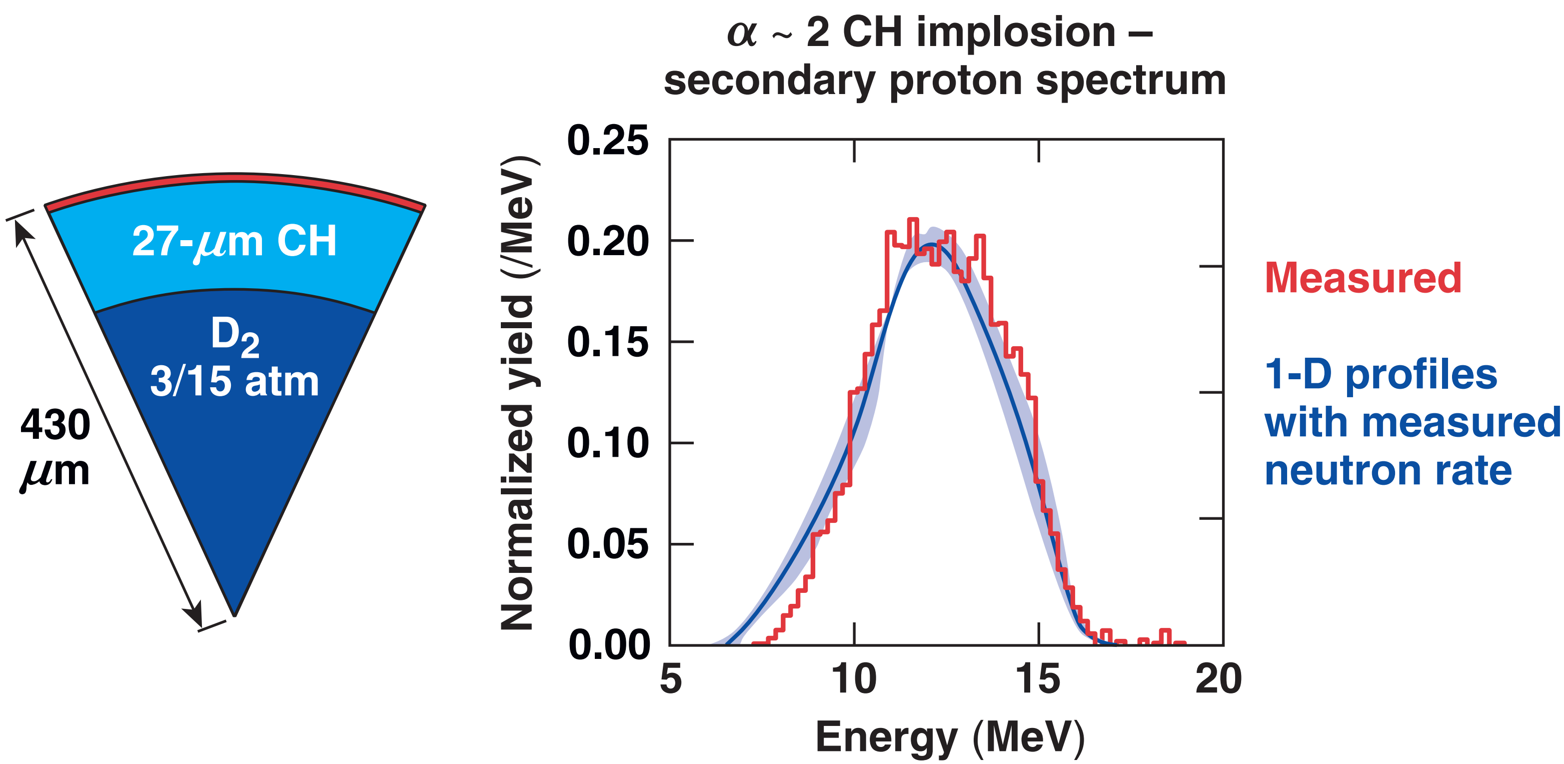
Inferring Areal Density in OMEGA Implosions



P. B. Radha
University of Rochester
Laboratory for Laser Energetics

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Summary

Simulated and measured areal densities are in good agreement for plastic-shell implosions on OMEGA

- **Secondary proton spectra are sensitive to ρR history through their energy loss.**
- **Differences between simulated and measured neutron-averaged values of areal density are primarily due to the different sampling of areal densities by the experimental neutron rate.**
- **Simulated secondary proton spectra are in good agreement with measured spectra indicating nearly 1-D evolution of areal densities during neutron production in OMEGA implosions.**

Collaborators

**R. Betti, J. A. Delettrez, V. Yu. Glebov, V. N. Goncharov,
J. P. Knauer, D. D. Meyerhofer, S. P. Regan, T. C. Sangster,
V. A. Smalyuk, and C. Stoeckl**

Laboratory for Laser Energetics
University of Rochester

J. A. Frenje and R. D. Petrasso

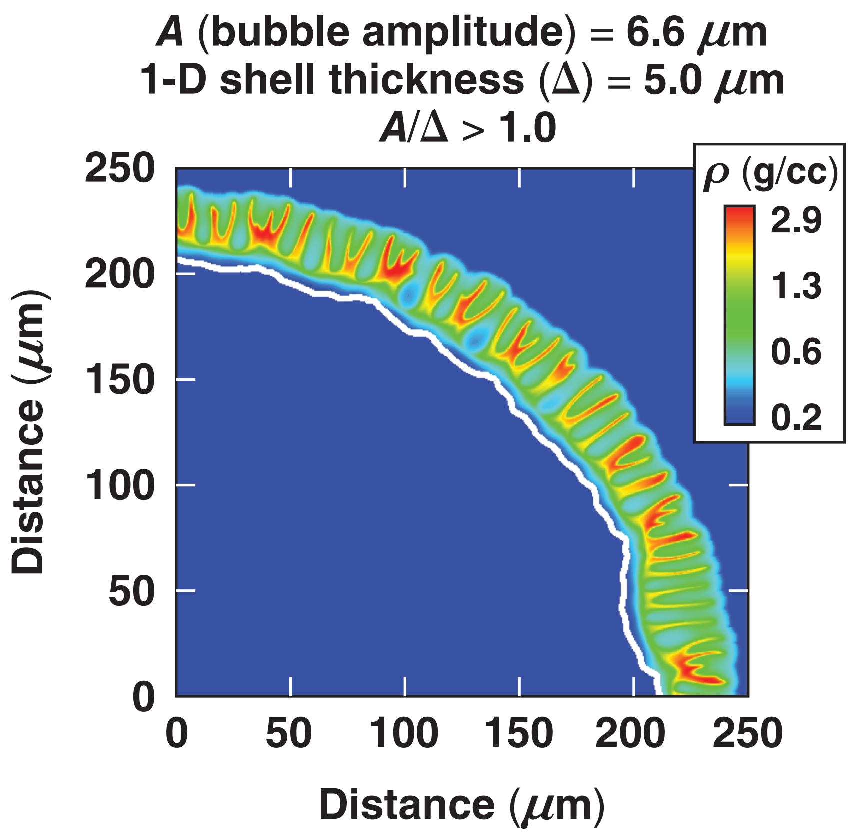
Plasma Science and Fusion Center
MIT

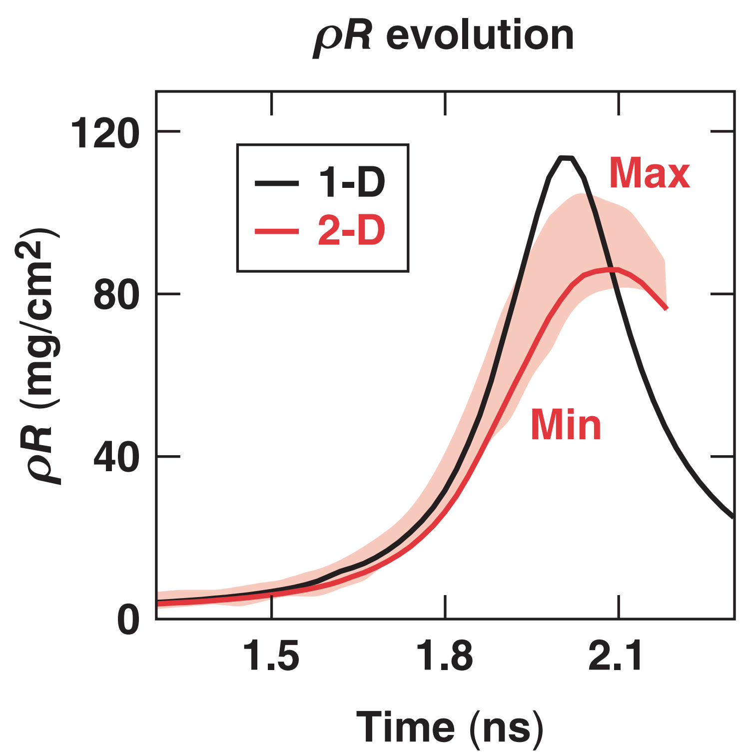
D. Shvarts

Department of Physics
Negev Research Center
Negev, Israel

A "broken shell" during acceleration can compromise areal density

DRACO simulation of $\alpha \sim 5$, 20-μm CH shell (imprint only)

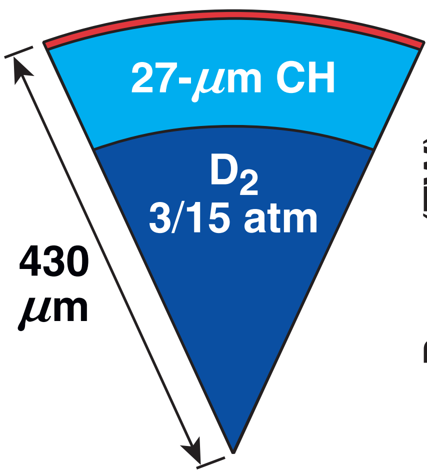


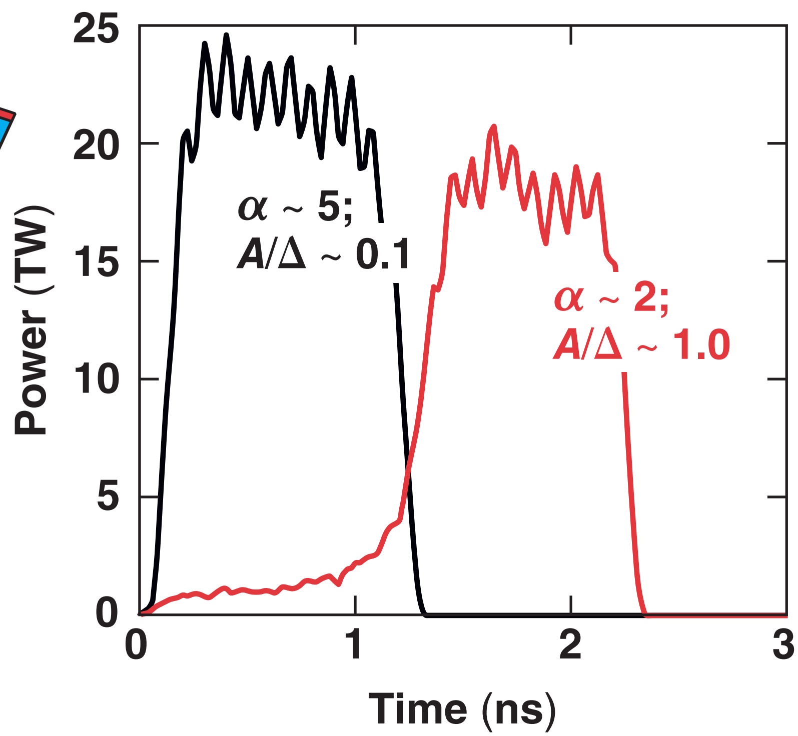


Inferring a ρR history is necessary to verify if the implosion achieved the necessary compression and densities.

TC7551

Areal density has been diagnosed for differing adiabats in OMEGA implosions





$$\alpha = \frac{P}{P_{TF}\left[\rho, T(0)\right]}$$

P = pressure

P_{TF} = Low temperature Thomas–Fermi pressure

A = bubble amplitude

Δ = 1-D shell thickness

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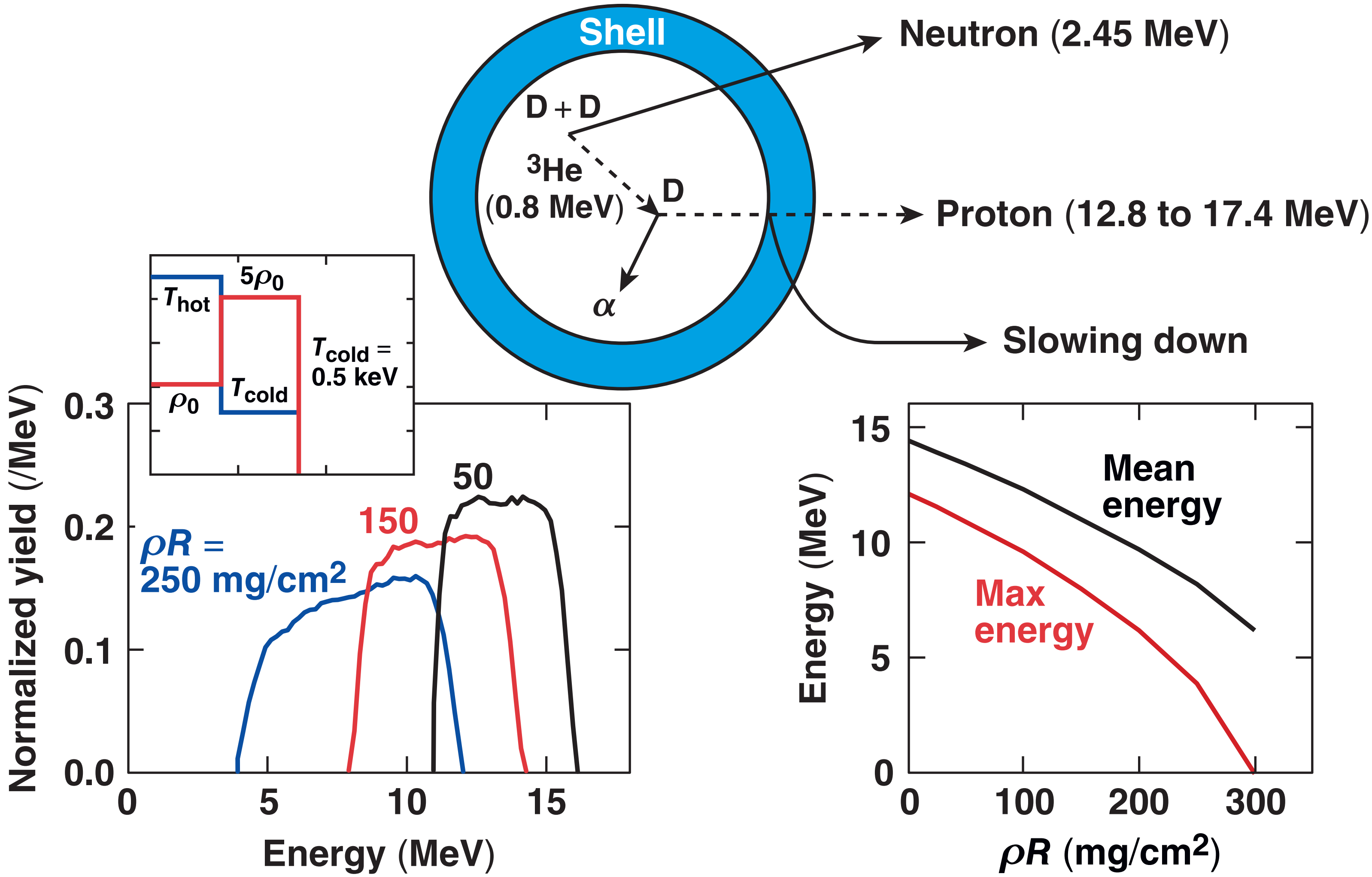
See W. Theobald, BO3.00004.

Secondary proton energy loss* is used to infer areal densities from D_2-filled implosions

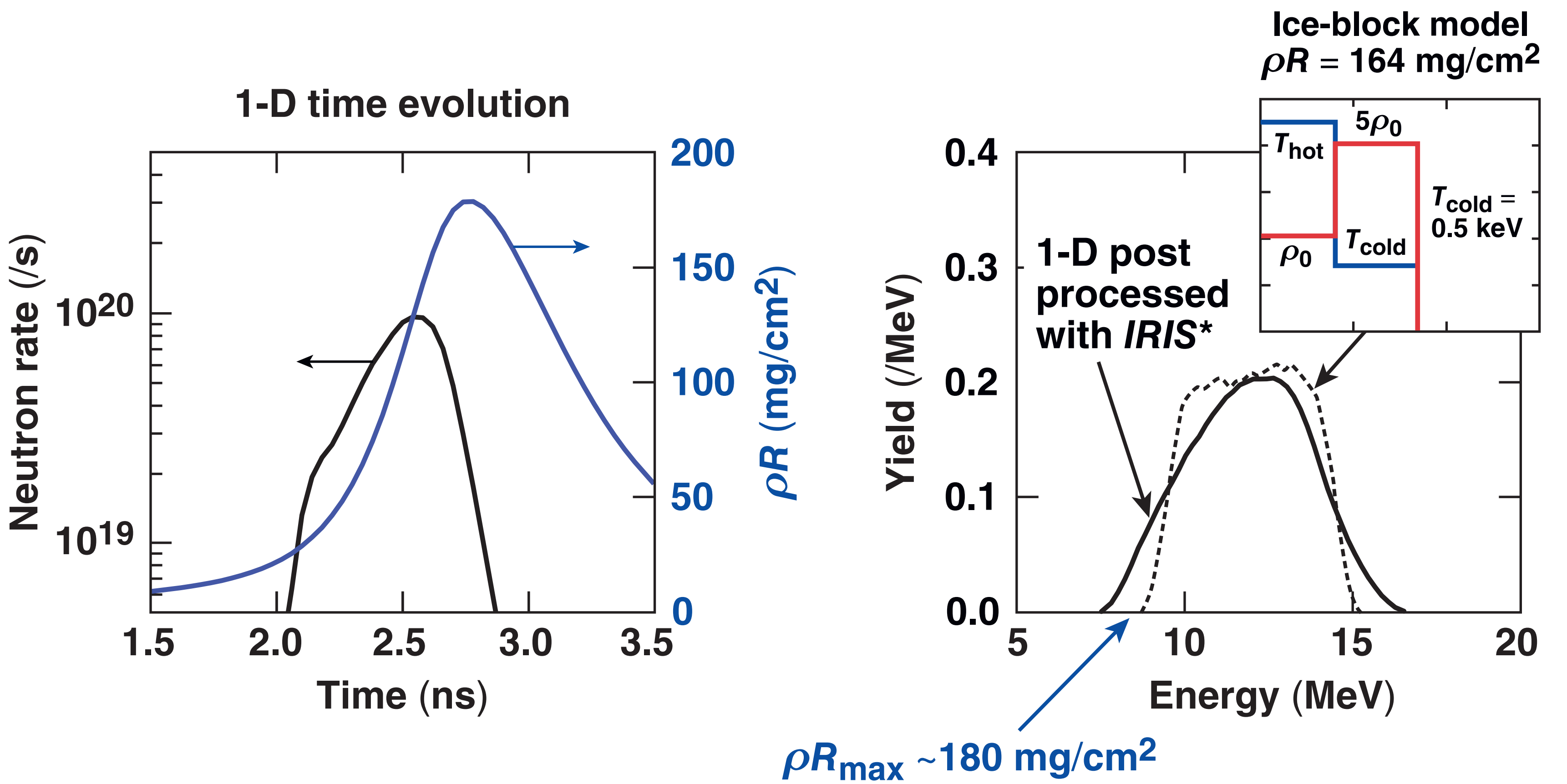


* F. H. Séguin *et al*., Phys. Plasmas 9, 2725 (2002).,
P. B. Radha *et al*., Bull. Am. Phys. Soc. 44, 194 (1999).

TC7553

Time evolution of areal density in an implosion broadens the secondary proton spectrum

$\alpha \sim 5$, 1-ns square pulse, 27-μm 3 atm, $A/\Delta \sim 0.1$

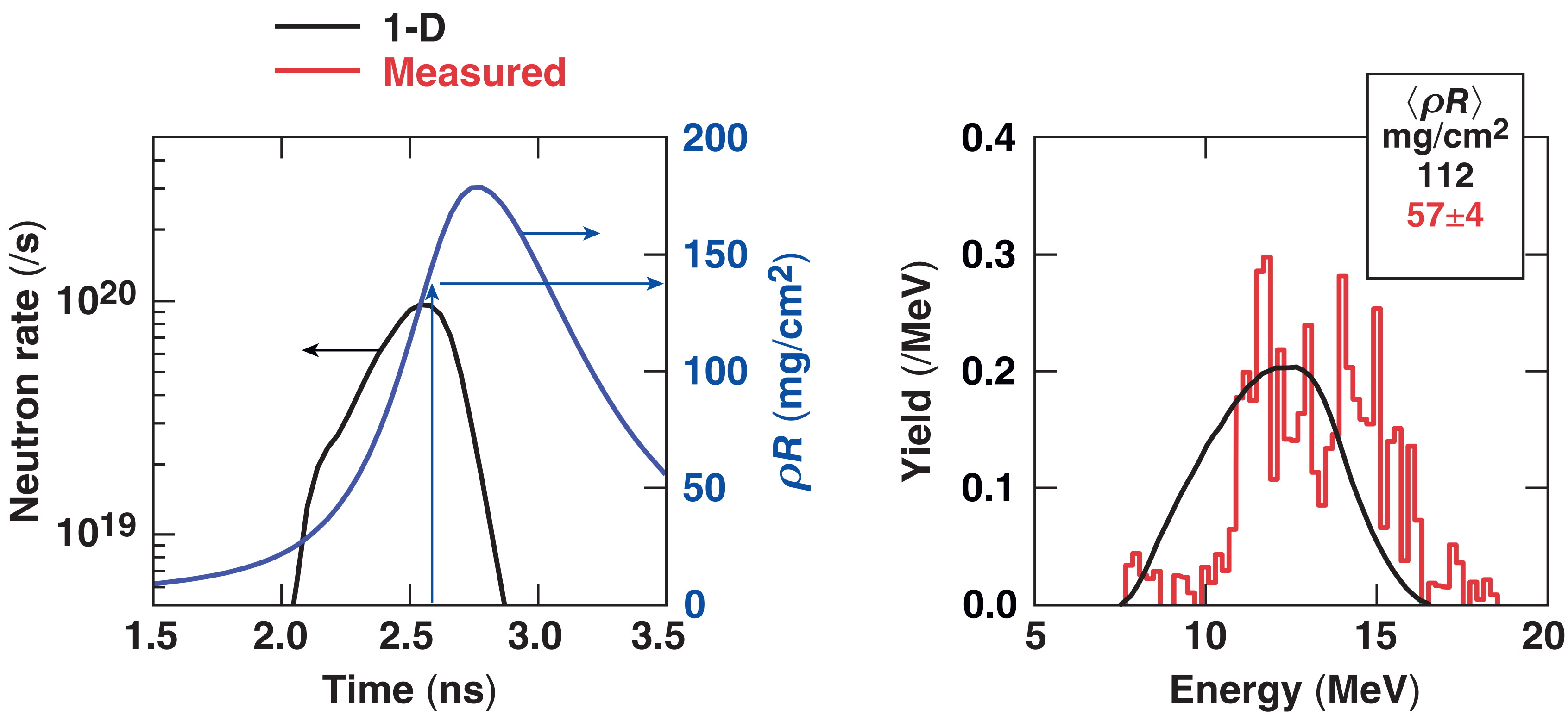


TC7554

*IRIS: P. B. Radha et al., Bull. Am. Phys. Soc. 44, 194 (1999).

1-D values of ρR are achieved during neutron production in high-adiabat implosions

α ~ 5, 1-ns square pulse, 27-μm 3 atm, A/Δ ~ 0.1



TC7574

1-D values of ρR are achieved during neutron production in high-adiabat implosions

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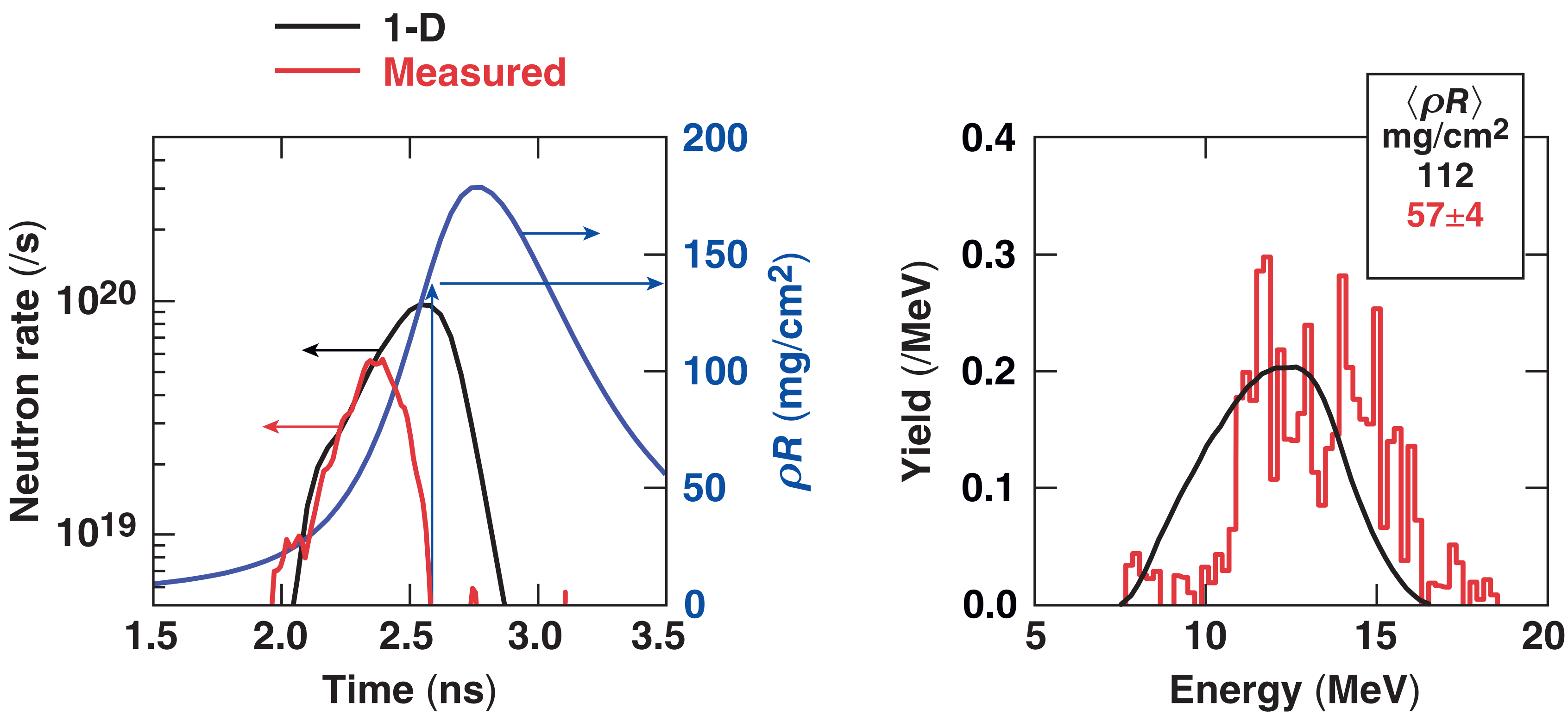
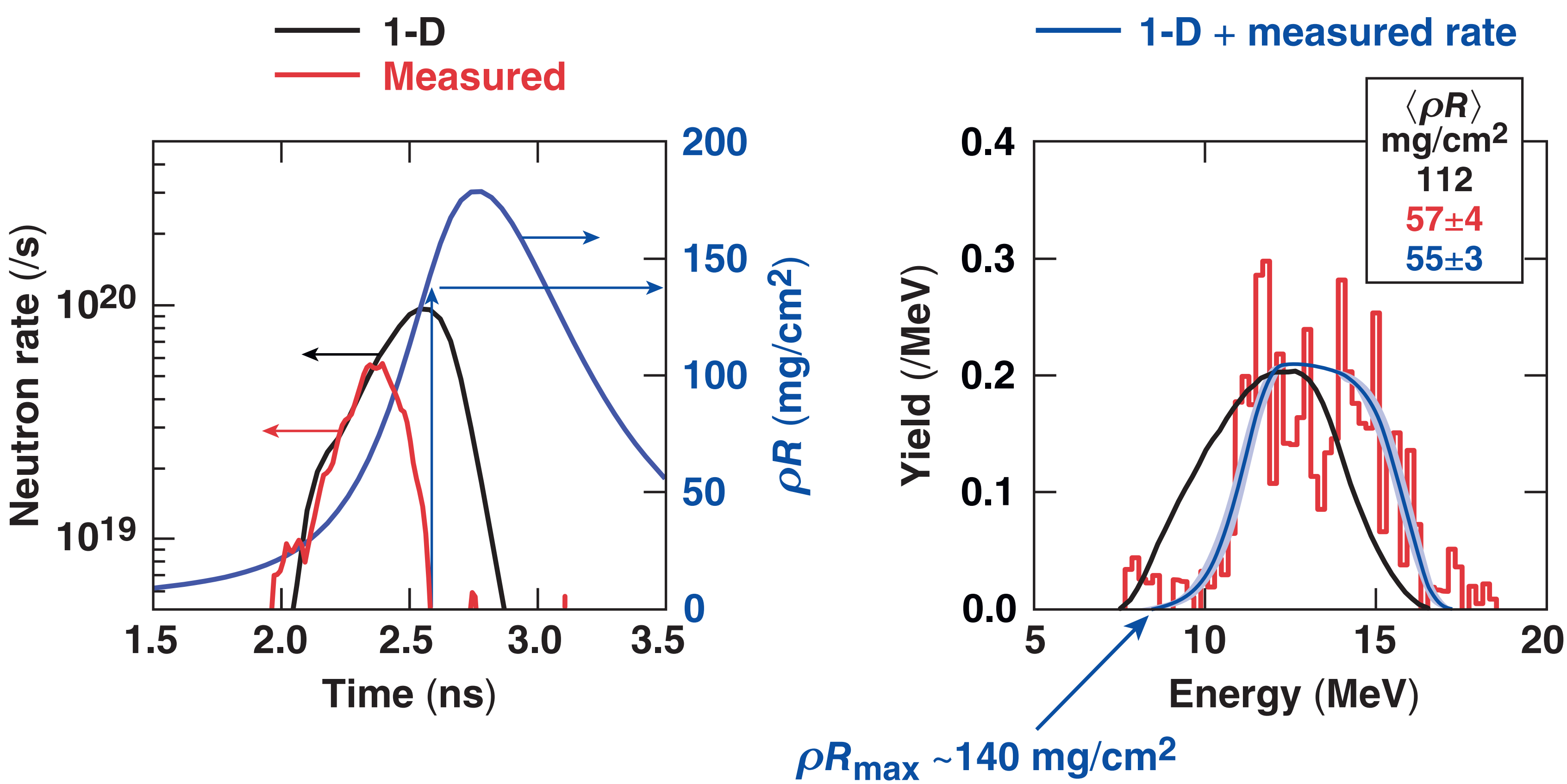
α ~ 5, 1-ns square pulse, 27-μm 3 atm, A/Δ ~ 0.1



1-D values of ρR are achieved during neutron production in high-adiabat implosions

α ~ 5, 1-ns square pulse, 27-μm 3 atm, A/Δ ~ 0.1



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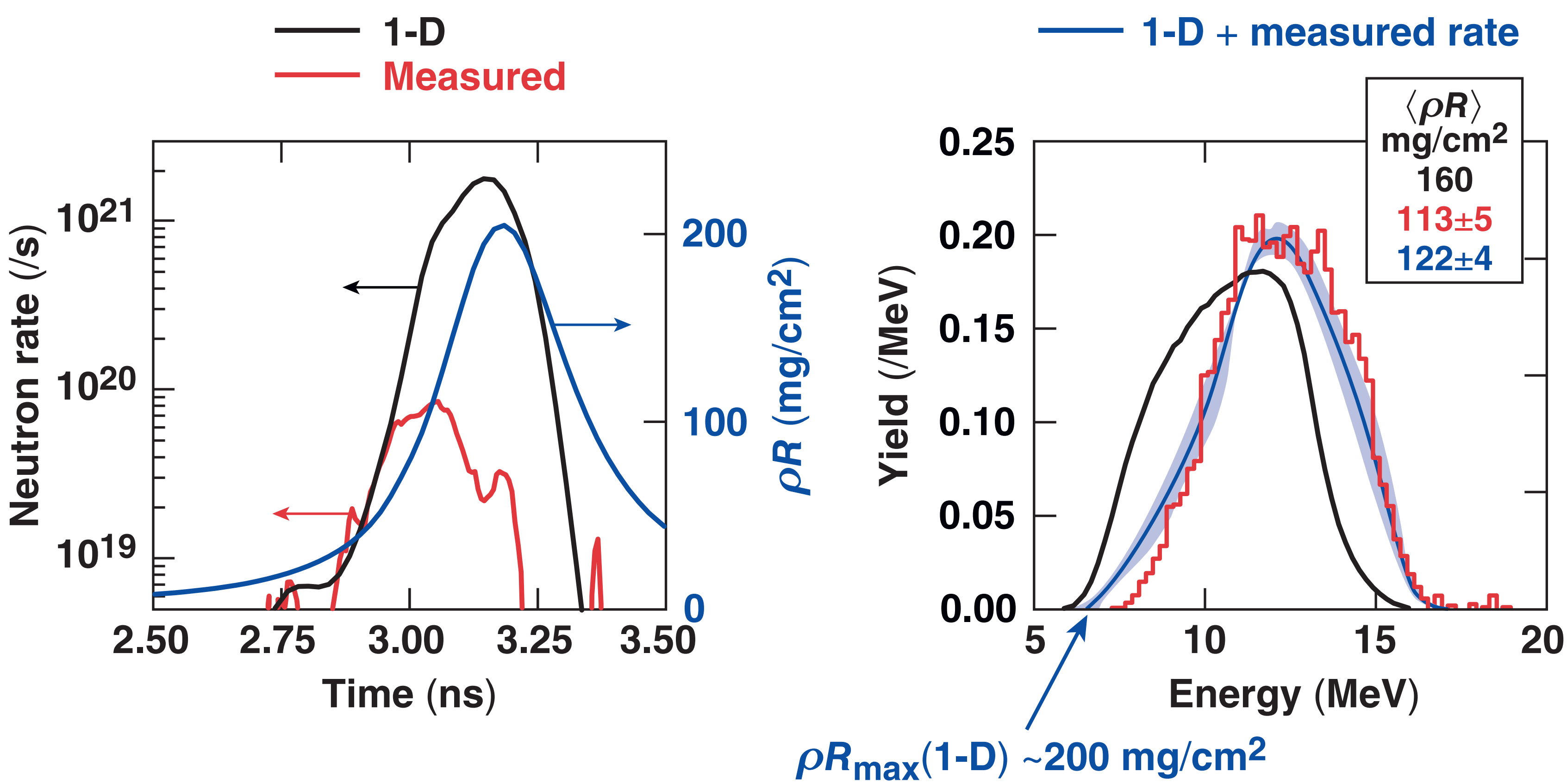
Low-adiabat implosions achieve nearly 1-D values of ρR

α ~ 2, shaped pulse, 27-μm 15 atm, A/Δ ~ 1.0



TC7575

Summary/Conclusions

Simulated and measured areal densities are in good agreement for plastic-shell implosions on OMEGA

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