Z_{eff} and small-scale turbulence in NSTX

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- *Objective: change Z_{eff} by varying the concentration of Neon in a D-plasma*

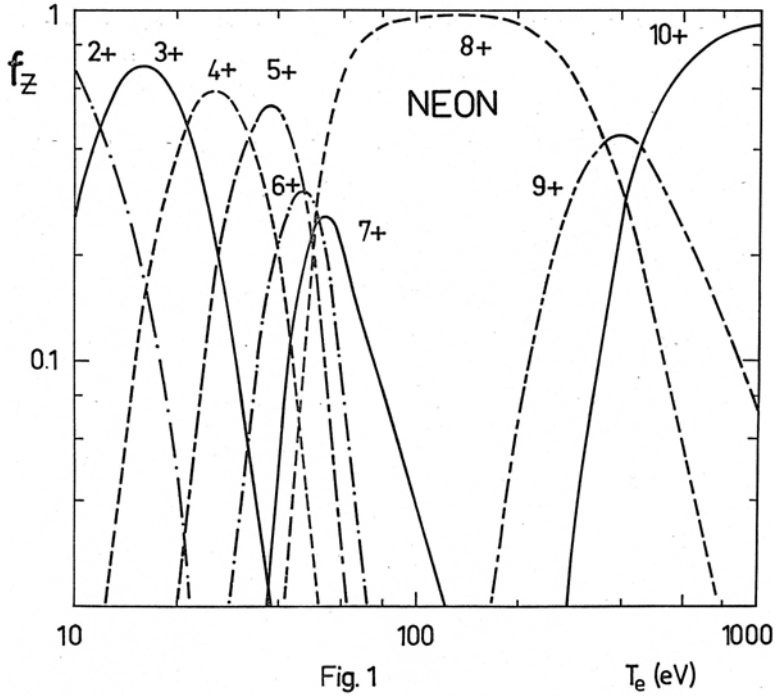
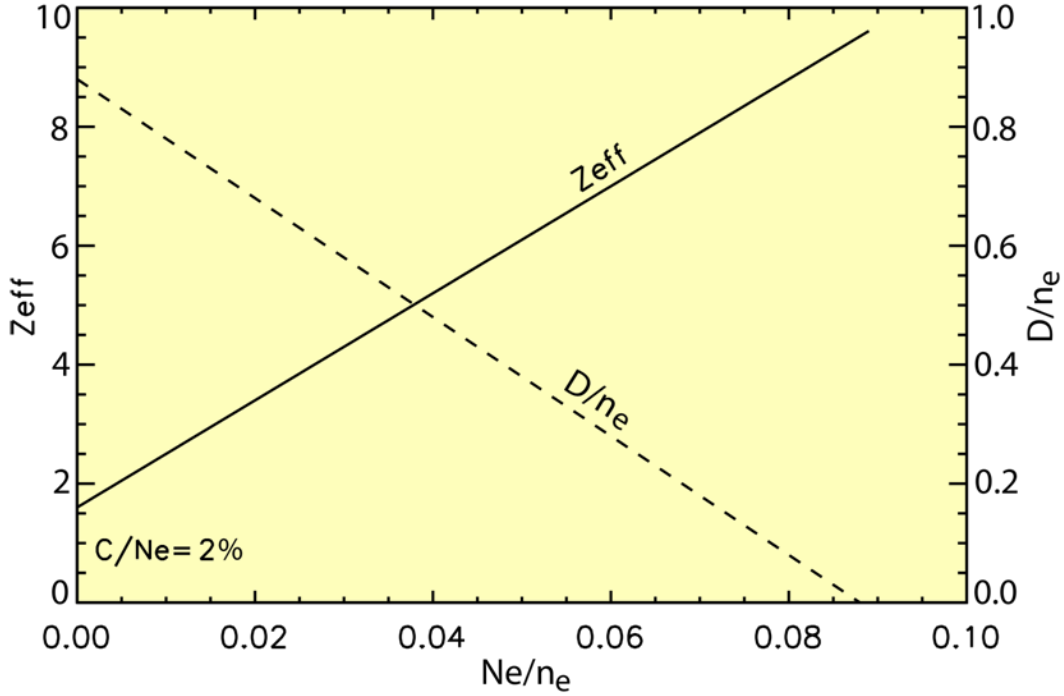


Fig. 1



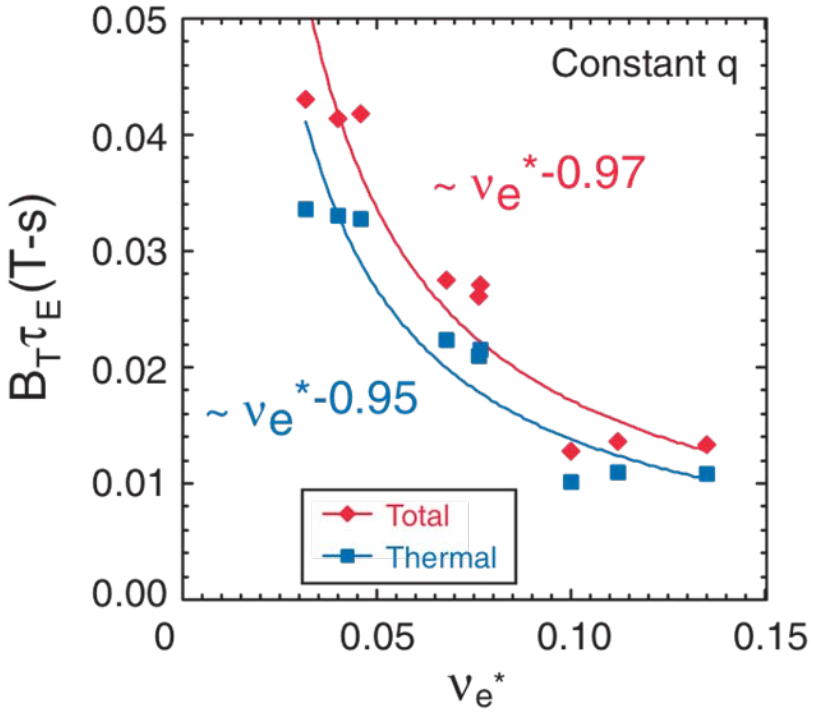
5% Neon + 2% Carbon result in Z_{eff} =6 and 40% Deuterium

Motivation:

1. *Previous measurements (Kaye et. al, NF 2007) indicate that the energy confinement time in NSTX scales like*

$$\tau_E \propto 1/\nu_e^*$$

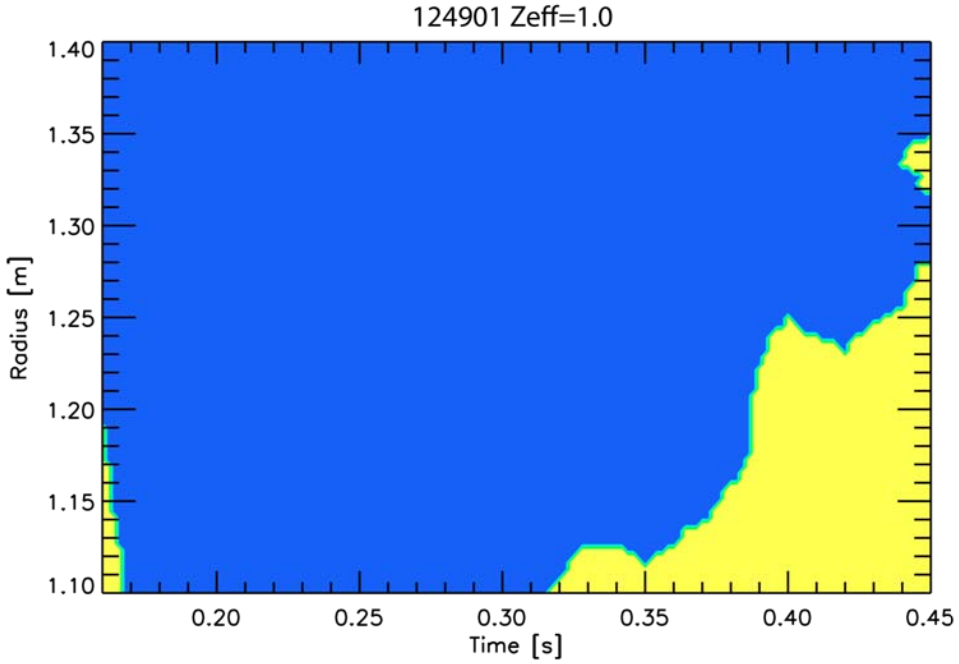
The proposed experiment will revisit these results



2. *The ETG mode is very sensitive to the value of Z_{eff}*

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

ETG is suppressed by large values of Z_{eff}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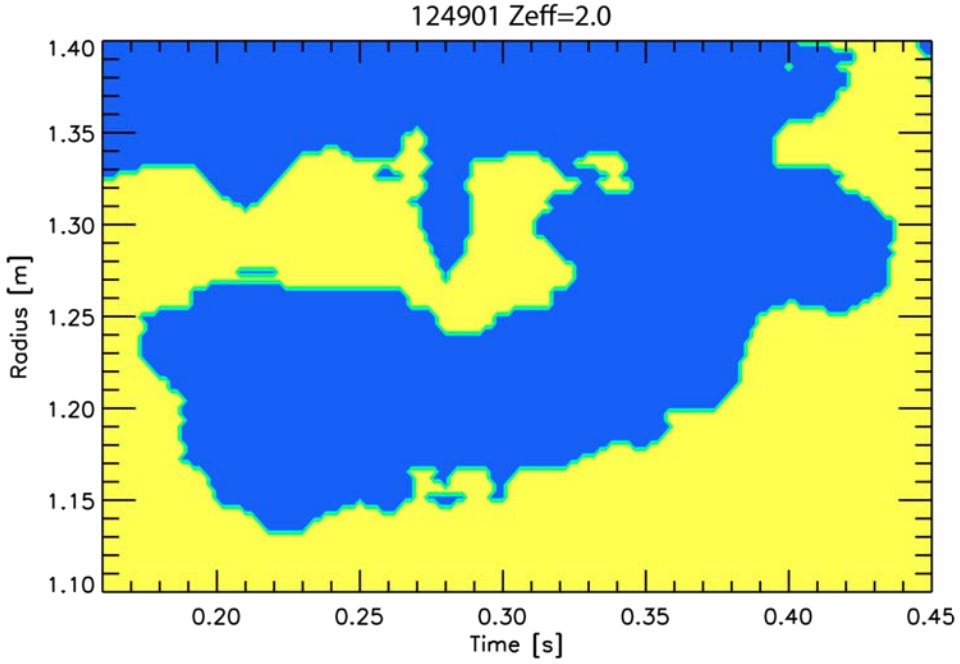
1.40
1.35
1.30
1.25
1.20
1.15
1.10
0.20
0.25
0.30
0.35
0.40
0.45
Time [s]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0.35
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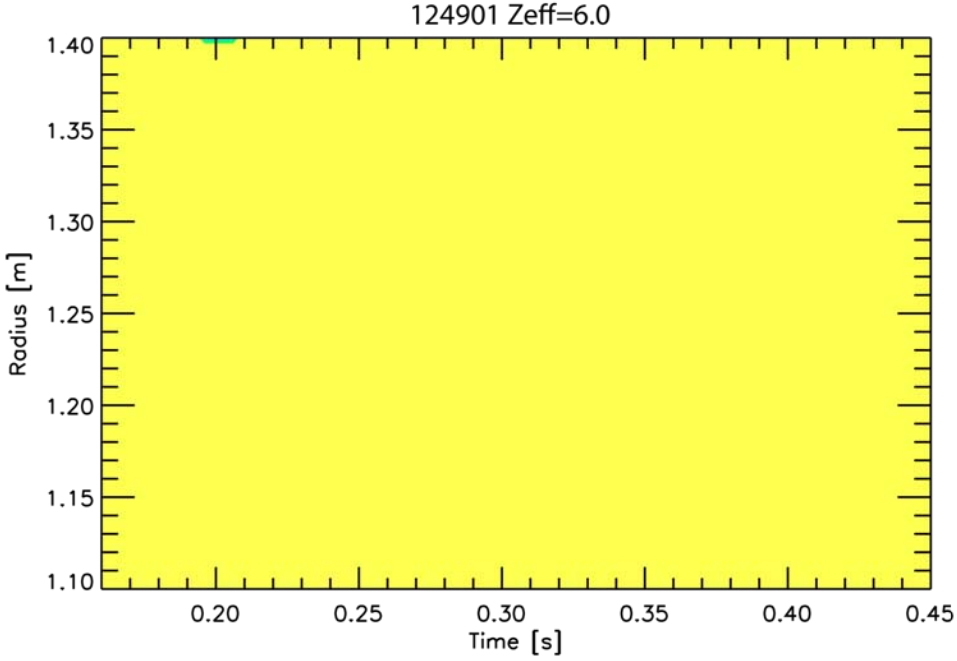
Time [s]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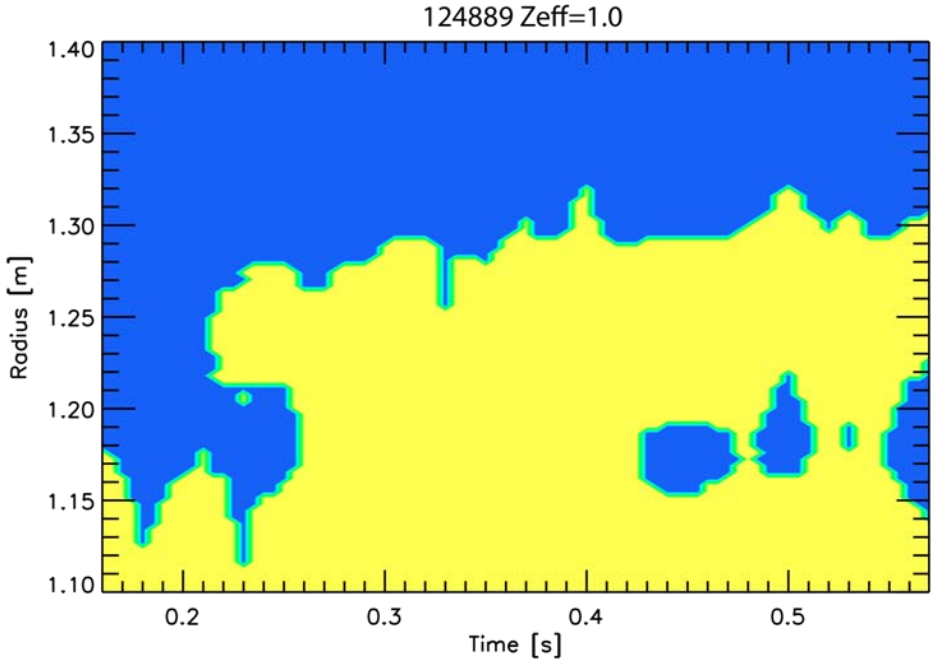
0.35
0.40
0.45
Time [s]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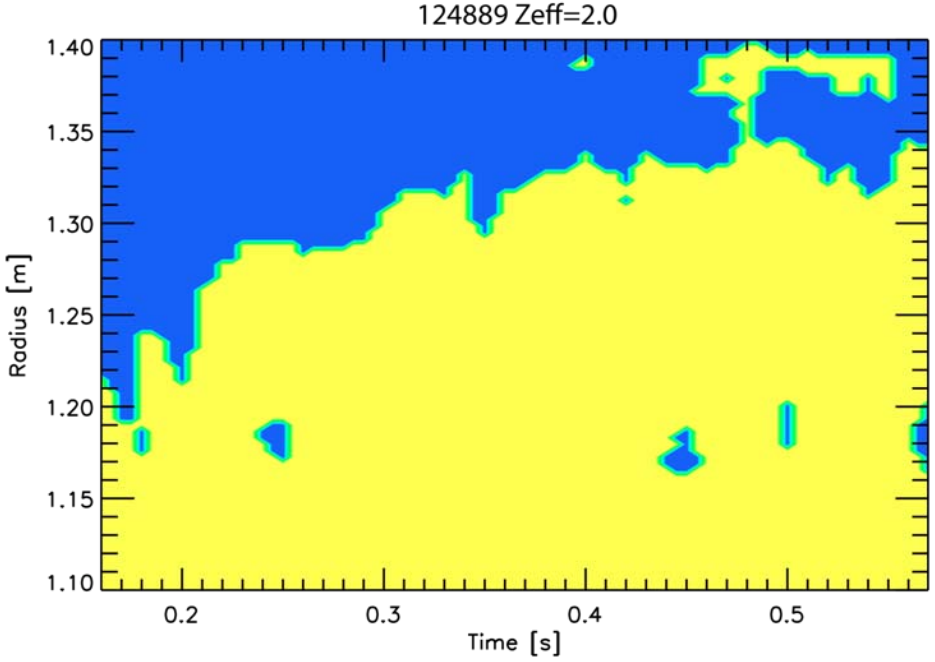
1.10
0.2
0.3
0.4
0.5
Time [s]


124889 Zeff=2.0
Radius [m]
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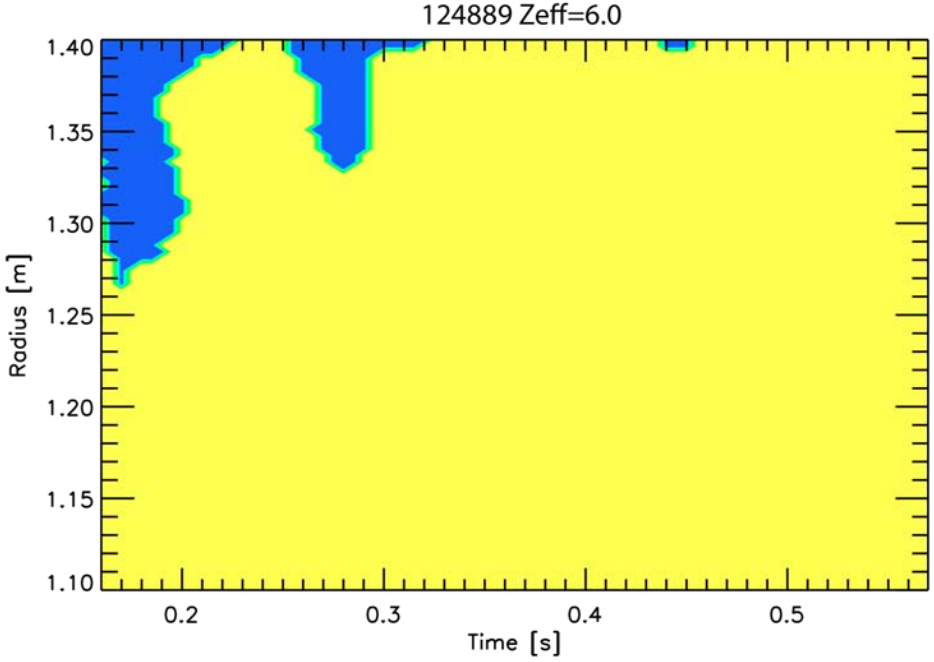
1.30
1.25
1.20
1.15
1.10
0.2
0.3
0.4
0.5
Time [s]


124889 Zeff=6.0
Radius [m]
1.40
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1.30
1.25
1.20
1.15
1.10
0.2
0.3
0.4
0.5
Time [s]

2. *The proposed experiment could add further evidence on the ETG nature of the observed high-k turbulence*

3. *The microtearing mode has linear growth rates ($\gamma_{lin} \propto \nu_e$) that seem to be in agreement with measured confinement times in NSTX (see 1).*
   Hence, since an increase in Z_{eff} should make microtearings more unstable, the proposed experiment could provide important information on the role of this phenomenon in plasma confinement.