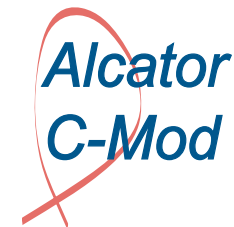


# Reflectometry measurements of turbulence in Alcator C-Mod plasmas



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## Outline:

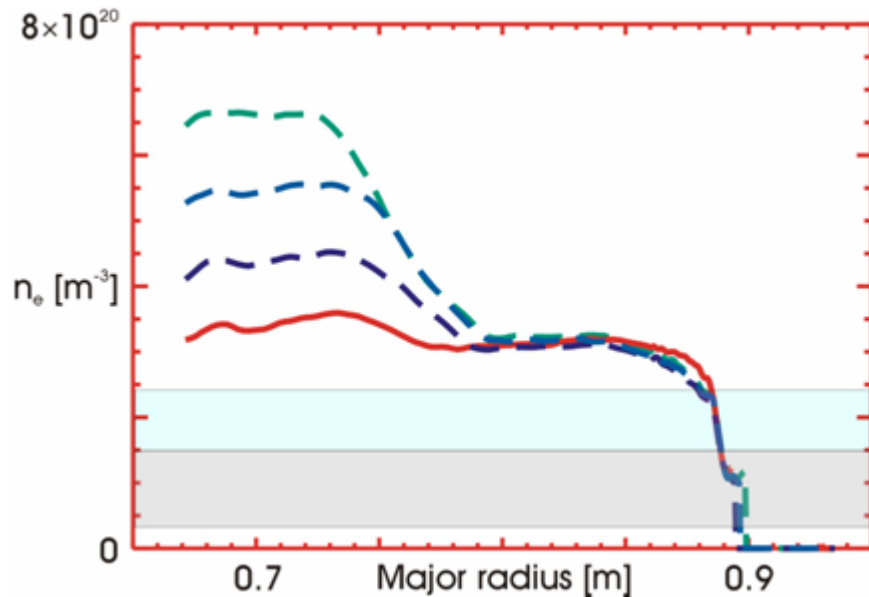
- **Reflectometer**
- **Discharges**
- **Analysis**
- **Conclusions**

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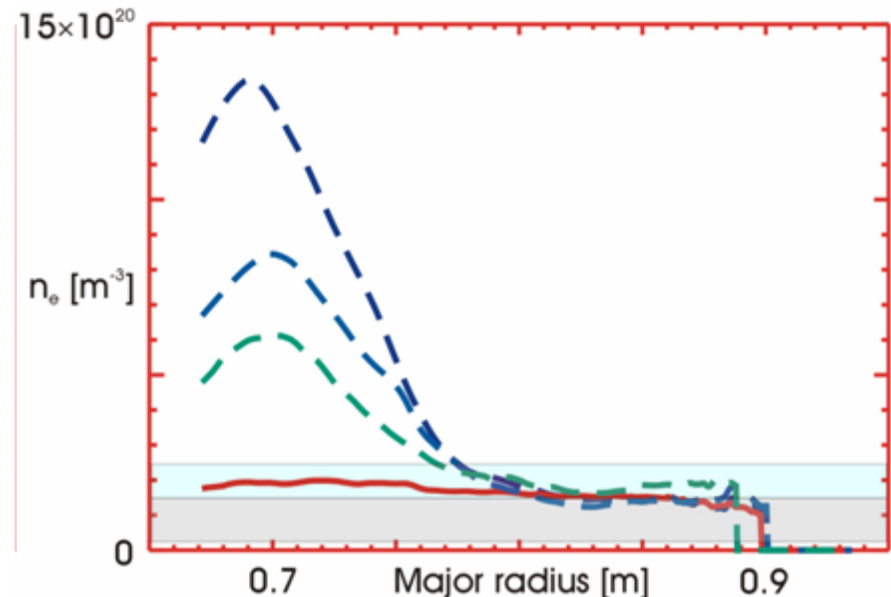


# Reflectometer

Off-axis ICRF internal transport barrier (ITB).



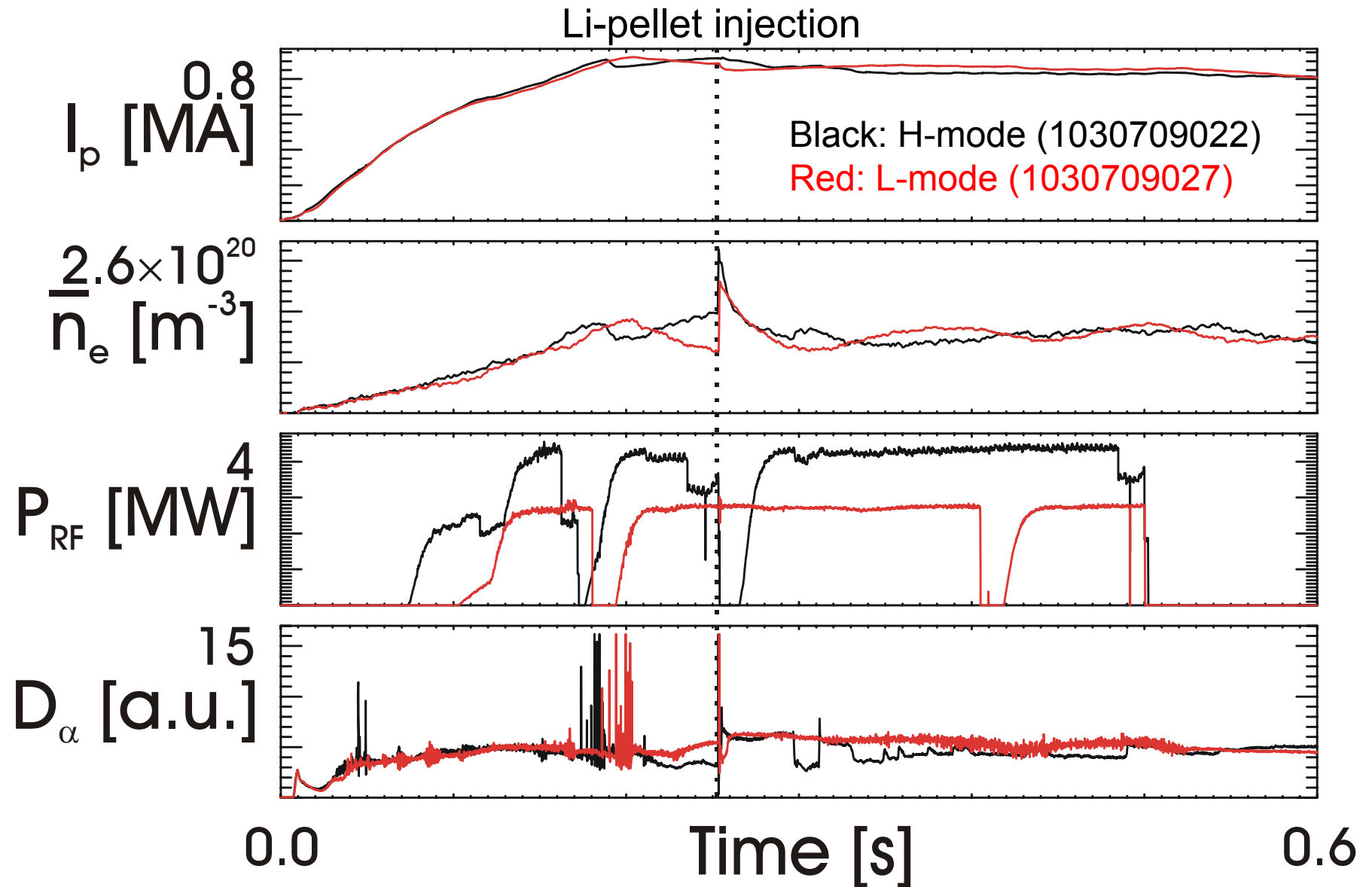
Pellet enhanced performance (PEP) mode.



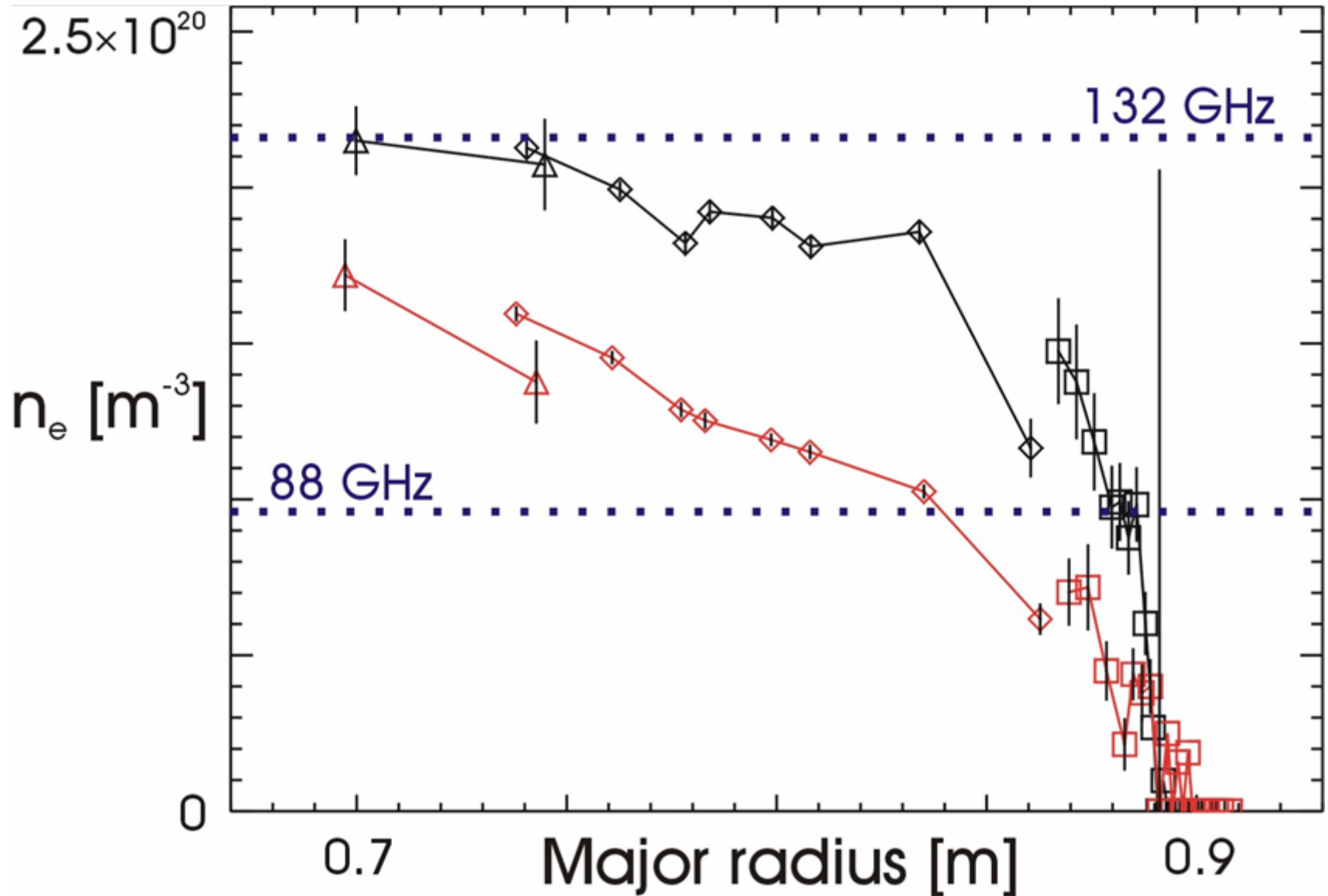
Grey: MIT system (5 channels), light blue: PPPL system (2 channels).

- Low frequency (50-110 GHz) system: Amplitude modulated, O-mode. The upper and lower sidebands are separately detected for the 88 GHz channel.
- High frequency (132-140 GHz) system: Dedicated fluctuation channels, have been brought into operation from May to July 2003.

# Discharge waveforms

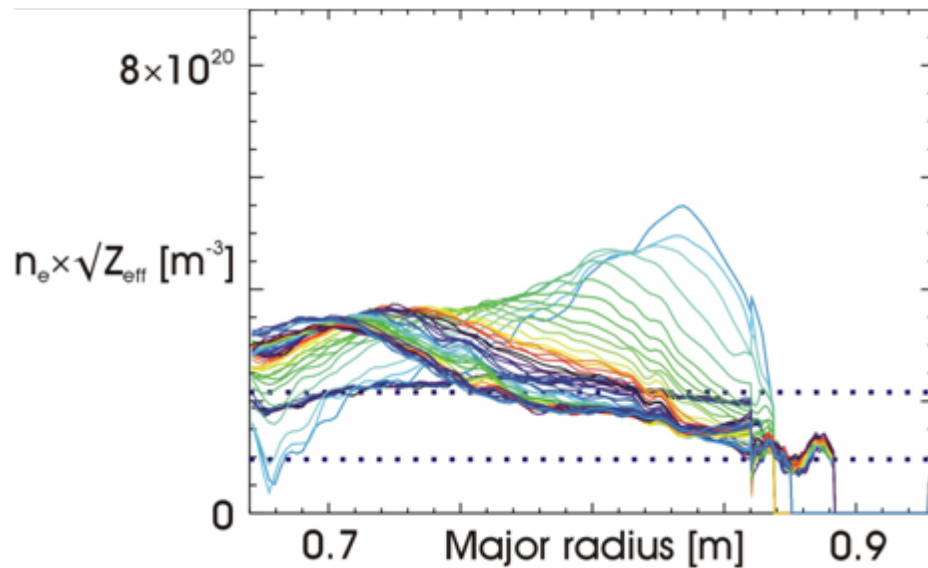


# Thomson density profiles

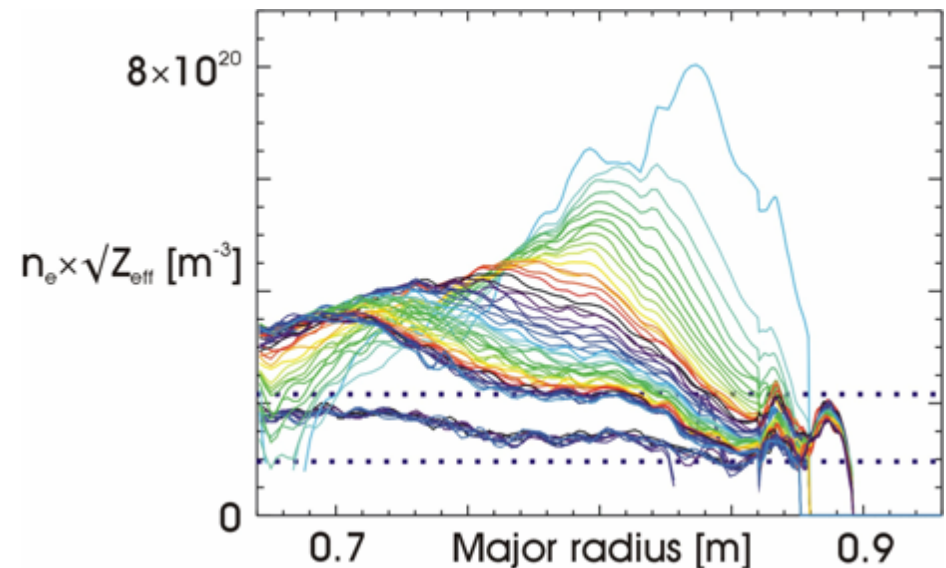


# Bremsstrahlung profiles

Visible bremsstrahlung profiles  
for pellet injection into H-mode.



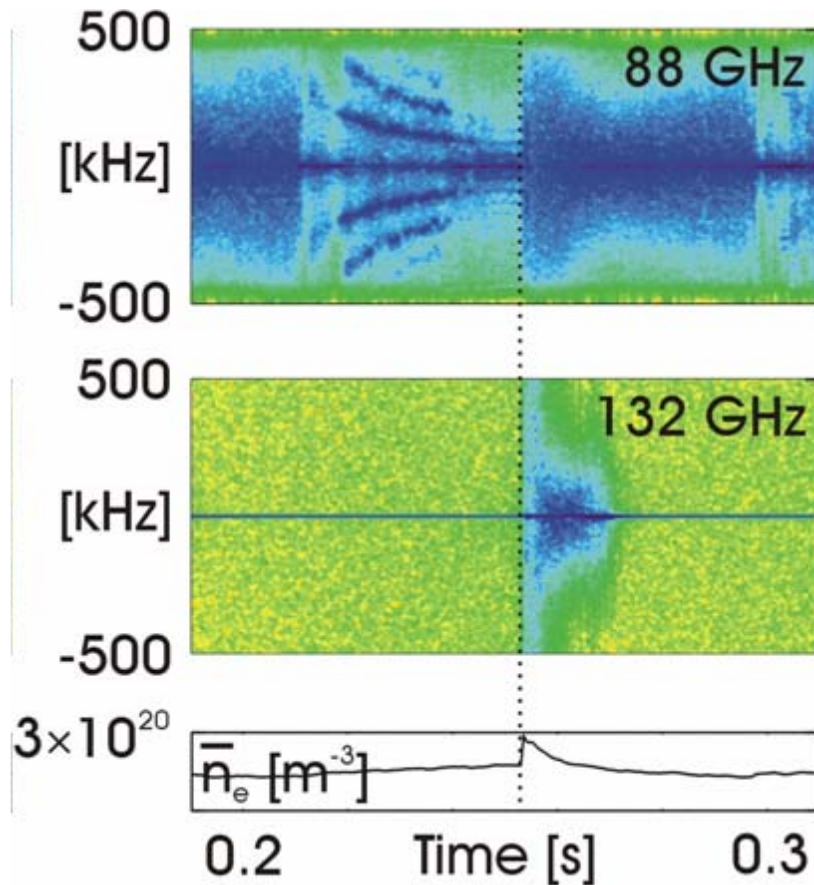
L-mode profiles.



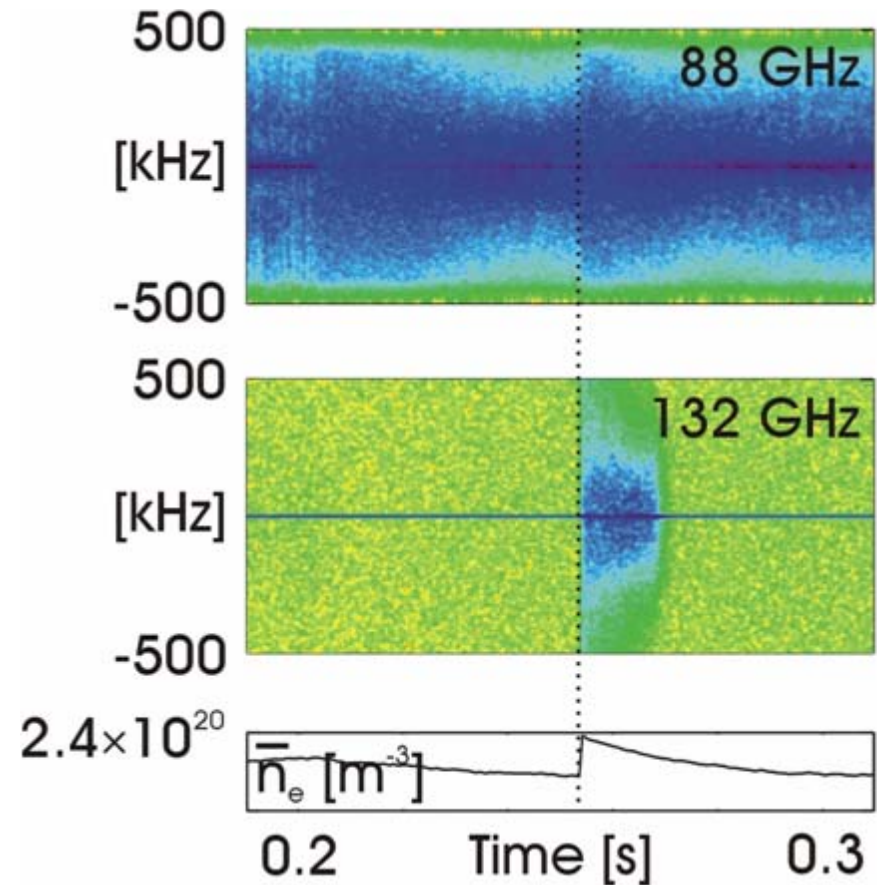
- Time resolution of profiles is 0.5 ms, spatial resolution is 1 mm.
- Pellet injection is from the low field side, close to the midplane.
- The Li-pellet has a size of  $1/2 \text{ mm}^3$  and a velocity of 800 m/s.
- Detection of ablation cloud by high-speed gated CCD camera.

# Spectrograms

Spectrograms of two reflectometer channels for the H-mode shot.



Spectrograms for the L-mode shot.

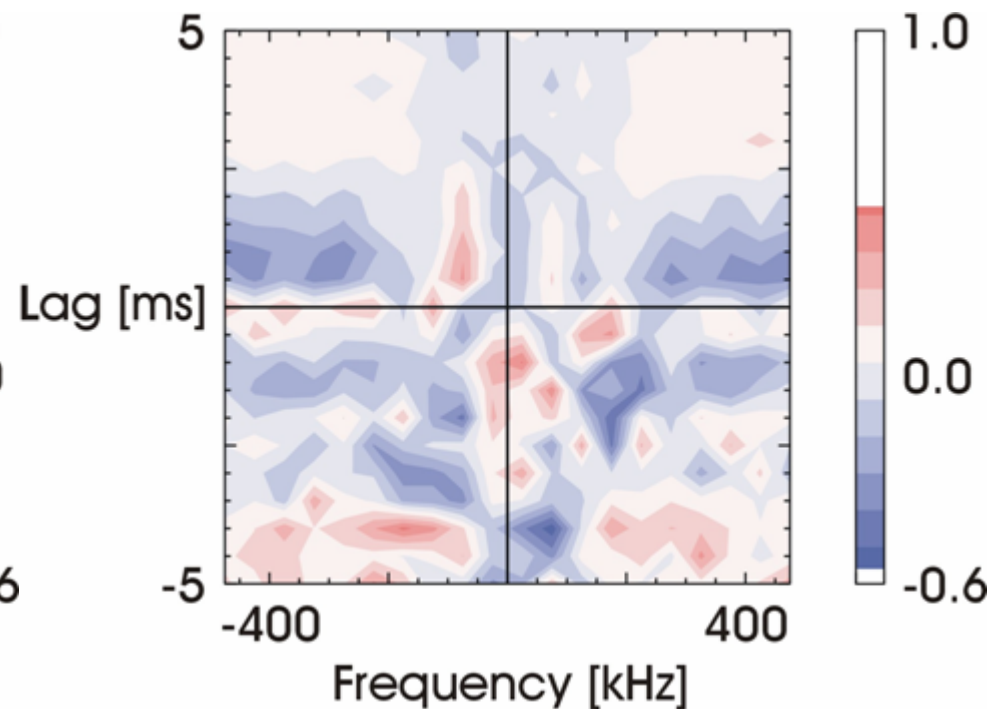
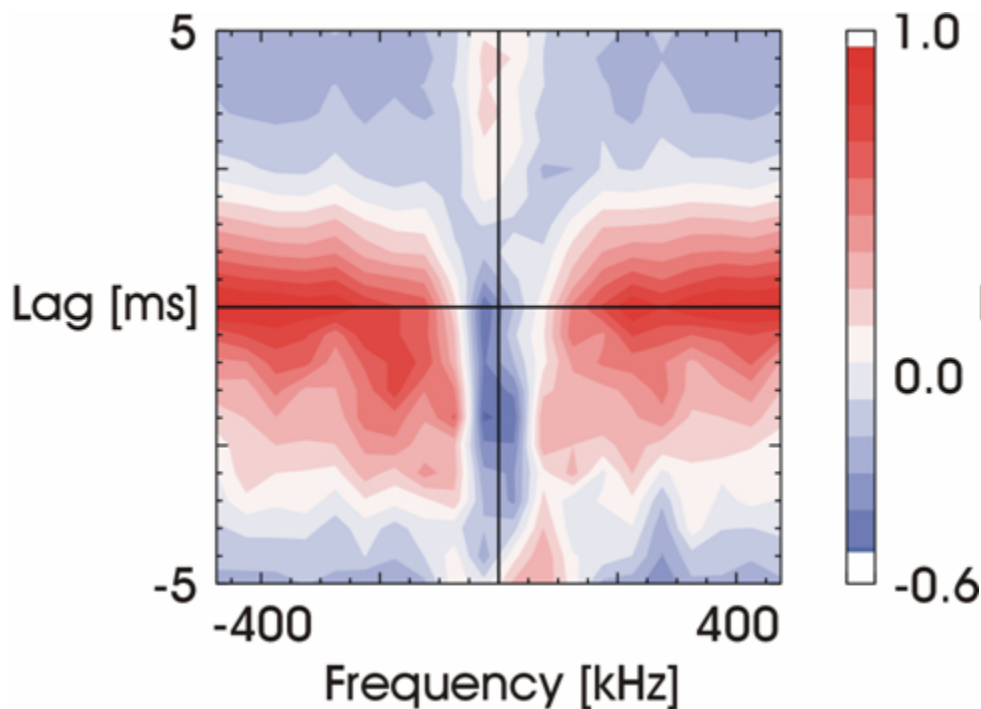


The 132 GHz signal disappears when the density decays below cutoff.

# Cross correlations

Cross correlation between rms magnetic fluctuations and 132 GHz reflectometer band autopowers for the H-mode shot. Band resolution 50 kHz, time resolution 0.5 ms.

Cross correlation for the L-mode shot.



Positive (negative) time lag: Density fluctuations occur before (after) the magnetic fluctuations.

# Conclusions

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First turbulence measurements from two new high frequency reflectometer channels have been made in Alcator C-Mod.

We have studied two discharges where Li-pellets were injected:

- Density perturbation decays in roughly 15 ms.
- 132 GHz signals almost identical for the two shots: Core fluctuations low frequency compared to edge fluctuations.
- Correlations with magnetic fluctuations show that density and magnetic fluctuations are strongly (weakly) correlated for the shot initially in H- (L-) mode.

Future analysis and upgrades:

- Non-RF heated plasmas display a stronger density peaking and a slower decay, about 30 ms, in response to pellet injections.
- Correlation analysis will be extended to include phase-contrast imaging, D-alpha, correlations between reflectometry channels et cetera.
- Reflectometer will be upgraded to a 'pure' fluctuation diagnostic (removal of amplitude modulation).