Possible US demonstrator implementation

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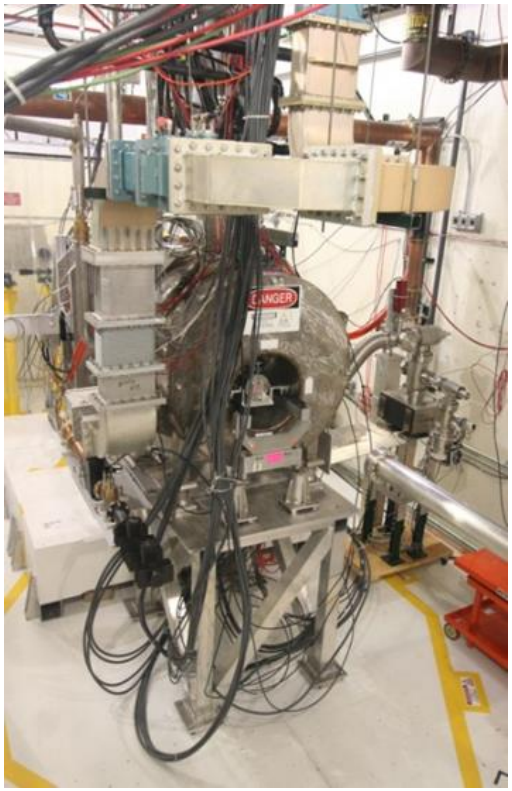
Outline

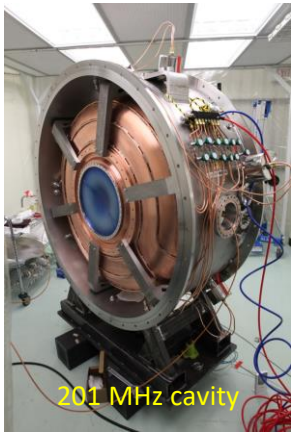
- This talk will cover possibilities for proton driver tests, target tests, rf stand and cooling demonstrator in the US

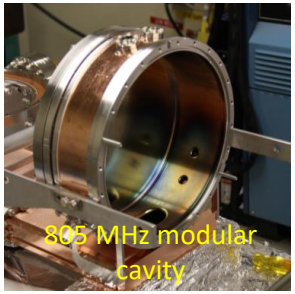
Past US experience: NC RF in B-fields tests

- Muon Test Area (MTA): a dedicated facility at Fermilab for muon accelerator components testing – RF and absorbers
- Experimental NCRF R&D conducted at 805 MHz cavities for vacuum and high pressure cavities, and MICE prototype cavity at 201 MHz

- High pressure cavity reached 60 MV/m without B dependence
- Modular cavity reached 50 MV/m in 3 Tesla magnetic field.
- MICE cavity with Be windows and module with vacuum protection reached to the design goals.

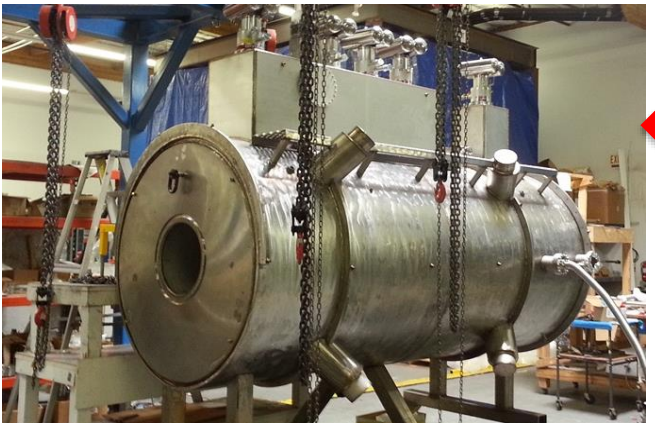




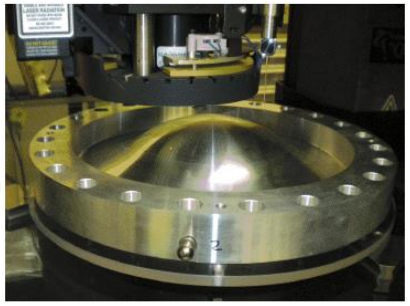


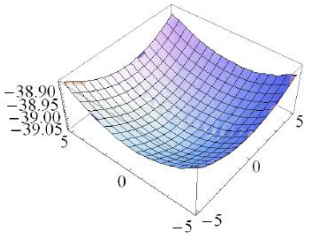
Past US experience: cooling channel elements

- Many elements for a cooling channel was fabricated in the US
- As a result significant experience gained **and still exists**!

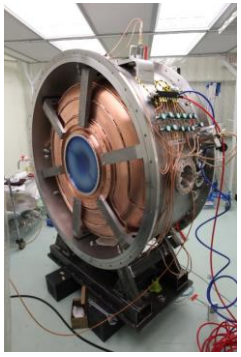


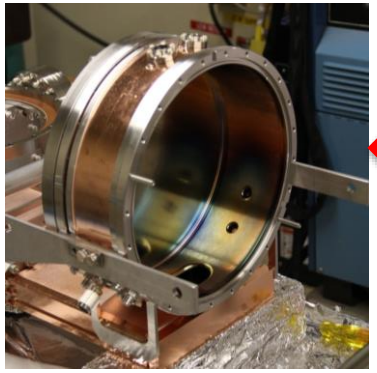
spectrometer solenoid



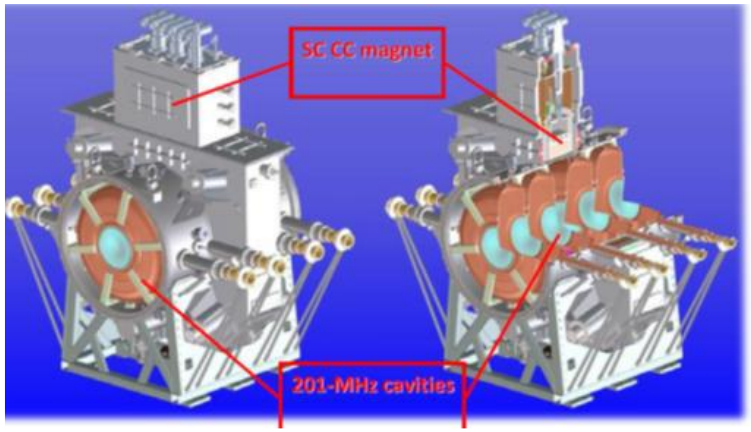


Absorber window





NC 201 MHz and 805 MHz cavities



RF Module design for MICE

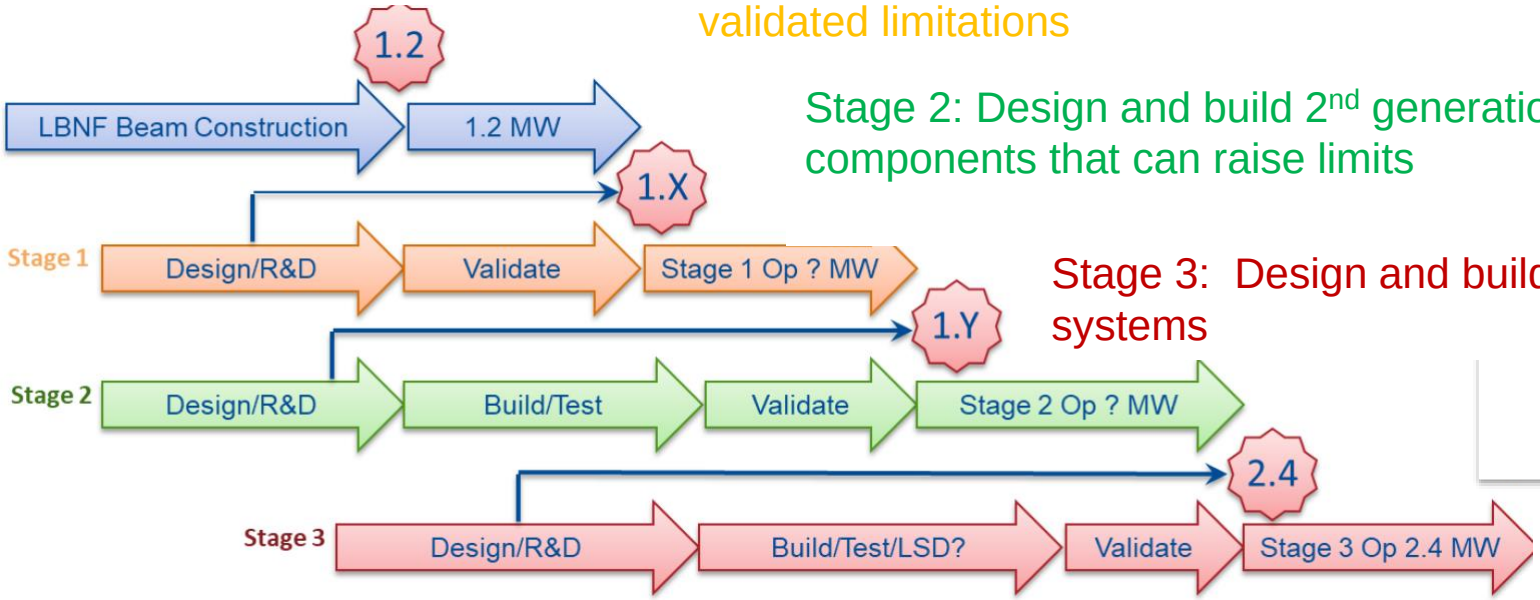
Fermilab ACE program

- In the next decade, LBNF plans to use protons which will operate at 1.2 MW to start and will be upgradeable to 2.4 MW
- ACE aims a Main Injector upgrade to deliver 1.2+ MW by 2032
  - Will include a rigorous **target R&D program for 2+ MW** beam powers
  - **This program is synergistic with MuC R&D**

Stage 1: Push current designs (1.2 MW) to validated limitations

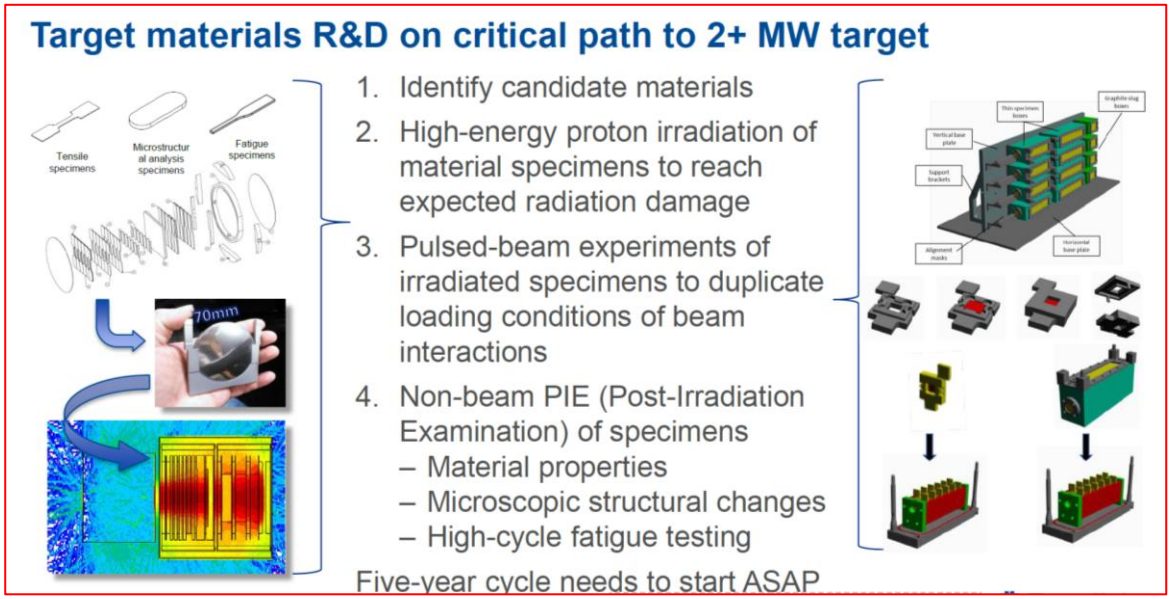
Stage 2: Design and build 2nd generation components that can raise limits

Stage 3: Design and build fully optimized systems



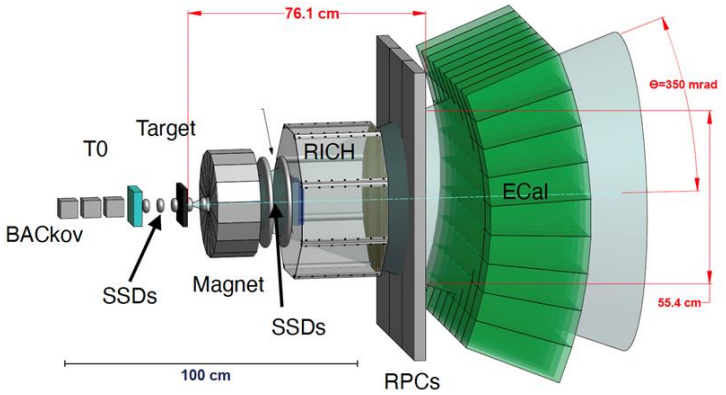
Target R&D possibilities at Fermilab

- Fermilab ACE plan includes a intensified program for testing targets



ACE vision as presented to the P5 panel

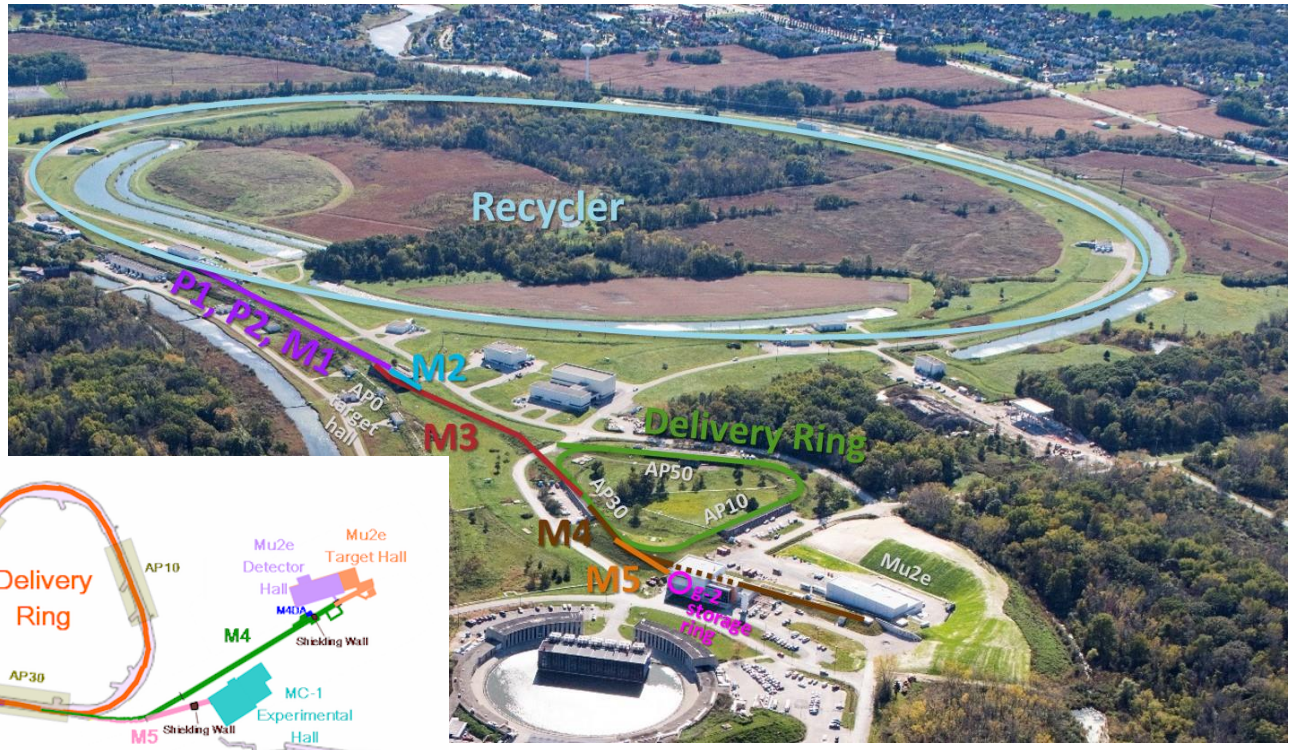
- Secondary beam study:
  - Angular distribution
  - Target Z dependence
  - Energy dependence
  - Hadronic shower

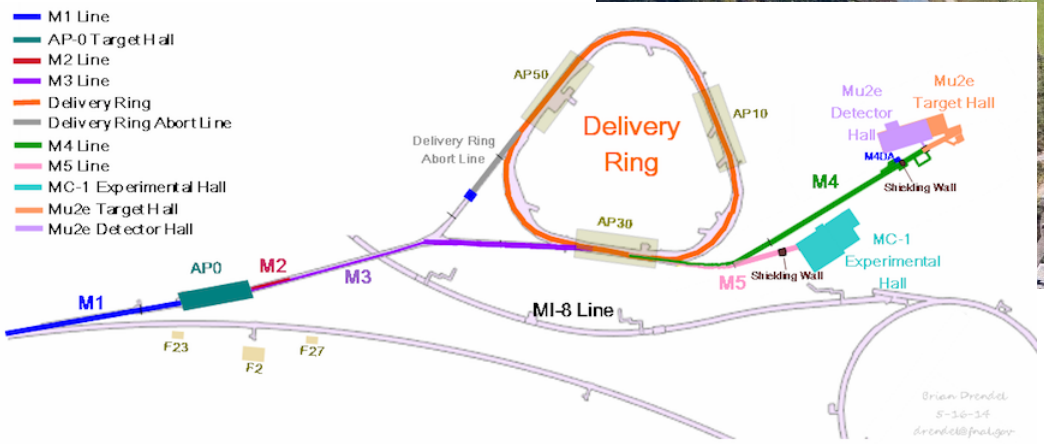


Emphatic spectrometer at Fermilab

Fermilab Muon Campus

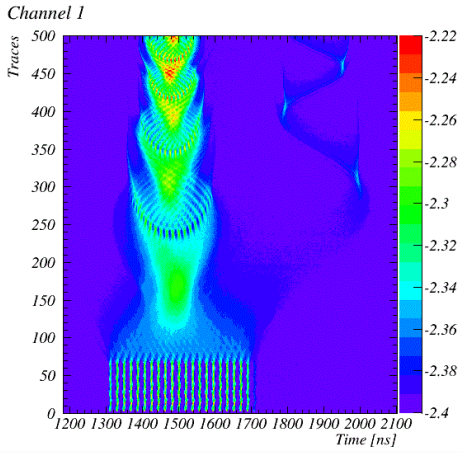
- Designed to provide beam for the Muon g-2 and Mu2e experiments
  - Muon g-2 experiment will end this summer



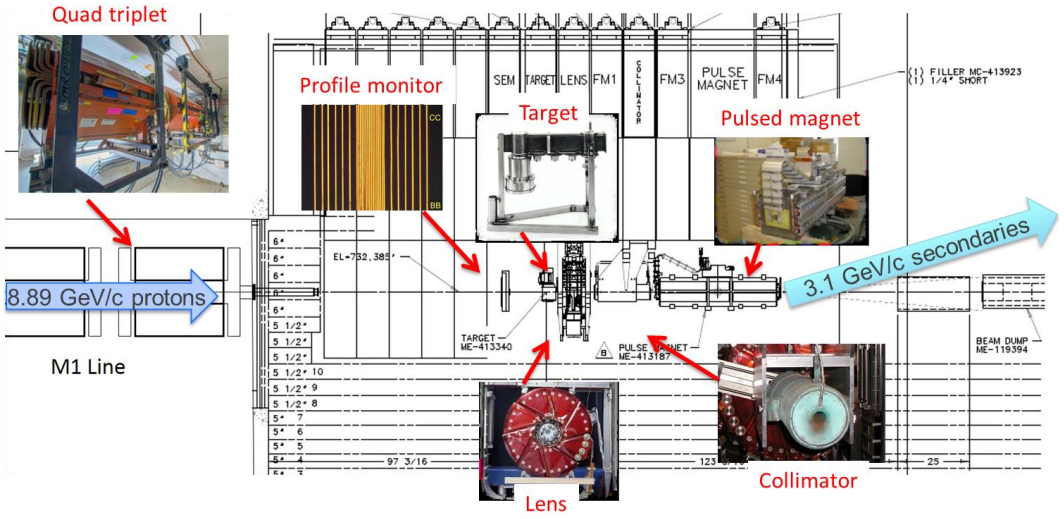


Muon Campus capabilities

RF system to create short 8 GeV bunches before target

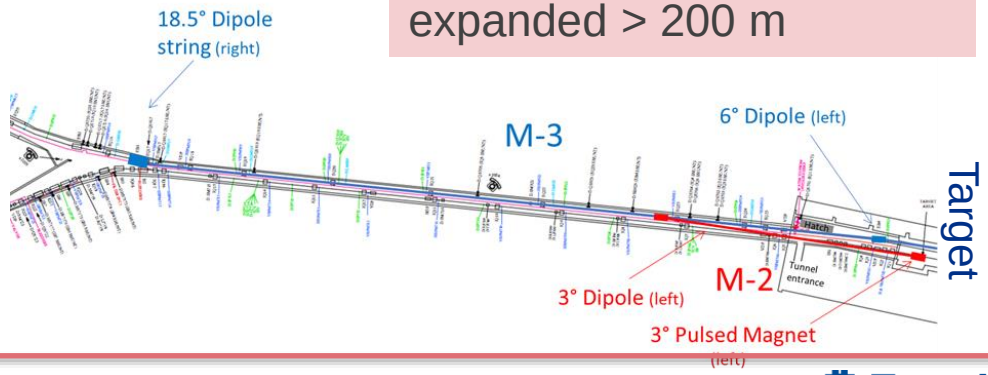


Target can serve as a test-bed for material studies



Two beamlines; instrumentation available

Line after target can be expanded > 200 m



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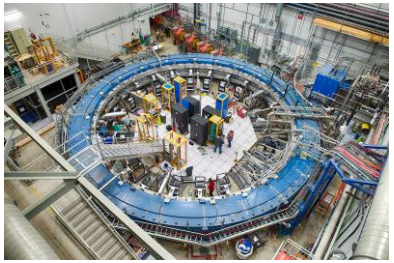
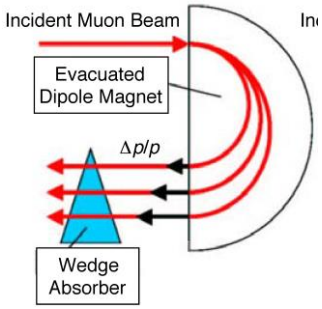
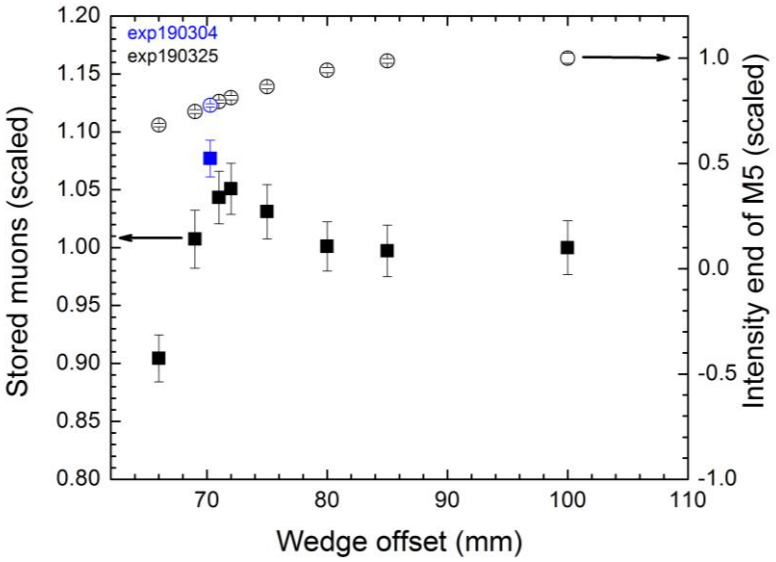
Muon campus experience with cooling

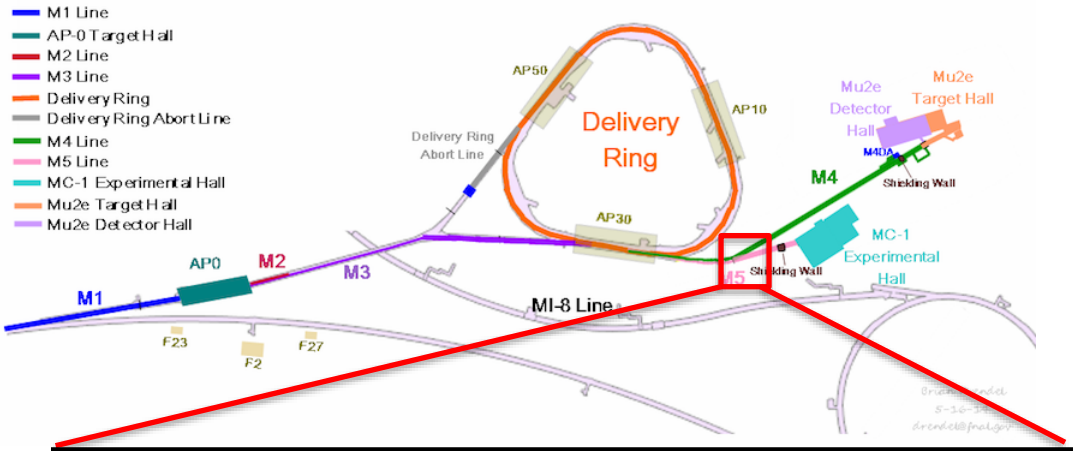
- Proof-of-principle for emittance-exchange carried out. Resulted to MORE muons for the Muon g-2 Experiment

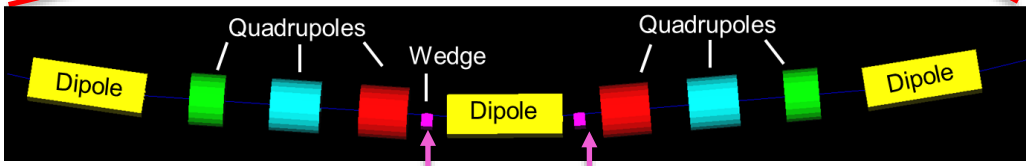


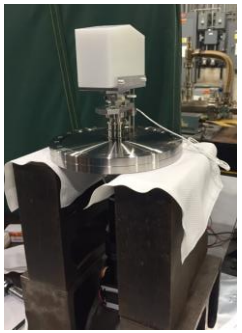




LDRD at Fermilab
Laboratory Directed Research and Development







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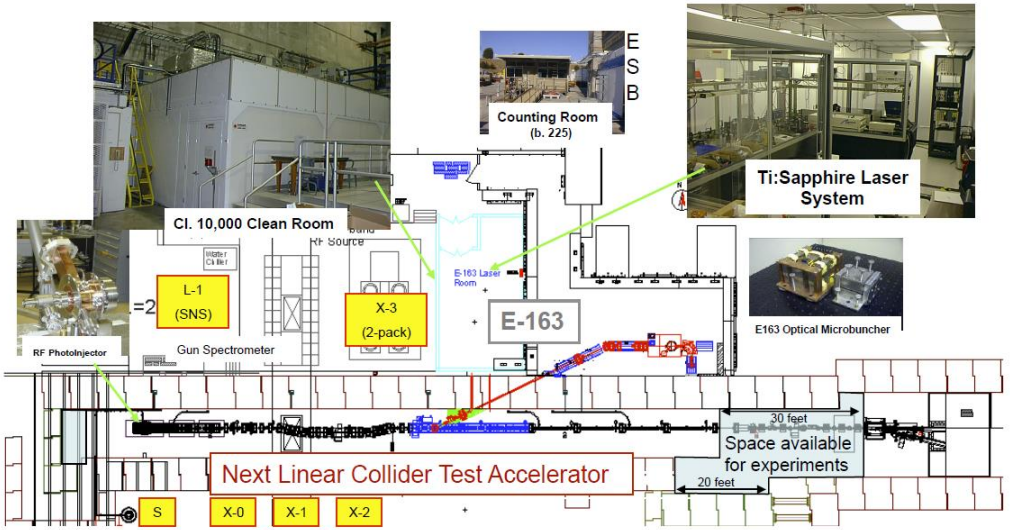
MuC NC RF test-stand

- SLAC Next Linear Collider Test Accelerator (NLCTA)
  - NLCTA has a bunker with L/S/X-band high power rf sources.



NLCTA capabilities: 120 MeV beams (to ~300 pC)

L band cavity in a 0.5 T field magnet @ NLCTA

MuC proton driver tests

- Goal: carry a proton compression R&D program in existing facilities
- IOTA/FAST @ Fermilab
  - Intense space-charge 2.5 MeV p beam, may have unique opportunities for expanded diagnostics or lattice modification studies
  - Aid our understanding on how space-charge can affect the process
- SNS @ Oak Ridge National Laboratory
  - 1.8 MW facility with painted H- injection of 1-1.3 GeV beam
  - Allows testing of laser stripping