

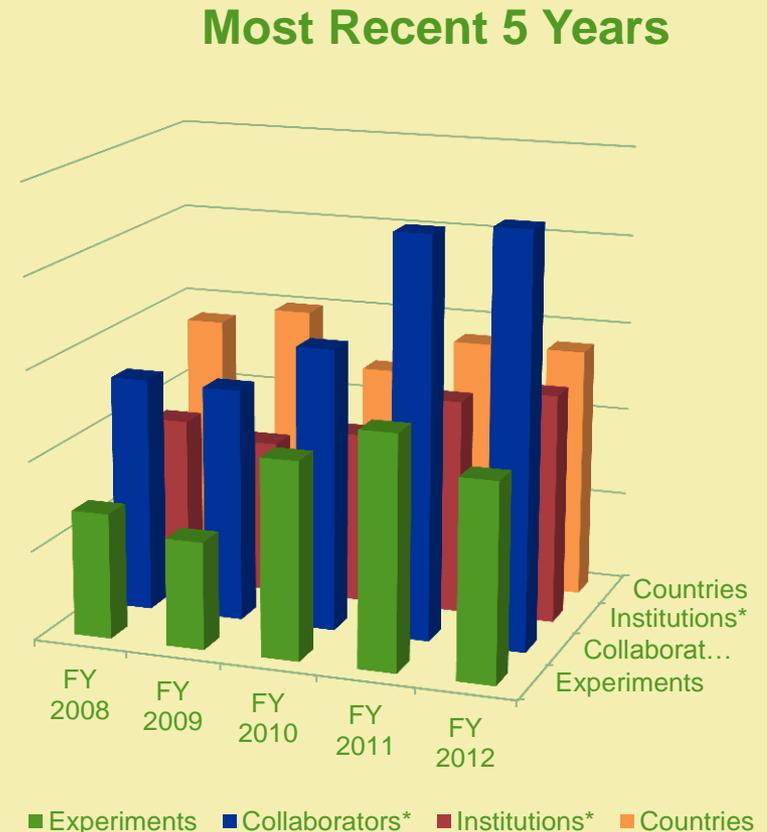
# FERMILAB TEST BEAM FACILITY

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# The Fermilab Test Beam Facility

- World Class Facility
- The only U.S. HEP Test Beam
- Detector R&D focus
- In 2012:
  - 11 experiments
  - 229 collaborators
  - 64 institutions
  - 14 countries



\*Number of *Collaborators* has been scaled to fit on plot

\*Number of *Institutions* has been scaled to fit on plot.

◆ FY12 only consisted of 7 months of Beam

# Location

Fermi National Accelerator Laboratory

Meson Detector Building – West



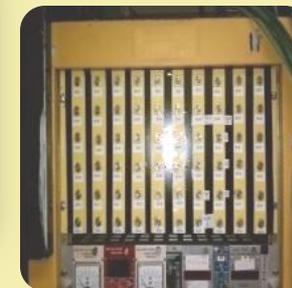
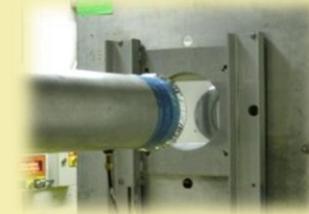
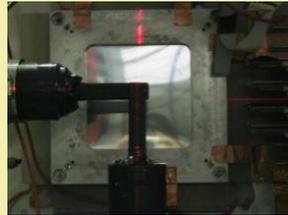
# Facility Details

- Multiple Control Rooms
- Conference Room
- Climate-controlled areas for experiments
- Machine Shop
- Several Work Rooms
- Storage Rooms and Cabinets



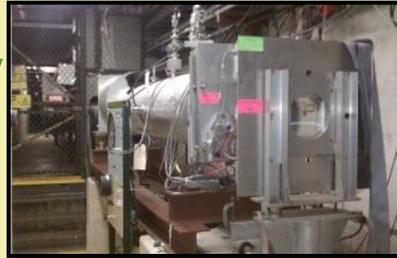
# Facility Details

- Remotely controlled Motion Tables
- Laser Alignment
- State-of-the-Art, web-based Cameras
- Helium Tubes
- Gas Delivery
- Signal and High Voltage cable patch panels



# Facility Instrumentation

- 2 Cerenkov Detectors



- 2 Pixel Telescopes



- 4 MWPC Tracking System



- Time of Flight System



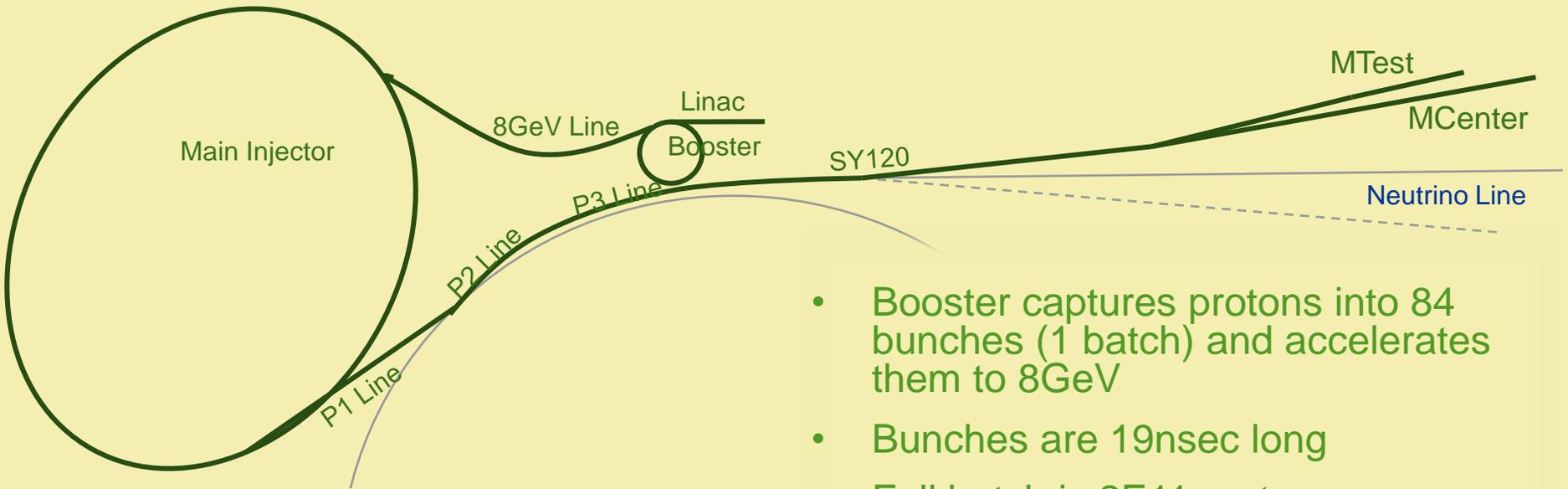
- Lead Glass Calorimeters



- Assorted Trigger scintillators



# Beam Delivery

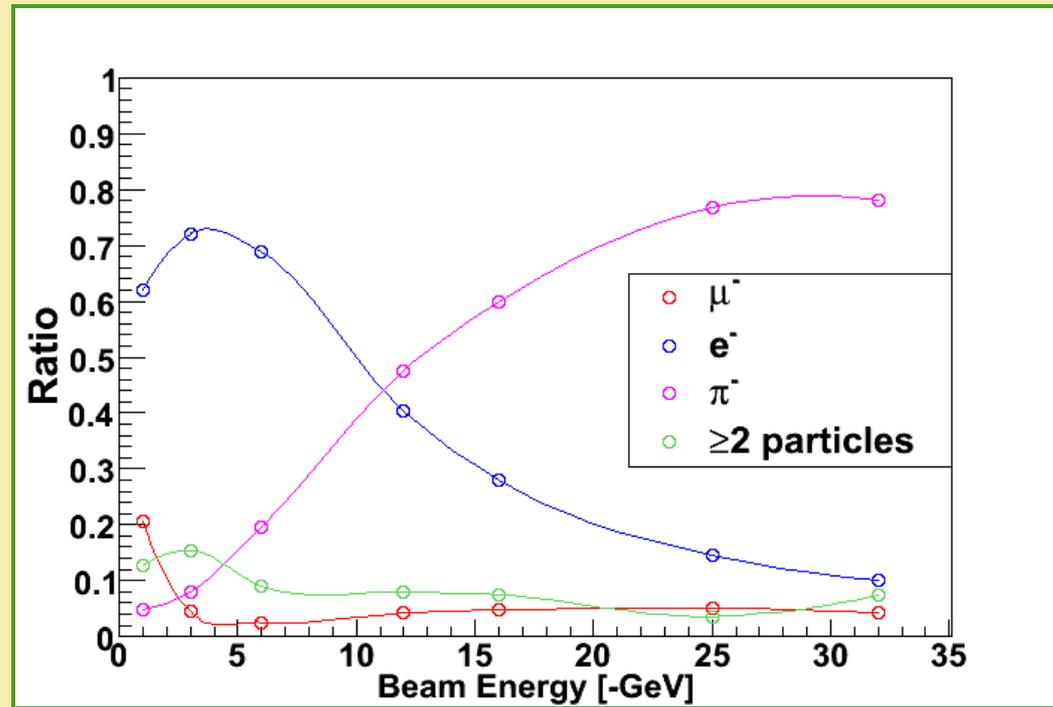


- 6 sec event  
(4.2 sec spill)  
every 60 seconds
- Control room manned  
during beam hours

- Booster captures protons into 84 bunches (1 batch) and accelerates them to 8GeV
- Bunches are 19nsec long
- Full batch is  $2E11$  protons
- Each batch is 0.2 – 1.6  $\mu$ sec in length
- MI accelerates beam to 120 GeV
- Fraction of the beam resonantly extracted each rotation over 4.2 sec to Switchyard
- In Switchyard Septa Magnet splits beam to Mesonline (and Neutrinoline)

# Particle Composition of Beam

- 120 GeV Protons
- 2 - 66 GeV Pions
- 0.5 – 32 GeV Electrons
- Broadband Muons

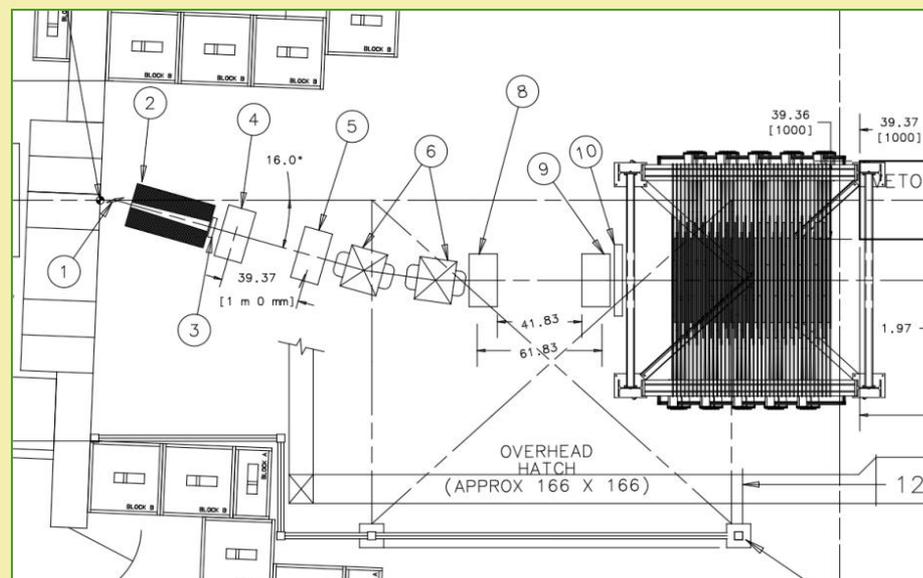


- If beam were smoothly extracted, 100 kHz or less would imply 1 particle per MI rotation would occur.
- Beam extraction is not smooth resulting in up to 35% double occupancy per MI rotation

Beam Energy (GeV)	Rate at Entrance to Facility (per spill)	Rate at Exit of Facility (per spill)	% Pions, Muons	% Electrons
16	132,000	95,000	87%	13%
8	89,000	65,000	55%	45%
4	56,000	31,000	31%	67%
2	68,000	28,000	<30%	>70%
1	69,000	21,000	<30%	>70%

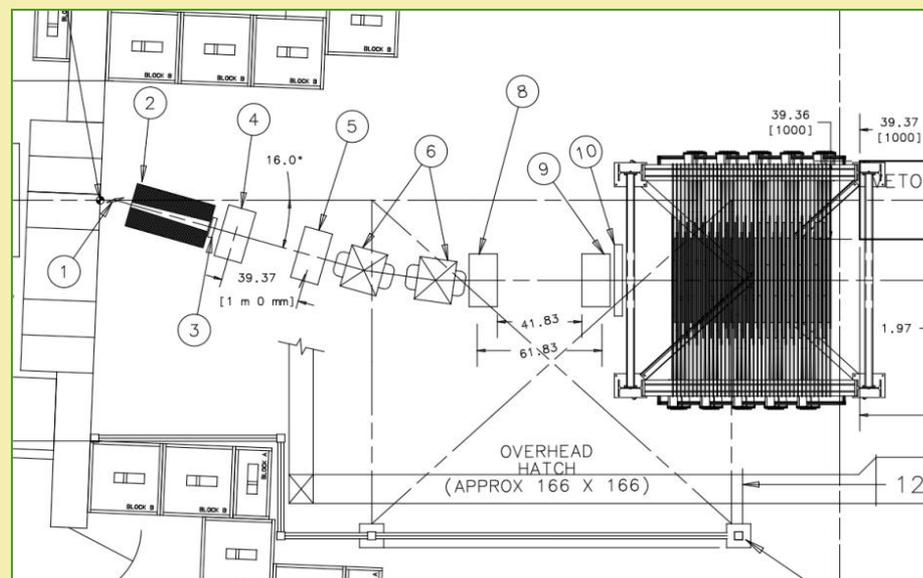
# Accommodating Users

- In 2008, T-977 MINERvA experiment requested
  - ~200 – 1000 pions/spill,
  - with momentum as low as 200 MeV/c
- They requested Fermilab build another beamline...



# Accommodating Users

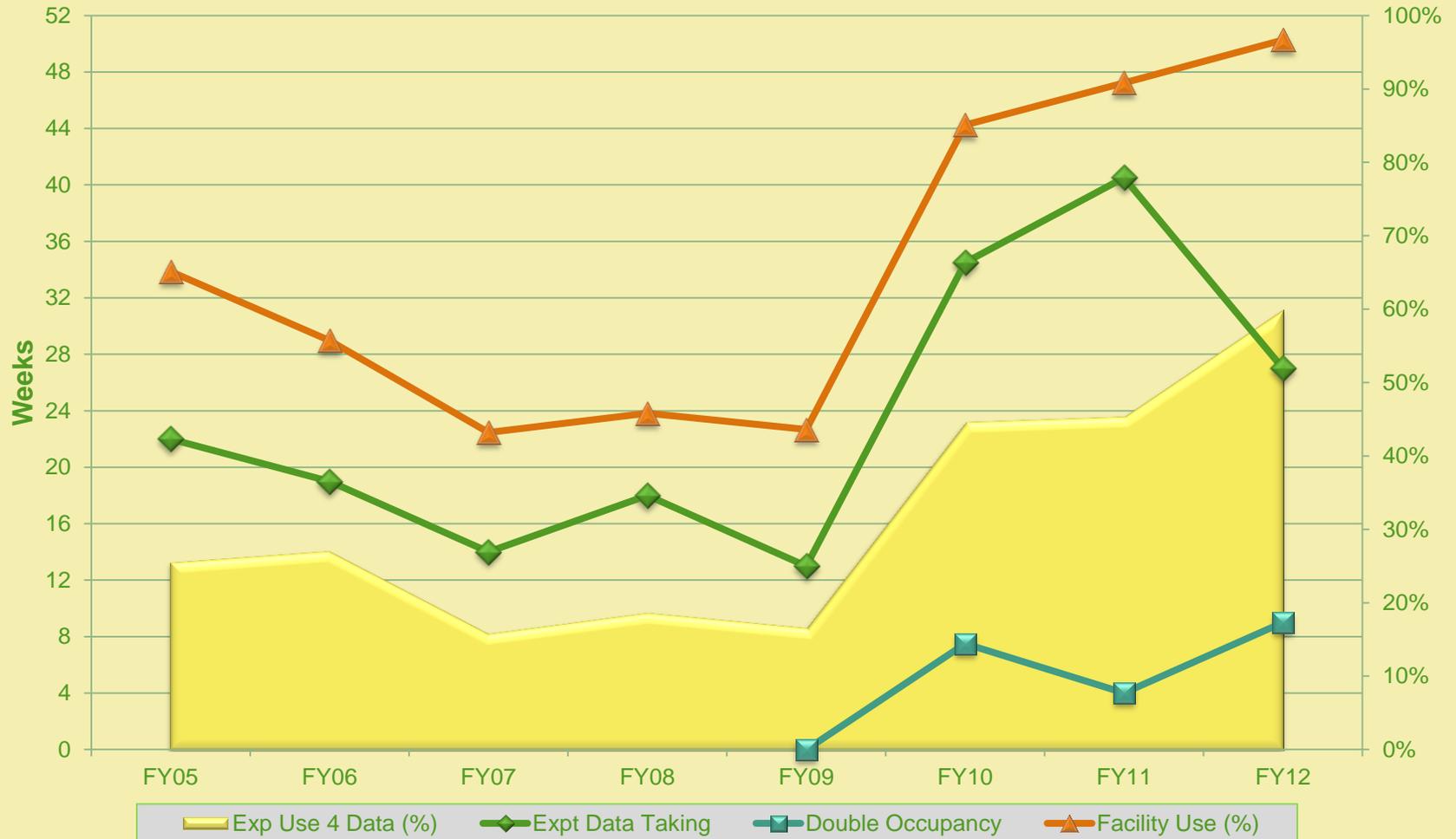
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# Tertiary Beam Details

- **Rates:** ~200 particles / 4 sec spill (~50 Hz)
- 60% pions, 40% protons,
- very few electrons, kaons, and deuterons
- **Momentum Resolution:**  $dp = 3\%$ 
  - multiple scattering limited for this momentum range
- design momentum is 200MeV minimum

# Weekly Usage



- FY2012 only consisted of 7 months of beam
- Facility use includes Beam studies, and educational support such as EDIT 2012.

# Accelerator Shutdown

- 11 month Accelerator shutdown
- Requests for beam will be considered in January 2013 at the earliest (even though already coming in)
- Upgrading facility during shutdown to increase User ease
  - New tracking system & read out
  - Upgraded pixel telescope
  - Expanded/Upgraded patch panel system
  - Increase facility cooling capacity for SiPM's

# Facility Expansion

- Expecting MCenter addition
  - support large & long potential experiments such as
    - NOvA Calibration
    - Liquid Argon Detector Beam Test
    - MINERvA upgrade calibration test
  - Dedicated lower energy beamline  
(200 MeV – 32 GeV Pions)

# FTBF Summary

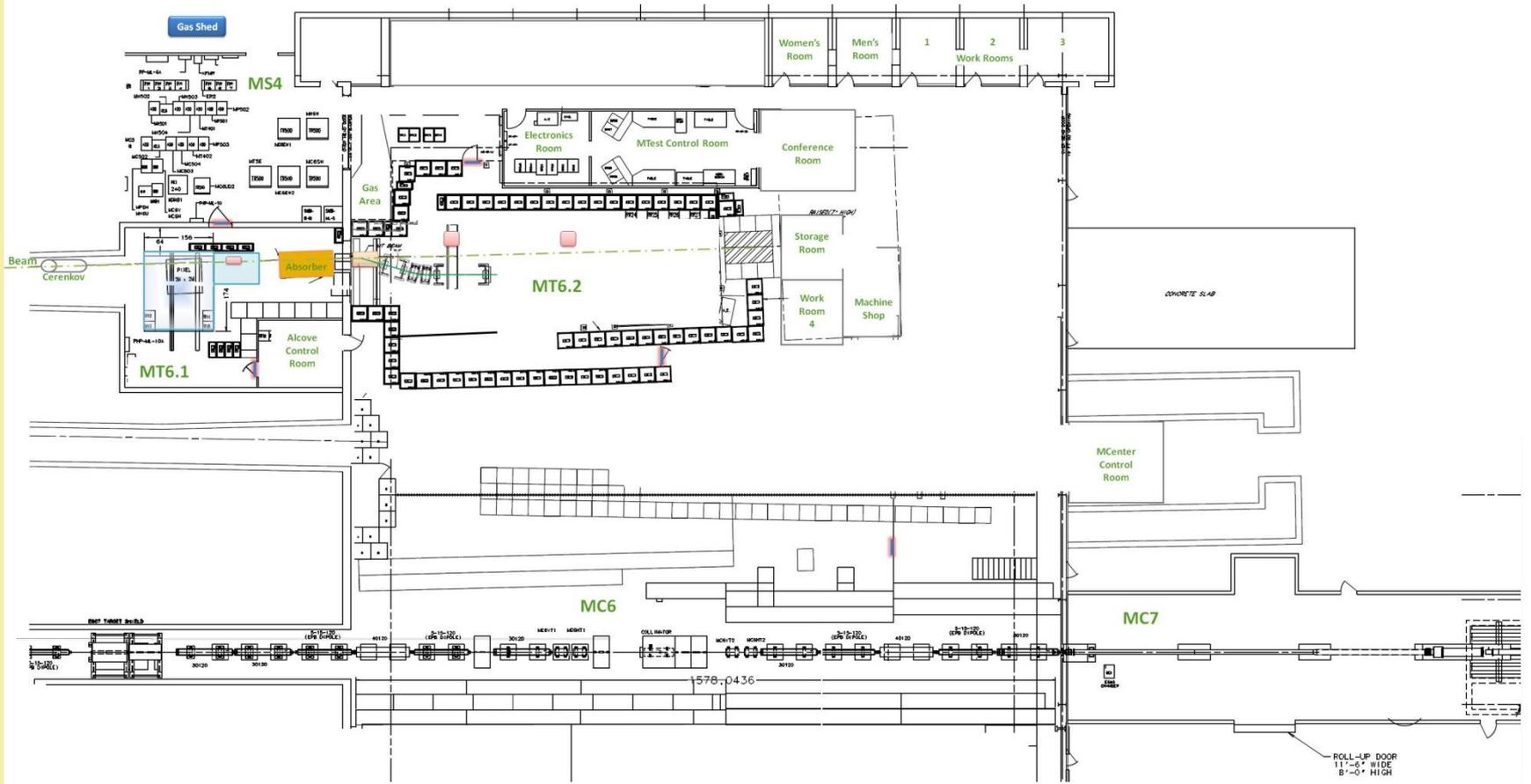
- Fermilab Test Beam Facility is an HEP Beam facility for world-wide Detector R&D
- Extensive facility infrastructure & instrumentation
- Flexible beam delivery
  - Protons, pions, muons, electrons, kaons
  - 200 MeV – 120 GeV
  - 1 – 300 kHz intensities

<http://www-ppd.fnal.gov/FTBF>

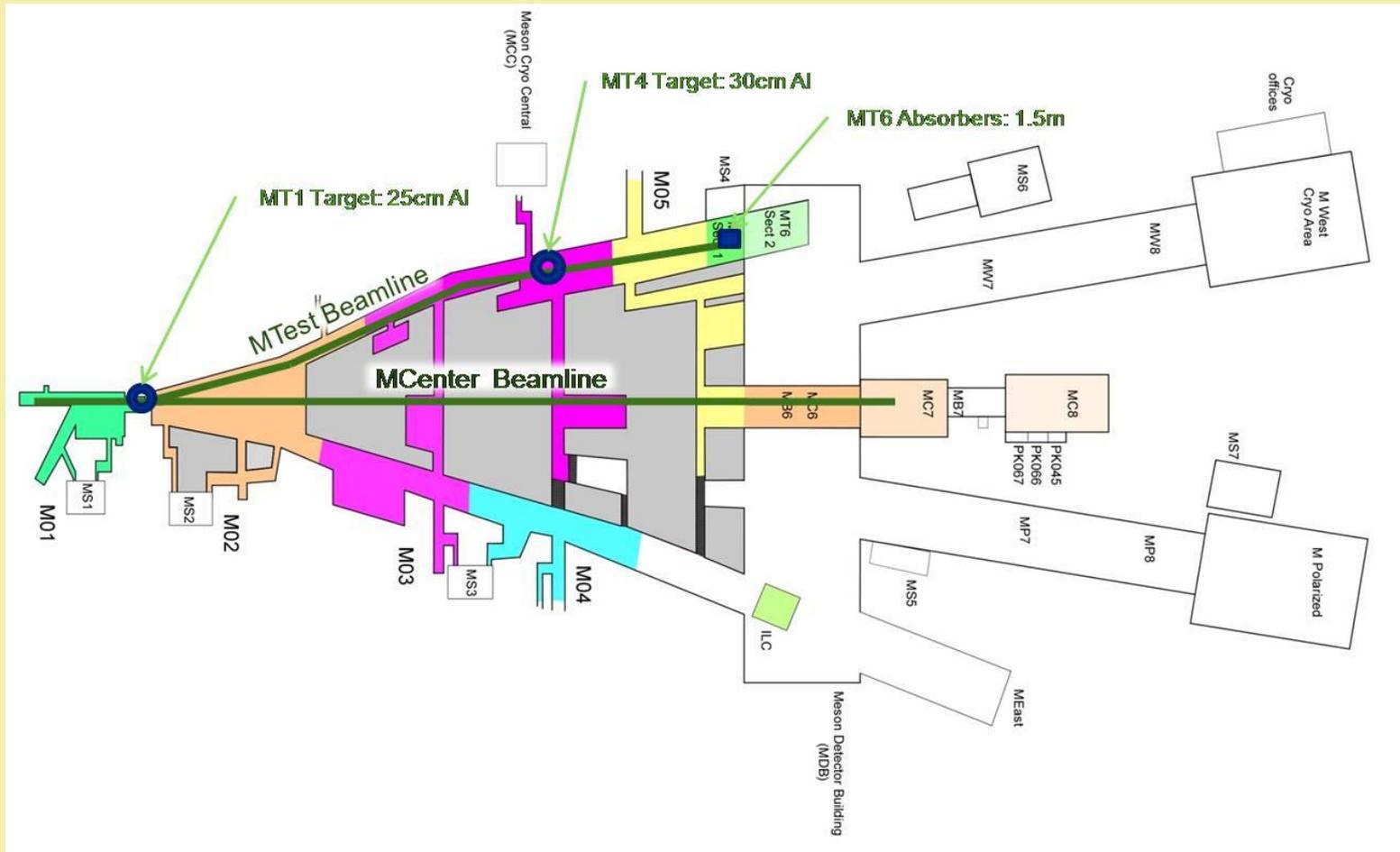
Additional Slides

**ADDITIONAL SLIDES**

# Facility Overview



# Meson Area Beamlines



# MCenter User Area



This section of beam pipe has been modified to have flanges and a bellows, so as to make it easily removable.

# Tertiary Beam Details

Plot of Fit Momentum vs. TOF;  
Shows: Separation of Species and Available Momenta

- 60% pions,
- 40% protons,
- very few electrons, kaons, and deuterons.

