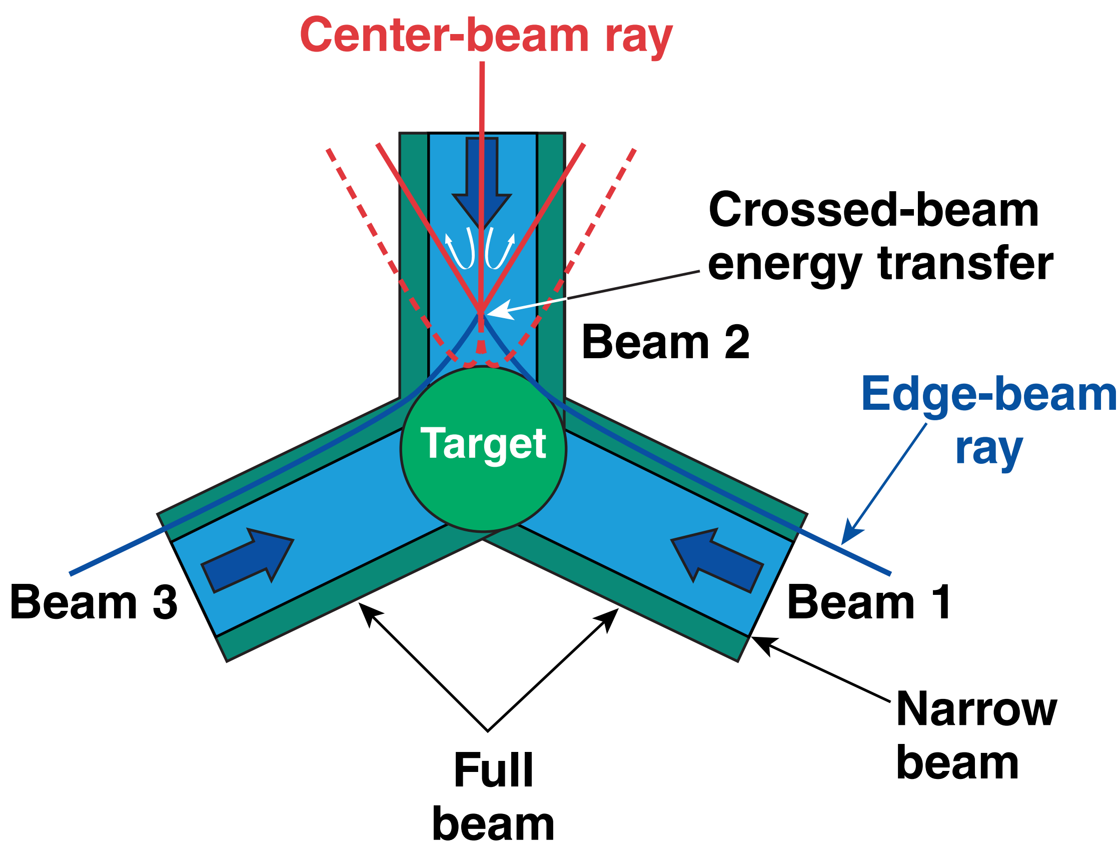
Numerical Evaluation of Subtangential Focusing in OMEGA Target Implosions



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Summary

Direct-drive phase plates require precise design to achieve the necessary imprint and laser–plasma interaction (LPI) mitigation

- Subtangential focusing leads to higher laser absorption
- Hydrodynamic instabilities are enhanced by reduced target illumination uniformity
- Bifocal phase plates are being examined to evaluate their applicability to OMEGA and NIF experimental platforms

Collaborators

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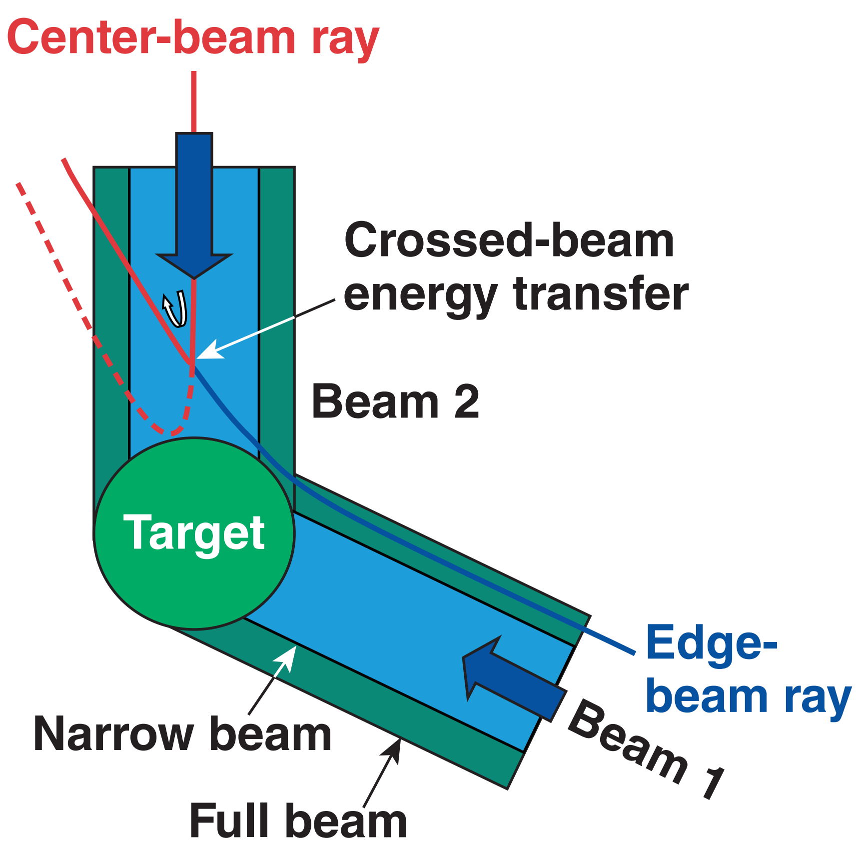
Laser absorption can be increased by implementing subtangential focusing



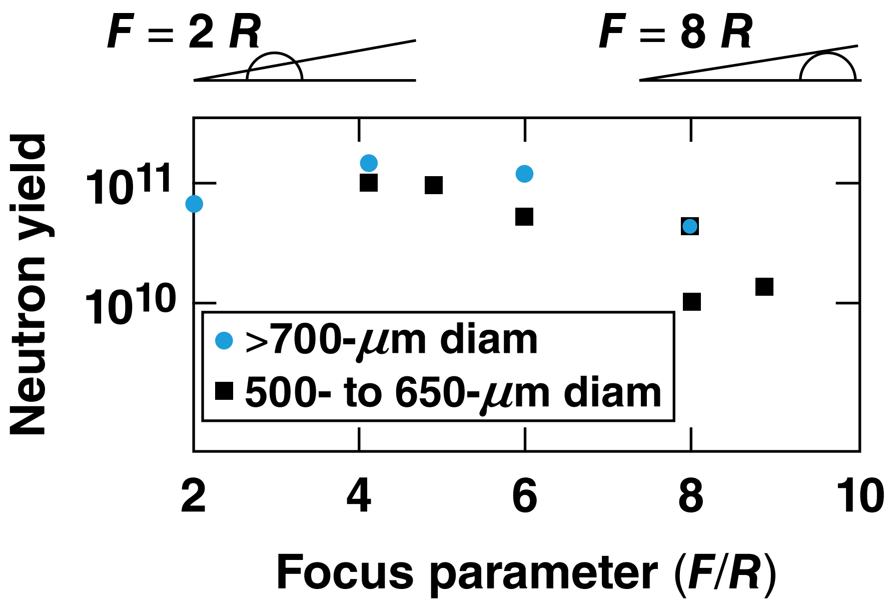
Positives

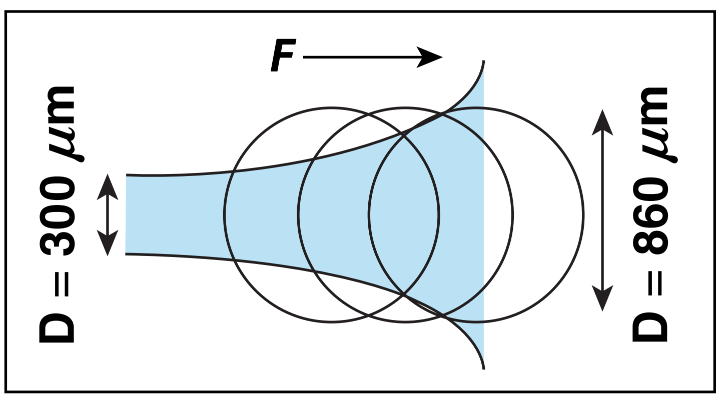
- Decreased refraction
- Reduced crossed-beam energy transfer

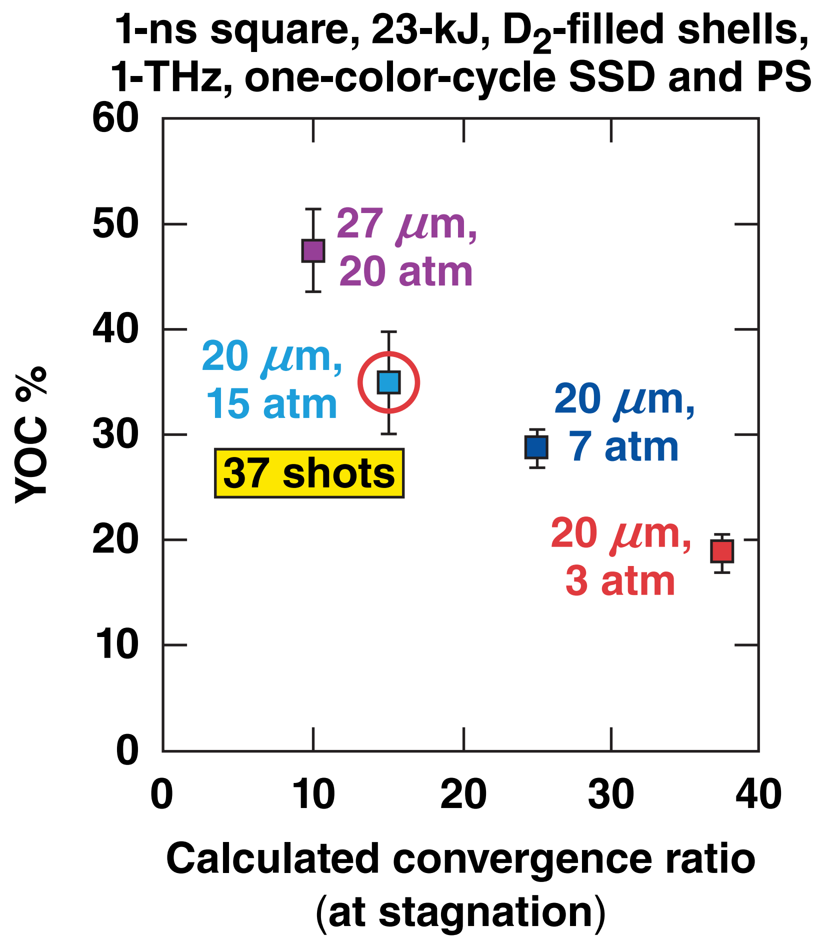
Negatives

- Enhanced overlap nonuniformity
- Reduced imprint smoothing

Subtangential-focus experiments are drawn from previous OMEGA capsule implosions

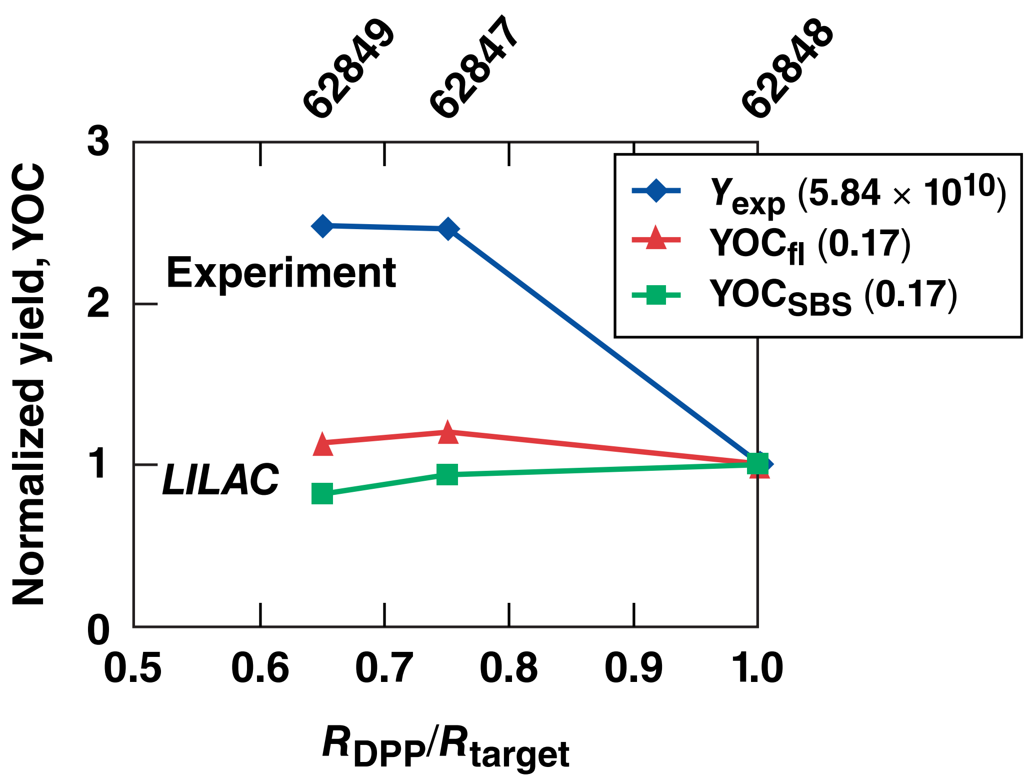


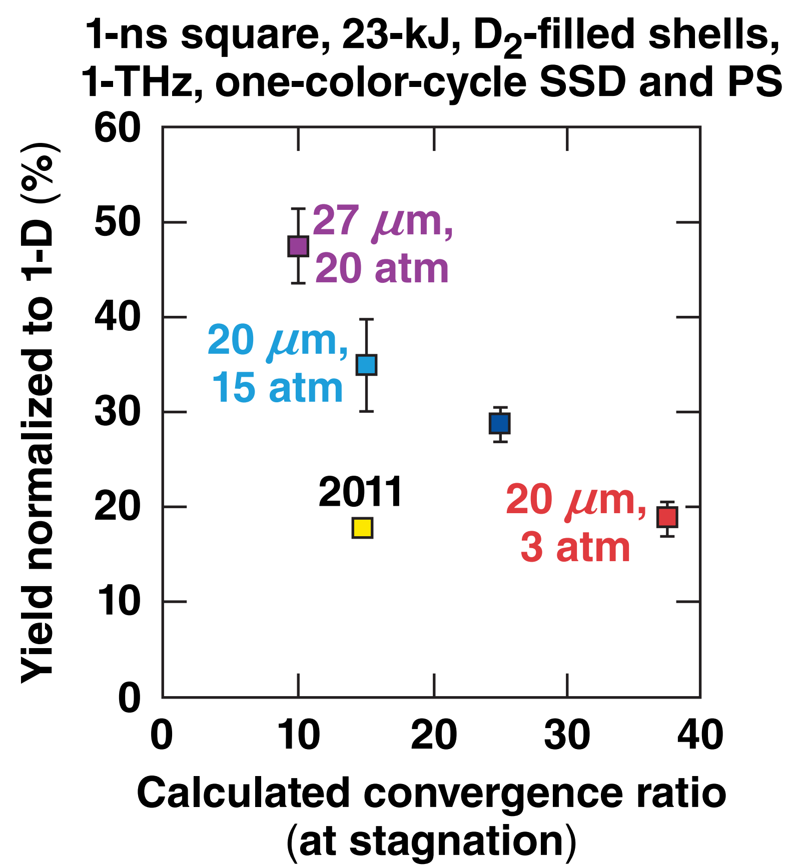




TC9809

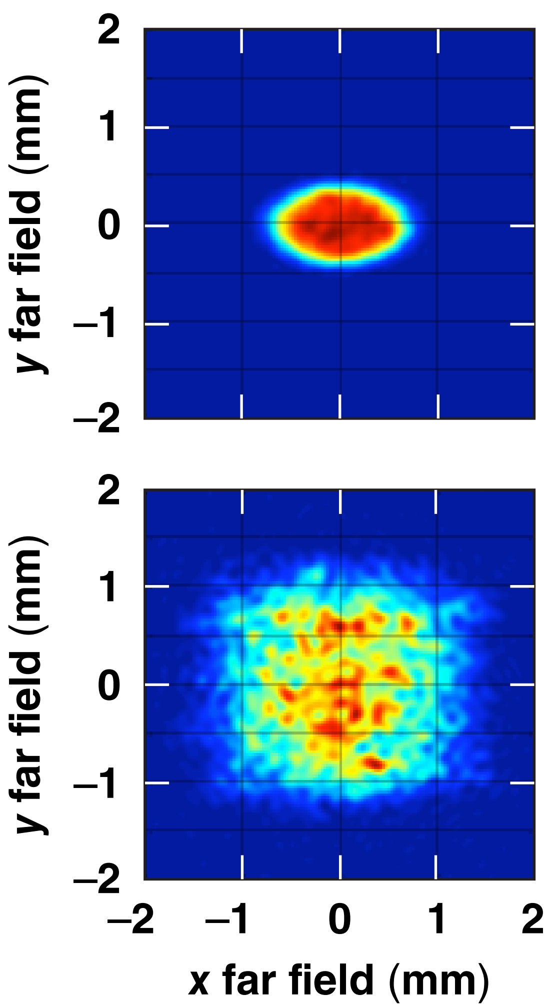
Subtangential-focus experiments showed a relative yield improvement at tighter focus but 2× reduction in yield performance overall

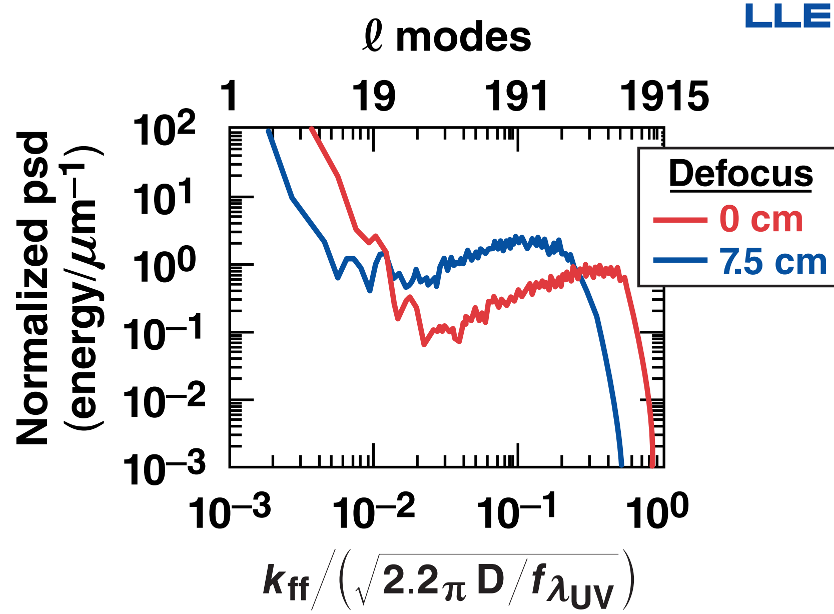


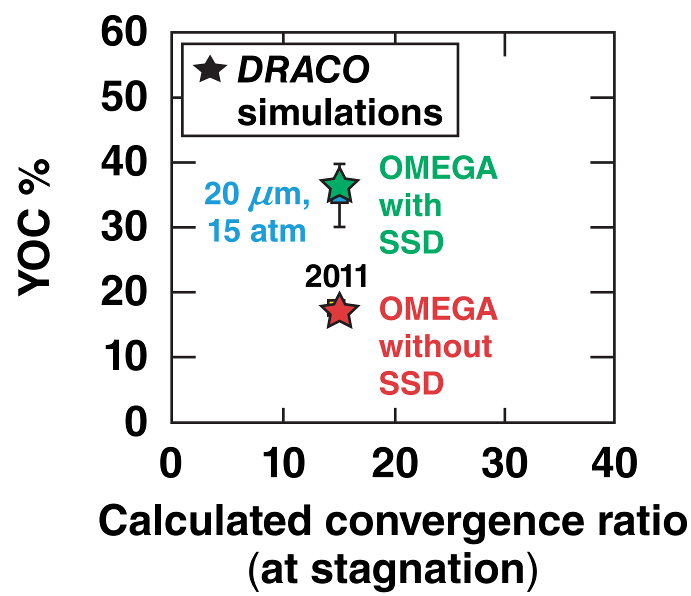


TC9810

Defocused phase plates lead to higher levels of imprint nonuniformities and lower target performance

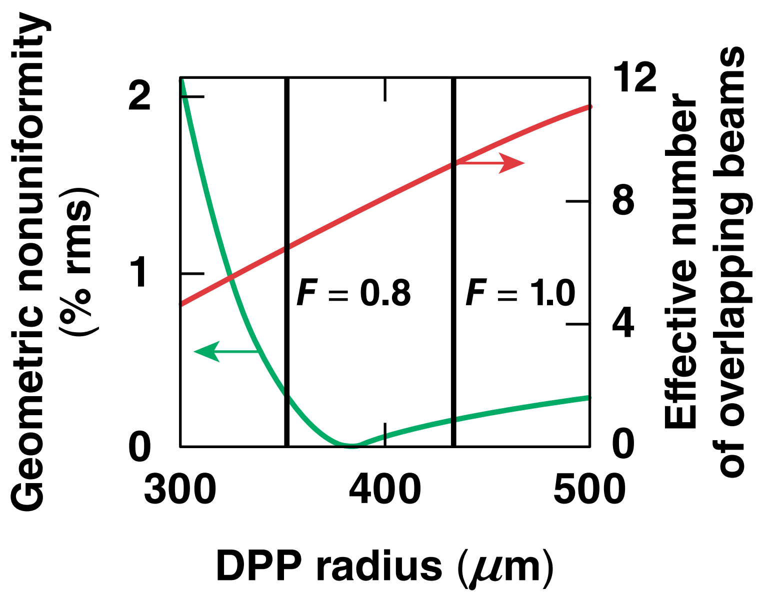


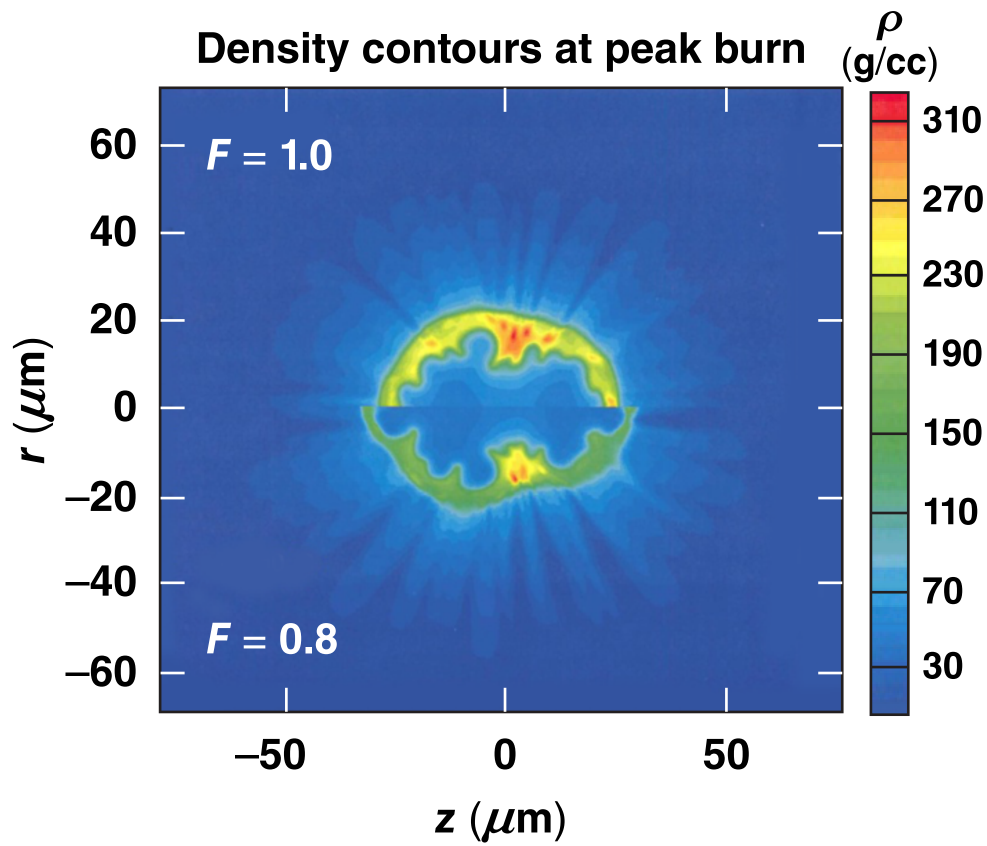




TC9811

DRACO simulations of an *F* = 0.8 OMEGA cryogenic implosion show degraded target performance





<u>*F* = 1.0</u>

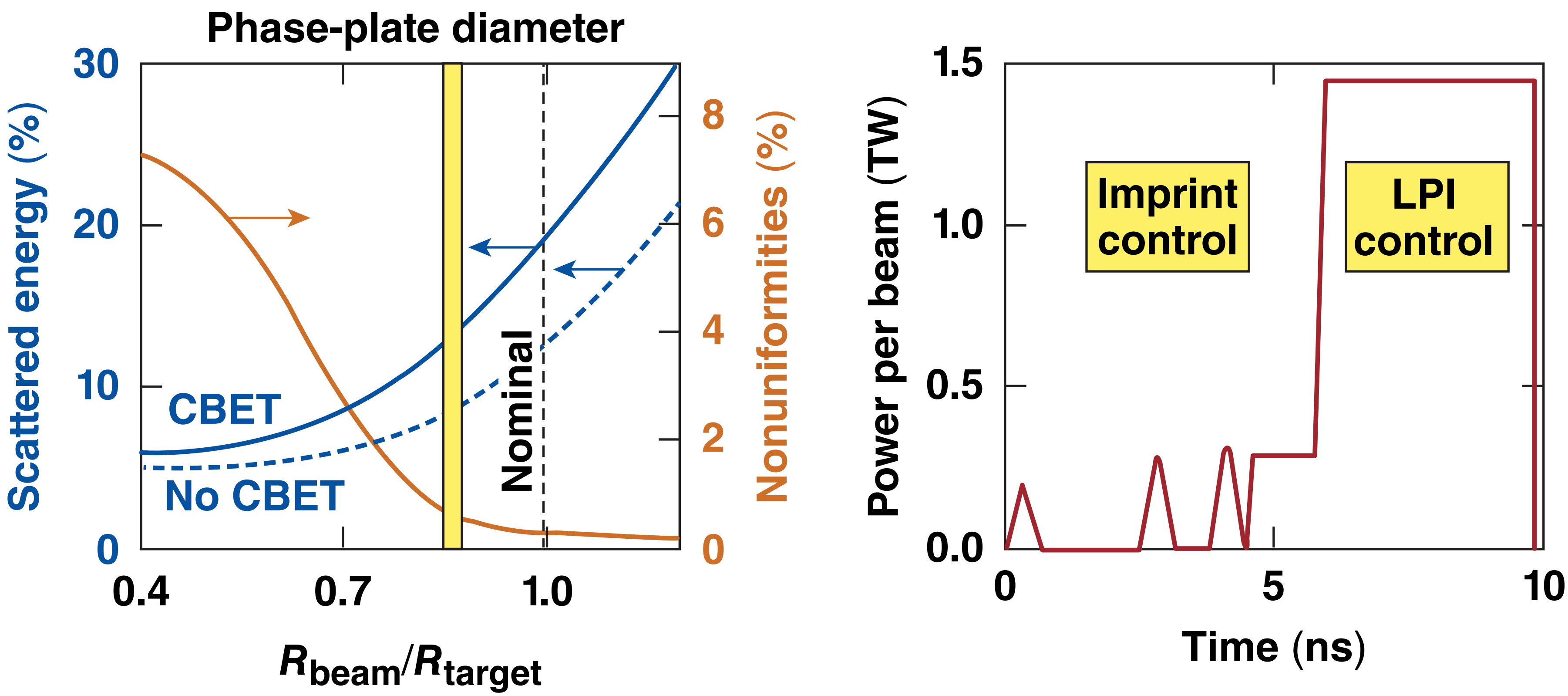
- Yield over clean 30%
- *ρR* over clean 92%

<u>*F* = 0.8</u>

- Yield over clean 21%
- *ρR* over clean 70%

TC9812

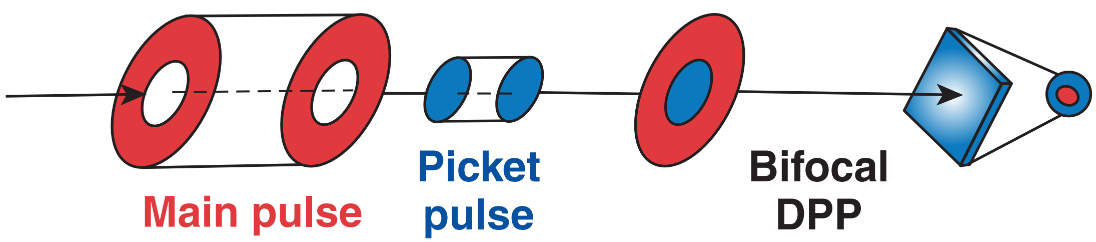
Single-focus phase plates can only straddle the desired regions of imprint and LPI control

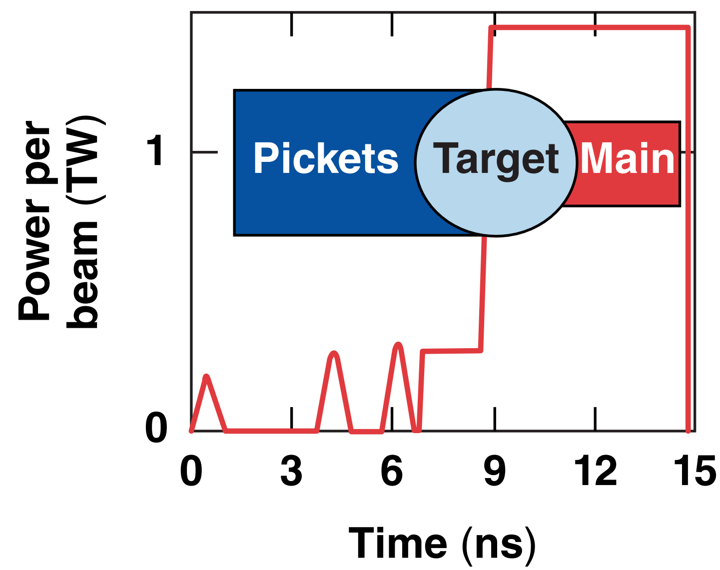


TC9813

Bifocal phase plates, coupled with co-propagation of spliced pulses, can deliver two-step laser zoom

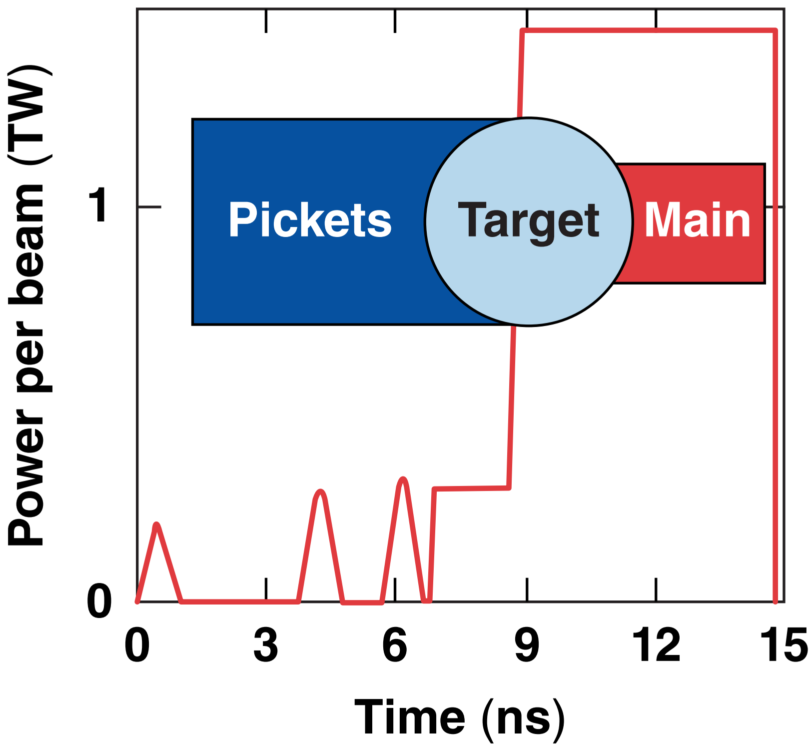
- Two-state phase modulation yields efficient energy transfer
- Sensitivity to focal-spot shape and profile is reduced
- Smaller focal spot decreases CBET for the main laser pulse
- Reduced phase gradients lower laser-damage probability

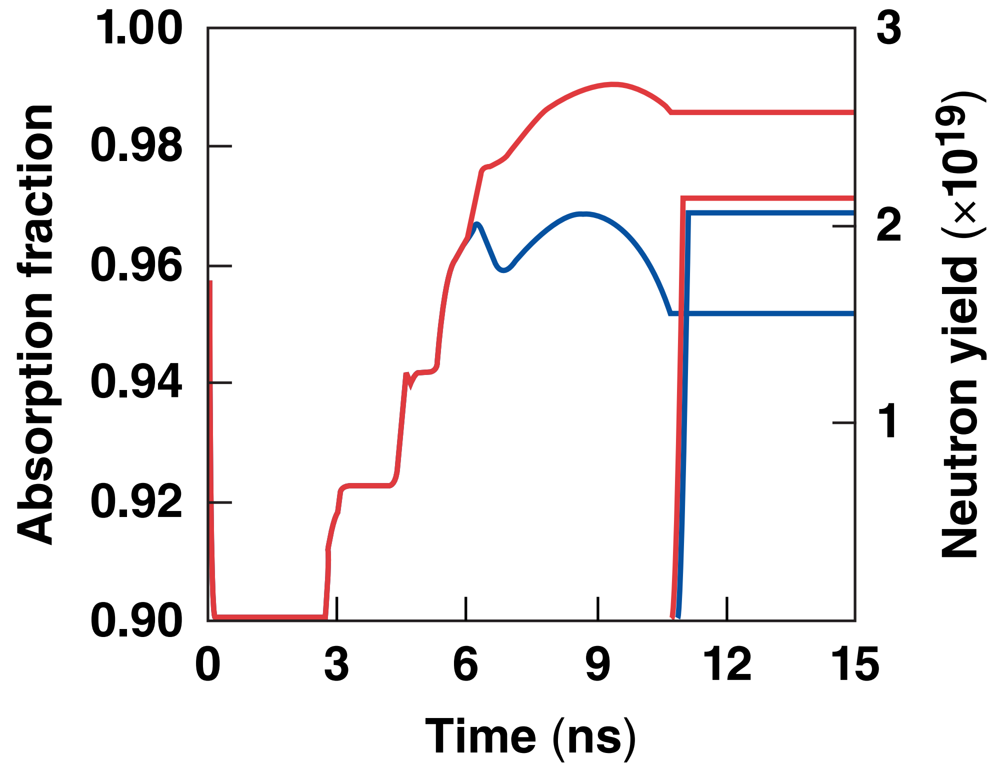




TC9814

Two-step zooming can provide both imprint and LPI mitigation while maintaining target performance





TC9815

Summary/Conclusions

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