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Search for the elusive jet-induced diffusion wake in Z/γ -jets with 2D jet tomography in high-energy heavy-ion collisions

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Jet-induced medium response carries the information for the properties of quark gluon plasma produced in high-energy heavy-ion collision. Diffusion wake as an unambiguous part of the medium response will lead to a depletion of soft hadrons in the opposite direction of the jet propagation. New experimental data on Z-hadron correlation in Pb+Pb collisions at the Large Hadron Collider show, however, an enhancement of soft hadrons in the direction of both the Z and the jet. Using a coupled linear Boltzmann transport and hydro model, we demonstrate that medium modification of partons from the initial multiple parton interaction (MPI) gives rise to a soft hadron enhancement that is uniform in azimuthal angle that can overwhelm the signal of the diffusion wake. To make the effect of diffusion wake visible in the near-side Z-hadron correlation, we use a mixed-event procedure to subtract the contribution from MPI. We further employ the longitudinal and transverse gradient jet tomography for the first time to localize the initial jet production positions in Z/γ -jet events in which the effect of the diffusion wake is apparent in Z/γ -hadron correlation even without the subtraction of MPI.

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