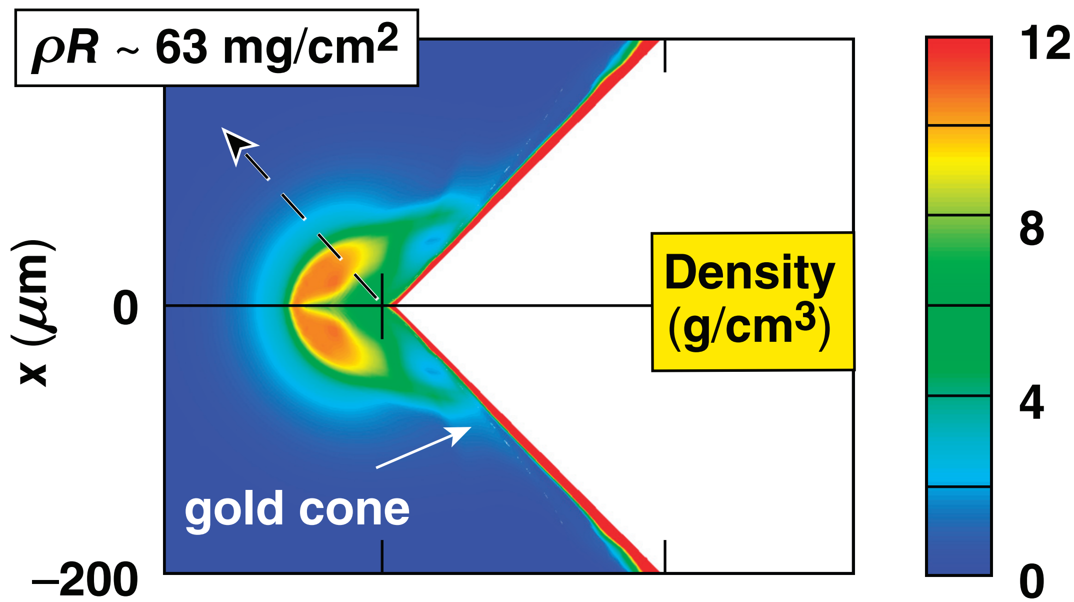
2-D Simulations of OMEGA Fast-Ignition Cone Targets



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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 ρR's and convergence ratios are in agreement with experiment

[*] M. M. Marinak *et al.*, Phys. Plasmas 8, 2275 (2001).

TC7486

Collaborators

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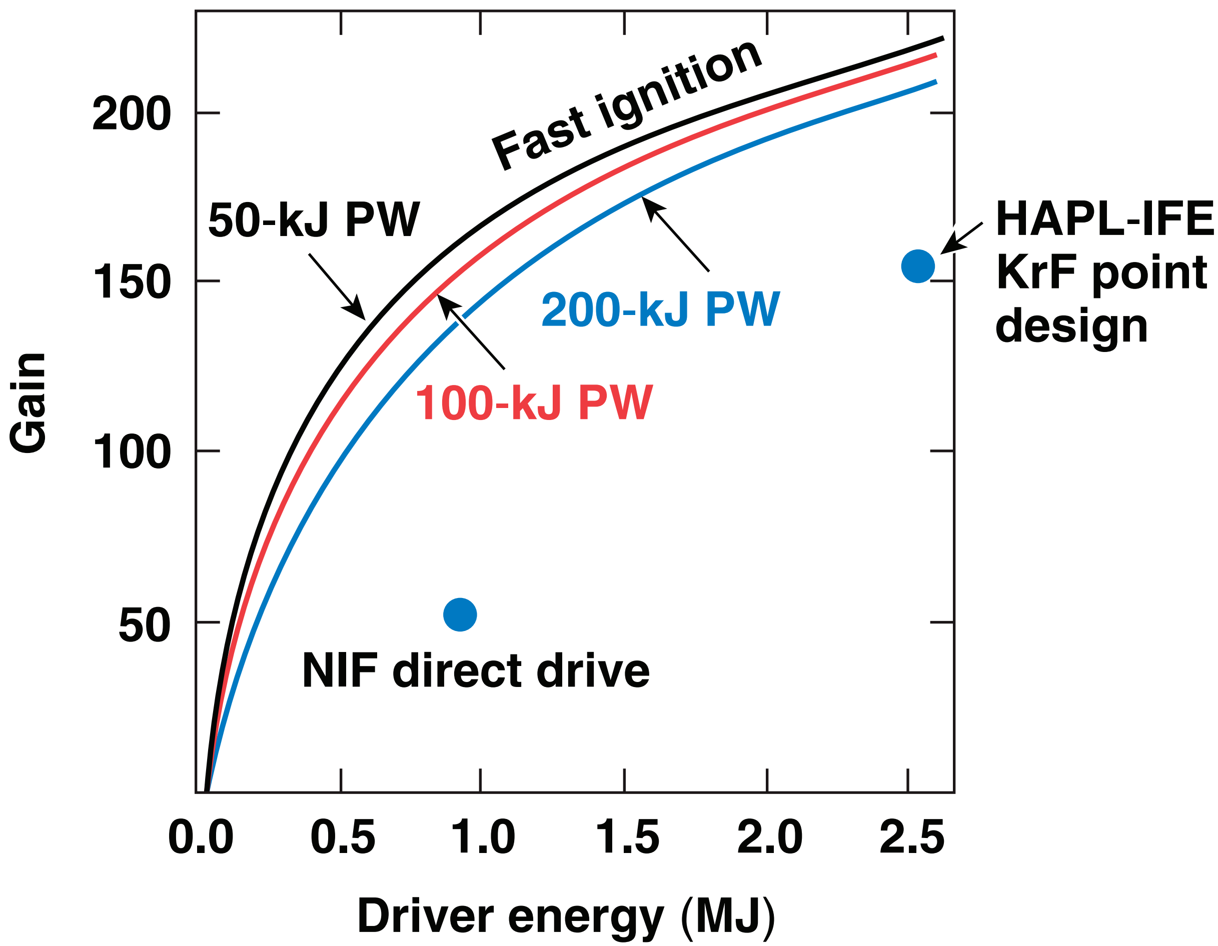
Fast ignition offers the potential of higher gains and lower driver energies



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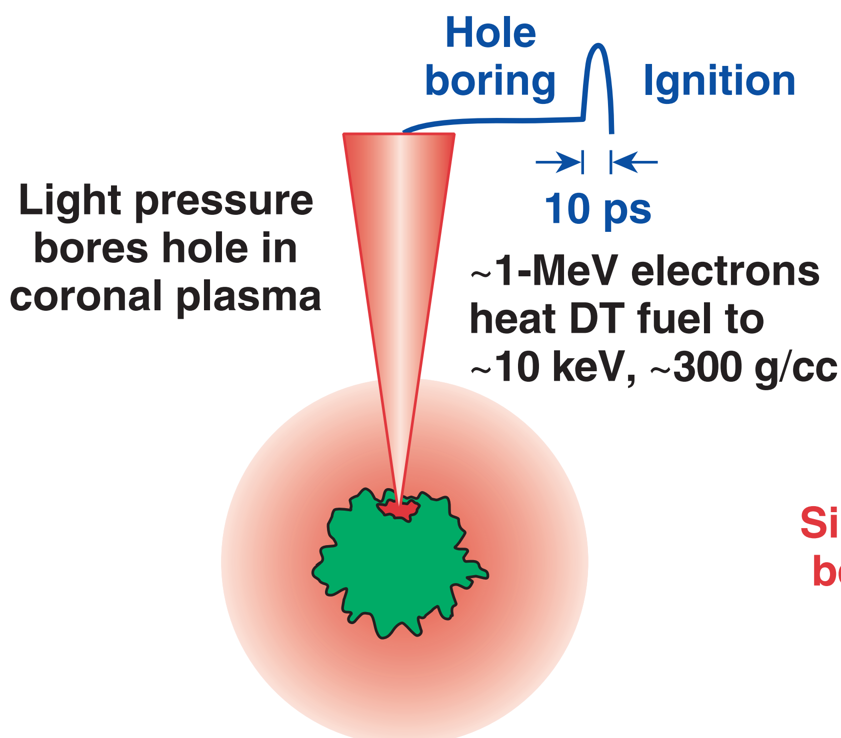
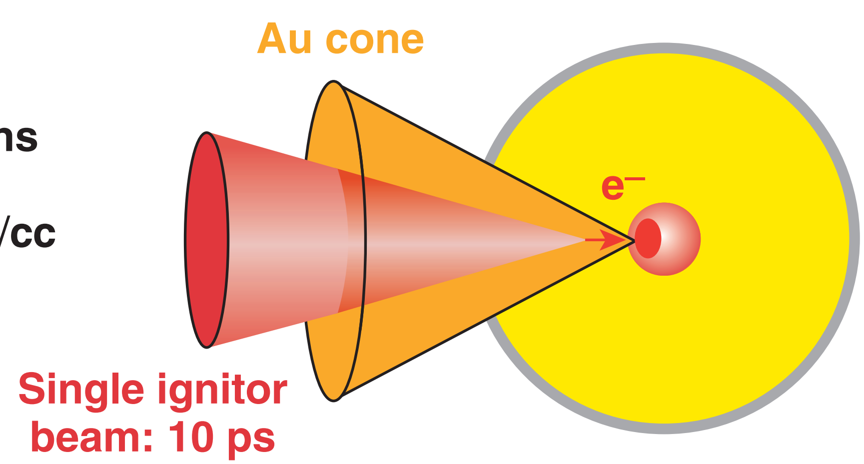
R. Betti, A. A. Solodov, J. A. Delettrez, and C. Zhou, Phys. Plasmas 13, 100703 (2006).

The two viable fast-ignition concepts share fundamental issues: hot-electron production and transport to the core

Channeling Concept



Cone-Focused Concept



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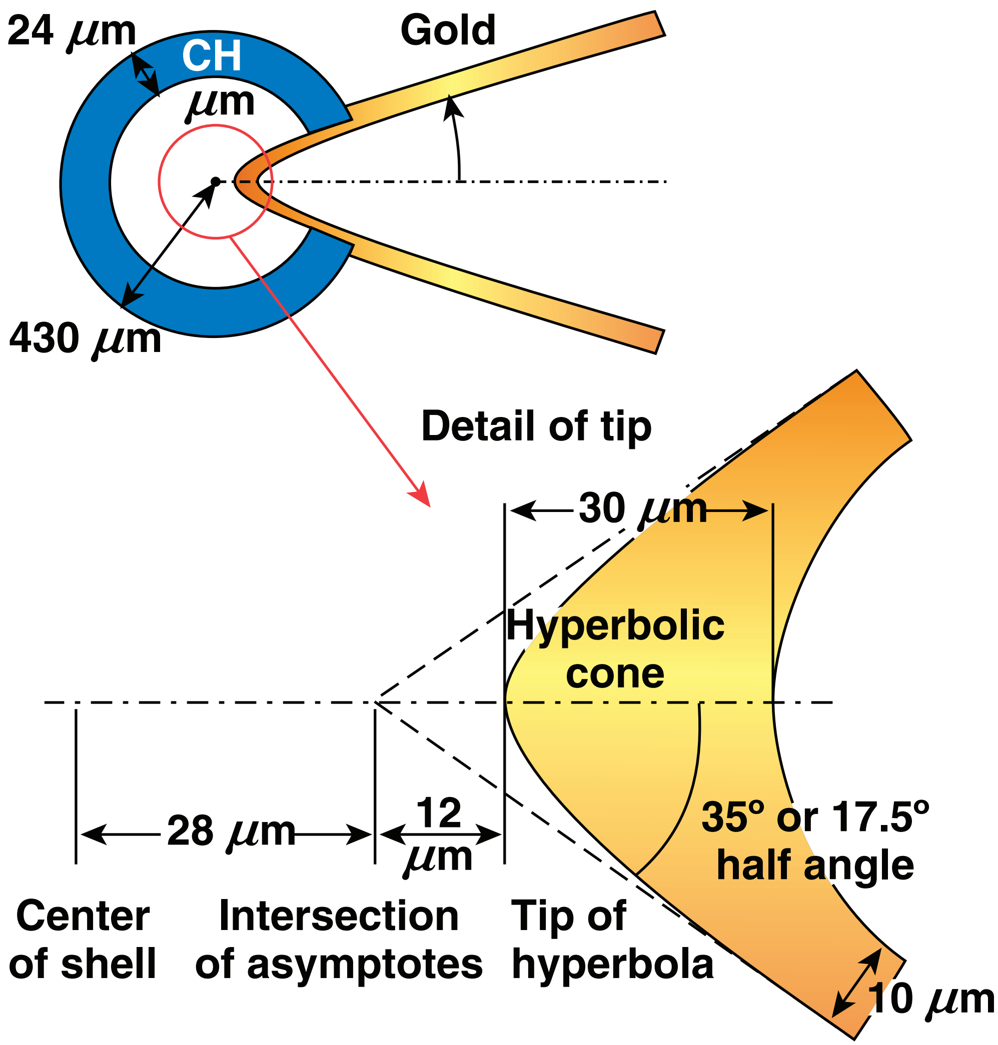
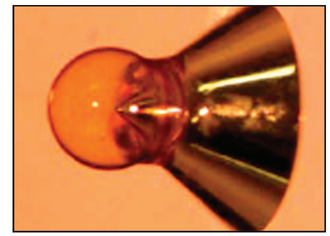
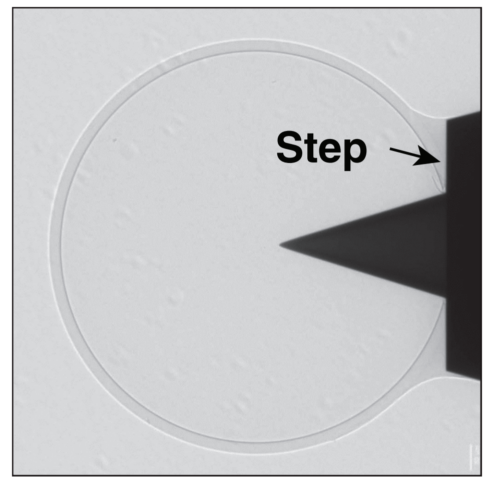
Cone-in-shell targets with plastic shells have been imploded on OMEGA







Radiograph of target

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C. Stoeckl *et al.*, Phys. Plasmas 47, 859 (2005).

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

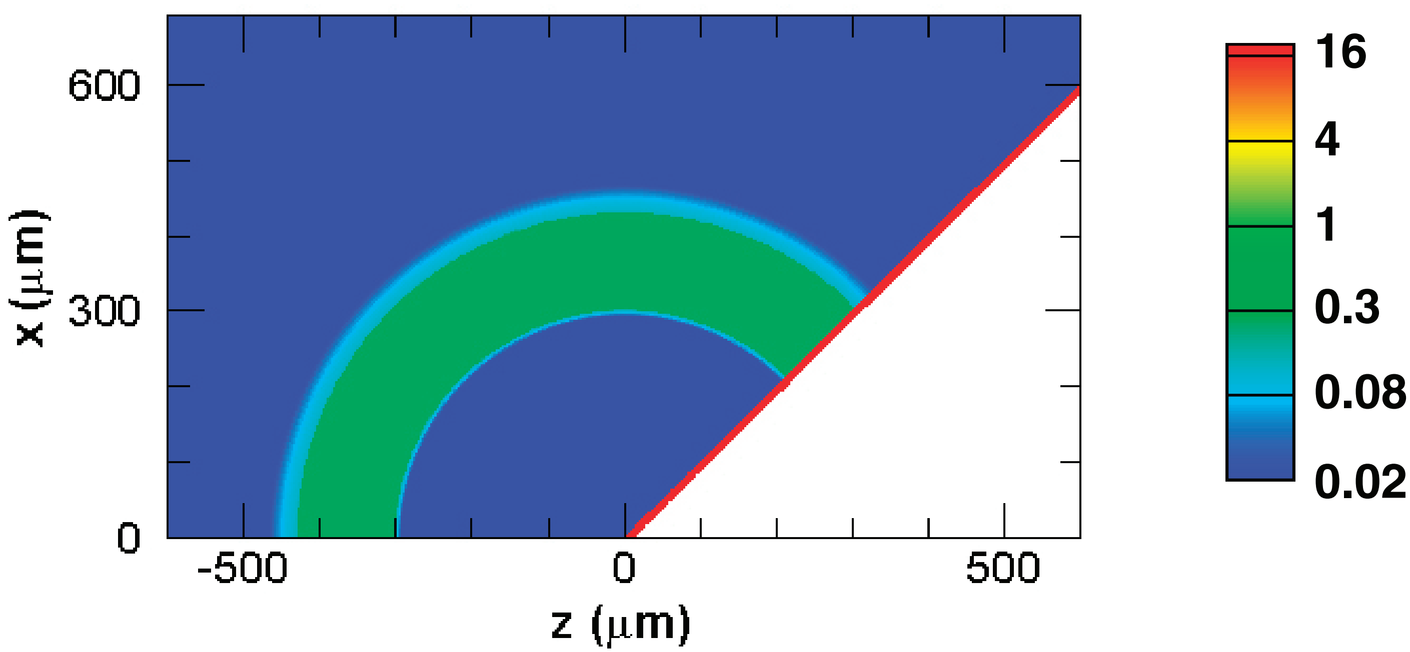
- Radiation transport not modeled
- No step in cone at outer-shell boundary
- Cone inner-surface boundary fixed
- Uniform laser illumination

An all-D_2 cryogenic capsule has been modeled using *HYDRA*

OMEGA-like capsule:
130-μm D_2 ice, 23 kJ in 1-ns square pulse

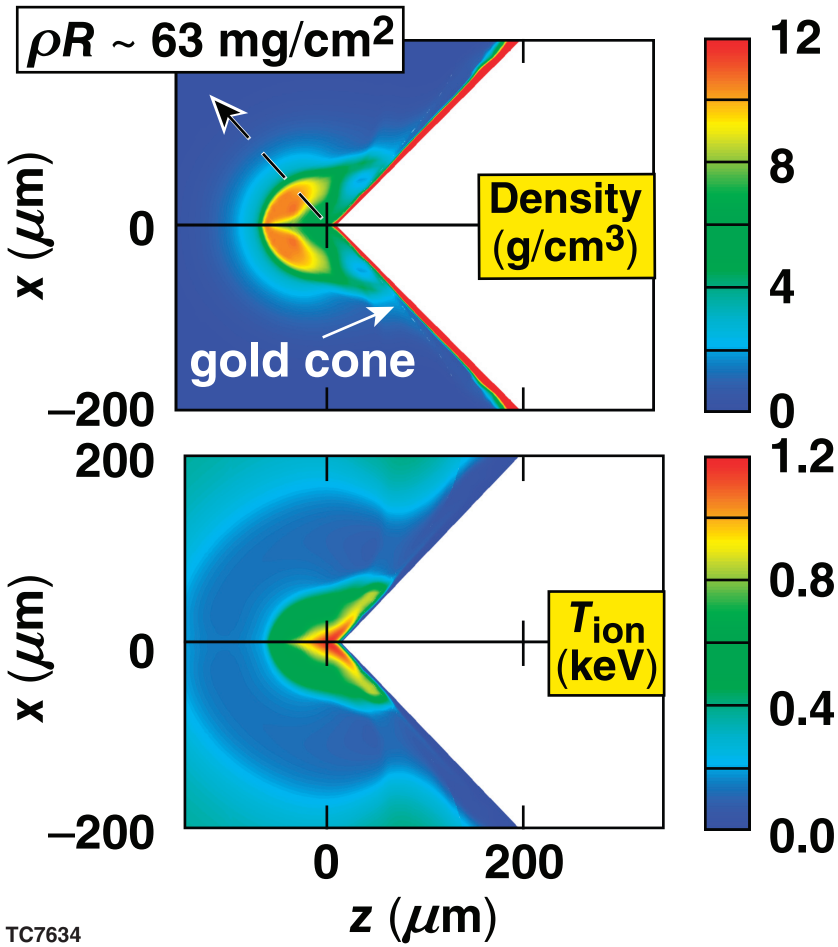
- Cone half angle = 45°
- No offset of cone from center of capsule

Density (g/cc)

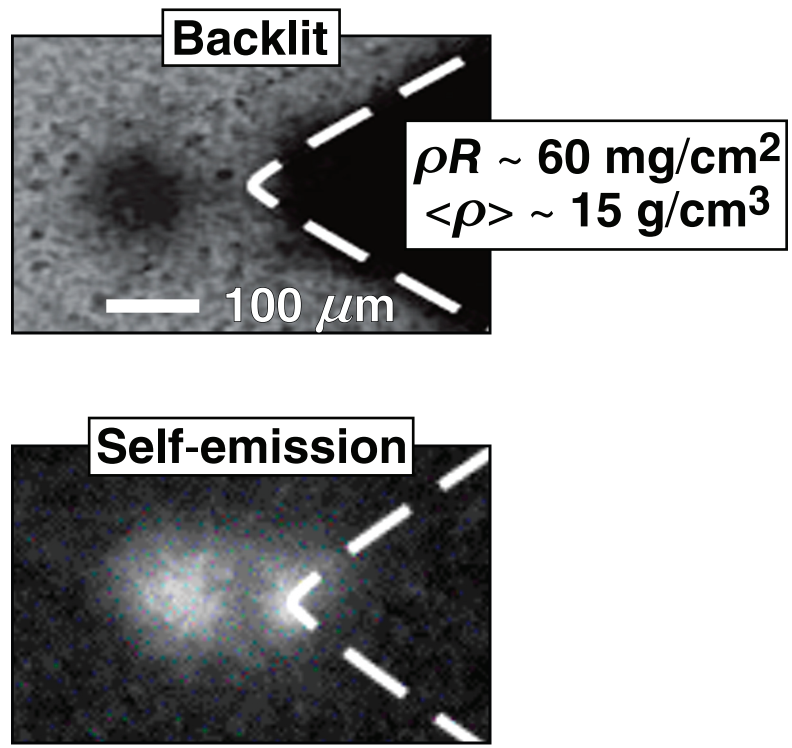


Simulation results give a consistent picture of the hydrodynamic compression of the shell around the cone

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

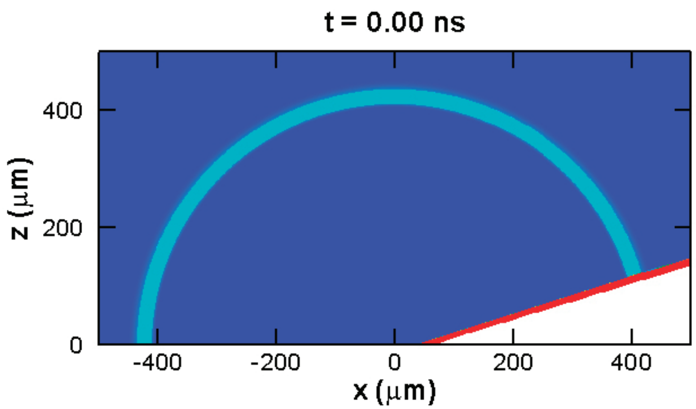


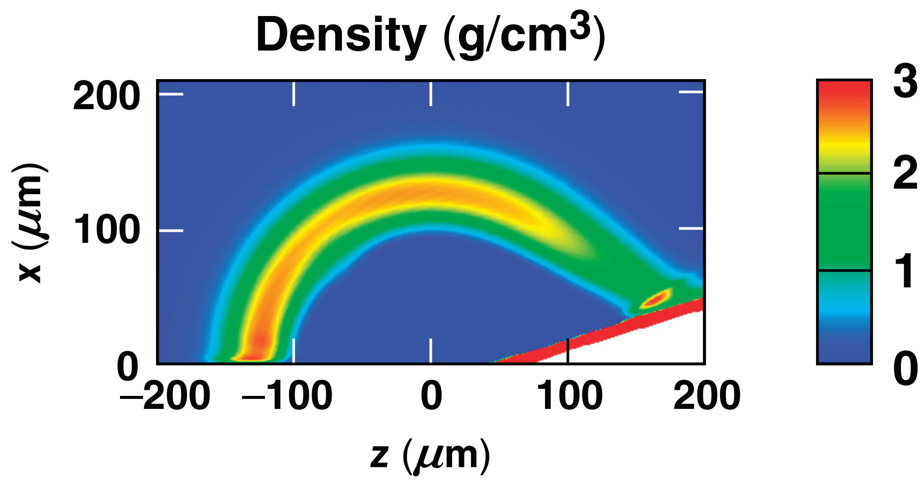
Experiment: 24-μm CH, 22 kJ in 1-ns square, peak compression



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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Summary/Conclusions

Preliminary cone-in-shell simulations agree well with experiment

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