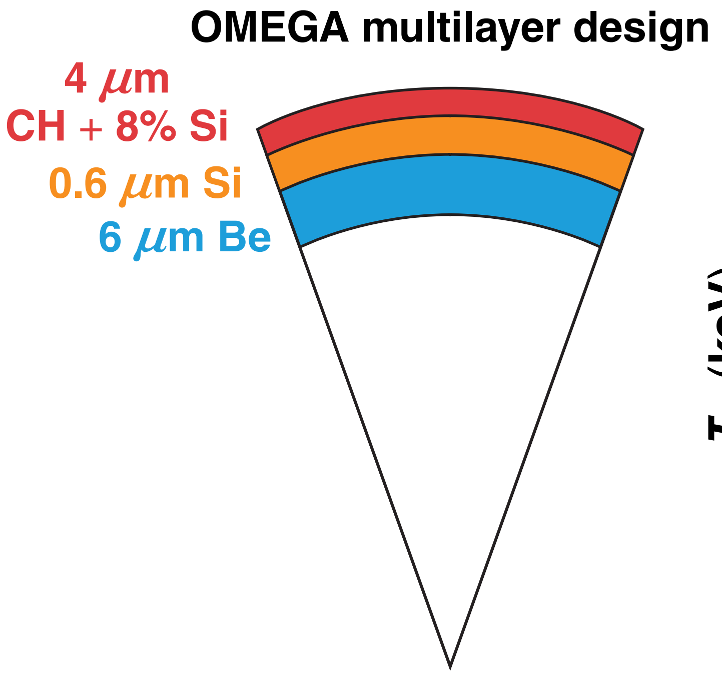
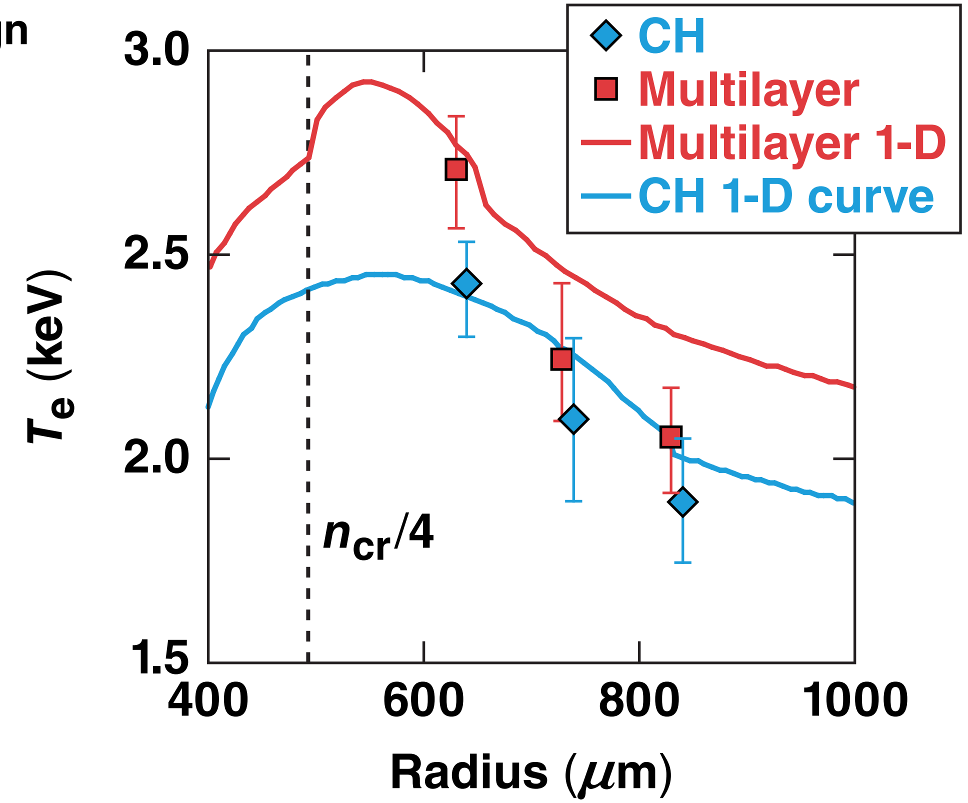
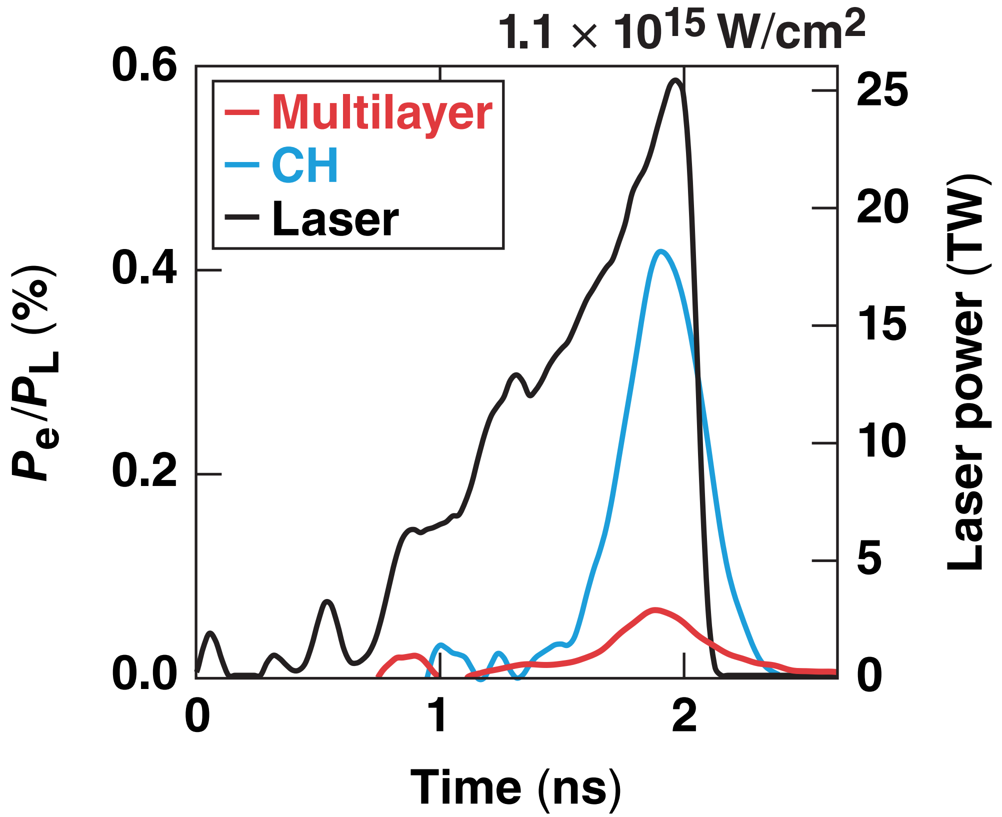
Mitigation of Two-Plasmon Decay in Direct-Drive Implosions Using Multilayer Targets







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Summary

Multilayer targets are shown to reduce hot electrons generated by two-plasmon decay (TPD)

- Mitigating cross-beam energy transfer (CBET) is expected to increase the intensity at quarter critical, resulting in more hot electrons from TPD
- A mid-Z layer was added to the target to increase the electron temperature at the quarter-critical surface
- Thomson scattering shows an increased electron temperature around quarter critical
- The increased electron temperature leads to a factor-of-5 reduction in hot electrons

E24501

Collaborators

**R. K. Follett, R. J. Henchen, V. N. Goncharov, A. A. Solodov, J. A. Delettrez,
D. H. Edgell, B. Yaakobi, C. Stoeckl, and J. F. Myatt**

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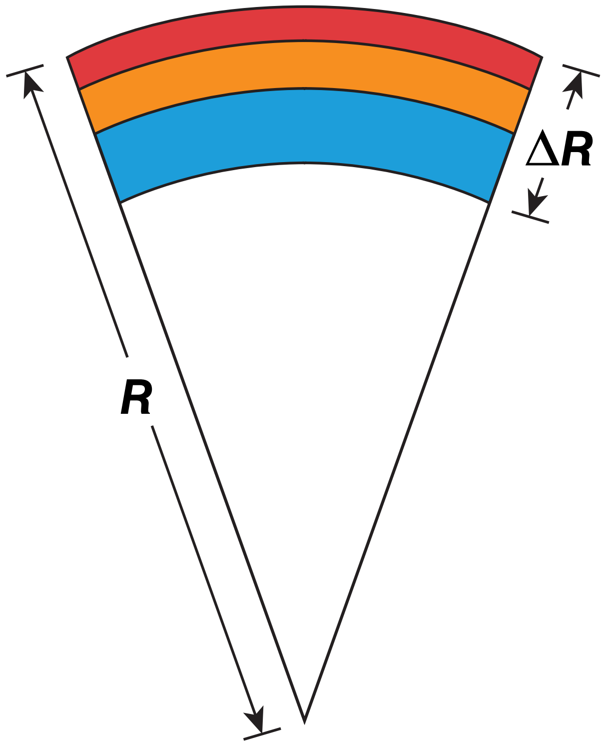
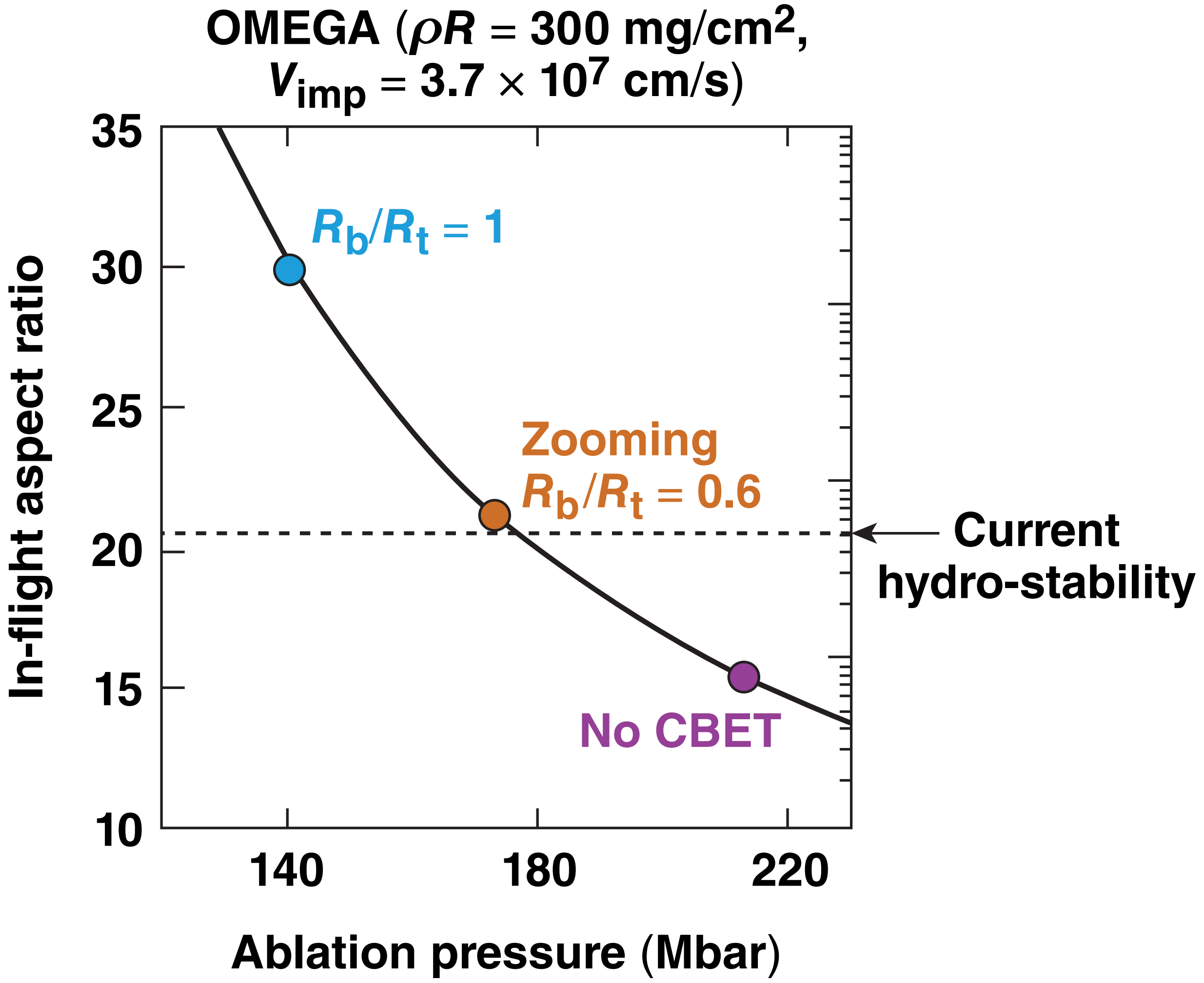
Reduction of CBET in direct-drive implosions on OMEGA is required to achieve hydrodynamic equivalence





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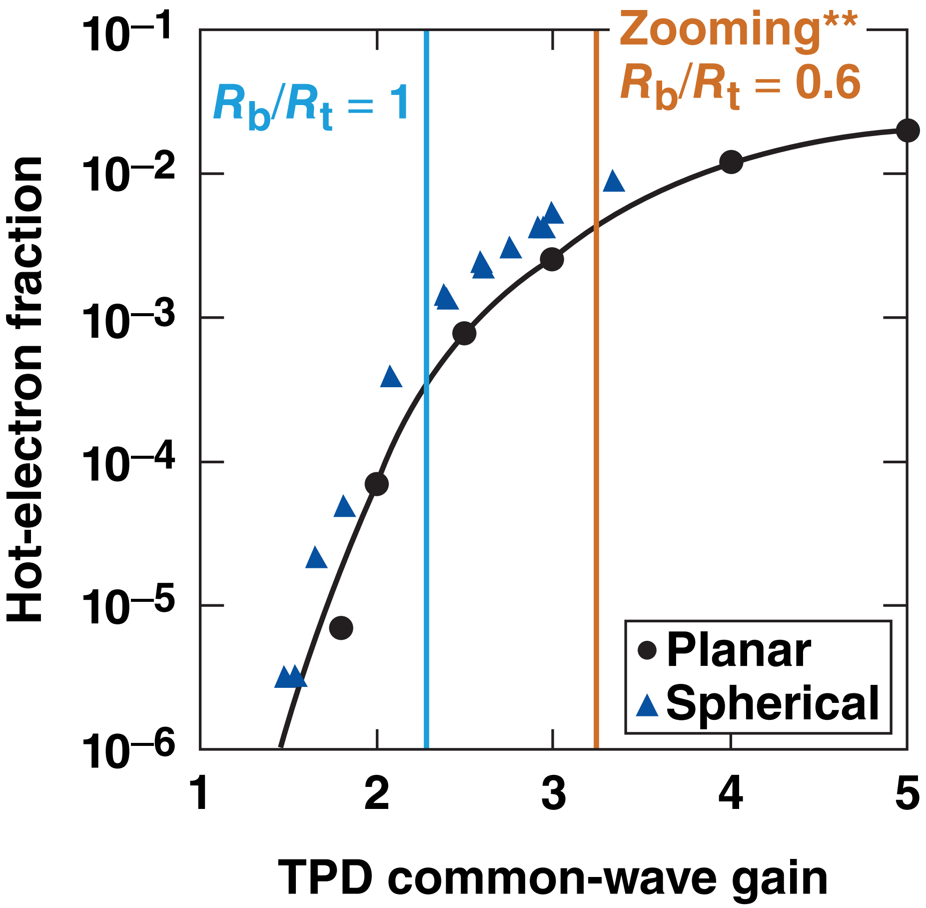
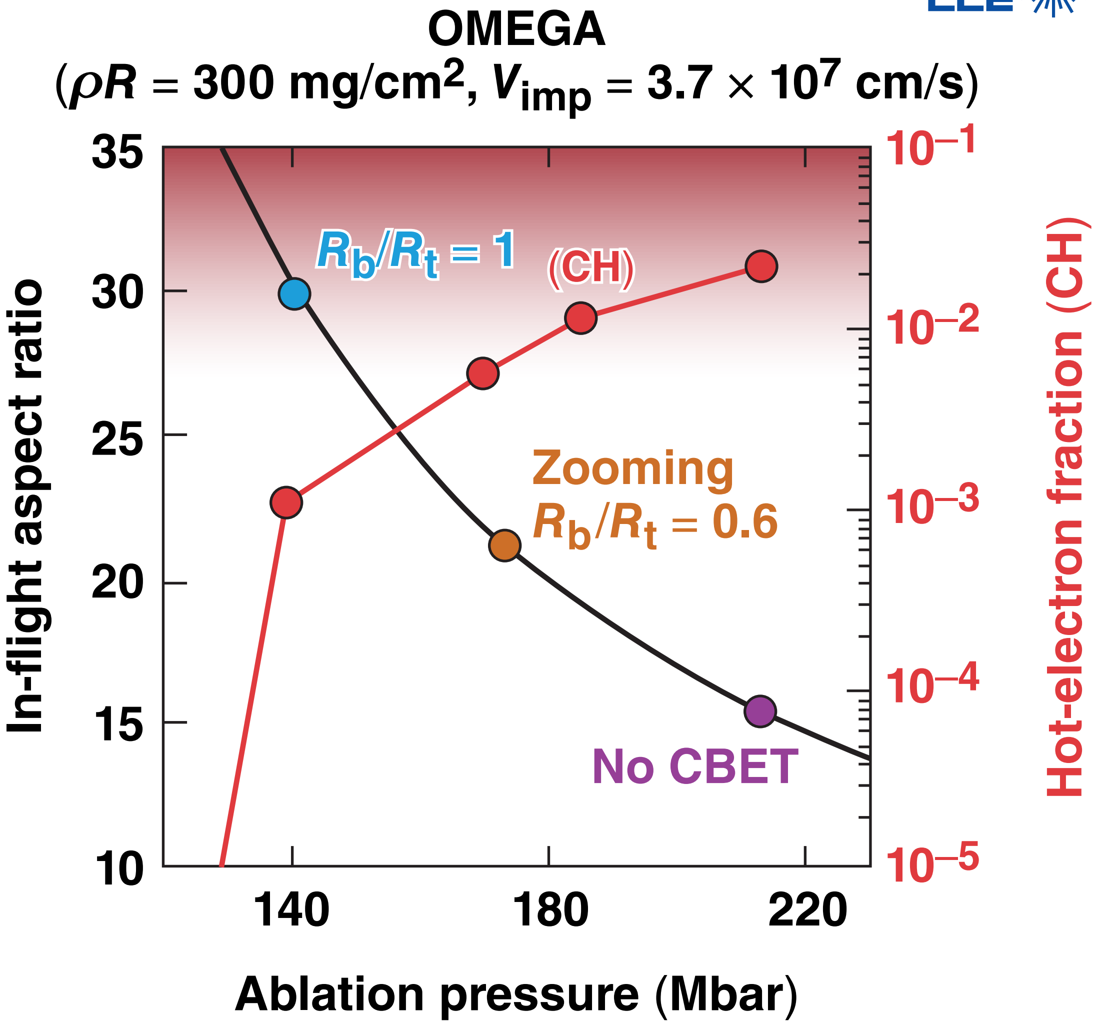
Mitigating CBET is predicted to increase the hot electrons generated by TPD

$$G^*_{MB} \cong \frac{I_\Sigma L_n}{T_e} \times 10^{-16}$$



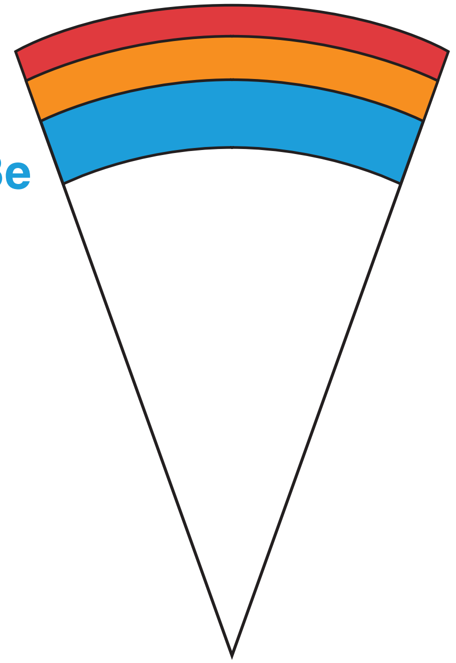


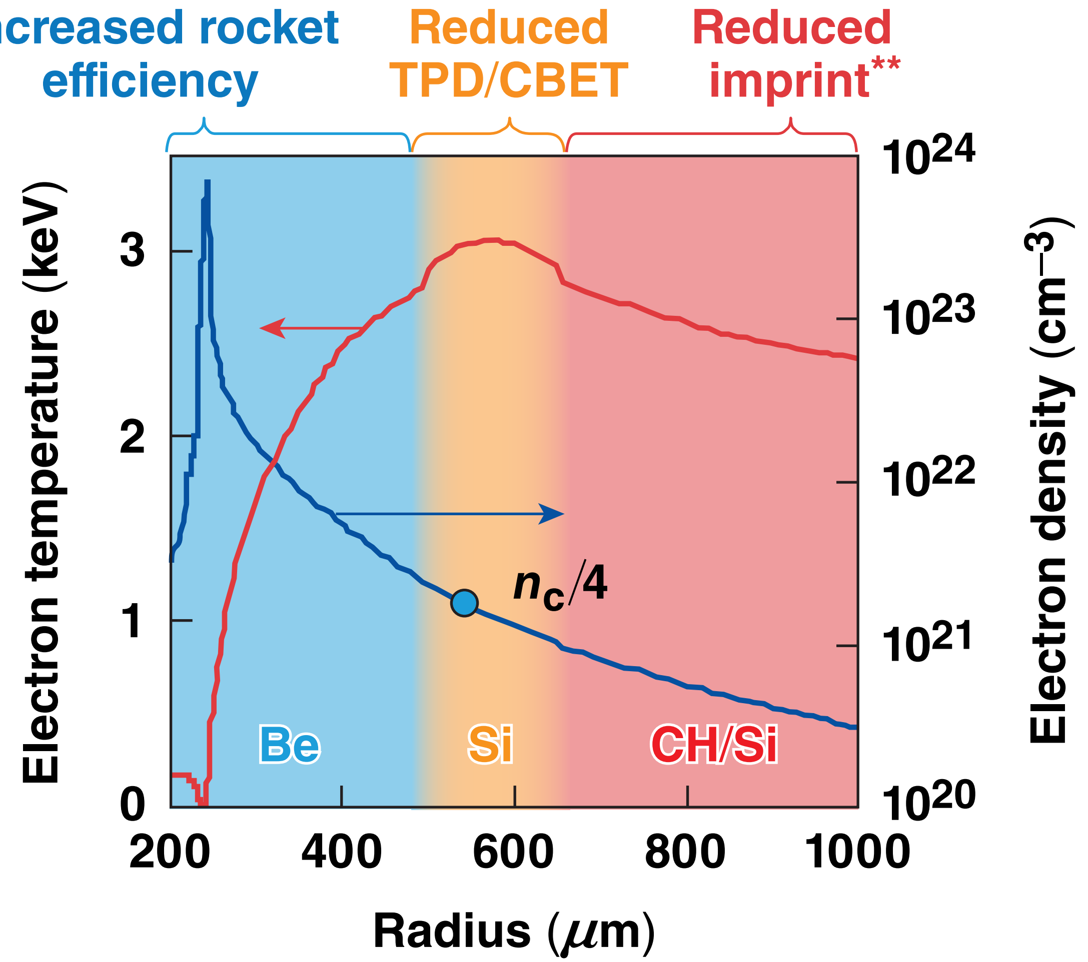
Current cryo experiments show no evidence of hot-electron preheat, but simulations suggest a factor-of-2 increase will degrade the areal density.

*D. T. Michel *et al*., Phys. Rev. Lett. 109, 155007 (2012).
**D. H. Froula *et al*., Phys. Plasmas 20, 082704 (2013).

Multilayer targets have been designed to increase the hydrodynamic efficiency and laser–plasma interaction thresholds while limiting the effects of imprint

OMEGA multilayer design*



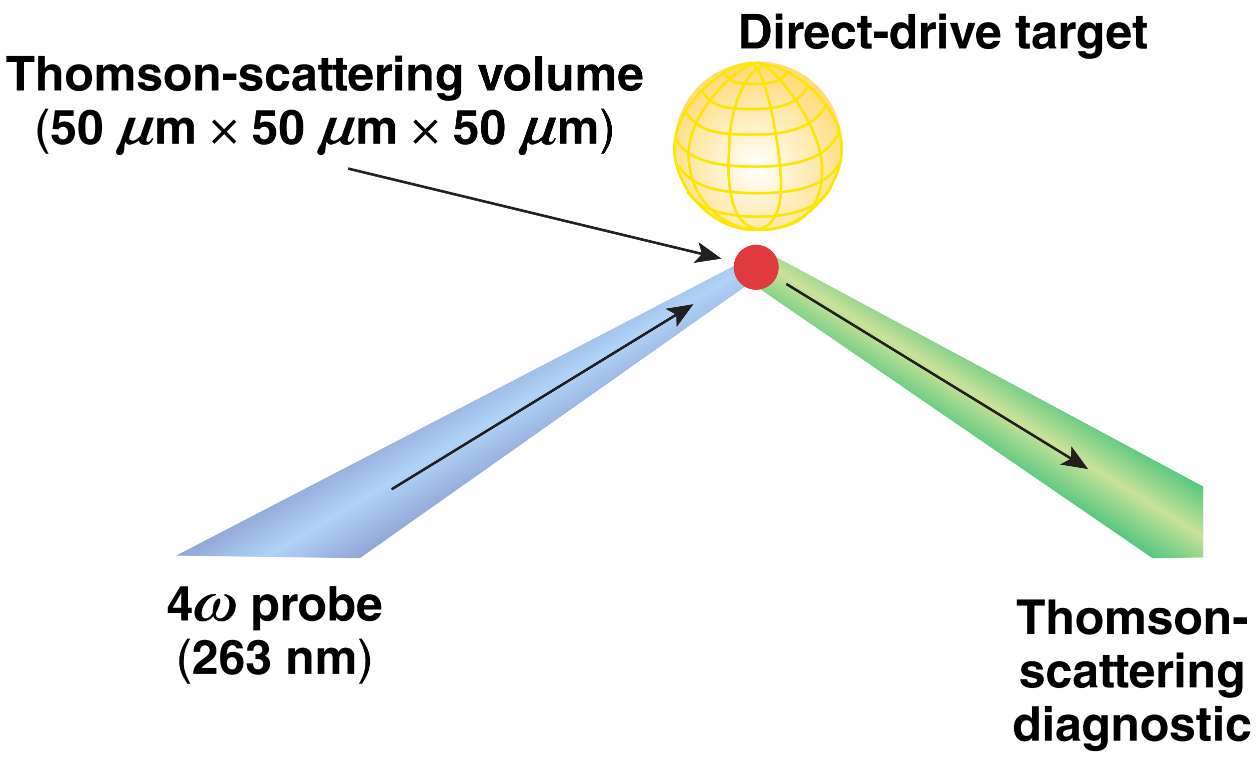


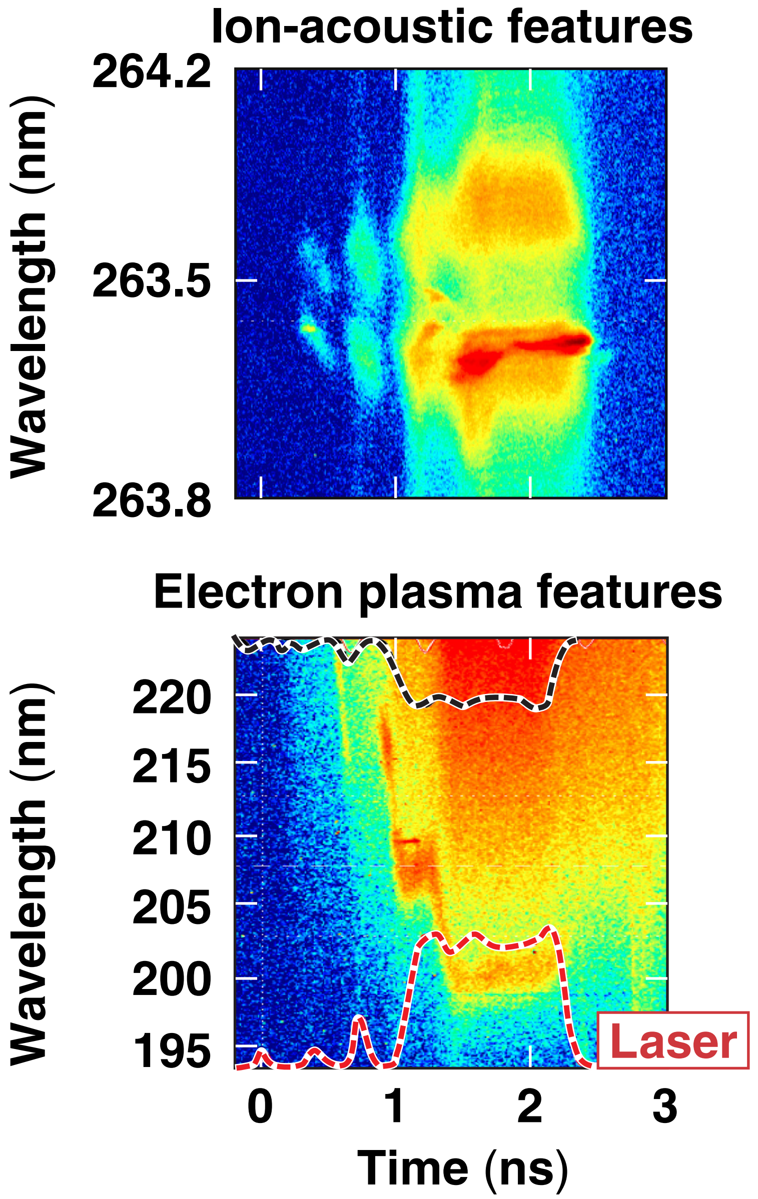
The layer thicknesses are optimized to have increased laser absorption at $n_c/4$ (Si higher T_e) and increased ablation in Be (higher A/Z).

*V. N. Goncharov *et al.*, "Improving the Hot-Spot Pressure and Demonstrating Ignition Hydrodynamic Equivalence in Cryogenic DT Implosions on OMEGA," to be published in Physics of Plasmas (invited).
**S. X. Hu *et al.*, Phys. Rev. Lett. 111, 123003 (2013); G. Fiksel *et al.*, Phys. Plasmas 19, 062704 (2012).

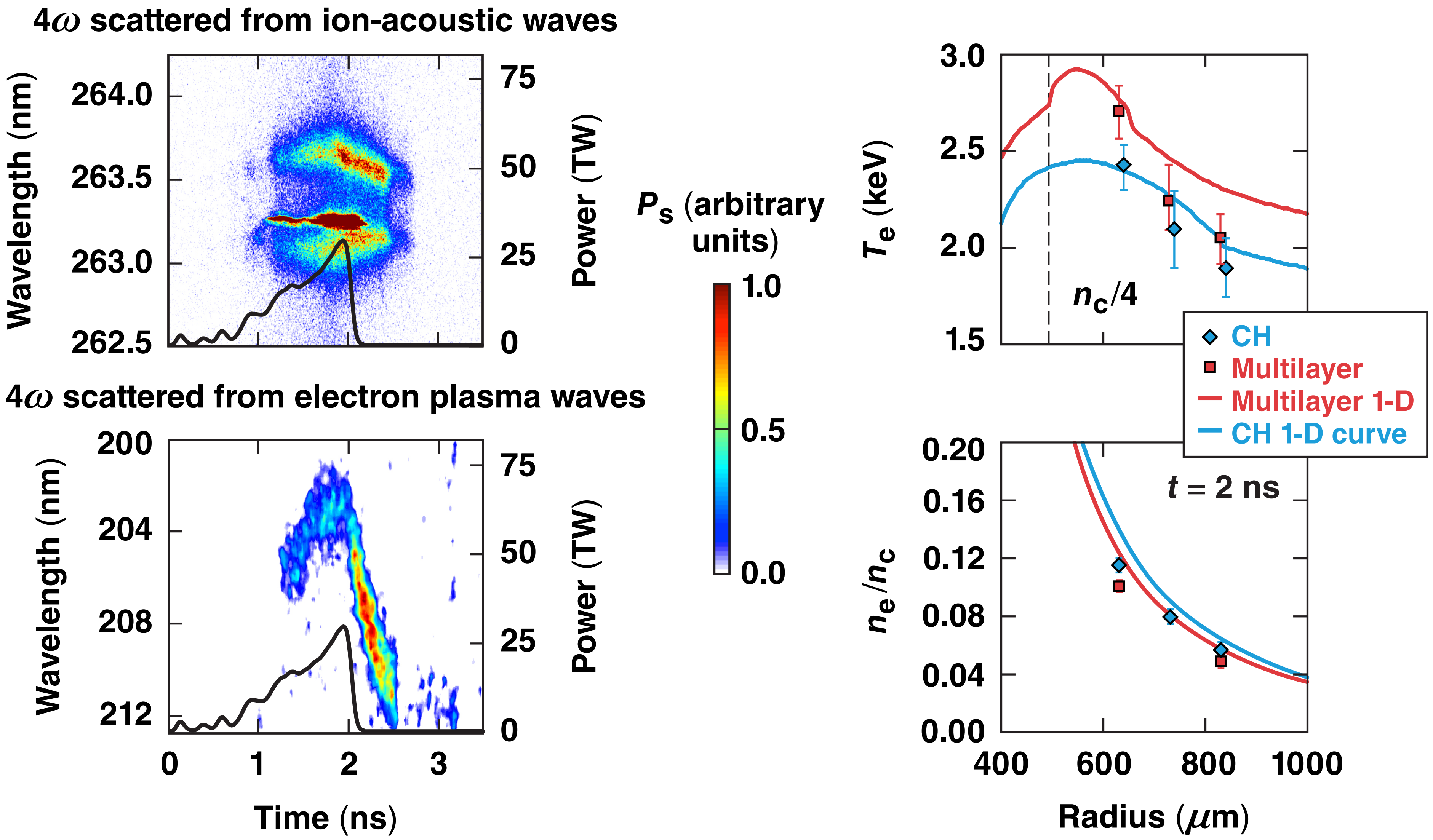
E22920g

Simultaneous measurements of the collective ion-acoustic and electron plasma wave features provide local plasma conditions in laser-produced plasmas





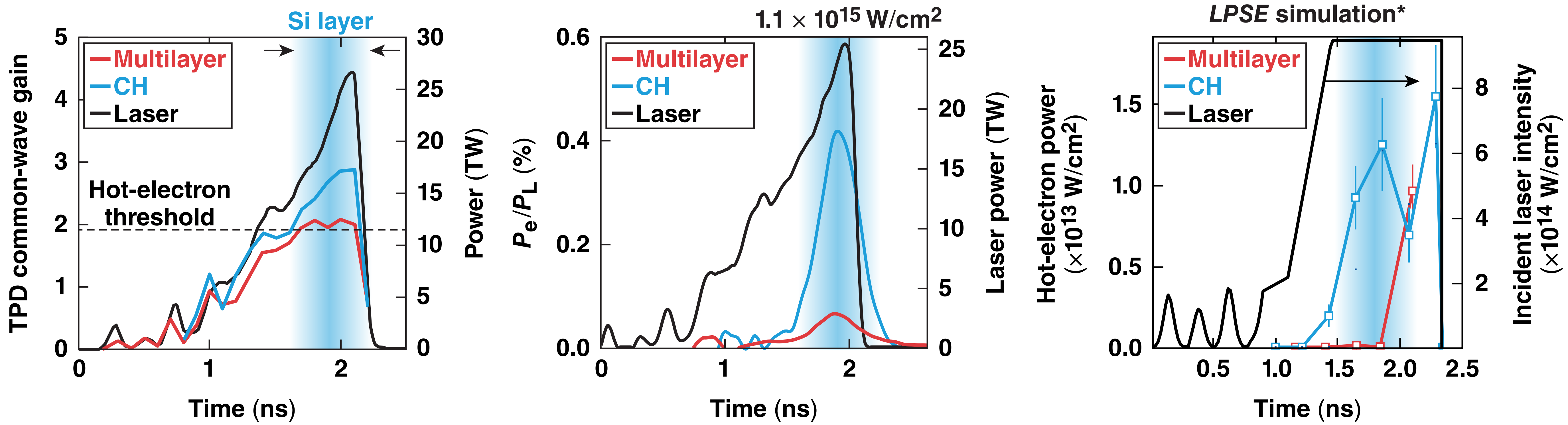
Thomson scattering from electron plasma and ion-acoustic waves shows enhanced electron temperatures in multilayer targets compared with CH targets



Multilayer ablators increase the electron temperature around quarter critical by ~15%.

E22930a

The increased electron temperature in the multilayer targets reduces TPD gain, resulting in fewer hot electrons



The hot-electron fraction is reduced by a factor of 8 in multilayer targets compared with CH.

*J. F. Myatt *et al*., NO5.00002, this conference.
J. A. Delettrez, J. F. Myatt, and B. Yaakobi, NO5.00004, this conference.

E22922e

Multilayer targets are shown to reduce hot electrons generated by two-plasmon decay (TPD)

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