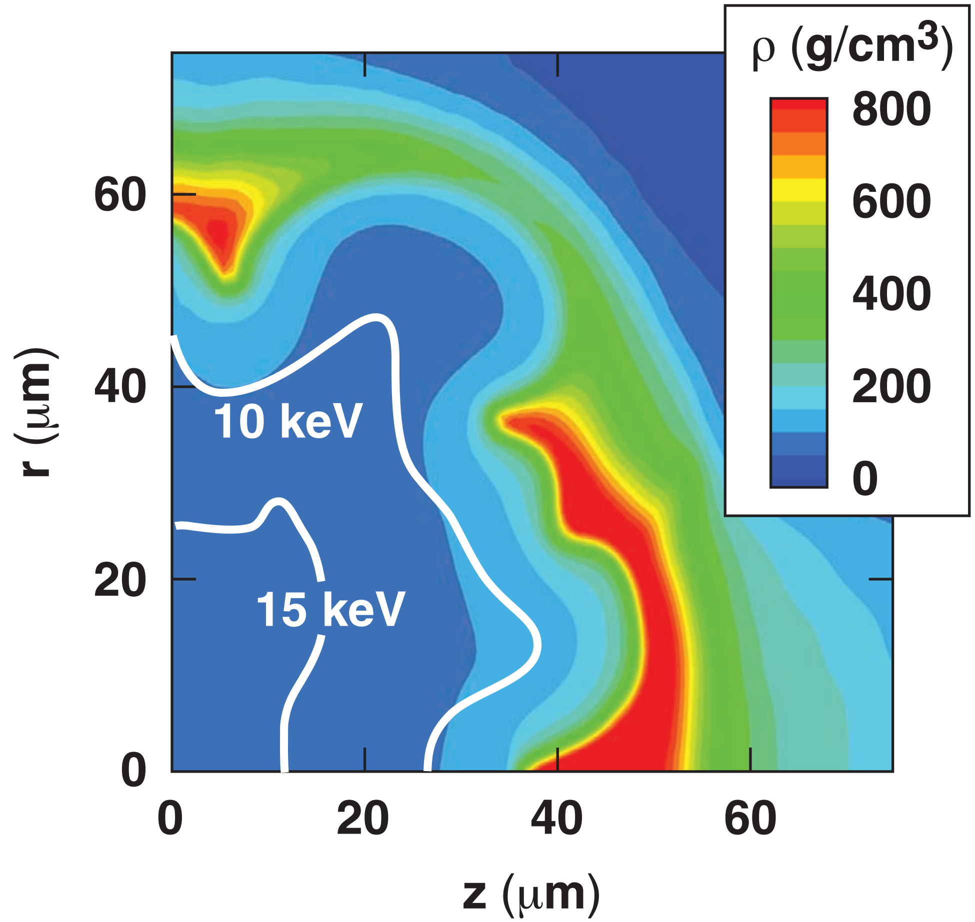
Polar Direct Drive—Ignition at 1 MJ



S. Skupsky *et al.*
University of Rochester
Laboratory for Laser Energetics

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Collaborators

R. S. Craxton, F. J. Marshall, R. Betti, T. J. B. Collins, R. Epstein,
V. N. Goncharov, I. V. Igumenschev, J. A. Marozas, P. W. McKenty,
P. B. Radha, D. D. Meyerhofer, T. C. Sangster, and R. L. McCrory

University of Rochester
Laboratory for Laser Energetics

J. D. Kilkenny

General Atomics
San Diego, CA

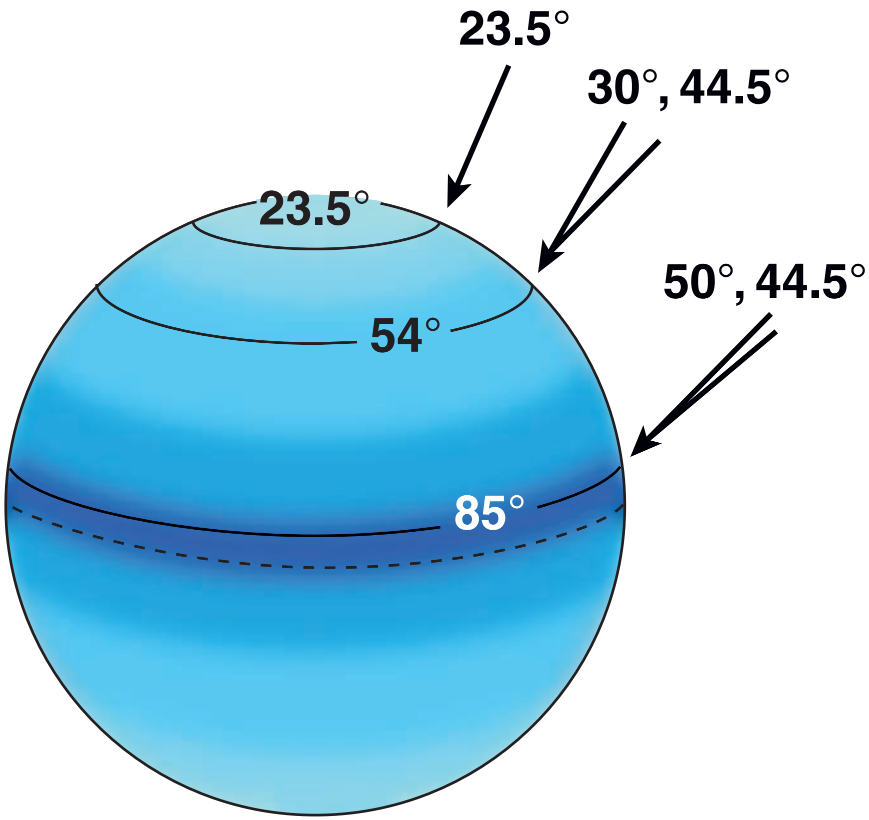
Summary

PDD simulations at 1 MJ show ignition with moderate target gain over a range of laser conditions

UR LLE

- The PDD design can tolerate modest variations in beam pointing and pulse shape
  - beam pointing (±20 μm)
  - pulse foot (±100 ps)
  - peak power (±5%)
  - ratio of peak power between pole and equator (±5%)
- PDD might benefit by “shimming” the ice layer to make the equator thinner than the pole

PDD enables direct-drive ignition experiments while the NIF is in the x-ray-drive configuration

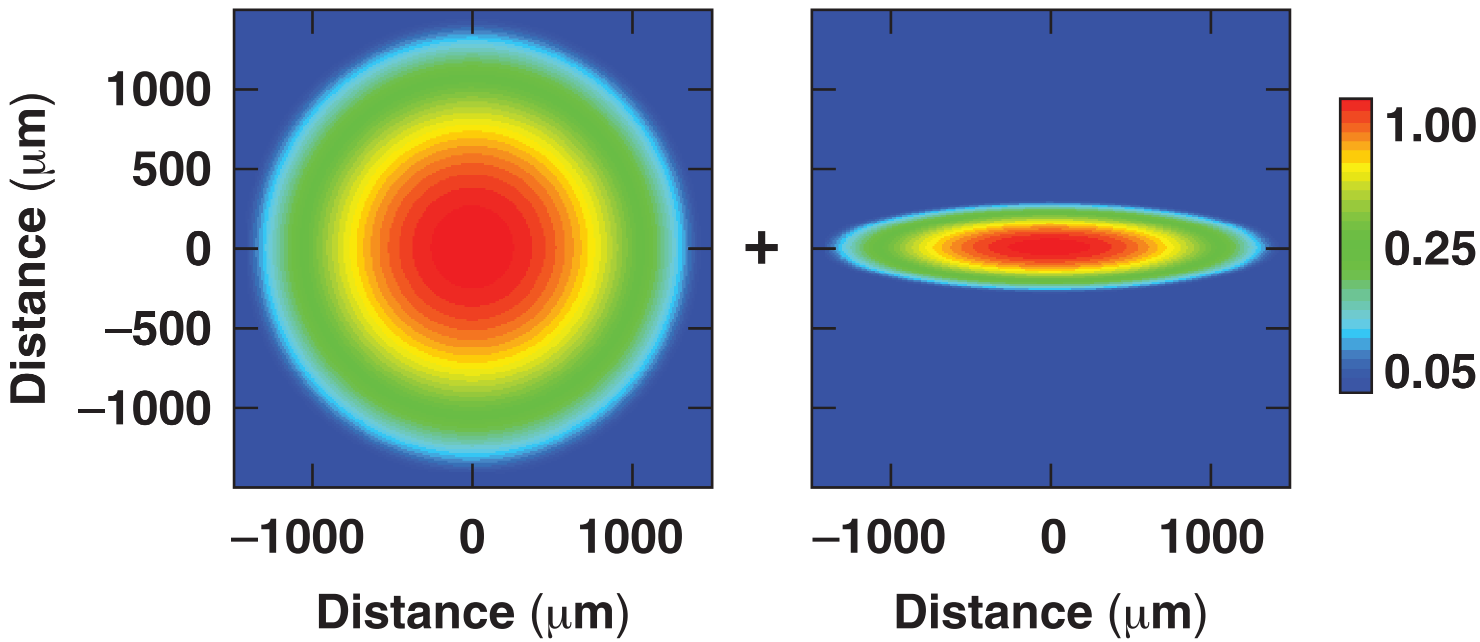


- Laser intensity at the equator must be increased to compensate for reduced absorption and reduced hydro efficiency from oblique irradiation

The required intensity variations on target can be achieved through a combination of spot shape, pulse shape, and beam pointing control.

The "equatorial" beam spot shapes use a superposition of circular and elliptical spots to achieve good mid-latitude uniformity and high equatorial intensity

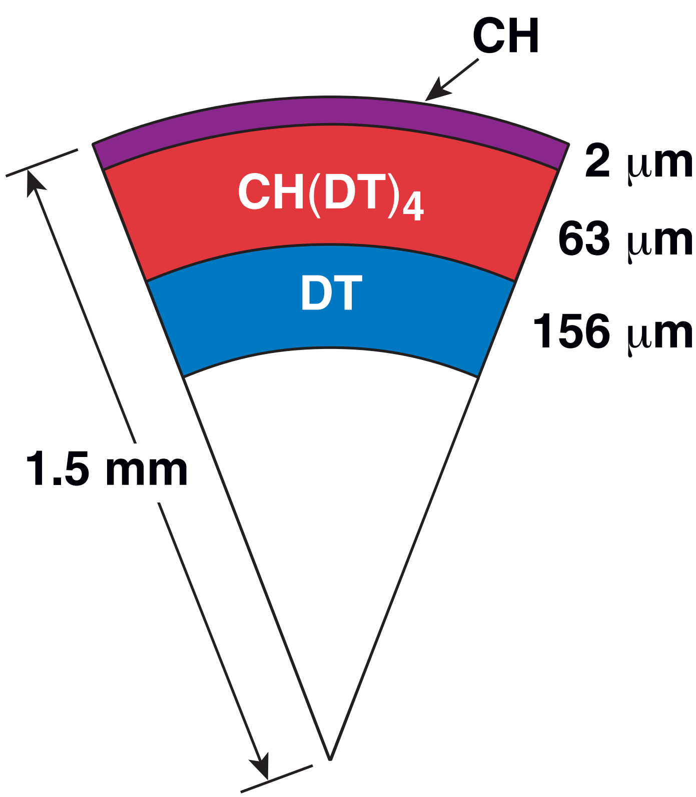
- **Beam profile = 0.7 × circle + 0.3 × ellipse.**

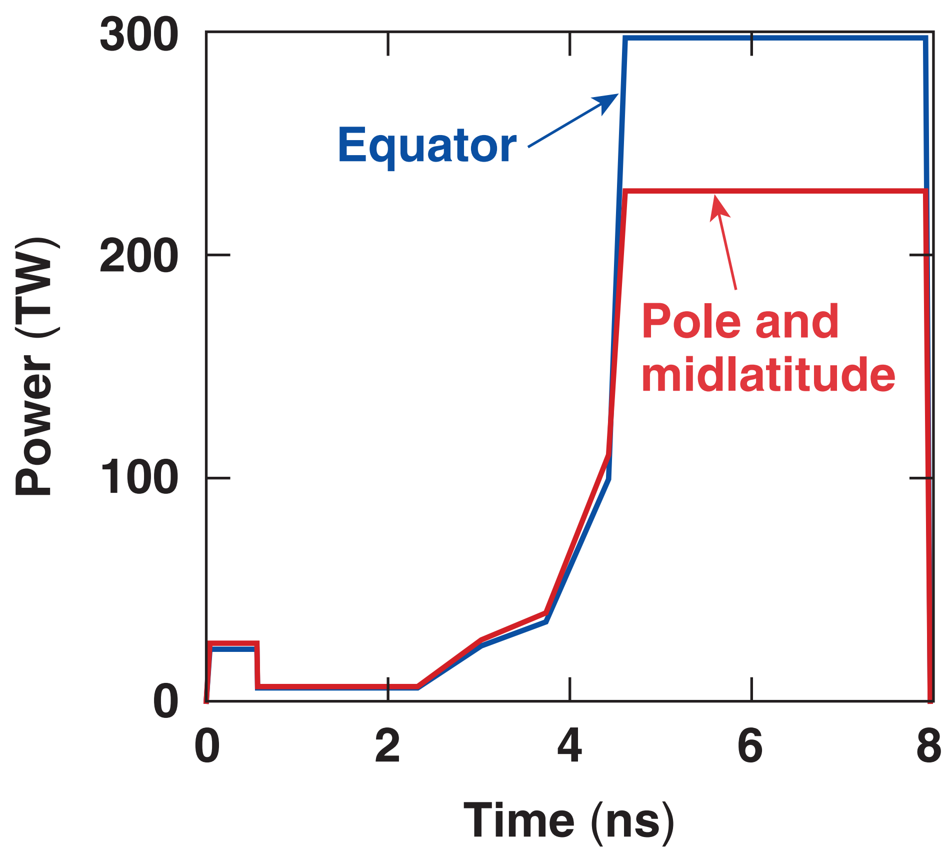


"Polar" and "mid-latitude" spots have the same shape as the circular part of the "equatorial" beam.

TC7079

Power in the equatorial pulse is increased by 30% at the peak to compensate for reduced laser coupling at the higher angle in incidence





TC7061

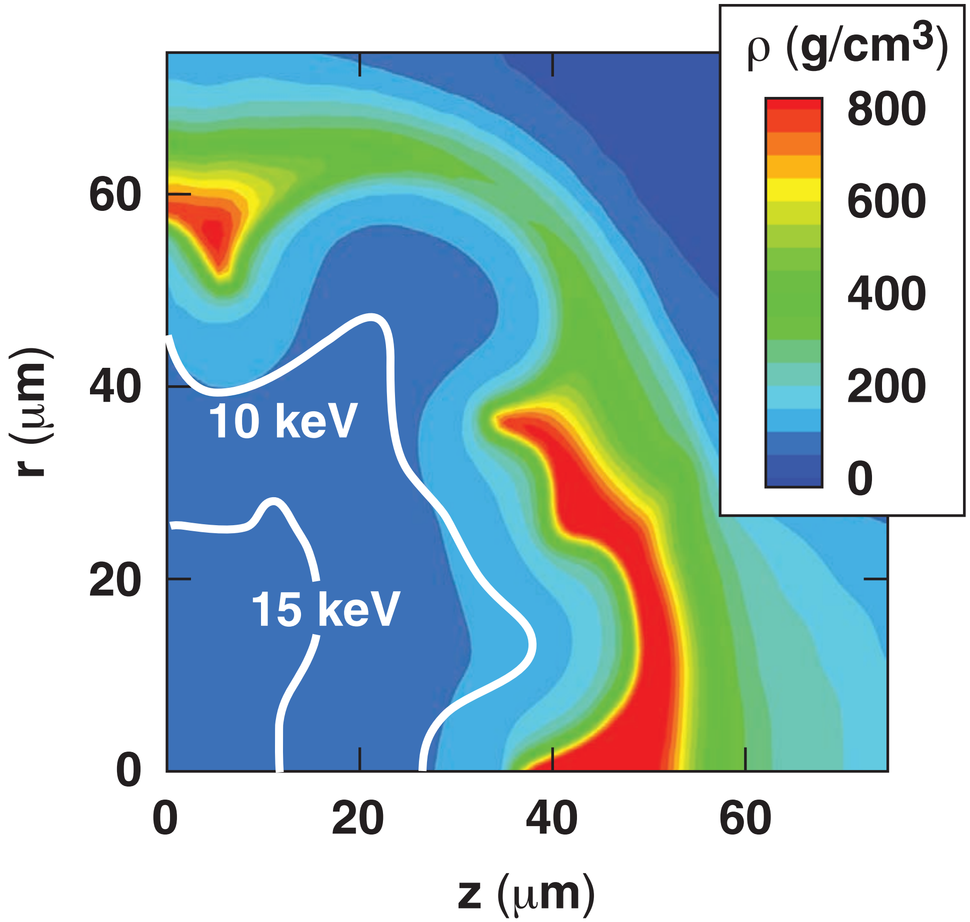
PDD simulations show near 1-D target gain

	Direct-drive ports	X-ray drive ports
Incident laser (MJ)	0.9	1.0
Absorbed energy (MJ)	0.74	0.77
Absorption fraction	0.82	0.77
Adiabat	2.5 to 3.0	—
Implosion velocity (cm/s)	4.5×10^7	$\sim 4.5 \times 10^7$
Peak ρR (g/cm^2)	1.2	—
Target gain	44	35

TC7058

PDD simulations show gain = 35 at 1 MJ

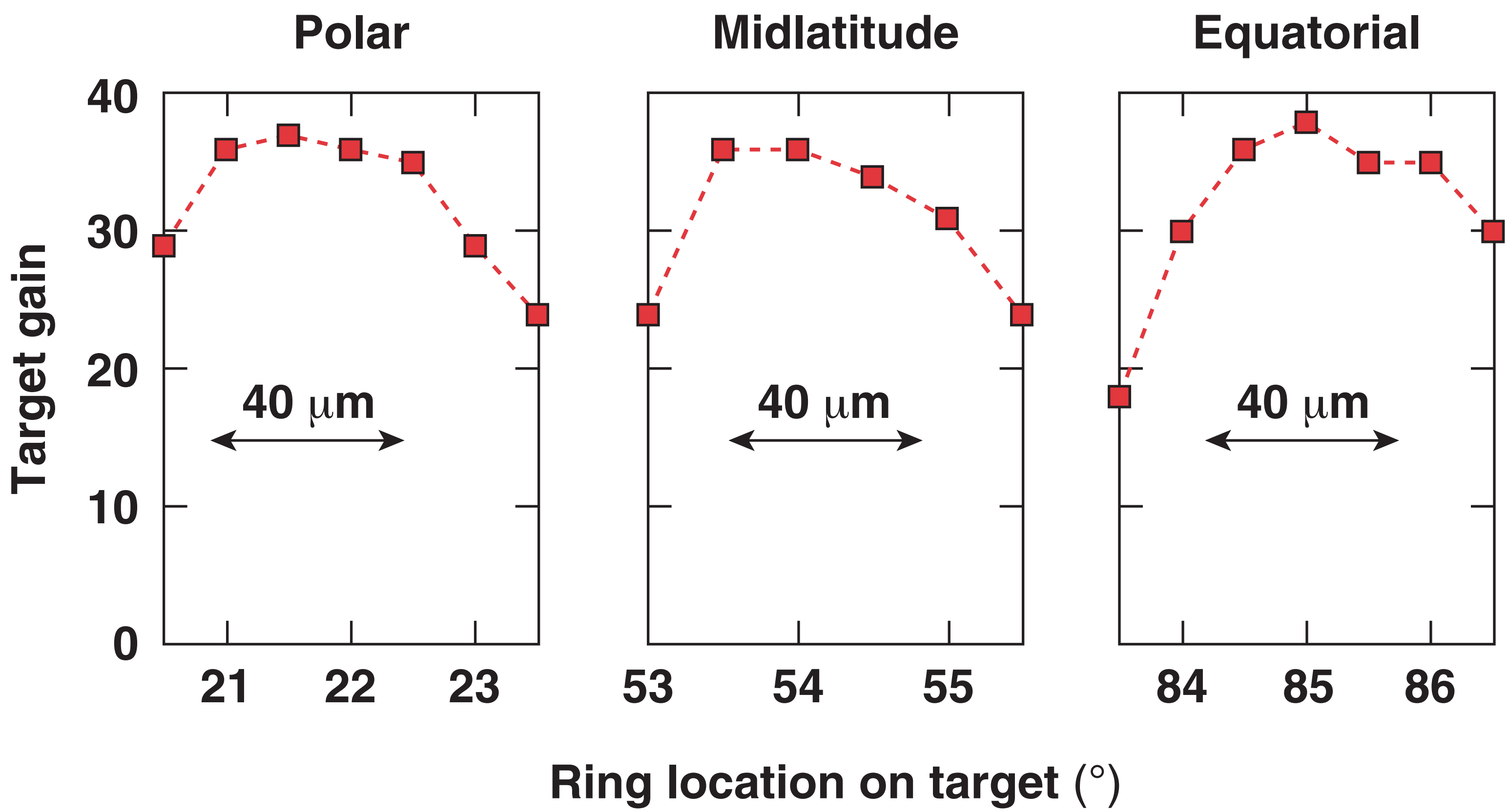
Near peak compression (8.5 ns)



- Smooth laser beams used. Simulations with single-beam nonuniformity in preparation.

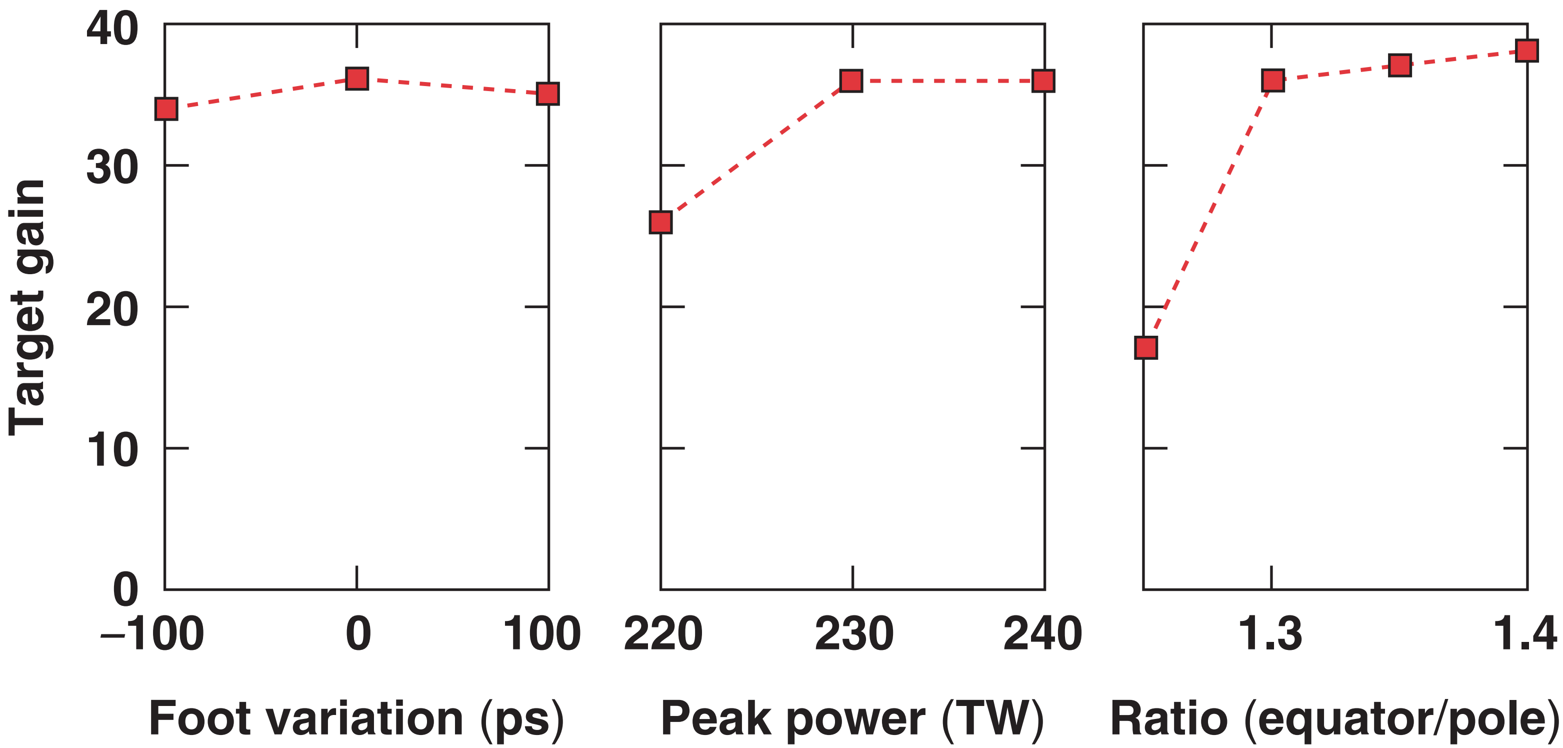
TC7059

High performance is achieved over a wide range of pointing conditions for the three illumination rings



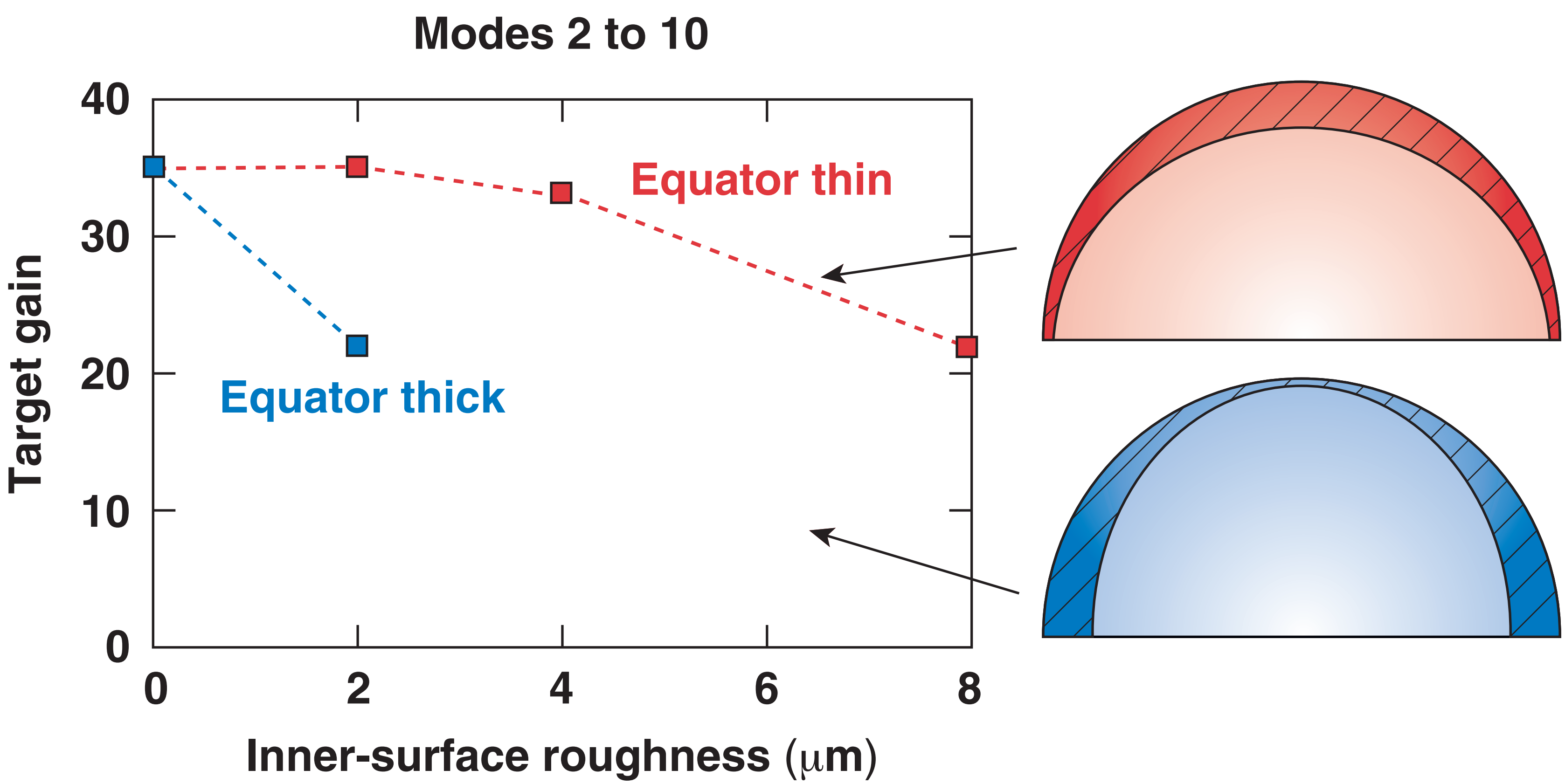
TC7060

High performance is obtained over a range of pulse conditions



TC7062

PDD performance depends on the phase of the inner-surface roughness



PDD might benefit by "shimming" the ice layer.

TC7063

Summary/Conclusions

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