Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Determination of plasma sheath current distributions by comparison of Zeeman spectroscopy with B-dot measurements in laser ablation Z-pinch experiments[1] ERIC DUTRA, RADU PRESURA, Nevada National Security Site, Livermore Operation, Livermore, Ca 94550, WILLIAM ANGERMEIER, ROBERTO MANCINI, AARON COVINGTON, Department of Physics, University of Nevada, Reno, NV 89557 — In plasma pinch experiments, measurements of current distributions and losses across the anode-cathode (A-K) gap are needed to ensure uniform and repeatable implosions. Traditional B-dots measure current a considerable distance away from the plasma source and provide little detailed information on the current distribution across the plasma sheath near the pinch. In the experiments presented here, visible spectroscopic techniques were used to measure magnetically induced Zeeman splitting. Ionic plasma species were chosen such that the Zeeman splitting of different fine structure doublets split non-uniformly with increasing magnetic field strength in the plasma. This differential splitting enables measurements of non-directional B-field strengths in the plasma across a wide range of conditions. More specifically, the optical emission of Al III, C IV, and O VI doublets, $^2P_{3/2}$ to $^2S_{1/2}$ and $^2P_{1/2}$ to $^2S_{1/2}$ transitions were measured and used to determine the Zeeman broadening. We have applied this technique to diagnose time- and space-resolved B-field strengths in laser ablation Z-pinch experiments (LAZE). Experiments were conducted at the Nevada Terawatt Facility (NTF) using the TW-class Leopard laser and the 1 MA Zebra Z-pinch. The currents inferred from Zeeman spectroscopy measurements were compared to those determined from the B-dot diagnostics.

[1]DOE/NV/259463272

Eric Dutra
Natl Security Technologies LLC

Date submitted: 14 Jul 2017 Electronic form version 1.4