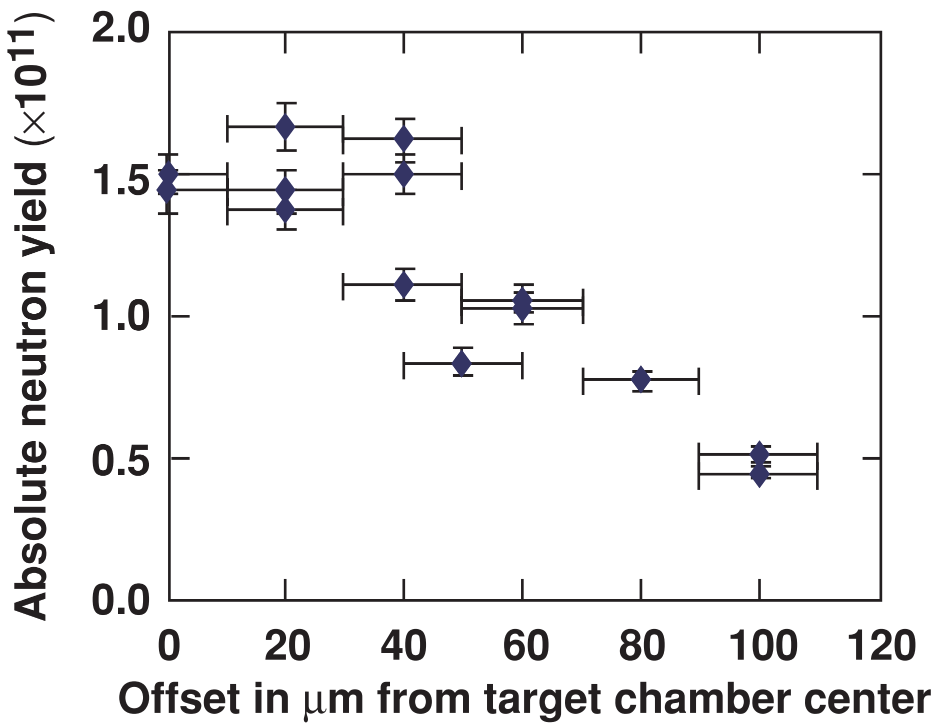
# Numerical Investigation into the Sensitivity of OMEGA Cryogenic Capsule Implosions to Low-Order-Mode Ice Perturbations





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Summary

# Additional experiments are required to determine the ice smoothness at which laser nonuniformities dominate current $\alpha \sim 25$ cryogenic implosions

- Warm, plastic experiments have traditionally shown a consistent yield plateau at ~35% YOC for high-adiabat implosions.
- 2-D simulations of warm and cryogenic offset implosions verify target performance when large low-order asymmetries are present.
- Limited experimental results indicate that $\alpha \sim 25$ cryogenic implosions are more resilient to nominal levels of laser perturbations than similar warm implosions.
- Future work will include
  - additional high- and low-adiabat cryogenic implosions
  - sensitivity scans for laser mispointing and power imbalance
  - offset scans for warm low-adiabat implosions
  - deployment of new DPP's

# Collaborators

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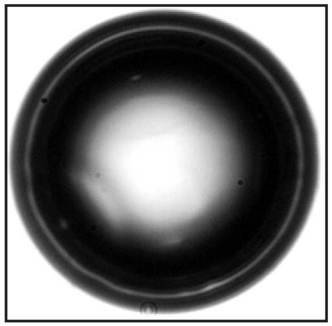
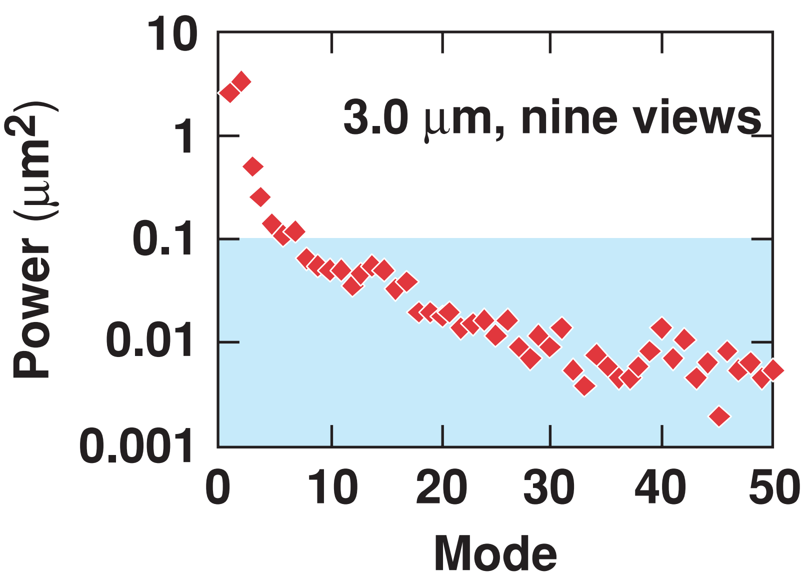
# Outline

- Cryogenic layering
- Warm target experiments
- Comparison of simulation with experiments
- Extension of experiments to cryogenic implosions

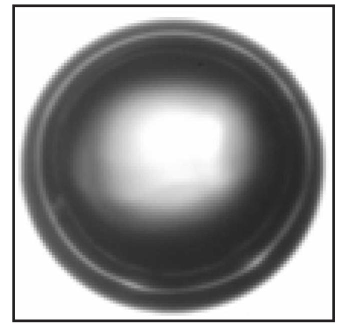
# Variability in the measured ice roughness, while correlated, did not seem to mimic overall performance

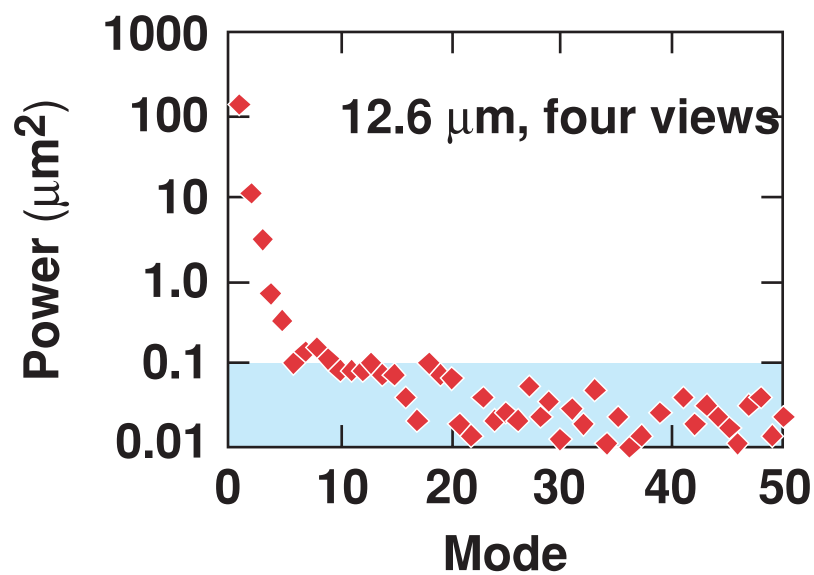
1 ns
31% YOC
Shot 26477





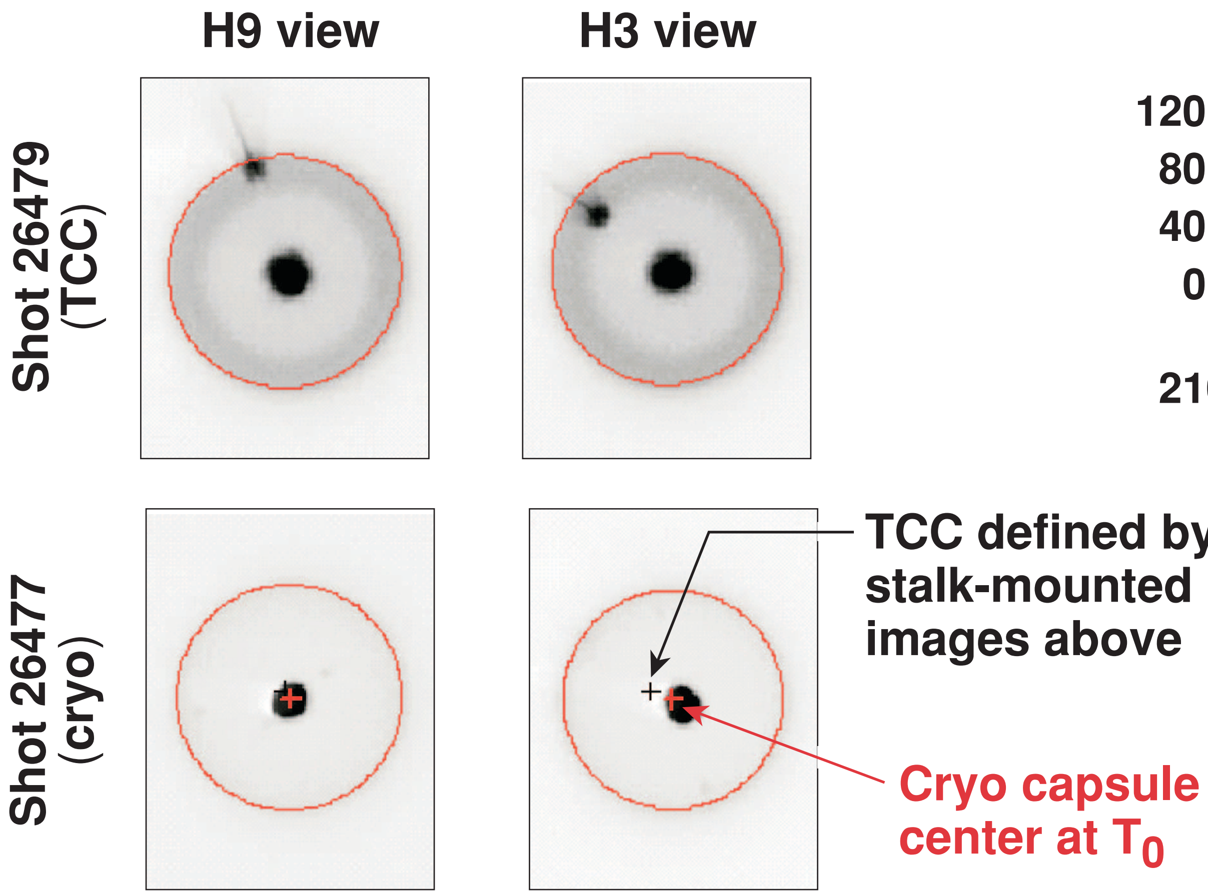

1 ns
25% YOC
Shot 26130

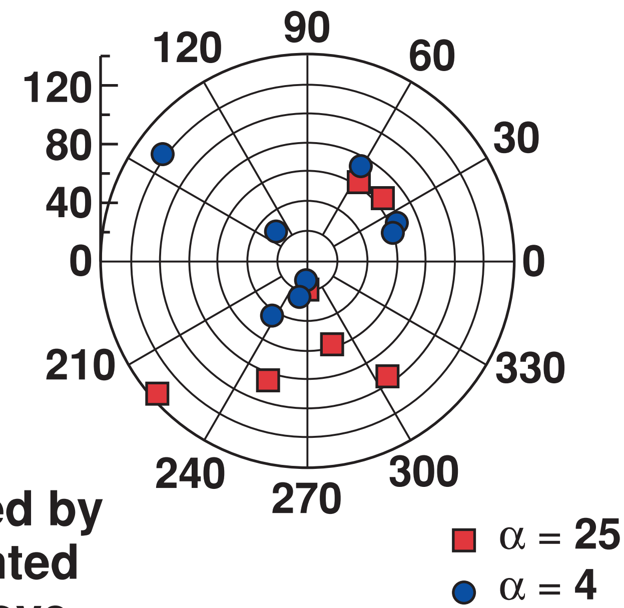





TC6104

# Careful analysis of XPHC images from same-day shots revealed a mispositioning of cryogenic targets




The offset is computed as the average of up to five XRPHC views on each shot, reducing the errors significantly.

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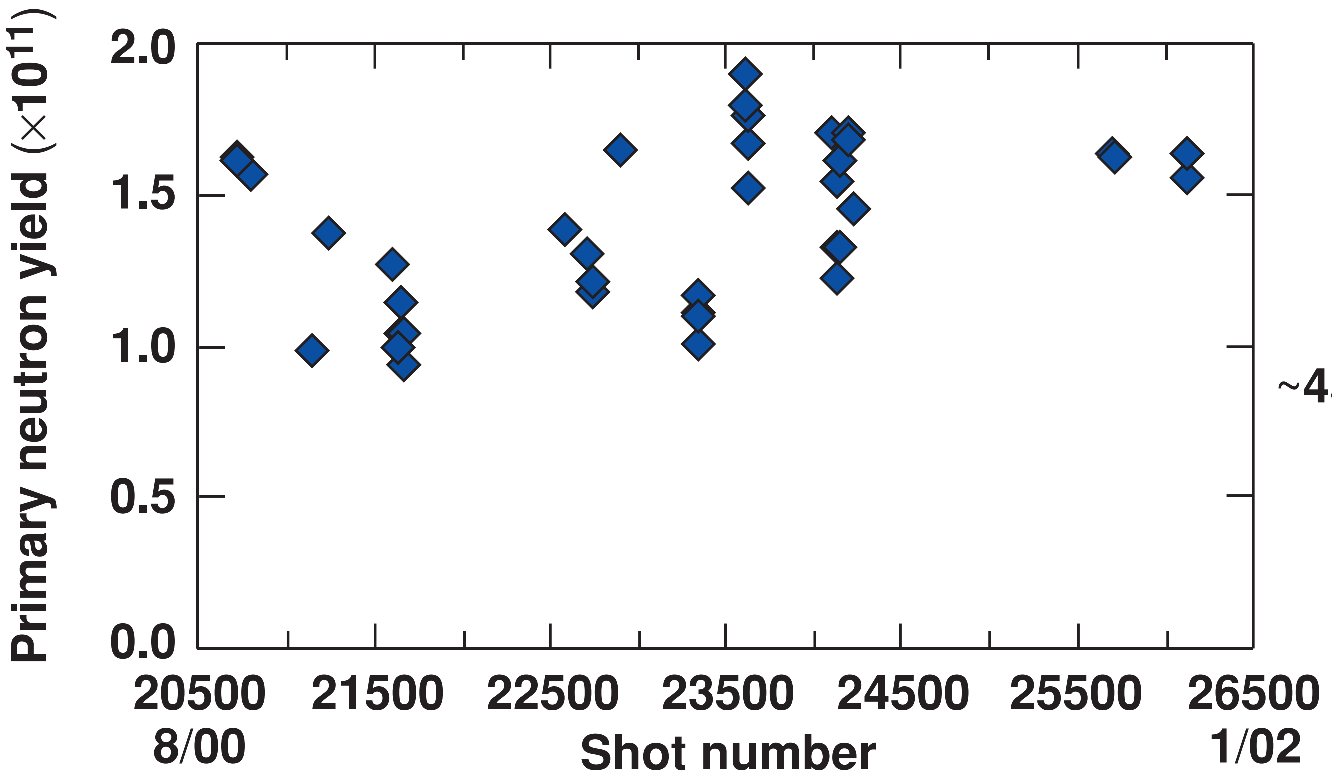
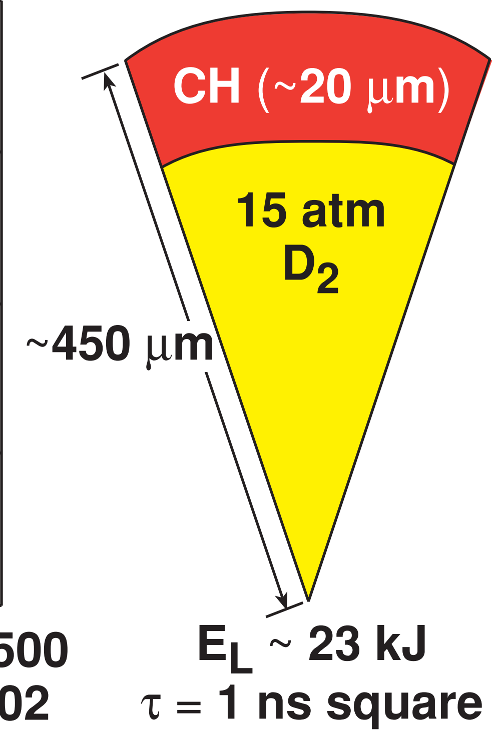
# Experiments on the OMEGA laser system are highly reproducible



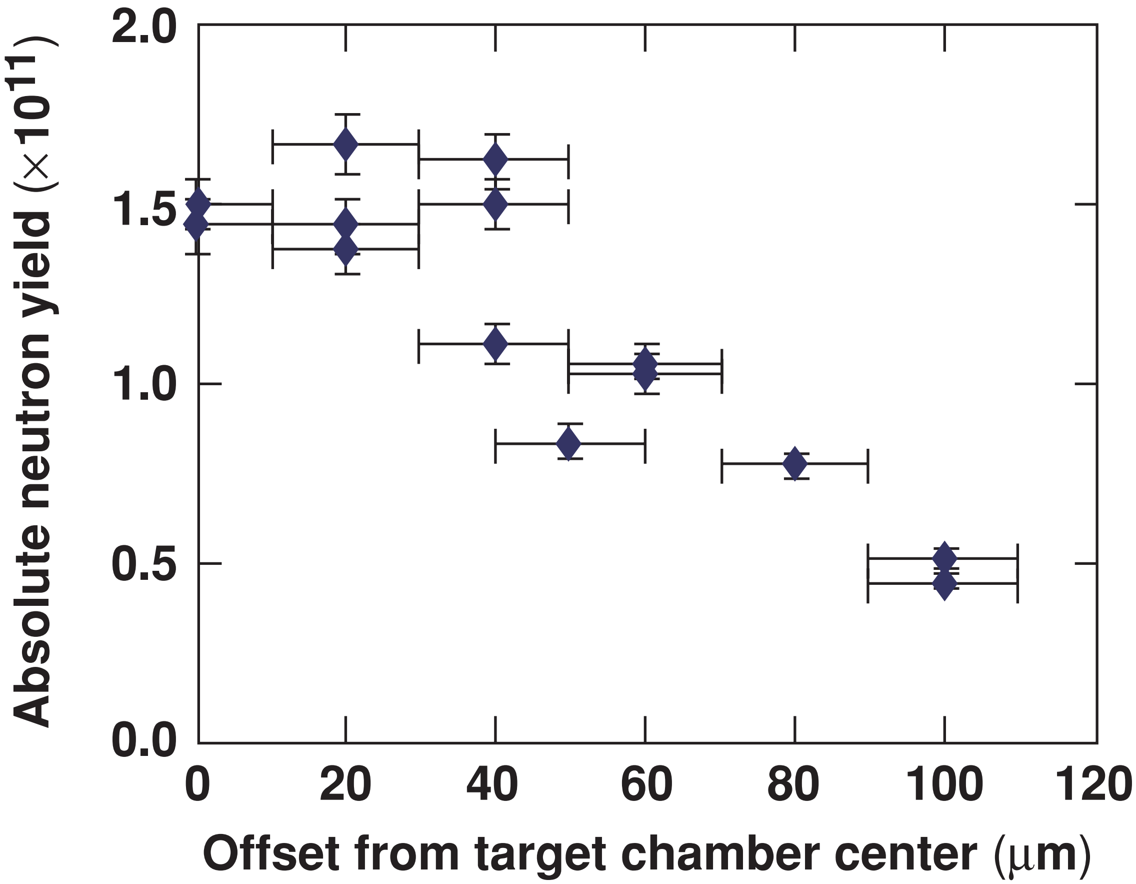

$\langle Y_n \rangle = 1.4 \pm 0.3 \times 10^{11}$ (19% spread)

$YOC = \langle Y_n / Y_{clean\ 1\text{-}D} \rangle = 28 \pm 5\%$ (17% spread)

E11519

# Experimental neutron results are a good indicator of target sensitivity if the variant perturbation dominates

UR LLE




E11827

# 2-D simulations reproduce the trend of the offset gas experiments below the experimental plateau

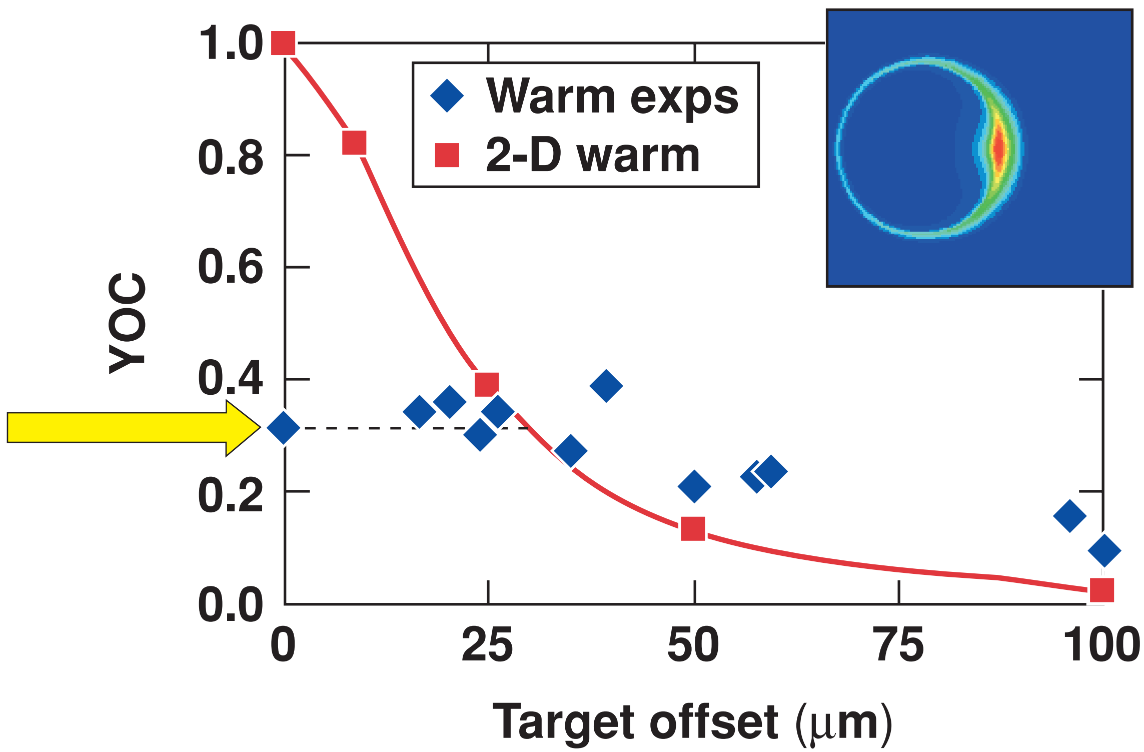
UR LLE

**Experimental plateau at 30 to 40% 1-D**

**Combination of small amounts**

- Power imbalance
- Beam mispointing
- Imprint

- Only offset perturbations modeled

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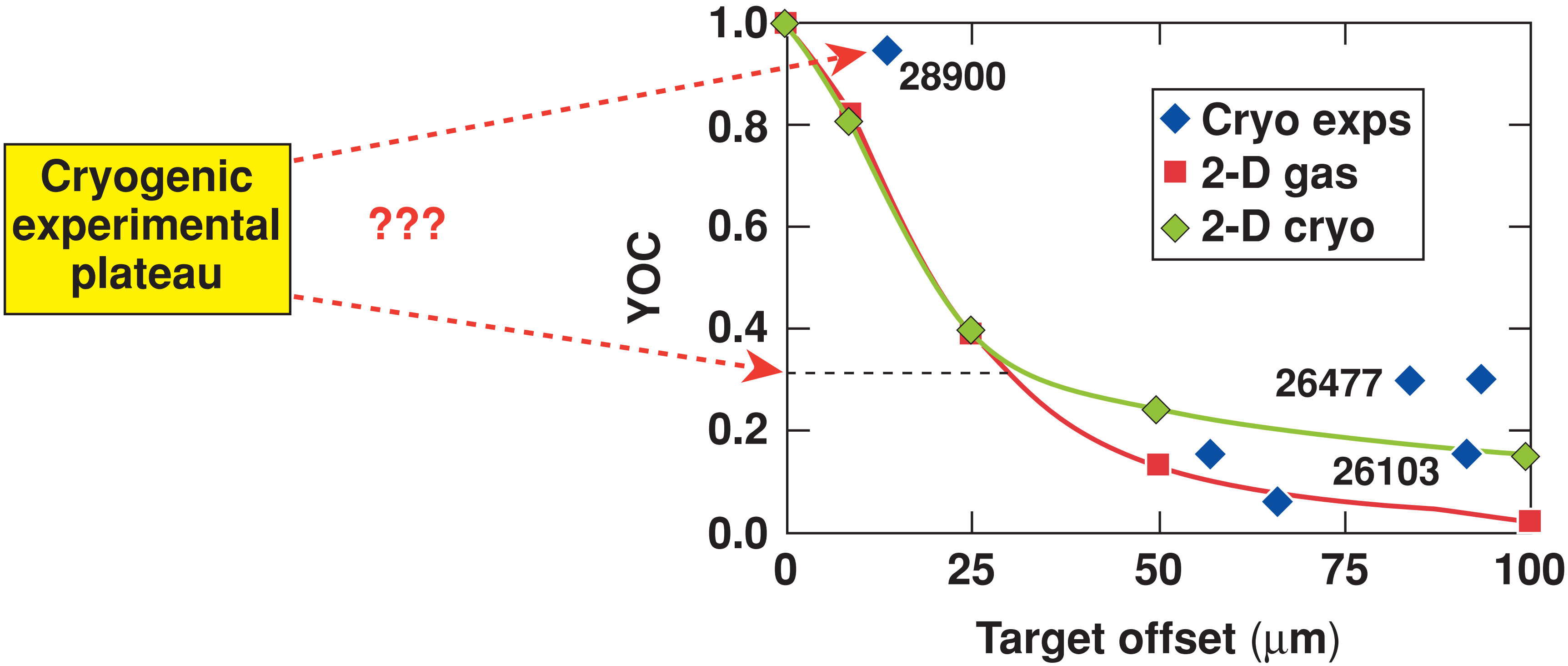
# Nonuniformities due to target offset help explain the discrepancy of similar YOC's for disparate ice roughness

- Only offset perturbations modeled




**Employ the warm plateau as a lower limit for performance scans of ice roughness.**

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# The nature of the low-order spectrum of the ice layer remains somewhat indiscriminate

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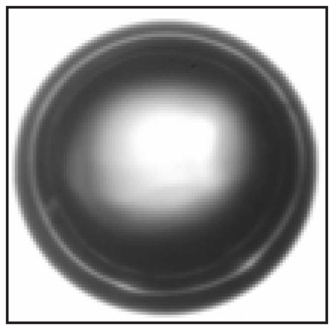
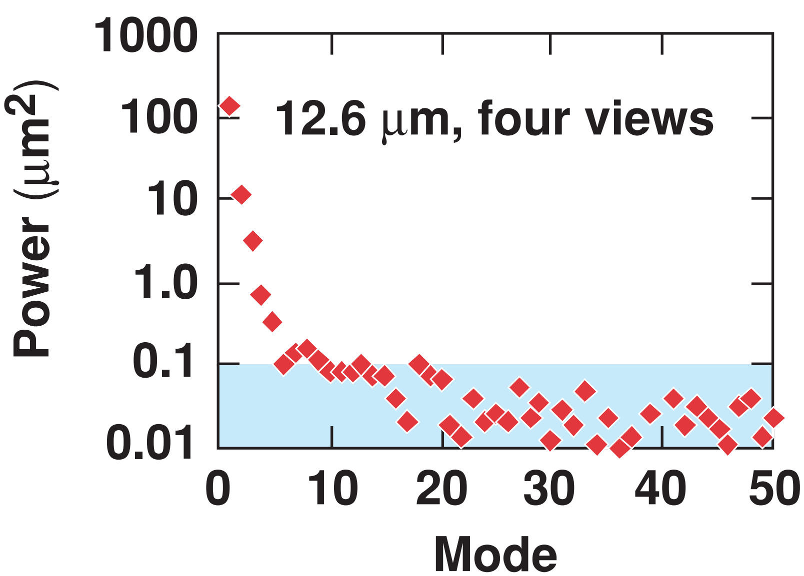
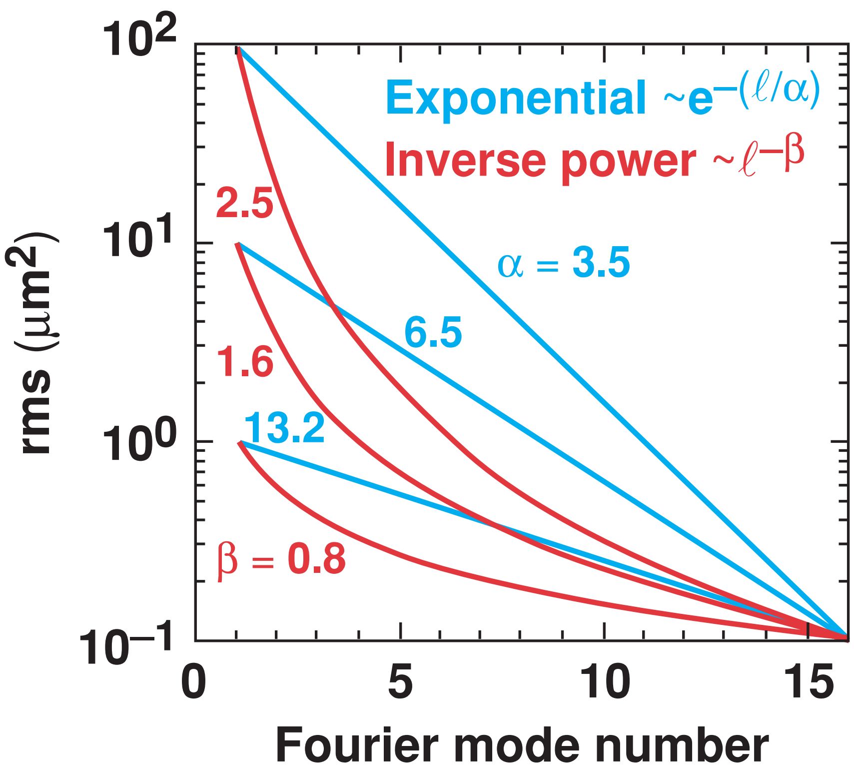
1 ns
25% YOC
Shot 26130

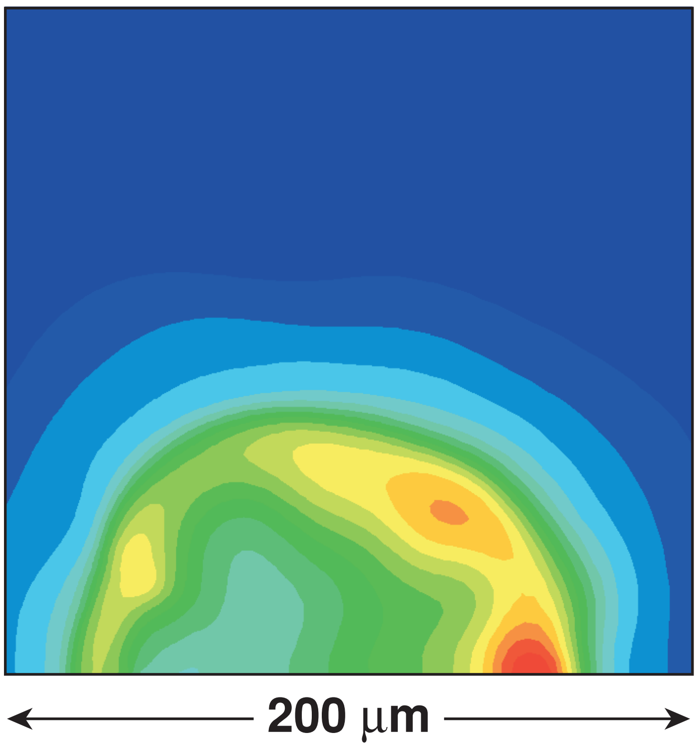




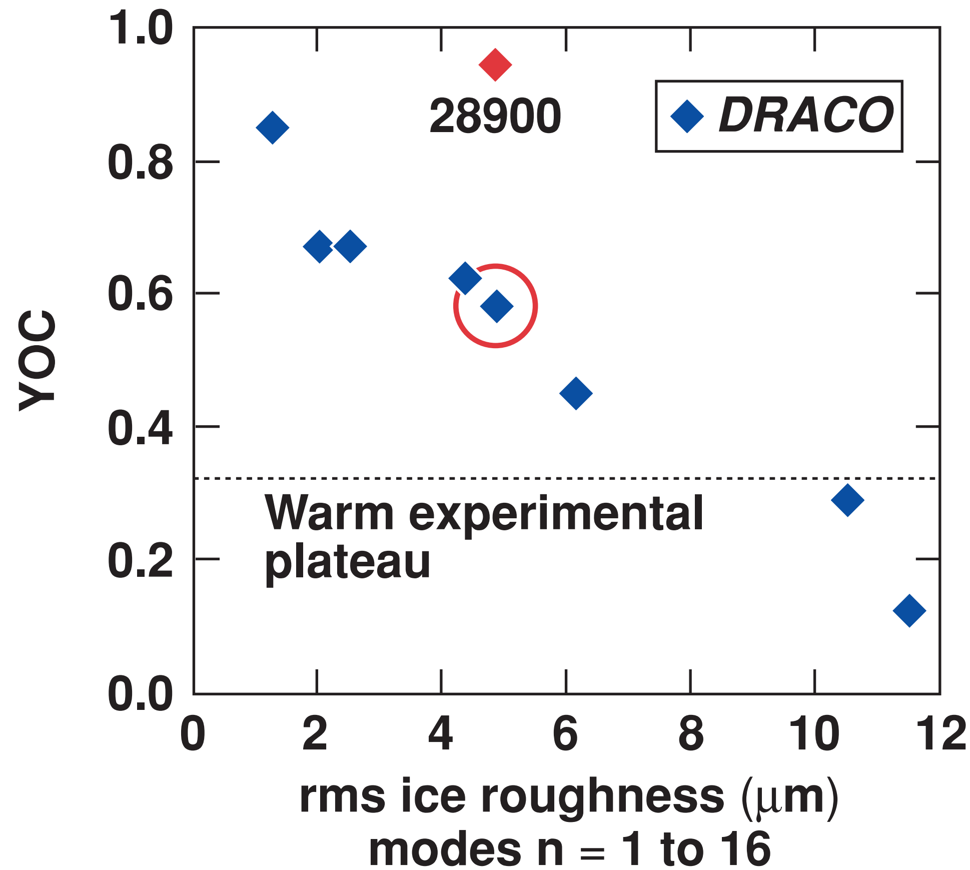



# Experimental results suggest an acceptable ice roughness of ~5 to 6 μm rms for current high-adiabat implosions

Shot 28900




- Only ice roughness modeled

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Summary/Conclusions

# Additional experiments are required to determine the ice smoothness at which laser nonuniformities dominate current $\alpha \sim 25$ cryogenic implosions

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