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The NOvA Simulation Chain

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The NOvA experiment is a two-detector, long-baseline neutrino experiment operating in the recently upgraded NuMI muon neutrino beam. Simulating neutrino interactions and backgrounds requires many steps including: the simulation of the neutrino beam flux using FLUKA and the FLUGG interface; cosmic ray generation using CRY; neutrino interaction modeling using GENIE; and a simulation of the energy deposited in the detector using GEANT4. To shorten generation time, the modeling of detector-specific aspects, such as photon transport, detector and electronics noise, and readout electronics, employs custom, parameterized simulation applications. We will describe the NOvA simulation chain, and present details on the techniques used in modeling photon transport near the ends of cells, and in developing a novel data-driven noise simulation.

Due to the high intensity of the NuMI beam, the Near Detector samples a high rate of muons originating in the surrounding rock. In addition, due to its location on the surface at Ash River, MN, the Far Detector collects a large rate (~ 40 kHz) of cosmic muons. We will discuss the methods used in NOvA for overlaying rock muons and cosmic ray muons with simulated neutrino interactions and show how realistically the final simulation reproduces the preliminary NOvA data.

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