

Measurement of the Higgs Boson Transverse Momentum and its Sensitivity to New Physics Beyond the Standard Model

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Using the Standard Model of particle physics (SM) to model the interactions between fundamental particles, simulations of processes resulting in the production of Higgs bosons were done for different centre of mass energies of the CERN Large Hadron Collider (LHC). The results from these simulations were then compared to actual data obtained at the ATLAS and CMS experiments and it was found that there is an excess of transverse momentum in the actual results above the simulation results. One hypothesis, which explains this excess transverse momentum, is that a Beyond Standard Model Pseudo scalar boson is being produced, which then decays into a dark matter particle and a SM-like Higgs Boson. Thus, the emission of the dark matter particle would give the Higgs Boson more transverse momentum than predicted by the SM. This was loosely modeled by simulating the production of a heavier than SM Higgs boson which would represent the Beyond Standard Model Pseudo scalar boson. By doing this it was found that as the running centre of mass energies at the CERN LHC was increased the total production cross-section for the Pseudo scalar boson increased faster than that for the SM Higgs boson. This tells us that if this hypothesis is correct we would expect a greater Higgs boson production cross-section to be seen at the LHC in 2015 when the centre of mass energy increases. The measurement of the transverse momentum spectrum of the Higgs boson is sensitive to physics beyond the SM, in particular to the production of Dark matter.

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