

 MLF Experimental Report	提出日 Date of Report 2009/07/11
課題番号 Project No. 2008A0040 実験課題名 Title of experiment Commissioning of the 4SEASONS spectrometer 実験責任者名 Name of principal investigator Ryoichi Kajimoto 所属 Affiliation J-PARC Center, Japan Atomic Energy Agency	装置責任者 Name of responsible person Ryoichi Kajimoto 装置名 Name of Instrument/(BL No.) 4SEASONS/BL01 実施日 Date of Experiment 2008/12/23-2009/2/28

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.
polyethylene Al ₂ O ₃ powder Pr _{0.82} LaCe _{0.18} CuO ₄ single crystal

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.
<p>In this experiment, we performed several kinds of commissioning of the instrument. Here, we describe some major results.</p> <p>1. Measurement of the beam profile and flux We measured the beam profile at the sample position using an imaging plate. We confirmed that the center of the incoming beam corresponds to the designed position of the sample. We also measured the beam flux at the sample position by C-TOF technique in collaboration with Neutron Source Section of J-PARC. Though the guide tube was partially installed at that time, we found that the measured intensity is in good accordance with the calculated intensity obtained by Monte-Carlo simulation. We will measure the flux again after the guide tube is fully installed.</p> <p>2. Calibration of the detectors We calibrated the position sensitive detectors (PSDs). Currently, 4SEASONS has 160 pcs. of one-dimensional</p>

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

PSDs, which covers -35.4deg. – -6.3deg. and 10.3deg. – 54.5deg. in horizontal. Each PSD is $\phi 3/4''$ wide and 2.5m long. In order to calibrate the position in each PSD, we placed slits made of cadmium on the PSDs, and measured incoherent scattering from polyethylene. Neutrons going through the slits make peaks in intensity distribution on each of the PSDs. We tuned the parameters that define the position in a PSD so that the peaks are appeared at the correct positions (Fig. 1).

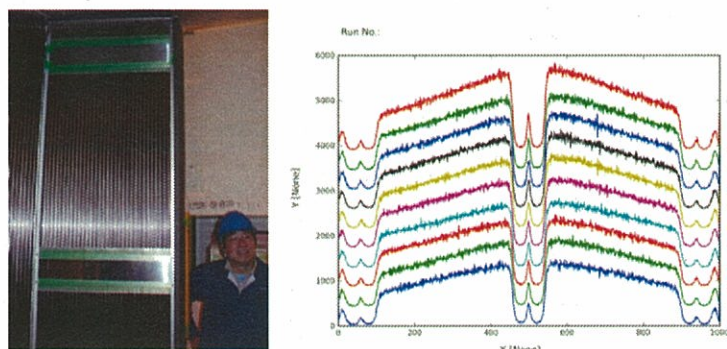


Fig. 1: Cadmium slits on a detector bank (left) and position dependence of the neutron intensity detected by the detectors on that bank (right).

3. Diffraction measurements

In order to check the performance of the detectors, we performed diffraction measurements of a Al_2O_3 powder sample and a single crystal of a high- T_c superconductor $\text{Pr}_{0.82}\text{LaCe}_{0.18}\text{CuO}_4$. Figure 2 shows the results, where neutron intensity in a limited time region was extracted from the data and plotted as two-dimensional maps of the PSDs. Though background due to air scattering is quite high, large Debye-Scherrer rings (Fig. 2(a)) and many Laue spots (Fig. 2(b)) were clearly seen. By these measurements, we succeeded in not only confirming the PSDs worked properly, but also the great advantage of the wide angular coverage of PSDs.

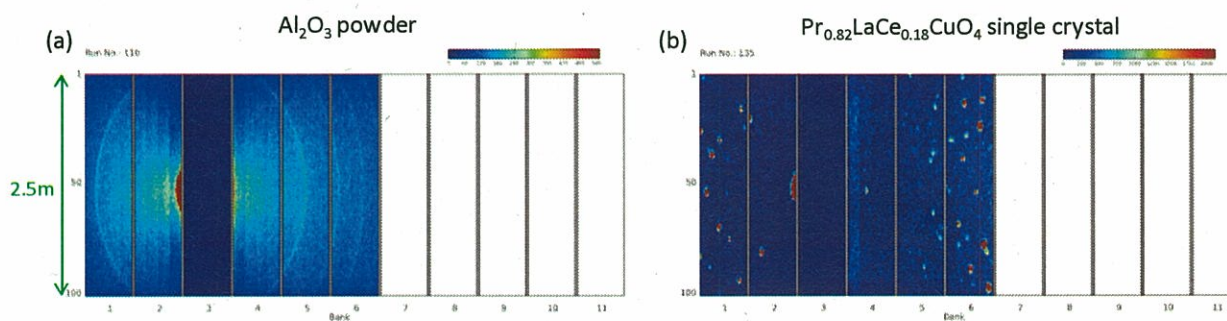


Fig. 2: Diffraction patterns of (a) a Al_2O_3 powder sample and (b) a $\text{Pr}_{0.82}\text{LaCe}_{0.18}\text{CuO}_4$ single crystal.

4. Test and bug-fix of the data acquisition system and data analysis system

During the experiment, we were able to check the performance and fix a lot of bug of the data acquisition and data analysis systems. Since the data acquisition and data analysis systems are largely shared by many instruments in MLF, the improvements in 4SEASONS will be reflected in the development in the other instruments.