Energy Dependence of π^-/π^+ Ratio in In+^{28}Si Reaction

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The density dependence of the nuclear symmetry energy $E_{sym}(\rho)$ is one of hot topics in both nuclear physics and astrophysics. The model calculations of heavy-ion reaction suggested that yield ratio $Y(\pi^-)/Y(\pi^+)$ for central heavy-ion collisions in intermediate energy region would provide significant constraint on the $E_{sym}(\rho)$ at supra-normal densities ($\rho > \rho_0$). The transport model calculation[1] predicted that the incident energy dependence of the $Y(\pi^-)/Y(\pi^+)$ is related with the behavior of $E_{sym}(\rho)$ in supra-normal density region and that the $Y(\pi^-)/Y(\pi^+)$ would increase as the incident beam energy approaches to the pion-production threshold.

We carried out measurements of the $Y(\pi^-)/Y(\pi^+)$ using 400, 600, and 800 MeV/nucleon with a centrality filter and a pion range counter, both of which consist of plastic scintillators [2][3]. The $Y(\pi^-)/Y(\pi^+)$ measured at 90° in the laboratory system is shown as a function of transverse momentum of pions in fig.1. Contrary to our expectations, there are not much difference of the $Y(\pi^-)/Y(\pi^+)$ between three different incident energies. The data analysis in mid rapidity region is in progress.
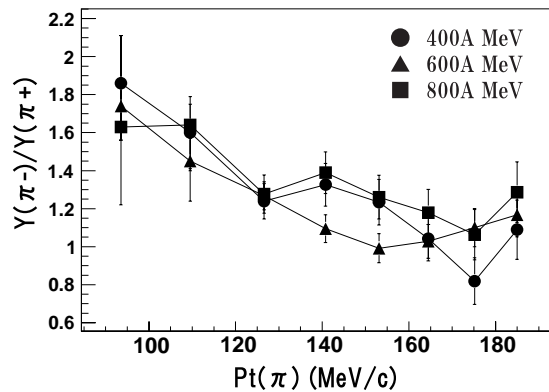

Figure 1: Results of $Y(\pi^-)/Y(\pi^+)$ yield ratios at 90° in the laboratory system for In+^{28}Si reactions at three different incident energies.

[1] Bao-An Li, Lie-Wen Chen, Che Ming Ko, Phys. Rep. **464** (2008) 113.
[2] T.Murakami et al., Nucl. Phys. A**834** (2010) 593.
[3] T.Murakami et al., RIKEN Accel. Prog. Rep. **43** (2010)(to be published)