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Characterization of Rare Reverse Flow Events in Adverse Pressure Gradient Turbulent Boundary Layers[1] CHRISTIAN J. KAEHLER, MATTHEW BROSS, THOMAS FUCHS, Univ Bundeswehr — Time-resolved tomographic flow fields measured in the viscous sublayer region of a turbulent boundary layer subjected to an adverse pressure gradient (APG) are examined with the aim to resolve and characterize reverse flow events at $\mathrm{Re}_\tau = 5000$. The fields were measured using a novel high resolution tomographic particle tracking technique. It is shown that this technique is able to fully resolve mean and time dependent features of the complex three-dimensional flow with high accuracy down to very near-wall distances ($\sim$10 μm). From time resolved Lagrangian particle trajectories, statistical information as well as instantaneous topological features of near-wall flow events are deduced. Similar to the zero pressure gradient case (ZPG), it was found that individual events with reverse flow components still occur relatively rarely under the action of the pressure gradient investigated here. However, reverse flow events comprised of many individual events, are shown to appear in relatively organized groupings in both spanwise and streamise directions. Furthermore, instantaneous measurements of reverse flow events show that these events are associated with the motion of low-momentum streaks in the near-wall region.

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