§3. Thomson Scattering Measurement with Six Channel Wavelength Polychromator for ECH Plasma with Internal Transport Barrier on CHS

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High temperature electrons are confined in the inside region of internal transpot barrier (ITB) of ECH plasma on CHS (HET mode) [1]. There is a problem whether the measured electron temperature is affected by the tail component of the electron or not. If the measured temperature is affected by the high energy electron, the temperature of the bulk electron is lower than the measured temperature. Because our Thomson scattering system has normally three wave length channels [2], additional channels are needed to estimate the effect of superthermal electron. However, it is not easy to modify the optical configuration of the polychromator. To solve this problem, we set a combination of center wavelength of the interference filter of polychromator to the following. (1) 570nm, 740nm, 1045nm, (2) 740nm, 840nm, 1045nm, (3) 940nm, 1000nm, 1045nm. The 1045 nm filters are used for the relative calibration of sensitivity for the three polychromators. Using these three polychromators, we can measure the Thomson scattering light at six kinds of center wavelength. The range of temperature which can be measured expands from 50 eV - 3 keV to 50 eV - 20 keV. On the other hand, spatial resolution is reduced to ~5 cm from ~1.5 cm, which is about half of radius of the inside region of ITB.

Fig. 1 shows Thomson scattering spectrum shape measured with the six channel polychromator. The horizontal axis indicates a square of wave length shift normalized by the YAG wave length, and the vertical axis indicates a logarithm of the intensity of the scattering light. If the measurement is affected by the high energy electrons, they have nonlinear relation, so that the Thomson scattering spectrum shape is not gaussian. Fig. 1 (a) shows the HET mode case. The Thomson scattering spectrum has linear relation within the ITB except the point of the largest shifted wavelength, so that the shape is almost gaussian. We conclude that the effect of tail electron to the calculated temperature is negligible.

The results of the six channel measurement also show that there is obvious difference of the gradient of the spectrum between the inside and the outside of the ITB as shown in Fig. 1 (a), while the difference is small in the case of L mode, as shown in Fig. 1 (b). The calculated temperature within ITB in the HET mode case is three times as large as that of the outside region near ITB, and is almost two times as large as that at the plasma center in the L mode case.

These clearly show the existence of the high temperature electrons within ITB.

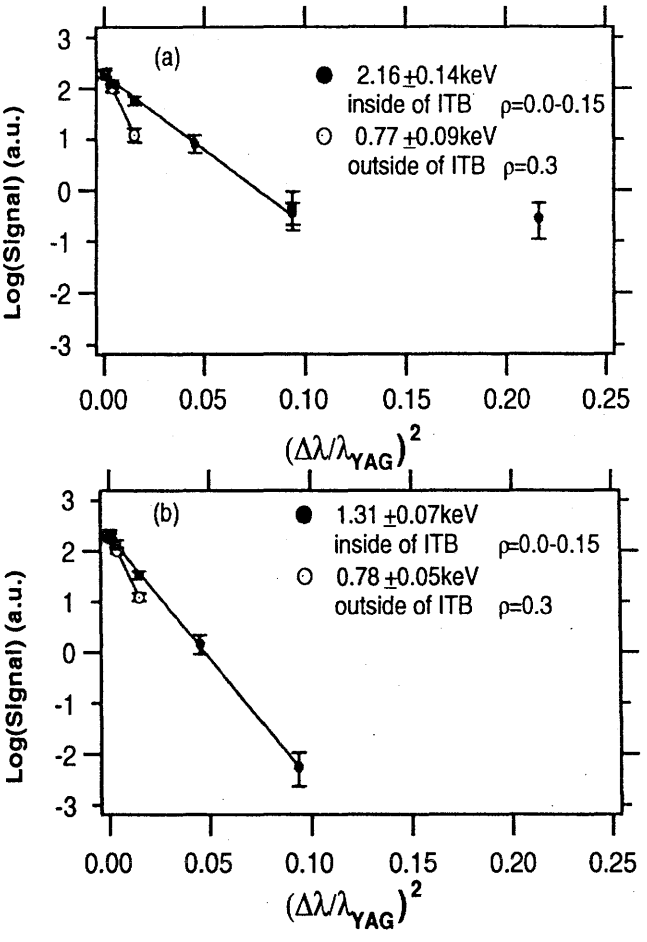

Fig.1 The Thomson scattering spectrum shape. (a) the injected power is ~200kW. Profile has ITB. (b) the injected power is ~150kW. Profile has no ITB. The horizontal axis indicates a square of wave length shift normalized by the YAG wave length, and the vertical axis indicates logarithm of the intensity of the scattering light.

References

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2) K.Narihara, et.al. Rev.Sci.Instrum. **66** (9) (1995)