Experimental study of initial condition dependence for turbulence design in shock-driven flows

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The recent work at LANL has shown that buoyancy-driven turbulence can be affected at late time by initial conditions whose memory is not lost ([1], [2]). This remarkable discovery presents an opportunity to predict and "design" late-time turbulence, *i.e. Turbulence by Design*, with transformative impact on our understanding and prediction of Inertial Confinement Fusion (ICF) and general fluid mixing processes. We report results on the initial condition parameters that impact the material mixing and transition to turbulence in shock-driven, Richtmyer-Meshkov instability. A detailed study on the impact of amplitude (δ) and wavelength (λ) of initial condition perturbations on turbulence in a heavy gas varicose curtain (air-SF_6-air) is undertaken. Experiments were conducted with stable single mode, membrane-free initial conditions at shock Mach number, Ma = 1.2 and Atwood number, At=0.67 [3]. Quantitative measurements on the temporal and spatial evolution of the ensuing structures after the first shock and subsequent reshock at different times were made using simultaneous Particle Image Velocimetry (PIV) and Planar-Laser Induced Fluorescence (PLIF). The mixing width was measured for different combinations of δ and λ. The results obtained are being compared with data from ongoing numerical simulations.

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References

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