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A search for tWZ production in the trilepton channel using Run 2 data from the ATLAS experiment

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A search for tWZ production using events containing three leptons from Run 2 ATLAS proton-proton collision data with a centre of mass energy of 13 TeV will be presented. An event selection scheme was developed using simulation to select tWZ events and to broadly suppress background events. Events were then separated into mutually-exclusive regions of phase space to increase the amount of tWZ events compared to background events, and to calibrate the modelling of the background production processes. Background events were further suppressed through the use of Gradient Boosted Decision Tree (GBDT) machine learning algorithms. First, a GBDT was trained to identify hadronically-decaying W bosons since these are a characteristic feature of tWZ events and help distinguish between tWZ and one of the major background processes, WZ. Then, this GBDT and other event information was used to train an event-level GBDT used to distinguish between tWZ and all backgrounds. Using the output of the event-level GBDT, a maximum likelihood fit was used to estimate the signal strength, μ, of tWZ production, where nuisance parameters were assigned to theoretical and experimental systematic uncertainties. A signal strength of $\mu = 1.80^{+1.88}_{-1.83}$ was determined with an expected significance of 0.55σ, and an expected upper limit on μ of $3.6^{+3.1}_{-1.7}$ was also determined. The preliminary blinded results show that the search has the potential to put the strongest ever constraint on tWZ production, but does not have the potential to observe tWZ production as predicted by the Standard Model. These constraints are limited by statistical uncertainties, therefore an outlook on future measurements of tWZ within ATLAS will be discussed.

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

Yes

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

PhD

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