（ ※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 August 23rd, 2013
課題番号 Project No. 2013A0105 実験課題名 Title of experiment Large grain effect on pseudo-strain induced in neutron strain measurement 実験責任者名 Name of principal investigator Hiroshi Suzuki 所属 Affiliation Japan Atomic Energy Agency	装置責任者 Name of responsible person Kazuya Aizawa, Stefanus Harjo 装置名 Name of Instrument/（BL No.） TAKUMI/ BL19 実施日 Date of Experiment Apr 28th – Apr 29th, 2013 May 3rd –May 5th, 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.

JIS AC2A aluminum casting alloy bar: 20 mm × 20 mm × 140 mm

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 the neutron strain measurement, pseudo-strains are well known to be caused by the surface-effect and/or the neutron attenuation effect. In the previous experiment using TAKUMI (2012A0043), it was clarified that the incident neutron beam divergence is one important factor that produce large pseudo-strains in the strain measurement using TOF neutron diffraction [H. Suzuki et al, Nuclear Instruments and Methods A, 715, (2013) 28–38]. On the other hand, pseudo-strains might be induced in the strain measurement of a large grain material due to position difference in diffracted grains from the gauge volume center.

Figure 1 shows lattice constant distributions measured in an aluminum casting alloy with the average grain size of 400 μm, using the TAKUMI engineering diffractometer. The gauge volume used here was 2mm cubic, and the lattice constants were determined by multi-peak analysis for 15 peaks from the 111 to 442 reflections. The multi-peak analysis can provide higher accuracy in the lattice constant than the single-peak analysis because the multi-peak analysis involves information from more diffracted grains. As shown in Fig. 1, a large scattering in the lattice constant distribution appears in low resolution mode (corresponding to high intensity mode), and the lattice constant distributions before and after sample flipping are symmetrical. This is an influence of pseudo-strains occurred by the difference in diffracted positions in large grains before and after flipping. The coarse-grain-induced pseudo-strain can be cancelled by averaging lattice constants before and after sample flipping, resulting in reducing the scattering in the lattice constant distribution. On the other hand, lattice constants measured in high resolution mode are less-scattered than in low resolution mode, and it is close to the average lattice constant distribution in low resolution mode. This behavior is caused by the difference in incident beam divergences irradiated to the crystal grains between high and low instrument resolutions. In our previous study, it has been already confirmed that the beam divergence for 2 mm gauge volume in high resolution mode is smaller than that in low resolution mode. This indicates that higher instrument resolution can decrease the coarse-grain-induced pseudo-strains.

Therefore, the optimum measurement condition for coarse grain materials is suggested to be a combination of higher instrument resolution, multi-peak analysis and averaging of pseudo-strains before and after sample flipping.

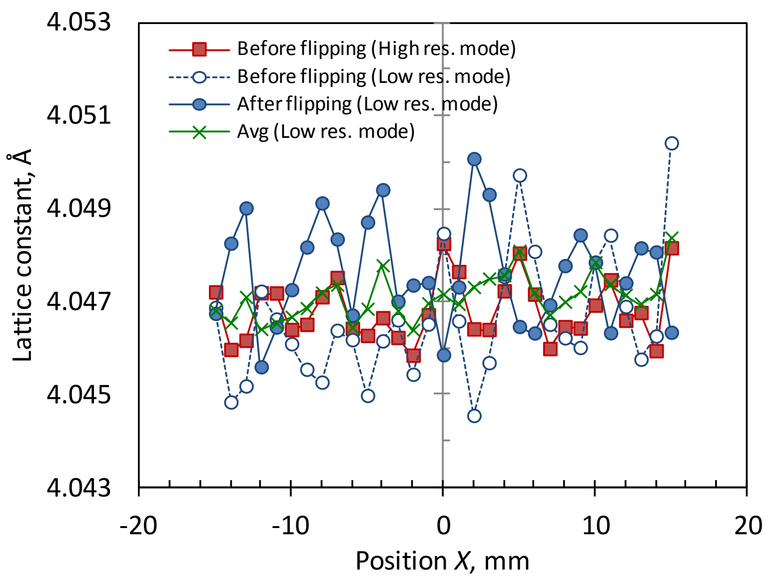

Fig. 1 Lattice constant distribution of the coarse grain aluminum casting alloy measured in high and low resolution modes. Average error bars were approximately 1.7×10^{-4} Å.