Inclusive jet spectra in pp and PbPb collisions at $\sqrt{s_{NN}} = 2.76$ TeV

Probing the dependence on jet distance parameter

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Introduction

In this poster, inclusive jets that are produced in pp and PbPb collisions are presented to study jet quenching and to differentiate competing models of parton energy loss mechanisms. For this analysis, we reconstruct jets using the anti-k_t algorithm with three different jet distance parameters. The reference pp jet cross section is measured and compared to perturbative quantum chromodynamic (pQCD) calculations. The jet measurements are performed as a function of three experimental observables: the jet reconstruction distance parameter, the jet p_T, and the event centrality of the collisions. The observable of interest is the jet nuclear modification factor (R_{AA}), defined as,

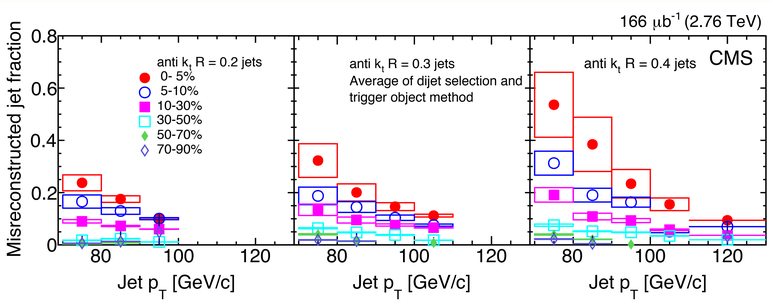
$$R_{AA} = \frac{d^2N^{AA}_{jets}/dp_T d\eta}{\langle T_{AA}\rangle \, d^2\sigma^{pp}_{jets}/dp_T d\eta}$$

where N^{AA}_{jets} is the jet spectrum measured in PbPb, σ^{pp}_{jets} is the jet cross section from pp collisions. $\langle T_{AA}\rangle$ is the nuclear overlap function averaged over the event class studied.

Analysis

Jet energy is corrected in a CMS factorized approach that are derived from Pythia. After applying pseudorapidity and p_T dependent correction factors, an iterative pileup removal scheme is used to remove the heavy ion background in PbPb collisions. Inclusive jets are further corrected for misreconstructed jets that are estimated from minimum bias events with a data-driven methods described below

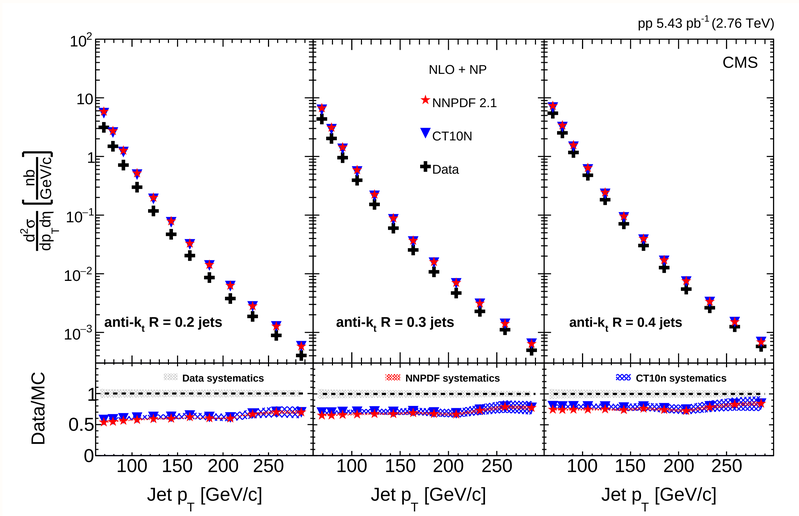
- trigger object: selects all events with a leading high level trigger jet p_T of less than $60\mathrm{GeV}/c$ as a control sample potentially containing misreconstructed jets. This p_T threshold is chosen based on analysis of random cones in minimum bias data with the leading and subleading jets removed.
- dijet selection : An event is tagged as background if it fails any of the criteria: Leading jet $p_T > p_T^{min1}$ or $\Delta\phi_{j1,j2} > 2\pi/3$ or subleading jet $p_T > p_T^{min2}$, where the thresholds are set as follows: $p_T^{min1} = 3\times$ RMS of the background fluctuations for the leading jet, and $p_T^{min2} = 1.8\times$ RMS for the subleading jet, to allow for jet modification in the medium.



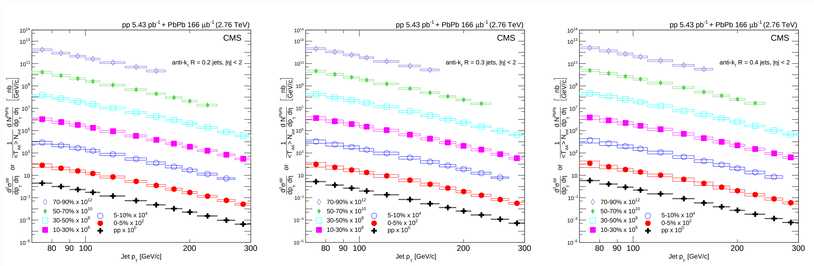
The rates for different distance parameters are show in the different panels (left: $R = 0.2$, center: $R = 0.3$, and right: $R = 0.4$) as a function of the jet p_T. The minimum bias background jet spectra are then normalized to a per-event yield and this estimated background is removed from the measured jet spectra. These spectra are then unfolded with SVD technique available in the RooUnfold framework, with correspondingly determined regularization parameters.

Results

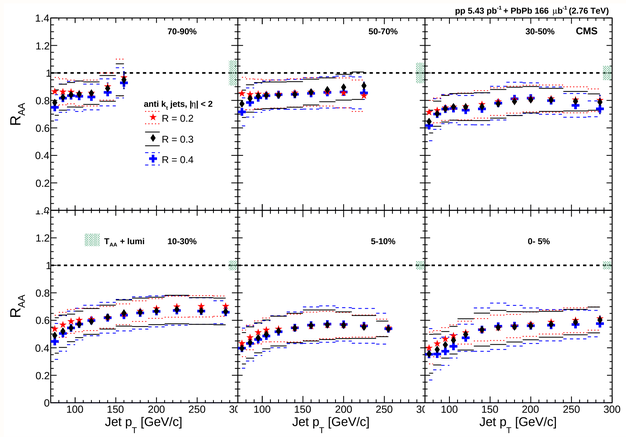
The inclusive jet cross section in pp collisions for three different distance parameters are presented and compared to next-to-leading-order (NLO) calculations of quantum chromodynamics, with two different parton distribution functions (PDF) sets. These calculations include non-perturbative (NP) contributions due to multi-parton interaction and hadronization effects. The calculations overestimate the jet cross section at small distance parameters with less disagreement for larger distance parameters.



The fully corrected jet yields for PbPb are shown normalized by the number of minimum bias events in each corresponding centrality interval. They are further scaled by $\langle T_{AA}\rangle$ and each centrality bin is multiplied by a factor for better visualization.

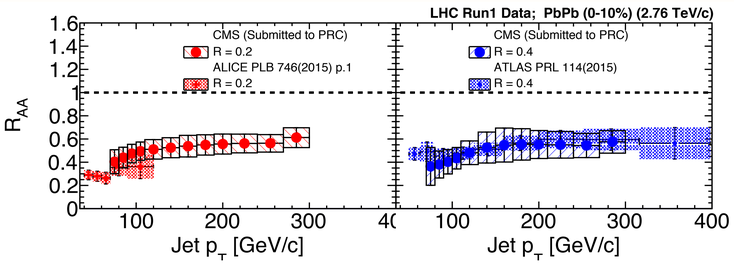


The jet R_{AA} for different centrality bins are shown from peripheral (top left) to central (bottom right) events. The jet R_{AA} decreases with increasing collision centrality in the range of the measured jet p_T. Within the systematic uncertainty, the jet R_{AA} shows the same level of suppression for the three distance parameters in all centralities.



Conclusions

The NLO calculations with NP corrections over-predict the pp cross sections, with a smaller discrepancy for larger distance parameters. The inclusive jet nuclear modification factors show a steady decrease from peripheral to central events, with a slight rise with jet p_T for the three distance parameters in our measured kinematic range.



The R_{AA} for central collisions measured at the three LHC experiments are compatible within the systematic uncertainties in the respective kinematic ranges. No significant dependence of the jet nuclear modification factor on the distance parameter is found for the jets in the kinematic range measured in this analysis. New high statistics data collected during Run2 is expected to lead to better constraints in the kinematic region of interest ($p_T < 100$ GeV/c) to highlight any possible R_{AA} ordering in the jet distance parameter.

This paper has been submitted to PRC and references are found on arXiv 1609.05383

This material is based upon work supported by the National Science Foundation under Grant No.1067907 & 1352081.