(TG4) Plasma instability group report

Dec. 1, 2021 (Y. Takemura)

Date: Dec. 1, 2021
Time: 9:50 - 18:45
Shot#: 173847 – 173995 (149 shots)

Prior wall conditioning: D_2
Divertor pump: On except for 2-I
Gas puff: D_2, Pellet: None
NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.4, 1.6, 0.0, 4.9, 4.9)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.45, 0.37)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.40, 0.36, 0.34)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.81, 0.79, 0.81, 0.45)MW
Neutron yield integrated over experiment = 1.3×10^{17}

Topics
1. Acceleration of NBI deuterium beam ions by ICRF second harmonic heating (T. Seki)
2. Measurement of neutron emission rate and fast ion in ICRF 2nd deuteron heating (R. Seki)
3. Investigating EBW heating characteristics via X-B mode conversion from high field side injection (R. Yanai)

Acceleration of NBI deuterium beam ions by ICRF second harmonic heating (T. Seki)

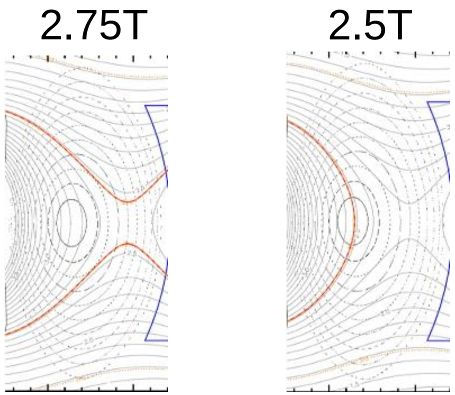
Shot #: 173847 - 173921
Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q)
= (3.6 m, CW, 2.75/2.72/2.65/2.5T, 1.2538, 100.0%)

Background and motivation:

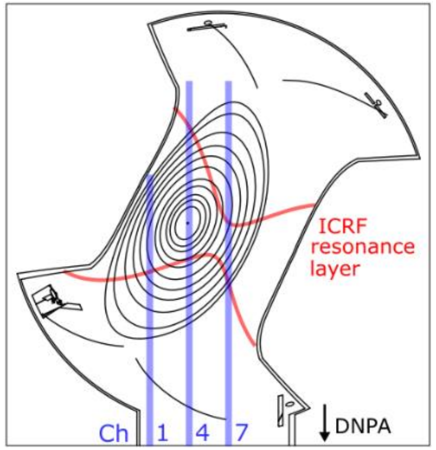
- Strong coupling of NBI deuterium beam ions and ICRF second harmonic waves is expected. However, obvious heating effect of ICRF 2nd harmonic heating on NBI deuterium ions was not observed so far.
- Heating condition of ICRF 2nd harmonic heating was investigated by changing the position of ion cyclotron resonance layers.

Results:

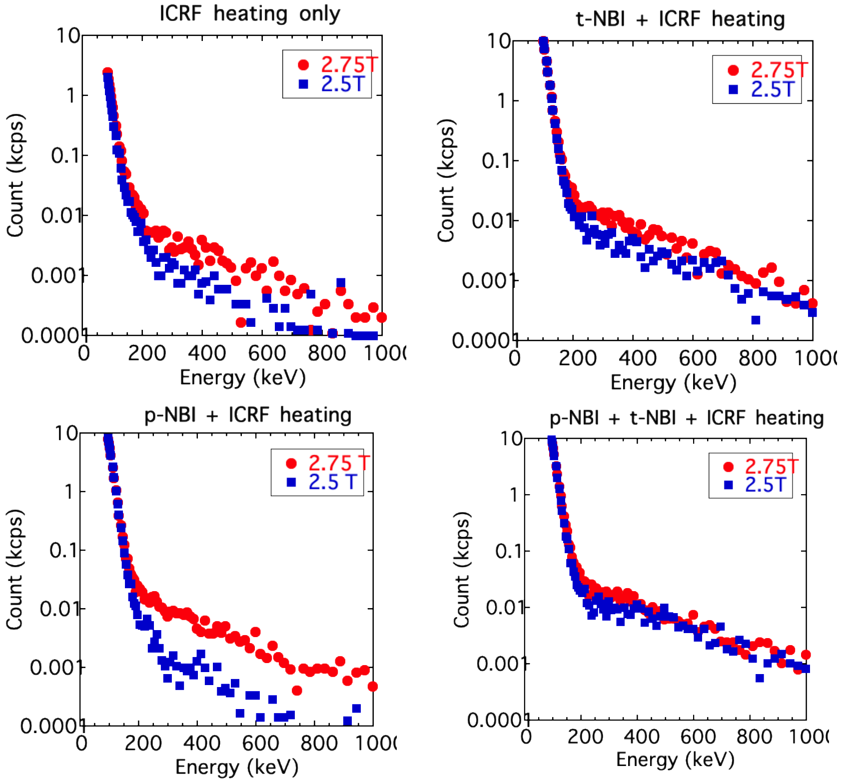
- Energy spectrum of DNPA was compared in different position of ion cyclotron resonance layers.
- Ion tails were enhanced by super-position of NBI beams.
- In the case of super-position with t-NBI, effect of neutron is suspected and careful treatment is necessary.
- Ion tails were higher in the case of 2.75T than that of 2.5T. This shows the better confinement of high energy ions in off-axis heating than on-axis heating.
- We will analyze the details of heating effect with ion tails and neutron emission rate.



Poloidal cross section of second harmonic ion cyclotron resonance layers of deuterium.



Lines of sight of DNPA.



Energy spectrum of DNPA (ch1).

Measurement of neutron emission rate and fast ion in ICRF 2nd deuteron heating

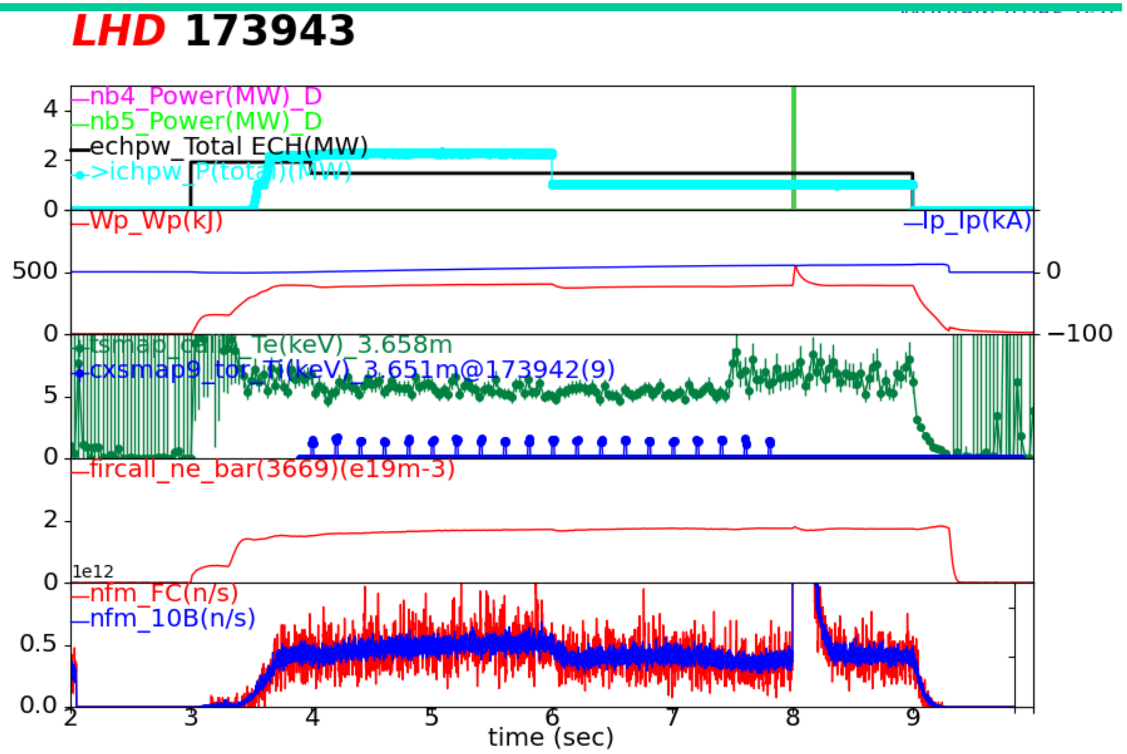
Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 2.75 T, 1.254, 100%)
H/(D+H) << 1%
Antenna distance from plasma = 8 cm

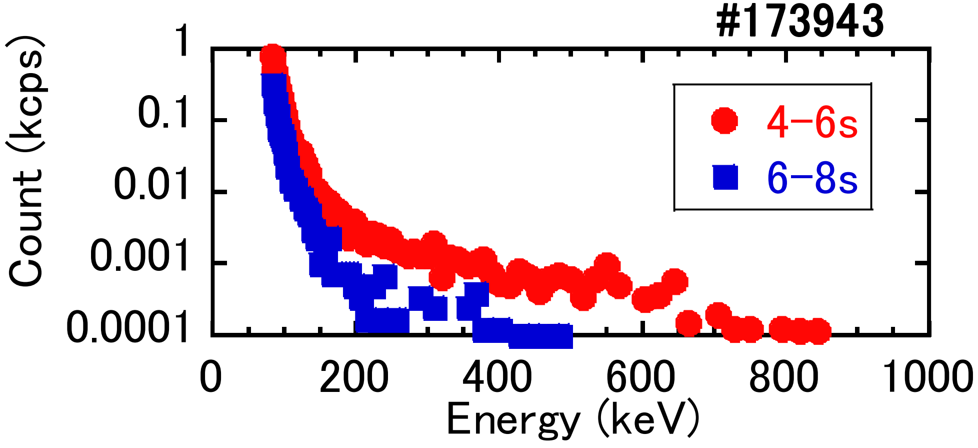
Background and motivation

- In the 22nd cycle, the neutron emission rate database in the ICRF deuteron plasma was created. On the other hand, no clear fast deuteron tail due to ICRF 2nd heating was observed by DNPA.
- The fast deuteron tail and neutron emission rate will be measured in order to investigate the effect of the fast deuteron tail on the neutron emission rate.

Results

- The fast deuteron tail and neutron emission rate were measured by changing the ICRF power, the ECH power, and the electron density.
- The ion temperature profile was measured by CXS for the evaluation of the bulk component of the neutron emission rate.
- The increase of the effective temperature of the fast deuteron tail was observed by increasing the ICRF power and increasing the electron temperature.
- We will evaluate the effect of fast deuteron tail on the neutron emission rate by using the effective temperature of fast deuteron tail.





Fast ion measurement (DNPA) during ICRF power of 2 MW (4-6 s) and 1 MW (6-8 s).

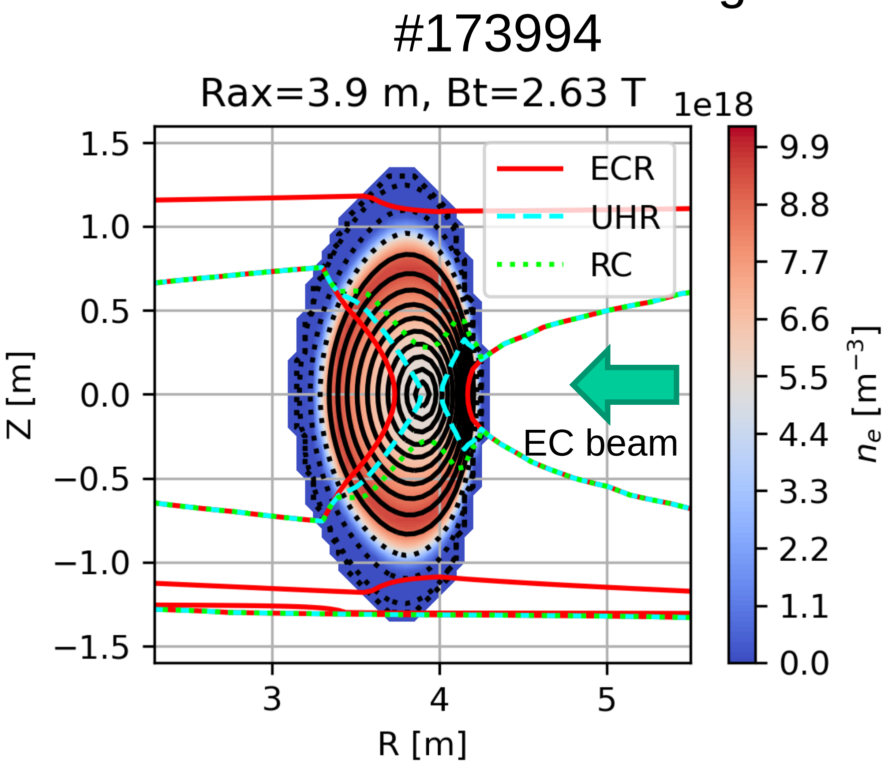
Investigating EBW heating characteristics via X-B mode conversion from high field side injection   R. Yanai et. al.

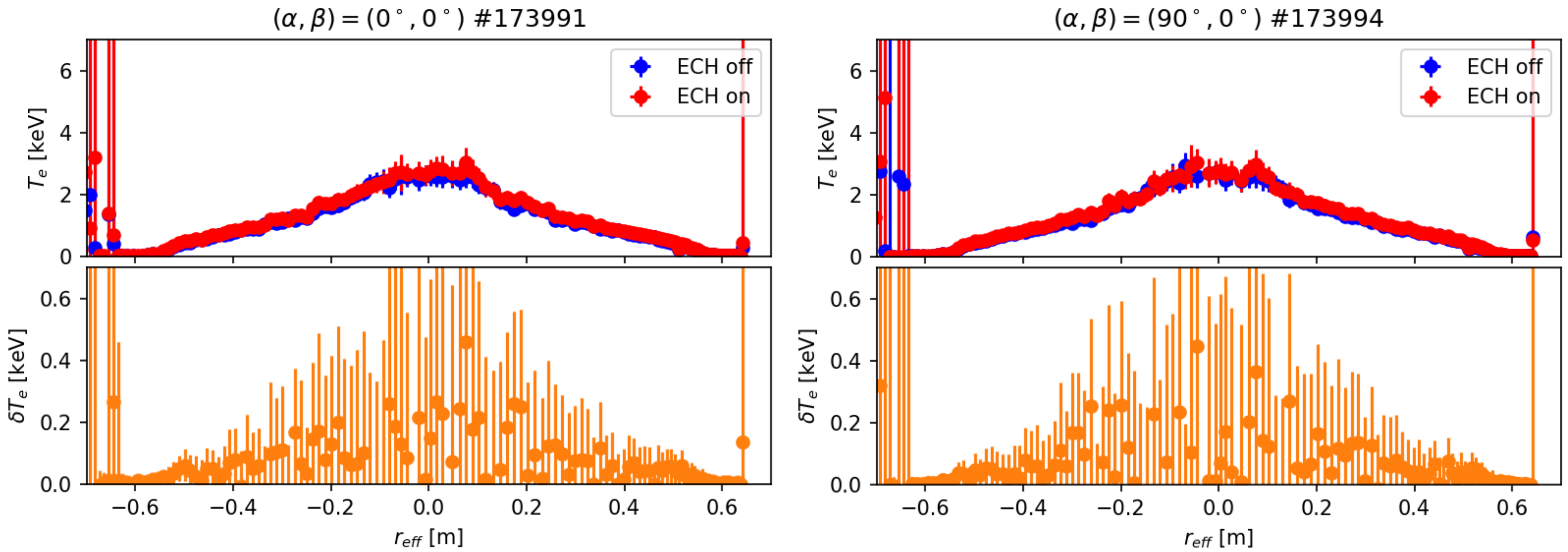
Shot#: 173957-173995

Experimental conditions: (R_{ax}, B_t, γ, B_q) = (3.9 m, 2.63 T, 1.2538, 100.0%)

Objective: Investigating the EBW heating and current drive by using the 1.5UO mirror.

Method: Injecting the X-mode wave from the 1.5UO launcher to excite EBW via UHR and comparing the characteristics of heating and driving current with O-mode injection.

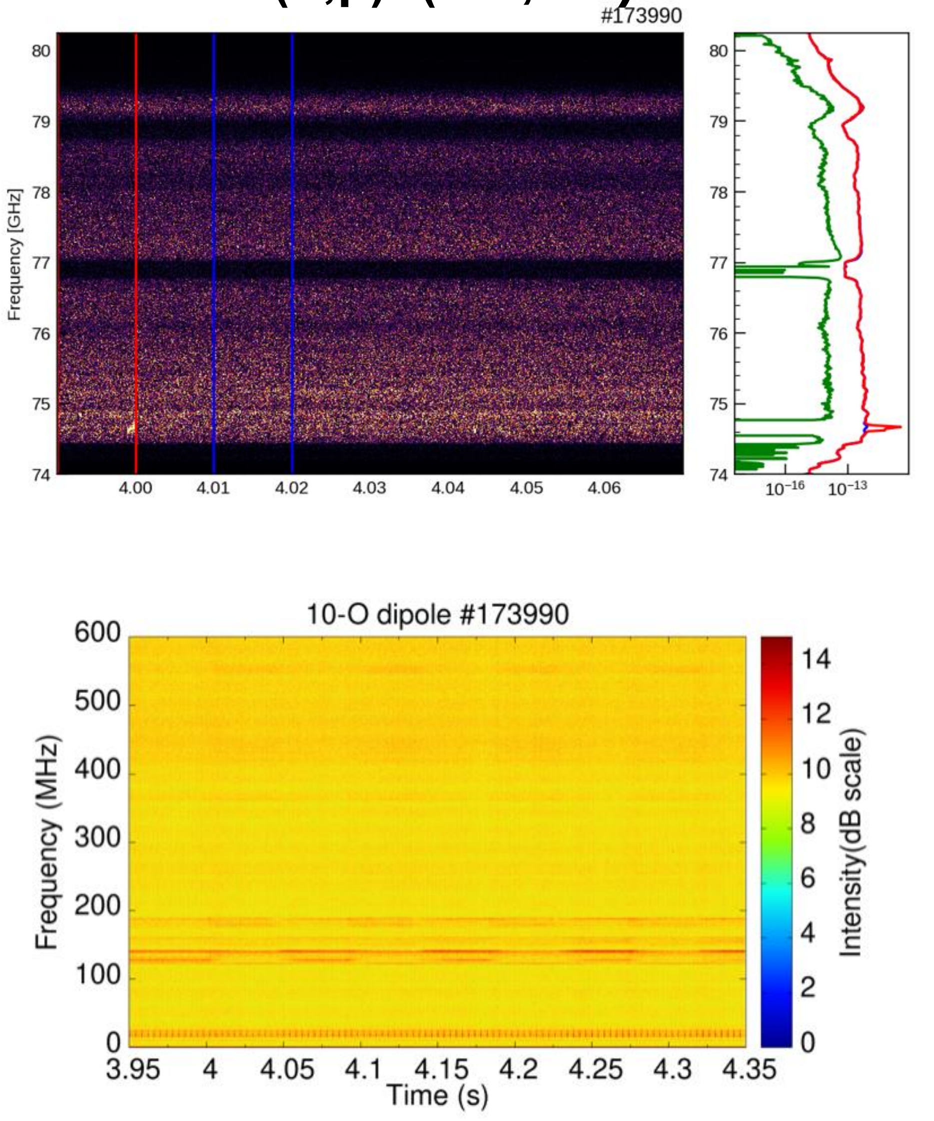




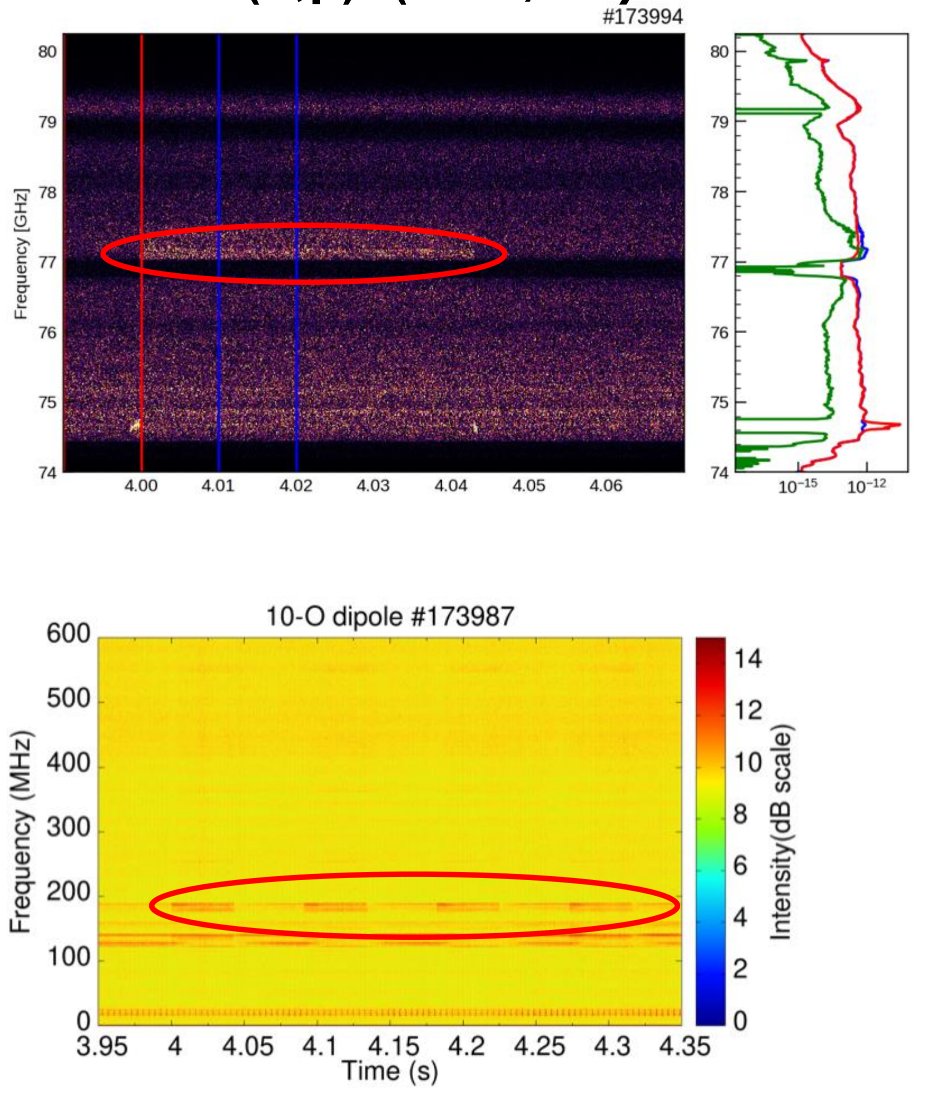
We injected the ECH of different polarization settings into the plasma ($\overline{n_e} < 1 \times 10^{19}\ \mathrm{m}^{-3}$) to put the UHR in the front of the 1.5UO launcher. We could not observe the significant difference in the δT_e profiles derived by the conditional average.

Investigating EBW heating characteristics via X-B mode conversion from high field side injection R. Yanai et. al.

(α,β)=(0°,0°)



(α,β)=(90°,0°)



- We measured RF signal using CTS receiver and 10-O dipole antenna.
- In the case of (α,β)=(90°,0°), we found characteristic RF signal around 77 GHz and 200 MHz.
- These RF signals may be excited due to parametric decay instability.