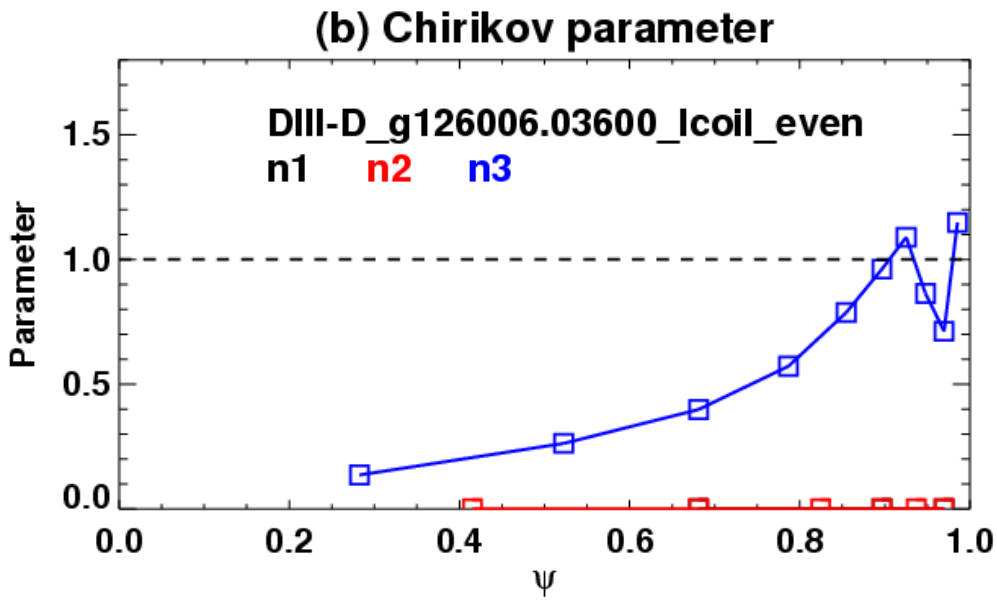
Supported by
Office of Science

ELM Mitigation in NSTX by n=2+3 RMP

Jong-kyu Park,
Jonathan Menard, Rajesh Maingi, Allen Boozer,
Steve Sabbagh, Stefan Gerhardt, David Gates

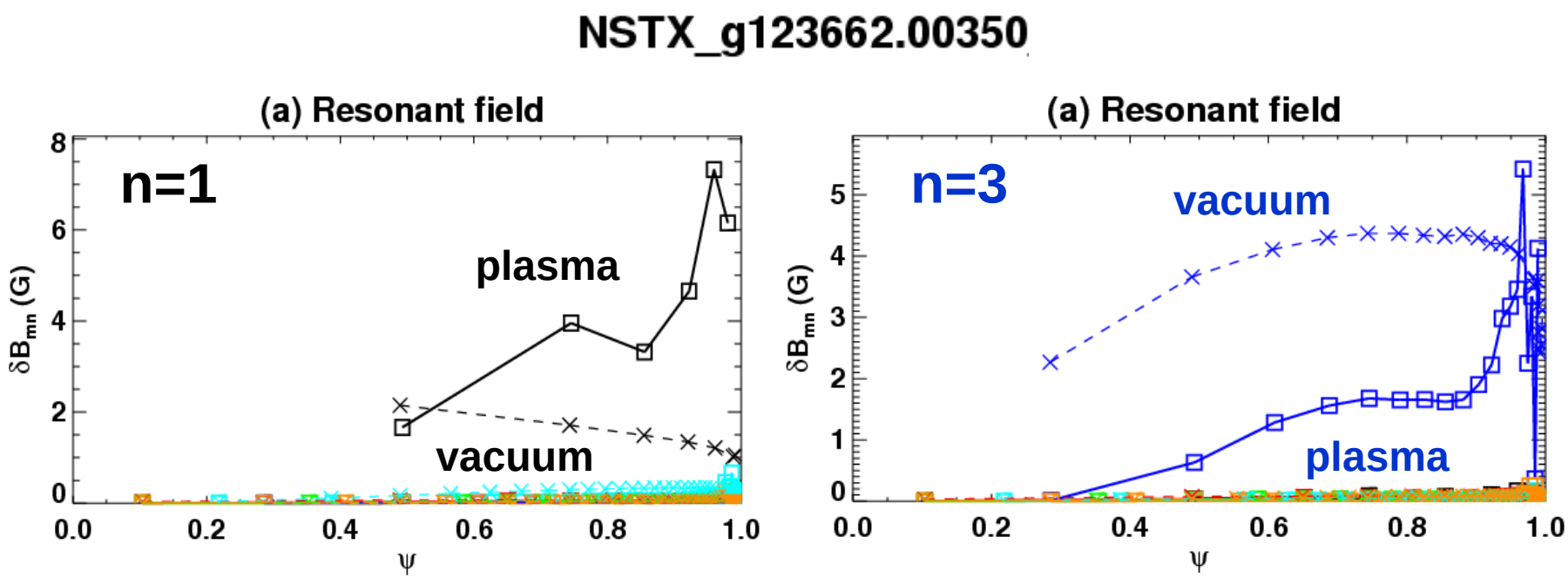
Previous discussion

- n=2 and 3 RMP may produce favorable configuration of Chirikov overlap in low q plasmas (q_{95} ~ 6)
  - n=2 : RWM 3kA, n=2+4 : RWM1.5kA
  - n=3 : RWM 2kA
- n=1 RMP may work for higher q plasmas (q_{95} > 7)
  - n=1 : RWM 1kA(q_{95}~8) ~ 3kA(q_{95}~13)



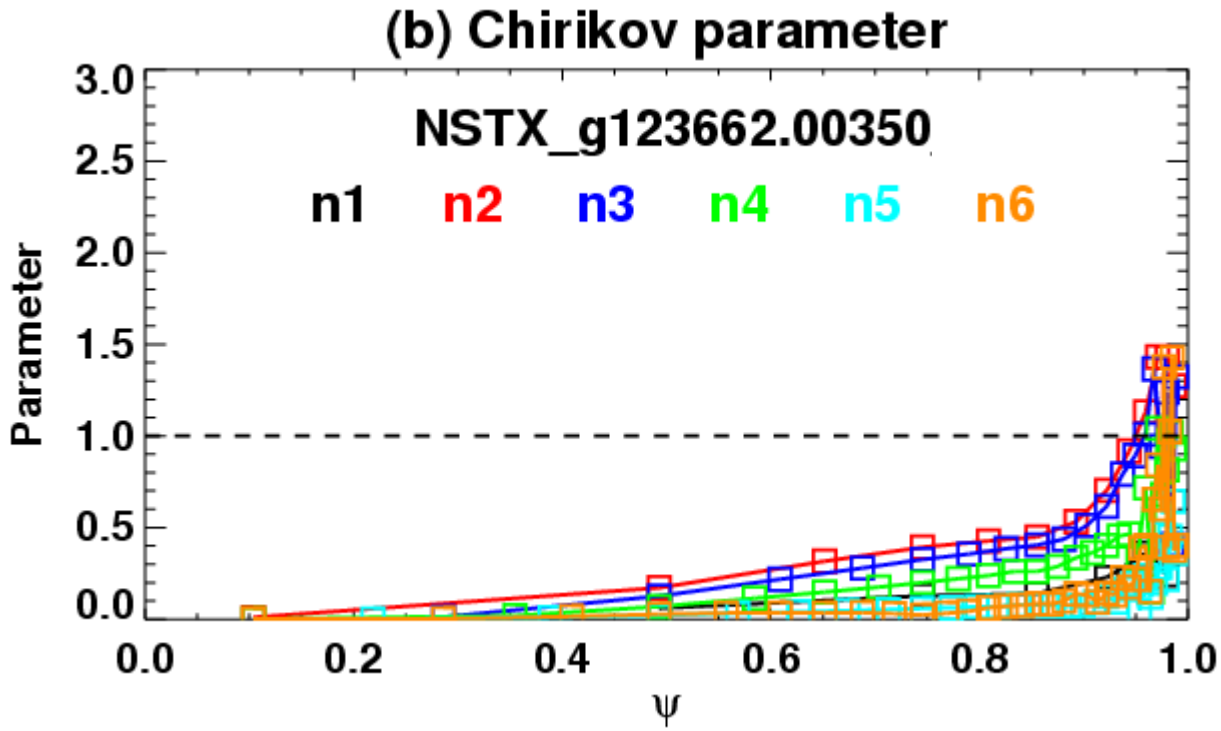
Resonant Field with Plasma Response

- Amplification is greater for lower n due to plasma
- Shielding is greater for higher n due to plasma
- The features depend strongly on plasma profile



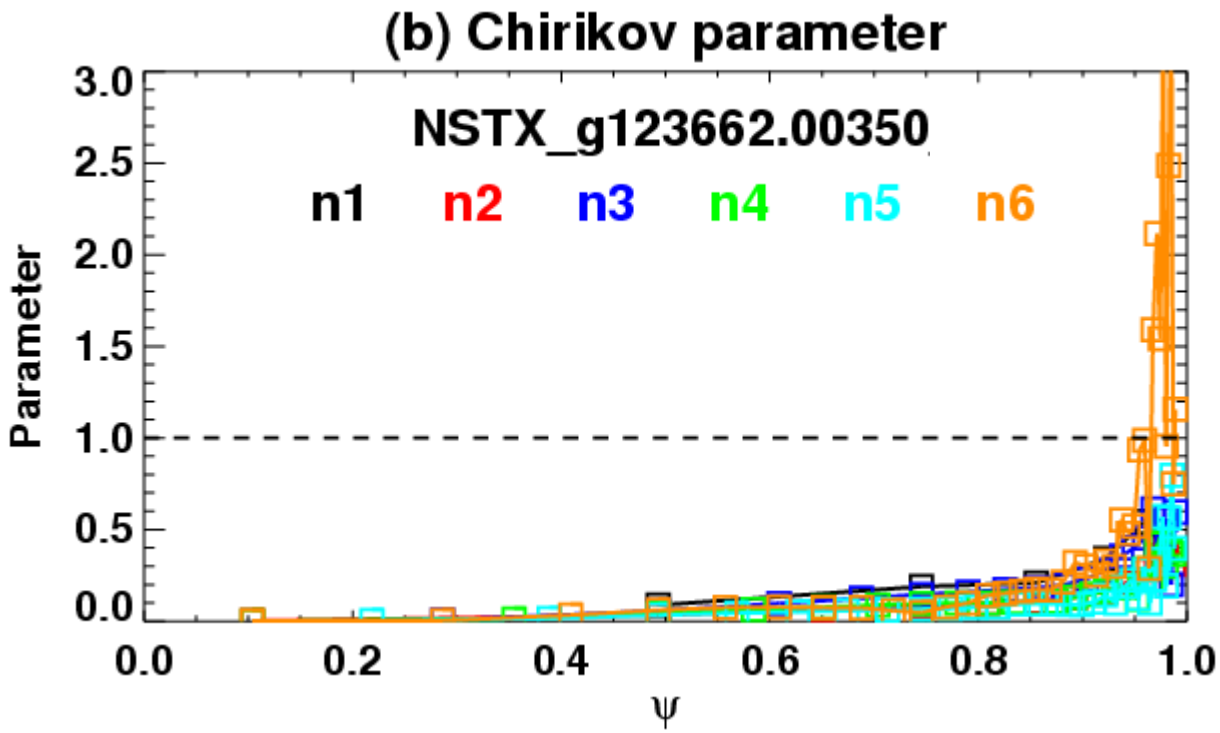
N=2+3 RMP to q_{95}~6

- n=2+3 RMP can produce Chirikov overlap at ψ=0.9 efficiently with low SPA currents, if different n's are simply added
  - RWM(1-4) 0.5kA, RWM(2,6) 0.5kA, RWM(3,5) 1.5kA



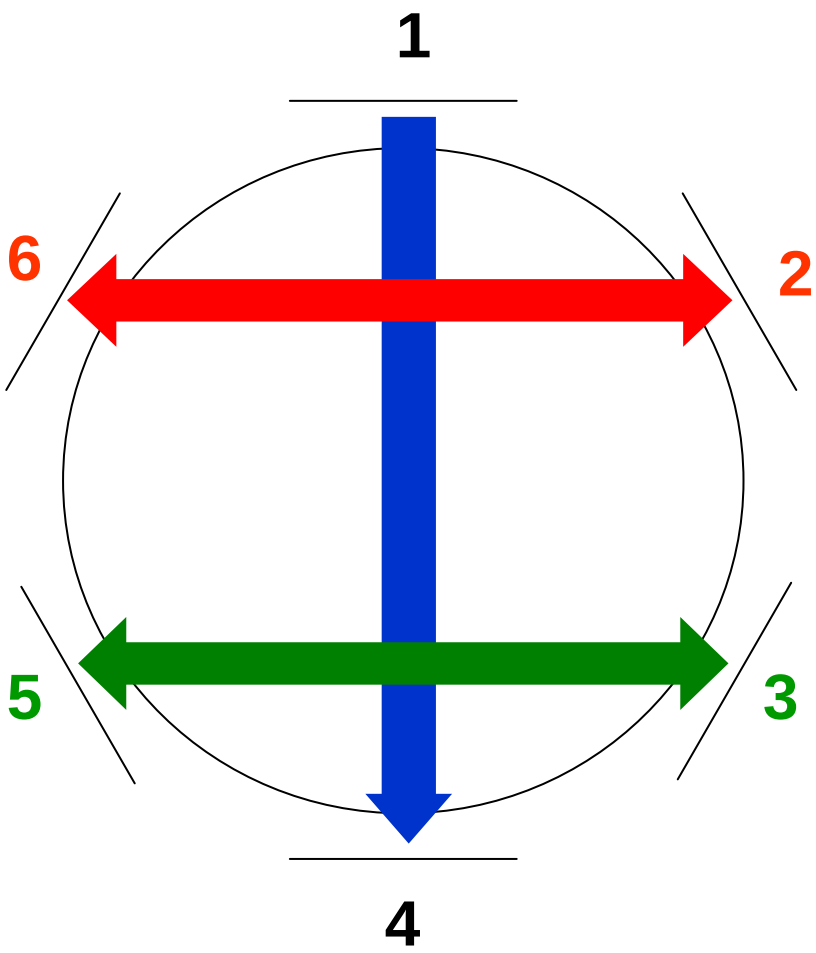
N=6 RMP to q_{95}~6

- n=6 seems difficult to produce Chirikov overlap at ψ=0.9 due to low penetration
  - RWM 3kA
- The fall-off is more rapid for higher q plasmas



SPA Reconnection for n=1+2+3

- Three power supplies can produce n=1+2+3, but with fixed toroidal phases (n=1 intrinsic field can be considered)



rwm	1	2	3	4	5	6
n=1	+	0	0	-	0	0
n=2	0	+	+	0	+	+
n=3	+	-	+	-	+	-
sum						

Shot plan ~0.5 day for n=2+3 (24 shots)

- Using SPA connections with (1-4) anti- and (2-6),(3-5) series
- Diagnostics:
- Starting with reference shot #123662 (q_{95}~6), or most recent one followed by other ELM experiments : 12 shots
  - Reproduce target plasma and ELM : 3 shots
  - Apply n=3 field with different amplitudes (1~2kA): 3 shots
  - Apply n=2 field with different amplitudes (2~3kA): 3 shots
  - Apply n=2+3 mixing field with different combinations when failed: 3 shots
- Repeat the experiment for higher q, reference shot #124331 (q_{95}~8): 12 shots
- If successful, repeat the experiment with higher q, but with n=1: ???