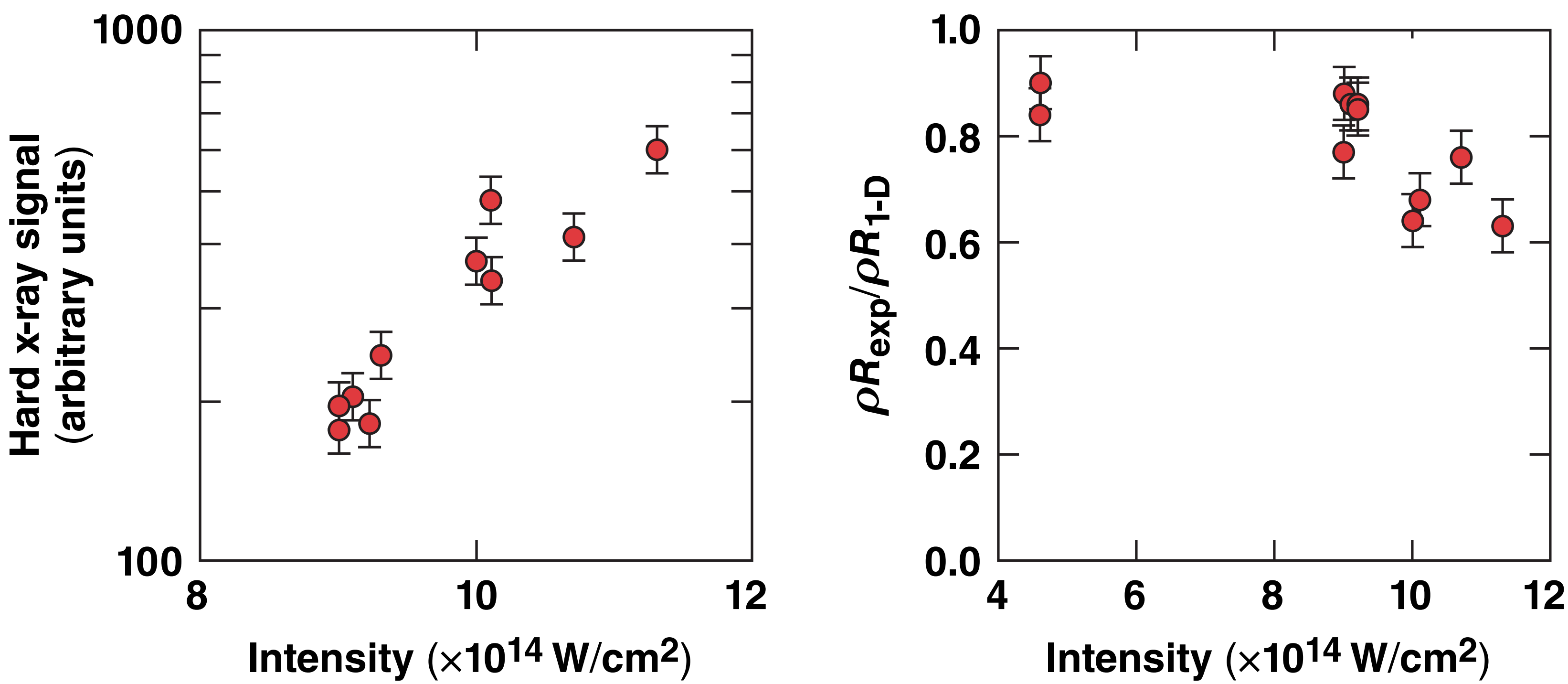
Preheat Studies Using Low-Adiabat Plastic Shell Implosions with Triple-Picket Pulses on OMEGA



C. Stoeckl
University of Rochester
Laboratory for Laser Energetics

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Summary

Hot-electron preheat marginally reduces the areal density of CH implosions at high intensity (10^{15} W/cm^2)

- Hot electrons generated from the two-plasmon-decay (TPD) instability can preheat implosion targets reducing the areal density
- CH shell implosions were performed with triple-picket pulses of up to 1.1×10^{15} W/cm^2 to assess the hot-electron preheat
- At intensities of $>10^{15}$ W/cm^2, 70% of the 1-D calculated areal density was observed compared to ~85% at intensities $<10^{15}$ W/cm^2
- A hot-electron model in the 1-D hydrocode *LILAC* reproduces the hard x-ray signature from the hot electrons quite well, but overestimates the areal-density reduction

Collaborators

**P. B. Radha, R. E. Bahr, J. A. Delettrez, D. H. Edgell,
V. Yu. Glebov, V. N. Goncharov, I. V. Igumenshchev,
T. C. Sangster, and W. Seka**

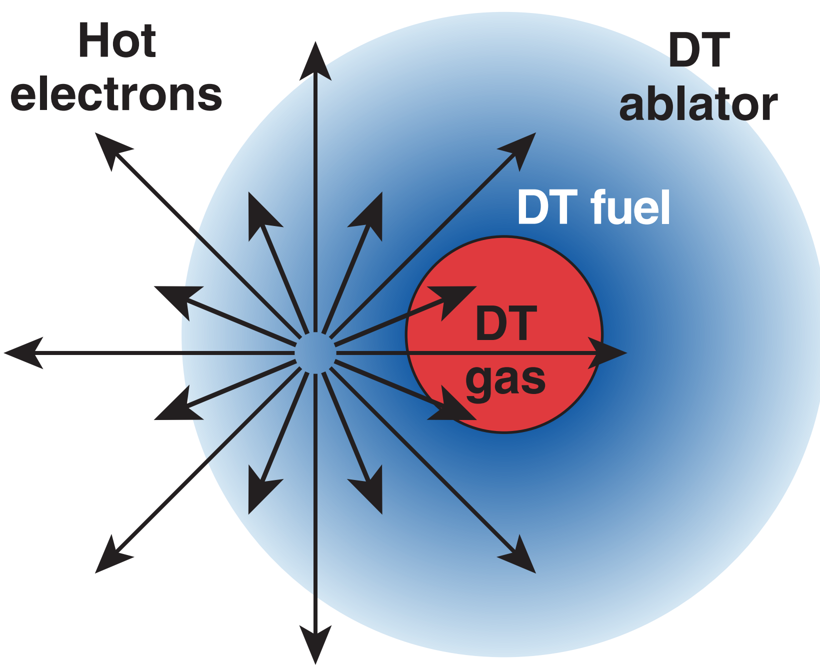
University of Rochester
Laboratory for Laser Energetics

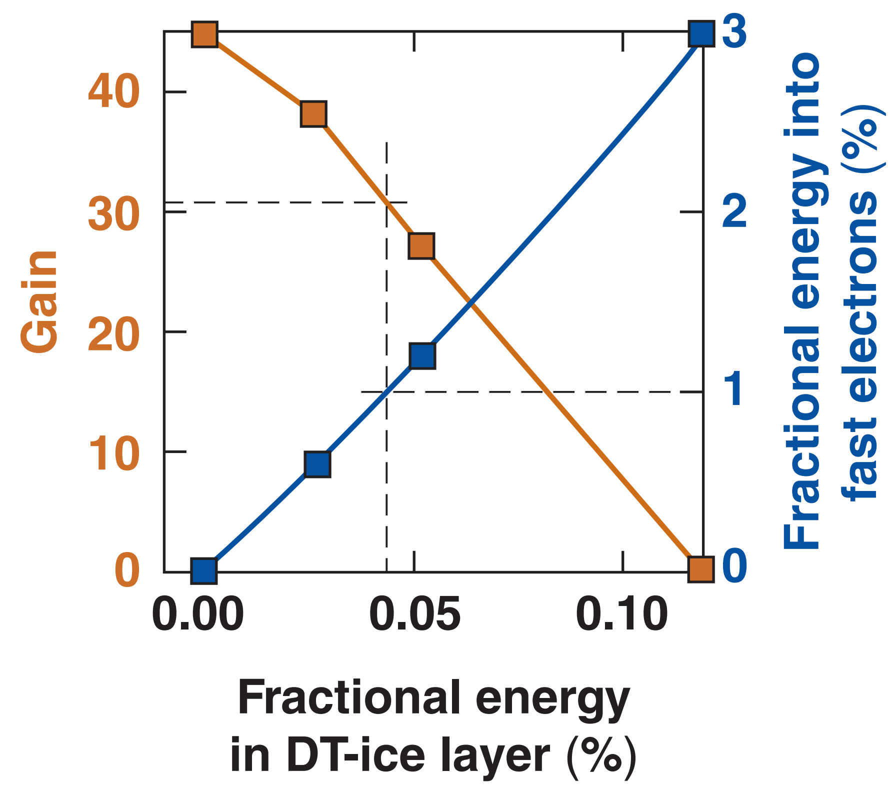
J. A. Frenje and R. D. Petrasso

Plasma Science and Fusion Center
Massachusetts Institute of Technology

Hot electrons can significantly reduce the target gain

- The effect of an 80-keV hot-electron tail was simulated using the fast-electron package in *LILAC*
- About 4% of the energy absorbed into fast electrons couples into the DT-ice fuel layer





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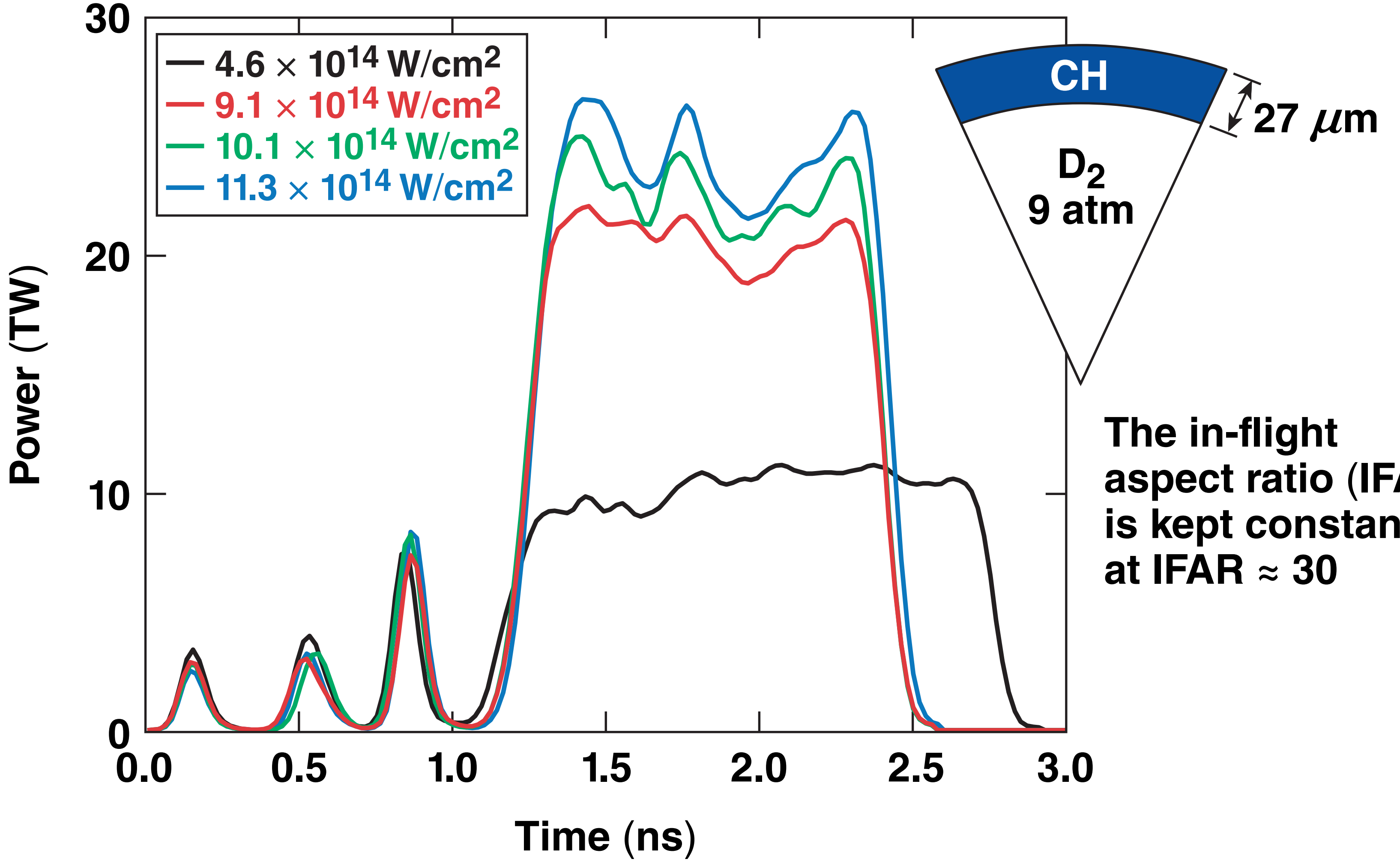
A number of different pulse shapes were used with D_2-filled, 27-μm-thick plastic targets



The in-flight aspect ratio (IFAR) is kept constant at IFAR ≈ 30

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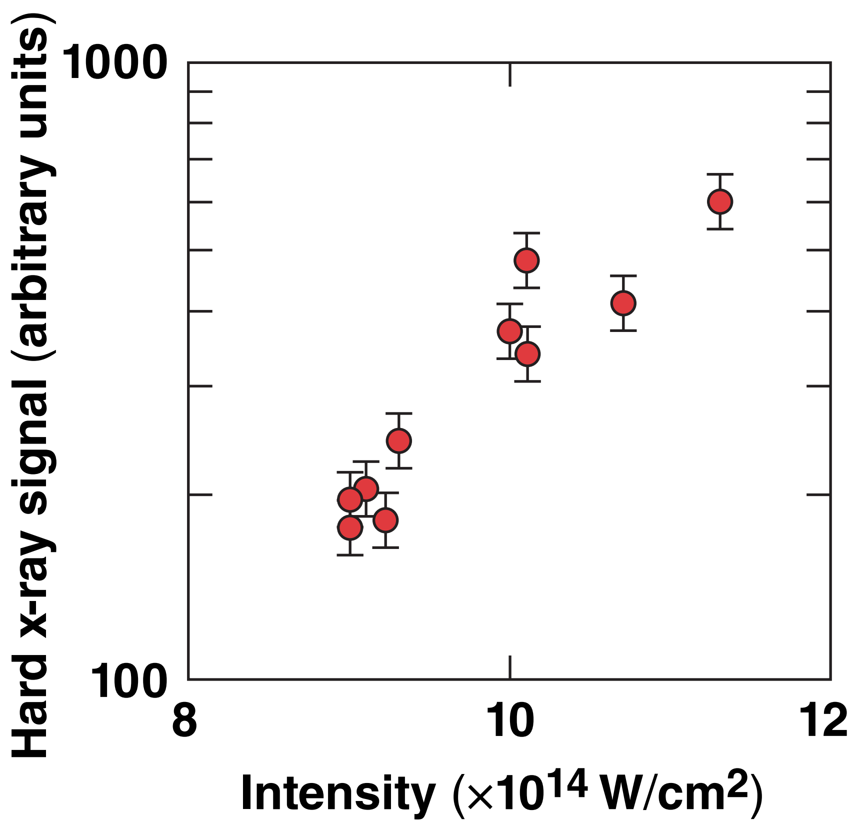
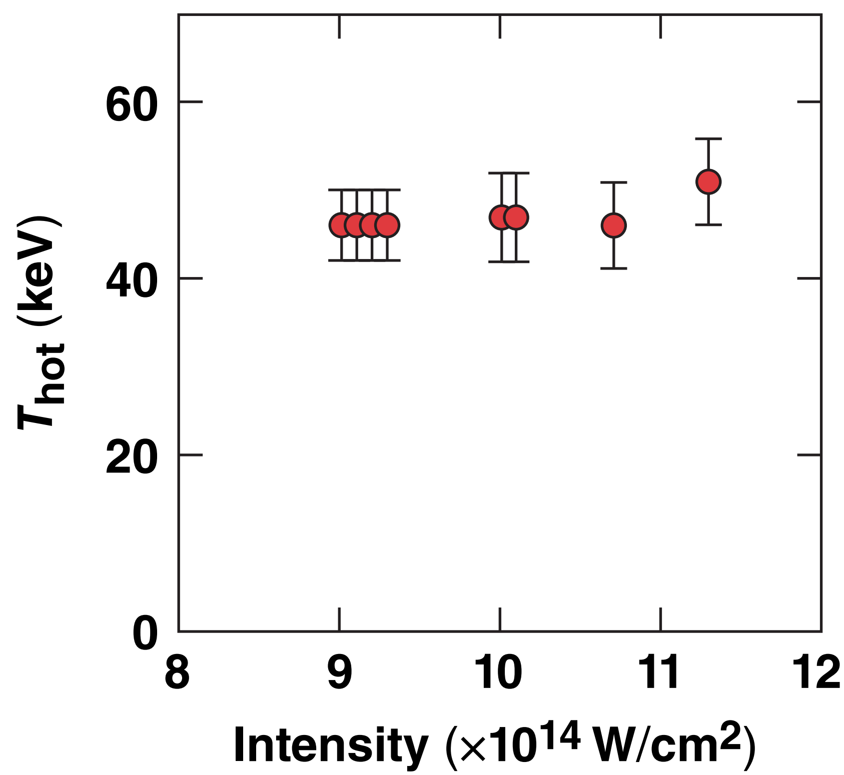
The hard x-ray emission and the hot-electron temperature scale with intensity as expected*





- No hard x-ray emission was observed at an intensity of 4.6×10^{14} W/cm^2

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*C. Stoeckl *et al.*, Phys. Rev. Lett. 90, 235002 (2003).

The measured areal density decreases compared to 1-D *LILAC* simulations with increasing intensity

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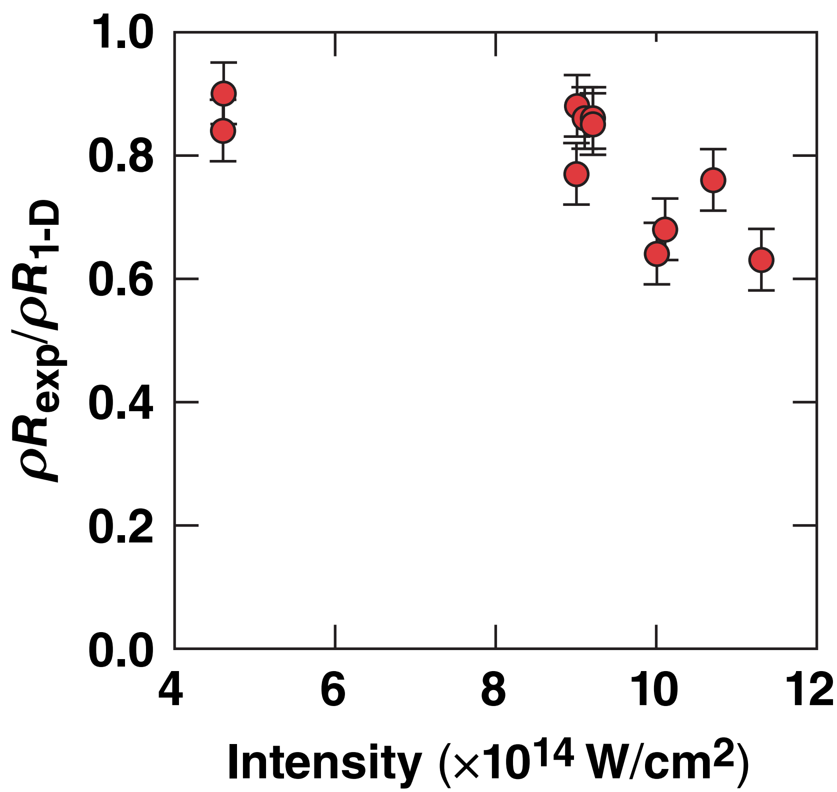
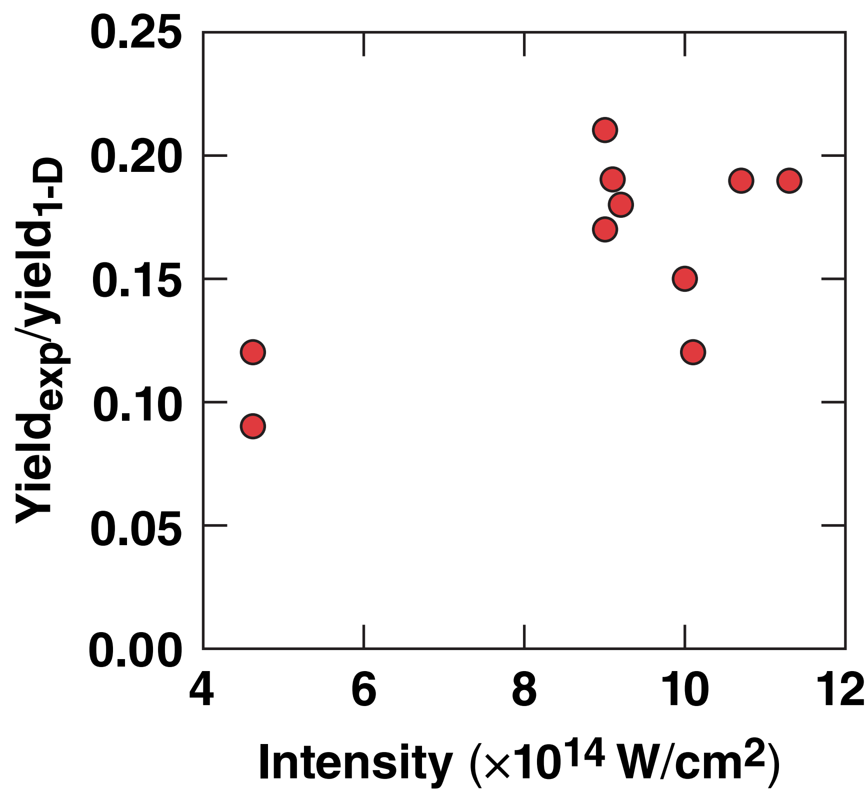
Massachusetts Institute of Technology





- The areal density (ρR) was measured using wedged range filters (WRF)*

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*F. H. Séguin *et al*., Rev. Sci. Instrum. 74, 975 (2003).

A hot-electron transport model has been added to the 1-D hydrocode *LILAC*[1]

- The percentage of laser energy into TPD electrons is a function of the threshold parameter given by[2]

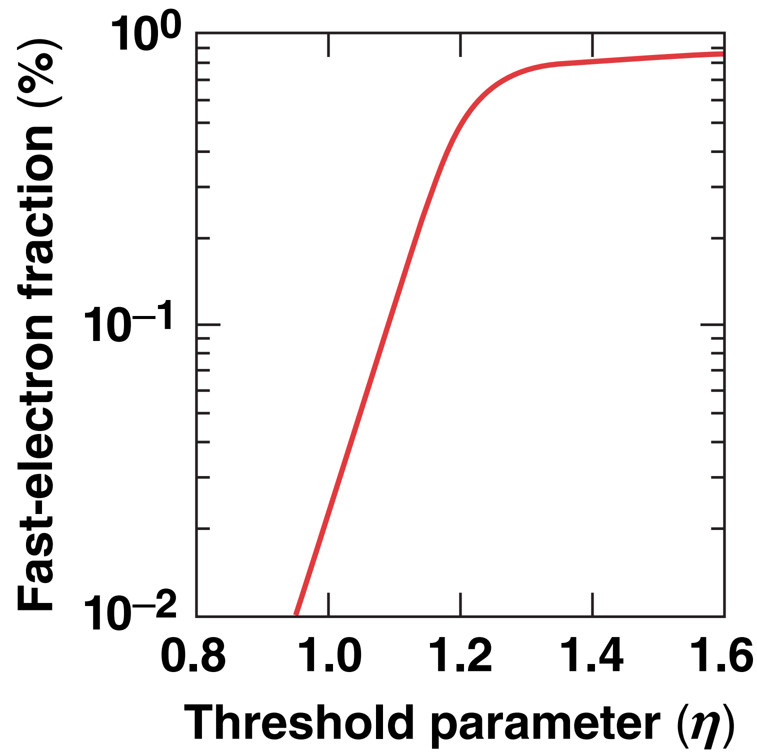
  $\eta = I_{14} \times L\ (\mu\mathrm{m})/[233 \times T\ (\mathrm{keV})]$

- The electrons are created at the quarter-critical surface with the temperature

  $T_h\ (\mathrm{keV}) = 10 \times I_{14}\ (\mathrm{W/cm^2})$

- The electrons are given a uniform 30° spread based on previous experiments

- The energy loss formula is from Li and Petrasso[3]



[1] J. A. Delettrez *et al.*, Bull. Am. Phys. Soc. 53, 248 (2008).
[2] A. Simon *et al.*, Phys. Fluids 26, 3107 (1983).
[3] C. K. Li and R. D. Petrasso, Phys. Rev. E 70, 067401 (2004).

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The hard x-rays signature generated from the hot-electron model in *LILAC* compares well with the data

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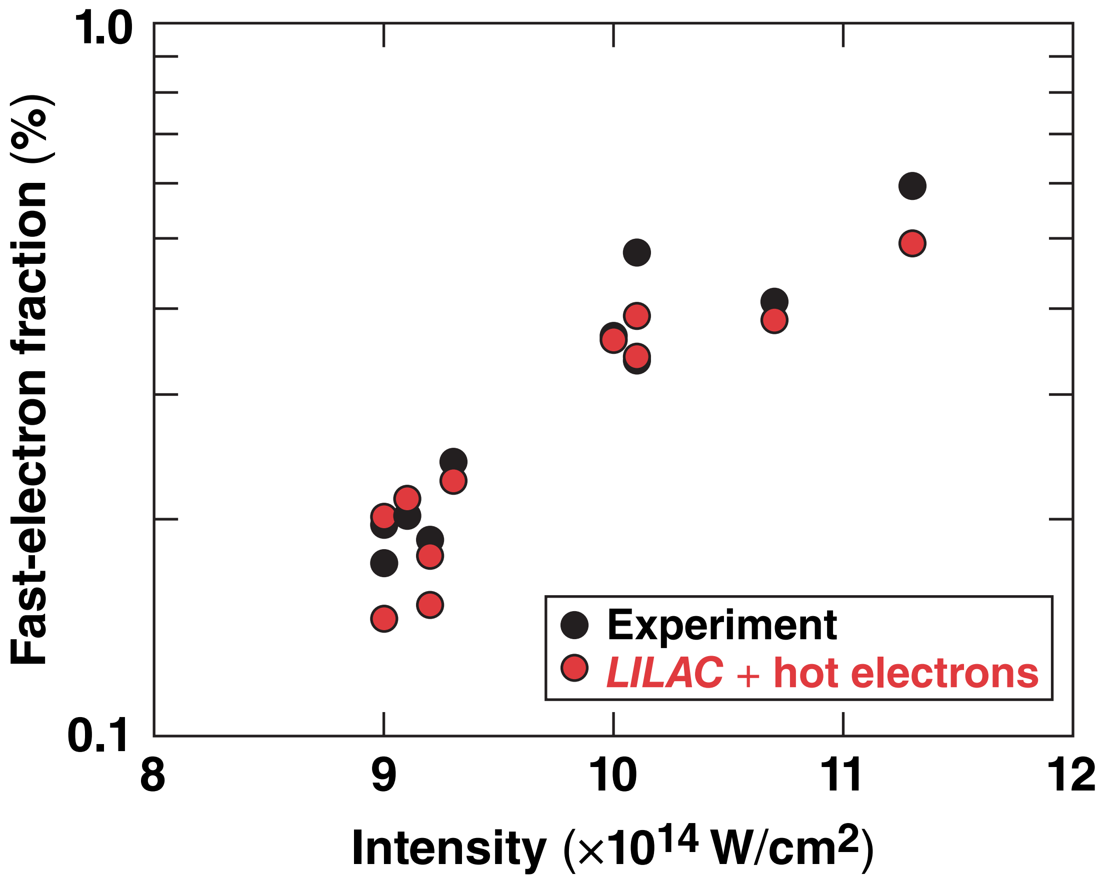

• The hard x-ray detector was absolutely calibrated using K_{α} spectroscopy*

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*B. Yaakobi *et al*., Phys. Plasmas 7, 3714 (2000).

The hot-electron model in *LILAC* overestimates the ρR reduction compared to the experiments

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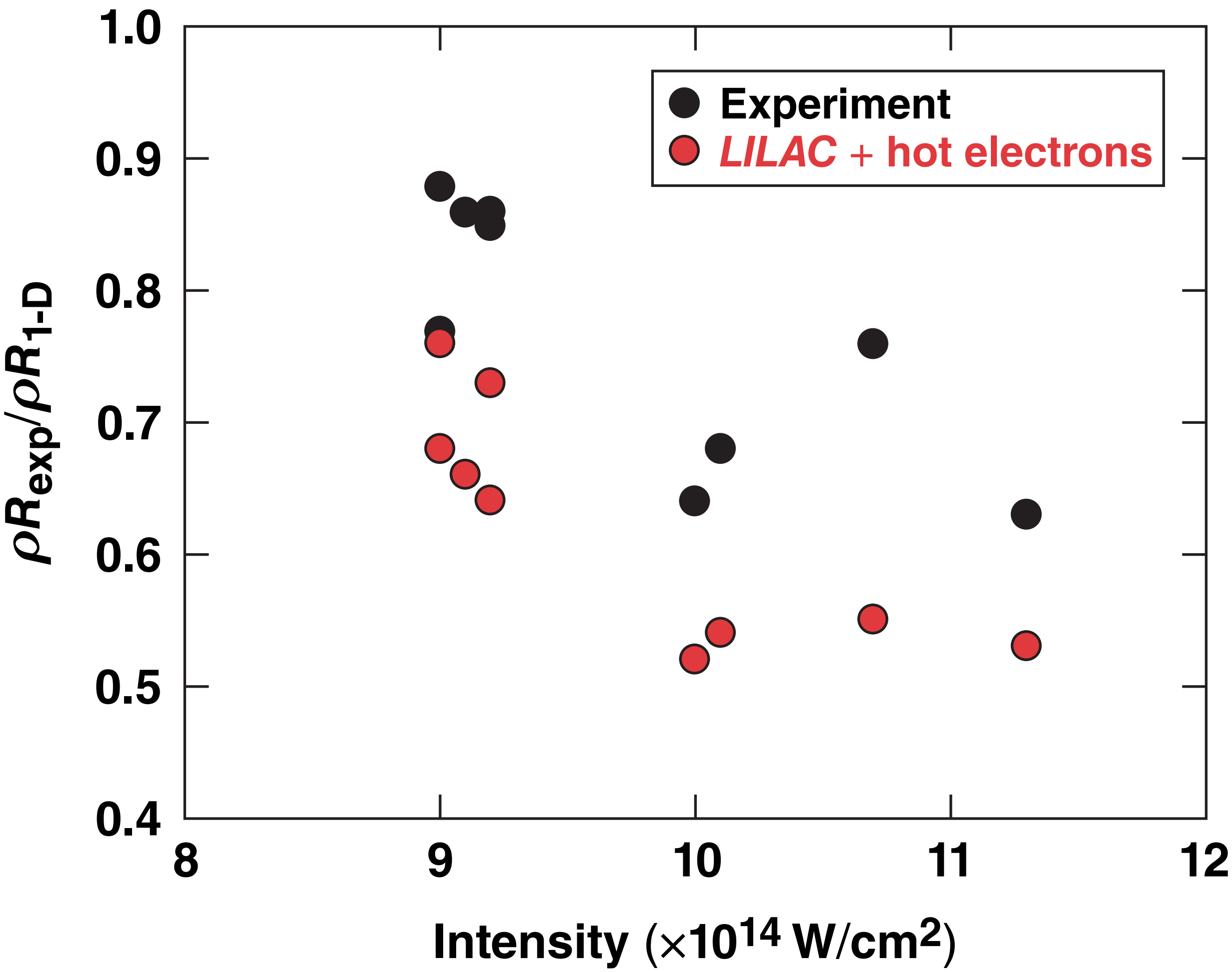

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Summary/Conclusions

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