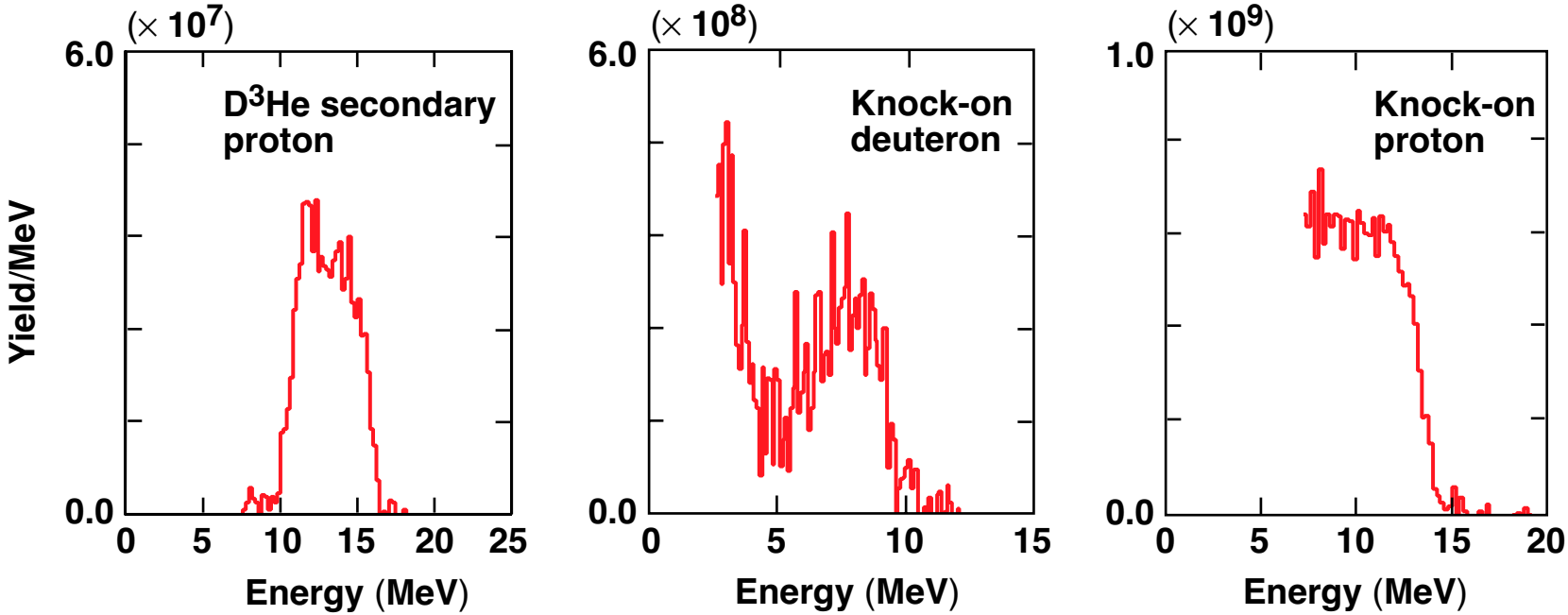
Direct-Drive Spherical Implosions of OMEGA Capsules with 3- to 15-atm Gas Fill



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43rd Annual Meeting of the
American Physical Society
Division of Plasma Physics
Long Beach, CA
29 October–2 November 2001

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Summary

Target implosion performances and fuel–shell mix effects are studied with room-temperature, CH-shell capsules filled with D_2 and DT gas

- Recent implosions establish the dependence of target performance on gas-fill pressure from 3 to 15 atm for 20-μm CH shells.
- Moderate convergence (CR ~ 10) is achieved for all implosions irrespective of the gas-fill pressure.
- The 15-atm capsule implosions are closer to 1-D predictions.
- More fuel–shell mix is inferred for 3-atm implosions:

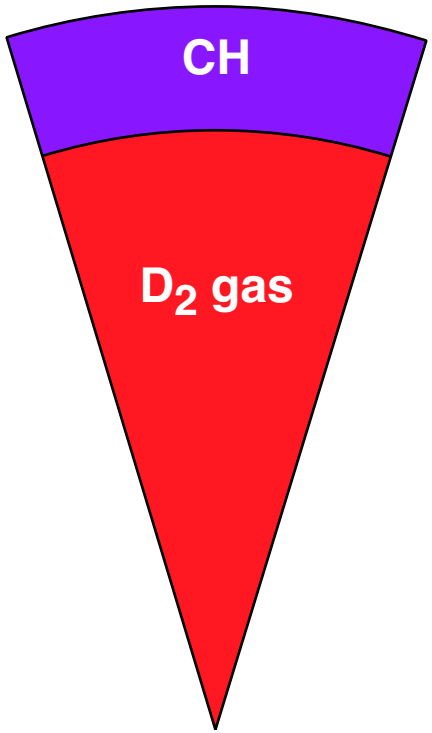
  3 atm: entire core;
  ~ 0.9 μm of the original inner CH shell

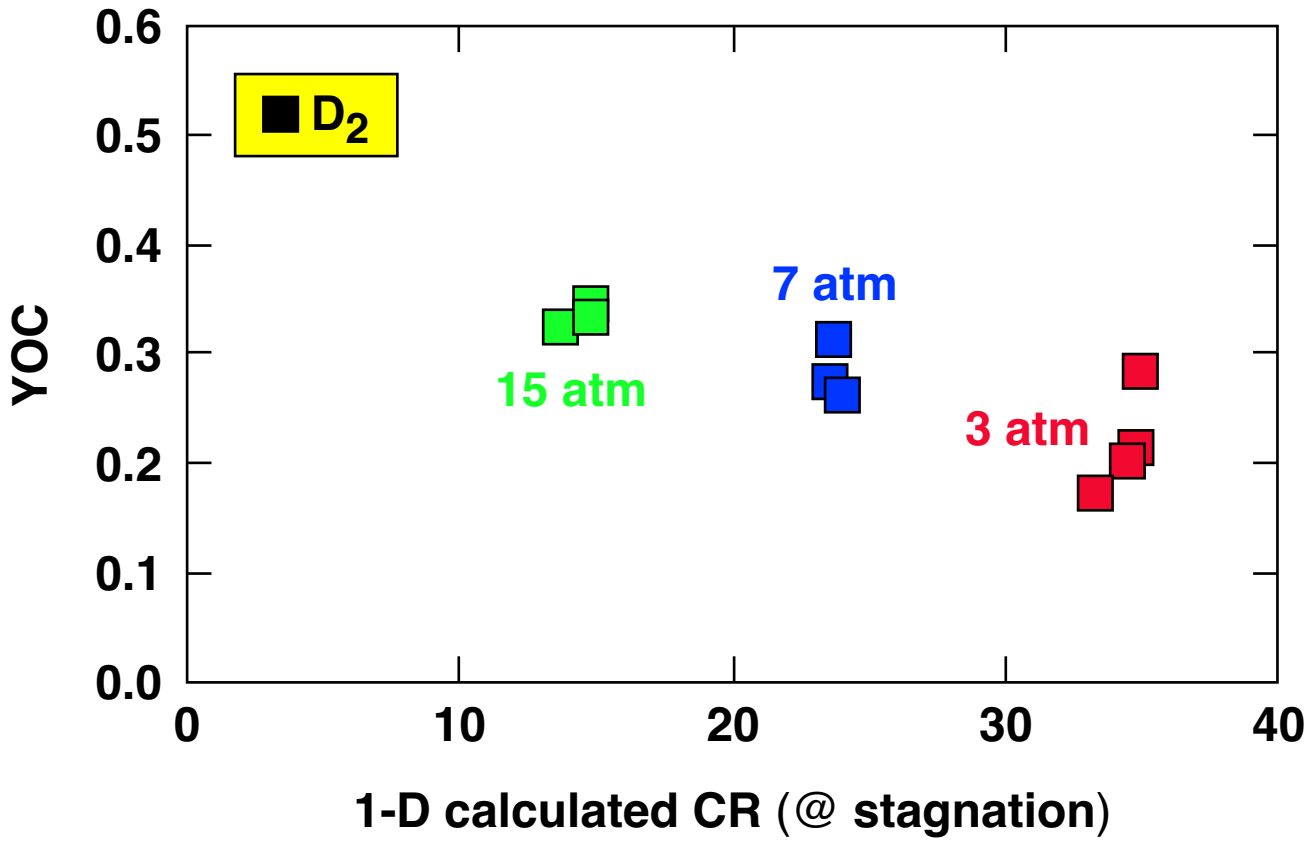
  15 atm: outer part of the core,
  ~ 0.5 μm of the original inner CH shell

Outline

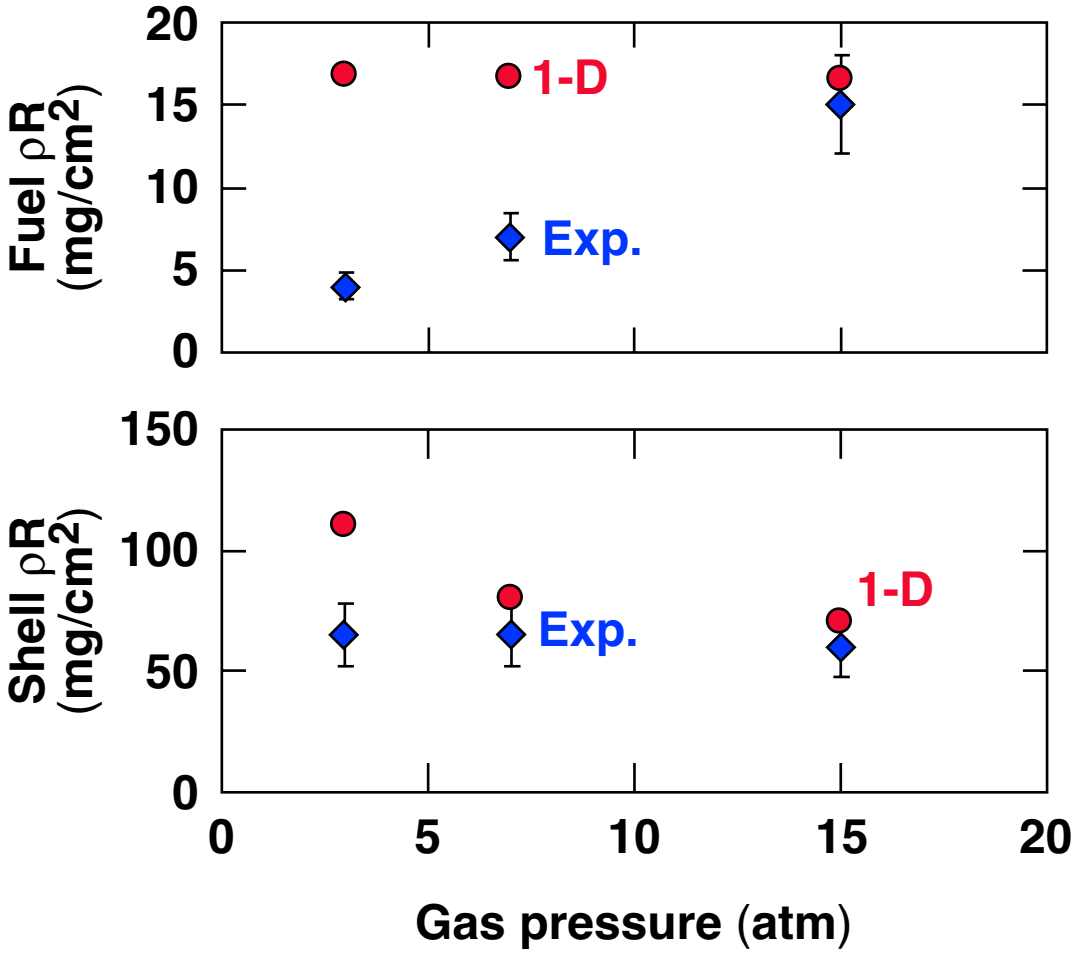
- Implosion performance of capsules with 3- to 15-atm gas fill
- Measuring the effects of fuel–shell mix on target performance
- Modeling of fuel–shell mix

The overall core performances are characterized by comparisons between the experimental data and the 1-D calculations





Implosions of 15-atm capsules achieve ~90% of 1-D predictions for both ρR_{fuel} and ρR_{shell}, while 3-atm capsules achieve, respectively, ~25% for ρR_{fuel} and ~60% for ρR_{shell}



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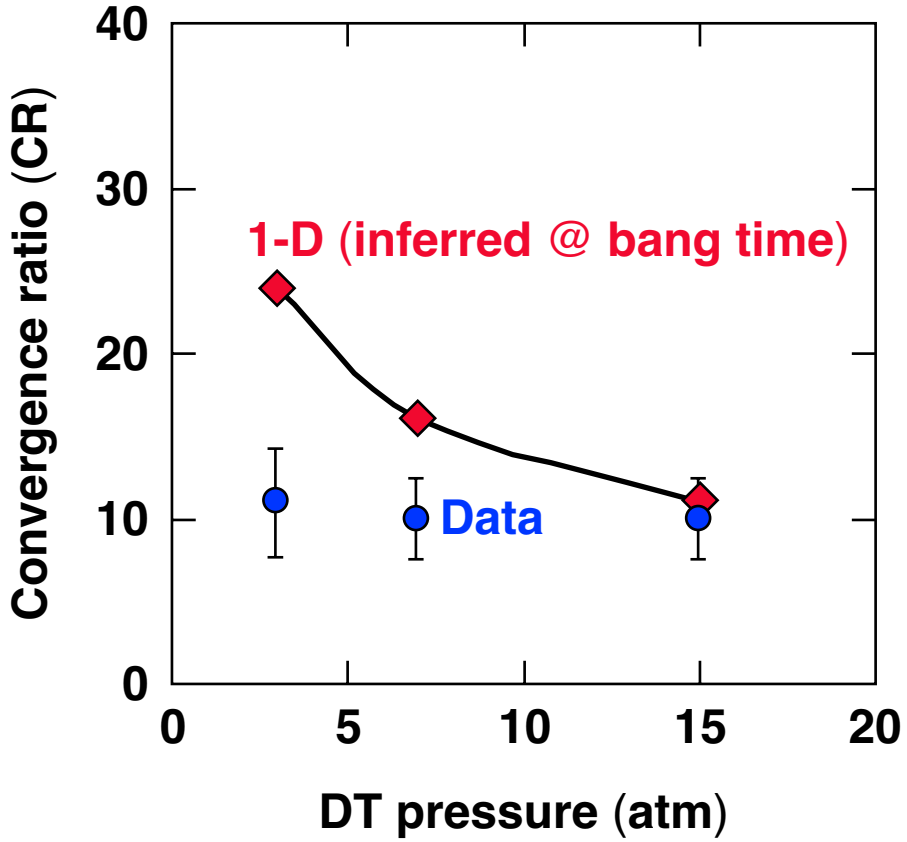
While 1-D simulations predict high convergence ratios for 3-atm capsule implosions (CR ~ 25), the implosions achieve ~45% of 1-D predicted values (CR ~ 10, similar to the 15-atm case)



CR is determined by either ρR_{fuel} or ρR_{shell} measurements:

Fuel:

$$CR = \sqrt{(\rho R_{fuel}/\rho R_{fi})}$$

Shell:

$$CR = \sqrt{3(\rho \Delta R_{shell}/\rho \Delta R_{si})}$$

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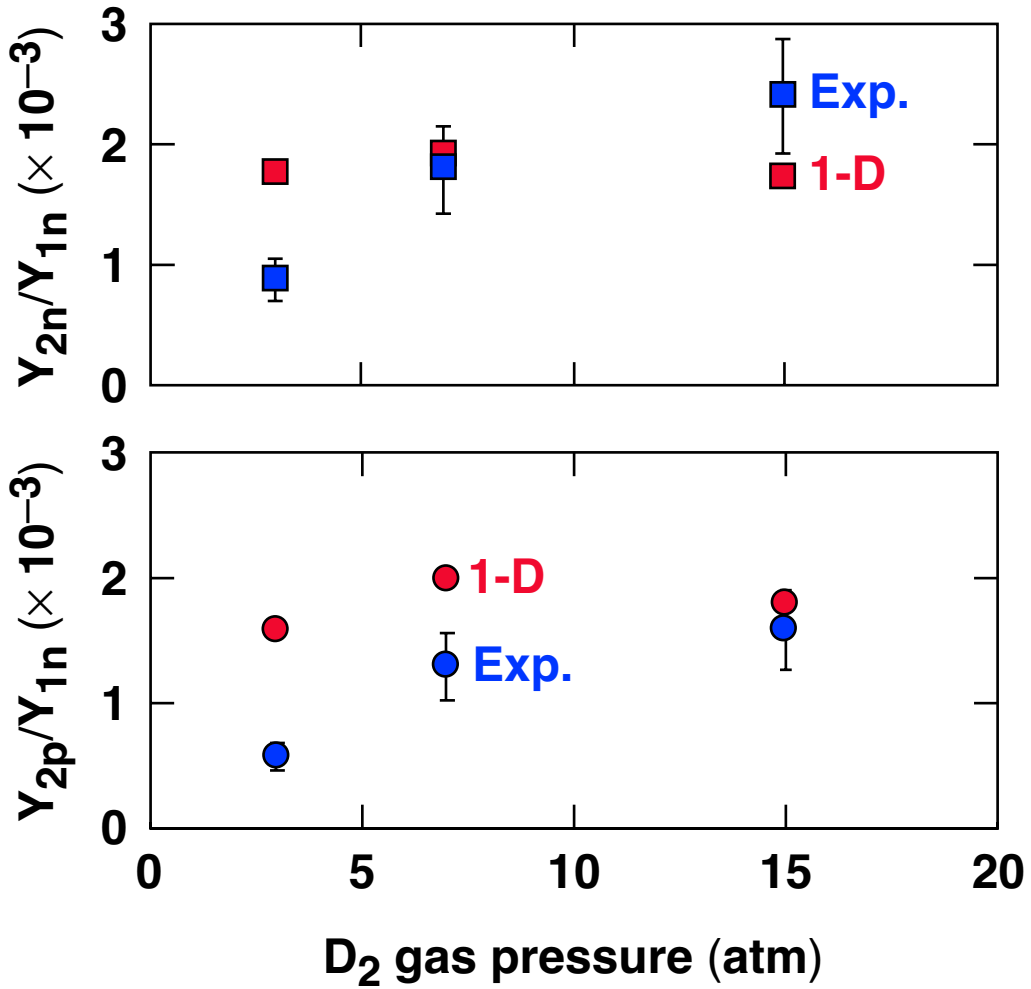
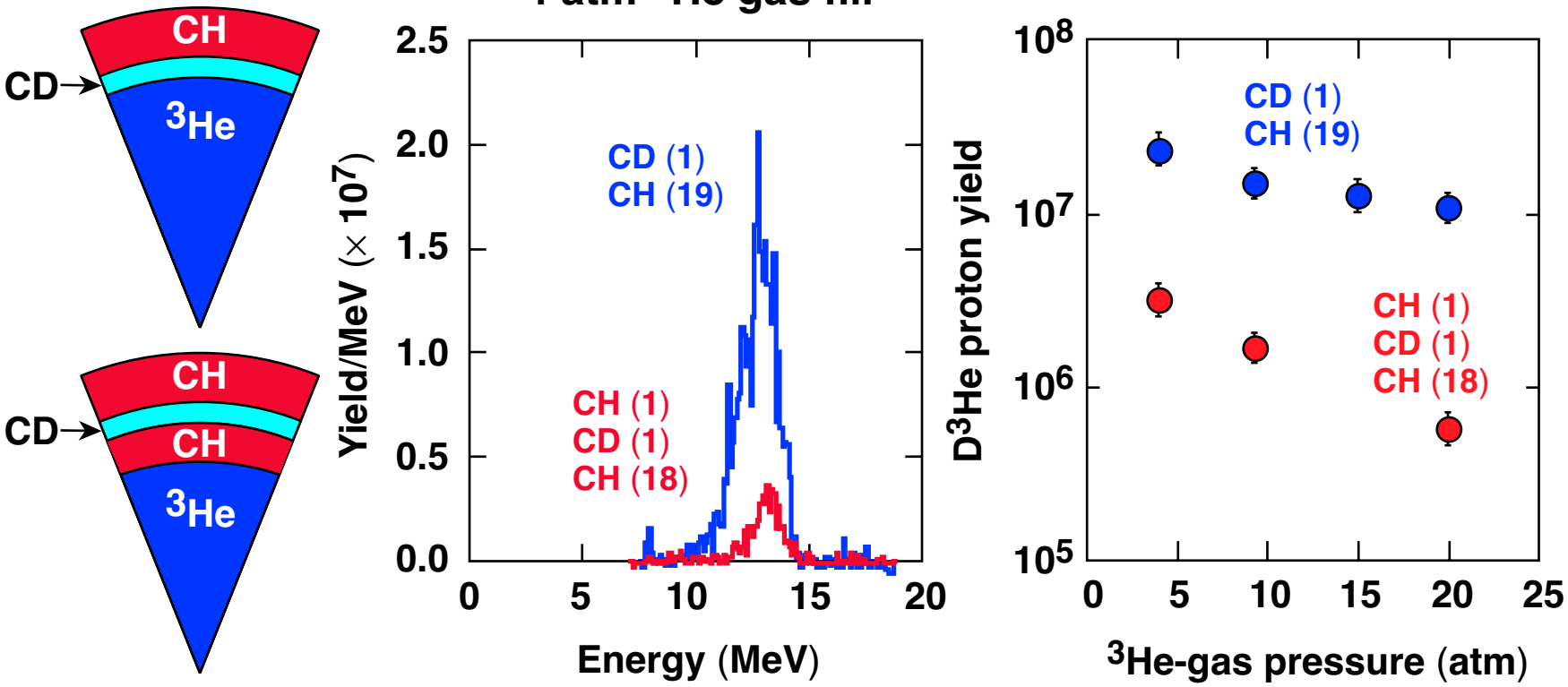
The ratios (Y_{2n}/Y_{1n}, Y_{2p}/Y_{1n}) indicate that mix is more severe for 3-atm implosions

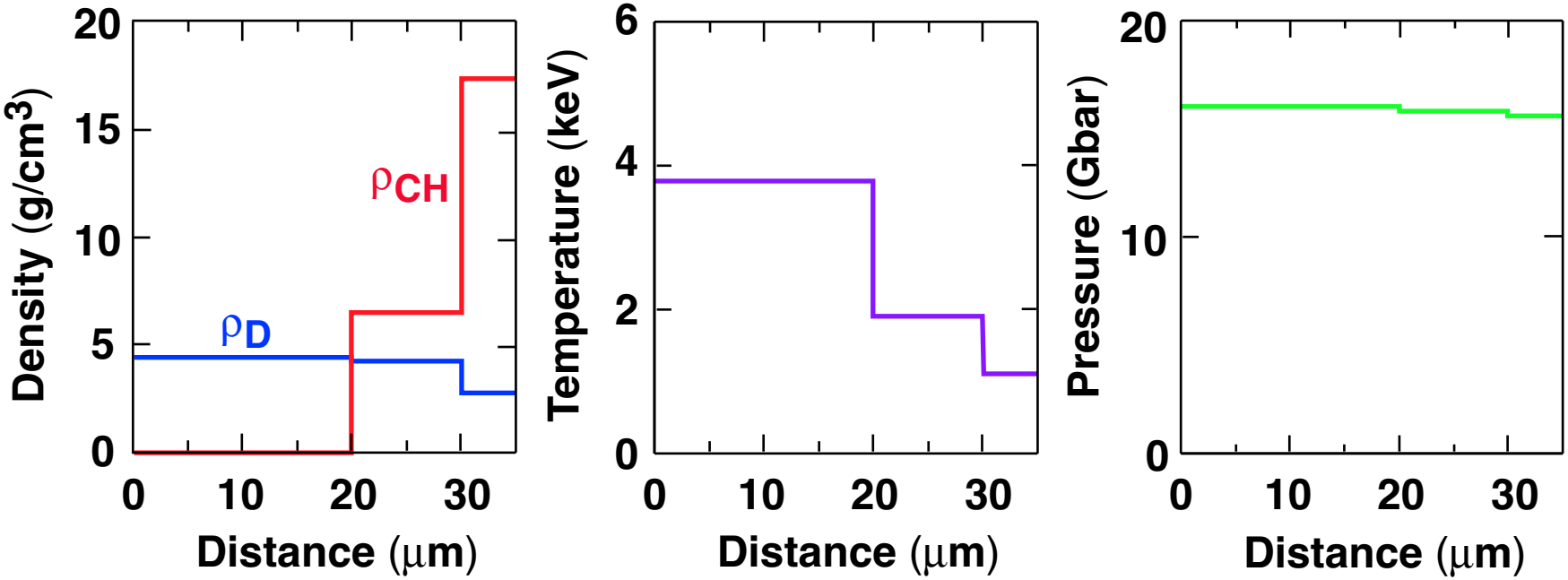


The D^{3}He yield increases as the gas-fill pressure decreases, indicating more mixing



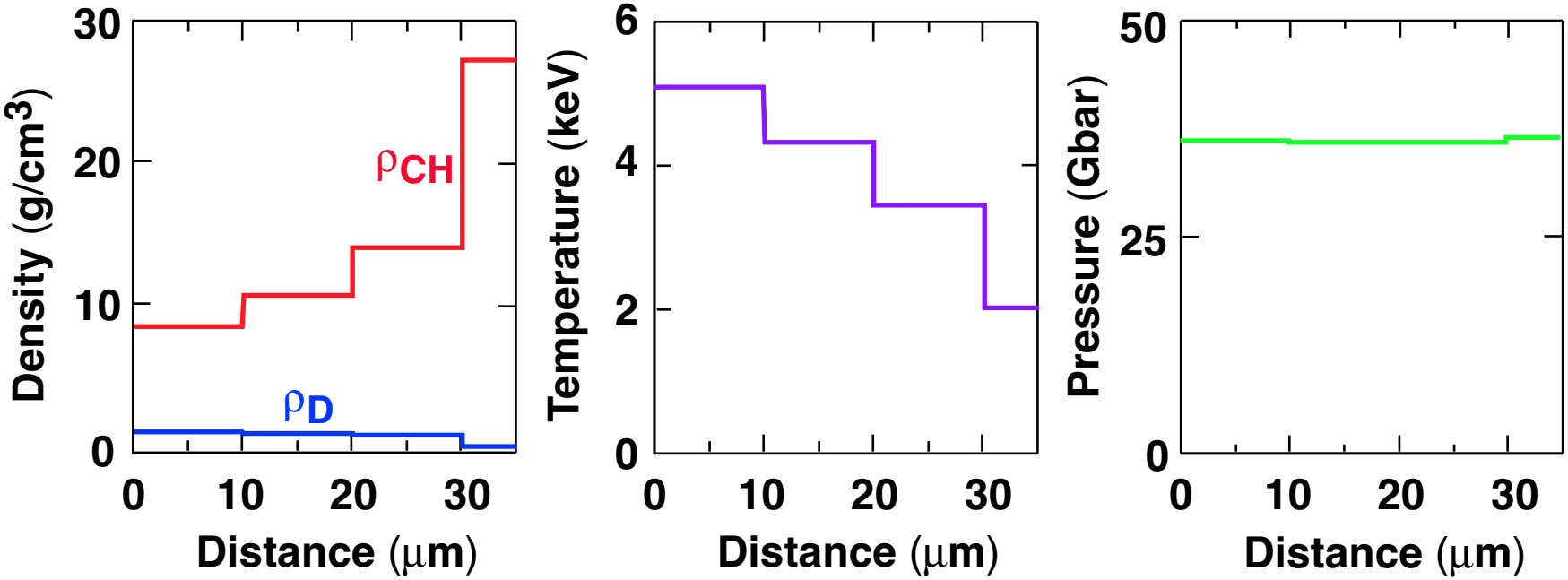
E11195

Modeling of 15-atm implosions indicates that ~0.5 μm of the original inner CH shell mixes into the outer part of the fuel



E11129

Modeling of 3-atm implosions indicates that ~0.9 μm of the original inner CH shell mixes into the entire core



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