(TG1) Multi-ion group report

Date: Oct. 26, 2021
Time: 12:35 - 18:42
Shot#: 170983 – 171090(108 shots)

Oct. 27, 2021 (G. Motojima)

Prior wall conditioning: No
Divertor pump: Off
Gas puff: D2, H2, He, Ar
Pellet: D pellet, Impurity Pellet (C, Fe, Mo)

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, D, D)=P(4.5, 4.3, 4.2, 6.1, 5.7)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(209, 196)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(205, 203, 125)kW
ICH(38.47MHz)=ant(3.5U, 3.5L, 4.5U, 4.5L)=P(550, 400, 800, 450)kW
Neutron yield integrated over the experiment = 1.2×10^{16}

Topics

1. Particle species dependence of impurity hole phenomenon (S. Satake et al.)
2. Wall recycling control using low Z powder dropping and the change of their spatial distributions (N. Ashikawa et al.)
3. Mixture-induced phase transitions in multi-ion transport (A. Dinklage (IPP), N. Tamura et al.)

1. LHD experiment summary 2021/10/26 impurity-hole with C/Fe/Mo pellet

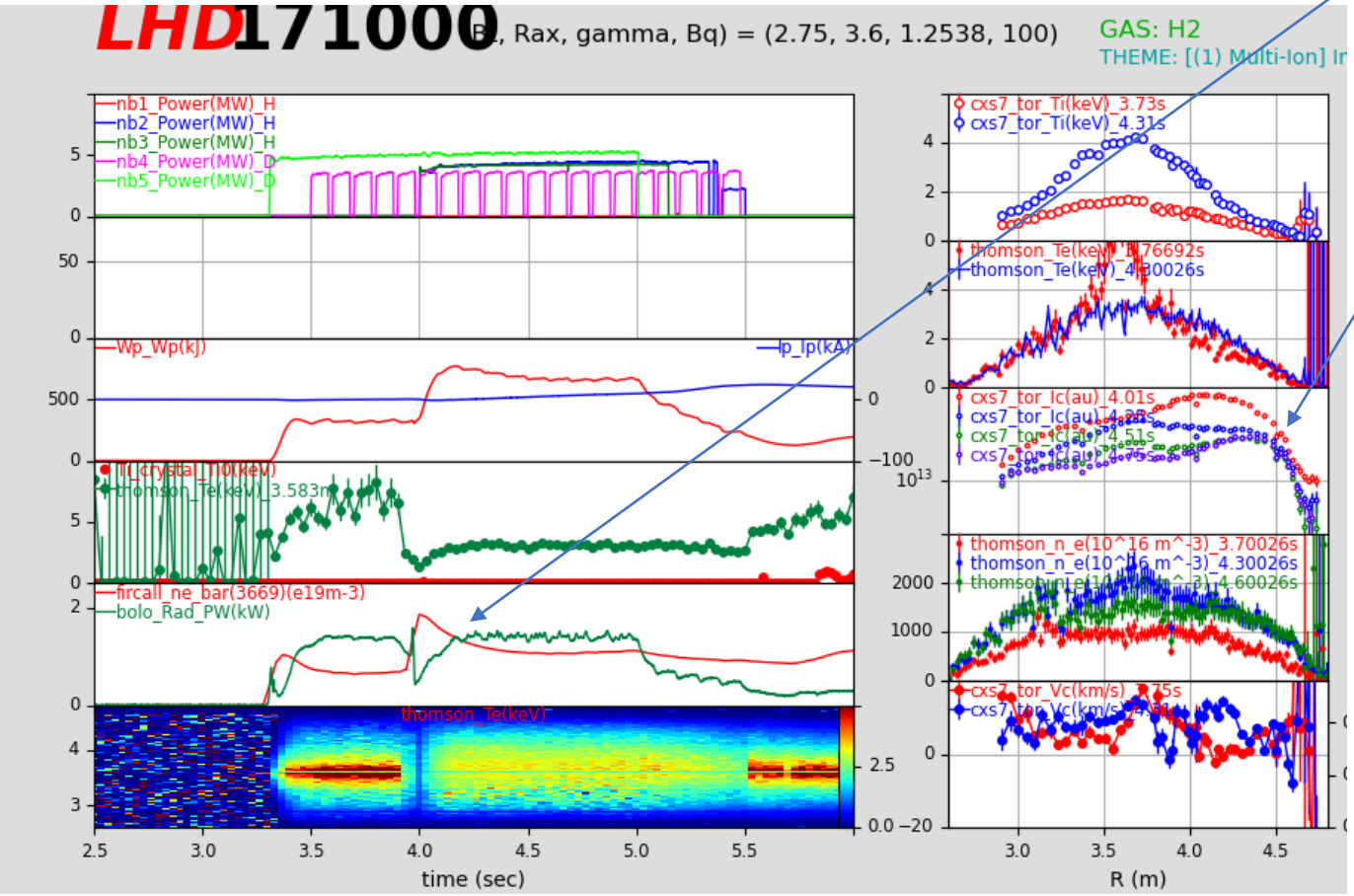
S. Satake, J. L. Velasco

- Main subject

  Measure Er profile in impurity hole plasma by HIBP and examine the impurity-species dependence of the impurity hole phenomenon, and analyze the impurity neoclassical / turbulent transport

- Results

(fig: C pellet shot)



- Low-ne plasmas (0.8×10^{19} and 1.6×10^{19} before and after pellet injection timing) were obtained, which is preferable for HIBP measurement.
- Impurity hole seems to have been created in C and Mo pellet shots.
- Succeeded to obtain impurity hole shots in balanced-tangential NBI shots (for C pellet), which is easy to compare Er profile with neoclassical simulation.
- Fe pellet shots seem to have been collapsed because of strong radiation.

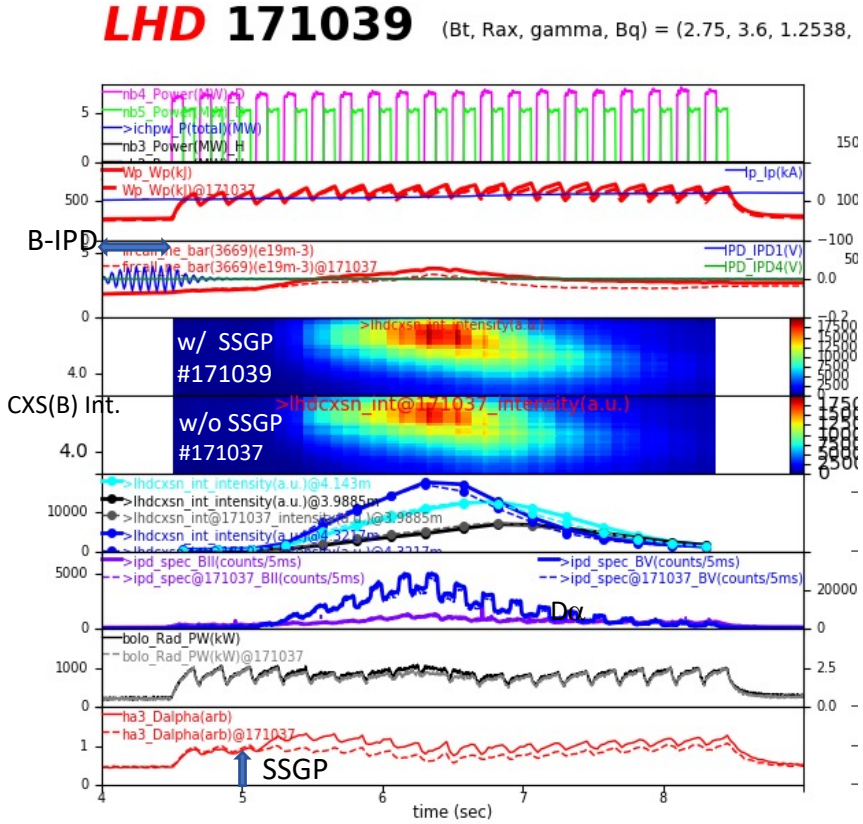
N. Ashikawa, C.L.Li, Z.Sun, T. Kawate, T. Oishi, PPPL

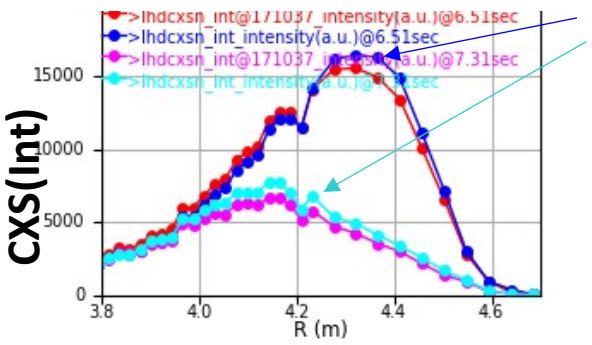
2. Wall recycling control using low Z powder dropping and the change of their spatial distributions

#171020-#171254, Rax = 3.6m, B=2.75T

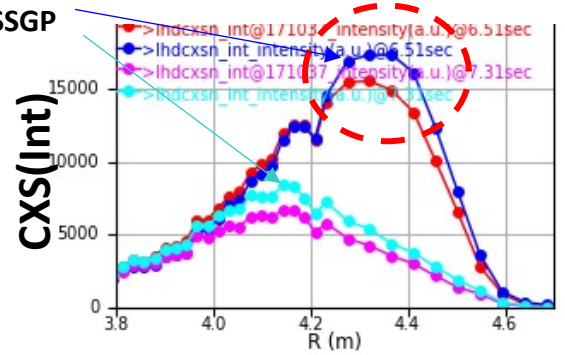
For understandings of the effective spatial region of recycling control by B, the following experiments were planned. We estimate that the outside of plasmas region might be effective for H or D reduction.

Methods;, **B** powder are dropped during ECH **D plasmas about 10 seconds.** Changing of spatial profiles of **B** by CXS, total radiation by bolometer are compared.





W/ SSGP



SSGP at 6s (#171038)

Ionized boron had already penetrated the core plasma region at SSGP injection.

No difference between w/ and w/o SSGP

SSGP at 5s (#171039)

Ionized boron arrival at the core plasma region and SSGP injection were done about the same time

A difference of profile are shown at about the maximum intensity of CXS-B

Other profile data, including CXS density, will be analyzed later.

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

Magnetic Configuration: (R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.75 T, 1.2538, 100.0%)
Shots: 171057-171090 (34 shots)
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 ion ratio of H/D/He by using different gas puff settings around n_{e_bar} of 4e19 m^{-3}
  → A simultaneous feedback control of H/D has been tried firstly
  → It works successfully, but H seems to mainly contribute

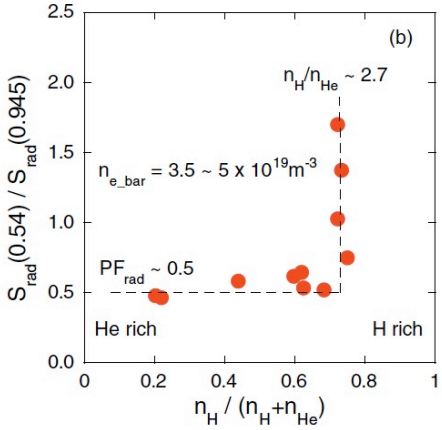
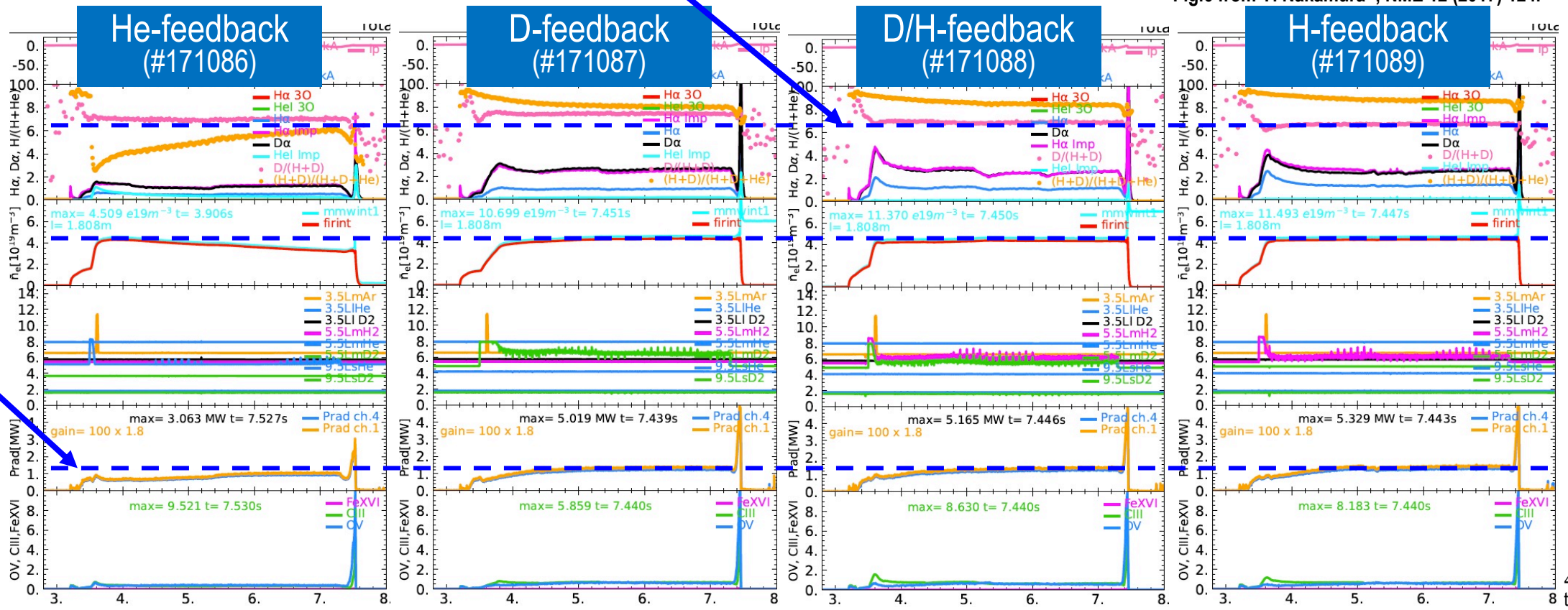


Fig.6 from Y. Nakamura+, NME 12 (2017) 124.



Smallest P_{rad} in the plasma with He-FB
← It seems to be consistent with YN's results