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Present status of ERIS (Electron-beam-driven RI separator for SCRIT) at the SCRIT electron scattering facility

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ERIS (Electron-beam-driven RI separator for SCRIT) [1] at the SCRIT (Self-Confined Radioactive isotope Ion Target) electron scattering facility [2] is an online isotope separator system to produce low energy radioactive isotope (RI) beams, used for electron scattering experiments of short-lived unstable nuclei. ERIS consists of a production target, a forced electron beam induced arc discharge (FEBIAD) ion source [3], and a beam-analyzing transport line. In ERIS, RIs are produced in photo fission reaction of uranium and we prepared our own uranium carbide disks as the production target. The produced RIs are ionized in the FEBIAD ion source. They are extracted and transported to the SCRIT system [2] through FRAC (Fringing-RF-field-activated ion beam compressor) [4]. In FRAC, continuous beams are converted into pulsed beams with an appropriate stacking time.

In the commissioning experiment of the RI production, 23 uranium carbide target disks of 0.8 mm thickness and 18 mm diameter were used and the total amount of uranium was about 15g. They were irradiated with the 10-W electron beam. The observed rates for ^{132}Sn and ^{138}Xe were 2.6×10^5 and 3.9×10^6 atoms s^{-1}, respectively. Details are reported in Ref. [5].

Recently, ion stacking and pulse extraction at ERIS were developed to shorten the opening period of the FRAC's entrance and inject the same number of ions as in the continuous injection. In order to stack ions inside the ionization chamber, entrance and exit grids are connected to the ionization chamber through an insulator, and the applied voltages of these grids are slightly higher than that of the ionization chamber. Then, ions are trapped in the longitudinal direction.
As a result, with a 1-ms stacking time and 300-μs pulse width, the measured pulse height is about 5 times larger than that of the continuous beam and the total number of ions in the pulsed beam is the same as those of the continuous injection with a 1-ms injection. Using this scheme, a number of the accumulated ions inside FRAC is 2–3 times larger than using the continuous injection.

As a further development, the surface ionization system will be introduced
in order to extend the variety of ion beams, and the commissioning experiment will be performed soon.

In this paper, we would like to report the present status of ERIS and recent results.

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[3] R. Kirchner et al., Nucl. Instr. and Meth. 133 (1976) 133.
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[5] T. Ohnishi et al., Phys. Scr. T166 (2015) 014071.

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