



Poster session 4 – Friday 8 July

P4.029 Single-pion production in the NEUT neutrino interaction generator

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NEUT is the primary neutrino interaction generator used by the T2K and Super-Kamiokande experiments. Neutrino-nucleon induced single-pion production (SPP) encompasses interactions in which a neutrino and a nucleon produce exactly one outgoing lepton, one outgoing pion and one outgoing nucleon. The single-pion final state stems from a combination of SPP and DIS interactions, which in nuclei is complicated further by pion re-scattering. SPP is an important channel in the intermediate neutrino-energy regime in which most current and future long-baseline oscillation experiments reside.

The SPP cross-sections account for roughly one third of the inclusive up to 2 GeV and is dominant between 2-3 GeV. Recent measurements on nuclear targets from MiniBooNE and MINERvA display interesting tensions in pion kinetic energy – which remain unresolved – adding value to upcoming T2K results on CH and H₂O. SPP also poses an irreducible background to the signal interaction at oscillation experiments – defined as having exactly one charged lepton and zero pions – when the pion is absorbed in the nucleus, causing a significant bias in reconstructed E_ν . Furthermore, T2K oscillation analyses are planning to include the $\nu_e \text{CC1 } \pi^+$ topology as signal at Super-Kamiokande to increase $\nu_\mu \rightarrow \nu_e$ statistics.

The above emphasises the importance of accurate SPP modelling, and this poster evaluates the current status of SPP in NEUT. The implementation follows the formalism of Rein and Sehgal, using helicity amplitudes of resonant nucleon-states, to determine the interaction strength and outgoing particle kinematics. The first generator implementation of M. Kabirnezhad's model, which includes resonant/non-resonant interference terms, is also evaluated. Fits to neutrino-nucleon SPP bubble chamber data are presented, followed by predictions of neutrino-nucleus data from MiniBooNE, MINERvA and T2K. The results of these fits will be propagated to analyses at T2K and Super-Kamiokande.