

Search for the Higgs boson decay into a charm quark-antiquark pair at the CMS experiment and future developments

The discovery of the Higgs boson represents a milestone in the history of Particle Physics, since it confirmed the electroweak symmetry breaking mechanism, predicted by the Standard Model. So far, the Higgs couplings to third generation fermions as well as to muons have been measured with a good precision, while the assessment of second-generation quark and first generation fermions still represents a challenge at the major collider experiments, like CMS and ATLAS. Searches for $H \rightarrow c\bar{c}$ have been carried out by both ATLAS and CMS using data collected during Run 2 at the LHC. The best result was obtained by CMS, by exploiting the VH production mode, which offers a good signal to background discrimination. With this study, an upper limit of 14 times the Standard Model prediction was set on the production cross section. By investigating vector boson fusion (VBF), yet unexplored, during Run3, it will be possible to set a yet tighter upper limit. In this work, the search for H_{cc} performed by CMS with Run 2 data will be described and a novel trigger strategy, based on the ParticleNet algorithm for jet flavor tagging, proposed for Run 3, will be presented.

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