National Synchrotron Light Source II

Project Progress Report

September 2009

report due date:
October 20, 2009

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Upton, New York 11973

OVERALL ASSESSMENT

The National Synchrotron Light Source II project continued to make excellent progress and has met all major FY 2009 goals that were set at the beginning of the fiscal year.

Unfortunately, on September 30 a serious injury occurred at the ring building construction site. The project immediately decided to commission an independent construction safety investigation to evaluate the incident as well as actions taken in response to the incident. The final report from this investigation is due on November 13 and will identify root causes and judgments of need to be addressed by the project and the laboratory.

Construction of the ring building and chilled water plant expansion continued to perform on schedule and on budget. Design of the Lab Office Buildings (LOBs) also continued on schedule. All material procurement contracts associated with the conventional construction activities are in fabrication and are expected to be delivered on or ahead of schedule.

Accelerator Systems continued with progress in testing prototypes, refining final designs, and gearing up for production. Contracts for the quadrupole magnets were awarded, and the production order for the storage ring RF beam position monitor (BPM) button antennas was placed. Studies on impedance of the vacuum chamber, filters for the main dipole power supply, corrector power amplifier, and high-stability BPM stand were successfully completed. A mockup of BPM cabling and prototypes of controls hardware, multipole power supplies, and second-generation power supply electronics have been received and are being tested. Progress on procurement of the linac, booster, and damping wigglers continued.

The conceptual designs of the six project beamlines were completed and final drafts of the Conceptual Design Reports (CDRs) were submitted for the October review. Good progress continued in both the 1 nm and 0.1 meV R&D areas.

Overall project performance remains satisfactory and the activities funded by the American Recovery and Reinvestment Act (ARRA) continue to be on schedule and on budget.

A first look at the overall project schedule from the completion of the near-term planning indicates that the projected early completion date can be as early as February 2014, about 4 months earlier than the current baseline. Before this schedule update is finalized, a more careful analysis on critical path, near-critical path, and schedule floats will be conducted.

SCHEDULED EVENTS 2009

XFD Conceptual Design Review (CDR) meeting	Oct. 13-14
Accelerator Systems Advisory Committee (ASAC) meeting	Oct. 22-23
Conventional Facilities Advisory Committee (CFAC) meeting	Nov. 9-10
Project Advisory Committee (PAC) meeting	Dec 10-11
DOE Review of the NSLS-II Project	early 2010

ACCELERATOR SYSTEMS DIVISION (ASD)

Accelerator Systems made good progress in September. The accelerator physics group held a review on the impedance of the vacuum chamber. Studies at the Advanced Photon Source (APS) had shown that the vacuum chamber with an antechamber design resulted in TE (rogue) modes that were driven by the beam and interfered with vertical BPM readings. Extensive measurements were carried out to characterize the TE modes and show that there could be a potential problem. A scheme for providing shielding for the modes has been tested. The review provided valuable input to the final design of the shielding system.

The contracts for the quadrupole magnets were awarded on September 23, and the effort to finalize the procurement documents for the booster continued.

For insertion devices, efforts concentrated on procuring damping wigglers and measurement equipment. The Hall probe bench contract was awarded. A permanent magnet structure has been developed for calibrating the Hall probe and stretched wire measurement apparatus.

For vacuum systems, the most pressing issue is to move ahead with extrusion of the aluminum vacuum chamber. The multipole chamber extrusion work will be awarded soon. To optimize machining procedures for industrializing chamber production, APS and industry provided feedback on their machining and welding of prototype chambers. The schedule for the vacuum chamber production continues to be critical.

The production order for the RF BPM button antennas for the storage ring (SR) was placed after thorough and successful microwave testing of the first article. Delivery of the first 20 pieces is scheduled for mid-December. A mockup of the BPM cabling with an updated prototype junction box (Fig. 1) has been assembled. This is used to verify cable impedances and helps to ensure no interference with other systems during accelerator installation.

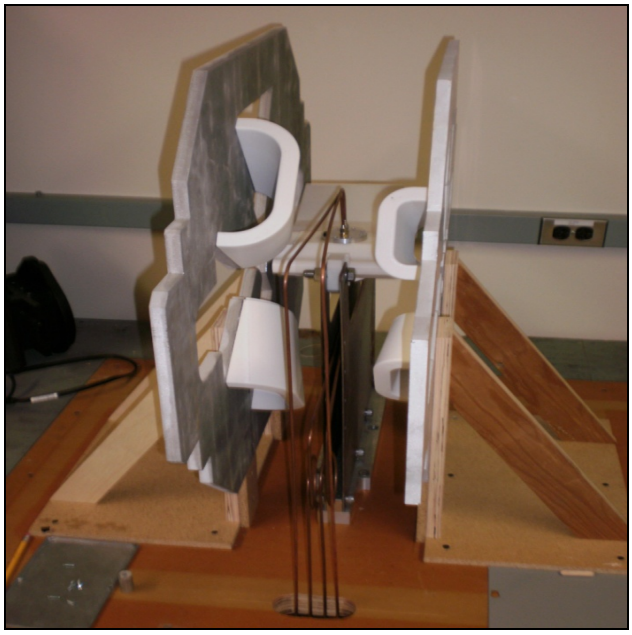


Figure 1: Mock-up of the RF BPM cable assembly.

With successful optimization of the filters, the design for the main dipole power supply is nearly complete. Prototypes for the regulator boards, second-generation power supply electronics, controls hardware, and chassis for the multipole power supplies were delivered for testing. The corrector power amplifier has been integrated with a power converter and tested for full current (over 20 Amps). Results show that it should meet all requirements. Calibration systems for the DCCTs have been designed and are ready to be procured. The first 40-inch-deep electronics rack has been delivered and its quality was found to be very good.

Tests on the high-stability BPM stand with a Renishaw Laser Interferometer confirmed that the stability requirement of ±100 nm over a 24-hour time scale has been met. Exploration continued on the feasibility of an option for in-house development of the BPM electronics as an alternative to commercial electronics. A conceptual design is now under study. The in-house design promises to overcome some shortcomings of the commercial product and appears to have cost advantages.

EXPERIMENTAL FACILITIES DIVISION (XFD)

The conceptual designs and associated safety reviews of the six project beamlines were completed in September. The final drafts of the CDRs were submitted. Various risk analyses and associated mitigation plans were also developed. The beamline CDRs will be reviewed by the XFD Conceptual Design Review Committee on October 13–14.

In the R&D area, significant progress was made in the high-energy-resolution test experiment being conducted at NSLS X16A. The Borrmann transmission of the Si (800) back reflection was measured in the new Collimating-Dispersing-Wavelength-selecting (CDW) optical configuration. The measured D-crystal rocking curve (Fig. 2) is well matched to the dynamical diffraction theory predictions. This is a critical step in the CDW scheme and allows further experimentation to proceed at X16A.

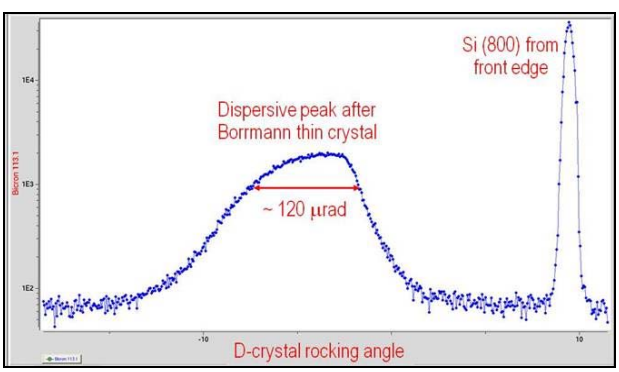


Figure 2: Measured D-Crystal rocking curve.

In the high spatial resolution R&D area, the assembly of the new deposition chamber for multilayer Laue lens (MLL) development continued to make progress (Fig. 3). A new x-ray reflectometer for multilayer growth characterizations was received and is being installed in the MLL deposition laboratory. Further experimental tests continued at the Center for Functional Nanomaterials (CFN) on reactive ion etching as an alternative for MLL slicing and polishing.

Figure 3: New deposition chamber for multilayer Laue lens development.

CONVENTIONAL FACILITIES DIVISION (CFD)

Construction of the conventional facilities continued to make excellent progress. Regrettably, on September 30 a worker sustained a serious leg injury at the ring building construction site; this is further discussed in the ESH section of this report.

The accelerator tunnel in the ring building is beginning to take shape, as substantial progress was made in pouring the tunnel floor slabs from Pentant 1, well into Pentant 2. The chilled water plant expansion has progressed rapidly, with site excavation completed and work beginning on foundations. The electrical substation and chilled water piping contractors have received notice to proceed and are mobilizing to begin work. Accelerated design of the LOBs continued on schedule, with A/E submittal of the 100% design drawings and specifications on September 25. The first structural steel elements were installed in the ring building, vehicle tunnel (Fig. 4), and utility tunnel.

Figure 4: Installing structural steel columns in the vehicle tunnel.

The balance of structural steel is in fabrication, and all steel shop drawings have been approved. More than 90% of the phase 1 and 2 steel has been fabricated and is in storage at the steel fabricator. Deliveries of steel will begin to arrive at NSLS-II in December, and erection of the main building will begin in January.

Concrete placement for the ring building ramped up during September, as placement activities were underway in the utility tunnel, vehicle tunnel, Pentant 3 column footings, and SR tunnel floor slab and tunnel wall areas, as well as the RF building compressor building (Figs. 5 and 6), and injection building areas.

Figure 5: Pouring foundation walls for the RF building.

Concrete placement has been running on schedule overall; placement of the tunnel floor slab is well ahead of schedule but the tunnel walls are slightly behind. Additional care was exercised in placement of the first set of tunnel walls to enssure all critical dimension requirements were satisfied; this process took longer than planned. With the dimensions of the wall forming system now confirmed, the contractor is confident they can pour two wall sections per week and quickly regain and surpass the tunnel wall schedule.

Additional ring building activities underway include installation of utilities for water, sanitary and drainage, and delivery of the steam system piping. The site development associated with parking and road entry on the northern side of the site is underway, including the installation of curbing, and preparation for paving parking lots and roadways.

The chilled water plant expansion contractor is off to a quick start by completing excavation of the building footprint, installing shoring systems to support the existing plant basement wall and electrical ductbank, and preparing foundations for the basement and condenser water pipe pit. The Chilled Water Piping contractor and Electrical Substation contractor are providing submittals, issuing contracts to subcontractors, placing orders for materials, and mobilizing at their respective construction sites. All material procurement contracts for electrical gear—the 8-unit substations, main substation transformer, and 15kV switchgear—are in fabrication and progressing well. Arrangements are being made for in-process inspections, and delivery of each item is expected about 2 months earlier than planned.

Figure 6: Foreground: Prepping foundations for the RF Bldg. compressor building. Background: Foundation of the main entrance to the tunnel floor.

The accelerated design of the LOBs continues to progress well. The 100% design drawing and specification package was submitted for review by the A/E on September 25 and a design presentation meeting is scheduled for early October. Upon receipt and incorporation of all comments in the design, the bid issue drawings and specifications will be released for inclusion in the RFP in early November. An informational meeting was held on September 24 with general contractors interested in building the LOBs. More than 20 general contractors were represented at the meeting and included many large firms with substantial construction experience. Contractor interest in the LOB procurement is high and should assure a competitive pool of qualified bidders.

Figure 6: Preparations began in July for the ductbank work.

ENVIRONMENT, SAFETY, AND HEALTH (ESH)

A serious injury occurred at the ring building construction site on September 30. While bundles of rebar were being moved from a storage lay-down area to a crane access area with a "LULL" fork truck, a laborer who was guiding the load was struck by a bundle of rebar and sustained a broken right leg below the knee. He was transported to a local hospital for treatment of his injuries and is expected to make a full recovery.

Immediate actions were taken to secure the scene and suspend work involving the moving or mechanical handling of rebar. An initial assessment of the contractor safety program was performed and improvements are being implemented.

The NSLS-II Project Director commissioned an Independent Construction Safety Investigation Committee to investigate this incident. This committee is supplemented with DOE observers from BHSO and the Chicago Office and a construction safety subject matter expert from Oak Ridge National Lab. The committee is charged with evaluating personnel, equipment, and procedures directly related to the incident as well as all systems and processes leading up to the incident and actions taken in response to the incident.

The investigation's scope will be consistent with a DOE "Type B Accident Investigation" as outlined in DOE Order 225.1A, Accident Investigations. This report will identify root and contributing causes as well as judgments of need that will be addressed by the Project and the Laboratory. A final report is due on November 13.

PROCUREMENT ACTIVITIES

DOE approved the LOB Acquisition Plan on September 16. Magnet proposals continue to be reviewed by the Proposal Evaluation Panel. The quadrupole contracts were placed on September 23. Sextupole and corrector magnet evaluations are complete, with awards expected early in October. Proposals for the dipole and large-aperture magnets are in evaluation and awards are planned to be made in October. The Request for Proposals (RFP) package for the linac procurement will be submitted to DOE in early October.

COST/SCHEDULE BASELINE STATUS

The cumulative Cost Performance Index (CPI) has decreased to 1.01 and the cumulative Schedule Performance Index (SPI) remained the same, at 0.93. Both cumulative indices have green status and are well within the DOE acceptable range. The CPI for the month is 0.77 (red status) because September's monthly close includes an extra 10 days of labor and additional costs incurred due to close-out of the fiscal year, including accruals of outstanding invoices and travel. The project's monthly SPI is 0.99 (green status).

A preliminary update to the critical path resulted from the near-term planning process. It runs through ring building construction in parallel with booster procurement, then continues to booster and SR commissioning. The currently projected early completion date is February 2014, about 4 months earlier than the current baseline. Near-critical path items with fewer than 50 days of total float include: SR vacuum system, pumps and valves; injection straight vacuum; transport line magnets and vacuum components; SR equipment enclosures, injection pulsed magnets, SR main dipole power supplies, and SR RF systems. A careful analysis of the critical path, near-critical path, and associated schedule floats will be conducted before the overall project schedule is finalized.

ARRA activities: During September 2009, ARRA-funded work continued to make excellent progress. Activities included concrete work for Pentants 1 and 5 and the injection building, and the excavation of foundations for Pentant 2 and the RF and compressor buildings. Scheduled site utility work covering electrical utility and ductbanks for unit substations and communications and data lines was also completed.

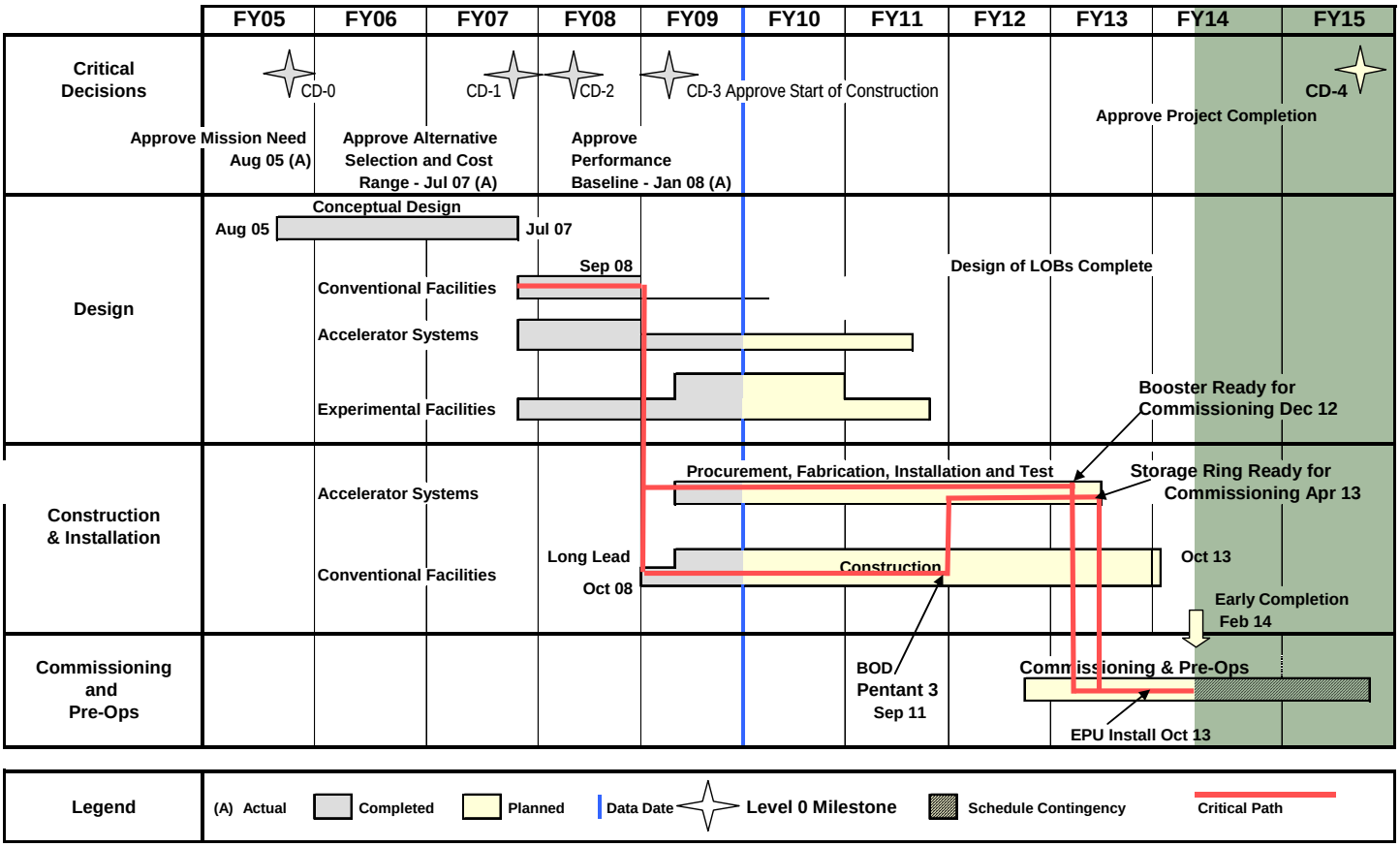
RECENT HIRES

Aftab Hussain – Mechanical Engineer – Mechanical Engineering, ASD
Fanglei Lin – Research Associate – Accelerator Physics, ASD
Michael Lucas – Mechanical Engineer – Mechanical Engineering, ASD
John Van Houten – Enterprise & Scientific Computing – PSD

PROJECT DESCRIPTION

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.

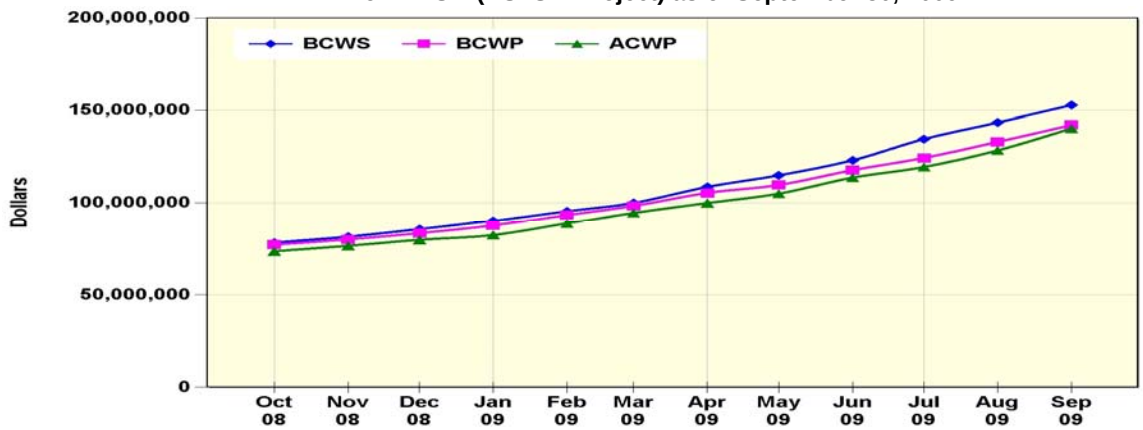
PRELIMINARY Update of the DOE Project Milestone Schedule



RECENT PROJECT ACCOMPLISHMENTS

- Contracts for production of quadrupole magnets were placed.
- The Hall Probe Bench contract was awarded.
- Prototypes regulator boards, second-generation power supply electronics, controls hardware, and chassis for the multipole power supplies arrived and are in testing.
- The first 40-inch-deep electronics rack was delivered and its high quality was verified.
- The high-stability BPM stand has passed the test for stability of ±100 nm over a 24-hour period.
- The conceptual designs and associated safety reviews of the six project beamlines were completed.
- The final drafts of the beamline CDRs were submitted and various risks and associated mitigation plans were developed.
- A new x-ray reflectometer for use in MLL development is being installed.
- The 100% design drawing and specification package for the LOBs was completed.
- The first structural steel elements were installed in the ring building.
- Support columns were placed in the vehicle and utility tunnels.
- Notices to proceed were issued for electrical substation and chilled water piping contractors.
- Deliveries of the 8-unit substations, main substation transformer, and 15kV switchgear are expected to be about 2 months ahead of schedule.

EV for WBS 1 (NSLS-II Project) as of September 30, 2009



Cumulative to Date (K$)	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09
BCWS	78,248	81,437	85,551	90,181	95,480	100,025	108,753	115,036	123,163	134,682	147,567	152,869
BCWP	77,088	79,974	83,373	87,572	93,407	98,407	105,508	110,000	117,841	124,463	133,133	142,268
ACWP	73,505	76,479	79,754	82,330	88,714	94,556	100,000	105,100	113,794	119,538	128,528	140,413

Project as of 9/30/09	Current Period	Cum-to-date
Plan (BCWS) $K	9,264	152,869
Earned (BCWP) $K	9,135	142,268
Actual (ACWP) $K	11,885	140,413
SV $K	-130	-10,601
CV $K	-2,750	1,855
SPI	0.99	0.93
CPI	0.77	1.01
Budget at Completion $K (PMB)		744,688
Planned % Complete		20.5%
Earned % Complete		19.1%
Mgmt Rsrv/Cont. as % of BAC remaining		27.8%
Mgmt Rsrv/Cont. as % of EAC remaining		26%

Levels 1, 2, 3 Milestones – Near Term

Level	Description	Baseline Date
L1 00040	CD-3 Approve Start of Construction	Feb09 Actual=Jan09✓
L2 00100	100% Conventional Facility Title II Design Complete	Aug 2008✓
L2 00220	Begin Site Preparation	Nov 2008✓
L2 00240	Issue Ring Building NTP	Jun09 Actual=Mar09✓
L2 00260	Contract Award for Booster System	Mar 2010
L3 05732	40% Accelerator Design Complete	Feb 2008✓
L3 05735	60% Conventional Facility Title II Design Complete	May 08✓
L3 05765	Conventional Facility Site Prep Complete	Jan09 Actual=Feb09✓
L3 05770	Accelerator SR Magnet Design Complete	Feb 2009✓
L3 05780	Exp. Facilities – Prelim. Design End Stations 1 Complete	June 2010

✓ = Completed; on schedule, unless otherwise noted

Schedule Performance Index, Project to Date:

SPI **0.93**

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

Cost Performance Index, Project to Date:

CPI **1.01**

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

ACWP = Actual Cost of Work Performed
BAC = Budget at Completion
BCWP = Budgeted Cost of Work Performed
BCWS = Budgeted Cost of Work Scheduled
CPI = Cost Performance Index (BCWP/ACWP)
EV = Earned Value
IPT = Integrated Project Team
PMB = Performance Measurement Baseline
SPI = Schedule Performance Index
WBS = Work Breakdown Structure

SPI or CPI in the range of:	
	0.9 – 1.15 is green
	0.85 – 0.89 or 1.16 – 1.25 is yellow
	<0.85 or >1.25 is red

Four PCRs were implemented in September:

PCR #	Area	Δ cost	Title or Description
PCR_09_078	ASD	$449K	Completion of Magnet Assembly Facility
PCR_09_088	PRJ	$2.2M	Project Management Staffing Increases
PCR_09_091	PRJ	-0-	Changes to Authorization Basis Milestone Dates
PCR_09_094	CFD	-0-	Ring Building Cost Corrections Resulting from Detail Planning and Profile Modification

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

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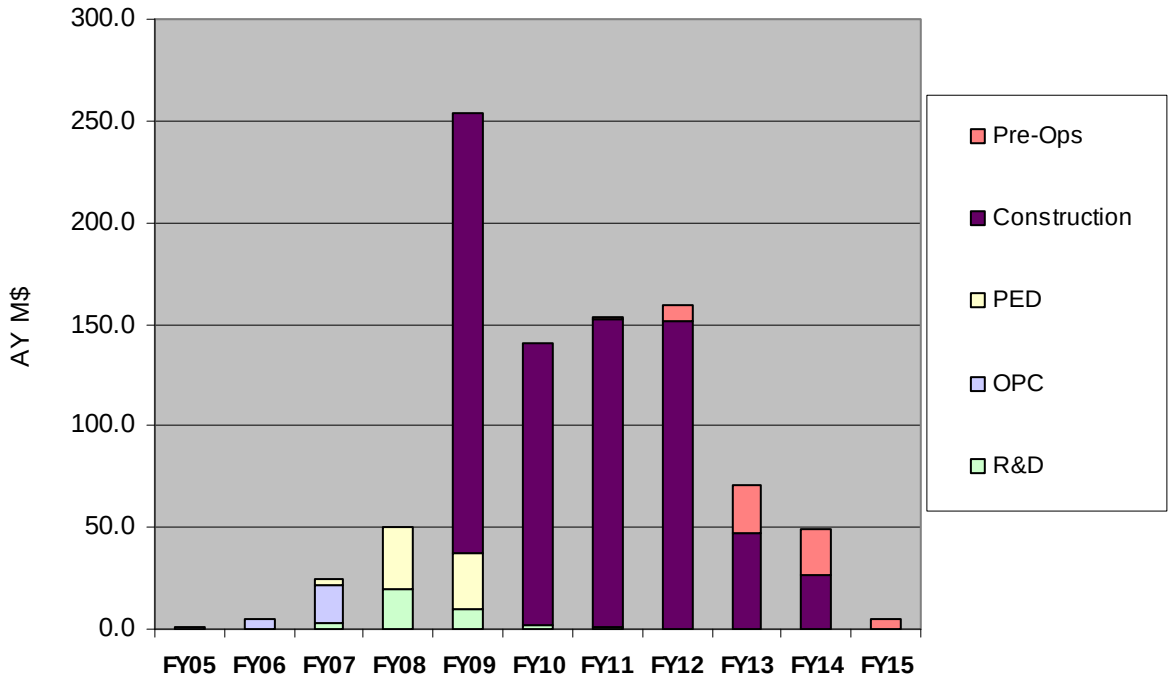
Funding Profile (revised to reflect ARRA funding)

	NSLS-II Funding Profile ($M)												
Fiscal Year	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	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
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NSLS-II Associate Project Director for Life Sciences	Wayne Hendrickson	whendrickson@bnl.gov wayne@convex.hhmi.columbia.edu	631-344-5681
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NSLS-II Experimental Facilities Division Director	Qun Shen	qshen@bnl.gov	631-344-3465
NSLS-II Conventional Facilities Division Director	Martin Fallier	fallier@bnl.gov	631-344-3475
NSLS-II Project Support Division Director	Diane Hatton	dhatton@bnl.gov	631-344-5073

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	a. NAME NSLS_EV8 - NSLS II Project	a. FROM (YYYYMMDD) 2009 / 09 / 01
b. LOCATION (Address and ZIP Code) Brookhaven National Laboratory, Upton,NY	b. NUMBER	b. PHASE	b. TO (YYYYMMDD) 2009 / 09 / 30
	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	

a. BEST CASE	0			c. SIGNATURE	d. DATE SIGNED (YYYYMMDD)
b. WORST CASE	0				
c. MOST LIKELY	0	912,000,000	912,000,000		

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:	337,914	337,914	108,596	0	229,318	2,430,863	2,430,863	2,449,853	0	-18,990	7,445,412	7,445,412	0
1.01.02 Environmental, Safety & Health													
WBS[3]Totals:	81,455	81,455	104,069	0	-22,613	1,692,485	1,692,485	1,976,448	0	-283,963	6,154,591	6,154,591	-0
1.01.03 Project Support													
WBS[3]Totals:	1,133,676	1,133,676	1,138,779	0	-5,102	13,691,843	13,691,843	13,945,662	-0	-253,819	37,878,194	39,305,194	-1,427,000
1.01.04 Quality Assurance													
WBS[3]Totals:	52,249	52,249	32,638	0	19,611	1,011,695	1,011,695	706,911	0	304,784	3,073,212	3,073,212	-0
1.01.05 Configuration Management & Document Contro													
WBS[3]Totals:	27,545	27,545	33,091	0	-5,546	638,882	638,882	504,371	0	134,511	1,972,567	1,972,567	0
WBS[2]Totals:	**1,632,840**	**1,632,840**	**1,417,172**	**0**	**215,667**	**19,465,768**	**19,465,768**	**19,583,245**	**-0**	**-117,477**	**56,523,975**	**57,950,975**	**-1,427,000**
1.02 R&D and Conceptual Design													
1.02.01 Accelerator Systems R&D													
WBS[3]Totals:	179,449	99,406	201,869	-80,042	-102,463	9,226,047	8,709,177	9,093,770	-516,870	-384,593	11,460,076	11,460,076	1
1.02.02 Experimental Systems R&D													
WBS[3]Totals:	299,323	246,228	438,886	-53,094	-192,658	11,017,410	10,363,922	9,325,843	-653,487	1,038,079	19,166,553	19,163,549	3,004
1.02.03 Conceptual Design - Accelerator Systems													
WBS[3]Totals:	0	0	-10	0	10	12,998,214	12,998,214	12,953,517	0	44,697	12,998,214	12,998,214	0
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 & Support													
WBS[3]Totals:	0	0	0	0	0	7,086,188	7,086,188	7,325,314	0	-239,126	7,086,188	7,325,314	-239,126
1.02.07 Project Management - R&D													
WBS[3]Totals:	51,789	51,789	32,468	0	19,321	4,671,086	4,671,086	4,741,006	0	-69,919	5,305,339	5,066,213	239,125
WBS[2]Totals:	**530,560**	**397,424**	**673,213**	**-133,137**	**-275,790**	**49,595,342**	**48,424,984**	**48,024,777**	**-1,170,357**	**400,207**	**60,612,767**	**60,612,767**	**0**
1.03 Accelerator Systems													
1.03.01 Accelerator Systems Management													
WBS[3]Totals:	114,216	114,216	222,904	0	-108,688	2,182,692	2,182,692	2,038,320	0	144,371	6,019,099	11,081,099	-5,062,000
1.03.02 Accelerator Physics													
WBS[3]Totals:	214,407	214,407	227,212	0	-12,805	2,758,247	2,758,247	2,368,009	0	390,238	10,071,767	10,071,767	-0
1.03.03 Injection System													
WBS[3]Totals:	206,833	107,285	170,322	-99,548	-63,037	1,885,838	1,532,538	1,176,208	-353,300	356,330	39,969,095	40,970,095	-1,001,000
1.03.04 Storage Ring													
WBS[3]Totals:	1,074,263	572,349	1,483,367	-501,914	-911,018	14,458,874	12,209,077	12,280,144	-2,249,798	-71,067	140,738,451	144,108,452	-3,370,000
1.03.05 Controls Systems													
WBS[3]Totals:	221,440	195,174	349,171	-26,265	-153,996	3,629,867	2,596,112	2,980,546	-1,033,756	-384,435	20,121,954	20,121,953	0
1.03.06 Accelerator Safety Systems													
WBS[3]Totals:	21,761	47,573	54,054	25,812	-6,481	634,391	597,704	500,863	-36,687	96,841	4,297,433	4,506,432	-209,000
1.03.07 Insertion Devices													
WBS[3]Totals:	58,134	17,156	19,809	-40,977	-2,653	1,151,865	849,897	433,765	-301,968	416,132	25,237,478	27,487,479	-2,250,000
1.03.08 Accelerator Fabrication Facilities													
WBS[3]Totals:	296,972	203,848	300,284	-93,124	-96,436	4,918,073	3,569,427	3,610,834	-1,348,646	-41,406	6,171,696	6,142,387	29,309
WBS[2]Totals:	**2,208,026**	**1,472,010**	**2,827,124**	**-736,016**	**-1,355,114**	**31,619,848**	**26,295,693**	**25,388,689**	**-5,324,155**	**907,004**	**252,626,972**	**264,489,663**	**-11,862,691**
1.04 Experimental Facilities													
1.04.01 Experimental Facilities Management													
1.04.01 Experimental Facilities Management	87,917	87,917	167,866	0	-79,948	1,503,048	1,503,048	1,917,742	0	-414,694	4,568,673	5,118,673	-550,000
WBS[3]Totals:	87,917	87,917	167,866	0	-79,948	1,503,048	1,503,048	1,917,742	0	-414,694	4,568,673	5,118,673	-550,000
1.04.02 Standard Local Controls & Data Acquisition Systems													
1.04.02 Standard Local Controls & Data Acquisition Systems	1,325	0	0	-1,325	0	21,887	11,656	0	-10,231	11,656	69,585	69,585	-0
WBS[3]Totals:	1,325	0	0	-1,325	0	21,887	11,656	0	-10,231	11,656	69,585	69,585	-0
1.04.05 User Instruments													
WBS[3]Totals:	189,919	295,056	304,564	105,137	-9,507	3,023,002	2,936,511	1,972,466	-86,491	964,045	63,573,084	67,523,084	-3,950,000
1.04.06 Front End User Requirements Development													
1.04.06 Front End User Requirements Development	0	0	0	0	0	456	456	1,205	-0	-749	456	1,205	-749
WBS[3]Totals:	0	0	0	0	0	456	456	1,205	-0	-749	456	1,205	-749
1.04.07 Optics Labs													
WBS[3]Totals:	4,548	0	3,853	-4,548	-3,853	831,771	633,098	552,787	-198,674	80,311	2,072,162	2,072,162	0
WBS[2]Totals:	**283,710**	**382,974**	**476,282**	**99,264**	**-93,308**	**5,380,165**	**5,084,769**	**4,444,200**	**-295,395**	**640,569**	**70,283,960**	**74,784,709**	**-4,500,749**
1.05 Conventional Facilities													
1.05.01 Conventional Facilities Management													
1.05.02 Conventional Facilities Engineering and Desigr													
WBS[3]Totals:	169,849	141,822	931,915	-28,027	-790,093	14,613,719	14,574,576	15,226,335	-39,143	-651,760	20,673,299	23,342,952	-2,669,653
1.05.03 Conventional Facilities Construction													
WBS[3]Totals:	4,095,808	4,775,627	5,188,085	679,819	-412,458	27,878,477	24,223,469	23,659,024	-3,655,008	564,445	217,414,846	235,354,281	-17,939,435
1.05.04 Integrated Controls & Communications													
1.05.04 Integrated Controls & Communications	14,236	0	13,594	-14,236	-13,594	139,236	0	13,594	-139,236	-13,594	561,273	961,273	-400,000
WBS[3]Totals:	14,236	0	13,594	-14,236	-13,594	139,236	0	13,594	-139,236	-13,594	561,273	961,273	-400,000
1.05.05 Standard Equipment													
1.05.05 Standard Equipment	0	0	0	0	0	0	0	0	0	0	1,025,586	1,025,586	0
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													
1.05.06 Commissioning	2,500	5,098	1,693	2,598	3,405	20,000	42,330	36,518	22,330	5,812	578,000	578,000	0
WBS[3]Totals:	2,500	5,098	1,693	2,598	3,405	20,000	42,330	36,518	22,330	5,812	578,000	578,000	0
WBS[2]Totals:	**4,609,116**	**5,249,269**	**6,490,870**	**640,153**	**-1,241,601**	**46,807,809**	**42,996,753**	**42,971,802**	**-3,811,056**	**24,951**	**254,440,009**	**275,485,683**	**-21,045,674**
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	3,823,660	0
1.06.04 Spares													
1.06.04 Spares	0	0	0	0	0	0	0	0	0	0	9,134,454	9,134,454	-0
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**	**50,200,405**	**0**
b. Cost of Money	0	0	0	0	0	0	0	0	0	0	0	0	0
c. Gen. and Admin.	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Undist. Budget											0	0	0
e. Sub Total	9,264,252	9,134,516	11,884,662	-129,736	-2,750,146	152,868,932	142,267,968	140,412,713	-10,600,964	1,855,255	744,688,088	783,524,202	-38,836,114
f. Contingency/Management Resrv.											167,311,912		
g. Total	9,264,252	9,134,516	11,884,662	-129,736	-2,750,146	152,868,932	142,267,968	140,412,713	-10,600,964	1,855,255	912,000,000		
9. Reconciliation to CBB													
a. Variance Adjustment													
b. Total Contract Variance													