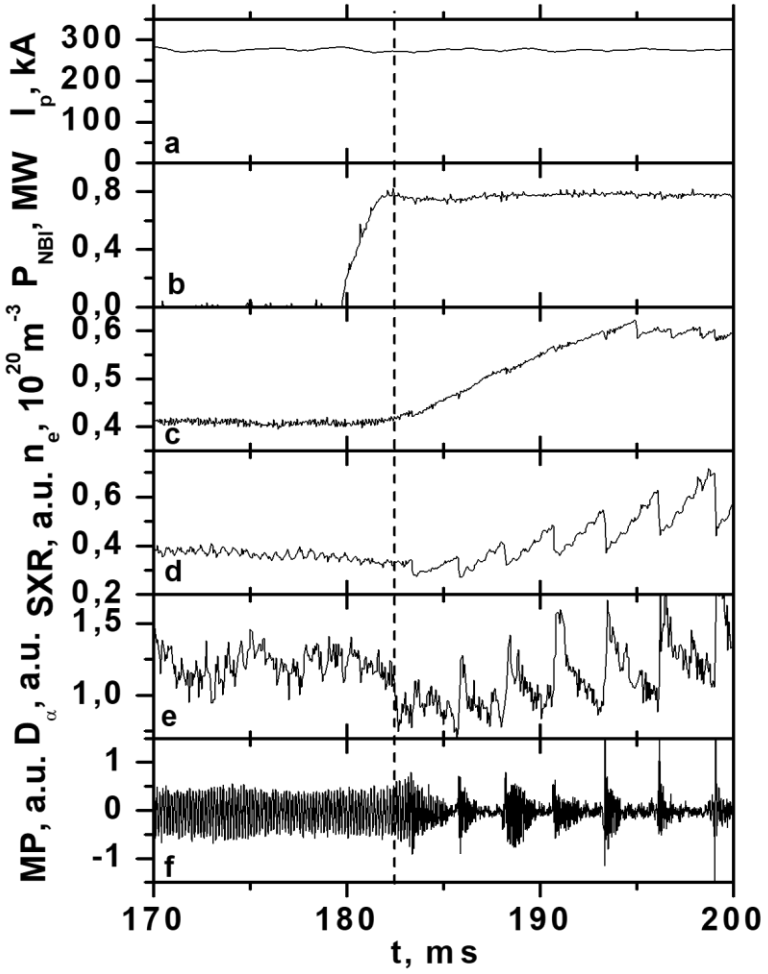
FIRST OBSERVATIONS OF THE TRANSITION TO H-MODE ON THE GLOBUS-M2 TOKAMAK USING DOPPLER BACKSCATTERING

A.YU. YASHIN, V.V. BULANIN, V.K. GUSEV*, G.S. KURSKIEV*, V.B. MINAEV*, M.I. PATROV*, A.V. PETROV, YU.V. PETROV*, A.M. PONOMARENKO

Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia
* Ioffe Institute, St. Petersburg, Russia

Email: alex_yashin@list.ru

H-MODE ON GLOBUS-M2



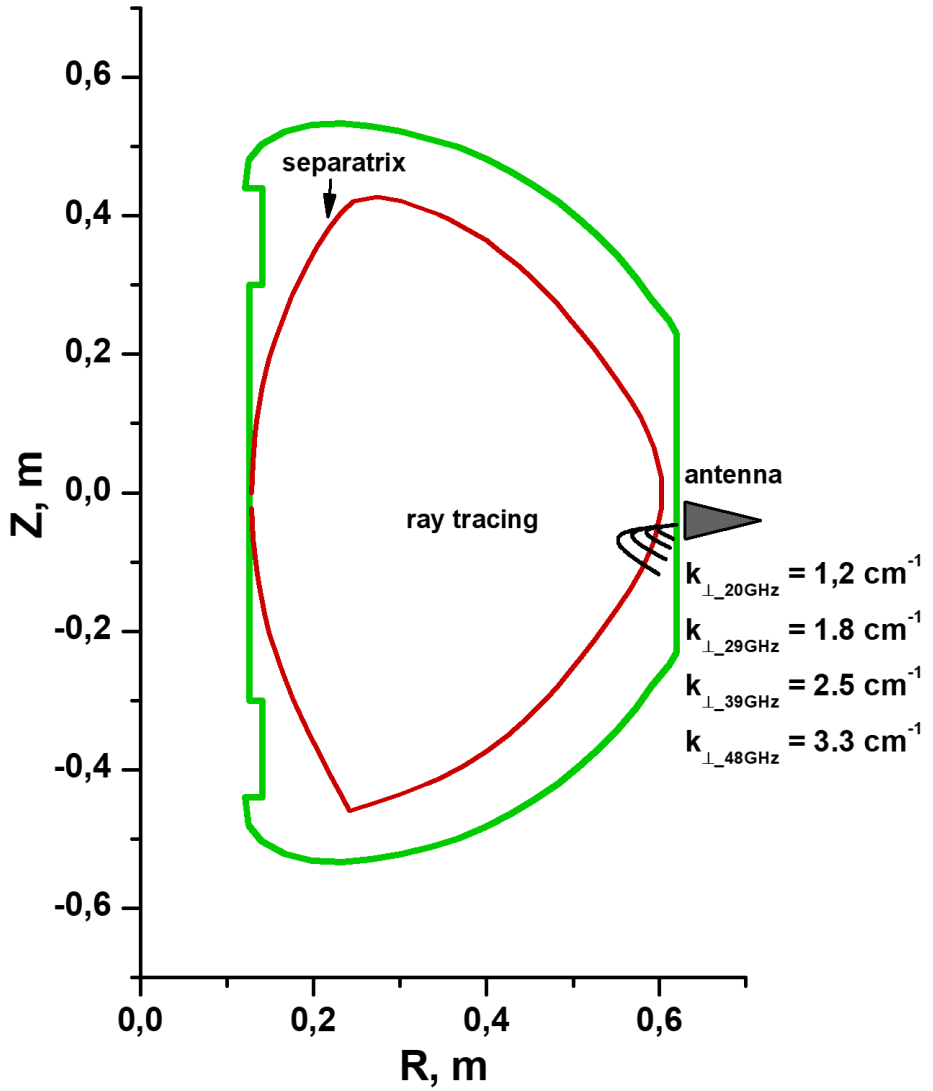
Globus-M2 parameters:

- Bt = 0.7 T
- Ip = 280 kA
- $\langle n_e \rangle = (3\text{-}6)\cdot 10^{19}$ m^{-3}

H-mode indicators:

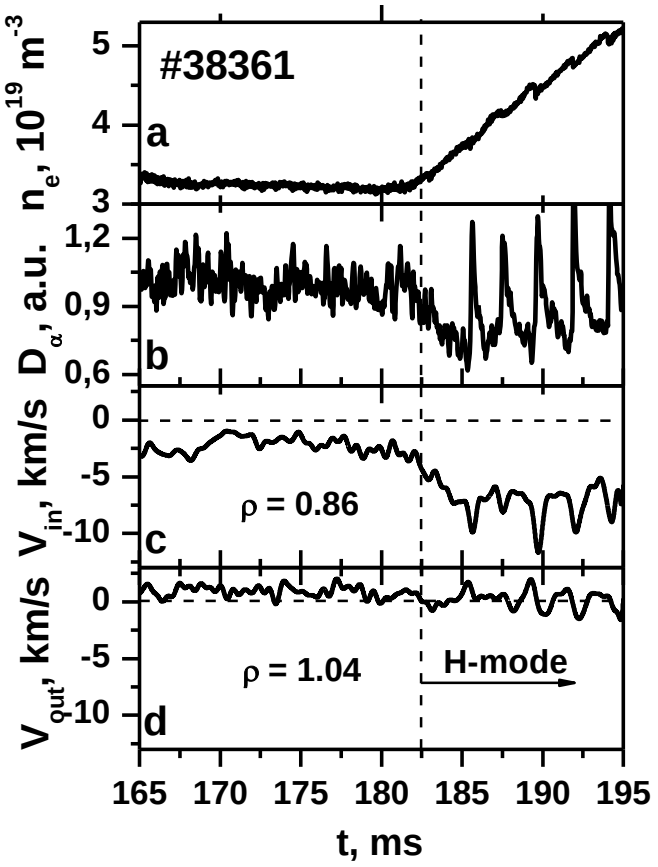
- electron density n_e increase
- D_α emission drop
- the appearance of edge localized modes (ELMs)

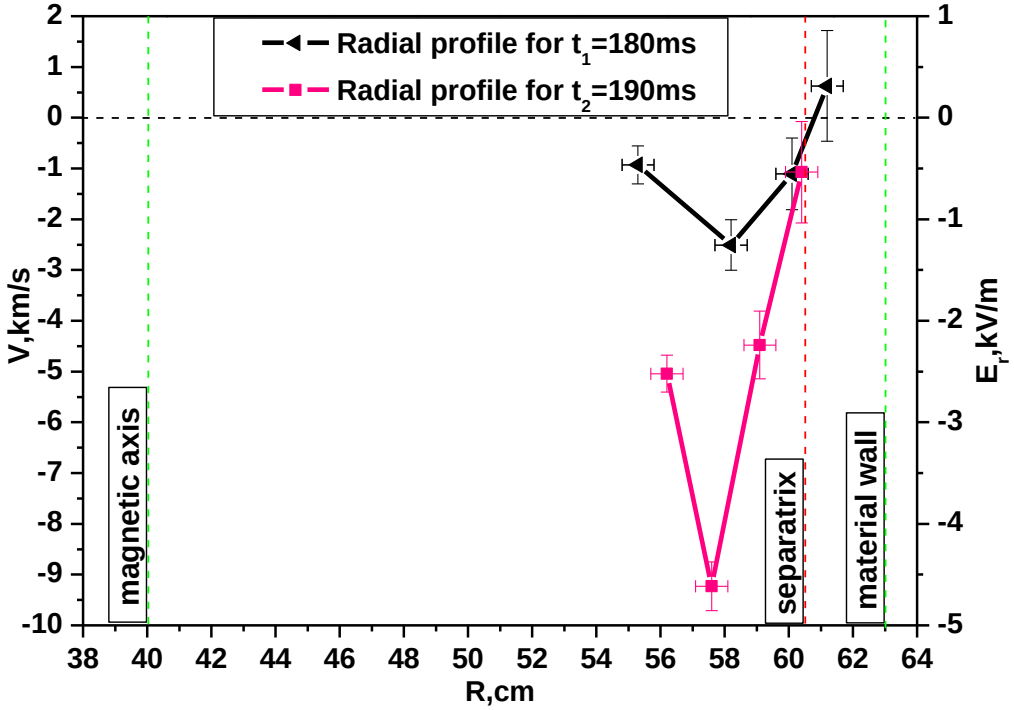
DOPPLER BACKSCATTERING



- 4-frequency system:
  20, 29, 39, 48 GHz
- Localization of the measurements:
  $\rho = 0.7 – 1.1$
- Backscattering fluctuations:
  $k = 2 - 8$ cm^{-1}

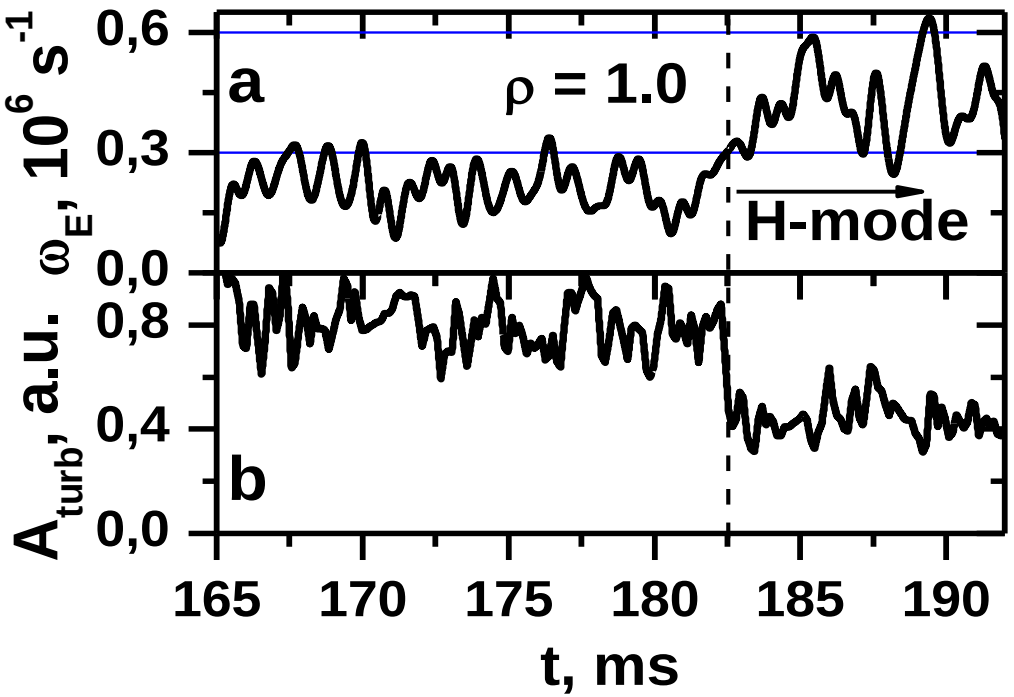
VELOCITY MEASUREMENTS





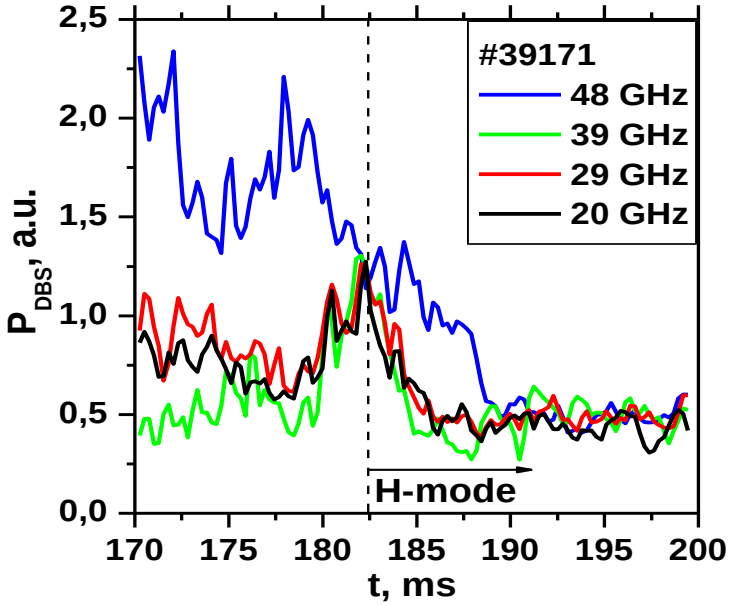
- The velocity increases from 3 km/s in L-mode to 9 km/s after transition to H-mode

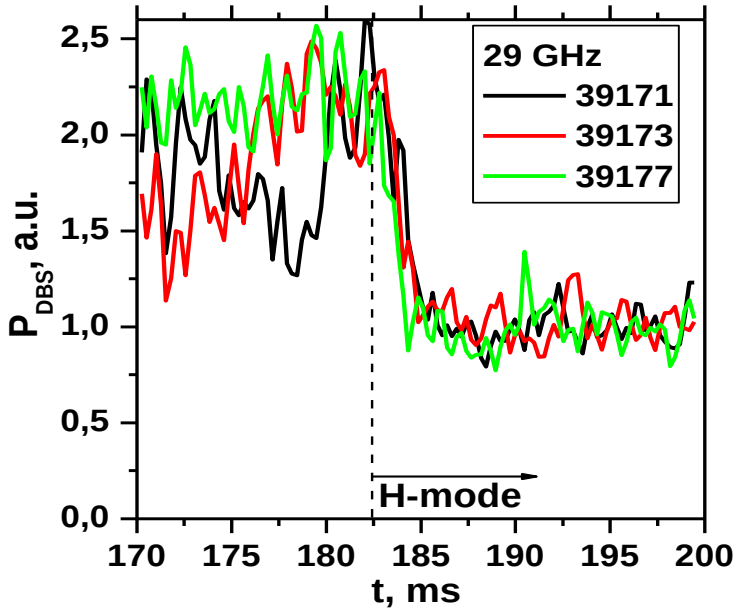
VELOCITY SHEAR



- The value of the velocity shear was around $3 \cdot 10^5$ s^{-1} (the threshold value that initiates the transition to H-mode)
- After the LH transition there is an increase in velocity shear along with a decrease in fluctuation amplitude

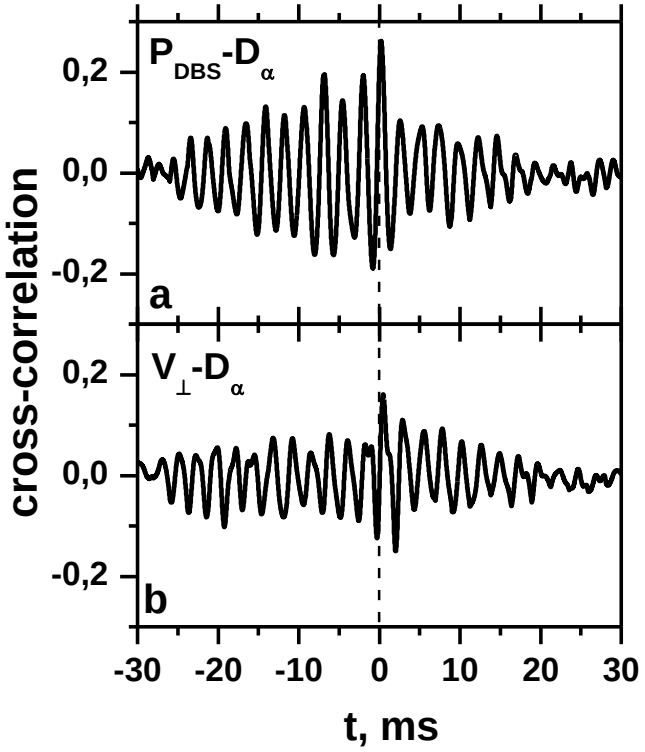
TURBULENCE MEASUREMENTS

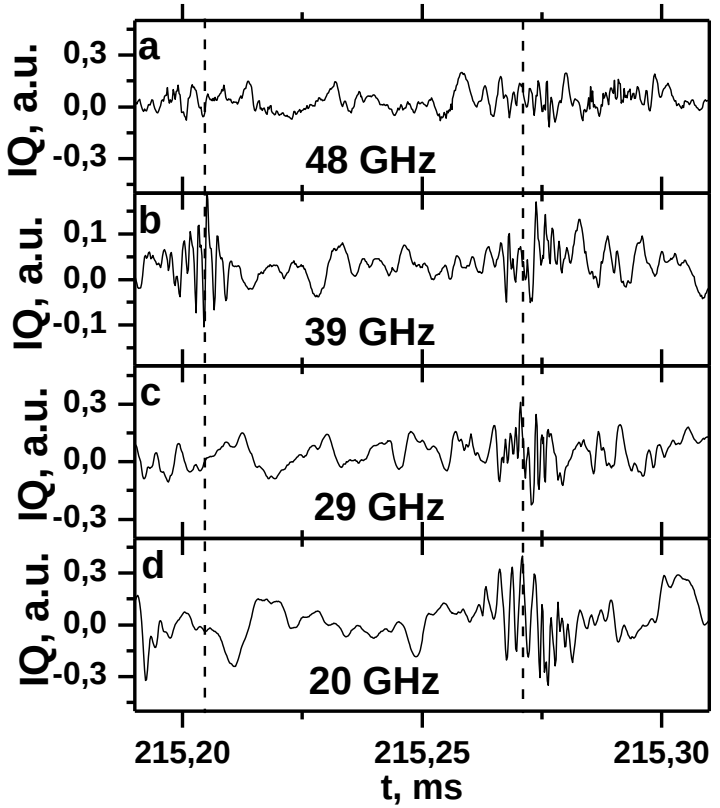




- A decrease in fluctuations during the LH transition most prominent for the 39, 29, 20 GHz frequencies
- A drop in the turbulence level during the LH transition is observed for all discharges at the 29 GHz frequency

EDGE LOCALIZED MODES





- The plasma rotation velocity and the backscattered power are linked to the appearance of ELMs

- Bursts of quasi coherent fluctuations during inter-ELM periods:

  - filaments

CONCLUSION

- A four-frequency Doppler reflectometer was installed in the new spherical tokamak Globus-M2. The study of small-scale plasma fluctuations demonstrates the peripheral nature of turbulence suppression during LH transition.
- The velocity of the plasma rises significantly from 3 km/s in L-mode to 9 km/s in H-mode. The measured value of the velocity shear before the transition was close $3 \cdot 10^5$ s^{-1}, which is closed to the threshold value, observed in other tokamaks of different sizes and configurations.
- It was discovered that the plasma rotation velocity and the backscattered power are linked to the appearance of ELMs Bursts of quasi coherent fluctuations have been discovered in the DBS signals during inter-ELM periods. These bursts have been interpreted as filaments.