NSTX

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XP proposal : ELM suppression with n=3 field in low q_{95} target plasmas

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NSTX Research Forum for 2011-2012 Campaign
B318, PPPL
March 15-18, 2011

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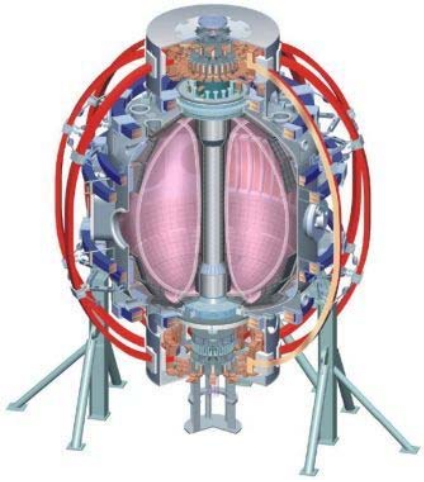
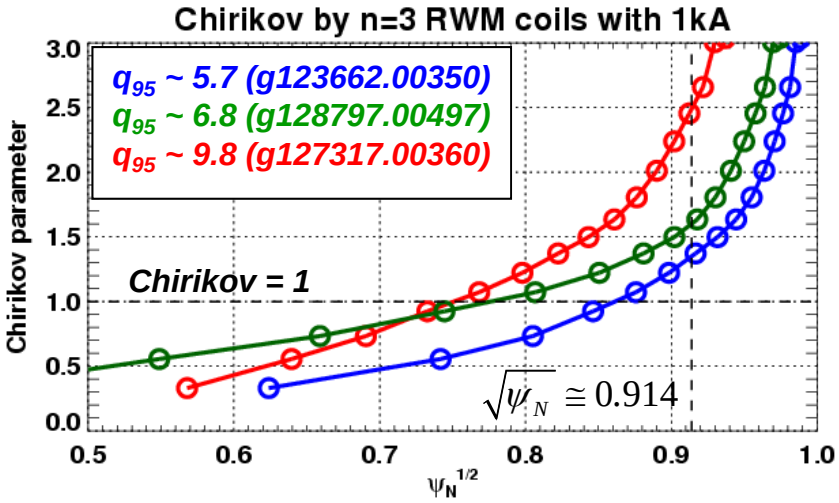


Motivation

- ELM suppression (or mitigation) was never found in NSTX
- A condition that may be favorable for ELM suppression is low q_{95} (<6) target with successive ELMs, but is never fully achieved
  - Chirikov and pitch alignment conditions become closer to DIII-D cases for lower q_{95}
  - Low q_{95} is unfavorable for ELM triggering
- ELMing targets will be reproduced in the early period of campaign, and so this XP can be revisited

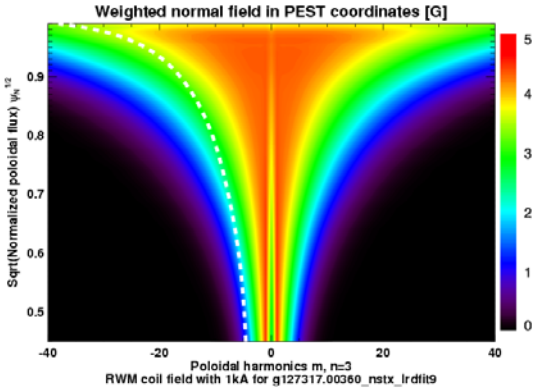
Low q_{95} target plasmas are favorable to produce similar 'RMP' conditions

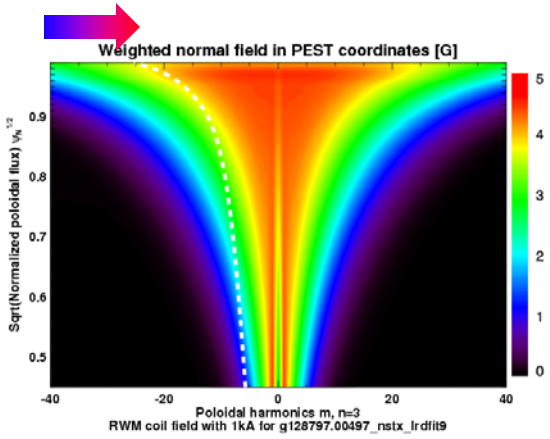
- Vacuum Chirikov profiles become similar to DIII-D for low q_{95}



- Pitch-alignment becomes better for low q_{95}

High q_{95} (< 9)

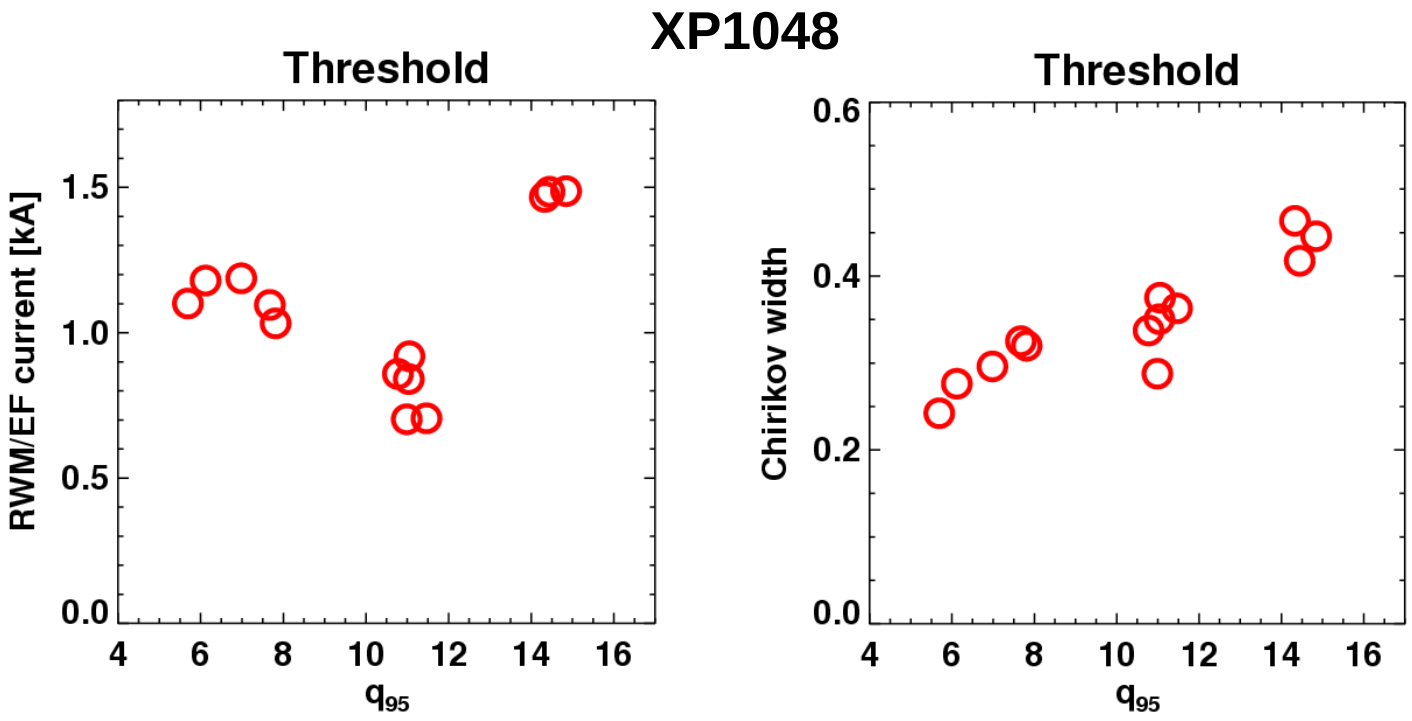




Low q_{95} (< 7)

Low q_{95} target plasmas are unfavorable for ELM triggering

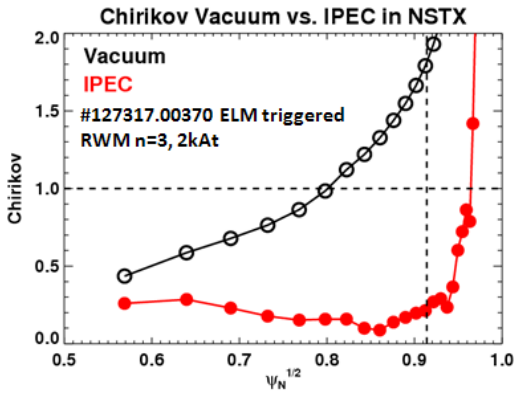
- ELM triggering thresholds increase for lower q_{95}

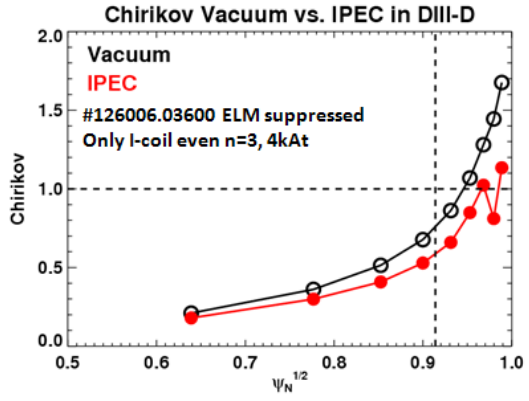


- ELMing targets have different pedestal structure anyway

Many observations will be useful to guide plasma response theory

- Vacuum picture is not perfect, and various plasma response effects should be tested
- For instance,
  - Vacuum vs. IPEC





  - Stochastic vs. non-ambipolar transport

$$\chi_{NA} \approx \frac{31}{4} D_{NA} \quad \text{and} \quad D_{NA} \sim \frac{q^2 T}{\varepsilon N B_0^2 \omega_\phi} \left\langle \phi \cdot \nabla \cdot \Pi \right\rangle_{1/\nu} \sim \frac{M^{1/2} q^2 T^{7/2}}{\varepsilon^{1/2} N B_0^2} \left(\frac{n \delta B}{B_0} \right)^2$$

Shot plan (0.5~1day)

- Reproduce low q_{95}, ELMing targets
  - So this XP is desired to go with ELMing target development
- Test n=3 and measure ELM modifications
- Test other 3D fields if time permitting
  - A single coil field for n=1-6
  - EF [1:1:1:3:-1:3] for n=2+3+4
  - HHFW fields for n=3+4+5+6
- Or, try n=3 for low q_{95} targets with reduced collisionality