Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Space-Time Correlation of Large-Scale Structures in a Turbulent Boundary Layer[1] NICOLAS BUCHMANN, CALLUM ATKINSON, MATTHIAS KUEHN, JULIO SORIA, Department of Mechanical and Aerospace Engineering, Monash University, Victoria 3800, Australia — Taylor's hypothesis is often used to project temporal data into the spatial domain and has been used in the past to show the presence of large-scale structures ($> 10\delta$) in the log and lower wake region of the turbulent boundary layer (TBL). To investigate the spatial and temporal evolution of such large-scale structures, the present study employs time-resolved Particle Image Velocimetry (PIV) in several streamwise-spanwise planes in the log-layer of a TBL ($Re_\theta = 2,000$). In order to capture the full extent of these structures, four high-speed, high-resolution PIV systems are combined to span a region of approximately $3\delta \times 12\delta$ and a continuous time sequences of $\approx 50\delta/U$. Such data sets are currently unavailable from previous experimental investigations and reveal the existence of long and very long ($> 8\delta$) low- and high-speed structures. Two-point space-time correlations are employed to examine the temporal extent and meandering nature of these structures with respect to their size and spacing in the log-layer. Furthermore, the validity of Taylor's hypothesis is tested for such long projection distances.

[1]This work is supported by the Australian Research Council through a Discovery and LIEF grant.

Nicolas Buchmann
Department of Mechanical and Aerospace Engineering,
Monash University, Victoria 3800, Australia

Date submitted: 19 Oct 2011 Electronic form version 1.4