(TG1) Multi-ion group report

Date: Oct. 15, 2021
Time: 10:55 - 18:42
Shot#: 170162 – 170289(131 shots)

Oct. 19, 2021 (G. Motojima)

Prior wall conditioning: No
Divertor pump: On (except for 2I)
Gas puff: H2, He
Pellet: D pellet, TESPEL

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(3.7, 3.9, 3.8, 3.7, 4.1)MW
ECH(77GHz)=ant(1.5-UO, 2-OUR)=P(333, 365)kW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(296, 364, 343)kW
ECH(56GHz)=ant(1.5U)=P(320)kW
ICH(38.47MHz)=ant(3.5U, 3.5L, 4.5U, 4.5L)=P(800,700,800,600)kW
Neutron yield integrated over the experiment = 1.3×10^{13}

Topics

1. Plasma/Device Commissioning (G. Motojima)
2. 56 GHz ECH commissioning (R. Yanai)
3. Investigation of particle transport by non-sinusoidal modulation (R. van Kampen (Differ), K. Tanaka)
4. Investigation of the impurity shielding performance of the ergodic layer by systematic scan of the dust drop rate using the IPD (M. Shoji)

Plasma/Device Commissioning (G. Motojima et al.)

Experimental Conditions: 1.(R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 1.0T, 1.254, 100%)
2.(R_{ax}, Polarity, B_t, γ, B_q) = (3.60 m, CW, 2.75T, 1.254, 100%)
3.(R_{ax}, Polarity, B_t, γ, B_q) = (3.75 m, CW, 2.65T, 1.254, 100%)
4.(R_{ax}, Polarity, B_t, γ, B_q) = (3.90 m, CW, 2.54T, 1.254, 100%)

Goal of this experiment:

- ✓ To confirm the plasma startup and the stable sustainment of the plasmas in various magnetic configurations
- ✓ To confirm the operation of diagnostics, fueling, heating devices

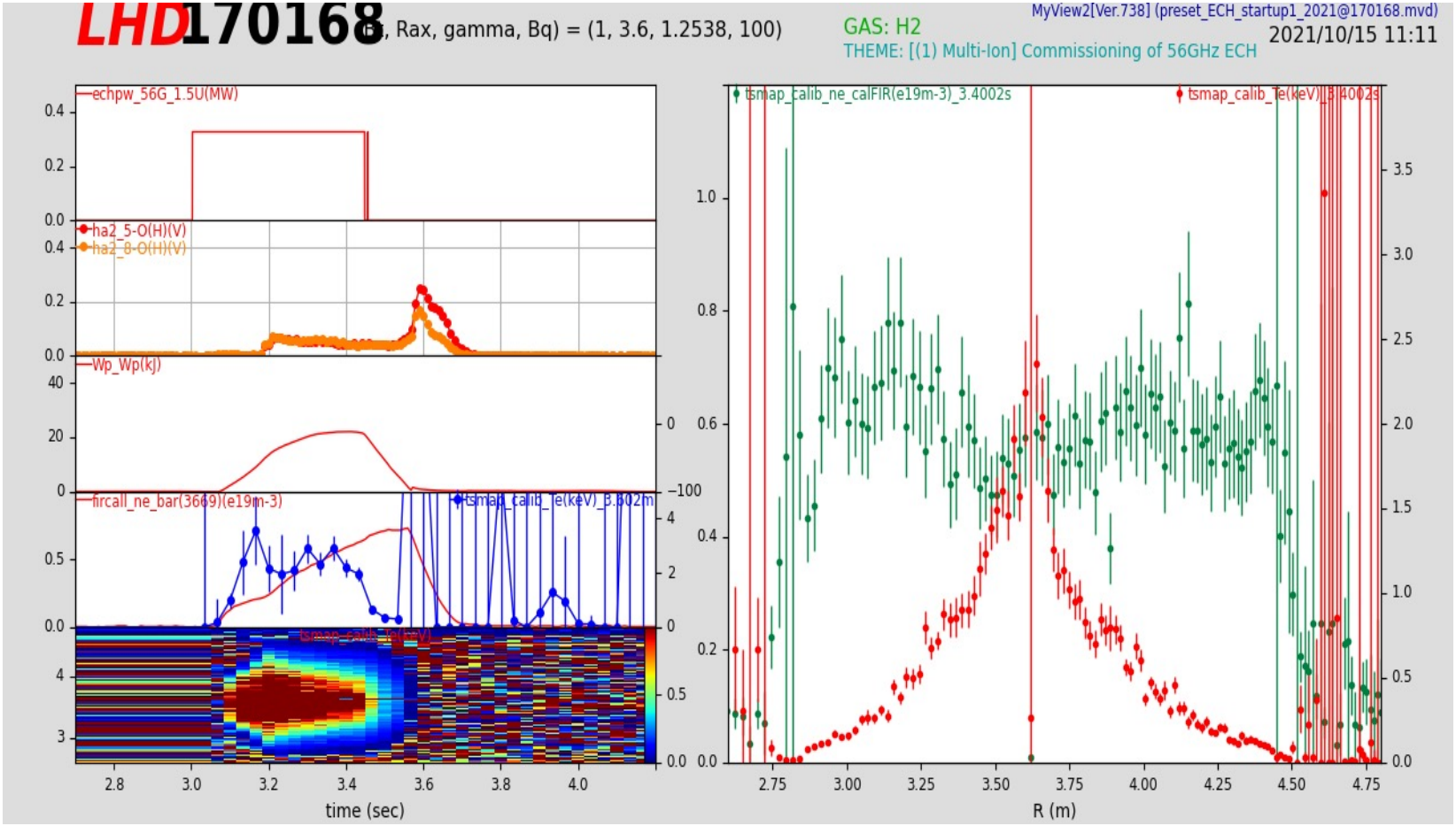
Results:

- ✓ We have confirmed the stable sustainment of the NBI+ECH heated plasmas smoothly in all the magnetic configurations conducted on the day.
- ✓ Commissioning of SSGP, deuterium ice pellet, TESPEL, gas puff modulation have been proceeded.
- ✓ The adjustments of Gas puff imaging (GPI) and Penning gauge were conducted.
- ✓ Thomson Scattering diagnostics had trouble in the data acquisition in the morning. However, the trouble was solved after noon.

56 GHz ECH commissioning R. Yanai

Experimental conditions: (R_{ax}, B_t, γ, B_q) = (3.6 m, 1 T, 1.2538, 100.0%)

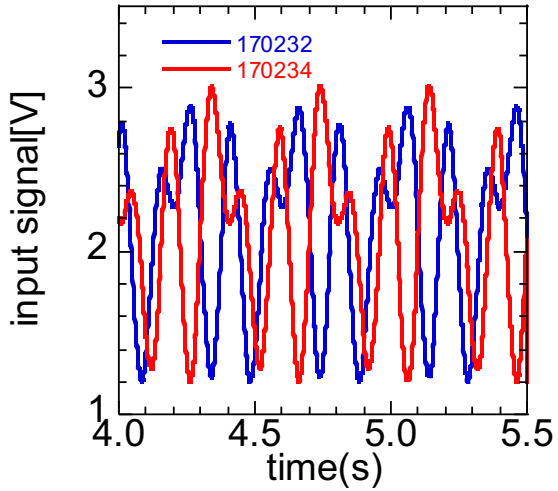
- 56 GHz ECH commissioning was conducted to check whether the ECH can initiate plasma as performed in last experimental campaign.
- The 56 GHz ECH could initiate and sustain plasma. (n_e~6x10^{18} m^{-3}, T_e~2.5 keV around the magnetic axis and W_p~20 kJ)
- There seemed to be no problem with the 56 GHz ECH system and experiments of pure deuterium plasma around 1 T can be carried out.



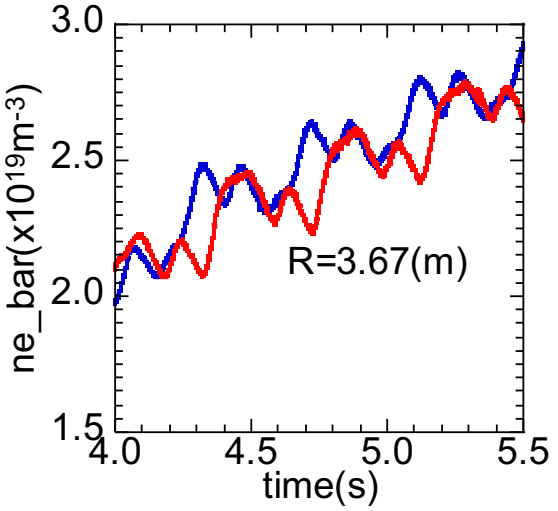
Investigation of particle transport by non-sinusoidal modulation

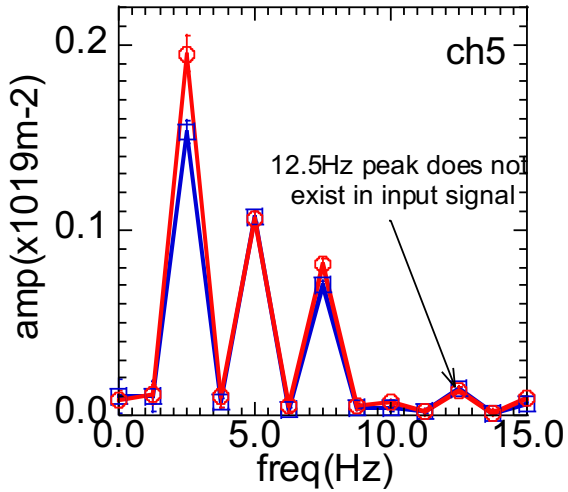
R. van Kampen (Differ), M. van Berkel (Differ),
T. Kinoshita (Kyushu Univ.), H. Sakai (Kyushu Univ.), K. Tanaka

170196-170292, 170255-170235, Rax=3.6m, g=1.254, BQ=100%, Bt=+2.75T

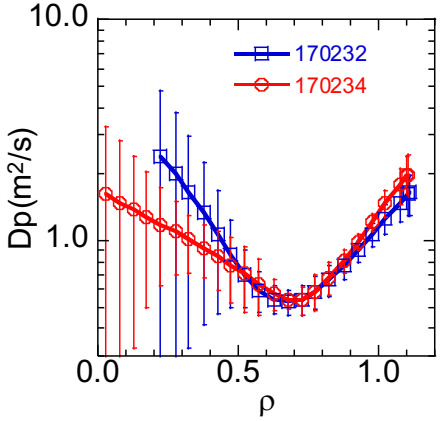


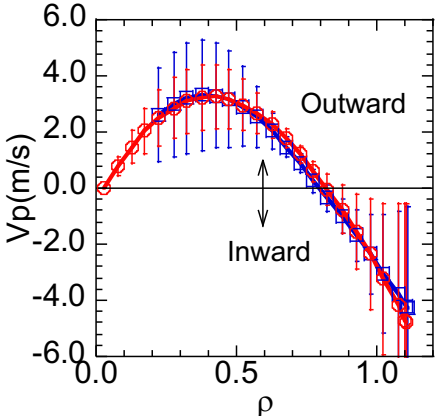
Three frequency (2.5,5, 7.5Hz) identical spectrum but different time domain signal due to the different phase relation

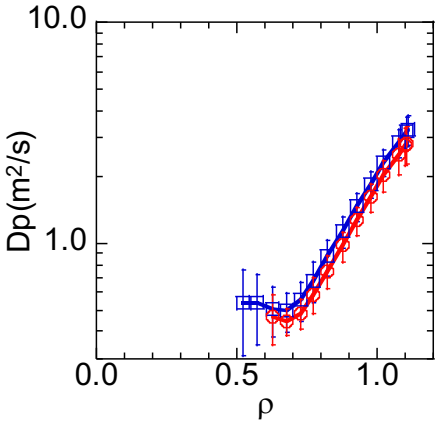




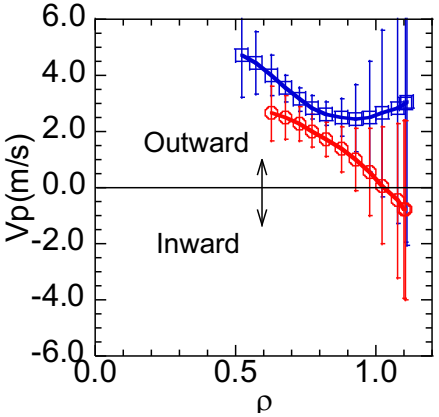
2.5Hz







5Hz



Almost identical D,V at 2.5Hz, but different V at 5Hz.

The small difference of V at 5Hz (the difference was comparable with estimation uncertainty) were found. The difference may due to the non-linear coupling between components.

Investigation of the impurity shielding performance of the ergodic layer by systematic scan of the dust drop rate using the IPD (M. Shoji)

Experimental conditions:

Shot No: #170213 - #170224, R_{ax}=3.60 m B=2.750 T, $n_{e,bar}$=1～6×10^{19} m^{-3} (Polarity, γ, B_q) = (CW, 1.2538, 100.0%)
#170250 - #170267, R_{ax}=3.75 m, B=2.640 T, $n_{e,bar}$=1～6×10^{19} m^{-3} NBI: #1,2,3,4 (duration is 2s)
#170277 - #170288, R_{ax}=3.90 m, B=2.538 T, $n_{e,bar}$=1～6×10^{19} m^{-3} H Plasma, IPD: Boron d=140 μm (2.5～4.5 sec)

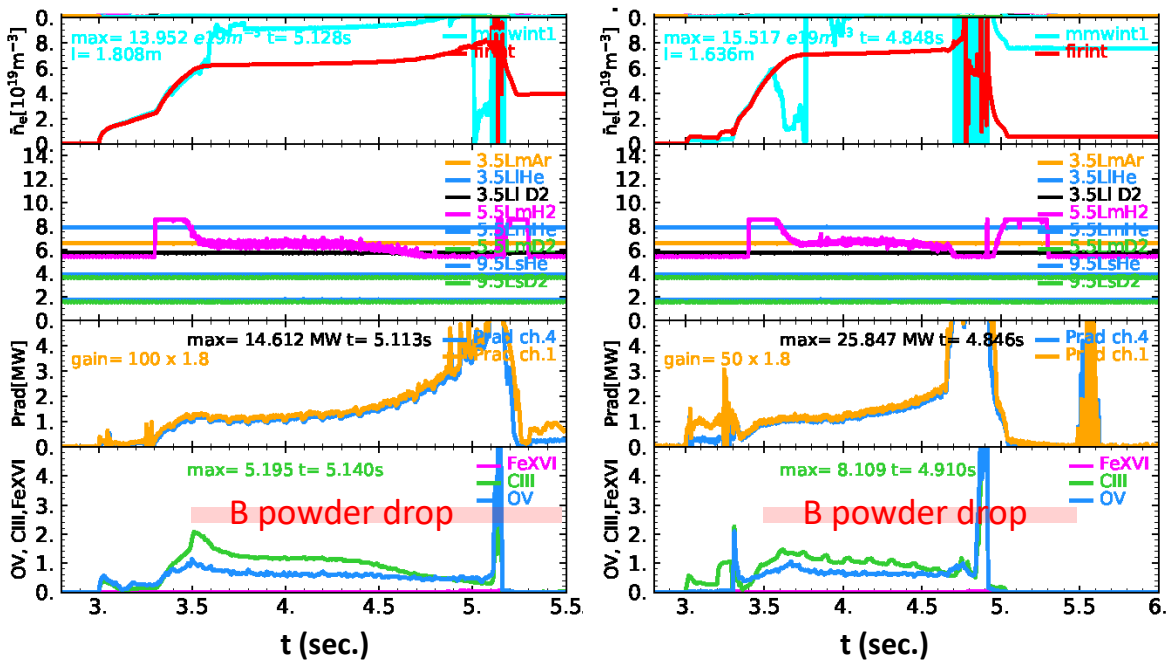
Motivation and objective:

- The investigation of the performance of the dust shielding effect of the LHD peripheral plasma in the three different magnetic configurations.
- Verification of the simulation results by EMC3-EIRENE coupled with DUSTT by comparing the observed boron ion profiles with the simulations.

Preliminary results:

- The boron dust drop experiments were performed under the three different plasma density conditions ($n_{e,bar}$～1, 3, and 6×10^{19} m^{-3}) in the three magnetic configurations (R_{ax}=3.60, 3.75, and 3.90 m).
- The plasmas in R_{ax}=3.75 and 3.90 m were collapsed with quite smaller drop rates compared to those in R_{ax}=3.60 m.

R_{ax}=3.60 m (#170224) **R_{ax}=3.75 m (#170267)**



V_{IPD}(∝drop rate)=3.5 V **V_{IPD}(∝drop rate)=2.0 V**

- It suggests the effect of the dust shielding effect by the plasma flow on the divertor leg for R_{ax}=3.60 m.