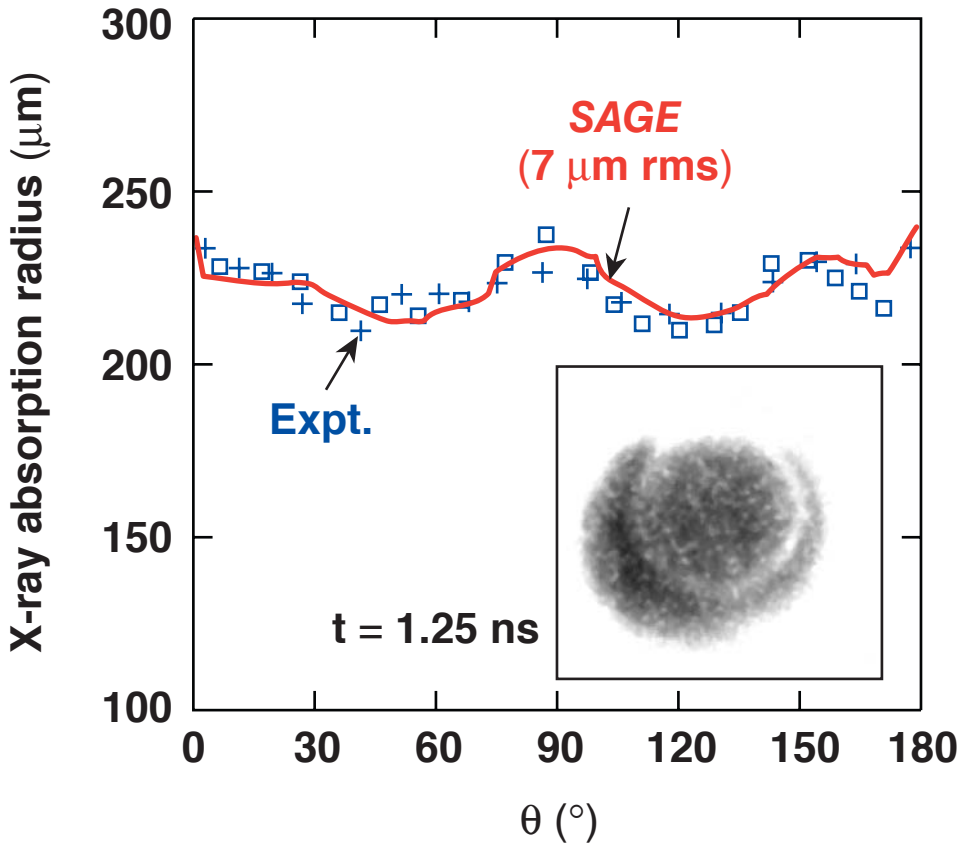
Polar-Direct-Drive Experiments on OMEGA



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34th Anomalous
Absorption Conference
Gleneden Beach, OR
2–7 May 2004

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Summary

The deviations from sphericity in OMEGA polar-direct-drive implosions are close to *SAGE* predictions

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- Forty beams with optimized pointings have produced near-symmetric implosions.*
- The zero-order implosion dynamics are consistent with 1-D modeling.
- There is a decrease in neutron yield and core symmetry.

* Similar to earlier experiments carried out by G. Glendinning (LLNL) and G. Kyrala (LANL).

Outline

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- Experimental configuration
- Simulations
  - self-consistent ray tracing
  - x-ray backlighting
- Results
  - streaked x-ray imaging
  - framed x-ray backlighting
  - time-integrated KB-microscope x-ray imaging
  - neutron yield

Forty beams irradiated the target in the polar-direct-drive configuration while six beams were used for backlighting

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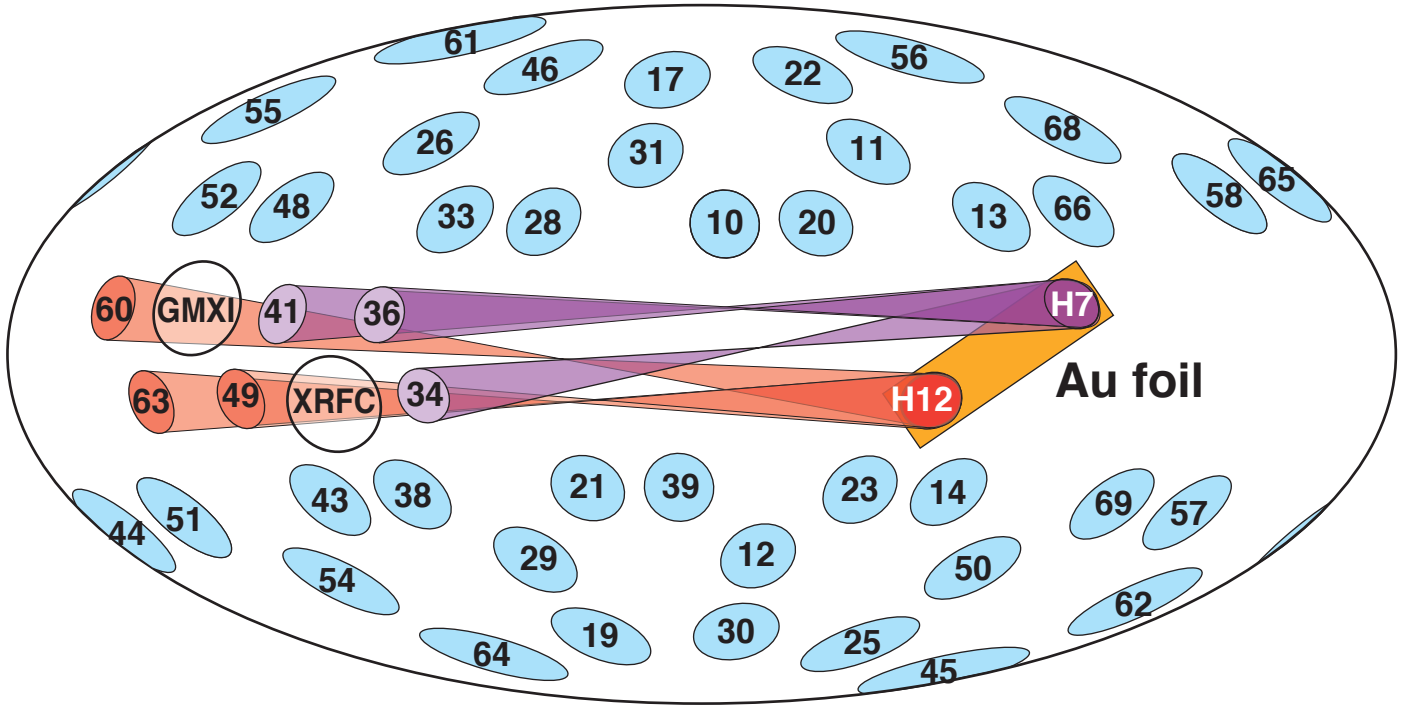
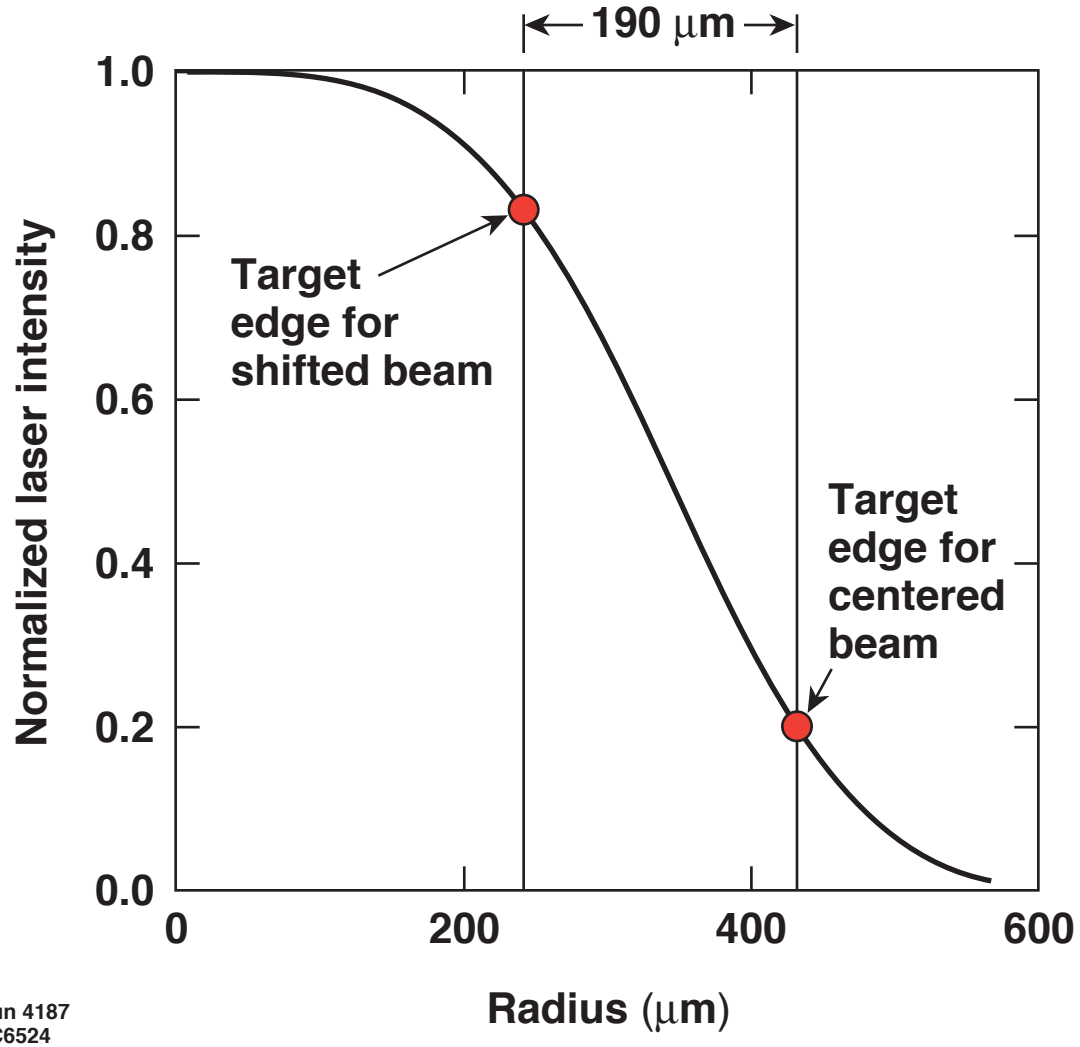


- Drive beams
- GMXI backlighter beams
- XRFC backlighter beams
- Backlighter foil (from TIM 2)

20-μm CH shell
865-μm diameter
15-atm D_2 fill
1-ns square pulse
385 J/beam

TC6523

For PDD implosions, the 42° and 59° beams were shifted 190 μm, resulting in energy missing the target at early times



Ring	θ	Δr (μm)
1	21°	91
2	42°	188
3	59°	196

"SG4":

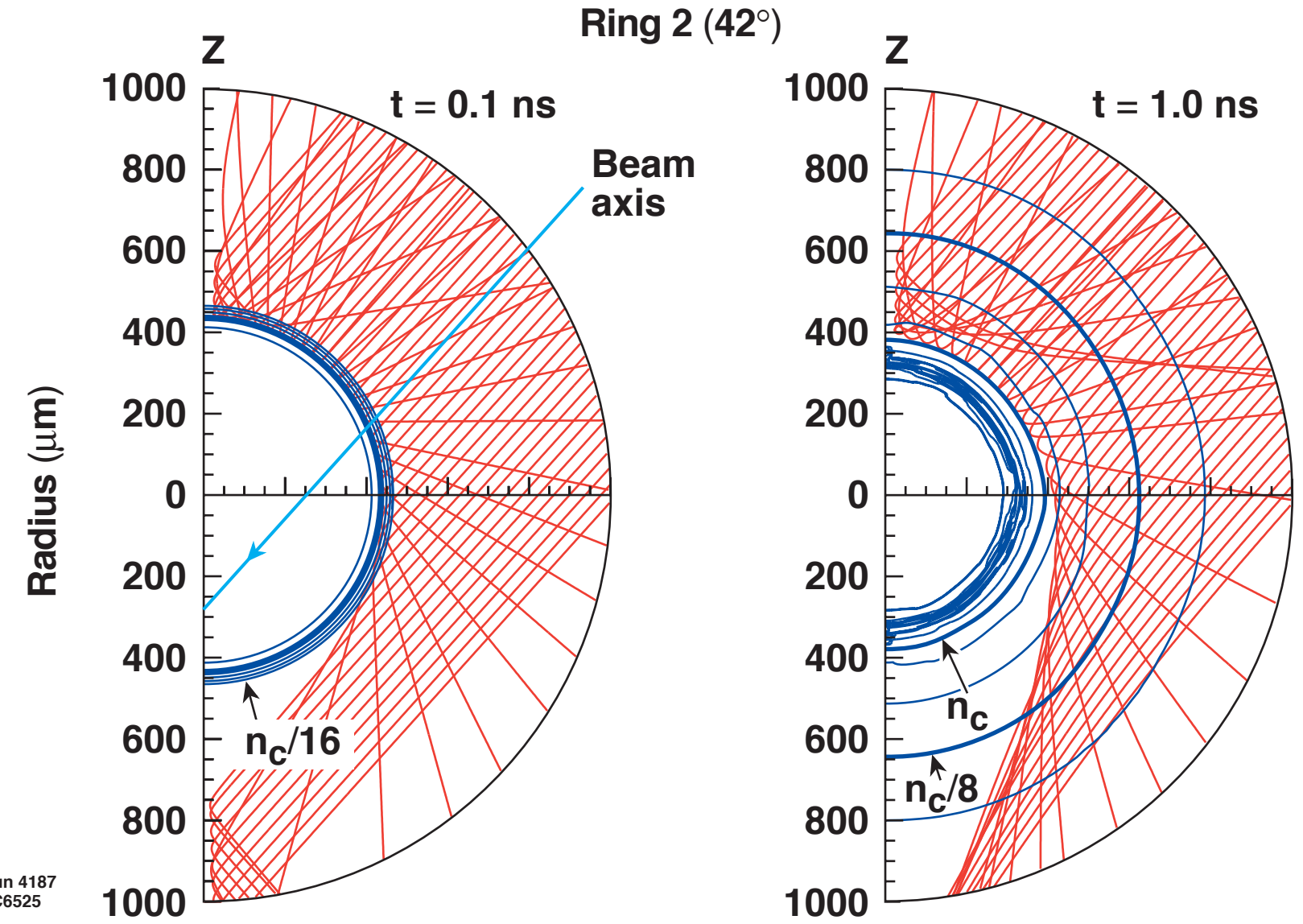
$I(r) = e^{-(r/r_0)^n}$

$r_0 = 380$ μm

$n = 3.7$

Run 4187
TC6524

Some rays miss the target at early times but all are refracted later



Run 4187
TC6525

Gated backlit x-ray images show a nearly symmetric target implosion

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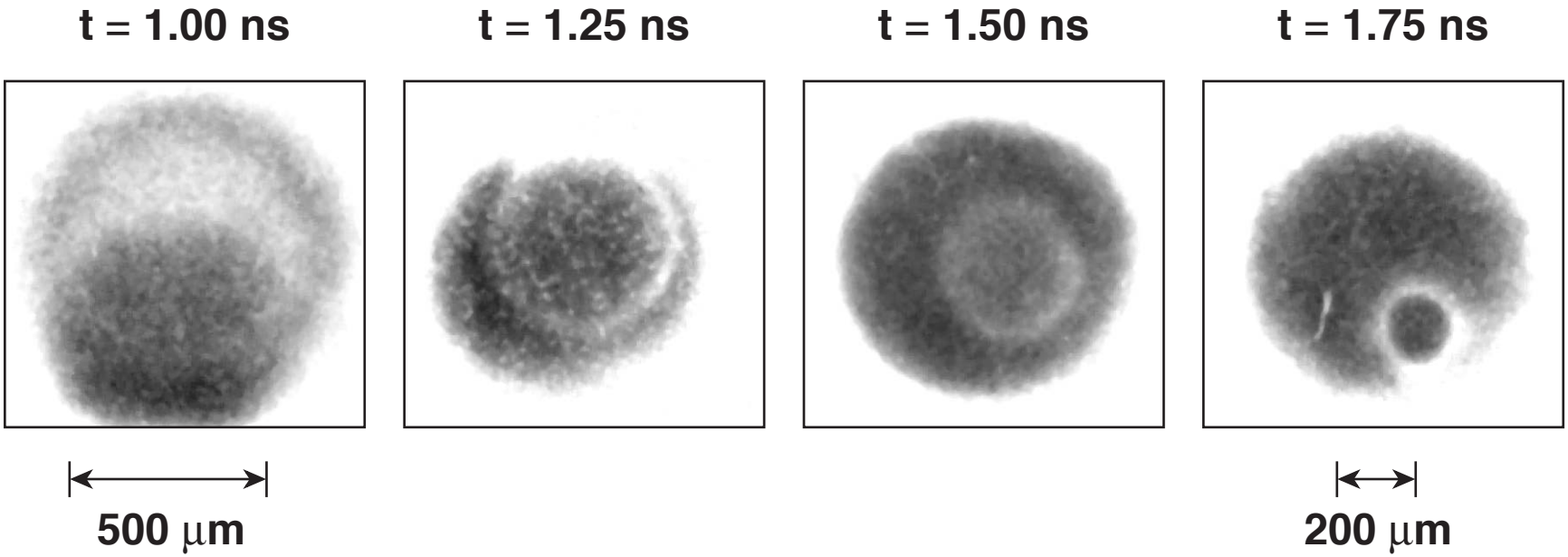
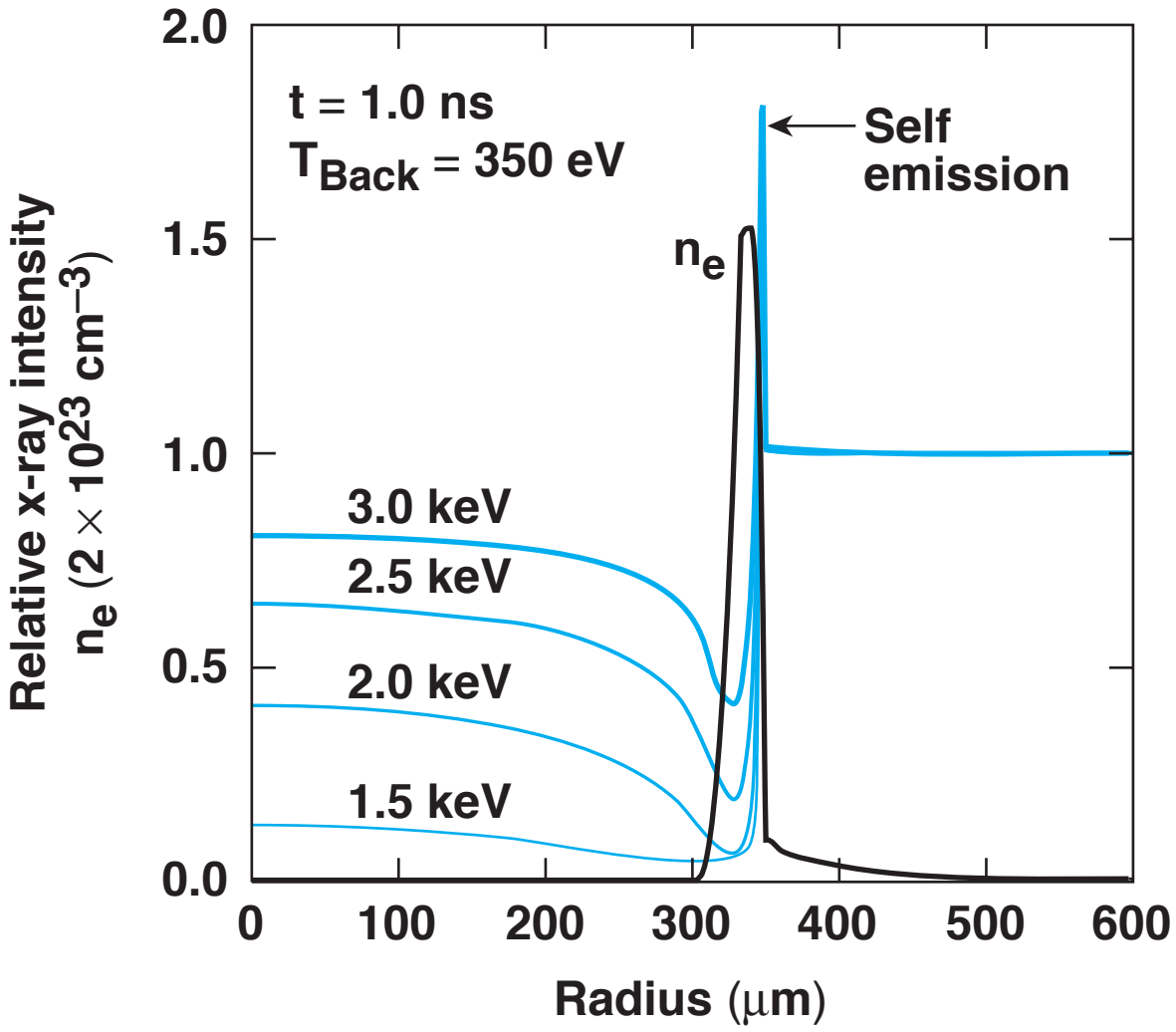
OMEGA shot 34669



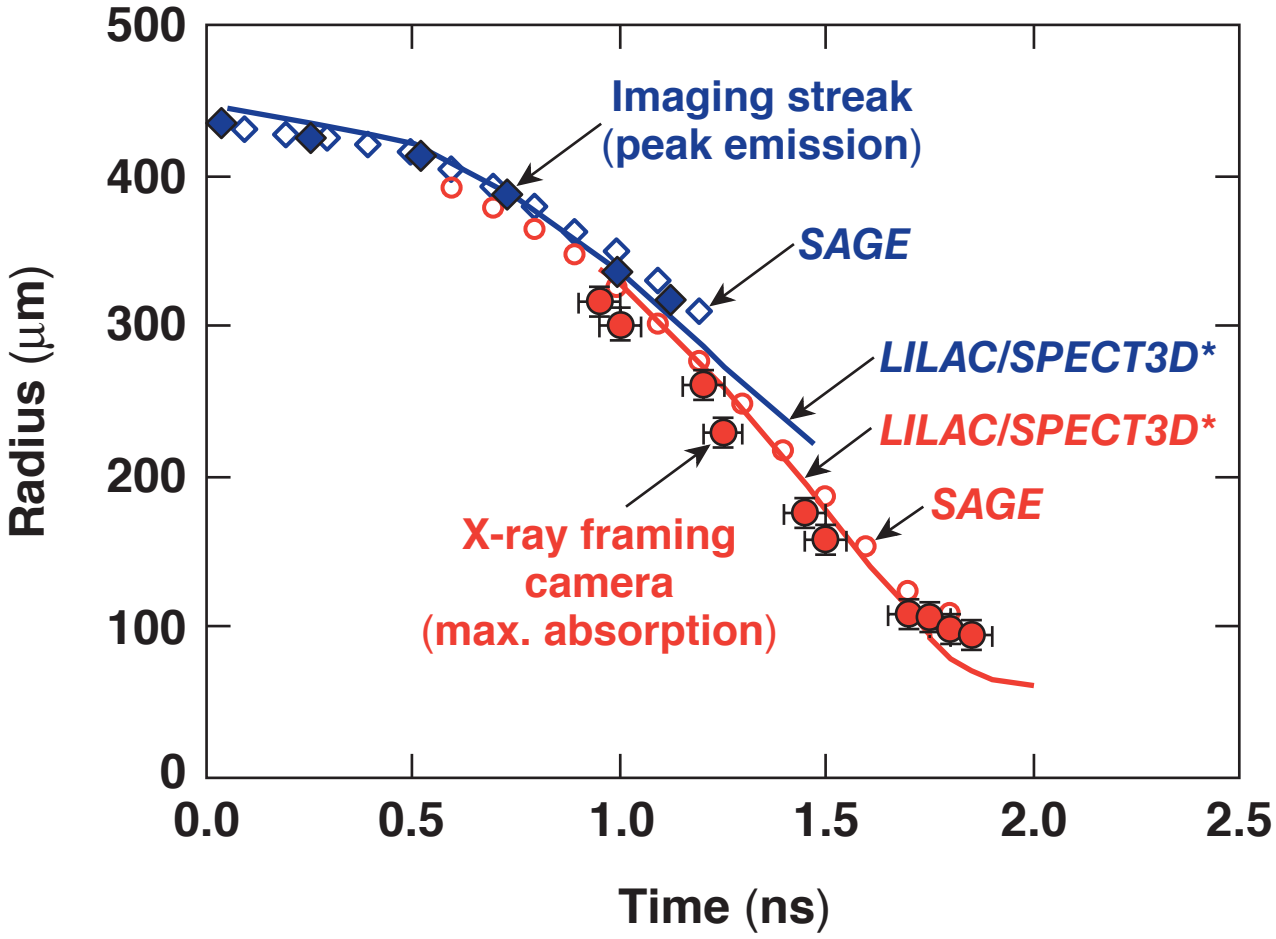
Shot 34669
TC6526

The radii of peak emission and maximum absorption are largely independent of backlighter photon energy



Run 4184
TC6527

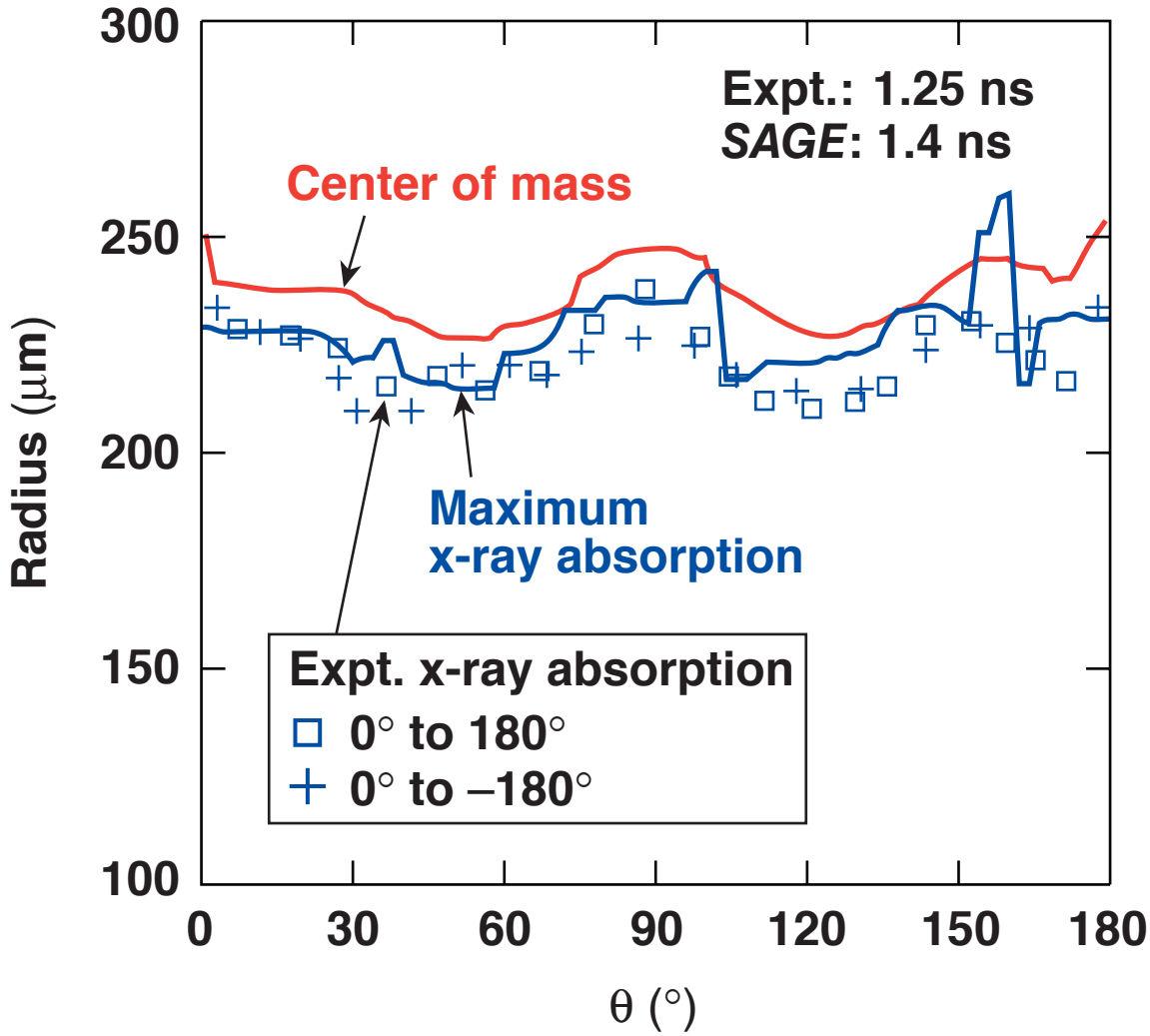
The shell trajectory, measured using streaked imaging and framed x-ray radiography, is consistent with 1-D *LILAC* and *SAGE* simulations



Shot 34669
Run 4184
TC6528

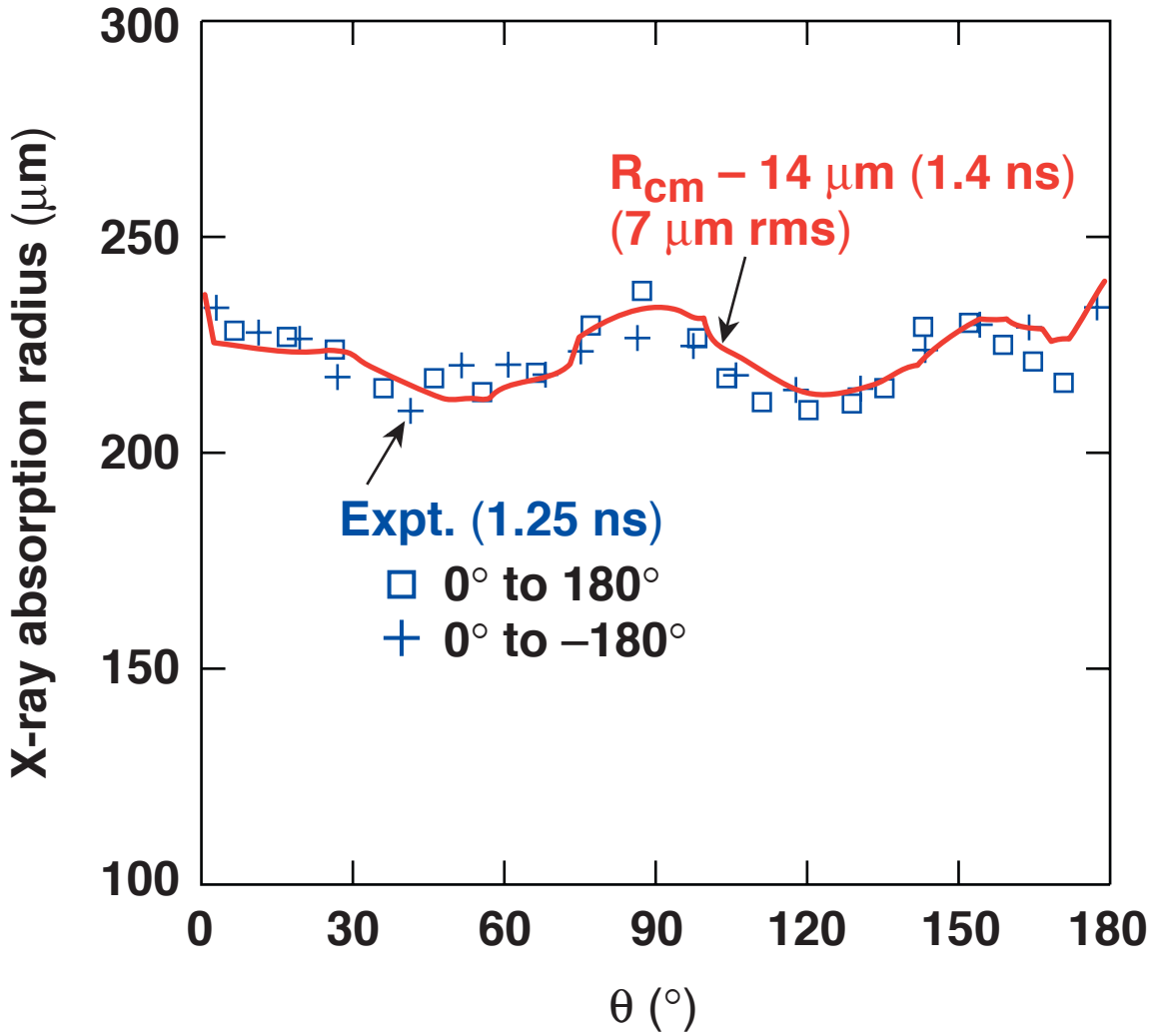
*SPECT3D: PRISM Computational Sciences, Inc.

The observed $\ell = 4$ nonuniformity is seen in the calculated center-of-mass and x-ray absorption variations



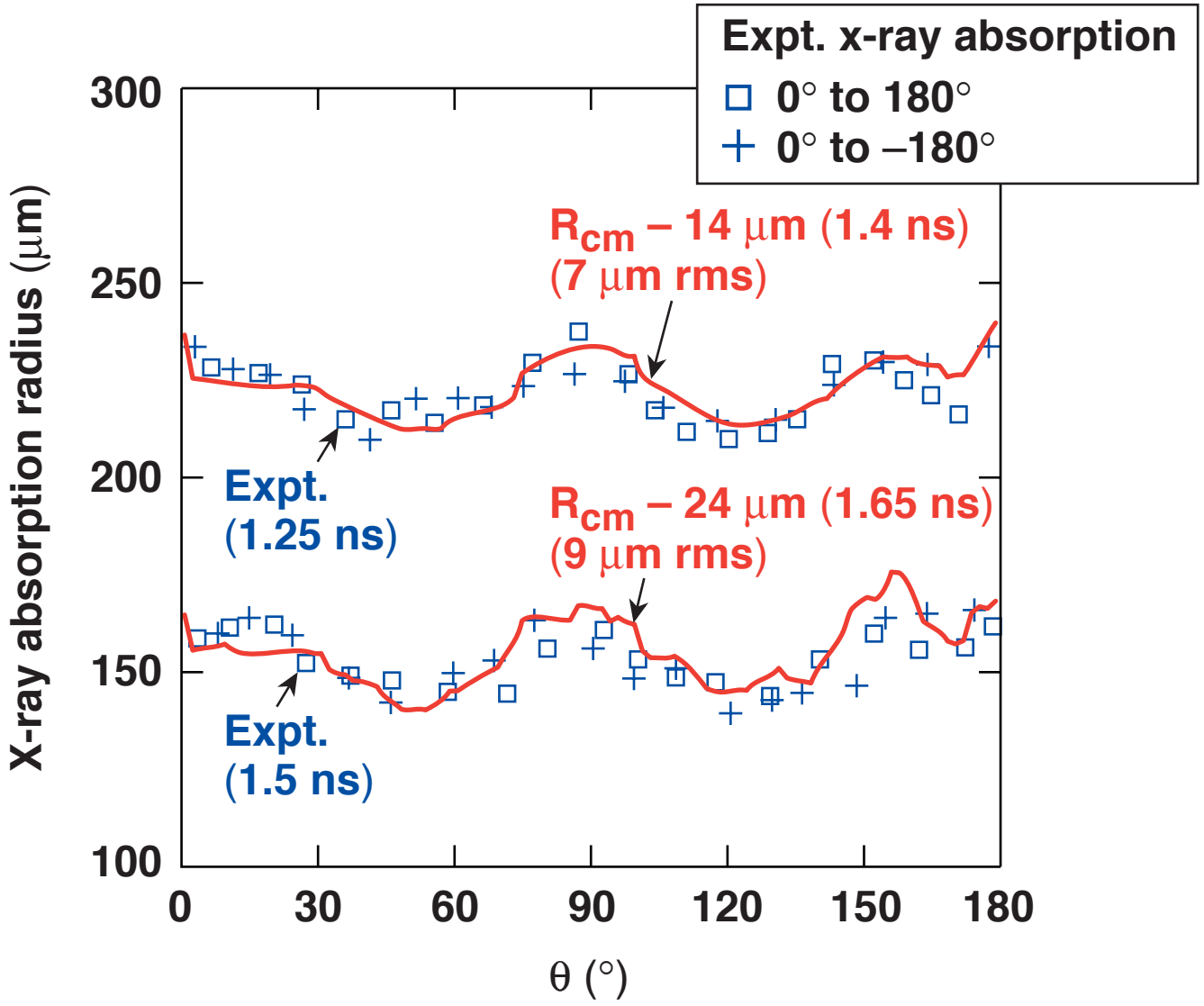
Shot 34669
Run 4187
TC6529

A better prediction of the nonuniformity in the x-ray absorption radius can be made by working from the calculated center-of-mass radius (R_{cm})



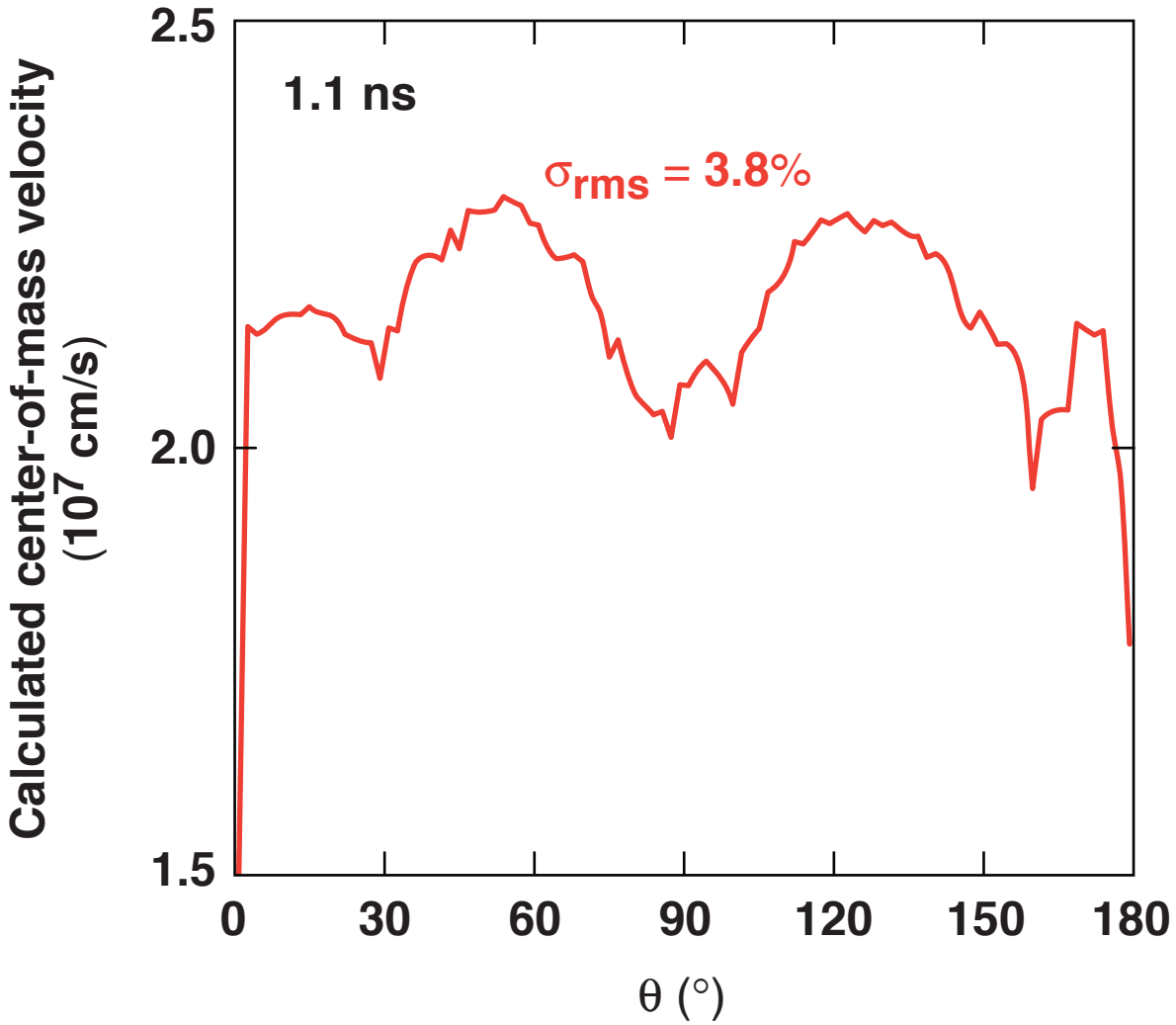
Shot 34669
Run 4187
TC6530

The experimental data follow the predicted center-of-mass variations very closely at two successive times



Shot 34669
Run 4187
TC6531

The calculated center-of-mass velocity at the end of the laser pulse shows similar angular variations



Run 4187
TC6532

The core-stagnation symmetry is affected by the illumination configuration

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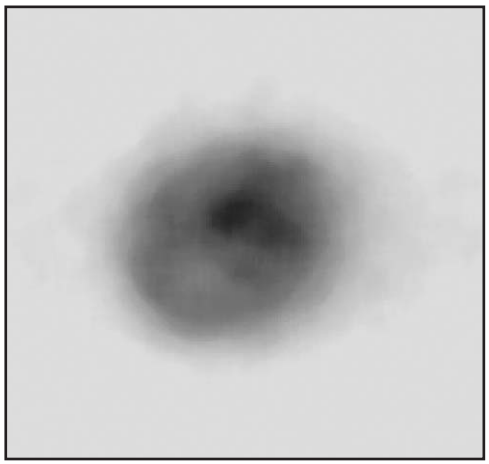
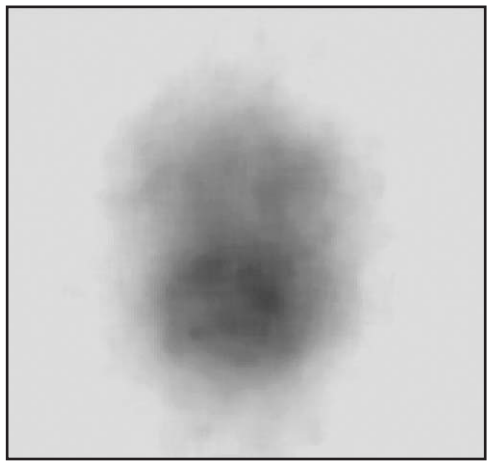
Time-integrated KB microscope images

	60 beams TCC 15.6 kJ $Y_{DD} = 8.4 \times 10^{10}$	40 beams PDD 15.4 kJ $Y_{DD} = 2.9 \times 10^{10}$
Shot 34644 / Shot 34668		

100 μm

TC6533

Summary/Conclusions

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- Forty beams with optimized pointings have produced near-symmetric implosions.*
- The zero-order implosion dynamics are consistent with 1-D modeling.
- There is a decrease in neutron yield and core symmetry.

The agreement with predictions is encouraging for the development of NIF designs.

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