

PRESENT STATUS OF KENS

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ABSTRACT

The KEK Neutron Science Division (KENS) is responsible for operation and maintenance of the Materials and Life Science Research Facility (MLF) of the Japan Proton Accelerator Research Complex (J-PARC), under the collaboration with the Japan Atomic Energy Agency (JAEA). The KENS is also responsible for the promotion of the neutron science at MLF as well under the framework of the Inter-university Research Program. We report the present status of the framework of the research program in KENS.

1. KENS - Brief History

The spallation neutron source KENS (KEK Neutron Source) became operational at the Booster Synchrotron Utilization Facility of the National Laboratory for High Energy Physics (KEK) in 1980 following the successful demonstration of a powder diffractometer using the electron linear accelerator at Tohoku University. The KENS-facility had provided pulsed thermal and cold neutrons to approximately 15 instruments until it was shutdown in March 2006. The KENS has been responsible for the operation of the KENS-facility and the promotion of the neutron science under the framework of the Inter-university Research Program, in which the facility is shared by university researchers according to the priority evaluated by the Program Advisory Committee (KENS-PAC) and is promoted under the collaboration among universities and the KEK.

The KENS was restarted as the KEK Neutron Science Division (KENS) after the shutdown of the spallation source. The Inter-university Research Program was continued under the international collaboration among ISIS of the Rutherford Appleton Laboratory, LANSCE of the Los Alamos National Laboratory, the IPNS of the Argonne National Laboratory and KENS during the period of 2006 to 2008 when the pulsed neutron beam was not available.

The domestic Inter-university Research Program was reorganized in 2009 according to the startup of the spallation neutron source at the Materials and Life Science Experimental Facility (MLF) of the Japan Proton Accelerator Research Complex (J-PARC) constructed in Tokai village. The KENS is currently responsible for (1) the operation and maintenance of J-PARC MLF in the J-PARC Center under the collaboration with the Japan Atomic Energy Agency (JAEA) and (2) the promotion of neutron sciences and the Inter-university Research Programs in Tsukuba campus and Tokai campus.

The KENS is also promoting the fundamental researches and developments based on the inter-university collaboration network and the intra-KEK collaboration as illustrated in Figure 1.

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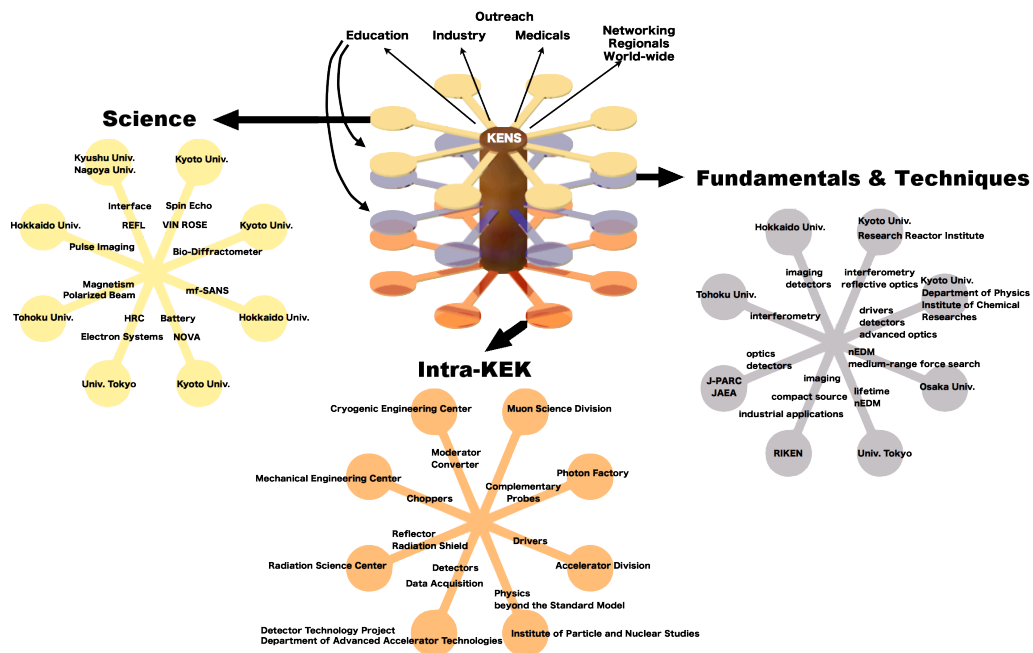


Figure 1. Conceptual Illustration of the research network of the KENS.

2. Promotion of Strategic Research Projects (S-type Projects)

The KENS has initiated a new program to promote medium-term strategic research projects to accept one to five year proposals involving the construction of neutron instruments at the J-PARC, experimental studies requiring more than one instruments and strategic plan on the incubation of new ideas, the development of advanced technologies, the activation of new research fields and the expansion of the neutron science community to other research fields and application. The new program is categorized as the S-type projects. The S-type projects are evaluated by the KENS-PAC and approved projects are supported by the KENS.

In principle, each group involving the construction of a neutron instrument is promoted by the corresponding S-type project. A fraction of the beam time of each beamline is allocated to the corresponding S-type project group. The fraction is referred to as $\beta\%$. The S-type project group is responsible for the technical support to the general users sharing the other $(100 - \beta)\%$ beam time. The value of the β is defined in the KENS-PAC. In the fiscal year of 2009, the total beam time was 100 days, which will be gradually increased to reach the planned annual beam time of 200 days per year.

The KENS-PAC has approved following S-type projects listed in the Table I.

The research and development of common technologies is being promoted based on the Inter-university Research Program together with the intra-KEK collaboration with the Institute of Particles and Nuclear Studies, the Mechanical Engineering Center and the Computing Research Center of KEK. The intra-KEK collaboration is covering the development of the T_0 -choppers, Fermi-choppers, time-resolved imaging detectors, the electronics for the signal processing, the middleware for the list-mode data acquisition

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system and the software for the generalized analysis platform. The time-resolved imaging detectors and polarized ^3He filter are under development under the collaboration among universities.

The KENS is promoting the practical use of compact accelerator-driven neutron sources to expand the basis of the neutron research community by install the opportunity of neutron use in universities. The installation of neutron sources at the users' campus would contribute to educate beginners and students so that the neutron science can be succeeded over generations.

Table I. Approved S-type projects at the beginning of the fiscal year 2010.

Program Number	
2009S01	title "Studies on Dynamics in Condensed Matters by using the High Resolution Chopper" PI Shinichi ITOH BL BL12 (HRC) High Resolution Chopper
2009S02	title "Time of Flight Neutron Diffractometer Specialized for Structural Biology" PI Toshiyuki CHATAKE
2009S03	title "Fundamental Physics with Pulsed Cold Neutrons" PI Hirohiko M. SHIMIZU BL BL05 (NOP) Neutron Optics and Physics
2009S04	title "Technical Feasibility Study of Mini-Focusing Small-Angle Neutron Scattering Instrument" PI Michihiro FURUSAKA
2009S05	title "Structural Study of Functional Materials and Development of Advanced Methodology using SuperHRPD" PI Yukio NODA BL BL08 Super High Resolution Powder Diffractometer
2009S06	title "Fundamental Research of Hydrogen Storage Mechanism with High-Intensity Total Diffractometer" PI Toshiya OTOMO BL BL21 (NOVA) High Intensity Total Diffractometer
2009S07	title "Construction of Advanced Neutron Beam Line for Village of Neutron Spin Echo Spectrometers (VIN-ROSE)" PI Masahiro HINO BL BL06 (VIN-ROSE) Village of Neutron Spin Echo Spectrometers
2009S08	title "Analysis of Dynamics at Nano Interface of Functional Soft Matter" PI Atsushi TAKAHARA BL BL16 (REFL) Horizontal Reflectometer
2009S09	title "Synamic and Static Structural Analysis by 3D Polarimetry and Spectroscopy on Neutron Analysis System for Functional Materials" PI Kenji OHYAMA BL BL23
2009S10	title "Development of Advanced Special Diffractometer using Extreme Environment for Materials" PI Toshiharu FUKUNAGA BL BL09
2009S11	title "Neutron Transmission Imaging" PI Yoshiaki KIYANAGI

3. Innovative instruments at J-PARC/MLF

Some of the S-type project groups (2009S01, 2009S03, 2009S05, 2009S06 and 2009S08) have already constructed their innovative instruments at MLF, and started leading-edge researches, respectively. For example, High Resolution Chopper (HRC) at BL12, Neutron Optics and Physics (NOP) at BL12, Super High Resolution Powder Diffractometer (SHRPD) at BL08, High Intensity Total Diffractometer (NOVA) at BL21 and Horizontal Reflectometer (REFL) at BL16. Figure 2 shows the illustration of the SHRPD, which realized the world's highest resolution of $\Delta d/d = 0.03\%$, and succeeded to find out a very tiny distortion around the phase transition. The NOP is providing the high quality polarized neutron beam, which enables the efficient in-flight neutron lifetime measurement.

In addition, the groups of 2009S09 and 2009S10 will start to detailed design of their instruments and to construct those soon. The group of 2009S10 has proposed an innovative instrument of Mini-Focusing SANS, and realized the prototype using JRR3-M reactor neutrons. The group of 2009S07 has also proposed an innovative instrument of Neutron Spin Echo Spectrometer, and checked the feasibility using J-PARC pulsed neutrons. These groups will start detailed design of their instruments.

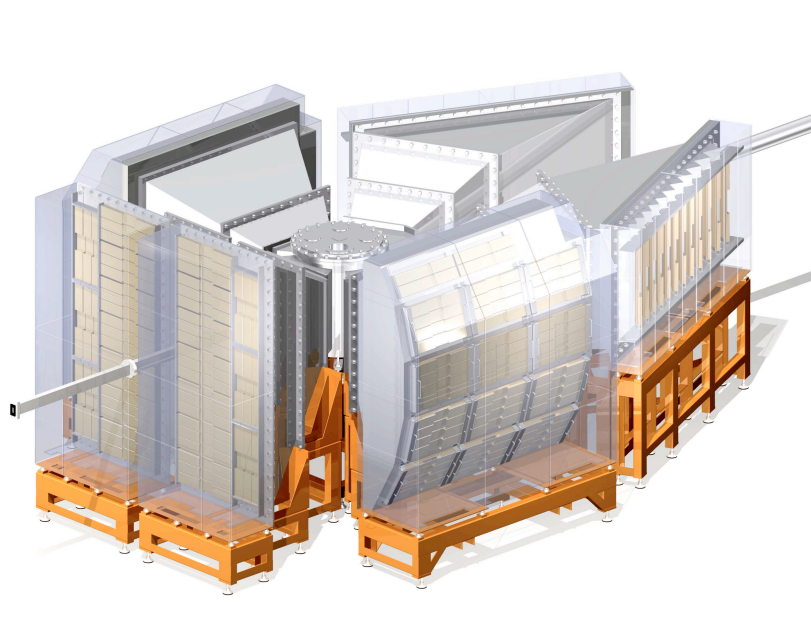


Figure 2. Super High Resolution Powder Diffractometer (SHRPD) installed at the BL08 of J-PARC/MLF.

4. Summary

The kW-class KENS has been upgraded to the MW-class J-PARC/MLF. Baseline instruments will deliver intense pulsed neutrons with improved performance. At this occasion, the KENS is initiating discussions on medium- and long-term strategies for maximizing the science activities, developing fundamental researches and developments to incubate new ideas and methodologies, activating new research fields based on the inter-university research network including the satellite neutron sources at users' campus, in order to enable the over-generation expansion.