Department of Energy
Office of Nuclear Physics

Reviewer Excerpts

from the

Technical, Cost, Schedule and Management Review

of the

Solenoidal Tracker At RHIC (STAR)
Heavy Flavor Tracker (HFT)

November 12-13, 2009

EXCERPTS FROM PANEL MEMBER REPORTS

The Department of Energy (DOE) Office of Nuclear Science (NP) Technical, Cost, Schedule and Management (TCSM) Review of the Solenoidal Tracker At RHIC (STAR) Heavy Flavor Tracker (HFT) project was held on November 12-13, 2009 at the Brookhaven National Laboratory (BNL) in Upton, New York. Provided below are excerpts from the reports of the review panel members regarding their findings in response to the review criteria they were asked to address.

The merit and significance of the proposed project:

Reviewer:
"The STAR Collaboration proposes to fabricate a silicon-based tracking device inside the Time Projection Chamber (TPC) to enhance STAR's heavy flavor physics capability. This multi-layered Heavy Flavor Tracker (HFT) would consist of two new layers of silicon pixel detectors (PXL), a new single layer of silicon pad detectors (IST), and an existing double-sided layer of silicon strip detectors (SSD) with new readout electronics. Unlike other measurements at RHIC, the HFT proposed by the STAR collaboration aims to use the exclusive $D^0 \rightarrow K\,\pi$ channel measures the meson momentum directly and the D^0 mass peak provides clear identification of the heavy meson. This measurement is a significant contribution to the heavy flavor physics at RHIC.

"However, the collaboration has not explained in enough details how the physics requirements of the experiment have driven the technical design of the project. There were statements that if the material budget is significantly increased, then there would be big loss in efficiency. From Table II of the TDR, the percentage loss in resolution from the original design between using an AL cable to copper cable is going from 19% to 32%. I found that this modest loss in resolution would mean a factor of four loss in efficiency at low pt a bit hard to believe. The TDR did say, for example, that they could try different cuts at low pt to recover some of the loss. The collaboration has also not adequately demonstrated the impact on the physics measurements (v2 and RAA) with this degradation in resolution and significance of the signal at low pt."

Reviewer:
"Unlike most other measurements at RHIC, most based on the detection of leptons from semi-leptonic decays of heavy mesons where there is only an indirect connection to the actual heavy meson momentum, the exclusive $D^0 \rightarrow K\,\pi$ channel measures the meson momentum directly and the D^0 mass peak provides a clear identification of the heavy meson. The measurement of the exclusive $D^0 \rightarrow K\,\pi$ channel, with direct connection to the charmed-meson, is a significant contribution to heavy-quark physics at RHIC.

"No connection to the spin or to the d+Au cold nuclear matter program was made with measurements that were discussed. A major strength of the RHIC facility is the ability to explore physics with ion-ion, deuteron-nucleus, and polarized proton-proton collisions. For a major project like this, it is somewhat unfortunate that there were not golden measurements identified in each of these three areas.

“The stated plan to remove the inner PXL layers during full-intensity 500 GeV p+p running is disappointing, both for the above reason, and also in that the proposed reduced-intensity 500 GeV p+p running would be disruptive to the rest of the 500 GeV program at both of the RHIC experiments.

“In terms of physics impact, there is a major concern that the measurements provided by the HFT, which would come about 3 years later than similar measurements at PHENIX with its vertex detector upgrades, might not provide substantial advances in significance for many of the physics observables that are worthy of the large investment proposed for the HFT project. For example, in the RCP measurement, it looks like the main advantage over PHENIX would come at small pT, but this observable is relevant primarily at high pT where energy loss of heavy quarks and its separation for b and c is the main physics. In the v2 measurements where one separates b and c, it is not clear (Nu Xu backup slide 31) that even in the important low-pT region, the HFT measurements are superior; especially since there is a substantial risk that the PXL layer may increase in thickness and damage the low-pT performance of the HFT by about a factor of four in rate.

“A schematic strategy was given for the statistical separation of D from B mesons in their semi-leptonic decay to electrons using distance-of-closest-approach (DCA) cuts, the different DCA distributions of D and B decays, and input from exclusive hadronic decays of heavy mesons. One would have liked to see a demonstration of how well the statistical D and B meson separation would work, since it involves a complicated mix of inputs from different sources, involves statistical subtractions, and will have systematic uncertainties due to lack of a priori knowledge of the true pT shape for each meson.

“In general for the simulations, realistic efficiencies and dead regions should be included and estimates of the expected systematic uncertainties should be shown for the final physics performance plots. If performance is degraded due to some change in the detector characteristics that is studied, this degradation should be presented in terms of reduced significance, not in terms of additional running time needed – increasing running time for already long running periods at RHIC is normally not realistic.”

Reviewer:

“The STAR collaboration has proposed a Heavy Flavor Tracker (HFT) to extend the capabilities of the experiment to include reconstruction of particles with b and c quarks in heavy ion collisions. This upgrade includes a new inner pixel detector based on Monolithic Active Pixel Sensor (MAPS) technology, a new silicon pad detector (IST), and a refurbished silicon strip detector (SSD), as well as associated electronics and mechanical infrastructure.

“Overall the HFT project is well designed to meet the goal of upgrading the capability of STAR to measure elliptic flow and R_{AA} of D mesons. Simulations show that the physics goals can be achieved if the detector performs as proposed. The CMOS APS technology is challenging, with risks associated the first large-scale deployment of a new detector type. The groups involved have world-class expertise and have a good chance of success."

Reviewer:
"The STAR Heavy Flavor Tracker (HFT) uses three different silicon technologies. The inner detector uses Monolithic Active Pixel Sensors (MAPS) developed by the IPHC group in France. This technology integrates readout electronics onto the silicon detector itself. This produces a much lower radiation length compared to the traditional silicon detectors. With the STAR low Level 1 trigger rate, the technology is a good match for the experiment."

The technical status of the project:

Reviewer:

"As noted above, the project has not made convincing quantitative arguments on how the physics requirements would drive the technical design of the HFT. The technical design of the HFT was rather well presented and complete. There were, however, quite a few questions and high risk items.

"For example, the pixel detector will use the MAPS sensor developed by the Strasbourg group which is not really part of the experiment. This is going to be the first large scale application of this novel technology in the experimental high energy and heavy-ion physics. The development of the MAPS technology has been driven by the needs of the ILC. What has been proposed for STAR HFT would be a variant from the main line of the MAPS effort. The effort would be ongoing and the STAR collaboration should decide soon which version of the MAPS should be their baseline and proceed from there. The other two items of significant risk for the PXL are: the use of air cooling and Al cables. The mock-up test that they have done showed a vibration of the order of 20 microns which is significant. The use of Al cable poses serious problems in feasibility and fabrication. The collaboration is encouraged to carry out a system test with close to final electronics readout as soon as possible. For this, they should consider using Copper cables as prototype. At the same time, they should continue pursuing the Al option.

"On the IST and SSD: technically, these are not as complicated as the PXL. Nevertheless, we are concerned about the long-term support of the SSD. The project has made a good case that they would need a couple of tracking layers between the PXL and the outer TPC. What is missing is a careful analysis of the trade-offs between building a two layer IST (and drop the SSD) and their current proposal (one layer IST and new electronics for the SSD). For the IST, there were concerns about the saturation of the APV25. The project should also consider performing a system test and a beam test with pad detectors and APV25 as soon as possible."

Reviewer:

"Given the sorted history of the SSD and that there is only one spare ladder, it seems risky to rely on it for the HFT. It may be better, although more costly, to build instead a second layer of the IST. Although simulations showed only about a 20% loss in efficiency if the SSD (or IST) were not there, these simulations apparently do not include realistic efficiencies and dead regions in the detectors and so the loss of redundancy without the SSD might cause larger losses than shown. The need for a second layer of IST could become more apparent if these simulations were done more realistically.

"If the PXL thickness is substantially increased, e.g., if the project used copper instead of aluminum trace flex cables, the project showed that there was about a factor of four loss in efficiency due to poorer pointing resolution at low transverse momentum, below a pT of ~2 GeV/c. But it was unclear to the committee for the main Au+Au observables, v2 and RAA, how significant this loss of efficiency (or statistics) below pT ~ 2 GeV/c is;

especially in light of similar measurements to be made by the PHENIX vertex detectors about 3 years earlier.

“It was stated that radiation damage to the inner layer of the PXL was substantial in Au+Au collisions, and would make it necessary to build four times as many ladders as needed to populate the (inner and outer) PXL layers, so that the radiation damaged inner ladders could be replaced annually. In addition, it was stated that the radiation environment in 500 GeV p+p collisions was five times worse, and in that case the inner ladders would have to be removed during any full-intensity 500 GeV p+p running. It was unclear what the total cost was for the extra ladders that would be built in order to provide these replacements in future years. A number of $64k to replace the inner layers was mentioned. However it was unclear if the initial build would be enough ladders to replace both PXL layers four times? If so, I guess the total cost for radiation damage replacement spares would be quite large.

“There was what appeared to be conflicting information on the extent to which PXL layers would suffer radiation damage, on how that would affect the performance at the physics level, and therefore whether it would actually be necessary to replace the inner PXL layers each year. Some estimates did not include contributions both from charged and neutral particles.

“It would be useful to understand what the assumed 500M minimum-bias events correspond to in terms of recorded and delivered luminosity, given the tight (±5 cm) vertex cut required and the limiting DAQ bandwidth at STAR. I.e. what are the trigger strategies that could enable the accumulation of higher sampled luminosity for the main physics measurements, compared to minimum-bias triggered data.

“A set of performance requirements that can be directly connected to the key physics results should be developed. These should be requirements, which if not met, will cause the physics measurements to fall below the required level of physics significance. These requirements, intended for CD-4, should each have a well defined method for their measurement identified that can be accomplished before commissioning with beam. A separate set of technical requirements, which will not be explicitly required at CD-4, that will be used to guide completion of the design and prototyping of the detectors elements should also be prepared, along with clear justification of each requirement”

Reviewer:

“Overall I found the technical design and associated choices of the project to be sound. The upgrades are driven by the physics goals of charm reconstruction at low Pt to map out elliptic flow and R_{AA} of charmed mesons in heavy ion collisions. Efficient D-meson reconstruction at low Pt requires minimal mass in the inner detector layers. I believe that this has been adequately demonstrated by the collaboration. The low mass requirement drives the choice of thinned MAPS technology for the inner pixel layers. This requirement also means that air, rather than water-cooling must be used for the inner layers.

“The intermediate layers are designed to provide a link for tracks reconstructed in the TPC to the PXL layers. This is a crucial function for robust tracking. The two layers include a new IST and refurbished SSD. The SSD is an existing device with a somewhat checkered past, only one spare ladder, and technical support from a group no longer formally on STAR. New electronics must be produced for the SSD to accommodate the STAR DAQ-1000 standard. The IST is a new pixel array utilizing CMS APV chips for readout. The choice of this hybrid SSD/IST arrangement is said to reduce costs by keeping and refurbishing an existing detector, but the long-term cost of supporting two systems may be significant. My feeling is that this decision may be reasonable, but a carefully considered comparison of the benefits and costs of a two-layer IST versus the current SSD/IST hybrid is important to fully validate the choice made by the collaboration.

“MAPS technology has not been used in a large colliding beams experiment, and is the largest technical risk. There is important operational experience from the EUDET telescope and a number of test beam runs which lends confidence in the technology. Mechanical, cooling, and electronics challenges in fabricating and operating a device with unprecedentedly low mass are significant. An early system test utilizing the existing chip (MIMOSA26), which achieves all of the functionality required for the STAR pixel layers in a smaller size, would be very beneficial. I do have some concern that the planned air-cooling might be an issue. The power dissipation in the pixel layer has increased by 70% from initial estimates, requiring more mass flow. Cooling air is in the turbulent flow regime, which will cause vibrations in the low mass structures. Indeed, measurements by the collaboration show that the position resolution will be dominated by the vibration of the ladders. I feel that long term testing of ladders with realistic support and interconnections is quite important.”

Reviewer:

“The detector has 2 layers with 18.4 um x 18.4 um pixel sizes. The total channel count is 436 million channels. The rate of fake hits is estimated to be 10^{-4}. This low fake hits rate could be achieved in small sensor test runs, but large scale detectors not only have to deal with individual sensors, but they also have systemic problems like sensor production variation, power/grounding issues and noise pickup in various stages of the readout etc. With high fake hit rates, one has to either raise the threshold or reduce the overall trigger rate. Raising the threshold will reduce tracking efficiency. Reducing trigger rates will lead to a longer run time to achieve the same physics goal. A plan needs to be developed to deal with the possibility of a higher noise rate.

“Although the MAPS technology is an appropriate choice for the pixel detector, the technology has never been used in heavy ion or high energy particle physics large experiments. The LBNL and IPHC groups have very close working relationships. However STAR is more interested in the resulting physics from use of the technology. The IPHC group, on the other hand, is more interested in the technology itself and its future development. To be successful in implementing the technology in the STAR experiment, the LBNL group has to find out all the details of whichever version of MAPS chips they choose to use. These details include all the underlying features and necessary work around of the chip. The best way to learn about the chip is to perform chip testing in the lab and some beam testing by the LBNL group with consultation from the IPHC group. The test should be done as close as possible to the running condition in the STAR experiment. The LBNL group did use analog versions of MAPS chips in a beam test. The group should be encouraged to perform similar tests with MIMOSA26. The test results will be helpful for feedback to the final version of the Silicon technology.

"The Intermediate Silicon Detector (IST) readout is using well understood APV 25-S1 chips. The readout electronics will be the same as for the STAR Forward GEM Tracker (FGT) readout electronics. Reusing electronics designs is a good idea. It lowers the project development costs and manpower requirements. The details for FGT readout electronics were not presented at this review. The cost and engineering detail design should be presented at the CD-2 review so that the cost and risk of using the same readout electronics can be evaluated.

"The last set of detectors in the HFT hardware is the refurbished STAR Silicon Strip Detector (SSD). Because it is a refurbished detector, the SSD system only has 1.5 spare modules. One would have strong concern about lack of spare modules with regard to the short-term loss in installation and long-term maintenance.

"The SSD readout system will replace a single ADC with 16 ADCs per ladder. This ADC upgrade will increase the overall readout speed of the detector. The dominant dead time of the system is in the ADC conversion time. The dead time is estimated to be 12% with a 750 KHz trigger rate. One should do a careful study to see if the electronics can be read out at faster speed to reduce the all-over dead time.

"The HFT electronics design teams are separated over many groups. The MIT group is working on the IST readout. The SUBATECH in Nantes, France and BNL teams are working on the SSD readout. The pixel electronics are designed by the IPHC group and the implementation is through LBNL group. All these sub-systems need to be installed next to each other. A detailed power and grounding plan needs to be developed for individual detectors and the system as a whole. These efforts also need to be tracked by the management team. There is a mechanical engineer in the project management team to oversee all the mechanical interfaces among the detectors and all over the integration. A similar person should be included in the project management team for the electronics effort."

The feasibility and completeness of the proposed budget and schedule, including workforce availability

Reviewer:
"A fully resource-loaded schedule for the whole HFT was not available. Neither was a cost book. It was difficult to judge the feasibility of the schedule given the absence of linkage amongst the various sub-projects and the outside constraint (such as the GEM Tracker, beam pipe and so on). The proposed budget seemed to be reasonable. The big concerns are: the contingency and their complaint on the funding profile.

"The project did not present the methodology that they used for the contingency analysis. They presented a much higher contingency for the IST and SSD (36% and 44% respectively) than for the PXL (only 32%). These made no sense at all.

"The project mentioned that they were not happy with the funding profile which would constrain them to almost forgo the RUN 14. However, there was no clear answer and explanation on what was on the critical path and how their preferred profile would allow them to be ready for RUN 14.

"Workforce availability: the project uses a lot of re-directed labor (from BNL and LBNL) and contributed labor (from the universities). Workforce outside the project is about 75% of the total workforce. This will make effort and status reporting complicated. It is also difficult to assign contingency to labor.

"The project management team also needs an electronic system engineer to oversee the effort."

Reviewer:
"It is unclear whether the large cost of the proposed HFT is justified by the limited golden physics goals that were highlighted (primarily the D0 and heavy quarks in Au+Au collisions) and the significance of these measurements compared to similar measurements to be made at PHENIX starting about 3 years earlier. The cost of this device is substantially larger than the combined cost of the two PHENIX vertex detectors (VTX, FVTX).

"If it is necessary to build a second layer of the IST instead of using the SSD, this will presumably increase the cost of the project further. Also further increases could occur as the design matures.

"The CD-4 deliverable date should be set carefully in concert with the plan for demonstrating the required performance specs and with consideration of the uncertain RHIC shutdown schedules.

"Since the French group at Strasbourg that is designing and building the PXL chips is not in this project for the physics, physicists from other core groups in the collaboration should become intimately familiar with the PXL chips, their operation and testing - so that they can assure continued expertise well into the physics running at RHIC."

Reviewer:
"At the time of CD-1 approval, a project is still in the definition phase which requires only a cost range be established at this point. As of this review, the Total Project Cost (TPC) range is $12.76M to $17.53M, with $3.54M of cost contingency identified. A mathematical methodology was employed across the Level 2 WBS (independent of risk impacts) to develop the cost range. The methodology used the estimated cost for a Level 2 WBS and multiplied it by 1.05 to get the low range value. It then used the estimated cost for the same Level 2 WBS and multiplied it by 1.35 to get the high range value. All of the low range values were summed together to get the TPC low range and all of the high range values were summed together to get the TPC high range value. The TPC range does not account for planned redirects from BNL and LBNL, which are estimated at ~$2.3M and are spread over five years of the project. This method of calculating the TPC range does not take into account the current contingency estimates by Level 2 WBS, nor does it account for high or lower risk impacts (e.g., lower potential risk impact on Project Management versus higher risk impact on Pixel or Integration subsystems). Since the TPC high range exceeds by ~$3M, the current estimated cost to complete the project including 100% (or $3.48M) of the contingency, one could assume there is more than sufficient funds to complete the Project. The TPC high range almost doubles the amount of contingency currently estimated for the Project.

"The Project has also identified contributed labor for the Project, which is estimated at $2.6M, however, no cost contingency has been applied to the contributed labor to insure against some of the contributed labor not materializing or costing more than estimated. To be conservative in contingency estimation, some allocation of contingency may want to be considered in case some of the contributed labor does not materialize or the work effort being performed by contributed labor is more than estimated. The Project may also want to consider updating the PPEP/PEP to include procedures for ascertaining, establishing agreements, and monitoring the contributed and redirected labor costs, and the strategy for handling associated cost overruns.

"Overall at this point in the Project, the TPC range appears to be appropriate to proceed to CD-1. I think the completion of a bottom-up contingency analysis is important to validating the appropriate amount of cost contingency for the HFT Project.

"Evaluation of the HFT Project schedule and critical path was difficult because there has been no integrated schedule developed to date. Each individual subsystem owner is currently developing the detailed, resource-loaded schedule for their specific subsystem. Based on Project personnel knowledge and expertise in developing detector systems, a critical path has been identified, but it has not been substantiated by an integrated resource-loaded schedule of all of the subsystems.

"It appeared that significant work is being applied to developing detailed integrated schedules and resource allocations, but it is all very scattered and at different levels of completeness to judge it as a completed product at the time of the review.

“The HFT Project is currently under $20M TPC, as such, it is not required to implement Earned Value (EV) reporting. In lieu of EV the Project has established a number of milestones to monitor Project progress. However, the currently established critical path has only six milestones defined over a five-year period until CD-4. I think this number of milestones is insufficient to monitor progress on the critical path. The Project should consider defining at least quarterly milestones for the critical path so the Project’s progress can be more effectively monitored.

“The Project work breakdown structure (WBS) and corresponding WBS dictionary has been developed down to Level 5 and appeared to be logically organized and well defined at this point in the project. The WBS dictionary in some cases appropriately provided details of specific quantities of components to be built or purchased. The Project should ensure that both the integrated schedule and WBS/WBS dictionary maintain alignment.
“Overall, it is difficult to assess the preparedness of an integrated project schedule and corresponding critical path when they have not been completed. I consider the Project integrated, resource-loaded and critical path schedule not ready for CD-1 approval. The status of WBS and WBS dictionary are mature enough for CD-1 approval.”

Reviewer:
“During the course of the review it became clear that it is quite important to have the capabilities of the HFT available for Run-14. At the moment the DOE funding profile does not match this goal and the collaboration has asked for advanced funding to allow deployment in FY 2014. If advanced funding is not made available the collaboration should think carefully about the possibility of a descoped or staged detector plan, possibly without the refurbished SSD or IST. These detectors have clear benefits, but missing the 2014 run seems to me to be unacceptable and tradeoffs may be necessary to ensure that a heavy flavor detector is available for Run-14.”

The effectiveness of the management structure and project documentation:

Reviewer:
"The project management team needs strengthening. Besides the electronic system engineer, they would need a budget officer, a scheduler and a Safety Officer."

Reviewer:
"The project needs an overall electrical engineer to coordinate, watch over and plan the whole electrical/electronics system across all parts of the project."

Reviewer:
"The Preliminary Project Execution Plan (PPEP) for the Heavy Flavor Tracker (HFT) Project conveys the management organization and responsibilities for the HFT Project. The organizational structure and associated responsibilities are appropriate for a project of this size and complexity. A Federal Project Director (FPD) and Contractor Project Manager (CPM) are identified, including specific responsibilities to ensure the success of the HFT Project. In addition, consistent with other Office of Science (SC) projects and consistent with DOE O 413.3A, an Integrated Project Team (IPT) has been established and is chaired by the DOE FPD. The IPT membership includes the DOE Program Manager, DOE Science Program Manager, CPM and Deputy CPM, as well as other DOE (e.g., BHSO Contracting Officer and BHSO Facility Representative) and BNL (e.g., ESSG Lead and Physics Assistant Chair for Administration) personnel.

"There are also numerous participating institutions contributing to the HFT Project. The major subsystem contributors include: Lawrence Berkeley National Laboratory (LBNL), Massachusetts Institute of Technology (MIT), Kent State University (KSU), and Institut Pluridisciplinaire Hubert Curien (IPHC). There are eleven participating institutions (including BNL) contributing to this Project. Memoranda of Understanding (MOUs) between BNL and all HFT Project participating institutions are planned to be in place by CD-2. It may be challenging to complete all of the MOUs by 4QFY10, but nonetheless, it is a good goal.

"A draft Risk Management Plan has been developed that describes a typical risk identification and classification process. The risks identification process is both a bottom-up and top-down risk identification process. The methodology then analyzes the identified risks and evaluates the likelihood or probability of a particular risk occurring against the impact to either baseline cost or schedule, or technical specifications. A risk matrix has been developed which outlines nine high risks; ten moderate risks and 31 low risks. I did not see any clear correlation or spreadsheet that allocates Project contingency as it relates to the different project risks. It appeared from discussions with LBNL participants that a bottom-up contingency analysis by WBS was being performed with the development of the resource-loaded subsystem schedules. Understanding project risks and their potential impact (e.g., cost, schedule or technical) is critical, so that appropriate mitigation plans and the allocation of contingency can be applied to those known risks to ensure the success of a Project.

“Overall, while the PPEP indentifies the proper management structure and responsibilities required to ensure a successful project; success will typically be ensured by having personnel in project leadership positions with strong knowledge in project management, which I think the HFT Project is presently lacking. My recommendation would to significantly increase project management support to the HFT Project to provide the necessary project management expertise that the Project leadership needs. There are numerous DOE O 413.3A requirements and significant work to be accomplished by 4QFY10 to achieve CD-2 approval, and without increased project management support, I don’t think the HFT Project will be able to be ready for CD-2 approval in that timeframe.

“The HFT Project involves the development, design, fabrication, testing and installation of a relatively smaller detector into the STAR detector in the BNL RHIC facility. A Project of this type has minimal environmental, security, safety or health (ESSH) impacts. The Project will follow the standard BNL Standards Based Management Systems (SBMS) process to identify and control hazards associated with the different aspects of the HFT Project. In addition, the quality assurance aspects of the Project will comply with the BNL site-wide Quality Assurance Program in its entirety. Related to security, a letter has been issued by the BNL Laboratory Protection Division Manager that simply confirmed that the HFT Project fell within a previous assessment of security risks and no further actions related to security were required.

“A preliminary Hazard Analysis has been developed for the HFT Project. This document outlines the project; discusses the hazard analysis process which is performed using the BNL Standards Based Management System (SBMS) to identify and control hazards for all equipment and work at BNL. The building, testing and installation of the HFT does not introduce any new or unique hazards that have not already been encountered at BNL. The preliminary Hazard Analysis is appropriate for this stage of the project.

“Overall, I think a project of this size and complexity can appropriately utilize standard BNL ES&H and QA polices and procedures and be successful. I think that the applicable CD-1 ES&H and QA requirements related to the HFT Project have been appropriately addressed. Project safety is also enhanced by a dedicated Safety Coordinator that has been assigned to the Project.

“DOE O 413.3A has in excess of 18 requirements that have to be addressed prior to CD-1 approval. A number of these requirements (e.g., One-for-One Facility Replacement, High Performance Sustainable Building considerations) are not applicable to the HFT Project. Most of the Order requirements do need to be addressed by the Project in some level of detail, such as, environmental documents (e.g., NEPA) and preliminary Hazard Analysis Report. The key requirements for a project of this type and size that should be addressed are the Conceptual Design Report, Acquisition Strategy, preliminary Project Execution Plan, FPD appointment, and establishment of the IPT. The HFT Project has addressed the applicable CD-1 requirements in some manner, including: development of a PPEP and Acquisition Strategy; FPD appointment; establishment of an IPT; draft Risk Management Plan; preliminary Hazard Analysis; NEPA documentation; Environmental Protection, Safety, Security, Health and Quality Assurance commitments; as well as, commitment to conduct Value Engineering study by CD-2/CD-3.

“While I think the HFT Project has addressed the applicable CD-1 requirements, I think efficiencies can be achieved by this Project and future projects of this size. DOE O 413.3A allows for “Tailoring,” which for a project of this magnitude, tailoring some of the requirements or documentation would be an effective use of limited Project resources. Projects of this size don’t have the luxury of more staff resources that larger projects have, which allows those larger projects to fully address order requirements without significantly impacting project resources.

“As an example of where tailoring is being applied effectively on the HFT Project, is how the Project addressed the requirement to update the Preliminary Security Vulnerability Assessment Report. A concise BNL letter was issued from the Laboratory Protection Division Manager that simply confirmed that the HFT Project fell within a previous assessment of security risks and no further security-related actions were required. This saves the HFT Project valuable resources having to generate or fund an unnecessary Preliminary Security Vulnerability Assessment Report that wouldn’t add any value to the HFT Project. Similarly, simply adapting the BNL Quality Assurance Program (QAP) in its entirety (as stated in the PPEP) shouldn’t then require a project specific HFT-QAP. A simple letter or at a minimum a very shorten HFT-QAP that states the HFT Project is following the BNL QAP in its entirety should suffice.

“This tailoring strategy could be applied in other circumstances related to Project documentation. For example, there are numerous redundant sections in both the PPEP and Acquisition Strategy. This redundancy is required for large projects where the approval chain for the PPEP/PEP and Acquisition Strategy are somewhat different paths; which would then require redundant information pertaining to project scope, deliverables, cost, schedule, management organization to be fully detailed in both documents to ensure those concurring or approving the documents have a complete understanding of all aspects of the project. In the case of the HFT Project and other smaller NP projects, the concurrence and approval chains are essential identical, so there is no need to expend the resources to repeat the same information in both the PPEP/PEP and the Acquisition Strategy. In my opinion, the HFT Project Acquisition Strategy has too much “boiler plate” and minimal acquisition discussion. The most important section of the Acquisition Strategy, the “Business and Acquisition Approach section is less than one page of a 17 page document, and the actual details about how the Project is going to conduct procurements or acquisitions is merely two sentences long, and the second sentence referring to sole-source procurements is not a complete statement. These two sentences are the heart of the acquisition strategy, but I think more effort was put into ensuring the document boiler plate, which isn’t important in this case, was in place in the document. This section makes no mention of MOUs between contributing institutions and how that procurement process will take place. There is also no details related other procurement topics such as: “Make vs. Buy;” best value vs. low bid or small business set-aside.

“A draft Risk Management Plan has been developed that describes a typical risk identification and classification process. The risks identification process is both a bottom-up and top-down risk identification process. The methodology then analyzes the identified risks and evaluates the likelihood or probability of a particular risk occurring against the impact to either baseline cost or schedule, or technical specifications. A risk matrix has been developed which identifies nine high risks; ten moderate risks and 31 low risks. I did not see any clear correlation or spreadsheet that then showed Project contingency as it relates to risks. It appeared from discussions with LBNL participants that a bottom-up contingency analysis by WBS was being performed now. Understanding Project risks and their impact to the Project is critical to the success of a Project. The Project should develop a consistent, defensible methodology to calculate project contingency that takes in account documented project risks.

"Overall, I think the HFT Project has developed (in some cases overdeveloped) the appropriate documentation for the achieving CD-1 approval. I think all Project documentation should be further scrutinized to eliminate any inconsistencies with redundant sections or language. The Project should also consider adding language in the PPEP/PEP related to the charter of the IPT; versus creating separate IPT charter document that would require concurrence/approval the same as the PEP."

Reviewer:
"In general the STAR HFT is an exciting upgrade project. Each detector element is reasonably planned with an impressive project team at this stage. Hopefully the project can move forward in a timely manner."