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Data-driven approaches to pile-up subtraction at the LHC

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Experiments in the upcoming high-luminosity runs at the LHC face the challenges of very large pile-up. Primary techniques to deal with this are based on vertexing by trackers. Outside the detector tracking acceptances, however, lie regions of much interest for a great many aspects of the LHC physics program. Treatments of pile-up in these regions rely more strongly on Monte Carlo simulations. Here, on the other hand, one is also approaching parts of the phase space in which the tuning of the Monte Carlo event generators becomes subject to increasingly large uncertainties. In this work we explore complementary approaches to pile-up corrections, with a view to developing data-driven techniques which treat pile-up and do not spoil the physics of the signal process. We present numerical illustrations of these approaches for a variety of processes, including Drell-Yan vector boson production, Drell-Yan plus jets, and associated underlying events.

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