27 February 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 January 2004 Report

Attached is the monthly report summarizing the January 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. 14
1 - 31 January 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, January 2004 saw a couple of significant developments for these projects. The first circuit board orders for the TDC were placed in January, which will set the assembly and testing of the first TDCs in motion. Also, a commitment from the Particle Physics Division electrical engineering group was obtained for support of these projects, beginning in February. Finally, a Level 2 subproject manager was named for the Data Acquisition and Trigger subproject. These are significant developments, and will improve our progress in these areas.

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	19-Nov-03	CR in process
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

The production order was placed with the University of Chicago for the Pulsar boards.

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 %%. 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 make progress in January. Sixty-five spliced fibers were delivered by Lab 7, to go into the Preshower pre-production module. The splicing used the recently delivered thin heat-shrink tubing, and by eye the splices look very good. Close-up pictures were taken of 15 of the splices, these pictures will be correlated with detector response to help refine the splicing technique. These fibers are now at Michigan State being assembled into fiber holders.

Twenty production scintillator tiles were delivered from Dubna, light yield tests are underway on these. Seven hundred tiles per month are expected to be delivered, starting in March (2600 are needed). All other parts for the Preshower module production are either in hand or expected to be delivered in February.

The Crack Detector prototype assembly and testing was finished at ANL. The production parts for this detector will be ordered in early February.

Phototube box assembly is beginning at MSU. Installation hardware design, including the scaffolding, has begun at FNAL and ANL.

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

The final design of the PC board for the TDC was sent out for fabrication in December and five unpopulated boards were received in early January. We have tweaked up the board design and are still adjusting the chip firmware to meet system expectations. The present design should meet the specifications. We are also developing more test simulations.

Parts were ordered to assemble two complete boards and a partial board to test the VME functionality. We already have quotes on assembly for the two boards which will be placed when we are satisfied with the bus interface. The assembly vendor promised two week delivery after receipt of boards and parts. The order should go out in mid-February.

Connectors and cables were ordered for the test stand after seeing and understanding how the present test chamber operates. Small paddle cards will be made to accept a very high performance cable to enable testing at full capability, up to 833 MHZ if necessary. The paddle cards have been designed but we are still waiting for completion of a design of a bracket to hold the connectors into the TDC board. We will make enough cables for testing a total of 12 boards for three possible test stands (one at UC, 2 at Fermilab).

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 mezzanine card production has been finished and all testing has been completed. Preproduction of the Back of crate transition modules has been completed. The Production Readiness Review has been done and production has begun. We are now in the Production phase and we have started to order the S-Link LDC/LSC cards. The firmware implementation and testing for various data paths is in progress and will continue for some time.

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

The Linker upgrade work at Ohio State University has been focused on implementing the improved tracking linking algorithm in the latest Altera Stratix devices. Work continues on the Linker and Finder upgrade modules to determine which devices will actually be used on the board and their specific layout (schematic capture). A workshop was held at the end of December at Fermilab. As a result of the workshop, several more physicist has expressed an interest in the XFT project. Specifically, Matthew Jones, recently hired by Purdue University has expressed an interest in laying out the new Linker Board. Prof Jones visited Columbus at the end of January for detailed discussion. In addition, we are in the process of formulating a detailed specification document for all portions of the XFT upgrade.

1.3.4 Event Builder – Bruce Knuteson

The Cisco switch that will be used in the final system has arrived and has been installed on the 3rd floor of B0. A test system has been set up with 16 PCs linked to the switch. A VMIC 7750 board has successfully read out a CDF DAQ VRB, and the DMA rate over the backplane has been clocked at slightly over 40 MB/s, somewhat better than anticipated. An interface to the COT readout is congealing. Software design continues.

1.3.6 SVT (Silicon Vertex Tracker) – Luciano Ristori

No work is scheduled to begin 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: 12/31/2003	1/31/2004	
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	0	8,702,000	0		0	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	24,494	32,479	3,571	7,985	28,909	222,370	96,046	39,187	-126,324	56,859	356,574
1.2.2 Electromagnetic timing	0	0	0	0	0	35,630	35,630	23,403	0	12,227	35,630
WBS[2]Totals:	24,494	32,479	3,571	7,985	28,909	258,001	131,676	62,589	-126,324	69,087	392,204
1.3 Run 2b DAQ and Trigger Project											
1.3.7 Silcon Detector DAQ Upgrades	9,982	12,204	0	2,222	12,204	125,128	42,907	0	-82,220	42,907	847,705
1.3.1 Run 2b TDC Project	4,099	37,649	36,605	33,550	1,045	103,302	93,359	36,611	-9,942	56,749	1,107,743
1.3.2 Run 2b Level 2 Project	32,258	115,770	0	83,512	115,770	148,356	223,439	38,353	75,083	185,086	363,119
1.3.3 Run 2b XFTII Project	7,327	1,016	0	-6,311	1,016	149,036	1,309	0	-147,727	1,309	1,149,238
1.3.4 Event-Builder Upgrade	14,241	3,441	42,069	-10,800	-38,628	97,811	58,603	42,069	-39,208	16,533	517,361
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:	67,907	170,081	78,674	102,174	91,407	623,632	419,617	117,033	-204,015	302,584	4,638,516
1.4 Administration											
1.4.3 Construction Phase	28,094	23,567	12,399	-4,527	11,168	299,364	298,777	263,604	-587	35,173	1,006,266
WBS[2]Totals:	28,094	23,567	12,399	-4,527	11,168	299,364	298,777	263,604	-587	35,173	1,006,266
Funding Type-CATotals:	120,496	226,127	94,644	105,631	131,483	1,180,996	850,071	443,227	-330,925	406,844	6,036,985
Gen. and Admin.	0	0	0	0	0	0	0	0	0	0	0
Undist. Budget											0
Sub Total	120,496	226,127	94,644	105,631	131,483	1,180,996	850,071	443,227	-330,925	406,844	6,036,985
Management Resrv.											2,665,015
Total	120,496	226,127	94,644	105,631	131,483	1,180,996	850,071	443,227	-330,925	406,844	8,702,000

CDF Project Obligations Report Through January 2004

CDF RIIb EQU - JAN FYO4 IN $K							
Task Number	Expenditure Category	Current Mth Direct Cost	Current Mth Obligation	YTD Total Cost	YTD Obligations W/Indirect	Current PO Open Comm	Prior Yr Total Cost
	M&S	22.5	9.2	62.2	15.7	697.9	220.9
	SWF	14.1	14.1	151.0	151.0	0.0	346.2
	OH	0.0	0.0	50.9	50.9	0.0	140.1
	Total Silicon 1.1	36.6	23.3	264.1	217.6	697.9	707.2
	M&S	0.2	0.0	20.5	35.6	15.2	0.0
	SWF	2.5	2.5	9.4	9.4	0.0	19.7
	OH	0.0	0.0	6.2	6.2	0.0	6.4
	Total Calorimeter 1.2	2.7	2.5	36.1	51.2	15.2	26.1
	M&S	69.6	16.9	104.0	59.3	89.8	2.9
	SWF	2.1	2.1	2.1	2.1	0.0	0.0
	OH	0.0	0.0	7.6	7.6	0.0	0.5
	Total DAQ 1.3	71.7	19.0	113.7	69.0	89.8	3.4
	M&S	0.8	0.8	8.6	8.6	0.0	13.3
	SWF	8.8	8.8	56.7	56.7	0.0	126.7
	OH	0.0	0.0	18.1	18.1	0.0	40.1
	Total Administrative 1.4	9.6	9.6	83.4	83.4	0.0	180.1
Total Project	M&S	93.1	26.9	195.3	119.2	802.9	237.1
	SWF	27.5	27.5	219.2	219.2	0.0	492.6
	OH	0.0	0.0	82.8	82.8	0.0	187.1
Grand Total		120.6	54.4	497.3	421.2	802.9	916.8

TOTAL PROJECT COST (INCEPTION TO DATE):	1414.1

VII. VARIANCE ANALYSIS – P. Lukens

The most significant variance the Project has from the baseline schedule is in the TDC development. This will be best remedied by additional manpower from the collaboration, and we are currently trying to secure this effort.

VIII. BASELINE CHANGES

Two Change Control action documents were approved during January 2004 and are listed below.

- Change Control #7 – Trigger schedule technology change for the Event Builder subproject. Some Level 2 Milestone dates have changed but the funding profile remains the same.

- Change Control #10 – Calorimeter schedule increase in the Preshower construction costs. These changes are based on the experience gained during the construction of the prototype detector.

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