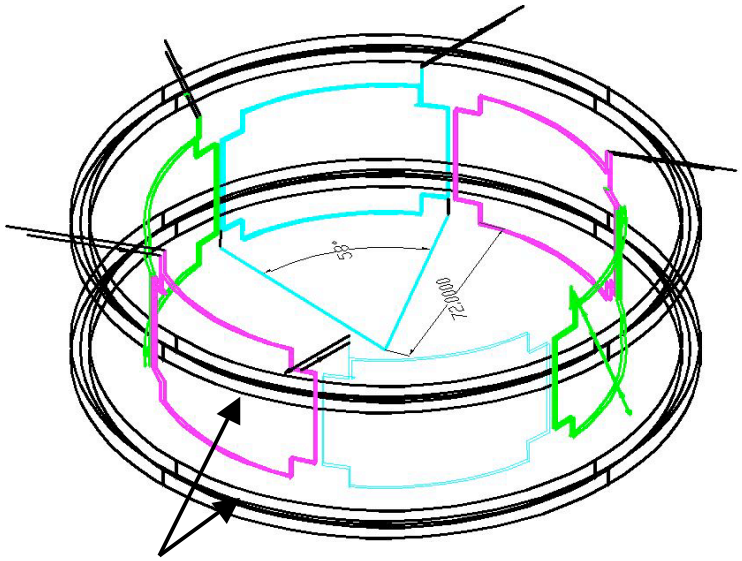
ELM suppression in NSTX with a stochastic boundary

- Can the NSTX external correction coil be used to suppress ELMs?
  - In DIII-D large ELMs are:
    - Significantly modified with n=1 C-coil perturbations
    - Strongly suppressed with n=3 I-coil perturbations
  - Field Line Integration (FLI) modeling of the DIII-D edge indicates that the ELMs are sensitive to the:
    - Magnetic topology of the pedestal gradient region
      - Size and position of remnant magnetic islands
      - Width of the poloidal magnetic flux loss layer



PF5 coils (main vertical field)

Approach:
-Model the NSTX correction coil with the FLI code
-Assess possible ELM suppression scenarios (e.g., n=1 versus n=3)
-Propose an experiment once the correction coil is ready for operations

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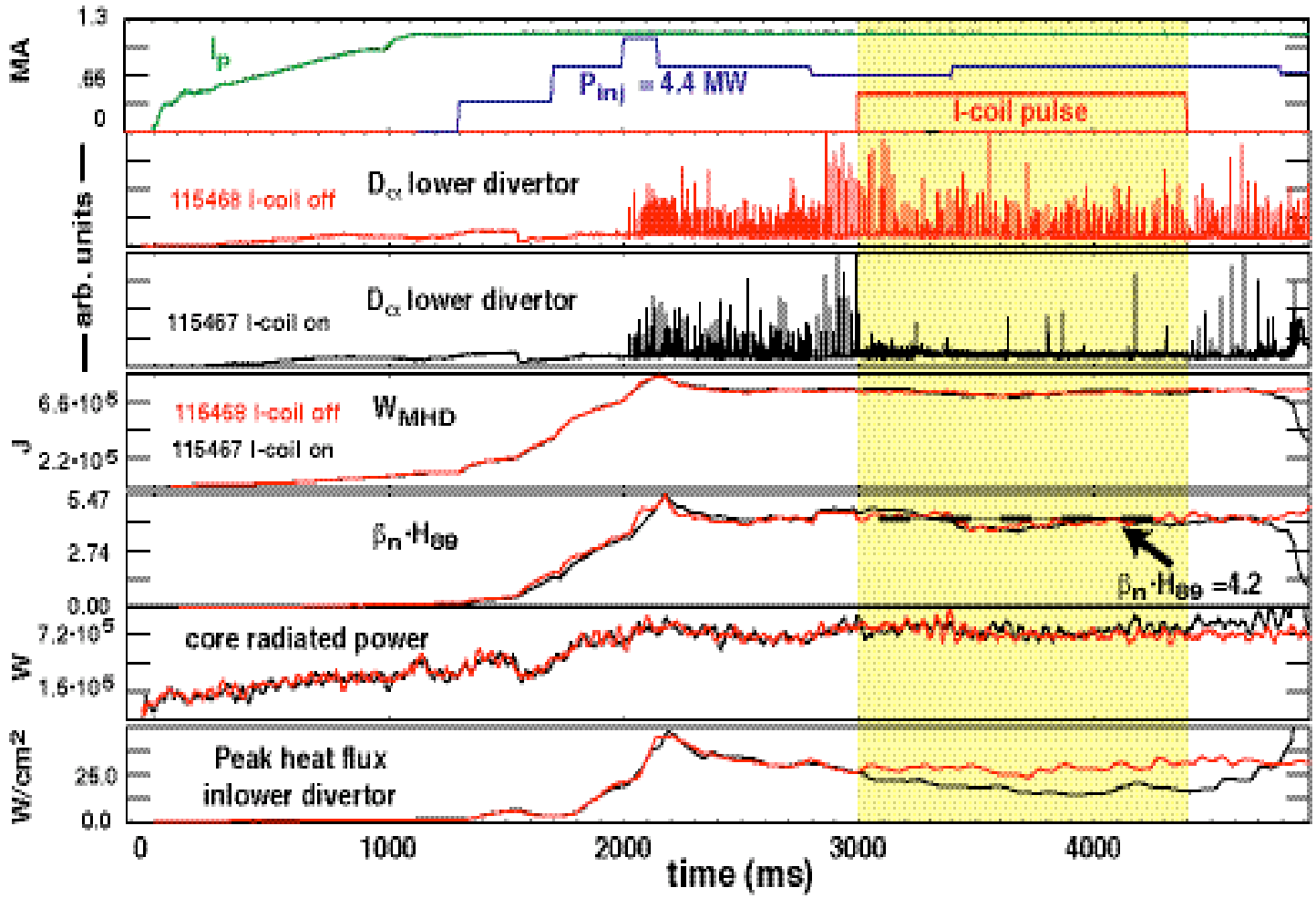
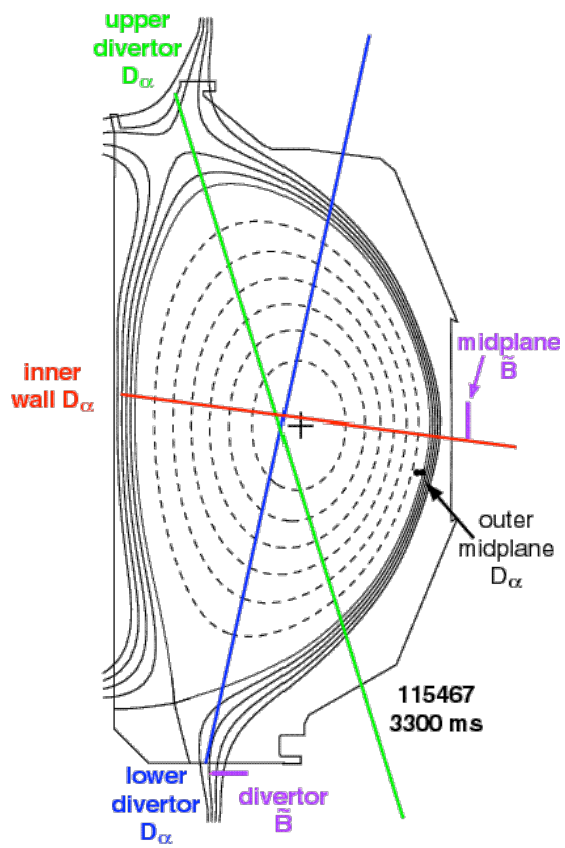
NSTX ROF, 10-12 November 2003,
PPPL, Princeton, NJ

In DIII-D large ELMs are suppressed during n=3 I-coil pulses without degrading the core confinement

- Type I ELMs suppressed in high performance ELMing H-modes ($\beta_n \bullet H = 4.2$) with an edge resonant perturbation.





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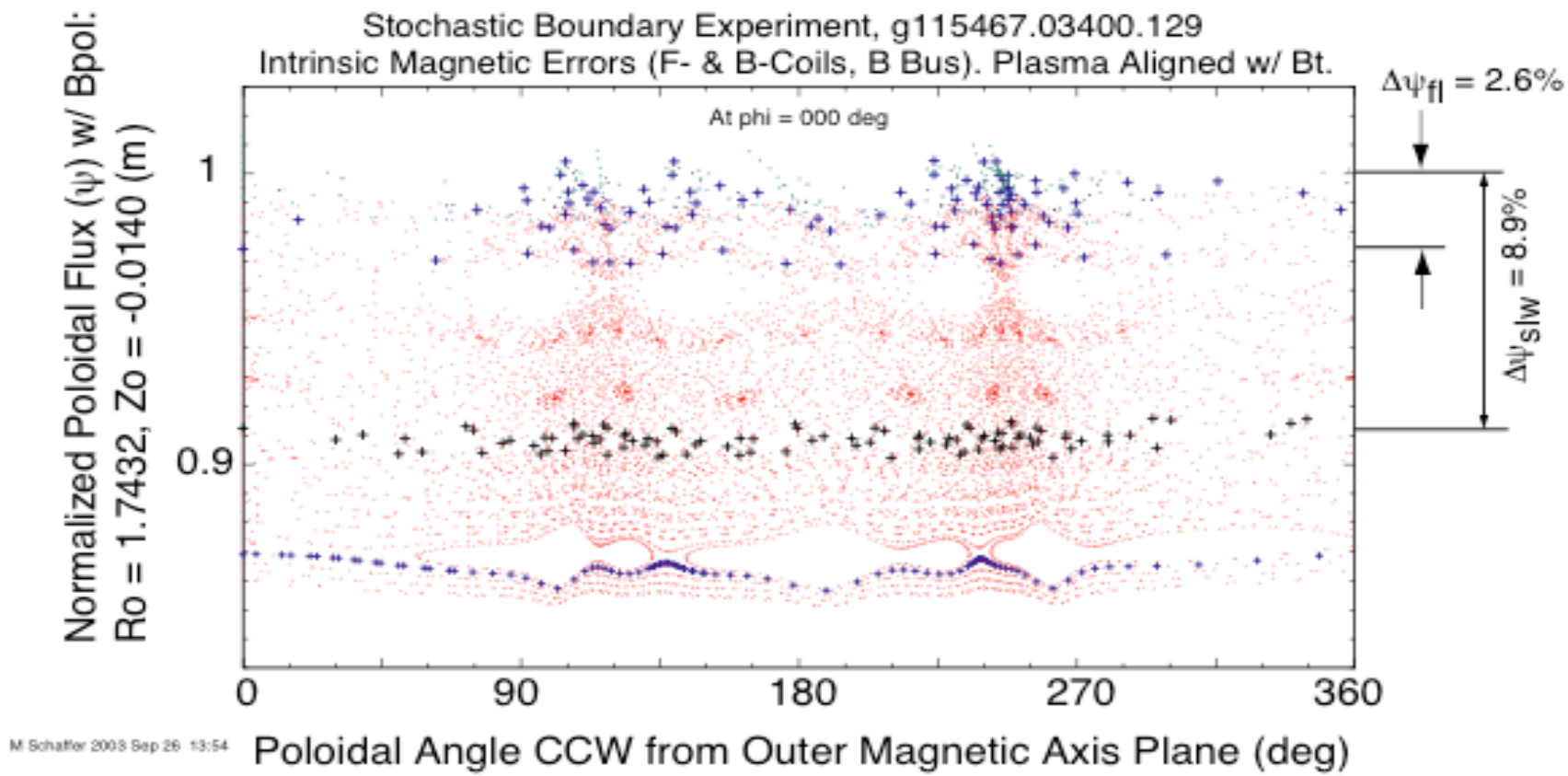
The effectiveness of the ELM suppression is related to the stochastic layer width $\Delta\psi_{slw}$, the poloidal magnetic flux loss $\Delta\psi_{fl}$ and the location of remnant islands



- Poincaré plot showing a FLI calculation of the magnetic structure in DIII-D pedestal *(no plasma response included)*.

Proposed approach for NSTX ELM suppression experiments

- Used GA's FLI code (TRIP3D) with NSTX equilibria to model perturbations from the NSTX correction coil.
- Identify coil configurations (n=1 versus n=3) and discharge parameters (q95, outer gap, shape, etc.) that are best suited for the NSTX ELM suppression experiments.
- Once the correction coil is operational on NSTX, propose and execute ELM suppression experiments (based on the FLI stochastic layer modeling results).
- Compare the NSTX stochastic layer ELM suppression results with those found in DIII-D in order to:
  - assess the applicability of the technique to other machines, and
  - to better understand the mechanisms involved in the physics of ELM triggers and in the suppression of ELM with a stochastic layer