Fluctuation observation by the microwave imaging reflectometry in LHD

T. Yoshinaga, D. Kuwahara[a], Y. Nagayama, Z. B. Shi [b], S. Yamaguchi [c],
Y. Kogi [d] and A. Mase [d]

National Institute for Fusion Science, 322-6 Oroshi-cho, Toki 509-5292, Japan
[a] Tokyo Institute of Technology, 2-12-1 Ohokayama, Meguro-ku 152-8550, Japan
[b] SOKENDAI, 322-6 Oroshi-cho, Toki 509-5292, Japan
[c] Kansai University, 3-3-35 Yamate-cho, Suita 564-8680, Japan
[d] KASTEC, Kyushu University, 6-1 Kasuga Koen, Kasuga 816-8580, Japan

yoshinaga.tomokazu@LHD.nifs.ac.jp

The microwave imaging reflectometry (MIR) is under development in the Large Helical Device (LHD) in order to obtain the 2-D/3-D image of the electron density fluctuation. Present system is a prototype of MIR, as it has 3 horn antennas and 3 frequencies (54, 66, 69 GHz). From the phase difference between poloidally separated two antennas, the poloidal mode number can be determined. We develop 1-D V-band (50-75 GHz) detector array using horn antenna. By stacking this 1-D array, we made a 2-D array (5 in toroidal and 8 in toroidal directions). We also develop a tunable V-band microwave source, a 110 MHz intermediate frequency (IF) system and a phase detection system. A new system which uses these new components is under development. This new system will be attached to LHD in order to observe turbulence and instabilities. In this paper, we will present experimental results on the MIR experiment in LHD. By using the prototype of MIR, we have observed the high frequency mode in the core plasma and the low frequency mode with multi harmonics in the edge plasma in LHD. The base frequency of the multi-harmonics mode in edge plasma is a few kHz, and the frequency looks proportional to the ion temperature. This mode is localized near the iota = 1 and/or the iota = 4/3 surfaces. The frequency of the high frequency mode is a few 10 kHz, and the frequency is changing during the discharge. These modes are observed in the plasma with high power heating in LHD. These MHD modes may be important, as these MHD modes may enhance the particle transport. In the MIR experiment in TPE-RX RFP device, we found that the phase is very sensitive to turbulence. A new system in LHD is expected to reveal turbulence in helical plasma. This work is supported by the National Institute for Fusion Science (Grant No. NIFS07ULPP525) and the National Institute of Natural Sciences (Grant No. NIFS07KEIN0021).