§16. Monitoring of Static and Varying Electromagnetic Fields for Safety Management in a Large Plasma Experimental Facility

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Environmental electric and magnetic field strength around a large magnetic plasma experimental facility like LHD and the relating devices had been surveyed. The guidelines for various electromagnetic fields namely non-ionizing radiation has been proposed by the International Commission on Non-ionizing Radiation Protection (ICNIRP) and the other organizations. Although acute health effect has not been found it would be useful to considering safety management. The property of environmental electromagnetic fields around the LHD is to be occurred statistically, namely unstable. The LHD has the largest super conductive plasma confinement device with strong static magnetic field and not less magnetic field is leak out. Except the static magnetic field, there are many sources of varying electromagnetic fields. They are NBI and its electric power source of a motor generator (60Hz), plasma heating devices like ICRF (25-100 MHz), and ECH (84-168 GHz). Also for discharge cleaning, resonance frequency (2.45 GHz) system is used. Safety issues are not only uniform electromagnetic field but also complex of static magnetic field and variable frequencies of magnetic fields, which are from extremely low frequency (ELF) to extremely high frequency (EHF). Since the first plasma experiment of the LHD in 1998, in order to examine about the safety management system at the plasma experimental facility, leakage of static magnetic field strength has been measured with Gauss Meter 9900 (F.W. Bell Co) and three axial probe ZOA99-3208, at the fixed monitoring point where is 23 m far from the center of the LHD in south direction. Background of not-operation period is about 0.06 mT, which is a double of terrestrial magnetic field. It is caused by magnetization of steel materials in the monitoring room. On the LHD plasma experiment, it increased to 0.1 -0.2 mT.

Except the coil systems of LHD, there are microwave generators for plasma heating device of the ICRF. We started continuous monitoring around the ICRF wave generator using a data logging system. The measurement instrument is EMC-300 and three axes electric field probe Type 18 and magnetic field probe Type 10 (Narda S.T.S.). The devices arrangement and the probes setting point are shown in Fig.1. The data logging time is 5 Hz, 0.2 sec, and mean values of optionally selected time can be calculated.

The measured data of maximum electric and magnetic fields strength are shown in Fig. 2. The maximum electric field observed was less than 15 V/m, although 6 minute mean value is extremely small. The magnetic field strength was less than 0.025 /m. All data were less than the occupational regulation level proposed as guide line by the ICNIRP. For the future problem, statistically varying EMF in the large plasma facility should be precisely concerned.

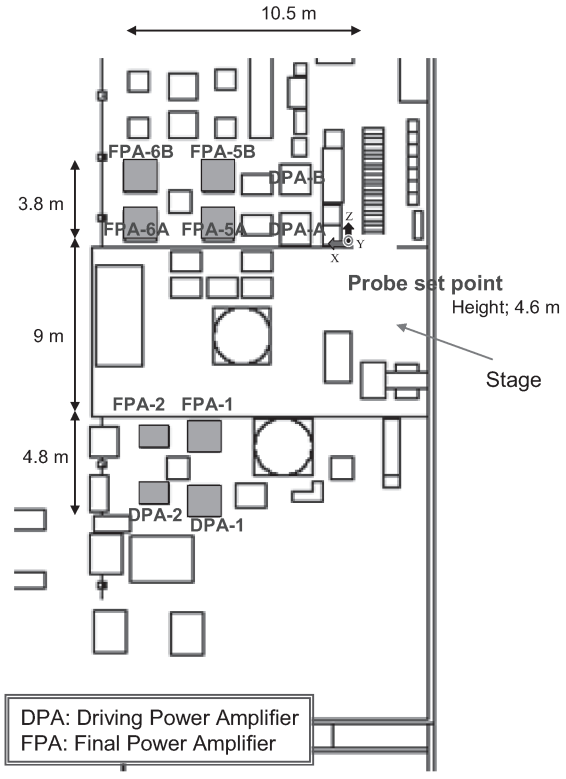

Fig. 1 Layout of ICRF RF power source devices.

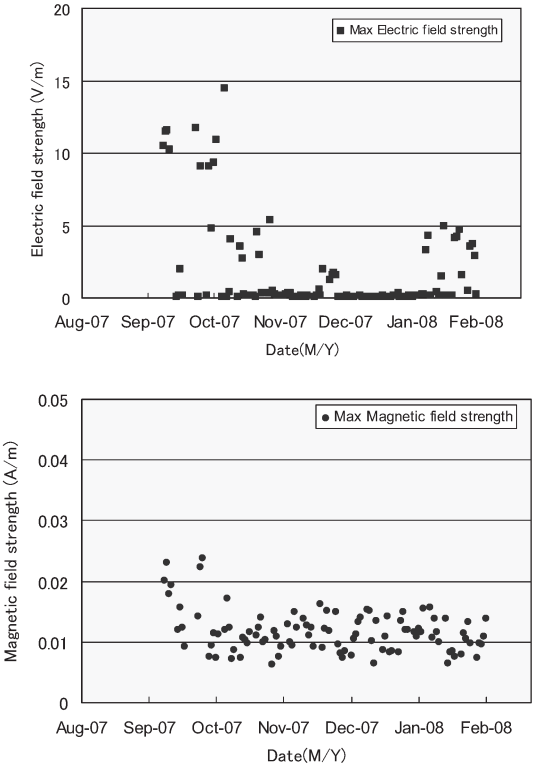

Figure 2 Electric and magnetic field strength around the ICRF power source devices.