Reduced dispersion of transverse momentum of fragmentation products observed at 290 MeV/u

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Fragmentation process is usually used to prepare radioactive nuclear beams. The momentum distribution of fragmentation products is one of good probes to investigate the reaction mechanism. At relativistic energies, observed momentum distributions are well reproduced by an isotropic Gaussian function. The dispersion of the distribution can be understood based on the Fermi motion of removed nucleons [1]. At intermediate energies around E~100 MeV/u, the distributions becomes anisotropic and a transverse-momentum dispersion (σ_T) was larger than a longitudinal-momentum dispersion (σ_L). This behavior was discussed based on orbital deflection and the formulation proposed in [2] has been usually used to describe P_T distributions. However, there have still remained uncertainties in experimental results. There were few systematic measurements of P_T distributions and isotopes were not resolved in some measurements.

Recently, a remarkable correlation between σ_T and longitudinal momentum (P_L) has been obtained through well-organized measurements by using Ar beam at 95 MeV/u [3]. According to the results, σ_T at beam velocity agrees with σ_L as shown in Fig. 1(a), and that observed at lower P_L becomes larger than σ_L. The additional dispersion of P_T, observed in previous experiments, would be attributed to the contribution of lower P_L component.

The experimental method, used in [3], was applied to fragmentation process in higher energy. σ_T of fragmentation products, produced from Ar and Kr beams at 290 MeV/u, was obtained as a function of P_L. In contrast to the results at 95 MeV/u, σ_T is almost constant concerning P_L. This behavior implies the suppression of lower P_L component, which provides remarkable P_L dependence at 95 MeV/u. In the case of Ar beam, σ_T agrees with σ_L, like as Fig. 1(a). In the case of Kr beam, a significantly reduced σ_T, compared to σ_L, is observed as shown in Fig. 1(b).

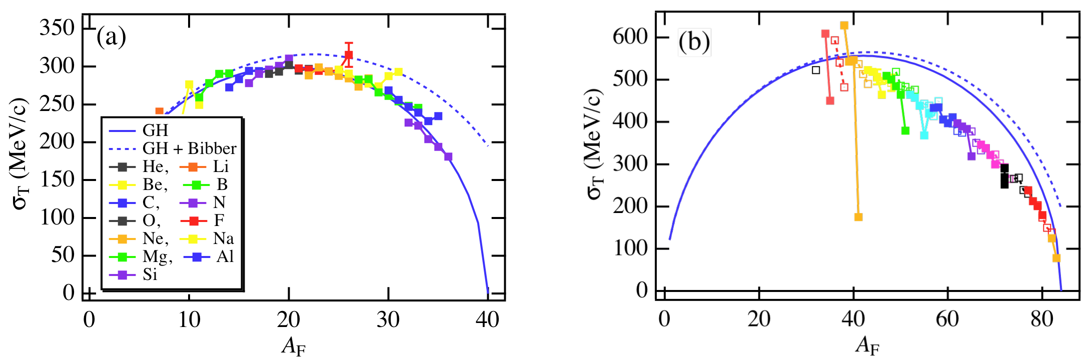

Fig. 1. σ_T as a function of fragment mass (A_F) at beam velocity. Fragments were produced through reactions (a) ^{40}Ar+^{9}Be at 95 MeV/u and (b) ^{84}Kr+^{12}C at 290 MeV/u. The blue solid lines in figures correspond to σ_L derived from observed P_L distributions.

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