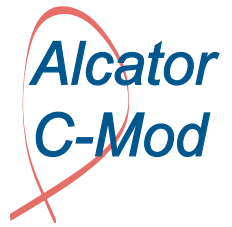


# Vanilla turbulence seen by PCI in L- and EDA H-mode

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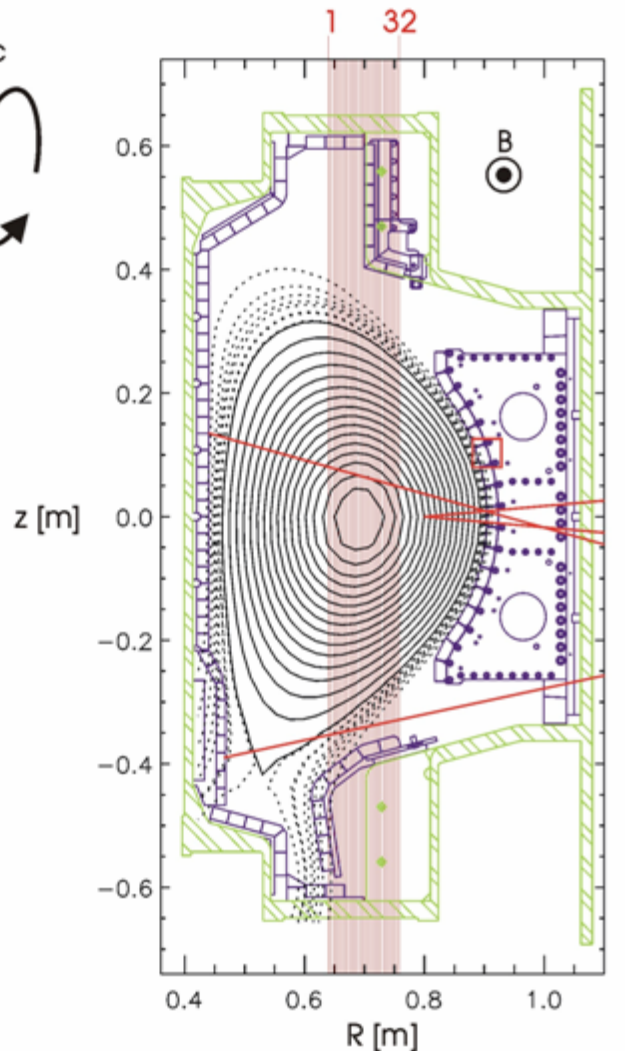
<sup>3</sup>*KFKI-RMKI, Hungary*

**C-Mod meeting**  
**4th of October 2004**



# Phase-contrast imaging

electron  
diamagnetic  
drift  
direction

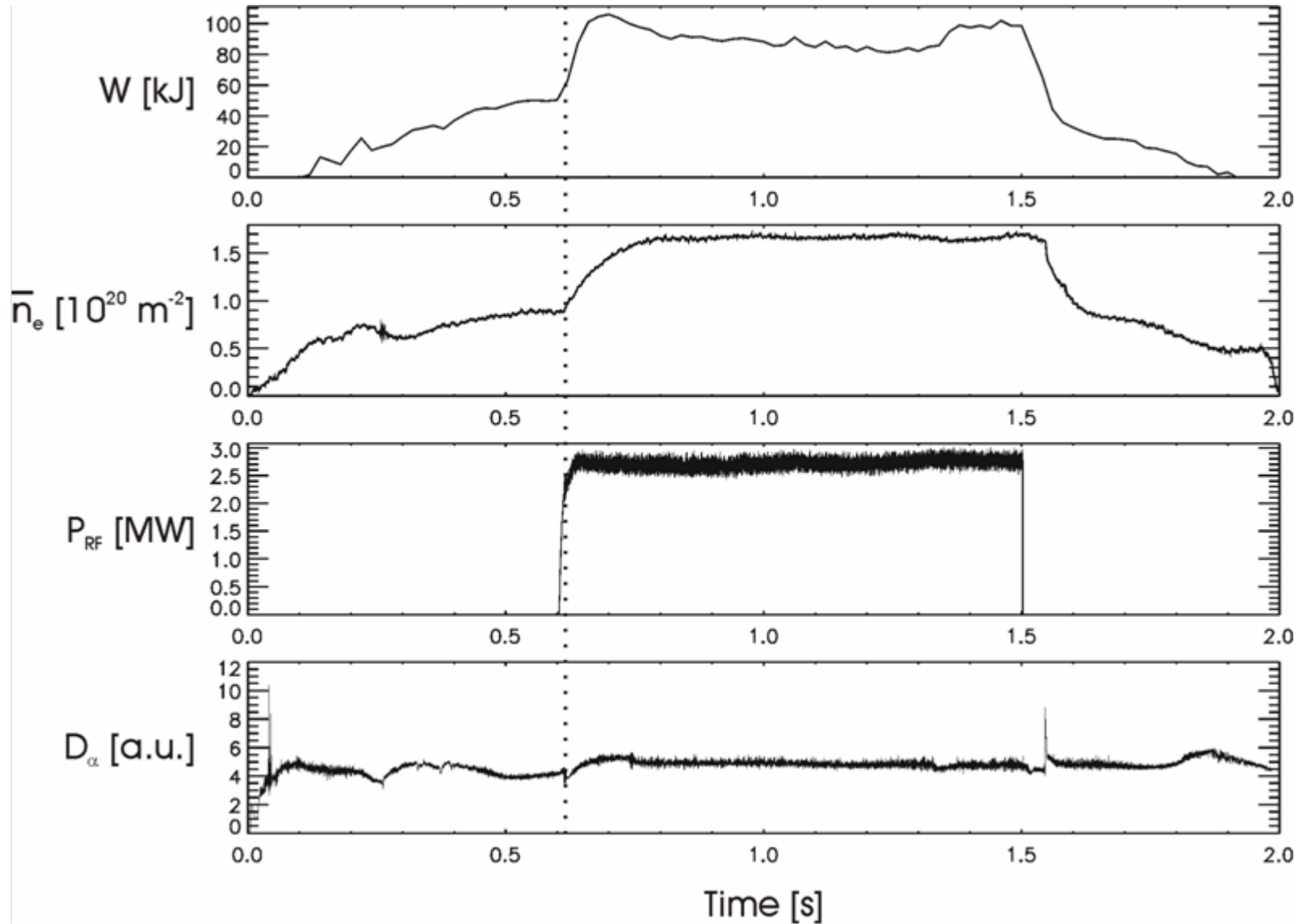


- Measures line integrated electron density fluctuations along 32 vertical chords.
- Sensitive to turbulence from 0.6 to 16.8 cm<sup>-1</sup>.
- Radiation source is a 25 W CO<sub>2</sub> laser, wavelength 10.6 μm.
- A phase plate converts phase fluctuations to intensity fluctuations.
- Detector is a LN<sub>2</sub> cooled linear array of photoconductive elements.
- D<sub>α</sub>-light diode viewing inner wall.
- Poloidal magnetic field probe on outboard limiter.

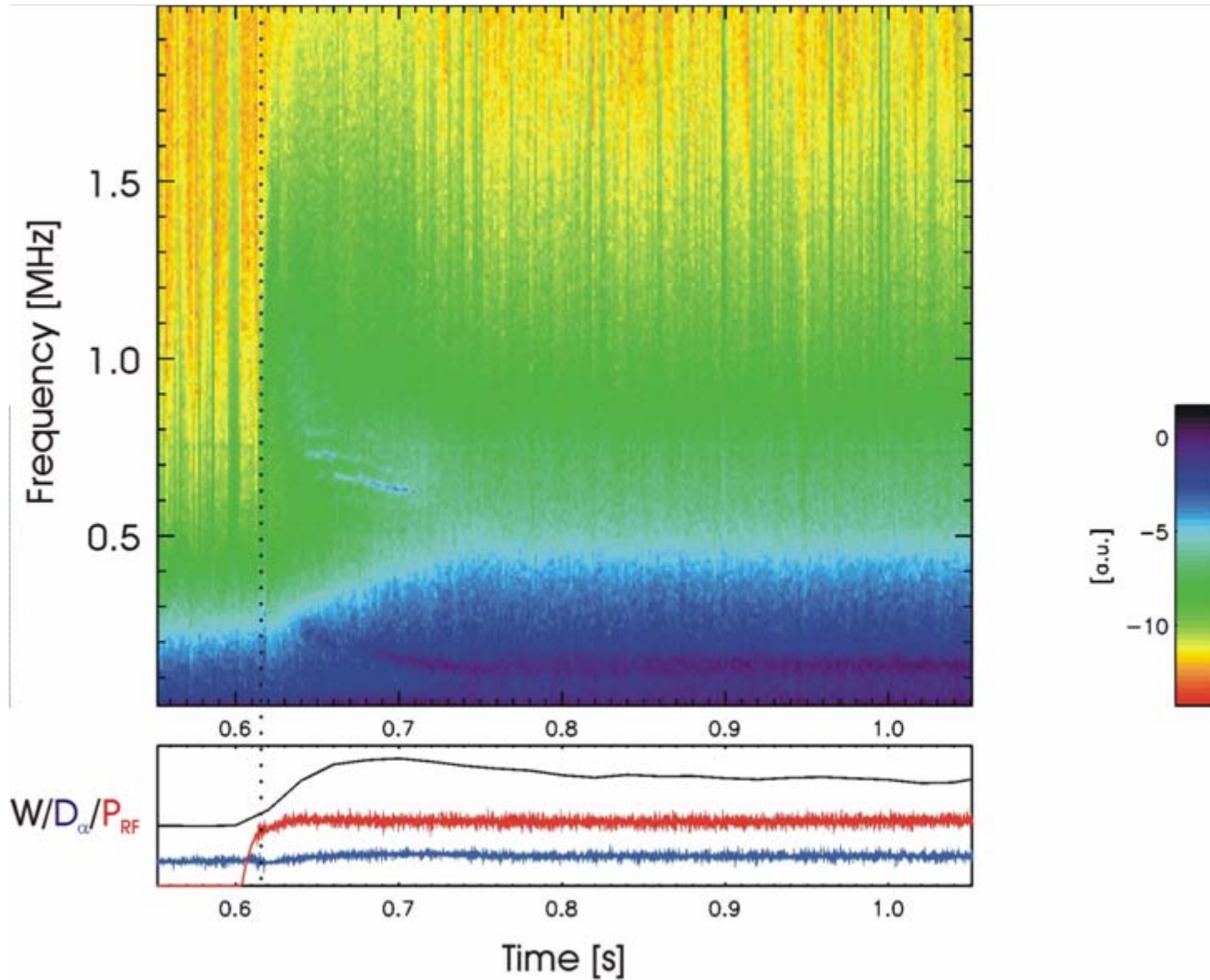
# L- to EDA H-mode transition

## shot 1040310007

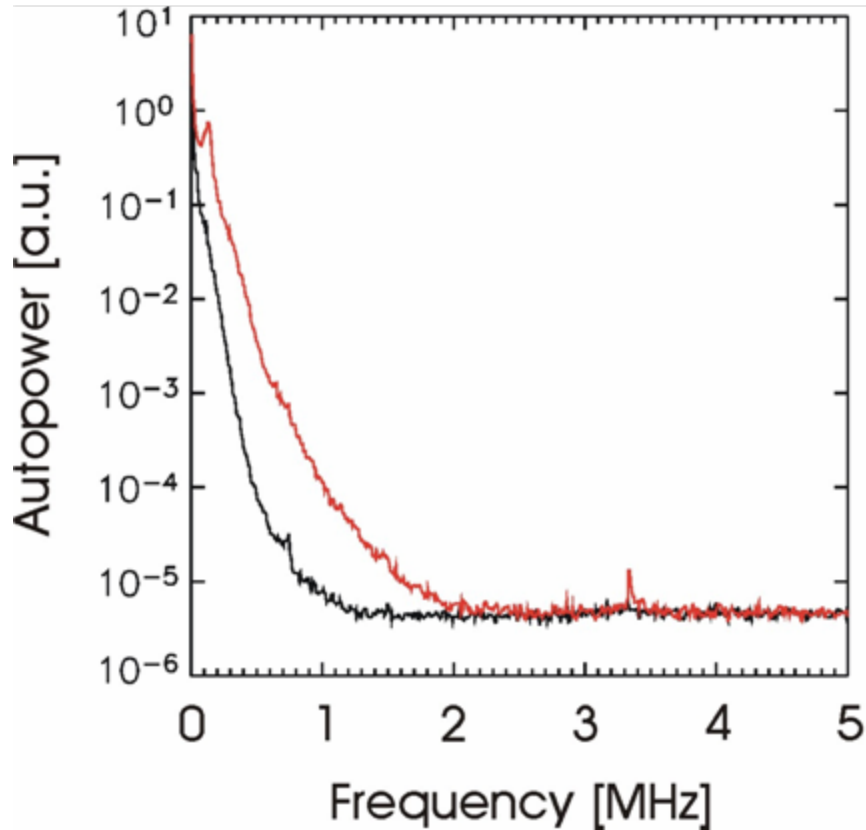
Alcator  
C-Mod



# Spectrogram core channel

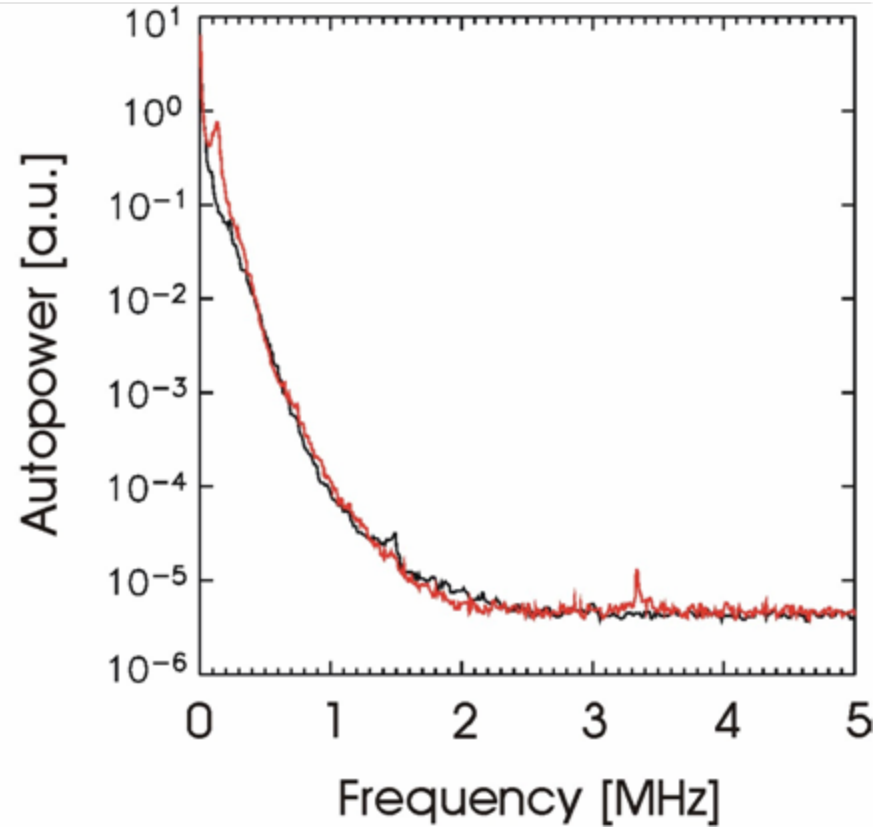


# Autopower spectra core channel



Black is L-mode

Red is EDA H-mode

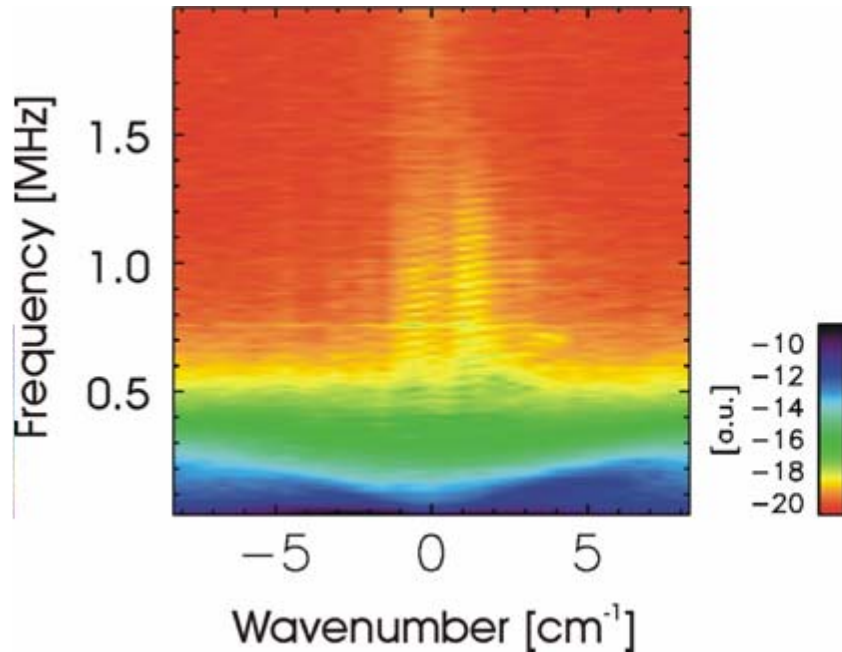


Black is L-mode,  
frequencies multiplied by two.

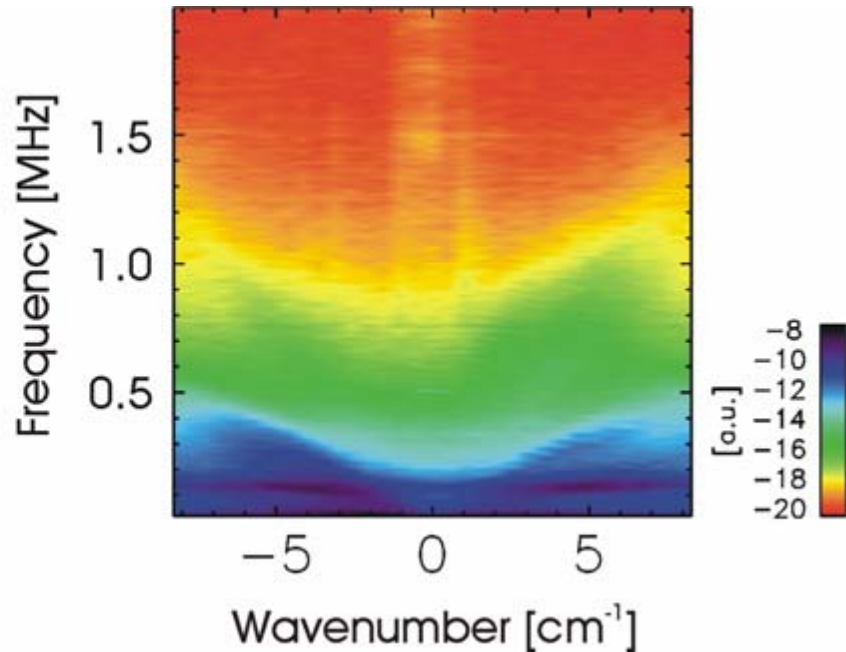
Red is EDA H-mode

# Frequency-wavenumber spectra

L-mode

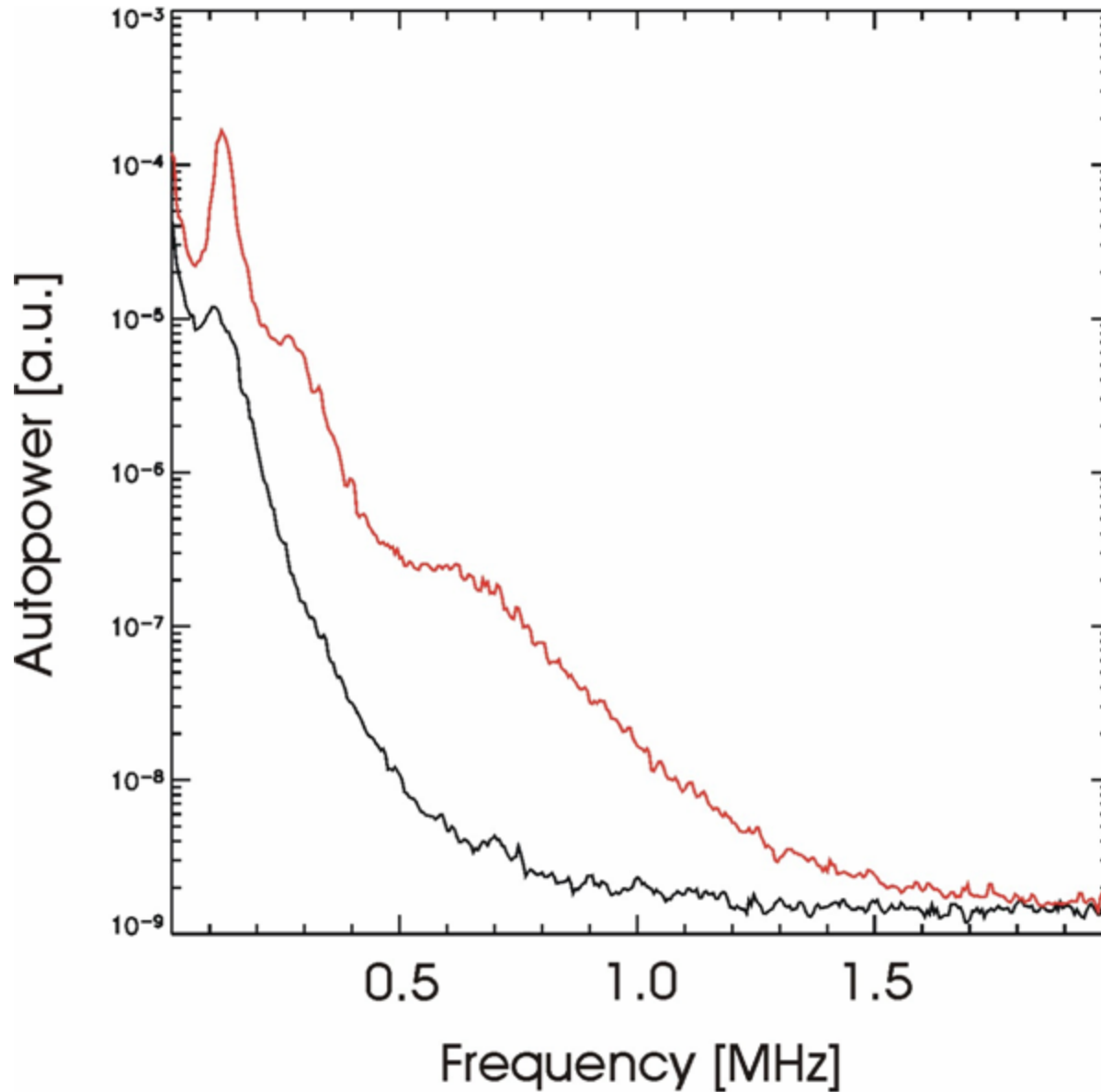


EDA H-mode



- By performing 2D Fourier transforms on the PCI data from all 32 channels, we arrive at frequency-wavenumber spectra.
- The largest increase in frequency coverage from L- to EDA H-mode is at large wavenumbers.
- Negative (positive) wavenumbers are due to fluctuations travelling outward (inward) parallel to the major radius.

# Autopower spectra all channels

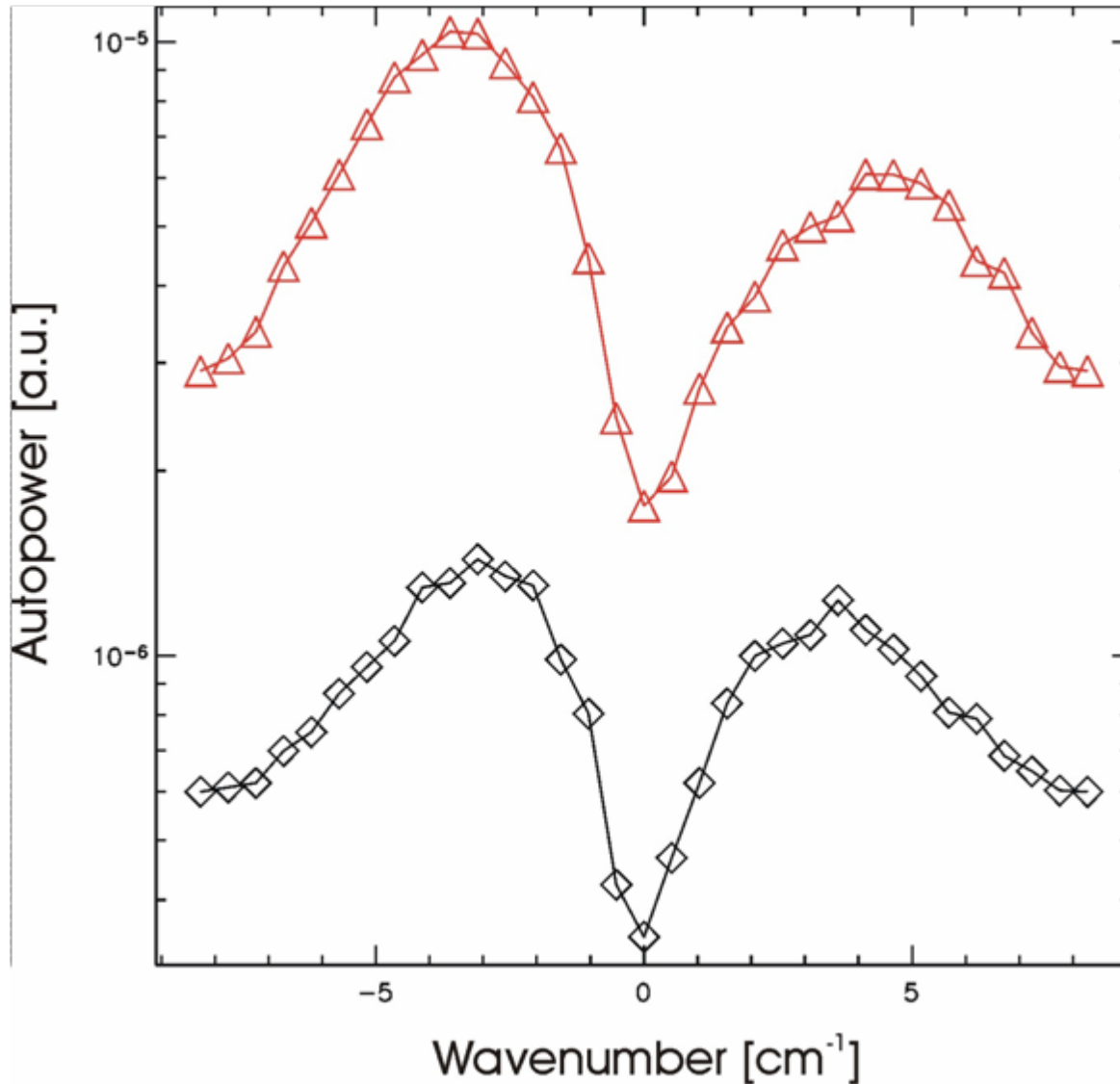


Wavenumber is  $4.7 \text{ cm}^{-1}$

Black is L-mode

Red is EDA H-mode

# Autopower-wavenumber spectra



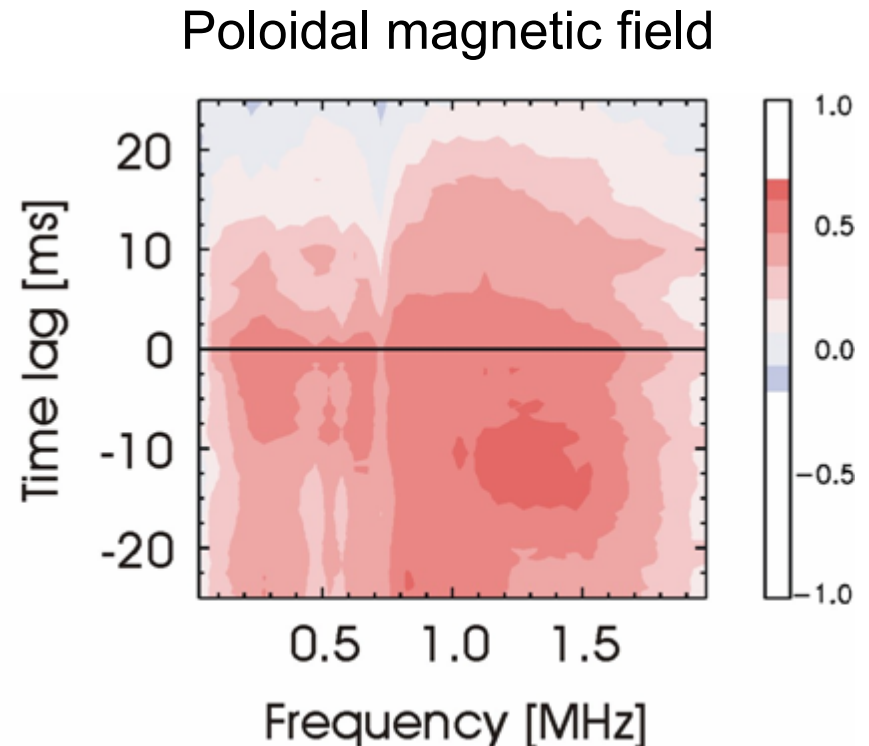
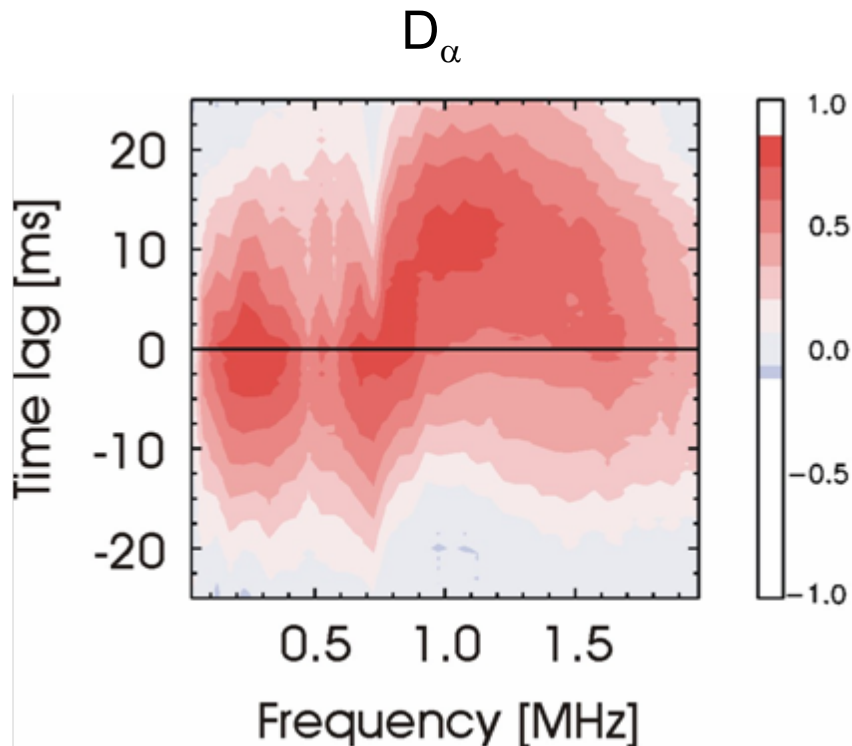
Integrating fluctuations over all frequencies we can plot wavenumber spectra for L- and EDA H-mode.

Black diamonds are L-mode.

Red triangles are EDA H-mode.



# Correlation between PCI and $D_\alpha$ /poloidal magnetic field



Cross correlation between rms  $D_\alpha$ /poloidal magnetic field fluctuations and PCI band autopowers. Band autopower resolution 50 kHz, time resolution 0.5 ms.

Positive (negative) time lag:  
PCI fluctuations occur before (after)  
the  $D_\alpha$ /poloidal magnetic field  
fluctuations.