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Reversed magnetic shear suppression of electron-scale turbulence on NSTX

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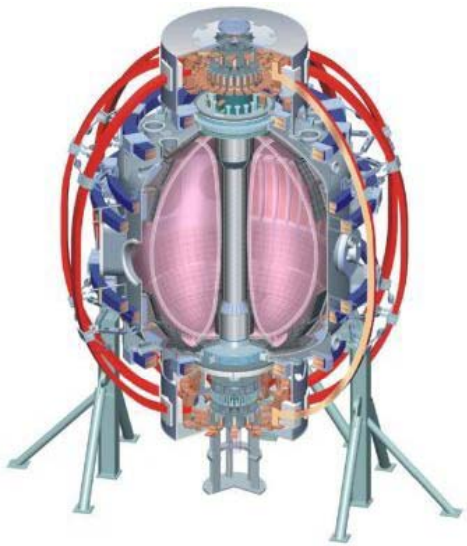

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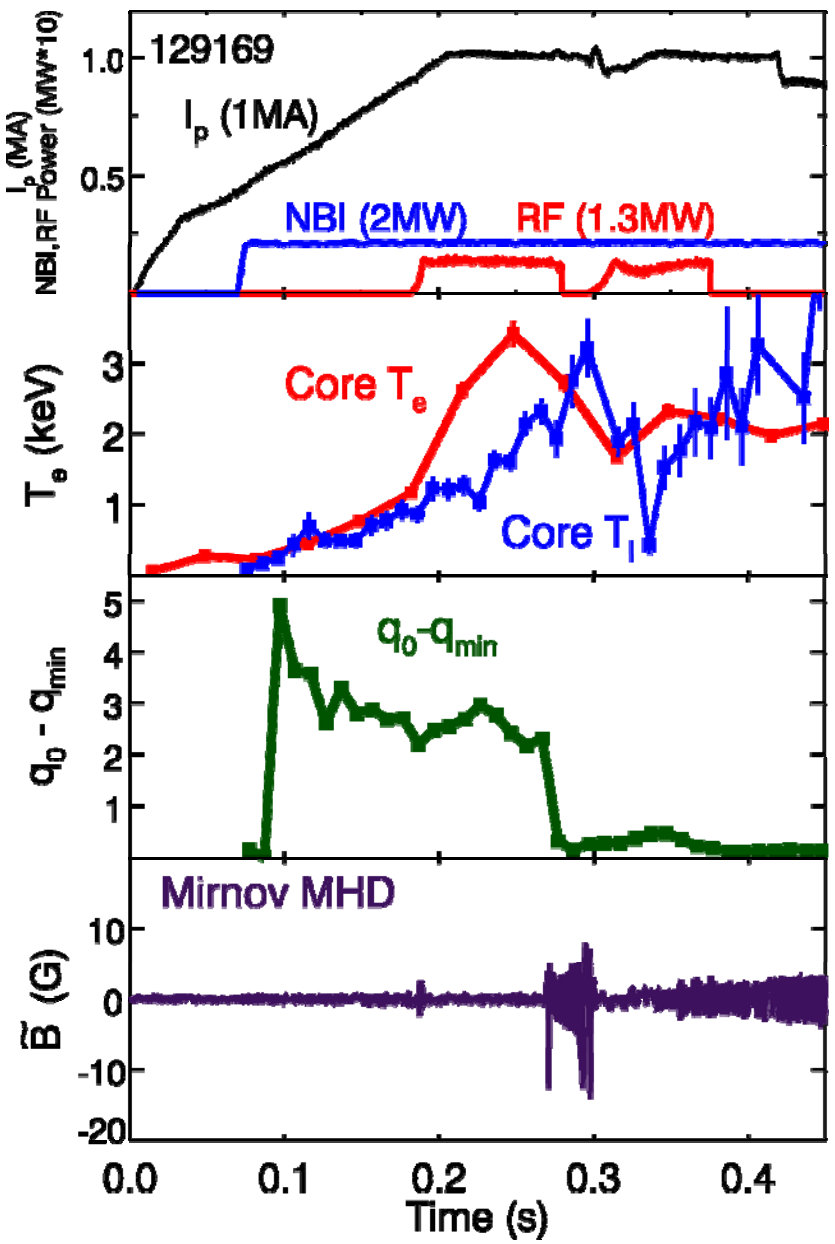
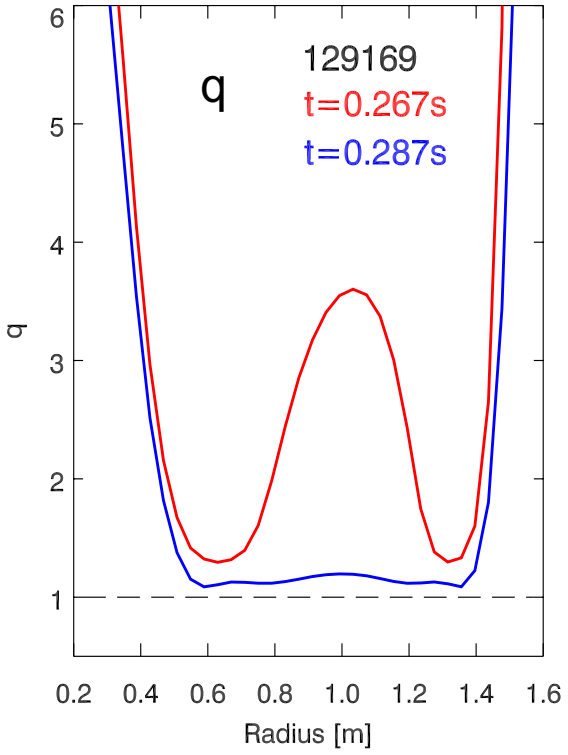
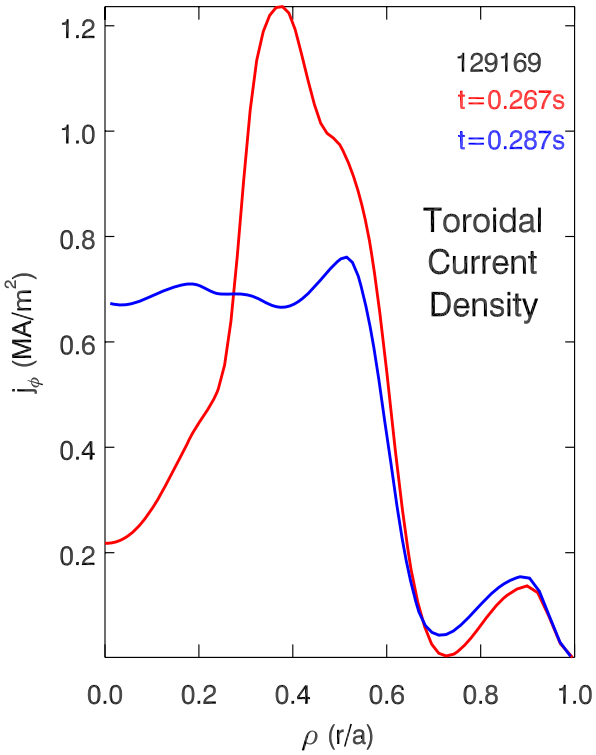
Reversed shear plasmas can have simultaneous e-ITB, i-ITB, and momentum transport barriers

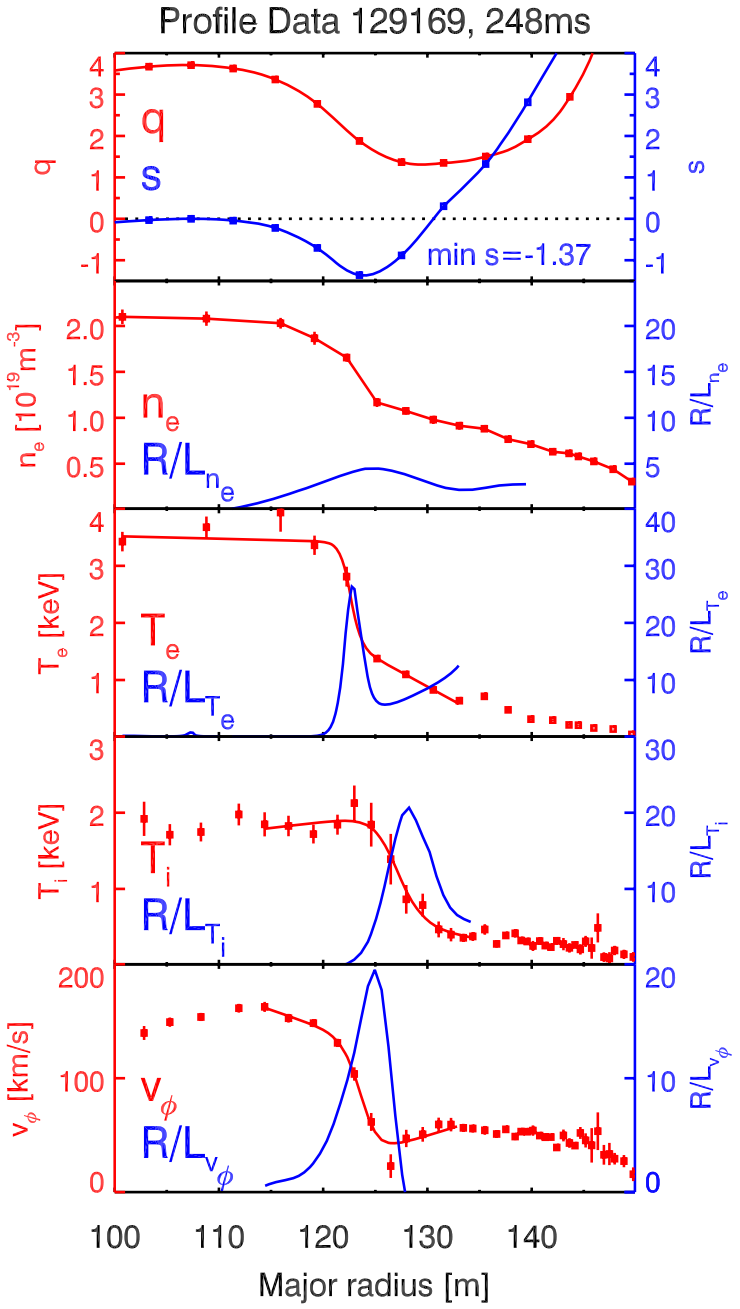


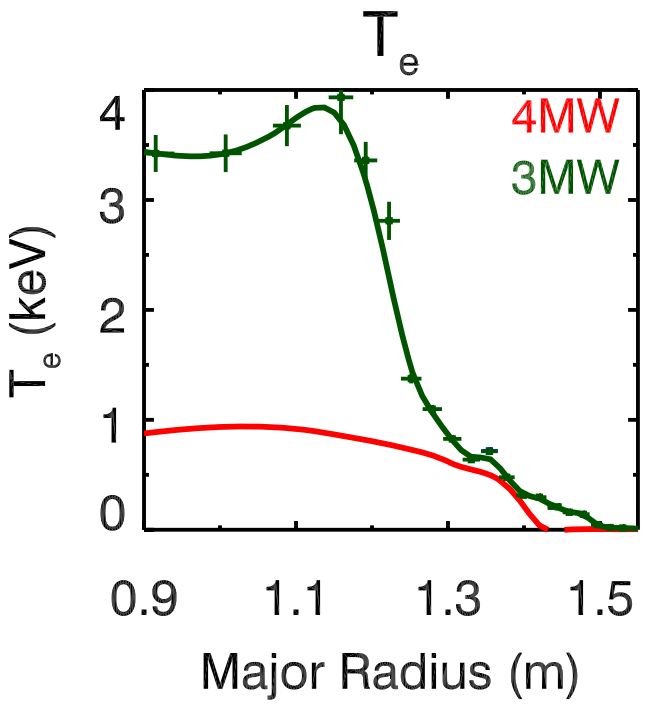


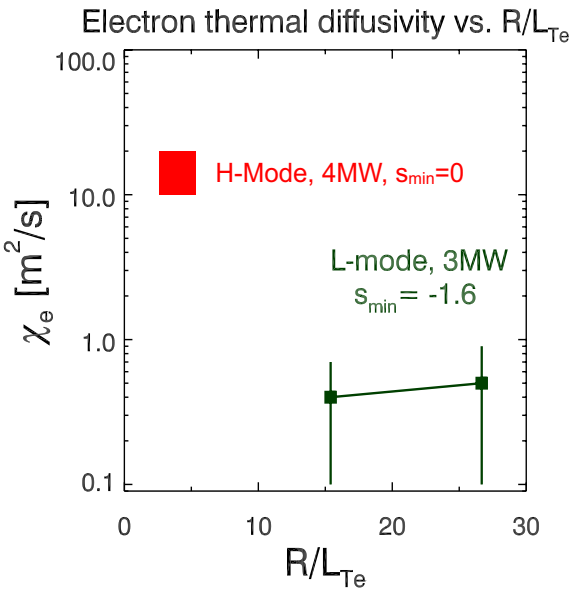


- ITBs occurs only during reversed shear portion of discharge
- MSE constrained q, current profiles

Electron confinement is particularly improved

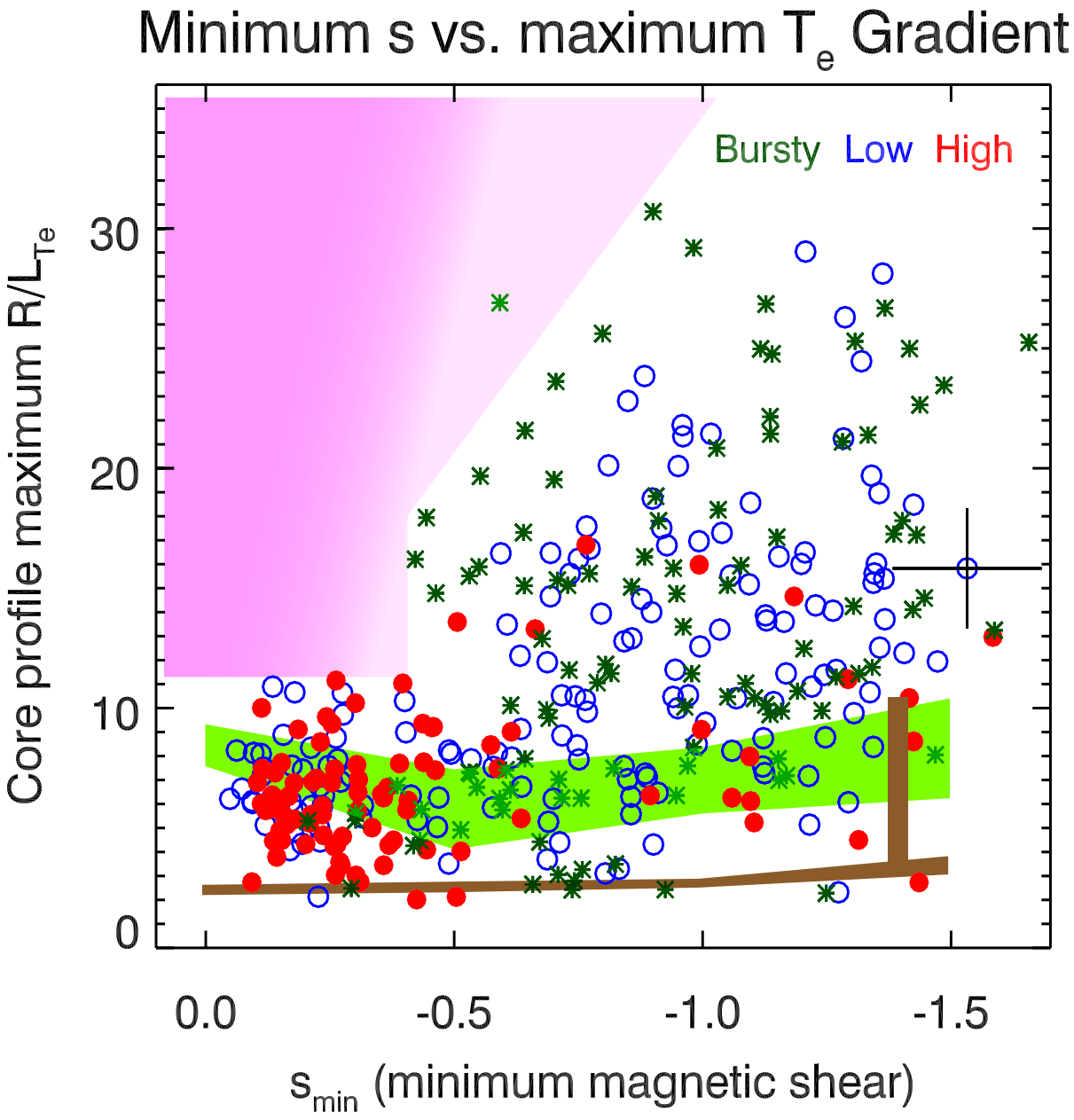






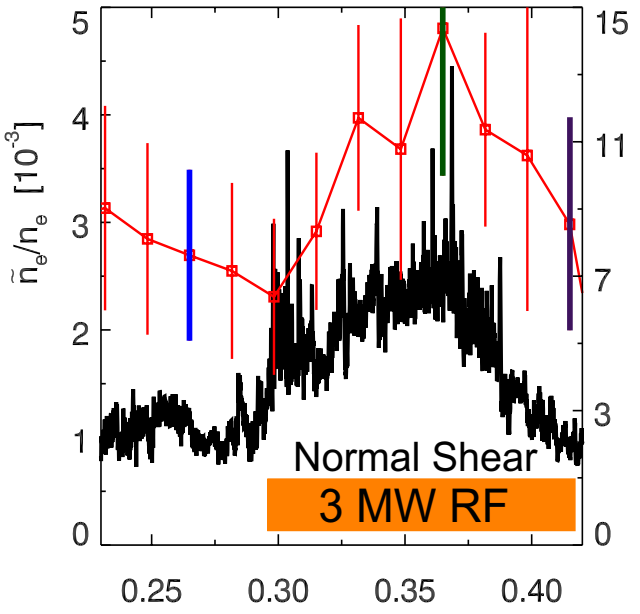
- In e-ITBs, χ_e can improve by nearly two orders of magnitude
- Can Electron Temperature Gradient (ETG) mode suppression be identified as responsible for improvement?

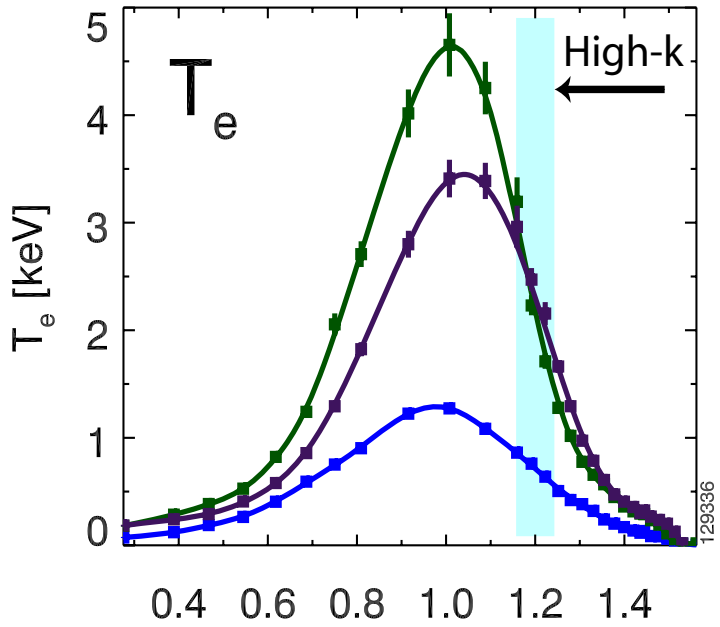
Electron gyroscale n_e fluctuations become bursty or suppressed under strongly reversed magnetic shear

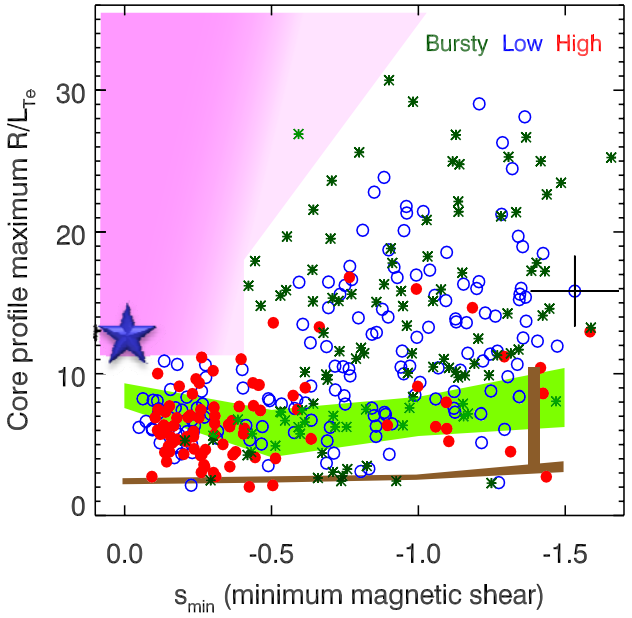


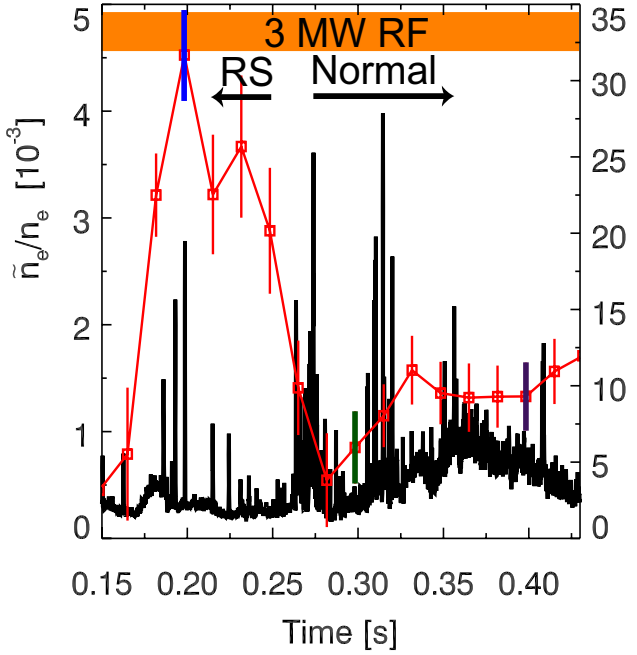
- High-k scattering measures local n_e fluctuations $k_\perp \rho_e \leq 0.6$
- e-ITBs are only formed in the absence of continuous, high amplitude fluctuations
- Bursty fluctuations limit electron gradients at intermediate values of shear reversal
- *Can NL simulations provide insight into the reason for transition into bursty behavior*

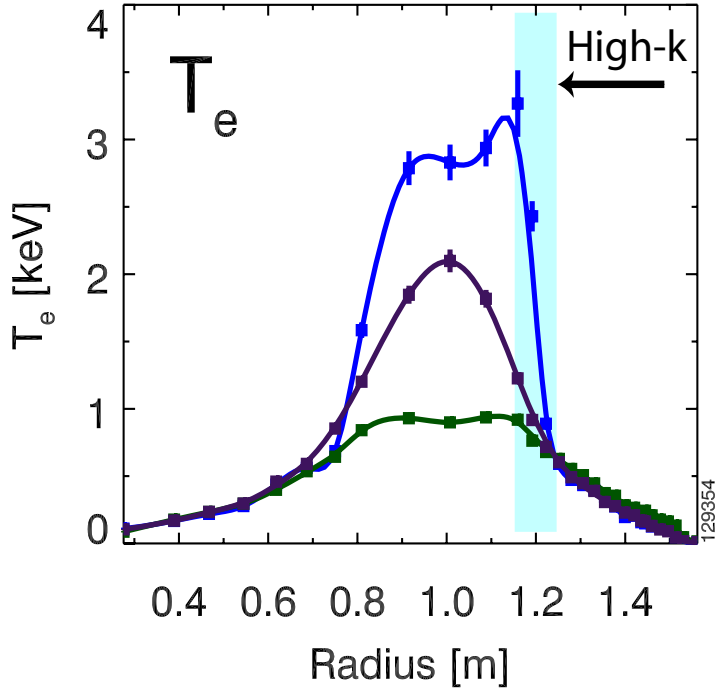
Continuous high amplitude fluctuations limit normal shear gradients, bursts limit e-ITB

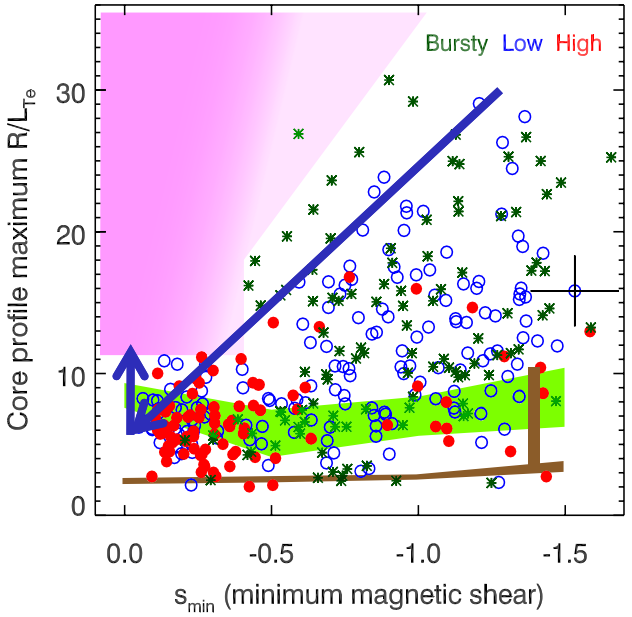




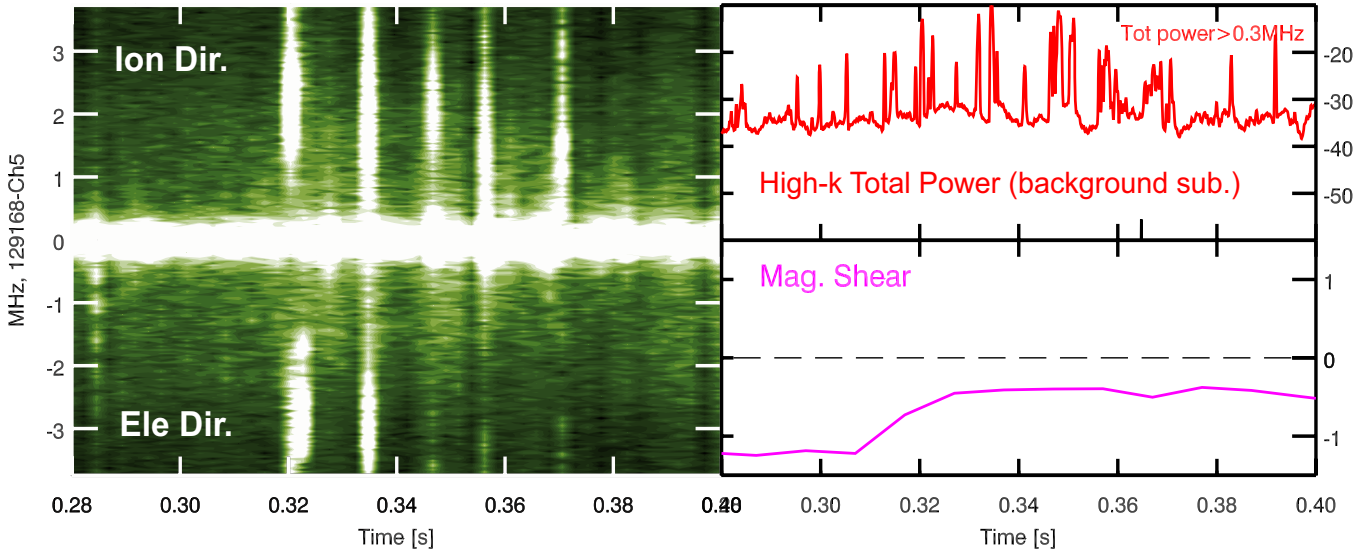




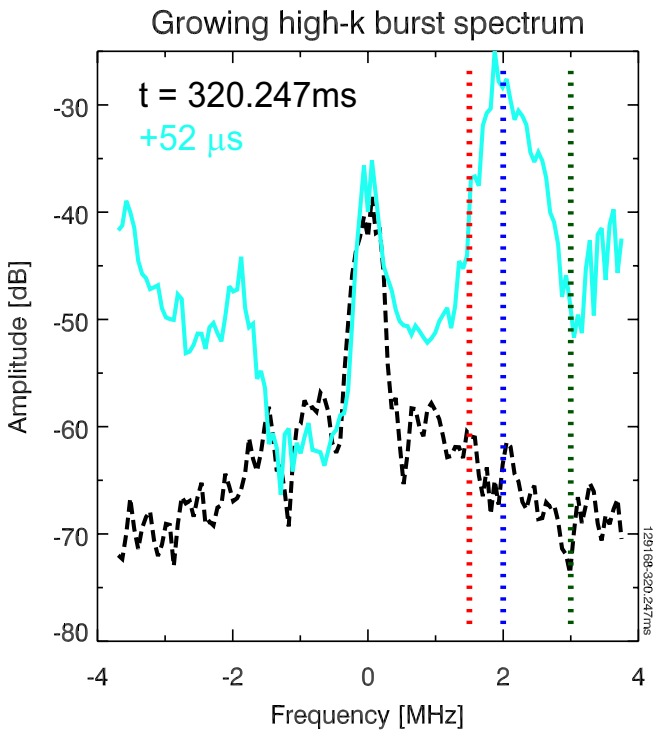


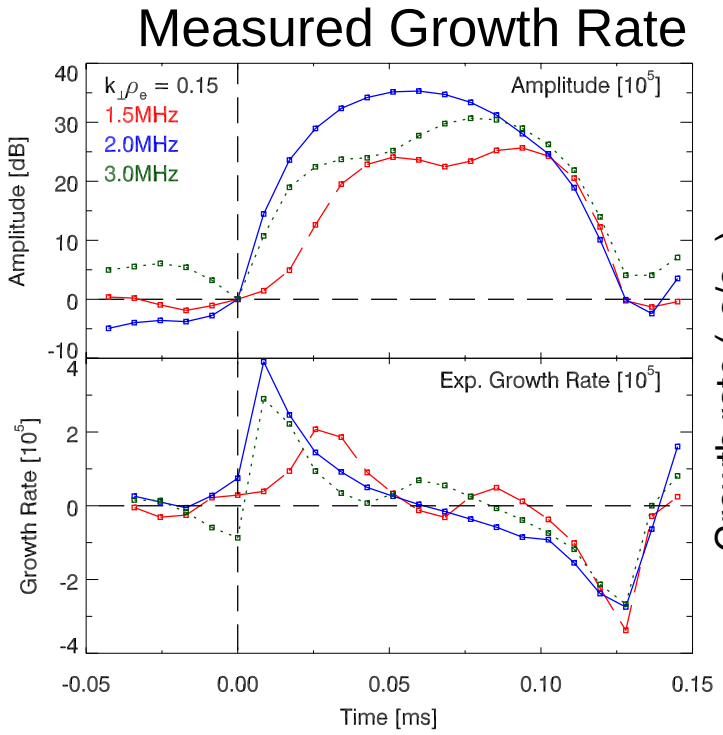


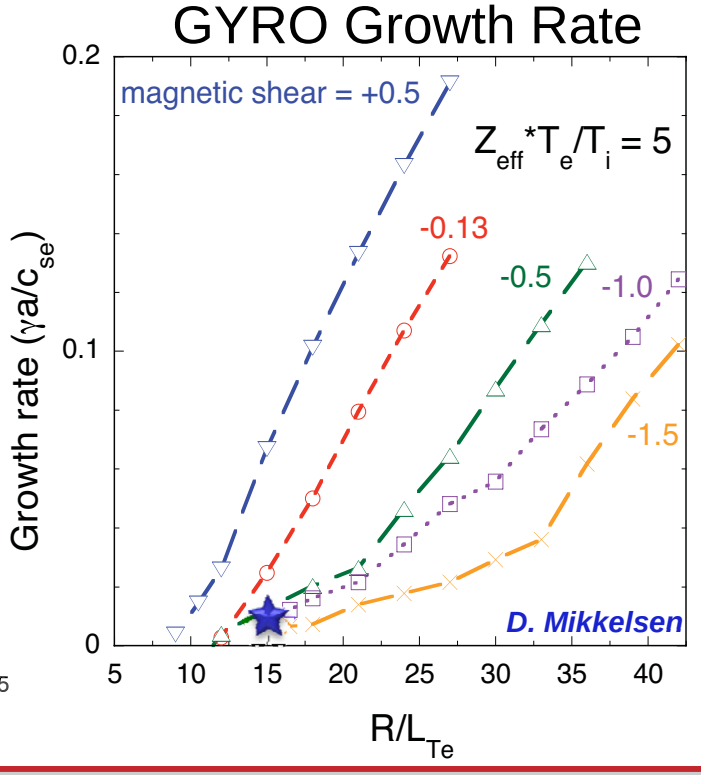
Growth rate match ETG calculated value



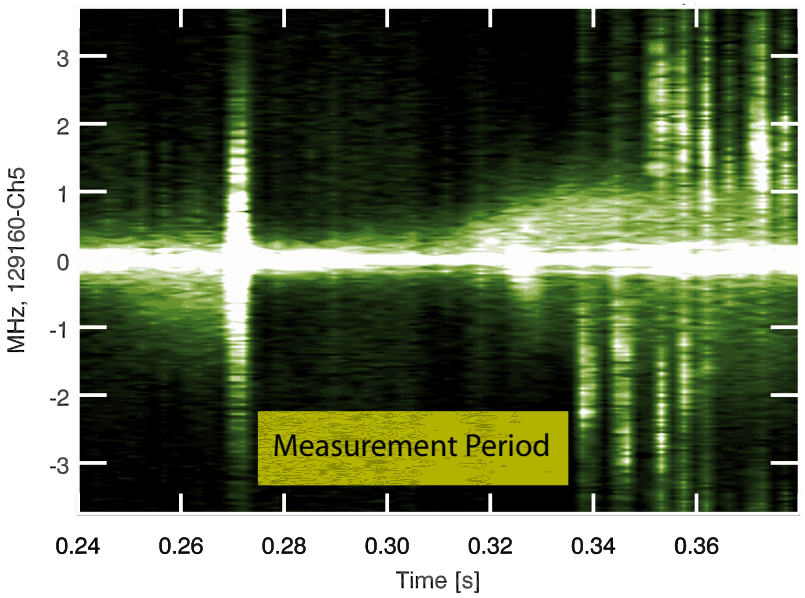
- ETG unstable for all e-ITBs
- Strong negative magnetic shear is suppressing mode amplitude

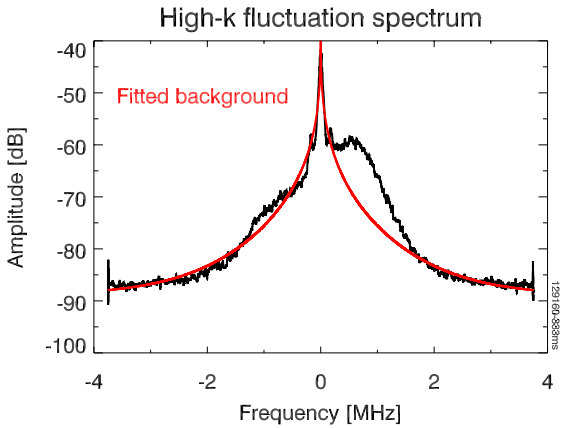


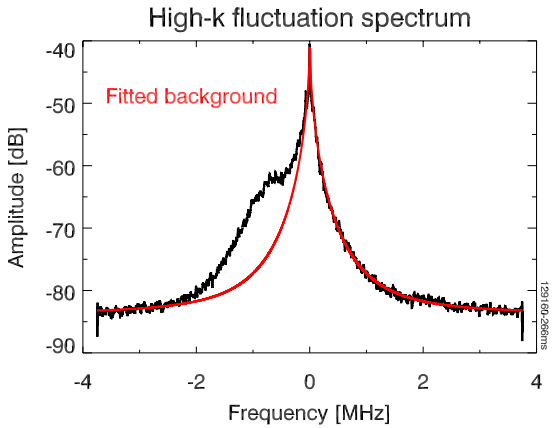


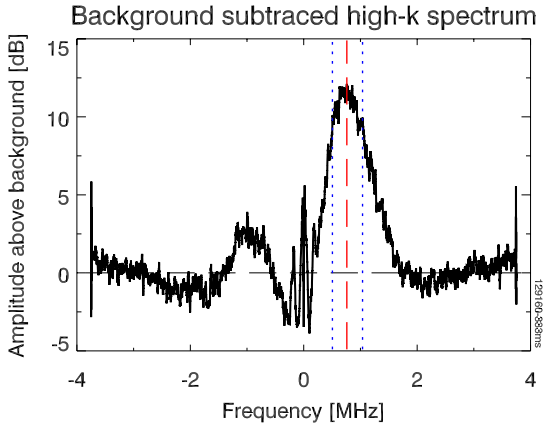


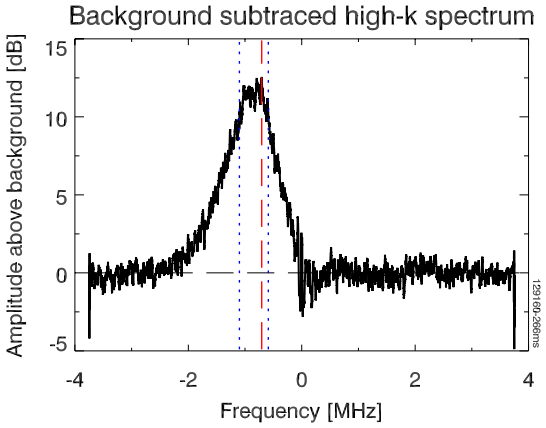
Rest frequency of peak amplitude matches ETG calculated values





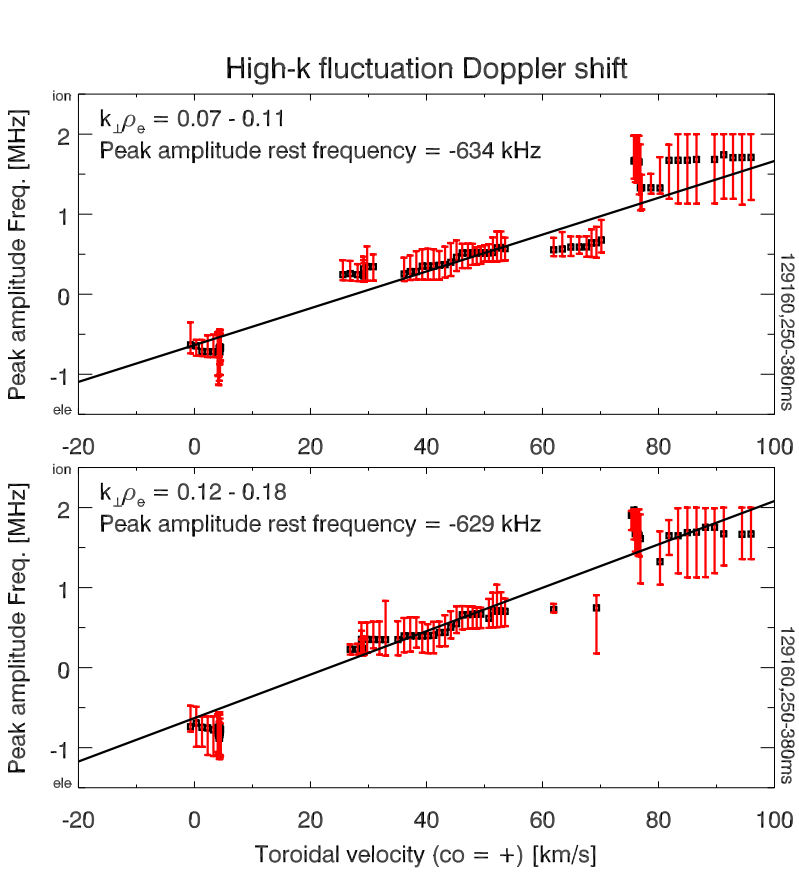


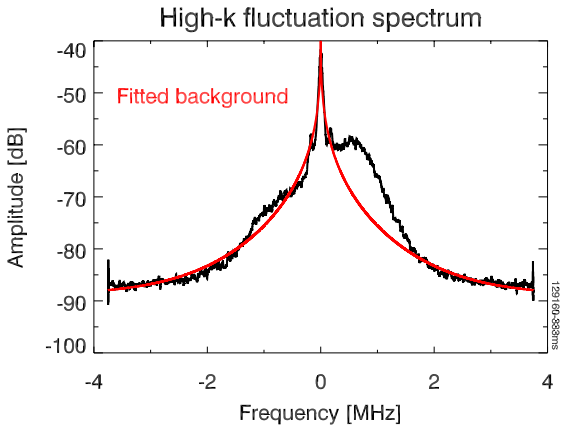


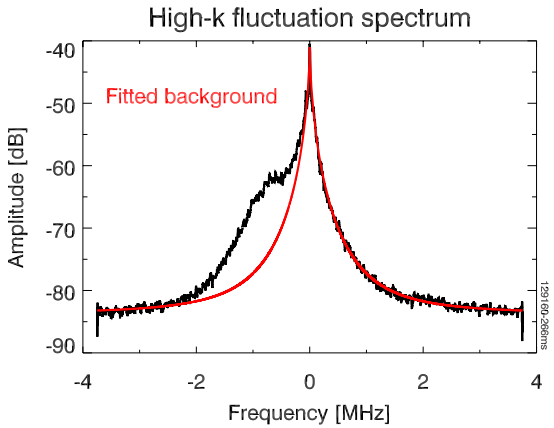


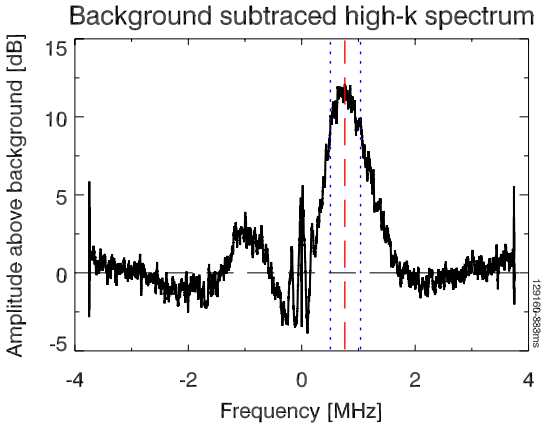
- Plasma spinup allows rest frequency measurement

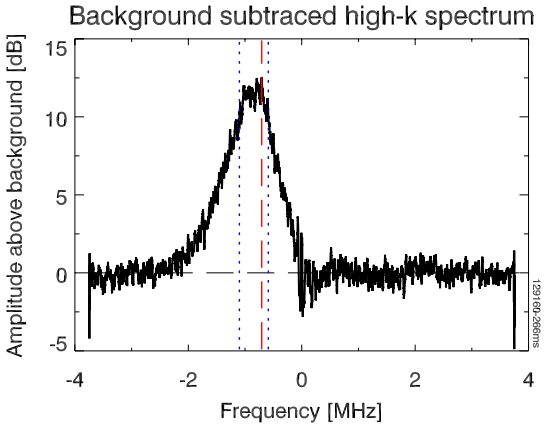
Rest frequency of peak amplitude matches ETG calculated values











- Plasma spinup allows rest frequency measurement
- Rest frequency of ~600 kHz matches GS2 calculations
- Highest amplitude is not necessarily fastest growing eigenmode

Conclusions & Future Work

- The Electron Temperature Gradient mode causing stiff electron temperature profiles is suppressed in amplitude by strongly negative magnetic shear
- Measured electron gyroscale n_e fluctuations match calculated ETG growth rate and rest frequency
- Electron thermal diffusivity greatly improves when ETG mode amplitude is suppressed
- ETG bursts limit maximum gradient for e-ITBs
- Comparisons with NL simulations will provide additional insight to mode dynamics