

BeamHNL, a GENIE-based general heavy neutral lepton generator

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Heavy Neutral Leptons (HNL) are a compelling target for discovery searches at accelerator experiments. The GENIE BeamHNL module is an experiment-agnostic, configurable simulation of HNL produced in the decays of particles that are made in neutrino beamlines. Applicable to HNL with mass less than the kaon's mass, BeamHNL produces a detailed record of decay events in an arbitrarily complex detector at a user-specified location, by calculating the neutrino energy and acceptance probability event-by-event. It accepts flexible user input in the form of flat flux tuples, a ROOT geometry file, and a configuration file where desired decay channels (implemented from an effective field theory valid at Intensity Frontier neutrino energies) are specified. Deliverables include a dynamic flux calculation, HNL decay timing distributions for background reduction, an implementation of HNL polarisation, and a robust distribution of decay vertices in 3D space according to the position and size of the supplied detector.

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