

Centrality dependent correlations in higher order anisotropic flow coefficients in Xe-Xe collisions at 5.44 TeV

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INTRODUCTION

Anisotropic flow is an important signature of QGP that comes from the initial asymmetries in the geometry of the system produced in any noncentral collision. It plays an important role in the understanding of the collective motion and the bulk properties of the QGP. Recent work on Xe-Xe collisions [1] presented the study of flow harmonics as a function of p_T and centrality. Correlation between the flow coefficients was found to be dependent on geometry and on the system-size of collision. In this article, we will investigate the response of much higher order Fourier coefficients to the lower-order flow harmonics with respect to collision centrality through power-law scaling techniques.

MODEL DESCRIPTION

HYDJET++ (HYDrodynamics plus JETs) is a Monte Carlo event generator with the aim of simulating relativistic heavy-ion collisions. The HYDJET++ model works by superimposing the soft hydro type state and the hard state and simultaneously treating both the states independently. It gives an exhaustive approach to the soft hadroproduction and also to the hard parton production along with the

known medium effects. The in-depth details of the model and the procedure of simulation can be found in the corresponding article [5] and the references there within.

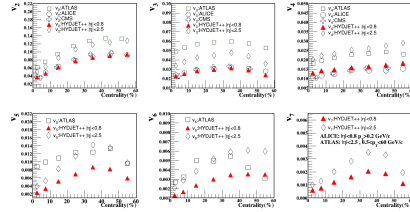


FIG. 1. Centrality dependence of calculated minimum bias v_n ($n=2-7$) for Xe-Xe collisions at 5.44 TeV centre of mass energy along with experimental data [2–4] for comparison. The figure presents results in $|\eta| < 0.8$ with $p_T > 0.2$ GeV/c and $|\eta| < 2.5$ with $0.5 < p_T < 60$ GeV/c kinematic ranges for (0-60)% centrality range.

RESULTS

Anisotropic flow coefficients present a significant dependence on centrality of collision (see figure 1). v_n decreases as the order n increases. At small pseudorapidities ($|\eta| < 0.8$), HYDJET++ model results show a suitable match with available ALICE and CMS experimental data [2, 3]. However, at large values of η ($|\eta| < 2.5$), only elliptic flow and to some extent v_4 shows a pleasant match with ATLAS data [4], while v_3 and other higher Fourier orders underpredict experimental data. However, it does not show a suitable quantitative

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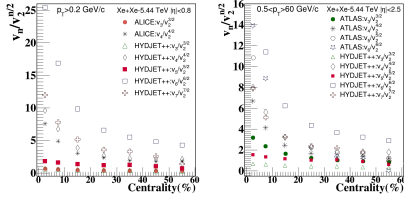


FIG. 2. The centrality dependence of mean values of scaled harmonics $v_n/v_2^{n/2}$ ($n=3-7$) in the (0–60)% collision centrality range. The left panel of the figure presents results in $|\eta| < 0.8$ with $p_T > 0.2$ GeV/c whereas the right panel shows results in $|\eta| < 2.5$ with $0.5 < p_T < 60$ GeV/c kinematic ranges. HYDJET++ model results have been compared with ALICE [2], and ATLAS [4] experimental data.

match with ATLAS experimental data. The variation with centrality is maximum for v_2 attributed to the large change in the second-order eccentricity from central to midcentral collisions. The role of fluctuations is not well expressed from the model. The removal of biasness from dijets by including all reaction channels in PYTHIA, enhances the even-order Fourier harmonics while suppresses the odd-order harmonics [4]. Thus, v_2 and v_3 do play an important role in the generation of higher harmonics.

To explicitly visualize the response of non-linear part of flow harmonics as a function of collision centrality (see figures 2 and 3), we employ the $v_n/v_m^{n/m}$ ratio technique to check the scaling behaviour of the flow coefficients. It is seen that the results are higher for lower $|\eta|$ values and lower at high pseudorapidity ranges. The scaling depends on the harmonic

order n and the centrality of collision. The average values of $v_n/v_2^{n/2}$ (see figure 2) are larger in central collisions and become smaller (almost approaching zero) in peripheral collisions. The scaling order is very much clear over 0-30% centrality interval where $v_6/v_2^{6/2}$ is maximum whereas $v_3/v_2^{3/2}$ is observed to be minimum. However, beyond 30% centrality, the difference between the ratios decreases. Similar observations are made when the scaling is performed with v_3 (see figure 3).

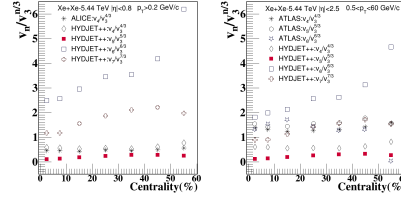


FIG. 3. Centrality dependence of mean values of scaled harmonics $v_n/v_3^{n/3}$ ($n=4-7$) for (0-60)% centrality range. The left panel of the figure presents results in $|\eta| < 0.8$ with $p_T > 0.2$ GeV/c whereas the right panel shows results in $|\eta| < 2.5$ with $0.5 < p_T < 60$ GeV/c kinematic ranges. HYDJET++ model results have been compared with ALICE [2], and ATLAS [4] experimental data.

ACKNOWLEDGMENTS

BKS sincerely acknowledges financial support from the Institutions of Eminence (IoE) BHU grant number-6031. Saraswati Pandey acknowledges the financial support obtained from UGC and IoE under a research fellowship scheme during the work.

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