Research Facility Development Division
Accelerator Group
Beam Dynamics & Diagnostics Team

1. Abstract

Aiming at stable and efficient operation of the RIBF cascaded cyclotron system, Beam Dynamics and Diagnostics Team develops power supplies, beam instrumentation, computer control, and beam dynamic studies. We have successfully increased the beam availability for user experiments to over 98%. We have also established small-beam-loss operations, which strongly contribute to recent high-power operations at RIBF.

2. Major Research Subjects

(1) Efficient and stable operations of the RIBF cascaded cyclotron system
(2) Maintenance and development of the beam instrumentation
(3) Developments of the computer control system for more intelligent and efficient operations
(4) Maintenance and improvements of the magnet power supplies for more stable operations
(5) Upgrade of the existing beam interlock system for high-power beams with a few tens of kW

3. Summary of Research Activity

(1) High-intensity heavy-ion beams have been successfully delivered, including 117-particle-nA (particle nA) uranium, 173-particle nA xenon, 690-particle nA krypton, 830-particle nA Zinc, and 740-particle nA calcium beams.
(2) A new Faraday cup capable of withstanding 50-kW beams began operation in FY2024. Development of a new spiral-shaped beam position monitor is underway to enable precise measurements of low-beta heavy-ion beams.
(3) Replacement and upgrading of outdated power supplies for RIKEN Ring Cyclotron (RRC) are in progress. Approximately 90% of the power supplies for the RRC trim coils have been renewed. Power supplies for the beam injection and extraction systems have also been upgraded with improved current feedback systems, enhancing long-term stability.
(4) A new beam interlock system with a response time of less than a few milliseconds has been developed using National Instruments' CompactRIO technology. The Curs-BIS system, which monitors fluctuations in excitation currents of magnet power supplies, is now fully operational across all units.
(5) The RIBF control system continues stable operation following the replacement of legacy hardware controllers with modern units. Several new operational tools have also been developed to support efficient facility operations.

Members

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List of Publications & Presentations

Publications

[Proceedings]

A. Uchiyama, M. Komiyama, M. Fujimaki, T. Nishi, and K. Kumagai, "High-response PLC-based machine protection system development and performance for SRILAC," in Proc. LINAC'24, Chicago, IL, USA, August 2024, pp. 739–742, doi:10.18429/JACoW-LINAC2024-THPB052.

A. Uchiyama, M. Komiyama, K. Kumagai, T. Ohshiro, M. Kidera, and H. Imao, "Design and planning of the control system for the next RIBF project," in Proc. The 21th Annual Meeting of Particle Accelerator Society of Japan, FRP036, (2024), pp. 933–937.

K. Kumagai, A. Uchiyama, and S. Fukuzawa, "Development of a monitoring system for electromagnet current fluctuations," Proc. of PASJ 2024, THP035, (2024), pp. 650–654.

Presentations

[International Conferences/Workshops]

K. Kumagai (poster), A. Uchiyama, M. Komiyama, M. Fujimaki, and T. Nishi, "High-response PLC-based machine protection system development and performance for SRILAC," 32nd Linear Accelerator Conference (LINAC2024), Chicago, Japan, August 25–30, 2024.

[Domestic Conferences/Workshops]

H. Imao (ポスター発表), A. Uchiyama, M. Komiyama, K. Kumagai, T. Ohshiro, and M. Kidera, "Design and planning of the control system for the next RIBF project," The 21th Annual Meeting of Particle Accelerator Society of Japan, Yamagata, Japan, July 31–August 3, 2024.

S. Fukuzawa (ポスター発表), K. Kumagai, and A. Uchiyama, "Development of a monitoring system for electromagnet current fluctuations," The 21th Annual Meeting of Particle Accelerator Society of Japan, Yamagata, Japan, July 31–August 3, 2024.

K. Yamada (招待講演), "Construction and current status of the helium refrigeration system for RIKEN superconducting heavy-ion accelerator," 9th IFMIF Workshop, Rokkasho, Aomori, Japan, February 19–20, 2024.