MLF Experimental Report	提出日 Date of Report April 23, 2013
課題番号 Project No. 2012B0245 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 Jan. 14-15, 2013 Feb. 9-11, 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.

A RHQ-Nb3Al superconducting wire: ϕ1 mm, 50 mm long, heat-r eacted at 800 °C for 10 hours in advance. Composite of Nb3Al, Cu, Ta, Nb. 3 wires.

SUS 304 cylindrical rod: 30 mm in a diameter, 39 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.

Two different experim ents were carried out in 2013B: axial tensile strain behavior of Nb_3Al superconducting wire at 6 K was measured in the fi rst beam time (Jan. 14-15, 2013) while the system commissioning of the compression jig at low temperature was made in the second beam time (Feb. 9-11, 2013).

Figure 1 shows sample setup in the cryogenic load frame for the first experiment . Three Nb_3Al superconducting wires were connected to chucks by soldering. Besides, the stack of Nb_3Al superconducting wires was directly attached to the cold stage for the residual strain measurement with better statistics. The wire samples were inclined at 45 degree w ith respect to the in cident neutron beam so that both axial and transversal strains of Nb_3Al can be determ ined at sam e time. Axial tensile loading and unloading were applied to the 3 Nb_3Al wires up to 200 MPa in several steps for the ne utron diffraction m easurement at 6 K to observe the internal strain behavior. Due to the trouble of the M LF target, the beam tim e was reduced to be 1 day. For this reason, the samples were cooled down to the lowest temperature prior to the beam time to allocate the sufficient measurement time at each loading step within a limited beam time. The measurement was successful and clear shift of the diffraction peaks were observed as a function of applied axial tensile stress.

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

The second experiment was dedicated for the system commissioning of the compression jig, which was newly developed for simulating the internal stress in the superconducting coil, at low temperature using neutron beam. Figure 2 shows the sample setup of the compression jig. For this system commissioning, a well-known stainless steel rod (SUS304) was utilized to confirm the validity of the neutron diffraction measurement at low temperature. The compressive loading up to 50 kN, which was the maximum limit of the load frame, was applied to the sample. The stress-strain behavior was successfully obtained by the neutron diffraction measurement.

However, the sample temperature was only cooled down to 30 K because the conduction cooling paths from the cold stage were insufficient in comparison with the substantial volume of the compression jig (~20 kg). Besides, the unwanted background neutron from the crosshead was observed. For the next experiment, some improvement for the jig will be necessary.

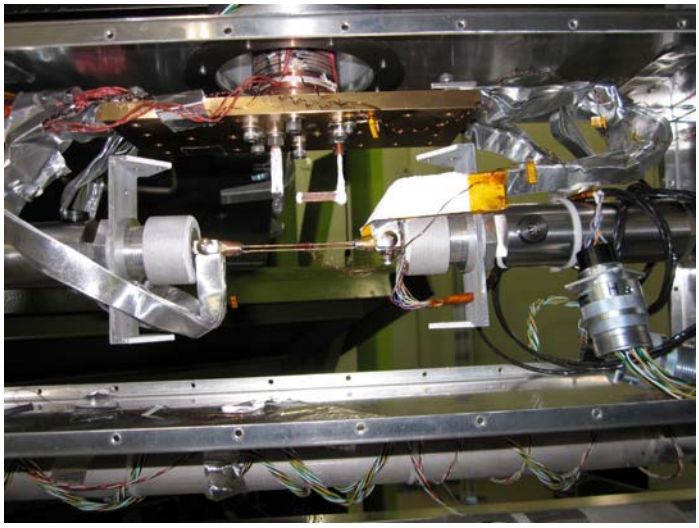

Figure 1. Photograph of sample setup for the first experiment: 3 Nb_3Al wires in parallel attached to the chucks.

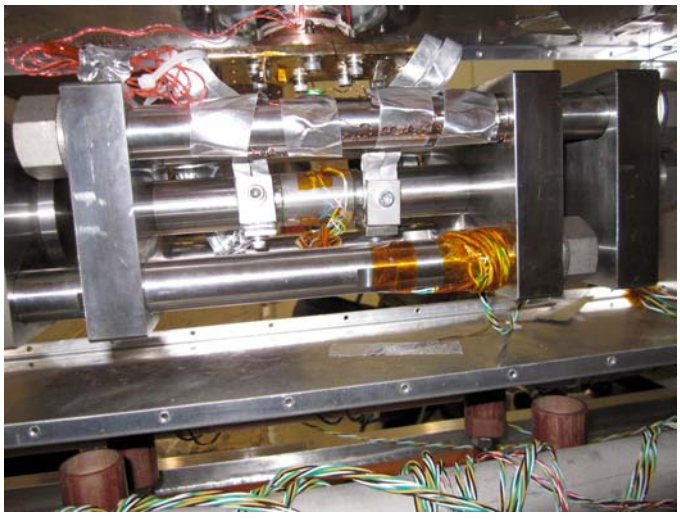

Figure 2. Photograph of sample setup for the second experiment: a cylindrical rod of SUS304 (39 mm long, 30 mm in a diameter) is sandwiched by the crossheads of the compression jig, where the tensile loading of the load frame is converted to the compressive loading on the sample.