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Extraction of the Top Quark Yukawa Coupling

Friday, 7 July 2023 11:20 (20 minutes)

An exploration into machine-learning based optimisation techniques applied to the extraction of the top quark Yukawa coupling (Y_t) from top quark pair production in the dilepton final state, using proton collisions recorded by the ATLAS experiment in LHC run 2 and 3 is presented. Electroweak corrections for the exchange of the Higgs boson between the top quark and the top anti-quark for different values of Y_t result in changes to the kinematic distributions of the top quark and top anti-quark system close to the $t\bar{t}$ production energy threshold. The aim of this analysis is to use the kinematic distributions of the $t\bar{t}$ events in the dilepton final state to constrain the value for Y_t. The observables that are most sensitive to Y_t are the invariant mass of the $t\bar{t}$ system, $m_{t\bar{t}}$, and the difference in rapidity, $\Delta y_{t\bar{t}}$. As the decay products of the $t\bar{t}$ system involve neutrinos in the dilepton final state, reconstructing the top quark and top anti-quark introduces resolution effects and additional systematic uncertainties. The proxy observables $m_{l\bar{l}b\bar{b}}$ (invariant mass of the $l\bar{l}b\bar{b}$ system) and Δy_{lblb} (the difference in rapidity between the two lb pairs) are used to mitigate this effect. In this talk, I will discuss the current state of the project, as well as future plans.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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