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# Initial state fluctuations in Pythia 8

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Initial state geometry has proved to be decisively important for quantitative descriptions of collective behavior in large collision systems, such as PbPb and AuAu. One of the most remarkable lessons from LHC has been the discovery of collective behavior in small collision systems, but here the notion of spatial structure is not as obvious as in nuclear collisions. In Monte Carlo event generators, ad hoc phenomenological schemes are usually employed with clear room for improvement. In this talk we present progress on including a transverse space structure of pp collisions based on the Mueller dipole formulation of QCD, into the Pythia8 event generator. This formalism has the advantage that parameters can be estimated from inclusive quantities in ep and pp collisions, such that the spatial structure becomes a true prediction of the model. Besides the importance for collective behavior, in particular in pp, but also in fluctuation dominated pA and peripheral AA collisions, the dipole picture also serves as an important starting point for including electron-ion initial states in the model for heavy-ion collisions in Pythia8, the Angantyr framework, a perspective which also will be discussed.

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