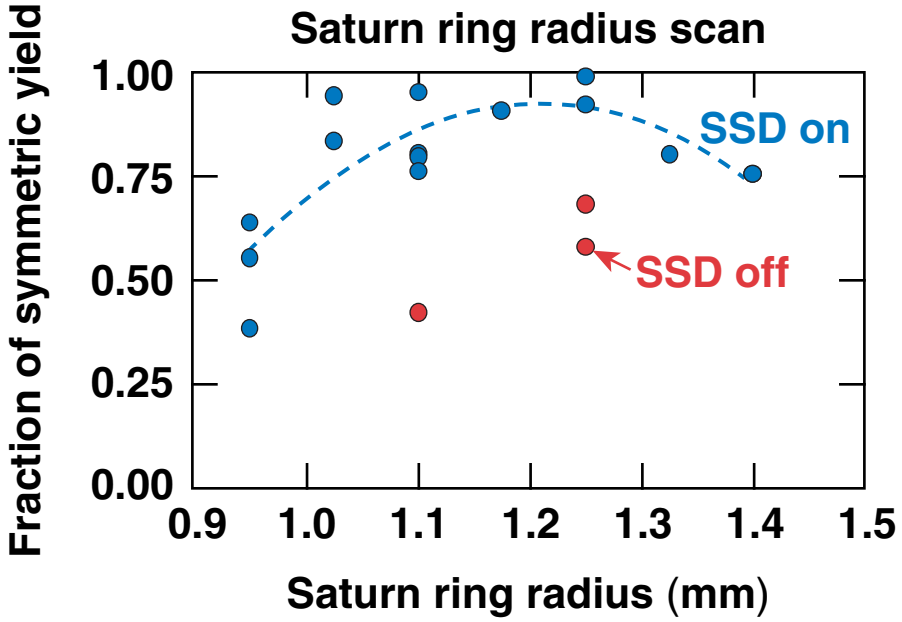
Optimized Polar-Direct-Drive Experiments on OMEGA



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Summary

Polar-direct-drive (PDD) experiments on OMEGA have achieved near-symmetric illumination yields

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- PDD experiments are performed on OMEGA with 40 drive beams and additional beams used for x-ray backlighting.
- The implosions have been optimized by varying the beam pointing and, for Saturn targets, the ring diameter.
- The beneficial effects of beam smoothing are being investigated by comparing performance with and without SSD modulation.

Collaborators

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40 of the OMEGA beams are used to emulate the NIF 48-beam indirect-drive configuration

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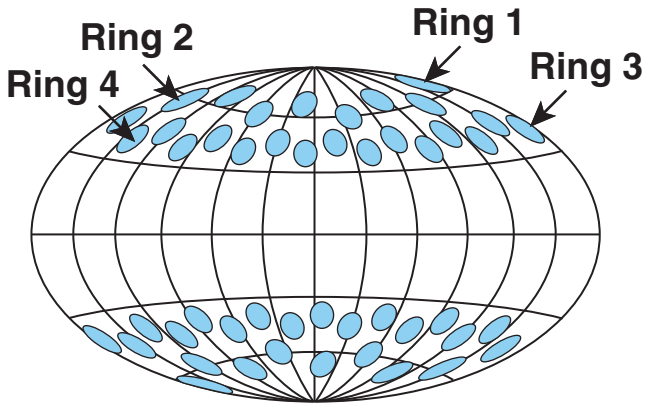
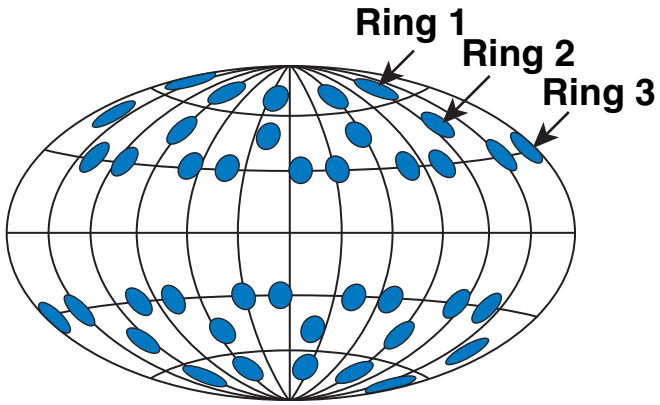
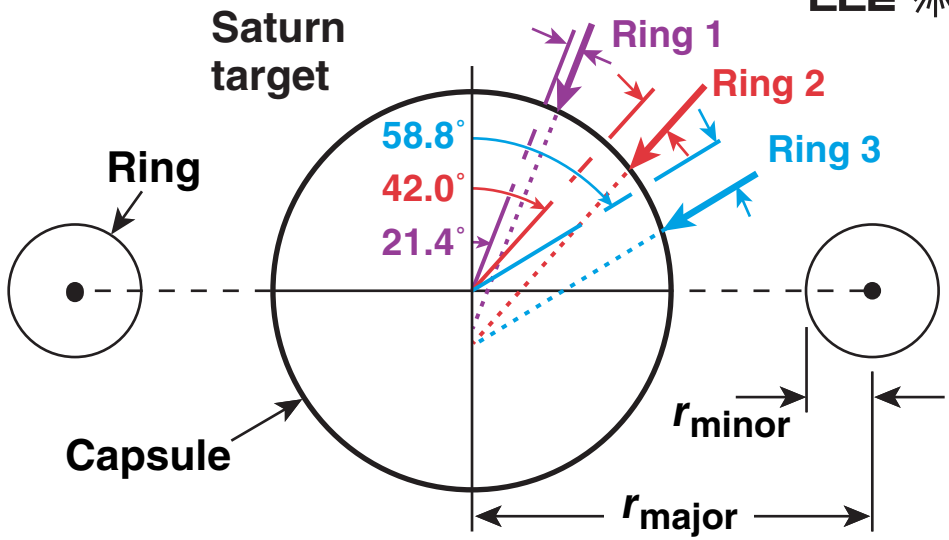
NIF configuration

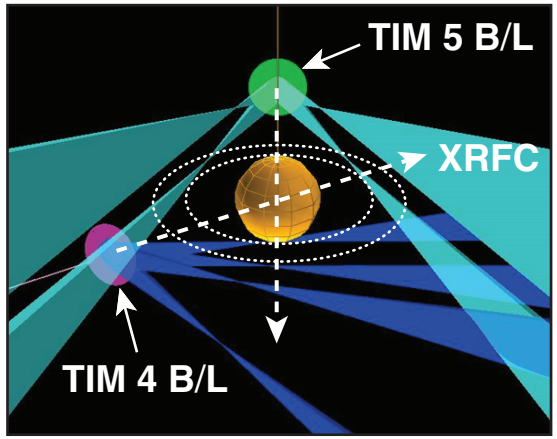


OMEGA PDD configuration



- The OMEGA beams, in six rings from 21° to 59°, are used to emulate the NIF geometry.





- Additional OMEGA beams are used for x-ray backlighting.

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Two types of PDD target designs are being investigated: standard and Saturn

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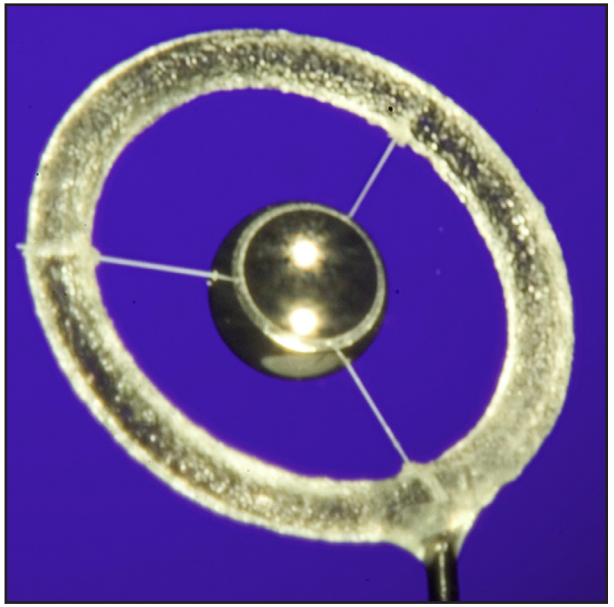
- Standard design

- Saturn design*
  - CH ring redirects laser energy toward the equator



*R. S. Craxton and D. Jacobs-Perkins, Phys. Rev. Lett. 94, 095002 (2005).
F. J. Marshall *et al.*, J. Phys. IV France 133, 153 (2006).
J. A. Marozas *et al.*, Phys. Plasmas 13, 056311 (2006).

Optimum beam pointing and Saturn ring radius have been determined empirically

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Summary of Configurations Used

Beam pointing (ring offset in μm)	Saturn Ring Major Radius (μm) (all with 300-μm minor radius)
Minimum (30, 60, 120) to Maximum (90, 180, 180)	950 1025 1100 1175 1250 1325 1400
Saturn optimum = (90, 120, 120)	Highest yields
Standard target optimum = (90, 150, 150)	

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The radiographs are fit with ideal Legendre modes to determine the deviations from spherical symmetry

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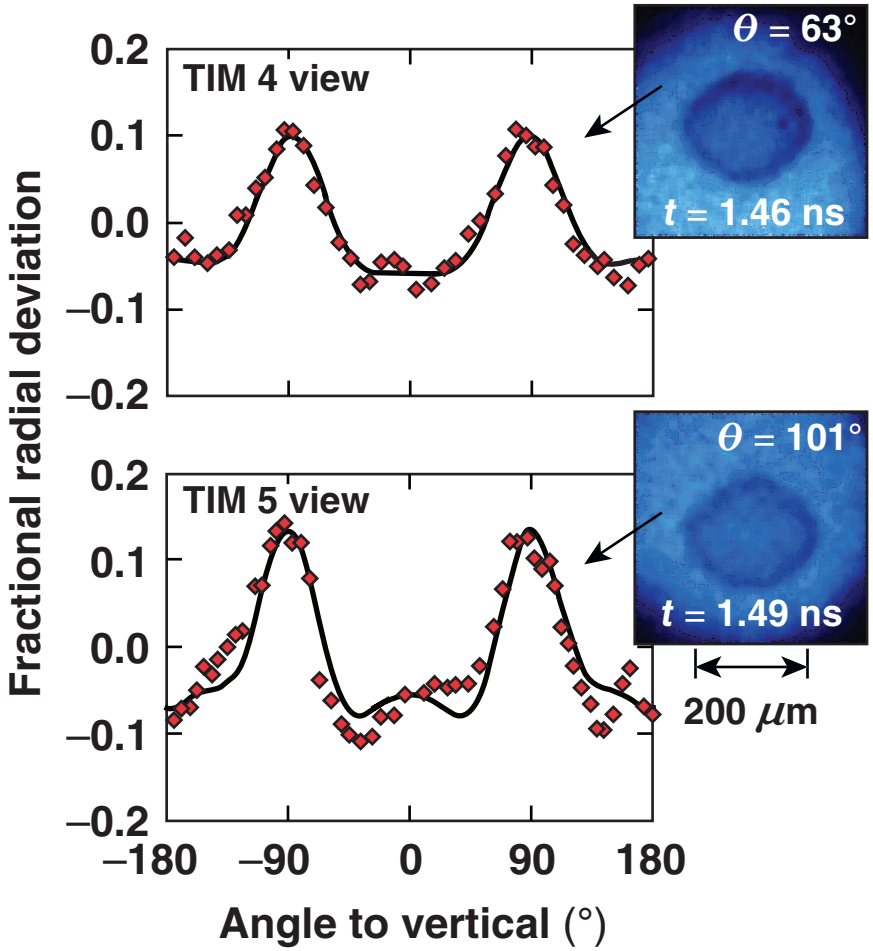
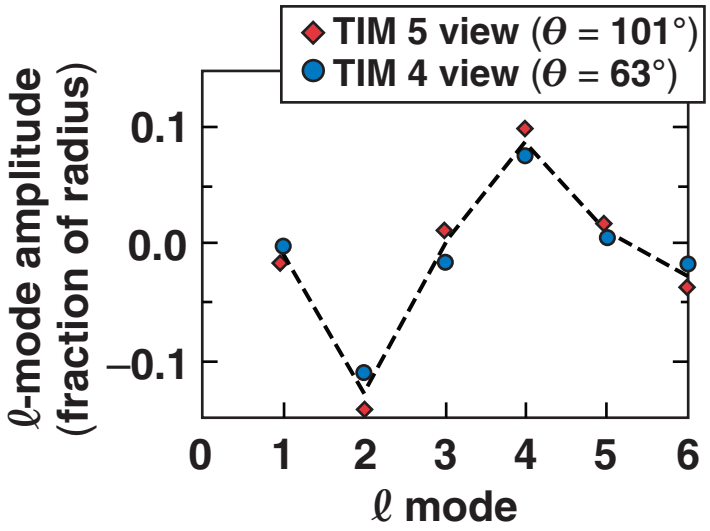
Standard PDD implosion of D_2(15)CH[20] target
OMEGA shot 38502





Pointing	
Ring	Offset
1	90 μm
2	120 μm
3	120 μm

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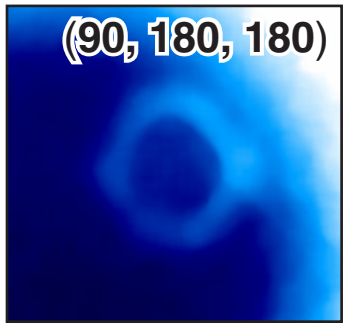
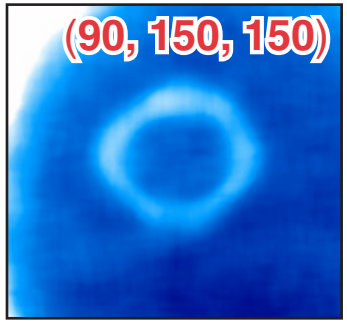
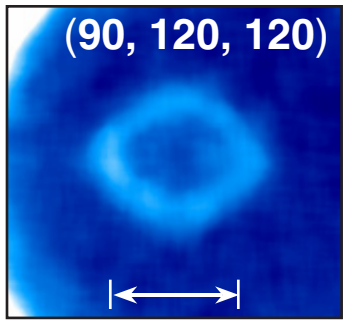
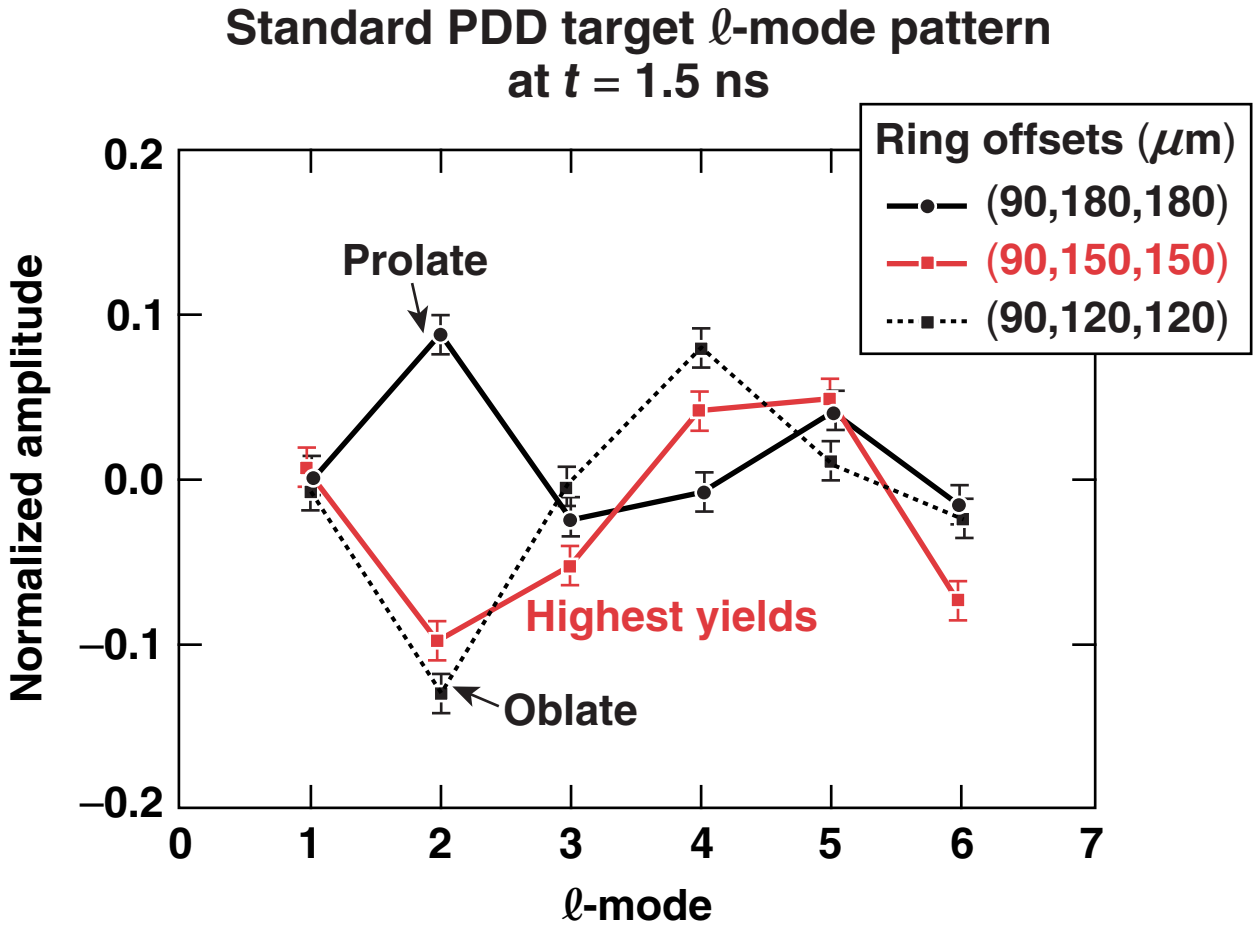
Different beam-pointing results in different modal structure as seen by the framing cameras







200 μm



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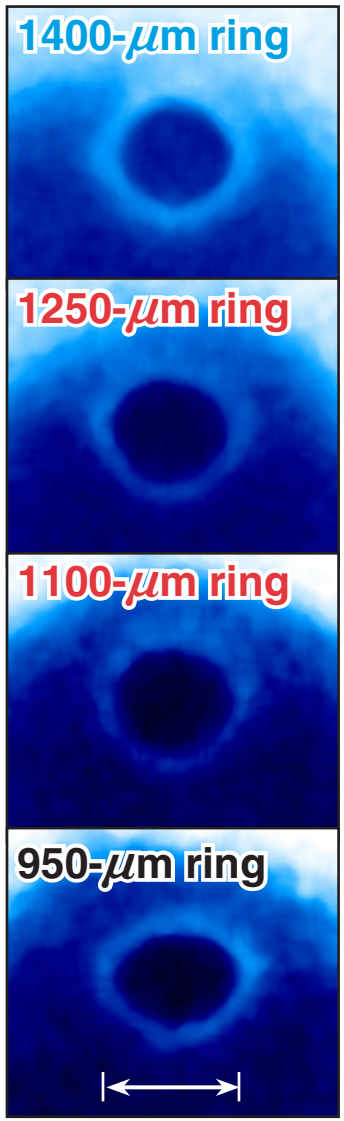
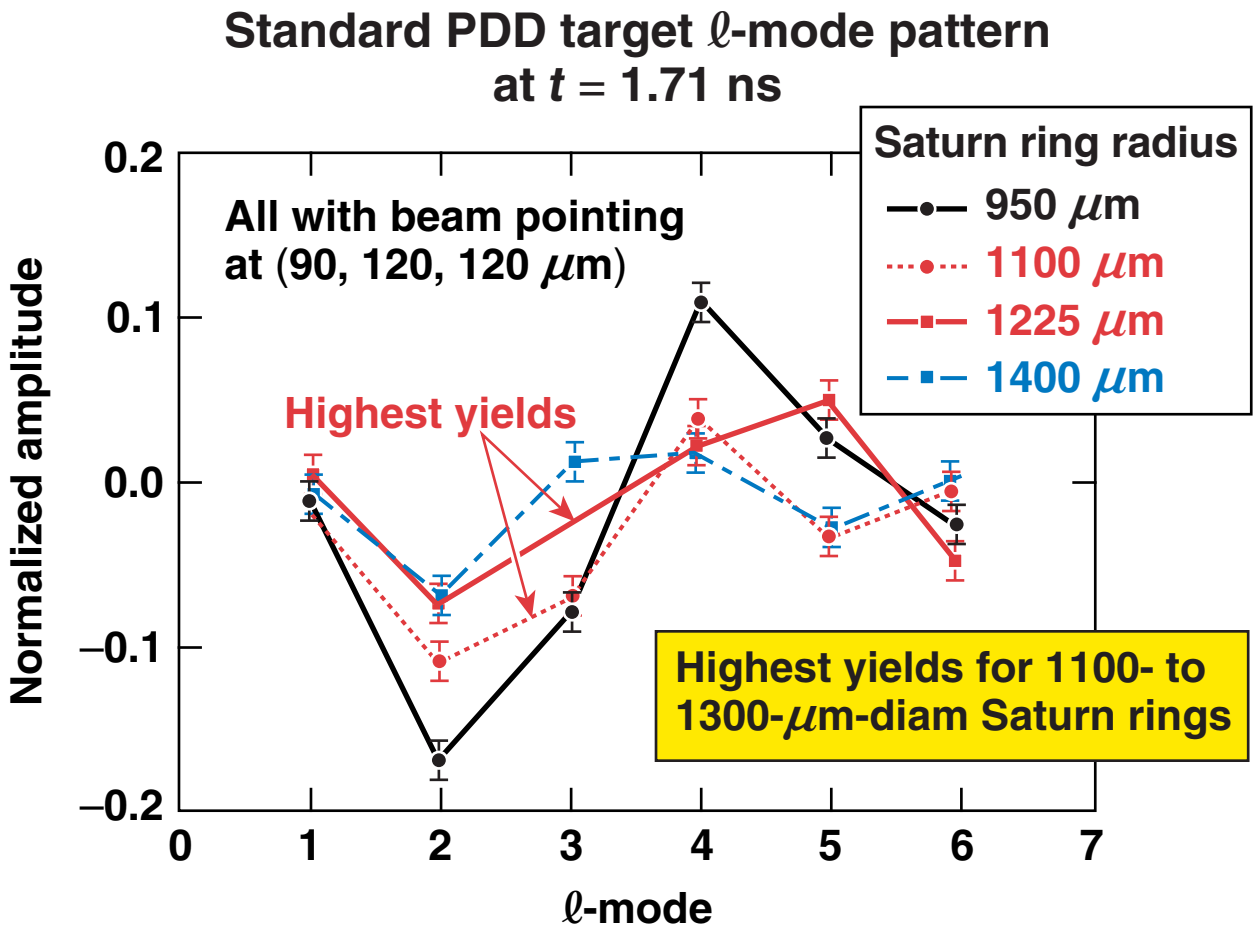
The largest Saturn rings produce the most symmetric implosions





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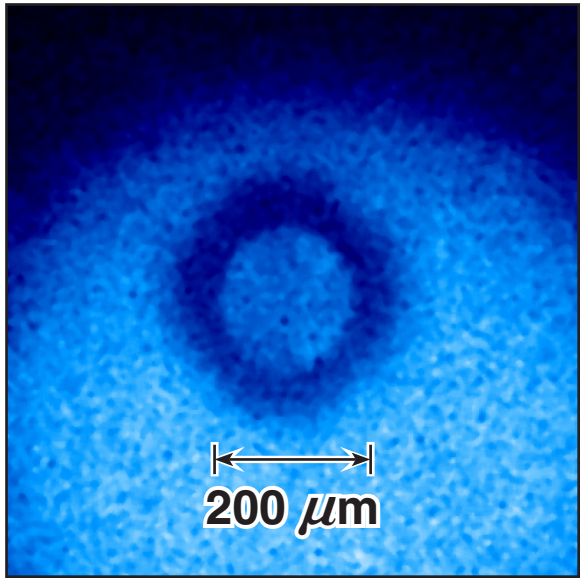
Both standard and Saturn targets produced greater yield with SSD on

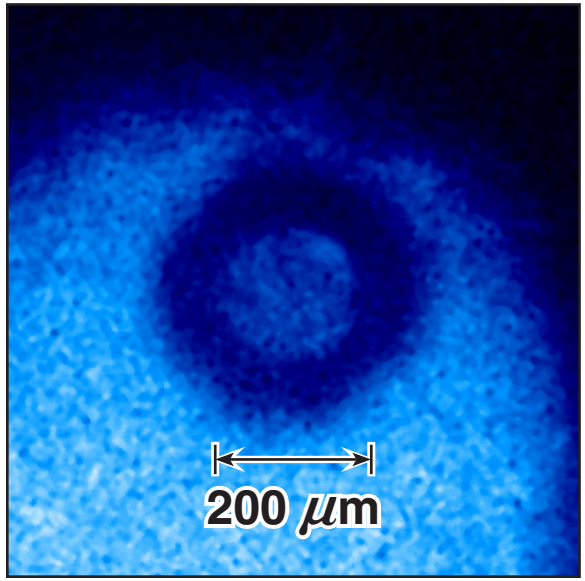
Example Saturn target radiographs

OMEGA shot 42937



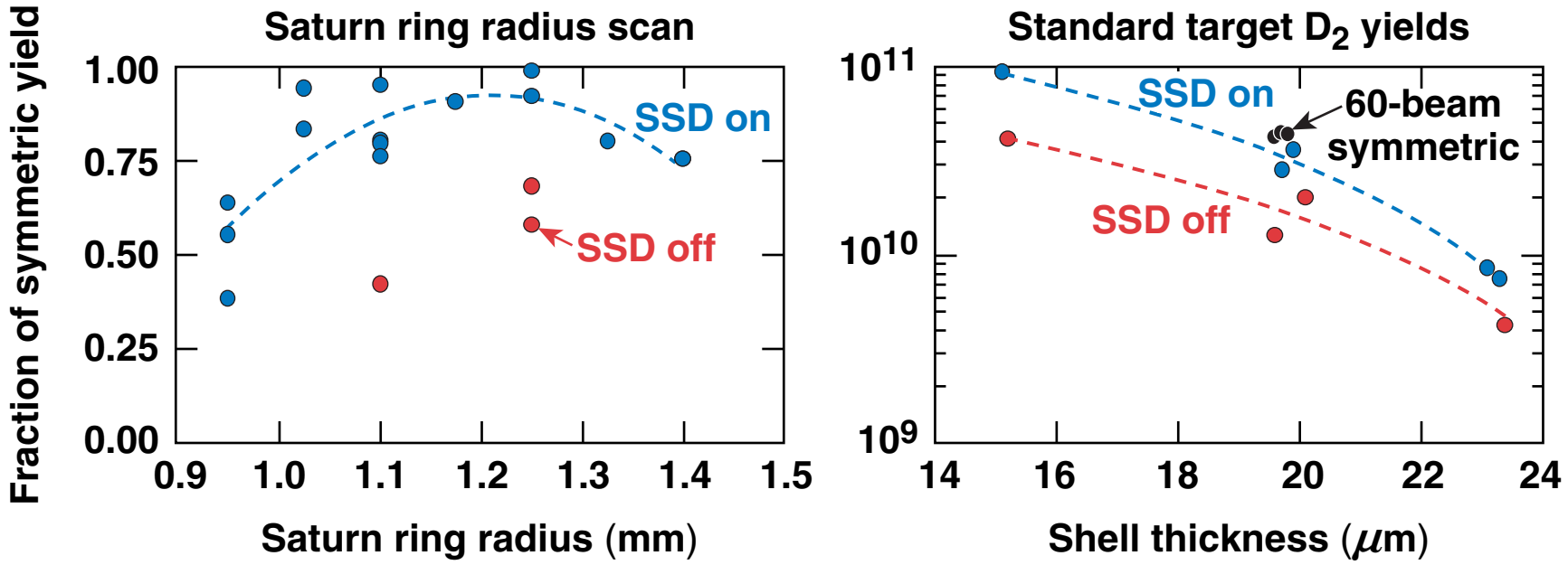
SSD on
$Y_n = 3.7 \times 10^{10}$

OMEGA shot 42938



SSD off
$Y_n = 1.9 \times 10^{10}$

Polar-direct-drive (PDD) experiments on OMEGA have achieved near-symmetric-illumination yields



1-ns-square pulse, 15.3-kJ, 15-atm-D_2-filled CH shell implosions (including 60-beam symmetric)

E15162

Summary/Conclusions

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