MeV ion beam extraction into air with a glass capillary filled with He

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Synopsis In order to obtain intense ion beam in air, we have developed the He capillary, which is normal glass capillary filled with low pressure He gas. Energy spectra of ion beam via the He-capillary with and without He have been measured. Enhancement of peak intensity and suppression of low energy components have been observed for the He- capillary.

Developments of in-air-analysis method with MeV ion beam have been expected in various fields such as biology, nano-technology and archaeology. In particular, a technique to extract ion beam in air by a tapered glass capillary has been developed by Nebiki et al and they have performed in-air-PIXE (particle induced X-ray emission) for the sea sludge [1]. This technique was so simple and effective to obtain an in-air micro beam that this technique becomes to be used in various laboratories. We have also developed several in-air-analysis techniques using glass and metal capillaries [2] and reported transmission properties of ion beam through several capillaries [3]. It is concluded that an ion beam diameter in air via capillary is determined by the inner diameter of the capillary and its energies and intensities are spread by atmospheric gas inside and outside of the capillary. In this work, we have newly developed the capillary named He-capillary, which is normal grass capillary filled with low pressure He gas. It is expected that an ion beam spread in the capillary is suppressed since energy loss and struggling of ion beam in He atmosphere are smaller than that in air.

We have measured energy spectra of an ion beam via He capillary as a function of He pressure in the capillary by using the SSD (silicone semiconductor detector). Figure 1 shows energy spectra of 3 MeV proton beam via the He-capillary filled with and without He gas in the capillary. As is shown in Figure, peak intensity is more enhanced at He-capillary with He than without He although peak energy is shifted lower. Furthermore, low energy components of the energy spectra with He is much suppressed than that without He condition.

In the presentation, we will introduce the He- capillary and discuss transmission properties of ion beam via the capillary in detail.

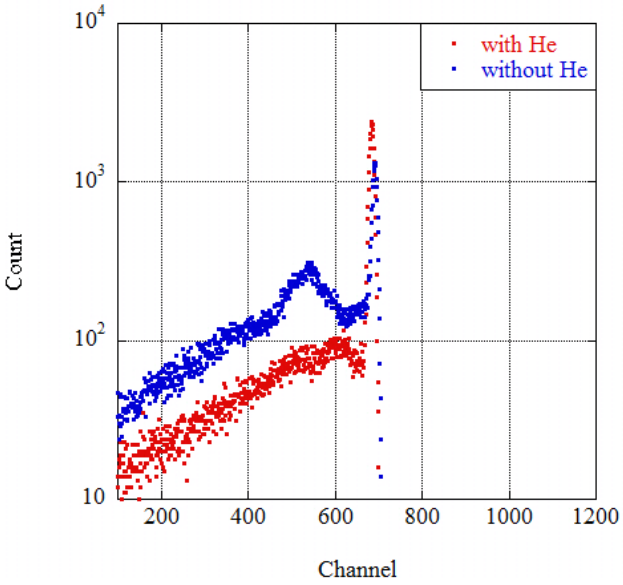

Figure 1. Energy spectra of 3.0 MeV proton beam via the He-capillary with and without He.

References

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