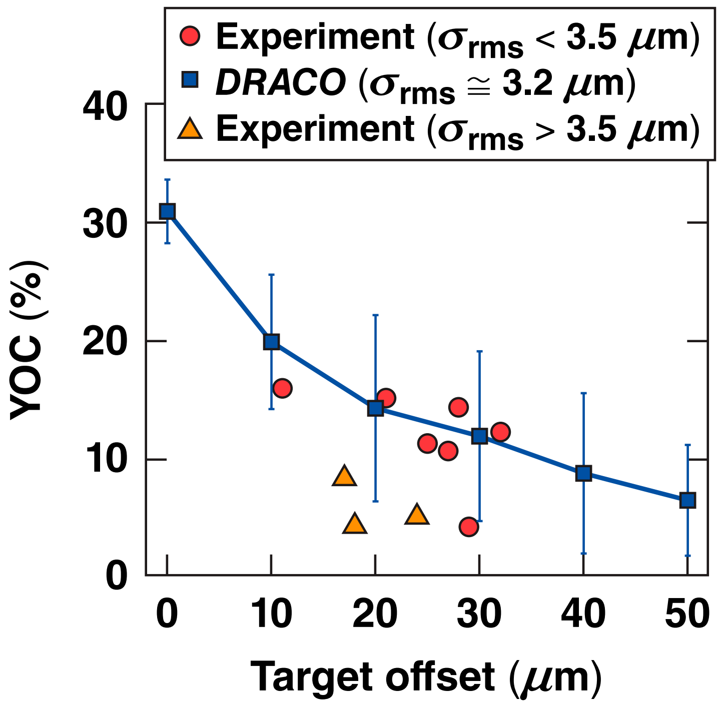
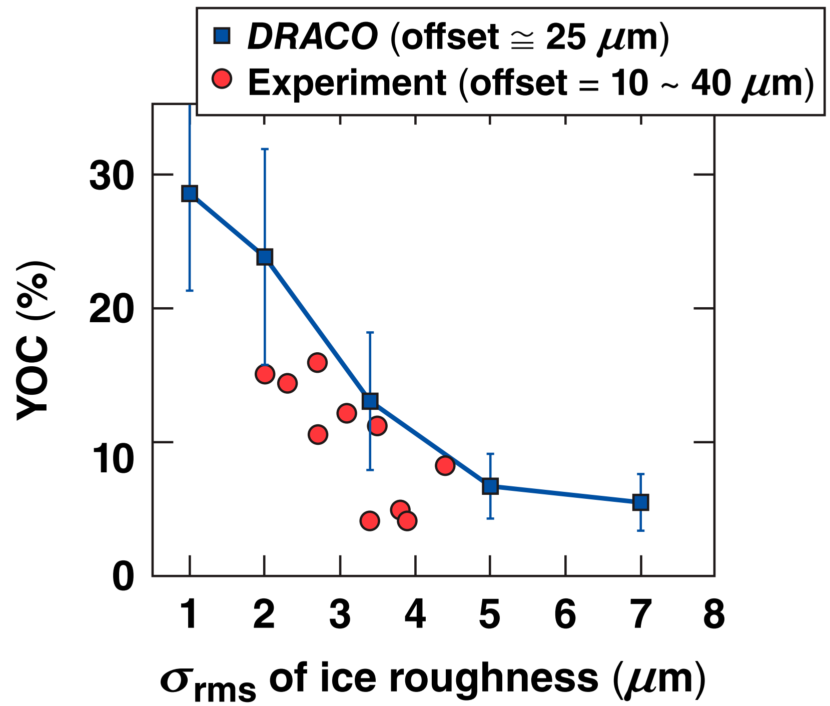
Two-Dimensional Investigation of Neutron-Yield Performance in Direct-Drive, Low-Adiabat, Cryogenic D_2 Implosions on OMEGA





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50th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Dallas, TX
17–21 November 2008

Summary

Trends in experimental neutron-yield degradation are reproduced in *DRACO* simulations of low-α, cryogenic D_2 implosions on OMEGA

- We have systematically investigated the neutron yield performance in direct-drive, low-adiabat, cryogenic D_2 implosions on OMEGA using two-dimensional, radiation-hydrodynamics code—*DRACO*.
- Our simulation results indicate that the low-mode perturbations (target offset and ice roughness) can generally explain the observed yield-over-clean (YOC) degradation in thin (~5-μm) CD-shell implosions.

TC8290

Collaborators

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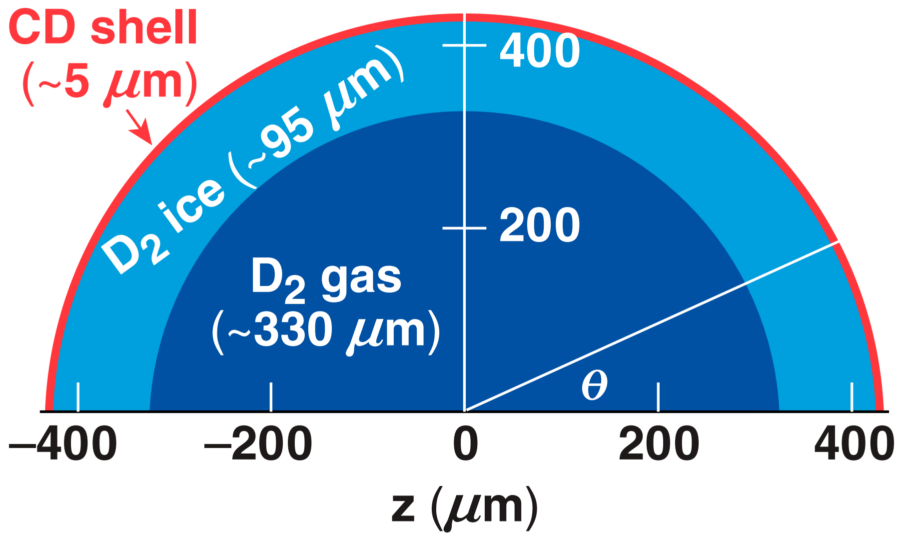
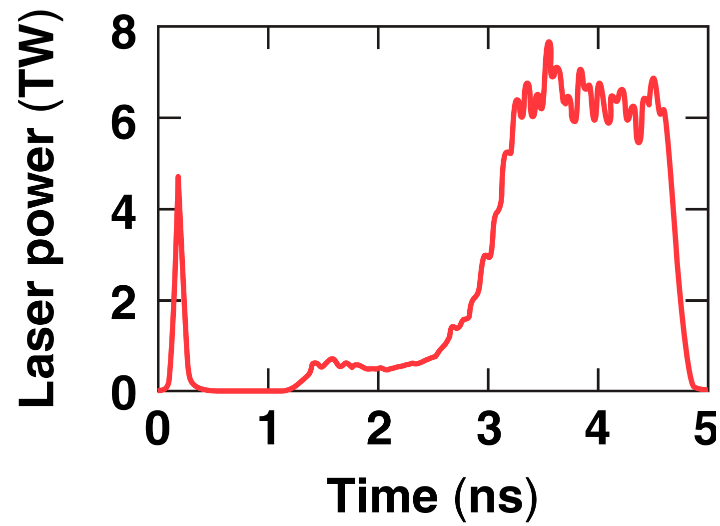
This study focuses on the neutron-yield performance of low-adiabat ($\alpha \approx 2 \sim 3$) cryogenic D_2 implosions

Typical targets imploded on OMEGA



A low-adiabat ($\alpha \approx$ 2 to 3) pulse shape



DRACO

- Full 3-D ray tracing
- 12 radiation groups (AOT)
- *SESAME* EOS
- f = 0.06 (flux limiter)

This target design is not sensitive to laser imprints. Low-mode perturbations (target-offset, ice roughness, and laser-power imbalance) effects on neutron yield will be examined.

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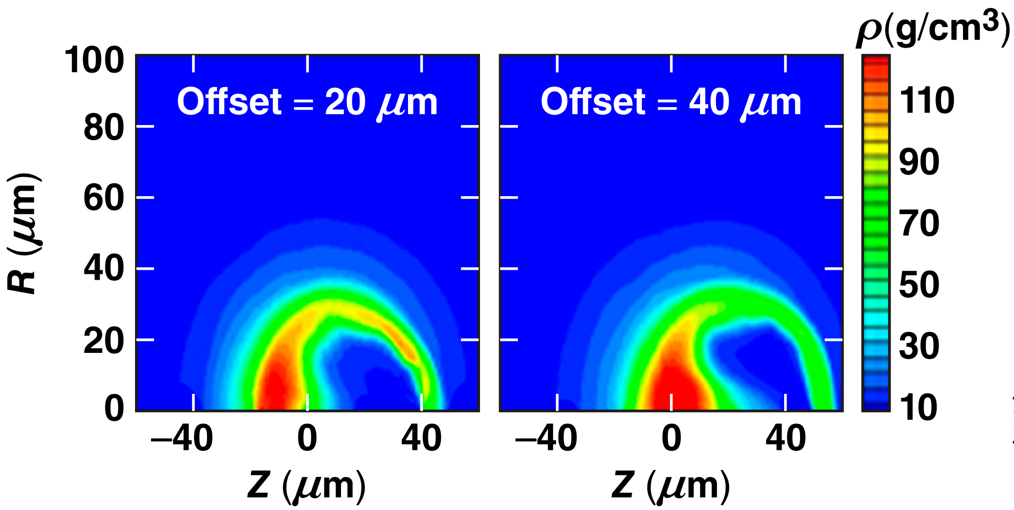
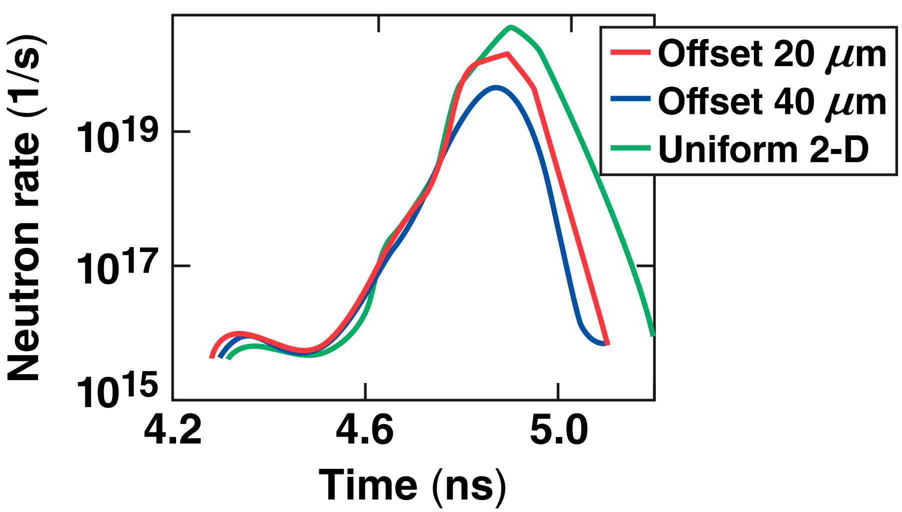
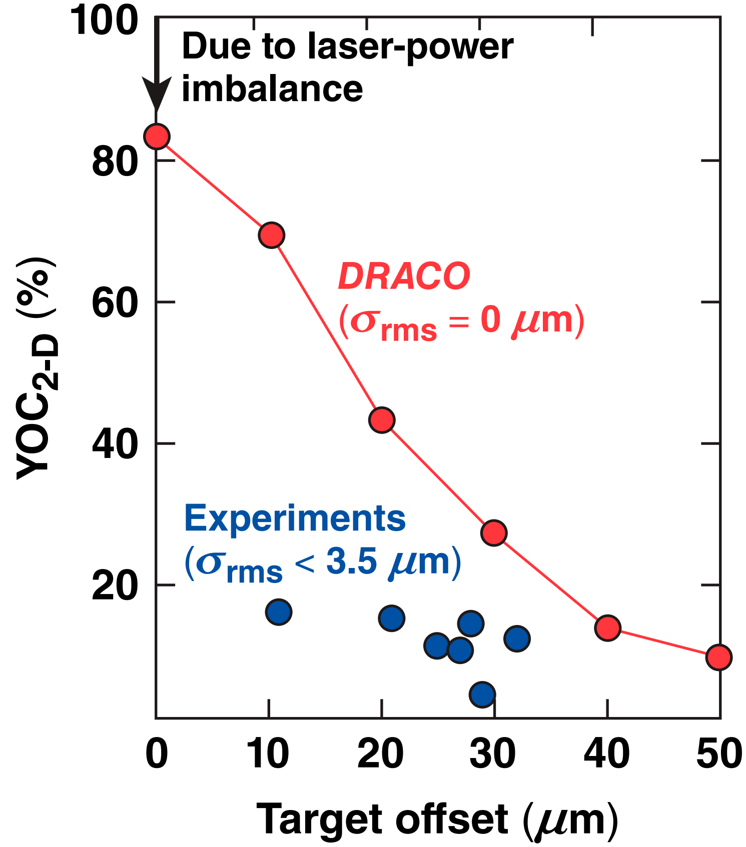
Target offset alone cannot fully account for the observed YOC degradation in experiments







- The target offset imposes a dominant $\ell = 1$ mode perturbation to a uniform (no ice roughness) target implosion

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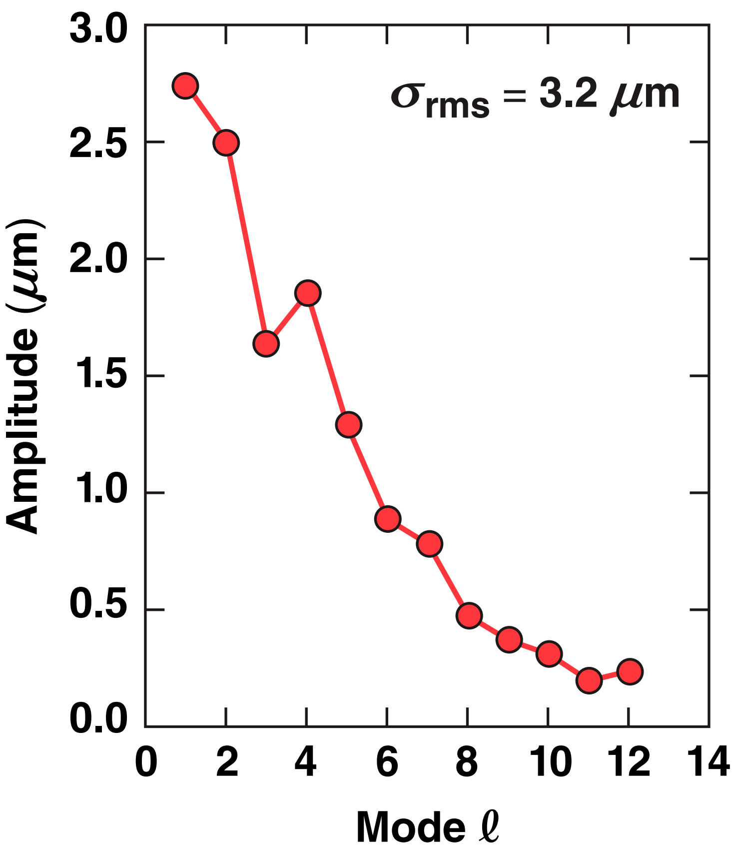
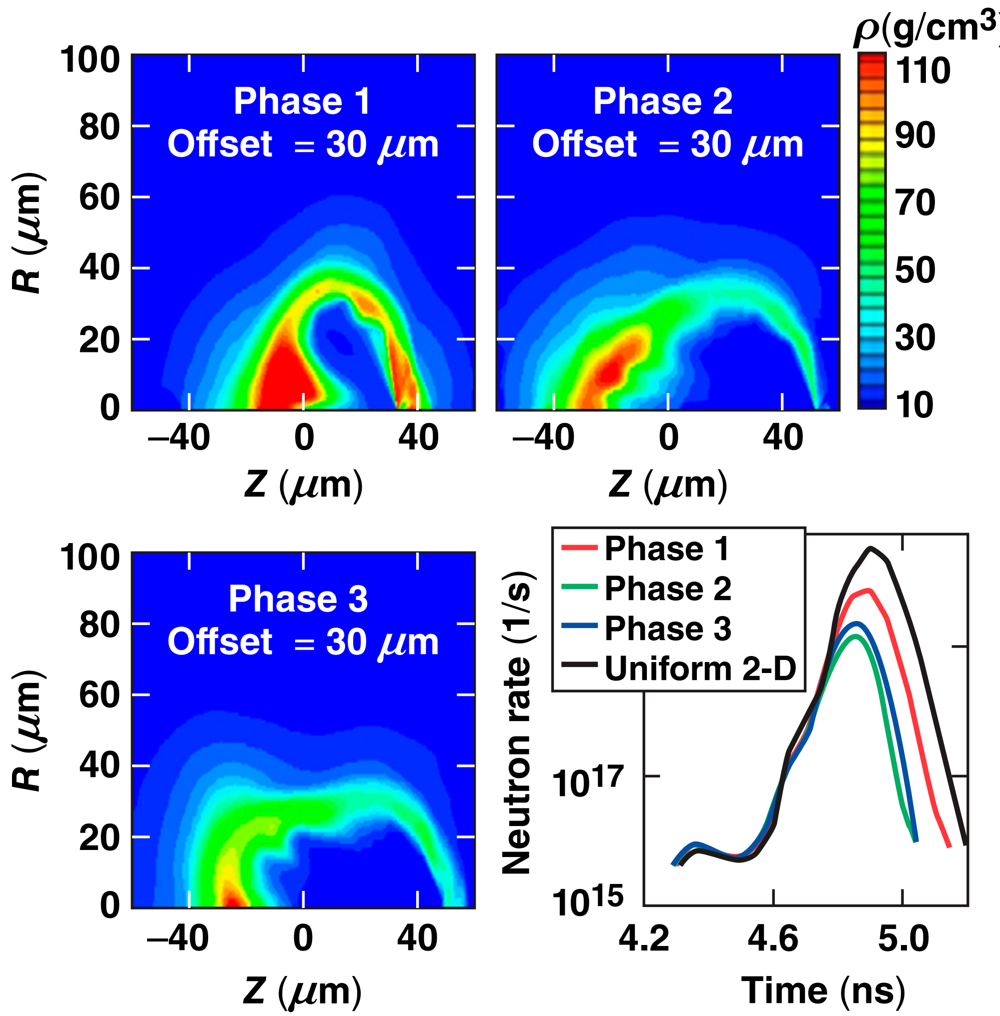
YOC is found to be sensitive to the phase between the target offset and the ice roughness





$$\Delta R(\theta) = \Delta R_0 + \Sigma \pm A_\ell \times \cos(\ell\theta)$$

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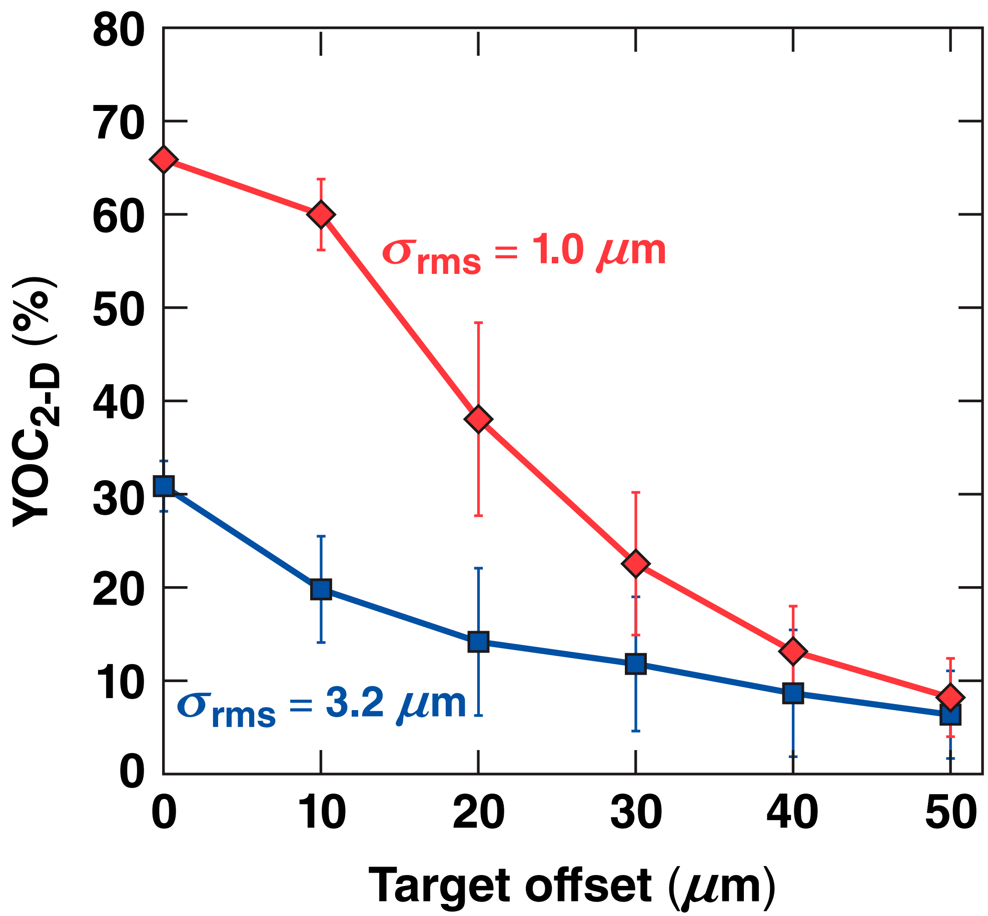
The combined target offset and low-mode ice roughness are the main causes of YOC degradation



The YOC range at each target offset has been obtained by averaging different explored rms phases.

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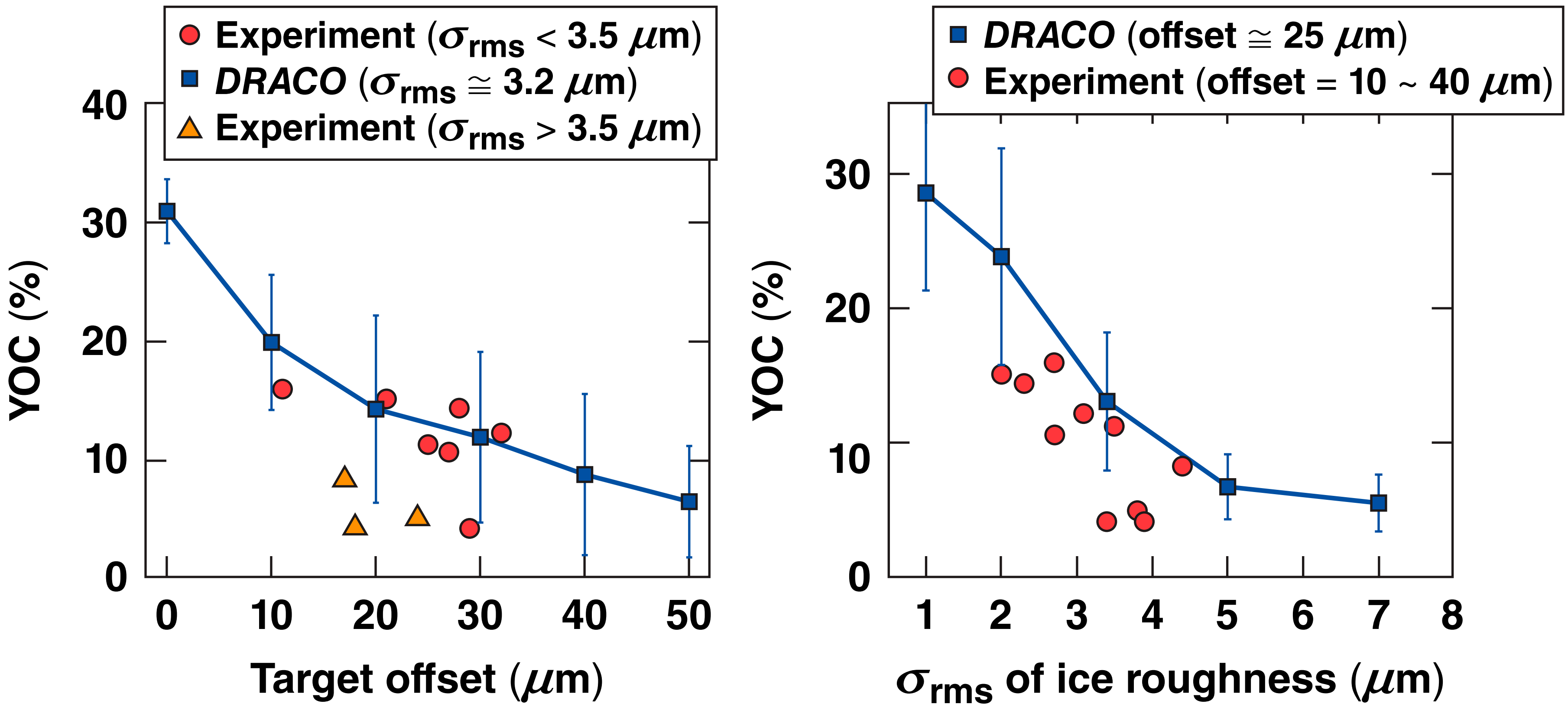
Compared to experiments, our simulation results reproduce the trends in the observed YOC degradation



<u>Experimental shots (1.8 < α < 3.0)</u>

- I = 2.5 ~ 6 $\times$ 10^{14} W/cm^2
- $\langle \rho R \rangle_{exp} / \langle \rho R \rangle_{1\text{-}D} \geq 60\%$
- $\langle \rho R \rangle_{exp} \gtrsim$ 100 mg/cm^2

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Summary/Conclusions

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