Commissioning of a new cryogenic ion storage ring RICE

Y. Nakano* [1], **Y. Enomoto*, T. Masunaga*, S. Menk*, P. Bertier*†, and T. Azuma *‡**

* AMO Physics Laboratory, RIKEN, Saitama 351-0198, Japan
† Universite de Lyon, F-69003, Lyon, France; Universit´e Lyon 1, Villeurbanne ;
CNRS/IN2P3, UMR5822, Institut de Physique Nucl´eaire de Lyon ; F-69622 Villeurbanne.
‡ Department of Physics, Tokyo Metropolitan University, 198-0398 Tokyo, Japan

Synopsis A new electrostatic ion storage ring has been developed at RIKEN with an ability to store large molecular ions under cryogenic environments for a long period. Details of the design and developments, as well as results of commissioning will be presented.

Developments of next-generation "cryogenic" ion storage rings, DESIREE (Stockholm University) [1], CSR (Max-Planck Institute) [2], and RICE (RIKEN) [3] are receiving a lot of attentions in terms of their unique advantages; the extended period of storage time under the absence of ambient black-body radiation. In 2011, we started the development of RIKEN electrostatic storage ring (RICE) with a view toward experimental studies of molecular properties and reaction dynamics in cryogenic environments [4].

The RICE uses three sets of two-stage GM cryocoolers, which attained entirely cooling of the storage ring to be 4.2 K. The base plate of the storage ring was made from CrCu alloy as a material having adequate vacuum, cryogenic, and mechanical properties. The first cryogenic operation of the RICE was successfully performed in August 2014 with a 15-keV Ne^+ beam. The observed residual-gas lifetime of the beam was 780 s, which estimated the room-temperature-equivalent pressure of the ring to be about 1 x 10^{-10} Pa. At present, injection of neutral atomic beams and also cold molecular ions extracted from cryogenic ion trap are under preparation.

References

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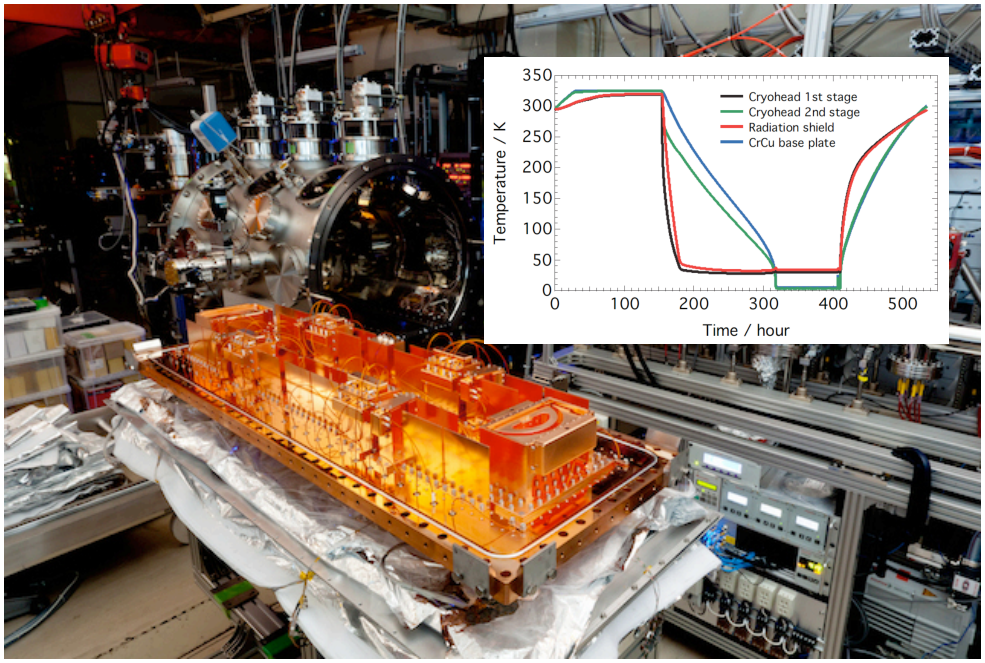

[1] E-mail: nakano-y@riken.jp