National Synchrotron Light Source II

Project Progress Report

October 2011

Sunrise after a rainy night in late October. Lab–Office Building (LOB) 2 is nearly enclosed and most LOB activity has shifted to LOB 3, barely visible here.

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OVERALL ASSESSMENT

The National Synchrotron Light Source II project continued to maintain satisfactory cost and schedule performance, completing 65% of the project by the end of October with about 32% of contingency and management reserve for the remaining Budget At Completion (BAC). The cumulative Schedule Performance Index (SPI) for the overall project is 0.96; the cumulative Cost Performance Index (CPI) is 1.01.

A project-wide comprehensive Estimate At Completion (EAC) analysis is being conducted which incorporates the current status of the conventional construction, updated magnet production and accelerator installation schedule, up-to-date procurement plans, and more detailed-out installation activities for the six project beamlines. The overall project plan, including the cost and schedule contingencies and the projected early completion date, will be updated based on this comprehensive EAC.

Construction of the ring building and lab–office buildings (LOBs) continues to be slightly ahead of schedule. Beneficial occupancy was taken for pentant 3, and site restoration around the ring building was substantially completed. Work in pentants 4 and 5 continues to proceed ahead of schedule. Mechanical, electrical, and other interior work in LOB 1 is underway, and wall installation and roofing of LOBs 2 and 3 are in progress. Structural steel erection for LOB 4 and concrete foundations for LOB 5 are underway.

Excellent progress was made on production and delivery of various Accelerator Systems components, especially magnets, linac, booster, power supplies, vacuum, RF, and cryogenic systems. Progress continued in accelerator installation in pentants 1 and 2, the RF building, the injector building, and the computer room. However, the monthly schedule variance for Accelerator Systems remains negative in October, largely due to the steep ramp-up of planned work over the past 10 months. It is anticipated that the schedule variance for Accelerator Systems will slowly recover starting next month.

Good progress continued with the procurements of long-lead-time components for the six Project beamlines, and the IXS group accomplished a scan with excellent resolution from the 1 meV prototype test at PETRA-III.

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

UPCOMING EVENTS 2011 – 2012

Final Design Review, CSX and HXN Steel, Lead/Steel Enclosures	Nov 22
Science Advisory Cttee 2011 Beamline Dev. Proposal Panels:	
Materials Science and Engineering	Nov 17–18
Biological and Medical Sciences	Dec 1
Spectroscopy and Spectromicroscopy	Dec 6
ALD's Conceptual Design Review for ABBIX	Jan 2012
DOE Review of NSLS-II	Apr 17–19, 2012

ACCELERATOR SYSTEMS

Installation activities in the ring building continue to progress well. In pentant 1, the sixth magnet-girder has been installed in the tunnel, the chilled water supply to racks is in place (Fig. 1), the installation of shelves and brackets in racks is complete, and the high-voltage (HV) cables for all ion pumps have been terminated and can be connected to the installed power supplies on the mezzanine. Other activities well underway or near completion include the installation and cabling of accelerator safety systems, diagnostic cabling, and the power supply installation for cell 25. In pentant 2 the floor has been prepared for girder installation, the AC cable work is in progress, the UPS system is complete, and racks are being prepared for the installation of equipment. Beneficial occupancy was received for pentant 3, where cable trays are being installed.

Figure 1. Racks with process chilled water (PCW) connections.

In the RF Building, the RF transmitter supplier is installing the waveguides (Fig. 2), the circulator, and first klystron tube, which completes the NSLS-II RF transmitter system.

Figure 2. RF Transmitter waveguide.

Piping for the deionized water systems in the cryogenics compressor building is well advanced. The first controls computers have been installed in the computer room (Fig. 3).

Figure 3. Computer room.

In the injector building, the linac structures have been placed and surveyed in the linac tunnel (Fig. 4) and the linac modulators have been installed in the klystron gallery. The installation of linac cable tray in the klystron gallery and injector service building is complete and cooling water piping for the linac is also complete. All electronic racks are in place and are being connected to AC power and chilled water while the power supply systems and diagnostic systems are being installed.

Figure 4. Linac structures in linac tunnel.

The linac tunnel also hosts the first part of the linac-to-booster (LtB) beam transfer line (TL). The LtB TL stands (Fig. 5) and part of the diagnostic system have been installed and surveyed. Cable trays and piping for the cooling water are complete and instrumentation and DC cables are being pulled.

Figure 5. Linac-to-booster pentant 1 transfer line stands.

Power supplies. A successful design review of the main dipole manufacturer was held and all specifications are expected to be met. The power supply contractor for the quadrupole and sextupole magnet power supplies is proceeding well and starting to catch up with delays in the delivery schedule. So far, more than 40% of these power supplies have been delivered. All power supply components (chassis, main board, and transition boards) needed for LtB TL phase 1 have been tested and are ready for installation. About 38% of the regulator chassis have been delivered, and all power supply interfaces (PSIs) have been received. The last power supply component, for which production has not yet started, is the power amplifier needed for polarity changing of the corrector magnets. A supplier has been selected and the award placement is imminent. Preproduction units of the fast orbit corrector supply have been built and will be used in the LtB TL after testing. The third delivery of production power converters has been received. Production of the AC input power modules and related hardware is progressing, with first deliveries due in early December.

Electrical utilities. The rack deliveries are complete. All universal power supplies for four pentants, the computer room, and injector area have been delivered and installed.

Vacuum. Nine cell chambers were assembled, baked, and vacuum certified this month, bringing the total available chambers to 109, including all those with diagnostic ports. Twelve S4A and 8 S5A chambers were delivered, bringing the total to 24 and 22, respectively. Fifty RF bellows housings are in house and the C25G4 girder was successfully baked and installed in the tunnel. All 350 storage ring ion pumps were received and tested. Eight all-metal gate valves for the injector and for front ends were received; all 24 NEG strip power supplies also were received. Delivery of residual gas analyzers, cold cathode gauges, Pirani gauges , vacuum gauge controllers, and titanium pump power supplies continues. Most cell vacuum cables for pentant 1 have been terminated at the mezzanine and at the four girders in the tunnel. The installation of the chemical cleaning facility is completed, followed by a test run and operation readiness evaluation. One temporary technician has joined the group this month and one will begin in early November. Interviews continue for the hiring of three additional temporary technicians.

Linac. The linac accelerating structures have been installed in the linac tunnel and the initial survey is complete. Installation of the solid-state Scandinova modulators is in progress. All three modulators have been placed in the linac gallery; one is shown in Figure 6.

A temporary water skid has been obtained to allow testing of the modulators in absence of the injector building water utilities final water system. Installation work leading to the site acceptance test is proceeding. The linac front end testing continued through October with commissioning and single-bunch studies. The measurement results were checked against model calculations and there is good quantitative understanding of the behavior of the linac front end.

Figure 6. Solid state modulator in the NSLS-II klystron gallery.

Booster RF. The booster transmitter system has progressed well and final acceptance tests are scheduled for January. The Thomson-Turgi high voltage power supply (HVPS) and control system have been delivered to Thomson-Southwick. The IOT amplifier is complete, and the booster 7-cell cavity has been refurbished and is under vacuum. It has been successfully leak-checked and is awaiting installation in the RF building blockhouse for high power tests to be conducted in January. The critical path for testing will be the installation and approval of the personnel protection system.

Storage ring RF. The first klystron transmitter HVPS and circulator-load with its associated waveguide network have been delivered and installed by the contractor (Fig. 7). The water manifolds have been rigged into position. The first klystron has been delivered and is stored in the RF building.

Figure 7. Klystron HVPS, control rack, and circulator/load waveguide network.

The superconducting cavity production made progress. AES has ordered material for the superconducting cavities and flanges, and has placed all the long-lead procurement items, including the RF power windows and VAT RF shielded gate valves. Meyer Tool has ordered all material for the cryomodule vacuum shell, LN2 shield, magnetic field shield, and helium vessel. A statement of work (SOW) has been written for the preliminary design of the cryogenic interface and instrumentation for the 1500 MHz SRF cryomodule. This preliminary design report will become part of the procurement documents for the final design and fabrication of the modifications to the module.

Cryogenic systems. The cryogenic system preliminary design review (PDR) was held in early October. Linde is now actively preparing for the final design review, to be held in January. The RF group is working to finalize the functional description of the valve box control for the CESR cavity. The drawing for the warm compressor suction and high pressure lines has been given to Linde for review with PHPK, the piping contractor. The specification and SOW documents for the liquid N2 system have been signed.

Magnets. Good progress experienced during last month (49 storage ring magnets were delivered in September) continued at all magnet production facilities. Most of the multipole magnet production has been on track and a full dipole magnet production has started. A few minor production issues have been resolved and the project team continues to provide technical oversight and support with vigilance. Magnet production is over 50% complete and a total of 38 storage ring magnets were delivered to BNL during the month of October.

Insertion devices. Danfysik's design of the damping wiggler is progressing. A new schedule on the basis of the delayed permanent magnet delivery has been worked out, with all units to be delivered in January 2013.

The second part of the PDR with Kyma for the EPU focused entirely on mechanical issues. Ray tracings are being actively performed for the CSX beamline. A thermal–structural study of the proposed EPU chamber was performed.

A set of design drawings for the in-vacuum measurement system was obtained from the contractor to prepare for the final design review. Bake testing on the 4 m vacuum vessel is in process. The contract award for the SRX and IVU undulators is imminent. The request-for-proposal (RFP) documents for the IXS IVU22 have been prepared and published. To avoid a cost increase for the magnets of the 3-pole wiggler, spare magnets from the damping wiggler production will be used.

RECENTLY HIRED

Victor Smalyuk – Visiting Scientist – Accelerator Systems Division

EXPERIMENTAL FACILITIES

Experimental Facilities work continues on various procurement packages for the long-lead-time beamline optical components. The hutch design work is continuing and the final design review will be held at BNL in mid November for both the lead and steel hutches.

IXS. The specification document for the KB Mirror System is ready for final review and good progress was made on the specification document for the first optical enclosure package.

The IXS group conducted a successful test experiment at the PETRA-III facility of DESY in Germany. In the test experiment, a combined 4-bounce (4B) monochromator and collimating-dispersive-wavelength (CDW) selecting analyzer optical setup (Fig. 8) was tested for the first time using a prototype IXS instrument developed in house at NSLS-II and shipped to DESY. This test was very successful, with 18% efficiency observed for the 4-bounce optics, and 20% for the CDW analyzer scheme. The measured energy resolution was 0.7 meV, in very good agreement with the designed value. Further analysis is in progress and improvement on the mechanical system used for the 4-bounce optics is being planned.

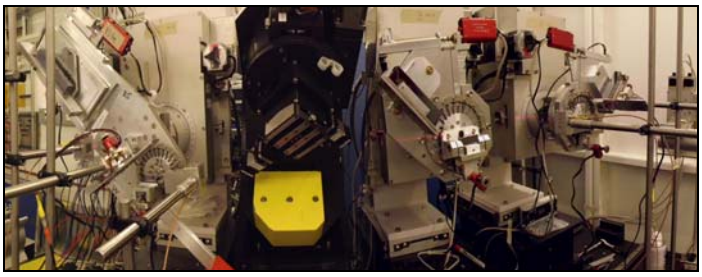


Figure 8. 4-bounce monochromator and CDW optical setup.

CHX. The RFP deadline for the CHX optics package is November 21. Work on the diffractometer RFP continues and the documentation is currently with Procurement.

CSX. SOWs and specs are being finalized for each mechanical component, and proposals for the gratings are expected in mid November. The procurements of toroidal mirrors, monochromators, and the M3A mirror will soon follow.

HXN. Evaluation of proposals for the optics package is in progress and a contract will be placed in mid November. The optics fabrication group made progress in the growth of a nitrogen-compensated multilayer Laue lens, resulting in much reduced internal stress, thus easier sectioning and polishing.

XPD. Five proposals for the Laue monochromator were received and are being evaluated. RFPs for the vertically focusing mirror system and the remaining beamline components package are being prepared for release shortly.

SRX. The optics package proposals will be received in mid December. The endstation design is in progress.

Optical metrology. Fabrication of the gantry for the Nanoradian Surface Profiler is progressing well and its delivery is expected to be on schedule at the end of January 2012.

CONVENTIONAL FACILITIES

Construction of conventional facilities continued to make excellent progress during October. Beneficial occupancy was taken for pentant 3, bringing more than 65% of the ring building space under beneficial occupancy and available for Accelerator Systems installation activities. Site restoration by the ring building contractor is nearly complete except for areas impacted by ongoing LOB construction; the site now looks like one approaching completion (Fig. 9). The ring building and LOB construction contracts continue ahead of schedule.

Figure 9. Site restoration completed for interior courtyard.

The ring building contractor continues work toward early phased turnover of the balance of the ring building for beneficial occupancy. With turnover of the cooling tower building and pentant 3 in mid October, only pentants 4 and 5 remain. These areas are expected to be turned over in late November and late December respectively, more than two months earlier than scheduled. With turnover of the cooling tower building, the cooling water systems that are needed to support equipment installation in the injection, RF, and storage ring buildings are undergoing pre-operational checks. Operations readiness reviews will be conducted in November to enable cooling water system operation in support of installation and start-up of accelerator systems.

Work in pentants 4 and 5 continues to proceed ahead of schedule. Building systems will be started up and commissioned during November to enable beneficial occupancy of pentant 4 in late November. Interior painting of pentant 5 is underway, and mechanical and electrical work in service building 5 is progressing rapidly in anticipation of beneficial occupancy of pentant 5 in late December. Completion of punch list work in the occupied areas continues to make good progress and is being coordinated with accelerator installation activities to prevent disruption or interference.

Site restoration by the ring building contractor was substantially completed during October, although some touch-up work may still be required. All areas that will not be impacted by ongoing LOB construction have been finish graded, top soiled, and seeded. All roads and parking lots in the ring building contract scope have had the finished paving course applied. Exterior site lighting is now in place and functional.

Some landscaping along the ring building exterior will be left for completion by the LOB contractor due to on-going construction of the LOBs. These areas will be completed by the autumn of 2012, due to the added scope of LOBs 4 and 5.

LOB construction continues to make excellent progress. LOB 1 mechanical and electrical work, standing seam roof installation, glazing installation, and building enclosure are underway. Partition wall installation and roofing of LOBs 2 and 3 are in progress. Drywall installation is underway in LOB 2 (Fig. 10). LOB 4 structural steel erection is underway and concrete foundations for LOB 5 are in progress.

Figure 10. LOB 2 drywall work is underway.

The coordination of work between the ring contractor, LOB contractor, and ongoing accelerator installation continues to progress well with minimal interference or disruption.

ENVIRONMENT, SAFETY, AND HEALTH

Beneficial occupancy readiness evaluations (BOREs) continued on schedule. BOREs have been completed for pentants 1, 2, and 3; RF compressor; injection buildings; and the cooling tower. BOREs for pentant 4 (late November) and 5 (late December) will complete the ring building turnover from construction to operations. A formal Lessons Learned report for the BORE process is being prepared.

The Booster Safety Assessment Document and Accelerator Safety Envelope underwent an internal Photon Sciences Directorate review and a Lab Safety Committee review. Approval is pending the incorporation of comments from the Laboratory review. That this process is approximately one month ahead of schedule is attributed to lessons learned during the development of linac documentation. Progress continues on documentation needed for a successful commissioning ARR, including operational procedures, emergency procedures, and training and qualifications criteria. These tasks are on schedule to be completed in late November/December. The linac ARR is now scheduled for February 2012.

COST/SCHEDULE BASELINE STATUS

The cumulative Cost Performance Index (CPI) for the overall project is 1.01 and the cumulative Schedule Performance Index (SPI) remains at 0.96, both well within the acceptable range. The project is 65% complete, with 30% of contingency and management reserve, based on EAC work remaining.

The project current-period SPI of 0.99 is close to plan, due to positive schedule performance in Conventional Facilities, with an SPI of 1.29 ($1.7M) for the month. Accelerator Systems had an SPI of 0.86 (-$1.6M), due primarily to delays in storage ring procurements including magnets, RF systems (cavities), and deliveries for controls systems.

The current-month CPI for the project, 1.55 ($6.8M), is well understood and had no impact on the cumulative CPI of 1.01. This positive variance is due largely to a number of factors, including a shortened “month” (3 weeks) for BNL labor at the end of the fiscal year and an adjustment to an accrual in Conventional Construction LOBs, all resulting in a monthly actual cost value ($12.3M) for the project that is lower than usual. Experimental Facilities continues to perform close to plan on a cumulative basis for both cost and schedule.

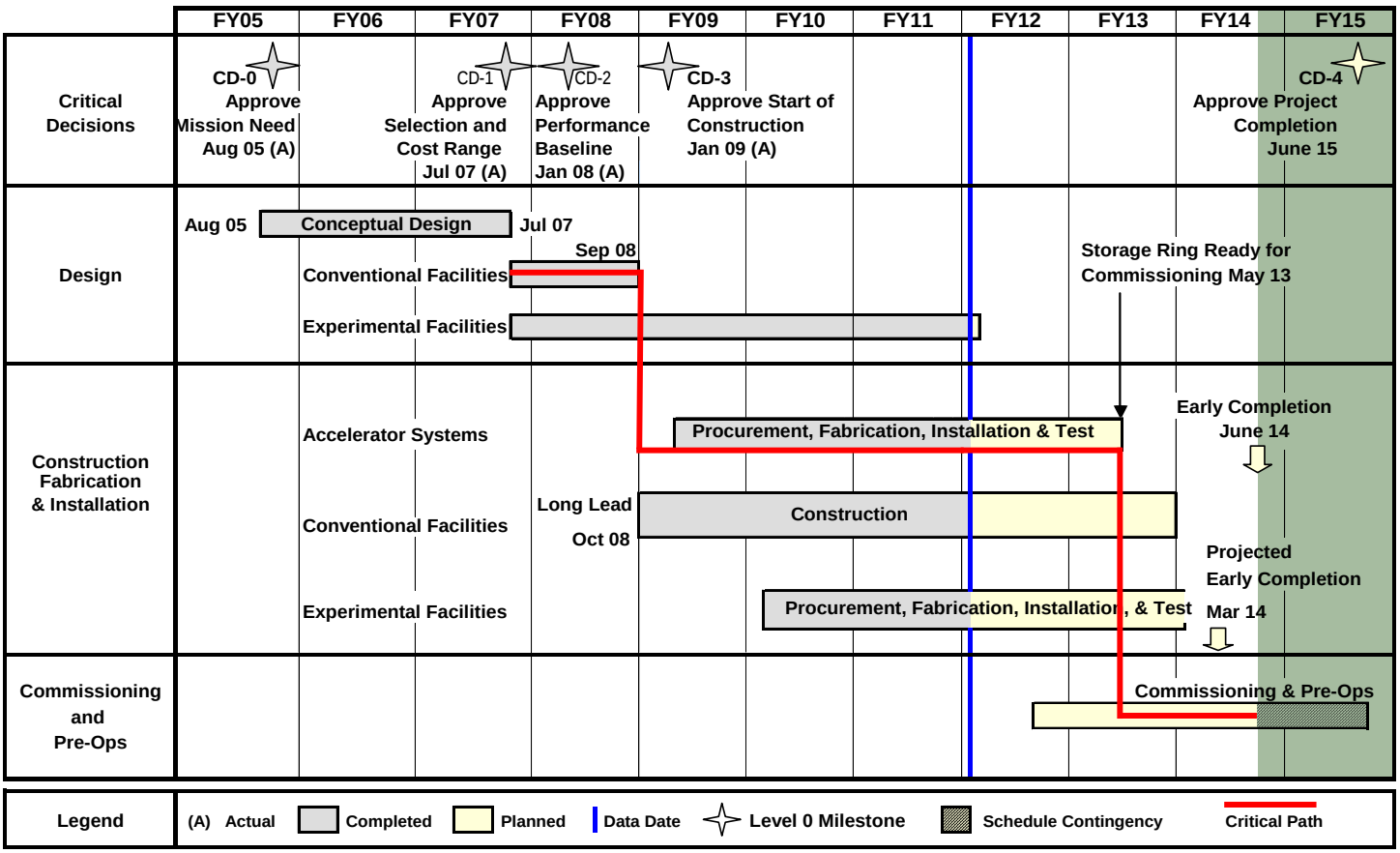
The critical path for the project has not changed since last month. The systems on the critical path include 35 mm dipole magnet deliveries; pentant 5 girder assembly, installation, survey, and alignment; subsystem test diagnostics; EPU installation; integrated tests; and commissioning of the storage ring. The projected early completion date for the project remains at March 2014. There are 15 months of float between the project early completion milestone and CD-4, with approximately 34% schedule contingency.

PROCUREMENT ACTIVITIES

The RFP for the CHX Beamline Optical Components Package was posted on FedBizOps, with proposals due by the end of November. The XPD Beamline Components and the SRX Beamline Optics Components packages were posted on FedBizOps with proposals due in early December. Proposals for the Double Laue Monochromator were received the first week of November. The proposals are being evaluated and award is expected to be made in late December. The RFP for the CHX Beamline Diffractometer is near completion and will be released to industry by the end of November.

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

	NSLS-II Funding Profile ($M)											
Funding Type	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	22.4	5.0	60.2
Total NSLS-II Project	1.0	4.8	25.0	49.7	253.3	141.0	152.8	159.1	71.6	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.