Expanding Our Understanding of Implosion Symmetry in Indirect Drive ICF through Experimental Measurements on NIF

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New data analysis and experimental techniques employed on integrated ICF experiments on the NIF are allowing us to expand our understanding of the interaction of hohlraum dynamics and beam propagation with implosion symmetry[1]. Inner cone beams are pointed at the equator of the hohlraum to produce x-rays that drive the implosion from waist. These inner beams must pass through a "bubble" region resulting from the local expansion of the hohlraum wall where outer beams are deposited closer to the pole. Measurements of the x-ray generation on the interior of the hohlraum wall indicate a strong correlation of implosion low mode symmetry with absorption of the inner beams in the bubble region during the peak power portion of the laser pulse. We find that the absorption of the inner beams by the bubble scales with bubble growth by the square root of the energy in the early part of the outer cone pulse shape times the pulse length. Moreover, we find that the capsule implosion P2 at stagnation and in-flight, is strongly dependent on this absorption. This dependence allows us to introduce a modification to the inner cone energy reflecting the actual energy reaching the hohlraum waist during the peak. Adding this correction, we find a simple phenomenological model that matches the observed P2 over many experiments.

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References

[1] Ralph et. al. in preparation.