National Synchrotron Light Source II

Project Progress Report

April 2010

The Ring Building takes shape, with erection of structural steel progressing rapidly in this photo taken April 30.

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OVERALL ASSESSMENT

The National Synchrotron Light Source II project continues to make excellent progress, and to maintain satisfactory cost and schedule performances.

Construction of the Ring Building and central chilled water plant expansion continues to be ahead of schedule. Concrete work picked up pace substantially in April, and structural steel erection continues to advance rapidly. The installation of underground utilities and mobilization of the chilled water piping contractor are well underway.

Progress in all areas of Accelerator Systems continued, maintaining its cost and schedule goals in April. The linac contract was awarded and the evaluation of booster proposals was completed. Production activities for magnets, girders, vacuum system components, power supplies, and electronics continued, and completed components are being delivered and tested. Good progress was made on the design of insertion devices. Preliminary designs for the six project beamlines are also on track for completion by September 2010.

Owing to excellent schedule performance, construction of the Ring Building—which was formerly on the project's critical path between FY09 and FY13—now moves to the near-critical path, with more than one month of schedule float. The projected early completion date for the project remains February 2014, and the new critical path now includes the fabrication and installation, followed by commissioning, of the accelerator systems.

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

As the project moved into its peak activity phase in 2010, the project calendar for the rest of 2010 is being filled with workshops, design and production readiness reviews, BAT meetings, and advisory committee meetings.

SCHEDULED EVENTS 2010

Beamline Development Workshops (12 planned to date)	April–June
Utility System Design Reviews (2)	June
Radiation Safety Workshop	June 22–23
Final Design Reviews: Electrical Sys. & Power Supplies (3)	May–July
Magnet Production Readiness Reviews (7)	July–Aug.
Beamline Access Team (BAT) meetings (6)	July
Scientific Advisory Cttee. (SAC) Proposal Review mtngs. (7)	July
Timing and Fast Orbit Feedback Workshop	July
Light Sources Directorate SAC meeting	Aug. 12–13
DOE Mini-review of NSLS-II	Aug. 25
NSLS-II Conventional Facilities Advisory Cttee. (CFAC) mtng.	Oct. 5–6
NSLS-II Accelerator Systems Advisory Cttee. (ASAC) mtng.	Oct. 14–15
NSLS-II Prelim. Design Rev. (PDR) of Experimental Facilities	Oct. 19-20
DOE Review of NSLS-II	Nov. 16–18

ACCELERATOR SYSTEMS DIVISION (ASD)

All technical issues with production of storage ring magnets have been resolved and the fabrications of the first article production for all magnet types are making good progress (Fig. 1).

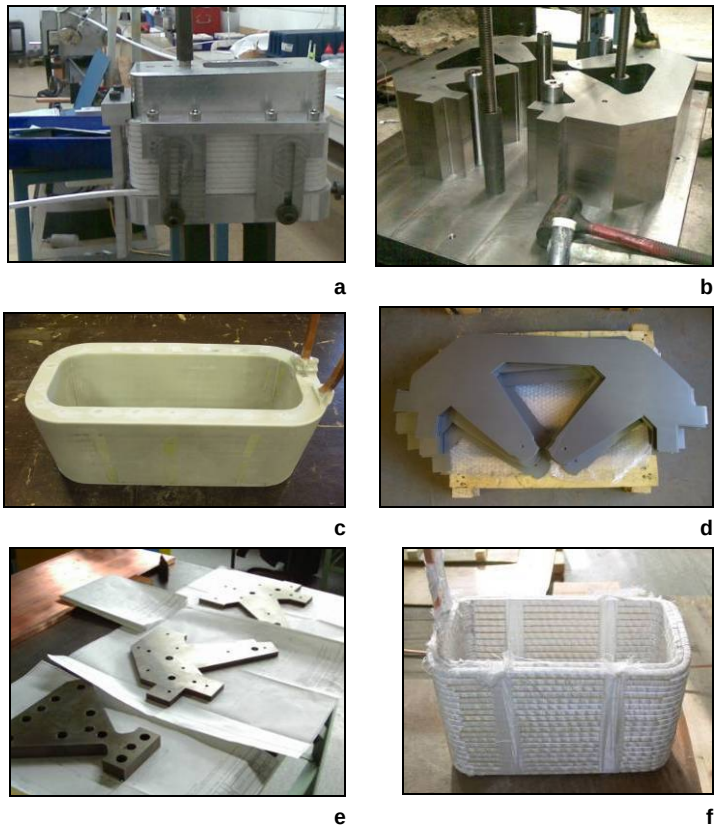


Figure 1. Magnet yoke and coil production: Buckley (a, b), Danfysik (c), Everson Tesla (d), and Budker Institute (e, f).

The first article of the magnet girders (Fig. 2) has been produced and will be delivered to BNL in early May.

Figure 2. First article of the girder at the factory before painting and shipping.

A prototype for the de-ionized cooling water system has been assembled (Fig. 3). After testing, this prototype system will be used to test RF equipment in Building 832 while production systems are assembled before being installed in the five service buildings.

The production of vacuum chambers starts to ramp up. Three additional S2O chambers were received from APS and detailed measurements were carried out by the Survey Group. Six S4 chambers were completed and are being tested at APS, and ten machined dipole extrusions are at APS ready for welding. Twenty dipole extrusions have arrived from the vendors. Design of the damping wiggler (DW) chambers began. A detailed thermal analysis of the chambers and downstream absorbers was carried out for the 15mm wiggler gap 100mm-period DW. The design of transfer line bending chambers has started.

Excellent progress was also made on other vacuum system components. First article BPM buttons have passed vacuum evaluation, and the prototype RF shield was successfully installed in the multipole chamber. Prototype RF shielded bellows were delivered to APS for beam tests. The first production batch of 32 ion pumps was received and successfully tested, with all pumps meeting the specifications.

Figure 3. Prototype de-ionized cooling water circuit for cooling NSLS-II magnets and absorbers, assembled at NSLS.

The control rack for the main dipole power supplies (PS) has been installed in the 902 high bay area for power tests. All PS controller boards are delivered and integration and testing have begun (Fig. 4). The layout of the two-channel regulator board for the corrector magnet PS is completed and the two prototype regulators for the fast corrector magnet PS and the corresponding power amplifiers have been tested on prototype air core corrector magnets. The design for the corrector PS interface card is completed. In house, we now have 1,190 DCCT modules (~ 60% of the total) for the power supplies.

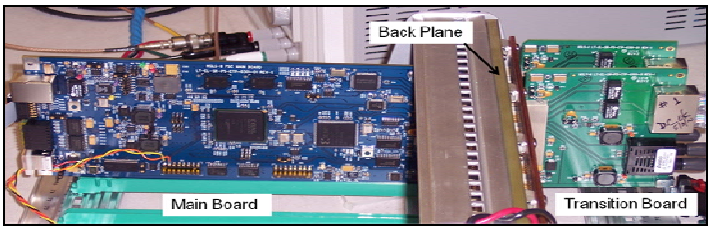


Figure 4. Controller board prototypes for multipole power supplies, for testing.

Good progress was made on the design of insertion devices (IDs) and setting up the ID measurement laboratory. The ANL group is in the final phase of testing the feasibility of shimming procedures for the fixed gap DW. Contracts for the integrated field measurement system and the insertion device clean room were awarded. A conceptual design for the in-vacuum undulator with 22mm period length was completed for the SRX beamline. The design includes the array holder, magnet core, cooling platen crossover and manifold, gap drive assembly and feed-thru, vacuum and thermal transitions, kinematic differential adjusters, thermal shielding, gap drive train and control scheme, as well as the integration of the in-vacuum measurement system. For the IXS beamline, a cryogenic in-vacuum undulator is being considered as an option. Power density distribution and thermal analysis for the elliptical polarized undulator EPU49 in different polarization modes have been performed. The prototype BPM receiver card was successfully tested, meeting an important milestone for the in-house BPM development effort.

EXPERIMENTAL FACILITIES DIVISION (XFD)

The NSLS-II Experimental Facilities Division continued to make a good progress on preliminary designs for the six project beamlines. Preliminary design reports for all six beamlines are scheduled to be completed by the end of September 2010. An example of a beamline design is shown in Fig. 5, for the Coherent Hard X-ray Scattering beamline.

Two workshops were held in April, one on scientific computing and the other on data acquisition and user interface. Participants included experts from the European Radiation Synchrotron Facility, Advanced Photon Source at Argonne, Linac Coherent Light Source at Stanford, Spallation Neutron Source at Oak Ridge National Lab, Diamond Light Source in the UK, and Riso National Laboratory in Denmark,

among others. These workshops provided helpful lessons learned by other facilities and useful input for future planning in these important areas of support for user science.

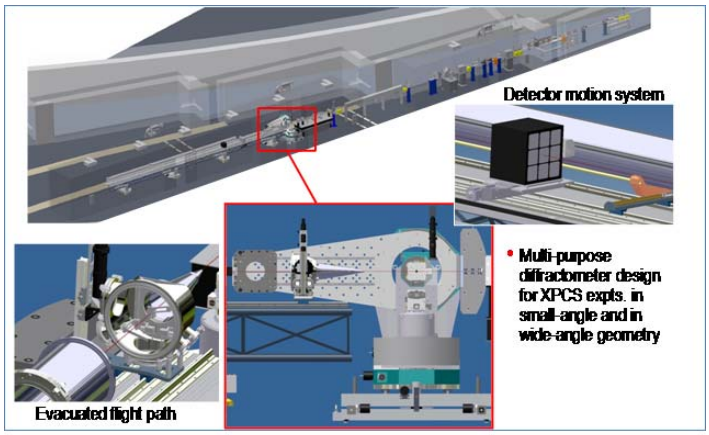


Figure 5. Illustration of preliminary design of an endstation instrument for the Coherent Hard X-ray Scattering (CHX) beamline.

In support of the call for beamline development proposals issued in March, a beamline development website has been set up to provide up-to-date information about NSLS-II to scientific user groups. In addition, an informational meeting was held for the beamline community on April 14. At the deadline for Letters of Intent (LOI) on April 26, fifty-seven LOIs had been received.

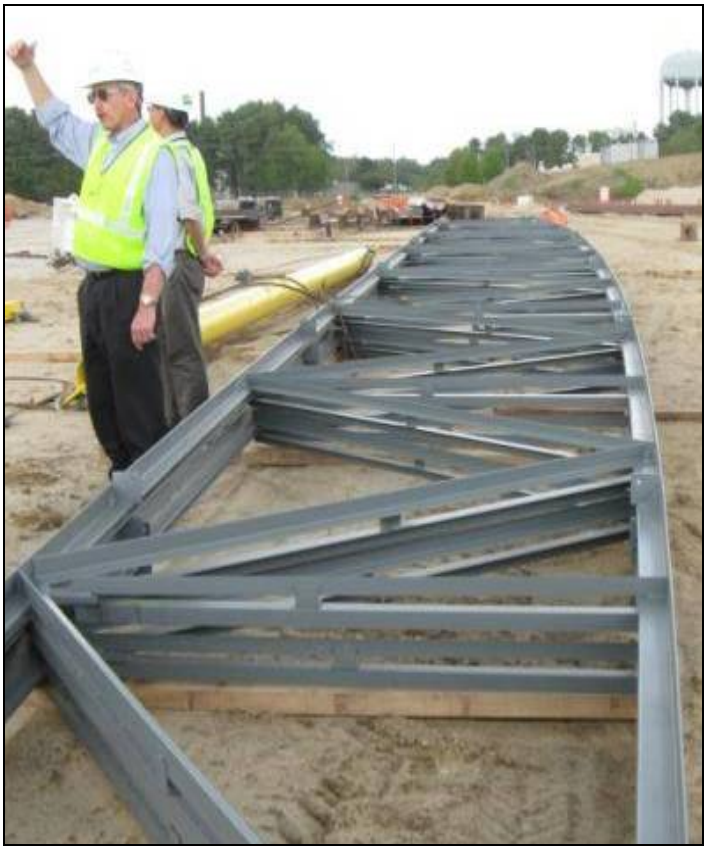


Figure 6. Curved roof joists for the Ring Building.

CONVENTIONAL FACILITIES DIVISION (CFD)

The pace of construction continued to accelerate in April, with the most notable progress being the continued placement of concrete and erection of steel. There were 3,854 cubic yards (CY) of concrete placed in April, more than any other month to date and 1,727 CY more than scheduled for April. With this work ahead of schedule, other activities can start earlier than planned. The storage ring (SR) walls were completed almost to the end of pentant 4. This enabled work on the SR tunnel roof (mezzanine) to proceed through the middle of pentant 4. Additional concrete was poured for service building 3 foundations and the start of foundations for service building 4. Footings for pentant 5 also were poured in April. Structural steel erection is approximately 1 month ahead of schedule.

April accomplishments included completion of structural steel for pentant 1 of the Ring Building and most of pentant 2, and the installation of curved roof joists (Fig. 6) for those pentant sections. The installation of roof decking was completed on the RF building, service building 1, and Ring Building pentant 1 (Fig. 7).

Figure 7. Structural steel and roof decking for Ring Building pentant 1, RF bldg, and service bldg 1 are near completion.

April saw the start of construction of steam manholes, which are poured-in-place concrete structures (Fig. 8). With these done, installation of steam and condensate piping begins in earnest. Chilled water piping was installed and tested in the vehicle tunnel. Chilled water lines are now being installed in the inner courtyard, moving south counter-clockwise from the vehicle tunnel. Electrical ductbank installation continues, with services being run to the buildings in the inner courtyard. Temporary electrical service was installed for the southern part of the site. Work on the electrical substation expansion continues: the interior of Building 603 is being modified to accommodate the new switchgear, cabling, and conduit. The transformer yard is being prepped to receive the new 20 MVA transformer, scheduled for delivery in early July. The major outage needed to tie the new transformer into the utility grid is still scheduled for September.

Figure 8. Steam manhole 47D being installed as part of underground utility work in the Ring Building courtyard.

The chilled water plant expansion continues ahead of schedule. Steel erection is completed, the composite concrete decks are all in place, the roof is nearing completion, and the building enclosure is proceeding rapidly. Piping in the basement pipe tunnel is nearly finished, condenser water pumps have been mounted in position, and building equipment is beginning to be installed on the upper floors. Cooling tower cells were installed in April and the chillers are ready for delivery and installation. The chilled water piping contractor continued deliveries of pipe to the site in anticipation of starting construction in May. The contractor has submitted all shop drawings and ESH documents and received approval to begin installation.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

A collaborative assessment of the contractor's excavation program is ongoing with DOE through the Brookhaven Site Office, as part of a monthly programmatic assessment to examine all aspects of the contractor's ESH program.

A near-miss was identified at the Ring Building site when an excavation operation pulled up an empty underground electrical conduit intended for low-voltage signal cable, one of six buried in the vicinity. Although the damaged conduit was empty, one of the others nearby contained two temporary 120V live circuits. Due to the proximity of the live circuit conduit to the damaged conduit, this event was categorized and reported in the Occurrence Reporting and Processing System (ORPS) as a Group 10(3) "near-miss," where no barrier or only one barrier prevents an event from having a reportable consequence. A causal analysis was conducted and corrective actions are being implemented.

A recordable injury occurred on April 22, 2010. A laborer was using a claw hammer to separate pieces of wood that were nailed together to form spacers used in pouring concrete. He swung the hammer and it slid off the form, hitting his leg and resulting in a cut that required four stitches. The worker returned to the job with no restrictions.

Three radiation monitors have been purchased and installed on the NSLS experimental floor for evaluation during calendar year 2010. These instruments are being connected to the local area network to permit online record-keeping and observation of their performance. The data collection and analysis are ongoing.

Supplementary shielding analyses for the linac/booster injection shutters, linac beam dumps, booster beam dump, injection, and extraction septa have been completed and are in an advanced stage of engineering design. The ratchet wall shielding and collimator shielding for six project beamlines have been designed and are ready for procurement. Radiation losses at the six diagnostic flags in the booster ring were calculated; supplementary shielding needs were determined.

FLUKA Monte Carlo simulations for the injection scrapers have been summarized, to determine the additional shielding required inside the storage ring. Copper and tungsten scrapers were compared for shielding requirements. FLUKA simulations for top-off injection have been completed and a document is being prepared. Based on the simulations, top-off injection interlock options have been determined.

A radiation safety workshop is planned for the last week in June. Radiation safety professionals from SSRL, ALS, and ESRF have been invited to participate.

PROCUREMENT ACTIVITIES

The linac contract was awarded on April 12, 2010. Booster proposal evaluations were completed in mid April. Final award of the booster contract is pending BNL and DOE approval; an announcement is anticipated in early May. The Laboratory–Office Building (LOB) solicitation closing date was April 6. Seven proposals were received; six were within projected cost estimates. Proposal evaluation is in progress, with award anticipated in late May.

RECENT HIRES

For the second year running, competitive fellowships under the auspices of the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM) Program are enhancing the project's summertime staff. Four additional student assistants were welcomed for the summer, and a new research associate joined the HXN beamline staff.

Daejin Eom – Research Associate, HXN Beamline, XFD
Irish Britt – GEM Fellow, Business Systems Dev, PSD
Darron Brumsey – GEM Fellow, HXN Beamline, XFD
Shana Collins – GEM Fellow, Controls, ASD
Bruce Davis – GEM Fellow, HXN Beamline, XFD
Samuel Fanfan – GEM Fellow, Diagnostics & Instrumentation, ASD
Niaja Farve – GEM Fellow, SRX Beamline, XFD
Tequisha Hendrickson – GEM Fellow, Civil/Struct. Eng., CFD
Joe Jackson – GEM Fellow, Civil/Struct. Eng., CFD
Rafael Lozano – GEM Fellow, Nanopositioning, XFD
Celest Okoli – GEM Fellow, Mechanical Engineering, ASD
Suchit Bhattarai – Student Assistant, Controls, ASD
Korey Hopkins – Student Assistant, Controls, ASD
Amber Liverpool – Student Assistant, Controls, ASD
Anita Quabili – Student Assistant, Controls, ASD

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.

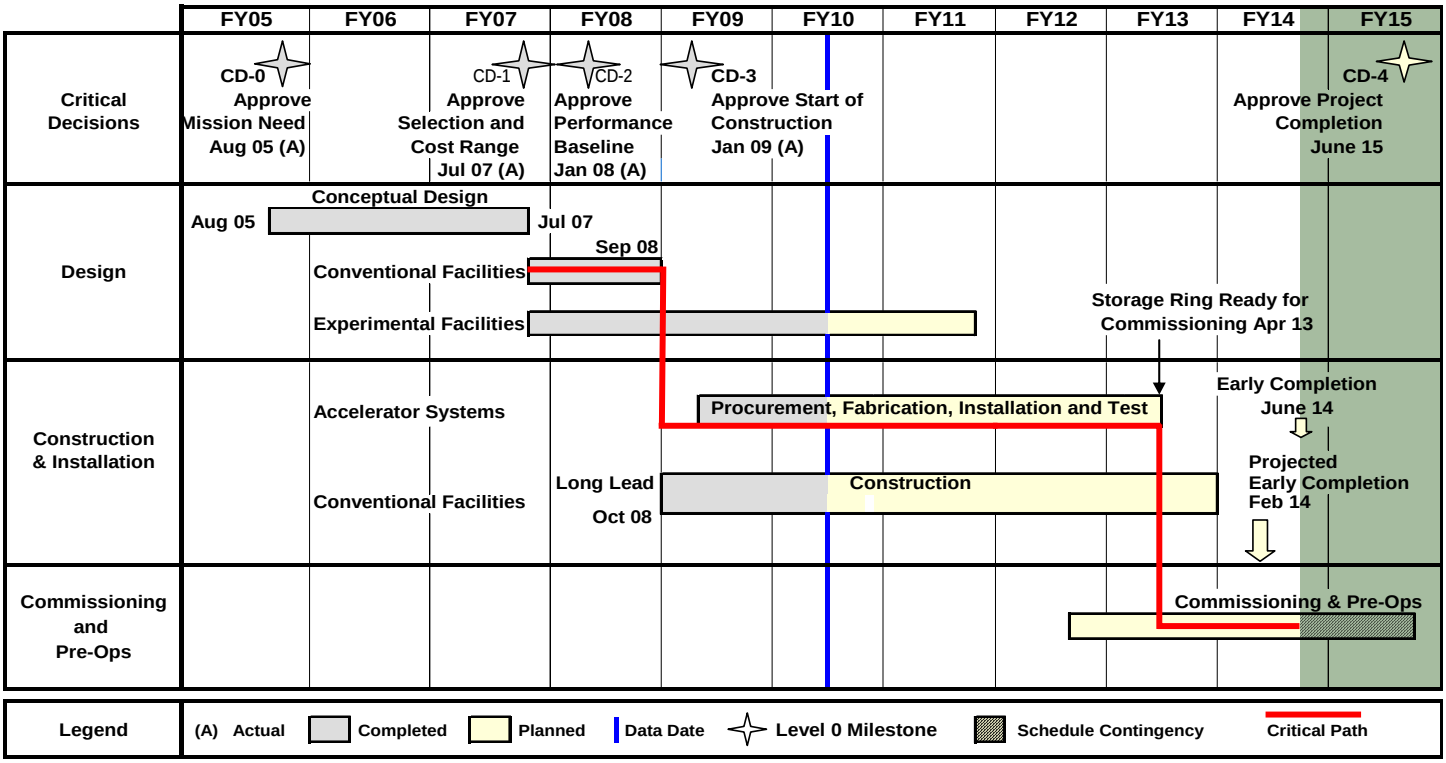
Progress during April in all areas of the project was on schedule and on budget. The current-month CPI (0.71) and SPI (0.79) are due to either the timing of invoice payments being out of phase from the actual period of work completed (e.g., Title II design for LOB, SR Magnets) or planned work in April being already performed in March (e.g., Ring Building and CCWF contracts). There are no cost and schedule impacts or issues.

With the Ring Building construction ahead of schedule, the critical path for the project has shifted from conventional construction of the Ring Building to a path through accelerator vacuum chamber welding, girder integration and survey and alignment, then through accelerator installation, testing, and commissioning (see milestone schedule on p. 7). The Ring Building construction is off the critical path by 37 days of schedule float. The booster and linac fabrication delivery schedules are each about 1–2 months off the critical path. The projected early completion date has not changed and remains February 2014—a full 16 months prior to the CD-4 milestone, the project completion date of June 2015.

RECENT PROJECT ACCOMPLISHMENTS

- Two successful workshops were held, on the topics of data acquisition/user interface and scientific computing.
- SR tunnel roof and storage ring walls were completed through the middle of pentant 4. Structural steel erection is approximately 1 month ahead of schedule. The installation of roof decking was completed on the RF building, service building 1, and Ring Building pentant 1.
- All steel erected for the chilled water plan expansion.
- The linac contract was awarded and booster proposal evaluations were completed.
- The first article of the magnet girders has been produced and will be delivered in May.
- A prototype de-ionized cooling water system was assembled and is being tested.
- The first shipment of 32 ion pumps for vacuum system was received and all met specs.
- The prototype BPM receiver card was successfully tested and is ready for a beam test.

DOE Project Milestone Schedule



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
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