PROCEEDINGS OF SCIENCE

SEARCH FOR HIGGS BOSON PAIR PRODUCTION WITH THE ATLAS DETECTOR

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The Standard Model (SM) very successfully describes experimental observations, but is known to be an incomplete theory. Measurements of SM parameters and checks of its self consistency are important to improve our understanding of nature. An important parameter to understand electroweak symmetry breaking is the Higgs boson self-coupling, which can be accessed in Higgs boson pair production. These studies are already important now to search for potential effects of physics beyond the SM as well as to prepare for the analysis of the full dataset of the HL-LHC. This poster will present the latest results on the Higgs pair production with the ATLAS detector with a focus on the 4b final state.

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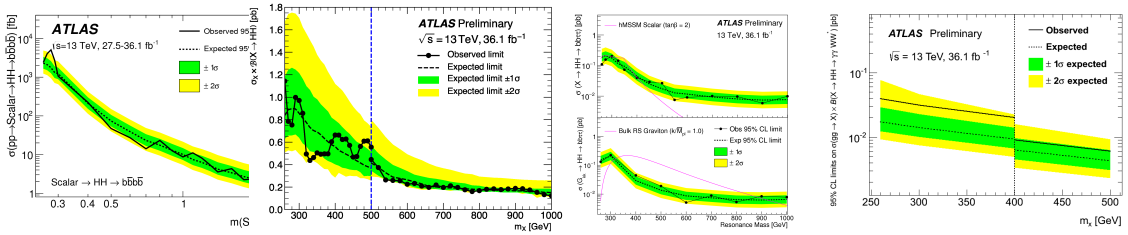

Figure 1: The observed and expected 95% CL upper limits on the production cross section times branching ratio for the narrow width scalar approximation for the a) $b\bar{b}b\bar{b}$[1], b) $\gamma\gamma b\bar{b}$[2], c) $\gamma\gamma WW$*[3], d) $b\bar{b}\tau^+\tau^-$[4] final states.

1. Standard Model Cross Section Limit

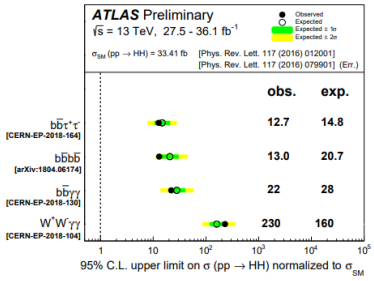

Figure 2: The observed and expected 95% CL upper limits on the Standard Model Di-Higgs production cross section normalized by the Standard Model Prediction [5].

2. Summary and Conclusion

No significant excesses reported for BSM Resonant Di-Higgs production for ATLAS during Run 2 at this point. With the largest deviation, in the $b\bar{b}b\bar{b}$, at a mass of 280 GeV with a global significance of 2.8 σ. Limits are set for resonant production in the $b\bar{b}b\bar{b}$, $\gamma\gamma b\bar{b}$, $\gamma\gamma WW$*, and $b\bar{b}\tau^+\tau^-$ final states. A 95% CL upper limit was placed on the non-resonant production corresponding to 12.7 times the SM expectation from the $b\bar{b}\tau^+\tau^-$ final state.

References

[1] ATLAS Collaboration, *Search for pair production of Higgs bosons in the $b\bar{b}b\bar{b}$ final state using proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, arXiv:1804.06174 [hep-ex], April 2018; submitted to JHEP.

[2] ATLAS Collaboration, *Search for Higgs boson pair production in the $\gamma\gamma b\bar{b}$ final state with 13 TeV pp collision data collected by the ATLAS experiment*, *arXiv* : 1807.04873$[hep-ex]$, July 2018; submitted to JHEP.

[3] ATLAS Collaboration, *Search for Higgs boson pair production in the $\gamma\gamma WW$* channel using pp collision data recorded at $\sqrt{s} = 13$ TeV with the ATLAS detector*, arXiv:1807.08567 [hep-ex], July 2018; submitted to EPJC.

[4] ATLAS Collaboration, *A search for resonant and non-resonant Higgs boson pair production in the $b\bar{b}\tau^+\tau^-$ decay channel in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, arXiv:1808.00336 [hep-ex]; submitted to Phys. Rev. Lett.

[5] ATLAS Collaboration, *Summary plot for SM non-resonant HH searches for ICHEP*, ATL-COM-PHYS-2018-841, https://cds.cern.ch/record/2625075, June 2018.