(TG4) Plasma instability group report

Nov. 19, 2021 (K. Nagaoka)

Date: Nov. 18, 2021
Time: 10:15 - 18:42
Shot#: 172945 – 173075 (131 shots)

Prior wall conditioning: None
Divertor pump: On
Gas puff: D2, He, Impurity pellet: C
NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.5, 2.5, 2.5, 8, 8)MW
Neutron yield integrated over experiment = 3×10^{17}

Topics

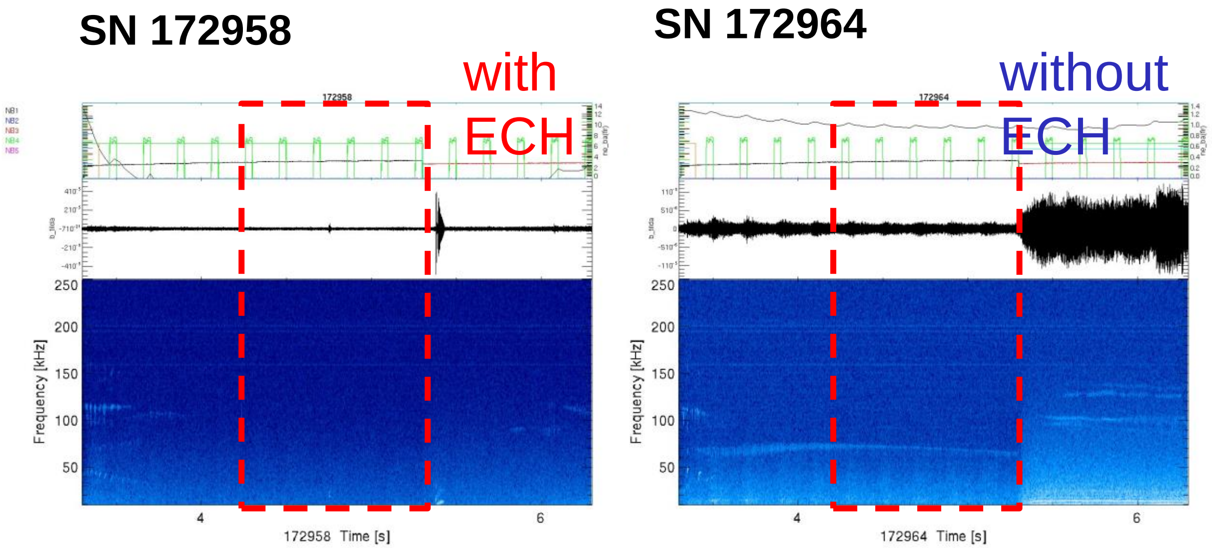
1. Effect of Electron Temperature on Fast-ion Distribution with Fast-ion D alpha diagnostic (Y. Fujiwara / S. Kamio)
2. Effect of phase-space distribution on Triton confinement (J. Jo (KFE) / K. Ogawa)
3. ECRH/ ECCD effects on energetic particle-driven Alfven eigenmodes (S. Sharapov / K. Ogawa)

Effect of Electron Temperature on Fast-ion Distribution with Fast-ion D alpha diagnostic

Experimental conditions:
(Rax, Polarity, Bt, γ, Bq) = (3.6 m, CCW, 2.75 T, 1.254, 100.0 %)
Shot numbers: #172958 - #172970 (13 shots)

Background and motivation:

To understand the effect of the superposition of the electron cyclotron resonance heating (ECH) on the fast ion distribution and transport, measurement of the radial profile of fast ion using the FIDA diagnostic was performed in the MHD-quiescent plasma.



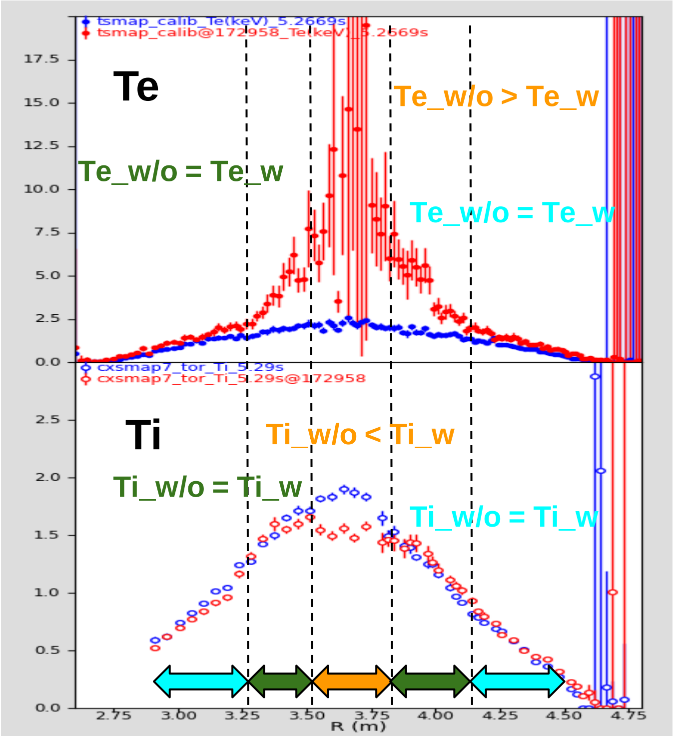
Results:

- We obtained ECH power scan data in a range of electron density ne~0.7-1.0 x 1019 m-3 for Rax=3.6 m on MHD-quiescent plasmas.

- Top figures show an example of typical discharge. Left is discharge with ECH, Right is discharge without ECH. As you can see, magnetic fluctuations are very weak at both cases.

- Bottom figures show Ti and Te profiles. From these figures, there are three regions.

- We will analyze the results of this experiment to investigate the effect of electron temperature on the fast-ion distribution.



Effect of phase-space distribution on Triton confinement

J. Jo (KFE), M. Isobe, K. Ogawa, M. Teshigawara (NIT, Toyama) et al.,

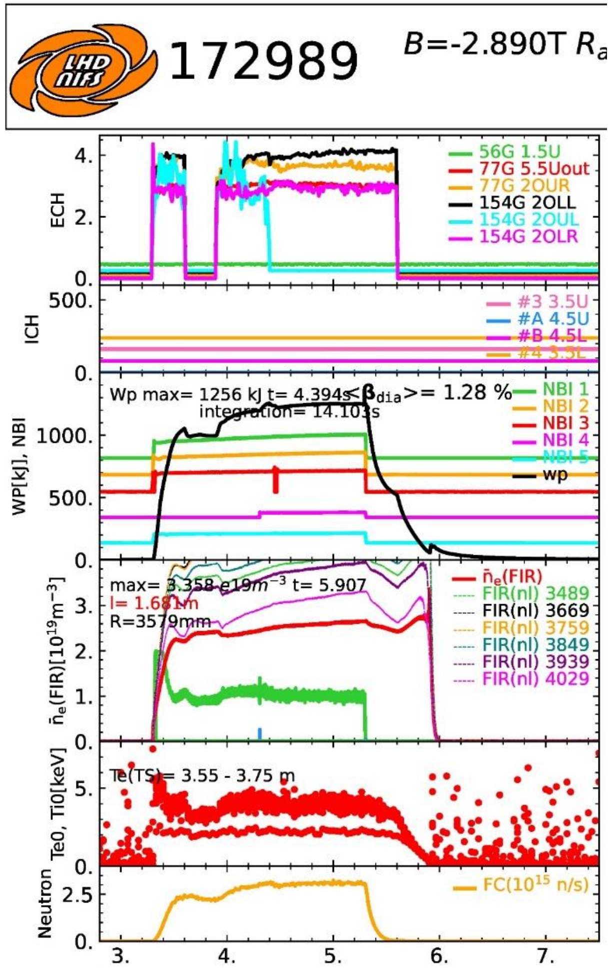
Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.254, 100%)
(R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CCW, 2.89 T, 1.254, 100%)

Background and motive

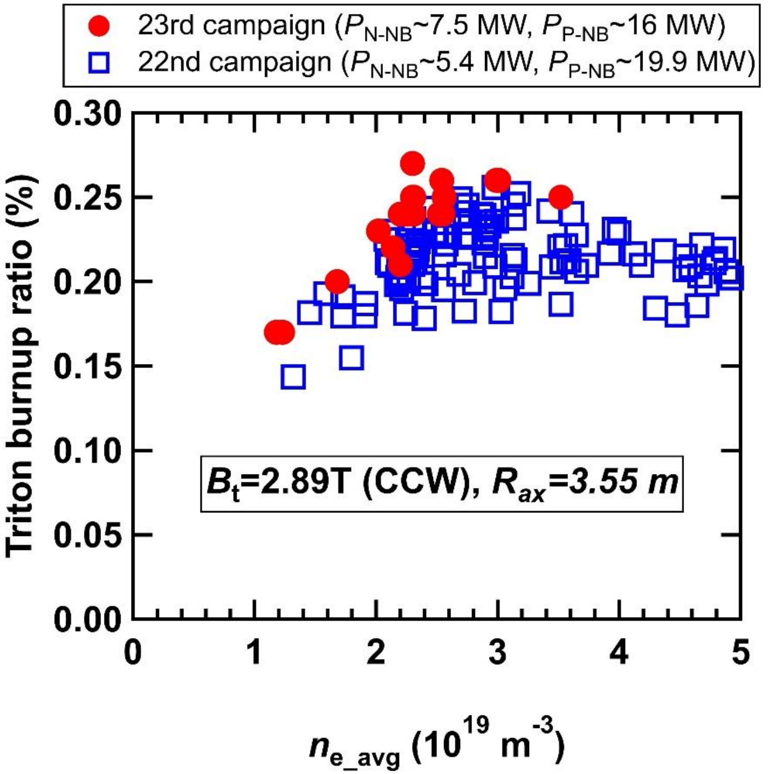
- We have been performing collaborative studies on triton confinement in KSTAR and LHD for systematic understanding of energetic ion confinement.
- In LHD, GNET simulation suggests that asymmetry of the initial triton velocity, formed by N-NB ions, improves triton burnup ratio due to the decrease of trapped triton.
- We would like to compare the triton burnup ratio co-NB dominant and counter-NB dominant plasmas to understand this asymmetric effect in detail.

Results

- We obtained triton burnup ratio at R_{ax}=3.55 m/B_t=2.89 T with CCW-B_t, e.g., co-NB dominant case.
- Triton burnup ratio was a little higher than that obtained in 22nd campaign due to the relatively high N-NB power. Maximum triton burnup ratio is 0.27%.
- We will compare the triton burnup ratio in CW-B_t condition, e.g., counter-NB dominant case, performed in Nov. 25th.
- As a by-product, we renew total neutron emission record from 4.1×10^{15} n/s to 4.9×10^{15} n/s.



$Y_{n\_DD}=5.5\times10^{15}$
$Y_{n\_DT}=1.3\times10^{13}$



ECRH/ ECCD effects on energetic particle-driven Alfven eigenmodes

Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q)=(3.90 m, CCW, 2.538 T, 1.254, 100%)
(R_{ax}, Polarity, B_t, γ, B_q)=(3.60 m, CCW, 2.75 T, 1.254, 100%)

S. Sharapov, M. Osakabe, K. Ogawa et al.,

Background and motive

- Feasibility study for suppressing alpha-driven AEs in a narrow radial ITER region with ECCD.
- The goal is to create the AEs suppression models including tokamaks and helicals.

Results

- We performed the co-ECCD, counter-ECCD and ECH in high-B_t configurations.
- The modes spread over whole frequency range up to 250 kHz, and the nature of the modes varied, as well as the radial position might be varied too, we could not expect ECCD suppress all modes at once.
- ECCD not only mitigate some modes, but also facilitated some modes.
- The most flexible modes affected by ECCD were modes in the range of 150 kHz.
- We will also analyze FILD signal to identify what frequency deliver highest losses.

ECRH to r/a = 0.7

Ctr. ECCD to r/a = 0.7