Committee Report
NSLS-II Project Advisory Committee Meeting
November 20-21, 2007

Members Present:

R. Hemley, Carnegie Institute of Washington
W. Hendrickson, Columbia University
T. Mason, Oak Ridge National Laboratory, Chair
G. Materlik, Diamond Light Source
G. Shenoy, Advanced Photon Source
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Summary:

The NSLS-II Project Advisory Committee met at Brookhaven National Laboratory on November 20, 2007. This meeting followed a series of project advisory committee meetings and reviews by the Department of Energy's Office of Science and Office of Engineering and Construction Management. Based on the work of the Project of the previous year and the results of those reviews NSLS-II had reached the point of Critical Design 2 – the mechanism by which the DOE formalize a performance management baseline. This is an important milestone in the life of a project since it marks the transition to the execution phase – with a start on detailed design and long lead procurements. The NSLS-II Project Team is to be congratulated for reaching this point, particularly in light of the funding shortfalls and attendant resource constraints. The committee heard presentations about the current state of the three main elements of the facility (and organization) – conventional facilities, accelerator systems, and experimental facilities – as well as presentations and discussion on project management, construction approach, the strategy for beamline development and a general overview. This report follows the conventional, accelerator, experimental template with the supplemental topics handled within the appropriate section. General observations about the status of the project as well as the key issues identified elsewhere in the report are contained in this summary.

Given the stage of the project at the time of this review there was a strong emphasis on readiness to proceed to the execution phase. One of the most important decisions faced by the project is how to manage the civil construction effort which represents a significant fraction of the overall budget, is technically challenging since the requirements for conventional facilities are driven by complex technical systems, and presents risks in terms of procurement, safety, and schedule. We recommend that a single entity hold full responsibility over the site during conventional construction, either as a construction manager or by structuring the GC package for the storage ring building to include site management functions.

The project is to be congratulated for successfully recruiting permanent Director of the Accelerator Systems Division. Finding a permanent Director of Experimental Facilities is now a matter of some urgency, especially in light of the pressing issues in formalizing the beamline selection process, and setting and maintaining a forward-looking science agenda. Also, with the transition to detailed design rapidly followed by start of construction the Project Management role will require a full time, on site presence.

We urge the Project to fully exercise the peer review process that will be applied to beamlines (involving Beamline Access Teams and a review of scientific objective driven instrument concepts) to all beamlines including those funded as part of the project. Given the timing this means that those project funded

instruments must be handled expeditiously but it would be a mistake to take the notional instruments in the Conceptual Design and fixed without careful consideration of the scientific objectives.

Future meetings of the NSLS-II PAC would benefit from additional time to formulate a draft report, by addition of a half day following the full day of presentations and discussion. It should be possible to do this while still permitting good participation by the members by scheduling far enough in advance. Addition of a few additional members, with some overlap in expertise would help mitigate the inevitable absences due to schedule conflicts.

Conventional Facilities:

- It is important that site controlled by single entity with appropriate incentives with respect to schedule, safety, property management, and subcontractor coordination. This function could be performed by the General Contractor for the storage ring building (which is the dominate civil construction activity). If market conditions require split contracts for the ring this coordination/control function still exists however, the identified CF staff is likely too small unless significant safety and project management built into the GC or site management equivalent such as a Construction Manager (not necessarily at risk).
- The construction site management should be decoupled from the balance of BNL as far as site access concerned, separate fence and ideally separate workforce access (without going through BNL main gate). Everything within this site boundary should fall under a single safety plan – backed up with construction safety experience and expertise.
- BNL should to clear site and hand off to entity with overall site responsibility (no hidden "skeletons")
- NSS-II needs to formulate it's labor strategy, including whether a Project Labor Agreement is required, labor agreement to safety discipline policies (which must be more rapidly enforceable than traditional laboratory models), and technical equipment installation handoff.
- If the funding profile is not maintain minimize impacts on Conventional Facilities and ready to spend if $$ available – don't allow contractors to manage/dictate funding profiles.
- A final decision on long straight sections very soon is needed to freeze CF design – a real study needed now.

Accelerator Systems:

- The accelerator project is well developed and of sound basis. An outline of accelerator related R&D activities was not given. The committee was assured, however, that these are not critical issues and do not require fallback solutions.
- For funding reasons, a delay in the booster commissioning is being considered in order to accelerate construction of the CF. This would mandate early system tests (for instance: BPM electronics, power supply controller, control system, etc.) and a subsequent refurbishing if required. A delay in the booster commissioning is not, however, endorsed by the committee
- Longer straight sections would be an interesting option for future scientific applications. It is the opinion of the committee that a thorough basis for enabling this decision does not presently exist. An investigation of the nonlinear dynamics of such a lattice, including all possible errors and insertion devices, would be required. The effort required to realize this option at some future date, should also be evaluated. This includes the re-arrangement of the magnet lattice to accommodate

these long straight sections. Open questions include the costs involved and the duration of the shut-down: is it feasible to interrupt beamline operation for such an extended period?

- The new girder design is endorsed by the PAC since it helps to meet one of the fundamental features of the facility, stability. One tenth of the beam size is already a mere 300 nm and future experiments will even be placing more stringent demands. One should be prepared for this.
- The push for a resonance frequency to beyond 50 Hz is a worthy aspiration. A short girder is the correct approach since it enhances the stability. To reach a similar result with an increased height, as is being considered, would require a more massive girder design with a corresponding cost increase.
- The elements of the accelerator scope contingency were presented. It is highly recommended that contingency plans for a spare sc cavity and a number of magnet power supplies are not released. To suspend acquisition of a spare sc cavity would significantly increase the risk of a lengthy interruption to machine operation at a rather modest saving. A reduction in the power supply number would require magnets to be grouped into larger families. This would reduce the capability of correcting for optical deviations and lead to a substantial reduction in performance. The concept of individually powered supplies is a key feature for a high performance machine and enhances its flexibility.
- A reduction in the number of damping wigglers would remain the only scope contingency for the machine. The effect on emittance reduction in any case decreases with each additional wiggler as the effect converges.
- The procurement strategy for the booster must be finalized. If a turn key solution is adopted an alternative to Danfysik must be sought in order to ensure a competitive prize.
- It is highly recommended to consider NEG coating for the ID chambers. It has been proved in other machines that coated chambers strongly enhance the vacuum performance.

Experimental Facilities:

- XFD position: this must now be a top priority and a matter of urgency given the pace of hiring and the importance of decisions to be made very soon (e.g. long straights). A dynamic individual with appropriate expertise must be identified and hired very soon.
- Deputy Director for Life Sciences: we consider this to be an excellent concept and a very important post. Intellectual leadership and stature (with community, NIH etc) are key attributes; perhaps a joint-appointment with a university should be considered to attract an outstanding biologist/life scientist. We suggest that NSLS-II consider a structure in which there are two “science” directors (i.e. for Life Sciences and Physical Sciences).
- Scientific focus: we believe that a focus on science and a forward-looking vision is needed, rather than simply lists of beamlines or BATs. We are concerned that the science program is not yet in a sufficiently developed state for the initial beamline suite to be established. The science drivers must be made very clear so that the correct choices of beamlines are made. There is also a strong need to identify the unique science program of NSLS-II.
- We commend the efforts to begin to engage the potential user community. For example, the July 2007 Workshop was an important event that made users aware of developments at NSLS-II and to initiate planning for the science to be done at the facility and to begin to identify potential BATs. It might be advisable that BAT membership relate to sets of beamlines, perhaps in a matrixed manner.

- However, there should be a clear distinction between the science program and the beamlines to be built. For example, scientific communities may wish to have access to several different beamlines and therefore need to provide input to the design these different beamlines, including those in the initial suite. Beamlines are technique-oriented and can serve widely different communities (e.g. high-resolution powder diffraction for both materials science and geoscience; imaging for electronic devices, catalysis, and biology). Commonalities between different communities should be nurtured to most effectively utilize the beamlines. This is particularly important for the first six beamlines.
- BATS list/CD0: the near-term BATS list appears to be too long. For the first MIE application, only generic instrument descriptions should be necessary for CD0 documentation. So we propose that the workshops in early 2008 should aim to produce generic descriptions rather than a specified set of beamlines, thus leaving flexibility and not requiring a completed BAT review before the CD0 application. There needs to be a plan for a properly staged succession of MIEs worked out in concert with and driving the DOE timelines.
- A full evaluation of the six beamlines already included in the project should be made (again), in competition with other contenders.
- It is important to ensure strong intellectual and functional ties between those who design and construct the beamlines and those who will use them (the scientific community). So consultation with the users needs to be emphasised at each stage of the process of beamline definition, design, construction and commissioning. Continued engagement of the user community and proactive nurturing and growth of that community throughout the course of the NSLS-II project is essential for its success. However, to maintain very high quality standards, NSLS-II staff need to be clearly in overall control of the beamline construction.
- Science workshops should be organized as a priority, with carefully chosen subject experts who are not SR specialists. In this context it will be important to identify and interest new scientific communities who are not habitual users of SR techniques. This can lead to an expanded user community, opening up new scientific opportunities for NSLS-II. New and existing (NSLS) communities will need to be educated as to the capabilities of the new facility.
- Conflict of interests policy: this is needed for EFAC and will be precipitated by the BATS.
- Relationship between NSLS and NSLS-II: This crucial relationship should be strengthened. NSLS-II should take advantage of planning underway by NSLS for future synchrotron radiation activities at Brookhaven. We point out that the series of workshops planned for early 2008 were organized by NSLS. Close coordination between NSLS and NSLS-Il, including strongly proactive follow-up, is needed to maximize the outcome of these workshops for BAT planning, given the May deadlines. NSLS-II should take advantage of NSLS's large user community to increase input to the EFAC. NSLS-II should organize its own workshops both to broaden its potential user base further as well as to bring together members of specific communities for the conceptual design of beamlines they may ultimately share. There are user groups and organizations associated with NSLS that are active in (and funded for) increasing the number of users at the facility (e.g., through NSF- and DOE-supported consortia that have as their mission the training of students in synchrotron radiation research). Here again, NSLS-II can benefit from these programs in nurturing and expanding its community.