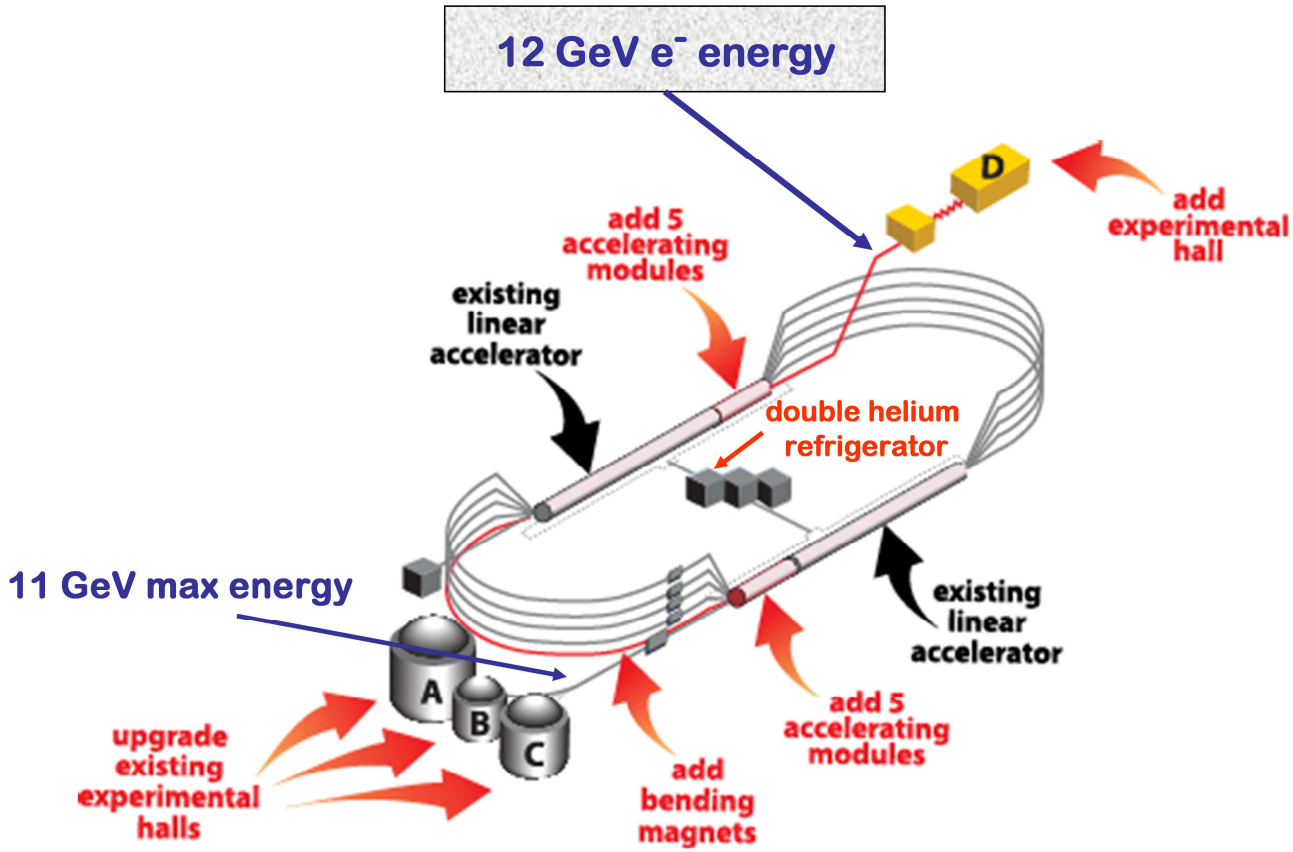
Jefferson Lab
Thomas Jefferson National Accelerator Facility

12 GeV CEBAF Upgrade
Monthly Report
October 2013



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Project Overview and Assessment

Highlights:

The project has continued to make good overall progress at Level 1. The contingency level including management reserve is 47.0% (percentage of ETC). Contingency plus Management Reserve is $20.4M. Construction is 83.4% complete. $240.2M of construction funds has been obligated. In addition, $8.9M of project scope has been obligated on WFO (Commonwealth of Virginia) funding (WBS 1.9).

The project has no Level 2 reportable variances.

Assessment and Issues:
The Project continues to achieve good overall Performance Indices at Level 1.

SPI = 1.00
CPI = 1.00
PERCENTAGE COMPLETE = 82.5%

OPC SPI = 0.99
OPC CPI = 0.99
PERCENTAGE COMPLETE = 56.1%

PED SPI = 1.00
PED CPI = 1.00
PERCENTAGE COMPLETE = 100%

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 83.4%
% OBLIGATED INCLUDING PHASED AND
AWAITING FINAL CONTRACT APPROVAL = 88.0%, $241.2M
FUNDING TO DATE = $284.5M

Risk Assessment:

As of the end of October, the project continues to track two Moderate risk items (box power supplies, and cryomodule microphonics) and six High risk items (SVT detector, Hall C Q1 magnet, Hall C HB magnet, Hall C D/Q2/Q3 magnets, Hall B Torus magnet, and Hall B Solenoid magnet).

High Risks:

The five superconducting magnets for Hall C continue to be tracked as High risks for both cost and schedule due to the technical difficulties with the Q2/Q3/Dipole magnets, and to delays at Michigan State University (MSU) on the Horizontal Bend (HB) magnet and at Scientific Magnetics for the Q1 magnet. Due to recent schedule delays for the HB and the Q1 magnets, these risks remain High following the project rebaseline implementation.

- The critical path for the HB magnet is still the helium vessel. Welding, machining after welding, and leak checking continued at MSU. The pace of welding of the helium vessel is still slower than planned, even though MSU has made arrangements for adding welders and inspectors and operating a second shift where possible.

- The problem with the bracket supporting the coil ends for Q1 was resolved and the yoke and coils fitted together into final form. Fabrication of the helium vessel parts and outer vacuum cryostat parts was completed at an SMI subcontractor, who is also assembling the nitrogen shield. Containment vessel parts were shipped to SMI.

- SigmaPhi began winding the second layer of the Dipole prototype coil after the needed spacers arrived. Analysis continued for the collaring process needed for the Dipole, and Sigma Phi continued work on open issues from the Dipole FDR. The JLab Procurement Group issued the contract modification needed to revise production costs and modify the intermediate schedule dates. Jefferson Lab continued to work with outside on the FEA work. SigmaPhi and Jefferson Lab made preparations for a formal outside review of the FEA work, to be held in November.

- The Quadrupole FDR was held at Sigma Phi on October 2-3, 2013. The Review went very well, since most design aspects are similar to those for the Dipole and had been previously reviewed. A brief punch list resulted.

The two superconducting magnets for Hall B are overall High cost and schedule risks.

- Fermi National Accelerator Laboratory (FNAL) completed winding the first, practice, full double-pancake coil for the Torus. The completed winding pack was transferred into the potting fixture Awards were made for the out-of-plane suspension system, thermal shield and outer vacuum jacket. Development of plans for the instrumentation, controls, quench protection, and power supply dump resistor continued. Design of the quench

protection circuit continued. Further coil cases were completed at the vendor and sent to FNAL. The conductor soldering vendor completed reels of Torus conductor, with shipment to FNAL expected in November.

- Discussions about the solenoid continued with Everson Tesla, Incorporated (ETI). An agreed-upon list of ~46 action items has been developed which require closure before the FDR can be scheduled. Currently, about 25% are closed. ETI was put in touch with the FNAL group working on the Torus to learn of their winding and potting techniques. Parametric studies continued at BNL to vary materials properties used in the thermal analysis.

The Hall B detectors, specifically the Silicon Vertex Tracker (SVT), remains a High risk element because of the likelihood of significant cost increases and schedule delays related to the complexity of the technology. The SVT flex cable manufacturer reported a problem with the latest batch of cables, which were all rejected during QA tests. The manufacturer identified the problem and began a new batch, now expected in late December. Further SVT module assembly at FNAL was accordingly suspended and a plan put together to recover the schedule once production resumes.

Moderate Risks:
The schedule risk item identified for the Accelerator Box Power Supplies continues to be monitored as a Moderate risk. Installation and testing of the Arc 1 and Arc 2 power supplies continued. Three more power supplies arrived this month, Arc 4, Arc 5 and the Hall A power supplies. Two more units shipped early in October and are due at JLab in November. The Arc 3 power supply failed during power testing at the vendor causing a production delay. A design revision was implemented; testing resumed. If the revisions are successful, there will only be a brief delay in production.

The Moderate risk of cost increases due to larger than expected microphonics behavior seen in the R-100 cryomodule during Test Lab testing continues to be tracked. The promising in-tunnel performance indicates that large microphonics do not limit the performance of one cryomodule, however this risk will continue to be tracked until testing is complete on multiple cryomodules in the tunnel operating with beam loading. Currently all ten C100 cryomodules are installed in the accelerator tunnel, and nine have been commissioned. The in-tunnel checkout of the final new cryomodule has been delayed for the reconfiguration of the cryogenics for the South Linac.

Project Management

WBS 1.7 Construction

Highlights:

As of October 31, 2013, 64 major procurements have been awarded.

The delivery schedule of the Hall C superconducting magnets continues to be a significant concern. Steady progress continues on the HB magnet at MSU, however welding of the helium vessel is still the critical path and is continues to take longer than expected. Progress has resumed on the Q1 magnet since the issue with the holding brackets has been resolved. SigmaPhi has begun winding on the second layer of the Dipole prototype coil, however the availability of spacers continues to slow progress. Jefferson Lab will convene a review of the Dipole FEA in November. The Q2/Q3 FDR was held in early October, with good results.

For the Hall B torus magnet, Fermi National Accelerator Laboratory (FNAL) transferred the first, practice, full double-pancake coil for the Torus to the potting fixture. Discussions continued with Everson Tesla, Incorporated (ETI) on the Hall B Solenoid, and a list has been developed of ~46 issues that need to be settled before the Final Design Review can be held. Parametric studies continued at BNL. Representatives from ETI made a visit to Jefferson Lab during October.

Assessment and Issues:

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 89.7%

Accelerator Systems

WBS 1.1.1, 1.2.1, 1.2.6, 1.3 R&D, PED, and Construction

Highlights:

Cryomodules: No progress in October. The in-tunnel checkout of the final new cryomodule, C100-8, has been delayed for the reconfiguration of the cryogenics for the South Linac.

Power: Commissioning of the LLRF on C100-8 is on hold awaiting in-tunnel checkout of the cryomodule.

Installation and testing of the Arc 1 and Arc 2 power supplies continued. Both new power supplies achieved full power into dummy loads. Three more power supplies arrived this month, Arc 4, Arc 5 and the Hall A power supplies. Two more units shipped early in October, LAM1 and LAM3, and are due at JLab in November.

The Arc 3 power supply failed during power testing at the vendor causing a production delay while a fault analysis was completed. A design revision was implemented. Testing and performance analysis have resumed. If the revisions are successful, we will have only a brief delay in production. The vendor is expected to finish all work ahead of the contract schedule.

High-pot and other load checks of the upgraded magnet strings started in preparation for powering magnet loads in early November. Arc 1 and 2 passed the tests after correcting some minor problems. Most of the other arcs were also checked. One YB magnet in the Arc 7 string failed the high-pot. Options for repair and/or repowering of the faulted magnets are being considered. This will not affect Run 1 or Run 2 goals.

Delivery of the 20 amp trim power supplies remained on hold due to problems with firmware for the interlocks. Vendor deliveries are being held at Jefferson Lab's request until the problems are corrected and fixes are implemented. It is believed that the problems are nearing resolution and the deliveries will resume in early November. There are a sufficient number of units at Jefferson Lab to support the Accelerator Run 1 commissioning plan.

Hot check out (final QA plan) for both 10 and 20 amp trim systems is well underway. At the end of the month, the majority of the trim supplies for Run 1 had been checked and a punch list of items needing correction was being worked.

Tunnel installation work (magnet hook-up) in the beam switchyard has been on hold for most of the month while other system check-out work is in progress.

Cryogenics: All scope has been completed.

Beam Transport: The injection line beam dump final alignment and mu metal shielding installation was completed. Instrument Air and LCW dipole header installation was completed in the Transport Recombiner. Final alignment of the dipoles and beampipes was completed in the 2nd extraction region. All eight dipoles and the balance of the quad girders were installed in the Hall B beamline and six of the eight dipoles were installed in the Hall C beamline; LCW was reconnected to these elements. Alignment for hookup was completed for the dipoles installed in the Hall A line and the vacuum pipes were reinstalled. Final alignment was completed on the 4m dipoles and 75% of the quad girders in the Hall D beamline. Options for recovering YB that failed high-pot are being evaluated.

Extraction: All scope has been completed.

Instrumentation, Controls and Safety Systems: The PSS stoppers were installed for a fit test and will be removed to complete installation of electrical components. A beam stopper slug has a leak and was sent back for re-brazing; it will be used as a spare. Work on the burn-through detector for the Hall D beamline has begun. The PSS BCM Cavity is fabricated; final assembly is on hold awaiting delivery of RF probes. PSS Console Wiring is complete. Hall D/Tagger PSS is conduit complete. Starting on cable and wiring. New VME FSD cards for the MPS are fully integrated in to FSD Tree and ready for beam. Locations for BLM in the new beam line and Tagger vault were finalized. BLM cable installation in the Hall D tagger transport line was completed; BLM cable installation in Tagger/Hall D continued. The dumps are ready for installation. Stands are being fabricated for the three synchrotron light monitors. The magnet communications system is nearly ready for testing. Final procurements for the new beam position monitors are underway. Fabrication of the electronics continues.

Assessment and Issues:

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 96.9%

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Physics Systems

WBS 1.4 and 1.5 Construction

Highlights:

Hall A
Work on the new optical system for the Compton polarimeter continued. Beam line installation neared completion.

Hall B
The SVT flex cable manufacturer reported a problem with the latest batch of cables, which were all rejected during QA tests. The manufacturer identified the problem and began a new batch, now expected in late December. Further SVT module assembly at FNAL was accordingly suspended and a plan put together to recover the schedule once new cables are received. This requires an added piece of assembly fixturing, which was designed and ordered by Jefferson Lab.

The first PCAL module was moved to Hall B in anticipation of installing it in November, once the lift fixtures are qualified for use.

Arrangements continued to ship the five completed Region 1 Drift chambers (Sectors 2, 3, 4, 5 and 6) from Idaho State Univ. to Jefferson Lab. Two are expected to arrive in December and the rest in Spring 2014.

Two Old Dominion University (ODU) technicians continued HV cabling for the Drift chamber sectors stored at Jefferson Lab. HV and LV board manufacture was completed, as was production of HV and LV cables. Work on HV and LV distribution boxes continued.

Window attachment and wire potting were completed for Sector 5 of Region 3 Drift chamber at Jefferson Lab. The box for Sector 6 was built. This is the last box for the drift chambers. The granite tables stored in the EEL cleanroom were moved to create space for constructing the Sector 6 box and for testing Sector 5. Load tests were completed for the strongback for Sector 6 and the box was mounted to it. The ensemble will be mounted on the spindle in November to start pre-tensioning and then wire stringing.

A revised procurement was placed to coat the mirror blanks of the High Threshold Cerenkov Counter (HTCC) following completion of prototype tests by the vendor. The first mirror should arrive in late November. The measurement gear to test an assembled half-sector was partially prepared. The fabrication work for the containment vessel frame continued, including priming the metal for later applying the flat black paint required for quiet operation as a Cerenkov counter. Assembly started for the support carriage for the HTCC. The test DAQ for checking the revised HV divider bases for the PMTs was set up.

Brackets for mounting the FTOF to the forward carriage were prepared at a vendor. Testing continued of the FTOF-1b slats at Jefferson Lab. These slats are configured into six arrays that have been placed into a common rack for cosmic ray tests, which in turn is being used to check

the counters' efficiencies and measure their timing resolution. The coincidence rate is low enough that a test of one quarter of the arrays requires nearly 4 weeks in order to obtain sufficient counting statistics to measure the timing resolution as precisely as done for individual slats during construction.

Re-polishing of the reformed downstream bent light guides for the central time of flight (CTOF) continued, and tests of the assembly in the modified fixture were made. Preparation of the orders for the various parts of the magnetic shielding for the PMTs continued. Interaction of these shields with the Solenoid magnet was checked to be acceptable.

Vendor quotes were obtained for the revised method of refurbishing the LTCC mirror array. This requires that thin 10-micron Lexan strips be coated with aluminum and a protective overcoating and then be attached to the existing mirrors used now as substrates. Vendor visits were made to continue tests, and a series of samples obtained from two vendors. Reflectance curves were measured as a function of wavelength, with particular attention to the near-UV range below 300 nm. Two vendors provide samples and also provided samples of various protective coatings. These coatings would be left on during handling of the substrates and then removed; tests were set up to determine how the reflectance varied as a function of the duration of storage. A wavelength shifter overcoating on the PMTs is included in the refurbishment.

Fermi National Accelerator Laboratory (FNAL) transferred the completed winding pack of the first, practice, full double-pancake coil for the Torus into the potting fixture and attached the copper sheets which act as the principal path for cooling the winding.

Prototype Hall B Torus Coil at FNAL with copper "thermal drain" sheets installed.

Power supplies to heat the potting fixture during epoxy impregnation were prepared. Closure and pump down of the posting fixture is planned for November, followed by epoxy injection. Regular visits and weekly videoconferences continued. Test samples of multi-layer stacks of conductor with proposed final surface preparation were tested to choose the final surface

preparation of the conductor, which is performed during production just before the insulating glass tape is applied.

Awards were made for the out-of-plane suspension system, thermal shield and outer vacuum jacket for the Torus. Development of plans for the instrumentation, controls, quench protection, and power supply dump resistor continued. Design of the quench protection circuit continued. The design of the cryogenic distribution can was reviewed further. Further coil cases were completed at the vendor and sent to FNAL (see photo below).

First Torus Coil Case at the vendor's shop.

The conductor soldering vendor prepared the six reels of Torus conductor for shipping to FNAL. Work continued to change over the soldering line for the Solenoid conductor and first short trial runs were made.

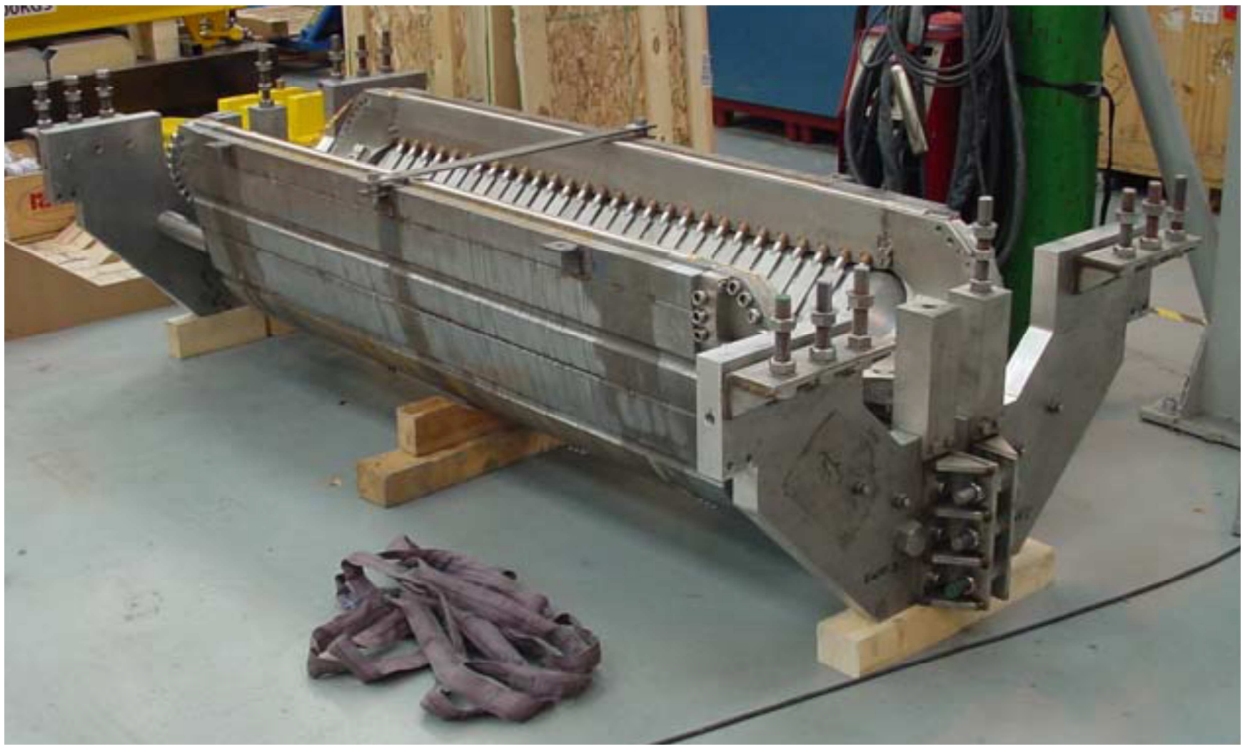
Discussions about the solenoid continued with Everson Tesla, Incorporated (ETI). An agreed-upon list of some 46 action items requiring closure before the FDR is complete has been developed, of which about 25% are closed. Many deal with required FEA analyses to verify the design. Open questions remain after the IDR on stress in the coil winding pack, axial constraints for the winding pack, radial constraints for the shielding section as well as main sections of the coil, design of the correction coils, and control of liquid helium volume. ETI was put in communication with the FNAL group working on the Torus to learn of the winding and potting

techniques used by FNAL staff; ETI plans visits to FNAL to further this and thus will be kept informed of the Torus winding schedule. Parametric studies continued at BNL to vary materials properties used in the thermal analysis, which is a point of discussion with ETI, notably emissivity data and the need for MLI between cold mass and thermal shield. Regular phone calls continued.

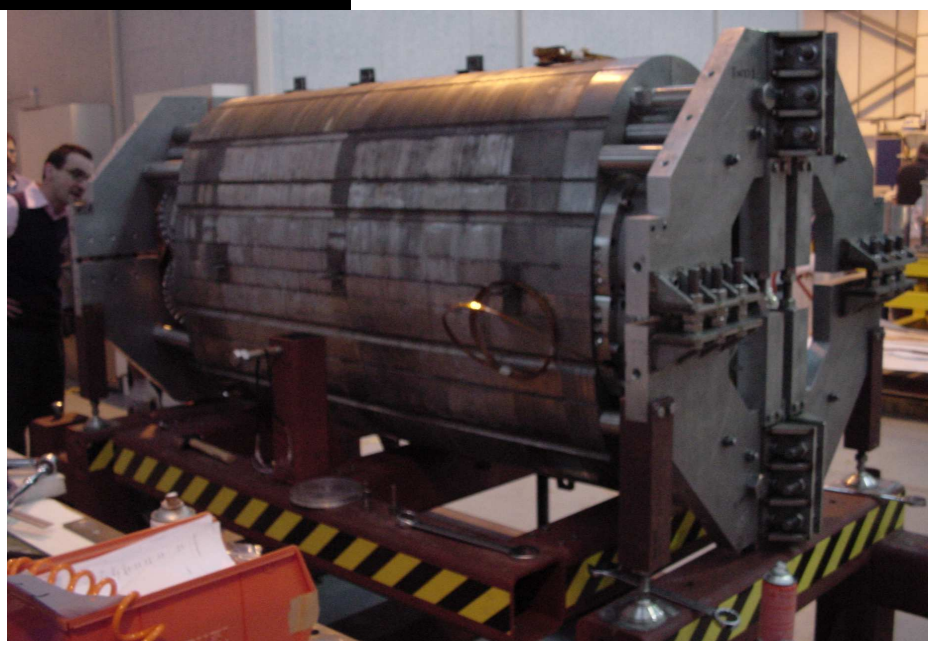
Hall C

Frequent phone calls continued with the three magnet vendors. Welding, machining after welding, and leak checking of the HB helium vessel continued at MSU, first coil being placed in the vessel and the top plates which capture it were test-fit. The critical path is still the helium vessel. The pace of welding of the helium vessel remains slower than planned. MSU has made arrangements for adding welders and inspectors and operating a second shift where possible.

The problem with the bracket supporting the coil ends for Q1 was resolved and the yoke and coils fitted together into final form (see photo below). Fabrication of the helium vessel parts and outer vacuum cryostat parts was completed at a subcontractor for SMI. The nitrogen shield is being assembled there. Containment vessel parts were shipped to SMI. The next major step, and last remaining step at SMI, before transfer to the nearby factory where the helium and outer vacuum vessels will be attached, is to install sensors and pipe-work, which is ongoing.

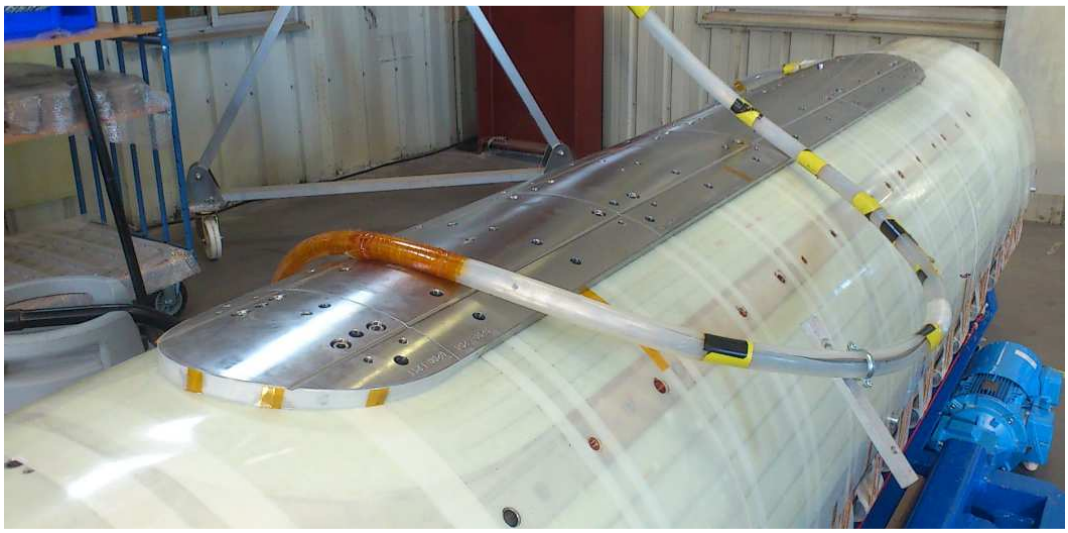


The Yoke attachment brackets have been fitted to the lower half of Q1.



Hall C Q1 yoke back together and being readied for the addition of the containment vessel.

SigmaPhi began winding the second layer of the Dipole prototype coil (see photo below) after the needed spacers arrived. The fabrication of the rest of the spacers is the rate-limiting step for the coil wind, and a second vendor is being qualified. Analysis continued for the collaring process needed for the Dipole. Sigma Phi continued work on open issues from the Dipole FDR. The Quadrupole FDR was held October 2-3, 2013. A brief punch list resulted, since most design aspects are similar to those for the Dipole. Tune-up continued of the revised set of consolidation equipment, which has two heads and process automation machinery, as did assembly of the second winding table. The large oven to be used for the vacuum epoxy impregnation of the coils was prepared.



The start of the second layer winding for the Hall C Dipole prototype. The G10 ground insulation layer is strapped in place over the first layer.

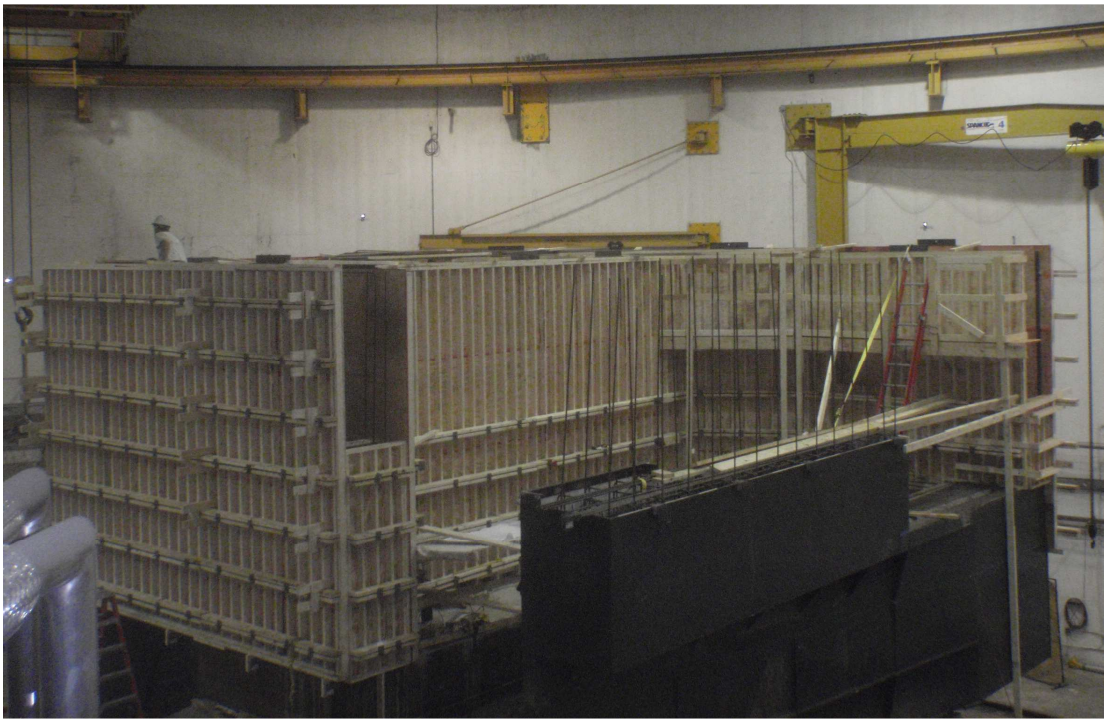
The JLab Procurement Group issued the contract modification needed to revise production costs and modify the intermediate schedule dates accordingly. SigmaPhi prepared new conductor samples to measure conductor properties at 4.5°K, since these properties remain a source of disagreement. These were done with improved control of the epoxy impregnation, including a much longer heating step as well as a pre-heat step. Compression tests at room temperature indicate this method is acceptable and reproducible. Jefferson Lab continued to work with outside reviewers to review Jefferson Lab's FEA work. SigmaPhi and Jefferson Lab made preparations for a formal outside review of the FEA work, to be held in November.

The University of Virginia continued work on the noble gas Cerenkov counter. The key remaining component is the gas vessel, which is being detailed.

The vendor completed forming and pouring the concrete for the SHMS shield house work on-site (see photos below) and began preparing special pieces as well as the pours of the concrete using boron carbide sand. Procurements were continued for the gears, bearings and other specialty hardware for the shield house. Work continued to refurbish and expand the transfer lines for cryogens inside Hall C to accommodate the SHMS.

Forming placed for the concrete pour for the SHMS shield house.

Concrete pour for the SHMS shield house.

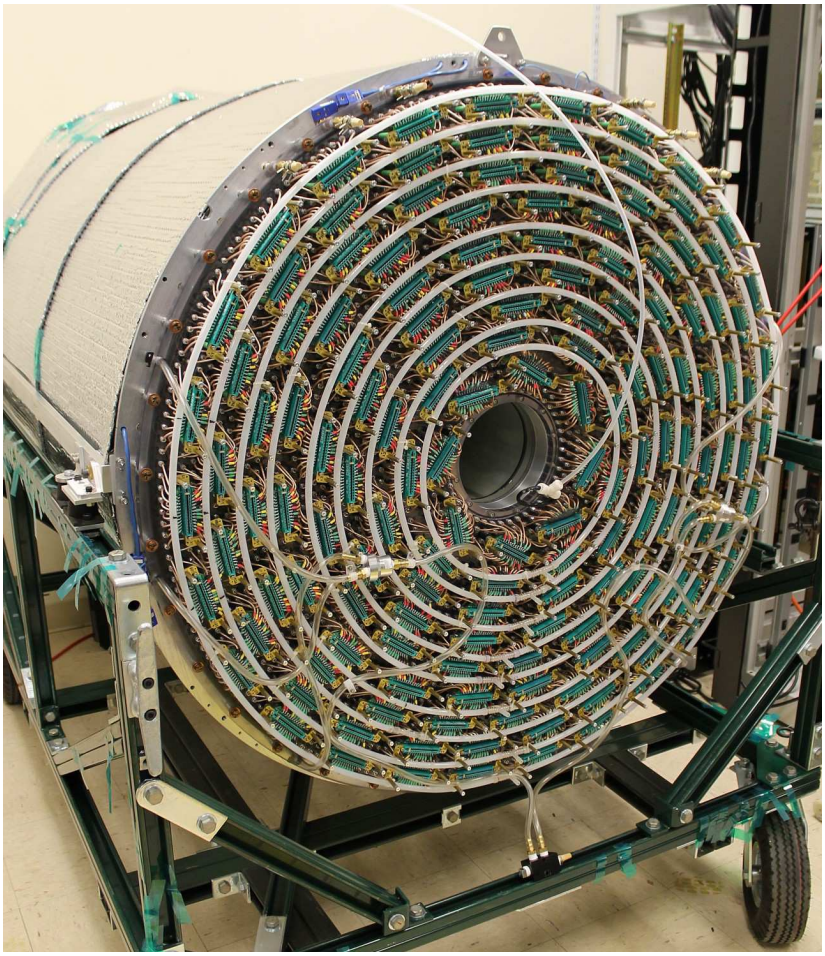


View of the forms for the SHMS shield house showing the detector site.

Hall D

The fully assembled FDC was moved to Hall D and surveyed. Cabling continued.

The Central Drift Chamber (CDC) was shipped from Carnegie Mellon University to Jefferson Lab (see photo below). After arrival and unpacking, wire testing started to check if any were broken during transit. Attachment of final electronics cards began.



Central Drift Chamber located in the EEL Building at Jefferson Lab for wire testing.

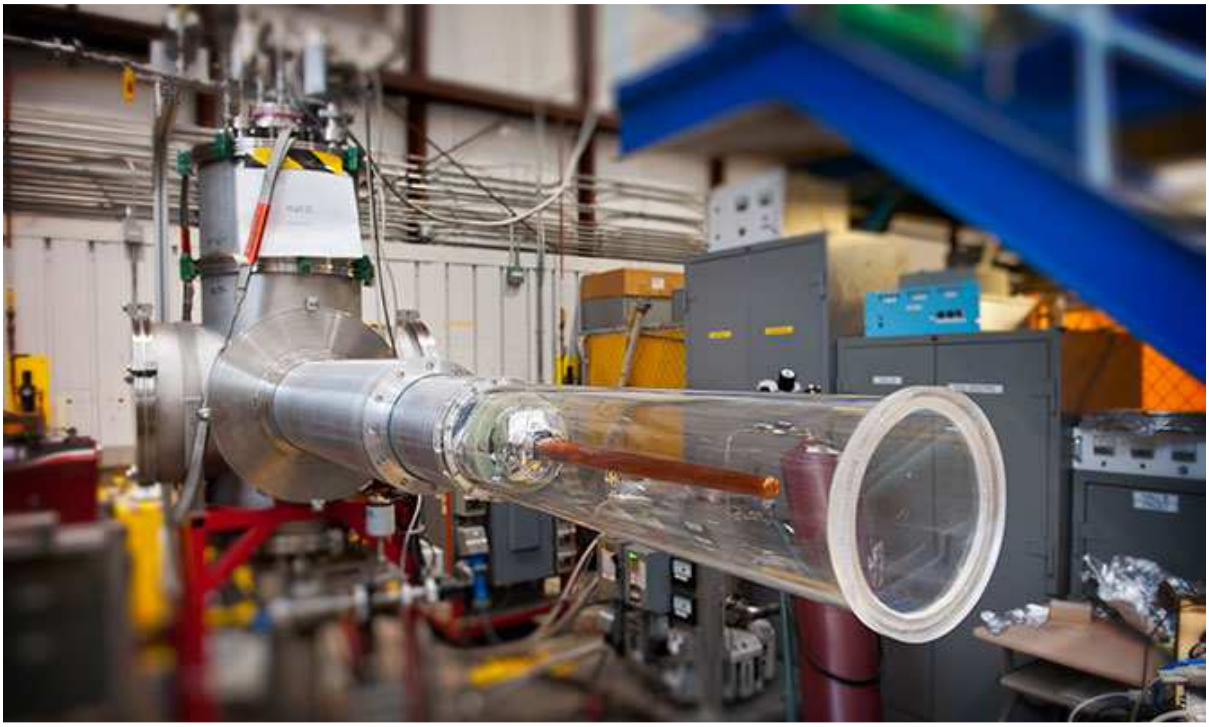
Florida State University (FSU) continued attaching light guides to TOF scintillators. The first half of the array was shipped to Jefferson Lab, and upon arrival was prepared for on-site testing.

Procurements were completed for the scintillators and light guides for the tagger hodoscope. Assembly of the tagger hodoscope elements began at Catholic University. The University of Connecticut continued with fabrication and assembly of the tagger microscope. A procurement to acquire the diamond crystals needed for the coherent bremsstrahlung radiator was discussed further with U. Connecticut, including required tests and possible production schedule, and the method of thinning these crystals (to 20 microns) was reviewed further.

Attachment of electronics and cables to the BCAL continued. Rack and electronics installation for the BCAL continued. Checkout of the similar installed electronics for the FCAL continued. Installation of the calibration system for both calorimeters began.

The non-working Crate Trigger Processor (CTP) boards for Halls C and D were returned to the vendor and re-worked, but re-testing did not indicate improvement. This is a concern because over 20% of the boards exhibit problems. A significant number of non-working FADC-125 boards, over 10% of the order, have also been identified and a path forward is being discussed with the QA staff at the vendor concerning repairs or replacement. Tests of assembled electronics boards continued for the start counter, tagger microscope and tagger hodoscope. Further items for the electronics for the pair spectrometer arrived. Firmware improvements for the various FADCs and trigger modules were continued. The fit-out of the Counting House continued. Placement of racks, power and cable race continued, with the cable race nearing completion. Routing of power wiring to racks continued. First fiber optics runs were installed and designs checked for the remaining ones. Initial tests to send data from the counting house to the storage silos were successful.

The hydrogen target assembly continued (see photo) and first tests were made. Work on gas distribution panels continued. Mapping procedures for the tagger magnet were prepared for approval by operations staff.



Hall D hydrogen target being prepared for final testing.

Assessment and Issues:

WBS 1.4 Halls A, B & C
CONSTRUCTION SPI = 1.01
CONSTRUCTION CPI = 0.99
PERCENTAGE COMPLETE = 62.3%

WBS 1.4.1 Hall A
CONSTRUCTION SPI = 0.98
CONSTRUCTION CPI = 0.97
PERCENTAGE COMPLETE = 98.4%

WBS 1.4.2 Hall B
CONSTRUCTION SPI = 1.01
CONSTRUCTION CPI = 0.99
PERCENTAGE COMPLETE = 62.3%

WBS 1.4.3 Hall C
CONSTRUCTION SPI = 1.02
CONSTRUCTION CPI = 0.99
PERCENTAGE COMPLETE = 61.6%

WBS 1.5, 1.9.5 and 1.9.7 Hall D
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 88.6%

WBS 1.5 Hall D - NP
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 87.2%

WBS 1.9.5 and 1.9.7 Hall D - VA
CONSTRUCTION SPI = 0.99
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 99.0%

Conventional Facilities

WBS 1.6 Construction

Highlights:
There are no Conventional Facilities highlights for October 2013. Reporting will resume when the Tunnel Air Conditioning project receives funding.
Assessment and Issues:

WBS 1.6, and 1.9.6 Civil
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 93.9%

WBS 1.6 Civil – NP
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 93.2%

WBS 1.9.6 Civil – VA
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 100%

Construction Pre-Ops

WBS 1.8 Construction Pre-Ops

Highlights:

Accelerator
Box power supply check out continued.

The full integration tests of the linacs are on hold awaiting completion of the cryogenics system reconfiguration.

Physics
Hall D trigger and electronic checkout continued.

Assessment and Issues:

WBS 1.8
CONSTRUCTION SPI = 0.92
CONSTRUCTION CPI = 0.94
PERCENTAGE COMPLETE = 18.1%

Jefferson Lab
Thomas Jefferson National Accelerator Facility

COST PERFORMANCE REPORTS

12 GeV Cost/Schedule Status Report												31-Oct-13
	Cumulative to Date ($K)											
	Budgeted Cost		Actual Cost	Variance		Performance Indices		Budget At Complete	Estimate At Completion	Independent Estimate At Completion	Contin. & MR %	% Complete
WBS	Work Scheduled	Work Performed	Work Performed	Schedule	Cost	SPI	CPI	($K)	($K)	($K)	($/ETC$_{ob}$)	
1.2 PED	20,993	20,993	20,993	0	0	1.00	1.00	20,993	20,993	20,993		100%
1.3 Construction Accelerator Systems	100,695	100,465	100,422	(230)	42	1.00	1.00	103,729	103,726	103,685		97%
1.4 Construction Upgrade Halls A, B & C	56,013	56,571	57,057	558	(486)	1.01	0.99	90,757	90,744	91,537		62%
1.4.1 Construction Upgrade Hall A	668	657	681	(11)	(24)	0.98	0.97	668	668	692		98%
1.4.2 Construction Upgrade Hall B	37,024	37,262	37,601	238	(339)	1.01	0.99	59,803	59,796	60,347		62%
1.4.3 Construction Upgrade Hall C	18,322	18,652	18,776	330	(124)	1.02	0.99	30,286	30,280	30,487		62%
1.5 Construction Hall D	34,735	34,894	35,038	159	(144)	1.00	1.00	40,008	40,003	40,172		87%
1.6 Construction Conventional Facilities	28,273	28,279	28,240	6	39	1.00	1.00	30,347	30,344	30,306		93%
1.7 Construction Project Management	8,226	8,226	8,242	(0)	(16)	1.00	1.00	9,171	9,171	9,189		90%
12 GeV Total Estimated Base Cost	**248,935**	**249,428**	**249,993**	**493**	**(565)**	**1.00**	**1.00**	**295,006**	**294,982**	**295,883**		**84.6%**
				Management Reserve					**302**	**302**	**1%**	
				IEAC Projected Variance					**(0)**	**(901)**	**0%**	
				DOE Held Contingency					**15,216**	**15,216**	**46%**	
				12 GeV Total Estimated Cost					**310,500**	**310,500**		
1.0 ACD/CDR	3,445	3,445	3,445	0	(0)	1.00	1.00	3,445	3,445	3,445		100%
1.1 R&D	7,052	7,052	7,052	0	0	1.00	1.00	7,052	7,052	7,052		100%
1.8 Construction Pre-Ops	2,378	2,197	2,332	(181)	(135)	0.92	0.94	12,118	12,156	12,118		18%
12 GeV Total Other Project Base Cost	**12,875**	**12,694**	**12,829**	**(181)**	**(135)**	**0.99**	**0.99**	**22,614**	**22,653**	**22,614**		**56.1%**
				Management Reserve					**461**	**461**	**5%**	
				IEAC Projected Variance					**0**	39	0%	
				DOE Held Contingency					**4,386**	**4,386**	44%	
				12 GeV Other Project Cost					**27,500**	**27,500**		
12 GeV Total Project Cost	**261,810**	**262,122**	**262,822**	**312**	**(699)**	**1.00**	**1.00**	**317,621**	**338,000**	**338,000**	**47.0%**	**82.5%**
										Contingency	45.3%	
										Mgmt Reserve	1.8%	
										Contingency + Mgmt Reserve on Actual Costs	36.7%	
										Contingency Based on Actual Costs	35.3%	
										Mgmt Reserve Based on Actual Costs	1.4%	

Monthly EVMS Data	BCWS	BCWP	ACWP
12 GeV Total Estimated Cost	3,338	3,023	3,120
12 GeV Other Project Cost	295	166	163
12 GeV Total Project Cost	3,633	3,189	3,283

Contingency and MR % calculation includes out-year phased contracts: 969

Contingency and MR % calculation includes contract vendor notifications.

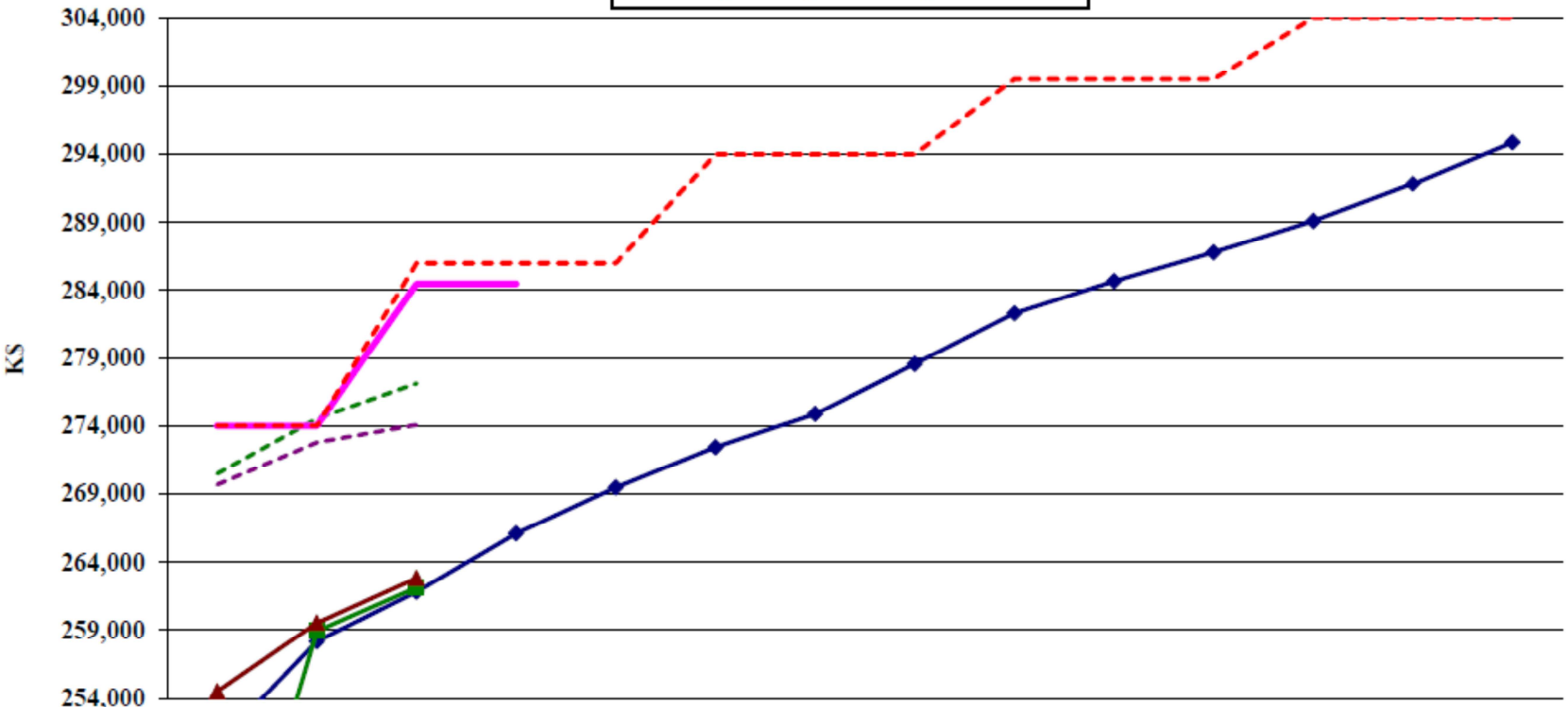
Assigned ~ $1.25M Mgmt Reserve for Civil contracts.

Non-DOE	BCWS	BCWP	ACWP	Sv	Cv	SPI	CPI	BAC	EAC	IEAC	Cont/MR %	% Complete
1.09 Work for Others	8,913	8,856	8,845	(57)	11	0.99	1.00	8,913	8,913	8,902	154%	99%
1.10 Non-DOE	624	624	N/A	-		1.00		624	-			100%

12 GeV Upgrade NP Project

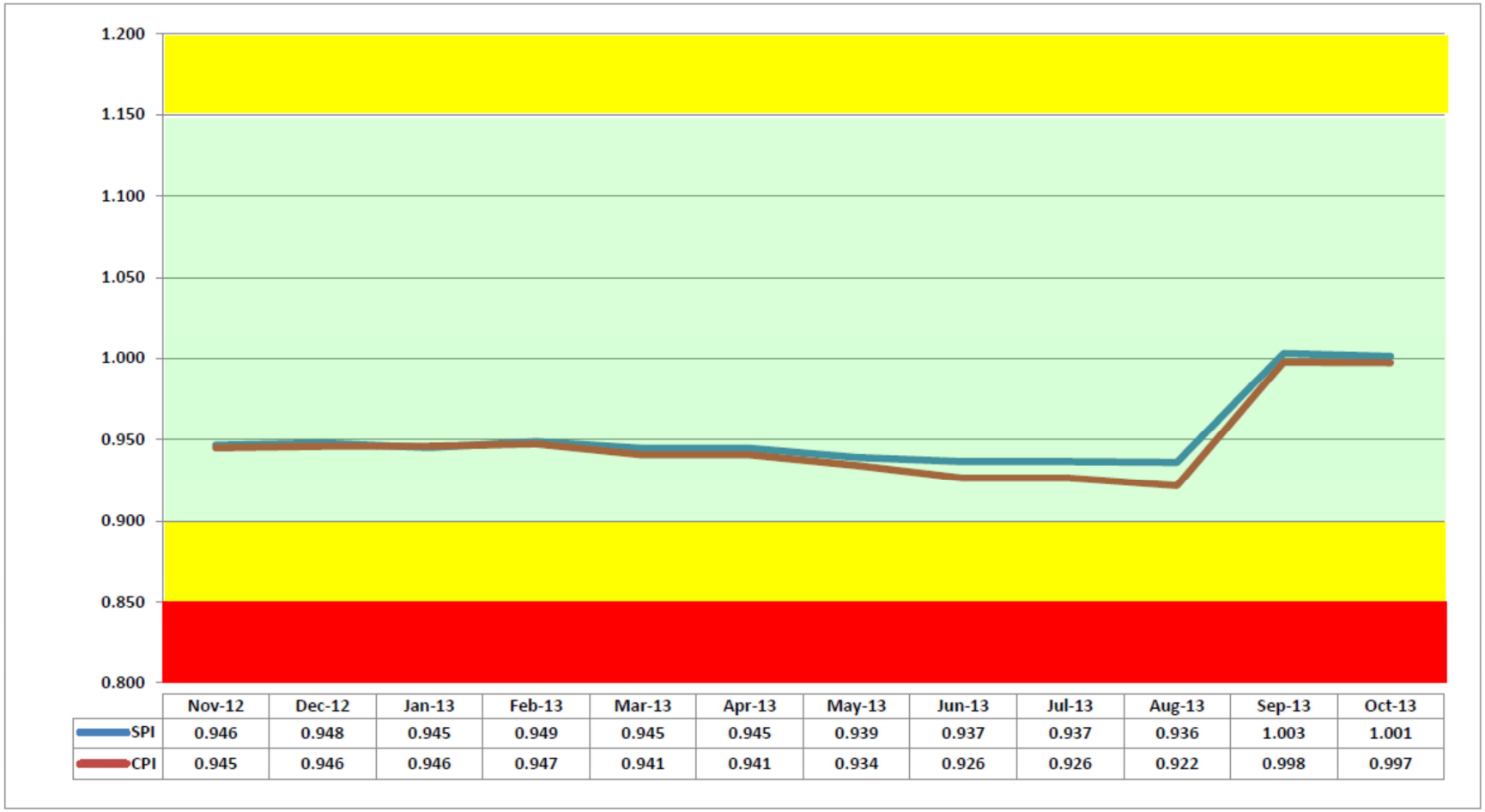
Earned Value $K

Including changes through CR14-001



	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	250,598	258,177	261,810	266,089	269,472	272,431	274,861	278,539	282,299	284,682	286,791	289,096	291,822	294,857
BCWP	234,591	258,933	262,122											
ACWP	254,509	259,539	262,822											
Obligated	269,694	272,784	274,064											
Pending	270,500	274,533	277,121											
Funding	274,000	274,000	284,476	284,476										
FY 14 Funding Request	274,000	274,000	286,000	286,000	286,000	294,000	294,000	294,000	299,500	299,500	299,500	304,000	304,000	304,000

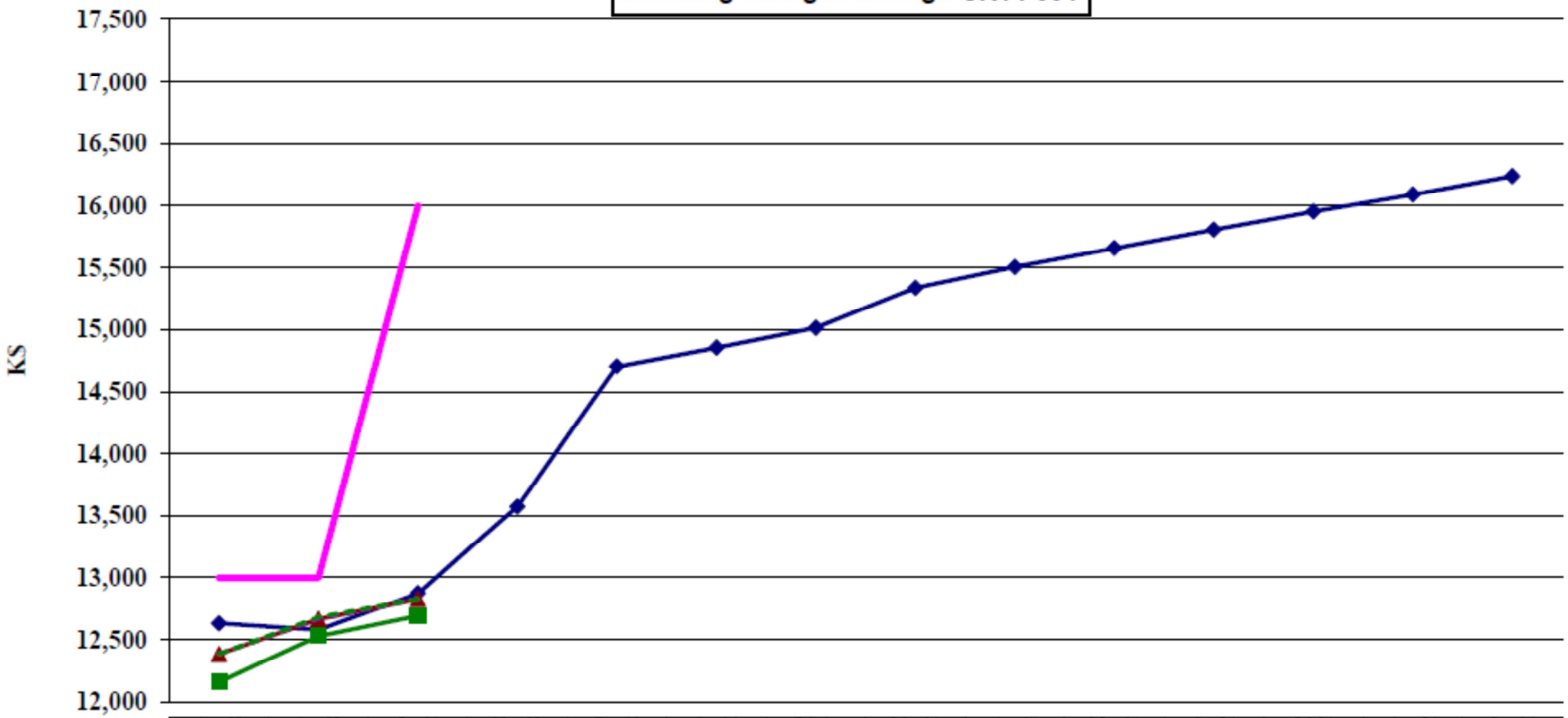
CPI / SPI October 2013



	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13
SPI	0.946	0.948	0.945	0.949	0.945	0.945	0.939	0.937	0.937	0.936	1.003	1.001
CPI	0.945	0.946	0.946	0.947	0.941	0.941	0.934	0.926	0.926	0.922	0.998	0.997

12 GeV Upgrade NP OPC
Earned Value $K

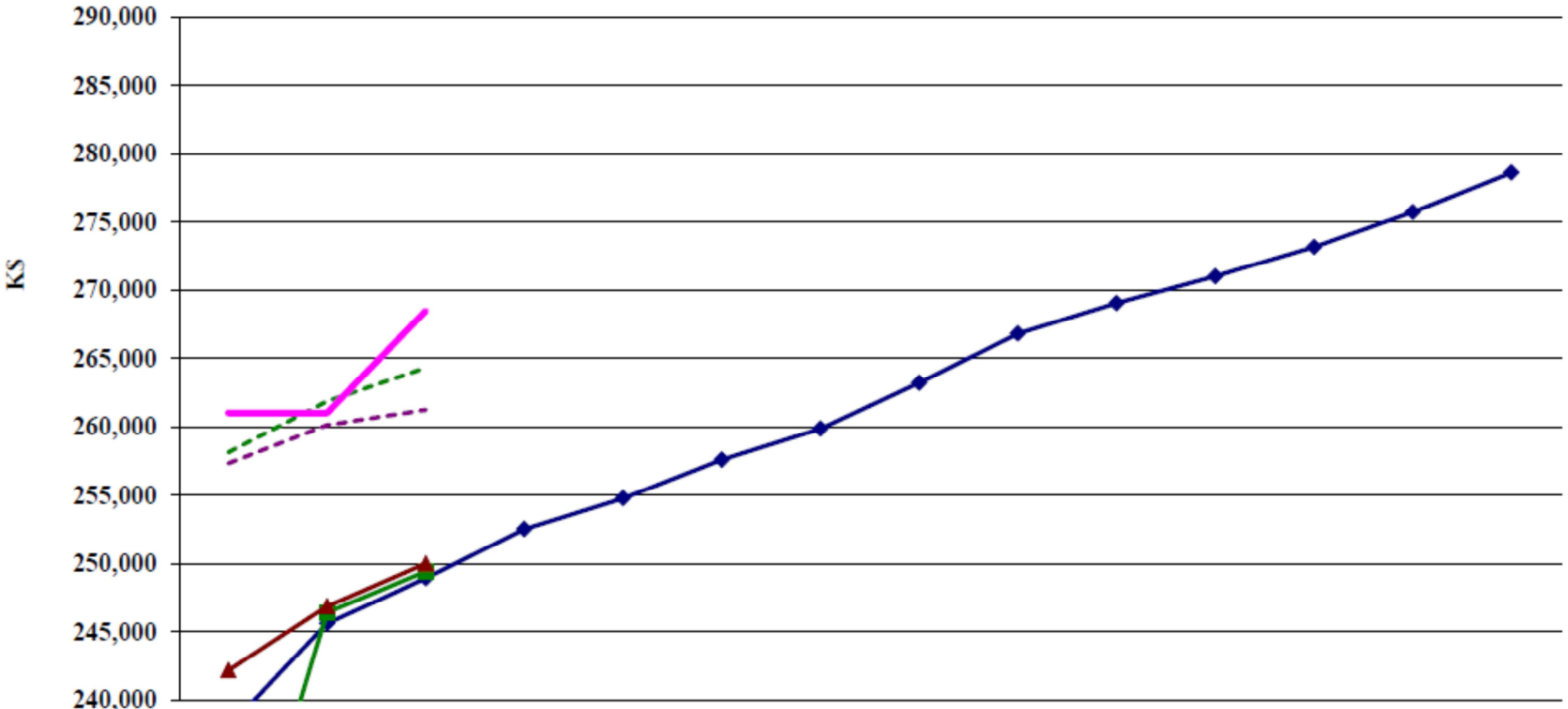
Including changes through CR14-001



	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	12,632	12,580	12,875	13,573	14,704	14,855	15,014	15,335	15,504	15,657	15,808	15,955	16,093	16,240
BCWP	12,158	12,528	12,694											
ACWP	12,382	12,666	12,829											
Obligated	12,383	12,667	12,830											
Pending	12,383	12,683	12,830											
Funding	13,000	13,000	16,000											

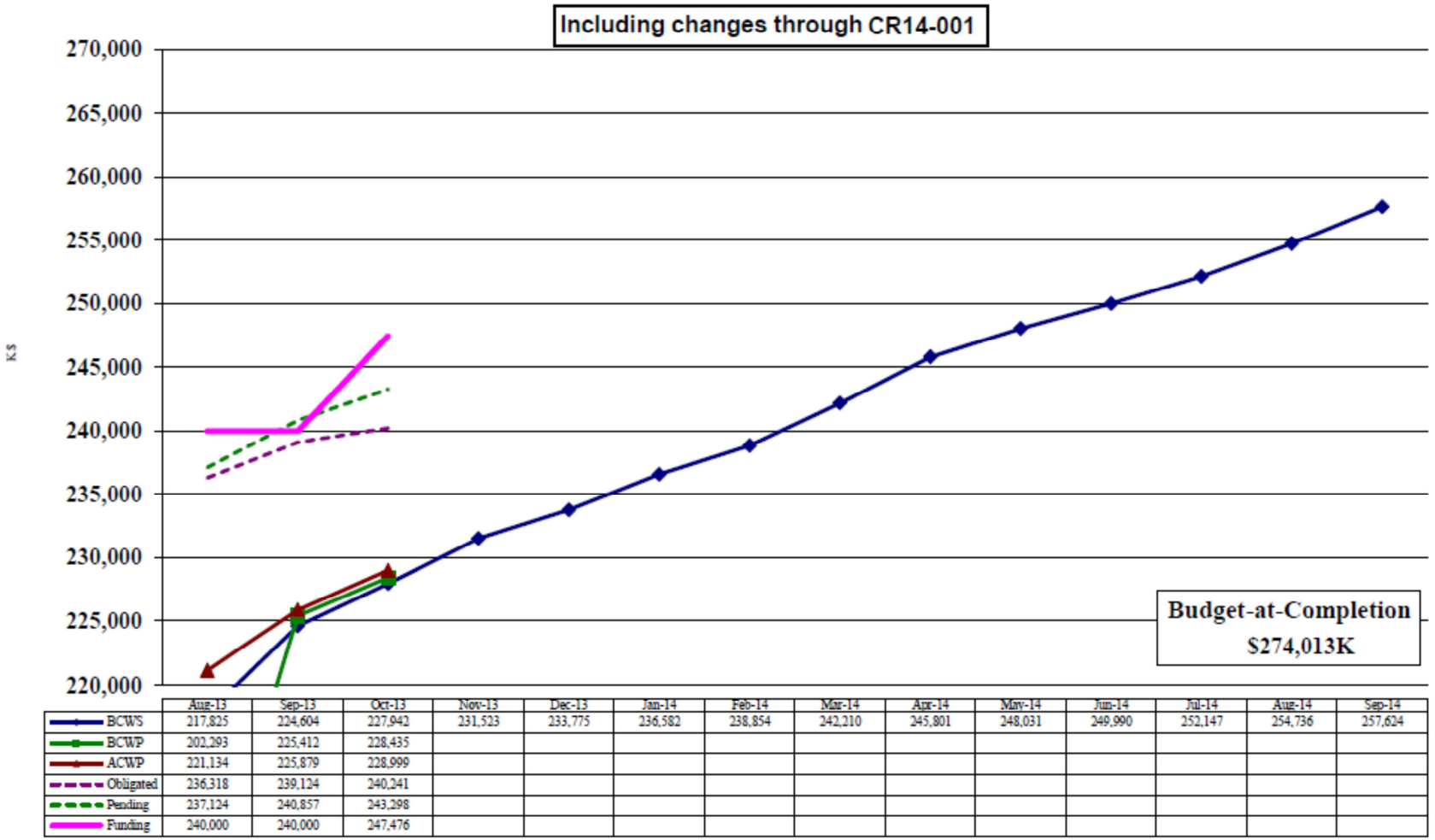
12 GeV Upgrade NP TEC
Earned Value $K

Including changes through CR14-001



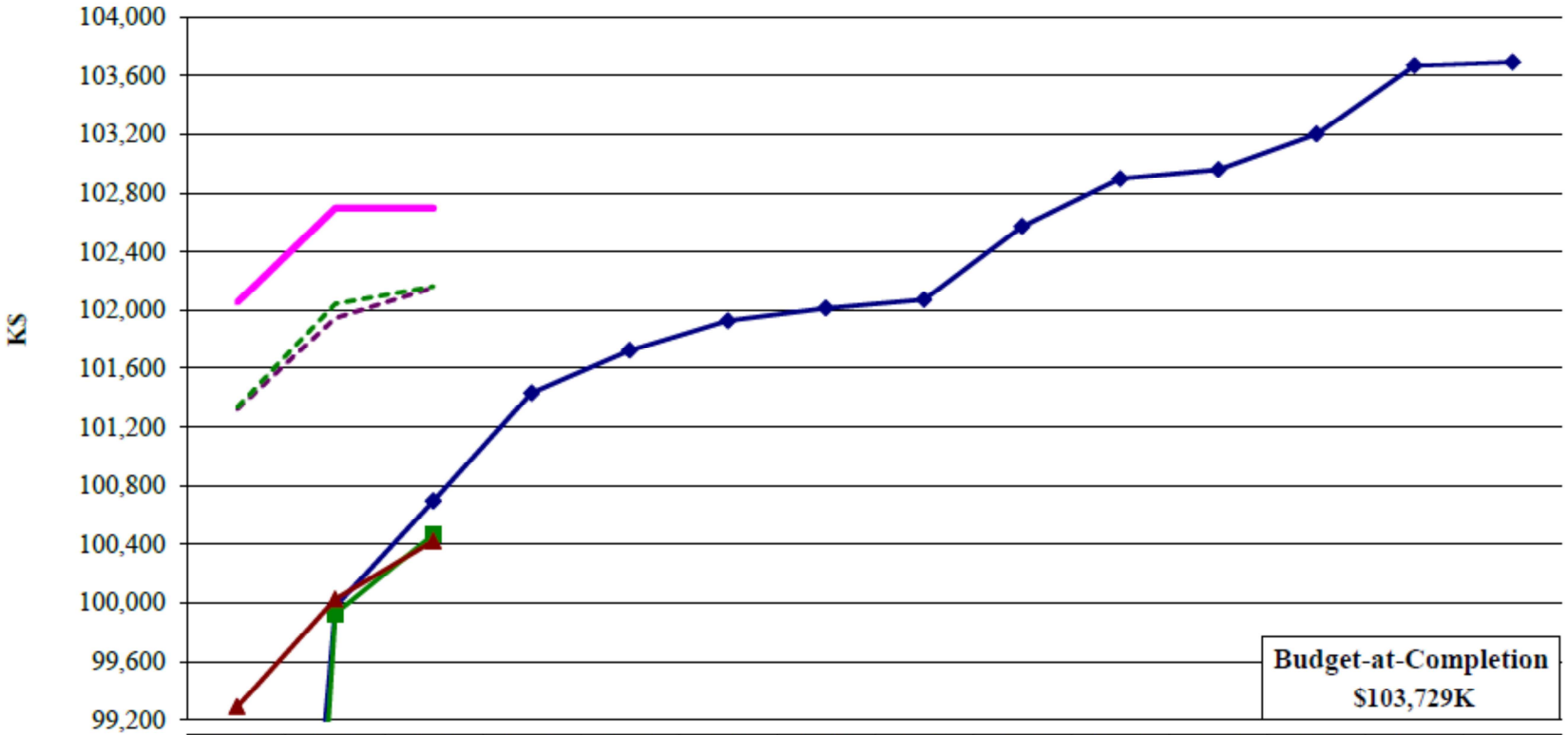
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	237,966	245,598	248,935	252,516	254,768	257,576	259,847	263,204	266,794	269,024	270,984	273,141	275,729	278,618
BCWP	222,433	246,405	249,428											
ACWP	242,127	246,873	249,993											
Obligated	257,311	260,117	261,234											
Pending	258,117	261,850	264,291											
Funding	261,000	261,000	268,476											

12 GeV Upgrade NP Construction
Earned Value $K



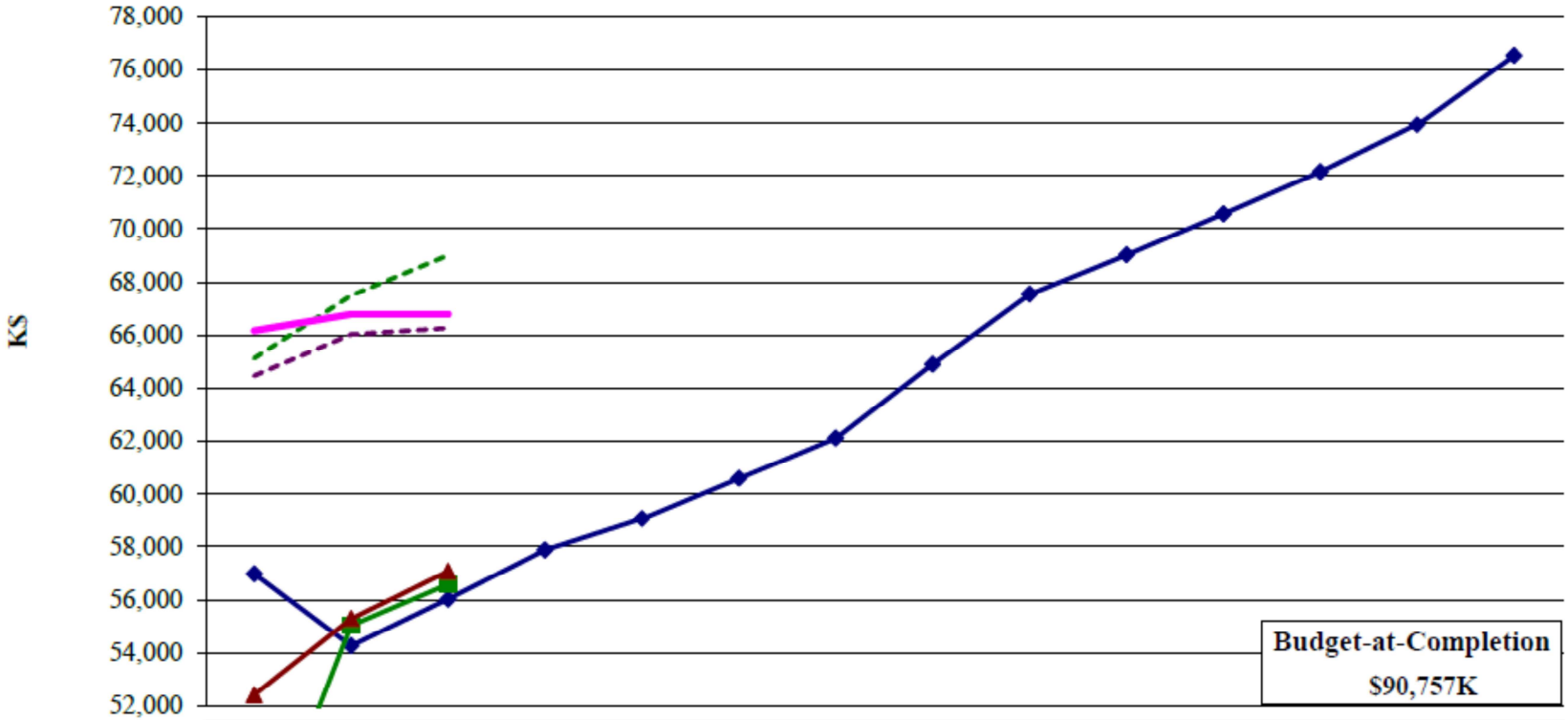
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	217,825	224,604	227,942	231,523	233,775	236,582	238,854	242,210	245,801	248,031	249,990	252,147	254,736	257,624
BCWP	202,293	225,412	228,435											
ACWP	221,134	225,879	228,999											
Obligated	236,318	239,124	240,241											
Pending	237,124	240,857	243,298											
Funding	240,000	240,000	247,476											

12 GeV 1.3 Construction Accelerator Systems
Earned Value $K



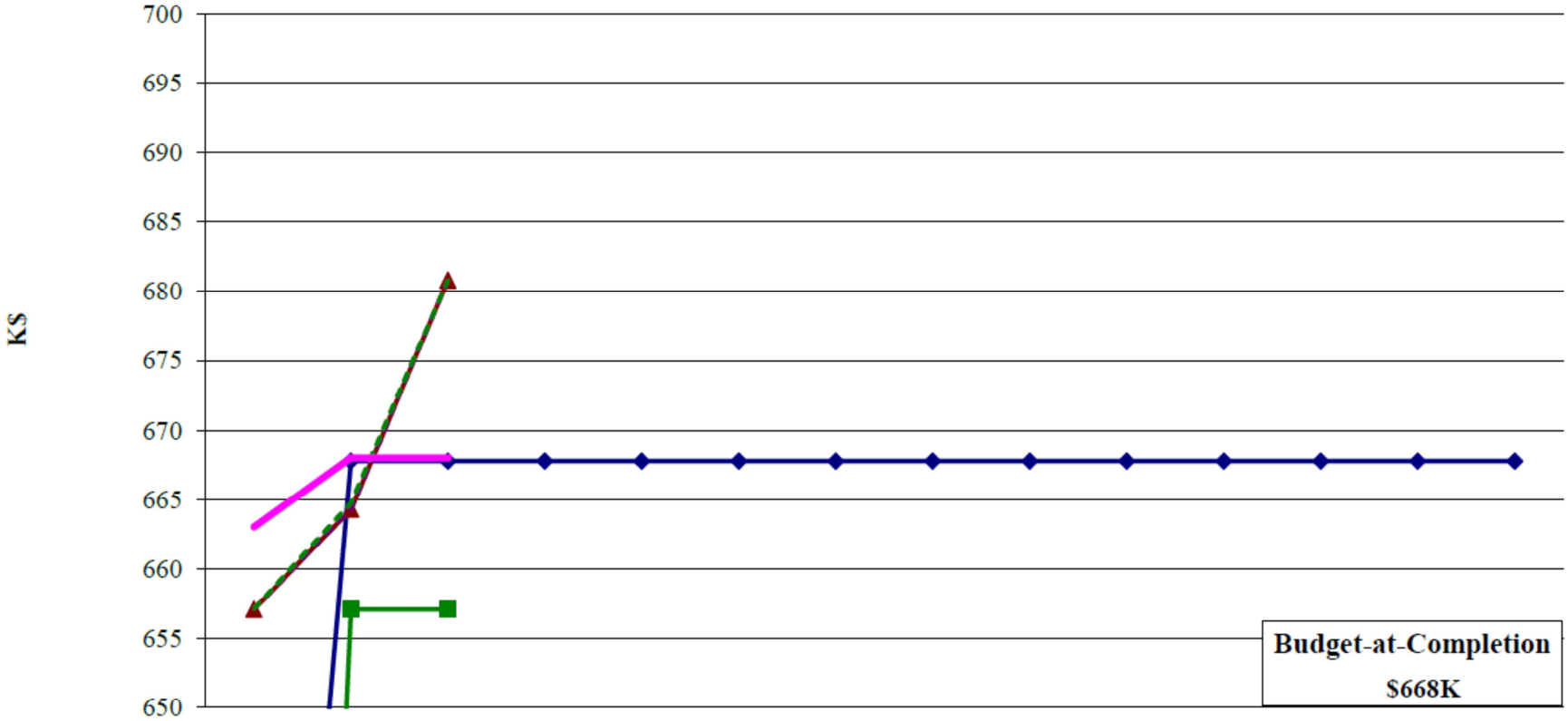
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	92,371	99,975	100,695	101,432	101,721	101,927	102,014	102,073	102,573	102,899	102,961	103,204	103,670	103,695
BCWP	89,492	99,928	100,465											
ACWP	99,290	100,024	100,422											
Obligated	101,321	101,945	102,158											
Pending	101,333	102,045	102,165											
Funding	102,054	102,698	102,698											

12 GeV 1.4 Construction Upgrade Hall A, B & C
Earned Value $K



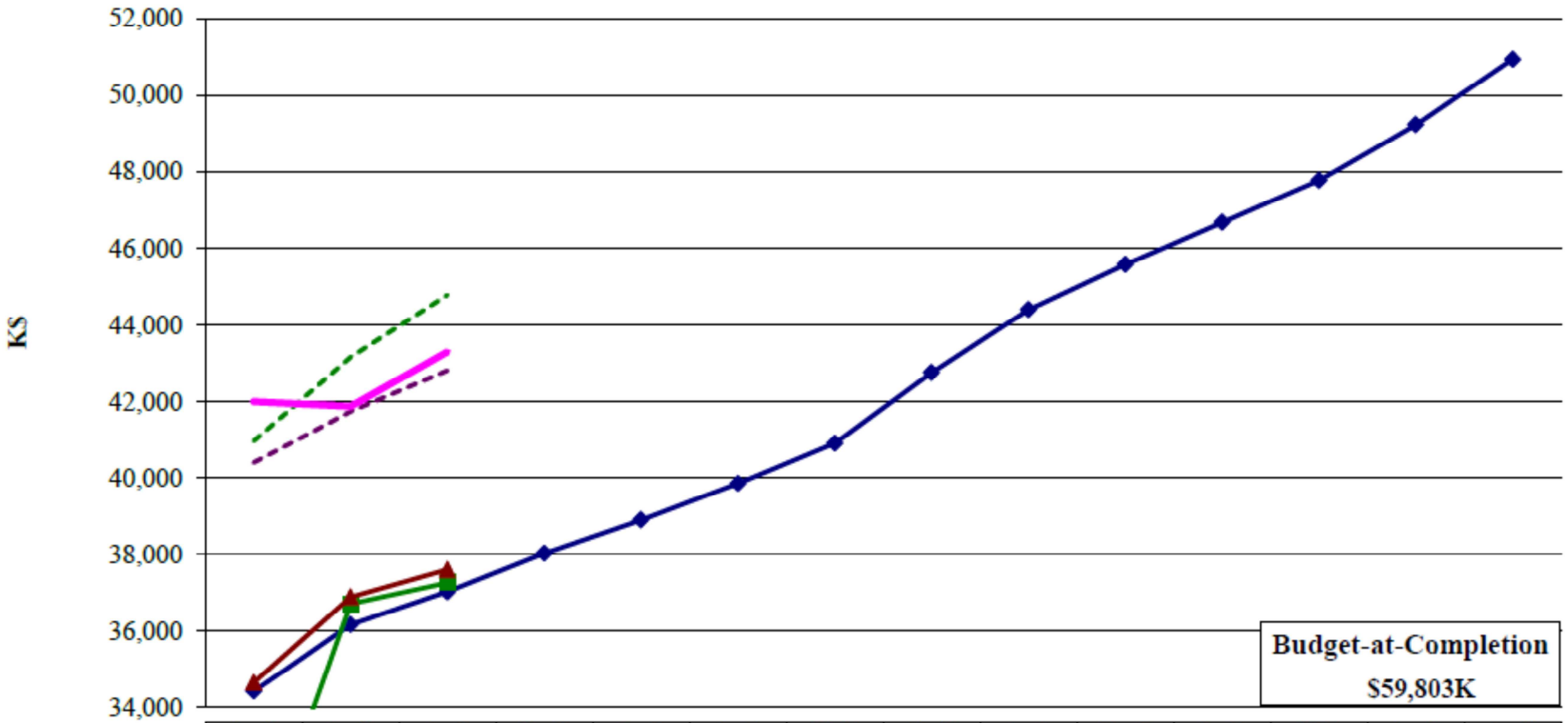
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	56,967	54,257	56,013	57,860	59,044	60,591	62,112	64,901	67,537	69,017	70,568	72,153	73,925	76,533
BCWP	45,759	55,021	56,571											
ACWP	52,408	55,279	57,057											
Obligated	64,464	66,033	66,261											
Pending	65,124	67,491	69,001											
Funding	66,163	66,788	66,788											

12 GeV 1.4.1 Construction Hall A
Earned Value $K



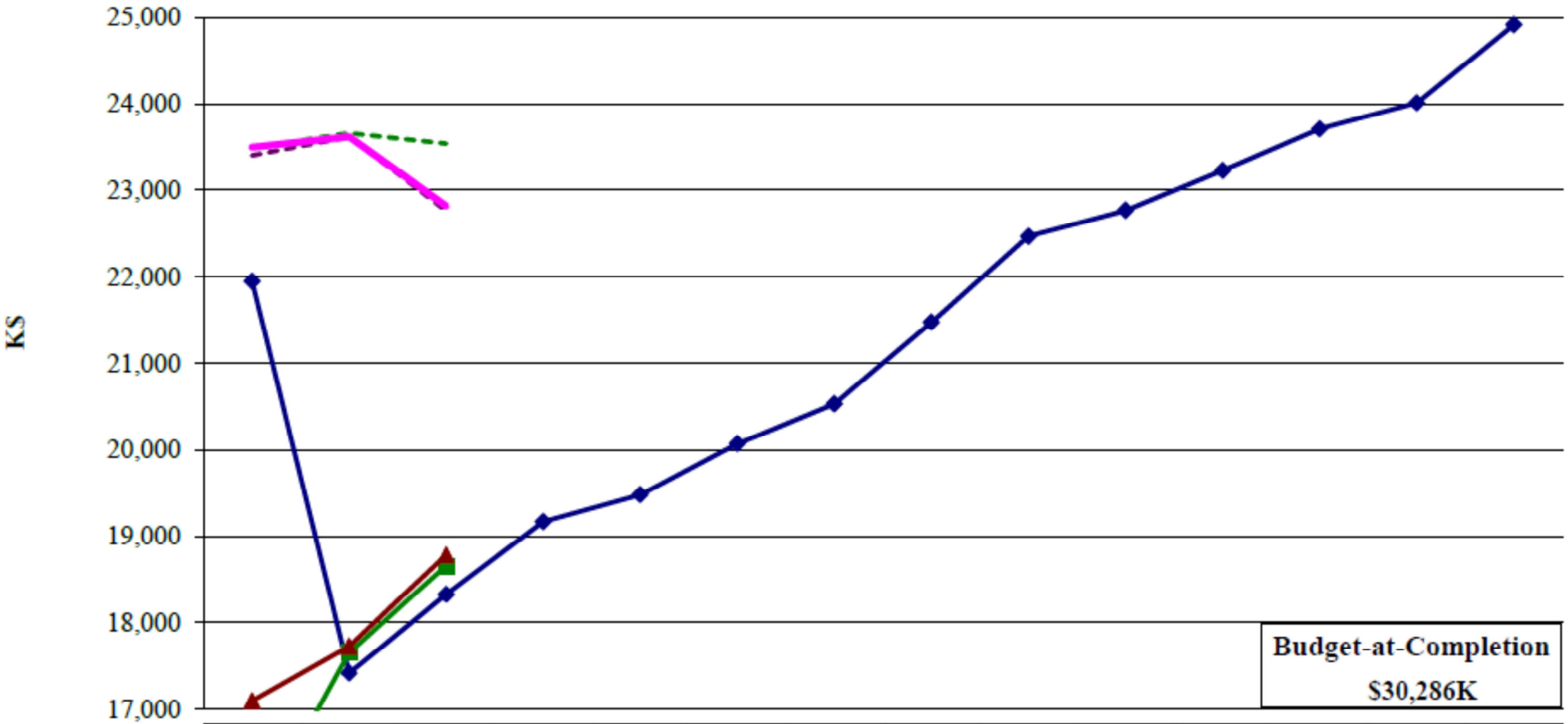
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	588	668	668	668	668	668	668	668	668	668	668	668	668	668
BCWP	505	657	657											
ACWP	657	664	681											
Obligated	657	664	681											
Pending	657	665	681											
Funding	663	668	668											

12 GeV 1.4.2 Construction Hall B
Earned Value $K



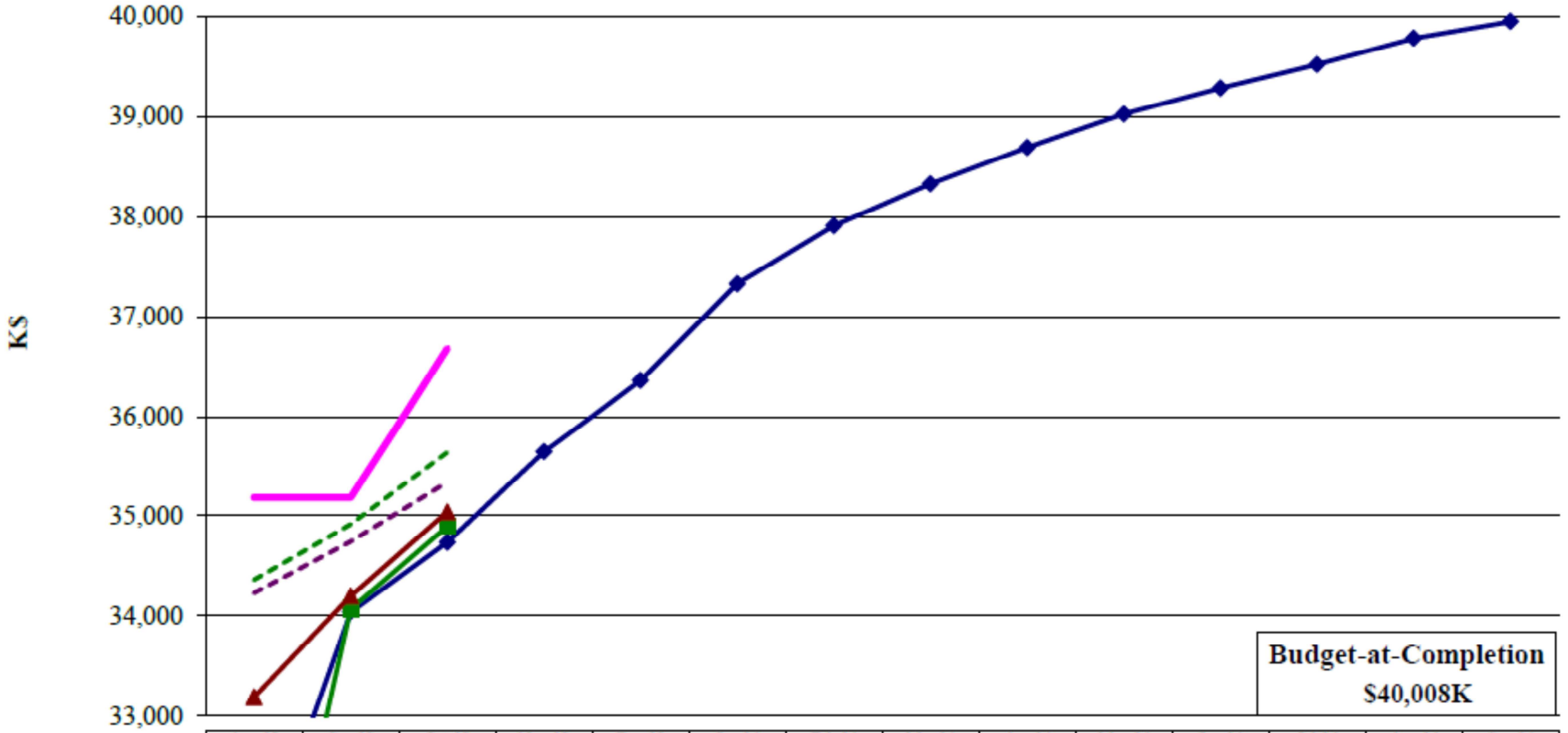
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	34,429	36,171	37,024	38,026	38,896	39,852	40,915	42,758	44,396	45,577	46,672	47,773	49,243	50,946
BCWP	29,635	36,709	37,262											
ACWP	34,659	36,890	37,601											
Obligated	40,405	41,749	42,813											
Pending	40,971	43,164	44,779											
Funding	42,000	41,875	43,300											

12 GeV 1.4.3 Construction Hall C
Earned Value $K



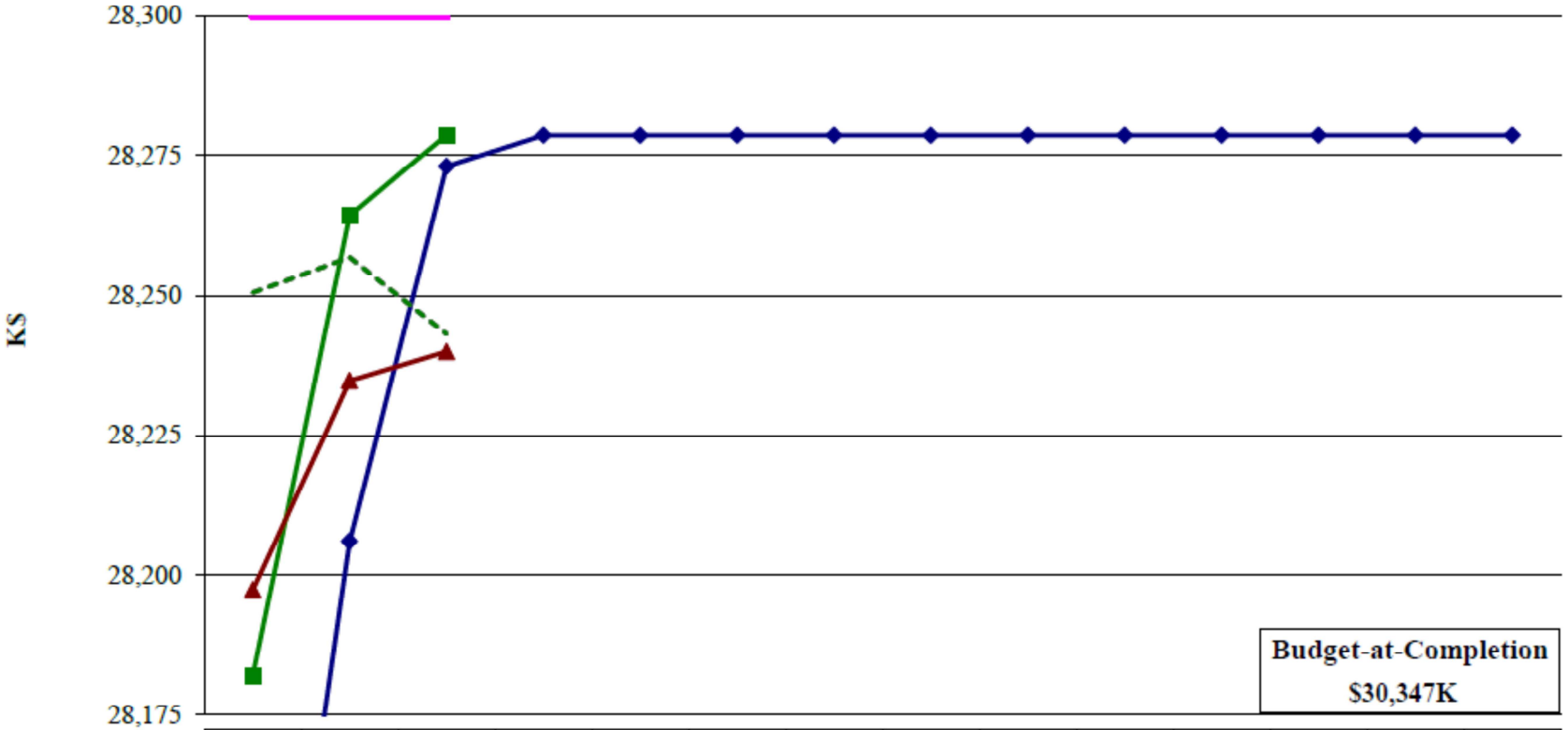
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	21,950	17,417	18,322	19,167	19,480	20,071	20,529	21,475	22,474	22,772	23,228	23,712	24,015	24,920
BCWP	15,619	17,654	18,652											
ACWP	17,093	17,725	18,776											
Obligated	23,403	23,619	22,767											
Pending	23,495	23,662	23,541											
Funding	23,500	23,620	22,820											

12 GeV 1.5 Construction Hall D
Earned Value $K



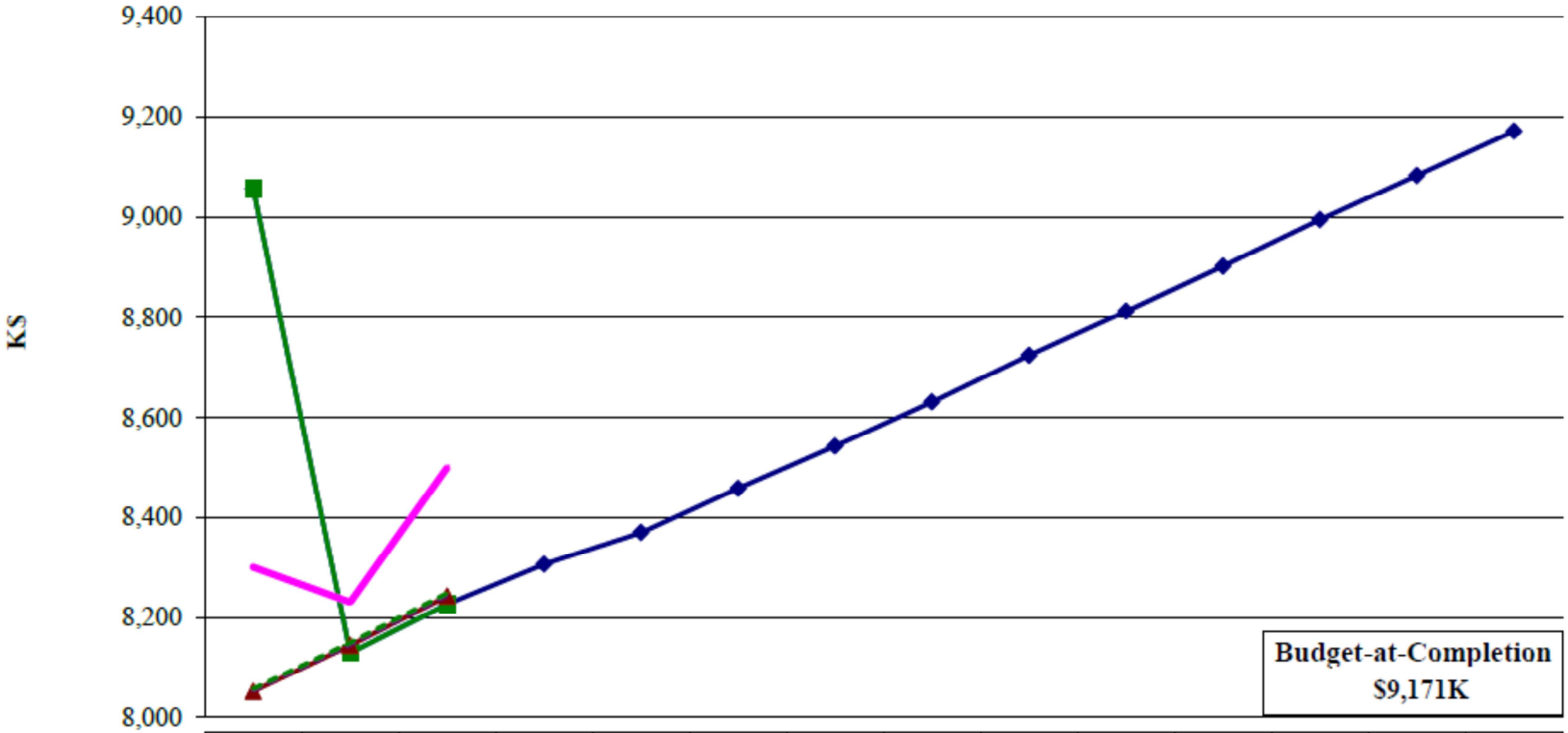
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	31,344	34,038	34,735	35,646	36,362	37,328	37,907	38,326	38,688	39,024	39,282	39,518	39,779	39,946
BCWP	29,803	34,070	34,894											
ACWP	33,187	34,197	35,038											
Obligated	34,229	34,744	35,337											
Pending	34,361	34,915	35,641											
Funding	35,183	35,183	36,683											

12 GeV 1.6 Construction Conventional Facilities
Earned Value $K



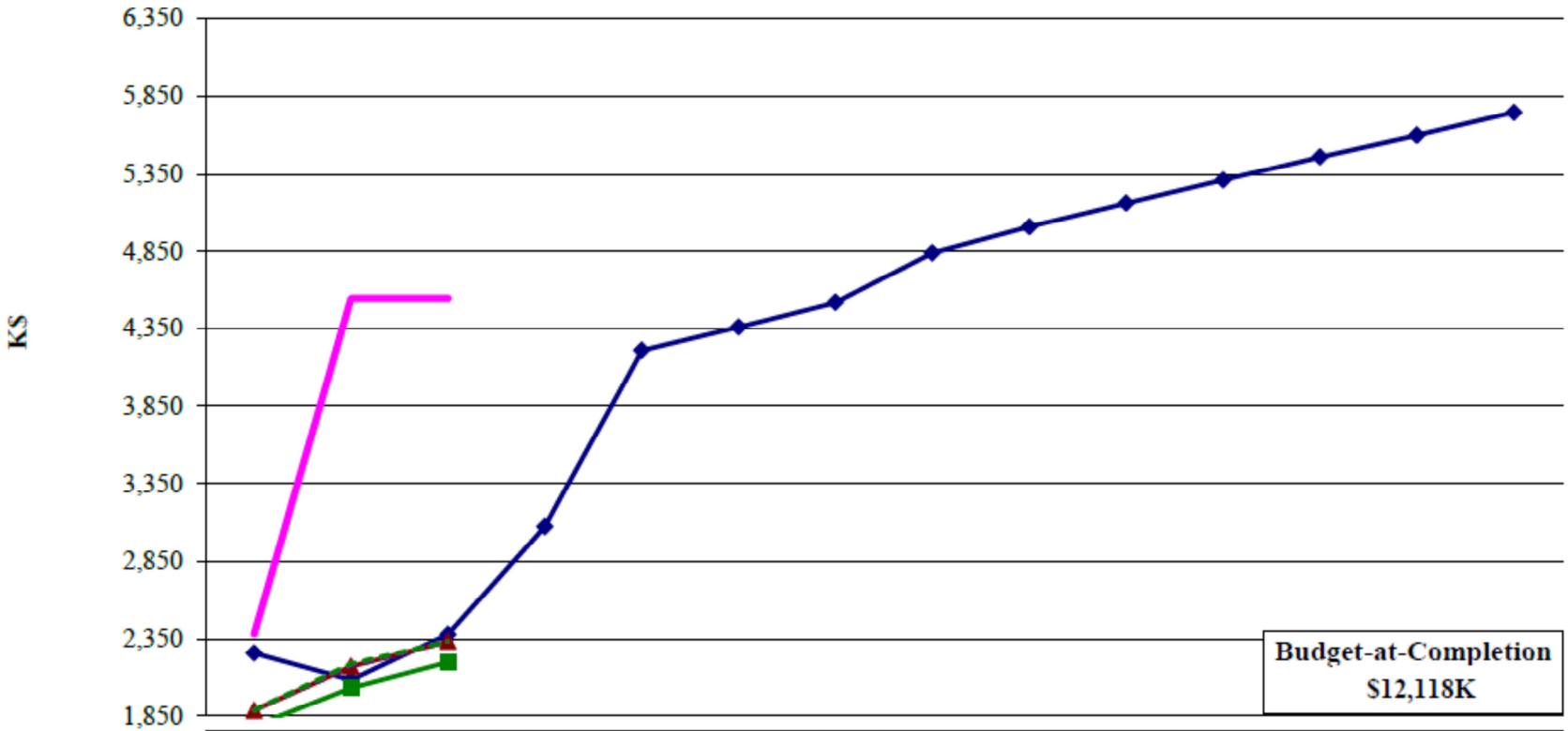
	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	28,087	28,206	28,273	28,279	28,279	28,279	28,279	28,279	28,279	28,279	28,279	28,279	28,279	28,279
BCWP	28,182	28,264	28,279											
ACWP	28,197	28,235	28,240											
Obligated	28,250	28,257	28,243											
Pending	28,250	28,257	28,243											
Funding	28,300	28,300	28,300											

12 GeV 1.7 Construction Project Management
Earned Value $K



	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	9,056	8,129	8,226	8,306	8,369	8,458	8,542	8,631	8,724	8,812	8,901	8,994	9,083	9,171
BCWP	9,056	8,129	8,226											
ACWP	8,051	8,143	8,242											
Obligated	8,053	8,145	8,243											
Pending	8,056	8,149	8,248											
Funding	8,300	8,230	8,500											

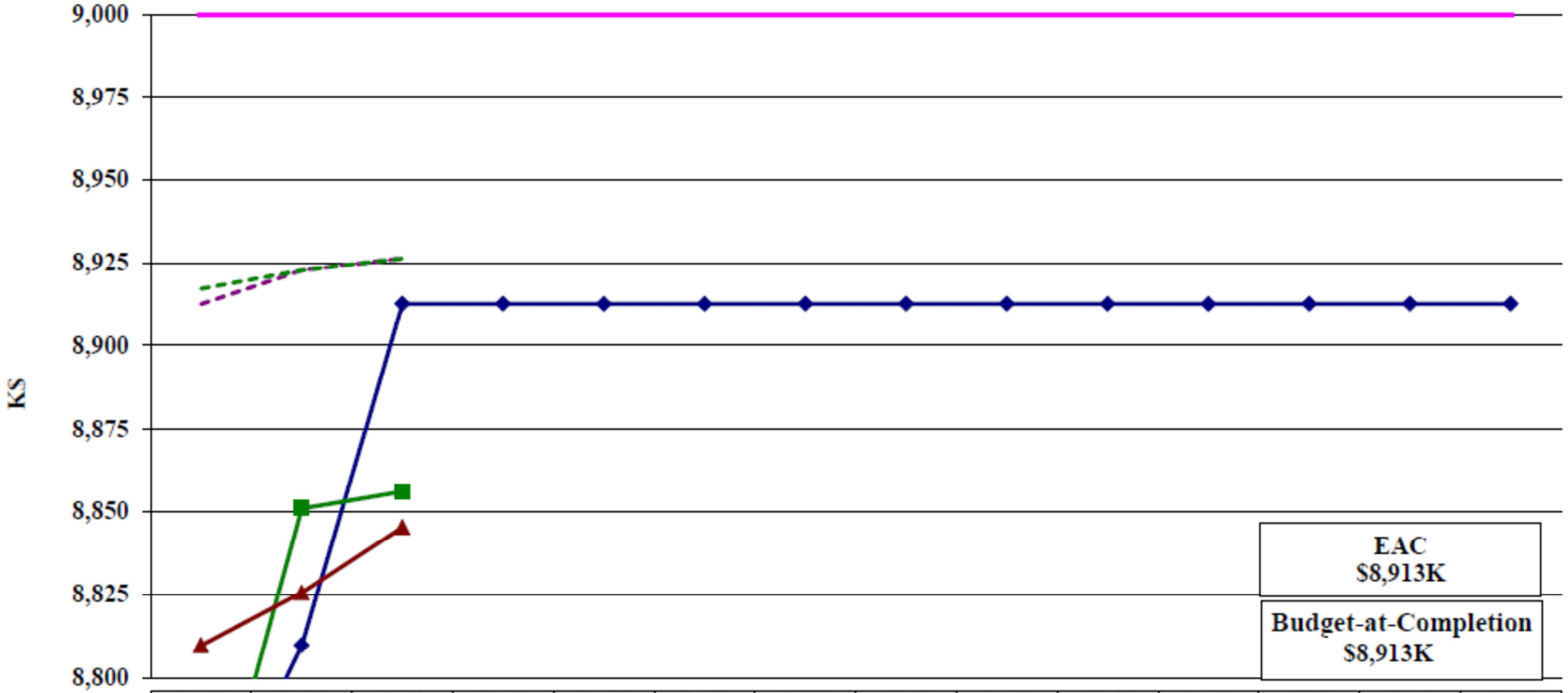
12 GeV 1.8 Construction Pre-Ops
Earned Value $K



	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	2,257	2,083	2,378	3,076	4,208	4,358	4,517	4,839	5,008	5,161	5,311	5,459	5,596	5,743
BCWP	1,783	2,032	2,197											
ACWP	1,885	2,170	2,332											
Obligated	1,886	2,170	2,333											
Pending	1,886	2,187	2,333											
Funding	2,382	4,543	4,543											

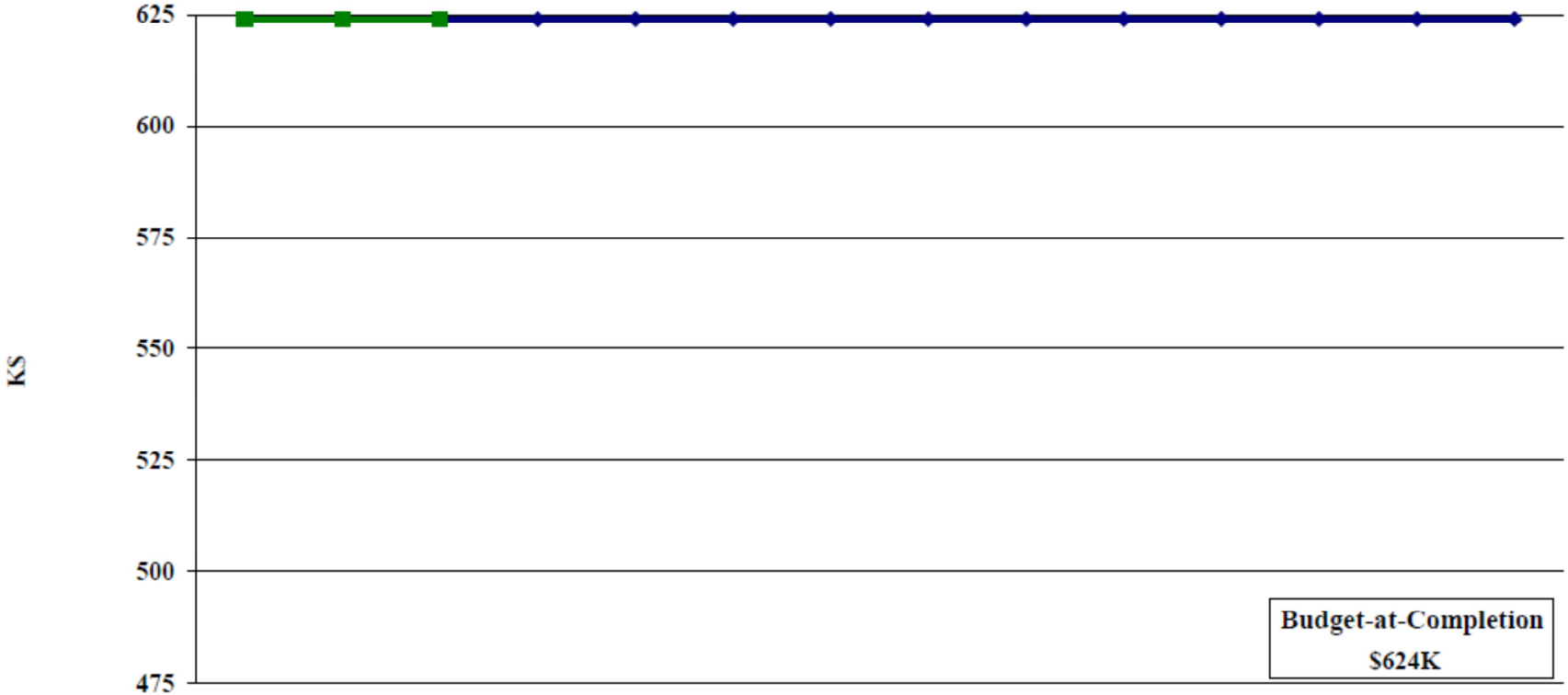
12 GeV 1.9 Work for Others

Earned Value $K

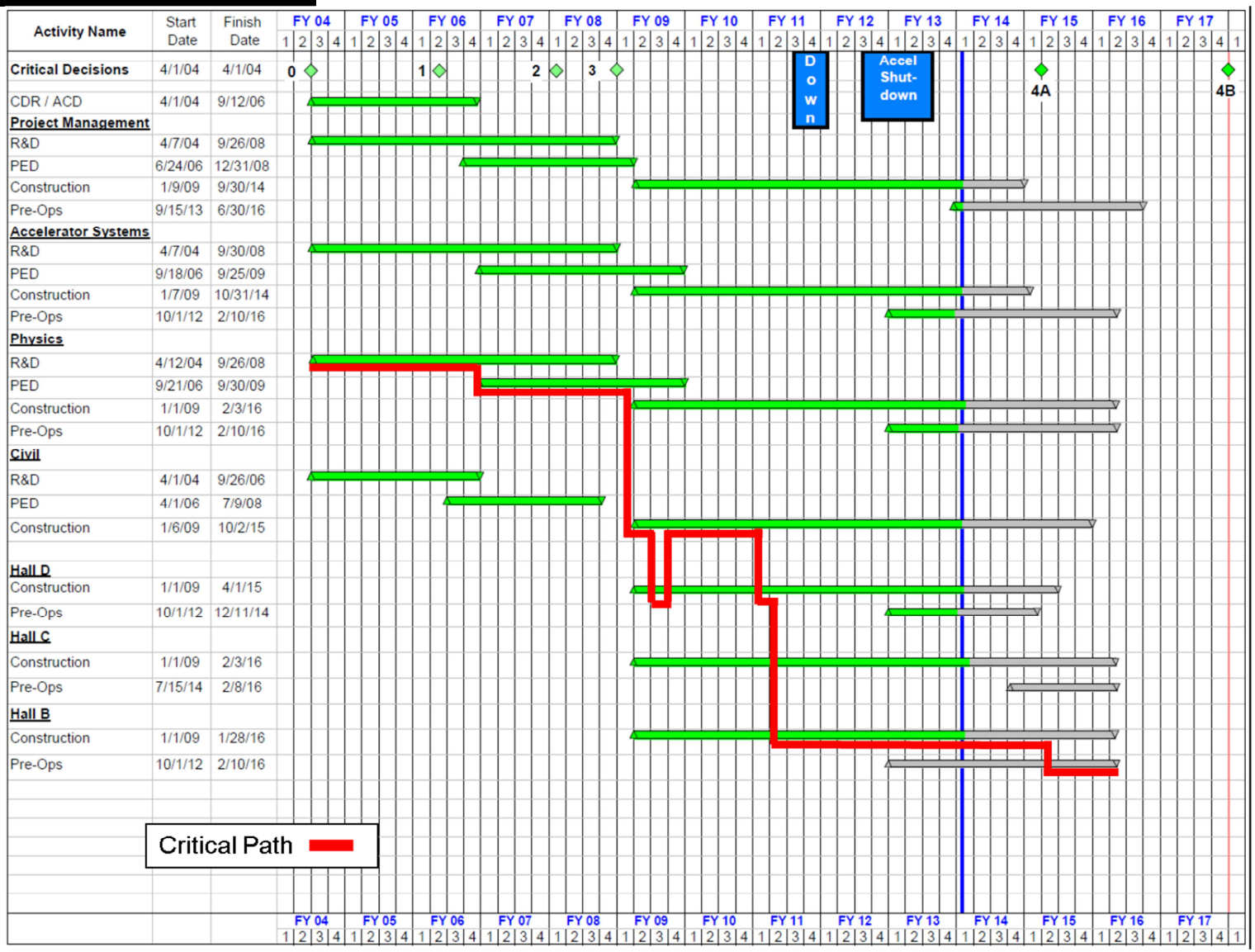


	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	8,747	8,810	8,913	8,913	8,913	8,913	8,913	8,913	8,913	8,913	8,913	8,913	8,913	8,913
BCWP	8,741	8,851	8,856											
ACWP	8,810	8,825	8,845											
Obligated	8,913	8,923	8,926											
Pending	8,917	8,923	8,926											
Funding	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000

12 GeV 1.10 Non-DOE Scope
Earned Value $K



	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
BCWS	624	624	624	624	624	624	624	624	624	624	624	624	624	624
BCWP	624	624	624											


Activity Name
Start Date
Finish Date
FY 04
FY 05
FY 06
FY 07
FY 08
FY 09
FY 10
FY 11
FY 12
FY 13
FY 14
FY 15
FY 16
FY 17
Critical Decisions 4/1/04 4/1/04
0
1
2
3
Down
Accel Shut-down
4A
4B
CDR / ACD 4/1/04 9/12/06
Project Management
R&D 4/7/04 9/26/08
PED 6/24/06 12/31/08
Construction 1/9/09 9/30/14
Pre-Ops 9/15/13 6/30/16
Accelerator Systems
R&D 4/7/04 9/30/08
PED 9/18/06 9/25/09
Construction 1/7/09 10/31/14
Pre-Ops 10/1/12 2/10/16
Physics
R&D 4/12/04 9/26/08
PED 9/21/06 9/30/09
Construction 1/1/09 2/3/16
Pre-Ops 10/1/12 2/10/16
Civil
R&D 4/1/04 9/26/06
PED 4/1/06 7/9/08
Construction 1/6/09 10/2/15
Hall D
Construction 1/1/09 4/1/15
Pre-Ops 10/1/12 12/11/14
Hall C
Construction 1/1/09 2/3/16
Pre-Ops 7/15/14 2/8/16
Hall B
Construction 1/1/09 1/28/16
Pre-Ops 10/1/12 2/10/16
Critical Path

Cost/Schedule Assessment

October 2013 NP Project Performance	AYK$
Total Project Cost (TPC)	**$338,000**
% Planned (Cumulative)	82.4%
% Complete (Cumulative)	82.5%
Funding Received	**$284,476**
Cost and Commitments to Date (does not include out year contractual phases)	$274,064
Pending	$2,088
Approved Baseline Funding	$338,000
Work Remaining (BCWP Remaining)	$55,499
DOE Held Contingency	$19,602
Contingency as % of ETC_{ob}	45.3%

Project Status

The rebaseline of the 12 GeV Upgrade Project was approved effective September 1, 2013 with implementation complete by September 30, 2013. The cost is consistent with a Total Estimated Cost (TEC) of $310.5M and a Total Project Cost (TPC) of $338M. The CD-4A milestone was unchanged; the CD-4B milestone was shifted to September 2017. All costs are in actual-year dollars and out-year costs are escalated.

The cost and schedule indices as of October 31, 2013, are 1.00 and 1.00 respectively.

Overall Cost/Schedule Assessment

The project had one change request (CR) at Level 3 approved and implemented during the month of October. No Level 1, no level 2, one Level 3, no Level 4 and no Level 5 change requests were approved and implemented.

- CR14-001, $16K, Annual Admin Costbook to Reflect FY13 Actuals and Commitments; Escalate Costbook, P6 and Cost Manager to FY14$: This Level 3 change request absorbs into the EAC, the cost and obligation variances incurred to date.

Jefferson Lab
Thomas Jefferson National Accelerator Facility

Milestone Performance

Level and Number	Milestone Description	Baseline	Projected	Actual
2-18	Preliminary Hazard Assessment Submitted to DOE	Jun-05		Jun-05
2-19	Environmental Assessment Completed	Jan-07		Jan-07
2-04	Design Report on Superconducting Magnets	Sep-07		Sep-07
2-20	Completion of Land Transfer	Jun-07		Oct-07
2-21	PEP Issued	Sep-07		Nov-07
2-22	OECM EVMS Contractor Certification Review Complete	Jan-08		Dec-07
2-23	Accelerator Safety Envelope (ASE) Completed	Jun-08		Jun-08
2-24	Safety Assessment Document (SAD) Completed	Jun-08		Jun-08
2-05	Design Review of Superconducting Magnet	Jul-08		May-08
2-14	Design of Conventional Facilities Completed	Sep-08		Sep-08
2-06	Award First Superconducting Magnet Contract	Jul-09		Jul-09
2-15	Ready for Equipment – CHL Addition (RFE)	Sep-10		May-10
2-16	Ready for Equipment – Hall D (RFE)	Nov-10		Dec-10
2-10	Start Hall D Installation	Nov-10		Nov-10
2-01	Klystron Mass Production Authorization	Jun-11		Mar-11
2-17	Accelerator Tunnel Extension Completed	Jul-12		Nov-11
2-02	Start Accelerator Installation Shutdown	Aug-12		May-12
2-07	Start Installation for Existing Halls	Jul-12		Jun-12
2-11	Installation of Hall D Solenoid Completed	Jun-13		Aug-13
2-08	Halls A Equipment Installation Completed	Dec-13	Dec-13	
2-03	Accelerator Commissioned	Sep-14	Sep-14	
2-09	Hall A Beam Commissioning Completed	Mar-14	Mar-14	
2-12	Hall D Equipment Installation Completed	Sep-14	Sep-14	
2-28	Hall C HB Magnet Delivered	Sep-14	Sep-14	

Level and Number	Milestone Description	Baseline	Projected	Actual
2-34	Hall B Torus Cold Mass Delivered	Sep-14	Sep-14	
2-25	Box Supply Installation Complete	Oct-14	Oct-14	
2-27	Hall C Q1 Magnet Delivered	Oct-14	Oct-14	
2-13	Hall D Beam Commissioning Completed	Dec-14	Dec-14	
2-35	Hall B Solenoid Cryostated Coil Delivered	Dec-14	Dec-14	
2-29	Hall C Dipole Magnet Delivered	Jun-15	Jun-15	
2-30	Hall C Q2 Magnet Delivered	Jul-15	Jul-15	
2-31	Hall C Q3 Magnet Delivered	Aug-15	Aug-15	
2-32	Hall C Equipment Installation Complete	Dec-15	Dec-15	
2-36	Hall B Equipment Installation Complete	Dec-15	Dec-15	
2-38	Conventional Facilities Complete	Dec-15	Dec-15	
2-33	Hall C Beam Commissioning Complete	Mar-16	Mar-16	
2-37	Hall B Beam Commissioning Complete	Mar-16	Mar-16	

Jefferson Lab
Thomas Jefferson National Accelerator Facility

Summary of Key Activities: Next 90 Days

Date	Activity
November 2 – 8, 2013	Magnet Vendor Visit: Sigma Phi
November 4 & 5, 2013	Magnet Vendor Visit: AES
November 5 & 6, 2013	Magnet Vendor Visit: MSU
November 8, 2013	DOE Monthly Video Conference
November 11 – 15, 2013	Magnet Vendor Visit: AES
November 12 & 13, 2013	Project Review of the SHMS Dipole FEA
November 18 – 23, 2013	Magnet Vendor Visit: Sigma Phi
November 20 – 22, 2013	Magnet Vendor Visit: FNAL
December 2, 2013	Project Review of Hall B Magnet Cryogenics
December 2 – 7, 2013	Magnet Vendor Visit: AES
December 2- 12, 2013	Magnet Vendor Visit: Sigma Phi
December 3 – 4, 2013	Magnet Vendor Visit: MSU
December 4, 2013	FNAL Torus Manufacturing Readiness Review
December 5, 2013	Magnet Vendor Visit: AES
December 6, 2013	Magnet Vendor Visit: ETI
December 9, 2013	DOE OPA Independent Lehman Mini-Review
December 10 & 11, 2013	Director's Progress Review of the 12 GeV SC Magnet Acquisitions
December 10 – 13, 2013	Magnet Vendor Visit: Sigma Phi
December 14 – 19, 2013	Magnet Vendor Visit: SMI

GLOSSARY

Actual Cost of Work Performed (ACWP) – Actual cost reported through the 12 GeV CEBAF Upgrade cost accounting systems, plus any accruals, for a specific WBS#, subproject, or project.

Budget Authority (BA) – Cumulative funds currently allocated and authorized by the Department of Energy that may be committed and spent by 12 GeV CEBAF Upgrade for project-related activities.

Budget at Completion (BAC) – The total budgeted cost at completion for a given WBS, subproject, or project. BAC is the budgeted cost of the project excluding contingency.

Budgeted Cost of Work Performed (BCWP) – Budgeted value of planned work for a WBS#, subproject, or project physically accomplished.

Budgeted Cost of Work Schedule (BCWS) – Budgeted value of planned work time-phased to the schedule for a specific WBS#, subproject or project.

Commitments – Funds allocated to subcontractors where work has been authorized but not yet expensed.

Cost Performance Index (CPI) – The ratio of the value of the work performed to actual cost; CPI = BCWP/ACWP. Values less than 1.0 represent "cost overrun" condition, and values greater than 1.0 represent "cost underrun" condition.

Cost Variance (CV) – Difference between the estimated value of the physical work performed and the actual cost expended for a specific WBS#, subproject, or project. CV = BCWP-ACWP. A negative result is unfavorable and indicated the potential for a cost overrun.

Estimate at Completion (EAC) – Forecast of the final cost for a specific WBS#, subproject, or project based on the current ACWP plus a management assessment of the cost to complete the remaining scope of work.

Estimate to Complete (ETC) – A realistic appraisal of the cost to complete the remaining scope of work.

Independent Estimate at Completion (IEAC) – Computer forecast of the final cost:
IEAC = BAC/CPI.

Other Project Cost (OPC) – 12 GeV CEBAF Upgrade "supporting" costs not directly contributing to the construction project. OPC costs generally include research and development and pre-operation (start-up) activities.

Pending – Purchase requisitions that have not been obligated through the purchasing system.

Percent Complete – The ratio of the work accomplished (earned-value) to the Budget at Completion for any WBS#, subproject, or project, % Complete = $BCWP_{CUM}$/BAC.

Percent Contingency Remaining – The ratio of unallocated Contingency divided by the Estimate to Complete (ETC).

Percent Planned – The ratio of the current plan to the Budget at Completion. % Planned = BCWS/BAC.

Project Engineering and Design (PED) – Funding used to support the engineering and design effort for the 12 GeV CEBAF Upgrade.

Schedule Performance Index (SPI) – The ratio of the value of work performed to work scheduled, SPI = BCWP/BCWS. Values less than 1.0 represent a "behind schedule" condition, and values greater than 1.0 represent "ahead of schedule" condition.

Schedule Variance (SV) – Difference between the value of the physical work performed and the value of the work planned (scheduled). SV = BCWP-BCWS. A negative result is unfavorable and indicates a behind schedule condition.

Total Estimated Cost (TEC) – The total capital budget authorized for the 12 GeV CEBAF Upgrade project for the construction phase of the project. TEC includes contingency but does not include OPC.

Total Project Cost (TPC) – The total capital budget authorized for the 12 GeV CEBAF Upgrade project, including TEC and OPC.

Work Breakdown Structure (WBS) – A method of hierarchically numbering tasks in a traditional outline numbering format. The WBS provides a basis for the 12 GeV CEBAF Upgrade work plan which is used to track all resources, schedules, and cost.