Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Inferring multiple ion temperatures and fluid velocities from neutron spectra BRIAN APPELBE, JEREMY CHITTENDEN, Imperial College London — Thermal broadening of the DD and DT neutron spectra is a common method for measuring ion temperature. However, recent work has shown that bulk motion of the fuel in ICF capsule implosions can also have a broadening effect on the emitted spectra. This can lead to errors in ion temperature estimates. In this presentation we show that, in addition, the neutron spectra emitted by non-igniting ICF plasmas are not dominated by a single ion temperature or velocity but are the superposition of component spectra produced by regions of the plasma with a wide variation of densities, temperatures and fluid velocities. In order to identify the different component spectra, it is necessary to analyze the overall shape of the spectra and not just the width. We develop a Maximum Likelihood Estimator (MLE) algorithm for analyzing the emitted spectra which allows us to identify multiple temperatures and fluid velocities and the relative density of these components. The algorithm works by finding a best fit to the emitted spectra for a specified number of components. It allows us to estimate the range of temperatures and fluid velocities which make significant contributions to the neutron spectra and estimate the peak ion temperatures achieved in the experiment. The algorithm is tested using 3D simulations of imploding capsules.

Brian Appelbe
Imperial College London

Date submitted: 10 Jul 2014 Electronic form version 1.4