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Measurement of the top quark Yukawa coupling from $t\bar{t}$ differential cross sections in the lepton+jets final state in proton-proton collisions at $\sqrt{s}=13$ TeV

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We present a measurement of the top quark Yukawa coupling derived from the top quark-antiquark ($t\bar{t}$) differential production cross sections. $t\bar{t}$ is reconstructed in the lepton+jets channel. Corrections to $t\bar{t}$ production due to virtual exchange of electroweak bosons, including the Higgs boson, can produce large distortions of differential distributions near the production. Therefore precise measurements of these distributions are sensitive to the value of Yukawa coupling. This analysis is based on data collected by the CMS experiment at the LHC at $\sqrt{s}=13$ TeV corresponding to an integrated luminosity of 35.8 fb⁻¹. Top quark events are reconstructed with at least three jets in the final state. A novel technique is introduced to reconstruct the $t\bar{t}$ system for events with one missing jet. This technique enhances the experimental sensitivity in the low invariant mass region, $m_{t\bar{t}}$. The data yields in $m_{t\bar{t}}$, the rapidity difference $|\Delta\eta_{t\bar{t}}|$, and the number of reconstructed jets are compared with distributions representing different Yukawa couplings. These comparisons are used to extract an upper limit on the top quark Yukawa coupling of 1.67 (1.62 expected) at 95% confidence level.

Author: Prof. DEMINA, Regina (University of Rochester)

Co-author: CMS COLLABORATION

Presenter: Prof. DEMINA, Regina (University of Rochester)

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