

Mass measurements with the Rare-RI ring for the $A = 130$ r -process abundance peak II

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In the fall of 2021, we conducted an experiment at the Rare-RI Ring (R3) aiming to measure masses of neutron-rich silver (Ag) and palladium (Pd) isotopes. The first part of this experiment was conducted in the fall of 2018.¹⁾ Some of these nuclei were measured at that time, however, the mass values of ^{125}Ag and ^{124}Pd showed large systematic uncertainties that were suspected to be due to the narrow extraction timing of the storage ring. Upgrade of the kicker magnets system was successfully conducted in the fall of 2020²⁾ and extraction timing window was extended from 100 ns to 400 ns, leading to extraction of all stored events at the same time.

Particles of interest for this experiment were produced at RIBF by impinging a 60 particle nA Uranium beam on a 5-mm thick Be target. Particles were identified at BigRIPS by energy loss in an Ionization Chamber (IC) placed at F3 and their Time-of-Flight (ToF) from F3 to F5. The ToF was measured by a 0.2 mm thick plastic scintillator at F3 and the PPAC's anode at F5. The particles were then transported to the SHARAQ spectrometer and then injected into the ring. After injection into the R3 and storage for about 1 ms, equivalent to almost 2000 turns, the particles were extracted. To determine the mass, the total ToF inside the ring is necessary. For this purpose, a timing detector³⁾ was placed at the focal plane S0 of the SHARAQ spectrometer for the start signal, while a thin plastic detector was placed at the exit of the R3 for the stop signal.

Figure 1 shows the PID at F3 of all events produced at BigRIPS and the extracted events from R3, which are indicated by open black circles. These events were selected by using the so-called TOF/ dE gate method that is necessary for the individual injection method.⁴⁾ To estimate the extracted events for each isotone, a PID gate of $\pm 2\sigma$ for ToF from F3 to F5 as well as a $\pm 2\sigma$ gate for energy loss at F3 IC were performed. Unfor-

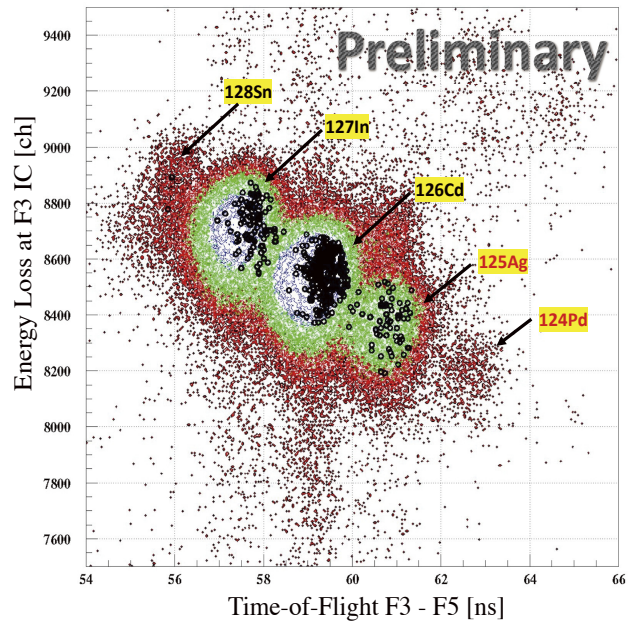


Fig. 1. Particle Identification (PID) showing the energy loss in the Ionization Chamber (IC) at F3 and ToF from F3 to F5. Extracted particles from R3 are shown in black empty circles.

tunately, no events of ^{124}Pd were extracted, however, sufficient events of ^{125}Ag and reference particles were extracted. Due to technical issues during the beam transport from BigRIPS to R3 and circulation inside the ring, the total efficiency was lower compared to previous experiments.^{1,5)}

In the near future, we will focus our efforts on solving the technical issues encountered during the experiment. We then plan to continue mass measurements of neutron-rich nuclei as well as neutron-deficient nuclei.

References

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