Angular Distribution of IMFs Produced in 8-12 GeV Proton and Light Heavy-Ion Induced Target Multifragmentation Reactions

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While the reaction dynamics of a relativistic heavy-ion collision is generally considered to be governed by an intra-nuclear cascade, there is some indication that the reaction mechanism of a target multifragmentation (TMF) is dictated by the total beam energy rather than by the beam energy per nucleon [1]. The appearance of sideward peaking in the intermediate-mass fragment (IMF) angular distributions at the total incident energy of approximately 10 GeV or higher is one of the most distinct evidence [2]. In order to search for a possible scaling rule in the TMFs, we initiated a series of experiments on the TMF by using GeV-energy light heavy-ion beams from the Heavy Ion Medical Accelerator in Chiba (HIMAC) at the National Institute of Radiological Sciences. We used the same large acceptance Bragg Curve Counter [3] array which had been adopted for the survey of the 8-GeV and 12-GeV proton induced TMFs [4].
Inclusive IMF energy-spectra for 8-GeV ^{16}O and 8-GeV and 12-GeV ^{20}Ne induced TMFs show usual Maxwell- Boltzmann shapes similar to the ones for the proton induced TMFs, but their absolute cross sections are about 4-5 times larger. It was found that the single moving source (SMS) model always underestimates their yields at sideward angles, especially for heavier ($Z \geq 10$) IMFs. By taking ratios between the measured yields and those predicted by the SMS model we could see clear peaks at around 110° in the laboratory system for these TMFs. Though this angle is a bit backward compared to the 70° for the proton induced TMFs [5], the common appearance of the sideward peaks in both light heavy-ion and proton induced TMFs at the similar TOTAL beam energy suggests that the total beam energy plays a decisive role, i.e. acts as a common scaling parameter, to govern a reaction dynamics for the IMF emission in TMFs.
At the conference we will present details of the experiments and results of the further analysis.

References

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