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P3.038 Event re-weighting in the NuWro neutrino interaction generator

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NuWro is a neutrino interaction event generator which is capable of producing predictions that are applicable over a wide energy range, 0.1–100 GeV. NuWro has been used in Monte Carlo studies by collaborations such as MINERνA, T2K, and ArgoNEUT. It has a large variety of neutrino interaction and nuclear models, making it well suited to investigating model-based systematic biases in neutrino scattering and oscillation analyses. However, the tuning of these models to experimental data has been hampered by the computational needs of generating large numbers of events for the many sets of proposed model parameter values. One way to significantly reduce the time taken to perform such tuning is to use an event re-weighting approach—similar to those currently used by the NEUT and GENIE neutrino event generators—in conjunction with complete event regeneration. A single set of events is produced using a nominal model choice. Weights are then calculated and applied on an event-by-event basis as a function of the free model parameters. Calculating and applying these weights does not affect the kinematics of a single event, but allows the predicted cross-section in the relevant region of phase space to be enhanced or suppressed according to the chosen parameter variations. This significantly reduces the required frequency of event re-generation, minimising computational cost when performing generator tunings. In this poster we present recent work implementing and validating a dedicated reweighting module into the existing NuWro framework. The re-weighting is capable of varying the quasi-elastic, pion-production, and nuclear cascade models. This allows the generator to be easily tuned to experimental, few GeV neutrino scattering data, opening up NuWro for use in more complex model analysis and systematic studies. Preliminary tuning results from fits to MINERνA and MiniBooNE charged current scattering data are shown. Such analyses will support precision oscillation and cross-section measurements in current and future experiments.