Report of the

Director's Review Committee

Director's Review

of CDF and D0

Run IIb Detector Upgrades

August 12-15, 2002

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2.3.4.1.Introduction

The findings, comments, and recommendations in this section are based on a less thorough review than had been planned when the review agenda was prepared. This is because the direction of the questions that arose to be addressed in the "technical breakout session," contained many aspects of a "cost/schedule" nature. Thus, it was determined by the Review Committee Chairman that having a separate "Balance of Committee" breakout session to discuss management and DOE documentation was not practical since the two Cost/Schedule Review SubCommittees would then miss the cost/schedule aspects of the "technical" breakout session.

Nonetheless, some findings, comments, and recommendations can be made.

2.3.4.2.Findings

2.3.4.2.1. D0 has an organization with managers named to Level 3 of the Workbreakdown Structure (WBS), while CDF has managers named only to Level 2 of the WBS.

2.3.4.2.2. The Silicon subprojects for each project are by far the largest cost component. They also define the critical path for each project. The operations at SiDet will need to run in a smooth "factory-like" manner in order to meet the planned project schedules. This espcially holds true since a third large effort (and a fourth smaller effort will be underway at SiDet coincidentally with these projects. A study titles "A Review of the Manpower Requirements at the Silicon Detector Facility for the Run IIb and CMS," notes there will be a need to increase staffing at SiDet.

2.3.4.2.3. The SVX4 chips are a crucial item for both detectors.

2.3.4.2.4. Project and Procurement staff have been working together and discussing preliminary plans for procurement support to the project.

2.3.4.2.5. The Silicon Subproject Teams said working meetings or reviews are held prior to placing major orders.

2.3.4.2.6. The two silicon projects together created a comparison document including a cost and manpower comparison.

2.3.4.2.7. An Acquisition Execution Plan draft that is well along has been prepared by a group led by the DOE Project Manager and comprised of DOE Procurement staff and Fermilab project and procurement staff.

2.3.4.2.8. A draft of the Project Execution Plan has been prepared by the DOE Project Manager.

2.3.4.2.9. Rough drafts of the Project Management Plans for each project have been prepared by the CDF and D0 Project Managers.

2.3.4.3.Comments

2.3.4.3.1. As noted in other sections of this report, in several areas in the cost/schedule arena the D0 documentation and "command" of various aspects of the project seemed much better than that of CDF. This is perhaps largely due to the deeper level of current staffing on the D0 project than on the CDF project. Current staff on both projects seems quite capable and highly dedicated, so the above comment is not a criticism of current CDF staff.

2.3.4.3.2. A great deal of planning will be required to make the SiDet operations run as efficiently and smoothly as required. This will include …….

2.3.4.3.3. Because of the crucial nature of the SVX4 chips, it is suggested that an MOU be developed with LBL on this topic. Furthermore, since timely completion of the Run IIb Detectors is critical to physics at FNAL in the second half of the decade, specific discussions between the Fermilab and LBL Directors on this topic might be appropirate to assure a high priority is given to this effort by LBL management.

2.3.4.3.4. Procurement must be a key part of the project and a key part of the project team.

2.3.4.3.5. A Production Readiness Review procedure is in use for the LHC detector projects.

2.3.4.3.6. The cost comparison for the silicon projects show a significant difference in labor hours for the projects.

2.3.4.3.7. The Acquisition Execution Plan has been reviewed and commented upon by DOE headquarters Program Office and Office of Science, Division of Construction Management Support. Their comments have been incorporated into subsequent drafts. This is good progress up the program chain of DOE Management.

2.3.4.3.8. The Acquisition Execution Plan has also been reviewed and commented upohn by the DOE Office of Engineering and Construction Management. There have been two cycles of such review. The OECM comments seem to be less appropriate for this kind of project which is performed by a single purpose laboratory and is of a highly specialized and technical nature than they might be for another kind of "acquisition".

2.3.4.3.9. The rough draft Project Management Plans do not yet incorporate the cost and schedule baselines presented at this review. Neither do the reflect the sets of schedule milestones and schedule change control thresholds presented in the review.

2.3.4.4.Recommendations

2.3.4.4.1. CDF should organize and staff the lower levels of the project as soon as possible. This should help in completing a significant amount of work involved in preparations for the Lehman Review. It will also demonstrate the commitment of the collaboration to the project.

2.3.4.4.2. D0 should continue to augment and grow the staff for their project and incorporate the new personnel into the team. These projects are under a much higher pressure to finish by a "date certain" than high energy physics have ever been before. In order to succeed here the project team must be assembled and made into a well-oiled machine in a timely manner.

2.3.4.4.3. A Silicon Production and Staffing plan should be prepared by each project. A Staffing Management Plan addressing how the Projects and Lab will take actions which describe how and when human resources will be brought onto and taken off of the project as required to meet the projects' time constraints These plans should be reviewed and concurred in by the Head of the Particle Physics Division (and the Associate Director of Research).

2.3.4.4.4. Project and laboratory management should focus a high level of attention to the SVX4 chips.

2.3.4.4.5. The project organization charts need to show the relationship with procurement. Also, a description of what the relationship is should be contained in the PMP.

2.3.4.4.6. Pre-production and Production Readiness Reviews need to be established and schedule to for transitions between the phases of prototype to pre-production and pre-production to production. These are formal reviews to verify the requirements/specifications have been meet and a quality product has been produced. The review will validate that the manufacture of the product is capable of producing a quality product, in the quantity required, at the approved cost and can deliver per the schedule.

2.3.4.4.7. The labor differences for silicon must be understood and explained before the Lehman Review.

2.3.4.4.8. The Fermilab Project Manager's should support the DOE Project Manager in gaining approval of the Acquisition Execution Plan.

2.3.4.4.9. The Fermilab Project Manager's should complete of the Project Management Plans prior to the Lehman Review.

APPENDICES

A. Charge to the Review Committee

Charge for the Director's Baseline Review Committee for the Run IIb Detector Upgrades
August 12-15, 2002 (Rev1)

The CDF and D0 collaborations are preparing to start upgrade projects that will make it possible for the experiments to continue operating at higher and higher luminosities through 2008. The systems needing the most attention for higher-luminosity running are the silicon detectors and the data-acquisition/trigger system. The collaborations have submitted Technical Design Reports (TDRs) for these and other required upgrades. The current schedule calls for installation of the new silicon and other detector components in 2005 or early 2006. For the success of the Tevatron Run II program, it is imperative that both the D0 and CDF upgrades be accomplished on this time scale.

This Director's Baseline Review Committee (BRC) has the primary goal of helping the the upgrade projects in their preparation to successfully complete a DOE Baseline Review. In this regard, the BRC should:

- Examine the scope of the proposed upgrades. Determine whether 1) the scope is appropriate for optimizing the research reach of the collider detectors, within the guidelines set forth by the Fermilab Directorate, in this time period and 2) the scope is well defined and understood by key participants. Assess the plans for carrying out the design, prototyping, fabrication, assembly and testing of the proposed upgrades.
- Assess the Total Project Cost estimate for the upgrades. Review and assess the detailed "basis of estimate" for the upgrades (both for the R&D components and the "on-project" components). Understand the risks involved in carrying out the projects and assess the cost contingencies that are being proposed.
- Assess the realism of the schedule and consistency of assumed funding profiles. Is there a detailed schedule, including a critical path, for completing the project? Are milestones appropriate in number and type identified so that both the project teams, Fermilab management, and DOE can effectively track and manage progress? Based on past experience, can the proposed schedules be met? Are appropriate schedule contingencies provided? Is there a "resource loaded schedule" and plan for providing the needed resources (M&S and technical support staff and physicists)? Have techniques such as forward funding by collaborators and phased funding of large contracts been appropriately incorporated into the planning? Does the anticipated funding profile support the resource requirements?
- Comment on the proposed management arrangements for the upgrades. Assess the probable effectiveness of the proposed management arrangements; the internal project structure, coordination between experiments, coupling to the Particle Physics Division and the Directorate and coordination with the Beams Division. Review and assess the formal required DOE documentation: Acquisition Plan, Project Management Plan, Project Execution Plan (as it sets requirements on the PMP), in addition to Scope, Cost, and Schedule Performance Baseline (which should be "conservatively" derived from the

information presented in response to the bullets above) and plans for the use of (and progress toward meeting) cost and schedule reporting tools.

Review findings, assessments, and recommendations should be presented in writing at a closeout with the Collaborations and Fermilab management.

B. Additional Charge Information

Run IIb Goals and Conditions

The goal of Run IIb operation of the Tevatron and the two collider detectors, CDF and D0, is to exploit the increasing luminosity of the Tevatron to search for new phenomena, including, but not limited to, the light Higgs boson if it exists.

We anticipate that modest upgrades to the Tevatron Collider complex, will lead to the accumulation of an integrated luminosity in the region of 15 inverse femtobarns. The details of the evolution of the performance of the Tevatron collider influence the running conditions under which the detectors must be able to operate. Until recently, the specification given to the detectors for planning the Run IIb upgrades was to be able to operate efficiently with an instantaneous luminosity at the start of a store of $5x10^{32}$ cm^{-2} sec^{-1} with a bunch spacing of 132 nsec.

The most recent information on collider operation indicates that operating with a bunch spacing of 396 nsec offers a surer path to higher luminosities. If the peak luminosity available from the collider at 396 nsec is $4x10^{32}$ cm^{-2} sec^{-1}, but luminosity leveling is used to keep the luminosity at $2x10^{32}$ cm^{-2} sec^{-1} because of detector limitations, the achievable integrated luminosity is expected to be the same as if there were no leveling and an initial luminosity of about $3.4x10^{32}$ cm^{-2} sec^{-1}. Since luminosity leveling has not yet been demonstrated, the upgraded detectors should retain the capability of running with 132 nsec bunch spacing. The 396 nsec option is the baseline plan for the collider, however, since it very probably will lead to the most physics on tape.

Two effects determine the rate conditions for the experiments:

- When the instantaneous luminosity is reduced, everything else being equal, the trigger and data rates are reduced.
- When the bunch spacing is increased from 132 nsec to 396 nsec, at fixed luminosity, the number of interactions per bunch crossing increases, and therefore so does the number of fake triggers. The number of interactions per crossing at $2x10^{32}$ cm^{-2} sec^{-1} with 396 nsec is comparable to $5x10^{32}$ cm^{-2} sec^{-1} with 132 nsec.

The Run IIb detectors must be designed to take advantage of the full capability of the high-P_T physics program, which leads to two requirements for running with 396 ns spacing. The first is that the detectors should operate efficiently, with some margin of error, at a luminosity of $2x10^{32}$ cm^{-2} sec^{-1} and a bunch separation of 396 nsec. Since the luminosity would remain at that level for much of a store, it is important that this condition can be met safely, taking into account the uncertainties in estimating occupancies. A contingency of a factor of two seems prudent, for example, in extrapolating present occupancies to expected conditions at $2x10^{32}$ cm^{-2} sec^{-1} for the upgraded detectors.

The second requirement is to ensure that comparable physics reach can be attained even if luminosity leveling is not achieved. This would necessitate at an initial luminosity approaching $4x10^{32}$ cm^{-2} sec^{-1} for the first part of the store, although this condition would ease with the familiar exponential decay. Thus one should design for a luminosity of $4x10^{32}$ cm^{-2} sec^{-1} , but in this case without the need of an additional contingency, since most of the collisions will occur at luminosity well below the initial one.

Within realistic errors of extrapolation and simulation, these two approaches reach the same conclusion. The Run IIb detectors should be designed to be efficient for the most important high-p_T physics processes at luminosities up to approximately $4x10^{32}$ cm^{-2} sec^{-1} at 396 nsec bunch spacing.

C. Committee Membership

Technical Review Subcommittee

Name	Affiliation
Lothar Bauerdick	FNAL
Francesco Forti	INFN/Pisa
Daniel Marlow	Princeton Univ.
Jim Pilcher (Chair)	Univ. of Chicago
Hartmut Sadrozinski	Univ. of California/Santa Cruz
Mats Selen	Univ. of Illinois/Urbana
Hiro Tajima	SLAC

Cost and Schedule Review Subcommittee

Name	Affiliation
Giorgio Apollinari	FNAL
Joel Butler (Chair, Non-Silicon SubComm.)	FNAL
Tony Chargin (Chair, Silicon SubComm.)	ORNL/SNS
Dean Hoffer	FNAL
Daniel Marlow	Princeton Univ.
Jim Pilcher	Univ. of Chicago
Mark Reichanadter	FNAL
Hiro Tajima	SLAC
Ed Temple	FNAL

List of Attendees

CDF

Nicola Bacchetta
Doug Benjamin
Brenna Flaugher
Al Goshaw
Joey Huston
Steve Kuhlmann
Nigel Lockyer
Pat Lukens
Christoph Paus
Kevin Pitts
Rob Roser

DZero

Alice Bean
Jerry Blazey
Bill Cooper
Marcel Demarteau
Hal Evans
Bill Freeman
Stu Fuess
Jon Kotcher
Meenakshi Narain
Andrei Nomerotski
Vivian O'Dell
Rich Partridge
Rich Smith
John Womersley
Darien Wood

Observers

John Cooper
Hugh Montgomery
Ken Stanfield
Mike Witherell

DOE

Jim Miller
Jane Monhart
Paul Philp

D. Review Agenda

Detailed Agenda for
Director's Review of CDF and D0 Run IIb Detector Upgrades
August 12-15, 2002
Fermilab Comitium WH 2 East

Monday, August 12 Meet in 1 West

8:00 AM	50m	Committee in Executive Session	
9:00	30m	Fermilab Program Overview & Run IIb Scope	Directorate
9:30	10m	D0 Collaboration Goals and Commitment	Spokesperson
9:40	50m	D0 Detector Upgrade PM Overview	Kotcher
10:30	15m	Break	
10:45	45m	Silicon: Technical Presentation	Demarteau
11:30	45m	Silicon: Cost & Schedule Summary	Bean
12:15	60m	LUNCH	Cmte & CDF/D0
1:15 PM	10m	CDF Collaboration Goals and Commitment	Spokesperson
1:25	50m	CDF Detector Upgrade PM Overview	Lukens
2:15	15m	Break	
2:30	45m	Silicon: Technical Presentation	Bacchetta
3:15	45m	Silicon: Cost & Schedule Summary	Flaugher
4:00	120m	Executive Session	
6:00		Leave for Dinner	

Tuesday, August 13 Meet in 1 West

Morning	min		
8:00	50	D-Zero Trigger	Wood
8:50	20	DAQ	Fuess
9:10	20	D-Zero Installation	Smith
9:30	20	BREAK	
9:50	45	Calorimeter	Kuhlmann
10:35	45	CDF Trigger/DAQ	Pitts
11:20	20	CDF Installation	Roser
11:40	60	WORKING LUNCH (Determine Tech Breakout Topics)	

Afternoon, (Technical SubCommittee and Balance of Committee in Separate Sessions)

Technical SubCommittee – Comitium			Balance of Committee – 1 North		
1:00PM	150m	Selected topics in Tech Breakout and/or 1-on-1 Discussions	1:00PM	120m	Review of Detector DOE Documentation AEP, PMP, (PEP) & Plans for Cost Performance Rptg
			2:50	30m	Details of Cost / Schedule Review
3:30	120m	Full Committee Executive Session			

Wednesday, August 14
(Technical SubCommittee and Balance of Committee in Separate Sessions)

Technical SubCommittee – Comitium		
8:00 AM	60m	Continue Selected topics in Tech Breakout and/or 1-on-1 Discussions as needed
9:00	180m	Draft Report
12:00	60m	Working LUNCH Dry Run Technical Closeout with Full Committee
1:00	60m	Finalize transfer files
2:00	60m	Technical Closeout
3:00	150m	Technical S/C members who must leave may do so. All remaining reviewers continue CDF Cost / Schedule Review

Cost / Schedule Review Breakouts: Silicon & Non-Silicon Subcommittees

8:00 AM	30m	D0 Cost / Schedule Overview 1 – North			
8:30	15m	Procurement Planning			
D0 Silicon SubCommittee – 1 North			D0 Non-Silicon Committee – Snakepit (2WH-NE)		
8:45AM	120m	D0 Silicon Cost Estimate Review	8:45	110m	D0 non - Silicon Cost Estimate Review
10:45	60m	D0 Silicon Schedule Review	10:35	30m	D0 non-Silicon Schedule Review
11:45	60m	Working LUNCH, Technical SubCommittee Closeout Dry Run			
1:00 PM	30m	CDF Cost / Schedule Overview 1 – North			
CDF Silicon SubCommittee – 1 North			CDF Non-Silicon Committee - Snakepit		
1:30	30m	CDF Silicon Cost Estimate Review	1:30PM	30m	CDF non-Silicon Cost Estimate Review
2:00	60m	Technical Closeout			
3:00	90m	Continue CDF Silicon Cost Estimate Review	3:00	80m	Continue CDF non-Silicon Cost Estimate Review
4:30	60m	CDF Silicon Schedule Review	4:20	30m	CDF non-Silicon Schedule Review

5:30	60m	Executive Session

Thursday, August 15

8:00	60	Executive Session
9:00	60	Final 1-on-1 discussions with project personnel as needed
10:00	120	Draft Report
12:00	60	Working LUNCH with Closeout Dry Run
1:00	60m	Finalize transfer files
2:00	45	~2 pm Cost / Schedule / Magement Closeout

Action Items

1.

2.

3.

4.

Michael Witherell

Jonathan Kotcher
Project Manager, DZero

Patrick Lukens
Project Manager, CDF