Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

The Non-Lte Stagnation Physics Of A Z Pinch: Spectroscopy Coupled With Rad-Hydro Simulations[1] T. MEHLHORN, J. GIULIANI, W. THORNHILL, A. DASGUPTA, Naval Research Lab, Y. MARON, E. KROUPP, G. ROSENZWEIG, Weizmann Institute, C. COVERDALE, Sandia National Labs, J. APRUZESE, Engility Corp, C. DEENEY, NSTech, LLC — We present modeling of the non-LTE ionization kinetics in radiation-MHD simulations of Z pinches, focusing on the origin of the large effective ion temperatures and the energy balance during the stagnation phase. Effective ion temperatures (Ti_{eff}), based on the widths of emission lines, have long been reported to exceed the electron temperature by more than 10X. Ne gas puff experiments at the Weizmann Institute also display this effect, and provide extensive time and space resolved measurements of the plasma during stagnation. MACH2-TCRE has been used to model this Ne. Ti_{eff} has been computed analogously to the experimental technique. The 2D model results are significantly larger than the ion thermal temperatures early in the K-shell pulse, in agreement with the data. This implies that the broad line widths reflect strong radially velocity gradients near the axis. Spectroscopic data from Al/Ti arrays on Z at SNL and gas puffs at the Weizmann Institute indicate that the stagnating pinch is defined by an accreting shock with the pressure behind the shock balanced by the ram pressure of the imploding material. Polarization spectroscopy indicates that the magnetic field does not penetrate deeply into the stagnating plasma.

[1]Supported by DOE/NNSA

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Date submitted: 24 Jul 2015 Electronic form version 1.4