

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2	Calorimeter Upgrades	\$967,388.00	\$852,728.00	\$114,660.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for the entire calorimeter project.						
1.2.1	Central Preshower and Crack Detectors	\$764,653.00	\$676,201.00	\$88,452.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for the central preshower/crack detector subproject.						
1.2.1.1	Start of Preshower/Crack Subproject	\$0.00	\$0.00	\$0.00	0	0	4
	<u>Notes</u> WBS Definition: Start of central preshower/crack detector subproject. (Milestone)						
1.2.1.2	Research and Development(US)	\$55,672.00	\$55,672.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for the U.S. R+D for the preshower/crack subproject.						
1.2.1.3	Research and Development(Japan)	\$28,940.00	\$28,940.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for the R+D in Japan for the preshower/crack subproject.						
1.2.1.4	Research and Development(Italy)	\$18,000.00	\$18,000.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for the R+D in Italy for the preshower/crack subproject.						
1.2.1.5	Procure parts	\$498,993.00	\$498,993.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for parts procurement common to both preshower and crack detectors.						

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.1.6	Preshower Detector Assembly	\$115,866.00	\$36,108.00	\$79,758.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for preshower detector assembly.						
1.2.1.7	Crack Detector Assembly	\$18,082.00	\$9,388.00	\$8,694.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task describing the assemble of the CDF Crack Detector.						
1.2.1.8	Fiber Bundle Assembly	\$29,100.00	\$29,100.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for fiber bundle assembly.						
1.2.1.9	Physicist or Student Labor	\$0.00	\$0.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for physicist and student labor testing detectors.						
1.2.1.10	Level 2 Milestones	\$0.00	\$0.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- Summary task for Preshower/Crack Level 3 milestones.						
1.2.2	Electromagnetic timing	\$202,735.00	\$176,527.00	\$26,208.00	0	0	0
	<u>Notes</u> WBS Definition- Highest level summary for electromagnetic timing project						
1.2.2.1	Research and Development	\$12,936.00	\$12,000.00	\$936.00	0	0	0
	<u>Notes</u> WBS Definition- Summary of research and development for electromagnetic timing project						

WBS	Name					Cost	M&S	Labor	M&S Cont.	Labor Cont.	Level
1.2.2.1.1	Procure parts for splitters & cable prototypes, misc test stand equip					\$2,000.00	\$2,000.00	\$0.00	0.3	0	0
ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost	
10	INKIND	2,000	2,000	0 mons	Jun 17 '02	Jul 29 '02	\$2,000.00	\$2,000.00	\$2,000.00	\$0.00	

Notes

WBS Definition-
Procure parts for splitter and cable prototypes, as well as miscellaneous test stand equipment.

Labor BOE-
N/A

M&S BOE-

Notes:

These are the prototypes of the splitter, PEM harness, ASD->TDC cable and miscellaneous Test stand equipment. We will use the existing 2nd floor test stands which have ADMEM's and TDC's in working crates.

Splitter: This is 2 harnesses (20 cables) of splitters. The cost per splitter is \$25 for a cost of \$500. The parts for his have already been purchased, and the splitters built. Written estimate.

PEM harness: This is 1 harness (8 cables). It is the LEMO connectors, the RG174 and the AMP connectors. The LEMO's are \$48 total, the cable is \$25 total and the AMP connectors are \$50 for a total of \$123. We are recycling all the parts for this assembly and the parts are all in hand. Written estimate.

We have purchased 2 ASD->TDC cables is purchased directly from 3M at a small-order cost of \$700. These parts are all in hand. Written estimate.

Other miscellaneous parts include extra LEMO connectors, terminators, BNC->LEMO connectors, short RG174 cables etc. Estimated cost \$300.

WBS	Name					Cost	M&S	Labor	M&S Cont.	Labor Cont.	Level
1.2.2.1.2	Assemble Splitter Prototype					\$624.00	\$0.00	\$624.00	0.5	0.5	0
ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost	
7	ElecTechU	100%	16 hrs	0 mons	Jul 30 '02	Jul 31 '02	\$624.00	\$624.00	\$624.00	\$0.00	

Notes

WBS Definition-
This is the assembly of the splitter prototype.

Labor BOE-

Written estimate details the following:

The individual splitters are about 20 minutes and bundling them up in to a harness takes another 20 minutes. The estimate is rounded to 2 days. This was already done at UC.

To be conservative we assume that this doesn't begin until all the prototype parts are ready.

M&S BOE-
N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.3	Assemble PEM harness prototype	\$312.00	\$0.00	\$312.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	ElecTechF	5%	8 hrs	0 days	Dec 6 '02	Jan 8 '03	\$312.00	\$312.00	\$312.00	\$0.00

Notes

WBS Definition-
This is assembling the splitter harness and the PEM harness.

Labor BOE-

The PEM harness is about 1 hour to put the cables into the single AMP connector. We assume a day to be conservative. This will be done by a FNAL tech.

To be conservative we assume that this doesn't begin until all the prototype parts are ready.

M&S BOE-
N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.4	Tests to finalize CEM Splitter	\$0.00	\$0.00	\$0.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	50%	320 hrs	0 days	Aug 1 '02	Nov 25 '02	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-
The final splitter must be shown to be mechanically compatible with the system, as well as perform as expected without introducing noise or a disruption to the existing CEM system. This is work done by TAMU post-doc. This includes building a test setup.

Labor BOE-
Prototypes of the CEM splitter exist and have been extensively tested with no known problems. A prototype of the mechanical harness exists and is being tested.

M&S BOE-
N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.5	Tests to finalize PEM Harness	\$0.00	\$0.00	\$0.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	10%	72 hrs	0 days	Jan 9 '03	May 15 '03	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-
This is the mechanical testing of a PEM harness between the PEM PMT box and the ASD/TB crates. This includes building a production test setup. This is work done by TAMU post-docs.

Labor BOE-
This estimate is based on previous experience testing harnesses at Fermilab.

M&S BOE-
N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.6	Tests to finalize ASD->TDC cables	\$0.00	\$0.00	\$0.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	10%	72 hrs	0 days	Jul 30 '02	Dec 5 '02	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-

The current ASD->TDC cable must be shown to pass the mechanical requirements as well as have timing resolution consistent with being small relative to the current TDC resolution (1nsec). These tests will be done by TAMU post-doc.

Labor BOE-

A cable already exists and has undergone detailed preliminary tests. This includes building a tester for the cables. Based on discussions with Fermilab electrical engineers.

M&S BOE-

N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.7	Build ASD/TB Prototypes and test	\$10,000.00	\$10,000.00	\$0.00	0.3	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
10	INKIND	10,000	10,000	0 mons	Jun 17 '02	Oct 15 '02	\$10,000.00	\$10,000.00	\$10,000.00	\$0.00

Notes

WBS Definition-

The Italian group will make a new batch of ASD's which are functionally identical to the existing ASD's but with a new output connector such that there is only one cable out.

Labor BOE-

N/A

M&S BOE-

Written estimate based on previous experience building equivalent boards.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.2.1.8	Prototype ASD tests with CEM Splitter, TDC cable, and TDC	\$0.00	\$0.00	\$0.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	50%	120 hrs	0 days	Jan 9 '03	Feb 20 '03	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-

Once we have an ASD prototype we can test it on a test bench with the splitters, the PEM harnesses as well as the finalized ASD->TDC cable and a TDC. While the final tests cannot be done until we have a prototype ASD, we can do much of the setup work before that. This is work done by TAMU post-doc.

Labor BOE-

These numbers are based on previous experience doing integration testing with ASDs and assume that all the parts individually have been shown to work.

M&S BOE-

N/A

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont.	Level
1.2.2.1.9	Assembly of wedge test stand	\$0.00	\$0.00	\$0.00	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	20%	144 hrs	0 days	Jul 30 '02	Dec 5 '02	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-

This is setting up the test stand with all the components as they come available. This will be done at B0 by TAMU post-docs.

Labor BOE-

This is based on previous experience setting up the existing components of the test stand.

M&S BOE-

N/A

1.2.2.1.10	Wedge test using all components	\$0.00	\$0.00	\$0.00	0	0	0
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ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
5	PostDocU	50%	188 hrs	0 days	Feb 21 '03	Apr 28 '03	\$0.00	\$0.00	\$0.00	\$0.00

Notes

WBS Definition-

Once we have all the components we do a wedge test with all the pieces together. While the final tests cannot be done until we have a prototype ASD, we can do much of the setup work before that. This is work done by TAMU post-doc.

Labor BOE-

This is based on previous integration testing at test stands.

M&S BOE-

N/A

1.2.2.2	Purchase parts for components and Produce	\$189,799.00	\$164,527.00	\$25,272.00	0	0	0
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Notes

WBS Definition-

This is high level summary for purchasing parts for the components and doing production. We note that the components for this project are:

CEM Splitter harnesses, PEM cable harnesses, TB, ASD's, ASD->TDC cables and TDC's. We itemize each part here.

Parts = 227,128 Labor = 15,552 Parts & Labor = 242,680 Recycling = 83,840

1.2.2.2.1	CEM Splitter	\$43,846.00	\$27,934.00	\$15,912.00	0	0	0
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Notes

WBS Definition-

This is the summary task for the CEM Splitter. The CEM splitter is used to pull off a small copy of the CEM anode signal for use into a ASD/TB. It is a completely passive device.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
"CEM Splitter" continued							
	<u>Notes</u>						
1.2.2.2.2	PEM Cable Harness	\$23,887.00	\$14,527.00	\$9,360.00	0	0	0
	<u>Notes</u>						
	WBS Definition- Summary task of creating the PEM Cable Harnesses						
1.2.2.2.3	ASD and Transition Boards	\$89,550.00	\$89,550.00	\$0.00	0	0	0
	<u>Notes</u>						
	WBS Definition- This is the summary task for building and testing the ASD and Transition boards.						
1.2.2.2.4	ASD->TDC Cables	\$22,516.00	\$22,516.00	\$0.00	0	0	0
	<u>Notes</u>						
	WBS Definition- This is the summary task for the ASD->TDC Cables which go up stairs.						
1.2.2.2.5	VME Crate for TDCs	\$10,000.00	\$10,000.00	\$0.00	0	0	0
	<u>Notes</u>						
	WBS Definition- This is the summary task for putting together the VME crate for the TDC's. This is the crate on the first floor which will contain all the TDC's for both the CEM and the PEM. As noted elsewhere, this crate will contain a Tracer, power supplies, and processor. There are 6 TDCs for the CEM and 4 TDCs for the PEM.						
1.2.2.2.6	TDC Boards	\$0.00	\$0.00	\$0.00	0	0	0
	<u>Notes</u>						
	WBS Definition- This is the summary task for the procuring of the TDC boards.						
1.2.2.2.7	EMTiming Level 2 Milestones	\$0.00	\$0.00	\$0.00	0	0	0
	<u>Notes</u>						
	WBS Definition- This is the procurement milestone summary task						

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
"EMTiming Level 2 Milestones" continued							
	<u>Notes</u>						
1.2.3	Calorimeter Milestones	\$0.00	\$0.00	\$0.00	0	0	0
	<u>Notes</u> WBS Definition- These are the EMTiming management milestones						
1.2.3.1	PAC Review	\$0.00	\$0.00	\$0.00	0	0	4
	<u>Notes</u> WBS Definition- This is the preliminary review approval process before Stage 1 approval and before critical decision 1.						
1.2.3.2	Approval to spend Construction funds	\$0.00	\$0.00	\$0.00	0	0	3
	<u>Notes</u> WBS Definition- This is the DOE critical decision. It is used, among other things, to finalize the final Italian funding.						
1.2.3.3	Italian R&D Funding Approval	\$0.00	\$0.00	\$0.00	0	0	4
	<u>Notes</u> WBS Definition- This is the preliminary approval needed for funding of the ASD prototypes to be built by the INFN groups						
1.2.3.4	Full Italian Government Approval	\$0.00	\$0.00	\$0.00	0	0	3
	<u>Notes</u> WBS Definition- Project has to be approved by Italian Government due the Italian government funds used on the project.						
1.2.3.5	End of Calorimetry Project: Level 2	\$0.00	\$0.00	\$0.00	0	0	2
	<u>Notes</u> WBS Definition- This is the end of the calorimetry project and is the Level 2 milestone. This milestone is coupled to the corresponding level 3 milestone with added schedule contingency.						

WBS Dictionary as of Mar 13 '03
CDF RunIIb Calorimeter Schedule

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.2.3.6	End of Calorimetry Project: Level 1	\$0.00	\$0.00	\$0.00	0	0	1

Notes

WBS Definition-

This is the end of the calorimetry project and is the Level 1 milestone. This milestone is coupled to the corresponding level 2 milestone with added schedule contingency.