§12. Spatial-Resolved VUV Spectrometer for Ti Measurement and Impurity Monitor System for LHD

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A spatial-resolved VUV spectrometer system has been constructed to measure full radial profile and some part of toroidal profile of ion temperature and impurity emissions, especially in edge and divertor regions, of LHD. An impurity monitor system has been also constructed for wall conditioning, steady-state operation and transport study with an impurity pellet injection.

The spatial-resolved T_i-VUV spectrometer system consists of a 3m normal incidence spectrometer, 2 CCD detectors (300-1500Å, 1200-2500Å), flat and cylindrical (11m radius) mirrors and spatial-resolved (radial) and toroidal-resolved slits. The mirror system enlarges the viewing angle of the spectrometer and enables to yield a vertical (full radial: a_{p_min}=43cm) profile of 100cm at plasma center. The spatial-resolved slit (typically several tens of μm) located between the grating and the incident slit determines the spatial resolving power.

A study on the divertor performance is one of the most important issues in LHD. For the divertor studies the spectrometer has the toroidal slit which can be moved as a function of time (typically 50cm per 1sec). Using this slit 2-dimensional information can be obtained for T_i, v_θ and impurity emission. From this measurement a detailed information is taken on the divertor function.

The impurity monitor system consists of 8 compact VUV monochromators (20cm normal incidence) and 1m grazing incidence monochromator. The lines to be measured are fixed to;

HeI (584Å), BII (1362Å), CIII (977Å),
NIV (765Å), OV (630Å), TiXII (480Å)
FeXVI (361Å), BKGD (365Å).

The vacuum vessel of LHD is made of SS316 (Fe71/Cr18/Ni8/Mo3). The Ti gettering and boronization are planned at present. The helium gas is used in ICRF experiment. The construction on the Hα poloidal and toroidal monitor system, H/D monitor and Z_{eff} measurement is scheduled in a fiscal year of 1997.

In LHD only the divertor position is covered with carbon plates because of the complicated surface structure of the vacuum vessel. Then, it is expected the impurity problem from metal elements becomes severe, although the boronization is planned. Especially in the case of the steady state operation more than 1000sec such a condition will be emphasized. This system will be used as a feed back tool for plasma control.

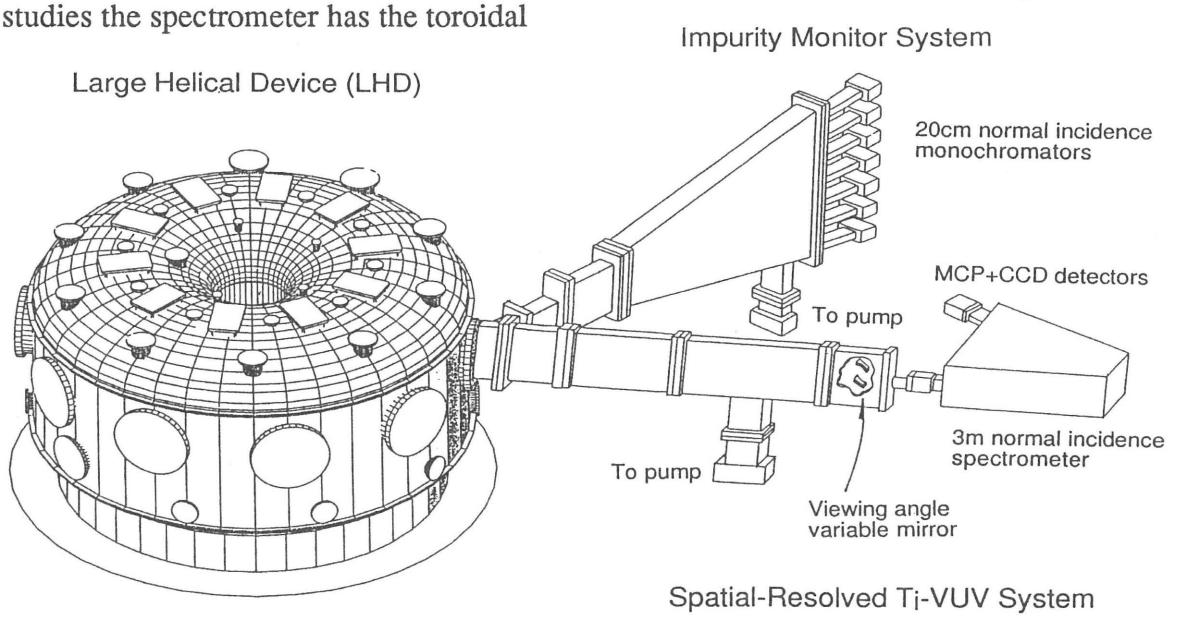

Fig.1 Schematic view of LHD, spatial-resolved VUV spectrometer system for ion temperature measurement and impurity monitor system. The size of LHD is reduced.