## §18. 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.

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. Two dimensional images of the density fluctuations 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 a 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, two-dimensional spatial measurements at the detecting plane were performed by making the detector array to rotate shot by shot under the condition of fixed operation to observe 2D image equivalently. The measurable frequency range determined by the frequency response of the detector is 20 kHz to 1 MHz. The measurable wavelength range determined by the beam width and number of detector channels is 2 mm to 47 mm.

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 the frequency increases. Figure 2 shows an example of a distribution of propagation direction of the fluctuations as a function of the frequency by the contour lines. 0 and 90 degrees show the components which propagate in major radius and toroidal directions, respectively. In this method spatial positions of the density fluctuations are required by the correspondence of observed propagation direction with direction of magnetic line of force, because the observed micro-turbulence generally propagates toward perpendicular direction to a magnetic filed. In Fig. 2, "+" means upper half region and "–" means lower half region along the probe beam path in the plasma cross

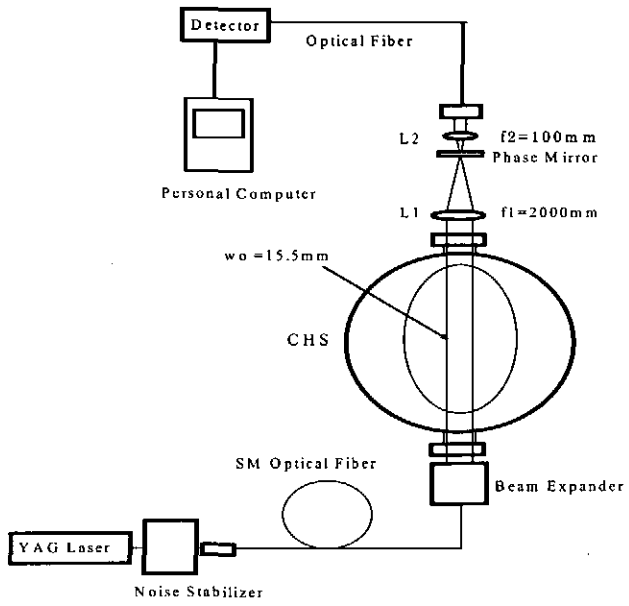


Fig. 1 Laser Imaging System for CHS.

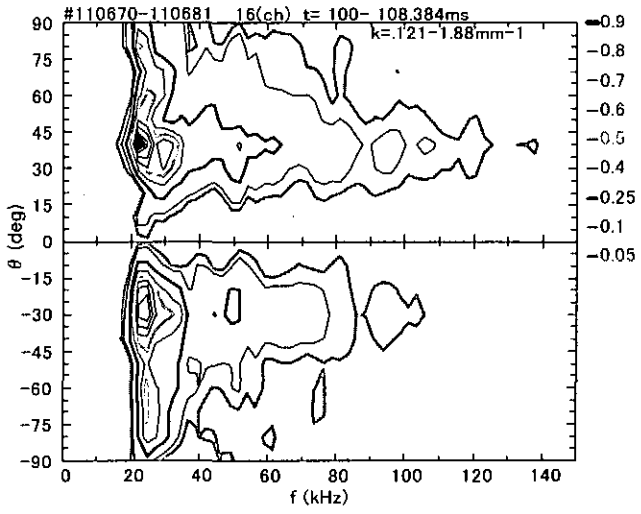


Fig. 2 An example of the distribution of the propagation direction as a function of the frequency.

section. The fluctuations are strong near +40 and -30 degrees. These angles are corresponding to normalized radius $\rho \sim 0.9$ when they are correspondent to the direction of magnetic lines of force of CHS.

By such original method, the data is going to be obtained on the spatial positions of the fluctuations in CHS.