MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2015A0129 実験課題名 Title of experiment Development of superconducting neutron detector by using Nb-based current biased kinetic inductance detectors (CB-KIDs) 実験責任者名 Name of principal investigator Takekazu Ishida 所属 Affiliation Osaka Prefecture University	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 Feb 27, 2016 – March 2, 2016 May 22, 2016 – May 26, 2016

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.

B10 dots (100 um in diameter) pattern (enriched boron)

B_{4}C plate with 3-mm hole in diameter (natural boron)

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.

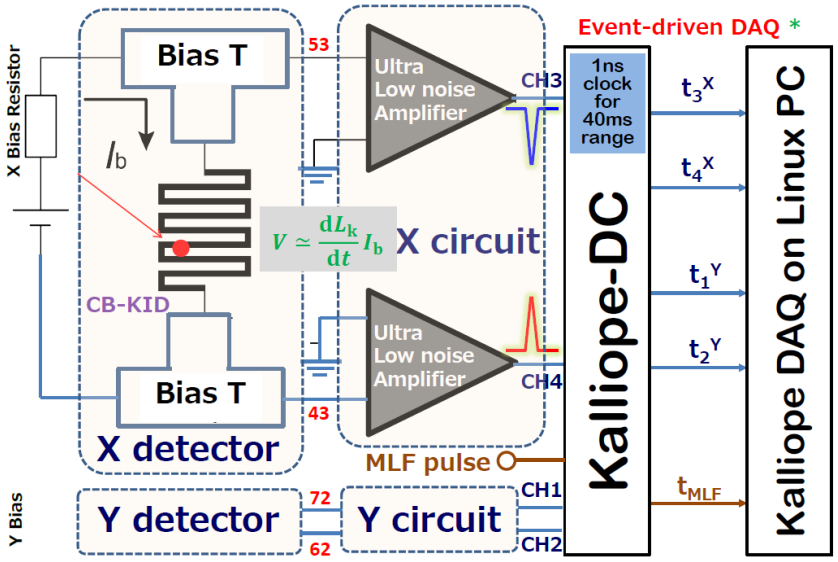
Neutron detectors, used for the present researches, are composed of Nb nanowires fabricated on SiO_2 coated Si substrate, where Nb layer (grand plane), SiO_2 layer, Nb layer (nanowire), SiO_2 layer, Nb layer (nanowire), SiO_2 layer, and ^{10}B layer. The detectors were operated after cooling down to the superconducting state at 4K. The sensitive area of the 22 mm x 22 mm chip covers 10.5 mm x 10.5 mm in area. The KALLIOPE circuit was used as the fast speed DAQ system of our measurements at BL10. The digital oscilloscope is also used to save the complete wave forms of the event signals, which are useful to investigate the operation principles of our CB-KID detector.

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

The measurement system is shown in the following block diagram. The superconducting sensor is biased by the low DC voltage to feed the small DC current of 0.3mA. After amplifying the signal, event data are taken by a Kalliope circuit or a digital oscilloscope. The neutron radiography images are analyzed by using the stored data.

Fig.1 **Neutron imaging system by CB-KID Signal Transmission**

* Digital oscilloscope is used to store the whole wave forms.



The next figure is a typical imaging result obtained by the experiment at BL10. The results show that our new proposal works well as an imager for neutron although the four channels are relevant to collect data. The principle is quite simple and new compared to other traditional neutron imaging systems. The operating speed is very high and the spatial resolution is on the top level among the existing neutron detectors.

Fig.4 **Neutron imager by time difference method in signal transmission**