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Hemisphere Mixing: A Fully Data-Driven Model Of QCD Multijet Backgrounds For LHC Searches

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Multijet processes have always been hard to model precisely in hadron collisions, and reliance of experimental studies and searches on Monte Carlo simulations has been problematic, at times resulting in controversies and retractions. Nowadays matrix-element-based tools can accurately predict the general features of energetic collisions producing several hadronic jets, yet often the huge involved cross sections make these events impractical to handle with simulations, hence analysts prefer to resort to signal-depleted control samples for their searches of new phenomena at the high-energy frontier.
A method never used before in hadron collisions is proposed here as a tool to model multijet processes. The method, dubbed "hemisphere mixing", is based on exploiting the schematization of high-pT QCD processes as 2->2 reactions made complex by subleading effets. The construction of libraries of "half events" with experimental data, and a kNN-based association map, allow the generation of artificial datasets that are shown to reproduce with surprising accuracy the kinematics of the background component in the original data, while washing out the effect of any small signal. The method will be described and tested with statistical procedures considering the multi-dimensional space of event features, and results based on LHC data will be shown to illustrate the excellent properties of the model.

Experimental Collaboration

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