Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Observed transition from Richtmyer-Meshkov jet formation through feedout oscillations to Rayleigh-Taylor instability in a laser target[1] Y. AGLITSKIY, SAIC, McLean, VA, M. KARASIK, A.L. VELIKOVICH, V. SERLIN, J.L. WEAVER, T.J. KESSLER, A.J. SCHMITT, S.P. OBENSCHAIN, Plasma Physics Division, Naval Research Laboratory, Washington, DC, S.P. NIKITIN, N. METZLER, J. OH, RSI, Lanham, MD — Experimental study of hydrodynamic perturbation evolution triggered by a laser-driven shock wave breakout at the free rippled rear surface of a plastic target is reported. We observed a transition between two qualitatively distinct types of perturbation evolution: jet formation at low shock pressure and areal mass oscillations at high shock pressure, which correspond respectively to high and low values of effective adiabatic index. The experiments were done on the KrF Nike laser facility with laser wavelength 248 nm and a 4 ns pulse. We varied the number of beams overlapped on the plastic target to change the ablative pressure driving the shock wave through the target: 36 beams produce pressure of ~8 Mbar, whereas a single beam irradiation reduces the pressure to ~0.7 Mbar. With the help of side-on monochromatic x-ray imaging, planar jets manifesting the development of the Richtmyer-Meshkov-type instability in a non-accelerated target are observed at sub-megabar shock pressure. As the shock pressure exceeds 1 Mbar, instead of jet formation an oscillatory rippled expansion wave is observed, followed by the "feedout" of the rear-surface perturbations to the ablation front and the development of the Rayleigh-Taylor instability, which breaks up the accelerated target.

[1]Work supported by US DOE, Defense Programs.

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Date submitted: 27 Jun 2012 Electronic form version 1.4