23P-3F-04

Improvement of Energy confinement with HIGP in Heliotron J

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The improvement of energy confinement has been observed in medium-density (n_e= 2-4×10^{19} m^{-3}) plasmas fueled by HIGP (high intensity gas puffing) in Heliotron J. Compared with a normal (continuous) gas puffing method, while the average electron density remains the same, a peaking of electron density profile is achieved during the HIGP phase. Fig. 1 shows the electron temperature profile when $T_e(0)$ are maximum in both cases, where the core electron temperature reaches 350eV compared to 250eV in the non-HIGP case. Fig. 2 shows the corresponding density profile. The density gradient around r/a=0.5 is much higher in the HIGP case, while that around the magnetic axis is flat for both cases.

The normalized scale length of electron density is calculated around r/a=0.5, indicating a simultaneous increase of both density peakedness and the core electron temperature after HIGP. Fig. 3 shows the relation between the core electron temperature and the normalized density scale length at r/a=0.5. Compared with the non-HIPG case, the core electron temperature rises significantly, together with a clear increase of a/L_n which represent the density peakedness when HIGP is performed. This indicates that the core electron temperature depends on the electron density scale length at the middle radius. The NBI absorption profile calculation is underway to estimate the heat transport coefficient and confirm the improvement of energy confinement.

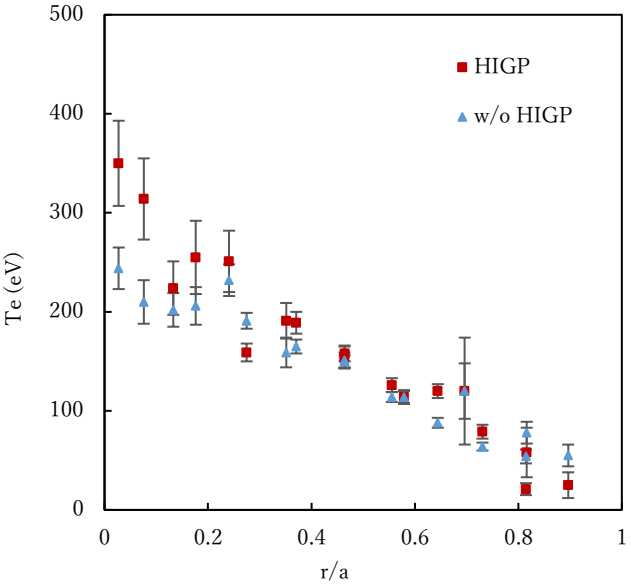

Fig. 1 Electron temperature profile with and w/o HIGP

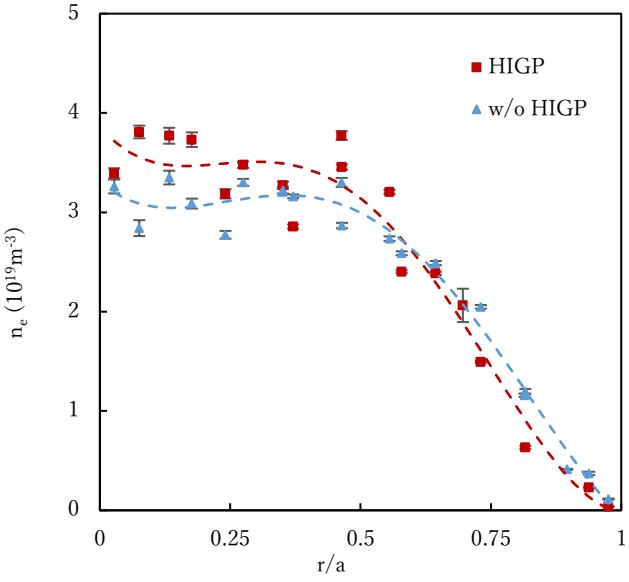

Fig. 2 Electron density profile with and w/o HIGP

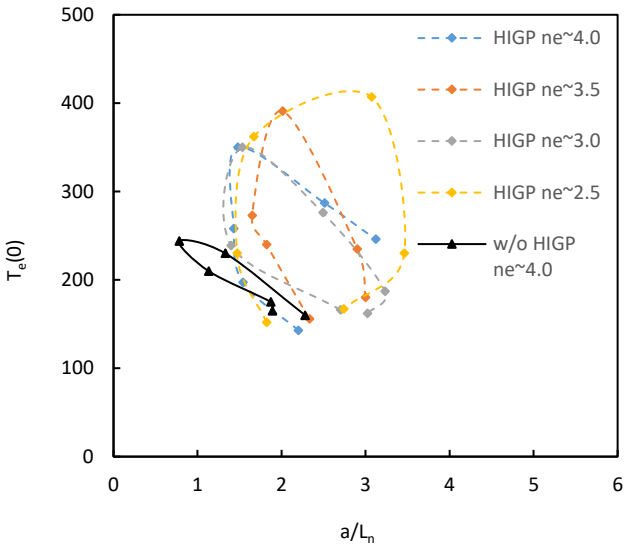

Fig. 3 Relation between normalized n_e scale length and core T_e