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Evolution of the three-dimensional Rayleigh-Taylor instability

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Results are reported from an experiment in which the evolution of the Rayleigh-Taylor (RT) instability from a well characterized, broad spectrum, three-dimensional (3D) initial condition was measured. The experiment was performed at the OMEGA laser facility as part of a series of supersonic jet experiments. In this experiment, a 1 ns 1.4 kJ laser pulse launched a strong blast wave into an 825 micron thick titanium washer that was backed by a 100 mg/cc foam. The rear surface of the washer had random 3D surface roughness with an average peak-to-valley amplitude of 2.5 microns. The blast wave shocked and then decelerated the titanium-foam interface causing perturbation growth due to RT.

In order to diagnose the growth of the perturbations at late times (up to 400 ns), we have developed and improved a point-projection imaging technique. We were able to measure both the hydrodynamic evolution of the RT spikes via absorption radiography and also the blast wave evolution via phase contrast imaging on the same diagnostic. Details of this technique will be presented.

This work is performed under the auspices of the U. S. Department of Energy by Los Alamos National Laboratory under Contract No. W-7405-ENG-36 and by Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.