Measurement of charged jets in p-Pb collisions with ALICE

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Highly energetic jets are sensitive probes for the kinematics and the topology of high energy collisions. Jets originate from high-momentum partons that are produced early in the collision and subsequently fragment into collimated sprays of hadrons.

The measurement of jet production in p-Pb collisions provides an ideal tool to study the effects of cold nuclear matter on hadronization and provides constraints for the nuclear parton density functions. In addition, the measurements of jet properties in p-Pb collisions can also serve as an important reference for Pb-Pb collisions. [1]

Our analysis focuses on charged jets in p-Pb collisions. The analyzed data – roughly 100 million minimum bias events – was taken in the beginning of 2013 with the ALICE detector at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV. The charged constituents of the jets are reconstructed mainly using the Time Projection Chamber (TPC) and the Inner Tracking System (ITS). Tracks with $p_{\mathrm{T}} > 0.150\ \mathrm{GeV}/c$ and within a pseudorapidity interval $|\eta| < 0.9$ were used. The minimum bias events are selected by demanding at least one hit in both of the scintillator trigger detectors (V0A and V0C).

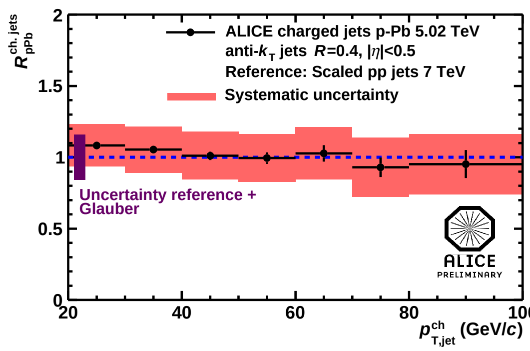
For our analyses, the FastJet [2] package is used in conjunction with the anti-k_{T} algorithm to clusterize the tracks into jets using a jet resolution parameter of $R = 0.4$. Those jets have to be corrected for the background momentum density, the fluctuation of those, and for detector effects. The background density is estimated event-by-event using a similar ansatz as in reference [3]. The within-event background fluctuations are determined using a random cone approach. Detector effects, e.g. including the tracking efficiency, are corrected via unfolding with a response matrix from a full detector simulation with PYTHIA and GEANT3. The *Singular Value Decomposition* unfolding technique is applied by using the RooUnfold package.

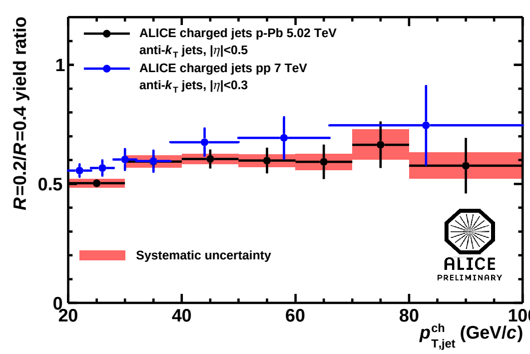
The two basic observables of our analysis are given by the nuclear modification factor R_{pPb} and the jet shape ratio. The latter is just the ratio of the spectra using $R = 0.2$ and $R = 0.4$ and is a measure for the collimation of jets in p-Pb collisions. R_{pPb} is defined by

$$R_{\mathrm{pPb}} = \frac{\text{pPb yield}}{\text{pp x-section}} \cdot \frac{1}{T_{\mathrm{pPb}}}, \qquad (1)$$

and relates to pp collisions. T_{pPb} accounts for the increased "parton luminosity" in p-Pb and is calculated using the Glauber model.

Since pp data at 5 TeV is not available, the necessary pp cross section is created by scaling of 7 TeV pp data. The scaling is done using PYTHIA at the two energies.





The nuclear modification factor R_{pPb} is shown up to $p^{\mathrm{ch}}_{\mathrm{T,jet}} = 100\ \mathrm{GeV}/c$ and no strong nuclear effects on the jet spectra are visible – it is compatible with no effect. The jet shape ratio $R = 0.2/0.4$ is compatible with 7 TeV pp data and it can be shown that it is also compatible with the predictions from PYTHIA Perugia 2011 at the same energy. There is no indication for a nuclear modification of the jet structure in p-Pb reactions between $R = 0.2$ and 0.4.

References

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[2] M. Cacciari / G.P. Salam: [hep-ph/0512210].

[3] The CMS Collaboration: [hep-ex/1207.2392].

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