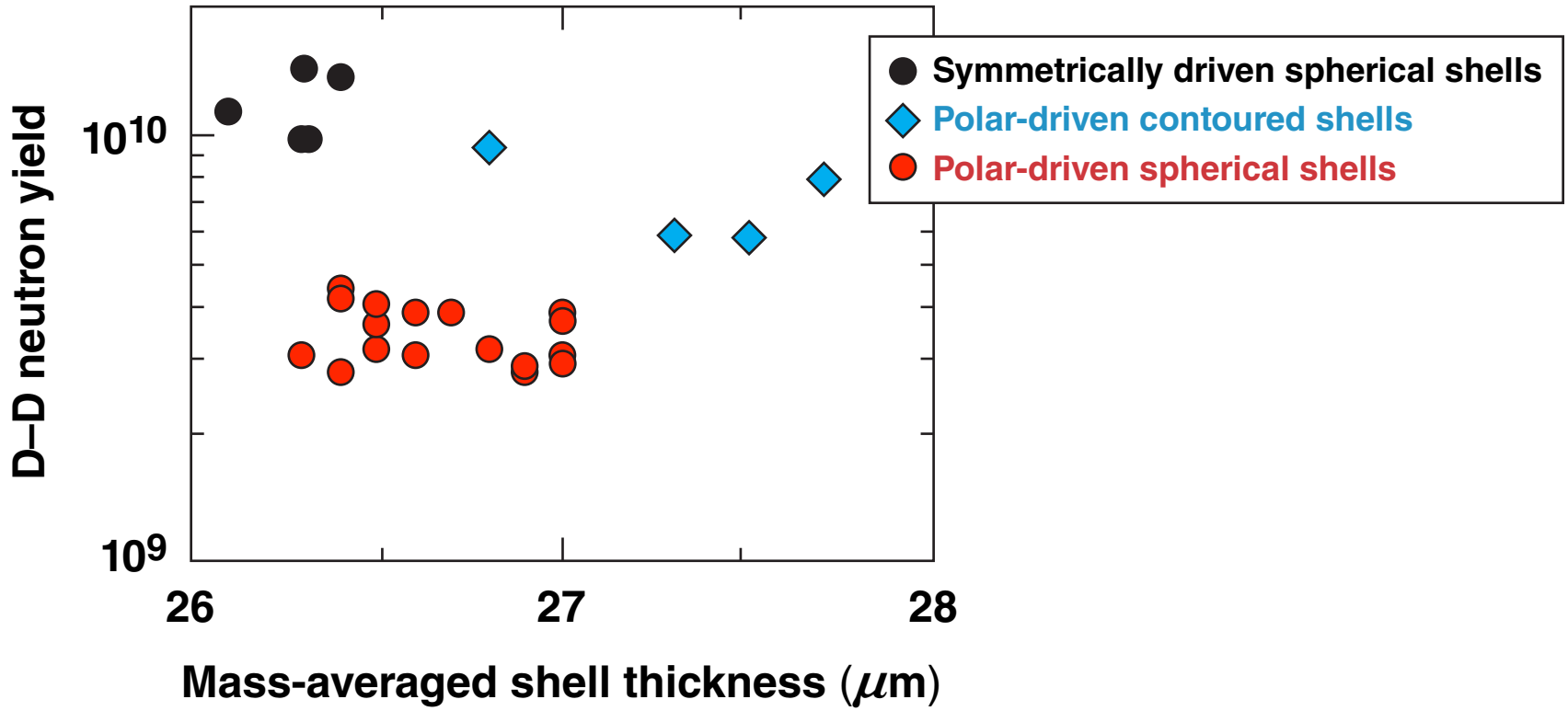
Improved Polar-Driven Implosion Performance Obtained with Contoured Shells



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Summary

Polar-driven (PD) implosion performance on OMEGA has been improved by the use of contoured shells

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- PD implosions of D_2-filled CH shells at a convergence ratio of 19 were performed with triple-picket laser pulses
- The low-mode symmetry of the implosions, diagnosed with x-ray radiography, has been improved by using contoured shells
- Contoured-shell PD implosion yields are increased relative to polar-driven spherical shells by a factor of ~2, approaching the yields of equivalent symmetrically driven implosions

Collaborators

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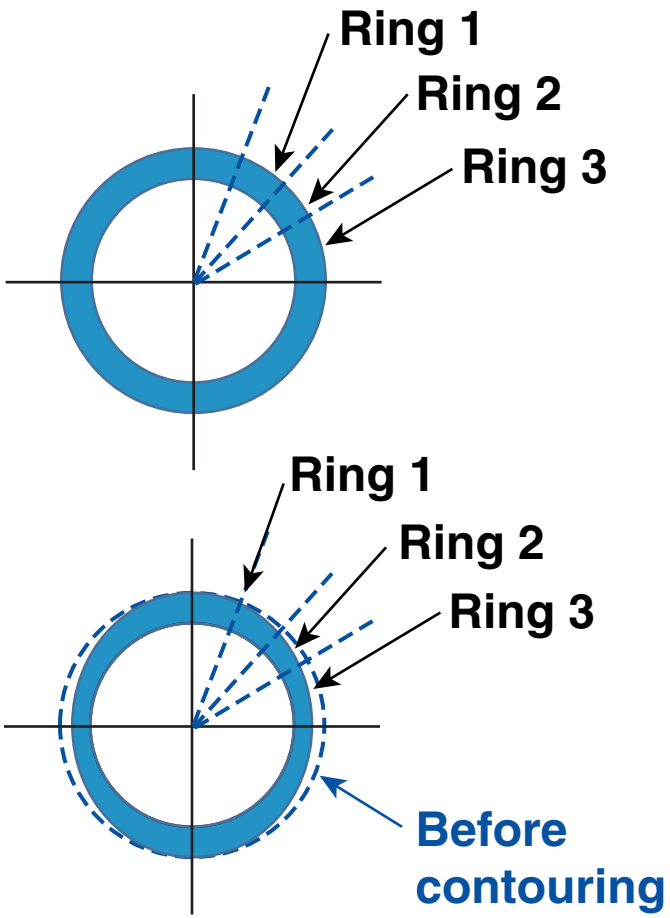
Reduced PD-equatorial drive can be mitigated by using contoured-shell targets



Beam repointing and spherical shell

- Minimizes P_2 mode at the expense of energy coupling
- Significant P_4 mode remains

Beam repointing and contoured shell

- Further reduces the magnitude of beam repointing, increases energy coupling
- Both P_2 and P_4 modes are reduced

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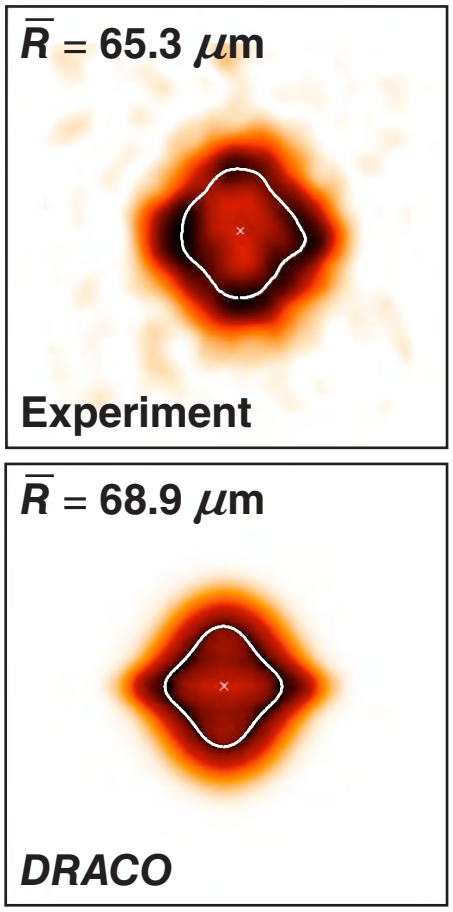
High-convergence-ratio PD implosions with spherical shells achieved a small $\ell = 2$ with a remaining $\ell = 4$

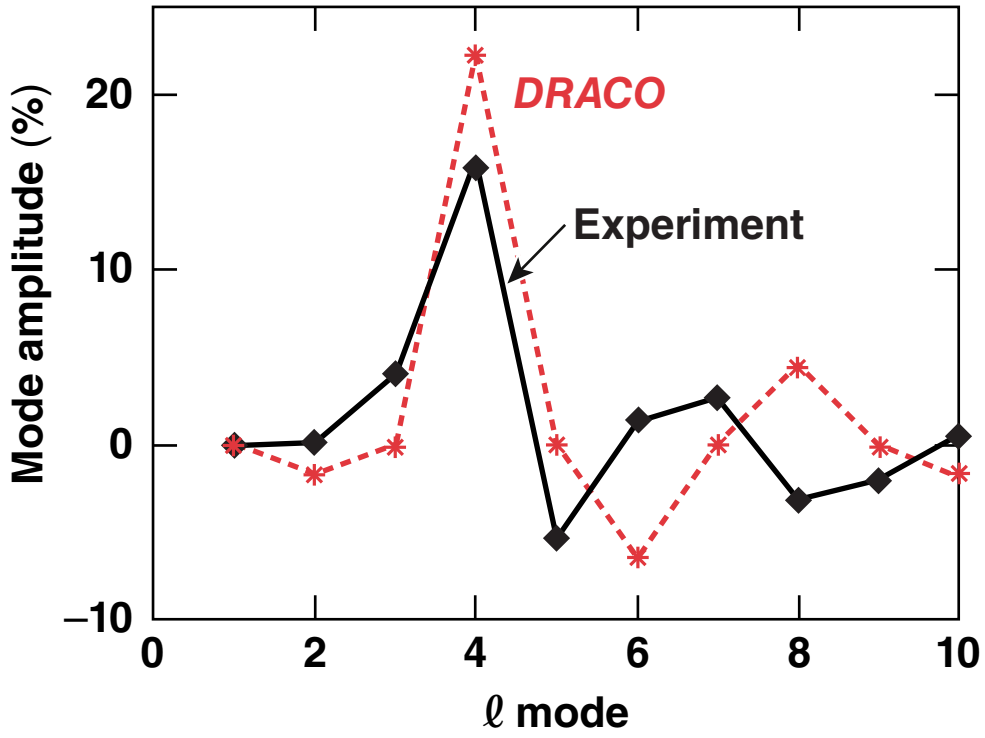
X-ray radiographs
(E ~ 4.7 keV) with peak fits



500 × 500-μm regions

10-atm, D_2-filled, 27-μm-thick CH shell,
13.7-kJ triple-picket implosion

Rings 1, 2, 3 – 90, 133, 133-μm offsets
OMEGA shot 60661, 3.55 ns



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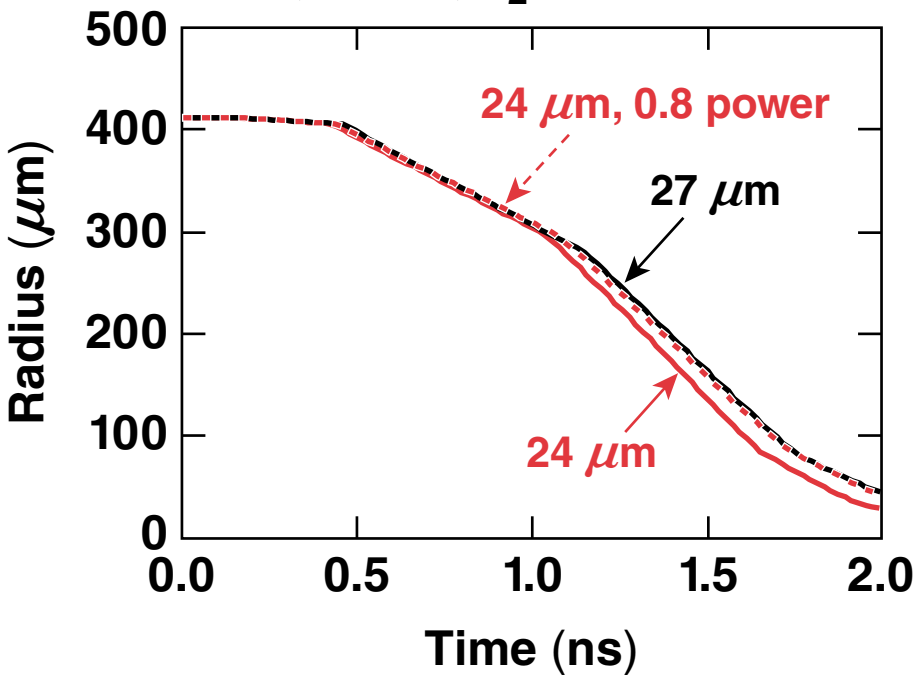
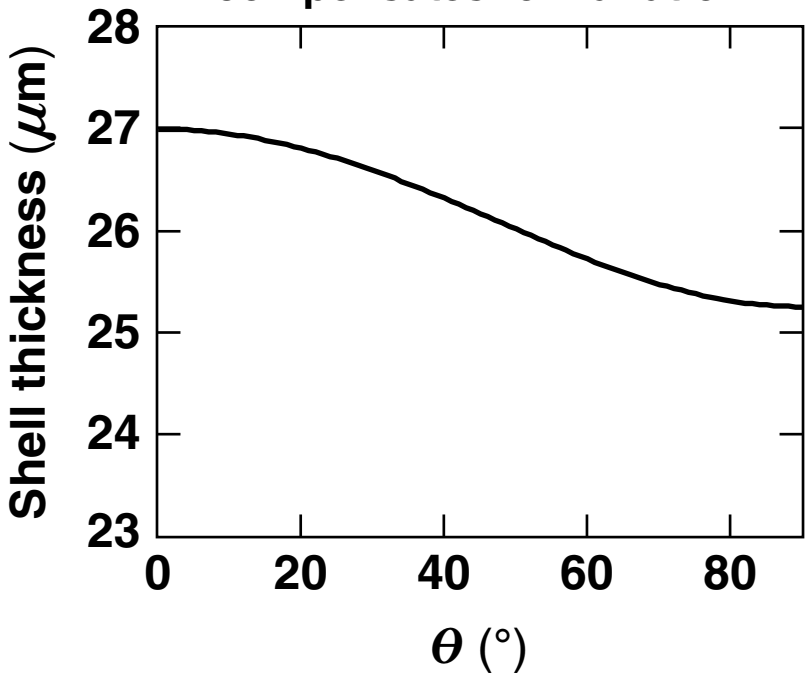
PD shimmed targets have been designed with a contoured wall thickness

- A series of *LILAC* runs (1-D hydro) were used to determine the shell thickness needed as a function of intensity

LILAC fuel/shell interface for 1-ns square pulse
27-kJ, 10-atm, D_2-filled CH shells



Shell thickness that compensates for variation



DRACO **(2-D hydro) was used to optimize the beam pointing that minimized the asymmetry of the imploded shimmed shell.**

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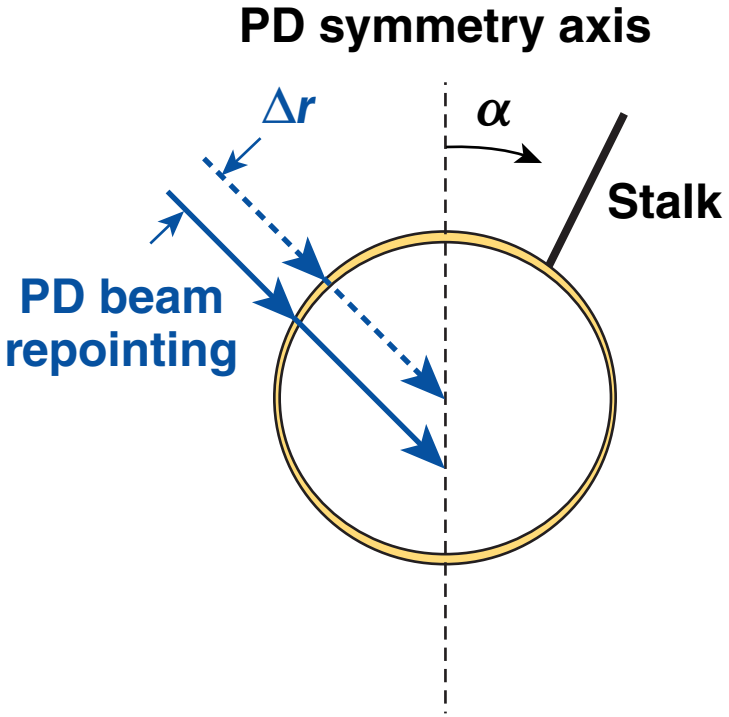
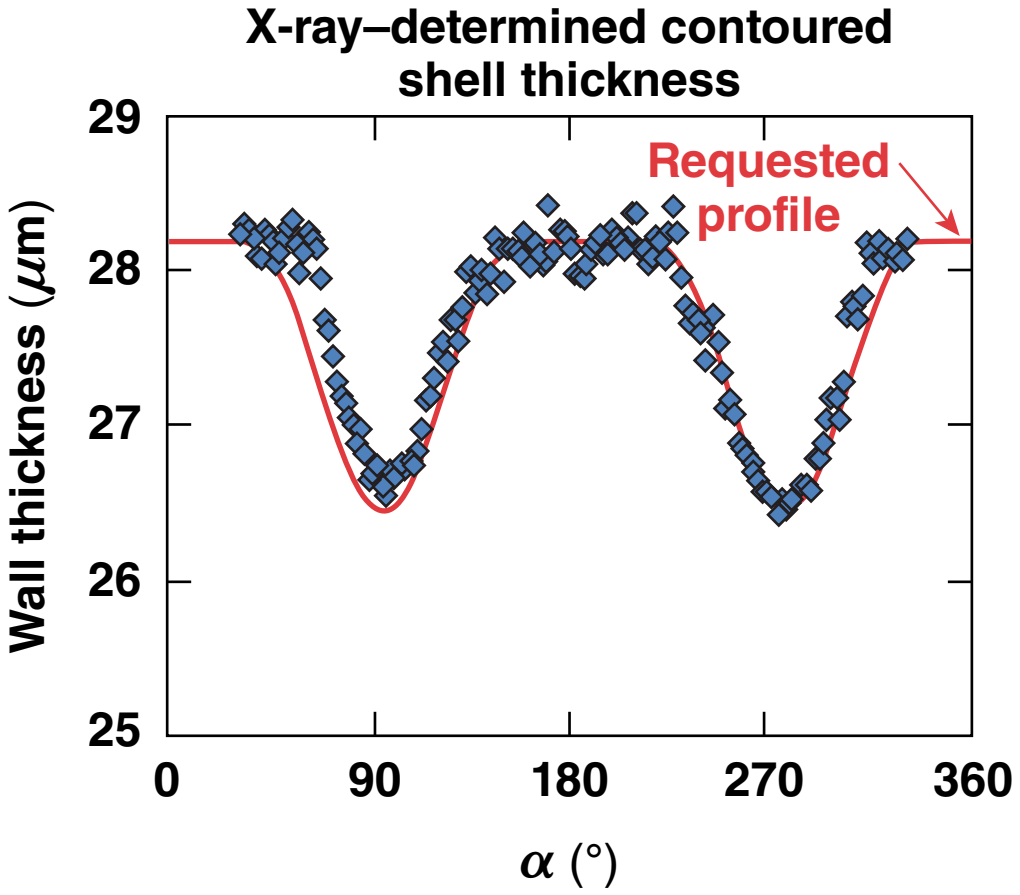
CH shells were precision machined at General Atomics





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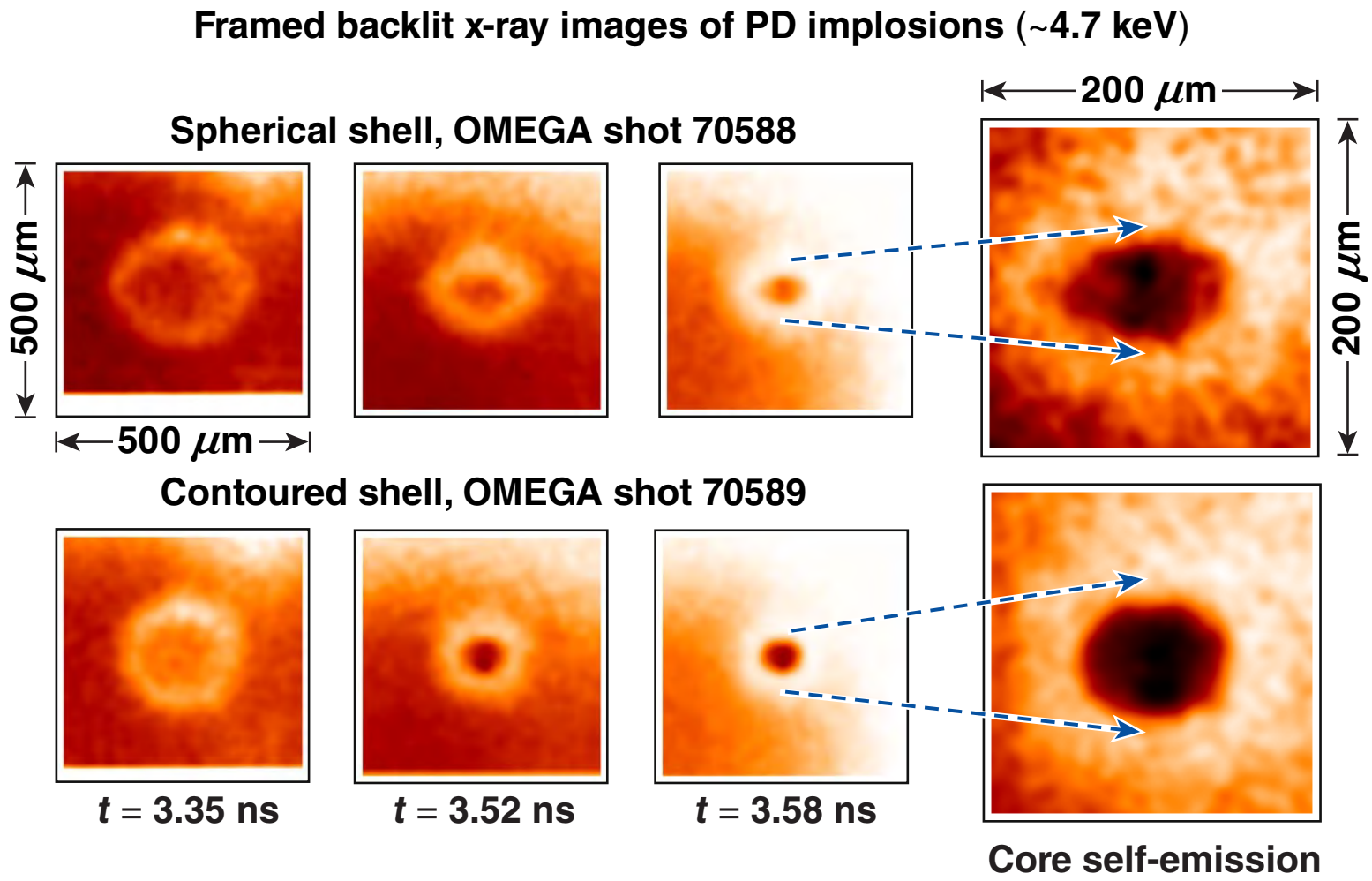
The introduction of a contoured shell dramatically changes the shape of a polar-driven implosion



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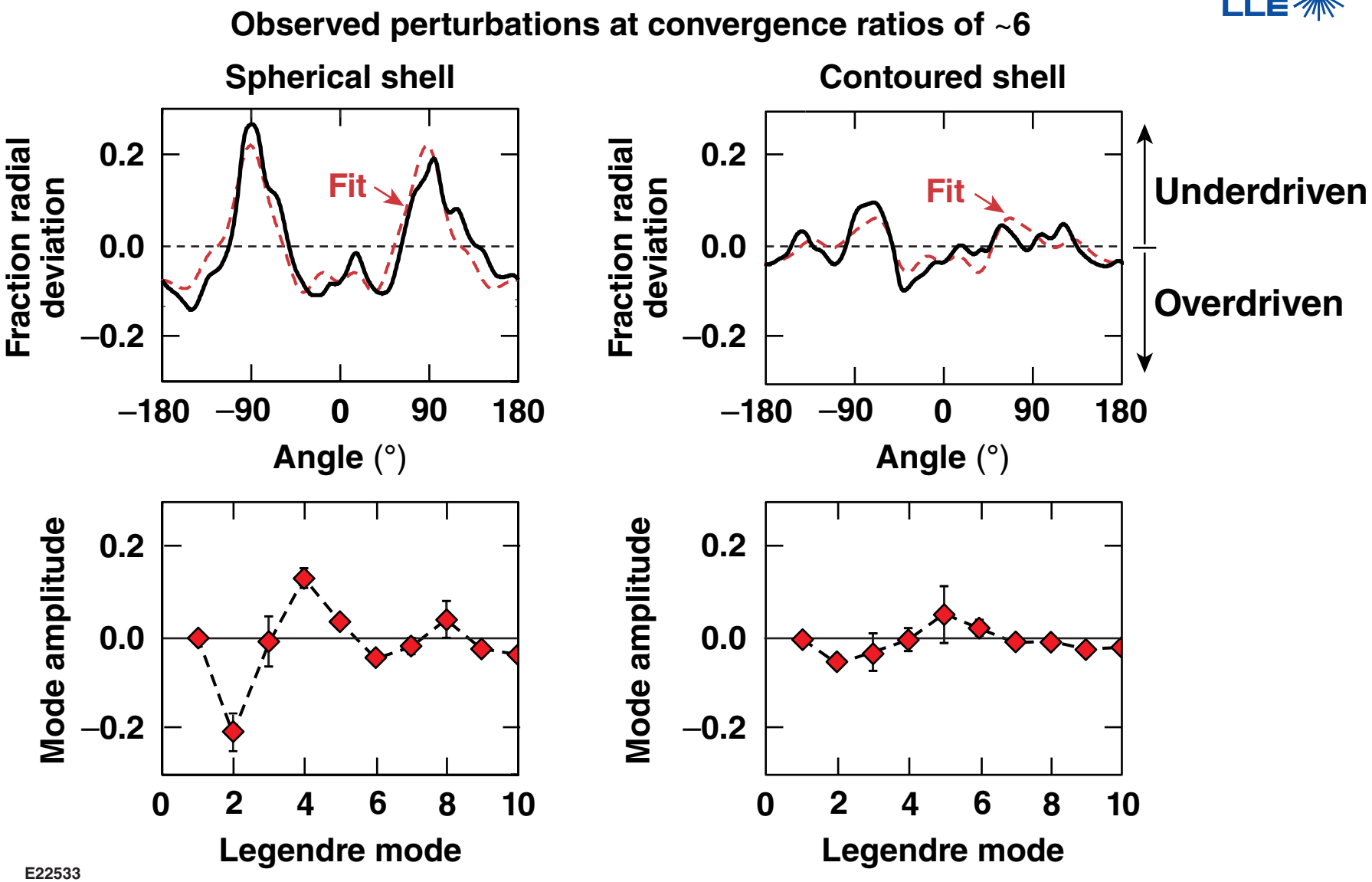
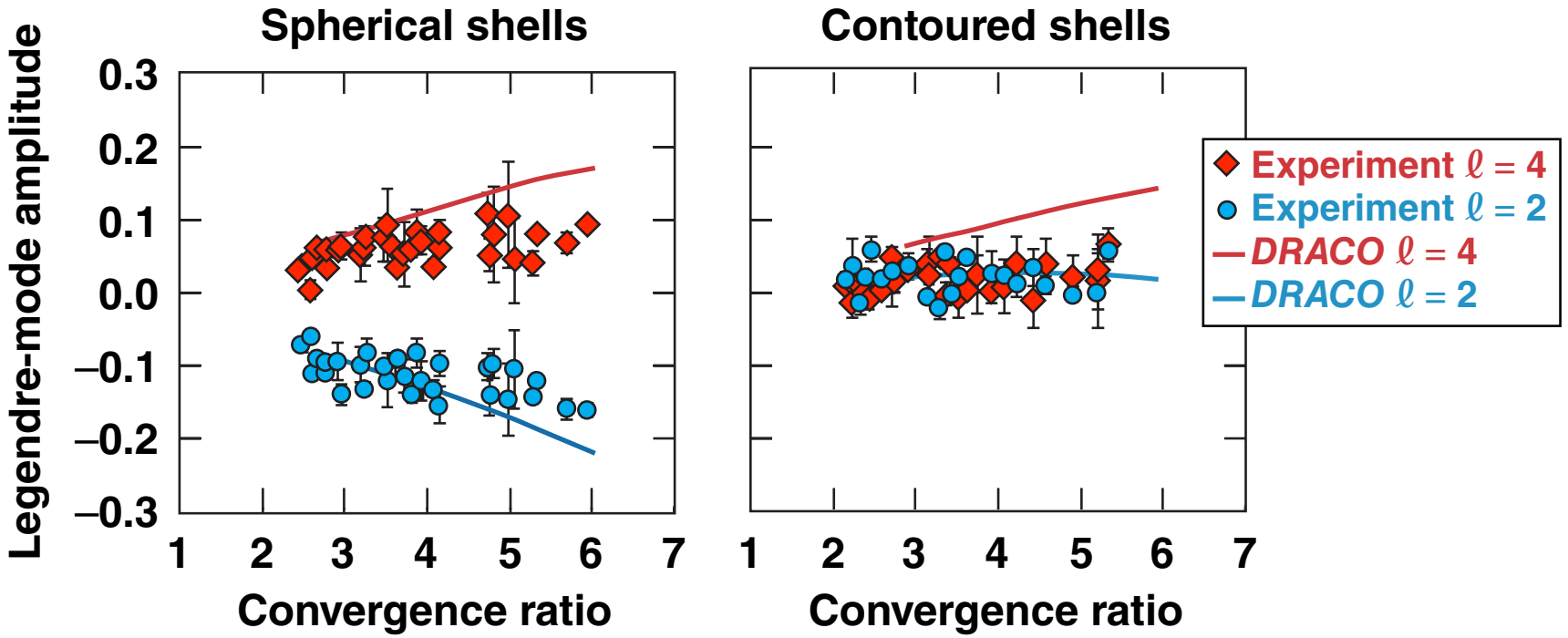
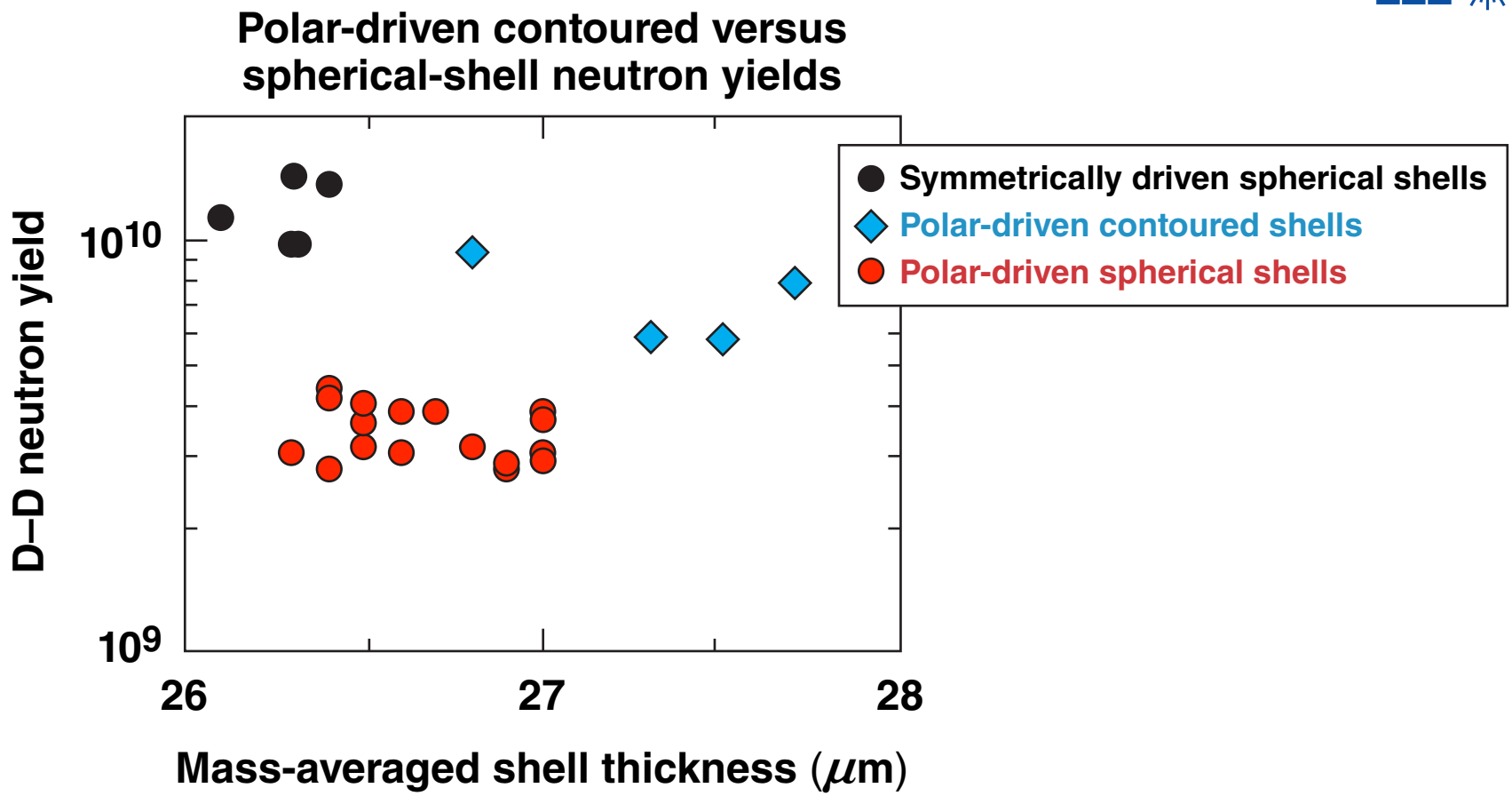
The change in implosion shape from spherical to contoured shell target is clearly evident



The amplitude of the lowest Legendre modes is significantly reduced by imploding a contoured shell with polar drive



The yields from the polar-driven contoured-shell implosions exceeded those of polar-driven spherical shells by about a factor of 2



The polar-driven contoured-shell yields approach the symmetrically driven spherical shell yields.

E22455

Summary/Conclusions

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The change in implosion shape from spherical-shell target to contoured-shell target is clearly seen with x radiography

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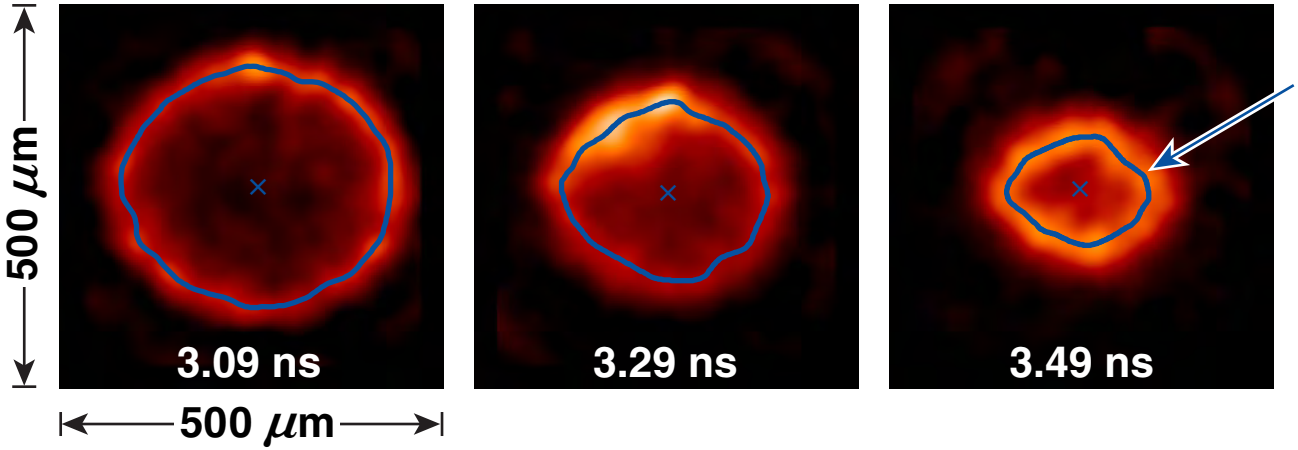
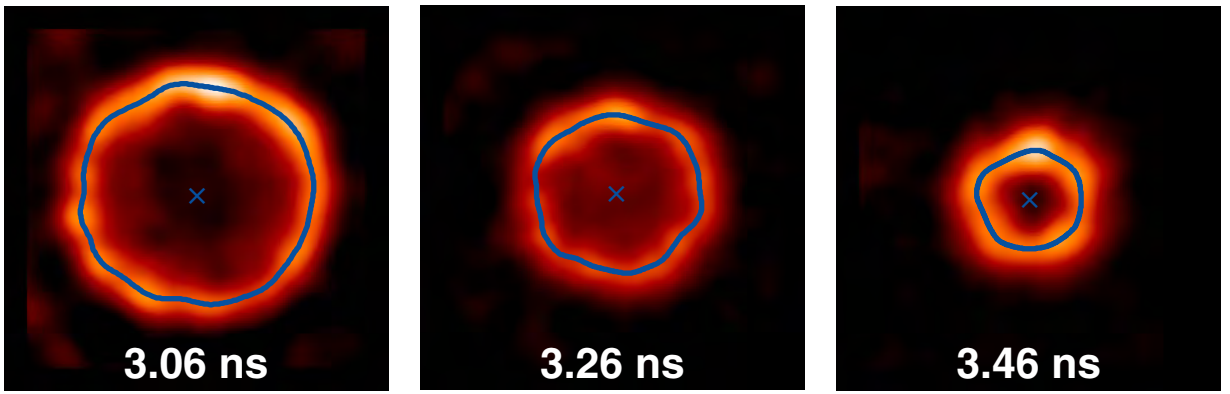
Spherical-target radiographs, shot 70586



Shimmed-target radiographs, shot 70589



E22531