(TG4) Plasma instability group report

Nov. 10, 2021 (S. Kamio)

Date: Nov. 9, 2021
Time: 12:00 - 17:30
Shot#: 172044 – 172137 (94 shots)

Prior wall conditioning: D2
Divertor pump: On except for 2-I
Gas puff: D2, Pellet: No
NBI#(1, 2, 3, 4, 5)=gas(H, D, D, D, D)=P(4.5, 2.2, 2.1, 0.0, 5.0)MW
ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(700, 790)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(980, 930, 990)kW
ECH(56GHz)=ant(1.5U)=P(290)kW
ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0.58, 0.58, 0.87, 0.50)MW
Neutron yield integrated over experiment = 4.3×10^{16} (TG2 and TG4 total)

Topics

1. Observation of knock-on tail (H. Matsuura)
2. Energetic ion transport due to toroidal Alfvén eigenmode in deuterium plasma in LHD and HL-2A/2M (K. Ogawa)
3. Impacts of rational surface on L-H transition in high-beta plasma (Y. Suzuki)

Observation of knock-on tail

H. Matsuura, K. Ogawa et al.

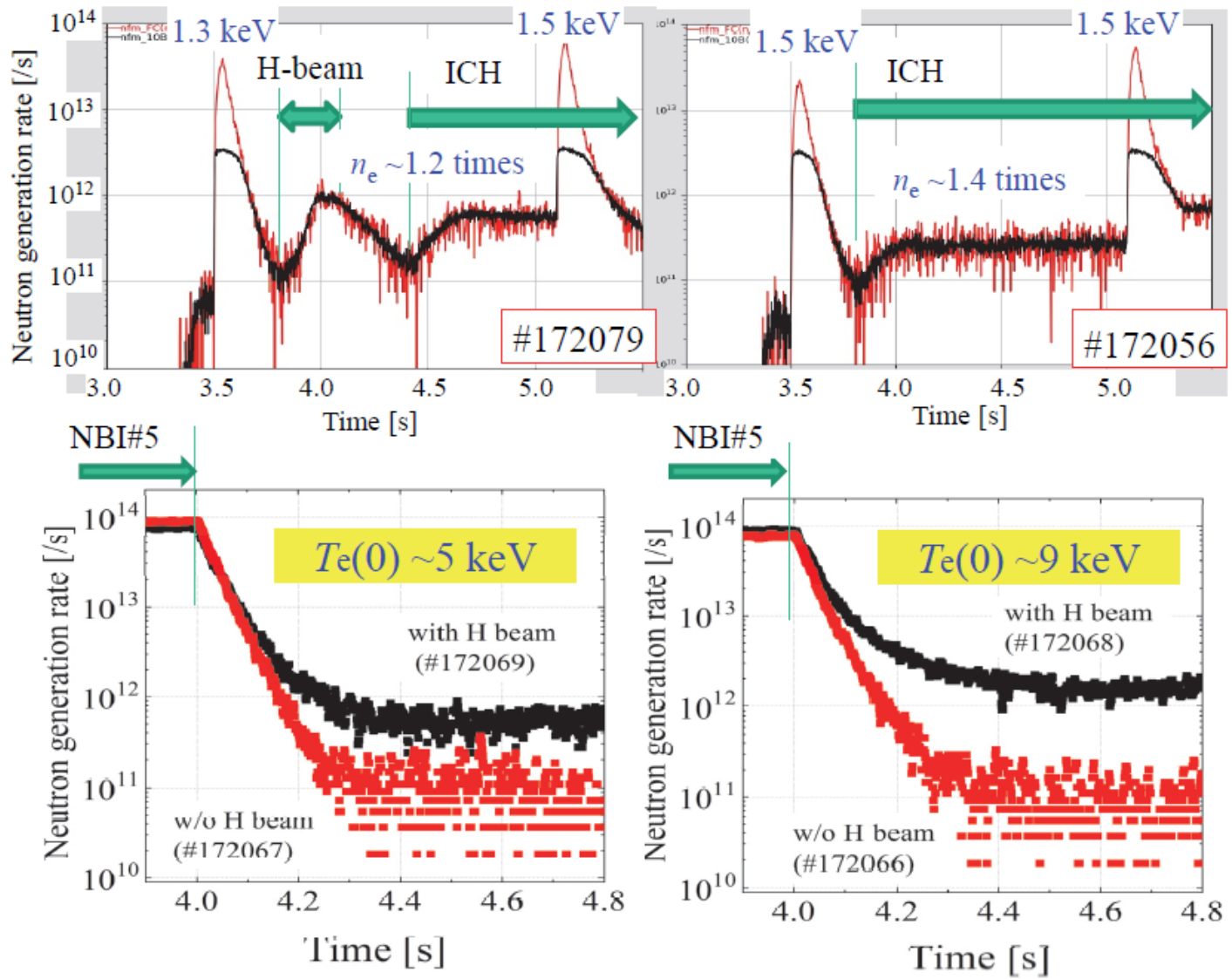
Experimental conditions: R_{ax}= 3.6 m, CCW, #172053 - #172083, B_t = 2.75 T

1. Knock-on tail observation in ICH plasmas

- The neutron generation rate increased after high-purity H beam or ICRF was injected.
- Observation experiment was performed in high-electron-temperature plasmas, i.e., $T_e(0)$~10 keV.
- Ion temperature was measured by CXS.
- Some kind of influence of fast deuterons could be suggested.

2. Electron-temp. dependency of NES effect on fast deuteron slowing-down properties

- NES effects on (a) neutron decay time, and (b) DD reactivity were observed for different electron temperatures.
- The electron temperature dependency was clearly observed.



Energetic ion transport due to toroidal Alfvén eigenmode in deuterium plasma in LHD and HL-2A/2M

Experimental conditions:
(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 0.60 T, 1.254, 100%)

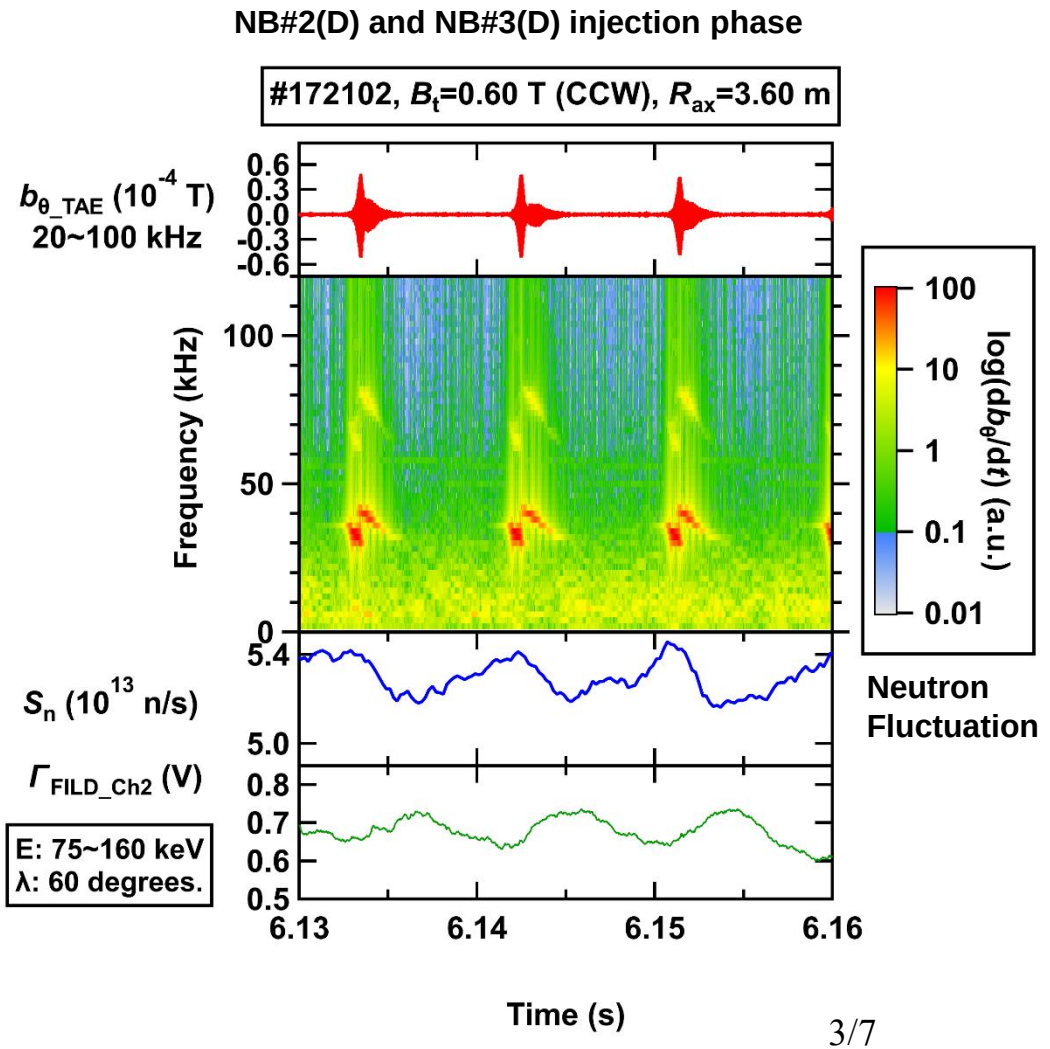
K. Ogawa, Y. P. Zhang et al.

Background and motive

- In deuterium experiments, we can obtain information of confined energetic particles using neutron diagnostics. => Expansion of energetic ion transport study due to toroidal Alfvén eigenmode
- In the last campaign, we found that the deuterium plasma can be sustained by two deuterium-NBs in B_t = 0.60 T, R_{ax} = 3.60 m. Therefore, full-deuterium plasma can be obtained if we initiate the plasma with a hydrogen-NB.
- In this campaign, we performed the experiment in full deuterium condition under a collaboration between LHD and HL-2A/2M.

Results

- A plasma was initiated by NB#1(H), then the plasma was sustained only by NB#2 and NB#3.
- Toroidal Alfvén eigenmode induced EP transport and loss were simultaneously obtained using neutron diagnostics and the fast-ion loss detector in the full deuterium condition.



Impacts of rational surface on L-H transition in high-beta plasma

Shot #: 172107-172137

Experimental conditions:

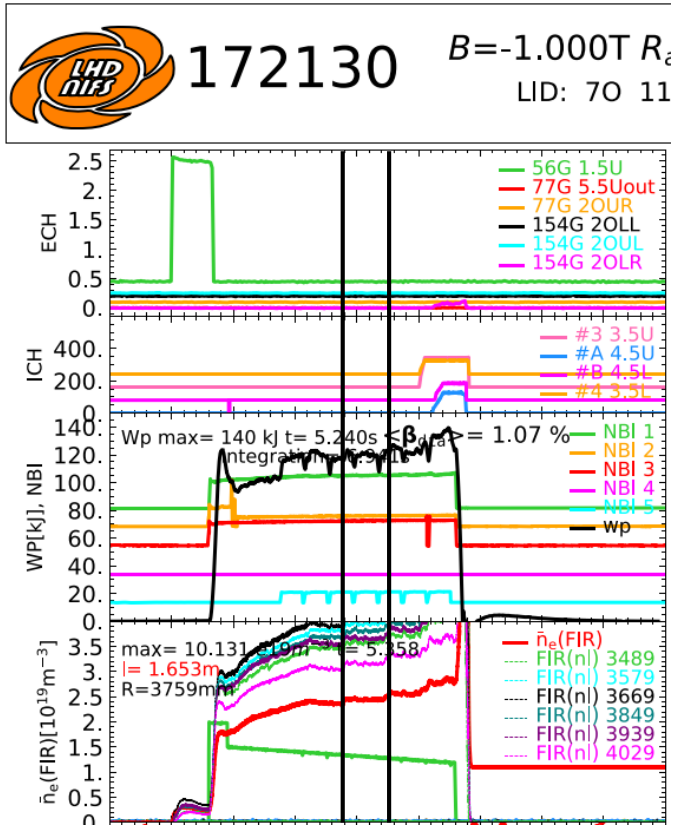
(R_{ax}, Polarity, B_t, γ, B_q) = (3.9/3.75 m, CCW, 1.0 T, 1.2538, 100 %)

Background and motivation:

- In the inward shifted configuration, the SSGP can trigger the L-H transition. However, in the outward shifted configuration, it was not found the SSGP triggered L-H transition.
- A hypothesis is the difference of the rational number on LCFS for inward and outward shifted configurations.
- Checking of the RMP impact on the SSGP triggered L-H transition.

Results:

- Unfortunately, clear dependence of the RMP was not observed.
- However, an interesting observation is obtained.
  - At the transition, the clear flattening of T_e is observed.



Edge instability trigger core instability?