Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Enstrophy along particle trajectories through vortex clusters in DNS of turbulent channel flow[1] JASON HACKL, JAVIER JIMENEZ, Universidad Politecnica de Madrid — We augment the traditional study of wall-bounded turbulence from the Eulerian point of view by analyzing the Lagrangian trajectories of fluid tracers tracked in a DNS of a turbulent channel at $Re_\tau = 2000$. After storing consecutive fields for 50 wall units in time, ensembles of $O(10^6)$ particles seeded on short detached vortex clusters centered at both $y^+ \approx 200$ and the core of the channel are tracked backward ($T_b^+ = -50$) in time, then restarted forward. Velocity gradients are interpolated along trajectories for these particles for a total duration of 100 units ($T_{forward}^+ = 50$ past the seeding instant), providing representative histories of enstrophy acquisition and loss by fluid particles throughout the expected lifetime of intense vortical structures. The statistics of initial position $X(T_b^+ = -50)$, along with joint and conditional statistics of temporal increments of velocity and vorticity throughout the complete simulation (from $T^+ = -50$ to 50), describe how the structures above the buffer layer, typically educed from Eulerian variables, act on fluid, clarifying our understanding. The corresponding results for particles initialized in the core are compared to the particles initialized around vortices centered at $y^+ = 200$.

[1]Supported by ERC MULTIFLOW and BSC-RES FI-2013-1-0028

Jason Hackl
Universidad Politecnica de Madrid

Date submitted: 02 Aug 2013 Electronic form version 1.4