NSTX

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RMP threshold of ELM modifications vs. q_{95} (XP1048)

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NSTX BP Group Review
B252, PPPL
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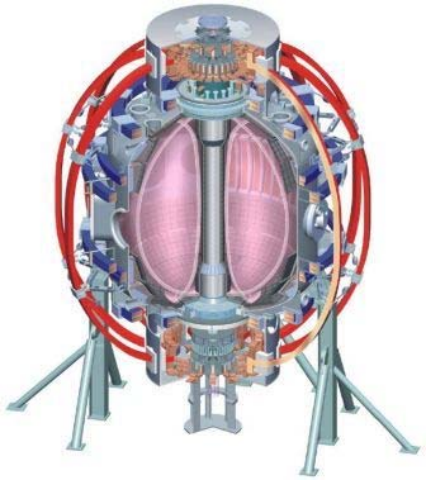


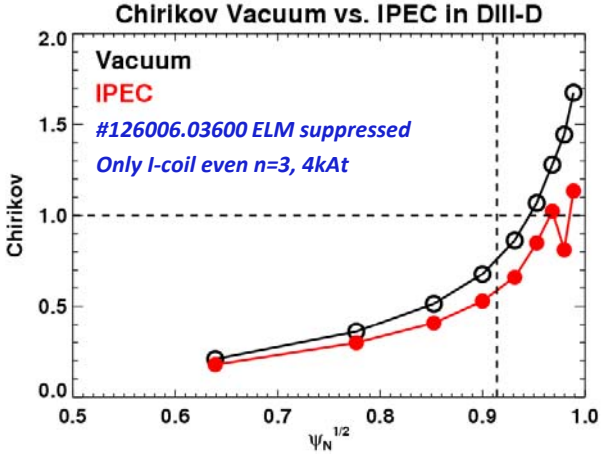
Motivation

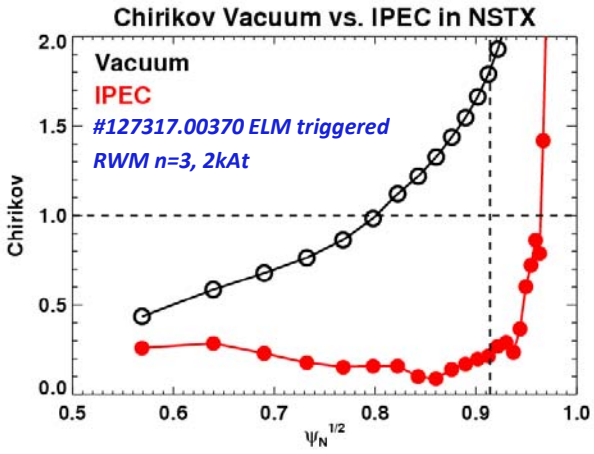
- RMPs (or 3D fields) work differently
  - Typically destabilizing for NSTX and stabilizing for DIII-D

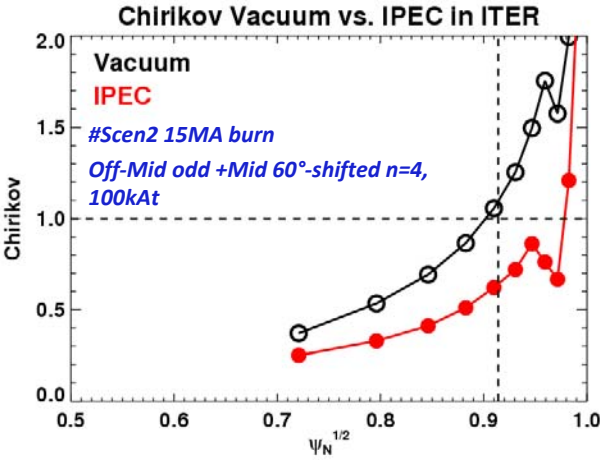
- Futher characterizations are necessary for comprehensive understanding across devices
  - DIII-D ELM suppression :
    Strong pedestal modification, Vacuum Chirikov Width>0.15, Pitch-aligned with narrow q_{95} (3.5~3.7) window, v^*_e<0.5
  - NSTX ELM triggering :
    Weak pedestal modification, Vacuum Chirikov Width>0.3, No pitch-aligned with wide q_{95} range (~9~11), v^*_e>0.5

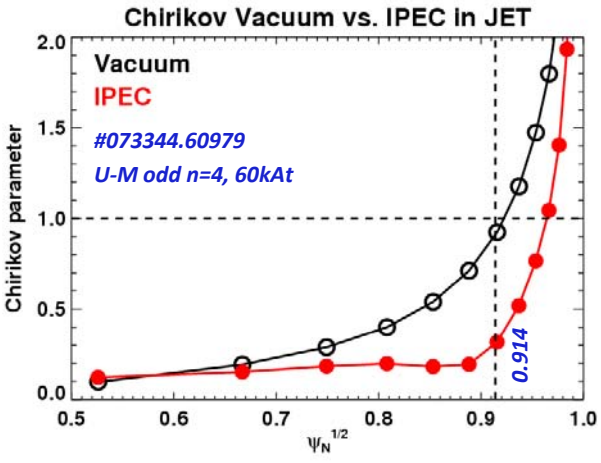
Physics study on different RMP functions is required for RMP coil design activities

- ITER and JET RMP coils should be designed based on DIII-D and NSTX



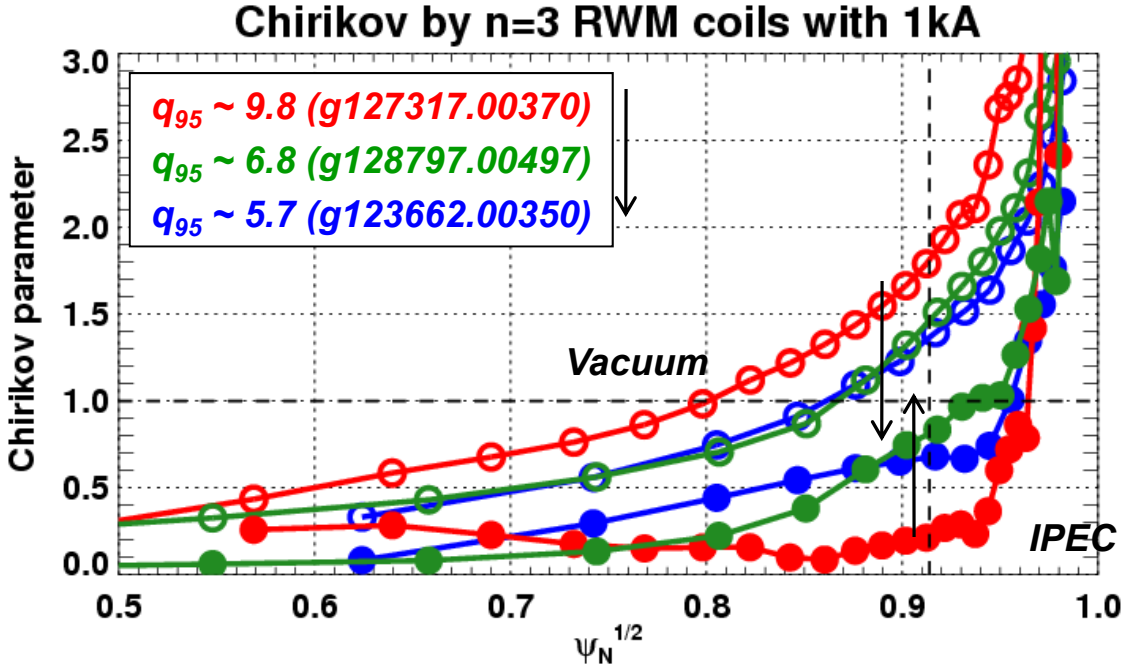






NSTX RMP Chirikov with lower q_{95} becomes similar to DIII-D RMP Chirikov

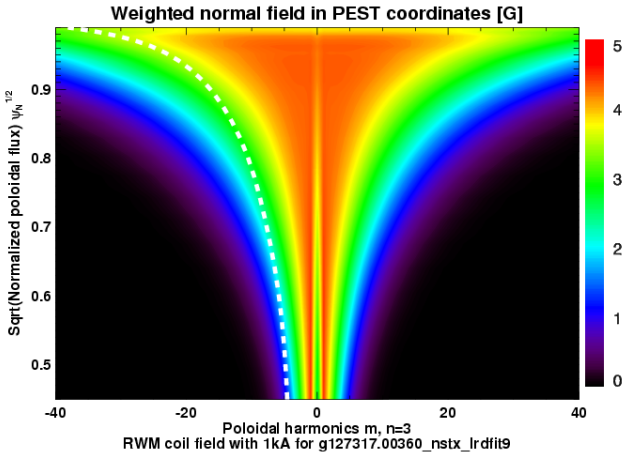
- Vacuum Chirikov width becomes smaller with lower q_{95}
- IPEC Chirikov penetration becomes stronger with lower q_{95}

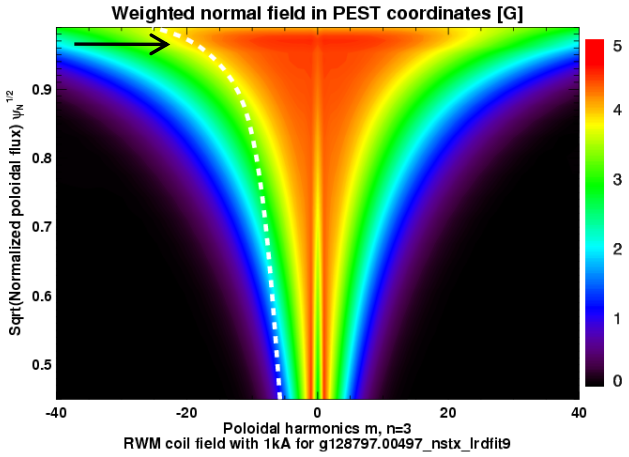


NSTX RMP pitch-alignment with lower q_{95} becomes similar to DIII-D RMP pitch-alignment

- Ratio of non-resonant components to resonant components becomes smaller with lower q_{95} in NSTX

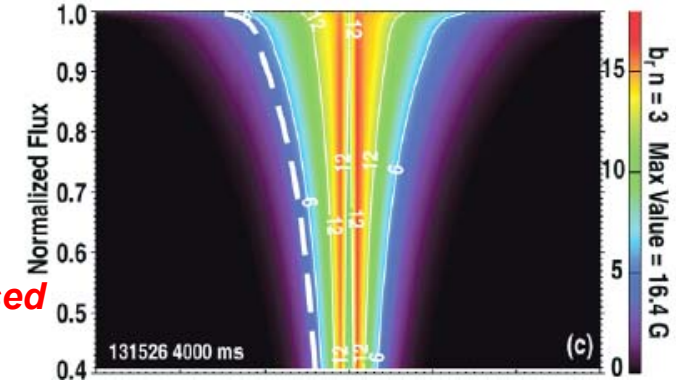
NSTX q_{95}~10

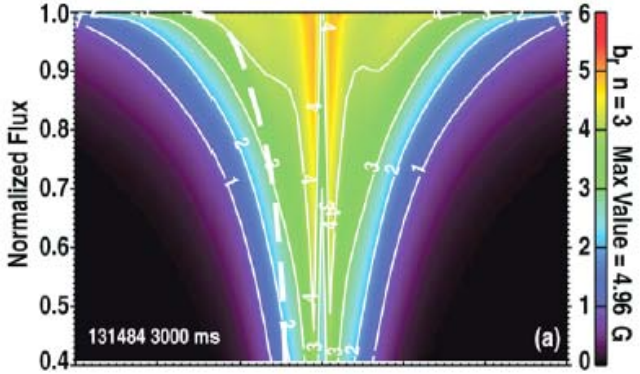




NSTX q_{95}~6

DIII-D Mid C-coil ELM Not suppressed

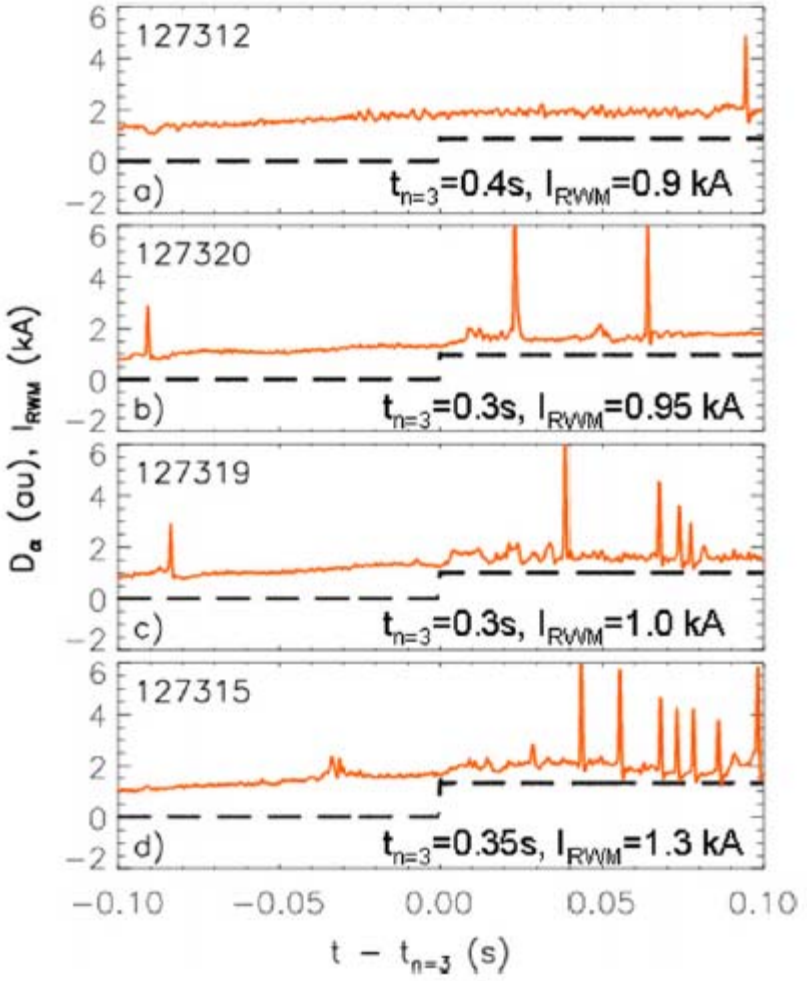




DIII-D Upper I-coil ELM suppressed

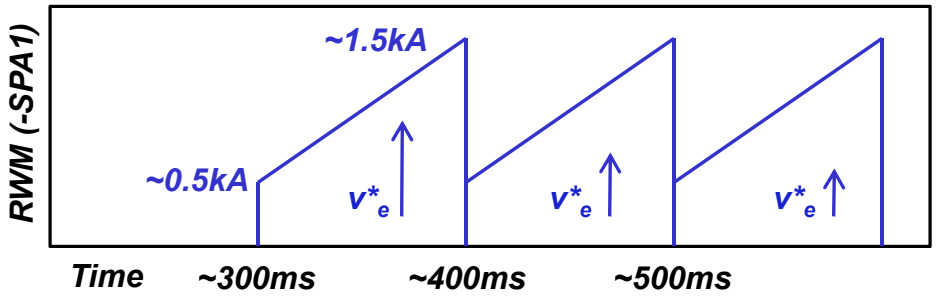
XP1048 will focus on two RMP characterizations with q_{95}

- RMP triggering threshold by the perturbation level, depending on q_{95}
  - Above threshold, the ELM frequency tends to increase along with the perturbation level (Canik, NF2010)
- RMP triggering window (Lower limit of q_{95} for ELM triggering) in lower q_{95}?



Shot plan (0.5 day, 15 shots)

- Reference shot development (1 shots):
  135185 or 138560 (LITER, κ~2.3, σ~0.8, q_{95}~11, I_P=800kA)
- RMP n=3 application (2 shots) :
  * Waveforms will be determined based on J.-W. Ahn's XP1046



- Repeat with (q_{95}~9, I_P=1MA), (q_{95}~7, I_P=1.2MA) (6 shots)
- Try lower q_{95} (Recent reference: 138228) (3 shots)
- If q_{95} window for ELM triggering is found, try to turn off LITER, produce ELMs, and try ELM suppression (3 shots)
- XP1048 will provide q_{95} scan for XP1046 (Divertor profile investigation)