

Daily Report for 2025-10-07

Y. Takemura

Date: October 7, 2025

Time: 10:00 – 17:15

Shot: 194413 – 194545 (133 shots)

Prior wall conditioning: No

Divertor pump: No

Gas puff: H₂, N₂, Ne, Ar

Pellet: H₂ pellet

LID: Yes

NBI: #1, #2, #3, #4, #5

ECH: 2-OUR (77GHz), 5.5-UO (77GHz), 2-OUL (154GHz), 2-OLL (154GHz)

ICH: 4.5UL (Commissioning)

Topics

1. Spatiotemporal structure of disturbance triggered by pure, doped, and massive hydrogen pellet injection : (A. Matsuyama, R. Sakamoto)
2. Prediction and control of radiative collapse using a camera and a deep learning method (piggyback) (Y. Suzuki)
3. Prediction and control of radiative collapse using a decision model (Y. Suzuki)
4. Anomaly detection of radiation profile in radiative collapse (K. Mukai)
5. Relation between toroidal asymmetry of divertor detachment and radiation localization (K. Mukai)

Spatiotemporal structure of disturbance triggered by pure, doped and massive hydrogen pellet injection

A. Matsuyama, Y. Arayashiki, F. Tanji, S. Nimura (Kyoto Univ.),
R. Sakamoto, G. Motojima, Y. Takemura, M. Goto (NIFS)

Experimental conditions:

(3.6 m, CCW, 2.75 T, 1.2538, 100%) #194497 - #194515 (19 shots)
(3.65 m, CCW, 2.7123 T, 1.2538, 100%) #194516 - #194526 (11 shots)

Motivation and methods

- Pellet injection is a key technology for burning plasma control as well as disruption mitigation
- Pellet injection into different combinations of ECH, NBI and magnetic perturbations (LID coils) with density scan

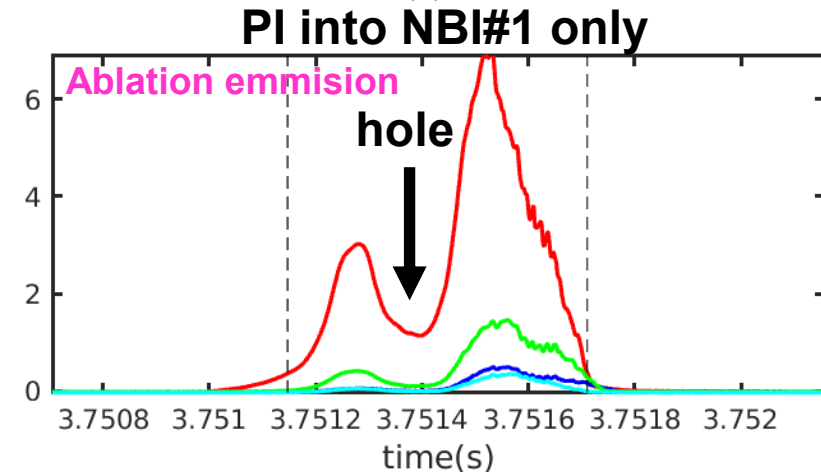
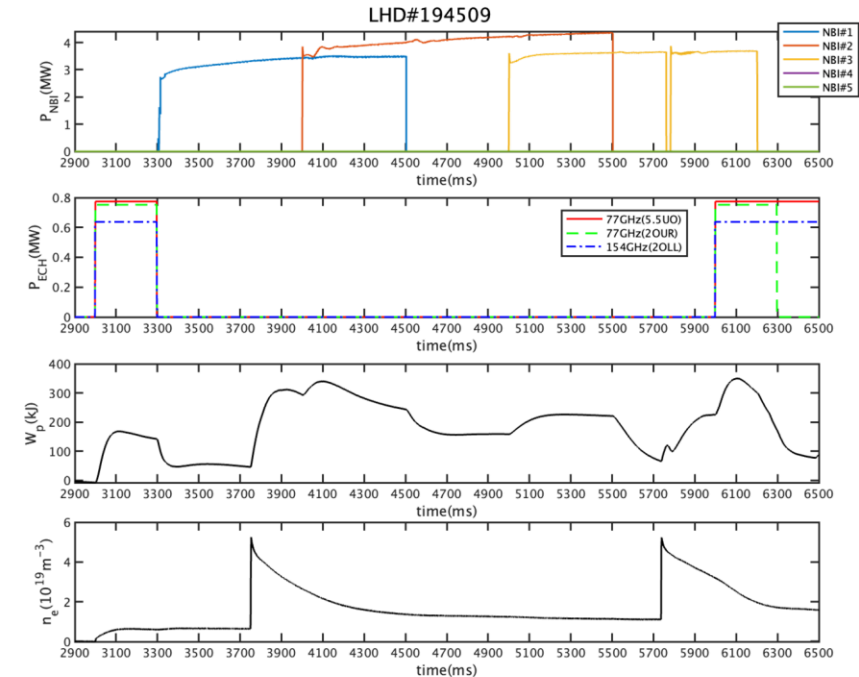
Results

- Successfully identified “**emission hole**” for the first time with CCW B_t polarity, which may detect absence of fast ions inside magnetic island

NBI	#1 co-injection	#2 ctr-injection	#3 co-injection	#1,3 co-injection	#2,3 Balance inj.
hole	Yes	No	Yes	Yes	No

→ To be interpreted by earlier observation for CW B_t polarity by modeling

- Other data was obtained mostly as planned but Thomson scattering data to identify the particle deposition was rather limited due to difficulty in adjusting pellet injection timing



Prediction and control of radiative collapse using a decision tree model.

T. Shibata, Y. Suzuki, N. Kenmochi, M. Yokoyama

Experimental conditions:

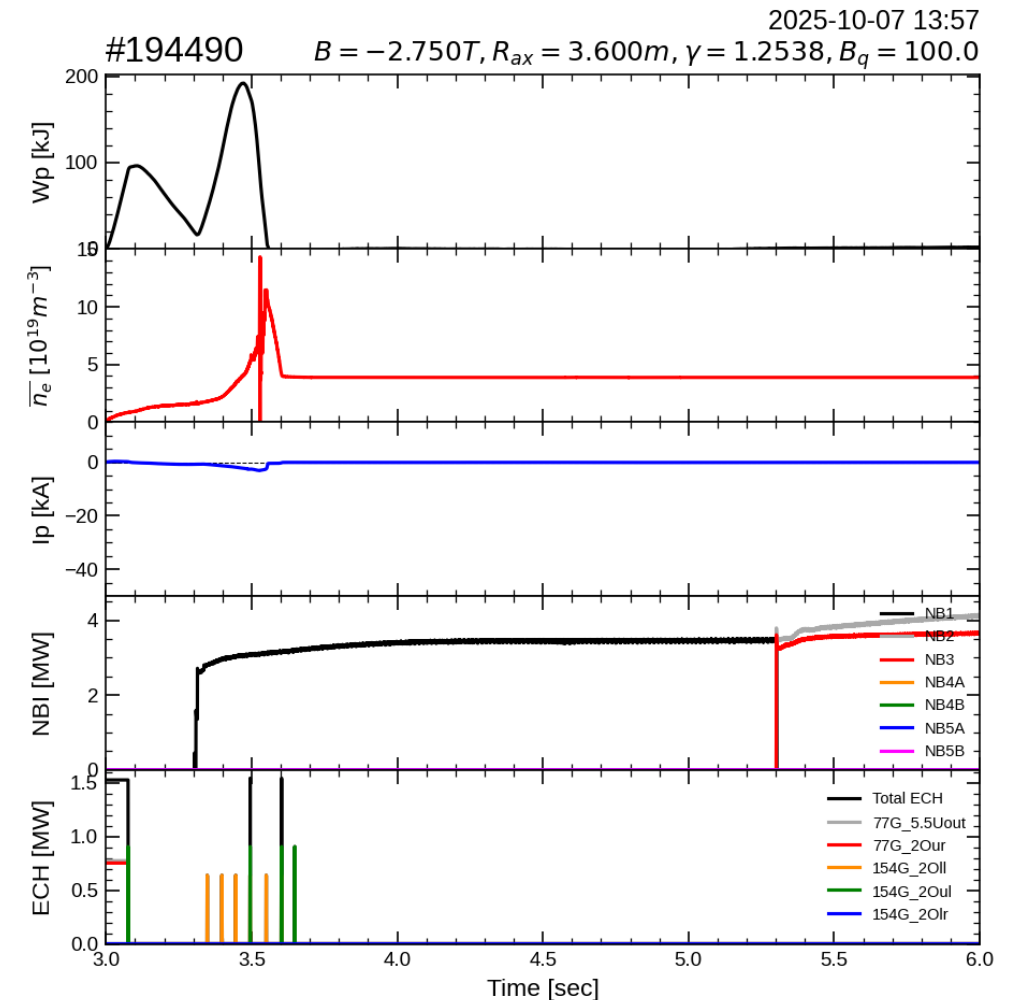
$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$
#194483 - #194496

Motivation and method:

- This experiment demonstrates the effectiveness of a data-driven approach for plasma control.
- Control gas puffing and additional ECH from signal of ECE measurement and VUV spectroscopy.
- Time Series Forest Classifier predicts collapse 100ms in advance from measured values.

Results:

- Successfully identified plasma parameters that intentionally trigger radiative collapse.
- Confirmed real-time quench prediction capability - control signals were issued prior to collapse events.
- Control intervention did not suppress radiative collapse in initial trials, but analysis suggests that adjusting gas puff pulse width will improve effectiveness - remaining 20 shots scheduled for Thursday.



Relation between toroidal asymmetry of divertor detachment and radiation localization

Kiyofumi Mukai

Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$
#194413 - #194479 (67 shots)

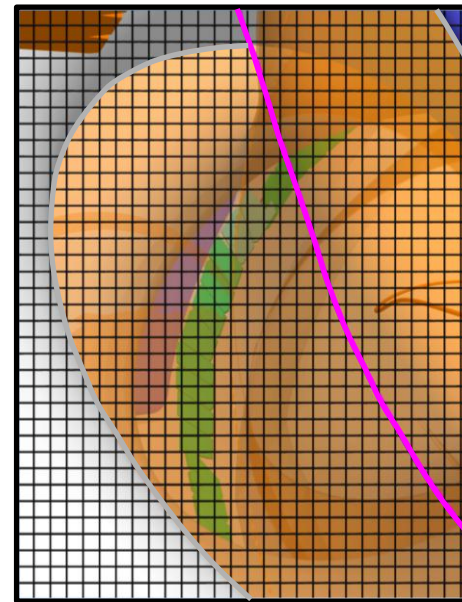
Motivation and method:

- Investigation of the physical mechanism of the localization of radiation structures, which causes the toroidal asymmetry of the divertor heat load reduction
- Location of localized radiation structures is identified using a newly installed IRVB at the 6-T port, close to the impurity injection port (5.5-L).

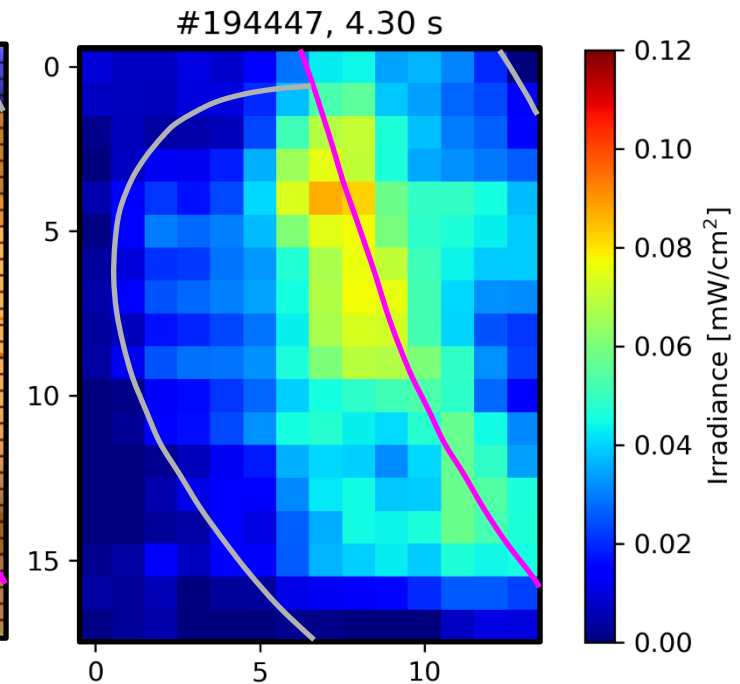
Results:

- 6-T IRVB is working well. Localized radiation structures will be identified using principal component analysis.
- Density scan ($1, 3, 5 \times 10^{19} \text{ m}^{-3}$) and impurity species scan (N₂, Ne, Ar) was performed.
- Unfortunately, after #194456 ($5 \times 10^{19} \text{ m}^{-3}$) impurities from 5.5-L port were not injected.
 - In #194455, N₂ was injected from 3.5-L port.
 - Due to vacuum degradation, gate valve at 5.5-L port was closed. However, we could not find the alert.
 - Therefore, impurities from 5.5-L was injected from piezo valves but blocked by the gate valve.

FoV of 6-T IRVB



Typical radiation profile in Ne seeded plasmas (Preliminary)



Anomaly detection of radiation profile in radiative collapse

Kiyofumi Mukai

Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.9 \text{ m}, \text{CCW}, 2.5385 \text{ T}, 1.2538, 100.0\%)$
#194528 - #194545

Motivation and method:

- Investigation of precursor radiation structure of radiative collapse (RC) and its dependence on magnetic configurations
- Further accumulation of the training data in $R_{ax} = 3.9$ m configuration using 3 IRVBs

Results:

- Due to the trouble of gas puff at 5.5-L, H was injected from 3.5-L port.
- Density control was quite difficult since gas puff at 3.5-L cannot use FIR feedback control.
- Few training data was accumulated using 3 IRVBs. Anomaly detection using autoencoder will be conducted.

Time evolution of radiation profile in radiative collapse (Preliminary)

