

Displaced fat-jets and tracks to probe boosted right-handed neutrinos in the $U(1)_{B-L}$ model

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We investigate the pair-production of Right-Handed Neutrinos (RHNs) via a $B - L$ Z' boson and present the sensitivity studies of the active-sterile neutrino mixing ($|V_{\mu N}|$) at the High-Luminosity run of the LHC (HL-LHC) and a future pp collider (FCC-hh). We focus on RHN states with a mass of $10 - 70$ GeV which naturally results in displaced vertices for small $|V_{\mu N}|$. Being produced through a mass resonance with $M_{Z'} \geq 1$ TeV, the RHNs are heavily boosted, leading to collimated decay products that give rise to fat-jets. We investigate the detection prospect of dedicated signatures in the inner detector and the muon spectrometer, namely a pair of displaced fat-jets and the associated tracks, respectively. We find that both the HL-LHC and FCC-hh can be sensitive to $|V_{\mu N}| > 10^{-6}$ and $|V_{\mu N}| > 10^{-7}$ with the number of events reaching $\mathcal{O}(10)$ and $\mathcal{O}(10^3)$, respectively. This allows probing the generation of light neutrino masses through the Seesaw mechanism.

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