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Observation of 152 GeV charged scalar at future lepton colliders

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The statistical significance of the “multi-lepton anomalies”—the discrepancies in the channels with multiple leptons, missing energy, and potentially (b)jets in the final states with the SM prediction—indicates the production of a scalar with a mass between 145 GeV and 155 GeV that is beyond the standard model. The associated production of a narrow scalar resonance of mass ≈ 152 GeV, with a significance of 5.4σ has been reported with the $\gamma\gamma$, $Z\gamma$, and WW final state. The requirement of the new scalar to decay dominantly to WW final state by the anomalies and the absence of any excess in ZZ final state significantly predicts the new scalar to be part of $Y = 0$ scalar-triplet. The model contains a CP-even neutral Higgs (Δ^0), and two charged Higgs bosons ($\Delta^\pm$), which are quasi-degenerate in mass. In this article, we focus on the possibility of finding the aforementioned predicted ≈ 152 GeV BSM charged scalar at the future proposed e^+e^- collider. We emphasize on the pair production of the charged scalars, $e^+e^- \rightarrow \Delta^\pm\Delta^\mp$ and scrutinize various signal regions depending on the decay products of $\Delta^\pm$.

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