National Synchrotron Light Source II

November 2013 Activity

The site at the end of the last workday in November after heavy winds and rain passed through the area.

report due date:
December 20, 2013

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OVERALL ASSESSMENT

The National Synchrotron Light Source II Project continued to make excellent progress, with the start of injector commissioning on November 27. This was preceded by a rigorous Accelerator Readiness Review (ARR) November 4--7, which resulted in 12 prestart findings that were addressed by November 22. It was the culmination of an enormous effort and validated the conformance of our injector commissioning program with the requirements of the Accelerator Safety Order. In essence, the ARR team judged that our processes, hardware and people are in place and ready for the safe and effective commissioning of the NSLS-II linac and booster. Injector commissioning is expected to last into February 2014, and preparations have started for the storage ring commissioning Instrumentation Readiness Review and ARR.

For the NSLS-II project, November saw a schedule variance of $2.5M for a schedule performance index of 1.51, primarily representing work performed later than originally planned in the accelerator area. The cumulative schedule variance is -$23.5M with an SPI of 0.97. This is down from $25.9M$ in October, and the current EAC of $900.8M represents a growth from October of about $51K. These are all indications that the project is 'catching up.' The current schedule shows a completion of all project scope by the end of September 2014, with 9 months of float to the CD-4 milestone.

The project is scheduled for a DOE 'mini-review' on December 4.

UPCOMING EVENTS

DOE 'Mini-review' of NSLS-II Project	Dec 4
EPICS4 Area Detector meeting	Dec 4–6
FDR for the HXN Endstation Vacuum Enclosure	Dec 5
NEXT Project Final Design Review	Dec 11–15
PS Science Advisory Committee meeting	Dec 18–19
SR Instrumentation Readiness Review (IRR)	Jan 6-10
SR Accelerator Readiness Review (ARR)	Feb 18-21

Figure 1. BtS Transfer Line Phase II (TL-II) with shielding Installed.

ACCELERATOR SYSTEMS

Magnets. All 90 fast correctors are assembled and tested, and 76 have been installed in the SR (storage ring). The rest are awaiting installation of the straight sections and bake out.

Radiation shielding. All BtS TL (booster-to-storage ring transfer line) shields have been installed (Fig. 1). Installation of the G4 and G6 dipole shadow shields is in process. Installation of the injection straight shielding hardware and supports has started, with the actual shielding to be installed in December and January. Parts have been ordered for wall and mezzanine shielding for the C (cell) 24 RF straight. Shielding installation at the C22 RF straight wall penetrations is partially complete.

Vacuum. The C24 straight was pumped down and reached 10^{-9} Torr vacuum after the installation of the 7-cell cavity. Many insulating vacuum lines were leak checked, with a few leaks found and repaired. The C30 straight was assembled with two downstream kicker chambers and three BPM (beam position monitor) chambers. The C30 Synchrotron Light Mirror (SLM) line was assembled and is ready for bake. Cells 03 and 11 were assembled with Day-1 chambers and prepared for bake. The C08 straight was installed with NEG-coated damping wiggler (DW) chambers and is awaiting special RF bellows with thermocouples.

The last BtS TL-II section was assembled with drift pipes. The Hot N2 flush work permit was approved and will first be tested at BST-II. The No. 3 and 4 ceramic chambers have arrived and been leak checked. All front-end (FE) vacuum PLCs are installed. Modification to read the fast valve sensor through programmable logic controllers (PLCs) and EPICS has started. Five of eight FE vacuum cables were terminated. The exit port pumps and gauges of these FEs are being powered up. All injector vacuum devices at EPICS were reviewed and updated with correct pump size and set points, and are ready for beam commissioning. Documentation and procedures for the SR IRR (instrument readiness review) are progressing well, with more than 50% of the documentation completed and approved.

Power supplies. The Main Dipole power supply was tested to full operating current for 3 hours and is ready for a longer heat run.

Regulators for the fast correctors and 35 mm dipole trim coils are being configured and tested. We have tested 70 percent of these regulator chassis and have installed regulators in two pentants so far. The production AC powered amplifiers are beginning to arrive at BNL. The first production units had some minor wiring problems requiring correction. The corrections are being undertaken. . We have about 25% of the production run at hand.

EPS & PPS. In the period between the ARR and the start of booster commissioning, pentants ("P") 1 and 2 were configured and tested in their final configuration, including the integrated Area Radiation Monitors (ARMs). The P1 and 2 personnel protection system (PPS) was configured back to the temporary configuration needed for booster commissioning. The P1 and 2 PPSs were re-certified and are ready for booster commissioning. Work continues on software integration and testing for P3, 4, and 5. The interlock group also is recon-

figuring the main dipole and RF critical devices. Their programming will be incorporated in the PLCs for P3 and 5, which required connecting the hardware located in P1 and 2 to different pentants—work that continues. Job shop technicians are continuing to build PPS PLC panels for the project beamlines. Much of the conduit work has finished on the hutches; some recent changes for water flow and vacuum PPS interlocks are being accommodated. Technicians have started the electrical connection to the flow meters.

Mechanical utilities. The deionized water (DI) piping to the C24 RF straight is tied in and pressure tested. The cooling tower piping reinstallation is complete; system cleaning and filling will start in early December. Capillary tubing installation is in process in the SR tunnel; P1-4 are complete; P5 is in process (20% complete). The P1 and 2 aluminum pump skids are running; Ps 3–5 need to be flushed and pressure tested. A contractor will start in December to begin programming the aluminum pump skids and finish programming the copper pump skids. DI water tie-ins are needed at the SLM beamline and scraper. The P5 PCHW heat exchanger needs to be repaired; the P5 racks are currently being fed from P1. Required tagging for the mechanical utilities is in process. The piping to the C5 SR tunnel for the SRX chiller will start in December.

Electrical utilities. AC tie-in of the injector berm lighting is complete. The cable tray installation for the IVUs and EPUs is complete. The AC power work for the aluminum pump skids is finishing. The AC power work on the mezzanine for the IVU and EPU racks is in process. The installation of the front end interlock boxes is complete.

Figure 2. Cell 28 damping wiggler straight.

Insertion devices. The C5 ID straight (SRX) floor preparation continues. The 1.5 m IVU for C5 has arrived and will be moved into the magnetic measurement lab in early Dec. The C8 DWs have been transported to Service Bldg. 3 and will be installed in late December, after chamber bakeout is complete. The sixth DW is finishing in the magnetic measurement lab. The C18 DWs will be installed in mid January.

Front ends. Flow testing was performed and flow restrictors will need to be added. Compressed air tie-ins of C5, 10, and 11 are complete. The photon shutters have been removed for wiring modifications. Plumbing work in the C8 and 18 FEs began.

Installation of the drift pipes (in place of the slits) is in process. The C8 mask has been installed. Bellows installation in P1 and 2 will follow the survey. Wiring is in process on the photon shutters and safety shutters. A test bakeout will be scheduled on one front end before commissioning begins. Outstanding hardware includes the ratchet wall collimators, slits, slit stages and burn-through devices.

Figure 3. CSX front end at Cell 23.

Survey. Profiling of the SR magnet/girders is complete. Survey of the correctors and BPMs is underway (P1 complete, P2 in process). Other survey work included the injection straight, FEs, 1.5 m IVU, ID straight sections, and installed DWs.

Vacuum. Bakeout of the vacuum straights continues (cells: 30 of 30 complete; straights: 24 of 30 complete). Bakeout of the C3 HXN straight is complete (Day 1 chambers). The C11 CHX straight will be baked in early December and the cell 8 DW straight in mid-December. The Day 1 vacuum chamber will be installed in the C5 SRX straight, but not conditioned. It can then quickly be removed when the 1.5 m IVU is ready to be installed in late January. The C18 DW straight has vacuum chamber stands installed; chambers are due in mid-December. Installation of the vacuum chamber in the C22 straight is in process. The vacuum chamber cooling lines have been pressure tested in the C28 DW straight.

The installation of chamber cooling lines continues in P3–5. The C24 RF straight is now under vacuum. The P1 and 2 aluminum system flow testing is complete.

Diagnostics & instrumentation. Rework of the SR RF BPM receivers is in process (P1–3 are complete; P4–5 are underway). Installation of the SiO_2 cables for the SR BPM pick-ups is in process. Installation of the SiO_2 cables in the injection straight will be starting. The PTC (pilot tone combiner) boxes need to be installed in the C28 DW straight.

The BPM/canting magnet stands are being installed. Work is starting in C16 for the tune monitor system.

RF. Assembly of the SRF Cavity is waiting for the official finding on misalignment of the short string to helium vessel bolt-ups. The second cavity's installation to the vertical test top plate will continue in December.

The LN2 system commissioning is finishing and commissioning will begin January 2. The cryo system vent line design in C24 is being finalized; installation will be in late February, pending access. Installation of the warm cavity is finishing; the wiring is complete. The Landau cavity has arrived and been transported to the RF cleanroom. The beneficial occupancy walk-through of the cleanroom has been performed with minimal pre-starts. The cleanroom will be inspected for certification in December.

Integrated testing. We have finished high-current testing in P5. We also have retested P1 after roof deck painting that lasted almost 8 months. We need to start running all five pentants at the same time. There still are a number of leaks from the water isolator block. We have completed polarity testing for the multipole and correctors in P1. We have started testing P2 and should finish in the first week of December. We have done a preliminary polarity test of all the dipole magnets, but did not perform a formal test because of the water leaks.

Commissioning. For the past weeks the linac has been operating well, delivering 200 MeV beam within the required parameters. During the past two weeks of commissioning, injection into the booster has been established by tuning the injection-pulsed magnets around their design setpoints. Optimization of the charge transport efficiency from the LtB (linac-to-booster) through the booster injection system is within reach.

The beam diagnostics systems were commissioned with the beam. Booster BPM controls and timing were optimized, and we now clearly see the beam trajectories throughout the ring. The booster DCCT (direct-current current transformer) was tested and provides reliable signal of the beam intensity from injection into the next cycle.

After the machine lattice is optimized, the beam "lives" in the lattice for hundreds of milliseconds. In the past few shifts we turned on the 500 MHz RF cavity and captured beam in the RF bucket. Now the beam circulates in the booster for the whole cycle. In the meantime, we are focusing on optimizing injection efficiency, understanding and improving beam lattice and orbit, minimizing energy jitter, and improving the reliability of injector pulsed magnets.

In accordance with the Commissioning Sequence, we commenced radiation fault studies in preparation for the next stage of commissioning: beam acceleration to the nominal energy of 3 GeV.

EXPERIMENTAL FACILITIES

Experimental Facilities continued to make good progress in November. Overall, the beamline utility installation is estimated to be approximately 90% complete, and component installation is now underway at all project beamlines. CHX beamline components have been received and installed, including the high stability mirror, all supporting infrastructure, slits, vacuum systems, and radiation safety components (masks and collimators). A second component delivery including the monochromator(s), cryocooler, and beam transport is now scheduled in Feb 2014. The CHX diffractometer was also installed and interfacing to NSLS-II control systems is underway. The HXN collimating mirror has now been recoated and inspection at the vendor site indicates the re-coating has been successful. The mirror will now be shipped to BNL where the mirror chamber has already been installed and is prepared for the mirror installation. At XPD, the beamline components installation is approximately 85% complete, the monochromator Factory Acceptance Test was completed and the unit was shipped to BNL. All major components for the IXS high-resolution monochromator have now been delivered, and assembly is in progress. The vacuum chambers are being tested at the vendor and delivery is expected next month. And at CSX, the M3B and M1A mirror systems and optics were installed, vacuum transport section for the polarization branch has begun installation, and the prototype of the CCD detector was installed in the endstation control rack where the controls group has begun to fully integrate this into the control system.

While activities in Experimental Facilities are making very good progress, there are a few areas with delays. Mirrors for several beamlines have delivery delays due to fabrication problems. The vendor for the SRX K-B mirrors had problems with instrumentation for figuring these mirrors which has caused a delay in the fabrication of both K-B mirror pairs. The figure of the vertical focusing K-B mirror for IXS has not yet met the specification, so the vendor is continuing to work at the final polishing steps to improve the figure needed to achieve our performance expectations. And the CSX torroidal mirrors for the polarization branch are delayed to allow the vendor the opportunity to correct problems with the repeatability of the positioning mechanism. At this time, these delays are not expected to impact the readiness of the beamlines to begin commissioning when the x-ray beam is first available.

CHX. The CHX beamline proceeded with one of the most significant milestones: the delivery and installation of the first set of components included in the optics package. This includes all the support structure: two massive granite blocks, a smaller granite support and two optical stands; a high-stability mirror system, high heatload slits, safety components; a tungsten bremsstrahlung collimator and bremsstrahlung stop and a number of smaller beam transport components. The installation of the CHX equipment on the experimental floor (see Fig. 4) proceeded smoothly under the direct supervision of the work control coordinator working

with the team from Bruker GmbH and with the great support of several NSLS-II support teams (rigging, survey, etc.).

Prior to the start of installation, all work on the utilities was completed inside the FOE hutch and continues now on the mezzanine (hutch roof).

In parallel with the installation of the optics package, the CHX team held successful FDR meetings for the Transfocator contract with JJ X-ray and the SAXS table with BNB Inc.

Figure 4. image recorded from the web camera installed in the 11IDA (CHX FOE) hutch showing the first part of the beamline optics installed on the experimental floor.

CSX. During November the M3B and M1A mirror systems were installed at CSX. The optics, having been measured by the BNL metrology group, were installed by FMB-Oxford personnel. The installation of M3B was finished and FMB-O will return to finalize M1A in January of the new year. CSX technicians started installing the vacuum transport section for the polarization branch of CSX, which is now ready for termination of the vacuum control cables. The prototype of the CCD detector was installed in the CSX endstation control rack and the controls group has begun to fully integrate this into the control system. The beamline IOCs were installed and all configured.

HXN. The HXN team completed factory acceptance testing of Phase 2 HXN Beamline Component Package. In addition, Phase 3 HXN Beamline Component Package was awarded. New cooling braids are now installed in the HXN monochromator and vibration sensors are fully tested. Three papers by the HXN team were accepted for publication, including a journal paper demonstrating 11 nm focus by MLL, which is an important milestone indicating that the HXN beamline will be able to deliver its initial goal of 10 nm focus.

IXS. Utilities installation has made tremendous progress in Nov. All mechanical utilities inside the FOE, B, C, and D hutches are now completed. All cable trays have been installed throughout the beamline and electrical installation has begun for the FOE and B hutch and is making excellent progress. A plan is in place to complete all utilities installation in December prior to the installation of beamline equipment.

All major components for the Harmonic Rejection Mirror system (HRM) except the vacuum chambers have now been delivered. Assembly of components is in progress (Fig. 5). The vacuum chambers are being tested at the vendor (Ability) site, and delivery is expected in December once the chambers pass the leak test. Installation of the HRM on the beamline is now planned for January.

The delivery of the KB mirrors and benders is postponed to late December to give more time to Winlight to improve the figure error of the VFM, which is not yet within specification. The FAT for the beamline optical component package by Bruker is postponed to next February due to delay in the delivery of the DCM components from their subcontractors. These delays are expected to have minimal impact on meeting the early completion date of the beamline.

The development of the IXS spectrometer is in progress according to schedule. The FAT of the base mechanism will be held in December and delivered is planned for next February. The PDR for the Montel mirror positioning mechanism was held on November 15. The contract for the analyzer and Montel mirrors was awarded to GNB on November 19. The analyzer mechanism will be developed in-house and the detailed design has begun.

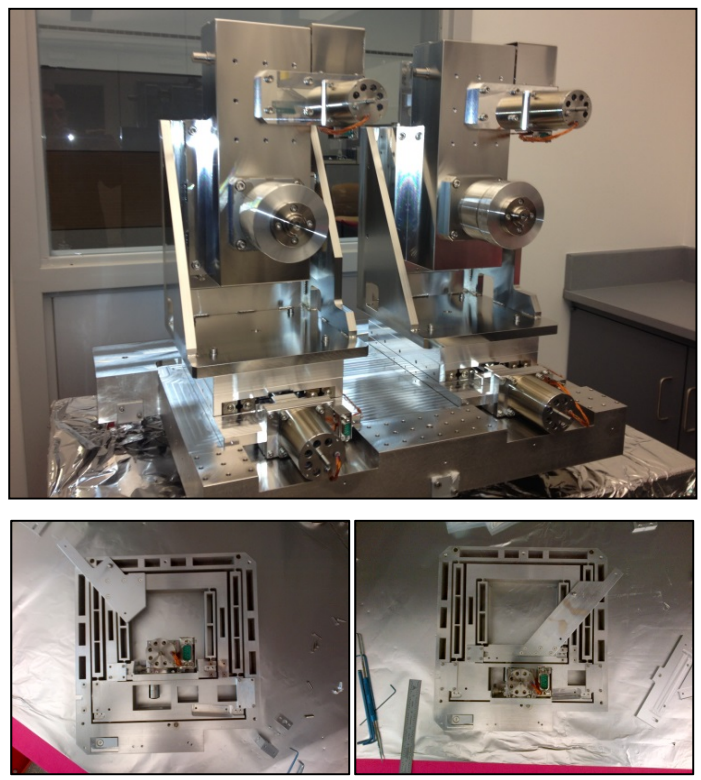


Figure 5. High-precision goniometers assemblies (top) and double flexure stages (bottom) being assembled for the IXS HRM.

SRX. The SRX team continued to stay in close contact with the suppliers Bruker-ASC, manufacturer of the SRX Optical Package, and WinlightX, manufacturers of the SRX KB Mirror System. Bruker continued to work on the manufacture of all accepted parts. Base plates for the large granite table supporting the horizontally focusing mirror and the monochromator have been surveyed, mounted and grouted in place in the 5-ID-A hutch. Bruker continued to work on the double-crystal monochromator. Due to serious engineering problems with the brazed parts for the cryo-

cooling, a factory acceptance test had to be re-scheduled for January. WinlightX has made progress in mitigating the delays encountered in deliveries of the necessary invar parts. A factory visit for monitoring the progress on mechanics, vacuum, and optics is scheduled for December. The SRX team continues to closely monitor the advancements in the work of both vendors. In parallel, work on the controls, data management and on the end station sample stages is ongoing.

XPD. The FMB-O team was at BNL November 4–5. Major tasks completed (Fig. 6) include the pre-survey, fiducialization, installation, and alignment of the second bremsstrahlung collimator and of a diagnostic module (BPM and White Beam screen). The floor plate for the Laue-Laue monochromator (DLM) is grouted in place (Fig. 7).

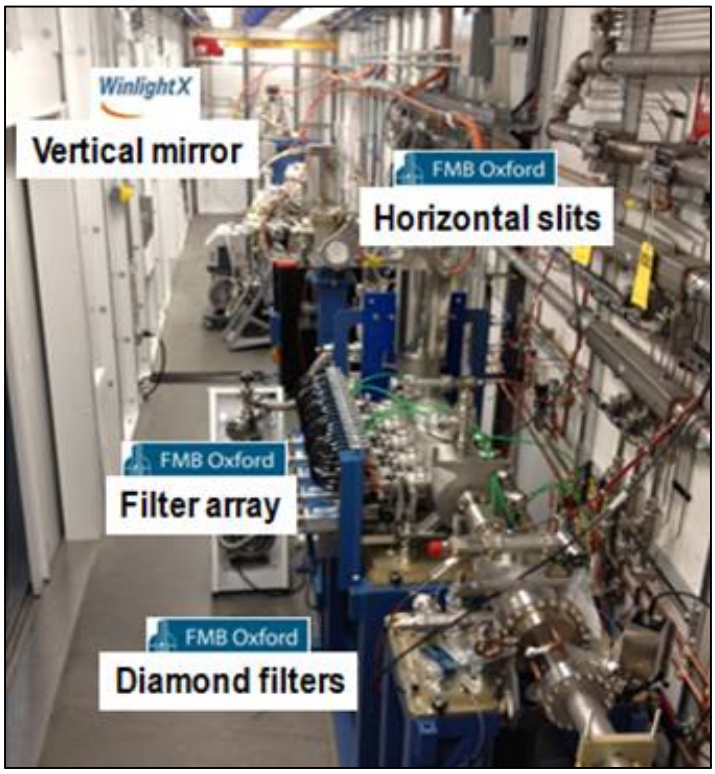


Figure 6. Photon Delivery System and utilities in hutch 28-ID-A (Optical Enclosure).

Figure 7. The monochromator will be mounted at this location on the steel floor plate grouted into position. There is adjustment at the base to fine-position the granite on the steel plate.

The factory acceptance test (FAT) of the DLM took place the week of November 4. The DLM was dispatched from FMB-O November 28 and is expected to arrive at BNL on or around December 16. Installation is currently scheduled for the second week of January 2014. The cryocooler is being tested at the FMB-O factory.

XPD diffractometer equipment was delivered to BNL on November 11, and The FAT report was sent on November 14. Everything is ready for installation in hutch C on starting December 2.

The mechanical utilities for the XPD lead/steel enclosures 28-ID are finished, and of process chilled water to racks is underway. A manufacturer has been identified for the multi-analyzer crystal x-ray detector and the contract is being processed, long lead-time procurements and fabrication of the various subsystems for the XPD robotic sample manipulator have started, and the x-ray flat panel detector has been completed and is being used at the NSLS.

COST AND SCHEDULE BASELINE STATUS

November's current-period schedule variance (SV) for the overall project was $ 2.5M with an associated schedule performance index (SPI) of 1.51, due primarily to work done later than planned in Accelerator Systems SR Installation and Insertion Devices. The cumulative SV is (-$23.5M), with an SPI of 0.97, for green status.

The current-month cost performance index (CPI) for the NSLS-II project in November was 0.80, (-$1.9M), red status, due primarily to timing of accruals for Experimental Facilities beamlines HXN and CXS, and IDs. The cumulative cost variance (CV) is (-$10.5M), with a cumulative CPI of 0.99, green status. The cumulative CV is due primarily to Accelerator Systems Division (ASD) cost overruns in the Injection System, Storage Ring Magnets, Power Supplies, Controls, Safety Systems, and Installation activities.

For ASD (WBS 1.3), there is a positive November SV of +$2.2M, primarily due to continued positive schedule performance in most Accelerator Systems, as well as a transfer of ID scope from WBS 1.3 to WBS 1.6. The cumulative SV continues to improve at (-$ 10.0M) and an SPI of 0.97. The ASD CV for the month is (-$814K) with a CPI of 0.70, red status, due primarily to ID accrual timing. The cumulative CV is (-$ 14.2M) with a CPI of 0.95, green status.

November schedule performance for Experimental Facilities, WBS 1.4, was positive, with a current-period SV of $223K for an SPI of 1.15, green status. The cumulative SV continues to improve at (-$6.4M) and an SPI of 0.91, green status. The current-period CV is negative at (-$1.83M) with a CPI of 0.48, red status, and a cumulative cost variance of (-$1.3M) with a CPI of 0.98.

Conventional Facilities, WBS 1.5, schedule performance for November is positive with a current period SV of +$ 96K. The cumulative SV is (-$327K) with an SPI of 1.00, green status. The current period CV is (-$91K). The cumulative CV is (-$1.0M) with a CPI of 1.00, green status.

Pre-Ops, WBS 1.6, has a negative current-period SV of (-$89K), SPI of 0.97, green status, and a positive current-period CV of +$945K (CPI 1.46). The Cumulative SV continues to be negative at (-$ 6.7M), SPI 0.84, with a positive cumulative CV of +$ 8.7M (CPI 1.34). The positive CV is due to continued underruns in Pre-Ops Project Management.

The project was approximately 93% complete as of November 30, with approximately 60% remaining contingency/MR on BAC work remaining. The project EAC is currently reported at $900,795K, against a PMB/UB (Baseline) of $872,696K. This EAC of $ 900,795K is a growth of about $ 51K from the EAC reported in October 2013. The contingency/MR based on the EAC is ~ 42% of the EAC work remaining. Percent complete based on EAC work remaining is ~90%.

The critical path was the same as in October and continues to run through Injector ARR, Booster Commissioning; SR Shielding; Safety Assessment Document/Accelerator Safety Envelope (SAD/ASE) activities for SR Commissioning; IRR/ARR preparation activities for SR Commissioning; SR Commissioning; Insertion Device Installation; Integrated Test and SR Cavity Installation; and Project Closeout activities. There are 9 months of float between the project's August 2014 early completion of original scope (Sept 2014 for all new scope additions) and CD-4.

ENVIRONMENT, SAFETY, AND HEALTH

Significant milestones were achieved at NSLS-II in November following a very successful Accelerator Readiness Review during the week of November 4. The objective of the ARR was to provide assurance that booster commissioning can be conducted in a safe and environmentally sound manner. The ARR was conducted in conformance with the requirements of DOE Order 420.2C, *Safety of Accelerator Facilities*, and consistent with guidance provided in draft DOE Guide 420.2-1A, *Accelerator Facility Safety Implementation Guide for DOE Order 420.2C, Safety of Accelerator Facilities*. The ARR Team found that NSLS-II has in place an appropriate contractor assurance system that maintains an internal assessment process, a facility configuration management program for accelerator safety, credited controls, and appropriate administrative processes related to accelerator safety as required by DOE Order 420.2C, *Safety of Accelerator Facilities*. Led by David Freeman of the Spallation Neutron Source, the ARR Team consisted of twelve individuals with extensive and diverse expertise. Eleven of the members were from peer facilities and one member was from BNL, but organizationally independent from NSLS-II. Observers consisted of representatives from DOE including the Brookhaven Site Office (BHSO) and two representatives from the Fermi Site Office, as well as the BNL Accelerator Safety Officer. The ARR Team reviewed documentation, participated in a video conference held on October 29, and visited the site November 4–7, 2013. In total, twelve actions were identified that must be completed before Booster Commissioning Authorization can commence, followed by sixteen post-start actions. Significant emphasis was placed on closing the pre-commissioning activities. A plan was prepared that included identifying actions to address the finding and a schedule for completion. All actions were completed by November 22 and authorization to proceed with Booster Commissioning was granted by DOE on November 27. Restart of the linac commenced on November 27 and operations continue, to optimize the electron beam. Injection of beam into the booster is expected in early December. One of the key deliverables for completing the Booster ARR pre-start actions was finalization and approval of the PS Conduct of Operations Matrix. The Con-Ops Matrix was approved by BHSO on November 26.

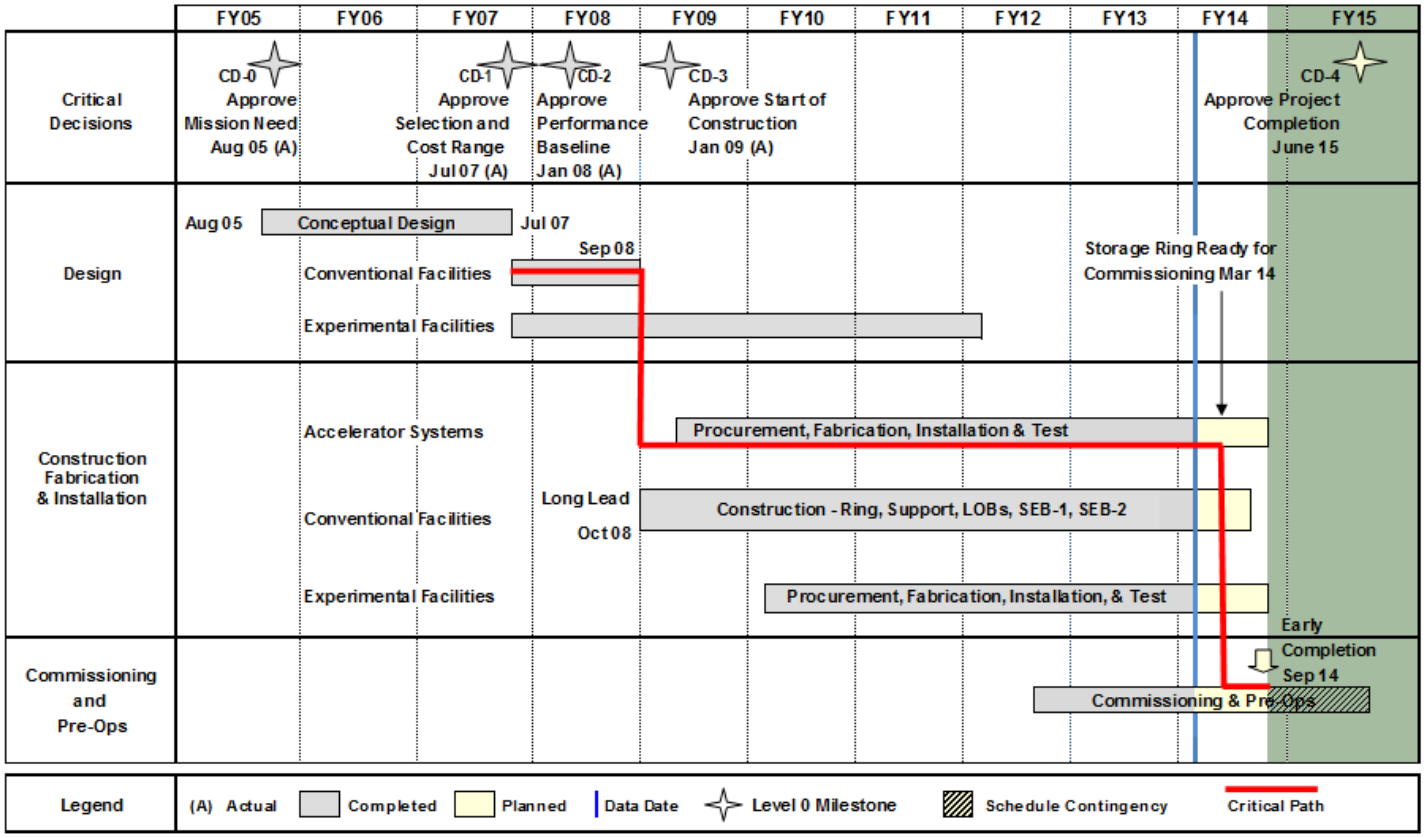
Progress on the construction of the SEB2 building continues, with the main building and roofing steel erection well underway. Safety performance continues to be excellent, with no first aid, reportable, or day-away injury cases reported in November.

ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ACWP	Actual Cost of Work Performed
ARR	Accelerator Readiness Review
ARRA	American Recovery and Reinvestment Act
ASE	Accelerator Safety Envelope
BAC	Budget At Completion
BHSO	Brookhaven Site Office
BNL	Brookhaven National Laboratory
BPM	Beam Position Monitor
BtS TL-II	Booster-to-Storage Ring Transport Line II
CCD	Charge Coupled Device
CD3, 4	Critical Decision-3, -4, etc. (milestones)
CHX	Coherent Hard X-ray beamline
CPI	Cost Performance Index
CSX	Coherent Soft X-ray beamline
CV	Cost Variance
DC	Direct Current
DI	Deionized (water)
DOE	Department of Energy
EAC	Estimate at Completion
ESH	Environment, Safety and Health
EVMS	Earned Value Management System
FAT	Factory Acceptance Test
FDR	Final Design Review
FOE	First Optics Enclosure
FV	Fast Valve
HVAC	Heating, Ventilation and Air Conditioning
HXN	Hard X-ray Nanoprobe beamline
ID	Insertion Device
IPT	Integrated Project Team
IRR	Instrument Readiness Review
ISR	In-Situ Resonant X-ray Studies beamline
IXS	Inelastic X-ray Scattering beamline
LOB	Lab–Office Building
LtB TL	Linac to Booster Transfer Line
OPC	Other Project Costs
ORE	Occupancy Readiness Evaluation
P1, P2	Pentant 1, Pentant 2, etc.
PCHW	Process Chilled Water
PCR	Project Change Request
PDR	Preliminary Design Review
PLC	Programmable Logic Controller
PPS	Personnel Protection System
PS	Photon Sciences
SAD	Safety Assessment Document
SAXS	Small-Angle X-ray Scattering
SPI	Schedule Performance Index
SR	Storage Ring
SRX	Submicron Resolution X-ray Spectroscopy
SV	Schedule Variance
WAXS	Wide-Angle X-ray Scattering
WBS	Work Breakdown Structure
XPD	X-ray Powder Diffraction beamline

The NSLS-II Project is being carried out to design and build a world-class user facility for scientific research using synchrotron radiation. The project scope includes the design, construction, and installation of the accelerator hardware, civil construction, and experimental facilities required to produce a new synchrotron light source. It will be highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. These capabilities will enable the study of material properties and functions down to a spatial resolution of 1 nm, energy resolution of 0.1 meV, and with the ultra-high sensitivity necessary to perform spectroscopy on a single atom.

DOE Project Milestone Schedule



Funding Profile

Funding Type	NSLS-II Funding Profile ($M)											
	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	TOTAL
R&D			3.0	20.0	10.0	2.0	0.8					35.8
OPC	1.0	4.8	19.0									24.8
PED			3.0	29.7	27.3							60.0
Construction					216.0	139.0	151.3	151.4	47.2	26.3		731.2
Pre-Ops							0.7	7.7	24.4	27.4		60.2
Total NSLS-II Project	1.0	4.8	25.0	49.7	253.3	141.0	152.8	159.1	71.6	53.7		912.0

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