

STUDY OF SOL CURRENT DURING ELM'S AND ITS
POTENTIALLY DE-STABILIZING INFLUENCE ON MHD MODES

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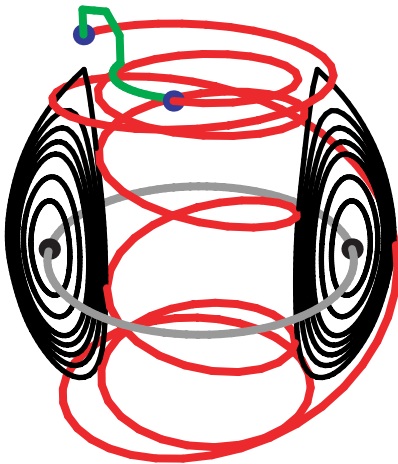
Princeton Plasma Physics Laboratory
Princeton, NJ 08543

SOL CURRENT IS A SOURCE OF ERROR FIELD

Error field produced by SOL current:

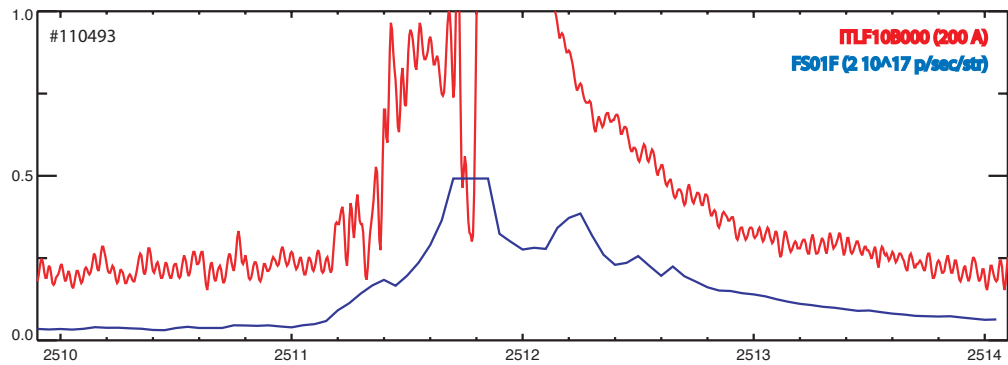
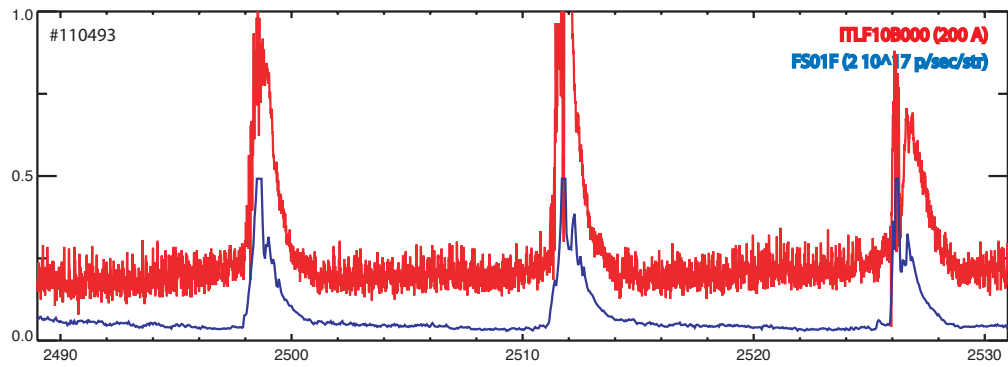
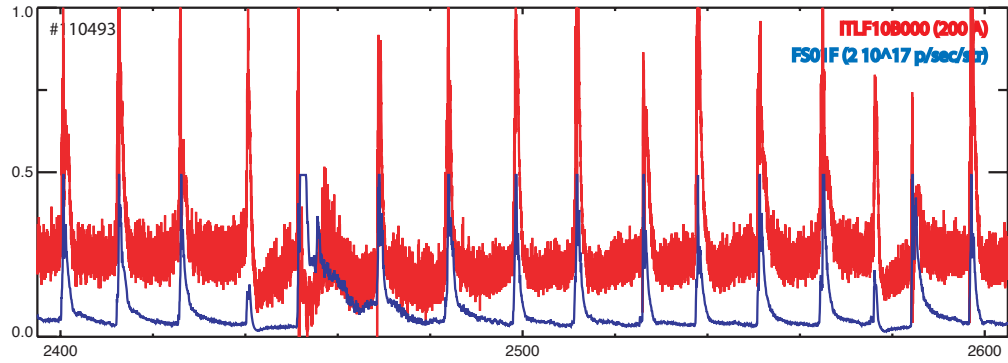
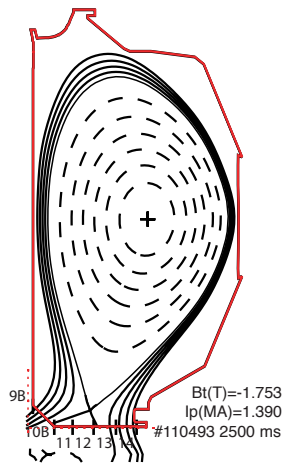
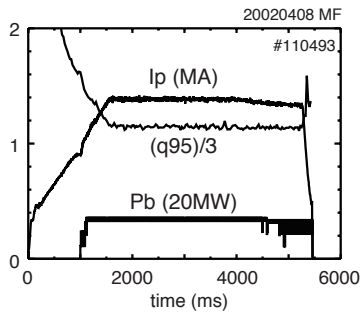
- (1) Comes into and out of existence **dynamically**.
- (2) Can be a **common thread** in:

- **ELM's**
- **RWM's**
- **NTM's**
- **LM's**
- **EHO's**
- **Intrusion into controls (machine, MHD feedback).**



Line-current Representation

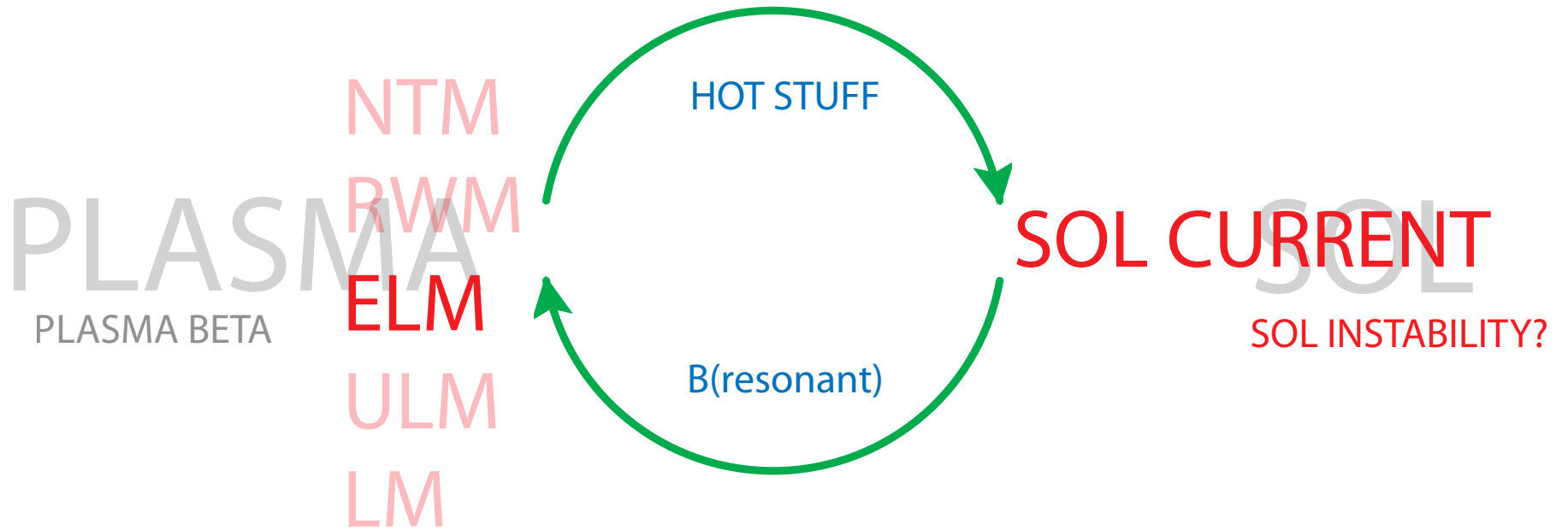
SPIKY SOL CURRENT AND D-ALPHA SIGNALS OCCUR SIMULTANEOUSLY IN ELMS



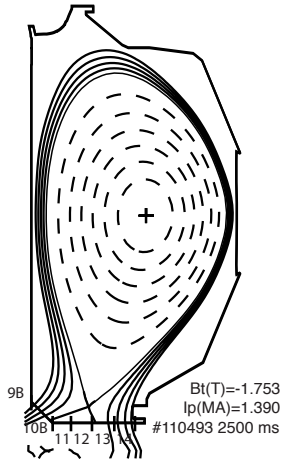
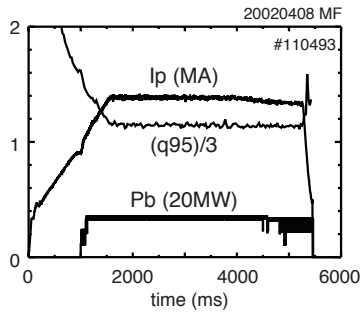
CAUSALITY MODEL - Prevailing



CAUSALITY MODEL - Unconventional

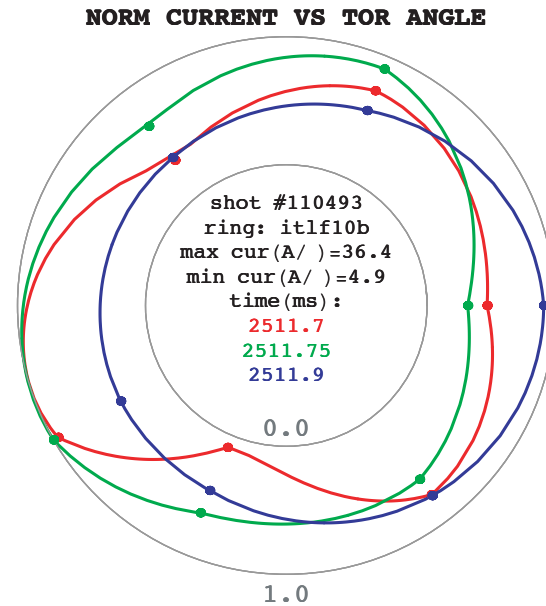
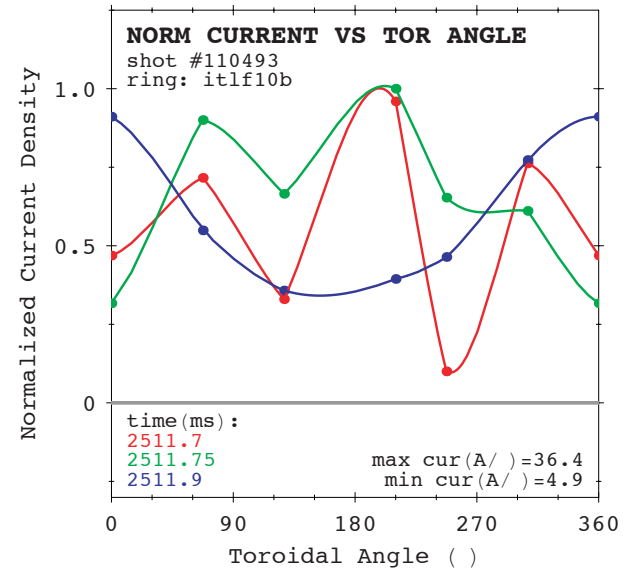
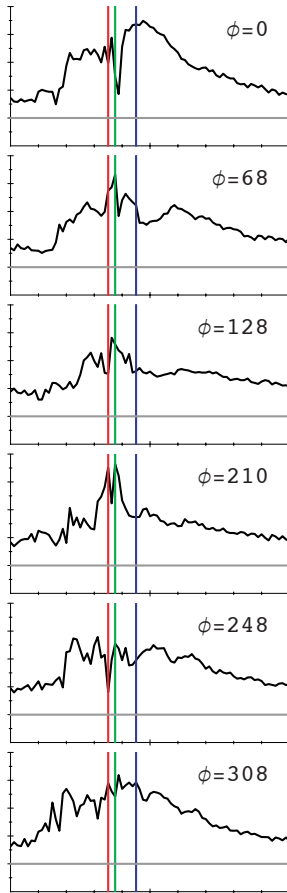


SOL CURRENT IN AN ELM IS NON-AXISYMMETRIC AND MAY BE DE-STABILIZING



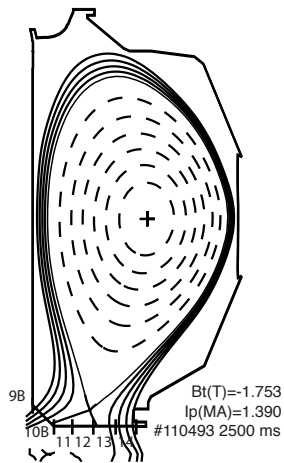
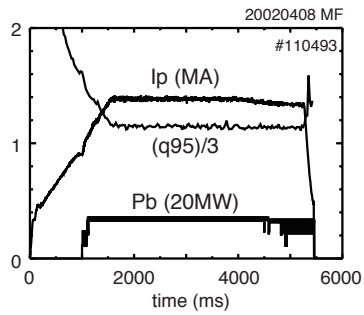
CURRENT EVOLUTION

shot #110493
ring: itlf10b
x(ms)=2511. - 2513.
y(A/)=-10 to 40
sampling(ms)=0.025

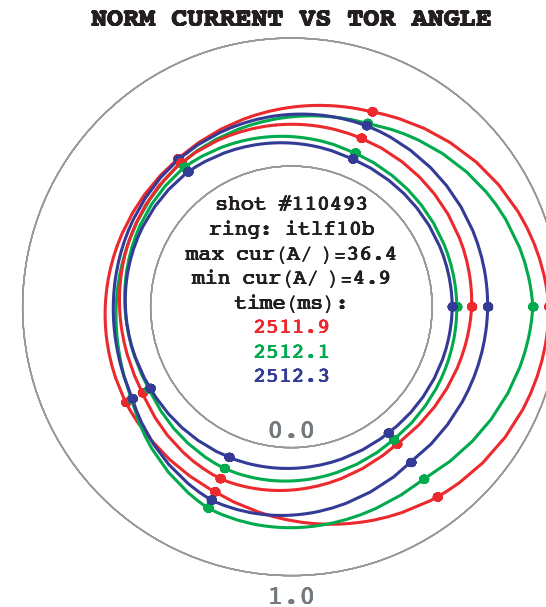
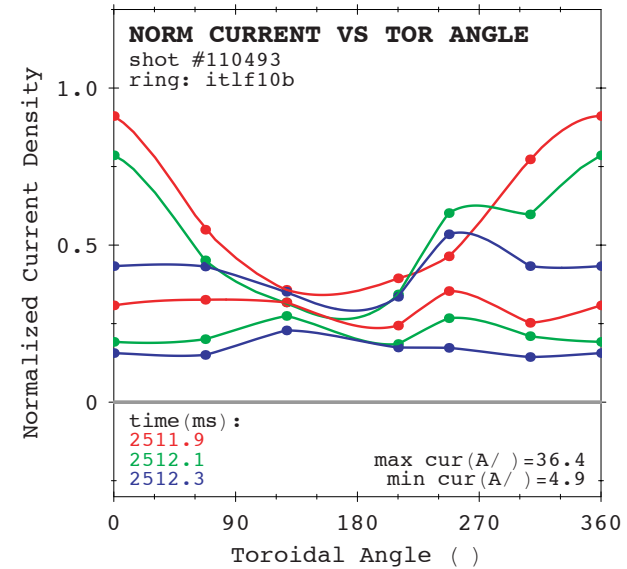
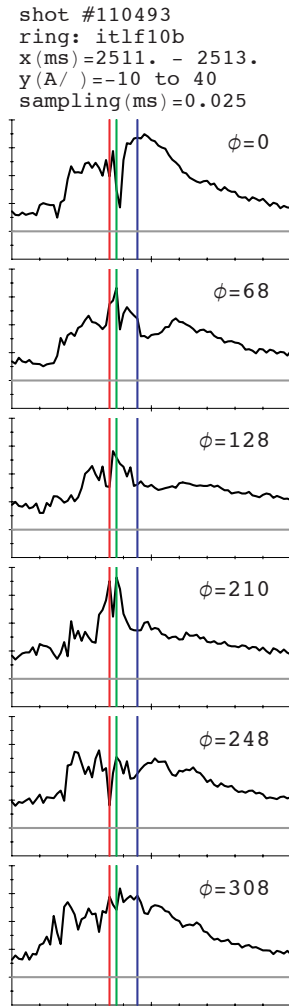


SOL current appears to be more "turbulent" in a rising phase of an ELM.

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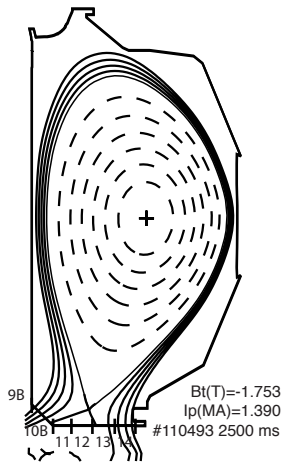
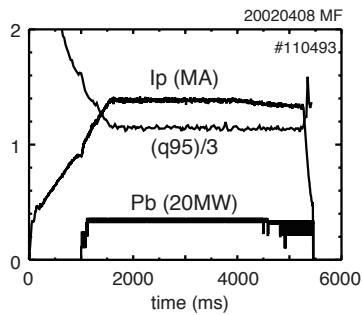


CURRENT EVOLUTION



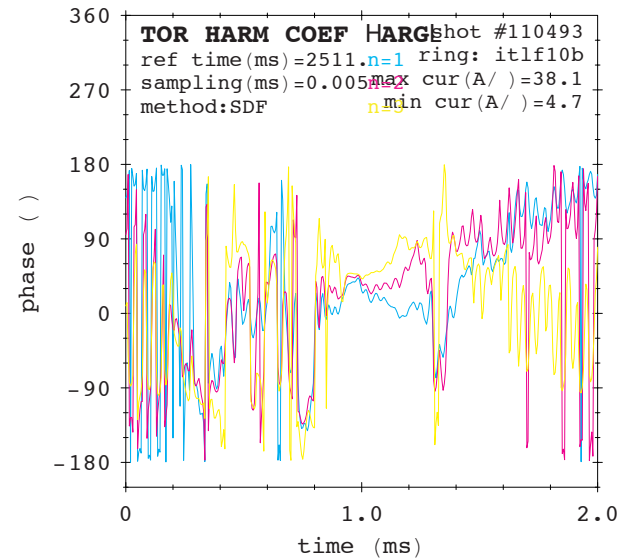
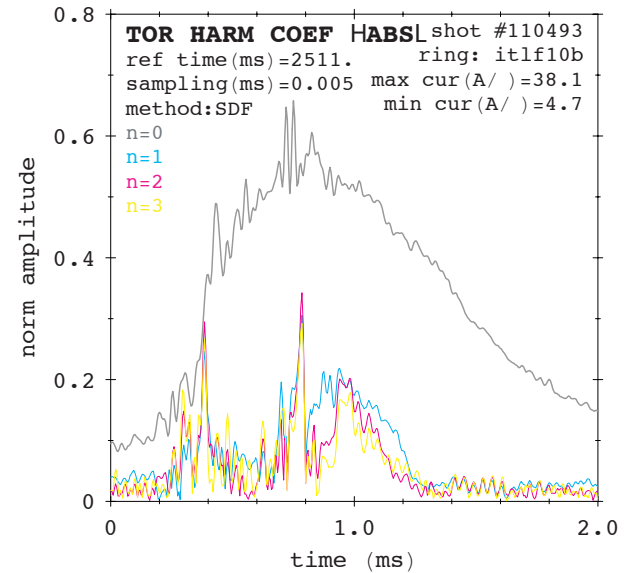
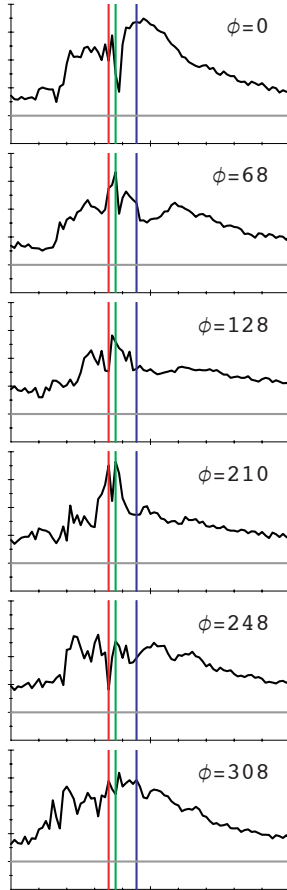
"Hot stuff" has smoothing effect on SOL current in a trailing phase of an ELM?

SOL CURRENT IN AN ELM HAS AT LEAST N=1-3 TOROIDAL HARMONICS



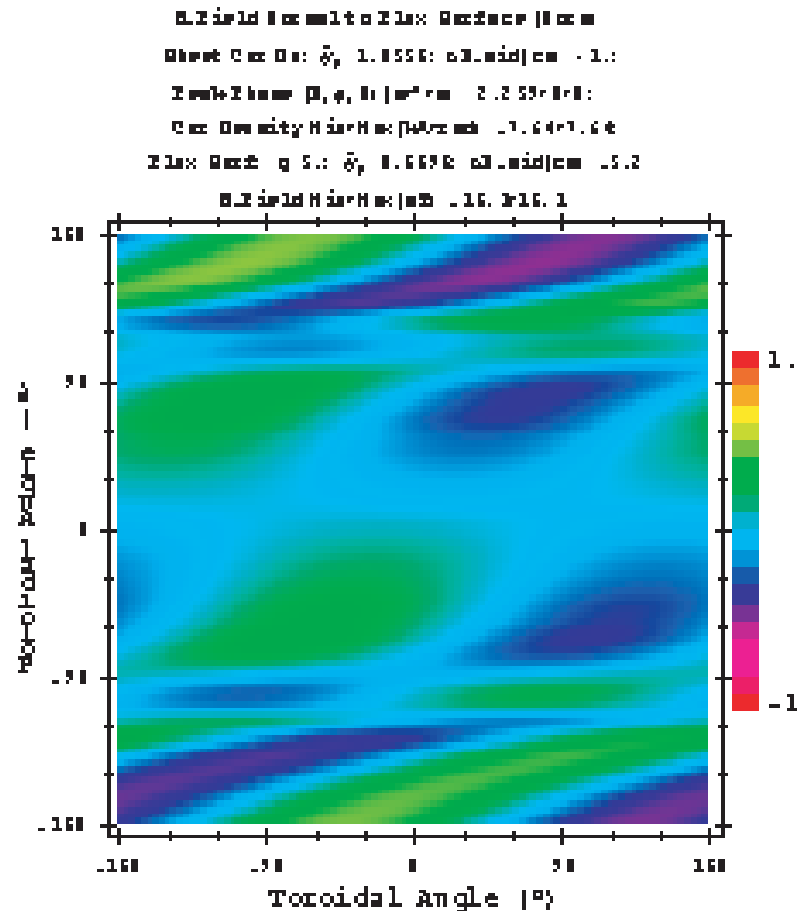
CURRENT EVOLUTION

shot #110493
ring: itlf10b
x(ms)=2511. - 2513.
y(A/)=-10 to 40
sampling(ms)=0.025



Non-axisymmetric components die out before the end of the ELM duration.

SOL CURRENT MAKES LARGE B-NORM ON RATIONAL SURFACES (#105919)



- (1) Total (before Fourier) B-field normal to $q=3$ surface reaches 36 mT (peak-to-peak) for a **unit model sheet** current (1 kA per 7.5-deg-tile) located at 1 cm outside separatrix in midplane.
- (2) Field pattern is helical, and likely to contain components resonant on flux surfaces, and can have destabilizing influence on MHD modes.

SUMMARY

Experiment

- (1) Passive observation.**
- (2) Measure SOL current using Langmuir probes.**

Hardware

- (1) Langmuire probes (fast power supply).**
- (2) Tile current sensors (future).**