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A collision geometry-based 3D initial condition for relativistic heavy-ion collisions

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We present a way to construct 3D initial conditions for relativistic heavy-ion collisions based on the Glauber collision geometry [1]. Local energy and momentum conservation conditions are imposed to set non-trivial constraints on our longitudinal profiles'parameterizations for the system's initial energy density and flow velocity. We show that the $\sqrt{T_A T_B}$ scaling of initial energy density profiles results from the longitudinal momentum conservation. After calibrating parameters with charged hadron rapidity distributions in central Au+Au collisions, we test model predictions for particle rapidity distributions in d+Au and peripheral Au+Au collisions in the Beam Energy Scan (BES) program at Relativistic Heavy-Ion Collider (RHIC). Simulations and comparisons with measurements are also made for Pb+Pb collisions at Super Proton Synchrotron (SPS) energies. We demonstrate that elliptic flow measurements in heavy-ion collisions at $\sqrt{s} \sim 10$ GeV can set strong constraints on the dependence of Quark-Gluon Plasma shear viscosity on temperature and net baryon chemical potential. The effects of event-by-event fluctuations on flow observables will be quantified in this approach.

[1] C. Shen and S. Alzhrani, "A collision geometry-based 3D initial condition for relativistic heavy-ion collisions,"Phys. Rev. C 102, 014909 (2020)

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