Polar-Direct-Drive Experiments on OMEGA

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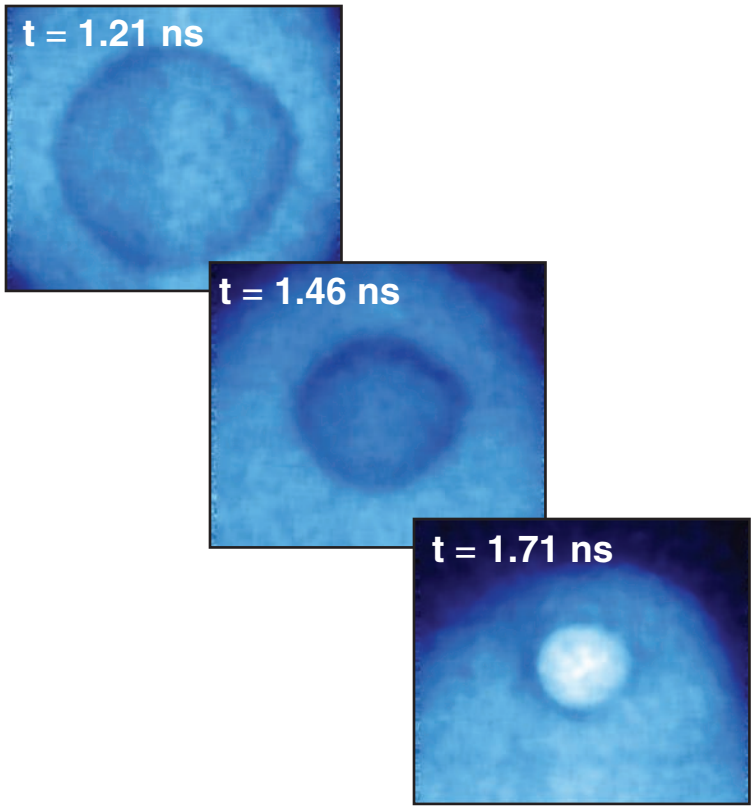
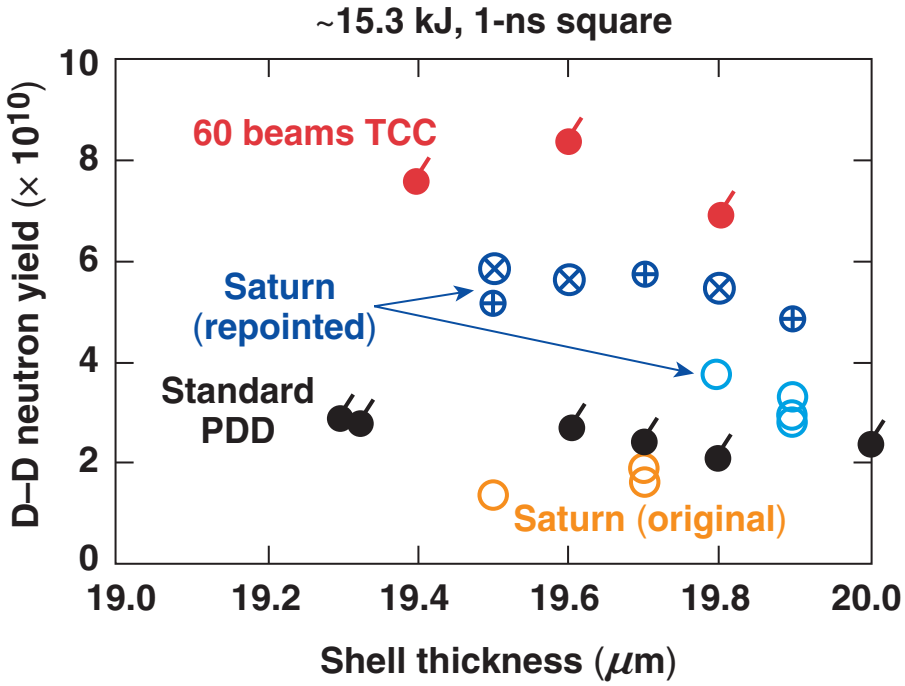
Spoke-mounted
Saturn target





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Contributors

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Summary

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

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- 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.

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

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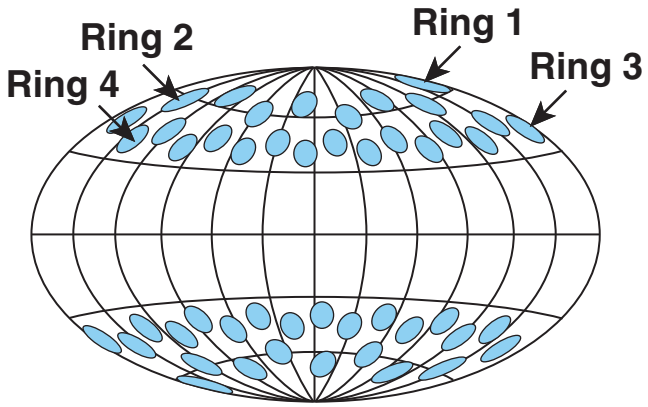
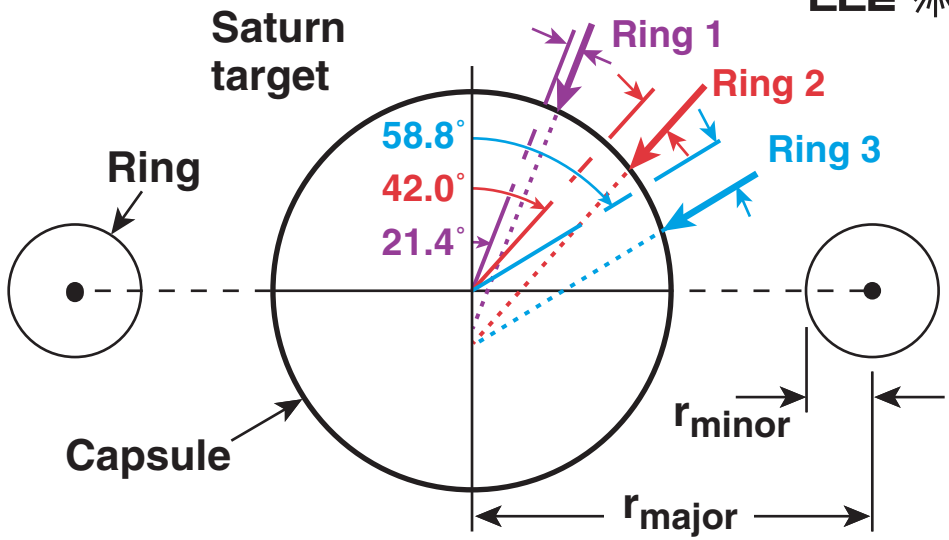
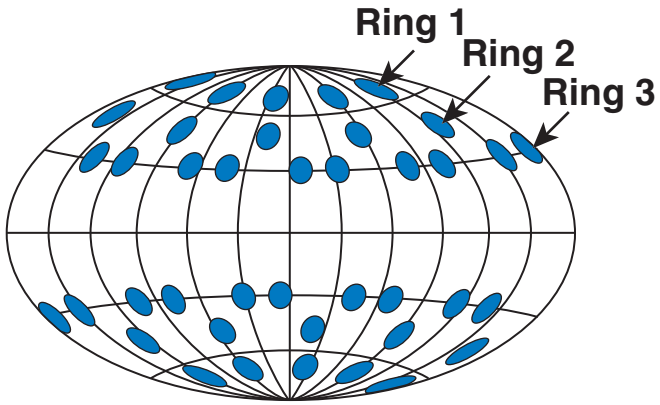
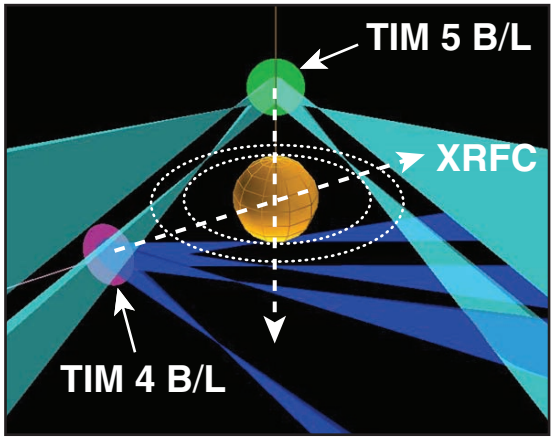
NIF configuration





OMEGA PDD configuration

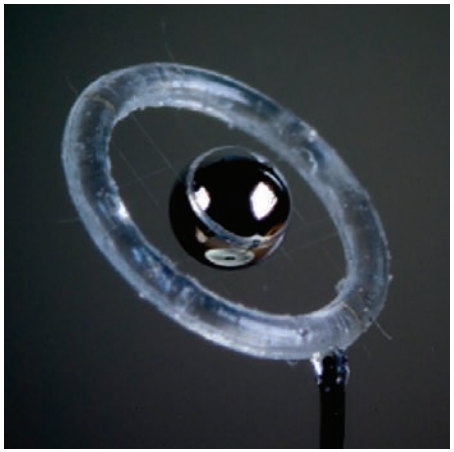


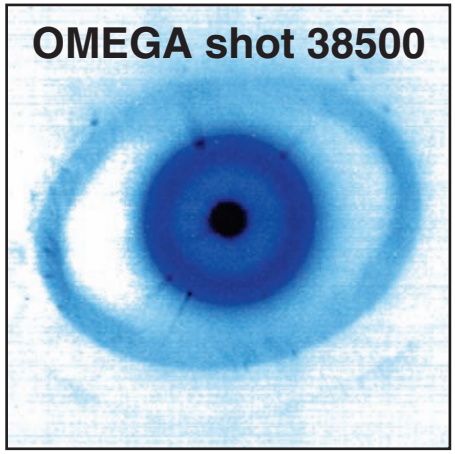


- The OMEGA beams, in six rings from 21° to 59°, are used to emulate the NIF geometry.
- Additional OMEGA beams are used for x-ray backlighting.

E14113

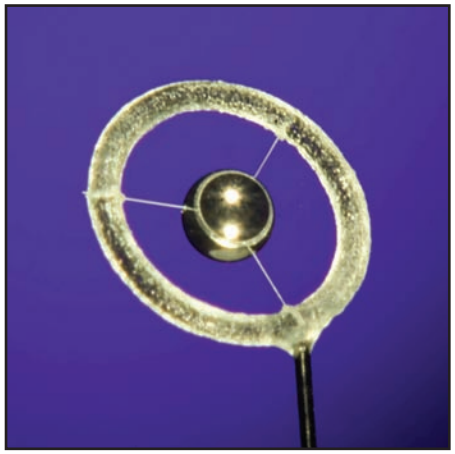
Silk-mounted and spoke-mounted Saturn targets have been shot on OMEGA

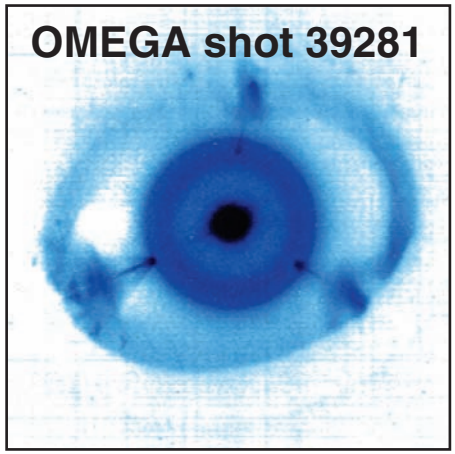




Time-integrated pinhole camera (2 to 5 keV)

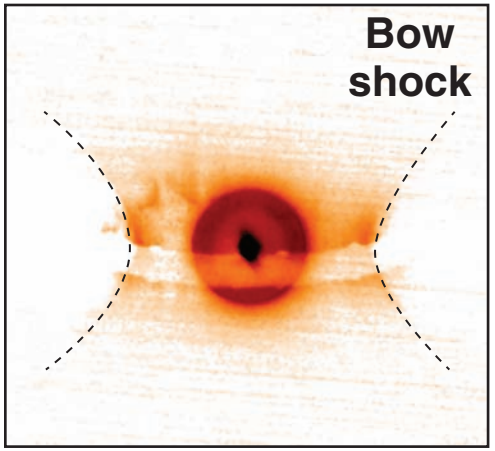
"Silk" mount





"Spoke" mount

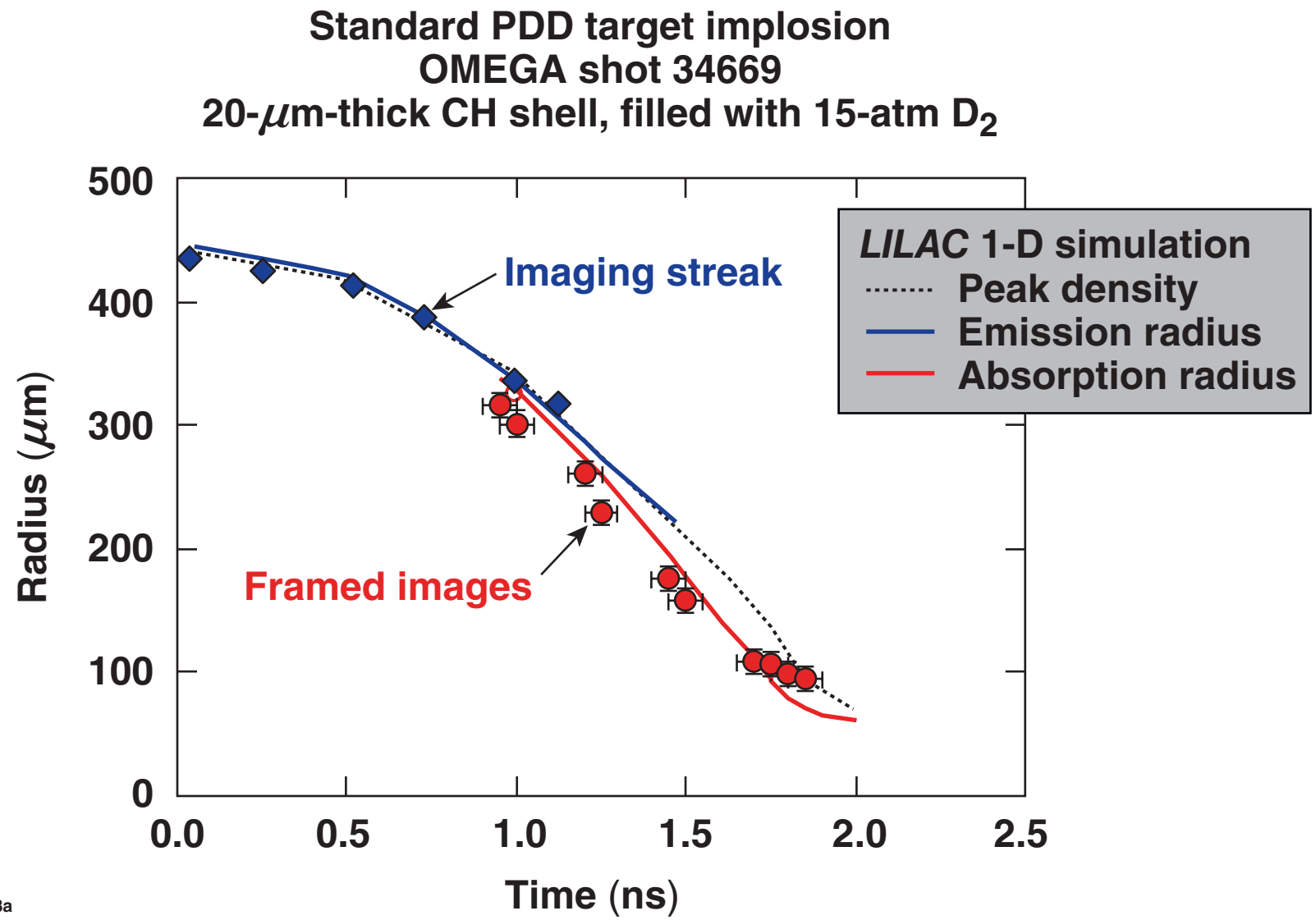
OMEGA shot 37430



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

TC6970a

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



E14033a

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

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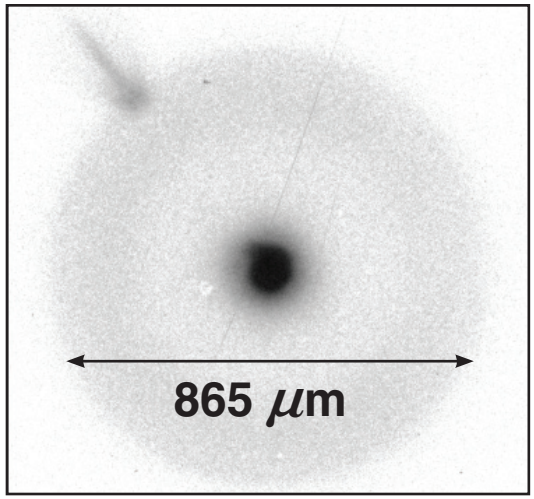
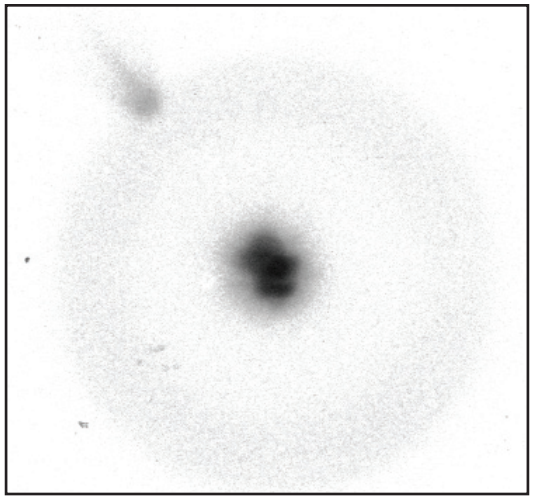
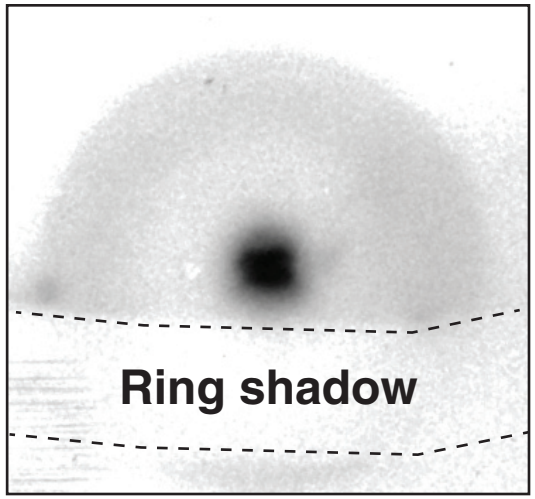
X-ray pinhole camera images (2 to 5 keV)

60 beam implosion	PDD 40 beam implosions	
	Standard target	Saturn target
		
OMEGA shot 37419 15.8 kJ, $Y_n = 6.9 \times 10^{10}$	OMEGA shot 37427 15.2 kJ, $Y_n = 2.1 \times 10^{10}$	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

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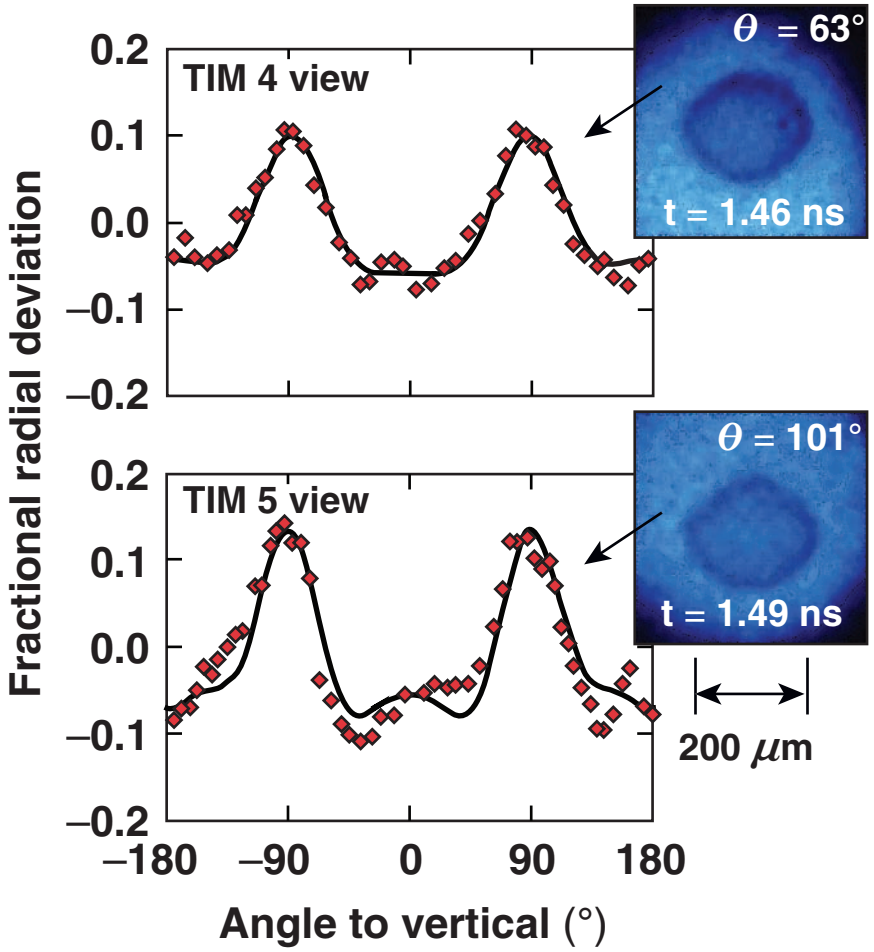
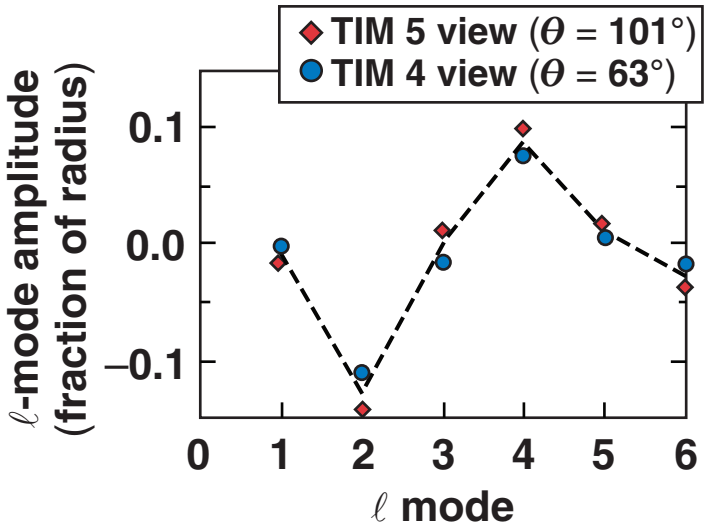
Standard PDD implosion of D_2(15)CH[20] target
OMEGA shot 38502

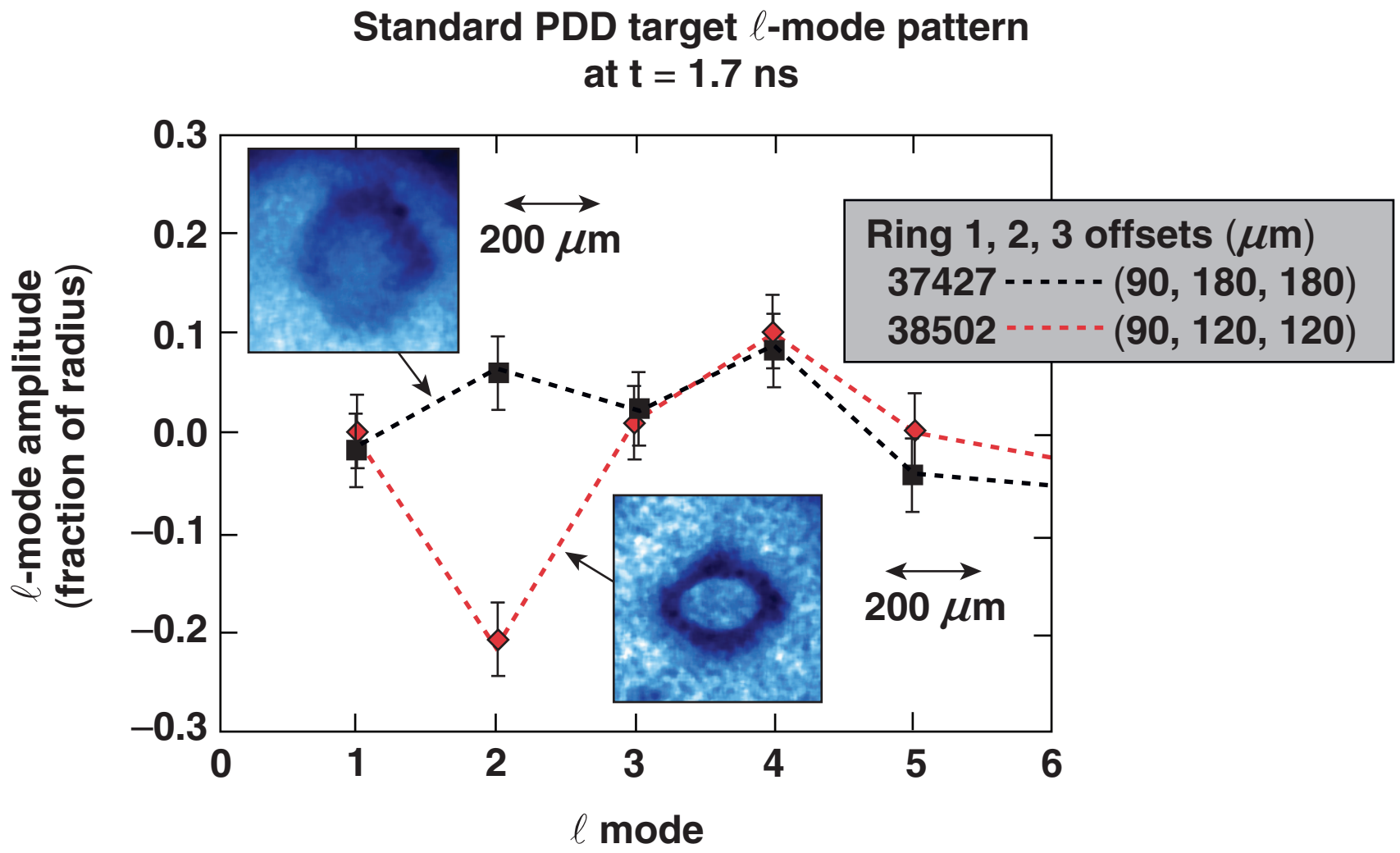




Pointing	
Ring	Offset
1	90 μm
2	120 μm
3	120 μm

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

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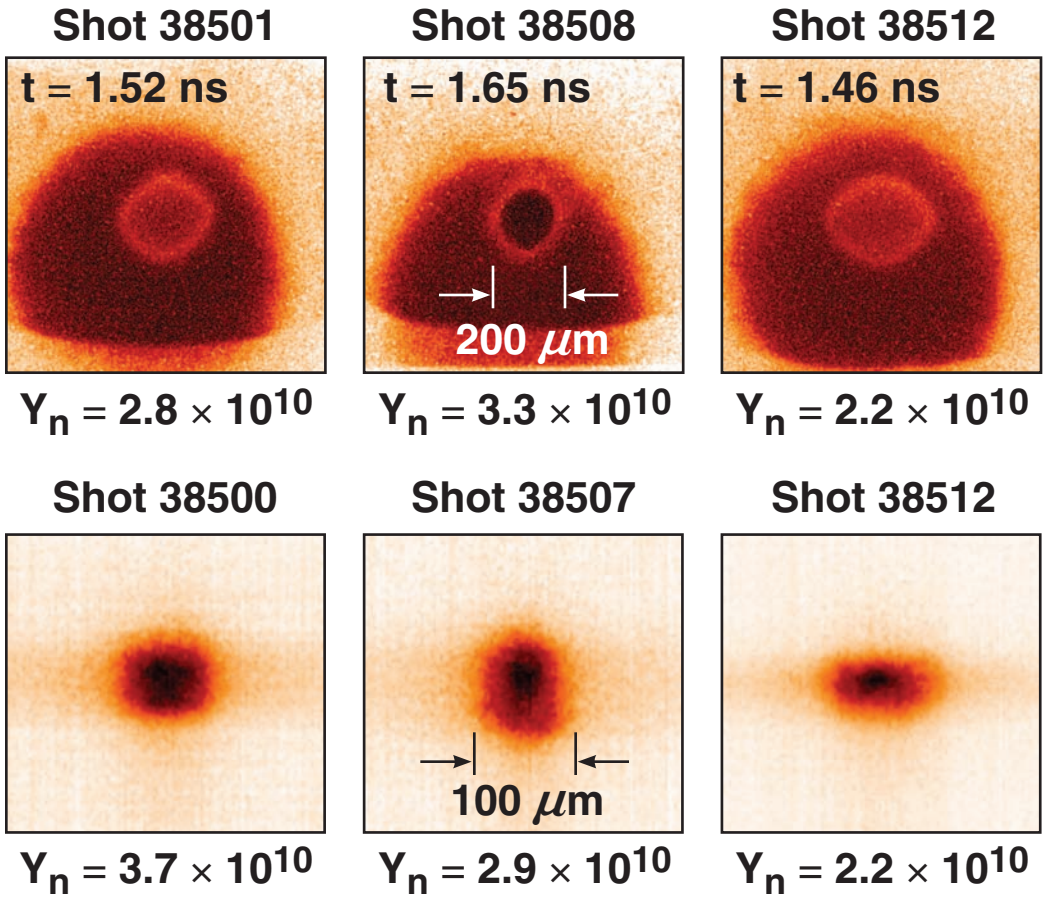
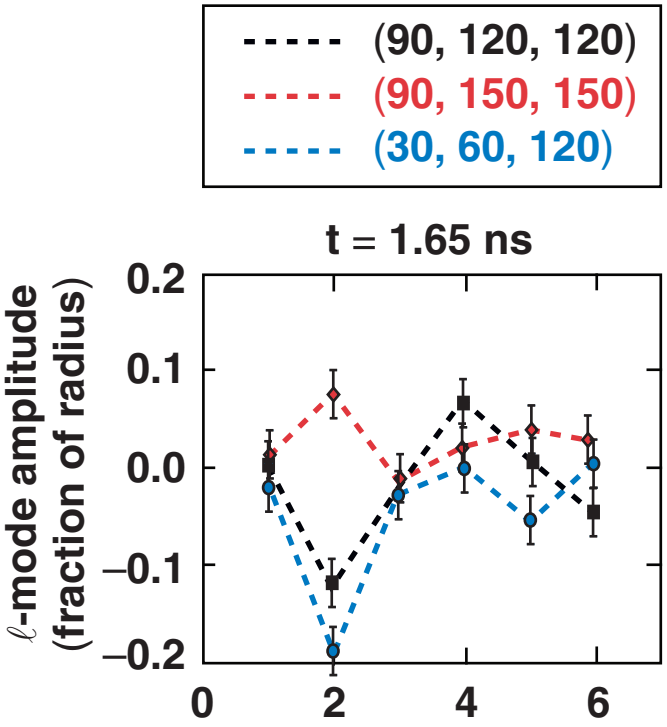
Rings 1, 2, 3 offsets (μm)		
(90, 120, 120)	(90, 150, 150)	(30, 60, 120)

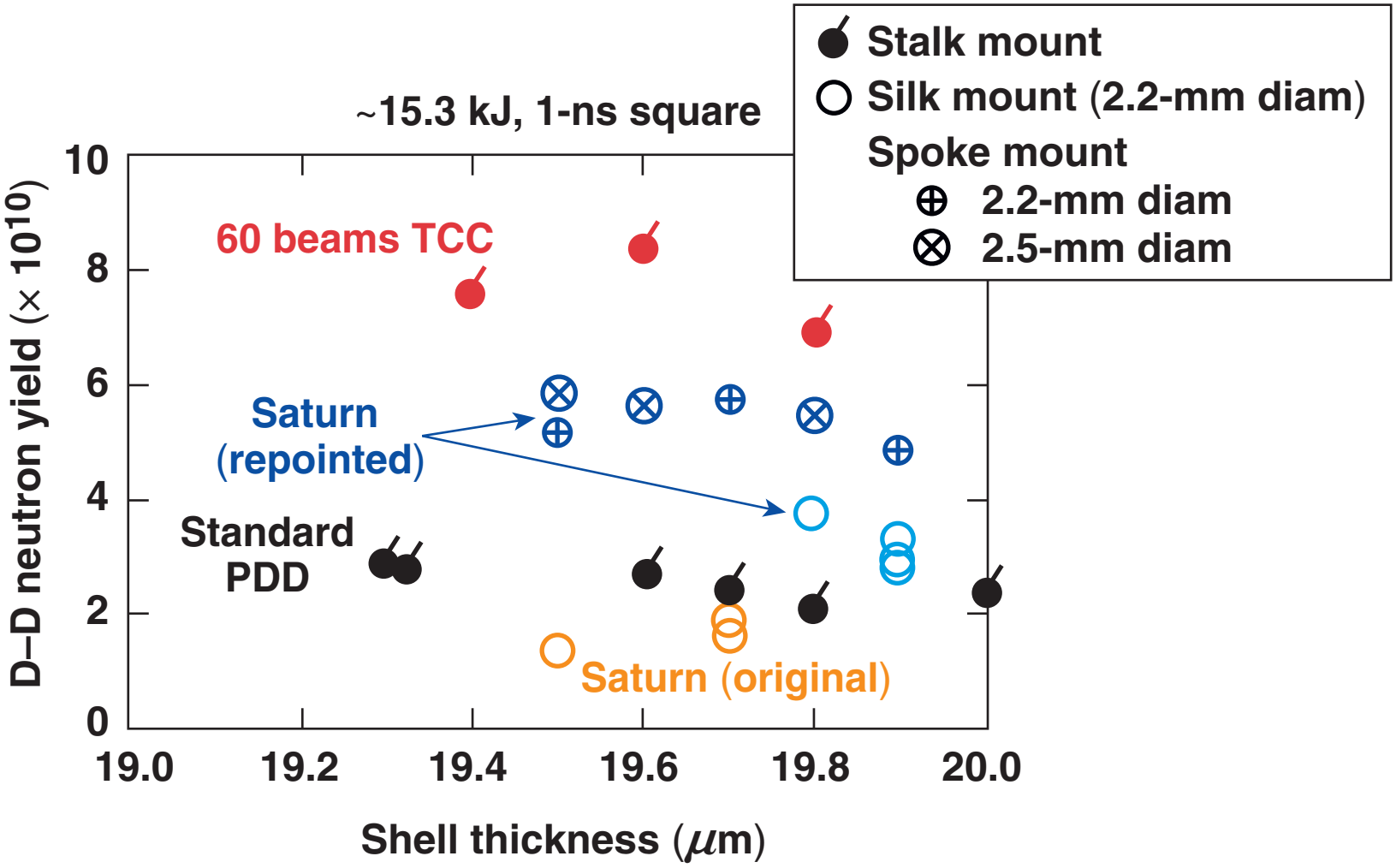




Saturn ring
2.2-mm diam
0.3-mm thick

E14114

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



TC6971b

Summary/Conclusions

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