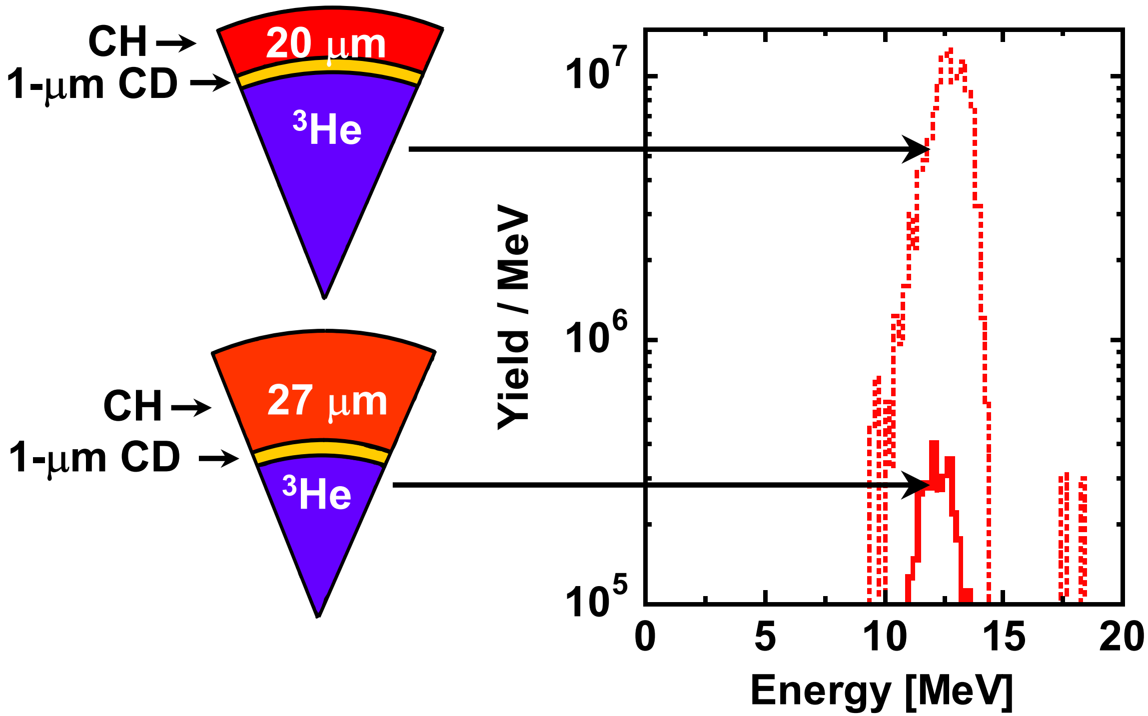
Effects of Fuel-Shell Mix in Implosions of Plastic Capsules on OMEGA



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Collaborators

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Summary

Fuel-shell mix has been studied using nuclear diagnostics

- Implosions of pure ^3He gas filled capsules with CD shell layer have further quantified levels of fuel-shell mix.
- For 4-atm implosions mix decreases for increasing shell thickness.
- For 20-atm implosions mix is independent of shell thickness.
- For 27-μm thick shells mix is independent of gas fill pressure from 4 to 20 atm.
- Target performance of hydrodynamically similar D_2 implosions relative to 1-D predictions confirms ^3He-CD data.

Related work

Recent related papers:

D. Wilson et al., submitted to Phys. Plasmas

C.K. Li *et al*., Phys. Rev. Letters 89 (2002) 165002

S. P. Regan *et al*., Rev. Letters 89 (2002) 085003

P. B. Radha *et al*., Phys. Plasmas 9 (5) (2002) 2208

D. D. Meyerhofer et al., Phys. Plasmas 8 (5) (2001) 2251

Related talks at this conference:

S. P. Regan *et al*., BO2.002

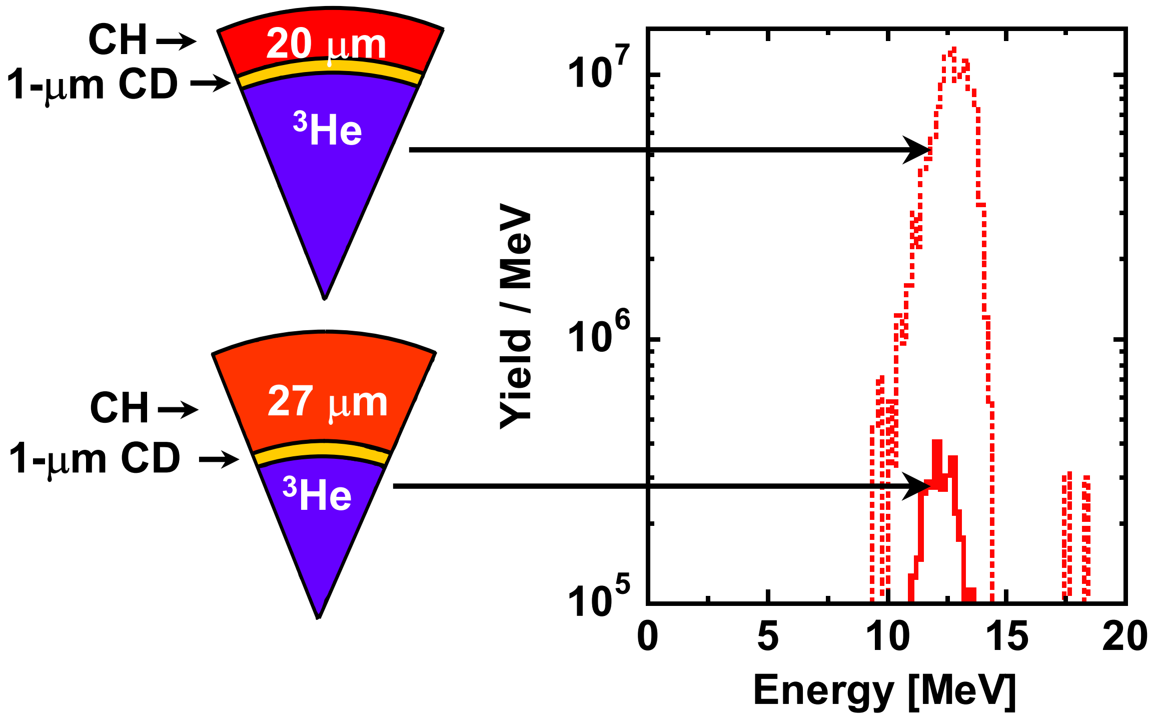
R. Epstein et al., BO2.001

Outline

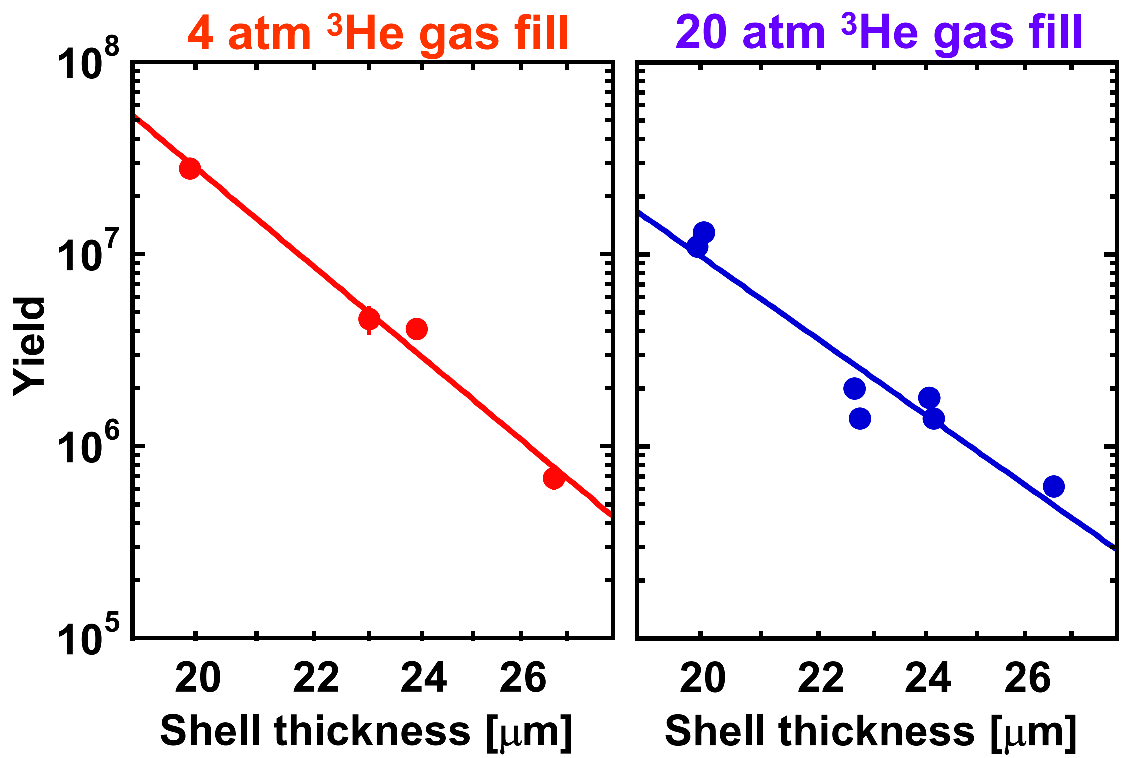
- Presence of fuel-shell mix.
- Effects of mix in spherical implosions of 20, 24 and 27 μm thick shells at various fill pressures.
- Modeling of fuel-shell mix.
- Target performance of hydrodynamically similar D_2 implosions relative to 1-D predictions.
- Summary
- Future work.

Implosions of ^{3}He gas filled capsules with CD shells have further quantified levels of mix

D + ^{3}He ⇒ p (14.7 MeV) + α (3.6 MeV)

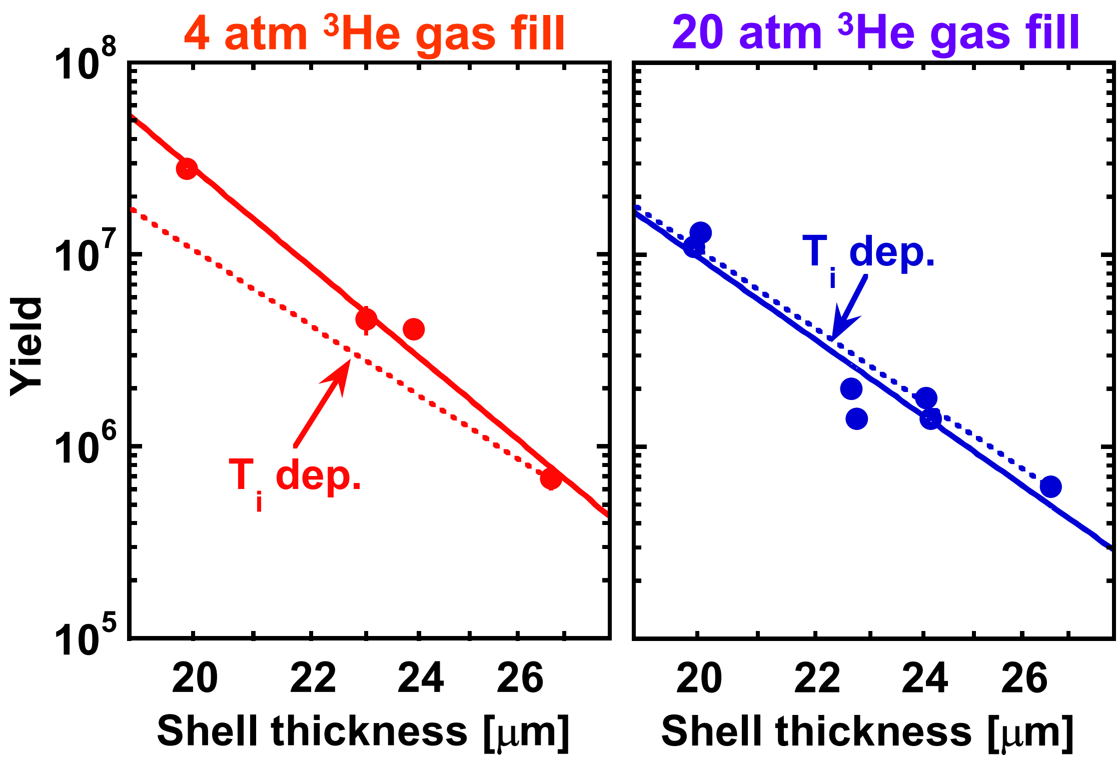


D^3He proton yield decreases as shell thickness increases



Does increased mix explain the reduced D^3He yield for thicker shells?

Mix decreases for increasing shell thickness for 4-atm implosions, while mix is independent of shell thickness for 20-atm implosions



Similar levels of mix are observed for 27-μm thick shells irrespective fill pressure.

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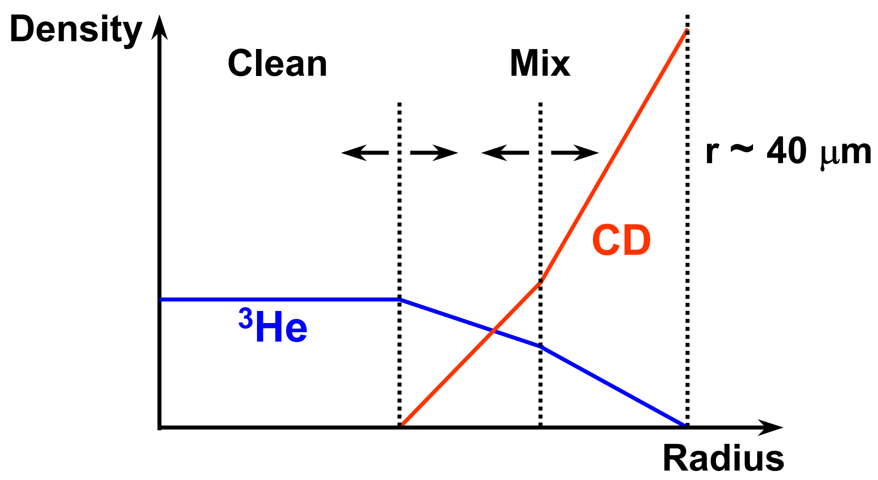
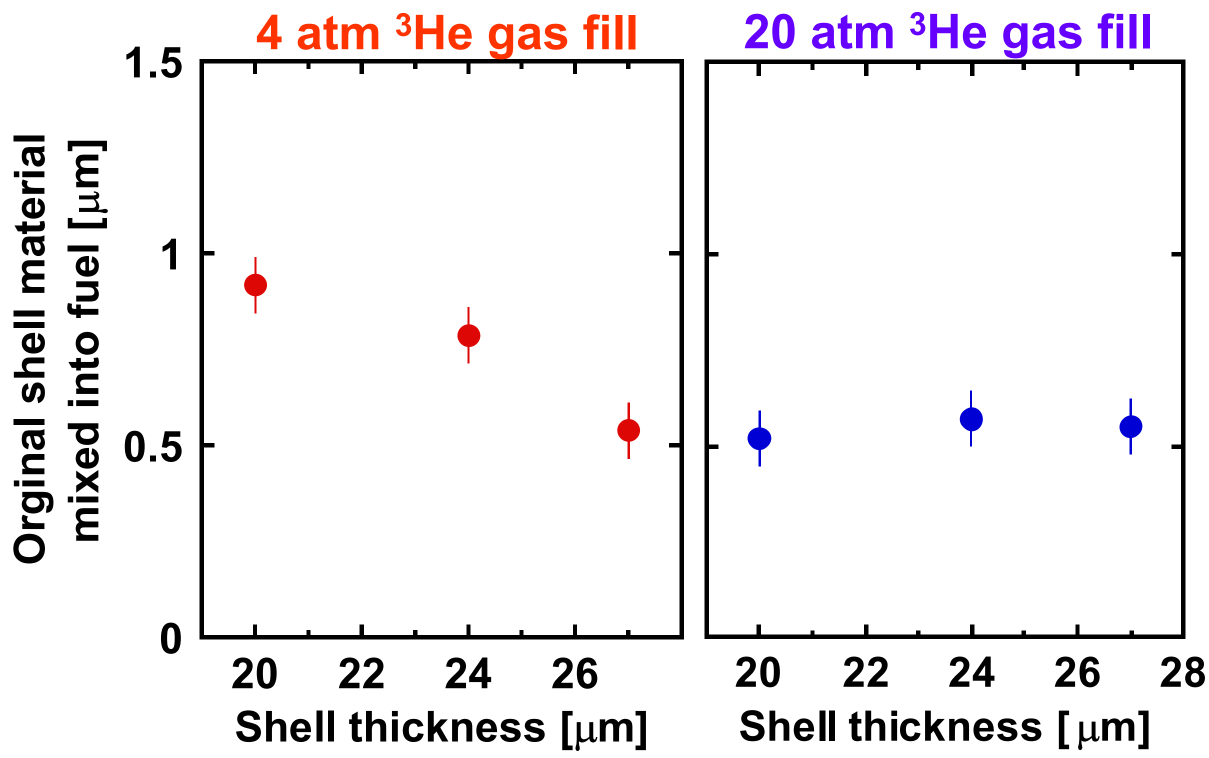
Modeling of fuel-shell mix

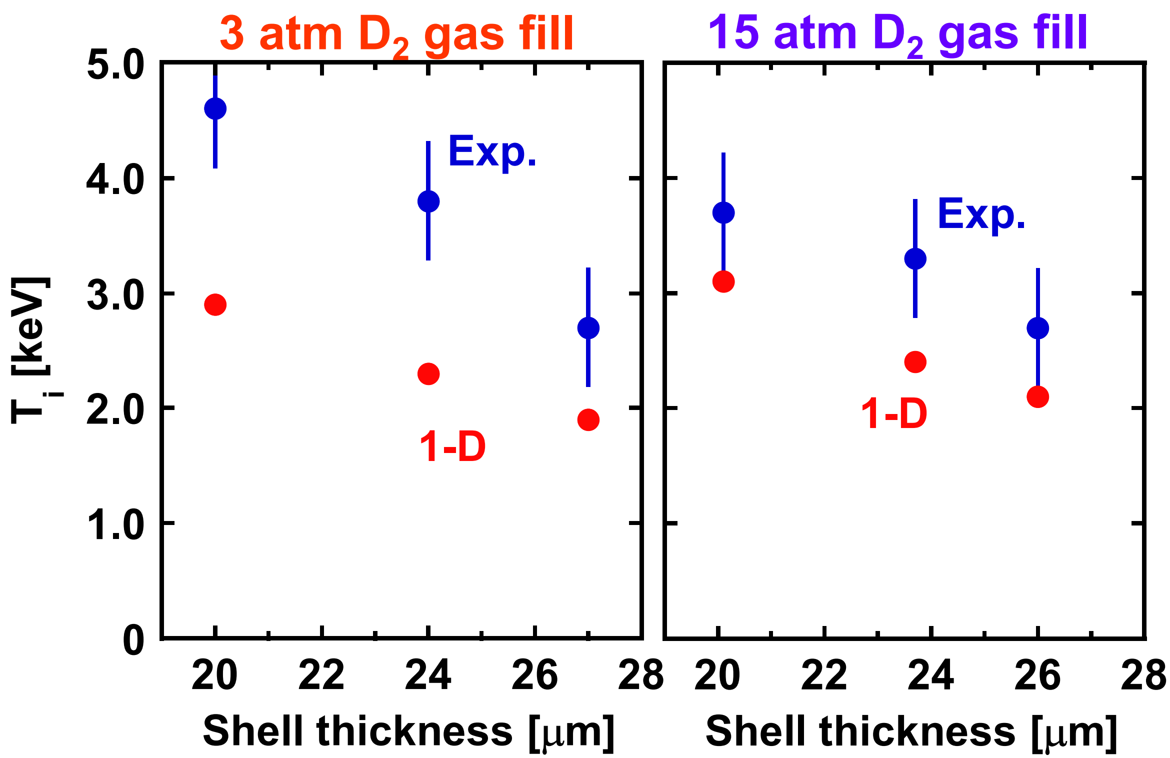


- Assume isobaric conditions at bang time.
- Match experimental results: $\langle T_i \rangle_{Doppler}$, $\langle T_i \rangle_{Ratio}$, Y_{1p}, Y_{1n}, ρR_{fuel}, and burn time

~0.5-0.9 μm of original shell mixes into fuel for 4-atm implosions, while ~0.5 μm of shell mixes into fuel for 20-atm implosions irrespective shell thickness

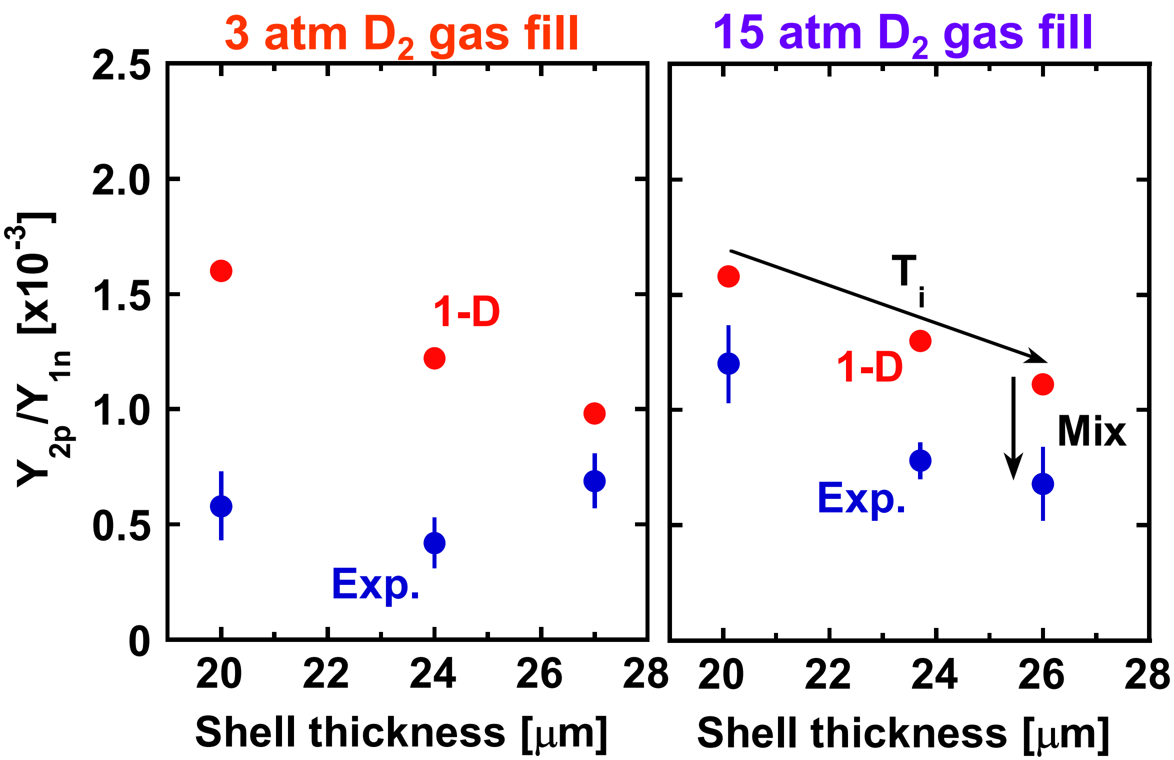


Target performance of hydrodynamically similar D_2 implosions relative to 1-D predictions confirms the ^{3}He-CD data



3-atm implosions - mix varies with shell thickness.
15-atm implosions - mix independent of shell thickness.

The dependency of Y_{2p}/Y_{1n} relative to 1-D for D_2 implosions also confirms the ^{3}He-CD data



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Future work

- **Study fuel-shell mix for different laser-pulse shapes.**
- **Study time resolved fuel-shell mix using a proton temporal diagnostic (PTD), which is now under development.**