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Three dimensional particle rearrangements during oscillatory flow in a split bottom geometry[1] WOLFGANG LOSERT, STEVEN SLOTTERBACK, CHRIS BERARDI, University of Maryland, KRISZTIAN RONASZEGI, Budapest University of Technology — We carry out three dimensional imaging of the positions and rearrangements of all particles during slow shear flow of granular matter in a split bottom shear cell geometry. The aim is to gain insights into dense granular flows at the level of individual particle displacements. To image particle motion in three dimensions plastic spheres are used that are immersed in index matching fluid that is fluorescently dyed. This allows for imaging of cross sections with a laser sheet and sensitive camera. Scanning the laser sheet generates a 3D image, from which we reconstruct the position of all particles in a 3D volume. We find that the interior of this fluid immersed material flows in a similar way as dry materials. Our focus is on reversible vs irreversible deformations in granular flows. Reversing the shear direction leads to a flow profile that does not exactly mirror the flow profile before reversal, indicating irreversible deformations in the shear zone. Following the motion of individual particles through at least 10 oscillations shows that the particles far from the shearband return to their original position, but particles in the shear band rearrange. Their mean squared displacement increases subdiffusively with the number of oscillations.

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Wolfgang Losert
University of Maryland

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