(SG2) Tronsport and Confinement Report

Jun. 6, 2024 (A. Shimizu)

Date: Jun. 5, 2024
Time: 13:39 - 14:39
Shot#: #192646 – #192689 (44 shots)

Prior wall conditioning: H
Divertor pump: YES
Gas puff: H2
IPD: OFF
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(4.4, 4.1, 4.3, 3.3, 2.6)MW

ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(698, 380)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(705, 806, 982)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.0, 0.0, 0.0, 0.0)MW

Topics

1. The study of the density dependence of ion transport in LHD for ITER operation (Ko. Won-Ha, K. Ida, M. Yoshinuma)
2. Real-time plasma control under low-turbulence conditions focusing on turbulent transition (T. Kinoshita, K. Tanaka)

Real-time plasma control under low-turbulence conditions focusing on turbulent transition

T. Kinoshita(Kyushu Univ.), Y. Morishita(Kyoto Univ.), N. Kenmochi,
H. Funaba, K. Tanaka, H. Sakai (Kyushu Univ.)

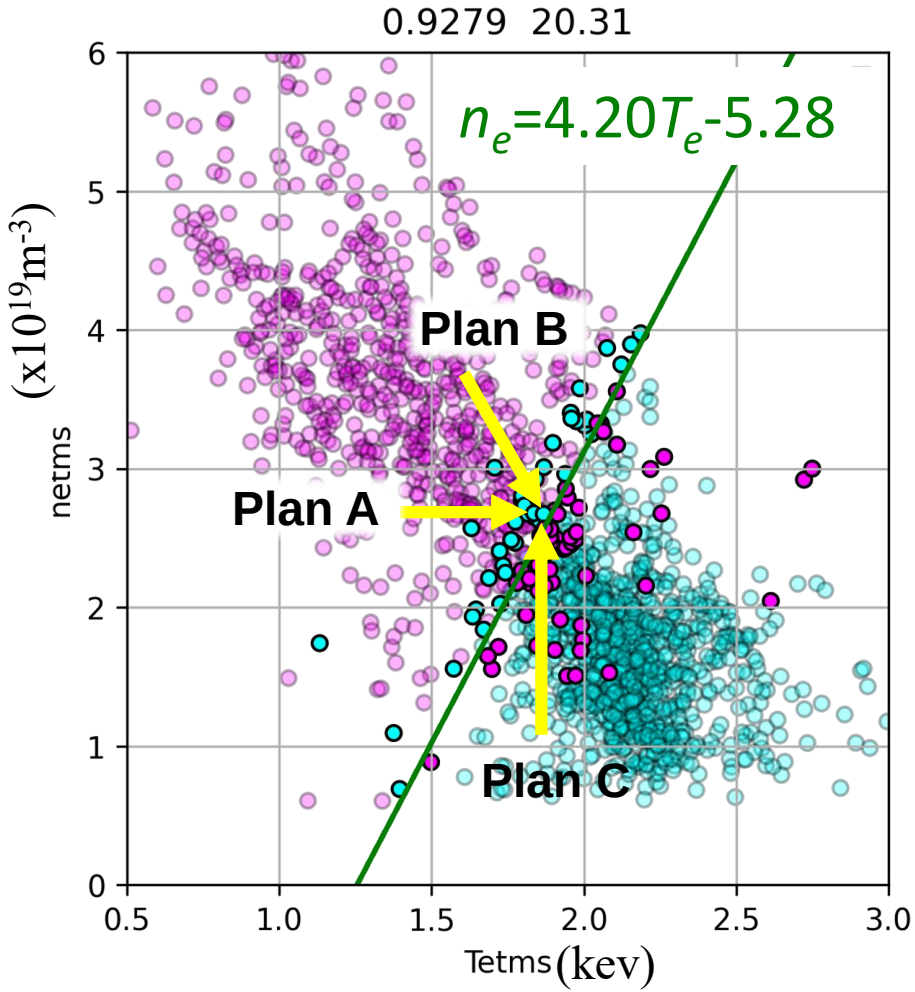
Shot No: #192646~192665 (20shots)
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.2538, 100 %)
Gas-puff: H

Background & Motivation

A turbulence and its driven anomalous transport are minimized when the dominate turbulence mode changes in LHD. The condition of turbulence transition is expressed by n_e=4.20T_e-5.28. The final target of this study is to realize a low-turbulence plasma by real-time plasma control.

Control plans

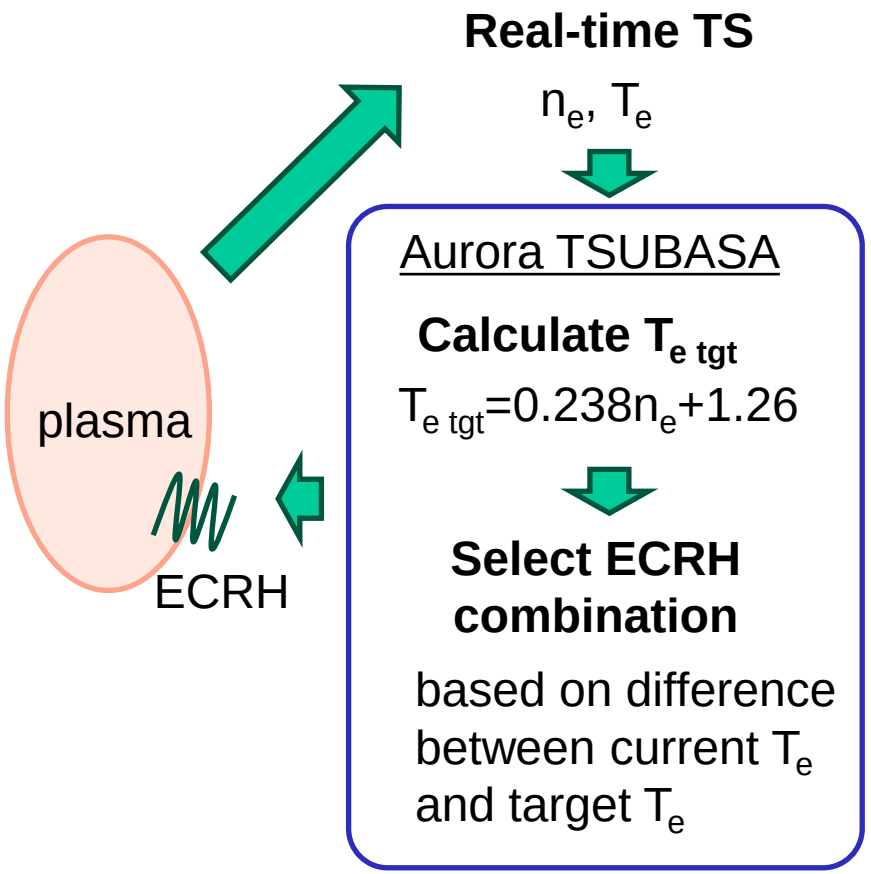
Plan A: Temperature control by ECRH under constant density conditions
Plan B: Density control by gas-puff under constant heating conditions
Plan C: Density control by gas-puff under constant temperature conditions



Real-time plasma control under low-turbulence conditions focusing on turbulent transition

Detail of plan A

Temperature control by ECRH under constant density conditions



Results

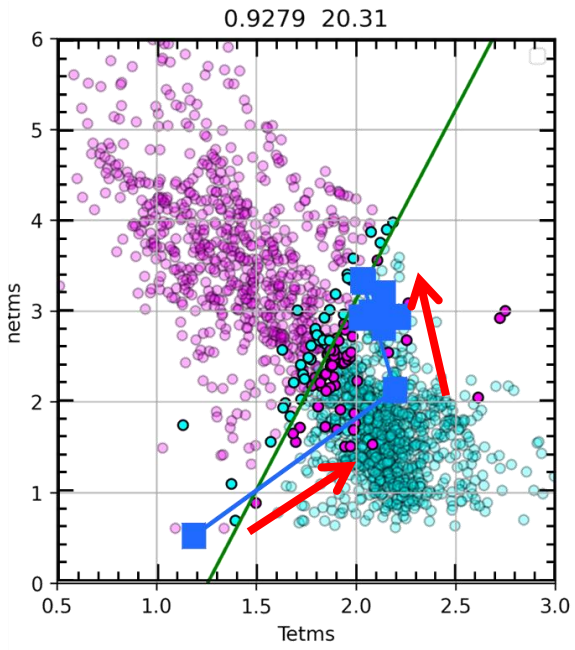
・Checked the control system for Plans A-C. Plans A and B worked well.

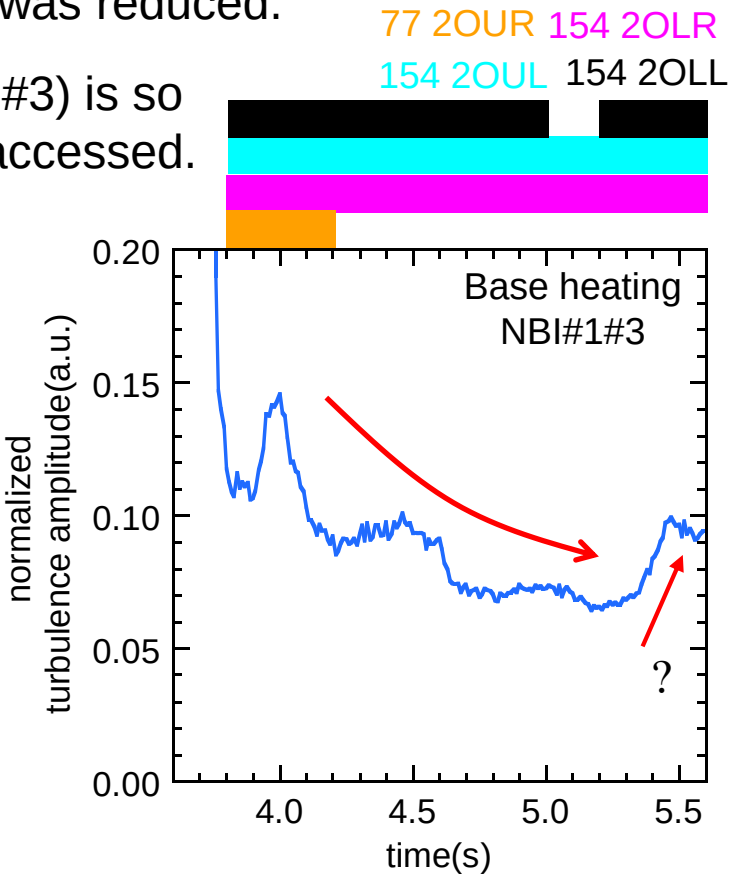
・Plan C will be reconfirmed for the system.

Typical result of Plan A

・The plasma was operated to satisfy the TT conditions, and at the same time turbulence was reduced.

・The base heating power (NBI#1#3) is so large that Te<2kev could not be accessed.





The study of the density dependence of ion transport in LHD for ITER operation

Won-Ha Ko, Jekil Lee(KFE), K. Ida and M. Yoshinuma(NIFS)

Experiments : #192676 ~ #192689

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CW, 2.7887 T, 1.2538, 100.0%)

Objective and background:

- We would like to search T_i changes as P_{NBI} increases in high-ne ECH-driven L-mode plasma in order to find how to increase Ti in ITER operation.
- The ion transport will give clue by P_{NBI} scan in high density ($5x10^{19}m^{-3}$) plasma sustained by ECH heating.

Results:

- T_i saturated when P_{NBI} is more than 14MW and **no matter how high the beam power is, T_i/T_e ratio is constant** at high-ne ($5x10^{19}m^{-3}$) and fixed ECH power (2.8 MW).
- The ion transport effect at high density is very low since the T_i/T_e ratio is almost constant at even high densities of 5 x 10^{19} m^{-3} or higher.