(TG2) Turbulence Topical Group Report

Dec. 3, 2021 (T. Tokuzawa)

Date: Dec. 2, 2021
Time: 10:15 - 18:45
Shot#: 173998 – 174142 (145 shots)

Prior wall conditioning: NO
Divertor pump: ON
Gas puff: D2, Ar
Pellet: None

NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.2, 2.1, 2.0, 5.9, 5.7)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(979, 930, 986)kW
ECH(56GHz)=ant(1.5U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(-, -, -, -)MW
Neutron yield integrated over the experiment = 1.6 x10^{17}

Topics

1. Effect of additional perturbations on the nonlocal transport phenomenon (N. Tamura)
2. Study of High-k and low-k turbulences characteristics (T. Tokuzawa)
3. Heat transport hysteresis with/without e-ITB during the peripheral 1st X-mode MECH (H. Igami)

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: #173998 - #174058 (#174058 for NBI calib.)

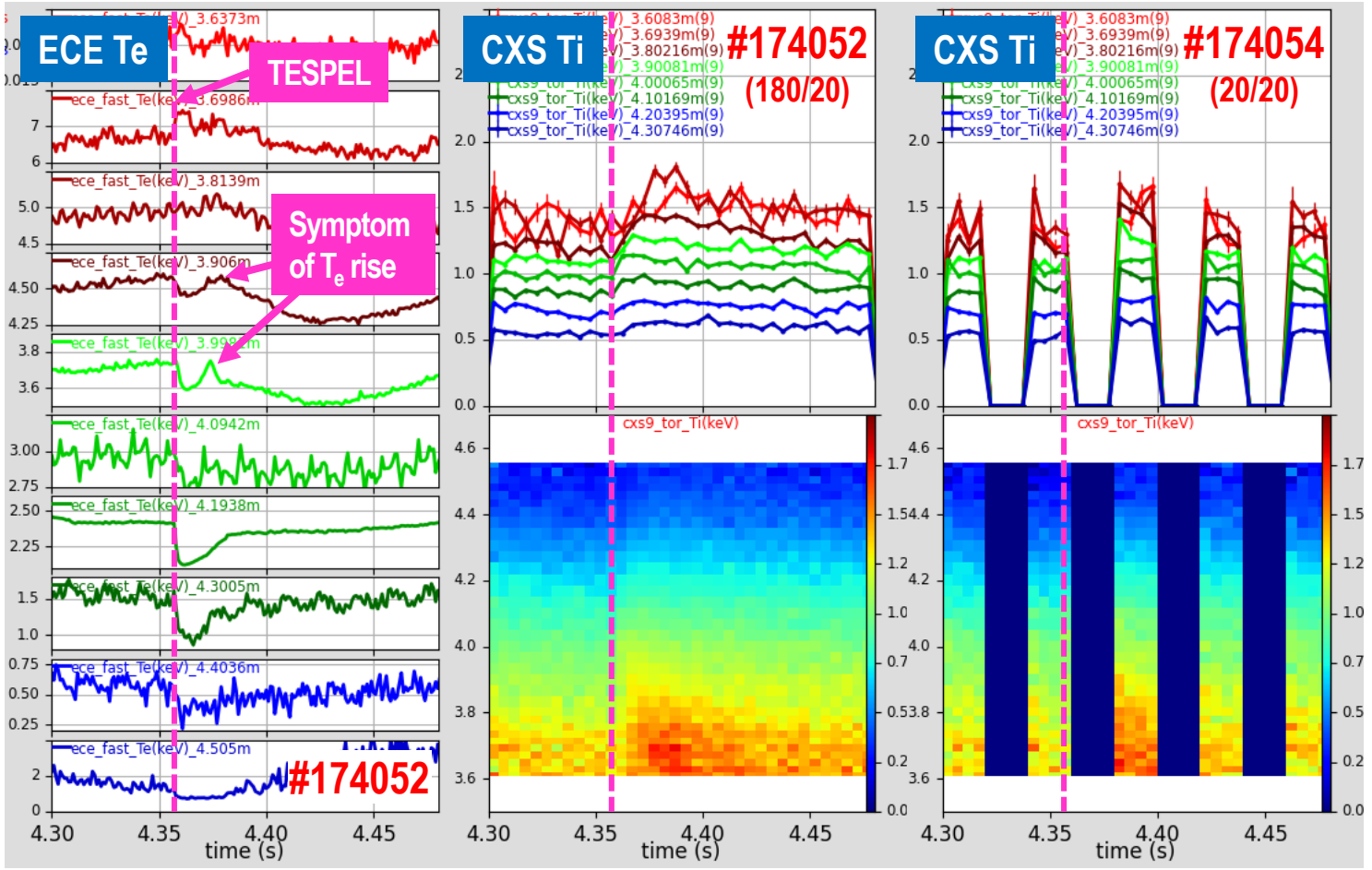
Goal of this experiment

- 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)
- **However, this time, there are no clear observations of nonlocal T_e rise right after the TESPEL injection**
  - ✓ The effect of additional perturbation on the NTP was also not apparent
- We have just observed symptoms of nonlocal T_e rise right after the TESPEL injection
- One of the possible reasons why we could not observe clearly NTP might be
  - ✓ **A very shallow penetration of the TESPEL**, caused by the non-thermal electrons possibly produced by a strong ECH power (~3 MW) at the low-density plasmas...

Te & Ti responses to the TESPEL (700um PS ball) injection



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

Experimental conditions: (#174059 - #174109)
1. (R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75T, 1.2538, 100.0%)
2. (R_{ax}, Polarity, B_t, γ, B_q) = (3.9 m, CW, 2.5384T, 1.2538, 100.0%)

Gas: D_2

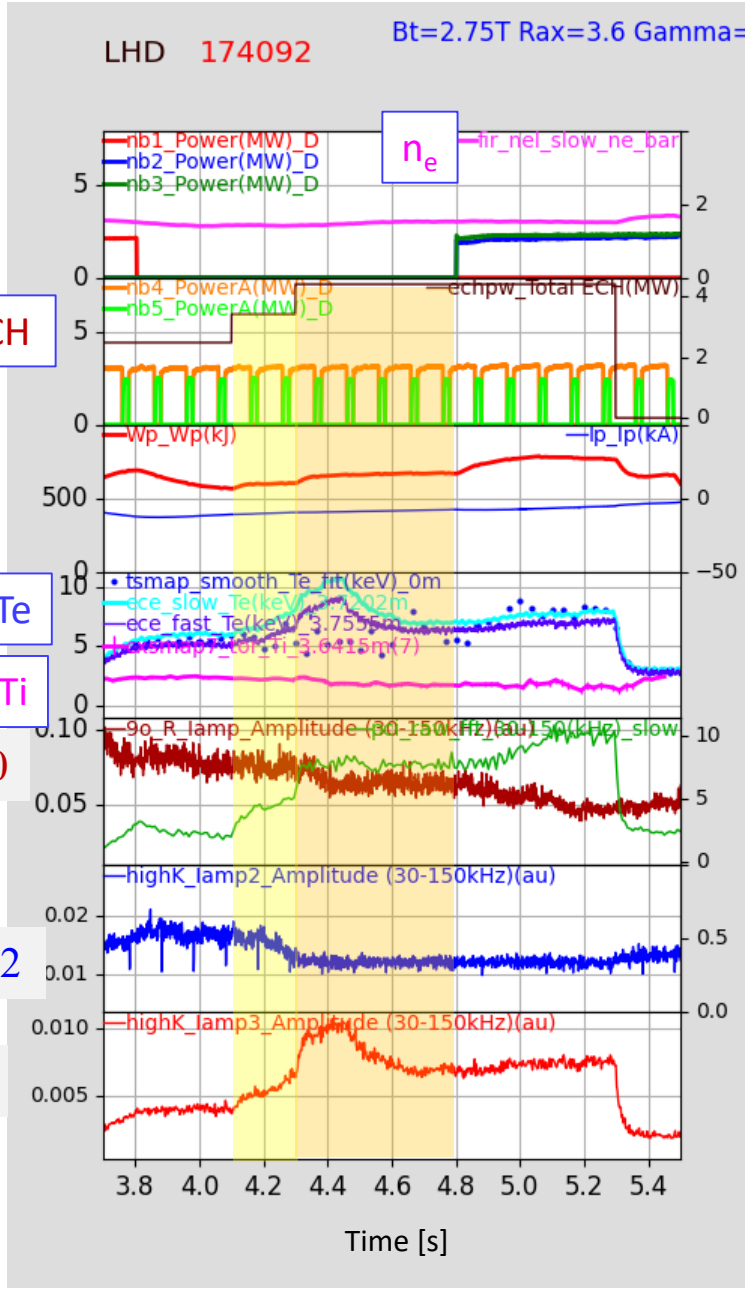
Motivation: To investigate the relationship between ion and electron scale turbulences in different isotope plasmas.

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 :
- 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.
- Different responses due to turbulence were found for each location and measured wavenumber vector.

i-scale
DBS : k_{pol}~3cm^{-1}@ρ~1.0
PCI : k~3cm^{-1}

e-scale
BS : k_{pol} ~20cm^{-1}@ρ~0.2
BS : k_r~30cm^{-1}@ρ~1.0



Heat transport hysteresis with/without e-ITB during the peripheral 1st X-mode MECH

H. Igami et al.

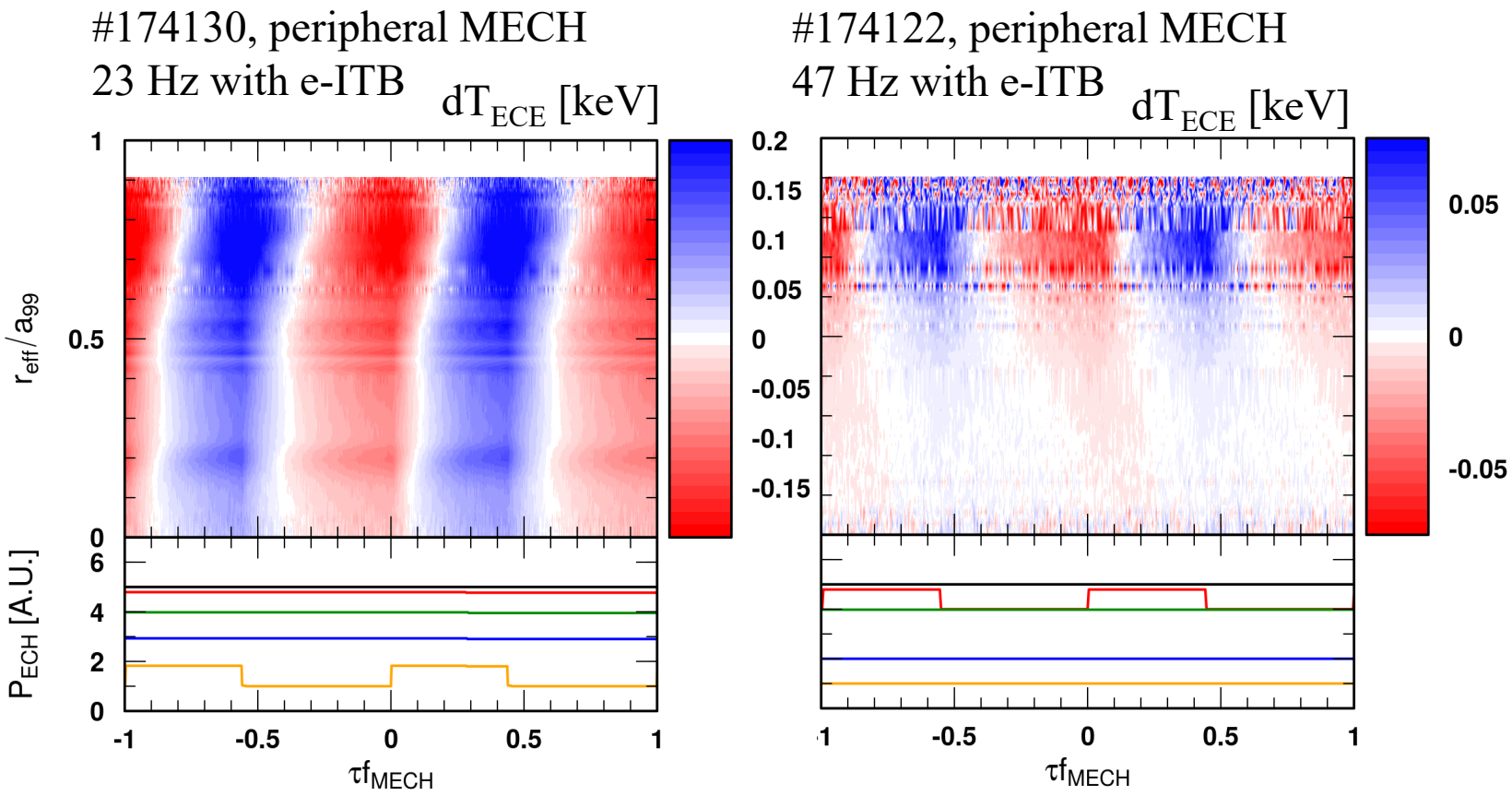
Shot #: 174110 - 174141
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.8 m, CW, 2.70 T, 1.2538, 100.0%)

Purpose:

- To clarify whether the structure of the heat transport hysteresis is affected by turbulent fluctuations with/without e-ITB
- To extract the ECH and gradient driven effects on the turbulent transport with/without e-ITB

Experimental result:

- "Backward" flow is observed around the e-ITB foot during MECH around r_{eff}/a_{99} ~ 0.2 (central MECH)
- dT ~ 0 is observed near the e-ITB during the central MECH, while dT ~ 0 is not observed during the peripheral MECH by the 1st X-mode
- Fluctuations around the e-ITB foot should be checked



Without e-ITB case, only 10 Hz MECH was applied, although higher MECH freq. is suitable to reduce the noise by conditional averaging