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Development towards intense uranium ion beam production of the RIKEN 28 GHz SC-ECRIS

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High intensity Uranium $^{238}U^{35+}$ ion beams are produced in the 28 GHz superconducting electron cyclotron resonance ion source(SC-ECRIS) and accelerated to high energies in the Radioactive Isotope Beam Factory(RIBF) at RIKEN. We report the current progress of the SC-ECRIS. Intense beam operation of U^{35+} was made possible through the development of high temperature ovens with optimized consumption rates of more than 10 mg/h and beam intensities reaching up to 250 eμA. With efforts toward realizing even higher beam intensities, it is now more important to optimize beam optics and minimize losses in the accelerator. This has stressed the study of emittance size and its growth factors. Measurement using a slit-collector type emittance monitor showed beam emittances that increase proportionally with the extraction current. For beam currents of 100 to 150 eμA, the beam emittances had minimal variation and remain at 0.15 π·mm·mrad for an extraction current of 5.5 mA. Differences between the normalized horizontal and vertical rms emittances were observed and horizontal emittances tend to be lower and less affected by beamline components. Using measured horizontal emittances coupled with a reference model calculation of space charge induced beam emittances, the $^{238}U^{35+}$ beam emittance ε_0 defined by the ion source was estimated. A systematic study using the calculated ε_0 to understand its correlation between the ECR parameters and magnetic field strength is currently ongoing.

Footnotes

Funding Agency

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Primary author: SAQUILAYAN, Glynnis Mae (Nishina Center for Accelerator-Based Science)

Co-authors: OHNISHI, Jun-ichi (RIKEN Nishina Center); KAMIGAITO, Osamu (RIKEN Nishina Center); NAGATOMO, Takashi (RIKEN Nishina Center); HIGURASHI, Yoshihide (RIKEN Nishina Center)

Presenter: SAQUILAYAN, Glynnis Mae (Nishina Center for Accelerator-Based Science)

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