Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Shadowgraph and schlieren imaging of explosions using a pulsed light source KEVIN MCNESBY, ERIC COLLINS, RICHARD BENJAMIN, GERRIT SUTHERLAND, US Army Research Laboratory, ENERGETIC TECHNOLOGY BRANCH COLLABORATION — A high-repetition rate laser is used as an illumination source for shadowgraph and schlieren imaging of explosions. The laser is a diode pumped solid state device (Nd:YAG) that operates at 200 kHz and outputs 0.33 milliJoules of energy per pulse (<40 nanosecond) at a wavelength of 532 nanometers. The laser pulse rate is synchronized to a high speed video camera, such that the light from the laser coincides with the onset of the exposure period of the camera. The camera is filtered at the laser wavelength, and the illumination and viewing lines-of-sight are made coincidental to minimize parallax. The system is designed such that the intensity from the laser exceeds that from an explosive event at the laser wavelength for the duration of the camera exposure time. This enables imaging of bright events, such as explosive breakout, while maintaining reasonable contrast with regions close to the explosion but not blast-illuminated. The system is used to image the explosive near-field and particles accelerated by the explosive event when their velocity is near maximum. Problems and advantages inherent to single wavelength shadowgraph and schlieren imaging, minimization of laser speckle, as well as applications to multi-phase blast analysis are discussed.

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Date submitted: 27 Feb 2017 Electronic form version 1.4