

Combining PYTHIA and Geant4 for High-Energy Event Simulation in Neutrino Telescopes

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Neutrino telescopes are large volume detectors ($\sim 1 \text{ km}^3$) embedded in optically transparent media that observe the secondary particles produced when neutrinos—ranging in energy from GeV to TeV—interact in the medium. These experiments rely on detailed Monte Carlo simulations to interpret their data, yet events at TeV energies and above produce extensive hadronic and electromagnetic particle cascades whose full modeling would involve propagating millions of secondary particles, creating a substantial computational challenge. Effective simulations must therefore balance physical accuracy with computational cost.

In this talk, I will present a new simulation pipeline for neutrino telescope experiments that is intended to deliver more accurate results than standard simulation approaches, while still remaining practically applicable. This framework combines PYTHIA for generating the primary neutrino interaction with Geant4 for particle transport and secondary production. Preliminary performance results will be shown.

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