2008A0060

実験報告書様式（装置グループ利用）

MLF Experimental Report	提出日 Date of report April 17, 2009

実験装置名／BL番号 Name of Instrument/BL

NOBORU / BL10

実験装置責任者 Name of the person responsible for the instrument:

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所属 Affiliation: Neutron Source Section, MLF Division, J-PARC center, JAEA

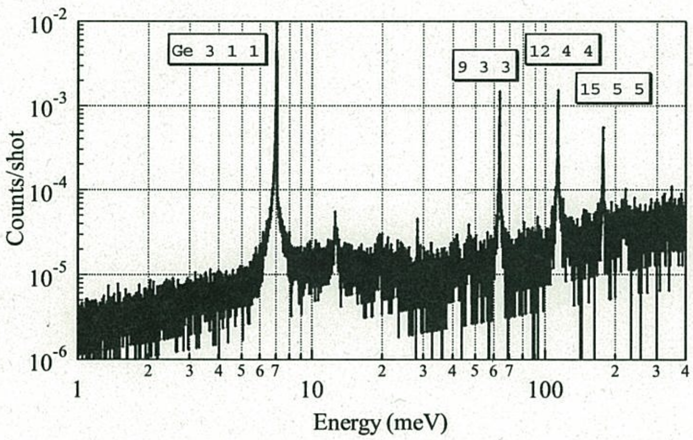
1．研究成果概要 (a)装置グループ内の成果、(b)ユーザー課題実装時における特筆すべきサポート、(c)ユーザー課題の執行状況について、まとめてください。A4 サイズ用紙使用のこと。

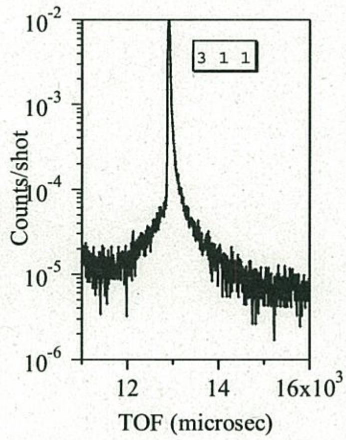
Outline of your activities. Following results at your instrument should be reported in A4 size papers: (a) results of your instrument goup, (b) significant user support works, and (c) statistical summary of user experiments.

(a) Results of your instrument goup

We measured neutron beam characteristics data to study neutronic performance of JSNS for validation of unique design features of JSNS. Typical examples are shown below.

i) Pulse shape up to several hundreds meV by diffraction.





Neutron pulse shape of a decoupled moderator was measured by a diffraction method using a single crystal (Ge 311). Diffusive tail was observed on the raising part of the Bragg peaks, as shown in the right figure, which may come from disturbance of the sample surface. We have to get non-disturbance crystal for reexamination.

ii) Thermal neutron spectrum by the TOF method and absolute flux of cold and fast neutrons by activation foils.

A neutron flux spectrum was measured with a 1/2" He-3 counter with a pinhole of 3 mm diam. made of B_4C. Figure ii compares the measured and calculated spectra in the absolute scale. The spectra agree very nicely each other in both spectral shape and intensity. Energy integrated neutron flux was deduced from the measured spectra as 4.5 x 10^3 n/s/cm^2 for 4 x 10^{11} proton incidence to the Hg-target. The Au-foil activation method was also adopted to measure the energy integrated flux. It was found to be 5.5 x 10^3 n/s/cm^2 while calculated value was 4.5 x 10^3 n/s/cm^2 for the same condition. Accordingly, very good agreement between the measured and calculated absolute neutron flux is again confirmed.

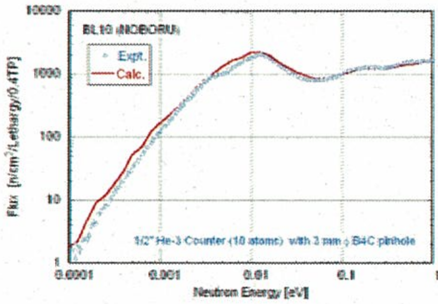
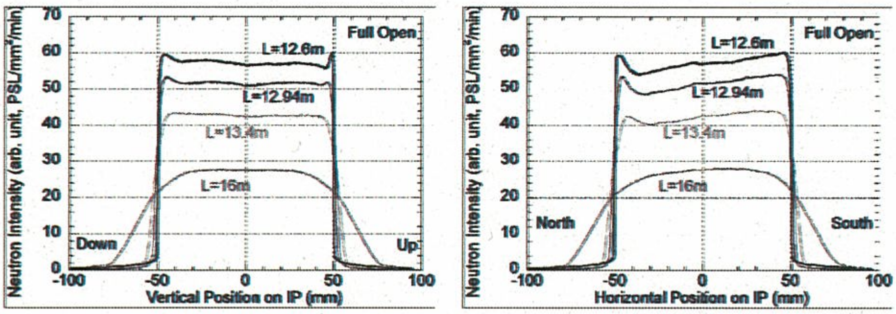


Fig. ii Comparison of measured and calculated neutron spectra.

iii) Luminosity distribution of the neutron beam by imaging plates.



Neutron intensity distributions were measured with imaging plates at several positions in BL10 experimental area. The left and right figures are projected distributions on the vertical and horizontal axes, respectively. The vertical distributions were almost flat while some gradient was recognized in the horizontal distributions: about 10% higher at the south side relative to the north side.

iv) Response to the neutronic performance by changing operation parameters of JSNS.

A response to the neutronic performance by changing proton beam injection positions on the mercury target was measured using ^{3}He counters. Figure iv shows dependence of the intensity ratio of the thermal neutron flux versus vertical proton beam position on the target, where zero is the central height of the target. The thermal flux increases when the injection point goes higher because the BL10 sees a decoupled moderator that is mounted above the target.

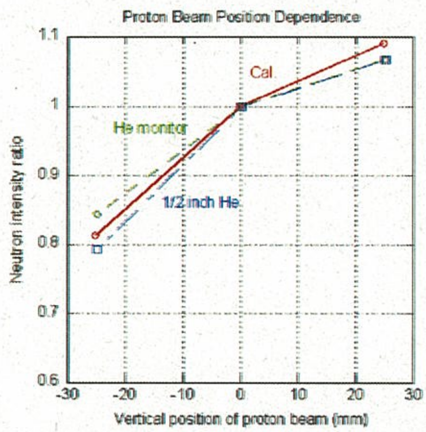
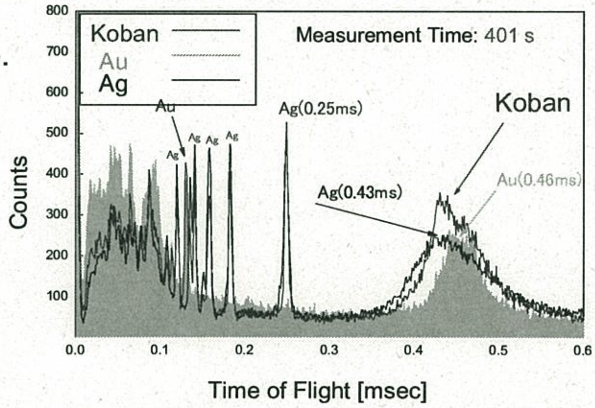


Fig. iv. Proton beam vertical position dependence on neutron intensity

The variation in intensity ratio is estimated as about 5 %/cm. In addition, the calculated values are in good agreement with the measured ones within the experimental error of 3 %. This experiment shows that the reproducibility of the proton beam position is one of important factors for the stability of the neutron flux.

v) TOF elemental analysis by detecting prompt gamma-rays from a sample irradiated by the neutron beam with a Ge detector.



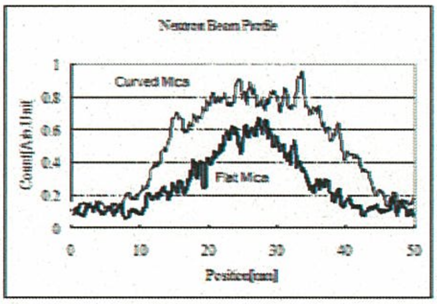
Time spectra of a Koban (old Japanese coin) and standard samples of Au and Ag. The standards spectra have been normalized to the same measurement conditions of Koban data.

Energy and TOF spectra of prompt gammas were obtained for some test samples such as polyethylene, boron rubber, Cd, In, Ag, Ta and Au. In addition, we succeeded in analyzing a principle component of Koban, an old Japanese coin made of silver and gold, in short measurement time. We found that BL10 (NOBORU) is good for the prompt gamma-ray analysis.

vi) Study of neutron focusing with bent crystal.

To focus/defocus the neutron beam, a diffraction method was applied using a bent crystal of Mica. The data were collected by neutron IP set at L2 = 60 cm at diffraction angle $2\theta = 90^\circ$. TOF data were also collected using a ^{3}He counter. Curvature of the bent crystal was adjusted to focus the diffracted beam at around 30 cm from the sample, where a cadmium pinhole was set.

The neutron profiles detected on IP with the bent and flat Mica are shown in Fig. vi-1. The neutron intensity distribution with the horizontally bent Mica was broader than that with the flat Mica. The bent crystal provides large beam divergence compared with that of the normal pinhole beam. Figure vi-2 shows a diffraction pattern obtained at just behind the cadmium pinhole. Neutron intensity was almost 1/1000 of the direct beam at the peaks. The neutron flux would be increased with changing curvature of the crystal by trial and error.



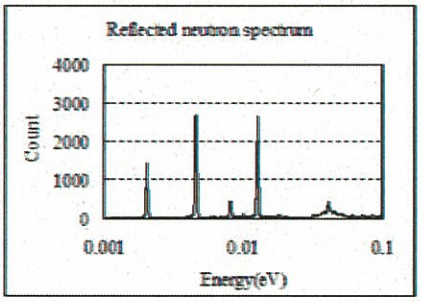


Fig. vi-1. Detected neutron profile through a cadmium pinhole. Fig. vi-2. Diffraction pattern of bent Mica.

(b) Significant user support works

We have spend so many our services to carry out the user experiments. For example, providing detailed information of instrument design including CAD data, utilities, on-beam commissioning data, and so on is one of them. An issue was found about the *internal* regulations, which is concerned with the application of high magnetic field for Nojiri-Gr. We had to arrange electric noise checking test for the other instruments during an off-beam time.

c) Statistical summary of user experiments

i) Experiment No. 2008A0018 (Nojiri-Gr.)

The beam time was almost allocated as user request. However, the total beam current was so poor because of the accelerator's troubles.

ii) Experiment No. 2008A0028 (Hino-Gr.)

The beam time was almost allocated as user request. The first experimental data of TOF-MIEZE system was successfully obtained in spite of unstable beam operation of the accelerator.

iii) Experiment No. 2008A0049 (Yamamoto-Gr.)

The experiment was postponed because of unstable beam operation and its very low intensity.

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.

2. 論文等による成果発表の成果（予定を含む）

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