MLF Experimental Report	提出日 Date of Report 16.May.2013
課題番号 Project No. 2012B0224 実験課題名 Title of experiment Study for fission from the resolved neutron resonances 実験責任者名 Name of principal investigator Katsuhisa Nishio 所属 Affiliation Advanced Science Research Center, Japan Atomic Energy Agency	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 18.Jan.2013 – 22.Jan.2013

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.

Americium Target.

Americium oxide AmO_2 with pressed pellet (mass of AmO_2 is 7.5 mg) in aluminum capsule (Diameter 10mm, Thickness 1.0 mm, 0.2 g).

Activity : 952 MBq

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.

In order to determine the relative values of the neutron-induced fission cross sections for ^{241}Am, we detected prompt neutrons and prompt γ-rays as fission events. The experimental set up is shown in **Fig.1**. The target material $^{241}AmO_2$ was located at the flight length position of L =21.5 m. This is the position where Ge spectrometers are usually placed to measure the capture cross sections. For the present fission measurement, three horizontal caves in the lead shield are used to install liquid organic scintillators (NE213, diameter=4 inch, thickness = 2 inch). The distance between the target position and the detector is 150 mm. Taking advantage of the pulse-shape discrimination technique the high energy neutrons (E_n > 1MeV) were separated from the prompt γ-rays as shown in **Fig. 2**. The spectrum shows the events on the pulse height and the pulse shape. Since the spectrum was obtained in the time interval between the J-PARC proton pulses, only possible origin for the neutrons in **Fig.2** is the prompt neutrons accompanied by the neutron induced fission of ^{241}Am. This was confirmed by placing an aluminum capsule without americium material, where no neutron were registered on this spectrum. The γ-rays are mostly originate from the deexcitation of the compound nucleus $^{242}Am^*$.

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

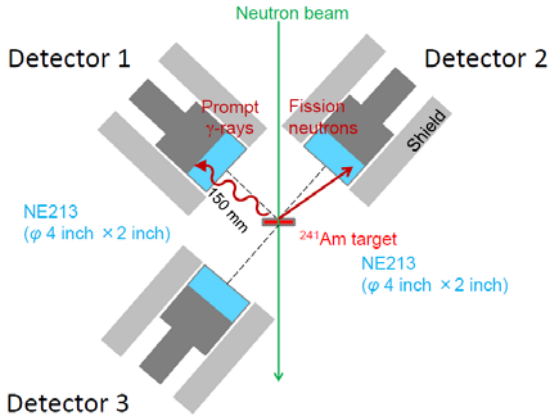

Fig.1 Experimental setup to determine the fission cross sections for n + ^{241}Am.

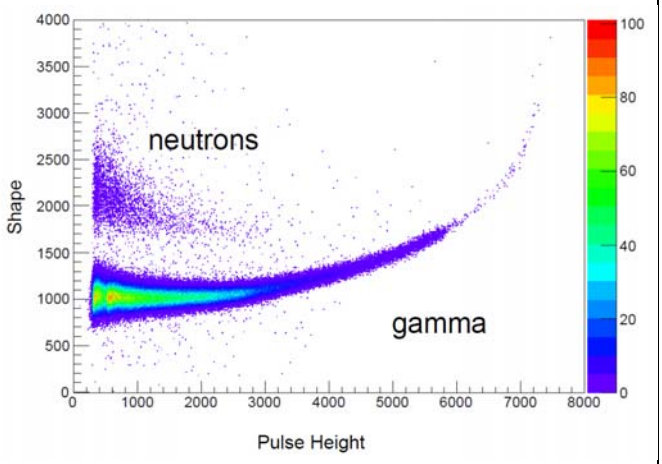

Fig.2 Spectrum on the pulse height and pulse shape obtained from the liquid scintillator.

Figure 3 shows the time-of-flight spectrum of recorded events relative to the J-PARC proton pulses. Lower spectrum shows the events for the prompt neutrons in fission at an imposed condition that the neutron is coincided with prompt γ–ray with the other NE213 detector in a proper time interval. We can clearly observe three resonances, 0.31, 0.57 and 1.27 eV, as well as resonances at higher neutron energies. The higher statics spectrum is obtained from the registered γ-ray events. The events originate mostly from the capture of neutron to the ^{241}Am nucleus. This is confirmed by the similar resonance structures to the fission spectrum.

It is shown that fission cross sections are measured by detecting prompt neutrons and γ–rays accompanied by fission. We also showed that capture cross sections can be measured in parallel with the same setup. Our run was the first to carry out the fission measurement at J-PARC facility.

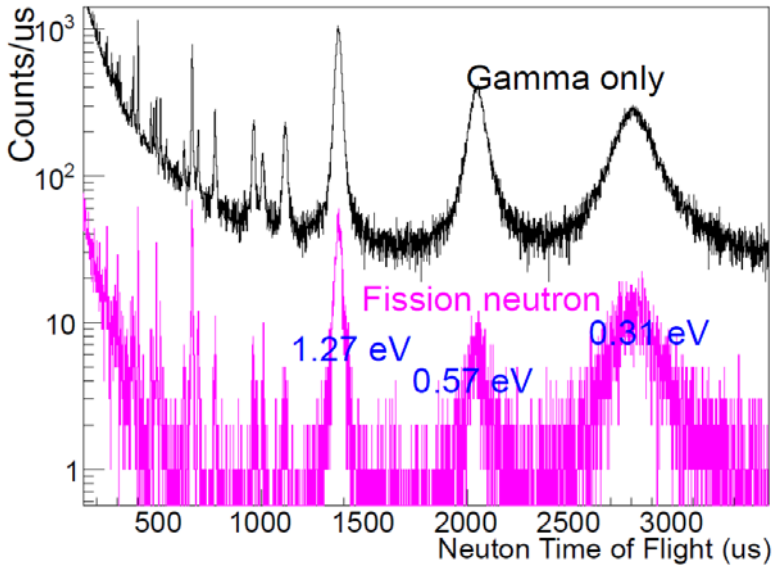

Fig.3 Neutron time-of-flight spectrum in the n + ^{241}Am reaction