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## VBF H(bb/cc) from sensitivity study to full analysis using ATLAS

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The Higgs boson gives masses to all massive particles in the Standard Model (SM) and plays a crucial role in the theory. Studying different production and decay modes of the Higgs at the Large Hadron Collider is essential. The Vector Boson Fusion (VBF) is the second-largest production mechanism of the Higgs. Higgs bosons have the largest probability of decaying into a pair of bottom quarks, whereas the Higgs interaction to charm quarks has never been observed directly before. Thus, I led a sensitivity study conducted in the summer of 2023 to give insight into the best optimizations for Run-3 VBF Higgs to bb and Higgs to cc analysis. A new VBF trigger was made in late 2018 at the end of Run 2, allowing us to observe the Higgs boson decay to charm quark using the VBF production mode. The sensitivity study utilized the new trigger and began with determining the best working points for the flavor tagging of b and c quarks. I optimized hyperparameters and input variables of the Boosted Decision Trees (BDT). I introduced cuts on the BDT score to increase the significance of the invariant mass of the two signal b-quarks and c-quarks. The sensitivity analysis proved the feasibility of searching for VBF Higgs to bb and Higgs to cc using a partial Run 2 and Run 3 ATLAS dataset, leading to a full ATLAS analysis in September of 2023. This talk will summarize the sensitivity study and my current involvement in further optimizing the analysis to enhance signal sensitivity.

### Mini Symposia (Invited Talks Only)

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