MLF Experimental Report	提出日 Date of Report April 23, 2013
課題番号 Project No. 2012A0038 実験課題名 Title of experiment Study of strain behavior in Rutherford-type A15 superconducting cables for future particle accelerators 実験責任者名 Name of principal investigator Tatsushi NAKAMOTO 所属 Affiliation High Energy Accelerator Research Organization (KEK)	装置責任者 Name of responsible person Stefanus HARJO 装置名 Name of Instrument/（BL No.） TAKUMI/BL-19 実施日 Date of Experiment June 21-23, 2012 Oct. 19-23, 2012

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.

SUS 304 rod: 3mm in a diameter, 90 mm long.

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.

A load frame for low-temperature neutron diffraction experiments at J-PARC Takumi was developed for studies of strain behavior in superconducting wires and cables. The system commissioning using the neutron beam was performed.

Figure 1 shows a photograph of the load frame. The system consists of (a) a vacuum vessel, (b) a Gifford–MacMahon (GM) refrigerator and (c) a external loading device. To allow measurements of large specimens such as an A15 superconducting cable stack under compression, the loading system had a capacity of 50 kN. Figure 2 shows a specimen setup with a SUS 304 wire for the system commissioning under tensile loading. The specimen is gripped by screw-on brass chucks. The Cernox thermosensors are attached to the grip chucks in order to monitor and control the temperature. An extensometer and strain gauges are attached to the specimen to measure the macroscopic strain. The grip chucks were cooled to a temperature of 15 K within the first 2.5 hours. The temperature was then gradually decreased for the next 8 hours until the lowest temperature of 7 K was reached.

Figure 3 shows the stress-strain behavior under tensile loading at 7 K. The changes in lattice strain were obtained by external load in the temperature holding process. In the single-peak analysis, the strain was determined using the lattice spacing d as $(d - d_0) / d_0$, where d_0 represents the lattice spacing at 7 K after cooling of the original specimen that had never been loaded. In the multi-peak analysis, the lattice constant a at 7 K was defined as a_0. In the figure, a linear dependence on stress is seen for all lattice planes, and a similar Poison's ratio of about 0.3 was obtained. Detailed analysis has been underway.

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

Figure 1. Photograph of cryogenic load frame.

Figure 2. Specimen setup: SUS 304 wire, grip chucks, thermal sensors, extensometer, strain gauges and pure aluminum (>99.9995%) thermal conductors.

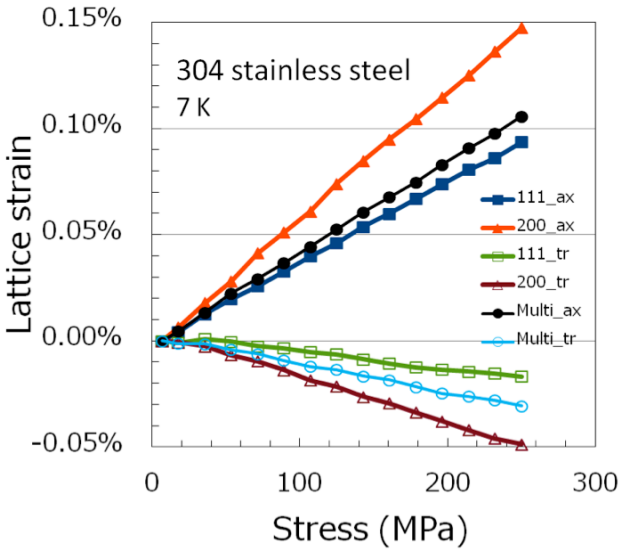

Figure 3. Lattice strain as a function of loading stress at 7 K.