(TG2) Turbulence Topical Group Report

Oct. 29, 2021 (T. Tsujimura)

Date: Oct. 28, 2021
Time: 9:39 – 18:44
Shot#: 171264 – 171387 (124 shots)

Prior wall conditioning: No
Divertor pump: On except for 2-I
Gas puff: D_2, Ar
Pellet: None

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, D, D)=P(3.9, 2.1, 2.0, 4.8, 5.0)MW

ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(936, 1033)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(0.81, 0.77, -, -)MW
Neutron yield integrated over the experiment = 4.6×10^{15}

Topics

1. Verification of the effect of magnetic field geometry on zonal flow in 3D confined configuration (S. Nishimoto, K. Nagaoka)
2. Robustness assessment of methods to prevent an impurity accumulation (N. Tamura *et al.*)
3. Effects of RMP field amplitude and impurity on turbulence spreading (M. Kobayashi *et al.*)

Magnetic Axis and Quadrupole Component Scan

Shu Nishimoto
Kenichi Nagaoka

Experimental conditions:

(Rax, Bt, Bq) = (3.55m, -2.63T, 0%) ZF activated

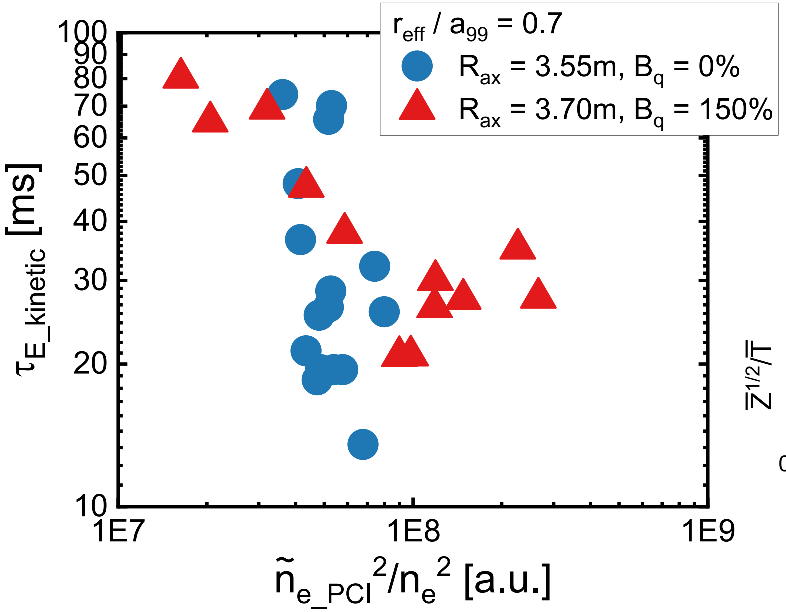
(Rax, Bt, Bq) = (3.70m, -2.63T, 150%) ZF suppressed

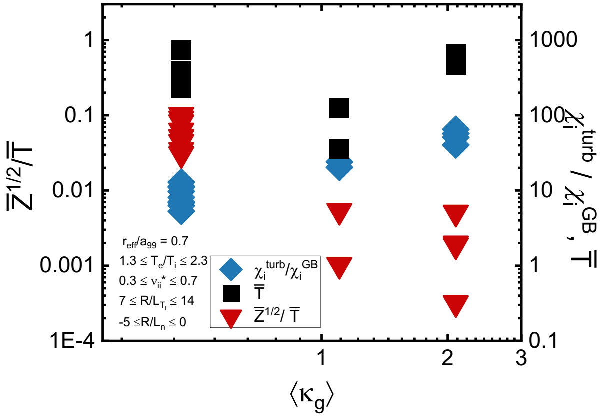
Motivation and Objectives:

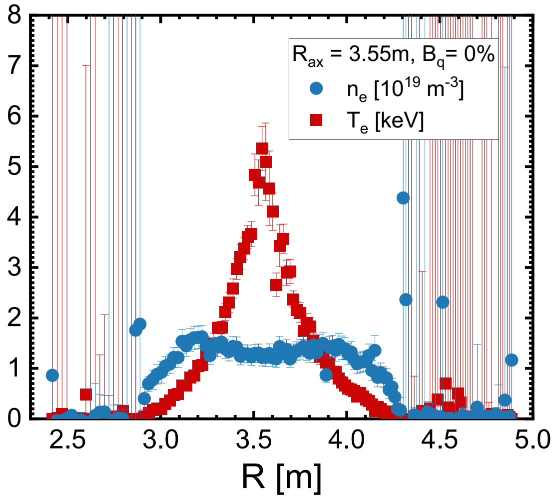
Investigate the zonal flow activation with magnetic geometry by changing the magnetic field configuration LHD.

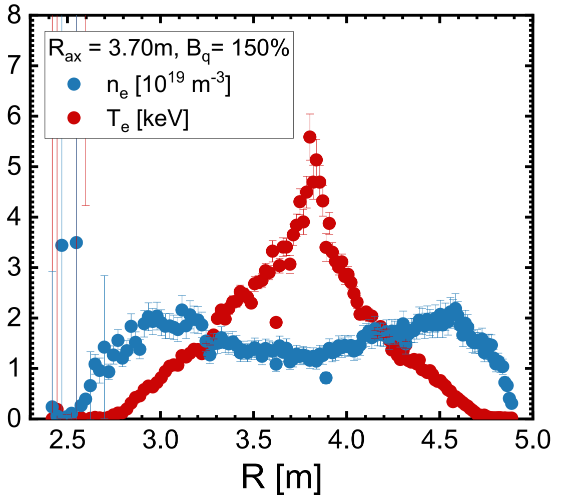
Experiments:

Magnetic field configuration was changed by scanning the Rax and Bq. Density and heating power scan was conducted. TESPEL was injected. Density fluctuation was measured.









Results:

- The difference of confinement time is not clear between two configurations.
- Confinement time for ZF suppressed configuration decreases with fluctuation amplitude. However, the confinement time at ZF activated configurations does not simply correlate with density fluctuation amplitude.
- This tendency is consistent with previous experiment.
- Density profiles is different.
  → Careful analysis is required.

Robustness Assessment of Methods to Prevent an Impurity Accumulation (N. Tamura et al.)

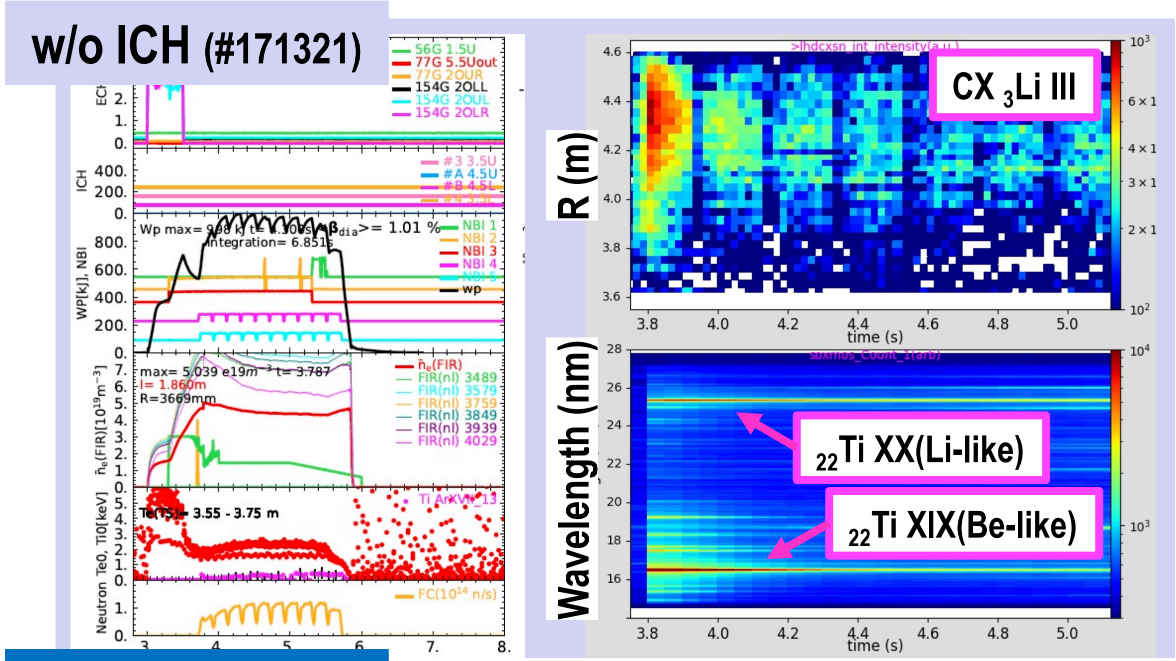
Magnetic Configuration:
(R_{ax}, Polarity, B_t, γ, B_q) =
(3.60 m, CCW, 2.75 T, 1.2538, 100.0%)
Shots: 171313-171334 (22 shots)

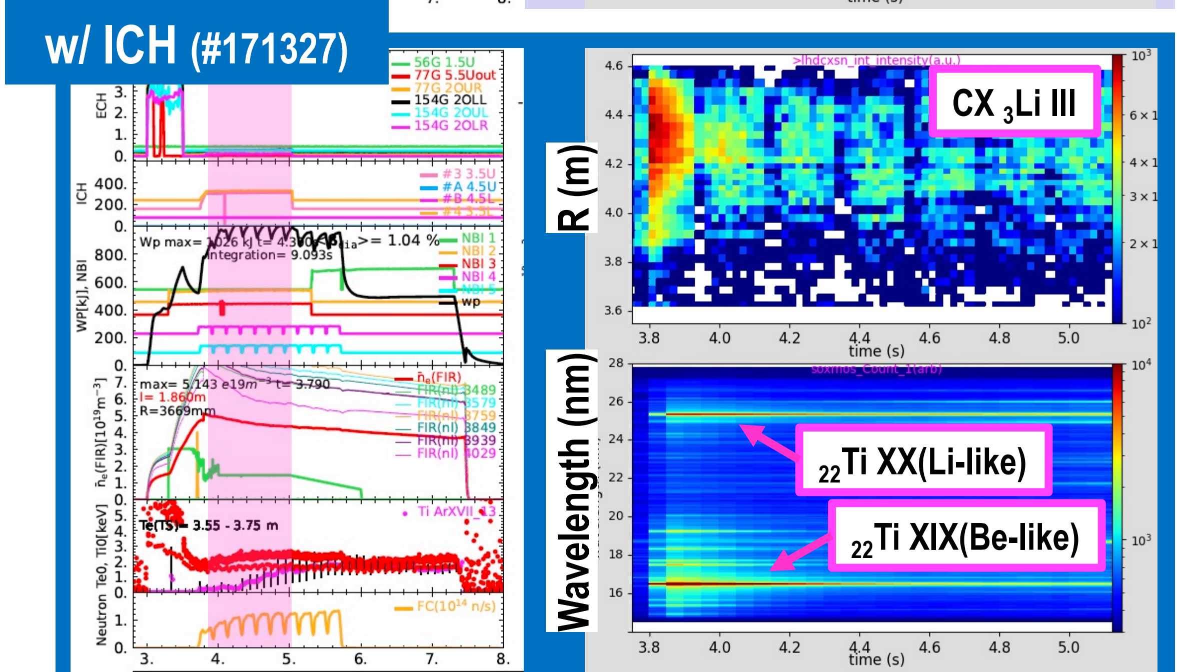
Goal of this experiment:

- We investigate the applicability of schemes (ECH/**ICH**) to prevent impurity accumulation in the core region of LHD plamas for different Z impurities

Results:

- We have injected TESPELs containing compound-tracers (**Li_2TiO_3, $CaAlO_4$, SiB_6, NaCl**) to study a (lower-Z sided) Z-dependence of the impurity transport
- We have applied ICH power additionally (t = 3.835 – 5.035s, for 1.2 s) immediately after the TESPEL injection (t = 3.785 s)
  - ✓ **P_{ICH} ~ 1.5 MW** (HAS antenna (3.5U/L) only)
- No significant effect of applying the ICH on the impurity behaivor has been observed.
  - ✓ Next trial: Higher ICH power (**more than 2 MW**) will be injected





Effects of RMP field amplitude and impurity on turbulence spreading (M. Kobayashi et al.)

Objectives:

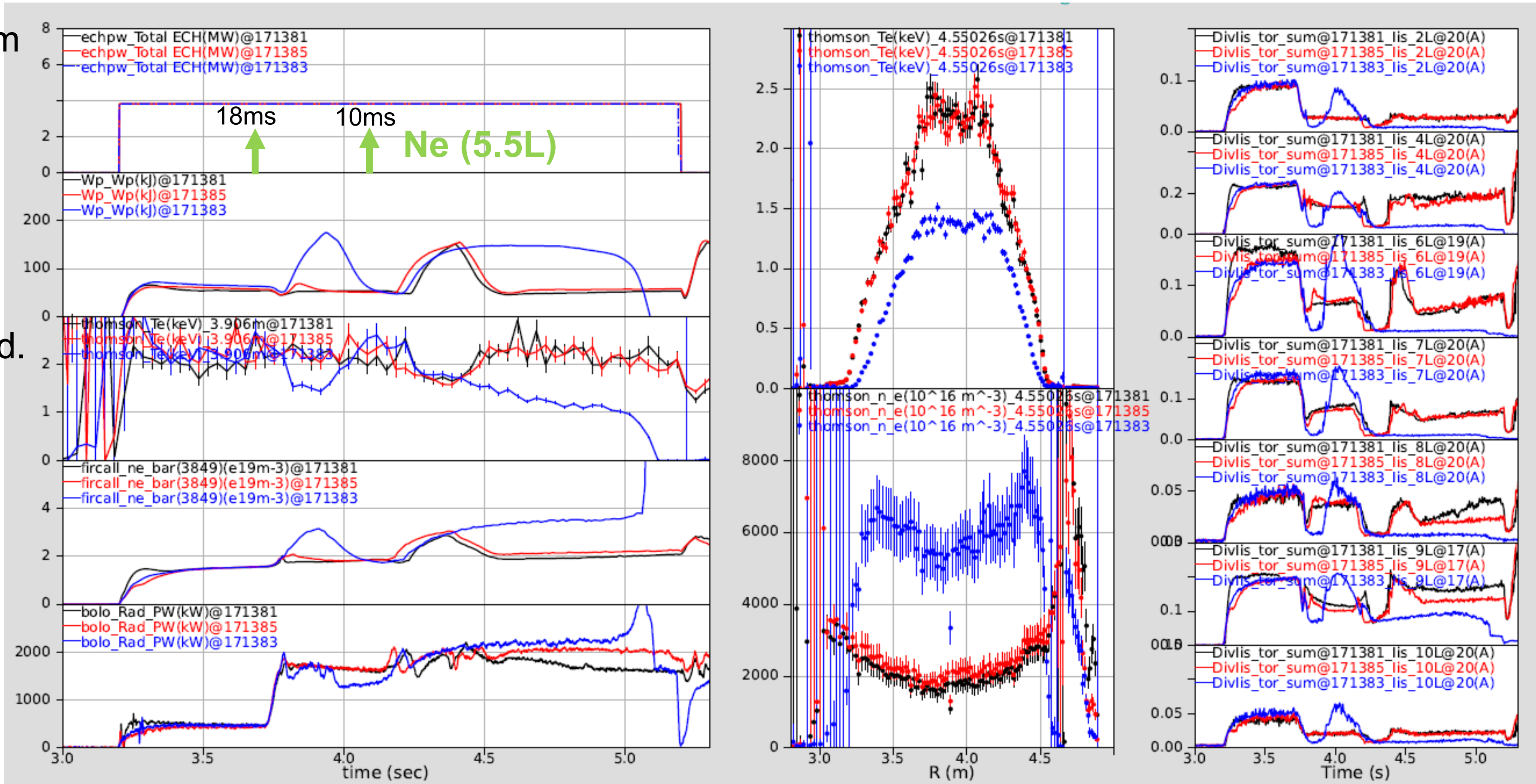
In the previous experiments, turbulence spreading into stochastic layer has been observed. In the present experiments, effects of RMP field amplitude and impurity on the spreading is investigated.

Results:

- R_{ax}=3.90m, B=2.54T, CCW, standard configuration.
- NBI heating with #2 & 3 could not sustain RMP induced detachment (maybe due to large amount of oxygen?).
- ECRH + Ne seeding + RMP operation is successful to induce detachment with high radiation fraction. The divertor heat load decreases in all toroidal section, but a certain asymmetry remains

  ← this can be a counterpart of similar detachment in R_{ax}=3.85m with uniform divertor heat load reduction.
- Ne seeding amount and RMP field amplitude scanned (2500A, 3000A, 3300A).
- GPI data were taken.
- Fast TS system was not very stable.
- LID coil control system error occurred. Recovered in several shots.

#171381 (3300A)
#171385 (3000A)
#171383 (2500A)
(Ne seeding fixed)



Effects of RMP field amplitude and impurity on turbulence spreading (M. Kobayashi et al.)

Results:

Different profile and intensity in density fluctuation are observed.

In the latter phase of #171383 with broad fluctuation profile, quasi coherent magnetic fluctuation around 5kHz is observed. Detailed analysis will be conducted.