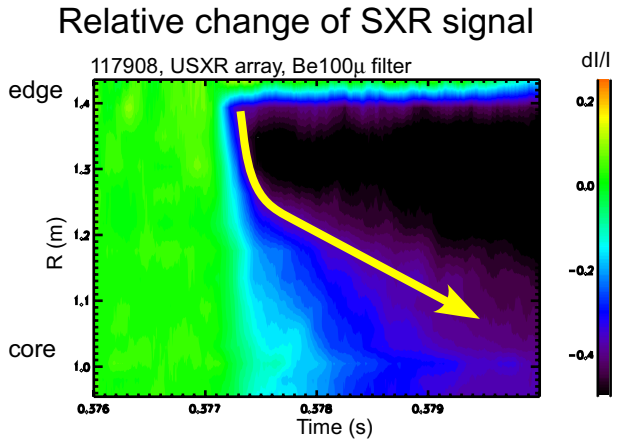
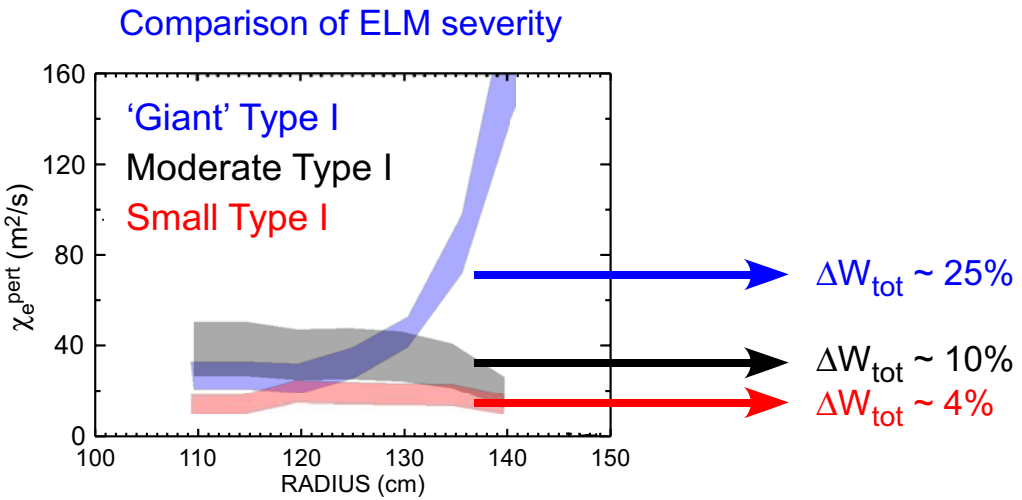
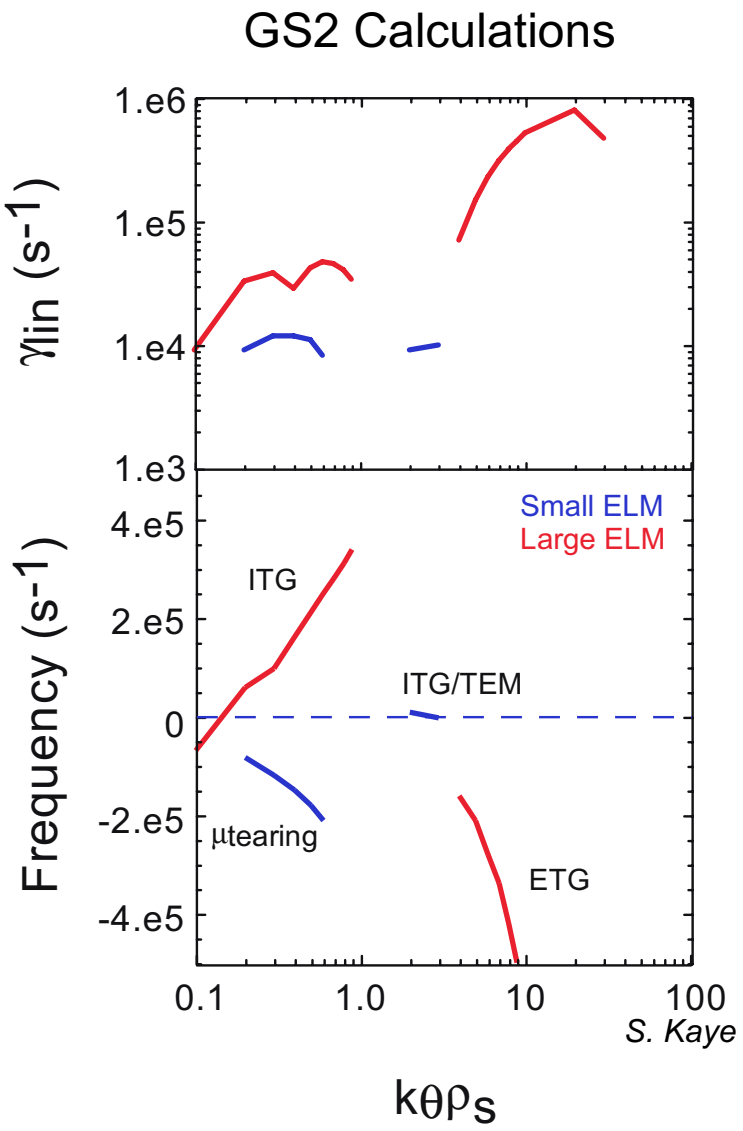
Severity of Type I ELMs Appears Related to Perturbed Electron Thermal Transport

- NSTX observes wide range of ELM types, related to collisionality, input power, etc...
- Within the Type I regime, ELM severity (ΔW_{tot}) varies under different plasma conditions (LSN, DND high-δ, j(r) differences, etc...)
- Initial ELM MHD signature appears similar, resultant electron temperature perturbation propagates with varying speed and penetration depths

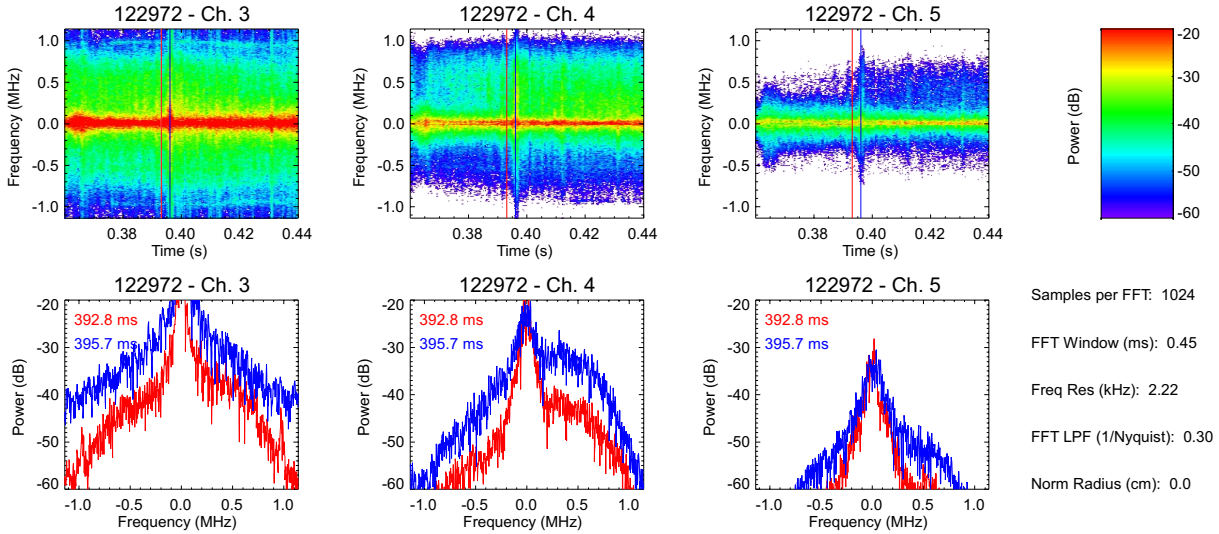




Initial Linear Stability Calculations Indicate Difference in Mode Growth Rates between Large/Small Type I ELMs

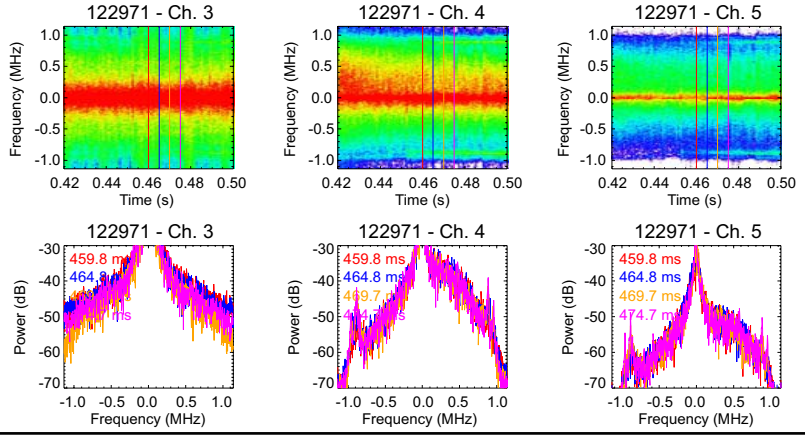


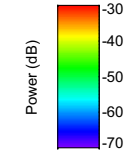
- Discharge with large ELM severity shows large ITG/ETG growth rates during perturbation
- 'Small' Type I ELMs have little μtearting, no ETG instability
- During ELM high-k measurements show increased fluctuations at short wavelengths k_r ~ 14-16 cm^{-1}



High-k Activity Correlates with ELM Events and Severity

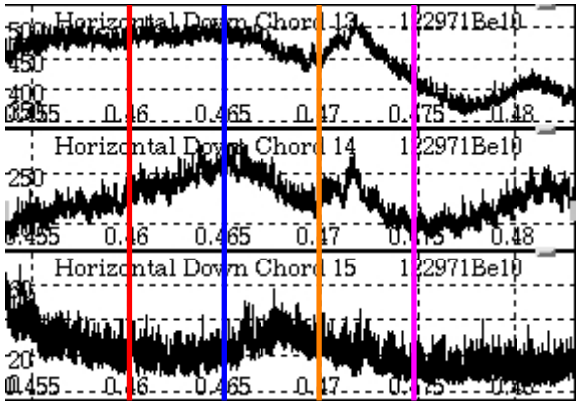
High-k Spectra



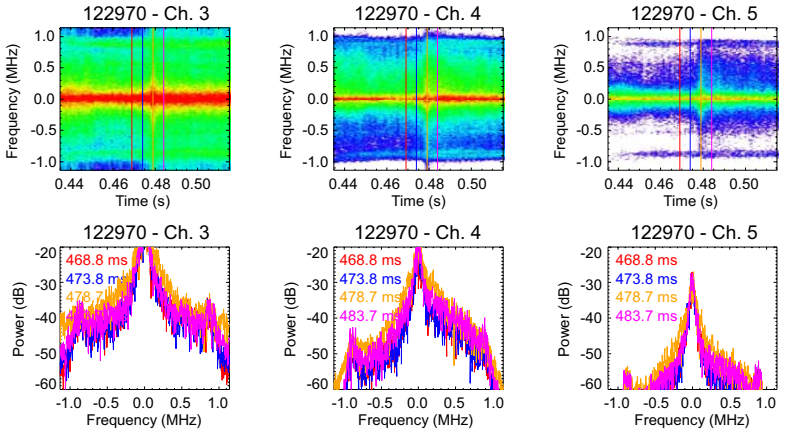


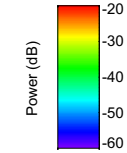
Samples per FFT: 1024
FFT Window (ms): 0.45
Freq Res (kHz): 2.22
FFT LPF (1/Nyquist): 0.30
Norm Radius (cm): 0.0

USXR Edge Chords

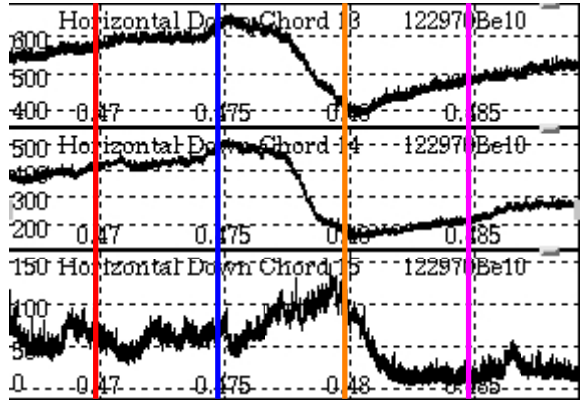


ΔW_{tot} ~ 1-2%

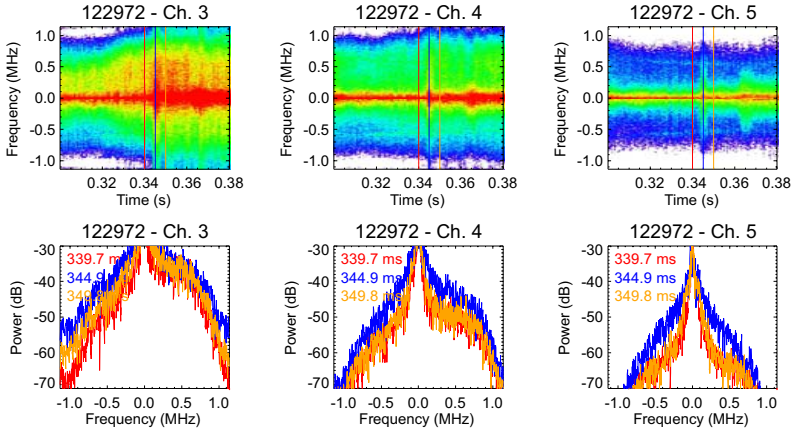


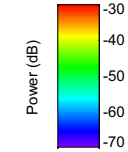


Samples per FFT: 1024
FFT Window (ms): 0.45
Freq Res (kHz): 2.22
FFT LPF (1/Nyquist): 0.30
Norm Radius (cm): 0.0

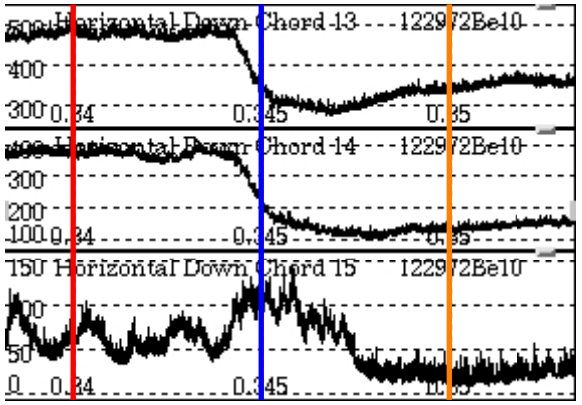


ΔW_{tot} ~ 3-5%





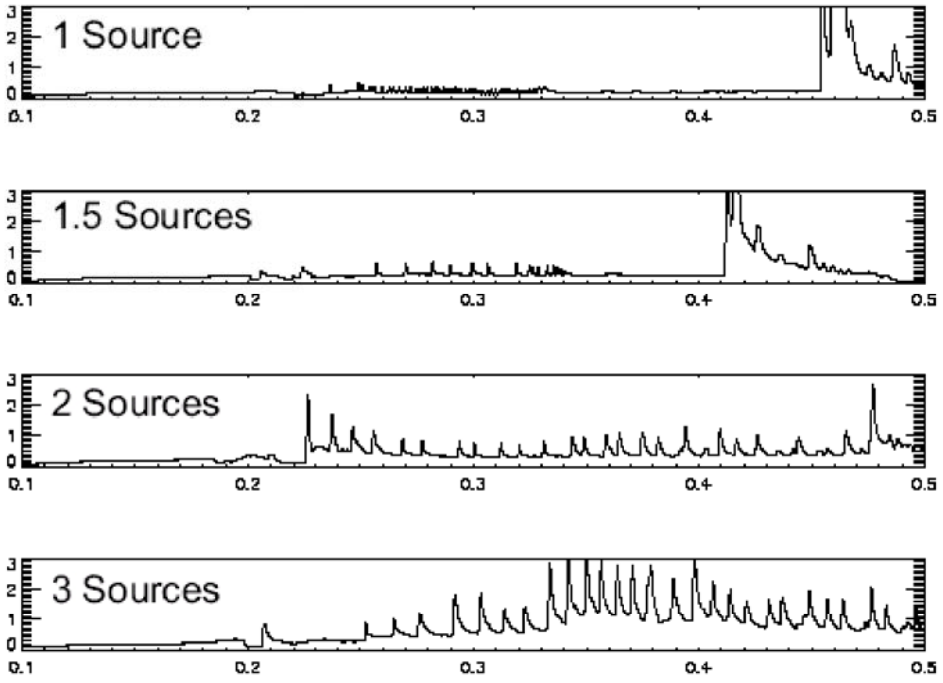
Samples per FFT: 1024
FFT Window (ms): 0.45
Freq Res (kHz): 2.22
FFT LPF (1/Nyquist): 0.30
Norm Radius (cm): 0.0

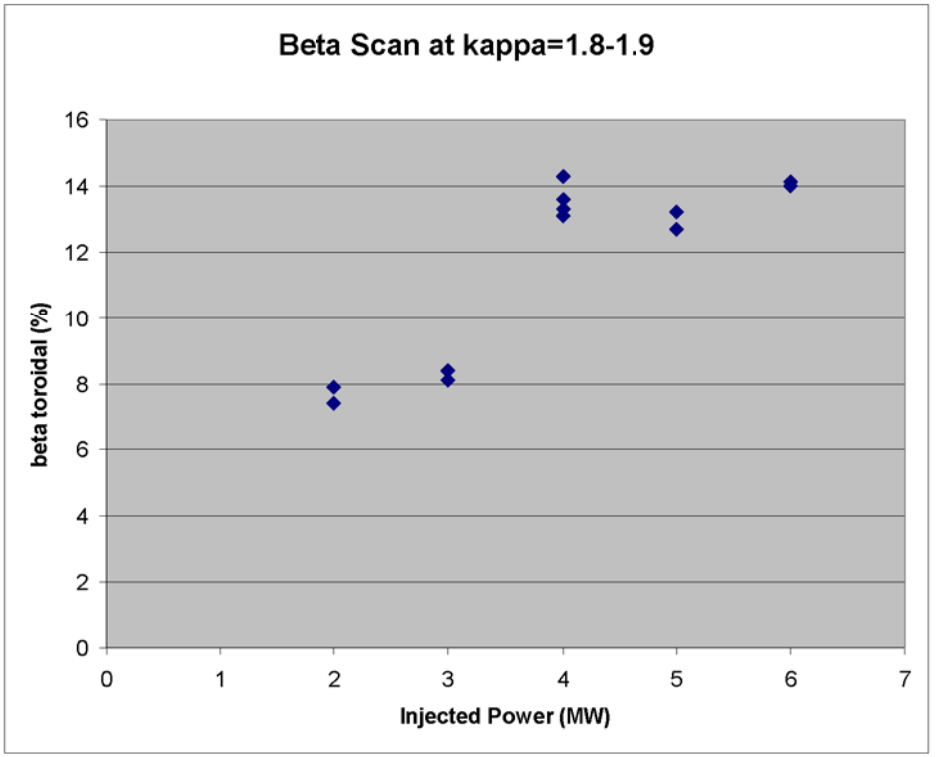


ΔW_{tot} ~ 10-15%

XP713 - Beta Scaling in Weakly Shaped Plasmas Show Confinement Degradation with Increased NB Power

- Increased NB power correlates with increasing ELM activity (frequency/magnitude)
- "Saturation" of beta indicates profile "stiffness"/increased electron transport?
- Strongly shaped plasmas ("small ELMs") do not exhibit same scaling with power





Experimental Plan: Scan Type I ELM "Regimes"

Use NB power scan from XP713 (small Type I ELMs 2-5%)

Shot:	124369	6MW	2 shots
		4MW	2 shots
		3MW	[2 shots, priority 2]
		5MW	[2 shots, priority 2]
subtotal:			4 + [4] + 1 contingency

Restore LSN "Giant" ELM discharge

119083, 6MW - 2

works → 119083, 4MW - 2
119083DN, 6MW - 2
119083DN, 4MW - 2
8 + 2 contingency

fails → 123859, 6MW - 1

works → 123859, 6MW - 1
123859, 4MW - 2
6 + 2 contingency

fails → 123859, lower k - 1

works → 123859, 6MW - 1
123859, 4MW - 2
7 + 2 contingency

fails → SPAs → 123874, 6MW - 2
123874, 4MW - 2
8 + 2 contingency

Repeat w/ 2nd high-k position:
~12 shots

Total: 24 + [4] + 3 contingency