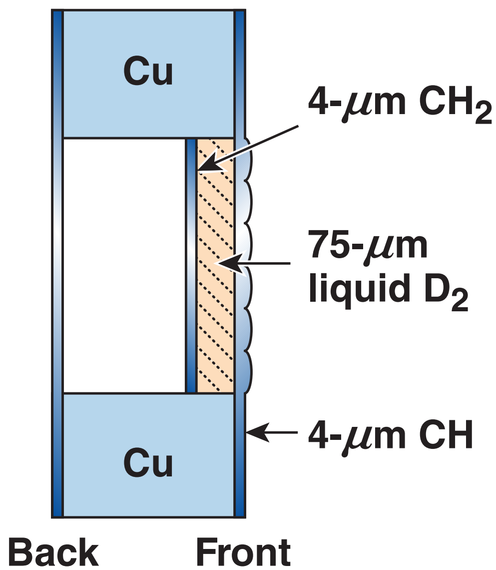
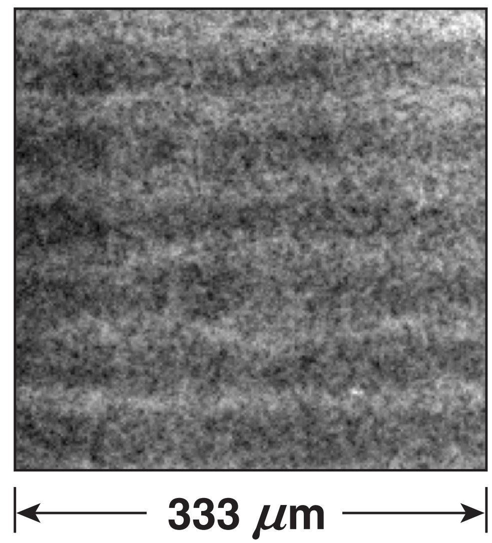
Rayleigh–Taylor Measurements in Planar Cryogenic D_2 Targets Using X-Ray Radiography on OMEGA

Schematic of Planar Cryo D_2 Target



X-Ray Radiograph of Planar Cryo D_2 Target with Preimposed 2-D Modulations



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Summary

Preliminary Richtmyer–Meshkov and Rayleigh–Taylor experiments have been performed on OMEGA using planar cryogenic D_2 targets

- X-ray radiography is used to measure modulation growth in D_2 indirectly.
- Modulations grow in D_2 and feed through to the back CH_2 window of the target and are detected by x-ray radiography.
- First proof-of-principle experiments demonstrated our ability to measure Richtmyer–Meshkov and Rayleigh–Taylor (RT) growth.

Collaborators

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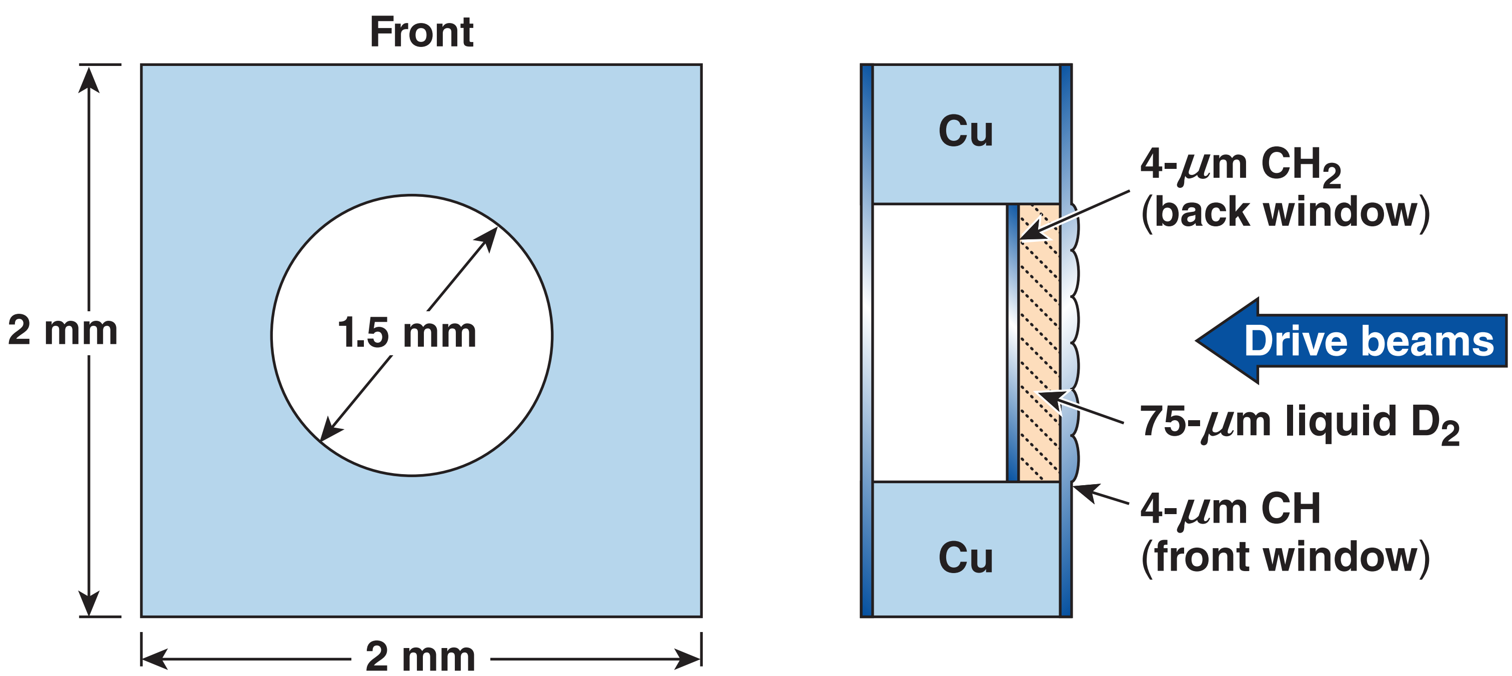
Planar D_2 cryogenic targets are equivalent to OMEGA spherical D_2 targets



Modulations grow in D_2 and feed through to the back CH_2 window of the target and are detected by x-ray radiography.

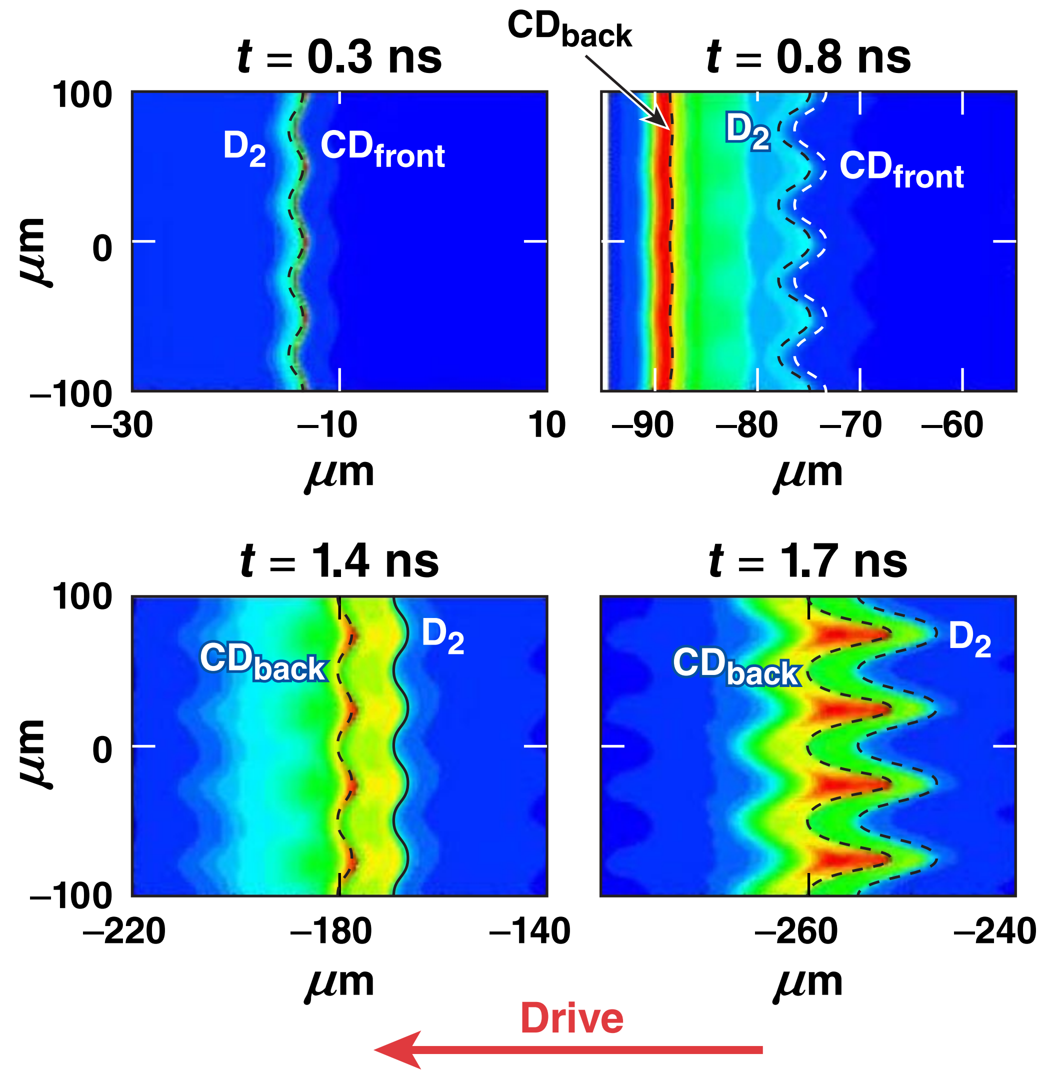
E17358

DRACO simulations show how modulations growing in D_2 are related to modulations on the back CH_2 window

$$a_{CH_2}^{(k)}(t) = a_{D_2}^{(k)}(t) \times e^{-kd(t)}$$

where *a* is the modulation amplitude, *k* is the wave number, and d is the distance from CH_2 to the D_2 ablation front.

- *d*(*t*) is approximately constant, simplifying the interpretation of results.



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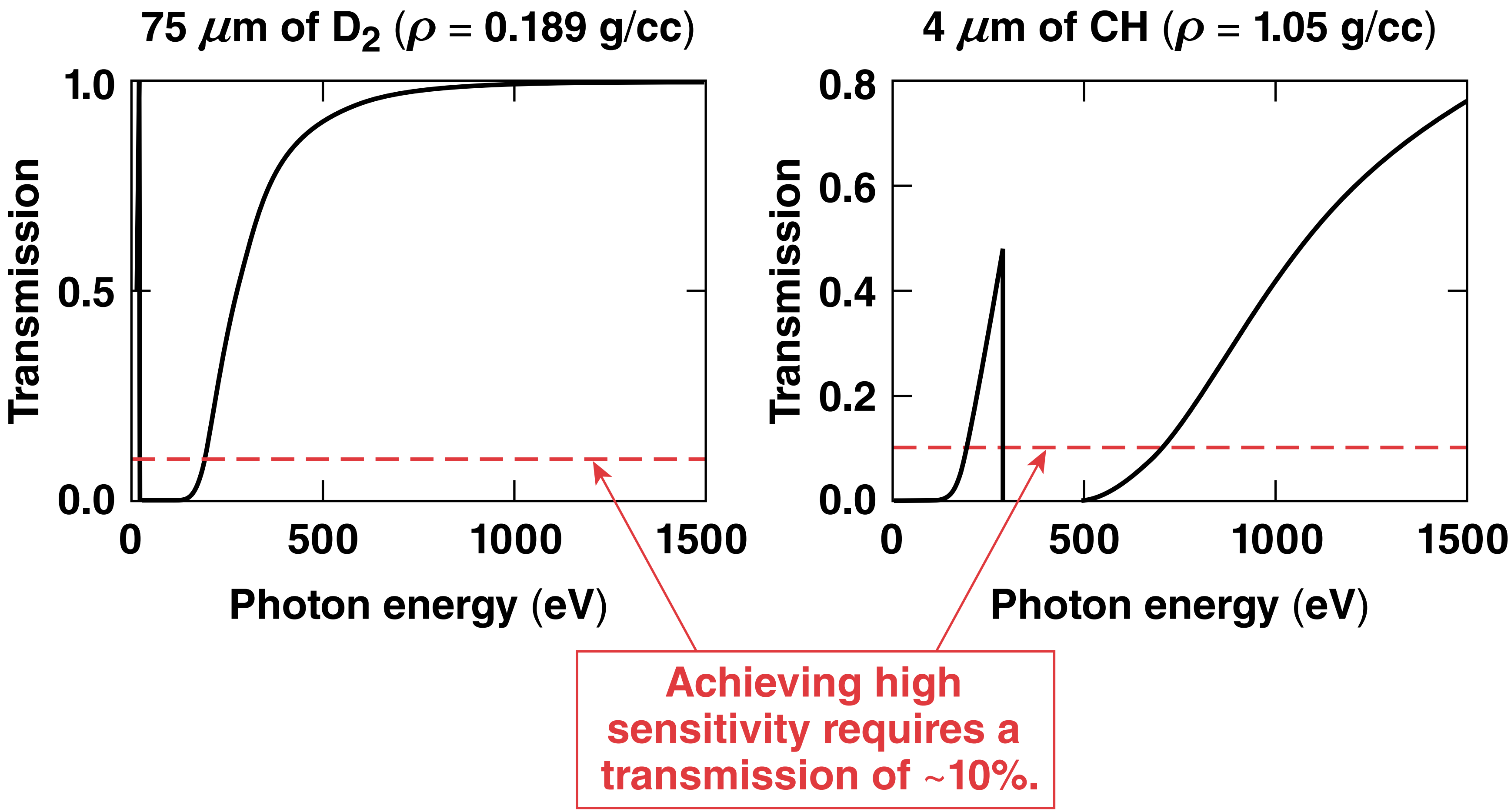
X-ray radiography can be used to measure the modulation amplitude on the rear CH window of the target



Approximately 1 to 2 keV x rays can be used to image CH windows, but they are not useful for directly imaging D_2.

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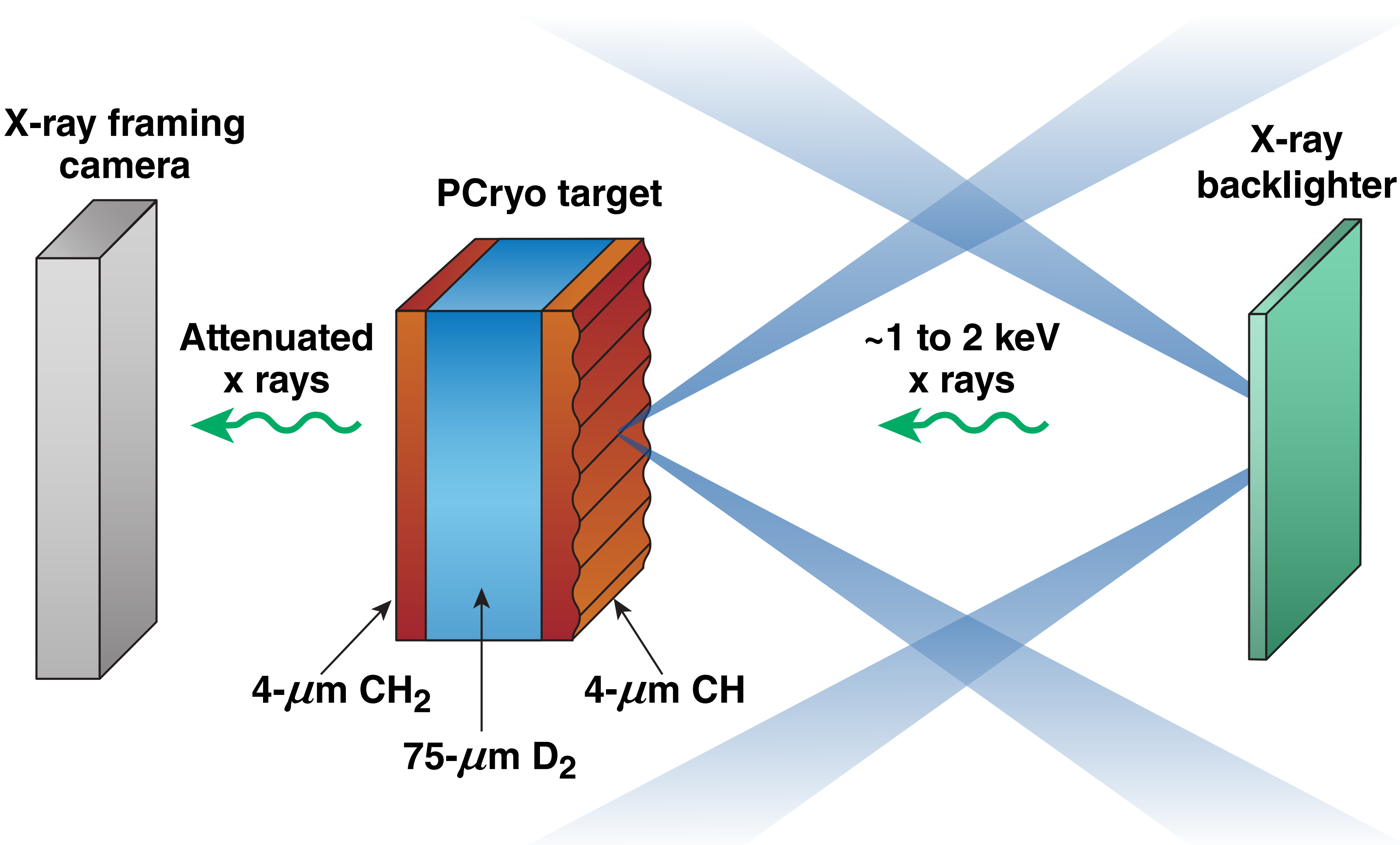
Planar cryo targets with 2-D modulations are driven by 10 to 12 drive beams while an x-ray backlighter is used to determine modulation growth



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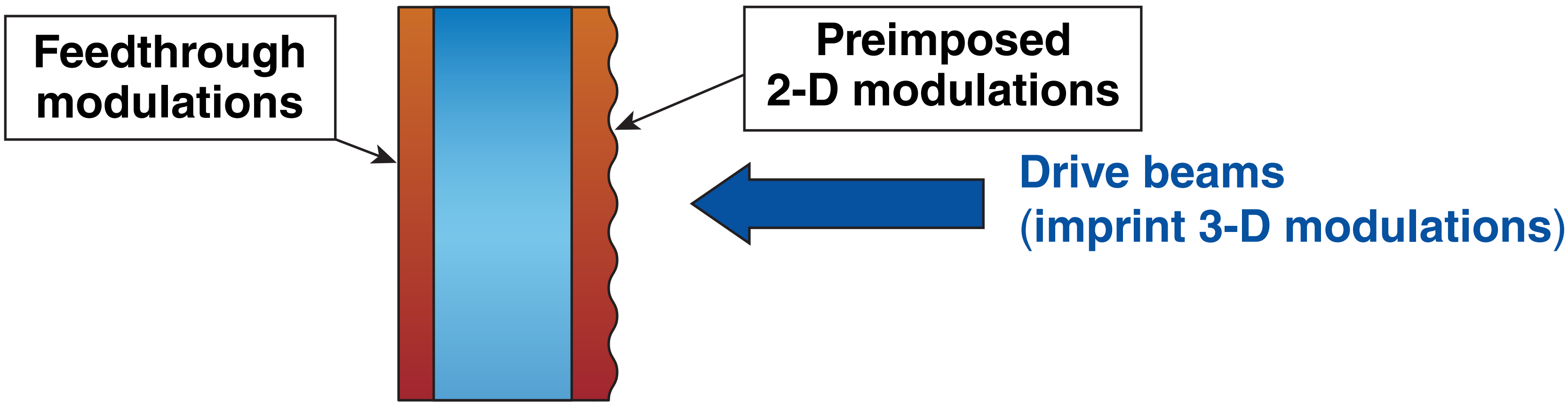
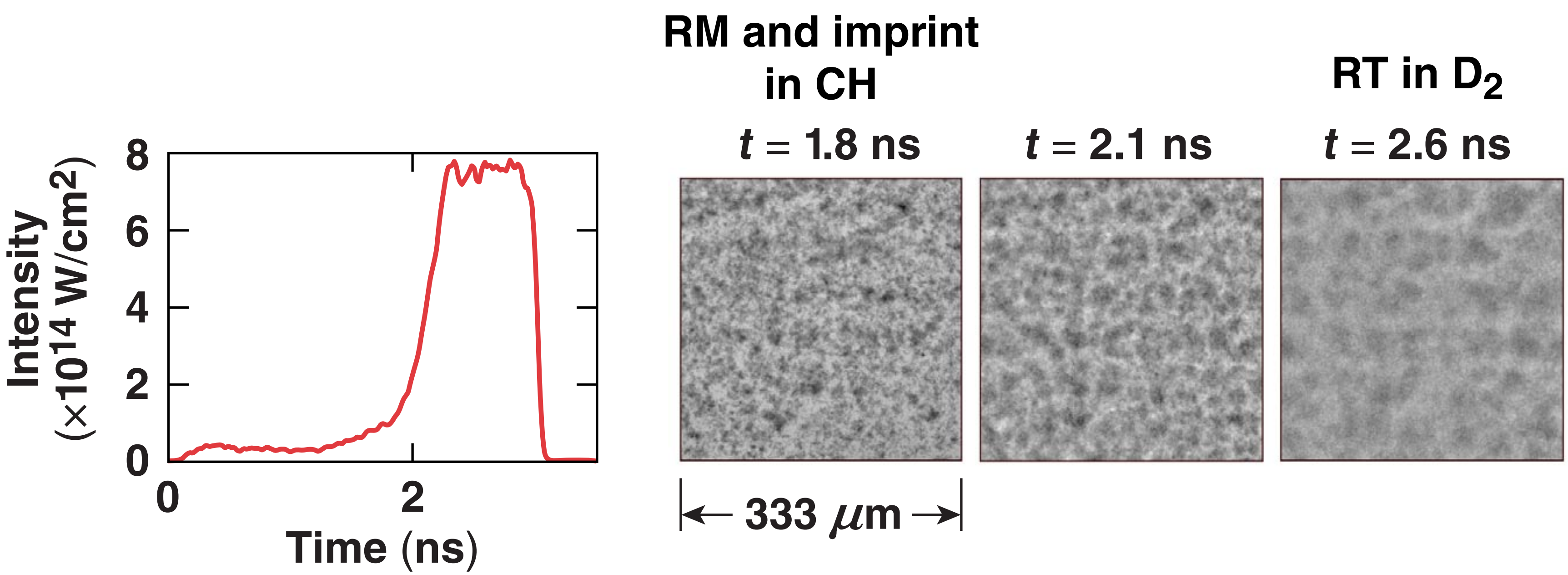
Richtmyer–Meshkov modulations were measured during the foot of the shaped drive pulse





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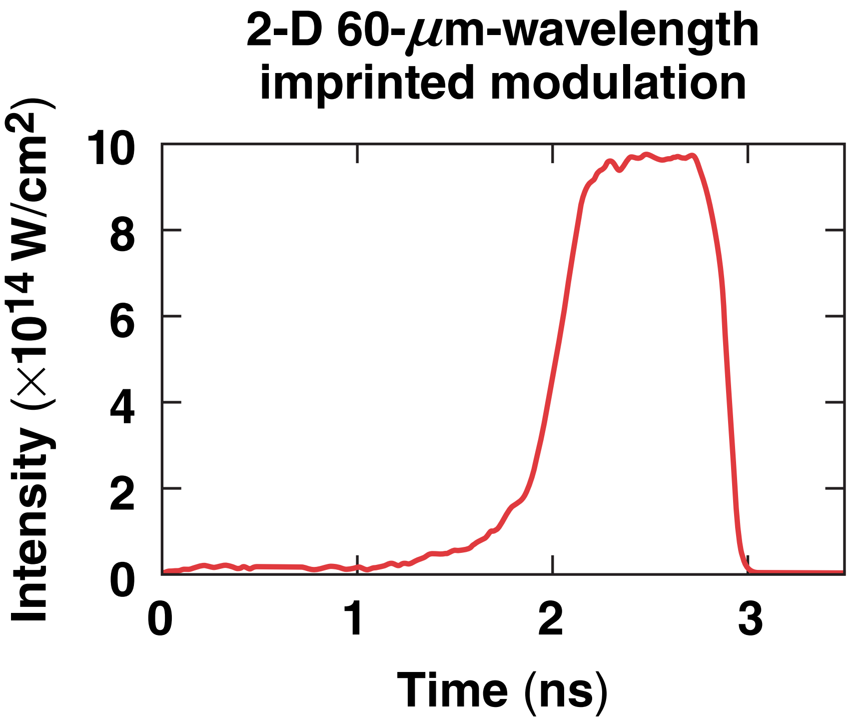
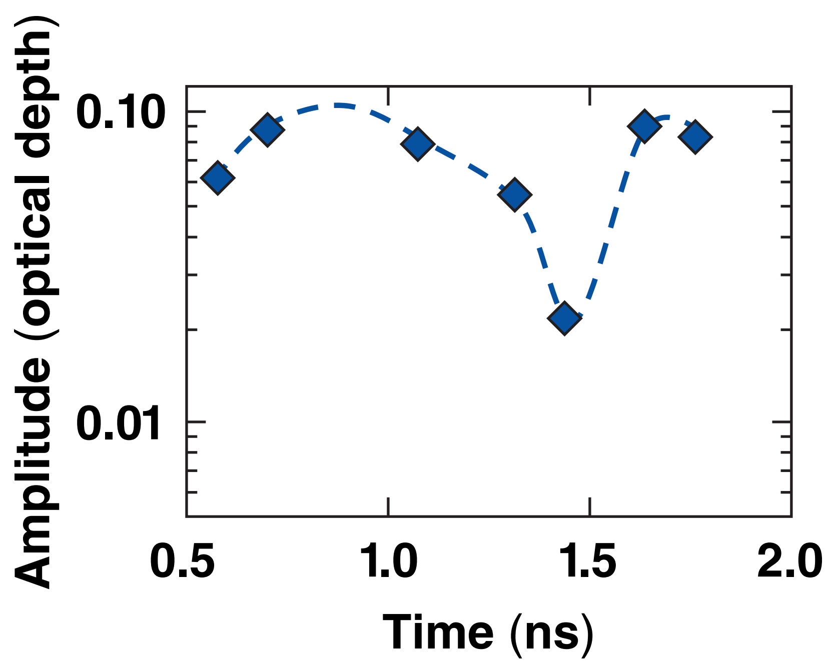
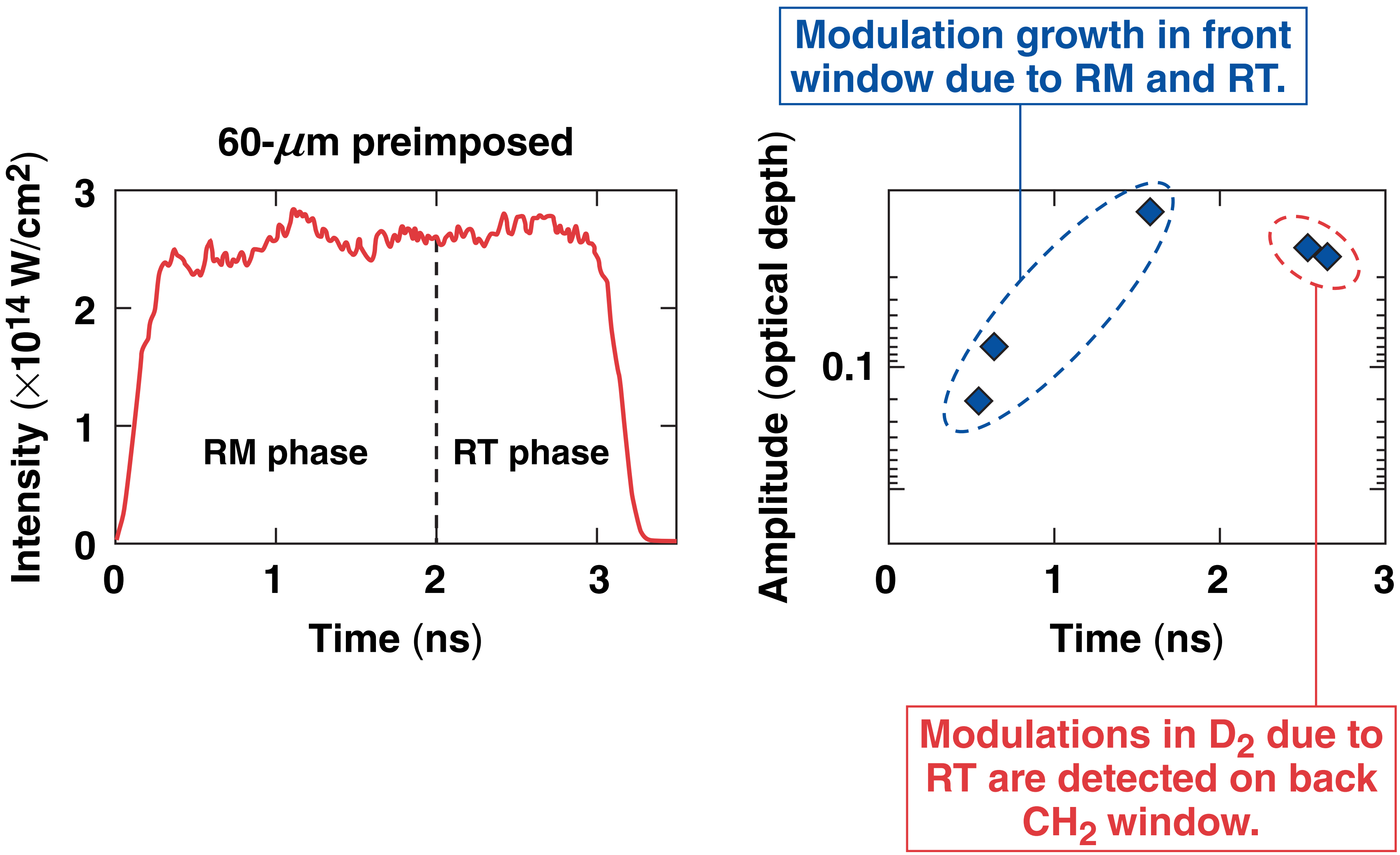
60-μm-wavelength 2-D modulation oscillates during shock transit time due to ablative RM instability*





*Y. Aglitskiy *et al*., Phys. Rev. Lett. 87, 265001 (2001).
*O. V. Gotchev *et al*., Phys. Rev. Lett. 96, 115005 (2006).

Up to ~2 ns, observed modulations grow due to RM instability and after ~2 ns due to RT instability



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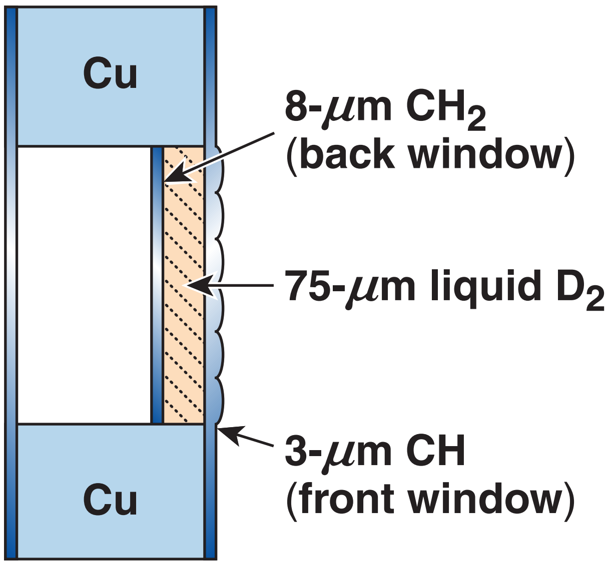
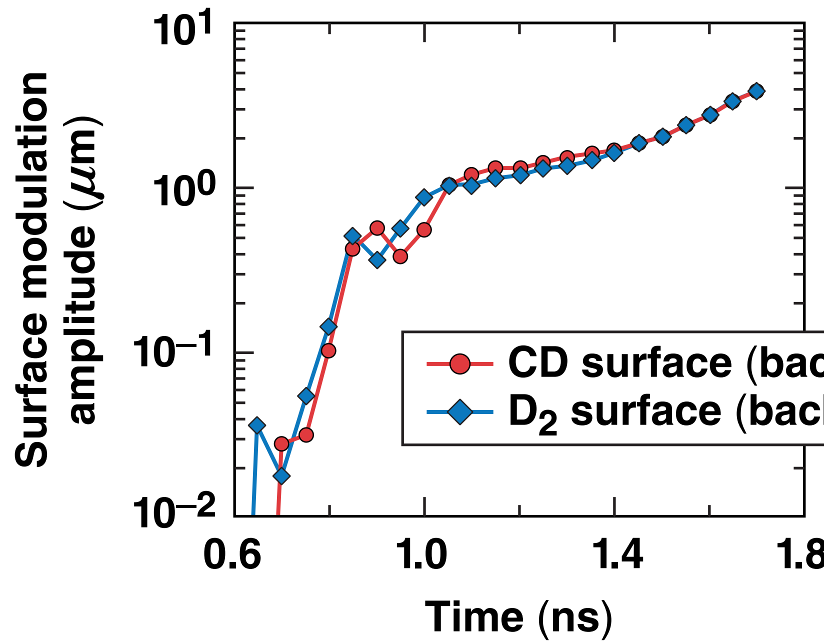
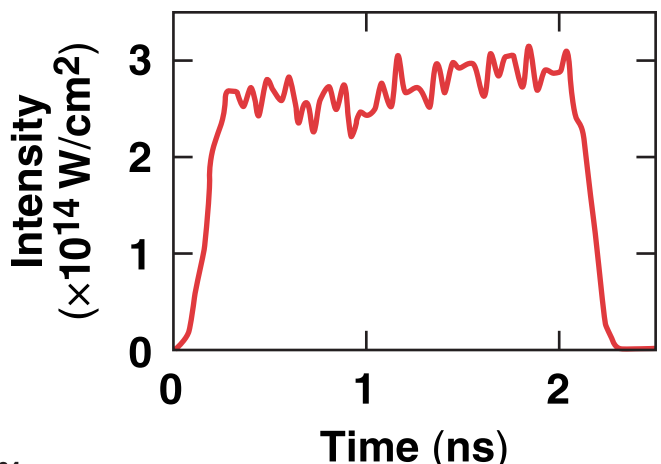
Rayleigh–Taylor experiments were designed using *DRACO* 2-D simulations







Targets with a 50-μm D_2 layer have been designed to increase the imprint on the back CH_2 window.

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Summary/Conclusions

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