(TG4) Plasma instability group report

Nov. 26, 2021 (S. Kamio)

Date: Nov. 25, 2021
Time: 10:00 - 18:45
Shot#: 173396 – 173523 (128 shots)

Prior wall conditioning: No
Divertor pump: Off
Gas puff: D2, Pellet: D2
NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, D)=P(2.3, 2.2, 2.1, 2.9, 3.8)MW
ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(700, 790)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(980, 930, 990)kW
ECH(56GHz)=ant(1.5U)=P(0)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.9, 0.8, 1.0, 0.7)MW
Neutron yield integrated over experiment = 2.3×10^{17}

Topics
1. Fast-ion transport in MHD-quiescent plasmas (W. Heidbrink)
2. Effect of phase-space distribution on Triton confinement (J. Jo)
3. Effect of Electron Temperature on Fast-ion Distribution with Fast-ion D alpha diagnostic (S. Kamio)

Neoclassical fast-ion confinement in MHD-quiescent plasmas

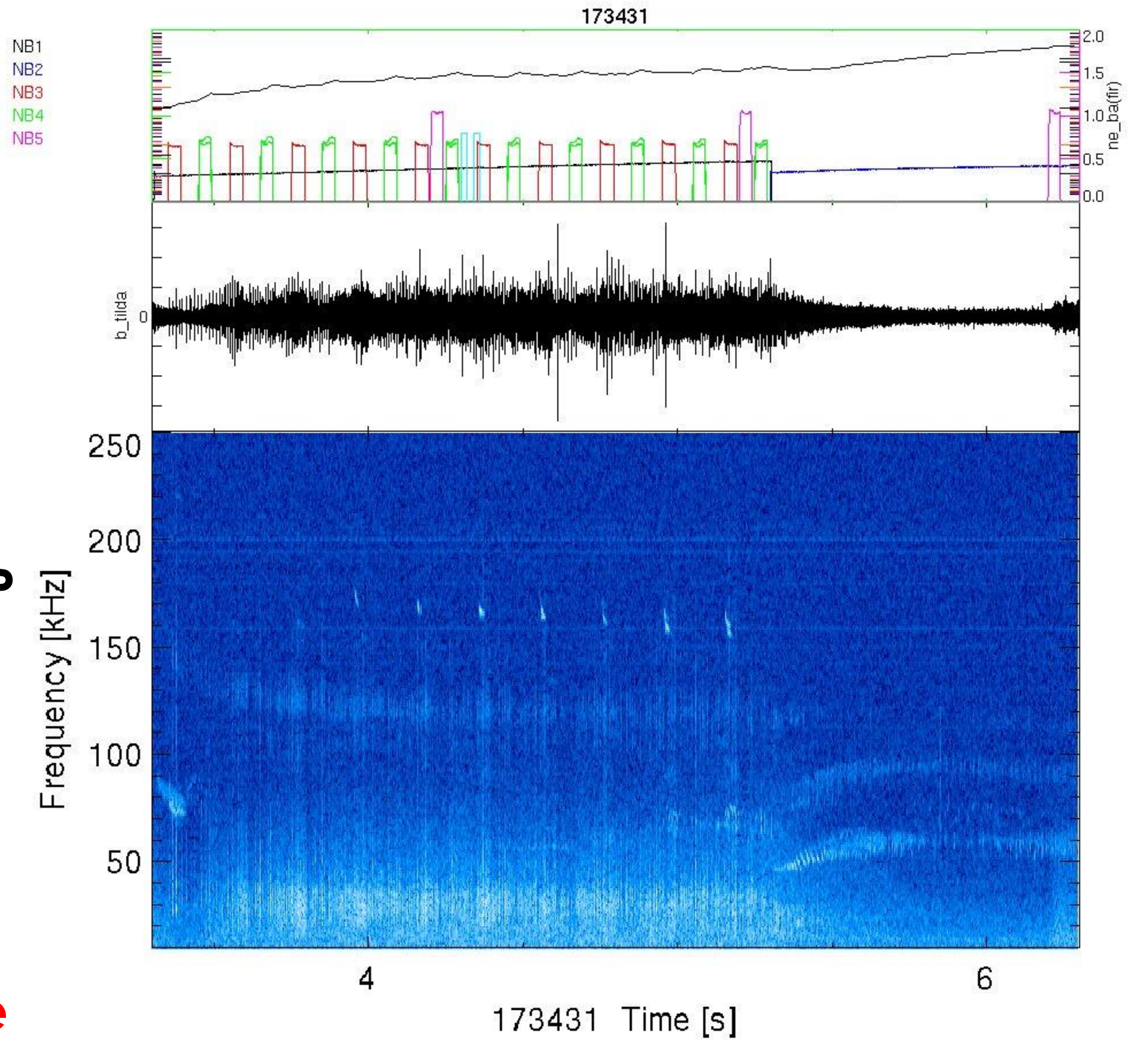
W.W. Heidbrink

Objective

- Measure fast ions in 4 magnetic configurations that are predicted to have different neoclassical confinement for (predominately) co-passing, counter-passing, and helically trapped populations

Approach

- Steady-state distribution functions from NB #1(A&B separately), 2 (A&B separately), 3, and 4 at 3 different values of R_{ax}
- Repeat shots from November 24 with a different configuration of FIDA channels and to acquire HIBP data
- Polarity = CW, R_{ax}=(3.6,3.55,3.6,3,75) and B=(1.375,2.79,2.75,2.64) D beams into D gas
- Good matches to the November 24 shots were usually achieved.
- Hoped for MHD-quiescent conditions for one of the beam types at all 3 radii but that was NOT achieved



Effect of phase-space distribution on Triton confinement

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

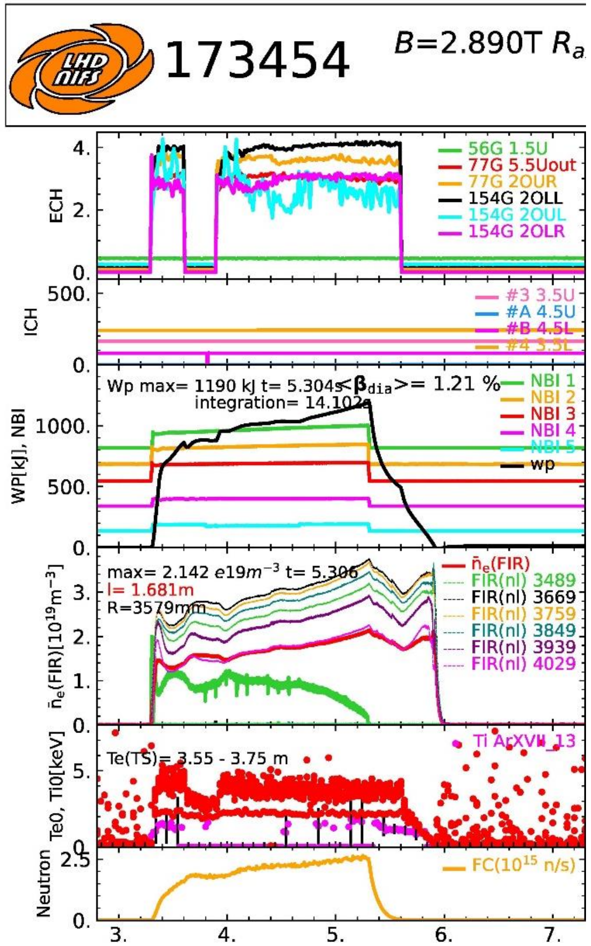
Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.55 m, CW, 2.89 T, 1.254, 100%)

Background and motive

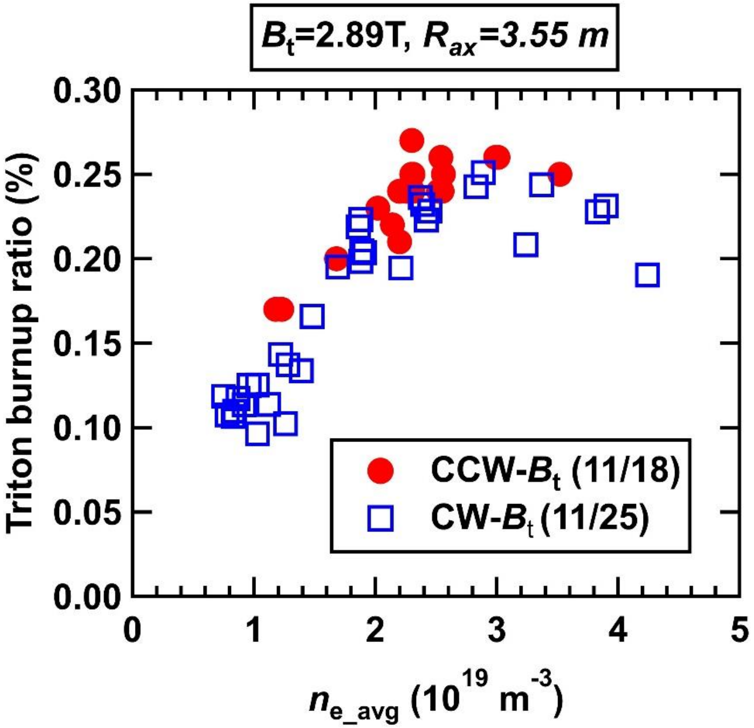
- We have been performing collaborative studies on triton confinement using scintillating fiber detectors in KSTAR and LHD for the systematic understanding of energetic ion confinement.
- In LHD, the GNET simulation suggests that asymmetry of the initial triton velocity, formed by tangential N-NB ions, improves the triton burnup ratio due to the decrease of trapped tritons.
- We perform the experiment to compare the triton burnup ratio in the CCW-B_t (co-NBx2 + ctr-NBx1) and the CW-B_t (co-NBx1 + ctr-NBx2) conditions to understand this asymmetric effect in detail.
- We performed triton burnup experiments in the CCW-B_t condition in Nov. 18th.

Results

- We performed triton burnup experiments in the CW-B_t condition.
- It is found that the triton burnup ratio obtained in the CW-B_t condition is slightly lower than that obtained in the CCW-B_t condition.
  - We will analyze the triton confinement ability in different phase-space distributions in detail.



$Y_{n\_DD}=4.1\times10^{15}$
$Y_{n\_DT}=5.5\times10^{12}$



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

Experimental conditions:

(*R*ax, Polarity, *B*t, *γ*, *B*q) = (3.6 m, CW, 2.75 T, 1.254, 100.0 %), (3.6 m, CW, 1.375 T, 1.254, 100.0 %)

Shot numbers: #173495 - #173523 (28 shots)

Background and motivation:

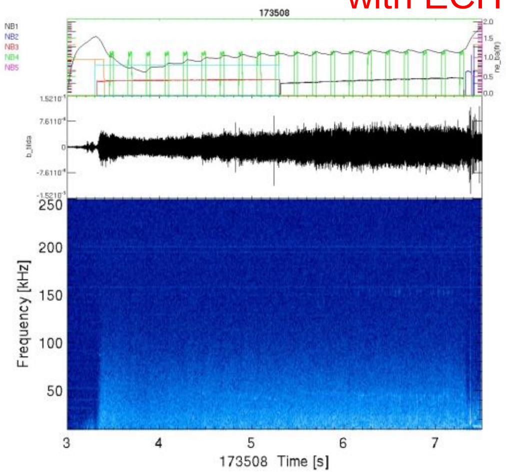
To understand the effect of the superposition of the electron cyclotron resonance heating (ECH) on the fast ion distribution and transport, measurement of the radial profile of fast ion using the FIDA diagnostic was performed in the MHD-quiescent plasma.

Results:

- We obtained ECH power scan (0 MW - 2.9 MW) data in a range of electron density ne ~ 1.0 x 10^{19} m^{-3} on MHD-quiescent plasmas.
- In this experiment, counter NBs were injected 4 seconds in counter clockwise direction by using NB #1 and NB #3 in order to take give count of the fast-ion slowing down time.
- Top figures show examples of typical discharges. Left is discharge with ECH, Right is discharge without ECH.
- Bottom figures show Te, ne and Ti radial profiles. Te and ne profiles are changed by increasing ECH power, but Ti does not.
- We will analyze the results of this experiment to investigate the effect of electron temperature on the fast-ion distribution.

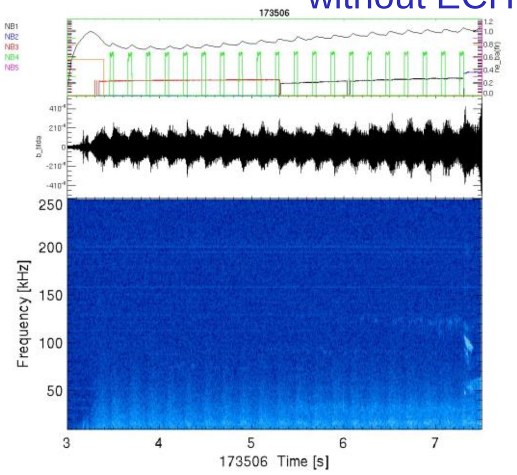
SN 173508

with ECH

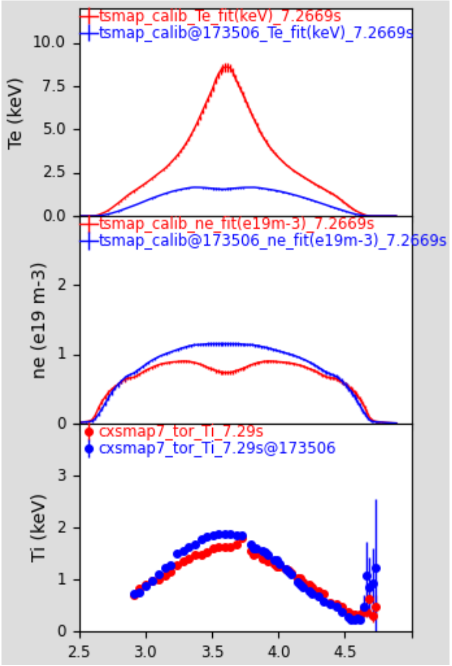


SN 173506

without ECH



ECH 2.9 MW vs 0 MW



ECH 2.9 MW vs 2 MW