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Granular Surface Flows in Three Dimensional Tumblers STEVEN W. MEIER, NICHOLAS A. POHLMAN, RICHARD M. LUEPTOW, JULIO M. OTTINO, Northwestern University — Many granular flows are confined to thin layers of rapid surface flow. Therefore, a complete understanding of surface flows is the key to an accurate representation of the entire flow. Experiments were conducted measuring the surface flow in three-dimensional tumblers: cylindrical tumblers with lengths of 17.5 cm and diameters of 7.0 cm, 10.0 cm, 14.0 cm and 17.0 cm, a double-cone tumbler with a maximum diameter of 13.8 cm, and a spherical tumbler with a diameter of 13.6 cm. Surface velocity measurements for 1 mm and 2 mm glass particles were obtained using particle tracking velocimetry. Results indicate that the streamwise surface velocity at the midpoint of the flowing layer is a linear function of local flowing layer length, regardless of tumbler shape, particle size, rotation rate, and fill fraction. In addition, the axial surface velocity at the midpoint of the flowing layer is negligible. These results are key for the development of three-dimensional models of granular flows. [Supported by NSF and DOE.]

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