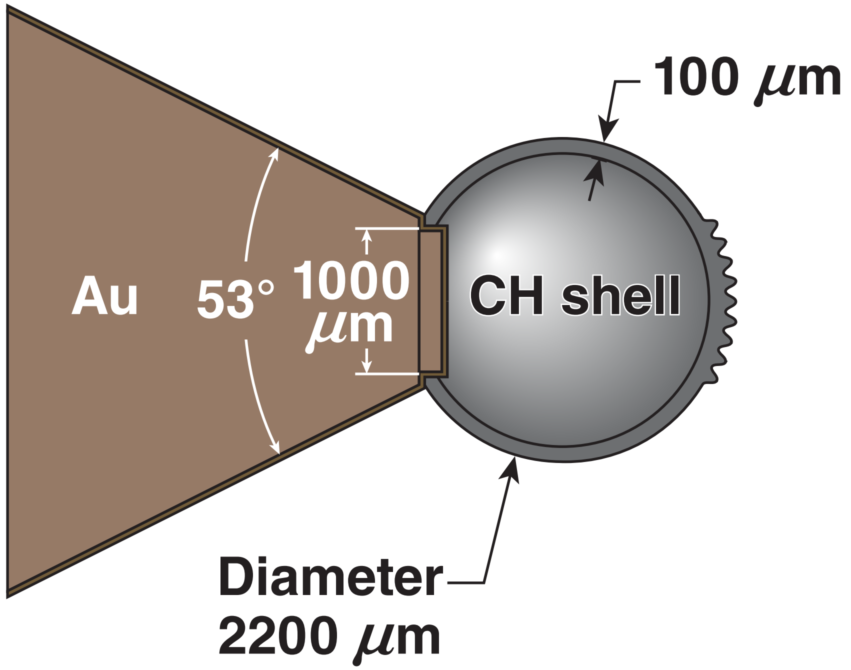
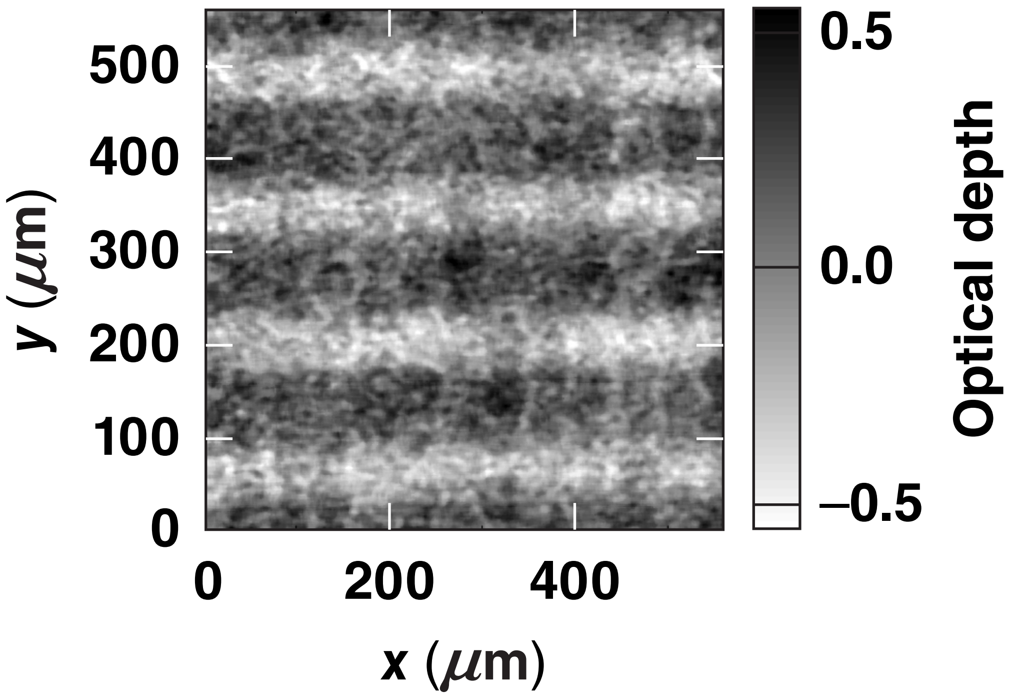
Hydrodynamic Instability Growth in Polar-Direct-Drive Implosions at the National Ignition Facility





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Summary

Experimental platforms for diagnosing laser imprint and hydrodynamic instability growth in polar direct drive (PDD) at the National Ignition Facility (NIF) are being developed

- **Rayleigh–Taylor (RT) growth from laser imprint and initial shell-surface perturbations are key performance limitations for current PDD implosions on the NIF**
- **Backlighter development on both OMEGA EP and the NIF will extend the current platform from 1-D to 2-D imaging**
- **Enhanced single-beam smoothing via 1-D multi-FM smoothing by spectral dispersion (SSD) is expected on the NIF by the end of FY18**

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Collaborators

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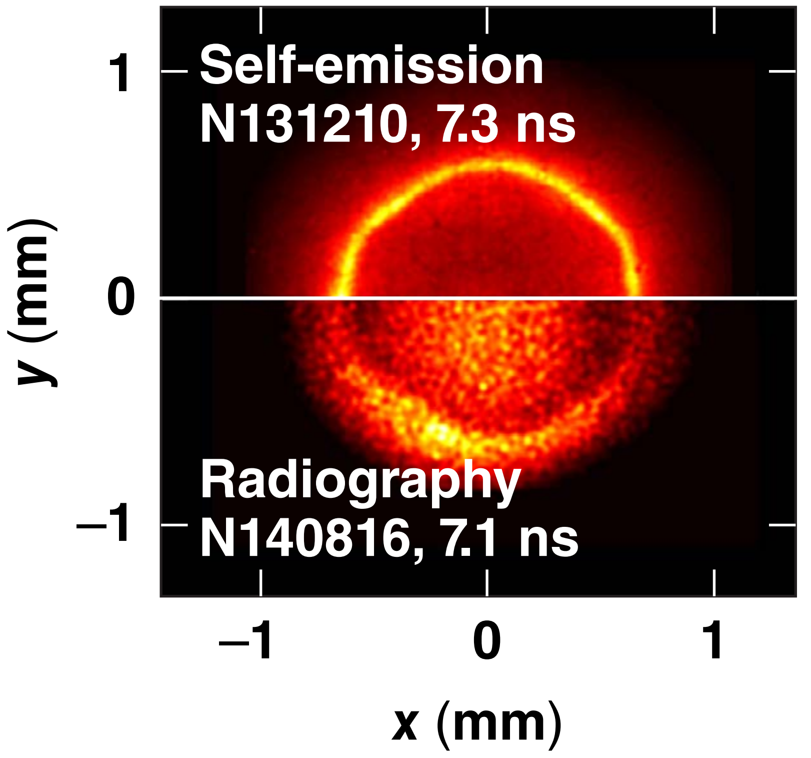
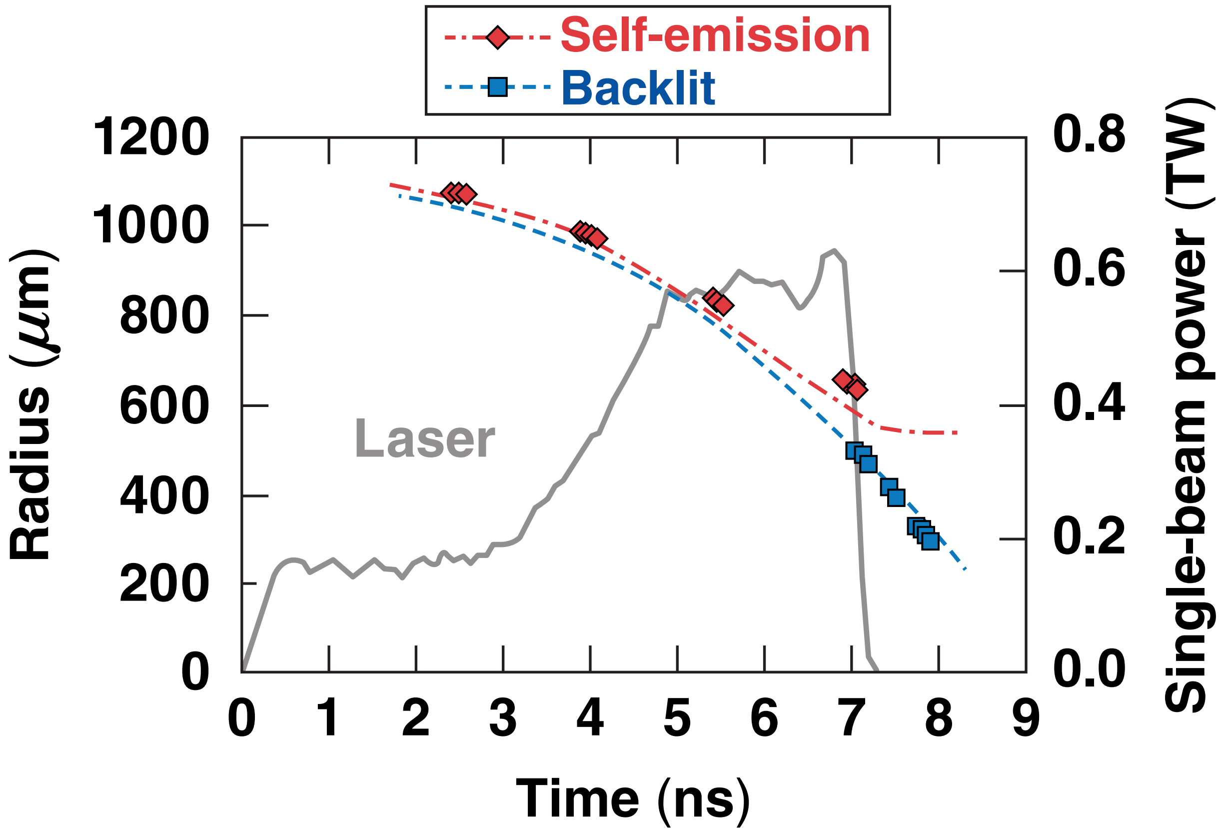
In current PDD implosions, the ablation-surface trajectory is delayed compared to the shell trajectory and simulations





Laser imprint is believed to cause a decoupling of the ablation surface from the shell.

M. Hohenberger *et al*., Phys. Plasmas 22, 056308 (2015);
P. B. Radha, CI3.00004, this conference (invited).

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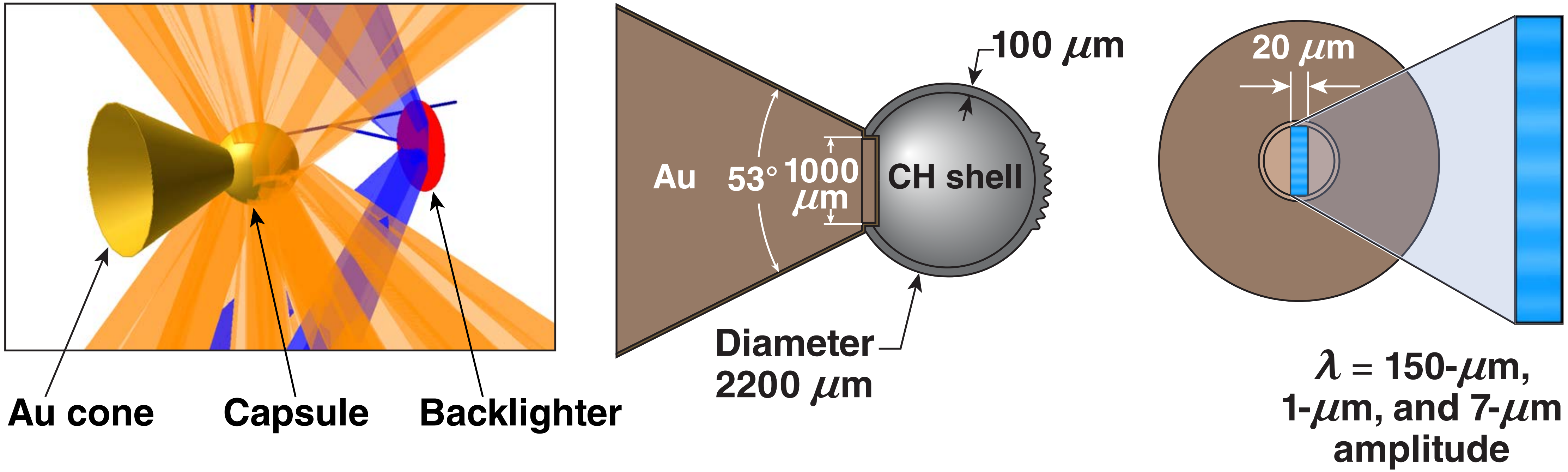
A platform to measure RT growth and laser imprint in PDD implosions on the NIF is being developed



- A CH capsule implosion is driven with 34 quads
- A Saran backlighter for face-on, x-ray radiography (Cl He_{α} = 2.8 keV) is used
- One-dimensional/slit imaging records growth of preimposed shell surface modulations

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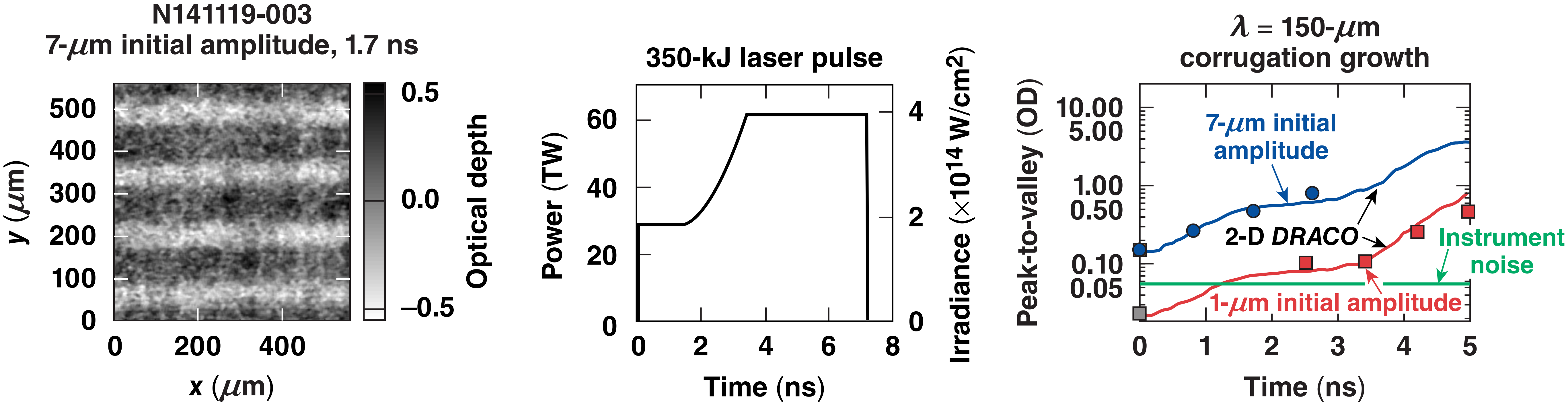
Optical-depth (OD) growth of the single-mode perturbation is a measure of shell compression and RT growth



- Saran backlighter brightness limits the measurements to large modulation amplitudes (>1 μm) and 1-D measurements
- A better backlighter is needed to resolve the most-damaging modes (~200 to 250)

A. Shvydky *et al.*, GO5.00005, this conference.

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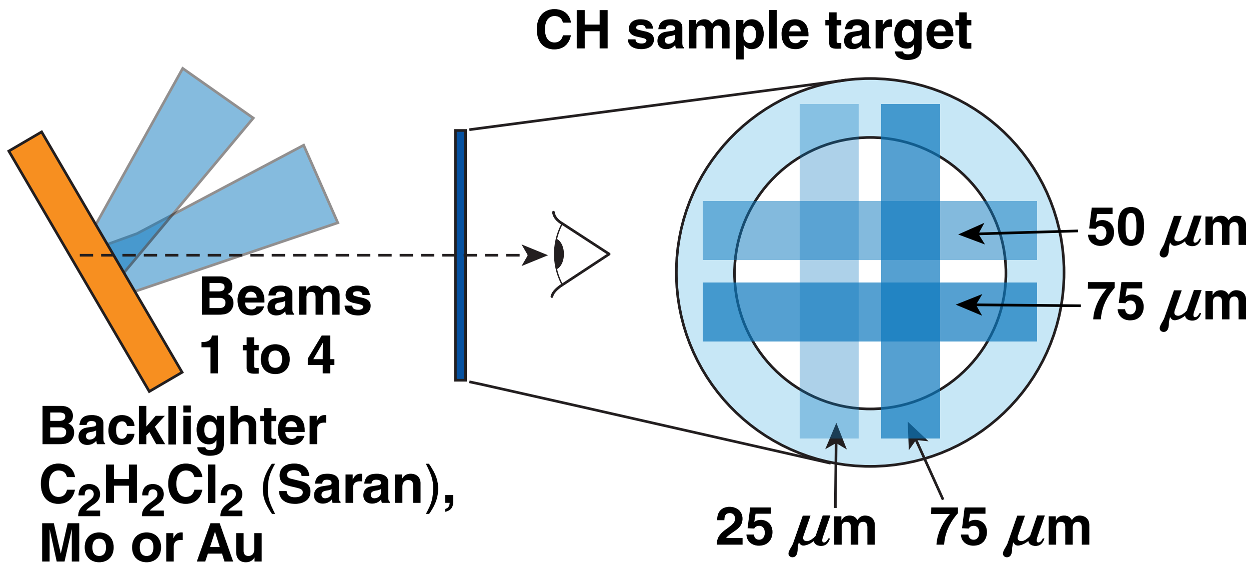
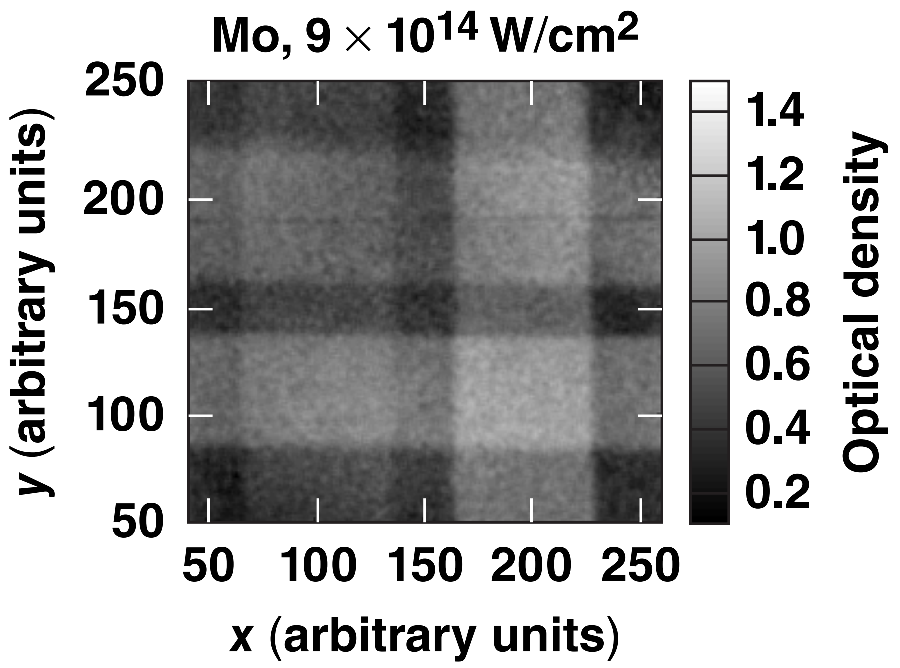
OMEGA EP experiments were used to optimize backlighter brightness and contrast for Au M-shell and Mo L-shell emission





Best brightness and contrast were achieved for a Mo L-shell backlighter at 9×10^{14} W/cm^2, ~4× brighter than Saran.

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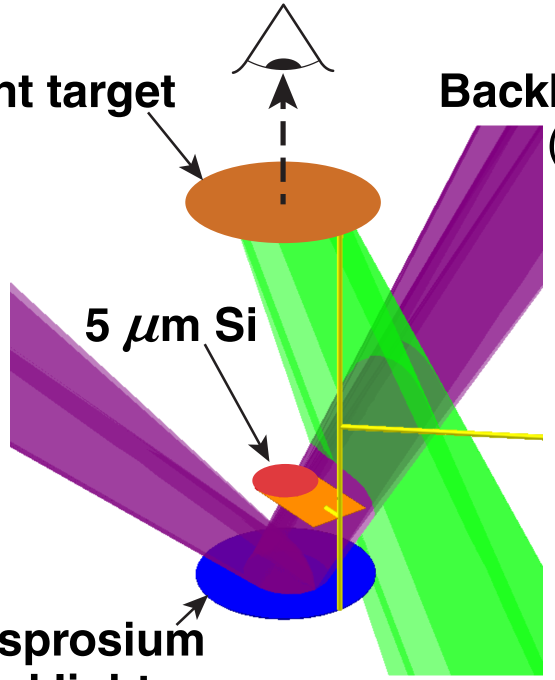
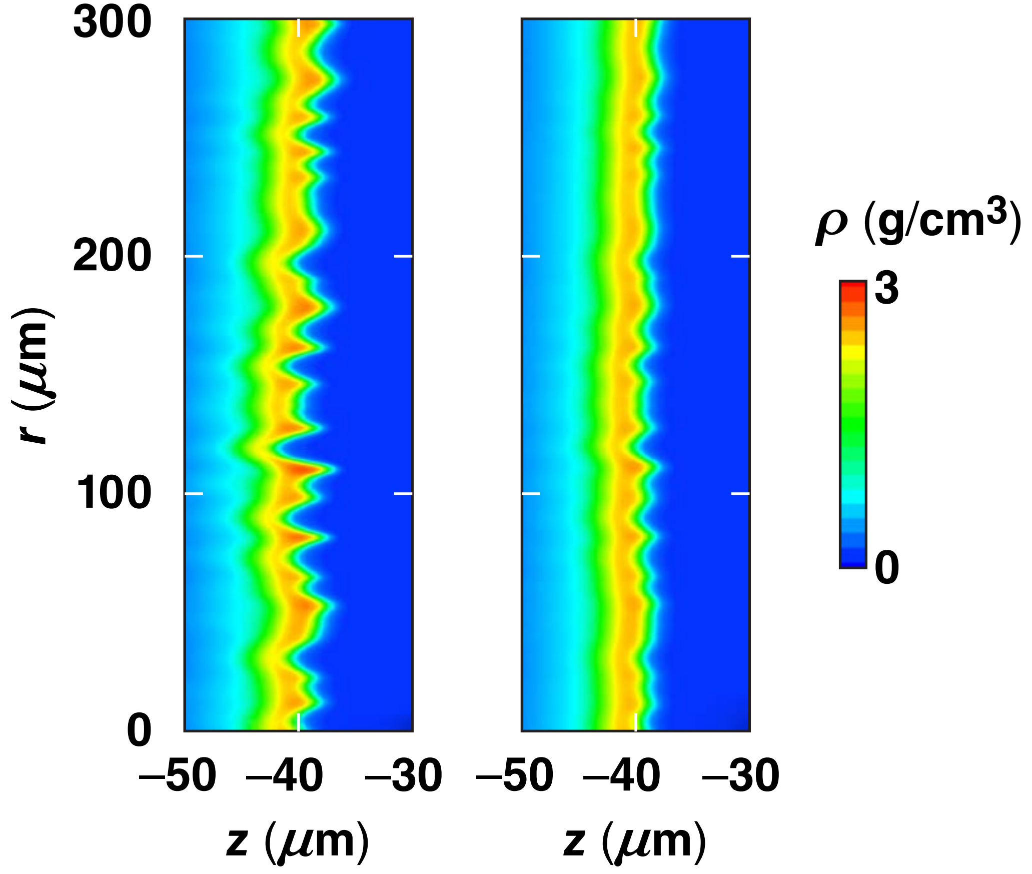
NIF experiments in FY16 will qualify 1-D multi-FM SSD performance and measure broadband Rayleigh–Taylor growth





- A single quad (Q24B) will have multi-FM SSD capabilities by January 2016
- Full NIF multi-FM SSD is expected by the end of FY18

A. Shvydky *et al.*, GO5.00005, this conference.

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Summary/Conclusions

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