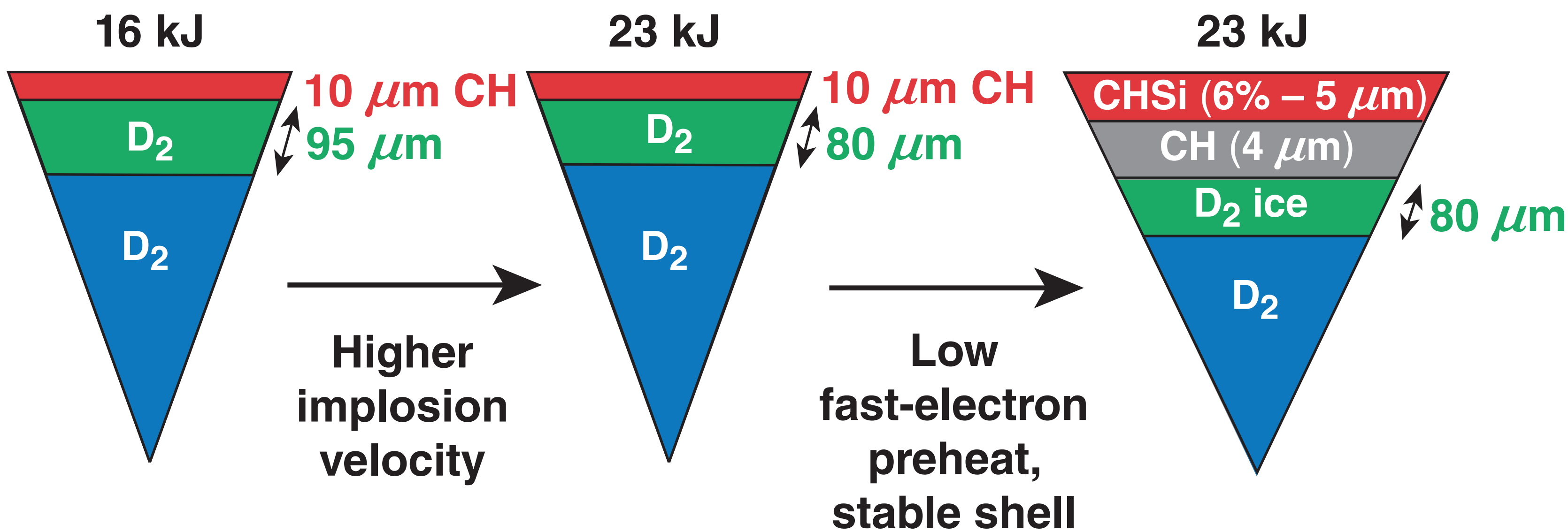
Doped Ablators for Low-Adiabat, High-Implosion-Velocity Cryogenic Implosions on OMEGA



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Summary

Doped ablators offer a promising route to achieve low-adiabat, high-implosion-velocity cryogenic implosions

- High laser intensities are required to achieve high-implosion velocities on OMEGA.
- Higher intensities result in a higher hard-x-ray signal, which is correlated with increased fast-electron preheat.
- Si-doped ablators are predicted to reduce hard-x-ray emission and reduce RT growth at the ablation surface (also Knauer PO6.00010).
- Warm plastic shell-implosions indicate that
  - hard-x-ray signals are reduced when the ablator is doped with Si
  - simulations of radiation emission are in good agreement with measurements

Collaborators

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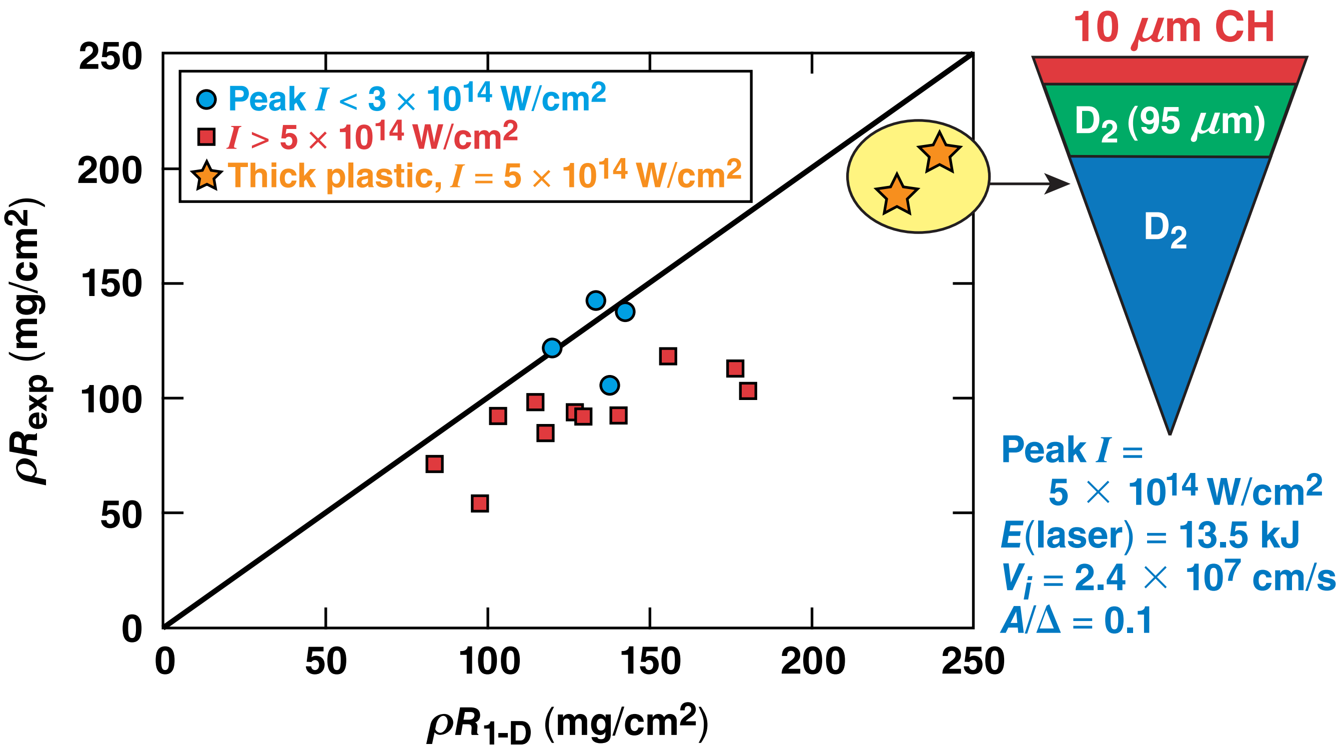
Low-adiabat cryogenic implosions achieve high ρR (~200 mg/cm^2) at low-implosion velocities

- High ρR was achieved by timing shocks correctly and reducing fast-electron preheat.



- Remaining differences in ρR can be attributed to fast-electron preheat or sampling of ρR by fusion products.
- For 20% ρR reduction, $E_{preheat}$ ~ 10 J (<0.1% E_L).

TC8048

T. C. Sangster (JO3.00001), V. N. Goncharov (GI1.00001), R. L. McCrory (FR1.00001)

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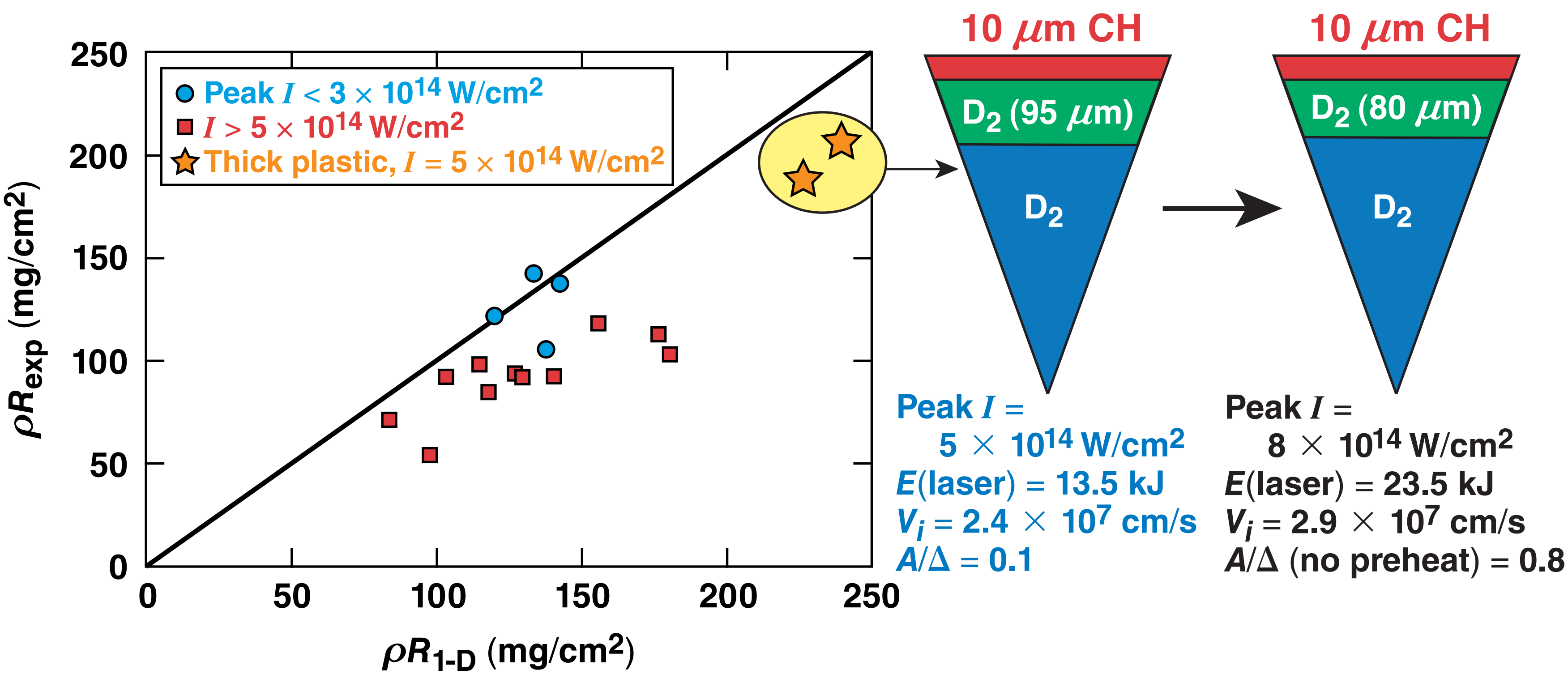

- Remaining differences in ρR can be attributed to fast-electron preheat or sampling of ρR by fusion products.
- For 20% ρR reduction, $E_{preheat}$ ~ 10 J (<0.1% E_L).
- Higher intensity is necessary for higher-implosion velocity.

TC8048

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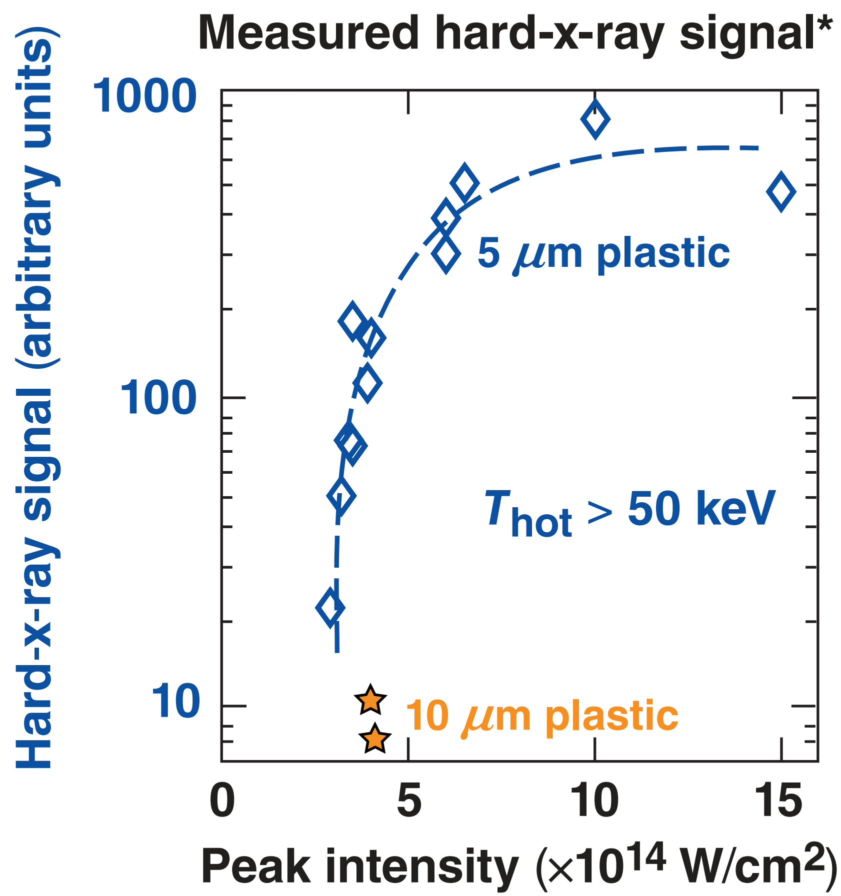
Measured hard-x-ray signals are correlated with laser intensity

UR LLE

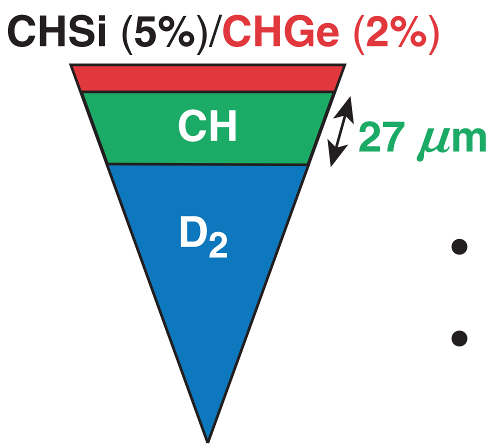


- Higher-*Z* ablators are being investigated as a way to reduce hard-x-ray emission.

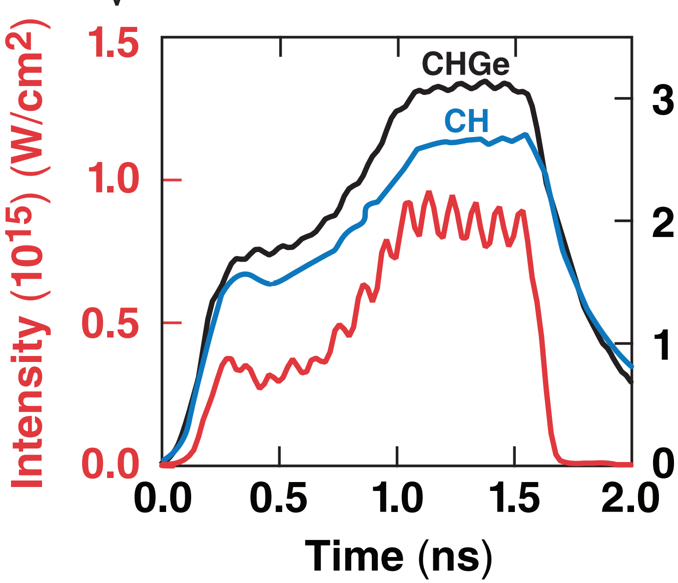
TC7985

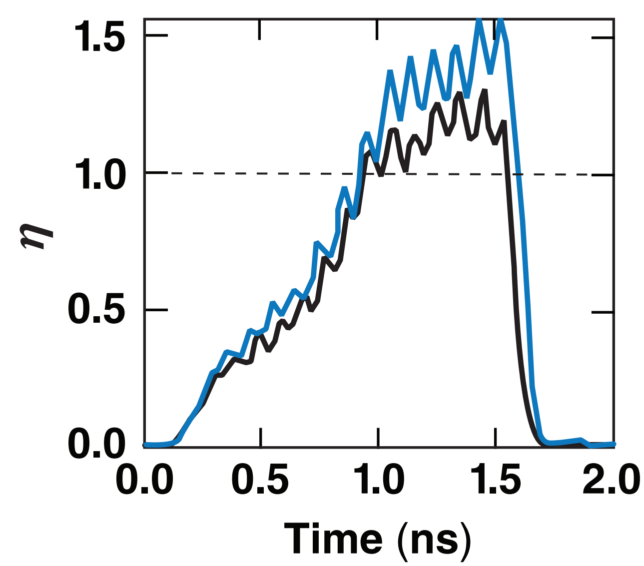
T. C. Sangster (JO3.00001), V. N. Goncharov (GI1.00001), R. L. McCrory (FR1.00001)

Si- and Ge-doped implosions are predicted to reduce hard-x-ray emission



- TPD threshold parameter* $\eta = I_{14}\, L_{\mu m}/230\ T_{keV}$
- Instability is triggered when $\eta > 1$



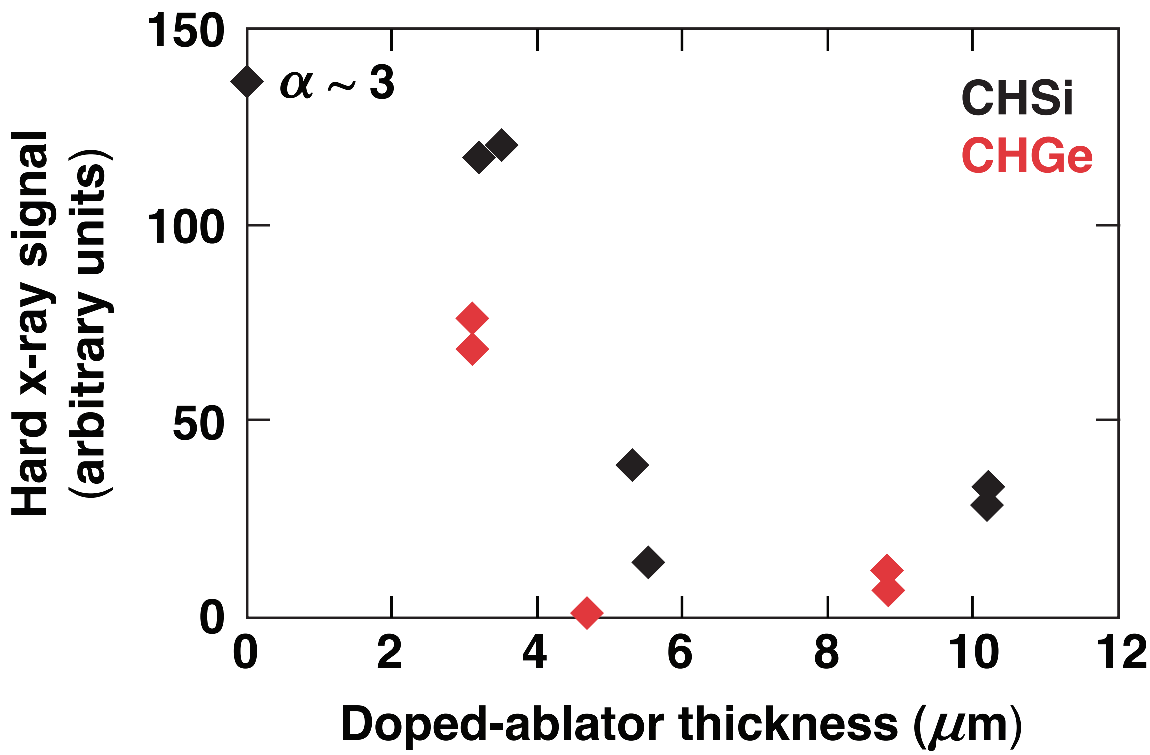


R. L. McCrory (FR1.00001), V. N. Goncharov (GI1.00001), J. P. Knauer (PO6.00010), J. A. Delettrez (JO3.00003)

*A. Simon *et al*., Phys. Fluids 26, 3107 (1983).

TC7987

Warm plastic implosions indicate reduced hard-x-ray signals due to high-*Z* doping



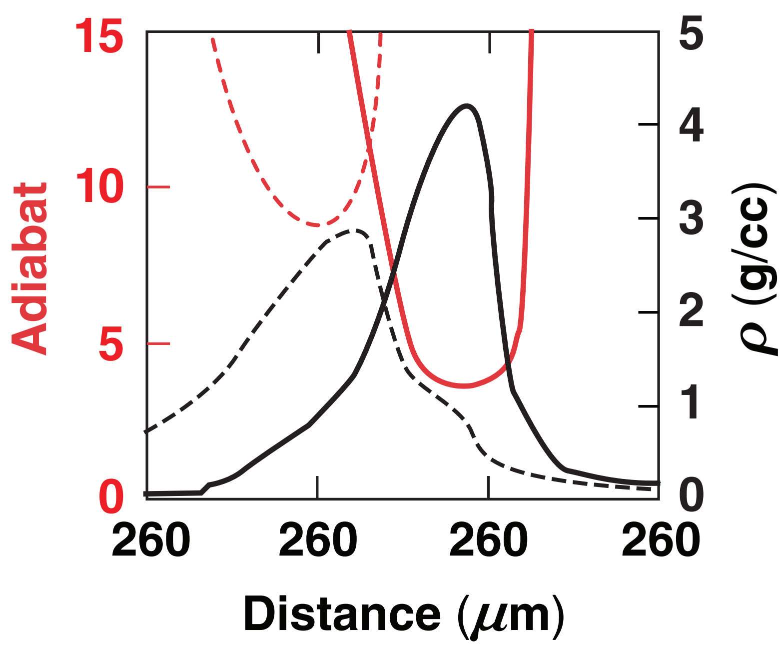
TC7988

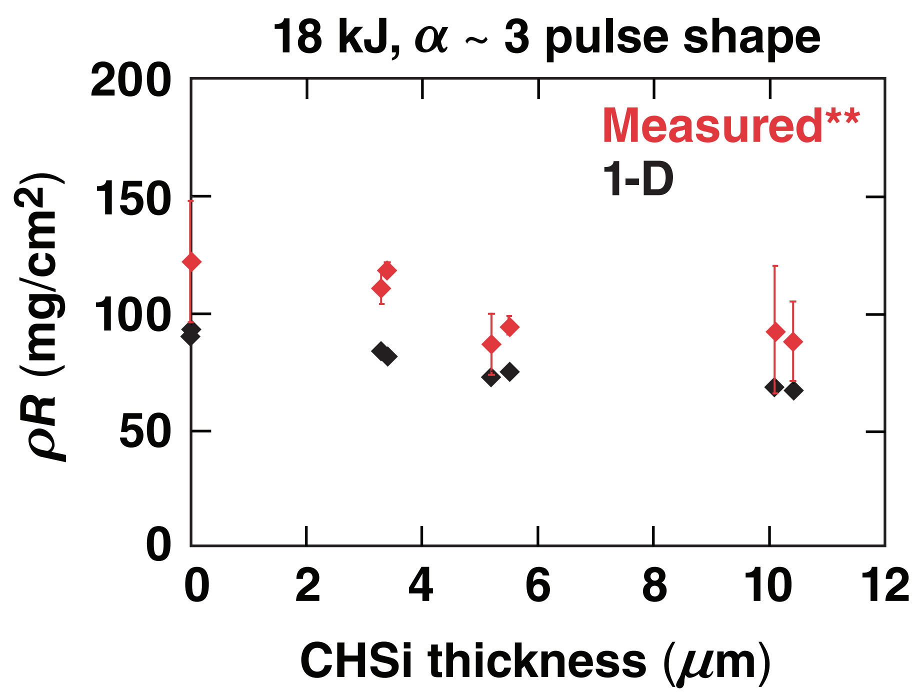
V. N. Goncharov (GI1.00001), J. A. Delettrez (JO3.00003)

Measured areal densities are approximately 20% higher than simulated

UR LLE

- For a given laser energy: $\rho R \sim 1/\alpha^{0.55*}$





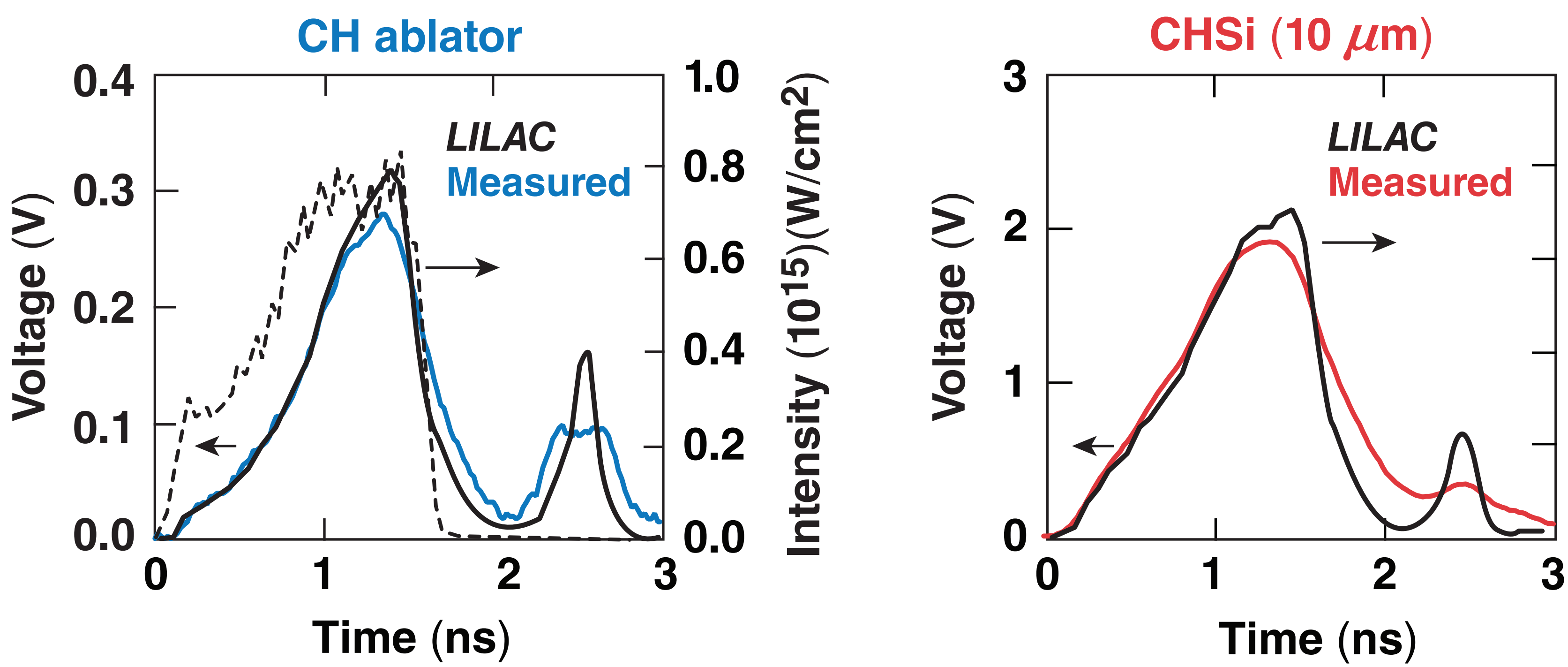
*R. Betti and C. Zhou, Phys. Plasmas 12, 110702 (2005).
**F. H. Séguin *et al*., Phys. Plasmas 9, 2725 (2002).

TC7989

Good agreement is obtained between simulated and measured x-ray emission

- **Energy of photons responsible for radiative preheat**
  for $\rho = 4$ g/cc and $T = 20$ eV; $\kappa(\rho R) \sim 1$ gives 2 keV < E_{photon} < 2.5 keV

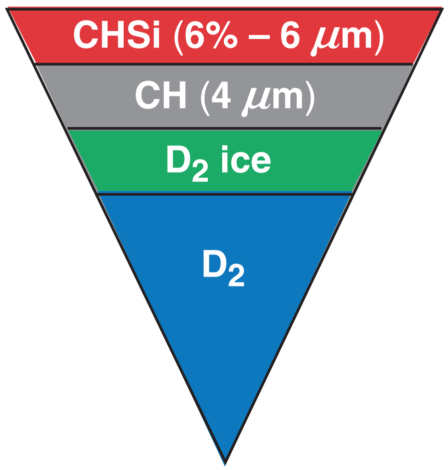
X-ray signals measured with DANTE* (1.8 to 2.5 keV)



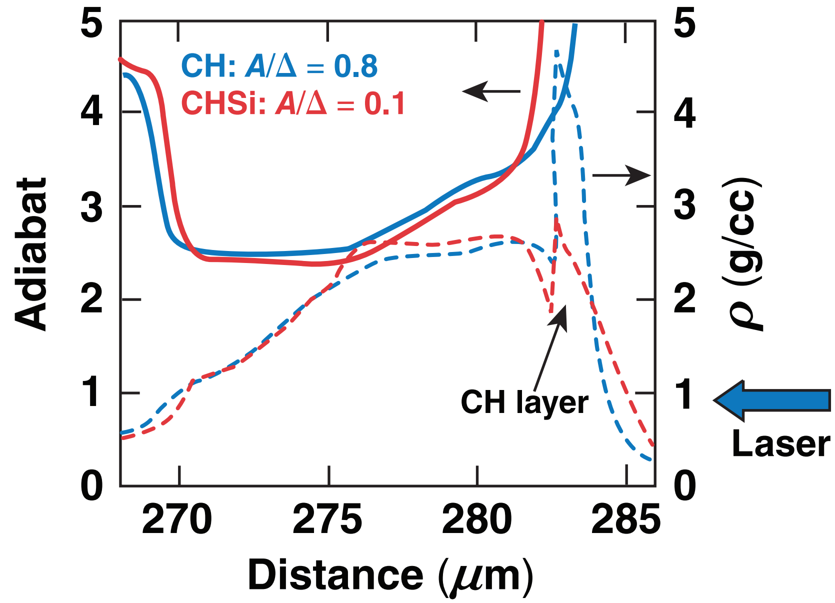
*H. N. Kornblum, R. L. Kauffman, and J. A. Smith, Rev. Sci. Instrum. 57, 2179 (1986).

TC8013

Doped ablators in cryogenic targets will also reduce imprint and RT growth at the ablation surface*



α ~ 2.5; peak $I = 8 \times 10^{14}$ W/cm^2



- RT growth will be discussed by Knauer**

*S. E. Bodner *et al*., Phys. Plasmas 5, 1901 (1998).
**J. P. Knauer (PO6.00010)

TC7986

Summary/Conclusions

Doped ablators offer a promising route to achieve low-adiabat, high-implosion-velocity cryogenic implosions

UR LLE

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