

LBNE Reconfiguration Engineering/Cost Working Group 4th Meeting

May 1, 2012

Present Committee Members:

- Jim Strait, FNAL (deputy chair)
- Bruce Baller, FNAL
- Mike Headley, SURF
- Christopher Mauger, LANL
- Elaine McCluskey, FNAL
- Vaia Papadimitriou, FNAL
- Bob O'Sullivan, FNAL
- Jeff Simms, ANL
- Jeffrey Appel, FNAL (Scientific Secretary)

Present Invitees:

- Milind Diwan (LBNE Collaboration Co-Spokesperson)
- Jeff Dolph (LBNE Systems Engineer)
- Tracy Lundin (LBNE CF project manager)
- Jim Stewart (LBNE (former) WCD project manager and expert-at-large)
- Bob Svoboda (LBNE Collaboration Co-Spokesperson)

Draft Agenda

- 14:00 (0:05) Setup ReadyTalk, attendance
- 14:05 (0:15) News from the Steering Committee - Jim Strait
- 14:20 (0:15) Near Detector Cost Estimates - Christopher Mauger
- 14:35 (0:15) LAr-Far Detector Cost Estimates - Bruce Baller
- 14:50 (0:20) Beam + CF Cost Estimates - Vaia Papadimitriou
- 15:10 (0:20) Far Site CF Cost Estimates - Tracy Lundin
- 15:30 (0:10) Summary costs of various options - Jim Strait
- 15:40 (0:20) Discussion of strategy and priorities - All
- 16:00 Adjourn

Steering Committee Meeting Summary

It was noted that the summary of the Steering Committee meeting held right after the Workshop had not yet been posted on the web (which was done immediately after the Engineering/Cost Working Group meeting).

Jim Strait reviewed the major conclusions of that meeting, and the implications for the immediate efforts by the Engineering/Cost Working Group; namely that two options were deemed potentially affordable under the DOE guidelines and should receive maximal effort: (1) a smaller surface LAr detector with a new beam to Homestake and (2) a larger LAr detector on the surface in Minnesota. There is hope in the Engineering/Cost Working Group and in the LBNE Collaboration that there can be an affordable detector underground, but possibly not documented in time for the draft report due June 1. Work will continue after that date.

Milind Diwan noted that the cost model requirements were developed when it was thought that an NSF multipurpose laboratory would be supported, rather than just costing a minimal single experiment. This led to inclusion of some items in the LBNE cost model that are not absolutely needed.

It is expected that the Working Group will be asked for cost estimates of phases beyond Phase 1, even though these costs might be cruder than those needed now for Phase 1.

Jim showed an example draft funding profile showing a possibility for profiles for individual phases of LBNE, Project X, etc., with the start of funding for a given phase of one project starting at the funding peak of the previous project. The example profile had a total of \$160M per year each year for all Fermilab project construction costs. It was pointed out that a multi-year hiatus in one or another activity in such a phased approach will certainly be more expensive than a continuous single project.

It is still unclear if the \$40M to \$50M which will have been spent by the DOE by the end of FY2012 has to fit into the first phase total of \$750M. It is possible that a separate CD-0 would alleviate this possible scenario.

Christopher Mauger – Near-Detector Cost Update

Christopher discussed rough costs for such options as dropping Michel detectors, costs for three forms of minimal near detectors (very basic, basic, and enhanced basic)), and focused on detectors in shafts as a reasonable boundary for options.

He also described a first-pass cost for using the MINOS hall, noting that additional costs would be incurred to shrink the transverse size to fit the hall shape. There is also a need to reexamine the fiducial volume for a new shape.

Use of the anticipated NOvA near-detector hall is hard, given the more constrained space there.

There was also a discussion of contingency required for risks in less-well-costed items. For items, there can be increased contingency. However, for scientific reach risk, no extra contingency should be budgeted.

Bruce Baller – Far Detector Cost Update

Bruce has done additional work on the cost-scaling spreadsheet; e.g., correcting an error in the scaling algorithm for pit size. There were about a dozen changes to the cost model, some even in the reference design model. The Arup cryostat cost was 10% larger than what was presented in the Director's review – resulting in a \$14M reduction in cost. There was also a change from liquid delivery to gas delivery to the detector. Management cost-scaling was also reduced.

There is also a need for review of the septum needed and comparisons of costs for single and double cryostats. There is also consideration of using laboratory technicians, whose cost was said to be less than using outside contractors.

Jeff Dolph commented that he and Jack Fowler had some food for thought in considering what should go into Phase 1. On their list were:

- Only design costs for a photon detector as part of the LAr system, not the actual devices
- Moving photon detector and data acquisition to universities to take advantage of zero-cost physicist labor.

- Not having a standby refrigeration plant
- Not having a storage tank for argon on the surface, but simply boiling off the argon if needed, significantly increasing operating costs to buy new argon
- Reducing automation costs by reducing system sophistication

It was suggested that cryogenic expertise at Fermilab (Accelerator Division and Technical Division) be used to help in looking for further cost reductions. Such a meeting is planned.

Bruce also suggested that one might remove the deputy managers in the project office, noting that such people do not exist at this point.

Vaia Papadimitriou – Beam and Its Conventional Facilities Cost Update

Vaia's group is working on three packages:

- Assuming that NOvA finishes running and that components can be taken for use in a new beamline; e.g., components of the work cell and horn power supplies.
- Assuming that NOvA continues running until the last day before LBNE would begin, allowing only use of target and horn designs – with a couple of options under this package.
- Costs of using the existing NuMI beam, but with consideration of different horn currents.

For the first two bullets, there is a distinction made between items that need short time (3-4 weeks) to be moved from NuMI and repurposed for LBNE and items that need longer time; e.g., more than half a year.

For a beam to Homestake, there is consideration of a shorter primary beamline, though optics need to be checked, a shorter decay volume, eliminating space for a muon monitor, and reconfiguration of the Target Hall to reduce its footprint and therefore the number of drilled piers to bedrock.

Tritium mitigation is also being examined, both for a Homestake and NuMI beam. Can we eliminate the tritium interceptors from the walls of the decay pipe? Is there redundancy which can be removed to save on costs? Can the interceptor be only once the beamline is in rock, and not needed when the beam is above ground level? Meetings with the Fermilab ES&H Section are part of this effort.

Tracy Lundin – Detector Conventional Facilities Cost Update

Tracy has posted new estimates for the surface configurations of conventional facilities need for 5 kT (single cryostat with septum), 17 kT (two cryostats with septum), and 33 kT (2 cryostats with septum) systems. Some savings are made by moving septum space to ground level rather than being in the pit. No further work will be done on the 33 kT options, focusing instead on the two smaller options.

There is need for further scrubbing of the underground infrastructure, omitting redundancies and planning for a more “Spartan existence”. Once this is done, the costs will be compared to those quoted by Marvin Marshak for Soudan.

Phasing of 33 kT detector capability at Homestake is being done with two 17 kT sized caverns, pulling the sites back toward the Ross shaft from closer to the Yates shaft. This allows omitting the need for the overhead ventilation drift. Revised dimensions are being reconciled with Bruce Baller’s spreadsheets.

It was noted that proposals have been solicited from two firms employing staff who have done work at Soudan. The proposals are to be for separate, independent cost estimates for use of the 2340 ft level for underground siting of LAr detectors at Soudan. The scope of the proposals (cavern excavation, shafts, drifts, concrete work, two new hoists and head structures) was reviewed by members of the Working Group, and some revisions suggested for more common assumptions. There will be a two-day meeting in Minneapolis the week of May 14th to go over the status of estimates.

A single shaft was not viewed as an option, given the NFAP 520 requirements.

There have been repeated requests to have people review cost models to see that common multipliers are applied uniformly and appropriately.

Jim Strait – Summary Costs of Various Options

Jim presented the current escalated costs for a Homestake option, starting with the estimate presented to the Steering Committee after the Workshop:

Phase 1 beam to Homestake, a minimum near detector, and 10 kT LAr detector on the surface - \$860M

For no near detector (or one provided off project; e.g., by a non-US collaborator), no inclusion of already spent DOE funds, and some additional savings as outlined by Bruce and Tracy above - \$760M.

So, costs are approaching the target maximum guideline cost for this option. However, there is more work to do, and there is a need for some headroom before going before any review committee.

Discussion of Strategy and Priorities

The list of priorities is to

1. Get the numbers as requested by the steering Committee.
2. First pass for putting a near detector in the MINOS and NOvA near cavern halls - expected to be completed this week
3. Update on the far detector costs
4. Cost of putting something underground in Phase 1
5. Costs for Phase 2 and beyond

Bruce Baller noted that we should try to construct the elements of the LBNE project so as to best attract non-US participation (e.g., allowing for a DOE first detector and cryostat and a second cryostat which could house a non-US detector).

Jim asked that there be a complete then-current cost available to him at the end of business each Thursday, May 4, 11, and 18. This will give Jim time to prepare a

summary for the next day's Engineering/Cost Working Group meeting – now planned for 1:00 each Friday. Please put these on your calendars.