Fermilab Update

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13 October 2025

Fermilab Accelerator Complex

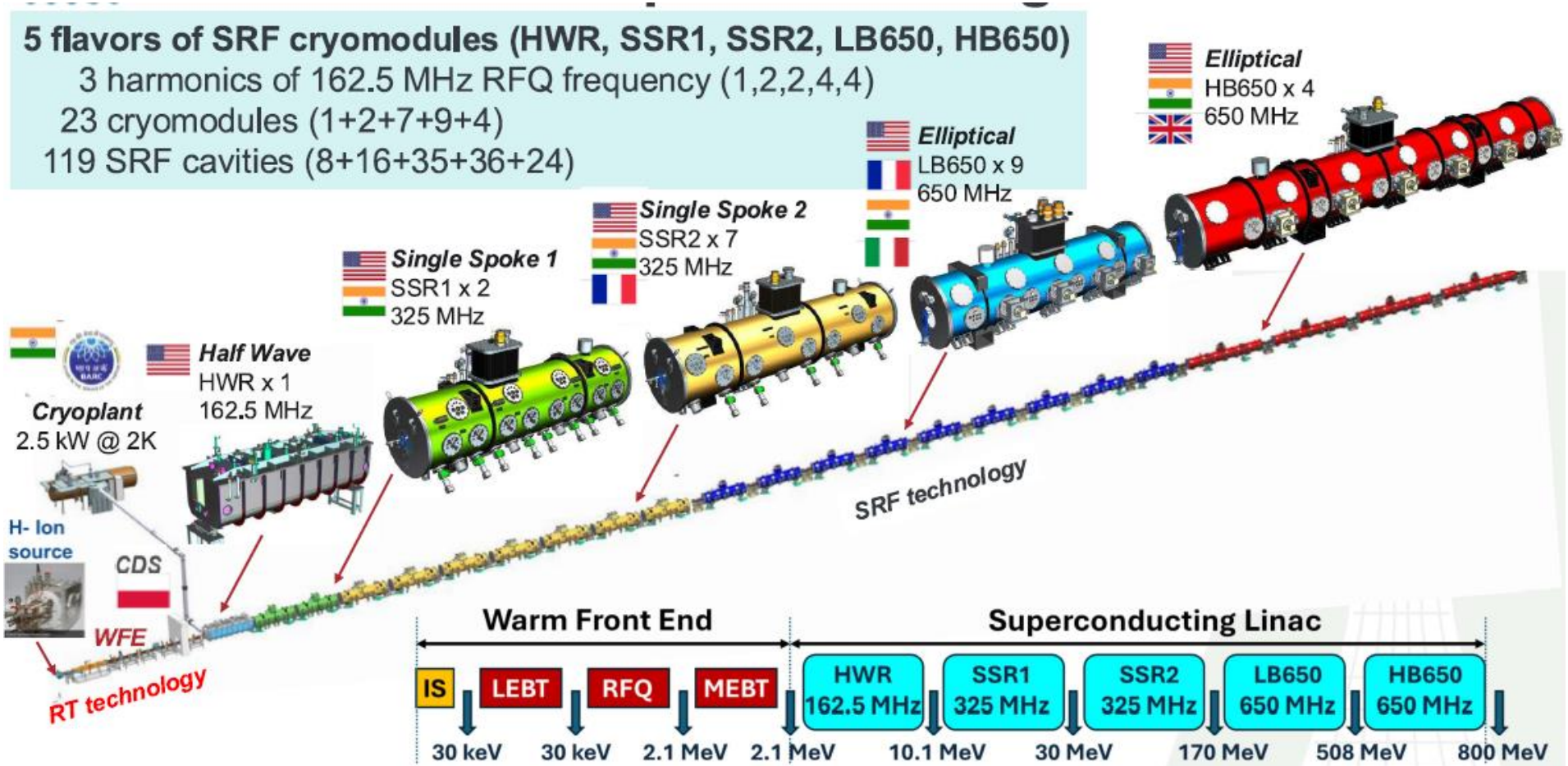
Project received DOE CD-3 approval in 2022

LLRF System final design review in 2024

Production stage 2025/26

Upgrades for Booster and Main Injector for higher beam power

PIP-II 800 MeV Superconducting RF CW Linac



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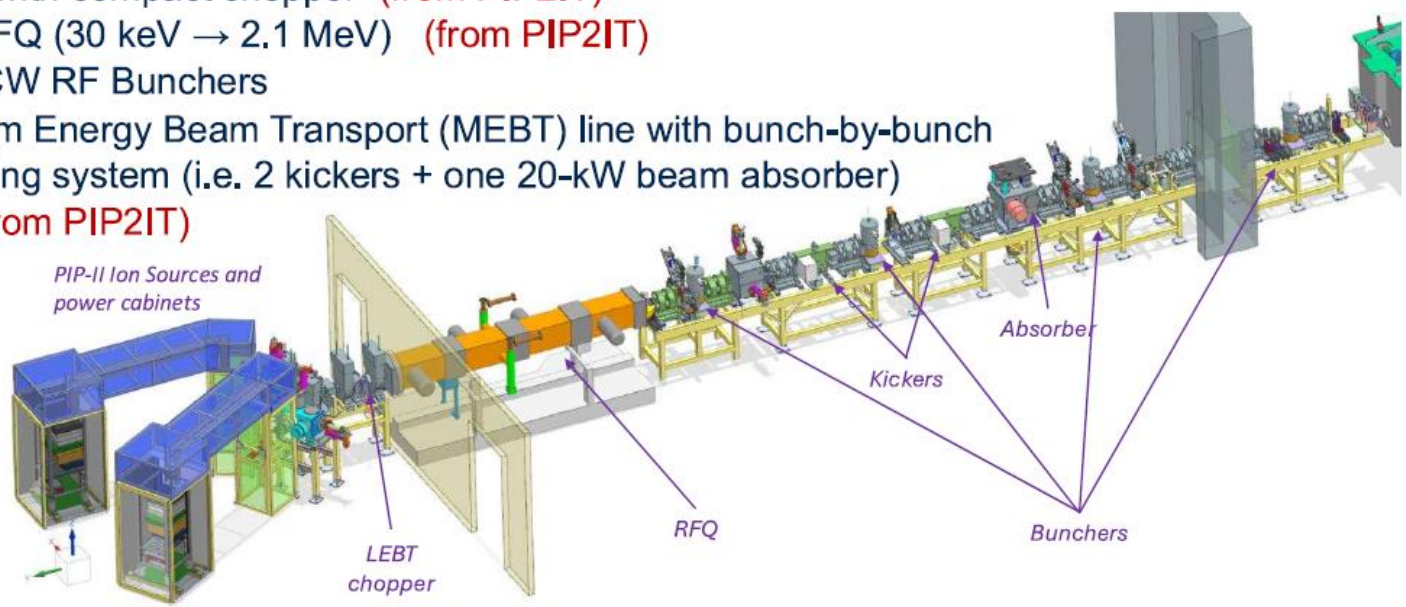
PIP-II Warm Front End

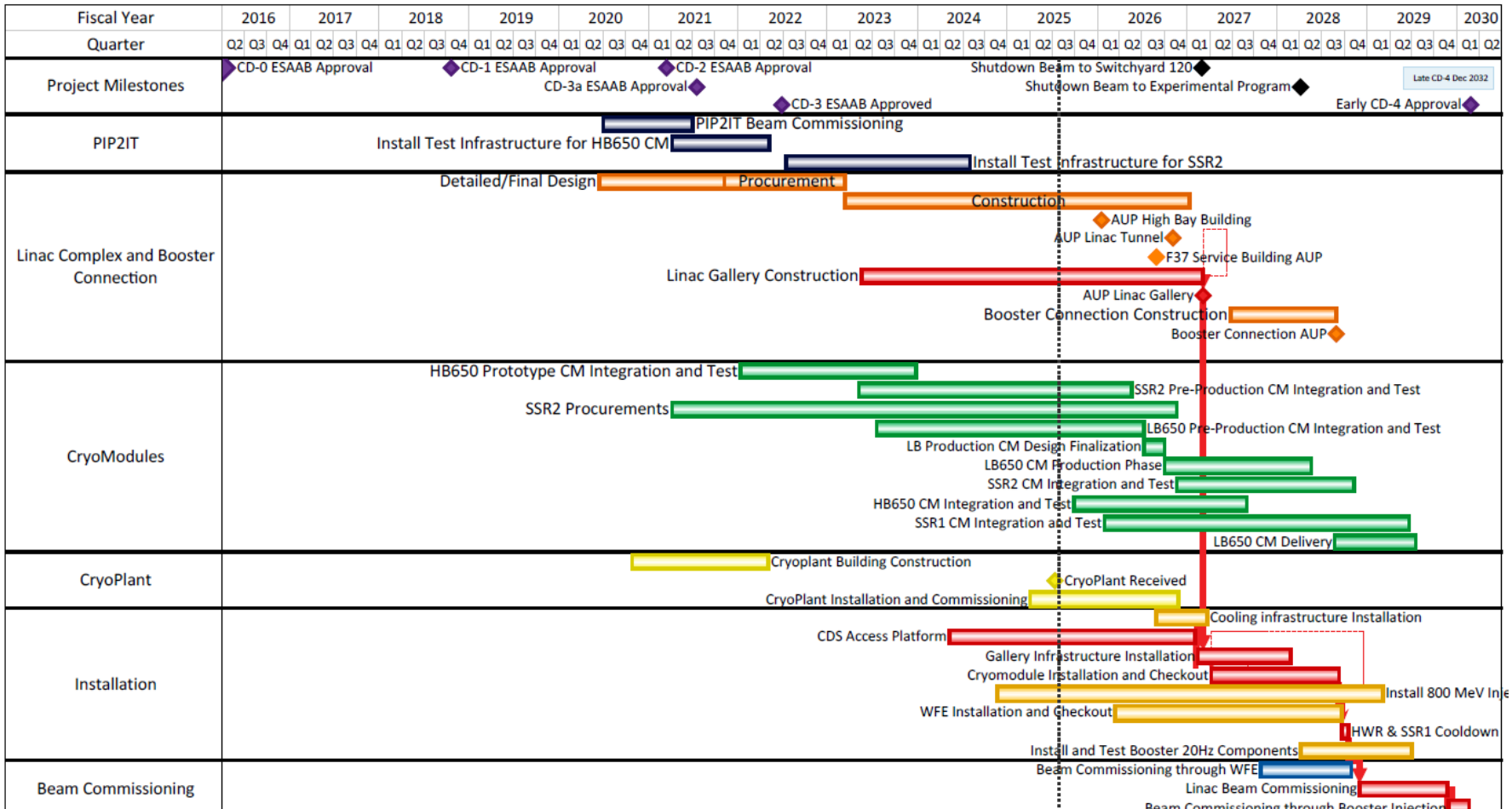
- Two H^- ion sources and Low Energy Beam Transport (LEBT) line in a Y-configuration
  - 30 keV, 15 mA, DC (one ion source from PIP2IT)
  - Switching dipole magnet to select either source (from PIP2IT)
- LEBT with compact chopper (from PIP2IT)
- CW RFQ (30 keV → 2.1 MeV) (from PIP2IT)
- Four CW RF Bunchers
- Medium Energy Beam Transport (MEBT) line with bunch-by-bunch chopping system (i.e. 2 kickers + one 20-kW beam absorber) (from PIP2IT)



LLRF system for RFQ, Bunchers and HWR is being upgraded – **Poster 23**

The Beam Pattern Generator drives the kickers and controls transfer to Booster – **Poster 21**

PIP-II Project Schedule



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Booster Upgrades

Current Status

- System has been tested operationally since early June.

Current Study Accomplishments

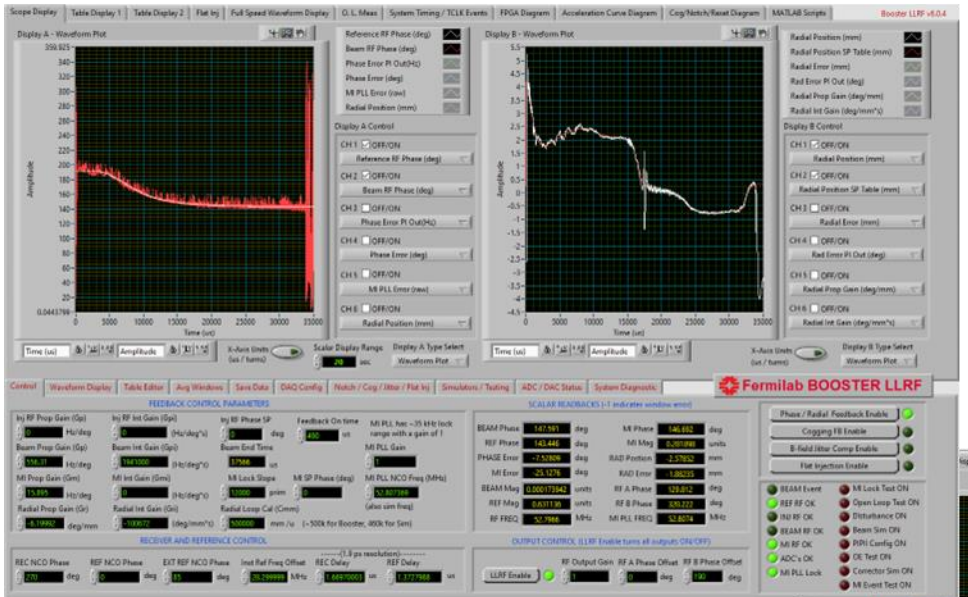
- Accelerated beam through transition to 8 GeV.
- Demonstrated phase damping and radial control.
- Demonstrated beam capture and para-phasing.
- Demonstrated synchronous phase feed forward.
- Demonstrated transition control.
- Demonstrated program curve automation.
- Demonstrated MI / Recycler phase locking.
- Demonstrated beam Notching, MI reset, and Beam Extraction (minor tweaks needed).
- Demonstrated fully functional Labview control interface.

Upcoming study plans:

- Cogging
- B-field jitter compensation.
- Flat injection incorporation.

New Booster LLRF FPGA System Upgrade

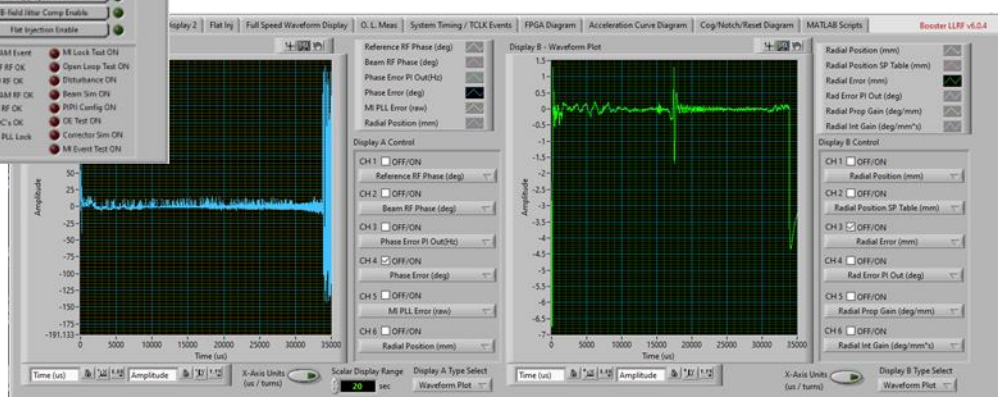
Booster Studies



Left plot:
Beam phase / Reference phase

Right plot:
Radial Position / Radial Setpoint

Beam phase Error / Radial Position Error



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Main Injector Upgrades

- 14 of 20 stations have all necessary cables pulled
- First article of twenty 8kW solid state amplifier received
  - Expect 2 per Month from October 2025 - May 2026
- All 20 of the 8 to 4 way combiners received
- Constructing new Grid Bias Power Supplies
- Built 8 of 40 new Y567B Cavity Power Amplifiers

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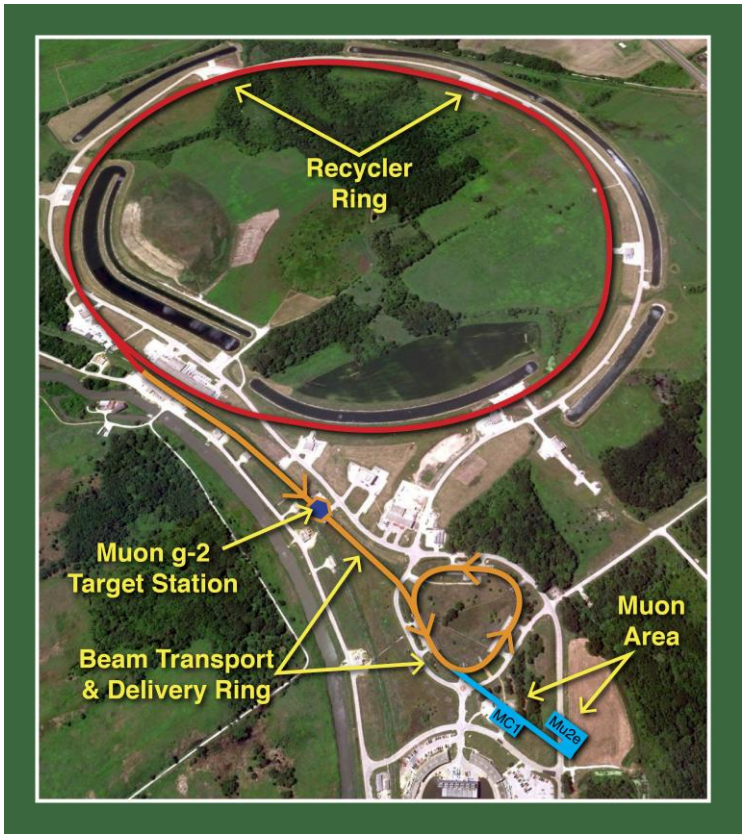
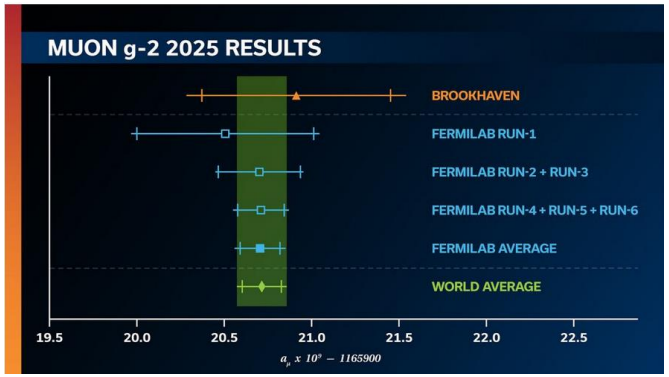
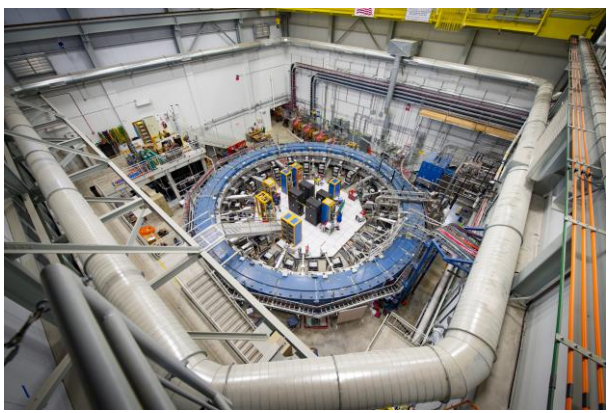
Muon g-2 Experiment

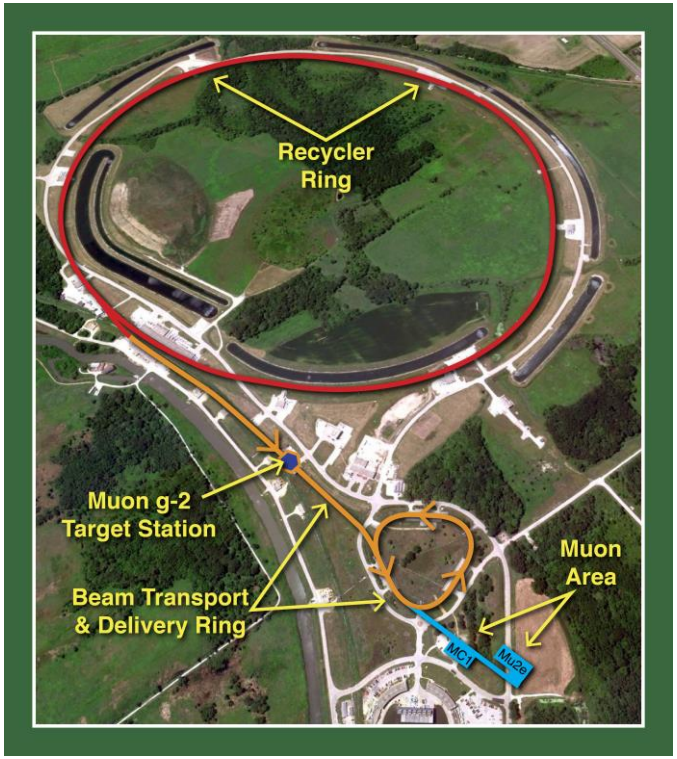


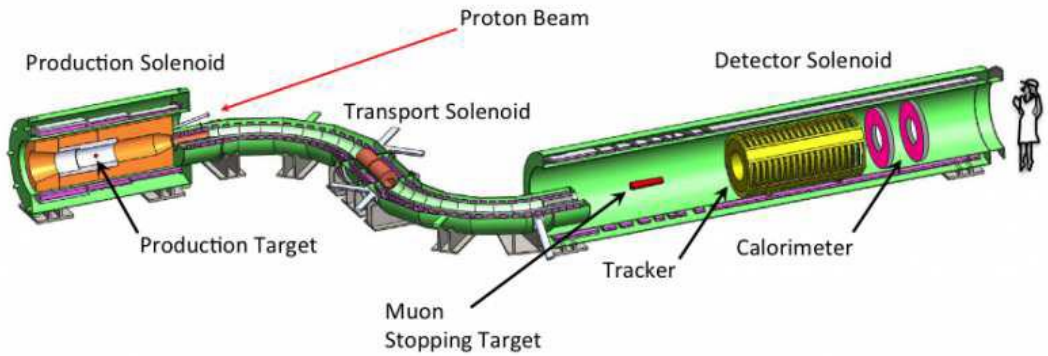




Muon g-2 run has ended
Final data has provided a measurement with a precision of 127 parts per billion

Mu2e Experiment

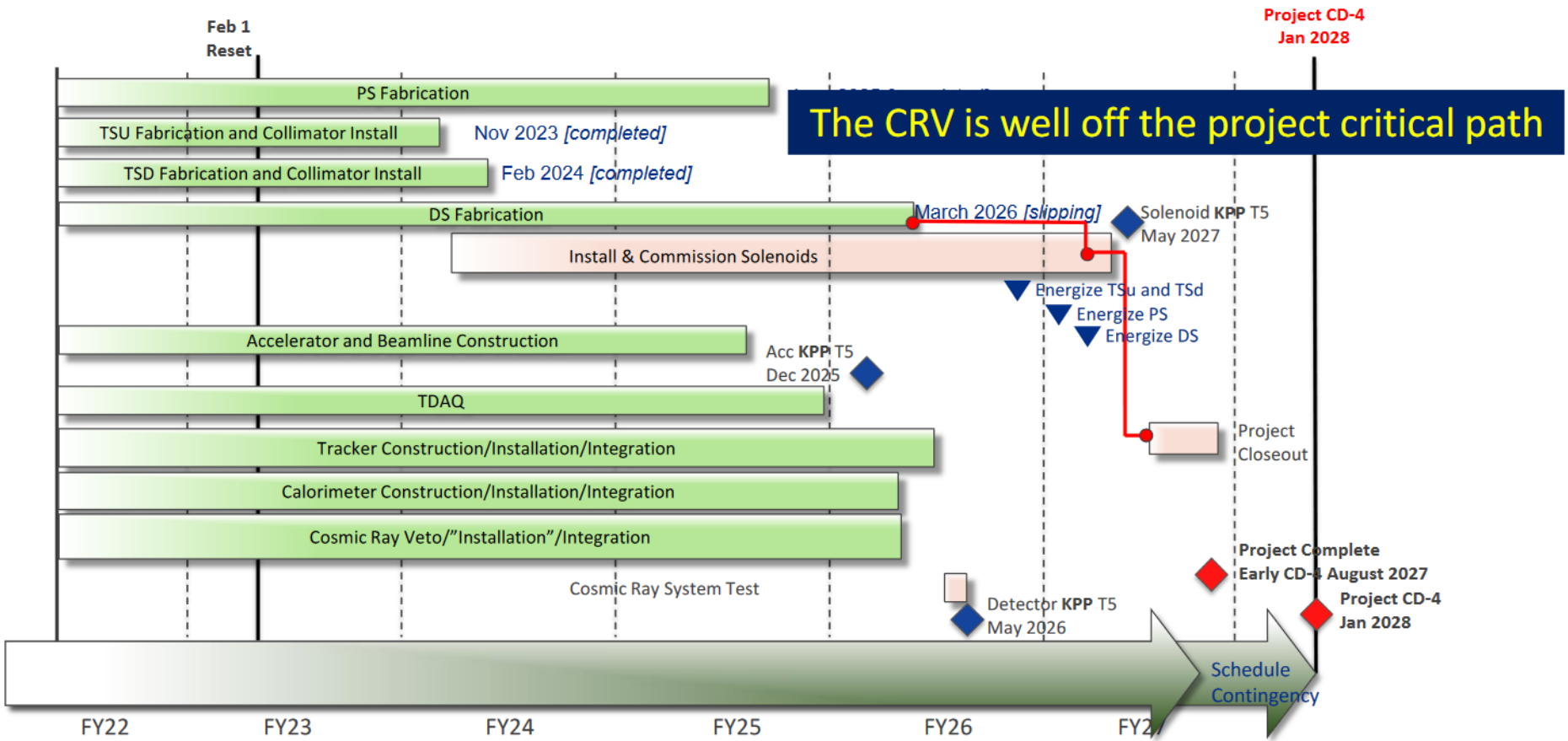




Mu2e installation and commissioning over the next year with some run time expected before the long shutdown for PIP-II installation
A second run will follow PIP-II installation, starting in 2030/31.

Poster 22

Mu2e Experiment



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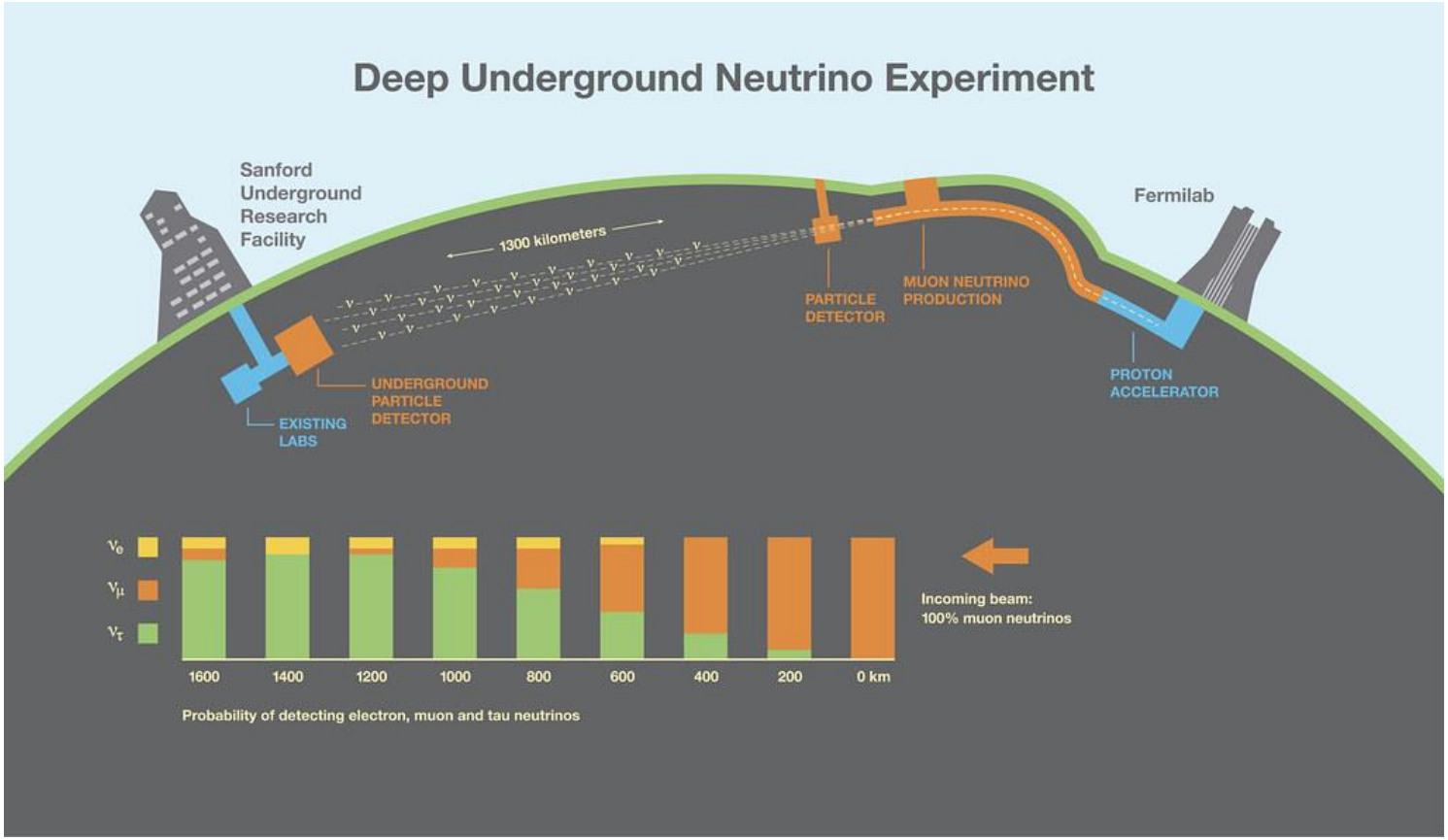
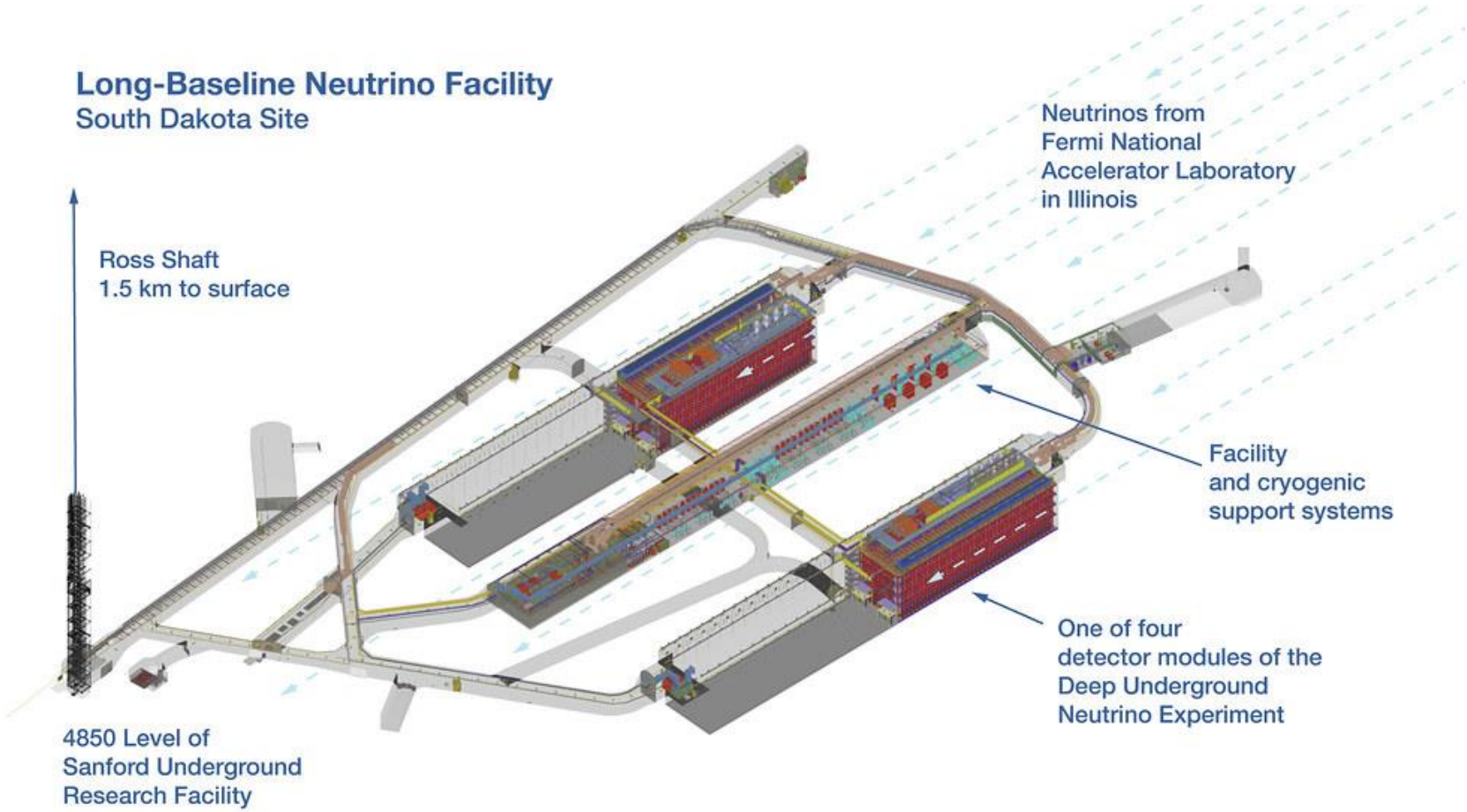
LBNF - DUNE



High intensity wide-band neutrino beam: produced from 120 GeV Main Injector. 1.2 MW with PIP-II then upgrades to 2.1MW with ACE-MIRT and 2.4MW with ACE-BR

LBNF - DUNE



Thank You !