Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Experimental measurement of unsteady drag on shock accelerated micro-particles ANKUR BORDOLOI, ADAM MARTINEZ, KATHERINE PRESTRIDGE, Physics Division, Los Alamos National Laboratory — The unsteady drag history of shock accelerated micro-particles in air is investigated in the Horizontal Shock Tube (HST) facility at Los Alamos National laboratory. Drag forces are estimated based on particle size, particle density, and instantaneous velocity and acceleration measured on hundreds of post-shock particle tracks. We use previously implemented 8-frame Particle Tracking Velocimetry/Anemometry (PTVA) diagnostics to analyze particles in high spatiotemporal resolution from individual particle trajectories. We use a simultaneous LED based shadowgraph to register shock location with respect to a moving particle in each frame. To measure particle size accurately, we implement a Phase Doppler Particle Analyzer (PDPA) in synchronization with the PTVA. In this presentation, we will corroborate with more accuracy our earlier observation that post-shock unsteady drag coefficients ($C_D(t)$) are manifold times higher than those predicted by theoretical models. Our results will also show that all $C_D(t)$ measurements collapse on a master-curve for a range of particle size, density, Mach number and Reynolds number when time is normalized by a shear velocity based time scale, $t^* = d/(u_f\text{-}u_p)$, where d is particle diameter, and u_f and u_p are post-shock fluid and particle velocities.

Ankur Bordoloi
Los Alamos National Laboratory

Date submitted: 26 Jul 2016 Electronic form version 1.4