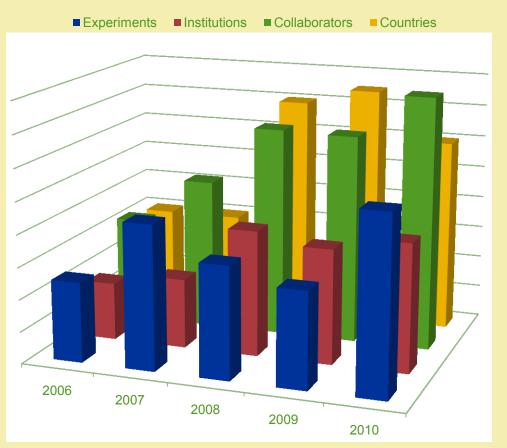
FERMILAB TEST BEAM FACILITY

Aria Soha June 11, 2011 TIPP 2011

The Fermilab Test Beam Facility

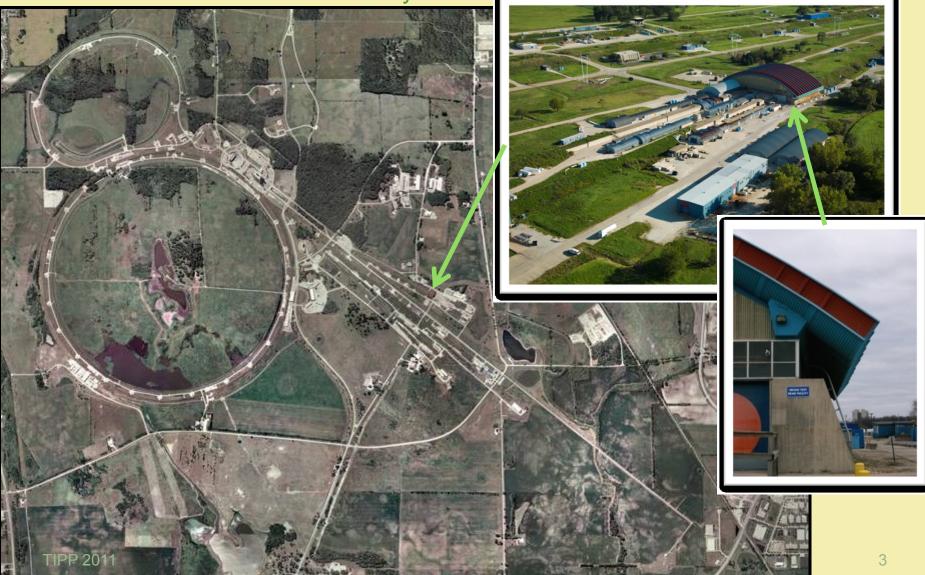
- World Class Facility
- The only operating U.S. HEP Test Beam
- Detector R&D focus
- Since 2005:
 - 32 experiments
 - 464 collaborators
 - 108 institutions
 - 24 countries



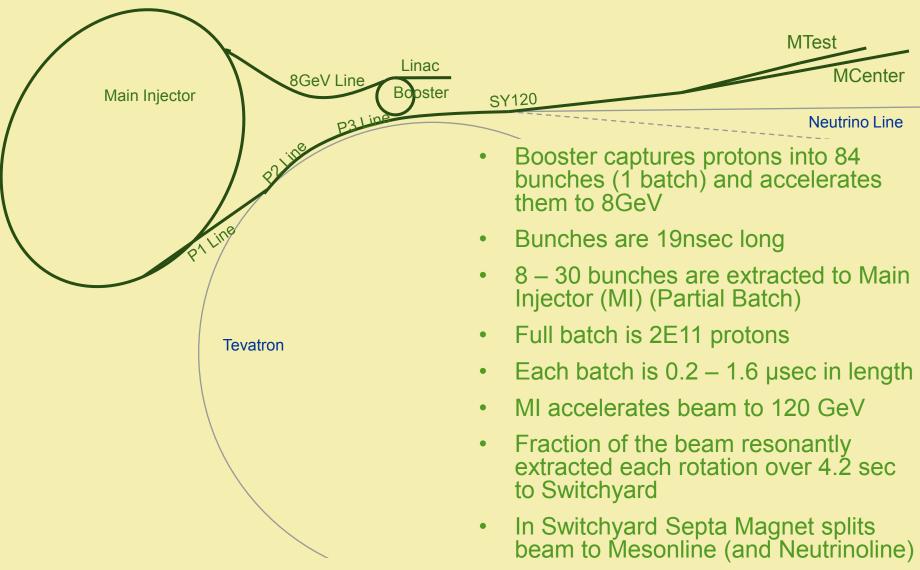
Location

Fermi National Accelerator Laboratory

Meson Detector Building – West



Beam Delivery

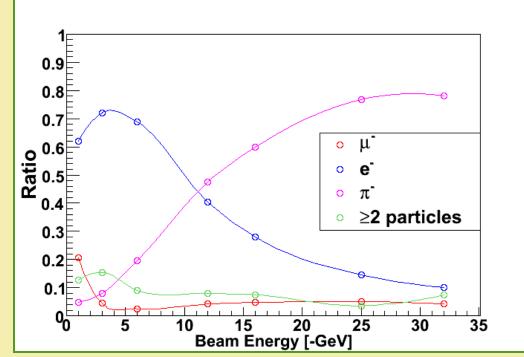


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Particle Composition of Beam

- 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 TIPP 2011



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%

Operating

- Test Beam makes up 5% of Fermilab's HEP program
- 6 sec event (4.2 sec spill) every 60 seconds for 12 hours a day
- Normal Operating Hours: 0400 1800
 - Stop for Tevatron Fill (2 hrs)
- Control room manned during beam hours

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
 TIPP 2011



MIG















Facility Instrumentation

2 Cerenkov
 Detectors



- 2 Pixel Telescopes
- 4 MWPC Tracking System
- Time of Flight System
- Lead Glass Calorimeters



• Assorted Trigger scintillators BF/







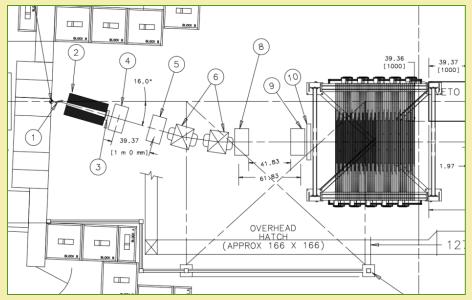


Accommodating Users

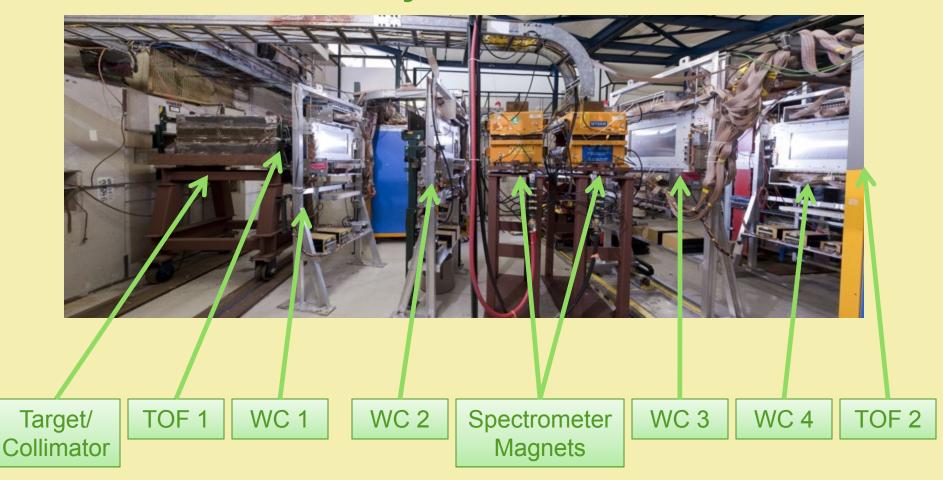
In 2008, T-977 MINERvA experiment requested

~200 – 1000 pions/spill, with momentum as low as 200 MeV/c

They requested
 Fermilab build
 another beamline...



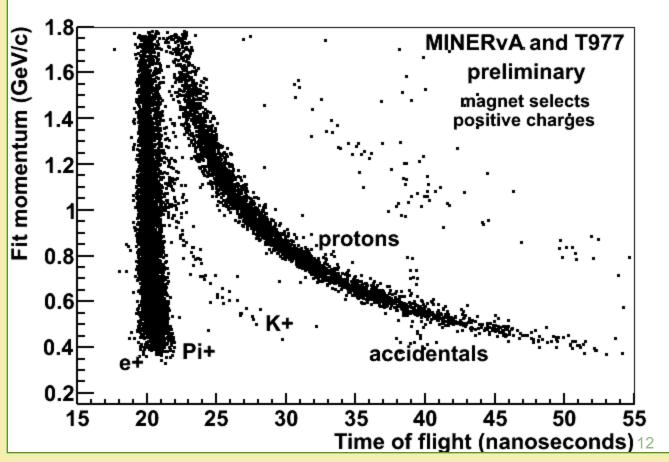
Tertiary Beamline



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.



Tertiary Beam Details

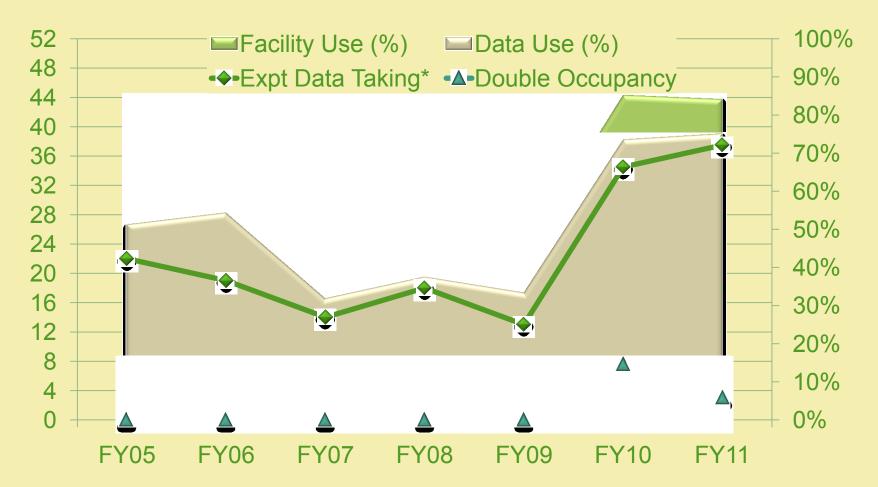
- Rates: about 200 particles / 4 sec spill (~50 Hz)
- **Momentum Resolution:** dp = 3%
 - multiple scattering limited for this momentum range
- Bias:
 - MINERvA design goal for bias is < 2%.
 - So far only 5% demonstrated
- WC4 can be moved to achieve lower or higher momentum
 - design momentum is 200MeV minimum

Schedule

http://www-ppd.fnal.gov/FTBF/schedule.html

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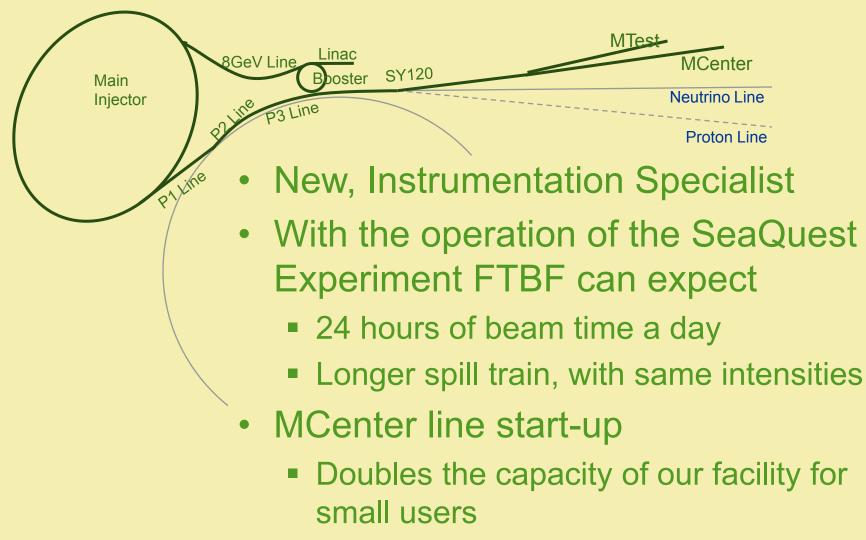
Weekly Usage



^{•*}Experiment Data Taking Includes Double Occupancy

•Facility Use includes Experiment Installation, Facility Tests, & Data Use, and is normalized to Beam Availability

Facility Expansion

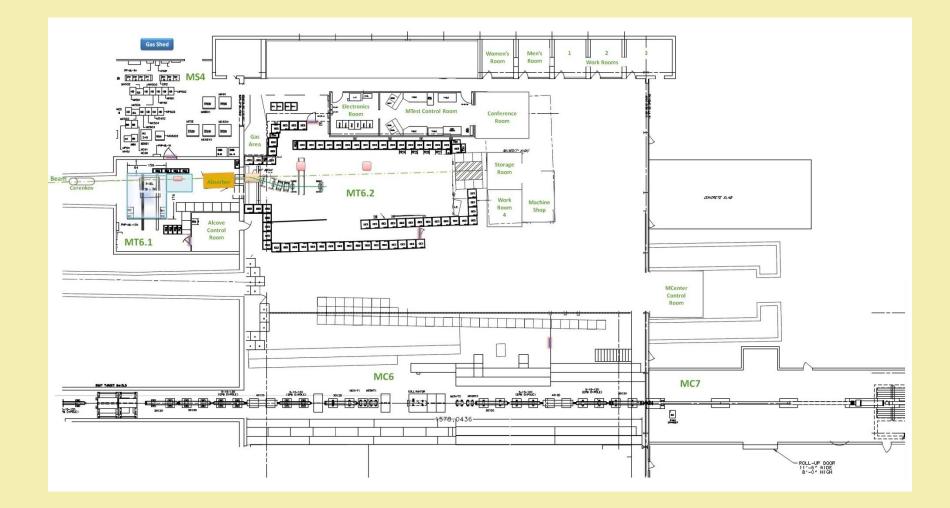


MCenter User Area

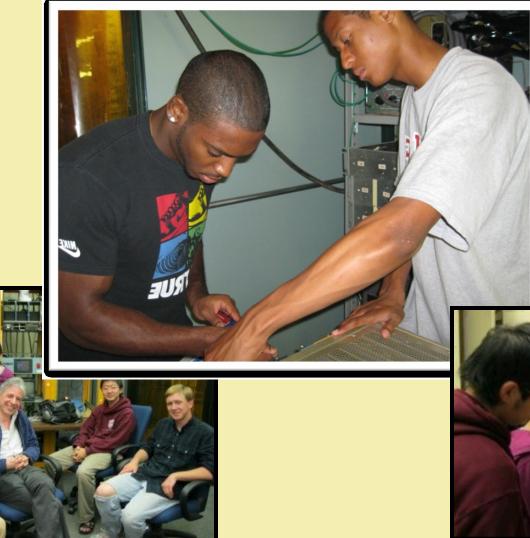


This section of beam pipe has been modified to have flanges and a bellows, so as to make it easily removable.

Facility Overview



Outreach



- opportunities for students to explore physics with **hands** on experience
- graduate and undergraduate students
- perform real beam tests with real equipment and detectors



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FTBF Summary

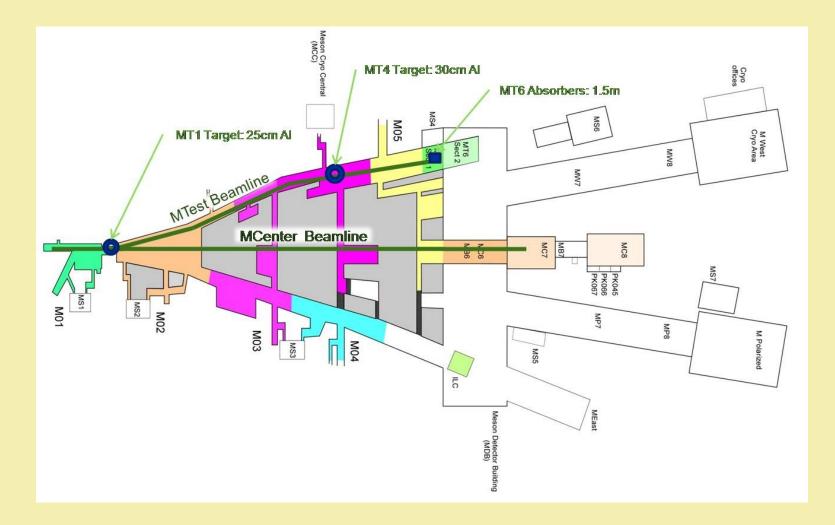
- Fermilab Test Beam Facility is an HEP Beam facility for world-wide Detector R&D
- Flexible beam delivery
 - Protons, pions, muons, electrons, kaons
 - 200 MeV 120 GeV
 - 1 300 kHz intensities
- Extensive facility infrastructure & instrumentation

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

Additional Slides

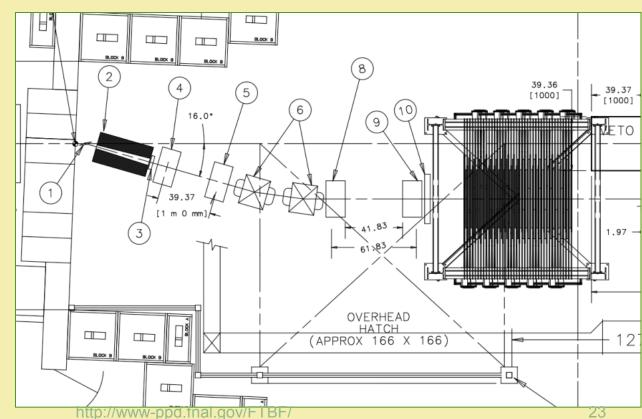
ADDITIONAL SLIDES

Meson Area Beamlines



Tertiary Beamline Proposal

- 1. 16 GeV pion beam hits a copper target and steel collimator at the entrance to MT6.2
- 2. Particles emerge at a 16° angle
- 3. TOF 1 (Scintillator)
- 4. Wire Chamber 1
- 5. Wire Chamber 2
- 6. Spectrometer magnets to straighten beam
- 7.
- 8. Wire Chamber 39. Wire Chamber 410. TOF 2 (Scintillator)11. MINERvA detector



Beam Spot Size

Energy Resolution

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