(TG2) Turbulence Topical Group Report

Nov. 30, 2022 (M. Nishiura)

Date: Nov. 29, 2022
Time: 9:50-18:45
Shot#: 184561-184708
Prior wall conditioning: D2
Divertor pump: ON
Gas puff: H2, D2, He, Ar
Pellet: C, H
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, D, D)=P(3.7, 3.7, 3.7, 7.0, 8.5)MW
ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(0.703, -)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.723, 0.799, 0.825)MW
ECH(56GHz)=ant(1.5U)=P(-)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.83, 0.56, 0.81, -)MW
Neutron yield integrated over the experiment = 1.9×10^{16}

Topics

1. Impact of low frequency MHD mode on ion velocity distribution function(K. Ida, M. Yoshinuma)
2. IPD effect on high Ti plasmas (H. Takahashi, S. Masuzaki)
3. Demonstration of real-time ECH plasma control by the data assimilation system ASTI (S. Murakami, Y. Morishita, N. Kenmochi)
4. Plasma behaviors at the boundary of the transition to the High Ion Temperature discharge (M. Yoshinuma)

Impact of low frequency MHD mode on ion velocity distribution function

K.Ida and M.Yoshinuma

Shot #: 184561- 184620

Experimental conditions:

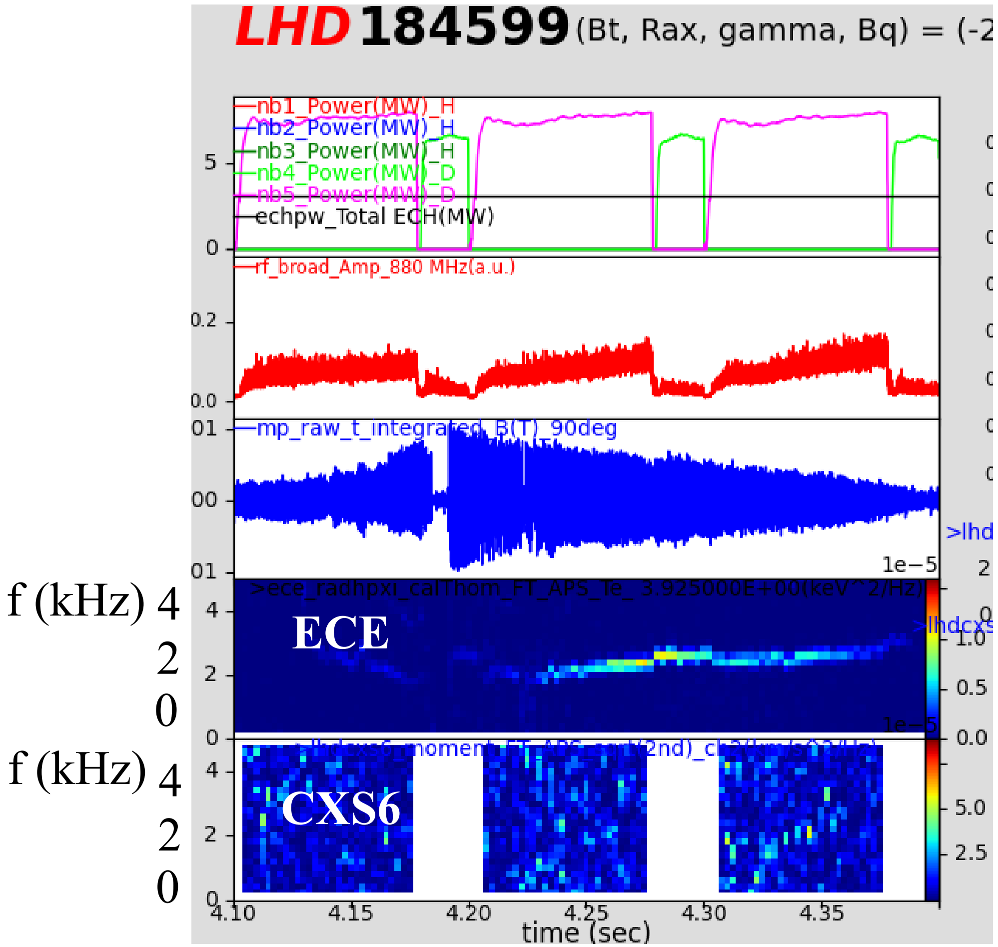
(R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CCW, 2.7887 T, 1.2538, 100 %)

Motivation and objective:

To investigate the impact of MHD on ion velocity distribution function

Test of new bulk charge exchange (CXS11)

Bulk charge exchange (CXS11) has been upgraded by introducing image intensifier.

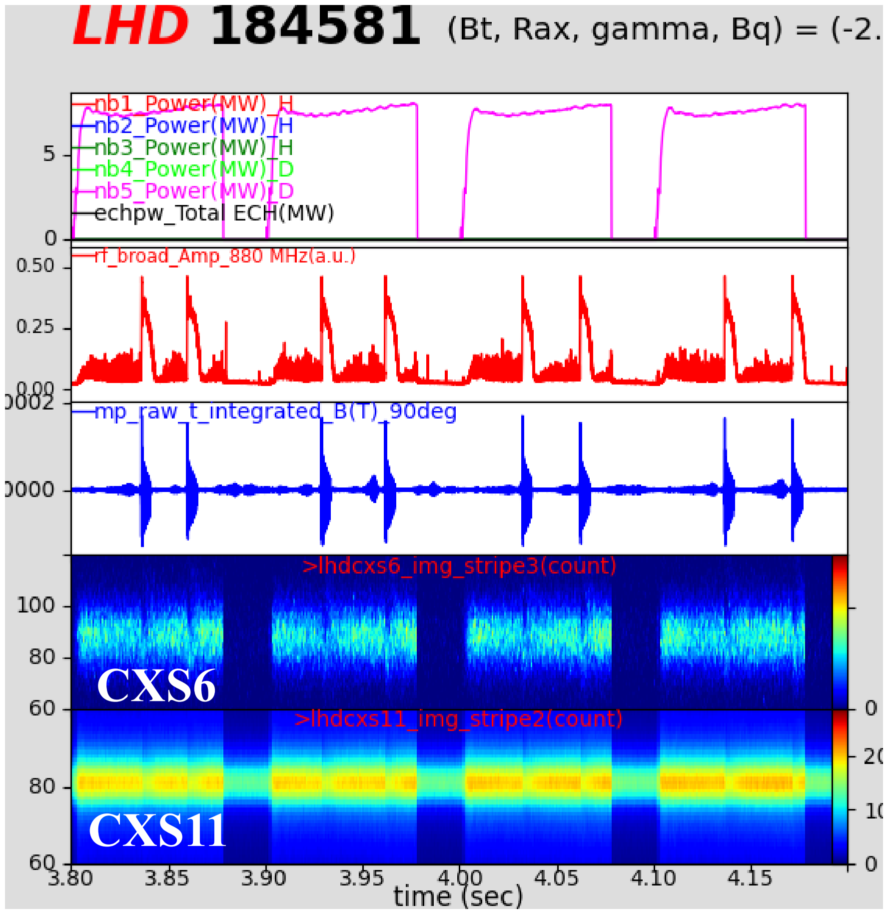


Results:

Low frequency (~2kHz) mode appears in electron temperature measured with ECE

Low frequency mode? is observed in 2nd moment of ion velocity distribution function measured with CXS6.

Further experiment is necessary



Impact of low frequency MHD mode on ion velocity distribution function

K.Ida, M.Yoshinuma

184566-184584 : MHD burst with NBI#5 only
184585-184595 : MHD burst with C-pellet
184596-184606 : MHD mode with ECH
184607-184620 MHD mode associated with e-ITB collapse
(184612-184614 : NBI cal. 18615-184618 : MSE cal.

Test of new bulk charge exchange (CXS11)

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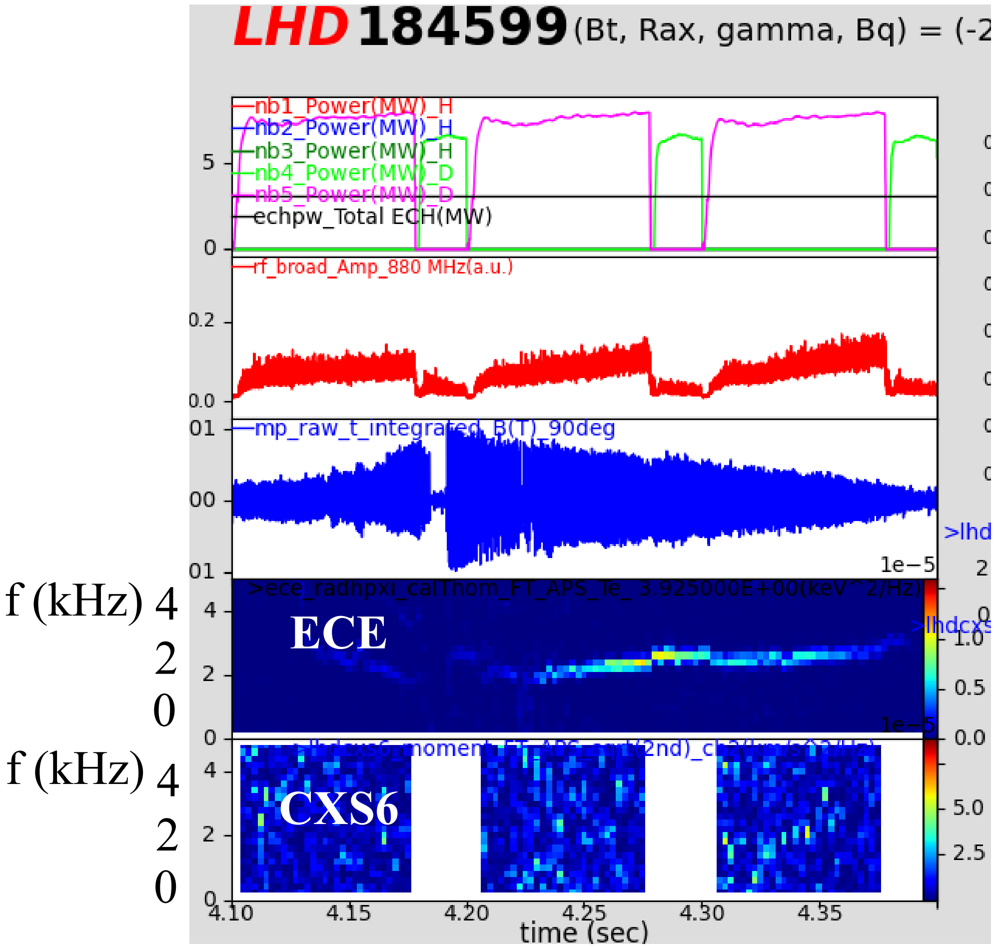

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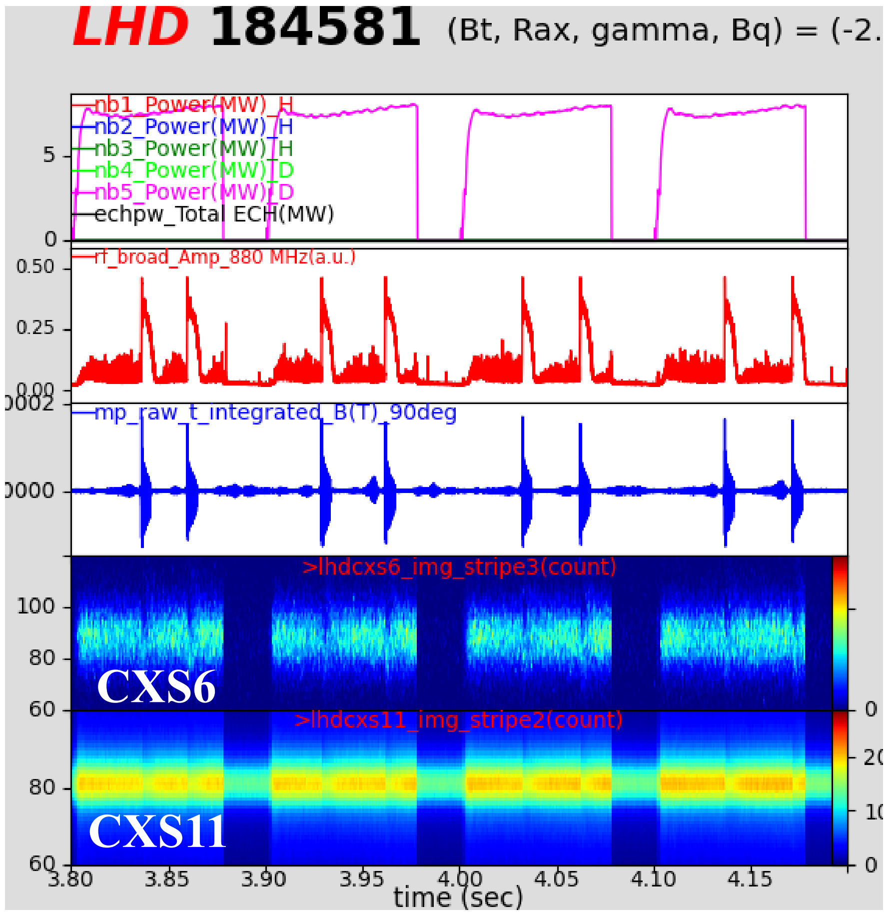


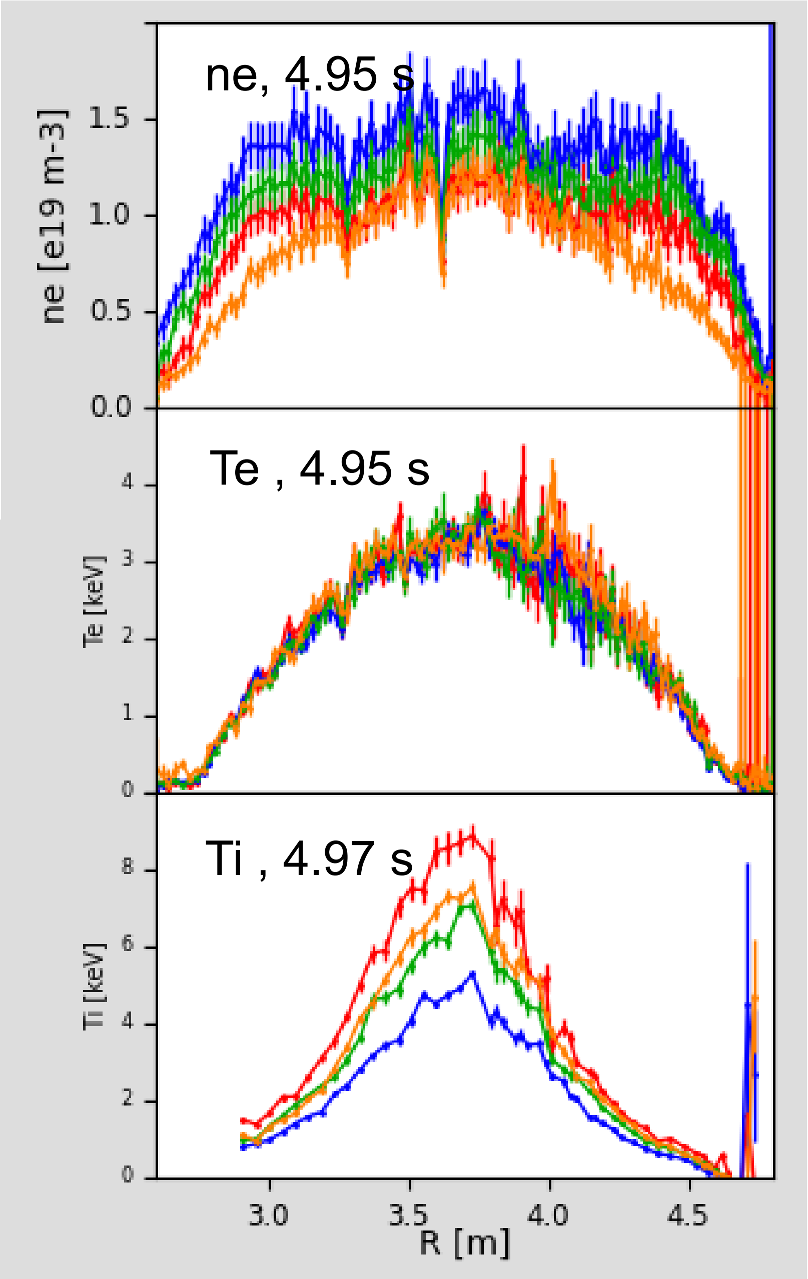
IPD effect on high Ti plasmas (H. Takahashi, S. Masuzaki)

Shot #: 184621 - 184708

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.85 T, 1.2538, 100 %)

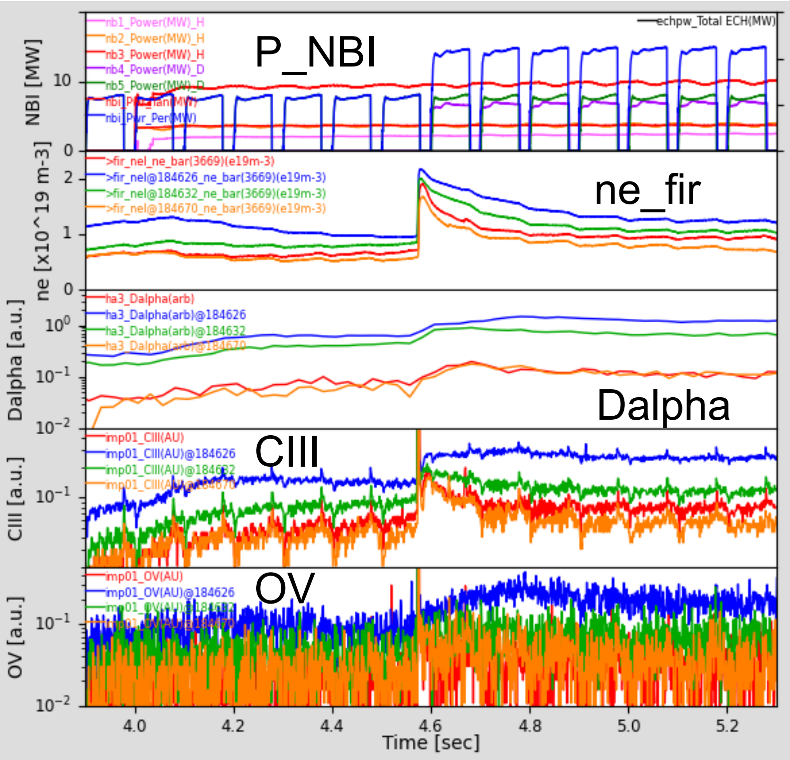
Motivation and objective: To investigate whether further wall conditioning effects are possible by combining IPD with conventional RF discharge cleaning in high Ti operation, thereby further improving the Ti-ITB.

#184626: Before ICDC, no IPD, **#184632: Before ICDC, W/ B-IPD**
#184670: After ICDC, no IPD, **#184684: After ICDC, W/ B-IPD**



Results:

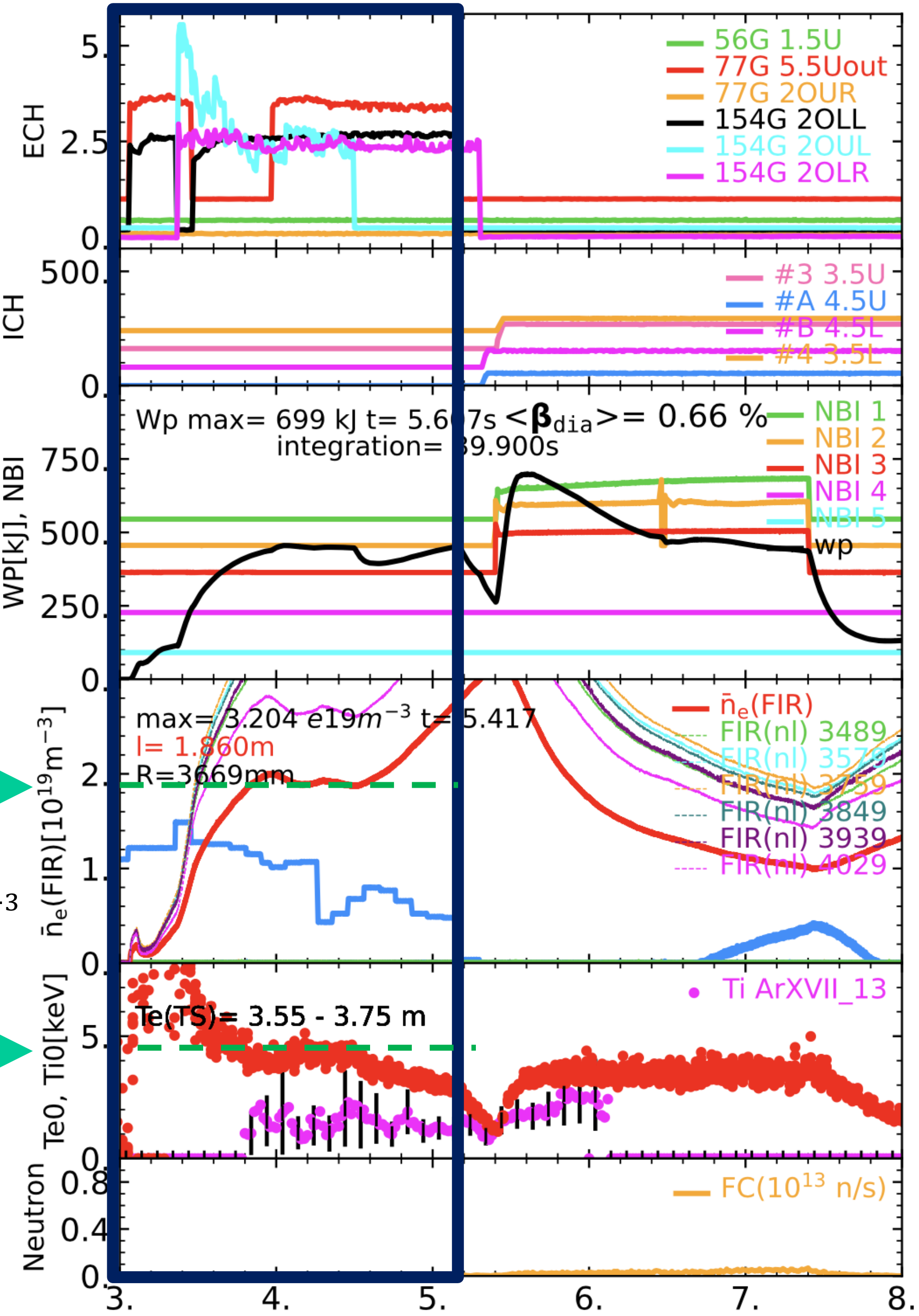
- We confirmed the increased Ti up to 7 keV with the wall conditioning effect by **Boron IPD**.
- In the experimental conditions at this time, further increase in Ti and decrease in emission of Dα, CIII, and OV was confirmed in **ICDC case** compared with **IPD alone**.
- The Ti was highest when **the ICDC and the IPD was combined** even though there was no significant difference in Dα, CIII, and OV between **#184670** and **184684**.



Demonstration of real-time ECH plasma control by the data assimilation system ASTI (S. Murakami, Y. Morishita, N. Kenmochi)

Target
2
$\times 10^{19}\ m^{-3}$

Target
5 keV



Shot #: 184636 - 184665

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.85 T, 1.254, 100 %)

Motivation and objective:

To demonstrate the real-time ECH control by the data assimilation system ASTI.

Results:

- ASTI assimilated the electron density and temperature obtained by the real-time Thomson scattering and estimated the ECH power and the voltage of gaspuf to produce target states .
- ASTI controlled the electron temperature and density at the plasma center from 3 s to 5.1 s.
- We successfully produced the target state (Te0=5 keV, ne0=$2.0 \times 10^{19} m^{-3}$) in #184653.

- Control experiment for 8 s ECH discharges is scheduled for December 27.

Plasma behaviors at the boundary of the transition to the High Ion Temperature discharge (M. Yoshinuma)

Shot #: 184621 - 184625

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.85 T, 1.2538, 100 %)

Motivation and objective: Understanding the high ion temperature discharge by studying the plasma behaviors at the boundary of the transition to it. In this cycle, confirm the reproducibility of the discharges which archives higher ion temperature and not observed in C23.

Experiments:

The behavior of the ion temperature was observed in the cases of balanced and co-directed NBI as additional heating with a perp. beam leading discharge in CCW configuration.

Results:

- ➢ The ion temperature is achieved to 4keV at t=4.51 in both the cases.
- ➢ There is no difference in the achieved ion temperature between the cases, while no change to the higher ion temperature was observed in the balanced case in Rax=3.55m.
- ➢ A broader ion temperature profile was observed in the case of Rax is 3.6 m compared with the profile for Rax is 3.55m.

The effect of the NBI direction is not observed in the Rax=3.6m. More analysis in difference of the two balanced case will be done.

C23 (Rax=3.55m)

#171700 (BL2+BL3) Balanced

#171699 (BL1+BL3) Co

C24 (Rax=3.6m)

#184624 (BL2+BL3) Balanced

#184625 (BL1+BL3) Co