



Inclusive jet measurements in Heavy Ion collisions at CMS

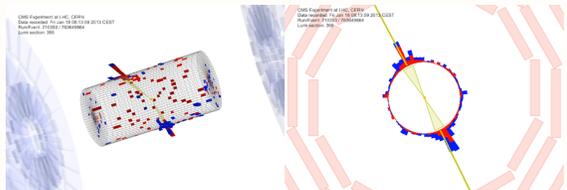


Raghav Kunnawalkam Elayavalli (for the CMS Collaboration)

Physics and Astronomy Department, Rutgers University, USA
raghav.k.e@cern.ch

Introduction

Proton-nucleus (pA) collisions serve as baseline measurements for the study of nucleus-nucleus (AA) collisions. Understanding the signatures of QCD matter created in heavy ion collisions relies on an understanding of elementary collisions, where final-state medium effects are expected to be largely absent.

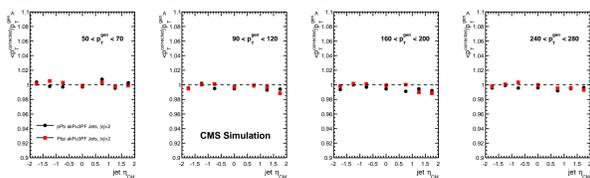


- anti- k_T jet algorithm with a distance parameter of $R = 0.3$ (FastJet framework [1]).
- iterative "noise/pedestal subtraction" technique for background subtraction [2].
- Particle Flow (PF) objects that are reconstructed by combining information from various sub-detectors [3].

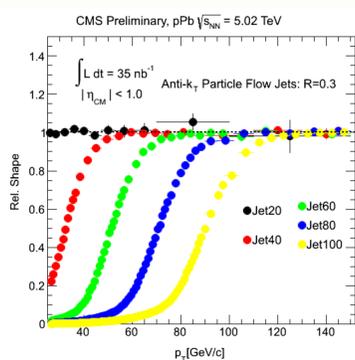
Methods - Jet Reconstruction

Jet Transverse Momentum Corrections

The ratio of the corrected (reco) jet transverse momentum (p_T) with the generator (gen) truth p_T for several gen p_T ranges are shown below after the jet p_T corrections using different direction of boosted PYTHIA [5] embedded into HIJING [6] (MC) samples representing the pPb and PbP data respectively. The ratios are found to be within 2-3% for all the η_{CM} (center of mass) ranges used in this analysis.



Trigger Combination

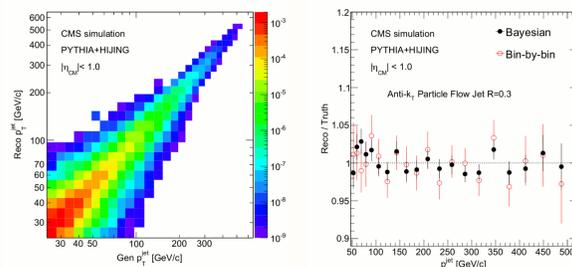


The data jet samples were collected using 5 different High level trigger (HLT) paths and categorized into five groups based on its trigger p_T [7].

- $A \leq \text{MAX}(\text{trig}p_T) < B = n_A \times \text{PS}_A$

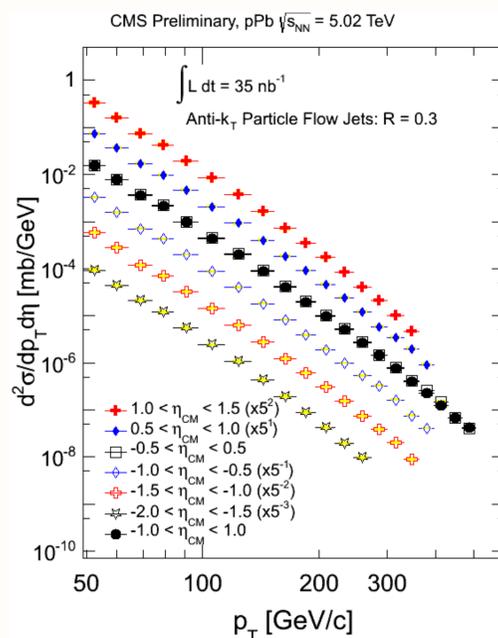
Where A and B are p_T thresholds, corresponding to the HLT used and $\text{MAX}(\text{trig}p_T)$ refers to the maximum value of the online p_T observed by the trigger and used to calculate the trigger decisions. The weights applied to each sample are simply the pre-scale factor ($\text{PS}_\#$) of the particular trigger.

Unfolding Methods on Data



The unfolding procedure uses a response matrix from MC simulation, and reconstructs the true jet distribution from the measured distribution. The event generator was tuned with the Z2 [4] tune at center of mass energy of $\sqrt{s} = 5.02$ TeV. Above we have shown the response matrix on the left and on the right the ratios of the unfolded MC with the generator truth for Bayesian [8] and bin-by-bin methods which show consistent results.

pPb and pp jet cross sections



Our final pPb cross section with integrated luminosity $L = 35 \text{ nb}^{-1}$ is shown as the first plot in the preceding couple of plots. The values for the cross sections for the different η bins are also overlaid on top of each other after appropriate scaling. The pp reference at $\sqrt{s} = 5.02$ TeV (below the pPb plot) is extrapolated from the published jet cross section measurement in pp collisions at $\sqrt{s} = 7$ TeV [9] by using the scaling factors calculated based on PYTHIA Z2 simulation.

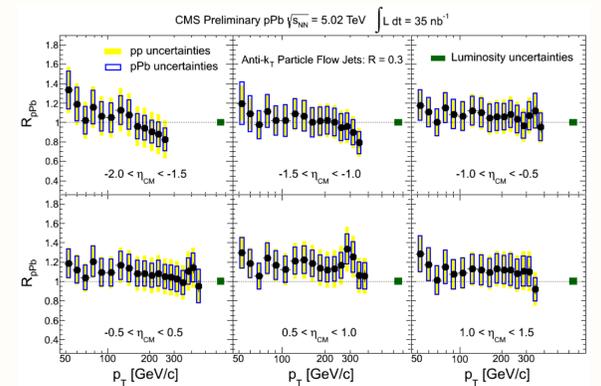
Inclusive Jet R_{pPb}

The inclusive jet nuclear modification factor as a function of jet p_T is shown below for six center of mass pseudorapidity bins.

- Slight jet p_T dependence \tilde{I} at large p_T ranges for mid-rapidity.
- Separation of the R_{pPb} between forward and backward ranges
- R_{pPb} from the proton beam direction is slightly larger than of the Pb beam direction.

$$R_{pPb} = \frac{d^2\sigma_{jet}^{pPb}/dp_T d\eta}{L \cdot A \cdot d^2\sigma_{jet}^{pp}/dp_T d\eta}$$

where $L = 35 \text{ nb}^{-1}$ is the recorded luminosity in pPb collisions and A is the nucleon number (208 for pPb).



References

This Analysis: CMS Collaboration, Jet nuclear modification factor in pPb collisions, CMS PAS HIN-14-001

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