SNS Accelerator Advisory Committee Report

February 16-18

2016

Contents

Introduction

The Accelerator Advisory Committee (AAC) for the SNS met February 16-18, 2016. This was the seventh meeting of the SNS ACC; the previous meeting was March 24-26, 2015. Committee members at this meeting are shown in Appendix A. Two new members have been added: Mark Gulley has filled the slot previously occupied by Martha Zumbro who has retired from the committee; and Patrick Hurh was asked to join after the 2015 DOE Target Review. Absent at this meeting were Richard Cassel and Steve Holmes. Craig Burkhart from SLAC filled in for Richard Cassel.

At the last AAC meeting the target was not included in the agenda or charge because of a BES review on the target that took place at nearly the same time. At this meeting the target was included.

Accelerator Advisory Committee Charge

At this meeting we were given a total of eleven charge questions in the context of two high level objectives for the next two years. These are:

A. Achieve by the end of FY2017 sustainable and predictable routine operation at or near 1.4 MW to the First Target Station (FTS) with availability against published schedule of ≥ 90% while using ≤ 2 target vessels per year.

B. Achieve the vision of a three-source strategy for “Neutrons 2025” (including HFIR, FTS, Second Target Station [STS]) as articulated in the 2016 Strategic Science Plan for the Neutron Sciences Directorate. The accelerator and target-related aspects of this plan are identified as “SNS 2.8,” incorporating the steps necessary to double the machine power and to design a FTS target capable of accommodating beam power up to 2 MW while maintaining reasonable target lifetime.

The charge questions are:

1. Has the performance of the accelerator complex and neutron source since the last meeting made suitable progress toward achieving Objective A?
2. Are the SNS responses and ongoing actions to recommendations from the 2015 AAC meeting reasonable?
3. Are the plans to achieve Objective A and associated risks reasonable? Accelerator initiatives and target initiatives will be evaluated by respective breakout sessions, with the integrated operations strategy evaluated as part of the plenary presentation and discussion process.
4. Is the scope of work identified for ongoing and future Accelerator Improvement Projects (AIP) appropriate and balanced between the competing interests building necessary margin for routine operation at 1.4 MW and addressing system obsolescence?
5. Are the proposed strategies to improve outage work planning in preparation for the first long facility outage in January-April 2017 reasonable? This 4-month outage is aimed at replacing the Target Inner Reflector Plug (IRP) and the front-end Radio-Frequency Quadrupole structure (RFQ), and also completing the majority of the in-situ high-beta cavity plasma processing scope of work.
6. Is the proposed strategy for the Proton Power Upgrade (PPU) project reasonable for an early project planning state, including the planned approach for the ring and transport systems?

7. How might the target design & fabrication decisions that we are making now be improved for reaching the short-term 1.4 MW reliability goal?
8. How aggressively should SNS pursue implementation of gas injection for the short-term (1-year) and long-term plans? Are we using the right strategies?
9. What other areas of target development (besides gas injection) might have significant rewards for future target reliability?
10. Is the proposed approach for the STS target systems reasonable for an early design stage, and in particular is the choice of a rotating target with vertical access for maintenance appropriate? Note that BESAC will be reviewing both the PPU and STS projects on February 11-12, 2016 with materials due to the committee by February 1, 2016.
11. Evaluate and comment on recent small-scale R&D projects conducted in collaboration with other organizations (U. Tenn.) and the readiness of the organization to pursue additional small-scale initiatives funded by other sources.

Executive Summary

Since the last meeting, the SNS facility has achieved sustained operation with beam power ≥ 1.2 MW, including a return to 1.4 MW operations in December 2015. Availability was typically ≥ 90%, excluding one target failure. The SNS staff has worked on a broad approach to minimizing all downtime incidents from short to longer duration and has achieved success in many areas. Resources appear to have been well distributed through these efforts and longer-term projects. The committee congratulates the SNS for this successful year of operation.

There was one target failure, T12, which experienced a leak in the nose area of the mercury vessel after setting an SNS longevity record of 4445 MW-hr.

The committee was shown the objectives noted above and asked to evaluate facility plans against these objectives. The accelerator today can get to 1.4 MW, but needs more operational margin to stay there reliably. What needs to be done appears to be well understood, and is well integrated into the various improvement programs including the use of AIP funding.

The Second Target Station and the Proton Power Upgrade projects have made good progress in developing the scientific case, and getting established in the Office of Science project prioritization.

In evaluating the plans against the charge questions, the committee had several high level concerns:

- In order to ensure the successful installation of the RFQ during the same outage as the Inner Reflector Plug replacement (scheduled for the winter of 2017), the RFQ should have been tested with beam, but this has not yet occurred.
- While there has been considerable good work in developing comprehensive prioritization criteria for funding and effort allocation, this task remains to be completed. The committee continues to encourage SNS to apply organization-wide standards, and produce transparent output from this process so that it is straight-forward to understand how decisions have been made.
- In the target vessel, local regions of high stress caused by pressure wave propagation are still problematic from a cyclic fatigue perspective and pose a threat to operating stably at design beam power. The committee encourages SNS to pursue a more ambitious short-term gas injection system as part of the mitigation plan.
- Outage planning continues to be challenging. This applies to both the choice of work to perform, and the assurance of adequate and efficiently deployed resources to accomplish it. To this end SNS management is strongly encouraging the use of project management scheduling tools (i.e., integrated resource loaded schedules) beginning in the coming summer outage. The committee supports this, noting that it will be challenging and require a culture change in order for it to be effective.

In light of this, the various section authors made a number of recommendations addressing these concerns. These recommendations are highlighted here in the executive summary. Numbers refer to the location of the corresponding recommendation in the report. The first occurrence of each is reproduced here.

Recommendations

1, 20, 22, 27: Begin beam testing of the RFQ as quickly as possible.

19, 21, 24: Continue the development of a quantitative prioritization process addressing outage work, AIPs, other large tasks, and ultimately the two major project activities. At the next AAC meeting, present us with the output of this process showing transparently how the approved projects met the criteria, and why those not funded were not.

8, 10, 29: Place more emphasis on an effective and stable gas bubble injection system.

25, 26, 28: We encourage quick dissemination of the planned outage work planning improvements to all impacted personnel. The schedule for doing this is already tight. Get the message out!

I. Operations

Observations and Comments

Since the last meeting, the SNS team has achieved sustained operations with beam power ≥ 1.2 MW, including a return to 1.4 MW operations in December 2015. Availability was typically ≥ 90%, excluding one target failure, and neutron production targets for FY2015 were almost met.

The recommendation that SNS should consider prioritization of availability, above the importance of 1.4 MW, has clearly been addressed. Operation at powers below 1.4 MW has become part of the strategy currently deployed to meet sponsor objectives. The sponsor has now clearly stated (recommendation from BES Triennial Review, August 2015) that predictability and availability are key, along with managing targets to ensure there are no unplanned replacements. It was good to hear that the requirement for 1.3 – 1.4 MW operations is now only driven by trying to achieve maximum scientific output for the facility, and that emphasis is being placed on the need to manage reliability more effectively in terms of impact on users.

Long downtime events continue to have an impact on scheduling, performance, and beam power levels. Shorter downtimes need regular attention to ensure that the overall goal of ≥ 90% availability can be attained in spite of longer downtime impacts. The machine is clearly well understood, with lots of performance metrics and extensive analysis leading to continuous system improvements. Lots of work is going on at local level (at <$500k) outside the AIP program to promote sustainable, reliable operations.

Recommendation

See Charge Questions 1&3 for recommendations for Operations.

II. Shutdown Planning

Observations and Comments

SNS is moving into a stage of its life cycle in which the need to plan, prioritize, and coordinate outage activities is becoming more evident. Critical activities, such as the RFQ and IRP replacements, are becoming drivers not only for outage planning, but for the scheduled length of outages, necessitating a longer outage and careful planning regarding when to schedule it.

SNS developed a risk prioritization process and used it to identify 15 priority activities for the winter 2016 outage. It was reported that 14 of the 15 activities were completed during the scheduled outage period with progress having been made on the fifteenth item. The committee feels that this is good progress towards the type of process needed for integrated outage planning and scheduling.

The Research Accelerator Division Director has described proposed strategies to improve outage work planning in preparation for the long facility outage in January-April 2017 and the committee found them reasonable. Communication of and implementation of these strategies to mitigate schedule risk associated with the long outage seems to be only in its very early stages. The committee did not see evidence of documentation of these strategies.

There seems to be a history of schedule risk on receipt of the IRP from the vendor. There is a tight schedule for the authorization process for RFQ beam operations/testing prior to installation. The fates of these two activities are closely tied to each other because of the need to perform them both in a single long outage. Understanding the status of these two large activities both prior to and during installation and how they interact with other major activities such as plasma processing and routine maintenance activities will be critical.

Recommendations

Recommendations for this topic are found in the answer to Charge Question 5.

III. Ion Source, RFQ and ITSF

Observations and Comments

The ion source continues to run with good reliability, although this year there were several failures of the electron dump which turn out to have been related to a change in vendor for the alumina insulator. The problem now seems to be resolved by reverting to the original supplier plus increasing the insulator thickness in the weakest area. Through ongoing improvements, the source intensity continues to get better, although it is not yet to the point where one has a comfortable margin over the operational requirements (partly due to the still reduced RFQ transmission). Good progress was made in the past year in several aspects of the ion source. There have been significant improvements in understanding and elimination of source plasma outages. The source is now operating at reduced gas pressure, which is good for the RFQ, as well as improving the delivered beam current. Operation with higher extraction voltage has also been investigated, and seems to reduce the emittance and improve the RFQ transmission.

External antenna studies were resumed on the ion source test stand with encouraging results on intensity and long term stability. This external antenna source seems close to use for operations, probably initially on the ITSF. Emittance measurements on the test stand were encouraged last year as a way to study source performance variations and benefits of operation at higher extraction voltages, but the front slits of the emittance device need to have water cooling added so that source emittances measurements can be made at full duty factor. This seems to be waiting for engineering support.

With respect to meeting future requirements, one expects that the source performance will continue to improve, since there is much activity worldwide on H- sources, and the SNS team members are active participants in this community effort.

The RFQ is "hanging in there." Windows were installed on the RFQ since the last review, which have allowed the measurement x-ray energies to determine the vane voltages. From these x-ray measurements, it is estimated that the voltage is 15% low. This is essentially as expected, since the RFQ is operating at reduced power due to reliability issues. This low voltage is also part of the reason for the present poor transmission through the RFQ.

A LEBT vacuum valve has not yet been installed on either the ITSF or operational source, and it was reported that it is still in the design phase. The Committee still supports the installation of this valve in both locations at the appropriate time, which the SNS team now feels will be only when the RFQ switch is made next January.

Regarding the ITSF and second RFQ, it was disappointing that there has been no beam yet through RFQ (27 months after its delivery). Things are clearly well behind the plan that was presented last year, now making potential installation in January 2017 very tight. What remains to be done at this point is completion and approval of the safety documentation, which has now been given a very high priority so that beam testing can finally begin by June 2016.

Almost all ITSF systems are ready, and essentially everything has been done short of the beam tests. The RFQ was tested (without beam) at full power and duty factor for several months. Hydrogen gas was flowed from the source while the RFQ was running and it was observed that there was no degradation in RFQ performance. The RFQ vacuum was bled up once, and it was reported that it reconditioned to full power in less than a day, which seems to confirm the feeling that the slow initial power conditioning last year was just due to the poor vacuum at that time. There are few weeks of work remaining for completion of the protection system, the design of which already has the required committee approvals.

For a go/no-go decision by September, one must quickly verify key performance parameters such as beam transmission, emittance, energy, and energy spread, as well as having an extended 24/7 run to demonstrate reliable, stable operation. Assuming all the above are found to be acceptable, what will probably be sacrificed by this delay will be sufficient time for a real extended "burn in" of all systems, which might lead to some extra downtime during the first run cycle with the new RFQ.

After the RFQ swap at the ITSF, there are good plans for future research there. Someone needs to be assigned as responsible person for the operation of the ITSF facility.

Recommendations

1. Begin beam testing of the RFQ as quickly as possible.
2. Carefully review the plan and schedule for all beam tests to make sure there is sufficient detail to prevent delays in testing once approvals are received, and that all items needed for the go/no-go decision are included in the plan.
3. Once the new RFQ is installed, appoint a manager for the ITSF who will be responsible for making it operational again with the old RFQ, and then for operation of the facility for the planned future research.

IV. Warm Linac

Observations and Comments

There were no explicit presentations on the warm linac, presumably due to the stable operation of the warm linac for the delivery of beam power > 1.2 MW and availability > 90%.

The warm linac mainly contributes to the shorter trips, which range from 20 minutes to 1 hour, and the number is about 0.8 time / day.

There have been no big changes during the past 5 years. However several AIP projects have targeted some persistent problems which we have heard about in previous years. This includes AIP-35, Warm Linac Vacuum Upgrade; ion pumps are replaced with large turbopumps, better suited to large accelerating structures with many "O" rings. The DTL portion has been completed; the CCL and MEBT part are underway. A reduction in RF trips due to vacuum bursts, and reduced RF processing time are expected.

Also, improvements have been made to the HVCM system in AIP-34, and other reliability improvements are planned.

The committee supports the continuation of these developments as a part of the overall strategy to further mitigate trips.

Recommendation

None

V. Linac Accelerator Physics and Software Tools

Observations and comments

Software for Linac simulations and operations has been developed and implemented. The linac RF tuning software, both for the warm and cold linac, greatly reduces tuning time.

The committee appreciates the efforts of the accelerator physics team.

Some laser wire profiles show large shoulder components. Transverse matching has been attempted but further studies are needed to understand the phenomena.

A new PIC code, PyORBIT, has been developed with the addition of linac models, a lattice package, 3D space charge models, RF gap models, etc. The benchmarking result shows good agreement with PARMILA, but there are meaningful discrepancies with the measured results at the end of the MEBT. Once the reason is understood, this will be a useful tool for operational improvements.

Recommendation

4. Continue to develop and refine the PyORBIT code.

VI. Superconducting Linac and SRF

Observations and Comments

The reliability and availability of the superconducting linac has generally been good for the past 5 years. The SNS team has developed methodologies to reduce the risk of cavity performance degradation. The committee views this as a good investment.

The SNS team has recognized the need for SRF expertise and spare cryomodules to support the SNS mission. The committee is impressed with the SRF capabilities and infrastructure that the SNS team has developed over the past few years in connection with this. The recent developments in cavity inspection, cavity testing capabilities, quality assurance for clean room activities, and barrel polishing are seen by the committee as additional steps in the right direction.

At the last committee meeting, plans were presented for small-scale chemical etching or electropolishing as a first step toward a larger-scale facility. However, no funding was available in the last year to make progress with on-site etching or electropolishing.

The SNS team has a plan to fabricate a spare medium-β cryomodule. Progress has been made toward fabricating one 6-cell medium-β cavity. The committee sees this as a positive development. The SNS management team did not provide funding for additional work on the spare cryomodule in the past year.

The SNS team has developed a plan to mitigate weak points in the high-β cryomodule design for the PPU project. The plan includes the removal of HOM couplers, improvement of the Nb thermal conductivity for the end groups, and redesign of the input coupler for higher power and better thermal stability. The committee views this as being a good plan which takes advantage of the operating experience with the SNS superconducting linac.

The SNS team did not present a funding strategy or a schedule for further expansion of the on-site SRF infrastructure or production of new cryomodules. However, the committee's perception is that the recent decoupling of the STS and PPU upgrade programs is causing the SNS team to rethink their plans, priorities, and schedules. Hence, the committee anticipates that the SNS team will have a new and refined plan for SRF infrastructure and cryomodule production at the time of the next AAC meeting.

The committee commends the SNS team on their impressive results with plasma processing of two high-β cryomodules, including one done in-situ in the SNS tunnel. The committee is pleased to see that there is no evidence of significant cavity contamination with particulates associated with the plasma processing.

The committee agrees that it would be very beneficial to perform the majority of the in-situ plasma processing on high-β cavities during the 4-month outage. However, the committee feels that there is a risk that there will be insufficient time and resources to complete plasma processing in parallel with other critical work during this outage. In light of this, the proposed procurement and commissioning of one or more additional plasma processing carts is seen by the committee as a good investment.

Likewise, the committee would encourage the SNS team to use the summer 2016 outage to gain more experience and make more headway with plasma processing, if possible. See Charge Question 5 for additional comments and a recommendation related to plasma processing and outage planning.

Recommendation

See Charge Question 5 for recommendation in this area.

VII. Ring

Observations and Comments

The ring team is to be commended in meeting the requirements for reliable operation at 1.4 MW. However, it is noted that the ongoing convoy electron damage rate, which increases at higher power, poses a risk to the operation and the PPU project. It warrants careful consideration and evaluation of the design options for an improved configuration that incorporates lessons learned from previous efforts. It would also be advantageous to incorporate the capability for effective in-situ adjustments in the new design.

Significant and continued progress was reported on the active damping system for ring. While the e-p instability is not presently a problem for 1.4 MW operations, it does present a risk for the higher power upgrades (up to 2.8 MW) of the PPU and STS. As such, continued development and testing of the damping system are prudent efforts for managing the risk from e-p and other possible instabilities at higher intensities.

Recommendation

5. Consider adding the redesign of the electron catcher to the project prioritization planning.

VIII. Target Systems (including IRP)

Observations and Comments

Overall, the target development and operations team has made excellent progress on all fronts. Both target experts on the Committee were part of the 2015 DOE review team which reviewed the state of target development efforts after the back-to-back early failures of targets T10 and T11. All of the review recommendations were taken seriously and progress was made towards understanding the failures and implementing prevention modifications. The committee found the team is committed, talented, and open to new ideas and criticism.

Inner Reflector Plug Replacement: Although not explicitly part of the target-related charge questions, the upcoming replacement of the Inner Reflector Plug (IRP) is a critical operation that is planned to take place in a 4 month outage starting on January 2, 2017. Therefore from an outage planning perspective, the Committee requested and reviewed the relevant information.

A step-by-step schedule for IRP replacement has been created that is 50 working days in duration. This appears to fit well within the 4 month outage planned. However, it was noted that this is the first time this operation will be attempted since the first installation. It is likely that physical differences between the actual IRP installation and the mock-up area exist, making for some uncertainty in the schedule estimate.

Mock-up time for the IRP replacement using a mock IRP in the mock-up stand has been planned. This work somewhat overlaps the summer 2016 outage in which both a target and a primary beam window will be replaced. Thus the remote handling crews may be over-subscribed during that period. Delivery of the real IRP is expected shortly after this in July 2016. This leaves about 1 month of time to perform QA and check-out of the IRP as well as mock-up tests with the actual IRP in the mock-up stand prior to the go/no-go decision in August.

It is critical to not rush the mock-up and IRP check-out process. Likewise it is important to not overwork and/or demoralize the remote handling crew just prior to this difficult replacement procedure. There may be some advantage to setting a realistic start date for this work soon that everyone involved can agree is achievable.

Hot Cell Servo-Manipulator Replacement: In the list of potential AIPs, replacement of the obsolete hot-cell (service-bay) servo-manipulator did not appear to be funded. An inoperable servo-manipulator will result in almost complete halt of SNS target facility operations. The committee is concerned that this critical device replacement is not receiving high enough priority relative to other improvement projects.

Target Reliability Strategy: The most successful target yet in terms of MW-hrs and operation above 1.3 MW, T12, developed a leak in the nose area of the mercury vessel and was recently removed from service. This is the first known nose leak on a target. The previous 4 leaks have been in the downstream transition or trapezoidal cover plate areas presumably due to fatigue failure at stress concentrations at weld joints or other features. The T12 target was one of the "original" design targets. It had a re-worked trapezoidal cover plate weld, but otherwise was identical in design to the other targets which failed with many fewer cycles. This indicates that the original design, in theory, is adequate to withstand the pressure wave cycles created by the beam passage, at least to the lifetime of target T12. The difference must have then been in the manufacture/fabrication of the targets.

Incomplete penetration at a weld joint, surface roughness, material micro-structure, inclusions, and other flaws can easily introduce stress concentrations that dramatically affect the gigacycle fatigue life. It may not be practical or economical to build "perfect" targets. It may also not be possible to design a functional target that exhibits a large enough safety factor to ensure gigacycle performance. The most recent experience of designing out the stress concentration on the center baffle only to reveal a stress concentration on the side baffle shows that such design changes can be very "hit or miss." Taking into account the long analysis cycle (5 months for the full complement of required analyses per design iteration), one cannot tolerate "chasing" stress concentrations from one area of the target to another.

Instead, lowering the loading on the target mercury vessel structure will reduce stresses everywhere, including at the stress concentrations caused by fabrication and/or material flaws. In the gigacycle fatigue regime, 20-30% reduction in alternating stress and/or mean stress could mean 100 times more cyclic lifetime. Gas bubble injection has been shown to reduce thermal strains caused by pressure wave propagation downstream of the nose.

Gas Bubble Injection: Plans for a short-term bubble injection system to be implemented over the next year were presented. The plan is limited to what can be implemented quickly with the least impact on current operations. However, it appears there are no quantitative criteria for evaluating success or failure of the system, and no plans for what to do if those criteria are not met. It seems like the objective for the short-term plan is to prove the principle of pressure wave mitigation and cavitation/erosion damage and build a minimal gas injection system to gain experience for the future long-term system implantation.

The relatively small modifications suggested for the mercury loop to accommodate the short-term bubble injection scheme are probably not enough to ensure stable and safe operation. J-PARC experience and the recent testing at TTF indicate that more significant system modifications will be required. Efforts to raise the bar for the short-term scheme should be made to have a chance of stable, reliable operation at 1.4 MW within 19 months (more like a mid-term plan).

Mitigation of cavitation/erosion damage using gas bubble injection has not been conclusively demonstrated. But it has been shown to reduce strain in the target vessel from the pressure wave at J-PARC and at the WNR. In addition, the jet-flow target design has been shown to dramatically reduce cavitation/erosion damage (T10 target).

We note that evaluating the implementation of any type of pressure wave mitigation system will be very difficult without instrumenting the target vessel. Current efforts have been very promising and impressive, and should continue to be supported and improved, especially if a gas injection system is implemented

Recommendations

6. Consider ~1 month lagging start to IRP replacement during the 4 month shutdown (or delay the start of the long shutdown).
7. Perform risk analysis to compare relative consequences of failure of the hot cell servo-manipulator among the potential AIPs under consideration.
8. Place more emphasis on an effective and stable gas bubble injection system.
9. Use fatigue and stress analyses to set a quantitative minimum reduction in strain required to achieve satisfactory target vessel performance.
10. Set the requirements and scope of the short-term bubble injection system such that significant pressure wave mitigation is achieved even at the expense of making needed changes to the mercury loop. Steps in the process are:

- Incorporate the short-term bubble injection system with the jet-flow design concept in the next target design/build cycle.
- Incorporate target vessel instrumentation in the gas bubble/jet-flow target design to ensure comprehensive evaluation of the effects of the gas bubble injection system.

IX. Pulsed Power and Electrical Systems

Observations and Comments

The Electrical and RF Systems Group is to be commended for the effective stewardship they provide for their systems. They have effectively employed a continuous improvement methodology that has significantly enhanced the reliability of their systems.

High Voltage Converter Modulator: The continued roll out of system upgrades that deliver quantitative improvements to reliability and performance demonstrate "best practices." It was noted that the upgraded IGBT drivers are now installed in all units, IGBT snubbers in all but 3 units, and the new control system that achieves pulse flattening has been installed in 3 stations to evaluate reliability. The additional RF overhead provided by pulse flattening has the added benefit of allowing systems to be run at lower power, increasing their lifetime and reliability. The resonant capacitors continue to be a reliability issue. The additional temperature diagnostics installed in select prototype capacitors may provide some insight into failure modes and the alternative self-healing thin film capacitor array is a promising technology to improve the reliability of this component.

New upgrades that are under development also appear well focused on improving system reliability. The Alternate Topology Modulator should significantly reduce both voltage and thermal stress on the aforementioned resonant capacitors. Ongoing test stand operation of this system should provide additional insight into the cost-effectiveness of adoption. The cooling system AIP that is planned to start this year should reduce thermal stress on all components in the HVCM tank. Given the lengthy down time that results from any failure in the tank, this could have significant impact on down time. Parasitic current flow induced by the inductance of the original cable-bundle buss between the ±1.25 kV energy storage and the switch plates has been long recognized as enhancing the impact of a switch plate arc fault. The new laminate buss should substantially alleviate these effects.

Magnet Power Supplies, Kickers, and Choppers: Over 10% of the total down time is attributed to these systems, and over half of this is due to power supplies. Among the challenges faced by the stewardship team is the large number of different supplies in use at the SNS. To simplify maintenance, they have identified a common model power supply that could replace over 10% of those in the field (these systems presently use 6 different models). This has been proposed as an upgrade, which should be evaluated as part of an integrated prioritization process. The fidelity of the LEBT chopper currently limits the minimum gaps in the storage ring. Improving this system would allow the gaps to be reduced and increase the overall utilization of the accelerator. This could increase neutron output and by increasing accelerator utilization, decrease stress on accelerator systems, improving reliability. Jitter in the thyratron switch was identified as a significant issue and a solid-state replacement is being considered. Recognizing that the requirements for this switch may be beyond the capabilities of present solid-state technology, the team may also want to consider active-feedback jitter reduction in the thyratron switch, as employed in the SLAC damping ring kickers. [1]

Radio Frequency Systems: The power RF systems, for the most part original to the commissioning of SNS, are starting to "show their age" as evidenced by failures of klystrons and circulators. Failure of these systems results in lengthy down times, so it is important that the stewardship of these systems evolves to effectively support aging systems. The team has taken some well-directed actions to increase the lifetime of these systems, such as lowering klystron cathode heater power settings during normal operation and implementing a low-power state when the accelerator is off for over 24 hours. They have also identified the source of the common failure mode in the high power circulators and have developed processes to field repair the units. Perhaps the biggest concern is the DTL klystrons, for which there are no commercial replacements available. Inquiries to multiple klystron manufacturers have failed to identify a suitable replacement, although they have received an offer for the development of a replacement. However, the proposed replacement suggested is higher power (3 MW) and is not the same perveance as the existing units. Since the HVCM is a resonant device, changing the load impedance also alters the coupling to the load. The concern is that another "tune" of the HVCM would be required to support such a new tube. A potential alternative would be to contact the klystron manufacturing organization at SLAC to see if they could offer a rebuild or a "plug and play" replacement of the existing tube. The team continues to look for data on which to base a plan for end-of-life klystron replacement and monitor their spares inventory closely. Likewise, on the basis of recent circulator failures they have increased the spares inventory of key models.

Recommendation

None

X. Controls

Observations and Comments

Good progress has been made in reducing downtime attributed to Controls with over 99% availability being recorded since our last visit.

Controls has also made vital contributions to accelerator developments including:

- Ion Source: spectrometer timing, new power supplies
- E-kicker power supplies
- New serial power supplies
- New features and PanelView upgrade for RF transmitter
- DTL vacuum upgrade (AIP-35)
- CHL He inventory tool
- MKS 937B vacuum gauge controller

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[1] Mattison, T.; Cassel, R.; Donaldson, A.; Gough, D.; Gross, G.; Harvey, A.; Hutchinson, D.; Nguyen, M. "Status of the SLC damping ring kicker systems," *Particle Accelerator Conference, 1991. Accelerator Science and Technology, Conference Record of the 1991 IEEE,* On page(s): 2955 - 2957 vol.5

- TCP350 turbo pump
- LEBT chopper controller

The Cyber Security self-assessment and adoption of NIST standards are strengths and best practice. This seems to have been recognized by the ORNL independent audit team. The actions taken as a result are necessary.

The adoption of Code Management tools for Process Controls PLCs is a strength. This will have a positive impact on maintainability of the systems. It will help to ensure correct versions of code are installed and malware is not inserted prior to code deployment.

The identification of CSS-BOY scaling problems is an issue of concern. However, the root cause of the problem has been identified. There appears to be a good plan to address this. Good progress has been made to date in development of a solution and the team has excellent evidence that they are on the correct course.

One of our recommendations from the last meeting was that people be added to the Process Control team. We note that this was done and that the team has been productive.

Given the importance of the PPS system and the deficiencies found in its grounding, having an external review on priorities for rework was sensible. Good work has been done in consolidating PPS architectures and equipment. The definition of a PPS prototype to benchmark a standard implementation for instruments is a positive step that should pay dividends moving forward.

The collaboration with the Electrical and IDAC groups to create a standard secondary shutter motion control assembly/PPS interface for EPICS beamlines is another good step towards standardized implementation.

It was very encouraging to hear that some critical thought had been given to the necessity for PPS interlocks. This resulted in the elimination of interlocks for some sample robots and detector motion controls. Particularly notable was the evaluation of the need for PPS interlocks on magnet power supplies. This resulted in the realization that these were not required which in turn allowed the PPS to be simplified. This has allowed significant savings in PPS checkout time and greatly simplified the process of working on the power supplies. This kind of "out of the box" thinking that challenges the established wisdom to result in significant savings is good to see and should be encouraged.

Recommendations

11. Keep a focus on Cyber Security. Keep current with evolving NIST standards. This is an ongoing and evolving battle – you are never done. Try to maintain a risk-based approach to mitigating measures. Unfortunately some impediments to ease of use are almost inevitable. Educating staff on the importance of cyber-security is a good thing.
12. Make sure your backups are reliable, including those of user data. Among the many other good reasons for reliable backups, it is a key mitigation for addressing ransom-ware attacks.
13. Consider adopting the same code management tools for other PLC systems at the facility, including, but not limited those that the Controls group has responsibility for. Importantly this should include the PPS PLC systems. This is an important tool for ensuring and validating that correct versions of code are deployed.
14. Continue to address CSS-BOY scaling problems. This is key if CSS-BOY (or its evolved version) is to replace EDM.

15. Many staff have been with the project since construction, any they have a lot of corporate knowledge. This knowledge will be critical for success of the PPU and STS upgrades. With the uncertainties around start dates for upgrade projects and the propensity for these to move out to the right, these staff may not be around when the projects are most active. Take the opportunity of this ‘gap’ to think about succession planning for key staff.

XI. Diagnostics

Observations and Comments

The diagnostics team has delivered very good technical performance, reliability and availability of the diagnostics systems to date. The committee especially appreciated the informative and useful summary table of the SNS Beam Diagnostics Performance Assessment in the diagnostics presentation.

A separate archiving system for diagnostics seems like duplication. Using the EPICS system would allow Accelerator Physicists access to the data in a uniform way. Evaluate if the facility archiver would be sufficient.

A plan was presented to upgrade several diagnostic systems including linac and ring BPMs as well as BLMs mainly because of hardware obsolescence. The plan called for AIP funds for the effort. Obsolescence is plausible but it is difficult for the committee to judge the risks to the operation from the evidence presented.

Recommendation

16. The priority for this effort should be part of the overall priority scheme for facility improvements.

XII. Proton Power Upgrade and Second Target Station

Observations and Comments

Significant progress has been made in plans to develop the Second Target Station (STS). Very good work was done in this past year in developing the scientific case resulting in $10M funds for FY2016 to move ahead with preparations towards CD-1. An additional recent (Jan 2016) development is that the power upgrade has been separated from the STS project and has been reconstituted as a stand-alone project called the Proton Power Upgrade (PPU) project. This provides the possibility of a “fast track” PPU implementation and lowers the cost of the STS.

The PPU technical challenges are basically unchanged from what we have seen previously. Many of the present upgrades will provide a good foundation for the PPU.

A project office has been formed and planning is proceeding on both projects.

Further comments, concerns and a recommendation are found in the answers to Charge Question 6 and 10.

Recommendation

None

XIII. Charge Question 1: Has the performance of the accelerator complex and neutron source since the last meeting made suitable progress toward achieving Objective A?

Observations and Comments

Facility operations since the last meeting have been impressive (see Operations section) and have moved significantly towards the specifications for Objective A. The SNS team should be congratulated on achieving this level of performance which cannot be done without having robust operational systems in place. However, whether this can be directly attributed as progress is difficult to quantify – this could just be down to statistics.

One of the key issues identified to achieve operational progress at the last meeting was testing and installation of the spare RFQ. Unfortunately there has been little discernable movement (although good planning work has been done). As noted elsewhere this has been explained as the result of inadequate resource to complete the PPS and safety paperwork.

Lower power (typically 850 kW) target conditioning and 'target conservation mode' seem to be somewhat empirical, but so far this approach has been effective in maintaining availability (although no correlation has yet been found between 850 kW running and target lifetime). It would be good to see this approach validated by simulation or appropriate target instrumentation, as obviously periods of running at lower power will compromise progress towards Objective A.

Recommendations

17. Keep doing what you are doing on gathering performance metrics, analyzing data and underpinning operations by tackling shorter downtimes.
18. Keep doing everything possible to tackle long downtime events, primarily focusing on understanding and alleviating target failures (see Charge Questions 7 – 9).

XIV. Charge Question 2: Are the SNS responses and ongoing actions to recommendations from the 2015 AAC meeting reasonable?

Observations and Comments

The committee appreciates the thorough and thoughtful responses to recommendations, and notes that in many cases the SNS staff have made significant progress in the areas addressed. Overall we emphasized two major areas in the recommendations of the 2015 meeting. The first was to develop a SNS wide prioritization process. Significant progress was made in this area; neutron science organizations developed a process to set priorities for instrument upgrades which were included in RAD prioritization, and an extensive and well defined process was used within RAD to define outage work. We note this progress, and agree with SNS that more work needs to be done in this area.

Secondly we strongly encouraged SNS to take the requisite steps to put beam through the new RFQ as quickly as possible. This did not happen for reasons that were explained. Furthermore, we were shown plans being ready to do this by June 1, 2016.

We repeat these recommendations for 2016, noting that the development of a thorough, rigorous prioritization process takes time, and a change within the institutional culture. In the first recommendation below, the committee would like to see those projects that we have listed in the previous recommendations be included in the project prioritization so that we can see how the determination was done either to do them promptly or to delay them. This would include the spare medium-beta cavity and the remote handling system replacement, among others.

Recommendations

19. Continue the development of a quantitative prioritization process addressing outage work, AIPs other large tasks, and ultimately the two major project activities. At the next AAC meeting, present us with the output of this process showing transparently how the approved projects met the criteria, and why those not funded were not.
20. Ensure that the plans for putting beam through the RFQ are successfully implemented in defined time frame.

XV. Charge Question 3: Are the plans to achieve Objective A and associated risks reasonable? Accelerator initiatives and target initiatives will be evaluated by respective breakout sessions, with the integrated operations strategy evaluated as part of the plenary presentation and discussion process.

Observations and Comments

The accelerator today can get to 1.4 MW, but needs more operational margin to stay there reliably. What needs to be done – achieving proper RFQ behavior, smart chopping, plasma processing, modulator flattop, *etc.* – appears to be well understood, and is well integrated into the AIP program. However, lack of progress in some areas since the last meeting, most notably testing of the spare RFQ, is a cause for concern. In-so-far as the SNS team was unable to make the collective effort required to get the RFQ testing done last year, the committee has reservations about whether the RFQ installation deadline will be met.

The immediate focus is on sustaining availability and continuing operation at the highest possible power, subject to operational and target lifetime constraints. A 'power strategy' has been developed for next year based on not exceeding the integrated power seen by the previous target, the upshot of which is that in FY2106 SNS seeks to demonstrate 2.5 months at 1.4 MW with the balance at lower powers to manage target lifetime.

Medium term efforts will seek to achieve reliable 1.4 MW operations by 2017, lay the foundation for 2.8 MW capability and maintain the potential to carry out the Proton Power Upgrade and Second Target Station (PPU/STS). Work on cavity plasma processing, getting a better handle on RFQ performance, HVCM, smart chopping, convoy electron damage to the stripper foil brackets and path to lower activation levels, are all moves in right direction to produce margin and move towards PPU/STS.

The instigation of an 'incentivized performance reward' system of bonuses for meeting operational challenges collectively is an interesting initiative. Each Group Leader has a specific objective intended to help achieve 1.4 MW operations, and all must be realized in order for the bonus to be paid.

The plans to achieve Objective A appear reasonable, but the associated risks have not been presented in any consistent fashion, making it difficult to understand or quantify them. The recommendation from the last meeting, encouraging a rigorous approach to project prioritization, such as the use of risk analysis, and looking into best practice elsewhere remains to be addressed. The committee will therefore reiterate last year's recommendation.

Recommendations

21. We encourage a rigorous approach to project prioritization, such as the use of risk analysis, and looking into best practice elsewhere.
22. Get spare RFQ tested and installed a soon as possible.
23. Sustainable performance requires investment - continue to make the case for an adequate AIP budget (see Charge Question 4).

XVI. Charge Question 4: Is the scope of work identified for ongoing and future Accelerator Improvement Projects (AIP) appropriate and balanced between the competing interests building necessary margin for routine operation at 1.4 MW and addressing system obsolescence?

Observations and Comments

In some respects both building operating margin and addressing obsolescence are two aspects of the same issue, that of ensuring reliable operation of the facility. The prima facie cases for the AIP projects that were presented to the committee seemed reasonable.

What the committee didn't get a sense of was how these projects were selected as part of a wholistic process that ranked the relative risk and reward of each project with respect to the overall needs of the facility.

It was good to hear individual presenters had assessed the causes of downtime amongst their own systems and were aggressively addressing the issues causing the most problems. However, the committee didn't see a clear picture of how resources were allocated relative to the overall causes of downtime.

The RAD prioritization process and scoring criteria used for planning for the winter shutdown seem like an excellent basis for building a methodology for ranking AIP requests. Indeed, this process could be used as a basis for prioritizing many areas of operations. It is the view of the committee that an open and transparent ranking process would be good for the whole facility including staff, management, review committees and sponsors.

The committee endorses the policy of spending down AIP carry over. This has benefits as it frees up money to do more things in a faster time frame. It also means money isn't held back if, for whatever reason, an AIP project is cancelled in future years.

A figure of $4M annually for AIP was stated to be the desired amount. There is some historic data to support this and given the size of the SNS this appears a reasonable number. The committee feels that to present the strongest argument for this budget, producing a prioritized list of projects, showing which have been approved and those that were not approved would be useful (i.e., describe what you are not able to do and what the impact will be of not doing those things).

Operating with obsolescent systems is not a desirable state in an ideal world. The committee notes that when resources are limited this is sometimes necessary. Presenters showed that they have mitigation strategies in place; the most important of these being procuring sufficient spares. With a known 'burn rate' of spares it should be possible to forecast the systems that need to be addressed.

A number of presenters mentioned that systems would need modifying/upgrading for either the PPU of the STS. We commend people for thinking ahead and preparing for the future. The committee does note that these projects are likely a number of years (or many years) out and that requirements may change in that time. Management may want to consider if this is an important driver of priority in the next two to three years.

Recommendation

24. We recommend that the SNS adopt a transparent grading system to prioritize requests for AIP funds. The criteria used for prioritization should be decided by SNS management, and applied uniformly throughout the organization. We note that the RAD prioritization process and scoring criteria used for planning for the winter shutdown seem like an excellent basis for building a methodology.

XVII. Charge Question 5: Are the proposed strategies to improve outage work planning in preparation for the first long facility outage in January-April 2017 reasonable? This 4-month outage is aimed at replacing the Target Inner Reflector Plug (IRP) and the front-end Radio-Frequency Quadrupole structure (RFQ), and also completing the majority of the in-situ high-beta cavity plasma processing scope of work.

Observations and Comments

Progress has been made in moving towards a quantitative risk prioritization process and the RAD Director laid out reasonable proposed strategies to improve outage work planning in preparation for the first long facility outage in January-April 2017. It is critical that implementation of these strategies proceed in a timely fashion.

Understanding not only the required work during the outage for major activities such as the RFQ and IRP replacements but what needs to be completed on these activities by the time of the “go/no-go” decision will drive the timing of the long outage.

The in-situ plasma processing is another excellent example of an opportunity for refining outage planning and the committee encourages the SNS team to plan carefully for in-situ plasma processing so that priorities, space, personnel, and resource allocations are clearly defined before the start of the outage periods. Anticipating that there might not be enough time to plasma-process all of the high-beta cavities, and that plasma processing may not be completely free of risk, the committee suggests prioritizing plasma processing of cryomodules which have highest potential for performance improvement.

Recommendations

25. We encourage quick dissemination of the planned outage work planning improvements to all impacted personnel. The schedule for doing this is already tight. Get the message out!
26. We encourage improvements to outage work planning proceed immediately and that the summer 2016 outage be used as a beta test of the new process.
27. We view completing the authorization basis requirements for ITSF operations to be a critical path item and that it be treated accordingly in order to meet the proposed June 2016 start of RFQ beam operations.

28. Proceed with plasma processing during the 4-month outage, and take advantage of other opportunities in the schedule for plasma processing. Plan strategically to ensure that resources are available for this effort and prioritize cryomodules with the highest potential for improvement.

XVIII. Charge Question 6: Is the proposed strategy for the Proton Power Upgrade (PPU) project reasonable for an early project planning state, including the planned approach for the ring and transport systems?

Observations and Comments

The decision to break out the PPU from the Second Target Station (STS) project is very recent, and it is not clear to the committee that a strategy has been fully developed. However, it is clear that the PPU work may happen earlier with PPU installation work being done during normal SNS outages. Other facilities have demonstrated that this can be done, although it will be challenging. It is therefore essential that SNS develop the outage planning tools (e.g., using resource loaded scheduling during outages, and well developed prioritization) to be ready for PPU installation work.

Recommendations

None

XIX. Charge Question 7: How might the target design & fabrication decisions that we are making now be improved for reaching the short-term 1.4 MW reliability goal?

Observations and Comments

Although the improvement work has been impressive, it is not clear that the current strategy will result in the reliability goal by the end of FY17. As discussed earlier, a strategy to reduce overall pressure wave effects, while still making some efforts to reduce stress concentrations through design (at a lower priority) may be a more efficient use of resources.

Recommendations

29. To this end, along with previous applicable recommendations, a re-prioritization of activities should be considered:

    1) Gas bubble injection with jet flow

    Note: Strain measurements on the target is an integral part of evaluating effects of gas bubble injection

    2) Continued PIE of spent targets

    3) Target design modifications to reduce stress concentrations and effects of fabrication flaws

    4) Fabrication improvements (QA, manufacturing methods, welding)

XX. Charge Question 8: How aggressively should SNS pursue implementation of gas injection for the short-term (1-year) and long-term plans? Are we using the right strategies?

Observations and Comments

As discussed earlier, to achieve reliable operation at 1.4 MW with two or less target replacements per year by the end of FY17 (Objective A), a more ambitious short-term gas injection system should be pursued aggressively. This likely includes more significant mercury loop modifications needed to safely and reliably handle gas-loading impacts on the system (pump tank overflow, gas bubble separation, etc).

Note that the goal is not just to demonstrate effects on pressure wave mitigation, but to achieve reliable operation at 1.4 MW by the end of FY17. The current short-term plan certainly would be helpful in *perhaps* demonstrating bubble injection effects and gaining experience with an injection system's effects on mercury loop operation. But in our opinion, the current short-term plan will not assure reliable target operation at 1.4 MW within the goal time frame of 1.5 years.

Long-term plans will always take a "back-seat" (lower priority) to achieving near-term goals, current operations and spare fabrication due to time criticality. Therefore, the short-term plan should be ambitious enough to achieve the reliability goal as well as inform the design of the long-term solution.

Recommendation

Recommendations relevant to this charge are given in the Gas Bubble Injection section above.

XXI. Charge Question 9: What other areas of target development (besides gas injection) might have significant rewards for future target reliability?

Observations and Comments

The team has identified all the most promising areas for target development. Expansion of some of the identified areas could be useful if these areas can be pursued without distracting from the higher priority efforts:

- Gas wall injection system could be pursued as a longer term solution if jet-flow and gas bubble improvements do not result in satisfactory reduction of cavitation/erosion
- Additional and/or improved instrumentation methods would help evaluate design changes, gas bubble injection systems, "break-in" period phenomenon, and target health.

PIE has been essential to target development and should be expanded if resources allow. In particular, CT scanning technology could be explored to image cavitation-erosion and leak areas rather than using destructive techniques.

It should be noted that the team has identified that radiation damage does not seem to be limiting factor for 1.4 MW operation due to the relatively low dose, and comparison of the available literature data for the beam intercepting materials. However, it may be an issue for future 2+ MW operation, especially radiation damage effects coupled with fatigue performance (which is very difficult to assess). Some low priority effort should be maintained on engaging with the high power target community on radiation damage issues as there may be some opportunity to gain relevant materials data at low relative cost. Note that the RaDIATE collaboration will have many stainless steel foils used in an upcoming (FY17) irradiation run at the BNL BLIP facility. With some coordination, the material specification for these foils can be altered to match SNS target materials so that they are relevant for PIE if the opportunity arises.

Recommendation

None

XXII. Charge Question 10: Is the proposed approach for the STS target systems reasonable for an early design stage, and in particular is the choice of a rotating target with vertical access for maintenance appropriate? Note that BESAC will be reviewing both the PPU and STS projects on February 11-12, 2016 with materials due to the committee by February 1, 2016.

Observations and Comments

The proposed approach for the STS target systems is reasonable at this early design stage. The safety implications of concentrated decay heat with a stationary target versus distributed decay heat with a rotating target are very compelling towards a rotating target and the scientific case for a solid target versus liquid target appears strong. Vertical access for maintenance is a proven method for remote handling, and the SNS and ORNL staff have extensive experience with this method.

The presented procedure for target replacement includes a remote handling step in which the target "wheel" is separated from the "axle" while the assembly is installed in the core (in-situ axle/wheel separation). Although this type of operation is certainly possible and the techniques are similar to other SNS work, it increases risk of dose to worker and limits the capability to recover from off-normal events. Exploration of alternative target replacement procedures may result in less risky and more flexible systems. IRP replacement should also be fully investigated as its replacement is expected to be more frequent than the target.

As the team has already identified, the neutronics (prompt and residual dose rates analyses) should be completed as soon as possible to ensure proper radiological controls and shielding measures are in place to enable hands-on and RH procedures as currently envisioned.

Of particular note is that a radioactive work cell (Service Bay) is not included in the current layout of the facility. This severely limits the autopsy and PIE capabilities of the facility. And it eliminates the capability for unexpected inspections or off-normal accident recovery.

Recommendation

30. Consider adding the conventional construction features for a radioactive work cell that could be outfitted later, if necessary.

XXIII. Charge Question 11: Evaluate and comment on recent small-scale R&D projects conducted in collaboration with other organizations (U. Tenn.) and the readiness of the organization to pursue additional small-scale initiatives funded by other sources.

Observations and Comments

Laser Assisted H- Stripping and the 6D Beam Dynamics Studies at ITFS are valuable, well-planned R&D projects conducted in collaboration with other organizations including UT and Fermilab. Both projects are making good progress in achieving their goals. Both are innovative research activities of great interest and value for the future of high intensity accelerators. Such activities are also of great value for the education, training and development of new talent in the accelerator field.

The 10 microsecond H- stripping experiment is ready to take data and is on track to commence very soon. The next major step will be extending the effort to 1 ms stripping.

The 6D Beam Dynamics Studies are of general accelerator community interest but will also be of direct benefit to improving the modeling efforts for SNS operations and development.

We believe that the SNS organization has the interest, enthusiasm and talent to pursue additional small-scale initiatives funded by other sources. The committee recommends that you keep up the good work; we believe that it is essential for the long-term viability of the enterprise.

Recommendation

None

Appendix A: AAC Committee Members

Name	Affiliation	E-mail Address	Comments
Alessi, James	Brookhaven National Lab	alessi@bnl.gov	
Burkhart, Craig	SLAC National Acceleratory Lab	burkhart@slac.stanford.edu	Substitute for Cassel
Cassel, Richard	RLCassel Consulting	rlcassel@pacbell.net	Unable to attend
Futakawa, Masatoshi	J-PARC/ Japan Atomic Energy Agency	futakawa.masatoshi@jaea.go.jp	
Gerig, Rodney (Chair)	Argonne National Lab (Retired)	rod@gerig.org	
Gulley, Mark	Los Alamos National Lab	gulley@lanl.gov	New 2016 – replaced Zumbro who retired
Hartung, Walter	FRIB/Michigan State University	hartung@frib.msu.edu	
Hasegawa, Kazuo	J-PARC/ Japan Atomic Energy Agency	hasegawa.kazuo@jaea.go.jp	
Holmes, Stephen	Fermi National Accelerator Lab	holmes@fnal.gov	Unable to attend
Hurh, Patrick	Fermi National Accelerator Lab	hurh@fnal.gov	New 2016 – after 2015 DOE Target Review
Macek, Robert	Los Alamos National Lab (Retired)	rjmacek@comcast.net	
Maclean, John	Argonne National Lab	jfm@aps.anl.gov	
Thomason, John	ISIS / Rutherford Appleton Lab	john.thomason@stfc.ac.uk	

Appendix B: Accelerator Advisory Committee Meeting Agenda

February 16-18, 2016

Building 8600, Conf. Room C-156

Event contact	Lisa Eady, 865-574-0557 (office); 865-567-7202 (mobile); eadylb@ornl.gov			
Time	**Event**	**Lead**	**Attendees**	**Place**
Tuesday, February 16, 2016				
7:30 - 7:45 am	*Badging*		*Committee Members*	*Guest House*
8:00 – 8:30 am	Executive Session	Kevin Jones, Director, Research Accelerator Division (RAD)	Committee Members	C-156
8:30 – 8:45 am	T1. Neutron Sciences Directorate (NScD) Overview	Paul Langan, Associate Lab Director, NScD	All	C-156
8:45 – 9:15 am	T2. Accelerator and Target Systems Management Overview and Responses to 2015 AAC Recommendations	Kevin Jones, RAD	All	C-156
9:15 – 9:45 am	T3. Operations Report for FY15 and FY16 - Q1	Glen Johns, Group Leader, Accelerator Operations	All	C-156
9:45 - 10:00 am	Discussion		All	C-156
10:00 – 10:20 am	*Morning Break with refreshments*		All	*C-156*
10:20 – 10:50 am	T4. Progress to 1.4 MW Reliable Operations	Michael Plum, Acting Group Leader, Accelerator Physics, Beam Instrumentation & Ion Source (APBIIS)	All	C-156
10:50 – 11:20 am	T5. Overview of Target Initiatives for the First Target Station	Mark Wendel, Group Leader, Source Development and Engineering Analysis	All	C-156
11:20 – 12:00 pm	T6. Overview of Proton Power Upgrade (PPU) and Second Target Station (STS) Projects	John Galambos, Project Director, STS Project	All	C-156
12:00 – 1:00 pm	*Working Lunch / Continue Discussion of PPUP and STS*	*Pick up lunch and return to C-156 to eat*	All	*C-150*
1:00 – 1:30 pm	T7. The SNS Accelerator Improvement Program	George Dodson, Deputy Director, RAD	All	C-156
1:30 – 2:00 pm	T8. Planning Initiatives for the 2017 Long Outage	Kevin Jones, RAD	All	C-156
2:00 – 2:30 pm	T9. Beam Dynamics Studies at the ITSF and Collaborative Accelerator R&D	Sarah Cousineau, Physicist, APBIIS	All	C-156
2:30 – 2:50 pm	Discussion		All	C-156
2:50 – 3:10 pm	*Afternoon Break with refreshments*		All	*C-156*
3:10 – 3:40 pm	T10. Controls and Protection Systems	Karen White, Group Leader, Control Systems	All	C-156

Time	Event	Lead	Attendees	Place
Tuesday, February 16, 2016 (cont.)				
3:40 – 4:10 pm	T11. Achievements in In-Situ Plasma Processing of High-beta Cavities	Marc Doleans, Physicist, Superconducting Linac Systems (SCLS)	All	C-156
4:10 – 4:40 pm	Discussion		All	C-156
4:40 – 6:00 pm	Executive Session		Committee only – others at Committee request	C-156
6:40 – 8:40 pm	*Review Dinner and Discussion*	*Kevin Jones – Dinner topic: Proton Power Upgrade and Second Target Station*	*All*	*Lakeside Tavern, Concord Drive, Knoxville, TN*

Time	Event	Lead	Attendees	Place
Wednesday, February 17, 2016				
8:00 – 9:30 am	Tour of SNS Accelerator/Target Facilities	George Dodson / Michael Baumgartner	Committee Only	Depart from C-156
9:30 – 9:45 am	Executive Session		Committee Only	C-156

	Accelerator Breakout Sessions, C-156		***Target Breakout Sessions, C-152***	
9:45 – 10:15 am	WA1. Status of Linac High Voltage Converter Modulator Upgrades	Dave Anderson, HVCM Team Leader, High Voltage and Pulsed Power	WT1. Target Systems Operations Experience and Remote Handling	Mike Baumgartner, Group Leader, Mechanical Systems and Operations
10:15 – 10:30 am	*Morning Break/refreshments*	*All*	*Morning Break/refreshments*	*All*
10:30 – 11:00 am	WA2. Advances in Accumulator Ring Beam Damping	Nick Evans, Postdoctoral Research Associate, APBIIS	WT2. Summary of Development and Engineering Activities and Staffing	Mark Wendel, Target Systems Engineering Lead
11:00 – 11:30 am	WA3. Progress in Ion Source Operation for Consistent High Current and Long Life Performance	Martin Stockli, Ion Source Team Leader, APBIIS	WT3. Update on Target Post-Irradiation Examination	Bernie Riemer, Engineering Analysis Team Lead
11:30 am – 12:00 pm	Discussion	All	WT4. Mercury Vessel In-Situ Instrumentation Progress and Direction	Mark Wendel
12:00 – 1:00 pm	*Working Lunch / Discussion of Accelerator Status and Upgrades*	*Pick-up lunch from Room C-150*	*Working Lunch / Discussion of Target Operations and Progress*	*Pick-up lunch from Room C-150*
1:00 – 1:30 pm	WA4. Laser Stripping Experiment Status	Sarah Cousineau, Physicist, APBIIS	WT5. Target Module Fabrication Status	Drew Winder, Target Systems Engineer
1:30 – 2:00 pm	WA5. PPU Ring and Beam Transport System Upgrades	Michael Plum, Acting Group Leader, APBIIS	WT6. Target Module Design & Analysis Status	Drew Winder

Wednesday, February 17, 2016 (cont.)				
	Accelerator Breakout Sessions, C-156		***Target Breakout Sessions, C-152***	
2:00 – 2:30 pm	WA6. Operational Performance and Development Projects for Magnet Power Supplies, Kickers, and Choppers	Robert Saethre, Power Supplies, Kickers and Choppers Team Lead, Electrical and RF Systems (EERF)	Discussion/ supplementary slides as needed	All
2:30 – 3:00 pm	WA7. Software Tools for Simulation and Operation	Andrei Shishlo, Physicist, APBIIS	continued	
3:00 – 3:20 pm	Discussion	All	*Afternoon Break/refreshments*	*C-150*
3:20 – 3:40 pm	*Afternoon Break/refreshments*	*C-150*	WT7. Implementing Gas Bubble Mitigation at SNS: Short and Long Term	Bernie Riemer
3:40 – 4:10 pm	WA8. Status of the Linac Radio Frequency (RF) Systems	John Moss, Linac RF Team Lead, EERF	continued	
4:10 – 4:40 pm	WA9. Status of Beam Diagnostics Systems	Sasha Aleksandrov, Beam Instrumentation Team Lead, APBIIS	Discussion/supplementary slides as needed	All
4:40 – 5:10 pm	WA10. SCL System Status, SRF Activities, and PPU Strategy	Matt Howell, Lead Engineer, SCLS	WT8. STS Target Concepts	Mark Rennich, Engineer, STS Pre-Conceptual Development
5:10 – 5:30 pm	Discussion	All	continued	
5:30 – 6:00 pm	Executive Session/Questions for SNS Management	Committee Only		
6:00 – 7:00 pm	Executive Session	Committee Only		
7:00 pm - ?	Dinner on your own			

Time	Event	Lead	Attendees	Place
Thursday, February 18, 2016				
8:00 – 10:45 am	Executive Session/Management Response to Questions		Committee Only	C-156
10:45 – 11:00 am	*Break with refreshments*		*Committee*	*C-156*
11:00am–12:00pm	Closeout		All	C-156