Department of Energy
Office of Nuclear Physics
Report

on the

Technical, Cost, Schedule and Management Review

of the

Pioneering High Energy Nuclear Interaction eXperiment (PHENIX) Forward Vertex Detector (FVTX) Upgrade

November 15-16, 2007

CONTENTS

Executive Summary

On November 15-16, 2007, the Department of Energy (DOE) Office of Nuclear Physics (NP) held a Technical, Cost, Schedule and Management Review of the Pioneering High Energy Nuclear Interaction eXperiment (PHENIX) Forward Vertex Detector (FVTX) Upgrade for the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) in Upton, New York.

The PHENIX Collaboration proposes to build the Forward Vertex Detector Upgrade to enhance their heavy flavor physics program in the forward rapidity region. This program revolves around the detection of muons with the PHENIX muon arms. The addition of a precise vertex tracker in front of the muon arms will provide measurements of the distance of closest approach (DCA) of tracks from vertices displaced from the primary collision point. The DCA measurements will be used to reject a large fraction of hadronic background tracks, and to separate charm from bottom meson decays on a statistical basis. For the purpose of project completion, the performance requirements detailed in the Project Management Plan (PMP) need to be demonstrated for a sufficiently large part of the FVTX system and under realistic conditions, i.e., at least one half of the FVTX, placed inside the PHENIX magnetic field, powered by production power supplies, and read out via the PHENIX data acquisition (DAQ). The procedures and schedule for verifying the project deliverables must be clearly articulated in the PMP. Furthermore, the FVTX team, with help from the collaboration, needs to develop the reconstruction, simulation, calibration, and alignment software necessary to extract the physics.

The FVTX will have two endcaps with three large and one small carbon fiber disks per endcap. Each disk (large or small) has 48 wedges with one silicon sensor per wedge for a total silicon area of 6500 cm^2. The sensors are 300 micron thick p-on-n, AC-coupled mini-strips with 75 micron pitch. The chosen sensor technology is standard and the associated technical, schedule, and cost risks should be low. Promptly identifying one or more reliable sensor and wire-bonding vendor(s) will further reduce schedule risk. Sensor specification, testing/quality assurance (QA) procedures, acceptance criteria, and assembly procedures need to be finalized and documented. There was concern about the size and experience of the workforce for wedge assembly and testing. An effort should be made to strengthen this team. As soon as prototype and/or pre-production parts become available, appropriate parts of the system should be assembled to validate procedures and workforce estimates, and to verify performance. Procurement quantities should be sufficient to accommodate possible losses during assembly and testing. Appropriate sub-system tests should be incorporated into the project schedule in the form of milestones.

The FVTX will be integrated with another ongoing project, the PHENIX Silicon VTX project. Both detectors share some common infrastructure and integration issues need to receive continuous attention.

The electronics scope of the FVTX project includes the production of the FPHX readout chip, four-layer high density interconnects (HDIs), readout card (ROC) and front end module (FEM) boards, and the procurement of ancillary electronics. Development of the FPHX chip by Fermi National Accelerator Laboratory (FNAL) and chip production and testing constitutes the project's critical path. At the same time, FNAL is not part of the collaboration but has the role of a vendor and contractor. Successfully managing this critical part of the project will be absolutely crucial. There was concern about the complexity of the HDIs and alternative designs should be considered. The risk that chip production and testing, and HDI performance optimization will require more time than planned is high. Sufficient and appropriately qualified workforce must be allocated for these tasks, and sufficient schedule float be added. There was concern about the accuracy of estimating power dissipation of the FPHX chips and its possible adverse effects on the design of the support structure. There was serious concern about the status of the current grounding and shielding plan. A detailed plan must be developed before finalizing the detector design and commencing procurement, and be validated by appropriate tests at various stages of system assembly. There was also serious concern about random and, more importantly, coherent noise hits saturating the bandwidth of the dataflow system, creating potential bottlenecks at the chip and/or ROC level. A detailed dataflow simulation that includes assumed noise hit frequencies in all bunch crossings in addition to signal hits in bunch crossings with simulated collisions should be performed to identify such bottlenecks, and a mitigation strategy be developed. Ultimately, this issue requires a detailed study of the trade-offs between noise hit levels, ADC signal thresholds, raw data bandwidth bottlenecks, Level-1 latency and memory requirements, tracking efficiency, and physics performance. Such a study should be presented at the next annual review, and it should include a set of "final" functional requirements that the FVTX system needs to satisfy within a reasonable time after project completion in order to achieve the proposed physics goals.

In order to ascertain adequate scientific and technical workforce availability, the project team should generate, at WBS level 3, a breakdown, by participating institution and fiscal year, of the scientific and technical workforce needed and available to support fabrication of the project. Furthermore, the PMP needs to be updated to address all relevant issues raised at this review prior to disbursement of project funds.

DOE Recommendations

- A breakdown at work breakdown structure (WBS) level 3 of the scientific workforce that supports the implementation of the project fabrication should be generated prior to the approval of the management plan.
- Prior to approval of the project management plan, clearly articulate in the plan when and how the deliverables will be demonstrated.
- Prior to the next annual review, perform a detailed study of the trade-offs between noise hit levels, ADC signal thresholds, raw data bandwidth bottlenecks, Level-1 latency and memory requirements, tracking efficiency, and physics performance. Derive a set of "final" functional requirements that the FVTX system needs to satisfy within a reasonable period of time after project completion in order to achieve the physics goals and meet the recommendations expressed in the FVTX Science Review report.
- Documents for technical specifications, testing plans, and procedures (assembly & testing) should be finalized, approved, and adopted prior to procurement, and presented at the next annual review.
- Prior to approval of the project management plan, add milestones to reflect the conclusion of sub-system tests.
- Prior to approval of the project management plan, re-assess the schedule to optimize the choice of a sensor vendor.
- Prior to the approval of the management plan, reevaluate the adequacy of workforce levels for wedge testing and assembly effort.
- Prior to approval of the management plan, reevaluate proposed procurement quantities in light of possible low production and assembly yields and losses during testing.
- A detailed grounding and shielding plan should be developed and reviewed prior to final design.
- Prior to approval of the project management plan, add schedule float in the critical path to handle possible delays in the FPHX design and testing, and HDI multi chip integration.
- Prior to the approval of the management plan, update the list of milestones in the plan to reflect comments raised at this review.
- Project research and development (R&D) activities must be clearly identified and separated from the fabrication costs.
- A breakdown at WBS level 3 of the technical workforce that supports the implementation of the project fabrication should be generated prior to the approval of the management plan.
- Prior to the next annual review, identify a systems integration manager.

Introduction

On November 15-16, 2007, the Department of Energy (DOE) Office of Nuclear Physics (NP) held a Technical, Cost, Schedule and Management Review of the Pioneering High Energy Nuclear Interaction eXperiment (PHENIX) Forward Vertex Detector (FVTX) Upgrade at Brookhaven National Laboratory (BNL). The review committee consisted of six external consultants: Ms. Susan Heston (Argonne National Laboratory), Dr. Sergio Zimmermann (Lawrence Berkeley National Laboratory), Professor Robert L. Ray (University of Texas at Austin), Dr. Simon Kwan (Fermi National Accelerator Laboratory), Professor Bolek Wyslouch (Massachusetts Institute of Technology), and Professor Carl Gagliardi (Texas A&M University). The review was chaired by Dr. Helmut Marsiske, Program Manager for Nuclear Physics Instrumentation. Dr. Jehanne Simon-Gillo, Acting Associate Director of the Office of Science for Nuclear Physics, Dr. Eugene Henry, Director of the Nuclear Physics Research Division, Dr. Brad Tippens, Program Manager for Medium Energy Nuclear Physics, and Dr. Gulshan Rai, Program Manager for Heavy Ion Nuclear Physics, participated in the review as well.

Each panel member was asked to evaluate and comment on any relevant aspect of the PHENIX FVTX Detector Upgrade, and evaluate drafts of project documentation. The following main topics were considered at the review:

a. The significance and merit of this proposed project;
b. The status of the technical design, including completeness and scope, and the feasibility and merit of the technical approach;
c. The feasibility and completeness of the proposed budget and schedule, including workforce availability;
d. The effectiveness of the proposed management structure and the approach to environment, safety and health; and
e. Other issues relating to the PHENIX FVTX upgrade.

Prior to the review, the PHENIX FVTX project team provided background material to the panel reviewers including the Technical Design Report, the Project Proposal, and a draft of the Project Management Plan.

The two day review was based on formal presentations given by the PHENIX FVTX project team and separate follow-up discussions with the reviewers. The second day included a question and answer session in which the project team responded to questions posed by the panel on the first day. The second day also included an executive session during which time the panel deliberated and prepared draft reports on their assigned focus areas, and a brief closeout with the PHENIX FVTX project team and collaborators. The panel members were asked to submit their individual evaluations and findings in a "letter report" covering all aspects of the charge. The executive summary and the accompanying recommendations are largely based on the information contained in these letters reports. A copy of the charge letter and the review agenda are included in Appendix A and B, respectively.

Significance and Merit

Findings:

The PHENIX Collaboration proposes to build a Forward Vertex (FVTX) Detector upgrade to enhance the heavy flavor physics program in the forward rapidity region. The proposed science program includes:

- Measurements of R_{AA} for D and B mesons in Au+Au collisions to constrain models of heavy-flavor energy loss;
- Measurements of ψ' suppression in Au+Au collisions; and
- Measurements of A_{LL} for D and B mesons in polarized p+p collisions to enhance our understanding of gluon polarization, especially at low-*x*.

The Office of Nuclear Physics Research Division conducted a Science Review of the project to establish "mission need" in July 2007.

The collaboration presented results of updated simulations completed since the Science Review using realistic GEANT Monte Carlo, tracking, and muon track matching. Their analysis was to provide support to the claimed distance-of-closest-approach (DCA) resolution, to the capabilities of the experiment to separate B- and D-meson decays, and to the capability for placing significant constraints on the heavy flavor energy loss mechanisms.

The collaboration has identified a project software leader and an offline software coordinator.

Performance deliverables have been identified in the project management plan.

The off-project scientific workforce for the FVTX includes ~11 Full-Time Equivalents (FTEs). A breakdown of that workforce by institution and by work breakdown structure (WBS) was presented.

Comments:

The proposed science topics have high merit. The FVTX will facilitate important new measurements that address questions of central interest to the Relativistic Heavy Ion Collider (RHIC) program. Heavy quark measurements are an essential expansion of the RHIC program.

The improvement in simulation since the previous review is substantial and builds confidence that the FVTX, in conjunction with the muon tracking arms, will be able to separate c- and b-meson yields and to provide significant new constraints on the various initial stage and energy loss mechanisms affecting R_{AA}.

The ability to separate D and B mesons will be critical for the overall FVTX science program to achieve its goals. A procedure to perform a statistical separation was presented, based on the DCA distribution of the muons at any given p_T. This approach appears quite promising, but the Collaboration has not yet investigated the sensitivity of the procedure to the assumed forms of the parent heavy meson spectra.

The FTE commitment to offline software, calibrations, and alignment should be established soon. Software development milestones should be identified.

The performance deliverables as presented on the second day of the review are appropriate with the exception of the noise hits/chip which requires further study. The noise specification needs to be discussed in the context of bandwidth requirements. The panel believes that the final performance specifications should be tested in the interaction region (IR) with a minimum of one quarter of the FVTX.

The management plan as presented does not clearly articulate how demonstration of the performance deliverables will be achieved.

Recommendations:

- A breakdown at work breakdown structure (WBS) level 3 of the scientific workforce that supports the implementation of the project fabrication should be generated prior to the approval of the management plan.
- Prior to approval of the project management plan, clearly articulate in the plan when and how the deliverables will be demonstrated.
- Prior to the next annual review, perform a detailed study of the trade-offs between noise hit levels, ADC signal thresholds, raw data bandwidth bottlenecks, Level-1 latency and memory requirements, tracking efficiency, and physics performance. Derive a set of "final" functional requirements that the FVTX system needs to satisfy within a reasonable period of time after project completion in order to achieve the physics goals and meet the recommendations expressed in the FVTX Science Review report.

<u>Technical Design</u>

Sensors, Wedge Assembly, Endcap Assembly, QA

Findings:

The FVTX will have two large endcaps with 3 large disks and 1 small disk/endcap. Each disk (large or small) will have 48 wedges per disk. The total silicon area is 6500 cm^2 (about 120 sensor wafers). This will have 330 large and 120 small wedges.

The chosen sensor technology is p-on-n detector, AC-coupled mini-strips with 75 micron pitch. One prototype run with ON Semiconductor has already happened. Test facilities exist at University of New Mexico (UNM) and Prague.

The cost estimate for silicon production is based on estimates from 4 vendors.

The wedge and endcap assembly procedure, testing, and Quality Assurance (QA) plan were presented. Three labs have been identified as possible sites. A brief alignment and survey procedure was also presented. The wedge assembly cost was given as $100,000 or 1 FTE technician. Endcap assembly cost was given as $38,000 including 26% contingency.

No test plan has been presented for the detector following assembly prior to integration into PHENIX.

Comments:

The chosen sensor technology is standard and the technical, schedule, and cost risks should be low. There are several good vendors available, which further reduces the risk. Promptly identifying a reliable vendor with whom the project has had a successful history will further reduce schedule risk. Sensor specification, QA procedures, and acceptance criteria need further development. If more than one lab is used for assembly and testing, there should be common procedures, tools, and test-stands.

The wedge assembly schedule depends on the availability of parts. To maintain the schedule and keep the project on cost, it is important to avoid having a large standing army waiting for parts. The project should qualify possible vendors for wire bonding and encapsulation as soon as possible and make a decision. Gaining experience on wedge/endcap assembly procedures as soon as possible would be beneficial—this could be accomplished using mock-ups or prototype parts.

Plans for QA and testing of wedges need further development and should include measurements of noise and cross talk. The on-project workforce seems low (1 FTE technician). The plan does not allow for low component yields during assembly.

The endcap assembly relies on the availability of wedges, half disks, Read Out Cards (ROCs), and assembly jigs. Any delay in the parts will have an impact on the cost and schedule. Alignment and survey procedures seem reasonable but it is important to demonstrate all the steps as soon as possible. The presented cost even with contingency (26%) seems low ($38,000).

It is important to perform sub-system tests as soon as prototype or pre-production parts are available, for example a wedge test. This is important for the project team and funding agency to track progress and catch unforeseen problems.

Recommendations:

- Documents for technical specifications, testing plans, and procedures (assembly & testing) should be finalized, approved, and adopted prior to procurement, and presented at the next annual review.
- Prior to approval of the project management plan, add milestones to reflect the conclusion of sub-system tests.
- Prior to approval of the project management plan, re-assess the schedule to optimize the choice of a sensor vendor.
- Prior to the approval of the management plan, reevaluate the adequacy of workforce levels for wedge testing and assembly effort.
- Prior to approval of the management plan, reevaluate proposed procurement quantities in light of possible low production and assembly yields and losses during testing.

FPHX, HDI, DAQ

Findings:

The electronics scope of this project includes the production of the FPHX chip, high density interconnect (HDI), the design and production of the HDI to ROC interconnect, production of the ROC and front end module (FEM), and the procurement of ancillary electronics (racks, LV and HV supplies, etc.)

The FPHX chip is being designed by Fermi National Accelerator Laboratory (FNAL). It uses the data push technology developed for the FPIX chip. The FNAL has designed other silicon strip chips. As presented, the project assumes two rounds of prototyping for the FPHX chip development, which constitutes the critical path.

The HDI uses a four layer polyimide cable: two layers for signals, one for power and one for ground. The HDI includes a total of ~ 110 signal traces. In some cases there are four-layer vias (e.g., for power to the FPHX chips).

The FPHX, the HDI and the ROC are subject to radiation. Adhesives will be used to attach these units. The radiation level at the ROC is about 200 Krad. The ROC board uses ACTEL FPGAs.

The chip readout will be done at 200 MHz. The two signal outputs flow through the following components: from the FPHX chip, to the HDI, through a connector, then a flex cable (~30 cm), another connector and the ROC printed circuit board before arriving to the ACTEL FPGA. The data bits must be stable and aligned at the FPGA input before they can be sampled.

The ROC board funnels the readout data through a set of fiber optics. The fiber optics bandwidth is smaller than the chip readout bandwidth. This is achieved because the occupancy of the FPHX chips is small.

The total power load from the front end chips was presented as ~54 Watts for each endcap.

There is preliminary work on the plans for grounding and shielding.

Comments:

In general, the design of chips with the complexity of FPHX requires substantial effort and time. The present schedule includes no float to accommodate difficulties with the chip design, testing and performance characterization. Poor chip performance may require more prototype chip submissions. The risk that the chip production and HDI performance optimization will require more time is high.

Ways to mitigate potential cost and schedule risks associated with the FPHX development process should be developed.

It is unclear whether the power dissipation of the low voltage differential signaling (LVDS) drivers of the FPHX chip was included in the total heat load estimate of the endcaps. This could adversely affect the mechanical design.

Producing reliable HDIs of this complexity can be difficult. It is advisable to consider alternative HDI designs to avoid four layer vias (e.g., two 2-layer HDIs, one on top of the other).

There are small variations on the propagation of parallel data flowing through interconnects and cables. Also, since that data passes through several different media (connectors, flex circuits and PCBs), it is possible that it will have some ringing before stabilizing at the input of the ROC FPGA. Therefore, it may be difficult to align all data bits before it can be sampled at the 200 MHz data readout speed.

There is a possibility that noise hits will saturate the FVTX system bandwidth.

There is a risk that in some cases the ROC board may not be capable to funnel all data that needs to be transmitted out on the fiber optics. The collaboration didn't present simulations to support the required level of data concentration. This has an impact on the depth of the ROC FIFOs. Also, some possible abnormal behavior can generate substantial data, and the ROC may not be able to handle this data. It is advisable to develop a way to gracefully handle such a situation.

Grounding and shielding is a very important aspect of the project due to the impact on the detector performance. In general, the grounding and shielding scheme drives several aspects of the system design.

Recommendations:

- A detailed grounding and shielding plan should be developed and reviewed prior to final design.

- Prior to approval of the project management plan, add schedule float in the critical path to handle possible delays in the FPHX design and testing, and HDI multi chip integration.

Mechanics and Integration

Findings:

The FVTX will be integrated with another ongoing project, the PHENIX Silicon VTX project and will share some common infrastructure.

The FVTX project team is interacting with the Los Alamos-based company HYTEC; the collaboration has worked successfully with this company before and is currently working with them on the VTX.

The VTX and FVTX will share a common installation system with common cooling and slow control systems, but with separate electrical and ground systems.

Comments:

Although the project relies on the local vendor HYTEC, the collaboration's previous, good experiences lend confidence to the company's ability to fulfill their commitments.

The integration of the VTX and FVTX appears to be well developed. The fact that the two systems have the same project electrical and mechanical engineers is very valuable.

Recommendations:

- None

Budget and Schedule

Findings:

As documented, the project is projected to start on 2nd Quarter Fiscal Year 2008 (2QFY08), and to be completed on 3QFY10. Some of the presentations implied a project completion date as late as 2QFY11. As explained during the review, the completion date is planned to fit with the customary RHIC run schedule. Depending on the definition of project completion, a delay in schedule could result in a delay in project completion of a year or more.

Total project cost (TPC) is $4.66 million, including contingency. Annual funding requirements are aligned with expected DOE funding levels (e.g., do not exceed available planned current year funds and planned carryover funds for any year of the project).

During the review, the project stated that some research and development (R&D) costs were included within the DOE project design and fabrication costs.

The overall project contingency is based on a qualitative risk-based contingency analysis, and represents 26% of the project costs. Items with the highest level of cost contingency include the FPHX (48%), ROC (33%), and FEM (33%).

The management plan includes a description of change control levels, including review and approval authorities, at Level 1, 2 and 3.

The FPHX is on the critical path, with no identified schedule float. The sensor is near the critical path, with approximately one quarter of schedule float.

The management plan includes 14 milestones, from first receipt of DOE construction funds through "project complete" at the end of 4QFY10.

Comments:

The milestones are not in synch with the project schedule as currently developed, and also appear to be inconsistent with the narrative schedule discussions in the management plan (Section 5.1) which states that the project will end in the 3QFY10 with installation into the VTX enclosure.

With few exceptions, draft control milestones are vague and not completion-oriented. It is more meaningful and more helpful to the project to develop milestones that focus on completion of key project activities, including critical project reviews and integration of key components. The "project complete" milestone should match with the project schedule, based on the completion criteria developed by the project and approved by the program sponsor.

It is not good practice to propose execution of a project with no overall schedule float.

The cost of major elements seems to be reasonable and based on quotes and past experience. However, it assumes success in many production steps.

The cost contingency process seems adequate to the scale of the project. However, a number of concerns were raised at this review that could impact the level of contingency, including workforce and schedule adjustments.

Recommendations:

- Prior to the approval of the management plan, update the list of milestones in the plan to reflect comments raised at this review.
- Project research and development (R&D) activities must be clearly identified and separated from the fabrication costs.

Management

Findings:

The project is funded by the DOE Office of Nuclear Physics, which has overall responsibility for the project. The Project Oversight Manager, who is administratively and fiscally responsible for the project, is located at Brookhaven National Laboratory (BNL). As described in the Project Management Plan, the PHENIX Collaboration Management group, which includes key participation by Stony Brook as well as BNL, has overall responsibility for successful execution of the PHENIX detector, including the FVTX. The PHENIX FVTX Project Office is lead by Los Alamos National Laboratory (LANL), although the electronics project engineer is from Columbia University and several subsystem managers are from Columbia, UNM, and New Mexico State University. FNAL will provide the FPHX chip design.

The management structure is organized around the production of major components. However, this does not match the WBS level-2 elements in all cases.

The people and the main participating institutions have a long history of successful collaboration on projects of similar size in PHENIX.

Risk estimates on all elements are low or moderate.

Comments:

The project management structure on this project is complex, with a relatively large number of national laboratory and university participants. In addition, the most critical element of the system is the readout chip which is being designed at FNAL who is not a direct participant in the project. The management plan should reference the agreements and contractual relationships that govern the responsibilities and authorities of each involved national laboratory and university.

Responsibility for the design, procurement, and testing of various major components are distributed throughout the project organization which could lead to communication inefficiencies and integration challenges.

It is noted that some individuals hold several management organization roles and some positions have yet to be filled. Project management should ensure that the sub-system positions are appropriately staffed with experienced personnel. The project would benefit from additional silicon detector project expertise.

Based on the information presented, it was difficult to determine whether the workforce levels are adequate to successfully implement the project. In particular, the planning for assembly and testing looks insufficient in terms of workforce.

The project should consider pulling together all cost, schedule and technical risks and mitigations in one risk register. This will facilitate the project's periodic review of remaining risks, as well as decisions regarding the need for additional actions as the project is implemented. Such a risk register could be developed over the first several months of the project.

Recommendations:

- A breakdown at WBS level 3 of the technical workforce that supports the implementation of the project fabrication should be generated prior to the approval of the management plan.
- Prior to the next annual review, identify a systems integration manager.

Appendix A: Charge Letter

Thank you for agreeing to participate as a committee member for the Technical, Cost, Schedule and Management Review of the proposed PHENIX Forward (FWD) Vertex (VTX) Detector Upgrade (~ $4.95 million actual year dollars) for the Relativistic Heavy Ion Collider (RHIC). This review is scheduled for November 15-16, 2007, at Brookhaven National Laboratory (BNL). A list of the members of the review panel and anticipated Department of Energy (DOE) participants is enclosed.

Each committee member is being asked to evaluate and comment on any relevant aspect of the PHENIX FWD VTX detector upgrade. However, the purpose of this review is to assess all aspects of the project's conceptual design and associated plans -- technical, cost, schedule, management, and environment, safety and health. The following main topics will be considered at the review:

f. The significance and merit of this proposed project;
g. The status of the technical design, including completeness of technical design and scope, and feasibility and merit of technical approach;
h. The feasibility and completeness of the proposed budget and schedule, including workforce availability;
i. The effectiveness of the proposed management structure; and
j. Other issues relating to the PHENIX FWD VTX detector.

In addition to the above, the committee will be asked to evaluate drafts of project documentation, including the project proposal and management plan. Each committee member is asked to review the above aspects of the PHENIX FWD VTX detector upgrade and write an individual "letter report" on his findings. These "letter reports" will be due at DOE two weeks after completion of the review. As Chairperson, I will accumulate the "letter reports," and compose a final summary report based on the information in the letters.

We take care to keep the identity of the reviewers confidential in the summary report. It would be convenient if you would prepare your response in a form suitable for transmittal to the proponents devoid of potentially identifying information. The cover letter may include other remarks you wish to add.

The first day will consist of presentations by the project team and executive sessions. The second day will include executive session and preliminary report writing; a brief close-out will occur at approximately 4:00 p.m. Preliminary findings, comments, and recommendations will be presented at the close-out.

The project team has been asked to provide relevant background materials prior to the review. This documentation, along with an agenda, will be distributed in the near future. If you have any questions about the review, please contact me at (301) 903-0028, or
E-mail: Helmut.Marsiske@science.doe.gov. If you have any questions regarding local travel or lodging, please contact Rachel Inguanta at BNL at (631) 344-3500, or E-mail: irachel@bnl.gov.

I greatly appreciate your efforts in preparing for this review. It is an important process that allows our office to understand the project and its readiness to proceed with fabrication. I look forward to a very informative and stimulating visit.

Sincerely,

Helmut Marsiske
Program Manager for
Nuclear Physics Instrumentation
Office of Nuclear Physics

Enclosure

Appendix B: Agenda

FVTX Review Agenda
Room 2-160 BNL Physics Building

15-November-2007

8:00 – 8:45	45	Executive Session	
8:45 – 9:15	20+10	FVTX in PHENIX	Axel Drees
9:15 – 10:15	50+10	Project Overview Physics Goals, Performance and Deliverables, R&D, Start-up, etc. Management, Work Force, ES&H, etc.	Melynda Brooks
10:15 – 10:45	20+10	Detector Overview	Dave Lee
10:45 – 11:00	15	Break	
11:00 – 11:50	40+10	Sensor, FPHX, HDI (WBS 1.4)	Jon Kapustinsky
11:50 – 12:40	40+10	DAQ (WBS 1.5)	Sergey Butsyk
12:40 – 1:30	50	Lunch	
1:30 – 2:10	30+10	Wedge and Detector Assembly (WBS 1.7)	Columbia / NMSU
2:10 – 2:35	15+10	Mechanics (WBS 1.6)	Walt Sondheim
2:35 – 3:00	15+10	Integration (WBS 1.8)	Eric Mannel
3:00 – 3:15	15	Break	
3:15 – 4:05	40+10	Cost and Schedule Contingency, Risk, Critical Path, etc.	Dave Lee
4:05 – 4:15	10	Summary	Melynda Brooks
4:15 –		Executive Session	

16-November-2007

8:00 – 10:00 Break-out Sessions

Topic	Reviewer and Subsystem Manager	Room
Mechanics, Integration, Science, Performance Requirements and Deliverables, R&D, Start-up, Work force	R. Ray / C. Gagliardi	2-160
Sensors, Wedge and Detector Assembly, QA	S. Kwan	1-189
FPHX, HDI, DAQ	S. Zimmerman	2-95
Project Management Management Plan, Cost and Schedule, Contingency, Risk, ES&H	B. Wyslouch / S. Heston	2-187

10:00 – 10:15 Break

10:15 – 11:00 Q&A **Room 2-160 BNL Physics Building**

11:00 – 12:30 Executive Session

12:30 – 1:30 Lunch

1:30 – 4:00 Executive Session

4:00 Close-out