Particle identification for Sn region with SAMURAI


We performed the SAMURAI17 experiment¹ at RIKEN RIBF to study Gamow-Teller transition in ⁱ³²Sn by (p, n) reaction with the WINDS² and the SAMURAI spectrometer³. 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-Bp-∆E method. Here we report the preliminarily results on the PID.

Here, we used the ⁱ³²Sn beam run with empty-target cell at F13 and selected the non-reacted trigger events in order to estimate the resolution of TOF, Bp and ∆E. The beam rigidity was measured by the BigRIPS with a typical momentum resolution of R/σR ~ 3000.

The TOF was measured by using the plastic scintillators SBT1,2 and the HODS with flight path length L ≈ 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 σ₁ = 62.1 ± 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 ⁱ³²Sn beam. In this analysis we gated the central position of SBT1 to estimate the TOF resolution, by using tracking information from BDC1,2⁴ 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 ∆E was measured by HODS. The ∆E 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 FDC2⁵ drift chamber which was placed after the SAMURAI spectrometer. The obtained ∆E resolution is σ_∆E/σE = 0.43 ± 0.03(stat.) %.

The rigidity was analyzed by using four drift chambers BDC1,2, FDC1 and FDC2⁵. The obtained rigidity resolution is R/σR = 1313 ± 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 σZ = 0.22 corresponding to 4.6σ separation for Z=50 and 51. The A/Q resolution is σA/Q = 0.14 % for ⁱ³²Sn⁵⁰⁺ 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 σZ = 0.22 and σA/Q = 0.14 % for ⁱ³²Sn⁵⁰⁺, respectively.

References
1) M. Sasano et al., in this report.
2) J. Yasuda et al., in this report.