Probing the particle production mechanism at intermediate p_T through identified triggered correlations in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV

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Introduction

The anomalous baryon-to-meson enhancement was first observed in heavy ion collisions at RHIC and LHC energy, where it has been discussed in terms of radial flow and/or quark coalescence model of hadronization. A similar inclusive baryon-to-meson enhancement was also observed in p-Pb collisions at 5.02 TeV. Several other observations, like, ridge, mass-ordering of the elliptic flow coefficient (v_2) of identified particles, quark-number-scaling of v_2 suggest similarity between the systems formed in small and heavy-ion collisions.

The origin of baryon anomaly is still not understood very well. Radial boost, generated during the hydrodynamical evolution, pushes the massive hadrons more to higher p_T and provide a natural explanation to the enhanced baryon generation at intermediate p_T [1]. On the other hand, this large baryon-to-meson enhancement seems to be naturally accounted by coalescence model of hadronization where collectively flowing quarks are recombined to baryons and mesons [2]. The rise in baryon-to-meson ratio at intermediate p_T with increase in multiplicity is qualitatively captured by both EPOS 3 (3+1 D event by event hydro model) and string melting version of AMPT (implements coalescence model of hadronization) as shown in Fig 1. Therefore, the exact origin of baryon enhancement remains incomprehensible till date.

Here we have used the dihadron correlation measurement, with pion and proton triggers at intermediate p_T as a tool to investigate the origin of baryon anomaly at this p_T range [1, 2]. Analogous measurement in heavy ion collisions suggests that the particle production by quark recombination leads to a suppression of the near side jet like yield associated with baryon triggers in the most central collisions [2]. But, because of the strong jet-medium interaction in A-A collisions, such interpretation may not be straight forward. In absence of significant jet-medium interplay in small collision systems like p-Pb, any possible deviation in the multiplicity evolution of the near side jet yields in the AMPT compared to the same observable in EPOS may be be used to disentangle the effect of coalescence from the hydrodynamical flow.

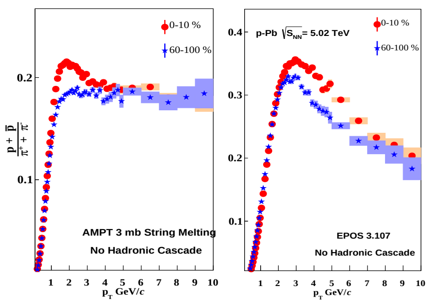

FIG. 1: p/π to ratio: **(left)** AMPT and, **(right)** EPOS.

1. Analysis Method

Two dimensional (2D) $\Delta\eta - \Delta\phi$ correlation functions are calculated by pairing pion and proton trigger particles with unidentified charged hadrons in trigger and associated p_T ranges of 1.5-2 < $p_{T,trig}$ <4 GeV/c and 1 < $p_{T,asso}$ <4 GeV/c, respectively. The cor-

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relation function $C(\Delta\eta, \Delta\phi)$ is defined as:

$$\frac{1}{N_{trig}} \frac{d^2N}{d\Delta\eta d\Delta\phi} = \frac{S(\Delta\eta, \Delta\phi)}{B(\Delta\eta, \Delta\phi)} \quad (1)$$

where $S(\Delta\eta, \Delta\phi)$ represents the number of same event pairs, constructed by pairing the trigger and associated particles from same event, and the background distribution $B(\Delta\eta, \Delta\phi)$ that corrects for the effects due to limited acceptance is constructed by pairing trigger and associated particles from different events, but of similar multiplicities.

2. Results and Discussions

Since the baryon enhancement in EPOS and AMPT are known to have different origins, it would be interesting to test, whether the correlation measurements are sensitive to the underlying dynamics. The top panel of Fig. 2

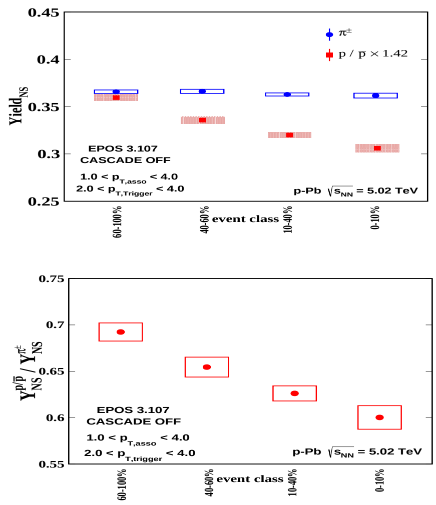

FIG. 2: Multiplicity dependence of: (**top**) near side jetlike yields and (**bottom**) ratio of yields from EPOS. For details refer to text.

shows the multiplicity evolution of the near side jetlike yields for pion and proton triggered correlations calculated from EPOS. While the pion triggered yields exhibit no multiplicity dependence, proton triggered yields are seen to be suppressed with increasing multiplicity. The gradual suppression of proton triggered yield with multiplicity is an indication of larger rate of increase of soft protons that lack small angle correlated hadrons [1]. Similar

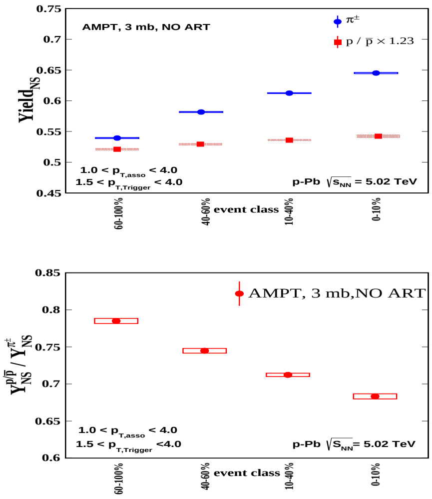

FIG. 3: Multiplicity dependence of: (**top**) near side jetlike yields and (**bottom**) ratio of yields from AMPT. For details refer to text.

measurement was repeated with the AMPT model and the results are presented in Fig 3. It shows, unlike EPOS, both pion and proton triggered yields in AMPT increase with the multiplicity, but the rate of increase has a trigger species dependence. The ratio of proton-to-pion triggered yields, shown in the bottom panel of Fig.2 and Fig.3, are gradually suppressed with increasing multiplicity in both EPOS and AMPT. However, the individual yields seem to demonstrate the differences in the underlying physics processes between the two cases. With the data available at LHC, these results may be compared to constrain the underlying dynamics of small collision systems in a better way.

References

[1] D. Sarkar et. al, Physics Letters B 760 (2016) 763-768.

[2] S. Choudhury et. al, Phys. Rev. C 93, 054902 (2016).