### Influence of In-Flight Shape on Stagnation Performance in Direct-Drive Laser Implosion Experiments



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#### Summary

# First measurements have been made of the sensitivity of stagnation performance to the in-flight low-mode symmetry ( $\ell \leq 3$ )

- . .....
- A 3-D measurement is used to diagnose the in-flight low modes of 60beam gas-filled implosions\*
- The yield is observed to correlate to changes in the measured lowmode symmetry
- The observed sensitivity to shape is less than half what is obtained in preliminary 3-D *ASTER* simulations including low modes and imprint

The weak response to asymmetry in the experiments is suggestive of degradation pathways not in the model.





#### **Collaborators**



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#### Technique

# The 3-D in-flight shape is obtained by imaging the x-ray self-emission of laser ablation from multiple directions



The symmetry is modified with adjustments to individual on-target laser-beam energies.

\* D. T. Michel et al., Phys. Rev. Lett. <u>120</u>, 125001 (2018).



#### Using the 3-D measurement, a residual mode is characterized



- $\ell = 1$ : Ongoing work suggests procedural issues associated with pointing
- $\ell = 2$ : Clear association with mounting



## Based on the 3-D measurement, a correlation is observed between in-flight symmetry and neutron production at stagnation





## The hot-spot x-ray emission at stagnation exhibits changes consistent with the 3-D measurement





# The experimental response to the asymmetry is weaker than predicted with 3-D calculations (accounting for in-flight symmetry and imprint) using *ASTER*<sup>\*</sup>.



- ASTER with low modes but without imprint show the most sensitivity (to symmetry)
- ASTER with low modes and imprint shows less sensitivity
- The experiment shows the least sensitivity



<sup>\*</sup> I. V. Igumenshchev et al., Phys. Plasmas 23, 052702 (2016);

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### Backup





#### Supplementary Figures

## Casting yield versus laser symmetry (reported from system) does not show correlation







## The best optimized implosion does not reach the calculated convergence



Note: 3-D modeling preliminary



Calculated ~ 23













