

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 more than 90%. We have also established small-beam-loss operations. The latter strongly contributes to recent high-power operations at RIBF.

2. Major Research Subjects

- (1) More efficient and stable operations of the RIBF cascaded cyclotron system
- (2) Maintenance and developments of the beam instrumentation
- (3) Developments of 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 few tens of kW

3. Summary of Research Activity

- (1) High-intensity heavy-ion beams such as 117-pnA uranium, 173-pnA xenon, 486-pnA krypton, 788-pnA Zinc and 740-pnA calcium beams have been obtained.
- (2) The world-first high- T_c SQUID beam current monitor has been developed.
- (3) The bending power of the fixed-frequency Ring Cyclotron has been upgraded to 700 MeV.
- (4) The world-most-intense V beams are stably supplied to super-heavy-element-search experiments.
- (5) The RIBF control system has been operated stably by replacing legacy hardware controllers carried over from our old facility with new ones. Several useful operation tools are also developed.
- (6) The dated power supplies exciting the main coils of RIKEN Ring Cyclotron has been upgraded to a new one having a better long-term stability than the old ones.
- (7) Developments of automatic beam tuning methods based on recent machine-learning technology and adaptive control are in progress.

Members

Team Leader

Nobuhisa FUKUNISHI

Research/Technical Scientists

Masaki FUJIMAKI (Senior Technical Scientist)
Keiko KUMAGAI (Senior Technical Scientist)

Tamaki WATANABE (Senior Technical Scientist)
Kazunari YAMADA (Senior Technical Scientist)

Technical Scientist

Akito UCHIYAMA (Technical Scientist)

Expert Technician

Misaki KOMIYAMA

Postdoctoral Researcher

Takahiro NISHI

Research Associate

Hiroki FUJII

Visiting Scientists

Shin-ichiro HAYASHI (Hiroshima Int'l Univ.)
Atsushi KAMOSHIDA (Nat'l Instruments Japan Corporation)

Takuya MAEYAMA (Kitasato Univ.)

List of Publications & Presentations

Publications

[Review Articles]

K. Yamada, "Upgrade of the rf system for RIKEN Ring Cyclotron," J. Part. Accel. Soc. Jpn. **17**, 159–168 (2020).

N. Fukunishi, "Performance upgrade and present status of RI Beam Factory accelerator complex," J. Part. Accel. Soc. Jpn. **17**, 236–246 (2020).

[Proceedings]

- N. Fukunishi, “Beam intensity upgrade of RIKEN RI Beam Factory,” Proceedings of 17th Annual Meeting of Particle Accelerator Society of Japan, 7–12 (2020).
- T. Nishi, A. Uchiyama, O. Kamigaito, N. Sakamoto, T. Nagatomo, N. Fukunishi, M. Fujimaki, T. Watanabe, and Y. Watanabe, “Emittance measurement and ion optics tuning for SRILAC beam line,” Proceedings of 17th Annual Meeting of Particle Accelerator Society of Japan, 116–119 (2020).
- T. Watanabe, T. Toyama, K. Hanamura, H. Imao, A. Uchiyama, K. Ozeki, O. Kamigaito, N. Sakamoto, T. Nishi, N. Fukunishi, K. Yamada, Y. Watanabe, R. Koyama, and A. Kamoshida, “Commissioning of the beam energy and position monitor system for the superconducting RIKEN heavy-ion linac,” Proceedings of 17th Annual Meeting of Particle Accelerator Society of Japan, 718–723 (2020).
- A. Uchiyama and M. Komiyama, “Introduction of archiver appliance to RILAC control system,” Proceedings of 17th Annual Meeting of Particle Accelerator Society of Japan, 739–742 (2020).
- T. Watanabe, N. Fukunishi, H. Imao, O. Kamigaito, T. Nishi, T. Ozeki, N. Sakamoto, A. Uchiyama, Y. Watanabe, K. Yamada, T. Toyama, A. Kamoshida, K. Hanamura, and R. Koyama, “Commissioning of the beam energy position monitoring system for the superconducting RIKEN heavy-ion linac,” Proceedings of 9th International Beam Instrumentation Conference, 295–302, ISBN:978-3-95450-222-6 (2020).

Presentations**[International Conferences/Workshops]**

- T. Watanabe (invited), N. Fukunishi, H. Imao, O. Kamigaito, T. Nishi, T. Ozeki, N. Sakamoto, A. Uchiyama, Y. Watanabe, K. Yamada, T. Toyama, A. Kamoshida, K. Hanamura, and R. Koyama, “Commissioning of the beam energy position monitoring system for the superconducting RIKEN heavy-ion linac,” 9th International Beam Instrumentation Conference, FRA004, Santos, Brazil (online), September 14–18, 2020.

[Domestic Conferences/Workshops]

- N. Fukunishi (invited), “Beam intensity upgrade of RIKEN RI Beam Factory,” 17th Annual Meeting of Particle Accelerator Society of Japan, WEOOP02, Online, September 2–4, 2020.
- T. Nishi (oral), A. Uchiyama, O. Kamigaito, N. Sakamoto, T. Nagatomo, N. Fukunishi, M. Fujimaki, T. Watanabe, and Y. Watanabe, “Emittance measurement and ion optics tuning for SRILAC beam line,” 17th Annual Meeting of Particle Accelerator Society of Japan, THOO08, Online, September 2–4, 2020.
- T. Watanabe (poster), T. Toyama, K. Hanamura, H. Imao, A. Uchiyama, K. Ozeki, O. Kamigaito, N. Sakamoto, T. Nishi, N. Fukunishi, K. Yamada, Y. Watanabe, R. Koyama, and A. Kamoshida, “Commissioning of the beam energy and position monitor system for the superconducting RIKEN heavy-ion linac,” 17th Annual Meeting of Particle Accelerator Society of Japan, FRPP20, Online, September 2–4, 2020.
- A. Uchiyama (poster) and M. Komiyama, “Introduction of archiver appliance to RILAC control system,” 17th Annual Meeting of Particle Accelerator Society of Japan, FRPP26, Online, September 2–4, 2020.
- T. Watanabe (invited), “Construction of beam energy position monitoring system using PXI digitizers for the superconducting RIKEN heavy-ion linac,” LabVIEW User’s Particle Accelerator Community 2020.12.16 Online Conference, Online, December 16, 2020.

Awards

- T. Nishi, “Emittance measurement and ion optics tuning for SRILAC beam line,” Oral Presentation Awards of 17th Annual Meeting of Particle Accelerator Society of Japan (2020).