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Director's Office

June 29, 2012

Robert Svoboda
University of California, Davis

Milind Diwan
Brookhaven National Laboratory

Mel Shochet
University of Chicago

Jim Strait
MS. 318

Dear Bob, Milind, Mel, and Jim:

Thank you very much for your presentations and participation in the June meeting of the Fermilab Physics Advisory Committee (PAC). The Committee explicitly mentioned its appreciation of the time and effort required of the proponents and presenters to prepare the reports for this PAC meeting.

LBNE and its reconfiguration planning were a major consideration at this meeting, and your efforts were crucial for the informed discussions which followed. Here is the text of the relevant part of the introduction and later text on LBNE which the PAC has sent to me in their Comments and Recommendations document:

The PAC reaffirms its strong endorsement of the physics goals of the Long-Baseline Neutrino Experiment (LBNE). The observation of CP violation and determination of the mass hierarchy for neutrinos are key missing pieces in the puzzles of the fermion masses and the origin of the observed baryon asymmetry in the Universe. A large liquid-argon detector, if sited underground, would also provide significant reach in the search for proton decay, as well as detailed information about neutrinos emitted from supernova explosions. The large observed value of $\sin^2(2\theta_{13}) = (0.092 \pm 0.016$ (stat) ± 0.005 (syst)) assures that the physics goal of measuring CP violation is achievable if the phase is not too close to 0 or π .

As a consequence of the March 19, 2012, letter from the DOE, Fermilab has been leading an intense effort to reconfigure the LBNE project into stages, each satisfying constraints on both total cost and peak spending and having its own physics

justification. The Committee is impressed with the effort by the Laboratory and the LBNE Collaboration in preparing staged options, using strong community involvement, on an extremely short time-scale. A national Steering Committee, with Working Groups for physics and engineering/costing, has produced a draft interim report that finds three viable options under the tight constraints: (1) a 30 kT surface detector at Ash River (810 km) using the NuMI off-axis (narrow-band) beam, (2) a 15 kT 2,340ft-underground detector at the Soudan Laboratory (735 km) using the NuMI on-axis (wide-band) beam, and (3) a 10 kT surface detector at Homestake (1300 km) with a new beam line. Excellent presentations of the physics considerations for the options in an international context, the engineering/cost issues, and the reaction of the LBNE Collaboration were given to the PAC.

The PAC concurs with the analysis of the pros and cons of each option as presented in the Steering Committee report. The PAC further agrees that if additional funds (\$135M current estimate) were available to place the 10kT detector underground at Homestake, the Phase 1 program would be greatly enhanced.

The PAC also concurs with the Steering Committee's inclusion of the unresolved technical risk of operating a liquid-argon detector on the surface, due to the large flux of particles from cosmic rays. Despite the optimistic initial estimates, this remains a key technical risk that must be managed and resolved. A large reduction in the fiducial volume would make the experiment unviable. Therefore, the PAC recommends that the underground options (Homestake and Soudan) be maintained, at least until this risk has been retired. The PAC recommends that the Laboratory and the LBNE Collaboration move as quickly as possible to answer this key question. The PAC would appreciate updates on the progress as new information becomes available.

The PAC reiterates that the ultimate goal -- a large detector underground for both high-intensity neutrino measurements and the other physics topics noted above -- is only fully realized in Phase 2. Concerns were expressed by PAC members that the beginning of Phase 2 is pushed far into the future in the staged program. The PAC also concurs with the Reconfiguration Report that a near detector is essential for full understanding of the physics of neutrino oscillations, particularly in case the data suggest new physics, e.g., sterile neutrinos. Therefore, the PAC encourages the Laboratory and the Collaboration to seek additional domestic and international partnerships to enhance the physics reach of Phase 1. Committing to a steady direction is necessary to enable a broad international effort on neutrino physics at Fermilab.

As you see, the PAC continues its very strong support for the LBNE experiment, even in the context of needing to perform the experiment in a staged fashion. The Committee recognized that that the options draft document was the result of a lot of very effective work by the Collaboration, Steering Committee, and Working Groups. The PAC, as all of us, appreciates the potential major benefit of siting the LBNE detector underground. The Laboratory is ready to work with the Collaboration to seek additional domestic and international partnerships to enhance the physics reach of Phase 1, both by finding a way to site the far detector underground and by enhancing the capability of any near-site detectors. We will also work to obtain a

commitment to the steady direction that the PAC noted is necessary to enable a broad international effort on neutrino physics at Fermilab.

Again, thank you for your help in informing the PAC about the reconfiguration effort and the options which the Laboratory is presenting to the DOE.

Sincerely,

A handwritten signature in black ink, reading "Piermaria Oddone". The signature is fluid and cursive, with a long horizontal stroke at the end.

Piermaria Oddone

cc:

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