

§13. Measurements of Environmental Neutrons in Toki Area

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The strength of the environmental neutrons varies with time and place. Higher intensity of neutrons has been observed at high latitude and at high altitude, and the strength of neutron intensity fluctuates by the difference of weather condition and solar activity, furthermore, its intensity is decreased by the shield of buildings. These are why the neutron measurement has to be performed in the place where the radiation protection information is needed.

So, from the view point of radiation protection of the natural environment, it becomes very important to measure the background neutron energy spectra before starting heavy hydrogen experiments using LHD facility. This is important to promote the social understanding of the environmental safety as well as to clarify the neutron doses caused by the operation of the facility.

The purposes of this investigation are to measure fluency rates or energy spectra of environmental neutrons. For determination of neutron energy spectra, Bonner Ball spectrometer which is composed of 25 cm^φ×30 mm^l cylindrical He₃ detectors and polyethylene moderators are prepared. The thickness of the moderators is 10, 25, 50, 80, 100 mm, respectively.

Since the energy spectra can be estimated with the iteration method using a response matrix, the response functions were calculated by the MCNP Monte Carlo simulation code. Examples of response functions are shown in Fig.1 and 2. As shown in Figs. 1 and 2, response functions are clearly different in thickness of the polyethylene moderator. Since the response functions and unfolding techniques are prepared, evaluation of sensitivity of the moderating type He₃ counter, measurements of background neutrons in the natural environment and extension of the energy region of the response functions are future problems to be solved.

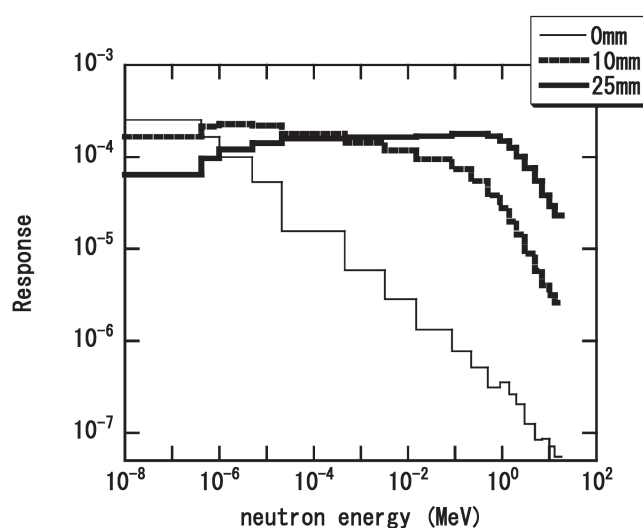


Fig.1. Response functions the Bonner Ball spectrometer. thickness of the moderators are 0 mm, 10 mm and 25 mm, respectively.

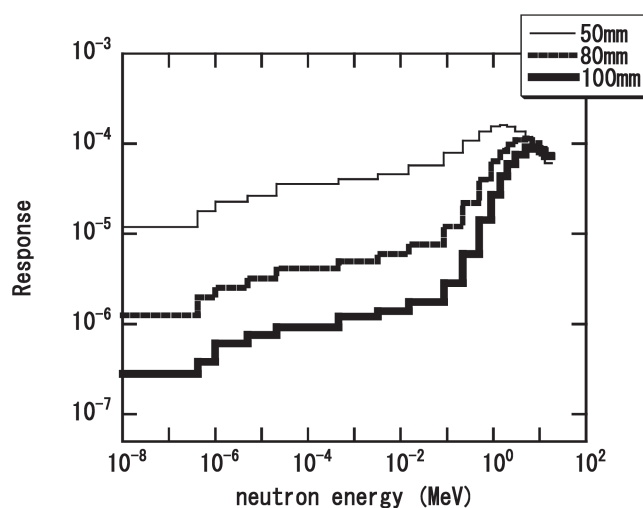


Fig.2. Response functions the Bonner Ball spectrometer. thickness of the moderators are 50 mm, 80 mm and 100 mm, respectively.