WG#3 - Neutrino Interactions Session

Preliminary List of Bullets

1) The Neutrino-Nucleus Interaction is the least understood component of a detector's response to neutrinos.

"Over much of the available parameter space, discovery of CP violation at LBNF will require, as-yet unachieved, percent-level control over ν_e appearance signals. A dominant source of uncertainty on this signal is due to the modeling of neutrino interactions with the target nucleus in the near and far detectors. Relating the fundamental quark-level interactions of the neutrino to the complete nuclear response is a difficult field theory problem, involving both particle and nuclear physics."

2) Improvements of the nuclear model from the theoretical side are essential and rapidly incorporating these improvements in event generators is equally important. This is best accomplished via a collaborative HEP and NP effort.

Improvements to neutrino-nucleus interaction theory that would come from a better nuclear model are also needed and should be incorporated swiftly into event generators via a collaborative HEP and NP effort.

3) The current experimental neutrino interaction program at FNAL including efforts to better characterize the neutrino flux should be supported to their conclusion.

The current experimental neutrino interaction program (MINERvA, NOvA-ND, MicroBooNE, T2K Near Detector) must be fully supported and completed. This program must provide the oscillation community with the measurements of not only signal and background processes for a wide range of energies and nuclei, but also provide input on how the incoming neutrino energy gets translated into visible energy outside the interaction nucleus.

4) The critical role of event generators in taking nuclear models and producing experiment-dependent predictions needs to be emphasized and more resources devoted to keeping them widely available, accurate, transparent, and current. It is critical to benchmark the generators against both accelerator-based neutrino-nucleus interaction measurements and, via a collaborative HEP and NP effort, e-nucleus interaction measurements.

The role of event generators in modeling neutrino interactions will only increase in importance as neutrino oscillation experiments improve in statistics. Additional support is needed to improve the generators' accuracy and transparency. It is critical to benchmark the generators against both neutrino-nucleus interaction measurements and e-nucleus interaction measurements via a collaborative HEP and NP effort.

5) Future neutrino interaction measurements are needed to extend the current program of GeV-scale neutrino interactions. Current and future long-and-short-baseline neutrino oscillation programs should evaluate what neutrino nucleus interaction data is required to meet their ambitious goals and support experiments that provide this data.

Future neutrino interaction measurements are needed to extend the current program of GeV-scale neutrino interactions (LAr1-ND, ANNIE, CAPTAIN-MINERvA). A prioritization of these different new proposals should be determined based on review processes that are already in place, once the resources needed for these proposals are well-understood

6) Measurements and theoretical work are needed also to characterize neutrino interactions in the low energy regime (<100 MeV). This regime is especially relevant for core-collapse supernova neutrinos, and understanding is essential for development of future underground detectors.