

## NSTX Research Forum: MHD

### Search For Resistive Wall Mode with Real Frequency

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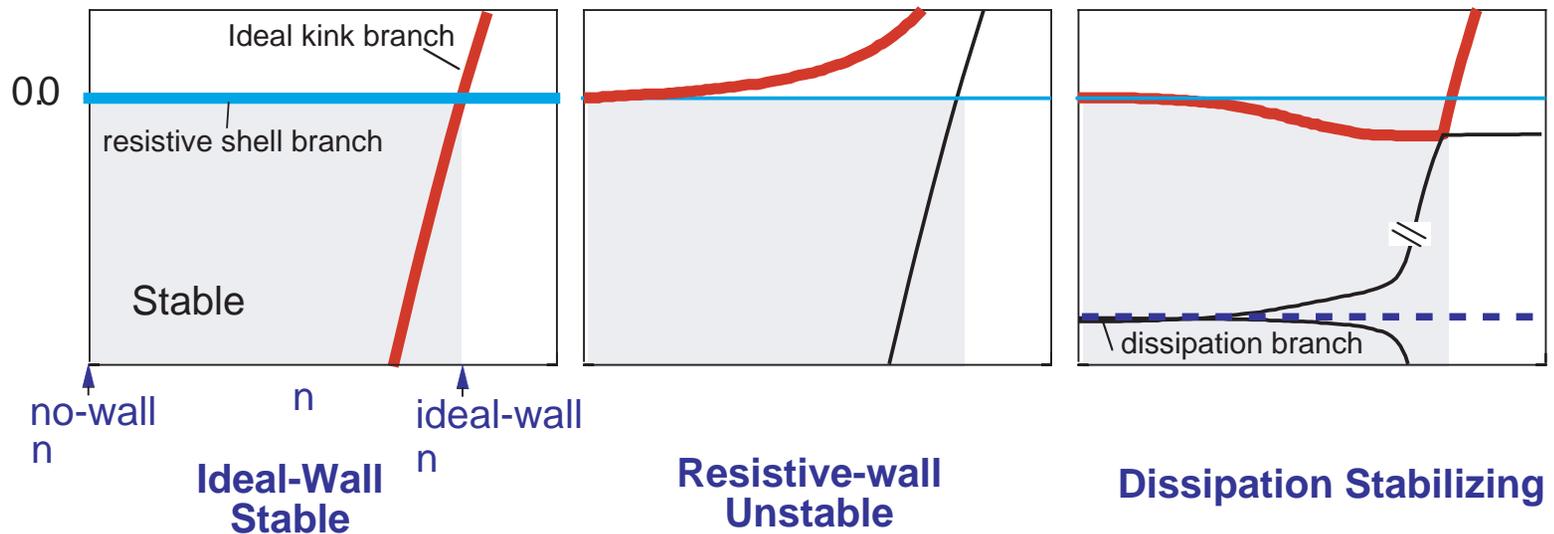
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## Objectives of Search for RWM with Real Frequency:

- RWM Suppression Has been Recognized as a Major Keystone for Achieving High Beta<sub>N</sub>, Leading to Long Sustained Ignited Plasmas
- Dissipation Branch is a Significant Factor for RWM Stability in DIII-D Device.
- Stable RWM with Real Frequency Should Reveal the Nature of Dissipation Branch
- Preliminary Data Was Observed in PBXM
- In addition, This Exploration Should Also Reveal the Significance of
  - Residual Error Field
  - $\square^*$

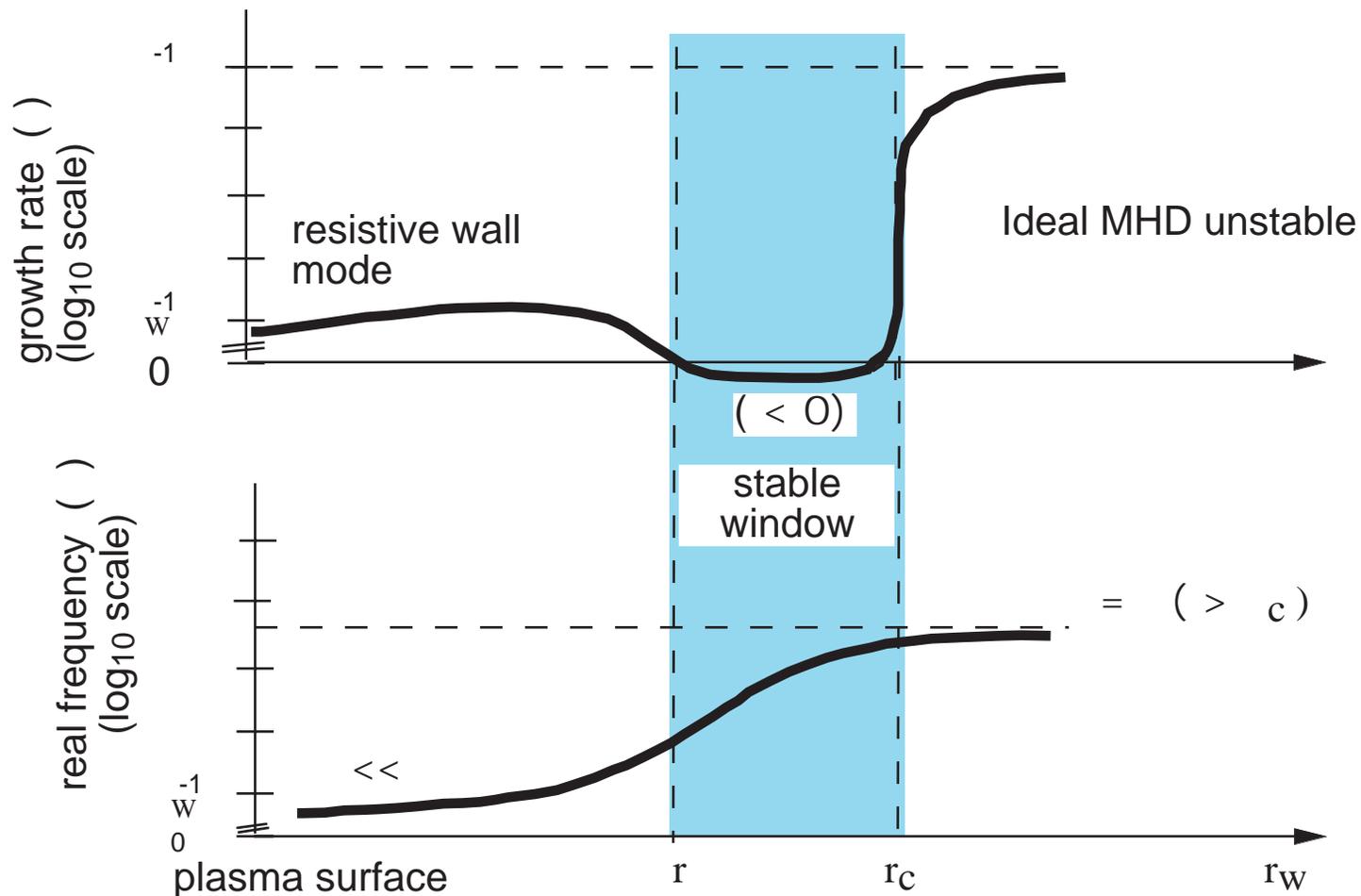
# Resistive Wall Mode - an External Kink Branch with Resistive Wall

$$\begin{array}{ccccccc}
 \text{Ideal kink} & & \text{Resistive Shell} & & \text{Dissipation} & & \\
 W_p & + & \frac{(W_V^b w + W_V)}{(w + 1)} & + & +(i N )D & = & 0
 \end{array}$$



\* In this schematic diagram,  $n$  and wall-separation is interchangeable.

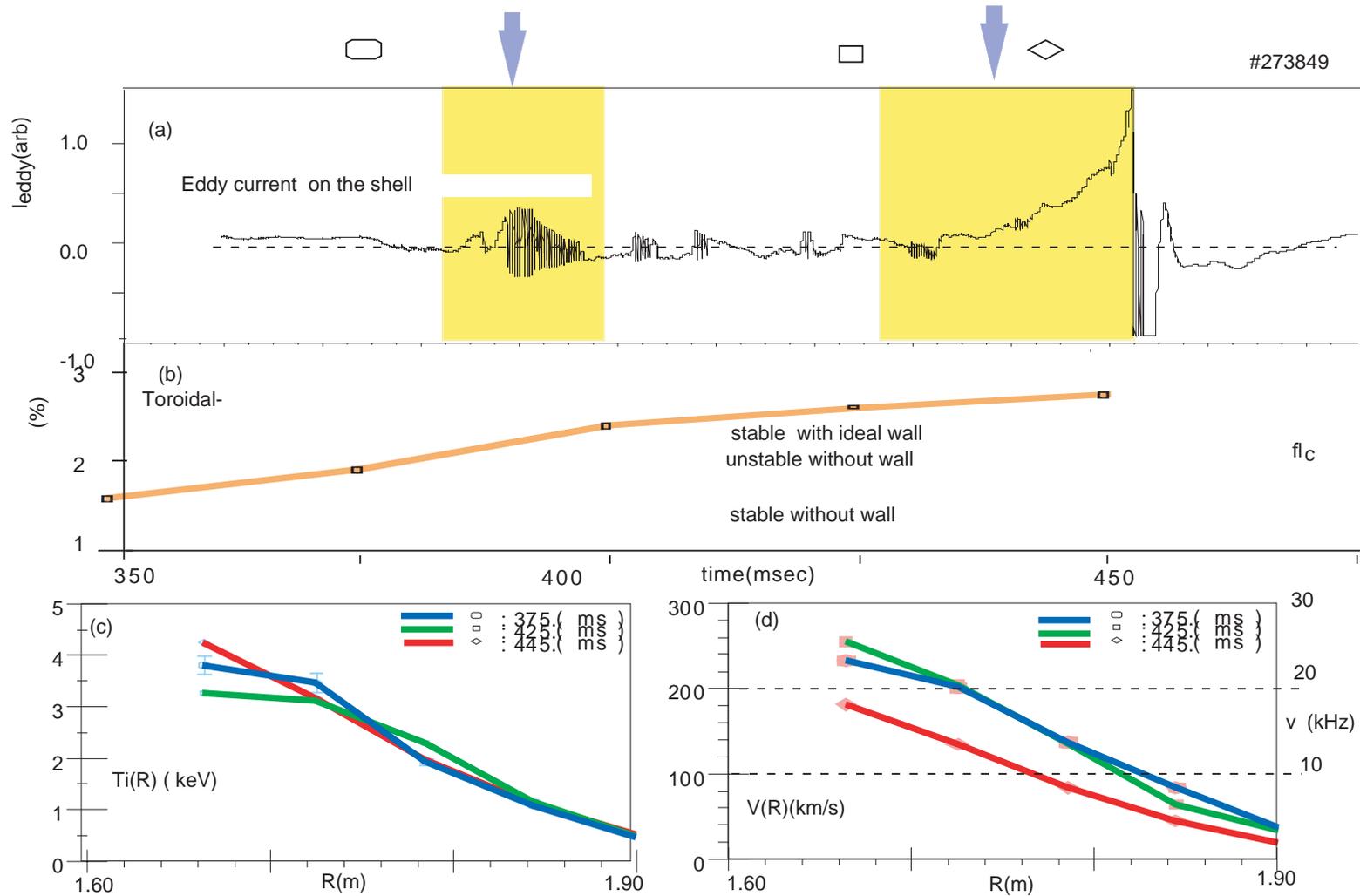
# Present RWM Hypothesis Predicts: Stable RWM should Have Substantial Real Frequency



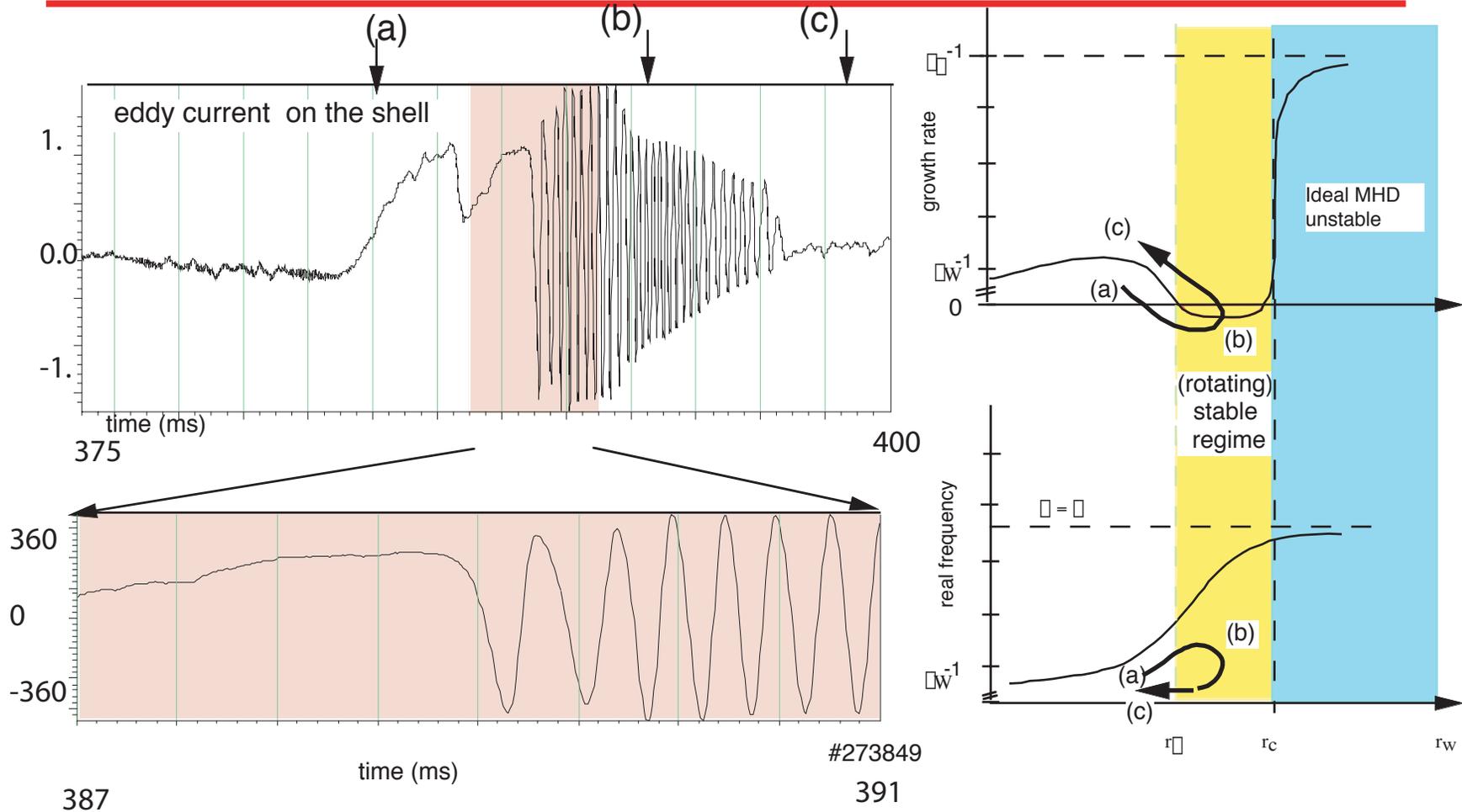
characteristic parameters:  $r_w / r_c$ ,  $w$

In this schematic diagram,  $n$  and wall-separation is interchangeable.

# RWM Grows with Several Hesitations, indicating that the Condition is Near Marginal Stability



# Resistive Wall Mode Near Marginal Stability

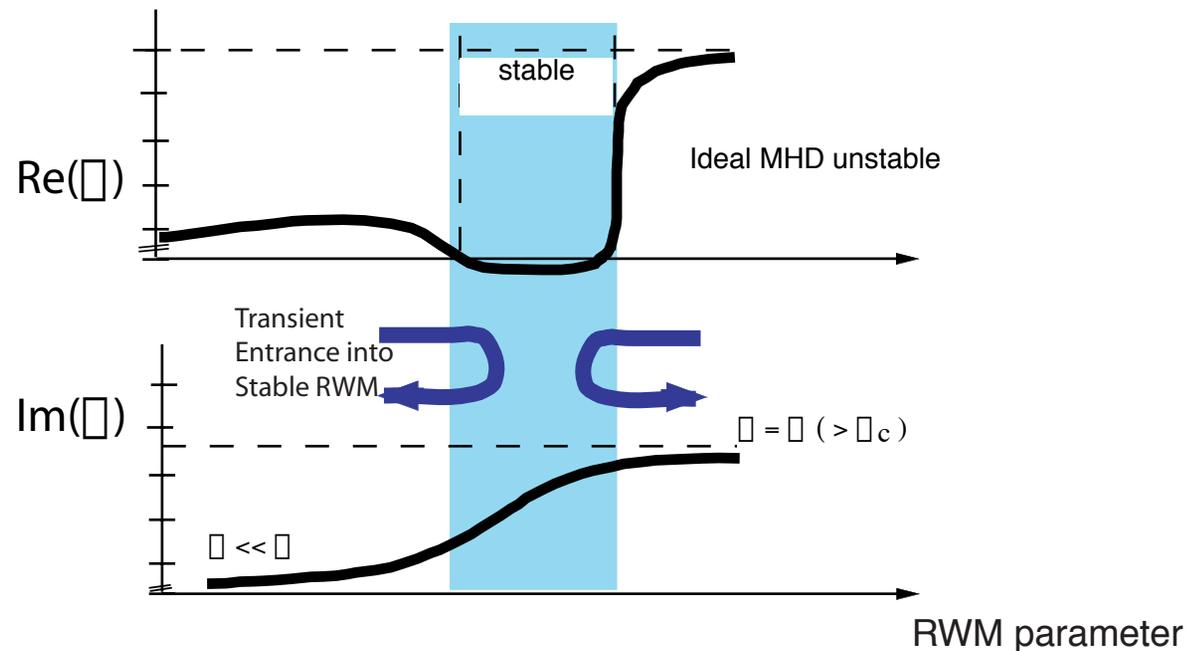


Transition from a growing stage ( $\gamma/2 \approx \text{zero}$ ,  $\tau \approx 1/5 \text{ ms}$ ) to a rotating damped mode stage ( $\gamma/2 \approx 3 \text{ kHz}$ ,  $\tau < 0$ ) is consistent with predictions of the resistive wall mode hypothesis

## Experimental Approach:

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- After External Kink or RWM Operation Is Established, Transiently, Configuration is shifted into the Stable RWM Regime by:



- (1) Pulsed Increase / Decrease of Pressure ( $\beta_N$ )
- (2) Swift Scan of Elongation (Coupling to Wall)
- (3) Rapid  $I_p$  ramp up/down (External Kink)