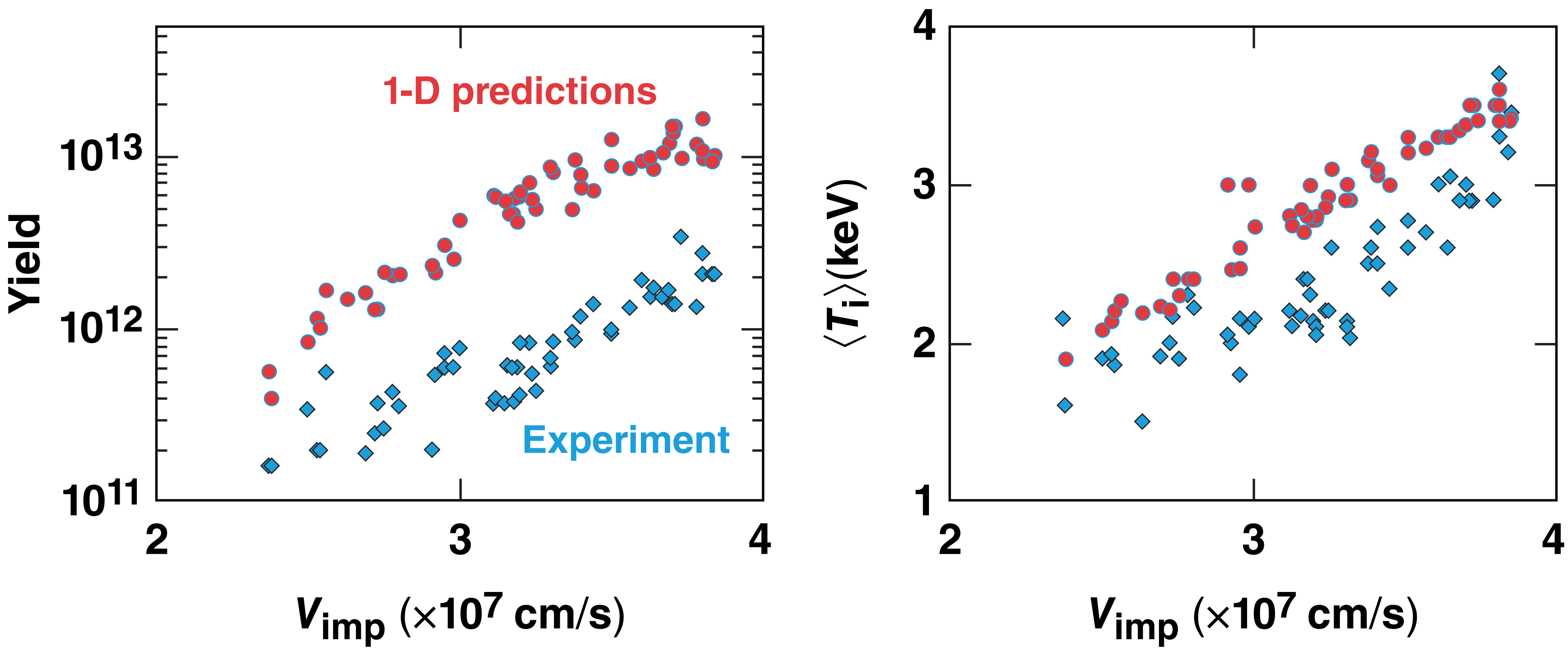
Recent Progress in Omega Cryogenic Implosions



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Omega Laser Facility
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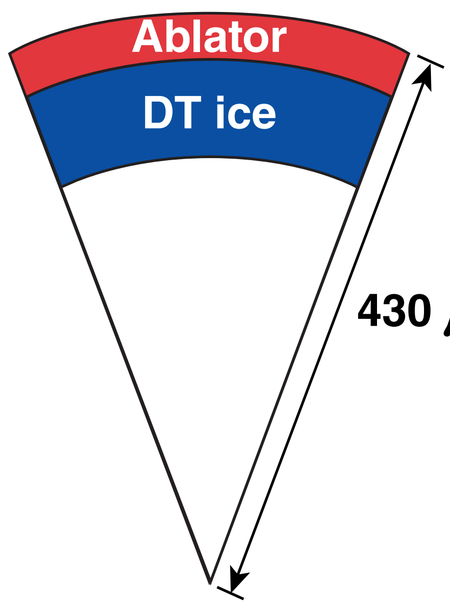
Both target yields and neutron-averaged ion temperatures have improved by increasing V_{imp} from 3.0 to 3.8 $\times$ 10^7 cm/s

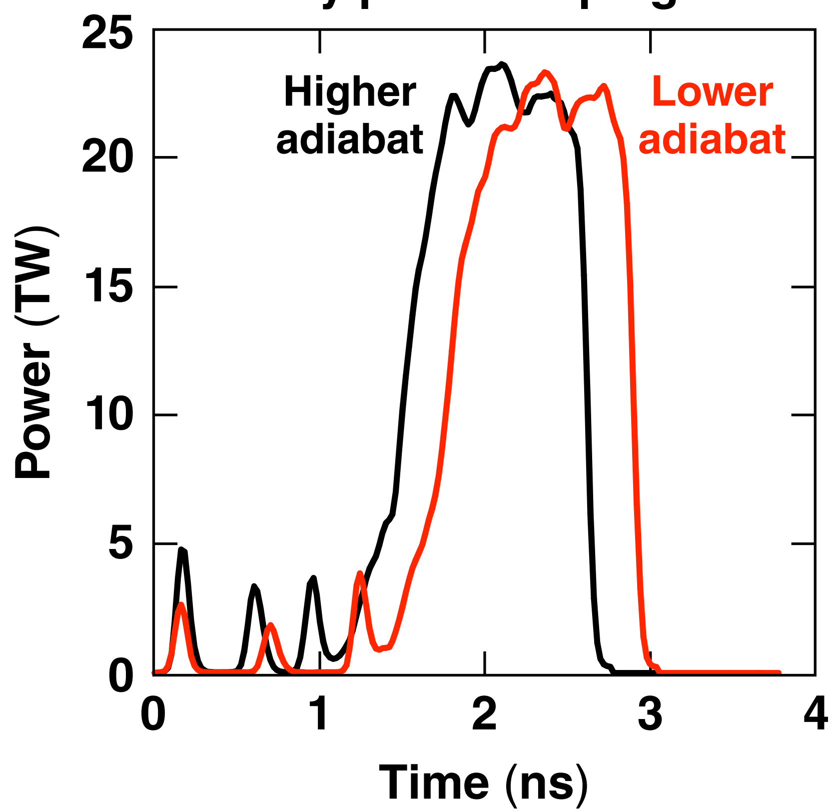
- The implosion velocity was increased in cryogenic targets on OMEGA over the last year by reducing the fuel mass
- Yields in excess of 2 $\times$ 10^{13} and ion temperatures up to 3.2 keV were measured in cryogenic implosions with V_{imp} ~ 3.8 $\times$ 10^7 cm/s
- Areal densities above 80% of 1-D 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

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



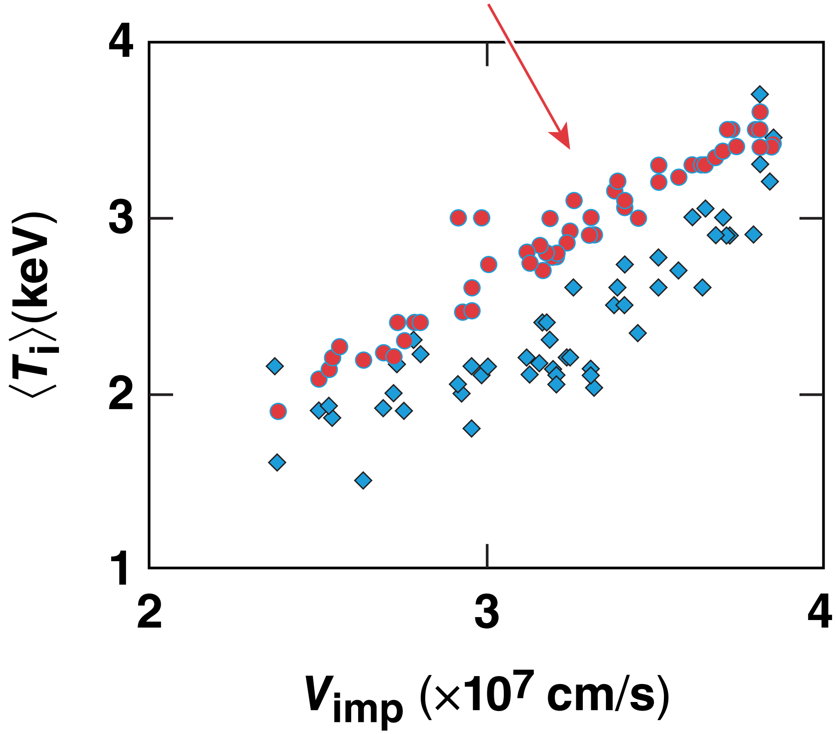
TC10248a

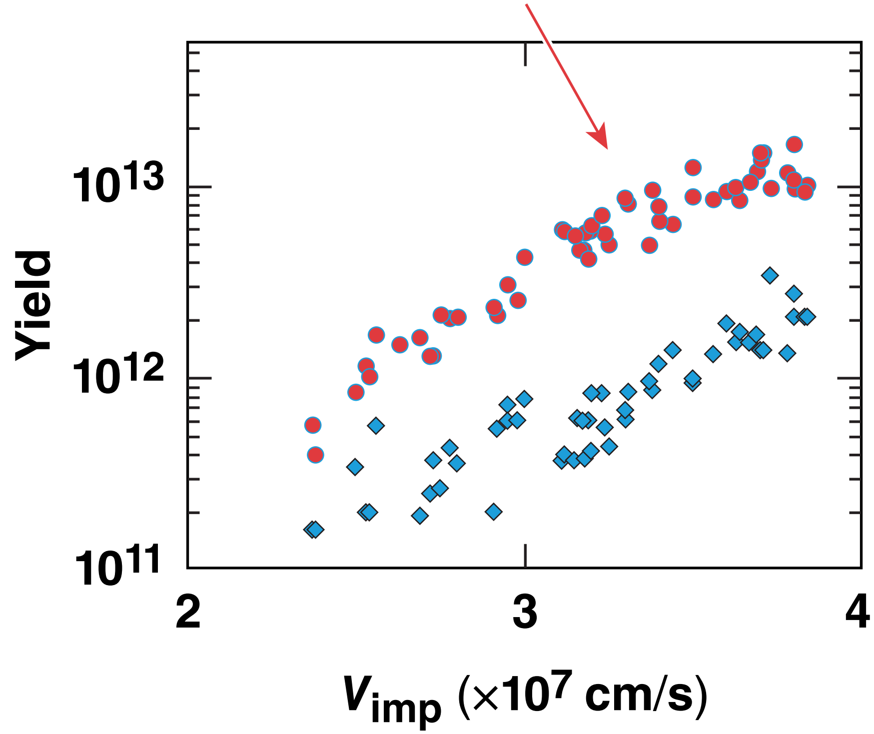
Both target yields and neutron-averaged ion temperatures increase with the implosion velocity

1-D predictions

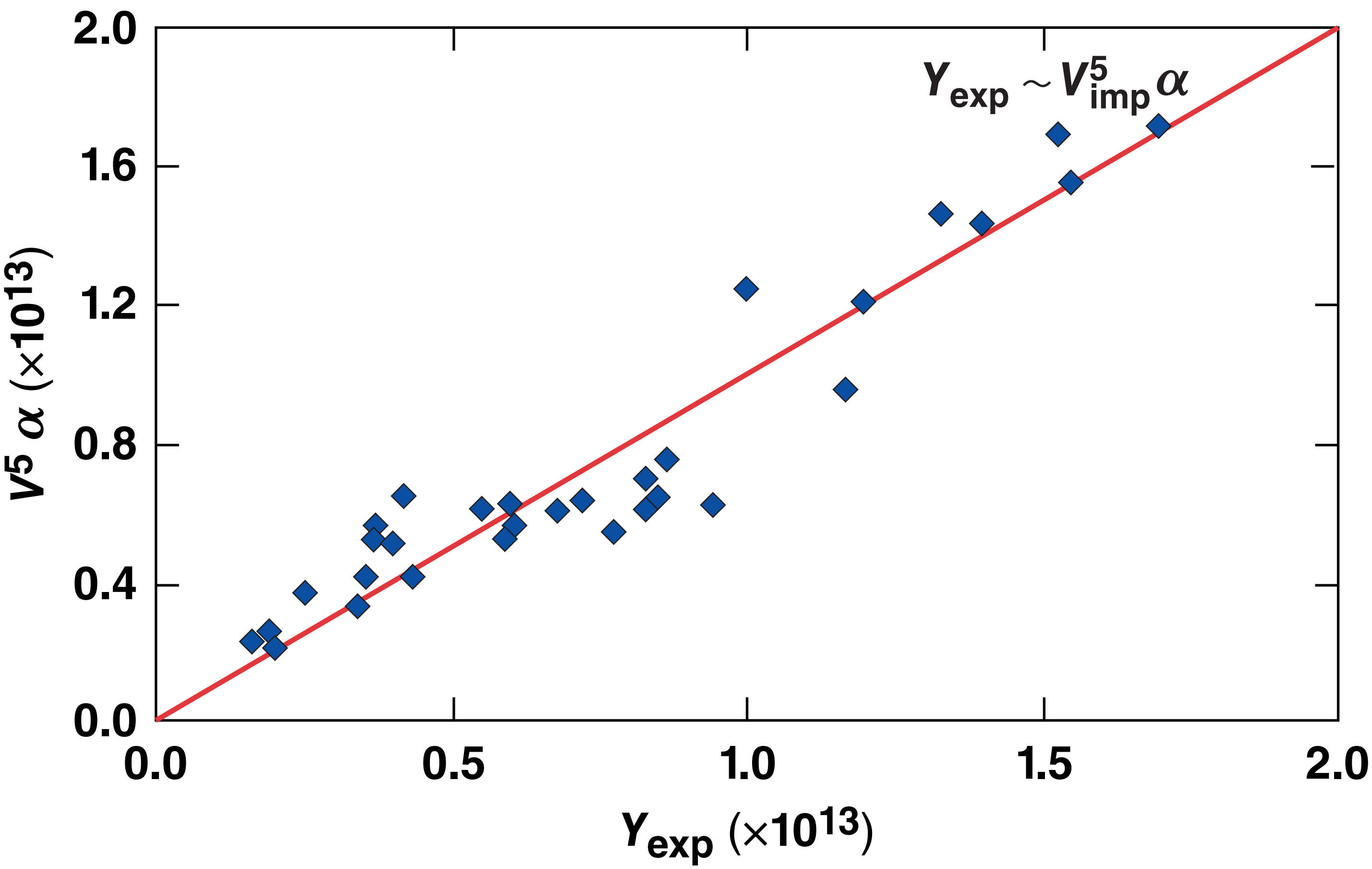
$$T_{\text{keV}} \sim 2.64\left(\frac{V_{\text{imp}}}{3\times10^7}\right)^{1.34}\left(\frac{\alpha}{3}\right)^{-0.05}$$

$$Y_{\text{1-D}} \sim 3.2\times10^{13}\left(\frac{V_{\text{imp}}}{3\times10^7}\right)^{6}\left(\frac{\alpha}{3}\right)^{-0.8}$$



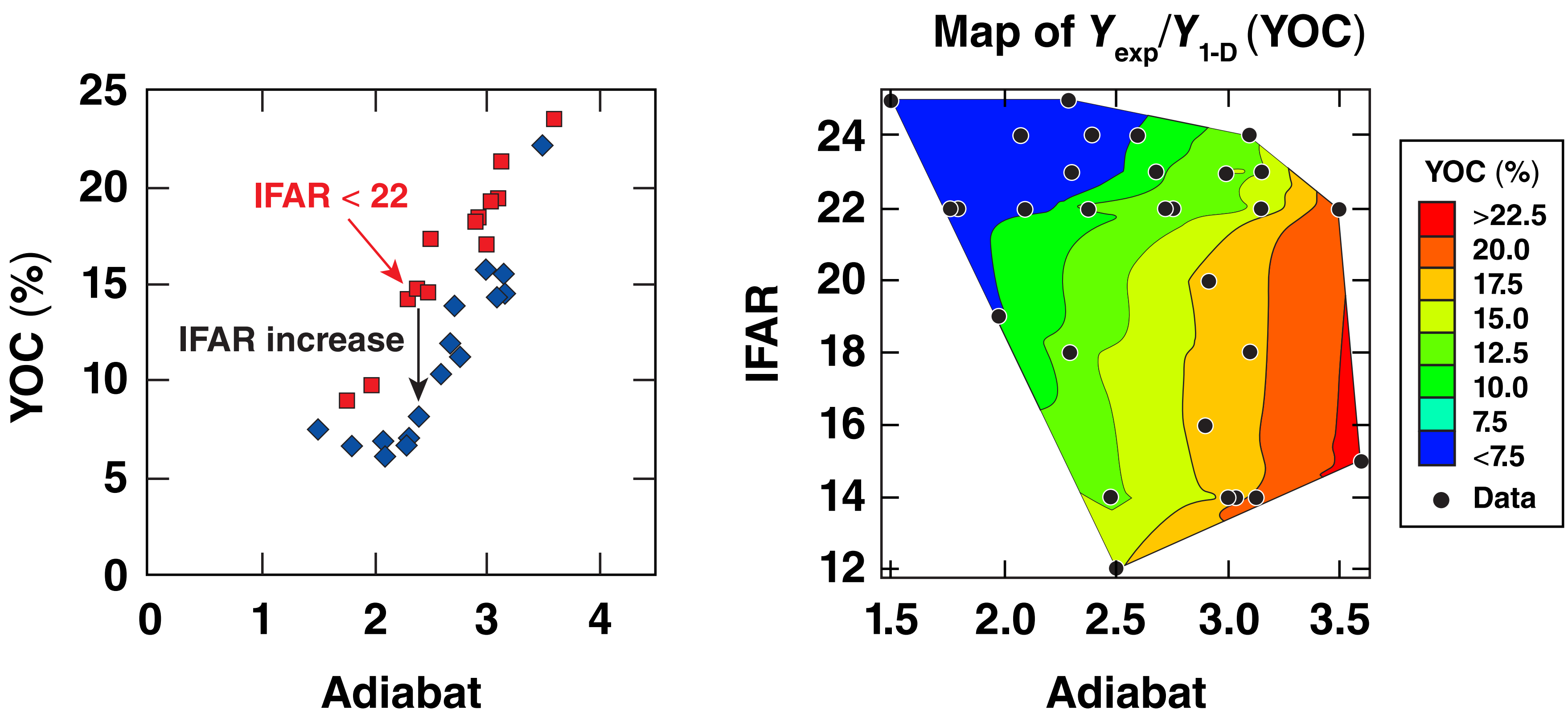


The OMEGA experimental yield scales as V_{imp}^5

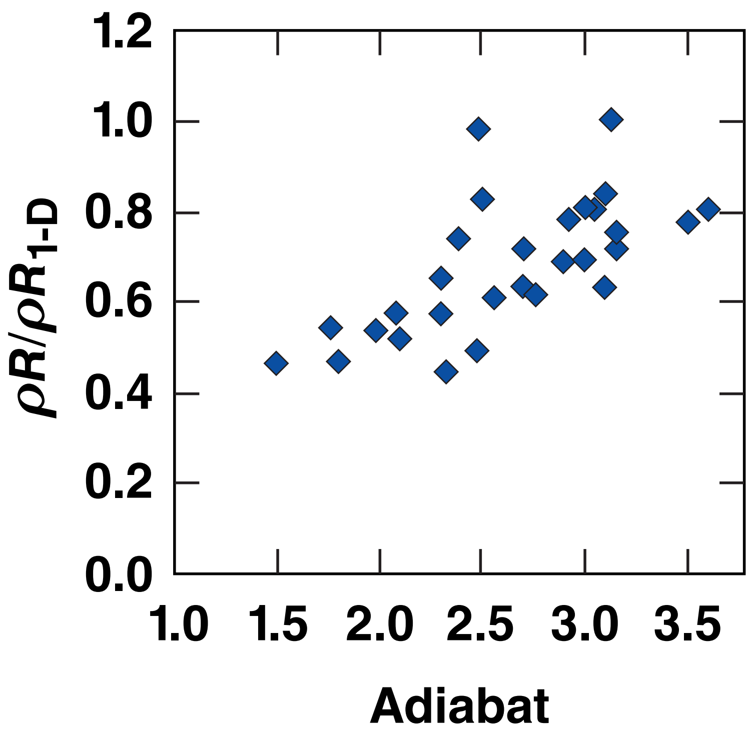


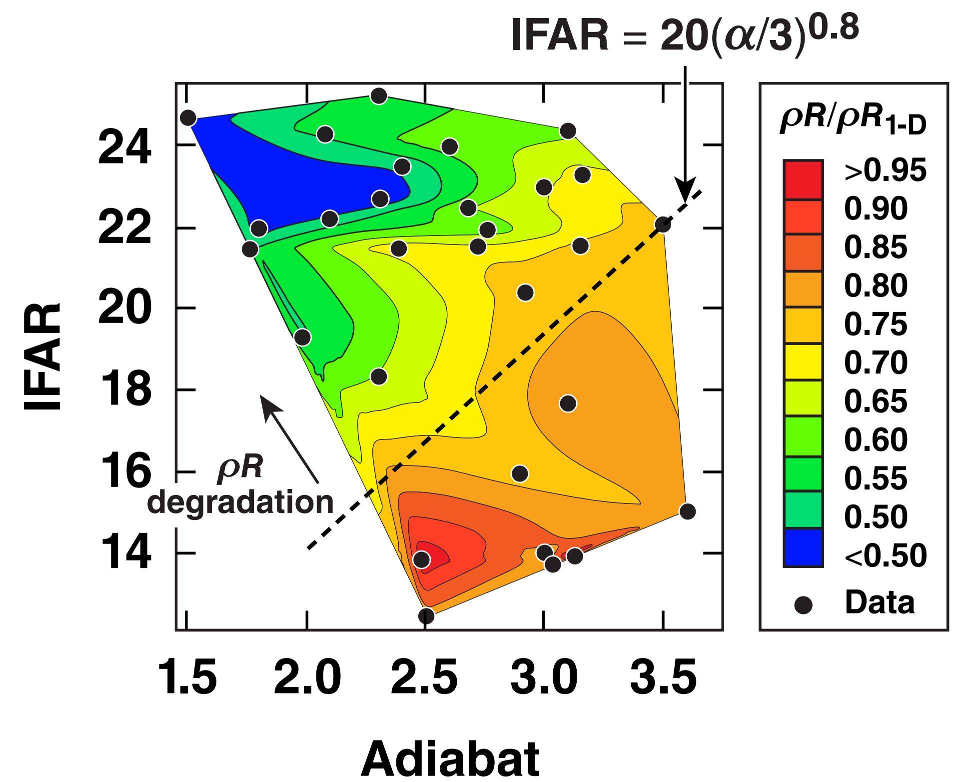
TC10251

Yield degradation is a strong function of fuel adiabat



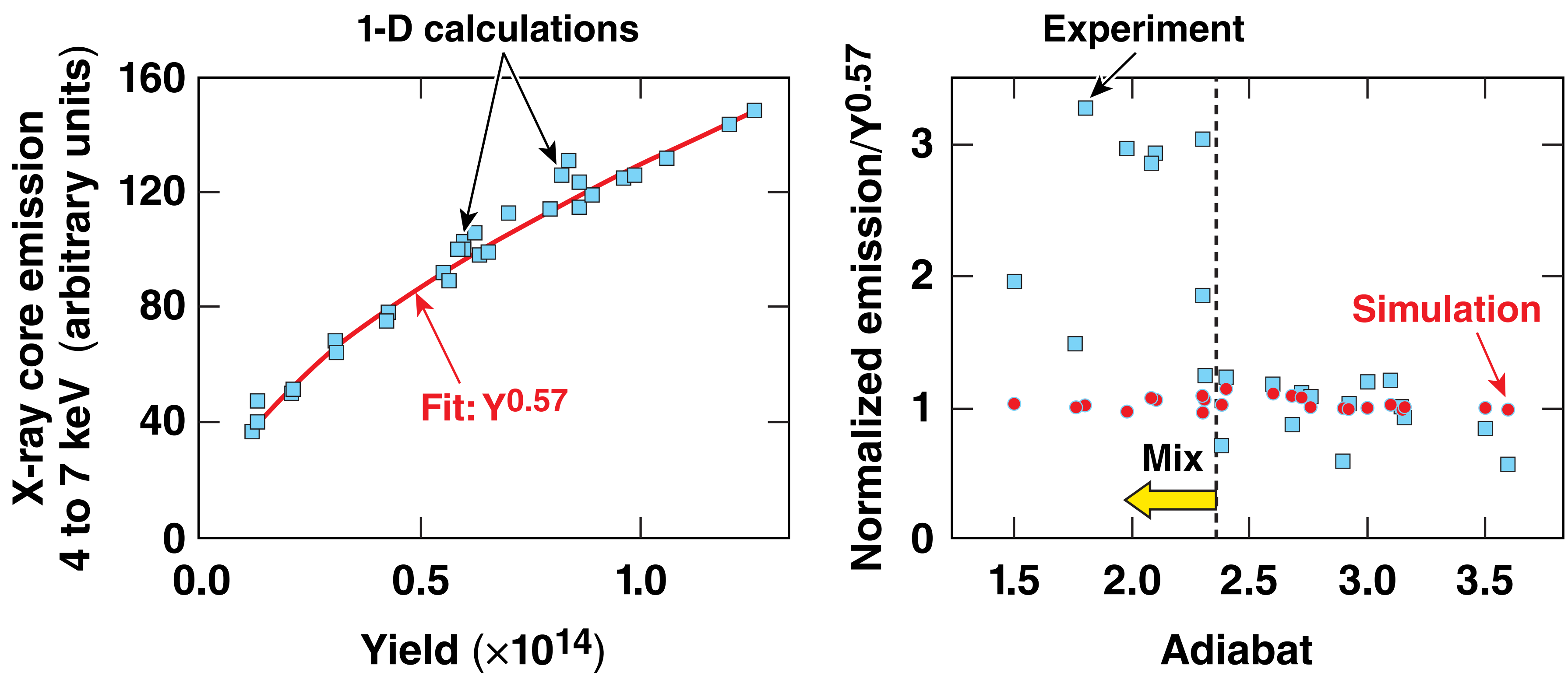
Areal density is degraded for $\alpha < 2.5$ and IFAR > 22





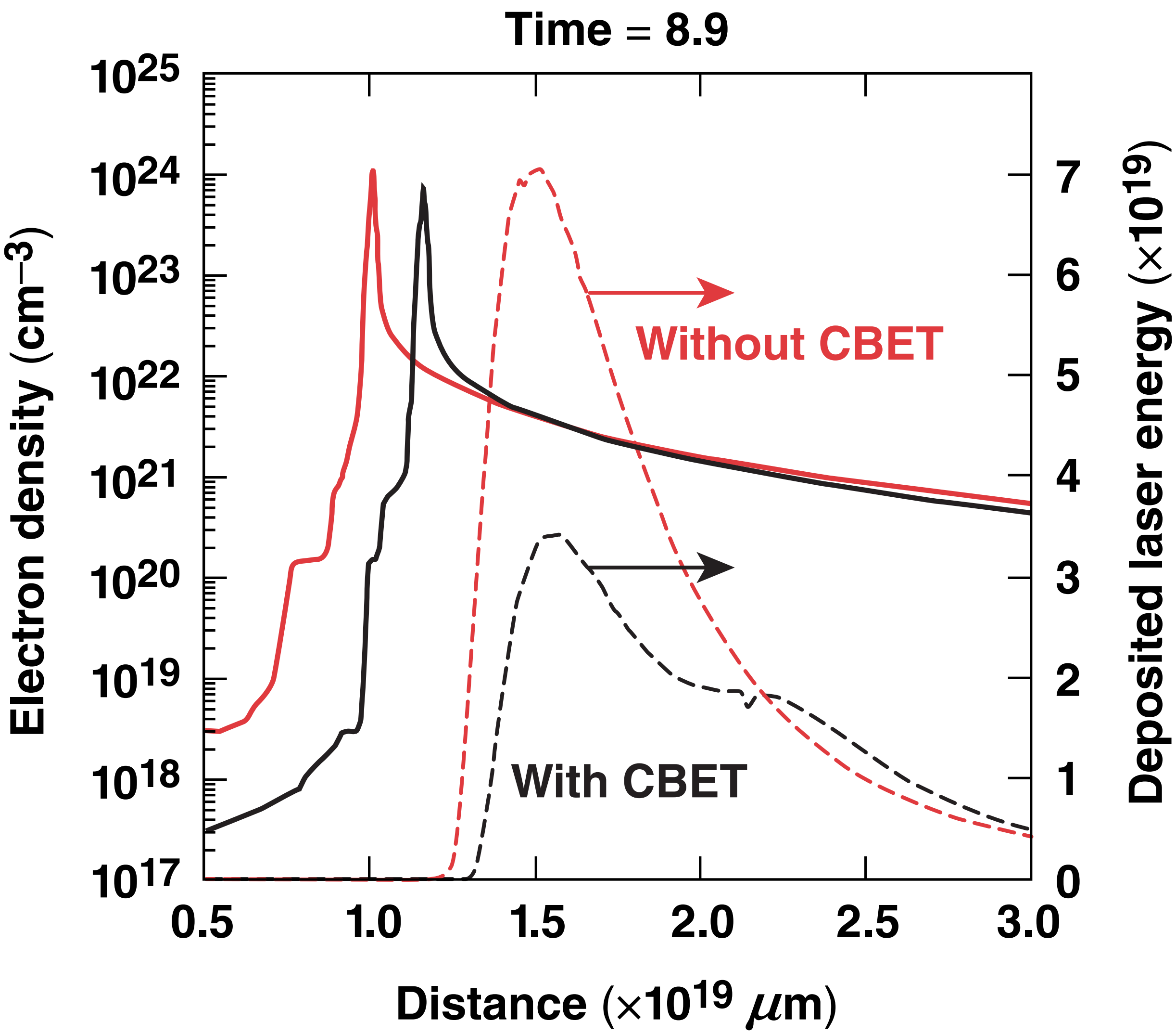
TC10252

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



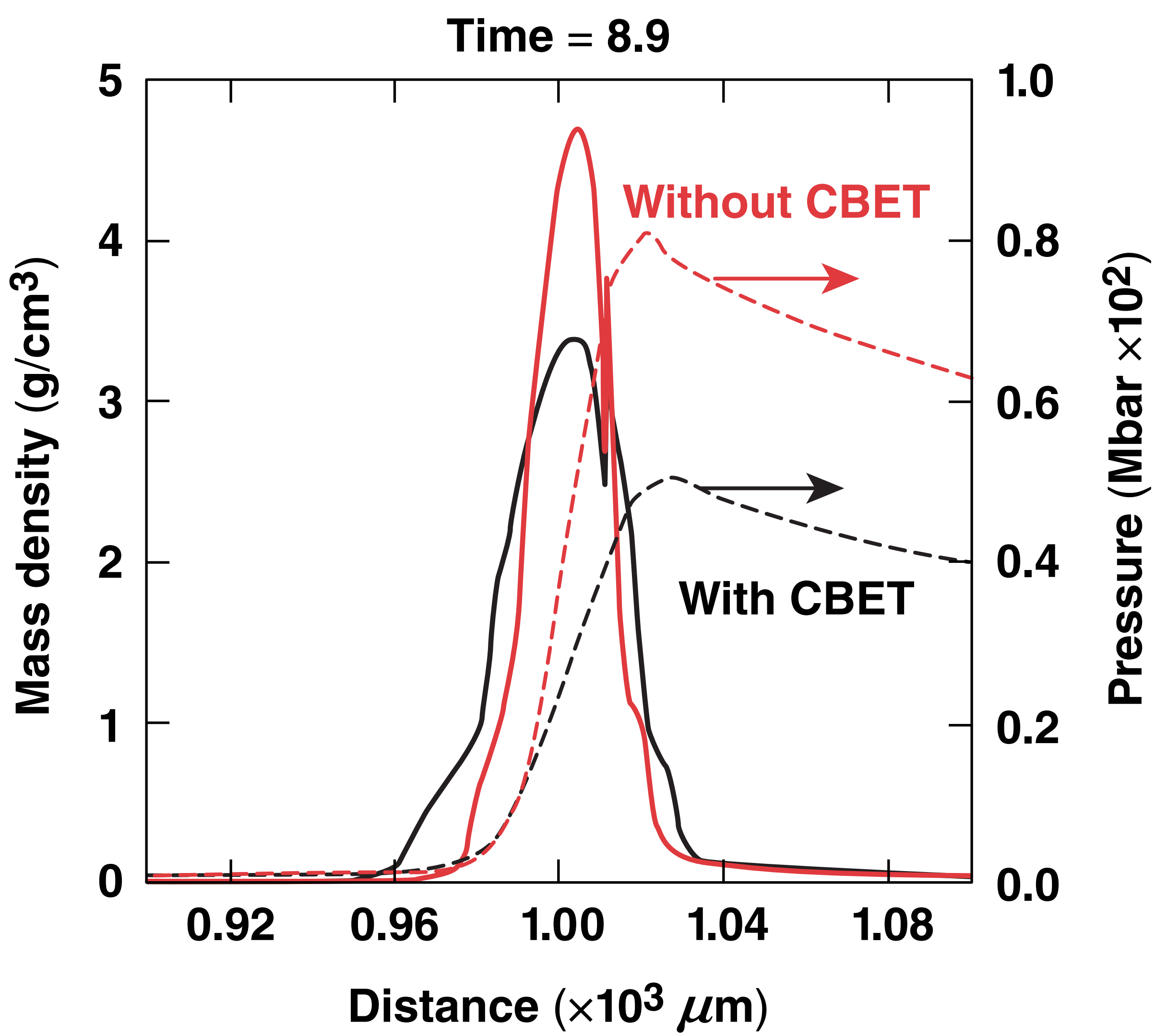
TC10254

Cross-beam energy transfer (CBET) reduces laser coupling



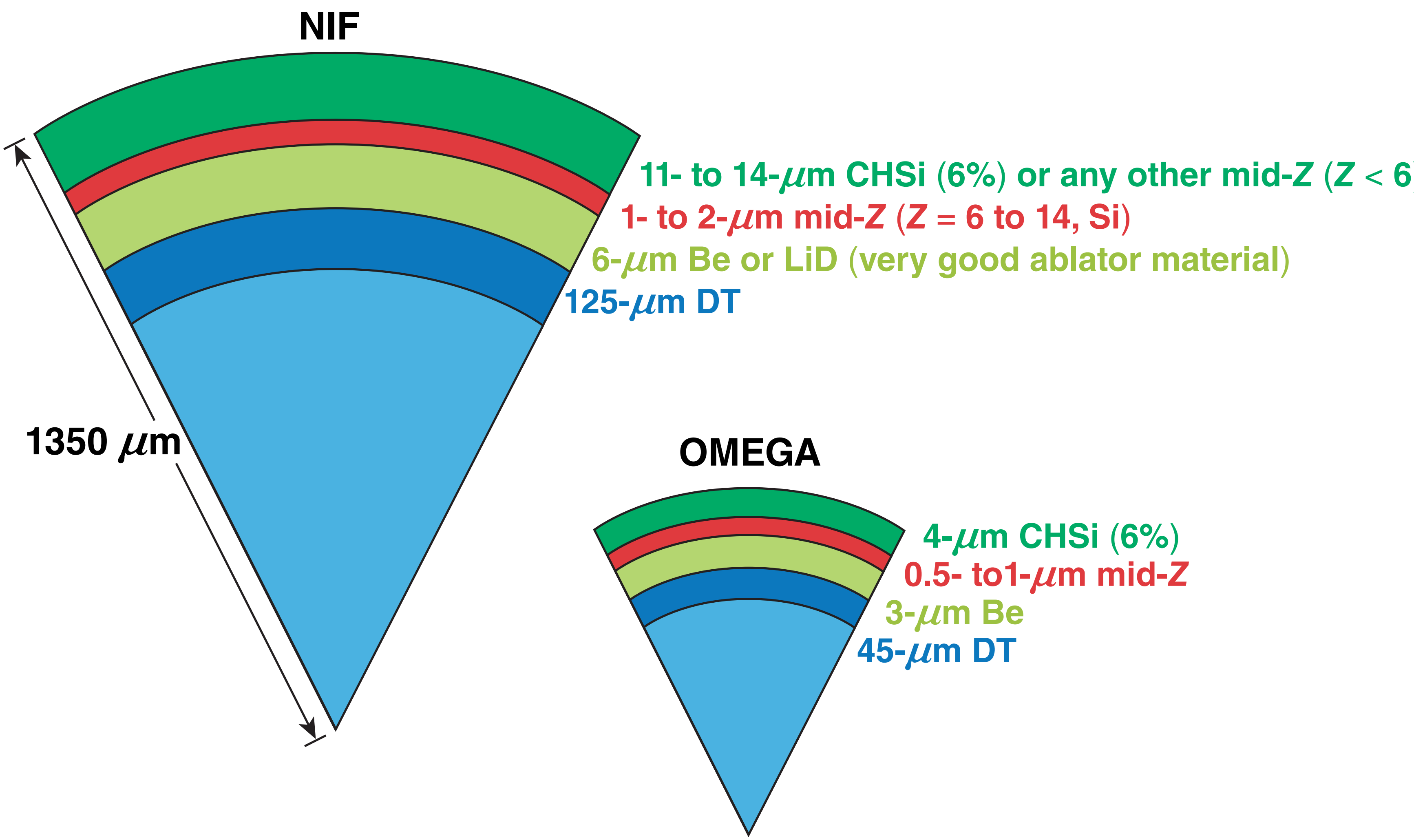
TC10542

As a result of reduced coupling, the ablation pressure is lower



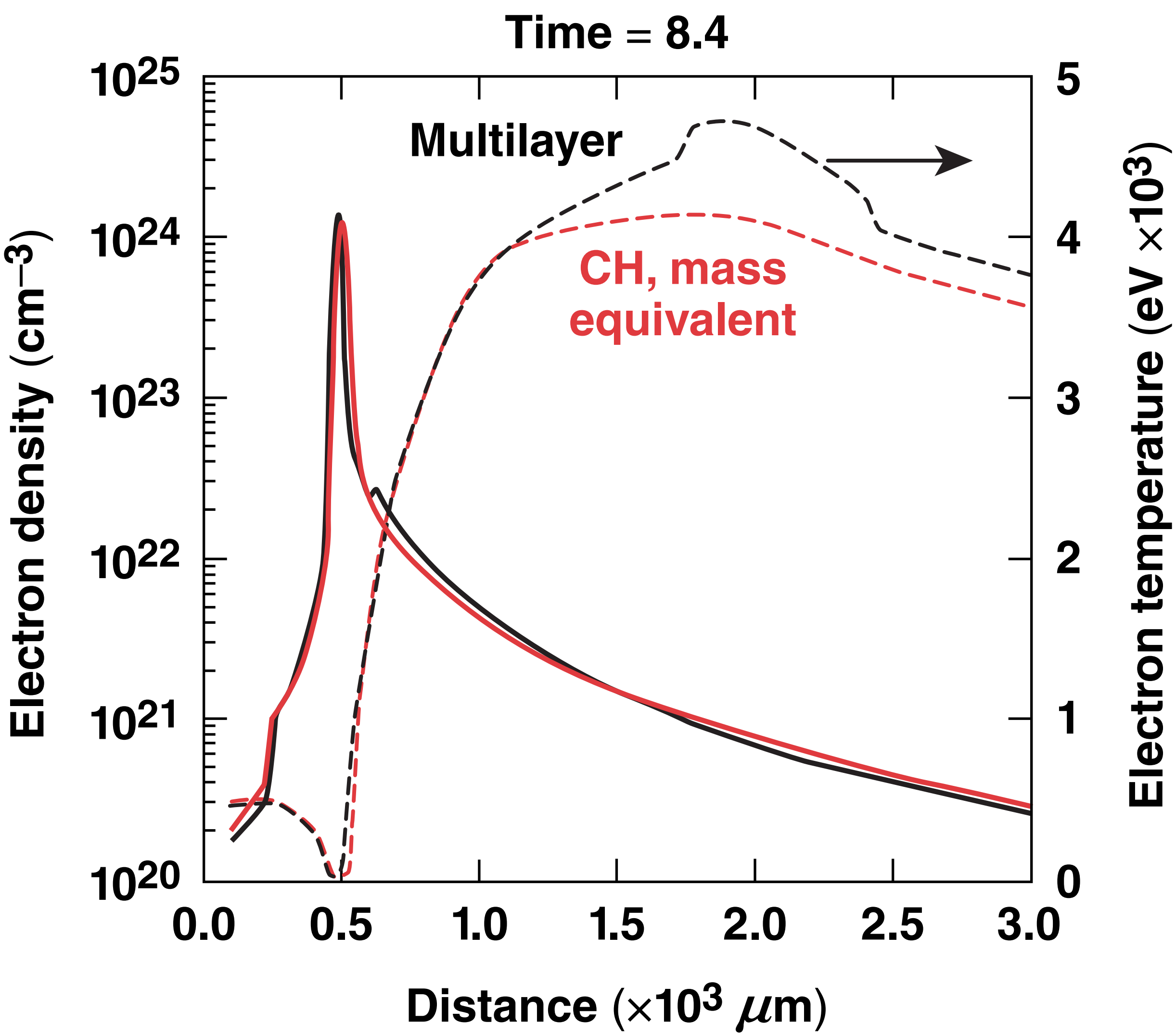
TC10543

A new design with a reduced CBET effect has a three-layer ablator



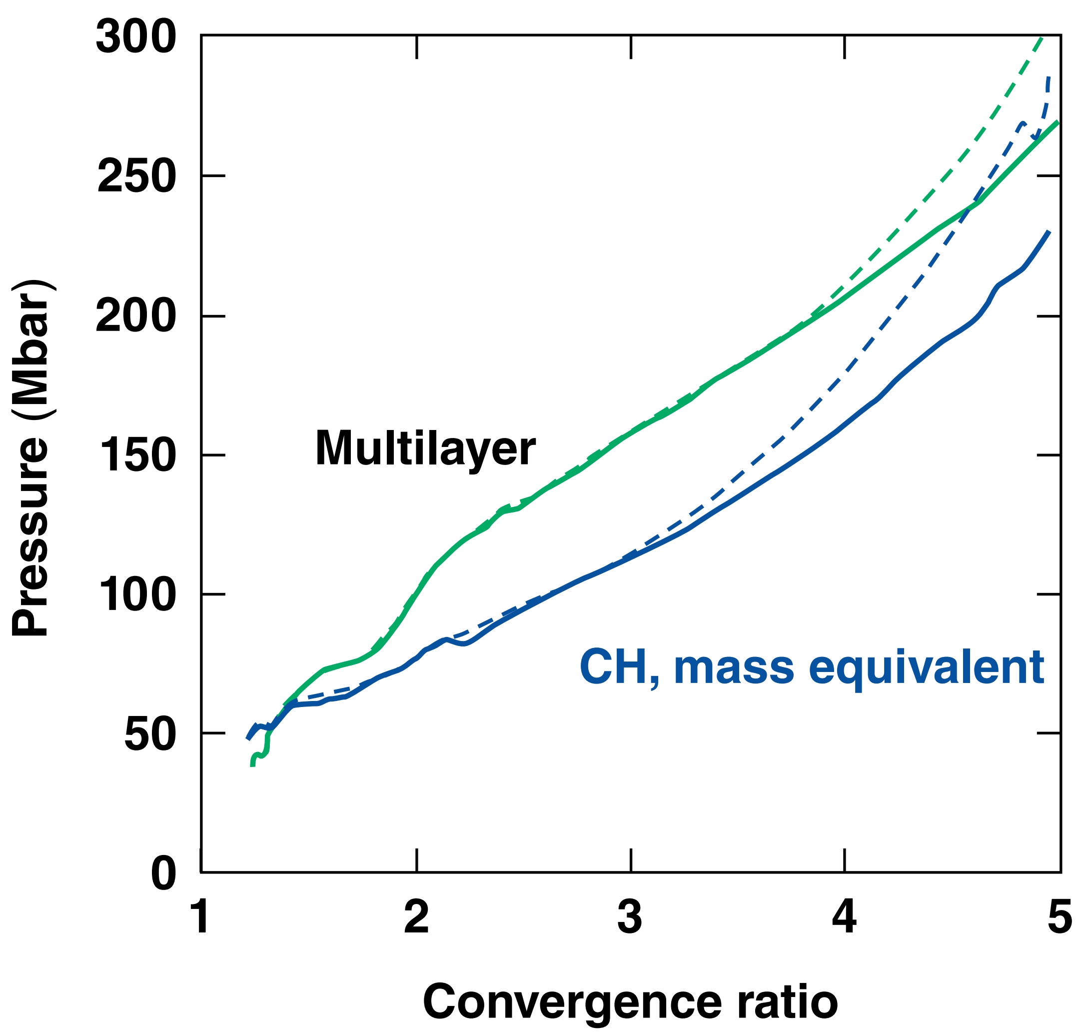
TC10544

Electron temperature in the corona is higher in the "multilayer" design



TC10545

Drive pressure is higher in the multilayer target



TC10546

Both target yields and neutron-averaged ion temperatures have improved by increasing V_{imp} from 3.0 to 3.8 × 10^7 cm/s

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