§1. Study on Technical Problems on Measurements of Total Neutron Yields during D-D Plasma Experiments with LHD

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It is important to measure total neutron yields during D-D plasma experiments from the standpoint of not only scientific features but managements of experiments and radiation safety. There have been not so many experiences of measurement of total neutron yields and calibration for the neutron yield measurements with very complicated fusion devices such as the LHD. It is the pressing issue to study the technical problems on the measurement and the calibration. We have studied neutron transport in and near the LHD with MCNP-4C2. We added main accessory components to the simplified geometry.

We have studied neutron transport in the LHD. It is common to use some Monte Carlo simulation codes, such as MCNP, to calculate neutron transport phenomena. It is, however, difficult to make the input geometrical file for the LHD with the very complicated structures, especially the twisted herical coils. No attempts had been done to simulate the neutron transport. In last year, we modeled the herical coils with finely segmented hexahedrons and we studied neutron transport in and near the LHD with MCNP-4C2. In this year, we added the main accessory components, such as many viewing ports for plasma diagnostics and a vibration isolation device for a laser interferometer equipment, to the simplified geometry.

In this report we will show the influence of the vibration isolation device. Figure 1 shows the simplified geometry that contains many viewing ports for plasma diagnostics and the vibration isolation device for the laser interferometer equipment. We studied the influence of the thick pile of the vibration isolation device in the center hole of the LHD. Figure 2 shows detection efficiencies of a fission chamber placed on the center axis and at 0, 200, 400, 600 cm above from the equatorial plane of the LHD, for a ^{252}Cf neutron source that is moved in the toroidal direction in the LHD. The fluctuations with a cycle of 36 degrees are due to neutron absorption by the herical coil. The big dents at 180 degrees are due to neutron absorption by the pile of the vibration isolation device. We successfully showed the influence of the main accessory components on the detection efficiency of the fission chamber.

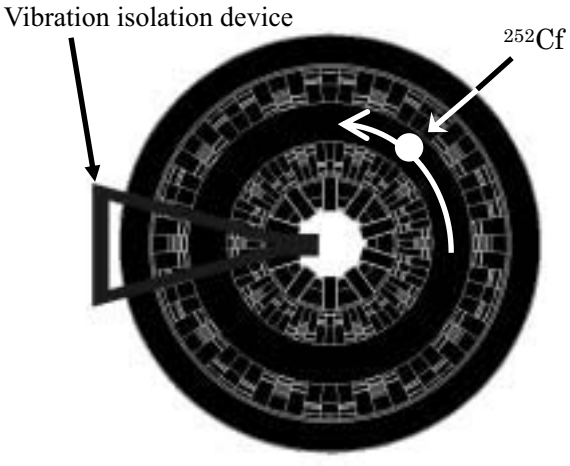

Fig. 1 Simplified geometry of the LHD for neutron transport simulations.

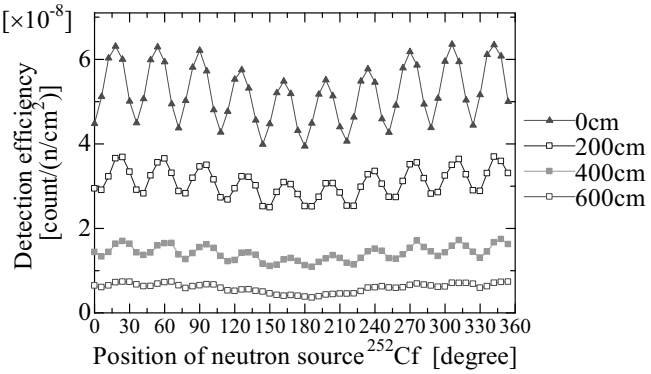

Fig. 2 Detection efficiencies of a fission chamber placed on the center axis and at 0, 200, 400, 600 cm from the equatorial plane of the LHD.