

Fermilab Accelerator Advisory Committee
February 3-5, 2009

Charge (Draft Rev. 2)

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:

1. Project X ICD and R&D Plan

An Initial Configuration Document (ICD) has been developed and released for Project X (see <http://projectx.fnal.gov>). The ICD is based on specific mission objectives that are expected to form the basis for the establishment of a mission need for Project X (CD-0 in the Department of Energy system). The purpose of the ICD is to provide the basis for a preliminary cost range estimate for Project X (required for CD-0), for the refinement of the Research, Design, and Development (RD&D) plan developed early in 2008, and to establish a starting point for consideration of design alternatives.

The Project X RD&D effort is aimed at supporting all activities required to complete a technical, cost, and schedule baseline (CD-2 in the language of DOE) by the end of 2012. The RD&D plan is integrated with R&D programs running in parallel on ILC, SRF Infrastructure, High Intensity Neutrino Source (HINS), and Muon-based Facilities.

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.

2. Muon 6-D Cooling Development

A proposal for experimental demonstration of six-dimensional ionization cooling in a Helical Solenoid (HS) version of a Helical Cooling Channel (known as MANX) has been received by Fermilab. This proposal goes beyond the scope of the Muon Ionization Cooling Experiment (MICE) being mounted at RAL, in particular by aiming to demonstrate cooling techniques that would be applicable to muon colliders, neutrino factories, and stopping muon beams. The MANX HS design also serves as a prototype for a stopping muon beam system for an upgrade to the mu2e experiment that could benefit from 1 MW of Project-X beam power.

In parallel, two related developments are in place: First, the Neutrino Factory and Muon Collider Collaboration (NFMCC) and the Muon Collider Task Force (MCTF) have jointly prepared and submitted to the DOE a five year proposal for the U.S. muon program with primary goals of: 1) contributing to the International Design Study for a Neutrino Factory currently being pursued by an international collaboration; and 2) completing a first feasibility study for a Muon Collider operating at an energy above 1 TeV with a luminosity of order $10^{34} \text{ cm}^{-2}\text{sec}^{-1}$. It is anticipated that the DOE will conduct a formal review of this proposal sometime over the next six months. Second, the laboratory has received a proposal to mount an experiment to search for muon to electron (mu2e) conversions at unprecedented sensitivity utilizing the existing Booster and Antiproton Source.

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?
- 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?

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.