The electron density and temperature profile measurements on the TST-2 spherical tokamak

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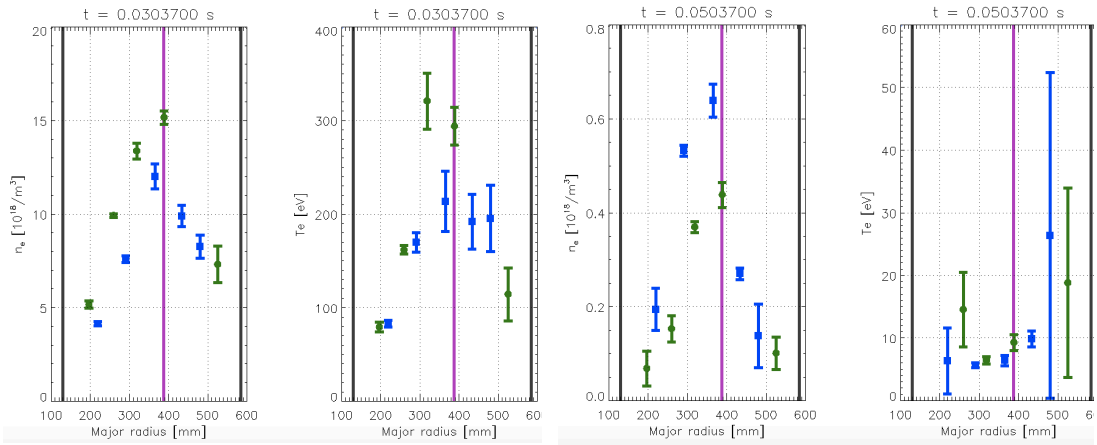
The Thomson Scattering (TS) measurement system on the TST-2 spherical tokamak device consists of a high energy laser (YAG laser), a light propagation and collection system, five polychromators, and a data acquisition system. An infrared YAG laser with the wavelength of 1064 nm and the pulse duration of about 10 ns is used as the incident light. Fifteen spatial measurement points along the major radius R = 197 – 564 mm are available, and five spatial points can be measured simultaneously. Each polychromator has six sets of an interference filter and an avalanche photodiode, and a pre-amplifier to measure six wavelength bands. The six wavelength signals are fitted to a Maxwellian distribution function to obtain an electron temperature and an electron density.

In TST-2, we can generate two types of discharges: OH (ohmic heated) and LHW (lower hybrid wave driven) plasmas, and the radical TS measurement positions are set as follows: SET X (R = 220, 291, 366, 434, and 481 mm) and SET Y (R = 197, 260, 319, 389, and 526 mm). The typical central temperature and density are about 200 eV and 10^{19} m^{-3} for OH plasmas with a typical plasma current of 100 kA, and both temperature and density profiles have a peak near the center (Fig. 1(a)). Figure 1(b) shows the electron temperature and density profiles of an LHW plasma with a plasma current of 20 kA. The typical central temperature and density are 10 eV and several times 10^{17} m^{-3}, respectively.

The electron temperature and density profiles are the input data for the calculation of wave propagation and absorption, as well as to calculate the time evolution of velocity distribution function of electrons. Comparison of the simulation results with the experimental results for various cases is important to understand and to optimize the LHW current drive. Therefore, we are going to accumulating TS data for various cases.



(a) OH plasma (b) LHW plasma

Figure 1. Electron temperature, density profiles for an OH plasma (a) and an LHW plasma (b).
(Blue and green color dot represents SETX and SET Y respectively)