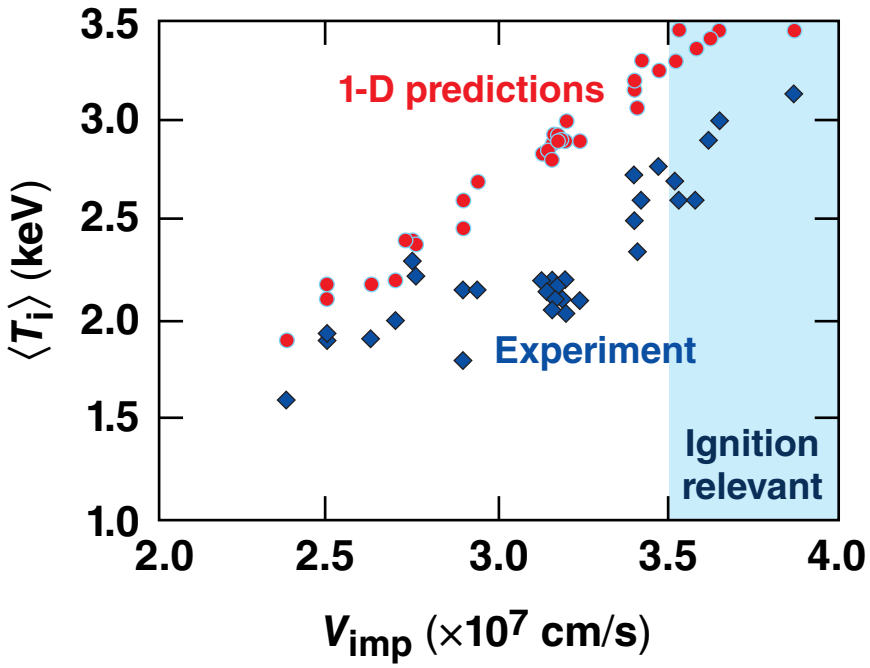
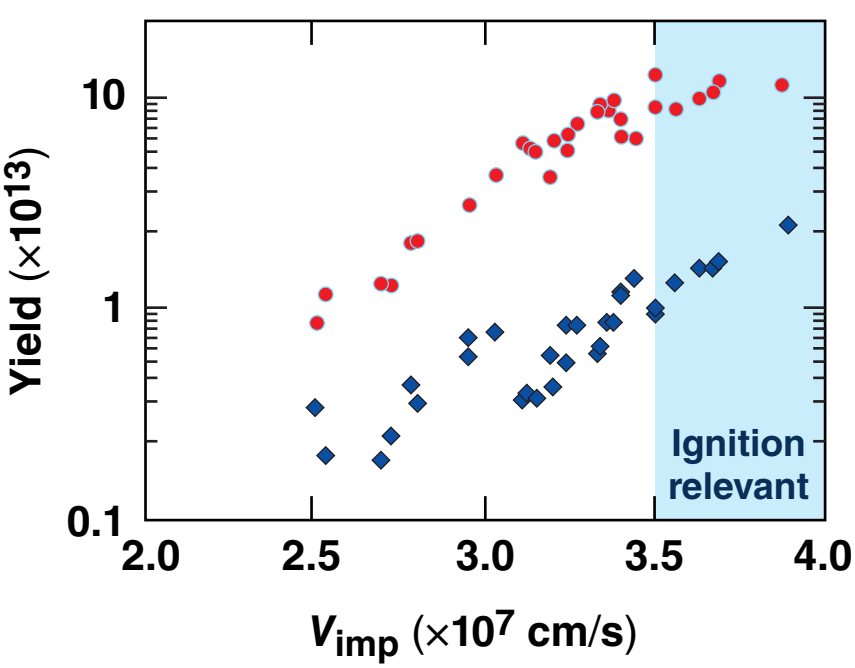
Performance of Cryogenic Deuterium–Tritium Implosions at Ignition-Relevant Implosion Velocities on OMEGA





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Summary

Both target yields and neutron-averaged ion temperatures have improved* by increasing V_{imp} from 3 to 3.8 $\times$ 10^7 cm/s

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- The implosion velocity was increased in cryogenic targets on OMEGA over the last year by reducing the fuel mass
- Yields in excess of 2 $\times$ 10^{13} and ion temperatures up to 3.2 keV were measured in cryogenic implosions with V_{imp} ~ 3.8 $\times$ 10^7 cm/s
- Areal densities above 80% of 1-D predictions were measured in implosions with fuel adiabat (α) exceeding 3(IFAR/20)$^{1.2}$, where IFAR is the shell in-flight aspect ratio
- Shell performance is currently limited by local defect growth**

*T. C. Sangster, NI2.00002, this conference.
** I. V. Igumenshchev, JO4.00002, this conference.

Collaborators

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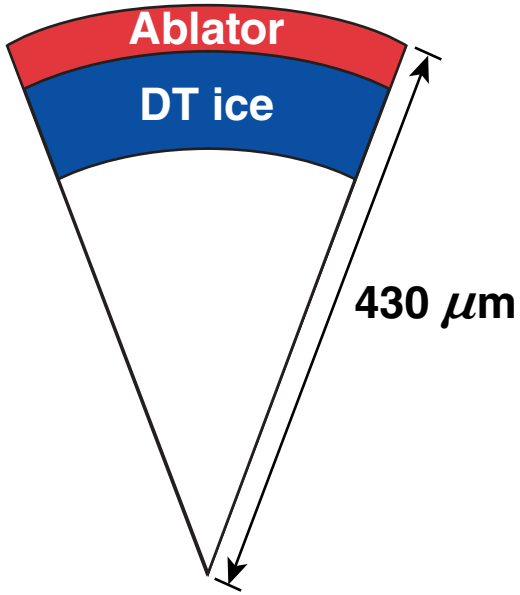
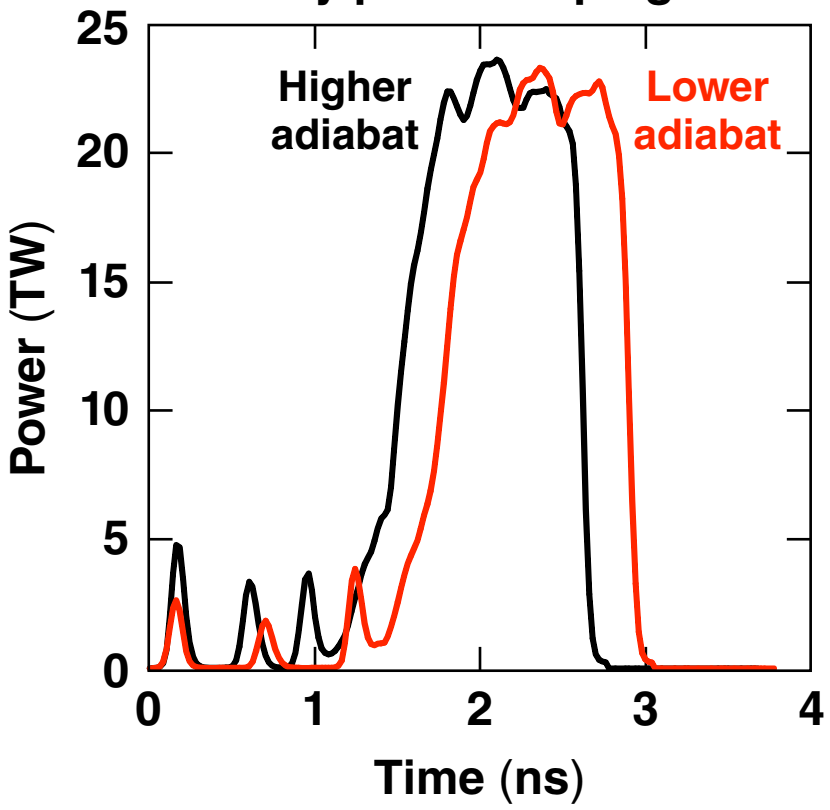
Target performance is optimized by varying implosion velocity, IFAR, fuel adiabat, and ablator material

- V_{imp} and IFAR are controlled by varying ablator (9 to 12 μm) and fuel thickness (40 to 66 μm)
- The effect of imprint is varied by introducing Si-doped layers*



Adiabat and IFAR are controlled by pulse shaping

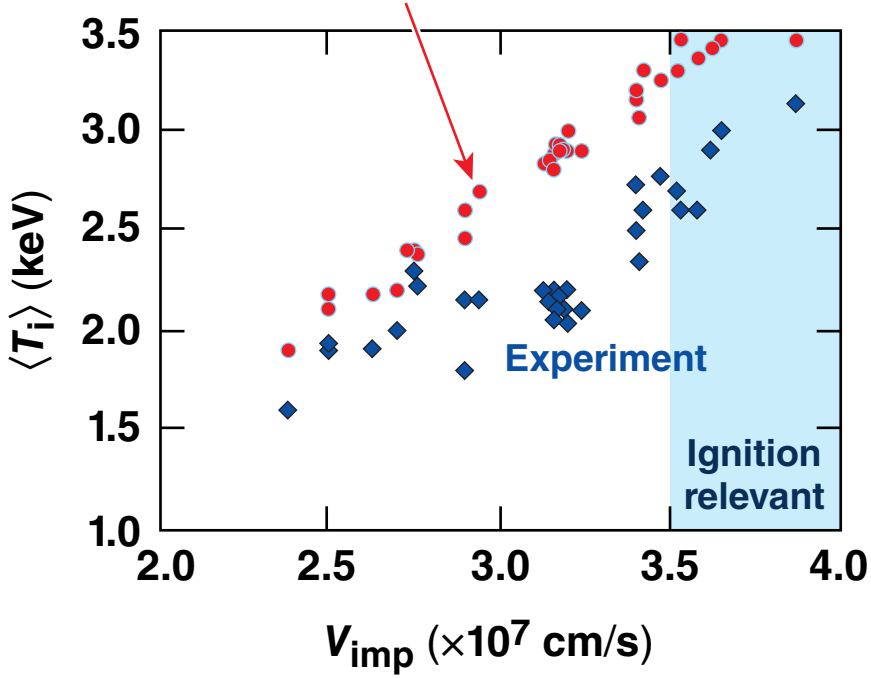


*G. Fiksel, CO5.00014, this conference.

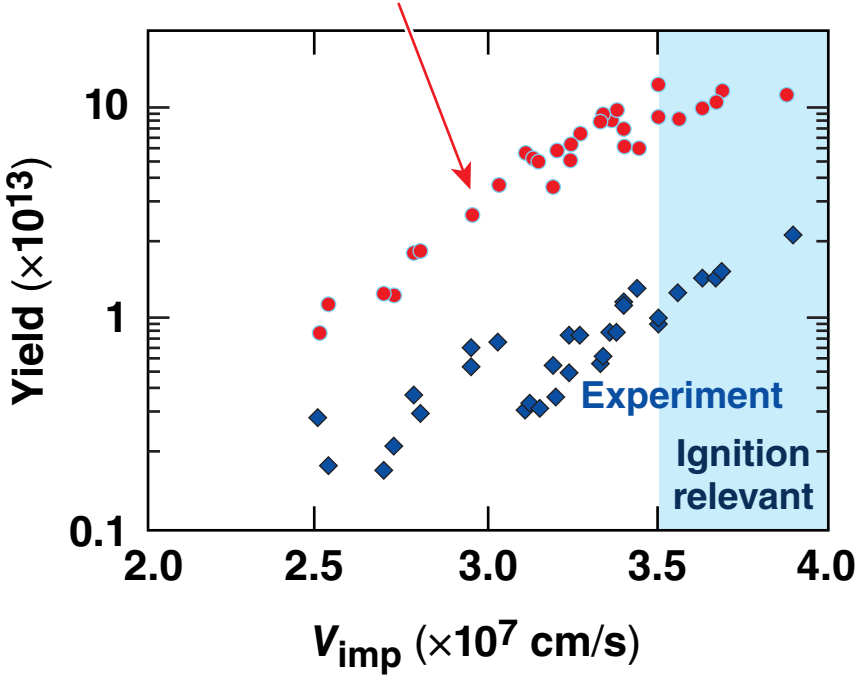
Both target yields and neutron-averaged ion temperatures increase with the implosion velocity

1-D predictions

$$T_{keV} \sim 2.64\left(\frac{V_{imp}}{3\times10^{7}}\right)^{1.34}\left(\frac{\alpha}{3}\right)^{-0.05}$$

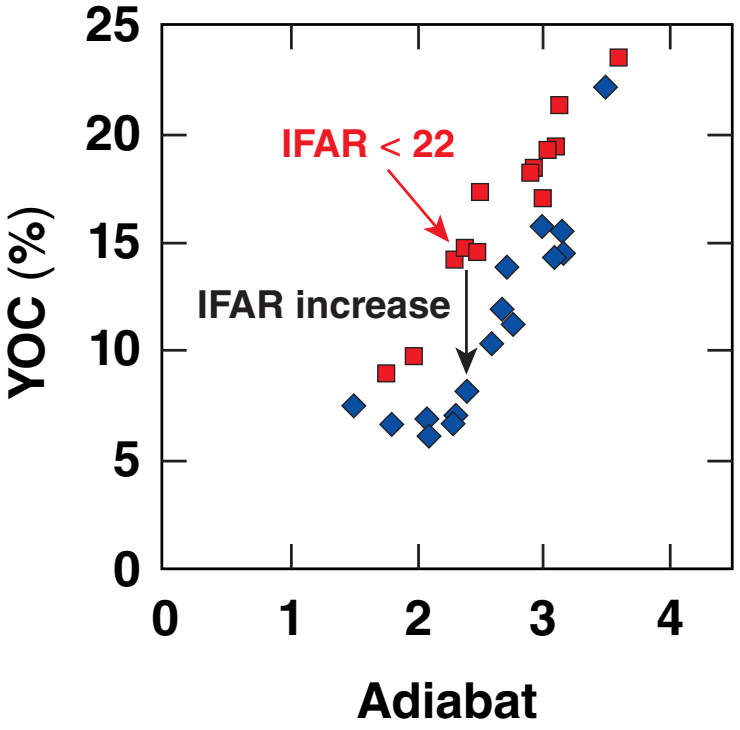


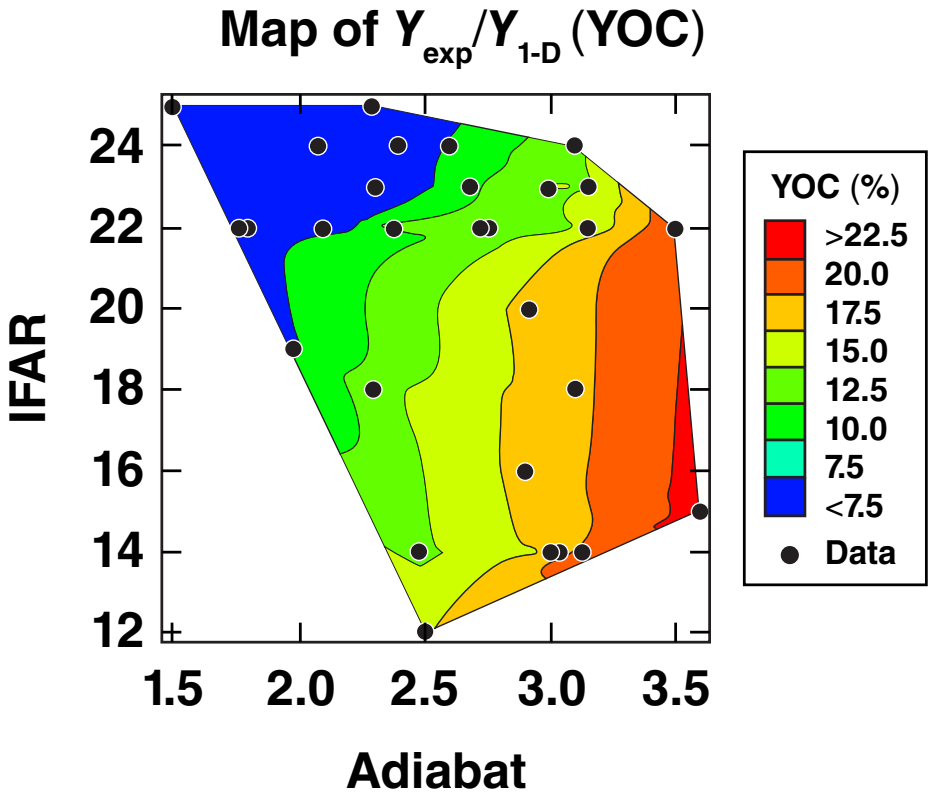
$$Y \sim 3.2\times10^{13}\left(\frac{V_{imp}}{3\times10^{7}}\right)^{6}\left(\frac{\alpha}{3}\right)^{-0.8}$$



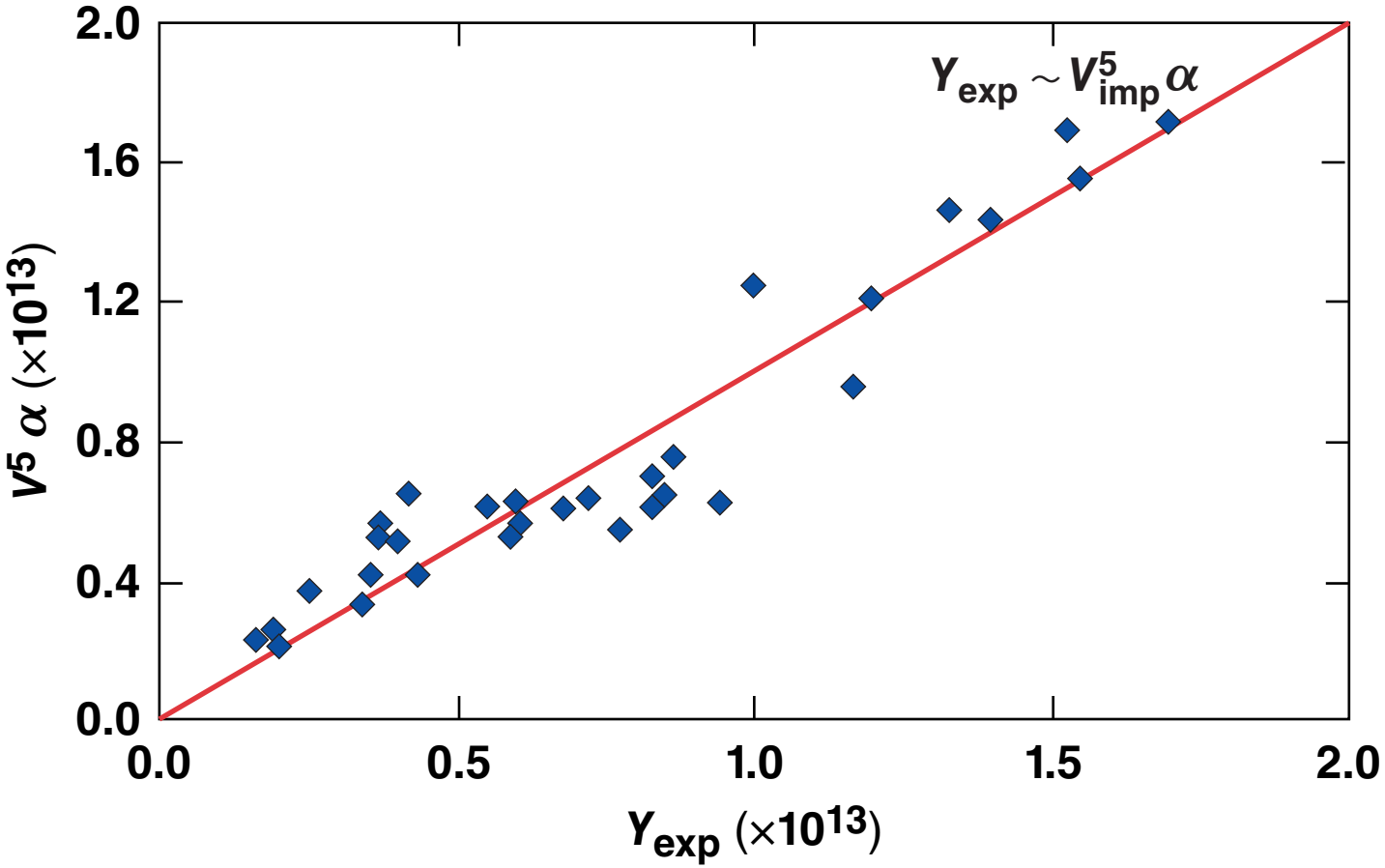
TC10249

Yield degradation is a strong function of fuel adiabat





The OMEGA experimental yield scales as V_{imp}^5



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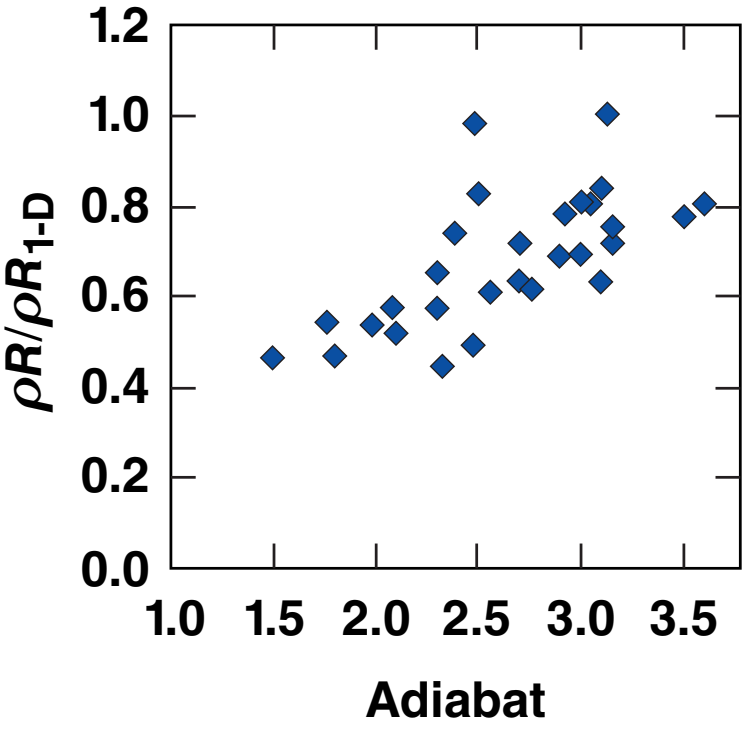
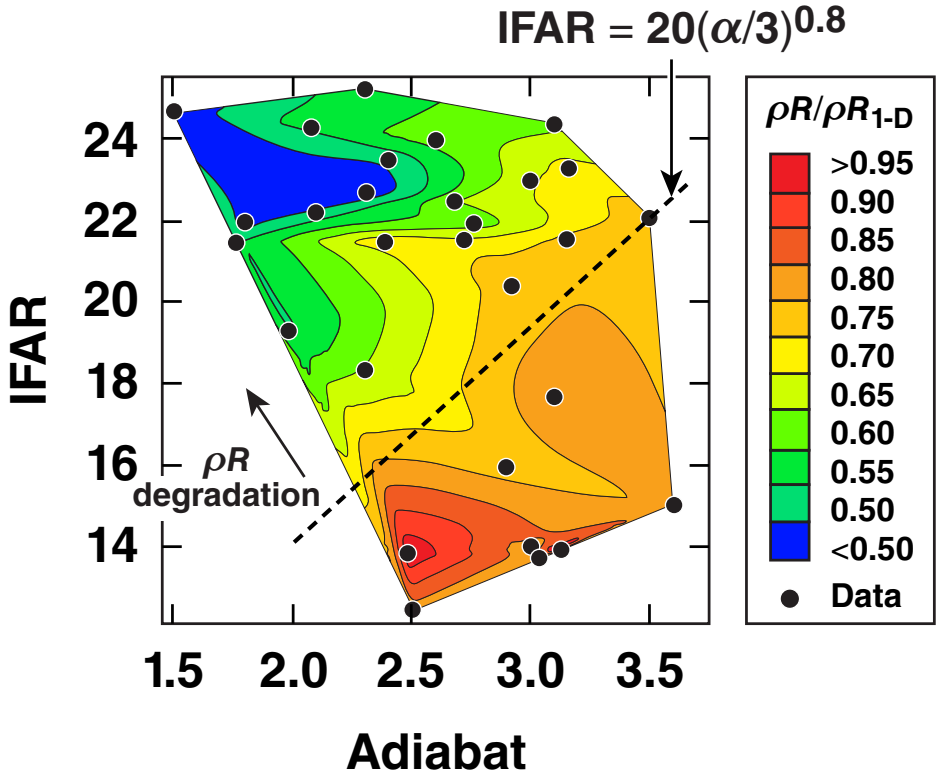
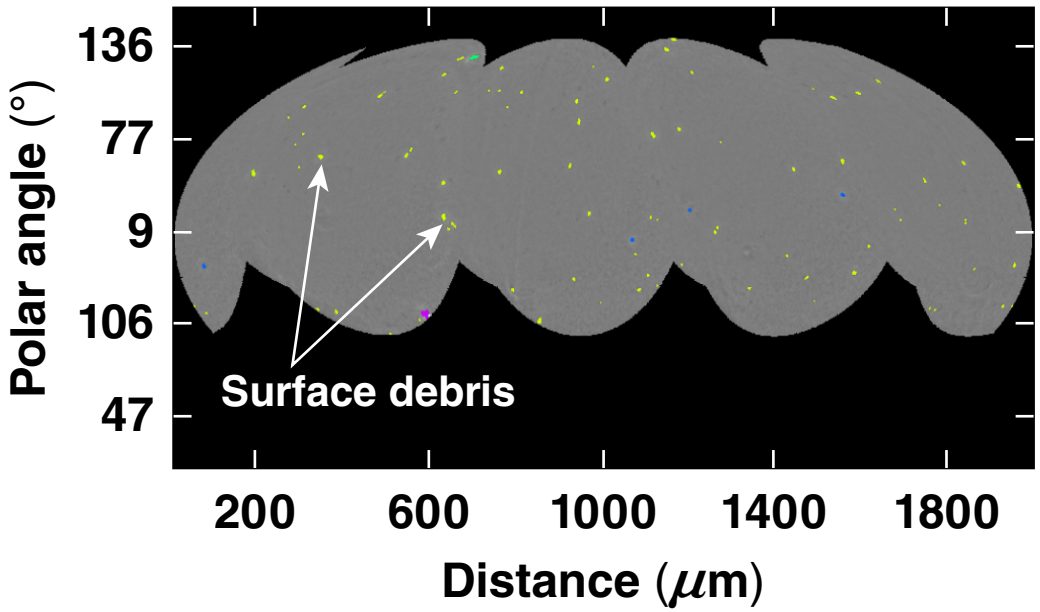
Areal density is degraded for $\alpha < 2.5$ and IFAR > 22



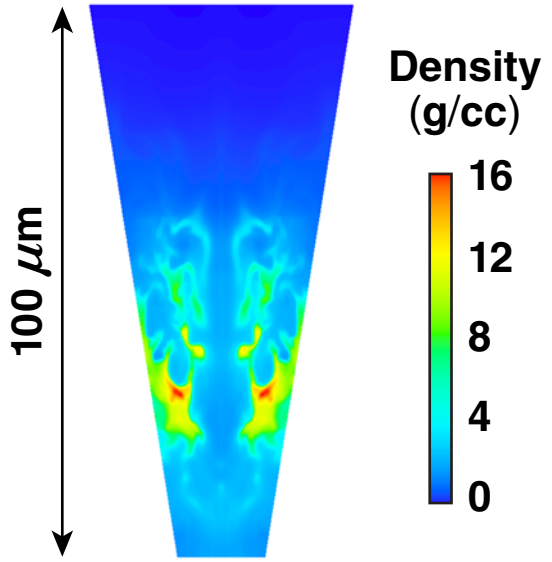


Current target performance on OMEGA is limited by local defect growth*

Cryo target characterization



Density contour at the end of drive pulse



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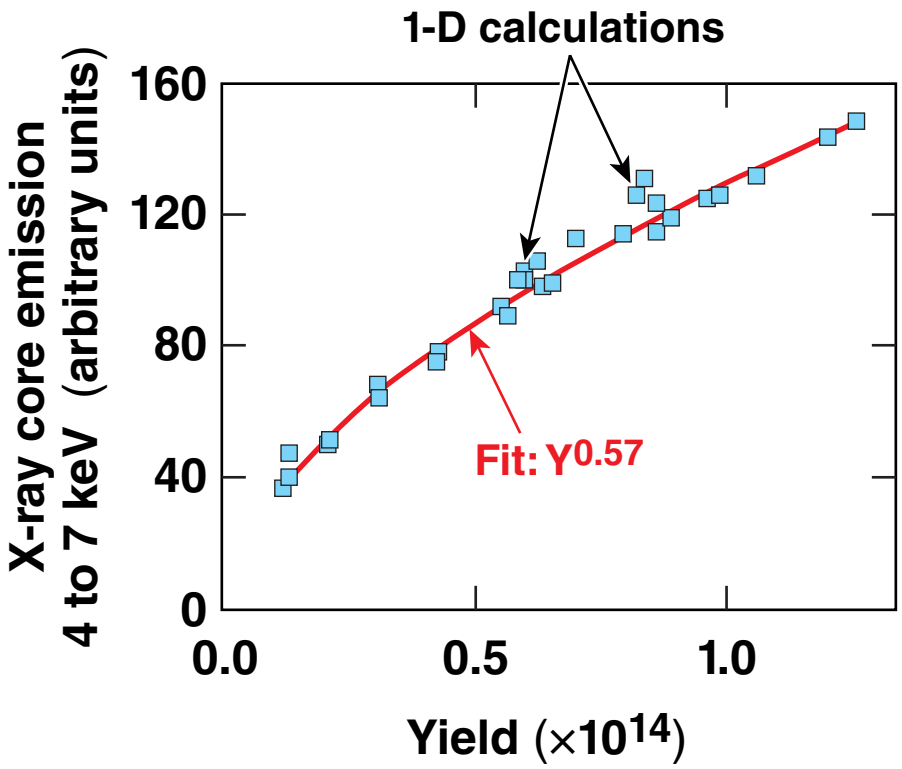
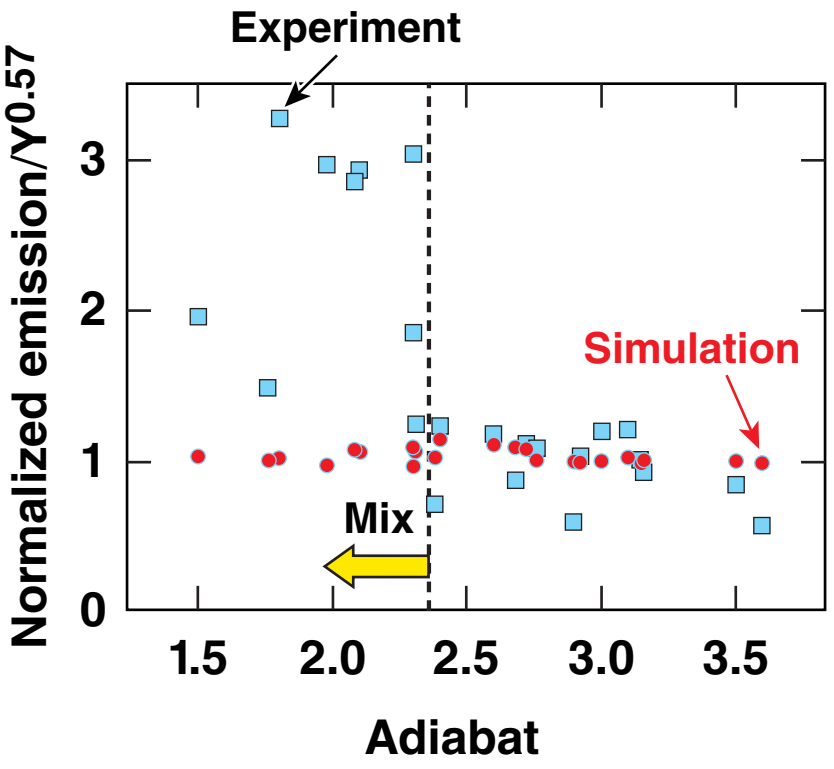
*I. V. Igumenshchev, JO4.00002, this conference.

An enhanced core emission for low-adiabat implosions suggests ablator mix into the hot spot





TC10254

Summary/Conclusions

Both target yields and neutron-averaged ion temperatures have improved* by increasing V_{imp} from 3 to 3.8 $\times$ 10^7 cm/s

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