Search for new isotopes near the proton drip-line close to ^{100}Sn

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The ^{100}Sn nucleus, the heaviest doubly magic and particle-stable nucleus with N=Z, has been the subject of numerous experimental and theoretical studies. It is one of the most important nuclei for testing nuclear structure models.

Prior to the main ^{100}Sn experiment in 2013, we performed a test experiment in December 2011 with the aim of optimizing the configuration settings of the BigRIPS[1] separator at RIKEN, for the production and selection of ^{100}Sn.[2] This experiment was subsequently used to set up our main ^{100}Sn experiment, which was performed in June 2013 and was dedicated to the measurement of Gamow-Teller strength in the decay of ^{100}Sn to ^{100}In (see D. Lubos et al.[3]), to the mapping of the proton drip-line in the region of Te-Ru, and to the study of short-lived isomeric states in this region of the nuclear chart. In this contribution, we report on the search for new isotopes close to the drip-line in the Te-Ru region.

Nuclei around ^{100}Sn were produced by fragmentation of a 345 MeV/nucleon ^{124}Xe^{52+} beam impinging on a 4-mm Be target. The average beam intensity was 30 pnA during 203 hours of data taking.

The nuclei were identified on an event-by-event basis through the Bρ - ΔE - TOF method using the standard BigRIPS focal plane detectors. The nuclei of interest were implanted in a stack of 3 double-sided silicon strip detectors called WAS3ABi, followed by a stack of 10 single-sided silicon strip detectors used to measure the total energy of β-particles emitted after the decay of the implanted nuclei. The implantation detectors were surrounded by the EURICA array consisting of 12 seven-element Ge cluster detectors and 18 $LaBr_3$ crystals for the detection of delayed γ-rays.

A confirmation of Z and A/Q identification was achieved by the observation of the characteristic γ-lines of known isomers in ^{98}Cd and ^{96}Pd. The relative r.m.s. Z and A/Q resolutions for the Sn and N=Z isotopes were 0.41% and 0.09%, respectively. Available signals from the PPACs, plastic scintillators, and ionisation chambers were used to apply additional off-line gates, which allows the removal of spurious events from the particle identification plot.

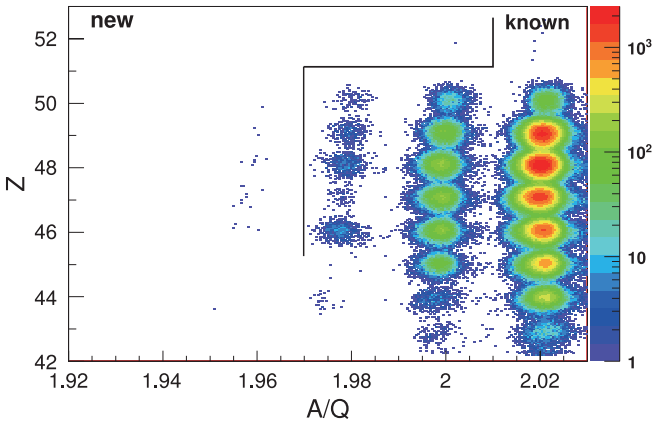

Fig. 1. Particle identification matrix Z vs A/Q around the ^{100}Sn after applying cleaning conditions.

We have discovered 3 new isotopes with more than 3 counts: ^{94}Cd, ^{92}Ag, ^{90}Pd. The consistency of all measured signals of interest for each nucleus has been checked, and the assignment of these new isotopes is unambiguous. We have also tentatively assigned events to ^{104}Te, ^{98}Sn, ^{96}In observed with less than 3 counts. One event was assigned to ^{86}Ru, the identification of which has been recently reported by H. Suzuki.[4]

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