

§5. Design and Construction of FIR Laser Interferometer System for LHD

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A multi-channel FIR laser interferometer system is being constructed for the measurement of the spatial and temporal behaviors of the electron density on the LHD. Last year we have constructed a twin optically -pumped 119- μm CH₃OH laser[1]. And we have successfully achieved output power more than 600 mW. The present main job for the development of the laser system suitable for LHD plasma diagnostics is to establish the active stabilizations of the pump CO₂ laser and heterodyne beat frequencies and FIR laser power. In this fiscal year we have designed and constructed the CH₃OH laser Interferometer system.

Figure 1 shows the schematic drawing of the interferometer system. All optical components used in the interferometer are housed in a box (3900 x 1500 x 4500 mm³), which is air tight and filled with dry air in order to minimize attenuation of the CH₃OH laser beam due to water vapor absorption. The FIR lasers are installed in the diagnostic room adjoining to the LHD hall. The laser beams (probe and reference beams) propagate about 40 m to reach the box through a couple of dielectric

waveguides. The probe laser beam is divided into 13 beams by the beam splitters(a) made of quartz. The power of each probe beam is controlled to be 4 % of the incident power by adjusting the thickness of the quartz plates. About 30 % of the power is estimated to be absorbed by the quartz plates. The each probe beam is focused to a beam waist diameter of 44 mm on the corner cube reflectors attached on upper shelf of the pneumatic vibration isolation stand[2]. The reflected beams are matched with the reference beams on the beam splitters(b), and downconverted into I.F. signals by GaAs Schottky barrier diode mixers.

References

- 1) Kawahata, K. et al., Ann. Rev. NIFS,1993-1994 (1994)
- 2) Okajima, S., Kawahata, K., Takahashi, H., Yamagishi, H., Maeda, H., Hamada, Y. and Fujita, J., Proc. 15th Int. Conf. on Infrared and Millimeter Waves, Florida (1990) 753.

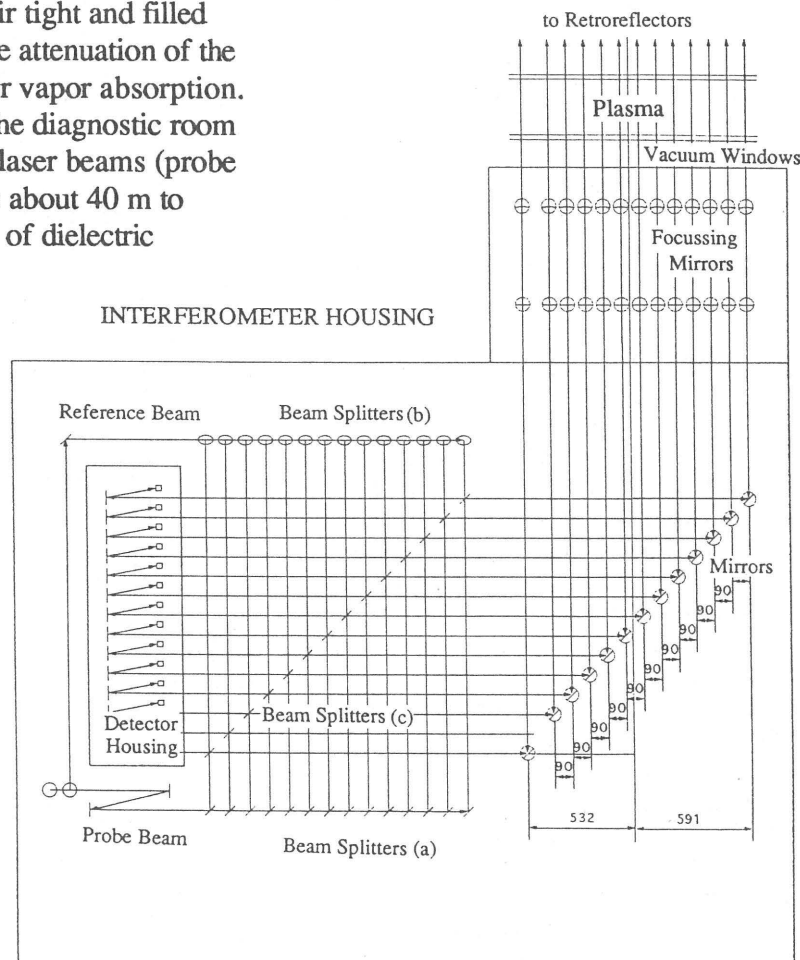


Fig.1
Schematic drawing of a 13-channel FIR laser interferometer. The main optical components are on one optical bench made of epoxy resin reinforced by fiber glass with a honey comb structure.