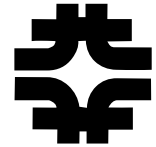
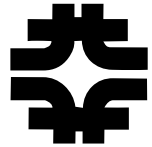


FNAL Status

International Finance Committee
Hugh Montgomery

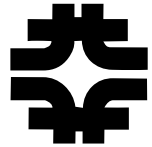
April, 2004

The FNAL Research Program



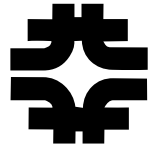
- FNAL Accel. Programs
  - Collider-Run II (CDF/D0)
  - Neutrinos
    - NuMI/Minos
    - MiniBooNE
  - MI-based Fixed Target
    - Test Beam
    - QCD, (Kaon) Expts
- LHC
- Theory
  - Particle
  - Astroparticle
- Astroparticle Expts
- Linear Collider R&D
- Computing

The Collider Experiments



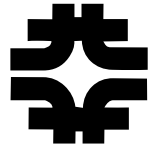
- CDF, D0
  - Search for new phenomena
    - Extra dimensions, SUSY, strong dynamics
    - Higgs
  - Top Physics
    - Top cross section, mass
    - Single top production
  - W, Z Physics
    - Multiboson production
    - W, Z asymmetries
    - W mass
  - Flavor Physics
    - Bottom, charm production, lifetimes
    - Heavy-heavy states
    - Mixing, CP violation
  - QCD
    - Production dynamics, the new spectroscopy
    - Diffractive physics
- BTeV
  - Flavor Physics
    - High precision, mixing, CP violation
    - New physics in decays

Collider Experiments



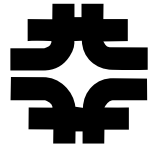
- **Detector Operations**
  - Accelerator Operating conditions are, for a very large fraction of the time, fine for the experiments.
  - Detector Operational Efficiency is as high as was achieved in Run I
- **Offline Processing**
  - Basic Processing is going well
  - External Review of Run II Computing (Bird Committee) in Fall 2003
  - Incorporation of increasing amounts of off-site computing, nascent GRID!
- **Integrated Luminosity**
  - Double from >200 pb^{-1} to 4- 500 pb^{-1} during FY04

CDF/D0 Status



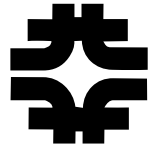
- Running very smoothly
  - Returned from a successful shutdown quickly
  - Achieved 90% efficiency!
  - Have 300 pb^{-1} to tape.
- In CDF all systems operational
- In D0 Integration of systems continues successfully
  - Luminosity uncertainty reduced to 6.5%
  - FPD in routine operations
  - STT fully integrated into readout
- Both experiments are using both on site and off site computing:
  - D0 reprocessing data analysis offsite
  - CDF Monte Carlo dominated by off site
  - The 200 pb^{-1} pre-shutdown data processed and available for analyses.
  - Many billion events processed for Moriond
- The physics program is building steam
  - Each experiment incorporating its new features
  - Lots of analyses discussed and presented at “conference level”
  - Many publications expected this year

Collider Experiments: Issues



- CDF
  - COT response pattern
    - Aging, polution, contamination?
    - Extensive investigations underway
- D0
  - Noise in Muon Triggers, Calorimeter
    - From muon toroids?
    - Problem disappeared, not understood
  - Nervousness about silicon channel count
- CDF/D0
  - Accelerator losses
    - During operation
    - Response to abnormal
    - Continual program of accelerator improvements
- Offline Computing
  - D0 Reconstruction time, reduced dramatically but number of events increased
  - CDF analysis load – lots of physics lots of analyses

The last seven months

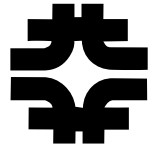


At the 7/21/03 accelerator review MW said:

- **"We will focus on**
  - **understanding and fixing limits to present luminosity, including several connected with the Tevatron,**
  - **reliability and maintenance issues,**
  - **Recycler commissioning, and**
  - **the upgrade program."**

We have, and it has paid off.

DOE review closeout, 2/26/2004



Review Summary:

Great progress has been made since last review in July 2003.

Successful shutdown – accomplished goals

The Tevatron complex has never performed better.

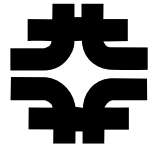
At last review we said –

"Success requires the new management team to effectively lead and integrate the many technically complex activities that make up Run II. The next 6 months will be critical."

The successes of the past 7 months are indicative of the very hard work of high quality staff working on Run II and the capabilities of the management team to lead and organize the Division's efforts.

The Laboratory as a whole appears to be focusing on run II and providing support at the level needed for success. This is important.

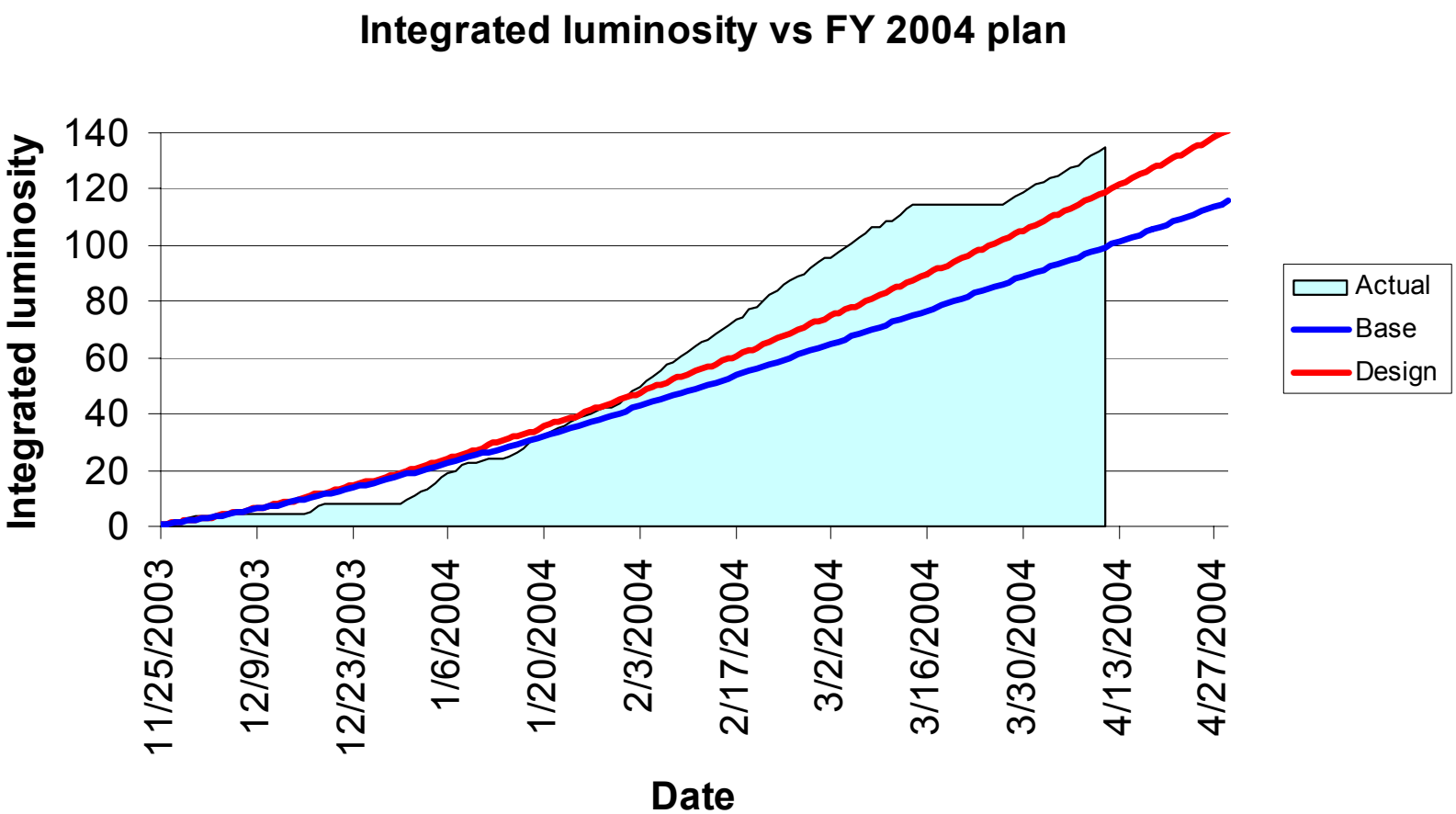
DOE review closeout (cont.)



So what's the bottom line?

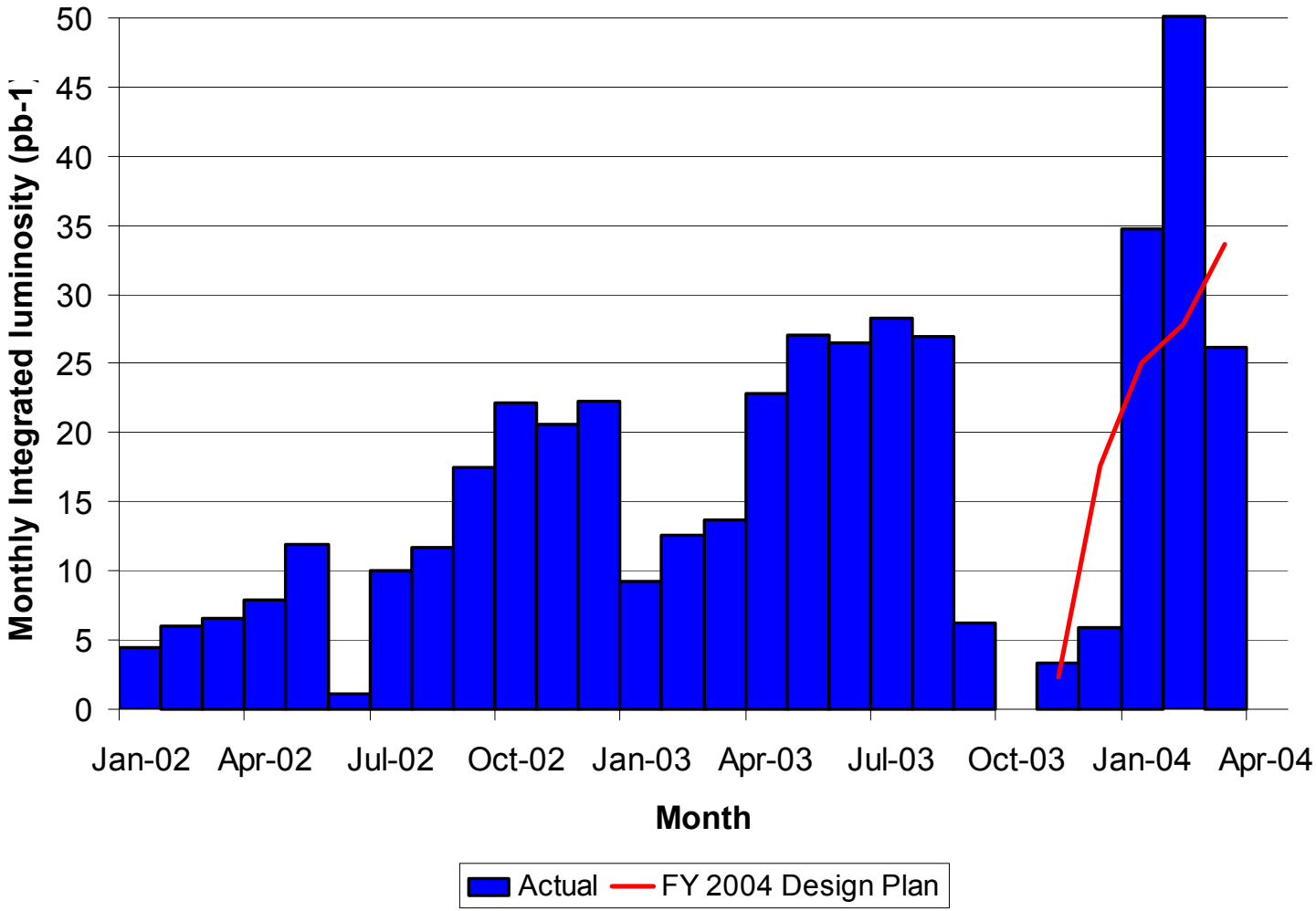
- We're very impressed with the progress in the past seven months.
- We have increasing confidence that Run II will be successful.
- We look forward to continued progress toward the Tevatron complex being reliable and well characterized to serve as a platform for the cutting-edge upgrades.
- But there's a long way to go in the complex campaign of operations, maintenance, upgrades, R&D, and studies that must succeed if the luminosity goals are to be reached.
- We see a significant challenge in the installation and successful commissioning of electron cooling in the next 16 months.
- **Keep up the discipline, focus, dedication and good work. We are very encouraged!!!**

Tevatron Operations: FY 2004 Plan and Status



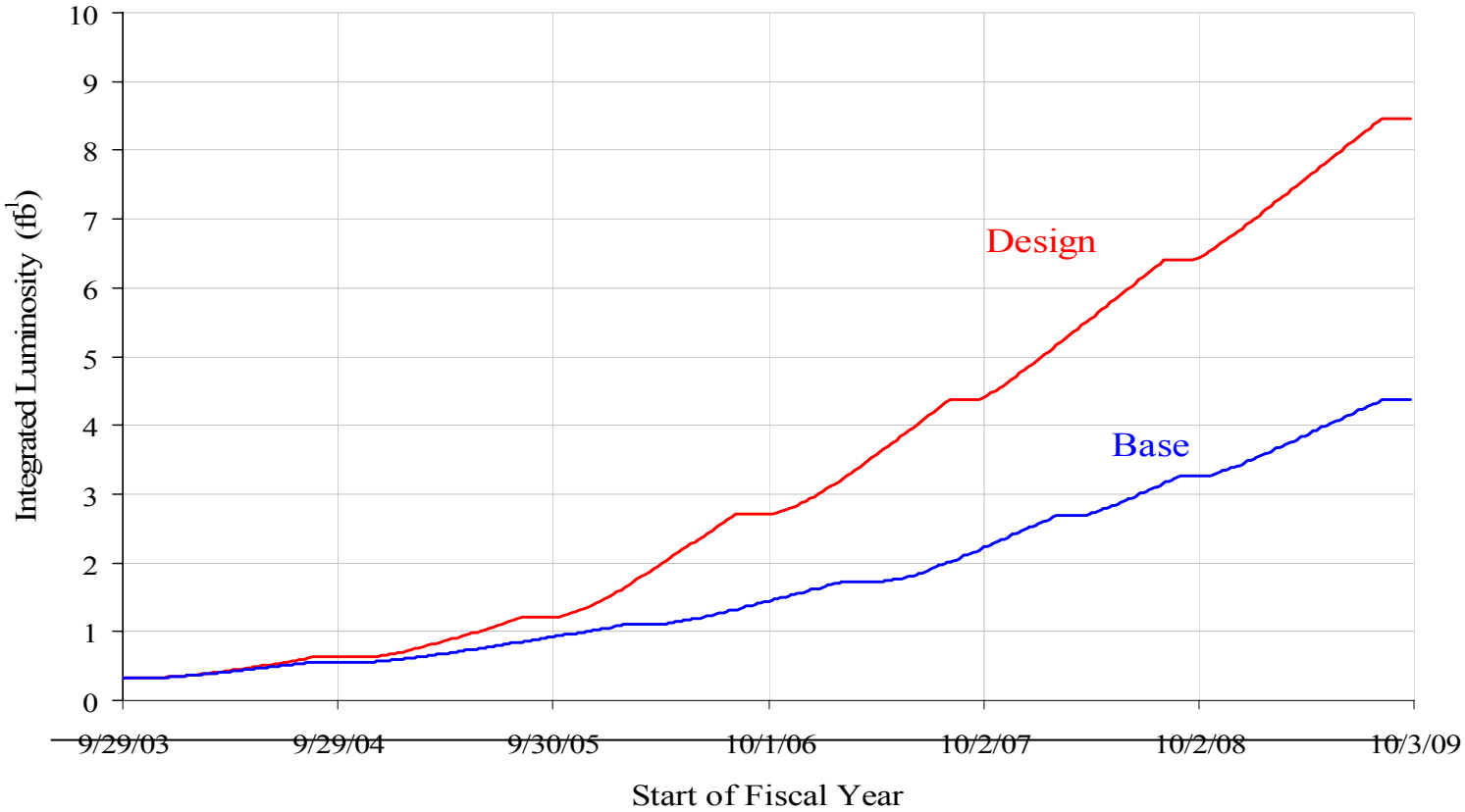
Physics total ~0.25 fb^{-1} on 10/03; plan ~0.55 fb^{-1} by 9/04

Progress of Run II



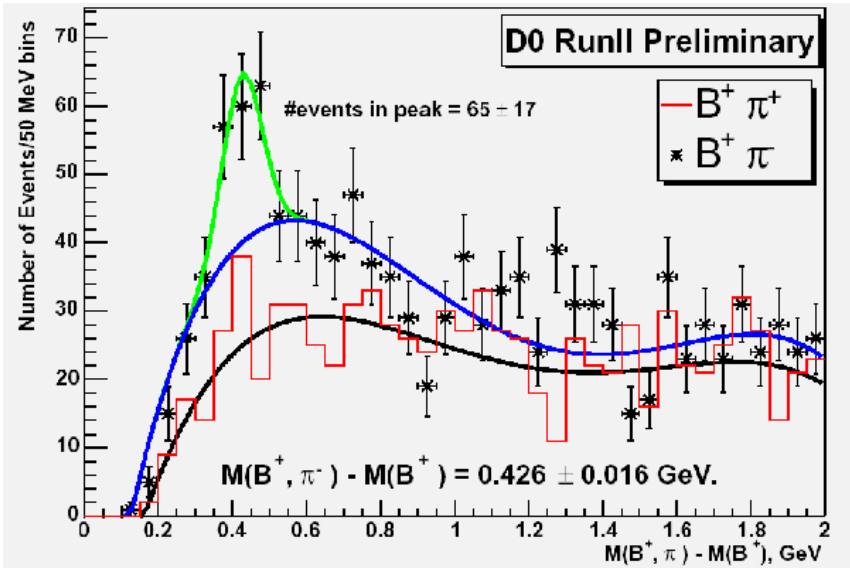
Projected Integrated Luminosity

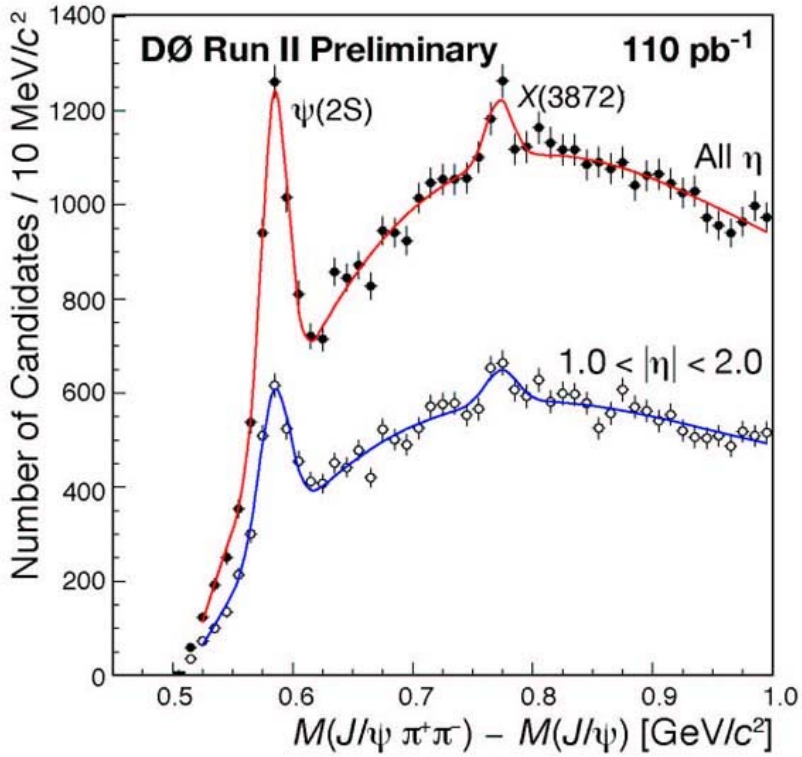
Integrated luminosity will about double every year for next 4 years



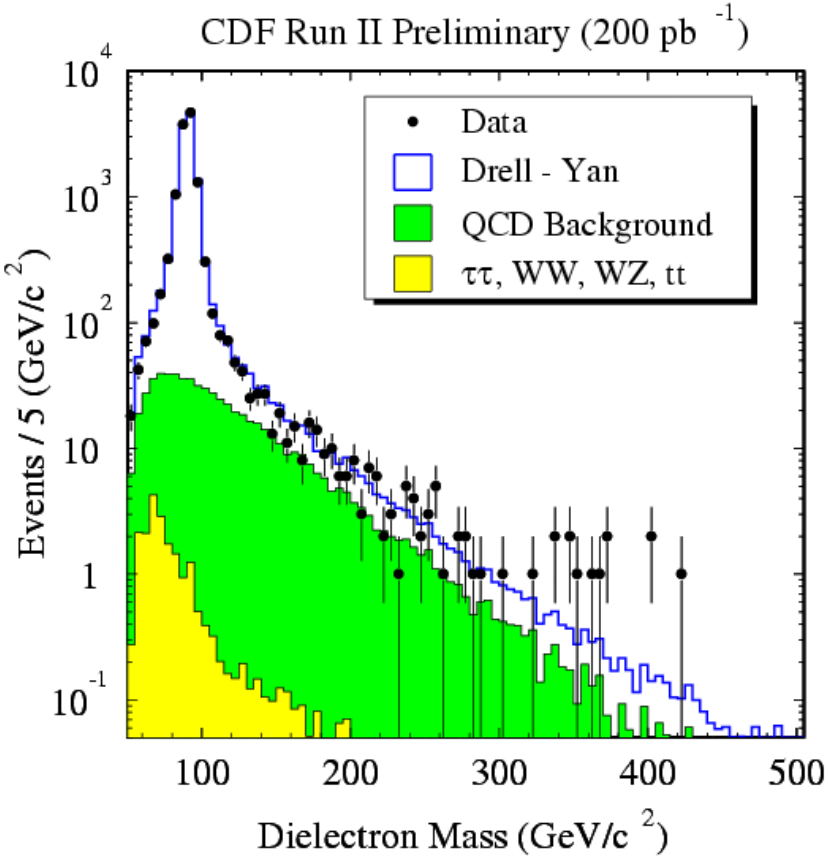
FY2004 05 06 07 08 09

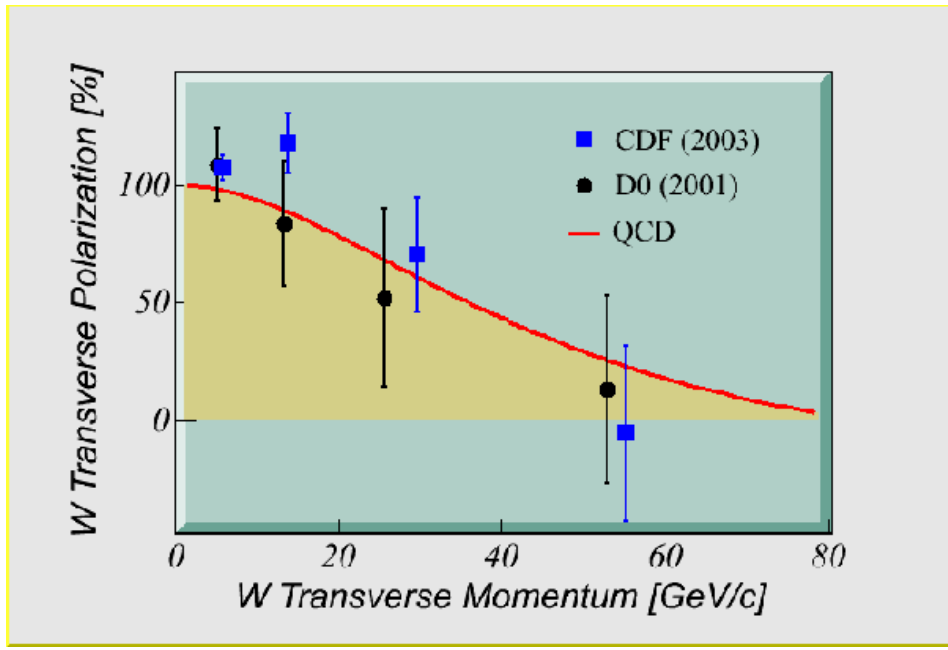
D-Zero Results



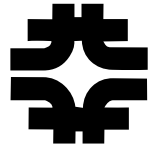


CDF Results


CDF Run II Preliminary (200 pb -1)
Data
Drell - Yan
QCD Background
ττ, WW, WZ, tt
Events / 5 (GeV/c 2)
Dielectron Mass (GeV/c 2)
10 4
10 3
10 2
10
1
10 -1
100
200
300
400
500


W Transverse Polarization [%]
W Transverse Momentum [GeV/c]
CDF (2003)
D0 (2001)
QCD
100
50
0
0
20
40
60
80

Run IIb Detector Upgrades



- Run IIB Silicon Detector construction cancelled.
  - Followed the development of the Accelerator Run II Upgrade Plan, delay in intregration of luminosity
  - Balance of resources
  - Retain upgrade of data acquisition and triggers to deal with higher instantaneous luminosity.
- P5 Recommendations, DOE HEP concurrence

- Internal Fermilab Reviews, Fall 2003
  - CDF, D0 Trigger-DAQ plans endorsed
  - D0 Layer 0 added
- ESAAB (approval from Acquisition Executive (Robin Staffin)) December, 2003.

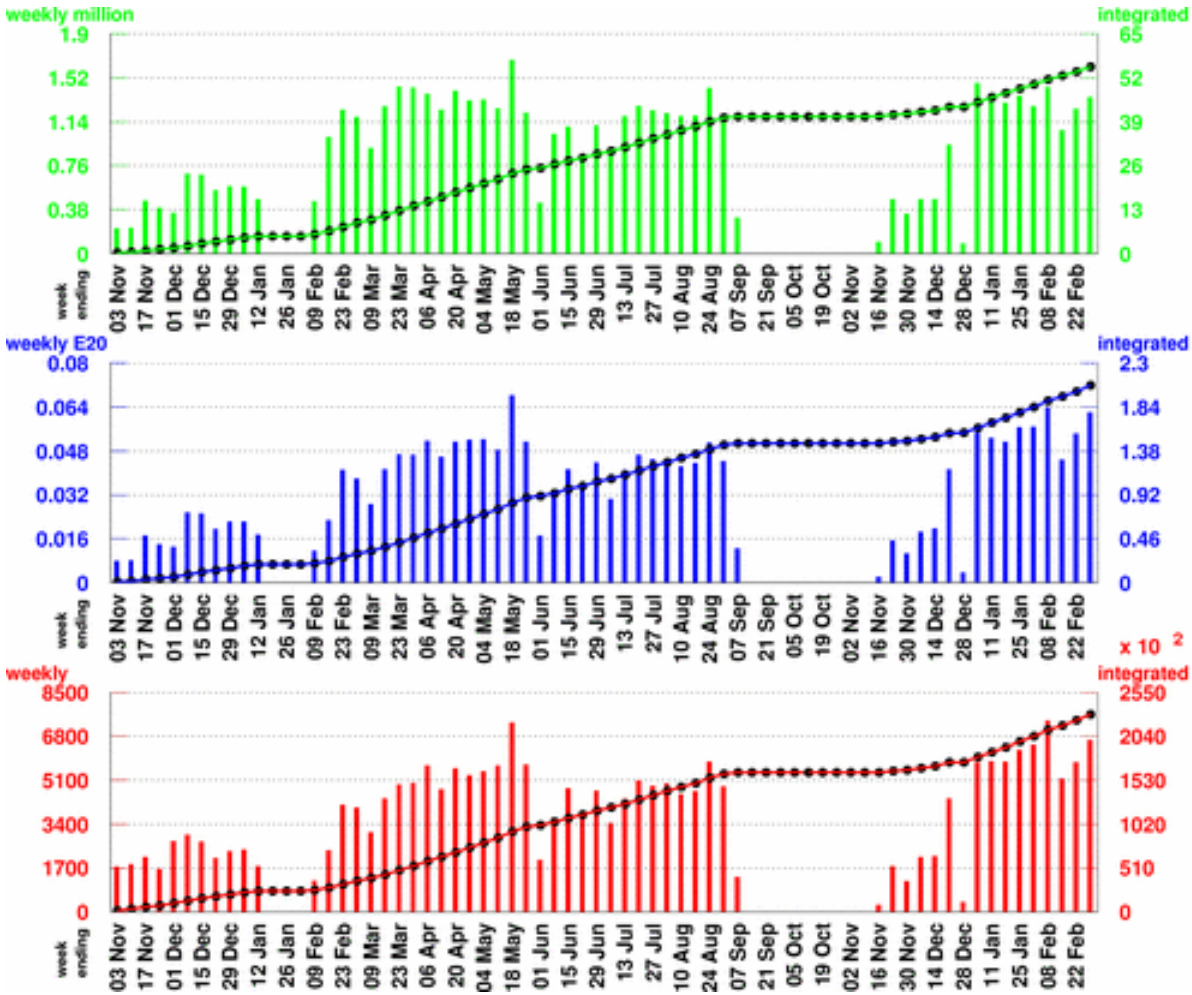
- CD3 for Construction

- Projects progressing well
  - Targetting Summer 2005 Shutdown for all subsystems

BTeV

- Inclusion in 1st Category of Orbach Office of Science 20 yr Facilities Report
- Recommendation of approval from P5
  - Strong endorsement of the physics
  - Recommended aggressive approach
- Directors' 1st CD1 Review in Fall 2003
- Discussions with HEP Program Office
- CD0 Approval of Mission need, February 2004
- Staffing of Project Office, Winter 2004
- Directors' reviews of IR, Outfitting, Overall Project, Spring 2004
- 1st Lehman Review (CD1+ ??), April 2004
- Construction start in 2005?

MiniBooNE



Number of Horn Pulses

To date: 55.28 million

Largest week: 1.67 million

Latest week: 1.35 million

Number of Protons on Target

To date: 2.0673 E20

Largest week: 0.0682 E20

Latest week: 0.0621 E20

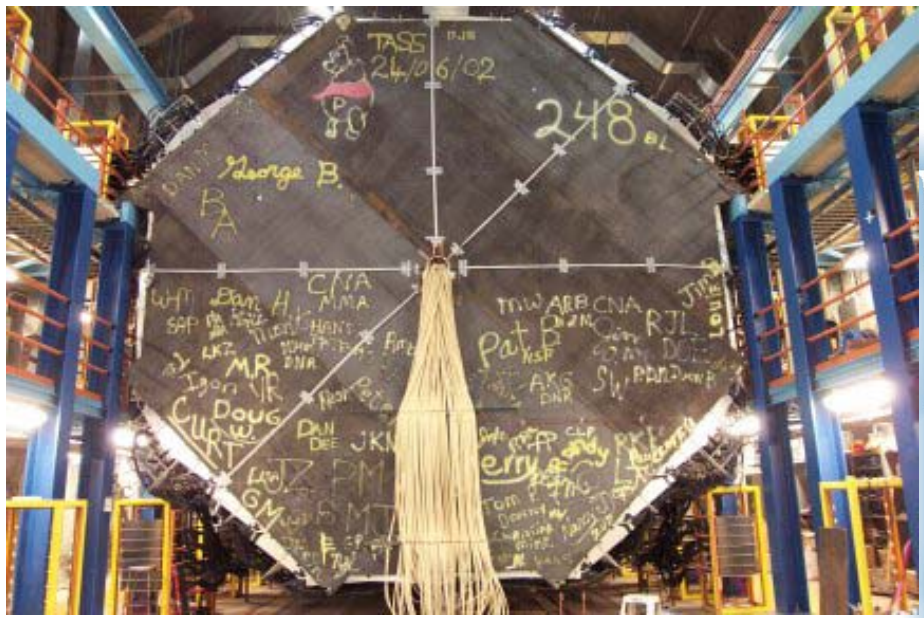
Number of Neutrino Events

To date: 229334

Largest week: 7402

Latest week: 6656

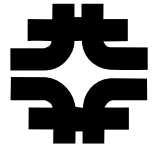
NuMI/MINOS Project



NuMI-MINOS

- Sensitive in the "Atmospheric Region"
- Long Baseline experiment with Near and Far Detectors
- Uses 120 GeV Protons from Main Injector

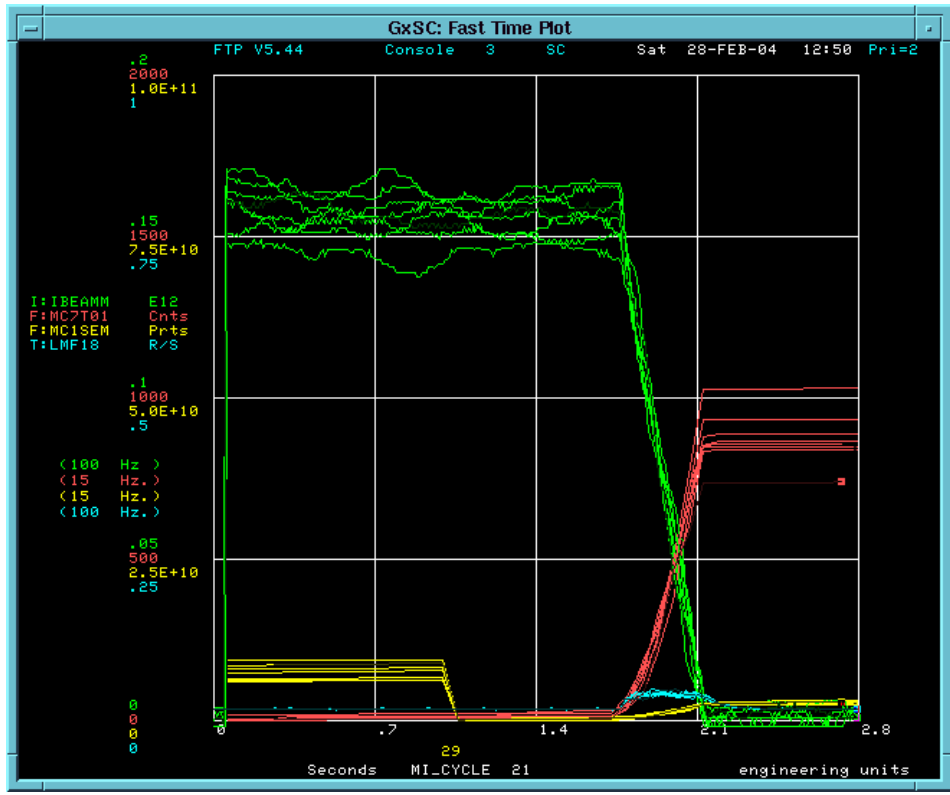
NuMI/MINOS Project



- MINOS far detector installed and operating
  - Only large underground detector with magnetic field
- Cosmic ray data taking
  - few dozen upward going atmospheric neutrino candidates
- CalDet
  - three year program successfully collected beam data at CERN
  - absolute and relative calibrations of the Far and Near detectors
- MINOS Near Detector
  - preassembled and are awaiting installation starting soon
  - 9 scintillator planes (of 282 planes) fully instrumented/powered,
  - cosmic ray muon events traversing the 9-planes read out
  - use the actual MINOS DAQ system.

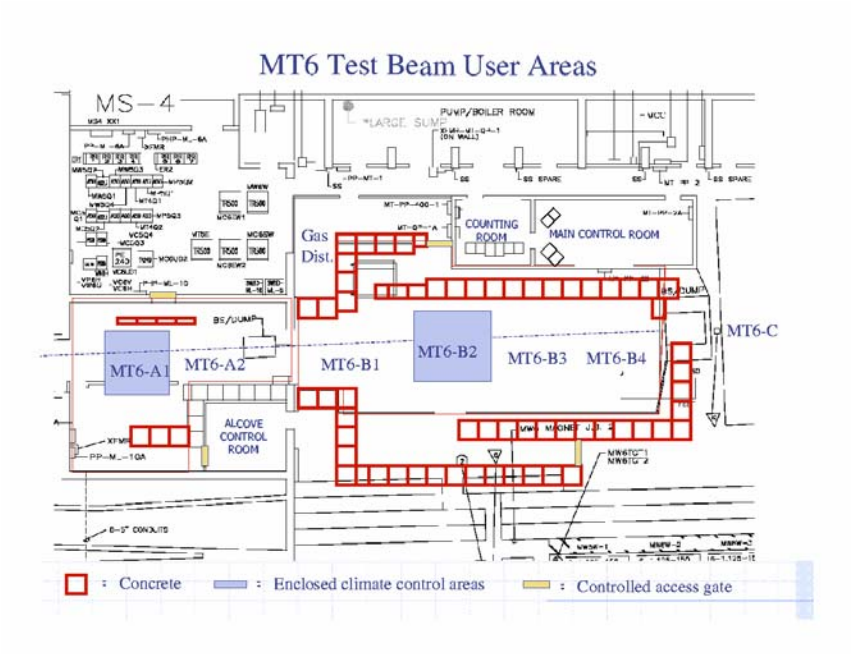
Main Injector: Fixed Target (SY120)

- MI to MIPP
  - 120 GeV protons
  - slow spill – 400 msec
  - M-Center beam line
  - secondary beam line
    - 40GeV/c



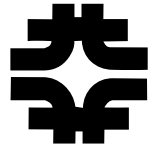
Main Injector Test Beam

- **Status**
  - Fast Spill RICE(926 (Radio Ice Cerenkov Experiment) has data
  - T930 (BTeV straw detector) has begun commissioning
  - Both fast extraction and slow spill extraction (400 msec) on a daily basis
  - Tuning begun for momenta other than 120 GeV (60 GeV)
  - Several tests with MOUs



http://www-ppd.fnal.gov/mtbfw/Meetings/mtbf_meetings.htm

Particle Astrophysics

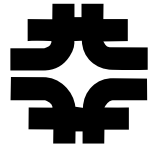


- **Strong astrophysics program**
  (FNAL was the pioneer among HEP labs)
  - **Dark Matter (SDSS, CDMS, Collider SUSY searches)**
  - **Dark Energy (JDEM nascent)**
  - **Ultra high energy cosmic rays (Auger)**

»

- **New initiatives**
  - **SDSS Program considering an extension.**
  - **Fermilab Technical Expertise significant (Focal Plane Arrays)**
  - **To list above, add CTIO/DECAM and LSST**
  - **PAC augmented to handle the discussion.**

Linear Collider Physics & Detector R&D

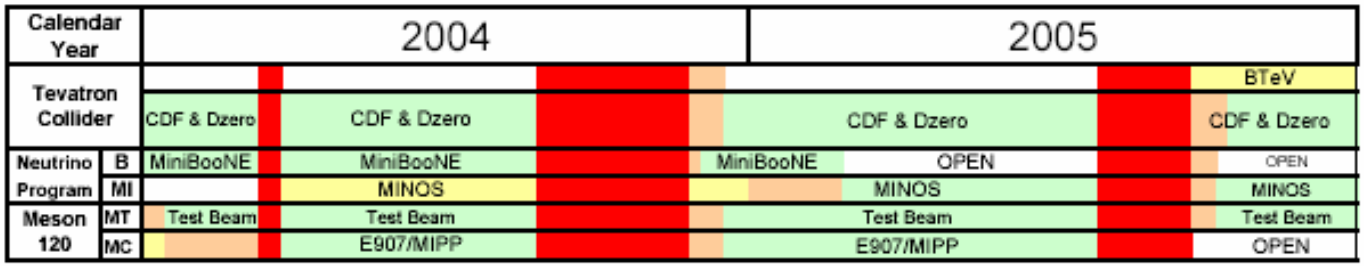


- **Established Tkaczyk & Fisk as leaders**
- **Increased FNAL participation in R&D**
  - Concentrated on collaboration with University partners
  - Muon System with Northern Illinois, Wayne State
  - Calorimetry in collaboration with NIU, ANL
  - Silicon Tracking
  - ASIC design
  - Mechanical Engineering
- **Test Beam**
  - Significant interest from CALICE (digital Tile Calorimeter) collaboration

Schedule

2004-5 Fermilab Accelerator Experiments Schedule

This Schedule will be updated regularly, as plans change.



Shutdown for M&D and CDF COT work, beginning March 15, 2004.
Summer 04 Shutdown is scheduled to begin on August 23, and is planned to last a nominal 13 weeks.
The length of the shutdown is driven by installation of electron cooling in the Recycler Ring.
The major 2005 shutdown is scheduled for the last 8 weeks of FY05.

This draft schedule will be updated as more precise information is made available.

Additional shutdown periods will be added, typically allowing 38-40 weeks of scheduled accelerator operation per year.

RUN or DATA

STARTUP/COMMISSIONING

INSTALLATION

M&D (SHUTDOWN)

4 March, 2004

Schedule

Draft 2006-9 Fermilab Accelerator Experiments Schedule

Revised Annually - This Version from March, 2004.

Calendar Year		2006	2007	2008	2009	
Tevatron Collider		BTeV / CDF & D0	BTeV / CDF & D0	BTeV / CDF & D0	BTeV / CDF & D0	BTeV / Open
Neutrino Program	B	OPEN	OPEN	OPEN	OPEN	OPEN
	NI	MINOS	MINOS	MINOS	MINOS / OPEN	OPEN
Meson 120	MT	TestBeam	TestBeam	TestBeam	TestBeam	TB
	MC	OPEN	OPEN	E906#	E906#	E906#
	MI	OPEN	OPEN	OPEN	E921*	E921*

This draft schedule is meant to show the general outline of the Fermilab accelerator experiments schedule.

Major components include:

Minimum of 6-8 week shutdown each summer, ~12 weeks estimated for Tevatron in 2009 for C0 IR installation.

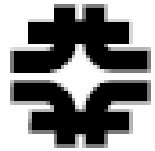
Further action is required to establish scheduling of E906.

* Formerly CKM; approach being reconsidered.

Additional shutdown periods will be added, typically allowing 30-40 weeks of accelerator operation per year.

- RUN or DATA
- STARTUP/COMMISSIONING
- INSTALLATION
- M&D (SHUTDOWN)

Major Goals for '04 Shutdown



- Run II

  Electron Cooling – civil construction and installation of beamline components
  Tevatron Alignment – continuing improvements
  Separators – add/move for helix improvement

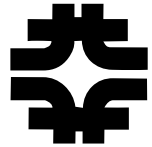
- NuMI

  Kicker – installation
  Instrumentation – installation
  Magnets – final hookup and polarity tests
  Vacuum – final hookups

- Experiments

  CDF and DZero – Upgrade installations

Summary

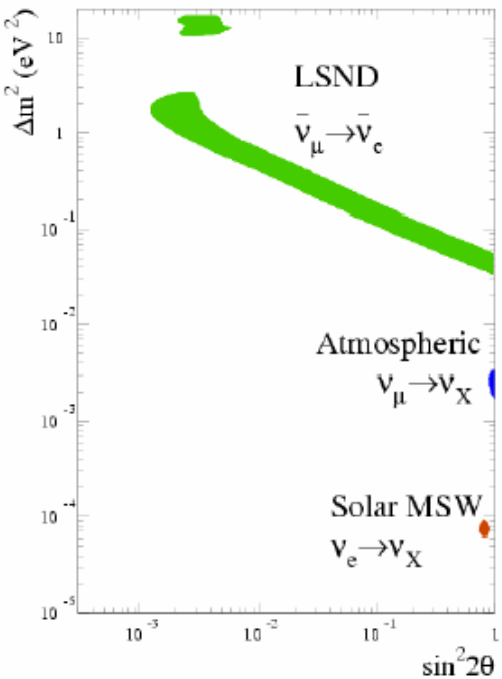


- **Collider Run II**
  - Detectors are operating well
  - Physics analysis is a big deal
- **Neutrino operations established**
  - MiniBooNE operating well
  - NuMI - MINOS Operations in 2005 on track
- **CMS (hampered by funding)**
  - Construction is proceeding
  - Maintenance & operations being established
  - Computing & Software going well
  - Physics and Analysis Center – increased activities
- **Result of the Week**

  http://www.fnal.gov/pub/today/resultoftheweek/index.html
- **Series of DOE Reviews, Accelerator, Operations and Program, all went well.**

Neutrino Oscillations

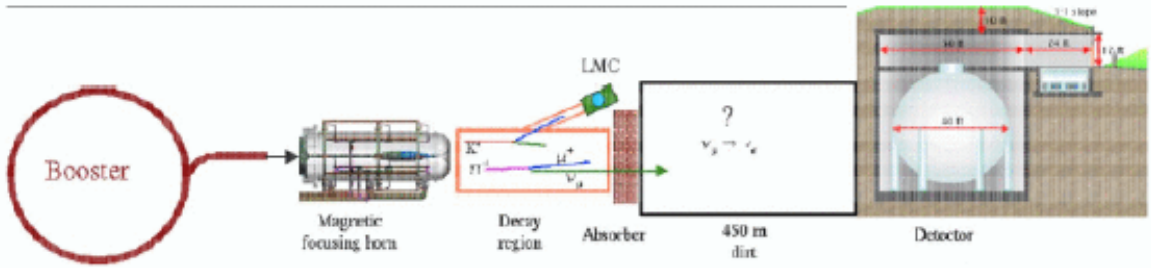
Current State of Neutrino Oscillation Evidence



Expt.	Type	Δm^2 (eV^2)	sin$^2 2\theta$
LSND	$\bar{\nu}_\mu \rightarrow \bar{\nu}_e$	~1	~3×10^{-3}
Atm.	$\nu_\mu \rightarrow \nu_\tau$	~2×10^{-3}	~1
Solar	$\nu_e \rightarrow \nu_{\mu,\tau}$	~7×10^{-5}	~0.8

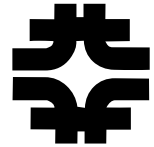
MiniBooNE

MiniBooNE - A Definitive Test of the LSND Evidence for ν Oscillations



- Booster - 8 GeV proton beam (5 x 10^{20} POT/y)
- Target - 71 cm Be
- Horn - 5 Hz, 170 kA, 143 μs, 2.5 kV, 10^{8} pulses/y
- Decay Pipe - 50 m (adjustable to 25 m)
- Neutrino Distance - ~ 0.5 km
- $\langle E_\nu \rangle \sim 1$ GeV
- $(\nu_e / \nu_\mu) \sim 3 \times 10^{-3}$
- Detector - 40' diameter spherical tank
- Mass - 800 (450) tons of mineral oil
- PMTs - 1280 detector + 240 veto, 8" diameter

MIPP



- MIPP is logging data
  - beam chambers, and
  - 1st 4 drift chambers
  - RICH and Calorimeters
  - TPC soon
- Commissioning the experiment
- Beam tuning
  - beam intensities ~30,000 per slow spill.
    - on the T01 counter (2” square) next to TPC