Three-Dimensional Distributions of Deposited Energy and Scattered Light in NIF “Exploding-Pusher” Polar-Drive Experiments

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Summary

SAGE modeling of NIF “exploding-pusher” experiments is consistent with experimental scattered light observations

- The simulations combine 2-D hydrodynamics with 3-D ray tracing including all 192 NIF beam directions
- The deposited energy is ~20% higher at the equator and very uniform azimuthally
- The scattered light predicted on the NBI plates shows strong spatial variations consistent with observations
Collaborators

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Understanding the scattered light distribution in NIF polar-drive experiments is important for two primary reasons

- By matching NBI/FABS observations to simulations one may estimate the target absorption
- For assessment of potential damage to NIF optics one needs realistic estimates of the scattered light flux
“Exploding-pusher” shot 100823 used a ramp laser pulse

![Graph showing power vs. time for Shot 100823]

- Incident (80 kJ)
- Absorbed (A = 71%)
- Scattered
The polar-drive design involves defocusing and repointing the NIF beams, using the indirect-drive phase plates.

Ring 3B ($\theta = 47^\circ$)
Defocus 1.4 cm

Initial target ($d = 1.5$ mm)
The cumulative deposited energy is \( \sim 20\% \) higher at the equator and very uniform azimuthally.
The deposited energy patterns of the individual rings combine to give a total deposition that is ~20% higher at the equator.
Rings 3B and 4 from the upper and lower hemispheres combine well at the equator.
The azimuthally averaged center-of-mass radius at 1.6 ns is uniform to 3.4 μm (rms)
Averaged over the sphere, the center-of-mass radius is uniform to 3.6 $\mu$m
The cumulative scattered light is concentrated in a narrow range of angles $\theta$ sampled by the two NBI plates.
The contributions of the individual rings to the cumulative scattered light can be identified.
The calculated scattered light on NBI plate B31B shows significant structure
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The SAGE simulation of the B31B NBI image is consistent with the experiment.
The calculated scattered light on NBI plate B36B shows a strong top-to-bottom variation.
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The SAGE simulation of the B36B NBI image is broadly consistent with the experiment.
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Comparisons with NBI/FABS measurements may enable the target absorption to be estimated.