

## RILAC operation

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This report covers RILAC operations, maintenance, and improvement work from January 1st to December 31st, 2024.

Some statistics on operations during the reporting period are presented in Table 1.

The RILAC stand-alone operation in 2024 consisted of the superheavy element search experiment and the MS for the RI production beamline, in which the He<sup>2+</sup> beam was transported to the Faraday cup in RI production beamlines for the first time.

The major machine issues encountered during the beam supply period are summarized below.

- (1) Failure of Solid-State RF Amplifier for SRILAC SC07.
- (2) RFQ digital low-level communication error.
- (3) Increase of SRILAC SC01, SC07 X-ray emission.
- (4) Malfunction of A2 vacuum tube filament power supply.
- (5) Failure of RILAC#4 final-stage vacuum tube.
- (6) Reduction in the output power of Ion source oven.
- (7) Failure of Differential pumping V30 dry pump.

The issues from (1) to (7) were properly addressed and repaired, allowing the beam supply to continue. The repairs for issues (1), (5), and (7) took a relatively longer time, requiring several days. For issue (5), although the vacuum tube was replaced, the RF Amplifier, in continuous use for over 40 years, is due for replacement. The RF resonator has also been in use for a similar period. Countermeasures for the aging of RILAC RF system are one of the most important issues.

The following is a list of major maintenance and improvement works performed during the maintenance period for the reporting period.

- (1) Replacement of RILAC resonator water cooling pump.
- (2) Replacement of RFQ resonator cooling water rubber hose.
- (3) Replacement of mid-stage filament power supplies in RILAC.
- (4) Installation of vibration sensors for cooling water pump.
- (5) Arrangement of RI production beamline.
- (6) Modification of cooling pipes for RFQ final-stage

Table 1. Statistical data of RILAC operation from January 1st to December 31st, 2024.

Operation time of RILAC	3698.0 h
Mechanical problems	498.3 h
Stand-alone RILAC	2588.8 h
Injection into RRC	0.0 h
Total beam service time of RILAC	2588.8 h

- amplifier.
- (7) Cleaning of RILAC#1 resonator flow meter.
- (8) Replacement of differential pumping V30 vacuum gauge.
- (9) Replacement of GV V30 valve plug.
- (10) Replacement of FC control from N-DIM to PLC compatible machine.<sup>1)</sup>
- (11) Replacement of rebuncher cooling water valve.
- (12) Replacement of all oscilloscopes for RF monitoring.
- (13) Replacement of crowbar panel push button switch in RILAC final-stage plate power supplies.
- (14) Parallelization of cooling pipes for vacuum system in RILAC#1 and #2.
- (15) Integration of signals from the flowmeters of RILAC#1-#6 and RFQ cryopump compressors into the interlock system (Ongoing).
- (16) Replacement of power supplies and addition of a water-cooling system for SH0A1 and SV0A1 electromagnet.
- (17) Development of web application for displaying accelerator archive data.

In addition, regular maintenance work has been performed on each device, resulting in 70.0% of the total annual beam supply hours in 2024, as shown in Table 1.

For other detailed reports on operation, trouble, maintenance, and improvement work, please refer to Ref. 2).

### References

- 1) A. Uchiyama *et al.*, in this report.
- 2) K. Kaneko *et al.*, Proc. of PASJ2024, (Yamagata, Japan, August 2024), WTSP07, pp. 1129–1132.

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