(TG1) Multi-ion group report

Dec. 8, 2021 (M. Kobayashi)

Date: Dec. 8, 2021
Time: 15:03 – 18:45
Shot#: 174552 – 174614 (63 shots)

Prior wall conditioning: No
Divertor pump: On
Gas puff: D2, He   IPD: No
LID: No
NBI#(1, 2, 3, 4, 5)=gas(D, D, D, D, He)=P(2.5, 1.7, 2.0, 6.8, 7.2)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(703, 792)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(723, 799, 825)kW
ECH(116GHz)=ant(2O-LR)=P(-)kW
ECH(56GHz)=ant(1.5-U)=P(-)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(-, -, -, -) MW
Neutron yield integrated over the experiment = 1.3×10^{17}

Topics
1. Poloidal in-out Asymmetric Distributions of Core Toroidal Rotation by ECH (W.H. Ko, K. Ida et al.)
2. Reconstruction of the 5D phase-space distribution function (M. Nishiura, D. Moseev et al.)
3. Wall/plasma exchange mechanism in multi-ions plasma (G. Motojima, M. Yoshinuma)

Poloidal in-out Asymmetric Distributions of Core Toroidal Rotation by ECH (by W.H. Ko)

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100.0%) ECH modulation with 1.25Hz as compared (CW, 2.75 T, 100.0%)

Objective and background:

- Poloidal in-out asymmetric distributions of core toroidal flow were observed in balanced NBI plasma by ECH
- Searching the source of the **ECH-driven flow asymmetry**. (i) Effect of Pfirsch–Schlüter flow, (ii) Asymmetric toroidal rotation by the ECH-driven **asymmetric flux** surfaces [Y Camenen, et al., PPCF (2010)]

Results:

- The lower the density(higher core Ti) and the stronger ECH power with the more on-axis, the more asymmetry distribution of toroidal flow (Fig. 1 & 2) If the direction of the toroidal magnetic field is change, the direction of toroidal flow is change and flow asymmetry is change by ECH deposition position .

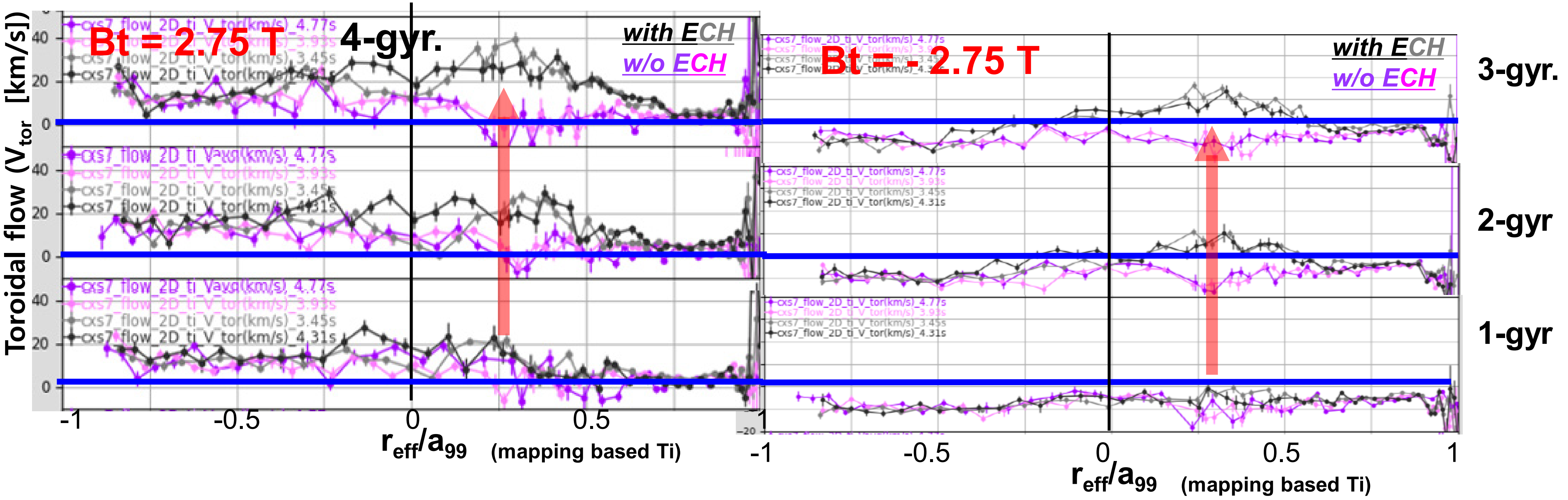

Fig. 1 ECH power scan (for on-axis case)

Poloidal in-out Asymmetric Distributions of Core Toroidal Rotation by ECH (by W.H. Ko)

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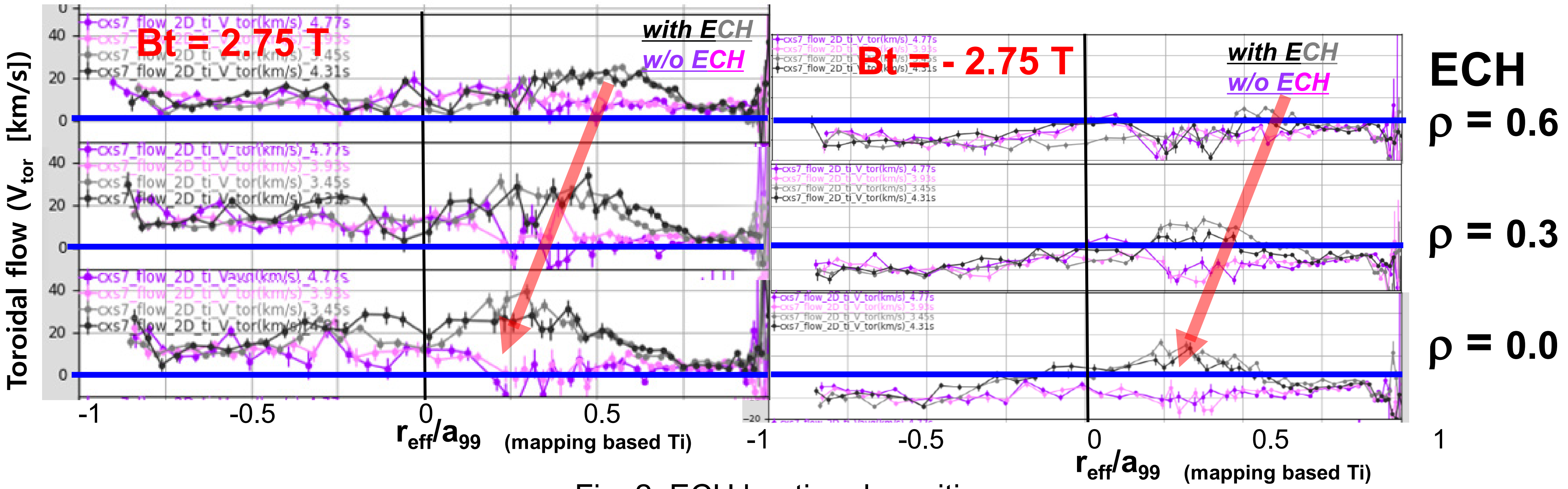
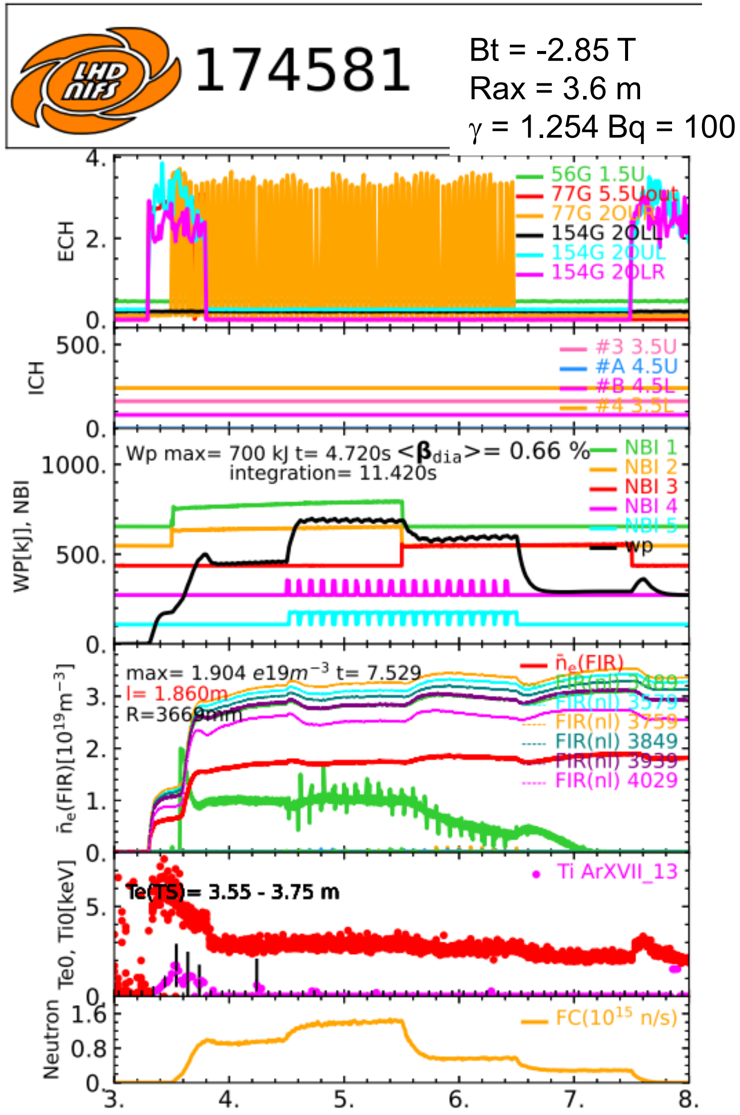


Fig. 2 ECH heating deposition scan

5D-velocity space tomography for fast ions
M. Nishiura, D. Moseev(IPP), N. Kenmochi, R. Yanai



Experimental Condition

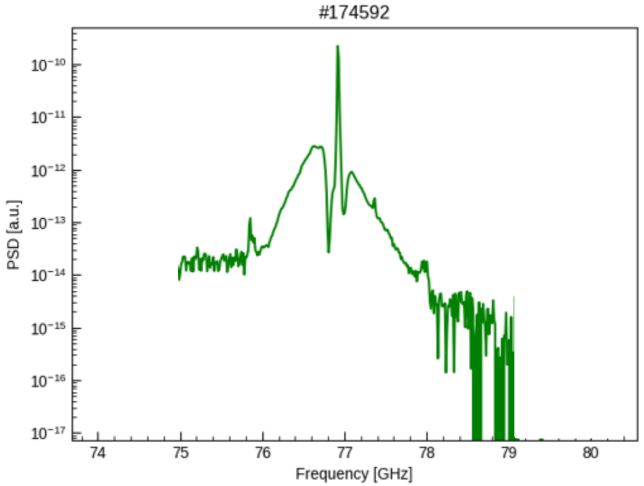
- #174579 - # 174595 (Rax=3.6m, Bt=-2.85T, gamma=1.254, Bq=100%)

Background and objective

- Fast ions was measured by FIDA and neutron diagnostics. Those data are combined for a tomographic inversion to reconstruct a velocity distribution. Denmark group has demonstrated the velocity space analysis combining FIDA and neutron diagnostics (B. Madsen et al., PPCF 62(2020)115019).
- FIDA, neutron, and CTS diagnostics has measured fast ions to reconstruct a velocity distribution. We conducted this experiment with the same condition on last Friday 3 Dec. 2021.

Results

- The probe beam (2O-UR) was modulated to subtract the ECE background. The receive beam (2O-LL) was overlaped at r/a=0.35, 0.5, and 0.8 to obtain the spatial profile of bulk and fast ions.
- The data from FIDA and neutron diagnostics is combined with CTS for the velocity space analysis of fast ions.



Typical CTS spectrum contains bulk and fast ion components at r/a=0.35.

Plasma changeover from deuterium to helium in ECH plasmas (G. Motojima, M. Yoshinuma(NIFS))

- ✓ Experimental conditions:
  - ❖ Shot No: 174596-174614
  - ❖ B_t, R_{ax}, γ, Bq = (-2.75, 3.6, 1.254, 100)
- ✓ Motivation and objective:
  - ❖ To understand the mechanism how to changeover the particles in plasma supplied from gas puffing and wall
  - ❖ The gas species were changed in one discharge from D2 to He.
- ✓ Results:
  - ❖ He/H ratio measured by CXS showed that the increase of He intensity in the core was observed just after the He puffing, suggesting that timescale of the changeover of particles in the core looks fast (shown in the circle of orange line). He/H ratio was finally flattened.
  - ❖ The peak position of He intensity measured by CXS looks shifted to the core, suggesting the time scale of transport? Further study is necessary.