Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

Computational Imaging of Electron Densities and Temperatures of a Cathodic Arc using Laser Excited Emission Data BRIAN Z. BENTZ, EDWARD V. BARNAT, Sandia National Laboratories — This communication reports computational methods to extract spatially resolved images of electron densities and temperatures from laser-collision induced fluorescence (LCIF) data in low-pressure helium environments. The primary advantage of the approach is the capability to determine electron densities up to 10^{16} cm^{-3}, whereas previous LCIF diagnostics were limited to electron densities up to about 10^{12} cm^{-3}. This was accomplished using the maximum likelihood estimator (MLE) to estimate the electron density and temperature within the plasma by minimizing the difference between LCIF measurements and collisional radiative model predications. The method is demonstrated with a cathodic arc expanding in 65 mTorr of helium. Unexpectedly, a discontinuity is found about 4 mm above the arc where the electron temperature increases from 0.5 eV to 5 eV and the electron density drops from about 10^{14} cm^{-3} to about 10^{12} cm^{-3}. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy National Nuclear Security Administration under contract DE-NA0003525.

Brian Z. Bentz
Sandia National Laboratories

Date submitted: 24 May 2019 Electronic form version 1.4