Density Correction Method Using a Beam Image Position Monitor in the LHD Thomson Scattering System

Ichihiro Yamada, Ryo Yasuhara, Hisamichi Funaba and Hiroshi Hayashi
National Institute for Fusion Science, 322-6 Oroshi, Toki, 509-5292, Japan

Thomson scattering diagnostic system is one of the key diagnostic systems in laboratory plasma researches. The LHD Thomson scattering system measures electron temperatures and densities of LHD plasmas at 144 spatial points along the LHD major radius [1]. In general, electron temperatures are determined from relative measurements of Thomson spectrum. On the other hand, electron densities are obtained from absolute measurements of Thomson scattered light. So, careful treatments are required to accurately determine densities. In the LHD Thomson scattering system, large errors in measured electron densities are seen occasionally due to misalignments of laser beam and/or light collection optics. We proposed a few techniques to fix the problem [1][2][3]. In this paper, we propose new method to fix the problem.

The method is based on the similar concept proposed by the JAEA Thomson scattering diagnostic team [4]. In our LHD Thomson scattering system, two couples of pair fibers are used as an image position monitor system. In our case, half right and left areas are masked in two neighboring fibers respectively. When beam image is located at the center of fibers, signal intensities from the two fibers will be the same. If the image position is shifted to the right, signal intensity from the fiber of which the left side is masked will be higher than that from the fiber of which the right side is masked. Therefore, image position is estimated from the intensity ratio measured by the two fibers. Then, the light loss due to misalignment is estimated from the beam position information for more accurate electron density measurements. In the conference, we will present the image position monitor system and some result of the system calibration.

This work was supported by the NIFS LHD project budgets (NIFS12ULHH005 and NIFS13ULHH005) and JSPS KAKENHI Grant Number 25289341.

[1] I. Yamada *et al.*, Fusion Sci. Tech., **58**, 345 (2010).
[2] I. Yamada *et al.*, Rev. Sci. Instrum., **72**, 1126 (2001).
[3] I. Yamada *et al.*, Plasma Fusion Res. Ser., **8**, 670 (2009).
[4] H. Yoshida *et al.*, Rev. Sci. Instrum., **68**, 1152 (1997).