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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S03
Title: Fundamental Physics with Pulsed Cold Neutrons
Principal Investigator: Hirohiko Shimizu
Brief summary of the proposal:

The aim of the proposal is to perform fundamental physics using neutrons at the beam line BL05. In order to accomplish the research, advanced neutron optical devices are developed to exceed the traditional accuracy, and then measurements on the fundamental physics are performed concerning to neutron decay, scattering, interference and diffraction.

Decision: A
Beam time allocation: (days/year) (β=85%)
Approval and suggestion(s) to IMSS: budget and resources:

The proposed physics and the instrument developments are unique and significant. The research is going well and gradually and steadily approaching the final goal. The fundamental physics using the neutrons occupies an important place in the neutron science field in the world. Therefore, it is recommended to promote this project. The proposed research program in 2013 is reasonable for promoting the project, so the budgetary scheme will also be reasonable. However, it is recommended to show milestones for the research steps. Although the allocated beam time is large compared with other beam lines, the beam allocation should be considered depending on the characteristics of the theme. Accordingly, the proposed beam time will be within the allowance level, though it is better to supply or share the beam time to general users as much as possible.
Comments:

The neutron life time measurement will be performed using the pulsed nature at the polarized beam branch. To achieve an accuracy of 10^{-3}, improvement of the spin flip chopper system and the time projection chamber are planned. It is desired to exceed the necessary accuracy as soon as possible and to obtain the data with sufficient accuracy.

A rebuncher, time focusing for UCN, was tested at ILL due to the Higashi-Nihon earthquake, although it was originally planned at the unpolarized beam branch of BL05. They succeeded in observing the time focusing effect but the result did not approach the expected level, so the improvement is required. This method is one of useful methods to increase UCN spatial density, so intensive effort is desired to improve the method.

At the low divergence beam branch, several kinds of experiments were performed such as a multilayer interferometer for gravity experiment, a neutron reflectometer for precise reflectivity measurements, and also a test experiment to develop the new instrument of MIEZE spectrometer. It is useful to have such capability to perform various kinds of experiments in order to deal with general user's requirements.

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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S04
Title: Technical feasibility study of mini-focusing small-angle neutron scattering instrument
Principal Investigator: Michihiro Furusaka
Brief summary of the proposal:

This program (ID=2009S04) proposes to continue the development and verification of basic devices and components such as mirrors for beam collimation, benders and detectors for mini-focusing small-angle neutron scattering instrument (mfSANS), aiming at installation of mfSANS machines in J-PARC/MLF and other small size neutron sources.

Decision: A.
Beam time allocation: β=0 (No beam time requirement)
Approval and suggestion(s) to IMSS: budget and resources:

Requested budget is reasonable and should be supported by IMSS.

Comments:

The project has a clear aim and has made a progress in the development of essential devices and components for mfSANS according to the original schedule although it delays somewhat. The developed devices were reported and discussed on a meeting of the project held on 17th December, 2012.

Neutron focusing mirrors made of SUS and Ai coated with NiP are under development and some preliminary results were already obtained. As for the neutron detectors, M-MSGC with He-3 gas has been almost completed, but some spark discharge problem remains. Scintillation counter with LiCaF shows very low γ-ray sensitivity, showing a possibility of practical use in future. GEM on a glass substrate 30 × 30 cm in size has been almost completed, but readout circuit has not completed yet. Neutron benders have been developed for beam splitting, reaching a performance of 35 % transmittance of neutron with wavelength of 8 Å, and the researchers still continue to develop the benders aiming at 50 % transmittance for neutrons with wavelength longer than 3 Å.

As shown above, the essential devices and components for mfSANS have been developed well in this project, and some of the devices were already installed in small-neutron source based on Hokkaido University electron linear accelerator. The preliminary experiments were done on materials from steel industry to give fruitful results on magnetic nano-structure, which have been submitted as a paper to a prestige journal. Future challenging experiments on biomolecules are also planned in the mfSANS. Such outcomes are highly appreciated by the reviewer.

The reviewer strongly recommends the project members to discuss the future plans on the installation of the developed devices to J-PARC and/or other small neutron sources to construct mfSANS although the installation of these devices is not a mission of the project.

（様式 2）

Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S05

Title: Advanced Development of Powder Diffraction Method and the Structural Study of Functional Materials

Principal Investigator: Takashi Kamiyama

Brief summary of the proposal:

This proposal aims to perform structural studies on strongly correlated electron systems, to perform precise structure analysis on energy conversion materials, and to develop powder diffraction techniques for complex materials, based on the very high resolution of the SuperHRPD.

Decision: A

Beam time allocation: 69 (days/year) (β= 52%)

Approval and suggestion(s) to IMSS:

The committee approves the continuation of this project. The requested budget should be supported.

Comments:

On the SuperHRPD, although the guide tube was damaged by the earthquake in March 2011, it was recovered. At the same time, a background noise was successfully reduced by using a disk chopper with a $^{10}B_4C$ blade, and the resolution of $\Delta d/d = 0.05\%$, which is the highest resolution expected for the current detector system, by tuning the system. A comprehensive structure analysis software, Z-Code, was developed and improved, and many users are now using the Z-Code for data analysis. A superconducting magnet was designed and will be installed in FY2013. The research plan using the magnet should be presented by the start of the experiments.

In the initial design, the highest resolution of $\Delta d/d = 0.03\%$ will be achieved by using MSGC tubes. We here confirmed that the achievement of $\Delta d/d = 0.035\%$ by using 8 mm PSDs is a realistic goal. At present, $\Delta d/d = 0.05\%$ was confirmed in the study on the structural phase transition in SrTiO3 by using 1/2 inch PSDs transferred from Tsukuba Campus. The replacement of the current PSDs by 8 mm ones is now in progress.

This project has a scientific significance, and the instrumentation including effort for the achievement of the highest resolution as well as development of analysis environment is being improved well.

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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S06

Title: Fundamental Research of Hydrogen Storage Mechanism with high intensity total diffractometer

Principal Investigator: Toshiya OTOMO

Brief summary of the proposal:

This proposal is aiming at clarify mechanism of hydrogen storage by detailed structural investigation using extremely high intensity total diffractometer, NOVA, installed at BL21 at J-PARC_MLF. By supports of the NEDO project "Advanced Fundamental Research on Hydrogen Storage Materials", the construction of NOVA was completed in 2011, after steady progresses of constructions, and commissioning using beams. In particular, preparations of some important equipements, such as instruments for high pressure experiments and for atmosphere control sample environments, refrigerators, furnaces, have been completed. This experimental circumstance have already provided some notable results of structural investigations of hydrides have been already obtained. NOVA is now in the normal and full operation phase, in which general proposals for mainly hydrogen storage materials are accepted. Moreover, as the next step of preparation of equipments, development of accurate analysis techniques for determination of hydrogen circumstances, and reliable software to generate S(Q), improvement of S/N of NOVA are in progress. Based on the steady preparations of experimental circumstance, to make a peak in science, investigations of hydrogen storage materials, ion condactors, liquid based on collaborations of scientists in different fields. Moreover, progress of ambitious novel techniques such as Reverse Monte Calro analysis, and levitation sample environments will be highly required.

Decision: A

Beam time allocation: (days/year) (β=67%)

Approval and suggestion(s) to IMSS:

Requested budget and resources are reasonable and should be supported by IMSS.

Comments:

In FY2012, the acceptance of general proposals began, and in FY2013 full-fledged operations are slated to start. Along with the promotion of advanced research under S-type proposals for crystals, glass, liquids, etc., the desire is to obtain many fruitful results by virtue of broadening the availability to a wider range of fields. Crystal PDF analysis employing neutron total scattering is one example. It is important to promptly develop a process that quickly provides reliable S(Q) and g(r) to users for obtaining maximum performance from the world's top-performing instruments, and to provide the same to other instruments as well. In this context, coordination with the budget plan for this proposal, which is based on the preparation of accessories, is appropriate.

Since the world top performance will be definitely achieved in near future, purposes of the S-type project should be changed; improvement of collaborations with scientists in universities must be built up to develop prominent science by S-type projects which will start after the

construction phase.

Thus, the referees have agreed the stable and satisfactory progress of this project, and highly recommend to prompt this project with high priority in KEK.

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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S07
Title: Construction of advance neutron beam line for VIllage of Neutron Spin Echo spectrometers (VIN ROSE)
Principal Investigator: Masahiro Hino
Brief summary of the proposal:

This program (ID=2009S07) proposes to continue the construction of new types of spin echo spectrometers, MIEZE and NRSE (collectively referred to as VIN-ROSE), on BL06 (J-PARC/MLF) in FY2013.

Decision: A
Beam time allocation: β=100% for construction and commissioning on BL06
Approval and suggestion(s) to IMSS:

Requested budget and resources are reasonable and should be supported by IMSS.

Comment:

Neutron scattering which can obtain S(Q,ω) is an essential experimental technique to describe complicated time-space hierarchical material structures. Among neutron scattering, neutron spin echo (NSE) is the sole method which can obtain I(Q,t) directly, and is quite a unique and promising technique in the study of material dynamics. Especially its capability to address dynamics with long time-span and large scale of space makes NSE an important and effective method in soft matter and polymer physics. Therefore, the improvement of the performance of NSE is highly expected.

In order to develop the spin echo with pulse source, the applicants propose to construct two novel types of spin-echo spectrometers: MIEZE and NRSE (collectively referred to as VIN-ROSE).

The dynamics of confined water in nano-space will be intensively investigated with these spectrometers. The substantial progress of this subject is highly expected. Slow lattice dynamics in relaxor ferroelectric materials would be surely a promising subject with VIN ROSE. For the measurement, applying a magnetic field at the sample position is only possible with pulse neutron. Therefore, the VIN ROSE will open a new way to study magnetism by NSE. NSE studies of soft matter, polymers and proteins will be extended by the new spectrometers.

On the other hand, all users should be requested to consider deeply the science conducted using VIN ROSE. A serious question will be: are there any unique essential properties which are only possible to approach with NSE observation? Reconfirmation and qualification of the data obtained so far by the other techniques or NSE itself may be insufficient to justify the construction of these spectrometers.

The present status of the construction is appropriate and on schedule. The future plan is also reasonable. IMSS should support this proposal as is requested. The evaluator expects the applicants to develop new science fields using NSE with pulse neutrons. It is also requested to show the effectiveness of NSE in related scientific fields as well as industry applications. This proposal will

take the initiative for such requests, and leads NSE science in the world.

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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S08
Title: Analysis of Dynamics at Nano Interface of Functional Soft Matter
Principal Investigator: Atsushi Takahara
Brief summary of the proposal:

Aim of this proposal is understanding dynamics at nano interface in functional soft matter by utilizing neutron scattering methods and simultaneously developing new functional materials. Under this line, the applicant group has constructed and improved analyze system for interface of functional soft materials centered mainly on a horizontal type neutron reflectometer at BL16 (SOFIA) in J-PARC.

Decision: A
Beam time allocation: (days/year) (β= 50%)
Approval and suggestion(s) to IMSS: budget and resources:

Requested budget and resources are reasonable and should be supported by IMSS

Comments:

Overview

Outstanding feature of this project is that both of instrumentation/methodology development and material research are well-organized and their results feedback each other. Furthermore, the material research itself covers from fundamental topics to application ones. This project should continue because it produces excellent outputs to field of neutron science.

Instrumentation/Methodology

The horizontal type neutron reflectometer (SOFt International Analyzer: SOFIA) has constructed and is in operation mode for users, overcoming the disaster. Improvement and development such as a focusing mirror, scintillation detector (LiCAF) and so on show the possibility for time-resolved measurement for dynamics observation with SOFIA. About Grazing-insidence Small Angle Neutron Scattering (GI-SANS), methodology improvement is expected.

Material research

This project has generated excellent results in various fields, mainly polymer research: time-resolved measurement of dehydration process in polymer blend, diffusion behaviors of ring and linear polymers in interface and so on. These researches revealed the static and dynamical structural information by using the NEUTRON contrast between protonated and deuterated polymers.

Comments for Future

#1: Concerning about instrumentation, this group has developed SOFIA and is improving it (including the development of the accessories). Under this circumstance, it could be overwork to develop NSE and GI-SANS without increasing human resource.
Therefore, it should be clarified what this group does about developments of NSE and/or GI-SANS in this proposal

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#2: Biological interface, cell membrane, is also one of interesting research fields. It is expected that this group starts to investigate biological membrane with their established techniques.

（様式 2）

Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S09

Title: Dynamic and Static Structural Analysis by 3D polariometry spectroscopy on Neutron Analysis System for Functional Material

Principal Investigator: Kenji Ohoyama (IMR, Tohoku Univ.)

Brief summary of the proposal:

This project is aiming at constructing the first chopper instrument in J-PARC under collaboration between IMR-Tohoku U. and KENS dedicated to polarization analysis spectroscopy for studying static/dynamical spin correlations, which will be indispensable for making breakthrough in the field of magnetism and strongly correlated electron systems and for establishing center of excellence over east-Asian community. The instrument is currently planned to be installed in BL23, and preparation work such as installation of radiation shields, fabrication of super-mirror analyzer, and development of neutron beam polarizer/analyzer are in progress in H25.

Decision: A

Beam time allocation: N/A (days/year) (β=)

Approval and suggestion(s) to IMSS: budget and resources:

Support based on the demand for budgetary appropriations (概算要求) would be necessary.

Comments:

- While we appreciate that the project has made steady progress, we see it problem that the necessary resource has not been secured.
- We support modified plan for polarization analysis technique. However, our concern is that it may give rise to other problem of shortage in the beam intensity as a trade off, for which some measure should be taken.
- We think the time is mature to make decision on method of beam polarization and associated practical schedule. Plan should be defined for the development of software needed for polarization analysis.
- In any event, we encourage the project as it would play a leading role in the development of beam polarization techniques for inelastic neutron scattering.
- Concerning the planned research, there are many interesting subjects being proposed and discussed with consideration of merit due to polarized beam. We think it crucial to secure researchers within the group who are actively involved in the planning and execution of experimental programs until the instrument will become available.

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Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2009S10
Title: Structural study of batteries by using the special environment neutron powder diffractometer
Principal Investigator: Toshiharu Fukunaga (~FY2012), Masao Yonemura (FY2013~)
Brief summary of the proposal:

This S-type research collaborates with NEDO project: the Research and Development Initiative for Scientific Innovation of New Generation Batteries (the RISING project). Demands of batteries have extended in modern life with, for instance, hybrid automobiles and energy storage, for which lower cost and higher efficiency are required (the target is 500 Wh/kg in the NEDO project). It is important to develop environmentally-friendly batteries composed of smaller amount of resources and producing less wastes.

Development of next-generation batteries stands on various research activities: searching for new materials, optimizing performance of cells, etc. Materials structures in state-of-the-art lithium ion batteries have been studied in terms of extensive length scale by using various probes. In order to identify positions and behaviors of lithium ions, complementary use of neutron and synchrotron radiation scattering techniques is highly promising. The aim of S-type research is to investigate materials for batteries under working conditions, on the basis of constructing a new instrument SPICA on BL09 of MLF, J-PARC.

M. Yonemura is to be replacing T. Fukunaga as the principal investigator from FY2013.

Decision: A
Beam time allocation: (132 days/year) (β= 100%)
Approval and suggestion(s) to IMSS: budget and resources:

2 million JPY for travel expenses of group members and students.

Comments:

In FY2012, neutron beam was guided to SPICA, and commissioning of instruments has been continued up to now. The research group succeeded in obtaining diffraction data which is expected to be sufficient for structural analysis based on the Rietveld refinement method. Reduction of background was also achieved by installation of a T0 chopper. These activities have been proceeded by strong collaboration with the other diffractometer teams for the development of Z-Code, for instance. In FY2013, the research group will install an in-situ measurement system for detecting time evolution of materials structure in working battery cells, and extend measureable range of scales inside materials with high accuracy. The committee expects the start of practical use of SPICA for the aim of development of batteries. In order to make scientific and industrial progresses, it is necessary to construct a system for arranging research subjects and performing experiments consecutively under the collaboration between KEK and NEDO, in particular, the academic-industrial alliance in Kyoto University. It seems to be urgent to initiate neutron researches conducted by many scientists who are not familiar with neutron experiments. The proposed requirement of budget in the S-type project for travel

expenses of group members is adequate. The committee hopes that the research team fix such system, in order to get remarkable results immediately after the instrumental commissioning.

（様式 2）

Dec. 19, 2012: Neutron Program Advisory Committee

Program ID: 2013S01

Title: Studies on Dynamics in Condensed Matters by using the High Resolution Chopper Spectrometer

Principal Investigator: Shinichi Ito and Takatsugu Masuda

Brief summary of the proposal:

HRC (High Resolution Chopper Spectrometer) has been constructed to study dynamic structures of condensed matters with a wide energy range (Ei = 0.1-1000 meV) and a high energy resolution (ΔE/Ei = 1 %). At present, because of limited detector area (2θ < 40 deg), the proposed studies were focused to magnetic excitations of metallic magnets, low-dimensional quantum magnets, etc., but will be extended to molecular/lattice vibration spectroscopy and electric excitations.

Decision: A

Beam time allocation: 100 days (β=75%)

Approval and suggestion(s) to IMSS: budget and resources:

The requested budget and resources are reasonable and should be supported by IMSS.

Comments:

As of 2012, Ei of 500 meV and ΔE/Ei = 2.5 % have been achieved in HRC. In 2013, developments of the instrument, sample environment, and computer environment are proposed to realize the initially-planed specs. These developments should be done to obtain more definite data in the continuing subjects and also to extend the research field as described above. In particular, the expansion of detectors is indispensable to meet the high scientific demands at HRC. In 2012, there were many scientific results as presented in the workshop on Nov. 6. The neutron Brillouin scattering measurement has been realized to observe ferromagnetic spin waves propagating from (000) using powder samples. This type of experiment was only available at HRC by utilizing small-angle banks and high Ei. The orbital wave excitations in YVO3, J-multiplet excitations in Sm-based filled skutterudites, and magnetic excitations in an itinerant electron antiferromagnet Cr were also excellent works taking advantage of HRC. In 2013, other than these studies, the works on magnetic semi-conductors, magnetic frustration systems, quantum transitions in random 1D systems, and stripe ordering in 2D perovskite oxides are proposed. The experiments on Fe-based superconductors and permanent magnet materials are also planed under the MEXT "genso-senryaku" project. All of the proposed instrumental developments and scientific studies are significant as described above and should be performed using 75% of beamtime in 2013. In the near future, however, the studies which are not specifically oriented to HRC, should be performed

not in S-type but in general user program. This is recommended also to expand the research field of HRC.