Closeout Presentations

from the

Director's Review

of

CDF Run IIb Detector Upgrade

July 20-21, 2004

Calorimeter Status

Findings

- The present central preshower and central crack detectors will be replaced by scintillator counters with optical fiber readout and 16 channel photo multiplier tubes.

- Timing capability will also be added to the electromagnetic calorimeter.

- It is expected that all of the equipment can be installed in a Fall 2004 shutdown. Partial installation in 2004 with the balance in a 2005 shutdown is a fall back position.

- Construction of the preshower detectors are 75% complete with 100% complete by mid August.

- 6% of the crack detectors are complete but the assembly time required is a small fraction of the time required for the preshower detectors. The crack detectors are expected to be complete by the end of August.

- Complete systems checks have taken place with production parts.

- New equipment for the EM timing includes Transition Boards (TB), Amplifier Shape Discriminators (ASD) and splitter harnesses. Splitter harnesses are complete and 27 TB/ASD pairs are complete.

- New transition boards are being made to correct mechanical problems with initial boards. The new boards are expected to be complete by the end of August

- 10 (2 spares) Additional ASD boards are being fabricated and are expected from INFN in September.

Comments

- With one month remaining until the start of the fall 2004 shutdown. The Calorimeter upgrade group is managing the end of detector assembly, parts acquisition and planning for installation. The July EM timing installation readiness review committee recommended weekly tracking of parts procurements. The calorimeter group should consider extending weekly tracking to all parts for the calorimeter upgrade. The managers should also consider delegating to one person the responsibility for tracking the status of parts so they can concentrate on installation planning.

2004 Installation

- The major work of the Fall 2004 Shutdown is
  - Solenoid Watt can repair
  - COT Maintenance (Aging)
  - EM Timing installation
  - Preshower and Crack Detector Installation
  - Perhaps new Low Beta Quad support structure installation
  - A number of reliability related maintenance tasks in and out of the collision hall
- The Calorimeter preshower and crack detector installation is the major job and has the greatest uncertainty because of access limitations and unknowns about existing equipment geometry.
- The installation involves, removing existing detectors, installing new detectors, PMT boxes and routing optical cables. The PMT boxes and optical cable routing will require some field judgment.
- The major installation issue is determination of the final length of the optical cables. ½ of the optical cables will be made prior to the start of the shutdown based on best estimate and the balance will be made after the first week of the shutdown.
- The installation will proceed in a serial fashion, installing and testing 1 wedge, then 1 arch, next arch then final two arches.

There are natural decision points for when to proceed to the next step.

- Major installation operations have been planned and the decision has been made to make access for ½ of the installation through a confined entry point to avoid the time required to pull the North Arch out full.

- Installation fixtures have be built and reviewed and confined workspace planning has taken place with ES&H personnel.

- 18 Technicians will be available for the shutdown. Approximately half will be involved with the preshower installation. 30 Physics/post-docs/grads are also available and will be involved.

- One mechanical engineer will be available fulltime and 3 other mechanical engineers will be available at a one FTE equivalent.

- The lower priority maintenance tasks provide contingency because they can be deferred if more manpower is required for the higher priority task.

<u>Comments</u>

- The Calorimeter upgrade and installation groups have identified the aspects of the installation with the greatest uncertainty and are managing the schedule and resources to accommodate changes in plans that may be required to accomplish the most important tasks.

- The preshower detectors have received much more careful handling so far than they may receive during the installation operation. The detectors cannot be fully checked after transport until they are installed. The Calorimeter group has considered

some handling/transportation trials with one likely spare detector prior to the shutdown. The Calorimeter group is encouraged to conduct these trials and should consider involving some of the personnel that will be involved with the installation at FNAL.

- The preshower/crack detectors will undergo an internal readiness review on August 3rd. The calorimeter group is encouraged to develop draft procedures and checklists, which are complete as possible prior to the review.

Fuzzy comment

- Low Beta Quad support structure (I am not sure who to address this to but it seems that CDF needs more direct contact with whomever in Accelerator division will be driving this project and the decision to go ahead or not)

2005 Installation

Finding/Comment

The work in the 2005 shutdown is not well defined at this time. The work depends on how much of the Calorimeter upgrade is installed along with decisions on whether to proceed with new TDC and possible changes in the Trigger.

Review of CDF Trigger and DAQ Upgrades

- General
- Scope and Status
- Specific WBS items

Data Acquisition and Trigger General

- The overall CDF Trigger/DAQ Upgrade project was presented by Peter Wilson, the level 2 manager, in plenary session. In the break-out session, the rescoped XFT was presented by Richard Hughes, level 3 co-manager, and the rescoped SVT by the level 3 manager, Mel Shochet,

Data Acquisition and Trigger General

- Findings
  - The present level 2 manager was appointed in February 2004. The level 3 manager for the SVT sub-project took on this responsibility in June 2004.
  - The scheduled project completion date is September 30th 2005

Data Acquisition and Trigger General

Comments

- Strong experienced teams - impressive amount of effort is being brought to bear.
- appointments of the present Level 2 manager and the new SVT level 3 manager are welcome.
- rescoped projects seem to have come into focus.
- recent impressive Tevatron luminosity has not hurt.
- Projects approaching end date—need to monitor progress on all fronts.
- December 2004 would be a good time to check on progress

Data Acquisition and Trigger Scope and Status

- Findings
  - Focus on high-pt and B-physics
  - Benchmark assumptions
    - Peak luminosity of 4E32 $cm^{-2}s^{-1}$ at 396 nsec
      - Average of 10 interactions per crossing
    - L1 accept rate of 30kHz (currently 25kHz)
    - L2 accept rate of 1kHz (currently 0.3kHz)
    - L3 accept rate of 0.1kHz (currently 0.08kHz)
    - <10% deadtime
  - Suite of upgrades planned to address current limitations of trigger and data-acquisition system

Data Acquisition and Trigger Scope and Status

- Findings

  The project includes in WBS order:

  replacing the TDC's used for the central tracker (1.3.1)

  replacement of the Level 2 trigger system (1.3.2)

  an upgrade to the XFT, the Level 1 track trigger (1.3.3)

  replacement of the Event Builder (1.3.4)

  replacement of the Level 3 processors (1.3.5)

  replacement of the SVT (1.3.6)

  WBS 1.3.7, an upgrade to the Silicon data-acquisition, has been cancelled.

Data Acquisition and Trigger Scope and Status

- Findings (cont)
  - uniform structure for the schedule for each part of the Trigger/DAQ upgrade set by the Level 2 manager.
  - Level 3 managers provided the task durations.
  - no explicit schedule contingency

Data Acquisition and Trigger Scope and Status

- Comments
  - Implementations intended to maximize physics output are to be lauded:
    - Retaining existing infrastructure
    - Plug compatibility
    - Modular designs
    - Implementations of splitters
    - Self-testing capabilities
    - Parasitic testing possible - leading to commissioning plan?
  - Some projects have little room for slippage at any stage
  - The procurement process needs to be monitored closely

Data Acquisition and Trigger Scope and Status

- Comments (cont)
  - The PULSAR board is used throughout the trigger system and seems to be a highly successful design. Some concern was expressed about the availability of firmware support - this issue needs to be resolved.

Data Acquisition and Trigger Scope and Status

- Recommendations
  - Coordinate 2005 shutdown scheduling with laboratory
  - Produce a list of the resources (physicist, engineering, technician, software) not presently identified by name and propose a plan for dealing with this.
  - (to the Laboratory). Accept the rescoping proposed for the XFT and SVT projects

1.3.7 Silicon Detector Data Acquisition

- Findings
  - This subproject has been removed.

1.3.1 TDC Replacement

- Findings
  - Higher than anticipated COT occupancy leading to longer readout times motivates consideration of replacement of 315 TDCs to improve L2 trigger accept rate
  - Prototypes under test
  - Tests of full crate planned for Nov 2004
  - Full installation expected to take 8 weeks and requires shutdown
  - Significant improvements in performance of current TDC have been reported

1.3.1 TDC Replacement

- Comments
  - The strategy for the replacement TDC project should include the review of the performance of the existing TDC, scheduled for 9/04, as a decision point.
  - The opportunity for a full crate test of the new TDC's scheduled for late in shutdown should not be missed.

WBS 1.3.2 , 1.3.4, 1.3.5

(Level 2 Infrastructure, Event Builder, Level 3 Trigger Processors)

- Findings
  - Employs more flexible standard interfaces and PCs
  - Exploits PULSAR boards already in use
- Comments
  - Well motivated
  - Did not raise any flags
  - Pulsar is very powerful innovation
  - Important to ensure that the necessary firmware and software support team is identified

1.3.11 Track Trigger (XFT)

- Findings
  - Identifies charged tracks with Pt>1.5 GeV/c
  - Intended to reduce fakes (improving effective L1 accept rate)
  - Behind original schedule (attributed to COT problems and related manpower issues)
  - Substantial progress on realistic simulations

1.3.11 Track Trigger (XFT)

- Findings (continued)
- Proposed rescope
  - Eliminate upgrade of axial system
  - Use up to three stereo layers (rather than one) with more precise timing for improved segments
  - Requires development of new components
    - Either new TDCs or 126 new XTCs
    - 126 TDC transition cards
    - 36 Hit finders
    - 24 Stereo Linker Association Modules
    - (PULSAR boards for stereo information at L2)
  - Ready for Installation July 27 2005

1.3.11 Track Trigger (XFT)

- Comments
  - the proposed new scope has the advantage of leaving the present axial system in place, except for the SLAMs which replace the LOMs, thus allowing the experiment to continue using the current trigger until the upgraded one is fully ready
  - the proponents clearly felt that the present proposal is technically feasible and significantly simpler than the previous plan; it involves the design of fewer major new boards (SLAM, Stereo Finder and XTC) than the previous plan (2 Axial Finders, Linkers, SAMS and XTC). The cost increase cf previous scope is probably the result of a more accurate estimate.
  - The schedule for the new XFT is based on experience in constructing the original XFT and on recent experience with the manufacture and testing of boards of similar complexity for C.M.S.

1.3.11 Track Trigger (XFT)

- Comments
  - The increase in manpower on the XFT is welcome
  - the ability to predict the conditions to be met at high luminosity was impressive and gives some confidence that the proposed upgrades can achieve the required reduction in trigger rates.
  - the rejection quoted with the present algorithms is adequate and further gains may be possible
  - it would be good to verify that latency of the data into the SLAMs is not an issue asap
  - The schedule has very little room for slippage

1.3.11 Track Trigger (XFT)

- Recommendations
  - Attempt to address concerns regarding availability of layout technician and CP from PPD/EED for finder design
  - (to Laboratory management) Accept the rescoped XFT project

1.3.6 Silicon Vertex Trigger

- Findings
  - Originally intended to accommodate Run IIb silicon and improve processing speed
  - Proposed rescope to reduce L2 execution time by implementing narrower roads and faster track fitter execution time
  - Anticipated to provide a 77% increase in L1 SVT trigger rates for 5% L2 deadtime at 3E32
  - SVT scheduled to be ready for installation June 3 2005

1.3.6 Silicon Vertex Trigger

- Findings (cont)
  - The schedule for the new SVT has a component for the production of the AM++ board (fully funded by INFN), a component for the production of the mezzanine card and a component for producing the required firmware. The estimates are largely based on previous experience with the previous SVT and/or equivalent projects.
  - The AM++ prototype testing is expected to begin 8/04

1.3.6 Silicon Vertex Trigger

- Comments
  - see above re the Level 3 manager..
  - capability for phased implementation of improvements provides flexibility to get benefits asap
  - Rescoped SVT schedule appears to be rather terse

1.3.6 Silicon Vertex Trigger

- Recommendations
  - Identify the (Fermilab) engineer for SVT pulsar firmware
  - (to the Laboratory) Accept the rescoped SVT project

CDF Run IIb Director's Review

Management

M. Crisler

Management

- Finding
  - There is a strong management team in place and they are taking appropriate actions to deal with evolving circumstances.
    - Accelerator performance evolution
    - Cancellation of Silicon Upgrades
      - Evolution of SVT upgrade technical requirements
    - Technical problems with COT
      - Schedule slippage in XFT upgrade

Management

- Finding
  - Management has recently appointed a new L2 manager for the Trigger/DAQ systems and a new L3 manager for the SVT upgrade.

Management

- Comment
  - The committee applauds the addition of strong new members of the management team and recognizes the significant technical progress that has resulted from these appointments.

Management

- Finding
  - Considerable work has been done to refine the understanding of the expected accelerator performance, and to understand how the increased interaction rates will affect the CDF detector systems.

Management

- Comment
  - The committee feels that the changes in scope and planning for the upgrade project appropriately reflect the improvements in understanding of the technical requirements.

Management

- Finding
  - There has been excellent progress in the calorimeter system upgrades. Management is pursuing an aggressive schedule in which both the preshower/crack and EM timing systems would be installed in the Fall 2004 shutdown.
    - Contingency plans have been developed to stage the installation continuing into the Fall 2005 shutdown if the work is not completed in 2004.

Management

- Comment
  - The committee endorses the strategy of attempting to accelerate the completion of the calorimeter upgrades. We agree with the management assessment that this strategy is likely to lead to successful completion of these efforts in 2004, but that the schedule is tight and fallback positions need to be in place.

Management

- Finding
  - There has been significant schedule slippage in the track trigger (XFT) and it is no longer possible to complete the originally proposed scope. Improvements in understanding the technical requirements have shown that a re-scoped system can meet the technical requirements and improve the chances of keeping to the schedule.

Management

- Comment
  - The committee feels that the schedule for the rescoped XFT is “difficult”.
  - The new proposal draws upon additional resources from the PPD EE Department (engineering support and layout.) It is important to work with PPD to secure these resources or identify alternate resources.

Management

- Finding
  - A significant rescope of the Silicon Vertex Trigger has been proposed based on improved understanding of the technical requirements of that system.

Management

- Comment
  - The committee agrees that the scope changes are technically sound and appropriate.

Management

- Finding
  - There has been excellent progress in the development of the new TDC and a fully satisfactory prototype board is in hand.
  - There has also been excellent progress in the improvement of the original TDC (through firmware upgrades.)
  - It is possible that either the old or the new TDC would meet CDF run IIb technical requirements.

Management

- Finding
  - A procurement plan has been developed to complete a full crate of the new TDC while retaining the option for a complete production order. Following an evaluation the existing TDC systems in September 2004, a decision will be made whether to proceed on the new TDC procurement.

Management

- Comment
  - Clearly the project managers recognize the potential savings of resources if the original TDC can be made to work. The committee concurs and agrees with the proposed evaluation and procurement plan. A thorough evaluations of the options is necessary and a final decision must be made by December of 2004.

Management Recommendations

- Ensure that appropriate engineering and layout resources are identified to meet the schedule for the rescoped XFT.

- Decide, by December 2004, whether to proceed with the full production order of the new TDC or to proceed with the firmware upgrades of the existing TDC.

Recommendation to Lab Management

- Approve the proposed scope changes for the XFT and SVT trigger systems

- Review progress on this project in six months.

Cost

- Findings:
  - MIE funding is $10.4M
  - Overall Project Contingency is 35%. Current contingency for remaining work is 57% and after the pending Change Request on the DAQ and Trigger subproject a contingency of 66%.
  - Total Cost of the DAQ and Trigger Project pending Change Request of ($413,466)
  - MIE funds for University work are $229K for Cal and $891K for DAQ. Total of $1,120K.

Cost

- Comments:
  - It is felt that there is adequate contingency on the remaining work to be performed.

Cost

- Recommendations:
  - Performance indicators do no consistently reflect actual costs for the work that has been completed. Some discrepancies relate to the work being done at the universities, which may reflect that invoices have not been received or accruals performed. It is not evident that reasons for other cost variances are well understood. Analysis should be performed on a monthly basis to better understand the reasons for cost variances.

Schedule

- Findings:
  - Resource Loaded Microsoft Project (MSP) file exist and are statused monthly.
  - CD-4 Approve Project Completion is November 2006.
  - Track Trigger (XFT) has fallen behind schedule.
  - The Level 2 milestone dates for the same two Level 1 milestones have built in schedule contingency.

Schedule

Level 1 Milestone #	Level 2 Milestone #	Description	Level 1 Milestone Date	Level 2 Directors Milestone Date
CDF 1.2	1.2.3.5	Calorimeter Upgrades Ready for Installation	January 2006	6-May-05 (8 months float)
CDF 1.3	1.3.8	Data Acquisition and Trigger Upgrades Ready for Installation	January 2006	30-Sep-05 (4 months float)

Schedule

- Comments:
  - Performance indicators show that schedule adherence is lacking. In particular WBS 1.3 Run 2b DAQ and Trigger Project. A Change Request is in process to modify the scope, schedule and costs of WBS 1.3. The revised schedule indicates that the Level 2 Milestone 1.3.8 “Finish Run 2b Trigger DAQ project” dated 30-Sep-05 should still be meet. This milestone has approximately 4 months of contingency to the equivalent Level 1 Milestone CDF 1.3 “Data Acquisition and Trigger Upgrades Ready for Installation” dated January 2006. Based on past schedule performance the revised schedule and resource availability should be further assessed to assure that the Level 2 Milestone 1.3.8 can realistically be accomplished by the current completion date.

Schedule

- Comments: (continued)
  - A working/forecast schedule is not being utilized by CDF. This was apparent when reviewing the Project Milestone Summary in CDF's month report. The majority of the open milestones have the same Forecast Completion Date as the Baseline Completion Date, even though there were references to earlier dates for some of these activities during presentations for this review. CDF should evaluate the Forecast Completion Dates for the open Level 2 Milestones and modify the dates to reflect what the Level 2 and 3 Managers predict when the work will really be completed. Then monitor the monthly changes to the forecast dates to determine a trend to predict if the Baseline Completion Dates will be accomplished.

Schedule

- Recommendations:
  - Schedule adherence is important to assure meeting the Level 1 Milestones. The committee recommends that the Directorate schedule a Director's Review in approximately 6 months (January/February 2005) in order assess CDF progress, results from the 2004 shutdown work and the plans for the 2005 shutdown work.

Schedule

- Recommendations: (continued)
  - The Level 2 Milestones 1.2.3.5 “End of Calorimetry Project: Level 2” and 1.3.8 “Finish Run 2b Trigger DAQ project” are the same as the Level 1 Milestones CDF 1.2 “Calorimeter Upgrades Ready for Installation” and CDF 1.3 “Data Acquisition and Trigger Upgrades Ready for Installation” respectively. The CDF’s Monthly Report does not indicate that the two Level 2 Milestones are also Level 1 Milestones. A heighten level awareness is needed on the float available on the two Level 2 Milestones and their equivalent Level 1 Milestones. This can be addressed by emphasizing these milestones separately in the Projects Monthly Report.

Executive Summary

An executive summary of the CDF Run IIb Detector Upgrade Director's Review held July 20-21, 2004 is provided here.

According to the Charge the Committee was to review progress since the last review, installation planned for the 2004 and 2005 shutdowns as well as status and proposed changes to the trigger upgrade systems.

Technical

Good progress is being made on the Central Preshower and Crack Detectors. These detectors and the EM Timing are slated for installation during the FY04 Shutdown.

Scope change requests will be processed for the XFT and SVT trigger subprojects reflecting the new plans for these systems. Progress had been halting on these systems until early spring when the project team carefully revisited both systems, developed new plans, and staffed to implement the plans to be ready for component installation in FY05.

Cost

The CDF Run IIb Detector Upgrade MIE Project is reported by the Project Manager to be 38% complete.

A cost change request will return $854K reserved for the Silicon DAQ to contingency. When change requests to increase the baseline for the XFT and SVT are included the net return to contingency is $436K.

An estimated contingency on the estimate to complete is ~57%.

Schedule

The Central Preshower and Crack Detectors and EM Timing are on track for installation during the FY04 Shutdown. The TDCs, Level 2 trigger decision hardware, and Event Builder Trigger / DAQ subsystems are progressing well. New Microsoft Project schedules in support of the XFT and SVT revised scope plans have been prepared. The target completion for these systems is the shutdown of 2005. This leaves only 14 months to complete these systems, so the schedule will be tight.

An installation schedule has been prepared for the FY04 Shutdown. The Central Preshower and Crack Detector installation is planned for this shutdown. However, if experience shows full installation can't be completed, part will be installed in FY04 and the balance will be installed in the FY05 shutdown.

The remaining installation for the FY05 shutdown is mostly electronics.

Management

The CDF Collaboration is supporting the project by populating the Run IIb CDF Detector Upgrade project team to complete the effort in an effective and timely manner. A strong Level 2 manager has been put in charge of the Trigger and DAQ effort and a newly recruited Level 3 leader has taken over the SVT activities.

The project managers have maintained schedule files and cost information on continuing activities and prepared new schedules and cost estimates in support of change requests for the revised XFT and SVT plans.

Given the intensity of activities required to complete the project, a Director's Review to look at status and progress is suggested for January 2005.