

National Synchrotron Light Source II

Project Progress Report

August 2010



August 31: Progress on conventional facilities continues, with siding and roofing installation most visible in this photo.

report due date:
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OVERALL ASSESSMENT

The National Synchrotron Light Source II project maintained excellent technical progress and satisfactory cost and schedule performances. The cumulative cost and schedule performance indices are 1.02 and 0.98, respectively. The DOE Independent Project Review (IPR) was conducted by the Office of Science on August 25 and the committee concluded, "*The overall technical and cost performance is excellent and the safety performance has improved substantially. Schedule performance needs attention and is being addressed.*"

Construction of the ring building continues to make excellent progress without any safety incidents and is on track for beneficial occupancy of the first section of the building in February 2011. With much of the concrete and steel work nearly complete, the work emphasis has shifted to the building envelope and interior. The contract for the Lab-Office Building (LOB) was awarded in late August.

Accelerator Systems progress continued with successful procurement and delivery of major production components. A number of production and final design reviews were completed in August. Schedule delays in the delivery of acceptable first article production magnets, however, continue to be a concern and are being watched closely.

Preliminary design of the six project beamlines is more than 60% complete and engineering designs are on track to issue RFPs for the major long-lead procurement items late this year.

February 2014 remains the projected early completion date, but the critical path for the project has changed slightly, now tracking through the delivery of acceptable magnet first articles. Schedule float for key elements in the accelerator systems is being closely monitored, and potential mitigation plans for schedule risks are being actively discussed.

Activities funded by the American Recovery and Reinvestment Act (ARRA) continue to be on schedule and on budget.

UPCOMING EVENTS

2010 – 2011

ASD Secondary Cooling System Design Review	Sept. 1-2
RF Bellows and Absorbers Review	Sept. 8-9
Earned Value Management System (EVMS) Training	Sept. 9-10
Coherent Hard X-Ray (CHX) Beamline Adv Team (BAT) meeting	Sept. 14
Insertion Devices Review	Sept. 14-15
Inelastic X-ray Spectroscopy (IXS) BAT meeting	Sept. 16
Injection Straight Review	Sept. 16-17
Beamline Adv Team X-ray Powder Diffraction (XPD) meeting	Oct. 6
NSLS-II Conventional Facilities Advisory Cttee (CFAC) meeting	Oct. 5-6
EPICS Collaboration Meeting	Oct. 11-14
NSLS-II Accelerator Systems Advisory Cttee (ASAC) meeting	Oct. 14-15
Experimental Facilities Div (XFD) Prelim Design Rev (PDR)	Oct. 19-20
DOE Review of NSLS-II Project	Nov. 15-18
Project Advisory Committee (PAC)	Feb. 9-11, 2011

ACCELERATOR SYSTEMS DIVISION (ASD)

Three additional first article magnets (two quadrupoles, one produced by BINP and one by Tesla, as well as one sextupole) were completed in early August. The BINP quadrupole finally achieved desired field quality after special shimming, and the TESLA quadrupole is being tested. IHEP sextupole magnets have acceptable field quality and a few more units are planned to be built before series production starts, in order to get the assembly procedure better under control. Danfysik production was fully authorized after partial production started in July and final reproducibility tests on the first article magnets were demonstrated. So far, Buckley Industries has produced two quadrupoles and two sextupoles but testing has not been completed. Delivery of fully acceptable first article magnets in order to commence the start of full production continues to be delayed. Although it has not impacted the overall project schedule yet, the magnet production schedule is being carefully monitored.



Figure 1. Magnet production at Tesla, Ltd.

The production readiness review for the storage ring girders was carried out and the full production of girders was approved. All twelve first article units have been accepted with only minor issues.

Vacuum chamber production progressed well. Fourteen dipole extrusions which had been received earlier were bent, measured, and sent to a vendor for machining. More dipole extrusions produced at an Arkansas vendor were about to be shipped at the end of the month. Six S2E multipole chambers were received after welding at APS. Six S4 multipole chambers have been welded at APS and are under vacuum testing. In addition, nine dipole chambers were received after welding. They have been surveyed and NEG pump assembly

has begun. One prototype S4A inconel chamber magnet was received but returned to the vendor for a weld repair.

Chamber mounting tests were successfully carried out on production girders using prototype stands. Orders for carbon fiber stands for multipole chamber mounting were placed with two vendors.

The delivery of 100 l/s ion pumps continues, while the vendor works to improve the heaters for 200 l/s ion pumps. The ion pump mounting holes on the girders were updated. The first shipment of fifteen ion pump controllers arrived; they are being tested with dummy loads.



Figure 2. Preproduction prototype current regulator board.

Preproduction units of the corrector magnet regulator (dual-channel architecture, Fig. 2) were received, and testing of these units started. The production versions of the single- and dual-channel current regulator designs are completed. All drawings were released and purchase orders (POs) have been submitted for approval.

The designs for power supply components (PSC) and the regulator have been completed, and procurement of the various hardware systems is proceeding as planned. In particular, the PSC hardware tests have been completed and the main and transition boards are ready for production. All changes needed for production have been completed, drawings were released, and the corresponding POs are in the approval stage.

The production of the equipment enclosures by Crenlo/Emcor in Rochester, Minnesota proceeds well. The final design report is expected the first week in September and the new schedule calls for first articles by mid October. The PO for the uninterruptible power supplies has been submitted, with expected first deliveries in February of 2011.

A successful RF Systems Preliminary Design Review (PDR) was carried out, and as a result some significant changes have been made in the linac beamline: adding 20 cm to the low-energy beam transport to allow future development of a chopper for bunch train cleaning, reducing the 2m spacing for a future second linac injection dog-leg, reducing triplet lengths, and adding a third triplet.

The contract for the storage ring 500MHz 310kW RF transmitters was awarded to Thomson in July and is now fully active. A kickoff meeting was held and discussions on the safety system, physical layout, and controls interface have been clarified so that production can start.

Phase glitch problems during frequency jumps occurred with the Agilent master oscillator. This has now been resolved. The design of the master oscillator distribution system has started and parts have been ordered and will be assembled and tested in the laboratory.

The proposals for the damping wiggler design and manufacturing have been received and are under evaluation. The insertion device clean room in Bldg. 832 is now under construction by American Clean-Room. The RFP for the cryogenic plant has been released and the proposals are due on October 15. Release of the RFP for the In-Vacuum Magnetic Measurement System is expected on September 10.

The NSLS 3rd Harmonic Cavity (NSLS-3HC) has been successfully e-beam welded (Fig. 3). The cavity will next be pre-tuned to the operating frequency and the pi-zero mode separation will be set and tuning investigated. An independent weld inspector will visit the Niowave site and x-ray the welds for compliance with ASME code. All weld and braze samples have been prepared and have been tested by the independent laboratory. Results will be written into the weld qualification reports for review by the laboratory safety committee.



Figure 3. Two finished NSLS-3HC SRF cavities.

The model is now mature for the SRX in-vacuum undulator (1.5m long with a 21mm period length and an option for a second cryogenically cooled unit). The design includes subassemblies for the magnet core, the cooling platen, crossover/manifold, coolant/cryogen transfer lines, gap drive assembly and feed-through, vacuum chamber and penetrations/transitions, kinematic differential adjusters, thermal shielding, drive train and bearing system, structural frame, and bucking system.

The booster procurement continues to make good progress. The vendor visited BNL to clarify technical boundary conditions with NSLS-II staff. The preliminary design is advancing as expected, and so far the activities are compatible with the schedule for the PDR at the end of September. The design of the power system for the injection kicker is iterated to take into account improvements suggested in technical discussion with external reviewers.

The design concept for the injection septum is completed and the detailed design of components is underway. The concept of a local DC bump has been integrated into the layout of the injection straight and the needed components have been specified. This will reduce demands on the kicker system.

EXPERIMENTAL FACILITIES DIVISION (XFD)

The Experimental Facilities Division continued to advance the preliminary design for the six project beamlines. Ray-trace drawings for the six beamlines were being completed following completion of the preliminary design layout of the front-end components upstream of the shield wall. Draft beamline preliminary design reports (PDRs) were started for the beamlines. Two Beamline Advisory Team (BAT) meetings were held in August to review and discuss the preliminary designs, one for the Coherent Soft X-ray Scattering (CSX) beamline and the other for the Submicron Resolution X-ray Spectroscopy (SRX) beamline. Preliminary designs of the experimental hutches (radiation enclosures) further advanced in August, with additional details specified. Beamline design and safety reviews are being planned to review major safety parts of the beamline designs in the September timeframe. Preliminary designs for beamline controls and standard utilities layouts are also being finalized.

The Scientific Advisory Committee (SAC) met in August to review the status of the Experimental Facilities, including scope addition priorities for the six project beamlines. The SAC also reviewed 54 beamline development proposals from the scientific community for additional future beamlines at NSLS-II, and provided useful recommendations on the priority rankings of these proposals.

In nanofocusing optics R&D, the plan was finalized in August for the first multilayer Laue lens (MLL) to be grown in the newly commissioned sputter deposition system. This MLL will consist of 6,510 layers of WSi₂/Si with a total thickness of 43 microns, and 5nm outmost zones. This MLL will set a new record for thickness and number of layers. It is also the first test using 4-cathodes (only 2-cathodes were used in past growths).

Figure 4 shows the layout of the Hard X-ray Nanoprobe (HXN) beamline, designed to take full advantage of the MLL nano-focusing capabilities.

Figure 4. Preliminary design of the Hard X-ray Nanoprobe Beamline, a 115m-long beamline with its endstation in a satellite building.

CONVENTIONAL FACILITIES DIVISION (CFD)

Construction of conventional facilities continued to make excellent progress in August, as the ring building workforce is nearing its projected peak. Sitewide, the workforce will continue to grow, with the recent award of the LOB contract and mobilization of the LOB contractor. Overall progress continues to be ahead of schedule and on track for beneficial occupancy of the first building section in early 2011.

The structural steel for the ring building is nearly complete. The only portions remaining are erection of the injection building equipment area and the section of the ring building at pentant 5 that has been kept open for access. These last sections of steel, which will complete the circle of the ring building, are planned to be erected in early October.

Concrete work for the ring building is now more than 85% complete. The only concrete work remaining includes some bypass corridor slabs, exterior retaining walls, and the pentant 5 tunnel and booster ring sections that are being kept open for construction access.



Figure 5. Vehicle tunnel being readied for use during construction.

Excellent progress continues to be made in the installation of utility systems. The inner courtyard mechanical utility installation has progressed sufficiently to allow work to begin on the final sections of electrical ductbank near the service building 1 and the RF area.

Much of the work emphasis now shifts to the building envelope (cover shot). After initial work to confirm all fit-up details for the siding and roofing systems, the building envelope is now making rapid progress and the installation teams are fully mobilized. The roof decking is now complete to pentant 4, including insulation and membrane, and the standing seam finished roof panels are being installed on pentant 1. Waterproofing of the booster tunnel began (Fig. 6).

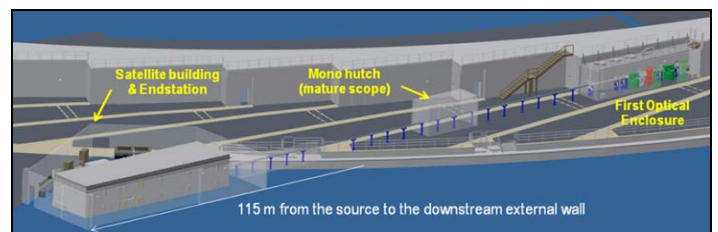




Figure 6. Waterproofing of the booster tunnel roof begins. Note also that backfill operations at the booster tunnel are in progress.

The interior liner system is now extended into pentant 3, and finished exterior siding is progressing rapidly on pentant 1. Interior mechanical, electrical, and plumbing (MEP) work continues to make rapid progress. Major HVAC equipment items, including air handlers for the experimental floor and storage ring, have been installed in pentant 1. Fire protection headers and return air ductwork are now installed from pentant 1 through pentant 3. Supply and exhaust air ductwork is nearly complete in pentant 1. Electrical conduit and lighting in the storage ring tunnel are now complete from pentant 1 through pentant 2. Work continues on all piping, HVAC, and electrical systems throughout the ring building.

Additional progress continues to be made on various architectural finishes, including masonry block and the installation of shield doors in pentant 1. Painting of the storage ring tunnel is now complete up to pentant 4, and mezzanine railings and stairs have been installed. The RF area (Fig. 7) and RF compressor buildings have also seen significant progress during the period and are nearly ready for enclosure to begin.



The Chilled Water Plant Expansion is ahead of schedule and will likely be ready to deliver chilled water several months earlier than required. The chilled water piping is now installed adjacent to the NSLS-II site and will be connected by late September. The electrical substation main transformer tie-in began a week earlier than planned and is on schedule to be completed in October, enabling permanent power to be available to the site in November.

The LOB contract has been awarded and the contractor is making good progress toward mobilization. It is anticipated that notice to proceed will be issued in late September, with physical work getting underway in October, more than a year earlier than the original baseline plan.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

Excellent progress has been made on the development of the Linac Commissioning Safety Assessment Document (SAD). The draft SAD is scheduled to be complete in January 2011, when it will undergo extensive internal and external review. This document is part of the commissioning package that must be approved prior to the start of the accelerator readiness review for the linac, scheduled for September 2011. Procurement of the area radiation monitors to support the linac commissioning is also underway. Three units have been ordered and will be accepted, installed, and pre-commissioned in FY11 to support commissioning activities in October 2011.

An overall Transition to Operations Plan is in development that will provide a comprehensive process to manage the transition from the NSLS-II construction project to the full operations of the NSLS-II facility. This includes identification of key staff responsibilities, essential program requirements, facility acceptance criteria, technical equipment installation and acceptance criteria, authorization basis and approvals, and operational controls.

Interviews are ongoing for a QA/ESH assessment position to develop, implement, and administer an effective and comprehensive construction assessment/oversight program. Working with subject matter experts from construction management, QA, and ES&H, this person will take the lead in evaluating the construction contractors' compliance with established contractual and regulatory requirements, codes and standards, and plans and procedures as these relate to the contractors' processes, systems, and products. This position is expected to be filled by the end of September.

Figure 7. RF area masonry wall seen the from electrical mezzanine. Installation of the railing and stairs is complete, and masonry wall block finishing is in progress.

PROCUREMENT ACTIVITIES

The Laboratory–Office Building (LOB) contract was awarded on August 27, 2010. Construction is anticipated to begin by the end of September or early October, 14 months ahead of schedule. The Transport Line Magnets and SR Cryogenic System requests for proposals (RFPs) were issued and posted on FedBizOps in August. Closing dates are September 27 and October 14, respectively.

RECENT HIRES

Charles Amarito – Mechanical Designer, Mechanical Engineering, ASD

Kenneth Decker – Mechanical Technician, Vacuum, ASD

Yong Hu – Controls Engineer, Controls, ASD

Paul Palecek – Mechanical Technician, Vacuum, ASD

RECENT PROJECT ACCOMPLISHMENTS

- Conventional facilities progress on the ring building continued, with siding and roofing being installed (see Fig. 8 and cover).
- The BINP quadrupole achieved desired field quality. IHEP sextupoles have acceptable field quality. Danfysik production was fully authorized after successful final reproducibility tests on the first articles.
- All first article storage ring girders have been accepted with only minor issues, and full production was commenced.
- Production of the vacuum chambers is proceeding well.
- The BINP quadrupole achieved desired field quality. IHEP sextupoles have acceptable field quality. Danfysik production was fully authorized after successful final reproducibility tests on the first articles.
- All first article storage ring girders have been accepted with only minor issues and full production was commenced.
- The RF Systems Preliminary Design Review was successful, with some significant design changes as a result.
- The proposals for the damping wiggler design and manufacturing have been received and are under evaluation.
- Beamline advisory teams met in August to review PDRs for the CSX and SRX beamlines. All six project beamlines are deeply into preliminary design work.
- The LOB contract has been awarded and the contractor is making good progress toward mobilization.
- Excellent progress has been made on the development of the Linac Commissioning Safety Assessment Document.

COST/SCHEDULE BASELINE STATUS

The cumulative Cost Performance Index (CPI) is 1.02 and the cumulative Schedule Performance Index (SPI) is 0.98, both well within the acceptable range.

Progress during August in most areas of the project was on schedule and on budget. The current-month CPI is 1.03, green status, and the current-month SPI is 0.96, also green status. The cumulative accelerator schedule continues to run behind the baseline, due primarily to a delay in the delivery of storage ring first article magnets and to late deliveries in vacuum chamber production.

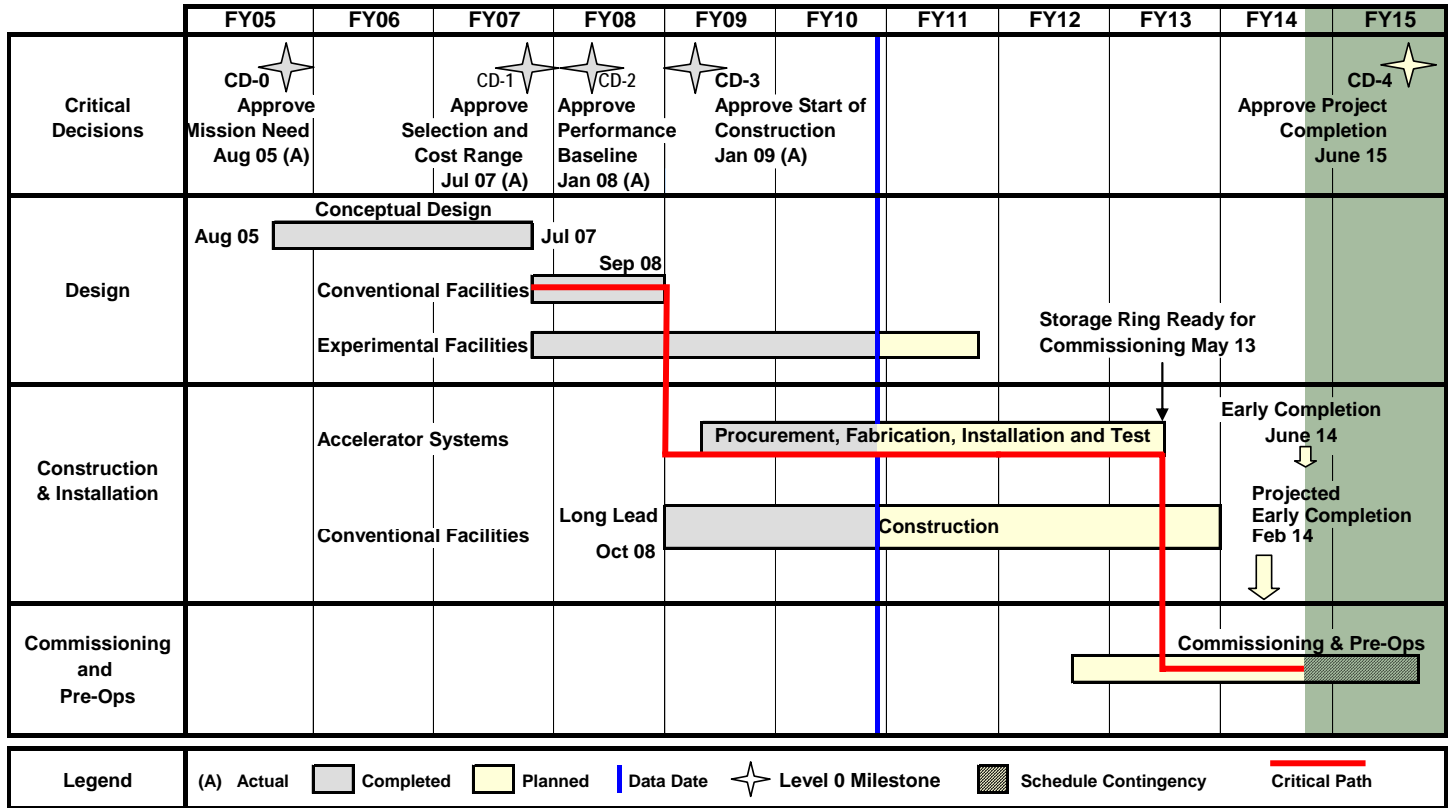
The critical path for the project changed slightly in August, now passing through accelerator magnet first article production; girder assembly, installation, survey, and alignment; then through accelerator installation, testing, and commissioning. Ring building construction, magnet production, and vacuum chambers/components are within 3 months of the critical path, and the projected early completion date continues to be February 2014.



Figure 8. Pentant 1 standing seam metal roof being installed.

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

Fiscal Year	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	151.6	151.4	46.9	26.3		731.2
Pre-Ops							0.7	7.7	24.4	22.4	5.0	60.2
Total NSLS-II Project	1.0	4.8	25.0	49.7	253.3	141.0	153.1	159.1	71.3	48.7	5.0	912.0

The NSLS-II Project Progress Report is prepared monthly for submission to the Department of Energy. This condensed version is available to the public at the NSLS-II website in PDF format. For questions or comments, contact the editor, Kathleen Robinson, at krobinson@bnl.gov, or via mail at: Room 37, Bldg 830M, Brookhaven National Laboratory, Upton, NY 11973.