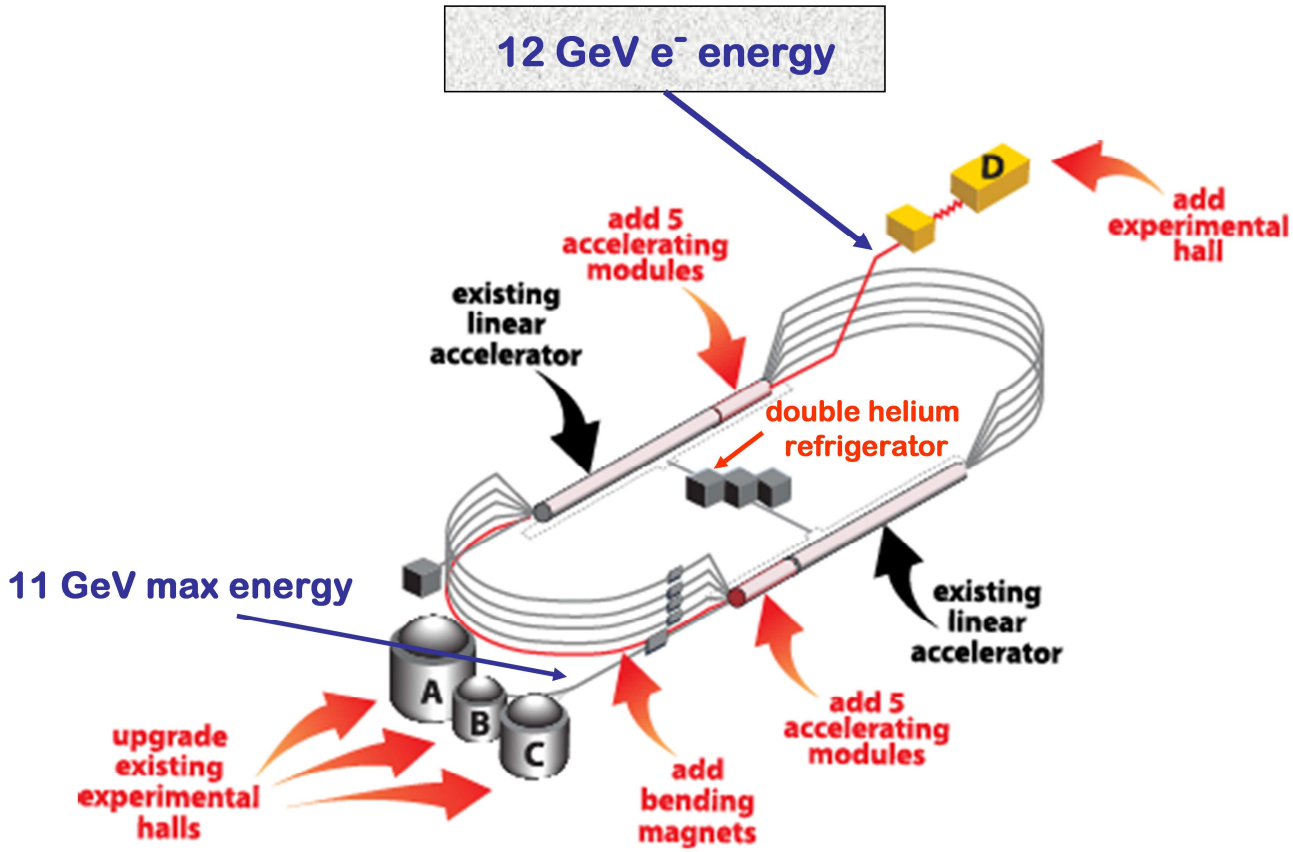
Jefferson Lab
Thomas Jefferson National Accelerator Facility

# 12 GeV CEBAF Upgrade
## Monthly Report
September 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 45.8% (percentage of ETC). Contingency plus Management Reserve is $20.4M. Construction is 82.3% complete. $239.1M 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).

At the request of DOE's Office of Nuclear Physics, Daniel Lehman, director of the Office of Project Assessment in DOE's Office of Science, convened a Mini-Independent Project Review of the 12 GeV CEBAF Upgrade Project at the DOE Office in Germantown, MD on August 9th. Following the Jefferson Lab response to Recommendations regarding additional cost and schedule risk mitigation for superconducting magnets, an ESAAB meeting was held on September 4, 2013 and the project rebaseline was approved effective September 1, 2013. Implementation of the revised project plan was completed by the end of the month.

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 = 81.5%

OPC SPI = 1.00
OPC CPI = 0.99
PERCENTAGE COMPLETE = 55.4%

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

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 82.3%
% OBLIGATED INCLUDING PHASED AND
AWAITING FINAL CONTRACT APPROVAL = 87.6%, $240.1M
FUNDING TO DATE = $274.0M

**Risk Assessment:**

As of the end of September, 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). The High risks associated with the FY12 funding allocation impact and the Hall D solenoid have been retired.

High Risks:

The FY12 funding allocation for the Project was $50M, a reduction of $16M from the baseline plan. This had represented a High risk to completion of the project on cost and on schedule. With the approval of the project rebaseline, this risk has been retired.

The potential for schedule risk to the 12 GeV Project, related to the refurbishment of the existing solenoid magnet, planned for Hall D, had been High. With the successful ramp of the magnet to a series of set points culminating in 1355A, this risk has been retired. An evaluation of the magnet refrigerator repair is underway, and may result in the development of a Moderate risk and related mitigation plan.

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. The pace of welding of the helium vessel is slower than planned. MSU has made arrangements for adding welders and inspectors and operating a second shift where possible.

- The process of attaching the coils to the yoke steel for Q1 continued but had to be suspended due to a problem fitting a support bracket for one of the coils. An analysis was done to determine whether the bracket could be adjusted or would have to be rebuilt. SigmaPhi completed winding the first layer of the Dipole prototype coil. The fabrication of the rest of the spacers is the rate-limiting step for the coil wind, with those required for the second layer now expected to arrive from the vendor on October 15. SigmaPhi began qualifying a second vendor for spacers; this can help on the planned schedule for the Quadrupoles but is not likely to help with the schedule for the Dipole. Analysis continued for the collaring process needed for the Dipole. Sigma Phi continued work on open issues from the Dipole FDR and made all submissions for the Quadrupole FDR, which is planned for October 2-3, 2013.

Dipole prototype wind.

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 vendor for the potting fixtures informed FNAL that the delivery of that fixture would be in early October. Test samples of multi-layer stacks of conductor with proposed final surface preparation were prepared. Procurements continued for the out-of-plane suspension system, thermal shield and outer vacuum jacket. The first coil case was completed at the vendor and sent to FNAL. Bids arrived for the outer vacuum jackets. The conductor soldering vendor operated the buffing line to buff the six completed reels of Torus conductor.

- Discussions continued with Everson Tesla, Incorporated (ETI) and have moved to issues that need to be settled before the Final Design Review. 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. Parametric studies continued at BNL. A trip to Tesla in the UK was made, as were two trips to Jefferson Lab by Everson senior engineers.

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. Manufacturing of the first five production SVT modules was completed at Fermi National Accelerator Laboratory (FNAL) (see photo below). Manufacturing designs were reviewed for the cooling plates and support structure to be used at Jefferson Lab to assemble the SVT barrel and the procurement was started.

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. Arc 1 PS achieved full voltage, full current operation, into a dummy load. Initial control power checks on Arc 2 were completed and it will undergo power testing in early October. Three power supplies are in transit by boat from the vendor, the Arc 4, Arc 5 and Hall A power supplies.

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.

# Project Management

**WBS 1.7 Construction**

**Highlights:**

As of September 30, 2013, 64 major procurements have been awarded.

Manufacturing of the first five production SVT modules was completed at Fermi National Accelerator Laboratory.

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 taking longer than expected. Vendor visits to SMI to assess progress on the Q1 magnet took place in September 2013; progress has slowed due to required analysis of holding brackets. SigmaPhi continues to wind the Dipole prototype coil, however the availability of spacers has slowed progress. Progress has been made resolving differences on the Dipole acceptance criteria. The FDR is being scheduled for early October.

For the Hall B torus magnet, Fermi National Accelerator Laboratory (FNAL) completed winding the first, practice, full double-pancake coil for the Torus. Discussions continued with Everson Tesla, Incorporated (ETI) on the Hall B Solenoid, and centers on issues that need to be settled before the Final Design Review. Parametric studies continued at BNL. A trip to Tesla in the UK was made, as were two trips to Jefferson Lab by Everson senior engineers.

At the request of DOE's Office of Nuclear Physics, Daniel Lehman, director of the Office of Project Assessment in DOE's Office of Science, convened a Mini-Independent Project Review of the 12 GeV CEBAF Upgrade Project at the DOE Office in Germantown, MD on August 9th. Following the Jefferson Lab response to Recommendations regarding additional cost and schedule risk mitigation for superconducting magnets, an ESAAB meeting was held on September 4, 2013 and the project rebaseline was approved effective September 1, 2013. Implementation of the revised project plan was completed by the end of the month.

All EVMS data shown in this Monthly Progress Report reflect performance against the rebaseline plan.

**Assessment and Issues:**

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 88.6%

# Accelerator Systems

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

**Highlights:**

Cryomodules: In-tunnel checkout of C100-10 was completed; it achieved 110MV. In-tunnel checkout of the final new cryomodule, C100-8, has been delayed for the cryogenics reconfiguration.

Power: NL26 completed cryomodule commissioning and final RF system optimization in September. The tenth and final RF zone, SL26, was undergoing cryomodule commissioning when CHL support was terminated as part of a scheduled reconfiguration.

Installation and testing of the Arc 1 and Arc 2 power supplies continued. Arc 1 PS achieved full voltage, full current operation, into a dummy load. Initial control power checks on Arc 2 were completed and it will undergo power testing in early October. Three power supplies are in transit by boat from the vendor, the Arc 4, Arc 5 and Hall A power supplies. By the end of September, the LAM 1 and LAM3 PS were in test.

Deliveries of the 20 amp trim power supplies remain on hold due to production problems at the vendor. Deliveries are being held at Jefferson Lab's request until the problems are corrected and fixes are implemented. It is believed that one of the problems has been corrected but validation of that result is still in progress.

The units required for the CD-4A beam commissioning goals are on hand. Hot check out (final QA plan) for both 10 and 20 amp trim systems is about to begin. The plan will confirm proper installation, do polarity checks and exercise power supplies into the magnet loads utilizing the control systems.

All cable pulls in the tunnel are now complete. Tunnel installation work (magnet hook-up) in the accelerator proper is virtually complete with only punch list items remaining. About 1/3 of the BSY tunnel work is complete as well. Installation and check out efforts have moved to the equipment service building with shunt installation and populating of trim racks being the main focus.

Cryogenics: The final scope for the Cryogenics system was completed.

Beam Transport: The injection line beam dump was reinstalled and aligned for vacuum hookup. Vacuum leak check was completed for the west spreader and west recombiner. Beamline installation was completed in the transport recombiner region. LCW plumbing and instrument air headers were installed on the Hall D beamline ramp. Final alignment of the RF separators and septa dipoles was completed in the extraction region.

Extraction: All scope has been completed.

Instrumentation, Controls and Safety Systems: Beam position monitors electronics fabrication continued. Electronics for the Hall D tagger beam dump are nearing completion. All PSS certifications for the CD-4A beam commissioning run have been completed. A problem was found with a component for the beam stopper for the Hall D tagger beam line; repairs are underway. Installation of the Hall D PSS system continued.

**Assessment and Issues:**

CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 96.3%

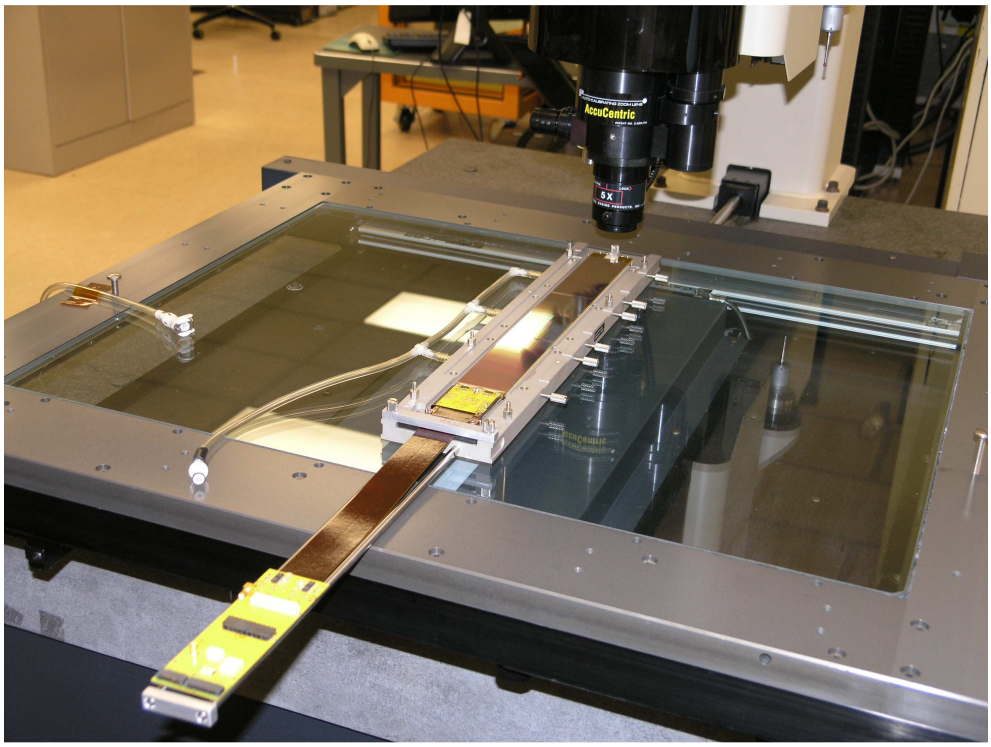
# Physics Systems

## WBS 1.4 and 1.5 Construction

**Highlights:**

**Hall A**
Work on the new optical system for the Compton polarimeter continued.

**Hall B**
Manufacturing of the first five production SVT modules was completed at Fermi National Accelerator Laboratory (FNAL) (see photo below). Manufacturing designs were reviewed for the cooling plates and support structure to be used at Jefferson Lab to assemble the SVT barrel and the procurement was started.



First SVT production module completed at FNAL.

The PCAL sixth sector was kept operating in the cosmic ray test stand to gain information on long term stability and a higher-statistics map of the sector's efficiency than measured during production testing. It is expected this test will end in October. The mounts for PCAL were added to the forward carriage in the Hall.

HV checks and wire end potting were done for fifth and sixth (final) sector of Region 1 at Idaho State University (ISU). Arrangements continued to ship the five completed R1 chambers (Sectors 2, 3, 4, 5 and 6) from ISU to Jefferson Lab.

Two Old Dominion University (ODU) technicians continued HV cabling for the four R2 sectors stored at Jefferson Lab. To date, three R3, three R2 and one R1 chambers have HV cables installed. The last two R2 chambers were shipped from ODU to Jefferson Lab (see photo).

R2 drift chamber from ODU arriving at Jefferson Lab.

Sense wire stringing was completed for Sector 5 of Region 3 at Jefferson Lab. Wire tension testing, window attachment, and wire potting were started for Sector 5. Construction of the box for Sector 6 is planned to start in October, when PCAL sectors are planned to start moving to Hall B, to have space. This is the last box to be built for the drift chambers. The R3 chamber stored in the EEL cleanroom will have to be moved to have space for constructing the Sector 6 box and for testing Sector 5. Arrangements were started to load test the strongback for Sector 6.

An acceptable coating for the mirror blanks of the High Threshold Cerenkov Counter (HTCC) was produced by the vendor. The procurement for the coatings will be revised to cover the changed masking method needed to coat the mirrors. The vendor demonstrated that multiple mirrors can be coated together. The fabrication work for the containment vessel frame continued, with all parts having arrived. Further parts for the support carriage for the HTCC arrived from the 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. Parts were ordered for mounting the FTOF-1a arrays on the forward carriage.

Re-polishing of the reformed downstream bent light guides for the central time of flight (CTOF) continued. Preparation of the orders for the various parts of the magnetic shielding for the PMTs began.

Vendor quotes were requested 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. A wavelength shifter overcoating is still planned. Vendor visits to make first tests were done, with further visits planned for October. Plans were reviewed for the machining required to reduce the size of the LTCC array boxes to fit the CLAS12 configuration.

Fermi National Accelerator Laboratory (FNAL) completed winding the first, practice, full double-pancake coil for the Torus. The vendor for the potting fixtures informed FNAL that the delivery of that fixture would be in early October. Regular visits and weekly videoconferences continued. Test samples of multi-layer stacks of conductor with proposed final surface preparation were prepared.

Procurements continued 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. The first coil case was completed at the vendor and sent to FNAL. Bids arrived for the outer vacuum jackets.

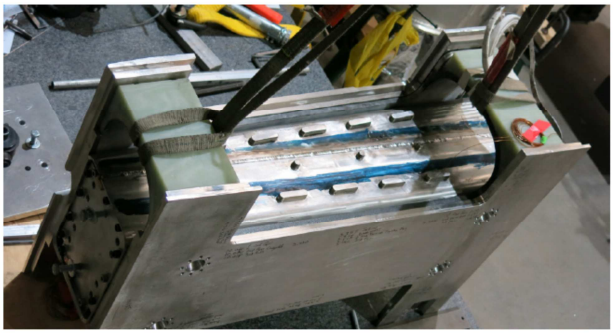
The conductor soldering vendor operated the buffing line to buff the six completed reels of Torus conductor. Work continued to change over the soldering line for the Solenoid conductor.

Discussions continued with Everson Tesla, Incorporated (ETI) and have moved to issues that need to be settled before the Final Design Review. 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. Results of conductor testing done for the Torus were communicated to ETI, because parameters determined there should be applicable for the Solenoid. Results from FNAL on winding and test potting with the Torus conductor were also communicated to ETI. 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. A trip to Tesla in the UK was made, as were two trips to Jefferson Lab by Everson senior engineers.

**Hall C**

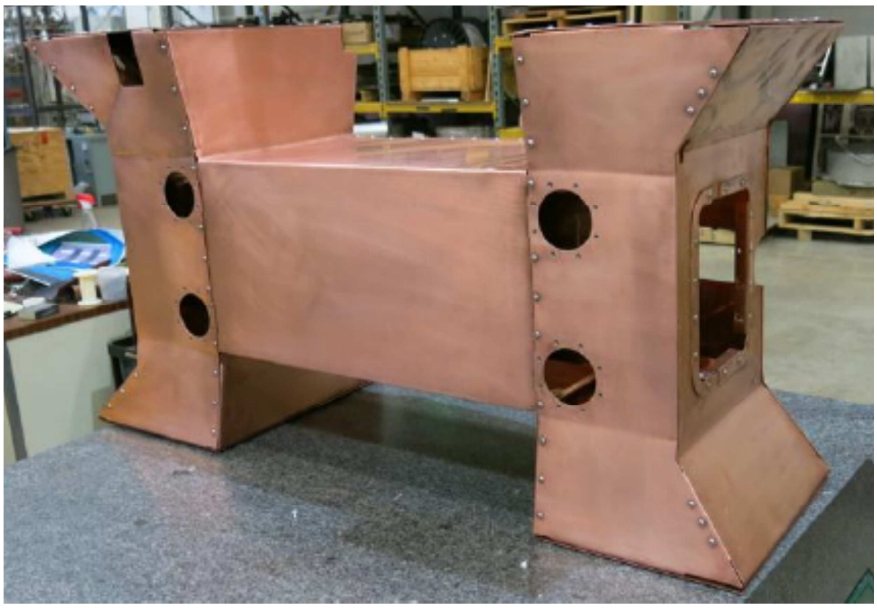
Frequent phone calls continued with the three magnet vendors. Welding, machining after welds, and leak checking of the HB helium vessel continued at MSU, with the side plates being added, the coil test fit, and sensors being installed.

A saddle-shaped magnet coil was test fitted into the helium vessel of the Horizontal Bend Superconducting Dipole Magnet (see photo to right).

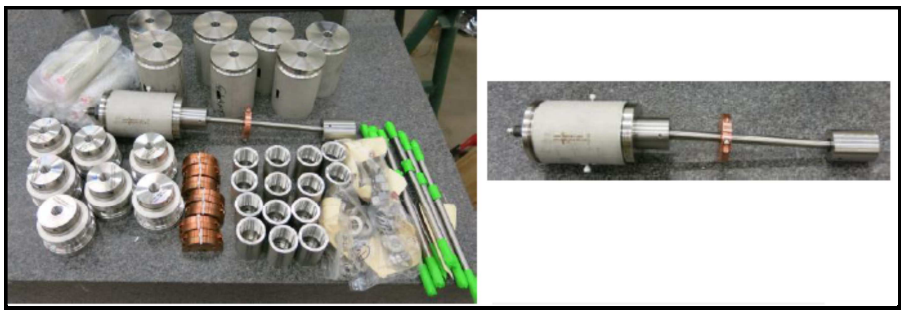


HB Magnet coil being test fitted.

The $LN_2$ thermal shield fabrication continued (see photo below). The critical path is still the helium vessel. The pace of welding of the helium vessel is slower than planned. MSU has made arrangements for adding welders and inspectors and operating a second shift where possible.



HB LN2 Shield preassembled.



HB Support-link parts and an assembled unit.

Top coil installed and undergoing hi-pot test.

The process of attaching the coils to the yoke steel for Q1 continued but had to be suspended due to a problem fitting a support bracket for one of the coils. This bracket links the clamps that cover the return ends of the coil to the main yoke, thus providing a key restraint for the coil ends when the magnet is powered; it experiences some of the highest stress relative to yield in the magnet. Bolt-hole positions in the as-built yoke and clamps did not permit attachment of the bracket. An analysis was done to determine whether the bracket could be adjusted or would have to be rebuilt. Fabrication of the helium vessel parts and outer vacuum cryostat parts continued at a subcontractor for SMI. Fit up and welding of these parts is nearing completion. Parts for the nitrogen shield are still arriving, delaying completion of this key part. This delay does not yet affect the overall critical path for Q1.

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

SigmaPhi completed winding the first layer of the Dipole prototype coil (see photo below). The fabrication of the rest of the spacers is the rate-limiting step for the coil wind, with those required for the second layer now expected to arrive from the vendor on October 15.

Dipole prototype wind.

SigmaPhi began qualifying a second vendor for spacers, a process that requires some 3 months; this can help on the planned schedule for the Quadrupoles but is not likely to help with the schedule for the Dipole. Analysis continued for the collaring process needed for the Dipole. Sigma Phi continued work on open issues from the Dipole FDR and made all submissions for the Quadrupole FDR, which is planned for October 2-3, 2013. A revised set of consolidation equipment with two heads and process automation machinery arrived and was assembled. A second winding table arrived and its assembly was started (see photo below).

Second winder (right side of photo) at SigmaPhi.

Work continued on the procurement for the contract modification needed to revise production costs and modify the intermediate schedule dates accordingly. SigmaPhi prepared conductor samples to measure conductor properties at 4.5°K, since these properties remain a source of disagreement. These samples were sent to CEA Saclay and first tests done but with inconsistent

results; the results are under study. SigmaPhi has arranged directly with ANSYS, the vendor of the FEA software used by both groups, to consult on the use of that software to perform non-linear FEA, to better compare with Jefferson Lab results. Jefferson Lab engaged outside reviewers to review Jefferson Lab's FEA work.

The vendor began forming and pouring the concrete for the SHMS shielding house work on-site (see photo). Procurements were continued for the gears, bearings and other specialty hardware for the shield house. Work started to refurbish and expand the transfer lines for cryogens inside Hall C to accommodate the SHMS.

Vendor forming and pouring concrete for SHMS shielding house.

**Hall D**

The fully assembled FDC was tested as a unit. The cradle to handle it in Hall D was prepared.

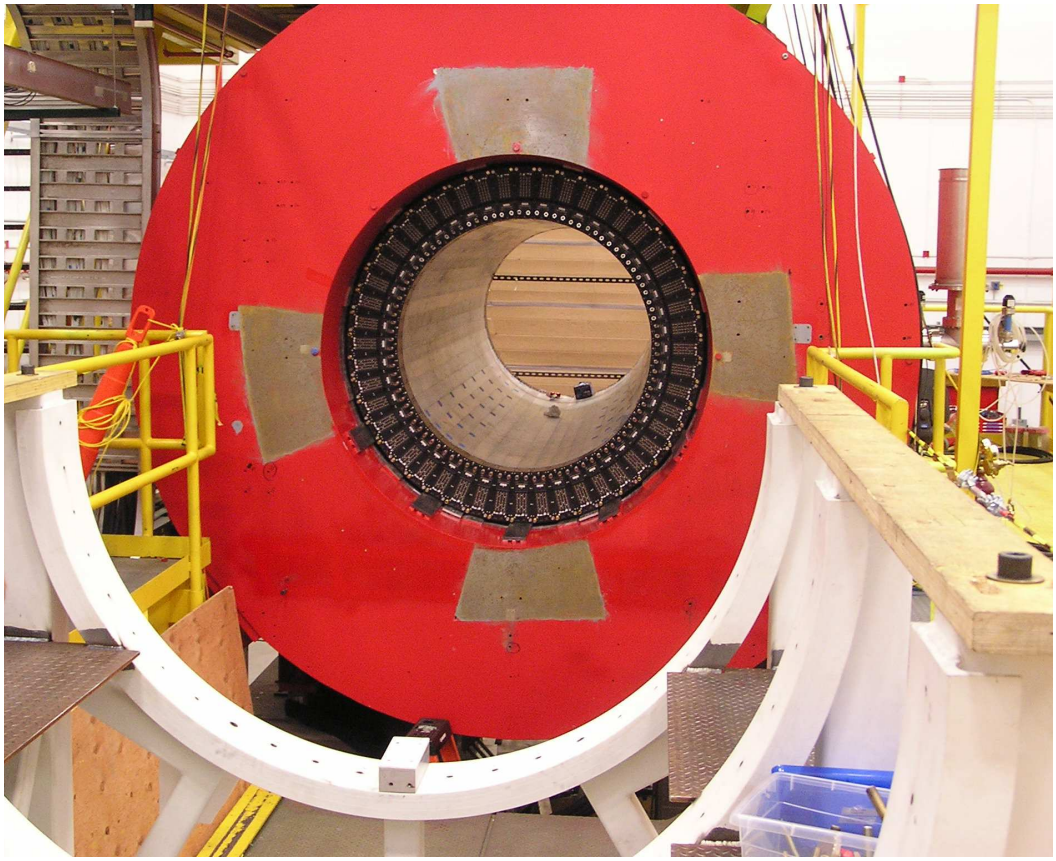
Tests for the Central Drift Chamber (CDC) continued at Carnegie Mellon University. These will continue until the chamber is shipped to Jefferson Lab in late CY2013.

Florida State University (FSU) continued attaching light guides to TOF scintillators. Delivery to Jefferson Lab by December is planned.

Procurements continued for the scintillators and light guides for the tagger hodoscope. A review was held of the work to date on assembly of the tagger hodoscope at Catholic University and acceptance testing procedures for finished units were established. 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 with U. Connecticut and the method of thinning these crystals (to 20 microns) was reviewed.

The full BCAL was inserted into the bore of the solenoid magnet (see photo below). Attachment of electronics and cables to the BCAL continued. Rack and electronics installation for the BCAL started. Checkout of the similar installed electronics for the FCAL continued.



Hall D solenoid detector installed.

Testing of completed Crate Trigger Processor (CTP) boards for Halls C and D continued. A significant number of non-working boards have been identified and are 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. First 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. The main rack power distribution panels were completed and routing of power wiring to racks began.

Further procurements were made for parts needed to assemble the hydrogen target. Mounts for solid targets were built. Work on gas distribution panels continued. Mapping fixtures for the tagger magnet were tested. Repairs were done on the power supply for the pair spectrometer magnet.

**Assessment and Issues:**

WBS 1.4 Halls A, B & C
CONSTRUCTION SPI = 1.01
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 60.6%

WBS 1.4.1 Hall A
CONSTRUCTION SPI = 0.98
CONSTRUCTION CPI = 0.99
PERCENTAGE COMPLETE = 98.4%

WBS 1.4.2 Hall B
CONSTRUCTION SPI = 1.01
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 61.4%

WBS 1.4.3 Hall C
CONSTRUCTION SPI = 1.01
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 58.3%

WBS 1.5, 1.9.5 and 1.9.7 Hall D
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 86.8%

WBS 1.5 Hall D - NP
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 85.2%

WBS 1.9.5 and 1.9.7 Hall D - VA
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 98.5%

# Conventional Facilities

## WBS 1.6 Construction

**Highlights:**
North and South Linac Service Building Air Conditioning Upgrades: The controls were completed. Water and air balancing were performed. Final inspection was held and substantial completion was established on September 17, 2013.

**Assessment and Issues:**

WBS 1.6, and 1.9.6 Civil
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 93.8%

WBS 1.6 Civil - NP
CONSTRUCTION SPI = 1.00
CONSTRUCTION CPI = 1.00
PERCENTAGE COMPLETE = 93.1%

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:**

See details in the Accelerator and Physics sections of this report.

**Assessment and Issues:**

WBS 1.8
CONSTRUCTION SPI = 0.98
CONSTRUCTION CPI = 0.94
PERCENTAGE COMPLETE = 16.8%

Jefferson Lab
Thomas Jefferson National Accelerator Facility

# COST PERFORMANCE REPORTS

| 12 GeV Cost/Schedule Status Report | | | | | | | | | | | | 30-Sep-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cumulative to Date ($K) | | | | | | | | | Independent | Contin. | |
| | Budgeted Cost | | Actual Cost | | | | | Budget At | Estimate At | Estimate At | & MR | |
| | Work | Work | Work | Variance | | Performance Indices | | Complete | Completion | Completion | % | % Complete |
| WBS | Scheduled | Performed | Performed | Schedule | Cost | SPI | CPI | ($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 | 99,975 | 99,928 | 100,024 | (47) | (97) | 1.00 | 1.00 | 103,729 | 103,729 | 103,830 | | 96% |
| 1.4 Construction Upgrade Halls A, B & C | 54,257 | 55,021 | 55,279 | 764 | (258) | 1.01 | 1.00 | 90,763 | 90,758 | 91,189 | | 61% |
| 1.4.1 Construction Upgrade Hall A | 668 | 657 | 664 | (11) | (7) | 0.98 | 0.99 | 668 | 668 | 675 | | 98% |
| 1.4.2 Construction Upgrade Hall B | 36,171 | 36,709 | 36,890 | 538 | (181) | 1.01 | 1.00 | 59,808 | 59,806 | 60,102 | | 61% |
| 1.4.3 Construction Upgrade Hall C | 17,417 | 17,654 | 17,725 | 237 | (71) | 1.01 | 1.00 | 30,287 | 30,284 | 30,408 | | 58% |
| 1.5 Construction Hall D | 34,038 | 34,070 | 34,197 | 32 | (127) | 1.00 | 1.00 | 40,008 | 40,007 | 40,157 | | 85% |
| 1.6 Construction Conventional Facilities | 28,206 | 28,264 | 28,235 | 58 | 30 | 1.00 | 1.00 | 30,348 | 30,345 | 30,316 | | 93% |
| 1.7 Construction Project Management | 8,129 | 8,129 | 8,143 | 0 | (15) | 1.00 | 1.00 | 9,171 | 9,171 | 9,188 | | 89% |
| **12 GeV Total Estimated Base Cost** | **245,598** | **246,405** | **246,873** | **808** | **(467)** | **1.00** | **1.00** | **295,013** | **295,004** | **295,673** | | **83.5%** |
| | | | | **Management Reserve** | | | | | **281** | **281** | 1% | |
| | | | | **IEAC Projected Variance** | | | | | **(0)** | **(23,669)** | 0% | |
| | | | | **DOE Held Contingency** | | | | | **15,215** | **15,215** | 44% | |
| | | | | **12 GeV Total Estimated Cost** | | | | | **310,500** | **287,500** | | |
| 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 | 2,083 | 2,032 | 2,170 | (51) | (138) | 0.98 | 0.94 | 12,118 | 12,118 | 12,118 | | 17% |
| **12 GeV Total Other Project Base Cost** | **12,580** | **12,528** | **12,666** | **(51)** | **(138)** | **1.00** | **0.99** | **22,614** | **22,615** | **22,614** | | **55.4%** |
| | | | | **Management Reserve** | | | | | **500** | **500** | 5% | |
| | | | | **IEAC Projected Variance** | | | | | **0** | **(4,999)** | 0% | |
| | | | | **DOE Held Contingency** | | | | | **4,385** | **4,385** | 43% | |
| | | | | **12 GeV Other Project Cost** | | | | | **27,500** | **22,500** | | |
| **12 GeV Total Project Cost** | **258,177** | **258,933** | **259,539** | **756** | **(605)** | **1.00** | **1.00** | **317,627** | **338,000** | **310,000** | **45.8%** | **81.5%** |

| | |
|---|---|
| Contingency | **44.1%** |
| Mgmt Reserve | **1.8%** |
| Contingency + Mgmt Reserve on Actual Costs | **34.7%** |
| Contingency Based on Actual Costs | **33.4%** |
| Mgmt Reserve Based on Actual Costs | **1.3%** |

| Monthly EVMS Data | BCWS | BCWP | ACWP |
|---|---|---|---|
| 12 GeV Total Estimated Cost | 3,470 | 4,284 | 4,745 |
| 12 GeV Other Project Cost | 198 | 146 | 284 |
| 12 GeV Total Project Cost | 3,668 | 4,430 | 5,029 |

Contingency and MR % calculation includes out-year phased contracts: **974**

Contingency and MR % calculation includes contract vendor notifications.

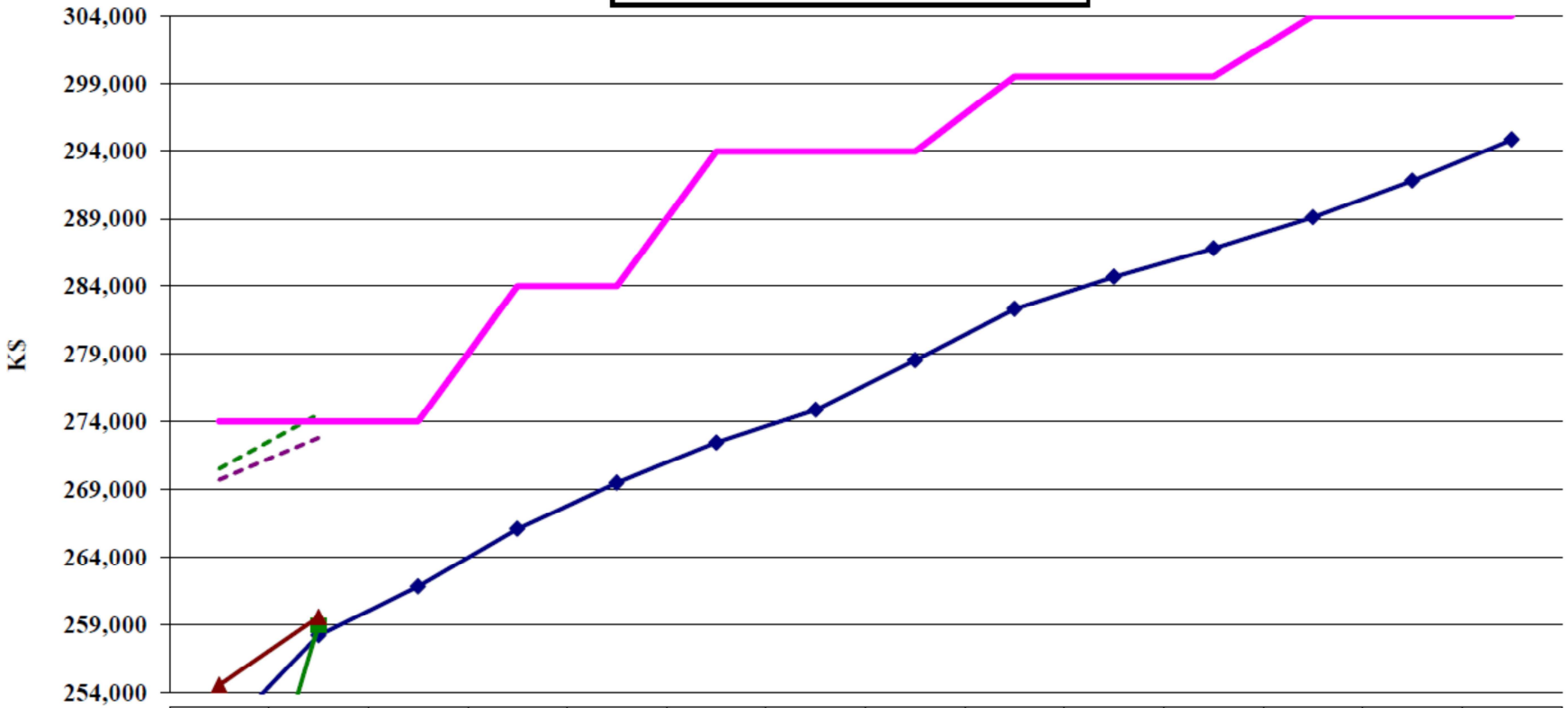
Assigned ~ $1.25M Mgmt Reserve for Civil contracts.

| Non-DOE | BCWS | BCWP | ACWP | Sv | Cv | SPI | CPI | BAC | EAC | IEAC | Cont/MR % | % Complete |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.09 Work for Others | 8,810 | 8,830 | 8,825 | 20 | 4 | 1.00 | 1.00 | 8,913 | 8,913 | 8,908 | 106% | 99% |
| 1.10 Non-DOE | 624 | 624 | N/A | - | | 1.00 | | 624 | - | | | 100% |

# 12 GeV Upgrade NP Project

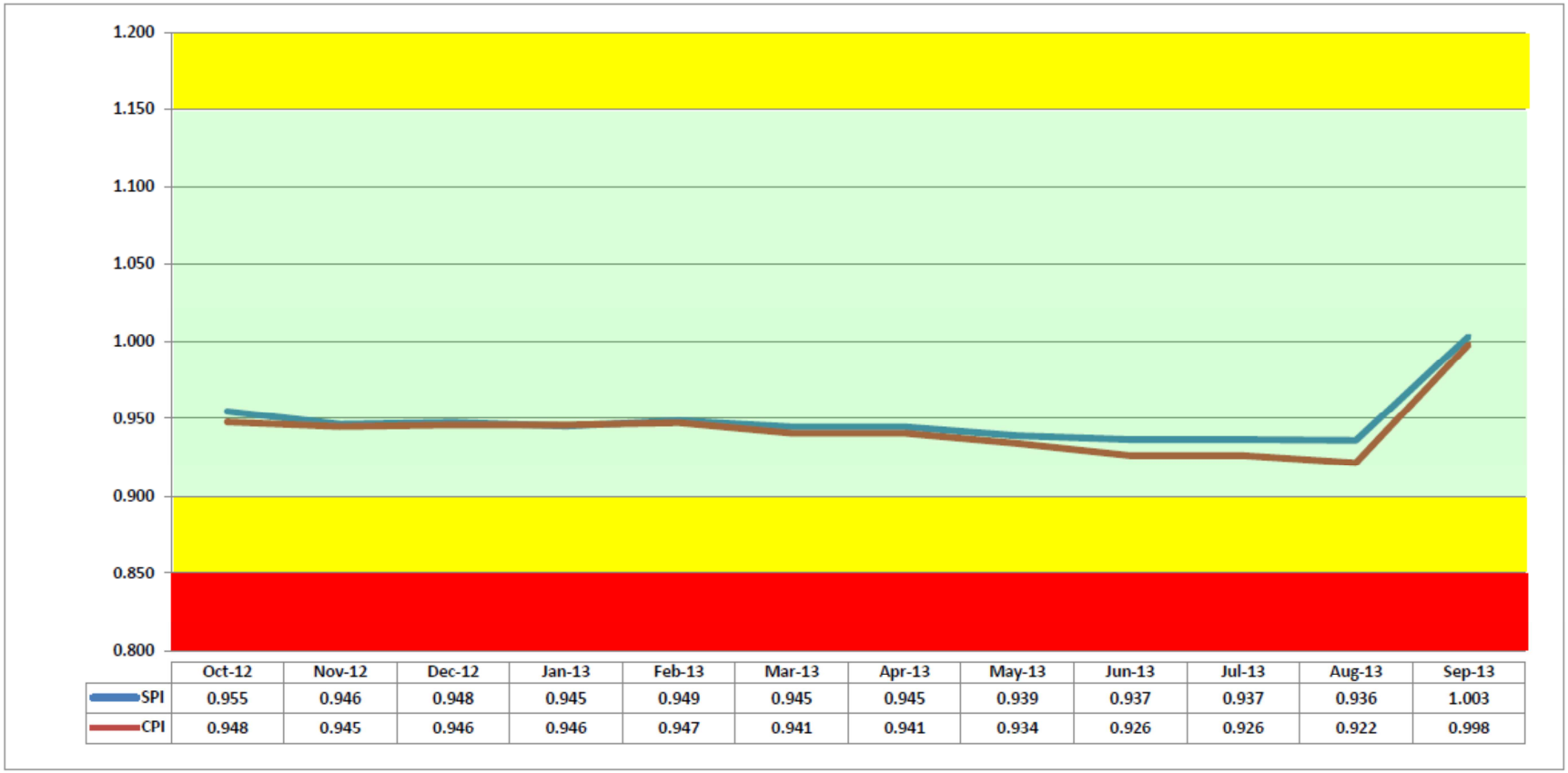
## Earned Value $K

**Including changes through CR13-015**




| | 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 | 269,473 | 272,431 | 274,862 | 278,540 | 282,301 | 284,684 | 286,795 | 289,100 | 291,827 | 294,862 |
| BCWP | 234,591 | 258,933 | | | | | | | | | | | | |
| ACWP | 254,509 | 259,539 | | | | | | | | | | | | |
| Obligated | 269,694 | 272,784 | | | | | | | | | | | | |
| Pending | 270,500 | 274,533 | | | | | | | | | | | | |
| Funding | 274,000 | 274,000 | 274,000 | 284,000 | 284,000 | 294,000 | 294,000 | 294,000 | 299,500 | 299,500 | 299,500 | 304,000 | 304,000 | 304,000 |

## CPI / SPI September 2013

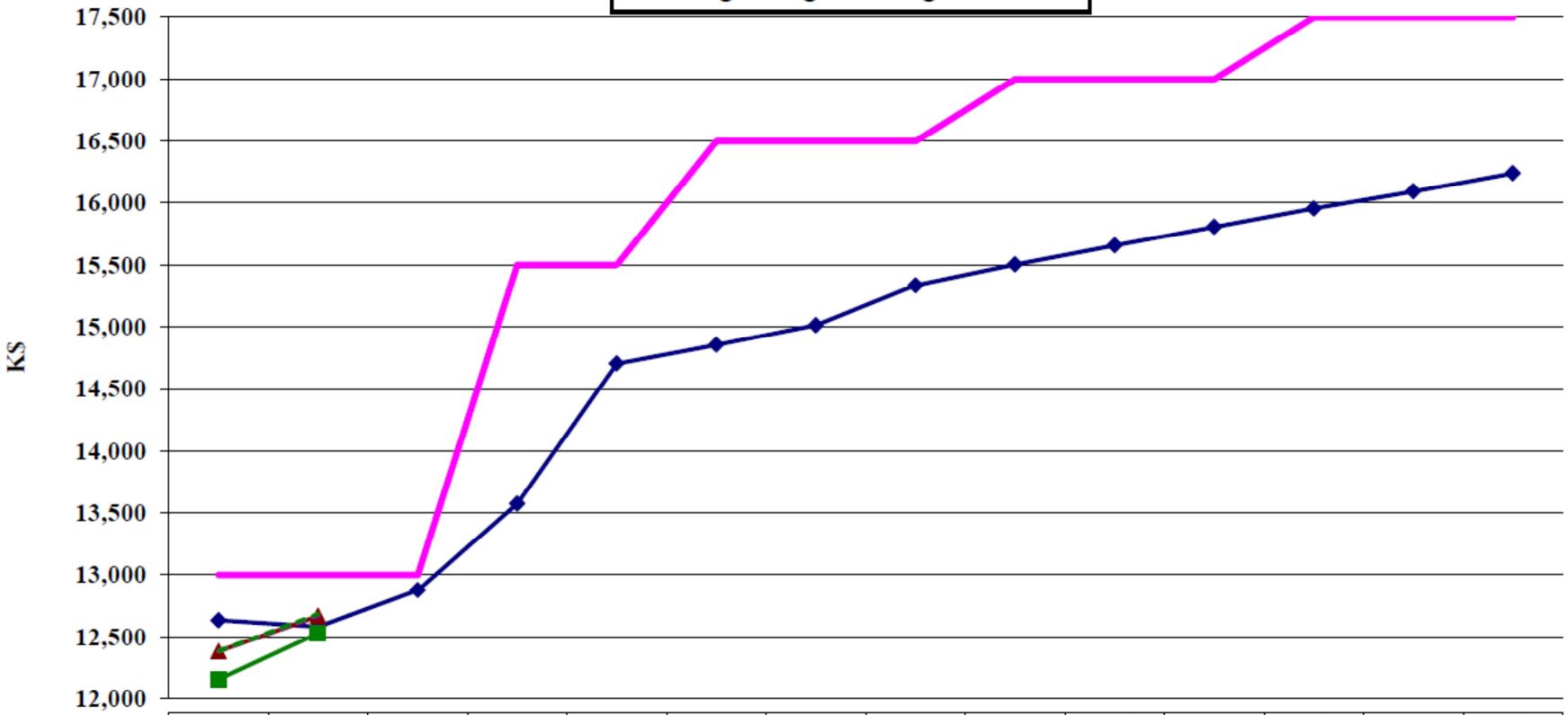



| | Oct-12 | Nov-12 | Dec-12 | Jan-13 | Feb-13 | Mar-13 | Apr-13 | May-13 | Jun-13 | Jul-13 | Aug-13 | Sep-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPI | 0.955 | 0.946 | 0.948 | 0.945 | 0.949 | 0.945 | 0.945 | 0.939 | 0.937 | 0.937 | 0.936 | 1.003 |
| CPI | 0.948 | 0.945 | 0.946 | 0.946 | 0.947 | 0.941 | 0.941 | 0.934 | 0.926 | 0.926 | 0.922 | 0.998 |

# 12 GeV Upgrade NP OPC

## Earned Value $K

**Including changes through CR13-015**

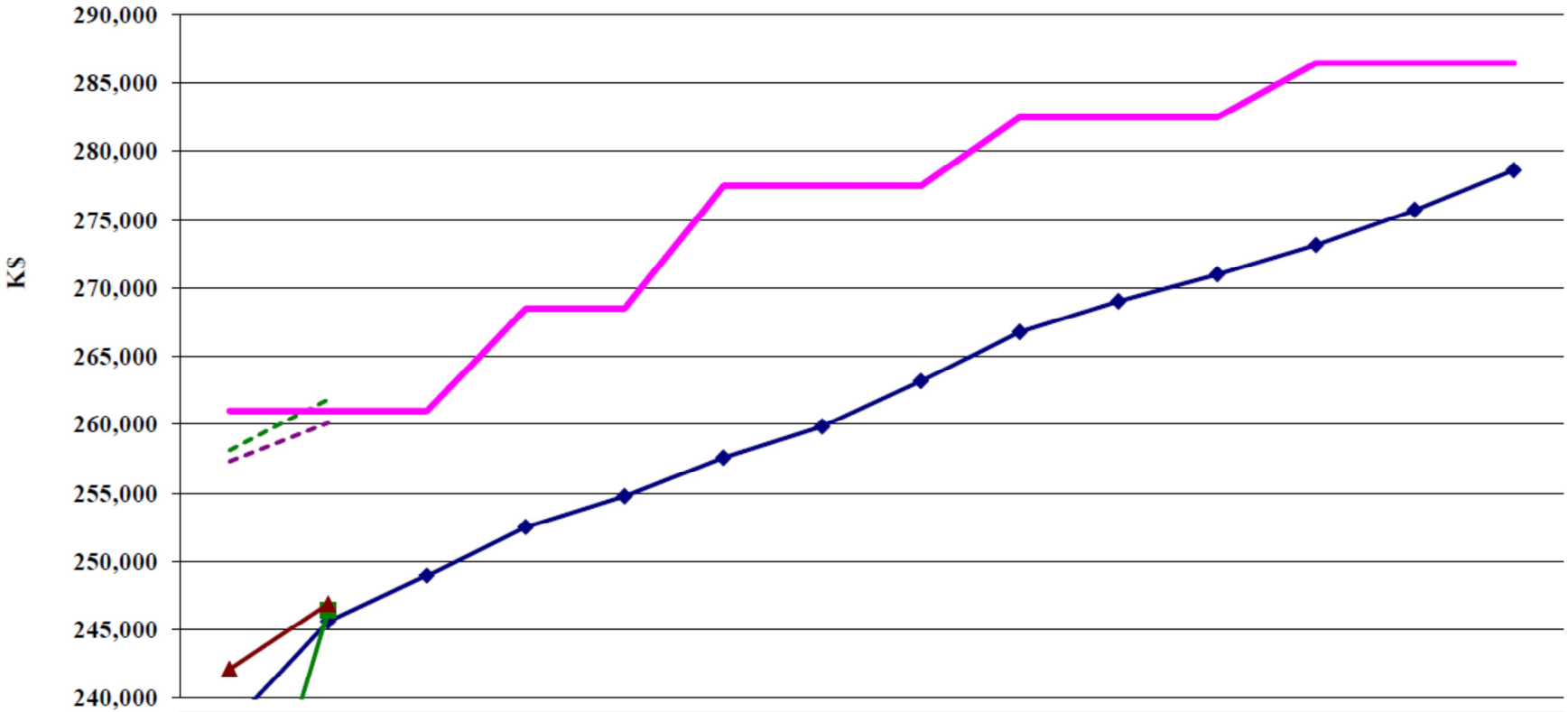



| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 12,632 | 12,580 | 12,875 | 13,573 | 14,704 | 14,855 | 15,014 | 15,335 | 15,504 | 15,657 | 15,808 | 15,955 | 16,093 | 16,240 |
| BCWP | 12,158 | 12,528 | | | | | | | | | | | | |
| ACWP | 12,382 | 12,666 | | | | | | | | | | | | |
| Obligated | 12,383 | 12,667 | | | | | | | | | | | | |
| Pending | 12,383 | 12,683 | | | | | | | | | | | | |
| Funding | 13,000 | 13,000 | 13,000 | 15,500 | 15,500 | 16,500 | 16,500 | 16,500 | 17,000 | 17,000 | 17,000 | 17,500 | 17,500 | 17,500 |

# 12 GeV Upgrade NP TEC

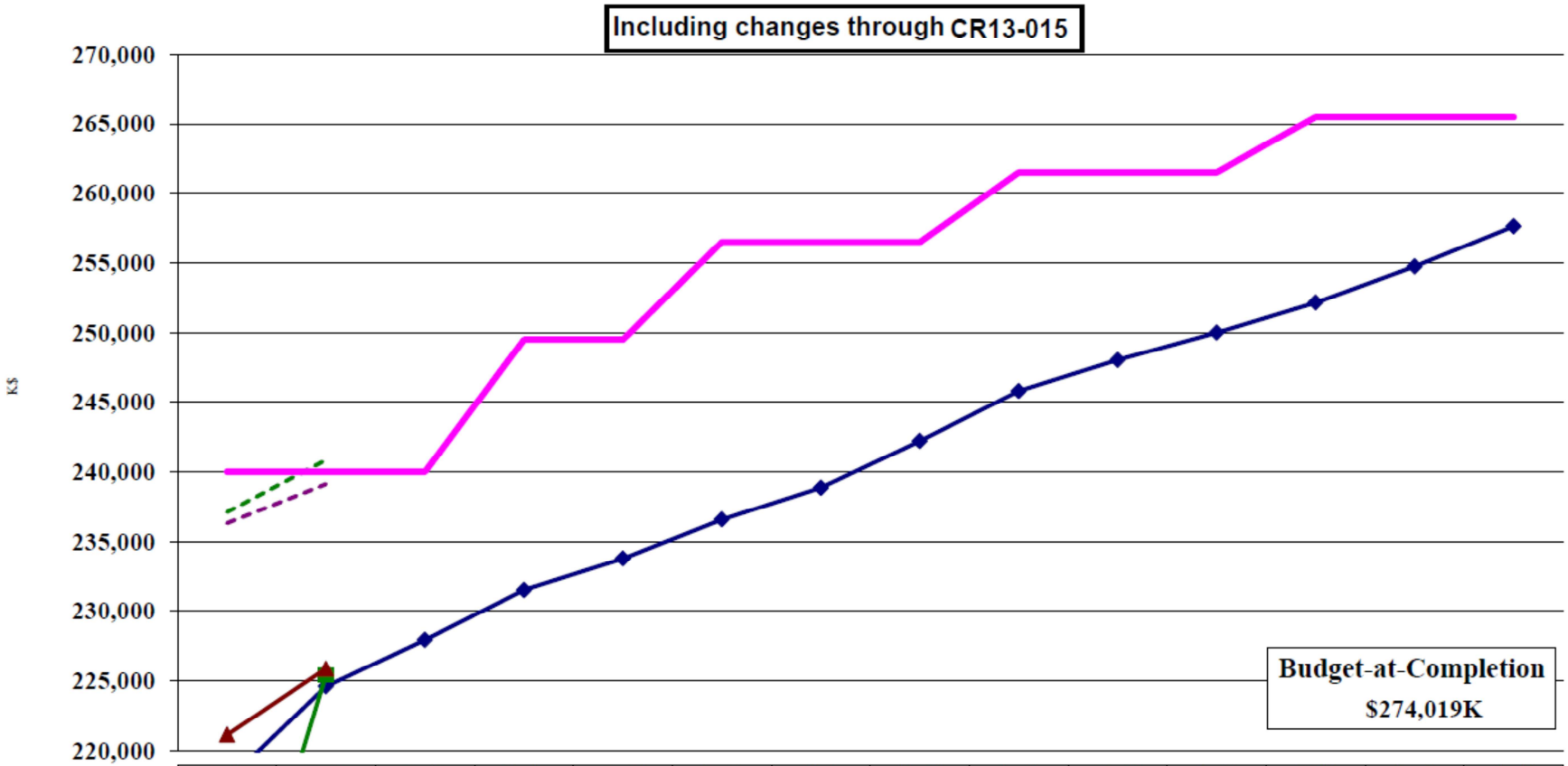
## Earned Value $K

**Including changes through CR13-015**



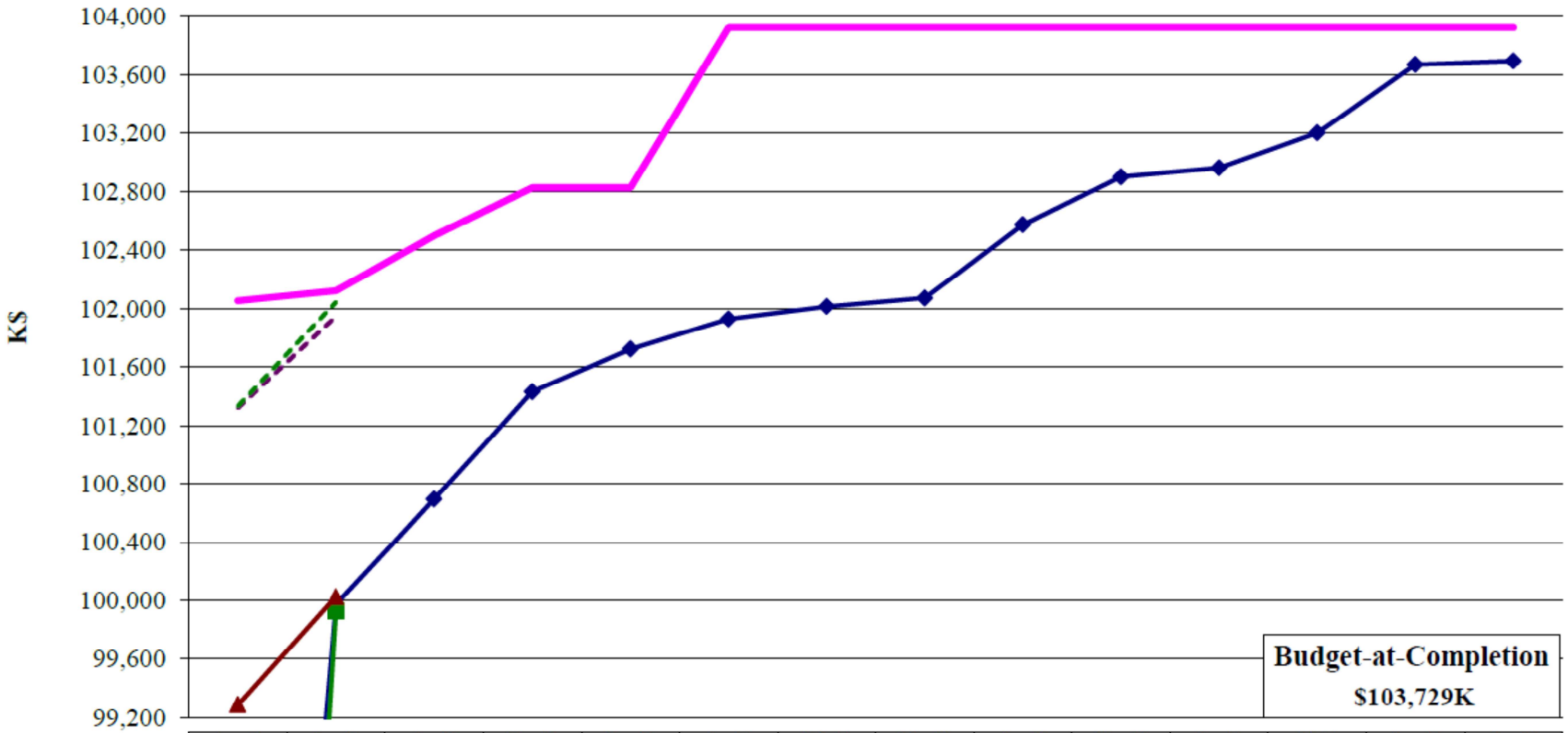

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 237,966 | 245,598 | 248,936 | 252,516 | 254,769 | 257,577 | 259,849 | 263,205 | 266,796 | 269,026 | 270,988 | 273,145 | 275,734 | 278,622 |
| BCWP | 222,433 | 246,405 | | | | | | | | | | | | |
| ACWP | 242,127 | 246,873 | | | | | | | | | | | | |
| Obligated | 257,311 | 260,117 | | | | | | | | | | | | |
| Pending | 258,117 | 261,850 | | | | | | | | | | | | |
| Funding | 261,000 | 261,000 | 261,000 | 268,500 | 268,500 | 277,500 | 277,500 | 277,500 | 282,500 | 282,500 | 282,500 | 286,500 | 286,500 | 286,500 |

# 12 GeV Upgrade NP Construction
## Earned Value $K



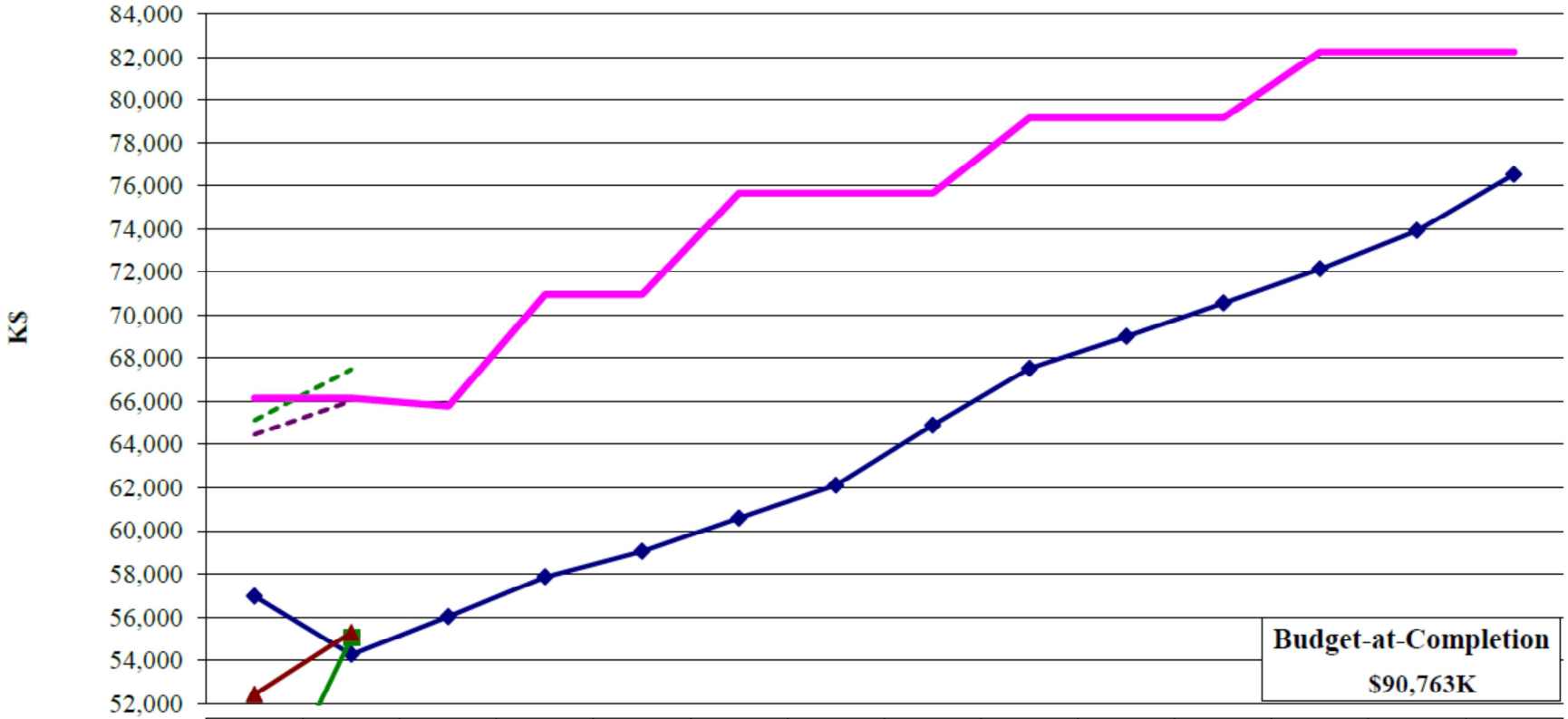

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 217,825 | 224,604 | 227,942 | 231,523 | 233,775 | 236,583 | 238,855 | 242,212 | 245,803 | 248,033 | 249,994 | 252,151 | 254,741 | 257,629 |
| BCWP | 202,293 | 225,412 | | | | | | | | | | | | |
| ACWP | 221,134 | 225,879 | | | | | | | | | | | | |
| Obligated | 236,318 | 239,124 | | | | | | | | | | | | |
| Pending | 237,124 | 240,857 | | | | | | | | | | | | |
| Funding | 240,000 | 240,000 | 240,000 | 249,500 | 249,500 | 256,500 | 256,500 | 256,500 | 261,500 | 261,500 | 261,500 | 265,500 | 265,500 | 265,500 |

# 12 GeV 1.3 Construction Accelerator Systems
# Earned Value $K



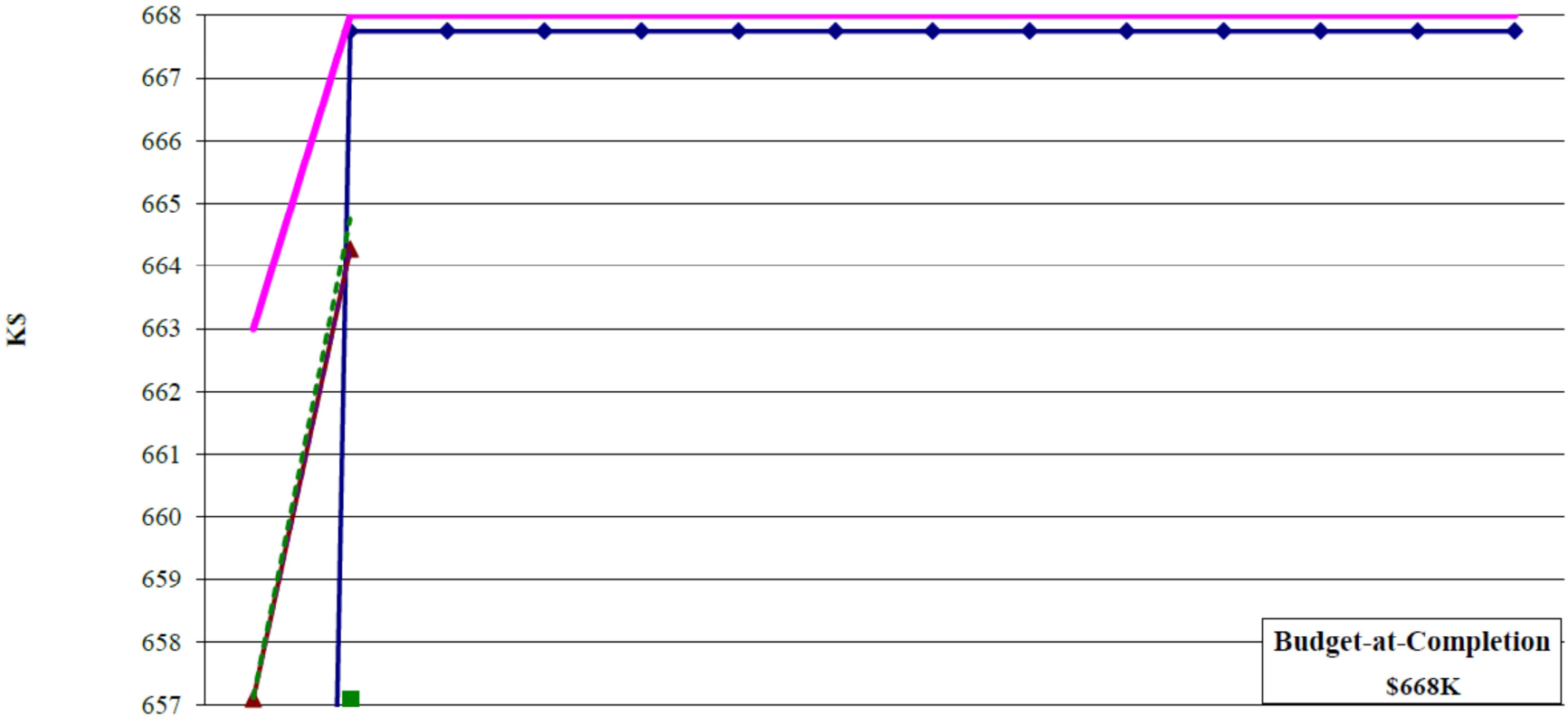

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 92,371 | 99,975 | 100,695 | 101,432 | 101,721 | 101,927 | 102,014 | 102,073 | 102,573 | 102,899 | 102,961 | 103,204 | 103,670 | 103,695 |
| BCWP | 89,492 | 99,928 | | | | | | | | | | | | |
| ACWP | 99,290 | 100,024 | | | | | | | | | | | | |
| Obligated | 101,321 | 101,945 | | | | | | | | | | | | |
| Pending | 101,333 | 102,045 | | | | | | | | | | | | |
| Funding | 102,055 | 102,124 | 102,499 | 102,826 | 102,826 | 103,926 | 103,926 | 103,926 | 103,926 | 103,926 | 103,926 | 103,926 | 103,926 | 103,926 |

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



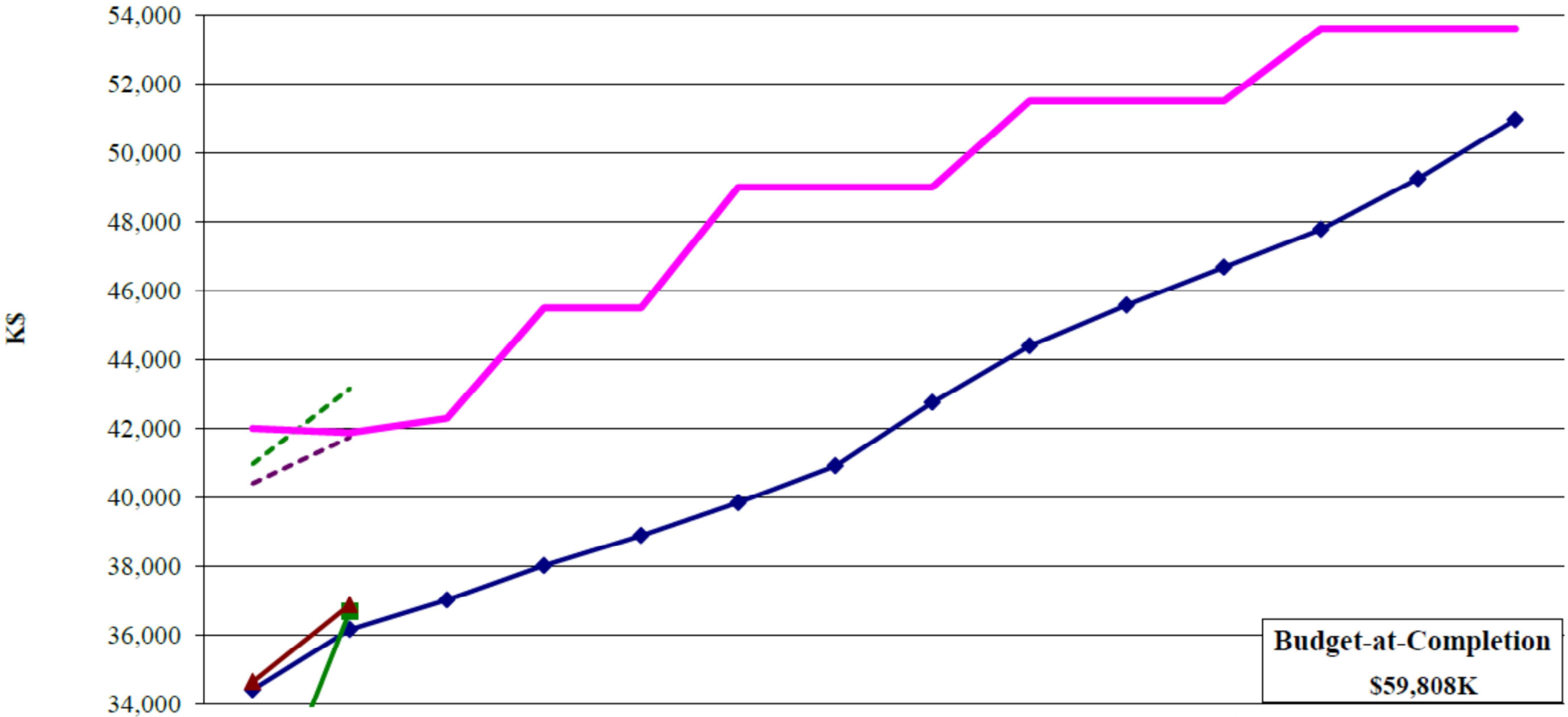

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 56,967 | 54,257 | 56,013 | 57,860 | 59,044 | 60,591 | 62,112 | 64,902 | 67,539 | 69,018 | 70,571 | 72,156 | 73,929 | 76,537 |
| BCWP | 45,759 | 55,021 | | | | | | | | | | | | |
| ACWP | 52,408 | 55,279 | | | | | | | | | | | | |
| Obligated | 64,464 | 66,033 | | | | | | | | | | | | |
| Pending | 65,124 | 67,491 | | | | | | | | | | | | |
| Funding | 66,163 | 66,163 | 65,788 | 70,968 | 70,968 | 75,668 | 75,668 | 75,668 | 79,168 | 79,168 | 79,168 | 82,268 | 82,268 | 82,268 |

# 12 GeV 1.4.1 Construction Hall A
# Earned Value $K



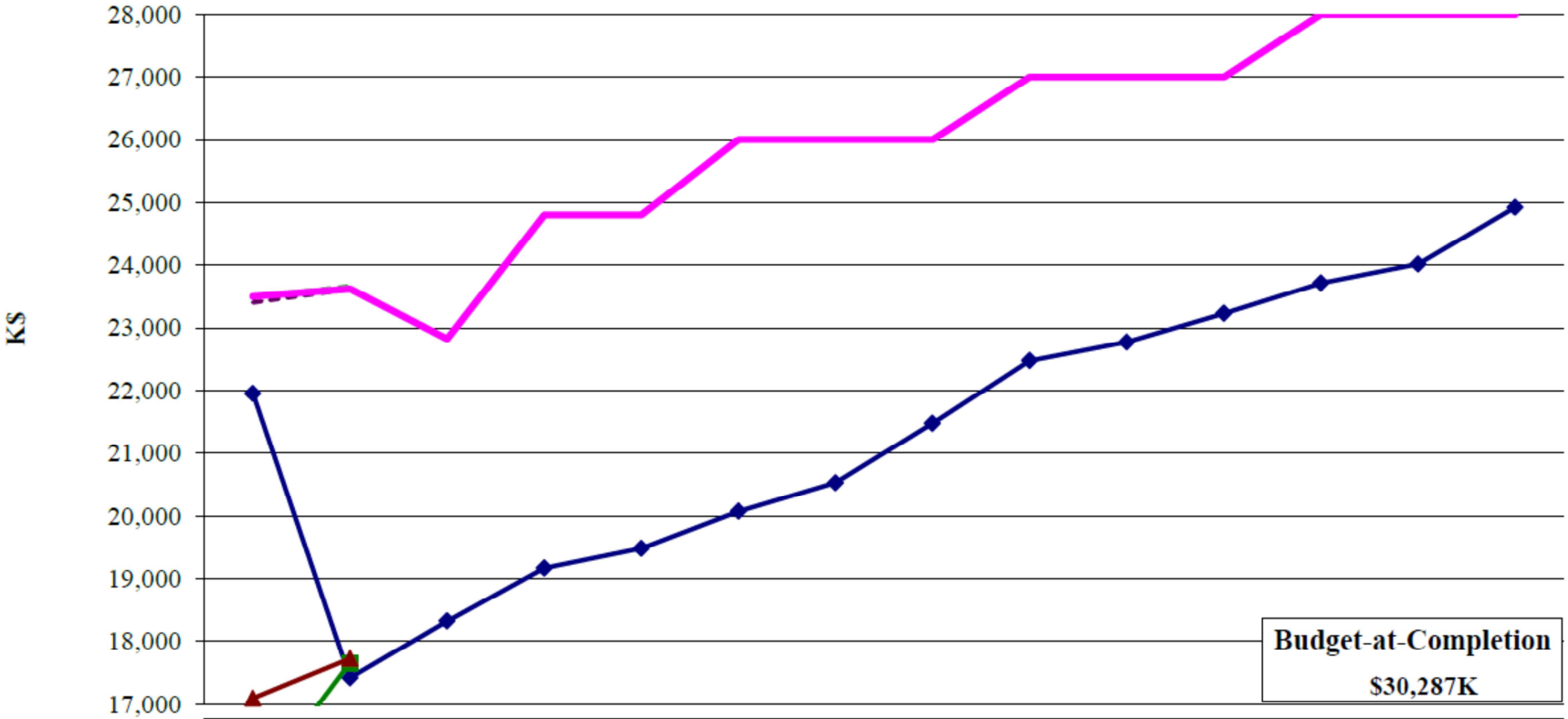

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 588 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 | 668 |
| BCWP | 505 | 657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

# 12 GeV 1.4.2 Construction Hall B
# Earned Value $K



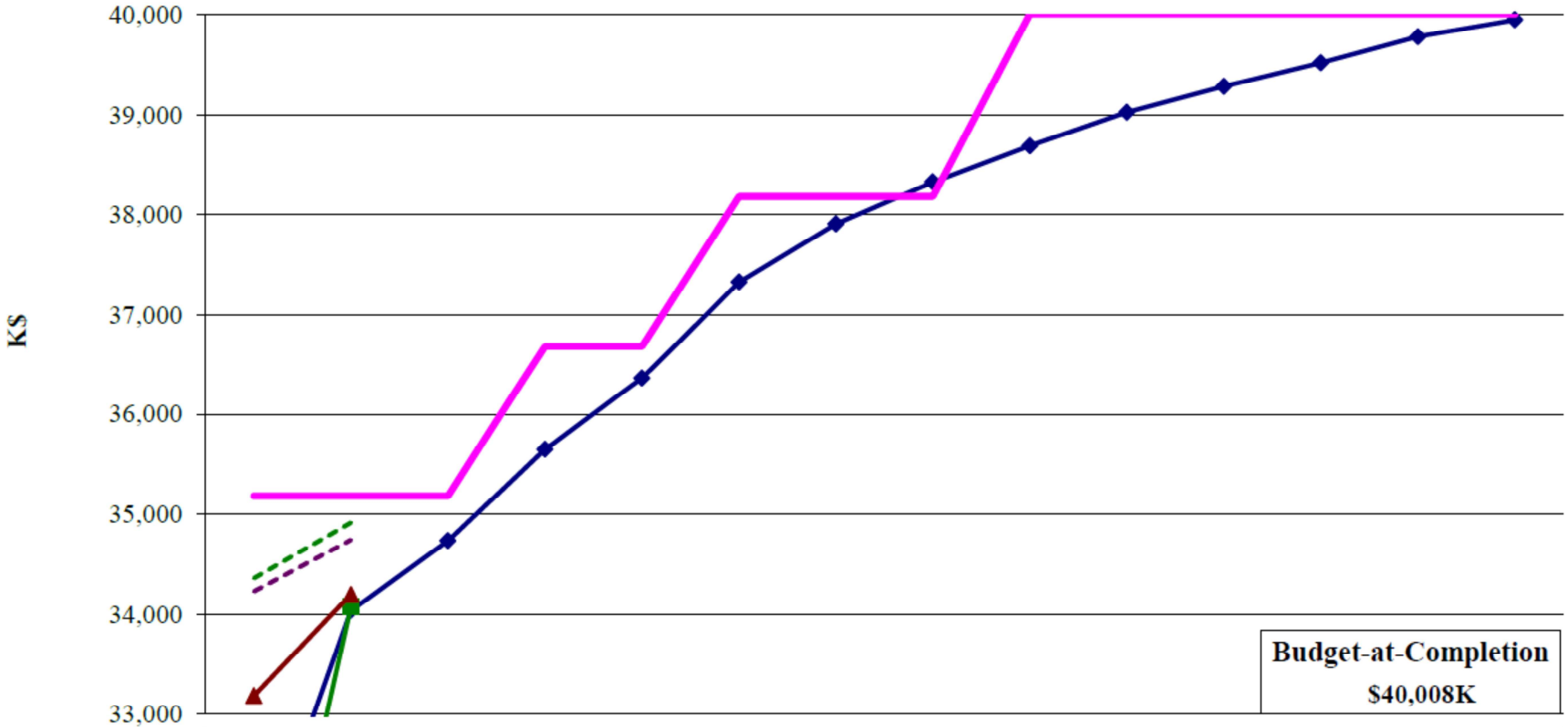

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 34,429 | 36,171 | 37,024 | 38,026 | 38,896 | 39,852 | 40,916 | 42,759 | 44,397 | 45,579 | 46,675 | 47,776 | 49,247 | 50,950 |
| BCWP | 29,635 | 36,709 | | | | | | | | | | | | |
| ACWP | 34,659 | 36,890 | | | | | | | | | | | | |
| Obligated | 40,405 | 41,749 | | | | | | | | | | | | |
| Pending | 40,971 | 43,164 | | | | | | | | | | | | |
| Funding | 42,000 | 41,875 | 42,300 | 45,500 | 45,500 | 49,000 | 49,000 | 49,000 | 51,500 | 51,500 | 51,500 | 53,600 | 53,600 | 53,600 |

# 12 GeV 1.4.3 Construction Hall C
# Earned Value $K



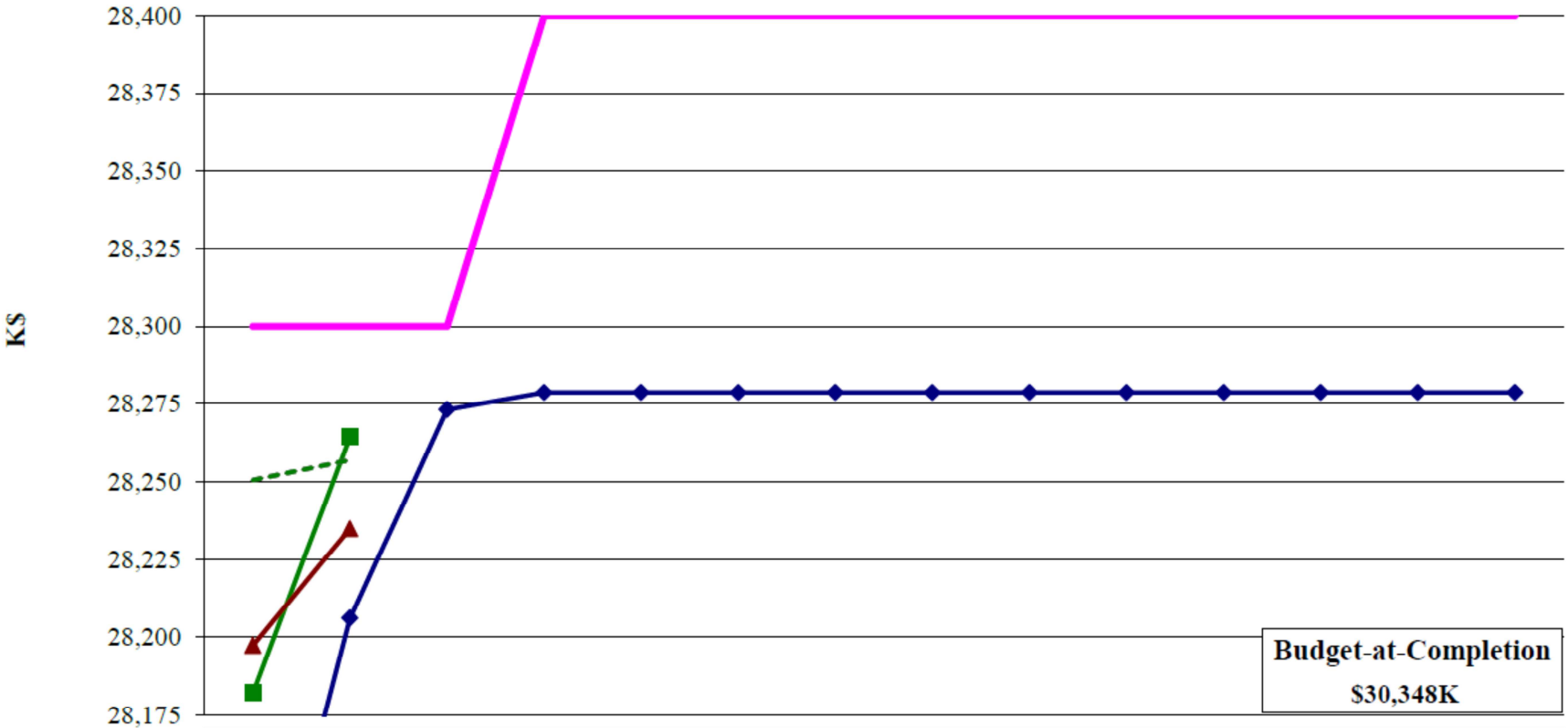

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 21,950 | 17,417 | 18,322 | 19,167 | 19,480 | 20,071 | 20,529 | 21,475 | 22,474 | 22,772 | 23,229 | 23,712 | 24,015 | 24,920 |
| BCWP | 15,619 | 17,654 | | | | | | | | | | | | |
| ACWP | 17,093 | 17,725 | | | | | | | | | | | | |
| Obligated | 23,403 | 23,619 | | | | | | | | | | | | |
| Pending | 23,495 | 23,662 | | | | | | | | | | | | |
| Funding | 23,500 | 23,620 | 22,820 | 24,800 | 24,800 | 26,000 | 26,000 | 26,000 | 27,000 | 27,000 | 27,000 | 28,000 | 28,000 | 28,000 |

# 12 GeV 1.5 Construction Hall D
# Earned Value $K



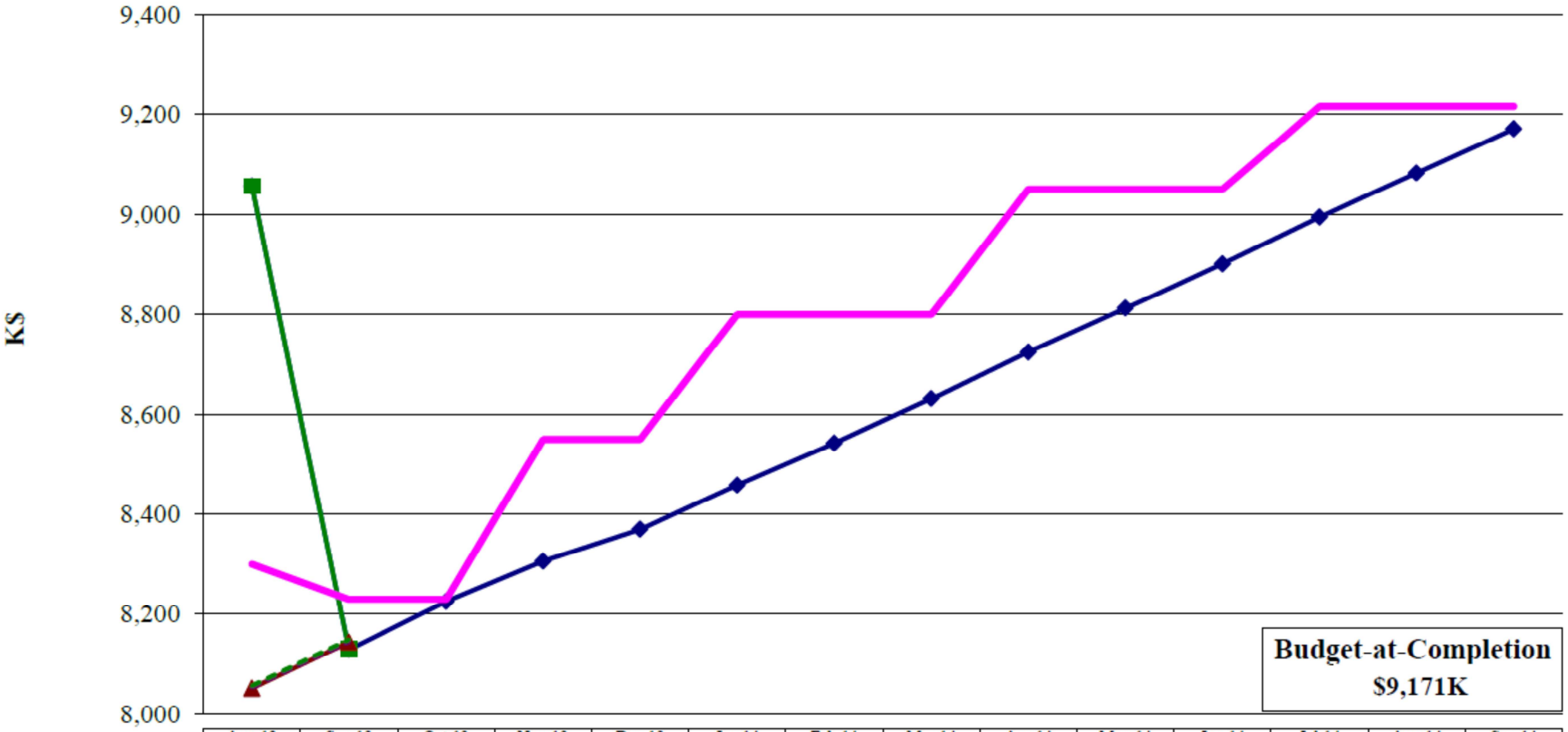

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 31,344 | 34,038 | 34,735 | 35,647 | 36,362 | 37,329 | 37,908 | 38,327 | 38,688 | 39,024 | 39,282 | 39,519 | 39,780 | 39,947 |
| BCWP | 29,803 | 34,070 | | | | | | | | | | | | |
| ACWP | 33,187 | 34,197 | | | | | | | | | | | | |
| Obligated | 34,229 | 34,744 | | | | | | | | | | | | |
| Pending | 34,361 | 34,915 | | | | | | | | | | | | |
| Funding | 35,183 | 35,183 | 35,183 | 36,683 | 36,683 | 38,183 | 38,183 | 38,183 | 40,007 | 40,007 | 40,007 | 40,007 | 40,007 | 40,007 |

# 12 GeV 1.6 Construction Conventional Facilities
# Earned Value $K



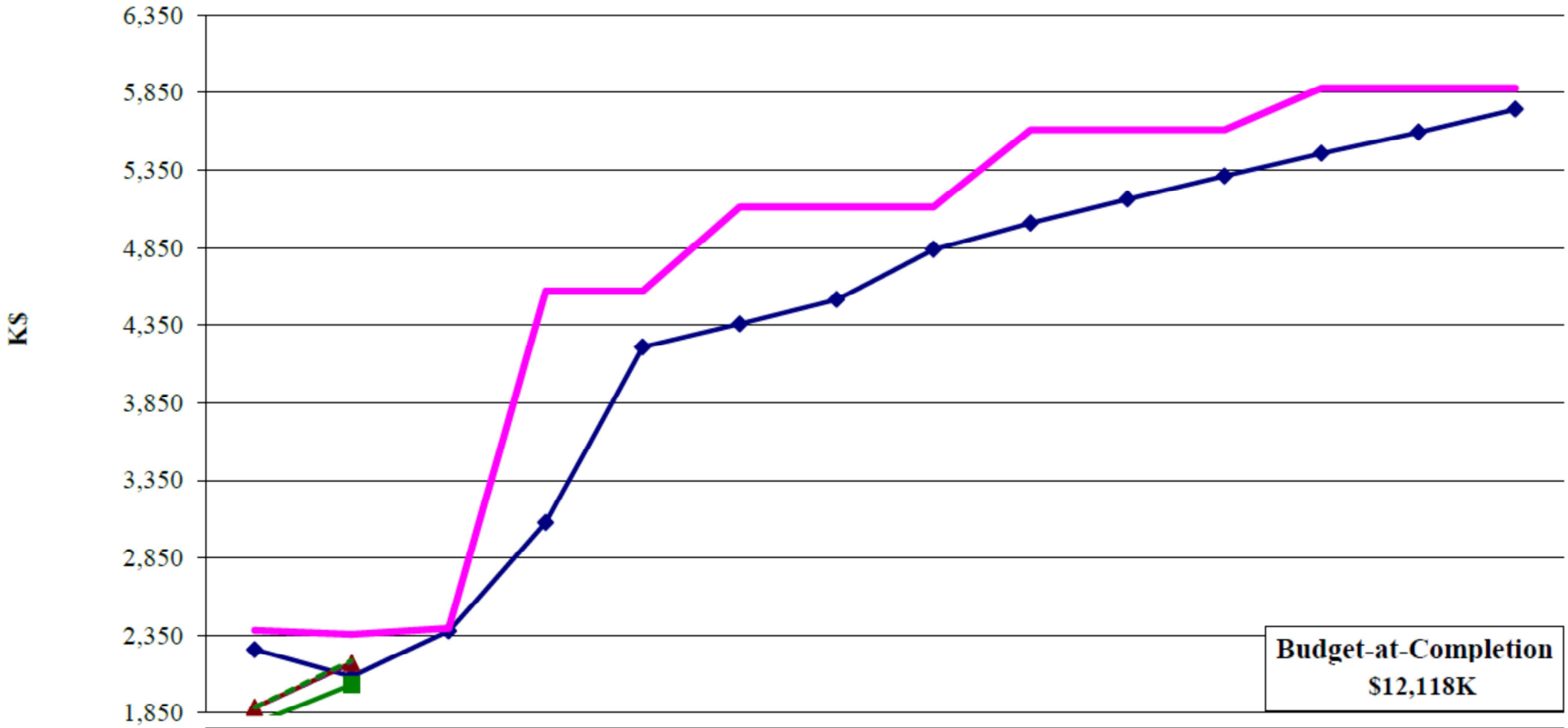

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 28,087 | 28,206 | 28,273 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 | 28,279 |
| BCWP | 28,182 | 28,264 | | | | | | | | | | | | |
| ACWP | 28,197 | 28,235 | | | | | | | | | | | | |
| Obligated | 28,250 | 28,257 | | | | | | | | | | | | |
| Pending | 28,250 | 28,257 | | | | | | | | | | | | |
| Funding | 28,300 | 28,300 | 28,300 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 | 28,400 |

# 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 | | | | | | | | | | | | |
| ACWP | 8,051 | 8,143 | | | | | | | | | | | | |
| Obligated | 8,053 | 8,145 | | | | | | | | | | | | |
| Pending | 8,056 | 8,149 | | | | | | | | | | | | |
| Funding | 8,300 | 8,230 | 8,230 | 8,550 | 8,550 | 8,800 | 8,800 | 8,800 | 9,050 | 9,050 | 9,050 | 9,216 | 9,216 | 9,216 |

# 12 GeV 1.8 Construction Pre-Ops
# Earned Value $K

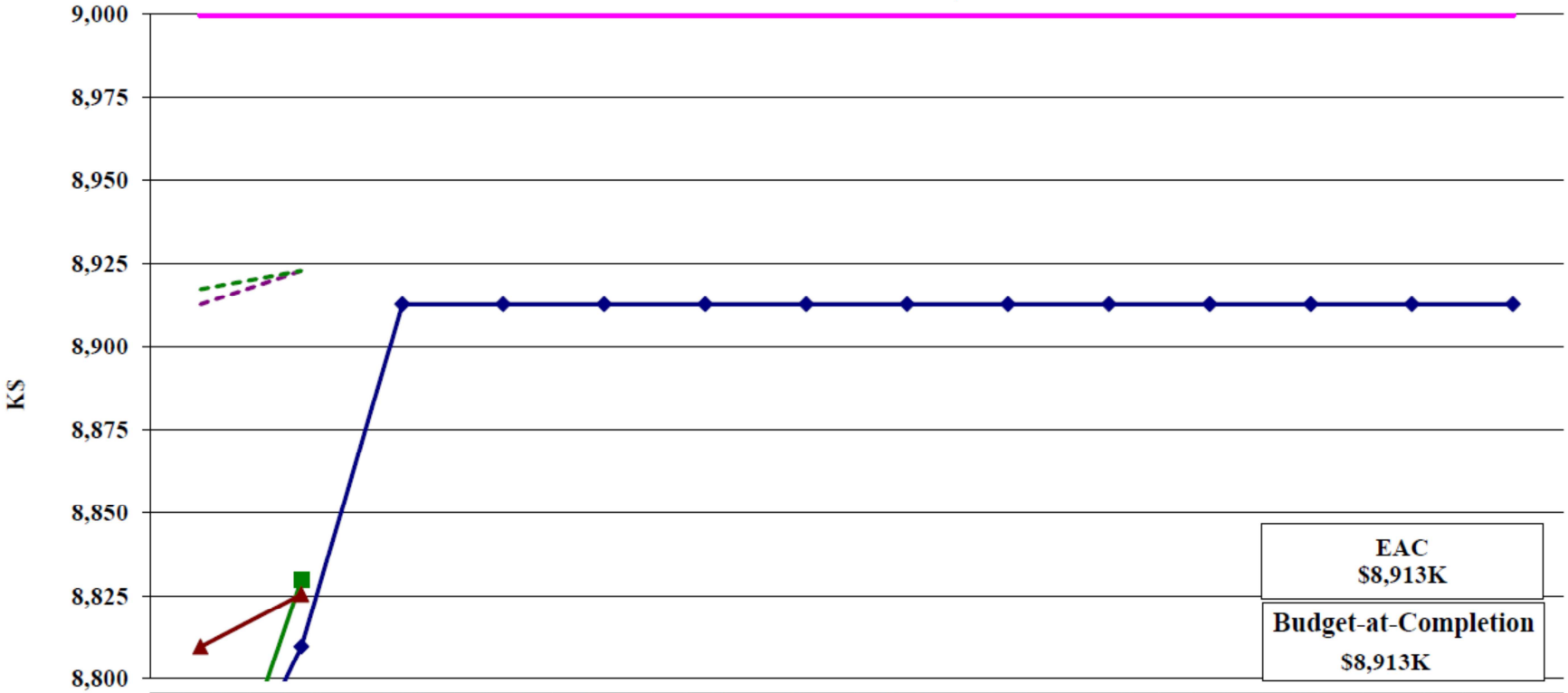



| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 2,257 | 2,083 | 2,378 | 3,076 | 4,208 | 4,358 | 4,517 | 4,839 | 5,008 | 5,161 | 5,311 | 5,459 | 5,596 | 5,743 |
| BCWP | 1,783 | 2,032 | | | | | | | | | | | | |
| ACWP | 1,885 | 2,170 | | | | | | | | | | | | |
| Obligated | 1,886 | 2,170 | | | | | | | | | | | | |
| Pending | 1,886 | 2,187 | | | | | | | | | | | | |
| Funding | 2,382 | 2,357 | 2,397 | 4,572 | 4,572 | 5,111 | 5,111 | 5,111 | 5,612 | 5,612 | 5,612 | 5,879 | 5,879 | 5,879 |

# 12 GeV 1.9 Work for Others

## Earned Value $K

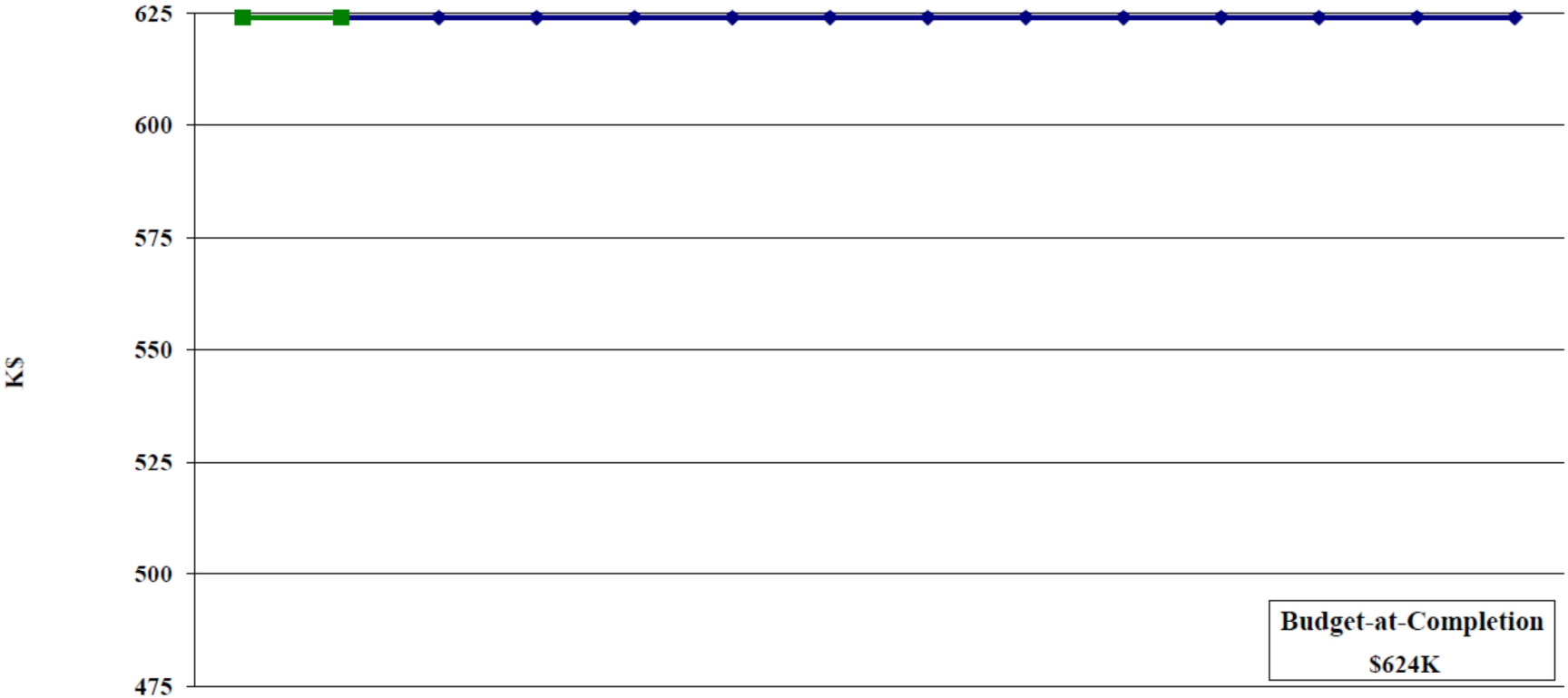
Account Closed



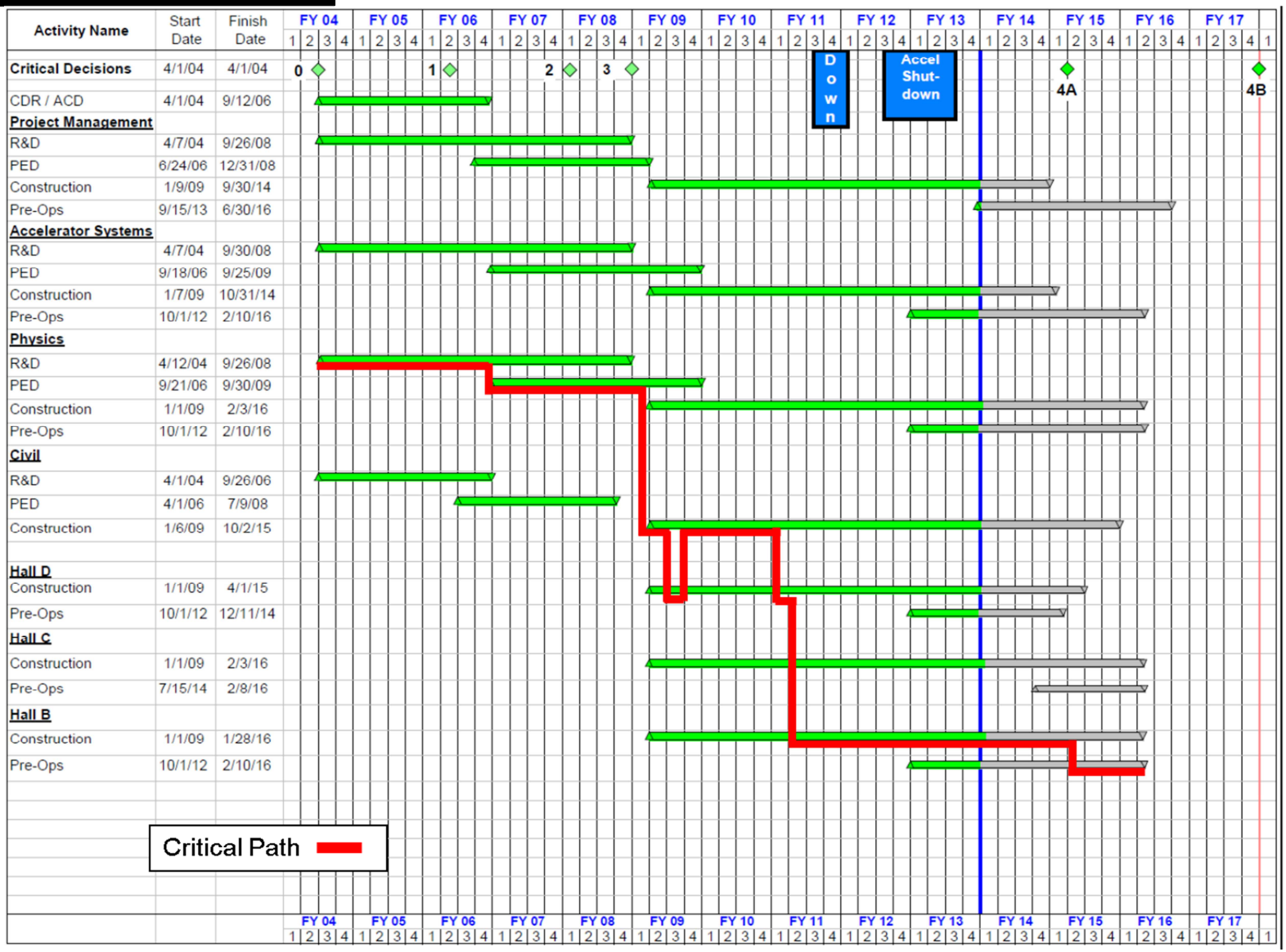

| | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCWS | 8,747 | 8,810 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 | 8,913 |
| BCWP | 8,741 | 8,830 | | | | | | | | | | | | |
| ACWP | 8,810 | 8,825 | | | | | | | | | | | | |
| Obligated | 8,913 | 8,923 | | | | | | | | | | | | |
| Pending | 8,917 | 8,923 | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | |


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
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
0
1
2
3
Down
Accel Shut-down
4A
4B
Critical Path

# Cost/Schedule Assessment

| September 2013 NP Project Performance | AYK$ |
|---|---|
| **Total Project Cost (TPC)** | **$338,000** |
| % Planned (Cumulative) | 81.3% |
| % Complete (Cumulative) | 81.5% |
| **Funding Received** | **$274,000** |
| Cost and Commitments to Date (does not include out year contractual phases) | $272,784 |
| Pending | $1,749 |
| Approved Baseline Funding | $338,000 |
| Work Remaining (BCWP Remaining) | $58,694 |
| DOE Held Contingency | $19,600 |
| Contingency as % of $ETC_{ob}$ | 44.1% |

## 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 September 30, 2013, are 1.00 and 1.00 respectively.

### Overall Cost/Schedule Assessment

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

- CR13-015 12 GeV Project Rebaseline: This Level 2 change request set the project to an SPI and CPI of 1.000 as of 31-August-2013 and replanned the remaining work.

- CR13-016 Hall B Magnet Contract Close Out: This Level 3 change request captures the final negotiated contract settlements for the CLAS12 Torus magnet and the CLAS12 Solenoid magnet.

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# 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 |
| 2-03 | Accelerator Commissioned | Sep-14 | Sep-14 | |
| 2-09 | Hall A Beam Commissioning Completed | Mar-14 | Mar-14 | |
| 2-12 | Hall D Equipment Installation Completed | Jun-14 | Sep-14 | |
| 2-13 | Hall D Beam Commissioning Completed | Dec-14 | Dec-14 | |
| 2-08 | Halls A, B & C Equipment Installation Completed | Mar-15 | Mar-15 | |

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# Summary of Key Activities: Next 90 Days

| Date | Activity |
|---|---|
| October 1 & 2, 2013 | Final Design Review (Sigma Phi): Hall C Q2/Q3 Magnets |
| October 17 & 18, 2013 | Magnet Vendor Visit: FNAL |
| Oct 28 – Nov 2, 2013 | Magnet Vendor Visit: Scientific Magnetics |
| October 28 & 29, 2013 | Director's Review of the CLAS12 Torus Integrated Design |
| 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 |
| December 4, 2013 | FNAL Torus Manufacturing Readiness Review |
| December 9, 2013 | DOE OPA Independent Lehman Mini-Review |
| December 10 & 11, 2013 | Director's Review of the 12 GeV SC Magnets |

# 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.