National Synchrotron Light Source II

Project Progress Report

December 2010

December 31 (New Year's Eve): All is quiet on site, but December progress is evident despite the snow.

report due date:
January 20, 2011

Steve Dierker
NSLS-II Project Director

Brookhaven National Laboratory
Upton, New York 11973

BROOKHAVEN NATIONAL LABORATORY

OVERALL ASSESSMENT

The National Synchrotron Light Source II project maintained satisfactory cost and schedule performance. The project is 46% complete with 30% of contingency and management reserve for the remaining cost to go. The cumulative schedule index is 0.98 and the cumulative cost index is 1.02. The current-month schedule variance is negative due to a record-setting blizzard and holiday closings late in the month which impacted the pace of conventional construction and delivery of production components.

Construction of the ring building is on track to turn over the first section in February, and the Lab–Office Building (LOB) contractor mobilization is completed. The beneficial occupancy readiness evaluation (BORE) process has begun by conducting weekly pre-BOREs since early November. With growing workforce at the construction site, the project continued to proactively manage both the ring building and LOB contracts to ensure that sitewide safety goals are met.

Good progress continued in the production of girders, vacuum chambers and pumps, linac, booster, controls, power supplies, and electrical utilities for Accelerator Systems. The manufacturer's conceptual design of the damping wiggler was approved and a proposal for the 3-pole wiggler was received. Magnet production continues to progress slowly, resulting in a delay of the projected early completion date by 3 weeks from February 2014 to March 2014. Satoshi Ozaki was appointed as manager for magnet production to provide full-time, focused, and dedicated management oversight. Potential mitigation plans will be continuously formulated and implemented over the next few months based on actual progress. The projected early completion date is expected to fluctuate during this adjustment period.

After completion of the preliminary designs for six beamlines in September 2010, excellent progress continues on their final designs and the technical specifications and statements of work for key procurement components. The engineering design of endstations and R&D activities continued to advance at good pace.

The critical path for the project has changed slightly and now includes the RF cavities procurement as well as storage ring magnet production. Careful analysis and formulation of the schedule mitigation plan will continue over the next few months. Activities funded by the American Recovery and Reinvestment Act (ARRA) continued to be on schedule and on budget.

UPCOMING EVENTS 2011

Production Readiness Review (PRR) for BINP Magnets	Jan 12–13
BINP Final Design Review	Feb 7–11
Project Advisory Committee (PAC) meeting	Feb 8–9
DOE Mini-review of NSLS-II Project	Feb 25
SRX Beamline Advisory Team (BAT) meeting	Feb 28
Science Advisory Committee (SAC) Review	Apr 4–5
ASAC	May 10–11
DOE Review of NSLS-II Project	June 21–23

ACCELERATOR SYSTEMS

Accelerator physics. Progress has been made on the design of a lattice having three long straights with large horizontal beta function and 12 long straights with small horizontal beta function. This will provide a large β_x for injection and small β_x for insertion devices. A family of linear lattice solutions has been investigated and the study of the nonlinear dynamics is underway. One particular configuration has been found with reasonable dynamic aperture. The results are encouraging, but more work is needed before we can be sure that this solution is adequate for operation.

An important issue for the top-off safety analysis has been recognized. Quadrupole and sextupole power supplies have been designed to provide significant margin above the stated maximum current. Simulations are underway to determine the controls required to assure safe top-off operation, taking into account this increase in the potential field strength in the quadrupole and sextupole magnets.

The impedance of the strip-line kicker for the transverse feedback system has been found to be significant. Work is underway to optimize the design to provide high shunt impedance while keeping beam impedance within acceptable limits.

A scraper has been installed on the NSLS x-ray ring. Plans are underway for experiments to measure radiation produced by the scraper and compare the results with calculations.

A parallel computer code is being developed to simulate the transverse coupled bunch instability and to study the damping effect of positive chromaticity.

Controls. Strong interactions and information transfer with the linac and booster manufacturers consolidated the design for the vendor-provided injector controls systems. The support and EPICS implementation for vacuum instrumentation (MKS RGA) is complete. Now all system controls for vacuum devices are completed. The controls group has adapted new digitizing requirements for the integrating current transformers. The beam position monitor (BPM) data acquisition software is completed and tested, and user documentation is being written. Readout software for the power supply controllers (PSC) was tested with the PSC first articles. All essential functions have been tested and no issues with hardware or software could be detected. This completes the EPICS integration.

First versions of applications for the booster, injector kicker, and storage ring have been tested. The controls for equipment protection systems have been upgraded to accommodate the recently re-specified need for a response time of 1 milli-second, which is accomplished via the cell controller structure. For beamline and insertion device controls, an RFP has been published for ten controllers, each with eight motors. The first deliverable has an early target date to support integration and prototyping. The controls group worked with ITD and the construction group to ensure connectivity in the first pentant of the NSLS-II ring building and early availability of the equipment room.

The evaluations of VME cPCI and commercial UNIX servers as well as network "edge-switches" were completed, and purchasing of this hardware can start. All timing hardware for the storage ring is in hand. IRMIS tools that had previously been developed at APS, BNL, and Michigan State University (MSU) are being separated into packages so that functionality and code bases are distinct for each functional part. The portion for documenting system installation will use MSU extensions for capturing inventory. The Diamond IOC that provides data services is being installed and tested to provide a platform to develop NSLS-II controls servers for high-level physics applications. The first servers to be deployed here will be the orbit and magnet services. A single-channel display, "Probe," was rewritten to use the NSLS-II server environment. It demonstrates a significant drop in CPU utilization and data loss.

Magnets. In order to address schedule and technical challenges, Satoshi Ozaki was appointed as the manager for magnet production in early December. This appointment will ensure that there is full-time, focused, and dedicated management oversight of this complex activity. In addition, two consulting contractors were added to the magnet production team who will provide full-time support and oversight at two vendor sites. Pre-shipment checklists for all magnets have been submitted to the manufacturers. The revised inspection traveler for the production sextupole magnet is completed. An engineering change notice for corrector magnets has been produced, closing out remaining action items from the corrector magnet Production Readiness Review (PRR). The first quadrupole magnet from Budker arrived; acceptance tests showed a few issues which have been discussed with the manufacturer. Buckley was authorized to ship the first large-aperture quadrupole magnet and has committed to complete all first article magnets by 1/31/2011. The PRR could possibly take place that week. The first quadrupole magnet from Tesla has been received. The shipment of twenty-seven magnets in two batches from Danfysik has been approved. Thirteen of these magnets have arrived at BNL. Mechanical engineering continues to support the magnet manufacturers by magnetic modeling in the effort to analyze and optimize first article results.

Mechanical engineering. First article floor plates for the magnet girders in the tunnel have been inspected at the vender's facility and approved for shipment. Seven girders arrived for the December delivery. In preparation for routine girder integration, a second set of multipole girder lifting fixtures was manufactured and another "strong back" was manufactured for load testing.

The beamline front end work continued with ray tracing and redesign of the manufacturing stands. The order for Glidcop material for front end components has been placed. The photon shutter body models and drawings have been revised. They have a standard length, height, and width, along with standard actuator stroke.

The prototype for a 300mm-long stripline monitor set-up using copper-plated invar was completed and is ready for testing. A prototype primary mirror was fabricated for the Synchrotron Light Monitor beamline. The mirror consists of a Glidcop flap that has been machined and lapped followed by electro-less nickel plating, then polished to ~1nm surface roughness.

The final design of the in-flange synchrotron radiation absorber is complete. A Final Design Review (FDR) was held in December, with no major findings. Test fixtures were designed and fabricated for testing first article transport line BPMs and the storage ring DCCT.

The FDR of the Faraday Cup beam-dump design for the transport lines was held, recommendations were implemented, and the drawings were released. Prototype construction is in progress, with all purchased items received.

A prototype carbon fiber support for front-end components was tested for vibration performance. The natural frequency was 43 Hz, with 2.5X amplification of ground motion in the transverse direction. Thermal stability is expected to be ±70 nm in the tunnel.

Linear potentiometers, precision home switches, and forward-limit switches were added to the transport line energy slit design. The reference design of the high order mode (HOM) damper for the Landau cavity was completed, as was the preliminary design of the waveguide shielding at the penetration of the ratchet wall.

The storage ring tunnel utility piping work was awarded to Torcon, Inc. Procurement documents for the pumping skid have been completed and routed for approval. The procurement documents for the injector utility and pumping skids also have been completed.

The preliminary design for the kicker and septa magnets has been completed. A contract kick-off meeting was held at Stangenes Industries for transport line magnet production.

Power supplies and electrical utilities. The order for the PSC has been placed. Tests for the 2-channel regulator were completed successfully. The main production contract has been awarded. The power supply interface board and chassis bids were received and the contract has been awarded. The contract for production of the power converters for the multipole power supplies has been awarded.

The output cables having Zero Halogens requirements have been submitted to the BNL Electrical Safety committee because the cables are not yet UL listed. We have conditional approval upon vertical flame tests (to be done at BNL) or after the cables have received UL listing. All power supply output cable orders have been awarded, with delivery near the end of January 2011.

The first article equipment enclosures were successfully tested. The racks met all specifications. A PRR for the equipment enclosures was held; production will start in January and delivery of the first production units should be in mid March.

The installation of cable trays in the tunnel and on the mezzanine was awarded to Torcon. The order for the AC power connection cable has been placed. This is the cable for most of the power connections on the storage ring mezzanine and in the injector service building. The low-precision temperature control panel production drawings were finished and a purchase order (PO) was submitted. Bids have been received, and award is expected in early January. A PO was submitted for a long-lead-time component for the high-precision temperature controller chassis.

The first article for the uninterruptable power supply (UPS) has been received and is ready for installation.

A change to the booster dipole power supplies required a new layout of the equipment racks in the booster service building. Four new enclosures had to be added for energy storage capacitors in the dipole power supplies. This new layout has started: engineering has worked out a new layout for which final drawings are being prepared.

Vacuum. Six additional storage ring Al-chambers were assembled, baked, vacuum certified, and are ready for girder integration, making a total of twenty-six chambers available. Twelve S6 chambers have been completed by APS and nine were received. The contract for all the multipole extrusions is completed and extrusions have been shipped. Prototype S4A extrusions were made and sent to two vendors for test fabrication of prototype chambers. Orders for carbon fiber stands for multipole chambers have been placed with an outside vendor; orders for stainless stands for multipole/dipole chambers were placed with BNL Central Shops. Fabrication of LBT bending chambers has begun at Central Shops.

The order for sixty-two RF-shielded gate valves was placed, as was the order for 280 titanium pump power supplies. Fifty-two titanium pumps were delivered this month and are being evaluated. The quotes for vacuum gauge controllers are being evaluated and the order is to be placed in early January. The types and specification of vacuum instrument cables were sent to the electrical group for approval. Eight additional turbo-pump stations have been assembled and are being tested. The acceptance test of the chemical cleaning facility at the manufacturer's site was successful and the equipment is to be shipped to BNL in early January.

Injector. The mechanical aspects of the linac (including alignment) were clarified with the manufacturer. BNL experts visited the booster manufacturer, BINP. General findings are that the project is on schedule; the date for the FDR remains the second week of February 2011. The accelerator physics group is working on the possible beam loss pattern in the injection line, and beam-dump hardware is under design. A compact pulse forming network (PFN) is being tested for the pulsed magnets. Procurement documents for the elements of the injection straight of the storage ring are complete and purchasing of components can begin.

Insertion devices. The manufacturer's conceptual design of the damping wigglers was approved. Software was prepared for operating the Hall probe bench in the permanent magnet measurement facility. A comprehensive report on thermal performance of IVU cooling was completed. The supporting Vendor Interface Control drawing for the technical specification is being reviewed. A single proposal to construct the three-pole wiggler was received.

EXPERIMENTAL FACILITIES

Experimental Facilities activities in December focused on a week-long vendor informational meeting to communicate the technical requirements for beamline systems before the official start of the long-lead-time procurements. This meeting was very successful and a number of areas were highlighted where specifications could be amended slightly.

Work continues on the technical specs and statements of work (SOWs) for long-lead-time procurement beamline components (including the larger beamline optics packages), with the requests for proposals (RFPs) for motion controllers and the grating substrates about to be released. For the experimental hutches, the SOW and specs documents are completed and drawings and specification tables for each hutch are being completed. Utility layouts inside and on top of the hutches for each beamline are progressing well and should be completed in about 2 to 3 months.

High energy-resolution optics R&D. Final design of the prototype spectrometer system for testing the CDW/CDDW optics was completed in December (Fig. 1). Critical high-precision goniometers for the system have been ordered; other components are being fabricated by the vendor. Delivery of the system is expected in May 2011. In parallel, the design of high-precision mechanical stages for testing the CDW optics was completed, and fabrication of parts is underway. These stages will be used for beamtime at the SPring-8 synchrotron in February 2011. The vendor meeting in December provided a head start for procurement of the major optical components of the beamline. Work is in progress to complete the technical specs and the SOW for these components.

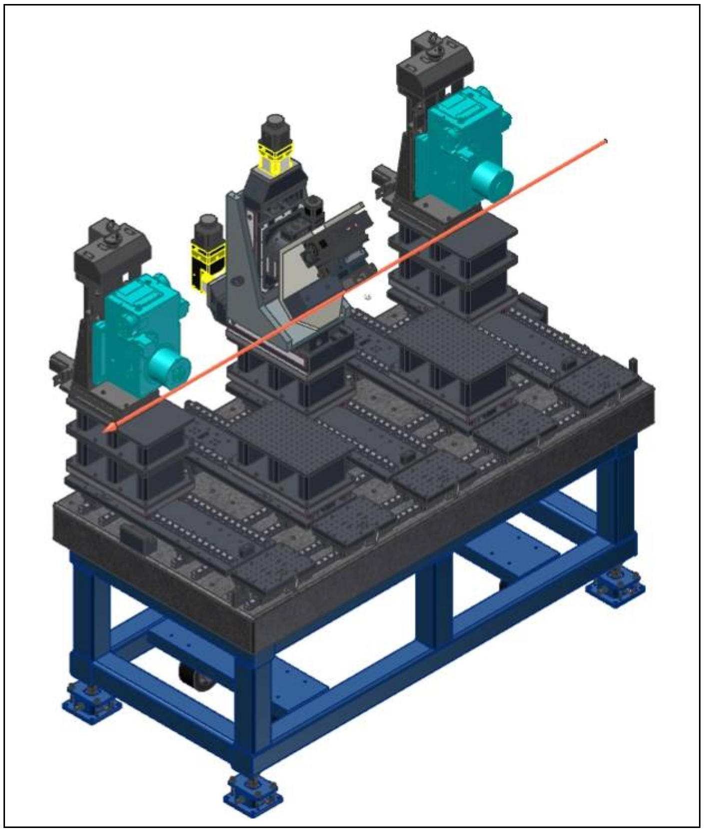


Figure 1. Final design by ADC of the prototype spectrometer system for testing high-energy-resolution CDW/CDDW optics with the multilayer collimating mirror.

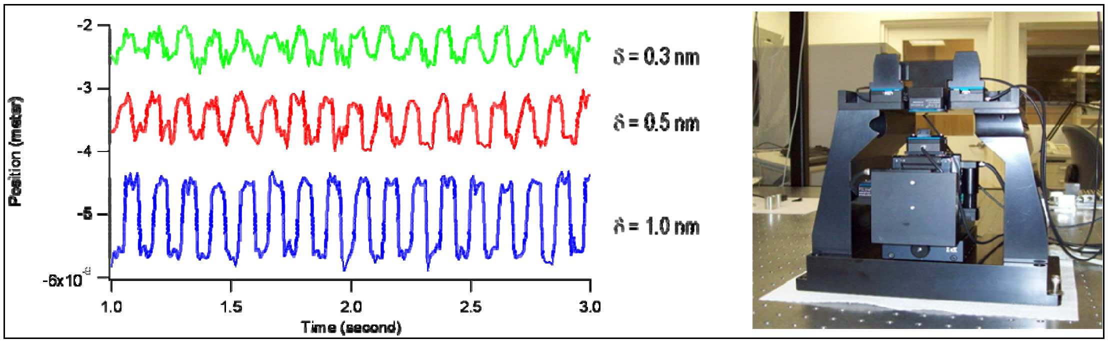


Figure 2. (left): The fiber optic laser interferometer demonstrated sufficient resolution to detect step size down to 0.3 nm. (right): The second version of the MLL microscope is nearly completed. The photo shows the assembled manipulators for the MLL optics that provide the 8 degrees of motion required for aligning the two crossed MLLs.

Hard x-ray nanoprobe. The HXN team made major progress in beamline design, nanopositioning, and x-ray optics R&D. Technical specs for the beamline optics and components are compiled, after detailed discussions with the vendors. The nanofocusing experiment performed in Dec. 2010 resulted in dramatic improvement in the stability of the focus beam: as little as ~10nm vertical drift over a 1-hour period. The same experiment also provided confirmation on the primary source of the drift. The laser interferometers being developed under the nanopositioning R&D have demonstrated detection resolution better than 0.3 nm (left, Fig. 2). The second version of the MLL microscope with enhanced capabilities is nearly completed. MLL manipulators providing 8 degrees of freedom of motion are assembled and ready for performance tests.

Coherent hard x-ray scattering. The CHX team focused on finalizing technical specs for the beamline optics in thorough interactions with potential vendors. The in-house facilities of three important x-ray optics and mechanical system makers were visited during a 1-week trip at the end of November and early December. With time for detailed discussions about important possible solutions and design features, these meetings were quite useful and informative. Discussions continued during the week-long meetings subsequently held at NSLS-II. These discussions showed that although the CHX optics specifications are, in general, beyond the current state of the art, especially in terms of instrumental stability and figure errors, several vendors have impressive track records in advanced instrument design, proving that the design goals are ambitious but also realistic.

Coherent soft x-ray scattering. The CSX beamline team progressed with the beamline optical design and detailing the beamline final design. Interaction with the ASD staff is advancing the EPU and the canting magnet design; the EPU design is now approved for procurement. The CSX team also progressed on the beamline optics enclosure and utilities procurement packages. Study of the expected degree of coherence at the beamline (wave front analysis) continued. Procurement packages for the grating substrates are almost finalized, as well as for the internally water-cooled mirrors.

Submicron resolution x-ray spectroscopy. Following discussions with potential vendors, the SRX team finalized the specifications for a horizontally focusing mirror unit, double-crystal monochromator, and the two KB sets (high flux/moderate resolution and moderate flux/high resolution) for the endstation.

X-ray powder diffraction. The procurement strategy and R&D work plan for the Laue–Laue monochromator were carefully considered. The technical specifications and SOW for the monochromator are advancing well. The preliminary design of the mount of the first monochromator crystal was guided by in-depth mechanical/thermal stress analyses and modeling, as well as optical measurements at the NSLS-II metrology facility. An alternative white-beam filtering scheme using a gas absorption chamber was also examined.

Optics fabrication labs. All acid etching (currently for metals and silicon) has been consolidated to Laboratory E8. After ESH/Waste Management approved the final procedure for silicon etching with a hydrofluoric and nitric acid solution, the first etch was completed in the E8 lab fume hoods with ESH staff present. This initial run exposed a few small changes that will be implemented in the procedure and equipment, and proved the ability to etch silicon as needed. Future effort will be directed toward determining etching rates and optimization of a dilute-etch process for obtaining strain-free silicon with surface roughness as low as possible. The fabrication of CW and D crystal is underway with orientation, slicing, and lapping completed for two pairs. Polishing and CW crystal thinning is underway. The MOS in-situ film stress monitor has been commissioned and aligned on the MLL deposition system. A new process-gas mixing system has been designed and implemented in a deposition system for stress-reduction experimentation. Initial tests using a nitrogen/argon mixture showed higher stress reduction than using a neon/argon mixture. Quantitative measurements and multi-layer roughness due to gas mixing are being examined.

Optical Metrology Lab (OML). Facilities at Building 703 are operational and outfitted with three commercial pieces of visible light metrology equipment, including a ZYGO MST Fizeau-type 4-inch interferometer, an upgraded ZYGO NewView 6300 white light interferometric microscope, and an atomic force microscope (Nanosurf AG). These instruments were routinely used by scientists from different groups and by the OML to measure optical components.

CONVENTIONAL FACILITIES

Construction of conventional facilities continued to progress well in December, although a record-setting blizzard late in the month impacted the pace of construction. Despite the weather, construction is progressing on track to turn over the first section of the ring building in February, if more typical winter conditions prevail in the intervening weeks.

The LOB contractor mobilization is completed, and foundation installation is underway for LOBs 1 and 2 (Fig. 3). Shop drawings for structural steel have been submitted and review is being expedited to support the delivery of steel and the start of steel erection for LOB 1 early this spring. Work planning among the ring building and LOB contractors is proceeding cooperatively and without impact on the pace of each contractor's work.

Figure 3: Foundation work for the Lab–Office Buildings.

Concrete work for the ring building is now more than 96% complete. The storage ring tunnel slab and walls have been poured in the pentant 5 area; all that remains to be done are the tunnel roof and experimental floor in this area and the ground floor slab in the booster building.

Utility systems are being readied for startup; electrical systems have been completed. Installation of mechanical systems in service building 1 and the cooling tower building is nearly done. These systems are being readied for acceptance testing under the oversight of the commissioning contractor. Operations and maintenance staff are being familiarized with the newly installed equipment.

Final detail work associated with the enclosure of the first phase of construction is nearing completion. Temporary division walls (Fig. 4) now separate the areas still under construction from the nearly completed pentant 1 area. Temporary heating equipment enables temperature-dependent finish work such as spackling and painting to be completed. Building enclosure also continues to progress, with the RF area now fully enclosed; exterior siding panels are installed as far as pentant 3 and interior liner panels up to pentant 4.

The roof in pentant 1 is now complete, and installation of the finished standing seam panel has progressed to pentant 2 and adjacent pentant 5 in the area of the RF building interface. Progress on the roof system installation has been slowed by the icy conditions, but as this activity was ahead of schedule it is not a concern at this time.

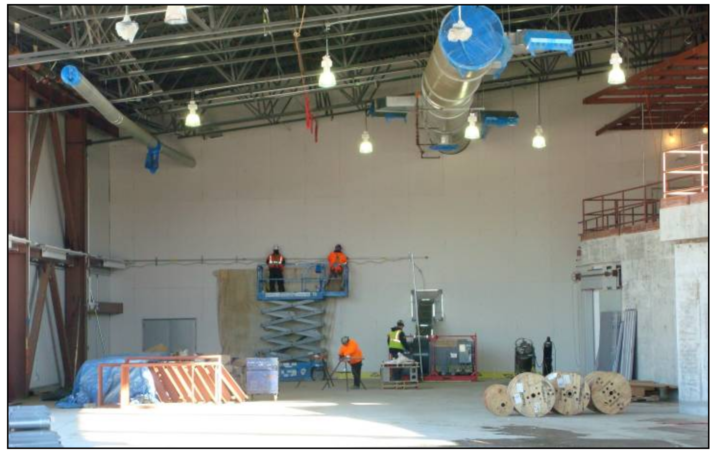


Figure 4: Temporary wall and heating being installed in December.

Interior mechanical, electrical, and plumbing work continues to progress around the ring. Major HVAC equipment, including air handlers for the experimental floor and storage ring, has been installed up to pentant 5. Fire protection headers and return air ductwork have been installed from pentant 1 into pentant 4. Electrical conduit and lighting in the storage ring tunnel are complete from pentant 1 through pentant 4. Work continues on all piping, HVAC, and electrical systems throughout the ring building complex.

The chilled water plant expansion is well into the equipment startup and testing phase. Permanent power is available to the expanded portion of the plant, and individual equipment items are being tested and commissioned. The newly installed systems would have been fully operational by February; however, a repair to the chiller motor starters was required. This will delay startup of the chilled water systems to the end of February, still several months earlier than needed. The underground chilled water piping installation is ready to convey chilled water to the NSLS-II site from the central chilled water plant. Final restoration of the area disturbed by the installation was completed in December.

The electrical substation expansion is also nearly complete. The switchgear and cabling work is done, and permanent power is available to be sent to the NSLS-II site. The 20MVa transformer requires only some punchlist items before startup. It will be available by January 2011, more than one year earlier than needed.

Figure 5: Punchlist items are being addressed.

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. The project is 46 percent complete, with 29 percent of contingency and management reserve remaining, based on EAC work remaining.

The current-month CPI is 1.09, green status; the current-month SPI is 0.71, red status. This negative current-month schedule variance is due primarily to weather-related conventional construction delays affecting the installation of mechanical piping, electrical work, and painting in pentant 1 and to delays in the building enclosures, metal roofing, and wall panel installation for pentants 3 and 4. However, conventional construction maintained a slightly net-positive cumulative schedule variance. The current-month accelerator schedule performance was negative due primarily to delays in magnet production deliveries and vacuum chamber procurements.

The critical path for the project has changed to include the RF cavities procurement lead-time to delivery along with the delivery of the storage ring production magnets. The critical path runs through accelerator magnet deliveries; RF cavity contract award and fabrication, girder assembly, installation, survey, and alignment; then accelerator installation, integrated test, and commissioning. Within 2 to 3 months of the critical path are vacuum chambers/components; storage ring RF cryogenic system; and booster vendor production, assembly, and testing. The projected early completion date for the project has been pushed out by 3 weeks, from February 2014 to March 2014. There are 15 months of float between the project early completion milestone and CD4, with approximately 28 percent schedule contingency.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

The Fire Hazards Analysis for NSLS-II has been completed and signed off. This is an important supporting document for the Authorization Basis Documentation package.

The beneficial occupancy readiness evaluation (BORE) process has begun for phase I, which includes pentant 1 and the vehicle tunnel. Weekly pre-BOREs are being conducted to familiarize the BORE committee with the facility and identify any issues prior to the actual BORE, which is scheduled for the first week in February. Issues identified are being tracked by the project and resources needed to correct those issues are being assigned. A complete BORE will allow the occupancy of pentant 1 and the installation of technical equipment. Processes for work control and to manage the staff/contractor interfaces are being established.

RECENT HIRES

Michael Bilello – Student Assistant, Electrical Engineering, ASD

Corey Hopkins – Student Assistant, Controls, ASD

Kenneth Lauer – Controls Engineer, HXN Beamline, XFD

Amber Liverpool – Student Assistant, Controls, ASD

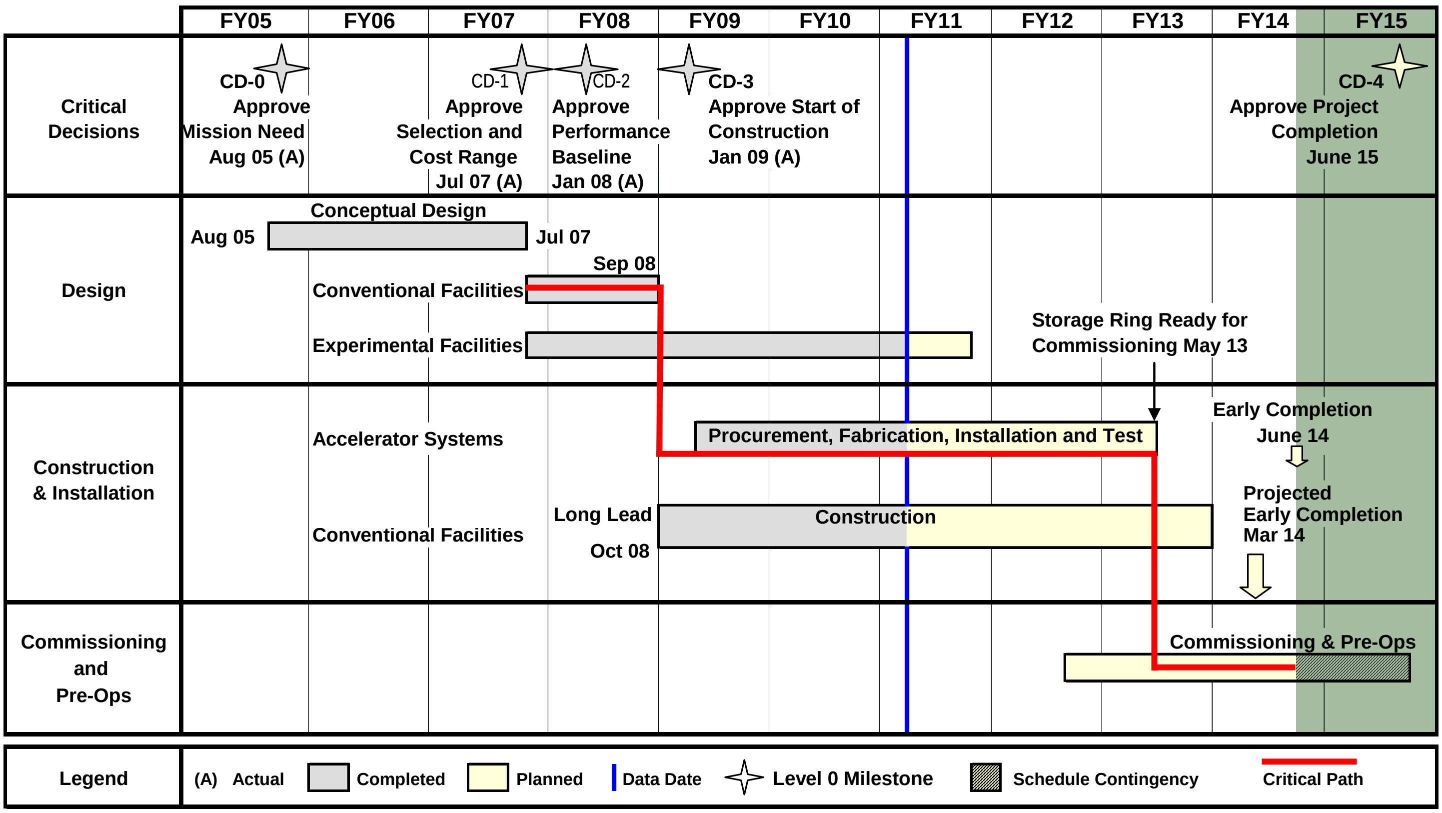
Michael Poat – Student Assistant, Enterprise Computing, PSD

RECENT PROJECT ACCOMPLISHMENTS

- Satoshi Ozaki was appointed as the manager for magnet production to provide full-time, focused, and dedicated management oversight.
- Thirteen sextupole magnets from Danfysik arrived at BNL and fourteen more are in transit.
- The first quadrupole magnet from Budker arrived and Buckley was authorized to ship the first large-aperture quadrupole.
- All system controls for vacuum devices are completed and the EPICS integration to all subsystems is completed.
- The manufacturer's conceptual design of the damping wiggler was approved.
- The SOW and specification documents for the experimental hutches are completed.
- Final detail work associated with the ring building enclosure of the first phase of construction is nearing completion and on track for beneficial occupancy in February.
- The LOB contractor mobilization is completed.
- Fire Hazards Analysis, part of the Authorization Basis Documentation package, was completed and signed off.

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

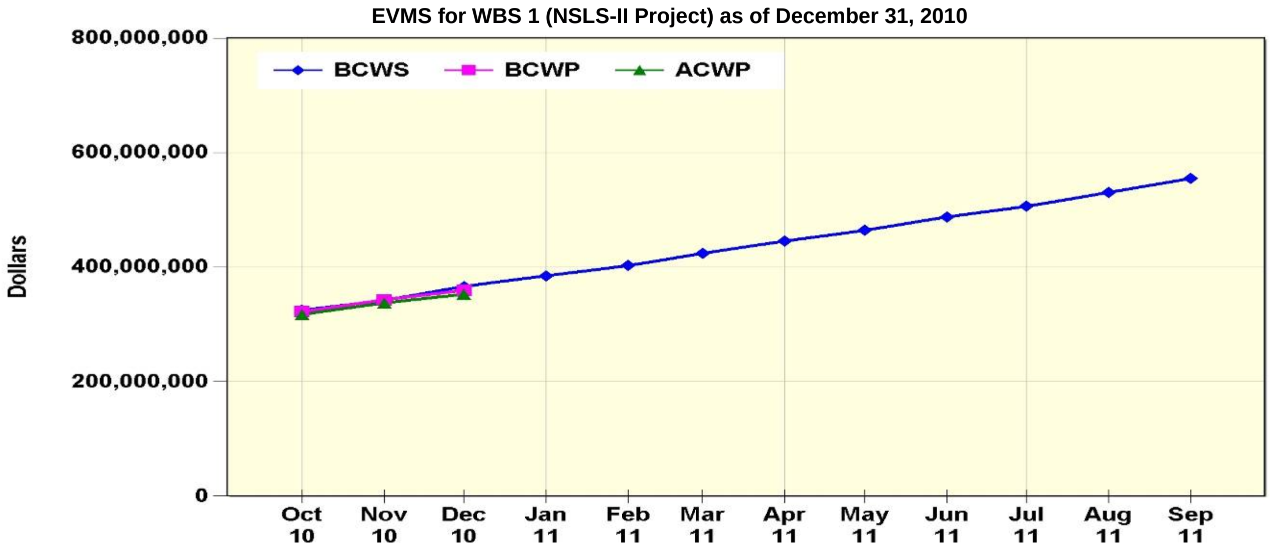


Funding Profile

Topic	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

Key Personnel

Title	Name	Email	Phone
Federal Project Director	Frank Crescenzo	crescenzo@bnl.gov	631-344-3433
NSLS-II Project Director	Steve Dierker	dierker@bnl.gov	631-344-4966



Cumulative to Date:	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
BCWS	325,023	342,599	366,097	384,967	403,115	424,115	445,580	464,438	487,583	506,490	530,611	555,003
BCWP	322,376	342,811	359,505									
ACWP	317,488	337,352	352,687									

Project as of 12/31/10	Current Period	Cum-to-date
Plan (BCWS) $K	$23,498	$366,097
Earned (BCWP) $K	$16,693	$359,505
Actual (ACWP) $K	$15,335	$352,687
SV $K	$-6,805	$-6,592
CV $K	$1,358	$6,818
SPI	0.71	0.98
CPI	1.09	1.02
Budget at Completion $K (PMB (UB))		$784,704
Planned % Complete		46.7
Earned % Complete		45.8
Mgmt Reserve/Cont as % of BAC remaining		29.9
Mgmt Reserve/Cont as % of EAC remaining		29.0

The IPT can find further details on NSLS-II cost and schedule data at http://www.bnl.gov/nsls2/project/IPT/default.asp.

Milestones – Near Term	Baseline	Done
L3-Clean room contract awarded	12/30/09	✓
L3-Linac contract awarded	2/05/10	✓
L3-APS welding S2 ODD – first chamber ready for assembly	3/17/10	✓
L3-Pentant 1 structural steel erected	3/31/10	✓
L3-Initial test of new MLL deposition system completed	6/30/10	✓
L3-LOB construction contract awarded	7/01/10	✓
L3-LOB construction Notice to Proceed (NTP) issued	7/01/10	✓
L3-SR Magnet – Quads first article ready for integration	7/19/10	
L2-Pentant 2 structural steel erection completed	8/05/10	✓
L3-Safety review of preliminary designs for project BLs completed	8/30/10	✓
L2-BAT reviews of 100% prelim. designs for project BLs completed	9/15/10	✓
L2-Ring building pentant 1 BOD	2/01/11	
L3-Lobby BOD	2/01/11	

L3 = Level 3 milestone, L2 = Level 2 milestone

Schedule Performance Index, Project to Date:

SPI	0.98

Cause & Impact: No reportable variance.
Corrective Action: None Required.

Cost Performance Index, Project to Date:

CPI	1.02

Cause & Impact: No reportable variance.
Corrective Action: None Required.

Eleven PCRs were approved in December:

PCR #	Area	Δ cost	Title or Description	PCR #	Area	Δ cost	Title or Description
11_203	CF	$1,207K	HXN Endstation Building Cost Increase	11_202	ASD	$111K	Purchase of Halogen-Free Cables
11_204	CF	$2,608K	DI Water Scope Transfer to CF	11_205	ASD	-$676.4K	DI Water Scope Transfer
11_221	CF	-0-	HXN Building Consolidation in LOB 3 Scope	11_215	ASD	-$1,345.7K	Damping Wiggler Contract Award & Specs Change
11_225	CF	$1,999K	Addition of ASD Cable Tray Scope to CF	11_224	ASD	-$1,194K	Transfer of ASD Cable Tray Scope to CF
11_229	CF	-0-	Cost Allocation per Amendment #4	11_228	NA	$10,000K	Request for Management Reserve
				11_172	EF	$752K	Additional Engineering Staff for Beamline Design

ARRA DETAILS

The Recovery Act has provided advanced funding for NSLS-II construction, created jobs, and substantially reduced the cost and schedule risks for the project. The overall schedule for the ring building completion has not been accelerated; however, Recovery Act funds have allowed for re-ordering of the work sequence with a six-month acceleration of the injection building completion. Acceleration of the injection building allows for earlier installation and commissioning of the injector, which had been close to critical path. This addition of schedule float significantly reduces the schedule risk for the accelerator. In addition, Recovery Act funds have allowed for accelerated completion of the Laboratory–Office Buildings by approximately 15 months, which has enabled the project to maximize the cost advantage of the depressed construction market.

ARRA$ as of 12/31/10	Current Period	Cum-to-date
Plan (BCWS) $K	$7,227	$100,025
Earned (BCWP) $K	$4,242	$98,938
Actual (ACWP) $K	$4,373	$97,476
SV $K	$-2,985	$-1,087
CV $K	$-132	$1,462

ARRA Milestones		
Description	Baseline Date	Status
Install sanitary UG piping SB3 footings.	12/08/09	Completed 12/10/09.
Pour tunnel slab CL 018-024.	12/14/09	Completed 11/02/09.
Excavate booster svc bldg. foundations.	12/24/09	Completed 10/7/09.
Pour tunnel slab CL 024-030.	12/30/09	Completed 11/25/09.
Begin concrete tunnel roof pentant 1.	12/10/09	Completed 11/12/09.
Complete tunnel slab pentant 2.	1/15/10	Completed 1/15/10.
Pentant 2 tunnel walls complete.	3/16/10	Completed 3/11/10.
Begin steel erection pentant 1.	4/14/10	Completed 3/16/10.
Start metal decking for pentant 1 Service Building.	5/12/10	Completed 4/14/10.
Pentant 5 tunnel slab complete.	5/25/10	Completed 12/9/10.
Begin experimental floor concrete, pentant 1.	6/2010	Completed 6/7/10.
Begin experimental floor concrete, pentant 2.	7/2010	Completed 6/21/10.
Complete structural for steel pentant 3.	9/2010	Completed 8/13/10.
Complete chilled Water Plant enclosure.	9/2010	Completed 8/2010.
Pentant 1 building enclosure complete.	10/2010	Completed 10/2010.
RF building enclosure complete.	11/2010	Completed 11/2010.
Injection Bldg Enclosure Complete	12/2010	Deferred until February 2011.
Permanent Power Available Pentant 1	01/2011	On track for early January 2011.

Blue text represents an addition.

CLASSIFICATION (When Filled In)

CONTRACT PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

FORM APPROVED
OMB No. 0704-0188

1. CONTRACTOR	2. CONTRACT	3. PROGRAM	4. REPORT PERIOD
a. NAME Brookhaven Science Associates	a. NAME National Synchrotron Light Source II (NSLS-II)	a. NAME December 2010	a. FROM (YYYYMMDD) 2010 / 12 / 01
b. LOCATION (Address and ZIP Code) Brookhaven National Laboratory, Upton,NY	b. NUMBER	b. PHASE	b. TO (YYYYMMDD) 2010 / 12 / 31
	c. TYPE / d. SHARE RATIO	c. EVMS ACCEPTANCE NO YES X (YYYYMMDD)	

5. CONTRACT DATA

a. QUANTITY	b. NEGOTIATED COST	c. ESTIMATED COST OF AUTHORIZED UNPRICED WORK	d. TARGET PROFIT/ FEE	e. TARGET PRICE	f. ESTIMATED PRICE	g. CONTRACT CEILING	i. DATE OF OTB/OTS (YYYYMMDD)
1	912,000,000	0	0	912,000,000	0	0	

8. PERFORMANCE DATA

ARRA Cost Account	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
ITEM (1)	WORK SCHEDULED (2)	WORK PERFORMED (3)	WORK PERFORMED (4)	SCHEDULE (5)	COST (6)	WORK SCHEDULED (7)	WORK PERFORMED (8)	WORK PERFORMED (9)	SCHEDULE (10)	COST (11)	BUDGETED (14)	ESTIMATED (15)	VARIANCE (16)
A ARRA													
1.05.02.02.01 CF Title II A/E Design	0	0	0	0	0	300,000	300,000	313,466	0	-13,466	300,000		
1.05.03.02.01 General Requirements	78,665	80,526	80,526	1,861	0	5,182,343	5,287,809	3,326,438	105,466	1,961,371	5,295,535		
1.05.03.02.02 Site Work	0	10,736	10,736	10,736	0	3,448,026	3,537,669	3,364,636	89,643	173,033	3,611,419		
1.05.03.02.03 Pentant 1 and Service Building	1,901,594	931,714	931,715	-969,880	-1	18,613,892	17,850,320	17,953,473	-763,572	-103,153	19,042,764		
1.05.03.02.04 Pentant 2 and Service Building	457,588	451,685	451,687	-5,904	-2	10,921,620	13,327,276	13,435,088	2,405,656	-107,812	15,437,011		
1.05.03.02.05 Pentant 3 and Service Building	626,440	244,132	244,132	-382,308	0	7,343,962	9,033,033	9,171,078	1,689,071	-138,045	10,346,995		
1.05.03.02.06 Pentant 4 and Service Building	67,300	96,347	96,348	29,047	-1	1,960,654	2,232,402	2,404,764	271,748	-172,362	2,733,490		
1.05.03.02.07 Pentant 5 and Service Building	342,526	603,239	603,239	260,713	0	6,411,067	6,119,914	6,052,168	-291,153	67,746	7,324,886		
1.05.03.02.08 Injection Building	122,718	294,965	299,172	172,247	-4,207	4,463,055	3,697,403	3,598,206	-765,652	99,197	5,918,100		
1.05.03.02.09 RF and Compressor Building	463,912	268,700	268,700	-195,212	0	4,127,352	3,442,496	3,519,177	-684,856	-76,681	4,950,780		
1.05.03.02.10 Lobby	695,059	146,632	146,633	-548,427	-1	2,515,404	1,893,079	1,897,563	-622,325	-4,484	3,005,358		
1.05.03.02.11 Cooling Tower and Process Water	449,330	117,223	117,222	-332,107	1	4,187,647	2,749,439	2,846,301	-1,438,208	-96,862	4,471,519		
1.05.03.02.12 Underground Mechanical Utilities	0	156,151	156,149	156,151	2	8,564,615	8,378,511	8,437,486	-186,104	-58,975	8,573,121		
1.05.03.02.13 Site Electrical Utilities	247,002	35,288	14,753	-211,714	20,535	7,920,900	7,894,075	8,026,191	-26,825	-132,116	8,411,720		
1.05.03.02.14 LN2 and GN2 Systems	0	0	0	0	0	0	0	0	0	0	0		
1.05.03.03 Electrical Substation and Feeder (Contract)	46,654	85,879	75,426	39,225	10,453	2,943,143	2,889,065	2,574,341	-54,079	314,724	2,943,143		
1.05.03.04 Chilled Water Plant (Contract)	629,451	57,481	103,283	-571,970	-45,802	9,091,538	8,593,691	8,723,054	-497,847	-129,363	9,200,000		
1.05.03.06.01 LOB 1	696,168	580,926	675,693	-115,242	-94,767	1,458,638	1,468,932	1,564,267	10,293	-95,335	13,293,500		
1.05.03.06.02 LOB 2	402,239	80,080	116,607	-322,159	-36,527	536,318	164,780	201,616	-371,538	-36,836	7,700,000		
1.05.03.06.03 LOB 3	0	0	-18,746	0	18,746	34,488	77,961	66,264	43,473	11,697	15,465,073		
ARRA Sub Total	**7,226,646**	**4,241,704**	**4,373,276**	**-2,984,942**	**-131,572**	**100,024,664**	**98,937,855**	**97,475,576**	**-1,086,808**	**1,462,279**	**148,024,415**		
d. Undist. Budget											**242,837**		
ARRA Total	**7,226,646**	**4,241,704**	**4,373,276**	**-2,984,942**	**-131,572**	**100,024,664**	**98,937,855**	**97,475,576**	**-1,086,808**	**1,462,279**	**148,267,252**		

CLASSIFICATION (When Filled In)

CONTRACT PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

FORM APPROVED
OMB No. 0704-0188

1. CONTRACTOR	2. CONTRACT		3. PROGRAM	4. REPORT PERIOD
a. NAME Brookhaven Science Associates	a. NAME National Synchrotron Light Source II (NSLS-II)		a. NAME December 2010	a. FROM (YYYYMMDD) 2010 / 12 / 01
b. LOCATION (Address and ZIP Code) Brookhaven National Laboratory, Upton,NY	b. NUMBER		b. PHASE	b. TO (YYYYMMDD) 2010 / 12 / 31
	c. TYPE	d. SHARE RATIO	c. EVMS ACCEPTANCE NO YES X (YYYYMMDD)	

5. CONTRACT DATA

a. QUANTITY	b. NEGOTIATED COST	c. ESTIMATED COST OF AUTHORIZED UNPRICED WORK	d. TARGET PROFIT/ FEE	e. TARGET PRICE	f. ESTIMATED PRICE	g. CONTRACT CEILING	i. DATE OF OTB/OTS (YYYYMMDD)
1	912,000,000	0	0	912,000,000	0	0	

6. ESTIMATED COST AT COMPLETION

7. AUTHORIZED CONTRACTOR REPRESENTATIVE

8. PERFORMANCE DATA

WBS[2] WBS[3] Control Acct	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
ITEM (1)	WORK SCHEDULED (2)	WORK PERFORMED (3)	WORK PERFORMED (4)	SCHEDULE (5)	COST (6)	WORK SCHEDULED (7)	WORK PERFORMED (8)	WORK PERFORMED (9)	SCHEDULE (10)	COST (11)	BUDGETED (14)	ESTIMATED (15)	VARIANCE (16)
1.01 Project Management													
1.01.01 Project Management													
WBS[3]Totals:	133,175	133,175	325,134	0	-191,959	4,641,954	4,641,954	4,714,685	0	-72,730	7,503,242	7,503,242	0
1.01.02 Environmental, Safety & Health													
WBS[3]Totals:	119,705	119,705	86,524	0	33,181	3,064,953	3,064,953	3,479,540	0	-414,587	6,478,032	6,478,032	0
1.01.03 Project Support													
WBS[3]Totals:	651,892	651,892	930,815	0	-278,923	26,659,397	26,659,397	26,947,224	-0	-287,828	40,447,041	42,123,066	-1,676,025
1.01.04 Quality Assurance													
WBS[3]Totals:	67,448	67,448	76,128	0	-8,679	1,886,782	1,886,782	1,527,210	0	359,572	3,397,133	3,397,133	0
1.01.05 Configuration Management & Document Contro													
WBS[3]Totals:	30,452	30,452	21,968	0	8,484	1,061,101	1,061,101	857,876	0	203,226	1,972,567	1,972,567	0
WBS[2]Totals:	**1,002,672**	**1,002,672**	**1,440,568**	**0**	**-437,896**	**37,314,187**	**37,314,187**	**37,526,534**	**-0**	**-212,347**	**59,798,015**	**61,474,040**	**-1,676,025**
1.02 R&D and Conceptual Desigr													
1.02.01 Accelerator Systems R&D													
WBS[3]Totals:	8,370	33,441	11	25,072	33,431	11,048,309	10,748,983	10,865,778	-299,326	-116,795	11,460,076	11,890,274	-430,198
1.02.02 Experimental Systems R&D													
WBS[3]Totals:	282,370	316,300	400,860	33,930	-84,560	15,103,541	14,890,656	14,505,123	-212,886	385,532	19,166,550	18,771,057	395,493
1.02.03 Conceptual Design - Accelerator Systems													
WBS[3]Totals:	0	0	0	0	0	12,998,214	12,998,214	12,960,504	0	37,709	12,998,214	12,960,504	37,709
1.02.04 Conceptual Design - Experimental Facilities													
WBS[3]Totals:	0	0	0	0	0	709,445	709,445	712,450	0	-3,005	709,445	712,450	-3,005
1.02.05 Conceptual Design - Conventional Facilities													
WBS[3]Totals:	0	0	0	0	0	3,886,952	3,886,952	3,872,878	0	14,074	3,886,952	3,886,952	0
1.02.06 Conceptual Design - Project Management & Suppor													
WBS[3]Totals:	0	0	0	0	0	7,086,188	7,086,188	7,326,180	0	-239,992	7,086,188	7,325,314	-239,126
1.02.07 Project Management - R&D													
WBS[3]Totals:	18,933	18,933	34	0	18,900	5,144,820	5,144,820	5,033,943	0	110,877	5,305,339	5,066,213	239,126
WBS[2]Totals:	**309,673**	**368,675**	**400,905**	**59,002**	**-32,230**	**55,977,469**	**55,465,257**	**55,276,856**	**-512,211**	**188,402**	**60,612,763**	**60,612,763**	**-0**
1.03 Accelerator Systems													
1.03.01 Accelerator Systems Management													
WBS[3]Totals:	86,279	86,279	131,718	0	-45,439	3,514,902	3,514,902	3,862,513	0	-347,611	6,019,099	6,127,099	-108,000
1.03.02 Accelerator Physics													
WBS[3]Totals:	200,265	200,265	250,742	0	-50,477	5,966,002	5,966,002	5,909,984	0	56,018	10,071,767	10,071,767	0
1.03.03 Injection System													
WBS[3]Totals:	1,960,424	1,780,441	300,762	-179,983	1,479,679	15,983,802	13,537,471	8,499,928	-2,446,331	5,037,543	41,194,968	42,501,677	-1,306,709
1.03.04 Storage Ring													
WBS[3]Totals:	2,741,377	2,220,043	2,209,505	-521,334	10,538	47,680,709	39,935,827	41,574,098	-7,744,881	-1,638,271	151,085,712	156,053,139	-4,967,427
1.03.05 Controls Systems													
WBS[3]Totals:	319,690	290,499	261,506	-29,191	28,993	8,801,259	8,130,505	7,398,401	-670,755	732,104	20,084,946	20,084,946	0
1.03.06 Accelerator Safety Systems													
WBS[3]Totals:	11,668	28,395	75,013	16,728	-46,617	1,470,577	1,171,346	2,189,736	-299,231	-1,018,390	4,488,070	4,932,382	-444,312
1.03.07 Insertion Devices													
WBS[3]Totals:	527,941	510,646	103,769	-17,295	406,877	2,622,949	2,185,734	1,554,357	-437,216	631,377	24,086,796	24,086,796	0
1.03.08 Accelerator Fabrication Facilities													
WBS[3]Totals:	66,773	98,945	129,843	32,172	-30,897	6,615,499	5,599,977	5,827,976	-1,015,522	-227,999	6,961,411	7,192,171	-230,760
WBS[2]Totals:	**5,914,416**	**5,215,513**	**3,462,858**	**-698,903**	**1,752,656**	**92,655,699**	**80,041,764**	**76,816,994**	**-12,613,935**	**3,224,771**	**263,992,769**	**271,049,977**	**-7,057,208**
1.04 Experimental Facilities													
1.04.01 Experimental Facilities Managemen													
WBS[3]Totals:	96,843	96,843	89,046	0	7,796	3,102,599	3,102,599	3,665,849	0	-563,250	4,828,335	6,586,298	-1,757,962
1.04.02 Standard Local Controls & Data Acquisition Systems													
WBS[3]Totals:	0	0	0	0	0	37,454	44,941	3,457	7,487	41,485	69,585	69,585	0
1.04.05 User Instruments													
WBS[3]Totals:	369,082	356,340	332,417	-12,742	23,924	7,215,981	7,177,015	6,551,828	-38,966	625,187	63,864,915	64,589,648	-724,733
1.04.06 Front End User Requirements Developmen													
WBS[3]Totals:	0	0	0	0	0	456	456	2,111	-0	-1,655	456	1,099	-643
1.04.07 Optics Labs													
WBS[3]Totals:	0	0	0	0	0	880,354	721,212	638,991	-159,142	82,222	1,117,071	2,582,890	-1,465,819
WBS[2]Totals:	**465,925**	**453,183**	**421,463**	**-12,742**	**31,720**	**11,236,845**	**11,046,224**	**10,862,236**	**-190,621**	**183,988**	**69,880,362**	**73,829,519**	**-3,949,157**
1.05 Conventional Facilities													
1.05.01 Conventional Facilities Managemen													
WBS[3]Totals:	333,778	333,778	257,814	0	75,965	8,428,122	8,428,122	8,350,714	0	77,408	16,099,717	16,136,305	-36,588
1.05.02 Conventional Facilities Engineering and Desigr													
WBS[3]Totals:	121,670	-57,579	4,161	-179,250	-61,740	20,393,282	20,215,153	19,132,835	-178,129	1,082,318	23,041,410	23,181,410	-140,000
1.05.03 Conventional Facilities Constructior													
WBS[3]Totals:	15,150,828	9,366,350	9,242,987	-5,784,477	123,364	139,340,754	146,483,492	144,200,330	7,142,738	2,283,162	235,793,693	239,169,000	-3,375,307
1.05.04 Integrated Controls & Communications													
WBS[3]Totals:	167,298	-4	89,848	-167,302	-89,851	539,181	345,981	435,847	-193,200	-89,866	1,256,000	1,256,000	0
1.05.05 Standard Equipment													
WBS[3]Totals:	0	0	0	0	0	0	0	0	0	0	1,025,586	1,025,586	0
1.05.06 Conventional Facilities Commissioning													
WBS[3]Totals:	31,595	10,692	14,251	-20,903	-3,559	211,102	164,415	84,502	-46,686	79,914	578,000	578,000	-0
WBS[2]Totals:	**15,805,170**	**9,653,238**	**9,609,060**	**-6,151,932**	**44,178**	**168,912,442**	**175,637,163**	**172,204,227**	**6,724,722**	**3,432,936**	**277,794,406**	**281,346,302**	**-3,551,895**
1.06 Pre-Operations													
1.06.01 Management - Pre Ops													
WBS[3]Totals:	0	0	0	0	0	0	0	0	0	0	20,170,700	20,170,700	0
1.06.02 Accelerator Systems - Pre Ops													
WBS[3]Totals:	0	0	0	0	0	0	0	0	0	0	17,071,591	17,071,591	0
1.06.03 Experimental Facilities - Pre Ops													
WBS[3]Totals:	0	0	0	0	0	0	0	0	0	0	3,823,660	4,310,217	-486,557
1.06.04 Spares													
WBS[3]Totals:	0	0	0	0	0	0	0	0	0	0	9,134,454	9,134,454	0
WBS[2]Totals:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50,200,405**	**50,686,962**	**-486,557**
Performance Measurement Baseline - PMB	23,497,856	16,693,281	15,334,854	-6,804,575	1,358,427	366,096,642	359,504,596	352,686,847	-6,592,046	6,817,749	782,278,722	798,999,564	-16,720,841
Undistributed Budget											2,424,795	0	2,424,795
Sub Total	23,497,856	16,693,281	15,334,854	-6,804,575	1,358,427	366,096,642	359,504,596	352,686,847	-6,592,046	6,817,749	784,703,517	798,999,564	-14,296,046
Contingency/Mangement Reserve											127,296,483		
Total Project Cost -TPC	23,497,856	16,693,281	15,334,854	-6,804,575	1,358,427	366,096,642	359,504,596	352,686,847	-6,592,046	6,817,749	912,000,000		