Particle identification for Sn region with SAMURAI

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We performed the SAMURAI17 experiment[1] at RIKEN RIBF to study Gamow-Teller transition in ^{132}Sn by (p,n) reaction with the WINDS[2] and the SAMURAI spectrometer[3]. The SAMURAI spectrometer was used for tagging (p,n)-reaction events with the particle identification (PID) of the beam heavy fragments. The PID was performed with the TOF-$B\rho$-ΔE method. Here we report the preliminarily results on the PID.

Here, we used the ^{132}Sn beam run with empty-target cell at F13 and selected the non-reacted trigger events in order to estimate the resolution of TOF, $B\rho$ and ΔE. The beam rigidity was measured by the BigRIPS with a typical momentum resolution of $R/\sigma_R \sim 3000$.

The TOF was measured by using the plastic scintillators SBT1,2 and the HODS with flight path length $L \simeq 12.5$ m. The HODS consists of 6 plastic scintillation counters with size of 450 mm × 100 mm × 5 mm. The obtained TOF resolution is $\sigma_t = 62.1 \pm 2.7$(stat.) ps, where the statistical uncertainty is indicated. It should be noted that the non-uniformity of SBT1 thickness is as large as about 20 % which corresponds to 1 MeV/nucleon energy loss difference for 200 MeV/nucleon ^{132}Sn beam. In this analysis we gated the central position of SBT1 to estimate the TOF resolution, by using tracking information from BDC1,2[3] drift chamber which were placed between SBT1,2 and the target. In the following the resolution was estimated with the same manners.

The energy loss ΔE was measured by HODS. The ΔE is sensitive to the HODS thickness. In this experiment the non-uniformity of HODS thickness is about 10–20% for 6 counters. In order to correct the thickness dependence, we used the tracking information from FDC2[3] drift chamber which was placed after the SAMURAI spectrometer. The obtained ΔE resolution is $\sigma_{\Delta E}/\Delta E = 0.43 \pm 0.03$(stat.) %.

The rigidity was analyzed by using four drift chambers BDC1,2, FDC1 and FDC2[3]. The obtained rigidity resolution is $R/\sigma_R = 1318 \pm 27$(stat.).

Figure. 1(a) shows the PID spectrum with respect to atomic number Z and mass to charge ratio A/Q. The Z resolution is $\sigma_Z = 0.22$ corresponding to 4.6σ separation for Z=50 and 51. The A/Q resolution is $\sigma_{A/Q} = 0.14$ % for ^{132}Sn^{50+} which corresponds to 5.4σ separation.

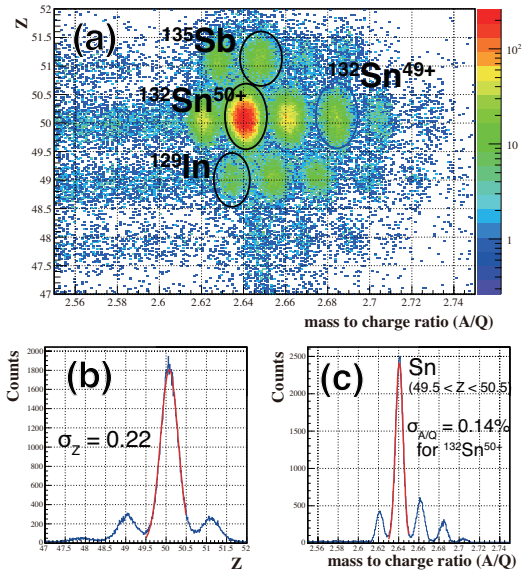

Fig. 1. (a) A SAMURAI PID spectrum with respect to Z and A/Q for non-reacted events with empty target cell. (b) Z distribution for all beam component and (c) A/Q distribution for Sn isotopes. The resolution of Z and A/Q are $\sigma_Z = 0.22$ and $\sigma_{A/Q} = 0.14\%$ for ^{132}Sn^{50+}, respectively.

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