

## 2021 Operational report for the Nishina RIBF water-cooling system

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### Operation condition

In 2021, the cooling systems of Nishina and RIBF were operated for a slightly longer period than the accelerators. Excluding the time for an installation that was performed continuously, RIBF's cooling systems were operated for approximately three months. Nishina's cooling systems as for AVF standalone, AVF+RRC, AVF+RRC+IRC, and RILAC2+RRC were operated for approximately five months. No significant troubles that might have caused the long-term interruption of accelerator operation occurred, and the cooling systems were operated stably, with the exception of some minor problems.

### Trouble report

In troubleshooting during FY2021, trouble symptoms were fortunately minor. Therefore, instead of interrupting the machine time for repairs, while providing emergency measures, repairs were carried out during long-term accelerator outage periods such as those for switching beams or summer maintenance.

Typical examples of troubles that occurred in FY2021 are as follows: water leak from the cooling plumbing joint and deterioration of cooling-water purity due to the water leakage, bearing failure of the cooling water pump motor, inverter failure of the cooling water pump, and device outage caused by an instantaneous voltage drop due to a lightning strike (1–2 times a year).

### Periodic maintenance

During the shutdown period of the accelerator, the following activities were carried out as part of regular maintenance.

- (1) Cleaning of the cooling towers
- (2) Inspection and overhauling of the cooling-water pumps
- (3) Replacement of some superannuated hoses, joints, and valves used in the system
- (4) Cleaning of the strainers and filters used in the deionized water production system
- (5) Extension of the sensing wires of the water-leakage alarm to floors of new areas
- (6) Flushing work of the cooling-water pipe that was blocked by dirt

### Others

The accelerator facility at the Nishina Center has been operational in the Nishina Building for 35 years and the RIBF facility has been operational for more than 15 years. The same applies to the cooling equipment. With a limited budget, maintenance is performed every year, but the equipment is inevitably aging. Moreover, cooling-water consumables used for repairing pumps that have been used for more than 15 years are basically unobtainable or very difficult to obtain. Aging equipment is not only a cause of failure, but also one of the causes of unstable accelerator beams. However, anti-aging costs The budget for equipment maintenance is insufficient to cover the costs of anti-aging measures, and solving these problems will be a significant challenge in the future.

### Reference

- 1) T. Maie *et al.*, RIKEN Accel. Prog. Rep. **54**, 78 (2021).

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