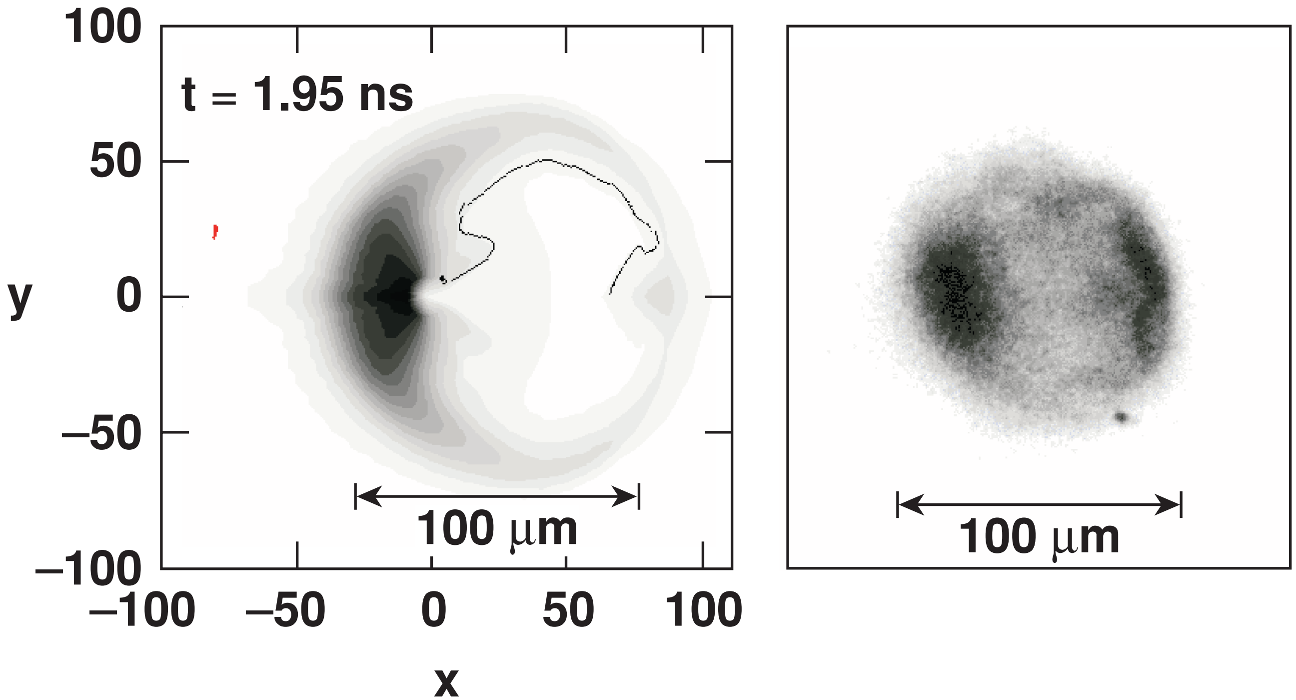
Offset, Direct-Drive, D_2-filled CH Capsule Implosion Experiments



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Related presentations:

Marshall *et al*. – GO2.007, McKenty *et al*. – GO2.008, Séguin *et al*. – GO2.012, C. K. Li – RI1.005 (invited), and T. C. Sangster -RI1.006 (invited)

Summary

OMEGA direct-drive implosion experiments confirm that precision target positioning is essential for uniform drive

- Direct-drive implosions with intentional offset of capsules show
  - strong low-ℓ-mode features in core x-ray imaging that correlate with offset,
  - reduced neutron yield for offsets $\gtrsim$40% of compressed core radius,
  - reduced average areal density for offsets $\gtrsim$40% of compressed core radius,
  - increased asymmetry in capsule areal density (lowest ρR is observed in the direction of target offset),
  - other factors (i.e., beam pointing, power balance) limit ultimate performance,
  - experimental results are consistent with multidimensional code calculations.

X-Ray Imaging

The offset implosions show asymmetric x-ray emission that correlates with the offset axis (Marshall *et al.*, G02.007)

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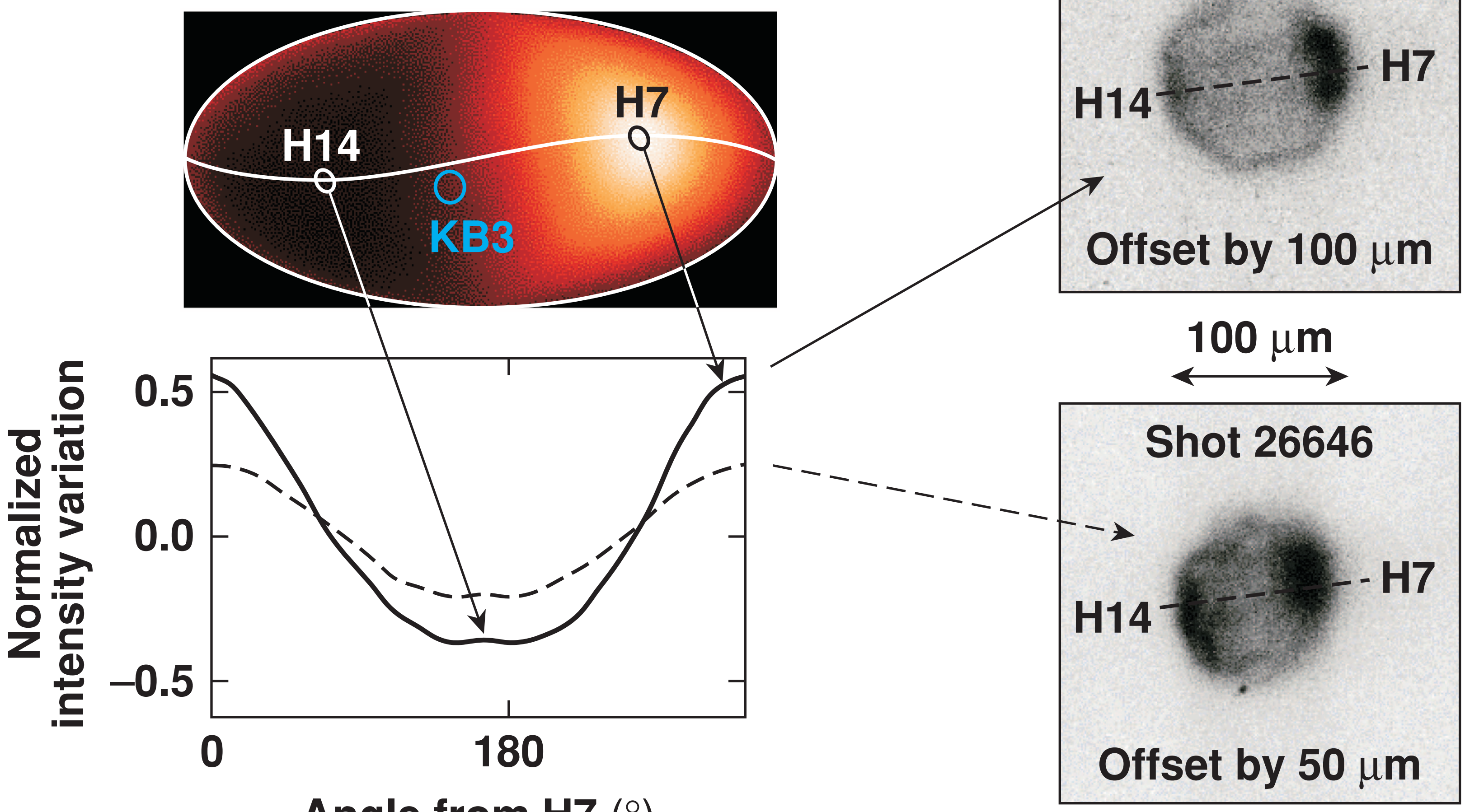
OMEGA offset implosions of 15-atm-D_2-filled, ~920-µm-diam, 20-µm-thick CH shells



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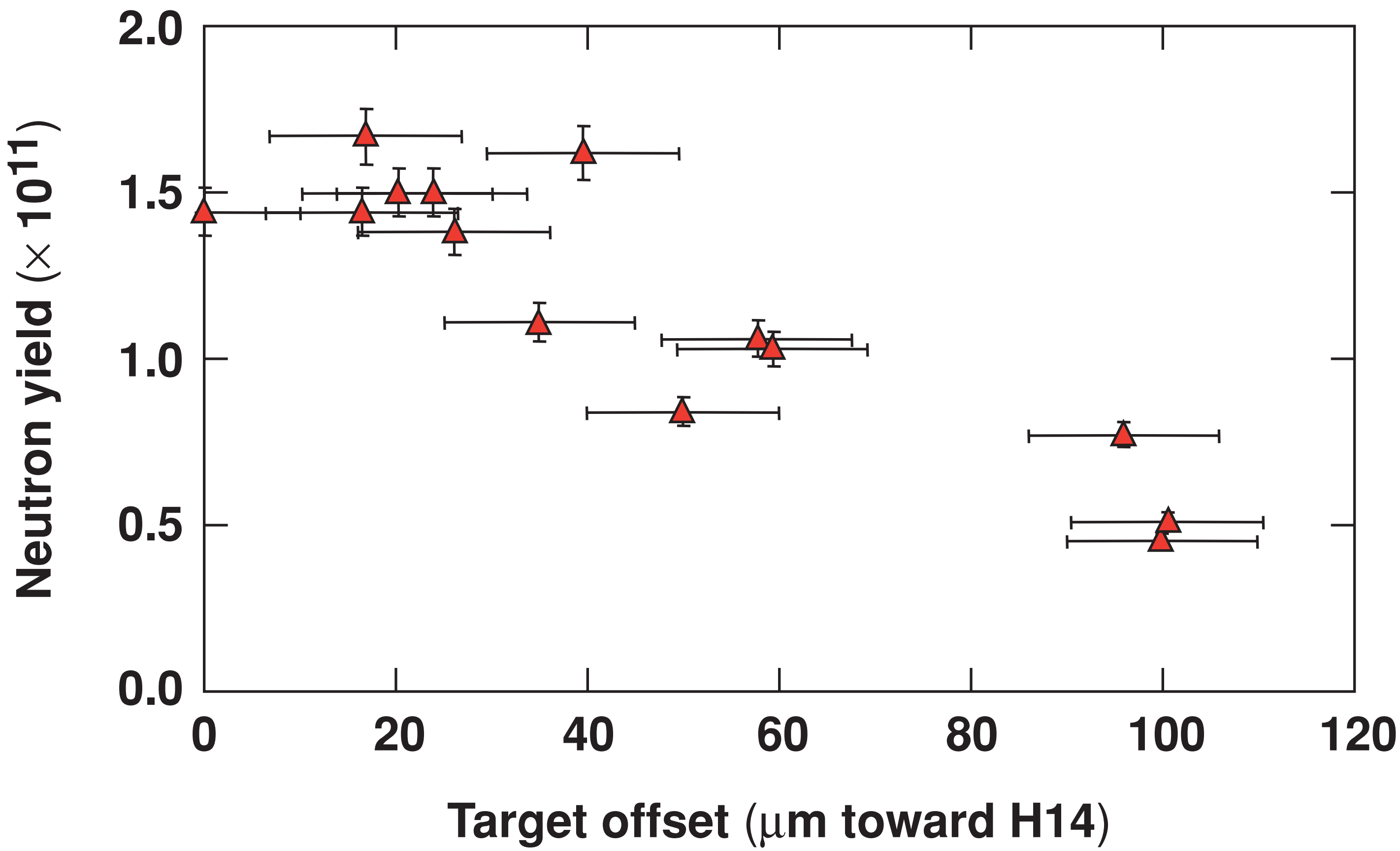
Neutron Yield

The neutron yield decreases with increasing target offset



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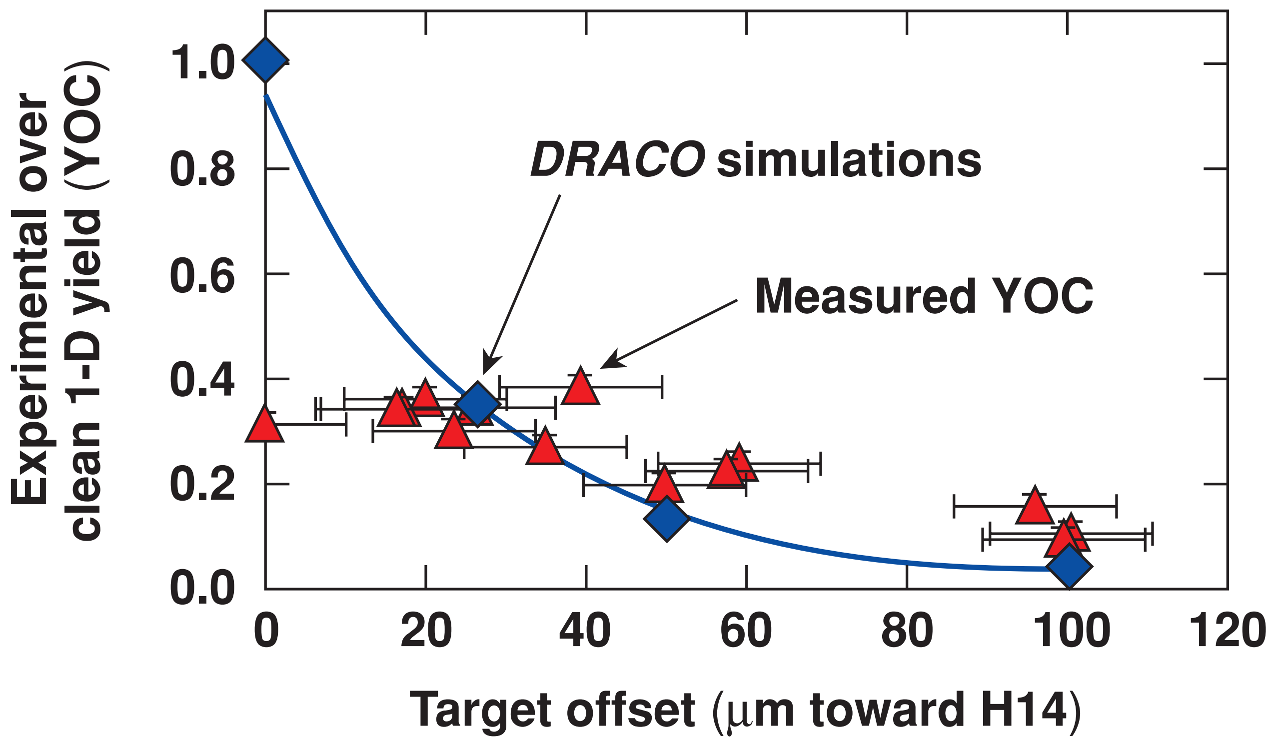
The ratio of experimental yield to predicted, 1-D, yield (YOC) decreases with increasing offset

- 2-D simulations including only offset effects predict ~ the measured yield for offsets greater than ~ 20 μm.



2-D simulations imply that other factors (power balance, pointing, etc.) may limit target performance (see Marshall GO2.007 and McKenty GO2.008).

Ion Temperature

The neutron-averaged temperature (T_i) increases with target offsets of up to ~60 μm

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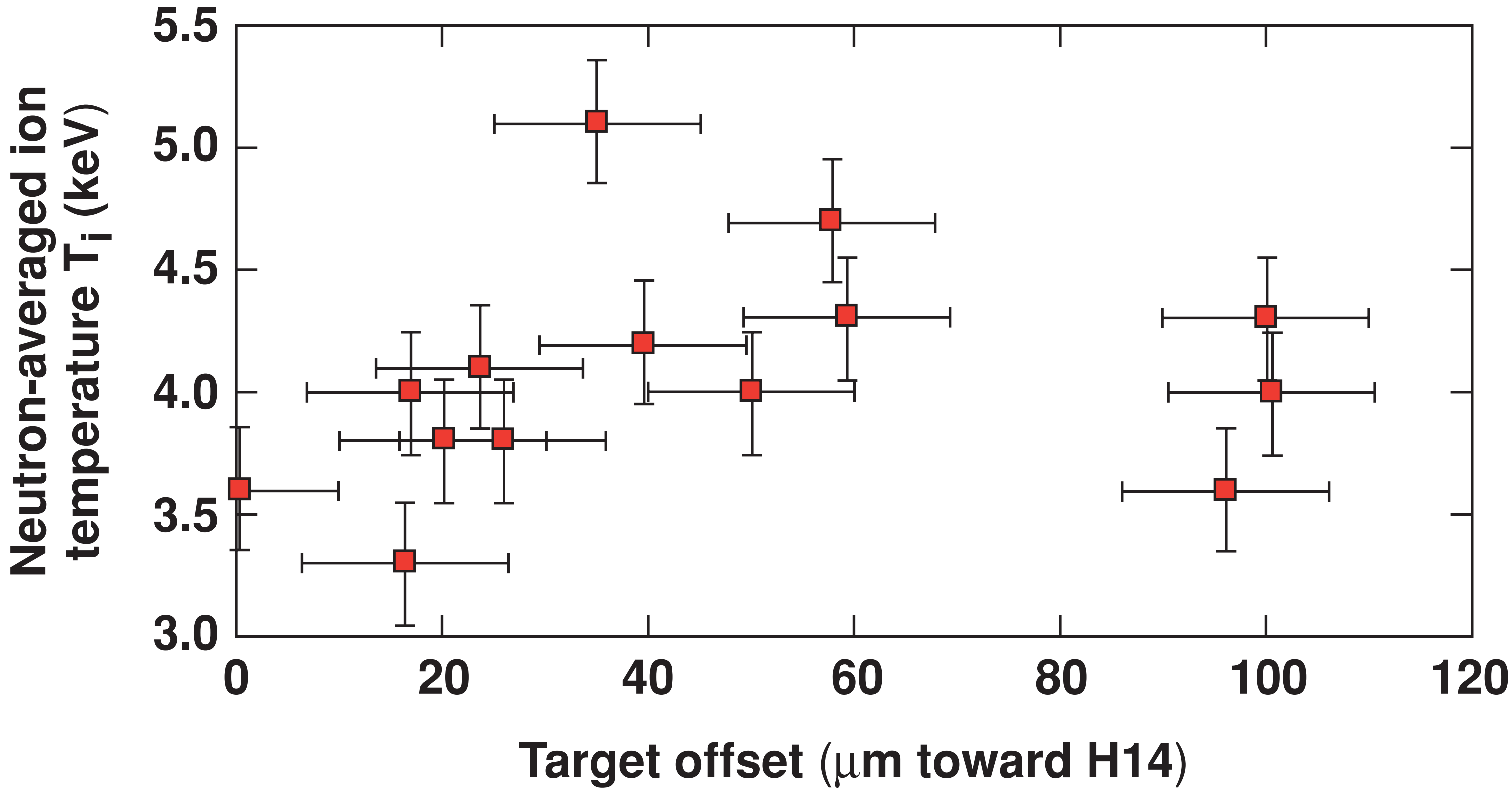

T_i is a combination of the temperature at shock time (~ 6 keV) and at peak compression (~ 2 keV).

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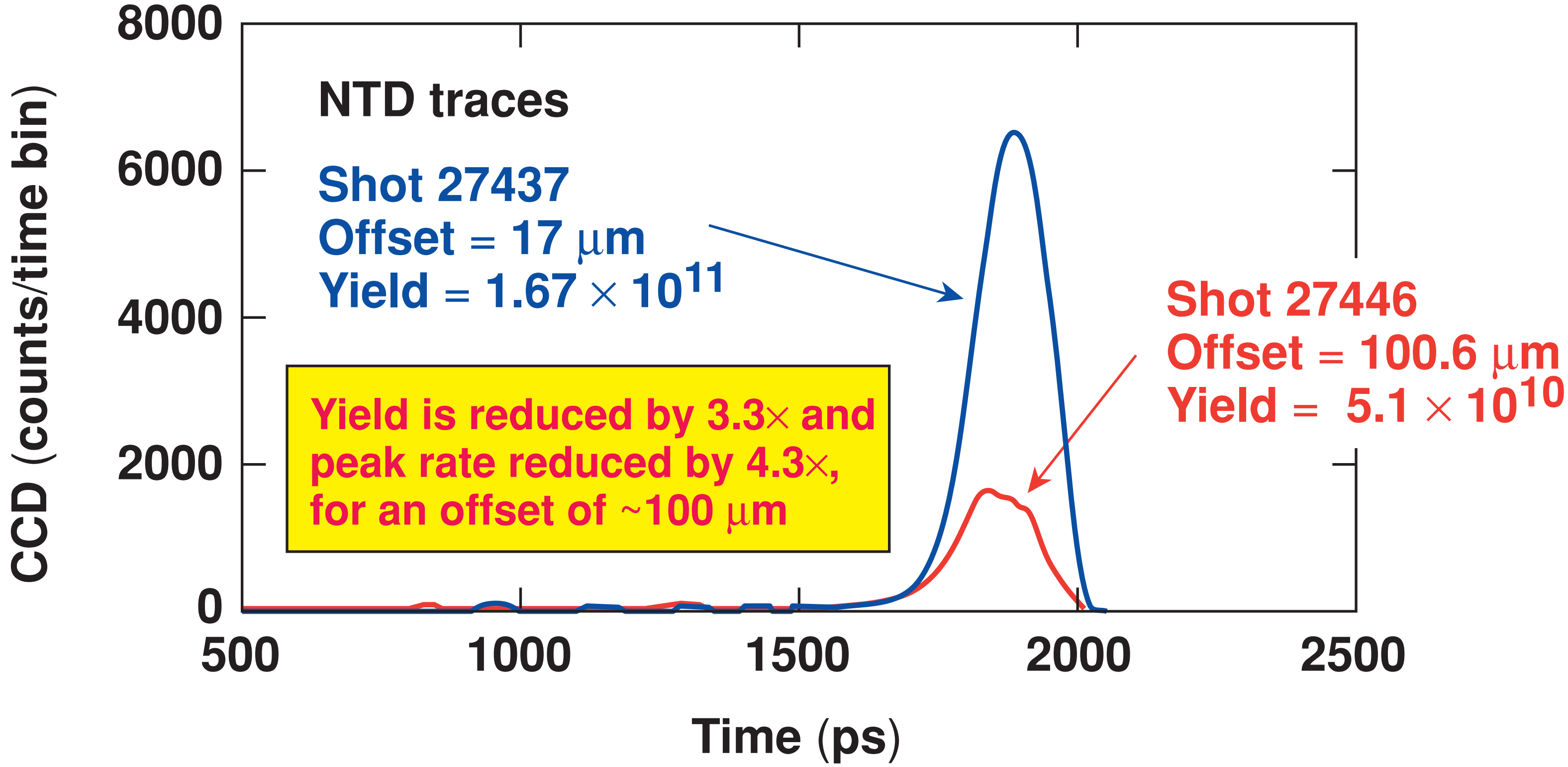
Neutron Burn

The time history of the neutron burn is modified significantly for an offset of ~100 μm



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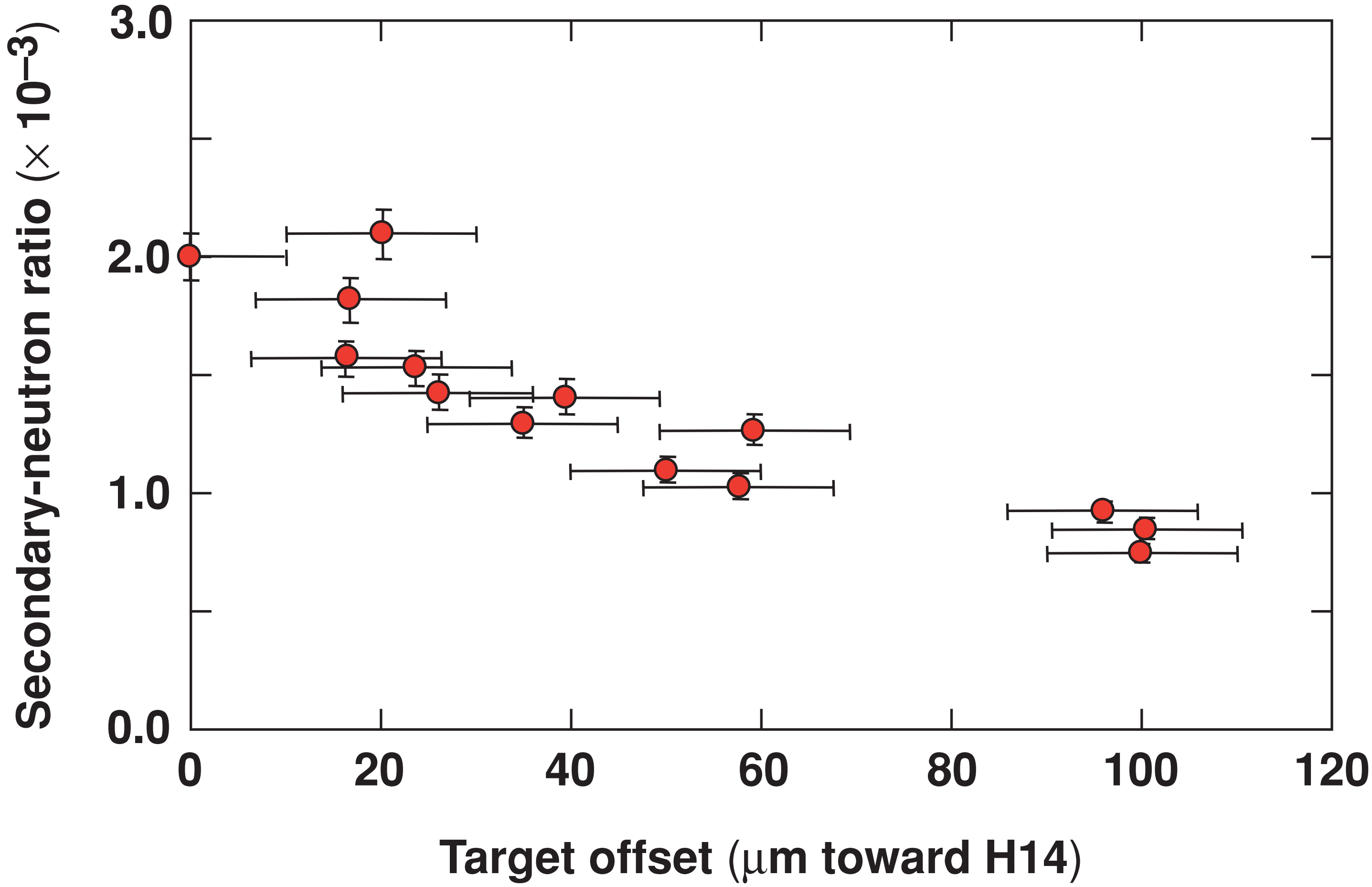
Secondary Neutrons

The secondary-neutron-yield ratio (dependent on fuel areal density) decreases with increasing target offset



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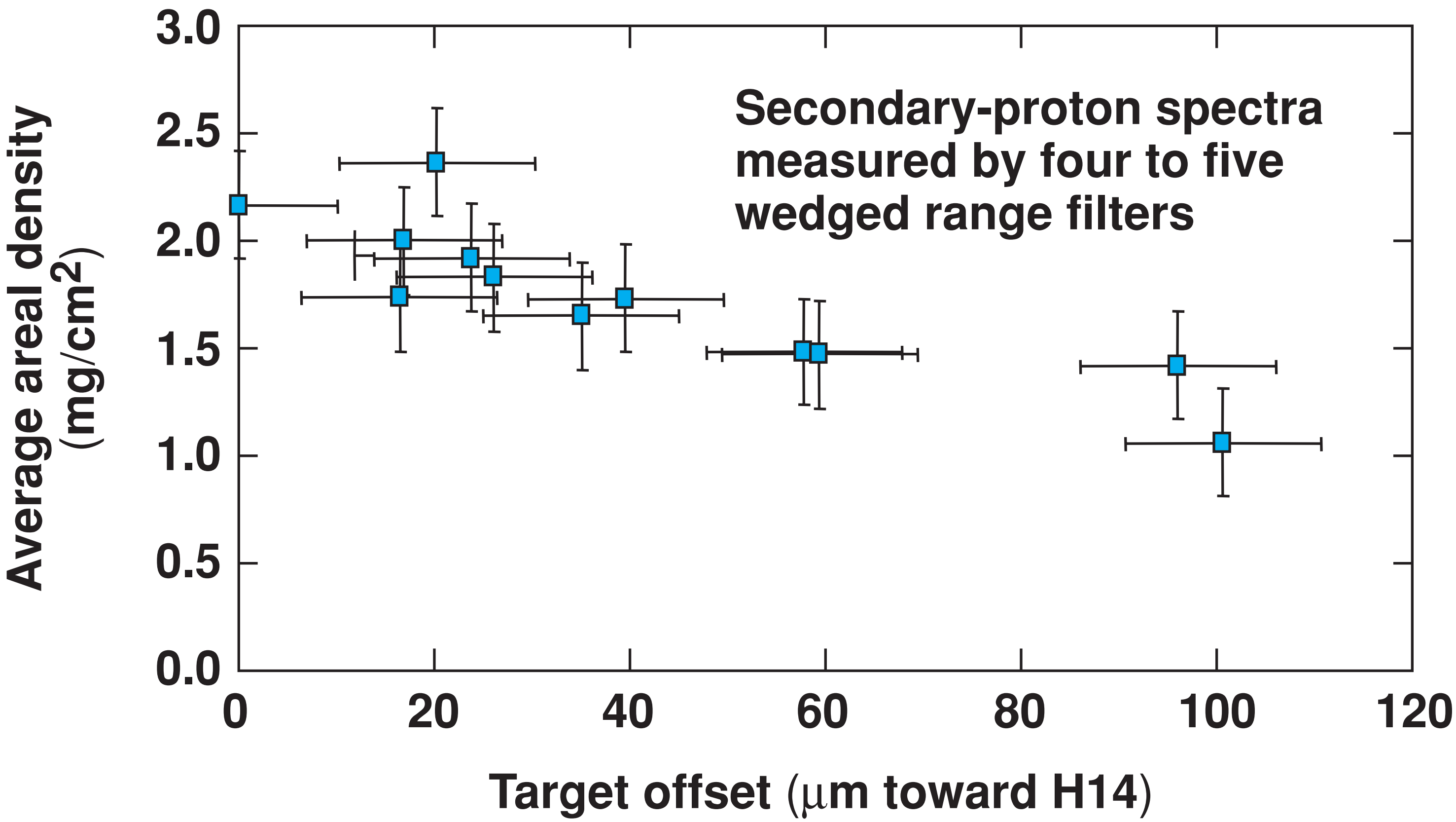
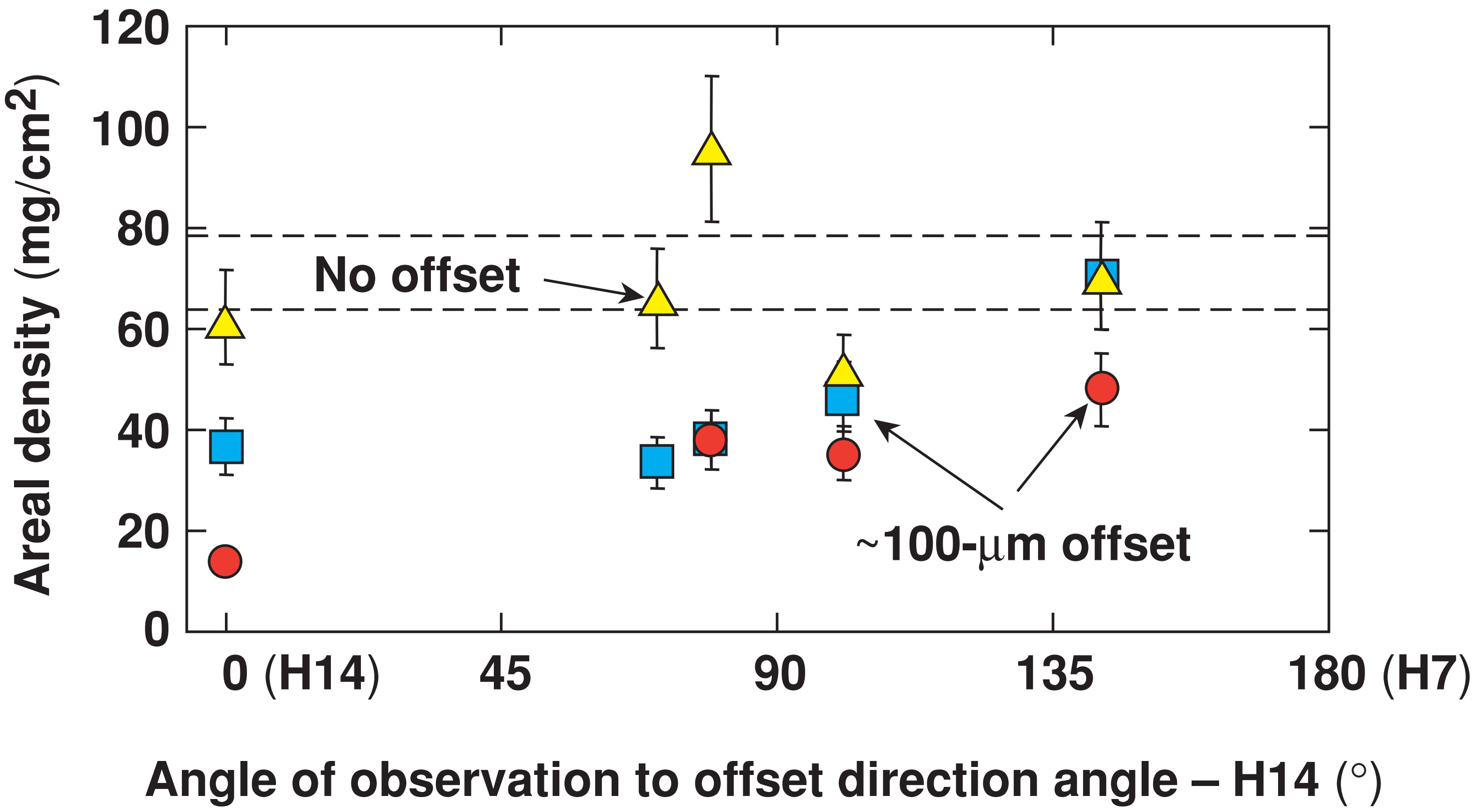
The average total areal density decreases with increasing target offset



Secondary Protons

The inferred areal density is observed to be lowest when viewed from the direction of the target offset (H14)



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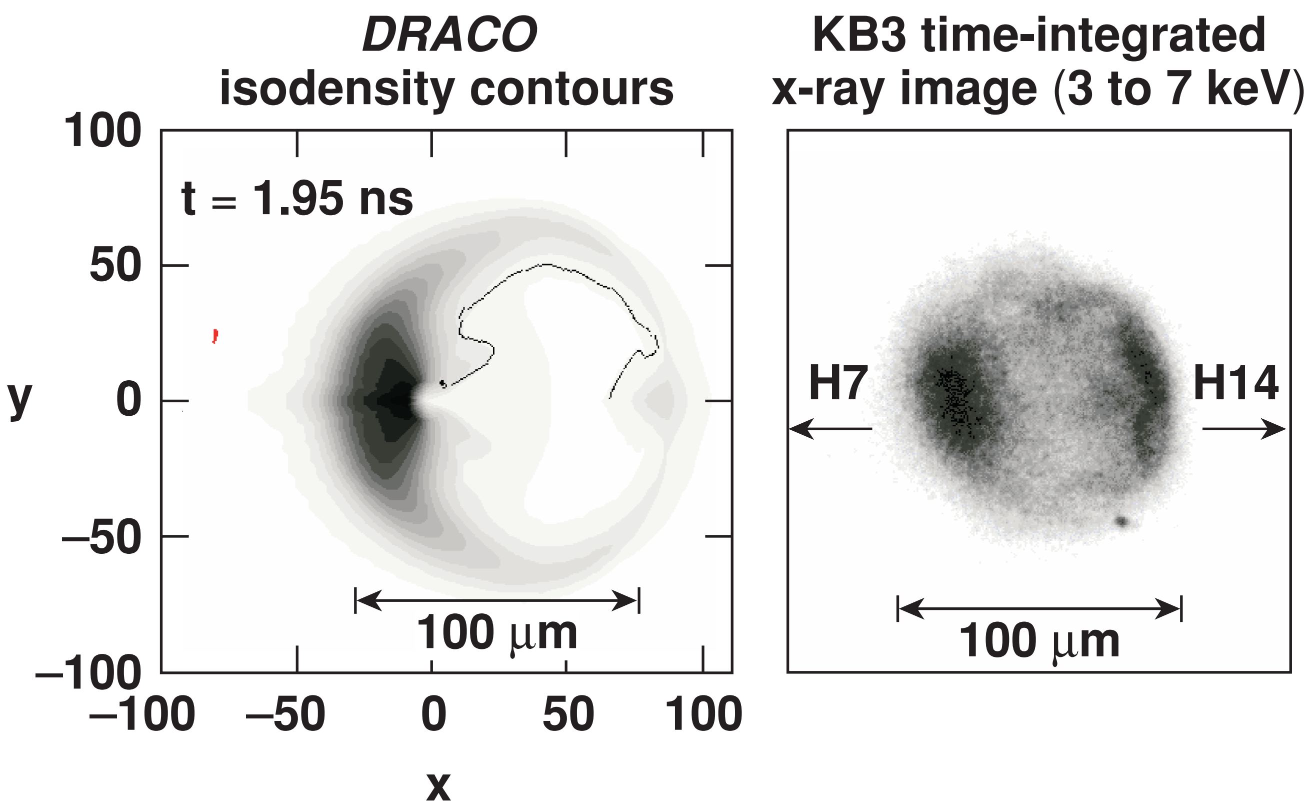
DRACO calculations are confirmed by the experimental observations

OMEGA shot 26646
D_2(15)CH[20]



- Misplacing the target by 50 μm introduces a strong $\ell = 1$ nonuniformity to the implosion.

Summary/Conclusion

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