Fermi National Accelerator Laboratory
Run IIb CDF and DØ Detector Projects
Acquisition Execution Plan

Introduction

This document describes the Acquisition Execution Plan for the Run IIb upgrades to the CDF and DØ experiments operating at the Fermilab Tevatron Collider. The upgrade of each experiment will be considered to be a separate project. The two projects are very similar from a technical and managerial point of view. Therefore, the common procurement issues between these projects motivates a single Acquisition Execution Plan to cover both projects. Specific differences between the two projects will be discussed in Appendices A and B.

A. Acquisition Background and Objectives

1. Statement of Need

The Fermilab Tevatron Collider brings circulating beams of high-energy protons and anti-protons into collision for the purpose of studying the fundamental constituents of nature. These collisions take place at two locations in the Tevatron Collider, and the remnants of these collisions are detected by the CDF and DØ experiments. By examining these remnants, the experiments are able to study the properties of the particles produced in these collisions, search for the production of new species of particles, and study the fundamental interactions that govern the production and decay of the particles.

The Fermilab Tevatron provides the highest energy particle beams in the world, enabling unique opportunities for scientific discovery. One such opportunity is the search for the Higgs Boson, which is thought to be responsible for breaking the Electro-Weak symmetry and giving rise to particle masses. Understanding the mechanism for Electro-Weak Symmetry Breaking has been identified as the highest priority of the US High Energy Physics (HEP) program by the HEPAP sub-panel assessing the long-range future of the field. There are strong indications that Higgs mass is likely to be within the range where CDF and DØ experiments are sensitive to it provided the experiments collect sufficient integrated luminosity. The purpose of this acquisition is to upgrade the CDF and DØ experiments to enable them to accumulate sufficient integrated luminosity to maximize the chance for discovering the Higgs Boson.

Fermilab will continue to operate at the “Energy Frontier” until 2007 or 2008, when the Large Hadron Collider (LHC) at CERN is anticipated to begin operation with a much higher beam energy. Thus, the Fermilab Tevatron Collider has a limited window of opportunity for making major scientific discovery before handing off the baton to CERN and minimizing the procurement time for the Run IIb upgrades is a significant consideration in the project planning process. The Run IIb upgrades will allow the experiments to operate at high luminosity and meet the laboratory’s goal of acquiring an integrated luminosity of 15 fb^{-1}. This is a significant increase above the Run IIa goal

of 2 fb^{-1} and will enable a sensitive search for the Higgs Boson, which has been identified as a top priority in the President's budget request for High Energy Physics.

2. Applicable Conditions

Installation of the Run IIb projects will be required to continue operation beyond 2005. However, the process of installation of the detector replacements necessitates an interruption to operations of approximately six months duration. Both experiments will need to be ready for this installation and strive to make it as short as possible.

Considerable experience in the construction and operation of detector elements that are included in the projects has been developed by both experiments. The new system designs will draw heavily on that experience.

3. Cost

The total project costs for the CDF and DØ projects have not yet been baselined. They are estimated to be approximately $25-35 million each. The CDF and DØ total estimated material and services cost to DOE for the Run IIb projects is $18,200,000. Significant contributions from foreign sources are anticipated. In addition, several university groups will contribute to the projects and be supported by National Science Foundation grants. Labor for the Run IIb Collider Experiment projects will be provided by the Fermilab base program and university supported researchers.

Life-cycle cost: Project costs are presented in the paragraph above. Operating costs for the Run IIb experiments will be comparable to the currently operating Run IIa experiments. The elements of the experiments built by the Run IIb projects will have a useful life of approximately five years. After that time, we anticipate that the pieces will discarded. No significant costs are foreseen in the decommissioning of the Run IIb projects, since they are relatively small, and should not present contamination problems. Operating costs of the experiments will not be affected by the Run IIb projects.

Design-to-Cost: Laboratory management provided initial design-to-cost guidance. This was provided with an understanding that cost is driven by technical requirements which are in turn driven by the physics goals and increased luminosity.
Application of should-cost: Although this effort does not explicitly use a detailed, special for of cost analysis as identified in Federal Acquisition Regulation 15.407-4, it has used an extensive amount of should-cost philosophy in preparing estimates. Detailed cost estimates of each of the major procurements for the Run IIb projects have been made from vendor quotes and experience with earlier and similar procurements. As a result, these cost estimates will serve as the should-cost benchmarks as these projects evolve.

4. Capability

The Run IIb upgrades of the CDF and DØ detectors will provide the necessary capability to make sensitive searches for the Higgs Boson and maximize the physics opportunities in Run IIb. The largest part of the Run IIb projects is to replace the silicon detectors in the CDF and DØ experiments. These detectors are capable of

identifying short-lived particles, such as b-quarks, that travel a small distance before decaying into other particles. The Higgs Boson is expected to decay into a pair of b-quarks and efficiently detecting them is crucial to the Run IIb goals. The CDF Run IIb project also includes a central preradiator detector with the capability of improving electron and photon identification, and an upgraded event builder with the capability of increasing the data throughput. The DØ Run IIb project includes upgrades to the Level 1 and Level 2 triggers to improve the selectivity in what data is recorded, and an upgrade to the online computing to provide the necessary computing infrastructure needed for Run IIb.

5. Delivery or Performance Period Requirements

Current estimates indicate that the Run IIb Collider Experiment projects must be completed by November 2006. This date is dictated by the operational needs of the collider program and the anticipated lifetime of the currently operating detectors. The key milestones for the projects are listed below

Milestone	Date
CD-0 Approval	June 2001
CD-1 Approval	August 2002
CD-2 Approval	August 2002
CD-3 Approval	August 2002
Begin major procurements	December 2002
Assembly and Installation	November 2005
CD-4 Approval	November 2006

6. Trade-offs

There are no tradeoffs associated with the acquisition execution plan.

7. Risks

Detector upgrades are well within the experience and expertise of the collider experiment collaborations. Every effort has been made to specify these projects in a manner that reduces the level of risk to an acceptably low level. The following steps will be taken to assure that the risk to these projects is low:

(1) Technical:

Preparation of clear and concise specifications, judicious determination of subcontractor responsibility and approval of proposed lower tier sub-subcontractors, and implementation of QA provisions will minimize technical risk. Projects have been designed to further minimize technical risk by exploiting previous experience to the greatest extent possible, and minimizing exposure to single vendor failures.

Technically risky elements of the silicon detectors for both experiments have been minimized by making deliberately conservative design choices. Use of single sided sensors, reduction in component variety, and common integrated circuit technologies will reduce risk.

(2) Cost

Use of fixed-price subcontracts and competition will be maximized to reduce cost risk.

(3) Schedule

Schedule risk will be minimized via:

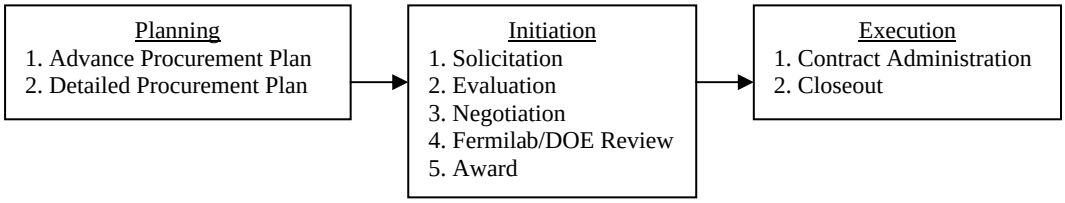
- realistic planning,
- verification of subcontractor's credit and capacity during evaluation,
- close surveillance of subcontractor performance,
- advance expediting, and
- incremental awards to multiple subcontractors when necessary to assure total quantity or required delivery.

Incentive subcontracts, such as fixed-price with incentive, will be considered when a reasonably firm basis for pricing does not exist or the nature of the requirement is such that the subcontractor's assumption of a degree of cost risk will provide a positive profit incentive for effective cost and/or schedule control and performance.

8. Acquisition Streamlining

Figure 1 demonstrates how the project intends to solicit and evaluate proposals for major and/or critical, negotiated, competitive contractual actions.

Figure 1 Chronological sequence of major procurement actions (>$1M)



(1) Detailed Procurement Plans

Detailed procurement plans will be utilized to supplement this Acquisition Plan. The planning process will bring the project procurement, controls and integration, and technical personnel together to identify major procurements and delivery date requirements. A detailed procurement plan will be developed by this group for each significant procurement to show the critical activities and time requirements of the procurement process and thereby establish procurement start dates. By developing these detailed procurement plans, the potential for schedule problems associated with the procurement process is reduced

(2) Significant and/or critical procurements

Detailed procurement plans apply specifically to critical, complex, high-dollar or long-lead requirements of significant importance to the project objectives. They are not intended to apply to common items of supply, such as “shelf’ items, although it is recognized that all procurements require some degree of planning. Any procurement estimated at $1,000,000 or more will have a detailed procurement plan.

DOE review and written approval will be required for any contract with a value greater than $1,000,000 or any change to a contract that causes it to exceed this threshold. Other individual procurements at a lower dollar amount may also require DOE approval if it is deemed necessary by the Contracting Officer. It is not anticipated that a significant number of award actions will require submittal to the DOE for approval. Sufficient time to satisfy this requirement will be included in the detailed procurement plan and each such action will be prioritized for expeditious processing.

B. Plan of Action

1. Sources

Sources for the projects will be many and varied. Several industrial vendors will be used for the manufacture of specialized integrated circuits. Other vendors will be utilized for the assembly of completed circuit boards. Universities will act as vendors, providing testing of components and/or specialized construction expertise. Labor will come from both university and Fermilab staffs.

2. Competition

To the extent possible, competition will be used to award contracts for the projects. This is detailed in the following section.

3. Source Selection Procedures

The source selection for all procurements is guided by Fermilab procurement procedures.

(1) Competition

To the extent practicable, fixed-price purchase orders and subcontracts for supplies, equipment and services will be awarded on the basis of competitive solicitations to technically capable responsive and responsible offerors. Awards made on a non-competitive basis will include adequate justification to support such award in accordance with Fermilab procurement procedures.

For critical components required in quantity, incremental awards may be made to subcontractors to obtain the total quantity on required delivery dates. The volume ordered from each subcontractor will be adjusted according to price and delivery. Unilateral options, as exercised by Fermilab, will be utilized to achieve these results.

A purchase order or subcontract for materials or services, may be awarded without competition, i.e., sole source procurement, when, in accordance with Laboratory procurement policy, the delegated levels of signature authority determine in writing that there is only one reasonable source for the required material or service.

(2) Solicitation Documents and Evaluation Criteria

The means of soliciting offers will be the Request for Quotation (RFQ) and the Request for Proposal (RFP). The nature, complexity and/or dollar value of each procurement will determine the type of solicitation to be used.

All major or highly technical procurements will, when appropriate, have a plan for evaluating proposals and evaluation criteria for ranking of prospective vendors or subcontractors who are competing. Criteria for evaluation will be based on technical, business and cost factors including technical capability, past

performance, capacity, and delivery, as well as subcontractor responsiveness to the solicitation and subcontractor responsibility factors such as financial wherewithal.

These evaluation criteria will relate directly to the specification and/or Statement of Work. The plan will include the criteria for the technical evaluation and will be as detailed as possible. Where evaluation criteria are used, technical review and approval of proposed subcontracts will be obtained. Evaluation criteria will be established prior to the distribution of the solicitation. The general criteria will become a part of the solicitation so that all potential offerors will reasonably know how their proposals will be evaluated.

4. Contracting Considerations

A Statement of Work (SOW) will be required for all procurement actions. The content and detail of each SOW will fully define or describe the proposed procurement.

(1) Use of functional or performance specifications.

The projects anticipate that a major portion of the technical design will be done in-house, leaving little design work for outside vendors. Procurements will primarily consist of fabricated items, state-of-the-art items, and off-the-shelf items. Functional or performance specifications will be used, to the extent practicable, for procurement of materials and services.

(2) Consolidation and standardization.

It is the intent of the project to consolidate off-the-shelf standard like-items in order to reduce the number of orders handled and to obtain quantity or volume discounts consistent with acceptable delivery. Run IIb Project requirements may be grouped with other Laboratory requirements under blanket purchase orders, basic ordering agreements, and multi-year procurements to maximize discounts, enhance standardization, and reduce administrative burden.

(3) Special Provisions

Except for long-lead items, the project does not anticipate that special contractual provisions will be required for this project that have not been discussed in other parts of the Acquisition Plan.

5. Budgeting and Funding

The anticipated M&S funds that will pass through the Fermilab procurement department for the Run IIb projects is as follows:

Fiscal Year	Budget ($ in millions)
2002	3.0
2003	5.6
2004	5.6
2005	5.0

In addition, foreign funds and grants from other agencies are expected to contribute to the projects. These details appear in Appendices A and B.

6. Product or Service Descriptions

Each project will deliver a completed radiation hard silicon tracking detector for use in Run IIb. These detectors are the largest single subprojects in each project. Other smaller deliverables are detailed in Appendices A and B.

7. Priorities, allocations and allotments

There are no unique priorities, allocations or allotments associated with the procurement of the Run IIb collider projects.

8. Contractor vs. Government Performance

All work associated with the Run IIb projects will be performed by contractor personnel. Fermilab will award all contracts to commercial firms, universities, and research laboratories. There is no apparent advantage for DOE to directly handle the Run IIb procurements.

9. Inherently Governmental Functions

There are no inherently governmental functions associated with the Run IIb projects. Neither design, construction, installation, nor high energy physics research are inherently governmental functions.

10. Management Information Requirements

Project procurements will include status reporting requirements. The extent of reporting is commensurate with the value of the procurement. Major project procurements will require general management, schedule/labor/cost, exception, performance, financial, and technical status reports which are consistent with this type of procurement. The type (technical/cost/schedule) and frequency of progress information and follow-up required will depend on such factors as the complexity of the procurement and how critical the work is to the project schedule. These periodic reports, along with on-site visits, will be the major tool for evaluating progress. The projects will maintain a comprehensive procurement follow-up program tracking all aspects of the procurement cycle.

11. Make or Buy Considerations

Fermilab will buy most components of the Run IIb projects, since technical expertise for making many required elements at Fermilab is not available. These components will be assembled by Fermilab into the custom units that are the final detector subsystems. Fermilab will comply with the Make or Buy Program set forth in the DOE/URA prime contract.

12. Test and Evaluation

The project teams will determine the items to be procured. The teams will develop technical requirements and specifications as appropriate, and are responsible for generating the procurement requisitions. The project teams will coordinate with the Procurement Department for the awarding of contracts and establishment of acceptance procedures for procured items.

13. Logistic considerations

No unique logistical considerations are anticipated for the Run IIb projects.

14. Government furnished property

In the event there is the need for Government or third-party-furnished equipment or supplies for the performance of project subcontracts, the Procurement Administrator will ensure that appropriate articles and clauses, e.g., special tooling, title, government property, as applicable, are included in procurement documents that will specify accountability requirements for Government-owned property. Property management provisions assure that all property acquired by Fermilab or third parties for this project is accounted for to the extent required by DOE-approved policies and procedures.

Fermilab procurement procedures covering Government property-supplier control will be followed. These procedures contain the guidelines for control, accountability and return/disposition of Laboratory (Government owned) equipment, supplies, or special tooling furnished to, acquired or fabricated by subcontractors in the performance of Laboratory work.

15. Government furnished information

These projects do not anticipate making use of any government supplied information.

16. Environmental and energy conservation objectives

The energy needs and environmental impact of these projects is negligible. No objectives have been identified, or seem appropriate.

17. Security Considerations

The security oversight for the overall site is Fermilab's responsibility. In terms of theft, any subcontractor working on the site will be responsible for necessary precautions to safeguard material and equipment. In the event of theft of subcontractor property, Fermilab property, and/or Government property, the subcontractor shall notify Fermilab's Security Operations.

18. Safety requirements and considerations

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM) for all work conducted on the Fermilab site and requires its subcontractor and sub-tier contractors to do the same. Integrated Safety Management is a system for performing work safely and in an environmentally responsible manner. The term “integrated” is used to indicate that the ES&H management systems are normal and natural elements of doing work. The intent is to integrate the management of ES&H with the management of the other primary elements of work: quality, cost, and schedule.

(1) Line Management Responsibility for Safety: Line management is responsible and accountable for the protection of the employees, the public and the environment.
(2) Clear Roles and Responsibilities: The roles and responsibilities, and authority at all levels of the organization, including potential sub-tier contractors are clearly identified.
(3) Competence Commensurate with Responsibility: Personnel possess the experience, knowledge, skills and abilities that are necessary to discharge their responsibilities.
(4) Balanced Priorities: Resources are effectively allocated to address safety, programmatic and operational considerations. Protecting the public, the workers and the environment shall be a priority whenever activities are planned and performed.
(5) Identification of Safety Standards and Requirements: Before work is performed, the associated hazards are evaluated and an agreed upon set of safety standards and requirements are established which will provide adequate assurance that the public, the workers and the environment are protected from adverse consequences.
(6) Hazard Controls Tailored to Work Being Performed: Administrative and engineering controls, tailored to the work being performed, are present to prevent and mitigate hazards.
(7) Operations Authorization: The conditions and requirements to be satisfied for operations to be initiated and conducted are clearly established and understood by all.

19. Contract administration

The Fermilab Procurement Department established within the Business Services Section will implement all aspects of procurement using DOE approved Fermilab procurement policies and approval authority guidelines.

Authorization to approve purchase requisitions, stores requests and service requests will be controlled by the Fermilab signature authorization system. The Procurement Department will procure all material, fabricated items, equipment, and services. It will also subcontract Research and Development authorized by either the Project Manager or Project personnel possessing the requisite signature authority.

The manager of the Procurement Department will assign specific procurements to Procurement Administrators having the skills and expertise to best handle the requirement.

The Procurement Department will be responsible for administering the presolicitation, solicitation, evaluation, negotiation, award, and subcontract administration activities, including expediting and close-out.

20. Other Considerations

Several of the more technically challenging and/or riskier elements to be procured by the two projects are being closely coordinated, in order to reduce the schedule risk and cost in the procurements. Specific examples include the SVX4 readout chip, which

will be used in the silicon detectors of both experiments; the beryllium beampipes; and the silicon sensors. Technically risky items have been scheduled with extra contingency in both time and cost, in the event that extra prototype cycles are required.

21. Milestones in the Acquisition cycle

The significant milestones for procurement are detailed in Appendix A and B.

22. Identification of participants in the Acquisition Executions Plan preparation

The following members of the Fermilab staff and experimental collaborations participated in developing the Run IIb Collider Experiments Acquisition Execution Plan:

Joe Collins, Procurement, Fermilab
Patrick Lukens, CDF, Fermilab
Rich Partridge, DØ, Brown University
Ed Temple, Directorate, Fermilab

Appendix A: The Run IIb CDF Detector Project

The CDF detector is the older of the two experiments and is located on the interaction point designated as "B0" by the accelerator group. Three subprojects are anticipated for the Run IIb project to replace existing equipment that will no longer meet the needs of the experiment. They are: a silicon detector, a central preradiator detector, and an upgraded event builder. The current cost estimate with contingency of the Materials and Services which will be subcontracted by the Fermilab Procurement Department is given in Table A-1 for each subproject.

Table A-1: Estimated Cost for the CDF Run IIb Project Materials and Services

WBS	Subproject	Estimated cost
1.1	Silicon Detector	$9,800,000
1.2	Central Preradiator	$870,000
1.3	Event Builder	$540,000
	Total	$11,210,000

Major Procurements

A list of the major procurements anticipated for the CDF Run IIb project with their current estimated costs appears in Table A-2. These are procurements whose estimated cost exceeds $100,000 and/or are seen as containing a significant degree of risk.

Table A-2: Major Procurements in Fiscal Years 2002-05

WBS	Description	Bid Release Date	Estimated Cost
1.1.1.1	SVX4 Chips	January 2003	$216,000
1.1.1.2.1	Outer Layer Hybrids	July 2003	$830,000
1.1.1.2.2	Layer 0 Hybrids	August 2003	$71,000
1.1.1.2.3	Layer 1 Hybrids	April 2003	$150,000
1.1.1.3	Bus Cables	January 2003	$105,000
1.1.1.4	MiniPortcards	January 2003	$247,000
1.1.1.6	Cables	March 2003	$145,000
1.1.1.7	Fiber Transition Module	November 2003	$120,000
1.1.1.9	Power Supplies	September 2003	$500,000
1.1.1.10	SVT Trackfitters	October 2003	$210,000
1.1.2.1	Sensors	August 2002	$2,300,000
1.1.3.1	Layer 0 Cables	July 2003	$100,000
1.2.2.1	Phototubes and Bases	December 2002	$257,000
1.3	32 Port ASX 4000	July 2004	$215,000

Anticipated Subcontractors and Participants

CDF is an international collaboration of 55 institutions, representing eight countries. It is anticipated that a number of procurements needed for the project will be made through collaborating institutions, due to the technical expertise available. Memoranda of Understanding (MOU) will be established with the collaborating institutions to establish responsibilities for the procurements they coordinate. In particular, hybrid construction will likely be coordinated by Lawrence Berkeley Laboratory

In every instance where a collaborating institution provides goods or services to the project, the Memorandum of Understanding established between Fermilab and the institution will assure that the Project Manager has oversight of the work performed and can establish specifications for acceptance of the work or goods provided.

Appendix B: Run IIb DØ Detector Project

The DØ detector was first brought into operation in 1992 and had a very successful "Run I" data run during 1992-1996. The detector underwent a major upgrade, completed in 2001, in preparation for the Run IIa data run which will continue until approximately 2005

The goal of the DØ Run IIb upgrade is to extend the usable lifetime of the detector and allow operation at high luminosities required to meet the goals of the Run IIb physics program outlined in Section 2. The largest of these upgrades is the Silicon Tracker Replacement, which is needed because of the significant radiation damage to the present silicon tracker during Run IIa. In addition, there are upgrades to the trigger and online systems to allow operation at the high luminosity expected in Run IIb and upgrades to the online computing system to provide continued operation. Table B-1 lists the estimated cost of these upgrades (including contingency).

Table B-1: Estimated price for the DØ Run IIb project.

WBS	Description	Estimated Cost
1.1	Silicon Tracker Replacement	$8,526,302
1.2	Level 1 Trigger Upgrade	$1,181,796
1.3	Level 2 Trigger Upgrade	$473,801
1.5	Online Computing Upgrade	$950,000
	Total	$11,131,899

A list of the major procurements anticipated for the DØ Run IIb project whose estimated cost exceeds $100,000 appears in Table B-2.

Table B-2: Major Procurements in Fiscal Years 2002-2005

WBS	Description	Bid Release Date	Estimated Cost
1.1.1.2	Layer 0 Sensors		$222,800
1.1.1.3	Layer 1 Sensors		$268,000
1.1.1.4	Layer 2-5 Sensors		$1,694,000
1.1.2.1	SVX4 Readout IC's		$605,100
1.1.2.2	Readout Hybrids		$1,073,075
1.1.2.3.1	Analog Flex Cables		$270,000
1.1.2.3.2	Digital Jumper Cables		$309,000
1.1.2.3.3	Twisted-Pair Readout Cables		$309,000
1.1.2.4	Junction Cards		$156,400
1.1.2.9.2	HV Power Supplies		$249,600
1.1.3.1	Layer 0 Support		$150,000
1.1.3.2	Layer 1 Support		$193,800
1.1.3.11	Beam Tube		$150,000
1.1.4.3	Module Burn-In Test Stand		$145,050
1.2.1.1.1	Digital Filter Boards		$367,500
1.2.1.2.1	Trigger Algorithm Boards		$225,000
1.2.3	Track Trigger Boards		$359,000

Over 600 physicists from 73 institutions in 18 countries are currently members of the DØ collaboration that utilizes the data acquired by the DØ detector for producing scientific results. Many of the collaborating physicists and institutions have played major roles in the construction of the present DØ detector and in the planning for the Run IIb upgrade. Many elements of the Run IIb upgrade require highly specialized expertise for their design and construction that can only be obtained in the collaborating institutions. Memoranda of Understanding (MOU) will be established for collaborating institutions in the Run IIb project.

In addition to DOE funding, the DØ Run IIb project is partially supported by NSF and DØ collaborating institutions. As a result of this outside support, some procurements will be performed by these collaborating institutions. Further details are given below.

An NSF Major Research Instrument (MRI) grant of $1,683,566 has been awarded to a consortium of eight US universities that provides partial funding for the Silicon Tracker Replacement. The following universities will receive funding through the NSF MRI that will be applied towards the procurement of the Silicon Tracker Replacement: Brown University, California Statue University at Fresno, University of Kansas, Kansas State University, University of Illinois at Chicago, Michigan State University, State University of New York at Stony Brook, and University of Washington. Alice Bean, an associate professor at the University of Kansas, is the project director for the MRI. In addition to the NSF funding, a total of $791,635 in cost sharing funds have been committed to the project by the collaborating universities and two foreign institutions: Moscow State University and CINVESTAV. To ensure that procurements made as part of the MRI award meet the requirements of the project, Memoranda of Understanding (MOU) will be executed between Fermilab and the universities listed above that detail the work to be performed by each institution. The MOU will also describe the approval process for procurements to ensure full oversight by the Project Manager.

A second NSF MRI proposal is pending that requests $1,999,794 in funding for the Trigger Upgrade. The proposal has been submitted by a consortium of seven US universities: University of Arizona, Boston University, Columbia University, Florida State University, Langston University, Michigan State University, Northeastern University, and University of Notre Dame. Meenakshi Narain, an assistant professor at Boston University, is the project director for the MRI. In addition to the requested NSF funding, $608,330 in cost sharing funds have been committed to the project by the collaborating universities should the MRI be awarded. As with the silicon MRI, MOU will be executed between Fermilab and the universities listed above that detail the work to be performed by each institution and describe the approval process for procurements.

In addition to the above MOU, we anticipate additional MOU to be executed with Louisiana Technical University, Northwestern University, and Rice University for parts of the Silicon Tracker Replacement and with the University of Virginia for parts of the Level 2 Trigger upgrade.