Elliptic Flow in semicentral Au + Au collisions at 2–8 AGeV

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There is mounting evidence that the elliptic flow analysis might reveal new insights into the early pressure built up in a heavy ion collision at relativistic energies which is strongly related to the nuclear equation of state [1, 2]. In the early stages of a relativistic heavy ion collision a hot zone of compressed nuclear matter is formed in the overlapp region and an out–of–plane emission of particles at midrapidity sets in. In the later stages the pressure gradient, which was built up in the initial phase, leads to a preferred in–plane emission.

Following this simple picture, the elliptic flow analysis measures the combined effect of the early out–of–plane emission and the late in–plane emission. At low incident beam energies this late in–plane emission can be distorted by shadowing effects of the surrounding spectator matter, leading to a further enhancement of the out–of–plane component. For beam energies of ≈2–10 AGeV the transit time of the two nuclei is of the order of only 15–5 fm/c and the shadowing effect by the surrounding spectator matter becomes progressively smaller (with increasing beam energy). Consequently the elliptic flow pattern can change from dominant out–of–plane emission to dominant in–plane emission. The incident beam energy at which the preferential out–of–plane emission of nuclear matter at midrapidity [3] turns into a preferential in–plane emission should be sensitive to the initial pressure which was built up during the collision and hence to the nuclear equation of state.

The E895 experimental setup is especially suited for flow studies. Using the EOS TPC [5] as the central detector it provides an almost complete event reconstruction for charged particles. This enables us to study flow effects over a large cm–rapidity range and to determine the reaction plane even at higher beam energies with very good accuracy.

The impact parameter selection is done via the measured charged particle multiplicity. The multiplicity range was selected to yield the strongest sideward flow. The reaction plane reconstruction uses a modified transverse momentum analysis taking all baryons into account. The strength of the elliptic flow is measured by determining the mean value of $\cos(2\Phi)$. Φ is the emission angle with respect to the reaction plane.

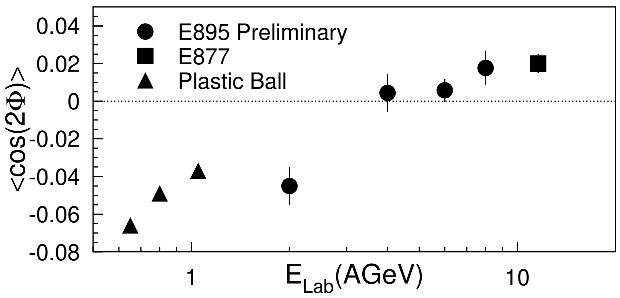

Figure 1: Preliminary elliptic flow excitation function for protons. Negative values characterize a dominant out–of–plane emission. For comparison results from E877 [4] and from the plastic ball [3] are included.

The preliminary results for the elliptic flow are shown in figure 1. The E895 experiment covers the beam energy region, where the change from a preferential out–of–plane emission to an in–plane emission occurs. The preliminary results indicate that the transition happens around an incident beam energy of 4 AGeV.

References

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