Operation of Pelletron tandem accelerator

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The Pelletron tandem accelerator (5SDH-2, since 1992) at the Nishina R&D Building provides ion beams accelerated by up to 1.7 MV for developments of detectors used in RIBF. The maintenance, operation, and updates of beam lines are managed by the Detector Team of RNC. Further, the accelerator is registered as a joint-use equipment (ID: WE0429)[1] at the Wako campus to perform sample surface modification, material analysis, irradiation to biological samples, and so on. Figure 1 shows the configuration of the accelerator part, two ion sources, four beam lines, and storage tanks of SF_6 insulator gas. Alphatross is a source of the RF charge-exchange type for generating He^- ions. Almost all other negative ions can be generated via the source of negative ions by cesium sputtering (SNICS). However, SNICS has been dedicated to H^- ions in the last years.

BL-E15 is used for material science or device engineering to perform Rutherford backscattering (RBS) spectrometry analysis[2,3] and elastic recoil detection analysis (ERDA). At BL-W15, detectors for RIBF experiments[4–6] or Nishina School experiments[7] are mounted at the beam port as well as an ion microbeam generator[8–12] that employs glass capillary optics. A research microscope and glass capillary microbeam generator are installed at BL-W30 for irradiating living cells in the liquid medium, where the range in water is less than 100 μm, and the corresponding stopping power (> 200 keV/μm) is sufficiently high to induce double strand breaks of DNA in cell nucleus. These activities were presented at a domestic annual conference, 36th Symposium on Tandem Accelerators and Related Technologies, held on June 27, 28, 2024 in RIKEN.

The total machine time from January 1 to December 31, 2024, was 30 days, as indicated in Table 1. The operation time of H^+ includes a regular inspection (1 day).

Experiments performed in this facility are listed below.
(1) Detector developments and Nishina School (12 days)
(2) RBS/ERDA with He ions (8 days)
(3) Microbeam application at BL-W15/30 (9 days)

An interlock switch for the switching magnet cooling was installed to avoid energization when water is not flowing (Fig. 2(a1), (a2)). The Pelletron room was flooded because of heavy rain on July 31. A large water drain (manhole) was built in front of the room entrance for increasing the drainage capacity of the road
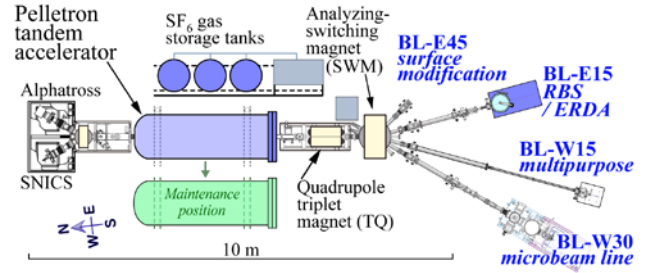

Fig. 1. Pelletron tandem accelerator and beam lines.

Table 1. Beam conditions.

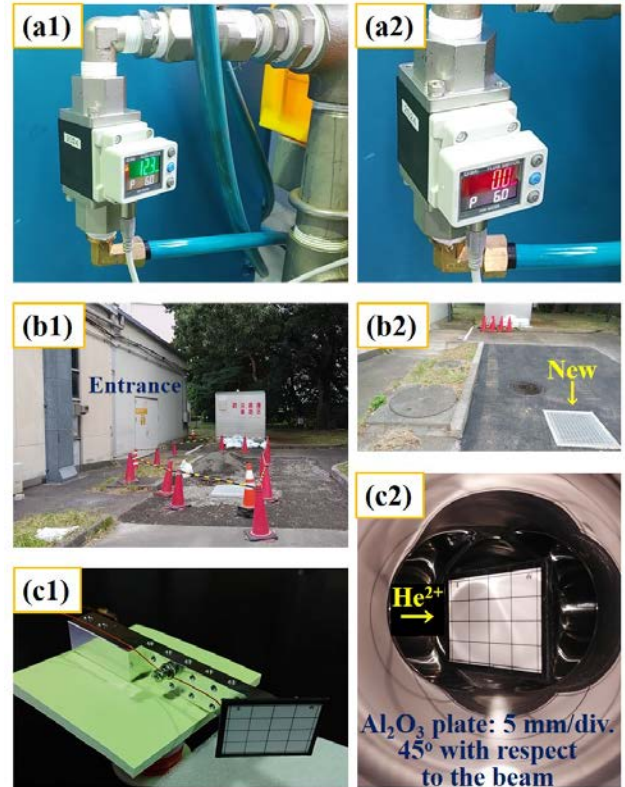| Ion	Energy [MeV]	Beam current [particle nA]	Experiment	Operation time [days]
$^1H^+$	0.992–3.4	1–990	Irradiation	22
$^4He^{2+}$	2.28	0.05–55	RBS/ERDA	8

Fig. 2. (a1) Current supply for SWM is On for water flow over 6.0 L/min, (a2) Off for 0 L/min. (b1), (b2) Construction of a manhole. (c1) Fluorescent plate and support. (c2) View to be taken by a video camera.

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(Fig. 2(b1), (b2)). A fluorescent plate was installed at BL-E15 to obtain the beam profile (Fig. 2(c1), (c2)).

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