

Study of tearing mode stability in the presence of external perturbed fields

Experimental validation of MARS-K/Q and RDCON codes

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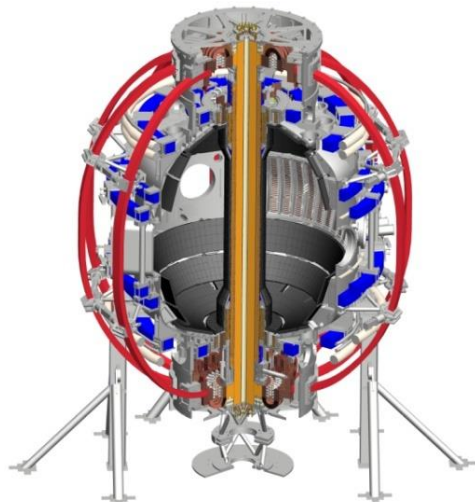
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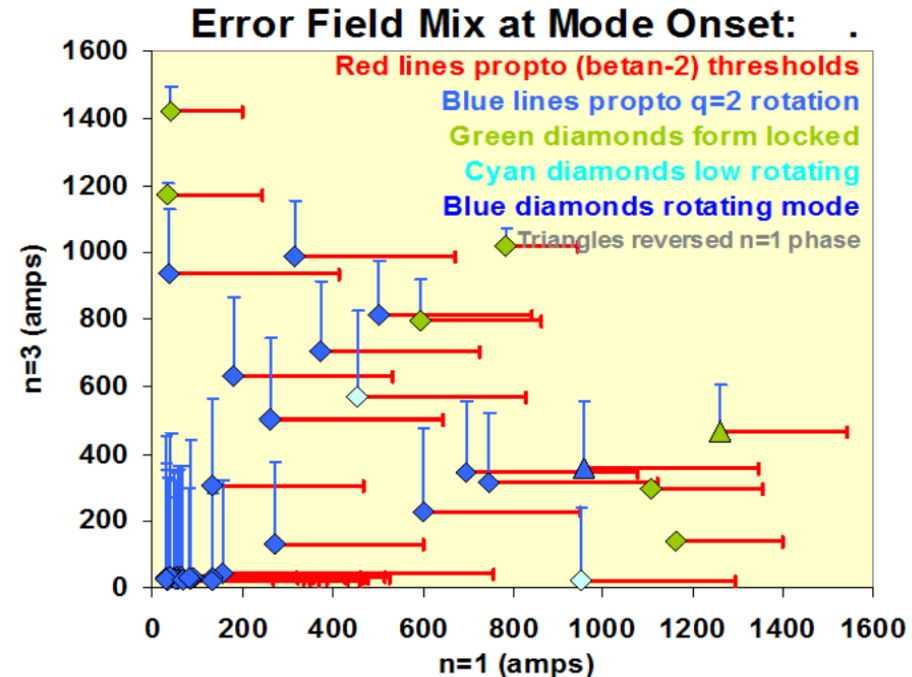
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NSTX-U Tearing Mode Experiments by Varying Plasma Rotation Through NTV Torque in Presence of External Fields

- Tearing mode limits the plasma beta when ideal kink mode is stable.
- Revisit tearing mode stability in NSTX
- Study the effect of rotation/shear on tearing mode stability in the presence of external magnetic perturbation.
- The idea of experiments to study the (2,1), (3,2) tearing mode stability



- Use NBI provides angular momentum at different location (on/off-axis).
- Apply n=1 and n=2 external perturbations with different strengths to induce NTV torque.

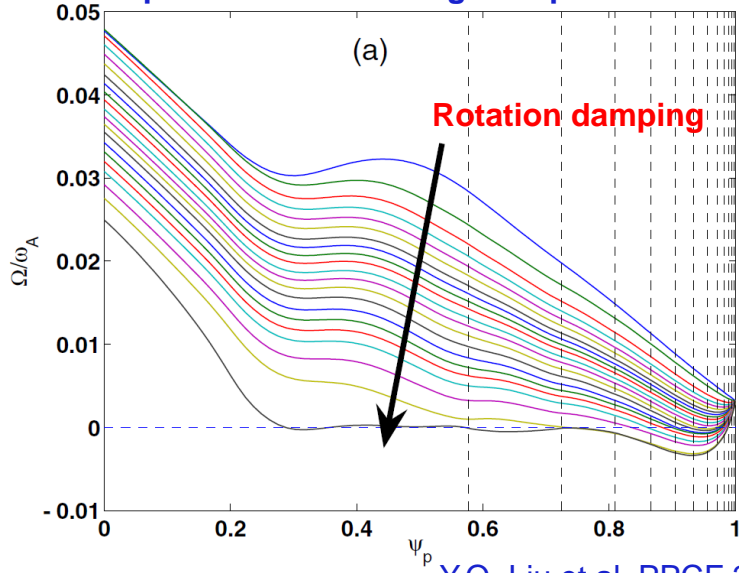
The correlation among the tearing mode stability, damped rotation profile and the strengths of applied field (resonant field penetration) can be investigated.

Numerical Capability to Carry Out Simulation of Tearing Instability and NTV Torque in Presence of External Fields

MARS-Q can do the physical analysis in terms of the small island in the quasi-linear approach.

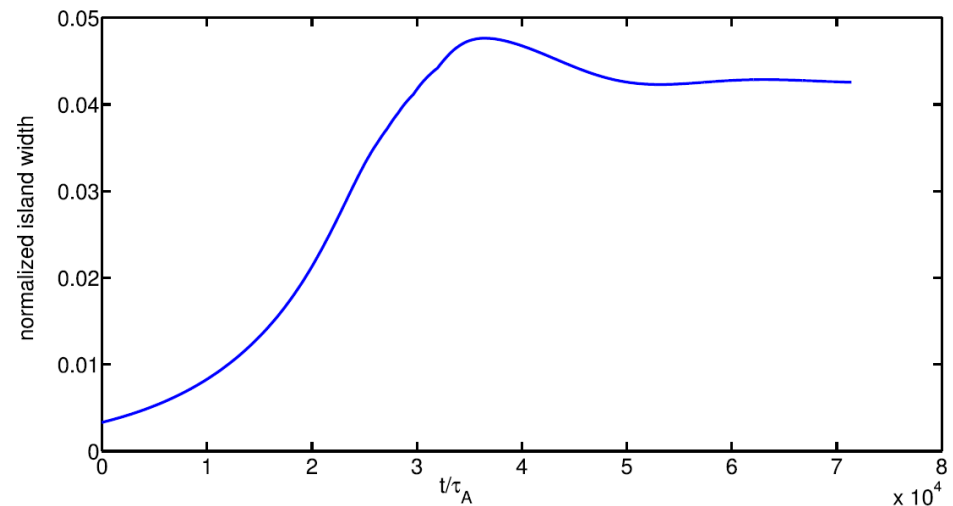
- The code can be used to simulate the dynamics of tearing mode in the experiments.
- The code includes the JxB resonant torque + Neoclassical toroidal viscosity(NTV) torque

MAST plasma with n=3 magnetic perturbation



Y.Q. Liu et al, PPCF 2012

Time evolution of (2,1) island width



G.Z. Hao et al, PoP 2014

- RDCON can also be used to study the effect of rotation shear at singular surface by matching the inner and outer region solutions.

Shot Plan (1 day)

- Revisit NSXT $n=1$ tearing mode experiments and find a target marginal to tearing mode stability
- Adjust NBI (on/off axis) to change plasma rotation/shear
- Apply the static $n=1$ magnetic perturbation with different strengths to damp plasma rotation through NTV torque
- Study the threshold of $(2,1)$ tearing mode stability, and time evolution of islands and rotation profiles (CHERS, MPTS, SXR)
- Threshold of $(3,2)$ tearing mode stability can be investigated through the same procedure with $n=2$ magnetic perturbation