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Turbulent Channel Flow Measurements Using Matched Hot-Wires BARAHEH ESTEJAB, SEAN BAILEY, University of Kentucky — We present an experimental study conducted in a turbulent channel flow facility using hot-wire probes with both constant and varying viscous-scaled wire length. The objectives of the study were threefold: first, to validate the flow produced by the channel flow facility; second, to investigate the validity of recently proposed spatial filtering corrections for Reynolds stress profiles; and third, to extend the investigation of the near-wall peak Reynolds number dependence in turbulent pipe flow conducted by Hultmark, Bailey and Smits (see J. Fluid Mech. (2010), vol. 649, pp. 103–113). We found that in channel flow, unlike in the pipe flow experiments, the near-wall peak exhibited the same Reynolds number dependence observed in turbulent boundary layer studies and channel flow DNS. Since the same measurement techniques and procedures were used in the current study as used in the pipe flow study, this demonstrated that the near-wall Reynolds number independence observed in the pipe study was not due to error introduced by measurement methodology. Furthermore, comparison of results from wires of different length verified that spatial filtering corrections work in channel flow as well as pipe and boundary layer flows. Corrected results were in good agreement with channel flow DNS, thus verifying that the flow in the facility approximates one-dimensional turbulent Poiseuille flow.

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