2x2 Cost and Schedule Review – Management Session

August 3, 2021

- List of Bern deliverables for cryogenics and module structure (WBS 1.1.5, 1.2.5a.1-2,1.6a.2.0)
- Cost table for cryogenics and installation
- Schedule drill down WBS 1.4.1 and WBS 1.4.2 (Q1, Q2)
- Schedule drill down for WBS 1.2.5a.5-1.2.5a.7: "Argon filter and piping design and engineering" (Q2)
- Schedule drill down for WBS 1.6a.2.4: "Assembly and inserting TPC modules to cryostat" (Q2)
- Use of Wiener DC power supplier (Q7)
- Electronics delivery in 2x2 installation schedule (Q10)
- Other committee questions

Questions from review committee 8-2-2021

1. There are a number of tasks with labor estimates that ended in the past. Can you point to a few of those tasks and explain how much labor was actually used for those tasks, and how that compares to what your initial labor estimate was for that task?

2. There are a number of upcoming large tasks that have labor estimates: we'd like to see what your basis of estimate is for the labor required for these tasks: by now Fermilab has a long history of bringing up liquid argon detectors, so can you give us an example of how much labor the same task took for the ProtoDUNE or MicroBooNE version of that task, or maybe the 35-ton version of that task for something closer to the scale of this effort?

We propose to drill down on task 1.4.2, for example: Procurement of cryostat valves and filter vessels: are those estimates based on past cryogenic procurements?

We'd also like you to show us the basis of estimate for a large design task, and a large installation task, and if possible an example from a previous similar effort if there was one.

3. We would like to see a labor profile: On slide 14 Ting showed the labor estimates for some people for all of FY2022, but not year by year for all the years. Can you please show a labor profile broken down by quarter if possible for this effort?

For example, we are also curious if you are expecting to get people working at 100% FTE for shorter periods, or if you are basing this schedule on assuming that people you get will only be working at 50% FTE.

4. We also note that the table on slide 14 does not include physicist labor. Could you also give an estimate (by quarter or by year) for how much physicist effort you are planning to have on these tasks, and if possible, how much of that physicist labor is Fermilab and how much is non-Fermilab physicist labor?

5. In the WBS document you call out "physicist" for some of the labor on some tasks: similar to the last question, can you specify where that physicist labor comes from? Is it 100% Consortium (including University) physicist labor, or is that labor considered separately?

6. Does the lifting fixture shown in Min's talk have to be rebuilt, or is it still in the design phase?

7. What will the Wiener power supplies be used for, and if it's to power the 2x2 electronics, does this mean that the DC power supplies used at Bern are not going to be used at Fermilab? Could you remind us where in the WBS this effffort (testing and possibly refurbishing the power supplies) is reflected?

8. Minor issue: Task 1.1.4.2 has a projected start date that is 1 day after the projected finish date, but the "duration" listed is 10 working days. Please correct this.

9. We noticed that "ODH mitigation, monitoring and installation design" does not start until May 2022, but the predecessor to that task is already complete (it has a completion date in the past). Is there a reason you are waiting to start that task?

10. how close are the TPC electronics delivery to the critical path, and what is the schedule for delivering the electronics to Fermilab? (We discussed the delivery schedule of each module, but does the associated readout come with each module, for example?)

11. Can you say more about the cycle time associated with adding an additional module to the cryostat? For example, could you put one (or two) modules into the cryostat, fill it, test those modules, and then add another one (or two modules)? Or do you need to warm up, empty the vessel, and then add more modules? Is the answer different depending on if you're in LarTF or if you're in MINOS?

(specifically: is the schedule you've presented only assuming that you are filling one time at LArTF and one time at MINOS?).