H-mode Power Threshold Studies on NSTX

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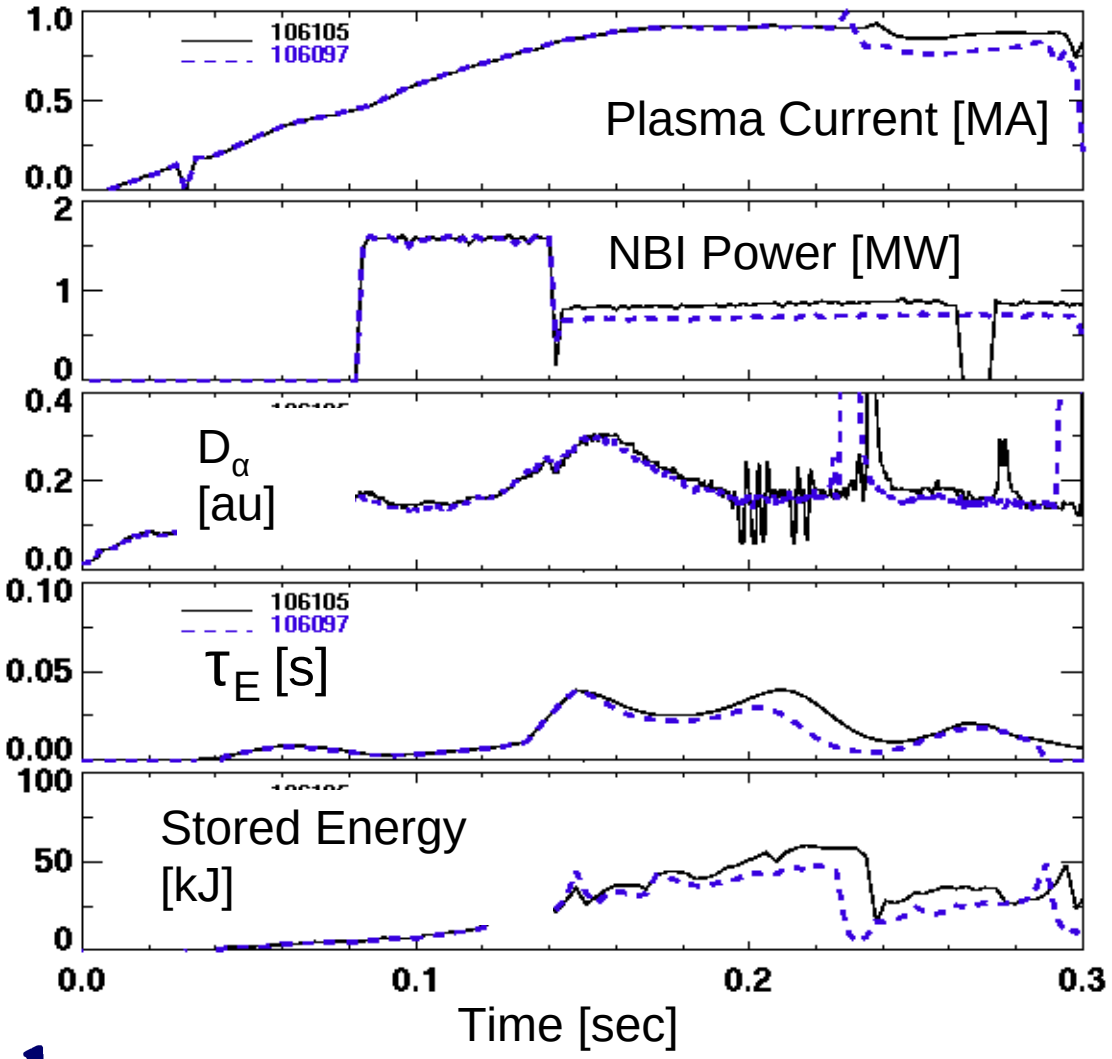
H-mode 'Dithers' Appear When NBI Power Approaches L-H Threshold Power



- Same plasma current. B_t = 0.45T, n_e
- NBI power near $P_{L\text{-}H}$
- Dithers show up in D_α
- τ_E improves slightly
- Stored energy increases slightly

New Capabilities for H-mode access and Power Threshold Studies

- Reduced error fields — Better coil alignment
  - Eliminate IRE?
- Inboard gas puff a` la MAST

Improved Diagnostics and Data Analysis -- Advantageous for Threshold Studies

- Edge Scanning Reflectometer —
- Edge Profile System (ORNL) —
- Thomson Scattering improvements —
- Reciprocating Probe —
- CHERS —

H-mode Power Threshold Studies on NSTX

Review & Motivation

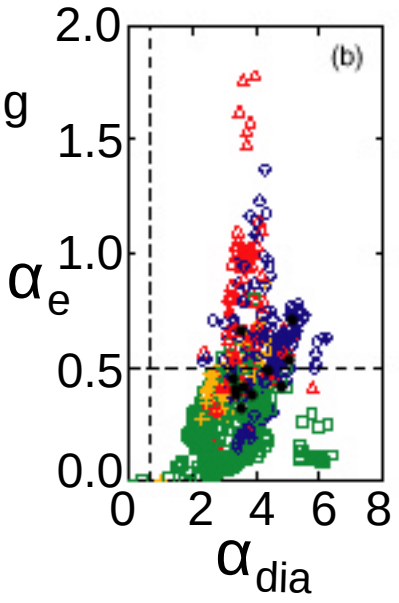
- Obtained high performance H-modes (τ_E~120 ms)
- H-Mode power threshold experiment done at a single set of parameters last NSTX run
  - — Used ELMy H-mode by choice
  - — P_b at threshold ~ 840 kW
  - — P_{th} multimachine scaling => 60 kW
- Must expand the operating space to investigate further
- New capabilities – (e.g Better n_e profiles at edge)
- Plan: Use mostly NBI- But also expect to use RF

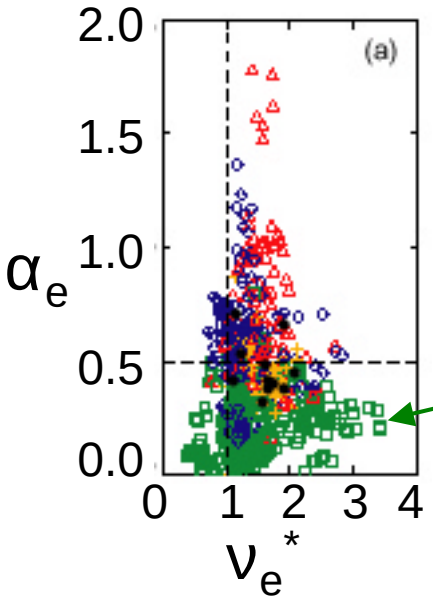
Experimental Approach

- Determine impact of improvements
- Obtain longer duration H-modes (but not required?)
- Can begin study quickly using P_{th} study of last run
- Reduced IRE, better wall conditioning, I_p control
- Obtain and document fiducial H-modes
  - — (a) ELM-free; (b) ELMy
- Expand the n_e, B_t, S, I_p space for NSTX H-modes
- Make power threshold determination with LSND
- Test same conditions with USND, DND and CSL
- See how profiles and turbulent fluctuations differ
- Determine role of ExB shear flow. (Exchange NBI and RF power)
- Compare to L-H Transition Theories
- Test other methods of triggering (lower P_{th}?) L-H transition

Transition Models and COMPASS-D

Rogers
-drift ballooning

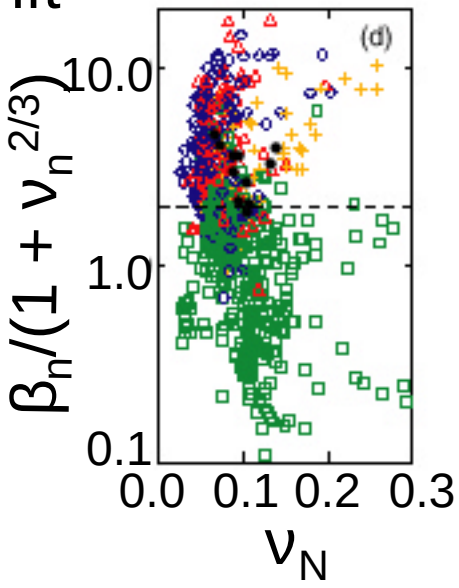


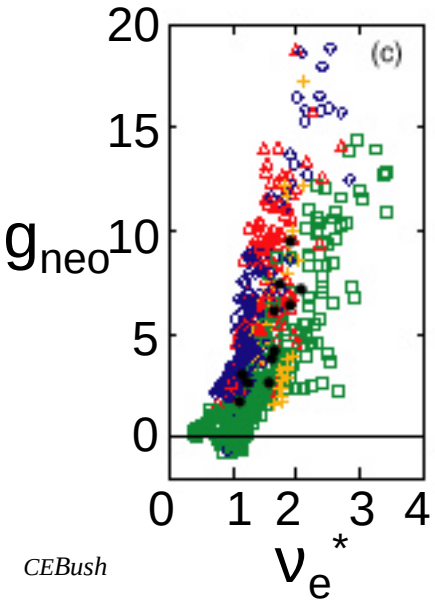


peeling mode

L-mode
-green squares

Alfven-drift

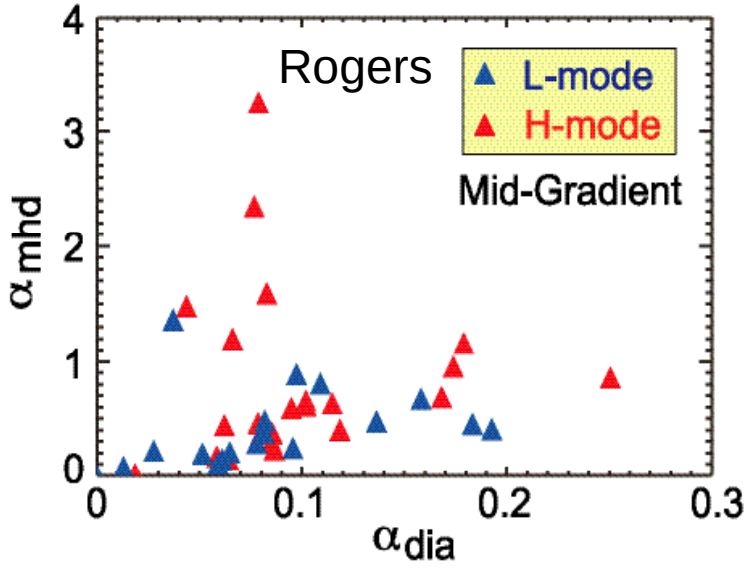


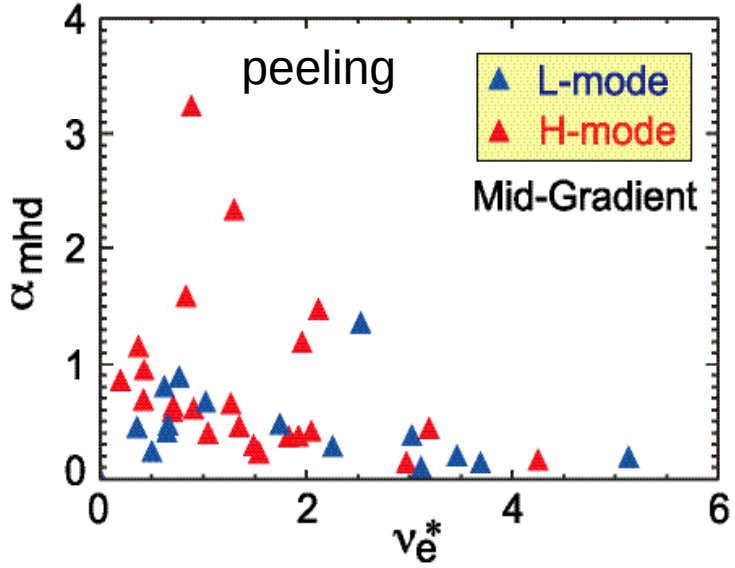


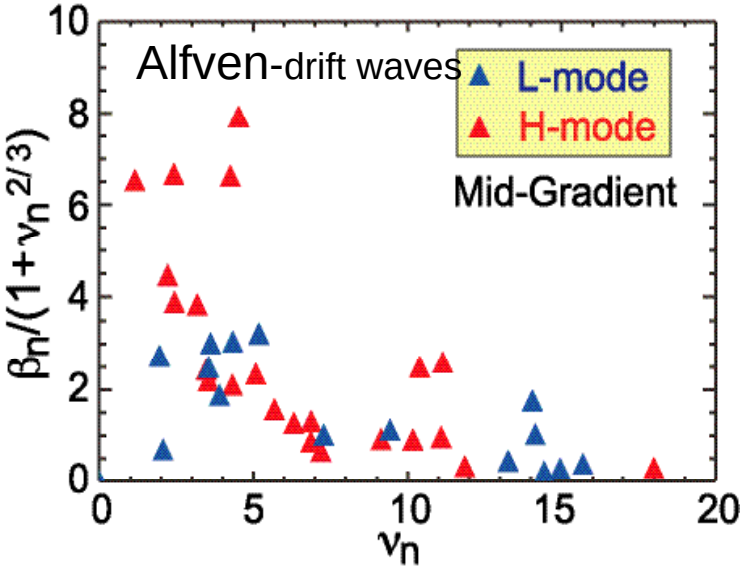
neoclassical
transport in impure plasma

NSTX H-modes: Three H-mode Transition Models

("H" points taken just before L-H transition)





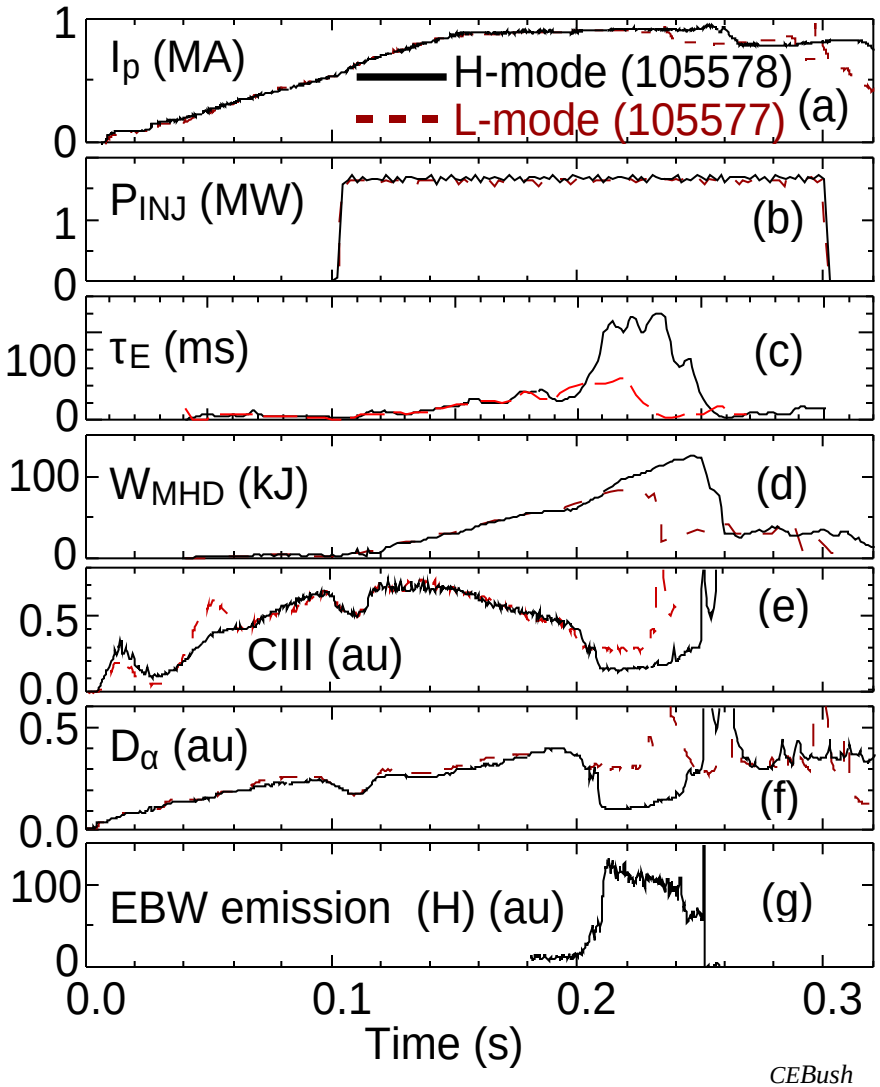


- L, H edge parameters on NSTX are not well ordered by any of the theories.
- Better estimates of L_n are needed for further study (reflectometer, reciprocating probe data).

S. Kaye

END

ELM-free H-mode with τ_E ~ 120 ms.-- Lower Single Null Divertor (LSND), P_b = .83 - 2.4 MW



- Same I_p, B_t, n_e
- Same P_b pulse
- τ_E improves
- Stored energy increases
- Central P_{rad} increased during H-mode
- D_α drop H-mode
- Emission from EBW increases 3 fold. steeper edge n_e gradient. (G. Taylor)
- Ti(0) increases. (from NPA) (S. Medley)

ornl

PPPL