Contribution ID: **137** Type: **oral**

Dynamical initialization of hydrodynamics for heavy-ion collisions at Beam Energy Scan energies

Wednesday 13 January 2021 18:10 (20 minutes)

At Relativistic Heavy Ion Collider (RHIC) Beam Energy Scan (BES) energies, the dynamics of the pre-hydrodynamic stage and the effects from a nonzero net baryon current become essential components of the dynamical evolution of the collision fireball. We develop a (3+1)-dimensional initial stage model for both energy-momentum and the net baryon current, as dynamical initial conditions for a hydrodynamic evolution module, before the colliding nuclei interpenetrate and the produced system gets completely hydrodynamized. More specifically, during the initial pre-hydrodynamic stage, the four-momenta and baryon numbers carried by secondary particles created within a transport module (modified-UrQMD), after a short hydrodynamization time, are deposited continuously into a (3+1)-dimensional viscous hydrodynamic evolution module (BEShydro). The sensitivity of the hydrodynamic evolution to its initialization will be studied by comparing this approach to other previously proposed dynamical initialization algorithms. We show the dependence on the hydrodynamization time of correlations between rapidity and space-time rapidity of the secondary particles from UrQMD. We also present the interplay between the hydrodynamic module and the dynamical initial conditions by comparing the evolution of eccentricities, temperature and flow velocities, etc., with and without the hydrodynamic module.

Supported by DOE (award no. DE-SC0004286) and NSF (JETSCAPE, award no. ACI-1550223).

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Session Classification: IS

Track Classification: The initial stages of heavy-ion collisions