Contribution ID: **7** Type: **not specified**

Next-generation multi-fluid hydrodynamics for energies from few to tens of GeV

Wednesday 28 June 2023 14:30 (20 minutes)

The hydrodynamic modelling of heavy-ion collisions at energies from few to tens of GeV per NN pair brings new challenges as compared to simulations at top RHIC or LHC energies. The contraction of the incoming nuclei is much weaker resulting in a long inter-penetration phase and a more complex initial-state geometry. Conventional hydrodynamic models, where the fluid phase starts at a fixed proper time $\tau 0$, therefore miss the compression stage of collision and may be therefore less sensitive to the EoS of the medium. Multi-fluid dynamics treats the incoming nuclei as two baryon-rich droplets of cold nuclear fluid creating a third baryon-free fluid from the friction between the two colliding fluids.
We present MUFFIN (MUlti Fluid simulation for Fast IoN collisions), a next-generation event-by-event three-fluid dynamic model to simulate heavy-ion collisions at RHIC BES, newly reimplemented with the use of 3+1 dimensional relativistic viscous hydrodynamic code vHLLE. We discuss the challenges in constructing the approach and present benchmark calculations for Au-Au collisions at different RHIC BES energies.

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Session Classification: Session III