(TG1) Multi-ion group report

Nov. 8, 2022 (G. Motojima)

Date: Nov. 4, 2022
Time: 13:10-18:42
Shot#: 182567-182652 (86shots)

Prior wall conditioning: No

Divertor pump: No
Gas puff: D_2, H_2, Ar
H pellet: NO

NBI#(1, 2, 3, 4, 5) = gas(D, D, H, D, D) = P(2.5,2.6,3.4,3.9,5.4)MW

ECH(77 GHz) = ant(5.5-Uout, 2-OUR) = P(209,196) kW
ECH(154 GHz) = ant(2-OLL, 2-OUL , 2-OLR) = P(205,203,237) kW
ECH(56 GHz) = ant(1.5U) = P(-) kW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.46,0.46,0.8,0) MW
Neutron yield integrated over the experiment = 2.5×10^{16} (TG1)

Topics

1. ICRF fast ion measurements and comparison of MEGA simulation (R. Seki)
2. Investigation of wave-particle interactions in ICRF heating on LHD deuterium plasmas at various light-hydrogen concentrations (N. Tsujii (Univ. Tokyo))
3. Wall recycling control using low Z powder dropping (Ashikawa)

1. ICRF fast ion measurements and comparison of MEGA simulation. (R. Seki and J. Wang.)

Shot #:182567-182591

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = (3.6, CCW, 2.6, 1.2538, 100), (3.6, CCW, 2.55, 1.2538, 100)

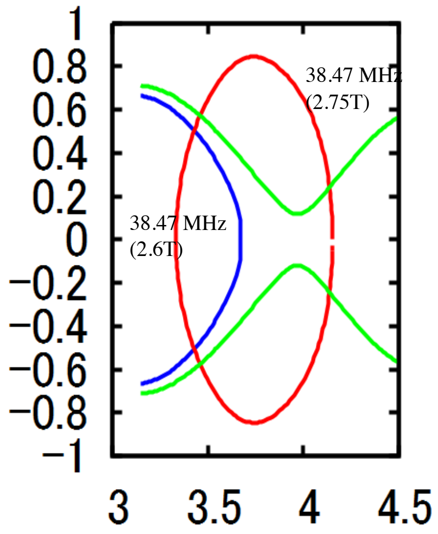
H/(D+H) < 10 %

Background and motivation:

- The ICRF fast ion kick model was introduced to the MEGA for analyses of the instability induced due to the ICRF fast ion. In the MEGA simulation, the Fast-ion induced instabilities are destabilized in the case of∼ 2.6 T, where the ICRF resonance layers er set near the magnetic axis. The validation of simulation results with experiments is important.

Results:

- We observed the fast-ion distribution and magnetic fluctuation in the case of 2.6 T and 2.55 T
- The predicted instabilities around 100 kHz were not observed, probably because Picrf ~1.5 MW.
- We will validate the MEGA simulation by comparing the comparison of fast ion tail with CNPA and We will discuss the reason why the instability was not destabilized.



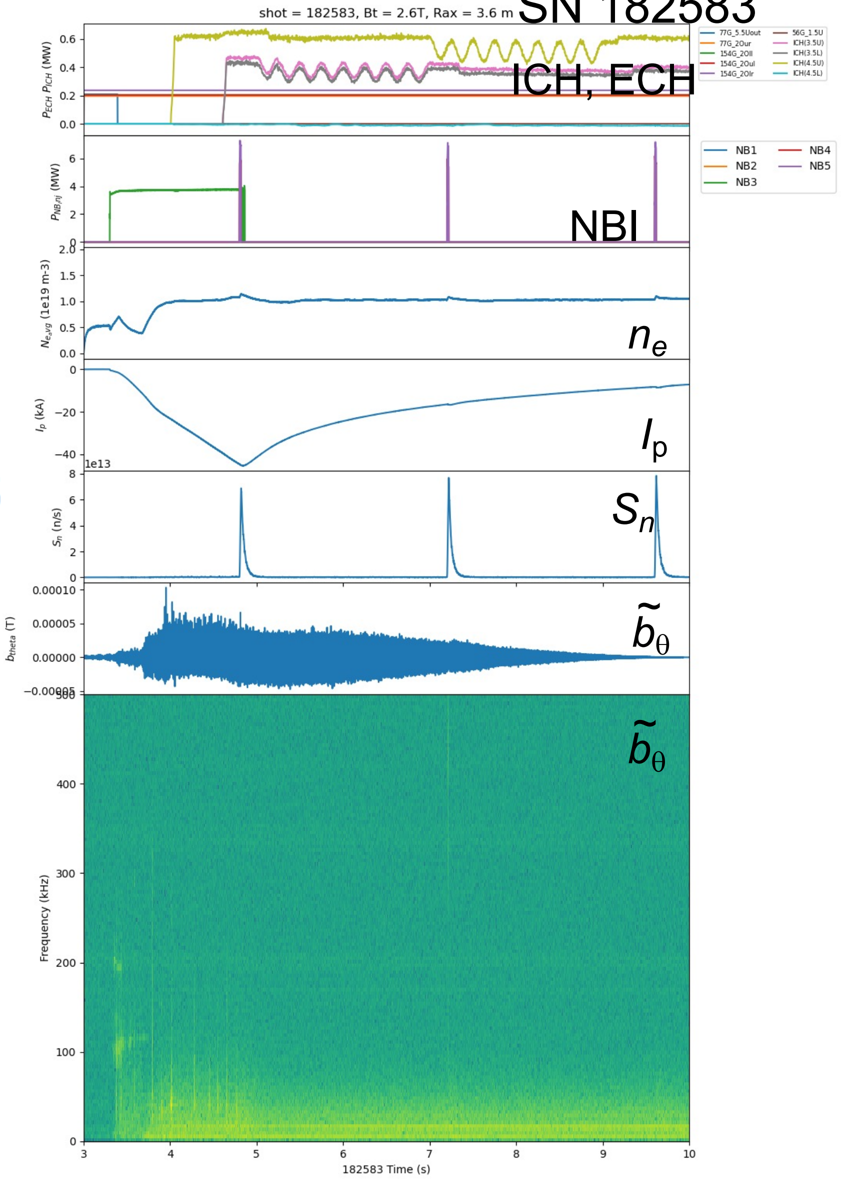


Fig.1 Time evolution of ICRF and ECH power, density, signal of magnetic probe.

2. Investigation of wave-particle interactions in ICRF heating on LHD deuterium plasmas at various light-hydrogen concentrations (Experiment date: Nov. 4, 2022)

N. Tsujii[1], R. Seki, J. Wang, H. Kasahara, K. Saito and T. Seki

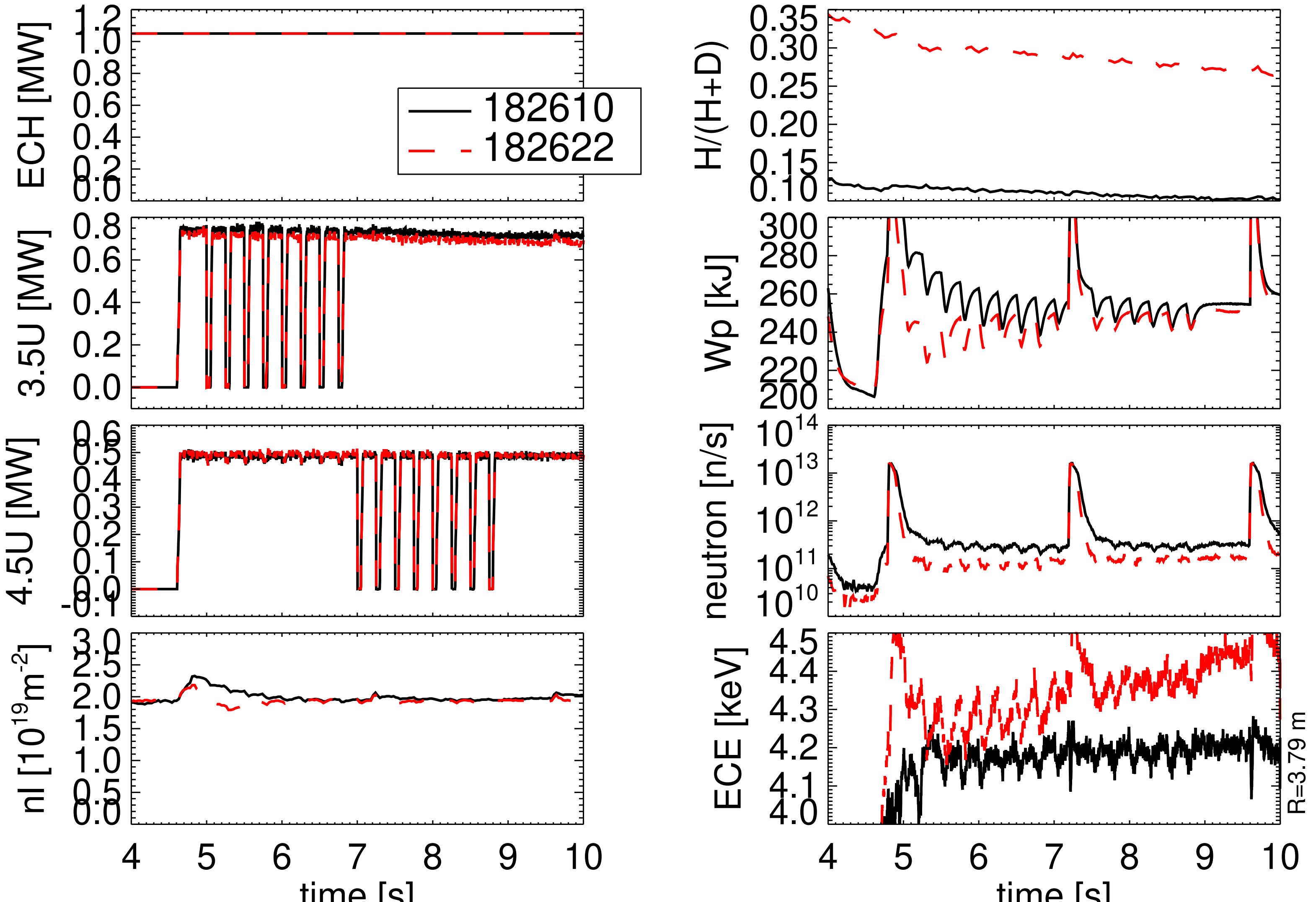
[1]The University of Tokyo, NIFS

LHD debriefing / Nov. 8, 2022

Investigation of wave-particle interactions in ICRF heating on LHD deuterium plasmas at various light-hydrogen concentrations

- Shot: 182592-182628 (22 fully successful shots)
- Experimental conditions: CW, 3.6 m, 2.75 T, 1.2538, 100.0
- Objective
  - Validation of 3-D ICRF wave and fast ion transport simulations
  - LHD ICRF has a unique D(H) heating characteristics (good absorption for a wide range of H concentrations) $\rightarrow$ good platform to test code predictions
- Results
  - H/(H+D) was scanned from 10–30 % according spectroscopy
  - ECE, CNPA data obtained
  - Heating characteristics changed substantially (neutron rate, ECE)

Clear heating characteristic change was observed as the H concentration was varied



2022 Nov. 4

N.Ashikawa, Z.Sun, T.Oishi, T.Kawate, M.Yoshinuma, R.Lunsford, PPPL-Gr

Topic: 3. Wall recycling control using low Z powder dropping

CW, R_{ax}=3.6m, B=2.75T, 1.2538, 100.0 #182629-652

Motivation: Li has advantages for the reduction of wall recycling. Plasma responses by Li powders are investigated in LHD. In particular, no CXS observations for Li in EAST, and then spatial profiles of Li are newly obtained.

- A decrease in **D alpha** was observed **immediately** with increasing Li intensities.
- After Li dropping, a density profile is changed (hollow => peaky), and **core Te and Ti increase.**
- Core Te and Ti increase occurs after Li drop.

- Li : A peak int. shows around 4.2 s during powder-plasma interaction.
- B: A peak int. is delayed by more than 0.5 s. Gradual increase/decrease gradients are observed.