(TG1) Multi-ion group report

Jan. 21, 2022 (M. Kobayashi)

Date: Jan. 21, 2022
Time: 9:48 – 12:45, 13:45-17:15
Shot#: 176916 – 176967, 176987-177043 (109 shots)

Prior wall conditioning: H2
Divertor pump: On
Gas puff: D2, H2, He, Ar IPD: No
LID: No
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H,)=P(3.9, 4.0, 3.9, 1.9/1.9, 1.9/1.9) MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(703, 792)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(398, 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(0.6, 0.6, 0.6, 0.4) MW
Neutron yield integrated over the experiment = 1.3×10^{13}

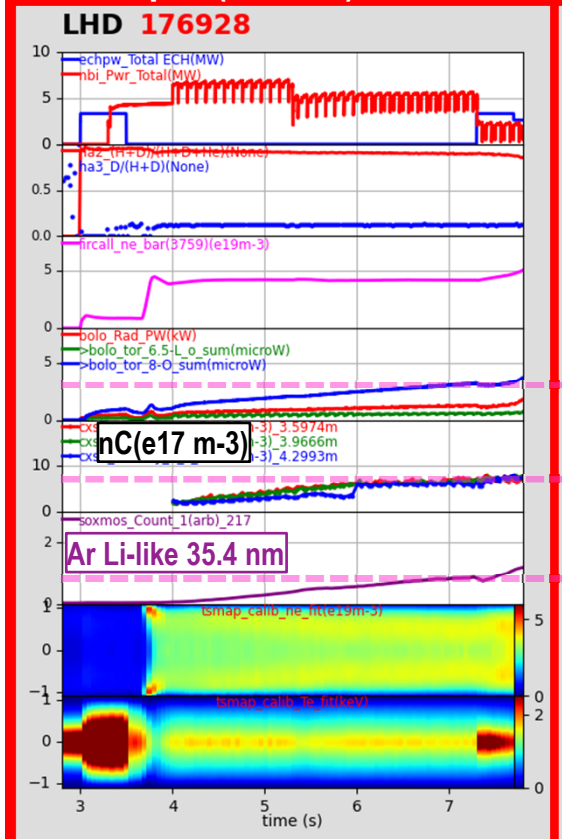
Topics
1. Mixture-induced phase transitions in multi-ion transport (A. Dinklage, N. Tamura)
2. Performance of new pressure gauges of the ITER type (U. Wenzel, G. Motojima)
3. Analyses of plasma transport and fast ion confinement with ICRF power modulation (R. Seki)

Mixture-induced phase transition in multi-ion transport (A. Dinklage, N. Tamura et al.)

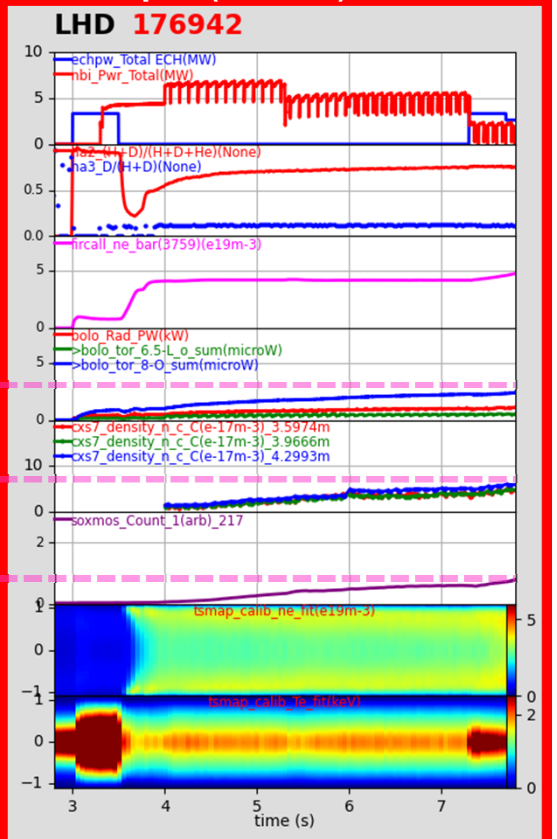
Magnetic Configuration:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.75 m, CCW, 2.64 T, 1.2538, 100.0%), (3.6 m, CCW, 2.75 T, 1.2538, 100.0%)
Shots: 176918-176967
Goal of this experiment: To study the change of the impurity accumulation window in H/D/He-mixed plasmas
Results: We tried to change the He contents in the plasma by using different gas puff settings around n_{e_bar} of 4e19 m^{-3} under the **H-dominated condition: D/(H+D) ~ 0.1**

R_{ax} = 3.75 m

He puff(160 ms) 0.00 V



He puff(160 ms) 2.75 V



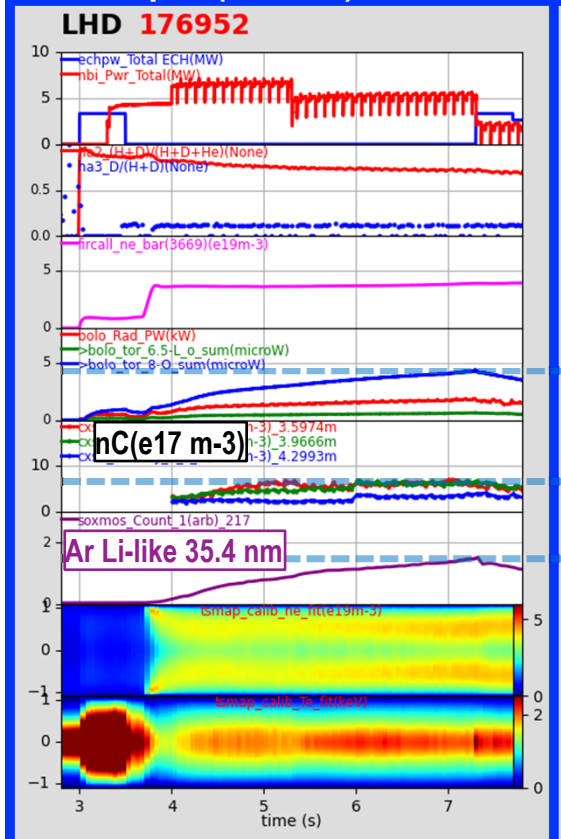
When He contents increased, as a general trends,

- **Bolometer signal level decreased**
- **C-density level decreased**
- **Ar Li-like intensity level decreased**

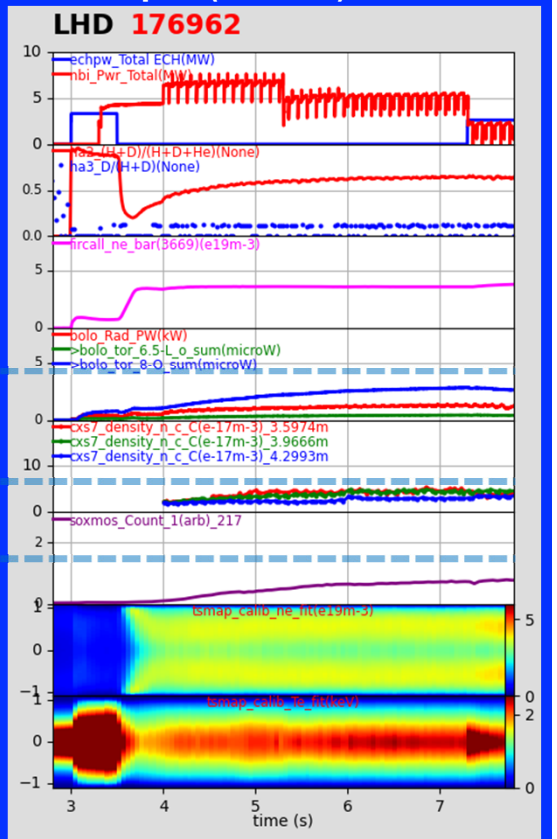
However, such decreases are small at R_{ax} = 3.75 m

R_{ax} = 3.60 m

He puff(160 ms) 0.00 V

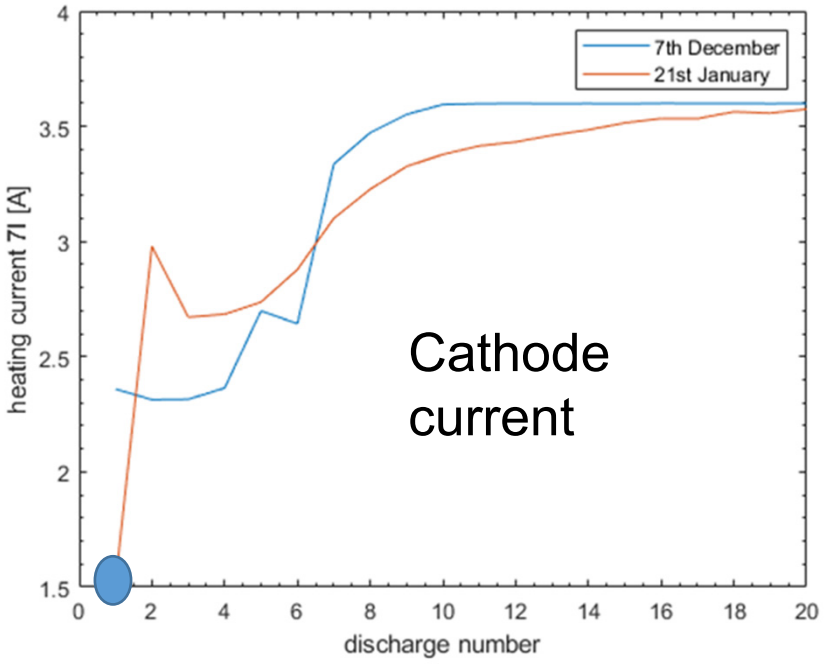


He puff(160 ms) 2.75 V



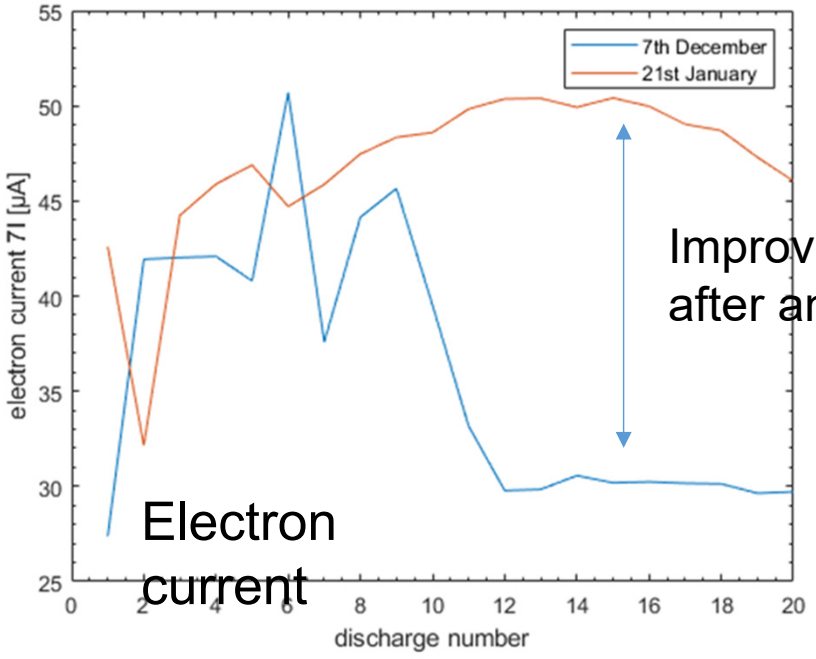
Performance of LaB6 pressure gauges

Standard performance: cathode current of 1.5 A for 200μA at the anode (Laboratory, W7-X, LHD before D-D)



Blue line – shot sequence during D-D operation from 7th of December

Orange line - shots 176987-177006 same heating pattern (NBI 2&3, ECH) and similar density to 7th December



During D-D operation electron current of 50μA in 7I could not be sustained. The same was true immediately after the D-D operation. Annealing of the cathode in the days prior a second experiment in H-H. **The performance is better now. 50 μA was obtained, but the heating current is still near the limit. The LaB6 crystal recovered, but not fully. It remains damaged, very likely by the neutrons.**

Analyses of plasma transport and fast ion confinement with ICRF power modulation (R. Seki)

Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.254, 100%)
H/(D+H) ~ 40 %
Antenna distance from plasma = 9 cm

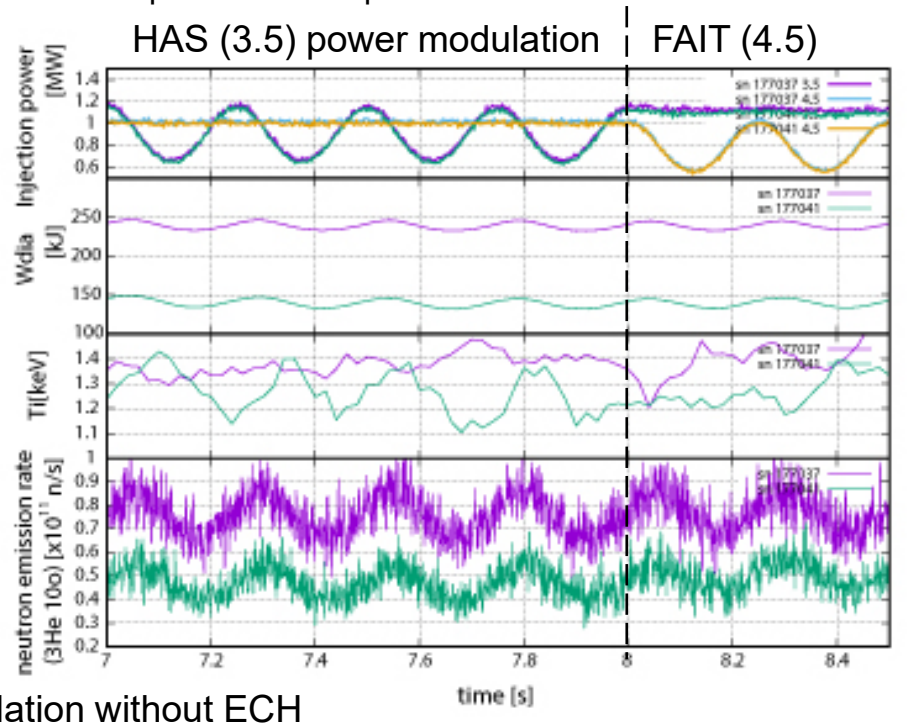
Background and motivation

- The confinement time of fast-ion and bulk plasma can be analyzed from the response caused by the ICRF power modulations.

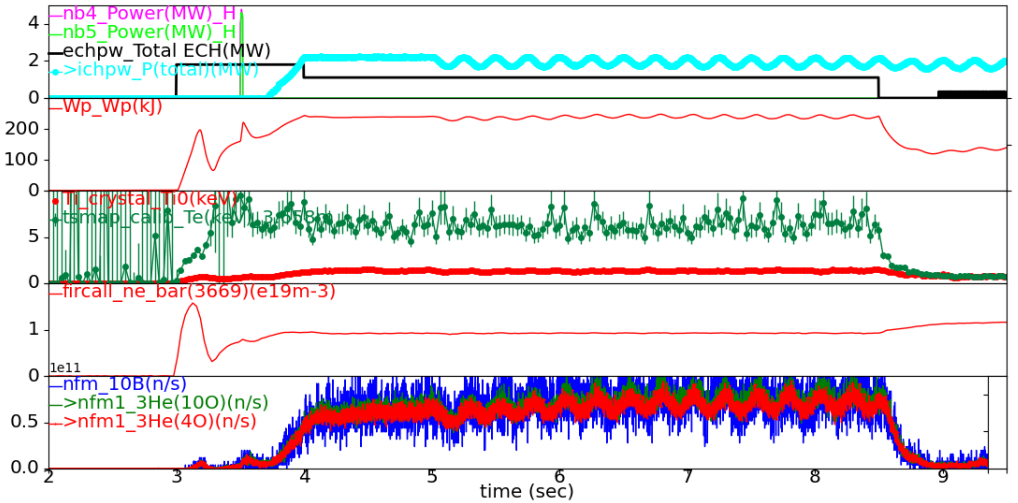
Results

- The stored energy, electron temperature (ECE), ion temperature (Ar), neutron emission rate, and fast ion (DNPA, CNPA) was measured by changing the ECH power and the density in the ICRF power modulations.
- Since the responses of fast-ions and the plasma affect each other, we will analyze them by comparison with simulations.

Response of ICRF power modulation with ECH
Response of ICRF power modulation without ECH



***LHD* 177037** ICRF power modulation with ECH



***LHD* 177041** ICRF power modulation without ECH