Improvement of dual-path multi-pass Thomson scattering system in GAMMA 10/PDX

M. Yoshikawa[1*], K. Yoshida[1], K. Kudo[1], J. Kohagura[1], Y. Shima[1], Y. Nakashima[1], N. Ezumi[1], R. Minami[1], T. Minami[1], R. Yasuhara[2], I. Yamada[2], H. Funaba[2], N. Kenmochi[2], H. van der Meiden[4], M. Sakamoto[1]

[1]Plasma Research Center, University of Tsukuba, Tsukuba 305-8577, Japan

[2]National Institute for Fusion Science, National Institutes of Natural Sciences, Toki, 509-5292, Japan

[3]IAE, Kyoto University, Uji 611-0011, Japan

[4]DIFFER, Eindhoven, Netherlands

The dual-path multi-pass Thomson scattering system (DMTS) has been developed for observing electron temperatures and densities in both the central and end regions of GAMMA 10/PDX. GAMMA 10/PDX is the largest tandem mirror device, comprising a central cell (main confinement region), MHD-sustained anchor cells, plug and barrier cells, and an end region dedicated to divertor simulation experiments. Typical plasma parameters before radiator gas injection in divertor simulation experimental module for divertor simulation experiments are electron temperature Te = 40 eV, electron density ne = 2×10^{18} m^{-3}, and ion temperature Ti = 1 keV in the central cell; and Te = 40 eV, ne = 1×10^{17} m^{-3}, and Ti = 100 eV in the end cell.

The DMTS consists of a central cell Thomson scattering system (C-TS) and an end cell Thomson scattering system (E-TS). The C-TS utilizes a YAG laser and a multi-pass system with laser amplification. We refined the multi-pass system by repositioning the Pockels cell within the laser beam path, effectively extending the duration of the multi-pass signals. In the E-TS system, we added new laser beam apertures, reducing stray light intensity to 1 % of its original level.

We are applying this new DMTS to observe high-density plasma experiments with SMBI in the central cell and to investigate detached plasma experiments. We successfully obtained the behavior of detached simulation plasma under higher density injection conditions.

This study was conducted with the support and under the auspices of the NIFS Collaborative Research Program (NIFS11KUGM056) and the Bidirectional Collaboration Research Programs (NIFS14KUGM086, NIFS14KUGM088).