

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

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For last 4 years, we have been developing two kinds of high power laser sources[1,2] for application to multichannel FIR laser interferometer on the LHD. So far, we have successfully achieved output power more than 800 mW for 194- μm DCN laser and 450 mW for 119- μm CH₃OH laser. On the basis of these developments we decided to adopt a cw CO₂ laser pumped twin 119- μm CH₃OH laser as a probing light for the LHD from the view points of output power level, small refraction effect, high beat frequency and so on. In this fiscal year we have designed and constructed the laser system.

Figure 1 shows the schematic drawing of the laser system. The dimension of the CO₂ laser is the same as the R&D device[2]. The zeroth order laser radiation from the grating is used to monitor the laser output power and wavelength, and also stabilize the laser frequency. In order to stabilize the CO₂ laser frequency, d.c. and a.c. Stark effects of an external CH₃OH stark cell are used. The FIR laser is newly designed one and has the following parameters, cavity length of 2190 mm, laser tube

diameter of 35 mm, gold coated Cu input mirrors with off-axis 3 mm holes and gold coated Si hybrid output couplers with 13 mm diameter clear aperture. The laser optics are mounted inside vacuum chambers of both ends in order to free from atmospheric pressure changes. The cavity mirrors are mounted on the base plates made of stainless steel, of which separations are fixed by using two super-inver rod of 25 mm in diameter. The length of the base plate is decided so as to compensate the thermal expansion of the super-inver rod. Therefore, the cavity length should be kept constant ideally under the room temperature changes. The positions of mirror mounts is controlled by using stepping motor with the minimum step size of 0.01 μm , which enables us to control the beat frequency ($\Delta\omega=2\text{MHz}$) with an accuracy of ~ 10 kHz. All optical components are mounted on the optical bench (4500mm x 1500mm) floated on vibration isolation legs.

References

- 1) Kawahata, K., Hamada, Y., Fujita, J. and Okajima, S., Proc. 5th Int. Symp. on Laser-Aided Plasma Diagnostics (Bad-Honnef), (1991) 92.
- 2) Okajima, S., Kawahata, K., Naitou, Y., Ejiri, A., Hamada, Y. and Fujita, J., Proc. 17th Int. Conf. on Infrared and Millimeter Waves, Pasadena (1992) 366.

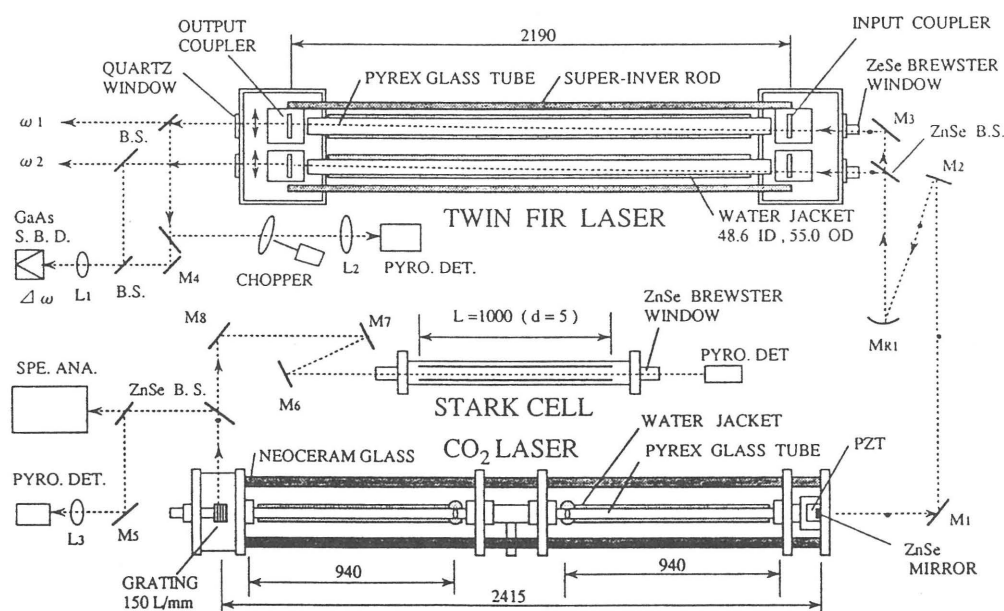


Fig. 1 Schematic drawing of twin FIR laser pumped by cw CO₂ laser.