Particle identification in ^{11}Li(p, n) experiment at SAMURAI

Y. Hirai,[*1] L. Stuhl,[*2] M. Sasano,[*3] J. Gao,[*3,*4] K. Yako,[*2] T. Wakasa,[*1] D. S. Ahn,[*3] H. Baba,[*3] A. Chilug,[*5,*3] S. Franchoo,[*6] Y. Fujino,[*7] J. Gibelin,[*6] I. S. Hahn,[*8] Z. Halász,[*9] T. Harada,[*10] M. N. Harakeh,[*11,*12] D. Inomoto,[*1] T. Isobe,[*3] H. Kasahara,[*1] D. Kim,[*13] G. G. Kiss,[*9] T. Kobayashi,[*14] Y. Kondo,[*15] Z. Korkulu,[*3] S. Koyama,[*16] Y. Kubota,[*3] A. Kurihara,[*15] H. N. Liu,[*17] M. Matsumoto,[*15] S. Michimasa,[*2] H. Miki,[*15] M. Miwa,[*18] T. Motobayashi,[*3] T. Nakamura,[*15] M. Nishimura,[*3] H. Otsu,[*3] V. Panin,[*3] S. Park,[*8] A. T. Saito,[*15] H. Sakai,[*3] H. Sato,[*3] T. Shimada,[*15] Y. Shimizu,[*3] S. Shimoura,[*2] A. Spiridon,[*5] I. Stefanescu,[*5] X. Sun,[*3,*4] Y. L. Sun,[*17] H. Suzuki,[*3] Y. Togano,[*7] T. Tomai,[*15,*3] L. Trache,[*5] D. Tudor,[*5,*3] T. Uesaka,[*3] H. Yamada,[*15] M. Yasuda,[*15] K. Yoneda,[*3] K. Yoshida,[*3] J. Zenihiro,[*3] and N. Zhang[*19,*2]

The details of the particle identification (PID) of the incoming secondary cocktail beam and the reaction residues in the SAMURAI30 experiment are reported.

A secondary cocktail beam of unstable ^{11}Li and ^{14}Be was produced via the fragmentation reaction of a 230 MeV/nucleon ^{18}O primary beam on a 14-mm-thick ^{9}Be target. In the experimental setup[1] around the SAMURAI spectrometer.[2] two 1-mm-thick plastic scintillators (SBT1, 2) were installed for the detection of beam particles. The SBTs were used to produce the beam trigger (threshold was set to $Z > 2$). The beam PID was performed on an event-by-event basis by measuring the energy loss in the SBTs and the ToF of the beam particles in BigRIPS between F7 and F13. The secondary cocktail beam consisted of ^{11}Li at 182 MeV/nucleon with an intensity of 2.5×10^5 particle/s and ^{14}Be at 198 MeV/nucleon with an intensity of 1×10^5 particle/s with purities of 48% and 19%, respectively. The triton contamination was below 30%. Figure 1 shows the incoming beam PID spectrum.

The secondary beam was transported onto a 10-mm-thick liquid hydrogen target.[3,4] The reaction residues entered SAMURAI after passing through the forward drift chamber, FDC0. The magnetic field of the spectrometer was set to 2.75 T. At the focal plane of SAMURAI, a wall (HODF24 detector) of 24 plastic scintillator bars with dimensions of $1200^W \times 100^H \times 10^D$ mm^3 was installed, to measure the trajectories, energy loss, and ToF (from SBTs) of the reaction residues. Further downstream, an additional wall, HODP, with 16 plastic bars (same as HODF24 bars) was installed. The 2 bars of HODF24 that were hit by the unreacted beam were excluded from the trigger. Figure 2 shows a typical PID spectrum in HODF24 for events generated by the ^{11}Li or ^{14}Be beams. Using the PID information, the reaction channels for ^{11}Li$(p, n)^{11}$Be[5] and ^{14}Be$(p, n)^{14}$B[6] can be identified.

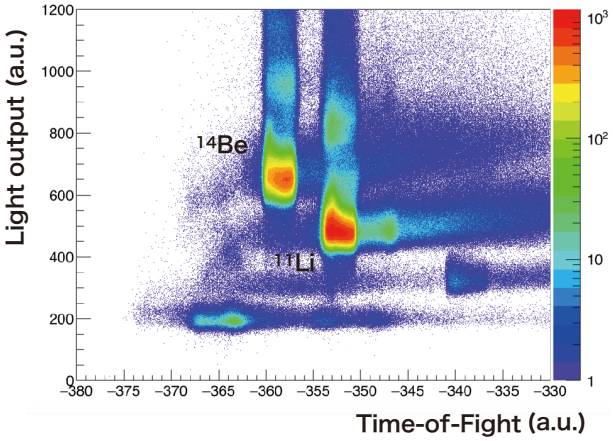

Fig. 1. An incoming PID spectrum of the SBT detector. The separation of ^{11}Li and ^{14}Be is clear.

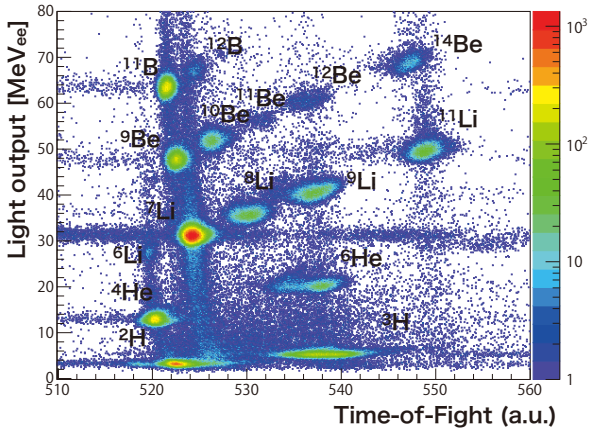

Fig. 2. A PID spectrum in the focal plane of SAMURAI, measured by one bar (bar ID = 7) of HODF24.

*1 Department of Physics, Kyushu University
*2 Center for Nuclear Study, University of Tokyo
*3 RIKEN Nishina Center
*4 School of Physics, Peking University
*5 Horia Hulubei Nat. Inst. of Phys. and Nucl. Eng.
*6 LPC CAEN
*7 Department of Physics, Rikkyo University
*8 Department of Physics, Ewha Womans University
*9 ATOMKI, Institute for Nuclear Research, HAS
*10 Department of Physics, Toho University
*11 KVI - CART, University of Groningen
*12 GSI Helmholtzzentrum für Schwerionenforschung
*13 Department of Physics, Korea University
*14 Department of Physics, Tohoku University
*15 Dept. of Physics, Tokyo Institute of Technology
*16 Department of Physics, University of Tokyo
*17 Dépt. Physique Nucl., CEA, Univ. Paris-Saclay
*18 Dept. of Physics, Saitama University
*19 Institute of Modern Physics, Chinese Acad. of Sci.

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