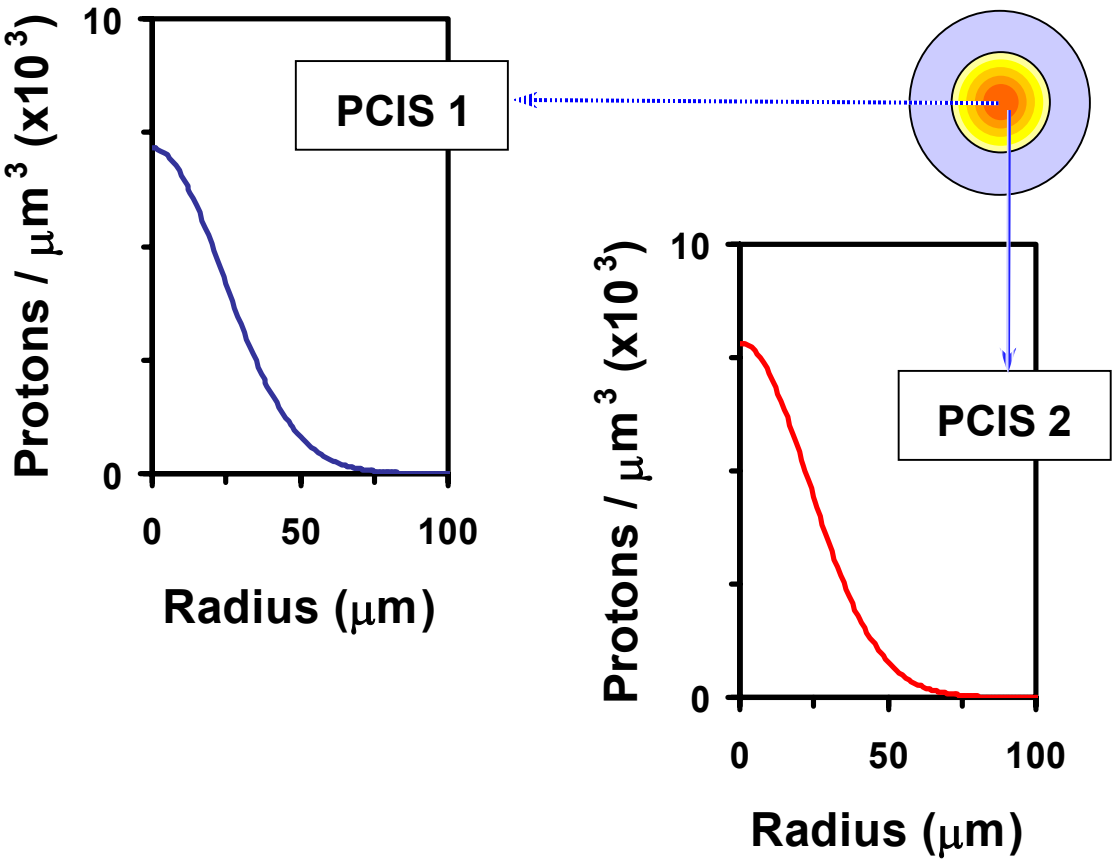
Imaging D^3He burn profiles of OMEGA implosions



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Collaborators

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Summary

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- **Proton Core Imaging Spectroscopy (PCIS) provides radial profiles of DD and D^3He proton production.**

- **For thin (~3 μm) glass shell capsules, DD and D^3He burn profiles were measured, from which, $T_i(r)$ and $n_i(r)$ profiles were inferred and then compared to 1D simulations.**

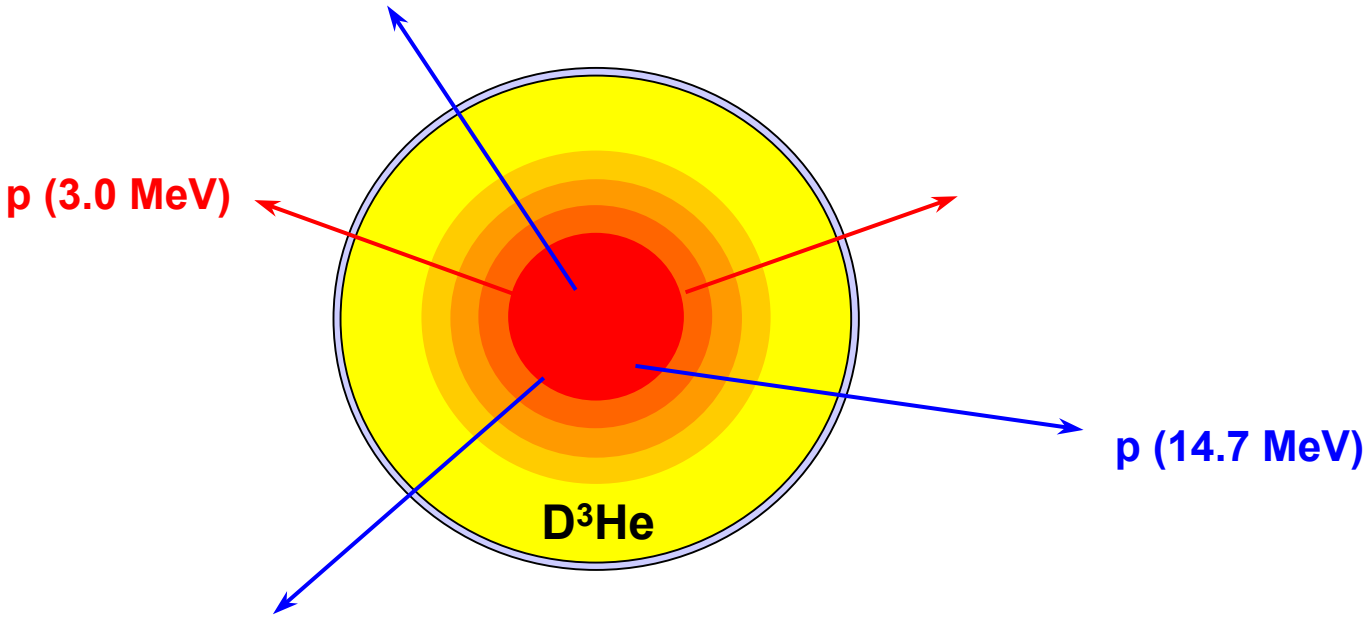
- **For thick (~20 μm) CH shell capsules, D^3He burn profiles were measured. The first orthogonal images were obtained.**

- **Burn profiles from thin and thick shell capsules were compared to demonstrate PCIS versatility.**

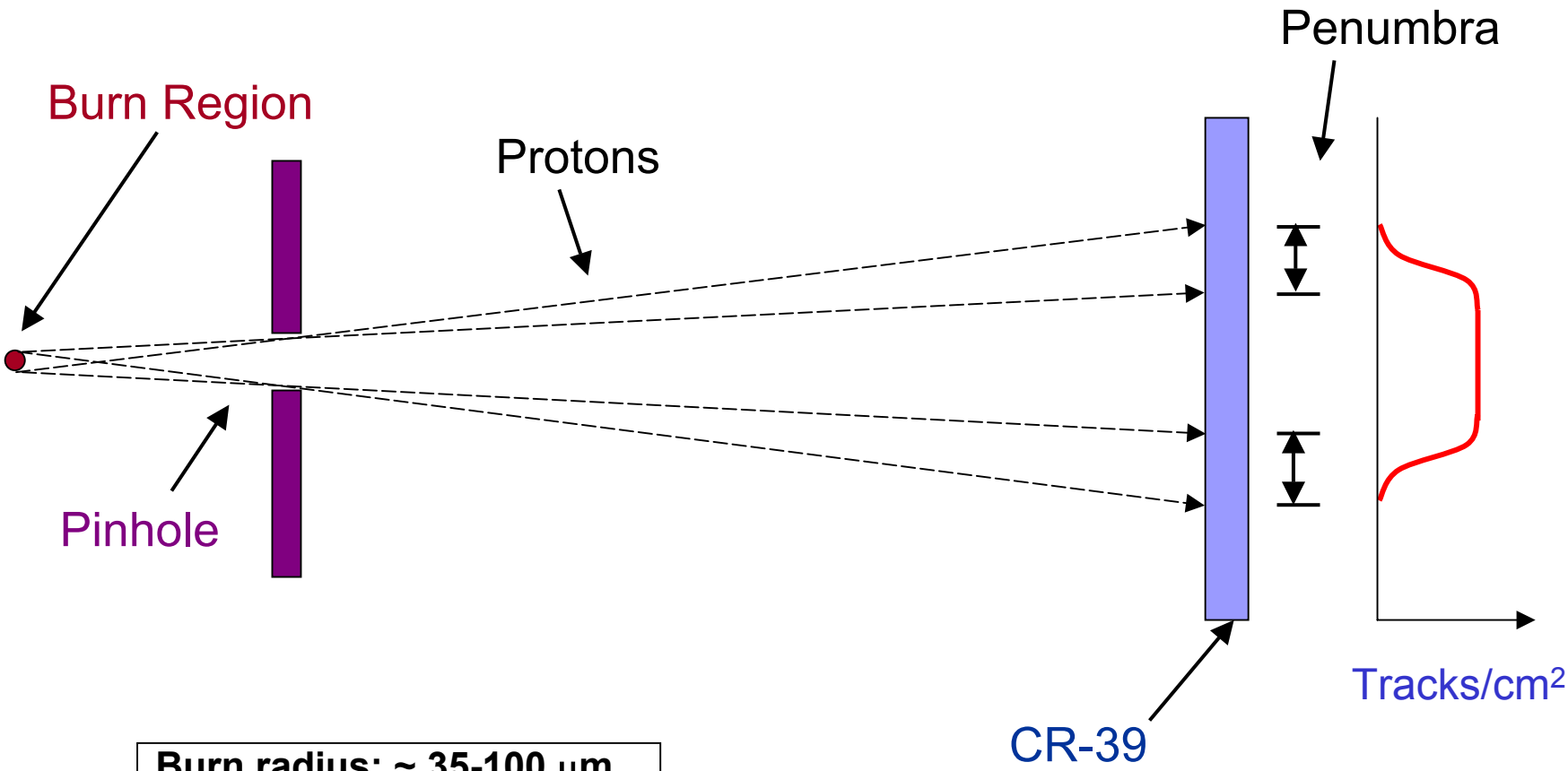
Reactions of interest for PCIS

$D + {}^3He \rightarrow \alpha[3.6\ MeV] + p[14.7\ MeV]$

$D + D \rightarrow T[1.0\ MeV] + p[3.0\ MeV]$

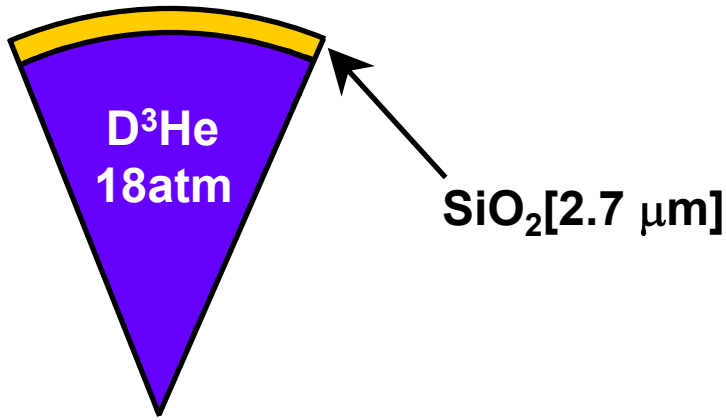


PCIS images proton emissions with CR-39 detector



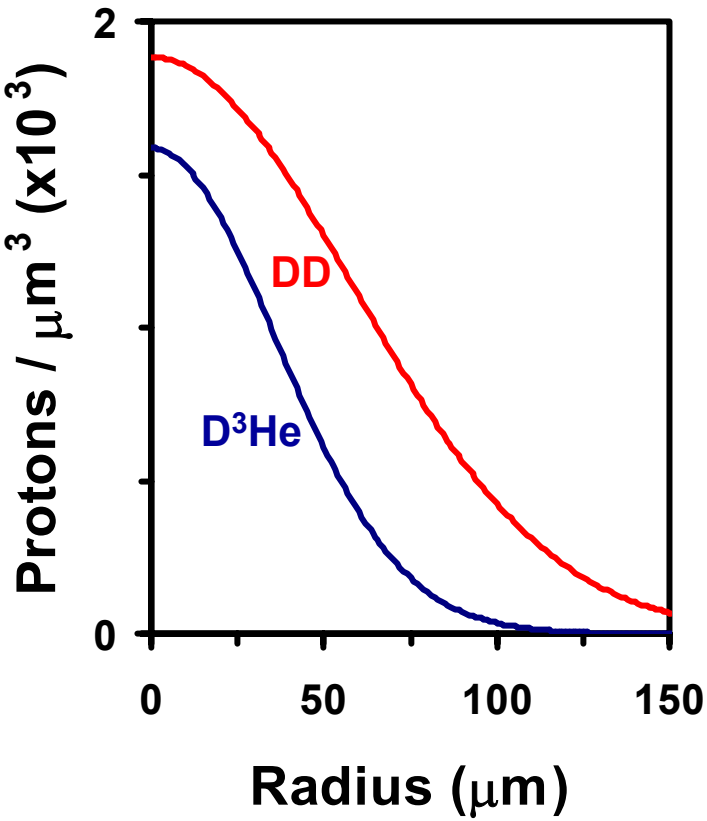
Burn radius: ~ 35-100 μm
Pinhole radius: 300 μm

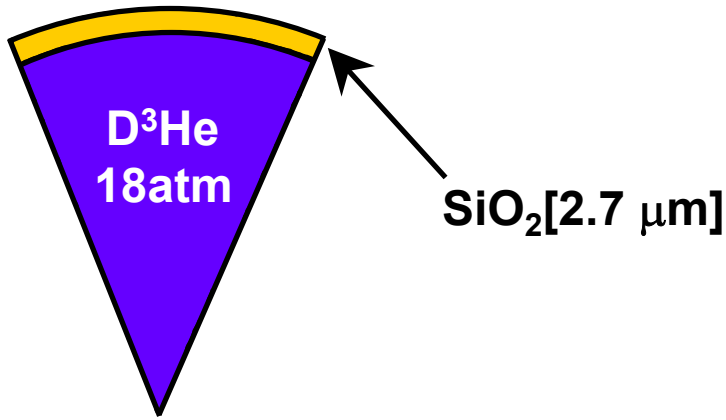
Burn profiles of DD and D^3He protons from a thin (2.7μm) glass shell D^3He implosion



Burn profiles of DD and D^3He protons from a thin (2.7μm) glass shell D^3He implosion

Shot 29827: D^3He(18 atm) SiO_2[2.7 μm]





Characteristic burn radius (r_b)

$r_b = 51 \pm 9$ μm

$r_b = 82 \pm 3$ μm

$T_i(r)$ and $n_i(r)$ were inferred from these burn profiles

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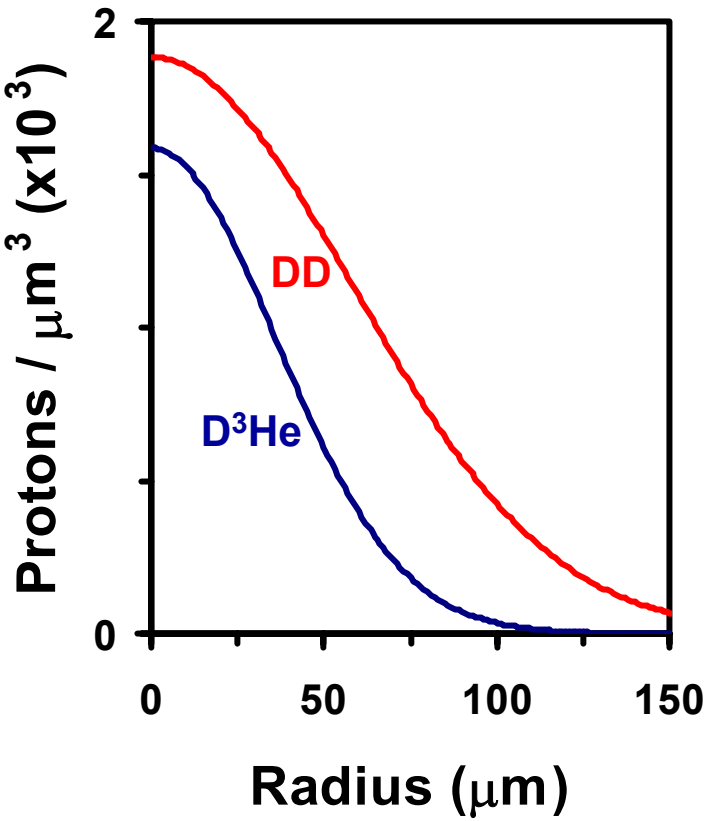

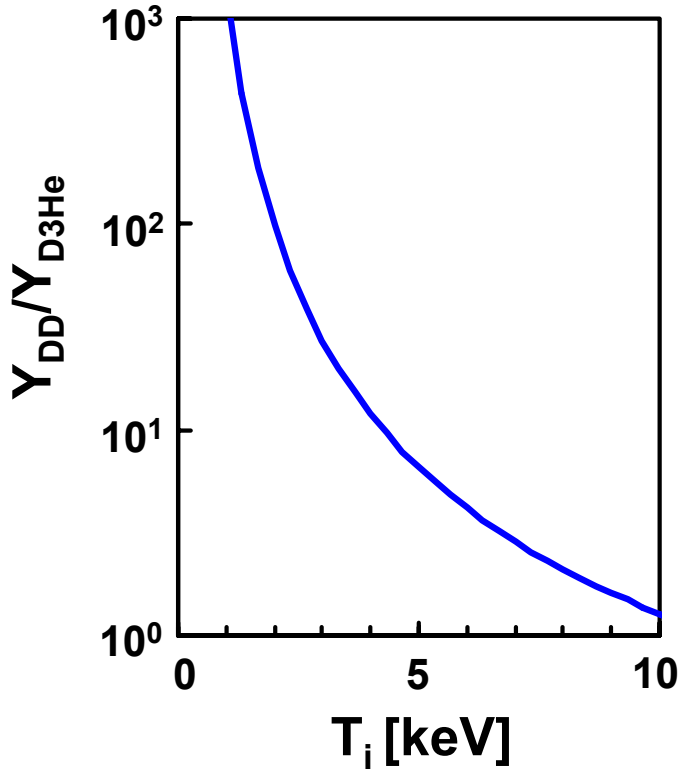

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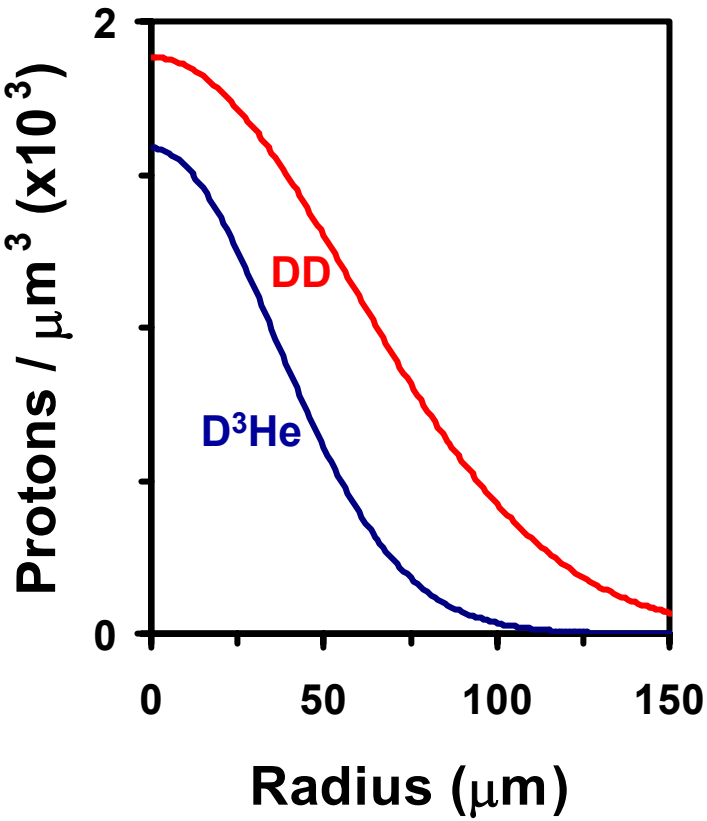

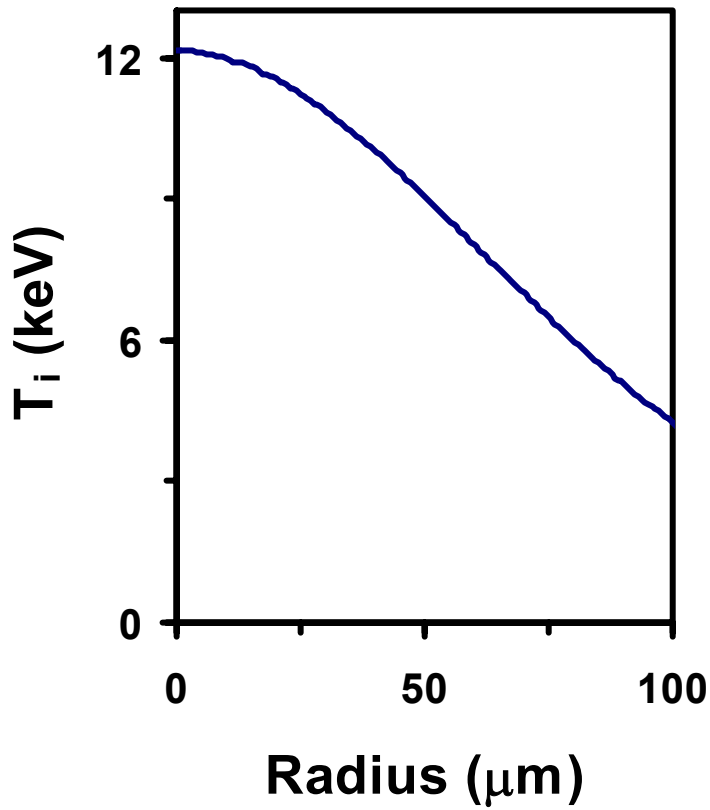

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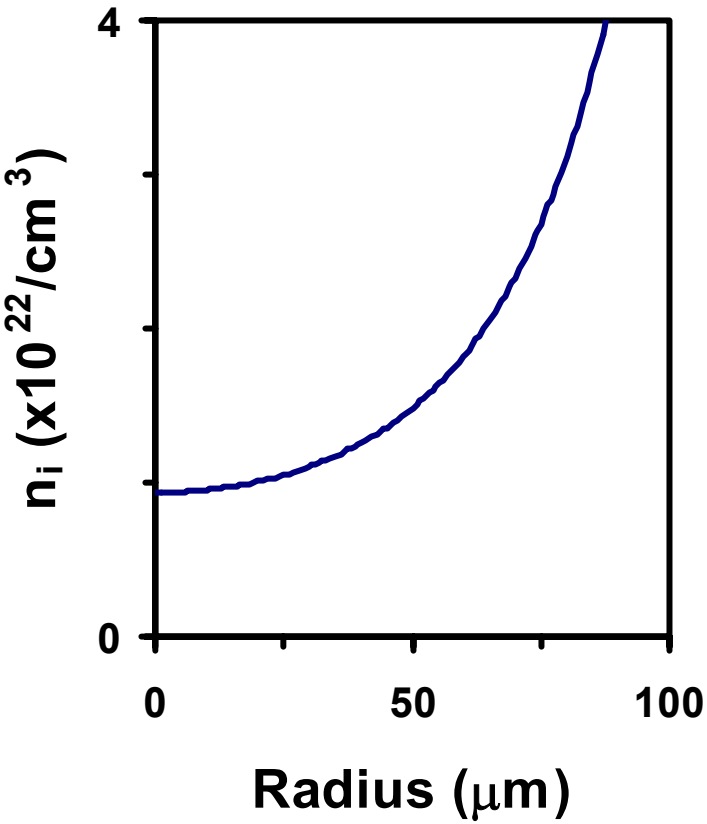
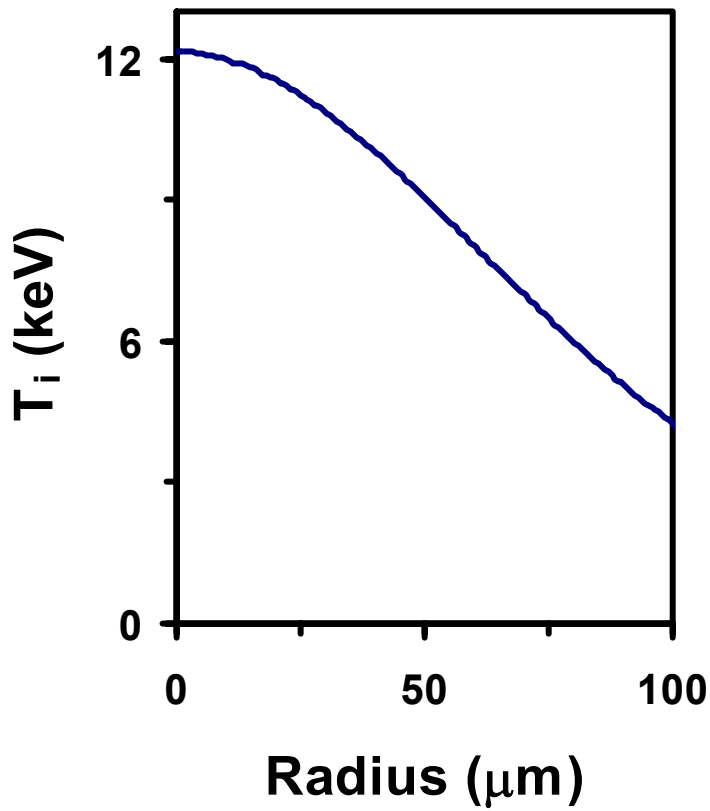
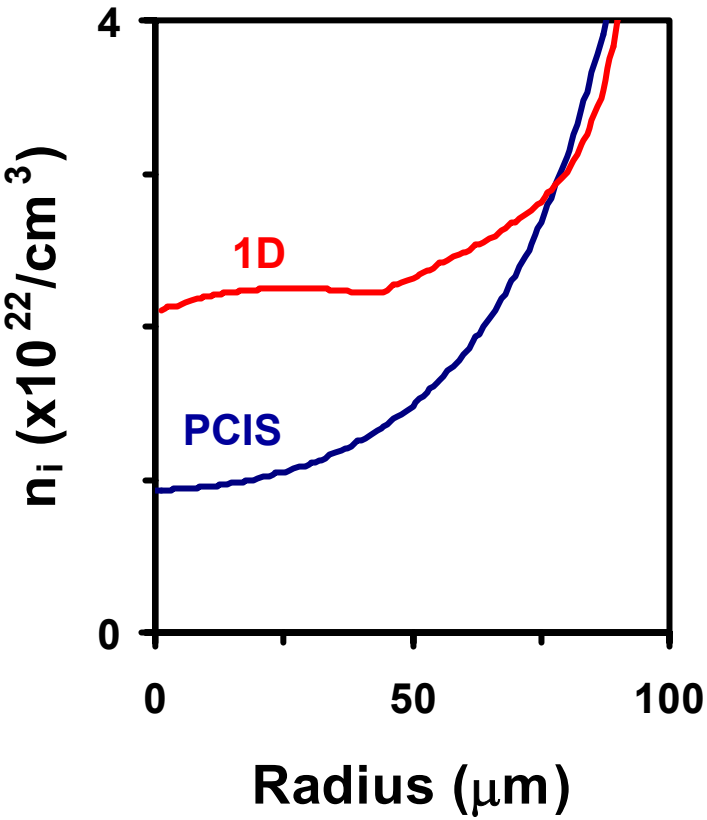
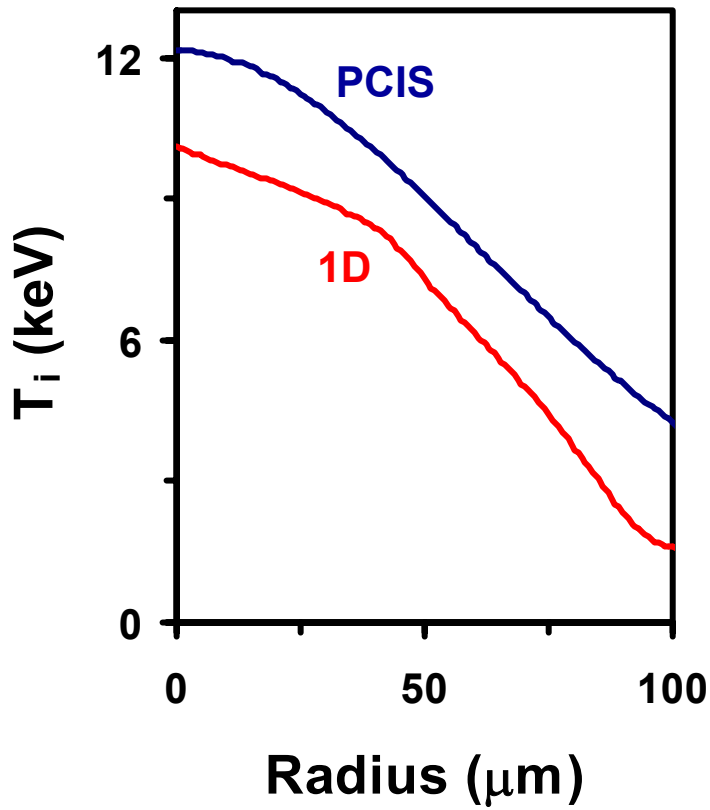




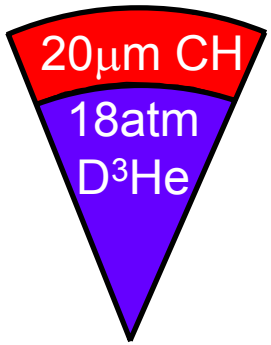
The measured $T_i(r)$ and $n_i(r)$ profiles were compared with 1D simulations

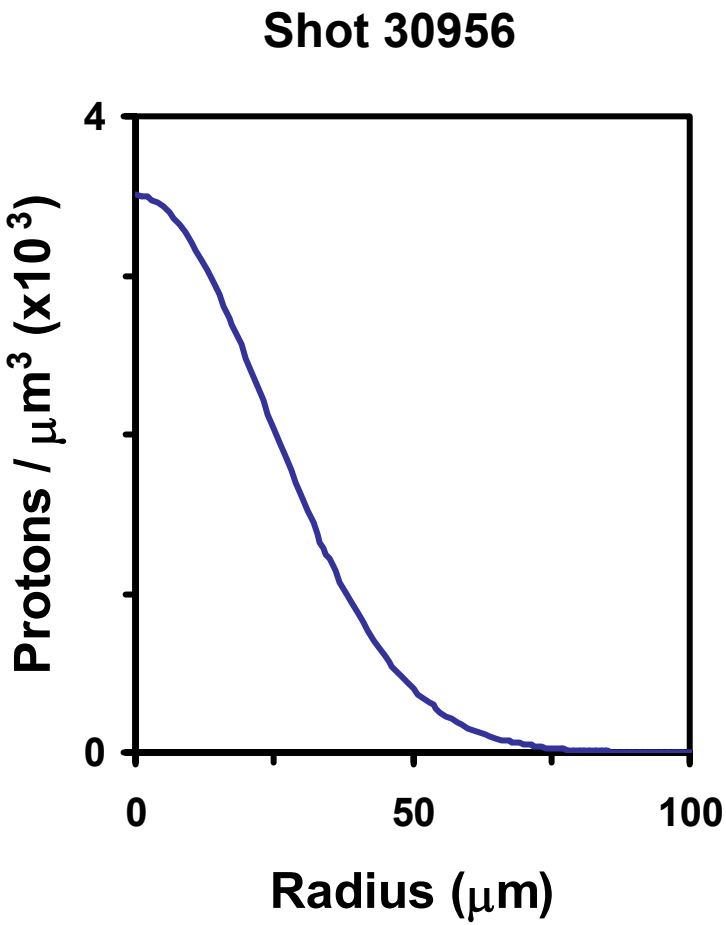
Shot 29827: D^3He(18 atm) SiO_2[2.7 μm]





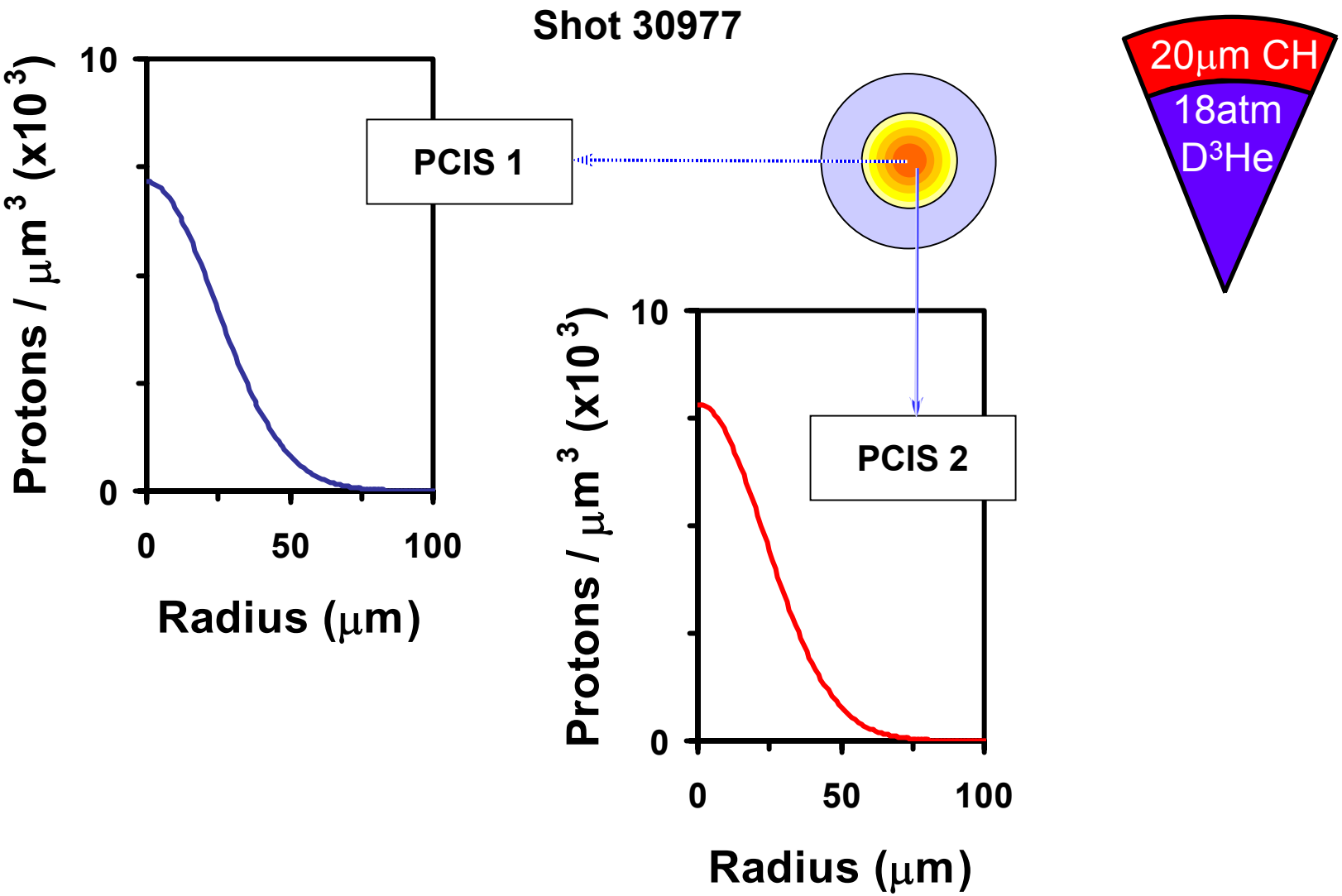
D^3He burn profiles from a thick (~20μm) CH-shell D^3He implosion



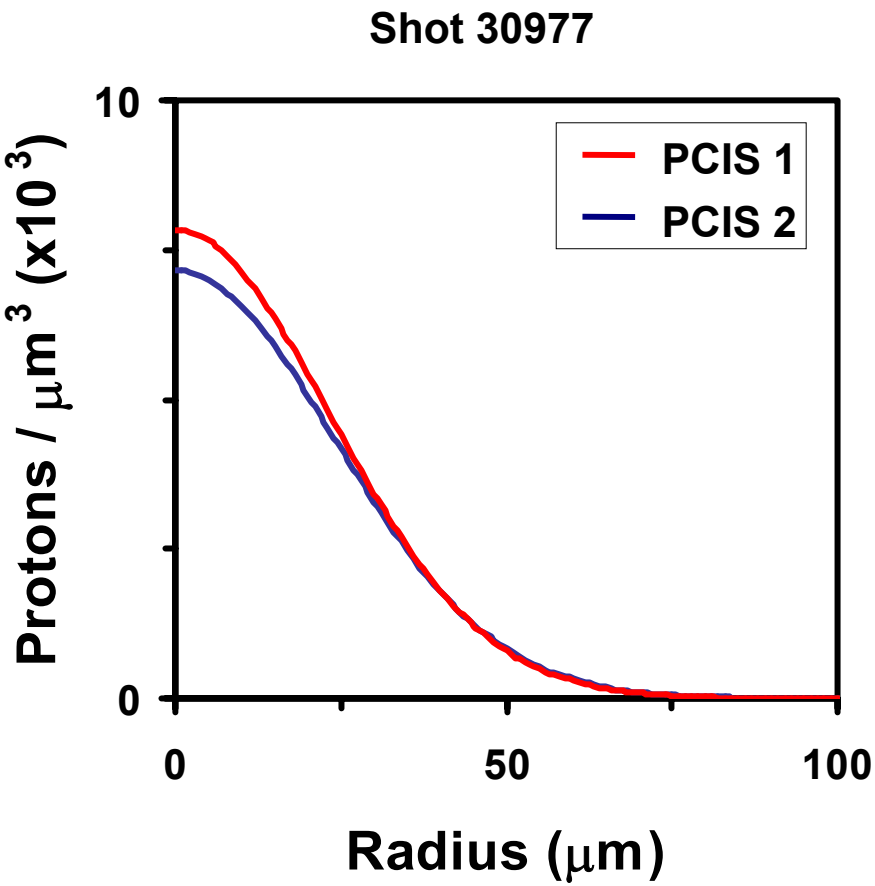


$r_b = 34 \pm 5$ μm

Orthogonal imaging is being developed to examine burn asymmetries.



Orthogonal burn profiles from a symmetric implosion give consistent results



$r_b = 34 \pm 5$ μm

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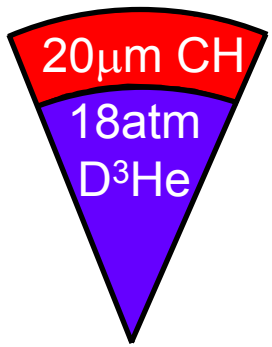
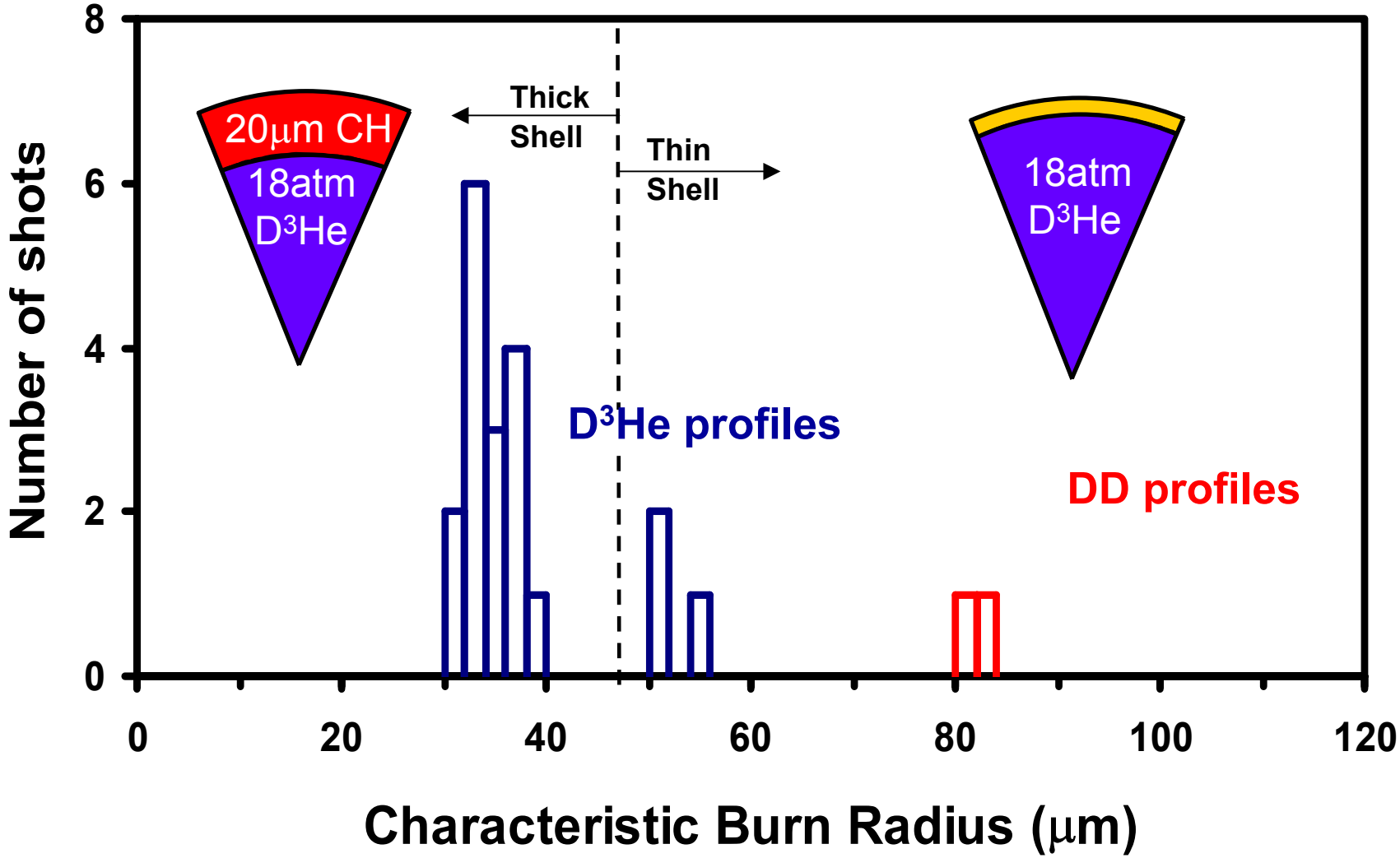


Different implosion conditions resulted in burn regions of different sizes



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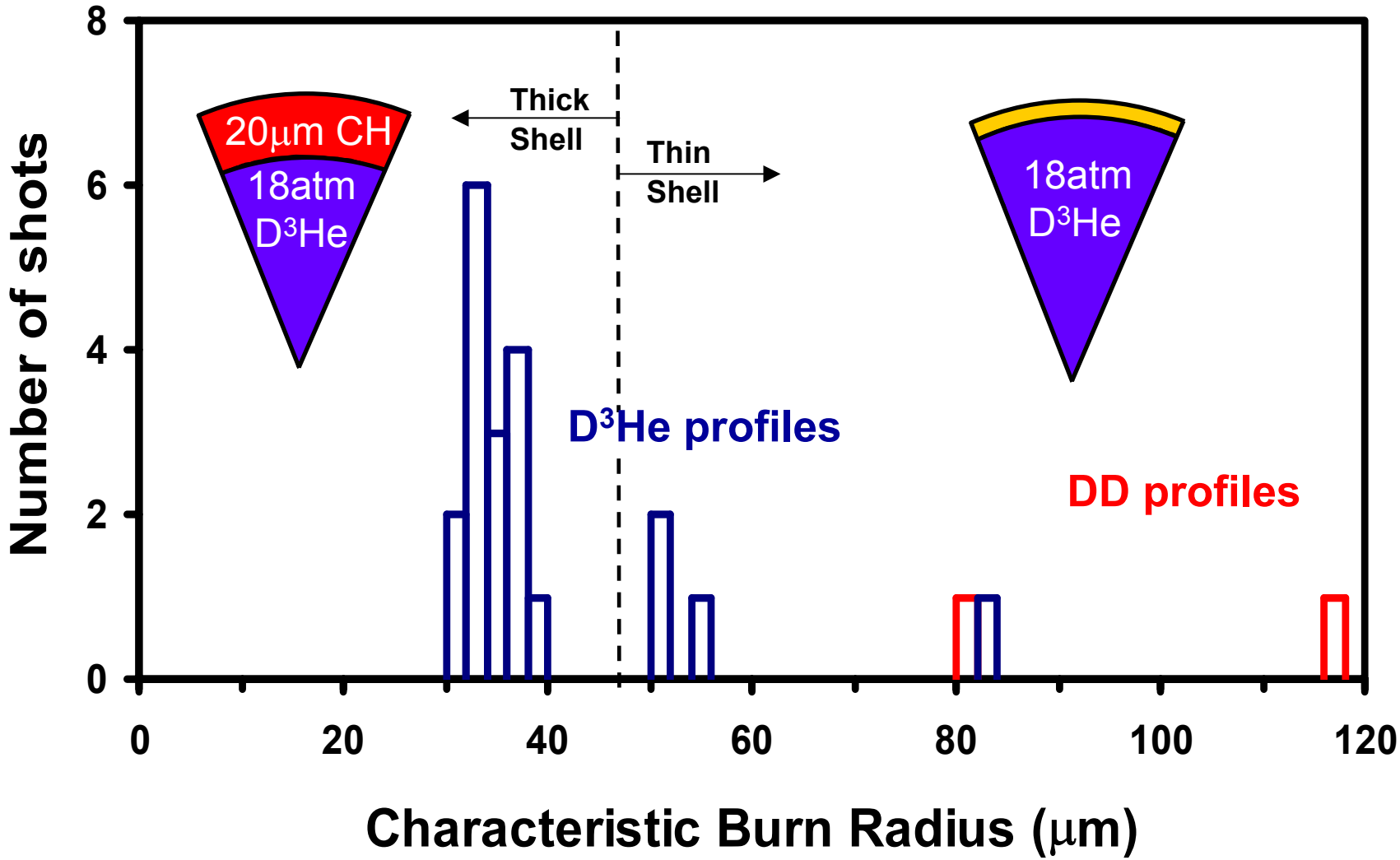

Summary

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- With Proton Core Imaging Spectroscopy (PCIS), burn profiles of D^3He reactions have been obtained.

- DD and D^3He burn profiles were measured for thin shell implosions. $T_i(r)$ and $n_i(r)$ profiles were inferred are compared to 1D simulations.

- The first orthogonal images were obtained for thick shell implosions. The next step is to examine implosions known to be asymmetric.

- PCIS is also being developed as a diagnostic to study mix effects on burn profiles.

Finding a source profile that provides the best fit