WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3	**Run 2b DAQ and Trigger Project**	**$4,102,492**	**$3,519,122**	**$583,371**	**0**	**0**	**0**

Notes
WBS Description:

Project includes TDC upgrade, XFT upgrade, L2 upgrade, SVT upgrade, EVB upgrade and L3 PC replacements.

1.3.1	**Run 2b TDC Project**	**$827,643**	**$647,894**	**$179,750**	**0**	**0**	**0**

Notes
WBS Description:

This summary element covers the development and construction of new time to digital converters (TDC) used in the readout of the CDF central outer tracker (COT).

1.3.1.1	L3 Start Run 2b TDC Subproject	$0	$0	$0	0	0	3

Notes
WBS Description:

Milestone - denoting the start of the Run 2b TDC level 3 subproject

1.3.1.2	**Specification & Development**	**$45,240**	**$38,640**	**$6,600**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers the new TDC's specification and development on hit time digitization, buffer management, front-end ASDQ and trigger interfaces and data compression

1.3.1.3	**Detailed Design (FNAL)**	**$172,155**	**$125,022**	**$47,133**	**0**	**0**	**0**

Notes
WBS Description:

This summary tasks covers the detailed design for the specifications developed previously.

1.3.1.4	**Detailed Design (Chicago)**	**$43,551**	**$43,551**	**$0**	**0**	**0**	**0**

Notes
WBS Description:

This summary tasks covers the detailed design for the specifications developed previously.

1.3.1.5	L3 TDC Design Review	$0	$0	$0	0	0	3

Notes
WBS Description:

milestone on TDC Design Review . The TDC's have been sucessfully designed and prototype board fabrication can begin.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.1.6	**Prototype - V1.0 (FNAL)**	**$93,919**	**$93,919**	**$0**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers the first round of TDC prototypes including building the boards, debugging and evaulating their performance.

1.3.1.7	**Prototype - V1.0 (Chicago)**	**$16,803**	**$16,803**	**$0**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers the first round of TDC prototypes including building the boards, debugging and evaulating their performance.

1.3.1.8	L3 Design Review Milestone	$0	$0	$0	0	0	3

Notes
WBS Description:

Milestone - completion of TDC design review after prototyping as a requirment for the commencement of preproduction and production

1.3.1.9	**Preproduction**	**$184,397**	**$155,100**	**$29,297**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers preproduction TDC board fabrication and performance testing with single and multiple boards.

1.3.1.12	**TDC Modifications**	**$174,120**	**$77,400**	**$96,720**	**0**	**0**	**0**
1.3.1.17	**TDC Readout System**	**$97,458**	**$97,458**	**$0**	**0**	**0**	**0**
1.3.2	**Run 2b Level 2 Project**	**$358,716**	**$308,820**	**$49,896**	**0**	**0**	**0**

Notes
WBS Description: This summary task covers the development and production of the Level 2 Trigger system

1.3.2.1	L3 Start of Run 2b Level 2 Project	$0	$0	$0	0	0	3

Notes
WBS Description: Milestone denoting the start of the Level 2 Trigger Project

1.3.2.2	Testing and Software work existing L2 Pulsar test stand	$0	$0	$0	0	0.5	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
14	*Physicist*	*150%*	*768 hrs*	*16 days*	*Fri 9/27/02*	*Thu 1/2/03*	*$0*	*$0*	*$0*	*$0*
15	*PostDoc*	*250%*	*1,280 hrs*	*16 days*	*Fri 9/27/02*	*Thu 1/2/03*	*$0*	*$0*	*$0*	*$0*

Notes
WBS Description:The prototype Pulsar board will be commissioned as part of a test stand for the Run 2A system. Specific

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level

"Testing and Software work existing L2 Pulsar test stand" continued

Notes

prototypes

M&S BOE: N/A

Labor BOE: Based on Run 2A experience

1.3.2.3	Commission L2 Pulsar for each data path - proof of principle tes	$0	$0	$0	0	0.5	0			

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
14	*Physicist*	*150%*	*2,040 hrs*	*0 days*	*Fri 1/3/03*	*Wed 9/3/03*	*$0*	*$0*	*$0*	*$0*
15	*PostDoc*	*50%*	*680 hrs*	*0 days*	*Fri 1/3/03*	*Wed 9/3/03*	*$0*	*$0*	*$0*	*$0*

Notes

WBS Description:The Pulsar board will be commissioned for each data path coming in to and out of the Level 2 decision system.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience.

1.3.2.4	**Preproduction run of Pulsar L2 system**	**$145,516**	**$145,516**	**$0**	**0**	**0**	**0**

Notes

WBS Description: This task covers the preproduction run of the Level 2 system, which consists of three Pulsar boards, associated mezzanine cards, S-link boards and interface hardware, and L2 decision processor, and will be configured for a vertical slice test.

1.3.2.5	Vertical Slice Test	$0	$0	$0	0	0.5	0			

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
14	*Physicist*	*150%*	*1,200 hrs*	*0 days*	*Tue 1/27/04*	*Wed 6/16/04*	*$0*	*$0*	*$0*	*$0*
15	*PostDoc*	*50%*	*400 hrs*	*0 days*	*Tue 1/27/04*	*Wed 6/16/04*	*$0*	*$0*	*$0*	*$0*

Notes

WBS Description: This item covers assembly of a vertical slice of the Level 2 system. Specific tasks include: use test stand to fine tune receiver firmware for each data path; system integration at crate level with test stand; L2 code testing for new system.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience

1.3.2.6	**Production run of Pulsar L2 system**	**$129,804**	**$129,804**	**$0**	**0**	**0**	**0**

Notes

WBS Description: Summary task for Production Run of Pulsar Level 2 system: fabrication and purchase of boards, link hardware, L2 decision processors.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.2.7	System Integration standalone w/ test stand	$0	$0	$0	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
14	Physicist	150%	636 hrs	0 days	Tue 6/8/04	Fri 8/20/04	$0	$0	$0	$0
15	PostDoc	50%	212 hrs	0 days	Tue 6/8/04	Fri 8/20/04	$0	$0	$0	$0

Notes

WBS Description: This item covers integration of the system, first using the Pulsar teststand to drive the Pulsar L2 system, and after studying/optimizing the performance, testing the L2 decision system using test runs with beam data.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.2.9	Pulsar Level 2 subproject ready for installation	$0	$0	$0	0	0	2

Notes

WBS Description:

Level 2 subproject ready for installation.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.2.10	Pulsar Hardware Ready for Installation	$0	$0	$0	0	0	2
1.3.2.11	Operational Readiness Review	$0	$0	$0	0	0	0
1.3.2.12	L3 MS: Puslar Level 2 subproject ready for installation	$0	$0	$0	0	0	3
1.3.2.13	Firmware development for deployment in B0	$49,896	$0	$49,896	0	0.5	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
4	ElecEngF	60%	907.2 hrs	0 days	Wed 1/5/05	Fri 9/30/05	$49,896	$49,896	$16,368	$33,528
34	Pitkanen	100%	1,544 hrs	0 days	Wed 1/5/05	Fri 9/30/05	$0	$0	$0	$0

Notes

This task is to cover the engineering used for the preparation for operation of the L2 pulsar project.

The ElecEngF fraction is determined to reflex the amount of money paid to Sakuri Pitkanen for the 9 months. ($38,250)

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.2.14	L2 Filar Hardware purchase	$33,500	$33,500	$0	0.3	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
11	MANDSPASS	33,500	33,500	0 wks	Mon 5/16/05	Tue 8/9/05	$33,500	$0	$0	$33,500

Notes

Purchase Components for Pulsar project 19-Apr-05

10 CERN Filar boards - 2280 CHF /each - 22800 CHF (1.15 CHF/ 1$) = $19,826.09

20 U of C HOLA's (quote of $8789.28 / 20 HOLA) - $8789.28

1 week Uof C eshop time $4500

Total with small round up - $33500

Time estimate includes SOW revision etc.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.4	**Event-Builder Upgrade**	**$372,056**	**$314,200**	**$57,856**	**0**	**0**	**0**

Notes

WBS Description:

This summary element covers the Event-Builder upgrade. It includes the complete software development, the construction of a prototype and the construction of the full system.

1.3.4.1	L3 Start Event-Builder Upgrade	$0	$0	$0	0	0	3

Notes

WBS Description:

This milestone marks the beginning date for work on the upgrade of the Event-Builder.

1.3.4.2	technology evaluation	$0	$0	$0	0.3	0	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
15	*PostDoc*	*40%*	*384 hrs*	*0 days*	*Thu 12/5/02*	*Fri 5/30/03*	*$0*	*$0*	*$0*	*$0*

Notes

WBS Description:

Before starting to buy a prototype system an evaluation of the present technology will be performed. This evaluation results in the purchase of a prototype which is the most promising technology. The further schedule has been designed to fit the schedule for an upgrade using more powerful successor of the ATM technology. In case a different technology is chosen the schedule should still be appropriate. The price for the ATM technology is almost certainly higher than an alternative technology like Gigabit Ethernet.

M&S BOE: N/A

Labor BOE:
Based upon experience with the Run 2a system.

1.3.4.3	**upgrade software**	**$130,000**	**$130,000**	**$0**	**0**	**0**	**0**

Notes

WBS description:

This summary element covers the software development for the Event-Builder upgrade. It includes an evaluation of the operating system and the associated driver, the work needed for adjusting the drivers and the remaining software.

1.3.4.4	**construct prototype**	**$99,736**	**$54,200**	**$45,536**	**0**	**0**	**0**

Notes

WBS Description:

This summary element covers the construction of a prototype. It includes the purchase of the necessary elements, the installation and evaluation of a test stand.

The cost is based on a quote from a possible vendor in December 2001.

1.3.4.5	**construct full size system**	**$120,000**	**$120,000**	**$0**	**0**	**0**	**0**

Notes

WBS Description:

This summary element covers the construction of the full size Event-Builder system. It includes a readiness review, the purchase, installation and evaluation of the hardware and finally the completion of the system.

M&S BOE:

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
"construct full size system" continued							

Notes
The cost is based on a quote by a possible vendor from December 2001.

1.3.4.6	Switch Data taking to new Event Builder	$0	$0	$0	0.3	0.5	0

Notes
WBS Description:

Hardware and software commissioning involves data taking since only then the last problems can be found and corrected. Experience from Run IIa show that 2 month is a reasonable time to fix the most important problems.

M/S BOE: N/A

Labor BOE:
Based upon experience with the Run 2a system.

1.3.4.7	L3 Finish Event Builder Upgrade	$0	$0	$0	0	0	3
1.3.4.8	Finish Event-Builder Upgrade	$0	$0	$0	0	0	2

Notes
WBS Description:

This milestone marks the end of the Event-Builder upgrade. This means that the hardware is in place and has been proven to technically work, the software development has been finished and its functionality has been proven with real data.

1.3.4.10	Procure support hardware and software	$10,000	$10,000	$0	0	0	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
10	*MANDS*	*10,000*	*10,000*	*0 days*	*Thu 10/2/03*	*Fri 3/11/05*	*$10,000*	*$10,000*	*$10,000*	*$0*

Notes
These funds are to cover miscellaneous expenses.

1.3.4.11	Engineering support for testing	$12,320	$0	$12,320	0	0.5	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
4	*ElecEngF*	*20%*	*224 hrs*	*0 wks*	*Mon 3/14/05*	*Wed 9/28/05*	*$12,320*	*$0*	*$1,320*	*$11,000*
38	*Rechenmacher*	*20%*	*228.8 hrs*	*0 wks*	*Mon 3/14/05*	*Wed 9/28/05*	*$0*	*$0*	*$0*	*$0*

1.3.5	**Computer for Level3 PC Farm / DAQ**	**$874,114**	**$874,114**	**$0**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers the computer purchases for the general DAQ system and the Level-3 PC Farm. The purchases are staged since they are replacing PCs which become obsolete. Prices are based on a recent purchase of similar hardware.

1.3.5.1	Start Computers for Level3 PC Farm/DAQ	$0	$0	$0	0	0	3

Notes
WBS Description:

This milestone marks the beginning of the DAQ and Level3 computer purchases.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.5.3	**replace 15 DAQ PCs (2004)**	**$32,769**	**$32,769**	**$0**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task describing the purchase of 15 DAQ computers in FY004.						
1.3.5.4	**replace 20 DAQ PCs (2005)**	**$91,781**	**$91,781**	**$0**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task describing the purchase of 20 DAQ computers in FY2005.						
1.3.5.5	**replace 70 Level 3 PCs (2004)**	**$166,576**	**$166,576**	**$0**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task describing the purchase of 70 level 3 computers in FY2004.						
1.3.5.6	**replace 140 Level 3 PCs (2005)**	**$499,704**	**$499,704**	**$0**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task describing the purchase of 140 level 3 computers in FY2005.						
1.3.5.8	Finish Purchase of Computers for Level3/DAQ system	$0	$0	$0	0	0	2
	Notes						
	WBS Description:						
	This milestone marks the end of the PC purchases for the DAQ and the Level3 PC Farm.						
1.3.5.9	**Purchase Converter nodes**	**$83,284**	**$83,284**	**$0**	**0**	**0**	**0**
1.3.6	**SVT upgrade**	**$301,308**	**$219,908**	**$81,400**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	CDF Silicon Vertex Tracker Run 2b upgrade. Upgrade necessary due to differences between SVX IIa and SVX IIb detector geometry. System operation identical to the Run 2a SVT.						
1.3.6.1	**Design and Simulation**	**$81,400**	**$0**	**$81,400**	**0**	**0**	**0**
1.3.6.2	**Hardware Construction**	**$219,908**	**$219,908**	**$0**	**0**	**0**	**0**
1.3.6.3	SVT ready for installation	$0	$0	$0	0	0	2
	Notes						
	WBS Description:						
	Milestone denoting the completion of the SVT.						
1.3.6.4	L3 SVT ready for installation	$0	$0	$0	0	0	3

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
"L3 SVT ready for installation" continued							
1.3.8	Finish Run 2b Trigger DAQ project	$0	$0	$0	0	0	2
	Notes WBS Description: Milestone marking the end of the CDF Run 2b Trigger/DAQ upgrade subproject.						
1.3.9	Data Acquisition and Trigger Upgrades Ready for Installation	$0	$0	$0	0	0	2
	Notes WBS Description: Milestone marking the end of the CDF Run 2b Trigger/DAQ upgrade subproject. This milestone is coupled to the corresponding level 2 milestone with added schedule contingency.						
1.3.10	**Accelerator "Summer" Shutdown planning tasks**	**$0**	**$0**	**$0**	**0**	**0**	**0**
1.3.10.1	Accelerator Shutdown 2004	$0	$0	$0	0	0	0
	Notes WBS Description: Planning task to Cover 3 month accelerator shutdown in 2004.						
1.3.10.2	Ready for Accelerator Shutdown 2005	$0	$0	$0	0	0	2
	Notes WBS Description: Planning task to Cover 3 month accelerator shutdown in 2004.						
1.3.10.3	L3 MS: 2004 Shutdown Complete	$0	$0	$0	0	0	3
1.3.11	**Revised XFTII Project**	**$1,368,655**	**$1,154,186**	**$214,469**	**0**	**0**	**0**
	Notes WBS Description: Project to Upgrade the CDF Level 1 tracking trigger system.						
1.3.11.1	L3 Start of Revised XFTII Project	$0	$0	$0	0	0	3
	Notes WBS Description: Milestone - marking the start of the XFTII upgrade project.						
1.3.11.2	**Finder Boards**	**$682,669**	**$488,600**	**$194,069**	**0**	**0**	**0**
	Notes WBS Description: Development of axial and stereo segment Finder boards. These boards take hit information from the COT and find track segments in the COT superlayers.						

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.3	Test equipment	$23,773	$23,773	$0	0.3	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
10	MANDS	23,773	23,773	0 days	Fri 1/14/05	Tue 8/16/05	$23,773	$23,773	$11,887	$11,887

Notes

WBS Description:

purchase test equipment for production testing of boards

M&S BOE: **This cost is $23,773 in FY02 dollars.**

DVM's , oscilloscope, probes.

Labor BOE:

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.4	**TDC Transition Module**	**$170,000**	**$170,000**	**$0**	**0**	**0**	**0**

Notes

WBS Description:

TDC Transition Module: The design for these boards already exists and is being used in the Run 2A design. Additional boards are required for the Stereo Segment Finding. We need 54 boards + 6 spares.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.5	**TDC Mezzanine Card**	**$169,320**	**$169,320**	**$0**	**0**	**0**	**0**

Notes

WBS Description:

TDC Transition Module: The design for these boards already exists and is being used in the Run 2A design. Additional boards are required for the Stereo Segment Finding. We need 54 boards + 6 spares.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.6	**Cables**	**$57,720**	**$51,480**	**$6,240**	**0**	**0**	**0**

Notes

WBS Description:

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.7	**Stereo Linker Association Module (SLAM)**	**$182,020**	**$182,020**	**$0**	**0**	**0**	**0**

Notes

WBS Description:
Linker Output Module II captures the track list from Linker Modules and drives the data to the XTRP and the Stereo Association Module. We need 24 boards + 6 spares

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.8	**Level 2 Stereo Interface**	**$83,153**	**$68,993**	**$14,160**	**0**	**0**	**0**

Notes

WBS Description:

Summary task for XFT-> Level 2 interface board.

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.9	L3 XFT Ready for Installation at CDF	$0	$0	$0	0	0	3

Notes

Level 3 milestone

WBS	Name	Cost	M&S	FNAL Labor	M&S Cont.	Labor	Level
1.3.11.10	XFT Ready for Installation at CDF	$0	$0	$0	0	0	2

Notes

WBS Description:
Milestone indicating XFT project complete.

1.31	L3 Start of Run 2b DAQ and Trigger Project	$0	$0	$0	0	0	3

Notes

WBS Description:
Milestone - marking the beginning of the Run 2b DAQ and Trigger upgrade project