(TC) Transport and Confinement Report

May 9, 2024 (M. Nishiura)

Date: May 8, 2024
Time: 10:25 - 16:45
Shot#: 190685 – 1190796 (107 shots)

Prior wall conditioning: He GD
Divertor pump: OFF
Gas puff: H2, CH4
Pellet: YES
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.3, 3.6, 4.1, 3.8, 3.4)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, 889, 982)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(-, -, -, -)MW

Topics

1. CHARACTERIZATION AND MODELLING OF THE PARALLEL DYNAMICS OF IMPURITY IONS(J. R. Villén, M. Yoshinuma, N. Tamura)
2. Understanding Turbulence Suppression Mechanisms in Boron-IPD Experiments(T. Kinoshita(Kyushu Univ.), K. Tanaka, H. Sakai (Kyushu Univ.))
3. Density limit in relation to edge turbulence(G. Motojima, T. Morisaki, R. Kanno)

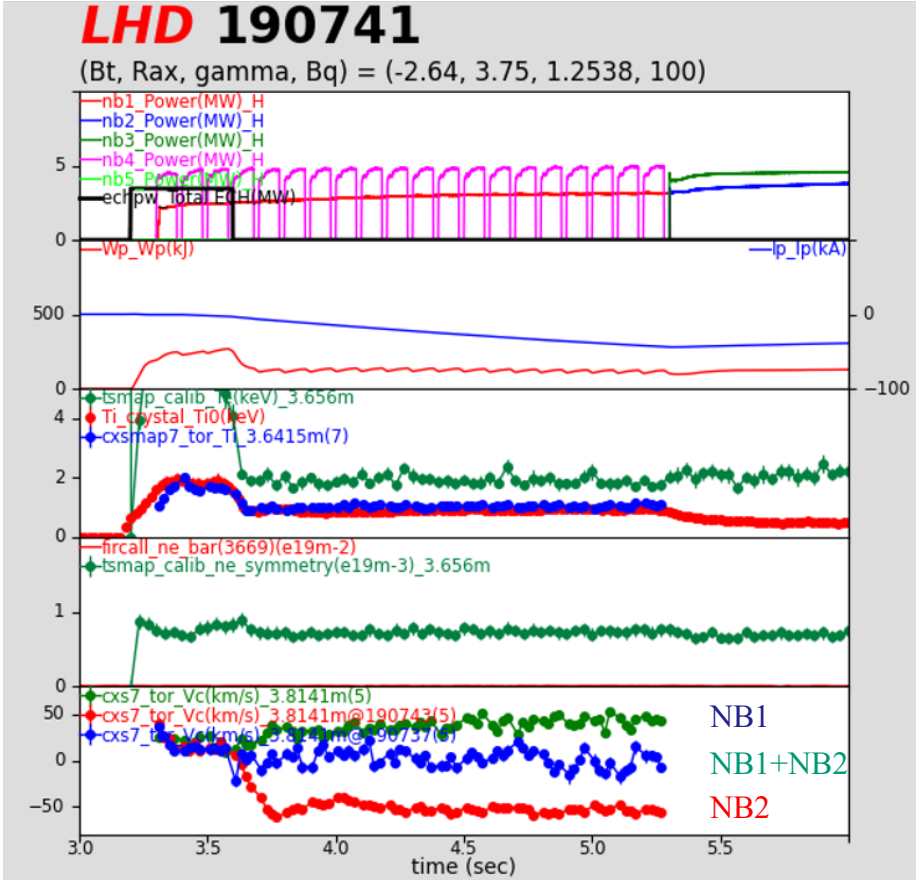
CHARACTERIZATION AND MODELLING OF THE PARALLEL DYNAMICS OF IMPURITY IONS

(J. R. Villén, M. Yoshinuma, N. Tamura)

Purpose: Study the transmission of momentum to the plasma produced by the NBI and other possible effects on the flow of impurities in CCW configurations by measuring parallel ion flows and radial electric fields using CXS technique.

Experiment:

- Shots: [190685 – 190704] & [190736 – 190754]
- Magnetic configuration in CCW:
  1)Rax =3.55 m, Bax=-2.7887T, g=1.2538,Bq=100.0%
  2)Rax =3.75 m, Bax=-2.64T, g=1.2538, Bq=100.0%
- NBI#1 and NBI#2 power varied for parallel an antiparallel injections experiment.
- NBI#5 power varied for perpendicular injections experiment.



Results:

- Plasmas with different NBI inyections and densities for two configurations were produced successfully.
- Velocity and Er profiles obtained by CXS will be analyzed.

Future work: Comparison with previous experiments in LHD (CW configurations). Parallel experiments have been performed in W7-X and TJ-II to compare results in different device.

Understanding Turbulence Suppression Mechanisms in Boron-IPD Experiments

T. Kinoshita(Kyushu Univ.), K. Tanaka, H. Sakai (Kyushu Univ.)

Shot No: #190707~190732　(26shots)
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100 %)
Gas-puff: H

Background & Motivation

An improved confinement has been observed in Boron-Impurity Powder Dropper (IPD) experiments. At the same time, a reduced ion-scale density fluctuation was observed, suggesting that it contributed to the improved confinement. However, there are not clear that the confinement improvement is due to wall recycling or change of plasma parameters.

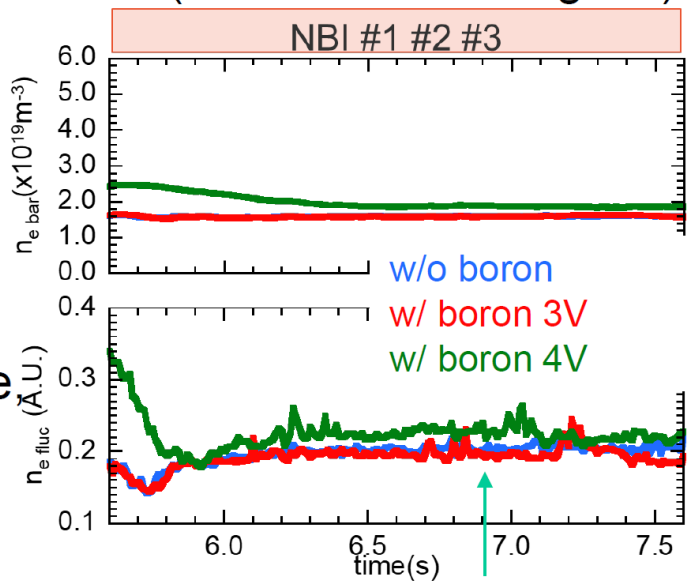
Results

・Density and boron content varied.
・Different effects of boron in different density regimes (dominant turbulence) were observed.

Future plan

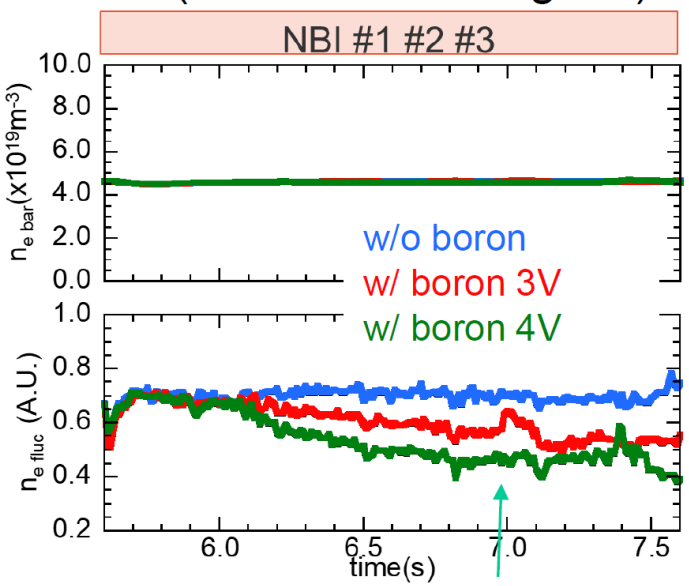
・Check profiles for turbulence, temperature, density, etc.
・Aiming to understand the physical mechanisms of boron effects.

low-density
(ITG dominated regime)



No difference

high-density
(RI dominated regime)



Suppressed as boron increases

Density limit in relation to edge turbulence

G. Motojima, T. Morisaki, R. Kanno

- ✓ Experimental conditions:
  - #190757-190776: R_{ax}=3.75m, B=-2.64T, γ=1.254, B_q=100%
  - #190777-190796: R_{ax}=3.75m, B=-1.375T, γ =1.254, B_q=100%
- ✓ Motivation
  - ❖ To understand the **behavior of edge turbulence at density collapse event**.
- ✓ Experiments
  - ❖ The edge temperature gradient (ρ ~ 1) was changed using LID coil.
  - ❖ The density limit was **investigated by flattening the electron temperature of edge plasma by LID (6O-extend).**
- ✓ Results
  - ❖ **Many collapse events** in different conditions of LID coil current were observed.
  - ❖ **Increasing LID coil current, the electron density limit at collapse timing is decreased**.
  - ❖ We accumulated the experimental data not only PCI and DBS but also CO2 interferometer, CXS (poloidal flow). The difference of plasma size, edge temperature/density, and edge turbulence related to density limit will be investigated.