(TG2) Turbulence Topical Group Report

Date: Nov. 2, 2022
Time: 11:50 - 17:30
Shot#: 182232 – 182335 (104 shots)

Nov. 3, 2022 (T. Tokuzawa)

Prior wall conditioning: None
Divertor pump: ON
Gas puff: D2 , Pellet: None
NBI#(1, 2, 3, 4, 5)=gas(D, D, H, D, D)=P(2.2, 2.3, 3.9, 6.6, 6.6)MW

ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(703, 792)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(723, 1012, 986)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.8, 0.76, 0.8, -)MW
Neutron yield integrated over the experiment = 7.4×10^{16}

Remarks

None

Topics

1. Feedback controle using turbulence level (H.Sakai/ K. Tanaka)
2. Density limit based on edge turbulenet transport related to Tokamak new scaling (G. Motojima)

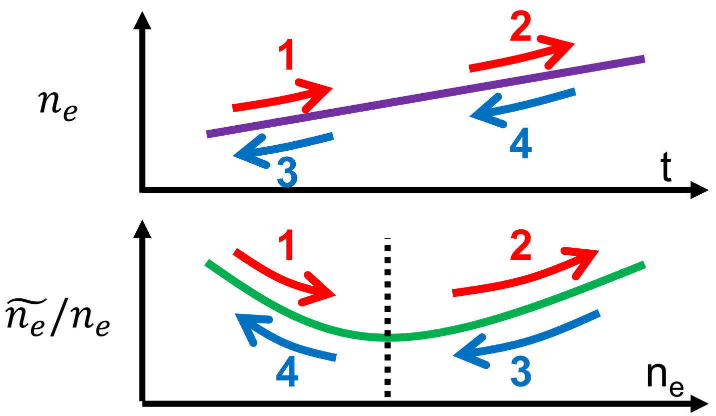
Plasma control using turbulence level (H. Sakai (Kyushu Univ.), K. Tanaka)

Shot No: #182235~182274 (40 shots)

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100 %) **Gas-puff: D_2**

Motivation: It has been reported that when the electron density is increased, a bottom appears in the turbulence level due to the turbulence transition. (by Kinoshita-san)
→Would it be possible to maintain plasma with suppressed fluctuation level ?

Approach: Exclusive OR using derivative signal of turbulence level and of electron density was used for gas puff and ECH control.

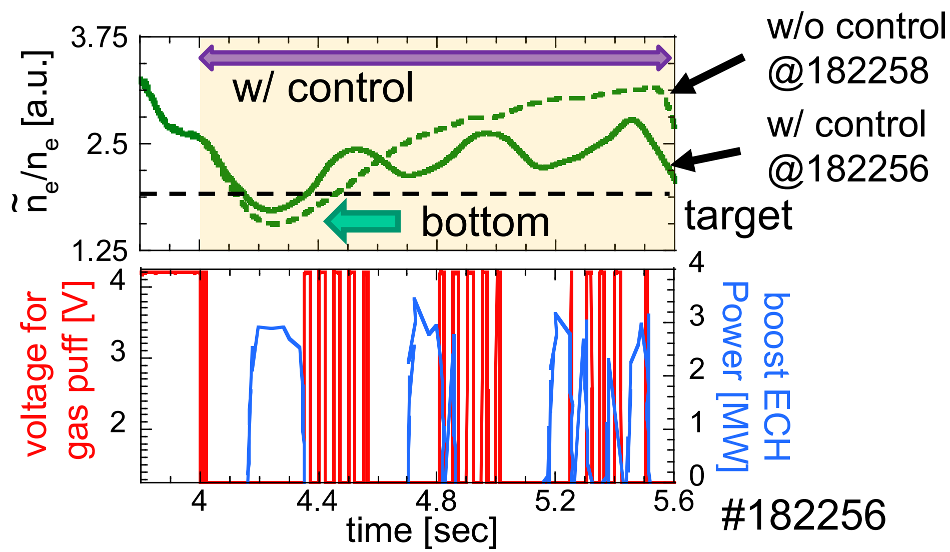


Logic	Exclusive OR	Gas puff	ECH
1: $\frac{dn_e}{dt} > 0$ and $\frac{d(\widetilde{n_e}/n_e)}{dt} < 0$	true	on	off
2: $\frac{dn_e}{dt} > 0$ and $\frac{d(\widetilde{n_e}/n_e)}{dt} > 0$	false	off	on
3: $\frac{dn_e}{dt} < 0$ and $\frac{d(\widetilde{n_e}/n_e)}{dt} < 0$	false	off	on
4: $\frac{dn_e}{dt} < 0$ and $\frac{d(\widetilde{n_e}/n_e)}{dt} > 0$	true	on	off

Results

- ✓ Gas puff and ECH worked as logic dictated.
- ✓ The control was successfully achieved near the bottom.

Possibility to follow the bottom even if heating conditions are changed.



Finally, we sincerely appreciate Nagahara-san.

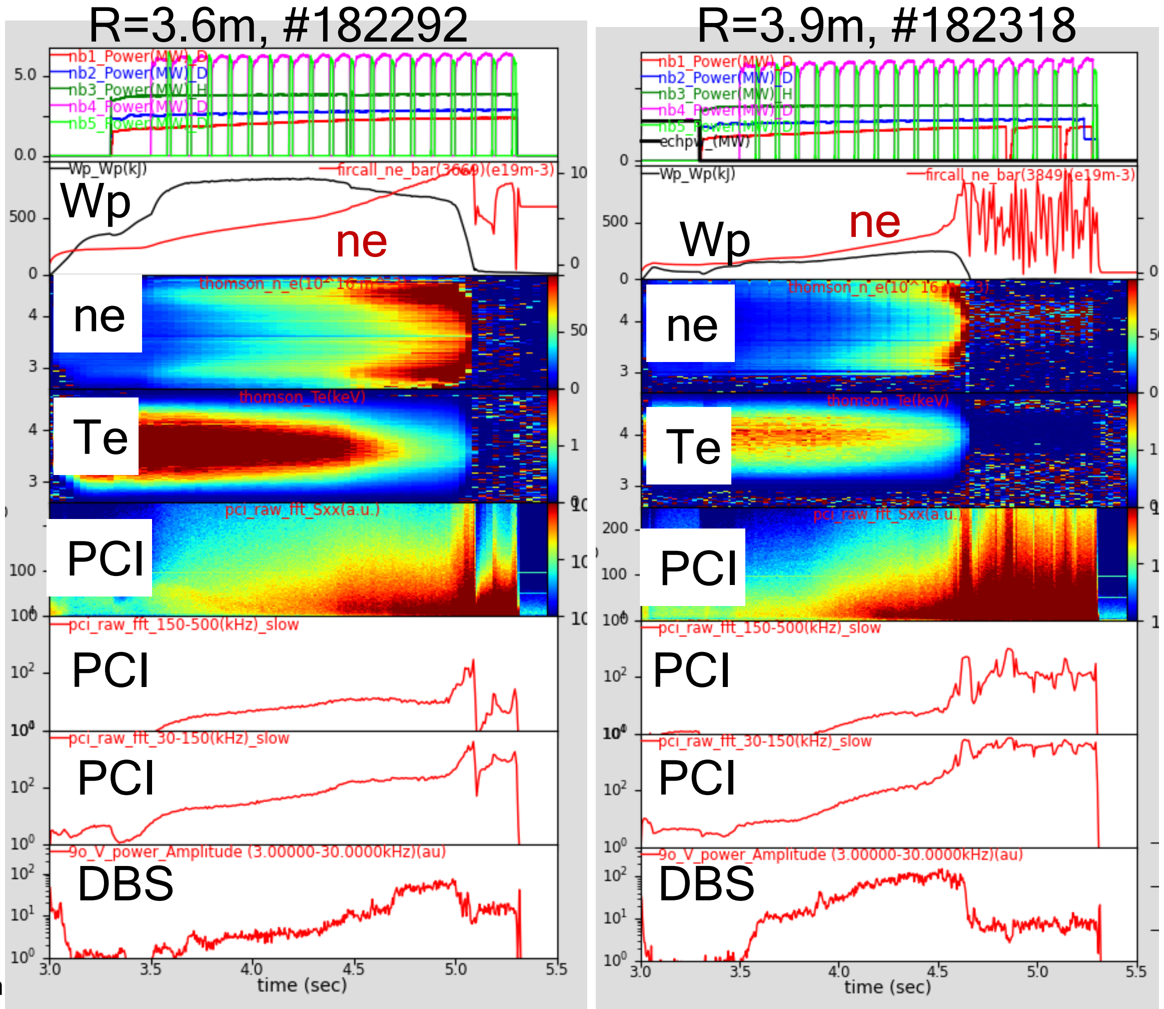
Density limit in relation to edge turbulence

G. Motojima, J. Miyazawa, T. Morisaki, K. Ida, P. Diamond, T. Tokuzawa, K. Tanaka+

SOKENDAI

#182275-182302 R_{ax}=3.6m, B=-2.75T, g=1.254, Bq=100%
#182303-182334 R_{ax}=3.9m, B=-2.538T, g=1.254, Bq=100%

We focused on the behavior of edge turbulence at density collapse event. Heating power of t-NBI (#1, #1+#2, #1+#2+#3) was scanned from 2MW to 8MW. Also, two R_{ax} configurations were tried for changing edge stochasticity.



- ✓ We observed many collapse events in different NBI heating power and R_{ax} configurations.
- ✓ PCI and DBS show $\tilde{n}$ increases with time near density collapse.
  (NOTE: it might be better to normalize it by density)
- ✓ We are now interested how the edge turbulence in different R_{ax} configurations is changed. Stochasticity must be related to edge turbulence, if there assumed to be a relationship between the stochastic region and the electric field.
- ✓ We accumulated the experimental data not only PCI and DBS but also CO2, Reflectometer, CXS (polidal flow), Divertor probe (fixed bias), BES. Further analysis will be conducted.
- ✓ We could observe the collapse event not only NBI but ECH plasmas.