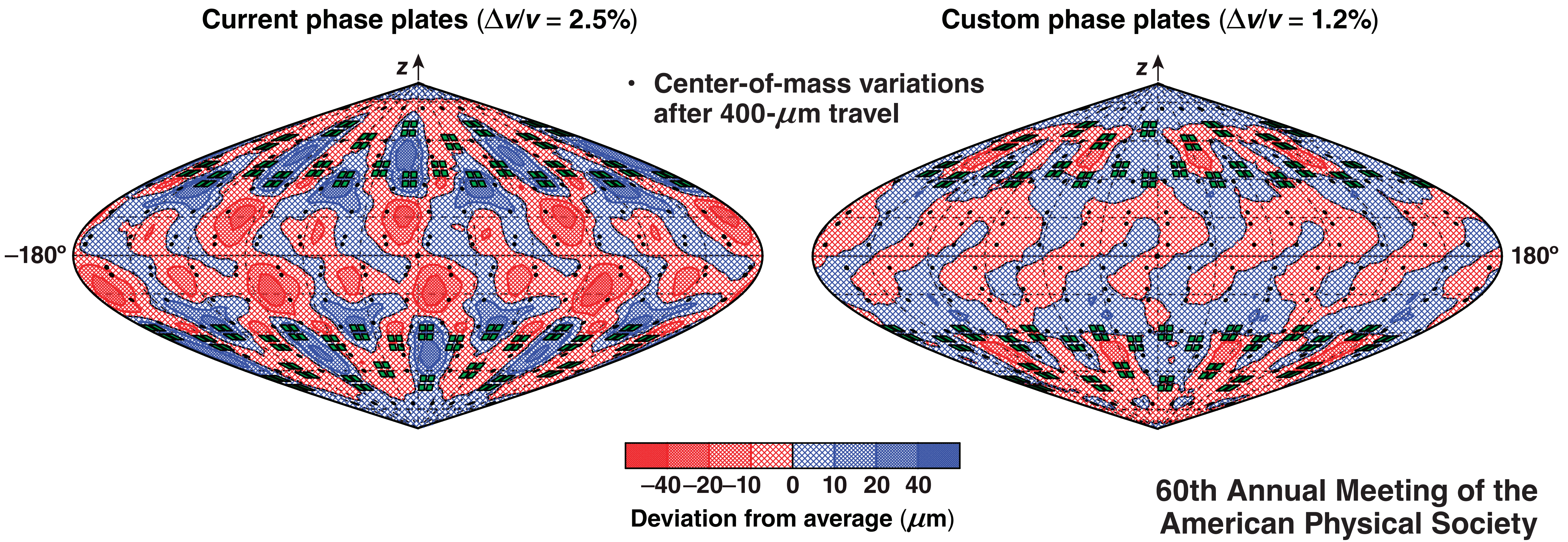
Revolver Designs for the National Ignition Facility Using Current and Optimized Phase Plates



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Summary

The drive uniformity of *Revolver* designs can be improved using custom phase plates

- The implosion velocity uniformity is improved using beam spots that are stretched in the azimuthal direction
  - $\Delta v/v \sim 2.5\%$ for current phase plates
  - $\Delta v/v \sim 1.2\%$ for custom phase plates
- The *Revolver* target operates in a regime with nearly 100% inverse-bremsstrahlung absorption

TC14479

Collaborators

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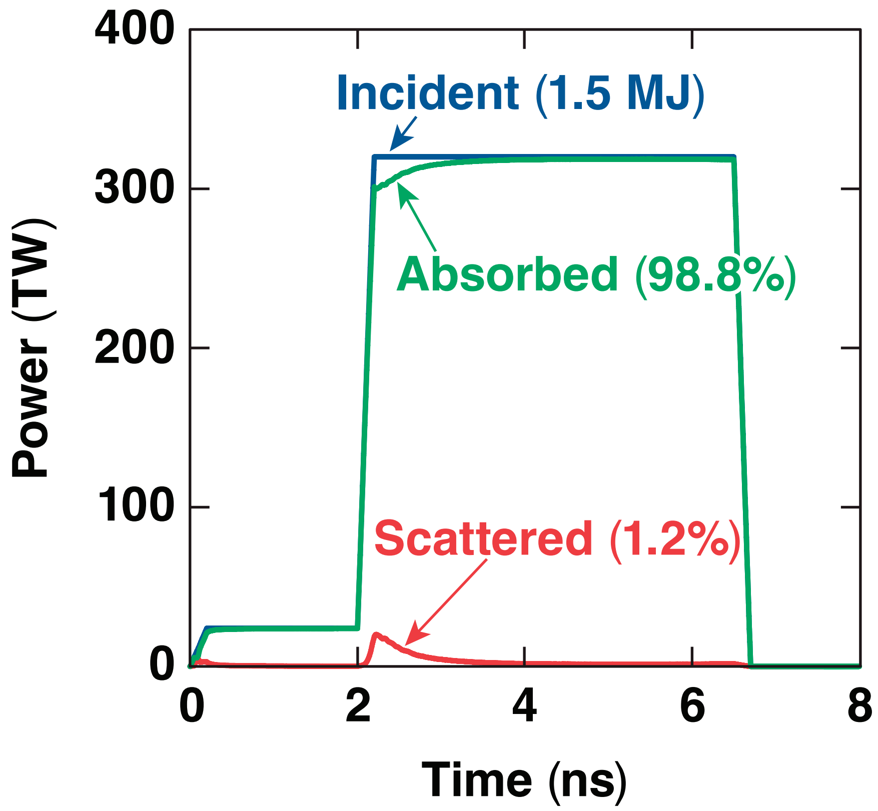
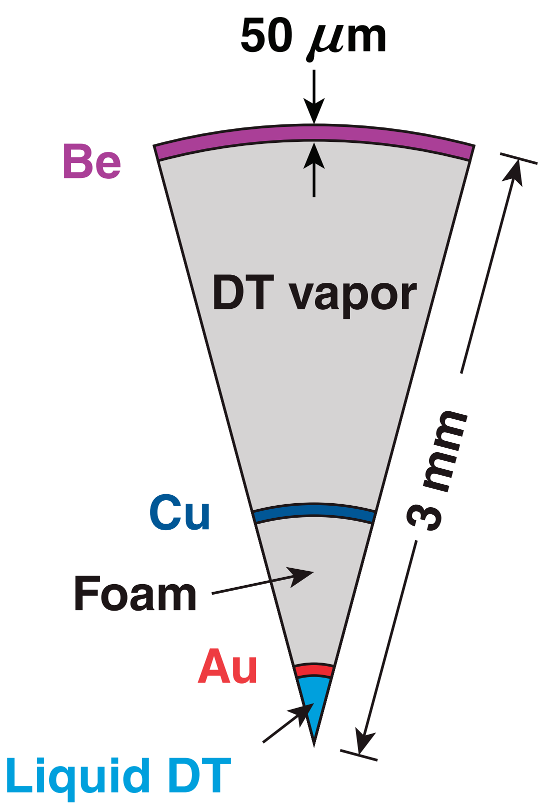
(*LLE Summer High School Research Program)

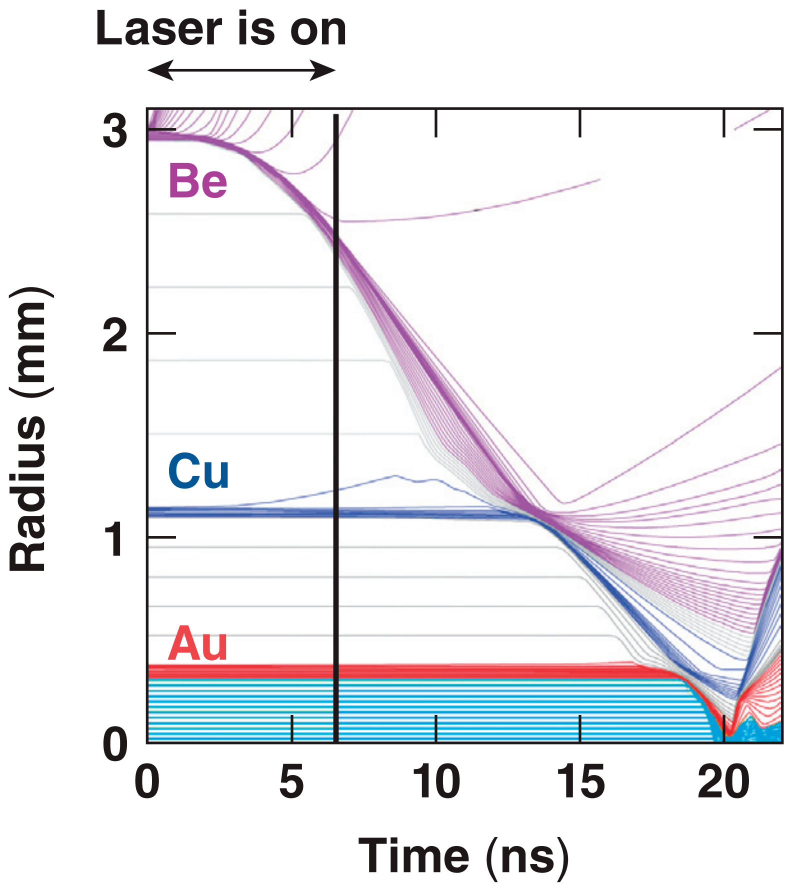
M. J. Schmitt and K. Molvig

Los Alamos National Laboratory

The *Revolver* design proposed by Molvig *et al.** was used for this work





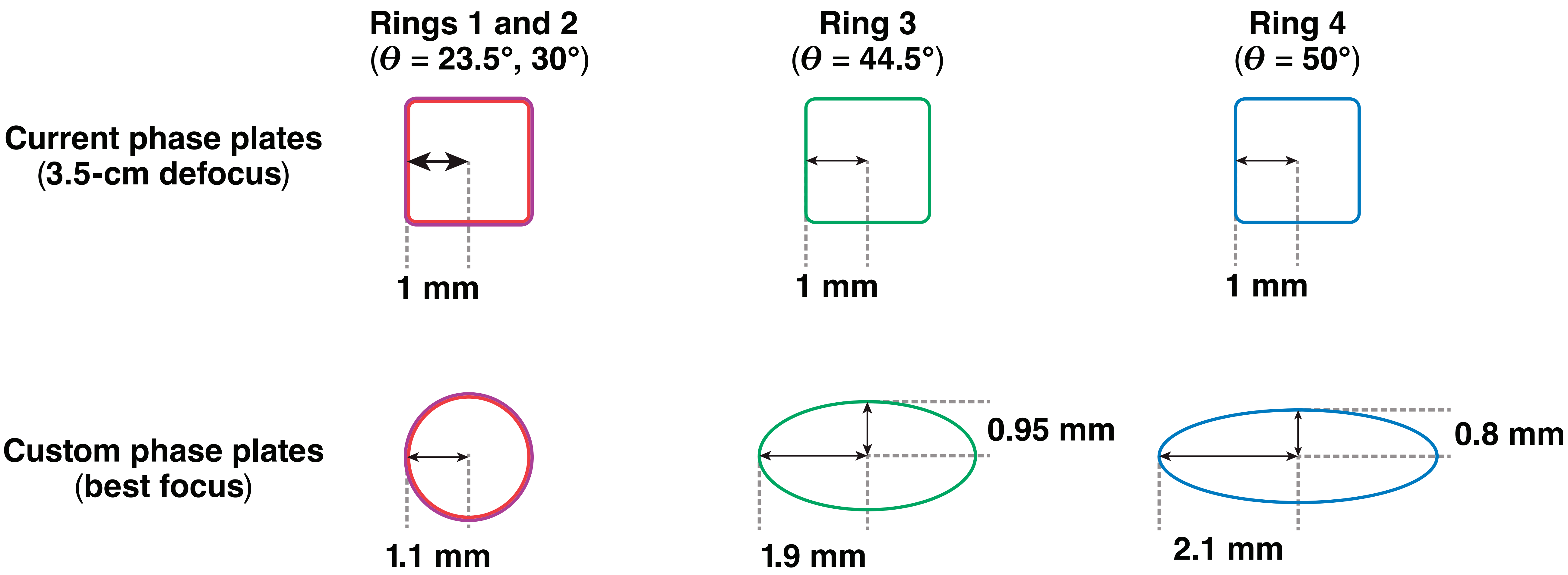


- Only the interaction of the laser pulse with the Be shell was modeled

Run Y1363
TC14480

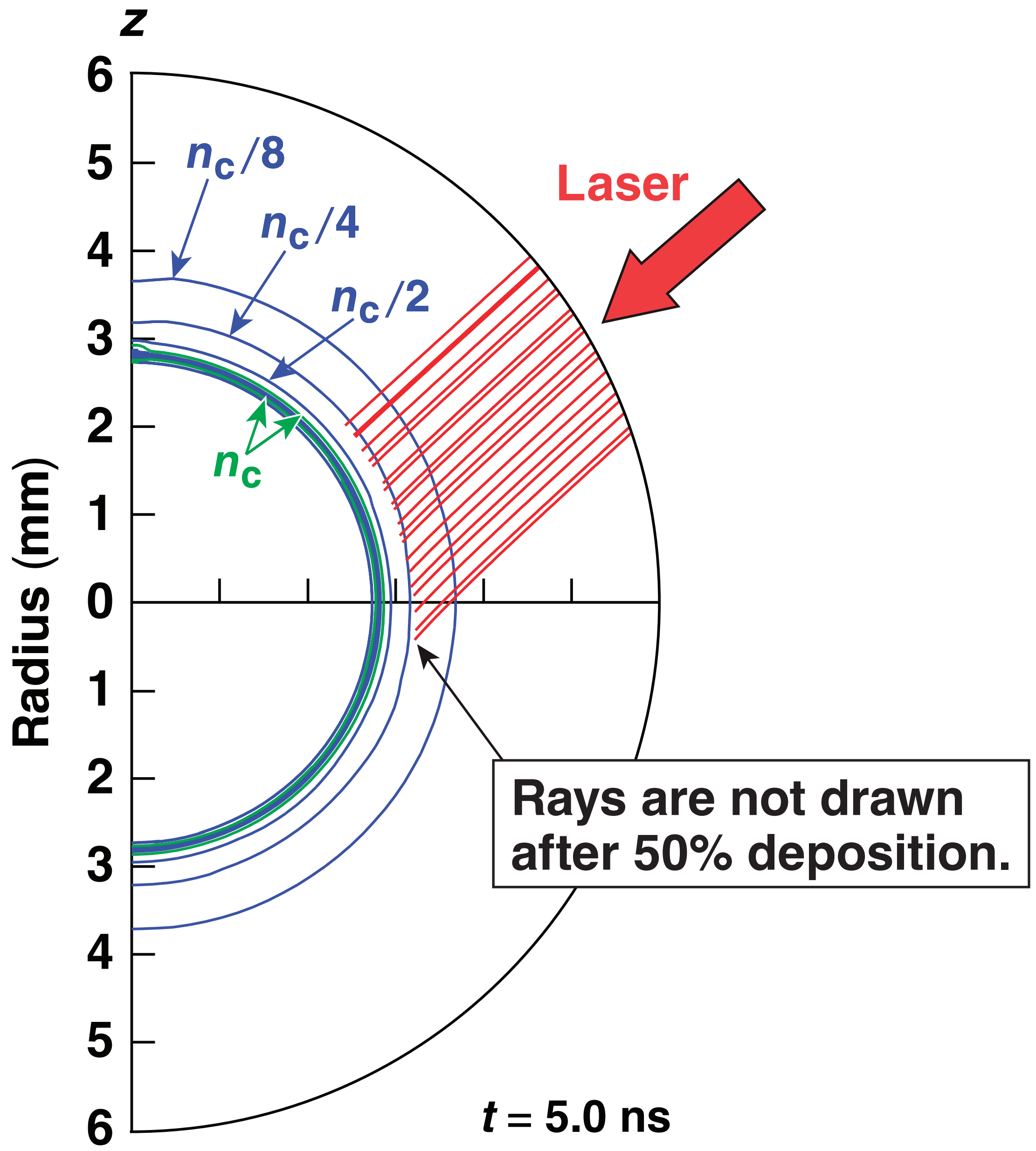
*K. Molvig *et al.*, Phys. Rev. Lett. 116, 255003 (2016).

Designs were generated for the current phase plates and custom phase plates



TC14171a

The laser–plasma interaction appears to be very classical

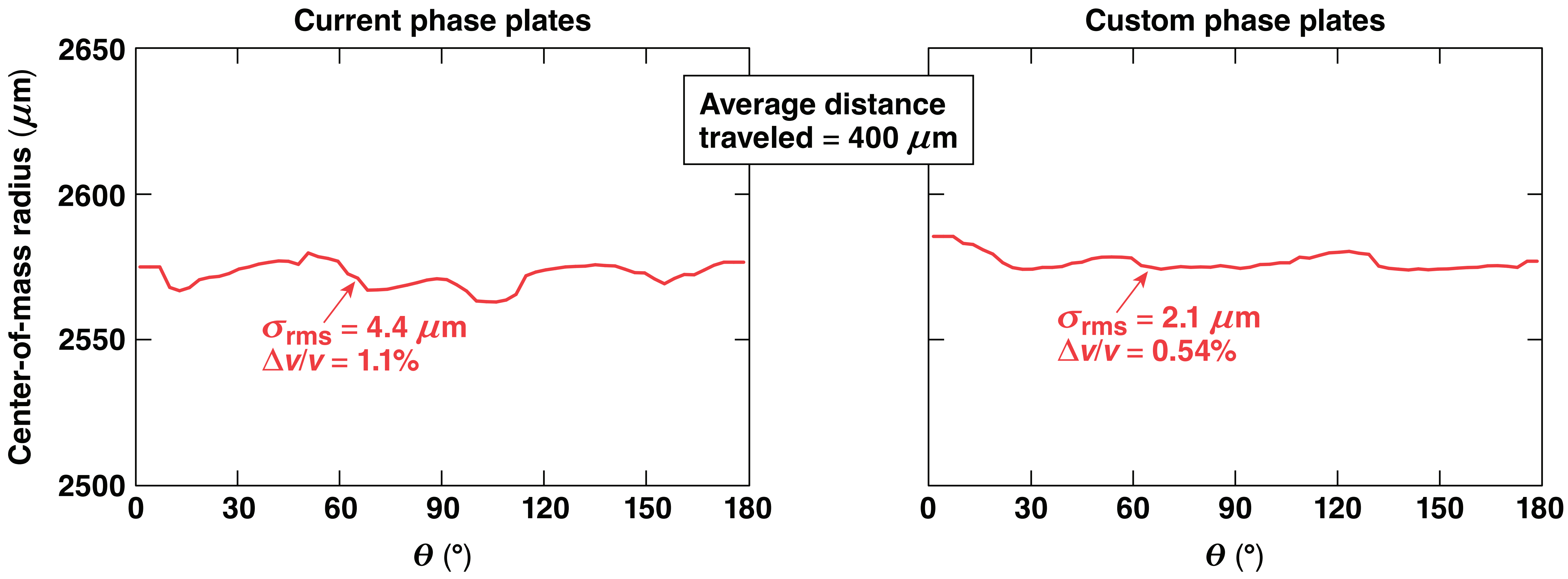


- Very high absorption (~99%)
- 50% of the laser energy is deposited by quarter critical
- The overlapped intensity at quarter critical is only 1×10^{14} W/cm^2
- The standoff distance between quarter critical and the ablation front is large (~350 μm)

Run Y1363
TC14482

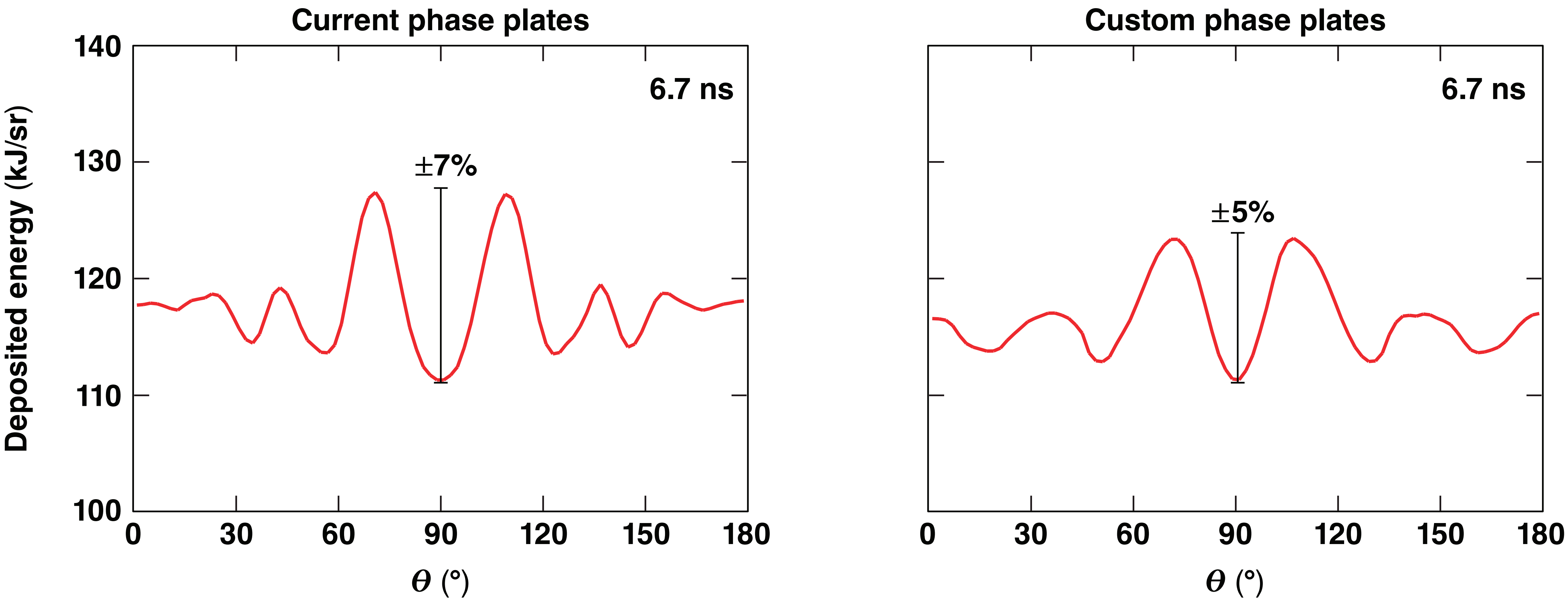
P. W. McKenty *et al.*, CO4.00002, this conference.

At the end of the laser pulse (6.7 ns), the azimuthally averaged center-of-mass radius is very uniform in both cases



Runs Y1002, Y1363
TC14483

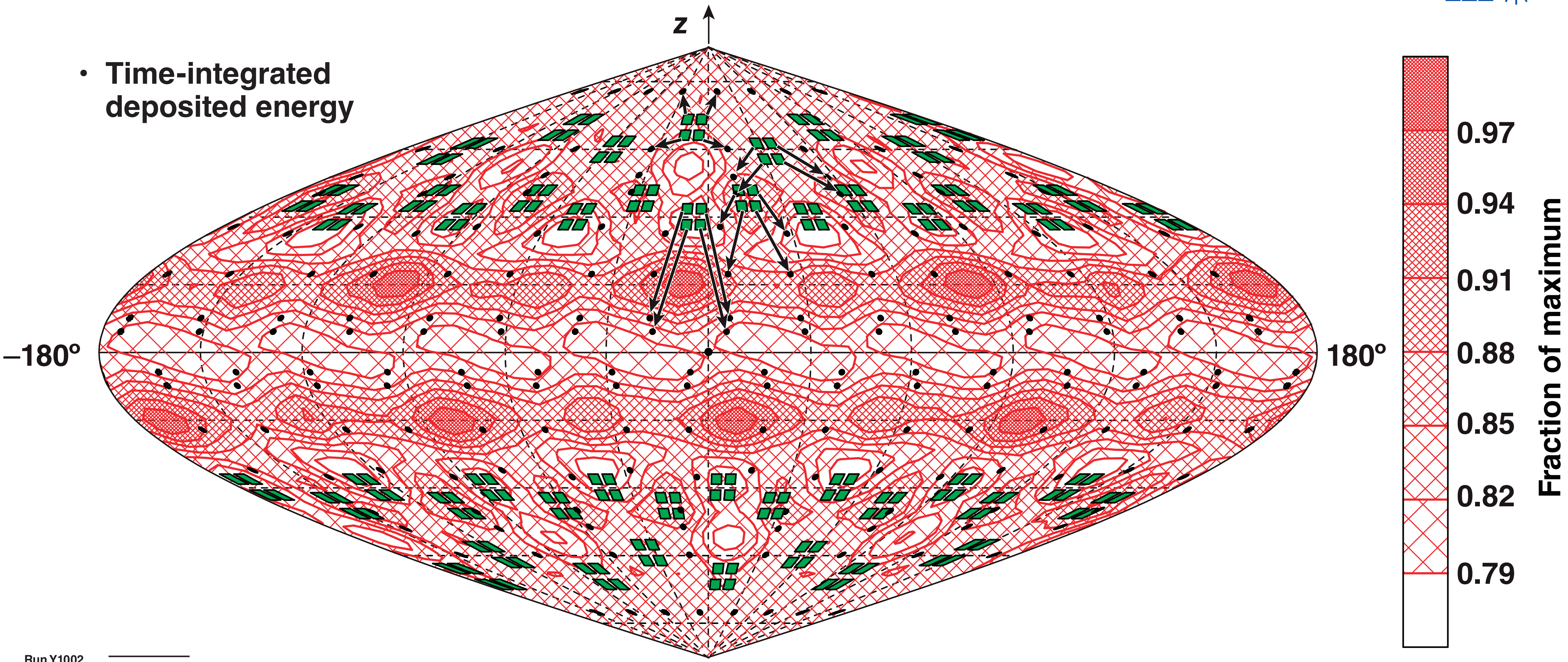
The azimuthally averaged deposition patterns exhibit modulations that appear to be smoothed out by thermal conduction



Runs Y1002, Y1363
TC14484

With the current NIF phase plates at 3.5-cm defocus, there are significant azimuthal nonuniformities in the deposited energy

- **Time-integrated deposited energy**

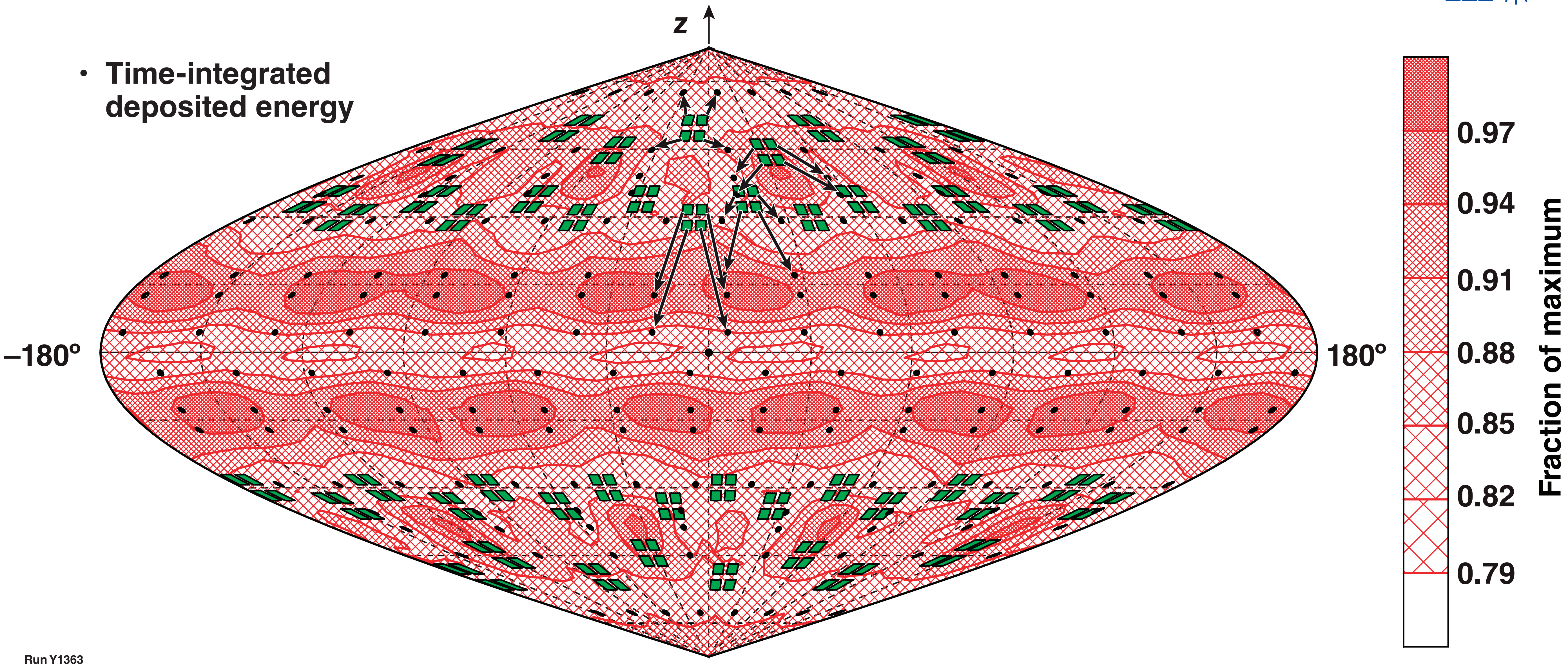


Run Y1002
TC14485

NIF: National Ignition Facility

With the custom phase plates, the azimuthal nonuniformities are greatly reduced

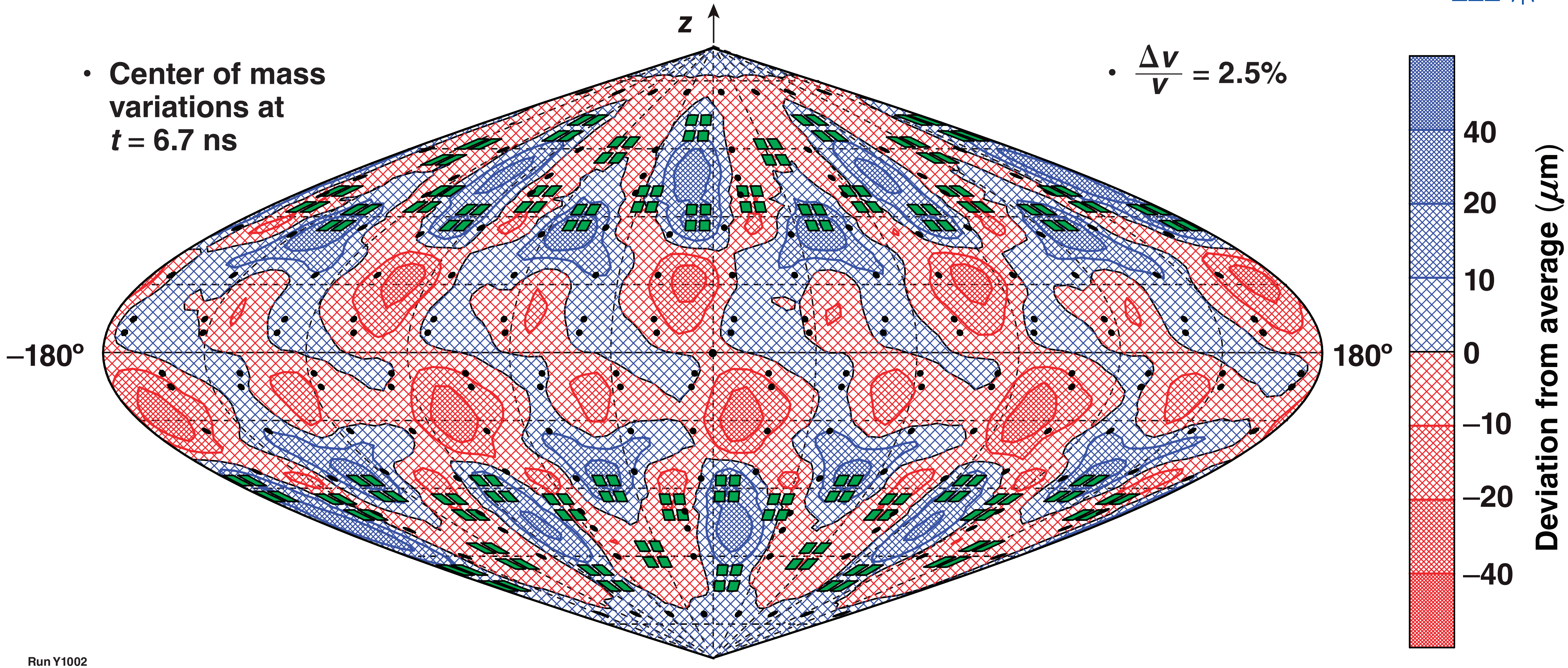
- Time-integrated deposited energy



Run Y1363
TC14486

With the current NIF phase plates, variations in the center-of-mass radius are ±10-μm (rms) after 400 μm of travel

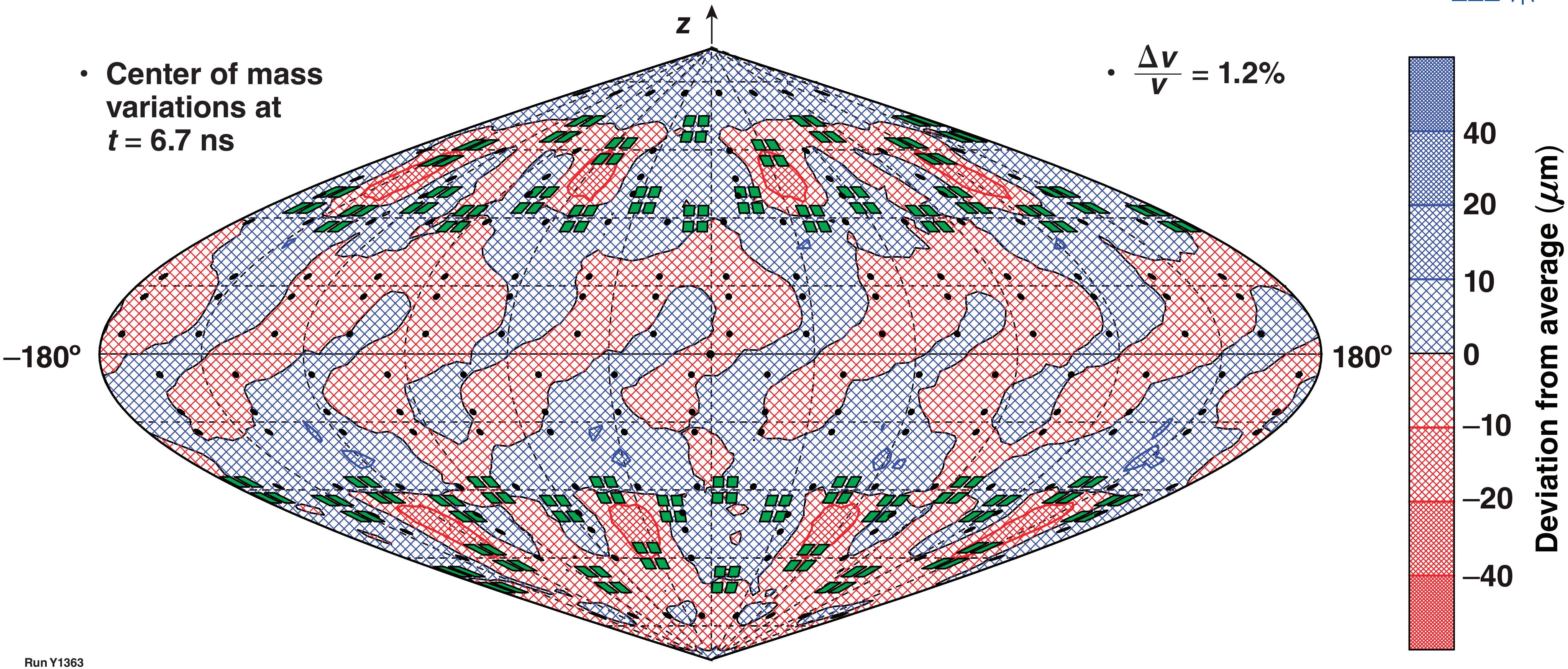
- Center of mass variations at *t* = 6.7 ns
- $\frac{\Delta v}{v} = 2.5\%$



Run Y1002
TC14487

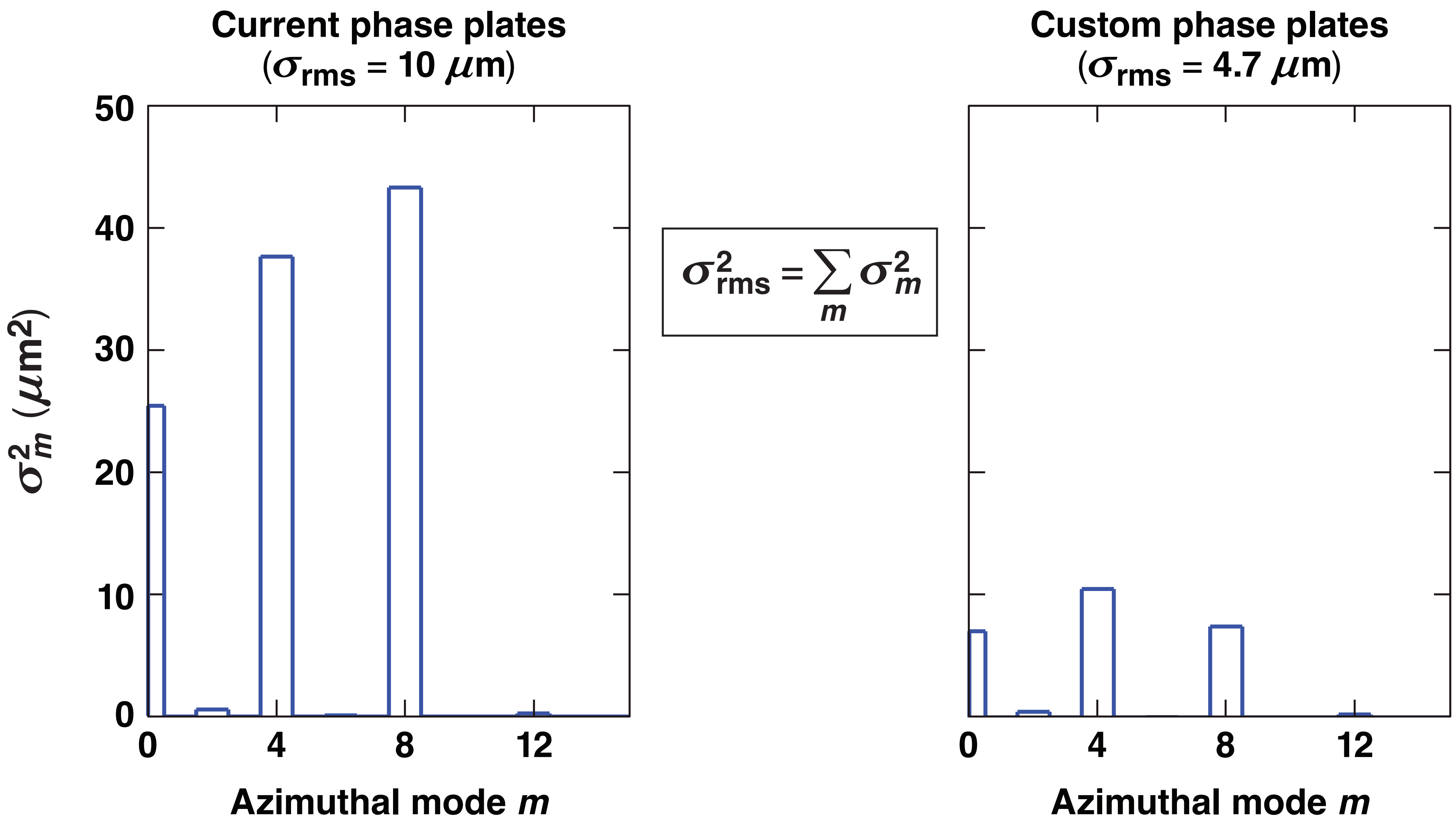
With the custom phase plates, variations in the center-of-mass radius are ±4.7-μm (rms) after 400 μm of travel

UR LLE



Run Y1363
TC14488

The *m*-mode spectra of center-of-mass variations (summed over ℓ) are dominated by m = 0, 4, and 8



$$\sigma_{rms}^2 = \sum_m \sigma_m^2$$

Runs Y1002, Y1363
TC14489

Summary/Conclusions

The drive uniformity of *Revolver* designs can be improved using custom phase plates

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NIF experiments using scaled-down *Revolver* targets would be interesting.