(TG4) Plasma instability group report

Dec. 22, 2022 (Y. Takemura)

Date: Dec. 21, 2022
Time: 9:50 - 18:45
Shot#: 186671-186824 (153 shots)

Prior wall conditioning: Off
Divertor pump: Off
Gas puff: H2, Pellet: None
NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(-, 3.1, 3.4, 4.7, 4.3)MW
ECH(56GHz)=ant(1.5-U)=P(0.29)MW
ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.70, -)MW
ECH(154GHz)=ant(2-OLL, 2-OUL, 2O-LR)=P(0.72, 0.72, 0.73) kW
Neutron yield integrated over experiment = (5.6E+13)

Topics

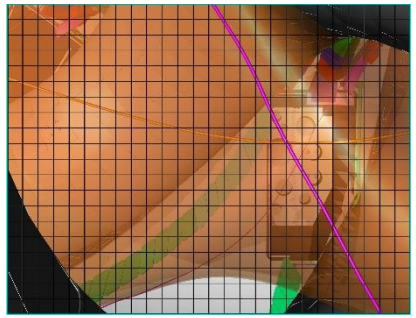
1. Anomaly detection of radiation profile in radiative collapse (K. Mukai)
2. MHD instability suppression by RMP field (S. Ito)
3. Study of topological bifurcation (Y. Suzuki, S. Ohnishi, F. Kojima, K. Takeda (Hiroshima Univ.))

Anomaly detection of radiation profile in radiative collapse

K. Mukai

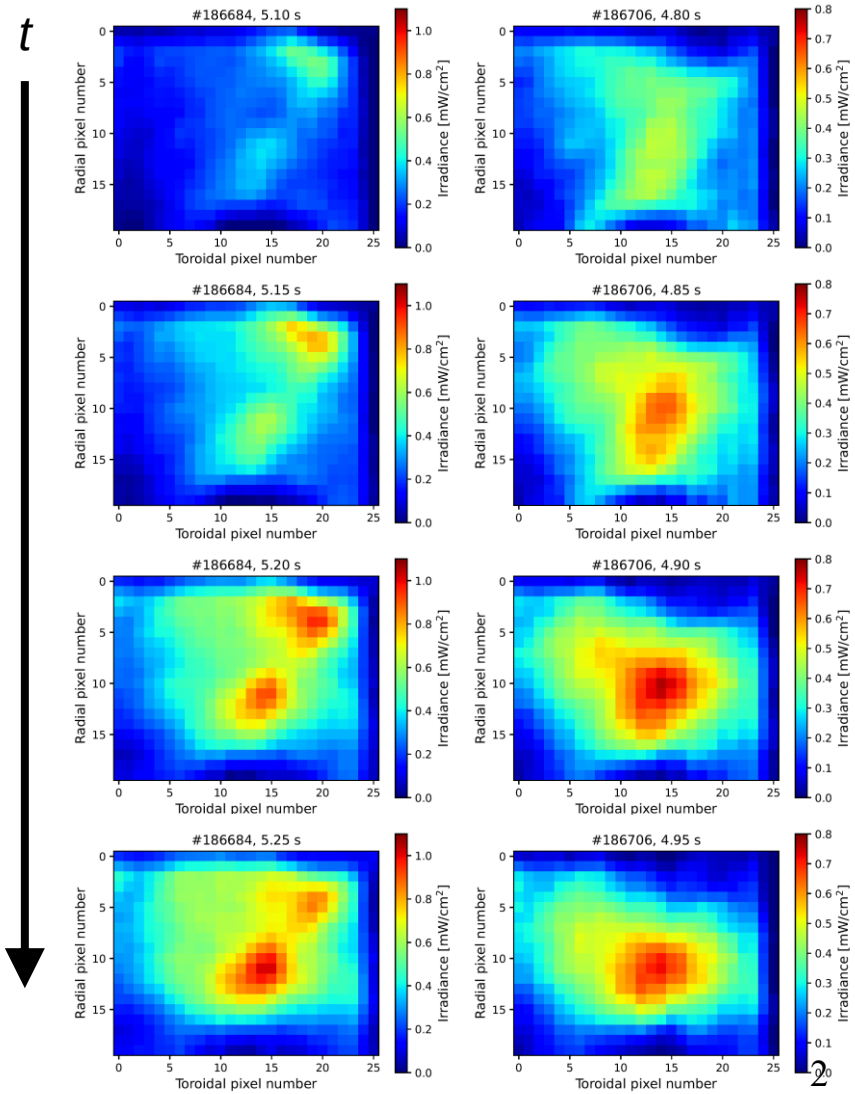
Shot #: 186671 - 186707 (37 shots)

FOV of 6.5-U IRVB



#186684 (R_{ax} = 3.6 m) 5.10 - 5.25 s

#186706 (R_{ax} = 3.9 m) 4.80 - 4.95 s



Experimental condition

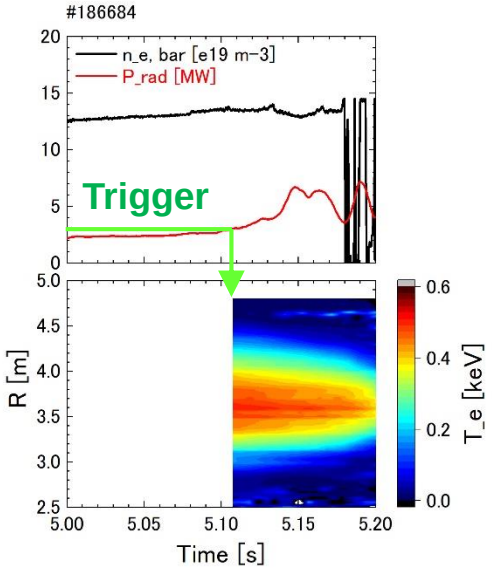
- (R_{ax}, B_t, γ, B_q) = (3.60 m, 2.75 T, 1.254, 100%),
  (3.90 m, 2.5384 T, 1.254, 100%)
- NBI #2, 3, 4, 5
- $n_{e,\,bar}$: ramped-up to ~ 14 x 10^{19} m^{-3}
- Divertor pumping: OFF
- Gas: H (5.5-L, FB crtl. by FIR)

Background and objective

- In the experiments of radiative collapse (RC) avoidance, obvious differences in the edge radiation structure were obtained between w/ and w/o RC using imaging analysis.
- Investigation of precursor radiation structure of RC
- Investigation of magnetic configuration dependence of the precursor

Results

- 2-D radiation profiles were obtained using IRVBs at 6.5-U (100 Hz) and 6.5-L (50 Hz).
  3.6 m: 7 (w/ RC) and 7 (w/o RC) shots
  3.9 m: 8 (w/ RC) and 7 (w/o RC) shots
- FTS w/ 1 kHz was performed with event trigger to measure the time evolutions of n_e and T_e profiles just before the RC.
- Anomaly detection will be conducted using AutoEncoder, AnoGAN etc…
- Data in previous experiments will be mined.



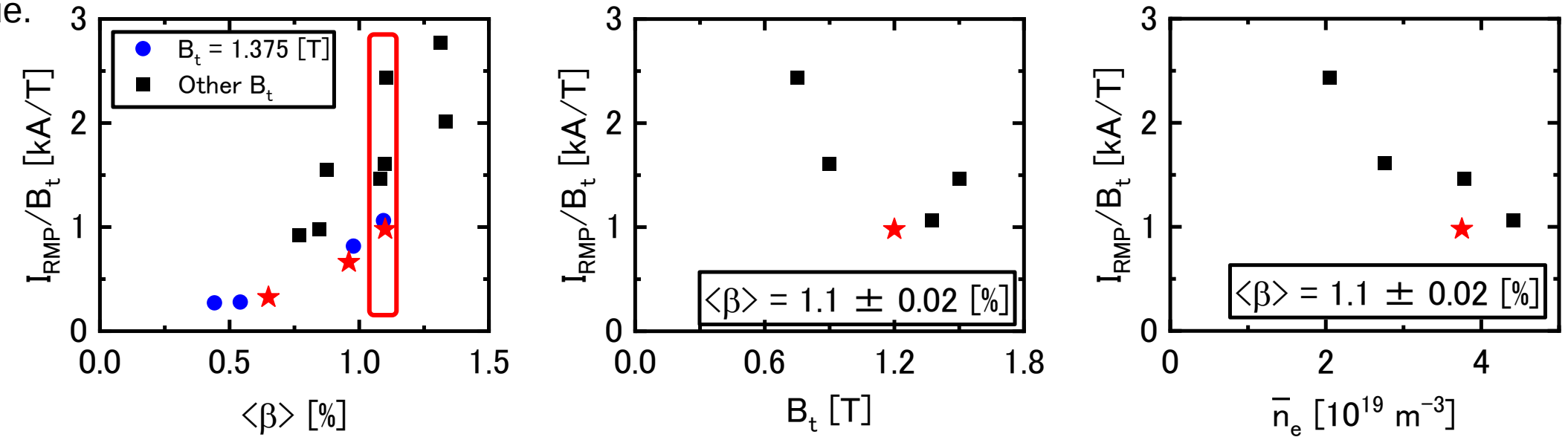
MHD instability suppression by RMP field (S. Ito)

Shot #: 186708 – 186791

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) = ① (*3.75m*, CW, 1.7T, 1.254, 100%)
② (*3.75m*, CW, 1.2T, 1.254, 100%)

Background and motivation: We are investigating an operational condition dependence of the external RMP amplitude which is needed to completely suppress the interchange instability without an RMP penetration. We have already got the data indicated by "■" and "●" in lower figures, and have found a higher correlation between the above external RMP amplitude and the volume-averaged beta value. So, in this campaign, we want to make clear the operational magnetic field strength (or collisionarity) dependence under the same beta value.

Results: We get the new data indicated by "★" in lower figures. In the middle figure, it is found that the above external RMP amplitude takes the minimum value around Bt=1.2T under the same beta value. Moreover, in the right figure, it is found that its amplitude has a higher correlation with the line-averaged electron density under the same beta value.



Study of topological bifurcation
(Y. Suzuki, S. Ohnishi, F. Kojima, K. Takeda (Hiroshima Univ.))

Shot #: 186795-186824

Experimental conditions: (R_{ax}, Polarity, B_t, γ, B_q) =(3.6m, CW, 1.0T, 1.129, 100%)

Background and motivation:

- Study of island dynamics in RMP screening or amplification. Internal current density, $\boldsymbol{j}$, distribution is a key.
- For LHD, direct measurement of $\boldsymbol{j}$ is difficult. The potential, Φ, is measured by HIBP, as a proxy of $\boldsymbol{j}$.
- For the standard configuration, HIBP cannot cover the plasma edge region, that is, 1/1 rational surface cannot be measured. Thus, HIBP measurement is tried for the low-γ configuration.

Results:

- Quasi-steady state discharge was possible by 5s NBI injection. This was good for scanning HIBP.
- The electron density is scanned with fixed and ramp-up RMP fields.
- Flattening of the electron temperature is different by the electron density.
- Magnetic diagnostics and HIBP date will be analyzed.