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Observation of Four-top-quark Production and Improving Top Quark Reconstruction Efficiency Using Machine Learning Method

The recent observation of four-top-quark production at the ATLAS experiment in 2023 has highlighted the complexities involved in the reconstruction of heavy particles like the top quark. This process is particularly challenging due to issues such as missing momentum and the extensive permutations of jets. To address these challenges, we apply SPA-Net, a machine learning method, which significantly enhances jet-parton assignment accuracy and neutrino momentum prediction compared to traditional methods. The improvement in top quark reconstruction efficiency not only bolsters our understanding of the four-top-quark process but also opens avenues for extending SPA-Net's application to additional multi-lepton top quark channels.

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