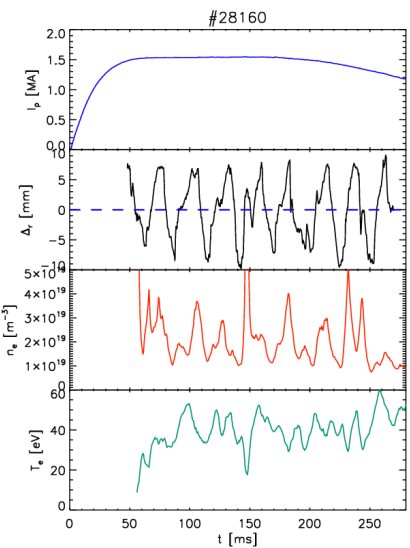


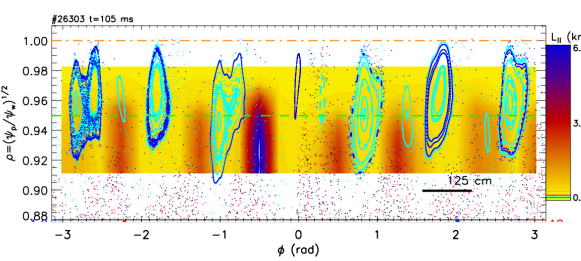
1. INTRODUCTION & OUTLINE

- ✓ The edge of fusion devices is characterised by strong gradients
- ✓ Gradients can act as source of free energy for the turbulence
- ✓ The role of the pressure gradient in generation and evolution of the edge turbulence of RFX-mod device is studied [P.Martin et al., NF 49 (2009) 104019]
- ✓ Characteristic radial length of the edge fluctuations, characteristic pressure length and turbulence injection scale are measured and compared
- ✓ Influence of the magnetic topology is studied

2. RFX-mod AND PLASMA EDGE

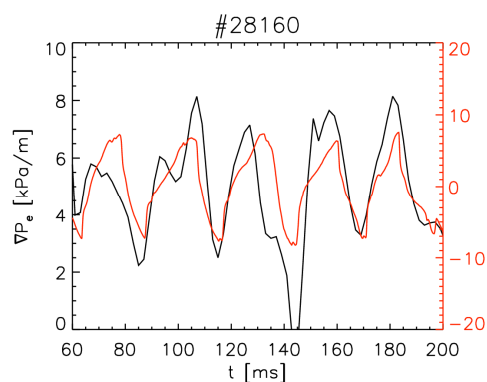


- ✓ The edge of RFX-mod is studied by means of GPI and THB diagnostics
- ✓ Gas Puff Imaging: measures the high frequency fluctuations of the edge plasma emissivity [M.Agostini et al., RSI 77 (2006) 10E513]
- ✓ Thermal Helium Beam: measures the edge radial profiles of electron density and temperature in the same position of the GPI [M.Agostini et al., RSI 81 (2010) 10D715]
- ✓ Magnetic shift shows periodic oscillations in time and space due to the presence of magnetic modes
- ✓ Magnetic topology influences the plasma edge [P.Scarin et al., IAEA 2010]

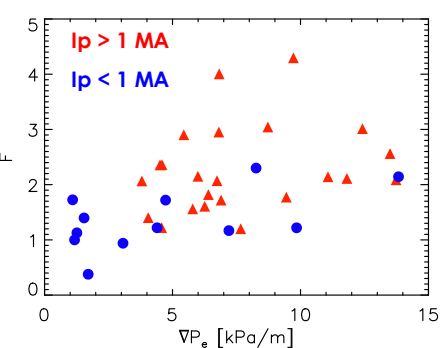


- $L_{||}$: parallel electron characteristic length
- It is the length of the path followed by the electrons parallel to the field to reach ρ from $\rho_0=0.99$

- ✓ Edge pressure gradient oscillates as a function of time
- ✓ Strongest gradients when $\Delta_r > 0$: outward shift
- ✓ Outward shift means also higher electron pressure

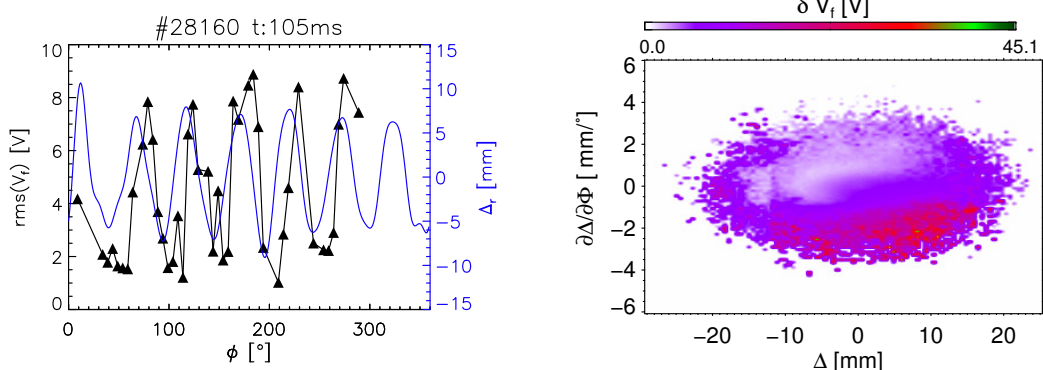


3. PRESSURE GRADIENT AND EDGE FLUCTUATIONS



- ✓ Statistical properties of the edge fluctuations are studied as a function of the edge pressure gradient
- ✓ Flatness of the GPI fluctuations increases with the local pressure gradient
- ✓ Steeper gradients are associated with stronger turbulence level

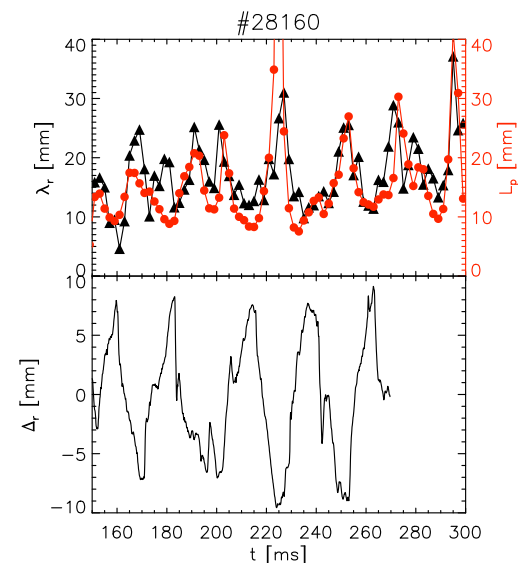
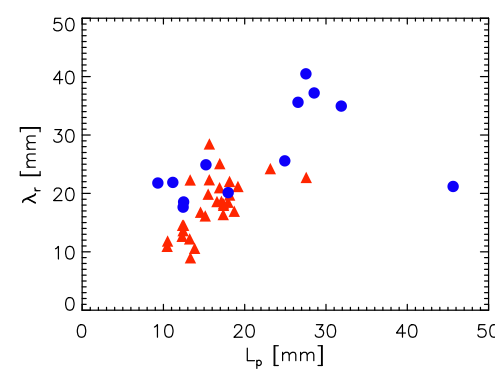
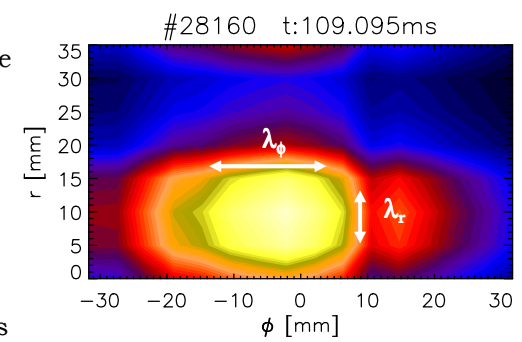
- ✓ This relation is confirmed by electrostatic probes measurement (ISIS) [G.Serianni et al., RSI 74 (2003) 1558]
- ✓ Fluctuations of floating potential V_f are strongly correlated to the magnetic shift
- ✓ Strongest fluctuations when magnetic shift $\Delta_r > 0$ so when the pressure gradient is steeper



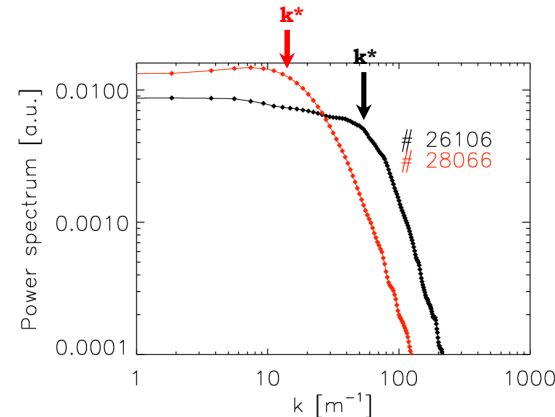
Pressure gradient is one source of energy for the edge turbulence development

4. CHARACTERISTIC RADIAL LENGTH OF THE TURBULENCE

- Characteristic radial length λ_r of the edge turbulence is compared with the characteristic pressure length L_p
- λ_r and L_p oscillate due to the magnetic shift Δ_r time behaviour
- The two characteristic radial lengths are clearly linked together
- Oscillations of Δ_r influence L_p and L_p sets the radial dimension of the edge turbulence



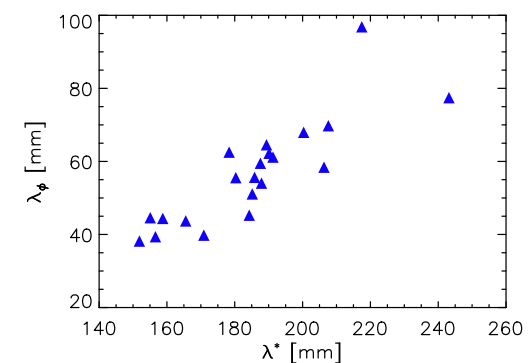
5. ENERGY INJECTION SCALE



- Toroidal k -spectrum of edge fluctuations measured with the GPI diagnostic (average over the current flat-top)
- Power-law decay for $k > k^*$

- k^* can be interpreted as the spatial injection scale: energy feeds the edge turbulence at this scale [U.Frisch, Turbulence, Cambridge University press, 1995]

- Different discharges can be characterised by different injection scales k^*

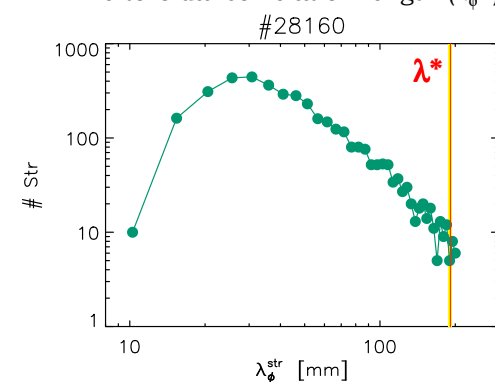


- Linear relation between the toroidal injection scale $\lambda^*=2\pi/k^*$ and the toroidal correlation length (average during the flat-top phase)

- Toroidal dimension of the structures linked with injection scale and with L_p

6. TURBULENCE CASCADE

- In the GPI time series signal strong bursts are present
- Bursts with amplitude larger than $2rms$ are considered as blobs
- The toroidal correlation length (λ_{ϕ}^{str}) of the coherent structures are measured



- ✓ The PDF of the toroidal correlation length of the blobs λ_{ϕ}^{str} is compared with the toroidal energy injection scale λ^*
- ✓ The structures dimension is smaller than the injection scale
- ✓ Energy enters the system and feeds smaller and smaller blobs?

7. CONCLUSIONS

- Pressure gradient is source of energy for the turbulence in the edge of RFX-mod device: increasing pressure gradient turbulence level increases
- L_p sets the radial dimension of the turbulence
- The spatial dimension of the turbulence is correlated with the injection scale
- Energy due to pressure gradient enters the system and feeds smaller and smaller blobs like a direct energy cascade