Mechanisms of jet quenching in PbPb collisions at the LHC

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PYQUEN (PYthia QUENched)
event generator to simulate rescattering, radiative and collisional energy loss of hard partons in expanding quark-gluon plasma in heavy ion collisions (implemented as modification of standard PYTHIA6.4 events)

http://cern.ch/lokhtin/pyquen


Collisional loss ⇒ high momentum transfer approximation

Radiative loss ⇒ BDMPS model, coherent radiation
- Small-angular radiation
- Wide-angular radiation

The LHC data on various jet characteristics (nuclear modification factors, internal structure) in PbPb collisions at $\sqrt{s_{NN}}=2.76$ TeV are analyzed and interpreted within PYQUEN jet quenching model


Jet nuclear modification factors

Jet internal structure

The specific modification of longitudinal and radial jet profiles is reproduced by PYQUEN with wide-angle radiative + collisional loss. The scenario with small-angle loss is inconsistent with the data.

Suppression factors for inclusive jets and b-jets, as well as a specific modification of longitudinal and radial jet profiles in most central PbPb collisions, are reproduced by PYQUEN simulations taking into account wide-angle radiative and collisional partonic energy loss. Precise measurements of jet internal structure can put strong constraints on the theoretical models of jet quenching.

Simulation results for $R_{AA}$ are close to the data within statistical and systematic experimental uncertainties. Since no qualitative difference between wide-angle and small-angle radiation scenarios seen for the energy dependence of $R_{AA}$ (only numerical difference ≤20% independently of $E_{T}$), making unambiguous conclusions in favor of either scenario based on jet $R_{AA}$ measurements is difficult.

Conclusions

The contribution from wide-angle radiative loss to the medium-modified intra-jet structure dominates. With all this the scenario with wide-angle radiative loss alone cannot match the data well, so taking into collisional loss is also necessary.