Daily Report for 2025-12-24

N. Kenmochi

Date: December 24, 2025
Time: 10:00 – 18:45
Shot: 200066 – 200219 (154 shots)
Prior wall conditioning: No
Divertor pump: On
Gas puff: H_2,He, Ne,Ar
Pellet: Impurity pellet (Li)
LID: Yes

NBI: #1, #2#3, #4, #5
ECH: 2-OUR (77GHz), 2-OUL (154GHz), 2-OLL (154GHz)

※Experiment suspended from 10:03 to 10:33 due to network equipment trouble

Topics

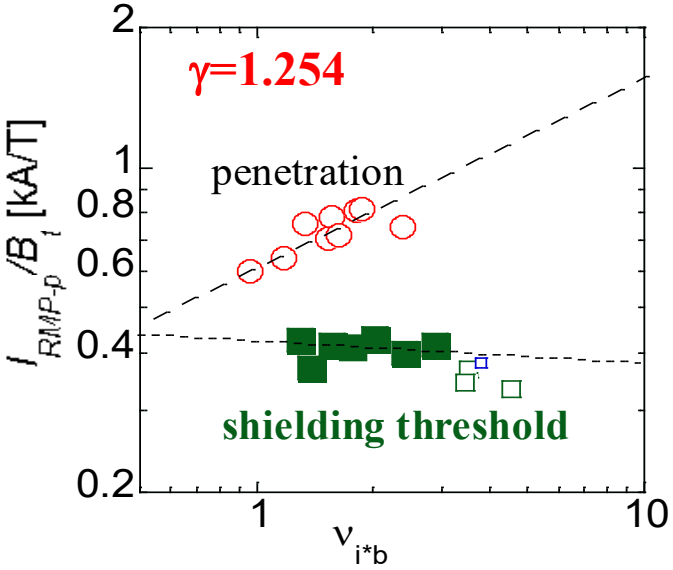
1. Study of the mechanism on shielding external RMP by plasmas (S. Shimode, K. Watanabe)
2. Hysteresis conditions in thermal instability with various impurities, densities, and magnetic islands, and their universality across fusion plasma and astrophysical plasma (M. Kobayashi)
3. Demonstration of p-6Li fusion reaction on LHD (M. Zarnstorff, M. Osakabe)

Study of the mechanism on shielding external RMP by plasmas (S.Shimode, K.Y.Watanabe)

Background and Motivation:

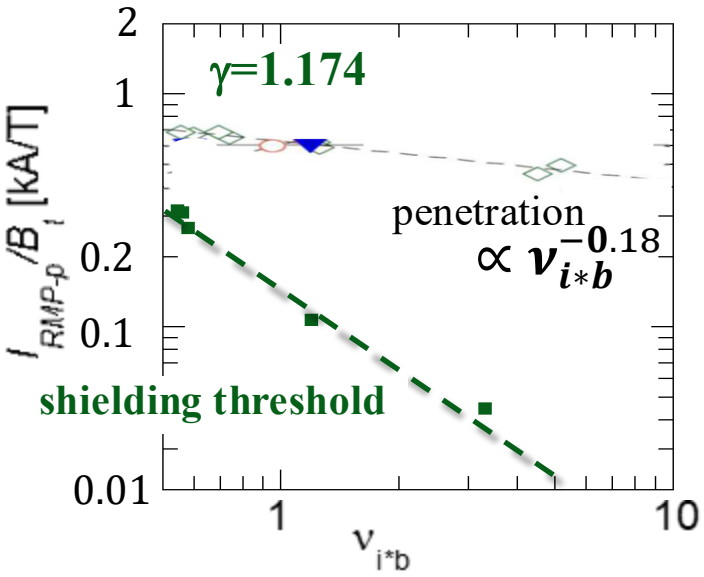
The collisionality dependence of the RMP penetration threshold is investigated for various aspect plasmas, and it has quantitatively and qualitatively different depending on the magnetic configurations. In this study, we focus on RMP shielding threshold dependence on the collisionality for some magnetic configurations, we compare them with some configurations, and try to find a model of the shielding mechanism on external RMP by plasmas.

As the graph on the top right shows, in γ =1.254 config., the shielding threshold dependence on collisionality is opposite to the penetration threshold dependence.
⇒ How about γ=1.174 config.???



Experimental conditions:

(Rax, Polarity, Bt, γ, Bq) = (3.60m, CCW, 1.375 T,1.174,100%) #200067-200093
RMP calibration; #200094,200095
#7O enlarged@3.6m,ramp down rate 300A/s@B2 coil



Results:

・We get the data on the RMP shielding threshold dependence on the collisionality for γ=1.174 config.
・In γ =1.174 config., the shielding threshold shows a similar collisionality dependence to that of the penetration threshold, but the slope of the shielding threshold is steeper than that of the penetration threshold.

Hysteresis conditions in thermal instability with various impurities, densities, and magnetic islands, and their universality across **fusion** plasma and **astrophysical** plasma

M.I.N.Kobayashi, M.Kobayashi, R.Ishikawa,
K.Nagaoka, (NIFS), Wei Li(SWJTU)

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.9 m / 3.85 m, CCW, 2.5385 T, 1.2538, 100.0%)
#200113 - #200196

Motivation and method:

- Crucial to find conditions to achieve stable detach plasma.
  Meanwhile, previous LHD experiments also observe “reattachment” back to high-temperature state, which potentially have some hysteresis.
- Such bistable media exist also in astrophysical plasma (i.e., in the interstellar medium) and those stable states evolve with cosmic age.
- Search hysteresis conditions in fusion plasma under thermal instability.
  → **Systematically vary the impurity species (Ne, Ar), their fraction, heating pattern, and density** (with LID).

Results:

- 7-8 shots with Ne achieved detachment. Some of them were successfully followed by either (1) reattachment or (2) oscillation within the low-temperature state.
- However, majority of the shots with Ar resulted in partial detachment

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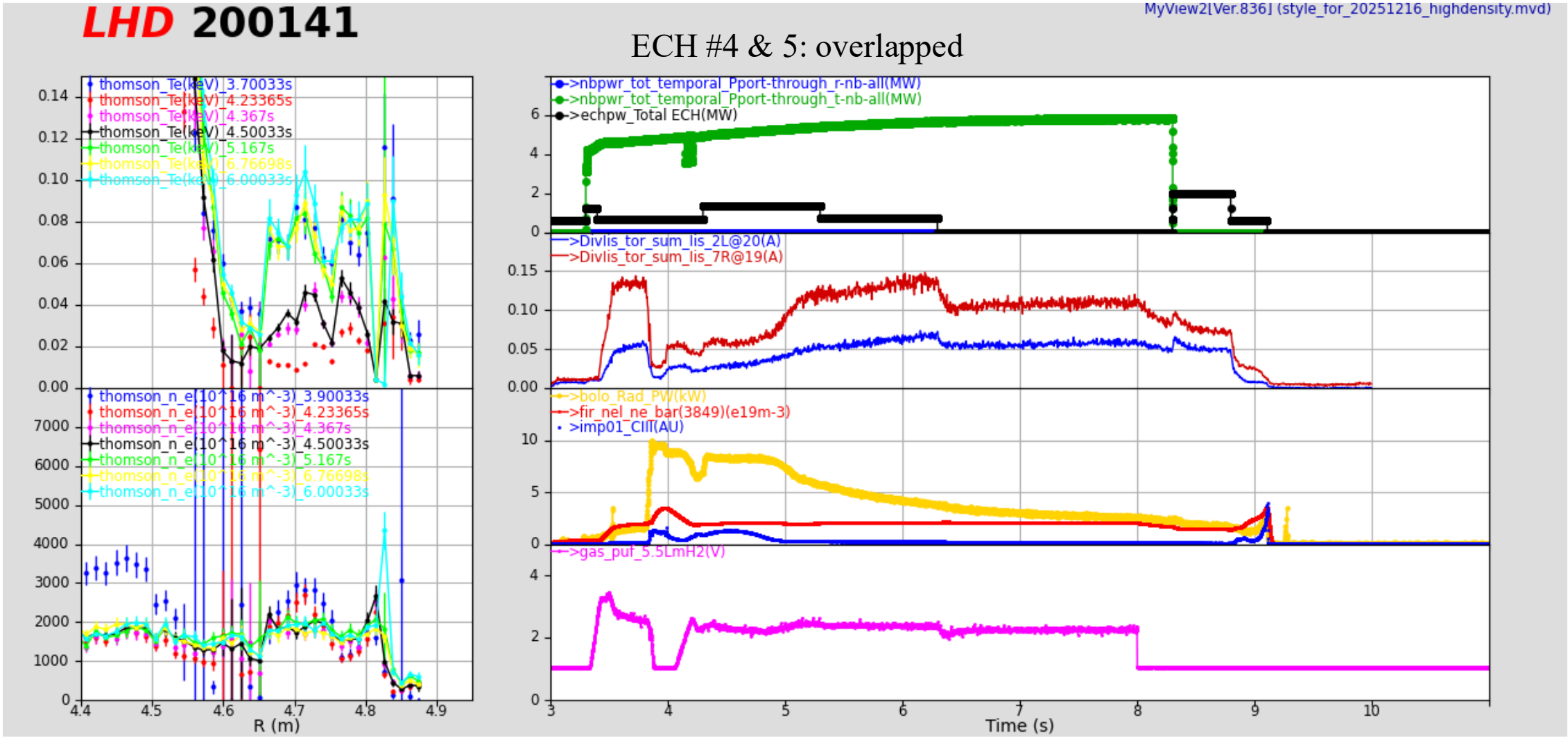
Ne 31ms injection @ 3.8 sec



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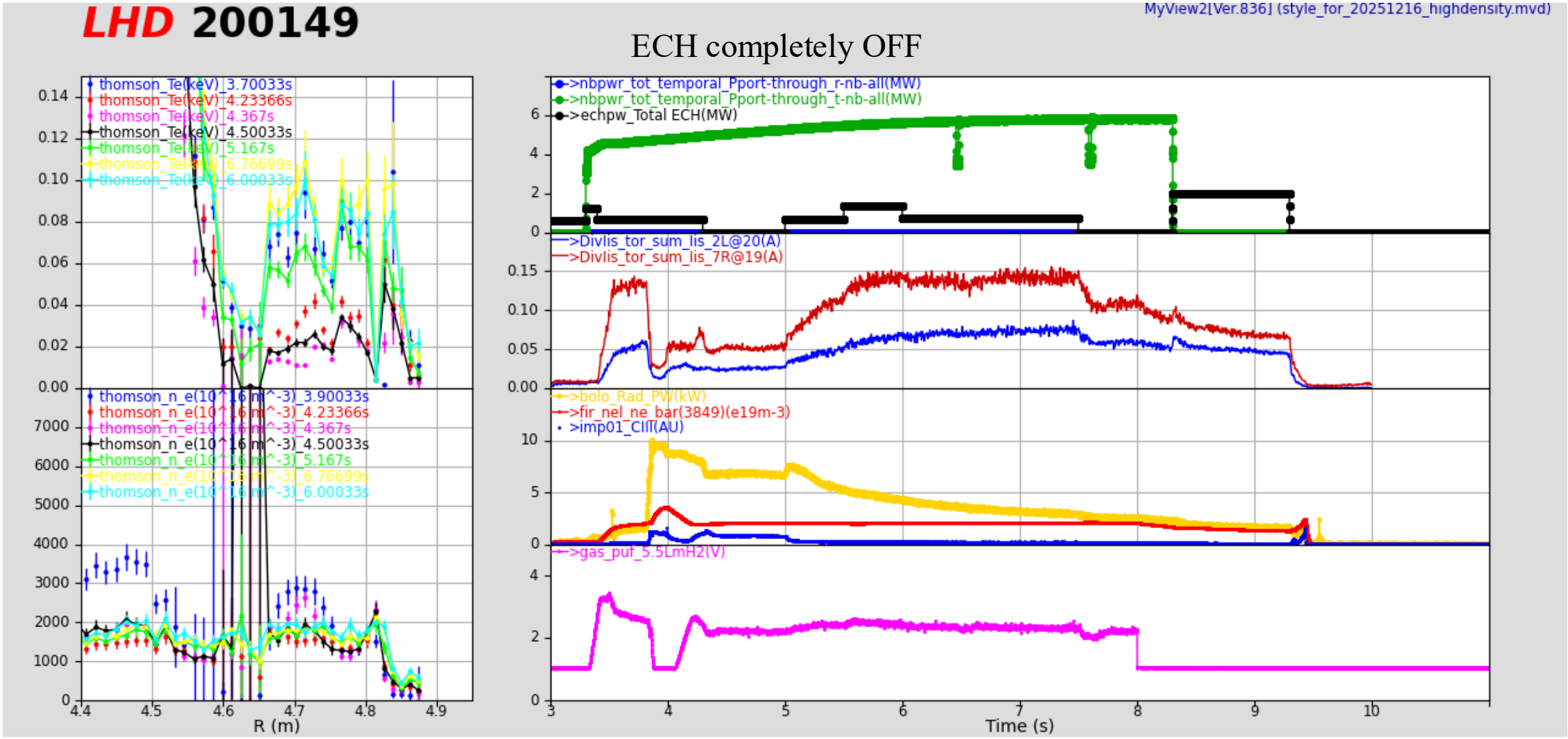

Demonstration of p-6Li fusion reaction on LHD

M. Zarnstorff (PPPL), M. Osakabe, K. Ogawa, M. Motojima, N.Tamura(IPP), M. Gotoh, T. Ishikawa and T. Qian (U. of W)

Experimental conditions:

(R_{ax}, Polarity, B_t, γ, B_q) = (3.6 m, CCW, 2.75 T, 1.2538, 100.0%)
#200197 - #200219 : First three shots are used for spectroscopic purpose (D.Katoh/M.Gotoh)

Motivation and method:

- Document p-6Li and p-7Li reactions through fusion products. Changing the amount of 6Li and 7Li using TESPEL/Impurity pellet at n_e-avg=~1e^{19}[m^{-3}]. Injection timing of these pellets is basically t=4.23s. Only in shot# 200215, TESPEL is injected at t=5.23s.
- We also scanned the NB power changing the number of injectors.
- Evaluating the NB energy dependence of the reaction.

Results:

- The difference between 6Li and 7Li are observed in gamma-ray data (7Li larger) and slight difference is observed in α-particle(6Li slightly larger) .
- Detailed analysis on spectra of α and γ are necessary to clarify the effect of fusion reactions.