Modification of Jets Reconstructed with Charged Particles in Pb–Pb Collisions at $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV with the ALICE-Experiment *

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The reconstruction of jets in elementary pp-collisions provides the most direct access to the properties of hard scattered (large momentum transfer Q^2) partons. In heavy-ion collisions the initial hard parton scattering occurs before the formation of a thermalized medium ($t \approx 1/Q \ll 1$ fm/c) and the modification of the subsequent jet fragmentation process compared to the QCD vacuum potentially allows to map out the properties of the QCD-medium. However, in nucleus-nucleus collisions the reconstruction of jets is complicated by the background from the underlying event and its fluctuations not associated with the hard scattering.

Jets have been reconstructed in Pb–Pb collisions with the sequential recombination algorithms k_{T} and anti-k_{T} based on charged particle tracks measured with the Inner Tracking System and the Time Projection Chamber of the ALICE-Experiment. The impact of the underlying event background on the reconstructed jet momentum depends strongly on the jet radius and the minimum p_{T} threshold ($p_{\mathrm{T}}^{\mathrm{min}}$) applied to the input particles of the jet finding process and has been determined in a data driven fashion as follows: The background momentum-density ρ is calculated on an event-by-event basis as the median of reconstructed p_{T} per area using all but the two leading reconstructed k_{T} clusters within one event [2]. Clusters reconstructed with the anti-k_{T} algorithm, the same $p_{\mathrm{T}}^{\mathrm{min}} = 0.15$ GeV/c, and $R = 0.2$ or 0.3 are used as basis for signal jets and corrected for the average background contribution via:

$$p_{\mathrm{T,jet}} = p_{\mathrm{T,jet}}^{\mathrm{rec}} - \rho \cdot A_{\mathrm{jet}}^{\mathrm{rec}}. \quad (1)$$

The impact of region-to-region fluctuations of the underlying event background has been evaluated by probing measured heavy-ion events on the scale of a typical reconstructed jet, e.g. via embedding cones with radius R at a random position in the event and summing up the p_{T} of all reconstructed tracks [1]. The distribution of the residuals after correcting for the average momentum background density in each random cone with $A = \pi R^2$ following Equation 1 is used as the measured background response (smearing), i.e. the probability distribution for a change of the jet momentum by δp_{T} due to a local fluctuation of the event background. It is combined with the detector response matrix, which encodes the detector specific modification of the jet momentum scale mainly due to track finding efficiency and momentum resolution. The reconstructed jet spectra for various centrality selections are corrected for their respective background fluctuations and the detector effects on a statistical basis via a χ^2 unfolding technique [3].

The resulting, fully corrected spectra allow to study the modification of jet production when going from peripheral to central Pb–Pb collisions. This is shown in Figure 1 a) using the most peripheral bin (50-80%) as reference in R_{CP}, the ratio of invariant yields scaled by the appropriate number of binary collisions. An increasing suppression is observed for more central events. The comparison of the jet yield for different cone radii as shown Figure 1 b) exhibits no significant modification in central collisions compared to peripheral Pb–Pb and simulated pp reactions.

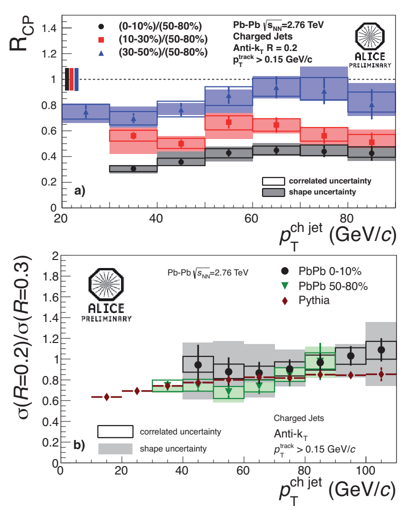

Figure 1: a) Nuclear modification factor R_{CP} for charged jets b) Ratio of charged jet cross sections for two radii.

References

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