§25. Measurements of Electron Density Fluctuation in CHS Plasmas by Using Laser Imaging Method

Matsuo, K. (Fukuoka Institute of Technology), Shouji, M. (Fukuoka Institute of Technology), Kado, S., Matsuoka, K., Tanaka, K.

We have applied a noble technique of a YAG laser imaging (LI) method for obtaining information on electron density fluctuations, including the spatial distribution in CHS plasmas. Until last fiscal year, the optical system was setup and the performance was evaluated. As a result, the required operation of the system was confirmed except for minimum detectable intensity. In this fiscal year, improvement of the system to increase mainly SNR was performed.

Figure 1 shows the optical system for CHS. 30 m YAG laser (λ_i= 1.064 μm 0.5W) beam is transported by an SM optical fiber near 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 transmitted through focusing (L1) and imaging (L2) lenses and a phase mirror, and received by a Si photo-diode connected to a low noise amplifier. The output power from the SM fiber was about 100 mW The beam width at the observing plane is 40 mm.

In this fiscal year, we have applied a noise stabilizer for decrement of the optical noise, which we developed, as a mean for improving the SNR of the system. The noise stabilizer is set at external of a laser cavity and reduces the optical noise within the laser beam by using optically negative feedback. As a result of applying the stabilizer, the noise level was reduced to 1/(2-3). SNR increased with the decrement of the noise, and the signals were observed in many operating condition of the high

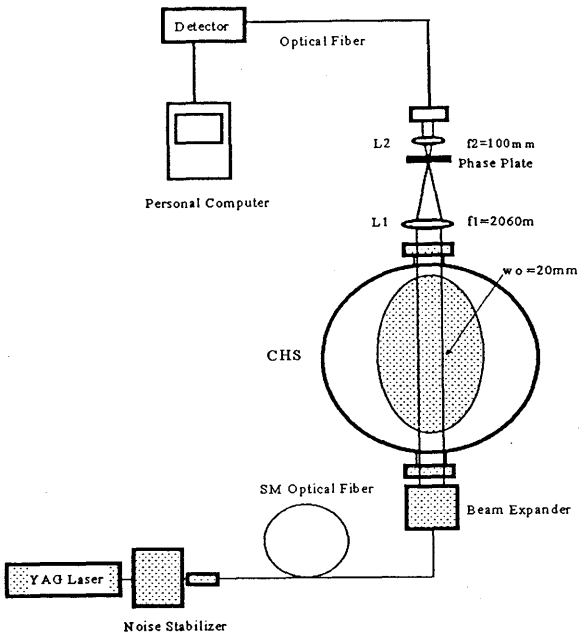

Fig.1 Laser Imaging System for CHS

density plasma. Fig.2 shows an example of time history of frequency spectra. Horizontal axis indicates the frequency, oblique axis indicates the time. Plasma was produced during t=5-165 ms and heated during 40-140 ms. Maximum average electron density is about 6 $\times 10^{19} m^{-3}$. The signal grew with increment of the density during NBI heating, and signal could be obtained with sufficiently large SNR.

By the further improvement of the system and an application of multi-channel detectors , we will measure the density fluctuations in relation to characteristics of the confinement in the next fiscal year.

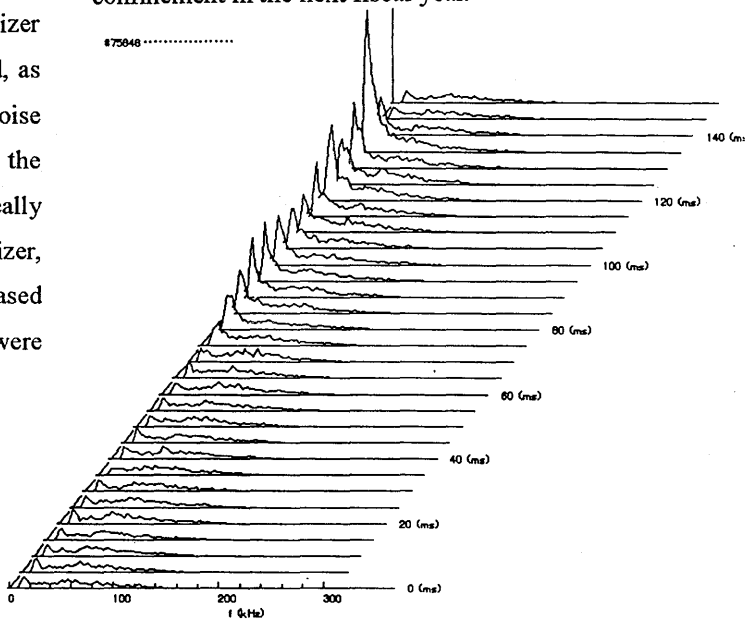

Fig.2 Time history of the LI frequency spectra.