Development of a Sextupole Ion Beam Guide for Improvement of the RF-IGISOL

II. 1. Development of a Sextupole Ion Beam Guide for Improvement of the RF-IGISOL

Shimada K.[1], Takahashi M.[2], Ueno H.[2], Izumi S.[2], Wakui T.[1], and Shinozuka T.[1]

[1]Cyclotoron and Radioisotope Center, Tohoku University
[2]Department of Physics, Tohoku University

A sextupole ion guide (SPIG)[1)] has been introduced into the radio frequency ion guide isotope separator on-line (RF-IGISOL)[2)] for reduction of the energy spread of the transported beam and improvement of the efficiency as compared with the skimmer-based technique.

The ion guide technique uses a gas-filled volume to thermalize the reaction products recoiling out of the target. In the case of RF-IGISOL the recoil ions are then collected and transported by the DC and RF electric fields and the gas jet through the exit hole of the cell. A skimmer is used to separate and focus the ions from the gas jet and to inject them in the acceleration stage of the separator. In order to focus the ions through the skimmer, it placed close to the exit hole, and an electric field is applied between the cell and the skimmer electrode. In this field, therefore, the vacuum is poor and the ions collide with the residual gas atoms, which causes the energy spread of the extracted beam. The SPIG is installed between the exit hole and the skimmer for improving the vacuum, and makes a pseudopotential for focusing and trapping the ions during the transport. The pseudopotential formed by RF 2*N*-pole fields is described as a function of the cylindrical coordinate *r* as

$$\Phi = \frac{qN^2}{4m\omega^2}\left(\frac{V_{\mathrm{RF}}}{r_0}\right)^2\left(\frac{r}{r_0}\right)^{2(N-1)},$$

where q, m, ω, V_{R} and r_0 are the ion charge, mass, RF frequency, RF voltage and the inner radius of the beam guide, respectively.

The SPIG consists of 6 rods of 1.0 mm in diameter and 40.0 mm long are mechanically supported and electrically insulated by glass ceramics (photoveel). A

diameter of the inner circle of the SPIG is 1.8 mm. A distance between the exit hole of the RF carpet and the SPIG can change from 0 to 6 mm. The rods are supplied with RF voltages between adjacent pairs, that are approximately 100 V at 2 MHz. The geometry of the electrodes is shown in Fig. 1, and a photo of the SPIG assembly is shown in Fig. 2.

Now we are preparing offline and online experiments.

References

1) Xu H.J., Nucl. Instr. and Meth. **A 333** (1993) 274.
2) Miyashita Y., PhD. thesis, Tohoku University (2008).

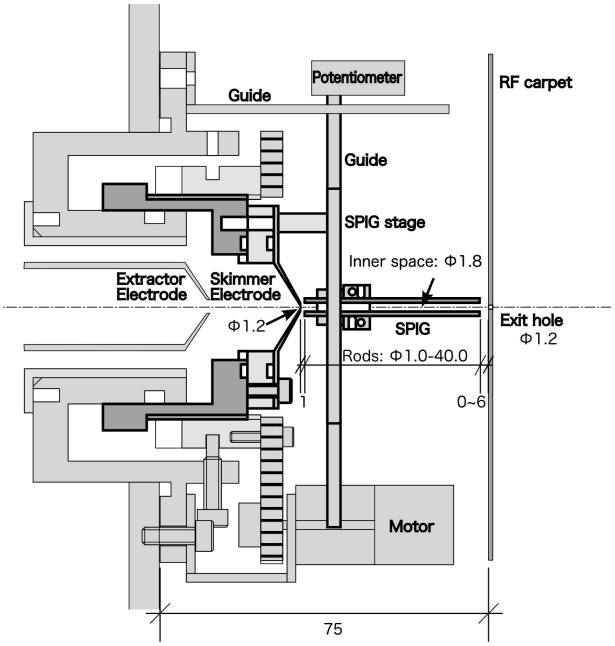

Figure 1. Schematic view of the SPIG.

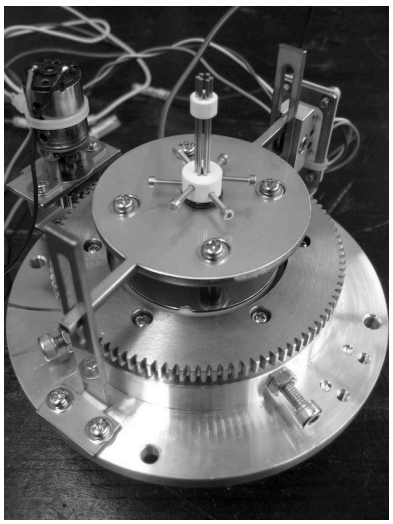

Figure 2. Photo of the SPIG assembly.