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Measurement of the top quark Yukawa coupling from tt kinematic distributions in the dilepton final state

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An extraction of the top quark Yukawa coupling (Y_t) from top quark pair production is presented using proton-proton collisions at $\sqrt{s} = 13$ TeV, corresponding to an integrated luminosity of 140 fb^{-1}, recorded by the ATLAS experiment. Corrections from a Higgs boson exchange between the top quark and top anti-quark can produce non-negligible modifications to differential distributions near the energy threshold of $t\bar{t}$ production. The kinematic distributions sensitive to these modifications at parton level, are the invariant mass of the $t\bar{t}$ system (m_{tt}) and the azimuthal angle of the top quark with respect to the beamline in the rest frame of the $t\bar{t}$ system known as $\cos(\theta^*)$ This analysis aims to constrain Y_t indirectly using the kinematic distributions of $t\bar{t}$ pair events using the eμ dilepton final state.

Since we are working in the dilepton channel $t\bar{t} \rightarrow W^+bW^-b \rightarrow \ell^+\nu b\ell^-\nu b$. The ATLAS experiment cannot measure the neutrinos and as such we need to reconstruct the $t\bar{t}$ kinematics sensitive to variations in Y_t. Machine learning was used to reconstruct the mass of the top quark system as this provides the greatest sensitivity to variations in Y_t. A binned profile likelihood fit was then implemented to extract a blinded estimation of Y_t using Asimov data including a complete set of statistical and systematic uncertainties.

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