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Statistics of particle velocity in slowly sheared granular materials PRABHU R. NOTT, ANANDA K. S., Indian Institute of Science — Our understanding of the hydrodynamics of molecular fluids has benefited greatly from knowledge of their statistical properties at the microscopic level. While knowledge of the statistics of dry granular materials is desirable for the same reason, it is lacking because of the complex nature of grain interactions. The difference between the deformation of dense granular materials and conventional fluids prompts the question of whether there is a fundamental difference in their statistical nature. Recently, we had reported the statistical distribution of particle velocity in gravity-driven flow of a granular material through a vertical channel. Our study had raised some important questions, namely whether our velocity distribution is universal or is limited to gravity-driven flows, and what the role of grain rotation is in determining macroscopic deformation. In this paper, we present measurements, made by video imaging and particle tracking, of the mean velocity field and the statistical distribution of velocity fluctuations of glass beads sheared in a cylindical Couette cell. Our results show important similarities with the velocity distribution in vertical channels, and hence indications of universality, but also some differences. In addition, we present measurements of the mean angular velocity field and the distribution of angular velocity fluctuations for a two-dimensional layer of disks in a vertical channel. We compare these observations with the predictions of the frictional Cosserat model we have recently proposed.

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