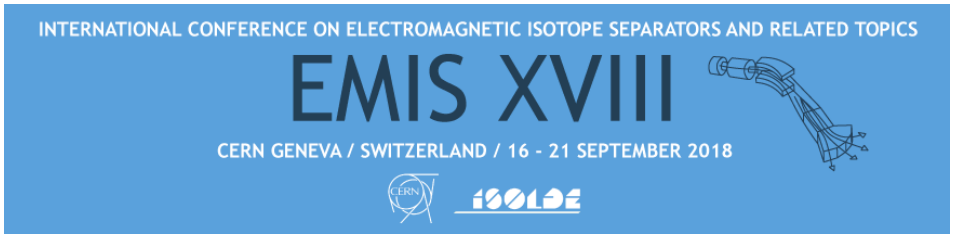

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Study of spin-isospin responses of radioactive nuclei with background free neutron spectrometer, PANDORA

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The (p, n) reactions in inverse kinematics provide uniqe 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 the separate an efficiently tag the reaction channel. The existing neutron spectrometers used for measuring the Time-of-Flight (ToF) 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. PANDORA consists of a plastic scintillator bars with pulse shape discrimination capability coupled to photomultiplier tubes.
After an overview of the pulse shape discrimination method, the evaluation of our programmed digital pulse processing mode will be presented. The quality (Figure-of-Merit) of the neutron and gamma peak separation of PANDORA will also be discussed. Using PANDORA the gamma-ray background is reduced by one order of magnitude.
PANDORA and the digital data acquisition were commissioned in 2017 December, at HIMAC facility in Chiba. We successfully identified the Gamow-Teller transitions of ^{6}He in inverse kinematical (p, n) reactions at 123 MeV/nucleon incident energy using polyethylene target. In this talk, properties of PANDORA, details of experimental setup and the intelligent triggering will be reported as well as a brief overview of our whole experimental program [3] at RIKEN RIBF aiming to study the spin-isospin responses of light nuclei along the neutron drip line.

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[2] L. Stuhl et al., Nucl. Instr. Meth. A 866, 164 (2017).
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