Underlying Details

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I. INTRODUCTION

The variables used in our study are:
1. **Multiplicity:**Charged multiplicity is defined as the total number of charged particles coming out of an interaction, and it is easier to study. Total multiplicity needs detectors for neutral particles and gamma rays. Multiplicity can be expressed as a function of some interesting variable, depending on the experiment's aims.
2. **Transverse Momentum :** As apparent from the name it is the amount of momentum perpendicular to the direction of the beam of the particle.Such case may appear to be a bit strange but the particle collision deals at high speed and there by virtue of momentum we can claim it to be possible.
3. **Leading Particle :** The Particle that will reach our detector first and will act as a reference to study other particles.We can Define Region based on the angle between the motion of leading particle and other particle and can claim these regions as : Towards , Away and the intermediate.
4.**Azimuthal Angle :** Basically in the spherical polar coordinate system it is the angle in the horizontal plane of the trajectory with the x-axis .It is the measure of the deflection.
5.**Pseudo Rapidity:**It is the spatial coordinate describing the angle of the particle with the beam axis.The formula given is by:

$$\eta \equiv -\ln\left[\tan\left(\frac{\theta}{2}\right)\right]$$

where the angle $\theta is the angle made by the three momentum p and the beam axis' s positive direction.$

6.**Beam Remnant:**The component of colliding beams that are not taking part in the "hard scattering processes".
7.**Transverse Region and the terminology of the TransMin and TransMax:** Once we detect the leading particle we draw the region for the sack of sorting out the particle, which we do by dividing the region into 4 sector with two opposite to each other and having the angle to be in the range of 60 to 120 and same in the opposite region as shown in the figure below :

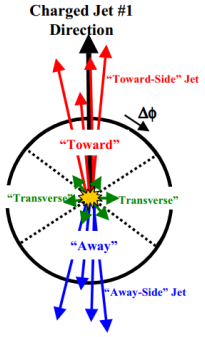


FIG. 1. Regions taking the leading particle as refrence.

Hard Events and Soft Events: On the basis of transverse momentum, we can classify these events in the following way:
1.**Hard Event:**When the Transverse momenta of the particles emitting out are coming out to be high then the event can be claimed as a hard event.
2.**Soft Event:**Similarly when the transverse momentum is coming out to be low then we claim the event to be a soft event.

II. ABSTRACT:

Before proceeding further let us have a look at the overall idea and methodology of the experiment :
So in a particle collision we can have different results i.e. experiments with various possibilities of the number of the

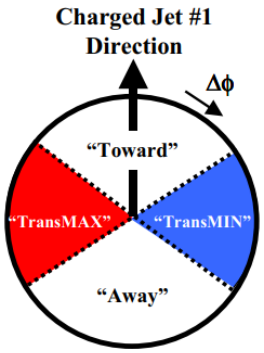
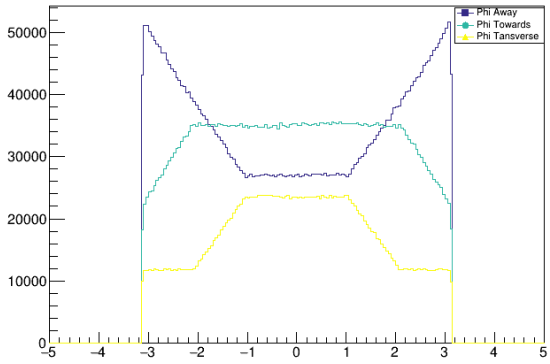


FIG. 2. defining TransMax and Transmin region

particle coming out after collisions, which we claim out to be multiplicity and for a particular multiplicity case we observe the number of particle that lie in various regions with respect to the leading particle and based on this we are detecting how much is lying in the **transmax and transmin** and in the towards and away region.Also by observing the graph we are drawing a conclusion regarding the soft and hard event as we go to higher momentum side.

III. EXPERIMENTAL OBSERVATIONS



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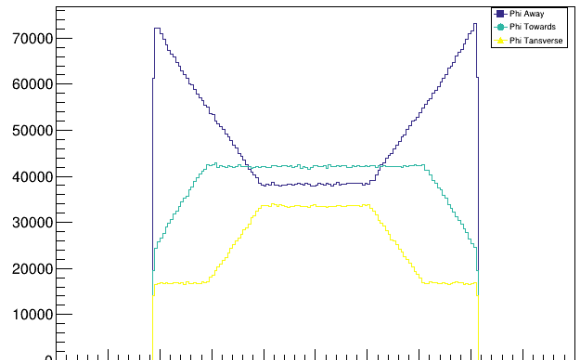

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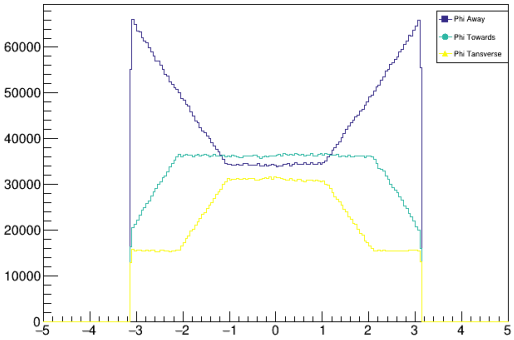

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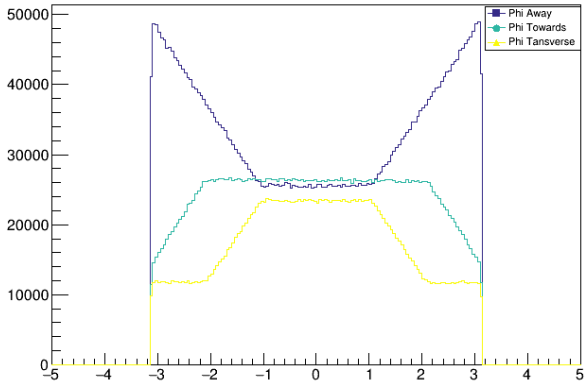

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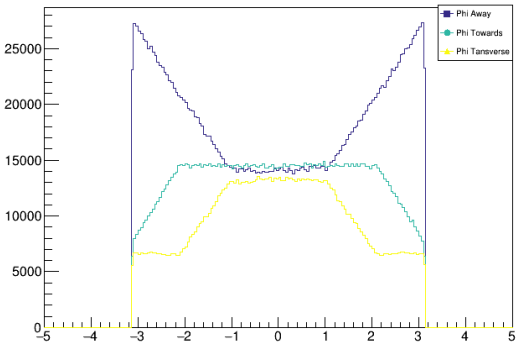

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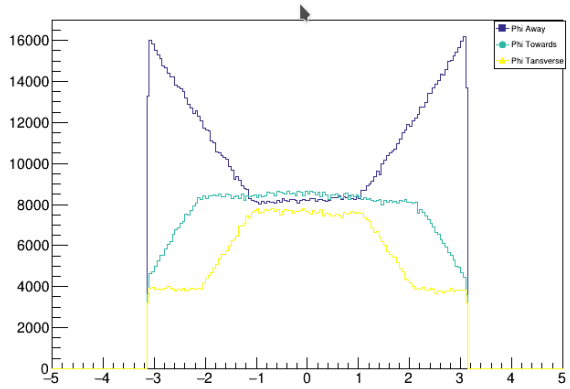
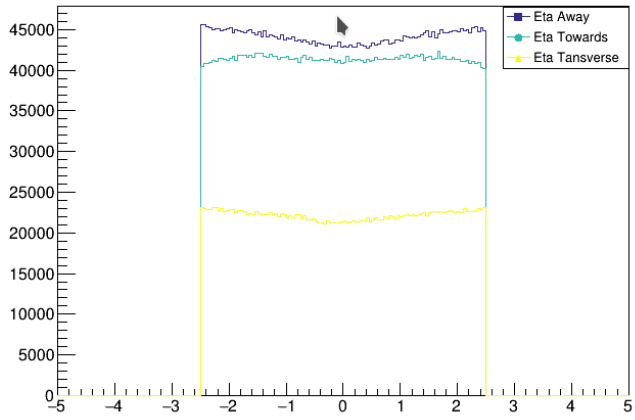


multiplicity class :More than 100



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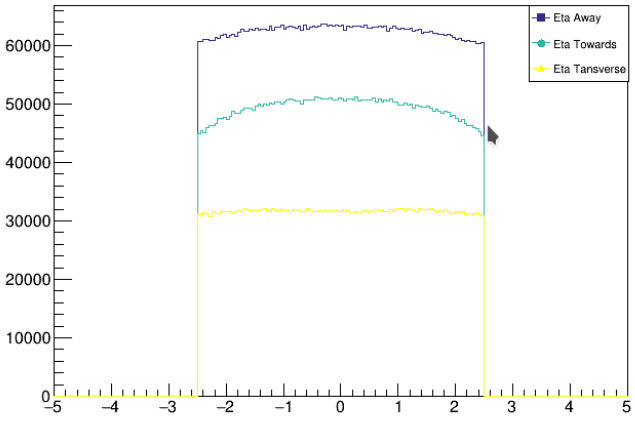

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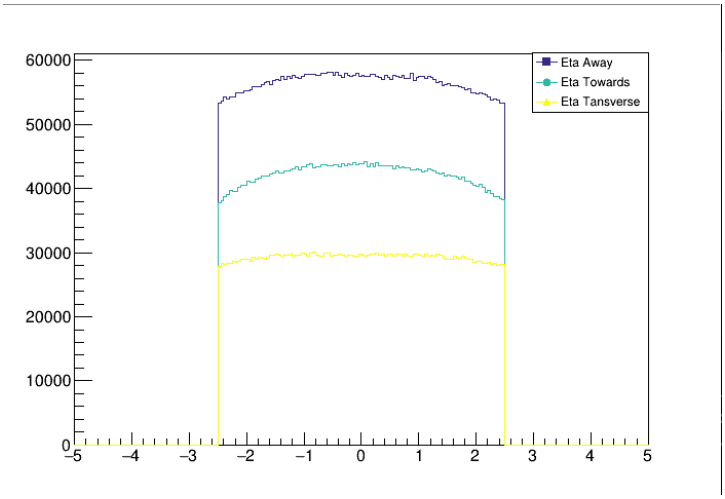

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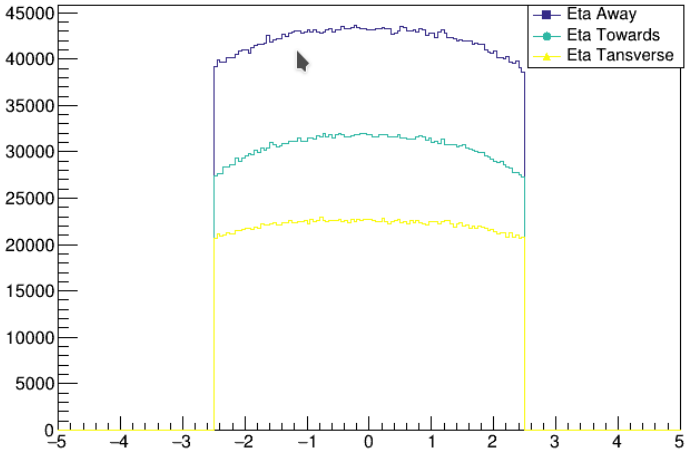

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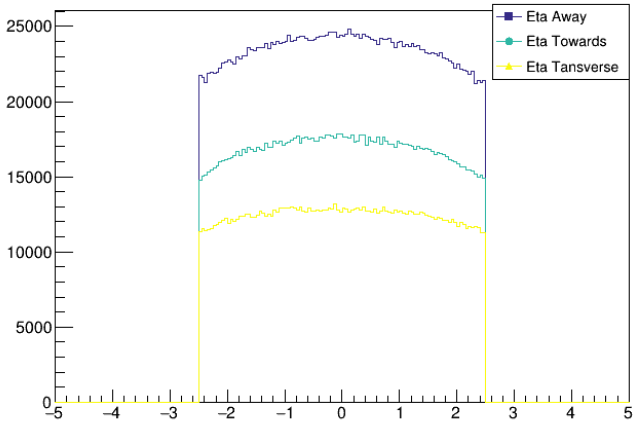

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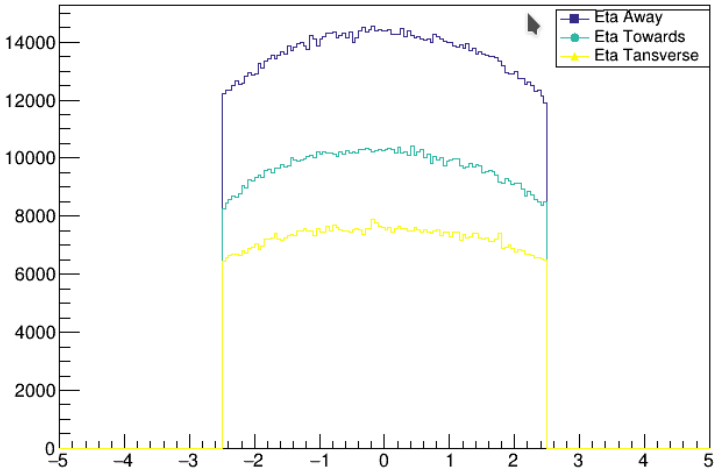

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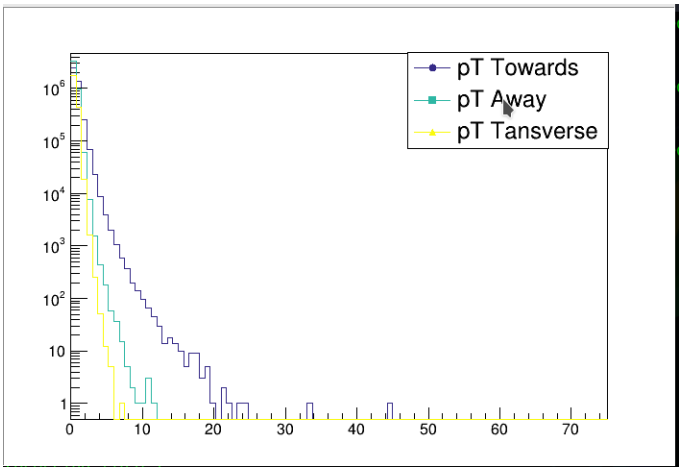

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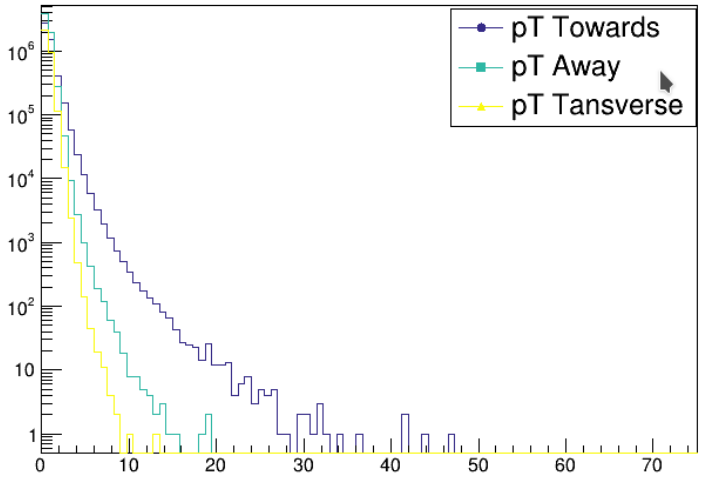

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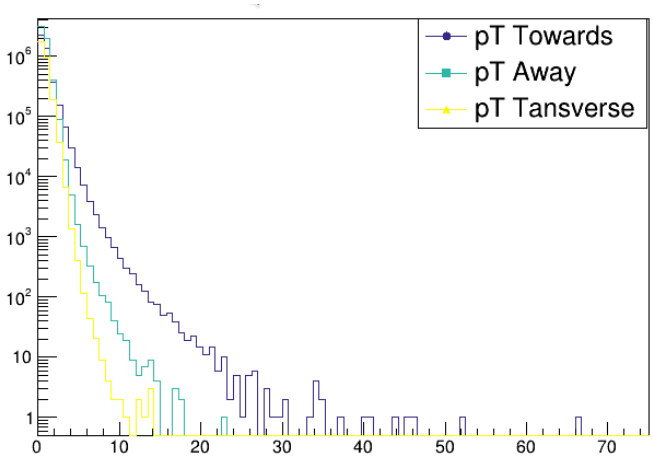

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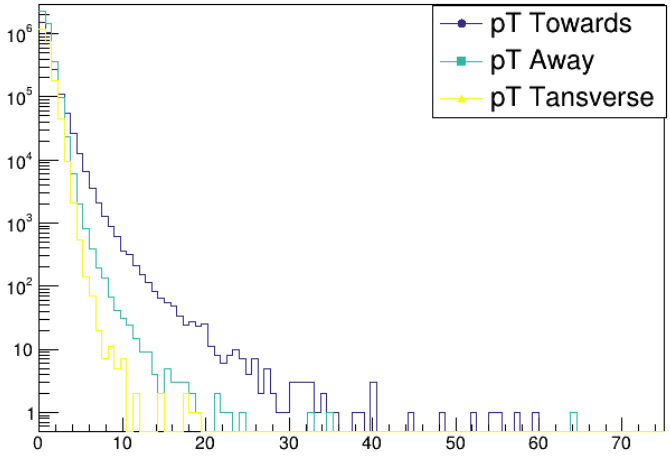

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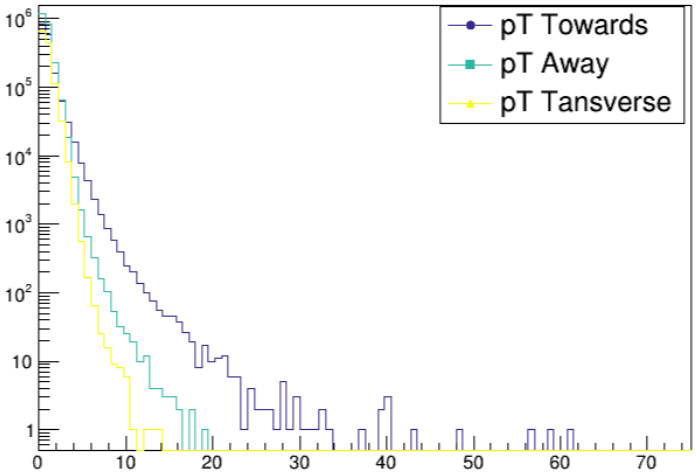

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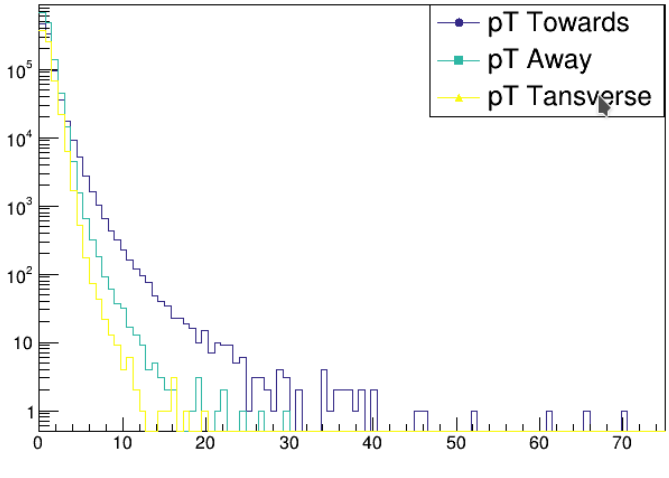

multiplicity class :More than 100

IV. SUMMARY

As can be easily seen from all of the above graphs that as we move to regions of higher transverse momentum the number of particle in that range will decrease that is, the probability of a hard event occuring is low, most of the events occuring in a collision are either soft or "semi hard".If we go on a theoretical side and consider the case of parton model of hadron collisions, which is useful to explain the **Quantum chromodynamic Process**the composite nature of the two incoming hadrons implies the possibility that several pairs of partons can enter into separate but simultaneous scatterings, 'multiple interactions'. In some fraction of events, these additional scatterings can be hard or semi-hard, but due to the **infrared peaking of the cross section** the bulk of them should normally be fairly soft compared to the primary interaction.

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[1] ttps://www.slac.stanford.edu/econf/C010630/papers/P501.PDF

https://github.com/ShubhamGurjarIITBOMBAY/Data-Analysis-Group-4-Project.git

Above is the github link to the code for getting the graph