

## Executive Summary

The Division of High Energy Physics requested that a baseline readiness review for the Run IIb upgrades of the CDF and D-Zero experiments be conducted September 24-26, 2002 at Fermi National Accelerator Laboratory. The purpose of the review was to assess the readiness of the projects to establish technical, cost, schedule and management baselines, which are needed for Critical Decision 2 (Approval of Performance Baseline) and Critical Decision 3 (Approve Start of Construction). The committee was asked to address the following specific items:

1. Is the proposed schedule reasonable and appropriate in light of the technical tasks required, addressing timing, funding and resources?
2. Is the cost estimate credible, and in sufficient detail to evaluate the contingency?
3. Have the major technical, schedule and cost risks been adequately identified and assessed and is the contingency adequate for the risk?
4. Is the management structure adequate and appropriate?
5. What is the status of the documentation required to support CD 2 and CD 3?

The detailed charge letter is in the Appendix of this report.

Run IIb of the Tevatron will occur after the current Run IIa, which should last four years. Portions of the CDF and D-Zero detectors will need to be replaced or improved for Run IIb. The projects consist of the replacement of the current silicon vertex detectors, upgrades to a number of the trigger subsystems and other electronics changes. The readout of the silicon utilizes a newly developed improvement of the SVX chips currently used by both CDF and D-Zero. This version, SVX4, will be implemented in submicron silicon technology, which is radiation hardened. Most of the required components have been successfully prototyped, including the SVX4 chip, hybrid, and sensors. The collaborations are ready to proceed with the major procurement of silicon sensors.

Specific to CDF, the Run IIa Central Preshower Detector is the last gas-based portion of the calorimetry at CDF that can be accessed for replacement. It will not be able to operate at the rate expected for Run IIb. Its primary purpose is to improve electron identification. The replacement is scintillator tile based with multianode photomultiplier readout. The Electromagnetic Calorimeter readout will be modified to add timing information that allows the rejection of cosmic ray and beam halo backgrounds. The higher luminosity of Run IIb will result in higher occupancies that the trigger must handle. It will be necessary to make the trigger more selective. Several upgrades of the trigger and data acquisition are planned.

Specific to D-Zero, The bandwidth through the trigger and data acquisition system will not be changed, so it is necessary to be more selective. The silicon track trigger must be modified to accommodate the new geometry of the silicon vertex detector. The calorimeter trigger upgrade will add digital filtering of the inputs and a new clustering algorithm. The Level 1 track trigger will use narrower tracker roads by using single fiber hits rather than pairing adjacent fibers. This requires the replacement of the FPGA in the track trigger by larger one capable of processing more combinations. The data

acquisition system and online upgrade will give a factor of seven increase in processing power.

The Committee concluded that the upgrades are technically ready to be baselined.

The Committee reviewed the cost estimate detail and concluded that the base cost estimates for Silicon were slightly low. However, the Committee was of the opinion that the contingencies assessed against the base costs are too high for the observed risks. The Committee recommended that Fermilab consider re-evaluation of the base costs and the contingency costs based on the comments provided by the Committee in this report.

There are three tiers of milestones established for this project:

- The Project Manager's Milestones - no explicit slack.
- The Director's/DOE Project Manager's Level 2 Milestones - modest contingency.
- The DOE Level 1 Milestones - additional added contingency.

The projects plan to be managed to the Project Manager's Milestones, which the committee concluded were very aggressive. The committee noted that the schedule contingency contained in the Level 1 and 2 milestones appears to be more than adequate to complete the project by the Level 0 Critical Decision 4 Project Completion Date and recommended that Fermilab re-evaluate the schedule float based on the comments provided by the Committee.

An experienced project management team is in place. The collaboration seems to be committed to support the upgrade with manpower and in-kind contributions. The required project documentation to support CD 2 and 3 are essentially complete.

The overall judgment of the Committee is that the Run IIb CDF and D-Zero Detector Projects are mature and well-managed projects. Once the cost and schedule concerns have been addressed, the Committee sees no reason to delay the start of construction.