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ML-Based Kinematic Top Quark Reconstruction in Dileptonic Decays — •Mads Hansen Baattrup[1], Alexander Grohsjean[2], Peer Stelldinger[3], and Christian Schwanenberger[1,2] — [1]Deutsches Elektronen-Synchrotron, Notkestr. 85, 22607 Hamburg, Germany — [2]Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [3]Hochschule für Angewandte Wissenschaften Hamburg, Berliner Tor 5, 20099 Hamburg, Germany

Reconstruction of the full kinematic properties of dileptonic $t\bar{t}$ events is important for precision tests of the standard model and also plays a role for many searches beyond the standard model (BSM). It is intrinsically challenging because of the presence of two undetected neutrinos, leaving the system underconstrained. Conventional analytical methods rely on assumptions and fixed mass constraints to close the system of equations. These methods introduce significant biases in important observables - particularly in the $m_{t\bar{t}}$ threshold region, which is highly relevant for both precision measurements and BSM-sensitive analyses.

In this work, we investigate supervised machine-learning-based reconstruction methods using transformer architectures and conditional generative models. We aim to learn the conditional phase-space distribution of parton-level quantities given event observables. This will reduce reconstruction biases while improving resolution relative to traditional analytical methods.

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