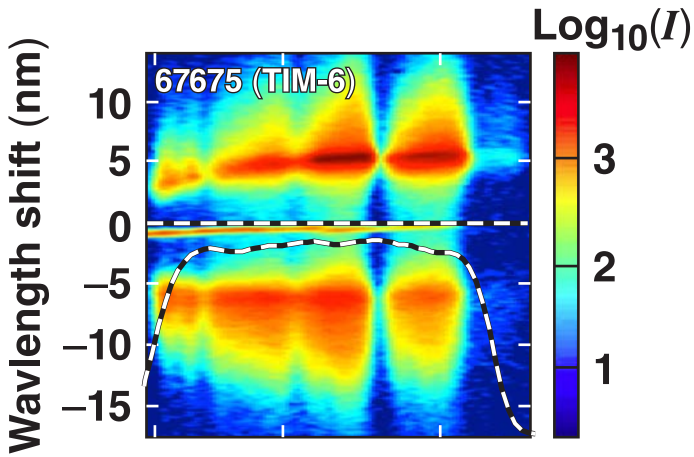
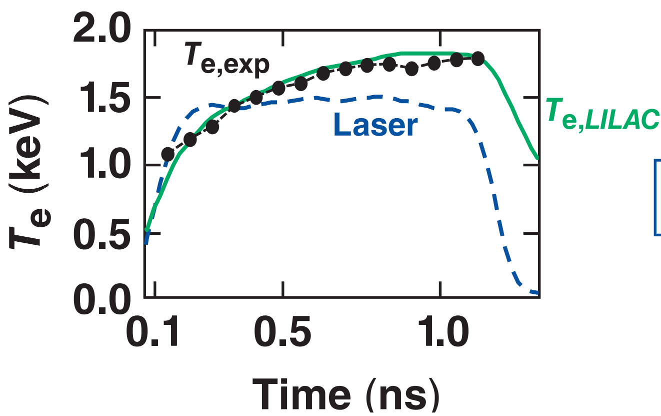
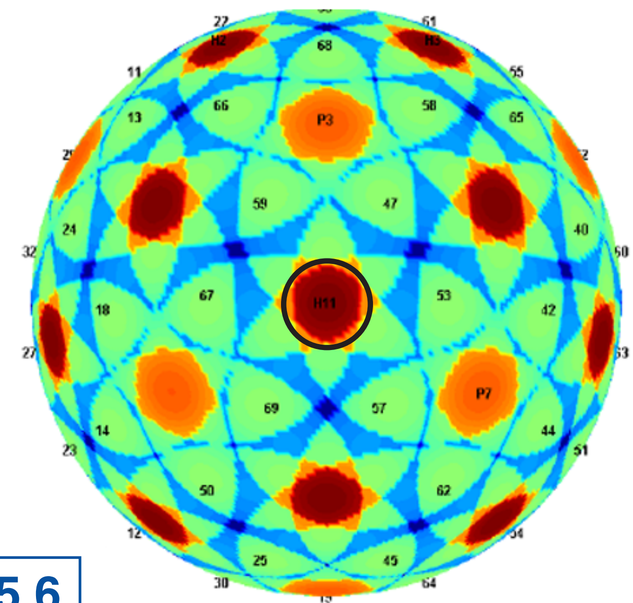
Time-Resolved Electron-Temperature Measurements Near $n_c/4$ Reveal Temperature Islands on Imploding Targets





$I_{14} = 5.6$



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Absorption Conference
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Summary

T_e measurements near $n_c/4$ point toward the existence of temperature islands on the target surface

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- T_e measurements near $n_c/4$ are based on a spectral feature of $\omega/2$ emission that is caused by the absolute two-plasmon–decay (TPD) instability
- Implosions close to the TPD threshold confirm T_e from hydrodynamic predictions
- For standard implosions well above the TPD threshold, T_e measurements in hex and pent ports exceed those taken through the focusing lenses
- These observations indicate locally driven, multibeam TPD as well as significant energy input into the TPD plasma waves and elevated temperature islands

Collaborators

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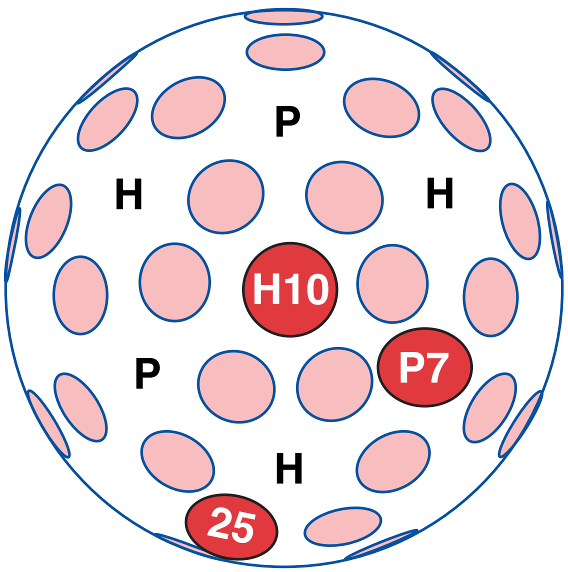
V. N. Goncharov, and I. V. Igumenshchev

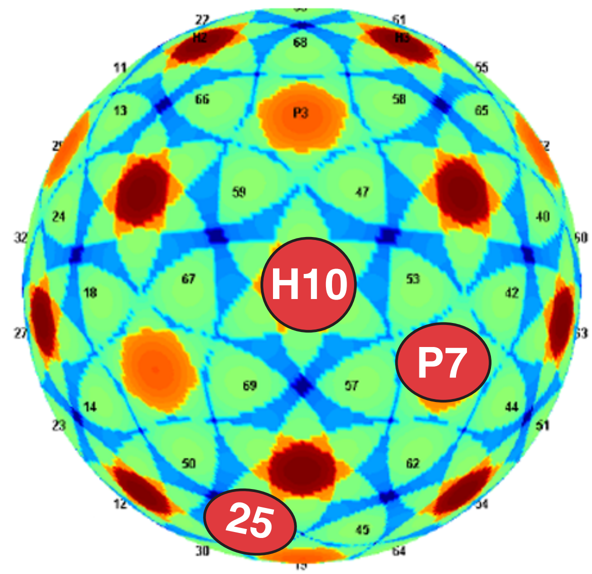
Laboratory for Laser Energetics
University of Rochester

For standard (tangential) illumination of the target, multibeam-driven TPD has the lowest thresholds near the hex and pent centers

OMEGA target chamber



Irradiation pattern on target



Incident angles are limited to 30°

- **Multibeam-driven TPD was established in 2003***
- **Multibeam-driven absolute TPD instability has been shown in Zakharov simulations** as well as analytically*****

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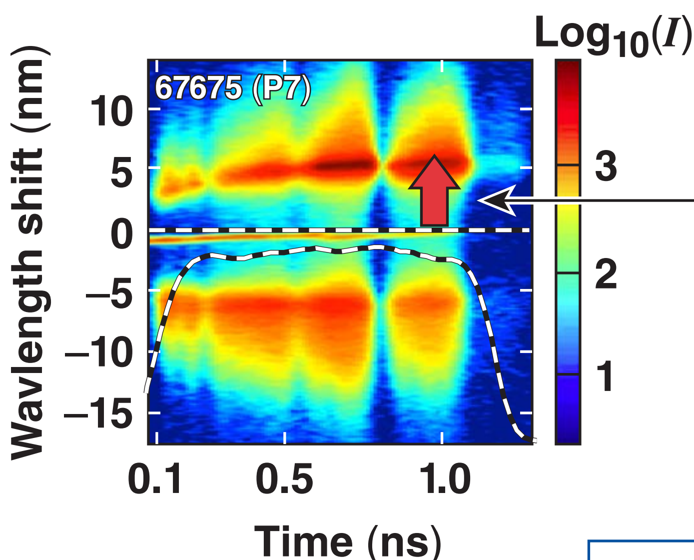
*C. Stoeckl *et al.*, Phys. Rev. Lett. 90, 235002 (2003).
**J. Zhang *et al.*, this conference and to be submitted to Physics of Plasmas.
*** R. W. Short *et al.*, this conference.

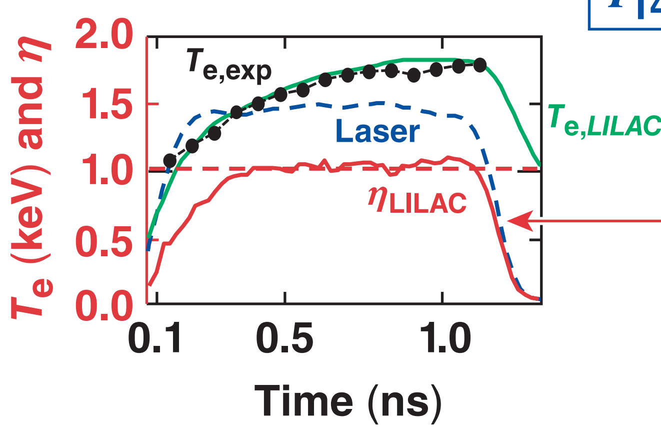
E22163

The sharp, red-shifted spectral feature in the $\omega/2$ emission is caused by the absolute instability and serves as the T_e measurement



$$\Delta\lambda_{nm} = 4.4 \times 10^{-3}\, T_{e,keV}$$

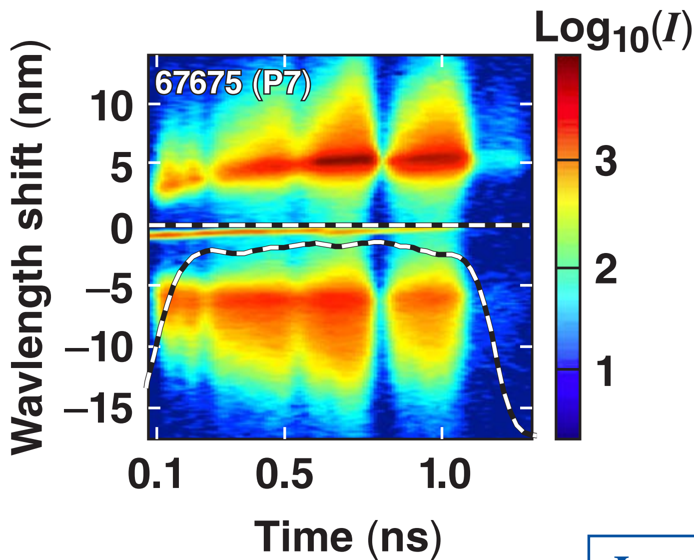
$I_{14} = 5.6$

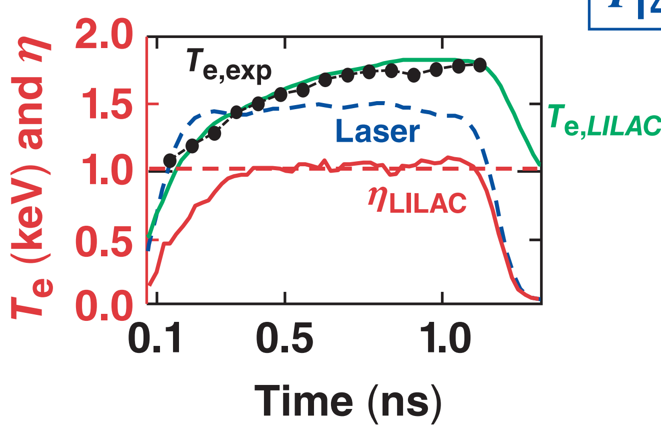


$$\eta_{LILAC} = \frac{I^{*}_{14}\, L_{n,\mu m}}{230^{*}\, T_{e,keV}}$$

E22111

The sharp, red-shifted spectral feature in the $\omega/2$ emission is caused by the absolute instability and serves as the T_e measurement





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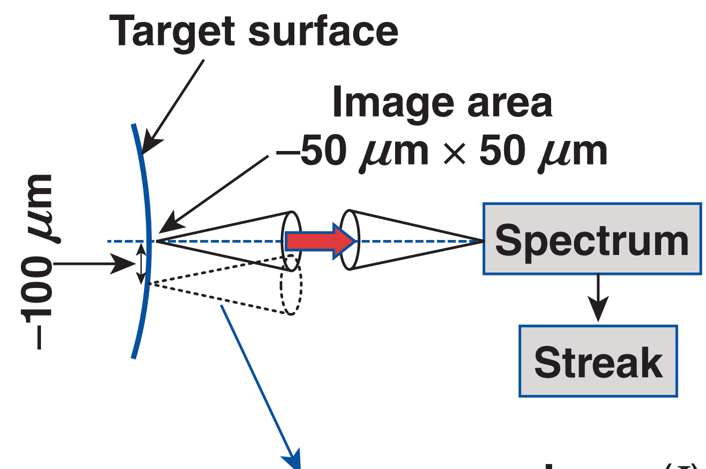
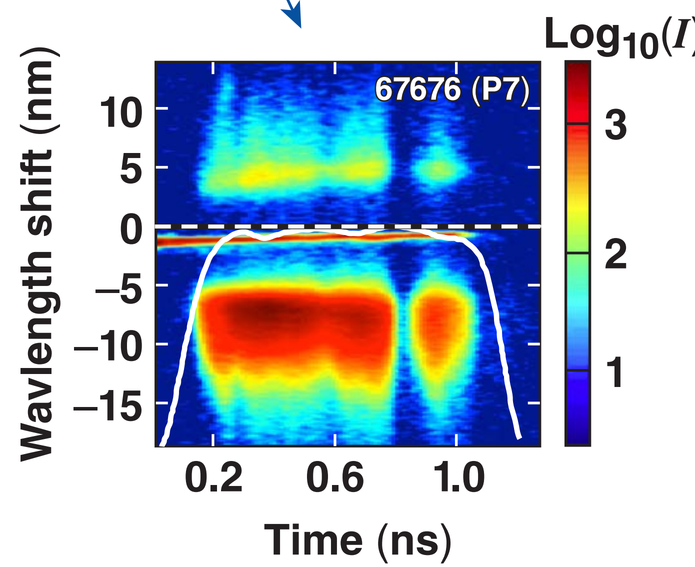
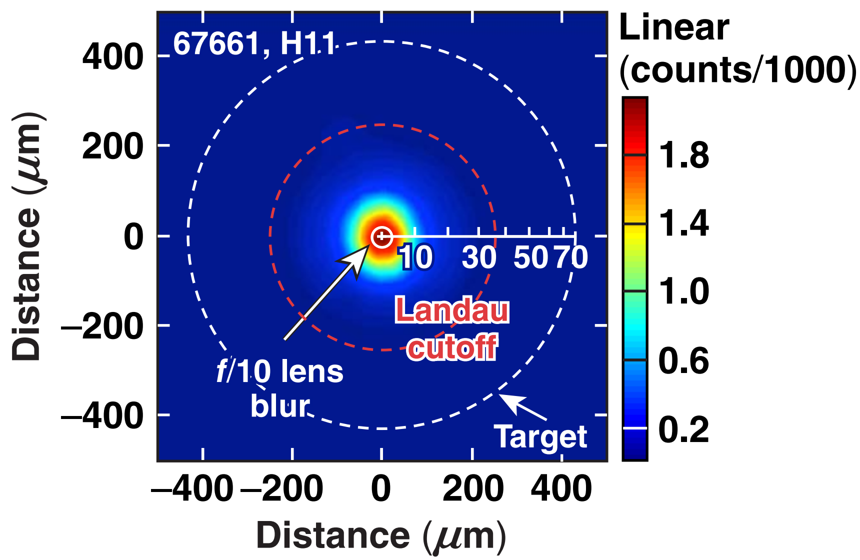
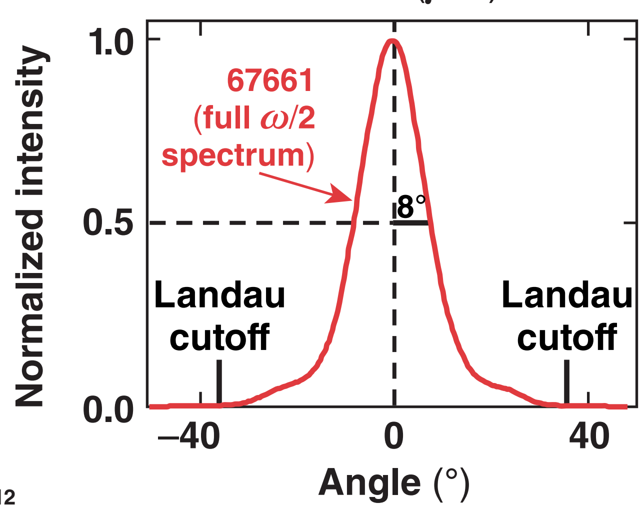




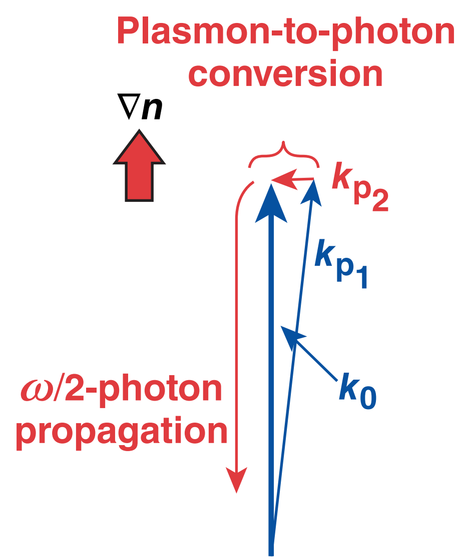
E22111a

Emission caused by the absolute TPD instability comes from its turning point and is guided by the density gradient





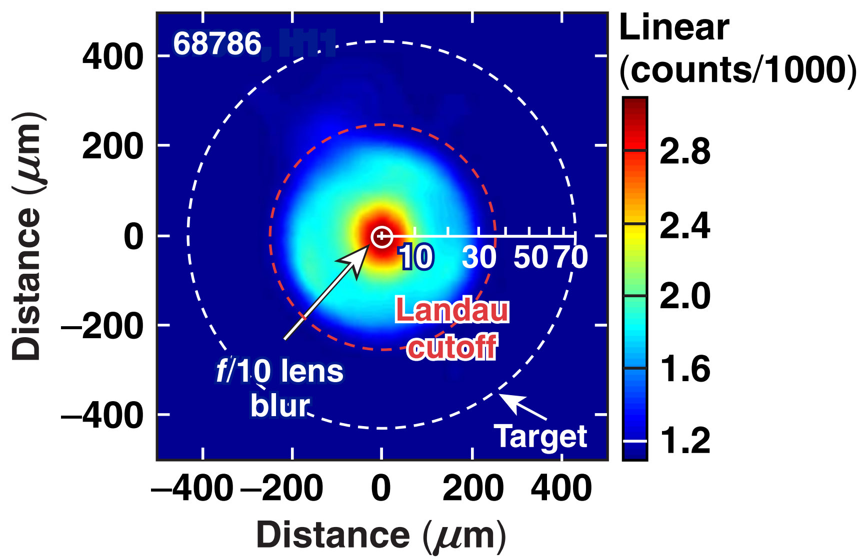
$I_{14} = 8.6$

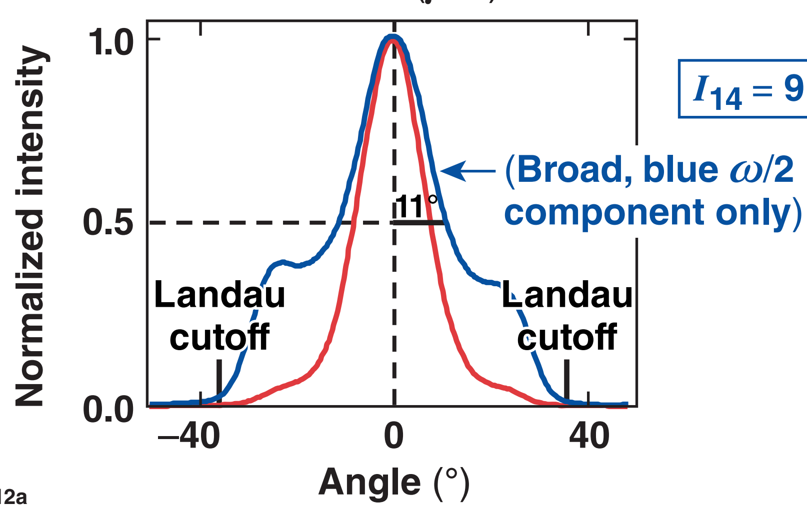


$n_e \sim 0.247\ n_c$

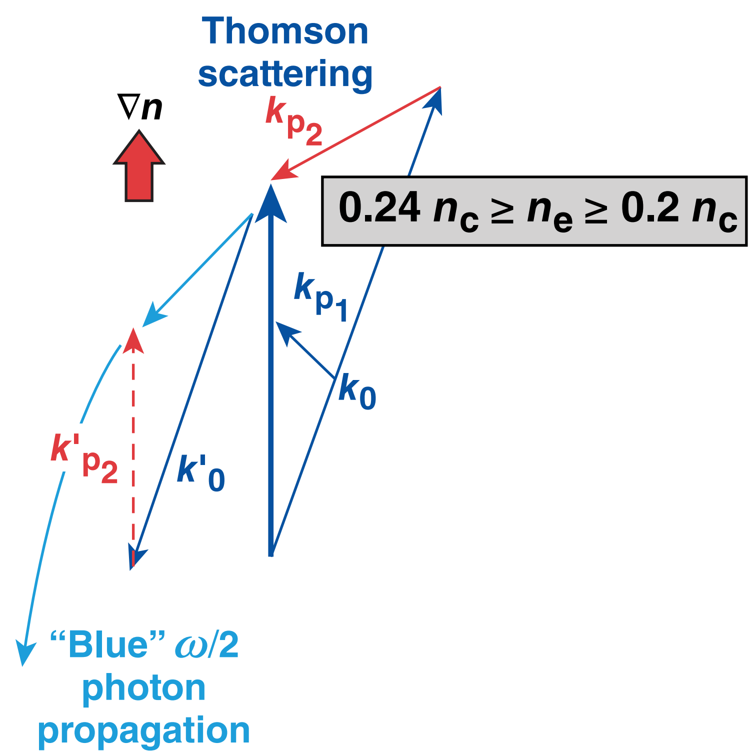
E22112

Broad spectral components of $\omega/2$ emission require Thomson scattering *and* TPD plasmon spectra that are very broad in k space



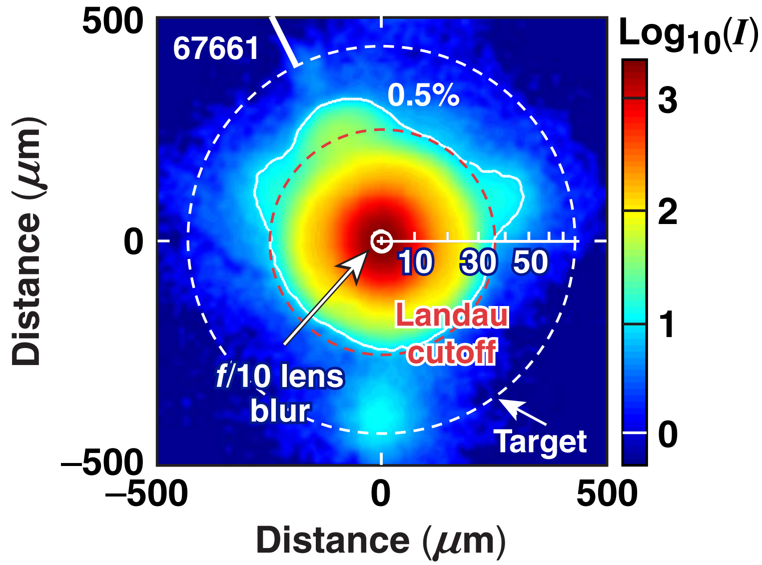


$I_{14} = 9.4$

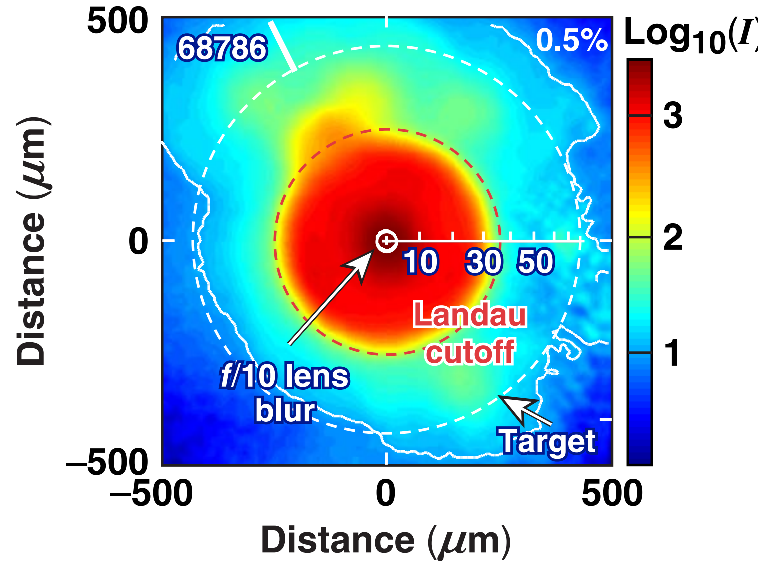


E22112a

The $\omega/2$ broadband emission is limited by the Landau cutoff to an ~37° half-cone angle

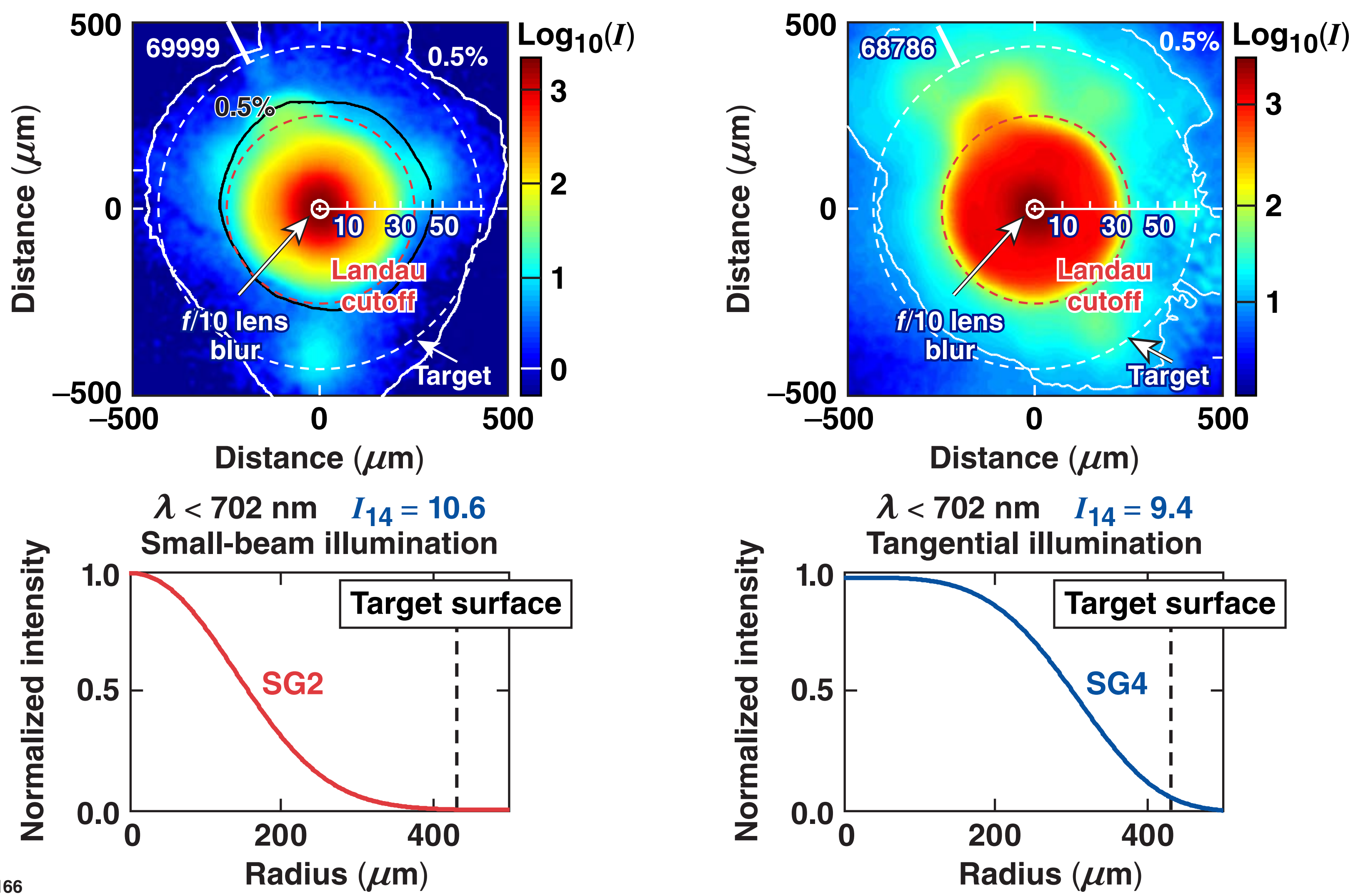


λ > 702 nm I_{14} = 8.6
Tangential illumination



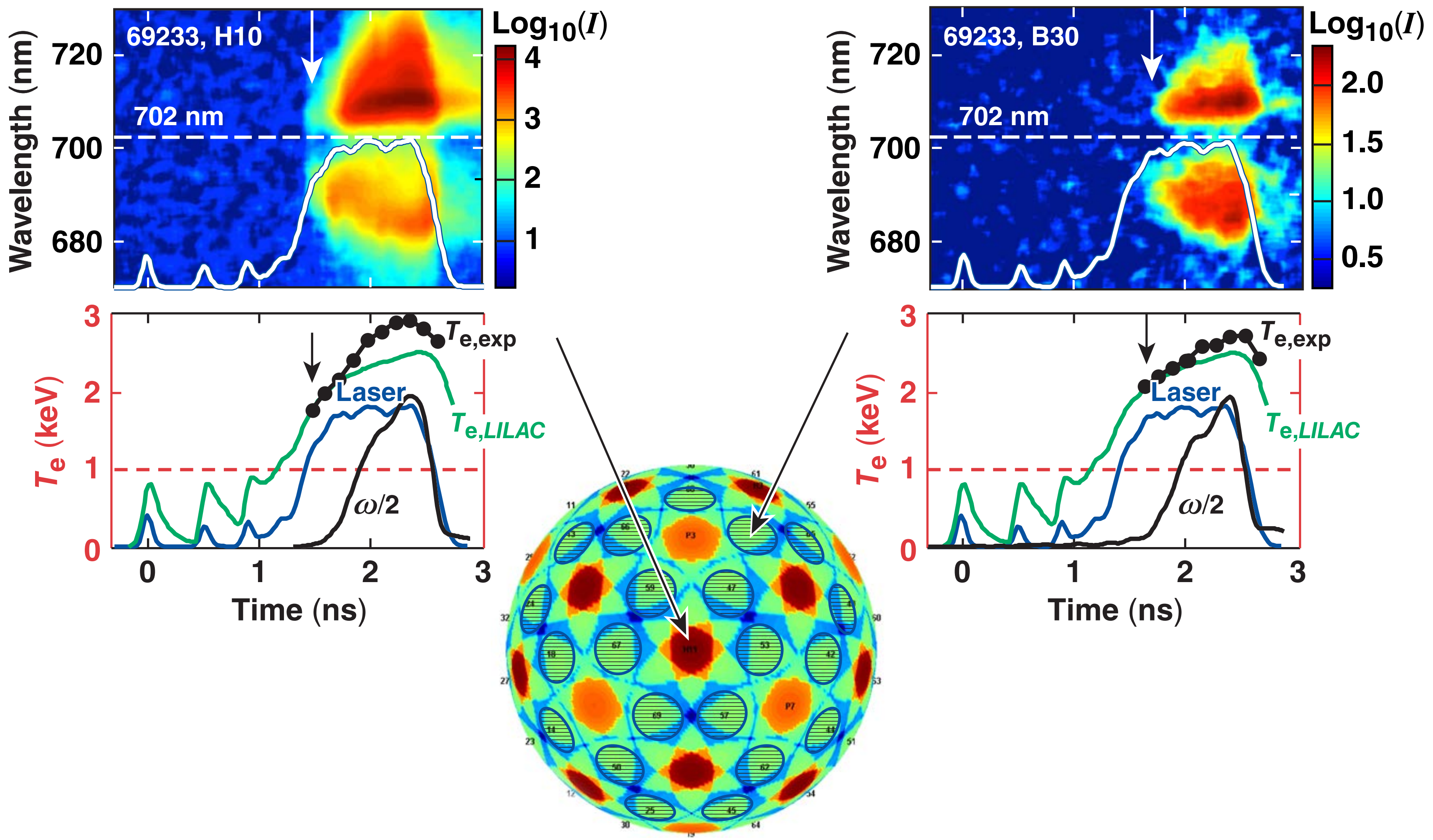
λ < 702 nm I_{14} = 9.4
Tangential illumination

The $\omega/2$ broadband emission is limited by the Landau cutoff to an ~37° half-cone angle



E22166

The electron temperatures vary in different areas of the target and exceed the *LILAC* prediction by 10% to 20%



E22113

T_e variations over the target entail perturbations of the $n_c/4$ density surface

- To maintain such temperatures differences, hydrodynamic simulations require significant (>20%) local energy deposition around $n_c/4$

Summary/Conclusions

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