Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Impact of Overburden on Segregation in Sheared Granular Flow
ALEXANDER M. FRY, PAUL B. UMBANHOWAR, RICHARD M. LUEPTOW, Northwestern University — Dense granular materials tend to segregate into size or density graded regions when subjected to shear. Previous experiments demonstrated that overburden – normal confining pressure on a granular system – can slow the rate of size segregation in an annular shear cell. Here, we explore the effects of overburden on sheared granular material through Discrete Element Method (DEM) simulations in a planar shear cell geometry in which shear is applied by a moving bottom wall, while a massive upper wall provides the overburden. Segregation decreases with increasing overburden, but the picture is complicated by concurrent changes in the streamwise velocity profile. To decouple these effects, we also test an idealized system in which a desired streamwise velocity profile – and therefore shear rate – is imposed by applying additional horizontal forces to each particle. Based on this approach, we link the effect of overburden on segregation to the grain-scale behavior of the system. Partially funded by Procter & Gamble.

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Date submitted: 06 Nov 2015 Electronic form version 1.4