

# Determination of neutron flux distribution in nuclear fuel by wire scanning

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Research reactors are among others utilized for irradiation and neutron beam application so it is necessary to determine the values and distributions of the neutron flux in the core and irradiation positions. In the reactor core, it is hard to install the neutron detector because of narrow space, especially for reactors using plate fuels such as JRTR or KJRR. In this study, in order to measure the neutron flux distribution in the fuel assembly, a wire scanning device for continuous gamma-ray measurement of irradiated Au wire was developed. And the software tools for control the scanning module and data acquisition for wire scanning was developed using LabVIEW. For the gamma-ray spectroscopy system, closed-ended coaxial type HPGe detector with relative efficiency of 40% was used to measure the gamma rays emitting from the irradiated Au wires and Au foils. In order to determine the neutron flux distribution using the measured reaction rate distribution, thermal to total reaction rate, and average thermal neutron cross-section are required. Two factors were obtained by Monte Carlo simulation for JRTR. The JRTR core was modeled and reactions of neutrons with Au wires and Au foils were simulated by using MCNP6 code. Au wires and foils were installed at five representative fuel assemblies (FAs) and two RI capsules in the IR0 rig and irradiated at an estimated power 2 kW for 8 h. PC plates were used to attach the activation detectors and they were inserted in the central coolant channels of FAs. After irradiation, Au wires were gamma scanned at every 25 mm with 25 mm slot width. The measured data were compared with calculated ones to determine the power and to confirm the reliability of power distribution calculation. The peak flux is  $6.434E10$  n/cm<sup>2</sup>-s at 1.820 kW, which corresponds to  $1.777E14$  n/cm<sup>2</sup>-s at 5 MW.

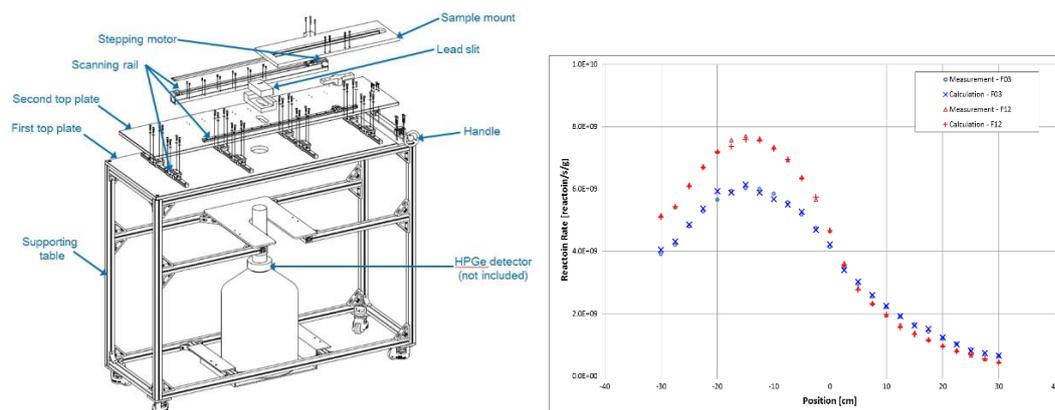


Fig. 1. Wire scanning device for measuring gamma-ray spectrum of irradiated Au wire.