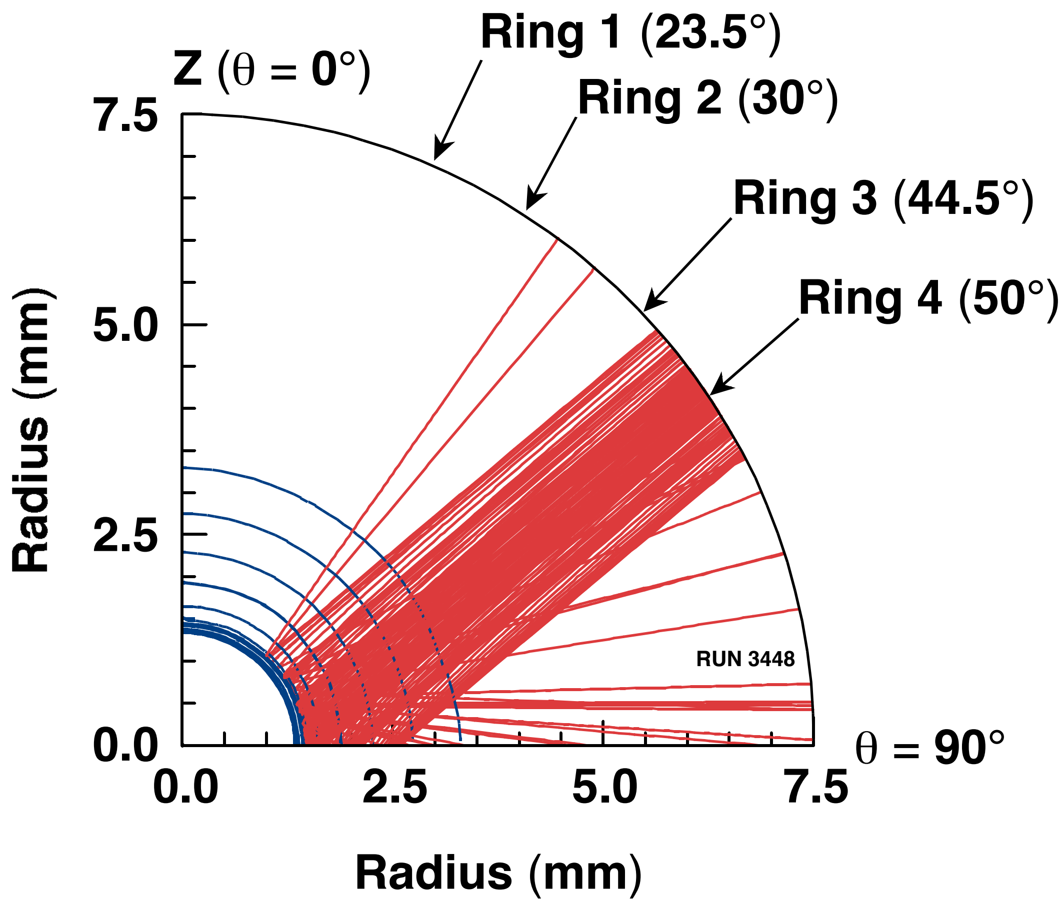
Two-Dimensional *SAGE* Simulations of Polar Direct Drive on the NIF



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Summary

Initial ray-tracing simulations of polar direct drive are encouraging

- 2-D NIF implosions are driven by full 3-D ray tracing for all eight rings of beams.
- Elliptical phase plates are used for some beams.
- A “polar” simulation performs nearly as well as a “symmetric” simulation at the time of shock breakout.
- The prospects for improved designs are good.

Outline

- Irradiation/target design for polar drive
- Comparison of "polar" and "symmetric" cases
  - t = 5.8 ns (shock breakout)
  - t = 9.0 ns (end of laser pulse)

The polar design is very simple

Ring	θ	Number of quads	Pointing shift (μm)	Ellipticity
1	23.5°	4	0	1:1
2	30.0°	4	240	1:1
3	44.5°	8	280	1.16:1
4	50.0°	8	750	2:1

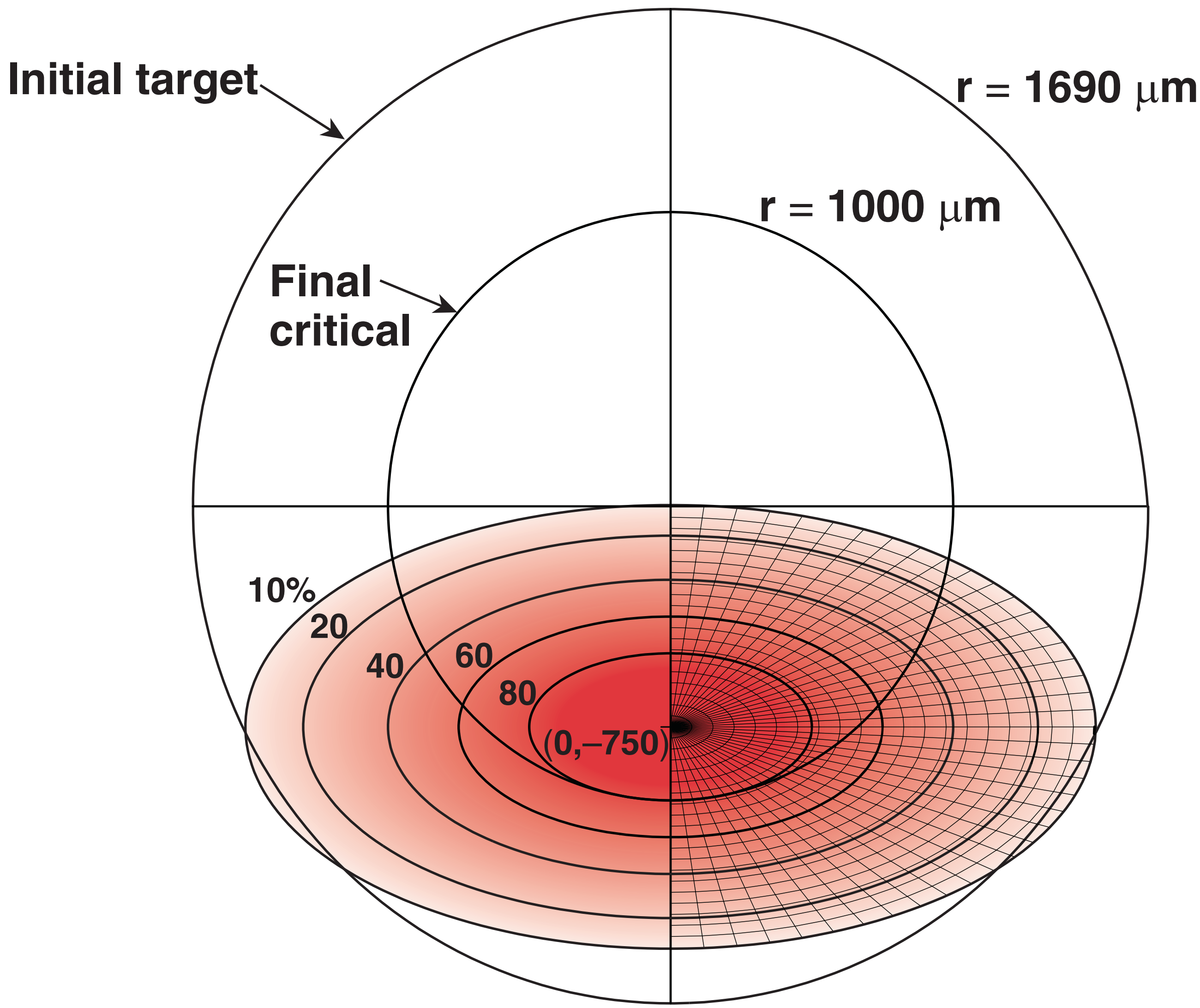
All runs use scaled OMEGA "SG3" profiles, roughly

$$I(r) \propto \exp - (r/r_0)^n$$

with r_0 = 1050 μm and n = 2.5.

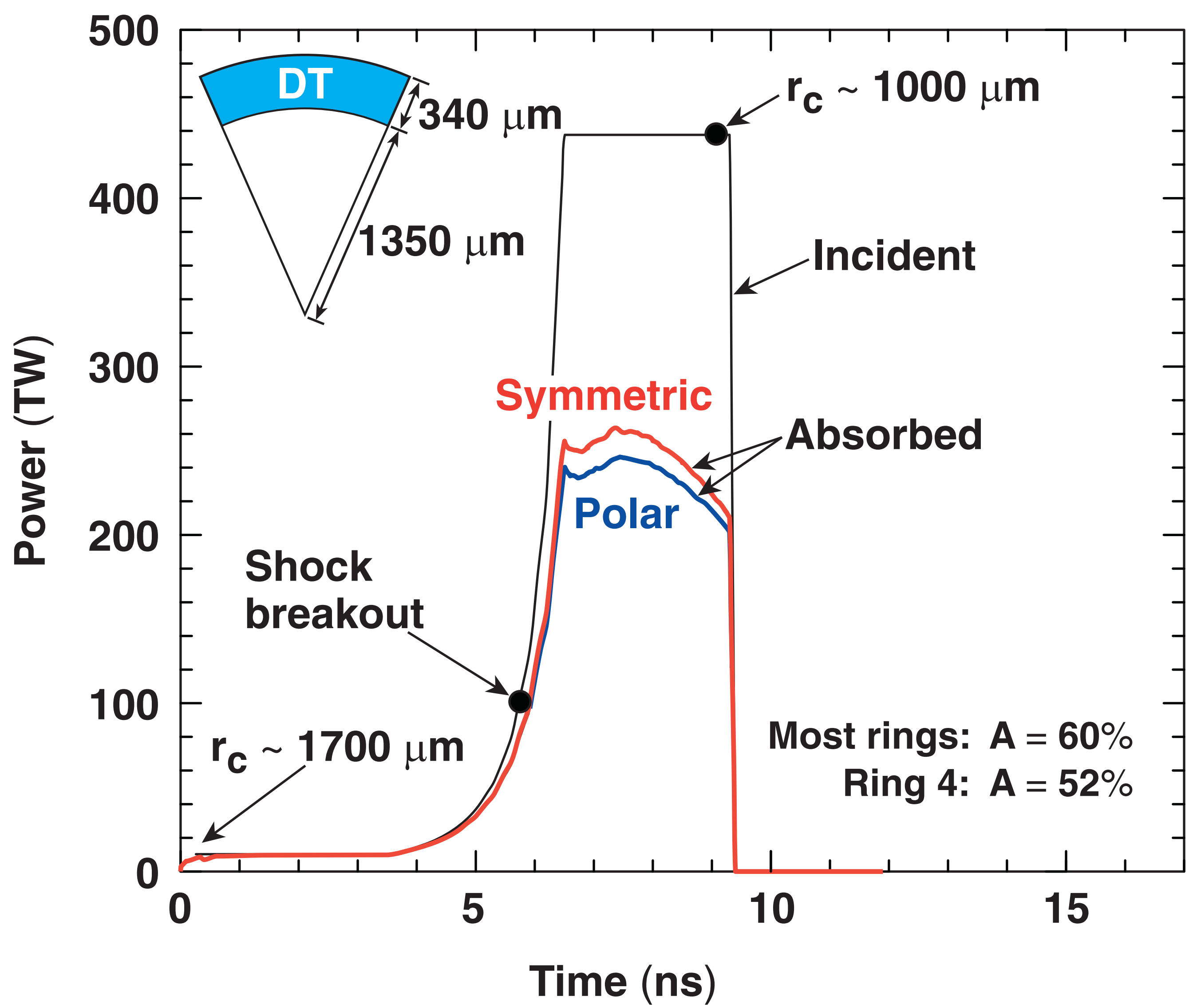
TC6179

Ring-4 beams are repointed 750 μm and use 2:1 elliptical phase plates



Sub26
TC6180

The polar design results in a small absorption loss

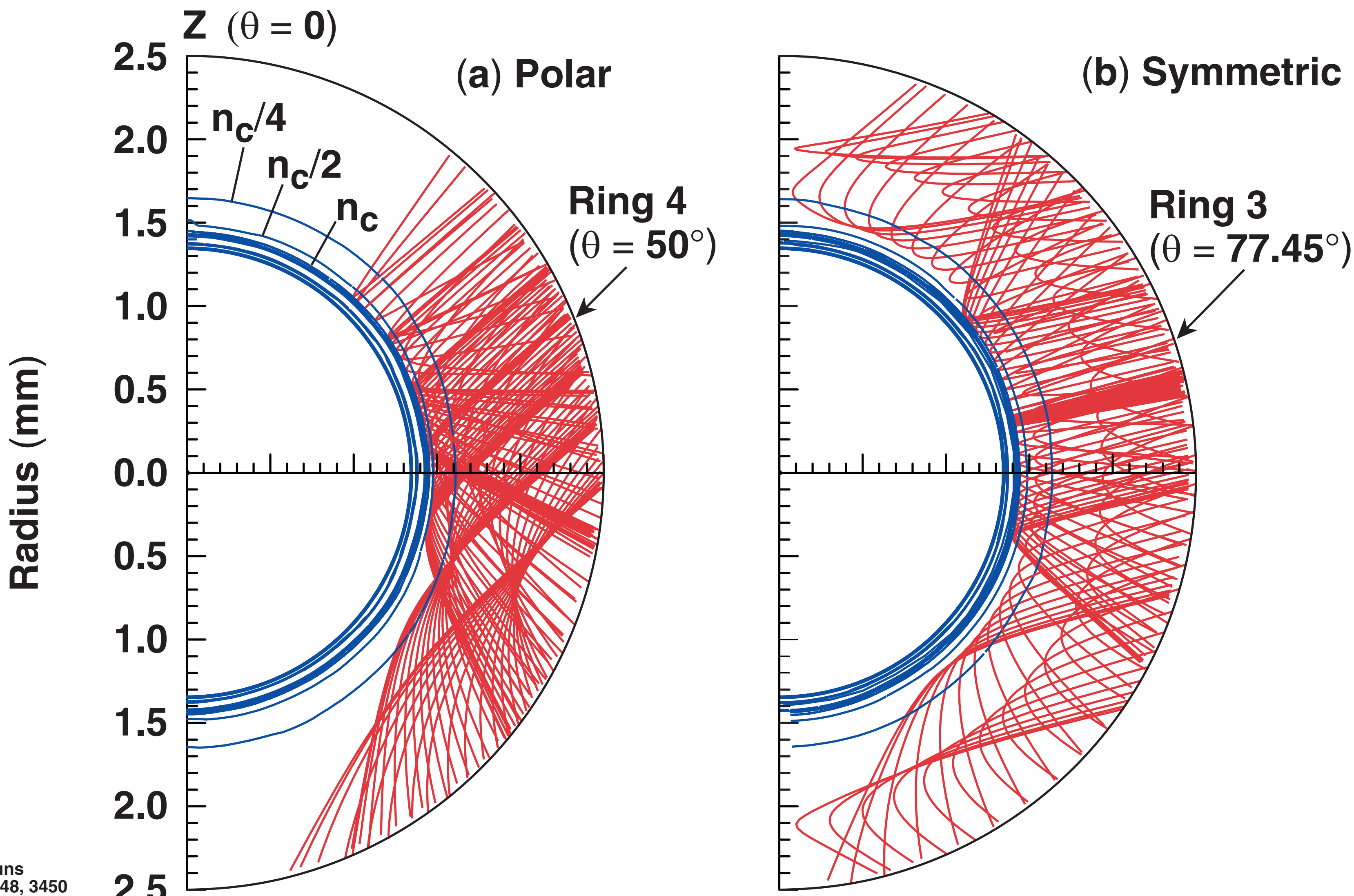


Runs 3448, 3450
TC6181

A large parameter space awaits exploration

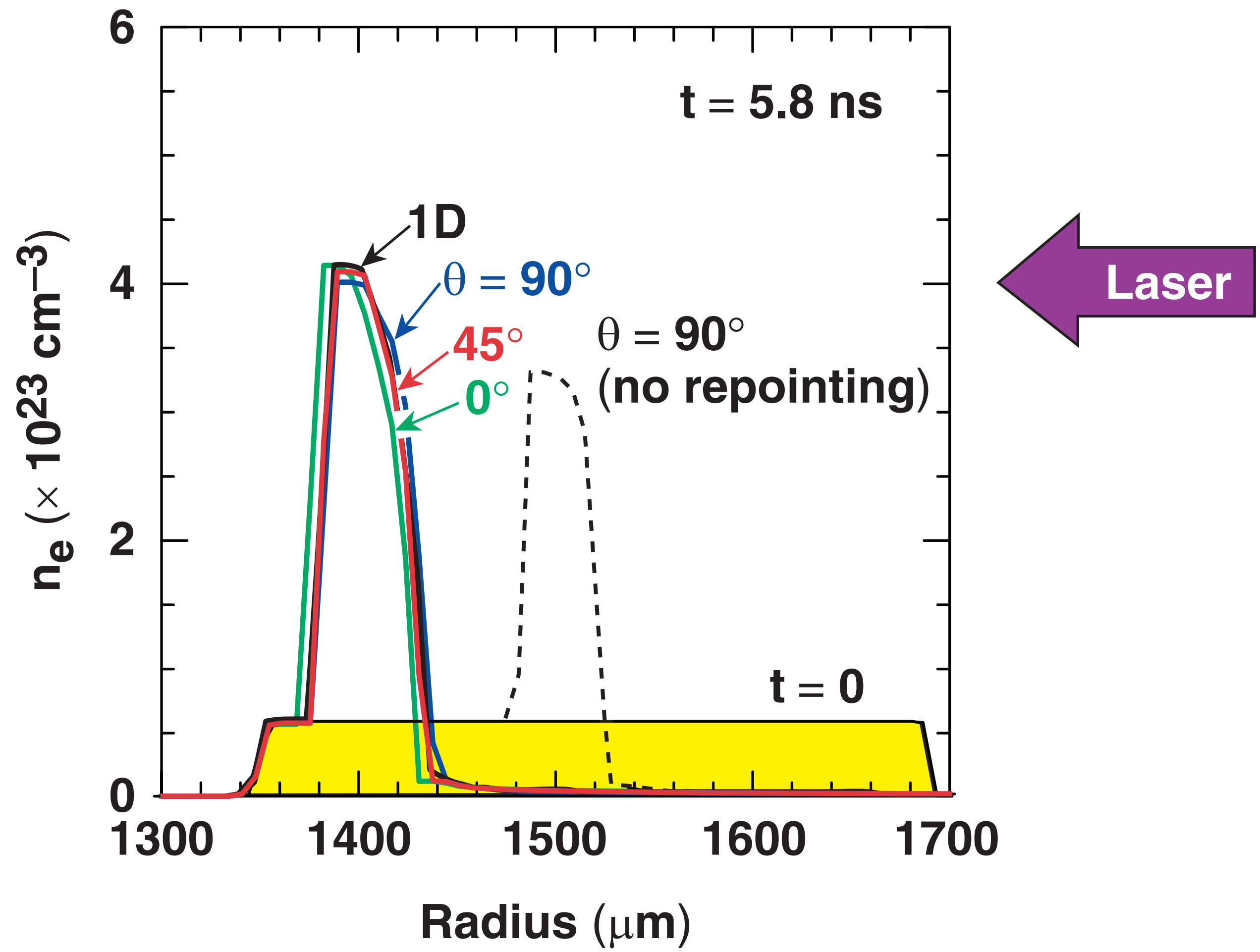
- These calculations have used
  - beam-pointing shifts
  - elliptical phase plates
- Future calculations will consider
  - varying spatial profiles
  - varying temporal profiles
  - varying beam energies
  - amended target designs
- We hope to avoid
  - shimmed targets

At 5.8 ns, a nearly spherical shock approaches the inner ice surface in both cases



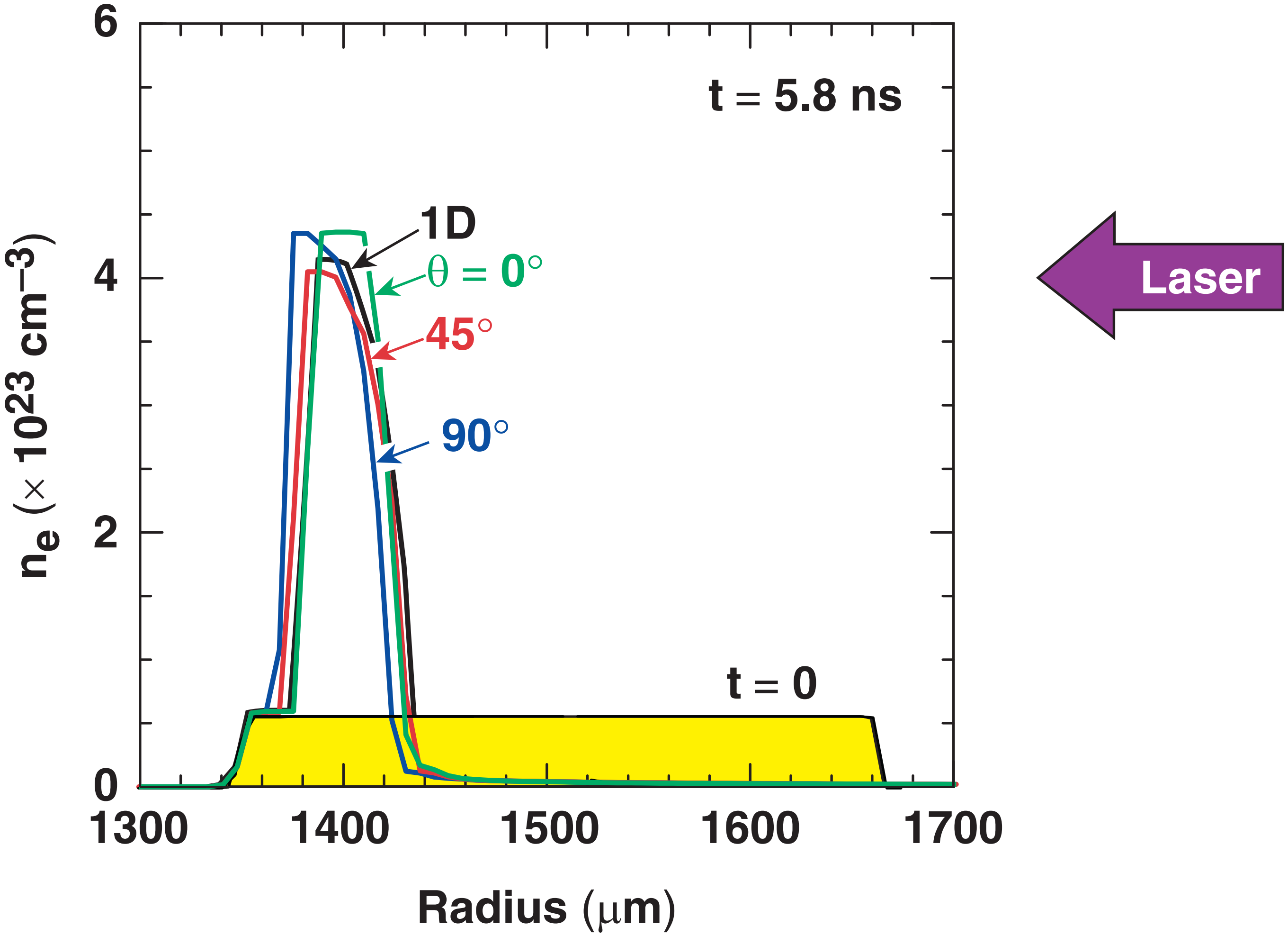
Runs
3448, 3450
TC6183

Just before shock breakout, the density profiles of the polar design are almost independent of θ



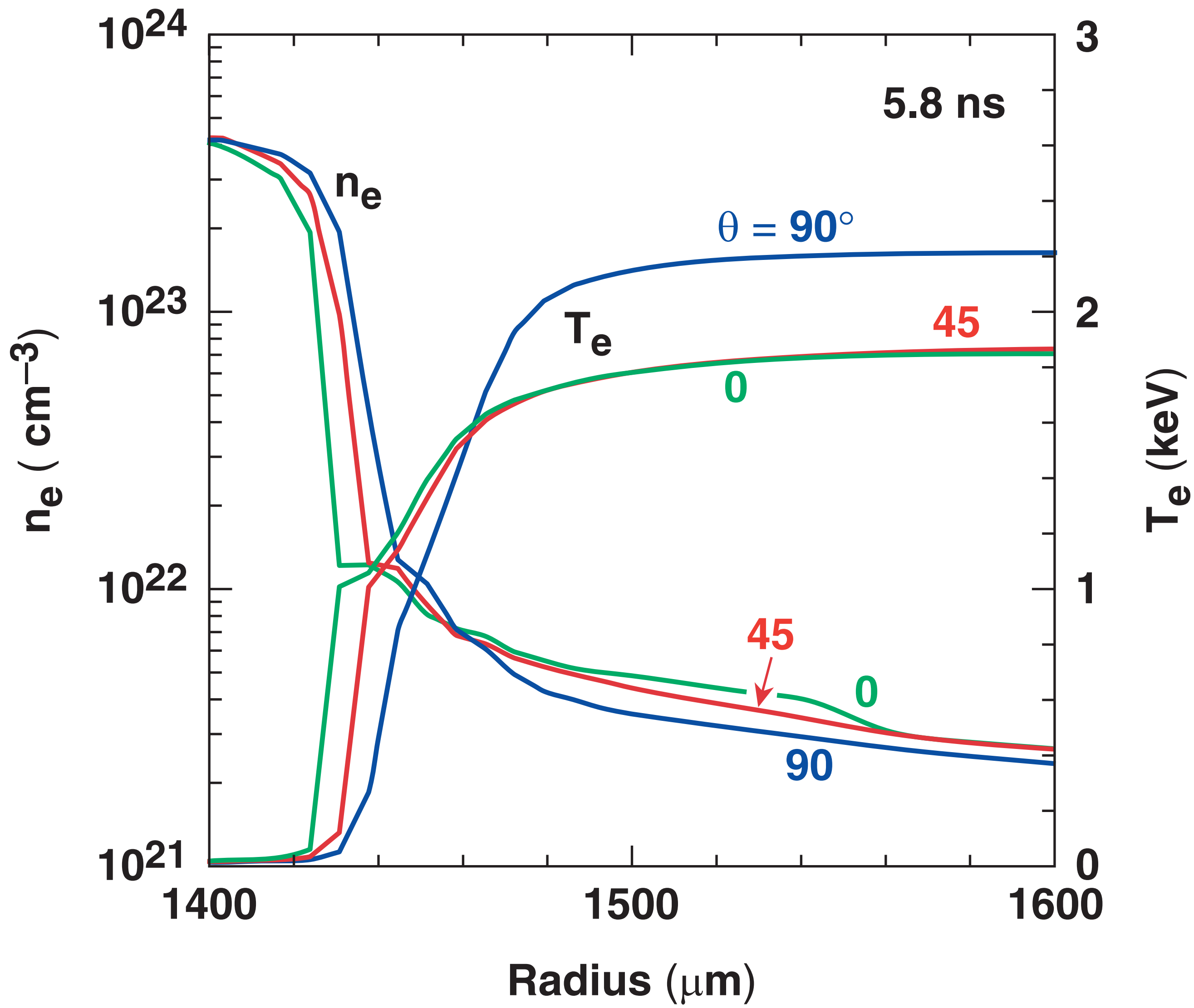
Runs 3448, 3405, 3500
TC6184

Comparable results are obtained for the symmetric design



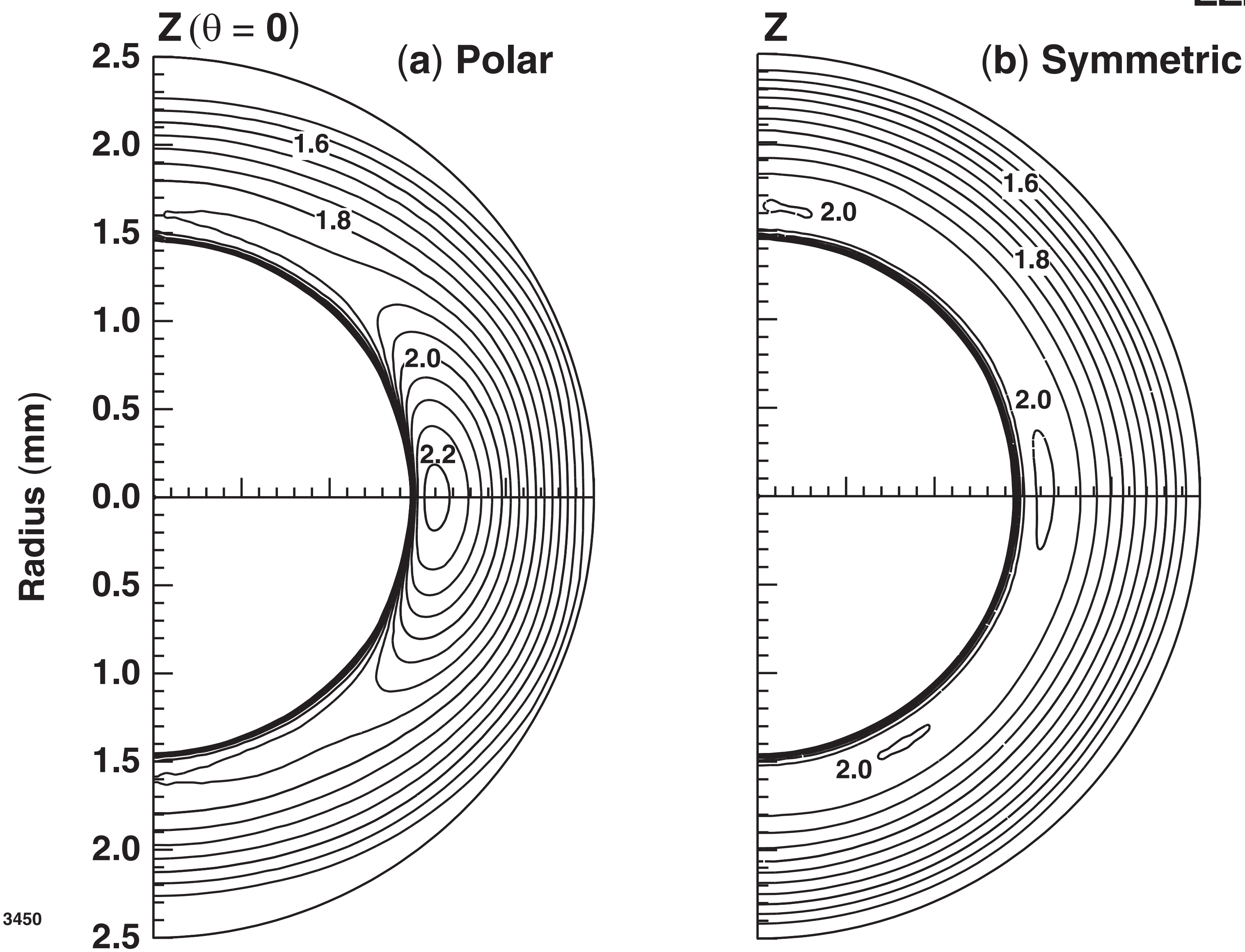
RUNS 3450, 3405
TC6185

The corona is hotter and steeper at $\theta = 90°$ for the polar design



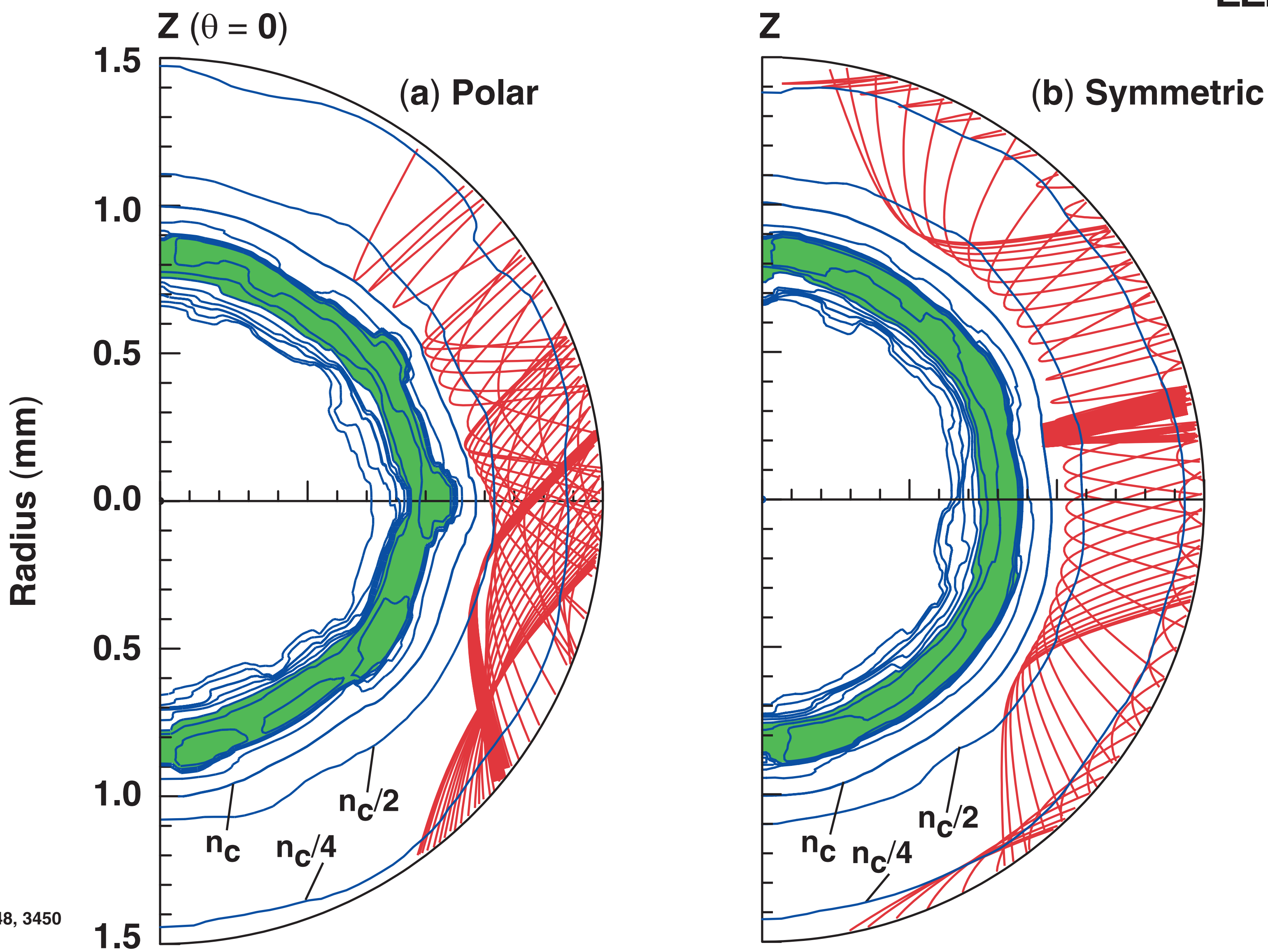
RUN 3448
TC6186

At 5.8 ns, the electron-temperature contours in the polar case show an ~10% enhancement near the equator



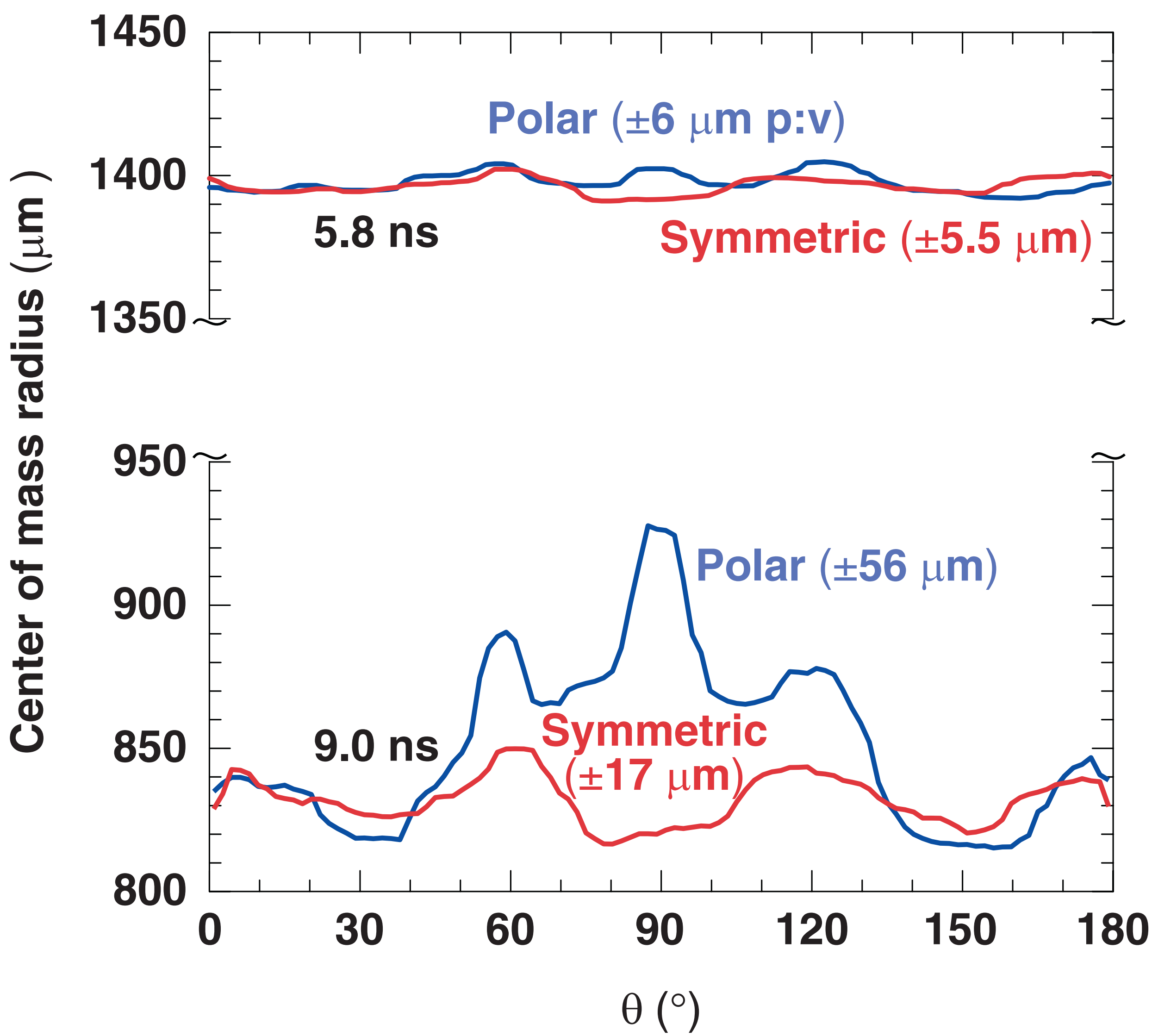
Runs 3448, 3450
TC6187

At the end of the laser pulse (9 ns), the polar case is almost as uniform as the symmetric case



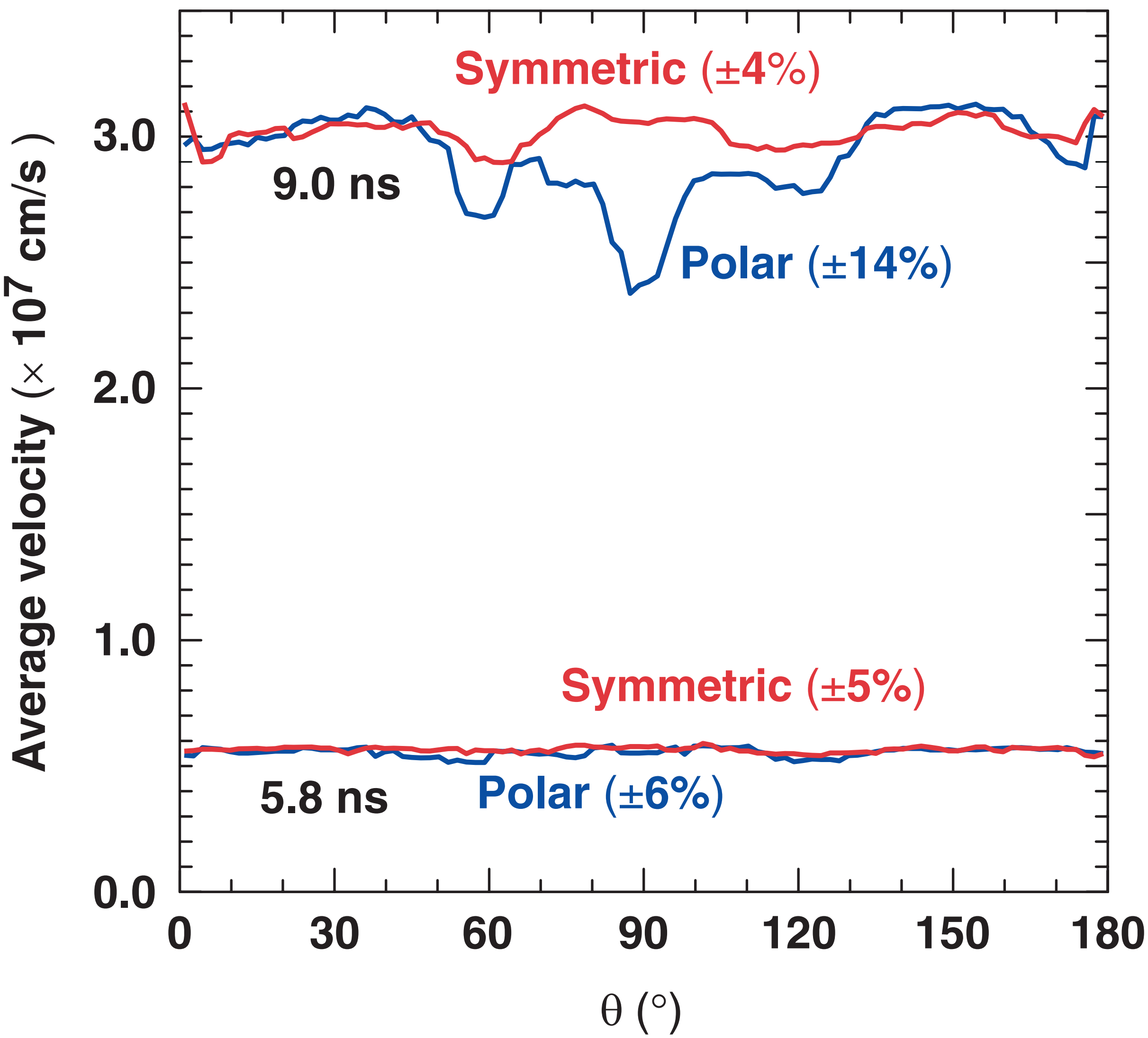
Runs 3448, 3450
TC6188

At 9 ns, the center-of-mass radius of accelerated DT is less uniform for the polar design



Runs 3448, 3450
TC6189

At 9 ns, the average velocity of accelerated DT is less uniform for the polar design



RUNS 3448, 3450
TC6190

Summary/Conclusion

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