

NSLS-II SAC Close-out Report

March 9, 2018

Opening remarks

- SAC congratulates NSLS-II on the achievements of the last six months
- The KPIs for accelerator operation have been and continue to be met
- Beamline construction and commissioning progresses according to schedule; the SAC congratulates NSLS-II management and staff for the very rapid increase in capacity
- The ramping up of the user program is also impressive
- The SAC very much welcomes the programs (internal, competitive): post-docs, graduate students, facility improvement

Opening remarks

Major challenge for the management of the facility in the next few years

- Transition from construction to operation
- Continuing budget pressure
- Incorporating the outcome of the triennial review
- Increase efficiency to cope with work force reduction
- Communicate decisions clearly to staff before the decisions or implemented; listen to their concerns

NSLS-II has a great potential and management has to find a way to realize that potential together with the staff

Accelerator (general)

- The SAC congratulates the Accelerator Division for achieving highly reliable high quality operation of the NSLS-II accelerator.
- AD is to be commended for using cross-training to mitigate the loss of staff.
- Establishing goals for reliability, MTBF, operating current, beam stability, etc. is an effective way to motivate staff and reach high performance.

Accelerator (1)

- Is the FY18-20 maintenance and spares program sufficient to meet our reliability goals?
 - AD has made a detailed assessment of the reliability of various systems and components and has determined the most vulnerable ones. Reliability issues are being addressed with a more aggressive preventive maintenance program, periodic RF/cryo warm-up, component upgrades, and by procuring spares over the next 5 years. Critical spare procurement is planned to be completed in 3 years.
 - The availability of funds for spares is limited by the need for high cost components needed to reach 500 mA operation: a 3rd SC RF cavity system and SC HHC, although a 3rd RF cavity provides redundancy and improved reliability for lower current operation as well.

Recommendation: If not done already, develop plans for restoring accelerator operation as quickly as possible should a critical component, for which there is no spare, fail.

Accelerator (2)

- Are the plans to reach the design goal of 10 pm-rad in the vertical appropriate given the performance requirements of the users?
 - AD has demonstrated that operating with an emittance of 10 pm or less is feasible.
 - While only 3 out of 19 beamlines report a preference of operating with 10 pm or less vertical emittance, it is evidently those beamlines that are capable of exploiting the high coherence that NSLS-II offers and operating in that mode should be justified.
 - The drawback of low lifetime when in low emittance mode, which is likely to be the most significant issue for some users, should be mitigated with a future high harmonic cavity.
 - NSLS-II management could decide to have specific periods of low-emittance operation.

Accelerator (3)

- Are the FY18-20 R&D plans appropriate in terms of their focus and their size?
 - R&D is presently focused on developing the high harmonic cavity system, improving BPM electronics, testing new undulator concepts, and exploring a future modest lattice upgrade that could reduce emittance by a factor of 3-4. These endeavors appear to be appropriate given the available resources.
 - Physics studies for operation at higher current with the harmonic cavity are important, challenging and interesting. The collaboration with MAX-IV on understanding their harmonic cavity problems will benefit the NSLS-II implementation. These studies could benefit other facilities as well, including the APS-U and ALS-U.
 - These R&D efforts are important for preserving the physics and engineering expertise that is needed to successfully operate and improve the performance of the accelerator.

Recommendation: Continue to develop an accelerator improvement roadmap that can provide focus for more near term developments.

Beamline Operations (1): Controls

- Is the controls program on a path to success?
 - Commends the NSLS-II for its high awareness of the critical role of the Controls.
 - Issues and frustration accumulating.
 - Insufficient information provided to SAC to understand the effectiveness or shortcomings of the program
 - Need mechanism to assess/prioritize resources required to address “tickets”, short and long term
 - Lacking actionable and measurable action plans/deliverables
 - BLs do not see POCs taking ownership of “tickets”

Beamline Operations (1): Controls (cont'd)

- Is the organizational structure appropriate for the operational needs of the facility?
 - SAC sees less of a structure issue but rather keenly recognizes the lack of implementation plan, involvement, and communication within Controls and with the BL programs
- Are the priorities of the program clear, transparent and are there appropriate mechanisms to align them with the priorities of the facility?
 - No. Lacking guidance on prioritization, needs
- Is the controls program on a path to functioning as a coherent team?
 - Some improvements over the last 6 months but still many issues on disconnected silos.
 - Urgent need to establish close communication channels with BL programs

Beamline Operations (2): Beamlines

- SAC compliments the NSLS-II in managing a very diverse and growing portfolio of beamlines
- A more complete model for sustainable beamline operations and staff work-life balance is urgently needed (1 in 9 weekends is not adequate)
- The model for technical/science commissioning seems to be working, but a large backlog of controls work continues to present many difficulties
- We encourage NSLS-II management to develop regular communication paths with beamline and accelerator staff and inclusive decision-making processes

Beamline Operations (2): Beamlines (cont'd)

- The loss of technical expertise through the recent RIF has caused serious problems; the staff have expressed that they were not included in this decision and the rationale has not been well-explained.
- Long term relationship with CSI is not clear, particularly concerning on-line data analysis
- We are concerned that the proposed beamline staffing model does not satisfy the BES sponsor

Operations & BL dev (3): BL value engineering

- Has the beamline value engineering exercise identified concrete opportunities to reduce costs?
this a very useful exercise that begins to show good results; represents an important step towards inclusiveness; controls **must** be included
- Is the exercise on a useful path to conclusion?
This is an evolving process at an early stage that should not stop

User Program: General

- Is the user program making appropriate progress?
 - User community growth is progressing well, on track to meet or exceed stated goals to sponsor. There seems to be a healthy mix of new and returning users for growing a proficient user community while still enabling access for new experimenters.
- Are there areas of concern?
 - Data Access (authorization, speed), Remote Analysis, Storage
 - Single sign-on is a good first step, but there is a lot to do here.
 - Remote access for MX
 - This is required for a world-class MX facility.
 - Frustrations with PASS system
 - The new proposed system may alleviate these issues.

User Program: General

- Is the plan for the user interface with the proposal system clear and executable on the required time scale?
 - The proposed move to a commercial system for proposal handling, coupled with the adoption of the scheduling system already developed by ALS, has the potential to address many of the issues presented by the current system. The timeline is quite reasonable (perhaps ambitious) to test this system. Movement in the direction of standardizing systems within the broader community is encouraging.

User Program: General

- Consolidation of processes
 - The SAC welcomes the instigation of the new One Stop Shop for badging and access
 - It also applauds the Single Sign-On initiative
 - Encourage continued consolidation where possible

User Program: PU Program

- Program appears to be effective in leveraging community interest and bringing resources that expand NSLS-II scientific capabilities and programs and help to expand the general user community.
- Program brings new instrumentation, software, and expertise that helps to expand these capabilities.
- Review of proposals appears to be thorough and effective.
- Expect that novel, forefront research will emerge from the program and that some will be unique to NSLS-II.
- Are there hidden costs to NSLS-II? Could one do a cost analysis of projects in the program to assess the leverage?

User Program: PU Program (cont'd)

- Forthcoming review (half a year from now) expected to provide critical assessment of the program.
- Expansion of the program offers the prospect of improving both the NSLS-II science and the budget situation.
- It is too early to assess long-term effectiveness of program, but what are projected lifetimes of projects and what criteria should be applied to facilitate decisions about sunseting them?
- What is to be done when science remains strong but outside funding disappears?

User Program: Triennial review

- Is the proposal for the triennial review of the beamlines reasonable?
 - Proposal seems appropriate
 - Carefully articulate lengths of each section for report from beamline
 - Consult beamline leads regarding inclusion of users in review

ISR

- Is it on track to develop world-leading programs? If not, what should be done?
 - Good progress achieved so far, capabilities available, despite usual technical problems. Science highlights demonstrate this. PU activities well integrated and valuable, significant increase of capabilities
 - Need to address/resolve issues with reliability of mechanical systems (differently); repair every 9 months is not an optimal solution.
- Does it have the correct mix between commissioning new capabilities and running a user program?
 - Balance between attracting users and develop capabilities, SAC recommends very slow increase GU share from current ratio
 - Keep balance between PU and general in-situ users to not skew user base.

ISR (continued)

- Is the user program looking healthy for this point in its development?
 - Some difficulties to attract in-situ users, but probably natural in the beginning. General scattering users take up focus, hopefully resolved with new 6-axis at NIST beamline.
- Is the future plan appropriate? Are there opportunities we are missing that we should go after? Conversely is the beamline pursuing directions that it should not?
 - Appropriate(ly phased) plan with a realistic yet ambitious time plan
 - Reconsider capabilities for in-situ program (attenuation system, WAXS detector - could share Pilatus 100K with resonant scattering?).

SMI

- Is it on track to develop world-leading programs? If not, what should be done?

SMI has a solid scientific program addressing a potentially very large user community; a large part of the capabilities are still in development; too early to make adjustments

- Does it have the correct mix between commissioning new capabilities and running a user program?

At this stage in the life of the beamline: yes

- Is the user program looking healthy for this point in its development?

A strong partner user has been acquired; the GU program is still in the beginning stages: looks good so far

- Is the future plan appropriate? Are there opportunities we are missing that we should go after? Conversely is the beamline pursuing directions that it should not?

Future plans are well adapted and seem to be realistic; design flaws in the optics (mirror mono stability) must be dealt with asap

ESM

- SAC complements the ESM staff in commissioning and producing early science on the ESM beamline.
- The plan for continuing development of the ESM ARPES branch is very strong. Most urgent: develop the EPICS-based control system for the Scienta analyzer. The ARPES capability will not be world-competitive without this development. This will likely be useful on a few other end stations at NSLS-II.
- The XPEEM station is also developing well, and also needs to have an EPICS control developed.
- The ability to transfer samples between the growth systems and the ARPES/XPEEM end stations is important. We encourage developing techniques to achieve sample registry between these two with micron precision

TES

- Is it on track to develop world-leading programs? If not, what should be done?
 - TES fills a niche in the “tender X-ray” 1-5 keV not common elsewhere; appeals to several relevant and diverse communities. Energy resolution excellent. Impressive performance with limited staff.
 - Success in integrating with the imaging group for leveraging experience in common equipment, controls, software processing
 - Positional stability with scanned energy sets TES apart. Required constraint of BM horizontal (first at NSLS-II) and a novel adjustment on mono
- Does it have the correct mix between commissioning new capabilities and running a user program?
 - Around 13 proposals accommodated per cycle is appropriate
 - Priorities and mix are favorable

TES (continued)

- Is the user program looking healthy for this point in its development?
 - Very strong GU and PU programs (32 GUPs in 2018-2); high demand; excellent early results from multiple communities. A popular and well-run beamline.
- Is the future plan appropriate? Are there opportunities we are missing that we should go after? Conversely is the beamline pursuing directions that it should not?
 - Goals - full EXAFS energy scanning; <2 and >5 keV energy; push toward $\sim 1 \mu\text{m}$ spot – these are needed by users and achievable
 - Recommend hybrid approach with other modalities, eg. MS and micro diffraction rastering, EM or CFN