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

Matsuo, K. (Fukuoka Institute of Technology),
Uchida, N. (Fukuoka Institute of Technology),
Kawakubo, M. (Fukuoka Institute of Technology),
Iguchi, H., Okamura, S., Matsuoka, K., Kado, S.
(The University of Tokyo)

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. A two dimensional image of the density fluctuations, which had not been measured until now, were measured in this fiscal year.

Figure 1 shows the optical system for CHS. The YAG laser ($\lambda_i$= 1.064 μm, 1.2 W) 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 along with a phase mirror, and then received by a one dimensional 16-fiber array connected to low noise detectors. In addition to the one dimensional spatial measurements made last year, a two dimensional spatial measurement at the detecting plane was performed by making the detector array to rotate shot by shot this fiscal year. The measurable frequency range determined by the frequency response of the detector was 20 kHz to 1 MHz. The measurable wavelength range determined by the beam width and number of detector channels was 2 mm to 47 mm. A spatial resolution of about 20 mm at k=1 $mm^{-1}$ around the plasma edge was estimated.

Plasma is initially produced and heated by ECH and further heated by NBI. The spectrum of the density fluctuation distributes broadly between 20 kHz - 300 kHz, and decreases as frequency increases. The data from the detector array was analyzed by the FFT to obtain the cross spectra C(x,y,f) and power spectra $S(k_x,k_y,f)$. Figure 2 shows an example of the 2D power spectra at f=29.5 kHz by the contour lines. There are some non-symmetrical peaks on the spectrum, which predicts that the propagation direction and position of the density fluctuations are no uniform. We plan to find the distribution of the density fluctuation by developing this analysis.

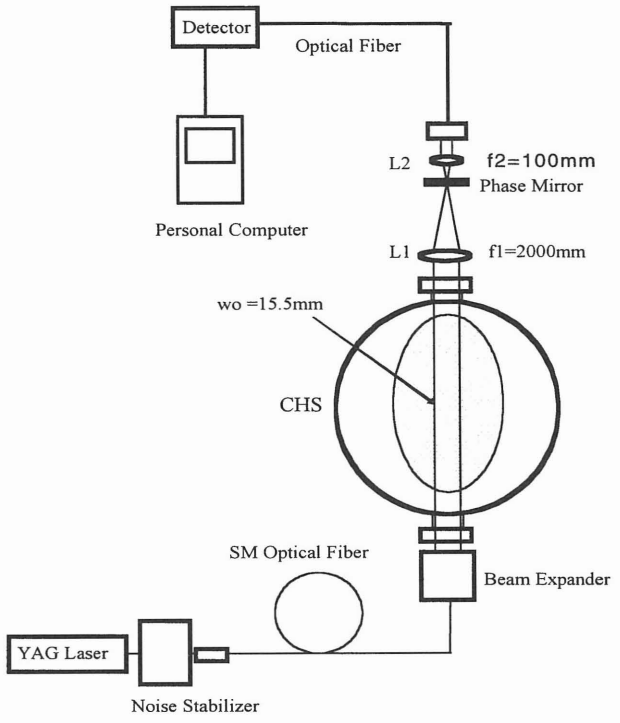


Fig. 1 Laser Imaging System for CHS.

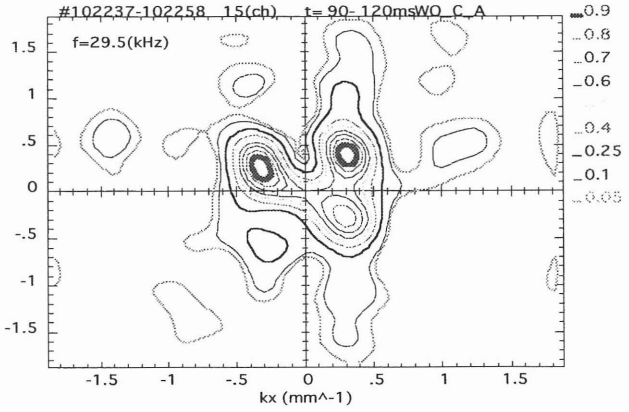


Fig. 2 An example of power spectra $S(k_x,k_y,f)$ at f=29.5kHz. The maximum and minimum values of the contour lines are different by 20 times. The vertical axis indicates the wavenumber $k_y$ (-1.88 ~ 1.88$mm^{-1}$) and the horizontal axis indicates the $k_x$ (-1.88~1.88$mm^{-1}$).