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NSTX

XP 730 - Effect of Resonant Magnetic Perturbations on ELMs in NSTX

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NSTX Results Review

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Motivation, Background and Goals

- Large ELM mitigation and/or suppression required to prevent excessive PFC damage in ITER
- DIII-D very successful at suppressing Type I ELMs with n=3 Resonant Magnetic Perturbations (RMP), using internal coils
- Limited success in affecting edge stability with external C-coils
- Recent success in JET: ELM mitigation with n=1 RMP, external coils
- NSTX error-field correction and resistive wall mode coils are external to vacuum vessel, but closer to plasma boundary than DIII-D's C-coil
  - Previous NSTX XP in 2005 showed brief periods of affecting ELMs, but the RMP effect could not be separated from recycling changes

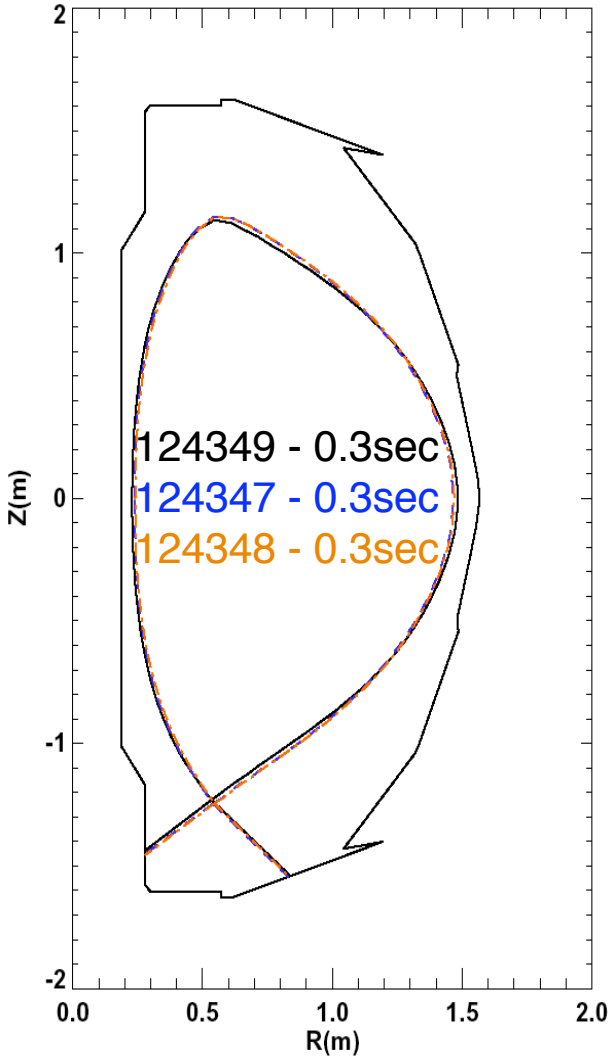
Goals

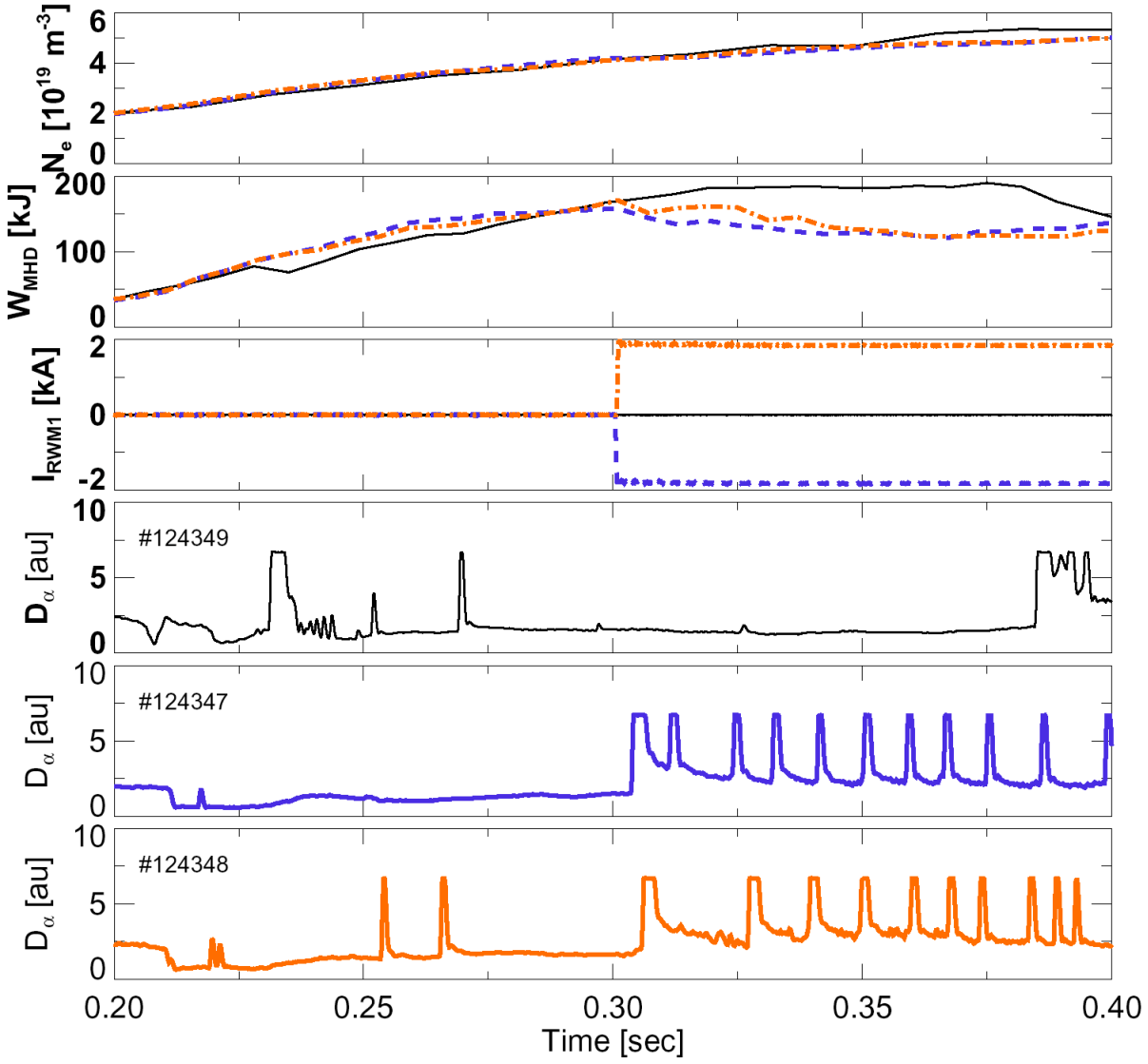
- Conduct discharges with reproducible ELMs
- Apply RMP to gauge effect on ELMs

Edge stability can be affected by RMP, i.e. ELMs can be de-stabilized

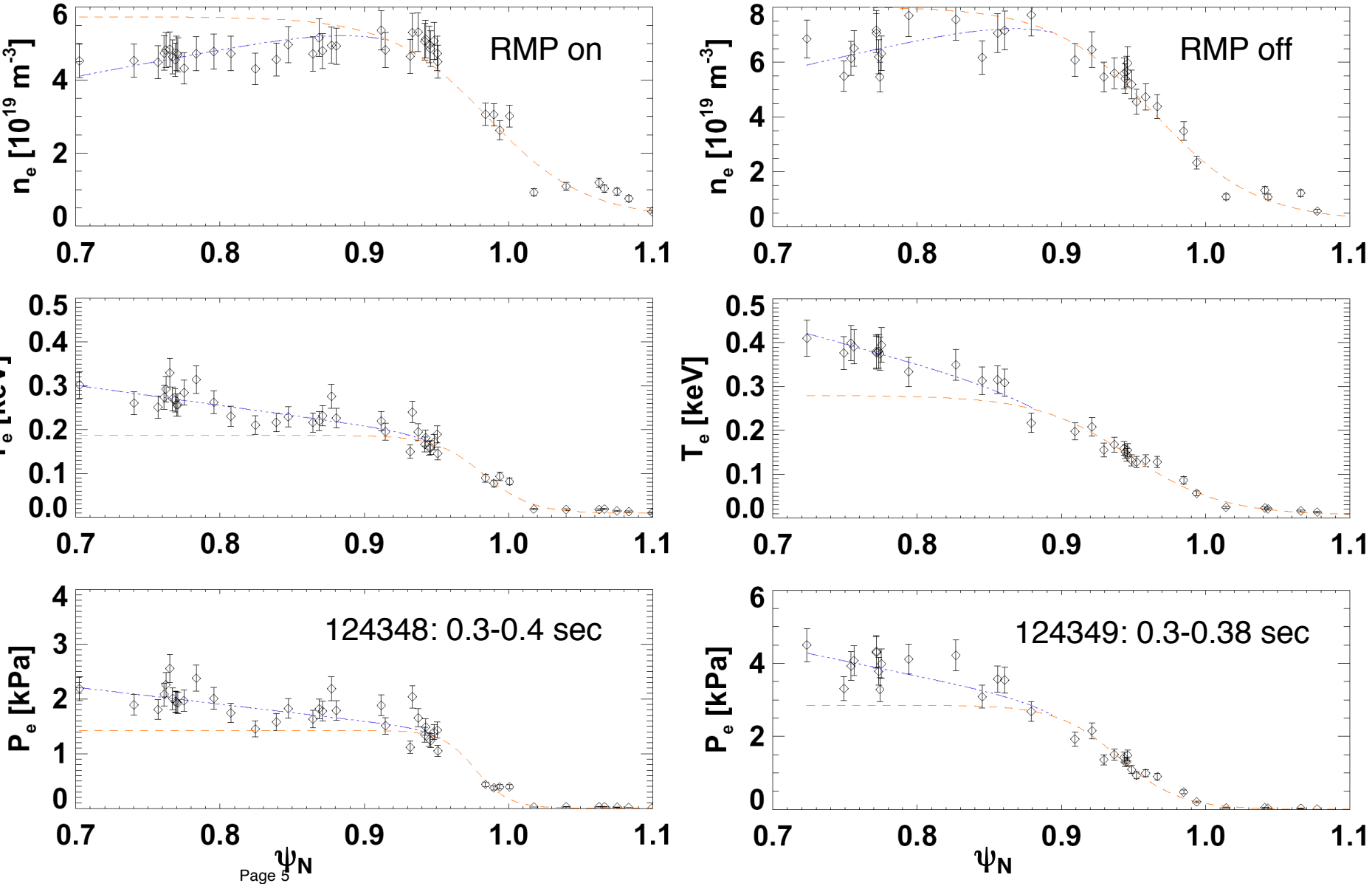
- EFCC current scan with n=3:
  - I_p=0.8 MA, B_t=0.5 T, P_{NBI}=4 MW, δ_r^{sep}=-0.5cm, κ=1.8, δ_l=0.5
  - no ELM mitigation
  - Clear signs of magnetic braking at higher EFCC current
- Fueling scan at I_{EFCC}=1.8 kA : no ELM mitigation
- Various timing comparisons: no ELM mitigation
- EFCC current scan with n=3, opposite phase, EFCC before ELMs start
  - I_p=0.8 MA, B_t=0.5 T, P_{NBI}=4 MW, δ_r^{sep}=-0.5cm, κ=1.8, δ_l=0.5
  - **ELM de-stabilization observed**
- ELM-destabilization also observed in other XPs
  - I_p=1.0 MA, B_t=0.45 T, P_{NBI}=4 MW, δ_r^{sep}=-0.5cm, κ=2.0, δ_l=0.7

RMP can de-stabilize ELMs in low δ_l discharges

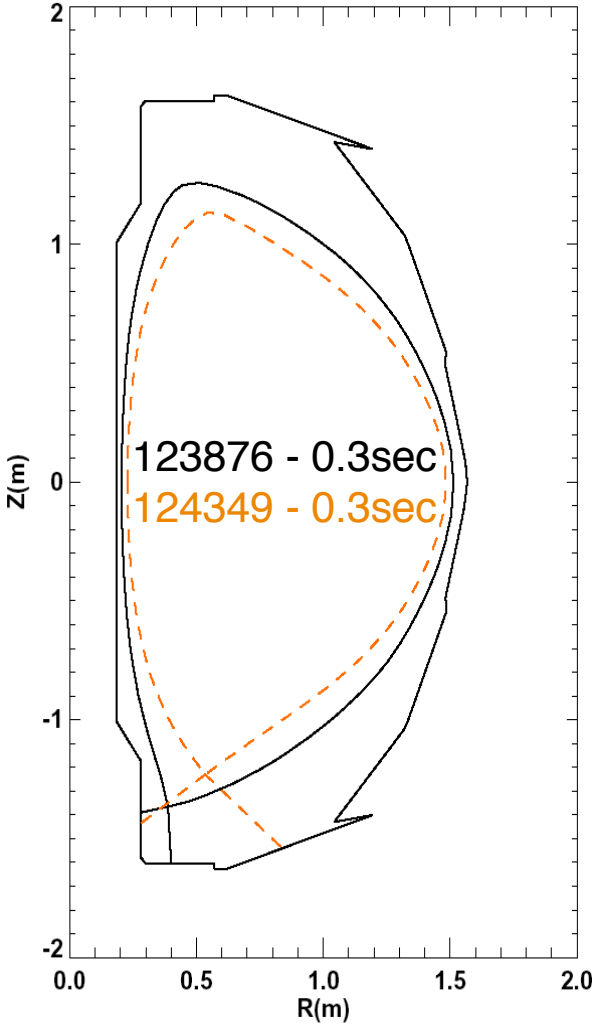


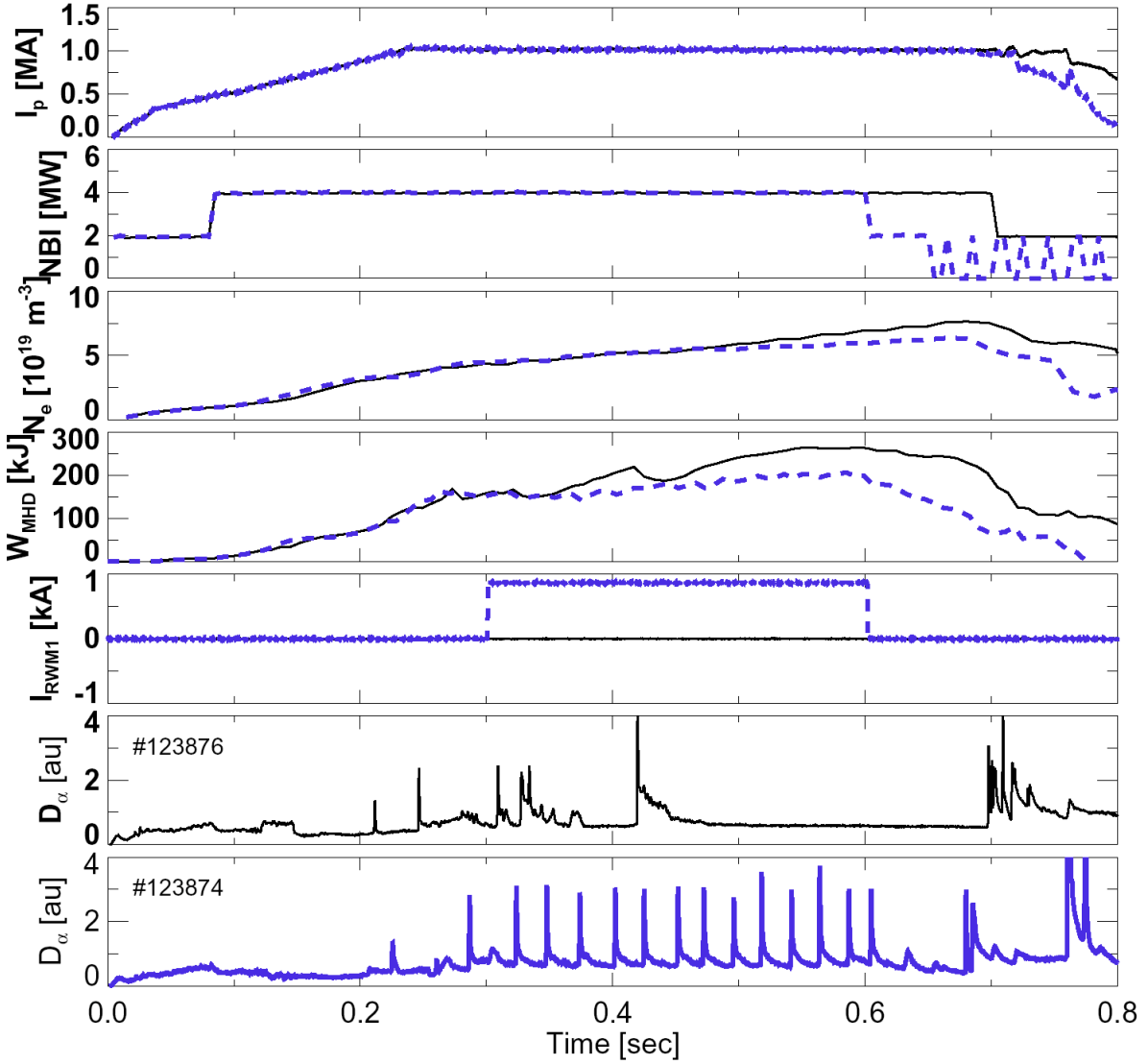


Preliminary tanhfits show peak pressure gradient comparable with and without RMP



RMP can also de-stabilize ELMs in high δ_l discharges





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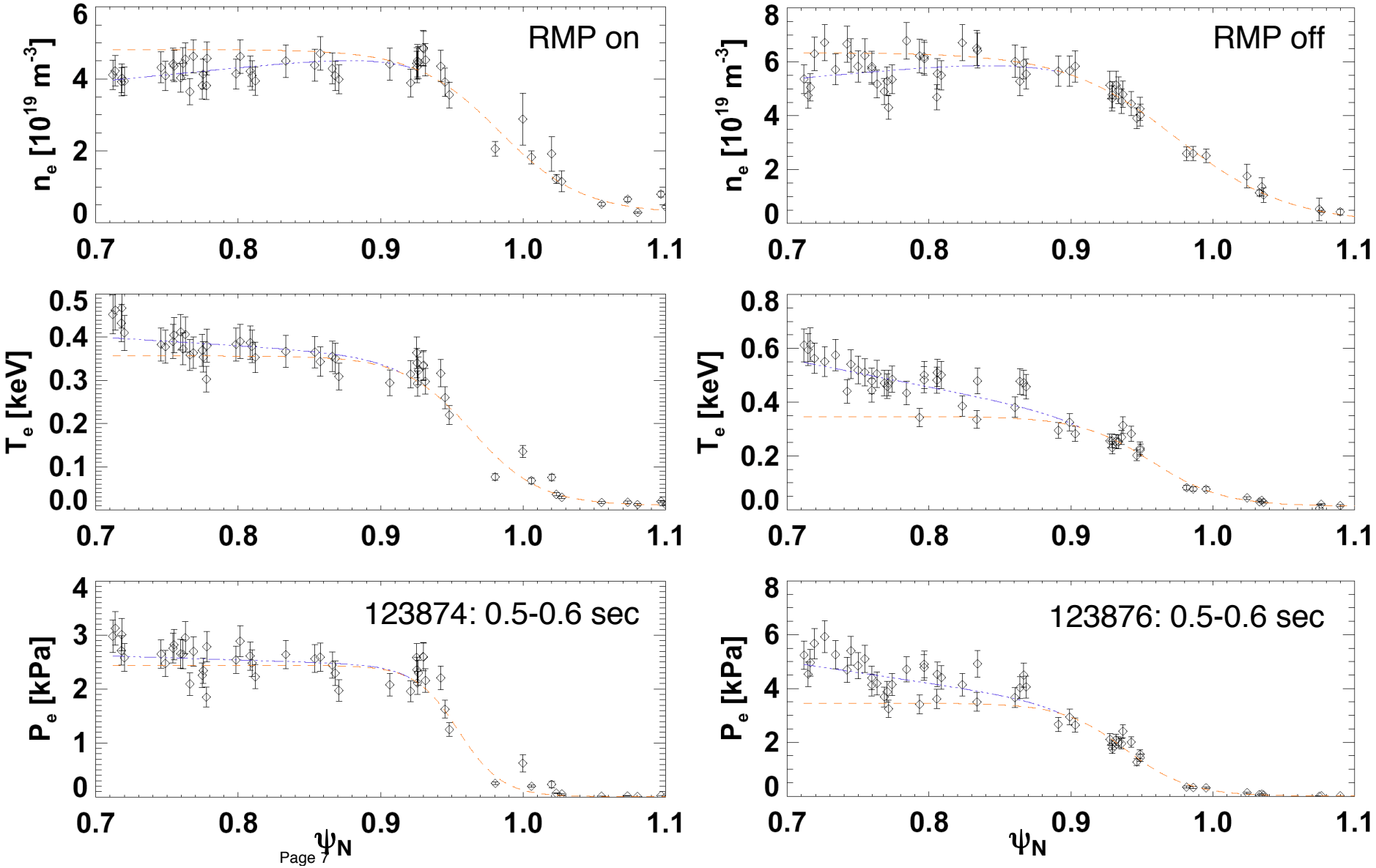

Summary and Plans

- Edge stability can be affected by application of RMPs in NSTX
  - Large ELMs can be de-stabilized
- Plan to run TRIP3D to determine field pattern, followed by edge stability analysis with e.g. ELITE
- Role of rotation in ELM stability merits detailed study, i.e. correlation of reduced edge rotation and ELM stability