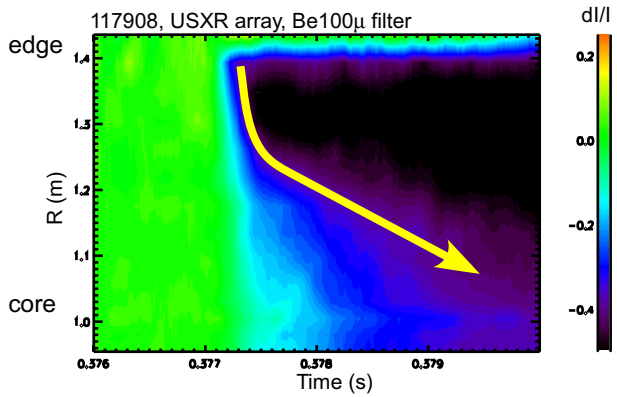
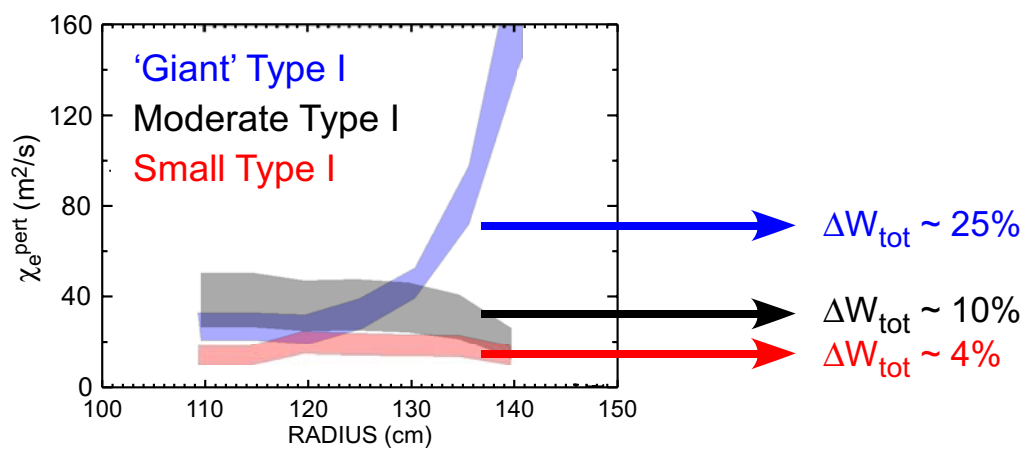
Severity of Type I ELMs Appears Related to Perturbed Electron Thermal Transport

- 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

Relative change of SXR signal

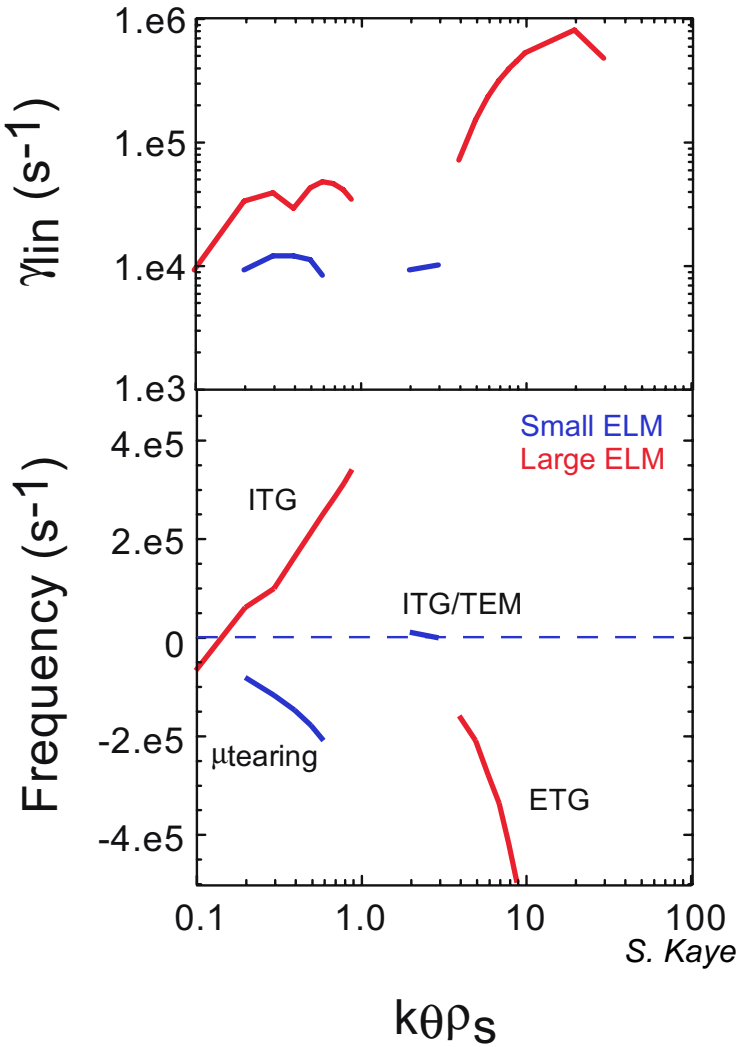


Comparison of ELM severity

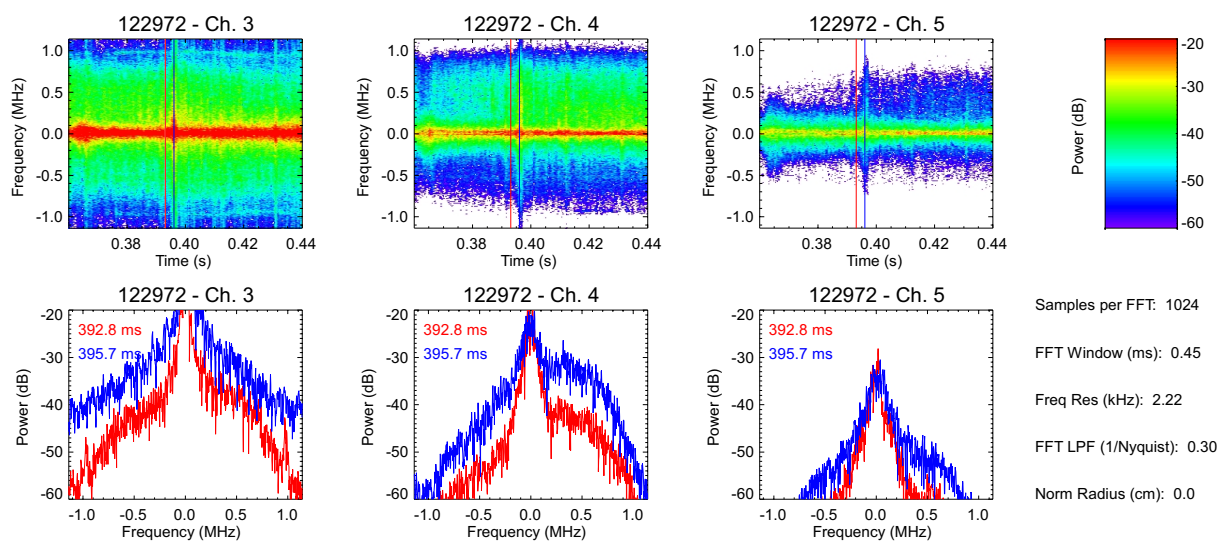


Initial Linear Stability Calculations Indicate Difference in Mode Growth Rates between Large/Small Type I ELMs

GS2 Calculations

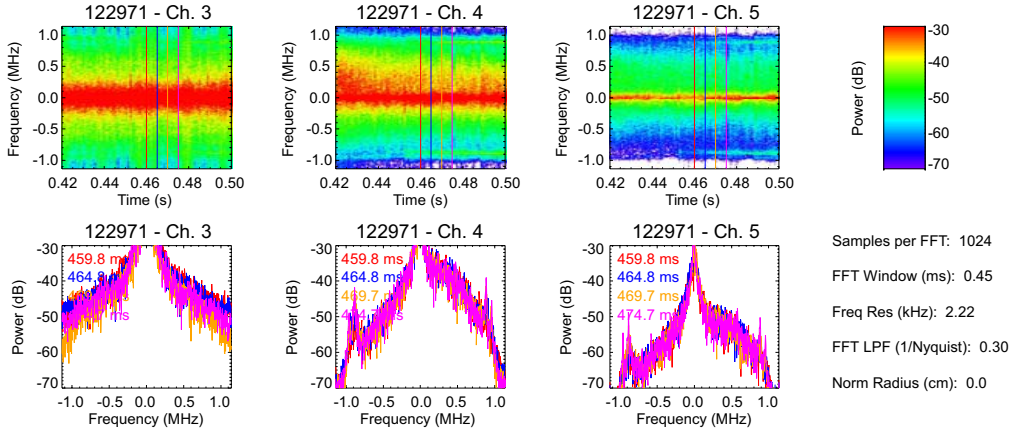


- Discharge with large ELM severity shows large ITG/ETG growth rates during perturbation
- 'Small' Type I ELMs have little μtearting, no ETG instability
- During ELM high-k measurements show increased fluctuations at short wavelengths k_r ~ 14-16 cm^{-1}



High-k Activity Correlates with ELM Events and Severity

High-k Spectra



Samples per FFT: 1024

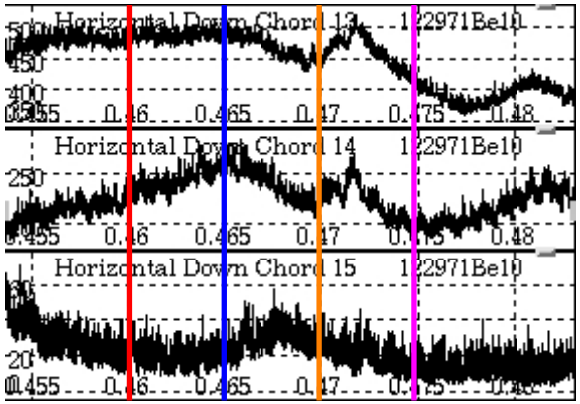
FFT Window (ms): 0.45

Freq Res (kHz): 2.22

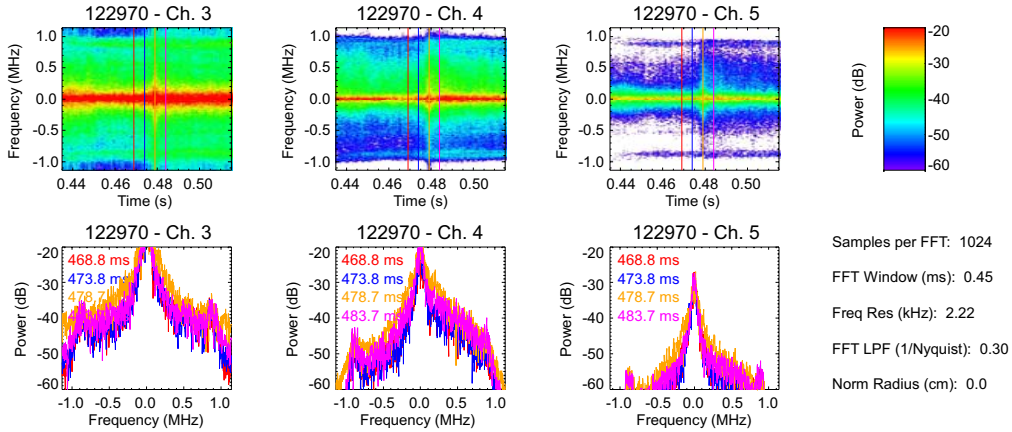
FFT LPF (1/Nyquist): 0.30

Norm Radius (cm): 0.0

USXR Edge Chords



ΔW_{tot} ~ 1-2%



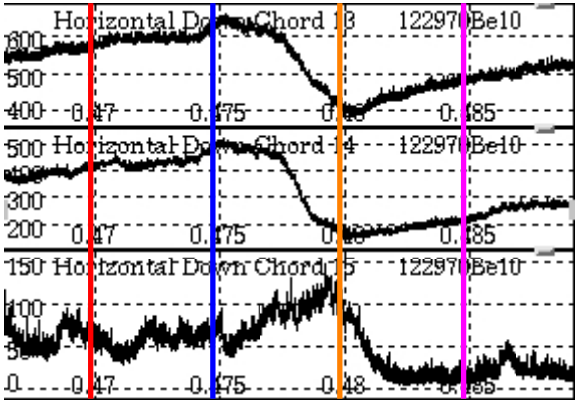
Samples per FFT: 1024

FFT Window (ms): 0.45

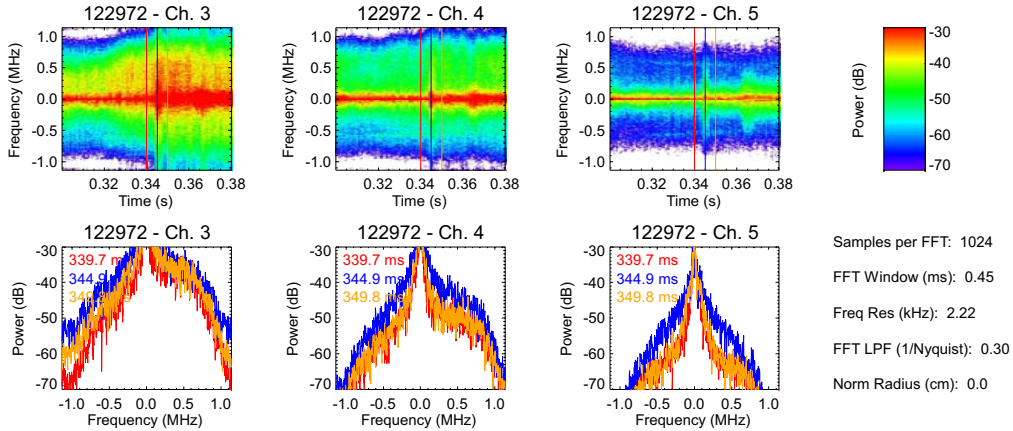
Freq Res (kHz): 2.22

FFT LPF (1/Nyquist): 0.30

Norm Radius (cm): 0.0



ΔW_{tot} ~ 3-5%



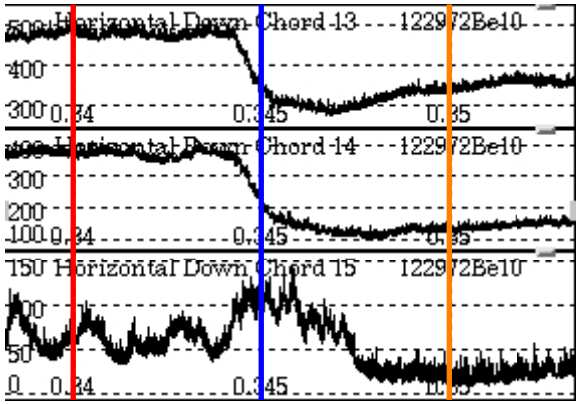
Samples per FFT: 1024

FFT Window (ms): 0.45

Freq Res (kHz): 2.22

FFT LPF (1/Nyquist): 0.30

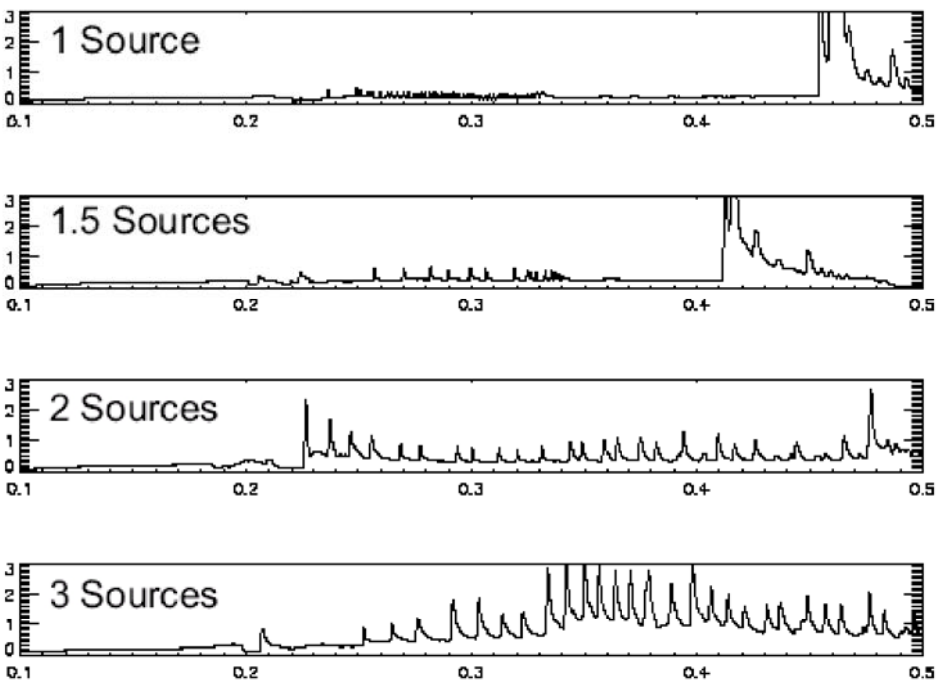
Norm Radius (cm): 0.0

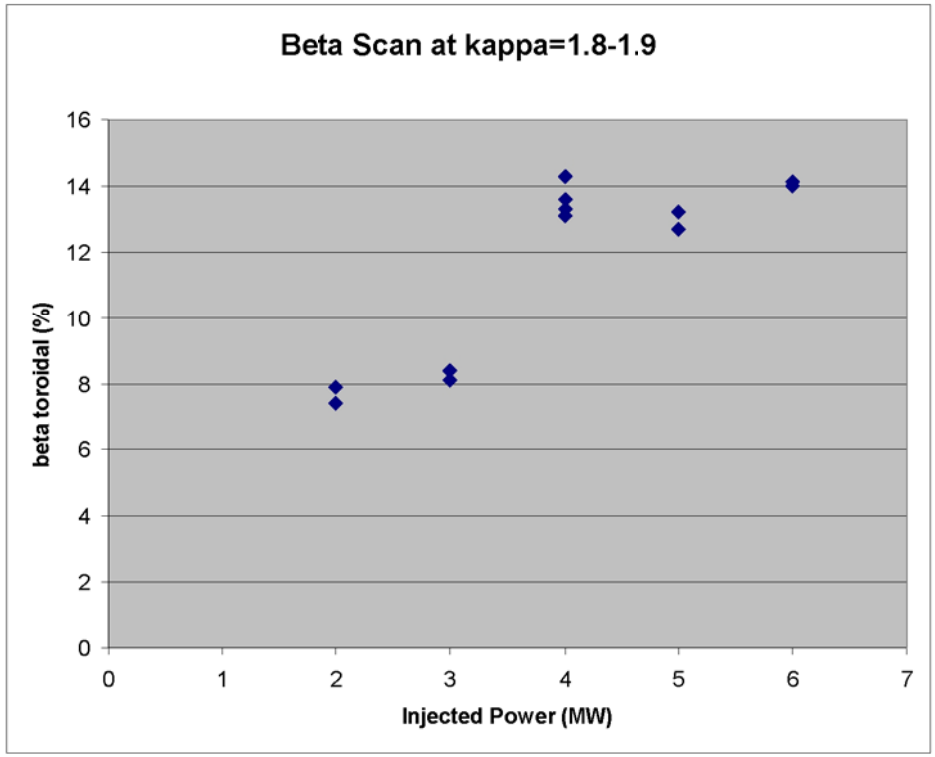


ΔW_{tot} ~ 10-15%

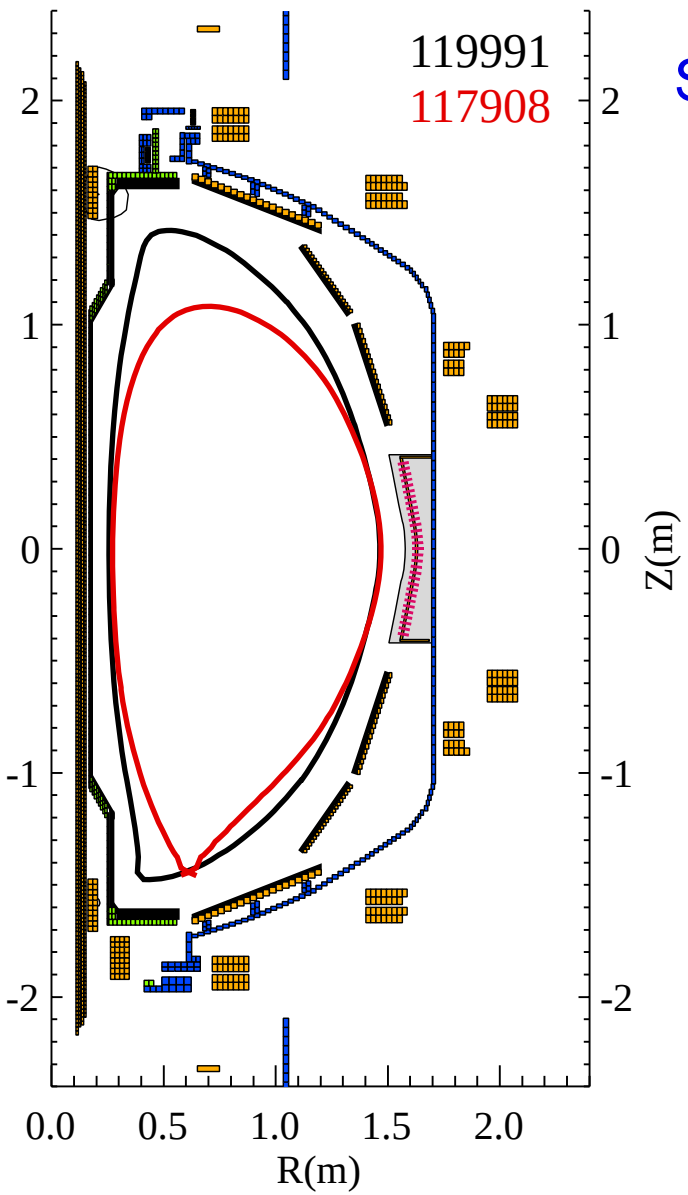
XP713 - Beta Scaling in Weakly Shaped Plasmas Show Confinement Degradation with Increased NB Power

- 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: Shape Scan



Scan dr_{sep} (and/or NB power?) at low and high-δ

shapes from XP609 (Rajesh) or XP713 (Kaye)

low-δ reference shot #119136
restore shot + scan (6 shots)

high-δ reference shot #119085
restore shot + scan (6 shots)

repeat scan with second high-k position
(consider intermediate shape)

Total shots 24 (1 day)

Diagnostics :
30 ch. Thomson, USXR + multicolor, FireTIP, Fast camera, full magnetics, CHERS, MSE, high-k.

- ELM understanding necessary for confident ITER/NHTX/CTF projections
- Plasma configuration and scan is relevant to ITPA PEP-6/20