

# Hohlraum modeling for opacity experiments on the National Ignition Facility

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We will discuss the modeling of recent efforts to make iron opacity measurements in local thermodynamic equilibrium (LTE) using hohlraum experiments at the National Ignition Facility (NIF). A previous set of experiments fielded at Sandia's Z facility [1] have shown discrepancies between theory and experiment, up to factors of two, and casting doubt on the validity of the opacity models. The purpose of the NIF experiments is to make corroborating measurements at the same densities and temperatures, with the initial measurements made at a temperature of 160 eV and an electron density of  $0.7 \times 10^{22} \text{ cm}^{-3}$ .

The X-ray hot spots of a laser-driven hohlraum are not in LTE, and the iron must be shielded from a direct line-of-sight to obtain the data [2]. This shielding is provided either with internal structure (e.g. baffles) or external wall shapes that divide the hohlraum into a laser-heated portion and an LTE portion. In contrast, most ICF hohlraums are simple cylinders lacking complex gold walls, and the design codes are not typically applied to targets like those for the opacity experiments. We will discuss the initial basis for the modeling using LASNEX, and the subsequent modeling of five different hohlraum geometries that have been fielded on the NIF to date. This includes a comparison of calculated and measured radiation temperatures, and for material temperatures of the iron taken from magnesium absorption spectra.

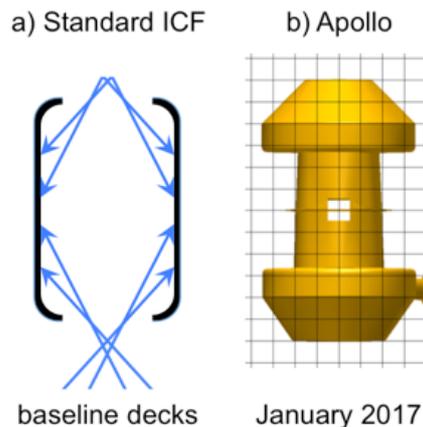


Figure 1: a) Depiction of a standard NIF vacuum hohlraum. b) The Apollo hohlraum will be used to field opacity experiments on the NIF.

## References

- [1] J. E. Bailey, T. Nagayama, G. P. Loisel, *et al.*, *Nature* **517**, 56 (2015)
- [2] T. S. Perry, P. T. Springer, D. F. Fields, *et al.*, *Phys. Rev. E* **54**, 5617 (1996)