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Overview of and motivations for studying neutrino interactions

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The discovery of neutrino mass and mixing is the first confirmed observation of phenomena not allowed by the standard model of particle physics. The "next next generation" of accelerator neutrino experiments will be focussed on the dual goals of searching for CP violation in leptons and measuring the neutrino mass hierarchy—but only if we can improve our understanding of neutrino-nucleus interactions. Recent cross-section measurements near 1 GeV have shown the conventional models for neutrino-nucleus scattering differ from nature in rates and kinematics of final state particles, and that discrepancies can be as large as 30%. Accelerator neutrino oscillation experiments, inherently wide-band, rely on comparisons of event rates at near and far detectors to extract oscillation parameters. Thus it is crucial that any possible differences in event rates or kinematics not due to neutrino oscillations be well understood. Poor modelling of neutrino interactions leads to incorrect predictions of event background rates as well as errors in neutrino energy reconstruction, and these errors will cause biases in the extraction of oscillation parameters. More importantly for the CP violation search, there may be un-modelled differences in ν_μ and ν_e cross sections.