

§2. 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 experimental experiences to measure total neutron yields or calibration experiments for the neutron yield measurements with very complicated fusion devices such as the LHD. It is the pressing issue to study the technical problems and perform the measurement and the calibration properly. Environments near fusion experimental devices are very severe for the neutron measurements due to high neutron and gamma-ray fluxes, high stationary and transient electromagnetic fields, and so on. It is also important to study technical problems regarding to the severe environments.

In the first year of this project, we had some meetings. In the meetings, we discussed the magnetic fields around the LHD, traceability to the national standard of neutron measurements held by AIST¹⁾, creation of an input file of a very complicated system of the LHD for MCNP code, and neutron measuring devices that can be used at NIFS. Also done were preliminary experiments for study of influence of a magnetic field on operation of a ^3He proportional counter. In these experiments the magnetic fields were applied to the ^3He proportional counter perpendicular to the counter axis due to the configuration of the experimental apparatus. The maximum magnetic field of 315 mT was applied. A weak ^{252}Cf neutron source surrounded by a polyethylene moderator was placed near the ^3He proportional counter. The pulse height spectra were observed with a multichannel pulse height analyzer. The experimental results are shown in the

figure and table. No influence of the magnetic field on operation of the ^3He proportional counter has been seen in this magnetic field range. In the next step we will do the experiments where much higher magnetic field will be applied parallel to the counter axis. Also planned are experiments to operate the ^3He proportional counter near the LHD during H-H plasma experiments.

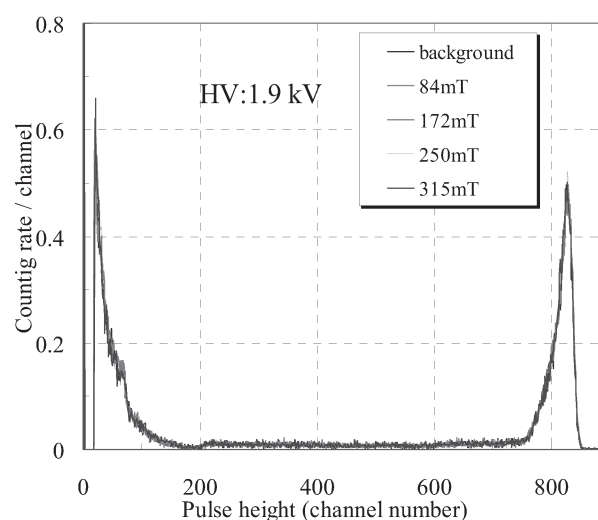


Fig. 1 Pulse height spectra of the ^3He proportional counter in the magnetic fields with different magnetic flux densities.

Table 1 Energy resolution and total counting rate of the ^3He proportional counter in the magnetic fields.

Magnetic flux density [mT]	Energy resolution of full energy peak [%]	Total counting rate [cps]
background	3.4	38.6
84	3.2	38.8
172	3.4	39.0
250	3.0	39.3
315	3.1	38.5

1) <http://www.nmij.jp/~quant-rad/neutron/newhp.html>.