LBNE Reconfiguration Physics Working Group 4th Meeting

April 24, 2012

Present:

- Mel Shochet, U.Chicago (chair)
- Mary Bishai, BNL
- Ed Blucher, UChicago
- Steve Brice, FNAL
- Milind Diwan, BNL
- Bonnie Fleming, Yale
- Gil Gilchriese, LBNL
- Mark Messier, Indiana
- Gina Rameika, FNAL
- Kate Scholberg, Duke
- Sam Zeller, FNAL
- Jeffrey Appel, FNAL (Scientific Secretary)

Mel Shochet's Workshop Introductory Slides

Mel will open the Physics Working Group session with slide on the membership of the Working Group, it's charge (the options), and detector, beam-on-target, and oscillation parameter assumptions. He will finish with the issues that it is already known will need to be addressed after the Workshop, including whatever comes up at the Workshop itself.

Gina Rameika Workshop Neutrino Oscillation Reach

Gina will begin with the scientific neutrino-oscillation physics goals of LBNE, and note the new measurements of theta_13 and their impact by showing how one looked at sensitivities vs sin^2(2 theta_13) before, and now looks at three new plots. These plots are to show (1) mass hierarchy and CP-violation parameter delta_cp vs delta_cp, (2) the fraction of delta_CP vs significance and the significance for mass hierarchy and delta_CP vs delta_CP, and (3) the error on delta_CP vs delta_CP. The definition of significance used will be given, since this is a somewhat different definition than that used by Mary Bishai for her presentation on the following day.

Gina will finish with a summary of results, but no conclusions. In spite of the difference in significance definitions, Gina will note the consistency of her results with those of Mary Bishai.

Gina will show a plot of the need for T2K results; e.g., noting that 5 E21 protons on target are needed for T2K to get to a minimum of 2 sigma mass-hierarchy determination assuming a 15 kT detector for LBNE.

While Gina will not cover physics other than the mass hierarchy and CP violation phase, Mary Bishai will cover other physics such as measurement of theta_13 and the quadrant of theta_23 (which side of pi/2).

Mary Bishai's Physics Reach Presentation

Mary's introduction begins with the goals as established by P5. She will note that the recently larger value of theta_13 means that CP asymmetries will be smaller, even though rates will be higher than for smaller theta_13. She will note the dominance of the matter asymmetry at the first oscillation maximum and the dominance of CP asymmetries at the second oscillation maximum.

Event rate plots will be shown for neutrino and antineutrino data to help in understanding what is actually measured, something not visible in sensitivity plots. Mary will also show sensitivities vs kT-years of exposure.

Finally, Mary will show sensitivities for other oscillation parameters as noted above and sensitivity to new physics, too. On the other hand, Mary's draft presentation appears to be as much as two times too long, and will have to be pared down. At the same time, there was interest in repeating a couple of Gina Rameika's slides for workshop participants who may miss the first day.

It was suggested that Mary make a point of the signal-to-background differences at Homestake vs Soudan as appears on a couple of her existing slides.

It was pointed out that a couple of bullets on Mary's conclusions slide need to be more precisely stated. In particular, "at any stage" really means "at equal masses" – which is a condition which will not be achieved comparing options where one includes building a new beamline (to Homestake) and the other does not need a new beam line (Soudan or Ash River).

briefly showed updated plots; e.g., sensitivities vs exposures out to 600 kT years. Jenny Thomas is working with Matt Bass on mass-hierarch sensitivity to the method of estimating sensitivities.

Kate Scholberg Non-Accelerator Physics Presentation

Kate updated her report on the non-accelerator physics reach in four areas: proton decay, atmospheric neutrinos, supernova-burst neutrinos, and supernova relic neutrinos. She added a couple of background slides for each of these physics topics. She is still waiting for input from the LBNE Collaboration atmospheric-neutrino group.

Kate added a plot showing the 5.6 ratio of sensitivities of LAr compared to water (waiting for input on this too), and a background vs depth for supernova signals.

Kate's conclusion is that a 20kT detector is needed to be competitive over the LBNE period, although a 10 kT detector running longer would still contribute to the world's knowledge.