

31 August 2004

To: Paul Philp
DOE Project Manager, Run IIb CDF Detector Project

From: Pat Lukens
Project Manager for the Run IIb CDF Detector Project

Subject: Run IIb CDF Detector Project July 2004 Report

Attached is the monthly report summarizing the July 2004 activities and progress for the Fermilab RunIIb CDF Detector Project. This report is available electronically at:

<http://www-cdf.fnal.gov/run2b.html>

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RunIIb CDF Detector Project
Progress Report No. 20
1 - 31 July 2004

I. PROJECT DESCRIPTION

The primary goal of the CDF Run IIb Detector Project is to enable the detector to exploit the physics opportunities available during Tevatron operation through 2008. The data from Run II will represent a set of detailed measurements that can be compared with the predictions of the Standard Model at the highest available collision energy. The increased size of the data sample will allow us to study the top quark by measuring the details of its production and decay mechanism. In addition, we plan precision electroweak and QCD measurements, continued searches for a variety of phenomena that are predicted to exist beyond the Standard Model framework, and to explore CP violation in the b quark sector. The detailed physics goals of the upgrade are described in the Technical Design Report (TDR).

The major tasks of this upgrade are:

- Upgrade the calorimeter by replacing the Central Preradiator Chamber with a device with shorter response time to allow operation in a high-luminosity environment, and adding timing information to the electromagnetic calorimeters.
- Upgrade the data acquisition and trigger systems to increase throughput needed for higher luminosity operation and efficiently trigger on the higher multiplicity events of Run IIb.

II. OVERVIEW OF PROJECT STATUS – P. Lukens

A Director's review of the project was held on 20-21 July 2004. The review examined the status of the project and the scope changes that were proposed. Reaction from the committee was favorable for both the status and new scope. A Change Request for the baseline adjustments will be made in August. Schedule milestones presented here are based on the schedules in place during July 2004. We anticipate that schedules that reflect the new scope will be available in August 2004.

The scope change for the Track Trigger (W.B.S. 1.3.3) simplifies the project. The new scope will retain the existing trigger system for the axial layers of the drift chamber, rather than increasing the time resolution on these layers. The new scope adds additional layer of stereo information to the trigger with the increased time resolution that previously had been planned for one layer only. In this way, the trigger rate required to meet the mission need will be achieved through the use of additional data (additional stereo information) rather than increased time resolution. Commissioning of the system will be less invasive than the original baseline, since the axial system will continue to operate without interruptions. The new scope is more suited to the future operations of the Tevatron, where shorter interruptions to operations are scheduled.

The scope change for the Silicon Vertex Trigger (W.B.S. 1.3.6) was the first change in the system scope since the cancellation of the silicon detector. The new scope is now established for the existing silicon detector. The new scope relies heavily on the Pulsar board technology already developed as part of the Level 2 trigger upgrade (W.B.S. 1.3.2).

The final report from the Silicon Longevity Committee has been released. This committee explored possible long-term weaknesses in the silicon detector, and worked to identify any needed replacements. No additions to the Run IIb project scope were motivated by this report. No significant procurements have been identified to support the long term operation of the silicon, so we plan to drop W.B.S. 1.3.7 from the project scope.

III. PROJECT MILESTONE SUMMARY (as of 31 July 2004)

CDF Level 2 Schedule Milestones from the Resource Loaded schedules

WBS	Title	Baseline Comp. Date	Forecast/Actual Completion Date	Complete
1.2.1.10.1	First phototube order placed	9-May-03	1-Apr-03	Yes
1.2.2.2.7.1	Prototype Testing Complete	16-May-03	28-Mar-03	Yes
1.2.2.2.7.4	ASD->TDC Cables ready for installation	16-May-03	26-Aug-03	Yes
1.2.2.2.7.2	CEM Splitters ready for installation	19-May-03	29-Jul-03	Yes
1.2.2.2.7.3	PEM Harnesses ready for installation	2-Sep-03	28-Apr-03	Yes
1.2.2.2.7.5	All cables done and ready to install	2-Sep-03	26-Aug-03	Yes
1.2.2.2.7.8	VME Crate ready for installation	7-Oct-03	30-Apr-03	Yes
1.3.2.6.3	Begin production of Level 2 Pulsar system	12 Nov 03	12 Nov 03	Yes
1.3.1.6.6	First Prototype TDC available for testing	19-Nov-03	16-Feb-04	Yes
1.2.2.2.7.10	Upstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.11	All EM Timing components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.6	ASD/TB ready for installation	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.7	Downstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.9	TDC boards ready for installation	7-Jan-04	16-Oct-03	Yes
1.3.3.2.3.4	Begin fabrication of Prototype Finder 1/3 board	8-Jan-04	8-Jan-04	CR in process
1.2.1.10.3	First set of Calorimeter phototubes tested	30-Jan-04	20-Oct-03	Yes
1.3.3.8.1.9	Prototype XFT Linker Module available for testing	26-Mar-04	26-Mar-04	CR in process
1.2.1.10.2	1 st Calorimeter WLS fiber holder finished	1-Apr-04	17-Feb-04	Yes
1.3.4.4.1.4	Prototype Event Builder hardware arrives	3-Jun-04	31 Mar 04	Yes
1.2.1.10.4	1 st CPR module finished and tested	4-Jun-04	15-Mar-04	Yes
1.2.1.10.6	1 st CCR module finished and tested	19-Jul-04	2-Mar-04	Yes
1.3.2.9	Pulsar Level 2 subproject ready for installation	4-Aug-04	4-Aug-04	
1.2.1.10.5	2 nd set of Calorimeter phototubes tested	6-Aug-04	26-Mar-04	Yes
1.3.5.2.5	Arrival of 0/10 PCs from the vendor	10-Sep-04	10-Sep-04	
1.3.4.5.3	Production Readiness Rev - Event Builder	4-Oct-04	4-Oct-04	
1.3.3.10.3.3	Preproduction XFT Stereo Assoc Modules	29-Nov-04	29-Nov-04	
1.3.6.5	SVT ready for installation	13-Dec-04	13-Dec-04	
1.3.1.12	Beginning of TDC Production	10-Jan-05	10-Jan-05	
1.2.1.10.7	50% Calorimeter CPR Detectors Tested	14-Jan-05	30 June 04	Yes
1.3.4.5.4.4	Arrival of Event Builder hardware	3-Feb-05	3-Feb-05	
1.2.1.10.8	50% Calorimeter CCR Detectors tested	14-Feb-05	30 Dec 04	
1.3.5.5.5	Arrival of 70 L3 & 15 DAQ PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.5.6.5	Arrival of 140/20 PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.3.8.3.3	Begin Production of XFT Linker Modules	24-Mar-05	24-Mar-05	
1.3.3.2.6.9	Begin Production Finder SL7 boards	28-Mar-05	28-Mar-05	
1.3.5.8	Finish Purchase of Computers for L3/DAQ	14-Apr-05	14-Apr-05	
1.2.1.10.9	Final Calorimeter CPR Detector Tested	15-Apr-05	15-Apr-05	
1.2.1.10.10	Final Calorimeter CCR Detector Tested	15-Apr-05	15-Apr-05	
1.2.1.10.11	Final set of Calorimeter phototubes tested	6-May-05	6-June-04	Yes
1.2.1.10.12	End of Central Preshower Project	6-May-05	6-May-05	
1.2.3.5	End of Calorimetry Project: Level 2	6-May-05	6-May-05	
1.3.4.8	Finish Event-Builder Upgrade	31-May-05	31-May-05	
1.3.1.14.16	Data Concentrator Production Completed	29-Jul-05	6-Jun-05	
1.3.3.10.4.6	XFT Production Stereo Modules complete	18-Aug-05	18-Aug-05	
1.3.3.23	XFT Ready for Installation at CDF	29-Sep-05	29-Sep-05	
1.3.1.13.10	TDC Production Board testing complete	30-Sep-05	30-Sep-05	
1.3.1.16	Run 2b TDC Ready for Installation	30-Sep-05	30-Sep-05	
1.3.8	Finish Run 2b Trigger DAQ project	30-Sep-05	30-Sep-05	
1.2.3.6	End of Calorimetry Project: Level 1	23-Jan-06	6-May-05	
1.3.9	DAQ and Trigger Upgrades Ready for Installation	17-Jan-06	30-Sep-05	

IV. PROCUREMENT – P. Lukens

An order for 64 computers was placed in July that will be added to the Level 3 trigger system.

V. PROJECT HIGHLIGHTS

1.2 – Calorimeter

1.2.1 Central Preshower and Crack Detector – Steve Kuhlmann

The Central Preshower/Crack Upgrade continued routine full production in July. 83% of the preshower modules have been assembled and tested at ANL, using fiber pigtailed produced at MSU. The modules are mapped with a source the same day as assembly, and the quality continues to be excellent. In addition to the previous contributions INFN/Rockefeller made to the assembly at ANL, KCHEP (Korea) is currently providing 3 physicists and students for the rest of the assembly. Production will be complete in August.

Preparation of the Crack scintillator finished at FNAL lab 8, and production of all the Crack fiber pigtailed finished at MSU. Therefore all parts for Crack assembly have been delivered to ANL. 25% of the modules have been assembled in the last week, with the remainder to be complete in August. Production of transition cards and cables is 50% complete, to be finished in August.

Optical cable production at MSU will begin early in August. This has been delayed on purpose, since the optimal lengths of these fibers depends on many other installation details which are being worked on. Only 50% of the detector will be produced before the shutdown, on purpose, so that feedback from the initial installation can be used to optimize the remainder.

The table below shows the current production status of the CPR and CCR components:

Component	Produced	Total needed	Complete
Preshower tiles	2268	2592	88 %
Preshower spliced fibers	2592	2592	100 %
Preshower fiber pigtailed	192	192	100 %
Preshower modules	40	48	84 %
Crack tiles	480	480	100 %
Crack spliced fibers	480	480	100 %
Crack pigtailed	48	48	100 %
Crack modules	12	48	25 %
Preshower & Crack clear fiber cables	10	192	5 %
Transition cards	48	96	50 %
PMT boxes	40	48	84 %

1.2.2 Electromagnetic Timing – Dave Toback

All EM Timing work has been completed. The components installed last year are fully functional and have established an extremely satisfactory operating history.

1.3 – Data Acquisition and Trigger

1.3.1 TDC (Time to Digital Converter) – Henry Frisch, Ting Miao

The major effort for July addressed the XFT interface functionality of the TDC board and specifications for the TDC Test Pattern Card. This is a collective effort from the XFT Group and the TDC Group. Discussions were held regarding the initial specifications of the XFT interface functionality and we are very close to determining the final requirements. Initial discussion on the specifications for the Test Pattern Card resulted in first round TPC documentation. As with the interface functionality above, these specifications should be finalized in the early part of August. Design and firmware work will begin shortly thereafter.

1.3.2 Level 2 – Ted Liu, Peter Wittich

The CDF Level 2 Trigger system continues to make progress on the following fronts:

- Pulsar hardware, firmware and VME software,
- PCI and CPU performance studies, and
- S-LINK data format definition for all data paths.

The table below shows the current production status of the Level 2 components:

Component	Produced	Total needed	Complete
Pulsar boards	30	30	100 %
S-Link LSC/LDC cards	20	20	100 %
S-Link PCI cards	6	12	50 %
S-Link fibers	30	30	100 %
AUX cards	20	20	100 %
Hotlink mezzanine cards	20	20	100 %
Taxi mezzanine cards	30	30	100 %
Hotlink/Taxi fibers	120	120	100 %
Fiber splitters	50	60	83 %
L2 decision CPUs	4	6	67 %

All custom hardware has arrived and everything has been fully tested. The firmware implementation and testing for various data paths is in progress and system integration and beam testing has already started. Two new Level 2 Decision CPU's have arrived and both have been fully tested with the pulsar boards.

1.3.3 XFT (eXtremely Fast Tracker) II – Richard Hughes, Brian Winer

Work continues on the simulation of the upgraded XFT. Recent developments with respect to the degraded performance of the COT have focused the simulation work on understanding how an upgraded device will perform with both an increase in instantaneous luminosity and a reduction of single hit efficiency due to an aged COT. Work during the month of July was focused on preparations for the internal and Director's reviews of the project. Cost and schedule development of the proposed new scope of the project was completed.

1.3.4 Event Builder – Bruce Knuteson

Code implementation has continued. Our vendor's delivery for the production run of VMIC 7805 boards has been delayed by three weeks but these boards should still arrive by the beginning of the accelerator shutdown. We have begun implementing a SmartSocket interface as well as interfaces to other parts of the system. A Yale student will be modifying the Trigger Manager code to allow us to test a GbE connection (replacing the existing Scramnet connection) during the shutdown.

1.3.6 SVT (Silicon Vertex Tracker) – Mel Shochet

We are not planning to begin work on the Silicon Vertex Tracker trackfitter and merger boards until later in calendar year 2004.

1.3.7 Silicon Detector DAQ Upgrades

We are not planning to perform any additional work on the Silicon Detector DAQ upgrades until later in calendar year 2004.

VI. FINANCIAL STATUS (as of 31 July 2004)

The baseline cost of the Project is \$10,375K, and consists of the costs for the scope of the Run IIb Project (\$8,702K) plus the closeout costs of the silicon detector upgrade (\$1,673K), which will no longer be constructed.

The following financial tables are attached:

CDF RunIIb Obligations Report - This report provides a summary, at Level 2, of the outstanding requisitions and purchase orders where money has been committed but for which the Project has not been invoiced. This does not include requisitions in the system that have not had a Fermilab Purchase Order number assigned as of the date of the report. A brief description of the columns included in this report is given below:

- Current Month Total Cost – The cost charged to the project for the reporting month.
- Current Month Obligation – This is the total of the obligations made against the project for the reporting month.
- Year to Date Total Cost – This is the total cost charged to the project in this fiscal year.
- Year to Date Obligations with Indirect – This is the total of the obligations made against the project for this fiscal year.
- Current Purchase Orders Open Commitment – This is the total of the open commitments against the project. It includes open commitments from the current and all prior years.
- Prior Year Total Cost - This is the total cost charged to the project in all prior fiscal years.

The total project cost is simply the sum of the Year-to-Date costs and the Prior Year costs. The total committed and spent is the Total Project Cost plus the Open Commitment value.

CDF Project Cost Performance Report (CPR) – This report is generated from COBRA and provides a complete financial snapshot of the Project down to Level 3 of the Work Breakdown Structure. Input data originates with the status (% Complete) of the Project schedules as reported by the Level 2 managers and actual costs extracted from the Fermilab accounting system. Financial summaries are shown for this reporting period (columns 2-6) as well as the project to date (columns 7-11). Column 12 contains our current value of BAC, and will only be changed after the formal implementation of the Change Control process. A number of specialized financial terms and abbreviations used in the CPR are defined here for convenience:

ACWP – Actual Cost of Work Performed. This is the actual cost of tasks that have been completed.

BAC – Budget at Completion. The BAC is the estimated total cost of the project when completed. It is equivalent to the BCWS at completion. The baseline value of the BCWS is contained in column 12 of the Cost Performance Report.

BCWP – Budgeted Cost of Work Performed. This is the scheduled cost profile of tasks that have been completed.

BCWS – Budgeted Cost of Work Scheduled. This is the sum of the budgets for all planned work to be accomplished within a given time period.

CV – Cost Variance. $CV = BCWP - ACWP$

EAC – Estimate At Completion. This is the ACWP to date, plus the BCWS (current scheduled estimate) of remaining tasks. $EAC = (BAC (current) - BCWP) + ACWP$

ETC – Estimate to Completion. $ETC = EAC - ACWP + Contingency$

Percent Complete - $\%Com = \frac{BCWP}{BAC}$

SV – Schedule Variance. $SV = BCWP - BCWS$

CDF Project Obligations Report Through 31 July 2004

CDF RIIb EQU - July FYO4 in \$K							
Task Number	Expenditure Category	Current Mth Total Cost	Current Month Obligation	YTD Total Cost	YTD Obligations w/Indirect	Current PO Open Comm	Prior Yr Total Cost
	M&S	8.1	0.2	302.3	349.1	93.0	221.0
	SWF	2.1	2.1	224.3	224.3	0.0	346.1
	OH	1.9	0.0	89.8	89.8	0.0	140.2
	Total 1.1	12.2	2.3	616.4	35.0	93.0	707.2
	M&S	6.8	0.0	176.9	235.3	58.4	0.0
	SWF	15.0	15.0	103.8	103.8	0.0	19.6
	OH	4.7	0.0	40.7	40.7	0.0	6.3
	Total 1.2	26.5	15.1	321.4	379.9	58.4	25.9
	M&S	53.0	63.1	288.7	393.0	238.7	2.9
	SWF	29.1	29.1	112.8	112.8	0.0	0.0
	OH	10.8	0.0	50.0	50.0	0.0	0.5
	Total 1.3	92.8	92.2	451.5	555.8	238.7	3.4
	M&S	0.1	0.1	14.4	14.4	0.0	13.3
	SWF	10.1	10.1	114.7	114.7	0.0	126.7
	OH	3.1	0.0	36.6	36.6	0.0	40.1
	Total 1.4	13.3	10.2	165.6	165.6	0.0	180.1
Total Project	M&S	67.9	63.3	782.2	293.6	390.1	237.2
	SWF	56.4	56.4	555.5	555.5	0.0	492.5
	OH	20.5	0.0	217.2	217.2	0.0	187.0
Grand Total		144.8	119.8	1554.9	1066.3	390.1	916.6

Total Project Cost (Inception To Date): 2471.5

**CDF Project
Cost Performance Report
at WBS Level 3**

Contractor: Location:				Contract Type/No:				Project Name/No: CDF Rllb Mstr Equ - De			Report Period: 6/30/2004 through 7/31/2004						
Quantity		Negotiated Cost		Est. Cost Authorized Unpriced Work		Tgt. Profit/ Fee %		Tgt. Price		Est Price		Share Ratio		Contract Ceiling		Estimated Contract Ceiling	
1		8,702,000		0		0		8,702,000		0		0		0		0	
Funding Type-CA WBS[2] WBS[3] Item		Current Period					Cumulative to Date					At Completion					
		Budgeted Cost		Actual Cost	Variance		Budgeted Cost		Actual Cost	Variance		Budgeted	Latest Revised Estimate	Variance			
		Work Scheduled	Work Performed	Work Performed	Schedule	Cost	Work Scheduled	Work Performed	Work Performed	Schedule	Cost						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)				
EQU Equipment																	
1.2 Calorimeter Upgrades																	
1.2.1 Central Preshower and Crack Detectors		11,445	51,330	26,519	39,885	24,811	306,153	295,792	324,629	-10,362	-28,837	360,073	358,263	(1,810)			
1.2.2 Electromagnetic timing		0	0	0	0	0	35,630	35,630	23,403	0	12,227	35,630	35,630	0			
WBS[2]Totals:		11,445	51,330	26,519	39,885	24,811	341,783	331,422	348,032	-10,362	-16,610	395,704	393,893	(1,810)			
1.3 Run 2b DAQ and Trigger Project																	
1.3.1 Run 2b TDC Project		86,429	2,704	70,589	-83,725	-67,885	241,913	102,367	224,378	-139,546	-122,010	1,105,744	1,127,683	21,939			
1.3.2 Run 2b Level 2 Project		6,322	12,702	0	6,380	12,702	261,588	354,021	151,593	92,434	202,428	366,655	363,735	(2,920)			
1.3.3 Run 2b XFTII Project		16,006	0	21,216	-16,006	-21,216	236,582	1,313	21,216	-235,269	-19,903	1,146,971	1,149,238	2,267			
1.3.4 Event-Builder Upgrade		22,203	102,379	1,035	80,176	101,344	233,385	185,307	57,651	-48,078	127,656	517,361	515,380	(1,981)			
1.3.5 Computer for Level3 PC Farm / DAQ		6,602	90,117	0	83,515	90,117	12,604	90,117	0	77,513	90,117	478,908	475,448	(3,461)			
1.3.6 SVT upgrade		30,603	0	0	-30,603	0	38,949	0	0	-38,949	0	174,441	174,441	0			
1.3.7 Silcon Detector DAQ Upgrades		34,232	0	0	-34,232	0	297,390	42,575	0	-254,814	42,575	854,289	854,370	81			
WBS[2]Totals:		202,396	207,902	92,840	5,505	115,062	1,322,411	775,702	454,838	-546,709	320,863	4,644,369	4,660,295	15,926			
1.4 Administration																	
1.4.3 Construction Phase		24,593	24,702	13,274	109	11,427	450,352	450,323	345,719	-29	104,605	958,867	958,867	0			
WBS[2]Totals:		24,593	24,702	13,274	109	11,427	450,352	450,323	345,719	-29	104,605	958,867	958,867	0			
Funding Type-CATotals:		238,434	283,933	132,634	45,499	151,299	2,114,546	1,557,447	1,148,589	-557,100	408,858	5,998,939	6,013,055	14,115			
Sub Total		238,434	283,933	132,634	45,499	151,299	2,114,546	1,557,447	1,148,589	-557,100	408,858	5,998,939	6,013,055	14,115			
Management Resrv.												2,703,061	2,688,945	(14,116)			
Total		238,434	283,933	132,634	45,499	151,299	2,114,546	1,557,447	1,148,589	-557,100	408,858	8,702,000	8,702,000	0			

As of 31 July 2004

VII. VARIANCE ANALYSIS – P. Lukens

Subproject	Schedule Variance	Cost Variance
Central Preshower and Crack	Not Significant, catching up from prior months.	Underestimate on the quantity of labor needed for scintillator preparation.
Electromagnetic Timing	None	Not Significant
Run 2b TDC	Unforeseen problems with the track trigger interface have delayed the preproduction submission.	Labor charges were not reflected in the progress made on this.
Run 2b Level 2	System is working well.	An error has been found in the cost accounting for labor on this task. This will be corrected in the future.
Run 2b XFTII	This project has been rebaselined, so the existing schedule is obsolete.	Labor for the month of July has not been statussed against the obsolete schedule.
Event Builder	Engineering and programming labor has not yet been applied to the project.	No invoices yet for the single board computers. This will correct itself with time.
Computers for Level 3 and DAQ	No invoices yet for the Level 3 computers. This will correct itself with time.	No invoices yet for the Level 3 computers. This will correct itself with time.
SVT Upgrade	This project has been rebaselined, so the existing schedule is obsolete.	This project has been rebaselined, so the existing schedule is obsolete.
Silicon Detector DAQ Upgrades	This project has been rebaselined, so the existing schedule is obsolete.	This project has been rebaselined, so the existing schedule is obsolete.

VIII. BASELINE CHANGES

No Change Control action documents were approved during July 2004.

IX. FUNDING PROFILES

The funding profile is shown below:

	Funding Plan in Current Year \$K				
	FY02	FY03	FY04	FY05	Total
DOE MIE	\$ 3,460	\$ 3,509	\$ 1,673	\$ 1,732	\$ 10,375
DOE R&D	\$ 1,670	\$ 480			\$ 2,150
Foreign Contributions	\$ 39	\$ 342	\$ 252	\$ 10	\$ 643
U.S. Universities	\$ 24	\$ 225	\$ 103	\$ 26	\$ 378
Total	\$ 5,193	\$ 4,556	\$ 2,028	\$ 1,768	\$ 13,545