Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Predictions of non-LTE spectra from large scale 3D magneto-hydrodynamic modelling of wire array Z-pinches[1] NICOLAS NIASSE, JEREMY CHITTENDEN, Imperial College — The last few years have seen considerable advances in the application of high performance computing techniques to 3D simulations of wire array Z-pinches. Whilst the intense soft X-ray radiation output is the principle application of wire arrays, the ability to encompass spectrally detailed models of this emission within such 3D calculations was thought to be computationally prohibitive. We have developed a non-LTE atomic and radiation physics model with detailed configuration accounting and n-l splitting which is sufficiently streamlined to run in-line with large scale 3D simulations. In order to handle the volume of data generated by the spectral treatment of the billions of numerical cells, a novel data structure derived from a self-balancing binary search tree was developed, enabling the use of non-LTE DCA calculations within large scale 3D simulations for the first time. A brief description of the model is provided and the application of the simulations to understanding the X-ray generation processes within wire array Z-pinches on the Z generator at Sandia National Laboratory is reported. The contribution of the ion temperature and the motion of the unstable plasma at stagnation to the Doppler widths of the lines is described in detail.

[1]Work supported by the CEA.

Nicolas Niasse
Imperial College

Date submitted: 17 Jul 2012 Electronic form version 1.4