April 11, 2004

Report of the Accelerator Systems Advisory Committee
Of the Spallation Neutron Source
March 2004 Meeting

Introduction

The tenth meeting of the Accelerator Systems Advisory Committee (ASAC) for the Spallation Neutron Source was held on March 9 - 11, 2004 at the SNS Office in Oak Ridge, Tennessee. The committee membership is: M. Allen (SLAC), D. Boussard (CERN), D. Finley (Fermilab), R. Jameson (LANL), R. Kustom (ANL), W. McDowell (ANL), G. McMichael (ANL), D. Proch (DESY), G. Rees (RAL), P. Schmor (TRIUMF), R. Siemann (SLAC, Chair), and F. Zimmermann (CERN). M. Allen was unable to attend, and T. Peterson (Fermilab) joined ASAC for this meeting.

This was the last meeting with Los Alamos National Laboratory attending as one of the SNS partner laboratories. They have made significant contributions to the SNS, and the scientific community will be grateful to them for many years to come. ASAC wishes Don Rej, the LANL Senior Team Leader, and the members of the LANL SNS Division the very best for the future. They can be proud of their accomplishments.

Charge to Committee

1) Provide an overall assessment of the physics and technical progress on the project. Does the committee see any serious problem areas?
2) Provide a detailed assessment on hardware installation and recommendations for improvements and increased efficiencies within the constraints of funding and schedules.
3) Provide a detailed assessment on beam commissioning and recommendations for improvements and increased efficiency within the constraints of funding and schedules.
4) Comment on installation and commissioning scope, costs and schedule risks and resource allocation to mitigate these risks.

General Assessment

There has been impressive progress extending throughout the SNS project since the last ASAC meeting. Highlights include:

- An extended run of the ion source without maintenance (twenty-four days at the time of the ASAC meeting).
- Thousands of hours of operation of High Voltage Converter Modulators.
- Impressive installations of the high power RF system including the first 5 MW, 805 MHz klystron.
- Assembly and installation of tank 2 of the Drift Tube Linac. Commissioning of tanks 1 – 3 is scheduled to begin in early April.
- The progress with the Coupled Cavity Linac including the installation of the first module and developing needed tuning procedures.
- Completion of nine of the eleven medium beta cryomodules.
- Delivery of twenty-four of thirty-two Accumulator Ring half-cells and the installation and alignment of the High Energy Beam Transport and six of the half cells.
- Simulations of space charge effects in the Los Alamos PSR.

Many past problem areas have been addressed successfully. This includes the Drift Tube Linac, the Coupled Cavity Linac, the High Voltage Converter Modulators, and the 5 MW, 805

MHz klystrons. The technical performance of these systems will be sufficient to reach the formal project completion (CD-4) goals.

Major subsystems that are causes for concern at the present time include the Central Helium Liquefier, the superconducting linac high-β cavities, and the Accumulator Ring diagnostics. The commissioning schedule has slipped from that presented at the March ASAC meeting, and the commissioning goals have become limited and focused on CD-4. In addition, there remains the concern that the Accelerator Systems Division staff is too small for all the installation, testing, conditioning and commissioning activities for which they are responsible.

The ultimate goal of the SNS project is to provide a high availability, high reliability operation of the world's most powerful pulsed neutron source, but CD-4 is the present focus of the installation and commissioning schedule. Decisions are dominated by the need to achieve the CD-4 objectives, and consideration of going beyond that level of performance is unclear from the presentations. This raises two questions that are within the scope of the ASAC charge. First, are there concerns about meeting the CD-4 objective on schedule? The schedule slip for commissioning, the minimal objectives of the commissioning, and the staffing level are all concerns in this regard. Second, are there aspects of the present activities that would significantly delay reaching the ultimate goal of the world's most powerful neutron source? We do not see anything that will compromise the long term performance of the SNS. However, with the limited commissioning objectives it may be necessary to perform measurements and experiments in the future that could be performed more efficiently now.

Front End System

Front end reliability has been improved by more than a factor of two, and being able to run the ion source for twenty-four days without maintenance is an excellent accomplishment. This increased reliability was in part the result of experience with beam commissioning that highlighted systems that need improvement. The test stand is proving to be useful not only to test improvements but also as a vital source of spare components for the on-line operational system. Indeed, the fact that most failures have not previously been seen is strong evidence that the developments from the test stand are effective. Nevertheless, the current 7.6% down time still needs to be reduced by more than a factor of 10 to reach the design goal. The effort needed to achieve this improvement should not be underestimated.

The Linac was not designed to be current insensitive with respect to emittance matching and at present the current varies over the pulse. We recommend re-examining whether this variation is acceptable, including consideration of downstream beam loss. It may be necessary to implement a control loop around the source to flatten the pulse. That, and other work such as understanding the reduced effectiveness of repeated injections of fresh cesium, could be done on the test stand.

An experimental test of a round-beam optics in the MEBT was successful. The round beam optics strongly reduced the beam halo. The magnitude of the measured reduction is in good agreement with PARMILA simulations, which demonstrates that the important processes contributing to halo generation in the early part of the linac are well modelled and can be controlled.

Linac RF Systems

The progress on linac RF has been impressive. Problems with the low level RF system have been resolved, and production is well underway. A substantial number of RF systems have been installed and are running. The difficulties with the 5-MW klystron, which in the past was a critical item, are now solved with the vendor, albeit at the cost of a slight decrease in efficiency.

Thousands of hours of successful operation have been logged on the High Voltage Converter Modulator.

Many of the issues with the linac RF system have become ones of availability and reliability rather than initial articles and testing. The 5-MW klystron is now established. Five tubes have been factory acceptance tested, and two have been acceptance tested at Los Alamos and delivered to the SNS. Continuous effort is still required to cure the remaining, non fundamental, problems appearing at the highest power - arcing, a long conditioning time, and uncertainty with the new SF_6 windows. Testing at the highest power, 5.5 MW, cannot be overemphasized to guarantee the safety margin needed for a high reliability machine.

The same comment applies to the High Voltage Converter Modulator. The LANL staff that designed and developed the HVCM and the LANL/ORNL staff that did the follow up development deserve considerable credit for bringing this new technology into reality. There appear to be no fundamental obstacles, but there are numerous problems that need to be solved one after the other. This will require continuing effort, and in this respect, the transfer of responsibility to Oak Ridge is welcome.

There has been a substantial failure rate of 5-MW circulators and loads during testing. In addition, there has been some arcing in waveguides and overheating and RF leakage from bellows. Continuous effort will be required to achieve the high reliability needed from the RF components, especially for those components that look difficult to exchange in the klystron gallery.

We remain concerned about the size of the RF group. There will be increasing demands of supporting operation and beam commissioning of upstream accelerator systems as more come on line, continuing installation, testing and conditioning of the over 100 klystrons, and the inevitable trouble shooting that will be required. The addition of an engineer to the group since the last ASAC meeting is a step in the right direction. The agreement that has been reached for the continuing involvement of LANL staff will help reduce this problem provided that these individuals are fully committed and plan to spend significant periods of time at ORNL. This commitment is only for a limited period, and the heavy demands on the RF group will last for a few more years at least. In addition, the responsibility for ring RF systems has been transferred to the RF group, but only one engineer and no technicians have been transferred. We recommend that the size of the RF group be increased and that the contract with LANL for additional staff support be continued for at least a full year.

Drift Tube and Coupled Cavity Linacs

The Drift Tube Linac (DTL) is now progressing well. The DTL installation is nearing completion. All the drift tubes are at ORNL. DTL tank 1 has been beam commissioned, and tank 3 has been RF conditioned. Tank 2 is in the final stages of assembly, and tanks 1 – 3 will be beam commissioned with a scheduled start in early April 2004. Assembly of the downstream tanks, tanks 4 – 6, is on track for commissioning in August 2004.

All the basic requirements needed for CD-4 were essentially met during commissioning of tank 1. There is considerable evidence that the beam performance is strongly sensitive to many things and that the characteristics vary with time, both during the pulse and over longer periods. The transverse emittance changes with current and the beam centroid moves during each beam pulse. The installation of DTL tank 2, which was necessary to keep the schedule, meant that the diagnostics plate had to be removed. It might be necessary to remove one or more of the DTL tanks in the future to reinstall the diagnostics plate to perform measurements that were skipped.

Operational problems were also encountered during DTL tank 1 commissioning, and these will require continuing work. Examples of the problems are:

- Substantial time was spent on Medium Energy Beam Transport (MEBT) and Front-End issues. There was a complicated procedure of establishing correct longitudinal match into the DTL. Retuning was necessary after each startup to reach the same beam conditions. This is not unusual, but can negatively influence commissioning schedules. There will be less instrumentation now that the diagnostics plate has been removed.
- MEBT Rebuncher issues including phase stability, stability of closed-loop operation, low output power, and reliability.
- Noise problems, particularly false Machine Protection System trips. They are being reduced with a multipronged approach. Noise sources are being identified and attempts are being made to mitigate the noise at the source. However, new systems are being added at a faster rate than the noise abatement efforts, and it is likely that noise and false MPS trips will get worse before they get better. Conversion of copper to fiber should be accelerated, particularly for the timing system and fast protection carriers.
- The water skid for the Resonance Control Cooling System of DTL1 has to operate at the bottom 10% of its capacity where the control valves are multi-valued or work in reverse. Skids for other tanks may work better at full power, but they are likely to have the same problem at lower duty factor or when the RF is off. There are both hardware and software improvements underway, but we are concerned whether they will be adequate. We recommend that a supplier of commercial systems or an outside expert be consulted to determine if there are some inexpensive modifications that would help.
- The still unresolved RFQ detuning event and unexplained shifts of the apparent RFQ RF phase

Many problems of this sort can be investigated without operation with beam and it is critical that this be done. The time available for commissioning the downstream systems is limited, and effective commissioning requires reliable performance of the upstream ones.

Originally there were sixty tasks identified for the DTL tanks 1 - 3 commissioning, but the present goals are much more limited and aimed at CD-4, specifically to:

- Demonstrate that diagnostics are working.
- Get a 50 microsecond beam through DTL tanks 1 - 3 and to beam dump.

The tuning procedure will basically optimize transmission using discrete beam loss monitors. Tuning for transmission is unlikely to be effective for achieving beam losses below the 0.1% that is ultimately needed, and the beam loss monitors will have to be adequate to ensure that there is no beam spill in areas without detectors. It is recommended that consideration be given to the taking of measurements of the DTL3 output energy variations, both during the 50 microsecond pulse duration and from pulse to pulse, because the variation of the beam pulse centroid, observed during the DTL1 commissioning suggests there may be accompanying beam energy variations.

The first module of the Coupled Cavity Linac (CCL) has been assembled at the SNS, aligned, leak tested and tuned. Installation of the second CCL module is in progress, and the third and fourth modules are being assembled and tested at ACCEL. Delivery is expected soon. CCL manufacturing and tuning has benefited significantly from close coordination via telephone and travel between ACCEL, LANL and ORNL. Commissioning of the last half of the DTL and the first three modules of the Coupled Cavity Linac is scheduled for August 2004.

Superconducting Linac

At the time of the last ASAC review the yield of accepted medium beta cavities after the first test was only fifty percent, and some of the remaining cavities required several reprocessing cycles for acceptance. Following the ASAC recommendation, an international advisory committee met at Jlab to investigate the situation of the infrastructure and to give a plan for improvements. Several changes of the treatment were implemented at the cleaning area accordingly. The main actions were:

- Increasing the amount of chemical etching
- Increasing the amount of rinsing water after chemical treatment
- modifying the drying procedure
- using fresh chemistry for the final etching.

As a result a remarkable increase of cavity performance was reached. The average maximum gradient of thirteen medium beta cavities went up to 16.4 MV/m, which is far above the design value of 10 MV/m. More importantly, twelve out of thirteen tested cavities met the acceptance criteria after the first vertical test. This demonstrates that the principal method of treatment and the performance of the infrastructure during this time period are adequate to reach the required cavity performance.

Subsequent measurements of a series of newly prepared high beta cavities, however, uncovered a new problem - strong multipacting barriers around 13 MV/m were observed. Multipacting had been seen earlier but could be processed easily. A high beta cavity with good performance was given a new preparation and measured again. It showed strong multipacting, also. This gives a strong indication of surface contamination that results in an increased secondary yield thus enhancing multipacting. Recently, grease contamination was detected in the high purity water circuit. It was argued that the grease is due to insufficient inspection/cleaning of a new pump used for high pressure rinsing before installation. New high beta cavities were prepared after cleaning the pump and the high purity water piping. They will be measured soon as qualification test of the infrastructure.

The six cavities for cryomodules 10 and 11 were treated with the same high purity water system after vertical testing and during the time when high beta cavities experienced multipacting problems. There is concern, that these six cavities are contaminated also. Nevertheless the cryostat assembly was continued and high power RF tests will start soon. There is a hope that, should multipacting appear, the high klystron power available during cryostat testing will allow fast processing. The committee is aware of the conflict between keeping the production schedule against an interruption to investigate and repair a possible problem. But we concur with the strong advice of the advisory committee that met recently - there is a basic need to try to understand and rectify the problem source, rather than "living with it".

Problems with contamination of the final cleaning infrastructure were reported several times over the last two years. Especially the last event demonstrates that Quality Assurance and Quality Control management is not adequate to assure stable and high level performance. We strongly recommend the immediate establishment of a QA/QC group headed by a knowledgeable person who will have the authority and responsibility of overseeing and correcting these production problems. This activity should be started by seeking the advice of members of the previous committee for identifying necessary actions to be taken.

Jefferson Lab has installed piston type pumps in the high pressure water system. There is risk that oil might penetrate into the high purity water circuit with such pumps. Membrane type pumps eliminate this danger. We were informed that such a pump is on order, but there is a several month delivery time and the need to modify the pump cabinet. Any possible means should be taken to have this pump in operation as soon as possible.

Important detailed information about technological issues was exchanged via a video conference with experts at Jefferson Lab during the ASAC meeting. The committee wants to have key SRF technical and physics expertise at the next meeting to assure optimum information exchange.

(It was reported, subsequent to the ASAC meeting, that seven high beta cavities had exceeded the average gradient specification and three of these exceed the maximum specification. In addition, three more met the minimum gradient specification.)

Cryogenics and Cryomodule Testing

The Central Helium Liquefier (CHL) is part of the way through commissioning with major systems installed and commissioned. An extended "burn-in period" for CHL operations was originally planned, but a number of problems have been encountered during the installation and commissioning of some systems. Problems with the warm compressor caused a ninety day schedule slip, and shorted heater wires were found during the checkout of the 4.5 K cold box. Commissioning of that cold box is now scheduled to begin in April.

There are two potentially serious problems with the cold compressors in the 2.1 K cold box. Two cold compressor housings have large dents as a result of mishandling during shipping, and the instrument feedthroughs leak at low temperatures. Room temperature tests performed by representatives of the manufacturer, SNS, and Jefferson Lab during the ASAC meeting have indicated that the dented cold compressor housings may not be a problem. These tests showed that the dented units had the same performance as the original undamaged units at the vendor. SNS is proceeding with plans for replacing or fixing the leaking instrument feedthroughs. Information from the vendor regarding the results of the first tests of their fix should be available by the end of March. As everyone involved already knows, working through the chain of subcontractors will require vigilance. The feedthroughs, and hence cold compressors and 2.1 K operations, remain a major schedule risk.

Integrated testing of the superconducting linac cryomodules should begin soon to provide a focus that would bring together the systems, documentation, training, data acquisition and analysis that will be needed to test and commission the superconducting linac. The SNS is developing plans for cryomodule testing that do not rely on the full CHL because of the delays and risks discussed above. These plans differ depending on whether 4.5 K liquid is available from the CHL and on whether or not the temperature is lowered to 2.1 K by pumping on the liquid helium. The simplest configuration would use local, stand-alone dewars and test at 4.5 K only.

Early, integrated cryomodule testing is important. We recommend proceeding with the plans and long-lead-time procurements for the stand-alone tests even though it will be unclear for several months whether or not one needs the dewars for a 4.5 K liquid helium supply. Use of the CHL for 4.5 K helium supply is preferable when it becomes available, but it would be prudent to have the capability for rapidly establishing stand-alone testing. Supplies of helium from dewars would allow the cryomodule testing to proceed, and it could provide valuable additional time to commission and gain operating experience with the CHL before it becomes critical for the accelerator and for accelerator operations.

A great deal would be learned from tests at 4.5 K, but 2.1 K is required for measuring the high gradient performance. We recommend that the SNS also proceed with 1) the procurement of a 3 - 5 gram/sec at 30 torr pump for 2.1 K testing and 2) plans for installation of such a system. Whether 4.5 K helium comes from CHL or from dewars, it is likely that one will want to do some 2.1 K cryomodule tests before the cold compressors are commissioned and operating procedures refined.

Cryogenic work and the schedule for CHL commissioning is limited by funding and manpower, and making some overtime available would be beneficial for holding the schedule during the upcoming commissioning period.

Accumulator Ring

The Ring is becoming a reality at ORNL after years of excellent work by BNL. The BNL effort on SNS is scheduled to end in a little over a year. People have been rolling off the project as jobs have been finished. The level of effort is dropping and is currently about half of the peak of ~95 FTE's. It is crucial for BNL and ORNL to coordinate closely so that the remaining work is finished efficiently. The formation of a Ring diagnostics plan discussed below is an example of such needed coordination. Other than the recent attention in this area, the committee does not perceive other issues with the HEBT-Ring-RTBT that need unusual attention at this time.

HEBT, Ring and RTBT Installation Progress - The progress in these areas is very impressive. The extensive magnet measurements and sorting at BNL are 90% complete and in line with the installation schedule. The HEBT line and injection beam dump line are nearing completion, with sections under vacuum. The early delivery of magnets from BNL to ORNL for installation in the Ring serves as an outstanding example of coordination between the two labs. This has resulted in a smooth transition of responsibilities and equipment. At the moment twenty-four of the thirty-two half cells for the arcs have been delivered and six have been set and aligned. Delivery of all components for the four straight sections is next, including the diagnostics and the specialty devices. The final components, mostly for the RTBT, are to be delivered in FY05. Fabrication, procurement, delivery and installation of the corresponding power supplies appear to be in good shape. Areas have been identified that could delay installation and these include the ring diagnostic and radio frequency systems. Delivery of these systems is now being re-planned to ensure the smooth continuation of installation. The production extraction kickers are soon to be modified to restore the low impedance, ground plane geometry used in the prototypes.

Magnetic Measurements - The magnet measurement groups at BNL and ORNL continue to identify and solve problems. The BNL group found unacceptably high multipoles in the 30Q58 and 30Q44 quadrupoles. The problem was traced to a manufacturing error which allowed the coils to shift position under their own weight. This was solved by inserting shims which prevent this motion. The ORNL group has observed magnet to magnet variations in the 21Q40 quadrupoles which are not understood at this time. A pair of these magnets is being sent to BNL for further analysis. The BNL measurements of the chicane magnets were presented, and they are as expected from the design. The next measurement on the chicane is to characterize the field angle at the point where the electrons are to be stripped from the H-minus ions. This angle is critical for transporting the electrons to their dump.

Accumulator Ring RF System - There has been good progress on ring RF : one complete high power chain (cavity, power amplifier and power supplies) has already been delivered to ORNL last October. The plan is for all systems to be delivered to ORNL by September. The LLRF basic functionalities have been demonstrated in a preliminary way on a prototype board. Complete testing of I/Q control and dynamic tuning should be done as soon as possible with the final boards and with the power amplifier because of its non-linearities. Running and studying the complete, dual harmonic system is recommended soon after installation in the tunnel even though single harmonic operation is adequate for CD-4. Final commissioning of the system requires high beam current in the ring when there will be heavy beam loading in the first harmonic cavities and lower loading for the second harmonic system. Adaptive feedback control is a refinement of the LLRF and would probably be best tested with beam.

The RF cavities and ring diagnostics are located in the same straight section, and interferences would not be surprising. We recommend injecting RF pulsed power in the cavities as early as possible to investigate possible parasitic couplings.

Ring to Target Beam Transport - The arrangement of quadrupoles near the spallation neutron target has now been finalised, together with the diagnostic requirements for defining the beam spot on target. Steering of the beam is used in the RTBT to limit upstream halo loss and keep the beam spot center within ± 2 mm of the target front face center. Remote handling needs of the RTBT and target interface are being evaluated. It is suggested that this topic be presented at the next ASAC meeting in September.

Accelerator Physics, Application Programming and Preparation for Commissioning

The SNS accelerator physics group is a strong team that is focused on preparing and conducting the SNS commissioning, for which it plays a leadership role. It has strong members, and it possesses both the competence and expertise to address all the problems that will likely be encountered. The group is committed to a variety of diverse tasks, e.g., application programming, operation, area supervision, damage-threshold calculations, etc., that go far beyond the usual concept of accelerator physics. Therefore, the limited staff level may prove a challenge during the future commissioning.

The accelerator-physics preparation of commissioning and later operation is well advanced. Commissioning simulations are performed that model optics measurements, matching, and the correction of optics errors. Promising results are obtained. These simulations are also used to test, develop and debug application software which will be employed in the commissioning. Most simulations of this type do not exploit the advanced features of the ORBIT code, and could as well have been done with conventional programs. For the questions addressed this might be adequate.

The simulations of space-charge effects and inductive impedances are impressive. They almost perfectly reproduce observations of persistent 200-MHz structures and longitudinal microwave instabilities at the Los Alamos PSR. These simulations provide an invaluable code benchmarking. Achieving a similarly accurate model for the SNS ring is a clear goal for the future.

The application programming is in a formidable shape, furnishing an environment that will greatly facilitate commissioning. Highlights on application programming include online models, online matching, one- and two-dimensional scans, correlation tools, SNS-specific scope application, machine protection system, save-restore option, electronic logbook, and beam-loss viewer. The XAL interface allows for an easy access and a high flexibility. We were pleased to see that accelerator physicists will be able to easily write and add their own applications. This is extremely rare and will be a great benefit.

Other studies in the last months have investigated damage thresholds and the effect of the magnetic chicane on the ring optics. The latter was found to be small, even when the measured multipole fields were taken into account.

Concerning conventional instabilities in the ring, the committee still recommends to plot analytical complex stability diagrams, including the effect of space charge, together with the expected coherent tune shifts for different times in the cycle, e.g., at injection, halfway through injection and at extraction. Such an analytical approach would permit a fast assessment of Landau damping, and it could guide strategies for beam stabilization, e.g., by adjusting chromaticity, nonlinearities, coupling, or the painting scheme. It is an established and fast treatment that would be complementary to ORBIT simulations. As a low-priority item, the accelerator physicists might want to contemplate whether resistive-wall waves traveling at low velocities could be important for the SNS ring (see, e.g., M.M. Karliner et al., Proc. EPAC96, p.1247).

Presently available predictions for the onset of electron-cloud instability in the SNS ring should not be considered reliable even though many countermeasures have been implemented. For this reason, continued study of the electron cloud effect is important. There have been detailed simulations of electron-cloud build up and the effects of various remedies using the BNL code CLOUDLAND. This code represents the state of the art in electron-cloud modelling and is superior to similar programs at CERN, SLAC or LBNL. It represents an important asset for the SNS project. The code employs a combination of cloud-in-cells particle simulation and finite-element method. It is the only existing electron-cloud program that is fully three-dimensional and can handle arbitrary complex boundaries.

Simulations for the SNS so far have studied the effect of uniform and symmetric or antisymmetric periodic solenoid fields, and of infinitely long clearing electrodes. They revealed interesting novel phenomena such as “polarization” and “half-frequency multipacting”, and they determined optimum clearing voltages. We recommend performing more detailed simulations that model electron cloud evolution for the exact three-dimensional geometries and electromagnetic field patterns of various key regions of the SNS ring. Such key regions are:

1) the area around the stripping foil, where the electron flow could possibly be optimized.
2) the collimator region with its actual geometry, assuming realistic spatial and energy patterns of primary electrons generated by scraped protons and considering the real solenoid configuration
3) the region around a beam position monitor and the effect of a bias voltage on the electron-cloud build up, especially the longitudinal distance over which the clearing by a biased beam position monitor would be effective and the optimum voltage for the three-dimensional case.

The coordination of electron cloud studies between BNL and ORNL could be improved. In particular, the CLOUDLAND code should be preserved and maintained at ORNL when BNL leaves the project. The practicality of ultimately implementing some of the CLOUDLAND algorithms into ORBIT should be explored.

The committee encourages the accelerator-physics group to pursue its admirable efforts for the near-term commissioning. It also supports, time permitting, that a limited level (perhaps 10-20%) of activities be directed towards the longer-term performance and to more fundamental questions. Cultivating beam-dynamics competence and maintaining a certain far perspective will be a good basis for understanding and overcoming limitations that will certainly be encountered as the beam intensity is increased.

Diagnostics

The diagnostics work to date has been impressive in terms of technical sophistication and delivery and availability for beam commissioning. The challenges in the immediate future will be to install and commission the diagnostics that are needed for the beam commissioning of the linac and accumulator ring.

It is important to assess diagnostics performance vs. accelerator physics requirements. A first comparison was presented at this meeting, but it was preliminary and limited. Such comparisons are a good way to track and summarize diagnostics performance, and we would like to have an update at the next meeting.

There was a meeting of the Diagnostics Advisory Committee in early February that identified serious shortcomings with the Accumulator Ring diagnostics. High priority diagnostics needed on the first day of beam in the ring were not receiving needed emphasis and attention, and the planned delivery schedule did not match the needs for installation, cabling, debugging, etc. The committee report contains details and also points to underlying causes of poor communication between BNL, where the work was being done, and the SNS. They strongly recommended that this problem be addressed and that BNL and SNS develop a mutually agreed upon plan. That plan should include a schedule for 1) the delivery of the highest priority diagnostics needed on the first day (beam position monitors, beam current monitors and beam loss monitors), and 2) the delivery of the vacuum components of other diagnostics systems even if the electronics and software for them had to be postponed. We concur with those recommendations.

The ring diagnostics are receiving increased emphasis at BNL, and there are active discussions between BNL and SNS that will lead to a plan meeting the objectives above. That plan will be finalized by the end of March. We endorse these recent developments, and we emphasize the importance of meeting the SNS installation schedule and having working diagnostics at the start of ring commissioning.

Controls

There were no plenary presentations for the Control system, but there were presentations to and discussions with a subset of ASAC to bring us up-to-date on the issues of current importance.

Controls installation is proceeding well. The Global Controls and the Process Controls Installation as well as the Process Controls Software are on time and are expected to proceed without problems that would impact schedule.

Progress has been made on improving network security for nodes residing on the Accelerator Controls Network, which is managed by the controls group. (The diagnostics group has authority for computers used for diagnostics.) A method of registering hardware addresses for all devices being attached to the network is being implemented, and blocking of unregistered devices is being discussed and should be implemented. Virus protection planning is in the early stages of development. Linux patches are sporadically installed. With the number of linux systems at SNS consideration should be given to implementing an SNS patch server. There is a DOE wide linux licensing initiative that should be investigated by SNS. Additional resources should be taken to add system configuration control for all devices attached to the Controls network. Configuration control implies that all devices are at a known and recorded hardware and software level and that software images are virus free.

The Controls group has done an extensive study of IOC performance issues. There are several matters involved. These are understood and can be mitigated. The situation is well under control.

Many of the hardware devices being delivered to the SNS by the collaborating laboratories are run by embedded software. These devices include Programmable Logic Controllers (PLC), Field Programmable Gate Arrays (FPGA), (DSP), etc. The SNS will have to be able to program and modify these devices. The code for these devices will have to be placed under or continued to be under configuration control. This will take resources and commitment. There are already cases of groups wanting PLC code changes on delivered devices. In some cases the SNS group responsible for the device does not have the expertise to make the modification.

Topics for the Next Meeting

The next ASAC meeting has been scheduled for September 27 – 29, 2004. We would like to hear presentations on the following at that meeting.

1) Comparison of achieved diagnostics performance with accelerator physics requirements.
2) Status of the MEBT chopper.
3) Performance of the Resonance Control Cooling System.
4) Remote handling needs of the RTBT and target interface.

Spallation Neutron Source ASAC Review
March 9 - 11, 2004

Tuesday March 9

8:00	Closed Session	
8:30	Welcome, Charge and Project Status	T. Mason
9:00	SNS Accelerator Systems Overview	N. Holtkamp
9:45	ORNL ASD Resources, Installation and Progress	D. Olsen
10:15	Break	
10:30	Accelerator Physics Overview	S. Henderson
11:15	DTL Conditioning, Readiness and Operations	G. Dodson
11:40	H- Ion Source and Test Stand Progress	M. Stockli
12:05	Lunch	
1:05	Final DTL Tank #1 Commissioning Results	D. Jeon
1:30	Beam Diagnostics Commissioning Results	S. Assadi
1:55	Application Programming	J. Galambos
2:20	Break and Questions	
3:00	SNS Site Tour	
5:00	Closed Session	
7:00	Review Dinner	

Wednesday March 10

8:00	Closed Session	
8:30	LANL Linac Overview and Progress	D. Rej
9:00	DTL installation	P. Gibson
9:20	CCL installation	G. Johnson
9:40	DTL-CCL tuning	C. Deibele
10:00	DTL and CCL Commissioning Plans	S. Aleksandrov
10:20	Break	
10:35	Cold Linac Overview and Cavity and Cryomodule Production	C. Rode
11:05	JLAB Cavity Performance Analysis	J. Delayen
11:30	ORNL SRF Activities	I. Campisi
11:55	Cryo Plant Progress and Commissioning	D. Richied
12:20	Lunch	
1:20	High Power RF Components	D. Rees
1:45	HVCM Progress	D. Anderson
2:10	HPRF Installation, Testing and Commissioning	R. Fuja
2:35	Break, Questions, and Closed Session	
2:50	HEBT-Ring-RTBT Overview and Progress	J. Wei
3:20	Ring Diagnostics Installation and Commissioning Plan	T. Shea
3:45	SNS Ri9ng Diagnostics Systems	T. Russo
4:10	Breakout Session – Ring Diagnostics	
4:10	Breakout Session – Cryomodule	

Thursday March 11

8:00	Closed Session	
8:30	HEBT-Ring-RTBT Installation Progress	M. Hechler
8:55	Magnet Analysis and Engineering Support	D. Raparia
9:20	HEBT-Ring-RTBT Construction Status	W. McGahern
9:40	Break	
10:00	Ring RF System Progress	T. Owens
10:20	RTBT-Target Interface	M. Plum
10:45	Calculations in Preparation of Ring Commissioning	S. Cousineau
11:10	Closed Session and Lunch	
1:00	Closeout	
2:00	Departure	