

Minutes of the 60th Machine-Time Committee Meeting

Date and time: November 16, 2012; 13:30–15:05

Place: RIBF Bldg., Room 203

Attendees: Sakai^a (Chair), Abe^a, Aoi^{d,†,‡}, En'yo^{a,†}, Fukunishi^a, Haba^{a,†}, Hirayama^b (in lieu of Miyatake), Kase^a, Kubo^a, Motobayashi^{a,†}, Nishimura^{a,†}, Shimoura^b, Ueno^a, Uwamino^a, Wakasugi^a, Hasebe^{a,†}, Imao^{a,†}, Kaji^{a,†}, Morimoto^{a,†}, Okuno^{a,†}

Absent: Kamigaito^a, Miyatake^{c,†}, Morita^a, Sakurai^a, Uesaka^a, Yamaguchi^b, Yoshida^{a,†}

^aRNC / ^bCNS / ^cKEK / ^dRIBF-UEC / [†]Observer / [‡]TV Attendee
(in random order)

Reports

1. Changes of the beam-time schedule (Ueno)

It was reported that the beam-time (BT) schedule for November–December was revised on October 29 to comply with the adjustments in the latest schedule of the official RIBF facility inspection. A further modification to the BigRIPS-tuning schedule of each BT was also made. After the start of the ²³⁸U beam series of the BigRIPS-based experiments, the BT schedule was modified twice on November 13 and 15 due to the delay of the beam delivery. Details of the modifications are summarized below.

Exp.-Prog.-Num.	previous	changed
RILAC:		
MS-EXP12-07 (Kuboki)	Dec 7, 9:00 – Dec 9, 9:00	→ Dec 8, 9:00 – Dec 10, 9:00
SRC:		
NP0702-RIBF10-04 (Nishimura)	Nov 6, 21:00 – Nov 14, 9:00	→ Nov 6, 21:00 – Nov 16, 9:00
NP0802 -RIBF60&62R-01 (Watanabe)	Nov 14, 9:00 – Nov 21, 21:00	→ Nov 16, 21:00 – Nov 23, 9:00
MS-EXP12-04 (Kubo)	Nov 26, 9:00 – Nov 26, 17:00	→ Nov 26, 21:00 – Nov 27, 5:00
NP1112-RIBF85-01 (Simpson)	Nov 26, 21:00 – Dec 1, 21:00	→ Nov 27, 21:00 – Dec 2, 21:00
NP0802-RIBF60&62R1-02 (Watanabe)	Dec 1, 21:00 – Dec 7, 9:00 (conditional)	→ Dec 2, 21:00 – Dec 8, 9:00 (conditional)

2. RIBF operation status – report on the ²³⁸U beam delivery (Fukunishi)

In the currently running ²³⁸U⁸⁶⁺ beam series, beam delivery started on November 5 at 0:52 with only 4 hours delay from the original BT schedule. Taking into account the total suspended BTs due to accelerator troubles, the beam delivered so far is 185 hours compared to the originally scheduled BT of 264 hours, suggesting that the accelerator reliability defined by the ratio of the former to the latter is 70.4%. The reduction in the reliability is mainly due to unexpected full-scale accelerator tunings conducted twice at the beginning of the series. In this series, beam was delivered at the current of 500–750 enA (5.8–8.7 pA) on an average, which already exceeded the instantaneous maximum beam current 3.8 pA recorded the last year. The current is still increasing. A key to the high current is the improved performance of the 28-GHz ECR ion source and fRC. The ECR ion source is providing the U ions at 75–80 eμA, and fRC was modified to accept and accelerate U ions at $q = 64^+$. It was also noted that the stability and sustainability in beam delivery had been improved significantly by the installation of a He-gas charge-stripping system downstream of RRC at the A02 site, and a rotating Be-foil charge

stripping system between fRC and IRC at M04 site, as the first and second-stage charge stripping systems.

3. MS reports

- KISS R&D (MS-EXP12-10) (Hirayama)

The facility-side BT in the machine study (MS) category was conducted using a 1-pnA ^{56}Fe beam at $E/A = 90$ MeV from September 29 at 22:00 to October 1 at 12:00. KISS (KEK Isotope Separator System) is designed to stop beam in an Ar gas cell after the energy was degraded to $E/A = 1$ MeV with a degrader plate. Then, only a particular isotope is selectively extracted based on the technique of the double resonance laser spectroscopy. Although the measurement of the extraction efficiency as a function of the Ar-gas pressure was originally planned, the extraction of ^{56}Fe ions was not observed due to an unexpected large background (BG) produced by the beam irradiation. To identify the origin of the BG, offline R&D studies are in progress.

- Charge-stripping foil R&D (MS-EXP12-05) (Hasebe)

The MS BT was conducted using a 340-enA $^{238}\text{U}^{35+}$ beam at $E/A = 11$ MeV from October 25 at 9:00 to 31 at 10:10. Details are as follows:

- Tests of fixed-type charge stripping foils: As a candidate of the first-stage charge stripper at the RRC–fRC (A02) site, performance of three different 300- $\mu\text{g}/\text{cm}^2$ carbon nanotube (CNT) foils were investigated, where charge-state distributions of ^{238}U ions and endurance times of the CNT foils were measured. It was revealed that the endurance time varies substantially depending on the difference in the shape and density. One showed much longer endurance time than 3 hours shown by the other two. For all these three foils, an increasing equilibrium charge state of ^{238}U was observed as a function of the irradiation time. There was no more increase beyond $q = 71^+$ after irradiation of 2 hours.
- Tests of rotational charge stripper foils: Performance of three foils, C (19 mg/cm^2), Ti (40 μm^f), and Be (100 μm^f) as a second-stage charge stripper at fRC–IIRC (M04) site were investigated. In a charge-state distribution measurement, an equilibrium charge state was observed as a peak in the charge-state distribution with the Ti and Be foils at $q = 82^+$ and 86^+ , respectively, while such equilibrium charge state was not identified with the C foil due to widening of the distribution. This observation indicates that U ions cannot be collected and transported efficiently with the C foil. In the next test on durability conducted with the Ti and Be foils, they were not damaged by the beam irradiation of 600 enA \times 13h and 700 enA \times 17h, respectively. It was determined from these results that rotational Be foils will be used in the U beam series of the BigRIPS-based experiments scheduled for this autumn.

- GARIS-II commissioning (MS-EXP12-9) (Kaji)

The MS BT was conducted for a performance investigation of GARIS-II, a QDQQD-type new RIKEN Gas-filled Recoil Ion Separator, using 1-pnA ^{40}Ar beams at $E/A = 2.93$ and 4.93 MeV from November 10 at 9:00 to 12 at 12:10. The $^{169}\text{Tm}(^{40}\text{Ar}, xn)$ and $^{208}\text{Pb}(^{40}\text{Ar}, xn)$ reactions were utilized

to discuss the performance. Details are as follows:

- Beam current monitor: The current of a beam incident on a target at GARIS-II was measured from the yield of the elastic-scattering beam particles from a target. In this monitoring system, a filter was installed to restrict the counting rate so that the system can measure the current correctly under the beam current higher than 1 μA .
- Target system: Recoil particles detected at the focal plane can be recorded together with the irradiated position of a rotating target. The system enables to measure, e.g., excitation functions efficiently without changing beam energy.
- Acceptance: An acceptance of GARIS-II was measured to be $\Omega = 12$ msr using ^{209}Bi recoil particles to 0 degrees, indicating that 67% of the recoil particles were accepted by GARIS-II.
- The overall performance of GARIS-II was first tested through the $^{169}\text{Tm}(^{40}\text{Ar}, 4n)^{205}\text{Fr}$ reaction. The produced ^{205}Fr particles were well separated from the beam particle and other reaction products due to a high resolution and a low background (BG) provided by GARIS-II.
- The performance was then tested through the $^{208}\text{Pb}(^{40}\text{Ar}, 3n)^{245}\text{Fm}$ reaction having a small cross section ($\sigma \sim 20$ nb). The cross section was measured with a high S/N ratio in a relatively short time due to the high acceptance and the low BG environment provided by GARIS-II.

From these results, the group concluded that GARIS-II functioned well as designed, and that it is expected to play a significant role in the field of SHE researches.,

4. Status of the PAC meetings (Ueno)

12th NP-PAC: It was reported that the schedule for the PAC meeting was set for June 28–29, 2013. The request for submission of proposals will be announced at the end of March.

Topics discussed

1. Approval of the minutes of the previous meeting (Sakai)

2. Modification of the BT for the FY2012 second half (Sakai)

The extension of the currently running ^{238}U beam series of the BigRIPS-based experiments originally scheduled to end on December 8, and the additional BigRIPS BT allocation in January were discussed. The Committee, however, had to postpone making a decision until RNC meets the requirements for budgetary restrictions and the electric power circumstance. The decision was left to the discretion of the MT Committee Chair, since this issue cannot be discussed at the next MT Committee meeting due to the schedule limitation. It was also determined to schedule experiments using RILAC, AVF, and RRC, for February and March. Note that SRC cannot be operated during this period, since the CGS (Co-Generation System) will not be available due to a scheduled regular maintenance work. Kase commented that RRC will be shut down for two weeks in February–March to perform maintenance work on the RRC main coil.

3. BT for the FY2013 first half (Sakai) relatively

The outline of the BT schedule for the first half of FY2013 was discussed. It was decided that the BT-scheduling process which newly includes a ^{124}Xe beam that could not be scheduled for

BigRIPS-based experiments for the second half of FY2012 will start in addition to the announced beams of ^{238}U and ^{78}Kr . The BT scheduling process will be conducted as follows:

Today: MT Committee Meeting (discussions on the BT outline for FY2013)

Tomorrow–Mid December: Period for submission of beam-time scheduling requests (BTs to be scheduled for February–March (up to RRC) and for the first half of FY2013)

Mid–End of December: Planning of the BT schedule

End of December–Mid January: Period for submission of Accelerator-Use Planning Sheets

End of January: In-house Safety Review Committee Meeting

End of January: MT Committee Meeting (approval of the BT plan)

4. Priority of the kind of heavy ions to be developed (Sakai)

Beams which should be developed after ^{238}U and ^{48}Ca were discussed. The discussions on this issue will be continued.

5. Next meetings

- The next meeting will be held on Friday, December 21, 2012, at 13:30.
- The meeting after the next will be held on Friday, January 18, 2013, at 13:30.