§1. Calibration of the Light Collection Optics in the LHD Thomson Scattering System

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The original LHD Thomson scattering system has a backward scattering configuration in which the scattering angle is 167°. Recently we got the first experimental results by using the forward scattering configuration in which the scattering angle is 13 ° in addition to the backward scattering measurement. Since there are large discrepancies between Thomson scattering spectrum in the backward and forward scattering configurations, more careful calibration is required to obtain reliable data. Up to now, we didn't carried out the complete calibration of the light collection system because the wavelength dependence of it could be assumed to be almost flat from the catalogue data. However, the secular change may be expected to occur. Therefore, we experimentally measured the wavelength dependence of the light collection system.

The light collection system of the LHD Thomson scattering system consists an observation window, light collection mirror and optical fibers, as shown in Fig. 1. We measured the wavelength dependence of the whole transmittance at six spatial points by using a light source and spectrometer. The whole transmittance means the product of window transmittance, mirror reflectance and fiber transmittance. Figure 2 shows the result as well as the spectral response of a polychromator. The wavelength range observed by the polychromator is λ=690-1080 nm. The whole efficiency shows a weak wavelength dependence and observation position dependence. The later will be caused by the difference of geometrical factors. As a reference, the results of window transmittance, fiber transmittance, mirror reflectance and the product of them are shown in Fig. 3. They were individually measured two years ago. There is a difference between the present and previous measurements. In the previous measurement, geometrical factors were not taken into accounts. On the other hand, the geometrical factor is the completely same as the real configuration in the present measuremets. So, the present data will be more reliable. Finally a comparison of measured electron temperatures obtained from analysis with and without the correction factor obtained in the measurement is shown in Fig.4. A small systematic difference is seen. However, we think the present result is a preliminary one, and more careful measurement of the whole transmittance is planed to be carried out.

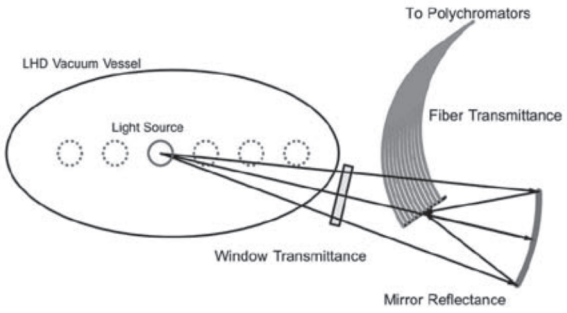

Fig. 1. Light collection system of the LHD Thomson scattering system.

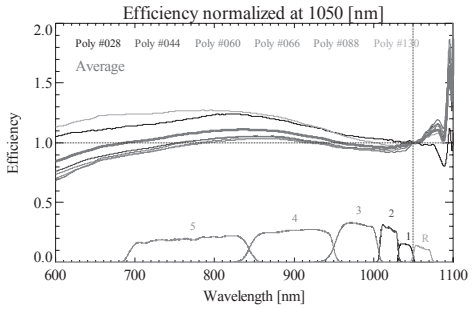

Fig. 2. Measured transmittance at six observation points. The thick curve shows the average of them.

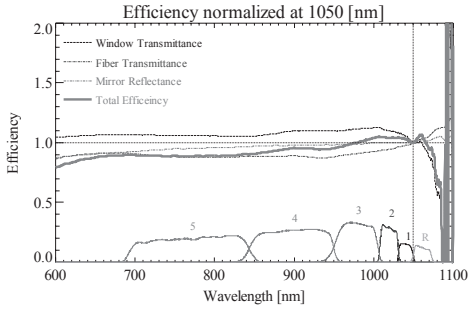

Fig. 3. Window transmittance, fiber transmittance, mirror reflectance, and the product of them

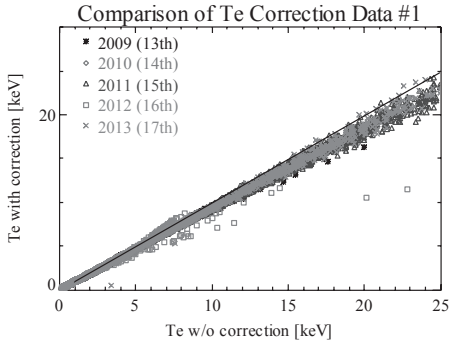

Fig. 4. Comparison of electron temperatures with and without correction factor. The data obtained in the high electron temperature experiments in the 13th-17th experiment campaigns are plotted.