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Hydrodynamics and the Initial Shape of the Droplet in p+p and p+Pb Collisions at the LHC

In order to test the applicability of hydrodynamics to small systems, we simulate p+p collisions at $\sqrt{s} = 7$ TeV and p+Pb collisions at $\sqrt{s} = 5.02$ TeV using the superSONIC package, which consists of AdS/CFT pre-equilibrium flow, 2+1-dimensional viscous hydrodynamics, and a hadron cascade stage. The initial conditions for hydrodynamics are generated using a Glauber-type model which replaces each nucleon in the collision by three quarks. In this model, the quarks obey a joint Gaussian distribution about a nucleon's center of mass, and each quark deposits a Gaussian-shaped cloud of entropy in the transverse plane. By varying the parameters of this model, we quantify the effect of quark substructure on observable quantities. Results from the simulations are compared with experimental data from the ATLAS, ALICE, and CMS experiments. In particular, the hydrodynamic approach reproduces the observed distribution of particle multiplicities, and further achieves a quantitatively accurate description of the flow coefficients v_2, v_3, and v_4 at high multiplicities. From this, we draw conclusions about the initial shape of the droplet formed in p+p and p+Pb collisions.

Preferred Track

Collective Dynamics

Collaboration

Not applicable

Primary author: WELLER, Ryan (University of Colorado at Boulder)

Co-author: ROMATSCHKE, Paul (University of Colorado, Boulder)

Presenter: WELLER, Ryan (University of Colorado at Boulder)

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