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Well-resolved turbulence measurements in high Reynolds number turbulent boundary layer flows MILAD SAMIE, IVAN MARUSIC, NICHOLAS HUTCHINS, The University of Melbourne, YUYANG FAN, MATTHEW FU, MARCUS HULTMARK, ALEXANDER SMITS, Princeton University — Despite several decades of research in wall-bounded turbulence there is still controversy over the behavior of streamwise turbulence intensities near the wall, especially at high Reynolds numbers. Much of it stems from the uncertainty in measurement due to finite spatial resolution. Conventional hot-wire anemometry is limited for high Reynolds number measurements due to limited spatial resolution issues that cause attenuation in the streamwise turbulence intensity profile near the wall. To address this issue we use the NSTAP (nano-scale thermal anemometry probe) developed at Princeton University to conduct velocity measurements in the high Reynolds number boundary layer facility at the University of Melbourne. NSTAP is almost one order of magnitude shorter than conventional hot-wires. This enables us to acquire fully-resolved velocity measurements of turbulent boundary layers up to $Re_\tau = 20000$. Results show that in the near-wall region, the viscous-scaled streamwise turbulence intensity increases with Re_τ in the Reynolds number range of the experiments. Moreover, the energy spectra in the near-wall region show excellent inner-scaling over the small to moderate wavelength range, followed by a large outer-scale influence that increases with Reynolds number.

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