§1. Absolute Electron Density Profile by the LHD Thomson Scattering System

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The LHD Thomson scattering system measures electron temperature and densities of LHD plasmas at 144 spatial points along the LHD major radius. The electron temperatures are determined from the estimation of the spectral shape of Thomson scattered light, and the densities are determined from the absolute measurement of Thomson scattered light intensity. We have carried out the absolute calibration of the LHD Thomson scattering system by using Rayleigh scattering in gaseous N_2, for which the fundamental scattering properties have been well established. We have also tried a similar calibration using Raman scattering in gaseous N_2, for which the physical properties have also well established. [1-3] When comparing the two calibration results, Rayleigh scattering calibration has been found to provide better results than Raman calibration in the LHD Thomson scattering system because the wavelength channel optimized for Rayleigh scattering calibration has been installed in all polychromators, whereas the spectral responses of our polychromators have not been optimized to Raman scattering wavelengths.

We have tried to analyze all Thomson scattering data obtained in the 18th LHD experiment campaign, and determine the absolute electron densities. In order to verify the accuracy and reliability of the absolute values, we compared the line-integrated electron densities calculated from the Thomson scattering data to those measured by the MMW interferometer. Since the LHD MMW interferometer measures line-integrated electron density along the LHD major radius at an LHD horizontally elongated section, the two line-integrated electron densities can be directly compared without any assumption. Figure 1 shows an example of the temporal history of the line-integrated electron densities by the Thomson scattering and MMW interferometer diagnostics. The two results show good agreements within the experimental errors. Figure 2 shows the comparison between the Thomson scattering data and MMW data obtained in the 18th LHD experiment campaign. Roughly speaking, they show good agreements throughout the 18th campaign. We are considering the disagreements seen in the Fig.2 are due to some reasons. First, it is not easy to accurately determine line density from Thomson scattering diagnostics. Next, it is also difficult to completely avid the fling jump effect in the MMW diagnostic.

Now we are preparing to provide reanalyzed absolute electron density data for the 18th LHD experiment campaign. It is noted again that the absolute density data are determined from the local measurements by the LHD Thomson scattering system without any assumption and the help of other diagnostics or calculations.

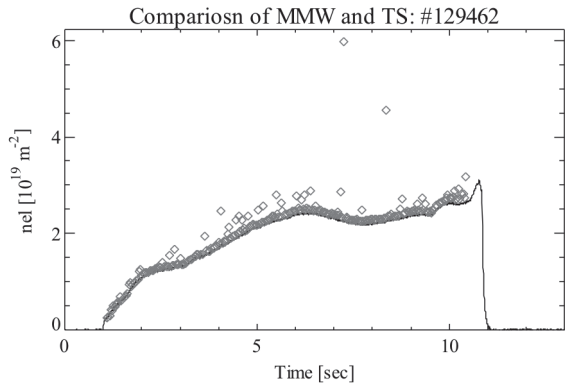

Fig. 1. Comparison of electron densities by the LHD Thomson scattering and MMW diagnostics.

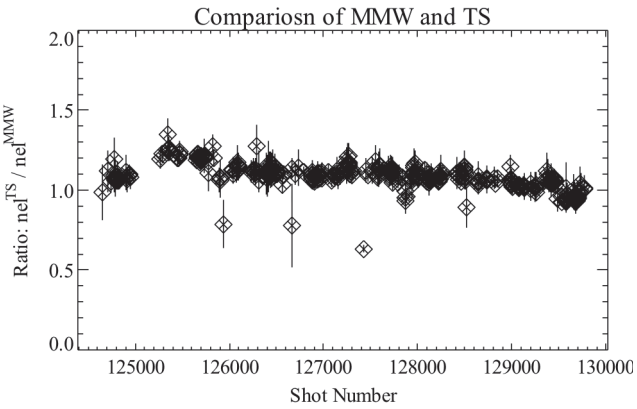

Fig. 2. Summary of the comparison of electron densities by the LHD Thomson scattering and MMW diagnostics in the 18th LHD campaign.

[1] I. Yamada *et al.*, Rev. Sci. Instrum., 74, No.3, 1675 (2003).
[2] I. Yamada *et al.*, Plasma Fusion Res., 2, S1106 (2007).
[3] I. Yamada *et al.*, NIFS Ann. Rep. 2006-2007, 141, (2007).