Pulsed-Power Driven Liner-On-Target Hydrodynamics Experiments Diagnosed with Proton Radiography using PHELIX


— The Precision High Energy-density Liner Implosion eXperiment, PHELIX, is a pulsed-power driver capable of delivering multi-mega-ampere currents to cylindrical loads. The pulsed-power system utilizes a high-efficiency transformer to couple a small capacitor bank (∼400 kJ) to a ∼5 cm diameter cylindrical Al liner. A peak current of ∼4 MA causes the liner to implode in 20 – 30 µs and attain speeds of >1 km/s. The PHELIX system is designed to be compatible with the Los Alamos proton radiography facility. Initial experiments with PHELIX explore shocked-ejected particle transport into gas in converging geometries. For these experiments a liner-on-target configuration is employed. To control the initial conditions, micron-sized tungsten particles are used in place of shock-formed ejecta. The inner surface of the cylindrical target is coated with a 0.1 mm uniform layer of W powder. The liner impacts the target generating a shock that launches the W particles off the target surface. The time history of the trajectory of the shocked-ejected particulate is captured in 21 proton radiographs recorded during the experiment. Comparison of 3 experiments, one into vacuum, one into Ar at 8.3 bars and one into Xe at 8.3 bars are discussed. Results are compared to simulations.

1Work supported by United States-DOE under contract DE-AC52-06NA25396

David Oro
Los Alamos National Laboratory

Date submitted: 30 Jan 2015

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