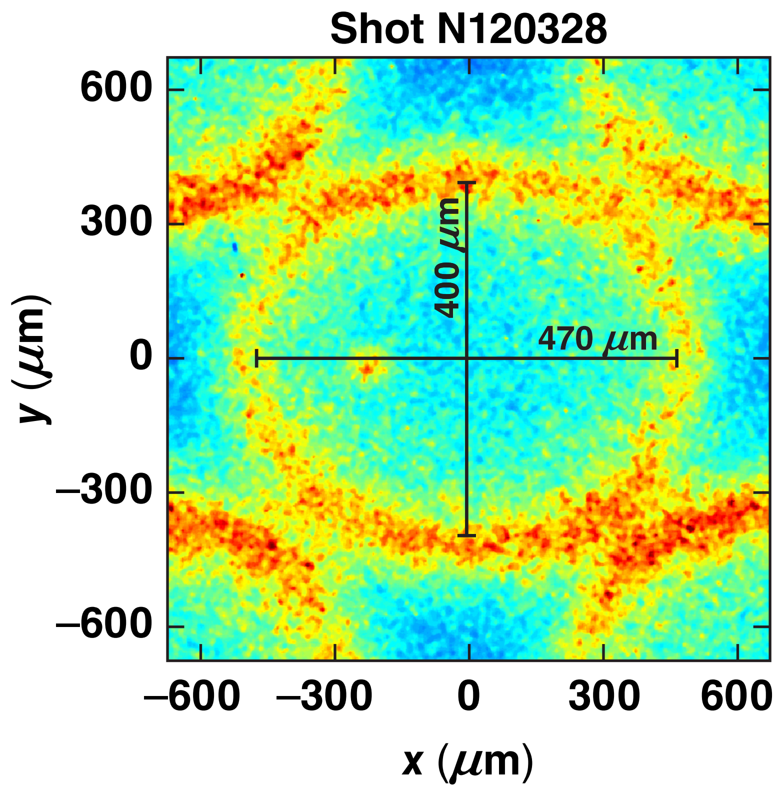
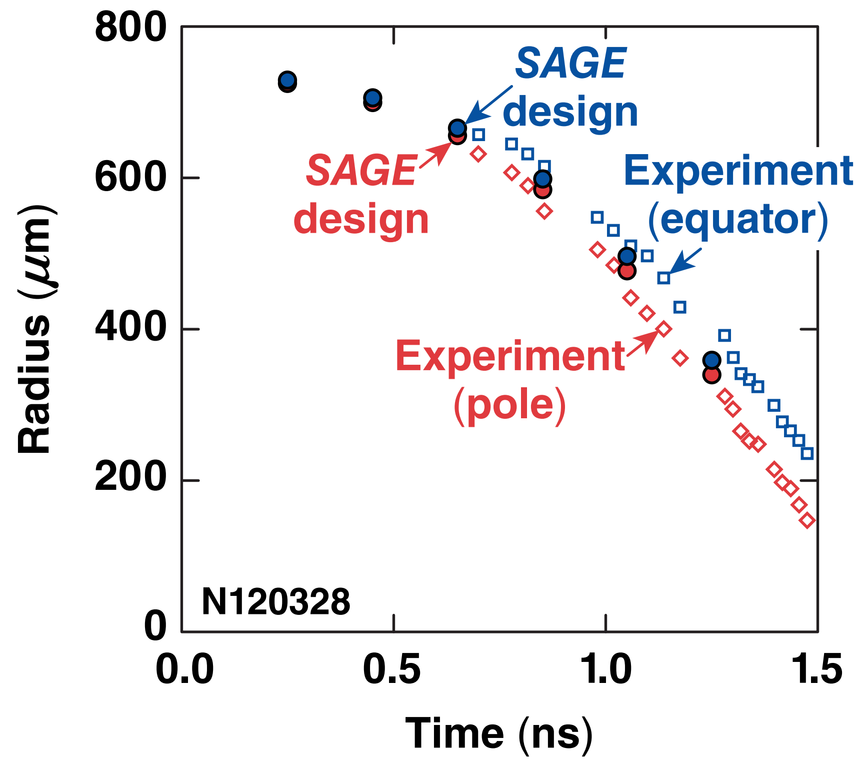
Optimization of Drive Uniformity in NIF Polar-Drive Implosions Using Gated X-Ray Self-Emission Images





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Summary

Gated self-emission images are being used to optimize drive uniformity in NIF polar-drive implosions

- Images from shot N120328 show an implosion that was underdriven at the equator
- This discrepancy can be modeled assuming that the 50° beam spot is bigger than predicted
- An amended polar-drive design has been developed that should correct the imbalance between equator and pole

Drive uniformity optimization will be an important component of LLE's polar-drive campaigns.

Collaborators

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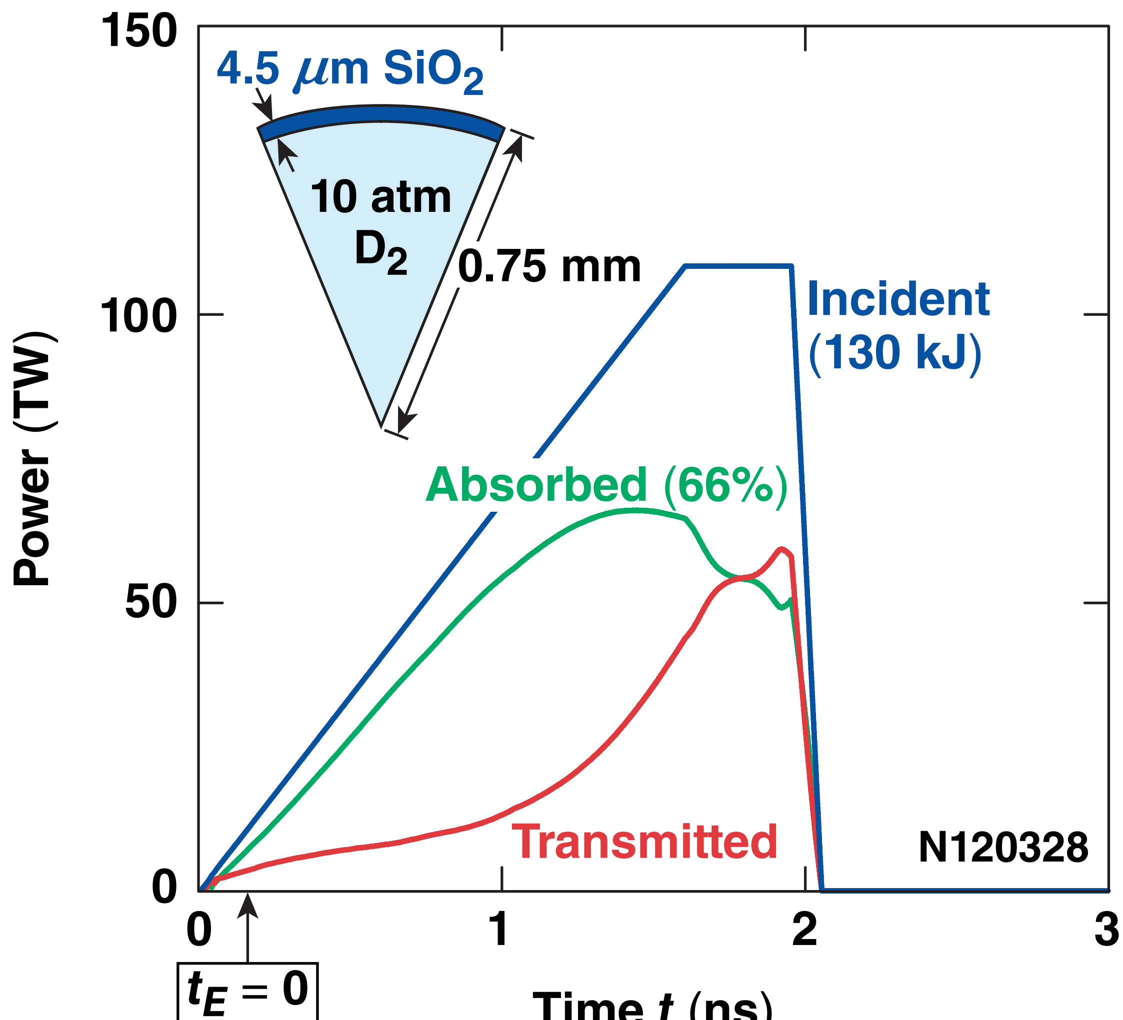
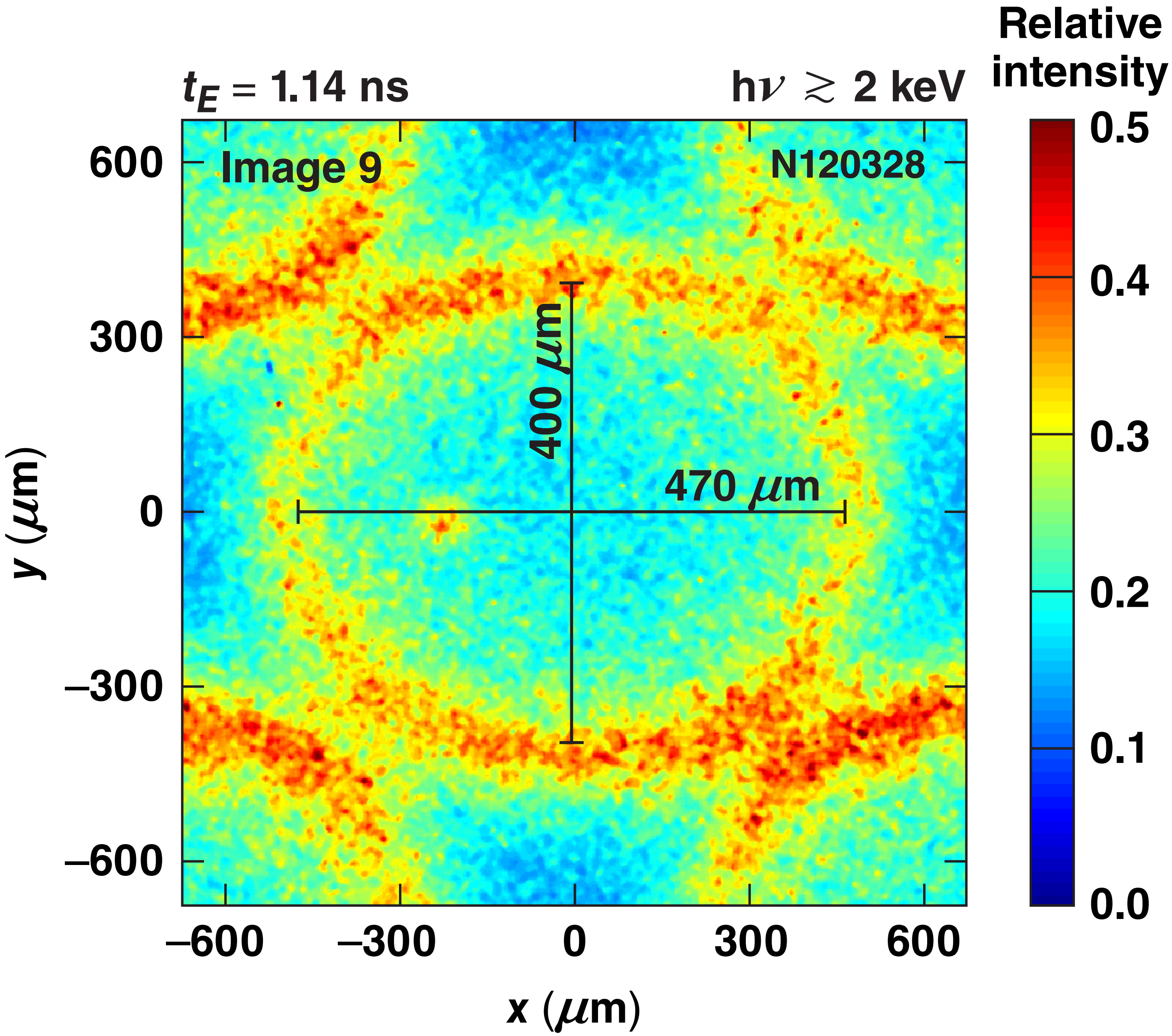
A 1.5-mm-diam SiO_2 "exploding-pusher" target was irradiated with a ramp laser pulse in polar-drive geometry

UR LLE



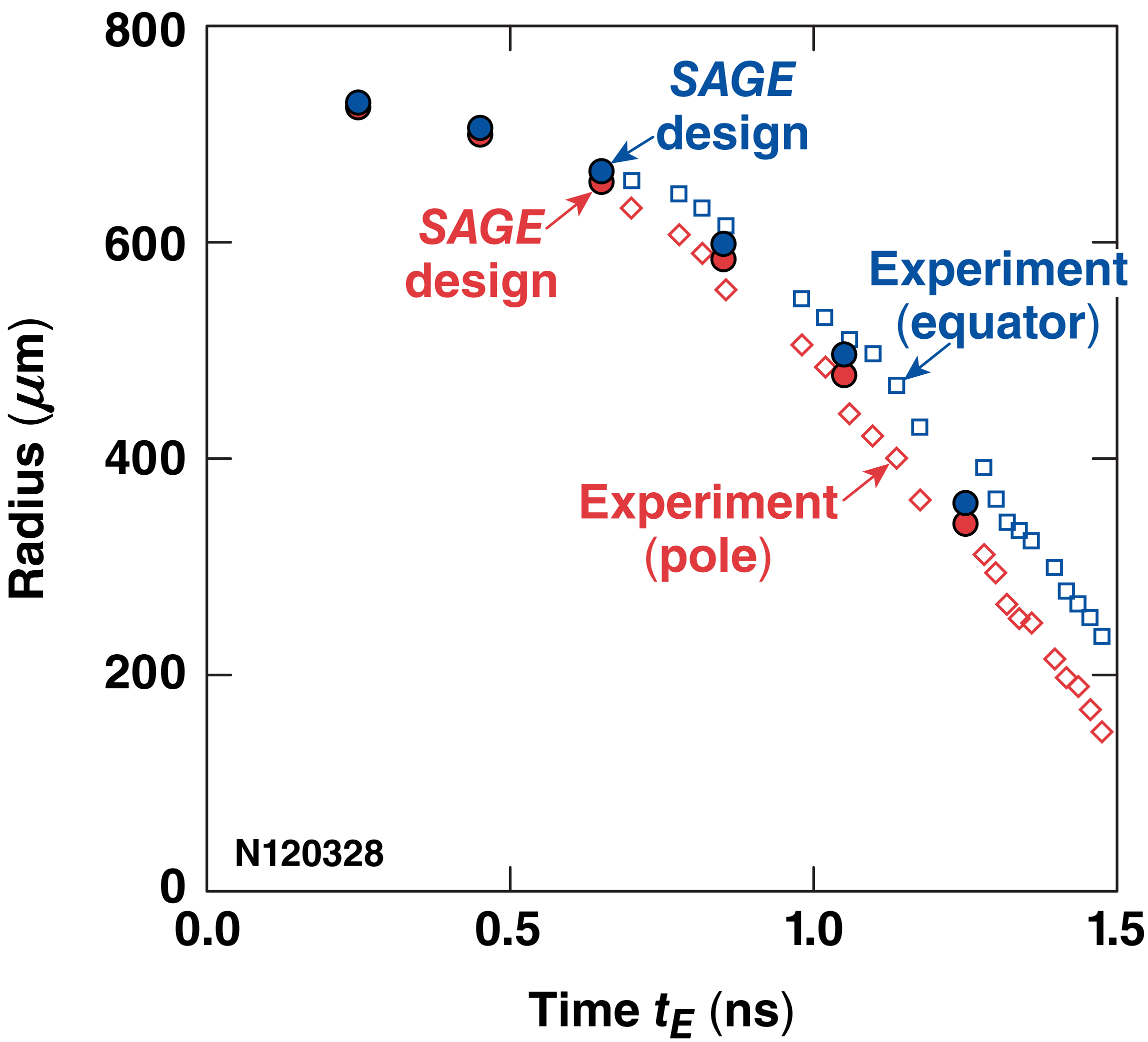
Run 6147
TC10177

Twenty framed images were measured for polar and equatorial radii



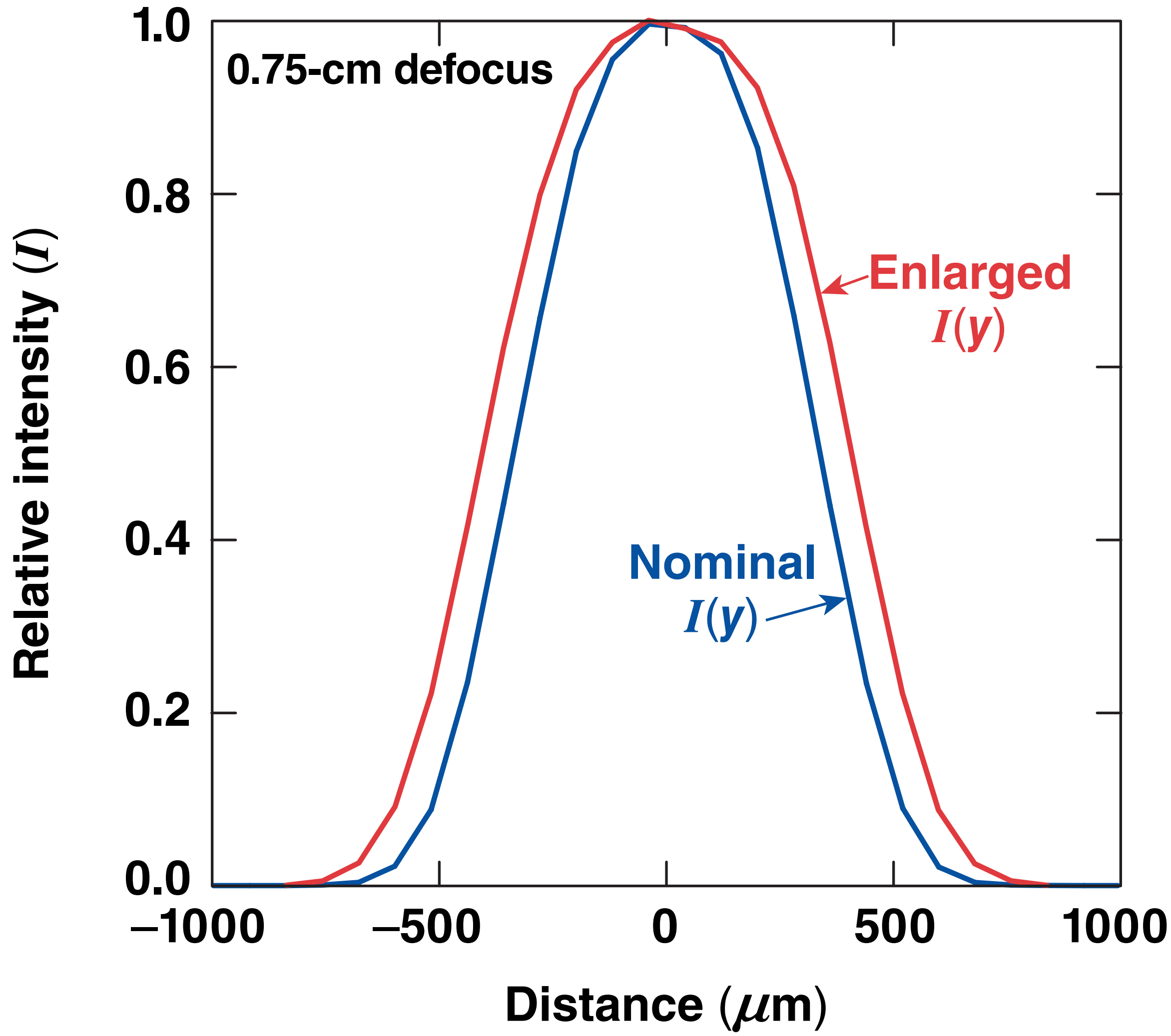
TC10178

The difference between equatorial and polar radii is larger than predicted by the design calculation

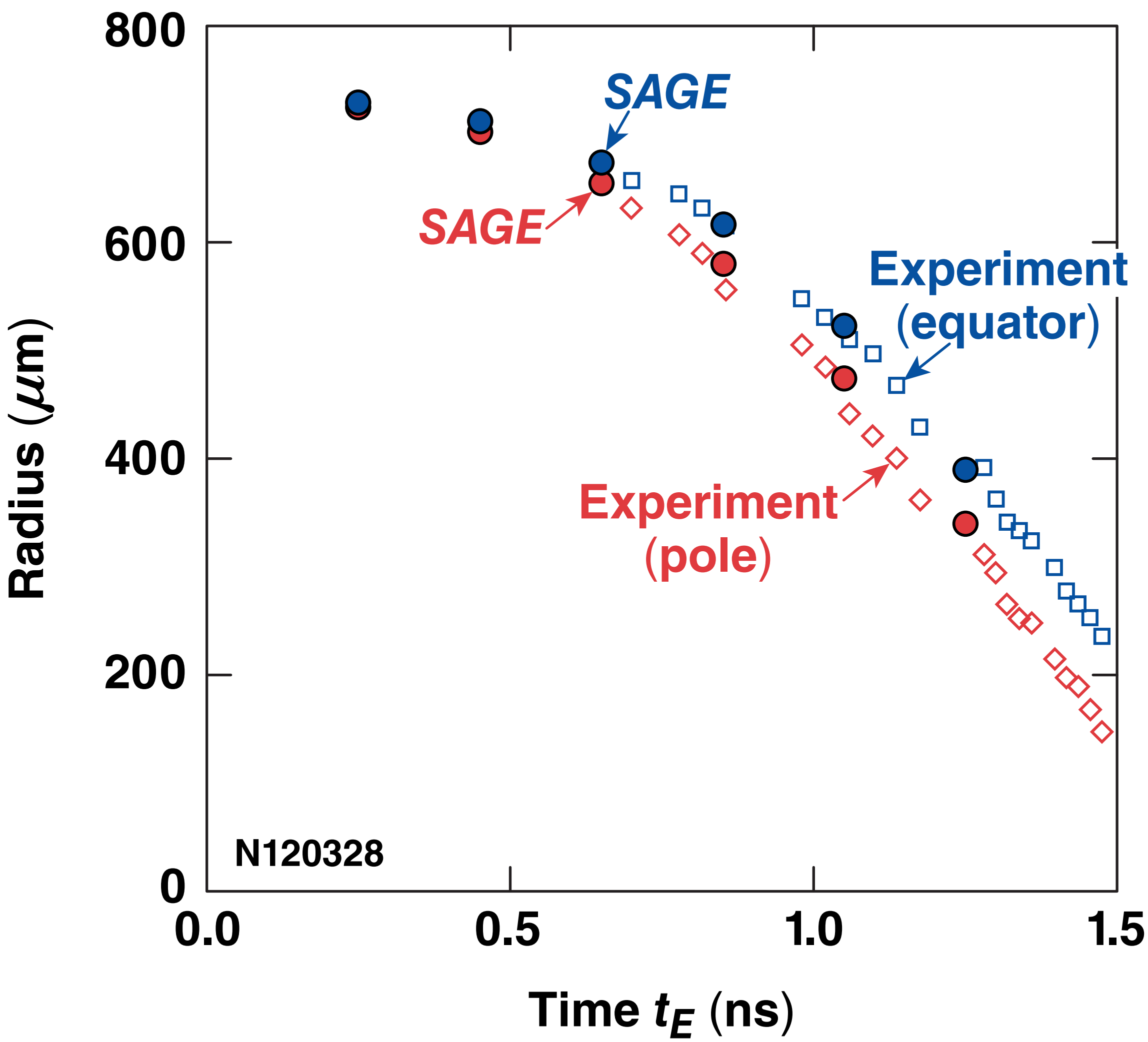


Run 6144
TC10179

Phase plates for the 50° quads were modeled assuming best-focus spots enlarged by 20%



Using the enlarged 50° beams, the experimental trajectories are closely matched



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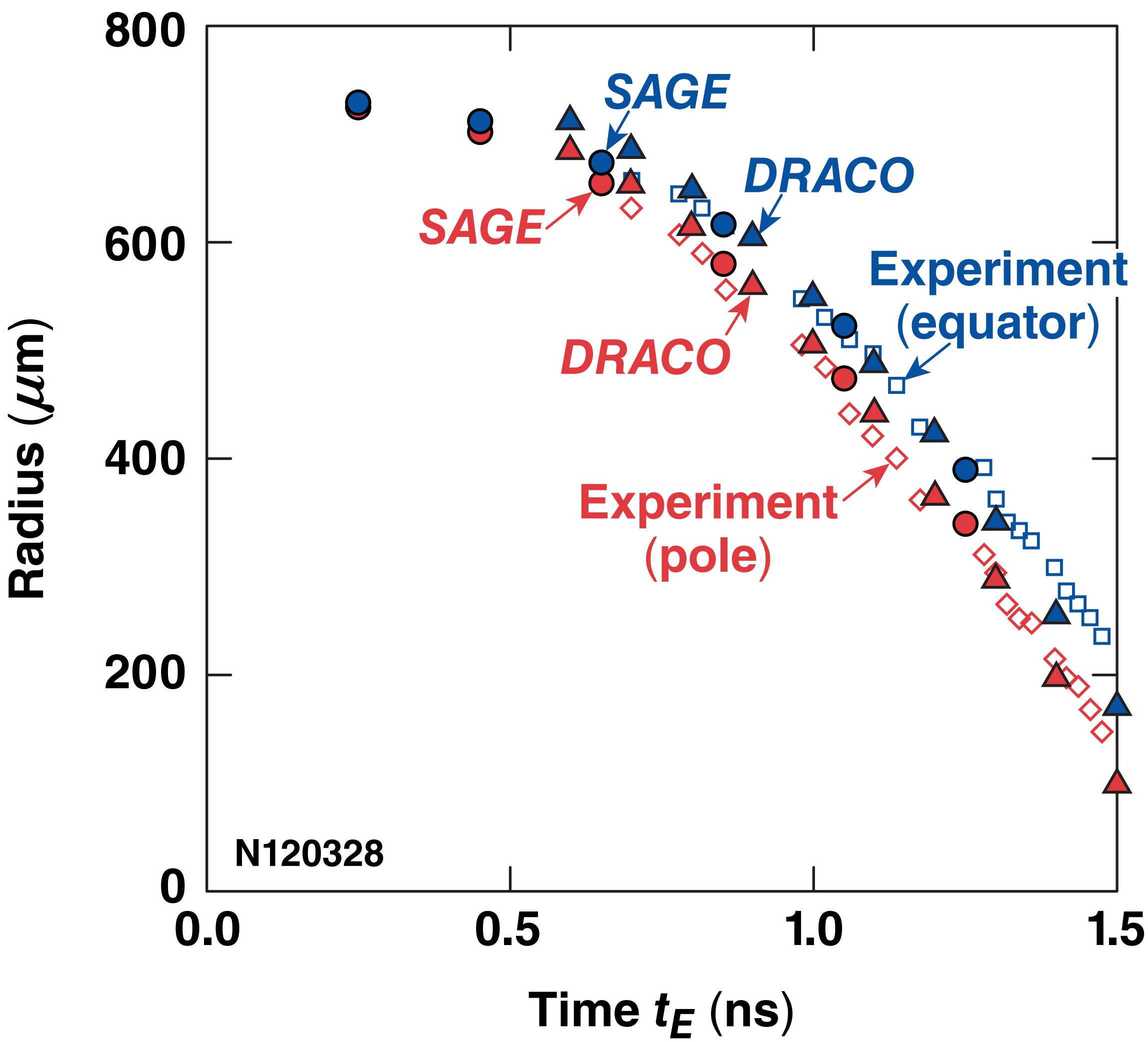
TC10181

DRACO simulations using the same beam profiles also agreee with the data

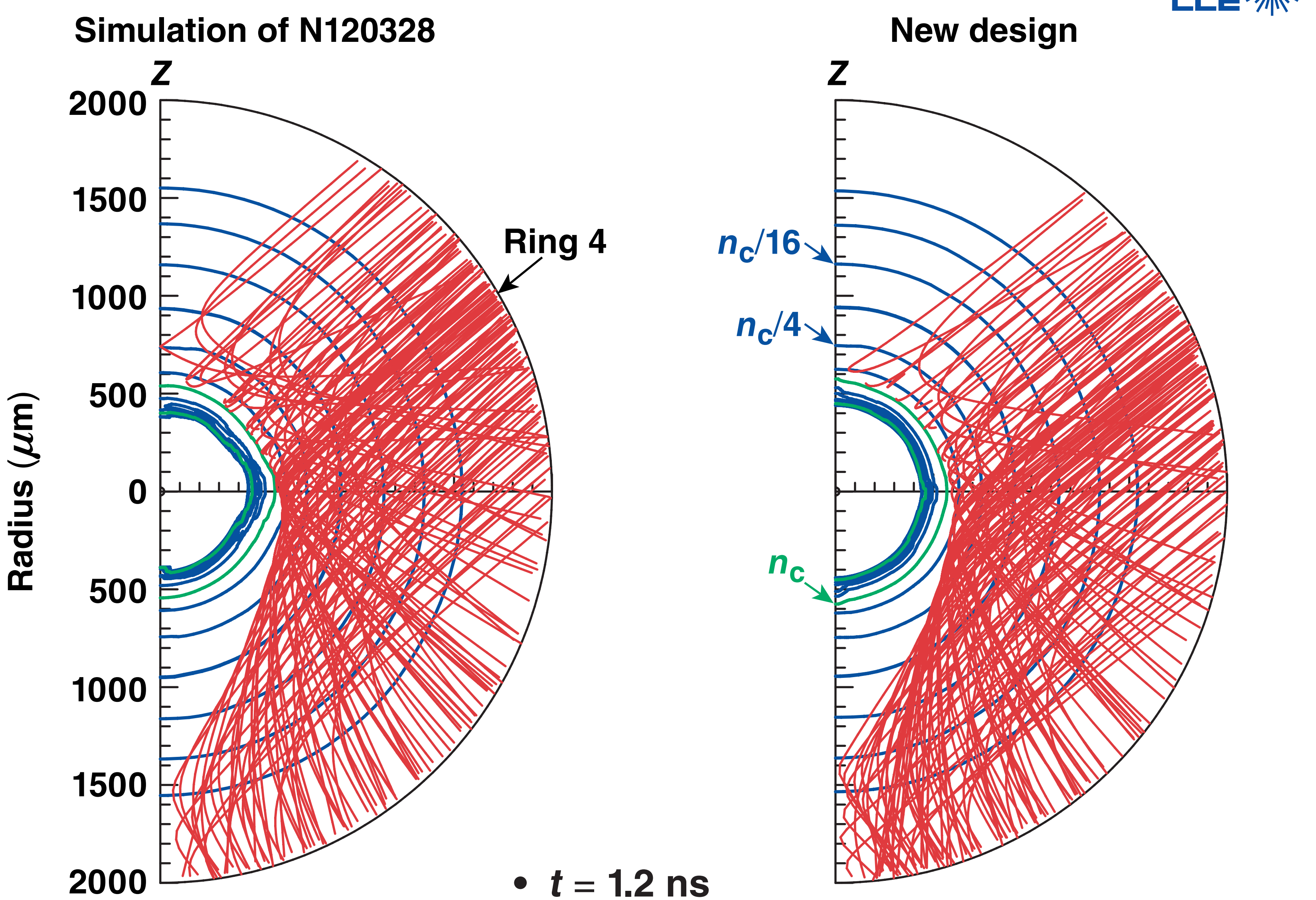


Run 6147
TC10182

A new design was developed to correct the pole: equator discrepancy

- The design entails minor modifications to
  - beam pointings (generally toward the equator)
  - beam defocus positions
  - beam energies (rings 2, 3 $\times$ 0.9, ring 4 $\times$ 1.25)
- All parameters are interdependent and optimized together

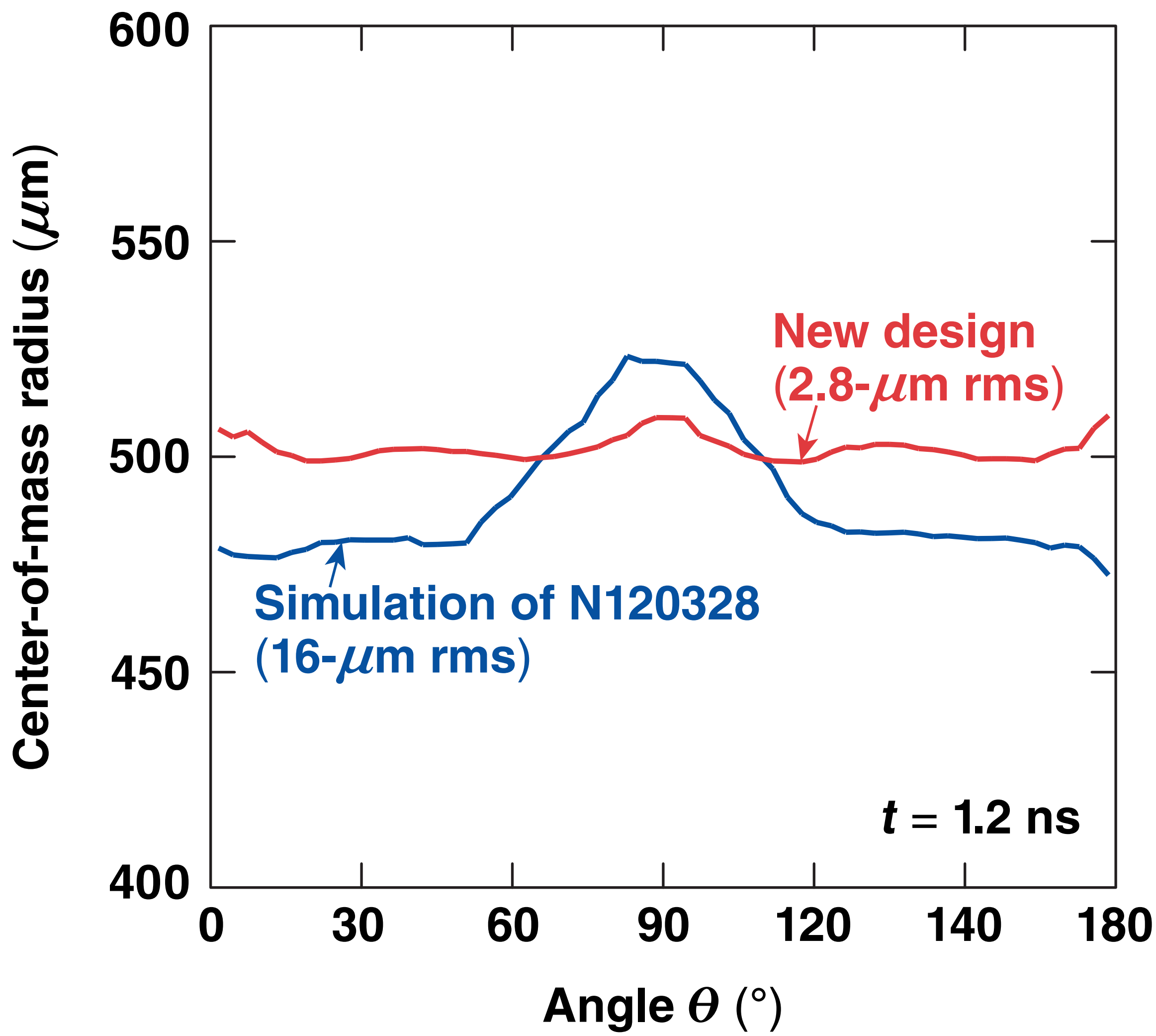
The new design produces a rounder implosion from early times



• t = 1.2 ns

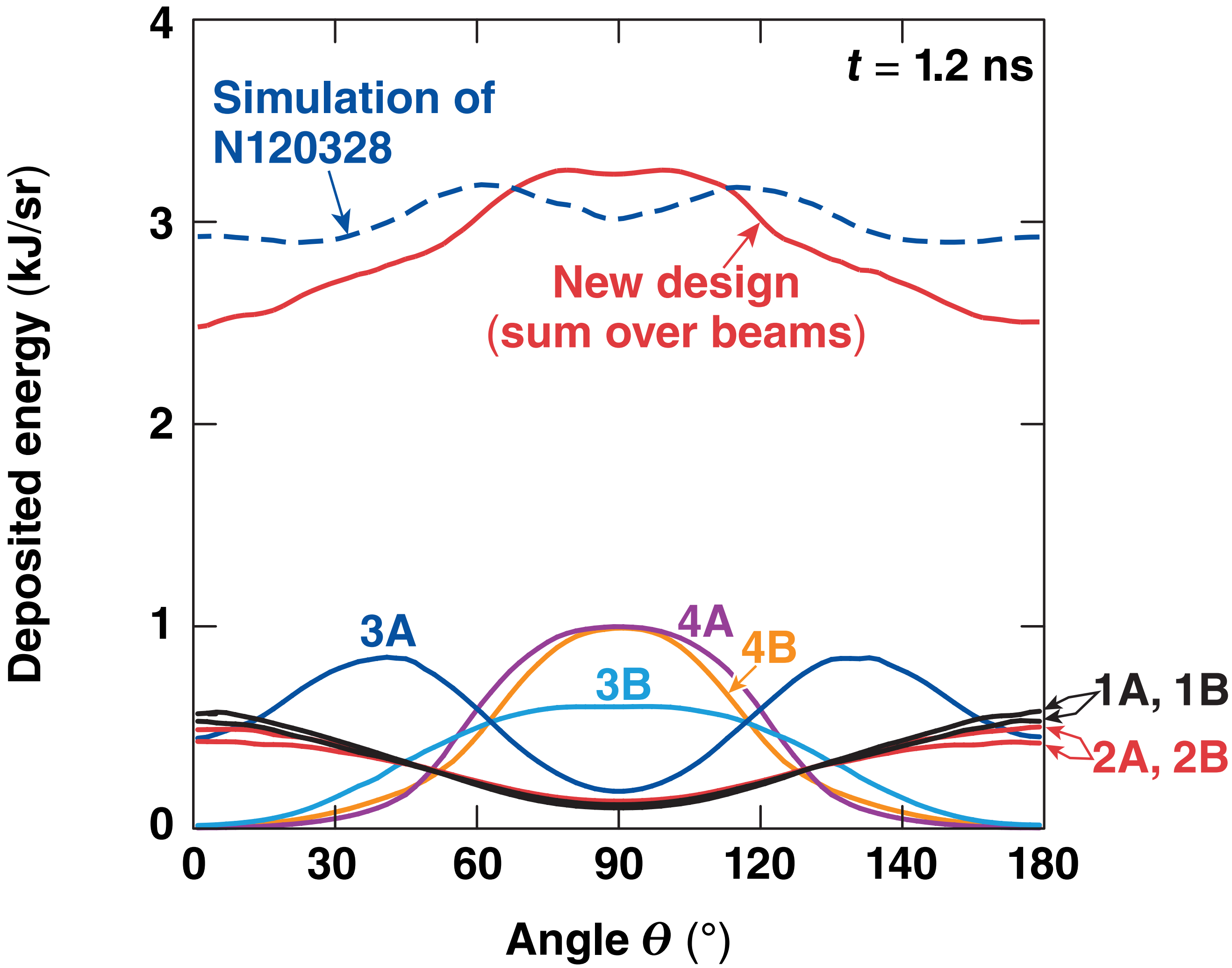
Runs 6147, p7117
TC10184

The new design produces much smaller variations in the center-of-mass radius



Runs 6147, p7117
TC10185

The new design deposits more energy near the equator



Runs 6147, p7117
TC10186

Gated self-emission images are being used to optimize drive uniformity in NIF polar-drive implosions

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The new design entails minor adjustments to the original design

	Original design			New design		
Ring	Vertical shift* (μm)	Defocus distance (cm)	Energy weight†	Vertical shift* (μm)	Defocus distance (cm)	Energy weight†
1A	–30	1.4	1.0	–30	1.0	1.0
1B	–30	1.4	1.0	–30	1.0	1.0
2A	–30	1.5	1.0	–30	1.5	1.0
2B	–30	1.5	1.0	–30	1.5	1.0
3A	135	1.4	1.0	20	1.0	0.9
3B	–345	1.4	1.0	–350	1.8	0.9
4A	–350	0.75	1.0	–500	0.0	1.25
4B	–350	0.75	1.0	–550	0.0	1.25
	Total energy = 130 kJ			Total energy = 136.5 kJ		

*Shift is perpendicular to the beam axis
†Energy weight is relative to shot N120328

Runs 6147, p7117
TC10187