The Effect of Cross-Beam Energy Transfer on Two-Plasmon Decay in Direct Drive

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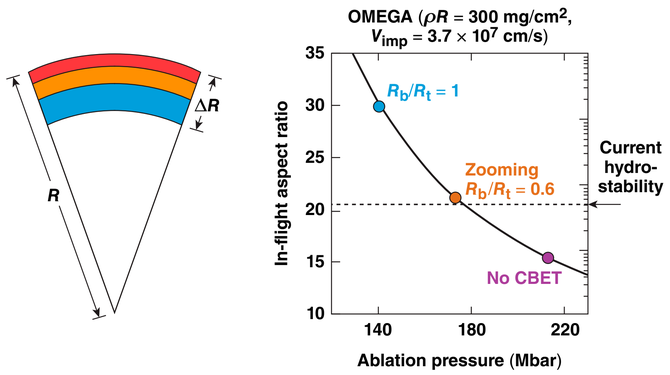
Summary

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

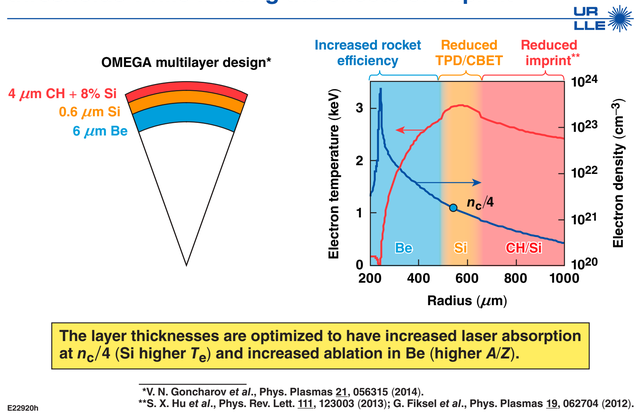
E24501a

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



E24664a

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

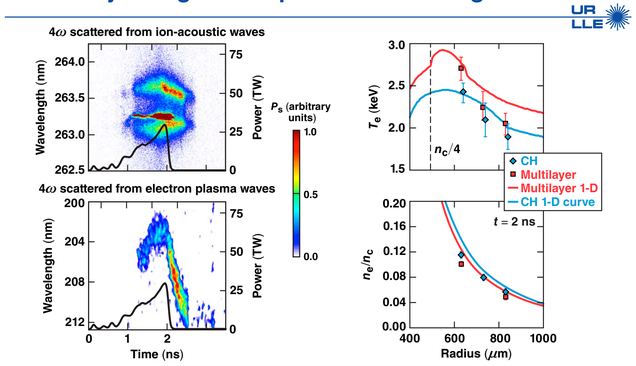


The layer thicknesses are optimized to have increased laser absorption at $n_c/4$ (Si higher T_e) and increased ablation in Be (higher A/Z).

*V. N. Goncharov *et al.*, Phys. Plasmas 21, 056315 (2014).
**S. X. Hu *et al.*, Phys. Rev. Lett. 111, 123003 (2013); G. Fiksel *et al.*, Phys. Plasmas 19, 062704 (2012).

E22920h

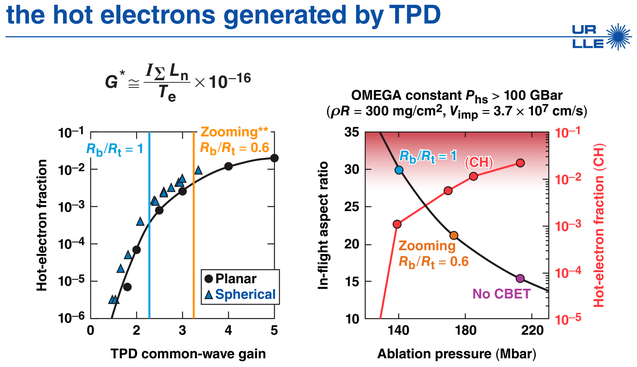
Thomson scattering from electron plasma and ion-acoustic waves shows enhanced electron temperatures in multilayer targets compared with CH targets



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

E22930b

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



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

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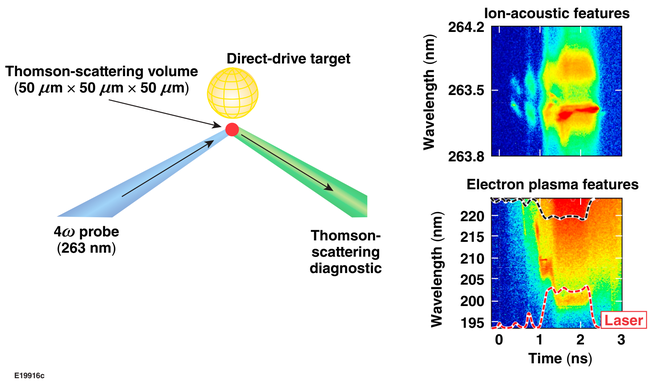
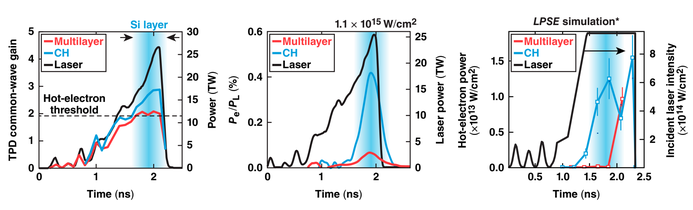
E22922f

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



E19916c

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.*, presented at the 57th Annual Meeting of the APS Division of Plasma Physics, Savannah, GA, 16–20 November 2015; J. A. Delettrez, J. F. Myatt, and B. Yaakobi, presented at the 57th Annual Meeting of the APS Division of Plasma Physics, Savannah, GA, 16–20 November 2015.

E22922g

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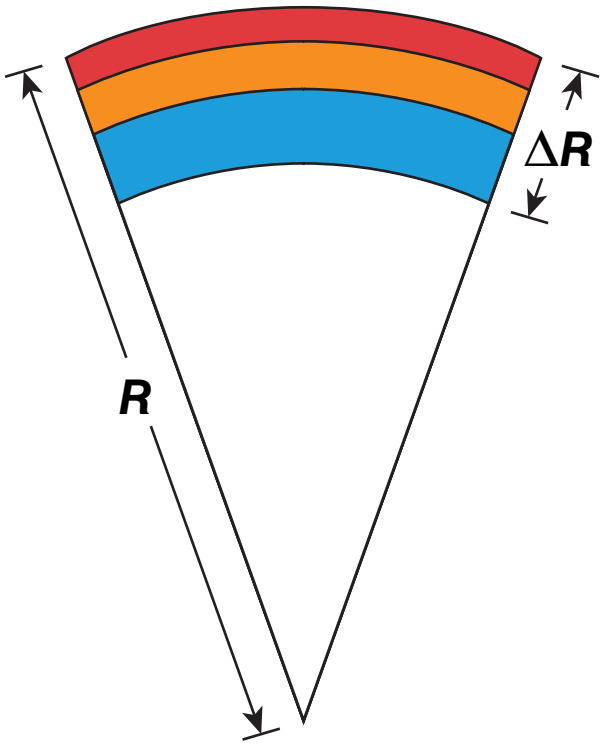

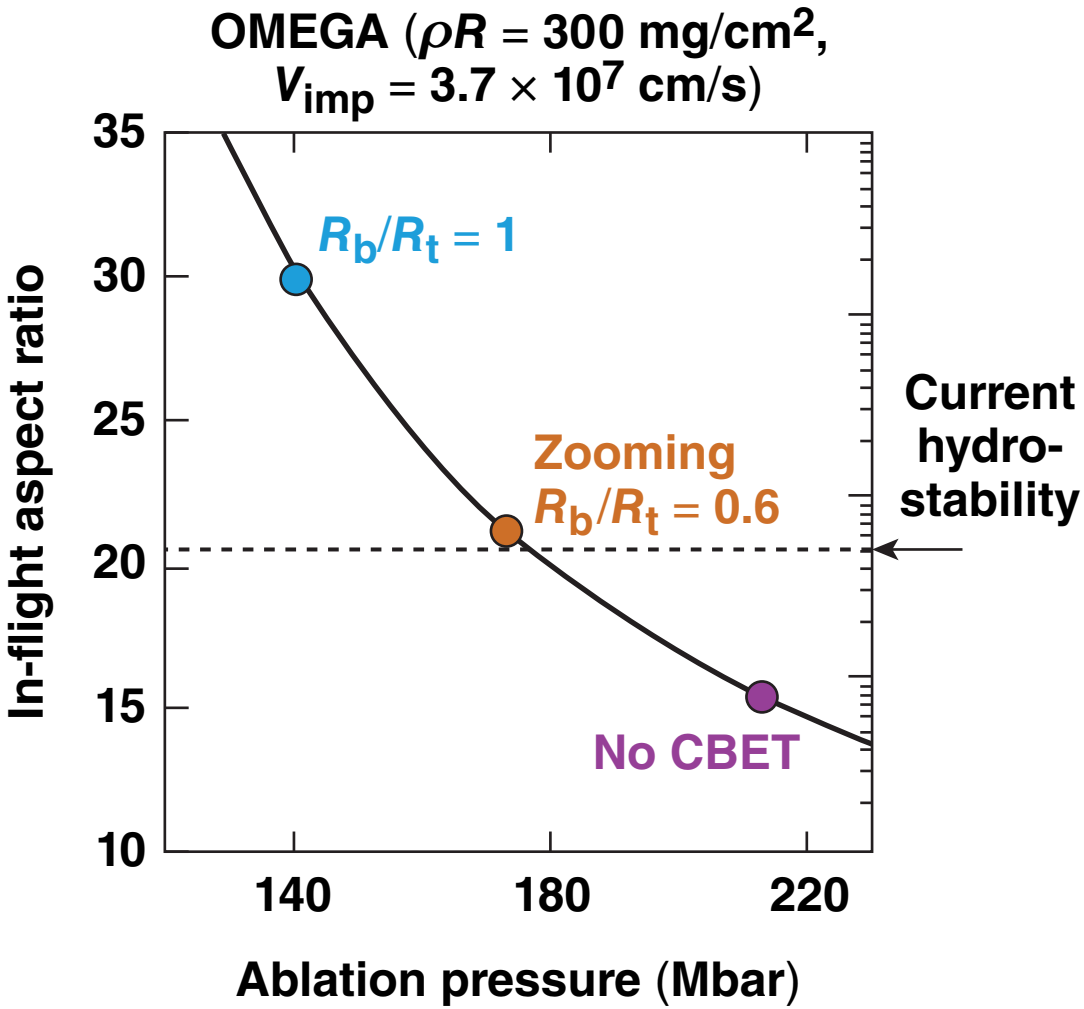

E24664a

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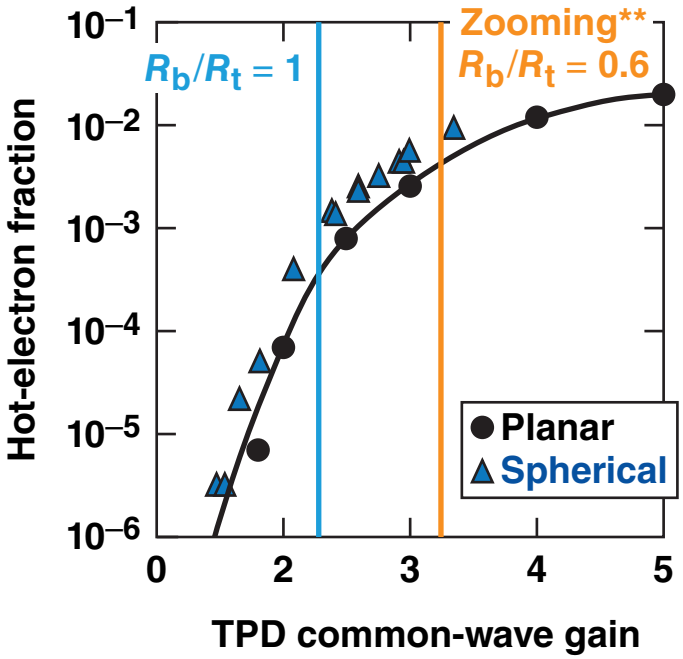
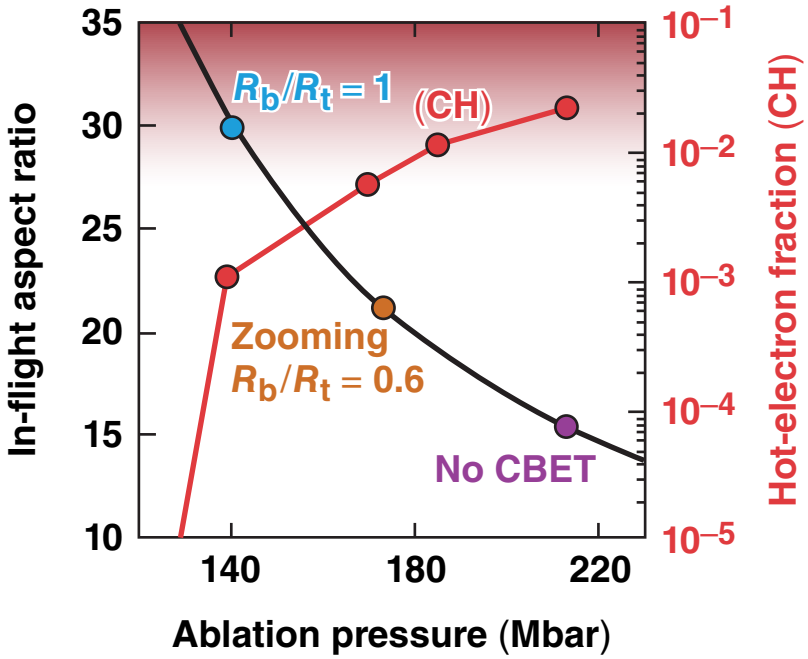
$$G^* \cong \frac{I \sum L_n}{T_e} \times 10^{-16}$$



OMEGA constant P_{hs} > 100 GBar
(ρR = 300 mg/cm^2, V_{imp} = 3.7 × 10^7 cm/s)



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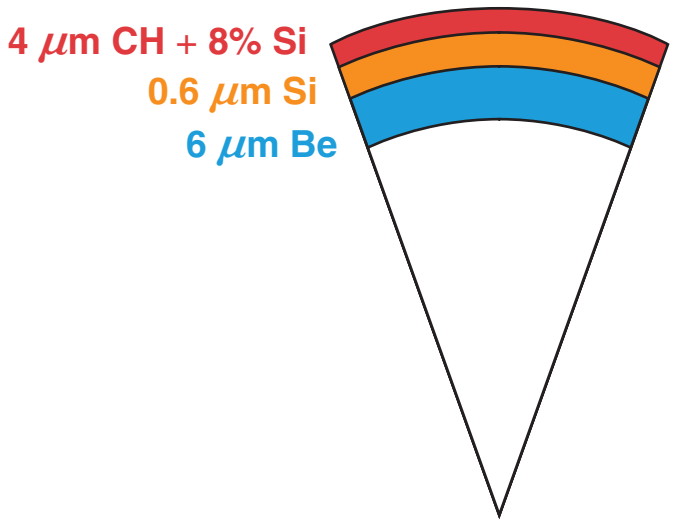
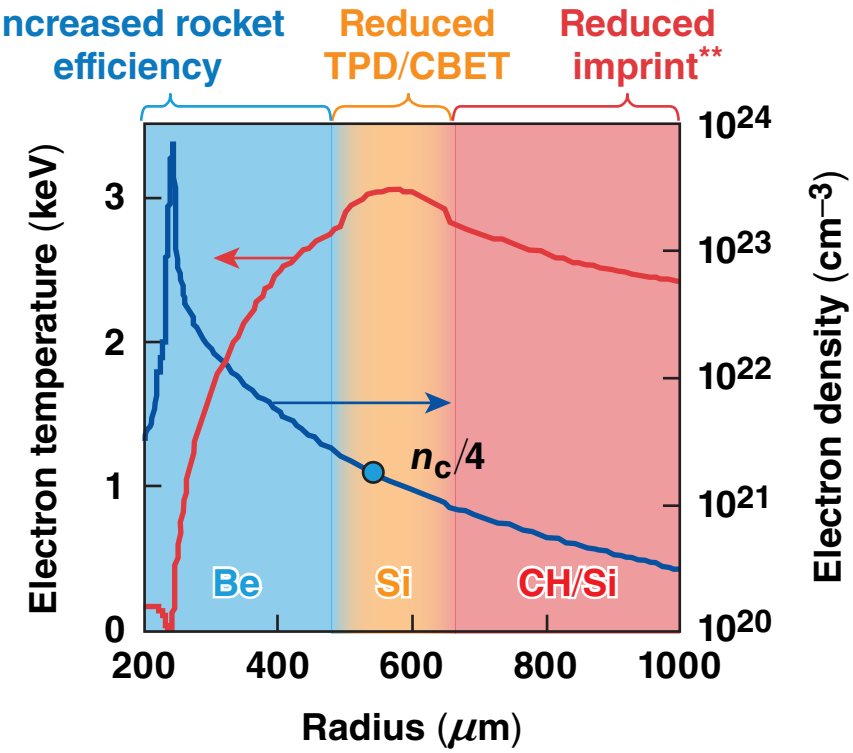
OMEGA multilayer design*





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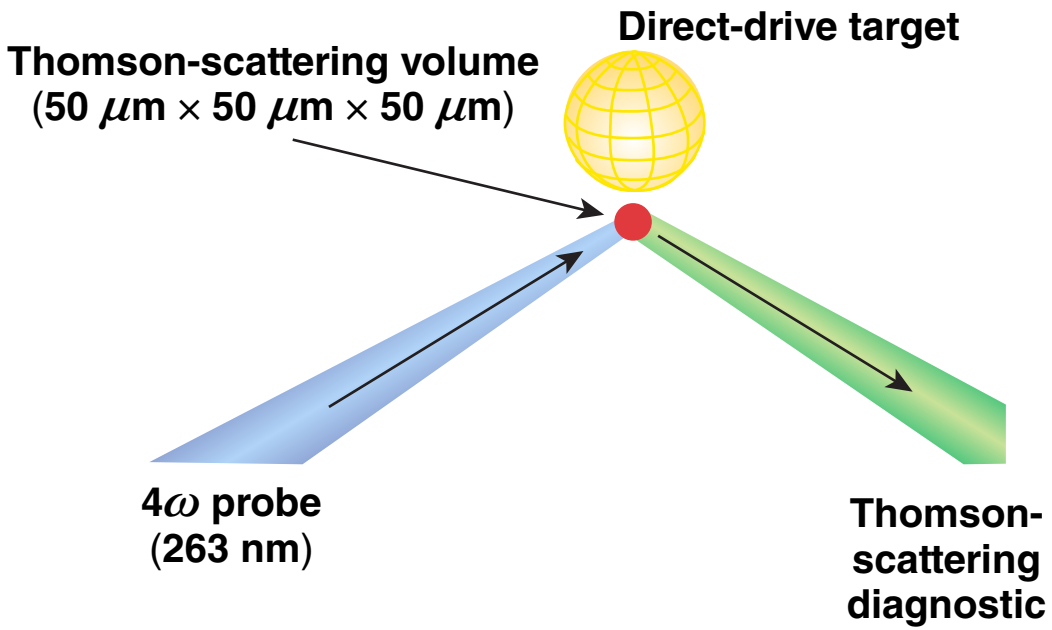

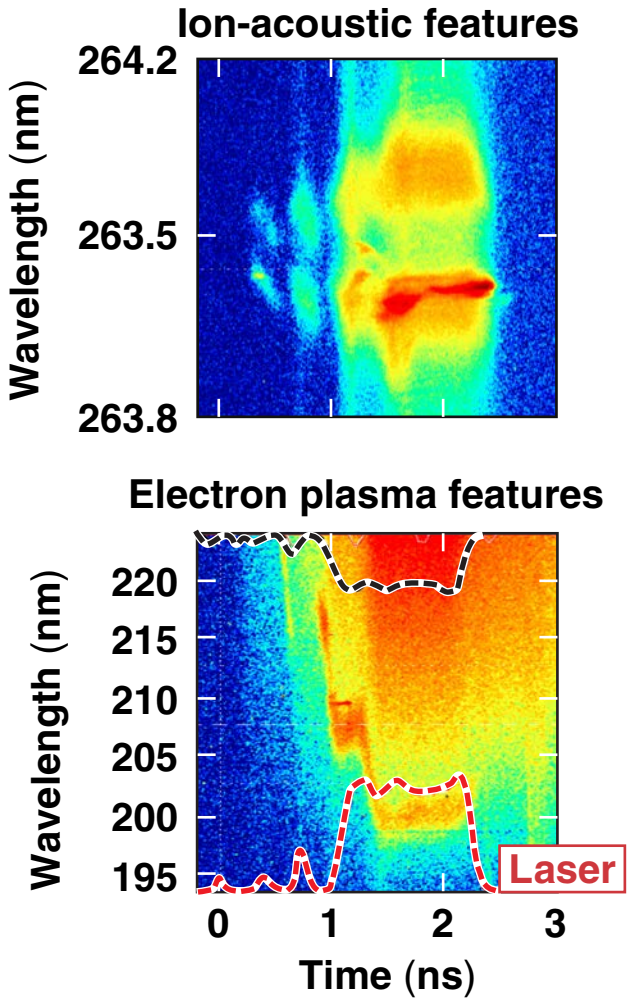

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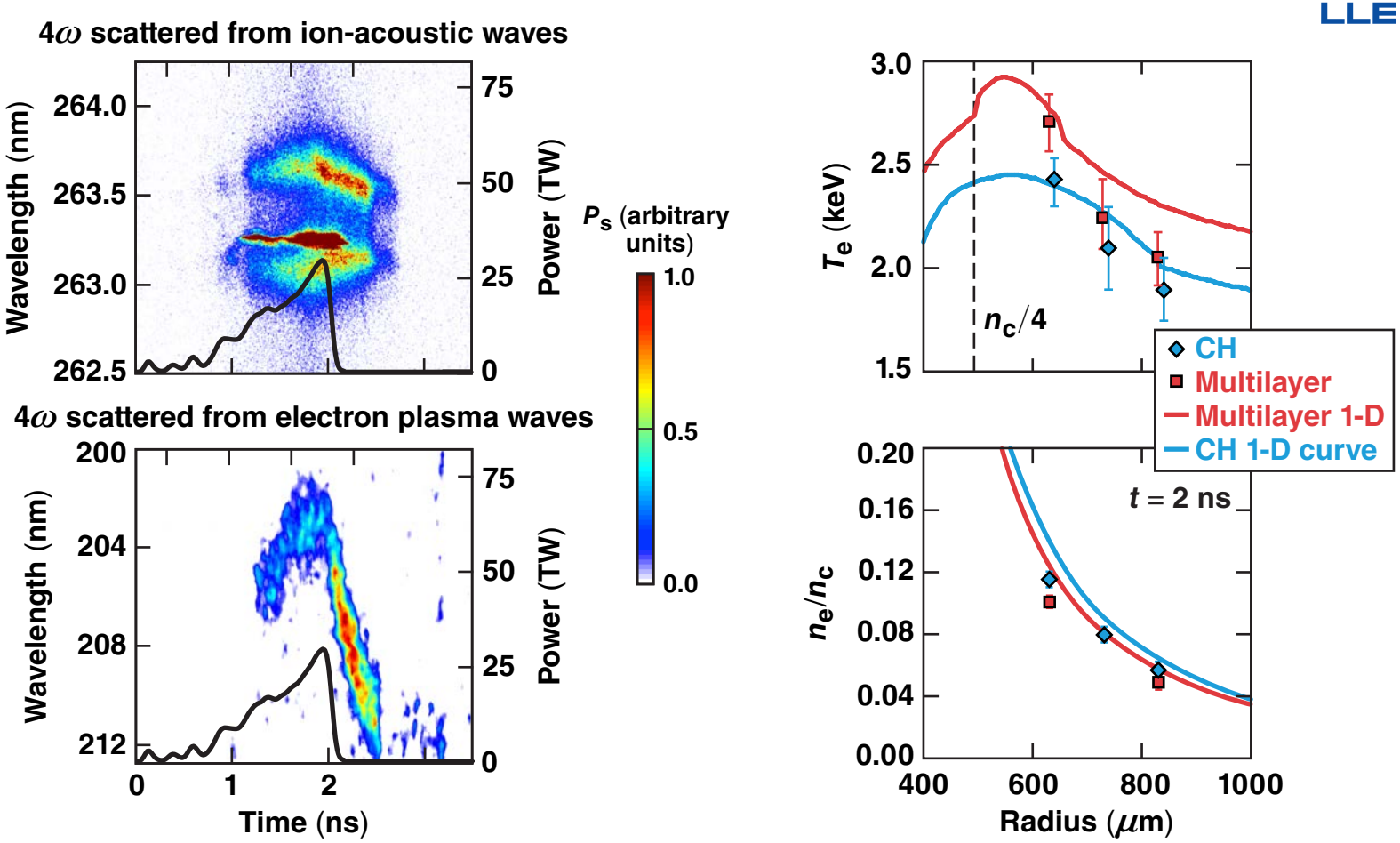

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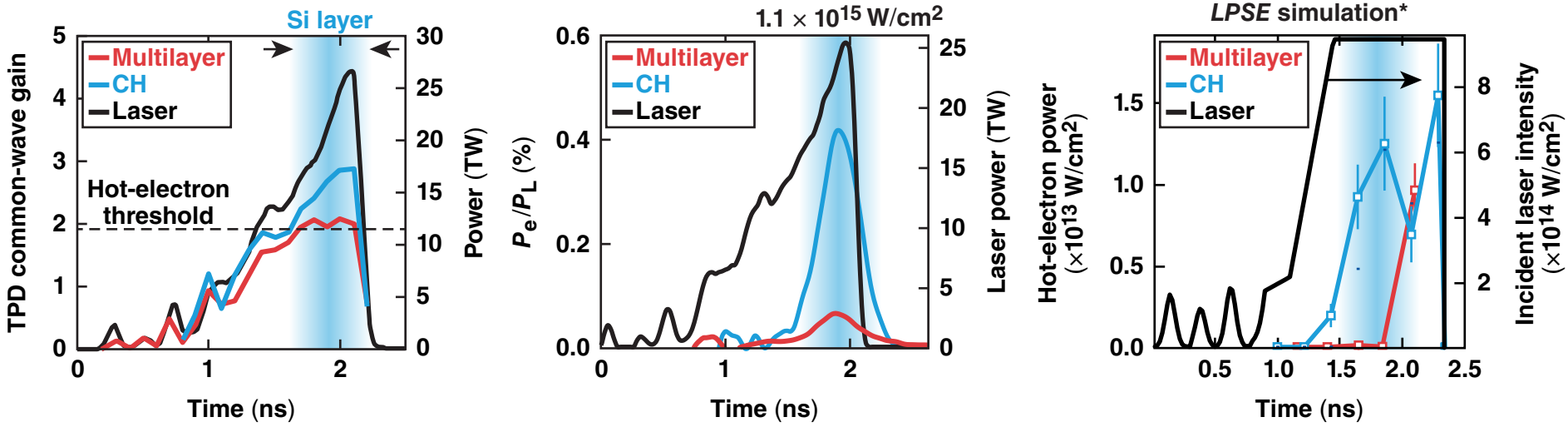

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