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Transition from Multifragmentation to Flow in Relativistic Nuclear Collisions at CBM energies

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Introduction

❑ The CBM experiment aims the study of the QCD phase diagram at low temperatures and high baryonic densities, mainly to find out the order of the phase transition between hadrons and partons under these conditions..

❑ Between the many predictions about signals to detect the phase transition point as: fluctuations[1], hydrodynamics [2], baryon-baryon correlations [3], etc., in our previous studies [4-6] we found as an interesting tool for the analysis of relativistic nuclear collisions: the "nuclear matter jets".

❑ Having a non-partonic origin, the number of jets indicates the centrality of the collision, i.e. the amount of incident energy pumped into the system, and the jet-kinematic and dynamic properties allowed us to make assumptions about their origin. A liquid-gas nuclear phase transition was indicated by the disappearance of jets.

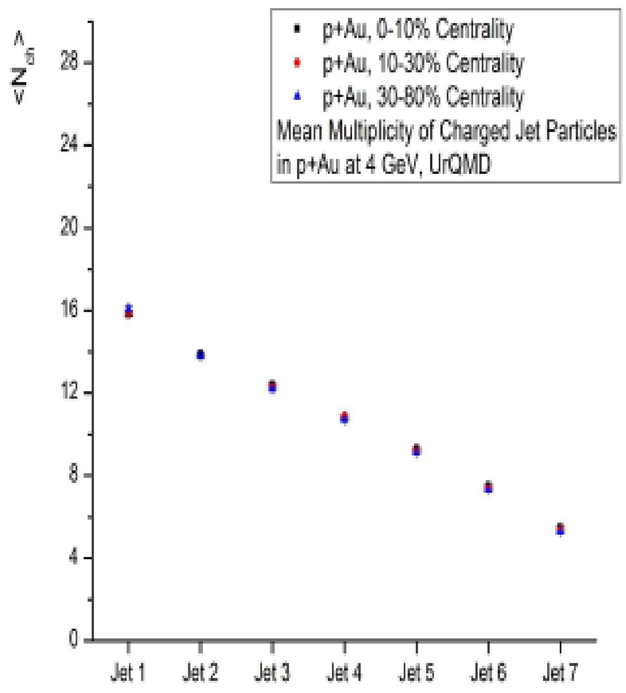
❑ At CBM energies, varying the projectile mass, we intend to study the evolution of the number and characteristics of nuclear matter jets when passing from the small projectile (p+Au) whose energy is converted into thermal energy leading to mutifragmentation, to a symmetric projectile (Au+Au) when flow is unleashed.

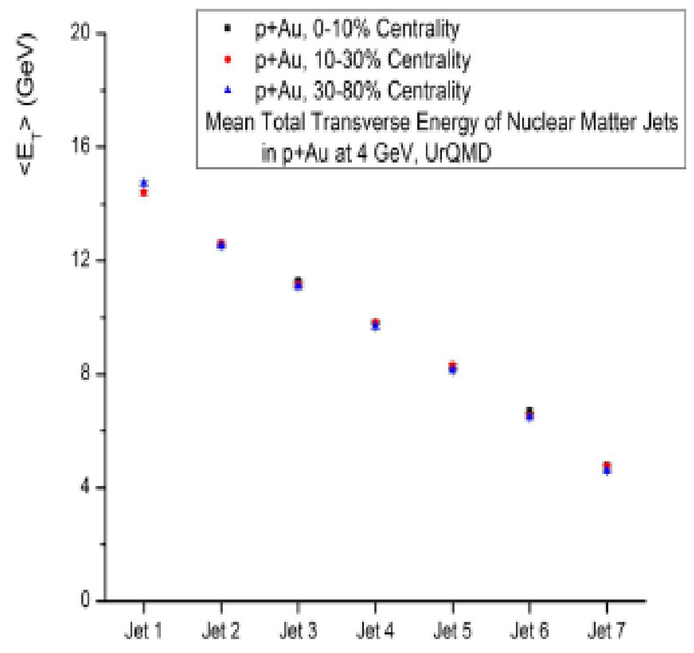
❑ For this, we made jetology studies on UrQMD simulations (performed at the computing system YaPT from "Nuclear Matter in Extreme Conditions" Research Center – Faculty of Physics, Bucharest University).

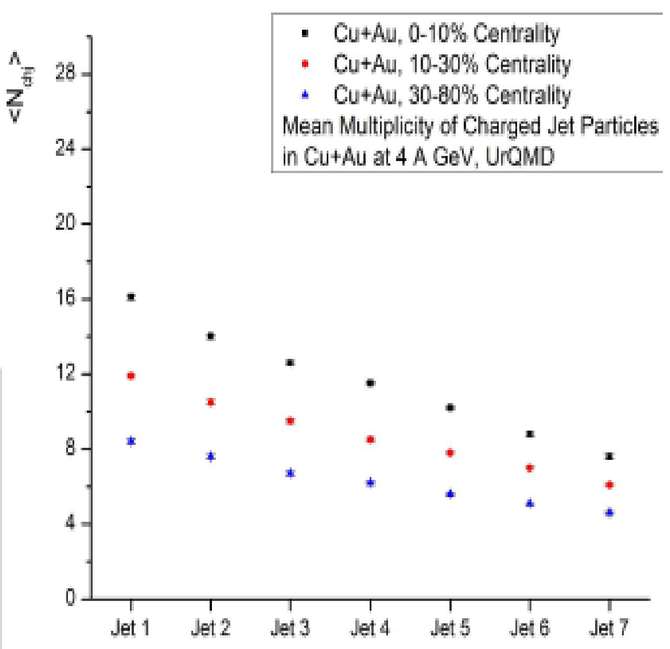
The Purpose

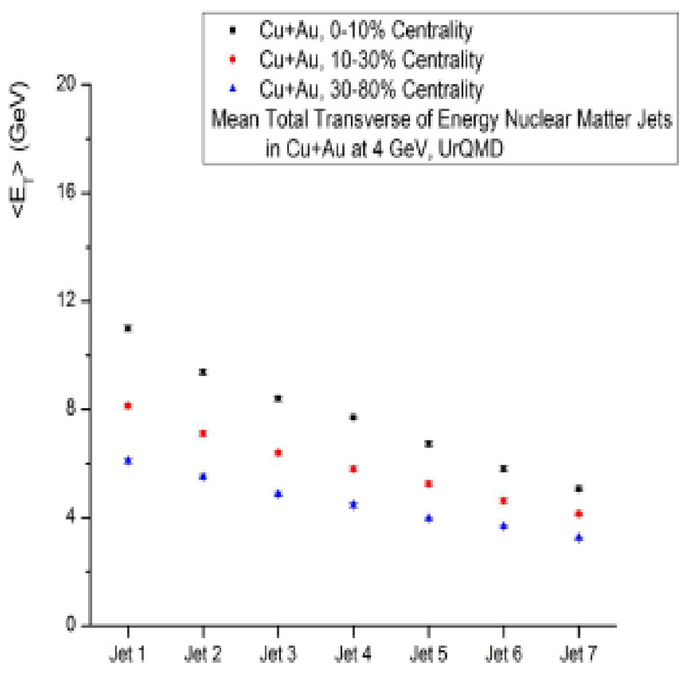
❑ **The aim is to extract the usefulness of the "nuclear matter jets" variable for relativistic nuclear collisions.**

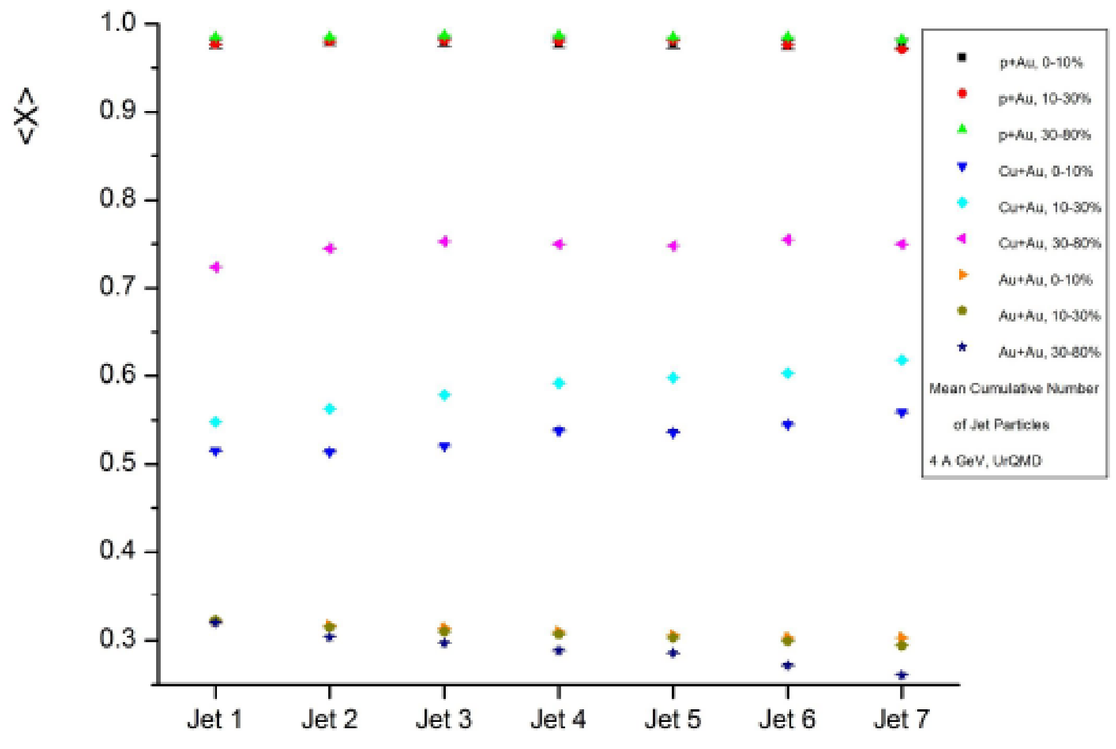
Results

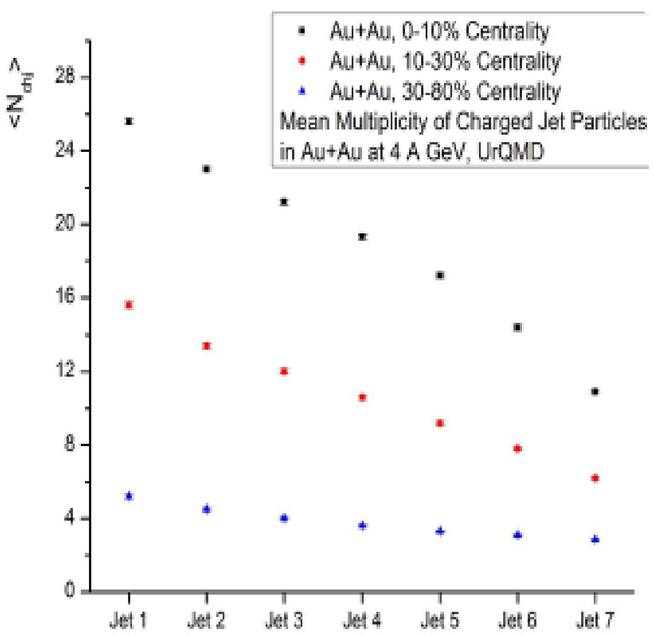


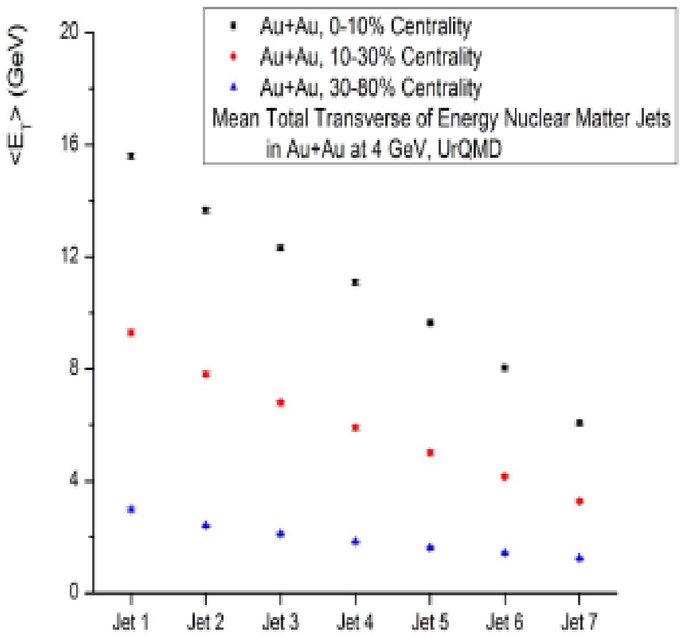












Conclusions

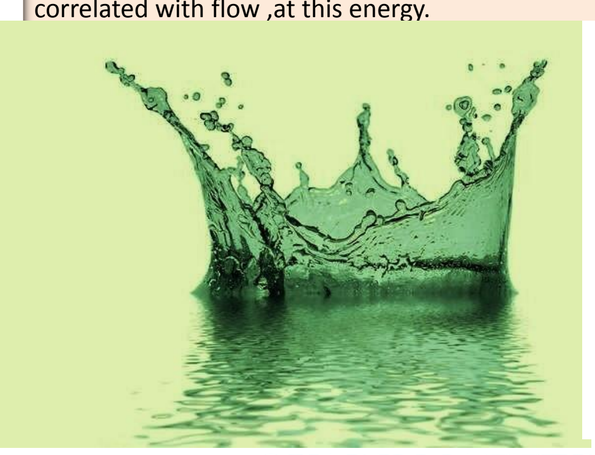
❑ In p+AuUrQMDsimulated collisions at 4 A GeV jet multiplicities do not depend on centrality; in Cu+Au and Au+Au UrQMD simulated collisions at 4 A GeV jet multiplicities start depending on centrality;

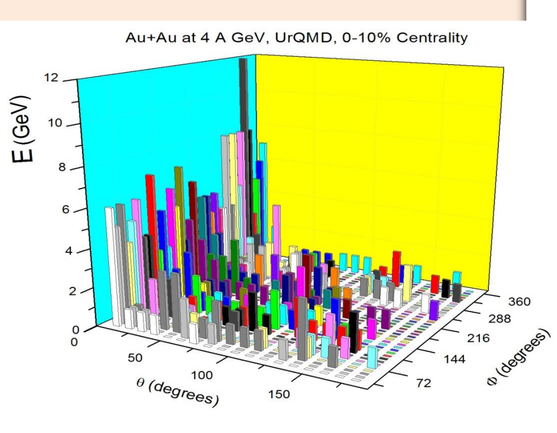
❑ Transverse energy (E*sin(θ)) has a very similar dependence on centrality with charged particles multiplicities.

❑ When the jet index increases transverse energy and multiplicity tend toward a common value. We will consider high index jets as a background.

❑ Cumulative number is a sign of fluctuations associated with phase transitions. In p+Au collisions at 4 A GeV the cumulative number has the greatest values and do not depend on centrality, in Au+Au collisions it has the smallest values and also do not depends on centrality. In Cu+Au collisions the mean value of cumulative number decreases from peripheral to central ones.

❑ Jet analysis can reveal interesting aspects of relativistic nuclear collisions dynamics, mostly correlated with flow ,at this energy.





Methodology

❑ p+Au, Cu+Au and Au+Au at 4 A GeV were UrQMD simulated in three centrality classes: 0-10%, 10-30% and 30-80%.

❑ The Anti-KT algorithm jet finder, with R=0.5, was used for jet detection;

❑ The midrapidity charged particles were selected for analysis at each of the three mentioned types of collisions.

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