MLF Experimental Report	提出日 Date of Report 2016/05/25
課題番号 Project No. 2015A0160 実験課題名 Title of experiment Measurements of Total Cross Sections of Np-237 実験責任者名 Name of principal investigator Kazushi Terada 所属 Affiliation JAEA	装置責任者 Name of responsible person Toh Yosuke 装置名 Name of Instrument/（BL No.） BL04 ANNRI 実施日 Date of Experiment 2016/03/08-2015/03/30

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.

Neputunium-237 sample were moved to Kyoto university research reactor, so we used an ^{241}Am sample with activity of 950 MBq for this experiment. Chemical formula of the Am sample is AmO_2, and net weight of Am is 7.5 mg. The powder of AmO_2 formed in a disk by mixing Y_2O_3 powder. Then, the Am disk was completely sealed in Al container with a thickness of 0.1 mm. Figure 1. shows the Am sample.

Figure 1. Am sample.

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.

Measurements of neutron total cross sections of ^{241}Am have been performed by the time-of-flight (TOF) method with a ^{6}Li-glass neutron detector. The ^{6}Li-glass detector manufactured by OKEN with dimensions of 10 cm x 10 cm and thickness of 1 cm using enriched ^{6}Li (^{6}Li>90%) was used to obtain transmission neutron TOF spectra. Transmitted neutrons from the sample are detected by the ^{6}Li-glass detector via the ^{6}Li(n,α)^{3}H reaction. The distance between the ^{6}Li-glass detector and the neutron source was 29 m. Signals from the ^{6}Li-glass detector were amplified with the ORTEC 474 timing filter amplifier, and the TOF and the Pulse Height (PH) of each event were recorded event-by-event in a list data format file. We repeated the measurements of the ^{241}Am sample (Am run) and Am sample container except for Am (dummy run) to obtain the neutron transmission ratio. Total cross sections of Au are well known. Hence, measurements of Au samples with thicknesses of 10 and 100 μm (Au run) were carried out to check validity of the data analysis. Lead shielding with a thickness of 10 cm was placed on the neutron beam axis to reduce the dead time of the Li-glass detector caused by intense gamma flash from the spallation neutron source. Neutron notch filters of ^{nat}Mn, ^{nat}Co, ^{nat}In and ^{nat}Ag were utilized to estimate the backgrounds from the TOF spectra obtained by the ^{6}Li-glass detector by the black resonance

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

Total cross sections are calculated from the equation as follows:

$$\exp(-n\sigma_{total}) = \frac{C^{Am}_{Foreground} - C^{Am}_{Background}}{C^{Dummy}_{Foreground} - C^{Dummy}_{Background}}$$

where σ_{total} is total cross section, n is sample thickness, C is count from TOF spectrum normalized by neutron intensity for the Am and dummy runs. In the beginning, dead time corrections were made for TOF spectra assuming that the measurement system has a fixed dead time of 708 ns for each signal. Figure 2. shows time-difference between two signals recorded by the measurement system and live-time ratio for the TOF spectra from the Au run. A rising edge of the time-difference spectrum is 177 ch., and the channel width is equal to 4 ns. Dead time corrections were less than 5% in the TOF region after 1.2×10^4 ns. Then, we are conducting background estimation of the TOF spectra due to gamma flash and scattered neutrons.

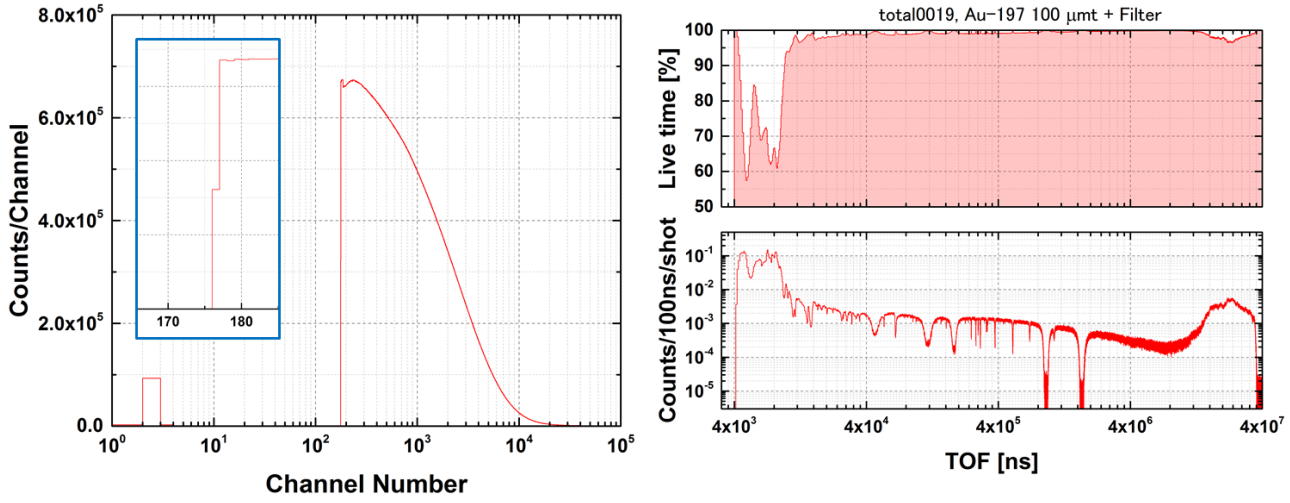

Figure 2. Time-difference between two signals was represented in the left figure. Ratio of live-time and TOF spectrum for the Au run were described in the right figure.

Additionally, measurements of capture cross sections of ^{241}Am have been performed with Ge detectors at the ANNRI. The Ge detectors consist of two cluster Ge detectors and 8 coaxial Ge detectors. The distance between the neutron source and the Ge detectors was 21.5 m. The sample was placed at the sample position of the Ge detectors. Lead sheets with a thickness of 5 mm were placed in front of the cluster Ge detectors in order to reduce the background caused by gamma-rays from the decay of ^{241}Am. Gamma-rays emitted from the sample were measured with the Ge detectors. Signals from the Ge detectors were amplified with the amplifier, and the TOF and the PH of each event were recorded event-by-event. We carried out Am, dummy and blank (no sample) measurements to determined neutron capture yields of the ^{241}Am. In order to obtain incident neutron energy distribution, boron sample measurements were carried out. Data analysis is in progress.