

Abstract Submitted
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Time-resolved Tomo-PIV measurements of the interaction between a stationary held sphere and a turbulent boundary layer. RENE VAN HOUT, Technion - Israel Institute of Technology, JERKE EISMA, EDWIN OVERMARS, GERRIT ELSINGA, JERRY WESTERWEEL, TU-Delft — Time resolved tomographic PIV measurements (acquisition rate 250Hz) were performed in a turbulent boundary layer (TBL) on the side wall of an open channel, water flow facility (cross section 60x60cm, $W \times H$), 3.5m downstream of the inlet at a bulk flow velocity of $U_b = 0.17\text{m/s}$ ($Re_b = U_b H / \nu = 102 \times 10^3$, $\delta_{0.99} = 5.0\text{cm}$, $Re_\theta = 891$). The measurement volume was a horizontal slab ($6 \times 1.5 \times 6\text{cm}^3$, $l \times w \times h$) extending from the side wall, 30cm above the bottom. The Tomo-PIV setup comprised four high-speed ImagerPro HS cameras (2016x2016pixels), a high-speed laser (Nd:YLF, Darwin Duo 80M, Quantronix), optics/prisms and data acquisition/processing software (LaVision, DaVis8.2). A sphere with diameter, $D = 6\text{mm}$ ($D^+ = 51$, “+” denotes inner wall scaling), was positioned at $y = 37.5$ and 5.4mm ($y^+ = 319$ and 46) from the wall (measured from the sphere’s center). The latter position covers most of the buffer layer while the former is well in the outer layer. Sphere Reynolds numbers based on D and the average streamwise velocity at the sphere’s center were 984 ($y^+ = 319$) and 684 ($y^+ = 46$). Results show the interaction between the coherent turbulence structures in the TBL and those generated in the sphere’s wake. Total and partial destruction of the log-law layer is observed when the sphere is positioned in the buffer and outer layer, respectively.

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