Polar-Direct-Drive (PDD) Experiments on OMEGA

\[ t = 1.00 \text{ ns} \quad t = 1.25 \text{ ns} \quad t = 1.50 \text{ ns} \quad t = 1.75 \text{ ns} \]

500 \( \mu \text{m} \)  200 \( \mu \text{m} \)

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Collaborators


Related papers:
R. S. Craxton (Invited Paper), BI2-002
R. Epstein, HO1-013
J. Marozas, HO1-014
Initial OMEGA PDD experiments confirm simulation and modeling predictions

• Initial OMEGA PDD experiments were carried out with 40-beam illumination.

• Absorption and drive measurements are consistent with hydrocode predictions.

• X-ray emission and absorption images show expected low-$\ell$ mode asymmetries.

• The first “Saturn” configuration PDD experiments show promise for control of low-$\ell$ mode nonuniformities.
The NIF 48-quad PDD configuration was simulated on OMEGA by repointing 40 beams.

- 42° beams moved to 66.6°
- 58.8° beams moved to 83.5°
- 21° beams moved to 33.4°
PDD beam pointing was determined with 4-mm-diam pointing targets

Accuracy = 18-µm rms
Energy Coupling

Absorption and drive measurements confirm simulation predictions for PDD configuration

Oblique incidence absorption on large CH solid spheres

Streaked and framed imaging on shells imploded with PPD configuration

*SPECT3D, PRISM Computational Sciences, Inc., Madison, WI
“Saturn” Target

A “Saturn” ring is used to refract light onto the target equator

Visible light image

X-ray pinhole camera image (2 to 5 keV)

OMEGA Shot 37430

*R. S. Craxton, this conference BI2-002
Two types of PDD implosions were carried out on OMEGA

X-ray Pinhole Camera Images (2 to 5 keV)

<table>
<thead>
<tr>
<th>Type of Implosion</th>
<th>OMEGA Shot</th>
<th>E_L (kJ)</th>
<th>Yield (10^10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 beam implosion</td>
<td>37419</td>
<td>15.8</td>
<td>6.9 x 10^10</td>
</tr>
<tr>
<td>PDD 40 beam implosion</td>
<td>37427</td>
<td>15.0</td>
<td>2.4 x 10^10</td>
</tr>
<tr>
<td>PDD 40 beam implosion with ring</td>
<td>37428</td>
<td>15.2</td>
<td>1.8 x 10^10</td>
</tr>
</tbody>
</table>
Implosion Symmetry

Implosion symmetry was measured with time-gated x-ray backlighting.
Gated backlit x-ray images show a nearly symmetric target implosion.

OMEGA Shot 34669 (PDD no ring)

- **t = 1.00 ns**
  - Self emission
  - 500 \( \mu \)m

- **t = 1.25 ns**
  - Backlighter spot

- **t = 1.50 ns**
  - Imploding shell
  - 200 \( \mu \)m

- **t = 1.75 ns**
The experimental data follow the predicted center-of-mass variations very closely.
The additional drive at the equator for the Saturn target is greater than predicted.
Summary/Conclusions

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