Is the centrality dependence of the elliptic flow v_2 and of the average $< p_T >$ more than a Core-Corona Effect?

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Recently we have shown that the centrality dependence of the multiplicity of different hadron species observed in RHIC and SPS experiments can be well understood in a simple model, dubbed core-corona model. There it is assumed that those incoming nucleons which scatter only once produce hadrons as in pp collisions whereas those which scatter more often form an equilibrated source which decays according to phase space. In this article we show that also kinematical variables like $v_2/\epsilon_{part}(N_{part})$ as well as $v_2^i/\epsilon_{part}(N_{part})$ and $< p_T^i(N_{part}) >$ of identified particles are well described in this model. The correlation of $< p_T^i >$ between peripheral heavy ion collisions and pp collisions for different hadrons, reproduced in this model, questions whether hydrodynamical calculations are the proper tool to describe non-central heavy ion collision. The model explains as well the centrality dependence of v_2/ϵ_{part} of charged particles, considered up to now as an observable which allows to determine the viscosity of the quark gluon plasma. The observed dependence of $v_2^i/\epsilon_{part}(N_{part})$ on the particle species is a simple consequence of the different ratios of core to corona particles.

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Simulations of heavy ion collisions with advanced event generators like EPOS [?], which reproduce a multitude of experimental observables, have revealed that nucleons at the surface of the reaction zone (called corona particles) have only few collisions and do not come to statistical equilibrium with the more central (core) particles which form an equilibrated system. To study the consequences of this observation we have developed a simple model [2] by defining corona particles as those nucleons which have only one initial collision whereas the others are considered as core particles. f_{core} is the fraction of core nucleons which depends on the centrality, the system size and (weakly) on the beam energy. In this simple model we could show that, independent of the system size, the centrality dependence of the multiplicity of all hadrons from SPS to RHIC energies can quantitatively be described by:

$$M^i(N_{\text{part}}) = N_{\text{part}}\left[f_{core}\cdot M^i_{\text{core}} + (1-f_{core})\cdot M^i_{\text{corona}}\right] \quad (1)$$

where f_{core}, shown in Fig. 1, has been calculated in a Glauber model and i refers to the hadron species. For our calculation we fix M^i_{core} by applying eq. 1 to the most central AuAu or PbPb data point. M^i_{corona} is given as half of the multiplicity measured in pp collisions. Once these parameters are fixed, the centrality dependence of M^i is determined by eq. 1. Especially the centrality dependence of the lighter CuCu system follows then without any further input. Certainly this is a very simple model with no free parameter (besides the Glauber calculation of f_{core}) but the present experimental error bars of the quantities which we analyze give not sufficient information to refine the model.

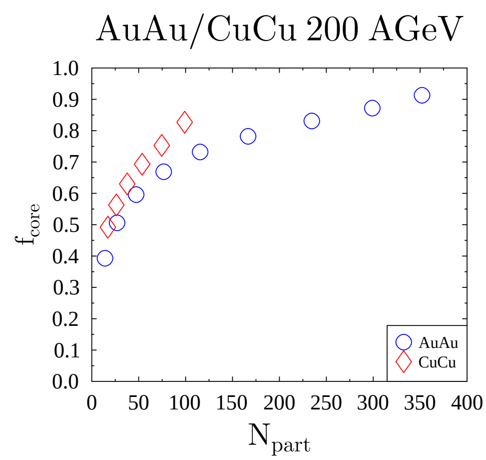

FIG. 1: f_{core} the fraction of core nucleons as a function of the participant number N_{part} for AuAu and CuCu collisions at $\sqrt{s} = 200GeV$.

One may ask whether the core - corona model can also describe the centrality dependence of other observables, like $< p_T > (N_{part})$ or $v_2/\epsilon_{part}(N_{part})$ of charged particles or identified hadrons. Especially the centrality dependence of $v_2/\epsilon_{part}(N_{part})$ has recently created a lot of theoretical activities. Initially the azimuthal distribution