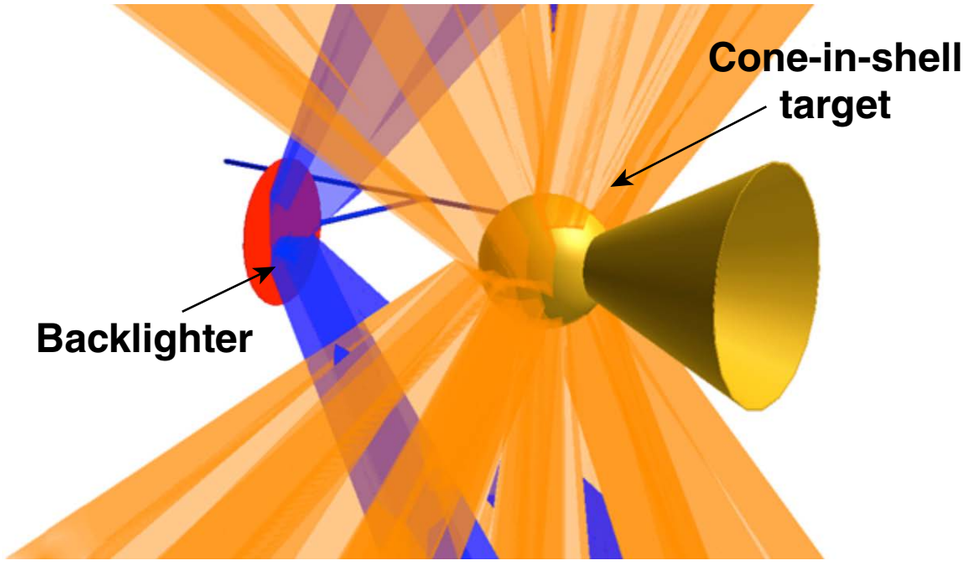
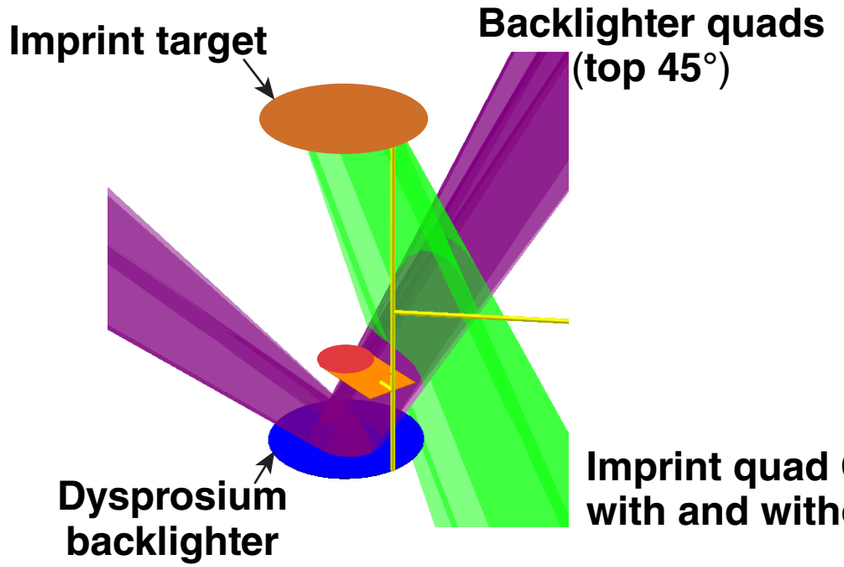
Numerical Simulations of Hydrodynamic Instability Growth and Imprint Experiments at the National Ignition Facility

UR LLE

NIF polar-direct-drive spherical-imprint platform



NIF planar multi-FM platform



A. Shvydky
University of Rochester
Laboratory for Laser Energetics

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Summary

Imprint and hydrodynamic instability growth experiments have been performed at the National Ignition Facility (NIF)

- Initial experiments examined single-mode modulation growth and showed good agreement with *DRACO* simulations
- Upcoming spherical imprint experiments examine the growth of broadband imprint and the preimposed surface perturbations
- *DRACO* simulations of these experiments indicate that the growth of the imprint modes will dominate
- *DRACO* simulations of the planar imprint experiments predict that multi-FM smoothing by spectral dispersion (SSD) is highly effective in mitigating imprint seeded nonuniformities

Related talk: M. Hohenberger *et al.*, JO4.00006, this conference.

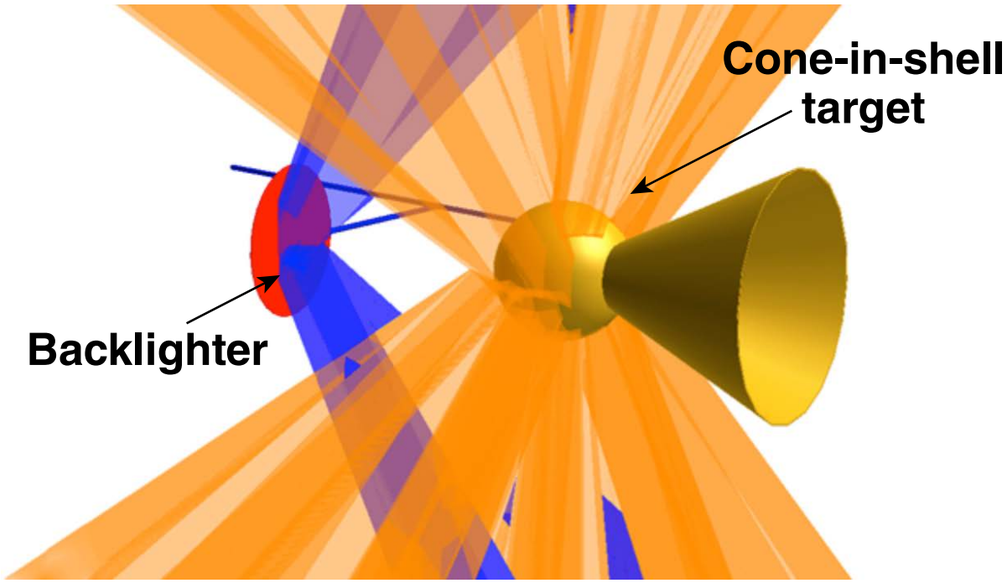
Collaborators

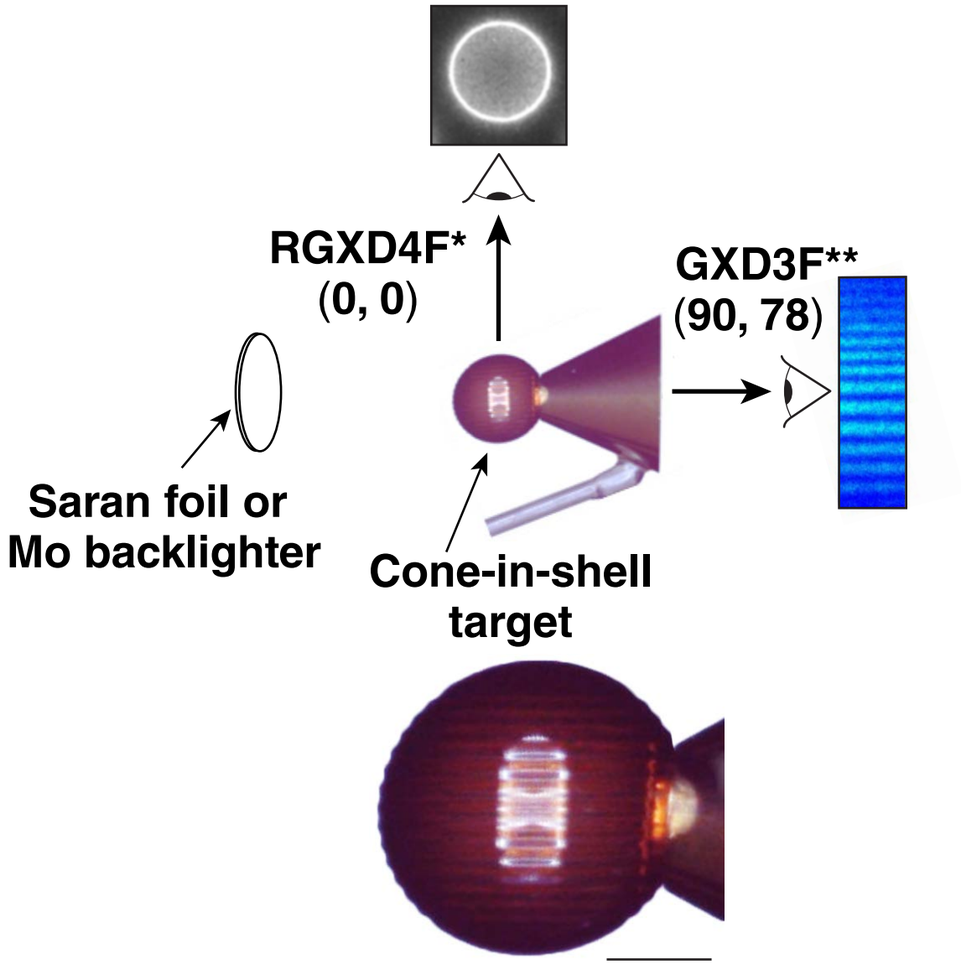
M. Hohenberger, P. B. Radha, M. J. Rosenberg,
R. S. Craxton, V. N. Goncharov, J. A. Marozas, F. J. Marshall,
P. W. McKenty, S. P. Regan, and T. C. Sangster

University of Rochester
Laboratory for Laser Energetics

NIF polar-direct-drive (PDD) spherical-imprint experiments employ cone-in-shell CH targets and simultaneous x-ray radiography and side-on self-emission imaging

The CH shell is driven with 34 quads

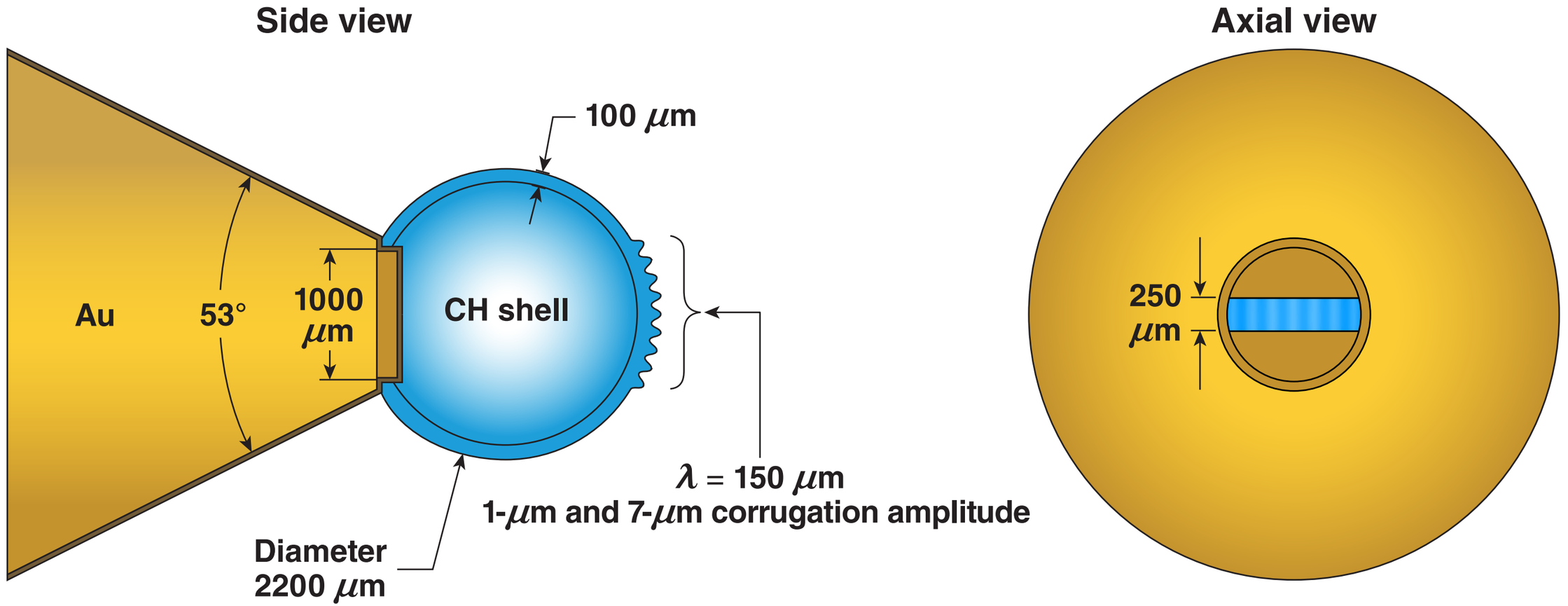




* RGXD4F: rotated gated x-ray detector 4F
** GXD3F: gated x-ray detector 3F

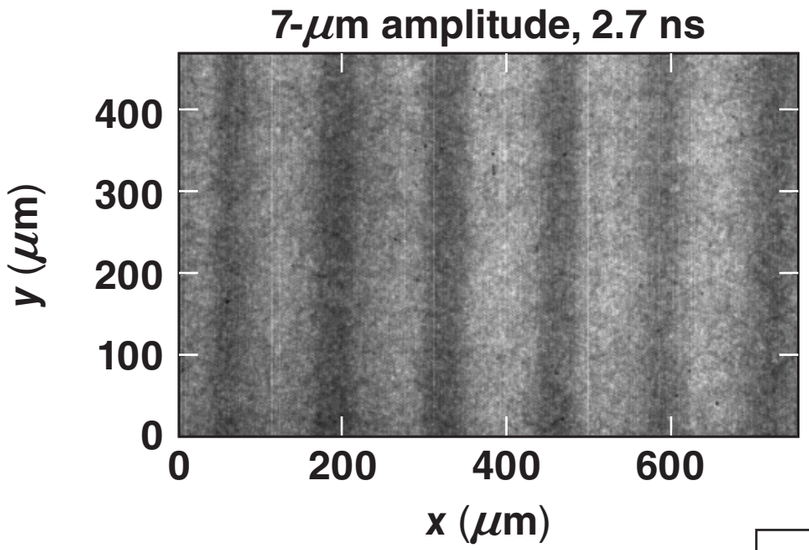
TC12559

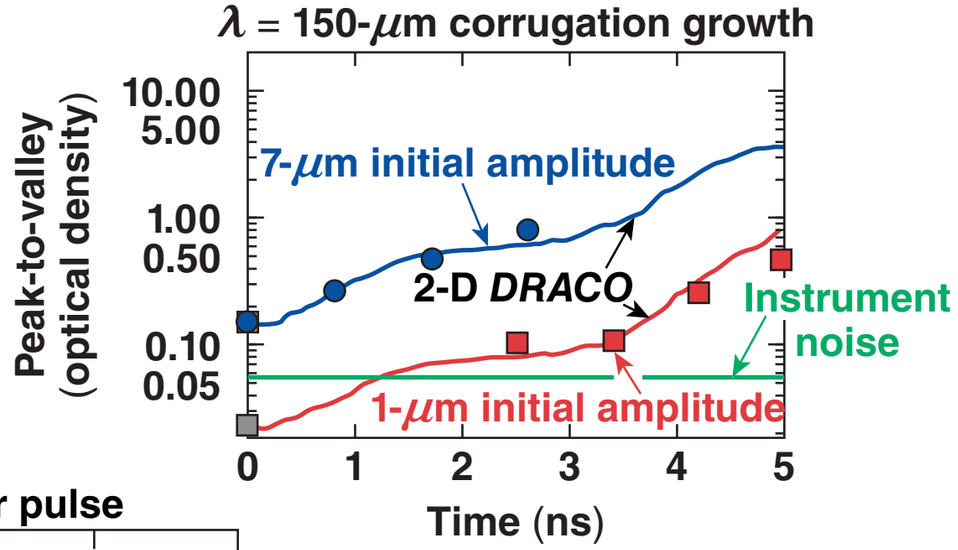
NIF shots N141119 and N141120 used corrugated shells and slotted cones for 1-D imaging of a single-mode modulation growth

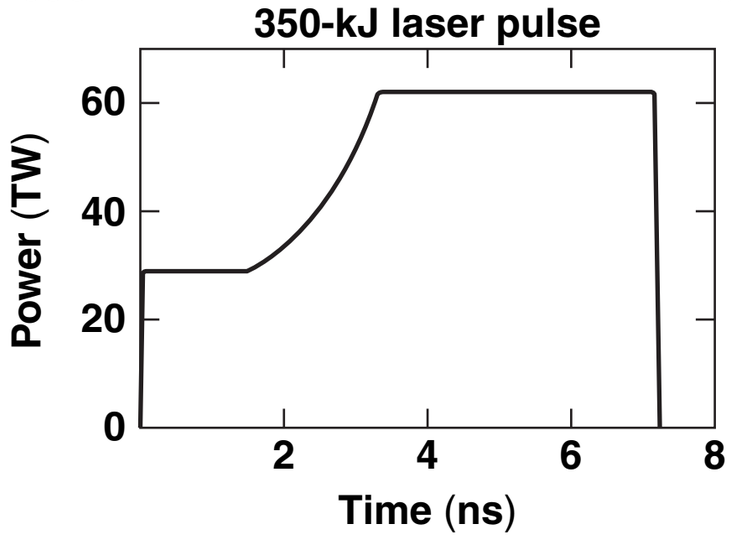


TC12560

Two-dimensional *DRACO* simulations predict the initial shell compression and the Rayleigh–Taylor (RT) growth of preimposed surface perturbations

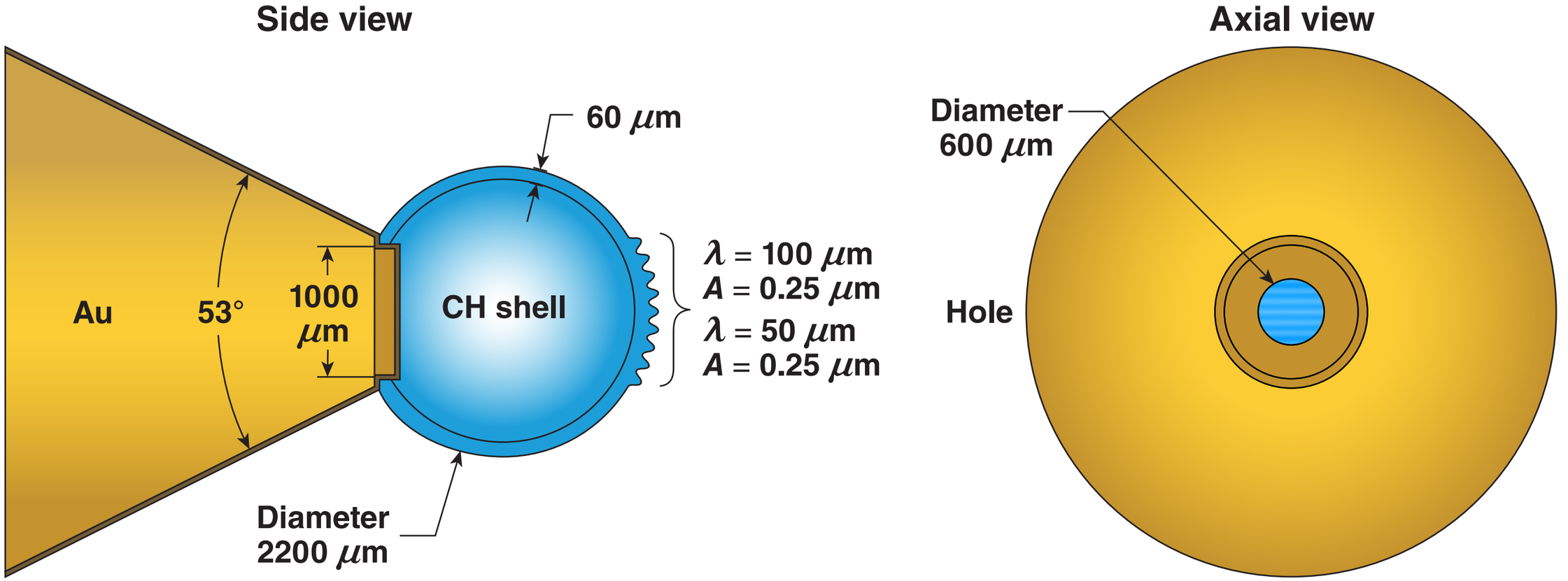






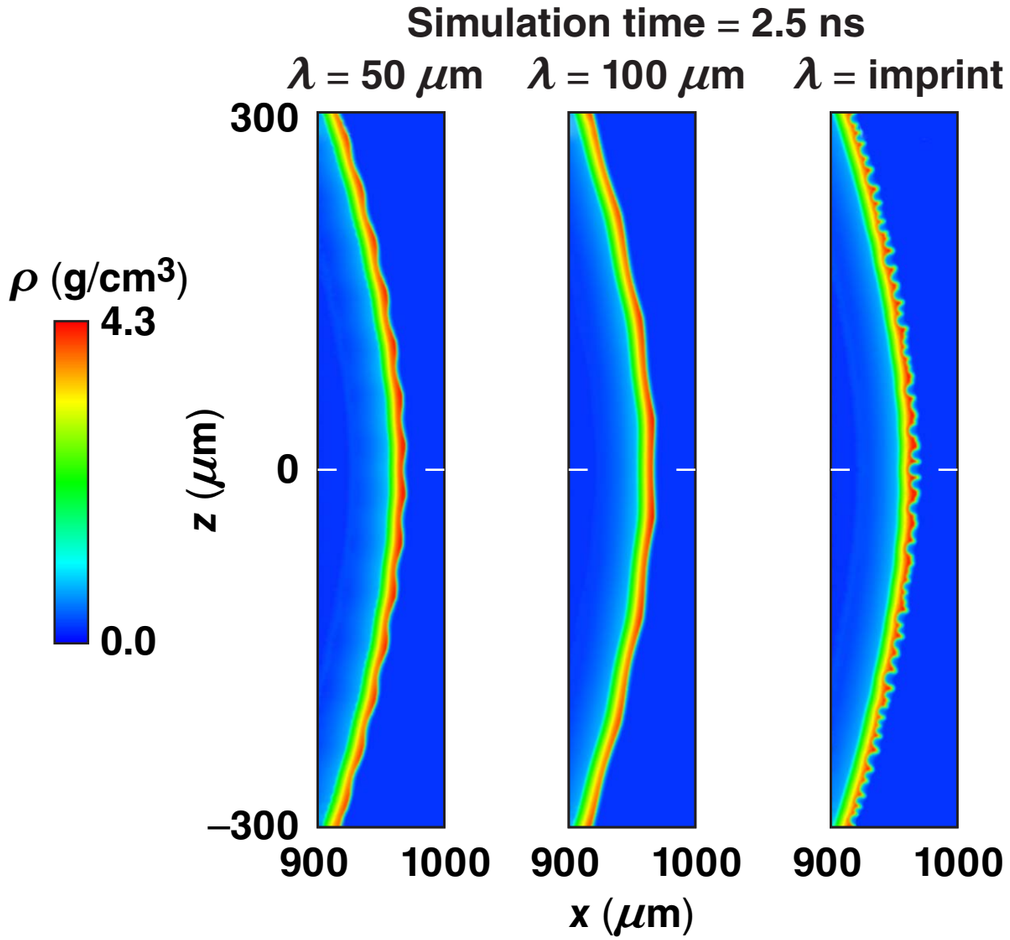
E23787e

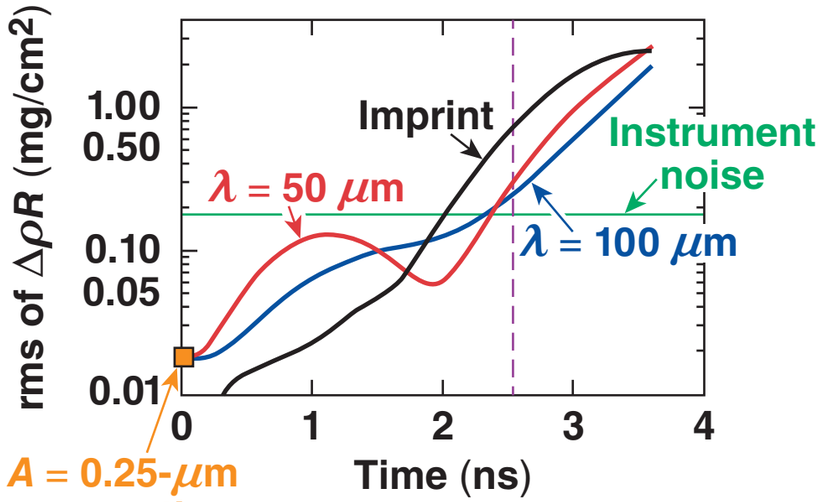
Upcoming spherical-imprint experiments will use cones with a hole for 2-D imaging of broadband imprint and the preimposed surface-perturbation growth

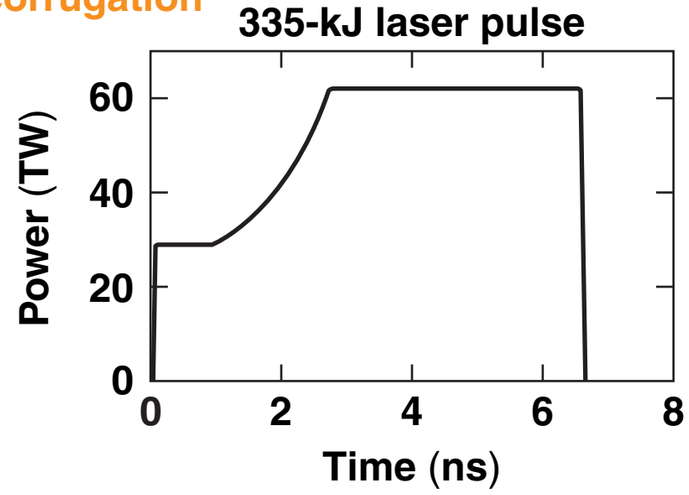


TC12562

DRACO simulations of the spherical-imprint experiments predict short-wavelength imprint modes dominate preimposed shell modulations



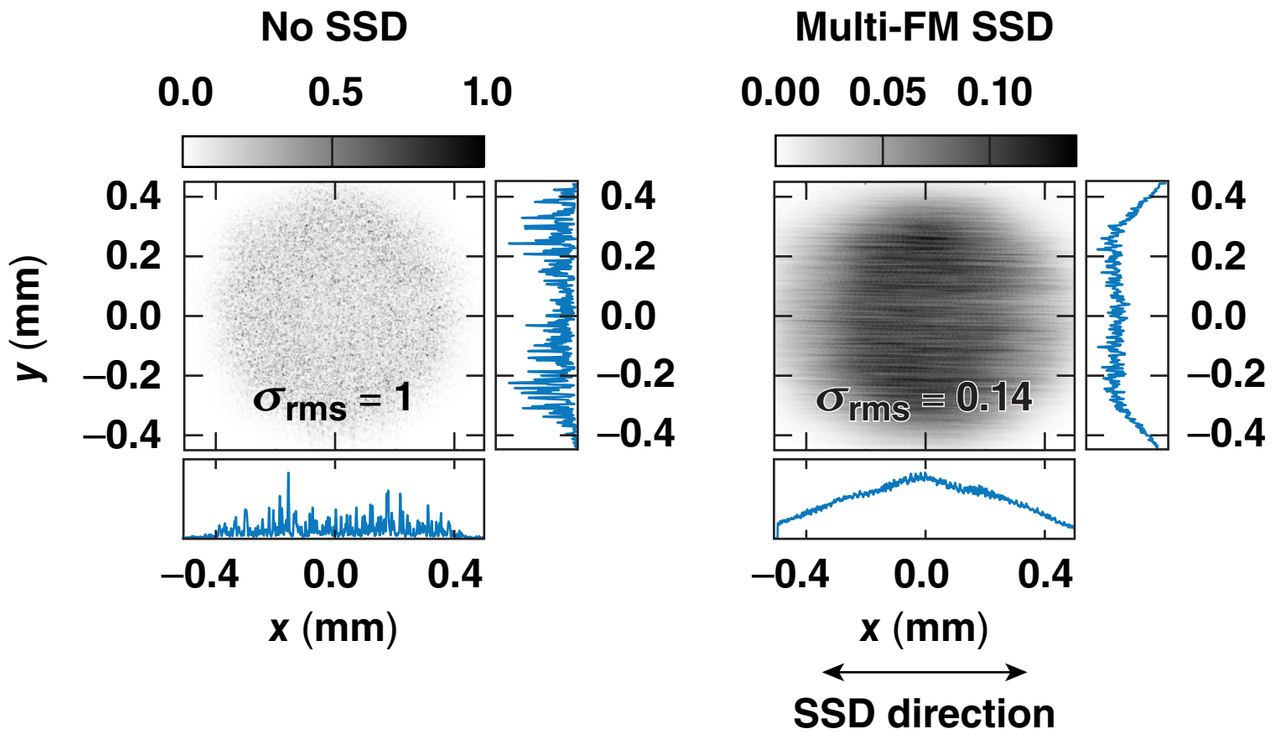




Imprint simulations include all of the single-beam imprint modes

TC12563

To mitigate laser imprint, single-beam smoothing is required for PDD ignition experiments on the NIF

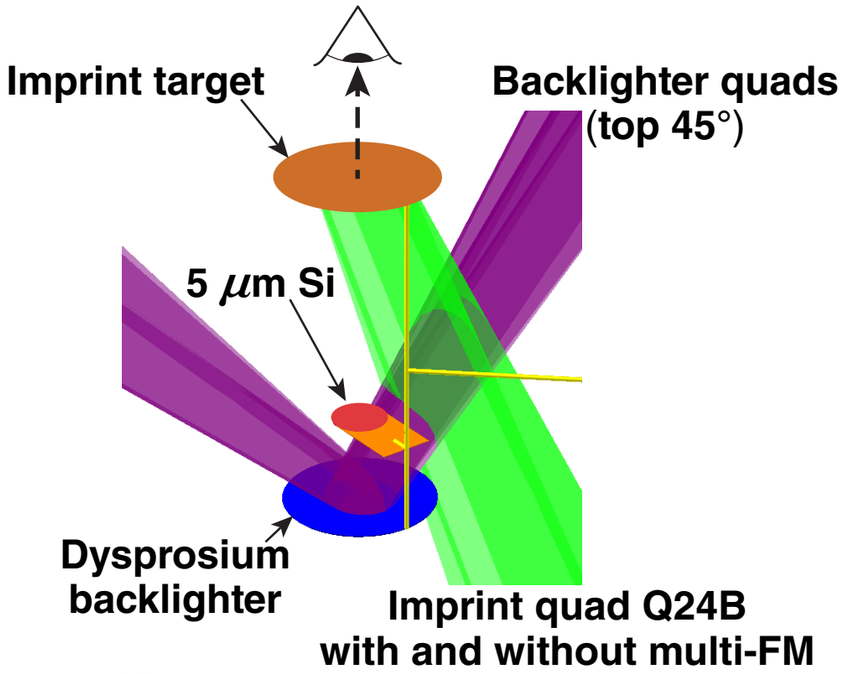


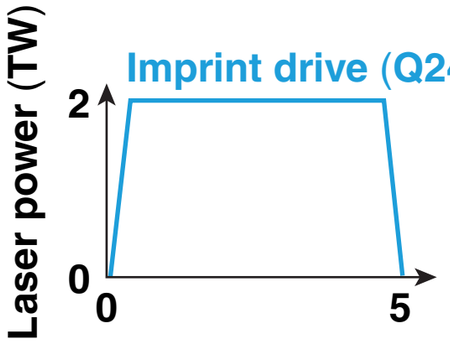
- 1-D multi-FM SSD* has been developed on OMEGA to provide the single-beam smoothing required for PDD ignition on the NIF
- A single quad (Q24B) will be converted to multi-FM SSD by Q1FY16

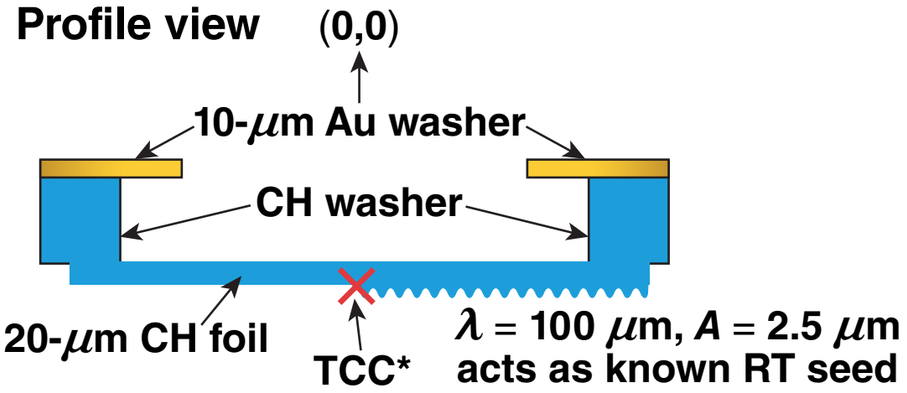
*J. A. Marozas, J. D. Zuegel, and T. J. B. Collins, Bull. Am. Phys. Soc. 55, 294 (2010).

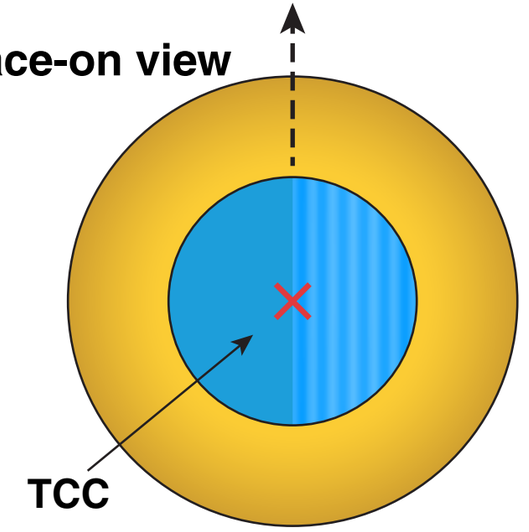
E24441b

One-quad multi-FM planar-imprint experiments will be used in Q1FY16 to validate multi-FM SSD on the NIF





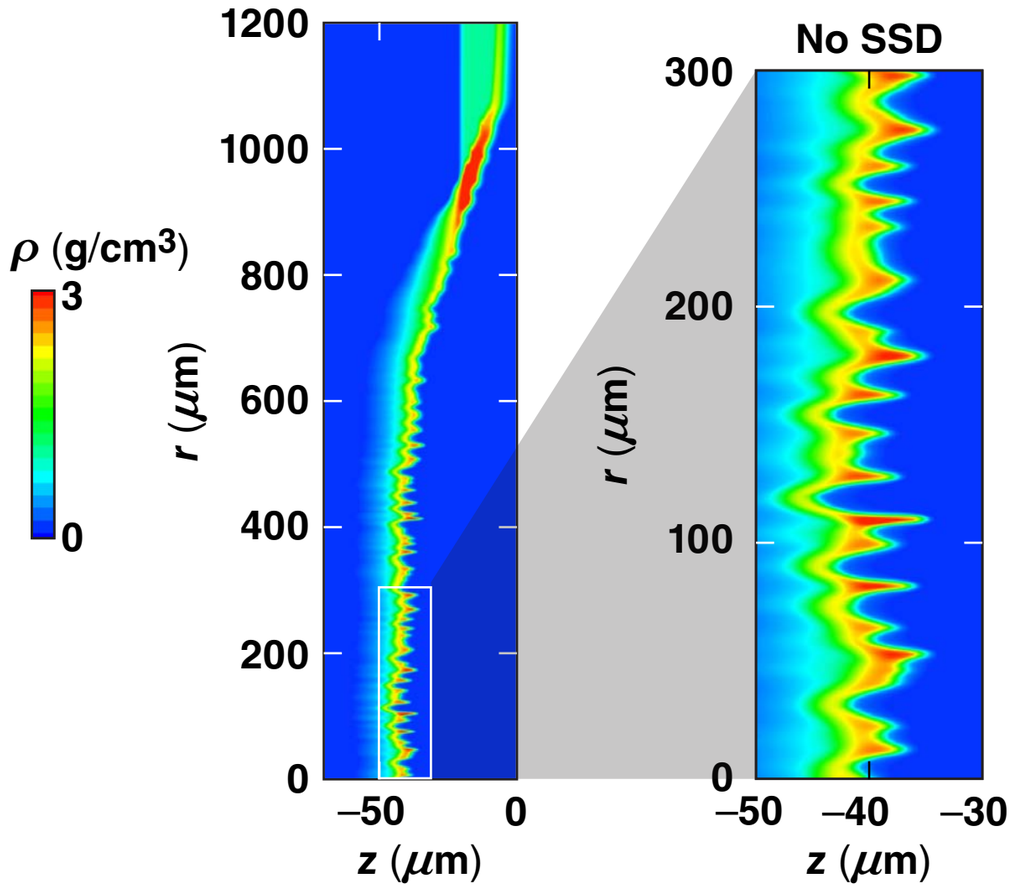


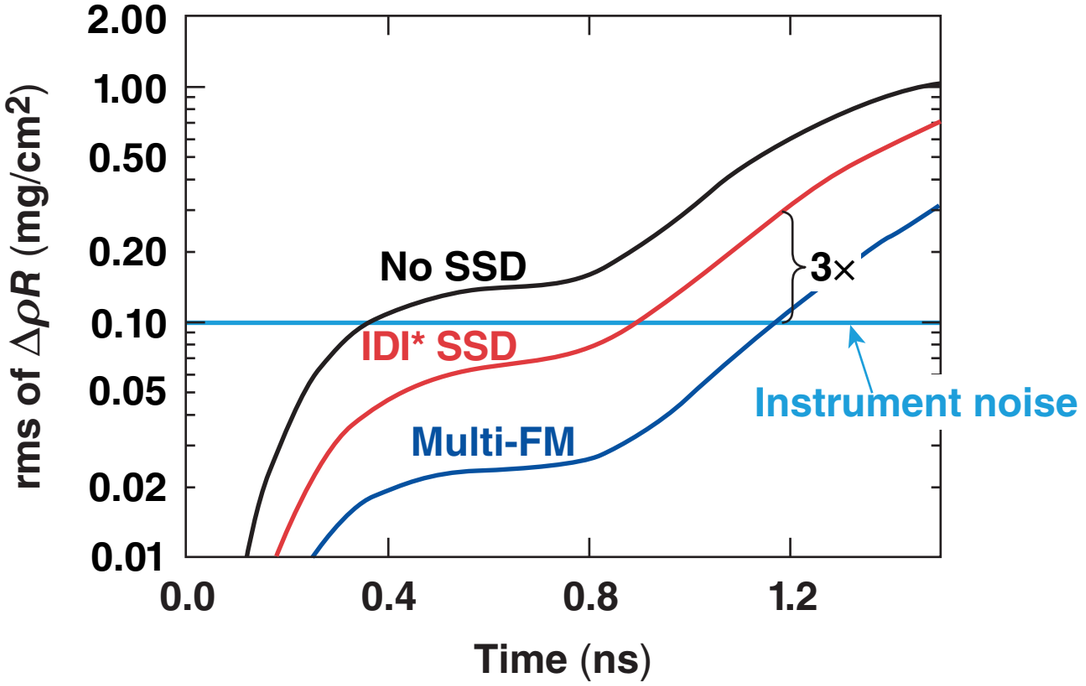


*TCC = target chamber center

TC12564

Two-dimensional *DRACO* modeling predicts high effectiveness of multi-FM SSD in mitigating imprint-seeded nonuniformities





Simulations include all single-beam imprint modes and resolve the speckle size.

TC12565

*IDI: indirect-drive ignition

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TC12558

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