Model-based Simulation Of Correlation Between J/Ψ and Charged Hadrons in p-p Collisions at LHC energy

Sk.Noor Alam[1*] and Subhasis Chattopadhyay[2]
[1],[2] *Experimental High-Energy Physics and Application Group, Variable Energy Cyclotron Centre, Kolkata - 700064, INDIA*

Introduction

In high energy collisions different mechanisms come into play during the dynamic evolution of the system of particles. The observed features in the final shape of the system results from the complex interplay of these processes. Studies of such physical mechanisms in the experimental data require the development of special analysis tools. One such tool is the two particle correlations. Two particle correlations are powerfull tool to explore the mechanisim of particle production in collisions of hadrons and nuclei at high energy.

Such studies involve measuring the distribution of $\Delta\phi$ and $\Delta\eta$ between pairs of particles: a trigger particles and associated particle where $\Delta\phi$ and $\Delta\eta$ are the differences in azimuthal angle ϕ and pseudo rapidity η between two particles [1].

This letter presents results extracted from two-particle correlation measurements in p-p collisions at $\sqrt{S}$=7 TeV. The Correlations are measured between two particle i.e J/Ψ and π^+ over two units of pseudorapidity and azimuthal angle.

Event Generator: In present analysis, event are generated using HIJING event generator for p-p collisions at$\sqrt{S}$=7 TeV.Impact parameter b=0 has been used i.e bmax=0 and bmin=0.

Hijing written in Fortran77 is a Monte-carlo simulation package for parton and particle production in high-energy hadron-hadron , hadron-nucleus, and nucleus-nucleus collisions.HIJING uses PYTHIA 5.3 to generate kinetic variables for each hard scattering and JETSET 7.2 for jet fragmentation [2].

Present work

Now from the data file generated using HIJING, taking J/Ψ(PID=443) and π^+ (PID=211) with P_t >2GeV and then calculating pseudorapidity η and angle between momentum P_x and P_y i.e ϕ of J/Ψ and Π^+, then $\Delta\eta$=$\eta_{J/\Psi}$ - η_{π^+} and $\Delta\phi$=$\phi_{J/\Psi}$ - ϕ_{π^+} are caculated, if there is a J/Ψ in an event. This procedure is repeated for all events.

$\Delta\eta$ and $\Delta\phi$ distribution from Hijing event generator

Fig. 1 shows two peaks. There is a peak at $\Delta\phi \sim 0.0$ in comparison to the other peak at $\Delta\phi \sim \pi$. However in Fig. 2 i.e for $\Delta\eta$ distribution, only one peak at $\Delta\eta \sim 0$ has been observed. One of the possible explanation of this peak is that they are produced from same jet like event and they have approximately same rapidity and same azimuthal angle ϕ.The away side

*Electronic address: nooralamk@vecc.gov.in

peak must be originated from jet-like production mechanism where a quark scattered on the away side fragmentations and peak observed at $\Delta\phi \sim \pi$.

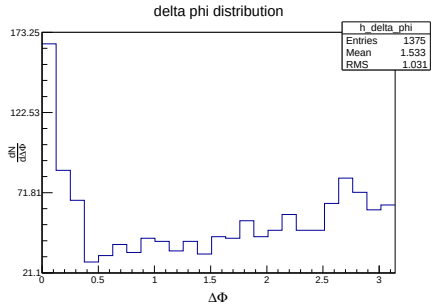

FIG. 1: $\Delta\phi$ distribution

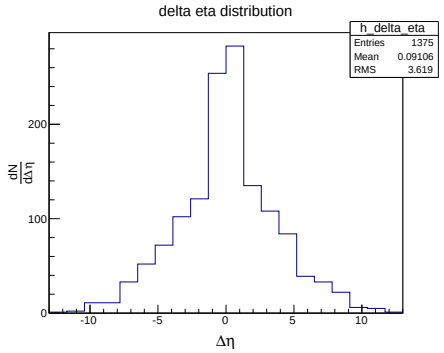

FIG. 2: $\Delta\eta$ distribution

$\Delta\eta\Delta\phi$ distribution

From Fig. 3, the correlation peak has observed at $\Delta\eta \sim 0.0$, $\Delta\phi \sim 0.0$ i.e J/Ψ and π^+ have followed each other One of possible explanation of this peak is that after collision, a lot of quark, antiquark, gluon are produced. Cosider one c and $\bar{c}$ have produced J/Ψ, Since for $c\bar{c}$, $(P^2 - m^2)$ do not equal zero. So it radiates gluons. Naturally energy of these gluons are very low. For this reason angle between J/Ψ and gluons is very small i.e they are alligned almost in same direction.

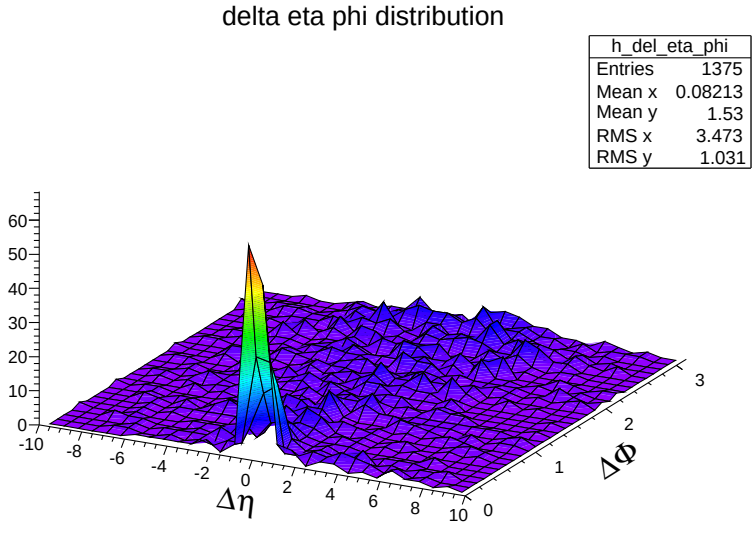

FIG. 3: $\Delta\eta\Delta\phi$ distribution

References

[1] Physics Letters. **B719**, 29-41 (2013).

[2] H.-U. Bengtsson and T. Sjostrand, Comp. Phys. Commun. 46, 43(1987)