 MLF Experimental Report	提出日 Date of report Jan. 2, 2015
実験課題番号 Project No. 2009A0083 実験課題名 Title of experiment Development and Application of Neutron Optical and Detection Systems 実験責任者名 Name of principal investigator Jun-ichi Suzuki 所属 Affiliation J-PARC Center, Japan Atomic Energy Agency	装置責任者 Name of responsible person Kenichi Oikawa 装置名 Name of Instrument/(BL No.) BL10 利用期間 Dates of experiments Jun. 2-3, 2009, Jun. 20-21, 2009, Nov. 10-12, 2009, Dec. 19-21, 2009, Jan. 28, 2010, Apr. 23, 2010, May 9-13, 2010

1. 研究成果概要(試料の名称、組成、物理的・化学的性状を明記するとともに、実験方法、利用の結果得られた主なデータ、考察、結論、図表等を記述してください。)

Outline of experimental results (experimental method and results should be reported including sample information such as composition, physical and/or chemical characteristics.

In order to make neutron scattering instruments of the MLF world-class instruments for frontier science, we developed novel neutron optical (polarizing, focusing, and converging) and detection systems and carried out experiments to evaluate their performances in the project proposal. In JPY2009, we carried out the experiments on the following three subjects.

(a) Development of N₂ neutron beam monitors

³He neutron beam monitors have been used in most of neutron scattering instruments. However, acceptable counting rate of the beam monitors was limited by the nuclear property of the ³He nucleus. We then developed a N₂ neutron beam monitor for counting intense pulsed neutrons of the MLF in collaboration with the ILL by using the property of the N nucleus which thermal absorption cross-section is 1.90 barn and is about 1/2,807 of that of the ³He nucleus. Fig. 1(a) shows a picture of a N₂ neutron beam monitor with an active area of 100 mm × 50 mm and efficiency of about 10⁻⁴. Fig. 1(b) shows a spectrum $I(\lambda)_{N_2}$ measured with this beam monitor at the BL10 in comparison with $I(\lambda)_{He}$ measured with a ³He beam monitor. The shapes of $I(\lambda)_{N_2}$ and $I(\lambda)_{He}$ are in agreement with each other. This result shows that the N₂ neutron beam monitor can be used as a beam monitor for counting intense pulsed neutrons by controlling the gas pressure of N₂ lower.

(b) Development of 2-dimensional detectors for TOF neutron imaging and small-angle neutron scattering measurements

For TOF neutron imaging and small-angle neutron scattering measurements, a 2-dimensional detector with high spatial resolution and high acceptable counting rate is required. One of the candidates is a micro pixel gas detector (μPIC). We carried out the evaluation of the detector at the BL10 and obtained preliminary but promising results. Fig. 2 shows a neutron image of a Cd plate with slits and holes, where the plate was put on a window of the detector. The spatial resolution of the detector estimated from the distribution of neutron intensity

1. 研究成果概要(つづき) Outline of experimental results (continued).

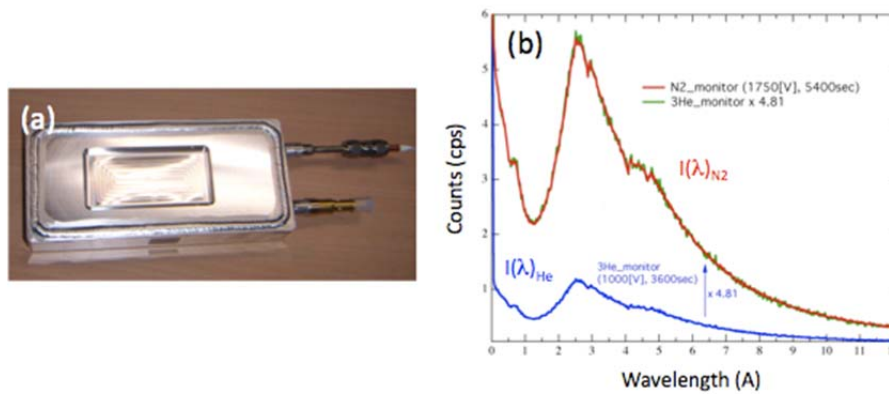


Fig. 1(a): A picture of a developed N_2 neutron beam monitor, (b): A spectrum $I(\lambda)_{N_2}$ measured with the N_2 beam monitor in comparison with $I(\lambda)_{He}$ measured with a 3He beam monitor.

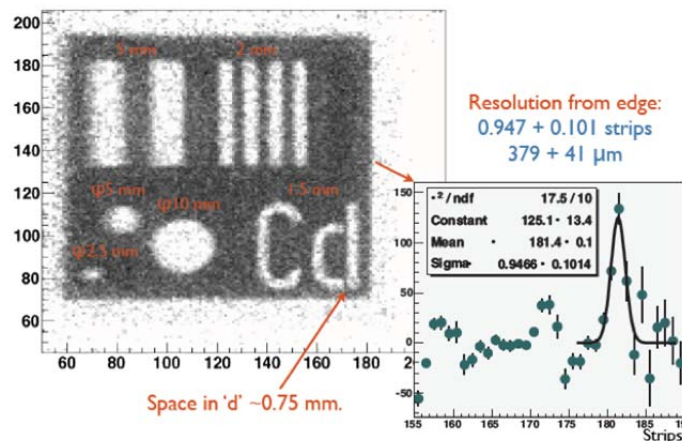


Fig.2 Neutron image of a Cd plate with slits and holes obtained with a μ PIC.

(c) Performance evaluation of Gd coated Si crystals as analyzer crystals of the backscattering spectrometer of the MLF

Si crystals of which Gd was coated on one side have been developed as analyzer crystals of the backscattering spectrometer for high S/N measurements by reducing the background scattering from back plates of Si crystals. A double crystal diffractometer was assembled at the BL10 (Fig. 3(a)). Bragg scattering from a Si crystal with Gd coating was compared with that without Gd coating. The difference of the width of Bragg scattering from Si crystals with/without Gd coating was not so large. We could then confirm that the Gd coating does not give serious deformation to the Si crystals.

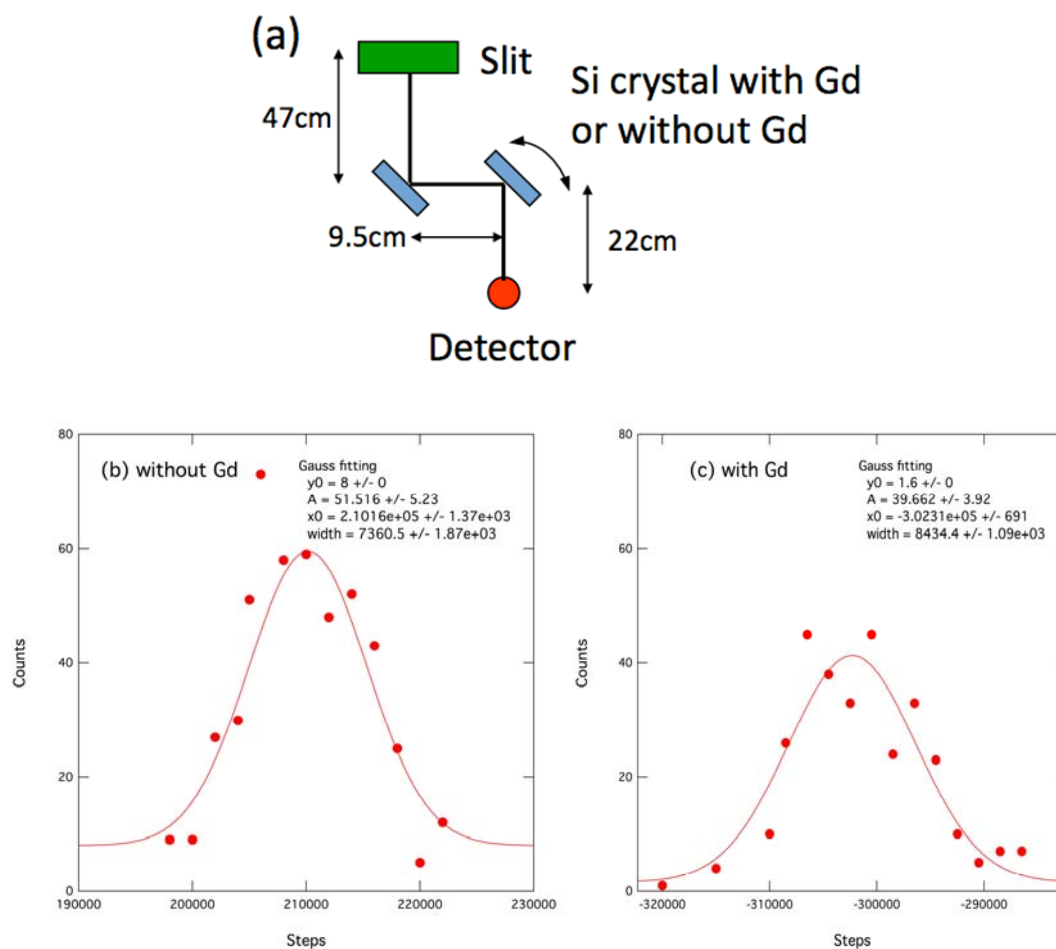


Fig.3 (a) Double crystal diffraction geometry for evaluation of Si crystals with/without Gd coating, (b) Bragg scatterings from a Si crystal without Gd coating, (c) Bragg scatterings from a Si crystal with Gd coating.

必要に応じて、A4 サイズの用紙に続きを記入して下さい。

Please use A4-size papers for further reporting, if necessary.

以下は、MLFで内部資料として使用します。(日本語可)

The following sheet is for internal use only. Description in Japanese is acceptable.

2. 論文等による成果発表の予定 (Your publication plan)

a) 発表形式 ^(*1) Publication style ^(*1)	b) 発表先(誌名、講演先) ^(*2) Publication/Meeting information ^(*2) (Name of journal/book or meeting)	c) 投稿/発表時期 ^(*3) Date of paper submission or presentation ^(*3)
Oral Presentation	Meeting of the Physical Society of Japan Meeting of the Japanese Society for Neutron Science	JFY2011-2014
Refereed Journal	Nuclear Instruments and Methods in Physics Research A	

【記入要領】(Instructions)

(*1) 原著論文、総説、プロシーディングス、単行本、特許、招待講演(国際会議)、その他口頭発表等、具体的な発表方法を示して下さい。

Please describe planned publication and/or presentation style; *ex.* refereed journal, review article, conference proceedings, book, patent, invited talk, oral presentation *etc.*

(*2) 成果を発表する誌名、講演先を示して下さい。

Please describe the name of journal or book you are planning to submit, or name of meeting you will make a presentation.

(*3) およその発表予定時期を示して下さい。(3月以内、6月以内、1年以内、2年以内、2年以上先、等)

Please describe the estimated date of paper submission or presentation; *ex.* within 3 months, within 6 months, within 1 year, within 2 years, beyond 2 years, *etc.*

3. 経費支出内容（プロジェクト研究実験の遂行に関連した主要な経費）

Budgetary expenses for conducting experiments in the project use.

No budgetary expense

4. MLF の運営に関する提言（Suggestions and/or requests to MLF）

No suggestions and requests