MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2012A0086 実験課題名 Title of experiment Development of neutron spin phase contrast imaging technique at a pulsed neutron source 実験責任者名 Name of principal investigator Hirotoshi Hayashida 所属 Affiliation J-PARC Center, JAEA	装置責任者 Name of responsible person Kenichi Oikawa 装置名 Name of Instrument/（BL No.） BL10 実施日 Date of Experiment 2012/06/23-2012/06/25

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.

Solenoid coil with aluminum wire was used as a test sample of this experiment. The picture of the coil is shown in fig. 1-1.

Fig. 1-1. The picture of the test sample.

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 neutron spin phase contrast (NSPC) imaging method is one of the effective methods to visualize magnetic domains in magnetic materials. The aim of this experiment was applying the NSPC imaging method to a pulsed neutron source.

The NSPC consists of polarizer, two π/2 flippers and analyzer. A guide magnetic field is applied from the polarizer to the analyzer in order to avoid a depolarization of neutron spins. Figure 2-1 shows a schematic view and picture of the setup of NSPC method at BL-10 NOBORU.

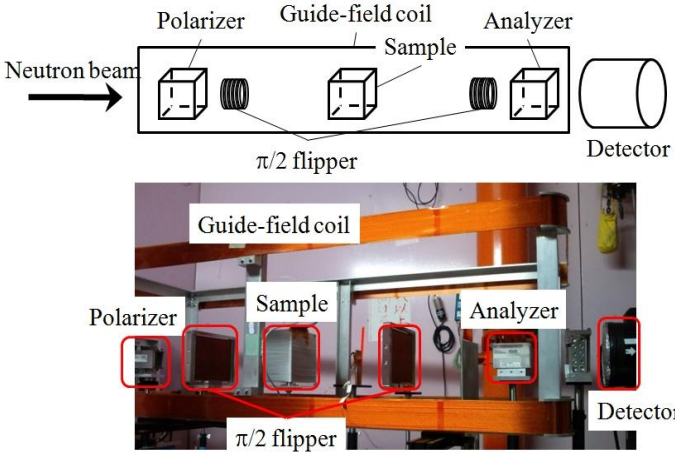

Fig. 2-1. The schematic diagram and picture of NSPC setup at BL-10.

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

Since a Mezei-type of spin flipper is effective to work as π/2 condition, the Mezei flipper is used in the NSPC method. However, the Mezei flipper works for a monochromatic neutron beam in generally, because a Larmor-precession angle of neutron spin depends on a velocity of neutron. Since the neutron velocity v at the flipper is given by $v = L/t$, where L is the distance from the neutron source to the Mezei-flipper and t is the time of flight, strength of the magnetic field of the Mezei-flipper have to be applied with $1/t$ decay in order to apply the Mezei-flipper to pulsed neutron. In this experiment, two π/2 flippers were driven with TOF mode explained above.

Figure 2-2, 2-3 and 2-4 shows a result of the NSPC signal measured at BL-10 NOBORU. Solenoid coil with aluminum wire was used as a test sample. Magnetic field of the solenoid coil was varied by changing a current applied to the solenoid coil. The magnetic field generated by the solenoid coil affects to the precession angle of neutron spin and this changes a cycle of the NSPC signal. Figure 2-2 and figure 2-3 correspond to the NSPC signal with the current of 0 A and 0.5 A, respectively. These results show a difference of the cycle of NSPC signal caused by the magnetic field generated by the solenoid coil. Figure 2-4 shows a 3-dimentional figure of the NSPC signal. This figure also shows that the cycle of the NSPC signal varies with changing the current.

An experiment applying the NSPC to the pulsed neutron source was successfully performed and expected results are obtained.

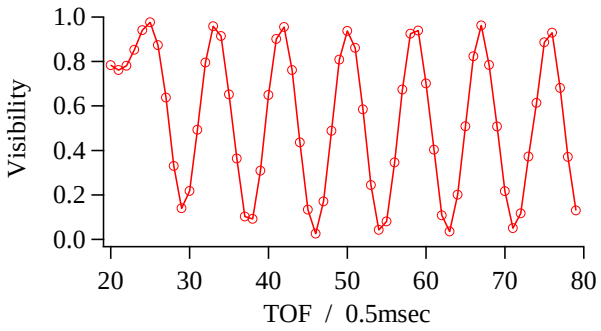

Fig. 2-2. NSPC signal with the current of 0 A.

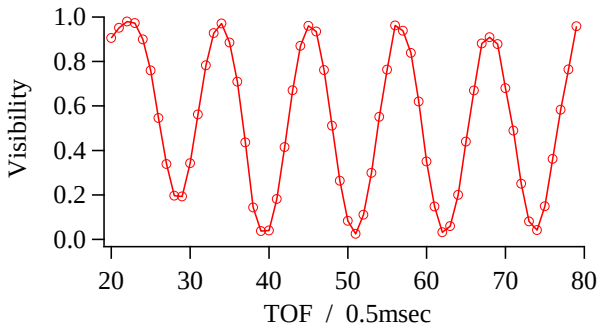

Fig. 2-3. NSPC signal with the current of 0 A.

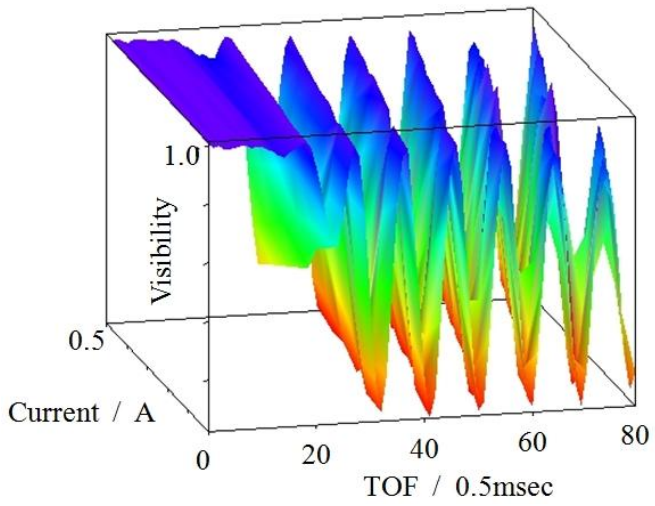

Fig. 2-4. 3D figure of the NSPC signal.