NSTX-U / Theory Joint Projects
Macroscopic Stability

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Meetings planned in three areas

I. Macroscopic physics issues involving linear MHD codes coupled with kinetic effects

II. Disruption physics

III. Non-axisymetric equilibria and the reconstruction of equilibria

This meeting is on the first area:

Macroscopic physics issues involving linear MHD codes coupled with kinetic effects

Four codes being used in this area at PPPL: (a) IPEC code with its variants developed by Park and collaborators, (b) the MISK code used by Sabbagh and Berkery, (c) the MARS code by Jon Menard, and (d) the M3D-C1 code by Jardin and Breslau.

Topics in first area include:

1. NTV and kinetic stabilization of resistive wall modes.
2. The required amplitude of a resonant perturbation to overcome shielding in rotating plasmas.
3. The determination of the external magnetic perturbations to which the plasma is sensitive.

Most time-sensitive topic is the third:
The determination of the external magnetic perturbations to which the plasma is sensitive

Information is needed within a year for the optimization of the design of the NSTX-U non-axisymmetric control coils. Present design appears to have too few rows poloidally.

Two types of external perturbations:

a. Resonant (island driving, only a few)
b. Non-resonant (all other, modifies field strength)

Importance of research on third topic

a. Number of error fields that must be controlled
b. Separation of external perturbations into resonant/non-res.
c. Resonant perturbation effects and RWM's
d. Plasma control by non-resonant effects

Number of field distributions that can be efficiently produced with coils at a reactor-scale distance

Number ~ $(2\ M_{max})(2N_{max})$ ~ (8)(16) =128 distributions & coils

Only a small fraction of these probably have important plasma effects, but little is known about which are important.

The non-axisymmetric control coils should be designed to independently drive the external fields of greatest plasma-importance.