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VH, H->cc Search in the Resolved-jet Regime at CMS

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The Standard Model (SM) predicts couplings to the Higgs boson for a given mass of the Higgs boson, and experimental values different from these predictions would be strong indicators of physics beyond the SM. While Higgs decays to vector bosons and third-generation charged fermions have been established with good agreement to SM couplings, the Higgs boson coupling to charm quarks has yet to be experimentally determined with statistical significance. In the production mechanism where the Higgs boson is produced in association with a vector boson (VH, H->cc) and subsequently decays to a pair of charm quarks, is a promising process for studying the Higgs-charm Yukawa coupling due to its high signal to background ratio. We discuss the planned SM search for VH, H->cc in the resolved-jet regime, where the Higgs boson has a low to moderate transverse momentum (<˜ 300 GeV), using CMS Run-3 proton-proton data. Previous analyses with CMS Run-2 data reconstructed the Higgs decay in the resolved-jet regime with two small-radius jets that were flavor-tagged independently, resulting in an underperformance due to excluding information from the radiation between the decay products of the Higgs. At the LHC Run-3, the Higgs, we intend to employ the novel "PAIReD"jet reconstruction technique: elliptical clusters of particles defined by pairs of small-radius jets with arbitrary separations between them. Modern flavor tagging algorithms trained on such novel jets allow us to increase tagging performance by exploiting correlations between hadronization products and extending the capabilities of merged-jet reconstruction flavor tagging techniques to small-radius jets. Flavor-tagging and simultaneously predicting the mass of PAIReD jets via machine learning provide greater leverage for separating the signal from the background. The overall analysis will be extended to include Higgs decays to bottom quarks, resulting in a simultaneous measurement of the Higgs-charm and Higgs-bottom Yukawa couplings. We expect to improve the rejection of major backgrounds by a factor of around 2.

Mini Symposia (Invited Talks Only)

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