(TG2) Turbulence Topical Group Report

Jan. 21, 2022 (T. Tsujimura)

Date: Jan. 20, 2022
Time: 9:52 – 18:44
Shot #: 176762 – 176915 (154 shots)

Prior wall conditioning: No
Divertor pump: On (except for 2-I)
Gas puff: H_2, Ar (for T_i), He (for GPI)
Pellet: None

NBI #(1, 2, 3, 4, 5) = gas(H, H, H, H, H) = P(3.9, 3.7, 3.9, 3.7, 3.7) MW

ECH (77 GHz) = ant(5.5-Uout (or 1.5U), 2-OUR) = P(703, 792) kW
ECH (154 GHz) = ant(2-OLL, 2-OUL , 2-OLR) = P(979, 930, 986) kW
ECH (56 GHz) = ant(1.5U) = P(-) kW
ICH (3.5U, 3.5L, 4.5U, 4.5L) = P(-, -, -, -) MW
Neutron yield integrated over the experiment = 2.4×10^{12}

Topics:

1. Effect of additional perturbations on the nonlocal transport phenomenon (N. Tamura)
2. Study of high-k and low-k turbulence characteristics (T. Tokuzawa)
3. Response of turbulence in SOL (T. Tokuzawa)
4. On the physics of the density limit: turbulence spreading and SOL width (C. Hidalgo (Ciemat), J. Valera Rodriquez (UC3M), T. Tokuzawa)

Effect of additional perturbations on the nonlocal transport phenomenon (N. Tamura)

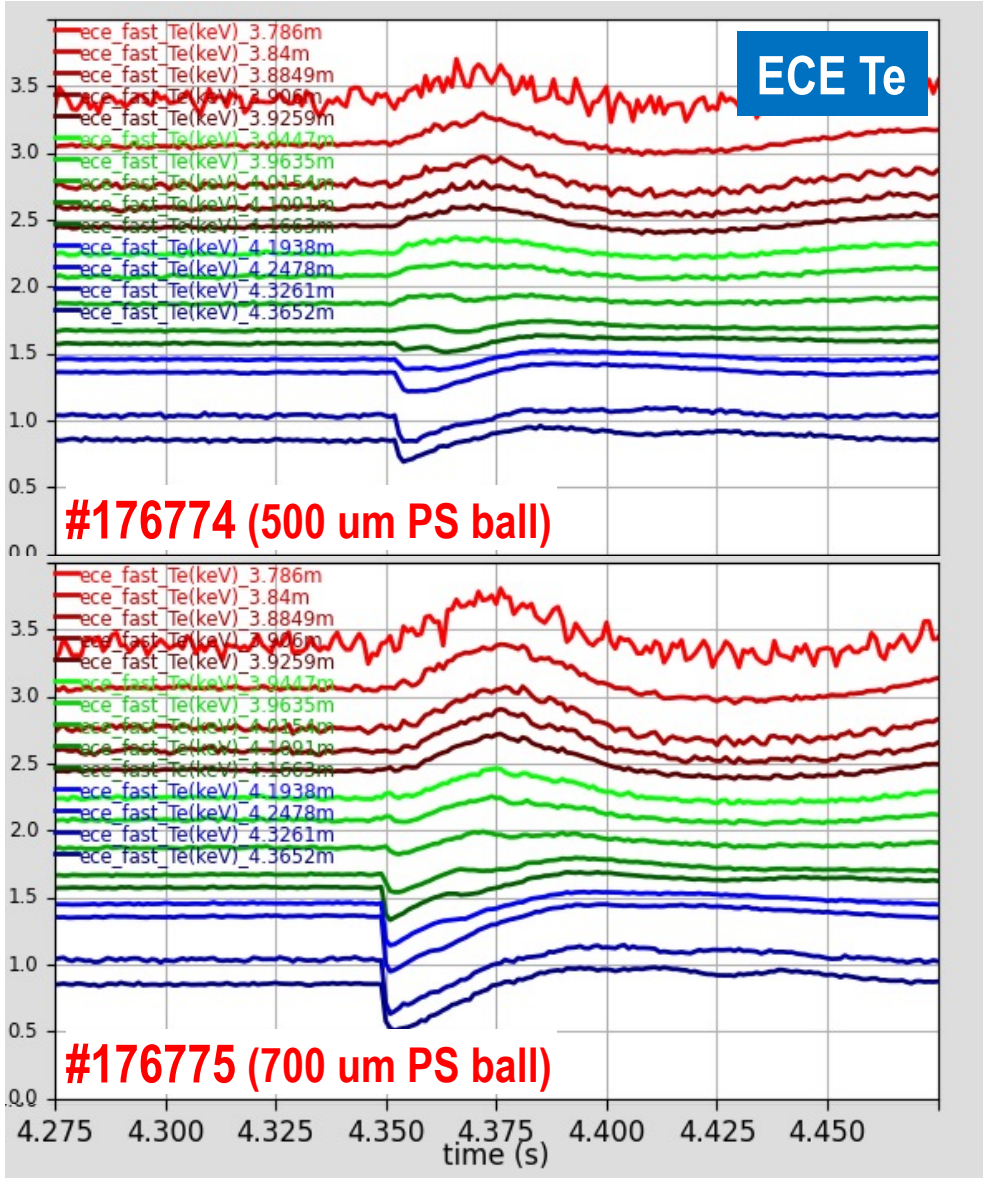
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.53 m, CW, 2.8045 T, 1.2538, 100.0%)
Shots: #176762 - #176805 (#176805 for NBI calib.)

Goal of this experiment

- To investigate the effect of additional perturbations on the nonlocal transport phenomenon

Main results of this experiment

- Small(500um)- & medium(700um)-sized PS balls were injected to induce the nonlocal transport phenomenon (NTP)
- **This time, clear observations of nonlocal T_e rise right after the TESPEL injection have been obtained**
  - ✓ Larger perturbation can invoke higher Te increment
    ← **Different results from the previous results**
- Data with HIBP and Fast TS (start time: 4.349 s) have been obtained
  - ✓ Other turbulent diagnostics were also worked
- Additional perturbation was tried by an Ar-gas puff or an Ar-SSGP, but the nonlocal Te rise could not be invoked by those ← **Different results from the previous results**
  - ✓ Reasons why nonlocal Te rise could not be observed remains unclear



Study of High-k & low-k turbulence characteristics (T. Tokuzawa)

Experimental conditions: (#176806 - #176852)
1. (R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CW, 2.7887T, 1.2538, 100.0%) Gas: H_2

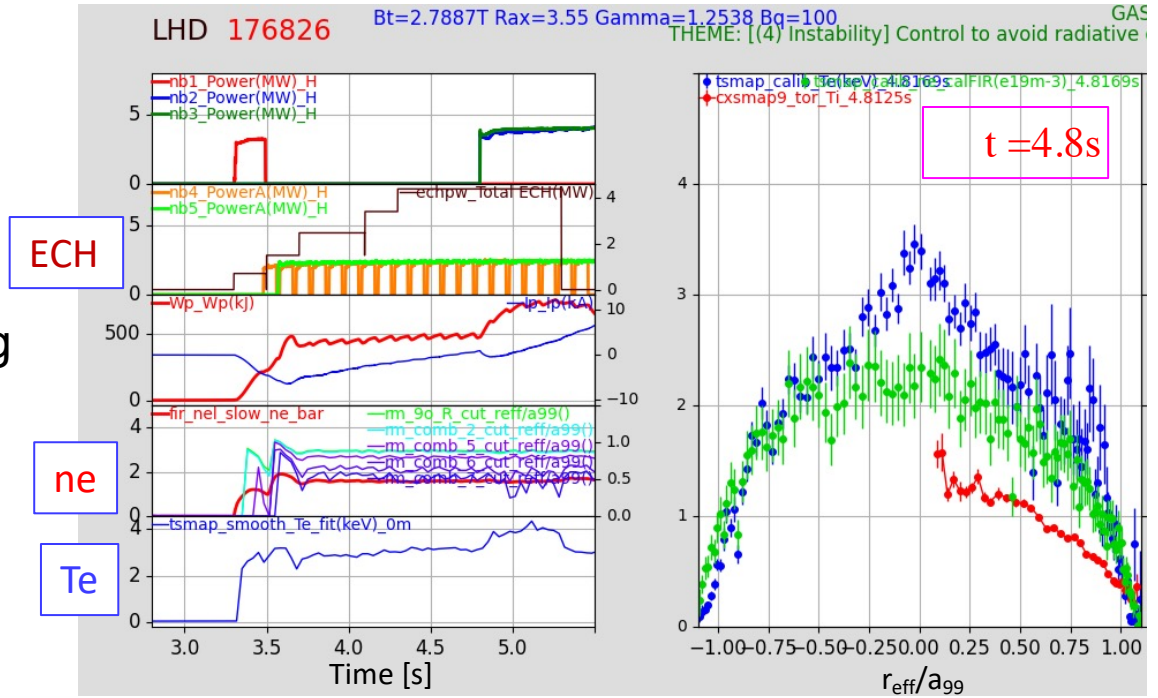
Motivation: To investigate the relationship between ion and electron scale turbulences in different isotope plasmas.

Subjects:
- Dependences of Te/Ti ratio and Te gradient controlled by ECH
- Radial structure of electron scale turbulence
- Cold pulse perturbation as a small stimulus by TESPEL injection

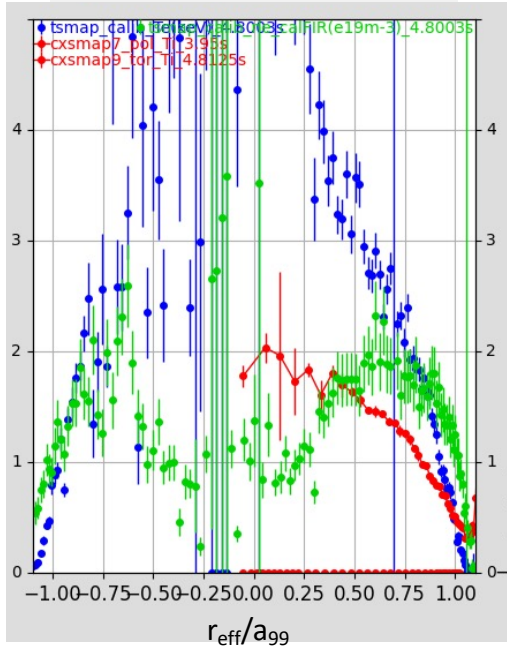
Results :
- Peaked density profile is kept during ECH which is focused to rho=0.8.
- With the step like increase of the ECH injection power, the Te/Ti ratio could be varied from 1 to 3 under constant density conditions.
- Correlation analysis between e-scale and i-scale turbulence responses will be done.

n_e , Te, Ti profiles during ECH

stepping-up ECH



Reference
#174092(R_{ax}=3.60m)



Response of turbulence in SOL

T. Tokuzawa

Experimental conditions:

(R_{ax}, B_t, γ, B_q) = (3.75 m, 1.75 T, 1.2538, 100.0%): #176853 - #176868
(R_{ax}, B_t, γ, B_q) = (3.60 m, 1.75 T, 1.2538, 100.0%): #176869 - #176876
(R_{ax}, B_t, γ, B_q) = (3.90 m, 1.75 T, 1.2538, 100.0%): #176877 - #176887

Motivation: Investigation of turbulence excitation in edge and SOL regions.

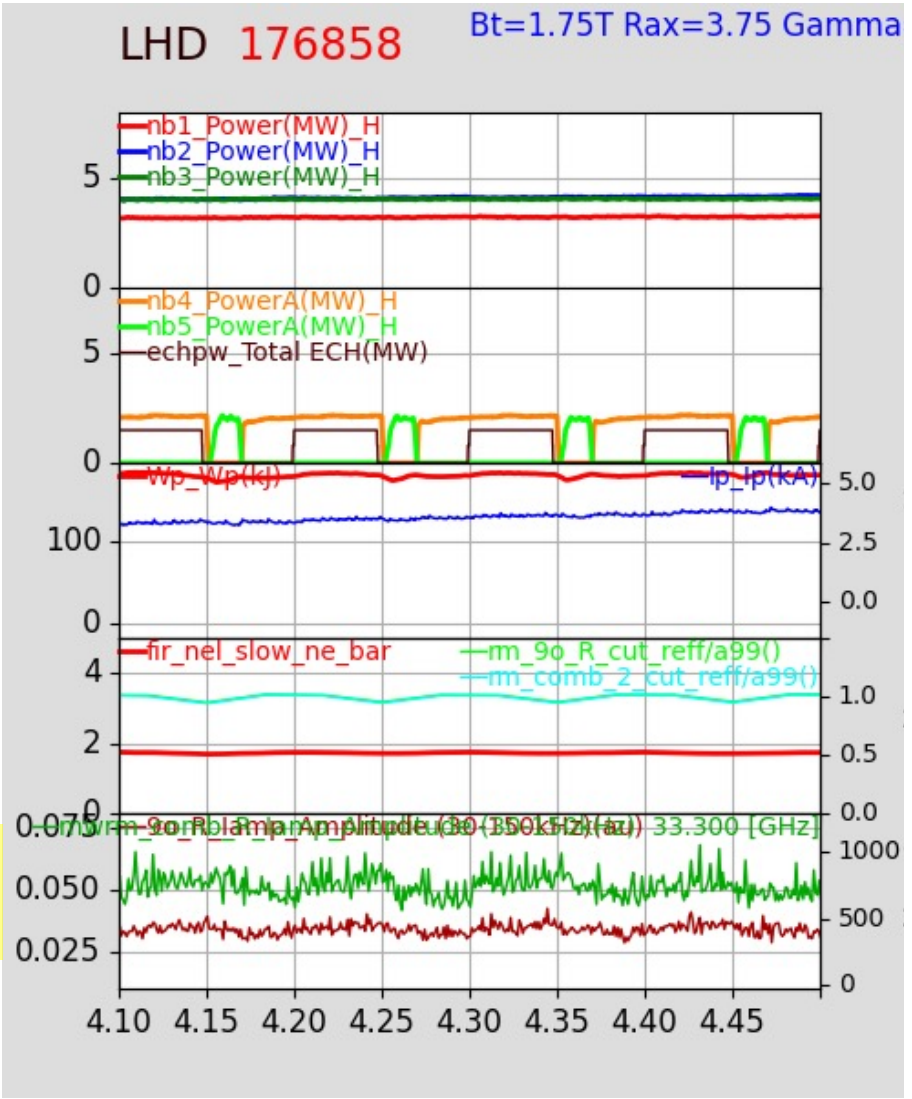
Subjects:

- Off-axis 77GHz ECH is applied to control the turbulence intensity.
- MECH : repetition rate: 10Hz, off-axis beam deposition: r/a~0.8
- LID current scan of 7O-mode and 6O-mode :
  cancel and +/-1920A (expand, reverse expand)

Results:

- ☐ response of SOL turbulence with MECH timing were clearly observed also in H2 plasma.
- ☐ Fast Thomson and divertor probe signals were also acquired.
- ☐ Relationship between the island and turbulence response will be done.

Turbulence intensity r/a~1.05@9-O&3-O

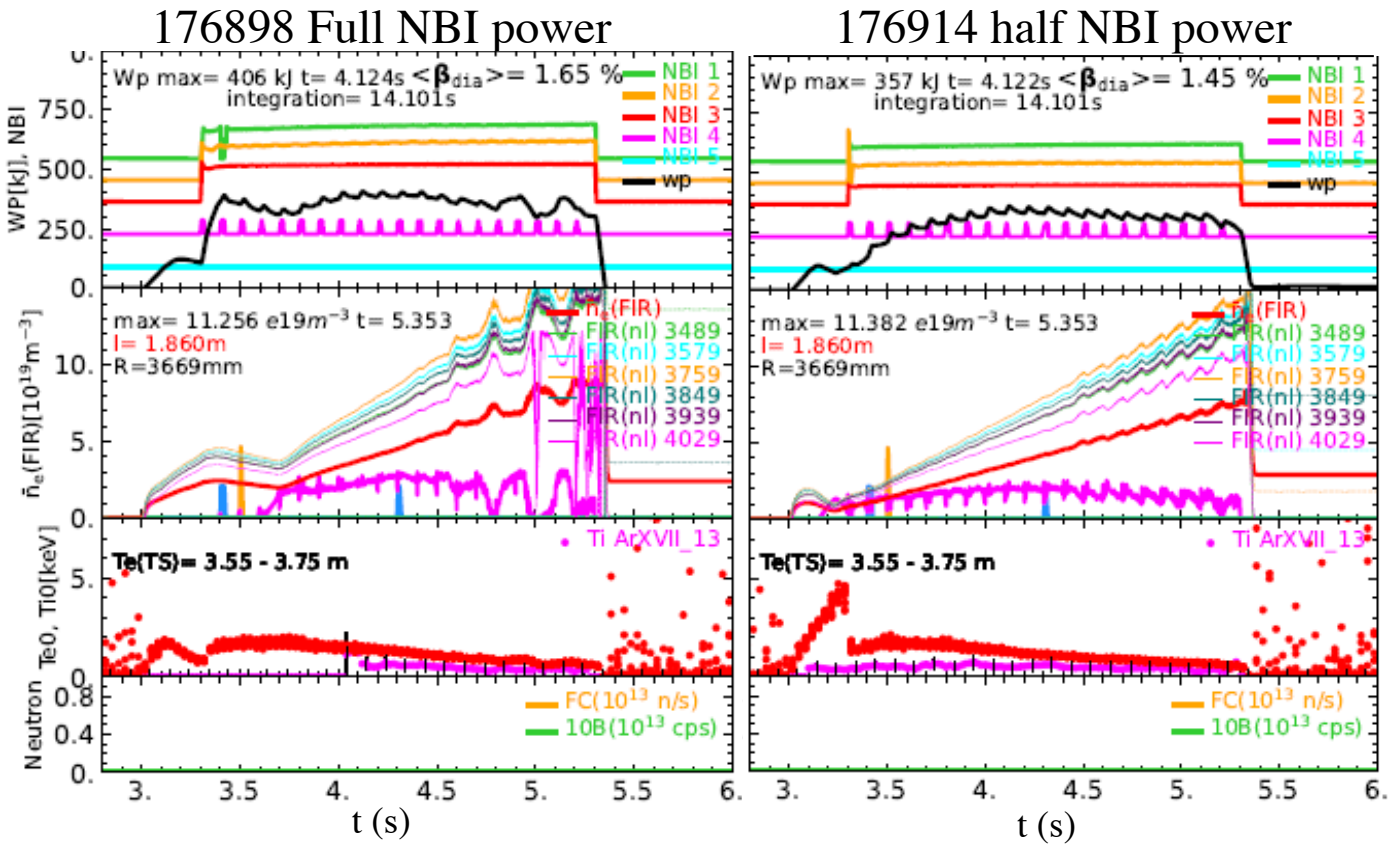


On the Physics of the density limit: turbulence spreading and SOL width
(C. Hidalgo, Jacobo Rodriguez (Ciemat))

Experimental conditions: (R_{ax}, B_t) = (3.6 m, 1.375 T, CW), γ = 1.2538, and B_q = 100 %,

Shot#: 176888 – 176915 (28 shots)

- Analysis of the density limit for the minimization of radial electric field at the plasma edge.
- Set of discharges ramping up the plasma density for two heating patterns with full and half power NBI
- HIBP and CXS to measure the electric potential and radial electric field at the plasma edge.



- Identification of the correlation between turbulence spreading and SOL width.
- Discharges with full / half power NBI and ramping up the density performed successfully.
- Analysis of HIBP and CXS data ongoing.