Detector development and related results

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on behalf of SAMURAI30 experiment

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The (p, n) reactions in inverse kinematics provide unique tool to study the spin-isospin responses of radioactive nuclei, including their giant resonances, in a wide excitation energy region. In particular, high luminosity can be achieved using thick hydrogen target without losing information on recoil neutron momentum applied for the missing mass reconstruction [1]. As a side effect in this measurements, a background of gamma rays overlaps with the low-energy neurons, this makes difficult to separate and efficiently tag the reaction channel. The existing neutron spectrometers used for measuring the Time-of-Flight of recoil neutrons are not able to provide online particle identification. A new, digital readout based low-energy neutron spectrometer, PANDORA (Particle Analyzer Neutron Detector Of Real-time Acquisition), was developed [2] for real time neutron-gamma discrimination. Using PANDORA the gamma-ray background is reduced by one order of magnitude. After an overview of the pulse shape discrimination method, the evaluation of our digital pulse processing mode and the properties of the new device will be presented.

PANDORA was commissioned in 2017 December, at HIMAC facility in Chiba, by identifying the Gamow-Teller transitions of ^{6}He in inverse kinematical (p, n) reaction. In this talk, details of the experimental setup and the intelligent triggering will be reported as well as a brief overview of our first experiment [3] using PANDORA at RIKEN RIBF in 2018 June. In SAMURAI-30 experiment the spin-isospin responses of ^{11}Li and ^{14}Be neutron drip line nuclei were studied.

[1] M. Sasano et al., Phys. Rev. Lett. **107**, 202501 (2011).
[2] L. Stuhl et al., Nucl. Instr. Meth. A **866**, 164 (2017).
[3] L. Stuhl et al., RIKEN Accelerator Progress Report **48**, 54 (2015).