

Research Facility Development Division Accelerator Group

1. Abstract

The Accelerator Group, consisting of seven teams, pursues various upgrade programs on the world-leading heavy-ion accelerator facility, RI Beam Factory (RIBF), to enhance the accelerator performance and operation efficiency. The programs include the R&D of superconducting ECR ion source, charge stripping systems, beam diagnostic devices, radio-frequency systems, control systems, and beam simulation studies. We are also maintaining the large infrastructure to operate RIBF effectively. Moreover, we are actively promoting the applications of the facility to various research fields.

Our primary mission is to supply intense, stable heavy-ion beams for the users through effective operation, maintenance, and upgrade of the RIBF accelerators and related infrastructure. The director members oversee the development programs that are not dealt with by a single team, such as intensity upgrade and effective operation. We also discuss the future plans of RIBF along with other laboratories belonging to the RIBF research division.

2. Major Research Subjects

- (1) Intensity upgrade of RIBF accelerators (Okuno)
- (2) Effective and stable operation of RIBF accelerators (Fukunishi)
- (3) Stable operation of the upgraded RILAC facility
- (4) Promotion of applied research through collaborations
- (5) Promotion of the RIBF upgrade plan

3. Summary of Research Activity

- (1) Thanks to the repairs and improvements made to the SRC in FY2023, we successfully and stably accelerated beams of ^{18}O , ^{70}Zn , $^{124,136}\text{Xe}$, and ^{238}U toward BigRIPS in FY2024. The total beam time amounted to 2,002 hours, achieving an availability of 95%.
- (2) At the SRILAC facility, high-intensity metal ion beams were stably delivered for new superheavy element synthesis experiments. As in the previous year, pulsed RF conditioning of the superconducting cavities was successfully carried out.
- (3) A wide variety of beams were provided for applied research aimed at solving societal issues, including ion-beam-induced mutagenesis, irradiation of semiconductors for space applications, and the production of radioisotopes.
- (4) As part of the commissioned research project by F-REI, “Development of RI Production Technologies Using Accelerators,” we fabricated an octupole magnet, a new type of non-destructive octupole beam monitor, and a new extraction electrode for the SRILAC superconducting ion source. Utilizing this external funding, we also succeeded in accelerating an alpha beam to 7.25 MeV/nucleon with SRILAC for the first time.
- (5) Further progress was made in the design and study of CSR1, a core component of the RIBF upgrade project.
- (6) As part of the Fusion Science School (FSS) program of the National Institute for Fusion Science, we hosted the “Workshop on the Fundamentals and Applications of Plasma and Ion Beams.” This event gave rise to various new opportunities for collaborative research.

Members

Director

Osamu KAMIGAITO

Deputy Directors

Hiroki OKUNO (for intensity upgrade)

Nobuhisa FUKUNISHI (for stable and efficient operation)

Senior Visiting Scientist

Takahide NAKAGAWA

Research Consultant

Eiji IKEZAWA

Visiting Scientists

Eiji KAKO (KEK)

Hirofusa NAKAI (KEK)

Kensei UMEMORI (KEK)

Hiroshi SAKAI (KEK)

Yasutaka IMAI (Okayama Univ.)