National Synchrotron Light Source II

Project Progress Report

January 2011

January 31: Work continues through the winter weather.

report due date:
February 20, 2011

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OVERALL ASSESSMENT

The National Synchrotron Light Source II project continued to make excellent progress in January despite record-setting snowfalls and temperatures well below average. The project is 48% complete with 30% of contingency and management reserve for the remaining cost to go. The cumulative schedule index is 0.97 and the cumulative cost index is 1.02, both well within the acceptable range. The current-month schedule variance is negative due to conventional construction being slowed by weather and the delivery of production magnets falling further behind schedule.

Construction of the ring building is still on schedule despite the laboratory being closed down five times in January due to harsh winter weather. Construction is on track to conduct the phase I beneficial occupancy readiness evaluation (BORE) on February 1, then turn over the first section in late February. Construction of the Lab–Office Building (LOB) also made excellent progress, with concrete foundations and steel fabrication being underway as scheduled. The project continued to proactively manage the construction site to ensure that sitewide safety goals are met. Both the chilled water plant and the electrical substation expansions are nearing completion.

Excellent progress continued in the production of girders, vacuum chambers and pumps, linac, booster, controls, power supplies, and electrical utilities for Accelerator Systems. A proposal for the cryogenic refrigeration system and three proposals for the Elliptically Polarized Undulator (EPU) were received, and the Request for Proposal (RFP) for the RF cavity was issued. Despite intensive effort, magnet production continues to progress slowly. Careful cost–benefit analysis and formulation of the schedule mitigation plan will continue over the next few months. The projected early completion date is expected to fluctuate during this adjustment period.

Excellent progress continues on the final designs of six beamlines and the technical specifications and statements of work for key procurement components. Preliminary specifications for the hutches were released and the engineering design of endstations and R&D activities continued to advance at good pace, as extensively described in this report.

The projected early completion date of March 2014 and the critical path remain the same as in December. Activities funded by the American Recovery and Reinvestment Act (ARRA) continued to be on schedule and on budget.

UPCOMING EVENTS	2011
Budker Institute of Nuclear Physics (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
IXS BAT meeting	Mar 16
CSX BAT meeting	Mar 29
Science Advisory Committee (SAC) meeting	Apr 4–5
Accelerator Systems Advisory Committee (ASAC) meeting	May 10–11
DOE Review of NSLS-II Project	June 21–23

ACCELERATOR SYSTEMS

Accelerator physics. Studies have been carried out to better understand the effect on dynamic aperture of the breaking of lattice symmetry. A study is nearing completion to determine whether a superconducting wiggler can be placed off-center downstream in a short straight. This would allow for a diagnostic stripline to be placed in the upstream portion of the straight. An important issue for the top-off safety analysis has been recognized. Quadrupole and sextupole power supplies have been designed with the capability to provide significant margin above the stated maximum current. Simulations are underway to determine the controls required to ensure safe top-off operation, taking into account this increase in the potential field strength in the quadrupole and sextupole magnets. Analysis has shown that safe top-off operation can be accomplished with the inclusion of proper horizontal aperture either at the crotch or downstream of it. Work to determine the better approach is proceeding.

Magnet systems. Further first article magnets have been received. Two short and one long quadrupole were received from Budker Institute of Nuclear Physics (BINP). From TESLA, a quadrupole with a double coil and the first large aperture quadrupole were received. The second batch of 14 production sextupoles was delivered to BNL. The crew in Bldg. 902A was busy performing acceptance and magnetic measurements on the magnets. Most of the magnets perform well and the field error is below or near the specified limits.

Vacuum. The production of Al vacuum chamber continued with about 35 vacuum chambers completed by the end of the month. The last multipole extrusions were received and are being measured. The last batch of dipole extrusions are being inspected at the vendor. Six S3 dipole chambers were completed and shipped from APS. Nine more chambers were assembled, baked, vacuum certified, and ready for girder integration, with a total of 35 chambers available. Production S4A extrusions were produced and sent to vendors for chamber fabrication, with a prototype expected in early March. LBT B3 and B4 chambers were made and are being measured. Gussets may be added to B1 and B2 chambers to reduce deflection. The order for 10 prototype synchrotron radiation absorbers and 10 so-called crotch absorbers were submitted for approval. Sixty more titanium pumps were delivered this month, bringing the total available to 110. A total of 136 ion pump controllers are also in-house and most have been tested. Orders for vacuum gauges and controllers were placed with the low bidder and the first articles are expected in early March. Two prototype RF bellows were cycle-tested, and the procurement should start in February. The draft specification for front end gate valves is being reviewed. The chemical cleaning facility was delivered in mid January, and the second containment is being installed in Bldg. 945.

Power supplies and electrical utilities. The power supply controller (PSC) chassis order has been placed. Production test fixtures have been designed for all PSC cards and they are in the process of being constructed. First units of the power

supply interfaces (PSIs) are available for software development and for BINP to start on the overall software integration. Production test fixtures have been designed for all PSI chassis and they are in the process of being constructed. Mechanical design work and printed circuit board layout continues on the design of the different power amplifiers needed for the low-current fast corrector, and high-current slow corrector power supplies. One-wire temperature sensor testing is taking place at NSLS, where the shielded new sensors have performed without failure. The production one-wire interface chassis procurement has been placed. The power converter procurement is progressing. An initial meeting with the vendor has taken place, along with a meeting to review the final design report. There were only very minor issues with the design report; these will be cleared up within a week's time. First article inspection at the vendor's facility is scheduled for March 7. Full production testing of DCCTs is continuing, with more than 1,600 units already tested. Almost all of the units exceed their specifications by a factor of 2. The first set of output cables have started to arrive and the rest should be in house next month. All the engineering is done for the one-line diagram for the injector complex AC power. We believe the information on the power supply AC mains requirements from BINP and the linac manufacturer is now complete. The new details required us to rearrange the equipment layouts to allow for placing the larger booster dipole power supplies and slightly larger equipment enclosures. The order for the AC power connection cable has been placed. This is the cable for almost all the power connections located on the storage ring mezzanine and in the injector service building. Some of the cables for large loads still need to be ordered but we are awaiting final details. The low-precision temperature control panels order has been placed, as well as the order for a long-lead component for the high-precision temperature controller chassis. The first articles for the uninterruptible power supplies (UPS) have been delivered and are ready for installation. All UPSs needed for the first pentant are available.

Insertion devices. Proposals for the EPU from four vendors have been received and examined and questions were sent to each vendor. The contract for the in-vacuum measurement system is ready to be placed. All the design issues for the integrated field measurement system have been resolved, except for knobs attached to motors. The Clean Room in Bldg. 832 is fully operable, and the high-precision Hall probe measurement bench is being commissioned.

EXPERIMENTAL FACILITIES

XFD activities in January focused on the technical specifications and statements of work (SOW) for long-lead-time procurement beamline components (including the larger beamline optics packages). The SOW and specs documents for the experimental hutches are now with the procurement team. Draft specifications were sent to potential offerors for review and comment; we estimate that the RFP will be released to potential suppliers around March 15. Bid responses for motion controllers are being evaluated.

Collaborating with the optics metrology group, the inelastic x-ray scattering (**IXS**) team has studied optical specs for the KB focusing mirrors. Initial vendor feedback indicates that these specifications can be met. Further work will focus on finalizing the specs and SOW in the coming weeks. Compilation of the technical specs for the first optical enclosure (FOE), including the high-heat-load double crystal monochromator, is progressing well.

In high energy-resolution optics R&D, components for the second version of the high-precision mechanical stages for testing the CDW optics were completed, assembled, and sent to the SPring-8 synchrotron for beamtime in early February (Fig. 1). This will be the first experimental test of the NSLS-II design at a third-generation synchrotron source. The results will provide valuable feedback on the mechanical design, crystal quality, and overall performance of the optical system. In collaboration with the optics fabrication group and the ESRF crystal fabrication lab, two sets of C, D, and W crystals have been made. In addition, another set of CDW crystals has been procured from reputable vendors. Plans are to test all these crystals using the coming beamtime at SPring-8 and elsewhere.

Figure 1. The new CDW-CDW mechanical system mounted on the high-resolution optics table of the BL12XU beamline at SPring-8.

The hard x-ray nanoprobe (**HXN**) team concentrated on technical specs for the beamline optics and components. The monochromator design was modified to ensure the highest level of angular stability. In addition, there was steady progress in nanopositioning R&D. After ~0.3 nm sensitivity was achieved last month, systematic measurements were made to characterize the operating range of the fiber optic interferometers, investigating their long-term electronic stability by cooling the cavity to the temperature of liquid nitrogen (Fig. 2). Over a 2-hour period, a stability of ~0.55 nm was achieved, with better than 1 nm achieved after 40 hours.

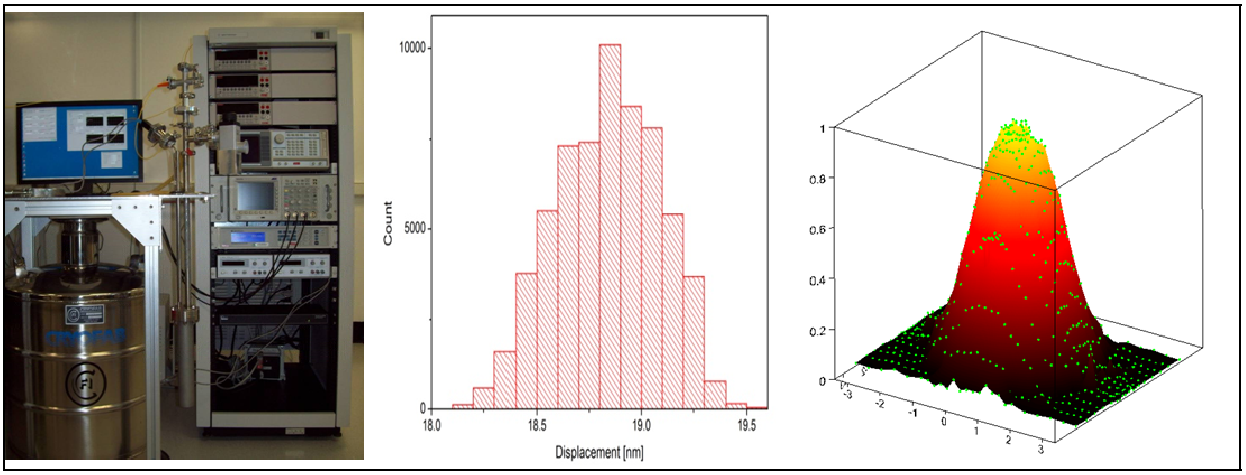

Figure 2: Left: Experimental setup for measuring long-term stability of the laser interferometers. Middle: Measured stability over 2 hrs with the FWHM of 0.55 nm. Right: Measured interferometer signal strength over 2D angular tilts. The FWHM width of the angular range is ~2°.

In addition, this investigation demonstrated an extremely encouraging property of the fiber-optic interferometer: the angular range (2°) is substantially larger than that of conventional interferometers. The large angular range is extremely useful for implementing these interferometers for the MLL x-ray optics, which require ~1° angular adjustment for proper focusing. The empirical verification of a large angular operating range is an important breakthrough in nanopositioning R&D.

The **CHX** team continued its focus on finalizing technical specs for the beamline optics through detailed interactions with potential vendors. Particular attention is being paid to the two main optical components: the white beam horizontal deflecting mirror and a pseudo channel-cut double crystal monochromator (DCM). Both instruments will be designed to achieve an unprecedented stability of 50 nrad over a wide range of time scales. To achieve this level of stability in the vertically deflecting DCM, novel solutions exclusively based on flexure coupling for the motions inside the crystal cage and flexible braid cooling are being carefully evaluated (Fig. 3).

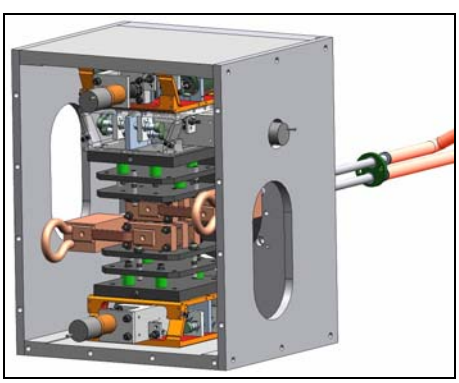

Figure 3: Design of a pseudo channel-cut monochromator crystal cage featuring flexure couplings for the roll and pitch crystal motions and thermal contact to the liquid nitrogen circuit via flexible braids.

The team for the coherent soft x-ray (**CSX**) beamline began detailing the beamline's final design. Procurement packages for the grating substrates and the internally water-cooled mirrors are progressing steadily and the CSX beamline team will meet regularly with experts in x-ray optics over the next weeks to complete the specs for the toroidal mirrors. A strong collaboration has been established with the ASD insertion device team; the EPU design was approved for procurement, and the specifications document for the phaser magnet located between the EPUs is nearing completion. The CSX team progressed on the beamline FOE and utilities procurement packages. There are parallel efforts to elucidate the degree of coherence to be delivered by the CSX high-coherence flux branch (wave front analysis). Expectations are very high and results will be available soon.

For the x-ray powder diffraction (**XPD**) beamline, specs and SOW documents for procuring the Double Laue Monochromator are being written. The layout for the lead hutches (one FOE, three end stations) was completed and is ready for handover to the procurement team. Discussions were carried out with potential vendors regarding ongoing development of a CdTe-based pixel array detector. This technology is particularly promising for XPD, combining a high-efficiency sensor, large area, high resolution, high dynamic range, and high framing rate. The specification for the XPD 1.3 m long, Pt-coated mirror was also discussed internally within a dedicated working group. Discussions are ongoing with ESRF regarding a custom design of the filtering stage.

The main task of the submicron resolution x-ray spectroscopy (**SRX)** beamline group in January was to continue working on specifications for the FOE optics package. Wave propagation calculations were made to verify SHADOW raytracing results. The first results affirmed an obtainable spatial resolution well below 50 nm. These calculations continue. To match the expected high spatial resolution, a model for highly accurate stages has been designed: hybrid stages move the sample from coarse to medium-fine, and an extremely accurate piezo stage moves the sample in very fine steps as well as compensates for any errors of the hybrid stages (Fig. 4). This is work in progress.

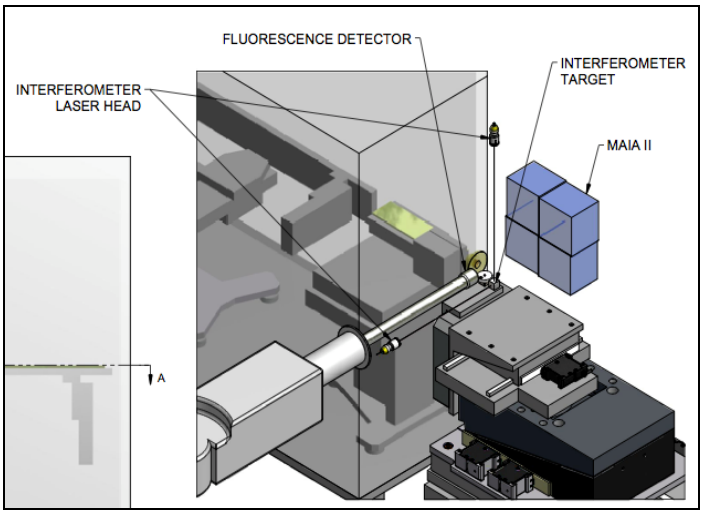

Figure 4: Model of sample stages for the SRX beamline end station.

The optics fabrication group has initiated chemical-mechanical polishing of silicon. A first test on oriented silicon using 40 nm colloidal silica (pH of approximately 10.5) was found to result in zero scratches or pits, with a roughness under 4 nm RMS. Further work to obtain a polishing quality lower than 1 nm RMS is planned. Manual multilayer sectioning and thinning by dicing and polishing was initiated as a backup plan for reactive ion etching. Multilayer thinning down to a thickness of 20 microns was successful. The BNL Office of Commercialization and Technology Transfer filed a provisional patent with the US Patent and Trademark Office on Feb. 11, 2011, "Technique for etching WSi_2 and Si based materials," which discloses the process for SF_6/O_2 and $CHF_3/Cl_2/O_2$ reactive ion etching of MLs to a trench depth of 40 microns. Work on nitrogen mixing for stress-reduced multilayer growth continues, with reflective multilayers grown using 9% nitrogen showing no degradation or loss of performance compared to multilayers grown only with argon.

The CHX and XPD beamline preliminary designs and some recent applications of x-ray photon correlation spectroscopy were summarized in an invited presentation at a workshop on "Dynamic Phenomena under Extremes," held during the week of January 24–28 at the University of Texas, Austin.

PROCUREMENT ACTIVITIES

The proposal for the Cryogenic Refrigeration System was received and is in evaluation, with award expected by late February or early March. Proposals for the Three-Pole Wiggler and the Elliptically Polarized Undulator have been received and are in evaluation; awards are expected in late February and early March, respectively. The RFP for the RF Cavity was issued with a closing date of February 25, 2011; competition is expected. Award was made for the Corrector, Transport Line, and Multipole Power Supplies.

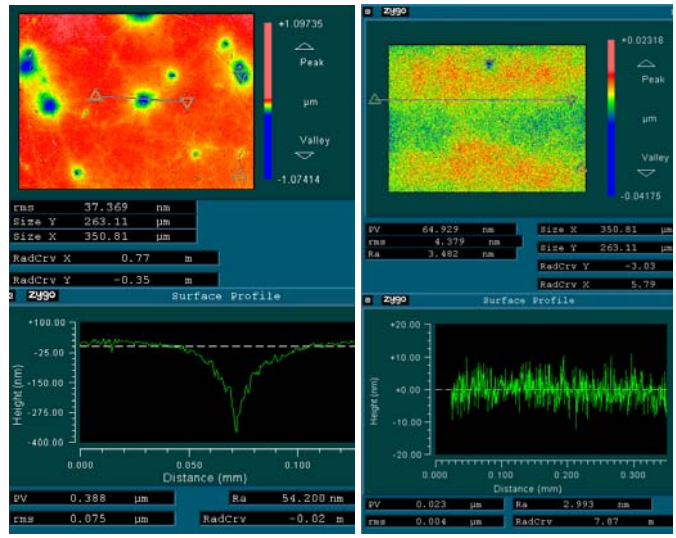

Figure 5: The optical metrology group continued working on specifications for the nanoradian measuring system. In addition, they progressed with the optical head pre-design and the measuring station using a Fizeau interferometer, measuring optical components (silicon polished crystal, mirror for the NLSL UV).

CONVENTIONAL FACILITIES

Despite record snowfall for January and temperatures well below average, construction of conventional facilities continued to progress well, albeit at a pace slower than planned. Despite the weather, construction is on track to turn over the first section of the ring building in late February, provided more typical winter conditions prevail in the coming weeks.

Utility systems are being commissioned and going through startup under the oversight of the commissioning contractor, with the participation of operations and maintenance staff. Electrical systems are now energized into pentant 1 and being utilized for equipment testing. The steam system also is energized and available in pentant 1. Mechanical systems in service building 1 are being readied for final testing and control system startup (Fig. 6).

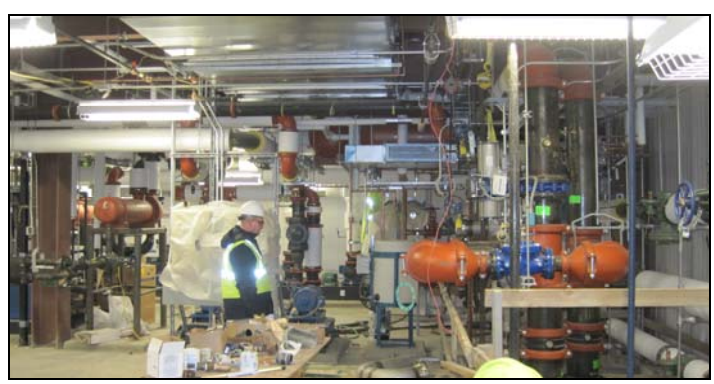

Figure 6: NSLS-II Lead Mechanical Engineer inspects contractor work.

Difficult weather has had the greatest impact on exterior envelope productivity. Some detail items required for final enclosure in pentant 1 have been delayed but are now on track for completion in February. Much of the building envelope

work in subsequent phases was ahead of schedule and thus is not expected to be delayed as winter conditions subside and full-scale roofing and siding installation resume.

Figure 7: Lobby exterior siding and curtain wall near completion in January.

Interior finish work in pentant 1 (Figs. 8–10) is nearing completion, aided by the installation of temporary heating systems and temporary closure walls to maintain necessary interior temperatures for spackling and painting.

Figure 8: Painting of structural steel in pentant 1 is nearly complete.

Interior mechanical, electrical, and plumbing continues to progress around the ring. Mechanical and electrical systems are being installed in the service buildings, mezzanine, and experimental floor areas. The work includes HVAC ductwork, equipment placement and installation, fire protection, heating and cooling system piping, compressed air, nitrogen and other utility services.

Concrete work on the storage ring tunnel slab and walls in the pentant 5 area is complete and the tunnel roof and experimental floor in this area and the ground floor slab in the booster building are the only significant concrete work that remains. They are being readied for final concrete pours in the February–March time frame.

The chilled water plant expansion is nearing completion of the startup and testing phase but is awaiting some components for the chiller motor starters. These components are expected in mid-February and will enable completion of chiller startup several months earlier than the added chiller capacity is needed. The underground chilled water piping installation has been completed and is ready to convey chilled water to the NSLS-II site from the central chilled water plant.

The electrical substation expansion is also nearly complete. Switchgear and cabling work is done, and permanent power is being delivered to the NSLS-II site. The 20MVa transformer requires only some punchlist items before startup. With some cooperation from the winter weather it will be available during February 2011, more than 1 year earlier than needed.

Figure 9: Lamps shrouded for paint protection illuminate the work area.

The LOB contractor has employed winter concrete techniques to continue foundation installation for LOBs 1 and 2 during January. A significant portion of the steel shop drawings have now been approved and steel fabrication is underway. The delivery of steel and the start of steel erection for LOB 1 are on track to begin early this spring. Work planning among the ring building and LOB contractors continues to proceed cooperatively and without impact on the pace of each contractor's work.

RECENT HIRES

Eric Blum – Sr. Physics Associate, Injector Systems, ASD

William Wahl – Mechanical Engineer, Mechanical Engineering, ASD

COST/SCHEDULE BASELINE STATUS

The cumulative Cost Performance Index (CPI) is 1.02 and the cumulative Schedule Performance Index (SPI) is 0.97, both well within the acceptable range. The project is 48% complete, with 29% of contingency and management reserve remaining, based on EAC work remaining.

The current-month CPI is 1.05, green status; the current-month SPI is 0.79, 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 steel stairs in pentant 1, and delays in electrical and mechanical installation in pentant 2 and the RF building. However, conventional construction maintained a slightly net-positive cumulative schedule variance of $6M. The current-month accelerator systems' schedule performance was negative due primarily to delays in magnet production and deliveries of multipole power supplies and vacuum chambers.

The critical path for the project remains the same and includes RF cavity 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 testing, and commissioning. Within 2 to 3 months of the critical path are vacuum chambers/components; the storage ring RF cryogenic system; and booster vendor production, assembly, and testing. The projected early completion date for the project is March 2014. There are 15 months of float between the project early completion milestone and CD4, with approximately 28% schedule contingency.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

The beneficial occupancy readiness evaluation (BORE) for phase I will be conducted on February 1. This includes pentant 1 and the vehicle tunnel. Any pre-occupancy items identified will be completed so the installation of technical equipment can begin.

The drafts of the Linac Commissioning Safety Assessment Document and Accelerator Safety Envelope have been completed and will be reviewed by the Photon Sciences Directorate on February 24. Following resolution of any comments, the documents will be formally reviewed by the BNL ESH Committee.

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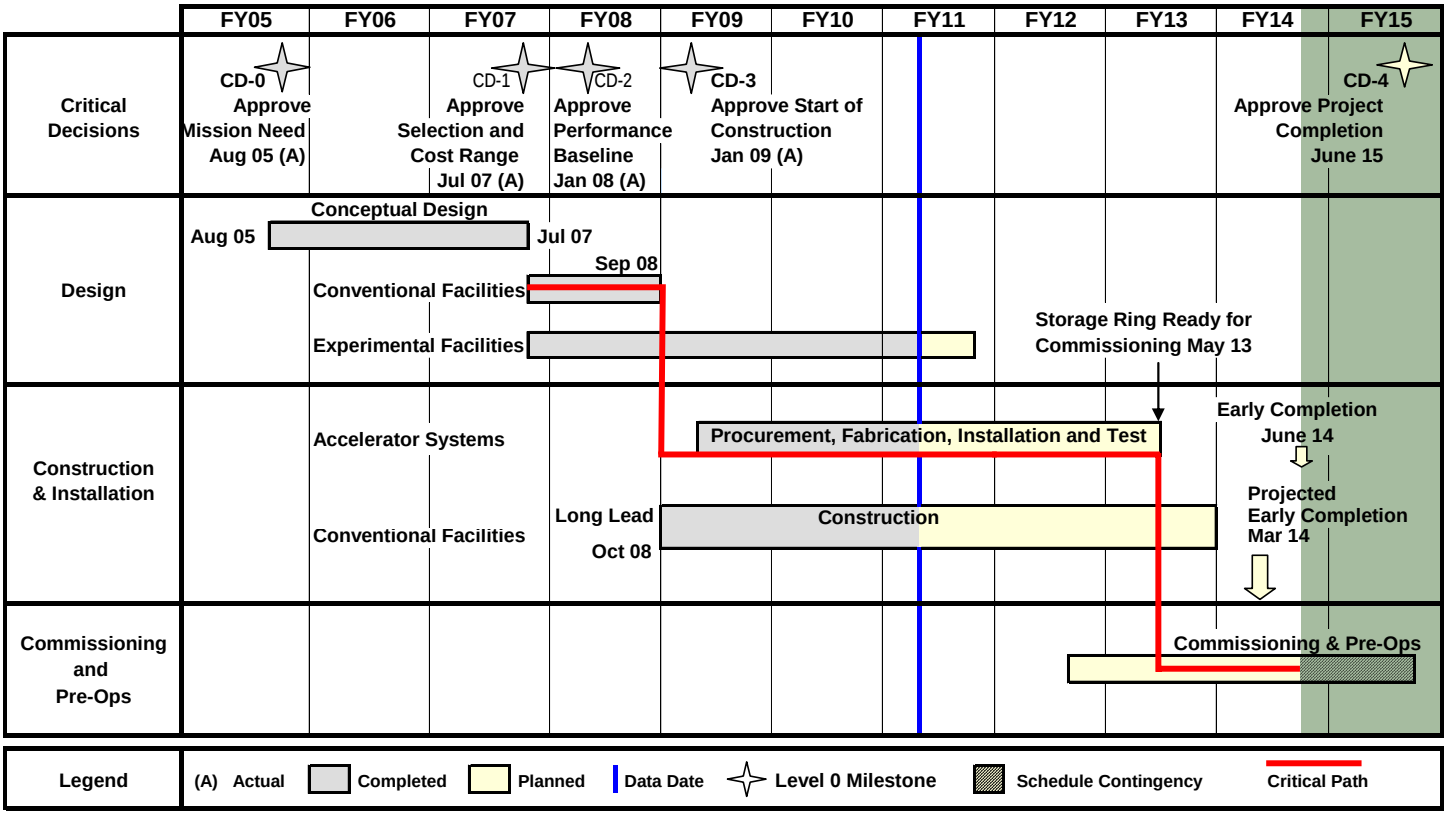
Figure 10: Different view of work underway in the lobby of the ring building.

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

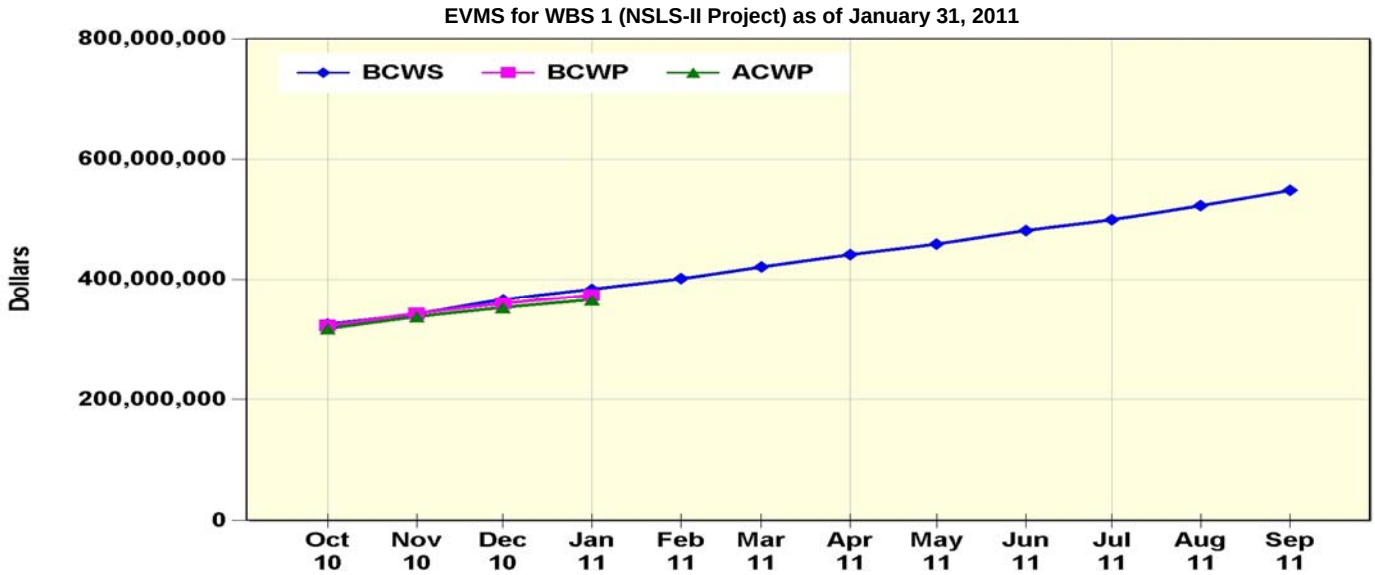


Funding Profile

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 (K$):	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	383,810	401,349	420,947	441,569	459,313	481,528	499,764	523,148	548,231
BCWP	322,376	342,811	359,505	373,554								
ACWP	317,488	337,352	352,687	366,062								

Project as of 1/31/11	Current Period	Cum-to-date
Plan (BCWS) $K	$17,713	$383,810
Earned (BCWP) $K	$14,049	$373,554
Actual (ACWP) $K	$13,375	$366,062
SV $K	$-3,664	$-10,256
CV $K	$675	$7,492
SPI	0.79	0.97
CPI	1.05	1.02
Budget at Completion $K (PMB [UB])		$786,989
Planned % Complete		48.8%
Earned % Complete		47.5%
Mgmt Reserve/Cont as % of BAC remaining		30.2
Mgmt Reserve/Cont as % of EAC remaining		29.2

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 **0.97**

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.

Six PCRs were approved in January:

PCR #	Area	Δ cost	Title or Description	PCR #	Area	Δ cost	Title or Description
11_237	CF	$0	Integration of LOB Contractor Schedule	11_215	ASD	-$1,314K	DI Piping Scope Adjustment
11_223	CF	$140K	Additional HDR Field Engineer Support	11_227	ASD	$2,499K	Installation Detail Planning
11_182	ASD	$313.5K	Second Source for Large Aperture Magnets	11_230	ASD	$647K	Additional Magnetic Field Measurement Res.

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 1/31/11	Current Period	Cum-to-date
Plan (BCWS) $K	$2,390	$102,415
Earned (BCWP) $K	$2,738	$101,676
Actual (ACWP) $K	$2,616	$100,092
SV $K	$348	$-739
CV $K	$122	$1,584

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	Completed 1/2011.

Blue text is new.

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 January 2011	a. FROM (YYYYMMDD) 2011 / 01 / 01
b. LOCATION (Address and ZIP Code) Brookhaven National Laboratory, Upton,NY	b. NUMBER	b. PHASE	b. TO (YYYYMMDD) 2011 / 01 / 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	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	ESTIMATED	VARIANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(14)	(15)	(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	0	0	0	0	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	6,805	0	0	-6,805	0	3,454,831	3,537,669	3,364,636	82,838	173,033	3,611,419		
1.05.03.02.03 Pentant 1 and Service Building	427,908	548,792	545,801	120,883	2,991	19,041,800	18,399,112	18,499,274	-642,688	-100,163	19,042,764		
1.05.03.02.04 Pentant 2 and Service Building	740,603	410,487	406,147	-330,116	4,340	11,662,224	13,737,763	13,841,235	2,075,539	-103,471	15,437,011		
1.05.03.02.05 Pentant 3 and Service Building	11,243	104,597	104,595	93,353	2	7,355,205	9,137,630	9,275,673	1,782,425	-138,043	10,346,995		
1.05.03.02.06 Pentant 4 and Service Building	33,925	85,563	85,563	51,638	0	1,994,579	2,317,965	2,490,327	323,386	-172,362	2,733,490		
1.05.03.02.07 Pentant 5 and Service Building	40,140	332,950	332,950	292,810	0	6,451,207	6,452,864	6,385,118	1,657	67,746	7,324,886		
1.05.03.02.08 Injection Building	121,228	114,345	114,345	-6,883	0	4,584,283	3,811,748	3,712,551	-772,535	99,197	5,918,100		
1.05.03.02.09 RF and Compressor Building	297,912	95,149	95,147	-202,763	2	4,425,264	3,537,645	3,614,324	-887,619	-76,679	4,950,780		
1.05.03.02.10 Lobby	489,954	228,189	235,051	-261,765	-6,862	3,005,358	2,121,268	2,132,614	-884,090	-11,346	3,005,358		
1.05.03.02.11 Cooling Tower and Process Water	278,872	342,957	225,680	64,085	117,277	4,466,519	3,092,396	3,071,981	-1,374,123	20,414	4,471,519		
1.05.03.02.12 Underground Mechanical Utilities	6,805	4,812	4,811	-1,993	1	8,571,420	8,383,323	8,442,297	-188,097	-58,974	8,573,121		
1.05.03.02.13 Site Electrical Utilities	323,507	172,083	172,092	-151,424	-9	8,244,407	8,066,159	8,198,283	-178,248	-132,125	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)	0	30,813	63,582	30,813	-32,769	2,943,143	2,919,877	2,637,922	-23,266	281,955	2,943,143		
1.05.03.04 Chilled Water Plant (Contract)	61,922	110,852	63,089	48,930	47,764	9,153,460	8,704,543	8,786,142	-448,917	-81,599	9,200,000		
1.05.03.06.01 LOB 1	-6,737	297,060	156,294	303,797	140,766	1,451,902	1,765,992	1,720,560	314,090	45,431	16,410,752		
1.05.03.06.02 LOB 2	-467,318	-67,329	11,326	399,990	-78,655	69,000	97,452	212,943	28,452	-115,491	6,873,152		
1.05.03.06.03 LOB 3	23,506	-72,961	0	-96,467	-72,961	57,994	5,000	66,264	-52,994	-61,264	13,174,669		
ARRA Sub Total	2,390,275	2,738,357	2,616,472	348,082	121,885	102,414,938	101,676,212	100,092,048	-738,726	1,584,164	148,024,415		
d. Undist. Budget											242,837		
ARRA Total	2,390,275	2,738,357	2,616,472	348,082	121,885	102,414,938	101,676,212	100,092,048	-738,726	1,584,164	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 January 2011	a. FROM (YYYYMMDD) 2011 / 01 / 01
b. LOCATION (Address and ZIP Code) Brookhaven National Laboratory, Upton,NY	b. NUMBER	b. PHASE	b. TO (YYYYMMDD) 2011 / 01 / 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

WBS[2] WBS[3] Control Acct ITEM (1)	CURRENT PERIOD BUDGETED COST WORK SCHEDULED (2)	BUDGETED COST WORK PERFORMED (3)	ACTUAL COST WORK PERFORMED (4)	VARIANCE SCHEDULE (5)	VARIANCE COST (6)	CUMULATIVE TO DATE BUDGETED COST WORK SCHEDULED (7)	BUDGETED COST WORK PERFORMED (8)	ACTUAL COST WORK PERFORMED (9)	VARIANCE SCHEDULE (10)	VARIANCE COST (11)	AT COMPLETION BUDGETED (14)	ESTIMATED (15)	VARIANCE (16)
1.01 Project Management													
1.01.01 Project Management													
WBS[3]Totals:	121,594	121,594	73,466	0	48,128	4,763,548	4,763,548	4,788,150	0	-24,602	7,503,242	7,503,242	0
1.01.02 Environmental, Safety & Health													
WBS[3]Totals:	109,294	109,294	88,741	0	20,553	3,174,247	3,174,247	3,568,281	0	-394,034	6,478,032	6,478,032	0
1.01.03 Project Support													
WBS[3]Totals:	601,658	601,658	776,866	0	-175,209	27,261,055	27,261,055	27,724,091	-0	-463,036	40,447,041	42,123,066	-1,676,025
1.01.04 Quality Assurance													
WBS[3]Totals:	61,584	61,584	60,005	0	1,579	1,948,365	1,948,365	1,587,214	0	361,151	3,397,133	3,397,133	0
1.01.05 Configuration Management & Document Contro													
WBS[3]Totals:	27,803	27,803	21,899	0	5,904	1,088,905	1,088,905	879,775	0	209,130	1,972,567	1,972,567	0
WBS[2]Totals:	**921,933**	**921,933**	**1,020,977**	**0**	**-99,044**	**38,236,120**	**38,236,120**	**38,547,511**	**-0**	**-311,391**	**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:	7,971	802	3,523	-7,169	-2,721	11,056,280	10,749,786	10,869,301	-306,494	-119,515	11,460,076	11,890,274	-430,198
1.02.02 Experimental Systems R&D													
WBS[3]Totals:	240,932	155,365	225,872	-85,567	-70,507	15,344,473	15,046,021	14,730,996	-298,452	315,025	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:	17,286	17,286	49	0	17,237	5,162,106	5,162,106	5,033,992	0	128,114	5,305,339	5,066,213	239,126
WBS[2]Totals:	**266,189**	**173,454**	**229,445**	**-92,735**	**-55,991**	**56,243,658**	**55,638,711**	**55,506,300**	**-604,946**	**132,411**	**60,612,763**	**60,612,763**	**-0**
1.03 Accelerator Systems													
1.03.01 Accelerator Systems Management													
WBS[3]Totals:	82,170	82,170	71,543	0	10,627	3,597,072	3,597,072	3,934,056	0	-336,984	6,019,099	6,127,099	-108,000
1.03.02 Accelerator Physics													
WBS[3]Totals:	190,728	190,728	274,347	0	-83,619	6,156,730	6,156,730	6,184,331	0	-27,601	10,071,767	10,071,767	0
1.03.03 Injection System													
WBS[3]Totals:	1,933,841	1,264,979	522,826	-668,862	742,153	17,917,643	14,802,450	9,022,754	-3,115,193	5,779,696	41,325,198	42,631,907	-1,306,709
1.03.04 Storage Ring													
WBS[3]Totals:	4,159,222	1,774,120	1,979,159	-2,385,103	-205,039	51,839,931	41,709,947	43,553,257	-10,129,984	-1,843,310	151,328,429	156,923,828	-5,595,400
1.03.05 Controls Systems													
WBS[3]Totals:	309,410	421,614	287,223	112,204	134,390	9,110,669	8,552,118	7,685,624	-558,551	866,494	20,322,248	20,322,248	0
1.03.06 Accelerator Safety Systems													
WBS[3]Totals:	226,065	253,548	81,763	27,483	171,785	1,696,642	1,424,894	2,271,499	-271,748	-846,605	5,625,701	6,070,013	-444,312
1.03.07 Insertion Devices													
WBS[3]Totals:	451,902	331,875	424,539	-120,027	-92,664	3,074,851	2,517,608	1,978,895	-557,243	538,713	24,086,796	24,086,796	0
1.03.08 Accelerator Fabrication Facilities													
WBS[3]Totals:	123,298	194,278	202,058	70,980	-7,780	6,738,797	5,794,255	6,030,034	-944,542	-235,779	7,358,739	7,589,500	-230,760
WBS[2]Totals:	**7,476,636**	**4,513,311**	**3,843,458**	**-2,963,326**	**669,853**	**100,132,336**	**84,555,075**	**80,660,452**	**-15,577,261**	**3,894,623**	**266,137,977**	**273,823,157**	**-7,685,181**
1.04 Experimental Facilities													
1.04.01 Experimental Facilities Management													
WBS[3]Totals:	88,421	88,421	89,752	0	-1,331	3,191,021	3,191,021	3,755,602	0	-564,581	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:	436,915	394,151	267,825	-42,764	126,326	7,652,896	7,571,166	6,819,653	-81,729	751,513	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	1,588	0	-1,588	880,354	721,212	640,578	-159,142	80,634	1,117,071	2,582,890	-1,465,819
WBS[2]Totals:	**525,337**	**482,573**	**359,165**	**-42,764**	**123,408**	**11,762,181**	**11,528,797**	**11,221,401**	**-233,385**	**307,396**	**69,880,362**	**73,829,519**	**-3,949,157**
1.05 Conventional Facilities													
1.05.01 Conventional Facilities Management													
WBS[3]Totals:	313,328	313,328	254,199	0	59,129	8,741,450	8,741,450	8,604,913	0	136,537	16,099,717	16,136,305	-36,588
1.05.02 Conventional Facilities Engineering and Desigr													
WBS[3]Totals:	130,285	307,442	241,279	177,156	66,163	20,523,567	20,522,594	19,374,114	-973	1,148,480	23,181,410	23,181,410	0
1.05.03 Conventional Facilities Construction													
WBS[3]Totals:	7,896,518	7,031,666	7,418,215	-864,852	-386,549	147,237,272	153,515,158	151,618,544	6,277,886	1,896,614	235,793,693	239,169,000	-3,375,307
1.05.04 Integrated Controls & Communications													
WBS[3]Totals:	159,332	286,019	0	126,687	286,019	698,513	632,000	435,847	-66,513	196,153	1,256,000	1,256,000	0
1.05.05 Standard Equipmen													
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:	23,923	19,699	8,180	-4,224	11,520	235,025	184,114	92,681	-50,911	91,433	578,000	578,000	-0
WBS[2]Totals:	**8,523,387**	**7,958,153**	**7,921,872**	**-565,233**	**36,281**	**177,435,828**	**183,595,317**	**180,126,099**	**6,159,488**	**3,469,217**	**277,934,406**	**281,346,302**	**-3,411,895**
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	17,713,481	14,049,423	13,374,916	-3,664,058	674,507	383,810,123	373,554,019	366,061,763	-10,256,104	7,492,256	784,563,929	801,772,744	-17,208,815
Undistributed Budget											2,424,795	0	2,424,795
Sub Total	17,713,481	14,049,423	13,374,916	-3,664,058	674,507	383,810,123	373,554,019	366,061,763	-10,256,104	7,492,256	786,988,724	801,772,744	-14,784,020
Contingency/Mangement Reserve											125,011,276		
Total Project Cost -TPC	17,713,481	14,049,423	13,374,916	-3,664,058	674,507	383,810,123	373,554,019	366,061,763	-10,256,104	7,492,256	912,000,000		