Argonne Laser Test Stand and Fermilab Test Beam Facility

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8 March, 2007

- Status of Argonne Laser Teststand (Joint ANL – UC program)
- Some first measurements (Argonne)
- Overview of Fermilab TestBeam Facility (E.Ramberg)
- FNAL Facility Capabilities at TestBeam

Argonne Laser Test-stand

- **Challenges with Testing psec timing**
  - Must Build Entire Sensor/Readout Chain to Fully Characterize Performance
  - Need Specialized Equipment, Ultimately a Test Beam
- **Two Step Plan**
  - Use ANL LED Test stands and setup a new laser laboratory
    - Fully Characterize MCPs which we are specifying and Burle/Photonis is designing.
    - A way to systematically measure sensor + readout in controlled environment
  - Ultimately, take the sensor + readout to the FNAL testbeam and test in particle beam.

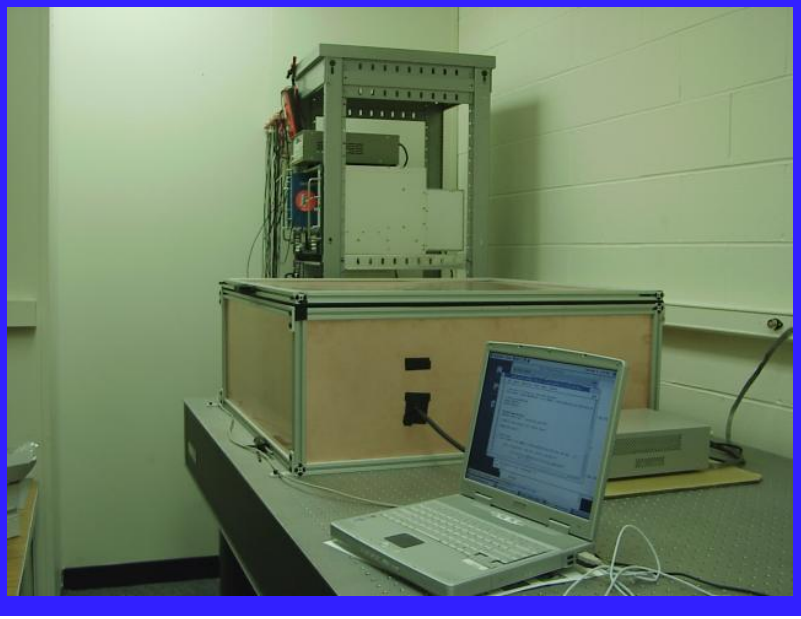
Hamamatsu PLP-10 Laser

- Controller with a laser diode head
- 11 heads available – frequencies from 375 nm to 1550 nm (we purchased 405 nm & 635 nm)
  - 405 nm head – pulse width max 100 ps – typ. 80
  - Pulse to pulse jitter < 10psec

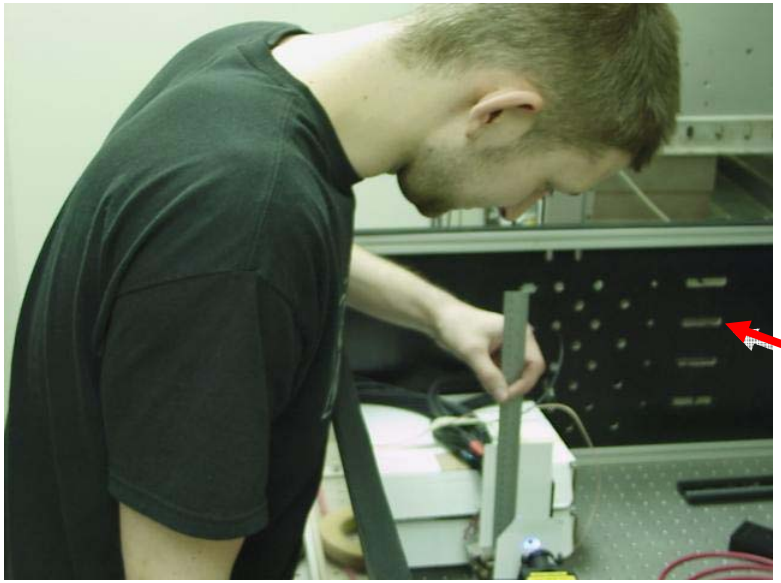
http://sales.hamamatsu.com/en/products/system-division/ultra-fast/picosecond-light-sources/plp-10.php?&group=1

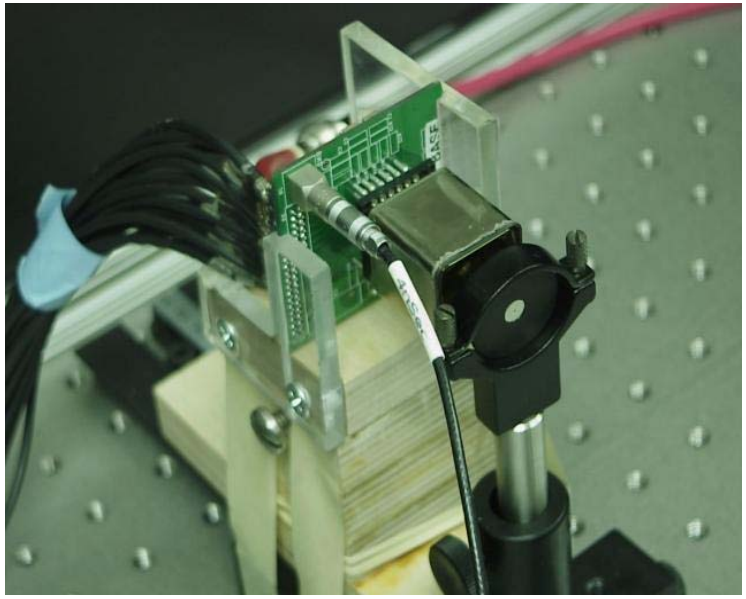
Laser Lab – Current Components

- Camac CC-USB processor/ connected to laptop running linux
- Phillips 7186 25psec/bin TDC
- Ortec 9306 Preamp
- Ortec 9307 CFD
- Ortec 9308 1-channel 1psec/bin TDC (on loan to Jerry)
- Hamamatsu PLP-10 Laser with 2 heads
- Optical Table
- Copper shielded Dark Box

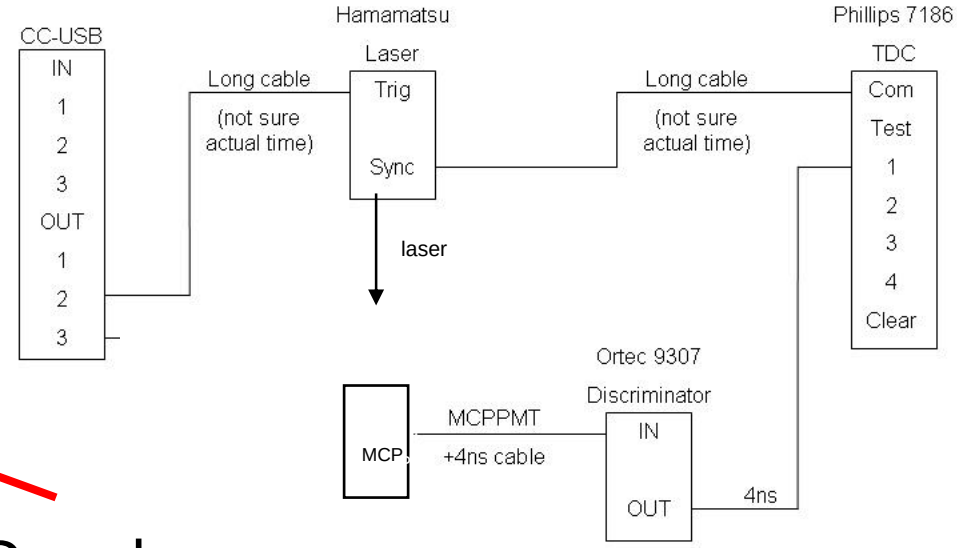


Setting Up

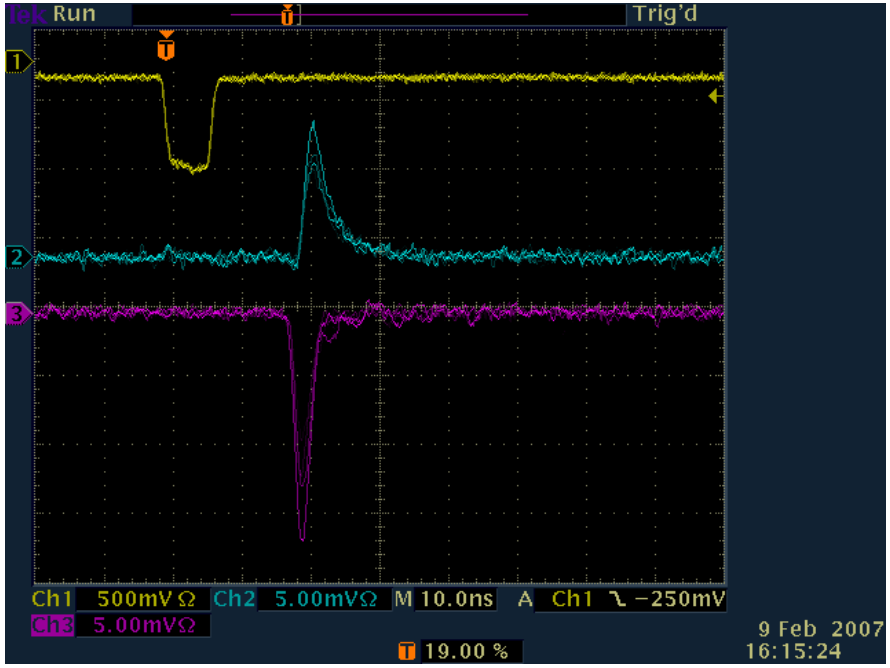




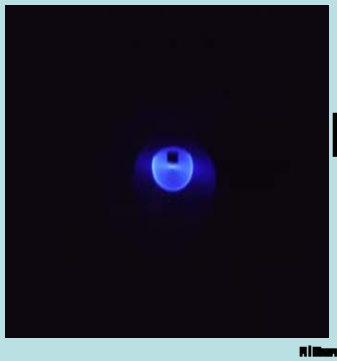
R8900 Hamamatsu MaPMT



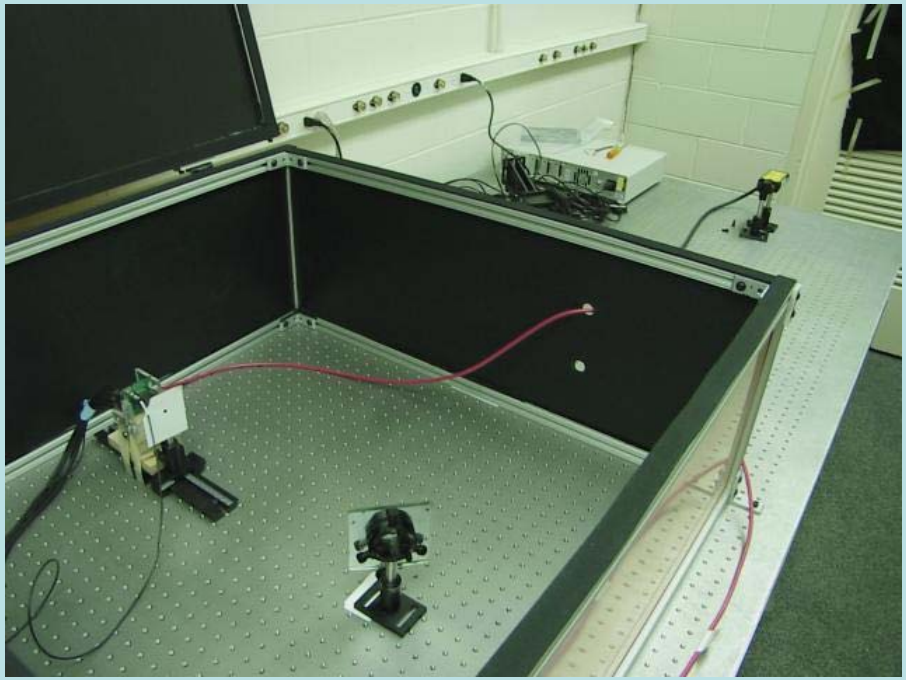
Camden Ertley

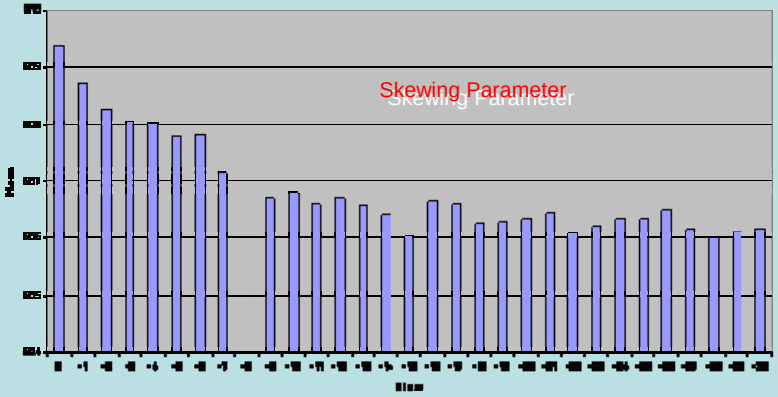


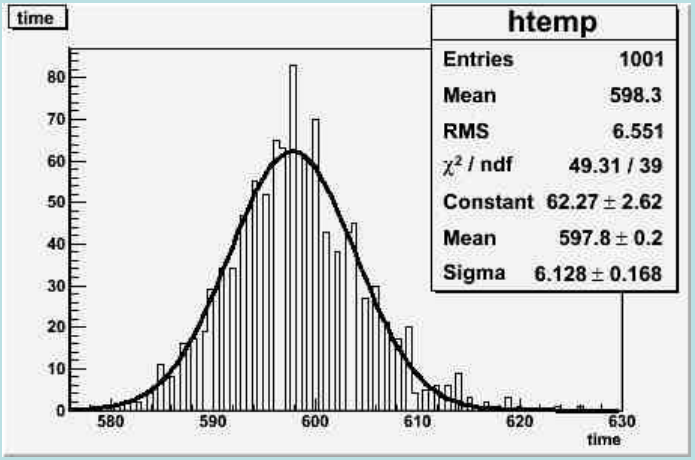
Calibration

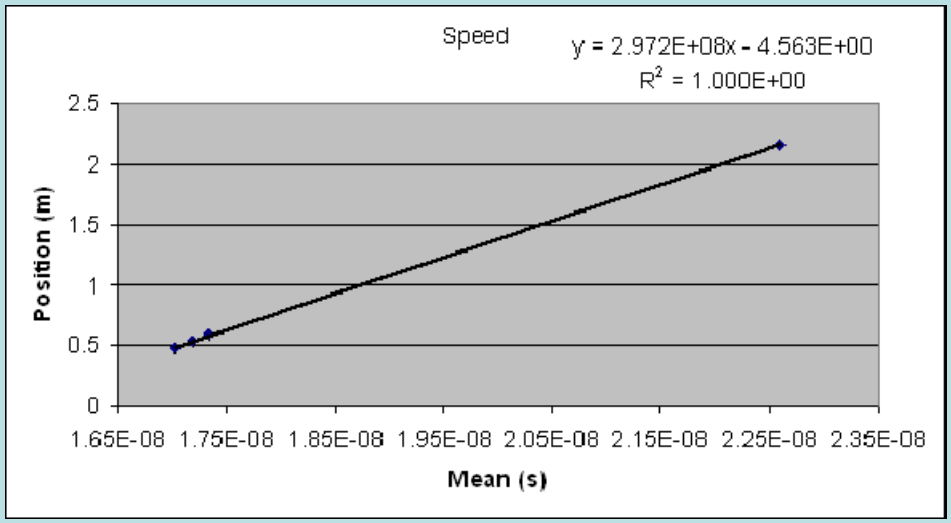


Beam is broad
~2-3cm







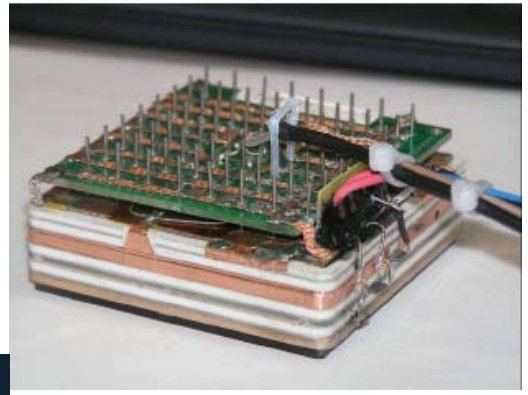


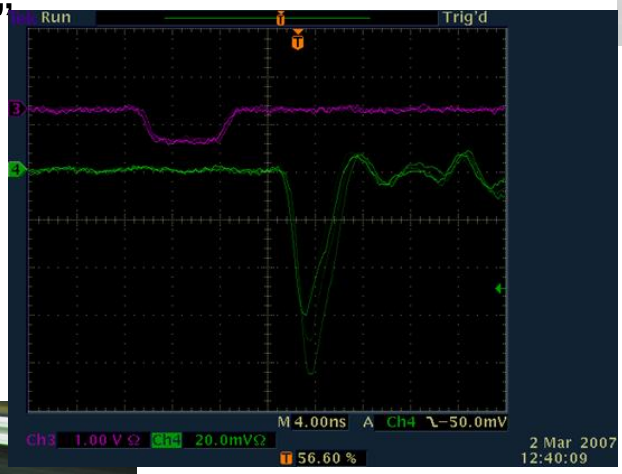
Speed of Light

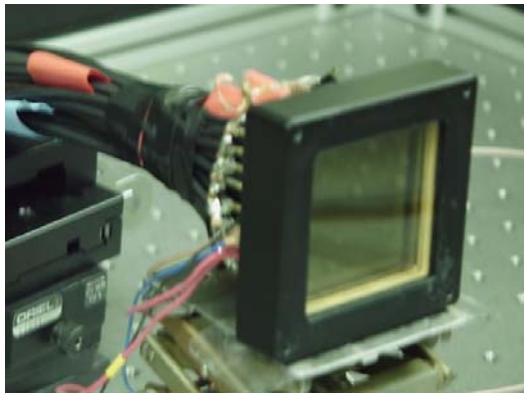
First Look at Mark-0

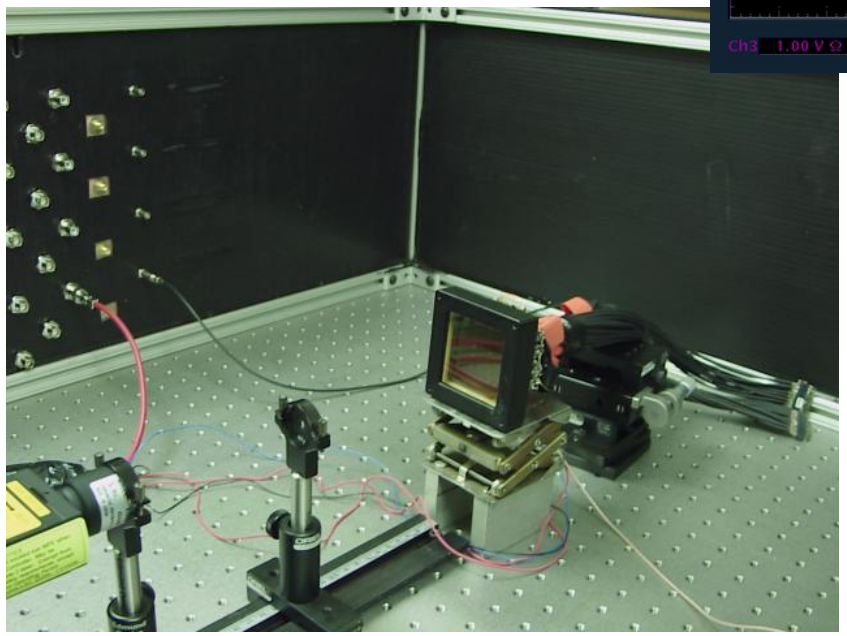
- Mark-0 is first of 4 devices (we have ordered)
- Mark-0 Burle 85011 2” x 2”
- 64 outputs (8x8 array)

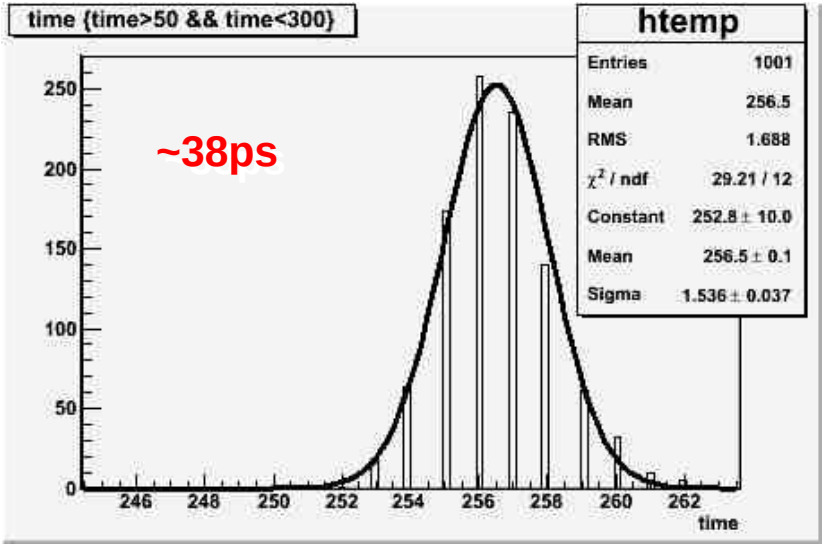
Mark0







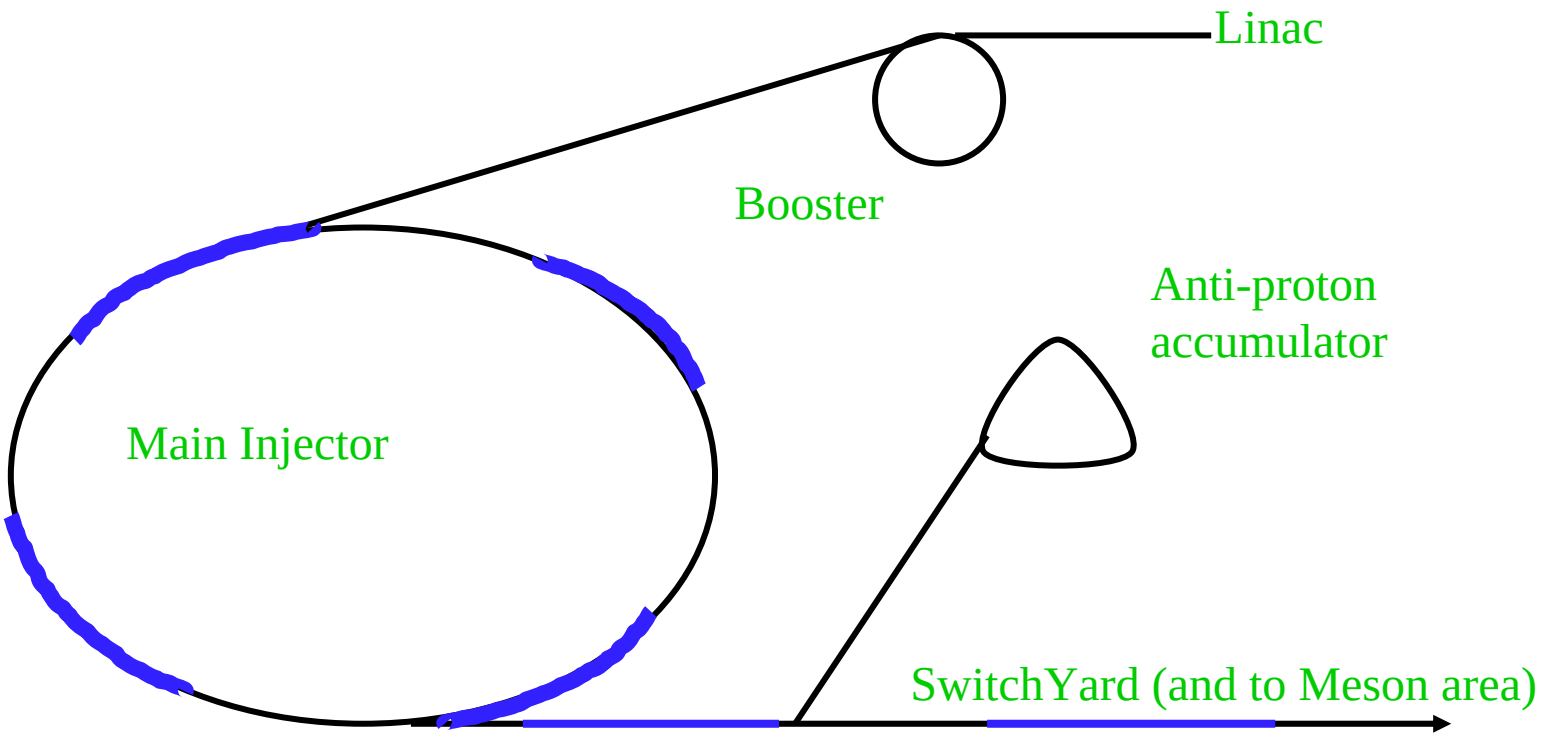




What's next

- **Fully characterize and understand laser beam to MCP performance. (ie laser power, beam size on MCP…)**
- **Add more instrumentation (enough to readout 2 MCPs)**
- **Instrument laser stand with 2 MCPs on xy stagers.**
- **Add filter wheel, etc.**

THE FERMILAB TEST BEAM PROGRAM



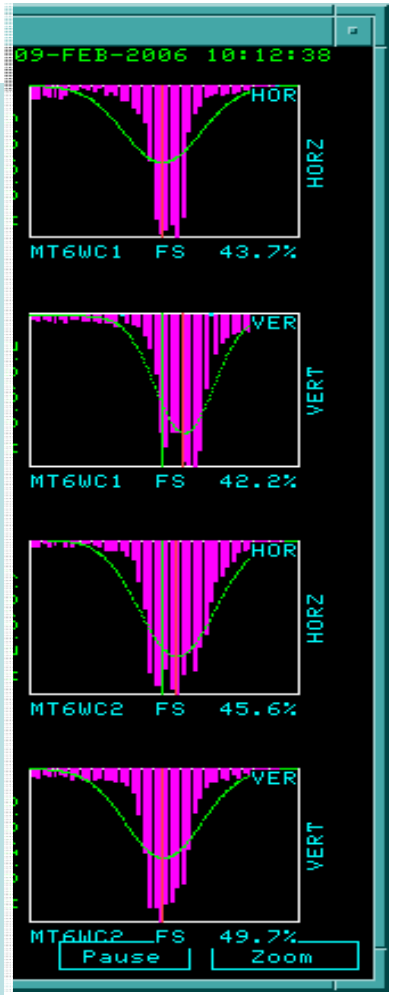
Extraction of beam from Main Injector:

- From 1 to 6 batches in the Main Injector
- Each batch from 0.2 to 1.6 μsec in length
- A fraction of the beam is resonantly extracted in a slow spill for each MI rotation
- 3 batches equals ~1E12 protons
- The slow spill to the SwitchYard is currently one 4 second spill every minute, for 12 hours a day
- The slow spill Switchyard beam competes in time with anti-proton production and MINOS targeting

MTest Profiles 120 GeV proton mode

Tune (GeV)	Rate in MT6/spill*	e- fraction
120	800,000	0
66	90,000	0
33	40,000	0.7%
16	14,000	10.0%
8	5,000	30.0%
4	500	60.0%

* (Rates are normalized to 2.4E12 protons in Main Injector)



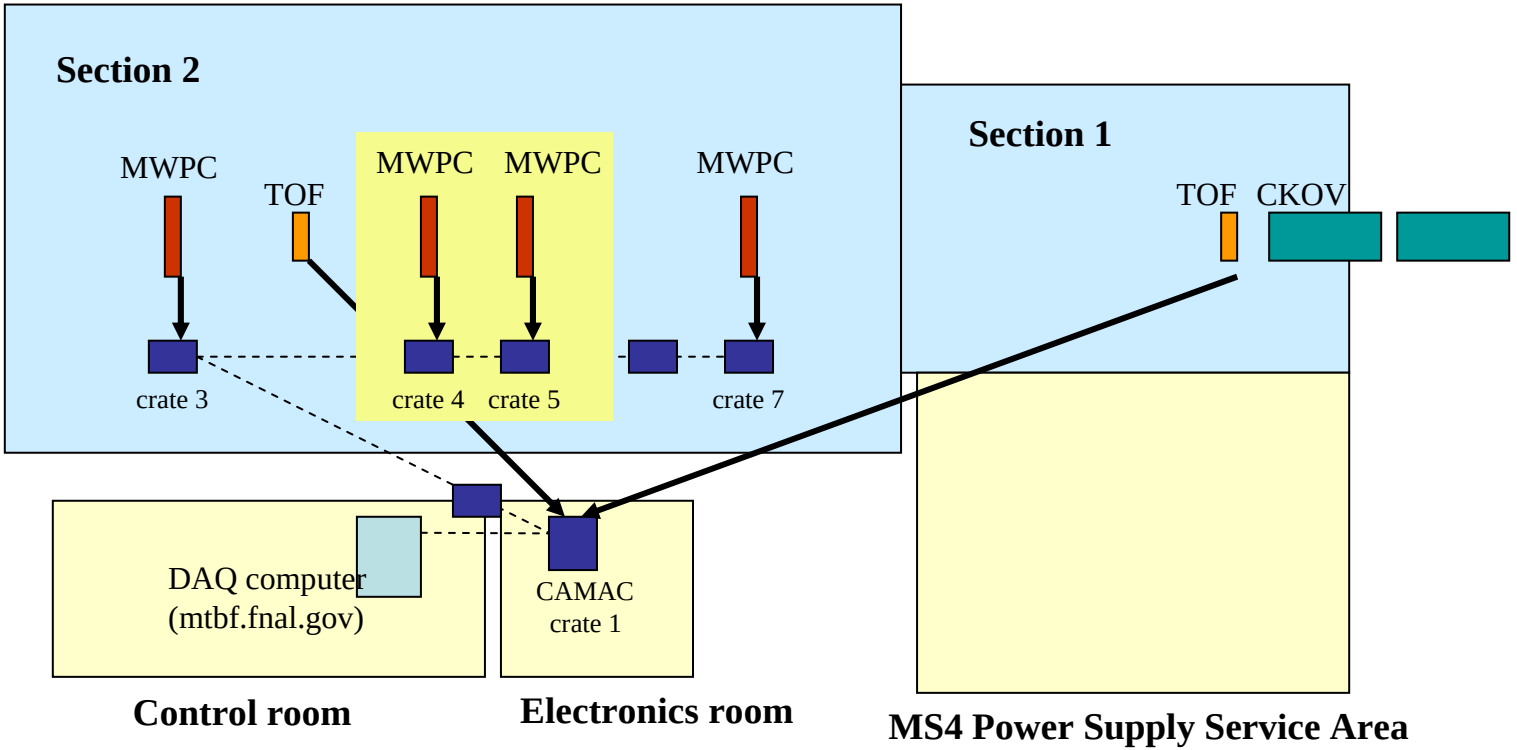
Web page for MTBF: http://www-ppd.fnal.gov/MTBF-w or Fermilab-at-Work → MTBF
Test beam coordinator: Erik Ramberg - ramberg@fnal.gov - 630-840-5731

- 6 user stations. An experiment can take up more than one station.
- 2 climate stabilized huts with air conditioning.
- 2 separate control rooms.
- 60 signal cables/20 HV cables to each area
- Outside gas shed + inside gas delivery system brings 2 generic gas lines, 1 nitrogen line and 2 exhaust lines to each of the user areas
- Lockable work area with 3 offices for small scale staging or repairs, plus 2 open work areas.

Setup of Meson Test Beam Facility tracking DAQ

Facility Capabilities include:

- TOF counters
- Cerenkov Detectors
- Tracking system



Improvements to the Test Beam

- About 6 months ago, Fermilab initiated a very significant investment in the Meson Test Beam Facility.
- As a consequence of this investment, both the beamline and user facilities were improved considerably over the last few years of running.
- The beamline improvements include:
  - An intermediate moveable target which will increase low energy pion flux
  - Low current power supplies and Hall probes to stabilize low energy tuning
  - Minimization of material in the beamline to reduce scattering and conversion
  - Ability to bring primary proton beam flux on an electron target
  - Quadrupole triplets to enhance tuning.
- The user facility improvements include:
  - Thorough cable installation
  - New control/conference room
  - 4th tracking station
  - New TOF system and differential Cerenkov detector
  - Motion tables and video system
  - Laser alignment
- The beamline is being commissioned now and has achieved a range of 2 to 120 GeV beam.

- Backups