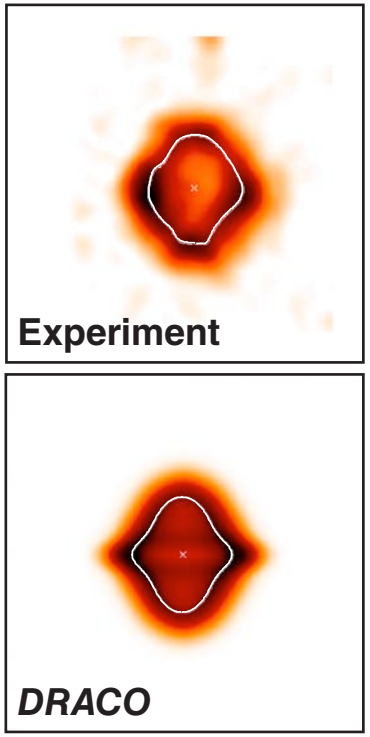
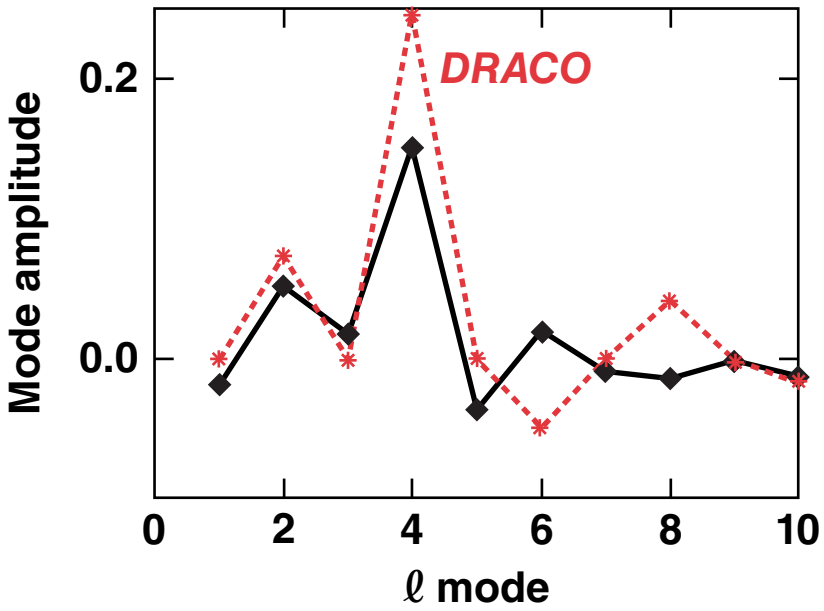
High-Convergence-Ratio Polar-Drive Experiments on OMEGA

Ti backlight image (4.7 to 5 keV)



500 × 500-μm regions

Rings 1, 2, 3 – 90, 150, 150-μm offsets
OMEGA shot 59649, 3.55 ns



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American Physical Society
Division of Plasma Physics
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Summary

High-convergence-ratio polar-driven experiments on OMEGA have demonstrated control of the implosion symmetry

- Polar-driven (PD) implosions of D_2-filled, CH shells at a convergence ratio of 19 have been performed with triple-picket laser pulses
- Low-mode shell perturbations resulting from PD illumination, measured with framed x-ray backlighting, are in close agreement with those predicted by 2-D simulations
- Implosion symmetry has been optimized using beam repointing, —techniques such as beam shaping, power balance, and target shimming will be explored next*

*P. B. Radha, P08.00008, this conference
T. J. B. Collins, KI3.00002, this conference

Collaborators

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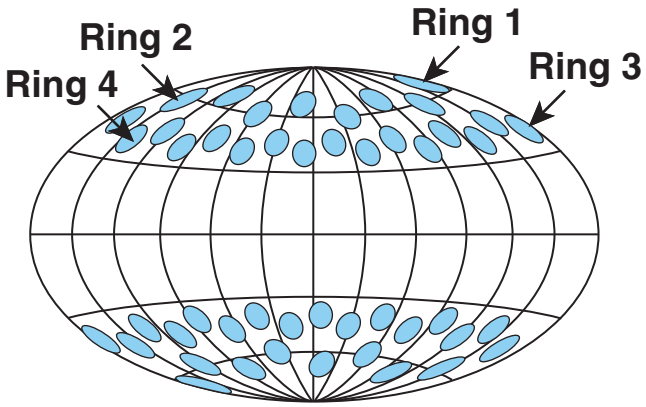
Plasma Fusion Center
Massachusetts Institute of Technology

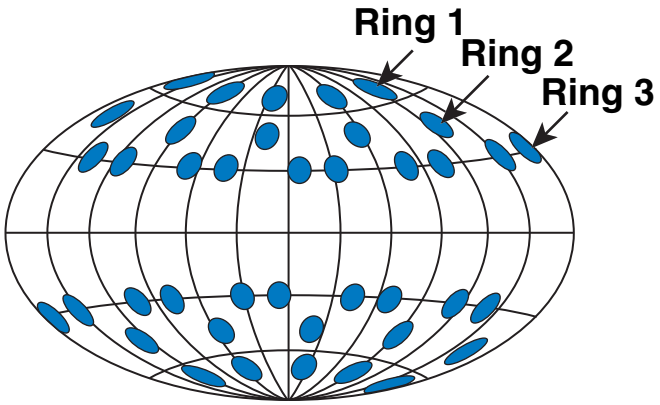
Experiments were performed with 40 beams emulating the NIF configuration and with triple-picket pulses

UR LLE

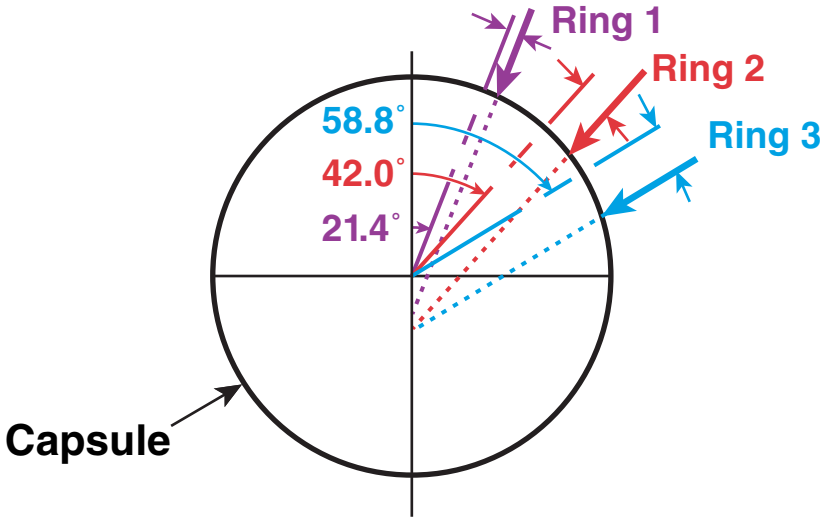
NIF configuration

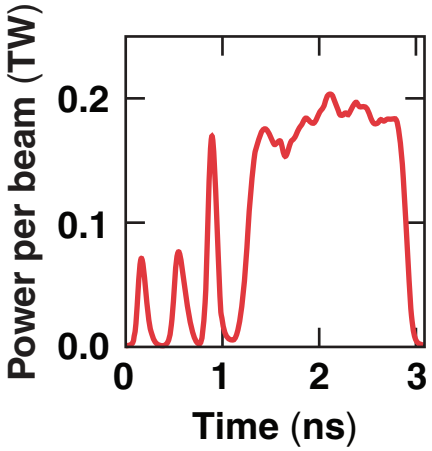


OMEGA PDD configuration



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

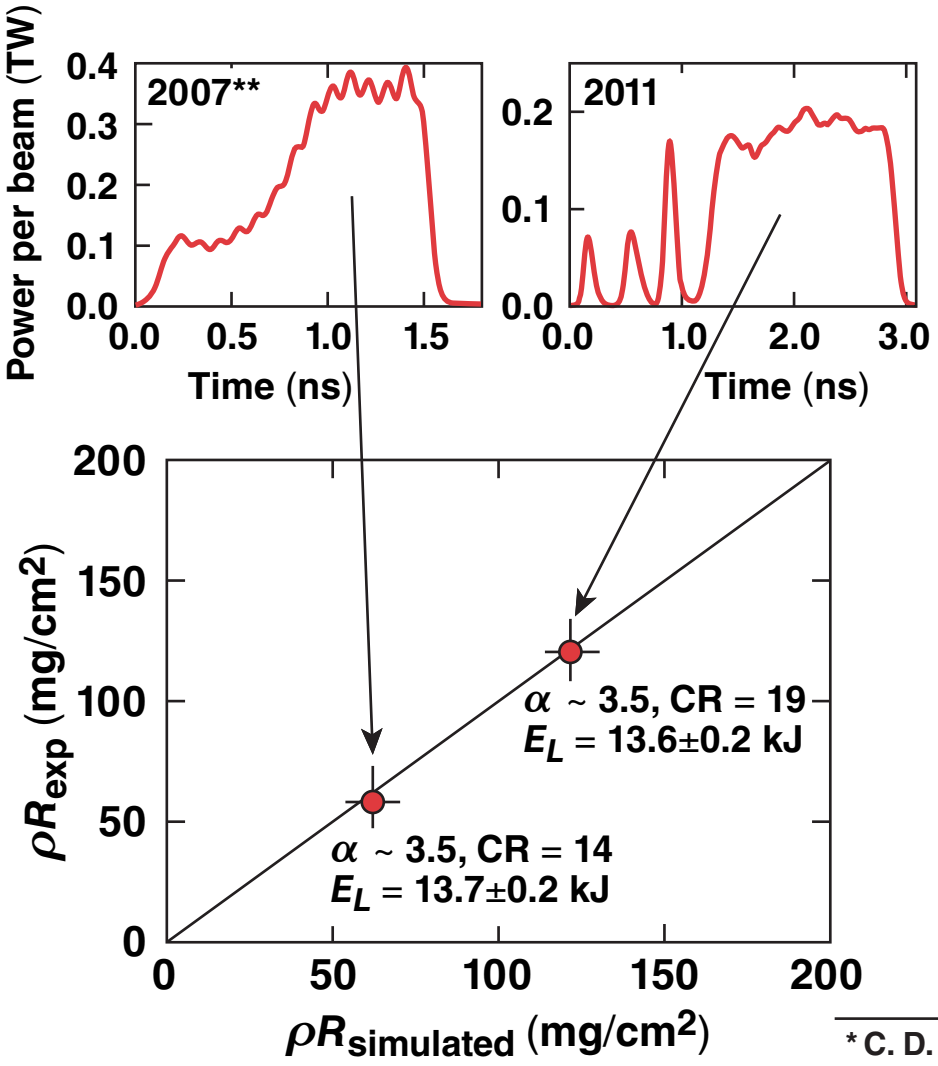




- Additional OMEGA beams are used for x-ray backlighting

E20391

Areal densities are close to *DRACO* predictions, indicating small shell density perturbations and good compression



- **Areal density depends on the pulse shape used which affects the adiabat α and the convergence ratio CR.***

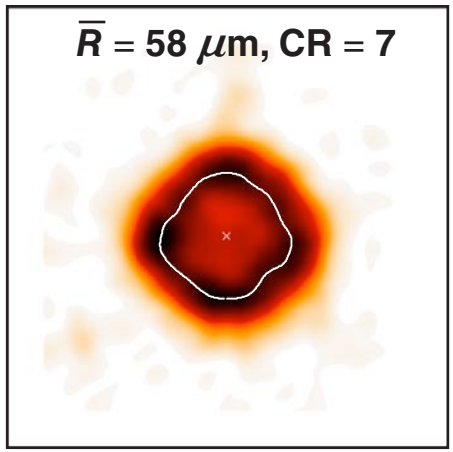
TC9479g

* C. D. Zhou and R. Betti, Phys. Plasmas 14, 072703 (2007).
** F. J. Marshall *et al.*, Phys. Rev. Lett. 102, 185004 (2009).

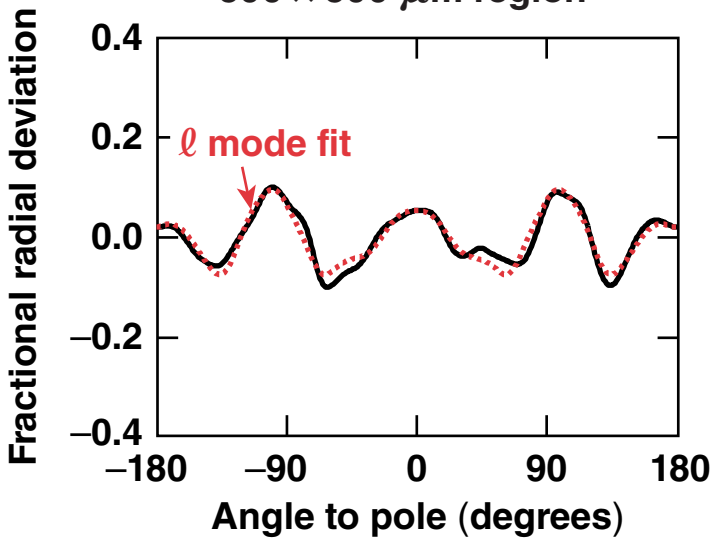
Framed x-ray radiographs are analyzed to determine shell size, Legendre mode amplitudes, and mass distribution

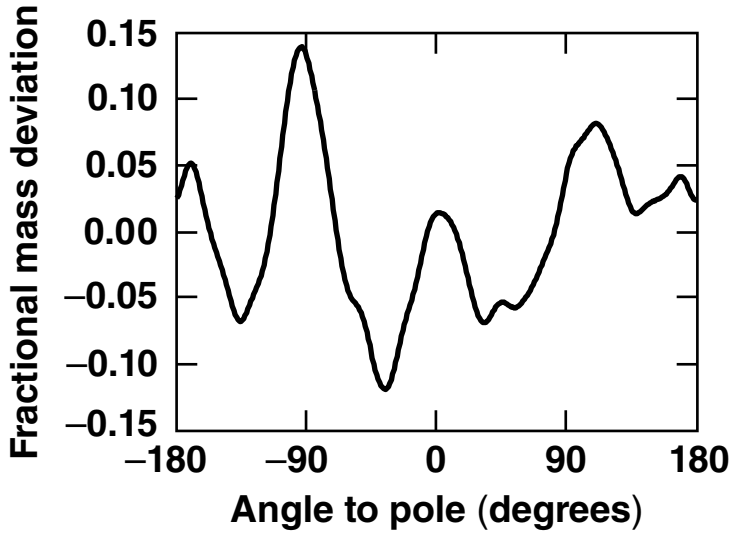
10-atm-D_2-filled, 27-μm-thick CH shell implosions
OMEGA shot 60651, 3.55 ns

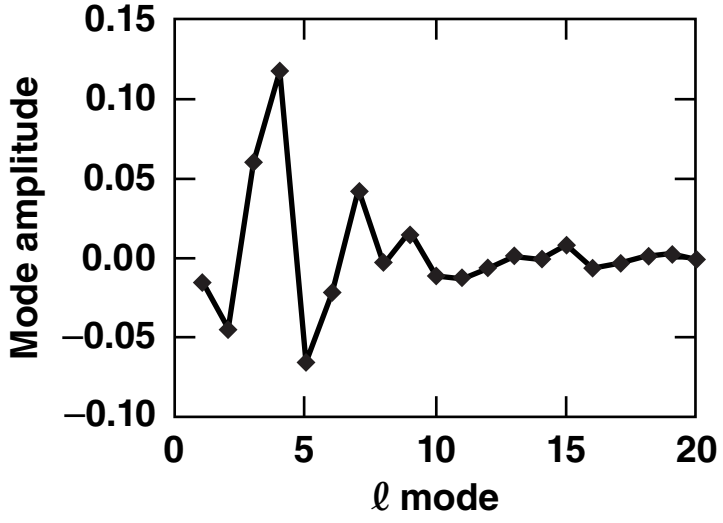
Ti backlight image (4.7 to 5 keV)



500 × 500-μm region



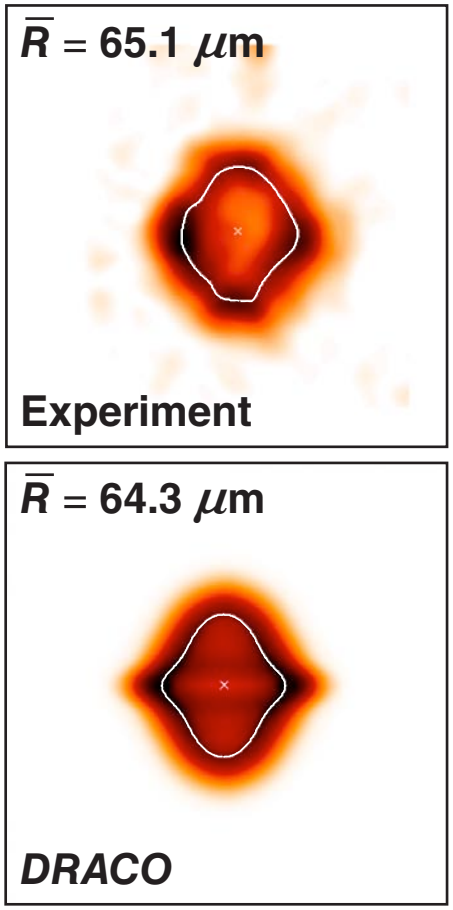




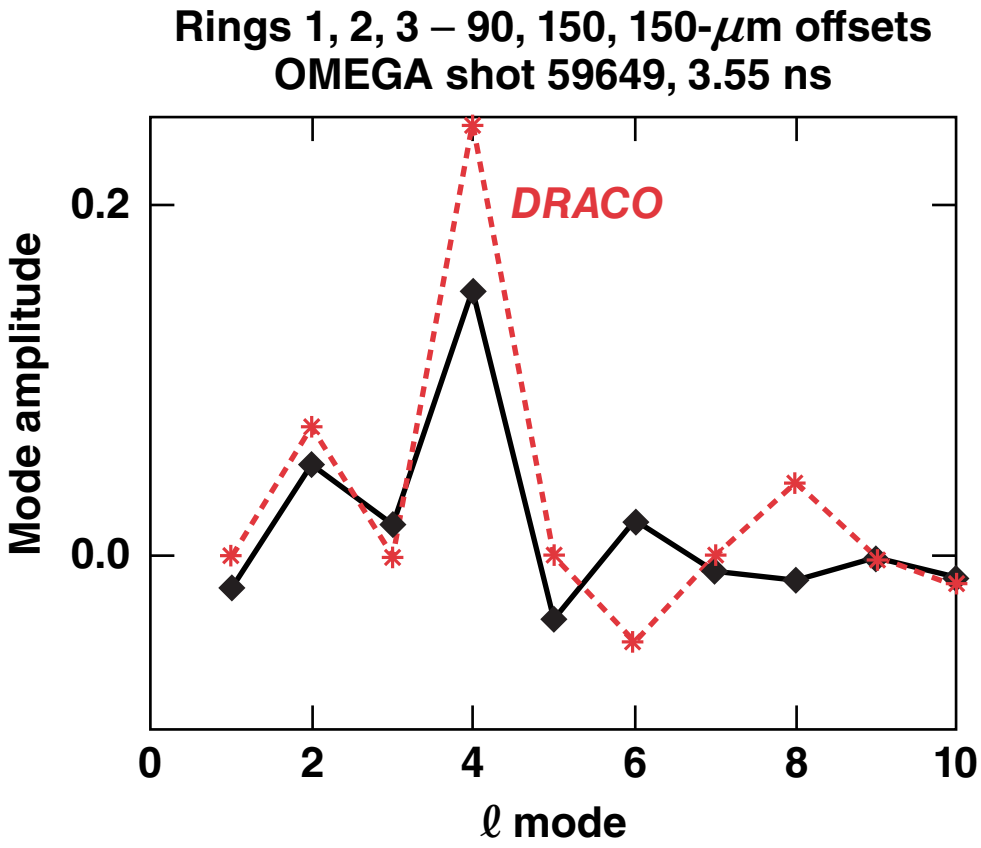
E20392

Initial high-convergence PD implosions revealed a small $\ell = 2$ and a larger $\ell = 4$ mode amplitude

Ti backlight image (4.7 to 5 keV)



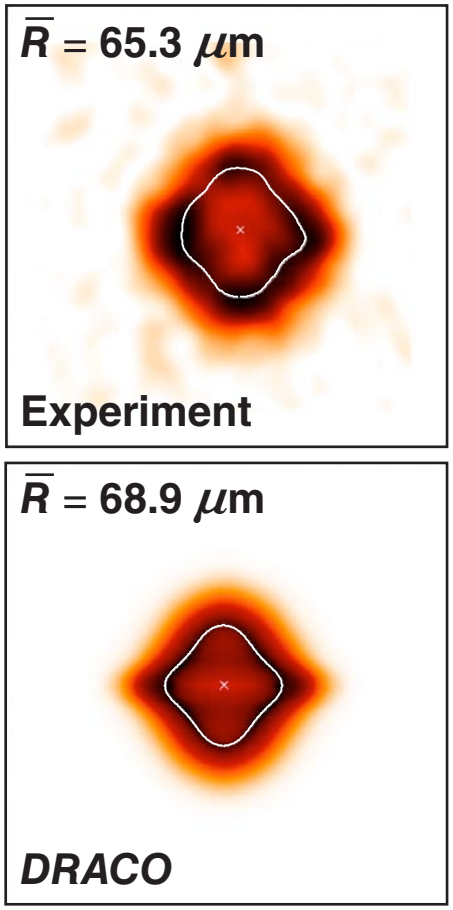
500 × 500-μm regions



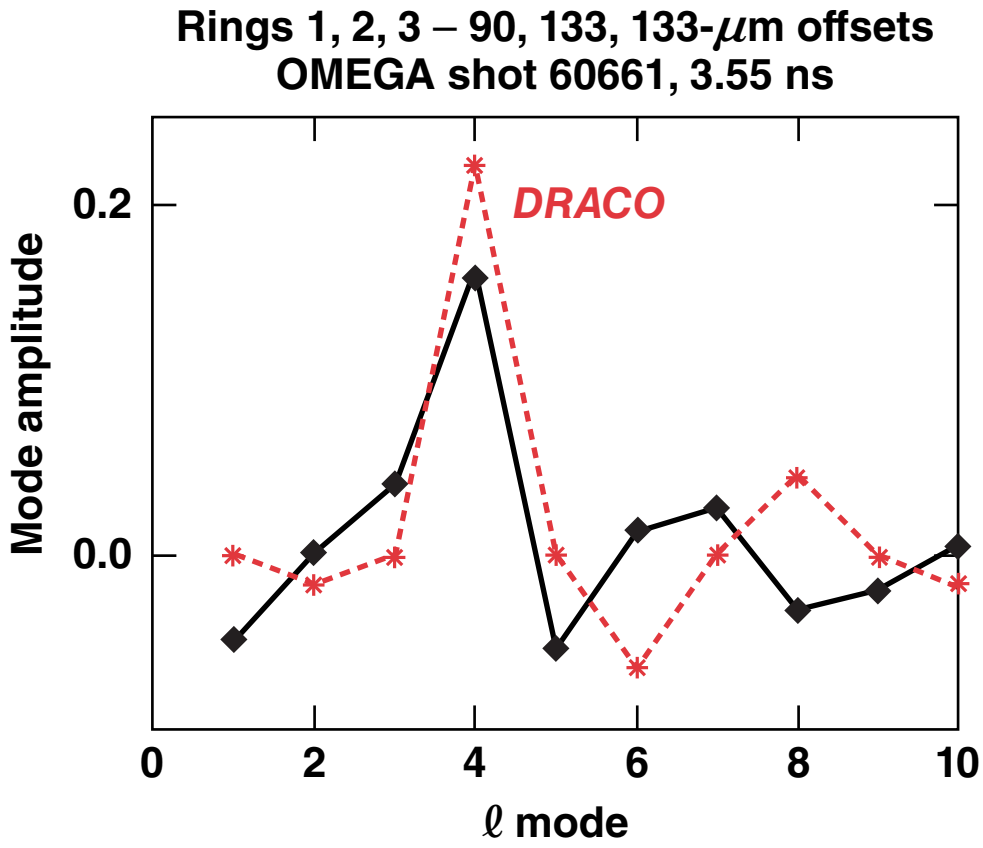
E20393

Further high-convergence-ratio PD implosions were able to minimize the $\ell = 2$ mode but not the $\ell = 4$ mode

Ti backlight image (4.7 to 5 keV)



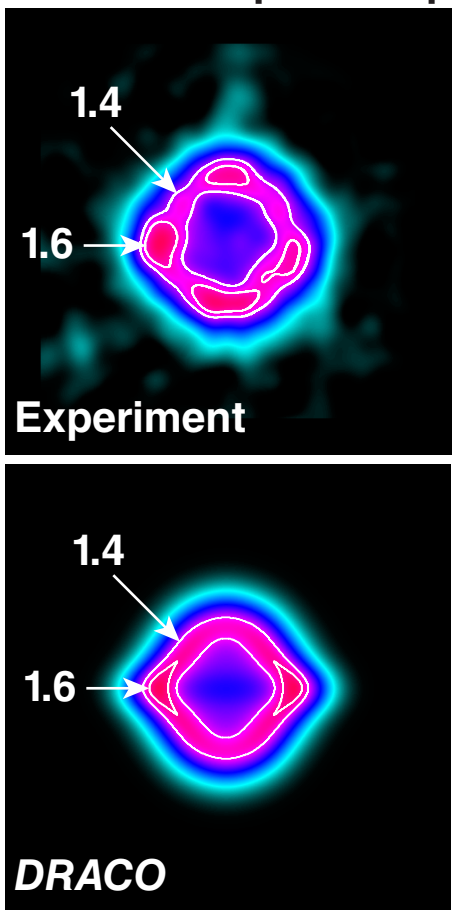
500 × 500-μm regions



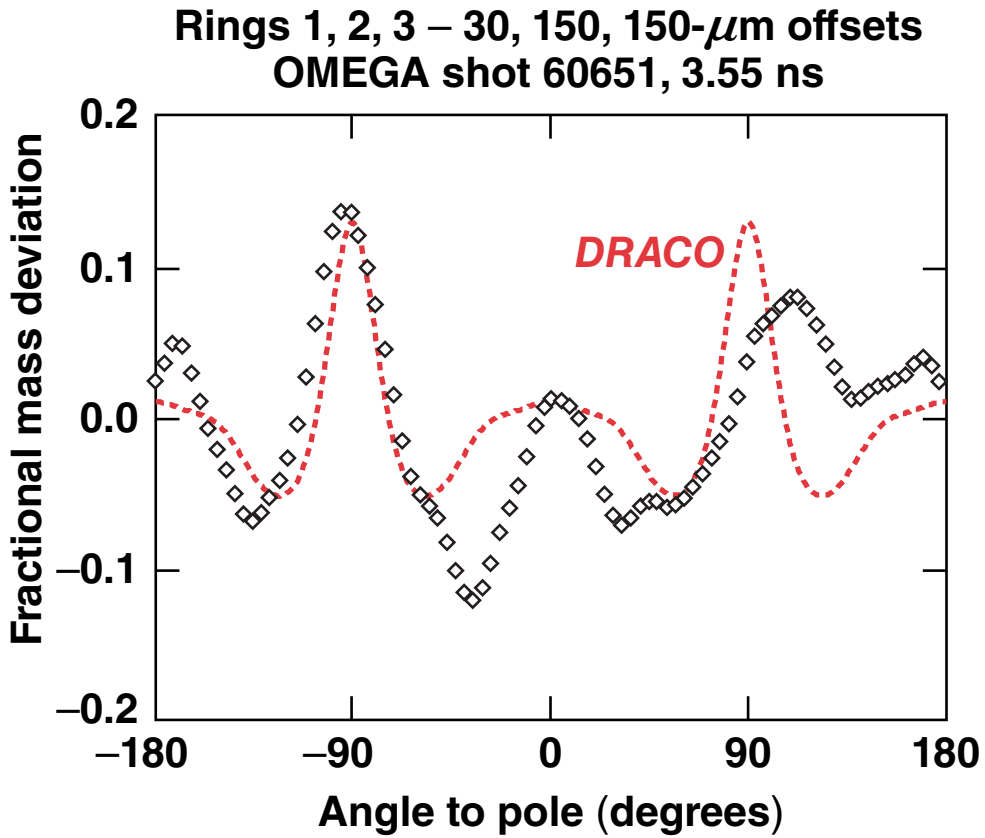
E20394

The inferred mass distribution in the imploded shell shows a similar angular variation to that of the *DRACO* simulation

Ti backlight image (4.7 to 5 keV)
Contours of optical depth

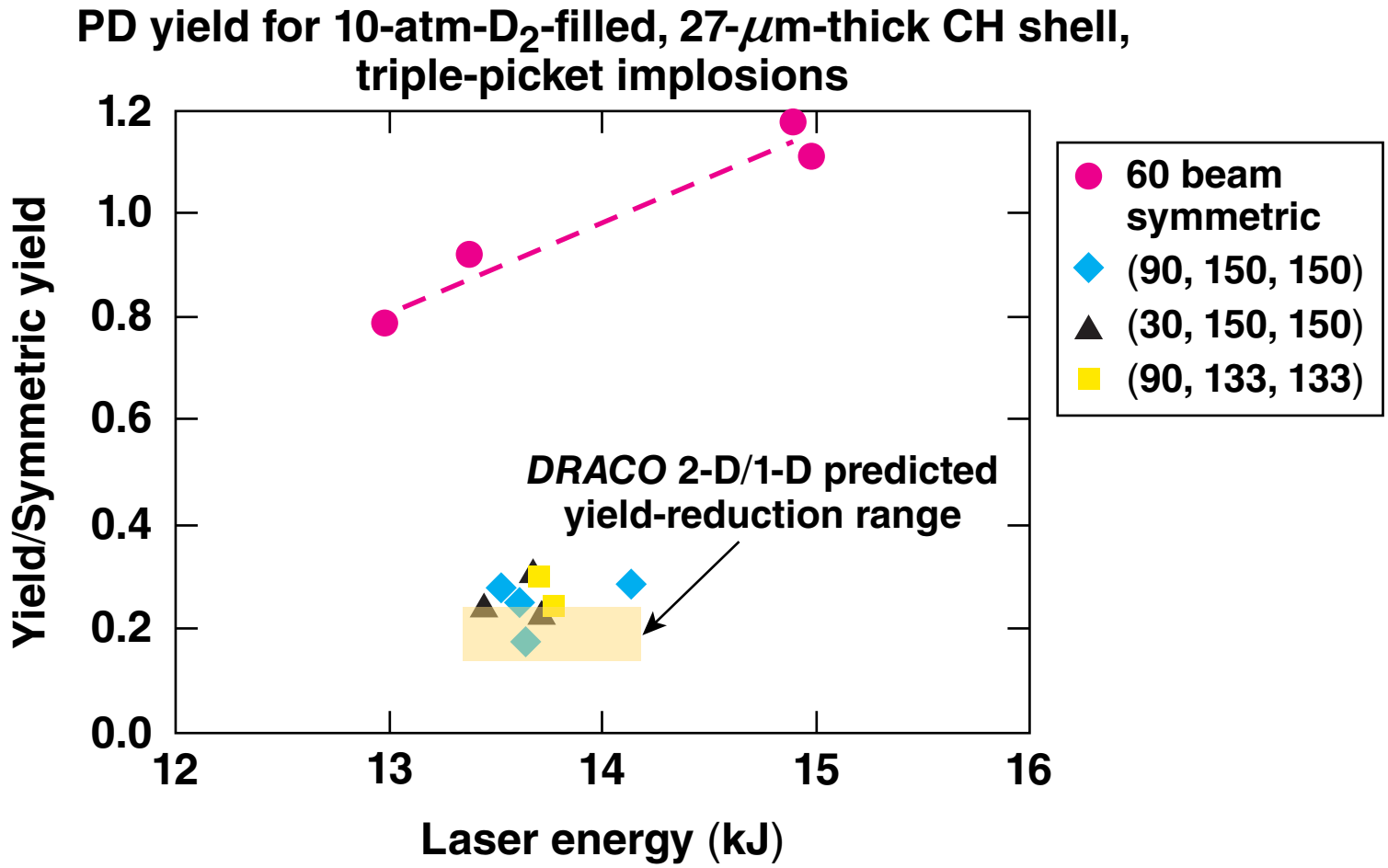


500 × 500-μm regions



E20396

Neutron yields of the high-convergence PD implosions are reduced by an amount close to that predicted by *DRACO*



E20395

Summary/Conclusions

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