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Deciphering the z_g distribution in ultrarelativistic heavy ion collisions

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Within perturbative QCD, we develop a new picture for the parton shower generated by a jet propagating through a dense quark-gluon plasma. In this picture, the vacuum-like parton branchings, as triggered by the parton virtualities, are factorized in time from the medium-induced emissions responsible for the energy loss by the jet. We implement this picture in a Monte Carlo generator that we use to study two phenomenologically important observables: the jet nuclear modification factor R_{AA} and the z_g distribution reflecting the jet substructure. In both cases, the outcome of our Monte Carlo simulations is in good agreement with the LHC measurements. We find that the energy loss by the jet is increasing with the jet transverse momentum, due to a rise in the number of partonic sources via vacuum-like emissions. This is a key element in our description of both R_{AA} and z_g. For the latter, we identify two main nuclear effects: incoherent jet energy loss and hard medium-induced emissions. As the jet transverse momentum increases, we predict a qualitative change in the ratio between the z_g distributions in PbPb and pp collisions: from increasing at small z_g, this ratio becomes slightly decreasing.

Primary authors: CAUCAL, Paul (IPhT); IANCU, Edmond (Université Paris-Saclay (FR)); SOYEZ, Gregory (IPhT, CEA Saclay)

Presenter: CAUCAL, Paul (IPhT)

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