Status of the Fermilab Test Beam Facility

Erik Ramberg/FNAL

LCWS – 22 April, 2004

- Test area layout
- Operational characteristics of beam
- Facility detectors and infrastructure
- Status, schedule and obtaining beam time

Web page for MTBF: http://www-ppd.fnal.gov/MTBF-w or Fermilab-at-Work → MTBF
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Meson Test Beam Facility

Introduction

The Meson Test Beam Facility is a versatile beamline in which users can test equipment or detectors in a beam of moderate energy particles (5-120 GeV) at moderate intensities (< 1 MHz). Beamtime is available to qualified users as discussed below.

Schedule for Beam and User Areas: (Weekly , Monthly)

Beamline and experimental area details

How to become a test beam user

Resources available for approved test beam users

Meson Test Beam Facility MOU's

Meetings and Talks

Email archive for test_beam@fnal.gov

Useful links to Beams Division status and logs

Pictures

Fermilab At Work web page

Security, Privacy, Legal

Last Updated: 11/01/2001

Meson Test Beam User Information

If you are interested in using the Fermilab Meson Test Beam Facility, the first step is to request beamtime using the form below. Fermilab will then review this user request through a test beam review committee, which will approve or reject the request. Requests will be rejected if the request can't be met by the facility, due to capability or schedule. Approved requests will be asked to make a more detailed plan resulting in a Memorandum of Understanding between the user and the laboratory. A lengthy and a short example are given below. The test beam user will then obtain a test beam experiment number associated with their request. Each approved test beam experiment must obtain a readiness clearance before actually taking beam. This readiness clearance is obtained from the Particle Physics Division's Fixed Target ES&H Committee, which has subcommittees to review electrical and gas safety. The makeup of the committee is given in a link below. Their requirements are outlined in documents that can be obtained below. Users will have to obtain a Fermilab User ID and pass a Radiation Worker class before using the test beam. Each experimenter must read the FNAL Procedures for Experimenters manual. To access the beamline during run conditions, a user also requires Controlled Access training. The various information needed for each of these steps is gathered here:

Beamtime Request Form

FNAL Procedures for Experimenters manual

Sample Test Beam MOU (T932) (MSWord)

PPD ES&H Committee

ES&H Safety Reviews Required for Experiments

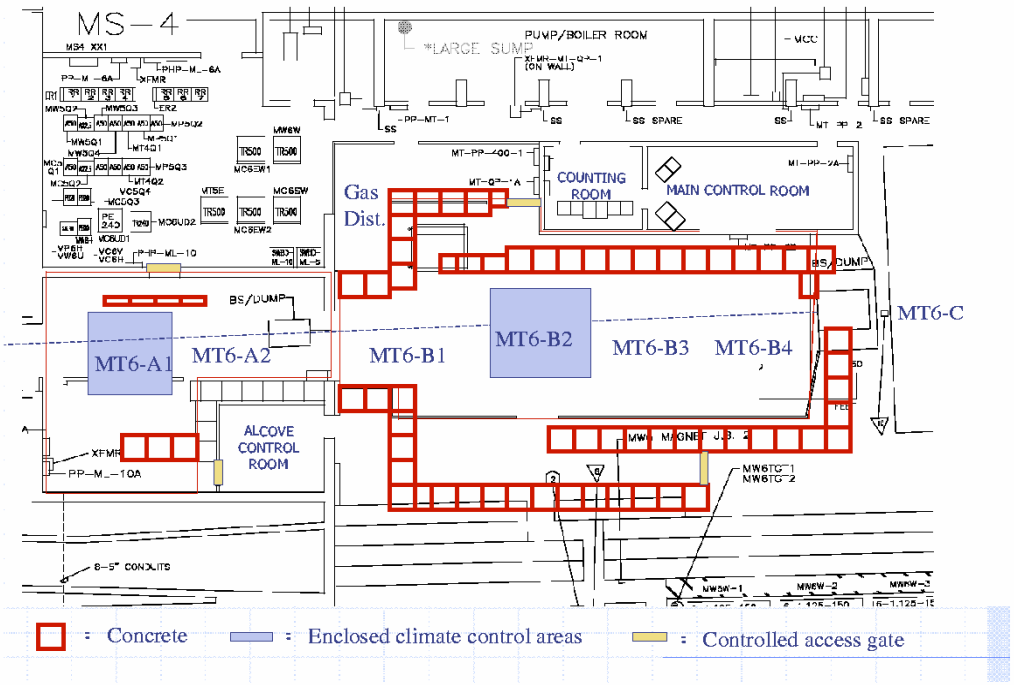
Electrical Safety Review Requirements

Flammable Gas Safety Review Requirements

Application for Radiological Worker and Controlled Access Training

Radiological Worker Training Study Guide

MT6 Test Beam User Areas

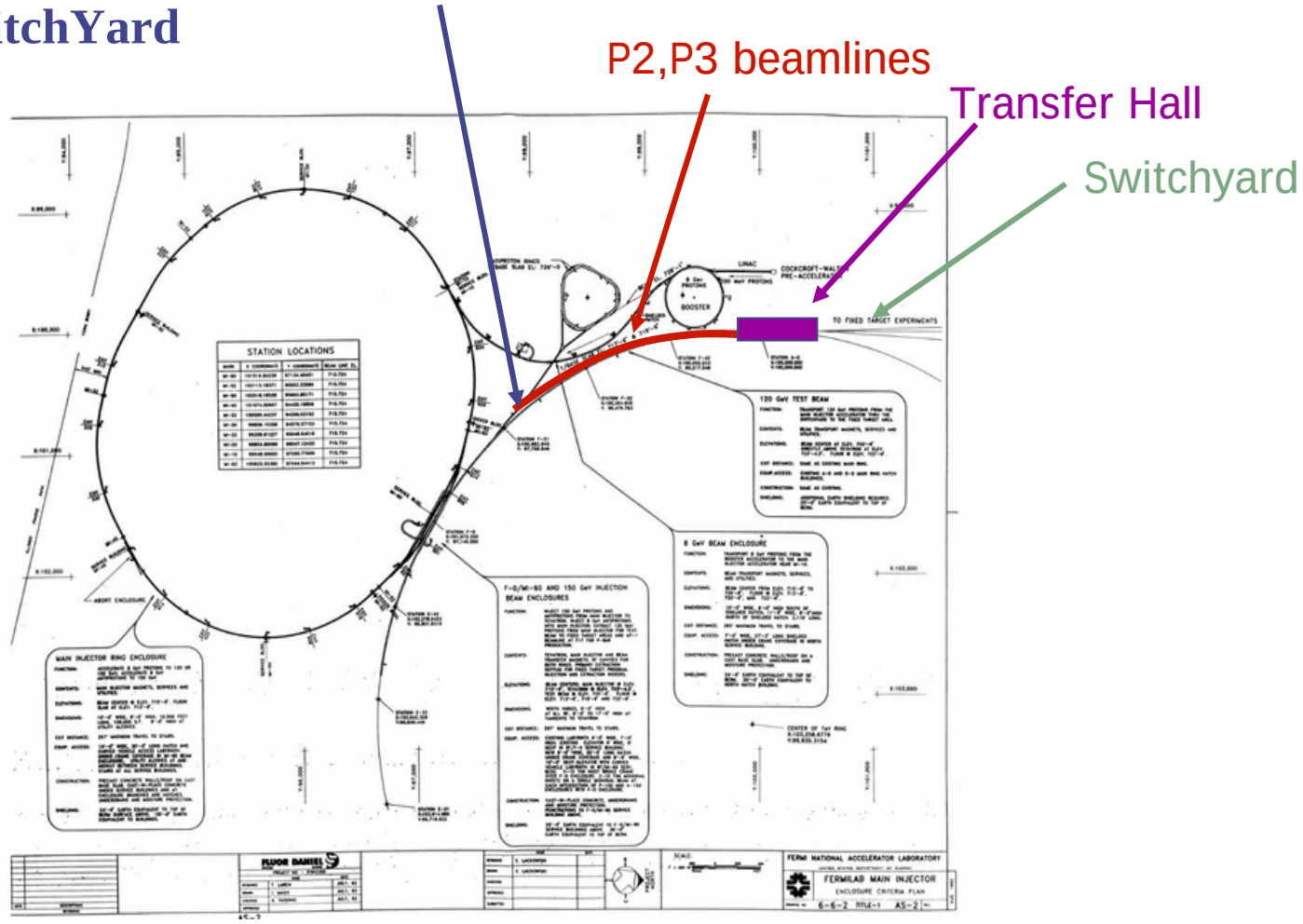


Scale:

~6 m

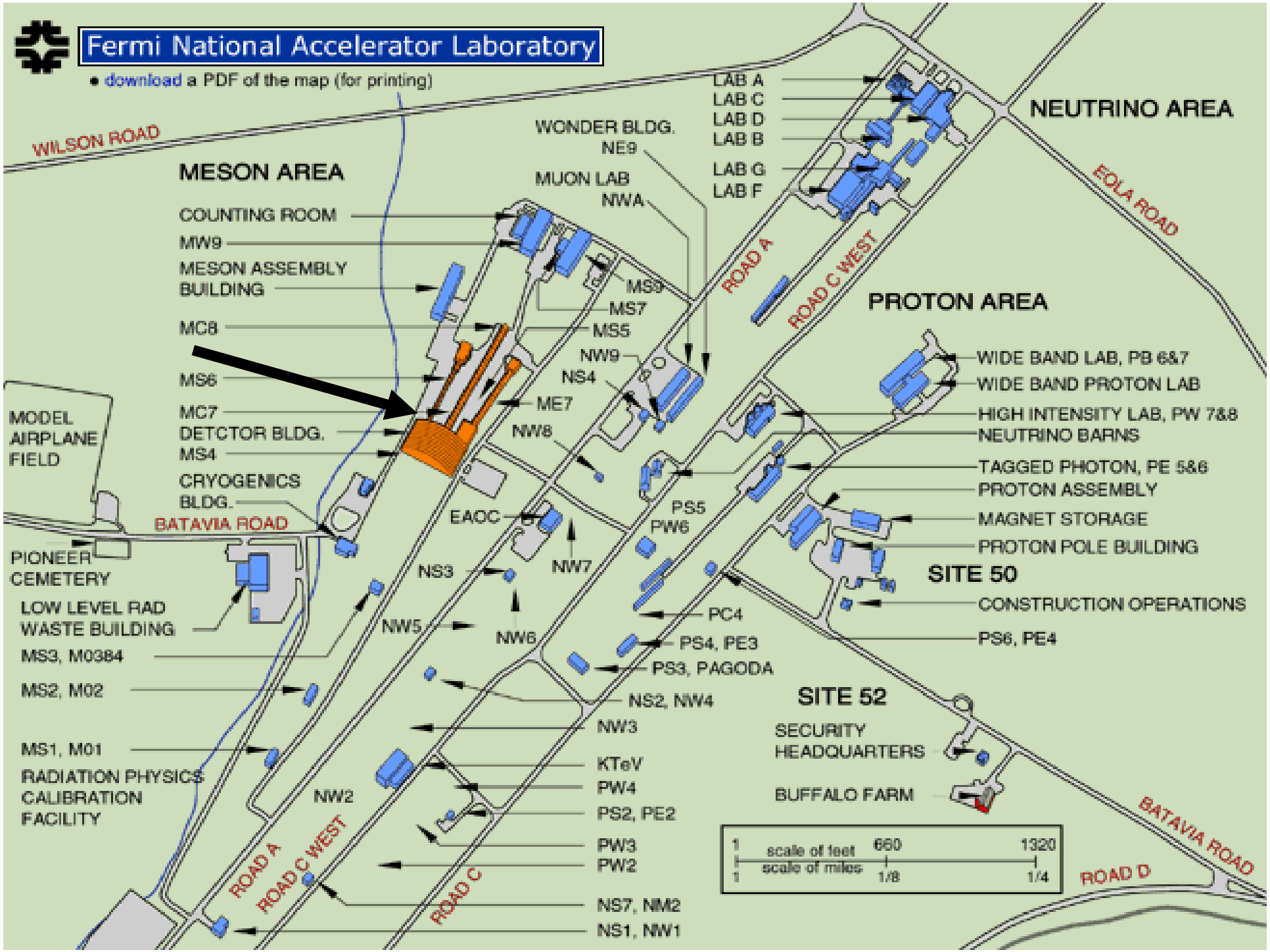
- 2 beam enclosures. Eventually, downstream enclosure will be operated independently of upstream.
- 6 user stations, with a 7th downstream of the beam dump. An experiment can take up more than one station.
- 2 climate stabilized huts with air conditioning.
- 2 separate control rooms.
- Outside gas shed + inside gas delivery system can bring any 2 gases (and exhaust lines) to any of the user areas
- Lockable work area for small scale staging or repairs.

Split between pbar production and SwitchYard



'SwitchYard 120' Project:

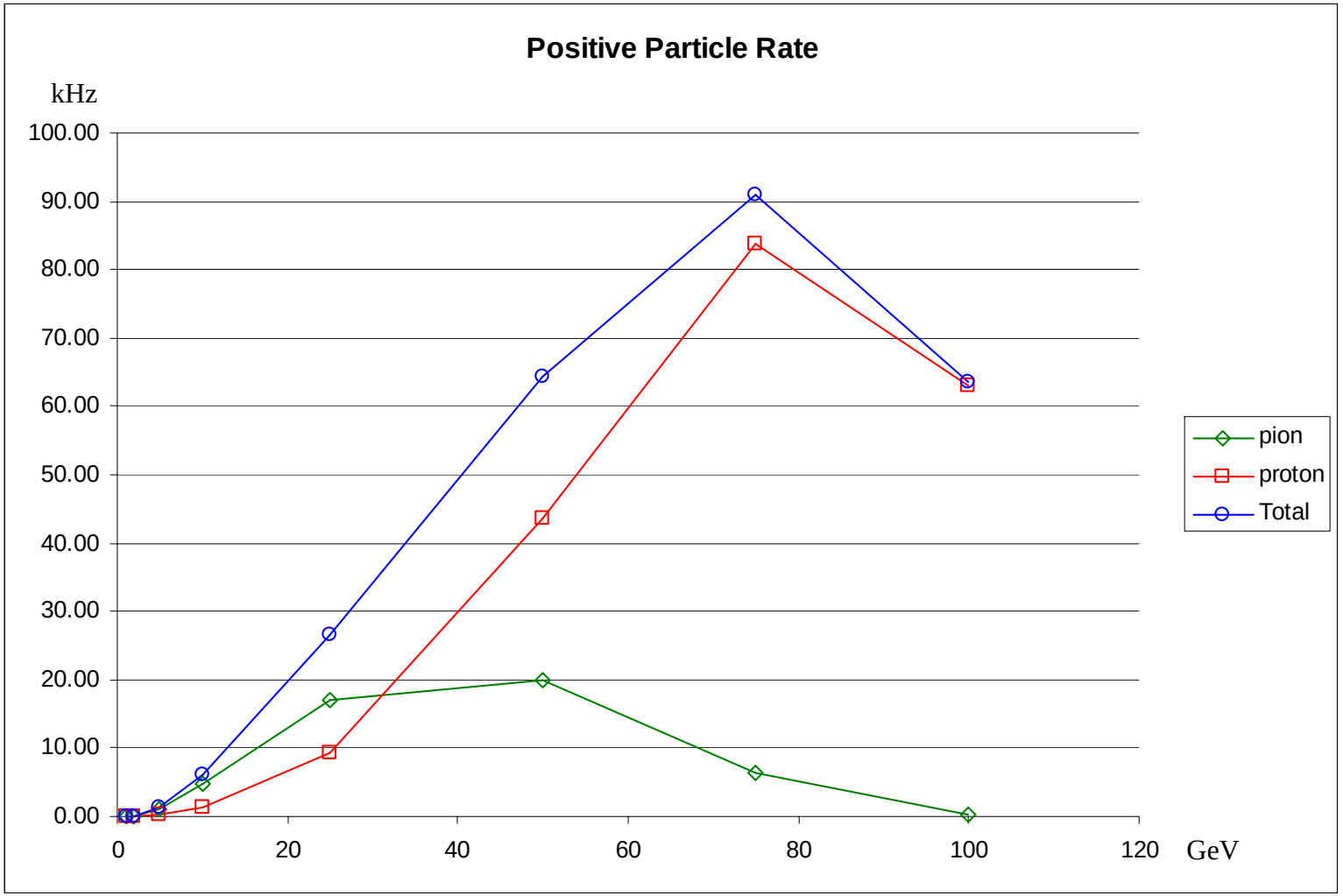
- Delivers Main Injector beam to Meson Detector Building
- Runs in conjunction with protons delivered to pbar source (and eventually NUMI)
- Spills to SY120 can impact pbar production by no more than 5%

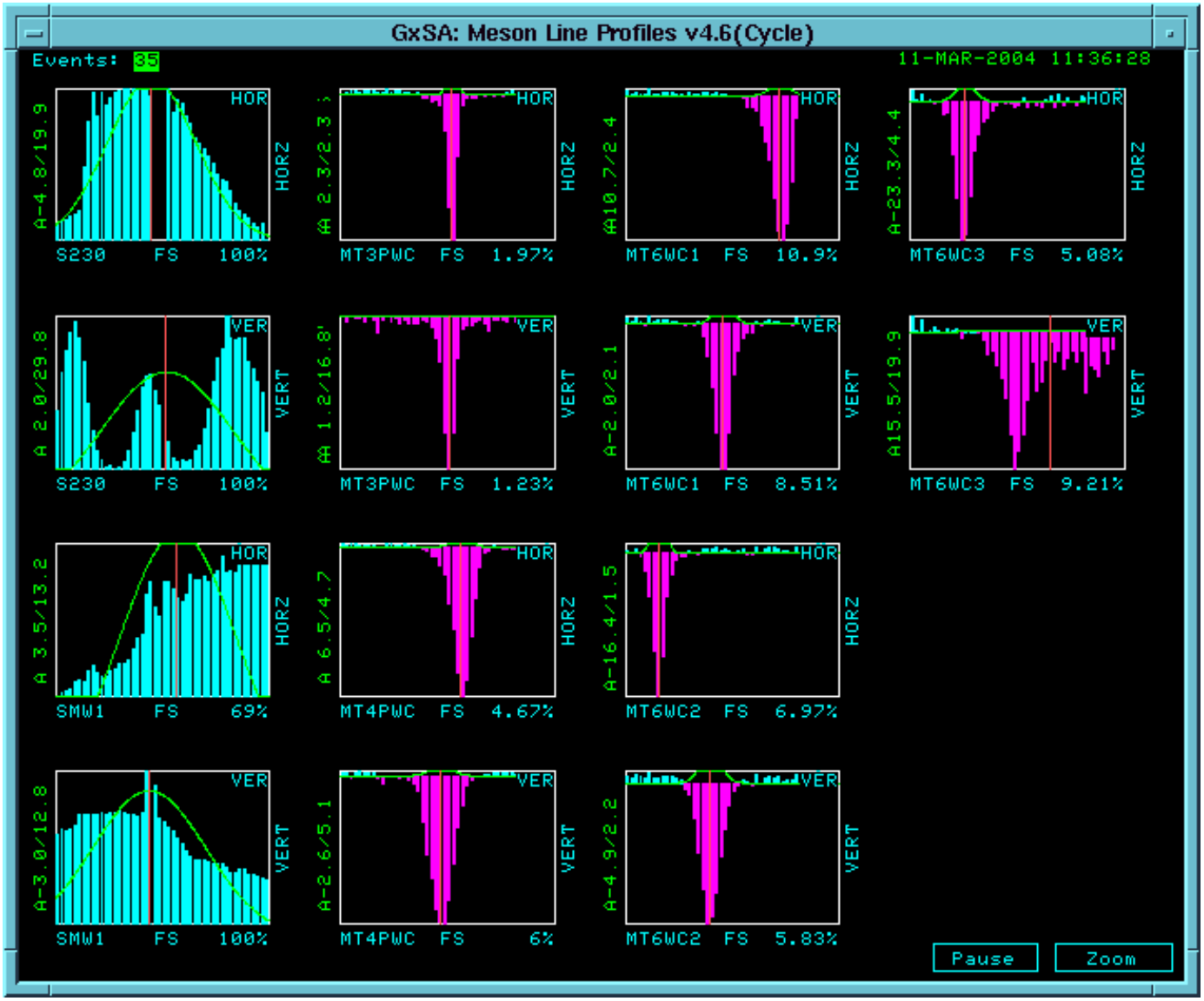

Fermi National Accelerator Laboratory
• download a PDF of the map (for printing)
WILSON ROAD
MESON AREA
NEUTRINO AREA
EOLA ROAD
WONDER BLDG.
NE9
MUON LAB
NWA
LAB A
LAB C
LAB D
LAB B
LAB G
LAB F
ROAD A
ROAD C WEST
PROTON AREA
COUNTING ROOM
MW9
MESON ASSEMBLY BUILDING
MC8
MS6
MC7
DETCTOR BLDG.
MS4
CRYOGENICS BLDG.
MS9
MS7
MS5
NW9
NS4
ME7
NW8
MODEL AIRPLANE FIELD
BATAVIA ROAD
PIONEER CEMETERY
LOW LEVEL RAD WASTE BUILDING
MS3, M0384
MS2, M02
MS1, M01
RADIATION PHYSICS CALIBRATION FACILITY
EACC
NS3
NW7
NW5
NW6
NW2
PS5
PW6
PC4
PS4, PE3
PS3, PAGODA
NS2, NW4
NW3
KTeV
PW4
PS2, PE2
PW3
PW2
NS7, NM2
NS1, NW1
ROAD A
ROAD C WEST
ROAD C
WIDE BAND LAB, PB 6&7
WIDE BAND PROTON LAB
HIGH INTENSITY LAB, PW 7&8
NEUTRINO BARNS
TAGGED PHOTON, PE 5&6
PROTON ASSEMBLY
MAGNET STORAGE
PROTON POLE BUILDING
SITE 50
CONSTRUCTION OPERATIONS
PS6, PE4
SITE 52
SECURITY HEADQUARTERS
BUFFALO FARM
1 scale of feet 660 1320
1 scale of miles 1/8 1/4
BATAVIA ROAD
ROAD D

Operational Characteristics

- There are several operational modes:
  - Proton Mode: Tune beamline for 120 GeV protons that get transmitted through the target. Rates at the user area are limited to 1 Mhz. Maximum rates so far are 200 KHz.
  - Secondary, or 'Pion' Mode: Vary the tune of the beamline according to the momentum desired. Maximum momentum is currently 66 GeV, with rates on the order of 10 kHz. Lowest momentum tune is on the order of 3-5 GeV. (See graph of calculated rates)
  - Muons: By inserting a beam stop upstream, muons of tagged momentum less than 66 GeV can be delivered to both areas. By inserting the beam stop between the two user areas, muons of indeterminate momentum can be delivered to the downstream area. The former mode has not been tested. The latter mode has delivered 100 Hz of muons to the user area.
  - Electrons: At low momentum (< 5 GeV), the beamline delivers an enhanced electron fraction, at very low rates. There are intermediate target wheels and sweepers to attempt production of an electron beam at higher momentum. This mode has not been tested yet.
- Fast extraction delivers from 20-80 buckets of 20 nsec duration. Each bucket has ~ 500 particles. Can insert beamstop to reduce rate to 0.5 particle/bucket.
- Resonant extraction delivers 'smooth' beam over .4 sec spill. Spill can be made shorter – down to 10 or 20 msec – thus making more intense beam.
- Spot sizes can be made as small as 3-5 mm square (with 120 GeV protons) and as large as 5 cm square.

Predicted maximum rates in MT6 as a function of momentum for pions and protons





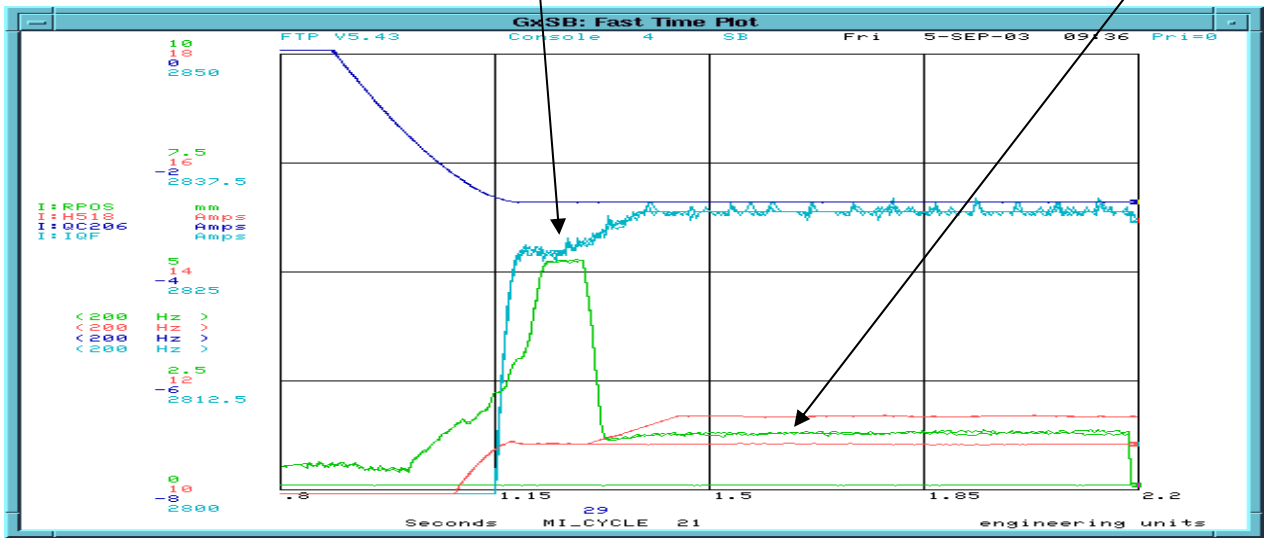
SWIC profiles while delivering 120 GeV beam (1 mm wire spacing)

Duty Factor in SY120

- Program planning has determined that SY120 operations will affect pbar production by less than 5%
- Standard operation is a single 400 msec slow spill every minute, but can request more frequent spills for short periods of time
- Magnet ramps are set so that, in the future, pbar extraction and resonant extraction could coexist in a single spill. Then the duty factor could be as high as a spill every 3.25 sec. This will probably be tested this summer.

Pbar production/fast extraction

400 ms SY120/
resonant extraction



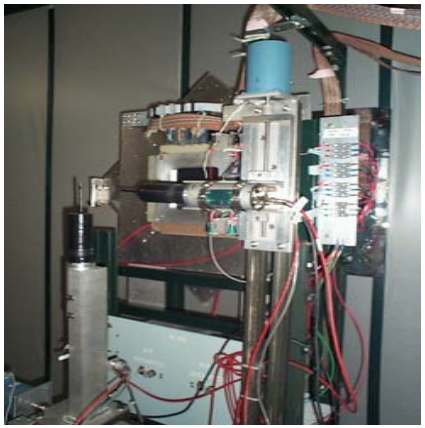
Facility Detectors

- Two beamline threshold Cerenkov counters can be operated independently for good particle i.d. (50’ and 80’ long)
- Two stations of X,Y silicon strip detectors are installed.
- Three 0.5 mm pitch MWPC into DAQ + Three 1.0 mm pitch MWPC into the accelerator ACNET control system.
- DAQ will be minimum bias triggered during the spill. The data from scintillators, Cerenkov counters, silicon and MWPC go into event buffers. Buffers are read out during and after the spill and this data will be accessible to experimenters.


MESON TEST
BEAM FACILITY

One of the two beamline Cerenkov counters

One of three MWPC stations



Remote controlled scintillator finger counters

Silicon tracker

T926: Radio Ice Cerenkov Experiment

T927: BTeV Pixel Test

List of MTBF Memoranda of Understanding (MOU):

T926: RICE	- Took data in Feb.
T927: BTeV Pixel	- Taking data in Spring
T930: BTeV Straw	- Taking data in Spring
T931: BTeV Muon	- Install over Summer
T932: Diamond Detector	- Taking data in Spring
T933: BTeV ECAL	- Install over Summer
T935: BTeV RICH	- Install over Summer
T936: US/CMS Pixel	- Taking data in Spring

Status of Fermilab Test Beam

- Several experiments have taken data or are currently doing so. Other experiments will be installing in the summer.
- 120 Gev, 66 GeV and 33 GeV beams have been delivered. Both fast extraction and slow spill have been tested.
- A low-rate, broad-band muon beam has been established
- Tracking and DAQ near completion

Summary of Operational Characteristics

- Either fast spill (0.4-1.6 μsec) or slow spill (.02-.6 sec)
- Typical operation of 1 spill/minute. Can request higher rates.
- ~50 K protons/spill at 120 GeV
- ~3 K secondary beam/spill at 66 GeV

} (Beam rates have improved x5 since these results)

- Lower momenta will give lower rates
- Muon filters decrease beam by ~10^{-3}
- Beam spot sizes of ~3 mm square at 120 GeV