Studying the nucleon size with hybrid model simulations of heavy ion collisions

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Hybrid simulations, where different models are coupled to simulate the space-time evolution of relativistic heavy ion collisions, constitute the most modern tools for computational studies of the QGP. In such simulations, the hydrodynamic code requires an entropy density distribution of the system as an input, and in the process of converting the two colliding nuclei into such an entropy density profile the notion of nucleon size is inevitably present.

Monte Carlo Glauber based simulations have modeled the nucleons as boosted two-dimensional Gaussians. The width of the Gaussian, w, which is associated with the transverse size of the nucleons, is a free parameter of the simulation, and its best-fit value is usually determined by Bayesian Analysis using experimental data from RHIC and LHC.

In this work, we study the influence of the choice of the nucleon width in a state-of-the-art hybrid simulation of heavy ion collisions. We study effects of w in the initial state characteristics by calculating the number of participants and binary collisions, the eccentricity harmonics, and total entropy produced in the collision. We study the effect of the nucleon size on the usual procedure of centrality determination used in computational simulations of heavy ion collisions, and its impact in final state observables, at the end of the full simulation.