The one and only professor Jiménez presents:

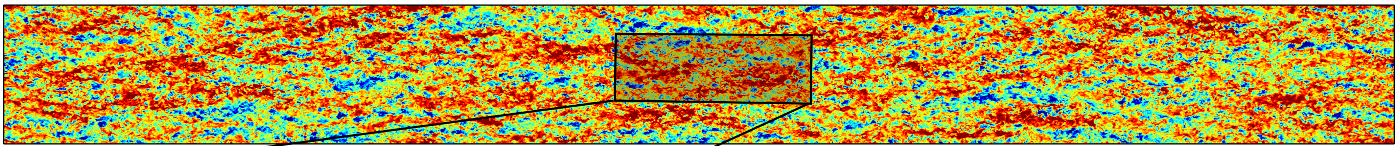
A VIRTUAL TOUR THROUGH TURBULENCE

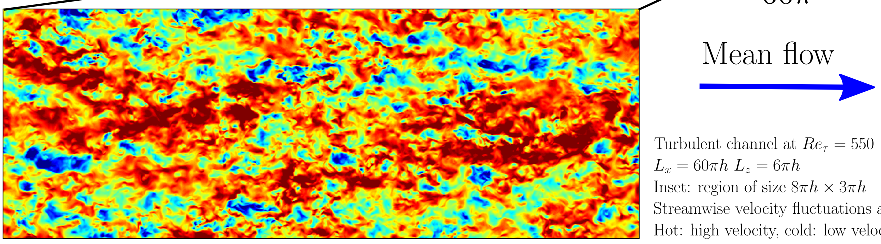
Be amazed by the stunning world of

TURBULENT STRUCTURES in Virtual Reality

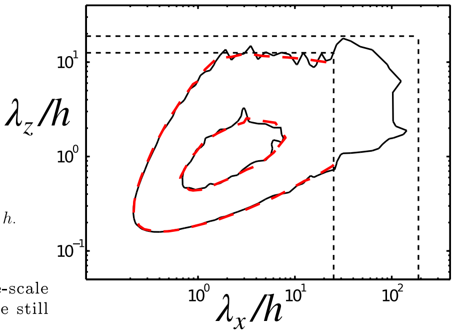
- Enjoy the unique experience of surfing through turbulence in our **virtual reality device**.
- Contemplate the intricate geometry of **momentum transfer structures** from every angle.
- Fly along **velocity streaks** and admire how long they can get to be in the largest domain ever.
- Feel free to explore turbulence at will in a way never seen before.

Are you ready?





Turbulent channel at $Re_\tau = 550$
$L_x = 60\pi h$ $L_z = 6\pi h$
Inset: region of size $8\pi h \times 3\pi h$
Streamwise velocity fluctuations at $y = h$.
Hot: high velocity, cold: low velocity.



Premultiplied two-dimensional spectra of the streamwise velocity at $y = h$, as a function of the streamwise and spanwise wavelengths. The contours are 0.1 and 0.6 of the maximum value. (- - -) (red), channel $L_x = 8\pi$ and $L_z = 3\pi$ (—), $L_x = 60\pi$ and $L_z = 6\pi$. The dashed lines mark the box dimensions, L_x and L_z of each case.

Low and high velocity streaks are a distinctive feature of turbulent channels. It is well-known that large-scale streamwise velocity fluctuations are organized in very elongated motions. However, its maximum lengths are still under debate, and are an object of ongoing research.

We present a new Direct Numerical Simulation of a turbulent channel in a computation domain with streamwise and spanwise lengths of $L_x = 60\pi h$ and $L_z = 6\pi h$, where h is the channel half-height, and is intended to test whether there is a largest size for the structures that develop in the channel.

The spectral results show that a contour of the two-dimensional premultiplied spectrum of the streamwise velocity containing 80% of the kinetic energy closes at $\lambda_x = 100h$. This is the first time that such a low energy contour has been shown to close within the computational box or within the spatial experimental domain and sets a new lower limit of $\lambda_x \approx 100h$ for the wavelengths at which some of the energy of the streamwise velocity fluctuations can be found.

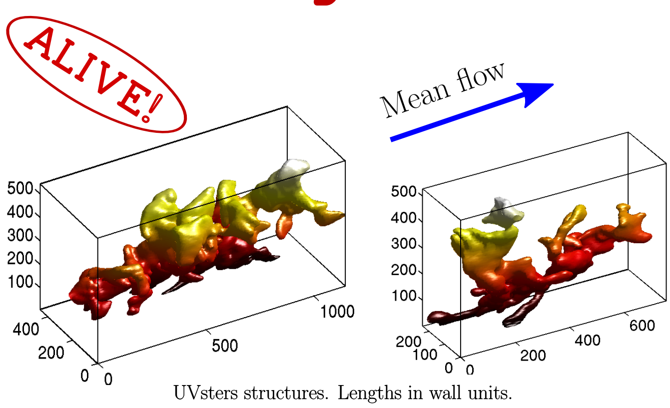
Dazzling streaks and shocking uvsters!

NOW IN 3D!

UVsters are the structures contributing most to the tangential Reynolds stress, which are obtained by extending the clasical one-dimensional quadrant analysis to three dimensions. The quadrant events are defined as connected regions satisfying

$$-uv > Hu'(y)v'(y)$$

where u and v are the instantaneous streamwise and wall-normal velocity fluctuations respectively, $u'(y)$ and $v'(y)$ their root-mean-square values and H the hyperbolic-hole size, taken to be $H = 1.75$ from a percolation analysis. Geometrically, they are 'sponges of flakes' with a thickness of the order of 12 Kolmogorov unit lengths.



UVsters structures. Lengths in wall units.

You won't belive your eyes!

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Funded by ERC