

**Director's Critical Decision 1 (CD-1) Review
of the
LHC CMS Detector Upgrade Project
July 16-18, 2013**

Charge

The Committee is to conduct a Director's CD-1 Review of the LHC Compact Muon Solenoid (CMS) Detector Upgrade Project to assess if the project meets the Critical Decision 1 (CD-1) "Approve Alternative Selection & Cost Range" CD-1 requirements as specified in DOE O 413.3B. The LHC CMS Detector Upgrade Project received CD-0 on September 18, 2012. The Project is scheduled for a DOE Critical Decision 1 (CD-1) Review on August 26-27, 2013.

The LHC CMS Detector Upgrade Project is the design and construction of upgrades to the Hadron Calorimeter, the Silicon Pixel detector, and the Level 1 Trigger subsystems of the CMS detector at CERN. The LHC, running at 8 TeV center of mass energy, has nearly reached its design luminosity. It is expected that with planned upgrades, it will exceed the original design by a factor of at least two. CMS was not designed to run efficiently at the luminosity now projected for the next several years. With these upgrades, the detailed study of the properties of the new boson and the search for new physics that should be associated with it can take full advantage of the excellent performance of the LHC and resolve many of the open questions in electroweak physics.

The Committee's main focus is the review of the Project's CD-1 readiness and will focus on the project's cost, schedule, management, risks, and ESH&Q. The project will present a Cost Range that the committee is to assess and determine if it is appropriate based on the following factors: the scope of work; the maturity of the design; the Basis of Estimate (BOE); and the risks associated with the scope of work. The team will also look at the WBS – Work Breakdown Structure, WBS Dictionary, BOE – Basis of Estimate documentation, risk and contingency analyses, RLS – Resource Loaded Schedule, and time phased funding and cost profiles. The committee is asked to review each of these items, for quality, completeness, and accuracy. Furthermore, the committee is asked to review and assess the quality of and comment on the additional formal project management documentation required for CD-1 approval.

A Director's Independent Conceptual Design was conducted on May 14-16, 2013, found that the designs are well advanced and should provide a good basis for establishing the cost and schedule range and are a good foundation for proceeding to DOE CD-1. There were a few recommendations resulting from this review. Additionally, a Director's Cost and Schedule Assessment was performed on May 15-16, 2013. The assessment focused on the state of the Project's cost estimate, schedule, and risk development as they prepared for a CD-1 review. The assessment resulted in several recommendations. The Committee is to assess the Project's progress on addressing the recommendations from these prior Reviews and Assessments.

In performance of a general assessment of progress, current status, and the identification of potential issues, the committee is asked to address the questions in Attachment 1 to assess the Project's progress. Finally, the committee should present findings, comments, recommendations, and answers to the charge questions at a closeout meeting with LHC CMS Detector Upgrade Project and Fermilab's management. A written report will be provided within two weeks after the review.

Mike Lindgren, Head, PPD; Line Manager, US CMS

Attachment 1

CD-1 Readiness Review Charge Questions

1. Has the Project developed a quality resource loaded schedule that includes the entire project's scope of work and is it achievable?
2. Are the estimated cost and proposed schedule ranges realistic, consistent with the technical and budgetary objectives, and justified by the supporting documentation? Has all the work been appropriately identified, estimated and scheduled, including the work associated with performing the preliminary design, final design and value engineering activities?
3. Has the Project implemented a Risk Management Process by identifying risks, performing a risk assessment and started developing mitigation plans at an appropriate level for the CD-1 stage?
4. Is the Project Team adequately staffed and does it possess adequate experience to successfully carry out the Project?
5. Is the current staffing level adequate to complete the work to achieve CD-2? If not, has the appropriate staffing level been identified in the schedule and has a staffing plan been developed to acquire the future staffing needs?
6. Are ESH&Q aspects being properly addressed given the project's current stage of development?
7. Are the draft Key Performance Parameters (KPPs) achievable based on the design, cost range and schedule range presented?
8. Is the scope of work clearly defined between what is funded by DOE or NSF, and is this reflected in the cost, schedule and risk assessment presented to the committee?
9. Has the relationship been clearly defined between the LHC CMS Detector Upgrade Project and International CMS at CERN?
10. Has the project acceptably addressed the relative recommendations from the Director's Independent Conceptual Design conducted on May 14-16, 2013 and the Director's Cost and the Schedule Assessment performed on May 15-16, 2013?
11. Is the documentation required by DOE O 413.3B and Fermilab's Project Management System in order and is the Project ready for a DOE CD-1 review scheduled for August 26-27, 2013?