

Modelling neutrino interactions for T2K analyses

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To achieve the ambitious goal of characterising neutrino flavour oscillations with percent-level precision, current and future long-baseline neutrino oscillation experiments must significantly reduce existing systematic uncertainties. Among the most challenging are those associated with modelling neutrino–nucleus interactions in the few-GeV energy range.

To address this, the T2K collaboration is undertaking a comprehensive effort to incorporate state-of-the-art theoretical models into its Monte Carlo event generator, NEUT, and to develop a robust parametrisation of model uncertainties for use in oscillation analyses. This talk will present the new uncertainty model developed for T2K's latest oscillation measurement. Key improvements include: newly introduced low-energy transfer parameters describing the strength of Continuum Random Phase Approximation (CRPA) and Final State Interactions (FSI); a more sophisticated parametrisation of the nucleon cascade; and an improved treatment of Pauli blocking, now extended to single pion production. In addition, a more robust approach to modelling ν_e/ν_μ differences has been implemented via collinear/soft photon correction, among other enhancements. Lastly, we will discuss ongoing work towards the ND280 upgrade analysis, including the introduction of a brand-new quasielastic model known as the Energy Dependant Relativistic Mean Field (ED-RMF) model.

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