NSTX

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

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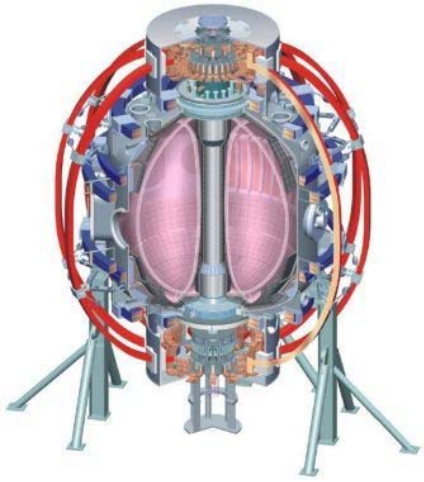
NSTX BP Team Review
B318, PPPL
August 4, 2010



Motivation

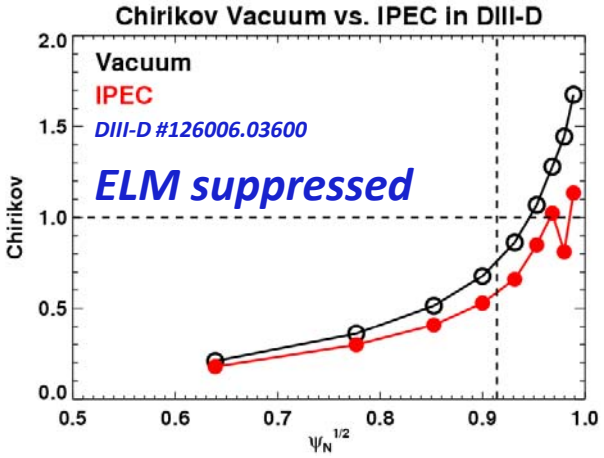
- RMPs (or 3D fields) work differently
  - Typically destabilizing for NSTX and stabilizing for DIII-D

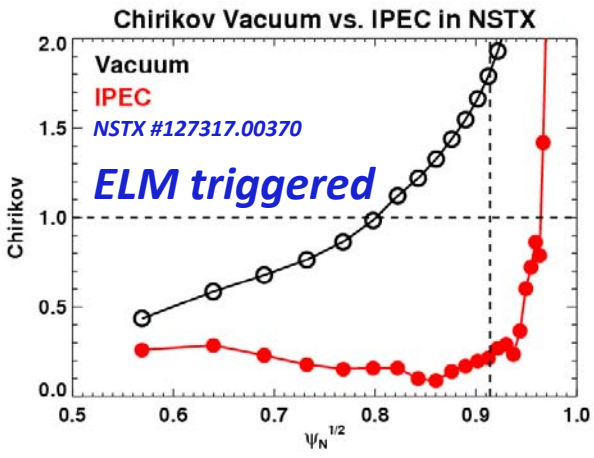
- Further characterizations are necessary for comprehensive understanding across devices

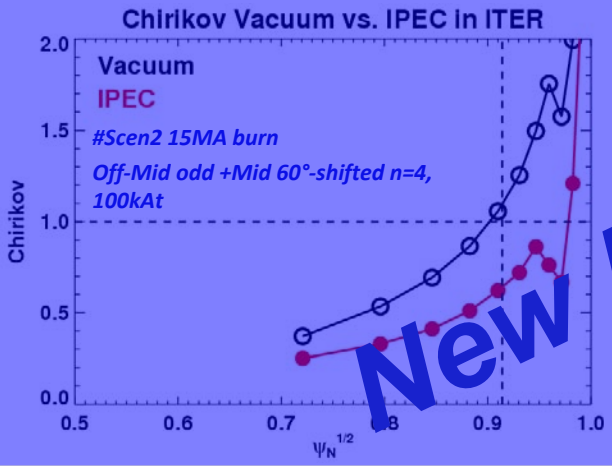
	DIII-D	NSTX
RMP functions	**Stabilization**	**Destabilization**
Field strength	**Vacuum Chirikov Δ > 0.15**	**Relatively unknown**
(Empirical parameter)	I-coil > 3~4kAt	RWM coil > 0.75~1kAt
Field spectrum	**Sufficient pitch-alignment**	**Relatively unknown**
(Empirical parameter #1)	I-coil n=3 even or one-row only	RWM n=3
(Empirical parameter #2)	q_{95} = 3.3~3.7	q_{95} = 9~11
Collisionality	**ν_e^*<0.5**	**ν_e^*>0.5**

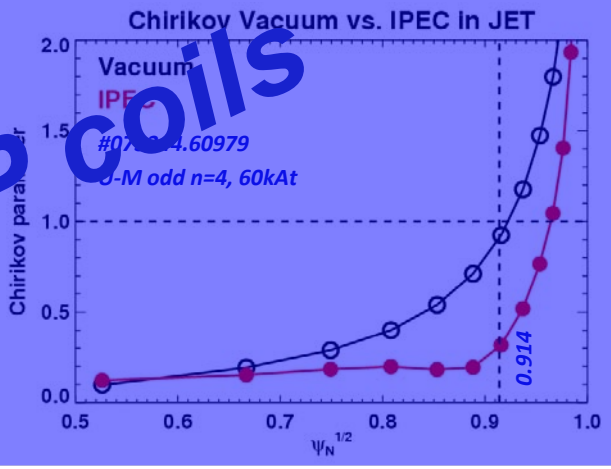
Physics study on different RMP functions is required for RMP coil design activities

- Different RMP results in NSTX and DIII-D should be understand to increase reliability of RMP coil design





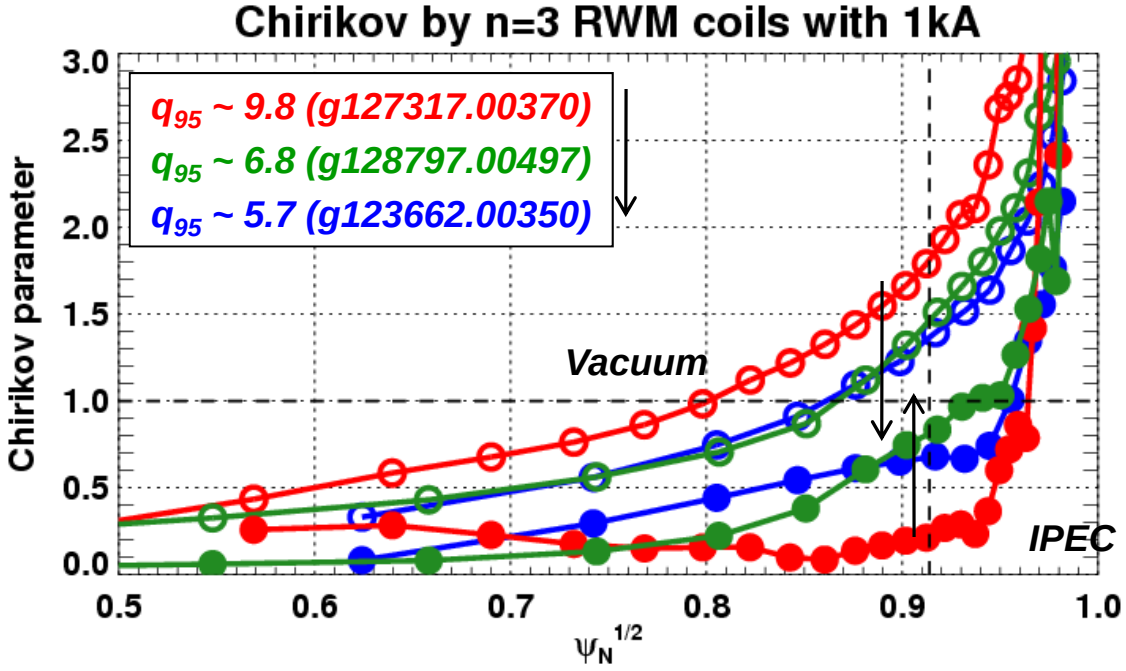




New RMP coils

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

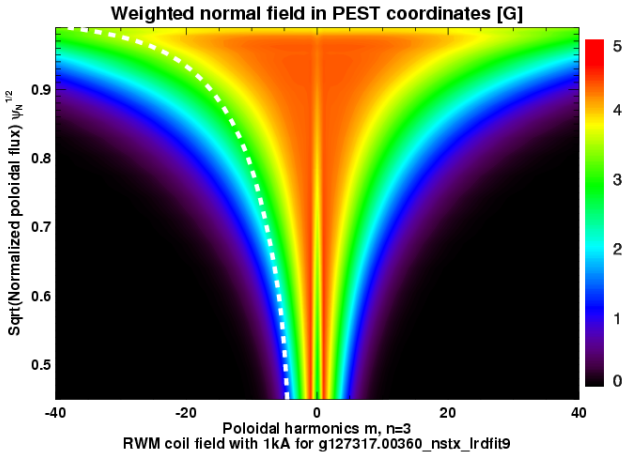
- Vacuum Chirikov width becomes smaller with lower q_{95}
- IPEC Chirikov penetration becomes stronger with lower q_{95}

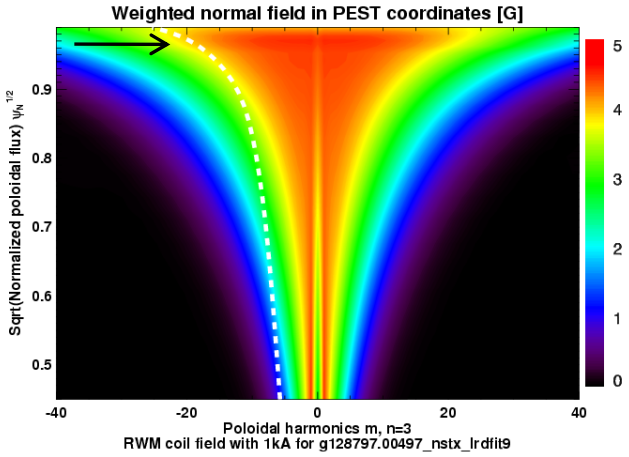


NSTX RMP pitch-alignment with lower q_{95} becomes similar to DIII-D RMP pitch-alignment

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

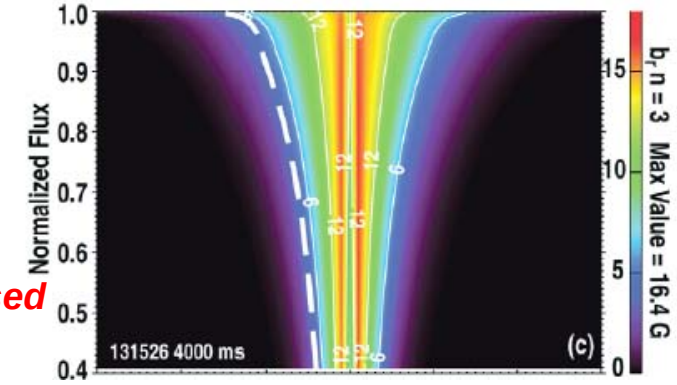
NSTX
q_{95}~10

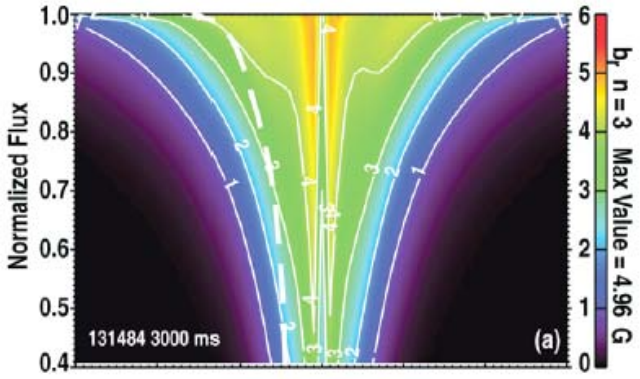




NSTX
q_{95}~6

DIII-D
Mid C-coil
ELM
Not suppressed

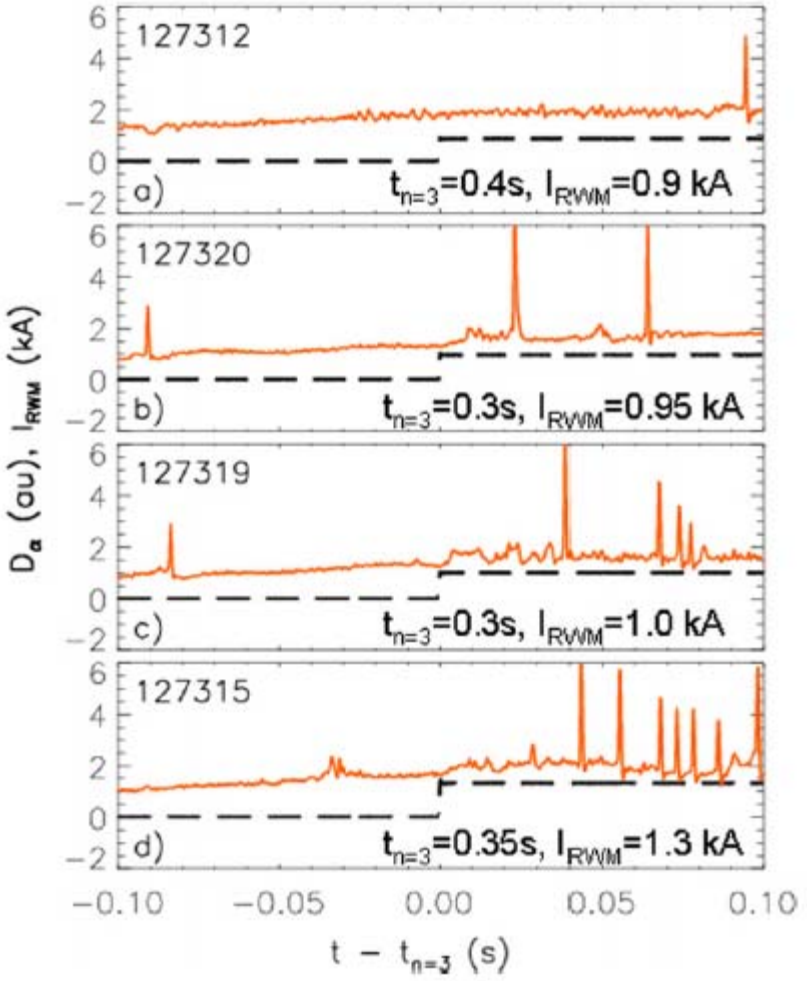




DIII-D
Upper I-coil
ELM
suppressed

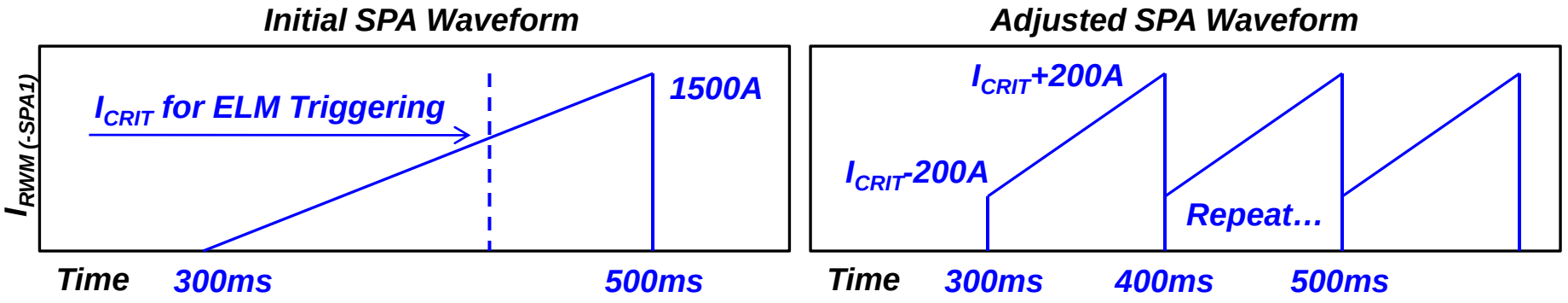
XP1048 will focus on two RMP characterizations with q_{95}

- 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, 18 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 (3 shots) :



- Repeat with (q_{95}~9, I_P=1MA), (q_{95}~7, I_P=1.2MA) (8 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)

This XP will provide strike splitting patterns for XP1046

- Lower q95 leads to smaller number of but thicker splitting points