Freeze out densities of expanding nuclear matter in central Au+Au collisions.

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Exploring the statistical and dynamical evolution of an hot expanding source, we have measured correlation functions of light charged particles. Fragments from the interaction zone in central Au+Au collisions at 100, 150, and 200 AMeV, which are subject of increasing amount of collective motion, where detected in three high-resolution hodoscopes within the ALADIN setup at GSI. The particular importance of the temporal evolution of the reaction is evident from the differences of temperatures obtained from isotopic yields and from populations of particle-unstable resonances [1]. Correlation functions of proton pairs and d-α pairs are shown in Fig. 1 for the three incident energies. The pp-correlation function in the left column shows a peak at q=20 MeV/c due to the final state interaction between two protons, which becomes more pronounced with increasing bombarding energy. A different behaviour shows the correlation function of d-α pairs. The peak due to scattering in the 3+ state of ^{6}Li remains unchanged for all incident energies. The extracted values [4, 5] were corrected for sequential feeding, Coulomb distortions of the emitting zone, and initial correlations caused by the radial flow [2, 3]. The obtained radius parameters from pα and dα correlations are large, indicating breakup densities of about one third of normal nuclear density. However, extracted breakup radii from proton pairs show a significant dependence on the beam energy (Fig. 2). Deduced freeze out densities increase from $0.25\rho_0$ to $0.65\rho_0$ for 100 AMeV and 200 AMeV, repectively, and reveal the expansion of the source, since deduced nuclear densities are smaller than the saturation density. It is interesting to compare these different freeze out densities with different freeze out temperatures, measured in the same experiment by using double ratios of isotopes and ratios of unbound excited states [1, 6].

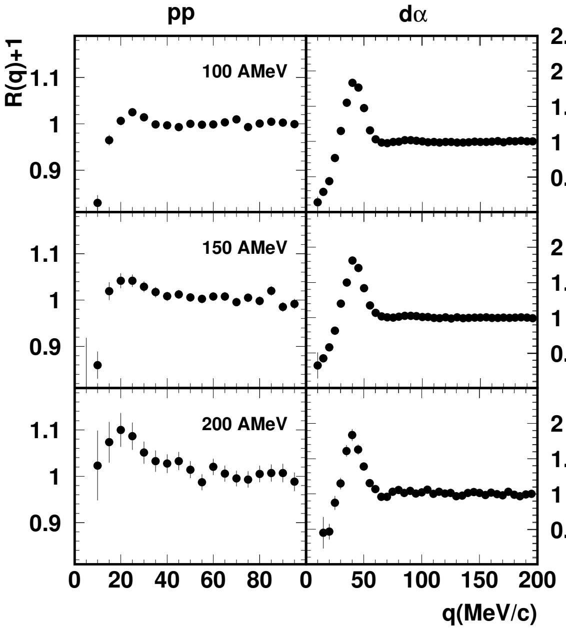

Figure 1: pp- and dα correlation functions for 10% of the most central collisions.

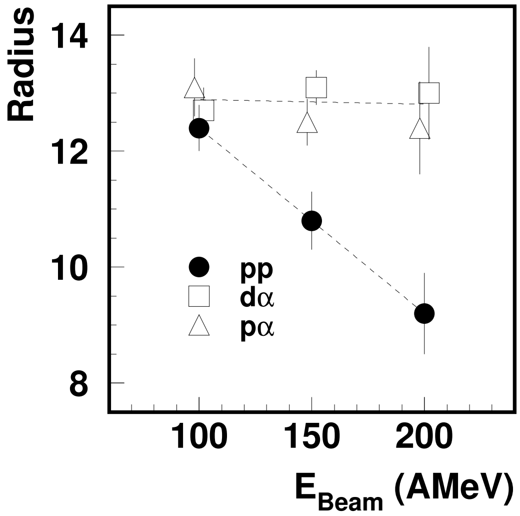

Figure 2: Extracted radii from pp-, dα, and pα correlations, corrected for radial flow and seqential feeding.

References

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