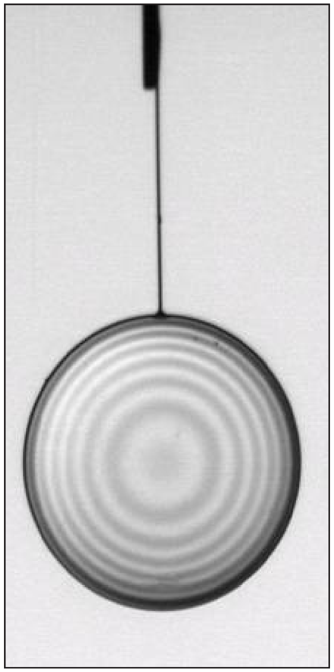
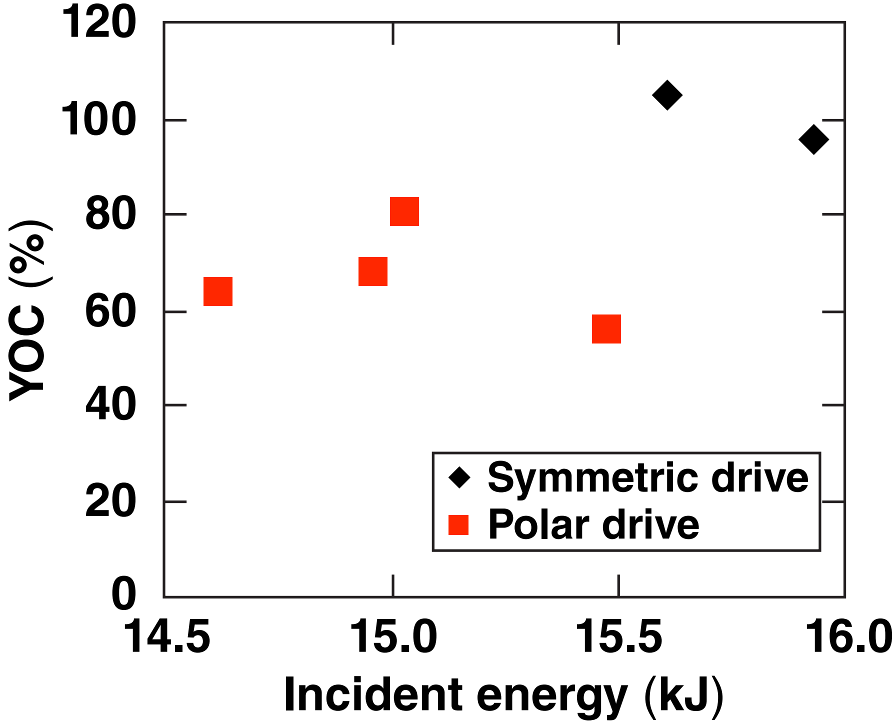
NIF Diagnostic Commissioning Platform Development on OMEGA

Exploding pusher target at TCC



DT fill, ramp laser pulse



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Summary

OMEGA experiments have demonstrated that polar-drive exploding-pusher implosions provide a reliable source of fusion products for the NIF

- Polar-drive (PD) implosions obtained 60% to 70% of 1-D yield
- Implosions were performed to study the effects of single-beam smoothing and target quality
- *DRACO* 2-D simulations correctly predict the onset and magnitude of neutron production
- There is qualitative agreement in the size and shape of x-ray images at later times when the incoming glass shell interacts with the outgoing shock wave

Six exploding-pusher targets have been shot on the NIF.

Related talks: P. W. McKenty (BO5.00005); A. J. Mackinnon (CO5.00001).

Collaborators

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S. Skupsky, and R. L. McCrory

University of Rochester
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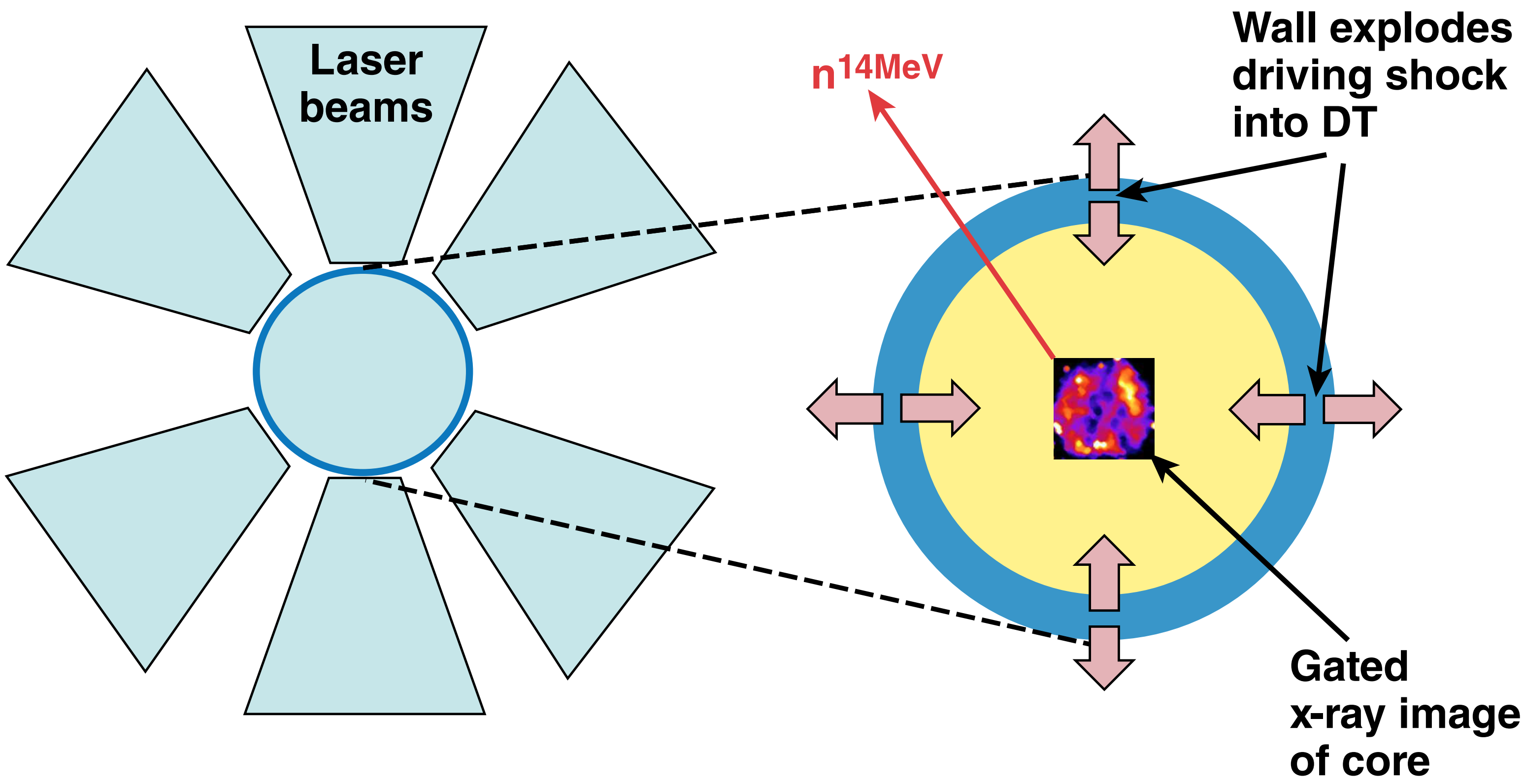
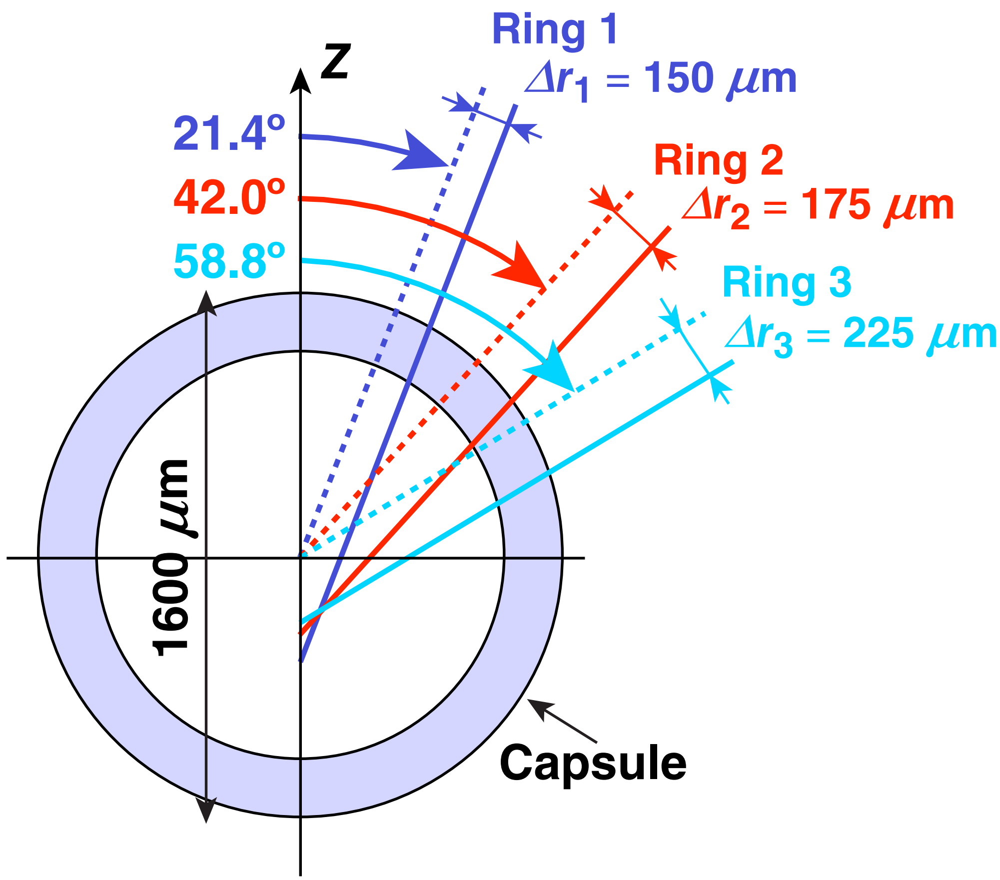
Exploding pushers use polar drive to heat thin, glass-walled targets that drive strong shocks to produce MeV neutrons



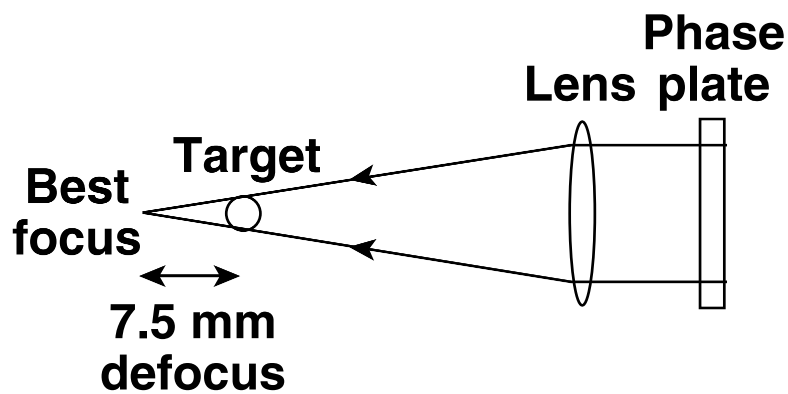
Controllable Y_n: up to 1×10^{16}, low ρr ~10's mg/cm^2, isotropic Y, easy fielding.

NIF's PD commissioning platform was validated on OMEGA using repointed and defocused laser beams

PD beam-repointing configuration



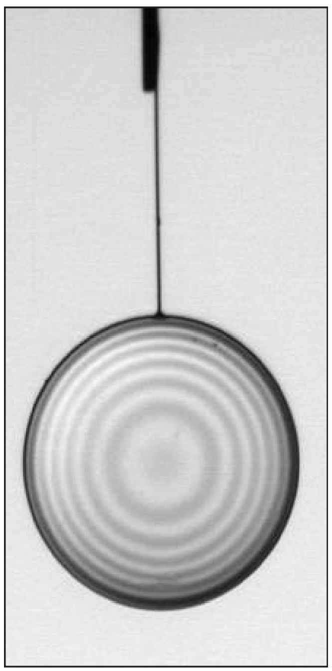
Defocusing was used to fill the NIF-sized target on OMEGA

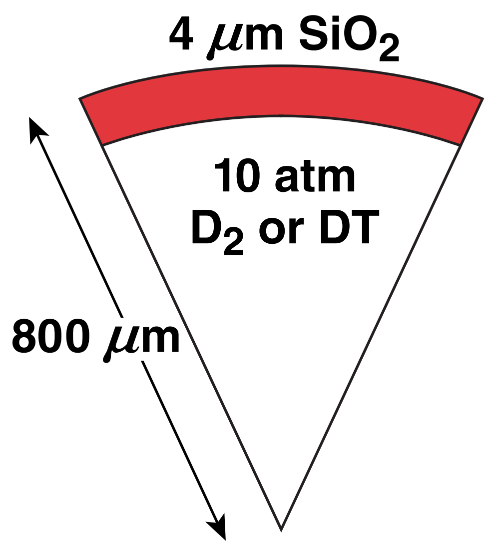


TC9101

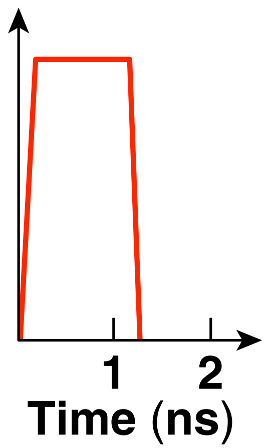
OMEGA experiments used the same thin-wall glass targets as deployed on the NIF

Target image at TCC

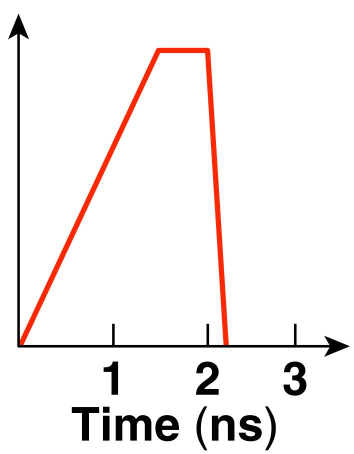




Square pulse ~15 kJ



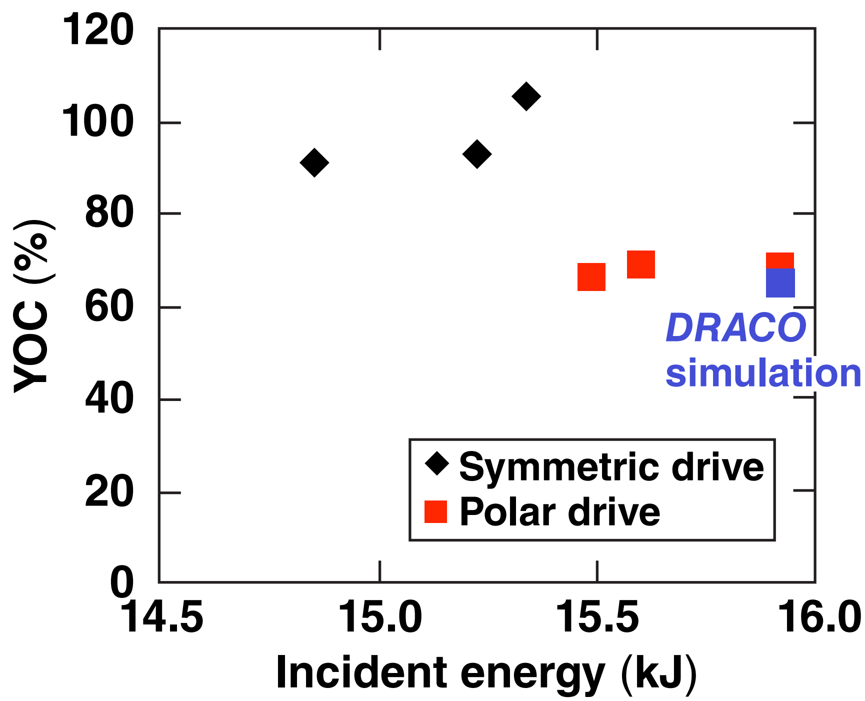
Ramp pulse ~15 kJ



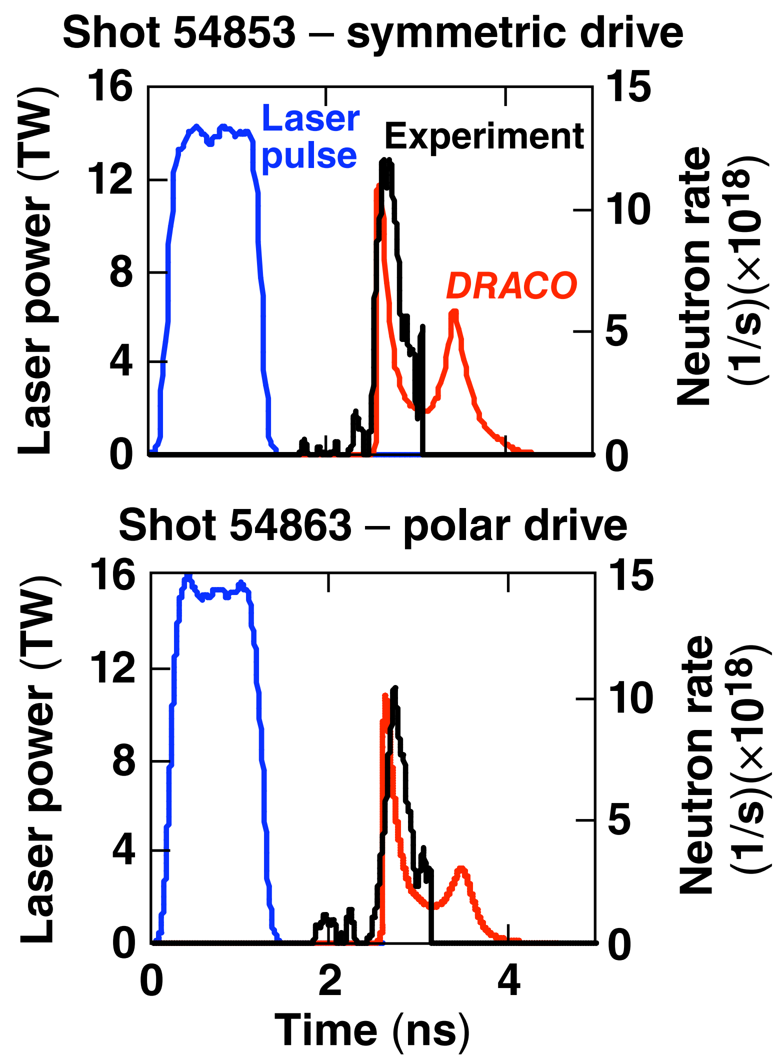
- Ramp pulse was developed to avoid blow-by on the NIF

TC9102

Initial D_2 PD experiments emulating NIF commissioning shots have demonstrated yields of 60% to 70% of 1-D predictions and good agreement with neutron production

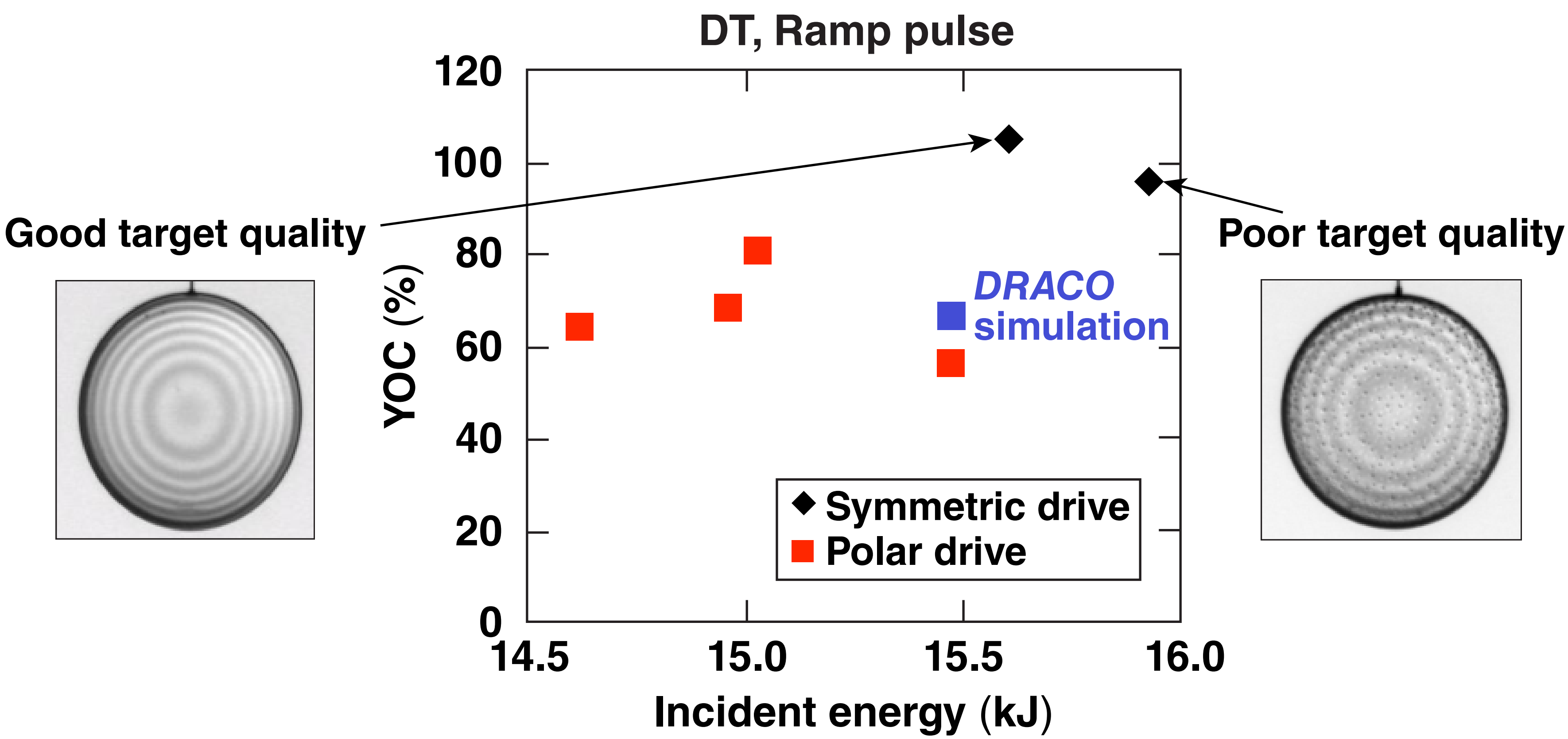


Average symmetric experimental yield = 4.6×10^9



TC9103

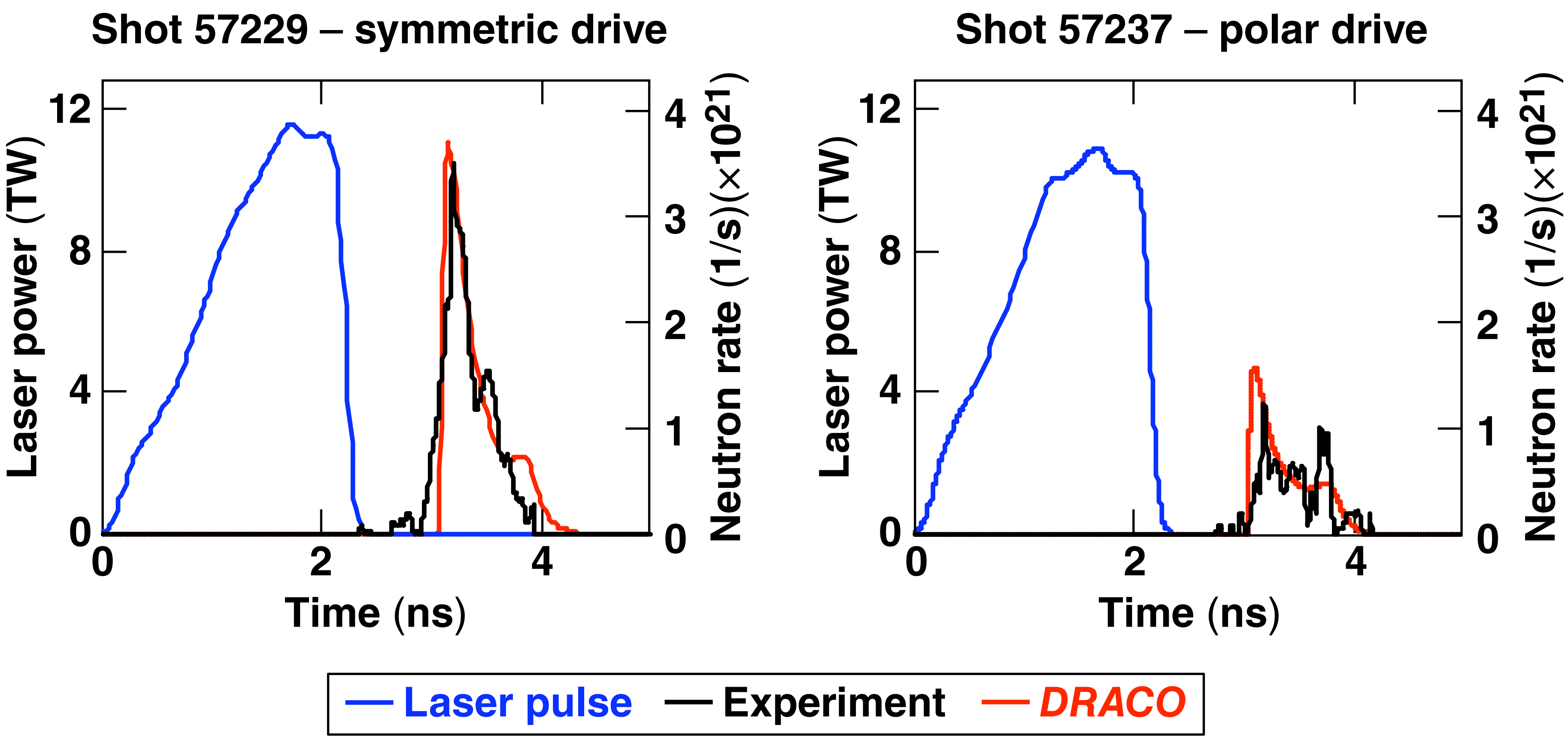
DT implosions have determined that performance is insensitive to target quality and SSD



Average symmetric experimental yield = 1.4×10^{12}

TC9104

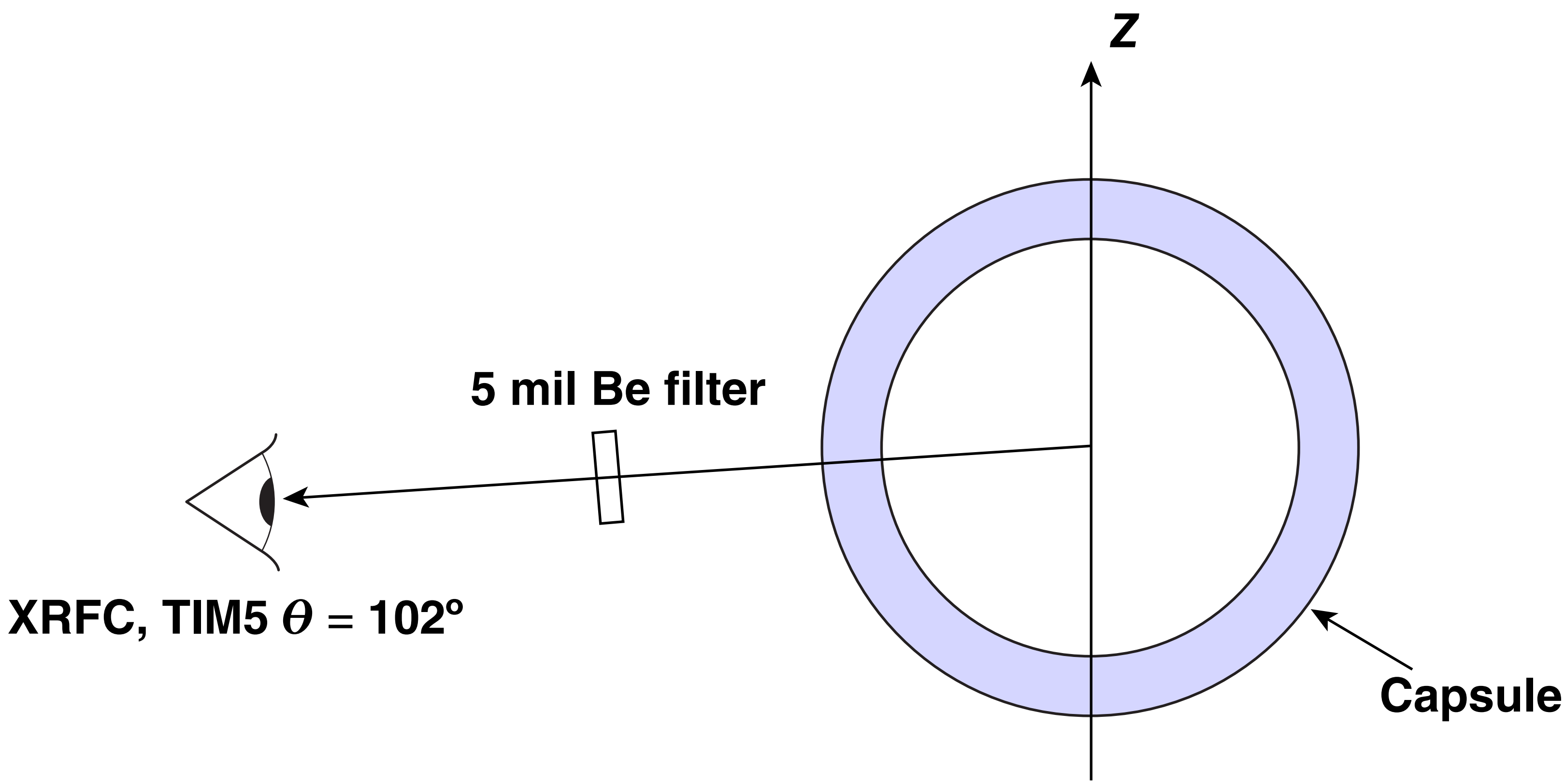
DRACO 2-D simulations reproduce the onset and magnitude of measured NTD neutron production of PD DT implosions



TC9105

An x-ray framing camera (XRFC) was used to study the implosion symmetry

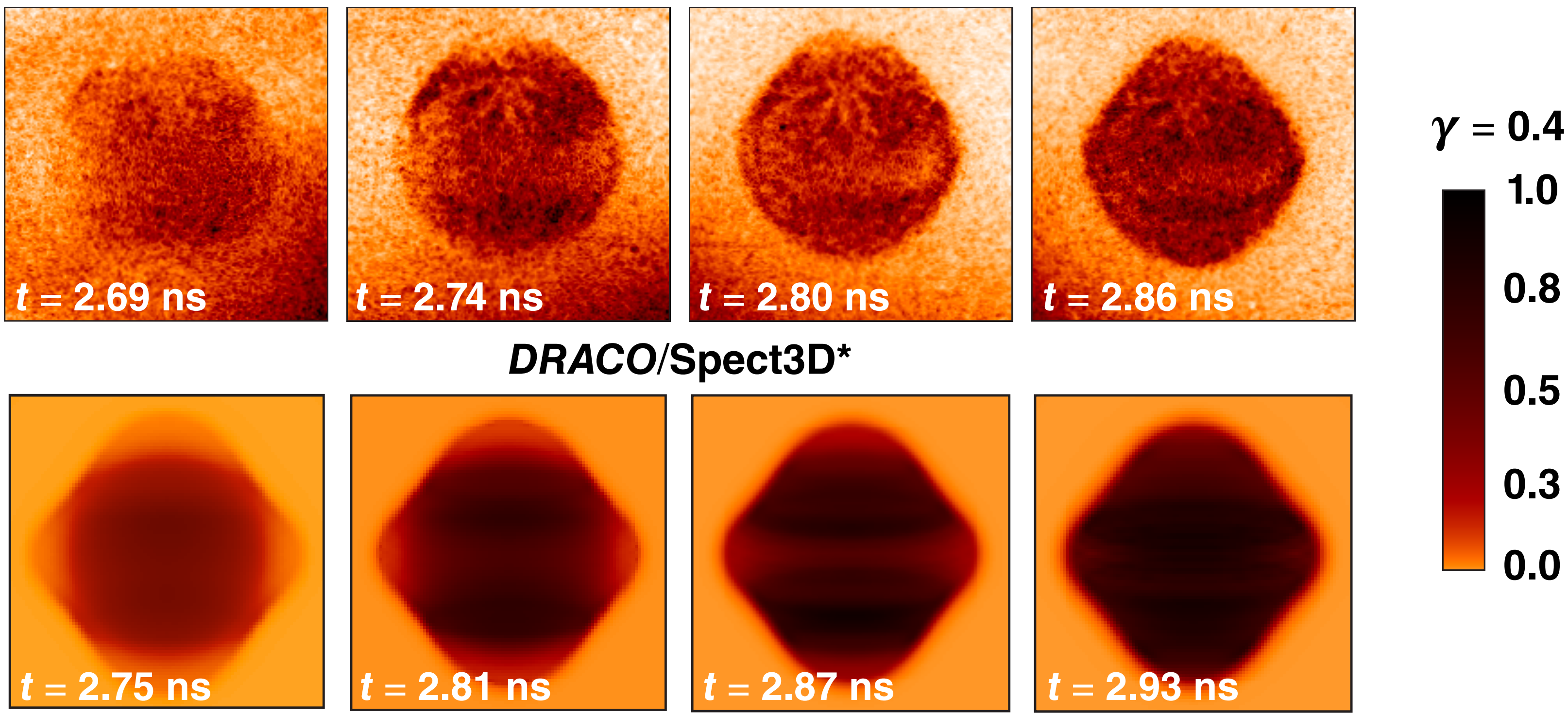
- The framing camera line of sight is 12° below the equator



TC9106

Self-emission images of D_2 implosions obtained with XRFC agree with Spect3D/*DRACO* simulations

PD D_2 shot 54863, XRFC, TIM5 $\theta = 101^\circ$



600 × 600-μm regions

Intensity of x-ray emission

TC9107

*Spect3D: Prism Computational Sciences, Inc., Madison, WI.

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