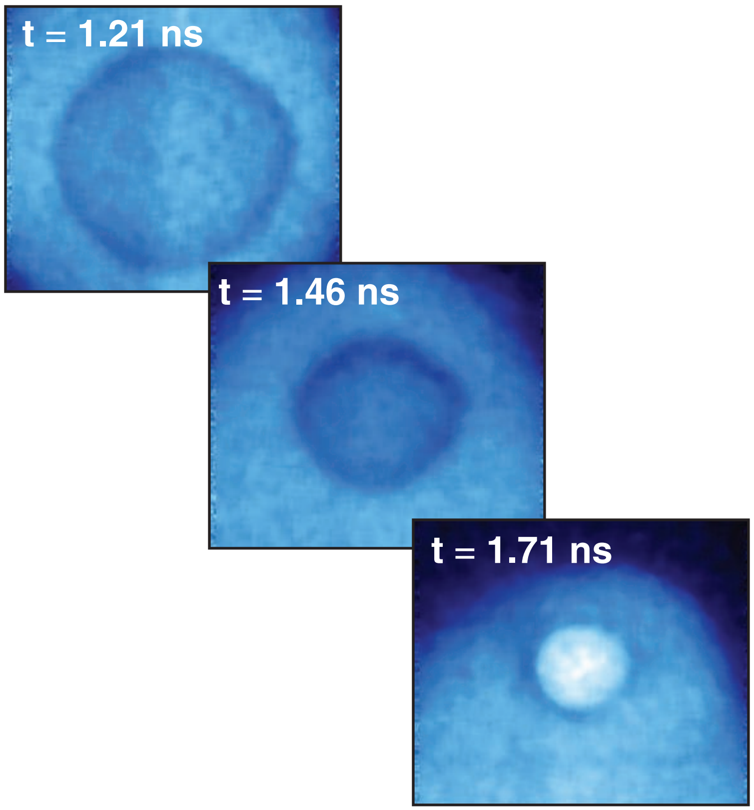
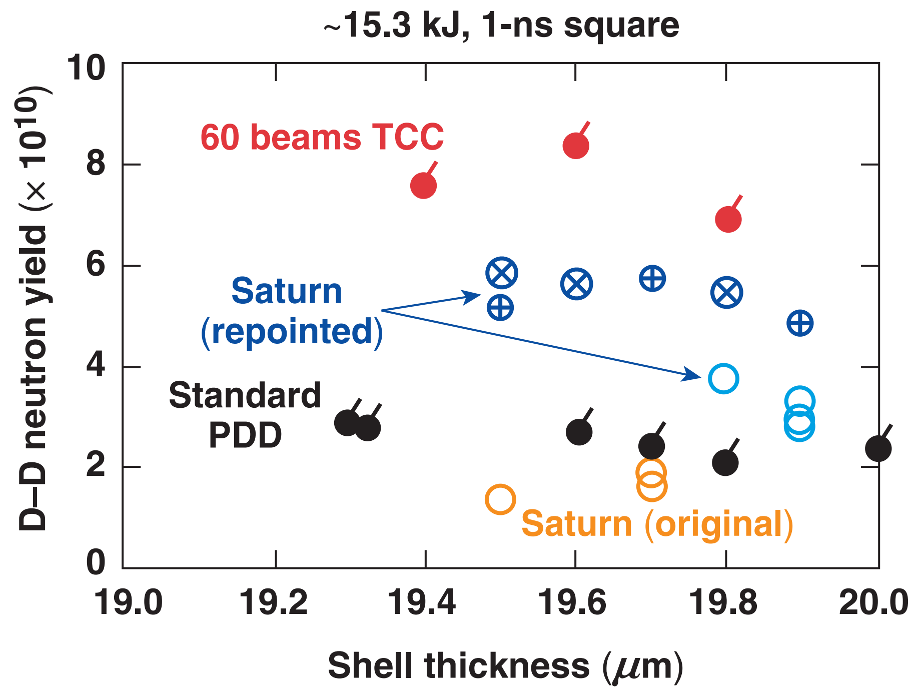
Polar-Direct-Drive Experiments on OMEGA

Spoke-mounted
Saturn target





F. J. Marshall
University of Rochester
Laboratory for Laser Energetics

47th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Denver, CO
24–28 October 2005

Contributors

R. S. Craxton, M. J. Bonino, R. Epstein, V. Yu. Glebov,
D. Jacobs-Perkins, J. P. Knauer, J. A. Marozas,
P. W. McKenty, S. G. Noyes, P. B. Radha. W. Seka,
S. Skupsky, and V. A. Smalyuk

Summary

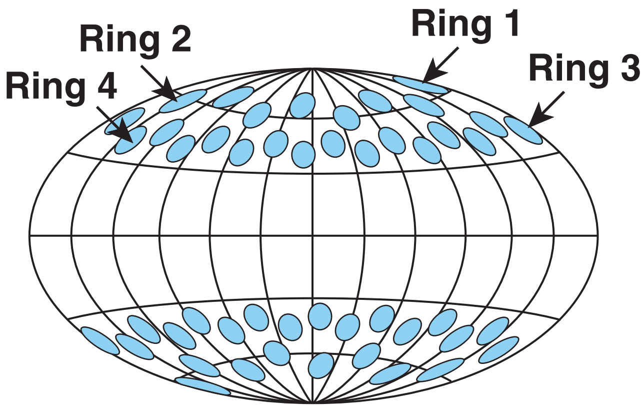
Polar-direct-drive (PDD) experiments on OMEGA have achieved up to 75% of symmetric yields using Saturn targets

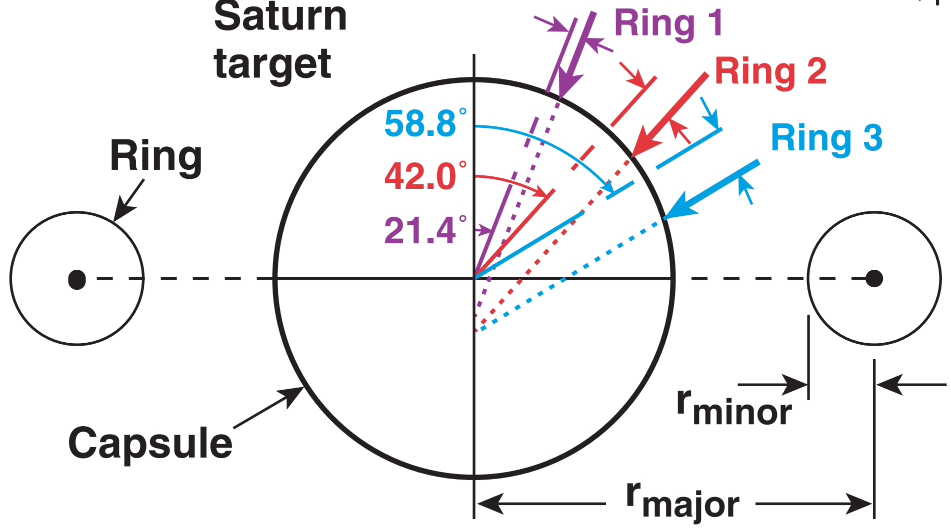
UR LLE

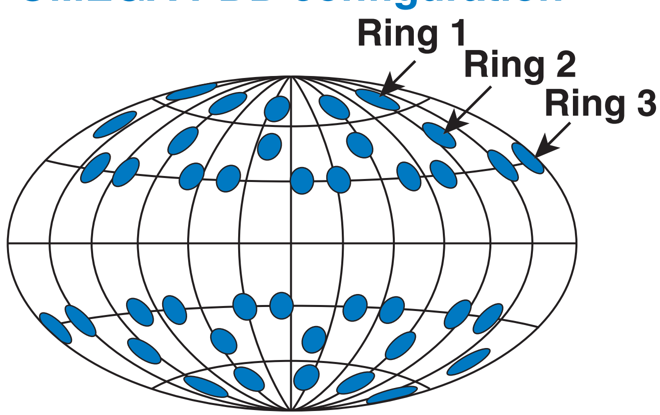
- PDD is being tested on OMEGA with 40 beams arranged to emulate the 48 NIF indirect-drive beam configuration.
- X-ray radiography is used to measure the effects of beam pointing and Saturn ring size on the implosion symmetry.
- Implosions with better symmetry produce higher fusion yields.
- Future experiments will attempt to further optimize implosion symmetry and address target mount effects.

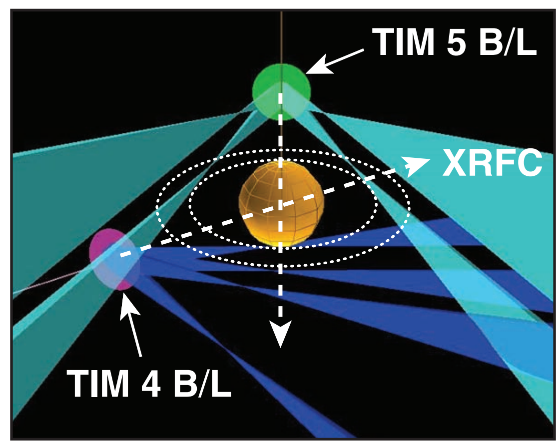
R. S. Craxton RO1.1
I. V. Igumenshchev RO1.3
S. Skupsky RO2.6
J. A. Marozas UI1.4

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







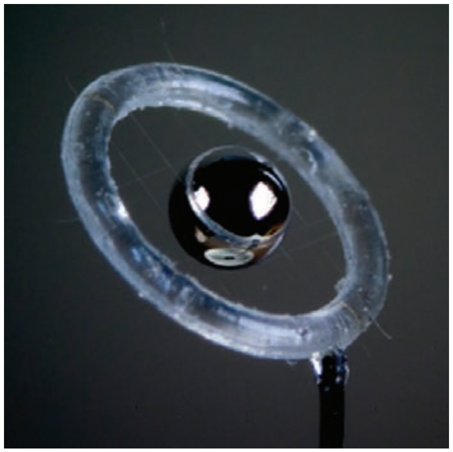


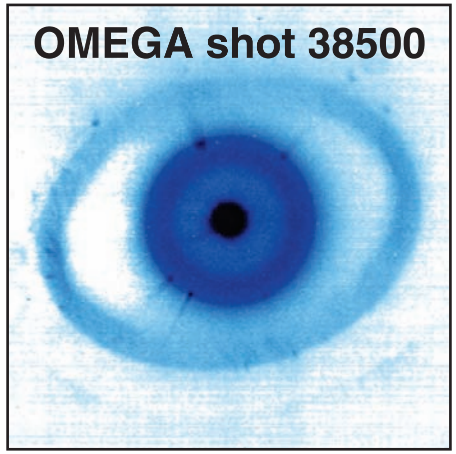
- The OMEGA beams, in six rings from 21° to 59°, are used to emulate the NIF geometry.

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

E14113

Silk-mounted and spoke-mounted Saturn targets have been shot on OMEGA

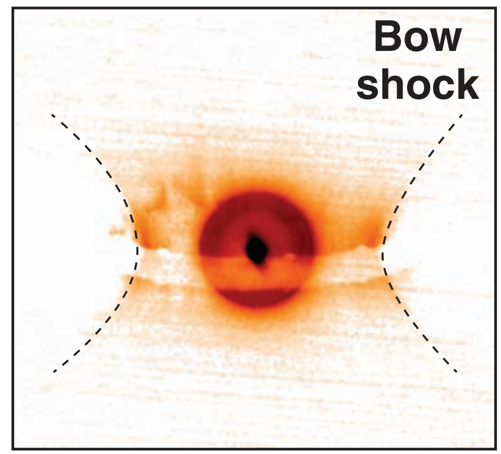




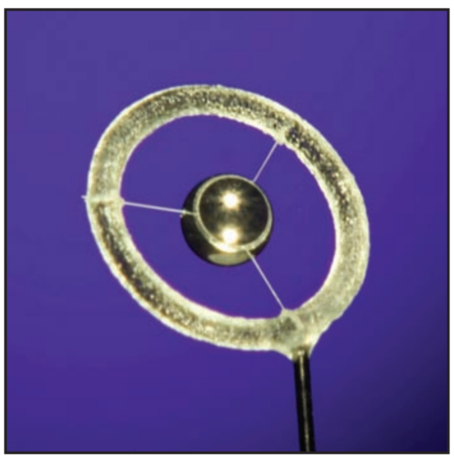
Time-integrated pinhole camera (2 to 5 keV)

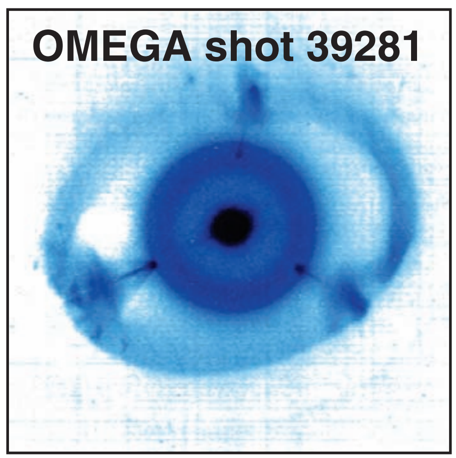
"Silk" mount

OMEGA shot 37430



X-ray pinhole camera image (2 to 5 kev)

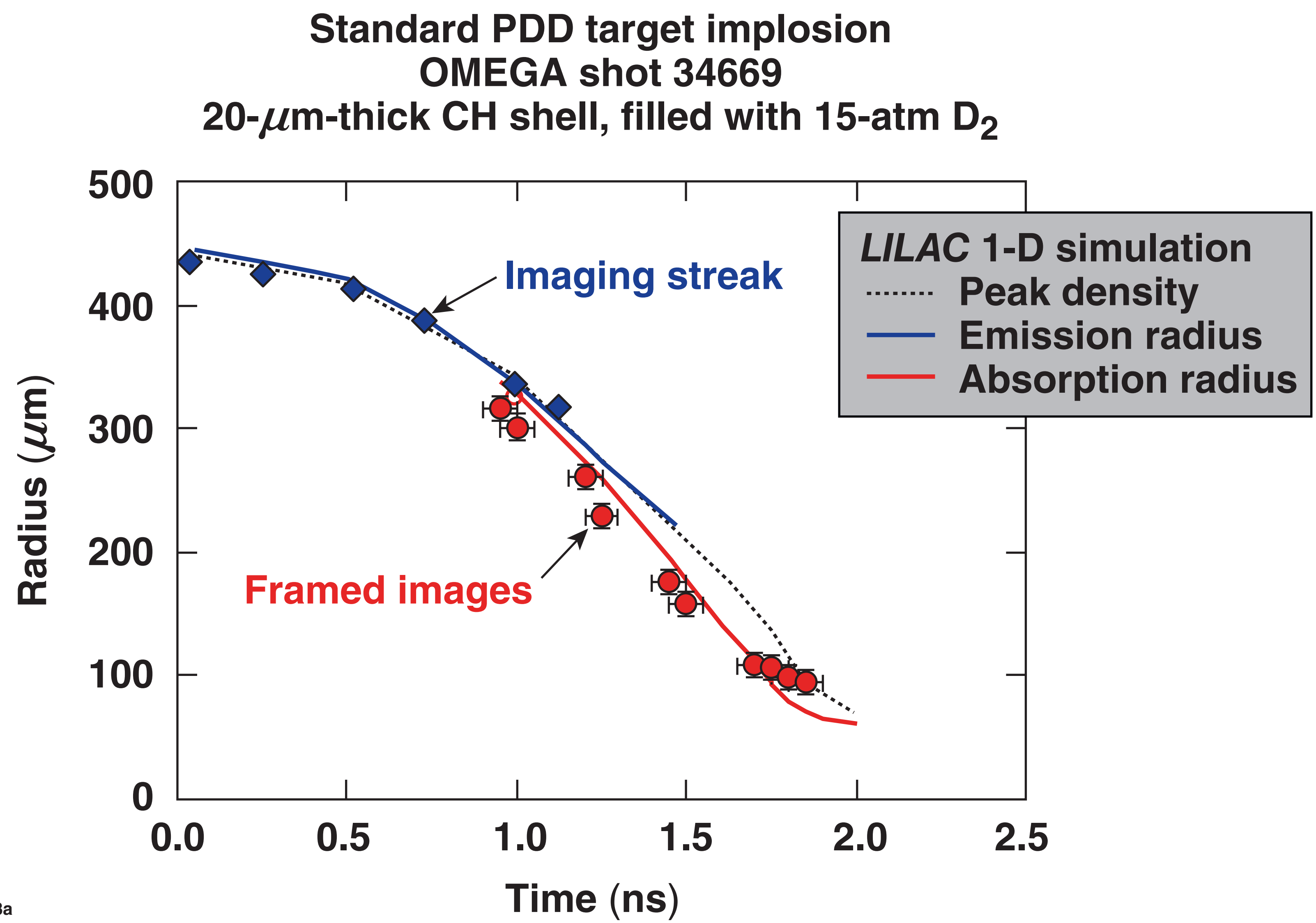




"Spoke" mount

TC6970a

PDD implosions show nearly 1-D behavior until just before stagnation



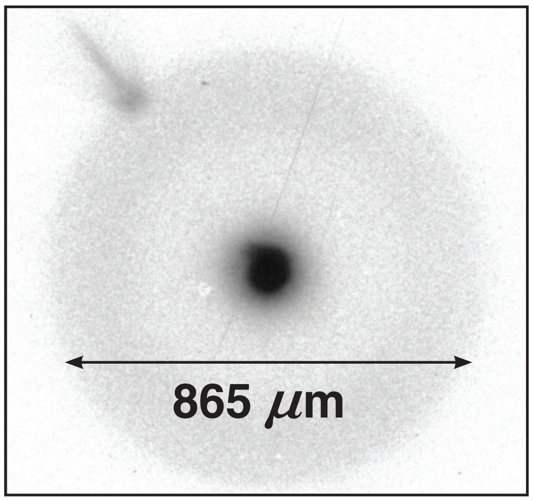
E14033a

Core stagnation symmetry is affected by the direct-drive illumination configuration

X-ray pinhole camera images (2 to 5 keV)

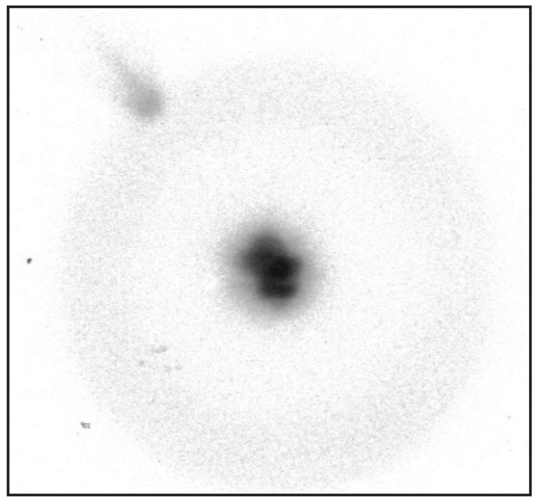
PDD 40 beam implosions

60 beam implosion



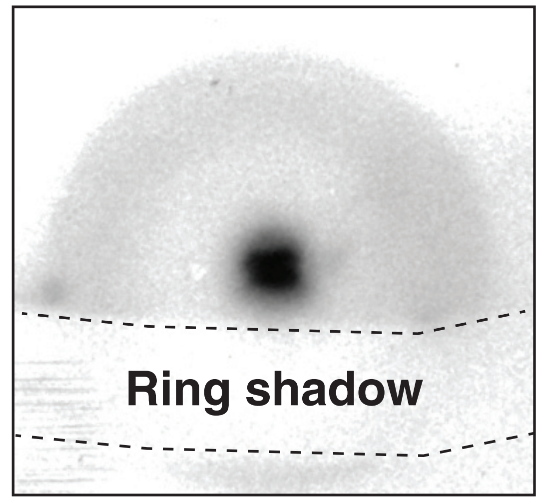
OMEGA shot 37419
15.8 kJ, $Y_n = 6.9 \times 10^{10}$

Standard target



OMEGA shot 37427
15.2 kJ, $Y_n = 2.1 \times 10^{10}$

Saturn target

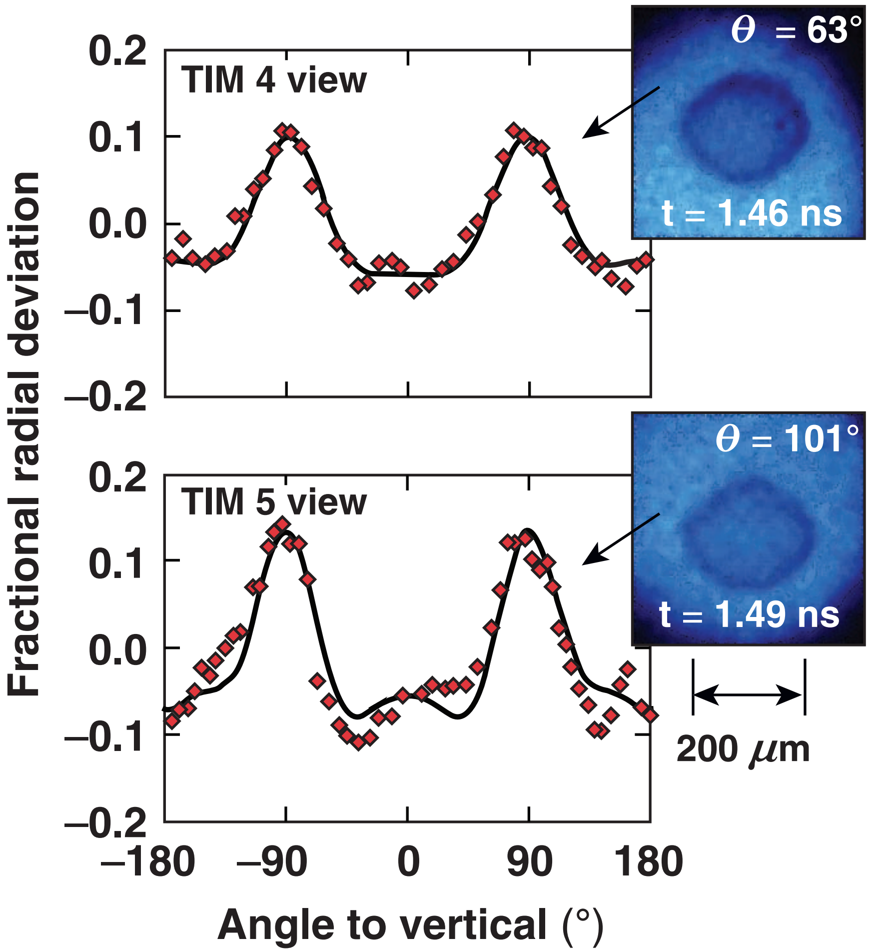


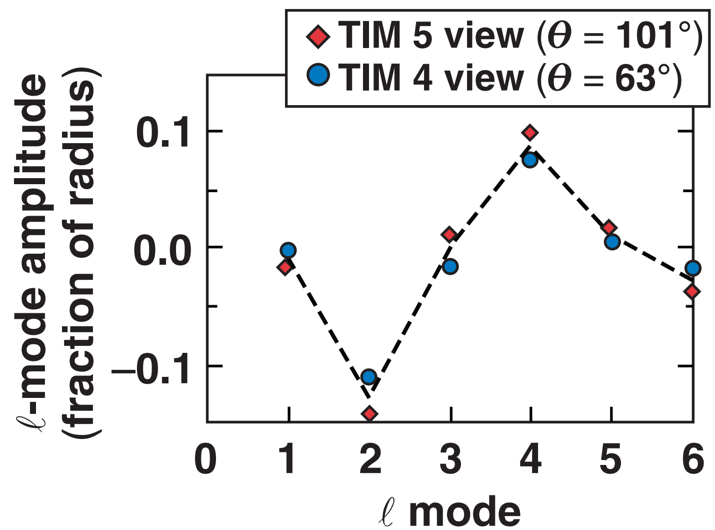
OMEGA shot 39285
15.6 kJ, $Y_n = 5.9 \times 10^{10}$

E14034

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

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

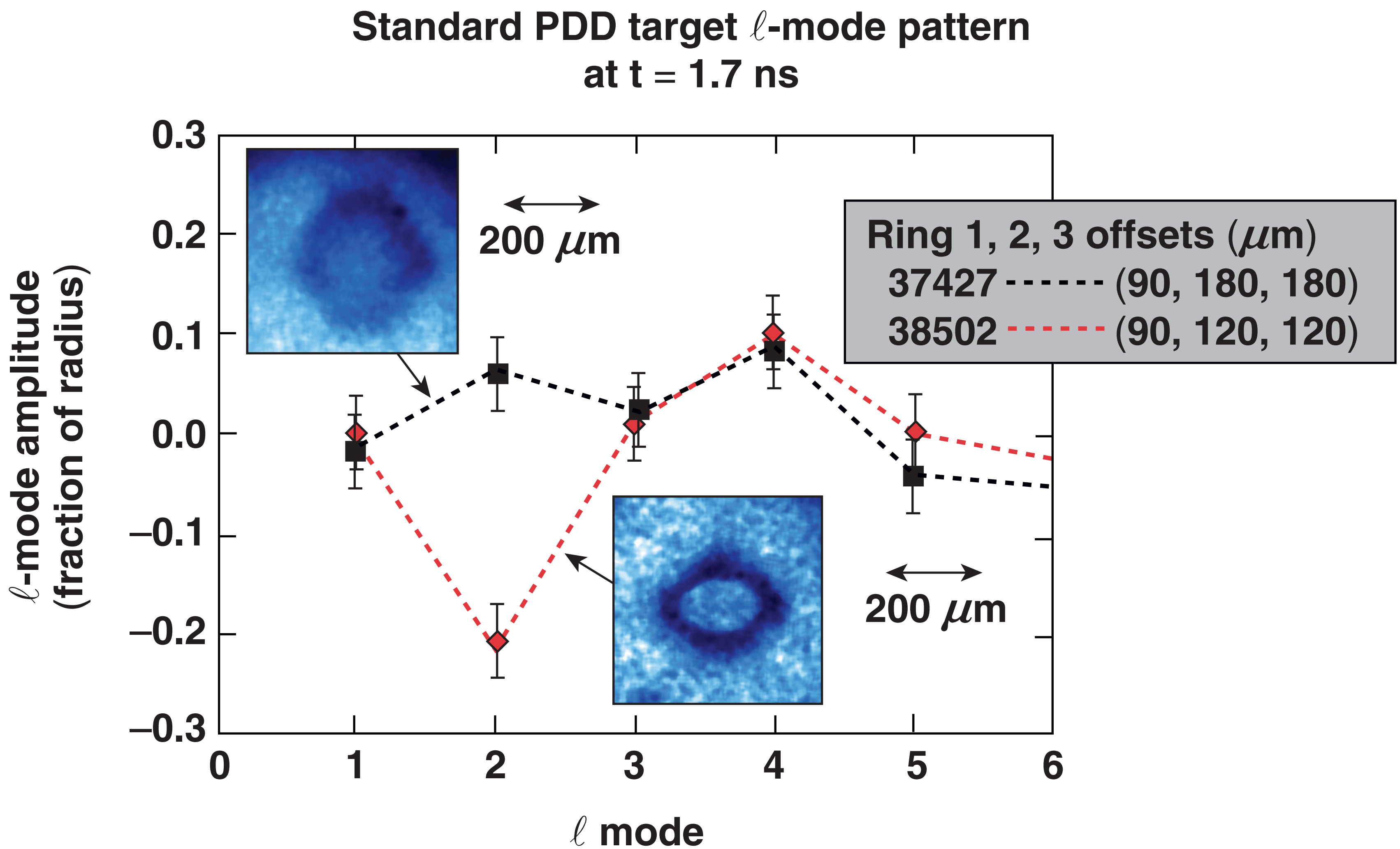




Pointing	
Ring	Offset
1	90 μm
2	120 μm
3	120 μm

E14036a

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

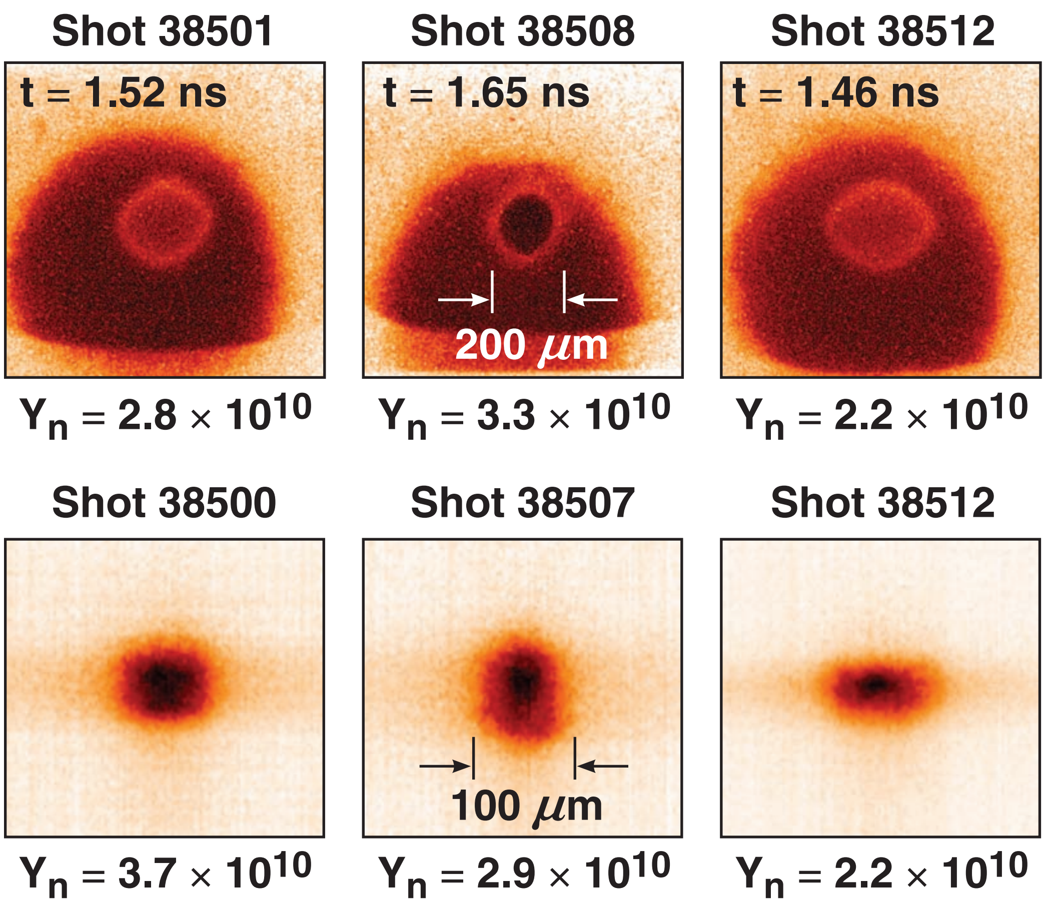


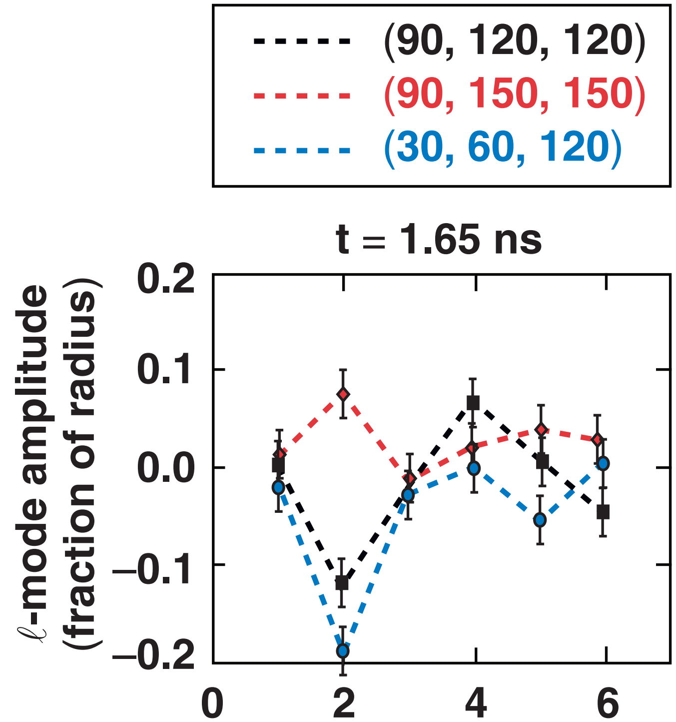
E14059

The symmetry of the imploding shell depends on beam pointing for Saturn targets as well

UR LLE

Rings 1, 2, 3 offsets (μm)		
(90, 120, 120)	(90, 150, 150)	(30, 60, 120)

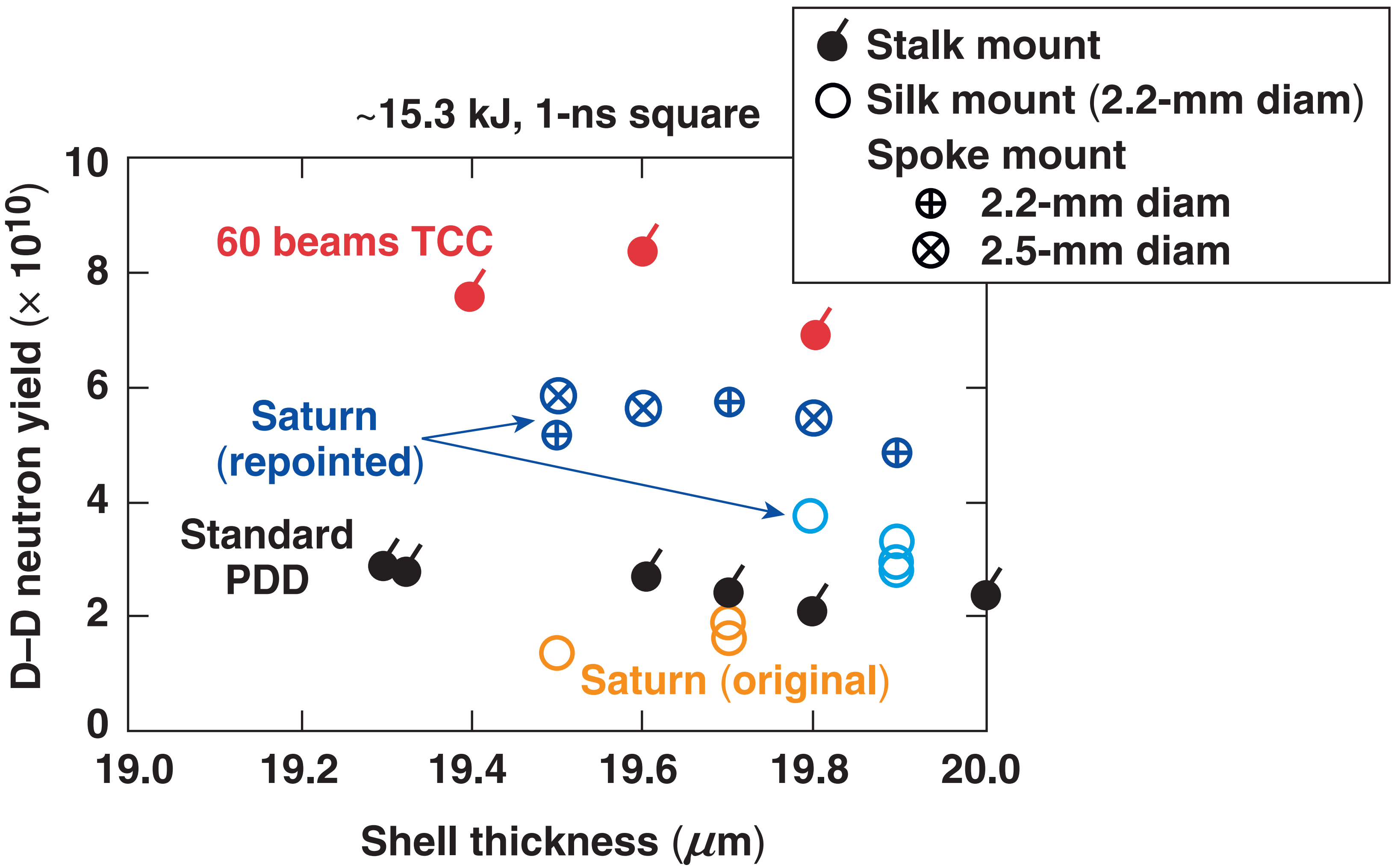




Saturn ring
2.2-mm diam
0.3-mm thick

E14114

The best Saturn targets achieve fusion yields that are ~75% of symmetrically irradiated targets



TC6971b

Summary/Conclusions

Polar-direct-drive (PDD) experiments on OMEGA have achieved up to 75% of symmetric yields using Saturn targets

UR LLE

- PDD is being tested on OMEGA with 40 beams arranged to emulate the 48 NIF indirect-drive beam configuration.
- X-ray radiography is used to measure the effects of beam pointing and Saturn ring size on the implosion symmetry.
- Implosions with better symmetry produce higher fusion yields.
- Future experiments will attempt to further optimize implosion symmetry and address target mount effects.

R. S. Craxton RO1.1
I. V. Igumenshchev RO1.3
S. Skupsky RO2.6
J. A. Marozas UI1.4