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Scalar Power spectrum and Structure Function analysis of the Richtmyer-Meshkov Instability Upon Re-Shock[1] CHRISTOPHER NOBLE, JOSHUA HERZOG, ALEX AMES, JASON OAKLEY, DAVID ROTHAMER, RICCARDO BONAZZA, University of Wisconsin - Madison — The Richtmyer-Meshkov instability of a twice-shocked gas interface is investigated in the vertical shock tube of the Wisconsin Shock Tube Laboratory at the University of Wisconsin– Madison. The initial condition is a shear layer, containing broadband perturbations, formed at the interface between a helium-acetone mixture and argon. The interface is accelerated with a shock of nominal strength M=1.9 with an initial Atwood number of A=0.43. Acetone is used as a molecular tracer for PLIF, allowing the extraction of concentration data by using a pulse burst laser system at 20kHz to excite acetone to fluoresce. The resulting fluorescence signal is measured using a high-speed Phantom camera. The evolution of the scalar power spectrum is investigated. As seen in previous single shock experiments a region of -5/3 slope is seen at late post-shock times, however at late re-shock times a larger region of -8/3 spectrum is observed. The measurement limit of the present experiments is estimated to be within the inertial range that may exist thus the measured slope is not expected to be a dissipation effect but the slope of the inertial range. Scalar structure functions are calculated, with the anomalous exponent being plotted against the structure function order also showing a non-KOC scaling. The terms in the scalar power spectrum evolution equation are calculated showing an asymmetry about the centre of the mixing layer and suggesting the emergence of an inertial range.

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