(TG1) Multi-ion group report

Feb. 17, 2022 (H. Kasahara)

Date: Feb. 16, 2022, Time: 9:45~18:45, Shot#: 179055~179196(142 shots)
Prior wall conditioning: No, Divertor pump: On (except for 2-I, 6-I)
Gas puff: H_2, He, SSGP: He(1.5MPa), Pellet: No, LID: No

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(0, 0, 0, 0.78, 0)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.14, 0.16)MW,
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.12, 0.28, 0.34)MW
ICH(3.5U, 3.5L, 4.5U, 4.5L) = P(0.54, 0.54, 0.74, 0.39) MW
Neutron yield integrated over the experiment = 7.3×10^{10}

Topics

1. ICRF plasma production in view of IC wall conditioning in W7-X (C.P. Dhard, H. Kasahara)
2. Improved regimes of radio-frequency plasma start-up in LHD (V. Moiseenko, H. Kasahara)
3. Performance of new pressure gauges of the ITER type(U. Wenzel, G. Motojima)
4. The relation between plasma confinement and neutral particle on divertor condition(G. Motojima)

The main gate for the LHD exhaust system was closed at 12:26 by the alarm for the pressure of the vacuum vessel, and it was a fault for the gas puffing operation.

ICRF plasma production in view of IC wall conditioning in W7-X

(C.P. Dhard, D. Naujoks (IPP), A. Goriaev (LPP-ERM/KMS), H. Kasahara(NIFS))

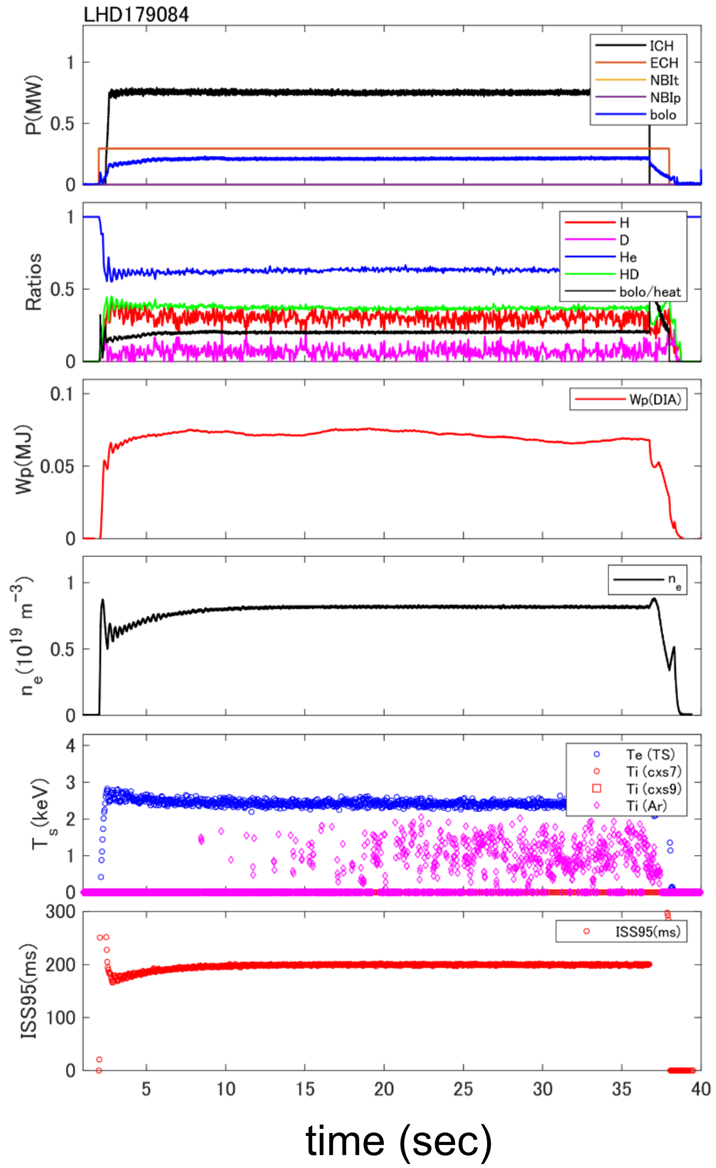
Magnetic Configuration: (Polarity, R_{ax}, B_{ax}, γ, B_q)=(CW, 3.6, 1.375T, 1.2538, 100%)
Shots: #179055 ~ #179092 (38 shots)

The goal of this experiment

In order to accelerate the hydrogen removal from first wall in W7-X, we have investigated wall condition techniques with repeated long-pulse He discharge using the ECH and the ICH in B of 1.375T.

Main results of this experiment

- It is difficult to control gas puffing with similar PID parameters in H and He plasma discharges, I-parameter for PID in He plasma has to be smaller than that in H plasma.
- By repeating the 40s discharge with helium gas puffs eight times, the hydrogen ratio was reduced from 60% to 40%. In 40s discharges, there was not a clear difference between plasma start-up and stop phase.
- We will conduct the wall conditioning analysis for the neutral pressures measured by fig in monopole and dipole operation for ICH.



Improved regimes of radio-frequency plasma start-up in LHD

(V. Moissenko(Kharrkov), Y. Kovtun(Kharrkov), S. Kamio(TAE), H. Kasahara(NIFS))

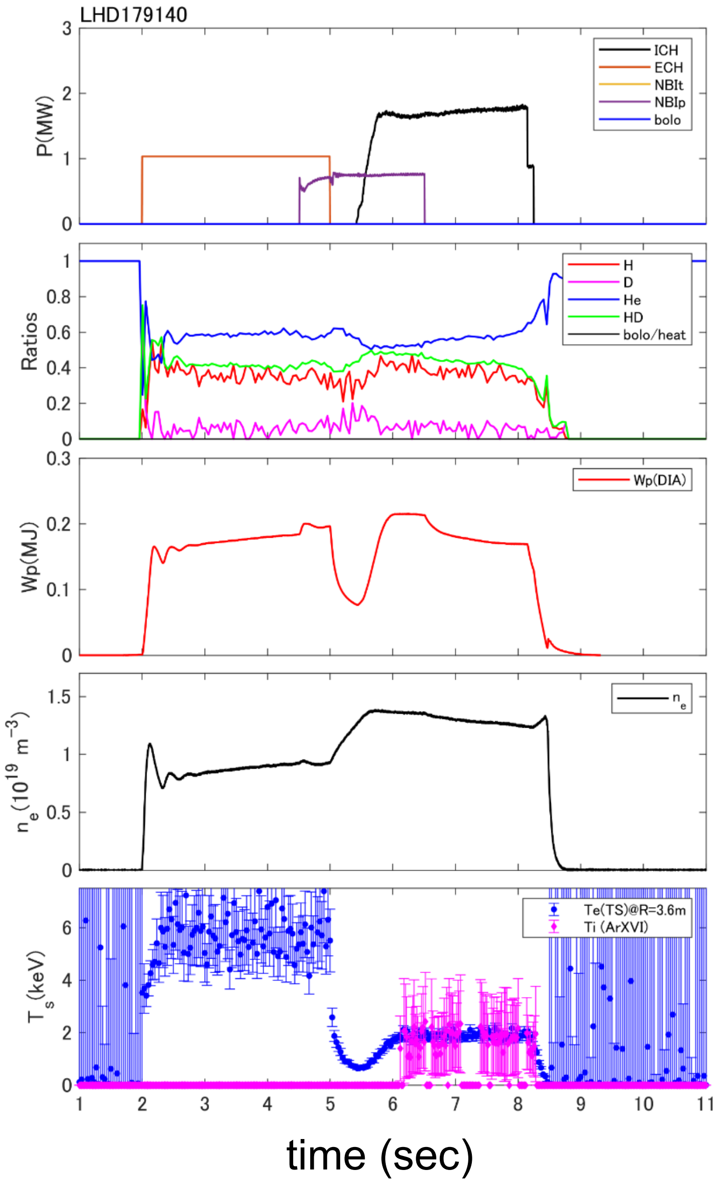
Magnetic Configuration: (Polarity, R_{ax}, B_{ax}, γ, B_q)=(CW, 3.6, 2.55, 1.2538, 100%), (CW, 3.6, 2.75, 1.2538, 100%), **Shots:** #179093 ~ #179154 62 shots)

The goal of this experiment

To establish the plasma start-up scenario for X3-ECH heating operation, ICRF plasma start-up has been investigated.

Main results of this experiment

- In these magnetic configurations, electrons density is clearly increased by ICRF heating, but electron temperature could not be observed by Thomson scattering in ICH only start-up operations.
- With additional ECH on these plasmas, electron temperature did not increase with the ECH power ~ 0.8MW.
- With the perpendicular NBI (~1MW) connected to ECH plasma could not keep plasma density and temperature, but ICH could easily recover them.
- We will conduct the analysis for rising temperature on the ICH start-up phase.



Improved regimes of radio-frequency plasma start-up in LHD

(V.E. Moiseenko(Kharkiv), Yu.V. Kovtun(Kharkiv), S. Kamio(TAE), H. Kasahara(NIFS))

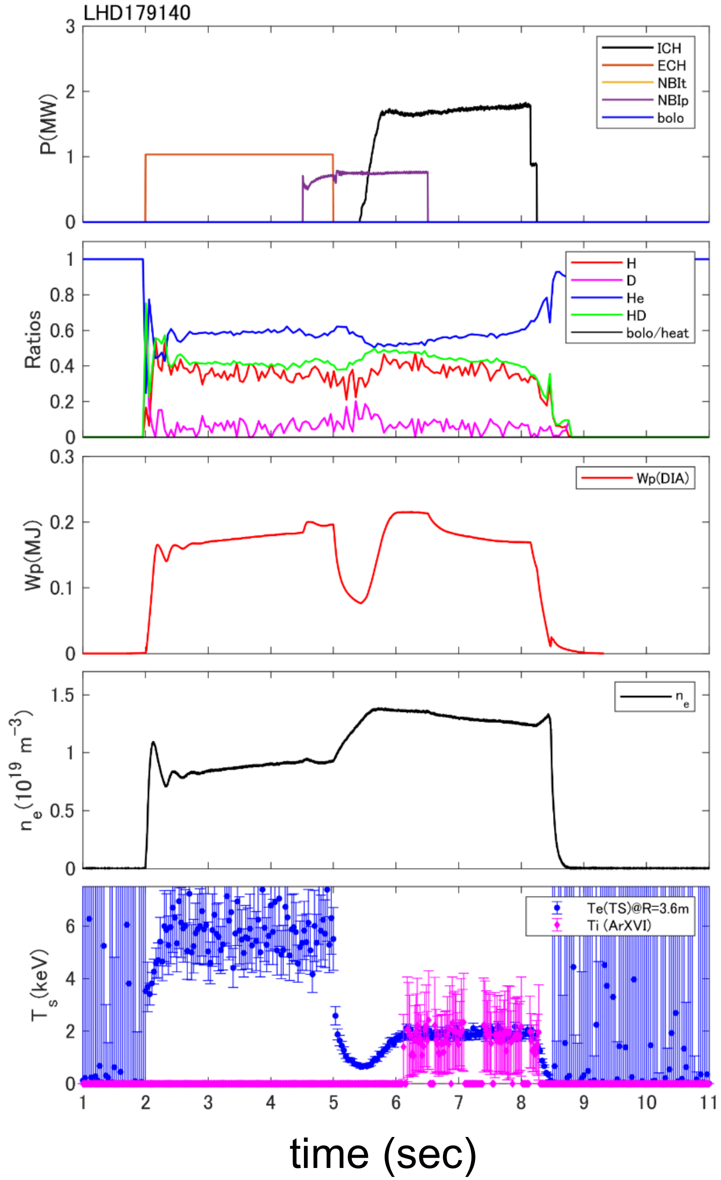
Magnetic Configuration: (Polarity, R_{ax}, B_{ax} , γ, B_q)=(CW, 3.6, 2.55, 1.2538, 100%), (CW, 3.6, 2.75, 1.2538, 100%), **Shots:** #179093 ~ #179154 62 shots)

The goal of this experiment

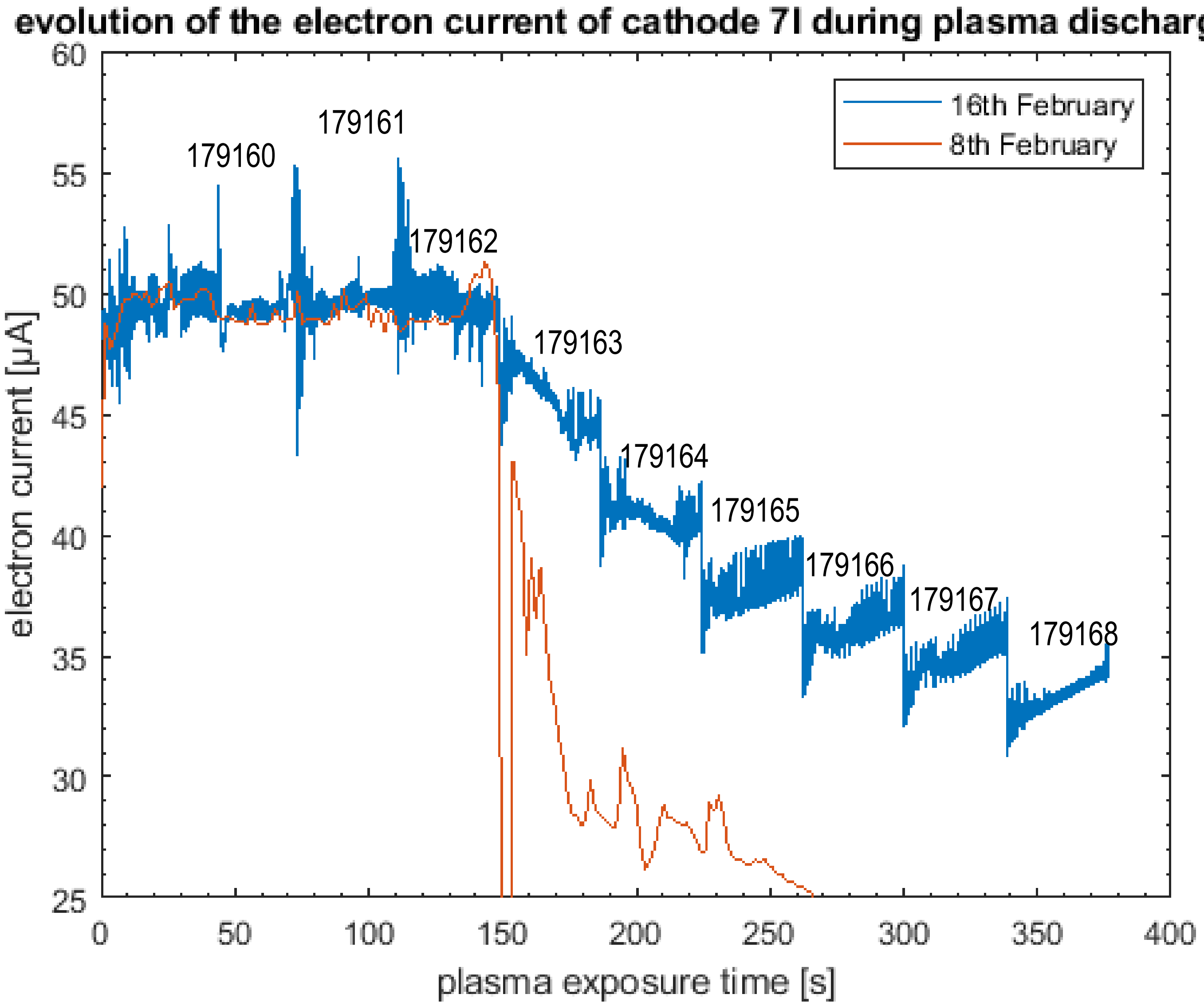
To establish the plasma start-up scenario for X3-ECH heating operation, ICRF plasma start-up has been investigated.

Main results of this experiment

- In these magnetic configurations, electron densities were clearly increased by ICRF heating, but electron temperature could not be observed by Thomson scattering in ICH only start-up operations.
- With additional ECH on these plasmas, electron temperature did not increase with the ECH power of ~ 1MW.
- With the perpendicular NBI (~1MW) connected to ECH plasma could not keep plasma density and temperature, but ICH could recover them.
- We plan to analyze the temperature rise in the ICH start-up phase.



Performance of new pressure gauges of the ITER type (V. Haak and U. Wenzel)

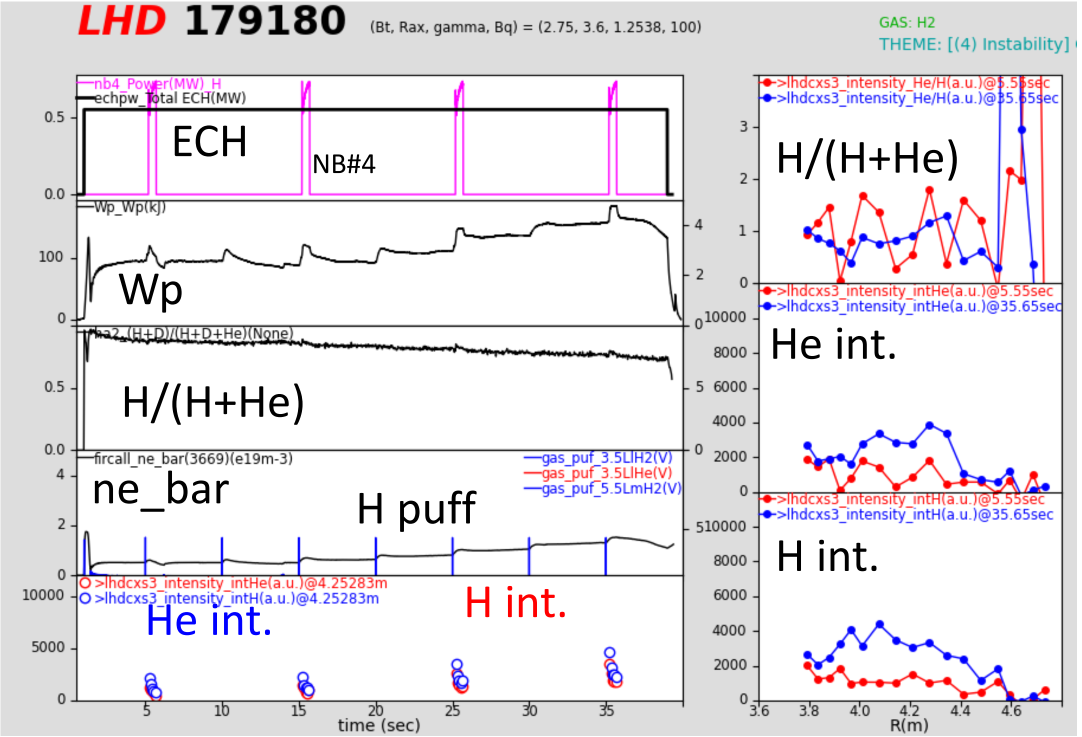


- discharges 179158-179168
- Target density: 2e19m^-3
- Cathode 7I was annealed in the morning and on the days before
- Nevertheless, reduction of the heating current was observed
- Ie decreases after the cathode was exposed to plasma for approx. 150s (as expected from previous experiments, e.g. last week, 8th February)

Wall changeover in 40 s discharges (G. Motojima)

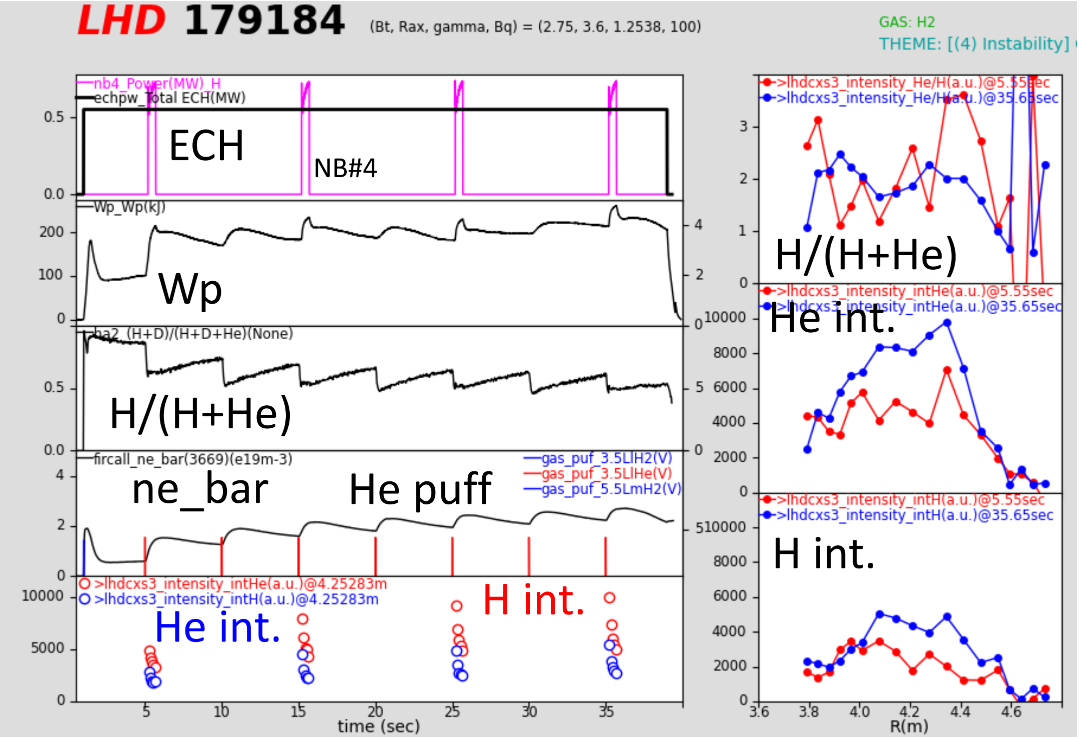
Magnetic Configuration: (R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.75 T, 1.2538, 100.0%)
Shots: 179171-179196 (26 shots)

H puff (0.2Hz)



- ✓ Even though H puff was injected, H/(H+He) was changed from 0.9 to 0.7. He particles were released from the wall (He dominant wall?).
- ✓ **Both He and H intensities in the plasma were increased with time.**

He puff (0.2Hz)



- ✓ After He puff was injected, H/(H+He) was changed from 0.9 to 0.5.
- ✓ **However, both He and H intensities in the plasma were increased with time.** That result suggests that H particles were also released from the wall (mixtured H and He wall?).
- ✓ To evaluate the wall condition, further discussion is required.