

Searching for Dark Matter in top quark production with the CMS experiment

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December 13, 2021

Astronomical observations provide strong evidence that a large proportion of the matter in the universe is “Dark Matter” (DM), which is currently not included in the Standard Model (SM) of particle physics. Furthermore, many cosmological models suggest Dark Matter should couple to the SM around the 100 GeV scale, and hence may be produced at the LHC, appearing as missing transverse momentum. We present a search for Dark Matter produced in association with top quarks, via a spin-0 mediator, with a focus on the dileptonic channel. This analysis will be part of the upcoming CMS result with the full Run-2 dataset, and will be the first to combine the top quark pair + DM and single top + DM processes for dileptonic, semileptonic and full hadronic final states, which greatly aids sensitivity to the highest mediator masses in the search.

The dileptonic channel poses an interesting challenge due to a large amount of missing transverse momentum in the SM $t\bar{t}$ background, and an irreducible $t\bar{t}Z(Z \rightarrow \nu\nu)$ background. This analysis therefore uses novel variables and machine learning techniques in the signal extraction, and new control regions to constrain the irreducible backgrounds.