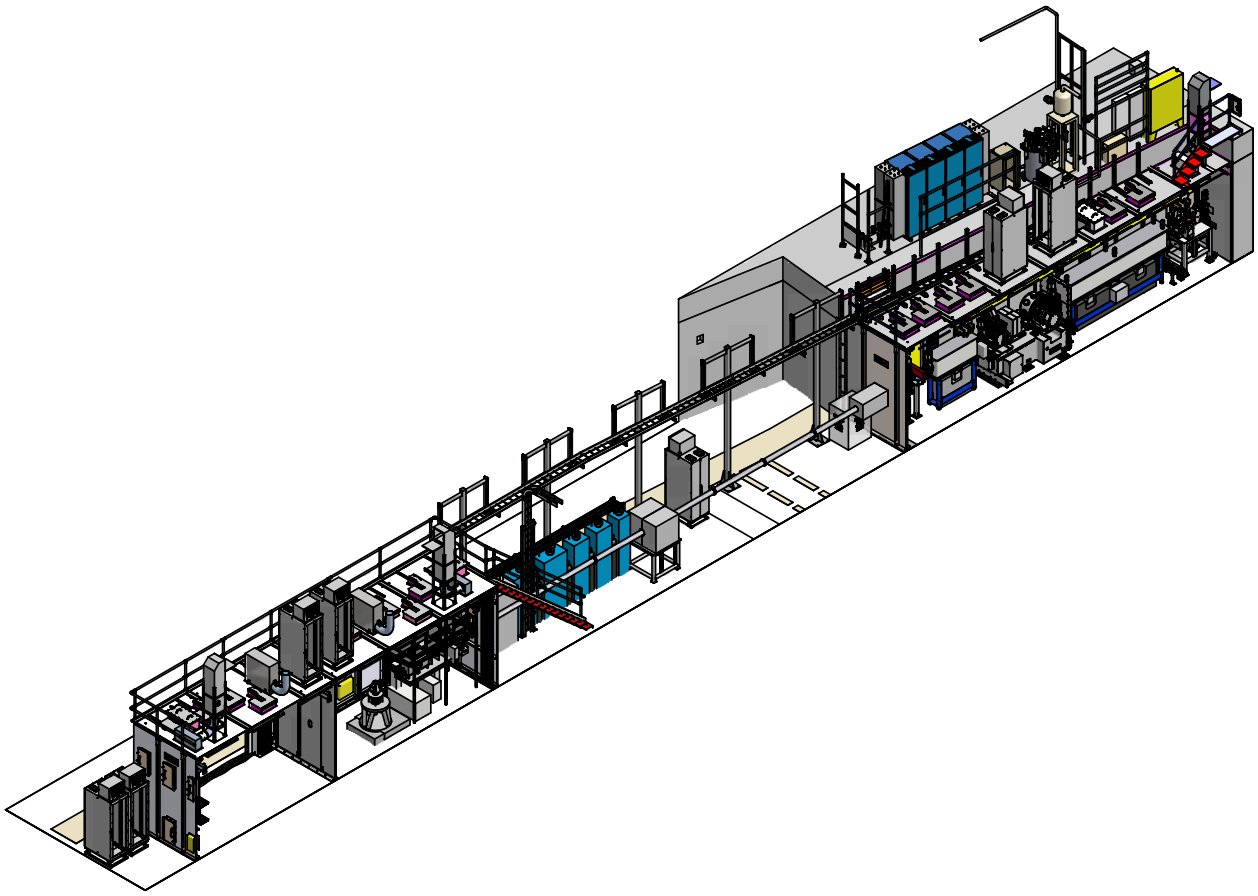
NSLS-II Experimental Tools (NEXT)

January 2015 Project Activity
Report due date: February 20, 2015



3-D rendering of the ISS beamline at 8-ID

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OVERALL ASSESSMENT

During January 2015, progress continued to be made on all phases of the project, including awarding major procurements, finalizing endstation designs, and installing utilities.

Three major procurements were awarded during January: a contract to design, fabricate, install, and test the ISR gas handling system on the 2nd, a contract to design, fabricate, install, and test the SIX emission spectrometer arm system on the 4th, and a contract for a soft x-ray detector for the SIX spectrometer on the 10th.

Bids for the FXI photon delivery system procurement contract were received in January. Evaluation of best value commenced, with an expectation of being ready for award by March.

Five PCRs were approved in January. PCR NEXT_14_032 ($0.83M) added construction of FXI shielded enclosures to project scope, PCR NEXT_15_073 ($0.14M) incorporated the ISS Beam Transport System contract award, PCR NEXT_15_061 ($1.4M) added labor to Common Beamline Systems, PCR NEXT_15_067 (-$0.039M) incorporated EPU and EPU vacuum chamber contract awards and added current strip power supplies to project scope, and PCR NEXT_15_076 ($0.0014M) implemented a minor schedule correction to PCR NEXT_15_064.

BAC rose $2.3M in January, to $78.5M, as a result of the budget impact of the five PCRs approved in January. EAC rose $1.46M in January, to $81.6M. The largest contributors to the -$3.1M VAC at this point are: (i) addition of IRR and project closeout activities ($1.2M), (ii) expected overage in project support ($0.6M), (iii) estimated cost overage of the ISR gas handling system ($0.4M), and (iv) estimated cost overages in SMI ($0.6M). Cost contingency is reported at $11.5M, which represents 23.5% of $48.8M BAC work remaining or 22.1% of $51.9M EAC work remaining. If all of VAC were to be added to project scope, the contingency would be reduced to $8.4M, which represents 16.2% of $51.9M EAC work remaining. Outstanding commitments total $19.0M. The $8.4M contingency on EAC represents 25.5% of $32.9M uncommitted EAC work to go.

The cumulative EVMS schedule index decreased 0.01 in January, to 0.96, driven mostly by delays in receipt of integrally-cooled high heat load mirrors for ISS, ESM, and SIX. The cumulative EVMS cost index increased 0.01 to 1.02, driven by earned value in January which will be accrued or paid in subsequent months.

Acceptance testing of NEXT shielded enclosures (hutches) continued in January.

COMMON SYSTEMS

PCR-15-061, approved in January, added $1.4M to common systems. This PCR consists mostly of labor additions estimated based on the effort required to complete NSLS-II Project beamline common systems.

Progress on design and installation of NEXT mechanical and electrical utility systems continued at an accelerated pace in January. Work was able to be accelerated because utilities work on the ABBIX project is nearly complete, thereby freeing up additional resources to assign to NEXT installation. The accelerated pace is expected to continue until mechanical and electrical utilities installation for NEXT is complete.

Utilities design efforts remain in progress, with a focus on the ESM, ISS, and SIX beamlines. It is expected that design work will be completed in April. Installation of utilities has made good progress this month on all NEXT beamlines. ISR utilities are now completely installed, while SMI and ESM utilities installation are both approximately 75% complete. Utilities installation on the SIX and ISS beamlines also made good progress, with both beamlines approximately 30% installed. The installation working schedule shows completion of NEXT electrical and mechanical utilities installation in April 2015.

The contract for NEXT liquid nitrogen distribution piping was awarded to Acme Cryogenics in December. The scope of this contract includes the design, fabrication, and installation of piping from the experimental floor mezzanine level to beamline cryo-coolers and to experimental hutches that require liquid nitrogen supply. Acme visited BNL on January 13-14 to meet the NEXT team, to continue design development, and take field measurements. Final drawings are expected to be signed off in February and installation is scheduled to start in late March.

The majority (80%) of Personnel Protection System (PPS) components have been received through January. The PPS group has begun initial design and development work for the NEXT project, with a focus to date on the ISR and SMI beamlines. Some of the PPS installation work started in January. Work will begin to accelerate in April, as resources currently allocated to ABBIX become available.

The procurement of Equipment Protection System (EPS) components is approximately 70% complete through January, with components continuing to be received as system definition matures. The EPS group is continuing to participate in beamline supplier final design reviews and to define interface points to the optical equipment. Final design and development of NEXT EPS systems will kick off in the next 1-2 months.

Specification of NEXT Control Station furniture has made good progress. The control stations for ESM, SMI, and SIX will be procured first, with a PCR processed upon award to reflect a phased acquisition plan for the ISR and ISS control stations. Award of contract for the ESM, SMI and SIX beamlines is expected by March 2015. Award of contract for ISS and ISR beamline furniture is anticipated in mid-2015.

BEAMLINE CONTROLS

In January, control engineers continued to work with beamline scientists and engineers on controls aspects of beamline optics engineering designs.

Development and testing of motion controls using Delta Tau controllers continued in January. The ISS controls engineer made good progress on motion tuning using stand-alone encoder-based closed-loop feedback and control capability provided by the Delta Tau motion controller. Progress was also made on motion control using absolute encoder position feedback. As mentioned in the November 2014 report, two units of an enhanced model of the Delta Tau motion controller that supports absolute encoders were purchased. Using this controller model, motion control based on closed-loop feedback from absolute encoders has now been implemented successfully. In January, one such unit was shipped to Bestec to be used for Factory Acceptance Test (FAT) of the SIX monochromator scheduled for February. The use of absolute encoders is expected to become more prolific, as a workable alternative to unrealistically complex homing sequences arising from mechanical constraints such as potential interferences of multiple motion axes inside vacuum systems. Successful implementation of absolute encoders is an important achievement, as it offers potential to simplify mechanical designs and control system implementations. Absolute encoders are expected to be considered for a variety of NEXT control applications. For example, Square One (subcontractor for Toyoma's ISR KB mirror package) has inquired about absolute encoders in their KB mirror support designs for ISR.

Installation of racks has been underway for the last few months, with all racks in position for ISR, SMI and ISS, while placement of the racks for SIX and ESM is 75% complete. Rack internal wiring for ISR is finished and ready for cable installations currently planned at the end of February. Internal rack electrical wiring for SMI, ISS, ESM is also making good progress. In preparation for cable installations, control engineers are working with electrical engineers and beamline engineers to finalize cable pulling plans.

Connectors for the cables that run between Delta Tau motion control units and their power supplies have been received from Delta Tau UK. With this, all control system equipment needed for installation over the next few months is in hand.

ESM – ELECTRON SPECTRO-MICROSCOPY

The schedule variance (SV) for ESM beamline systems (WBS 2.05.02), -$230K, was the largest contributor to the overall NEXT schedule variance for January. This SV resulted from delays in delivery of two procurements: (i) integrally-cooled M1 and M2 mirrors and (ii) wavefront reconstructors. While considerable schedule float exists for both, increased attention is being paid to these procurements.

Installation of utilities for ESM has been progressing at a fast pace over the past few months, as indicated in the photos of the 21-ID floor space shown in Figure 1. The ESM beamline space and egress walkways have been outlined on the floor with yellow lines. In the FOE (left panel of Figure 1), utilities are mounted on the walls. Along the beamline (middle and right panels of Figure 1), utilities are mounted on a robust structure supported by a series of white pylons bolted to the floor. The utilities structure provides electrical, liquid, and gas utilities for all beamline components.

Electrical power, illumination, and cable trays have been installed in the FOE and along all the beamline. The FOE utilities are almost complete, consisting of deionized water, chilled-water, compressed air, and nitrogen gas. A permanent x-y movable crane to handle heavy equipment is installed in the FOE.

All along the beamline, a three-level cable tray has been installed. At the moment only the top level has been filled, with AC power cables. The middle and bottom trays are for motor and vacuum cables, which will be pulled in the next few weeks.

Several of the ESM electronics racks have been positioned and installed. Two racks are located on the roof of the FOE and will host the control units for the equipment inside the FOE. The control units for all the rest of the beamline will be hosted in the four racks displayed in the middle panel of Figure 1, two for vacuum equipment and two for motor controllers. Four more racks have been installed between pylons along the beamline. These racks will host control units for the ARPES endstation and its preparation side-chamber. Four more racks will be installed close to the XPEEM endstation.

As of the end of January, installation of standard mechanical and electrical utilities systems for ESM are nearing completion. The next step is to install the PPS utilities system, which runs on a fully independent “grid” from regular utilities. Planning for this work is currently underway, with installation of the ESM PPS system expected by summer 2015.

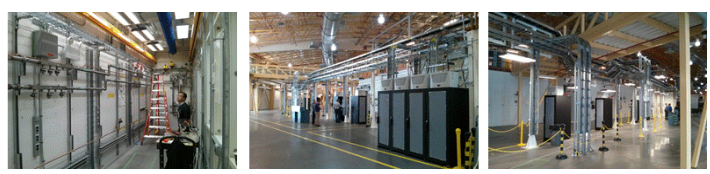


Figure 1: View showing the current status of utilities installation for ESM at 21-ID. Left: inside the FOE; middle: along the beamline; right: near the location of the ARPES and XPEEM endstations.

FXI – FULL-FIELD X-RAY IMAGING

Bids for the FXI Photon Delivery System package were received on the January 8 due date. The proposal evaluation process began immediately thereafter and is expected to be completed in late February. The procurement contract for this system is expected to be ready to award in March 2015.

The contract option to construct the FXI radiation enclosures (hutches) was exercised in December. PCR NEXT_14_032, which adds hutch construction and oversight activities to base scope ($0.83M), was processed and approved for January 2015 EVMS data.

ISR – IN-SITU AND RESONANT HARD X-RAY

A purchase order for vacuum gauges and controllers was placed on January 7. An RFQ for the area detector was posted on Fed Biz Opps on January 9, and a purchase order for this component was placed with DECTRIS Ltd. on January 30. A contract for shielded transport pipes for ISR was awarded to Toyama Co., Ltd., on January 30. Drawings of support stands for beam pipe in hutch C were released, and a requisition for slides that will translate this beam pipe into and out of the beam was routed for approval.

The diamond beam position monitor, shown in Figure 2, was received on January 5. The device was tested by Sydor Instruments, LLC, using the G-line at the Cornell High Energy Synchrotron Source, and was found to meet all specifications.

The PDR for the mirrors package was held at Toyama on January 27-28. The review began with a presentation from Square One, the subcontractor for the KB mirror table. The ISR team learned that in the proposed design of the KB mirror, the table will provide all but one— the exception being stripe selection— of the alignment degrees of freedom for the first mirror. If all specifications can be met, this will be an elegant design as it will avoid redundant degrees of freedom. The second day of the PDR focused on the double harmonic rejection mirror and secondary source aperture (SSA). A few design changes (e.g., location of ion pump, orientation of flexure stages, and addition of a granite support for the SSA) were requested.

An additional design review for the FOE optical components package was held at Toyama on January 28-30. A second round of synchrotron and bremsstrahlung ray tracings was presented to Toyama by the ISR Team. These ray tracings include an additional mask with a downstream aperture size of 100 μrad x 100 μrad, which is required due to potential extreme, ±40 mm, excursions of the electron beam in the storage ring. Additional agenda items included diagnostics and the DCM support structure. Thermal vetting of the white beam visual diagnostic is still required, while a vibration analysis of the new DCM support structure showed that the 60 Hz pitch changes of the previous design have been eliminated. Action items from the review are the re-design of masks, stops, and collimators to satisfy beam clearance requirements; mirror bender tests, which are scheduled for the week of March 9; and vacuum calculations for individual components, as well as the entire assembly.

Endstation transfer from NSLS beamline X21 continued. A second superconducting magnet and its electronics rack were moved to the ISR cage on the experimental floor. The base diffractometer for scattering in high magnetic field, which will be used with user-supplied magnets, was moved directly into hutch C.

Figure 2: ISR diamond BPM.

ISS – INNER SHELL SPECTROSCOPY

Final Design Reports of the Focusing Mirror, the Collimating Mirror and Tank, and the Gas Handling Package were approved in January and production of individual parts has been started. As a consequence, the vendor of the Focusing Mirror Package (Toyama) was able to place the order for the two focusing mirrors at the beginning of January. The contractual delivery dates for these items are December 2015 and April 2016.

The award of the Beam Transport Package (January 8th) to Toyama and subsequent approval of the project plan completed the procurement activities for all major components of the ISS photon delivery system. Specification documents for diamond screens used in pink and monochromatic beam monitors have been finalized and routed for signatures. A model of this unit is shown in Figure 3.

Significant effort in January was devoted to design and installation of endstation infrastructure. Procurement

documents for two packages, the Higher Harmonics Rejection Mirrors and the Higher Harmonics Rejection Mirror Mechanics package, both part of the beam characterization unit inside the endstation, were posted on FBO, with bid due dates at the beginning of February (mirrors) and the beginning of March (mechanics).

Electrical utility installation in the endstation enclosure was 80% complete at the end of January and mechanical utility installation was underway. To simplify installation and to provide additional rack space for equipment needed close to the endstation chamber, a "back bone" mechanical structure has been designed for the upstream endstation enclosure (B1). Similar to shelf structures used in laser labs, this unit will be installed above the beam transport components in the upstream half of this hutch. It will provide space and mounting points for all mechanical utilities, including the vent system, two cable trays, and four half-height 19" rack units. The FDR for this structure is expected in February.

Design of the ISS PPS system has begun with a walk-through at 8-ID conducted by the PPS group to evaluate ISS PPS requirements.

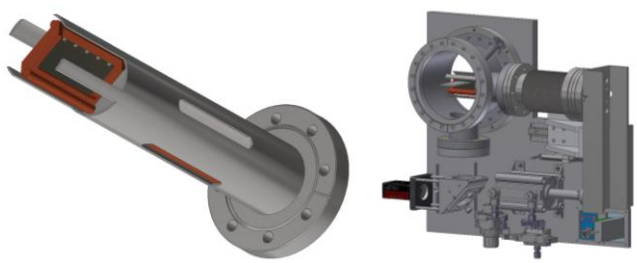


Figure 3: Renderings of the suggested configuration of a diamond screen unit capable of tolerating the ISS pink beam thermal load (left) and its visible light monitor (right). The unit will include the diamond screen itself, necessary mechanical support, water cooling (needed for pink beam monitors), and mechanical protection of the thin diamond screen.

SIX – SOFT INELASTIC X-RAY

Best and final offers have been received in response to the RFQ solicitation for the soft x-ray CCD detector, best value has been determined, and award is expected in February. Award of contract for the spectrometer arm is also anticipated in February.

The FDR for the M4 mirror mechanical system was held with Bestec at NSLS-II on January 19. A modified design of the system granite base and surrounding steel frame was proposed by Bestec to address concerns of interference with the envelope of the operating volume of the triple rotating flange of the sample chamber. This design update was approved by BNL.

JTEC Corp. has completed the fine polishing of the first two spectrometer grating substrates (100 nrad slope error) and shipped them on January 30, approximately three weeks later than the SOW date, but in advance of the need date of May. The remaining two substrates (50 nrad slope error) are expected to ship on time, March 9. Regarding the elliptical mirror M3, cutting of the raw material is now complete and pre-polishing has begun. For the ellipsoidal mirror M4, a toroidal mirror with specifications very close to M4 is about to be ordered by JTEC for metrology purposes.

The M2 high heat load mirror is expected to be shipped by InSync at the end of February, while the M1 ship date is on or before the end of March. These delivery dates represent a 2-month delay, but will precede delivery of the PGM. The M2 mirror will be mounted in the PGM during on-site installation and acceptance testing, which are expected to occur in June.

The vibration signature on the floor of the SIX satellite building SEB2 was measured over a period of two weeks by the PS Accelerator Division's Mechanical Engineering group between November and December 2014. Measurement results were presented to SIX on January 14, following a thorough data analysis effort. The setup is shown in the photograph in Figure 4. Two Guralp seismometers were placed 13.1 m apart on the floor, one at the sample location and the other close to the detector location. Vertical vibration was measured every 6 minutes, at both locations, for the two-week period. The plot in Figure 4 shows the RMS floor displacement integrated over the 2-100 Hz frequency range. Apart from spikes around 200 nm attributed to freight trains on the nearby railroad line, the RMS displacement was measured to be about 100 nm during daytime and about 20 nm at night. The larger displacement amplitude during daytime is believed to be due to local disturbances and truck traffic on the Long Island Expressway. The vertical stability required at the detector, 400 nm, will be satisfied provided the vibration amplification factor of the detector stand is kept below 4, which is not an unreasonable expectation based on discussions with qualified vendors.

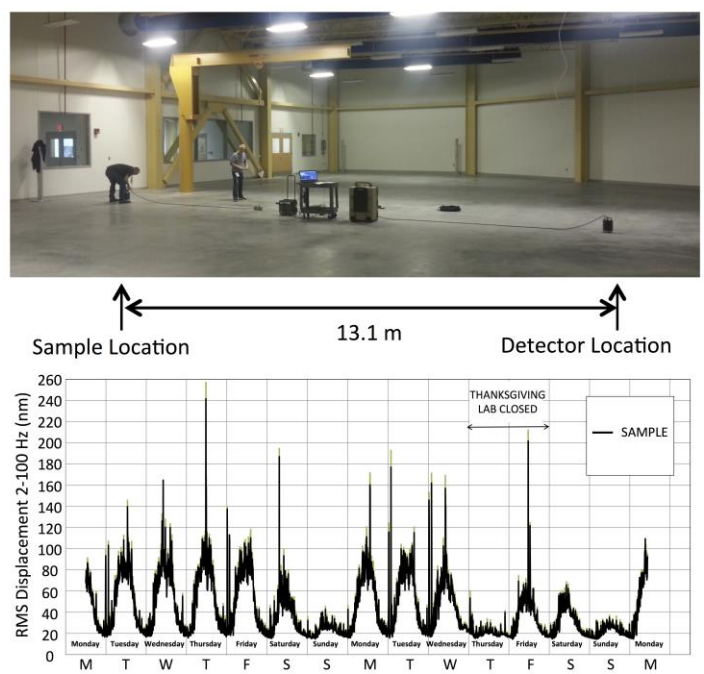


Figure 4: Top: Photograph of the setup for vibration measurements on the SEB2 floor. Bottom: RMS vertical displacement of the floor at the sample chamber location integrated over the 2-100 Hz range.

SMI – SOFT MATTER INTERFACES

During January, notable progress was made at 12-ID with respect to the hutches, utilities, and floor layouts. Tape markings on the floor now delineate the workstation furniture that has been specified, all racks are fastened into place, and a sturdy rectangular archway of cable trays and conduit supports has been constructed to convey utilities from the work area floor racks to the B hutch roof (dubbed the "SMI Gateway Arch"). All mechanical utilities layouts and drawings were finalized. The layout for liquid nitrogen supply on the mezzanine was also finalized, with drawings in the hands of the supplier. All of the SMI-procured cryo-lines and fittings have been ordered. Communications from Bruker confirm that the cryo-cooler is on schedule for delivery in July. Mechanical engineer Scott Coburn has been assigned to support SMI in the areas of utilities and cryogenic components; he will also support the installation of the SMI White Beam Components package.

Final designs of the H-V Mirrors and SSA Package are the subject of frequent interaction with the supplier, Cinel. As expected, the PDR documentation was received and approved in January. Weekly documentation milestones have been established with Cinel, to address specific matters such as beamline layout, mirror design, and strategies for optimizing vacuum performance. Also during this interval, Cinel interacted with the bimorph mirror vendor T-SESO to develop models for the mirrors, requiring final decisions on the substrate thickness and zero-volt tangential radius. These two criteria are mutually dependent since the thinner mirror requires less applied voltage to achieve the desired bend range, but is more susceptible to twisting and other uncorrectable deformations. The resulting agreed model is shown in Figure 5. SMI has specified one interesting innovation for the HFM, which is that the platinum coating stripe has been extended to have extra pads at the ends, outside the optically used area, to be used for measurement of drain current. This will enable energy-dependent measurements of harmonic rejection of x-rays immediately downstream of the DCM. Mechanical Engineer Daniel Bacescu has taken on the responsibilities to support SMI's mirror, CRL, and GISAXS endstation equipment designs and procurements.

A meeting of the SMI BAT was held on January 23. In addition to SMI status updates, two presentations describing recent developments at BNL relevant to SMI were given. First, John Smedley of the BNL Instrumentation Division shared his expertise with the instrumented diamond devices planned for SMI's XBPMs. Secondly, Stuart Wilkins from the NSLS-II Project beamline CSX gave an update on NSLS-II data architecture and acquisition. Group leaders of two peer beamlines, namely Masa Fukuto of the NSLS-II NxtGen beamline CMS and Oleg Konovalov of the ESRF Soft Matter and Coherent Scattering Beamline, shared their programs. This interchange of information is beneficial to SMI through comparison of techniques employed by high quality soft matter beamlines, while maintaining complementarity of capabilities, at NSLS-II and worldwide. Finally, Toshi Tanabe of the Photon Sciences Insertion Devices Group presented gap and field measurements of the first of two in-vacuum undulators received in the fall of 2014. With the proviso that these measurements are at preliminary stage, it appears that the measured phase error at minimum gap does not meet specification. SMI staff emphasized the importance of meeting magnetic specifications for the SMI IVU23 in order to support the high energy portion of the range covered by SMI (20-24 keV). The Insertion Devices Group will be working with the IVU23 supplier (Neomax) to ensure that all three IVU23s (one for SMI, one for ISR, and one for LIX (ABBIX Project)) meet specifications. Detailed magnetic measurements of these devices will be made by the ID Group and performance simulations based on the measured field profiles vs. magnetic gap will be performed by Oleg Chubar (NSLS-II).

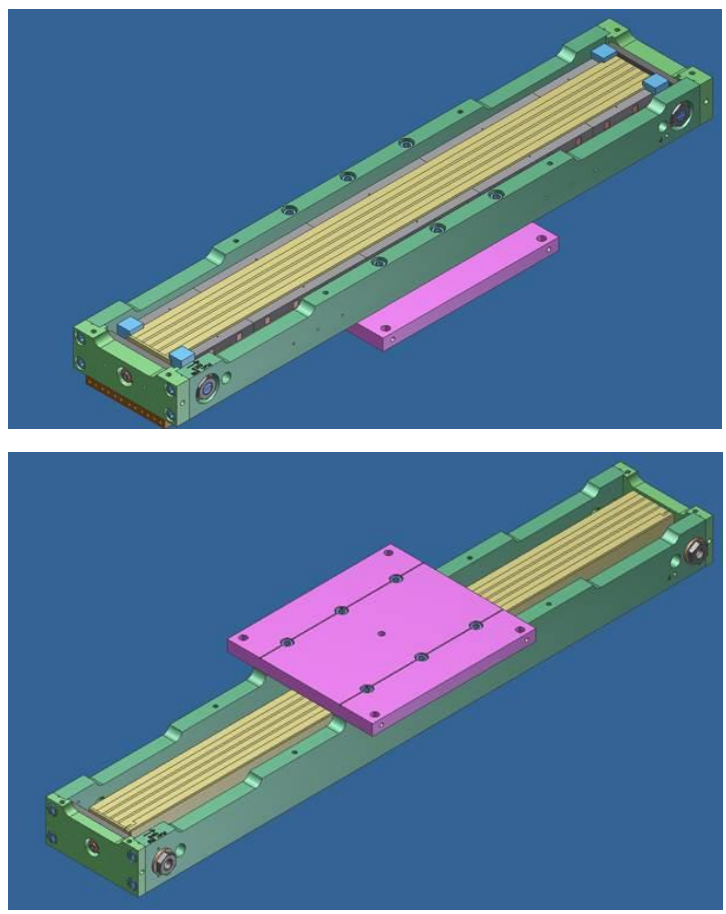


Figure 5. Top: Vertical Focusing Mirror (VFM). Bottom: Horizontal Focusing Mirror (HFM). Yellow/gray element: mirror substrate, indicating boundaries of stripe coatings. Green element: mirror cradle. Pink element: support bracket to attach cradle to positioning stages.

INSERTION DEVICES

During January, the EPU supplier (Kyma) was busy preparing for upcoming design reviews of the NEXT EPU contracts: FDR for the ESM EPU57 contract in February (mechanical, magnetic) and March (controls), and PDR in March and FDR in April for the ESM EPU105 and SIX EPU57 contracts. Kyma is planning to place purchase orders for the permanent magnets for the ESM EPU57 and SIX EPU57 contract in February.

PCR_15_067, approved in January, incorporates cost and schedule changes associated with awards of the SIX EPU57 and ESM EPU105 contracts and the ESM and SIX EPU vacuum chamber contract. This PCR also adds current strip power supplies and associated labor (total estimated value of $600K) to project scope. This PCR, which adds 1.5 FTEs effort, has a total budget impact of a reduction of $39K.

PROJECT MILESTONES

Milestone	Planned	Actual
CD-0 (Mission Need):	May 27, 2010	May 27, 2010
CD-1 (Alternative Selection):	Dec. 19, 2011	Dec. 19, 2011
CD-2 (Performance Baseline):	Oct. 9, 2013	Oct. 9, 2013
CD-3A (Long Lead Procurement):	Oct. 9, 2013	Oct. 9, 2013
CD-3 (Start Construction):	Mar. 31, 2014	Jul. 7, 2014
Early Project Completion:	Sept. 30, 2016	
CD-4 (Project Completion):	Sept. 29, 2017	

UPCOMING EVENTS

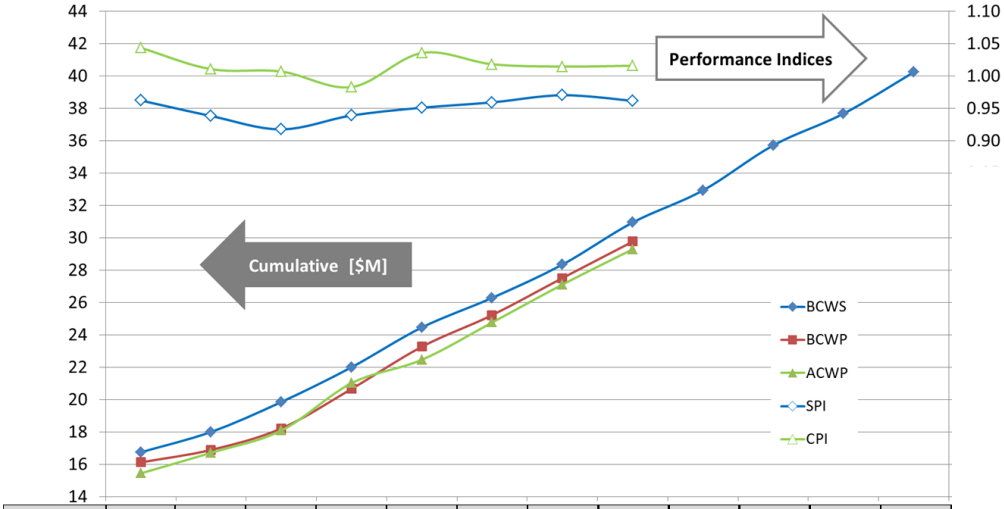
Visit by Phil Kraushaar	February 2015
DOE/OPA Mini-Review	April 2015
BNL EVMS surveillance review	June 2015

Acronyms and Abbreviations

ABBIX	Advanced Beamlines for Biological Investigations with X-rays
ACWP	Actual Cost of Work Performed
ARPES	Angle-Resolved Photo-Electron Spectroscopy
BAC	Budget at Completion
BAT	Beamline Advisory Team
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BNL	Brookhaven National Laboratory
CCD	Charge-Coupled Device
CD	Critical Decision
CPI	Cost Performance Index
CMS	Complex Materials Scattering
CRL	Compound Refractive Lens
CSX	Coherent Soft X-ray
CV	Cost Variance
DCM	Double Crystal Monochromator
DOE	Department of Energy
EAC	Estimate at Completion
EPS	Equipment Protection System
EPU	Elliptically Polarizing Undulator
ESM	Electron Spectro-Microscopy beamline
ESRF	European Synchrotron Radiation Facility
EVMS	Earned Value Management System
FAT	Factory Acceptance Test
FBO	FedBizOpps.gov
FDR	Final Design Review
FOE	First Optics Enclosure
FTE	Full Time Equivalent
FXI	Full-field X-ray Imaging beamline
FY	Fiscal Year
GISAXS	Grazing Incidence Small Angle Scattering
HFM	Horizontal Focusing Mirror
ID	Insertion Device
IPT	Integrated Project Team
IRR	Instrument Readiness Review
ISR	Integrated In-Situ and Resonant X-ray Studies
ISS	Inner Shell Spectroscopy beamline
IVU	In-Vacuum Undulator
KB	Kirkpatrick-Baez
LIX	X-ray Scattering for Life Sciences
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
PDR	Preliminary Design Report
PGM	Plane Grating Monochromator
PMB	Performance Management Baseline
PPS	Personnel Protection System
PS	Photon Sciences
RFQ	Request for Quotation
SAXS	Small Angle X-ray Scattering
SEB2	NSLS-II Satellite End Station Two
SIX	Soft Inelastic X-ray Scattering beamline
SMI	Soft Matter Interfaces beamline
SOW	Statement of Work
SPI	Schedule Performance Index
SSA	Secondary Source Aperture
SV	Schedule Variance
TEC	Total Estimated Cost
TPC	Total Project Cost
UB	Undistributed Budget
VAC	Variance At Completion
VFM	Vertical Focusing Mirror
WBS	Work Breakdown Structure
XBPM	X-ray Beam Position Monitor
XPEEM	X-ray Photoemission Electron Microscope

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.



Cum $M	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15
BCWS	16.8	18.0	19.9	22.0	24.5	26.3	28.4	31.0	32.9	35.7	37.7	40.2
BCWP	16.1	16.9	18.2	20.7	23.3	25.2	27.5	29.8				
ACWP	15.5	16.7	18.1	21.0	22.5	24.8	27.1	29.3				
SPI	0.96	0.94	0.92	0.94	0.95	0.96	0.97	0.96				
CPI	1.04	1.01	1.01	0.98	1.04	1.02	1.01	1.02				

The NEXT project Schedule Variance (SV) for January 2015 is -$347K, with an associated monthly Schedule Performance Index (SPI) of 0.87 (yellow status). The cumulative SPI is 0.96 (green status), 0.01 lower than in December 2014. The negative current month schedule variance results from three largest contributors: a -$230K schedule variance in WBS 2.05.02, ESM Beamline Systems, caused by delays in delivery of integrally-cooled M1 and M2 mirrors and of wavefront reconstructors; a -$69K schedule variance in WBS 2.07.02, ISR Beamline Systems, caused by late receipt (~1 month) of a design review report; and -$62K schedule variance in WBS 2.09.02, SIX Beamline Systems, caused by delays in delivery of integrally-cooled M1 and M2 mirrors.

The NEXT project Cost Variance (CV) for January 2015 is +$73K, with an associated monthly Cost Performance Index (CPI) of 1.03 (green status). The current-period cost variances will vary from month to month depending on the number, magnitude, and timing of accruals and payments. The cumulative CPI is 1.02 (green status).

As of January 31, 2015, the project is 37.9% complete with 23.5% contingency ($11.5M) for $48.8M Budget At Completion (BAC) work remaining, based on PCRs processed and approved through January 2015.

The project EAC for January is reported at $81,625K against a Performance Measurement Baseline (PMB)/Undistributed Budget (UB) of $78,540K. The Variance At Completion (VAC = BAC - EAC) of -$3,085K represents the sum of contributors to EAC which have not been added to baseline via PCRs. The major contributors to VAC at the end of January include: -$1.2M in WBS 2.01.01 (Project Management) for IRR and closeout activities (subject of forthcoming PCR NEXT_14_049, which is expected to be processed and approved in February), -$0.6M in WBS 2.01.02 (Project Support) for estimated overruns in this account, -$0.5M in WBS 2.07 (ISR Beamline) for upcoming procurement awards (driven mostly by the ISR gas handling system contract award), and -$0.6M in WBS 2.09 (SIX Beamline) for upcoming procurement awards of spectrometer system components.

The contingency ($11.5M) is 22.1% of $51.9M EAC work remaining.

5 PCRs were approved and implemented in January.

PCR	PCR Level	Delta	Description
14_032	2	$827K	FXI Hutch Scope Additions
15_073	3	$138K	APP091NX ISS Beam Transport System Contract Award
15_061	3	$1408K	Common Beamline Systems Labor Additions
15-067	3	-$39K	EPU Contract Award & Vacuum Chamber Power Supplies
15-076	3	$1K	Correction to Approved PCR-15-064

Forthcoming PCRs expected to be processed in February include:
A Level 3 PCR (NEXT_15_075) in WBS 2.07.02 (ISR Beamline Systems) for recent Contract Awards
A Level 2 PCR (NEXT_14_049) in WBS 2.0 (NEXT Project) for IRR and Project Closeout Activities
A Level 3 PCR (NEXT_15_078) in WBS 2.05.02, 2.09.02 (ESM, SIX Beamline Systems) for recent Contract Awards

NEXT as of 1/31/2015	Current Period	Cum-to-Date
Plan (BCWS) $K	2,601	30,955
Earned (BCWP) $K	2,254	29,773
Actual (ACWP) $K	2,181	29,299
SV $K	-347	-1,182
CV $K	73	474
SPI	0.87	0.96
CPI	1.03	1.02
Budget at Completion $K (PMB [UB])		78,540
Planned % Complete (BCWS/BAC)		39.4%
Earned % Complete (BCWP/BAC)		37.9%
Contingency $K		11,460
Contingency / (BAC – BCWP)		23.5%
EAC $K		81,625
Contingency / (EAC – BCWP)		22.1%
(Contingency + VAC) / (EAC – BCWP)		16.2%
TPC = PMB + Contingency		90,000

SPI Project to Date*:

0.96

CPI Project to Date*:

1.02

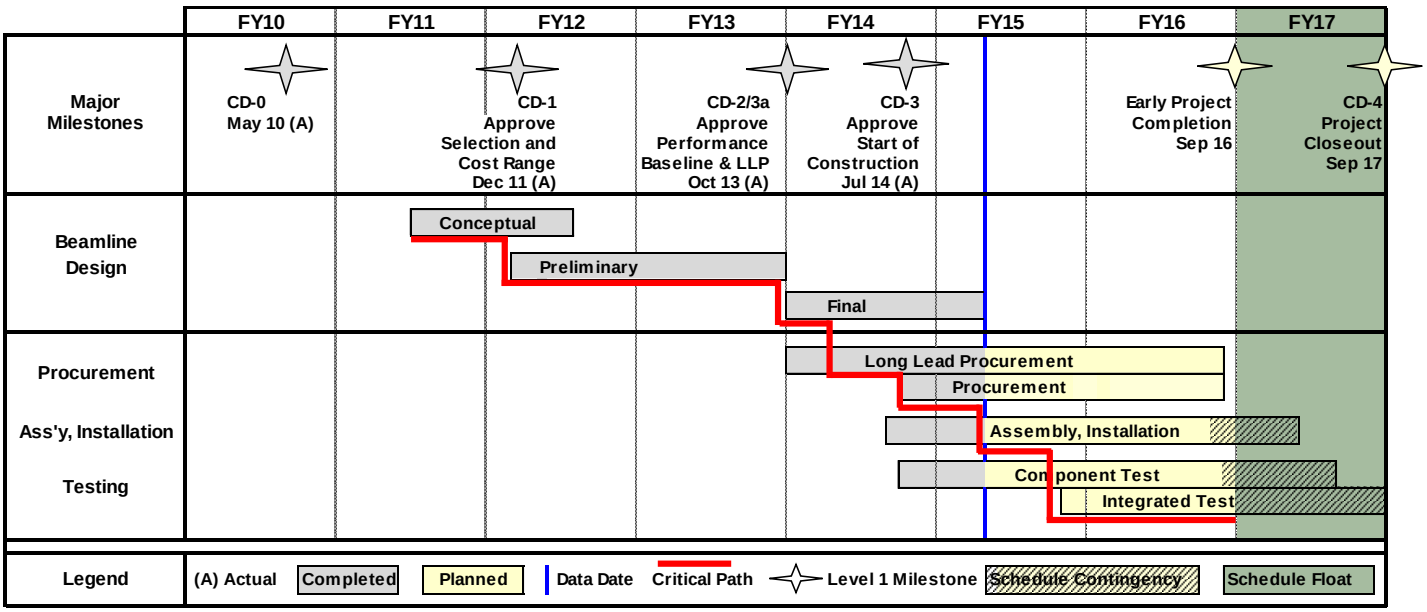
**Cause & Impact:* No reportable variance

Corrective Action: None required

Milestones – Near Term		Planned	Actual	Notes
L1	CD-3 Start Construction	31-Mar-14	7-Jul-14	
L3	ISS – Beamline Control System Design Complete	29-May-14	29-Jul-14	
L2	1st Shielded Enclosure Acceptance Test Completed	17-Nov-14	30-Oct-14	
L3	SMI – Beamline Control System Design Complete	29-Dec-14	23-Dec-14	
L3	SIX – Beamline Control System Design Complete	29-Dec-14	23-Dec-14	
L3	FXI – Beamline Control System Design Complete	29-Dec-14	23-Dec-14	
L3	ESM – Beamline Control System Design Complete	27-Feb-15	23-Dec-14	
L3	ISR – Beamline Control System Design Complete	27-Feb-15	23-Dec-14	
L2,L3	Receive ISS Gas Handling System	17-Mar-15		Expect May
L3	SIX – Award Spectrometer Grating Chamber	17-Mar-15		Expect Feb.
L3	ISS – Award XES Spectrometer	21-May-15		Expect May/June

The IPT can find further details on NEXT cost / schedule data at: http://www.bnl.gov/nsls2/project/NEXT/ipt.asp

PROJECT SCHEDULE



The project critical path runs through activities in WBS 2.09, the SIX beamline. As of January 2015, the active critical path activity is procurement, assembly, installation, and testing of the SIX emission spectrometer arm and grating chamber, which are principal components of the SIX endstation (WBS 2.09.03).

Staffing Report

Staffing as of 1/31/2015	Current Period		Cumulative-to-Date
	Planned (FTE-yr)	Actual (FTE-yr)	Actual (FTE-yr)
WBS 2.01 Project Management and Support	0.70	0.71	22.4
WBS 2.02 Conceptual and Advanced Conceptual Design	0.00	0.00	8.74
WBS 2.03 Common Beamline Systems	0.78	0.27 *	2.38
WBS 2.04 Control System	0.52	0.29	6.95
WBS 2.05 ESM Beamline	0.33	0.22	7.19
WBS 2.06 FXI Beamline	0.05	0.02	4.15
WBS 2.07 ISR Beamline	0.15	0.19	7.35
WBS 2.08 ISS Beamline	0.16	0.26	7.09
WBS 2.09 SIX Beamline	0.37	0.30	11.28
WBS 2.10 SMI Beamline	0.24	0.18	7.35
WBS 2.11 Insertion Devices	0.21	0.11	1.19
WBS 2.12 ID & FE Installation	0.00	0.39	0.39
Total	**3.50**	**2.94**	**86.46**

* Utilities installation is being performed by contractors (mostly M&S) rather than staff as originally planned

Number of individuals who worked on NEXT during January 2015: 91

Funding Profile

	NEXT Funding Profile ($M)						
Funding Type	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

Thousands of $

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 January 2015	
b. LOCATION (Address and ZIP Code)	b. NUMBER	b. PHASE	2015 / 01 / 01
			b. TO (YYYYMMDD)
	c. TYPE	c. EVMS ACCEPTANCE: X YES	2015 / 01 / 31
	d. SHARE RATIO		

WBS (2)	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
Control Account	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	171,615	171,615	191,799	0	-20,184	5,619,272	5,619,272	5,807,922	0	-188,650	9,202,262	11,053,867	-1,851,605
2.01.01 Project Management	70,728	70,728	48,776	0	21,953	2,780,813	2,780,813	2,724,704	0	56,110	4,368,423	5,650,944	-1,282,521
2.01.02 Project Support	100,886	100,886	143,023	0	-42,137	2,838,459	2,838,459	3,083,218	0	-244,760	4,833,839	5,402,923	-569,084
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	121,777	118,368	245,852	-3,409	-127,483	3,266,532	2,663,510	3,181,217	-603,022	-517,707	6,166,462	6,166,463	0
2.03.01 Utilities	88,353	95,266	193,544	6,914	-98,278	2,521,472	1,903,521	2,275,670	-617,951	-372,149	3,498,989	3,498,989	0
2.03.02 Personnel Protection System (PPS)	6,566	16,376	34,279	9,810	-17,903	286,133	316,808	456,502	30,675	-139,694	1,323,218	1,323,218	0
2.03.03 Equipment Protection System (EPS)	15,630	0	4,221	-15,630	-4,221	127,324	118,687	65,758	-8,636	52,929	594,451	594,451	0
2.03.04 Control Station	4,503	0	7,676	-4,503	-7,676	7,110	0	14,314	-7,110	-14,314	278,704	278,704	0
2.03.05 Common Beamline Systems Management	6,726	6,726	6,132	0	593	324,494	324,494	368,973	0	-44,479	471,101	471,101	0
2.04 Control System	85,290	84,231	68,879	-1,059	15,352	2,303,630	2,121,282	2,143,907	-182,348	-22,625	4,528,592	4,528,592	0
2.04.01 Control System Management	5,876	5,876	4,979	0	897	170,614	170,614	124,116	0	46,498	284,170	284,170	0
2.04.02 Control System Design & Implementation	79,414	48,549	48,358	-30,866	191	1,281,996	1,061,008	1,202,488	-220,989	-141,480	2,912,234	2,912,234	0
2.04.03 Control System Equipment	0	29,807	15,543	29,807	14,264	851,021	889,661	817,303	38,640	72,358	1,332,188	1,332,188	0
2.05 ESM Beamline	610,389	380,754	248,245	-229,635	132,509	4,035,770	3,962,540	3,481,073	-73,230	481,466	8,805,020	8,872,026	-67,006
2.05.01 ESM Management	9,939	9,939	7,981	0	1,958	345,018	345,018	345,427	0	-409	556,310	554,732	1,577
2.05.02 ESM Beamline Systems	600,450	370,815	240,263	-229,635	130,551	3,690,753	3,617,522	3,135,647	-73,230	481,876	8,248,710	8,317,294	-68,584
2.06 FXI Beamline	135,940	139,237	5,506	3,297	133,731	1,127,180	1,130,478	945,130	3,297	185,348	1,818,324	1,818,324	0
2.06.01 FXI Management	13,478	13,478	4,678	0	8,800	379,566	379,566	407,055	0	-27,490	409,359	409,359	0
2.06.02 FXI Beamline Systems	122,462	125,759	829	3,297	124,931	747,615	750,912	538,074	3,297	212,838	1,408,965	1,408,965	0
2.07 ISR Beamline	179,160	110,568	67,259	-68,592	43,310	1,967,843	1,897,562	1,980,080	-70,281	-82,518	9,971,304	10,480,397	-509,093
2.07.01 ISR Management	23,789	23,789	14,040	0	9,749	549,998	549,998	558,709	0	-8,711	940,783	1,020,120	-79,338
2.07.02 ISR Beamline Systems	155,370	86,779	53,218	-68,592	33,561	1,417,844	1,347,564	1,421,370	-70,281	-73,807	9,030,522	9,460,277	-429,755
2.08 ISS Beamline	332,306	325,282	805,324	-7,025	-480,042	3,683,849	3,711,338	3,488,122	27,489	223,216	9,590,776	9,605,786	-15,010
2.08.01 ISS Management	17,197	17,197	13,346	0	3,851	389,713	389,713	363,309	0	26,404	702,408	780,287	-77,879
2.08.02 ISS Beamline Systems	315,109	308,084	791,978	-7,025	-483,894	3,294,136	3,321,625	3,124,813	27,489	196,812	8,888,368	8,825,499	62,869
2.09 SIX Beamline	329,865	268,299	80,380	-61,567	187,919	3,541,888	3,392,675	3,212,359	-149,213	180,317	11,334,201	11,964,152	-629,951
2.09.01 SIX Management	16,277	16,277	17,878	0	-1,601	340,236	340,236	327,561	0	12,676	709,761	715,667	-5,907
2.09.02 SIX Beamline Systems	313,588	252,021	62,502	-61,567	189,519	3,201,652	3,052,439	2,884,798	-149,213	167,641	10,624,440	11,248,484	-624,044
2.10 SMI Beamline	399,101	388,121	387,086	-10,979	1,036	2,902,568	2,771,088	2,870,184	-131,479	-99,096	9,536,851	9,547,094	-10,242
2.10.01 SMI Management	21,277	21,277	8,793	0	12,484	401,360	401,360	386,590	0	14,771	782,793	788,998	-6,205
2.10.02 SMI Beamline Systems	377,824	366,845	378,293	-10,979	-11,448	2,501,207	2,369,728	2,483,594	-131,479	-113,866	8,754,058	8,758,096	-4,038
2.11 Insertion Devices	235,561	254,428	20,025	18,867	234,403	698,976	682,312	318,106	-16,664	364,206	4,771,231	4,773,490	-2,259
2.11.01 ESM EPU Insertion Device	205,249	198,970	7,004	-6,280	191,966	542,290	525,626	238,922	-16,664	286,704	4,562,016	4,562,016	0
2.11.02 SIX EPU Insertion Device	27,980	53,126	11,556	25,146	41,570	117,137	117,137	57,921	0	59,216	117,137	117,137	0
2.11.03 Insertion Device Management	2,332	2,332	1,466	0	866	39,549	39,549	21,263	0	18,286	92,078	94,337	-2,259
2.12 ID & FE Installation & Testing	0	13,160	61,075	13,160	-47,915	0	13,160	63,223	13,160	-50,063	1,007,524	1,007,524	0
2.12.01 ID & FE Installation & Testing Management	0	0	916	0	-916	0	0	916	0	-916	20,895	20,895	0
2.12.02 ID Installation & Testing	0	13,160	24,877	13,160	-11,717	0	13,160	24,877	13,160	-11,717	423,921	423,921	0
2.12.03 FE Installation & Testing	0	0	35,282	0	-35,282	0	0	37,429	0	-37,429	562,708	562,708	0
Total Project Baseline	2,601,005	2,254,063	2,181,429	-346,942	72,634	30,954,825	29,772,533	29,298,638	-1,182,292	473,896	78,539,864	81,625,030	-3,085,167
Undistributed Budget													
Management Reserve													
Performance Management Baseline - PMB	**2,601,005**	**2,254,063**	**2,181,429**	**-346,942**	**72,634**	**30,954,825**	**29,772,533**	**29,298,638**	**-1,182,292**	**473,896**	**78,539,864**	**81,625,030**	**-3,085,167**