Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Wall-Shear Stress Distribution in Turbulent Duct Flow SEBASTIAN GROßE, WOLFGANG SCHRÖDER, Institute of Aerodynamics, RWTH Aachen University, Germany — The wall-shear stress sensor MPS^3 based on flexible micro-pillars has been used to experimentally assess the two-dimensional wall-shear stress distribution in turbulent duct flow at moderate Reynolds number. A sensor array covering an area of 90x125 viscous length-scales along the streamwise and spanwise direction, respectively and 1-D sensor-lines spanning 125 viscous length-scales have been applied. The results evidence the co-existence of low- and high-shear regions representing "foot-prints" of near-wall coherent structures. Applying Taylor's hypothesis allows to crudely assess the streamwise length-scales of the near-wall flow field. Especially the low-shear regions attain streamwise dimensions of approximately 1,000 viscous length-scales. These low-shear regions resemble long meandering bands locally interrupted and deflected by regions of high-shear stress. A qualitative comparison evidences the structures detected in the present study to be similar to wall-shear stress distributions reported in the literature and to structures found in higher regions of the boundary layer. The results allow assessing statistics of the streamwise and spanwise wall-shear stress distribution, such as convection velocities of wall-shear stress fluctuations, two-point-, and auto-correlations. Geometric properties of the streak-like wall-shear stress distributions will also be discussed.

Sebastian Große
Institute of Aerodynamics, RWTH Aachen University, Germany

Date submitted: 29 Jul 2008 Electronic form version 1.4