Abstract Submitted
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Toward the measurement of differentiable high resolution profile data in wall turbulence[1] JOHN ELSNAB, JASON MONTY, University of Melbourne, CHRISTOPHER WHITE, University of New Hampshire, MANOOCHEHR KOOCHESFAHANI, Michigan State University, JOSEPH KLEWICKI, University of Melbourne and University of New Hampshire — High resolution streamwise velocity profiles are obtained in fully developed channel flow using molecular tagging velocimetry (MTV) over a Reynolds number based upon friction velocity and channel half-height from 200 to 2000. Due to the spatial resolution afforded from the MTV technique (800 points per profile), the velocity profile is differentiable in the wall-normal direction. This, along with pressure drop measurements, allows estimates of the mean viscous force and Reynolds stress (RS) via manipulation of the mean momentum equation. Differentiation of the RS profile allows for an investigation into the gradient of the RS. This quantity is central to the dynamics, as it acts as a net source or sink of mean momentum depending upon position relative to the RS maximum. The MTV technique and methods used to obtain the profiles are discussed. The main issue with obtaining smooth profiles is dealing with the inherent spatial pattern in the array of an intensified CCD camera. This pattern is significant in the outer region, where the profile variations and the data spacing relative to the inherent scales of motion are small. A dynamic flat-field image is used to remove a majority of this pattern. The MTV results are compared and evaluated relative DNS data.

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