

§12. Further Extension of High-Ion-Temperature Regime in LHD

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The high-ion-temperature regime has been further extended in the 11th experimental campaign (FY 2007) in the LHD beyond that achieved in the previous year¹⁾.

The more peaked profile of ion temperature (T_i) with a steep gradient has been formed in the core region and the central T_i of 6.8keV has been achieved in hydrogen-main plasma with the electron density of about $2 \times 10^{19} \text{ m}^{-3}$ (Fig.1).

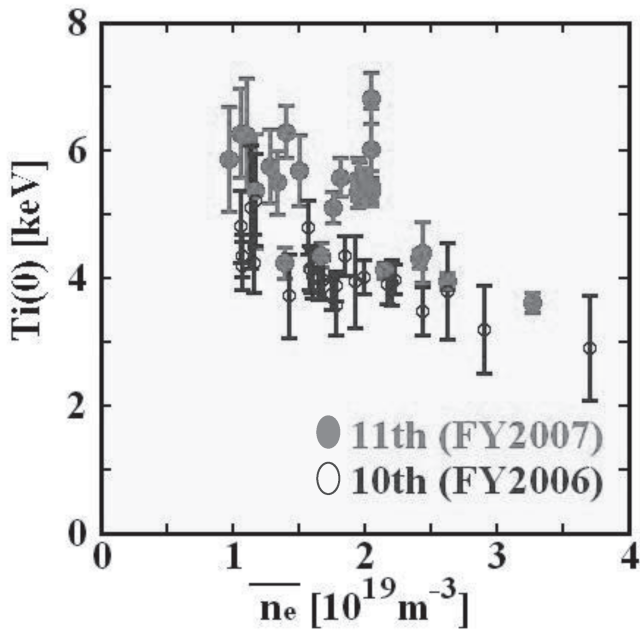


Fig.1 T_i at the plasma center (measured by charge exchange spectroscopy, CXS) as a function of line-averaged density. The closed circles are data obtained in 11th campaign (FY 2007) and open one in 10th campaign (FY 2006).

The effective increase of the injection power from the perpendicular NBI (#4) through the increase of the duration (CXS measurement requires the modulation of #4 injection to acquire the background signals) works to extend the record- T_i value. Bundling the CXS fibers to

overcome the difficulty in measuring T_i in “impurity hole” situations which had been recognized in 10th campaign²⁾, could also extend the measurable T_i values.

Increased capabilities of both the heating and the diagnostic successfully extend the ion-temperature regime.

The observation of the spontaneous toroidal rotation has been also accumulated, which indicates that the co-directed spontaneous contribution seems to exist as the T_i -gradient becomes larger as shown in Fig. 2 (seen around $R \sim 4.2 \text{ m}$), which is not observed in a low- T_i case as shown in a box.

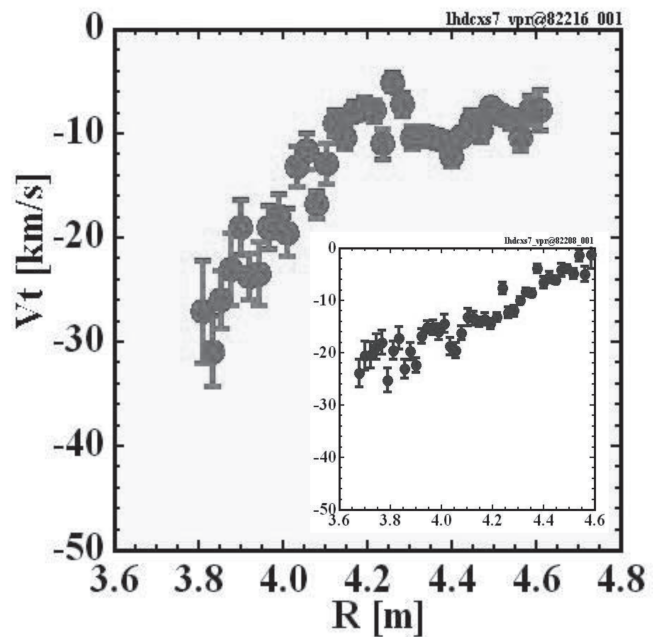


Fig.2 The toroidal rotation profile measured by CXS in a case with an enhanced T_i -gradient (higher- T_i case). Comparably, that in a low- T_i case is shown in a box.

Systematic experimental and theoretical studies are anticipated to extend the parameter regime of higher- T_i plasmas in LHD, and it also enhances the opportunities of the comprehensive confinement study of helical plasmas towards reactor-relevant regime.

1) M.Yokoyama, N.Nagaoka et al., Phys. Plasma, 15 (2008) 056111.

2) M.Yoshinuma et al., Stellarator News, Issue 111, Oct. 2007. (<http://www.ornl.gov/sci/fed/stelnews>)