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Sensitivity to Heavy Neutral Leptons with the SAND detector at the DUNE ND complex

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Heavy Neutral Leptons (HNLs) have been an interesting topic for experimental particle physics in the past few years.

A study has been performed within the framework of the multi-instrument DUNE near detector complex, specifically regarding the SAND muon tracker on-axis detector, to assess the sensitivity to HNL within six years of exposure.

The meson flux has been generated using Pythia8, focusing on charmed heavy mesons to explore HNL masses between 0.3 to 1.7 GeV/c². A MadGraph/MadDump model has been implemented based on the nuMSM lagrangian, and used to obtain accurate kinematics for the decay of mesons and HNL.

The simulated final-state particles were then propagated through the detector simulation and a track reconstruction algorithm, based on the Kalman Filter technique, along with a simple two-body decay selection, were implemented to estimate efficiency and background rejection.

The HNL sensitivity is estimated both from the purely phenomenological and experimental point of view, reaching $O(10^{-9})$ for higher HNL masses, with about a factor 3 deterioration between the phenomenological and the experimental case. In this poster, I will present the configuration and results of these studies, and discuss potential further improvements.

In-person participation

No

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