Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Real-time magnetic resonance imaging of highly dynamic granular phenomena ALEXANDER PENN, Laboratory for Energy Science and Engineering, ETH Zurich and Institute for Biomedical Engineering, University and ETH Zurich, KLAAS P. PRUESSMANN, Institute for Biomedical Engineering, University and ETH Zurich, CHRISTOPH MLLER, Laboratory for Energy Science and Engineering, ETH Zurich — Probing non-intrusively the interior of three-dimensional granular systems is a challenging task for which a number of imaging techniques have been applied including positron emission particle tracking, X-ray tomography and magnetic resonance imaging (MRI). A particular advantage of MRI is its versatility allowing quantitative velocimetry through phase contrast encoding and tagging, arbitrary slice orientations and the flexibility to trade spatial for temporal resolution and vice versa during image reconstruction. However, previous attempts to image granular systems using MRI were often limited to (pseudo-) steady state systems due to the poor temporal resolution of conventional imaging methodology. Here we present an experimental approach that overcomes previous limitations in temporal resolution by implementing a variety of methodological advances, viz. parallel data acquisition through tailored multiple receiver coils, fast gradient readouts for time-efficient data sampling and engineered granular materials that contain signal sources of high proton density. Achieving a spatial and temporal resolution of, respectively, 2 mm x 2 mm and 50 ms, we were able to image highly dynamic phenomena in granular media such as bubble coalescence and granular compaction waves.

Laboratory for Energy Science and Engineering, ETH Zurich and Institute for Biomedical Engineering, Univers

Date submitted: 06 Nov 2015 Electronic form version 1.4