

LBNE Reconfiguration Steering Committee 11th Meeting

(with Working Groups Invited, too)

June 13, 2012

Participants: See the lists at the end of this summary for those participating.

Agenda:

- Jim Siegrist – Comments from OHEP
- Marvin Marshak - Three Issues
- Milind Diwan 7 Bonnie Fleming - Cosmic Ray Backgrounds for Surface Detectors
- Near Detector Options
- European Neutrino Strategy Meeting

Jim Siegrist – Comments from OHEP

Special guest, Jim Siegrist, Head of the Office of High Energy Physics, summarized the recent interactions with the Laboratory on the LBNE reconfiguration, focusing on the June 6 briefing with Bill Brinkman and others and the DOE CD-1 for LBNE.

The June 6 briefing for the Office of Science was very well received, with lots of work evident. There were not a lot of questions, given depth of the presentations. Brinkman will be the one to talk to OMB and Congress, and is expected to do so with genuine enthusiasm. A go-ahead will be needed from the Office of Science before proceeding on CD-1, though this could come in a week or so).

There is a tentative schedule of June 26 for a meeting with Dan Lehman and Jim Siegrist to review the cost and schedule estimates status, an update on the useful February 14 briefing in which the cost model used for the recent LBNE review was favorably received.

Jim Siegrist had just spent a day at the Department of State on the subject of the interest by India in collaboration in the US, focusing on LIGO (putting an interferometer in India) and Fermilab collaboration (India providing support for the LBNE Project and for scientific collaborations). These collaborations were viewed as resurrecting and strengthening India's earlier collaboration on the Tevatron Collider program. It was thought that the two sides are "close to getting this nailed down." [Part of the discussion was also on the subject of multiple-entry visas for scientific collaboration, about which Siegrist was "guardedly optimistic."]

Marvin Marshak - Three Issues

Three issues were raised in a letter to the Steering Committee by Marvin Marshak about the preference expressed by the Steering Committee, a 10kT detector on the surface at Homestake. These issues,

1. Concern about not having a detector underground
2. Focusing on the mass hierarchy which might be known at the time of LBNE
3. Comparison of options with specific detector masses but different costs

were discussed at this meeting. Young-Kee said that these concerns were addressed in the face-to-face Steering Committee meeting, and would be addressed in the final document. She noted that in-kind contributions, possibly allowing a more capable first phase experiment, were expected to be easier to get for a Homestake-based experiment. There is already an agreement with India mentioning such collaboration explicitly.

Marvin noted that the LBNE Institutional Board had been unanimous in urging that an underground option be considered, and one of the three final options does this.

While much of the discussion has focused on mass-hierarchy determination and the CP phase as parametrized in the usual mixing model, there is strong interest in also being sensitive to non-standard model effects in neutrino oscillation. The longer baseline is thought to be more capable in this regard. Putting more money

up front for a more capable future is part of the argument for the preference expressed.

While the three choices are not all at the same cost level, they do highlight the range of options that are available. If the DOE will not have the funds for the most expensive option, the document does show what would still be available at a lower cost, but still have interesting physics potential. In any event, the appendices give the physics reach as a function of mass (cost).

There remain a few physics studies to complete. It was noted that the new, smaller Daya Bay uncertainty on θ_{13} will not change the bands on sensitivity plots appreciably. In fact, the uncertainty from θ_{23} can be larger than the remaining uncertainty on θ_{13} . However, this is not shown on the plots. What is shown is similar to what the uncertainty is for $\sin^2(2\theta_{23})$ in the range 0.9 to 1.0.

Again, it was noted that the absolute sensitivities in the draft report are dependent on the physics-sensitivity model use in the GLOBES studies. However, the relative sensitivities among the three options were thought to be reliable.

Milind Diwan & Bonnie Fleming - Cosmic Ray Backgrounds for Surface Detectors

Milind Diwan gave a progress report for Bob Svoboda on the team addressing the effect of cosmic rays for surface detectors. He expressed optimism based on his own experience on BNL E-743 (and E-766) which used a finely-segmented scintillator detector with drift chamber planes interspersed. There was 1 m of concrete above the detector. After selecting events that passed selection as neutrino-induced candidates, the event time-structure did not show out-of-time events. However, it was noted that this was for a short-baseline experiment with a much higher neutrino-interaction rate. Two documents were cited, DocDB #s 5950 and 5958. The problems addressed included:

1. Data acquisition system saturation
2. Confusion of neutrino events from overlapping cosmic ray tracks

3. Computing time limitations
4. Background mimics of real neutrino events (especially for events initiated by neutrals entering the detector).

The 300 Mb/s data rate per anode plane was viewed as not a problem. Similarly, the fractional volume taken by transiting muons (200 per 1.4 microsecond drift time) is very small, and deemed not a problem.

The off-line computing load was also deemed as manageable.

On the other hand, for only 100-270 events per year for a 34 kT detector, the possible fake events are hard to anticipate – and by a factor more for the event rate scaled to the initial detector mass.

Comparisons were made of expectations for the NOvA detector. However, compared to the drift time in a TPC detector, the NOvA detector has an advantage of 140 when using beam time windows rather than drift-time windows. Mark Messier noted that NOvA expects an upper limit of about 0.3 background events per year from neutrons and gammas.

Given data taking without a beam window, LBNE will have good statistics early on for backgrounds from cosmic rays.

Bonnie Fleming listed the following possible backgrounds which might mimic neutrino events:

1. Muon bremsstrahlung, decays at rest, and deep inelastic scattering (with 80 million muons going through the detector per year, the rate of high-energy muons will be low – leading, perhaps, to only a few events of this class as possible background)
2. Michel electrons (too low an energy to give significant background)
3. Decays in flight (possible problem)
4. Soft gammas (thought to be absorbed in the overburden)

More time will be needed to get numbers for these various cases, and a document will be needed too.

Near Detector Options

The study of near-detector influence on physics reach for the Phase 1 detector is competing with the Project X Physics Summer Study starting up this week.

There is the desire to find a way to put the cost of a hall for a near detector into the Phase 1 project, even if no money is available in the project for a detector. This will make it easier to get such a device as an in-kind contribution. While a near detector may not be needed to reduce systematic uncertainty on the early, lower statistics measurements that can be made the a smaller Phase 1 far detector, such a device could be critical in establishing and deciphering the nature of any non-standard model effects turned up in the Phase 1 data.

India is prepared to move more quickly than the US on participation in an LBNE experiment. There is significant money being discussed as possible for both Indian contributions to LBNE/Project X and Indian universities contributing to experiments. The challenge will be to capitalize on the technical skills and laboratory infrastructure in India in a way that can offset the costs of preparing a near-detector hall on site. The absence of an initial near detector is thought to be something that can be remedied quickly. On the other hand, the near detector is more critical for muon-neutrino disappearance, the first measurement likely to be made, than for electron-neutrino appearance which will take longer.

European Neutrino Strategy Meeting

The September 11-12 meeting in Cracow, Poland, on the European Neutrino Strategy is an important event. It would make a significant difference in our ability to attract European interest in LBNE if, by the time of the meeting, there is a strong statement and commitment from the Office of Science about pursuing LBNE as a keystone of the US Intensity Frontier strategy.

Committee Members Participating:

- Young-Kee Kim, FNAL, Chair
- Jon Bagger, JHU
- Charlie Baltay, Yale
- Gary Feldman, Harvard
- Kevin Lesko, LBNL
- Ann Nelson, Washington-Seattle
- Mark Reichanadter, SLAC
- Mel Shochet, U. Chicago (chair of physics group)
- Milind Diwan, BNL, for Bob Svoboda, UC Davis
- Jeffrey Appel, FNAL, Scientific Secretary

Ex-Officio Members Participating:

- PSAG Chair: Steve Ritz, UC Santa Cruz
- DOE's DUSEL review committee co-chair: Jay Marx
- DPF Chair: Pierre Ramond, U. Florida
- Fermilab Director: Pier Oddone
- LBNE Project Manager: Jim Strait

Special Guest:

- DOE Office of HEP Head: Jim Siegrist

Additional Physics Working Group Members Participating:

- Mary Bishai, BNL
- Ed Blucher, U Chicago
- Bonnie Fleming, Yale
- Mark Messier, Indiana
- Gina Rameika, Fermilab
- Kate Scholberg, Duke
- Charlie Young, SLAC
- Sam Zeller, Fermilab

Additional Engineering/Cost Working Group Members Participating:

- Bruce Baller, Fermilab
- Marvin Marshak, U. Minnesota
- Chris Mauger, LANL
- Elaine McCluskey, Fermilab
- Vaia Papadimitriou, Fermilab
- Tracy Lundin (LBNE Conventional Facilities Project Manager – guest)