

(TG2) Turbulence Topical Group Report

Jan. 13, 2023 (T. Tokuzawa)

Date: Dec. 27, 2022

Time: 12:27 - 13:38

Shot#: 187296 – 187316 (21 shots)

Prior wall conditioning: No

Divertor pump: ON

Gas puff: H₂

Pellet: None IPD: None

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, H, H)=P(-, -, -, -, -)MW

ECH(77GHz)=ant(5.5-Uout (or 1.5U), 2-OUR)=P(209, -)kW

ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(205, 203, 237)kW

ECH(56GHz)=ant(1.5U)=P(-)kW

ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(-, -, -, -)MW

Neutron yield integrated over the experiment = 2.4×10^{13}

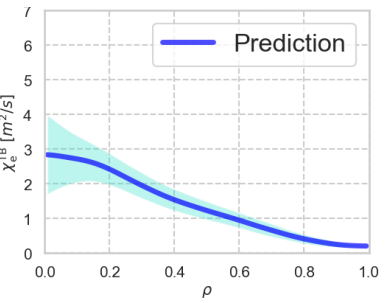
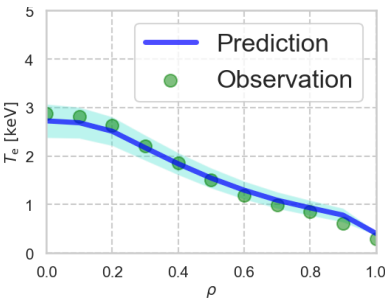
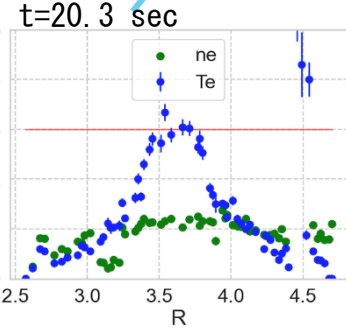
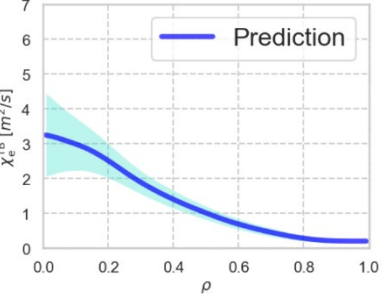
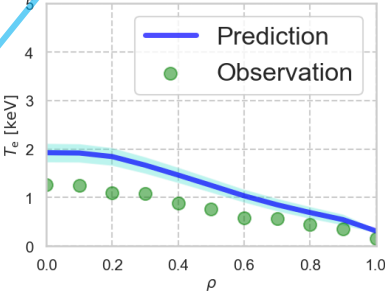
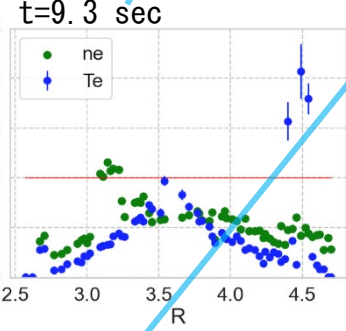
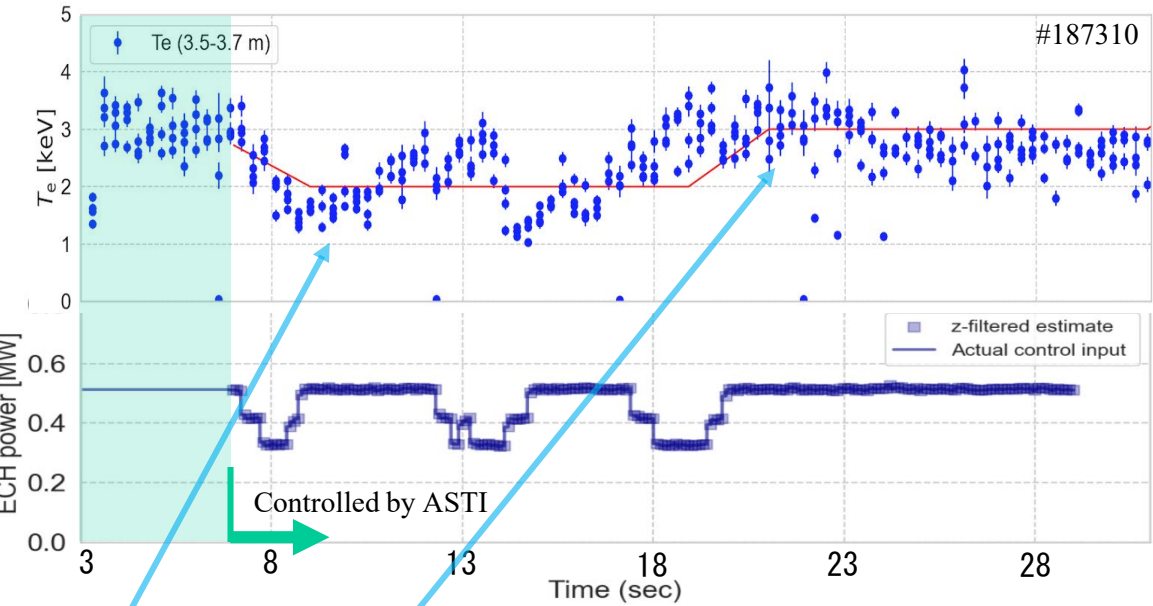
Remarks

None

Topics

1. Demonstration of real-time ECH plasma control by the data assimilation system ASTI (S. Murakami, Y. Morishita, N. Kenmochi)

Demonstration of real-time ECH plasma control by the data assimilation system ASTI (S. Murakami, Y. Morishita, N. Kenmochi)



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Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, -2.75 \text{ T}, 1.254, 100 \%)$

Motivation and objective:

To demonstrate the real-time ECH control by the data assimilation system ASTI.

Results:

- ASTI assimilated the electron density and temperature obtained by the real-time Thomson scattering and estimated the ECH power to produce a target state, while optimizing the thermal diffusivities.
- We have conducted experiments to control the electron temperature at the plasma center starting at 6.9 s to follow the time series of target temperature (red line) consisting of two temperatures: 2 keV and 3 keV.
- Four gyrotrons: 237 kW, 209 kW, 203 kW, 102 kW (50 Hz modulation) are used for the ECH; thus, ASTI controls the injection power by selecting the set of these four gyrotrons.
- We successfully produced the target temperature of 3 keV, but the control was destabilized for the temperature of 2 keV. This is because the mapping model of observed radial profile into the normalized minor radius underestimates the electron temperature (e.g., t=9.3 s) and has a negative impact on the optimization of thermal diffusivities
- We will improve the mapping model and stabilize the communication to control stably even for a long discharge. We would like to try controlling temperature profile and multi variables including density.