§11. Measurements of Electron Density Fluctuations in CHS Plasmas by Using YAG Laser Imaging Method

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We have applied a novel technique of a YAG laser imaging method for obtaining information on electron density fluctuations, including the spatial distribution in CHS plasmas. We are evaluating the adaptability of this system to the CHS plasma, because we carried out the system setting and measurement in the initial stage in the plasma last fiscal year. Its evaluation is described here.

Figure 1 shows the optical system for CHS. The YAG laser (λ_i= 1.064 μm 1W) beam is transported by an SM optical fiber near the CHS plasma. A radiation beam from the SM fiber is expanded and collimated by a beam-expander and passes through the plasma. The probe beam is then transmitted through focusing and imaging lenses and a phase mirror, and received by a single or 16- fiber array connected to low noise detectors. The measurable frequency range determined by the frequency response of the detector was 2 kHz to 1 MHz. The measurable wavelength range determined by the beam width and number of detector channels was 2 mm to 47 mm. Further, the spatial resolution of about 20mm at k=1mm^{-1} around the plasma edge was estimated.

Fig.2 shows the relation between fluctuation intensity and the line density. The figure shows that the line density and fluctuation intensity were almost proportional, and the signal exceeded the noise level shown in the dotted line from about $n_eL=2 \times 10^{15}cm^{-2}$. We found that an improvement in the SNR of about 5 times was necessary, because the CHS operation is performed from about $n_eL=5 \times 10^{14}cm^{-2}$. The stabilizer for further noise reduction has been improved based on this result. In addition, the preparation of the position stabilization mechanism for decreasing minute vibration of the laser beam is continuing. These improvements will enable real measurements. We will measure the density fluctuations in relation to characteristics of the confinement in the next fiscal year.

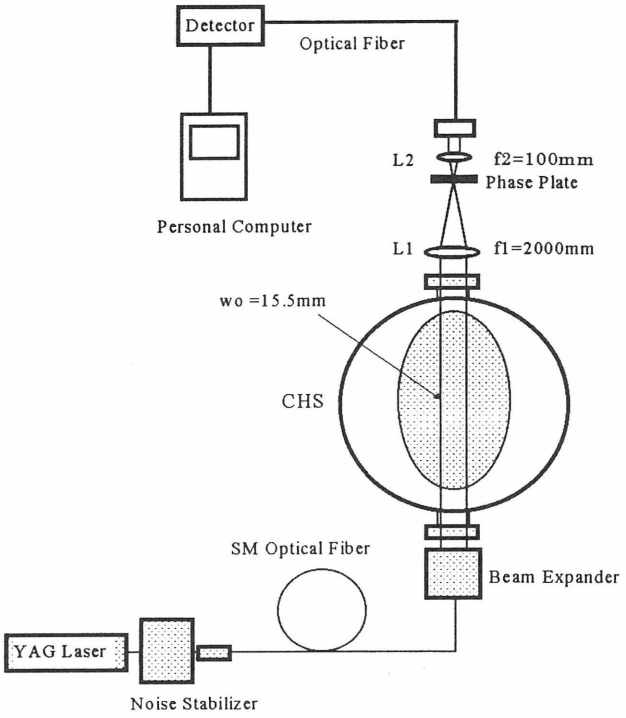

Fig.1 Laser Imaging System for CHS

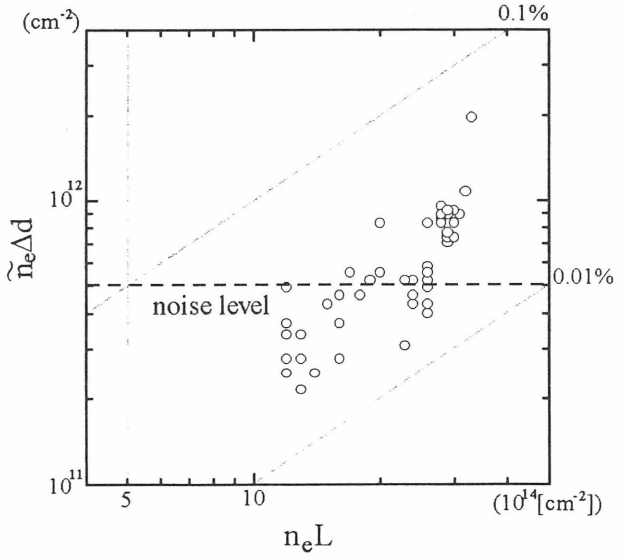

Fig.2 1 Fluctuation intensity as a function of line density.