Measurement of the energy, multiplicity and angular correlation of $\gamma$-rays from the thermal neutron capture reaction Gd($n, \gamma$)


Department of Physics, Okayama University, Okayama, 700-8530, Japan
$a$Japan Atomic Energy Agency, 2-4 Shirakata Shirane, Tokai, Naka, Ibaraki 319-1195, Japan

oiwa@fphy.hep.okayama-u.ac.jp

$^{157}$Gd has the largest thermal neutron capture cross sections among all stable nuclei. We conducted an experiment to measure the energy, the multiplicity and the angular correlation of $\gamma$-rays from the neutron capture of natural Gd film. The experiment was performed with an array of germanium detectors in the Accurate Neutron-Nucleus Reaction Measurement Instrument (AN-NRI) at Material and Life Science Experimental Facility (MLF) of the Japan Proton Accelerator Research Complex (J-PARC), which provides the most intense pulsed neutron beam for neutron TOF experiments in the world [1].

The angular correlation of $\gamma$-rays from the thermal neutron capture of Gd have never been measured before. The data will be very useful to improve the identification of the Gd neutron capture in a Gd-loaded water Cherenkov detector, which is proposed for neutrino detection [2,3]. We collected $3.5 \times 10^9$ events with natural Gd target in 60 hours. Fig.1 shows an example of the energy distribution taken in the experiment. The physics motivation, the experimental setup, and the status of the analysis will be presented.

![Energy Distribution](image)

Figure 1: The energy distribution from Gd($n, \gamma$) reaction measured with an array of Ge detectors.