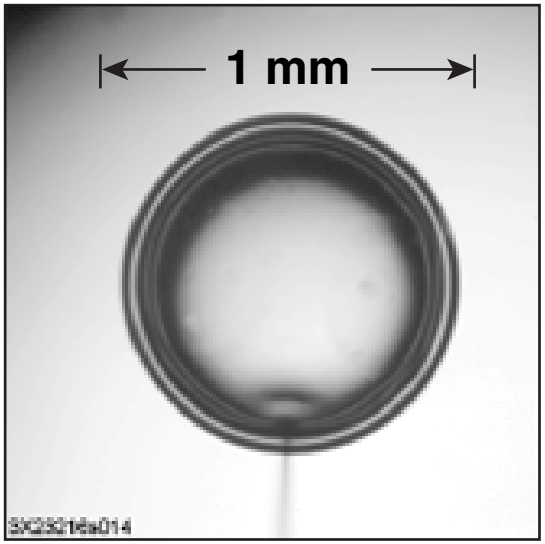
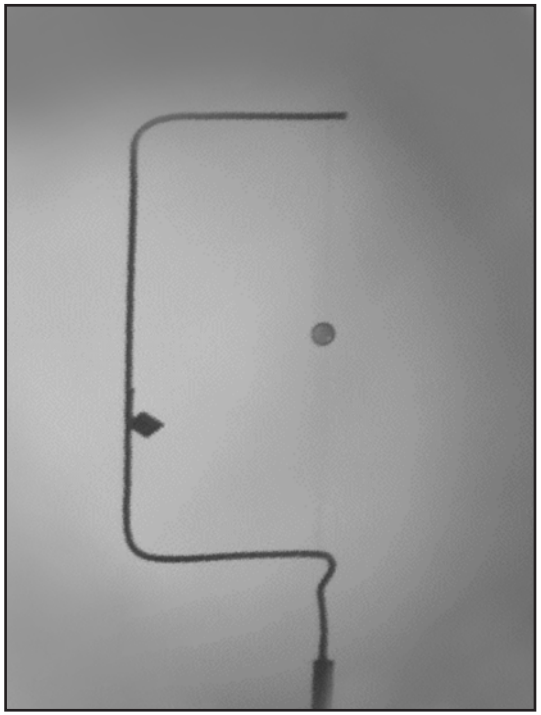
# Recent Experimental Results from Cryogenic Implosions on OMEGA



T. C. Sangster
University of Rochester
Laboratory for Laser Energetics

50th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Dallas, TX
17–21 November 2008

Summary

# New target designs are leading to consistently higher fuel areal densities in cryogenic implosions on OMEGA

UR LLE

- Shock-timing precision can be achieved and controlled using multiple-picket drive pulses.
- Multiple-picket designs give consistently better areal density performance relative to predictions.
- Stalk-mounted DT targets may provide significantly better data if new $\rho R$ instrumentation works as anticipated.

**Backlighting of a cryogenic DT target using a high-energy short-pulse beam in the OMEGA target will occur shortly.**

# Collaborators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Nuclear Research Center, Negev, Israel

# A careful analysis of compression wave generation reveals a potential source of adiabat degradation

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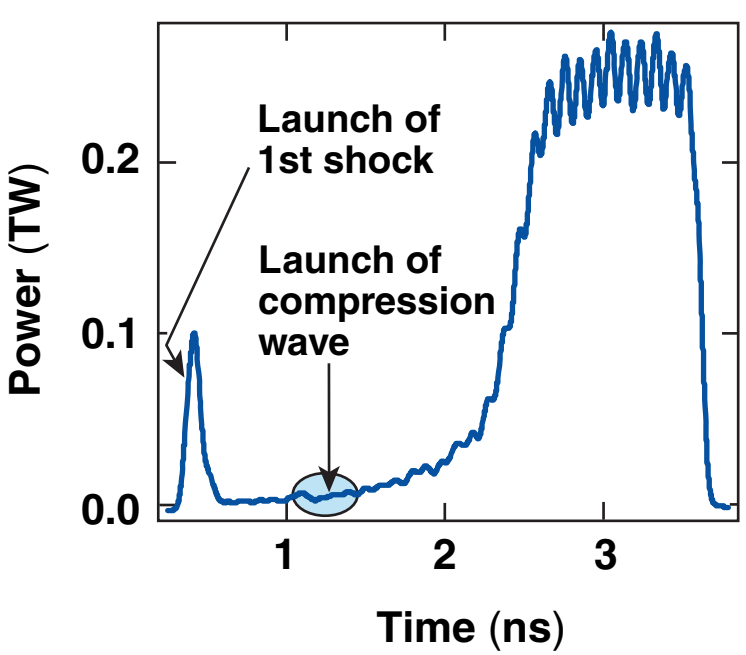
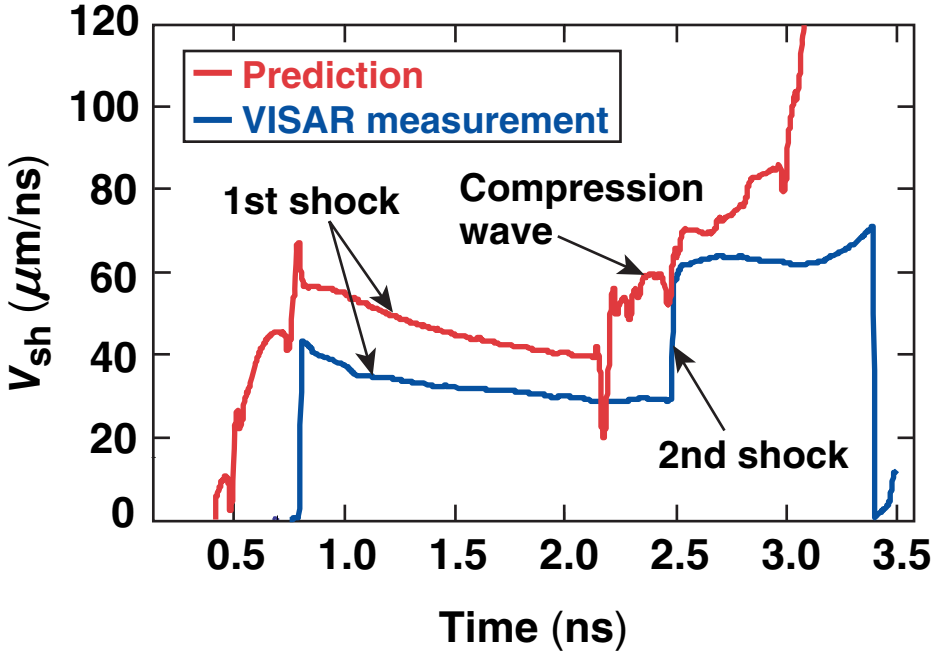
**Continuous-pulse baseline design**

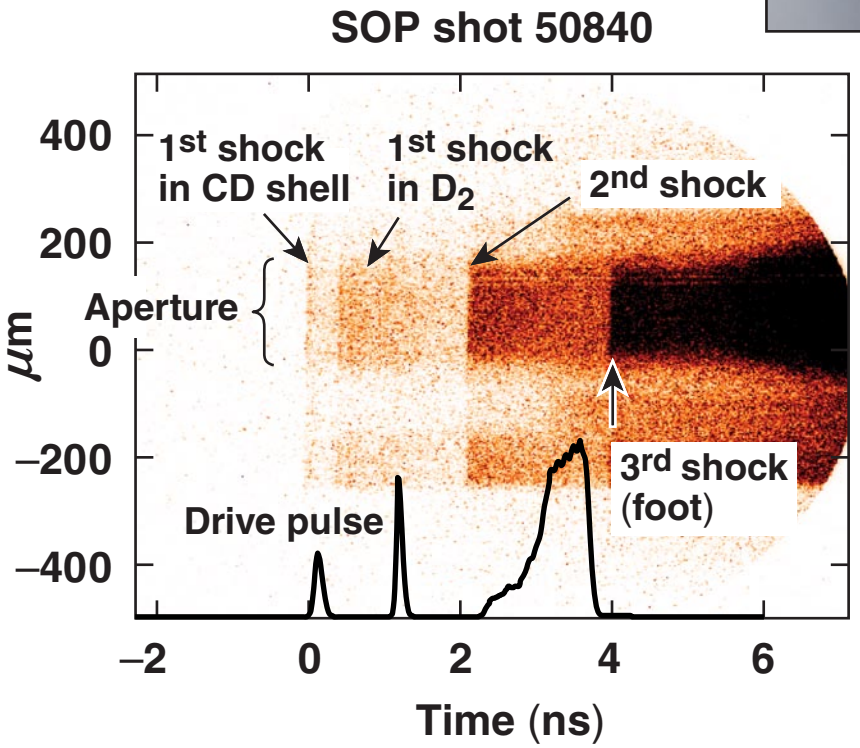


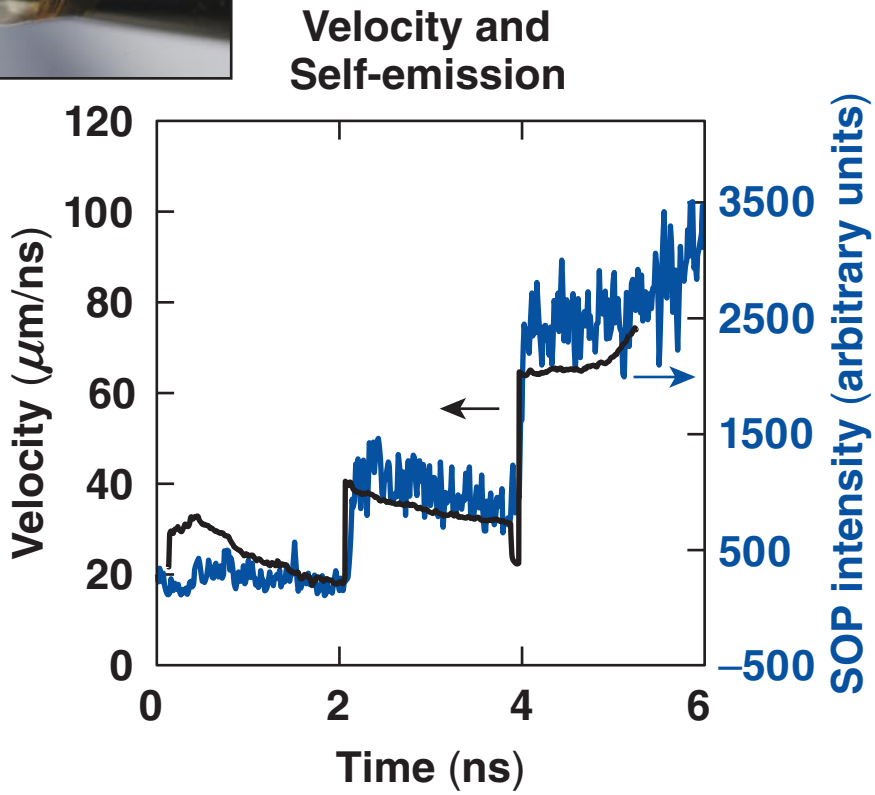




**Shock-velocity measurements indicate that the compression wave in continuous pulses prematurely turns into a shock inside the shell.**


T. R. Boehly (QI1.00003)
V. N. Goncharov (TO5.00006)

# A multiple-picket design is being developed to ensure accurate shock tuning (adiabat)




T. R. Boehly (QI1.00003)
V. N. Goncharov (TO5.00006)

# Double-picket experiments suggests shock heating is the primary source of areal density degradation

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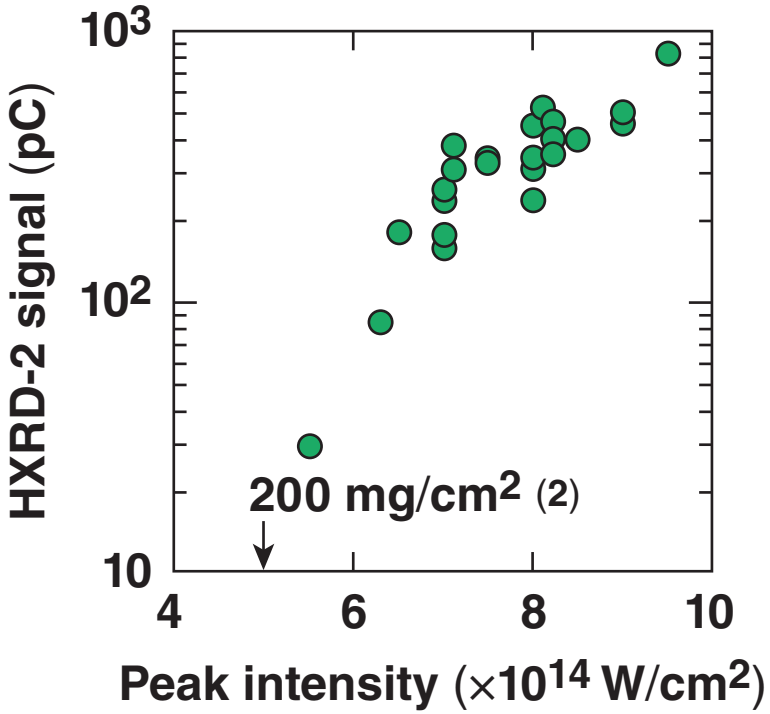
- At the APS meeting last year[1], hot electron preheat was considered a significant source of adiabat degradation.




[1]R. L. McCrory *et al*., Phys. Plasma 15, 055503 (2008).
[2]T. C. Sangster *et al*., Phys. Rev. Lett. 100, 185006 (2008).

E17436

# Double-picket experiments suggests shock heating is the primary source of areal density degradation

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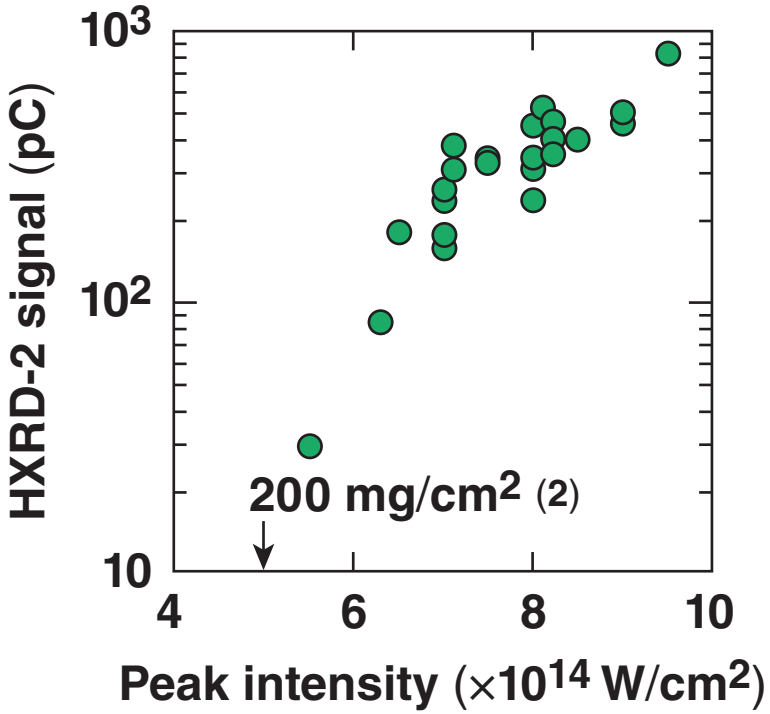
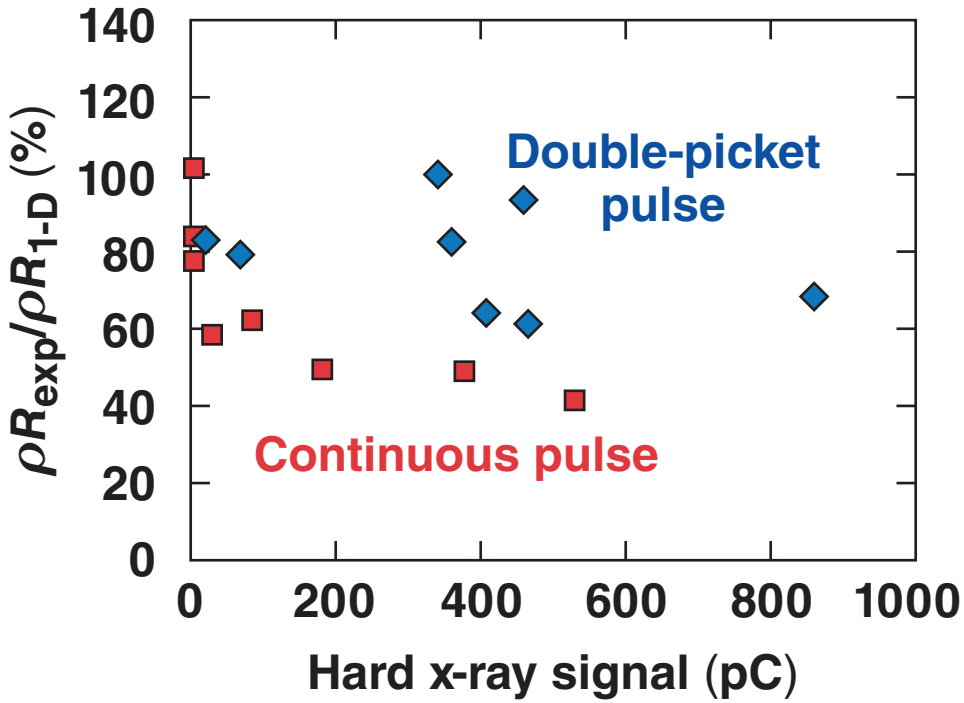
- At the APS meeting last year[1], hot electron preheat was considered a significant source of adiabat degradation.
- Adiabat degradation using multiple picket drive pulses with precise shock timing shows no dependence on the HXR signal.




[1]R. L. McCrory *et al.*, Phys. Plasma 15, 055503 (2008).
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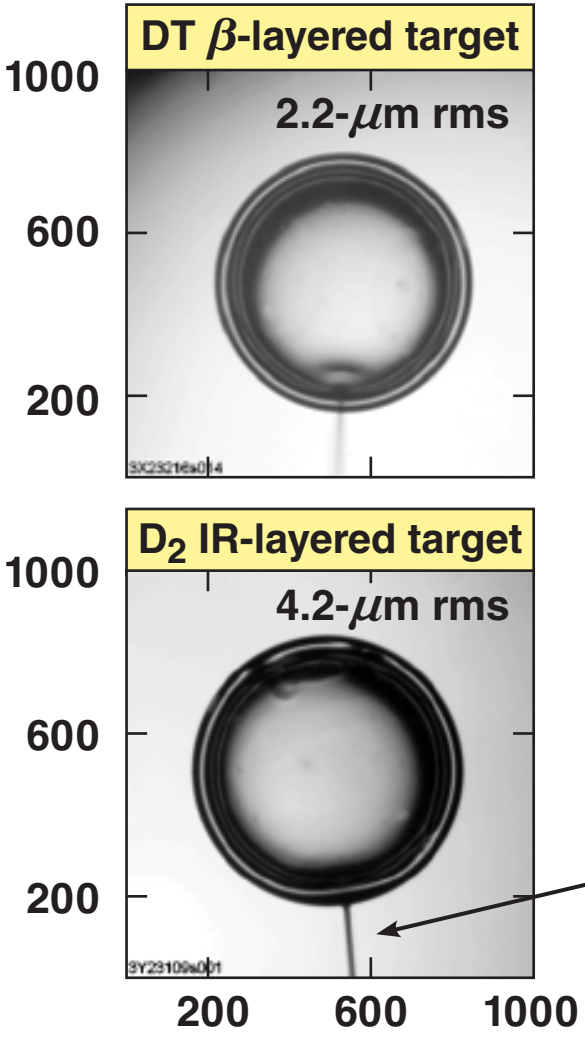
# Stalk-mounted targets are being developed to reduce target motion at shot time and improve performance




- *Potentially* less vibration and more damping prior to shot.
- Configuration compatible with fill-tube requirement for NIF polar-drive targets.
- Impact on $\beta$-layering is minimal.
- It appears to be possible to mitigate the stalk impact on IR layering with the appropriate thermal design.

10-$\mu$C fiber attached to a thin, 12-mm Z-Blan fiber glued to a stainless steel tube

I. V. Igumenshchev (CO5.00001)
T. J. B. Collins (CO5.00002)

# $\rho R$ diagnostics are being developed for high performance cryogenic DT implosions

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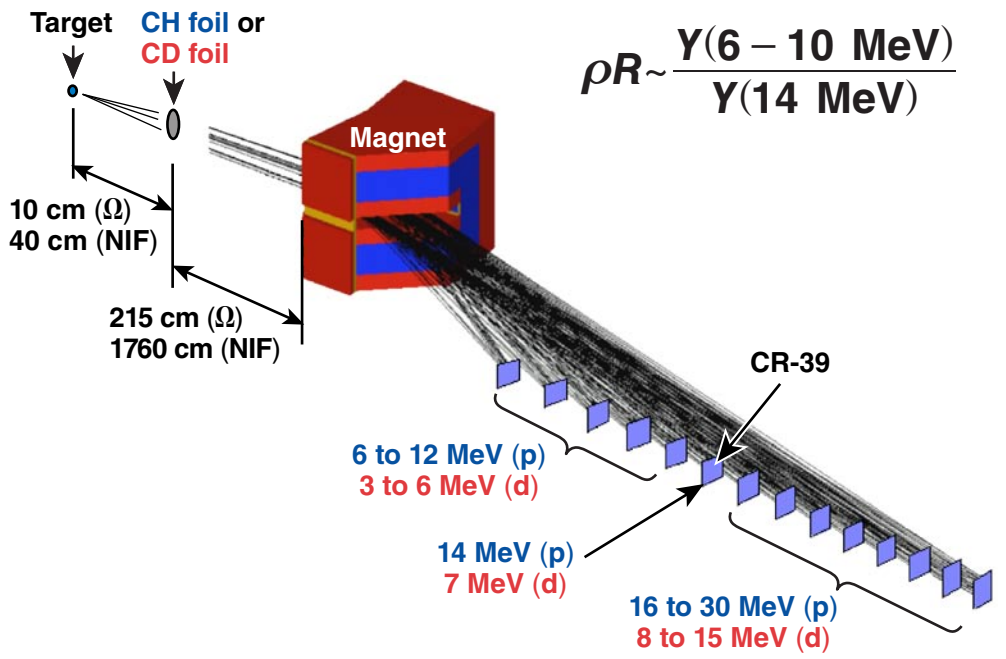
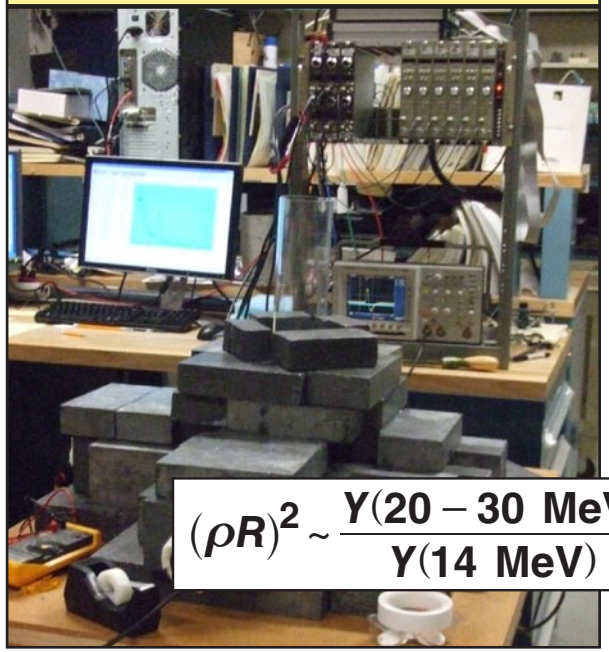
MIT

## Magnetic Recoil Spectrometer (MRS)




$$\rho R \sim \frac{Y(6-10\ \text{MeV})}{Y(14\ \text{MeV})}$$

## Multi-Channel Carbon Counting System (MC3)



$$(\rho R)^2 \sim \frac{Y(20-30\ \text{MeV})}{Y(14\ \text{MeV})}$$

**Both techniques require cryogenic DT yields in excess of $10^{12}$ to infer areal densities to ~10% (so thinner ice and higher $V_{imp}$).**

E14482d

J. A. Frenje (UO3.00003); D. T. Casey (YP6.00012).

# A recent cryogenic DT implosion (65-$\mu$m ice) produced a yield of ~$6 \times 10^{12}$ and an areal density of ~200 mg/cm$^2$

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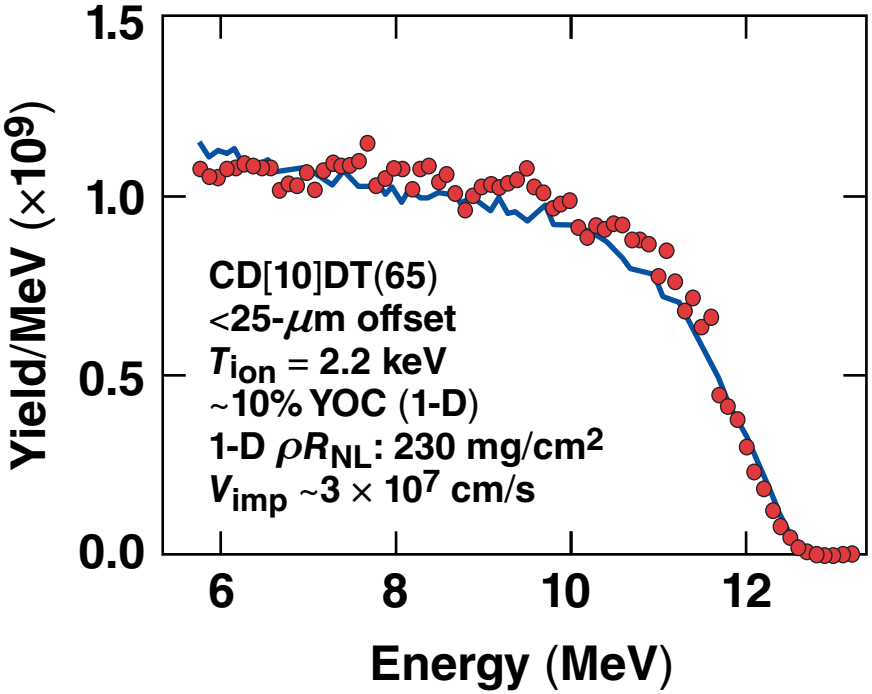
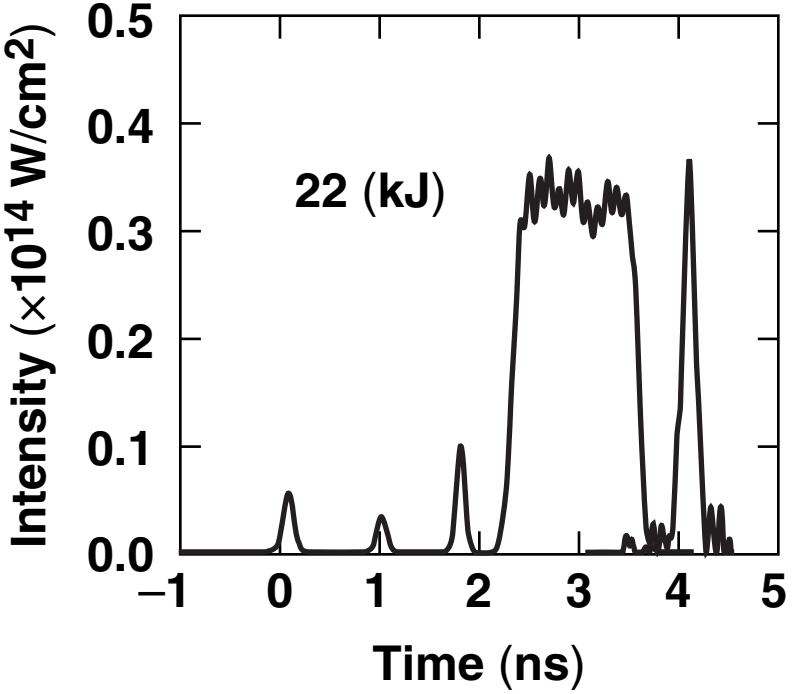
**KO-D data from the MRS gives 200±20 mg/cm$^2$**




**Triple-picket drive* pulse with neutron burn history**

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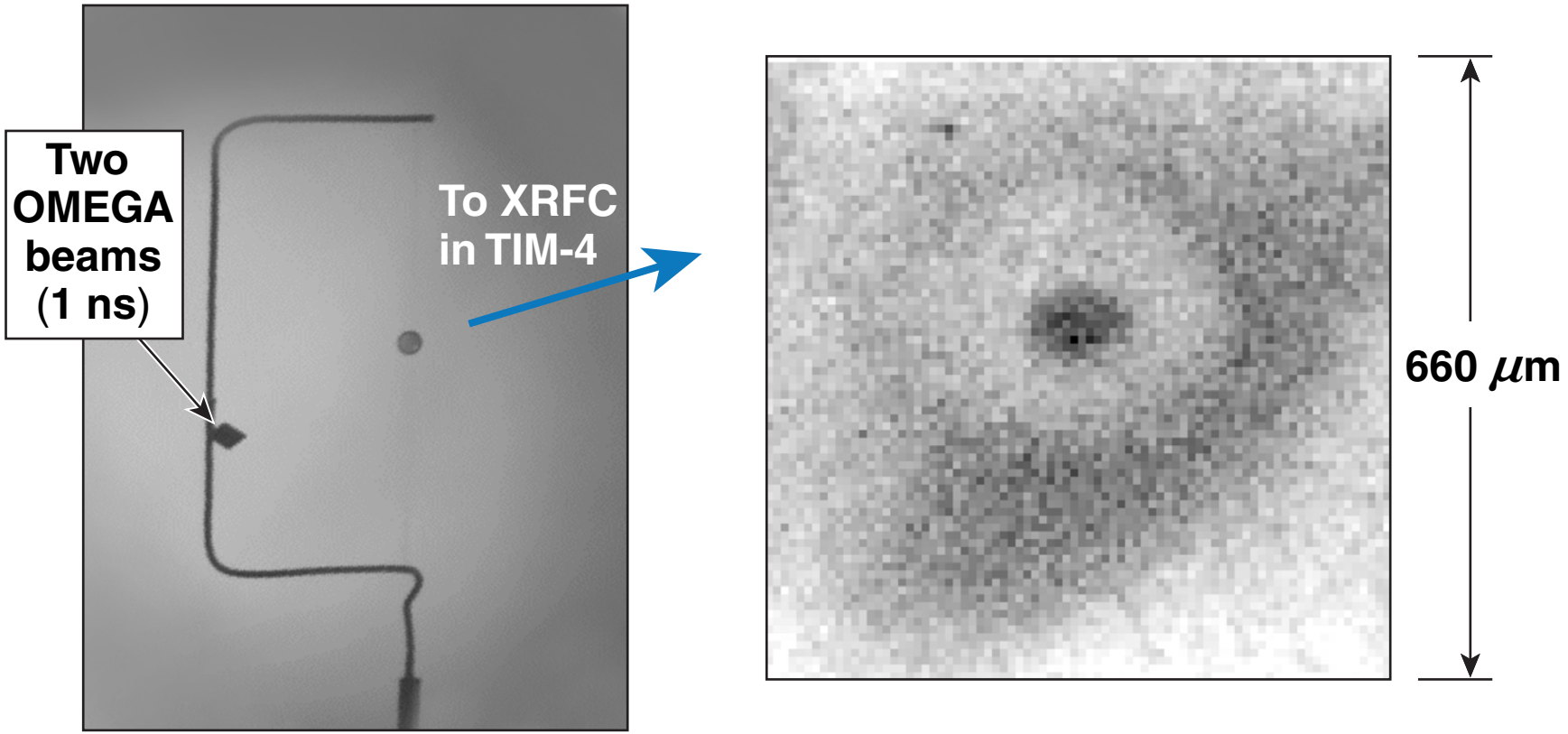
*V. N. Goncharov (TO5.00006)

# A cryogenic web-mounted backlighter target mount has been successfully tested using OMEGA beams




**The first backlighter experiments using a short-pulse OMEGA EP beam with a 60-beam cryogenic DT implosion are scheduled for early December 2008.**

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Summary/Conclusions

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