23 March 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 February 2004 Report

Attached is the monthly report summarizing the February 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. 15
1 - 29 February 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

Although the schedule slip in the TDC and XFT schedules remains, there were significant developments for these projects in February 2004. The first TDCs arrived from the vendor and performed well in the initial tests. Also, the TDC effort is moving forward supplemented by Fermilab engineering, an additional student, and promising discussions within the collaboration for additional institutional commitment to the project. Engineering effort was also added to the XFT project, which strengthens that project as well.

III. PROJECT MILESTONE SUMMARY

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
1.3.1.6.6	First Prototype TDC available for testing	19-Nov-03	10-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	
1.2.1.10.2	1st Calorimeter WLS fiber holder finished	1-Apr-04	1-Apr-04	
1.3.4.4.1.4	Prototype Event Builder hardware arrives	3-Jun-04	3-Jun-04	
1.2.1.10.4	1st CPR module finished and tested	4-Jun-04	4-Jun-04	
1.2.1.10.6	1st CCR module finished and tested	19-Jul-04	19-Jul-04	
1.3.2.9	Pulsar Level 2 subproject ready for installation	4-Aug-04	4-Aug-04	
1.2.1.10.5	2nd set of Calorimeter phototubes tested	6-Aug-04	6-Aug-04	
1.3.5.2.5	Arrival of 0/10 PCs from the vendor	10-Sep-04	10-Sep-04	
1.3.2.6.3	Begin production of Level 2 Pulsar system	17-Sep-04	17-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	14-Jan-05	
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	14-Feb-05	
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-May-05	
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	

IV. PROCUREMENT – P. Lukens

No significant procurements were placed in February, although several were submitted for laboratory approval and had reached the procurement department by the end of the month.

V. PROJECT HIGHLIGHTS

1.1 – Silicon Detector Closeout Work - Nicola Bacchetta

All hybrids have been built, tested and burned-in with excellent yield and minimum re-work (well below our goal of 10%). All stereo modules (40/40) and 75% of the axials (46/62) have been built and tested. Again, quality is excellent with non-useable channels in the range of a few parts per 10^{-4}. That's one order of magnitude below all previous CDF silicon detectors. Modules are placed on stave at a rate of 2 staves per week now and we completed 6 out of 15 staves. Firmware has been modified successfully to readout 5 staves in parallel as needed for the full test of staves in the barrel. The first fully functional stave has been installed in the preproduction barrel today (2/6/04) full test this afternoon. No major problems encountered.

1.2 – Calorimeter

1.2.1 Central Preshower and Crack Detector – Steve Kuhlmann

The Central Preshower/Crack Upgrade continued to ramp up to full production in February. The 2nd production order of phototubes arrived on time. All of the production mechanical parts for the Preshower modules were produced at ANL. The full production order of detector fibers arrived at Fermilab's Village Lab 7 and is being prepared. The first production Dubna tiles were tested and gave 36 pe/MIP with our standard configuration, which is the expected light yield.

Three production-quality fiber sets for the first production Preshower module were assembled at ANL using "pigtails" made at MSU.

The outer shell of the first production phototube box, produced at MSU, is at FNAL and the installation procedure will be finalized in the March 15th access.

1.2.2 Electromagnetic Timing – Dave Toback

All EM Timing work has been completed and the components are ready to install.

1.3 – Data Acquisition and Trigger

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

Two fully loaded TDC cards have been received and standalone testing has been started. We are using the jumpered, internally generated 132ns clock at this point. The first card has passed the initial power and simple VME read/write tests. We intend to use the Test Clock card in March. We still have work to do on the chip firmware to fix a few bugs found in the full simulation of the chip by running test data from the input memory to the output memories. This will take place while we are testing. The firmware problems result in an error in the edge detector for very long pulses and too long a latency for the XFT flags. Neither of these should be too difficult to correct.

Most actives for the past month has been focused on to get ready to test the TDC prototype board. Two test stands with CDF crates and power supplies were assembled in Fermilab and in University of Chicago. A simple framework of testing software was designed and detailed C code for TDC chip diagnosis and functionality testing was being written. Meanwhile, the chip design firmware is being imported to Fermilab for further development and testing.

For the TDC readout path upgrade, we got a loan from Motorola on one of the MVME550. We are working to get an evaluation license of the new VxWorks software needed for the MVME. We will compile and run the existing CDF DAQ code on the new MVME with the new VxWorks to evaluate the software.

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.

Production has begun on pulsar motherboards. We have ordered the S-Link LDC/LSC cards, some of them have already arrived at Fermilab, and they have tested satisfactorily. The firmware implementation and testing for various data paths is in progress and will continue for some time. The main activity this month has been to split the fibers for different data paths to prepare to run in parasitic mode with beam over the summer.

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

Heavy work has been carried out on the simulation of the upgraded XFT. With the recent developments with respect to the degraded performance of the COT the simulation work has focused 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. This work is being carried out primarily by Kevin Lannon and Ben Kilminster. The Linker upgrade work at Ohio State University has been focused on implementing the improved tracking linking algorithm in the latest Altera Stratix devices. Matthew Jones of Purdue has been provided all the mechanical and layout drawings for the former Linker board and will be working on pulling together a Linker board. The main focus now in on the development of the Finder board.

1.3.4 Event Builder – Bruce Knuteson

The EVB/COT interface has been finalized. Two prototype VMIC 7805 boards have arrived and have been installed in the EVB test stand. A new MIT postdoc (Markus Klute) has begun working on the project. Packets have been sent successfully through the GbE switch around the PCs in the test stand. Software design continues.

1.3.6 SVT (Silicon Vertex Tracker) – Luciano Ristori

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 – Nicola Bacchetta

Work continues toward the goal of getting more results from trigger simulations. We are trying to understand how much faster the silicon can be read out by implementing a "pre-digitize" scheme. A faster readout of the silicon system has implications on the maximum Level 1 trigger rate acceptable by CDF. The "pre-digitize" scheme can be implemented either within the present hardware configuration or by using the already developed PULSAR board with an additional interface card instead of the old SRC. We are still waiting for results on the simulation work and CDF data analysis. As stated in last month's report, we still expect to be able to review those results at the end of February.

VI. FINANCIAL STATUS (as of 31 January 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 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.

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 number of specialized financial terms and abbreviations used in the reports 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
Cost Performance Report
at WBS Level 3

Cost Performance Report - Work Breakdown Structure												
Contractor: Location:					Contract Type/No:			Project Name/No: CDF RIIb Mstr Equ - D		Report Period: 1/31/2004	2/29/2004	
Quantity 1	Negotiated Cost 8,702,000		Est. Cost Authorized Unpriced Work 0		Tgt. Profit/ Fee % 0	0	Tgt. Price 8,702,000	Est Price 0	Share Ratio	Contract Ceiling 0	Estimated Contract Ceiling 0	
Funding Type-CA WBS[2] WBS[3]	Current Period					Cumulative to Date					At Completion	
	Budgeted Cost		Actual Cost	Variance		Budgeted Cost		Actual Cost	Variance			
Item	Work Scheduled	Work Performed	Work Performed	Schedule	Cost	Work Scheduled	Work Performed	Work Performed	Schedule	Cost		Budgeted
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		(12)
EQU Equipment												
1.2 Calorimeter Upgrades												
1.2.1 Central Preshower and Crack Detectors	19,859	11,098	16,819	-8,761	-5,720	242,230	107,144	56,005	-135,085	51,139		356,484
1.2.2 Electromagnetic timing	0	0	0	0	0	35,630	35,630	23,403	0	12,227		35,630
WBS[2]Totals:	19,859	11,098	16,819	-8,761	-5,720	277,860	142,775	79,408	-135,085	63,367		392,115
1.3 Run 2b DAQ and Trigger Project												
1.3.7 Silcon Detector DAQ Upgrades	9,075	143	0	-8,932	143	134,202	43,050	0	-91,152	43,050		847,705
1.3.1 Run 2b TDC Project	6,911	3,125	5,969	-3,786	-2,844	103,996	95,006	42,580	-8,990	52,426		1,115,717
1.3.2 Run 2b Level 2 Project	58,681	15,928	15,987	-42,753	-59	206,462	239,367	54,340	32,905	185,027		363,119
1.3.3 Run 2b XFTII Project	7,516	4	0	-7,512	4	156,552	1,313	0	-155,239	1,313		1,149,238
1.3.4 Event-Builder Upgrade	13,445	5,589	2,834	-7,855	2,755	108,857	64,192	44,904	-44,664	19,288		518,867
1.3.5 Computer for Level3 PC Farm / DAQ	0	0	0	0	0	0	0	0	0	0		478,908
1.3.6 SVT upgrade	0	0	0	0	0	0	0	0	0	0		174,441
WBS[2]Totals:	95,627	24,790	24,791	-70,837	-1	710,069	442,929	141,824	-267,140	301,105		4,647,996
1.4 Administration												
1.4.3 Construction Phase	22,357	28,330	12,705	5,973	15,625	327,389	327,107	276,309	-281	50,798		958,867
WBS[2]Totals:	22,357	28,330	12,705	5,973	15,625	327,389	327,107	276,309	-281	50,798		958,867
Funding Type-CATotals:	137,843	64,218	54,314	-73,625	9,904	1,315,318	912,811	497,541	-402,507	415,270		5,998,978
Gen. and Admin.	0	0	0	0	0	0	0	0	0	0		0
Undist. Budget												0
Sub Total	137,843	64,218	54,314	-73,625	9,904	1,315,318	912,811	497,541	-402,507	415,270		6,074,992
Management Resrv.												2,665,015
Total	137,843	64,218	54,314	-73,625	9,904	1,315,318	912,811	497,541	-402,507	415,270		8,663,993

CDF Project Obligations Report Through 29 February 2004

CDF RIIb EQU - FEB FYO4 IN $K							
Task Number	Expenditure Category	Current Mth Total Cost	Current Mth Obligation	YTD Total Cost	YTD OBLIGATIONS W/ INDIRECT	Current PO Open Comm	Prior Yr Total Cost
	M&S	126.7	131.9	188.9	147.6	703.1	221.0
	SWF	26.3	26.3	177.3	177.3	0.0	346.1
	OH	18.4	0.0	69.1	69.1	0.0	140.2
	Total 1.1	171.3	158.2	435.3	394.0	703.1	707.2
	M&S	4.4	0.4	24.8	35.9	11.2	0.0
	SWF	9.0	9.0	18.5	18.5	0.0	20.6
	OH	3.4	0.0	9.6	9.6	0.0	6.3
	Total 1.2	16.8	9.4	52.8	64.0	11.2	26.9
	M&S	6.3	153.1	110.3	212.5	236.5	2.9
	SWF	13.4	13.4	15.5	15.5	0.0	0.0
	OH	5.1	0.0	12.6	12.6	0.0	0.5
	Total 1.3	24.8	166.5	138.5	240.6	236.5	3.4
	M&S	0.5	0.5	9.1	9.1	0.0	13.3
	SWF	9.4	9.4	66.1	66.1	0.0	126.7
	OH	2.9	0.0	21.0	21.0	0.0	40.1
	Total 1.4	12.7	9.8	96.2	96.2	0.0	180.1
Total Project	M&S	137.7	285.9	333.1	405.1	950.8	237.2
	SWF	58.1	58.1	277.3	277.3	0.0	493.5
	OH	29.8	0.0	112.4	112.4	0.0	187.0
Grand Total		225.6	344.0	722.8	794.8	950.8	917.6

TOTAL PROJECT COST (INCEPTION TO DATE):	1640.4

VII. VARIANCE ANALYSIS – P. Lukens

The most significant variance the Project has from the baseline schedule is in the TDC and XFT development. This will be best remedied by additional manpower from the collaboration, and we are currently trying to secure this effort. A reanalysis of the project schedules is planned for March.

VIII. BASELINE CHANGES

No Change Control action documents were approved during February 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