

# Welcome, Background, and Presentation of Charge

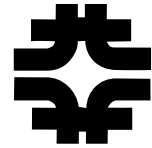
Steve Holmes

Accelerator Advisory Committee Meeting  
([http://www.fnal.gov/directorate/Fermilab\\_AAC\\_mtgs.htm](http://www.fnal.gov/directorate/Fermilab_AAC_mtgs.htm))

February 3-4, 2009

# Update Since May Meeting

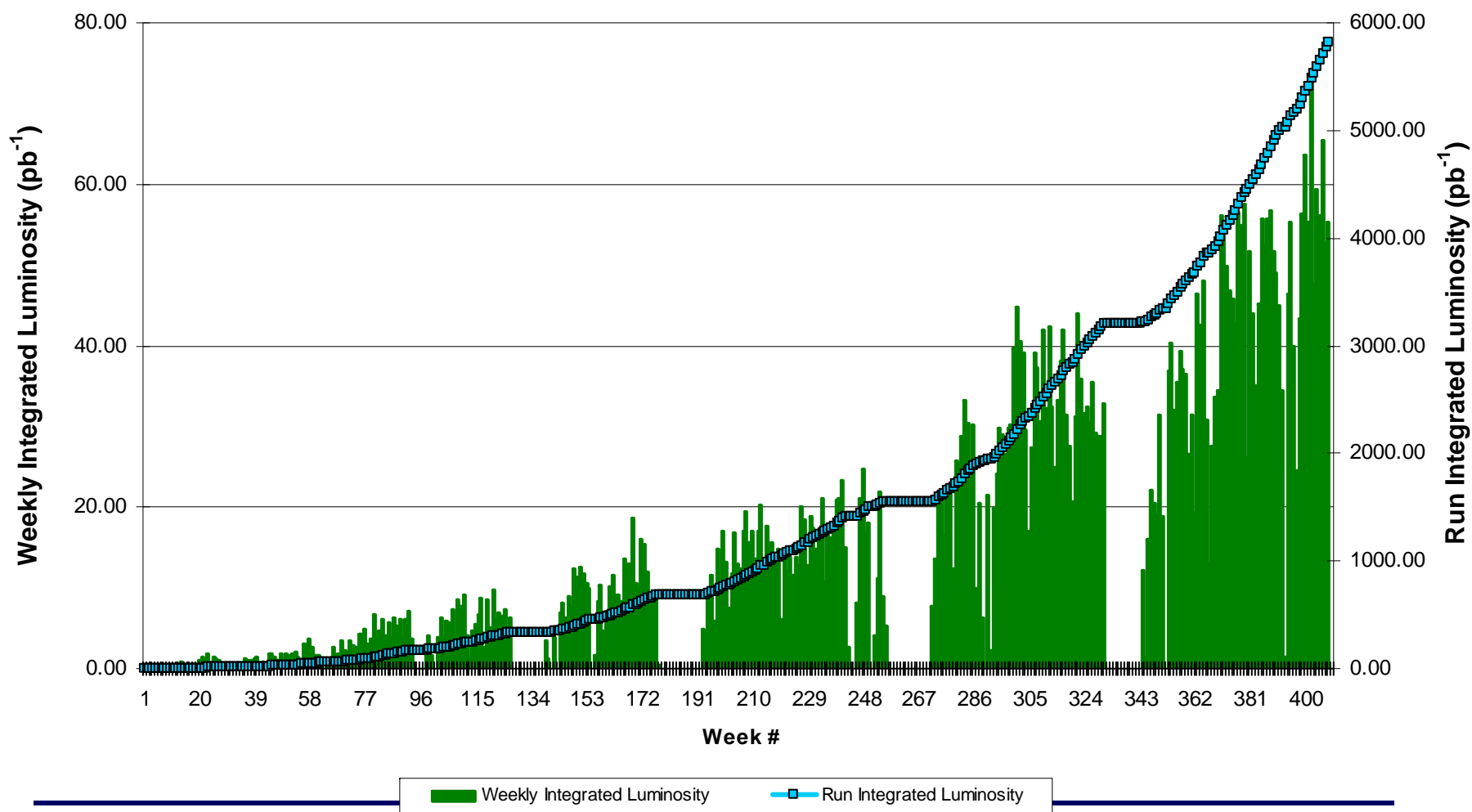
## Run II



- Continuous operations since May 2008 meeting with exception of one week shutdown in October
  - Realignment of B0 interaction region to remove aperture restriction resulted in significant performance improvement
- Records:
  - Antiproton stacking rate:  $28.6 \times 10^{10}$ /hour
  - Initial luminosity:  $3.61 \times 10^{32}$
  - Monthly luminosity (December):  $0.26 \text{ fb}^{-1}$
- $1.9 \text{ fb}^{-1}$  delivered to CDF and D0 since May 2008 meeting
  - $5.8 \text{ fb}^{-1}$  delivered Run II to date
- **The current expectation is that operations will continue through 9/30/10**
  - Last shutdown scheduled for summer 2009
  - Most likely integrated luminosity through FY2010:  $8 - 8.5 \text{ fb}^{-1}$

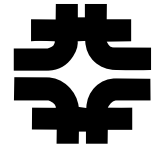
# Update Since May Meeting

## Integrated Luminosity (through 1/25/09)



# Update Since May Meeting

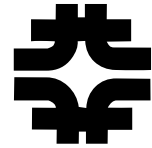
## Neutrinos



- $1.7 \times 10^{20}$  protons to NuMI since May 2008 meeting
  - $6.4 \times 10^{20}$  protons to NuMI to date
  - Horn 2 failure required 4 weeks for replacement
  - Typical operations at 260 kW simultaneous with antiproton production
    - Design goal is 320 kW
    - Limited by losses during injection
      - “Gap-clearing kicker” under construction for mitigation
- $1.8 \times 10^{20}$  protons to Booster Neutrino Beam (8 GeV) since May 2008

# Update Since May Meeting

## LHC

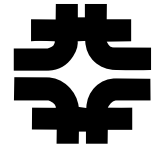


- U.S. contribution to the LHC Accelerator Upgrade (Phase 1)
  - Accelerator Project for Upgrade of LHC (APUL) formally established
    - CD-0 issued in October 2008
  - Fermilab designated host laboratory
  - Peter Wanderer (BNL) named Project Manager
  - Conceptual Design Report for U.S. contribution under development
- LARP continues to support commissioning and development of technologies for future upgrades
  - Successful testing of 1m Nb<sub>3</sub>Sn magnets; 4 m scheduled for 2009
  - Support for LHC hardware commissioning, preparations for beam commissioning
  - New LARP Leader: Eric Prebys
- Fermilab is contributing significant assistance to CERN as they resolve issues in the LHC quench protection system

# Update Since May Meeting

## Accelerator R&D

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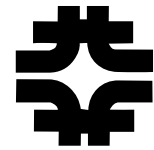


- DOE comprehensive review of all U.S. laboratory based programs in “Accelerator Science”, December 2008
  - Fermilab proposal included:
    - A0 photoinjector program
    - Muon program
    - Accelerator science within APC, including education and training programs
  - No formal report has yet been issued

# Update Since May Meeting

## Strategic Planning

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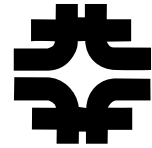


- P5 report delivered to, and accepted by, HEPAP:
    - Strong support for long baseline neutrino and flavor conversion initiatives
    - Strong support for proceeding with R&D on a multi-MW proton source (Project X) based on (mission need)
      - “A neutrino beam for long baseline neutrino oscillation experiments.”
      - “Kaon and muon based precision experiments exploiting 8 GeV protons from Fermilab’s Recycler, running simultaneously with the neutrino program.”
      - “A path toward a muon source for a possible future neutrino factory and, potentially, a muon collider at the Energy Frontier.”
    - Strong support for continued R&D on lepton collider including both ILC and “ alternative accelerator technologies, to permit an informed choice when the lepton collider energy is established.”
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# Strategic Planning

## Evolution of the Fermilab Complex

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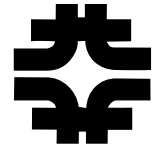


- Energy Frontier
  - Tevatron → ILC or Muon Collider as options for the Fermilab site
- Intensity Frontier
  - NuMI → NOvA → very long baseline/mu2e → multi-MW Proton Source
  - Initial stages supported by ANU (NOvA): 700 kW
- Project X, based on an 8 GeV superconducting linac, is the lynchpin of this strategy
  - Alignment with ILC technology development
  - Multi-MW beam capability when paired with Recycler and/or Main Injector
  - Potential stepping stone to muon storage ring based facilities



# Strategic Planning Project X

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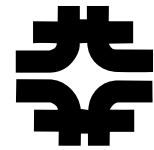


- Goals:
  - Complete R&D and establish project baseline (CD-2) by 2012
    - Referred to as the RD&D phase
    - Coordinate development with ILC/GDE and the Muon Collaborations
  - Construct over time period ~2013~2017
- Design Criteria based on mission need established by P5
  - 2 MW of beam power over the range 60 – 120 GeV;
  - Simultaneous with at least 150 kW of beam power at 8 GeV;
  - Compatibility with future upgrades to 2-4 MW at 8 GeV Project X

# Strategic Planning

## Project X: Near Term Strategy

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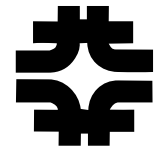


- Develop an Initial Configuration Document (ICD)
    - ⇒ Released 10/31: available at <http://projectx.fnal.gov/index.html>
  - Revise/update the current RD&D Plan
    - Will include consideration of alternative configurations
    - ⇒ To be finalized following input from this meeting
  - Create a preliminary cost range estimate
    - ⇒ Nearing completion; will be reviewed (internally) mid-March
  - Establish a multi-institutional collaboration for the RD&D phase and initiate design and R&D activities
    - “National project with international participation”
    - Coordination with GDE/ART on srf development
    - ⇒ Collaboration Meeting held November 21-22, 2008 at Fermilab; (final) draft MOU currently circulating for concurrence
  - CD-0 (establish mission need) in FY2009
    - Coordinated with very long baseline and mu2e CD-0's
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# Strategic Planning

## Muon Facilities

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- Goals:
    - Complete, with international partners, a Reference Design Report for a muon-storage-ring-based Neutrino Factory by ~2013
    - Complete, with national partners, of a feasibility study for a Muon Collider with a center of mass energy in excess of 1 TeV by ~2013
  - Proposal for 6-D ionization cooling demonstration (MANX) has been received
    - Could in principal be mounted either at Fermilab or at RAL
  - Strategy
    - 5-year proposal submitted to DOE in December covering above goals
    - Develop upgrade concept for the Project X linac aimed at 2-4 MW  
⇒ The ICD includes such a concept (up to 4 MW)
    - Develop a conceptual design for the NF/MC Proton Driver based on Project X linac and downstream accumulation/packaging ring(s).
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# Charge to the Committee



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- Review and comment on activities supporting the Fermilab strategic plan
    - Project X Initial Configuration and accompanying RD&D Plan
    - MANX, based on its role in the development of the Muon Collider or a muon-to-electron conversion experiment

# Charge to the Committee

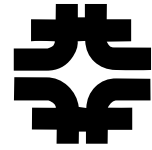


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The Fermilab Accelerator Advisory Committee is asked to look at several activities supporting the Fermilab strategic plan for the post-Tevatron era. The primary topics for review and discussion are:

# Charge to the Committee (cont.)

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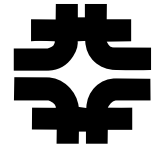
## Project X ICD and R&D Plan

The Committee is asked to review and offer comments/recommendations relative to the ICD and the accompanying Project X RD&D plan. In particular we request specific comments and recommendations in the following areas:

- Does the ICD describe a configuration that is likely to meet the proposed mission objectives?
- What are the primary technical risks associated with the ICD? Are these risks recognized and addressed effectively in the RD&D plan?
- Is the RD&D plan appropriately integrated with the ILC, SRF, HINS, and Muon programs?

More generally, we would be happy to receive comments and suggestions from the AAC on how the initial configuration and associated RD&D program could be strengthened.

# Charge to the Committee (cont.)



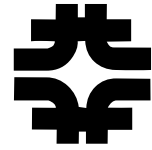
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## Muon 6-D Cooling Development

The Committee is asked to review and offer comments/recommendations relative to the MANX proposal both within the context of the Muon five year proposal and possible upgrades to the mu2e experiment. More specifically we would like the Committee to comment on:

- If successfully executed does the MANX proposal provide a validation of 6-D ionization cooling, based on requirements for a Muon Collider? What does the Committee view as the optimum mix of simulations and experimental demonstration required to provide such validations?
- If successfully executed does the MANX proposal provide a validation of an upgrade of the mu2e experiment based on a collection scheme that reduces “flash” deadtime and the use of the ionization-cooling energy-absorber to range out hadronic backgrounds? What does the Committee view as the optimum mix of simulations and experimental demonstration required to provide such validations?

# Charge to the Committee (cont.)



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- What are the primary technical risks within the MANX proposal and are they appropriately mitigated through the development period?
  - Given the anticipated timelines within the Muon five year proposal and the mu2e development plan, what is the appropriate schedule for implementation of MANX, either at Fermilab or at RAL?
  - Do the MANX resource requirements appear reasonably estimated?
  - Can the MANX approach to a mu2e upgrade impact the outlook for Project X?

## Fine Print

As usual the committee is invited to issue comments or suggestions on any aspect of the programs discussed beyond those specifically included in this charge. It is requested that a concise report responsive to this charge be forwarded to the Fermilab Director by April 1, 2009. Thank you.