Contribution ID: **90** Type: **Poster**

Improving the accuracy of neutrino energy reconstruction in charged-current quasielastic scattering off nuclear targets

Neutrino oscillation studies in accelerator experiments rely on reconstruction of neutrino energy in charged-current (CC) quasielastic (QE) scattering, typically performed from the measured kinematics of the charged lepton only.

The correct interpretation of their outcome requires an accurate estimate of neutrino cross sections for the nuclear targets of interest.

We develop an approach based on the impulse approximation formalism, suitable to provide an estimate of the CC QE cross section over a broad range of neutrino energy, between 0.1 and 10 GeV, relevant to accelerator neutrino experiments. Our model uses the target spectral function obtained from realistic description of nuclear dynamics, and accounts for the effects of final-state interactions between the spectator system an the struck nucleon.

Comparisons to precise electron scattering data allow us to understand and quantify the uncertainties of our calculations, which can be employed to improve the accuracy of the energy reconstruction in CC QE interactions.

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Track Classification: Neutrino Interactions