

§49. Far Infrared Laser Interferometer on the LHD

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A multi-channel FIR laser interferometer system has been developed for the measurement of the spatial and temporal behaviors of the electron density on the LHD. Among several candidates of the high power laser sources a 119- μm CH₃OH laser was adapted as a probing light. The optical configuration is of the Michelson interferometer type with 13 channels.

Figure 1 shows a schematic drawing of the interferometer system. The FIR lasers are installed in the laser room 30 m apart from the LHD, and propagate about 40 m through a couple of the dielectric waveguides to reach the optical bench of the interferometer. The optical housing, where 150 optical components are installed, is mounted on a massive frame. The frame encircles the plasma vacuum vessel and floats on three pneumatic vibration isolation mounts. This isolation stand is 18.4 meters tall and weights about 30 tons. The upper shelf of the stand supports thirteen corner cube reflectors which are located immediately above the vacuum windows, while the interferometer housing is supported by the lower shelf which is located below the floor of the LHD. The optical housing is air tight and filled with dry air in order to reduce absorption of the CH₃OH

laser radiation by atmospheric water vapor. Flexible airtight ducts are used between the optical housing-floor-LHD.

Figure 2 shows the time behavior of the line integrated electron density profile measured by the FIR laser interferometer. In this experiment the plasma was produced by the second harmonic ECH with the power level of 100-200 kW and auxiliary heated with NBI at 2 MW. The observed mechanical vibration level is about 1/100 fringes for the high frequency components and 1/50 fringes for $f < 1$ Hz. At the present experimental condition, the resolution of fringe counters is 1/100 fringes, and it corresponds to a line averaged density of $5.6 \times 10^{16} \text{m}^{-3}$ at the central chord.

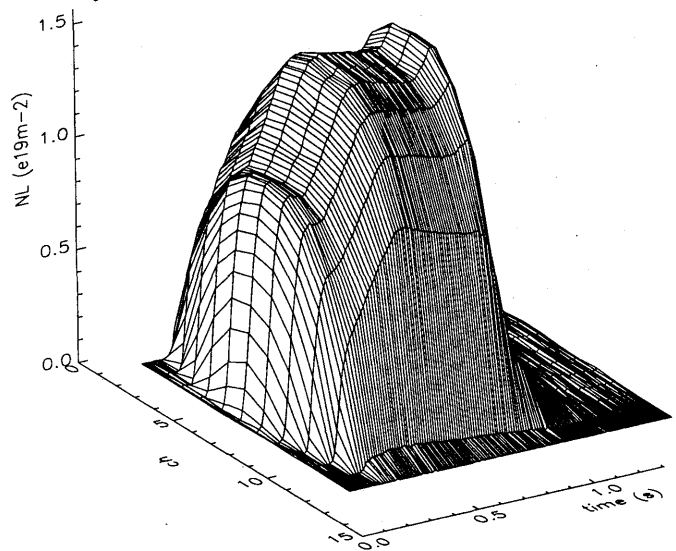


Fig.2 Output of the 13-channel interferometer as a function of time.

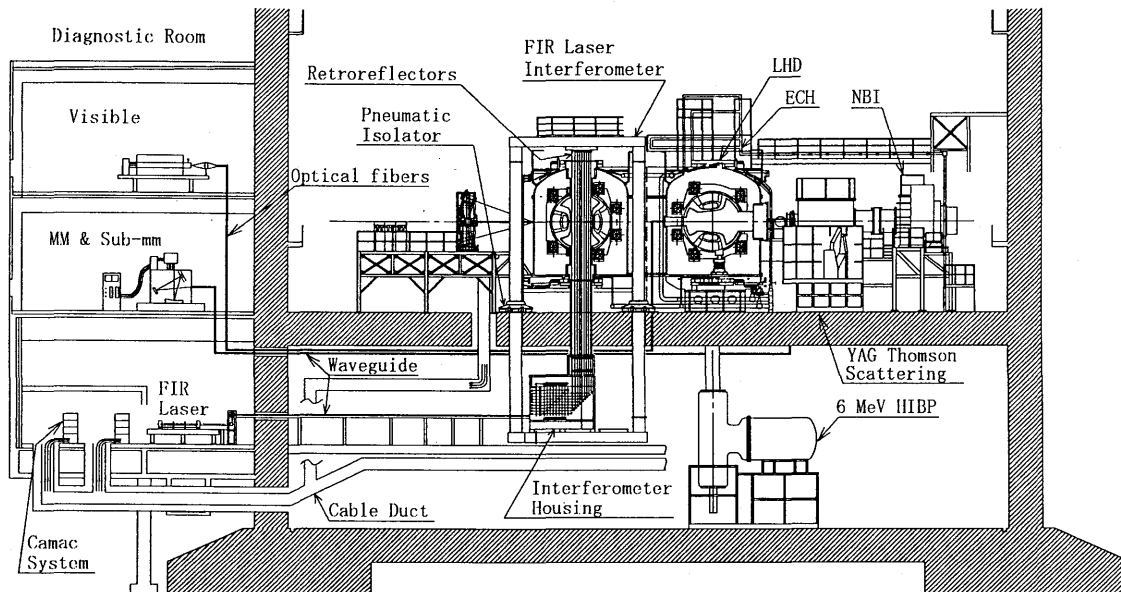


Fig.1 Cross sectional view of the LHD experimental room.