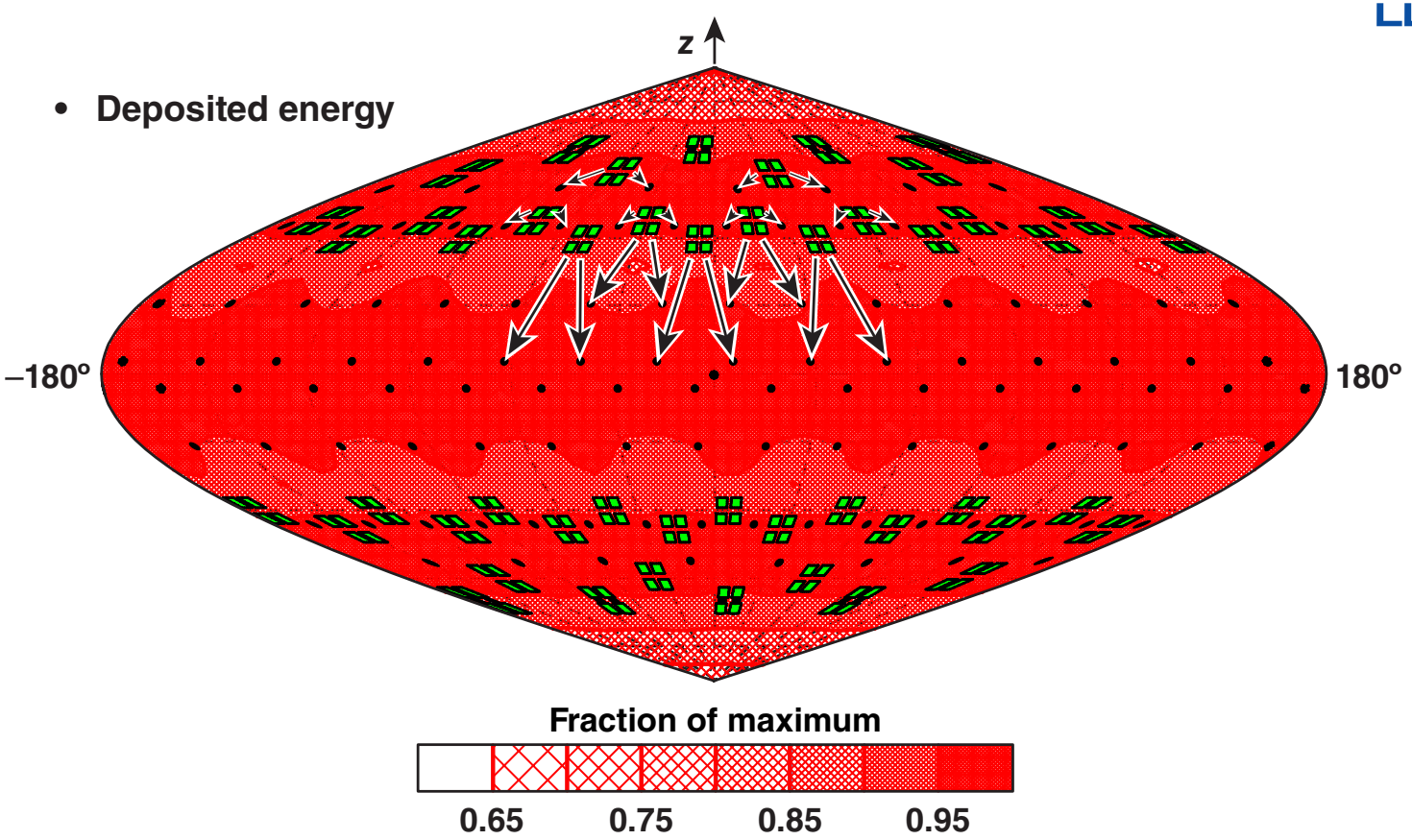
Optimization of Azimuthal Uniformity in NIF Polar-Drive Implosions

UR LLE

- Deposited energy



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Summary

The azimuthal uniformity of National Ignition Facility (NIF) polar-drive implosions can be calculated using a pseudo 3-D model in *SAGE*

UR LLE

- The uniformity is improved with azimuthal repointing of the laser beams
- Predictions of the model match many features of self-emission images for LLE polar-drive shots N130128, N130703, and N130731
- The self-emission diagnostic can detect predicted deviations of ~10 μm resulting from beam-energy imbalance

See A. K. Davis (UO4.00004, next talk) for detailed modeling of the x-ray images.

Collaborators

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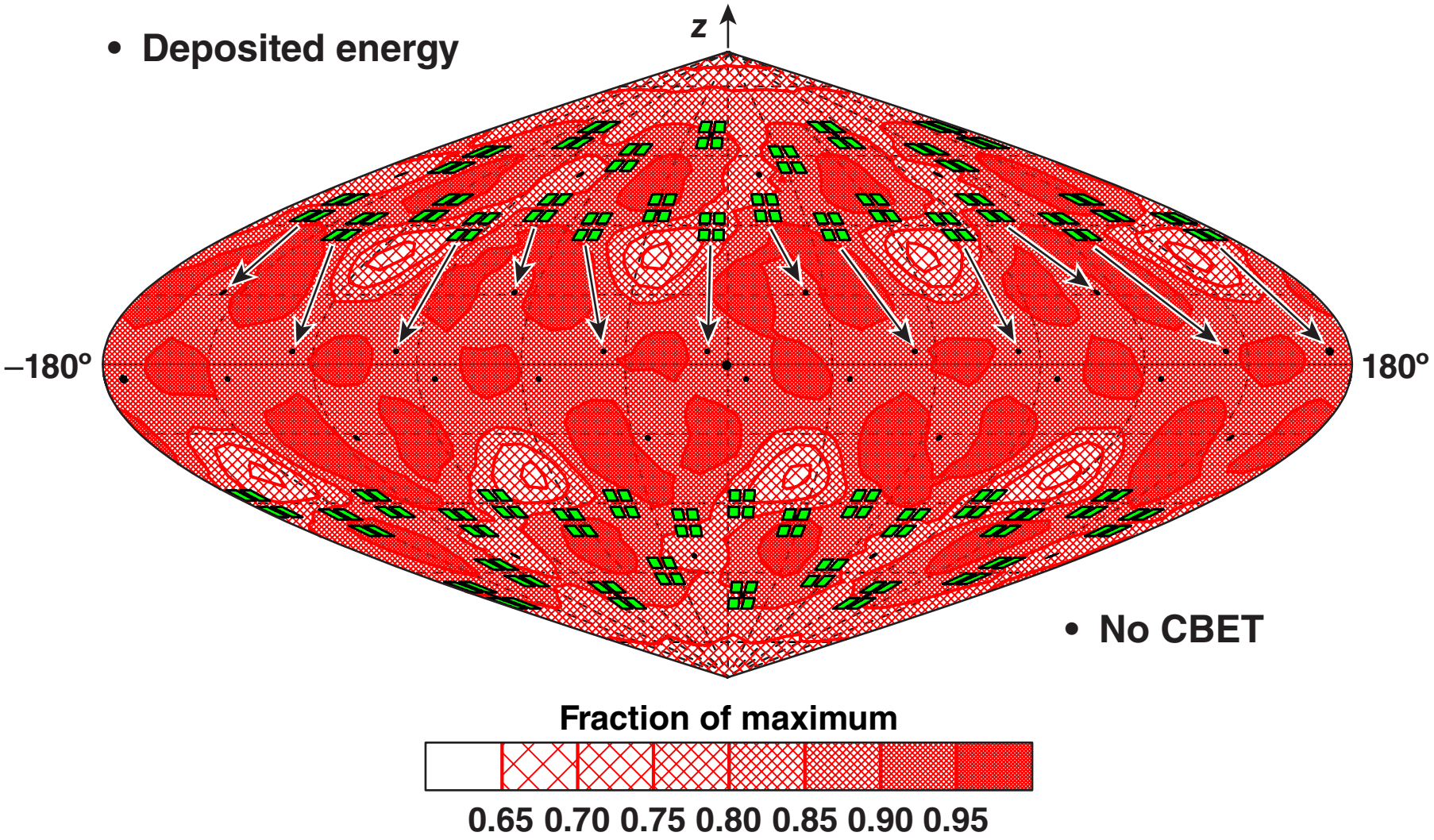
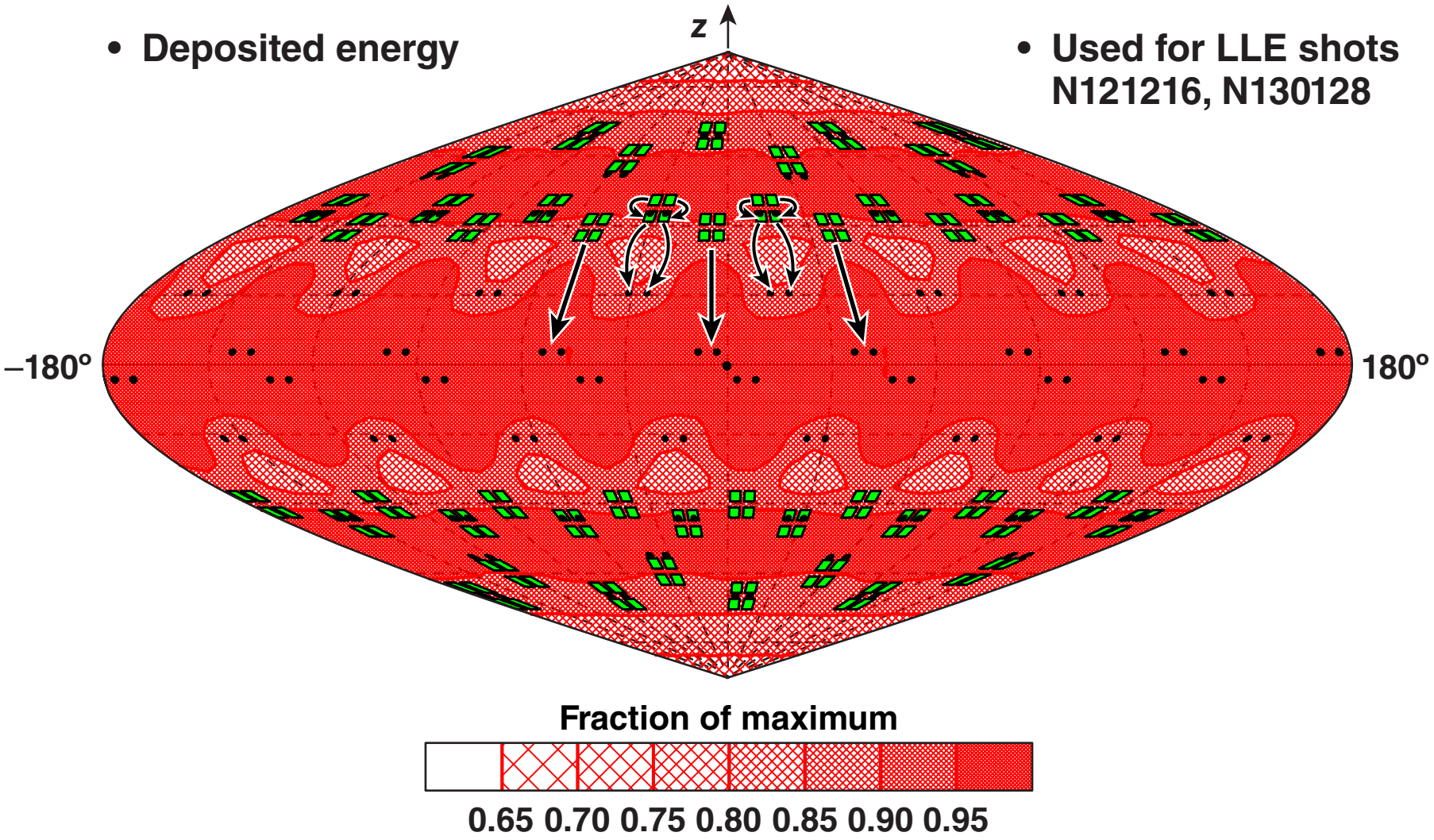
The alternating quad design results in a large $m = 4$ nonuniformity in the deposited energy



Run 6216
TC10474

The split-quad design shows improved azimuthal deposition uniformity with an $m = 8$ pattern



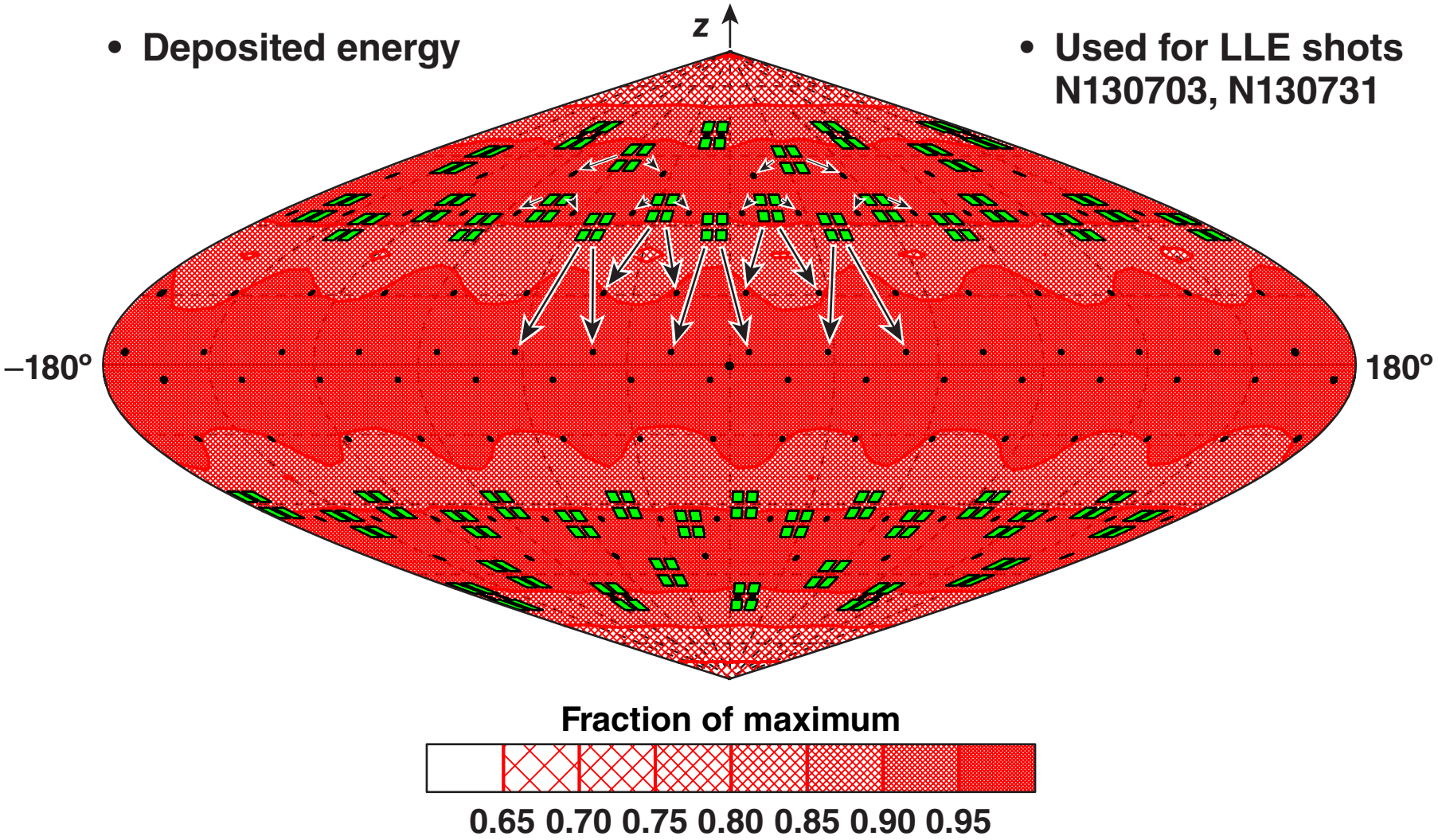
Run 6291
TC10475c

More improvement is obtained through the addition of azimuthal repointing

UR LLE

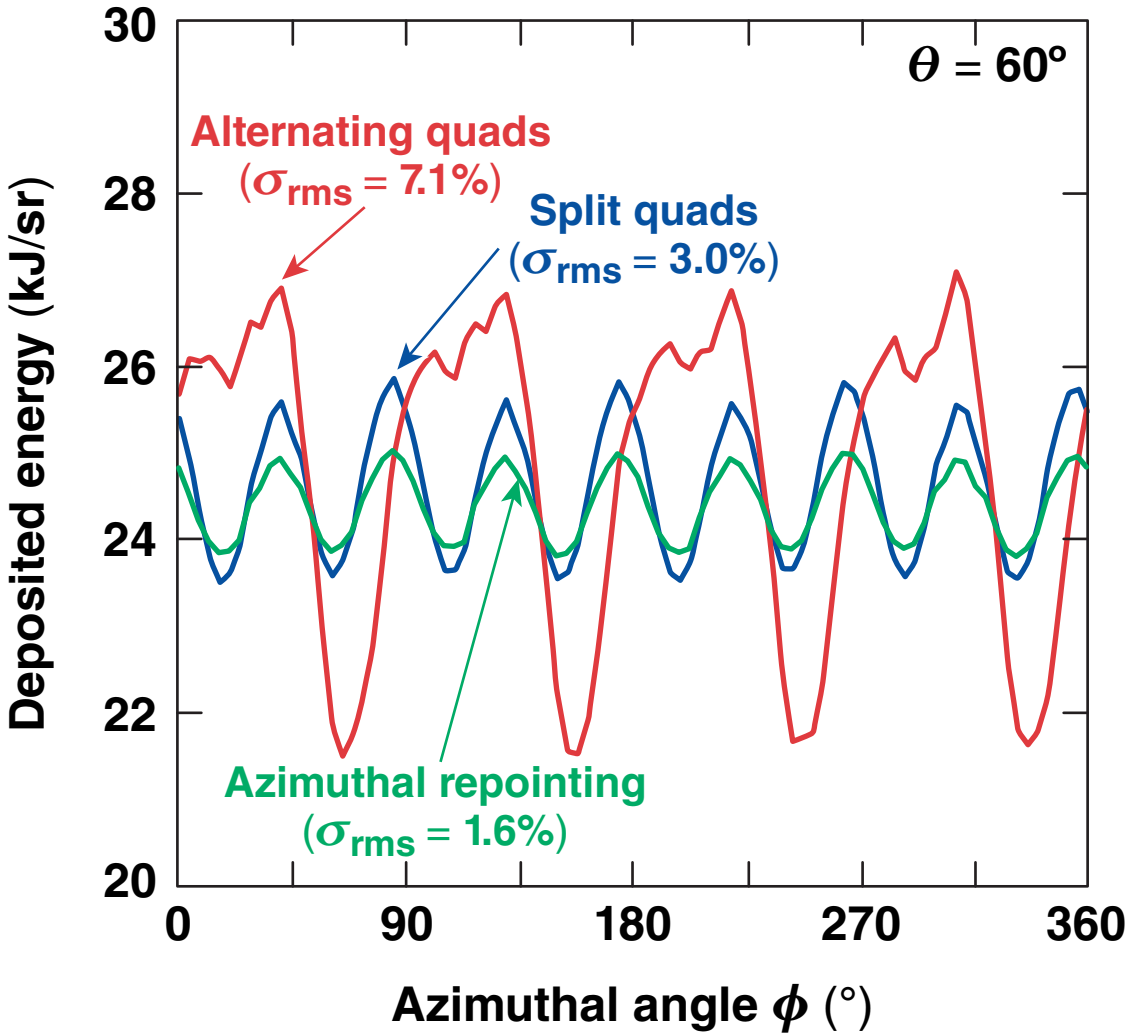
- Deposited energy

- Used for LLE shots N130703, N130731



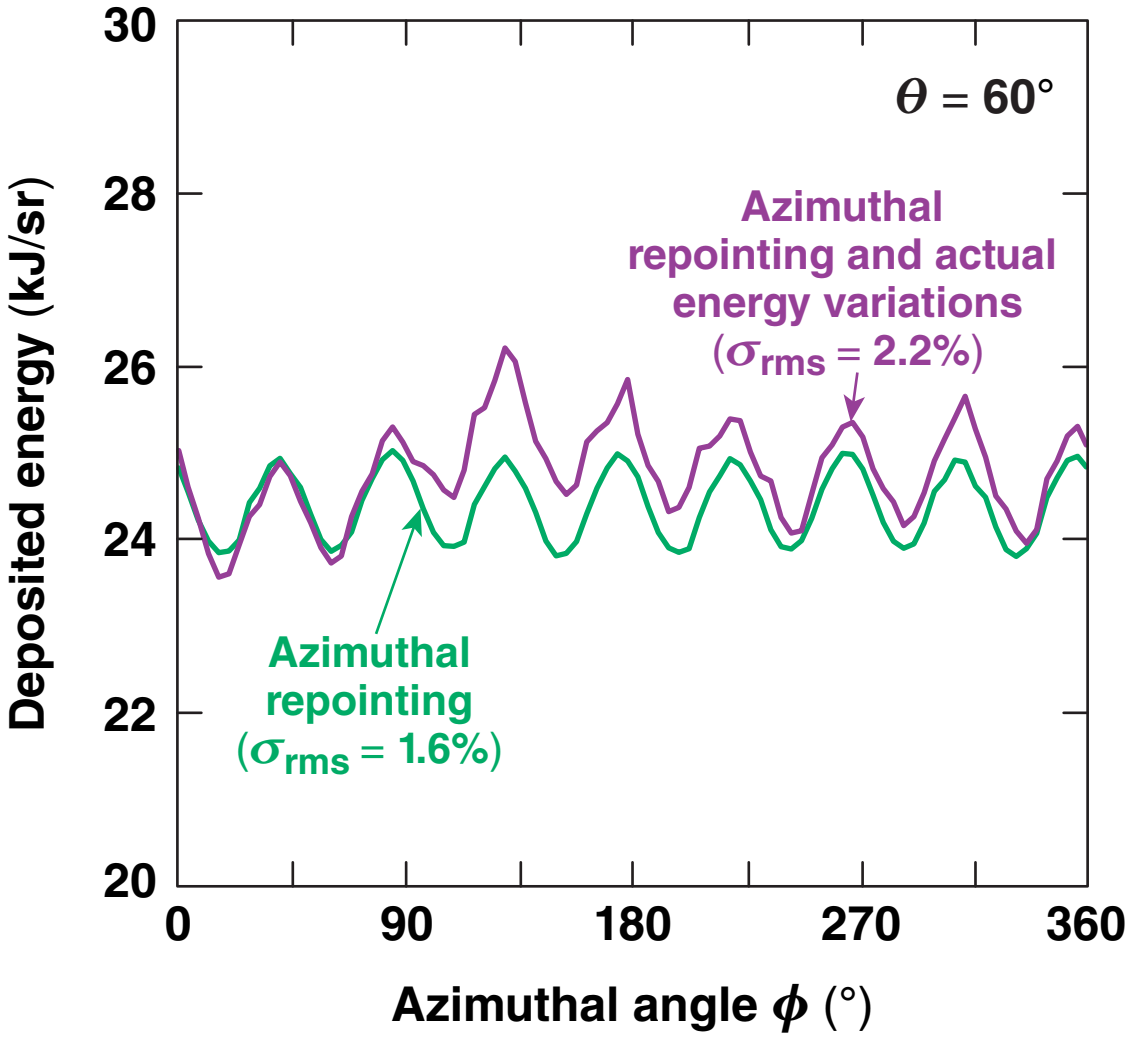
Run 6292
TC10477a

The best uniformity results from the azimuthal repointing design



Runs 6216, 6291, 6292
TC10745

Some additional nonuniformity results from actual beam-energy variations



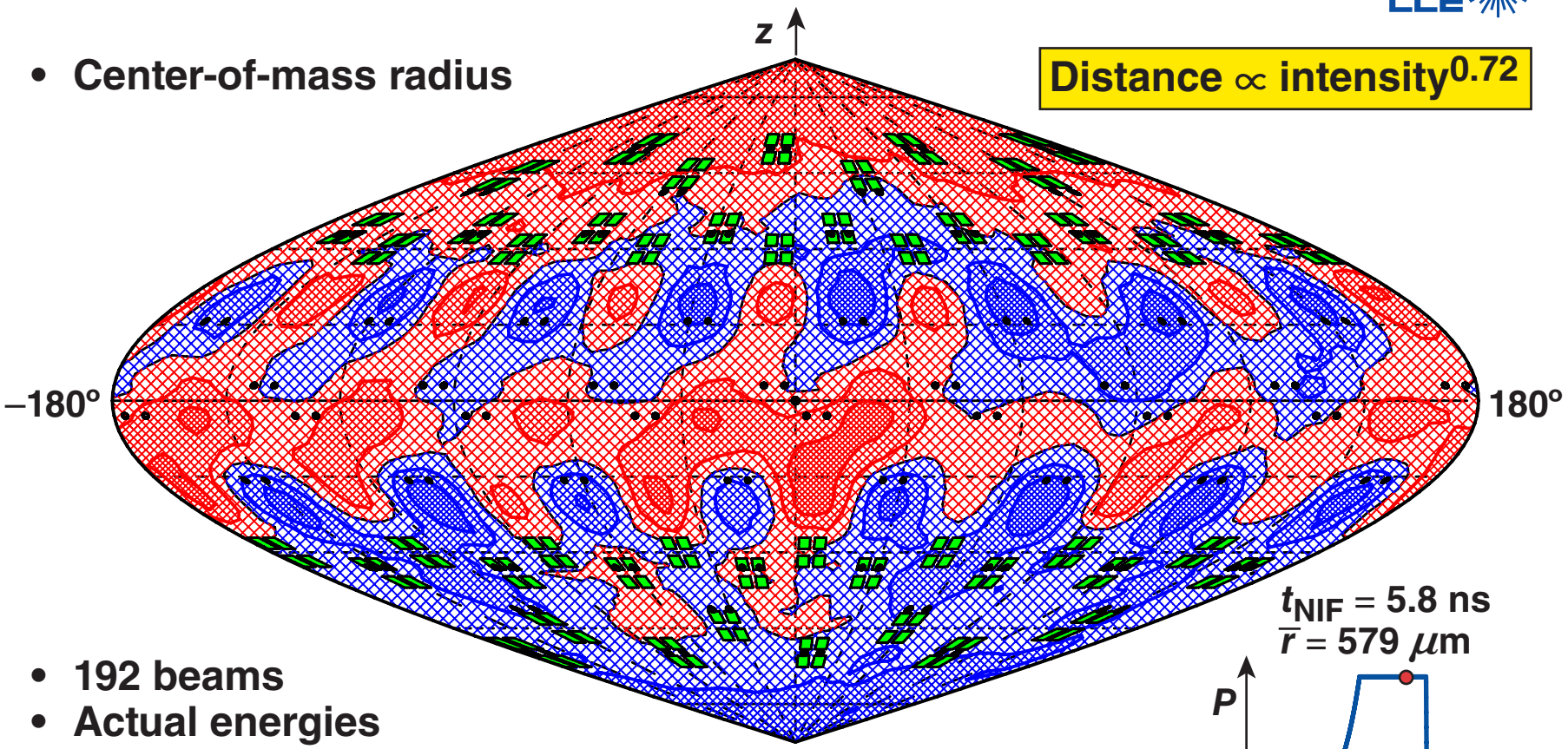
Runs 6292, 6301
TC10746

For shot N130128, the center-of-mass distribution was estimated from the deposited-energy distribution by applying a simple scaling law to the azimuthal variations

UR LLE

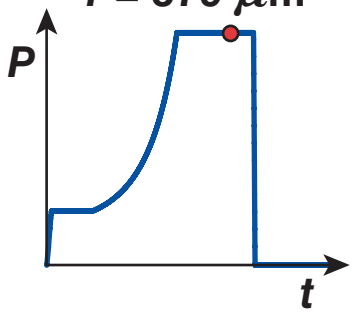
- Center-of-mass radius

Distance ∝ intensity$^{0.72}$

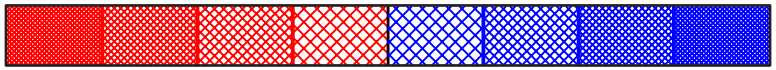


- 192 beams
- Actual energies

t_{NIF} = 5.8 ns
$\overline{r}$ = 579 μm

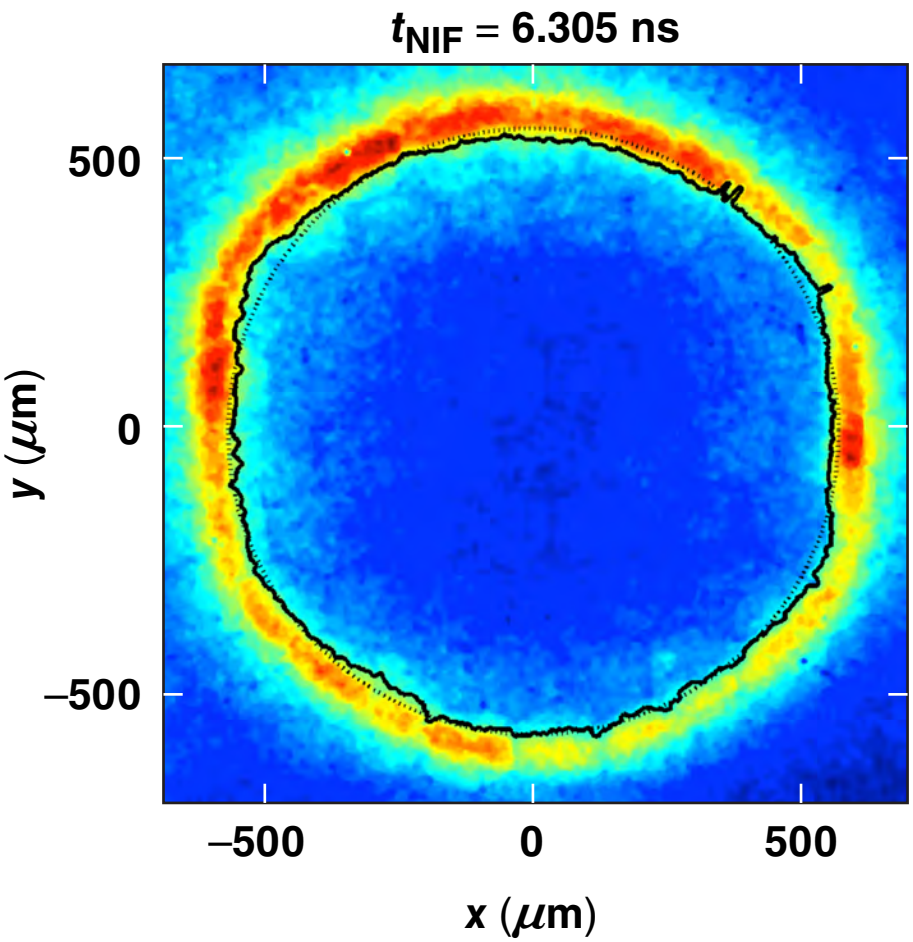


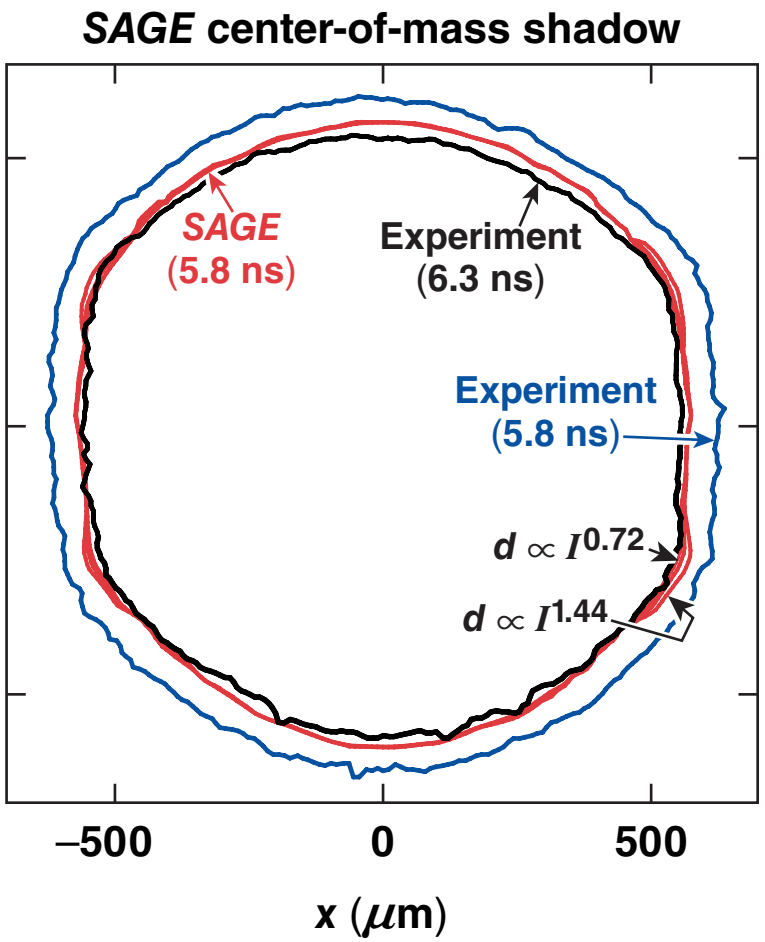
Deviation from mean (μm)



Run 6324
TC10747

Framing-camera self-emission images from shot N130128 show features at ±30° from the equator in agreement with simulations

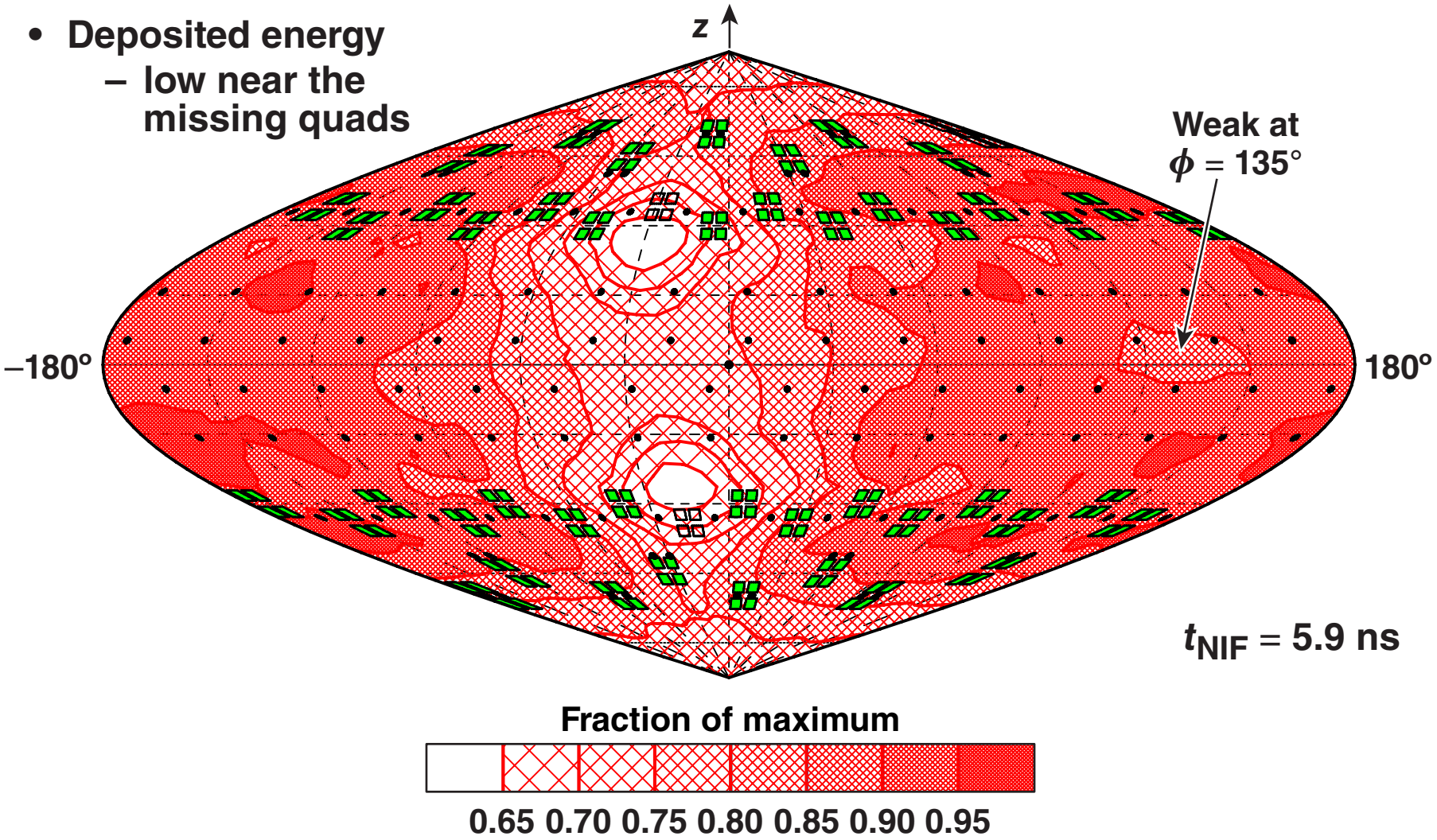




Run 6324
TC10748

Shot N130703 used azimuthal repointing but two quads were dropped

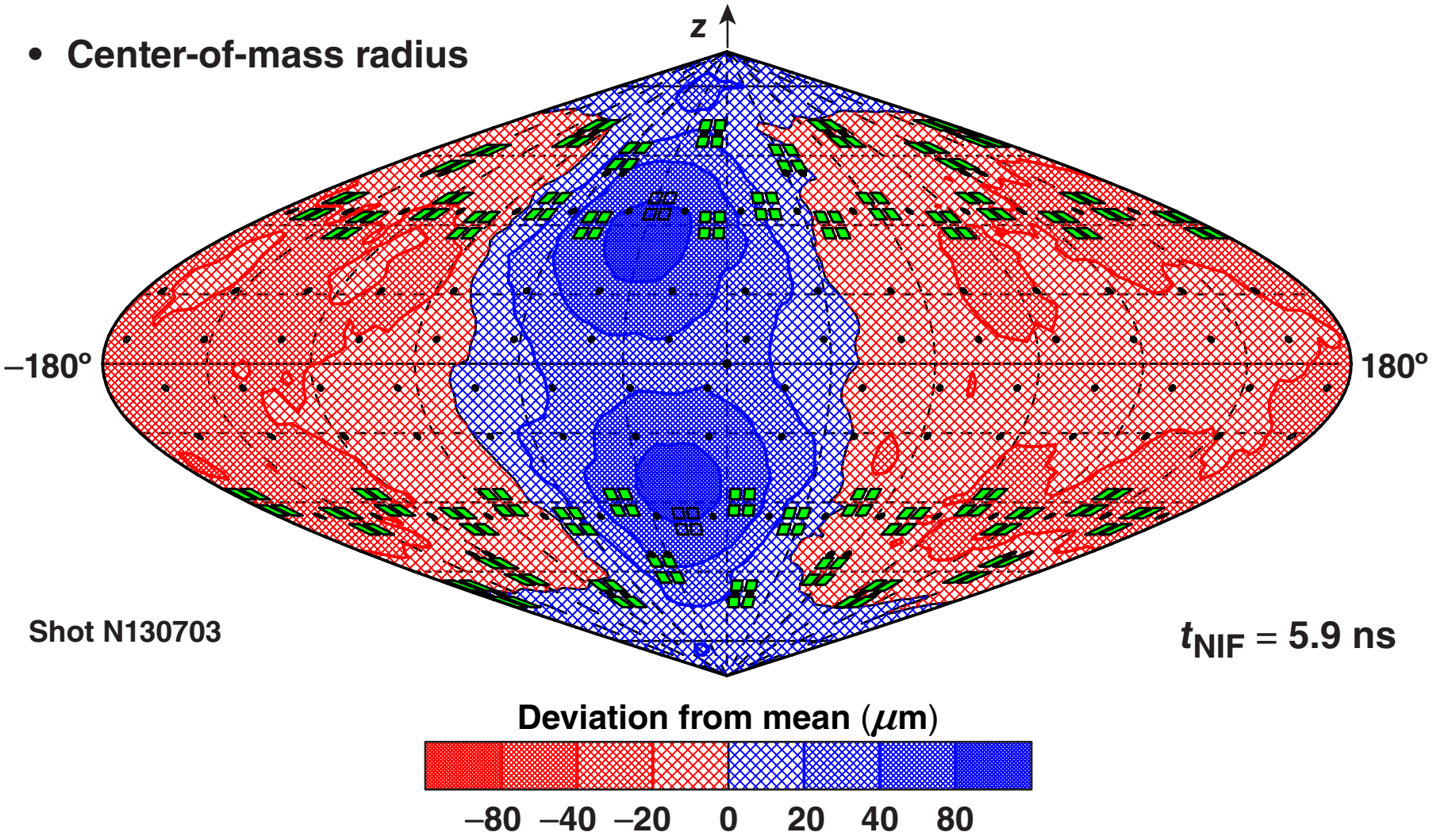
- Deposited energy
  - low near the missing quads



Run 6343
TC10749

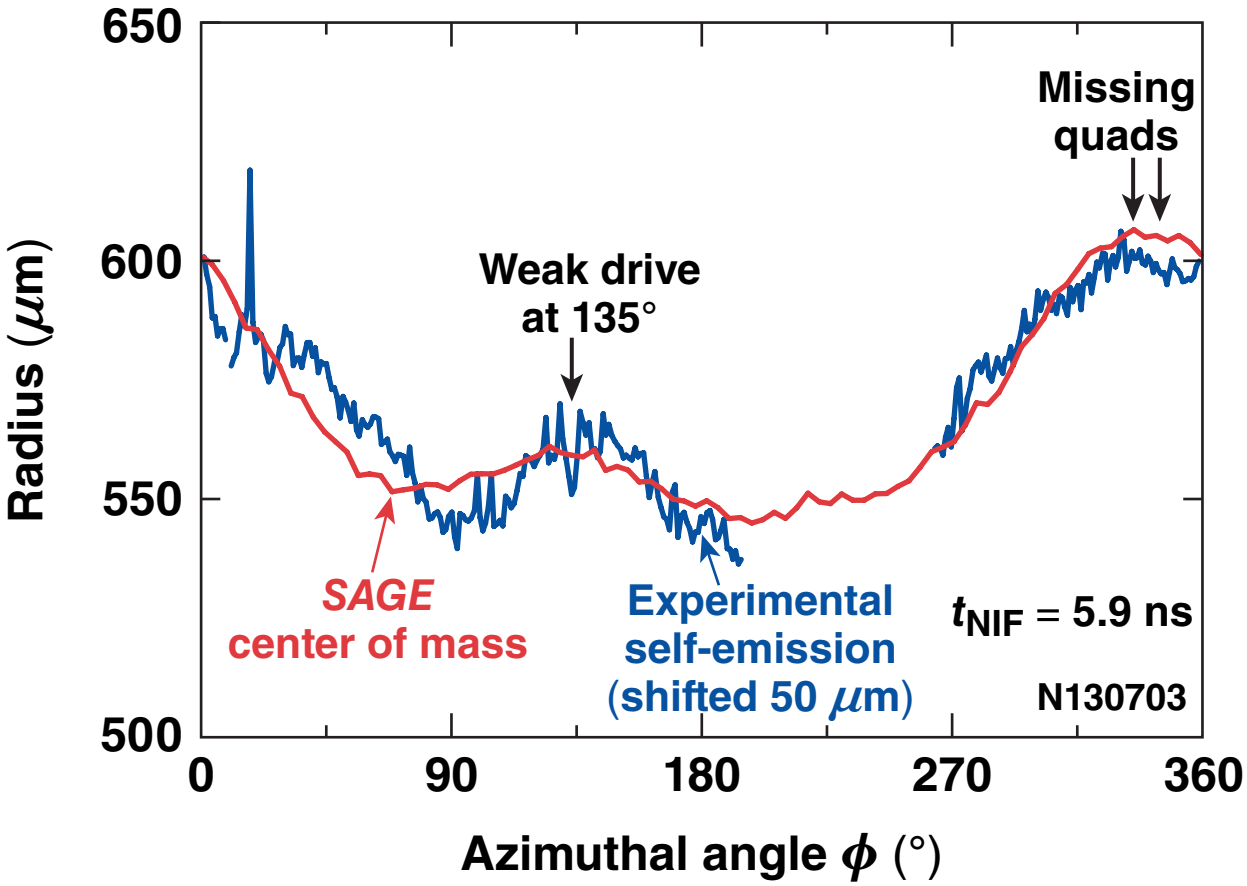
Large variations are predicted in the center-of-mass radius

- Center-of-mass radius



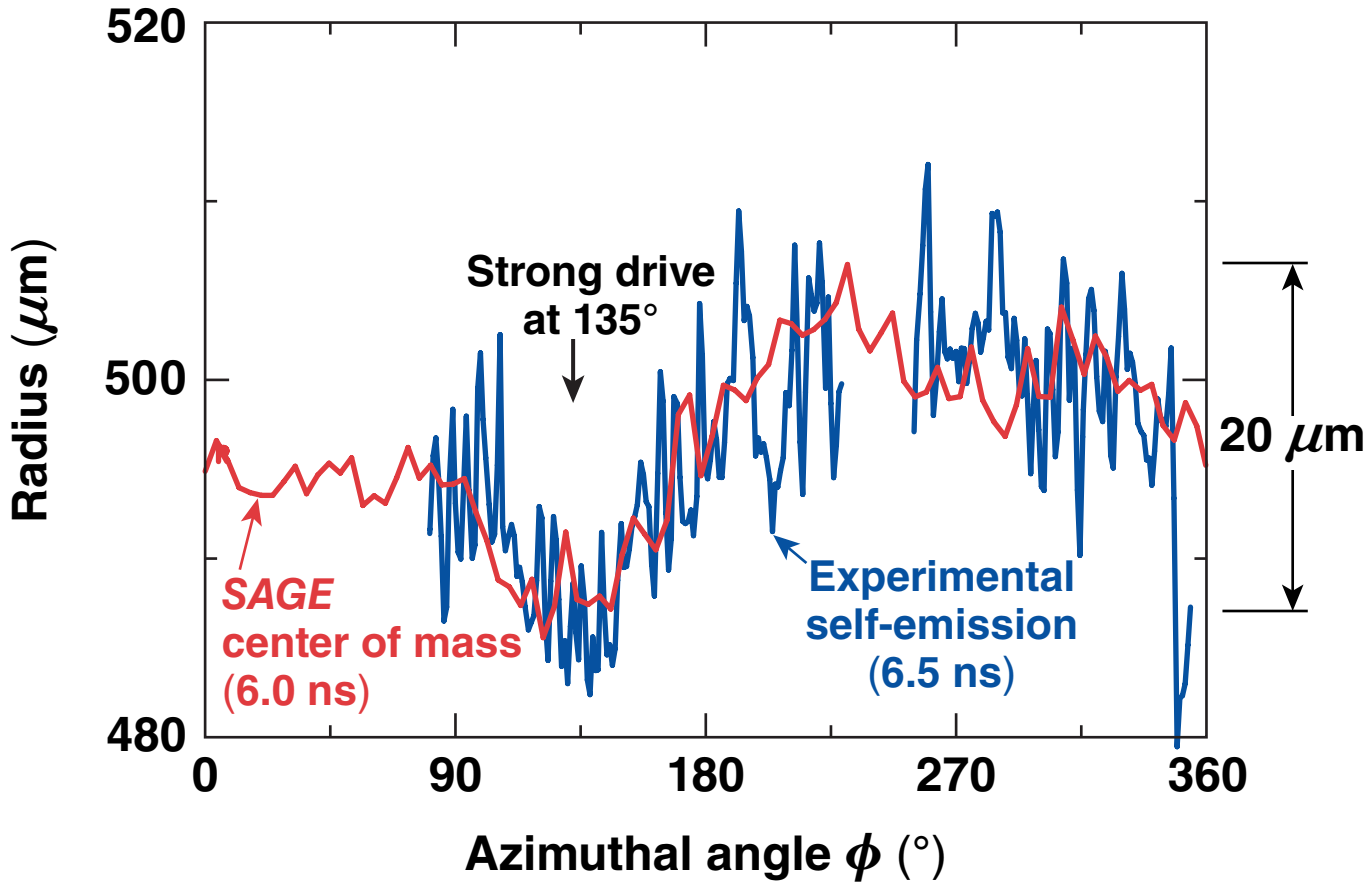
Run 6343
TC10750

The azimuthal variations in the experimental self-emission show the missing quads and the weak drive at 135°



Run 6343
TC10751

For shot N130731, the azimuthal variations are ~±10 μm and show the predicted strong drive at ϕ = 135°



Run 6349
TC10752a

Summary/Conclusions

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