Investigation of the underlying event in photon-initiated processes

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Abstract

The underlying event in photon-initiated processes has been investigated. This has been extensively studied in proton-proton (pp) and proton-antiproton ($p\bar{p}$) collisions where models of the underlying event can describe data in such collisions over a wide phase-space, including the large range in energy. This leads to a single set of parameters for a given model that can be used to give a reasonable description of $pp/p\bar{p}$ data. These same parameters, as derived using the PYTHIA Monte Carlo model, are not able to describe data from $\gamma\gamma$, at LEP, and γp, at HERA, collisions, where on average fewer interactions are observed. A single model and set of parameters can, however, describe simultaneously the $\gamma\gamma$ and γp collisions. This suggests that multi-parton interactions are different when the process is initiated by photons compared to purely hadronic collisions. Processes which are induced by photons, such as $\gamma\gamma$ events at the LHC or at future colliders such as the EIC should therefore choose the appropriate model of the underlying event.