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Matching Fixed-Order Calculations with Parton Shower for $t\bar{t}W^{\pm}Z$

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Abstract

We present an ongoing study of $t\bar{t}W^{\pm}Z$ production aimed at improving the accuracy and reliability of theoretical predictions by combining fixed-order QCD calculations with parton-shower simulations. We consider next-to-leading order (NLO) QCD predictions matched to a Pythia parton shower, using the POWHEG framework as the primary matching approach and MadGraph-based calculations for cross-validation. The study will investigate the impact of matching and parton-shower effects on inclusive rates and kinematic distributions, as well as their associated theoretical uncertainties. Particular attention will be given to the treatment of top-quark and electroweak-boson decays and, where possible, the preservation of spin correlations. By comparing different implementations and simulation approaches, we aim to establish a reliable description of $t\bar{t}W^{\pm}Z$ production. This is especially relevant for studies of rare processes such as three- and four-top-quark production, for which $t\bar{t}W^{\pm}Z$ is an important background.

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