Daily Report for 2025-12-18

M. Kobayashi, R. Yanai

Date: December 18, 2025
Time: 10:00 -17:15
Shot#: 199646 – 199772 (127 shots)

Prior wall conditioning: No
Divertor pump: On
Gas puff: H2
IPD: No
LID: Yes

NBI: #1, #2, #3, #4, #5
ECH: 2-OUR (77GHz), 2-OUL (154GHz), 2-OLL (154GHz)
ICH: None

Topics

1. Collisionality dependence study of the external RMP penetration threshold (Shogo SHIMODE, K.Y. Watanabe)
2. Suppression of R-Interchange instability by ex.-RMP (K.Y. Watanabe)

Resistive Interchange Instability suppression by Ext.-RMP (K.Y.Watanabe)

Background and motivation:

According to our previous work, m/n=1/1 RIC (Resistive InterChange) instability is known to be suppreseed by external RMP, and the empirical scaling law of ext. RMP amplitude to suppress the RIC completely was found as the following;

"Ext.-RMP amplitude to completely suppress RIC"

$$= 7.1\times10^{2}\cdot\beta^{1.8}\cdot\nu_*^{0.24}\cdot\rho_*^{0.85}$$

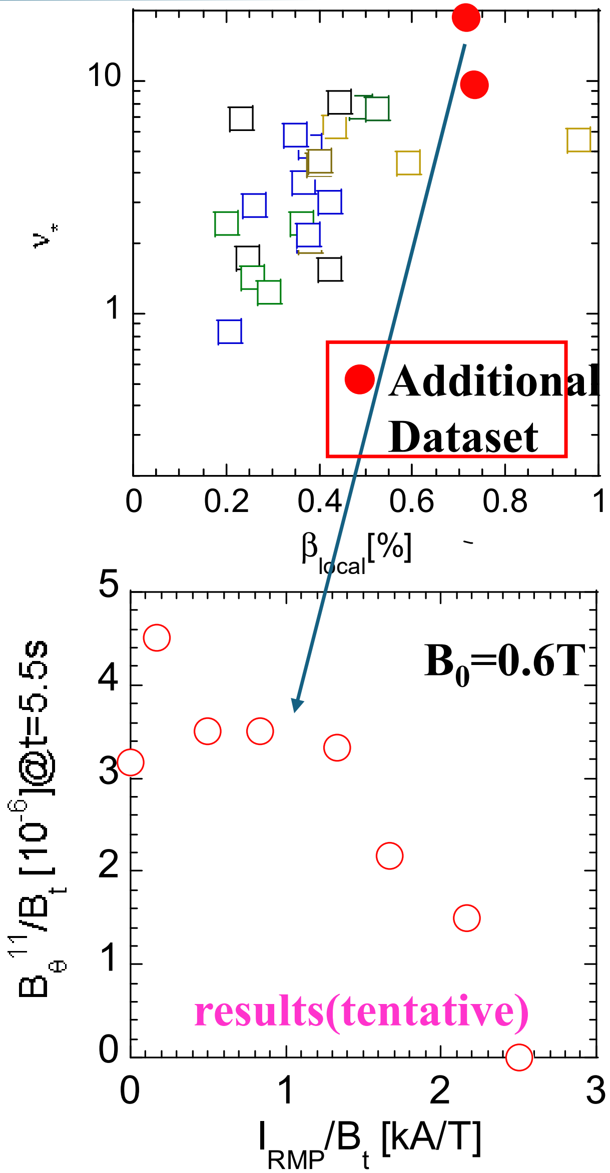
However, the exponent of β and ν* would not be accurate because the data, we used for our analysis, has high correlation between β and ν*. Now, we get the additional dataset to decrease the correlation between β and ν* to improve accuracy of the above scaling on β and ν*.

Experimental conditions:

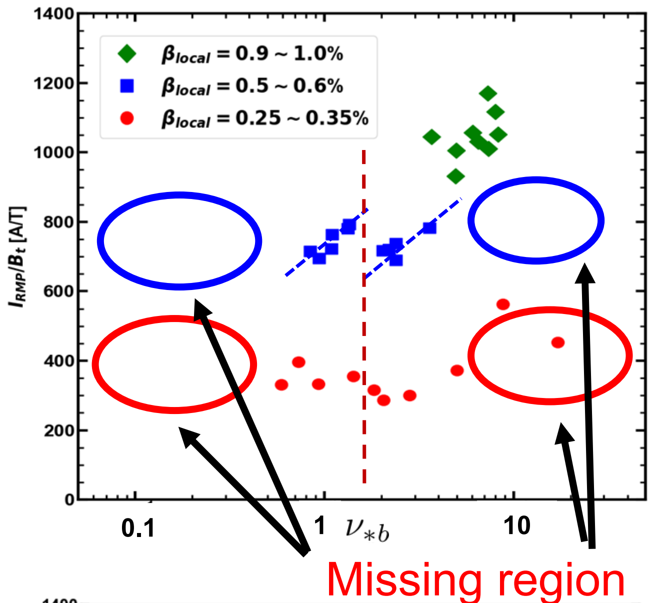
(R_{ax}, Polarity, B_t, γ, B_q) = (3.75m, CCW, 0.6T, 1.2538, 100%) ;#199755-71 for m/n=1/1 (3.55m, CCW, 0.75T, 1.2538, 100%);#199711-31 for m/n=2/1

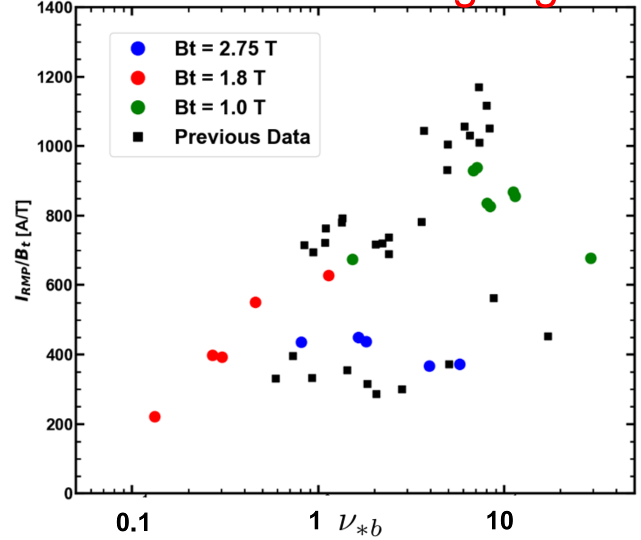
Results:

The dataset is extended as shown in the right-top figure. And, we obtain the data point on the scaling law of ext. RMP amplitude to suppress the RIC completely. Now we are improving the scaling law. In addition, we obtain m/n=2/1 mode response to Ext.-RMP. We will compare their



Collisionality dependence study of the external RMP penetration threshold (S.Shimode)





Background and Motivation:

To clarify the penetration mechanism of external RMP(Resonant Magnetic Perturbations) in heliotron plasmas and to improve the predictive accuracy of RMP pen. conditions infusion reactors, the scaling law is being developed.
Based on previous experiments, scaling laws have been obtained as the function of $\beta, \nu_*,$ and ρ_*. It dose not depend on collisionality.

$$I_{RMP-p}/B_t = 0.78 \cdot \beta^{1.2} \cdot \nu_{*b}^{-0.038} \cdot \rho_*^{-0.48}$$

However, the analysis of the threshold dependence on the collisionality for some beta ranges suggests that the dependence changes depending on the collisionality regime. Objective of this study is to resolve the collisionality dependence of the RMP pen.threshold in different collisional regimes, as well as to clarify the discontinuous behavior observed in the intermediate collisionality regime.

Experimental conditions:

(Rax, Polarity, Bt, γ, Bq) = (3.60m, CCW, [2.75 T,1.8 T, 1.0 T], 1.2538,100%)
#199647-675(2.75T), 199676-695(1.8T), 199696-708(1.0T)
RMP calibration; #199676,199696 #7O enlarged@3.6m,ramp up rate 300A/s@B2 coil

Results:

We obtained the RMP penetration thresholds in a new collisionality regime, as shown in the lower right. Now we are improving the scaling law.