Generation of non-linear ablative Rayleigh-Taylor growth using laser imprinting at the National Ignition Facility

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Rayleigh-Taylor (RT) growth seeded by small perturbations at the ablation front and target is detrimental to the performance of Inertial Confinement Fusion (ICF) applications [1] and of high interest for the Laboratory Astrophysics programs [2]. The National Ignition Facility's (NIF) unique capability for long duration, high power and precision shaped laser pulses enables a pioneering frontier in non-linear ablative RT growth studies [3]. Several experiments through the Discovery Science program at NIF have shown the generation of large 3-D spikes and bubbles in highly non-linear regime of RT instability in directly driven planar foils seeded by laser-imprinted perturbations. At a much larger scale, similarly evolving hydrodynamic instabilities are present in the core collapse of type Ib/c and type II supernovae. We present results of experiments where initial seeds for RT instability were significantly varied to study dependence of the non-linear RT phase on initial conditions. High quality x-ray radiographs were used to measure details of RT instability development in the non-linear regime. The dependence of the RT growth on initial conditions was quantified and the results will be presented.

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