XP-821: High-k turbulent fluctuations in NSTX

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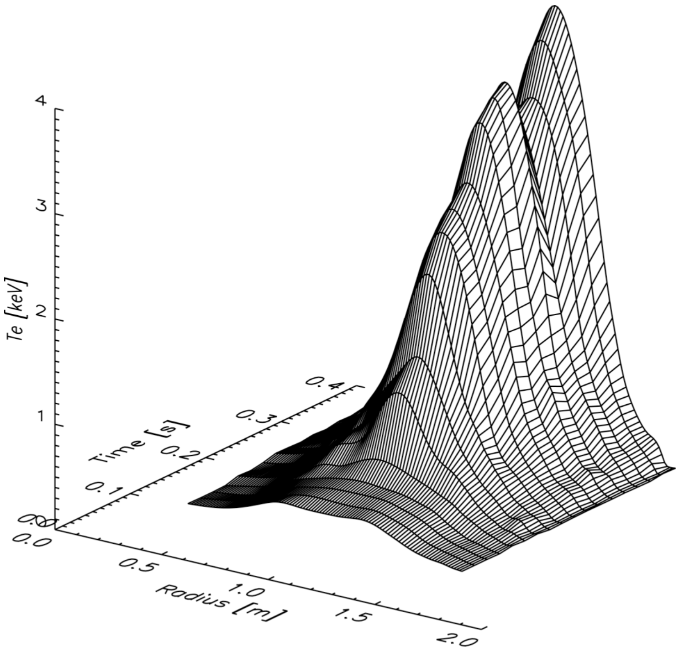
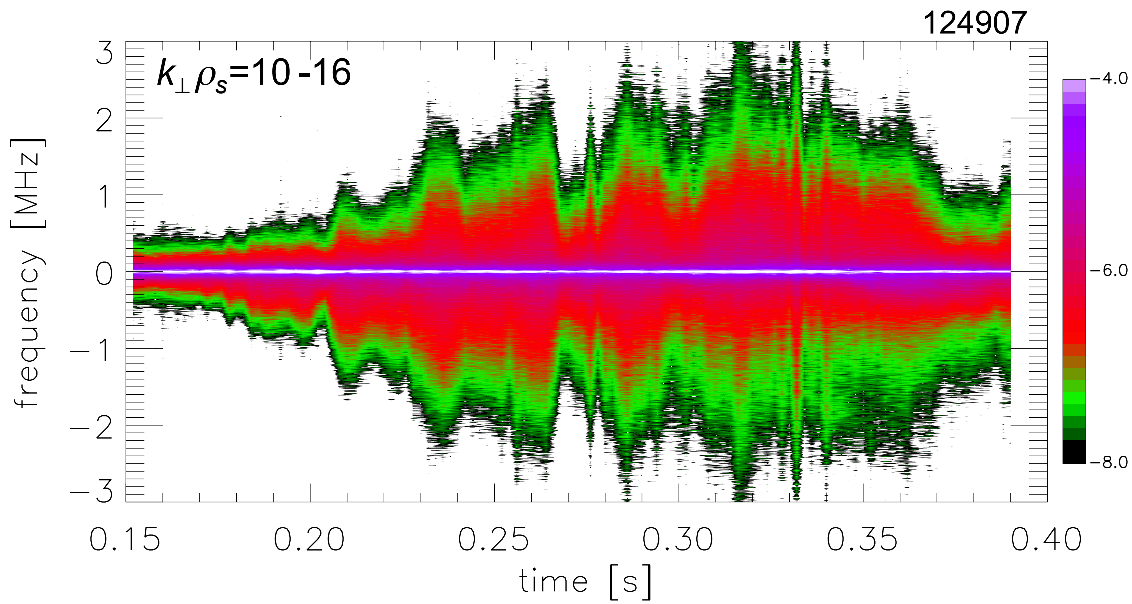
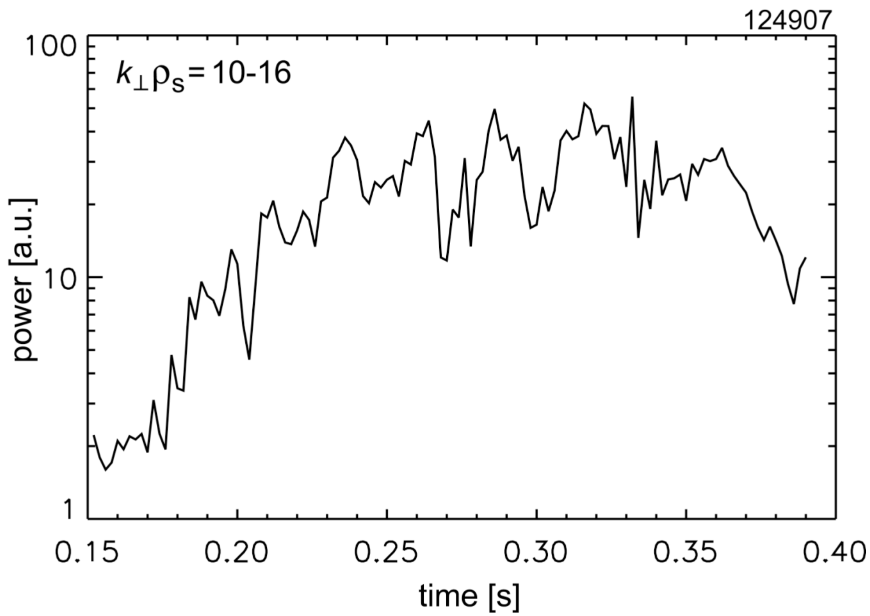
- *This XP is a continuation of XP-735. Main results from the latter are:*
  - *HHFW heating in He plasmas drives turbulent fluctuations with $k_\perp \rho_s$>>1*



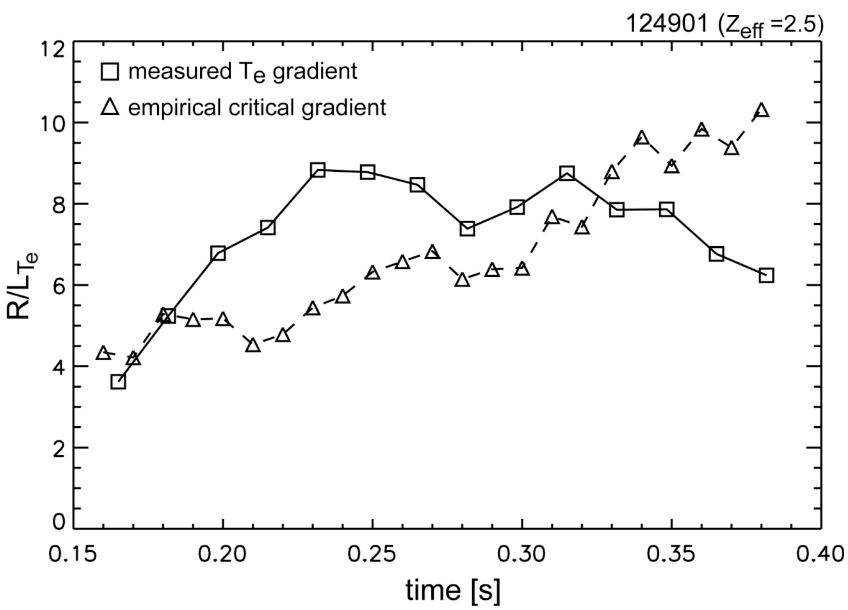


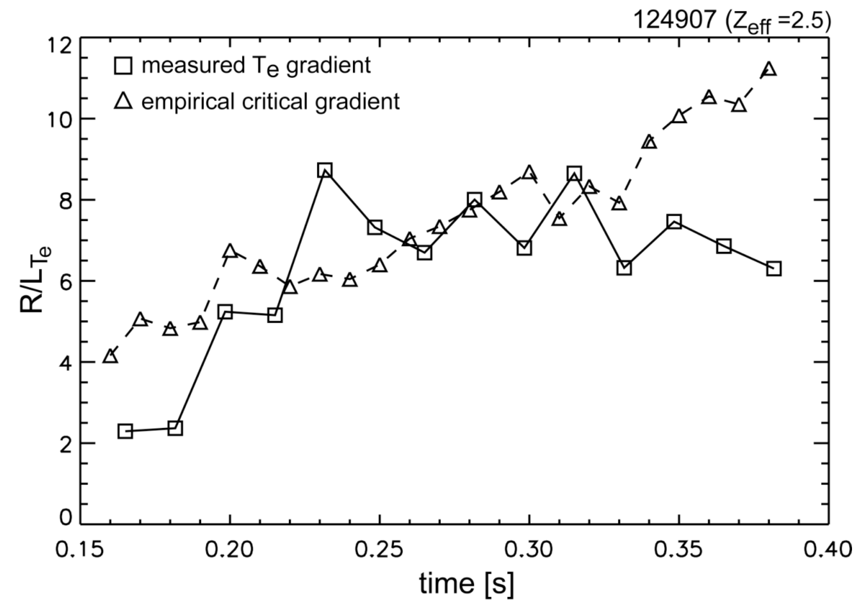


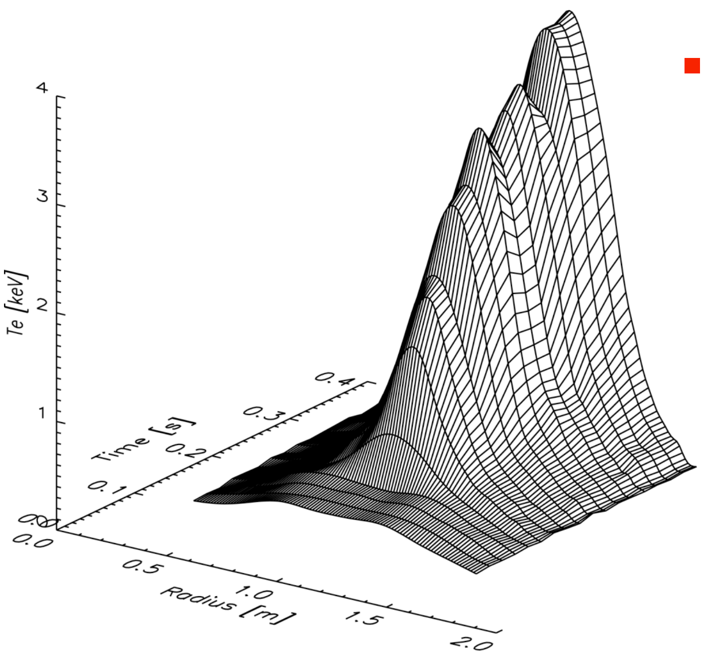
- *Plasma remained close to marginal stability, as defined by Jenko's critical gradient*

$$(R/L_{T_e})_{crit} = (1 + Z_{eff} T_e / T_i)(1.3 + 1.9\ s/q)(1 - 1.5\ \varepsilon)(1 + 0.3\ \varepsilon\ dk/d\varepsilon)$$

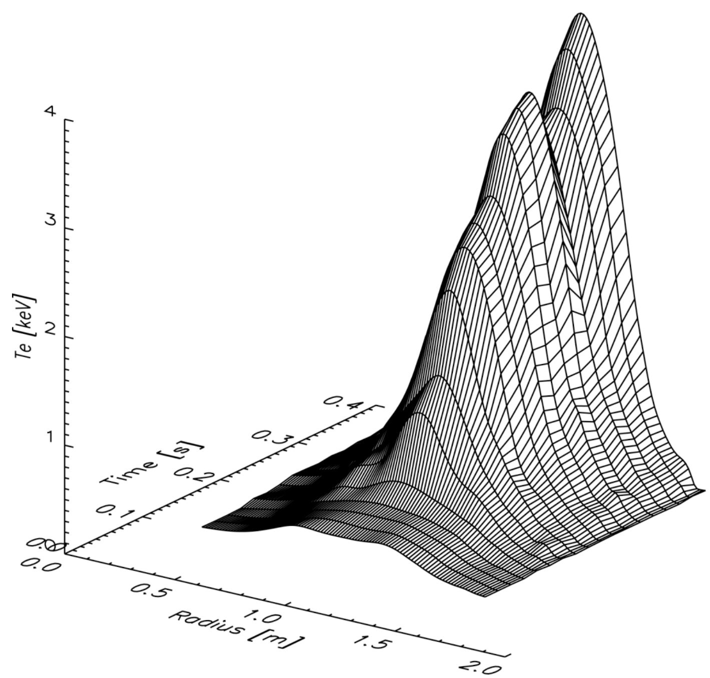
where $(Z_{eff}\, T_e / T_i)$ was the leading term for the plasma conditions of XP-735







- *Same results*

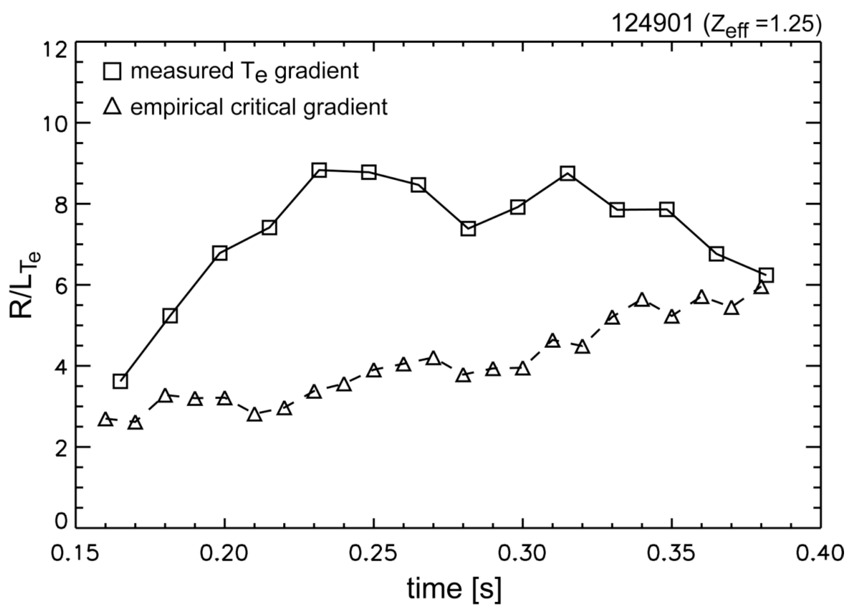


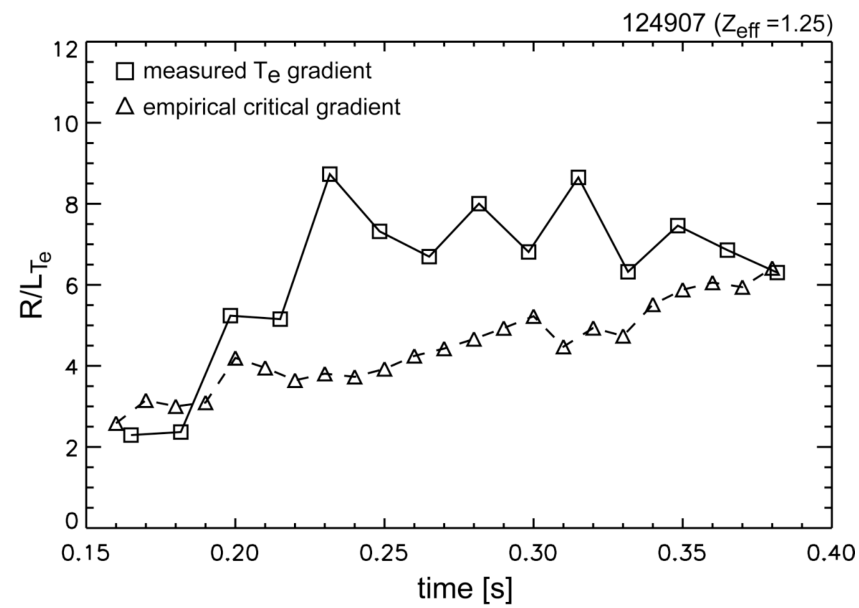
- *Question: what is the plasma response to a departure from marginal stability?*

- *Experiments from Tore Supra (G.T. Hoang et al., PRL 87,125001 (2001), W. Horton et al., PoP 11, 2600 (2004)) indicate:*

$$q_e \propto T_e^{\alpha}\left[(R/L_{T_e}) - (R/L_{T_e})_{crit}\right] \qquad \text{with } \alpha \approx 3/2$$

- *We can modify the critical gradient by changing either Z_{eff} , i.e., switching from He to D, or the temperature ratio, i.e., varying heating power and plasma density*





- *Confirmation of Tore Supra results would prove that measured fluctuations are indeed driven by the ETG mode*

First day (1/2+1/2) experimental Plan - RF heating

- *Plasma Conditions*
  - *Helium or Deuterium, B_T=5.5 kG, I_p=700 kA, n_o=1.5-2.0x10^{19} m^{-3}, optimum gap for minimum plasma-antenna interaction*
- *RF Conditions*
  - *Power*=1-2 MW
  - *Phase=best for RF coupling*
  - *Pulse* =400 ms
- *NBI Conditions*
  - *70 kV short pulse (40 msec) during RF for CHERS*
  - *90 kV short pulse (40 msec) at end of RF for MSE*
- *Coherent Scattering Conditions*
  - *Inboard (~1.2 m)*

Total # shots: 12 (D) +12 (He) + shots for D-He changeover

Rest of experimental plan

- *To be decided after first day run (outboard measurements, density scan, RF+NBI)*