

## Neutral Heavy Scalar Searches via Standard Model Gauge Boson Decays at the Large Hadron Electron Collider with Multivariate Techniques

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**Abstract :** In this article, we study the prospects of the proposed Large Hadron electron Collider (LHeC) in the search for heavy neutral scalar particles. We consider a minimal model with one additional complex scalar singlet that interacts with the Standard Model (SM) via mixing with the Higgs doublet, giving rise to an SM-like Higgs boson and a heavy scalar particle. Both scalar particles are produced via vector boson fusion and can be tested via their decays into pairs of SM particles, analogously to the SM Higgs boson. Using multivariate techniques, we show that the LHeC is sensitive to heavy scalars with masses between 200 and 800 GeV down to scalar mixing of order 0.01.

**Keywords :** beyond the standard model, large hadron electron collider, multivariate analysis, scalar singlet

**Conference Title :** ICHEP 2019 : International Conference on High Energy Physics

**Conference Location :** Paris, France

**Conference Dates :** September 19-20, 2019