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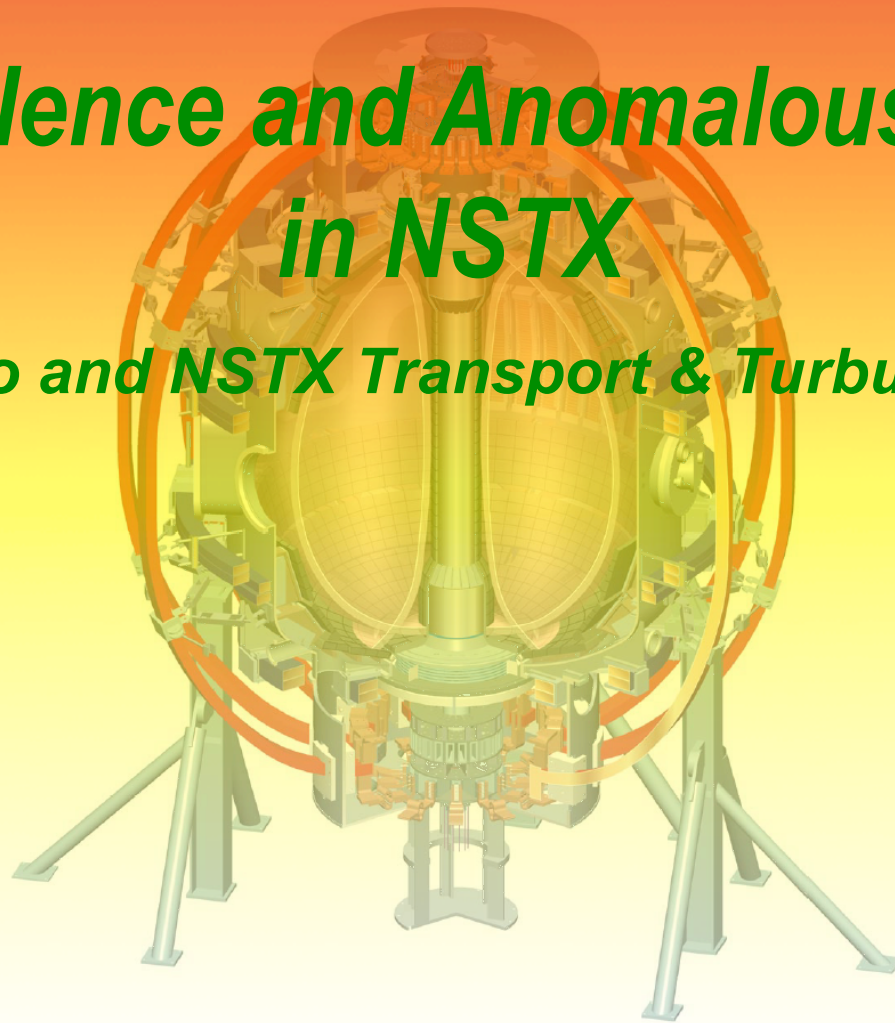


U.S. DEPARTMENT OF
ENERGY

Office of
Science

ETG Turbulence and Anomalous Transport in NSTX

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Introduction

- *Various theories and numerical simulations support the conjecture that anomalous electron transport may arise from a turbulence driven by the Electron Temperature Gradient (ETG)*
- *During the past three years, we have conducted a series of experiments indicating the existence of turbulent fluctuations with an electron gyro-scale*
- *However, while we have found some evidence that these fluctuations are indeed driven by the electron temperature gradient, we still do not know whether they are responsible for the anomalous electron transport in NSTX plasmas*
- *The goal of this proposal is:*
 - *collect further evidence on the ETG nature of these fluctuations*
 - *clarify their role in the transport of electron energy in NSTX*

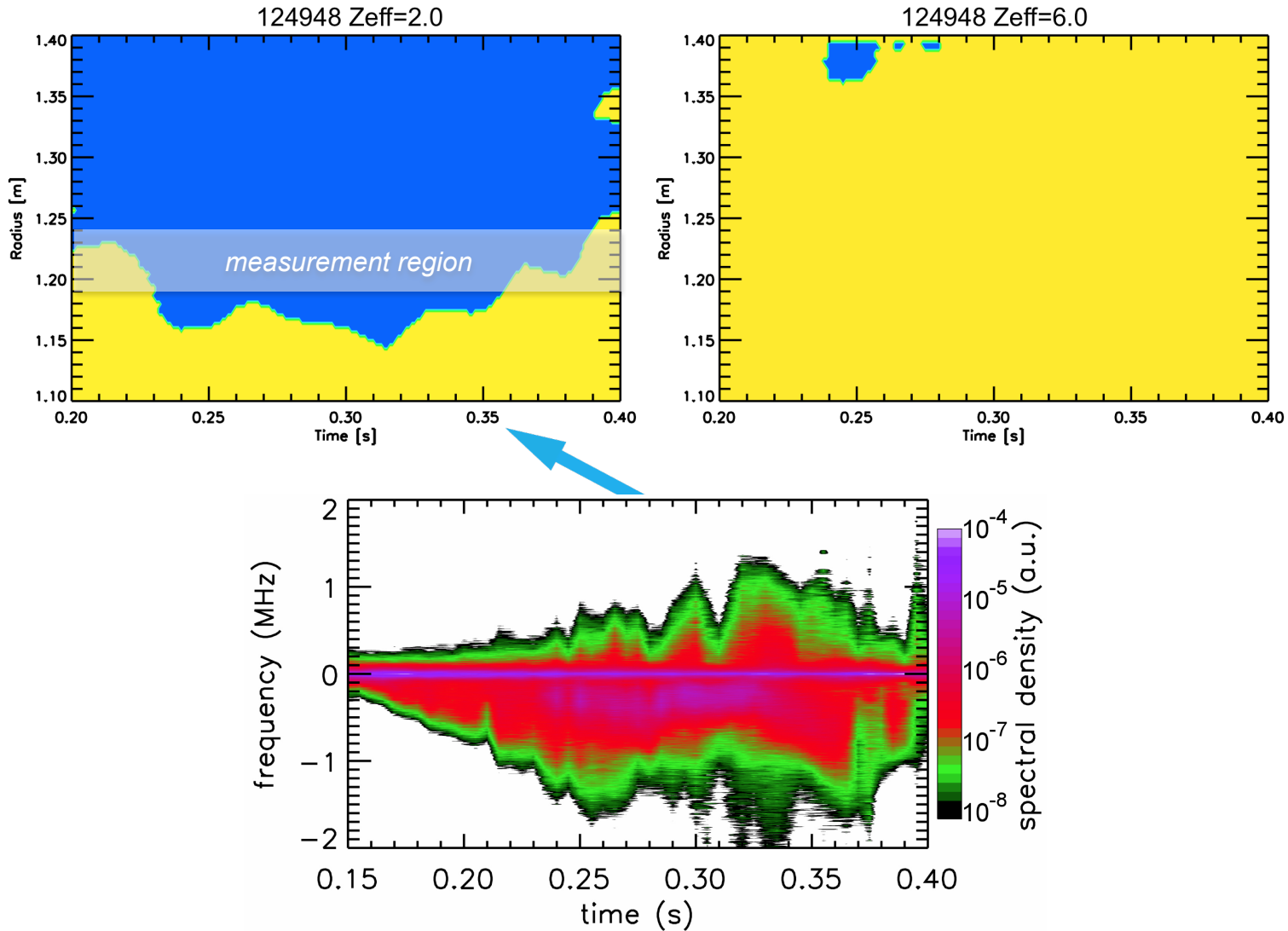
XP plan

- *Fluctuations measurements with both low and high k at different values of Z_{eff}*
- *Study correlation between changes in fluctuations and plasma transport*

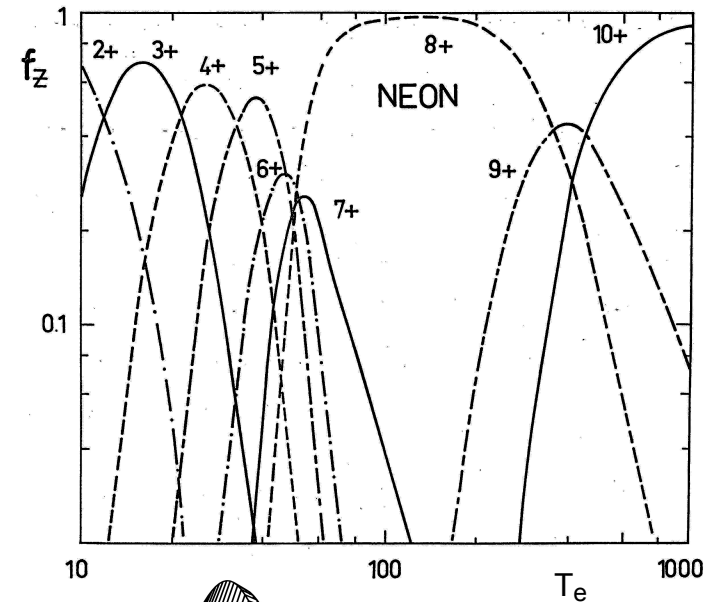
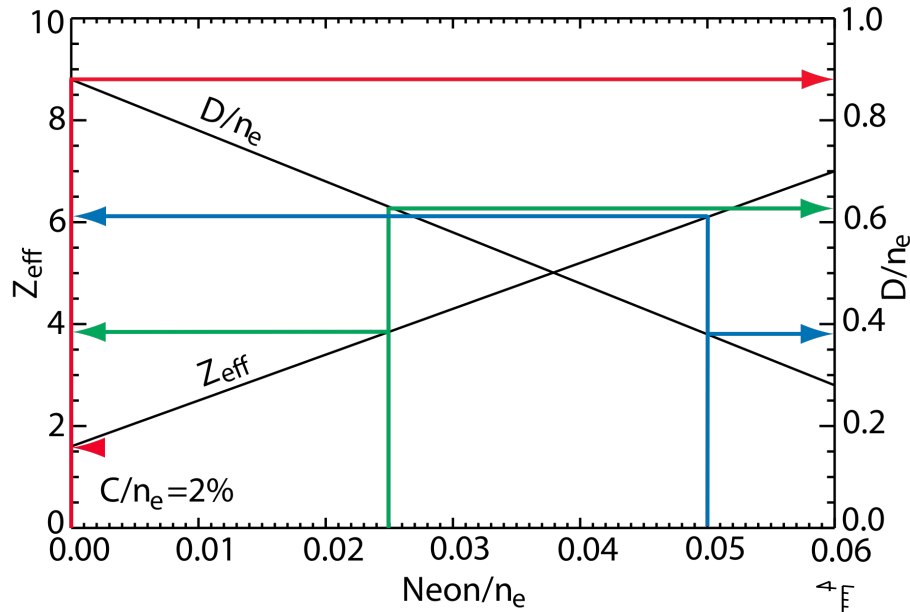
XP Justification

- XP stems from the the suppression of the ETG mode by large values of Z_{eff}

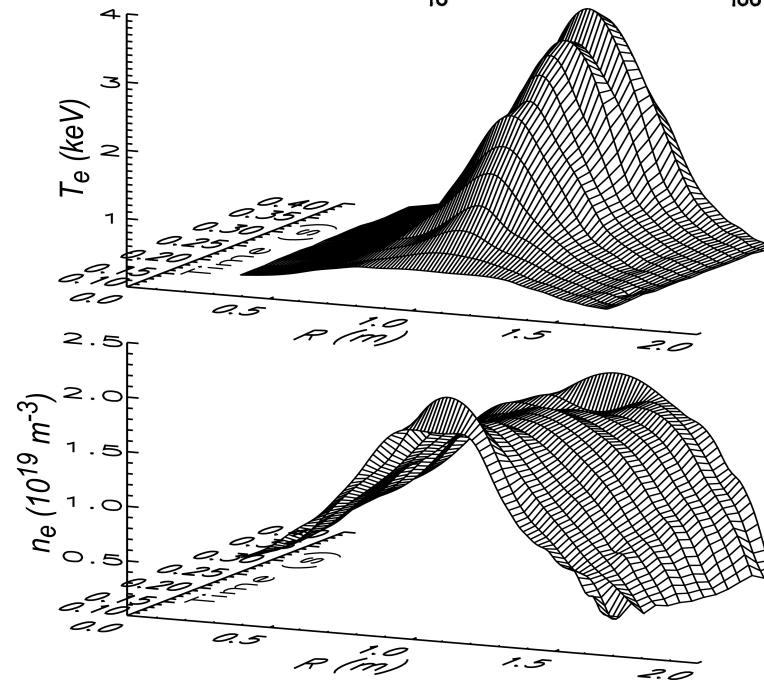
$$(R / L_{T_e})_{crit} = (1 + Z_{eff} T_e / T_i) (1.3 + 1.9s / q) (1 - 1.5\varepsilon)$$



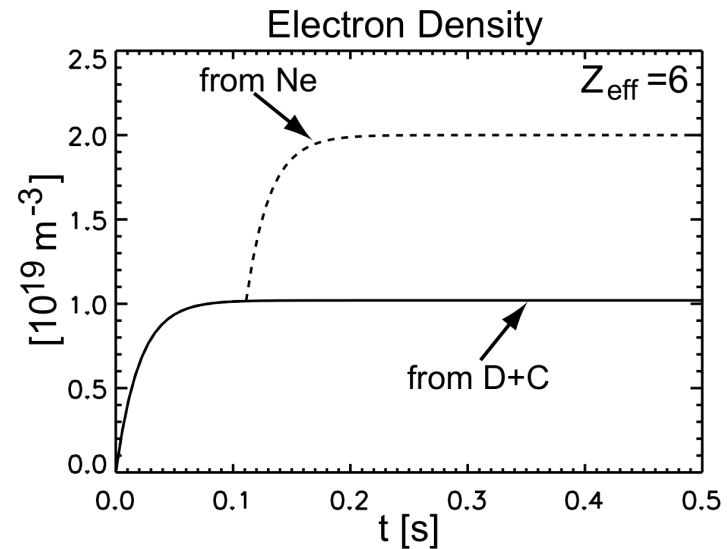
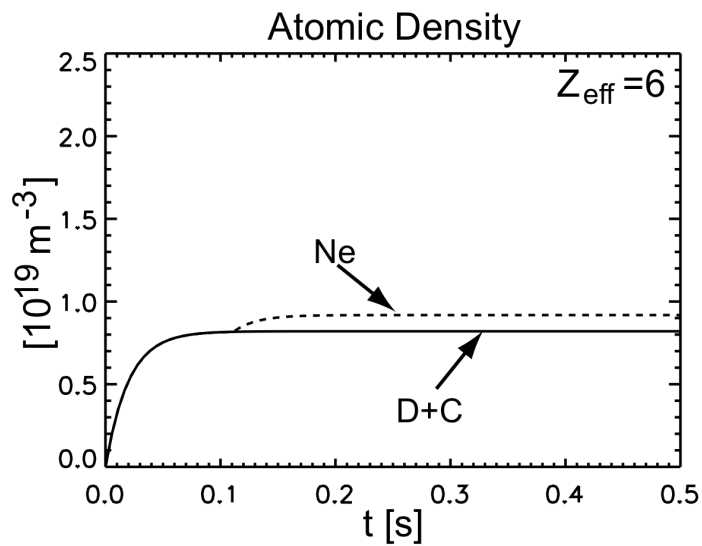
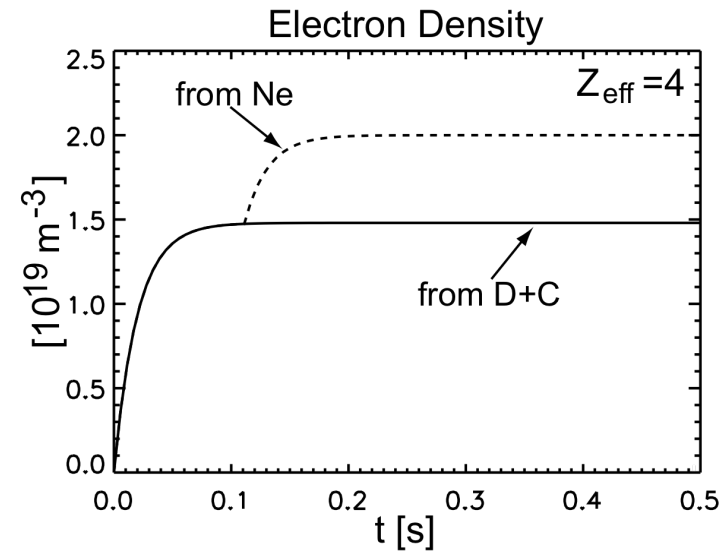
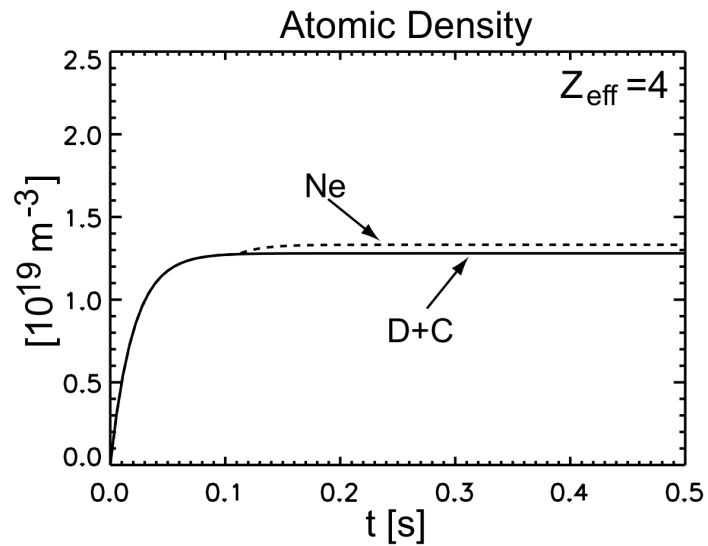
Change Z_{eff} by varying the concentration of Neon in D-plasmas



- Use of HHFW heating because of its ability to produce high T_e with peaked profiles



Atomic and electron densities with injection of Neon in D-plasmas



XP Plan

- *Experimental Run Plan*

- 1) Setup conditions of 124948 ($B_T=5.5$ kG, $I_p=700$ kA, $n_e L=1.5-2.0 \times 10^{19} \text{m}^{-2}$) using D_2 for both initial filling and gas injection (2 shots)
- 2) Increase P_{RF} in steps of 500 kW to maximum allowed (4 shots)
- 3) Perform fluctuations measurements at $R=1.20-1.25$ (3 shots)
- 4) Keeping the same electron density, add Neon injection with $Ne/D=0.04$ for $Z_{eff} \sim 4$ (2 shots)
- 5) Perform fluctuations measurements at $R=1.20-1.25$ (3 shots)
- 6) Increase injection ratio to $Ne/D=0.12$ for $Z_{eff} \sim 6$ (2 shots)
- 7) Perform fluctuations measurements at $R=1.20-1.25$ (3 shots)
- 8) Controlled access for changing scattering geometry (1/2 hour)
- 9) Perform fluctuations measurements at $R=1.35-1.40$ (3 shots)
- 10) Change injection ratio to $Ne/D_2=0.08$ as in 4) (2 shots)
- 11) Perform fluctuations measurements at $R=1.35-1.40$ (3 shots)
- 12) Change injection ratio to $Ne/D_2=0$ as in 1) (2 shots)
- 13) Perform fluctuations measurements at $R=1.35-1.40$ (3 shots)

- *Planned Analysis*

TRANSP, Turbulence Simulations (GYRO and/or GTS)

- *Planned Publications*

PRL, NF

Conclusion

- *Proposed XP has the potential for clarifying the role of ETG turbulence in anomalous electron transport in tokamaks*
- *XP should be scheduled after a successful high-power HHFW run*
- *Very likely, its implementation will require more run time than what was previously allocated (1/2 day)*