

10 January 2005

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 December 2005 Report**

Attached is the monthly report summarizing the December 2005 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. 37**  
**1 - 31 December 2005**

**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 – Pat Lukens**

The project has now completed its technical objectives. All components of the project are either installed into the experiment or are actively being tested with simulated data. This fulfills the technical objective as stated in the DOE Project Execution Plan for Run IIb CDF Detector Project and Run IIb D-Zero Detector Project, Section 7. Remaining work on the project consists of documentation, and completion of miscellaneous work needed to close out the construction.

### **III. SUBPROJECT SUMMARY AND STATUS**

#### **1.1 Silicon Detector Upgrade**

This detector construction was cancelled by the Director in September 2003. Closeout activities included demonstration of a small scale device. Results of the development for this detector have been submitted to Nuclear Instruments and Methods and accepted for publication

#### **1.2 Calorimeter Upgrades**

##### **1.2.1 Central Pre-shower Upgrade**

##### **1.2.2 Electromagnetic Calorimeter Timing**

These systems were installed in Autumn 2004, and have been included in operations since January, 2005.

#### **1.3 – Data Acquisition and Trigger**

##### **1.3.1 TDC (Time to Digital Converter)**

All of the TDCs used by the Central Outer Tracker have now been modified and installed. Work continues to complete the remaining TDCs, so that the full set of boards have common characteristics. Completion will probably be delayed by operations until the March, 2006 shutdown

##### **1.3.2 Level 2 Trigger Upgrade**

This system has been included in operations since April, 2005

##### **1.3.11 XFT (eXtremely Fast Tracker) II**

One fourth of this system was installed during December and is being commissioned. The remainder will be installed in March, 2006.

##### **1.3.4 Event Builder Upgrade**

This system has been included in operations since September, 2005

##### **1.3.5 Level 3 computers upgrade**

The additional computers purchased for the upgrade are either in operations or are being installed.

##### **1.3.6 SVT (Silicon Vertex Tracker)**

The majority of this system is currently included in operations. Some additional commissioning work is needed for the Hit Buffer, and this is ongoing.

#### IV. FINANCIAL STATUS (as of 31 December 2005)

The baseline cost of the Project is \$8,196K, consisting of Run IIb Project costs (\$6,855K) plus closeout costs of the silicon detector upgrade (\$1,341K), which will no longer be constructed.

**Current Financial Tracking Report** - The table below contains current values for financial tracking quantities that do not appear in the standard Obligations or Cost Performance Reports.

	ACWP		BCWP		BAC		Cont.	EAC	ETC	Complete
	Silicon	Non-Sil	Silicon	Non-Sil	Silicon	Non-Sil				
<b>CY 2005</b>										
<b>January</b>	1341	2277	1341	2909	1673	5254	3448	6295	6125	61%
<b>February</b>	1341	2396	1341	3095	1341	5531	3503	6173	5939	65%
<b>March</b>	1341	2866	1341	3361	1341	5531	3503	6377	5673	68%
<b>April</b>	1341	3028	1341	3378	1341	5945	3089	6936	5656	65%
<b>May</b>	1341	3274	1341	3850	1341	5945	3089	6710	5184	71%
<b>June</b>	1341	3715	1341	4378	1341	5945	910	6623	2477	78%
<b>July</b>	1341	4143	1341	4677	1341	6075	780	6882	2178	81%
<b>August</b>	1341	4291	1341	4885	1341	6075	780	6822	1970	84%
<b>September</b>	1341	4385	1341	5012	1341	6075	780	6789	1843	86%
<b>October</b>	1341	4510	1341	4942	1341	5846	1009	6755	1913	87%
<b>November</b>	1341	5243	1341	5567	1341	5846	1009	6863	1288	96%
<b>December</b>	1341	5641	1341	5672	1341	5846	1009	7156	1183	98%

**CDF RunIIb Obligations Report** - This report provides a Level 2 summary of outstanding Purchase Orders where funds have been committed but for which the Project hasn't been invoiced. This does not include requisitions in the system where a Fermilab PO number has not yet been assigned. Brief descriptions of the columns in this report are 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 – The total of the open commitments against the project. It includes open commitments from the current and all prior years.
- Prior Year Total Cost - 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  
Obligations Report  
Through 31 December 2005**

CDF RI Ib EQU - December 2005 In \$K							
Task Number	Expenditure Category	Current Month Total Cost	Current Month Obligation	YTD Total Cost	YTD Obligations w/Indirect	Current PO Open Comm	Prior Yr Total Cost
Silicon	M&S	0.0	0.0	0.0	0.0	0.0	538.8
	SWF	0.0	0.0	0.0	0.0	0.0	570.0
	OH	0.0	0.0	0.0	0.0	0.0	228.2
	<b>Total 1.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>1,336.9</b>
Calorimeter	M&S	0.0	0.0	0.0	0.0	1.6	275.0
	SWF	0.0	0.0	0.0	0.0	0.0	139.1
	OH	0.0	0.0	0.0	0.0	0.0	52.6
	<b>Total 1.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>1.6</b>	<b>466.7</b>
Trigger/DAQ	M&S	280.0	218.3	917.3	245.3	126.9	2,315.0
	SWF	50.3	50.3	113.5	113.5	0.0	641.8
	OH	53.0	0.0	178.3	178.3	0.0	377.3
	<b>Total 1.3</b>	<b>383.3</b>	<b>268.6</b>	<b>1,209.1</b>	<b>537.1</b>	<b>126.9</b>	<b>3,334.1</b>
Administration	M&S	0.0	0.0	0.0	0.0	0.0	42.2
	SWF	11.0	11.0	35.5	35.5	0.0	412.6
	OH	3.4	0.0	11.0	11.0	0.0	129.2
	<b>Total 1.4</b>	<b>14.5</b>	<b>11.0</b>	<b>46.4</b>	<b>46.4</b>	<b>0.0</b>	<b>584.0</b>
<b>Total Project</b>	M&S	280.0	218.3	917.3	245.3	128.5	3,170.9
	SWF	61.3	61.3	149.0	149.0	0.0	1,763.5
	OH	56.5	0.0	189.3	189.3	0.0	787.3
<b>Grand Total</b>		<b>397.8</b>	<b>279.7</b>	<b>1,255.6</b>	<b>583.6</b>	<b>128.5</b>	<b>5,721.7</b>

**Total Project Cost (Inception To Date): 6,977.2**

**CDF Project Cost Performance Report (CPR)** – This report is generated from COBRA and provides a summary of the WBS 1.2-1.4 costs of the Project down to Level 3 of the Work Breakdown Structure. Silicon detector subproject closeout costs are not tracked here. 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. Where possible, costs are accrued for items that have been delivered, but not yet invoiced. This is only possible for a small fraction of our cost. 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 baseline BAC, and will only be changed after the formal implementation of the Change Control process. Column 13 is the projected BAC, based on the current month's schedule. 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  
Cost Performance Report  
Through 31 December 2005**

Cost Performance Report - Work Breakdown Structure														
Contractor: Location:					Contract Type/No:			Project Name/No: CDF RIIb Equ		Report Period: 11/30/2005 12/31/2005				
Quantity		Negotiated Cost		Est. Cost Authorized Unpriced Work		Tgt. Profit/ Fee %		Tgt. Price	Est Price	Share Ratio	Contract Ceiling	Estimated Contract Ceiling		
1		6,855,000		0		0		0.00	6,855,000	0	0	0		
Funding Type-CA		Current Period					Cumulative to Date					At Completion		
WBS[2]		Budgeted Cost		Actual Cost	Variance		Budgeted Cost		Actual Cost	Variance		Baseline BAC	Latest Revised BAC	BAC Delta
WBS[3]		Work	Work	Work	Schedule	Cost	Work	Work	Work	Schedule	Cost			
Item		Scheduled	Performed	Performed	Schedule	Cost	Scheduled	Performed	Performed	Schedule	Cost			
<b>EQU Equipment</b>														
<b>1.2 Calorimeter Upgrades</b>														
1.2.1 Central Preshower and Crack Detectors		0	0	0	0	0	444,504	444,504	442,925	0	1,579	444,504	444,504	0
1.2.2 Electromagnetic timing		0	0	0	0	0	23,403	23,403	23,403	0	1	23,403	23,403	0
<b>WBS[2]Totals:</b>		0	0	0	0	0	467,908	467,908	466,328	0	1,580	467,908	467,908	0
<b>1.3 Run 2b DAQ and Trigger Project</b>														
1.3.1 Run 2b TDC Project		11,376	17,207	8,842	5,831	8,365	625,111	621,177	495,803	-3,934	125,374	651,795	652,473	678
1.3.2 Run 2b Level 2 Project		0	0	0	0	0	473,959	473,959	470,193	0	3,765	473,959	473,959	0
1.3.4 Event-Builder Upgrade		3,971	1,029	2,750	-2,942	-1,721	432,556	426,879	422,602	-5,676	4,277	435,624	445,651	10,027
1.3.5 Computer for Level3 PC Farm / DAQ		8,641	15,901	269,338	7,260	-253,437	1,080,075	1,080,075	1,269,528	0	-189,453	1,080,075	1,084,622	4,546
1.3.6 SVT upgrade		9,248	8,620	7,339	-628	1,281	362,639	362,639	327,177	0	35,462	362,639	362,639	0
1.3.11 Revised XFTII Project		23,595	43,296	95,067	19,701	-51,771	1,616,008	1,586,038	1,558,514	-29,970	27,523	1,629,697	1,745,641	115,944
<b>WBS[2]Totals:</b>		56,831	86,053	383,336	29,223	-297,282	4,590,347	4,550,767	4,543,818	-39,581	6,949	4,633,789	4,764,984	131,195
<b>1.4 Administration</b>														
1.4.3 Construction Phase		18,650	18,650	14,465	0	4,185	653,042	653,042	630,402	0	22,641	744,322	744,322	0
<b>WBS[2]Totals:</b>		18,650	18,650	14,465	0	4,185	653,042	653,042	630,402	0	22,641	744,322	744,322	0
<b>Funding Type-CATotals:</b>		75,481	104,704	397,801	29,223	-293,098	5,711,298	5,671,717	5,640,547	-39,581	31,169	5,846,019	5,977,213	131,195
Sub Total		75,481	104,704	397,801	29,223	-293,098	5,711,298	5,671,717	5,640,547	-39,581	31,169	5,846,019	5,977,213	131,195
Management Resrv.												1,008,981	877,787	-131,194
Total		75,481	104,704	397,801	29,223	-293,098	5,711,298	5,671,717	5,640,547	-39,581	31,169	6,855,000	6,855,000	0

## V. FUNDING PROFILES

The funding profile for the RunIIb CDF Detector Project is shown below.

	Funding Plan in Current Year \$K				
	FY02	FY03	FY04	FY05	Total
DOE MIE	\$ 3,460	\$ 3,509	\$ 1,227	\$ -	\$ 8,196
DOE R&D	\$ 1,670	\$ 480	\$ -	\$ -	\$ 2,150
Foreign Contributions	\$ 39	\$ 518	\$ 234	\$ 404	\$ 1,195
U.S. Universities	\$ 24	\$ 225	\$ 103	\$ 26	\$ 378
Total	\$ 5,193	\$ 4,732	\$ 1,564	\$ 430	\$ 11,918

## VI VARIANCE ANALYSIS

A significant cost variance appears in our Cost Performance Report for December, 2005. This is within subproject 1.3.5. Investigation into this has revealed that the variance is due to an error made in the accounting of costs for this task. A large purchase order for Level 3 computers appears to have been "double charged" against this account, due to both paying on an invoice, and logging an accrual against the account. The accrual should have been removed, but remained on the accounting records at the end of the month. We expect this to be resolved during January, 2006.