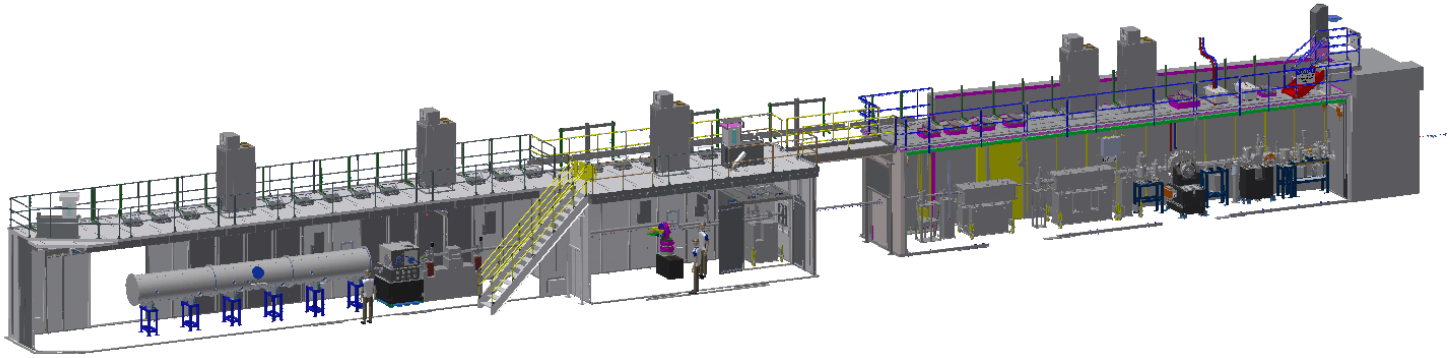
NSLS-II Experimental Tools (NEXT)

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



3-D rendering of the SMI beamline at 12-ID

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OVERALL ASSESSMENT

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

Six major procurements were awarded during February: a contract for the ISR gas handling system on February 2, a contract for the SIX emission spectrometer arm system on February 4, a contract for a soft x-ray detector for the SIX spectrometer on February 10, a contract for CRL focusing optics for SMI on February 23, a contract for the SMI sample chamber on February 25, and a purchase order for ISS data acquisition hardware on February 27. Upcoming major procurements include an instrumented 6-circle diffractometer for the ISR endstation, the higher harmonic rejection mirror system and endstation sample chamber assembly for ISS, and the spectrometer grating rulings for SIX.

Best value evaluation of bids for the FXI photon delivery system procurement has been completed and the contract will be ready to award (off project) by the end of March.

Five PCRs were approved in February. PCRs NEXT_15_075, NEXT_15_077, NEXT_15_079, and NEXT_15_074 incorporated contract awards in WBS 2.07.02 ($240K), WBS 2.10.02 ($57K), WBS 2.08.02 ($15K), and WBS 2.03.01 (-$41K), respectively. PCR NEXT_14_049 ($1.30M) adds IRR and project closeout activities to NEXT and extends the early project completion date to January 31, 2017.

BAC rose $1.6M in February, to $80.1M, with more than 80% of this increase associated with the PCR to add IRR and project closeout activities. EAC remained stable at $81.6M. The largest contributors to the -$1.5M VAC at this point are expected overages in project support ($0.4M) and SIX beamline systems ($1.1M). Cost contingency is reported at $9.9M, which represents 20.5% of $48.2M BAC work remaining or 19.9% of $49.7M EAC work remaining. If all of estimated VAC were to materialize, the contingency would be reduced to $8.4M, which represents 17.0% of $49.7M EAC work remaining. Since outstanding commitments total $20.8M, the $8.4M contingency on EAC represents 29.1% of the $28.9M of uncommitted EAC work to go.

The cumulative EVMS schedule index increased 0.01 in February, to 0.97, as schedule gains, led by utilities installation work in WBS 2.03 (Common Systems), outpaced declines. The cumulative EVMS cost index remained steady at 1.02.

Acceptance testing of NEXT shielded enclosures (hutches) made good progress in February, with all enclosures passing vibration tests with their ventilation fans operating.

Manufacturing issues at InSync, Inc. have delayed delivery of five integrally-cooled mirrors for three NEXT beamlines: ISS (1), ESM (2), and SIX (2). While these activities have not become schedule critical, NEXT and PPM staff are maintaining frequent contact with this supplier, by phone, visits (two to date), and weekly status updates provided by InSync.

COMMON SYSTEMS

PCR-15-061, approved in January ($1.4M) consists mostly of labor additions based on estimates informed by experience on the NSLS-II Project beamline commons systems.

Progress on design and installation of NEXT mechanical and electrical utility systems continued at an accelerated pace in February. Work accelerated because utilities work on the ABBIX project is 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 during February on the ISS and SIX beamlines. It is expected that design work will be completed in April as planned. 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 80% complete. Utilities installation on the SIX and ISS beamlines also made good progress, with both beamlines approximately 50% 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. Approval of final drawings began in February, and is to be completed in March. Installation is scheduled to start mid-April.

The majority (80%) of Personnel Protection System (PPS) components have been received through February. NEXT PPS design and development work is underway, with an initial focus on the ISR, ISS, and ESM beamlines. PPS installation will begin at ESM in March. PPS installation work is expected 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 station contracts for ESM, SMI, and SIX have been awarded, with installation expected in September 2015. Requirements for the ISS control station are currently being gathered, with contract award planned for June 2015. The working schedule shows contract award for the ISR control station furniture in August 2015.

BEAMLINE CONTROLS

In February, NEXT controls staff participated in the first Factory Acceptance Test (FAT) for NEXT, for the Plane Grating Monochromator (PGM) and slit package for the SIX beamline. NEXT control engineer Jun Ma traveled with the SIX team to Bestec in Germany and performed various tests of the PGM motions. Prior to the FAT, an NSLS-II motion control test stand, containing a Delta Tau motion controller enhanced to support absolute encoders, was sent to Bestec to enable the controls tests. With detailed preparation and good communication with the vendor, all motion tests proceeded smoothly.

Control engineers have been busy finalizing the rack layout and cable pull sheets for NEXT beamlines, to accommodate technical changes in beamline optics and endstation designs resulting from vendor FDRs. By the end of February, cable pull sheets have been completed and approved for ESM optics, the SMI FOE, and the entire ISR beamline.

As rack layouts have been finalized, installation technicians have started to populate racks with motion controllers. Figure 1 shows a rack at ISR beamline that has been populated with motion controllers. Cable pulling is scheduled to start in late March or early April.

Figure 1: An electronics rack at the ISR beamline populated with motion controllers.

ESM – ELECTRON SPECTRO-MICROSCOPY

Central to the scanning photoemission microscopy instrument currently in construction for the ESM μ-ARPES endstation is the 6-axis micro-scanning stage, based on piezoelectric actuators, which controls the position of the sample with nanometric precision. This custom stage, designed and fabricated by SmarAct according to our specifications, was delivered to BNL at the end of 2014. The stage is supported by a strong titanium column that is directly attached to the granite block that supports the final beamline optic (refocusing KB mirror pair). In this way, the relative motion between the incident x-ray beam and the sample is minimized. The micro-scanning stage must provide precise sample positioning with (i) high accuracy and repeatability, (ii) long term stability, and (iii) low amplification of vibrations.

The motion and vibration properties of the μ-ARPES endstation micro-scanning stage are being tested with nanometer sensitivity using optical interferometry techniques developed and operated by E. Nazaretski and W. Xu of the NSLS-II Optics and Metrology group. A typical arrangement for these measurements is shown in the left panel of Figure 2. Small mirrors are affixed at the sample position and their relative distances to the micro-scanning stage base are monitored during various types of stage motions to assess their accuracy and repeatability. The same interference signal monitored over long periods of time (typically 5-10 hours) is used to assess the long term drift of the apparatus. Tests are also made in the presence of external vibrations of variable amplitude and frequency to determine the amplification ratio at the sample position.

To date, translation motions (x, y, and z) of the micro-scanning stage have been measured and analyzed. Angular motions will be examined in the coming months. The measured linear step accuracy has been found to be extremely good, of the order of 5 nm. The repeatability is also satisfactory, approximately 100 times smaller than the step size. For example, the repeatability error for 1 micron steps is only 10 nm. Long term stability is also very good. Over a period of 15 h, the sample height relative to the Ti base drifted less than 150 nm. The vibration amplification results at the sample position relative to the base are shown in the right panel of Figure 2. There is a broad resonance in the amplification factor around 200 Hz with a peak value of 50. Fortunately, the natural vibrations present in the experimental floor at such high frequencies are negligible. More relevant is the amplification factor of 10 measured at 50 Hz. At this frequency, the vibration level is on the order of 10 to 50 nm and could become significant at the sample position. At the moment, additional measurements of the sample amplification factor at low frequencies are underway as well as measurements of the vibration spectrum of the experimental floor itself.

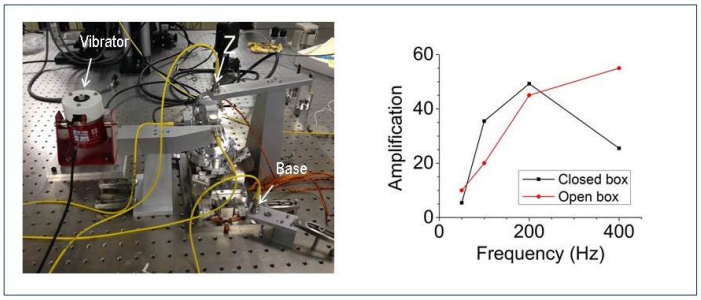


Figure 2: Left: interferometry measurement setup used to determine long term stability and response to vibration of the Smaract micro-scanning stage for the ESM μ-ARPES endstation. Right: frequency dependence of the vibration amplification ratio between the base of the micro-scanning stage and the sample position.

FXI – FULL-FIELD X-RAY IMAGING

Bids for the FXI photon delivery system procurement, received in January, have been evaluated and the best-value proposal has been selected. The procurement contract for this system is expected to be ready to award off project by the end of March.

The FXI radiation enclosure (hutch) contract is proceeding on schedule, with final designs complete and fabrication underway at Caratelli's site. Delivery and on-site construction is expected in September.

ISR – IN-SITU AND RESONANT HARD X-RAY

A contract for the Gas Handling System was awarded to Applied Energy Systems, Inc., on February 2, and a kick-off teleconference for this project was held on February 18. A requisition for slides that will translate Hutch C beam pipe into and out of the beam was approved on February 4, and the purchase order was placed. Proposals for the Instrumented Six-Circle Diffractometer were received for evaluation on February 12.

The Liquid Nitrogen Distribution Piping drawing from the supplier was reviewed and red-lined in order to optimize the locations of the drops in Hutches C and D and to shift the location of the mechanical keep-cold so that it is not directly over an electrical panel.

Vacuum gauge controllers arrived and are undergoing acceptance testing, as shown in Figure 3.

The PDR for the Shielded Transport Pipes was held at BNL on February 25-26. Agenda items were the design of the beam pipes, including details of the shielding and flange covers; ion pump enclosures; support structures; and hutch interfaces. One of the most significant challenges of this contract project is layout of the differential ion pump enclosure between Hutches B and C, as the stairs to Hutch B and the support for the bridge between the two hutches severely constrain the space available for the enclosure and its stand. Detailed measurements of the clearance were made by both ISR and Toyama staff, and the location and design of the enclosure will be modified to avoid interference.

Endstation transfer from NSLS beamline X21 was completed. Several of the motor cable connectors on the transferred endstations were replaced with the NSLS-II standard connectors. Following completion of further assembly work, these two endstations will be installed in hutches 4-ID-C and 4-ID-D.

Figure 3: Vacuum technician Ed Granger carrying out acceptance testing of vacuum gauge controllers.

ISS – INNER SHELL SPECTROSCOPY

The Preliminary Design Review of the major components of the Photon Delivery System was held with the contractor, Toyama, in February and all interface issues between the existing hutches and the beam transport system were discussed and resolved.

A significant delay in the fabrication of the directly cooled high heat load mirror (InSync) has developed. In addition to initial delays caused by the breakdown of a polishing machine and the interferometer system, a vacuum leak in the cooling manifold system was discovered. BNL was immediately informed by the supplier and various mitigations were discussed with the stakeholders: ISS staff, PPM, and NEXT project management. The agreed technical solution, re-fabrication of the back plate of the 1450mm long mirror, will result in a nine month delay in delivery (September 2015 compared to the original delivery date of December 2014) but will minimize significantly the risk of breakage from thermal loading during commissioning with beam. Additional mitigations arranged by the ISS CAM during a visit to InSync in February include (i) development of bi-weekly milestone schedules for all mirrors contracted with InSync and (ii) weekly delivery to PPM of progress reports for all mirrors. With twelve months schedule float for the ISS high heat load mirror package, reflecting the high production risk of such a

complex mirror, the enormous delay in delivery of this mirror will have no impact on the ISS completion schedule.

In addition, the ISS team is working with the supplier of the collimation mirror system and the focusing mirror system (Toyama) to minimize the impact of the delay in delivery of the high head load mirror on the installation of the other mirror systems. Close monitoring of the sub-contracted toroid mirror fabrication, also by InSync, was arranged. The production of a mirror bender prototype is making good progress. All other long lead parts, including the bender piezo actuator and controller, have been received by Toyama. An additional visit to Toyama to test this prototype is planned for March.

The high heat load monochromator package is in the production phase. All sub-contracted long lead items have been received by Toyama and fabrication and assembly of the monochromator has begun. A snapshot of the assembled direct drive motor during assembly and testing is shown in Figure 4. Delivery is expected in September 2015 as planned.

Procurement of the remaining endstation components is progressing. Best value determination for the sample chamber package was completed in February and award is expected by the end of March. Specification and SOW documents for the XES spectrometer mechanics package were prepared and handed over to PPM for bid solicitation. Award is expected as early as late May.

Installation of ISS utilities is making good progress. Electrical installation in the endstation enclosure has been completed and mechanical utility installation has begun in the FOE. A Final Design Review of the "backbone" frame structure to be installed in the endstation enclosure to support and route mechanical utilities and electronics was held in February. Suggestions to increase the rigidity of the structure have been incorporated in in the design.

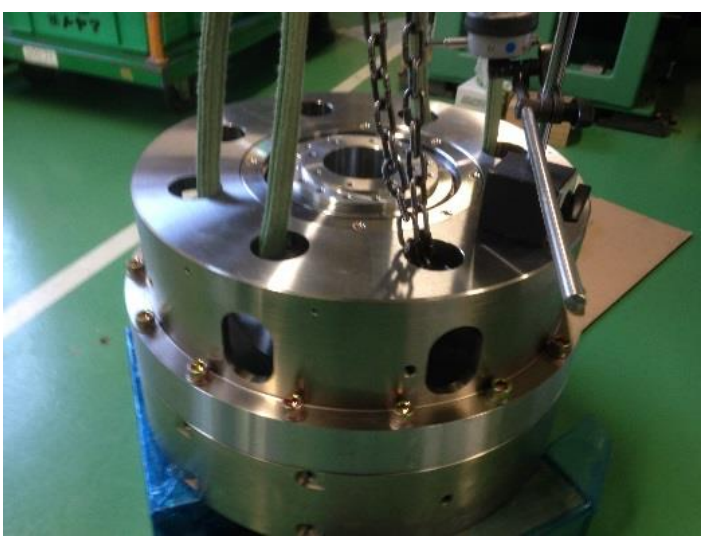


Figure 4: High heat load monochromator direct drive motor with its vacuum chamber, shown at the Toyama factory.

SIX – SOFT INELASTIC X-RAY

Two major packages of the endstation were awarded this month: the spectrometer arm and sample chamber mechanics, to Bestec on February 4, and the soft x-ray CCD detector, to XCAM on February 10. Kick-off meetings were held for these respective packages, on February 17 and 18 at Bestec (Berlin) and on February 20 at XCAM (Northampton, UK). The conceptual endstation design presented by Bestec at the kick-off meeting is shown in Figure 5. Both the optics tank and the detector stand will be equipped with motorized 2θ rotations on curved rails, and are only softly coupled via bellows to a connecting tube supported at its center of mass and guided radially by a third rail system. To compare the vibrational properties of this design with a rigid, massive one-piece arm structure, Bestec will perform an FEA study of the mechanical properties of both design approaches for the PDR. For the M5 (collimating mirrors) motion system, a stacked design using picomotors, also shown in Figure 5, was proposed. In the meantime, Bestec is also working on an alternative design for an in-vacuum picomotor-driven tripod, which will be presented for comparison of benefits at the PDR.

The FAT of the PGM was held at Bestec's site on February 19 and 20. All mechanical specs were met, including the very challenging grating pitch stability: 15 nrad with water flowing through the side-cooling pads (50 nrad specified). The other mirror systems in contract with Bestec — M1, M3 and M4 — are all in production and on schedule.

JTEC Corp. expects the second two spectrometer grating substrates (50 nrad slope error) to ship on March 20 instead of the SOW date of March 9, but in advance of the need date of May. Pre-polishing of the elliptical mirror M3 and of the circular cylindrical mirror M6 is in process, and the substrates for the ellipsoidal mirror M4 have been ordered.

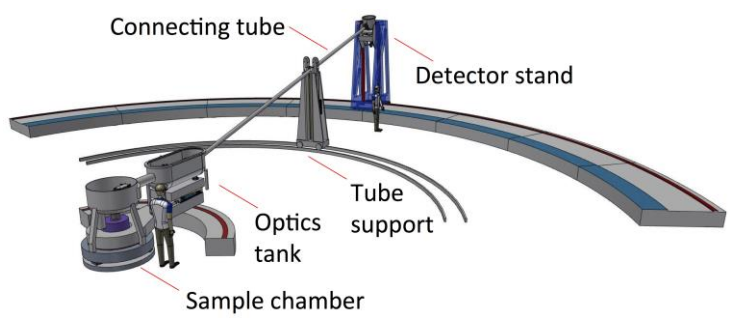


Figure 5: Top: Conceptual layout of the SIX endstation presented by Bestec at the kick-off meeting.

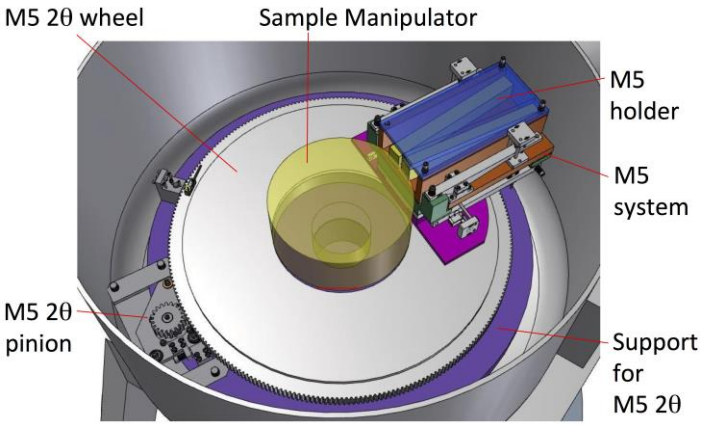


Figure 5: Bottom: Close-up view of Bestec's conceptual design of the interior of the sample chamber.

During the final pressure test of the M2 high heat load mirror substrate by the supplier (InSync), a leak was discovered. Additional testing to determine the leak location and corrective actions are anticipated to further delay the shipping of the mirror to mid-April. This delivery represents a 2.5-month delay, but precedes the re-planned date for commissioning of the PGM with optics (December 2015) which coincides with the delivery schedule of the first beamline grating from Inprentus. The other high heat load mirror, M1, is now expected to ship at the end of April, in time for the October installation of the M1 mechanical system.

SMI – SOFT MATTER INTERFACES

Several important SMI endstation procurement activities have been completed. Evaluation of bids received in mid-January for the CRL Transfocator (in-line focusing system), which produces the GISAXS micro-focus capability, was completed in February, with the contract being awarded to JJ X-ray in Denmark. JJ X-ray has specialized in transfocator designs for years, and their staff scientists had been active in the development of the lenses in their past work. The unit that will be delivered to SMI has many similarities with the one fabricated successfully by the same supplier for the CHX beamline in the NSLS-II Project. In addition, the SMI Sample Vacuum Chamber was awarded in February to GNB Corporation in Elk Grove, CA. The preliminary and final design activities for the CRLs and Sample Chamber will be completed from March to May 2015, for delivery within 1 year. Finally, good progress was made on the specifications for the Double Crystal Deflector (DCD), thanks to the expertise of engineer Scott Coburn, whose previous design experience includes liquid reflectometers for the NSLS/X22B and APS/CMC-CAT beamlines. Scott is also the primary engineer for NSLS-II's IXS beamline, which has a large air-bearing spectrometer with some mechanical similarities to the SMI Liquids instrumentation. Both the specifications for the DCD, shown conceptually in Figure 6, and an advanced draft of the Interface Control Drawing were completed by the end of the month. The DCD remains SMI's critical path item, but there are no obstacles to moving forward to the bid posting stage.

As with other NEXT beamlines, SMI has seen the remainder of punch list items completed for the hutches, and utilities installation activities are well underway. At SMI, mechanical utilities are installed in 12-ID-A, while installation in the B and C stations remains to be undertaken. The A hutch is ready for cable pulling, and the racks are ready to receive equipment. We anticipate that the upcoming two months will see SMI vacuum cables being pulled, and some of the pump, gauge, and motor controllers will soon be moved from storage to their assigned racks. The PPS system design is also partially completed, with all SMI requirements in the hands of the PPS group, for installation scheduled later this coming summer.

SMI has two priorities for March. First, it is time to commence the remainder of Beamline Non-Optics design and procurement activities. This includes the removable beam pipe, vacuum pumps and manifolds, and other support for the GISAXS configuration. Second, there are some crucial GISAXS endstation in-house design activities which must be advanced to support procurement of the SAXS Beam Chamber, an upcoming procurement with April milestones.

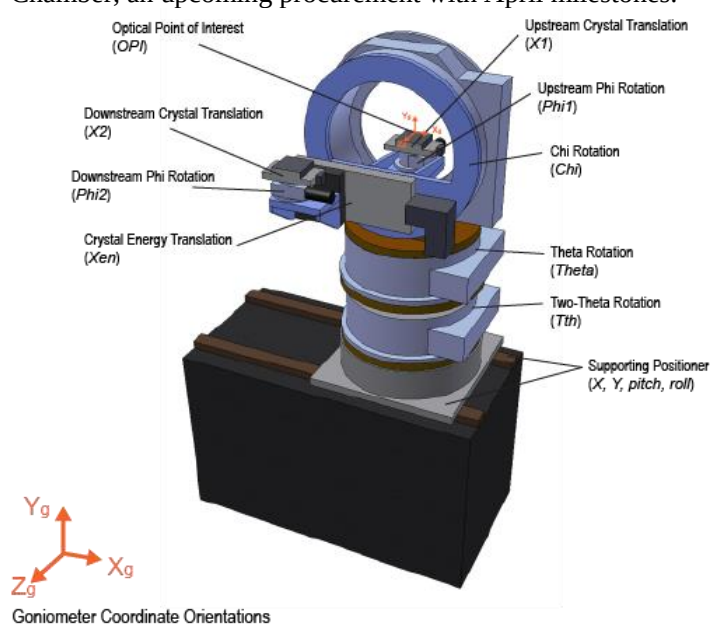


Figure 6. Conceptual drawing of the SMI Double Crystal Deflector, showing the goniometer with its thirteen degrees of freedom. The goniometer rotates a diffracting crystal at the Optical Point of Interest, and is capable of deflecting the scattered beam downward in both fixed-sample-height and variable-sample-height modes, depending on whether a second crystal is used on the downstream crystal positioners. The DCD translates horizontally on its granite stand to intercept beam of either the inboard or outboard branch of the SMI beamline.

INSERTION DEVICES

The magnetic and mechanical Final Design Review for the ESM EPU57 contract was held with Kyma during the first week of February at BNL. During this visit, progress on the design of the long EPUs was also reviewed. The controls FDR for the ESM EPU57 contract and PDR for the ESM EPU105 and SIX EPU57 contract will be held in March, remotely. The next visit to BNL by Kyma is scheduled in May 2015 for the FDR of the long EPUs contract.

Because of their complex 3D magnetic field profile, EPUs are known to strongly impact electron beam dynamics in storage rings and potentially the dynamic aperture. One method of restoring the dynamic aperture is through the use of multiple parallel current-carrying longitudinal wires affixed to the top and bottom surfaces of the EPU vacuum chambers. Use of such "flat wires" for EPU correction has been implemented for the CSX beamline. Because of their location in the ring and their large magnetic period, the NEXT long EPUs will have a stronger effect on beam dynamics than does CSX. As a result, a conservatively large number of flat wires for each EPU, 52 instead of 40, was initially chosen for the long EPU vacuum chamber design. While this number was sufficient, recent beam dynamics simulations have determined that successful correction can be accomplished with a smaller number of flat wires. At this point, the number of flat wires per device is as follows: 52 for the 3.5m-long SIX EPU57, none for the 1.4m-long ESM EPU57, and 28 for the 2.8m-long ESM EPU105. Further dynamic aperture simulations will consider a reduced number of flat wires for the SIX EPU57.

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:	Jan. 31, 2017	
CD-4 (Project Completion):	Sept. 29, 2017	

UPCOMING EVENTS

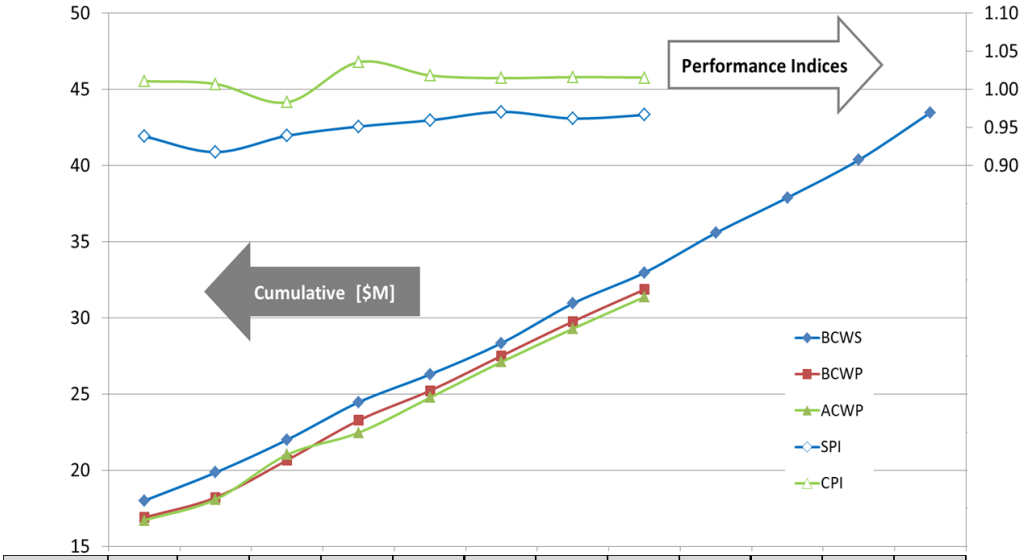
DOE/OPA Mini-Review	April 17, 2015
BNL EVMS surveillance review	June 29 – July 1, 2015

Acronyms and Abbreviations

ABBIX	Advanced Beamlines for Biological Investigations with X-rays
ACWP	Actual Cost of Work Performed
APP	Advanced Procurement Plan
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
CAM	Cost Account Manager
CCD	Charge-Coupled Device
CD	Critical Decision
CHX	Coherent Hard X-ray Scattering
CPI	Cost Performance Index
CRL	Compound Refractive Lens
CSX	Coherent Soft X-ray
CV	Cost Variance
DCD	Double Crystal Deflector
DOE	Department of Energy
EAC	Estimate at Completion
EPS	Equipment Protection System
EPU	Elliptically Polarizing Undulator
ESM	Electron Spectro-Microscopy beamline
EVMS	Earned Value Management System
FAT	Factory Acceptance Test
FDR	Final Design Review
FEA	Finite Element Analysis
FOE	First Optics Enclosure
FTE	Full Time Equivalent
FXI	Full-field X-ray Imaging beamline
FY	Fiscal Year
GISAXS	Grazing Incidence Small Angle Scattering
ID	Insertion Device
IRR	Instrument Readiness Review
ISR	Integrated In-Situ and Resonant X-ray Studies
ISS	Inner Shell Spectroscopy beamline
IXS	Inelastic X-ray Scattering
KB	Kirkpatrick-Baez
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
PPM	Procurement and Property Management
PPS	Personnel Protection System
SAXS	Small Angle X-ray Scattering
SIX	Soft Inelastic X-ray Scattering beamline
SMI	Soft Matter Interfaces beamline
SOW	Statement of Work
SPI	Schedule Performance Index
SV	Schedule Variance
TEC	Total Estimated Cost
TPC	Total Project Cost
UB	Undistributed Budget
VAC	Variance At Completion
WBS	Work Breakdown Structure
XES	X-ray Emission Spectrometer

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	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15
BCWS	18.0	19.9	22.0	24.5	26.3	28.4	31.0	33.0	35.6	37.9	40.4	43.5
BCWP	16.9	18.2	20.7	23.3	25.2	27.5	29.8	31.9				
ACWP	16.7	18.1	21.0	22.5	24.8	27.1	29.3	31.4				
SPI	0.94	0.92	0.94	0.95	0.96	0.97	0.96	0.97				
CPI	1.01	1.01	0.98	1.04	1.02	1.01	1.02	1.02				

The NEXT project Schedule Variance (SV) for February 2015 is +$74K, with an associated monthly Schedule Performance Index (SPI) of 1.04 (green status). The cumulative SPI is 0.97 (green status), 0.01 higher than in January 2015. The positive current month schedule variance is the net result of a number of contributors, both positive and negative: +$105K in WBS 2.03 (Common Systems) resulting from greater-than-planned installation progress in February, +$133K in WBS 2.05 (ESM Beamline) for fabrication of diagnostic elements (Diagon and wavefront sensor) which were scheduled in an earlier month, +$144K in WBS 2.06 (FXI Beamline) for hutch construction progress ahead of schedule, -$297K in WBS 2.08 (ISS Beamline) resulting from 1-2 month delays in achieving contract milestones, +$91K in WBS 2.10 (SMI Beamline) resulting from engineering effort planned in another month and early award of the WAXS positioner, and -$68K in WBS 2.11 resulting from a ~1 month delay in a PDR milestone of the long EPUs contract (Insertion Devices).

The NEXT project Cost Variance (CV) for February 2015 is +$16K, with an associated monthly Cost Performance Index (CPI) of 1.01 (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 February 28, 2015, the project is 39.8% complete with 20.5% contingency ($11.5M) for $48.2M Budget At Completion (BAC) work remaining, based on PCRs processed and approved through February 2015.

The project EAC for February is reported at $81,572K against a Performance Measurement Baseline (PMB)/Undistributed Budget (UB) of $80,116K. The Variance At Completion (VAC = BAC - EAC) of -$1,456K 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 February include: -$0.4M in WBS 2.01.02 (Project Support) for estimated overruns in this account, -$0.1M in WBS 2.05 (ESM Beamline) for expected changes to the KB Mirror System contract, and -$1.0M in WBS 2.09 (SIX Beamline) for upcoming procurement awards of spectrometer system components.

The contingency ($9.9M) is 19.9% of $49.7M EAC work remaining.

5 PCRs were approved and implemented in February.

PCR	PCR Level	Baseline Change [$]	Description
PCR-15-075	L3	240,090	APP022NX & APP096NX Contract Award
PCR-15-077	L3	57,084	APP063NX SMI CRL Focusing Optics Contract Award
PCR-15-079	L3	15,463	APP039NX ISS DAQ Contract Award
PCR-15-074	L3	(40,885)	LN2 Piping Contract Award
PCR-14-049	L2	1,304,086	IRR & Project Close-Out Activities

Forthcoming PCRs include:
A Level 3 PCR (NEXT_15_078) in WBS 2.05.02, 2.09.02 (ESM, SIX Beamline Systems) for recent contract awards,
A Level 3 PCR (NEXT_15_070) in WBS 2.03.04 (Common Systems Control Stations) for procurement refinements,
and Level 3 PCRs for contract awards and amendments.

NEXT as of 2/28/2015	Current Period	Cum-to-Date
Plan (BCWS) $K	2,019	32,974
Earned (BCWP) $K	2,099	31,871
Actual (ACWP) $K	2,083	31,382
SV $K	79	-1,103
CV $K	16	490
SPI	1.04	0.97
CPI	1.01	1.02
Budget at Completion $K (PMB [UB])		80,116
Planned % Complete (BCWS/BAC)		41.2%
Earned % Complete (BCWP/BAC)		39.8%
Contingency $K		9,884
Contingency / (BAC – BCWP)		20.5%
EAC $K		81,572
Contingency / (EAC – BCWP)		19.9%
(Contingency + VAC) / (EAC – BCWP)		17.0%
TPC = PMB + Contingency		90,000

SPI Project to Date*:

0.97

CPI Project to Date*:

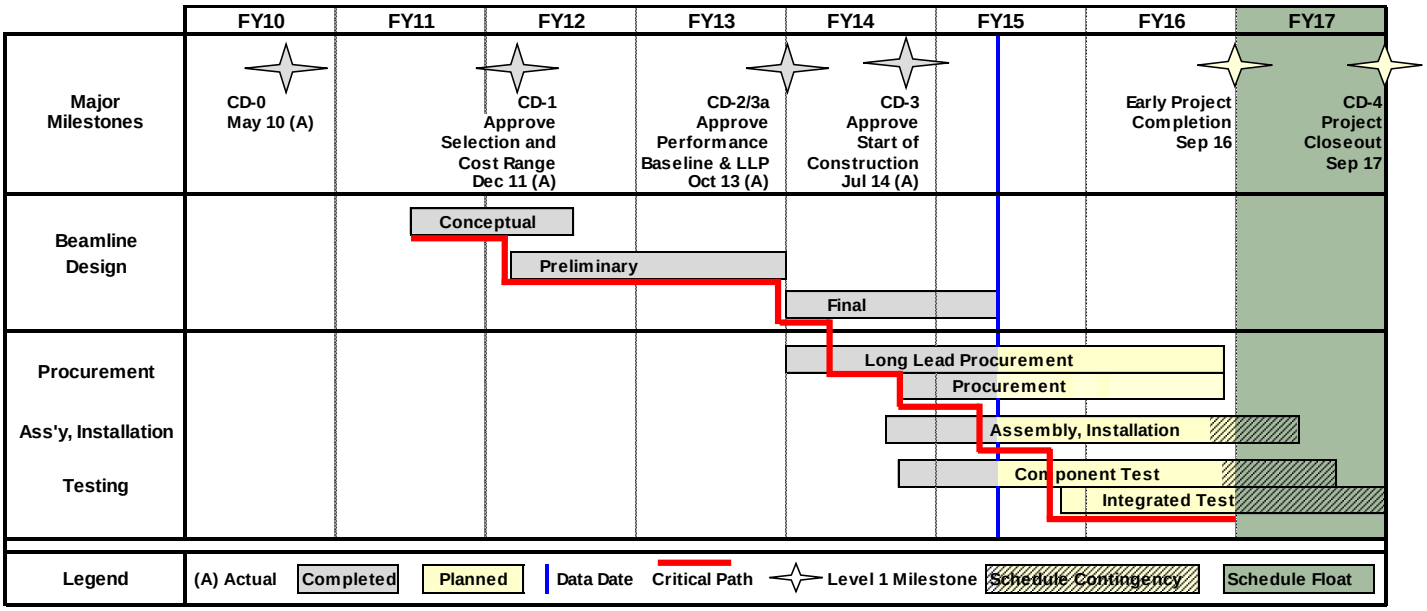
1.02

**Cause & Impact:* No reportable variance

Corrective Action: None required

Milestones – Near Term		Planned	Actual	Notes
L2,L3	Receive ISS Gas Handling System	17-Mar-15		Expect May
L3	SIX – Award Spectrometer Grating Chamber	17-Mar-15	4-Feb-15	
L3	ISS – Award XES Spectrometer	21-May-15		Expect May/June

PROJECT SCHEDULE



The project critical path runs through activities in WBS 2.10 (SMI beamline). As of February 2015, the active critical path activity is specification, procurement, design, fabrication, delivery, installation, and testing of the SMI Double Crystal Deflector MI, which delivers the SMI x-ray beam of varying energy to a fixed point on the surface of liquid samples in the liquids endstation (SMI ES1).

Staffing Report

Staffing as of 2/28/2015	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	1.01	22.81	23.41
WBS 2.02 Conceptual and Advanced Conceptual Design	0.00	0.00	8.74	8.74
WBS 2.03 Common Beamline Systems	0.62	0.53	10.53	2.91 *
WBS 2.04 Control System	0.57	0.43	9.27	7.38
WBS 2.05 ESM Beamline	0.35	0.62	7.50	7.81
WBS 2.06 FXI Beamline	0.05	0.09	4.56	4.24
WBS 2.07 ISR Beamline	0.24	0.34	7.63	7.69
WBS 2.08 ISS Beamline	0.42	0.71	7.39	7.80
WBS 2.09 SIX Beamline	0.32	0.48	11.64	11.76
WBS 2.10 SMI Beamline	0.18	0.29	7.55	7.64
WBS 2.11 Insertion Devices	0.11	0.18	2.06	1.37
WBS 2.12 ID & FE Installation	0.16	0.35	0.16	0.74
Total	**3.74**	**5.05**	**99.83**	**91.51**

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

Number of individuals who worked on NEXT during February 2015: 115

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

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		NSLS-II Experimental Tools (NEXT) Project	2015 / 02 / 01
b. LOCATION (Address and ZIP Code)	b. NUMBER	b. PHASE	b. TO (YYYYMMDD)
	c. TYPE / d. SHARE RATIO	c. EVMS ACCEPTANCE: NO / YES X	2015 / 02 / 28

WBS (2) / Control Account	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	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	180,647	180,647	319,608	0	-138,961	5,799,919	5,799,919	6,127,530	0	-327,611	9,792,909	10,181,909	-389,000
2.01.01 Project Management	74,451	74,451	68,657	0	5,794	2,855,264	2,855,264	2,793,360	0	61,904	4,657,379	4,657,379	0
2.01.02 Project Support	106,196	106,196	250,952	0	-144,756	2,944,655	2,944,655	3,334,170	0	-389,515	5,135,530	5,524,530	-389,000
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	150,718	256,035	376,160	105,317	-120,124	3,417,250	2,919,545	3,557,377	-497,705	-637,832	6,131,166	6,131,167	0
2.03.01 Utilities	65,258	201,359	266,146	136,100	-64,788	2,586,730	2,104,880	2,541,817	-481,850	-436,937	3,458,105	3,458,105	0
2.03.02 Personnel Protection System (PPS)	20,759	28,338	85,714	7,578	-57,377	306,892	345,146	542,216	38,253	-197,071	1,323,218	1,323,218	0
2.03.03 Equipment Protection System (EPS)	51,551	17,929	9,616	-33,622	8,313	178,875	136,616	75,374	-42,258	61,243	594,451	594,451	0
2.03.04 Control Station	4,740	0	1,632	-4,740	-1,632	11,850	0	15,947	-11,850	-15,947	278,704	278,704	0
2.03.05 Common Beamline Systems Management	8,410	8,410	13,051	0	-4,641	332,903	332,903	382,024	0	-49,120	476,689	476,689	0
2.04 Control System	122,386	77,903	89,686	-44,483	-11,783	2,426,016	2,199,185	2,233,593	-226,831	-34,408	4,538,849	4,538,849	0
2.04.01 Control System Management	6,185	6,185	5,195	0	990	176,798	176,798	129,311	0	47,487	294,427	294,427	0
2.04.02 Control System Design & Implementation	85,666	71,718	73,431	-13,948	-1,713	1,367,662	1,132,726	1,275,919	-234,936	-143,193	2,912,234	2,912,234	0
2.04.03 Control System Equipment	30,535	0	11,060	-30,535	-11,060	881,556	889,661	828,362	8,105	61,298	1,332,188	1,332,188	0
2.05 ESM Beamline	259,303	392,691	319,454	133,388	73,238	4,295,073	4,355,231	3,800,527	60,158	554,704	8,940,811	9,079,074	-138,264
2.05.01 ESM Management	10,463	10,463	11,867	0	-1,404	355,480	355,480	357,294	0	-1,813	692,100	692,100	0
2.05.02 ESM Beamline Systems	248,841	382,229	307,587	133,388	74,642	3,939,593	3,999,751	3,443,233	60,158	556,518	8,248,710	8,386,974	-138,264
2.06 FXI Beamline	143,095	286,863	19,969	143,769	266,895	1,270,275	1,417,341	965,098	147,066	452,243	1,818,324	1,818,324	0
2.06.01 FXI Management	14,187	14,187	15,469	0	-1,281	393,753	393,753	422,524	0	-28,771	409,359	409,359	0
2.06.02 FXI Beamline Systems	128,907	272,676	4,500	143,769	268,176	876,522	1,023,588	542,574	147,066	481,014	1,408,965	1,408,965	0
2.07 ISR Beamline	116,448	99,714	113,673	-16,734	-13,959	2,084,291	1,997,276	2,093,752	-87,015	-96,477	10,347,185	10,269,835	77,350
2.07.01 ISR Management	25,041	25,041	24,112	0	929	575,040	575,040	582,822	0	-7,782	1,076,573	1,076,573	0
2.07.02 ISR Beamline Systems	91,407	74,673	89,560	-16,734	-14,888	1,509,251	1,422,236	1,510,931	-87,015	-88,695	9,270,612	9,193,262	77,350
2.08 ISS Beamline	500,554	203,952	293,652	-296,602	-89,700	4,184,403	3,915,290	3,781,773	-269,113	133,517	9,742,030	9,679,161	62,869
2.08.01 ISS Management	18,102	18,102	38,642	0	-20,540	407,815	407,815	401,951	0	5,865	838,199	838,199	0
2.08.02 ISS Beamline Systems	482,451	185,850	255,010	-296,602	-69,160	3,776,588	3,507,475	3,379,823	-269,113	127,652	8,903,831	8,840,962	62,869
2.09 SIX Beamline	290,542	300,922	364,927	10,380	-64,005	3,832,430	3,693,597	3,577,285	-138,833	116,312	11,469,991	12,534,991	-1,065,000
2.09.01 SIX Management	17,134	17,134	7,545	0	9,590	357,370	357,370	335,105	0	22,265	845,551	845,551	0
2.09.02 SIX Beamline Systems	273,407	283,788	357,382	10,380	-73,594	3,475,059	3,336,226	3,242,180	-138,833	94,047	10,624,440	11,689,440	-1,065,000
2.10 SMI Beamline	44,296	135,711	88,510	91,416	47,201	2,946,863	2,906,800	2,958,694	-40,063	-51,894	9,729,726	9,733,763	-4,038
2.10.01 SMI Management	22,396	22,396	11,119	0	11,277	423,757	423,757	397,709	0	26,048	918,583	918,583	0
2.10.02 SMI Beamline Systems	21,899	113,315	77,391	91,416	35,924	2,523,106	2,483,043	2,560,984	-40,063	-77,942	8,811,142	8,815,180	-4,038
2.11 Insertion Devices	181,919	113,685	28,580	-68,234	85,105	880,895	795,996	346,686	-84,898	449,310	4,779,614	4,779,613	0
2.11.01 ESM EPU Insertion Device	179,464	111,230	14,661	-68,234	96,569	721,754	636,855	253,582	-84,898	383,273	4,562,016	4,562,016	0
2.11.02 SIX EPU Insertion Device	0	0	12,453	0	-12,453	117,137	117,137	70,375	0	46,762	117,137	117,137	0
2.11.03 Insertion Devices Management	2,455	2,455	1,466	0	989	42,004	42,004	22,729	0	19,275	100,460	100,460	0
2.12 ID & FE Installation & Testing	29,453	50,604	68,831	21,151	-18,227	29,453	63,764	132,053	34,311	-68,290	1,017,782	1,017,781	0
2.12.01 ID & FE Installation & Testing Management	2,458	2,458	618	0	1,840	2,458	2,458	1,534	0	924	31,153	31,153	0
2.12.02 ID Installation & Testing	26,995	8,773	35,654	-18,221	-26,881	26,995	21,933	60,531	-5,062	-38,598	423,921	423,921	0
2.12.03 FE Installation & Testing	0	39,372	32,559	39,372	6,814	0	39,372	69,988	39,372	-30,615	562,708	562,708	0
Total Project Baseline	2,019,360	2,098,728	2,083,048	79,368	15,680	32,974,185	31,871,261	31,381,686	-1,102,924	489,575	80,115,703	81,571,785	-1,456,082
Undistributed Budget													
Management Reserve													
Performance Management Baseline - PMB	**2,019,360**	**2,098,728**	**2,083,048**	**79,368**	**15,680**	**32,974,185**	**31,871,261**	**31,381,686**	**-1,102,924**	**489,575**	**80,115,703**	**81,571,785**	**-1,456,082**