Impact of Vacuum Vessel Wall and Saddle Coil Support Structure on External Kink Mode Studies

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Physics Constraints on V.V. Wall and Saddle Coil Supports

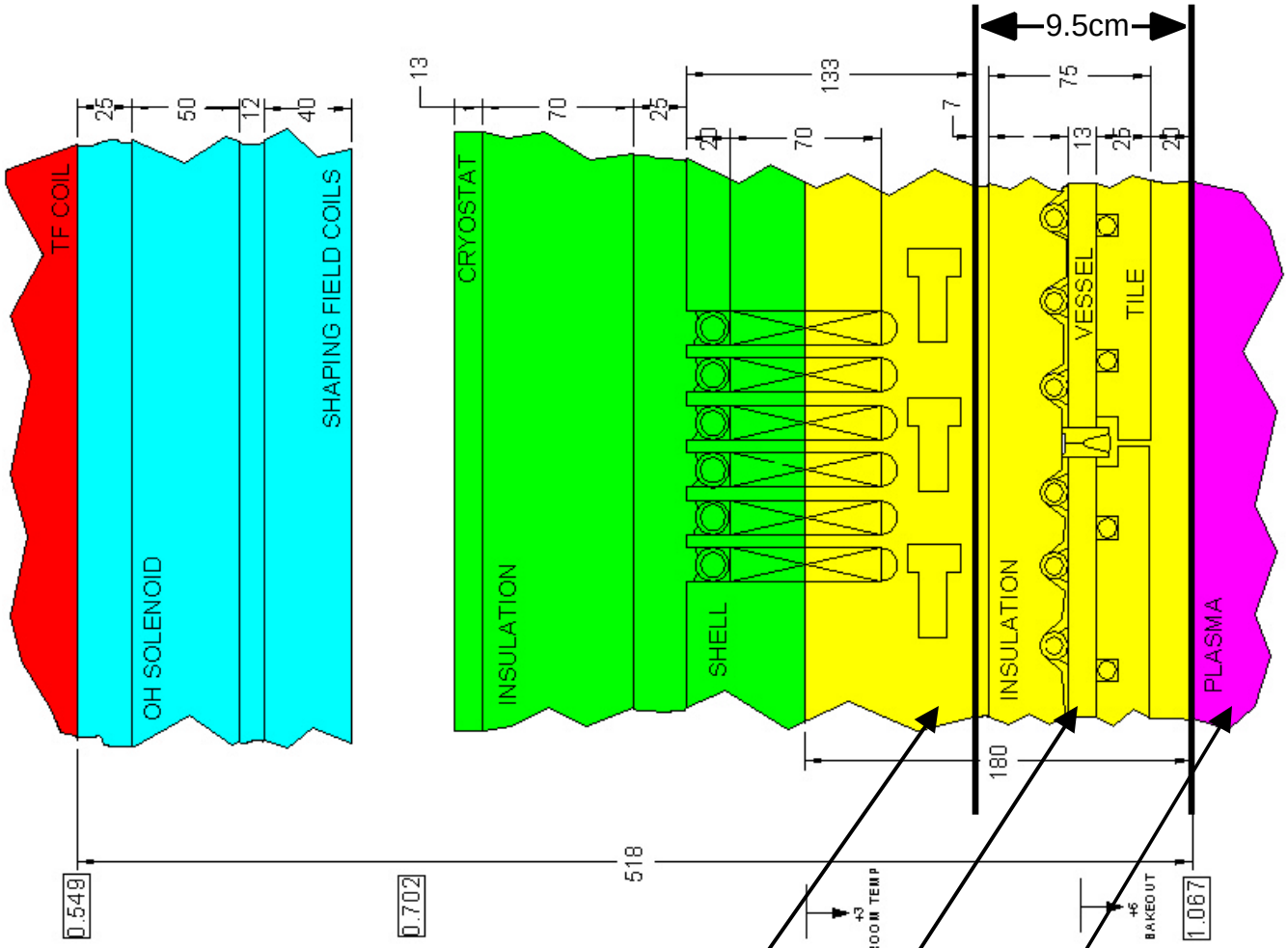
- Important physics result from NCSX will be demonstration of intrinsic stability to external kink mode.
- Presence of conducting wall will reduce external kink growth rate; if close enough, to wall time constant.
- Important to estimate minimum plasma-wall separation, wall time-constant.

Vacuum vessel will probably affect mode growth rate

- Stability calculations, using C82, with conformal wall show marginal stability point is about 10cm; a wall >10cm from plasma will reduce growth rate to $\approx \tau_{wall}$.
- Marginal point depends somewhat on configuration, plasma profiles through the structure of the mode.
- Vacuum vessel will play important role, but τ_{wall} is much shorter than pulse length.
- Time constant of saddle coil support structure could be much longer.

NCSX *minimum* radial build

Note: This is the minimum build. The VV and structural shell will be moved as far away from the plasma as practical (perhaps an additional 10cm or more) to provide space for shape flexibility.



Saddle coil support v.v. plasma

NCSX minimum radial build is close to marginal stability point

- An ideal wall at saddle coil support structure inner surface would marginally stabilize external kink in C82 - depends on how far above no-wall limit.
- Calculations are “thin-shell”; finite-thickness walls beyond present capabilities.
- In a practical senses, probably won’t have much affect on interpretation of experimental results.

Summary

- Present minimum radial build is at marginal stability point for external kink.
- Either more separation (15 cm?) or <10-20 ms wall time desirable for saddle coil support structure.
- Larger plasma-v.v. separation is probably desirable for flexibility.
- These conclusions are somewhat dependent on NCSX configuration/plasma profiles.