Accurate Modeling of NIF Implosion Experiments for Reliable Extrapolation to Larger Scales

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Recent attention has focused on extrapolating the performance of current NIF implosion experiments to higher energies to assess the prospects for fusion ignition at larger scales. Reliably predicting the scaling of implosion performance, however, first requires an accurate understanding of current and past experiments. Previous modeling efforts of NIF implosions [1, 2] have shown the need to resolve a wide range of scales (from microns to millimeters) as well as a faithful representation of the genuinely three-dimensional (3-D) character of the stagnation process. The simulation model is further complicated by the many perturbation sources that have been found to influence integrated implosion performance: flux asymmetries from the surrounding hohlraum [3], engineering features such as support tents and fill tubes [4, 5], surface defects and contaminants, and more recently the radiation shadow cast by the fill tube on the capsule [6]. A model including all of these effects, and with adequate resolution, challenges current computing capabilities but has recently become feasible on the largest computers now available. This talk reviews the status of these multi-effect, 3-D simulations of NIF implosions, their comparison to experimental data, and preliminary results on scaling to higher energy and performance.

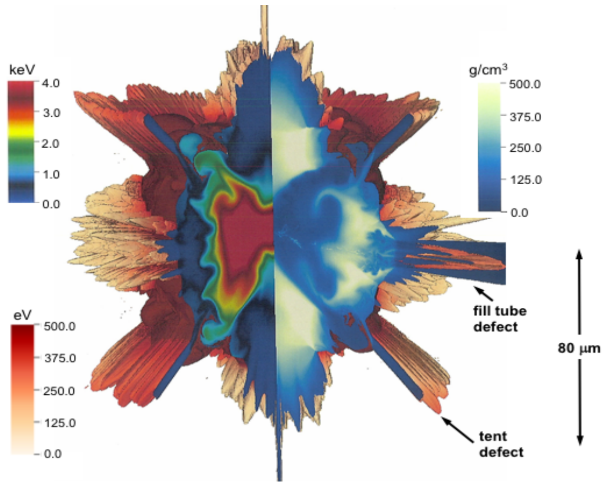

Figure 1: 3-D HYDRA simulation of the high foot implosion N140520 including perturbations from the tent, fill tube, surface roughness, and drive asymmetries.

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References

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