Daily Report for 2025-10-30

Y. Kawamoto

Date: October 30, 2025
Time: 10:00 – 17:15
Shot: 195674 – 195804 (131 shots)
Prior wall conditioning: He
Divertor pump: No
Gas puff: H2, Ar, Ne
Pellet: impurity pellet (W, Au)
LID: Yes

NBI: #1, #2, #3, #4, #5
ECH: 2-OUR (77GHz), 5.5-UO (77GHz), 2-OUL (154GHz), 2-OLL (154GHz)
ICH: 4.5UL(modulation)

Topics

1. Investigation of tungsten (W) and gold (Au) behavior injected via the TESPEL system into the NBI-heated hydrogen LHD plasma: effects on plasma density and temperature observed by VUV spectroscopy(T. Fornal)
2. Density profile control by off-axis ECH in high density plasmas(K.Ogihara)
3. Heating efficiency and fast ion tail formation of ICRF second proton heating(R. Seki)
4. Sawtooth Oscillation Excitation Conditions(Y. Takemura)

Investigation of tungsten (W) and gold (Au) behavior injected via the TESPEL system into the NBI-heated hydrogen LHD plasma: effects on plasma density and temperature observed by VUV spectroscopy

(T. Fornal, M. Kubkowska, Ł. Syrocki, N. Tamura, Ch. Suzuki et al.) **30 October 2025**

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100.0%)
#195675 - #195695

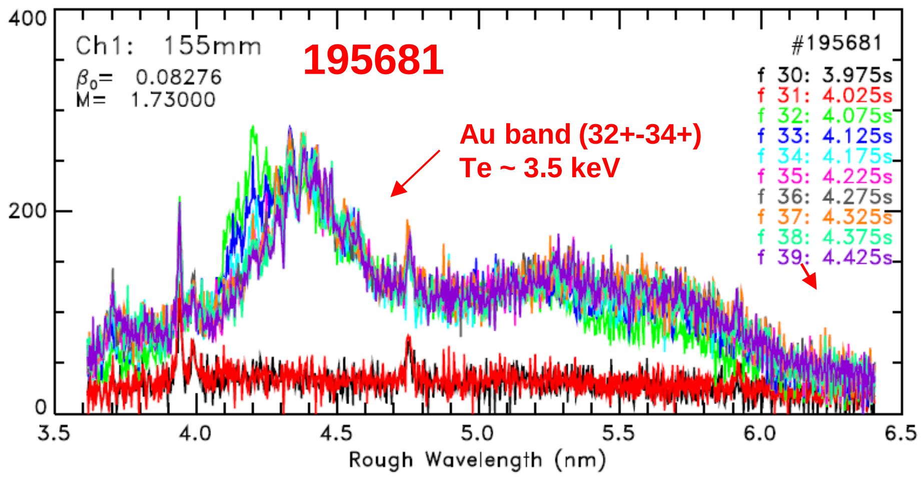
Motivation:

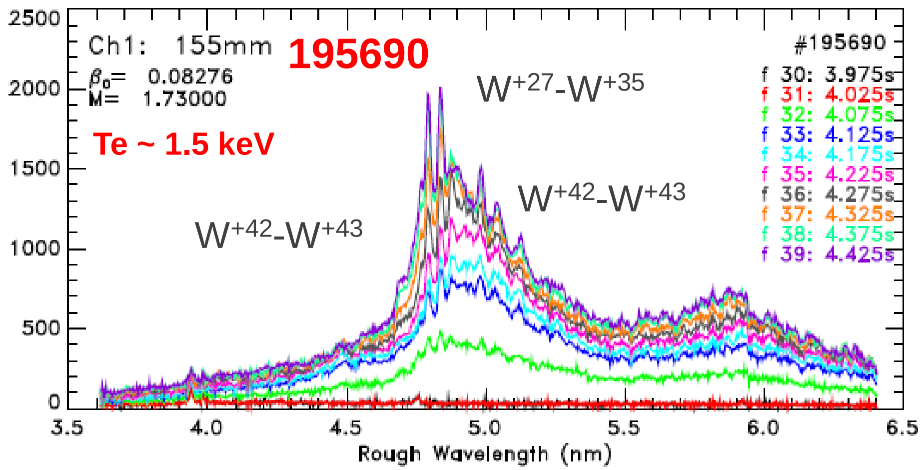
- Tungsten is a leading candidate for plasma-facing components in future reactors.
- Gold, with similar atomic number, provides a useful reference point in spectroscopic studies.
- Estimate the impurity decay time based on the line intensity evolution of injected elements for various electron plasma temperatures (~1.5 - 3.5 keV)

Results:

- **TESPELs** (t = 4.025 s) and Ar gas puff (t = 3.8 s) **are successfully injected** into the NBI-heated LHD H plasmas with n_e = 2E19 m^{-3}
- Measurements over different Te were successfully achieved.
- Emission bands of W and Au were clearly observed in SOXMOS data;
- The comparison between NBI and ECRH (experiment planned in the next week) heated plasmas will be performed;
- Detailed analysis and simulations needs to be performed using modeling tools such as Flexible Atomic Code (FAC);

In the discharges **with W and Au injections**, the emission band is clearly observed in SOXMOS data





Density profile control in high density plasma by off-axis ECH **(K. Ogihara, S. Inagaki, R. Yanai)**

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q)
(3.6 m, CW, 2.75 T, 1.2538, 100.0%) #195695-#195733

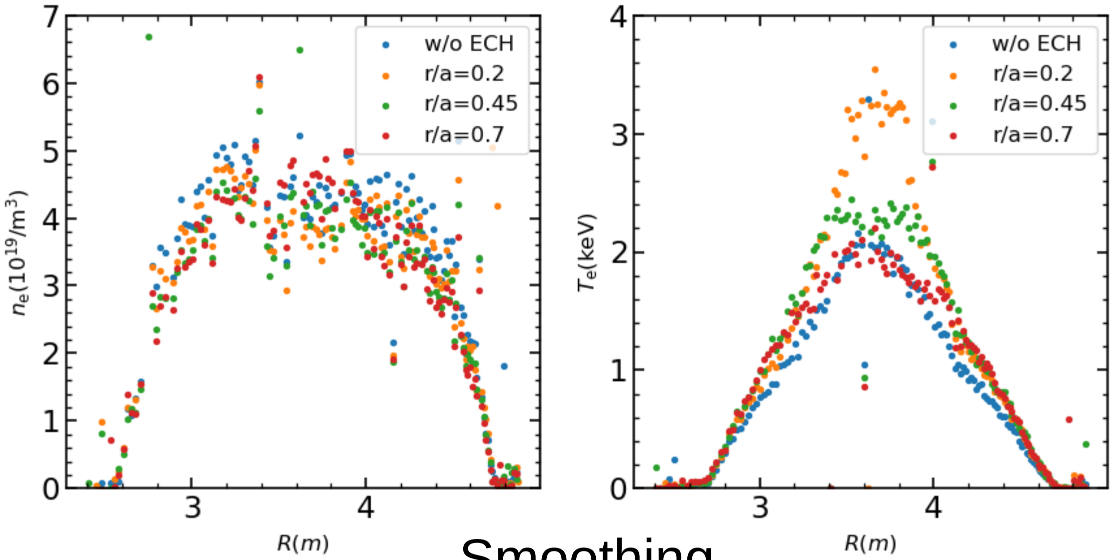
Aim:
To verify the possibility of density control by ECH off-axis heating especially at high density.

Method:
For multiple target densities, NBI and off-axis ECH heating were performed, and the ECH heating position was scanned.

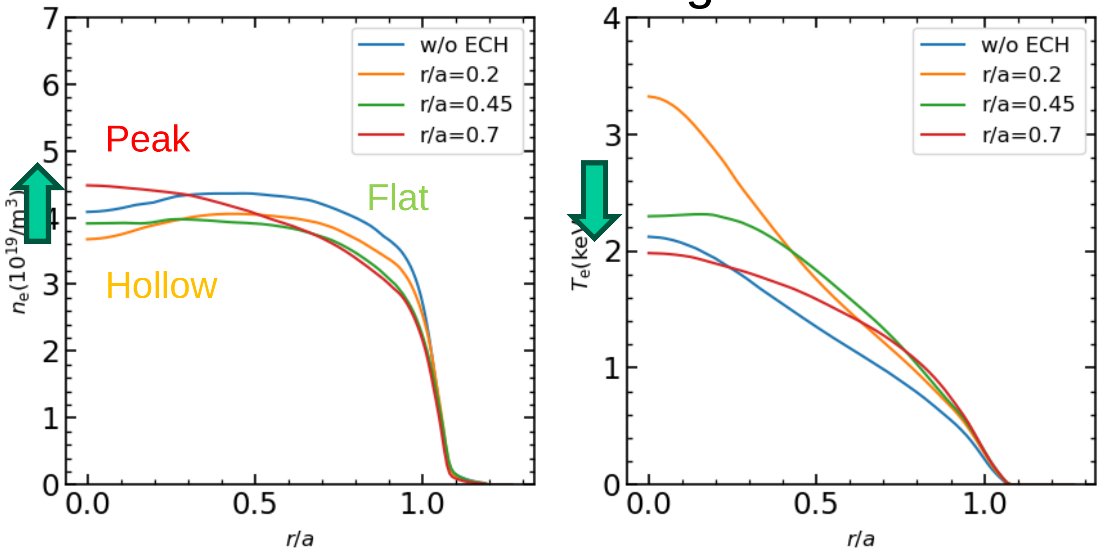
Results:
We successfully observed the dependence of the electron density profile on the ECH heating position, demonstrating that the density can be controlled by off-axis ECH.

Especially, a slightly peaked density profile was obtained when the heating position was r/a = 0.7.

#195711-195716
ne, Te profile at 5.2s

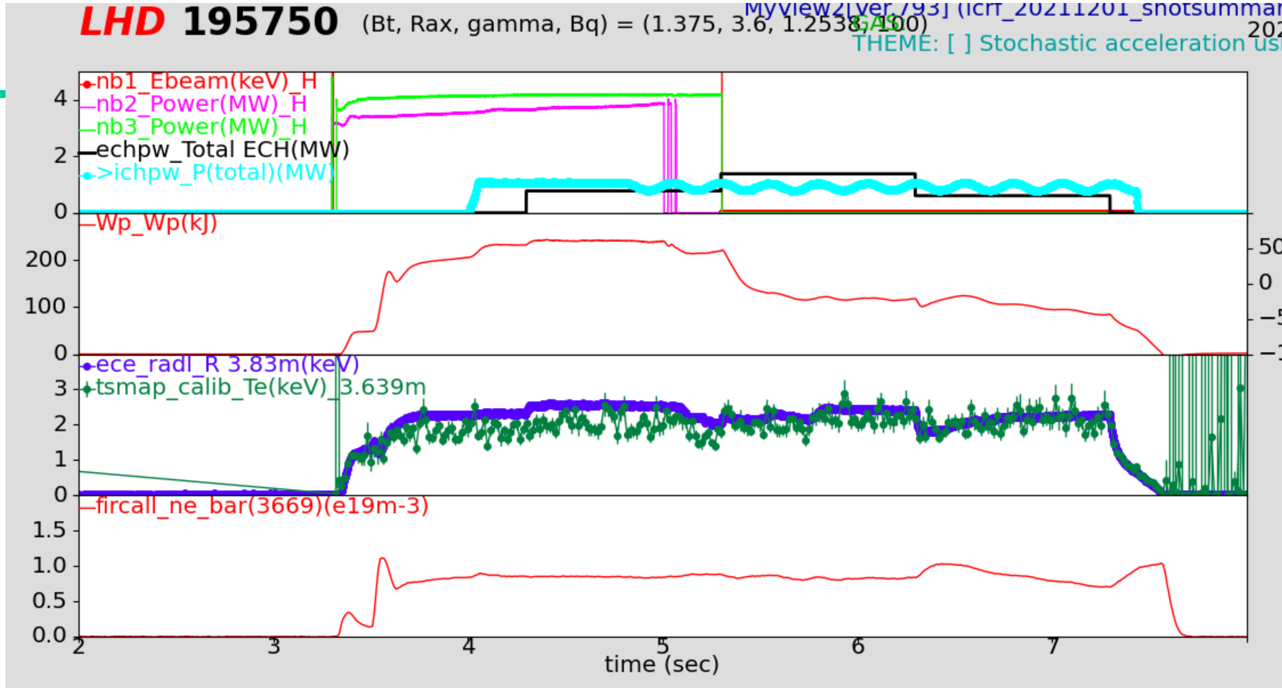


Smoothing



Heating efficiency and fast ion tail formation of ICRF second proton heating

R. Seki



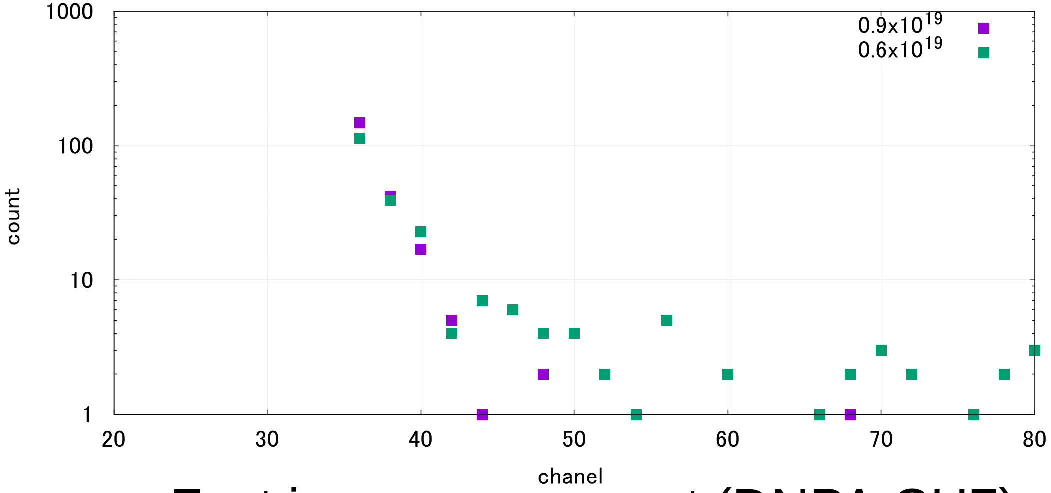
Experimental conditions: antenna from plasma: 10 cm
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 1.375 T, 1.2538, 100.0%)
#195737 – #195755
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 1.25 T, 1.2538, 100.0%)
#195756 – #195765

Motivation:

- To estimate the fast ion tail numerically, the dependence of the heating efficiency and the fast ion tail on the slowing down time (ICRF power) in the 2nd heating are required.

Results:

- The response of the plasma stored energy by ICRF power modulation was observed for the evaluation of the efficiency of ICRF 2nd proton heating.
- The ICRF 2nd fast ion tail was measured by changing the slowing down time with DNPA.
- The slowing down time dependence of the effective temperature of fast ion tail will be investigated.



Fast ion measurement (DNPA:CH7)

Sawtooth Oscillation Excitation Conditions

Y. Takemura

Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CW, 0.9 T, 1.129, 100.0%)
#195768 – #195804

Motivation and method:

- The onset of sawtooth observed at low γ in the high-collisionality regime may be related to the penetration and shielding of the external *m*/*n*=1/1 RMP.
- The threshold of penetration/shielding was investigated in the low-γ, high-collisionality regime.
- Ramp-up/down RMP experiments were conducted to obtain the threshold.

Results:

- By applying feedback control of density, both penetration and shielding were observed at high density and low temperature.
- Found that the penetration threshold becomes very low in the high-collisionality regime.