Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Electrical conductivity and Equation of State from Measurements of a Tamped Electrically Exploded Foil EDWARD RUDEN, DAVID AMDAHL, RUFUS COOKSEY, MATTHEW DOMONKOS, PAUL ROBINSON, Air Force Research Laboratory, Directed Energy Directorate, FRANCIS ANALLA, DARWIN BROWN, MARK KOSTORA, Science Applications International Corporation, FRANK CAMACHO, NumerEx, LLC — Results are presented for an experiment that produces and diagnoses dynamic surface conditions of homogeneous warm dense matter (WDM) to infer intrinsic bulk properties such as density, pressure, temperature, specific energy, electrical conductivity, and emissivity in the ranges of up to few eV and down to 0.1 solid density - typical of those encountered in single shot pulsed power device electrodes. The goal is to validate ab initio models of matter encountered for predictive modeling of such devices. In the test whose results are presented here, the WDM is produced by Ohmically heating and exploding an 80 μm Al foil placed between two fused quartz tampers by the discharge of a 36 μF capacitor bank charged to 30.1 kV and discharged in 2.55 μs to a peak load current of 460 kA. Measurements are presented from two division of amplitude polarimeters which operate at 532 nm and 1064 nm, a complementary pyrometer which measures the spectral radiance ratio at those wavelengths, a long-range 660 nm photonic Doppler velocimeter, and a B-dot probe array from which the aforementioned intrinsic properties may be inferred. Available results are compared to a 3-D MHD ALEGRA simulation of the full dynamic load and return conductor geometry with a two-loop external coupled circuit.

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Date submitted: 11 Jul 2013 Electronic form version 1.4