

National Synchrotron Light Source II

Project Progress Report

September 2010



At the end of September, work on the entrance lobby was well underway; activities continued all over the worksite.

report due date:
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OVERALL ASSESSMENT

The National Synchrotron Light Source II project continued to make excellent progress with satisfactory cost and schedule performance. The cumulative cost and schedule performance indices are 1.01 and 0.99, respectively.

Construction of the ring building continued without any safety incident and is on track for beneficial occupancy of the first section in February 2011. With much of the concrete and steel work nearly complete, work on the utilities, building envelope, interior, and exterior is making rapid progress. The workforce for the ring building was at its peak in September, although the sitewide workforce will continue to grow with mobilization for construction of the Lab-Office Building (LOB). The project has been proactively managing the contracts for both the ring building and the LOB to ensure that sitewide safety goals are met. The health and safety plan submitted by the contractor for the LOB is under review prior to approval of the notice to proceed.

Steady deliveries of production components for the accelerator systems, including girders and vacuum chambers, continued. Proposals for damping wiggler and in-vacuum measurement systems were received and are being evaluated. Magnet production began to pick up the pace with the production of sextupole magnets at Danfysik and four acceptable first articles produced at IHEP, BNP, and TESLA. Although some of the built-in schedule float has been eroded, the overall project schedule has not been impacted by the challenges encountered in magnet production. Schedule float for key elements in the accelerator systems is being closely monitored, and potential mitigation plans for schedule risks are being actively discussed.

Preliminary design of the six project beamlines has been completed. The project conducted a review to assess the status of the insertion devices for six project beamlines. The review committee noted that those designs are progressing well and provided a number of helpful recommendations.

February 2014 remains the projected early completion date, and the critical path for the project has not changed, passing through the delivery of acceptable magnet first articles.

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

UPCOMING EVENTS**2010– 2011**

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
NSLS-II Linac Final Design Review	Oct. 19–20
Beamline Front End Design Review	Oct. 26–27
DOE Review of NSLS-II Project	Nov. 15–17
DOE Review of NSLS Operations	Dec. 15–17
Coherent Soft X-ray (CSX) Beamline Design Review	Dec TBA
Project Advisory Committee (PAC) meeting	Feb. 9–11

ACCELERATOR SYSTEMS DIVISION (ASD)

The accelerator physics group provided support for technical design and component production. This included refined impedance analysis for vacuum components such as tapers, BPM buttons, and shielded bellows. In response to difficulties of our magnet manufactures to meet the specified field quality of the NSLS-II storage ring magnets, the accelerator physicists refined the specification of magnetic field tolerances, which results in a slight relaxation of the specification. This will help speed up magnet production at the cost of a small amount of safety margin in the dynamic aperture. Top-off analysis is still a major activity, as in previous months. In September the impact of dipole magnet defects on top-off safety was assessed. An ongoing study of an NSLS-II lattice with twelve long straights with low horizontal beta and three long straights with high horizontal beta has produced first results. The accelerator group continued to support the development of instrumentation. An improved design of the mirror for the visible-light diagnostic beamline was based on earlier findings. The design of the stripline kickers for bunch-by-bunch feedback system was carried out; this included the optimization of shunt and beam impedance. Accelerator physics is heavily involved in the refinement of active and passive protection systems. Analysis of synchrotron radiation heating of components was carried out, among other analyses, to generate the parameters for the equipment protection interlock system.

For magnet girder integration, a fixture has been produced which keeps the magnet jaw and pitch fixed during the high-precision alignment. Jaw and pitch get adjusted with laser trackers during magnet pre-alignment outside the environmental room. Modernization of the magnet measurement stand has been completed.

The magnet first article production at IHEP, BNP, and TESLA has produced three additional magnets with acceptable magnetic field properties. We expect first article production at these vendors to be completed in October. The production readiness review for the corrector magnets was held, with no major issues. The performance of the magnets falls a little short of expectations, but shortfall is relatively insignificant and the magnet can be produced, as demonstrated by first articles. Production by Danfysik of the 169 normal sextupole magnets (Fig. 1) has begun and three magnets have been produced. One production unit failed due to initial manufacturing problems. The first 35mm dipole magnet has been assembled at Buckley Industries. Field measurements will be available in early October.

The weld development of the Al-vacuum chamber S6 has started at APS. This chamber has a welded-on exit port which requires special attention. Four dipole chambers and four multipole chambers were assembled with NEG strips, RF screens, and BPM buttons. They were baked and vacuum certified, and they are now ready for girder integration. Two prototype S4A chambers were evaluated; significant re-design work is needed to make them more reliable and easier to

fabricate. Carbon fiber stands have arrived for one pentant of multipole chambers.



Figure 1: NSLS-II Sextupole final assembly at Danfysik.

Ion pumps and ion pump controllers continue to be delivered and tested. First-article titanium sublimation pump cartridges have arrived.

Following an external expert review of the photon absorbers and RF shielded bellows, significant modification to our present designs is underway to improve their performance and manufacturability.

The bidding process for the main and transition boards for the power supply controllers is underway. The two-channel regulator preproduction units are being tested. All results to date show the board works as designed. Some minor changes have resulted from the tests; these are being worked out at present and will be available at the time of production contract award.

The regulator board and chassis have been sent out for quotation, as have the PSI boards and chassis. Mechanical design work and PCB layout continues on the design of the different power amplifiers needed for the low-current fast corrector and high-current slow corrector power supplies. This work has slowed, due to testing requirements for the two-channel regulator boards. One-wire temperature sensor testing at NSLS revealed a problem with the radiation resistance of the used (recycled) sensors. New sensors that were installed at NSLS have not failed. Mechanical and electrical design continues on final production of the one-wire interface chassis. The RFP for the power converter was released at the end of September. DCCT testing continued; 780 units of the 1,825 have been tested. The purchase order for the high-precision digital meter and scanner cards procurement has been placed. Kooltronic Industries delivered the final design report for the equipment enclosure heat exchangers; this was accepted by the project and first article

manufacturing started. The rack manufacturer, Crenlo/Emcor, has developed a minor problem with the availability of door locking hardware for the first articles. This will delay first testing by a week. The order for the cable seals for the equipment enclosures has been placed and deliveries have begun. Bids for the UPSs have been received and are being evaluated. An award will be made early in October. The engineering design of the low-precision temperature control panels is finished and prototypes have been tested. Final mechanical design drawings are underway.

Technical proposals for the NSLS-II damping wiggler were received from five vendors, and a best value has been determined. Awards are expected to be placed in early November.

Two vendors submitted a proposal for the in-vacuum measurement system, and technical evaluations have been performed. Industry has completed fabrication of the Hall probe bench, which is in environmentally controlled storage until shipment. Open technical issues for the integrated field measurement system have been resolved, and the final design report has been approved. The array for calibrating magnetic insertion device measurement equipment is in the final stages of rework to meet the belatedly imposed criteria for field quality. The platens were properly ground by Arrow Grinding of Tonawanda, NY. The C-frame is being shipped to R.S. Precision Industries of Farmingdale, NY for double inside surface grind operations using a customized wheel on the built-up assembly.

The construction of the insertion device clean room in Building 832 is well advanced. The hydrostatic pressure test on the sprinkler system was conducted by the sprinkler subcontractor and passed with no problems.

After completion of the design for the three-pole-wiggler, the procurement paperwork is being prepared.

EXPERIMENTAL FACILITIES DIVISION (XFD)

The Experimental Facilities Division completed the preliminary design of the six project beamlines at the end of September. The completed designs included engineering details sufficiently mature to begin long-lead-time procurements of major beamline systems such as radiation enclosures and beamline optical systems, as well as other standard beamline components. Figure 2 shows the technical design of a water-cooled beryllium compound refractive lens assembly for the Inelastic X-ray Scattering (IXS) beamline.

The completed Preliminary Design Reports were submitted by the beamline group leaders and posted on the NSLS-II SharePoint website for the beamline advisory teams (BATs) to review before the meetings to be held in October. The Beamline Design and Safety Committee also reviewed the preliminary designs of the six beamlines and provided helpful feedback to the beamline design teams.

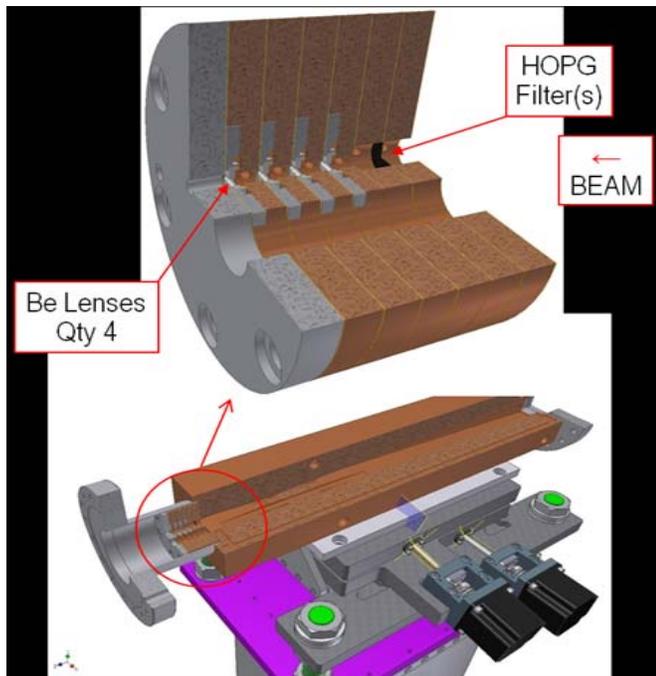


Figure 2: Preliminary design of a water-cooled beryllium compound refractive lens assembly for the IXS beamline.

In the area of high energy-resolution R&D, a test experiment on a prototype collimating mirror was conducted at the NSLS X16A beamline, and preliminary results were very encouraging. In nanofocusing optics R&D, the growth of the first multilayer Laue lens (MLL) using the new multilayer deposition system was completed. The MLL (#ZP12-1) consists of 6,510 layers of WSi₂/Si, and is 43 μm thick with an outmost zone width of 4 nm. A scanning electron micrograph of a portion of the cross-section view of the MLL is shown in Fig. 3. This MLL growth was the largest number of layers grown to date, and the thickest MLL ever grown without multi-growth bonding. More detailed characterization is ongoing.

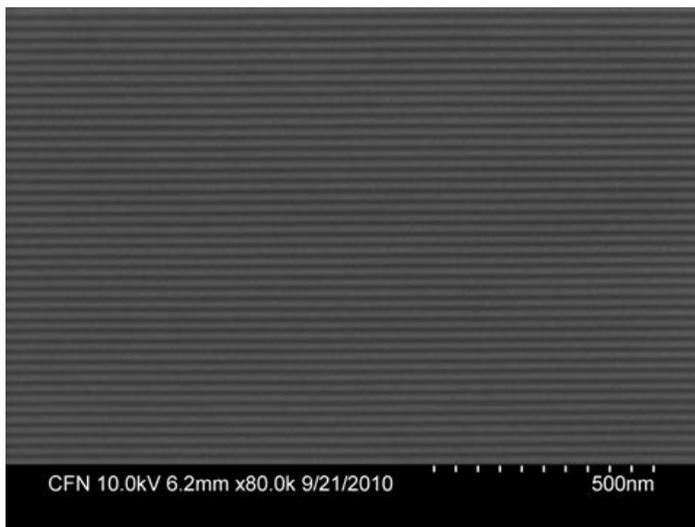


Figure 3: Cross-section scanning electron micrograph (SEM) view of the first MLL grown at BNL using the new multilayer deposition system.

CONVENTIONAL FACILITIES DIVISION (CFD)

Construction continued to make excellent progress in September, as the ring building workforce is at its projected peak. Site-wide, 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 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.

Excellent progress continues to be made in the installation of utility systems. The inner courtyard mechanical utility installation is nearly completed and electrical ductbank near the service building 1 and the RF area have been installed.

Much of the work emphasis now shifts to the building envelope (cover photo). The building envelope is now making rapid progress and the installation teams are fully mobilized. The roof decking is now complete to pentant 5, including insulation and membrane, and the standing seam finished roof panels are nearing completion on pentant 1. Waterproofing of the booster tunnel is also nearly complete, and backfilling of the tunnel roof will commence in October.

The wall siding interior liner system is now extended into pentant 4, and finished exterior siding is progressing rapidly on pentant 1 and the RF building. 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 into pentant 4. Supply and exhaust air ductwork is nearly complete through pentant 3. Electrical conduit and lighting in the storage ring tunnel are now complete from pentant 1 and into pentant 3. 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 2. Painting of the storage ring tunnel is now complete up to pentant 4 and painting of the ring building exposed steel and decking will get underway in October. The RF area and RF compressor buildings and cooling tower buildings have also seen significant progress during the period, with installation of MEP systems in progress.

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 to the NSLS-II site and will be tested for readiness in October. The electrical substation main transformer tie-in has been completed and the balance of substation work 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 October upon approval of the contractor's health and safety plan, with physical work getting underway in October, more than a year earlier than the original baseline plan.

PROCUREMENT ACTIVITIES

Five proposals for the Damping Wiggler were received on September 3 and are in evaluation, with award expected in early November. Proposals for the transport line magnets and the SR cryogenic system proposals were received, with awards expected by late October. An Invitation for Bid was issued to Torcon and E.W. Howell for construction of the HXN Beamline Building. Value is estimated between \$2 and \$2.5 million. Bids are due on October 21, with award planned for early November. Construction is projected to start by December 1.

COST/SCHEDULE BASELINE STATUS

The cumulative Cost Performance Index (CPI) is 1.01 and the cumulative Schedule Performance Index (SPI) is 0.99, both well within the acceptable range. The project is 39% complete with 27% of contingency and management reserve remaining on the project. The conventional construction schedule progress was impressive this month, with approximately \$11 million worth of work performed. 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 production.

Progress during September in most areas of the project was on schedule and on budget. The current-month CPI is .91, green status, and the current-month SPI is 1.22, yellow status. This current-month schedule variance is positive due to continued positive schedule performance in the ring building construction.

The critical path for the project remains the same in September, passing through accelerator magnet first article production; girder assembly, installation, survey, and

alignment; then 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.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

A National Emission Standards for Hazardous Air Pollutants (NESHAPs) Assessment was completed for the NSLS-II facility. This assessment completed a major milestone to support the ongoing development of the Authorization Basis Documentation for the facility.

The assessment was based on anticipated diffusive/fugitive losses during the operational phase of the accelerator. The CAP88-PC modeling program provided a conservative estimate (erring on the side of caution) of the "effective dose equivalent" to a hypothetical "maximally exposed individual." The potential effective dose equivalent from the NSLS-II facility, 2.32E-04 mrem/year, was below the 10mrem/year annual limit specified in the Code of Federal Regulations (40 CFR) 61, subpart H, and well below the 0.1 mrem/yr limit which would require a NESHAPs permit and continuous air monitoring. The potential exposure and dose to the general public from the release of very small quantities of short-lived gaseous radionuclides is negligible. In accordance with 40 CFR 61.93 (b) (4) (i), DOE facilities must perform periodic confirmatory measurements and/or take a graded approach to ascertain that the emissions from their operations remain below the 0.1 mrem in any given year.

The QA/ESH assessment position was filled. This Quality Engineer will develop, implement, and administer a 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 requirements, codes, and standards and will review plans and procedures as these relate to the contractors' processes, systems, and products.

RECENT HIRES

Ivy Hidalgo-Oldberding – Quality Engineer, PSD

William Kieffner – Supervisor Construction Inspection, CFD

Scott Orban – Electrical Designer, Electrical Engineering, ASD

