

Study of the underlying event in top quark pair production in pp collisions at 13 TeV and underlying event tunes with high order parton distribution functions

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Normalized differential cross sections as functions of the multiplicity and kinematic variables of charged-particle tracks from the underlying event are measured in top quark and antiquark pair events produced in proton-proton collisions at a center-of-mass energy of 13 TeV. The analysis is based on data collected by the CMS experiment at the LHC in 2016 corresponding to an integrated luminosity of 35.9 inv-fb. The selected events contain one electron, one muon, and two jets from the hadronization and fragmentation of b quarks. These measurements characterize, for the first time, the properties of the underlying event in events with top quarks and confirm its universality at energy scales typically above twice the top quark mass. Studies of underlying event using high order parton distribution function sets are also presented. For the first time, it is shown that predictions obtained with tunes based on higher-order PDF sets are able to give a reliable description of minimum bias and underlying event measurements, with a similar level of agreement as predictions from tunes using leading order parton distribution function sets.

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