongoing…

Thu AM:

Start	Title
08:30	Welcome
08:40	RF 101
08:55	RF 101 Q&A
09:00	Data driven CBO envelope
09:15	Data driven CBO envelope Q&A
09:20	CBO phase advance
09:35	CBO phase advance Q&A
09:40	buffer
10:10	break
10:25	CBO task force
10:40	CBO task force Q&A
10:45	Slow Term Task Force
11:00	Slow Term Task Force Q&A
11:05	buffer
11:35	CPT/LV Theory
11:55	CPT/LV Theory Q&A

Thu PM:

Start	Title
13:00	Tracker acceptance
13:15	Tracker acceptance Q&A
13:20	Tracker scattering device
13:35	Tracker scattering device Q&A
13:40	MiniSciFi
14:00	MiniSciFi Q&A
14:15	buffer
14:45	break
15:15	ED&I: Adaptability, Thinking, and Inclusion - A not to random walk (Patricia Rankin)
16:15	Phase acceptance
16:30	phase acceptance Q&A
16:35	E-Field correction racker
16:50	E-Field correction racker Q&A
17:00	E-Field correction CERN
17:15	E-Field correction CERN Q&A
17:20	buffer

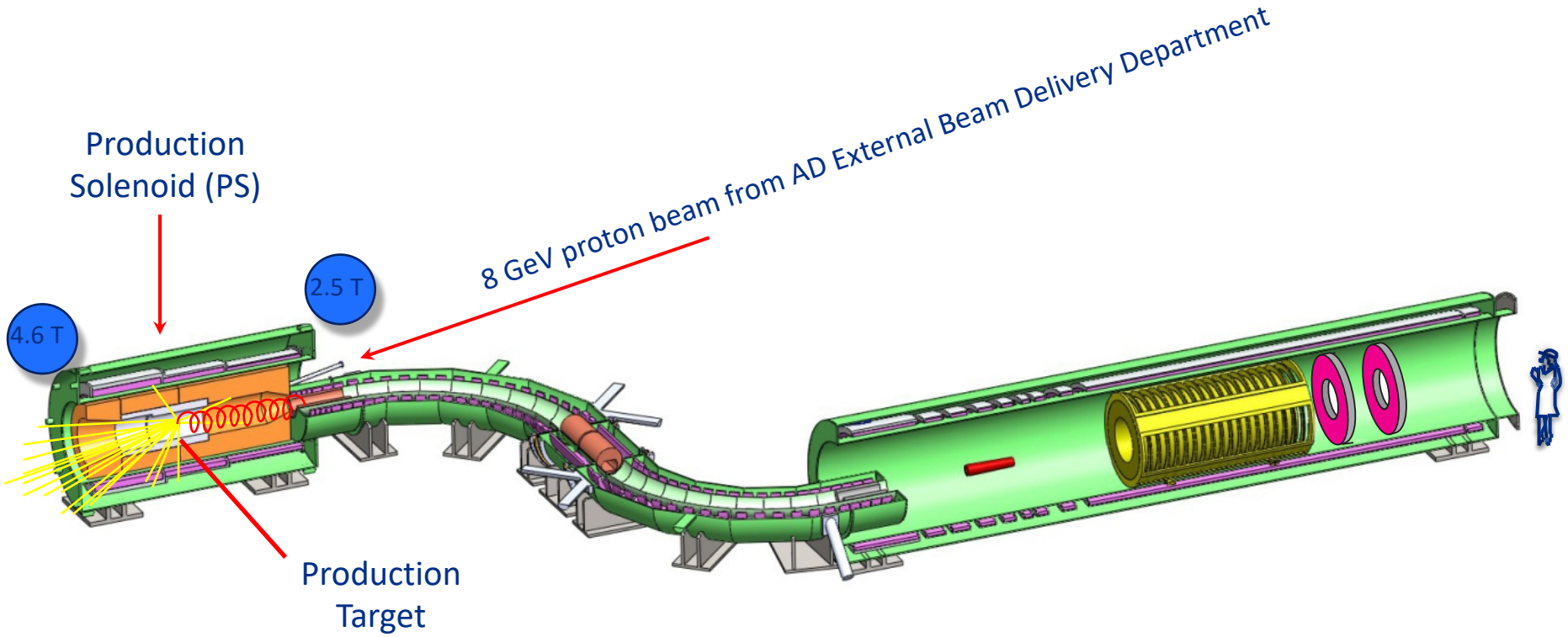
Fri AM:

Start	Title
09:30	Field trolley map & motion
09:45	Field trolley map & motion Q&A
09:50	Field muon weighting
10:05	Field muon weighting Q&A
10:10	buffer
10:40	break
10:55	Magnetometers
11:15	Magnetometers Q&
11:25	buffer

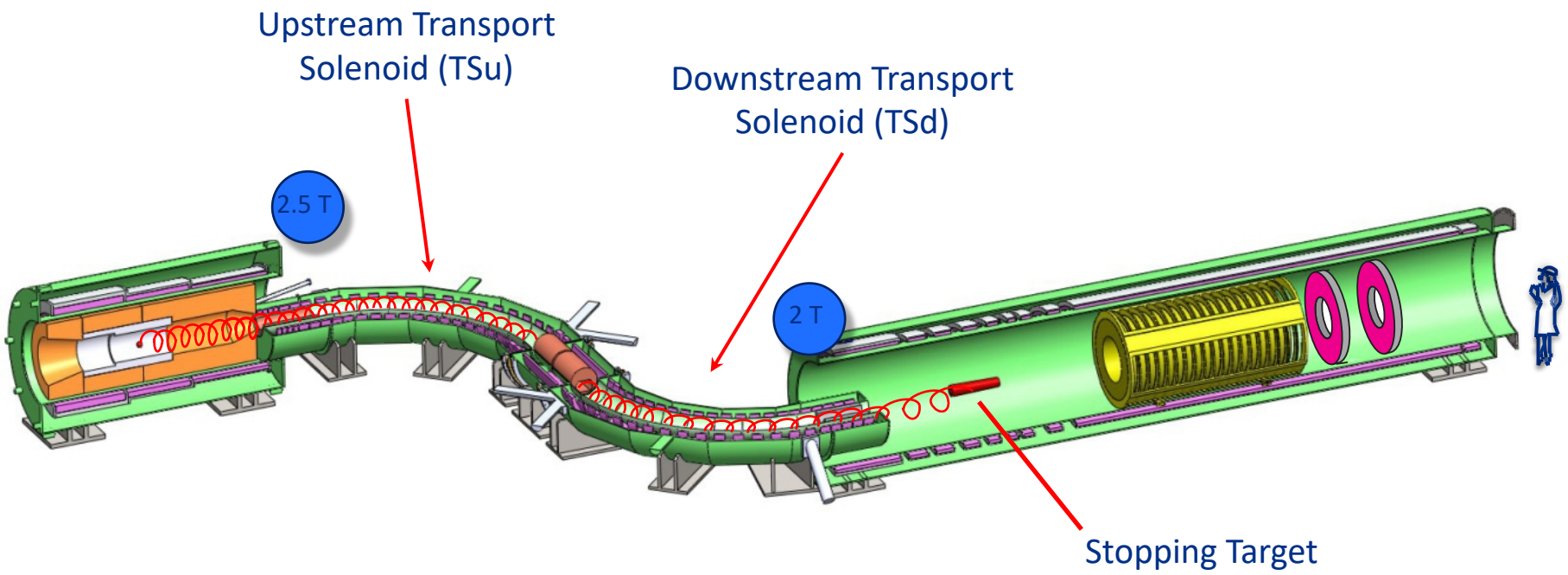
Fri PM:

Start	Title
12:45	Simulation Status
13:05	Simulation Status Q&A
13:15	Differential Decay
13:30	Differential Decay Q&A
13:35	buffer
13:50	Status & Overview Field
14:05	Status & Overview Field Q&A
14:15	Status & Overview BD
14:30	Status & Overview BD Q&A
14:40	Status & Overview Omega_a
15:00	Status & Overview Omega_a Q&A
15:10	Summary

Recall Mu2e experiment concept:
1. Protons hit production target in the Production Solenoid to create pions → muons

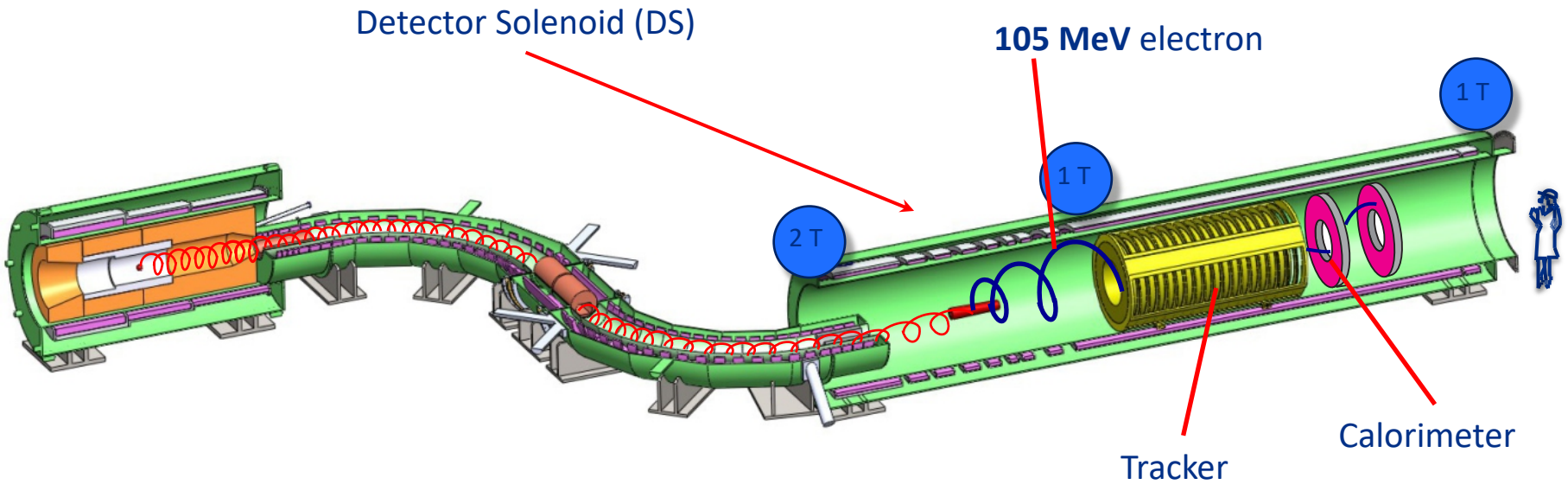


Recall Mu2e experiment concept:
2. “Backward”-going muons make the turns in Transport Solenoids and stop in Stopping Target



Recall Mu2e experiment concept:
3. Muon decays into electron that is detected by Tracker & Calorimeter in the Detector Solenoid

Mu2e is looking for muons that decay into electrons with NO neutrinos



Mu2e overview

- 2024 is a busy year at the Mu2e building (MC2)
- Received: upstream Transport Solenoid (TSu) and downstream Transport Solenoid (TSd)
  - In process of welding TSu to TSd, and to the floor
- Soon to arrive: Production Solenoid (PS) and then Detector Solenoid (DS)
  - We will need to rent a crane to lower the PS through the hatch
- Also soon to arrive: Calorimeter in Summer, followed by Tracker

Mu2e collaboration meeting – 18-22 March

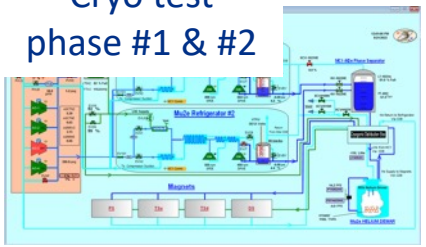
Many smiling faces surrounding the Mu2e Transport Solenoid

Infrastructure under construction at Mu2e to receive Project deliverables

- **Cryo:** build & commission cryo plant
  - Connections to vent headers under construction
  - U-tubes fabricated ; test insertion and leak check to be done
  - ODH analysis underway

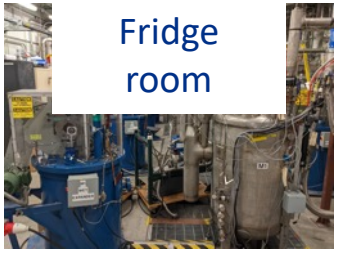
- **Facilities:** final outfitting of building
  - Equipment Cooling Water system under construction
  - Work by electricians continues
  - Tracker chiller under construction
  - Detector cables and optical fibers being installed

Cryo test phase #1 & #2



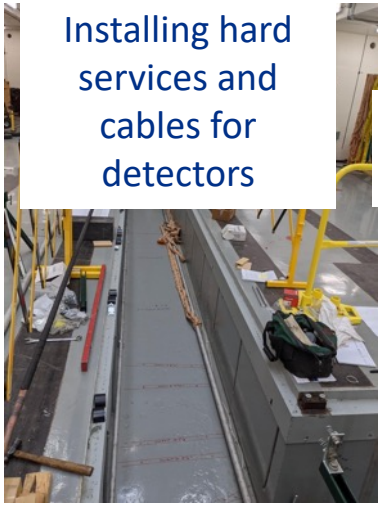
Cryo outdoor transfer lines

Fridge room

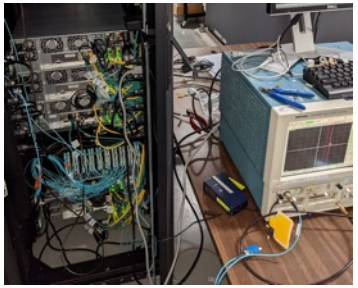


Cryo dist box & He dewar

Installing hard services and cables for detectors

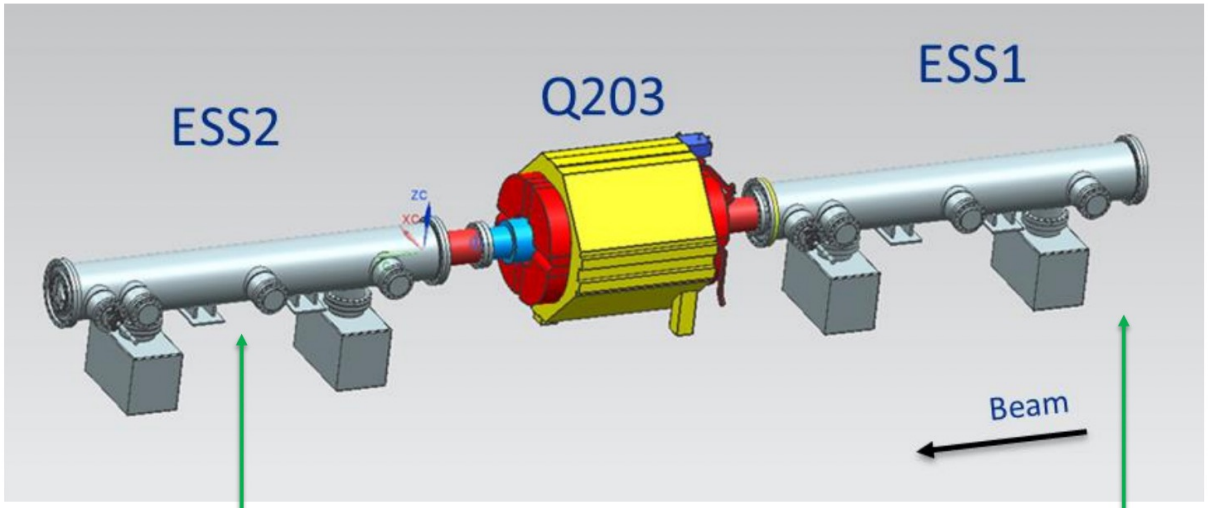


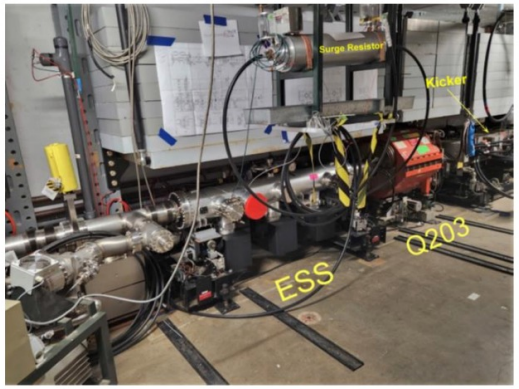
DAQ integration tests



Proton beam for Mu2e

- Resonant extraction system developed by the AD External Beam Delivery Department utilizes a pair of electrostatic septa (ESS1 and ESS2) to strip off protons in the Delivery Ring to send to Mu2e





Installed a prototype septum end of 2022. Allowed to study resonant extraction while co-sharing beam with g-2

First production septum will be installed during FY24

From Stratakis & Werkema (mu2e-docdb-48425)

Muon Campus beam studies plan

From Stratakis & Werkema (mu2e-docdb-48425)

Initial conditions: We do not expect ESS1 reassembly, HV conditioning, and transfer from project to operations to be complete before beam startup. Therefore we will run with a single electrostatic septum (the prototype septum).

Approximate chronological order:

- Startup ($\lesssim$ 1 week)
- Conduct high priority studies (see next slide)
- Possible ~1 week shutdown to install ESS1 (if ESS1 ready soon enough)
- Conduct planned studies until the summer shutdown

If all goes well, it is still possible (albeit unlikely) to complete our planned studies. The most likely outcome is that the beam studies we conduct will indicate that additional studies are necessary and our studies list will grow.

Initial list of beam studies for this running period

From Stratakis & Werkema (mu2e-docdb-48425)

- Shielding measurements for the shielding assessment (continued from the last run)
- Commission M3 beamline extinction monitor
- Troubleshoot M4 beamline profile monitor issues (most profile monitors in the M4 line don't see resonantly extracted beam)
- Delivery Ring BPM shake down
- Delivery Ring orbit correction (center beam in resonant extraction sextupoles and quadrupoles)
- Delivery Ring aperture optimization
- Delivery Ring injection optimization
- Understand/correct Delivery Ring injection tune shift
- Commission spill monitoring instrumentation
- Begin development of spill-monitoring software
- Begin implementation of spill control
- Perfect Delivery Ring tune tracking during the spill
- Optimize Resonant Extraction trim quadrupole ramps
- Careful transverse alignment of Delivery Ring extraction devices
- Installation and beam commissioning of ESS1 (when high voltage testing at NWA is complete)
- Catalog/study/correct beam losses during the spill

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Fermilab

Steve Werkema | Presentation Title or Meeting Title 3/21/2024

Backup