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Bulk evolution of heavy ion collisions in the beam energy scan: New developments and first results

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The beam energy scan (BES) and upcoming BESII at the Relativistic Heavy Ion Collider (RHIC) aims at pinning down the detailed phase structure of QCD and locate the critical point that marks the transition from a cross-over to a first order phase transition. In order to do this, fundamental theory needs to be linked to experimental observables, and sophisticated dynamical modeling becomes necessary.

We present important advancements in the fluid dynamic description of heavy ion collisions needed to account for the relevant physics of heavy ion collisions with center of mass energies ranging from 7 to 200 GeV. In particular, we present the latest developments in the 3+1 dimensional viscous relativistic simulation MUSIC, including bulk viscosity and finite baryon chemical potential. We construct an equation of state for finite baryon chemical potential, using Taylor expanded lattice QCD data and a hadron resonance gas model. Further we present a new model of the initial state using an extension of the conventional Monte Carlo Glauber model to three spatial dimensions, which provides fluctuating initial distributions of net baryon and entropy densities.

We use this model to compute a wide range of observables, including multiplicity and net-baryon rapidity distributions, as well as directed and higher order flow as functions of rapidity and beam energy. We discuss the sensitivity of various observables to the details of the equation of state, the transport parameters of the produced medium, and transverse and longitudinal geometric fluctuations, which will help guide experimental efforts in the BESII.

On behalf of collaboration:

NONE

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