

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Latest Developments on Obtaining Accurate Measurements with Pitot Tubes in ZPG Turbulent Boundary Layers HASSAN NAGIB, RICARDO VINUESA, IIT, Chicago — Ability of available Pitot tube corrections to provide accurate mean velocity profiles in ZPG boundary layers is re-examined following the recent work by Bailey *et al.* Measurements by Bailey *et al.*, carried out with probes of diameters ranging from 0.2 to 1.89 mm, together with new data taken with larger diameters up to 12.82 mm, show deviations with respect to available high-quality datasets and hot-wire measurements in the same Reynolds number range. These deviations are significant in the buffer region around $y^+ = 30 - 40$, and lead to disagreement in the von Kármán coefficient κ extracted from profiles. New forms for shear, near-wall and turbulence corrections are proposed, highlighting the importance of the latest one. Improved agreement in mean velocity profiles is obtained with new forms, where shear and near-wall corrections contribute with around 85%, and remaining 15% of the total correction comes from turbulence correction. Finally, available algorithms to correct wall position in profile measurements of wall-bounded flows are tested, using as benchmark the corrected Pitot measurements with artificially simulated probe shifts and blockage effects. We develop a new scheme, κB -Musker, which is able to accurately locate wall position.

Hassan Nagib
Illinois Institute of Technology, Chicago, IL 60616

Date submitted: 30 Jul 2013

Electronic form version 1.4