

Statement of Work
By
Computing Division at Fermilab
For
PHENIX Silicon Pixel Detector Project at
Los Alamos National Laboratory
During Fiscal Year 2006
Issue Date
March 2, 2006
Revision 1.0

CONCURRENCES:

Patrick L. McGaughey
PHENIX Silicon Pixel Detector Manager
Los Alamos National Laboratory

Date

Vicky White
Computing Division
FNAL Institutional Representative

Date

1. Introduction

This Statement of Work (SOW) provides details of the work agreed between Los Alamos National Laboratory (LANL) and Fermilab (FNAL). According to the initial plan, the duration of the project is for nine calendar months, beginning on March 1, 2006, provided the funds become available at Fermilab before the beginning date. However, this schedule may be delayed if there is a delay in the availability of the mechanical specifications of the project. The Project Leader (PL) for the project is Dr. Guilherme Cardoso of Fermilab.

2. Description

The work comprises the non-recurring engineering (NRE) costs for the electronics design of the pixel module test card, the pixel plane printed circuit board (PCB), and the test stand to characterize the pixel modules for the PHENIX experiment. The work will be performed by the Electronic Systems Engineering (ESE) section of the Computing and Engineering for Physics Applications (CEPA) department of Computing Division (CD), Fermilab. ESE will design the pixel high-density interconnect (HDI) required for the project. However, it is not included in this contract as it is not a LANL responsibility. The work consists of the following items:

1. Pixel module test card: The pixel module HDI is assembled and characterized on a test card. The test card is a printed circuit board onto which the pixel module is assembled and wire-bonded. Once the characterization of the module is complete, the pixel module is removed from the test card and assembled onto the pixel plane PCB.
2. Pixel plane PCB: The pixel plane PCB holds one layer of 12 pixel modules. The area on the pixel plane PCB where the pixel modules are assembled is cooled down to meet the project's required operation temperature. The mechanical design of the board will be performed by a mechanical group assigned by Los Alamos. ESE will work on the electronics design of this board and will collaborate with the mechanical design group in the overall design of the board.
3. Test stand: The test stand will be used to characterize the pixel modules. It's designed using the PCI test adapter developed at Fermilab. The work includes firmware to control and readout the modules and software (with a GUI) to interface with the PCI card.

3. Responsibility for this Period of Performance

3.1. Work Breakdown Structure (WBS) Items at lowest level, Estimated Cost and Work

The planned project start date is March 1, 2006. The project schedule is dependent on the availability of the general system requirements and the mechanical specification of the Pixel Plane PCB from LANL.

For each of the items described in section 2, Fermilab agrees to provide complete documentation of the work. This will include items schematics, board layout / artwork, bill of materials, software listings, simulation and test results. Fermilab also agrees to provide technical support via phone and videoconferencing to LANL as necessary during the project. LANL will provide a system requirements document and the mechanical specification of the board for the project and ESE will provide the specification of the work done.

It is estimated that this work will require 6.75 FTE month of Electronics Engineer (EE) and 4.5 FTE month of Electronics Technician (ET) to complete. See Appendix A for the breakdown of labor costs. This does not include any material purchases or travel costs. LANL will provide support for three trips for the PL to attend meetings at LANL or Brookhaven National Laboratory (BNL). Upon approvals from LANL, Fermilab staff will arrange travel through Fermilab's travel office. LANL will be billed later. It is understood that, using specifications defined by the PL, LANL will purchase necessary items for the project and ship them to Fermilab.

This agreement covers labor costs only. The source of support will be provided by LANL in the form of a LANL Memorandum Purchase Order (MPO) for the amount of \$150,108. The project work will begin after Fermilab receives the funds in the form of MPO. After the initiation of the project, Fermilab will send monthly invoices for labor to LANL. The fund received at Fermilab will be carried over the fiscal year boundary to the fiscal year 2007.

A detailed WBS for the project is presented in the Appendix B.

Following individuals will carry out tasks associated with the project:

- Guilherme Cardoso – Project Leader
- Marcos Turqueti – Engineer
- Jeffry Andresen – Engineer
- Alan Prosser – Engineer
- John Chramowicz – Electronics Technician

It may be necessary for Fermilab staff members to provide limited additional supports to the work beyond the term specified in the WBS. Further support of the test stand beyond the completion of the project will be negotiated between LANL and Fermilab/CD/ESE.

3.2. Coordination and Reporting

Fermilab will report all related expenditures and labor charges together with associated technical progress in each item of work to Patrick L. McGaughey, the PHENIX Silicon Detector Manager on a monthly basis covered in this Statement of Work. ESE will not be responsible for staffing the test stands to test production modules. This statement includes the delivery of a working test stand that will be staffed by PHENIX collaborators. LANL is responsible for the test of production units. The responsibilities of PL of the project terminate after the successful conclusion of the acceptance testing. It is stipulated that the acceptance testing will not be tied to the availability of bump-bonded pixel modules.

3.3. Collaboration with other Groups and Institutions

The PL for the project will collaborate with Fermilab's PPD division and vendors as necessary.

Change Log of SOW

Version	Issue Date	Cost (\$K) Added	Concurrence (Initial)	Description of Change
1.0	3/2/2006	\$150,108	PM	Original

Appendix A: Labor Cost Breakdown

DOE F 4620.1 (04-93) All Other Editions Are Obsolete	U.S. Department of Energy Budget Page (See reverse for Instructions) Year 1	OMB Co 1910-14 OMB Bu Statemen
ORGANIZATION Fermilab Computing Division		Budget Page No: <u> 1 </u>
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR Guilherme Cardoso		Requested Duration: <u> 9 </u>
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title; A.6. show number in brackets)	DOE Funded Person- mos.	Funds Requested by Applicant
	CAL ACAD SUMR	
1.		
2.		
3.		
4.		
5.		
6.		
() OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)		
7. () TOTAL SENIOR PERSONNEL (1-6)		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)		
1. () POST DOCTORAL ASSOCIATES		
2. (5) OTHER PROFESSIONAL (TECHNICIAN, PROGRAMMER, ETC.)	11.25	\$84,730
3. () GRADUATE STUDENTS		
4. () UNDERGRADUATE STUDENTS		
5. () SECRETARIAL - CLERICAL		
6. () OTHER		
TOTAL SALARIES AND WAGES (A+B)		\$84,730
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)		\$29,910
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A+B+C)		\$114,639
D. PERMANENT EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM.)		
TOTAL PERMANENT EQUIPMENT		
E. TRAVEL		
1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)		
2. FOREIGN		
TOTAL TRAVEL		
F. TRAINEE/PARTICIPANT COSTS		
1. STIPENDS (Itemize levels, types + totals on budget justification page)		
2. TUITION & FEES		

3.	TRAINEE TRAVEL		
4.	OTHER (fully explain on justification page)		
	TOTAL PARTICIPANTS ()	TOTAL COST	
G.	OTHER DIRECT COSTS		
1.	MATERIALS AND SUPPLIES		
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION		
3.	CONSULTANT SERVICES		
4.	COMPUTER (ADPE) SERVICES		
5.	SUBCONTRACTS		
6.	OTHER		
	TOTAL OTHER DIRECT COSTS		
H.	TOTAL DIRECT COSTS (A THROUGH G)		\$114,639
I.	INDIRECT COSTS (SPECIFY RATE AND BASE)		
	30.94% on Salaries		
	TOTAL INDIRECT COSTS		\$35,469
J.	TOTAL DIRECT AND INDIRECT COSTS (H+I)		\$150,108
K.	AMOUNT OF ANY REQUIRED COST SHARING FROM NON-FEDERAL SOURCES		
L.	TOTAL COST OF PROJECT (J+K)		\$150,108

Appendix B: Detailed WBS

ID	Task Name	Start	Finish	Cost	Qtr 1, 2006			Qtr 2, 2006			Qtr 3, 2006			Qtr 4, 2006		
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	FNAL/CD PHENIX	3/1/06	11/30/06	\$150,107.55												
2	Funds from LANL received at FNAL/CD	3/1/06	3/1/06	\$0.00												
3	Pixel Plane - Prototype	3/1/06	7/10/06	\$38,538.62												
4	Schematic entry	3/1/06	4/11/06	\$15,748.80												
5	Simulations	4/12/06	4/27/06	\$3,374.40												
6	Develop mechanical requirements with mechanical team	4/28/06	5/23/06	\$2,767.10												
7	Layout	5/24/06	6/26/06	\$16,648.32												
8	Pixel plane PCB delivered to FNAL	6/27/06	7/10/06	\$0.00												
9	Pixel plane PCB approved and delivered to LANL	7/10/06	7/10/06	\$0.00												
10	PM test board	5/24/06	8/3/06	\$21,395.33												
11	Schematic entry	5/24/06	6/8/06	\$6,299.52												
12	Simulations	6/9/06	6/16/06	\$1,687.20												
13	Develop mechanical requirements with mechanical team	6/19/06	6/26/06	\$922.37												
14	Layout	6/27/06	7/20/06	\$12,486.24												
15	PM test board delivered to FNAL	7/21/06	8/3/06	\$0.00												
16	PM test board approved and delivered to LANL	8/3/06	8/3/06	\$0.00												
17	Pixel plane PCB - Production	8/1/06	10/30/06	\$30,840.40												
18	Received sytem and pixel plane PCB mechanical requirements from LANL	8/1/06	8/1/06	\$0.00												
19	Schematic entry	8/1/06	8/21/06	\$10,405.20												
20	Simulations	8/22/06	8/29/06	\$1,687.20												
21	Develop mechanical requirements with mechanical team	8/30/06	9/12/06	\$2,099.68												
22	Layout	9/13/06	10/16/06	\$16,648.32												
23	Pixel plane PCB delivered to FNAL	10/17/06	10/30/06	\$0.00												
24	Pixel plane PCB approved and delivered to LANL	10/30/06	10/30/06	\$0.00												
25	Test stand	3/1/06	11/30/06	\$59,333.20												
26	Develop firmware to interface with FPIX2.1	3/1/06	7/7/06	\$15,690.96												
27	Develop software for PTA2	3/6/06	11/30/06	\$43,642.24												
28	Test stand approved and delived to LANL	11/30/06	11/30/06	\$0.00												