

A Holistic Approach to Predicting Top Quark Kinematic Properties with the Covariant Particle Transformer

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Precise reconstruction of top quark properties is a challenging task at the Large Hadron Collider due to combinatorial backgrounds and missing information. We introduce a physics-informed neural network architecture called the Covariant Particle Transformer (CPT) for directly predicting the top quark kinematic properties from reconstructed final state objects. This approach is permutation invariant and partially Lorentz covariant and can account for a variable number of input objects. In contrast to previous machine learning-based reconstruction methods, CPT is able to predict top quark four-momenta regardless of the jet multiplicity in the event. Using simulations, we show that the CPT performs favorably compared with other machine learning top quark reconstruction approaches.

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