Contribution ID: **24** Type: **Talk**

Indications for a 152 GeV Higgs boson

Saturday, 8 November 2025 09:20 (30 minutes)

The statistical significance of the multilepton anomaly - the discrepancies in the channels with multiple leptons, missing energy, and (b-) jets in the final states with the SM prediction -indicates the production of a scalar with mass between 145 and 155 GeV that is beyond the standard model. The associated production of a narrow scalar resonance of mass around 150 GeV, with a significance of 5.3σ has been reported with the analysis of $\gamma\gamma$, $Z\gamma$, and WW sideband spectra in Run 2 data. The requirement of the new scalar to decay dominantly to WW final state by the multi-lepton anomalies and the absence of any excess in ZZ final state significantly indicates 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. Identifying the charged scalar at the LHC is difficult due to large SM backgrounds, production rates suppressed by small mixing angles
(α, β), and low detection efficiency for its moderately energetic leptons. This motivates dedicated searches at future e^+e^--colliders, where the cleaner environment and well-defined initial state make $e^+e^- \to \gamma^*/Z \to \Delta^{\pm}\Delta^{\mp}$ the primary production channel. In this article, we focus on the possibility of finding the aforementioned predicted around 150 GeV BSM charged scalar at the future proposed e^+e^-– collider. We emphasize on the pair production of the charged scalars, $e^+e^- \to \Delta^{\pm}\Delta^{\mp}$ and scrutinize various signal regions depending on the decay products of $\Delta^{\pm}$.

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Session Classification: BSM

Track Classification: Physics: 10: Physics beyond the SM