（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

MLF Experimental Report	提出日 Date of Report 2013/10/15
課題番号 Project No.2012A0122 実験課題名 Title of experiment Measurement of Angular Distribution of Prompt Gamma-rays from Radiative Capture Neutron Reactions 実験責任者名 Name of principal investigator Hirohiko Shimizu 所属 Affiliation Nagoya University	装置責任者 Name of responsible person Hideo Harada 装置名 Name of Instrument/(BL No.) BL04 実施日 Date of Experiment 2012/11/02-2012/11/08

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

La metal.

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

We placed a lanthanum foil at the normal sample position, which is located 21.5 m from the moderator surface, and acquired gamma-ray signals from the set of cluster germanium detectors. The amplitude of the gamma-ray signals from individual germanium crystals were recorded as a function of neutron time-of-flight.

The obtained time-of-flight spectrum is shown in Fig.1, in which the gamma-ray signals are histogramed as a function of neutron time-of-flight. P-wave and s-wave resonances of ^{139}La are observed at tof=1.8ms and 18μs, which corresponds to the neutron energy of E_n=0.75 eV and E_n=72 eV. Random pulser signals with a constant rate were merged into the data acquisition system for the correction of the deadtime of the germanium detectors and the data acquisition system. The pulser signals had a constant amplitude beyond the pulse height region of physics signals and were unambiguously distinguished from physics signals. Figure 2 shows the observed rate, that was distorted from the constant rate due to the dead time of the detector and data acquisition system. The dead time correction was applied so that the pulse signals have a constant rate over the neutron time-of-flight.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

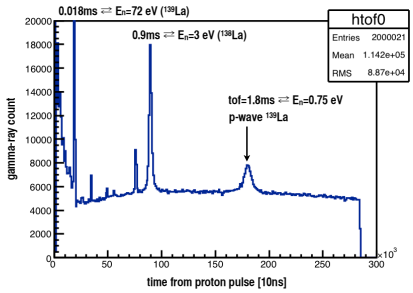

Fig.1 Raw time-of-flight spectrum

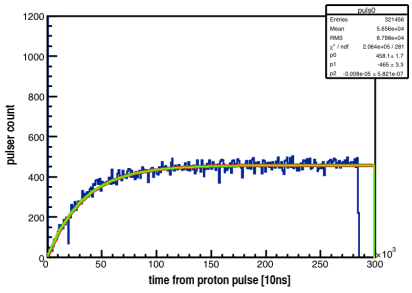

Fig.2 Pulser signal spectrum

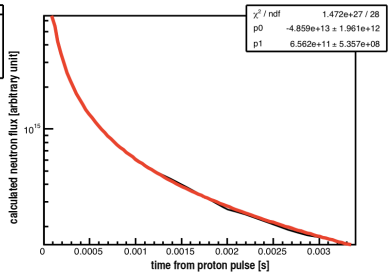

Fig.3 Calculated intensity of incident neutrons

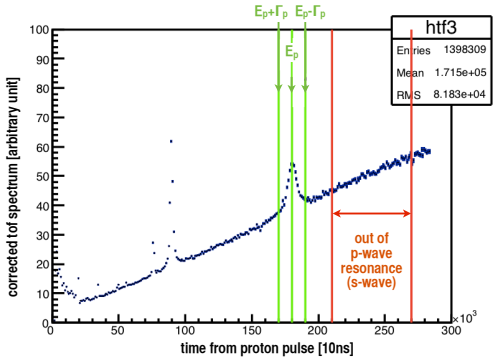

Fig.4 Corrected TOF spectrum

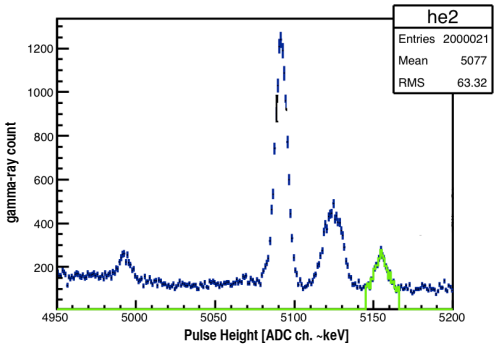

Fig.5 Gamma-ray spectrum

The corrected TOF spectrum with the dead correction and normalized by the incident neutron spectrum is shown in Fig.4. We observed no apparent p-wave contribution in the red region in the figure, which should have no angular distribution. The detection efficiency and angular coverage of all germanium crystals will be normalized so that gamma-ray yields are isotropic in that region.

The integrated gamma-ray spectrum is shown in Fig.5. Three gamma-ray transitions are clearly identified in the figure. They are considered to be corresponding to the ground state 3^- (green in the figure) , 5^- and 4^-. We are converting the gamma-ray counts into the angular distribution

$$\frac{\mathrm{d}\sigma}{\mathrm{d}\Omega_\gamma} \propto 1 + A_1 \cos\theta_\gamma + A_3 \left(\cos^2\theta - \frac{1}{3} \right)$$

The A_1 and A_3 are dependent on the neutron energy as described in the proposal. Currently, the statistical error of these terms are approximately 0.01 and 0.015, respectively. Further analysis to identify the accuracy of correction and the systematic errors is in progress