

Research Facility Development Division  
Accelerator Group  
Accelerator R&D Team

## 1. Abstract

We are developing the key hardware in upgrading the RIBF accelerator complex. Our primary focus and research is charge stripper which plays an essential role in the RIBF accelerator complex. Charge strippers remove many electrons in ions and realize efficient acceleration of heavy ions by greatly enhancing charge state. The intensity of uranium beams is limited by the lifetime of the carbon foil stripper conventionally installed in the acceleration chain. The improvement of stripper lifetimes is essential to increase beam power towards the final goal of RIBF in the future. We are developing charge strippers for high power beams, such as low-Z gas stripper, highly oriented graphene films and liquid lithium films. Another our focus is the upgrade of the world's first superconducting ring cyclotron.

## 2. Major Research Subjects

- (1) Development of charge strippers for high power beams (highly oriented graphene film, low-Z gas, liquid lithium films)
- (2) Upgrade of the superconducting ring cyclotron
- (3) Maintenance and R&D of the electrostatic deflection/injection channels for the beam extraction/injection

## 3. Summary of Research Activity

### (1) Development of charge strippers for high power beams (foil, low-Z gas, liquid lithium film)

(H. Hasebe, H. Imao, Y. Miyake, and H. Okuno)

We are developing the charge strippers for high intensity heavy ion beams. We are focusing on the developments on highly oriented carbon graphite films, gas strippers including He gas stripper and liquid lithium films.

### (2) Upgrade of the superconducting ring cyclotron

(J. Ohnishi, Y. Miyake, and H. Okuno)

We are focusing on the upgrade of the superconducting ring cyclotron.

### (3) Maintenance and R&D of the electrostatic deflection/injection channels for the beam extraction/injection

(J. Ohnishi, Y. Miyake, and H. Okuno)

We are developing high-performance electrostatic channels for high power beam injection and extraction.

## Members

### Team Leader

Hiroki OKUNO

### Senior Research Scientist

Hiroshi IMAO

### Technical Scientists

Hiroo HASEBE

Yasuto MIYAKE

### Special Temporary Technical Scientist

Jun-ichi OHNISHI

### JSPS PD Researcher

Yuga NAKAZAWA (~ October 31, 2024)

### Visiting Scientist

Noriyosu HAYASHIZAKI (Tokyo Tech)

## List of Publications & Presentations

### Publications

#### [Proceedings]

Y. Nakazawa, J. Ohnishi, A. Goto, T. Adachi, K. Shimomura, N. Teshima, P. Strasser, S. Kanda, T. Yuasa, T. Yamazaki, T. Adachi, Y. Miyake, Y. Oishi, Y. Nagatani, Y. Ikedo, K. Umeda, S. Nakamura, and T. Umezawa, "Beam profile measurement of the ultra-slow muon for the transmission muon microscope," in Proc. IPAC'24, (2024), pp. 2933–2936.

**Presentations****[International Conferences/Workshops]**

- N. Sakamoto and J. Ohnishi, “Operation test of new high-powered Gifford-McMahon Joule-Thomson (GM-JT) cryocooler,” TESLA Technology Collaboration (TTC) Meeting in 2024, Lund, Sweden, November 11–15, 2024.
- Y. Nakazawa (contributed oral), “Beam profile measurement of the ultra-slow muon for the transmission muon microscope,” 15th International Particle Accelerator Conference (IPAC’24), Nashville, USA, May 19–24, 2024.
- Y. Nakazawa (poster), “Time-of-flight measurement of ultra-slow muons at J-PARC MUSE,” 4th J-PARC symposium (J-PARC2024), Mito, Japan, October 14–18, 2024.
- H. Sakurai (invited), “Facility-upgrade of RIBF... in nuclear physics,” 13th International Conference on Nucleus-Nucleus Collisions (NN2018), Omiya, Japan, December 4–8, 2018.
- Y. Miyake, H. Imao, and H. Okuno (oral), “Design of  $N^{2+}$  He two-stage stripper for CSR1,” 31th World Conference of the International Nuclear Target Development Society (INTDS2024), Knoxville, United States, August 18–23, 2024.

**[Domestic Conferences/Workshops]**

- 大西純一, 永谷幸則, 中沢雄河, 後藤彰, 山崎高幸, 三宅康博 (ポスター), 「ミュオン顕微鏡のためのサイクロトロンで加速された 5 MeV ミュオンビームのエミッタンス計算」, 日本加速器学会第 21 回年会, 山形市, 2024 年 7 月 31 日–8 月 2 日
- 三宅泰斗, 奥野広樹, 渡邊幸志 (口頭発表), 「ダイヤモンド薄膜中の Be の拡散に対する表層状態の影響の評価」, 第 85 回応用物理学会秋季学術講演会, 新潟市, 2024 年 9 月 16–20 日.
- 三宅泰斗, 奥野広樹, 渡邊幸志 (口頭発表), 「核種変換による  ${}^7\text{Li}$  ドープダイヤモンドの製作」, 2024 年度核融合科学研究所スクーリング・ネットワーク事業プラズマ・イオンビームの基礎と応用に関するスクール, 理研和光キャンパス, 2025 年 2 月 20–21 日.
- 三宅泰斗, 奥野広樹, 渡邊幸志 (口頭発表), 「ダイヤモンド薄膜への  ${}^7\text{Be}$  のイオン注入」, 第 72 回応用物理学会春季学術講演会, 野田市 (東京理科大学), 2025 年 3 月 14–17 日.

**Awards**

- 中沢雄河, 「J-PARC ミューオン g-2/EDM 精密測定実験におけるミューオン線形加速器の開発に係る研究」, 第 19 回 (2025 年) 日本物理学会若手奨励賞 ビーム物理領域