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AGKY Hadronization Model Tuning in GENIE 3

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The next generation of neutrino oscillation experiments rely on the precise understanding of neutrino interactions in a wide energy range. The GENIE collaboration is constantly engaged in an effort to improve interaction models and fit them against available datasets. A lot of effort is going into pion producing processes, so far focusing on the resonant component of the pion production. This is not enough as pion production is entangled with hadronisation models due to the interplay between deep inelastic scattering and resonant processes. In particular, the knowledge of the exact mixture of hadrons in showers affects the efficiency to distinguish between NC/CC events, the topological characterization, and impacts the estimation of backgrounds. The GENIE neutrino Monte Carlo [2] employs an effective low-mass hadronization model known as AGKY [5] whose validity spans from low to high W. At low invariant mass (W < 2.3 GeV/c2), the model is based on the Koba-Nielsen-Olesen (KNO) scaling low while it gradually switches over to PYTHIA6 (W > 3 GeV/c2) [4]. The default AGKY model parameters controlling hadronization at low invariant masses were extracted from some of the FNAL 15”bubble chamber and the Big European Bubble Chamber analysis [6, 1] but PYTHIA has never been tuned to low energy neutrino-hadroprodution data. Moreover, comparisons of the GENIE model against neutrino-induced hadron shower data exposed disagreements between different datasets, which further deteriorates at the PYTHIA region. The GENIE Collaboration addressed this issue by tuning the hadronization model against charged averaged multiplicity data on hydrogen and deuterium targets from bubble chamber experiments. All the experimental procedures followed in the original analysis have been taken into account in the simulation. The tune has been done using the Professor Framework [3] providing with a complete error estimation of the parameters and the correlation between the low-W AGKY parameters and PYTHIA parameters. In this talk, we focus on the discussion of the tuning procedure as well as the impact of the tune on other observables.

References

[1] Amsterdam-Bologna-Padova-Pisa-Saclay-Torino Collaboration et al. Charged hadron multiplicities in high energy ν¯µn and ν¯µp interactions. Zeitschrift fu¨r Physik C Particles and Fields, 11(4):283–292, Dec 1982.
[2] C. Andreopoulos et al. The GENIE Neutrino Monte Carlo Generator. Nucl. Instrum. Meth., A614:87–104, 2010.
[3] Andy Buckley, Hendrik Hoeth, Heiko Lacker, Holger Schulz, and Jan Eike von Seggern. Systematic event generator tuning for the lhc. 2009.
[4] Torbj¨orn Sj¨ostrand, Stephen Mrenna, and Peter Skands. Pythia 6.4 physics and manual. Journal of High Energy Physics, 2006(05):026–026, May 2006.
[5] T. Yang, C. Andreopoulos, H. Gallagher, K. Hofmann, and P. Kehayias. A hadronization model for few-gev neutrino interactions. The European Physical Journal C, 63(1):1–10, Aug 2009.
[6] D. Zieminska et al. Charged-particle multiplicity distributions in νn and νp charged-current interactions. Phys. Rev. D, 27:47–57, Jan 1983.
[1] C. Andreopoulos et al. The GENIE Neutrino Monte Carlo Generator. Nucl. Instrum. Meth., A614:87–104, 2010.
[2] T. Yang, C. Andreopoulos, H. Gallagher, K. Hofmann, and P. Kehayias. A hadronization model for few-gev neutrino interactions. The European Physical Journal C, 63(1):1–10, Aug 2009.
[3] Torbjörn Sjöstrand, Stephen Mrenna, and Peter Skands. Pythia 6.4 physics and manual. Journal of High Energy Physics, 2006(05):026–026, May 2006.
[4] D. Zieminska et al. Charged-particle multiplicity distributions in νn and νp charged-current interactions. Phys. Rev. D, 27:47–57, Jan 1983.
[5] D. Zieminska, et al., Charged-particle multiplicity distributions in ν_μ n and ν_μ p charged-current interactions, Phys. Rev. D 27 (1983) 47–57
[6] Andy Buckley, Hendrik Hoeth, Heiko Lacker, Holger Schulz, and Jan Eike von Seggern. Systematic event generator tuning for the lhc. 2009.

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