

Performance evaluation of ionization chamber used for particle identification of heavy ion beams

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Ionization chambers are often used as E detectors for particle identification of heavy ion beams in RI beam facilities. The energy resolution of the ionization chamber is relatively high compared with that of solid detectors such as Si semiconductor with the same thickness in units of g/cm^2 .

Pfutzner et al. proposed that the high energy resolution of the ionization chamber is caused by the escape of high energy electrons (δ rays) from the sensitive area [1]. In our previous study, this effect of the δ -rays escape can be quantitatively reproduced by using the GEANT4 simulation at low atomic number Z [2]. However, experimental values of the energy resolution at $Z > 32$ were gradually worse than the GEANT4 simulation. The reason is probably that the charge fluctuation of the incident beams caused by the electron capture and the ionization inside the ionization chamber increase at high Z . In order to evaluate the influence of the charge fluctuation, the energy resolutions of the ionization chamber were measured under several conditions.

The experiment was performed at HIMAC(NIRS). The projectile fragments were produced by a 420-MeV/nucleon ^{132}Xe primary beam in a $370 \text{ mg}/\text{cm}^2$ Be target. The fragments with $18 \leq Z \leq 55$ were separated by the secondary beam line(SB2). They were transported to experimental hall, F3, and were passed through plastic scintillators and ionization chambers located at F3.

In this study, we compared the experimental values of the energy resolutions with the Monte Carlo simulation of charge fluctuations in the ionization chamber. In this presentation, we will report these results.

References

1. M.Pfutzner, et al, Nucl.Instr. and Meth.B 86,213(1994).
2. Y.Kanke, Tokyo University of Science, master's thesis(2015).

Field of your work

Instruments

Primary author: Mr TAKAHASHI, Hiroyuki (Tokyo City University)

Co-authors: Prof. NISHIMURA, Daiki (Tokyo City University); HIMAC-H093 COLLABORATION

Presenter: Mr TAKAHASHI, Hiroyuki (Tokyo City University)

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