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Measurement of event shapes in minimum bias events from pp collisions at 13 TeV

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The event-wise multi-dimensional unfolding is performed with the machine-learning-based OMNIFOLD algorithm to measure the event shape observables of the minimum bias data of low pile-up proton-proton collisions at a centre-of-mass energy of 13 TeV collected by the CMS detector. A machine-learning-based uncertainty estimation method is used to estimate the unbinned uncertainty and the uncertainty covariances among different variables. The optimisation of the training and the validation of the unfolding algorithm will be presented. Simulations from several Monte Carlo event generators were investigated, including EPOS-LHC, Herwig, and Pythia with multiple options of underlying-event tunes. None of the models are able to satisfactorily describe the data, and there are significant trends in this misdescription which is common amongst all generator setups studied, particularly showing data being more isotropic than any of the simulations.

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