2-D Simulations of OMEGA Fast-Ignition Cone Targets

\[ \rho R \sim 63 \text{ mg/cm}^2 \]

\( x (\mu \text{m}) \)

\( y (\mu \text{m}) = -200 \)

Density (g/cm\(^3\))

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Fusion Science Center for Extreme States of Matter and Fast-Ignition Physics

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Summary

Preliminary cone-in-shell simulations agree well with experiment

- 2-D cone-in-shell fuel-assembly simulations are being simulated using HYDRA*

- Simulated $\rho R$'s and convergence ratios are in agreement with experiment

Collaborators


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Fast ignition offers the potential of higher gains and lower driver energies.
The two viable fast-ignition concepts share fundamental issues: hot-electron production and transport to the core.
Cone-in-shell targets with plastic shells have been imploded on OMEGA.

Current *HYDRA* cone-in-shell simulations are simplified using a few assumptions

- Radiation transport not modeled
- No step in cone at outer-shell boundary
- Cone inner-surface boundary fixed
- Uniform laser illumination
An all-D\textsubscript{2} cryogenic capsule has been modeled using HYDRA

**OMEGA-like capsule:**
- Cone half angle = 45°
- No offset of cone from center of capsule

130-\textmu m D\textsubscript{2} ice, 23 kJ in 1-ns square pulse
Simulation results give a consistent picture of the hydrodynamic compression of the shell around the cone TC7634.

Simulation: 130-μm D_2 ice, 23 kJ in 1-ns square, peak compression

\[ \rho R \sim 63 \text{ mg/cm}^2 \]

Experiment: 24-μm CH, 22 kJ in 1-ns square, peak compression

\[ \rho R \sim 60 \text{ mg/cm}^2 \]

\[ <\rho> \sim 15 \text{ g/cm}^3 \]
HYDRA simulations of 17° cone-in-shell plastic targets are in progress

Uniformly driven 24-μm CH capsule with cone tip offset = 40 μm

Density at 1.4 ns
Current and future work

• Work in progress
  – Adding step to cone
  – *DRACO* Eulerian and ALE

• Future work
  – Radiation transport
  – Include real beam geometry
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