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## Study of the exotic Higgs boson decay $H \rightarrow Z\alpha$

This work extends previous ATLAS Run-2 analyses to improve the search for new physics through the decay of a beyond-Standard-Model Higgs boson,  $H \rightarrow Z\alpha$ . The theoretical framework is the Two-Higgs-Doublet Model, in which the Higgs sector is extended by an additional scalar doublet. The particle  $\alpha$  is a light (0.5–3.0 GeV) CP-odd scalar predicted in minimal extensions of the Standard Model and expected to decay hadronically. The experimental signature involves a dilepton pair from the  $Z$ -boson and a highly collimated jet from the boosted  $\alpha$ . A feasibility study is ongoing using Monte Carlo simulations and neural-network techniques, comparing previous ATLAS results and new simulated samples. Improved selection methods and analysis strategies are being developed to enhance the sensitivity to the  $H \rightarrow Z\alpha$  signal and its significance over background, aiming for optimised performance with the upcoming Run-3 dataset.

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