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Intra-jet asymmetry in heavy-ion collisions

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The interaction between the jet and QGP fluid will deflect particles associated with the jet from their initial orientation. Such deflection will depend on the energy of the jet constitutes and the velocity of the flow. The soft particles suffering stronger deflection will drift towards the direction of the flowing medium, away from the center of the jet cone where the hard particles are located, leading to an angular intra-jet asymmetry of particle distribution coupled with flow inside the jet. In this work, we first calculate the angular distribution of particles with different pT inside the jet and compare it with the experimental data to obtain the average effect of the jet-flow coupling. We further explore the intra-jet asymmetry in longitudinal and transverse directions and study their dependence on jet path length and fluid viscosity. Together with gamma-jet asymmetry, we can use the transverse intra-jet asymmetry to identify the initial production position of the gamma-jet. We further compare the difference between dijet and gamma-jet to investigate the effect of the diffusion wake induced by the back-side jet. With the implementation of a mirror-subtraction method, we observe a clear rapidity ordering of particles with different pT, which shows a clear jet-flow coupling in the longitudinal direction. Furthermore, we find that the longitudinal intra-jet asymmetry can provide solid proof of the jet-induced diffusion wake in heavy-ion collisions.

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