Status of mass measurements with CRISMASS@F11 in FY2024

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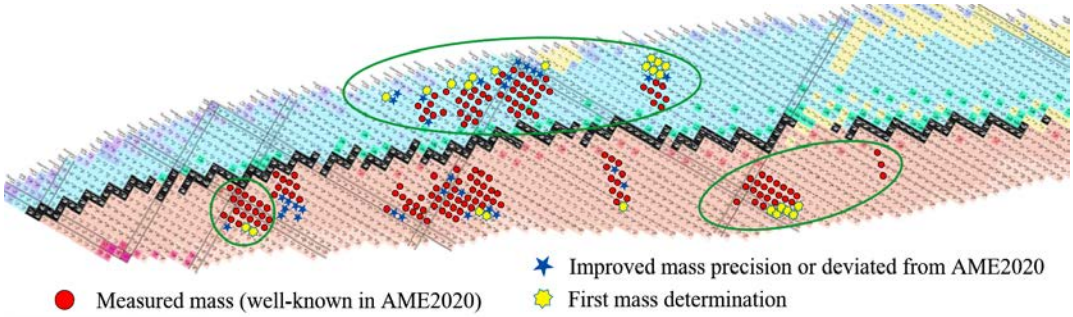

Fig. 1. Current status of mass measurement with CRISMASS@F11. Green circles indicate the result in FY2024. Original nuclear chart is from Ref. 1).

In our SLOWRI project, RIKEN-KEK Collaborative RI Stopper and Mrtof-based Analyzer and Spectroscopy System (CRISMASS) was installed at F11, where is the downstream of Zerodegree Spectrometer (ZDS) at BigRIPS. The CRISMASS is composed of a RF carpet type helium gas catcher (RFGC)[2] and a multi-reflection time-of-flight mass spectrograph (ZD MRTOF-MS).[3] It has been in operation since 2020 and is successfully engaged in the mass measurements of RIs supplied by BigRIPS.

The fast ($>$ 100 MeV/nucleon) RIs provided from BigRIPS are stopped in the He gas and extracted as slow ($<$ 10 eV) RI ions from RFGC using RF ion carpets. They are guided to an ion trap, accumulated, cooled, and injected into the mass spectrograph. The ions are reflected back and forth between the ion mirrors typically for 600 revolutions corresponding to roughly 10 ms at a maximum kinetic energy of 2.5 keV. Currently, the mass resolving power has reached 10^6 at maximum.[3]

In FY2024, two experimental programs, NP2112 - RIBF211 (Spokesperson: J. Lee) and NP2212 - RIBF205 (S. Kimura), were conducted using CRISMASS@F11, as well as three symbiotic experiments. Since the location of CRISMASS@F11 is just in front of the beam dump of ZDS, mass measurements can be conducted symbiotically by re-using the RIs from other experiment carried out upstream without extra cost. Our symbiotic experimental program, NP2312-RIBF234 has been also approved by NP-PAC. The total period of the beam time in FY2024 was 22 days including 9-days symbiotic experiments.

Mass-measured RIs in FY2024 are indicated by the green circles in Fig. 1. As a result, masses on about 120 RIs were measured in FY2024. Although the data analysis is going on, 21 isotope masses can be obtained for the first time. For 14 isotopes, a significant improvement in mass precision by a factor of 2 or more, or a large deviation ($>$ 50 keV) in mass values, can be also obtained compared to AME2020. A lot of physical outputs are expected to be obtained in the measured regions, including such as proton-rich Sn isotopes down to a double magic nucleus of ^{100}Sn, ^{136,137}Sn isotopes located on a rout escaping from 2nd r-process peak, and proton-rich isotopes from Y to Cd with N = Z.

As a back log, there are four experimental programs in the regions of isotopes around pathes for rare-earth-element r-process peak, isotopes on a rout of escaping from 2nd r-process peak and neutron-rich Ni isotopes toward ^{78}Ni.

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