

DYNAMIC ERROR FIELD GENERATED BY SOL CURRENT AND ITS ROLES IN MHD INSTABILITY

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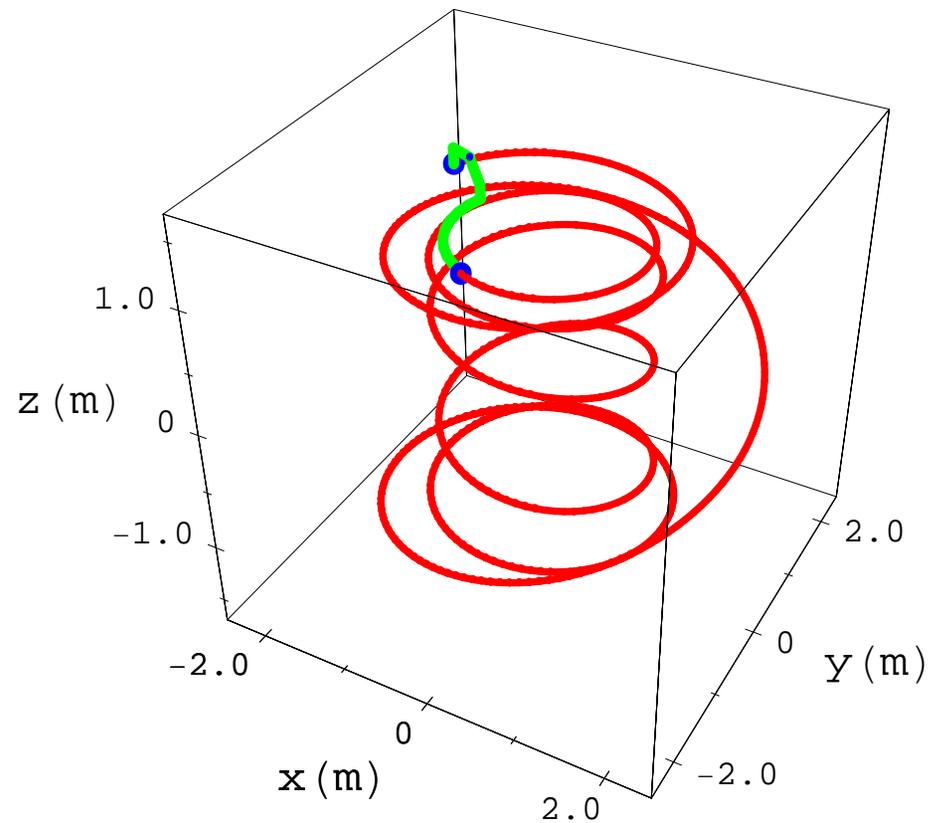
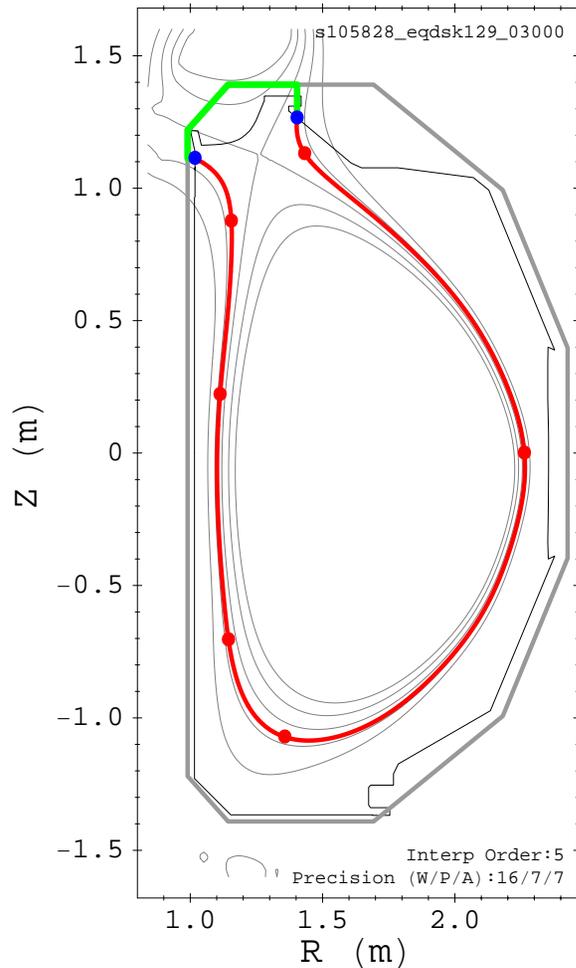
OBJECTIVES

Eliminate/alleviate performance-limiting low-frequency magnetic phenomena - LM, RWM, ELM, and NTM -, which may share a **common thread**.

References

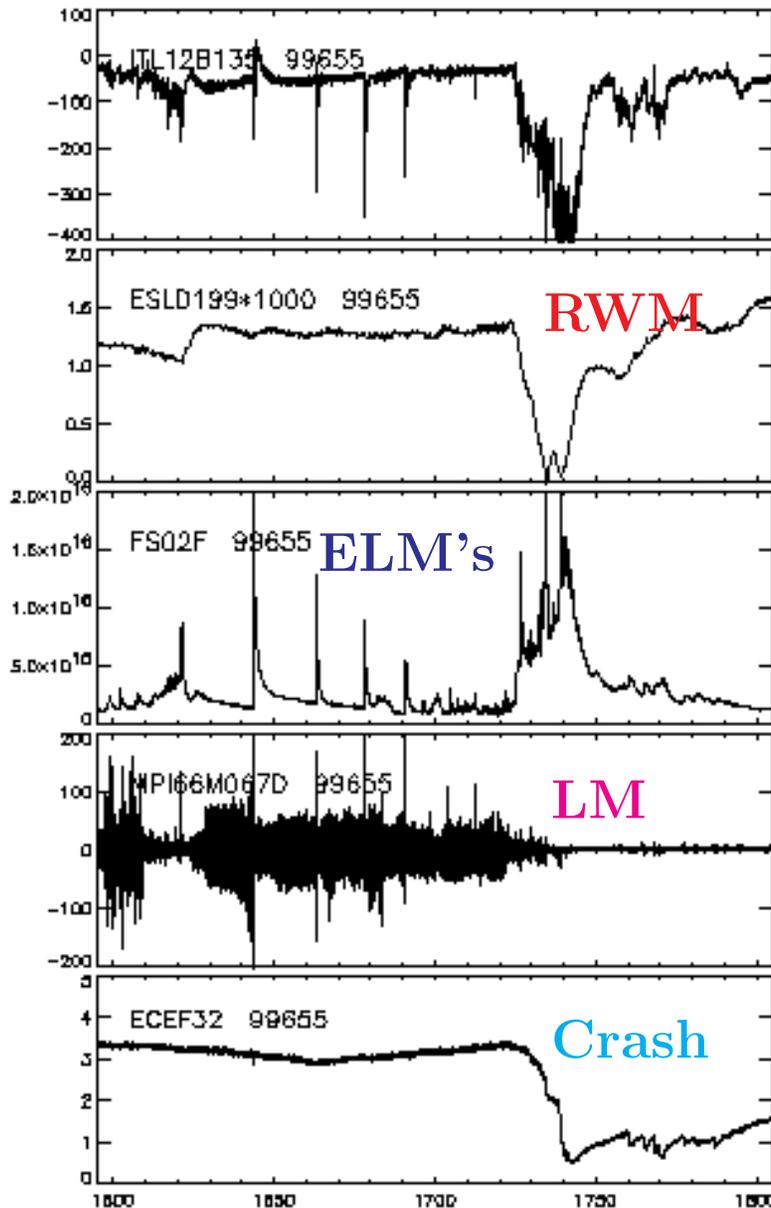
- (1) H. Takahashi, 'Interpretability of Magnetic Diagnostics in Tokamaks - Search for a Locked Mode in the TFTR Tokamak,' Invited Paper, Toki Conf., '95, Fusion Engineering and Design, **34-35**(1997)89
- (2) H. Takahashi, E. Fredrickson, and M. Chance, 'Unusual Low-Frequency Magnetic Perturbations in TFTR Tokamak,' accepted for publication in Nuclear Fusion.
- (3) H. Takahashi, et al., 'Measurement of Current in SOL Plasma in DIII-D Tokamak,' Poster CP1-83, APS-DPP Meeting '99.

SOL Current Generates **Helical Error Field** Dynamically.



Circuit of **helical field line in SOL** and **path in tokamak structure**.
 Field lines do **not** have to lie in a **rational** surface. (Figs. based on DIII-D.)

SOL Current Observed Con-currently with Low-Frequency MHD.



SOL Current (A) - thru one tile

B_R (mT) (RWM or LM Detector)

D_α (a.u.)

\dot{B}_θ (T/sec) (Mirnov Coil)

T_e (keV) (ECE)

AN UNCONVENTIONAL THESIS...

Mimic MHD \Leftarrow Field by SOL Current \Rightarrow **Rotation Slow-down**



Component Resonant on Singular Surface



Additional **De-stabilizing Force** on Tearing and Kink Modes



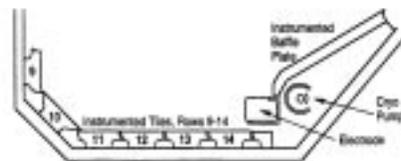
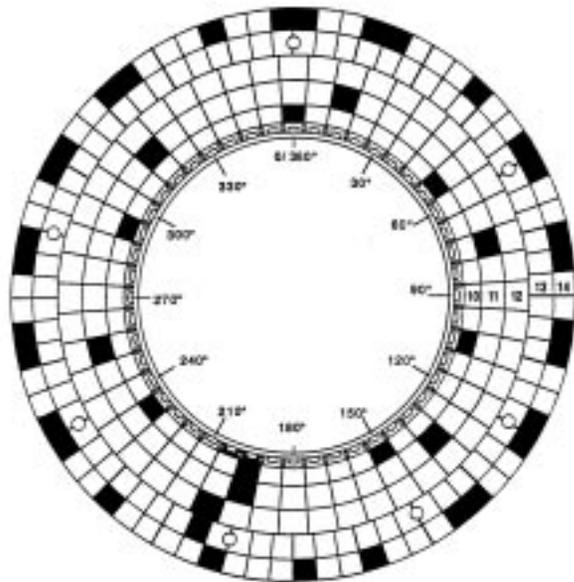
ELM, RWM, LM, and NTM

PROPOSAL:

- Examine external (magnetic) and internal (e.g., SXR) data for evidence of SOL current (this campaign).
- Build/install SOL current sensors (next opening).
- Verify SOL current's roles in performance-degradation (next campaign).
- **Get rid of SOL current** (future)

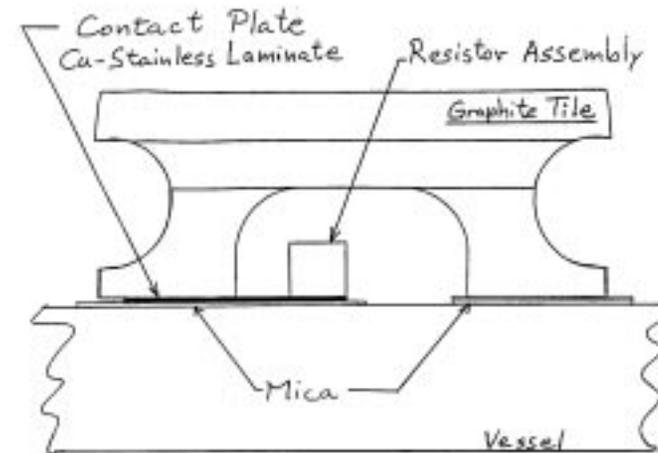
SOL CURRENT DIAGNOSTIC ON DIII-D

TILE CURRENT MEASUREMENT ARRAY-1996



GENERAL ATOMICS

TILE CURRENT MONITOR



- Sense resistors are $\approx 2.2 \text{ m}\Omega$ Inconel bars.

GENERAL ATOMICS

Divertor tiles are laid in rings. Some tiles are fitted with a resistor ($2.2 \text{ m}\Omega$) for measuring current through it.