Incident Energy and A_{part} Dependence of the Fireball Expansion in Au+Au Collisions

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A unified representation of the squeeze-out trends can be done in terms of the azimuthal distribution of the kinetic energy [1, 2]. A comprehensive description of the squeeze-out phenomena in the energy range 0.25 - 1.15 A·GeV is based on the parametrisation of the transverse mass spectra with an expression describing a radially symmetric expanding shell [1]. As far as such a situation can hardly be encountered in heavy ion collisions and is not specific at all for mid-central collisions, a presentation of the experimental information free of any model is preferred.

In this contribution we present results on azimuthal distributions of the collective flow β (=v/c) which is extracted from the rise of the experimental mean kinetic energy $< E_{kin}^{cm} >$ with the mass of the reaction products. We use the full coverage of the FOPI experimental device in order to extract as precise as possible this experimental information. Therefore, we have to combine the information from the forward plastic wall detector where the reaction products are identified only by their charge with the one from the central drift chamber (CDC) where the reaction products are identified by their mass. This is achieved by using the information obtained during earlier Phase I experiments when Si-CsI telescopes delivered a very good mass and charge separation of the light products within the acceptance of the plastic wall [3]. The collision geometry definition is based on CDC charged particle multiplicity and the ratio of transversal to longitudinal energies [4]. The analysis is performed in a reference frame with the z axis along the sidewards flow direction and within $80^o \leq \Theta_{cm} \leq 100^o$ polar angular range. The azimuthal distributions are symmetric with respect to 90^o and 270^o, hence, we overlap 0^o-90^o and 270^o-360^o azimuthal ranges to decrease the statistical errors, make five bins in azimuth and reflect the results in order to cover the full angular range 0^o-360^o. The average flow value, β_o, and the out-of-plane - in-plane difference, $\Delta\beta$, are taken from a fit to the flow (β=v/c) azimuthal distributions using the following expression:

$$\beta(\Phi)=\beta_o - \Delta\beta \cdot cos2\Phi$$

The elliptic flow characterised by the major axis perpendicular to the reaction plane rises continuously from 90 to 400 A·MeV for mid-central collisions (Fig. 1). At 90 A·MeV the in-plane and out-of-plane flow values are very similar, specific for the E_{tran} region [4]. At all energies the flow β_o increases with the centrality, namely with increasing the baryonic content of the fireball (A_{part}), while $\Delta\beta$, the difference between out-of-plane and in-plane flow, decreases showing the shadowing effect of the spectator matter. At lower centralities, i.e. larger impact parameters, the spectator matter being more compact, the bulk of products detected in the reaction plane emitted by the fireball and not hindered by the spectators correspond to the late phase of the expansion when the flow is weaker and the spectators moved apart from the collision zone.

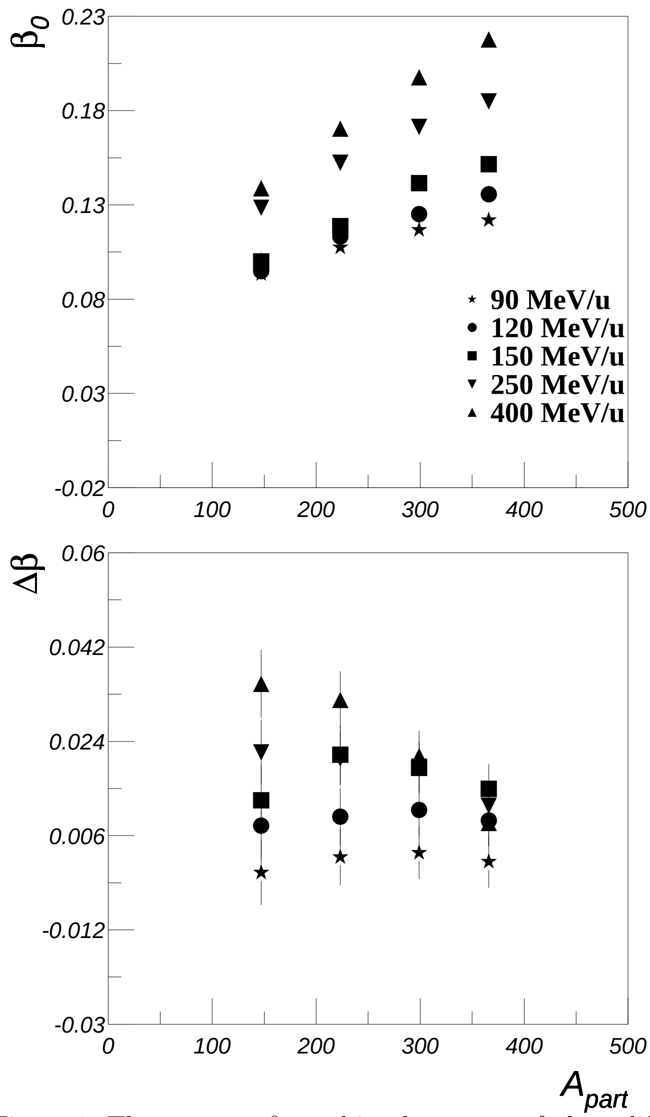

Figure 1: The average, β_o, and in-plane - out-of-plane difference, $\Delta\beta$, of the flow value as a function of centrality, for 90, 120, 150, 250, 400 A·MeV

These experimental trends can be followed in Fig.1. The continuation of these studies at higher energies and detailed comparisons with microscopic transport model predictions are in progress.

References

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