

Search for a heavy resonance decaying into a SM higgs boson and a new particle X, in a fully hadronic final state

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In ATLAS collaboration the search for new heavy particles in a wide mass range decaying in two bosons represents one of the main goals of the Beyond Standard Model (BSM) physics program. A search for a resonance Y (with mass > 1 TeV) decaying in the Standard Model Higgs boson and in another BSM boson X , is conducted exploiting the full Run-2 collision data collected at LHC with the ATLAS experiment. The particle X is assumed to decay to a pair of light quarks, and the fully hadronic final state $Y \rightarrow HX \rightarrow b\bar{b}q q'$ is analyzed. The high mass of the Y means that both the H and the X are boosted, and each boson's decay products can be reconstructed as a large radius jet. In order to recover sensitivity to less boosted topologies, the X boson is reconstructed using two small radius jets as well, extending the search to the unexplored region with $m_X/m_Y > 0.3$.

A data-driven background estimation is carried on using a Deep Neural Network since Monte Carlo simulations for QCD processes are not precise enough.

Other Machine Learning techniques are also adopted in this analysis for a model-independent search. Results are presented in the 2D plane of Y and X mass, and interpreted in a Heavy VectorTriplet simplified model.

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