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ヘリオトロンJにおけるECHプラズマでの粒子輸送特性
Particle Transport Characteristics in Heliotron J ECH plasmas

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Particle transport analysis is one of the important issues in the magnetically confined plasma research. The goal of this study is to reveal the contributions of the particle transport to the optimization of the magnetic configurations in helical devices. Density modulation experiments by using gas-puffing (GP) have been carried out to evaluate the particle transport coefficients in the core region, that is, the diffusion coefficient, D_{core}, and the convection velocity, V_{core}, in Heliotron J ECH plasmas with the standard magnetic configuration.

The experiments have been carried out in two line-averaged density ($\bar{n}_e$) conditions, 0.6 or 0.9 × 10^{19} m^{-3}. Figure 1 shows the time evolutions of $\bar{n}_e$, the stored energy W_p and GP control signal at the lower $\bar{n}_e$. Electron densities are modulated with the width of 0.1 × 10^{19} m^{-3} in 50 Hz under both conditions. Electron density (n_e) profile measurement is required to analyze particle transport. For this purpose, the n_e profile was measured with an amplitude modulation (AM) reflectometer [1].

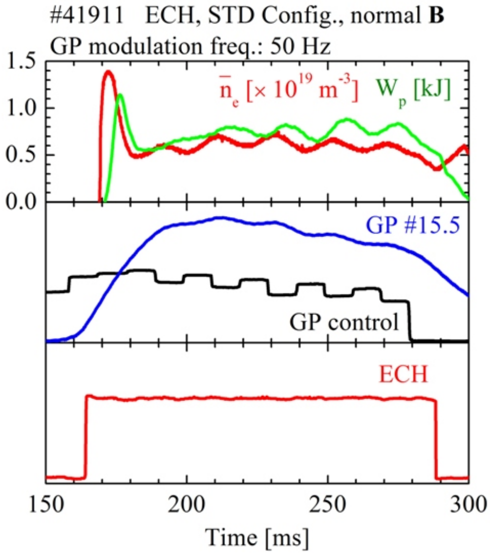

Fig. 1 Time evolutions of $\bar{n}_e$, W_p and GP control signal

In this study, D_{core} is assumed constant in the region of $0 \le \rho \le 0.6$ and V_{core} is assumed a linear function of the minor radius in the same region and is zero on the magnetic axis (ρV_{core}). These coefficients are determined by minimizing an evaluation parameter, χ^2 [2, 3]. As the result, (D_{core}, V_{core}) = (5.2 m^2/s, 59 m/s) are obtained at a low $\bar{n}_e$ and (D_{core}, V_{core}) = (2.3 m^2/s, 2.3m/s) are obtained at a high $\bar{n}_e$ for the standard configuration as shown in Figure 2. V_{core} are positive at both densities and is larger at the low density. These imply that the outward convective term plays an important role to determine the particle transport in ECH plasmas, especially in the low-density region. In this presentation, the dependence of the transport characteristics on the magnetic configurations will be discussed.

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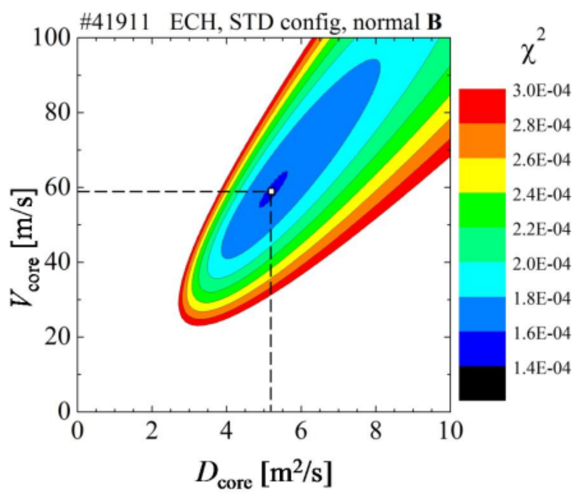

Fig. 2 χ^2 profile ($\bar{n}_e$ = 0.6 × 10^{19} m^{-3})