**CV Report for WBS 2.0 1008 I&F Upgrade Project**

April 2021

The following report discusses the major sources of cost variance and discusses the impact as well as the corrective actions taken. The analysis is done at level 2 of the Work Breakdown Structure.

**WBS 2.1 Management and WBS 2.4 Infrastructure**

Description –

The WBS 2.1 Management has BCWP = $2,469,054, ACWP = $2,026,808, CV = $442,246 and CPI=1.22

The WBS 2.4 Infrastructure has BCWP = $1,626,986, ACWP = $2,129,496, CV = -$502,510 and CPI = 0.76.

Engineering management time for Infrastructure was budgeted in WBS 2.1 but has been charged to WBS 2.4. About $230K of labor charges are involved.

Were this $230K instead charged to the planned account, i.e. increasing ACWP in WBS 2.1 by $230K and reducing ACWP in WBS 2.4 by the same $230K, the WBS 2.1 CPI would be 1.09 and that for WBS 2.4 would be 0.86.

A further reduction in time charged to WBS 2.1 (specifically WBS 2.1.2) occurred because a very senior cryogenics engineer has been moved to the EIC project. His work on the I&F Upgrade is being covered by another engineer who is supervising the cryogenics work and charging time as planned to WBS 2.2.3. A positive CV of $203K results due to avoided labor charges in WBS 2.1. Setting aside this CV, i.e. lowering the BCWP in WBS 2.1 by $203K, would further reduce the WBS 2.1 CPI to 1.00.

The remaining negative CV in WBS 2.4 of about -$275K results chiefly from two cost overruns in materials. The first overrun (in WBS 2.4.2.2) results from the Beryllium beampipe, which must be lengthened in order to fit within the sPHENIX envelope and then re-coated with Non-Evaporable Getter (NEG) material for vacuum reasons. Some $137K has been invoiced and paid but only $12K progress can be claimed due to the very low baseline estimate for this work, which assume a much simpler re-working. This results in $125K of cost overrun.

The other main contributor to the negative CV in WBS 2.4 results from the track reinforcement work (WBS 2.4.2.6), which will ultimately cost more than $800K above the earlier baseline estimate. The initial paid invoice for this work in the Assembly Hall in Bldg 1008 plus associated support labor is $160K of which only $55K corresponds to progress in the baseline that can be claimed, resulting in $105K in cost overrun. This will overrun increase as further invoices are paid for this work.

Impact – None. The labor charges for WBS 2.4 are continuing and are indeed for work on the I&F Upgrade. The avoided labor charge for WBS 2.1.2 will continue as the engineer in question will remain with the EIC effort.

Corrective – None. The cost overruns for the beampipe and track reinforcement work are not recoverable.

**WBS 2.2 Magnet Systems**

Description – The WBS 2.2 Magnet has BCWP = $2,954,042, ACWP = $2,466,338, CV = $4,688,604, and CPI = 1.20

Examination at WBS 2.2 at Level-3 shows that the cost variance derives largely from WBS 2.2.4 (power supply & quench detector) and from WBS 2.2.5 (field measurements.) In both cases the ACWP is entirely comprised of “Actual” charges (both labor and M&S), incurred prior to baselining, plus **only** M&S charges since baselining. There are nearly $425K of planned labor charges that did not occur, because work was done more efficiently than expected, or was performed but not charged to the magnet accounts. This breaks down to $275K in WBS 2.2.4 and $150K in WBS 2.2.5

Impact – None

Corrective – None. The work is done. This positive CV will persist.

**WBS 2.5 Installation**
Description – The WBS 2.5 Installation has BCWP = $914,963, ACWP = $660,457, CV = $254,506 and CPI = 1.39

About $50K in positive CV is due to less cost incurred than planned for the OuterHCal installation fixture in design and fabrication labor and M&S charges. This fixture is delivered and fully invoiced. It was found that an earlier design from the sPHENIX MIE for assembling OHCal structures could be re-used for the I&F Upgrade.

About $170K in positive CV results in engineering, design and fabrication effort that did not need to be expended to create a specialized installation fixture for the cradle carriage. Standard rigging equipment already in hand was found to suffice after the carriage cradle design matured and its manufacturing decided. This view has been proved out at the vendor’s factory. Thus, these charges will not be incurred.

About $40K in positive CV results from avoided costs via a reorganization of how the InnerHCal is to be assembled and transported.

Impact – None.

Corrective – None. The positive CV will persist since the finished work was done for less cost than planned.