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Current Status of The Energy-Resolved Neutron Imaging System, RADEN, at J-PARC MLF

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The world's first pulsed neutron imaging instrument dedicated to energy-resolved neutron imaging experiments, named RADEN, was constructed at beam port 22 in the Materials and Life Science Experimental Facility (MLF) of J-PARC [1]. This instrument is designed to conduct state-of-the-art energy-resolved neutron imaging, such as Bragg-edge imaging, resonance absorption imaging, and pulsed polarized neutron imaging, together with conventional/energy-selective neutron radiography and tomography by fully utilizing the high intensity, short-pulsed neutron beam. The construction of RADEN was completed in 2014, and user operation was started from April 2015. By the end of April 2017, the number of conducted proposals reached 72 and about half of the total beam time was utilized by general users.

Besides the user program, the RADEN instrument group is continuing the technical development and improvement of the instrument so as to conduct more advanced energy-resolved and conventional neutron imaging experiments. To improve the detector performance, we exchanged the optical system of our camera-type detector for increased brightness to achieve fine spatial resolution, and upgraded an event-type detector, the μNID [2], for improved count rate, neutron detection efficiency, and spatial resolution. Also, the collimation system was upgraded and additional slits were introduced into the instrument for better beam shaping and efficient background reduction. The device controlling software has been replaced with a newer version in order to make the interface more user friendly and to provide flexiblity to easily include additional equipment under the control. Regarding the development of new imaging techniques, we have constructed a Talbot-Lau interferometer at the pulsed neutron source for the first time and applied the wavelength-dependent analysis to phase imaging [3]. Moreover, to analyze the spatial distribution of nano-scale structural information, a technique to extract the small-angle scattering contribution in the neutron transmission spectrum using orthogonally-arranged neutron Soller collimators has been developed [4].

In this presentation, we will report the current status of RADEN along with recent results of the technical development and application studies regarding energy-resolved neutron imaging techniques conducted at RADEN.

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