

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost																																																																												
1.5	<b>Run IIb Installation</b>	9/23/04	10/25/06	\$82,200.00	\$0.00	\$537,019.32	\$619,219.32																																																																												
<p><i>Notes</i></p> <p>WBS Definition- This summary task has as its scope the removal of the Run IIa silicon tracker from the D0 detector, the installation of the Run IIb silicon tracker system, the installation of the L1 Calorimeter tracking trigger, the L1 Calorimeter track matching system, upgrades to the Level 2 beta processors, the L2 silicon track trigger upgrade, and the technical commissioning of all the new systems prior to the closing of the detector and the restart of the colliding beam program.</p>																																																																																			
1.5.1	<b>Run IIb Silicon Installation</b>	3/14/05	10/25/06	\$42,200.00	\$0.00	\$392,627.74	\$434,827.74																																																																												
<p><i>Notes</i></p> <p>WBS Definition- This summary task covers the effort to install the silicon tracker for the D0 Run IIb upgrade project. The detector will replace the existing silicon microstrip tracker currently in use for Run 2a, and will enable operations up to integrated luminosities of 15 pb-1 or more.</p>																																																																																			
1.5.1.1	<b>Silicon Ready To Move To DAB</b>	5/25/06	5/25/06	\$0.00	\$0.00	\$0.00	\$0.00																																																																												
<p><i>Notes</i></p> <p>WBS Definition- Milestone: Date determined by Run IIb Silicon Project</p>																																																																																			
1.5.1.2	<b>Shutdown for Installation Begins</b>	3/30/06	3/30/06	\$0.00	\$0.00	\$0.00	\$0.00																																																																												
<p><i>Notes</i></p> <p>WBS Dictionary- Milestone-Derived by chaining tasks at DAB that must be accomplished before silicon can be installed in the detector, given the date of completion of the detector at SiDet.</p>																																																																																			
1.5.1.3	<b>Prepare Silicon Infrastructure</b>	3/14/05	5/24/06	\$38,600.00	\$0.00	\$218,136.20	\$256,736.20																																																																												
<p><i>Notes</i></p> <p>WBS Definition- This summary task includes activities that must take place to ensure that all infrastructure components required for the Run II b silicon (cables, adapter card horseshoes, chiller and piping, and dry gas sytem) are in hand prior to shutdown.</p>																																																																																			
1.5.1.3.1	<b>Design and Fabricate Run IIb Horseshoes</b>	3/14/05	6/6/05	\$15,000.00	\$0.00	\$24,086.40	\$39,086.40																																																																												
	<table border="1"> <thead> <tr> <th>ID</th> <th>Resource Name</th> <th>Units</th> <th>Cost</th> <th>Baseline Cost</th> <th>Act. Cost</th> <th>Rem. Cost</th> <th>Work</th> <th>Ovt. Work</th> <th>Baseline Work</th> <th>Act. Work</th> <th>Rem. Work</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>MechEngF</td> <td>33%</td> <td>\$7,341.84</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$7,341.84</td> <td>158.4 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>158.4 h</td> </tr> <tr> <td>3</td> <td>ElecEngF</td> <td>50%</td> <td>\$11,256.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$11,256.00</td> <td>240 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>240 h</td> </tr> <tr> <td>11</td> <td>PhysicistF</td> <td>50%</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>240 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>240 h</td> </tr> <tr> <td>15</td> <td>DesignerF</td> <td>33%</td> <td>\$5,488.56</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$5,488.56</td> <td>158.4 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>158.4 h</td> </tr> <tr> <td>51</td> <td>MandS</td> <td>15,000</td> <td>\$15,000.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$15,000.00</td> <td>15,000</td> <td></td> <td>0</td> <td>0</td> <td>15,000</td> </tr> </tbody> </table>	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	1	MechEngF	33%	\$7,341.84	\$0.00	\$0.00	\$7,341.84	158.4 h	0 h	0 h	0 h	158.4 h	3	ElecEngF	50%	\$11,256.00	\$0.00	\$0.00	\$11,256.00	240 h	0 h	0 h	0 h	240 h	11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h	15	DesignerF	33%	\$5,488.56	\$0.00	\$0.00	\$5,488.56	158.4 h	0 h	0 h	0 h	158.4 h	51	MandS	15,000	\$15,000.00	\$0.00	\$0.00	\$15,000.00	15,000		0	0	15,000										
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51	MandS	15,000	\$15,000.00	\$0.00	\$0.00	\$15,000.00	15,000		0	0	15,000																																																																								
<p><i>Notes</i></p> <p>WBS Definition- This task provides for the design and fabrication of the N and S "horseshoes", the annular plate-aluminum rings that support the silicon interconnections (adapter boards, twisted pair cables, 80-conductor cables, radiation monitor boards and cables, and L0/L1 temperature monitor boards and cables) on the N and S faces of the Central Calorimeter.</p> <p>M&amp;S BOE- Machinist time to fabricate the horseshoes is estimated at 300 hours (\$15000). There is substantial uncertainty in this estimate because the method whereby the heat will be conducted from the adaptor cards to the horseshoe cooling line is not yet defined. The contingency on this estimate is therefore set at 100%.</p> <p>Labor BOE- Based on Run IIa experience, it is estimated that 3 man-months of engineering, 3 man-months of designer, and 6 man-months of physicist time are required to design the new horseshoes, including the means of cooling the new adapter cards that will be mounted on them. Bill Wray and Lynn Bagby are the likely physicists, and Russ Rucinski the engineer. An electrical engineer as "cable czar" follows this task at the 50% level.</p>																																																																																			
1.5.1.3.2	<b>Procure, Test, and Label HV and LV Cables</b>	7/6/05	9/28/05	\$1,500.00	\$0.00	\$35,832.00	\$37,332.00																																																																												
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work																																																																								
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5	MechTechF	100%	\$13,320.00	\$0.00	\$0.00	\$13,320.00	480 h	0 h	0 h	0 h	480 h																																																																								
11	PhysicistF	25%	\$0.00	\$0.00	\$0.00	\$0.00	120 h	0 h	0 h	0 h	120 h																																																																								
51	MandS	1,500	\$1,500.00	\$0.00	\$0.00	\$1,500.00	1,500		0	0	1,500																																																																								
<p><i>Notes</i></p> <p>WBS Definition- This task labels and bundles the (tested) HV cables (MCH to Platform, and Platform to Interface Board Crates and Horseshoes), and LV cables (Platform to Interface Board Crates), and the radiation monitoring</p>																																																																																			

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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"Procure, Test, and Label HV and LV Cables" continued

Notes  
and temperature monitoring cables (Platform to horseshoes).

M&S BOE-  
\$1500 label cost (per 11/01 D0 Purchase of similar)

Labor BOE-  
Testing, labeling, bundling effort: (LV) 6 voltages x 144 Interface boards plus 2 voltages x 8 bundles for the adapter cards on the horseshoe, (HV) 144 new HV cables, plus 24 rad monitoring cables and 12 temperature monitoring cables.  
Labeling & Testing: Glenair tester permits testing of 1 cable in 5-10 minutes. Adding time to affix labels yields estimate of 25 cables per day. A total of 1024 cables requires 51 days, or 10 weeks effort.  
Bundling (especially the LV cables) requires an additional 2 weeks effort.  
To this technician effort is added 3 weeks physicist time to direct the work, and a "cable czar" electrical engineer to take full responsibility for every aspect of the task.

1.5.1.3.3	Begin Installation of Chiller Pre-shutdown	2/2/06	3/1/06	\$2,000.00	\$0.00	\$10,490.00	\$12,490.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
3	ElecEngF	50%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
5	MechTechF	100%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
42	WelderF	50%	\$2,298.00	\$0.00	\$0.00	\$2,298.00	80 h	0 h	0 h	0 h	80 h
51	MandS	2,000	\$2,000.00	\$0.00	\$0.00	\$2,000.00	2,000	0	0	0	2,000

Notes  
WBS Definition-  
This task provides for the pre-shutdown installation activities for the new chiller for the -20 C system that cools the silicon. The system (not yet designed) is assumed to consist of an additional chiller, heat exchangers, storage vessels, gas purge and removal systems, and piping, all added to the existing -10C Run IIA chiller. Acceptance testing of the new chiller(s), plus modest progress towards incorporating the new components into the existing system before shutdown, are included in this task.

M&S BOE-  
The procurement costs of the major components of the new system are included in the silicon schedule. Depending on details of the system design, installation of certain elements of the system can begin at DAB, requiring expenditures for piping materials, estimated at \$2000.

Labor BOE-  
Includes engineering (4 weeks) and physicist effort (2 weeks) for the acceptance testing and installation followup at DAB. Welder time for pre-shutdown piping work is estimated at 80 hours. 4 weeks of technician time are included for this task. The lack of a final system design sets the contingency on these estimates at 150%. Dan Olis is the preferred engineer, and Bill Cooper the physicist.

1.5.1.3.4	Complete Installation of Chiller, Perform functional test	3/2/06	3/29/06	\$0.00	\$0.00	\$15,142.00	\$15,142.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
3	ElecEngF	50%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
5	MechTechF	100%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h
9	ElecTechF	50%	\$2,354.00	\$0.00	\$0.00	\$2,354.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
42	WelderF	100%	\$4,596.00	\$0.00	\$0.00	\$4,596.00	160 h	0 h	0 h	0 h	160 h

Notes  
WBS Definition-  
This task provides for the completion, after the shutdown begins, of installation for the new chiller for the -20 C system that cools the silicon. The checkout will consist of fixing a jumper to the supply/return lines and operating the system to verify its capacity at DAB.

M&S BOE-  
Piping materials (\$2000) and miscellaneous minor electrical hookup items (\$1000) comprise the M&S needs of this task.

Labor BOE-  
Includes time (see M&S above) for interconnection of chiller and related components with piping (vacuum-jacketed) and necessary valves, instrumentation, etc., and connection of instrumentation and controls to the existing PLC controller, as well as testing of the system. Run2a experience has guided the effort estimates: 1 full-time mechanical technician and one half-time electrical tech and one half-time electrical engineer, and 2 w of physicist time to evaluate the results of the testing. The lack of a final system design sets the contingency on these estimates at 150%. Dan Markley and Dan Olis are the preferred engineers, and Bill Cooper the physicist.

1.5.1.3.5	Install and check out piping	3/23/06	5/24/06	\$5,000.00	\$0.00	\$35,326.80	\$40,326.80
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	30%	\$5,005.80	\$0.00	\$0.00	\$5,005.80	108 h	0 h	0 h	0 h	108 h
5	MechTechF	200%	\$19,980.00	\$0.00	\$0.00	\$19,980.00	720 h	0 h	0 h	0 h	720 h
11	PhysicistF	30%	\$0.00	\$0.00	\$0.00	\$0.00	108 h	0 h	0 h	0 h	108 h

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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"Install and check out piping" continued

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
42	WelderF	100%	\$10,341.00	\$0.00	\$0.00	\$10,341.00	360 h	0 h	0 h	0 h	360 h
51	MandS	5,000	\$5,000.00	\$0.00	\$0.00	\$5,000.00	5,000		0	0	5,000

Notes

**WBS Definition-**

This task provides for the installation and test of the piping, vessels, etc. which interconnect the chiller of the -20 C system (on the sidewalk) to the silicon system in the collision hall. In addition to helium leak testing, flow tests of the system (with a jumper connecting the supply and returns near the silicon) will be conducted prior to connection with the silicon system itself.

**M&S BOE-**

New lines likely required for Run IIb will be routed into the detector along very complicated and congested pathways. The M&S costs of piping materials are estimated at \$5000.

**Labor BOE-**

Includes time for pipe welding (360 hours) as well as helium leak testing, flushing and flow testing of piping system. With Run IIa experience in mind, two full time technicians, plus 3 w of a mechanical engineer to direct the work and 3 w of a physicist to evaluate the flow testing, are estimated to be required for the task. The lack of a final system design sets the contingency on these estimates at 150%. Russ Rucinski is the preferred engineer and Bill Cooper the preferred physicist.

1.5.1.3.6	Install new dry gas system	2/16/06	4/12/06	\$2,500.00	\$0.00	\$12,632.00	\$15,132.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
3	ElecEngF	25%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
5	MechTechF	100%	\$8,880.00	\$0.00	\$0.00	\$8,880.00	320 h	0 h	0 h	0 h	320 h
11	PhysicistF	25%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
51	MandS	2,500	\$2,500.00	\$0.00	\$0.00	\$2,500.00	2,500		0	0	2,500

Notes

**WBS Definition-**

This task provides for the installation of new/refurbished compressors, dryers, updated controls and piping for replacement dry air system that has yet to be designed.

**M&S BOE-**

Miscellaneous electrical hardware (wire, connectors, etc.) piping, and pipe fittings estimated at \$2500 comprise the M&S needs of this task. Contingency is set at 100% given the lack of detail available for this system.

**Labor BOE-**

The labor estimates are quite uncertain since the system has not yet been designed, but with Run IIa experience in mind, and considering the complexities of running any required new piping into the detector, one full time technician, plus 2w of a mechanical engineer, 2 weeks of an electrical engineer, and 2w of a physicist to guide the task, are required. Contingency is set at 150%, given the lack of detail available for this system. Dan Markley is the preferred electrical engineer, Bill Cooper the preferred physicist, and Dan Olis the preferred mechanical engineer.

1.5.1.3.7	Design Silicon Transport Fixture	3/14/05	4/8/05	\$0.00	\$0.00	\$12,960.00	\$12,960.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$7,416.00	\$0.00	\$0.00	\$7,416.00	160 h	0 h	0 h	0 h	160 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
15	DesignerF	100%	\$5,544.00	\$0.00	\$0.00	\$5,544.00	160 h	0 h	0 h	0 h	160 h

Notes

**WBS Definition-**

This task designs the transportation fixture required to safely move the RunIIb silicon from SiDet to DAB

**M&S BOE-**

NA

**Labor BOE-**

The fixture is expected to substantially resemble that made for Run IIa, so the estimate for the effort required is based on that experience: 1 month engineer, 1 month designer, 2 weeks physicist.

1.5.1.3.8	Fabricate Silicon Transport Fixture	4/11/05	5/6/05	\$2,500.00	\$0.00	\$3,708.00	\$6,208.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	50%	\$3,708.00	\$0.00	\$0.00	\$3,708.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	25%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
51	MandS	2,500	\$2,500.00	\$0.00	\$0.00	\$2,500.00	2,500		0	0	2,500

Notes

**WBS Definition-**

This task fabricates the transportation fixture required to safely move the RunIIb silicon from SiDet to DAB

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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"Fabricate Silicon Transport Fixture" continued

Notes

M&S BOE-

The fixture is expected to substantially resemble that made for Run IIA, so the estimate for the shopwork and materials is made with that device in mind: 40 hours machinist time (\$2000), plus \$500 materials

Labor BOE-

The fixture is expected to substantially resemble that made for Run IIA, so the estimate for the effort required is made with that device in mind: 2 weeks mechanical tech and 1 week supervision by a physicist.

1.5.1.3.9	Test Silicon Transport Fixture		5/9/05	5/13/05	\$0.00	\$0.00	\$2,964.00	\$2,964.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$1,854.00	\$0.00	\$0.00	\$1,854.00	40 h	0 h	0 h	0 h	40 h
5	MechTechF	100%	\$1,110.00	\$0.00	\$0.00	\$1,110.00	40 h	0 h	0 h	0 h	40 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h

Notes

WBS Definition-

Measure gravitational loadings imparted to an object of the same size and weight as the silicon tracker during a trial move to D0

M&S BOE-

NA

Labor BOE-

Run2a experience guides the estimate for this task: 1 week for an engineer, a technician, and 50% time for a physicist.

1.5.1.3.10	Design Silicon Installation Fixture		5/16/05	6/27/05	\$0.00	\$0.00	\$19,440.00	\$19,440.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$11,124.00	\$0.00	\$0.00	\$11,124.00	240 h	0 h	0 h	0 h	240 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	120 h	0 h	0 h	0 h	120 h
15	DesignerF	100%	\$8,316.00	\$0.00	\$0.00	\$8,316.00	240 h	0 h	0 h	0 h	240 h

Notes

WBS Definition-

This task designs the fixtures for moving silicon from the D0 high bay into final position within the CFT

M&S BOE-

NA

Labor BOE-

The fixture is expected to largely resemble that used for RunIIa, so the estimates of effort required for its design are based on considerations of that device: 6 weeks mechanical engineer, 6 weeks designer, and 3 weeks physicist.

1.5.1.3.11	Fabricate Silicon Installation Fixture		6/28/05	8/9/05	\$6,500.00	\$0.00	\$12,222.00	\$18,722.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	50%	\$5,562.00	\$0.00	\$0.00	\$5,562.00	120 h	0 h	0 h	0 h	120 h
5	MechTechF	100%	\$6,660.00	\$0.00	\$0.00	\$6,660.00	240 h	0 h	0 h	0 h	240 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	120 h	0 h	0 h	0 h	120 h
51	MandS	6,500	\$6,500.00	\$0.00	\$0.00	\$6,500.00	6,500		0	0	6,500

Notes

WBS Definition-

This task fabricates the fixtures for moving silicon from the D0 high bay into final position within the CFT

M&S BOE-

The fixture is expected to largely resemble that used for RunIIa, so the estimates of M&S required for its fabrication are based on considerations of that device: 80 hrs machinist (\$4000), \$2500 materials

Labor BOE-

The fixture is expected to largely resemble that used for RunIIa, so the estimates of effort required for its design are based on considerations of that device: 3 weeks mechanical engineer, 6 weeks mechanical tech, and 3 weeks physicist.

1.5.1.3.12	Test Silicon Installation Fixture		8/10/05	8/16/05	\$0.00	\$0.00	\$2,037.00	\$2,037.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	50%	\$927.00	\$0.00	\$0.00	\$927.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	100%	\$1,110.00	\$0.00	\$0.00	\$1,110.00	40 h	0 h	0 h	0 h	40 h

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Test Silicon Installation Fixture" continued											
<u>Notes</u>											
WBS Definition- This task tests the fixtures for moving silicon from the D0 high bay into final position within the CFT, to the extent possible before shutdown begins, by performing a trial run using the fixtures with dummy silicon assemblies											
M&S BOE- NA											
Labor BOE- 1 week mechanical tech, plus mechanical engineer oversight are required for this task.											
1.5.1.3.13	Design Silicon Alignment Fixtures	8/17/05	9/14/05	\$0.00	\$0.00	\$12,960.00	\$12,960.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	100%	\$7,416.00	\$0.00	\$0.00	\$7,416.00	160 h	0 h	0 h	0 h	160 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
15	DesignerF	100%	\$5,544.00	\$0.00	\$0.00	\$5,544.00	160 h	0 h	0 h	0 h	160 h
<u>Notes</u>											
WBS Definition- Design the fixtures to aid in aligning silicon with CFT barrel 1											
M&S BOE- NA											
Labor BOE- The fixtures required are expected to resemble those used for Run IIA, so the estimates of effort required are based on considerations of that tooling: 2 weeks physicist, 4 weeks designer, 4 weeks mechanical engineer.											
1.5.1.3.14	Fabricate Silicon Alignment Fixtures	9/15/05	10/12/05	\$2,100.00	\$0.00	\$5,928.00	\$8,028.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	50%	\$3,708.00	\$0.00	\$0.00	\$3,708.00	80 h	0 h	0 h	0 h	80 h
5	MechTechF	50%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
51	MandS	2,100	\$2,100.00	\$0.00	\$0.00	\$2,100.00	2,100		0	0	2,100
<u>Notes</u>											
WBS Definition- Fabricate the fixtures to aid in aligning silicon with CFT barrel 1											
M&S BOE- The fixtures required are expected to resemble those used for Run IIA, so the estimates of effort required are based on considerations of that tooling: 40 hours machinist (\$2000) plus \$100 materials											
Labor BOE- The fixtures required are expected to resemble those used for Run IIA, so the estimates of effort required are based on considerations of that tooling: 2 weeks mechanical engineer, 2 weeks mechanical tech.											
1.5.1.3.15	Design Beampipe Insertion Fixtures	10/13/05	10/26/05	\$0.00	\$0.00	\$6,480.00	\$6,480.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	100%	\$3,708.00	\$0.00	\$0.00	\$3,708.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
15	DesignerF	100%	\$2,772.00	\$0.00	\$0.00	\$2,772.00	80 h	0 h	0 h	0 h	80 h
<u>Notes</u>											
WBS Definition- This task designs the fixtures needed to insert the beryllium beampipe into the silicon											
M&S BOE- NA											
Labor BOE- This fixture is expected to resemble that used for Run IIA, so the estimate of labor is based on considerations of that device: 2 weeks mechanical engineer, 2 weeks physicist, and 2 weeks designer.											

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.3.16	Fabricate Beampipe Insertion Fixtures	10/27/05	11/23/05	\$1,500.00	\$0.00	\$5,928.00	\$7,428.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 50% \$3,708.00 \$0.00 \$0.00 \$3,708.00 80 h 0 h 0 h 0 h 80 h						
	5 MechTechF 50% \$2,220.00 \$0.00 \$0.00 \$2,220.00 80 h 0 h 0 h 0 h 80 h						
	51 MandS 1,500 \$1,500.00 \$0.00 \$0.00 \$1,500.00 1,500 0 0 0 1,500						
	<u>Notes</u>						
	WBS Definition- This task fabricates the fixtures needed to insert the beryllium beampipe into the silicon						
	M&S BOS- This fixture is expected to resemble that used for RunIIa, so the estimate of M&S is based on considerations of that device: 20 hrs machninst (\$1000) plus \$500 materials						
	Labor BOE- This fixture is expected to resemble that used for RunIIa, so the estimate of labor is based on considerations of that device: 2 weeks mechanical engineer, 2 weeks mechanical tech.						
1.5.1.3.17	Silicon Infrastructure Prepared	5/24/06	5/24/06	\$0.00	\$0.00	\$0.00	\$0.00
	<u>Notes</u>						
	WBS Definition- Milestone-All infrastructure required by the silicon (cables, chiller and piping, dry gas system) is complete.						
1.5.1.4	Open Detector and Install CC-EC Scaffolding	3/30/06	4/5/06	\$0.00	\$0.00	\$2,942.10	\$2,942.10
	<u>Notes</u>						
	WBS Definition- This summary task opens the detector, disconnects the Tevatron beampipe, and prepares the CC-EC gaps for use by the people who will uncable and remove the RunIIa silicon system. Included is the erection of scaffolding and the installation of lighting, with masks to protect the CFT fibers.						
	M&S BOE- NA						
	Labor BOE- Run IIa experience, based on the number of people (peaks at 6 during EC opening) required to open the detector, and the reduced number (4) who can efficiently work in the CC/EC gaps at any one time to install the scaffolding.						
1.5.1.4.1	Retract S Muon Shield and S EF, Disconnect Tev Bea	3/30/06	3/31/06	\$0.00	\$0.00	\$536.70	\$536.70
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 25% \$92.70 \$0.00 \$0.00 \$92.70 2 h 0 h 0 h 0 h 2 h						
	5 MechTechF 200% \$444.00 \$0.00 \$0.00 \$444.00 16 h 0 h 0 h 0 h 16 h						
	<u>Notes</u>						
	WBS Definition- This task retracts the S Muon shield in the S EMC truss, disconnects the Tevatron beampipe at the isolation valve near the low beta quad, opens the S EF steel, and disconnects the Tev beampipe from the downstream end of the S EC beampipe.						
	M&S BOE- NA						
	Labor BOE- RunIIa experience, where this task (except the disconnection of the Tevatron beampipe) was done repeatedly, forms the basis of estimate for effort (typically SEF can be opened in 1/2 shift).						
1.5.1.4.2	Open N EF, CF steel	3/31/06	4/3/06	\$0.00	\$0.00	\$980.70	\$980.70
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 25% \$92.70 \$0.00 \$0.00 \$92.70 2 h 0 h 0 h 0 h 2 h						
	5 MechTechF 400% \$888.00 \$0.00 \$0.00 \$888.00 32 h 0 h 0 h 0 h 32 h						
	<u>Notes</u>						
	WBS Definition- This task retracts the N Muon Shield, opens the N EF, and opens the central CF steel.						
	M&S BOE- NA						
	Labor BOE-						

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
"Open N EF, CF steel" continued							
<i>Notes</i> RunIIa experience, where this task was done routinely in 1 shift, forms the basis of estimate for effort.							
1.5.1.4.3	Open EC's	4/3/06	4/4/06	\$0.00	\$0.00	\$536.70	\$536.70
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 25% \$92.70 \$0.00 \$0.00 \$92.70 2 h 0 h 0 h 0 h 2 h						
	5 MechTechF 200% \$444.00 \$0.00 \$0.00 \$444.00 16 h 0 h 0 h 0 h 16 h						
	11 PhysicistF 400% \$0.00 \$0.00 \$0.00 \$0.00 32 h 0 h 0 h 0 h 32 h						
<i>Notes</i> WBS Definition- This task opens the end calorimeters.  M&S BOE- NA  Labor BOE- RunIIa experience, where this task was done several times, forms the basis of estimate for effort. Six people are required (4 as observers), to ensure cables, etc. aren't damaged.							
1.5.1.4.4	Install accesways, CC-EC gap scaffolds	4/4/06	4/5/06	\$0.00	\$0.00	\$888.00	\$888.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 400% \$888.00 \$0.00 \$0.00 \$888.00 32 h 0 h 0 h 0 h 32 h						
<i>Notes</i> WBS Definition- This task installs the accessways into the cathedral, and the special scaffolds in the CC/EC gaps, plus needed lighting.  M&S BOE- NA  Labor BOE- RunIIa experience, where this task was done on several occasions, forms the basis of estimate for effort.							
1.5.1.4.5	<b>Detector Open and Ready for Access</b>	<b>4/5/06</b>	<b>4/5/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>
<i>Notes</i> WBS definition- Milestone-The detector is open and ready for all authorized access.							
1.5.1.5	<b>Uncable Silicon, Remove LVPS and IB Crates</b>	<b>4/5/06</b>	<b>5/9/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$10,978.00</b>	<b>\$10,978.00</b>
<i>Notes</i> WBS Definition- This summary task incorporates the decabbling of the RunIIa silicon, the removal of the LVPS system, and the IB crates.							
1.5.1.5.1	Remove Interface Boards from first IB Crate	4/5/06	4/5/06	\$0.00	\$0.00	\$0.00	\$0.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	11 PhysicistF 100% \$0.00 \$0.00 \$0.00 \$0.00 8 h 0 h 0 h 0 h 8 h						
<i>Notes</i> WBS Dictionary- This task removes interface boards (18) from single selected interface board crate. 80-conductor cables must first be disconnected from boards, then boards removed. Completion of task is important so first installment of boards can be immediately sent to KSU to initiate the rework process.  M&S BOE- NA  Labor BOE- Estimate made from RunIIa experience, where task was done on occasion.							

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.5.2	Uncable Low Mass cables and Rad Mon Cables	4/5/06	4/11/06	\$0.00	\$0.00	\$0.00	\$0.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	11 PhysicistF 400% \$0.00 \$0.00 \$0.00 \$0.00 160 h 0 h 0 h 0 h 160 h						
	<u>Notes</u>						
	WBS Definition- This task disconnects all the "low mass" flex-circuit cables of the silicon detector from the adapter cards on the horseshoe. It also disconnects the radiation monitor cables and removes the radiation monitor boards from the horseshoe. The cables will be bundled as appropriate to facilitate the removal of the SMT.						
	M&S BOE- NA						
	Labor BOE- Based on two people working at any on time on the scaffolding between either CC/EC gap. There are 2 low-mass cables per adapter card (489 adapter cards per side). Each cable is strain-relieved at the adapter card connector by a small two-screw clamp that must be removed before the cable is disconnected. An alternate approach would be to sever the low-mass cables (e.g. with scissors) to save time. There are 12 radiation monitor cables per side to disconnect, plus the 12 radiation monitor cards on each horseshoe. The radmon cards will be reused for RunIIb.						
1.5.1.5.3	Uncable 80-conductor cables and clock cables	4/12/06	4/18/06	\$0.00	\$0.00	\$0.00	\$0.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	11 PhysicistF 400% \$0.00 \$0.00 \$0.00 \$0.00 160 h 0 h 0 h 0 h 160 h						
	<u>Notes</u>						
	WBS Definition- This task disconnects the "high mass" 80-conductor cables from the adapter cards on the horseshoe. As a consequence of this operation, the adapter cards are also removed from the horseshoe. The clock cables are also disconnected during this task. The high mass cables and clock cables are temporarily bundled and fastened out of the way on the face of the CC, beyond the radius of the horseshoe, as they will be reused for RunIIb.						
	M&S BOE- NA						
	Labor BOE- Estimates derived by considering that two people can work in each CC/EC gap at any one time. There are 576 high-mass cables (288 per side) and it is estimated that one person can disconnect and set aside ~ 25 per day, removing the adaptor cards as the task proceeds.						
1.5.1.5.4	Remove Si LVPS	4/5/06	4/11/06	\$0.00	\$0.00	\$2,986.00	\$2,986.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	3 ElecEngF 100% \$1,876.00 \$0.00 \$0.00 \$1,876.00 40 h 0 h 0 h 0 h 40 h						
	5 MechTechF 100% \$1,110.00 \$0.00 \$0.00 \$1,110.00 40 h 0 h 0 h 0 h 40 h						
	<u>Notes</u>						
	WBS Definition- This task disconnects and removes the silicon low voltage power supplies from the racks at the base of the central calorimeter. It also removes the VESDA and silicon cooling interlock cables from each supply.						
	M&S BOE- NA						
	Labor BOE- RunIIa experience guided the estimates of the required effort for this task.						
1.5.1.5.5	Remove Interface Board Crates, Test 80-conductor ca	4/12/06	4/25/06	\$0.00	\$0.00	\$0.00	\$0.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	11 PhysicistF 400% \$0.00 \$0.00 \$0.00 \$0.00 320 h 0 h 0 h 0 h 320 h						
	<u>Notes</u>						
	WBS Definition- This task disconnects the 80-conductor cables (72 per crate) from the top of the interface board crates, removes the clock cables, removes the temperature monitoring probe, removes the 18 interface boards from the crates, lifts and suspends the crate, disconnects the 50-conductor cables from the bottoms of the crates, disconnects the 1553 interface cable and 21 power supply harnesses from each crate, disconnects the 34-conductor cables (HV supply cables, 18 per crate) from the crates, then removes the crates from the racks which are at the base of the central calorimeter. The 80 conductor cables are tested for integrity after the IB crate is removed.						
	M&S BOE- NA						

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Remove Interface Board Crates, Test 80-conductor cables" continued											
<u>Notes</u> Labor BOE- Estimate based on RunIIa experience gained when the crates were first installed, incremented to allow time for testing the 80-conductor cables. Four physicists (one per quadrant) will decable and remove two crates each in one week, then spend a second week checking the cables. The cable checks use the Glenair instrument, which does one cable in 5-10 minutes (the elapsed time is dominated by hooking up the jumper cable(s), and keeping one's mind on task), and for 72 cables this is 6-12 hours per crate. Two crates are 12-24 hours.											
1.5.1.5.6	Remove Fuse Panels	4/12/06	4/18/06	\$0.00	\$0.00	\$2,220.00	\$2,220.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	200%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
<u>Notes</u> WBS Definition- This task disconnects and removes the fuse panels from the low voltage power supply system. The fuse panels will not be reused for Run IIb.  M&S BOE- NA  Labor BOE- Run IIa experience has guided the estimation of labor required for this task.											
1.5.1.5.7	Remove unneeded Rack Monitor Chassis	4/19/06	4/19/06	\$0.00	\$0.00	\$222.00	\$222.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	100%	\$222.00	\$0.00	\$0.00	\$222.00	8 h	0 h	0 h	0 h	8 h
<u>Notes</u> WBS Definition- One 1553 per quadrant is no longer needed in the cathedral (it goes to the platform) and will be removed.  M&S BOE- NA  Labor BOE- Run IIa experience has guided the estimation of labor required for this task.											
1.5.1.5.8	Remove HV cables	4/5/06	5/9/06	\$0.00	\$0.00	\$5,550.00	\$5,550.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	100%	\$5,550.00	\$0.00	\$0.00	\$5,550.00	200 h	0 h	0 h	0 h	200 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	100 h	0 h	0 h	0 h	100 h
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	400 h	0 h	0 h	0 h	400 h
<u>Notes</u> WBS Definition- This largely contingent task removes some (perhaps all) of the HV supply cables (34-conductor, 1 per IB slot) from the wireways beneath the interface board crates. It may happen that most of the cables can be reused for RunIIb, but it still may be necessary to remove the balance in order to fit the additional new ones in the wireways.  M&S BOE- NA  Labor BOE- The labor estimates are based on consideration of the effort required to remove the 144 cables from the wireways (without unduly disturbing other cables in the wireways). Task time is allowed to fabricate and install 4 restraints to lift the 50-conductor cables off the HV cables.											
1.5.1.6	Modify RunIIa Interface Boards, Test, Reinstall	4/6/06	7/27/06	\$3,600.00	\$0.00	\$4,708.00	\$8,308.00				
<u>Notes</u> WBS Definition- This summary task modifies the existing interface cards (8 crates x 18 boards per crate = 144) as they are removed from the detector. (In fact, 1 crate's worth will pre exist from SiDet, and an equivalent number will serve as spares when the task is completed).											
1.5.1.6.1	Quadrant 1	4/6/06	4/19/06	\$900.00	\$15,000.00	\$0.00	\$900.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
4	ElecEngU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h



WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
"Quadrant 2" continued							
<u>Notes</u>							
M&S BOE- NA							
Labor BOE- Estimates, based on Run IIa experience: one physicist for testing, one electrical tech to prepare and load the crates.							

1.5.1.6.5	Quadrant 3	5/24/06	6/21/06	\$900.00	\$15,000.00	\$0.00	\$900.00				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	25%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
10	ElecTechU	225%	\$0.00	\$0.00	\$0.00	\$0.00	360 h	0 h	0 h	0 h	360 h
12	PhysicistU	23%	\$0.00	\$0.00	\$0.00	\$0.00	36.8 h	0 h	0 h	0 h	36.8 h
51	MandS	900	\$900.00	\$0.00	\$0.00	\$900.00	900		0	0	900

Notes

**WBS Definition-**  
This task modifies the existing interface cards (8 crates x 18 boards per crate = 144) as they are removed from the detector. (In fact, 1 crate's worth will pre exist from SiDet, so the excess 18 boards will serve as spares once Run IIb gets underway. The availability of these 18 boards at the beginning of installation means the first quadrant can be stocked after only 2 weeks time at KSU).

**M&S BOE-**  
All required parts were procured previously (when the test station was set up at KSU), so the remaining M&S will be only shipping/insurance to-from KSU/ FNAL, \$900 per shipment.

**Labor BOE-**  
From detailed estimate prepared by Ron Sidwell (KU, where RunIIa boards were done). Fabrication requires 4 hours (electrical tech at \$35 per hour) per board (240 parts changed on each board), testing (uses SASEQ test stand with hybrids and SVX4), requires 4 hours (\$35/hour) per board. 10% allowed for repair, at 2 hrs per board. This is \$350 per board, and for 18 boards/crate, 2 crates/quadrant, \$12600. In addition, an electrical engineer at \$60/hour for 5 days for integration and installation at D0, i.e. \$2400, for a total \$15000 KSU labor; plus 1 hr per board physicist time is required for training, monitoring, reporting, etc. (36 hrs/4w = 23%).

1.5.1.6.6	Quadrant 3	6/22/06	6/28/06	\$0.00	\$0.00	\$1,177.00	\$1,177.00				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
9	ElecTechF	100%	\$1,177.00	\$0.00	\$0.00	\$1,177.00	40 h	0 h	0 h	0 h	40 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h

Notes

**WBS Definition-**  
This task installs the new J1 backplanes in the 2 crates, installs the modified interface cards (2 crates x 18 boards per crate = 36) received from KU, and tests the loaded crate.

**M&S BOE-**  
NA

**Labor BOE-**  
Estimates, based on Run IIa experience: one physicist for testing, one electrical tech to prepare and load the crates.

1.5.1.6.7	Quadrant 4	6/22/06	7/20/06	\$900.00	\$15,000.00	\$0.00	\$900.00				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	25%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
10	ElecTechU	225%	\$0.00	\$0.00	\$0.00	\$0.00	360 h	0 h	0 h	0 h	360 h
12	PhysicistU	23%	\$0.00	\$0.00	\$0.00	\$0.00	36.8 h	0 h	0 h	0 h	36.8 h
51	MandS	900	\$900.00	\$0.00	\$0.00	\$900.00	900		0	0	900

Notes

**WBS Definition-**  
This task modifies the existing interface cards (8 crates x 18 boards per crate = 144) as they are removed from the detector. (In fact, 1 crate's worth will pre exist from SiDet, so the excess 18 boards will serve as spares once Run IIb gets underway. The availability of these 18 boards at the beginning of installation means the first quadrant can be stocked after only 2 weeks time at KSU).

**M&S BOE-**  
All required parts were procured previously (when the test station was set up at KSU), so the remaining M&S will be only shipping/insurance to-from KSU/ FNAL, \$900 per shipment.

**Labor BOE-**  
From detailed estimate prepared by Ron Sidwell (KU, where RunIIa boards were done). Fabrication requires 4 hours (electrical tech at \$35 per hour) per board (240 parts changed on each board), testing (uses SASEQ test stand with hybrids and SVX4), requires 4 hours (\$35/hour) per board. 10% allowed for repair, at 2 hrs per board. This is \$350 per board, and for 18 boards/crate, 2 crates/quadrant, \$12600. In

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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"Quadrant 4" continued

Notes

addition, an electrical engineer at \$60/hour for 5 days for integration and installation at D0, i.e. \$2400, for a total \$15000 KSU labor; plus 1 hr per board physicist time is required for training, monitoring, reporting, etc. (36 hrs/4w = 23%).

1.5.1.6.8	Quadrant 4		7/21/06	7/27/06	\$0.00	\$0.00	\$1,177.00	\$1,177.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
9	ElecTechF	100%	\$1,177.00	\$0.00	\$0.00	\$1,177.00	40 h	0 h	0 h	0 h	40 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h

Notes

WBS Definition-

This task installs the new J1 backplanes in the 2 crates, installs the modified interface cards (2 crates x 18 boards per crate = 36) received from KU, and tests the loaded crate.

M&S BOE-  
NA

Labor BOE-

Estimates, based on Run IIa experience: one physicist for testing, one electrical tech to prepare and load the crates.

1.5.1.7	<b>Remove RunIIa Silicon</b>		<b>4/5/06</b>	<b>5/4/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$20,156.94</b>	<b>\$20,156.94</b>
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Notes

WBS Dictionary-

This summary task completes the mechanical disconnection of the Run IIa silicon and removes it and the adaptor card supports (horseshoes) from the detector.

1.5.1.7.1	Drain silicon coolant and dry passages		4/6/06	4/13/06	\$0.00	\$0.00	\$1,573.50	\$1,573.50
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	25%	\$463.50	\$0.00	\$0.00	\$463.50	10 h	0 h	0 h	0 h	10 h
5	MechTechF	100%	\$1,110.00	\$0.00	\$0.00	\$1,110.00	40 h	0 h	0 h	0 h	40 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h

Notes

WBS Definition-

Drain the coolant from the present -10 C system and dry the cooling passages

M&S BOE-  
NA

Labor BOE-

Estimates based on understanding of system complexity and access, plus Run2a experience gained when RunIIa lines were flushed after fabrication.

1.5.1.7.2	Remove EC flanges and bellows		4/5/06	4/7/06	\$0.00	\$0.00	\$1,110.48	\$1,110.48
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	30%	\$222.48	\$0.00	\$0.00	\$222.48	4.8 h	0 h	0 h	0 h	4.8 h
5	MechTechF	200%	\$888.00	\$0.00	\$0.00	\$888.00	32 h	0 h	0 h	0 h	32 h
11	PhysicistF	30%	\$0.00	\$0.00	\$0.00	\$0.00	4.8 h	0 h	0 h	0 h	4.8 h

Notes

WBS Definition-

Cut the end calorimeter beam tube flange and bellows assemblies from the inboard ends of the beam tubes passing through each end calorimeter.

M&S BOE-  
NA

Labor BOE-

Estimates are derived from Run2a experience where similar preparation of the end calorimeter beam pipes was required for the Run2a silicon.

1.5.1.7.3	Remove beryllium beam pipe		4/7/06	4/13/06	\$0.00	\$0.00	\$3,108.96	\$3,108.96
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	30%	\$444.96	\$0.00	\$0.00	\$444.96	9.6 h	0 h	0 h	0 h	9.6 h
5	MechTechF	300%	\$2,664.00	\$0.00	\$0.00	\$2,664.00	96 h	0 h	0 h	0 h	96 h
11	PhysicistF	30%	\$0.00	\$0.00	\$0.00	\$0.00	9.6 h	0 h	0 h	0 h	9.6 h

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Remove beryllium beam pipe" continued											
<i>Notes</i>											
WBS Definition- Install beam pipe handling fixturing, remove the Run 2a beryllium beam pipe from the Run 2a silicon. The pipe is removed via the beampipe through the south end calorimeter.											
M&S BOE- NA											
Labor BOE- Estimates derived from Run2a experience, for which this task is essentially a direct reversal of that required in Run2a.											
1.5.1.7.4	Remove H-disks	4/13/06	4/20/06	\$0.00	\$0.00	\$3,147.00	\$3,147.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	50%	\$927.00	\$0.00	\$0.00	\$927.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	200%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h
<i>Notes</i>											
WBS Definition- Remove the H-disks from within CFT barrel 3											
M&S BOE- NA											
Labor BOE- Estimates are based on Run2a installation experience, reduced by considerations of the expected simpler task of removal as compared with installation. It assumes the necessary scaffolding and lighting are in place from the prior decabling operation.											
1.5.1.7.5	Run IIa Silicon H-Disks Removed	4/20/06	4/20/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>Notes</i>											
WBS Definition- Milestone-The RunIIa silicon beam pipe and H-disks have been removed from the detector.											
1.5.1.7.6	Remove SMT-North	4/20/06	4/27/06	\$0.00	\$0.00	\$4,257.00	\$4,257.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	50%	\$927.00	\$0.00	\$0.00	\$927.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	300%	\$3,330.00	\$0.00	\$0.00	\$3,330.00	120 h	0 h	0 h	0 h	120 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i>											
WBS Definition- This task removes SMT-North from the CFT. It provides for the installation of the table and/or trolleys, the disconnection of the mounts between SMT and CFT, and the extraction of SMT-N from the detector.											
M&S BOE- NA											
Labor BOE- Estimates derived from Run2a installation experience. Task is essentially a reversal of that for Run2a.											
1.5.1.7.7	Remove S Cable Horseshoe	4/25/06	4/27/06	\$0.00	\$0.00	\$888.00	\$888.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	200%	\$888.00	\$0.00	\$0.00	\$888.00	32 h	0 h	0 h	0 h	32 h
<i>Notes</i>											
WBS Definition- This task removes the S cable horseshoe that supported the junction cards for the high-mass and low-mass silicon cables.											
M&S BOE- NA											
Labor BOE- The removal of the S horseshoe is overlapped with the removal of the N SMT to provide adequate workspace in the S CC-EC gap. The labor estimate is based on RunIIa experience.											

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.7.8	Remove SMT-South	4/27/06	5/4/06	\$0.00	\$0.00	\$5,184.00	\$5,184.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 100% \$1,854.00 \$0.00 \$0.00 \$1,854.00 40 h 0 h 0 h 0 h 40 h						
	5 MechTechF 300% \$3,330.00 \$0.00 \$0.00 \$3,330.00 120 h 0 h 0 h 0 h 120 h						
	11 PhysicistF 100% \$0.00 \$0.00 \$0.00 \$0.00 40 h 0 h 0 h 0 h 40 h						
	<u>Notes</u>						
	WBS Definition- Remove SMT-South from the CFT. It provides for the installation of the table and/or trolleys, the disconnection of the mounts between SMT and CFT, and the removal of SMT-S from the detector.						
	M&S BOE- NA						
	Labor BOE- Estimate is the same as that for removal of SMT-North.						
1.5.1.7.9	Remove N Cable Horseshoe	5/2/06	5/4/06	\$0.00	\$0.00	\$888.00	\$888.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 200% \$888.00 \$0.00 \$0.00 \$888.00 32 h 0 h 0 h 0 h 32 h						
	<u>Notes</u>						
	WBS Definition- This task removes the S cable horseshoe that supported the junction cards for the high-mass and low-mass silicon cables.						
	M&S BOE- NA						
	Labor BOE- The removal of the N horseshoe is overlapped with the removal of the S SFT to provide adequate workspace in the N CC-EC gap. The estimate is based on RunIIa experience and is the same as that for the removal of the S cable horseshoe.						
1.5.1.7.10	Run IIa North and South Silicon Detectors Remove	5/4/06	5/4/06	\$0.00	\$0.00	\$0.00	\$0.00
	<u>Notes</u>						
	WBS Definition- Milestone-The RunIIa N and S horseshoes have been decabled and removed from the detector.						
1.5.1.8	Install RunIIb Silicon Detector	5/4/06	6/26/06	\$0.00	\$0.00	\$37,159.00	\$37,159.00
	<u>Notes</u>						
	WBS Dictionary- This summary task installs the Run IIb adaptor card supports (horseshoes) on the N and S faces of CC, installs the Run IIb silicon alignment fixtures, transports the silicon from SiDet to DAB and installs it in CFT, and installs the temperature monitoring system and cooling systems for the silicon.						
1.5.1.8.1	Install N & S Cable Horseshoes	5/4/06	5/18/06	\$0.00	\$0.00	\$7,030.80	\$7,030.80
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 10% \$370.80 \$0.00 \$0.00 \$370.80 8 h 0 h 0 h 0 h 8 h						
	5 MechTechF 300% \$6,660.00 \$0.00 \$0.00 \$6,660.00 240 h 0 h 0 h 0 h 240 h						
	<u>Notes</u>						
	WBS Definition- This task provides for the installation of the Run IIb horseshoes onto the N and S faces of the CC cryostat. It includes the connection of the water cooling lines and leak testing of same.						
	M&S BOE- NA						
	Labor BOE- This estimate is based on Run IIa experience. The task is slightly more complex in that a cooling water manifold is an integral part of the new horseshoes.						
1.5.1.8.2	Run IIb North and South Cable Horseshoes Install	5/18/06	5/18/06	\$0.00	\$0.00	\$0.00	\$0.00
	<u>Notes</u>						
	WBS Definition- Milestone-The RunIIb N and S horseshoes have been installed on the respective EC faces.						

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.8.3	Install L0/L1 Temperature Monitoring Cables	5/18/06	6/1/06	\$0.00	\$0.00	\$3,158.00	\$3,158.00

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
3	ElecEngF	25%	\$938.00	\$0.00	\$0.00	\$938.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	100%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h

Notes

WBS Definition-

This task installs new L0/L1 silicon temperature monitoring cables from the horseshoe to the PLC rack on the SE corner of the platform.

M&S BOE-  
NA

Labor BOE-

Estimates are based on a consideration of the number of cables likely to be installed plus the complexities of routing them through the detector to the PLC I/O Rack on the platform.

1.5.1.8.4	Verify mating of ball mount rings with those on the end	5/18/06	5/22/06	\$0.00	\$0.00	\$1,185.60	\$1,185.60
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$741.60	\$0.00	\$0.00	\$741.60	16 h	0 h	0 h	0 h	16 h
5	MechTechF	100%	\$444.00	\$0.00	\$0.00	\$444.00	16 h	0 h	0 h	0 h	16 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	16 h	0 h	0 h	0 h	16 h

Notes

WBS Definition-

Verify that the z = 830 ball mount rings mate properly with those on the ends of CFT barrel 1, modify as required

M&S BOE-  
NA

Labor BOE-

Estimates based on use of manual precision gauges, etc, in tight confined space, with verification done in as real-time as possible, so that modifications can be effected without undue delay.

1.5.1.8.5	Install alignment fixtures	5/22/06	5/30/06	\$0.00	\$0.00	\$5,184.00	\$5,184.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$1,854.00	\$0.00	\$0.00	\$1,854.00	40 h	0 h	0 h	0 h	40 h
5	MechTechF	300%	\$3,330.00	\$0.00	\$0.00	\$3,330.00	120 h	0 h	0 h	0 h	120 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h

Notes

WBS Definition-

Install the fixtures to aid in aligning silicon with CFT barrel 1

M&S BOE-  
NA

Labor BOE-

Estimates based on Run2a experience for which substantially identical requirements were encountered.

1.5.1.8.6	Transport silicon detector to DAB	5/25/06	5/26/06	\$0.00	\$0.00	\$2,073.60	\$2,073.60
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	100%	\$741.60	\$0.00	\$0.00	\$741.60	16 h	0 h	0 h	0 h	16 h
5	MechTechF	300%	\$1,332.00	\$0.00	\$0.00	\$1,332.00	48 h	0 h	0 h	0 h	48 h
11	PhysicistF	200%	\$0.00	\$0.00	\$0.00	\$0.00	32 h	0 h	0 h	0 h	32 h

Notes

WBS Definition-

Transport silicon from SiDet to D0

M&S BOE-  
NA

Labor BOE-

Estimate based on Run2a experience, for which operation is essentially identical; included is effort required to establish and maintain gas purge and weather cover during move, load detector into transport vehicle at SiDet, and unload detector at DAB, all the while maintaining specified low shock loadings and accelerations.

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.8.7	Install silicon detector at DAB	5/30/06	6/19/06	\$0.00	\$0.00	\$15,552.00	\$15,552.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 100% \$5,562.00 \$0.00 \$0.00 \$5,562.00 120 h 0 h 0 h 0 h 120 h						
	5 MechTechF 300% \$9,990.00 \$0.00 \$0.00 \$9,990.00 360 h 0 h 0 h 0 h 360 h						
	11 PhysicistF 100% \$0.00 \$0.00 \$0.00 \$0.00 120 h 0 h 0 h 0 h 120 h						
	<u>Notes</u>						
	WBS Definition- Move silicon from the D0 high bay into position within CFT barrel 1, make mechanical connections that fasten it to CFT. In detail, the N half is first installed, and slid S until the Z=0 region is exposed at the S end of the CFT. The S half is then installed, mated to the N half, then the ensemble is slid N until centered in CFT. Time is allowed for the verification of the installed position of the detector.						
	M&S BOE- NA						
	Labor BOE- Estimates based on Run2a experience, for which conditions are similar.						
1.5.1.8.8	Make and Test Cooling and Dry Gas Connections	6/20/06	6/26/06	\$0.00	\$0.00	\$2,975.00	\$2,975.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	1 MechEngF 50% \$927.00 \$0.00 \$0.00 \$927.00 20 h 0 h 0 h 0 h 20 h						
	3 ElecEngF 50% \$938.00 \$0.00 \$0.00 \$938.00 20 h 0 h 0 h 0 h 20 h						
	5 MechTechF 100% \$1,110.00 \$0.00 \$0.00 \$1,110.00 40 h 0 h 0 h 0 h 40 h						
	11 PhysicistF 50% \$0.00 \$0.00 \$0.00 \$0.00 20 h 0 h 0 h 0 h 20 h						
	<u>Notes</u>						
	WBS Definition- Make and test the connections from the cooling and dry gas system to the silicon manifolds. Operate the cooling and dry gas system and verify temperature calibration of L0/L1 RTD's.						
	M&S BOE- NA						
	Labor BOE- The silicon cooling supply and return lines connect to manifolds on each end of the silicon detector. The dry gas supply line connects to spargers on each end of the detector. A week is allowed for the making of the connections, leak checking them, then operating the cooling and dry gas systems. The task requires one-half time contributions from an electrical engineer, a mechanical engineer, a physicist, and one full time technician.						
1.5.1.8.9	Run IIb Silicon Detector Installed In Fiber Tracker	6/26/06	6/26/06	\$0.00	\$0.00	\$0.00	\$0.00
	<u>Notes</u>						
	WBS Definition- Milestone-The detector is fully installed in the CFT and connected to the dry gas and cooling systems, whose proper operation have been verified. It is ready for cabling and electronic commissioning.						
1.5.1.9	Install New HV System	3/30/06	7/7/06	\$0.00	\$0.00	\$34,410.00	\$34,410.00
	<u>Notes</u>						
	WBS Definition- This summary element includes the installation of the Run IIb silicon HV system -- new HV cables from MCH to the detector platform, junction boxes on the platform, and cables to the interface board crates and horseshoes in the cathedral.						
1.5.1.9.1	Install HV Fanouts in MCH	3/30/06	7/7/06	\$0.00	\$0.00	\$2,220.00	\$2,220.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 200% \$2,220.00 \$0.00 \$0.00 \$2,220.00 80 h 0 h 0 h 0 h 80 h						
	11 PhysicistF 10% \$0.00 \$0.00 \$0.00 \$0.00 4 h 0 h 0 h 0 h 4 h						
	<u>Notes</u>						
	WBS Definition- This task installs 48 new HV pods, crates, and selector fanouts in the MCH for the Run IIb Silicon system.						
	M&S BOE- NA						
	Labor BOE- Run I and Run IIa experience is the basis of estimate for the labor for which identical units were installed.						

WBS Dictionary as of 10/23/02  
Run Iib Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.9.2	Install HV Cables to Platform	3/30/06	7/5/06	\$0.00	\$0.00	\$8,880.00	\$8,880.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 200% \$8,880.00 \$0.00 \$0.00 \$8,880.00 320 h 0 h 0 h 0 h 320 h						
	11 PhysicistF 10% \$0.00 \$0.00 \$0.00 \$0.00 16 h 0 h 0 h 0 h 16 h						
	<u>Notes</u>						
	WBS Definition- This task provides for the installation of the HV cables from the MCH to the platform.						
	M&S BOE- NA						
	Labor BOE- Run I and Run Ila experience is the basis for the estimated labor of this task.						
1.5.1.9.3	Install Breakouts Boxes on Platform	3/30/06	6/29/06	\$0.00	\$0.00	\$1,110.00	\$1,110.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 100% \$1,110.00 \$0.00 \$0.00 \$1,110.00 40 h 0 h 0 h 0 h 40 h						
	11 PhysicistF 10% \$0.00 \$0.00 \$0.00 \$0.00 4 h 0 h 0 h 0 h 4 h						
	<u>Notes</u>						
	WBS Definition- This task installs HV breakout boxes on the platform.						
	M&S BOE- NA						
	Labor BOE- Run Ila experience						
1.5.1.9.4	Install HV Cables to Interface Board Racks(L3--5 Silico	5/10/06	6/21/06	\$0.00	\$0.00	\$13,320.00	\$13,320.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 200% \$13,320.00 \$0.00 \$0.00 \$13,320.00 480 h 0 h 0 h 0 h 480 h						
	11 PhysicistF 10% \$0.00 \$0.00 \$0.00 \$0.00 24 h 0 h 0 h 0 h 24 h						
	<u>Notes</u>						
	WBS Definition- This task installs the HV cables from the platform fanout boxes to the interface board crates.						
	M&S BOE- NA						
	Labor BOE- Run Ila experience taking into account the complexities of running cables in the existing wireways.						
1.5.1.9.5	Install HV Cables to Horseshoes (L0 and L1 Silicon)	5/18/06	6/15/06	\$0.00	\$0.00	\$8,880.00	\$8,880.00
	<i>ID Resource Name Units Cost Baseline Cost Act. Cost Rem. Cost Work Ovt. Work Baseline Work Act. Work Rem. Work</i>						
	5 MechTechF 200% \$8,880.00 \$0.00 \$0.00 \$8,880.00 320 h 0 h 0 h 0 h 320 h						
	11 PhysicistF 25% \$0.00 \$0.00 \$0.00 \$0.00 40 h 0 h 0 h 0 h 40 h						
	<u>Notes</u>						
	WBS Definition- This task installs the HV cables for L0 and L1 silicon directly to the adapter cards on the horseshoes.						
	M&S BOE- NA						
	Labor BOE- Run Ila experience pulling cables from the MCH to the cathedral has guided the estimates of labor.						
1.5.1.9.6	<b>RunIib Silicon High Voltage System Installed</b>	<b>7/7/06</b>	<b>7/7/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>
	<u>Notes</u>						
	WBS Definition-						

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
<b>"RunIIB Silicon High Voltage System Installed" continued</b>											
<i>Notes</i> Milestone-The RunIIB silicon HV system has been installed.											
<b>1.5.1.10</b>	<b>Install New LV System</b>	<b>3/30/06</b>	<b>7/14/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$34,613.00</b>	<b>\$34,613.00</b>				
<i>Notes</i> WBS Definition- This summary element includes the installation of the LV power supply modules on the platform, the platform fuse panels, #4 cables, and junction plates in the cathedral racks of the interface board crates.											
1.5.1.10.1	Install Si LVPS crates on Platform	3/30/06	7/14/06	\$0.00	\$0.00	\$8,067.00	\$8,067.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	25%	\$1,407.00	\$0.00	\$0.00	\$1,407.00	30 h	0 h	0 h	0 h	30 h
5	MechTechF	200%	\$6,660.00	\$0.00	\$0.00	\$6,660.00	240 h	0 h	0 h	0 h	240 h
11	PhysicistF	10%	\$0.00	\$0.00	\$0.00	\$0.00	12 h	0 h	0 h	0 h	12 h
<i>Notes</i> WBS Definition- This task provides for the installation of the silicon LVPS on the detector platform, including fuse panels and distribution network.  M&S BOE- NA  Labor BOE- Run IIA experience forms the basis for the labor estimates for this task.											
1.5.1.10.2	Install LV Feeder Cables	5/10/06	6/21/06	\$0.00	\$0.00	\$18,948.00	\$18,948.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	50%	\$5,628.00	\$0.00	\$0.00	\$5,628.00	120 h	0 h	0 h	0 h	120 h
5	MechTechF	200%	\$13,320.00	\$0.00	\$0.00	\$13,320.00	480 h	0 h	0 h	0 h	480 h
11	PhysicistF	10%	\$0.00	\$0.00	\$0.00	\$0.00	24 h	0 h	0 h	0 h	24 h
<i>Notes</i> WBS Definition- This task provides for the installation of the cables that carry the LV current to the Interface board crates.  M&S BOE- NA  Labor BOE- RunIIA experience, taking into account the complexity of placing cables in existing crowded wireways: 2 people working 6 weeks, plus overview by cable czar electrical engineer at 50%											
1.5.1.10.3	Install Adapter Card Power Supplies	3/30/06	7/14/06	\$0.00	\$0.00	\$4,440.00	\$4,440.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	200%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h
11	PhysicistF	10%	\$0.00	\$0.00	\$0.00	\$0.00	8 h	0 h	0 h	0 h	8 h
<i>Notes</i> WBS Definition- This task installs the new adapter card power supplies and fuse panels on the platform.  M&S BOE- NA  Labor BOE- Estimates were made by engineers completely familiar with the Run IIA system and the platform area.											
1.5.1.10.4	Install Adapter Card Power Cables	5/10/06	7/13/06	\$0.00	\$0.00	\$3,158.00	\$3,158.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	25%	\$938.00	\$0.00	\$0.00	\$938.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	100%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	10%	\$0.00	\$0.00	\$0.00	\$0.00	8 h	0 h	0 h	0 h	8 h

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Install Adapter Card Power Cables" continued											
<i>Notes</i>											
WBS Definition- This task installs the adapter card power cables to the horseshoes.											
M&S BOE- NA											
Labor BOE- The feeder cables come from the platform and the labor estimate is made in consideration of the complexity of adding the feeder cables to a very crowded wireguide area with minimal disruption to the cables already routed in the wireguide: 9 weeks effort, plus oversight by cable czar at 25% level.											
<b>1.5.1.10.5</b>	<b>RunIIb Silicon Low Voltage System Installed</b>	<b>7/14/06</b>	<b>7/14/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- Milestone-The RunIIb silicon LVPS system has been installed.											
<b>1.5.1.11</b>	<b>Cable RunIIb Silicon</b>	<b>6/27/06</b>	<b>8/8/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$6,316.00</b>	<b>\$6,316.00</b>				
<i>Notes</i>											
WBS Definition- This summary task cables the Run IIb silicon, including the flex cables to the junction cards and twisted pair cables, and the 80-conductor cables to the adapter cards on the horseshoe.											
<b>1.5.1.11.1</b>	<b>Install Junction Cards in CFT Layer 3</b>	<b>6/27/06</b>	<b>7/11/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$4,440.00</b>	<b>\$4,440.00</b>				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
5	MechTechF	200%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h
11	PhysicistF	25%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h
<i>Notes</i>											
WBS Definition- This task installs the RunIIb junction cards into the bore of the CFT. The junction cards connect the digital cables from the silicon tracker to twisted pair cables that go to the adapter cards on the horseshoes. There are 216/3 + 672/2 = 72 + 336 = 408 junction cards, or 204 per side. Each junction card has three bundled and twisted wire-pairs ( that carry the silicon signals to the adapter cards on the horseshoes. The connections at the horseshoe are not made at this time.											
M&S BOE- NA											
Labor BOE- There are 204 junction cards per detector end; it is estimated that 3 can be installed per hour. Only one person can work at one time, and the region is poorly accessible and dimly lit. To each junction card is plugged the two or three digital cables that pertain to it; most likely this will be done before the card is installed.											
<b>1.5.1.11.2</b>	<b>Install 80-conductor and clock cables</b>	<b>7/12/06</b>	<b>8/8/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$1,876.00</b>	<b>\$1,876.00</b>				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	25%	\$1,876.00	\$0.00	\$0.00	\$1,876.00	40 h	0 h	0 h	0 h	40 h
11	PhysicistF	300%	\$0.00	\$0.00	\$0.00	\$0.00	480 h	0 h	0 h	0 h	480 h
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	320 h	0 h	0 h	0 h	320 h
<i>Notes</i>											
WBS Definition- Included in this task is the mounting of the adapter cards and HDI's on the horseshoes, and the reconnection of the high-mass cables and clock cables to the adapter cards.											
M&S BOE- NA											
Labor BOE- Run IIa experience: 2 people working in each gap 4 weeks, plus cable czar(25%), and physicist oversight.											
<b>1.5.1.11.3</b>	<b>Silicon 80-conductor and Clock Cables Installed</b>	<b>8/8/06</b>	<b>8/8/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- Milestone-The 80-conductor cables (disconnected from the horseshoes and interface crates, but otherwise left in place) have been reconnected to the adapter cards on the RunIIb horseshoes, and to the RunIIb interface crates.											

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
1.5.1.12	Install Run IIb Beryllium Beam Tube	8/9/06	8/22/06	\$0.00	\$0.00	\$6,868.50	\$6,868.50

Notes  
WBS Definition-  
This summary task installs the beryllium beam tube, connects it to the calorimeter beam tubes, and leak tests the entire Tevatron beamtube system at D0.

1.5.1.12.1	Install Beam Tube	8/9/06	8/15/06	\$0.00	\$0.00	\$3,147.00	\$3,147.00				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	50%	\$927.00	\$0.00	\$0.00	\$927.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	200%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h

Notes  
WBS Definition-  
Install the Run 2b beryllium beam tube through the silicon region.

M&S BOE-  
NA

Labor BOE-  
Run IIa experience indicates that time must be allotted to make and check precise alignment of beam tube in detector. Engineering and physicist time are required to certify that beam tube will perform as designed.

1.5.1.12.2	Make Beam Tube Connections	8/16/06	8/22/06	\$0.00	\$0.00	\$3,721.50	\$3,721.50				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
1	MechEngF	50%	\$927.00	\$0.00	\$0.00	\$927.00	20 h	0 h	0 h	0 h	20 h
5	MechTechF	200%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
11	PhysicistF	50%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h
42	WelderF	50%	\$574.50	\$0.00	\$0.00	\$574.50	20 h	0 h	0 h	0 h	20 h

Notes  
WBS Definition-  
Make and leak check connections from the beryllium beam tube to beam tubes passing through the end calorimeters. Leak checking may require that other activities in the gaps be suspended, the scaffolds removed, and the EC's be closed and opened to expose pipe connections.

M&S BOE-  
NA

Labor BOE-  
Effort is required to weld EC bellows and flanges onto EC beampipes before connecting the beryllium beam tube. All connections must be leak checked, so contingency on effort is set at 150%.

1.5.1.12.3	Run IIb Beam Tube Installed	8/22/06	8/22/06	\$0.00	\$0.00	\$0.00	\$0.00
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Notes  
WBS Definition-  
Milestone-The RunIIb beryllium beam tube is mated to the beam tubes in the end calorimeters, and all connections leak checked.

1.5.1.13	Ready To Begin Technical Commissioning	8/2/06	8/2/06	\$0.00	\$0.00	\$0.00	\$0.00
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Notes  
WBS Definition-  
Milestone-All the silicon hardware has been fully installed mechanically and the readout chain from the sensors to the MCH, on a quadrant-by-quadrant basis, is ready for electronic commissioning. The beryllium beam pipe has also been connected.

1.5.1.14	Technical commissioning of detector	8/2/06	10/11/06	\$0.00	\$0.00	\$0.00	\$0.00
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Notes  
WBS Definition-  
This summary element provides for checking the integrity, quadrant by quadrant, of the silicon readout chain. Tested are the digital and high-mass cables, the HDI, the junction cards, the adapter cards, the silicon sensors and SVX preamps, the bias voltage system, and the interface board cards. This task can assume the full functionality of the trigger framework (master clock, serial command link, etc.).

1.5.1.14.1	Quadrant 1	8/2/06	8/22/06	\$0.00	\$0.00	\$0.00	\$0.00				
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
11	PhysicistF	200%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h



WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
1.5.1.15	<b>Commission Online Readout Software</b>	8/23/06	10/18/06	\$0.00	\$0.00	\$0.00	\$0.00				
<p><i>Notes</i></p> <p>WBS Definition- This task provides for the testing of the Online Readout Software, which includes the unpacking software which facilitates the data transfer from electronic coordinates to physics coordinates, and the unpacking software for L3 and offline analysis. The majority of this software is taken from Run IIA and modified for use at SiDet for the 1% and 10% silicon test stands, prior to the start of the Run IIB shutdown.</p>											
1.5.1.15.1	Demonstrate multiple crate downloading and calibratic	8/23/06	9/6/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS Definition- This task installs and verifies the functionality of the monitoring and downloading software needed for the operation of the silicon system at DAB. It can begin when a readout crate is fully supported (i.e. when one quadrant of the detector is commissioned).</p> <p>M&amp;S BOE- NA</p> <p>Labor BOE- This effort is primarily based on verifying the proper function of well-understood modifications made to the Run IIA software.</p>											
1.5.1.15.2	Demonstrate data unpacking for two SMT crates	9/7/06	9/13/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
<p><i>Notes</i></p> <p>WBS Definition- This task installs and verifies the functionality of the software (electronics to physics addressing) needed for the operation of the silicon system at DAB.</p> <p>M&amp;S BOE- NA</p> <p>Labor BOE- Much of the software will have been created for the fabrication of the silicon system at SiDet, so the effort required is largely verification at DAB that the code is functional when more than one readout crate is involved.</p>											
1.5.1.15.3	Demonstrate data unpacking for all SMT crates	10/5/06	10/18/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS Definition- This task installs and verifies the functionality of the software (electronics to physics addressing) needed for the operation of the silicon system at DAB. This task can begin as soon as all quadrants of silicon become functional.</p> <p>M&amp;S BOE- NA</p> <p>Labor BOE- Much of the software will have been created for the fabrication of the silicon system at SiDet, so the effort required is largely verification at DAB that the code is functional when all readout crates are involved.</p>											
1.5.1.15.4	Demonstrate SMT Examine package with multiple craI	9/7/06	9/20/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS Definition- This task installs and verifies the functionality of the L3/offline software needed for the operation of the silicon system at DAB.</p> <p>M&amp;S BOE- NA</p> <p>Labor BOE-</p>											

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
"Demonstrate SMT Examine package with multiple crates readout " continued							

Notes  
This effort is primarily based on verifying the proper function of well-defined but substantial modifications made to the Run IIa software.

1.5.1.15.5	Verify SMT mapping using Examine Package	10/5/06	10/18/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h

Notes  
WBS Definition-  
This task installs and verifies the functionality of the L3/offline software needed for the operation of the silicon system at DAB.

M&S BOE-  
NA

Labor BOE-  
This effort is primarily based on verifying the proper function of well-defined but substantial modifications made to the Run IIa software, when all crates can be operated.

1.5.1.16	Close calorimeter and muon system	10/12/06	10/25/06	\$0.00	\$0.00	\$16,340.00	\$16,340.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
1	MechEngF	100%	\$3,708.00	\$0.00	\$0.00	\$3,708.00	80 h	0 h	0 h	0 h	80 h
3	ElecEngF	100%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
5	MechTechF	400%	\$8,880.00	\$0.00	\$0.00	\$8,880.00	320 h	0 h	0 h	0 h	320 h
11	PhysicistF	200%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h

Notes  
WBS Definition-  
Close End Calorimeters to Central Calorimeter, and close CF and EF toroids to detector centerbeam.

M&S BOE-  
NA

Labor BOE-  
Run IIa experience, including time to check clearance between central and end calorimeters for cable system, verify all technical operation aspects of the silicon system after final closeup of the end calorimeters.

1.5.1.17	Silicon System Ready for Beam	10/25/06	10/25/06	\$0.00	\$0.00	\$0.00	\$0.00
<u>Notes</u> WBS Definition- Milestone-The RunIIb silicon system has been installed, technically commissioned, and is ready for beam.							

1.5.2	Run IIb Trigger Installation	9/23/04	10/24/06	\$40,000.00	\$0.00	\$144,391.58	\$184,391.58
<u>Notes</u> WBS Definition- The Run IIb trigger upgrade includes upgrades to three systems - the Level 1 calorimeter trigger, a calorimeter cluster track match at Level 1, and the Level 1 central track trigger, as well as upgrades to the Level 2 beta processors and the Level 2 Silicon Track Trigger. This summary WBS element includes the effort required to install and initially commission these trigger upgrades.							

1.5.2.1	Prepare Infrastructure at DAB	4/11/05	5/18/06	\$37,500.00	\$0.00	\$82,493.08	\$119,993.08
<u>Notes</u> WBS Definition- This summary task includes activities that must take place to ensure that all infrastructure components required for the Run IIb trigger (Cal L1 racks, Cal BLS cables, L1 Cal/Track Match crates, boards, and cables) are in hand prior to shutdown.							

1.5.2.1.1	Prepare new L1 Cal Racks	4/11/05	9/28/05	\$37,500.00	\$0.00	\$73,468.08	\$110,968.08				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	150%	\$67,536.00	\$0.00	\$0.00	\$67,536.00	1,440 h	0 h	0 h	0 h	1,440 h
9	ElecTechF	21%	\$5,932.08	\$0.00	\$0.00	\$5,932.08	201.6 h	0 h	0 h	0 h	201.6 h
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	480 h	0 h	0 h	0 h	480 h
51	MandS	37,500	\$37,500.00	\$0.00	\$0.00	\$37,500.00	37,500		0	0	37,500

Notes  
WBS Definition-  
This involves outfitting the 5 new L1 Cal racks with water cooling, air blowers, safety systems (including safety reviews), power supplies, voltage monitoring, monitoring and alarm software, AC and DC power. This

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Prepare new L1 Cal Racks" continued											
<u>Notes</u> work must be done before the racks are moved to their final positions in the Moving Counting House.											
M&S BOE- Racks and equipment to be installed as described above: \$7500 per rack, R.Hance 3/12/2002 estimate											
Labor BOE- Detailed estimate by D. Edmunds of labor involved (see supporting documents). Assumes 6 months of preparatory work by an electrical engineer (plus the "cable czar" half time) and a physicist + 1 week of cabling, testing, etc. per rack for a technician, and part-time oversight by an electrical engineer.											
1.5.2.1.2	Preliminary commission of Cal Trig Elements	1/5/06	5/18/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	760 h	0 h	0 h	0 h	760 h
<u>Notes</u> WBS Definition- This task provides for the installation of Cal Trig components (ADFs, TABs and GABs and inter-card cabling as they become available) in at least one-eighth of Cal Trig system for testing, and for development and debugging of control software, in the DAB2 area before the shutdown.											
M&S BOE- NA											
Labor BOE- One university physicist working full time is required for this task.											
1.5.2.1.3	Plan new cable plant: Saclay	1/4/06	1/18/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
4	ElecEngU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Plan routing of BLS cables to ADF. This will involve verifying that the plan is feasible in the Dzero Moving Counting House. This item represents the Saclay part of the effort.											
M&S BOE- NA											
Labor BOE- Assumes 1 week at Fermilab for Saclay engineer plus planning time at Saclay.											
1.5.2.1.4	Plan new cable plant: MSU	1/4/06	1/18/06	\$0.00	\$0.00	\$1,876.00	\$1,876.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
3	ElecEngF	50%	\$1,876.00	\$0.00	\$0.00	\$1,876.00	40 h	0 h	0 h	0 h	40 h
4	ElecEngU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Plan routing of BLS cables to ADF. This will involve verifying that the plan is feasible in the Dzero Moving Counting House. This item represents the MSU part of the effort.											
M&S BOE- NA											
Labor BOE- Advising by MSU engineer as needed, plus oversight by "cable czar" electrical engineer.											
1.5.2.1.5	Modify MCH Racks for L1 Cal/Track Match	2/2/06	3/1/06	\$0.00	\$0.00	\$1,177.00	\$1,177.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
9	ElecTechF	25%	\$1,177.00	\$0.00	\$0.00	\$1,177.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS definition - Mechanical modifications to extend rack depth if necessary to accommodate cal-trk VME crate in MCH1.											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Modify MCH Racks for L1 Cal/Track Match" continued											
<u>Notes</u> Labor BOE - Run2a experience modifying racks in collision hall for Level 1 muon crates.  M&S BOE - No M&S associated with this task.											
1.5.2.1.6	Install L1CTM VME crates and power supplies	3/2/06	3/8/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Install cal-trk crate and power supplies in moveable counting house in existing rack.  Labor BOE- Run2a muon Level 1 experience with installation of similar VME crates and power supplies. Assumes two people at 50% FTE each for one week.  M&S BOE NA											
1.5.2.1.7	Install L1CTM splitter crate and power supply	2/2/06	3/1/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
<u>Notes</u> WBS definition - Install a single crate and its power supply on the platform (in existing "bare" rack) to contain the serial link splitters which are used as repeaters to drive the signals from the L1CTT to the cal-trk. Needs to be done when there is access to the collision hall, but can be done in advance of the end of run2a since it does not displace any existing equipment.  Labor BOE - Experience with installation of splitter crates for run 2a, plus extra time allowed for installation of new electronics on the detector platform.  M&S BOE - NA											
1.5.2.1.8	Install L1CTM rack services	3/2/06	3/29/06	\$0.00	\$0.00	\$2,220.00	\$2,220.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
5	MechTechF	50%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
<u>Notes</u> WBS definition - Install all necessary services (RMI, power, cooling water) in the rack on the platform that houses the L1CTM crate. Needs to be done when there is access to the collision hall, but can be done in advance of the end of run2a since it does not displace any existing equipment.  Labor BOE - Experience with installation of rack services throughout D0.  M&S BOE - No M&S associated with this task.											
1.5.2.1.9	Install L1 CTT/CTM cables	3/9/06	4/5/06	\$0.00	\$0.00	\$3,752.00	\$3,752.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
3	ElecEngF	50%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<u>Notes</u> WBS Definition- Run cables between the CTT and the cal-track match, and between cal L1 and cal-track match. CTT cable installation needs to be done when there is access to the collision hall, but can be done in advance of the end of run2a since it does not displace any existing equipment. Includes testing and labeling of cables.  Labor BOE-											

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost					
"Install L1 CTT/CTMcables" continued												
<u>Notes</u> Run2a muon Level 1 experience installing cables from muon front ends and CTT to the Level 1 muon triggers. Assumes two people at 50% FTE each. Effort added to test and label cables (cable czar).												
<b>1.5.2.2</b>	<b>Level 1 Calorimeter Trigger</b>	<b>1/5/06</b>	<b>10/24/06</b>	<b>\$2,500.00</b>	<b>\$0.00</b>	<b>\$43,017.50</b>	<b>\$45,517.50</b>					
<u>Notes</u> WBS Definition- This summary element covers the Level 1 calorimeter trigger modifications. It includes development and procurement of ADC/digital filter boards (ADF), development and procurement of trigger-algorithm boards (TAB), the provision of output signals to facilitate a match between calorimeter towers and tracks, and procurement and improvements in associated readout crates, power supplies, cabling, and controls hardware.												
<b>1.5.2.2.1</b>	<b>L1 Cal TAB/GAB Production And Testing Complete</b>	<b>1/5/06</b>	<b>1/5/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>					
<u>Notes</u> WBS Definition- Milestone- All L1 Cal components produced or procured. Full functionality of custom boards (ADF, TAB, GAB) bench tested at institutes where they were developed. Tests consist of using simulated inputs to verify that all the outputs of the board are as expected and that bit error rates are acceptable - corresponding to approximately 1 fatal error per day at nominal data volumes. Milestone is achieved when the number of boards required in the system (80 ADFs, 8 TABs and 1 GAB) have passed the bench tests above.												
<b>1.5.2.2.2</b>	<b>Installation And Technical Commissioning</b>	<b>3/30/06</b>	<b>10/24/06</b>	<b>\$2,500.00</b>	<b>\$0.00</b>	<b>\$43,017.50</b>	<b>\$45,517.50</b>					
<u>Notes</u> WBS Definition- This summary task describes the installation of the new calorimeter trigger in the DZero moveable counting house.												
<b>1.5.2.2.2.1</b>	<b>Remove old racks</b>	<b>3/30/06</b>	<b>4/12/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$9,713.00</b>	<b>\$9,713.00</b>					
	<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
	3	ElecEngF	50%	\$1,876.00	\$0.00	\$0.00	\$1,876.00	40 h	0 h	0 h	0 h	40 h
	5	MechTechF	300%	\$6,660.00	\$0.00	\$0.00	\$6,660.00	240 h	0 h	0 h	0 h	240 h
	9	ElecTechF	50%	\$1,177.00	\$0.00	\$0.00	\$1,177.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Decable present BLS cables from Cal Trig Racks (plus remove rack to rack internal cables, cables in the tray above the racks, and cables from the racks to the cable tray behind the racks), then remove 13 current L1 Cal racks, air blowers and ducts, power boxes and cooling manifolds. Move the VESDA fire monitor to new location.  M&S BOE- NA  Labor BOE- Detailed estimate by D. Edmunds of labor involved (see supporting documents): 6 hours per rack for decabling, 6 hours to remove a rack, + 80 hours for air, power, etc. disconnection for an electrical tech = 236 hrs. Because of safety issues, work should be supervised at the 50% level by a mechanical engineer and an electrical engineer.												
<b>1.5.2.2.2.2</b>	<b>Redress cables</b>	<b>4/13/06</b>	<b>5/17/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$21,842.50</b>	<b>\$21,842.50</b>					
	<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
	3	ElecEngF	50%	\$4,690.00	\$0.00	\$0.00	\$4,690.00	100 h	0 h	0 h	0 h	100 h
	5	MechTechF	150%	\$8,325.00	\$0.00	\$0.00	\$8,325.00	300 h	0 h	0 h	0 h	300 h
	9	ElecTechF	150%	\$8,827.50	\$0.00	\$0.00	\$8,827.50	300 h	0 h	0 h	0 h	300 h
<u>Notes</u> WBS Definition- Unbundle and reroute all 400 BLS cable ribbons so they will fit up to the new ADF boards in the new Cal Trig crates. Test each cable after it is repositioned.  M&S BOE- NA  Labor BOE- Detailed estimate by D. Edmunds of labor involved (see supporting documents). Assume 3 hours per ribbon, jointly by an electrical and a mechanical tech. 1200 hours total. Add supervision by electrical engineer cable czar at 50% level.												
<b>1.5.2.2.2.3</b>	<b>Install new racks in MCH</b>	<b>5/19/06</b>	<b>5/25/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$4,074.00</b>	<b>\$4,074.00</b>					
	<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
	1	MechEngF	100%	\$1,854.00	\$0.00	\$0.00	\$1,854.00	40 h	0 h	0 h	0 h	40 h

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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"Install new racks in MCH" continued

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
5	MechTechF	200%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h

Notes

**WBS Definition-**

This task involves moving the five assembled Cal Trig racks into MCH-1.

**M&S BOE-**  
NA

**Labor BOE-**

Detailed estimate by D. Edmunds of labor involved (see supporting documents). Assumes 2 technicians can move one rack into MCH1 and fasten it to its neighbor in one day, plus full time supervision by a mechanical engineer.

1.5.2.2.2.4	Connect new rack services	5/26/06	6/9/06	\$2,500.00	\$0.00	\$4,574.00	\$7,074.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
5	MechTechF	100%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h
9	ElecTechF	100%	\$2,354.00	\$0.00	\$0.00	\$2,354.00	80 h	0 h	0 h	0 h	80 h
51	MandS	2,500	\$2,500.00	\$0.00	\$0.00	\$2,500.00	2,500		0	0	2,500

Notes

**WBS Definition-**

Make power and water connections to new racks when they are in place. Involves modification of available wall power from 208 V to 120 V.

**M&S BOE-**

Depending on the final design of the Cal Trig system, it may be necessary to add power disconnect contactors, and water distribution headers to the existing systems in MCH1. \$2500 is included for these modifications.

**Labor BOE-**

Detailed estimate by D. Edmunds of labor involved (see supporting documents). Assumes 80 hours each for a mechanical and electrical tech.

1.5.2.2.2.5	Install ADFs, TABs and GABs	6/12/06	6/30/06	\$0.00	\$0.00	\$2,814.00	\$2,814.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
3	ElecEngF	50%	\$2,814.00	\$0.00	\$0.00	\$2,814.00	60 h	0 h	0 h	0 h	60 h
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h

Notes

**WBS Definition-**

Installation of ADFs, TABs and GABs and inter-card cabling (presently 240 cables - label and install).

**M&S BOE-**  
NA

**Labor BOE-**

Taken from cabling of the L2muon trigger system. Multiplied by 4 due to increased cable count and complexity, 6 physicist-weeks total. Add cable czar at 50% level.

1.5.2.2.2.6	Technical commissioning	7/3/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	75%	\$0.00	\$0.00	\$0.00	\$0.00	480 h	0 h	0 h	0 h	480 h
12	PhysicistU	125%	\$0.00	\$0.00	\$0.00	\$0.00	800 h	0 h	0 h	0 h	800 h

Notes

**WBS Definition-**

Verify the proper functioning (timing, verification of outputs and decisions) in the integrated trigger system with pulser runs, cosmic rays, etc. The task duration assumes at least one rack has received preliminary commissioning before the shutdown.

**M&S BOE-**  
NA

**Labor BOE-**

Estimated by people who built existing cal L1: total of 20 physicist weeks, 12 weeks electrical engineer.

WBS Dictionary as of 10/23/02  
Run IIb Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
1.5.2.2.2.7	<b>Level 1 Calorimeter Trigger Installed</b>	10/24/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<p><i>Notes</i></p> <p>WBS Definition- Milestone-The level 1 calorimeter trigger has been installed and technically commissioned, so that it is ready for beam in the detector.</p>											
1.5.2.3	<b>Level 1 Calorimeter Track Matching</b>	9/23/04	10/24/06	\$0.00	\$0.00	\$3,752.00	\$3,752.00				
<p><i>Notes</i></p> <p>WBS Definition- This summary element provides for improvements in the Run2a track-matching trigger. It includes development and procurement of slightly modified versions of existing Level 1 muon cards, and procurement of related cabling, connectors, readout crates, processors, and power supplies.</p>											
1.5.2.3.1	<b>L1 Cal/Track Match Production and Testing Compl</b>	9/23/04	9/23/04	\$0.00	\$0.00	\$0.00	\$0.00				
<p><i>Notes</i></p> <p>WBS Definition- Milestone-All production and testing for the cal/track match has been done.</p>											
1.5.2.3.2	<b>Installation And Technical Commissioning</b>	4/6/06	10/24/06	\$0.00	\$0.00	\$3,752.00	\$3,752.00				
<p><i>Notes</i></p> <p>WBS Definition- This summary task describes the installation of the complete cal-track matching system in the experiment.</p>											
1.5.2.3.2.1	<b>Hook up electronics</b>	4/6/06	5/3/06	\$0.00	\$0.00	\$3,752.00	\$3,752.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	50%	\$3,752.00	\$0.00	\$0.00	\$3,752.00	80 h	0 h	0 h	0 h	80 h
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS Definition- install MTCxx and MTCM in crate and connect cables and do final cable dressing.</p> <p>Labor BOE- Experience installing Level 1 muon trigger cards in Run 2a. Assumes two physicists at 50% FTE each. Add cable czar electrical engineer at 50%.</p>											
1.5.2.3.2.2	<b>Debug timing and trigger signals from the TFW</b>	5/4/06	6/1/06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS definition - Verify that the cal-trk trigger is receiving proper timing and trigger signals from the trigger framework.</p> <p>Labor BOE - Requires full electronics chain (trigger framework, serial command link hub, muon fanout card, muon readout card) to be available. In run 2a, this took approximately 4 months, but much more of the infrastructure will be in place and tested at the time of the Run IIb task: 1 month of physicist time.</p> <p>M&amp;S BOE - No M&amp;S associated with this task</p>											
1.5.2.3.2.3	<b>Debug input from all sources</b>	6/12/06	7/10/06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<p><i>Notes</i></p> <p>WBS Definition- Verify inputs from CTT, cal-L1 * note - relies on CTT and cal-L1 being ready to send outputs -- need at least 1/8 of Cal L1.</p> <p>M&amp;S BOE- NA</p> <p>Labor BOE-</p>											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Debug input from all sources" continued											
<i>Notes</i> RunIIa muon Level 1 experience debugging inputs from muon front ends and CTT: 1 full time physicist for a month.											
1.5.2.3.2.4	Debug MTM decision to TFW	7/11/06	7/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i> WBS Definition- Verify decisions of cal-track match are correct at the trigger framework  M&S BOE- NA  Labor BOE- RunIIa experience verifying Level 1 muon trigger decisions: 1 week for a physicist.											
1.5.2.3.2.5	Establish L2, L3 readout	7/25/06	8/21/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<i>Notes</i> WBS Definition- Record data sent to L2 and L3 and verify format  M&S BOE- NA  Labor BOE- RunIIa experience establishing readout of L2 and L3 data from Level 1 muon trigger: 1 physicist full time for a month.											
1.5.2.3.2.6	Technical Commissioning	8/29/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	200%	\$0.00	\$0.00	\$0.00	\$0.00	640 h	0 h	0 h	0 h	640 h
<i>Notes</i> WBS Definition- System tests including establishing beginning of turn (BOT) trigger, calorimeter-only triggers, CFT only triggers, simulator-data certification with noise, pulsers, and cosmic rays (no beam).  M&S BOE- NA  Labor BOE- In Run2a, the equivalent system tests for Level 1 muon trigger took six months with three physicists (full time). The cal-trk trigger is expected to go faster because it is approximately one sixth the size: 2 physicists working full time for 8 weeks.											
1.5.2.3.2.7	Level 1 Calorimeter Track Matching Installation	10/24/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>Notes</i> WBS Definition- Milestone-The level 1 calorimeter track matching trigger has been installed and technically commissioned, so that it is ready for beam in the detector.											
1.5.2.4	Level 1 Tracking	1/10/06	6/22/06	\$0.00	\$0.00	\$7,531.00	\$7,531.00				
<i>Notes</i> WBS Definition- This summary element provides for improvements in the existing track trigger. It includes design and development of algorithms that utilize larger FPGAs, and development and procurement of new Digital Front-End (DFE) boards that utilize these FPGAs.											
1.5.2.4.1	L1 Central Track Trigger DFEA Production And Test	1/10/06	1/10/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>Notes</i> WBS Definition-											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost
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**"L1 Central Track Trigger DFEA Production And Testing Complete" continued**

Notes  
Milestone-central track trigger complete except for installation and commissioning.

<b>1.5.2.4.2</b>	<b>Installation And Technical Commissioning</b>	<b>3/30/06</b>	<b>6/22/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$7,531.00</b>	<b>\$7,531.00</b>
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Notes  
WBS Definition-  
This summary task provides for the shared installation effort of all the DFEA's for the new Central Track Trigger.

1.5.2.4.2.1	Install, Fermilab effort	3/30/06	5/10/06	\$0.00	\$0.00	\$7,062.00	\$7,062.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
9	ElecTechF	100%	\$7,062.00	\$0.00	\$0.00	\$7,062.00	240 h	0 h	0 h	0 h	240 h
12	PhysicistU	25%	\$0.00	\$0.00	\$0.00	\$0.00	60 h	0 h	0 h	0 h	60 h

Notes  
WBS Definition-  
Install new DFEA boards on the run 2a DFE motherboards

Labor BOE-  
Install at the rate of about 5 boards per day. It will take one electrical tech 3 weeks to install all 80 boards in the L1 CTT racks in the platform. In-situ standalone tests on all boards will take a physicist working 1/4 time an additional 3 weeks.

M&S BOE-  
NA

1.5.2.4.2.2	Install, University Effort	3/30/06	5/10/06	\$0.00	\$0.00	\$0.00	\$0.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
10	ElecTechU	50%	\$0.00	\$0.00	\$0.00	\$0.00	120 h	0 h	0 h	0 h	120 h
12	PhysicistU	25%	\$0.00	\$0.00	\$0.00	\$0.00	60 h	0 h	0 h	0 h	60 h

Notes  
WBS Definition-  
Install new DFEA boards on the run 2a DFE motherboards

Labor BOE-  
Install at the rate of about 5 boards per day. It will take an additional electrical tech (working half time) 3 weeks to install all 80 boards in the L1 CTT racks in the platform. In-situ standalone tests on all boards will take a physicist working 1/4 time an additional 3 weeks.

M&S BOE-  
NA

1.5.2.4.2.3	Install, BU Effort	3/30/06	5/10/06	\$0.00	\$0.00	\$0.00	\$0.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
4	ElecEngU	50%	\$0.00	\$0.00	\$0.00	\$0.00	120 h	0 h	0 h	0 h	120 h
12	PhysicistU	25%	\$0.00	\$0.00	\$0.00	\$0.00	60 h	0 h	0 h	0 h	60 h

Notes  
WBS Definition-  
Install new DFEA boards on the run 2a DFE motherboards

Labor BOE-  
Install at the rate of about 5 boards per day. It will take an additional electrical tech (working half time) 3 weeks to install all 80 boards in the L1 CTT racks in the platform. In-situ standalone tests on all boards will take a physicist working 1/4 time an additional 3 weeks.

M&S BOE-  
NA

1.5.2.4.2.1	Debug all Inputs	5/11/06	5/17/06	\$0.00	\$0.00	\$0.00	\$0.00
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ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Debug all Inputs" continued											
<u>Notes</u> WBS Definition- Verify inputs from AFE, SCL.  Labor BOE- Run2a CTT experience, performed by physicists. Engineers play consulting role.											
1.5.2.4.2.2	Verify outputs	5/18/06	5/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Verify outputs to L1 Muon, L2, L3  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.3	System debug	5/25/06	6/22/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<u>Notes</u> WBS Definition- Run the system using the D0 DAQ system as part of the D0 trigger  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.4	Debug all Inputs	5/11/06	5/17/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Verify inputs from AFE, SCL.  Labor BOE- Run2a CTT experience, performed by physicists. Engineers play consulting role.											
1.5.2.4.2.5	Verify outputs	5/18/06	5/24/06	\$0.00	\$0.00	\$469.00	\$469.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
3	ElecEngF	25%	\$469.00	\$0.00	\$0.00	\$469.00	10 h	0 h	0 h	0 h	10 h
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Verify outputs to L1 Muon, L2, L3  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.6	System debug	5/25/06	6/22/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<u>Notes</u> WBS Definition- Run the system using the D0 DAQ system as part of the D0 trigger.  Labor BOE-											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"System debug" continued											
<i>Notes</i> Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.7	Debug all Inputs	5/11/06	5/17/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i> WBS Definition- Verify inputs from AFE, SCL.  Labor BOE- Run2a CTT experience, performed by physicists. Engineers play consulting role.											
1.5.2.4.2.8	Verify outputs	5/18/06	5/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i> WBS Definition- Verify outputs to L1 Muon, L2, L3.  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.9	System debug	5/25/06	6/22/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h
<i>Notes</i> WBS Definition- Run the system using the D0 DAQ system as part of the D0 trigger.  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.10	Debug all Inputs	5/11/06	5/17/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i> WBS Definition- Verify inputs from AFE, SCL.  Labor BOE- Run2a CTT experience, performed by physicists. Engineers play consulting role.											
1.5.2.4.2.14	Verify outputs	5/18/06	5/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<i>Notes</i> WBS Definition- Verify outputs to L1 Muon, L2, L3.  Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
1.5.2.4.2.15	System debug	5/25/06	6/22/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"System debug" continued											
<i>Notes</i>											
WBS Definition- Run the system using the D0 DAQ system as part of the D0 trigger.											
Labor BOE- Run2a CTT experience, performed by physicists. Consult with engineers.											
<b>1.5.2.4.2.16</b>	<b>Level 1 Tracking Installation Complete</b>	<b>6/22/06</b>	<b>6/22/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- Milestone-This milestone corresponds to the completion of the installation and technical commissioning of the L1 track trigger system.											
<b>1.5.2.5</b>	<b>Level 2 Beta Processors</b>	<b>1/5/06</b>	<b>6/16/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- This summary task provides for the installation of the L2 Beta trigger system and its technical commissioning.											
<b>1.5.2.5.1</b>	<b>Level 2 Beta Production Complete</b>	<b>1/5/06</b>	<b>1/5/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- Milestone- All parts for upgrade Betas in hand and working.											
<b>1.5.2.5.2</b>	<b>Verify Assembled Processors</b>	<b>1/5/06</b>	<b>5/25/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<i>Notes</i>											
WBS Definition- This summary task verifies processors in L2 trigger or test crates.											
1.5.2.5.2.1	Cut Code Release for new Hardware	1/5/06	1/19/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h
<i>Notes</i>											
WBS Definition- Cut first code release for new hardware. Update any trial code to meet release criteria.											
Labor BOE- Experience w/ original Alpha and Beta processors: 1 physicist full time for 2 weeks.											
M&S BOE- NA											
1.5.2.5.2.2	Online Code Support/Development	1/20/06	4/27/06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	25%	\$0.00	\$0.00	\$0.00	\$0.00	140 h	0 h	0 h	0 h	140 h
<i>Notes</i>											
WBS Definition- Tune online code: Develop any enhanced driver features over Run 2a, coordinate these with changes to high level trigger code. Assumes we propagate 2-3 changes at most through the online code.											
Labor BOE- Estimated need for physicist working 25% for duration of task.											
M&S BOE- NA											
1.5.2.5.2.3	Verify Processor Assemblies -- UVA	4/28/06	5/11/06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h

WBS Dictionary as of 10/23/02  
Run Iib Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Verify Processor Assemblies -- UVA" continued											
<u>Notes</u> WBS Definition- Test assembled processor boards in L2 trigger or test crates. Run through suite of I/O tests in test crate.  Labor BOE- Experience w/ Run2a Alpha and Beta processors: physicist working 1/2 time  M&S BOE- NA											
1.5.2.5.2.4	Verify Processor Assemblies -- ORS	5/12/06	5/25/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Test assembled processor boards in L2 trigger or test crates.  Labor BOE- Experience w/ Run2a Alpha and Beta processors - run through suite of i/o tests in test crate.											
1.5.2.5.8	Installation And Technical Commissioning	5/26/06	6/16/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>Notes</u> WBS Definition- This summary task installs the components of the L2 beta trigger and tests their operation.											
1.5.2.5.8.1	Install boards in L2 Trigger	5/26/06	6/2/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Install boards in L2 Trigger Crates.  Labor BOE- Experience w/ Run2a Alpha and Beta processors: 1 physicist working 1 week.											
1.5.2.5.8.2	Technical commissioning-UVA	6/5/06	6/16/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Test boards in-situ after installation.  Labor BOE- Experience w/ Run2a Alpha and Beta processors: 1 physicist for 2 weeks working 1/2 time.  M&S BOE- NA											
1.5.2.5.8.3	Technical commissioning-ORS	6/5/06	6/16/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u> WBS Definition- Test boards in-situ after installation.  Labor BOE- Experience w/ Run2a Alpha and Beta processors: 1 physicist working 2 weeks 1/2 time.											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
"Technical commissioning-ORS" continued											
<u>Notes</u>											
M&S BOE- NA											
1.5.2.5.8.4	Technical commissioning-FNAL	6/5/06	6/16/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
11	PhysicistF	25%	\$0.00	\$0.00	\$0.00	\$0.00	20 h	0 h	0 h	0 h	20 h
<u>Notes</u>											
WBS Definition- Test boards in-situ after installation.											
Labor BOE- Estimated labor (1/4 time physicist) for swapping boards and/or recabling crates during in-situ tests.											
1.5.2.5.8.5	Level 2 Upgrade Beta Installed & Commissioned	6/16/06	6/16/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>Notes</u>											
WBS Definition- Milestone-New Beta processors installed and i/o functions tested in-situ.											
1.5.2.6	Silicon Track Trigger Upgrade	10/17/05	10/24/06	\$0.00	\$0.00	\$7,598.00	\$7,598.00				
<u>Notes</u>											
WBS Definition- This summary task element includes upgrades to the Run 2a silicon track trigger to adapt it to the increased number of inputs from the Run 2b silicon detector. It consists of the procurement of additional electronics boards of the Run 2a type, together with the development and production of a new board type (the Link Echo Board). Also included are firmware changes, procurement of additional, slightly modified backplanes, and additional cabling and connector hardware.											
1.5.2.6.1	STT Hardware Production Complete	10/17/05	10/17/05	\$0.00	\$0.00	\$0.00	\$0.00				
<u>Notes</u>											
WBS dictionary- Milestone-All hardware components are ready to be installed.											
1.5.2.6.2	Installation	3/30/06	5/10/06	\$0.00	\$0.00	\$7,598.00	\$7,598.00				
<u>Notes</u>											
WBS Definition- This summary task covers installation of the components of the STT.											
1.5.2.6.2.1	STT Module Install	3/30/06	4/5/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u>											
WBS Definition- Daughter board that processes raw data from SMT. Design as the same as for Run 2A.											
Labor BOE- Labor provided by physicists: 1 man-week.											
M&S BOE- NA											
1.5.2.6.2.2	VTM Install	3/30/06	4/5/06	\$0.00	\$0.00	\$0.00	\$0.00				
<u>ID</u>	<u>Resource Name</u>	<u>Units</u>	<u>Cost</u>	<u>Baseline Cost</u>	<u>Act. Cost</u>	<u>Rem. Cost</u>	<u>Work</u>	<u>Ovt. Work</u>	<u>Baseline Work</u>	<u>Act. Work</u>	<u>Rem. Work</u>
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h
<u>Notes</u>											
WBS Definition- 9U board with 4 optical receivers and g-link serial link receivers that receive the raw data sent by SMT. The design of these boards is complete. They are used in D0 and CDF as part of the SVX DAQ system.											

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost																																																
"VTM Install" continued																																																							
	<u>Notes</u> Labor BOE- Labor provided by Physicists: 1 man week  M&S BOE- NA																																																						
1.5.2.6.2.3	TFC Module Install	3/30/06	4/5/06	\$0.00	\$0.00	\$0.00	\$0.00																																																
	<table border="1"> <thead> <tr> <th>ID</th> <th>Resource Name</th> <th>Units</th> <th>Cost</th> <th>Baseline Cost</th> <th>Act. Cost</th> <th>Rem. Cost</th> <th>Work</th> <th>Ovt. Work</th> <th>Baseline Work</th> <th>Act. Work</th> <th>Rem. Work</th> </tr> </thead> <tbody> <tr> <td>12</td> <td>PhysicistU</td> <td>100%</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>40 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>40 h</td> </tr> </tbody> </table>	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h																														
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work																																												
12	PhysicistU	100%	\$0.00	\$0.00	\$0.00	\$0.00	40 h	0 h	0 h	0 h	40 h																																												
	<u>Notes</u> WBS Definition- Daughter board that fits a trajectory to hits in SMT and CFT. Design is the same as for Run 2A.  Labor BOE- Labor provided by Physicists: 1 man week  M&S BOE- NA																																																						
1.5.2.6.2.4	Splitters Install	3/30/06	4/26/06	\$0.00	\$0.00	\$4,440.00	\$4,440.00																																																
	<table border="1"> <thead> <tr> <th>ID</th> <th>Resource Name</th> <th>Units</th> <th>Cost</th> <th>Baseline Cost</th> <th>Act. Cost</th> <th>Rem. Cost</th> <th>Work</th> <th>Ovt. Work</th> <th>Baseline Work</th> <th>Act. Work</th> <th>Rem. Work</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>MechTechF</td> <td>100%</td> <td>\$4,440.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$4,440.00</td> <td>160 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>160 h</td> </tr> <tr> <td>11</td> <td>PhysicistF</td> <td>100%</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>160 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>160 h</td> </tr> </tbody> </table>	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	5	MechTechF	100%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h	11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h																		
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work																																												
5	MechTechF	100%	\$4,440.00	\$0.00	\$0.00	\$4,440.00	160 h	0 h	0 h	0 h	160 h																																												
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	160 h	0 h	0 h	0 h	160 h																																												
	<u>Notes</u> WBS Definition- Passive optical splitters to create data path into STT  Labor BOE- Labor provided by physicists  M&S BOE- Panel on wall -- \$500																																																						
1.5.2.6.2.5	Fibers Install	4/27/06	5/10/06	\$0.00	\$0.00	\$3,158.00	\$3,158.00																																																
	<table border="1"> <thead> <tr> <th>ID</th> <th>Resource Name</th> <th>Units</th> <th>Cost</th> <th>Baseline Cost</th> <th>Act. Cost</th> <th>Rem. Cost</th> <th>Work</th> <th>Ovt. Work</th> <th>Baseline Work</th> <th>Act. Work</th> <th>Rem. Work</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>ElecEngF</td> <td>25%</td> <td>\$938.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$938.00</td> <td>20 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>20 h</td> </tr> <tr> <td>5</td> <td>MechTechF</td> <td>100%</td> <td>\$2,220.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$2,220.00</td> <td>80 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>80 h</td> </tr> <tr> <td>11</td> <td>PhysicistF</td> <td>100%</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>\$0.00</td> <td>80 h</td> <td>0 h</td> <td>0 h</td> <td>0 h</td> <td>80 h</td> </tr> </tbody> </table>	ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work	3	ElecEngF	25%	\$938.00	\$0.00	\$0.00	\$938.00	20 h	0 h	0 h	0 h	20 h	5	MechTechF	100%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h	11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h						
ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost	Work	Ovt. Work	Baseline Work	Act. Work	Rem. Work																																												
3	ElecEngF	25%	\$938.00	\$0.00	\$0.00	\$938.00	20 h	0 h	0 h	0 h	20 h																																												
5	MechTechF	100%	\$2,220.00	\$0.00	\$0.00	\$2,220.00	80 h	0 h	0 h	0 h	80 h																																												
11	PhysicistF	100%	\$0.00	\$0.00	\$0.00	\$0.00	80 h	0 h	0 h	0 h	80 h																																												
	<u>Notes</u> WBS Definition- 148 Optical fibers from splitters to VRBs(74) and to STT(74).  Labor BOE- Estimates based on RunIIa experience: 1 tech and 1 physicist working 2w full time, plus cable czar oversight (25%).  M&S BOE- Fibers in STT budget.																																																						
1.5.2.6.3	<b>STT Hardware Installed</b>	<b>5/10/06</b>	<b>5/10/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>																																																
	<u>Notes</u> WBS Definition- Milestone-All elements of the silicon track trigger have been installed.																																																						
1.5.2.6.4	<b>Technical Commissioning</b>	<b>8/1/06</b>	<b>10/24/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>																																																
	<u>Notes</u> WBS Definition- This summary task provides for a full system test: send test data through all modules, verify output, interface with other systems, test downloading and monitoring (need to verify with actual silicon data).																																																						

WBS Dictionary as of 10/23/02  
Run IIB Installation

WBS	Name	Start	Finish	M&S EQ	M&S Labor	FNAL Labor	Total Cost				
1.5.2.6.4.1	Technical Commissioning, BU effort	8/1/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h
<u>Notes</u>											
WBS Definition- System test; send test data through all modules, verify output, interface with other systems, test downloading and monitoring (need to verify with actual silicon data).											
Labor BOE- Done by physicists											
M&S BOE- NA											
1.5.2.6.4.2	Technical Commissioning, CU Effort	8/1/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h
<u>Notes</u>											
WBS Definition- System test. send test data through all modules, verify output, interface with other systems, test downloading and monitoring (need to verify with actual silicon data).											
Labor BOE- Done by physicists											
M&S BOE- NA											
1.5.2.6.4.3	Technical Commissioning, SUNY Effort	8/1/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h
<u>Notes</u>											
WBS Definition- System test. send test data through all modules, verify output, interface with other systems, test downloading and monitoring (need to verify with actual silicon data).											
Labor BOE- Done by physicists											
M&S BOE- NA											
1.5.2.6.4.4	Technical Commissioning, FSU Effort	8/1/06	10/24/06	\$0.00	\$0.00	\$0.00	\$0.00				
<i>ID</i>	<i>Resource Name</i>	<i>Units</i>	<i>Cost</i>	<i>Baseline Cost</i>	<i>Act. Cost</i>	<i>Rem. Cost</i>	<i>Work</i>	<i>Ovt. Work</i>	<i>Baseline Work</i>	<i>Act. Work</i>	<i>Rem. Work</i>
12	PhysicistU	50%	\$0.00	\$0.00	\$0.00	\$0.00	240 h	0 h	0 h	0 h	240 h
<u>Notes</u>											
WBS Definition- System test. send test data through all modules, verify output, interface with other systems, test downloading and monitoring (need to verify with actual silicon data).											
Labor BOE- Done by physicists											
M&S BOE- NA											
1.5.2.6.5	<b>Silicon Track Trigger Operational</b>	<b>10/24/06</b>	<b>10/24/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>				
<u>Notes</u>											
WBS Definition- Milestone-Silicon Track Trigger is commissioned.											

WBS Dictionary as of 10/23/02  
Run IIb Installation

<b>WBS</b>	<b>Name</b>	<b>Start</b>	<b>Finish</b>	<b>M&amp;S EQ</b>	<b>M&amp;S Labor</b>	<b>FNAL Labor</b>	<b>Total Cost</b>
<b>1.5.2.7</b>	<b>Trigger Upgrade Ready for Beam</b>	<b>10/24/06</b>	<b>10/24/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>
	<i>Notes</i> WBS Definition- Milestone- Run IIb trigger upgrades installed and commissioned.						
<b>1.5.3</b>	<b>Run IIb Detector Ready for Beam</b>	<b>10/25/06</b>	<b>10/25/06</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>
	<i>Notes</i> WBS Definition Milestone-Run IIb Detector is ready for beam.						