Development of the High-Intensity Fast Neutron Beam Facility

II. 1. Development of the High-Intensity Fast Neutron Beam Facility

Okamura H., Baba M., Kamata S., Itoga T., Hagiwara M., Hasegawa T., Sugimoto N., and Maeda K.[*]

Cyclotron and Radioisotope Center, Tohoku University
[*]*Department of Physics, Tohoku University*

A facility for producing neutrons in the energy range of 20–90 MeV has been constructed at the straight beam-line from the 930 cyclotron (32-course), where intense beams of multi-μA are available. The schematic layout of the facility is shown in Figure 1. The primary beam is transported to bombard the water-cooled production target, bent in the clearing magnet by 25°, and stopped in the water-cooled beam dump, which consists of a carbon block shielded by copper and iron blocks. Using the ^{7}Li(p,n)^{7}Be reaction, quasi-monoenergetic neutron beams of an intensity approximately 10^{6} $n$cm^{-2}sec^{-1}μA^{-1} can be obtained at an energy spread of 1 MeV. The number is almost 10 times larger than those of similar facilities[1,2] owing to the short distance between the production target and the irradiator. Although the thickness of the iron collimator or the concrete shield is rather moderate, thus sacrificing the signal-to-background ratio to some extent, the measured background level is reasonably low. A detailed analysis of intensities of the neutron beam as well as those of background neutrons obtained by using a liquid scintillation counter and time-of-flight method can be found elsewhere in this report[3]. Also the flux distribution of thermal neutrons has been measured by the comparison of activation of Au foils with and without Cd covers, and found to be acceptable in the area around irradiators.

Several projects are being carried out using this facility; a study of three-nucleon force effects via the *n-d* elastic scattering, data accumulation for material activation by fast neutrons which will be used in designing reactors or accelerator facilities, and accelerated simulations of software error in large-scale semiconductor memory devices.

References

1) Vorobyev A.S. et al., Proceedings of the International Conference on Nuclear Data for Science & Technology, ND2004, Santa Fe, Sep. 26-Oct. 1 (2004).
2) Jungerman J.A. and Brady F.P., Nucl. Instr. and Meth. **89** (1970) 167.
3) Kamata S. et al., in this report.

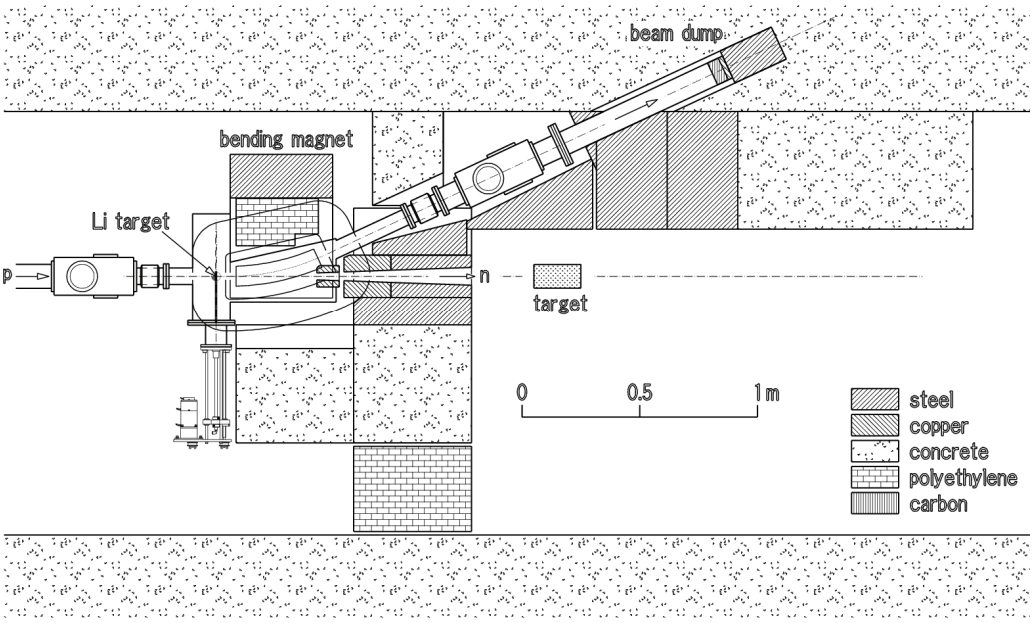

Figure 1. Schematic layout of the fast neutron beam facility constructed at 32-course.