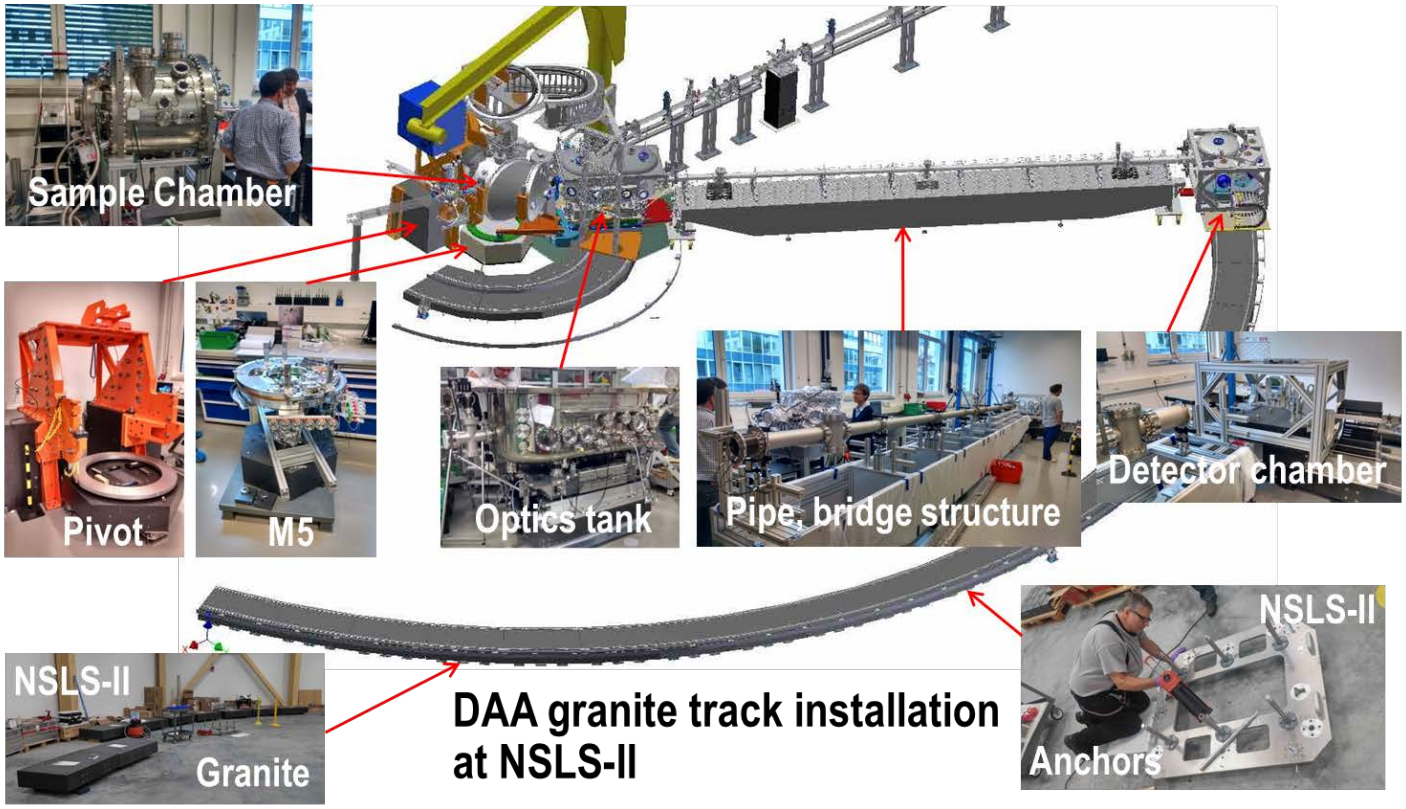
NSLS-II Experimental Tools (NEXT)

September 2016 Project Activity
Report due date: October 20, 2016

SIX Insertion Device and Front End installed in NSLS-II accelerator tunnel



SIX endstation: photos of SIX endstation construction progress at Bestec

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OVERALL ASSESSMENT

PDS installation and testing at the SMI and SIX beamlines continued in September, along with radiation shielding analysis and advancing travelers and other IRR documentation toward completion. These two beamlines remain on track for the first phase of their IRRs, scheduled for October (SMI) and November (SIX).

Endstation installation and testing activities continued at all NEXT beamlines.

The SIX EPU57 insertion device was installed in the 2-ID straight section this month, in preparation for the SIX ID/FE IRR scheduled for October. Preparations were made for magnetic assembly and testing of ESM EPU105, the final NEXT insertion device.

Two major procurements were completed in September: the gas handling system contract for ISS and the soft x-ray CCD detector contract for SIX. Monitoring and management of contractor progress on the 11 remaining major procurement contracts are important ongoing activities that are crucial to maintaining project schedule. Four of these contracts are for ISR, 3 are for SIX, 2 are for ISS, 1 is for ESM, and 1 is shared between ESM and SIX.

As of September 30, 2016, the project is 93.4% complete based on base scope performance earned to date. The cumulative EVMS schedule and cost indices remained at 0.96 and 0.94, respectively.

No PCRs were processed in September and none are planned for October. BAC remained at $82.97M. Cost contingency is $7.03M, which is 99.6% of $5.44M BAC work remaining.

The EAC, reported as the sum of actual cost to date (ACWP) plus the estimated cost to complete (ETC), is $87.93M, $0.24M greater than the August value. As of the end of September, contingency on EAC is $2.07M, which represents 38.5% of $5.38M EAC work remaining, or 156.7% of $1.32M unobligated work to go ($4.06M of the remaining work is obligated to fixed-price equipment contracts). ETC will continue to be assessed monthly through project completion to understand and contain costs while maintaining the good schedule performance that the project has demonstrated to date.

COMMON SYSTEMS

Utilities installation is nearing completion. Mechanical utilities installation work in the SIX Satellite Building is now completed, other than hookups to not-yet-delivered hardware. Delivery and installation of the SIX endstation systems are expected later in the calendar year, after which the utility connections will be completed.

PPS progress in September was focused at the SMI beamline. Final testing continued this month and is expected to be completed, along with certification, in October. PPS hardware installation has started at the SIX beamline and will continue into November. The progress of this work is expected to accelerate in October, as PPS resources roll off of the SMI beamline as well as one of the NSLS-II partner beamlines.

EPS installation as SMI was completed this month, in preparation for the IRR in October. EPS installation work continued at SIX this month, with installation of cables and I/O boxes, and will continue through October.

All remaining control station furniture has been delivered for the NEXT beamlines. Integration of AC power to the ISR control station is complete.

BEAMLINE CONTROLS

Beamline controls activities during September focused on preparation for the first-phase PDS IRRs scheduled in October (SMI) and November (SIX). These activities include full-range motion checking and validation for all axes of optics motion, validating all vacuum and diagnostic controls, and preparation of IRR documentation. Based on progress made to date, controls engineering for both beamlines is on track for completion by the IRR dates.

ESM – ELECTRON SPECTRO-MICROSCOPY

Commissioning of the ESM beamline continued in September. The horizontal focusing performance of the M3 mirror has been quantified, reaching the target focal size of 20 μm at the exit slits. Beam has been propagated through the refocusing KB mirrors to the ultimate focus at the ARPES endstation. Currently, the electron spectrometer is being vacuum-baked in preparation for conducting photoemission measurements, the principal experimental technique at ESM.

Characterization of the ESM source has continued with measurements of the angular dependence of emission from the EPU57 undulator using Diagon, a home-made undulator diagnostic device. Diagon functionality is based on reflection, at 45 degree angle of incidence, from a multilayer film grown on a Si single crystal. For ESM, the periodicity of the multilayer has been chosen to maximize reflectivity at 700 eV photon energy. The reflected soft X-rays are converted to visible light using a YAG crystal located vertically above the multilayer. The ESM Diagon device is located in the ESM front end, ~29 m downstream of the center of the EPU57 undulator, so the image content is dominated by the angular dependence of the source radiation through the energy filter of the multilayer. The upper portion of Figure 1 displays Diagon images corresponding to different values of the ESM EPU57 undulator gap. Circular images are the expected for the first harmonic of the undulator. Comparison with calculated emission patterns, currently underway, is expected to provide a quantitative estimate of the emittance of the electron beam in the NSLS-II storage ring.

Unexpectedly, the undulator emission images recorded by the ESM Diagon contain extra content, beyond that expected from the first undulator harmonic. The extra image content,

which is slightly displaced in angle with respect to the first harmonic images, results from Bragg diffraction of 4th harmonic emission at 2800eV from the Si(111) substrate, which is slightly miscut (~ 4 degrees). The lower panel of Figure 1 displays the angular distributions of EPU57 emission at 2800 eV. The angular dependence of the 4th harmonic emission further constrains the parameters used in the simulation of these images, and will consequently render a very precise determination of the machine emittance.

Looking ahead, only a very few ESM activities remain to be completed in the NEXT project. The most important of these are receipt and installation, by the supplier, of the M4 mirror for the XPEEM branch. The work remaining for M4 is quite minimal: the M4 chamber has been installed and its motions tested already a few months ago.

As of September 30, all ESM Beamline Systems labor has been earned. Starting in October, no further labor will be charged to NEXT.

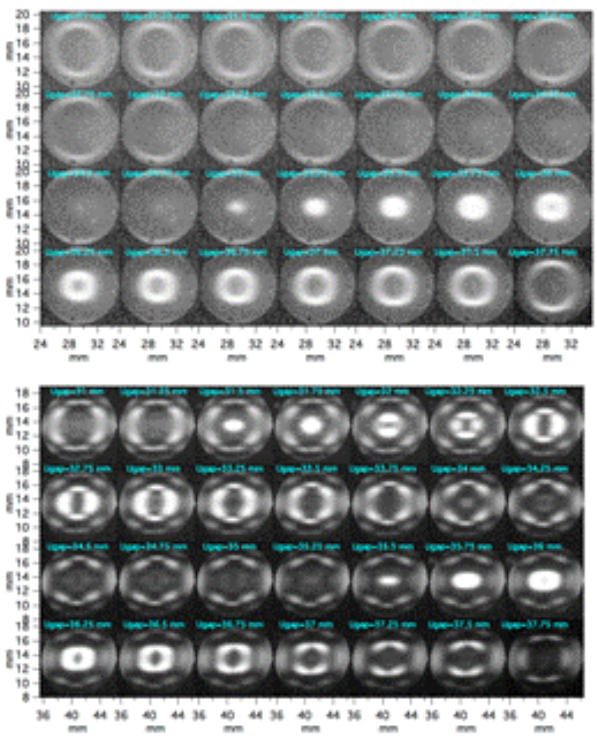


Figure 1. ESM: Upper panel: angular distributions of 700 eV emission from the ESM EPU57 insertion device as the magnetic gap is scanned through the onset of fundamental emission at that photon energy; Lower panel: corresponding angular distributions for 2800 eV radiation.

ISR – IN-SITU AND RESONANT HARD X-RAY

A purchase order for an ultra-clean nitrogen gas compressor was placed with Durr Technik USA, Inc., on September 29, with an expected delivery in late October.

The survey data drawing for the 6-Circle Diffractometer was released, and the survey group marked the locations of the translation rails, which will be installed in Hutch 4-ID-C in November.

The installation of the secondary bremsstrahlung shield in Hutch 4-ID-A was completed. The support structure for the lead was installed, the lead sheets were inserted, and a final survey was carried out to confirm the position of the shielding. This shield, shown in Figure 2, is now under configuration control, permitting ISR operations at ring current values >400 mA.

The design of the phase plate holder was completed, and one holder was fabricated. A set of diamonds — 1 mm thick (110), 0.5 mm thick (111), 0.25 mm thick (111), and 0.1 mm thick (111) — was glued into the holder, as shown in Figure 3. The diamond phase plates will be tested using the analyzer 2-circle, which is a part of the base diffractometer in Hutch 4-ID-C, in early October, prior to the expected arrival and installation of the Dual Phase Plate Assembly stacks. A report of vacuum tests for one of the two stacks was received on September 30, and the base pressure and RGA results meet specifications. Both stacks are expected to arrive at BNL in mid-October, and be installed in Hutch 4-ID-A during the second half of October.

Applied Energy Systems completed commissioning work on the Gas Handling System. Testing of all gas sensors was completed, and active alarm monitoring by BNL fire protection has begun. User training is expected in October.

Figure 2. ISR: Secondary bremsstrahlung shield, under configuration control in Hutch 4-ID-A.

Figure 3. ISR: One set of diamond phase plates installed in the phase plate holder, in preparation for testing. Note that the top, empty slot is for the 5 mm thick silicon phase plate, which has already been tested.

ISS – INNER SHELL SPECTROSCOPY

All major PDS procurement packages have been installed and all PDS testing and integrated testing activities in NEXT scope have been completed. All NEXT-related deliverables for these contracts have been received and all milestones have been achieved and accrued or paid.

All ISS endstation procurement contracts are similarly complete and accrued except for three remaining milestones, which are expected to be completed in October: (1) approval of the commissioning report for the sample chamber (PI), (2) approval of the commissioning report for the emission spectrometer mechanics (PI), and (3) final installation of the sample transfer system (Square One).

SIX – SOFT INELASTIC X-RAY

Termination of PDS vacuum cables was completed in September and hi-pot testing is scheduled for the first half of October. Connections of DI water circuits to the various water-cooled PDS optics and safety components were completed this month and pressure testing of these lines will take place in the second half of October. Progress in the installation of these components is illustrated in Figure 4.

Bakeout is now underway for two vacuum sections, one inside the FOE (Figure 5) and one on the experimental floor upstream of the PGM. Vacuum levels for both sections are promising, and the bake is expected to ramp down early October. Priority for the remaining bakes will be given to vacuum sections where IRR-related tasks cannot start until the bake is completed, such as pressure testing of the DI water lines and lead shield installation.

The recently delivered in-vacuum sample diffractometer from SmarAct (Figure 6) was accepted based on successful completion of range-of-motion tests. XCAM visited NSLS-II between September 1 and 7 to conduct electronic and noise tests of the soft X-ray CCD (Figure 7). These tests were successful and XCAM will return in 2017 for detector tests using synchrotron X-rays with the CCD installed in the detector arm of the SIX spectrometer. The testing-with-beam effort will be supported by NSLS-II operations.

Two SIX staff and the manager of the NSLS-II Soft X-ray Program visited Bestec on September 27-28 to witness progress on the sample chamber and emission spectrometer contracts, including receipt of components and assembly and testing of sub-systems. Delivery of most of the components to Bestec was confirmed, and motion tests were performed on the axes of the M5, M6, M7 mirrors and the gratings, using an NSLS-II Delta Tau controller.

Regarding installation of the granite blocks that will support angular travel of the 15m-radius detector arm, a jig to position and hold threaded anchors in place during epoxy curing was designed by the SIX endstation mechanical engineer and fabricated by BNL Central Shops (Figure 8). Hole-drilling and installation of these anchors will take place in October.

Figure 4. SIX: DI water lines and terminated vacuum cables.

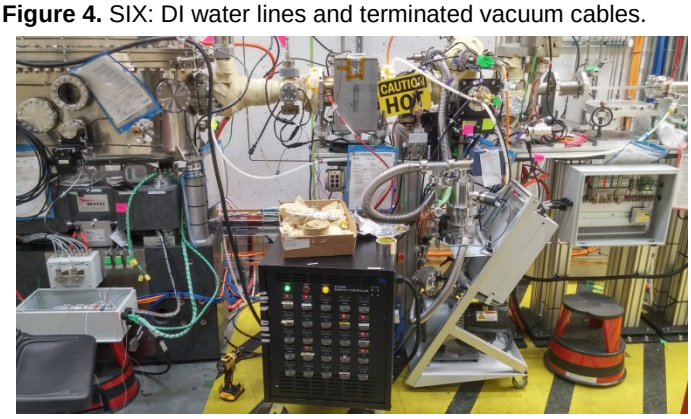


Figure 5. SIX: Bake-out underway in the FOE.

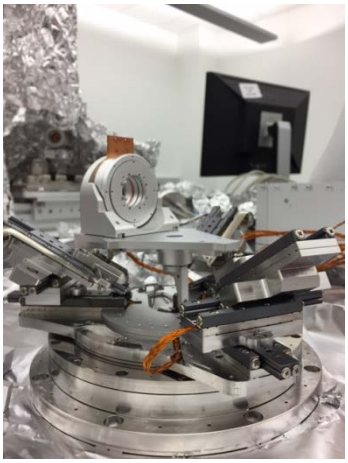


Figure 6. SIX: SmarAct in-vacuum diffractometer wired up for motion tests at NSLS-II.

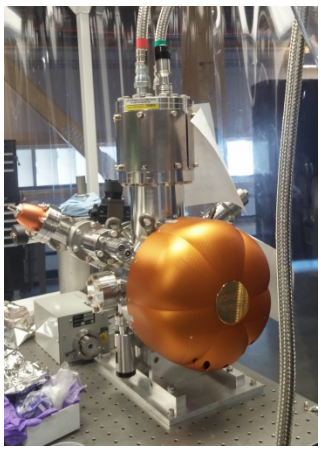


Figure 7. SIX: XCAM CCD on the test bench at NSLS-II.

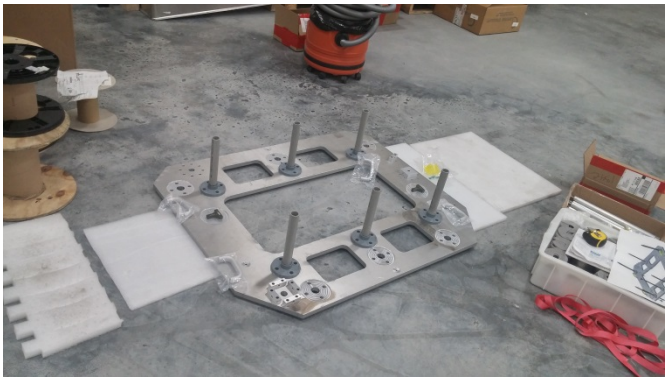


Figure 8. SIX: Jig to hold the anchors of the granite block threaded rods in place while the epoxy cures.

SMI – SOFT MATTER INTERFACES

Installation and testing of components in the WAXS Sample Vacuum Chamber continued during September, working toward completion in early October, prior to the first phase PDS IRR. First, the newly repaired Hexapod sample positioner system was tested and found to be performing properly. Next, the Sample Vacuum Chamber was pumped with the installed PEX dry turbo pump and reached pressures below 2×10^{-4} Torr with the equipment inside. In addition, the Pilatus 300K-W detector was mounted onto its bracket. As Figure 9 shows, the 300K-W detector was mounted on dummy blocks that take the place of the XY motion stages. This allows the team to test the WAXS goniometer under real load conditions and to work on cable management. The XY stages themselves have been fabricated and are being assembled in the lab (Figure 10) with expected completion early in October.

Fabrication of the SAXS chamber XYZ mechanics continued this month, along with assembly of the overall SAXS system.

Final installation and testing tasks remaining for the SMI PDS were completed in September, including: installation and testing of all components, completion of all EPS connections including final vacuum cable connections and tests, and preparation for taking SR beam. The newly-repaired DCM is cold, with the Cryo-Cooler running on automatic. The gas manifold of the PPS Aperture was completed and certified along with all other PPS utilities and hardware. The JJ X-ray slit lens actuator that was faulty has been repaired. In summary, the SMI beamline has been readied for the first phase of Photon Delivery System IRR, scheduled in October. The majority of components in the WAXS sub-assembly, including the WAXS goniometer, Hexapod sample positioners, and Bounce-Down Mirror, have been included in IRR scope.

Assuming successful completion of the October PDS IRR and confirmation of PPS certification in early November, first light at SMI is planned for November 7.

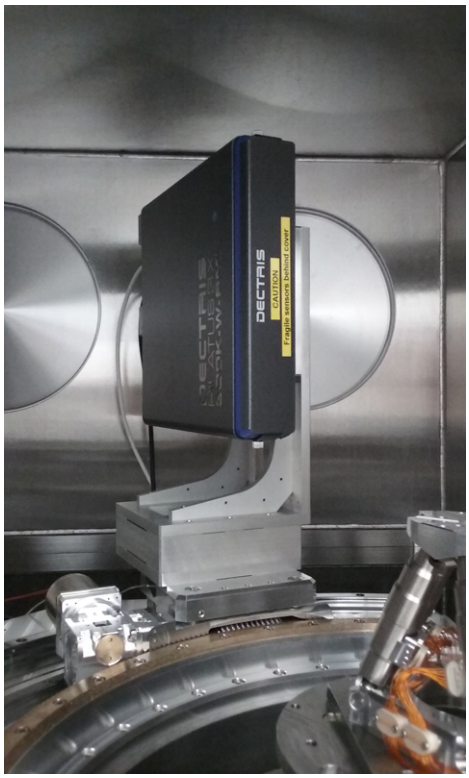


Figure 9. SMI: Pilatus 300K-W detector from Dectris on its bracket in the WAXS chamber. In this assembly, the XY stages are substituted by dummy blocks (see text). Beneath the detector, the arc of the goniometer stage is visible. To the right is the hexapod sample positioner.

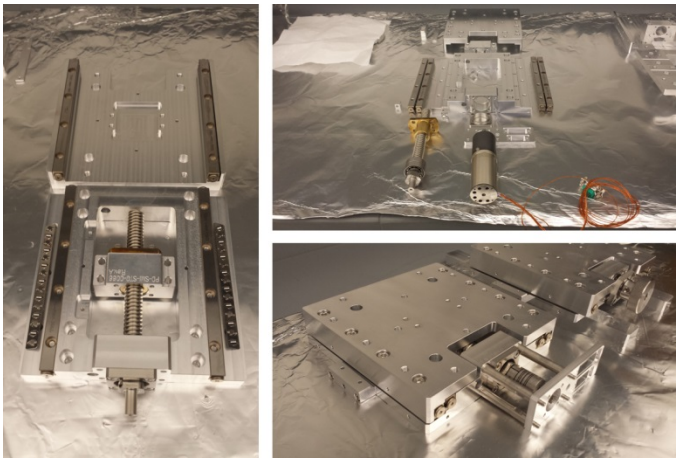


Figure 10. SMI: WAXS XY stages assembled on the bench. Left: lead screw, rails, and bearings. Top right: parts prior to assembly including the in-vacuum stepper motor. Bottom right: the two assembled stages.

INSERTION DEVICES

NEXT scope for the SIX EPU57 insertion device, ending when the device is ready for installation, was completed early in September. During the remainder of the month, this device was transferred to the NSLS-II storage ring building and then installed at the 2-ID straight section in the ring tunnel. The SIX EPU57 electronics were installed on the mezzanine above 2-ID and the cabling to the EPU57 routed, cut to length, terminated, and connected. EPICS control functionality was transferred to a central server to provide control of the device from the control room or from the SIX beamline.

After the SIX EPU57 device was removed from the magnetic measurement lab, this lab was prepared for assembly and the shimming of the ESM EPU105 insertion device. In addition to general clean-up of the lab, the two vertical stages of the field integral measurement system were realigned. Completion of assembly and testing of ESM EPU105 represent the final activities remaining in WBS 2.11. Completion of this work is expected by December.

PROJECT MILESTONES

Milestone	Planned	Actual
CD-0 (Mission Need):	May 27, 2010	May 27, 2010
CD-1 (Alternative Selection):	Sept. 30, 2011	Dec. 19, 2011
CD-2 (Performance Baseline):	Dec. 31, 2013	Oct. 9, 2013
CD-3A (Long Lead Procurement):	Dec. 31, 2013	Oct. 9, 2013
CD-3 (Start Construction):	Mar. 31, 2014	Jul. 7, 2014
Early Project Completion:	Jan. 31, 2017	
CD-4 (Project Completion):	Sept. 29, 2017	

RECENT AND UPCOMING EVENTS

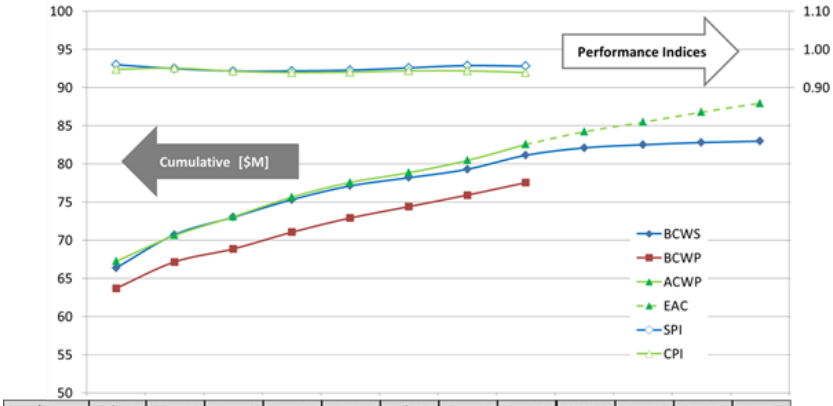
DOE OPA EVMS Review (BNL)	October 4-5, 2016

Acronyms and Abbreviations

AC	Alternating Current
ACWP	Actual Cost of Work Performed
ARPES	Angle-Resolved PhotoElectron Spectroscopy
BAC	Budget at Completion
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BDN	Beamlines Developed by NSLS-II
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
CAM	Cost Account Manager
CCD	Charge-Coupled Device
CD	Critical Decision
CPI	Cost Performance Index
CV	Cost Variance
DCM	Double Crystal Monochromator
DOE	Department of Energy
EAC	Estimate At Completion
EPICS	Experimental Physics and Industrial Control System
EPS	Equipment Protection System
EPU	Elliptically Polarizing Undulator
ES&H	Environment, Safety & Health
ESM	Electron Spectro-Microscopy beamline
ETC	Estimated Cost to Complete
EVMS	Earned Value Management System
FAT	Factory Acceptance Test
FDR	Final Design Review
FE	Front End
FOE	First Optics Enclosure
FTE	Full Time Equivalent
FXI	Full-field X-ray Imaging beamline
FY	Fiscal Year
ID	Insertion Device
I/O	Input / Output
IRR	Instrument Readiness Review
ISR	Integrated In-Situ and Resonant X-ray Studies
ISS	Inner Shell Spectroscopy beamline
IVU	In-Vacuum Undulator
KPP	Key Performance Parameter
M&S	Material & Supplies
NEXT	NSLS-II Experimental Tools project
NSLS	National Synchrotron Light Source
NSLS-II	National Synchrotron Light Source II
OPA	Office of Project Assessment
OPC	Other Project Costs
PCR	Project Change Request
PDS	Photon Delivery System
PGM	Plane Grating Monochromator
PMB	Performance Management Baseline
PPS	Personnel Protection System
RGA	Residual Gas Analysis
SAXS	Small Angle X-ray Scattering
SC	Office of Science
SIX	Soft Inelastic X-ray Scattering beamline
SMI	Soft Matter Interfaces beamline
SPI	Schedule Performance Index
SR	Synchrotron Radiation
SV	Schedule Variance
TEC	Total Estimated Cost
TPC	Total Project Cost
UB	Undistributed Budget
VAC	Variance At Completion
WAXS	Wide Angle X-ray Scattering
WBS	Work Breakdown Structure
WS	Working Schedule
XPEEM	X-ray photoemission electron microscopy

COST AND SCHEDULE STATUS

Cost and schedule progress is being tracked using an Earned Value Management System (EVMS) against the cost and schedule baseline established on October 1, 2013. All baseline changes are being controlled through the NEXT Change Control Board. Cost and schedule revisions are being managed using Project Change Control procedures. From June 2015 forward, EAC is reported as the sum of actual cost to date (ACWP) plus the estimated cost to complete (ETC), at the individual activity and resource level, with account-level cost corrections applied as needed to account for the difference between the Earned Value and accrual schedules. ETC values are shown in the final row of the EVMS table below, and all EAC changes are captured in the monthly EAC log.



Cum $M	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17
BCWS	66.4	70.7	73.0	75.3	77.1	78.2	79.3	81.1	82.1	82.5	82.8	83.0
BCWP	63.7	67.2	68.9	71.0	72.9	74.4	75.9	77.5				
ACWP	67.2	70.6	73.1	75.6	77.6	78.8	80.4	82.5				
SPI	0.96	0.95	0.94	0.94	0.95	0.95	0.96	0.96				
CPI	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94				
ETC									5.4	3.7	2.5	1.2

NEXT as of 9/30/2016	Current Period	Cum-to-Date
Plan (BCWS) $k	1,831	81,119
Earned (BCWP) $k	1,620	77,534
Actual (ACWP) $k	2,105	82,547
SV $k	-210	-3,585
CV $k	-485	-5,013
SPI	0.89	0.96
CPI	0.77	0.94
Budget at Completion $k (PMB [UB])		82,970
Planned % Complete (BCWS/BAC)		97.8%
Earned % Complete (BCWP/BAC)		93.4%
Contingency $k		7,030
Contingency / (BAC – BCWP)		129.3%
EAC $k		87,928
Contingency / (EAC – BCWP)		67.6%
(Contingency + VAC) / (EAC – ACWP)		38.5%
TPC = PMB + Contingency		90,000

The NEXT project Schedule Variance (SV) for September 2016 is -$210k, with an associated monthly Schedule Performance Index (SPI) of 0.89 (yellow status). The largest contributors to the current month schedule variance are provided in the table below. The cumulative SPI is 0.96 (green status), the same as it was in August.

The NEXT project Cost Variance (CV) for September 2016 is -$485k, with an associated monthly Cost Performance Index (CPI) of 0.77 (red status). A primary cost variance driver for all labor this month is the long charging month (Aug. 21 through Sept. 30, which is 30% greater than a standard month), whereas planned and earned value are for a standard-length month. The other significant contributors to the current month CV are provided in the table below. The cumulative CPI is 0.94 (green status), the same as it was in August.

Leading Current Month Variances [$k], September 2016

WBS	Title	PV	EV	AC	Schedule		Cost	
					SV	Issues	CV	Issues
2.01	Project Support	176	176	283	0	--	-107	Principal contributors: (i) labor charges ~30% above earned value owing to long time-charging month of September (~-$20k), (ii) higher than average payments for Project Controls this month (~-$15k), and (iii) an adjustment for Scientific Distributed Labor, much of which was performed in earlier months (~-$45k).
2.03	Common Systems	26	226	152	201	Greater work performed than planned, especially in PPS, in order to catch up on delayed work. Utilities (2.03.01): +$25k, PPS (2.03.02): +$149k; EPS (2.03.03): +$27k	75	Dominated by CV in Utilities (WBS 2.03.01, +$82k), resulting from removal of charges incorrectly made against the account for this WBS.
2.04	Controls	18	66	120	48	Dominated by CV in Control System Design & Implementation (WBS 2.04.02, +$45k), resulting from catch up work, especially for beamlines about to undergo IRR (SMI, SIX).	-54	Dominated by CV in Control System Design & Implementation (WBS 2.04.02, -$51k), caused by labor cost overages resulting in part from changes in requirements.

Leading Current Month Variances [$k], September 2016								
WBS	Title	PV	EV	AC	Schedule		Cost	
					SV	Issues	CV	Issues
2.05	ESM Beamline	30	70	49	39	Driven by CV in ESM Beamline Systems (WBS 2.05.02, +$59k) for catch up work as the work in this WBS nears completion.	21	--
2.07	ISR Beamline	328	254	230	-74	ISR Beamline Systems (WBS 2.07.02, -$74k): Due to the FAT for the 6-Circle Diffractometer not having taken place (-$311k), offset by catch-up work on activities that were scheduled to be completed during prior months: phase plate holder design (+$6k); changeover components, phase plate holder, and magnet windows fabrication (+$14k); changeover components and secondary bremsstrahlung shield installation (+$9k); integrated testing (+$28k); Gas Handling System commissioning (+$30k); and acceptance of the 6-Circle Diffractometer FDR report (+$151k).	24	--
2.08	ISS Beamline	14	267	279	253	ISS Beamline Systems (WBS 2.08.02, +$253k): resulting from earlier-scheduled activities performed this month: Sample Handling System activities, spectrometer mechanics activities, and endstation assembly, installation, and testing activities.	-12	--
2.09	SIX Beamline	1180	330	775	-850	SIX Beamline Systems (WBS 2.09.02, -$850k), resulting from two principal contributors: Activities performed this month but scheduled earlier [Delivery and acceptance of various non-optics components (+$59k), endstation fabrication activities (+$103k), detector installation and commissioning (+$98k)] and activities scheduled this month but not performed [the satellite building door opening performed earlier (-$5k), purchase of vacuum and camera mount hardware delayed (-$25k), receipt and installation of the endstation equipment delayed (-$1.1M)].	-445	Dominated by CV in SIX Beamline Systems (WBS 2.09.02, -$437k), consisting of: labor overage during the peak installation period prior to the SIX PDS IRR (-$179k), materials accruals processed for performance earned earlier (-$215k net cost increase, not impacting EAC), and unbudgeted materials costs (~-$40k).
2.10	SMI Beamline	20	198	158	178	SMI Beamline Systems (WBS 2.10.02, +$178k): catch up on work scheduled in the previous two months	40	Dominated by M&S CV (+$76k) in SMI Beamline Systems (WBS 2.10.02), resulting from earned value that will be accrued or paid next month; offset by modest labor cost overage (-$38k).
2.11	Insertion Devices	37	32	59	-4	--	-26	--
	Total	**1831**	**1620**	**2105**	**-210**	**Total**	**-485**	

As of September 30, 2016, the project is 93.4% complete with 129.3% contingency ($7.03M) for $5.4M Budget At Completion (BAC) work remaining, based on PCRs processed and approved through September 2016. The project EAC for September is reported at $87,928k against a Performance Measurement Baseline (PMB)/Undistributed Budget (UB) of $82,970k. The Variance At Completion (VAC) is given by VAC = BAC – EAC, with EAC = ACWP + ETC. Through September 2016, the VAC (-$4,958k) is dominated by the cumulative cost variance (-$5,013k), which is in turn dominated by labor cost overage on work performed to date.

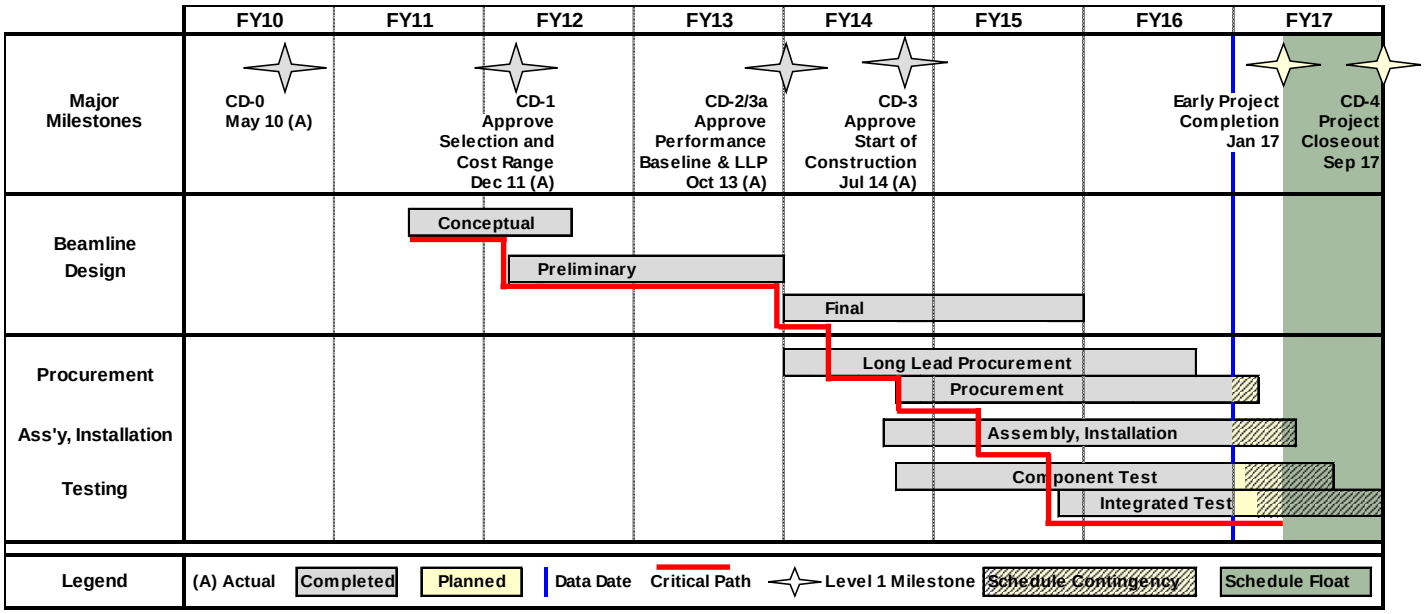
The September 2016 EAC ($87.93M) is $0.24M higher than the August value. The major drivers of EAC growth in September were: (i) labor overages in Project Support (WBS 2.01.02), Control System Design & Implementation (WBS 2.04.02), SIX Beamline Systems (WBS 2.09.02), SMI Beamline Systems (WBS 2.10.02), and ESM EPU Insertion Devices

(WBS 2.11.01), (ii) labor underages in PPS (WBS 2.03.02) and ISS Beamline Systems (WBS 2.08.02), and (iii) M&S overages in ISS Beamline Systems (WBS 2.08.02) and SIX Beamline Systems (WBS 2.09.02). As of the end of September, contingency on EAC is $2.07M, which represents 38.5% of $5.38M EAC work remaining. Outstanding commitments on fixed-price equipment contracts total $4.06M, so the $2.07M contingency on EAC represents 156.7% of $1.32M unobligated EAC work to go. ETC will continue to be assessed monthly through project completion to contain costs while maintaining the good schedule performance that the project has demonstrated to date.

No PCRs were approved or implemented in September and no PCRs are planned for October.

Milestones – Near Term		Planned	Actual
L3	SIX - Testing Monochromator and Slits complete	1-Mar-16	Expect October
L2, L3	Common Beamline Systems: Mechanical Utilities Installed	31-May-16	29-Aug-16
L3	ISR – Installation of Beamline Components Complete	29-Jun-16	Expect December
L3	SIX - Testing of Spectrometer Detector Complete	23-Aug-16	9-Sep-16
L3	WBS 2.04 – Beamline Control Systems Complete	14-Sep-16	Expect January
L3	SMI – Installation of Beamline Components Complete	16-Sep-16	Expect December
L3	ESM – Installation of Beamline Components Complete	29-Sep-16	Expect December
L3	SIX – Installation of Beamline Components Complete	30-Sep-16	Expect January
L3	Common Beamline Systems: EPS Installed	30-Sep-16	Expect December
L2, L3	Complete Installation of Common Beamline Systems PPS	30-Sep-16	Expect December
L2	Early Project Completion – incl. IRR	31-Jan-17	Expect January

PROJECT SCHEDULE



As of September 2016, the critical path runs through delivery, installation, and commissioning (without beam) of the sample chamber and spectrometer arm system for the SIX beamline (WBS 2.09.02.03, SIX Beamline Systems Endstation Equipment).

Staffing Report

Staffing as of 9/30/2016	Current Period		Cumulative-to-Date	
	Planned ** (FTE-yr)	Actual (FTE-yr)	Planned ** (FTE-yr)	Actual (FTE-yr)
WBS 2.01 Project Management and Support	0.73	0.68	39.42	35.63
WBS 2.02 Conceptual and Advanced Conceptual Design	0.00	0.00	8.74	8.74
WBS 2.03 Common Beamline Systems	0.95	1.17	31.38	17.66
WBS 2.04 Control System	0.41	0.75	21.23	20.14
WBS 2.05 ESM Beamline	0.05	0.07	15.73	18.52
WBS 2.06 FXI Beamline	0.00	0.00	4.77	4.60
WBS 2.07 ISR Beamline	0.27	0.43	17.28	15.64
WBS 2.08 ISS Beamline	0.30	0.28	14.93	14.91
WBS 2.09 SIX Beamline	0.51	1.36	19.02	22.83
WBS 2.10 SMI Beamline	0.66	0.67	16.36	15.45
WBS 2.11 Insertion Devices	0.39	0.33	7.23	6.49
WBS 2.12 ID & FE Installation	0.00	0.00	3.88	7.97
Total	4.26	5.74	199.97	188.58

** Based on the NEXT working schedule

* A large fraction of utilities installation has been performed by contractors (M&S) rather than staff as originally planned

September actual time charges are for the period from Aug. 21 through Sept. 30, which is ~30% greater than a standard month.
Number of individuals who worked on NEXT during September 2016: 130

Funding Profile

Funding Type	NEXT Funding Profile ($M)						
	FY11	FY12	FY13	FY14	FY15	FY16	Total
OPC	3.0						3.0
TEC – Design		3.0	2.0				5.0
TEC – Fabrication		9.0	10.0	25.0	22.5	15.5	82.0
Total Project Cost	3.0	12.0	12.0	25.0	22.5	15.5	90.0

Key NEXT Personnel

Title	Name	Email	Phone
Federal Project Director	Robert Caradonna	rcaradonna@bnl.gov	631-344-2945
NEXT Project Manager	Steve Hulbert	hulbert@bnl.gov	631-344-7570

COST PERFORMANCE REPORT

CONTRACT PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

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FORM APPROVED
OMB No. 0704-0188

1. CONTRACTOR	2. CONTRACT	3. PROGRAM	4. REPORT PERIOD
a. NAME	a. NAME	a. NAME	a. FROM (YYYYMMDD)
Brookhaven National Laboratory	NEXT	NSLS-II Experimental Tools (NEXT) Project	2016 / 09 / 01
b. LOCATION (Address and ZIP Code)	b. NUMBER	b. PHASE	b. TO (YYYYMMDD)
	c. TYPE	c. EVMS ACCEPTANCE	2016 / 09 / 30
	d. SHARE RATIO	X YES	

WBS (2)	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
WBS (3)	BUDGETED COST		ACTUAL	VARIANCE		BUDGETED COST		ACTUAL	VARIANCE		BUDGETED	ESTIMATED	VARIANCE
ITEM	WORK SCHEDULED	WORK PERFORMED	COST WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	COST WORK PERFORMED	SCHEDULE	COST			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(14)	(15)	(16)
2.01 Project Management and Support	176,369	176,369	283,079	0	(106,710)	9,260,408	9,260,408	10,143,587	0	(883,179)	9,918,232	10,665,533	(747,301)
2.01.01 Project Management	75,453	75,453	84,506	0	(9,053)	4,309,073	4,309,073	4,010,646	0	298,427	4,598,029	4,289,245	308,784
2.01.02 Project Support	100,916	100,916	198,574	0	(97,658)	4,951,335	4,951,335	6,132,940	0	(1,181,605)	5,320,204	6,376,289	(1,056,085)
2.02 Conceptual Design and Advanced Conceptual Design	0	0	0	0	0	1,807,316	1,807,316	1,807,316	0	0	1,807,316	1,807,316	0
2.03 Common Beamline Systems	25,669	226,189	151,541	200,520	74,648	7,206,134	6,893,838	8,184,478	(312,296)	(1,290,640)	7,340,417	8,554,255	(1,213,838)
2.03.01 Utilities	608	25,585	(56,046)	24,977	81,631	4,210,031	4,148,606	4,319,360	(61,425)	(170,754)	4,210,031	4,393,545	(183,514)
2.03.02 Personnel Protection System (PPS)	13,527	162,143	139,036	148,616	23,107	1,505,293	1,298,419	2,160,974	(206,874)	(862,555)	1,620,824	2,400,525	(779,701)
2.03.03 Equipment Protection System (EPS)	0	26,927	55,863	26,927	(28,936)	680,294	657,517	904,137	(22,777)	(246,621)	680,294	920,761	(240,467)
2.03.04 Control Station	0	0	4,297	0	(4,297)	306,744	285,524	210,405	(21,220)	75,119	306,744	231,378	75,366
2.03.05 Common Beamline Systems Management	11,534	11,534	8,390	0	3,144	503,772	503,772	589,601	0	(85,830)	522,524	608,045	(85,521)
2.04 Control System	18,410	66,090	120,404	47,680	(54,314)	4,558,761	4,506,263	4,791,899	(52,498)	(285,636)	4,648,844	4,918,265	(269,421)
2.04.01 Control System Management	5,200	5,200	6,200	0	(999)	284,170	284,170	250,274	0	33,895	294,427	259,797	34,630
2.04.02 Control System Design & Implementation	13,210	58,394	109,377	45,184	(50,983)	2,924,368	2,865,214	3,223,053	(59,154)	(357,839)	2,929,314	3,271,672	(342,359)
2.04.03 Control System Equipment	0	2,496	4,827	2,496	(2,331)	1,350,223	1,356,879	1,318,571	6,656	38,308	1,425,103	1,386,795	38,308
2.05 ESM Beamline	30,485	69,898	48,807	39,413	21,091	9,422,464	9,312,929	10,046,998	(109,535)	(734,068)	9,422,464	10,166,261	(743,797)
2.05.01 ESM Management	30,485	10,434	0	(20,051)	10,434	610,744	610,744	474,027	0	136,718	610,744	474,027	136,718
2.05.02 ESM Beamline Systems	0	59,464	48,807	59,464	10,657	8,811,720	8,702,185	9,572,971	(109,535)	(870,786)	8,811,720	9,692,235	(880,515)
2.06 FXI Beamline	0	0	0	0	0	1,818,324	1,818,324	1,793,425	0	24,899	1,818,324	1,793,425	24,899
2.06.01 FXI Management	0	0	0	0	0	409,359	409,359	470,908	0	(61,549)	409,359	470,908	(61,549)
2.06.02 FXI Beamline Systems	0	0	0	0	0	1,408,965	1,408,965	1,322,516	0	86,448	1,408,965	1,322,516	86,448
2.07 ISR Beamline	328,011	254,187	229,936	(73,824)	24,251	10,060,189	9,246,917	9,358,388	(813,272)	(111,471)	10,392,425	10,507,968	(115,543)
2.07.01 ISR Management	16,817	16,817	16,101	0	717	1,097,012	1,097,012	1,034,389	0	62,623	1,105,394	1,038,478	66,916
2.07.02 ISR Beamline Systems	311,194	237,370	213,835	(73,824)	23,534	8,963,177	8,149,905	8,323,999	(813,272)	(174,094)	9,287,031	9,469,490	(182,460)
2.08 ISS Beamline	14,497	267,072	279,308	252,576	(12,235)	10,336,421	10,417,141	11,149,495	80,719	(732,355)	10,472,212	11,186,636	(714,424)
2.08.01 ISS Management	13,543	13,543	8,739	0	4,804	702,408	829,816	680,915	127,408	148,901	838,199	678,585	159,614
2.08.02 ISS Beamline Systems	954	253,529	270,569	252,576	(17,040)	9,634,013	9,587,324	10,468,580	(46,689)	(881,256)	9,634,013	10,508,051	(874,038)
2.09 SIX Beamline	1,180,358	330,077	775,272	(850,281)	(445,196)	11,360,463	9,445,506	10,339,540	(1,914,957)	(894,034)	11,764,836	12,903,019	(1,138,183)
2.09.01 SIX Management	19,091	19,091	27,446	0	(8,355)	709,761	709,761	687,169	0	22,591	729,841	704,362	25,479
2.09.02 SIX Beamline Systems	1,161,267	310,986	747,826	(850,281)	(436,841)	10,650,702	8,735,745	9,652,370	(1,914,957)	(916,625)	11,034,995	12,198,657	(1,163,662)
2.10 SMI Beamline	20,197	198,161	158,154	177,964	40,007	9,055,244	8,770,953	9,037,640	(284,291)	(266,687)	9,126,837	9,381,970	(255,133)
2.10.01 SMI Management	15,865	15,865	22,565	0	(6,699)	734,063	734,063	670,486	0	63,577	805,656	711,416	94,240
2.10.02 SMI Beamline Systems	4,331	182,295	135,589	177,964	46,706	8,321,181	8,036,890	8,367,154	(284,291)	(330,264)	8,321,181	8,670,554	(349,373)
2.11 Insertion Devices	36,802	32,441	58,573	(4,361)	(26,132)	4,780,452	4,601,233	4,441,023	(179,219)	160,210	4,805,392	4,590,743	214,649
2.11.01 ESM EPU Insertion Device	34,102	29,741	56,214	(4,361)	(26,473)	4,571,237	4,392,019	4,281,966	(179,219)	110,053	4,587,795	4,423,933	163,862
2.11.02 SIX EPU Insertion Device	0	0	0	0	0	117,137	117,137	70,375	0	46,762	117,137	70,375	46,762
2.11.03 Insertion Devices Management	2,700	2,700	2,359	0	341	92,078	92,078	88,683	0	3,395	100,460	96,436	4,024
2.12 ID & FE Installation & Testing	0	0	0	0	0	1,452,816	1,452,816	1,452,960	0	(143)	1,452,816	1,452,960	(143)
2.12.01 ID & FE Installation & Testing Management	0	0	0	0	0	20,739	20,739	20,739	0	0	20,739	20,739	0
2.12.02 ID Installation & Testing	0	0	0	0	0	584,560	584,560	584,560	0	(0)	584,560	584,560	(0)
2.12.03 FE Installation & Testing	0	0	0	0	0	847,517	847,517	847,660	0	(143)	847,517	847,660	(143)
Total Project Baseline	1,830,798	1,620,483	2,105,074	(210,315)	(484,591)	81,118,992	77,533,645	82,546,749	(3,585,347)	(5,013,104)	82,970,116	87,928,351	(4,958,235)
Management Reserve													
Undistributed Budget													
Performance Management Baseline (PMB)	**1,830,798**	**1,620,483**	**2,105,074**	**(210,315)**	**(484,591)**	**81,118,992**	**77,533,645**	**82,546,749**	**(3,585,347)**	**(5,013,104)**	**82,970,116**	**87,928,351**	**(4,958,235)**