(TG4) Plasma instability group report

Jan. 20, 2022 (K. Nagaoka)

Date: Jan. 19, 2022
Time: 9:40 - 10:43, 16:30 – 18:45
Shot#: 176656 – 17676, 176723- 176759 (58 shots)
Prior wall conditioning: None
Divertor pump: On
Gas puff: H2, Ar, Impurity pellet: None
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(4.0, 4.0, 4.0, 4.0, 4.0)MW
ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(800, 700)kW
ECH(154GHz)=ant(2-OLL, 2-OUL , 2-OLR)=P(979, 930, 986)kW
ICH(3.5UL)=(0.80, 0.66)MW, ICH(4.5UL)=(0.72, 0.40)MW
Neutron yield integrated over experiment = 0.3×10^{12}

Topics

1. Effect of the NBCD on the stability of pressure gradient driven modes and Alfven modes in LHD high beta operations (J. Varela / K.Y. Watanabe, Y. Takemura)
2. Prediction and maintenance of detached plasma by data-driven approach (Y.Isobe, H.Yamada (UTokyo), M.Kobayashi)

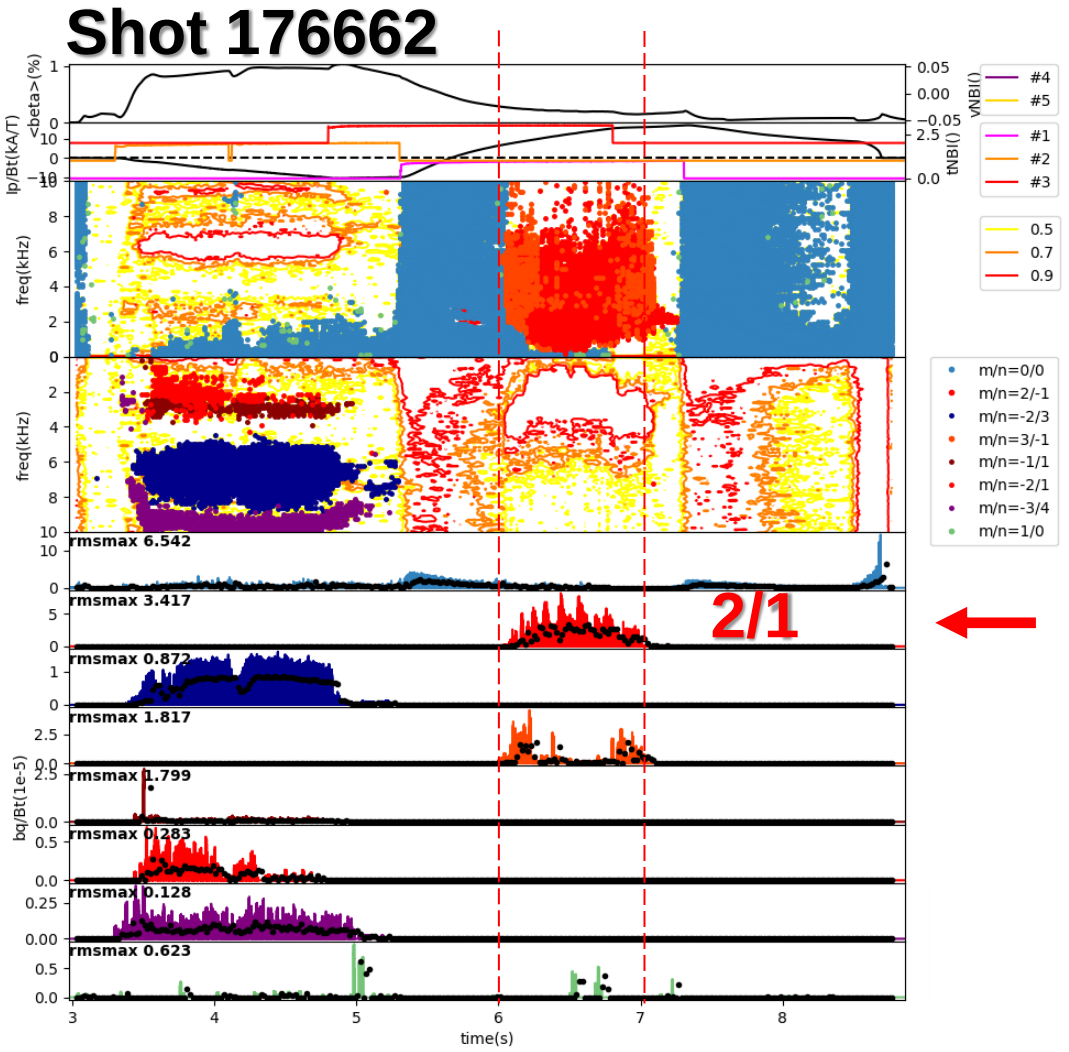
Plasma experiment was suspended from 10:43 – 13:00 due to a fire alarm inccident

EFFECT OF THE NBCD ON THE STABILITY OF PRESSURE GRADIENT DRIVEN MODES AND ALFVEN MODES IN LHD HIGH BETA OPERATIONS (J. Varela, K.Y. Watanabe, Y. Takemura)

Experimental conditions: (R_{ax}, B_t) = (3.55 m, 1.375 T, CCW), γ = 1.2538, and B_q = 100 %,

Shot#: 176657 – 176676 (20 shots)

- Analyze the stability of m/n=2/1 for different heating patterns with unbalanced NBI current drive.
- Several shots show the destabilization of 2/1 during co-NBCD phase (t = 6–7s).
- Likewise, some shots show unstable 2/1 during the ctr-NBCD phase (t=3-4s) if the thermal plasma <β> > 0.75%.
- MSE data is obtained to analyze the effect of the NBCD on the iota profile and MHD stability.
- FAR3d code will be used to reproduce the linear MHD stability along the discharges.



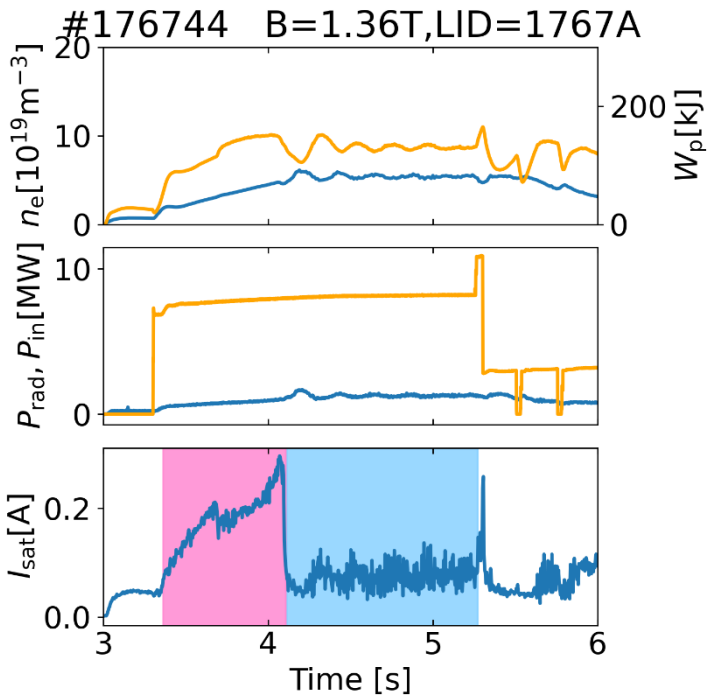
Prediction and maintenance of detached plasma by data-driven approach (Y.Isobe, H.Yamada (UTokyo), M.Kobayashi et al.)

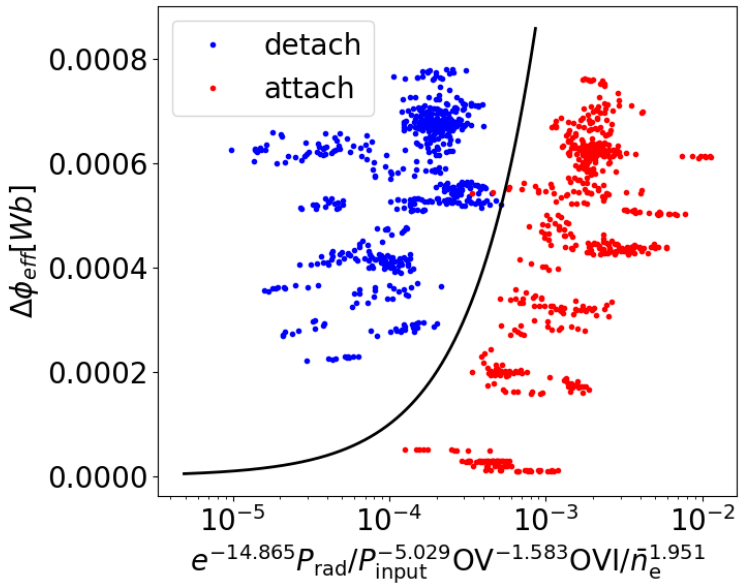
Background and objective

- To aim at quantitative clarification of the boundary condition between attachment and detachment by data-driven approach and then to provide hints to exploration of underlying physics of plasma detachment.
- Fulfilling missing data with small RMP and P_{input} in the existing data including the exp. on Dec. 10,2021 with D environment and CW magnetic field.
- Paying attention to the effect of RMP and the response of plasma with regard to the role of magnetic island.

Experimental Condition

- R_{ax}=3.9m, B=2.54/1.36T, I_{LID}=54–3000A with H environment and CCW
- Seek for transition boundary with surveying RMP amplitude, ramping up density and scanning NBI power.





Results

- Dataset has been extended.
- See typical discharge with detachment.

Scope

- The right figure shows the separation of detachment and attachment as a function of perturbed m/n=1/1 magnetic flux including plasma response in the ordinate and residual function in the abscissa derived from the machine learning (SVM-ES)
- Revision of analysis including plasma response to RMP based on extended dataset

Exp. 2022/1/19