Director's Independent Conceptual Design Review of the Muon g-2 Project June 5-7, 2013

Charge

The Committee is to conduct a Director's Review of the Muon g-2 Project. This review is an Independent Design Review (IDR) of the Project's conceptual Design. The Muon g-2 Project received CD-0 on September 18, 2012. Muon g-2 anticipates receiving DOE Critical Decision 1 (CD-1) "Approve Alternative Selection & Cost Range" late summer of 2013.

The Muon g-2 Project will construct a next generation experiment to measure the anomalous magnetic moment of the muon to an unprecedented level of precision, reducing the experimental error by a factor of 4 or 5 relative to the Brookhaven Muon g-2 experiment, E821. If the anomaly measured at BNL persists, this reduction in the experimental error will push the difference with theory to > 5 sigma, a clear signal of new physics. The Muon g-2 Project will reuse the storage ring and much associated equipment along with beam elements from the Brookhaven experiment. The reassembly of the g-2 equipment in the new Muon Campus area being developed at Fermilab will begin in January 2014. Reassembly of the device requires careful attention to detail in order to produce the sub-ppm magnetic field uniformity required for the experiment. Beyond reassembly of the experiment, a number of upgrades are planned to enhance the injection efficiency into the storage ring, operate at higher repetition rates, and better control systematics. Upgraded subsystems include electromagnetic kickers, electrostatic quadrupoles, field-monitoring NMR subsystems, and possibly a new superconducting inflector. New particle detectors based on PbF2 calorimetry and in vacuo straw trackers will be constructed for the experiment. Beyond the storage ring and associated subsystems, the project will include modifications to portions of the anti-proton source to deliver a customized muon beam. The project also depends on elements provided by the Muon Campus AIP and GPP initiatives that are common to Muon g-2 and Mu2e needs.

The Independent Conceptual Design Review is to verify that Muon g-2's design is technically adequate and should achieve the Project's scientific goals. To meet the requirements for CD-1 the design has to be at the conceptual level or greater. The committee will make their assessment based on Muon g-2's Conceptual Design Report (CDR), drawings, specifications, and discussions with the project team.

The committee is to assess the progress of the Muon g-2 in their preparations to meet the CD-1 requirements of DOE O 413.3B. To meet CD-1 readiness Muon g-2's conceptual design needs to be sound and achievable. The review committee is asked to address the following questions to assess the Project's progress:

1. Are the science goals and physics requirements clearly stated and documented? Have the science goals and physics requirements been adequately translated into technical performance requirements and specifications?

2. Is the design technically adequate? Is the design likely to meet the technical requirements needed to carry out the scientific goals?
3. Can the design be constructed, inspected, tested, installed, operated and maintained in a satisfactory way?
4. Is there adequate supporting documentation to support the conceptual design and the transition to developing the preliminary design?
5. Are the risks (on technical, cost, and schedule basis) of the selected base design approach and alternatives understood and are appropriate steps being taken to manage and mitigate these risks? Have areas been identified where value engineering should be done? If value engineering has been performed is it documented?
6. Are the project organization and lines of responsibility clearly defined and sufficient to ensure the successful engineering and design of the project? Are the design interfaces between the Accelerator Systems, Experimental Facilities, and Conventional Facilities groups understood and well enough defined to ensure a coordinated effort and an integrated design, including the Muon Campus AIPs/GGPs? Is there a reasonable plan in place for implementing configuration management to ensure changes to the technical requirements/specifications are controlled and communicated to all affected groups?

Finally, the committee should present findings, comments, recommendations, and answers to the above questions at a closeout meeting with Muon g-2 and Fermilab's management. A written report will be provided within two weeks after the review.

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