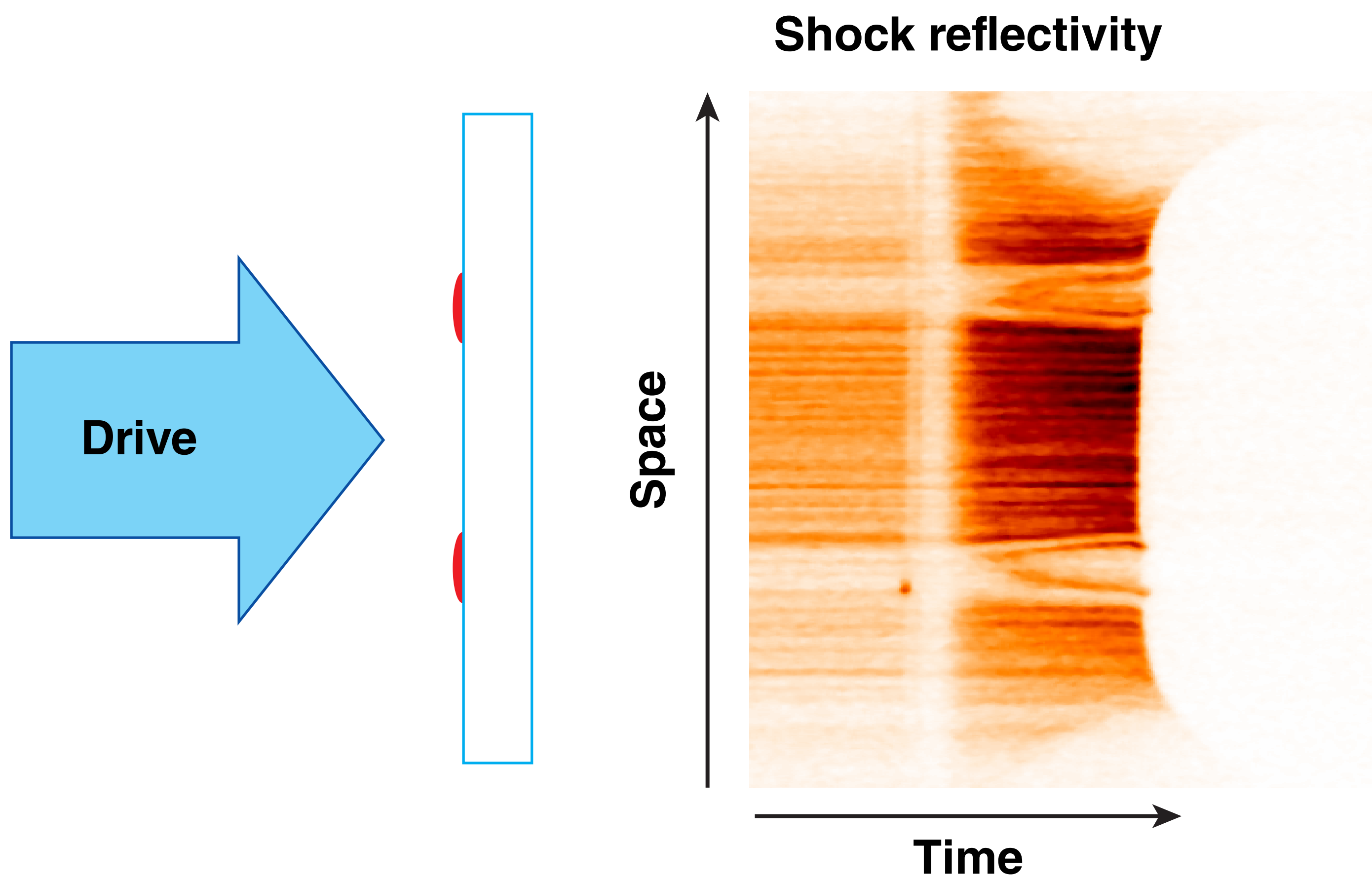
The Evolution of Surface Defects Driven by Shock Waves



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54th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Providence, RI
29 October–2 November 2012

Summary

The evolution of submicron surface defects was observed in planar targets using optical diagnostics

- Shell uniformity is critical to performance of inertial confinement fusion (ICF) implosions*
- Defects on the outer surface alter shock-wave propagation, creating nonradial velocities that alter mass distribution
- The effects of 0.5- to 5-μm high $\times$ ~50-μm glue dots are readily observed
- Cryogenic and spherical experiments are planned

Will use this technique to validate simulations of debris on targets.

* T. C. Sangster, NI2.00002, this conference.

Collaborators

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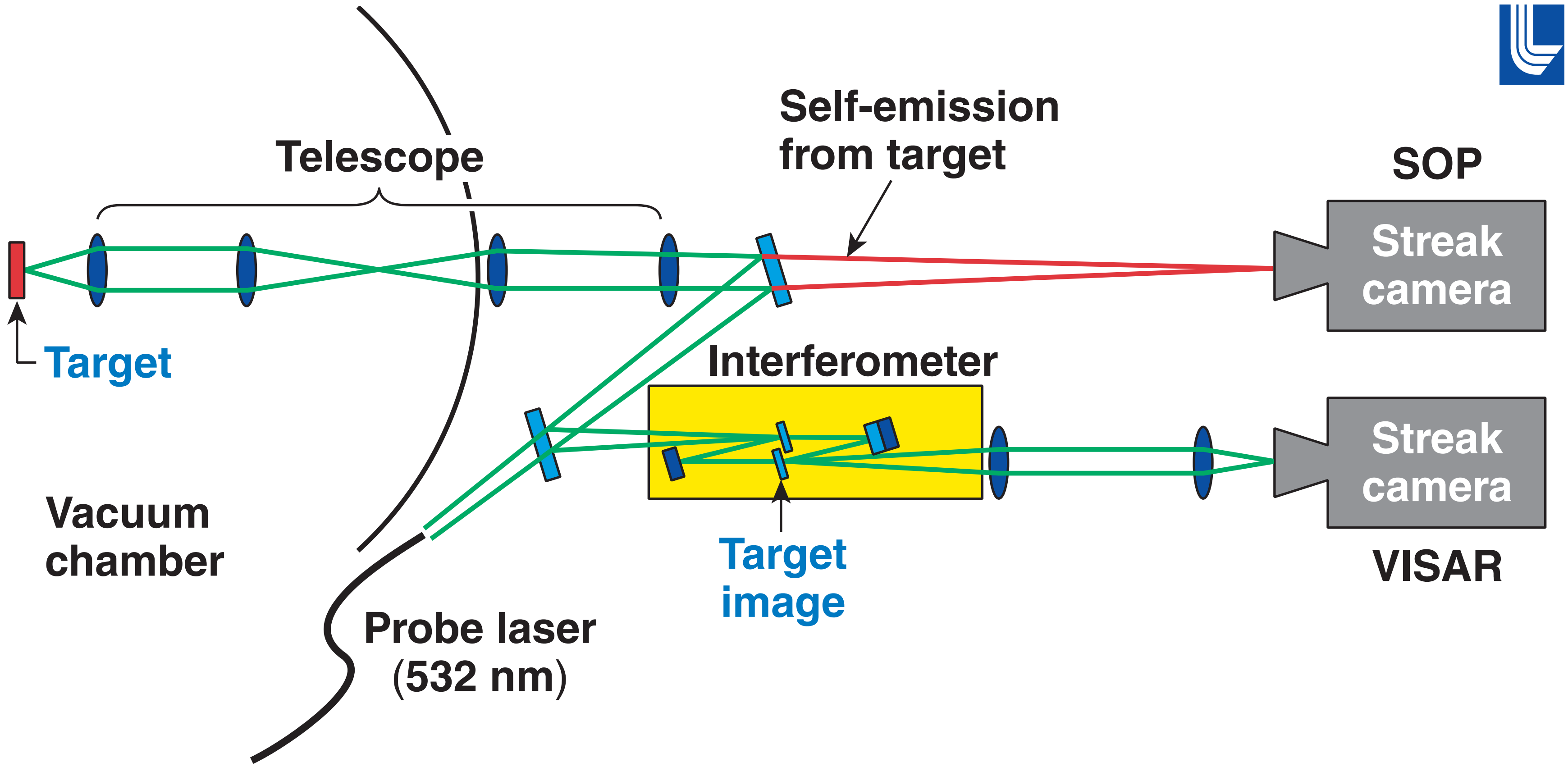
Shock waves are observed optically using time-resolved VISAR* and SOP**



Shocks are reflective and emit light.

* Velocity interferometer system for any reflector
** Streaked optical pyrometer

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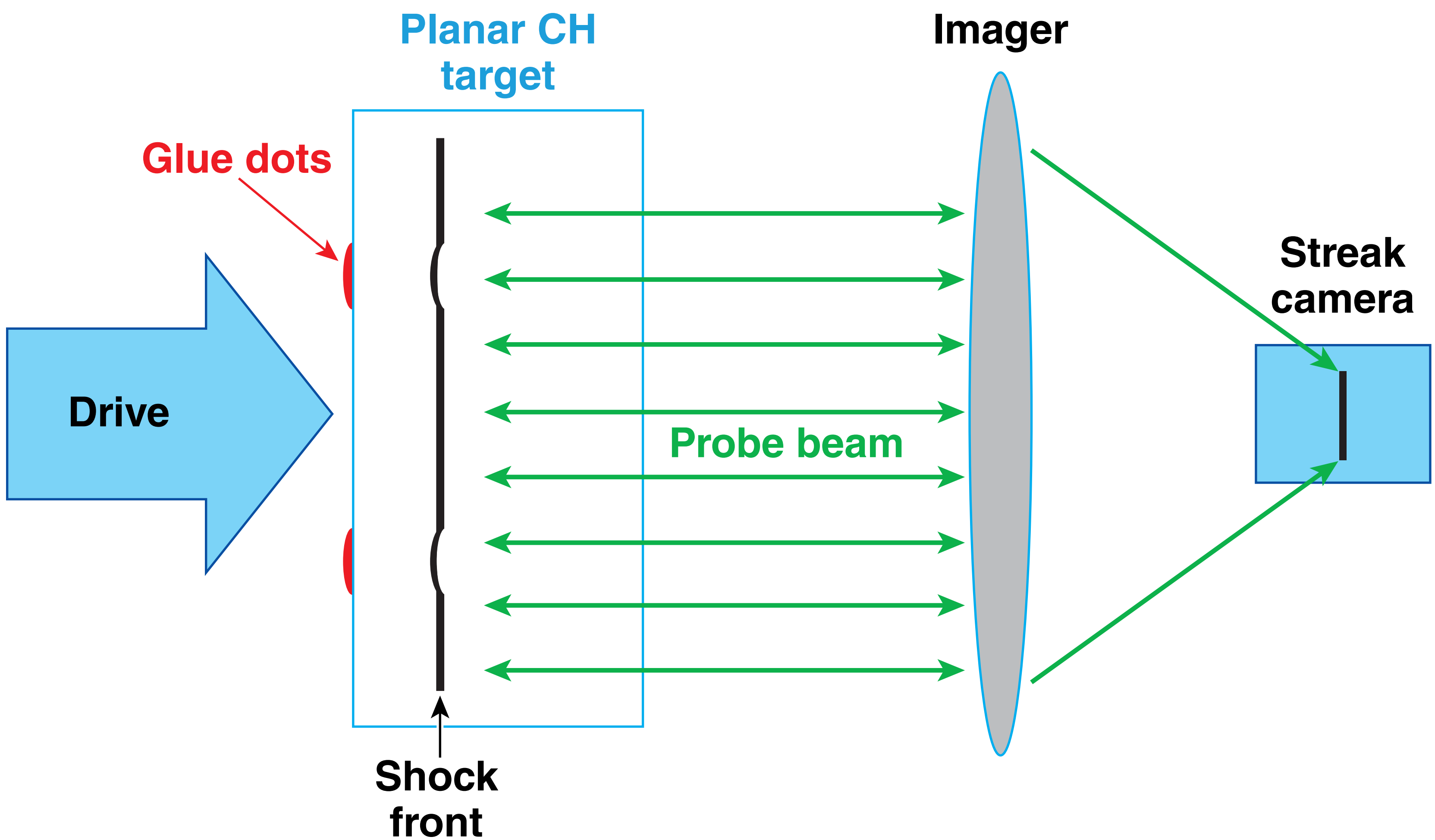
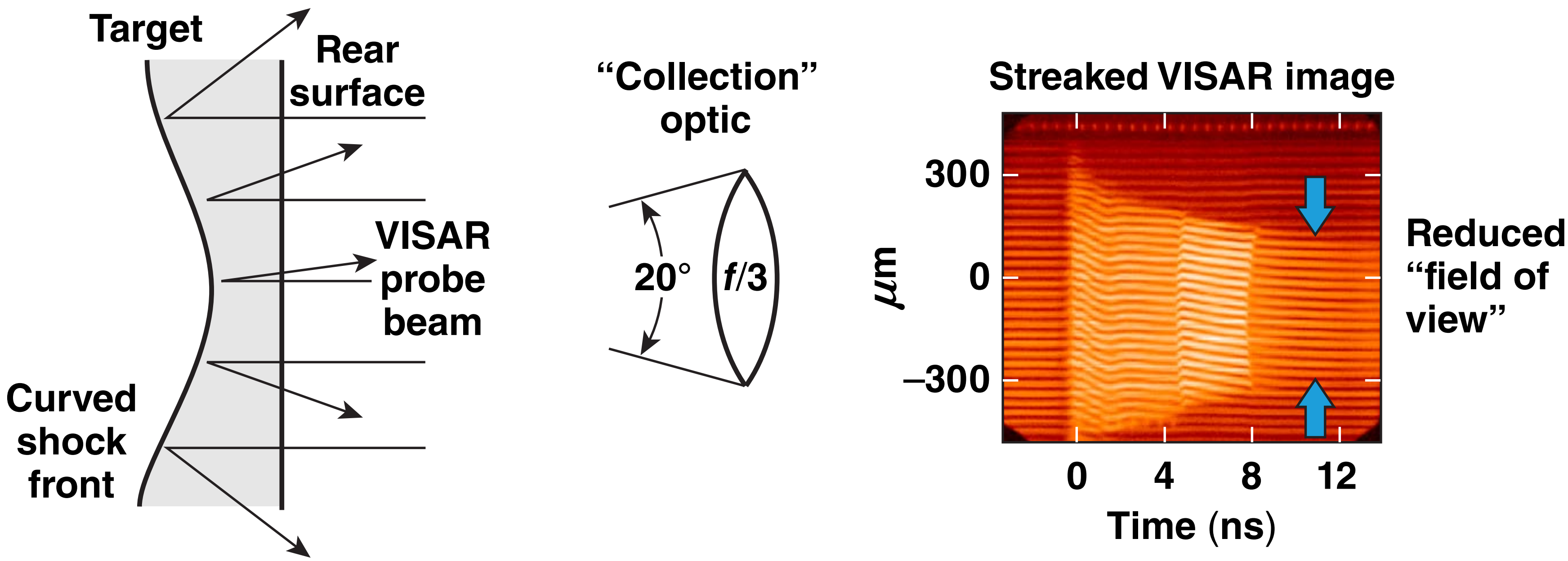
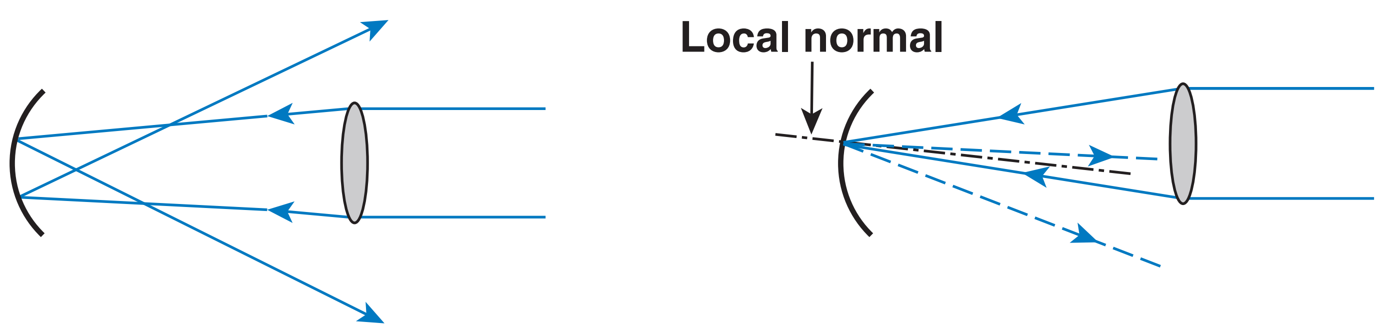
The effect of surface defects are observed using a probe beam reflected from the modulated shocks



Shock-front curvature affects the VISAR intensity



Return beam can be defocused or steered



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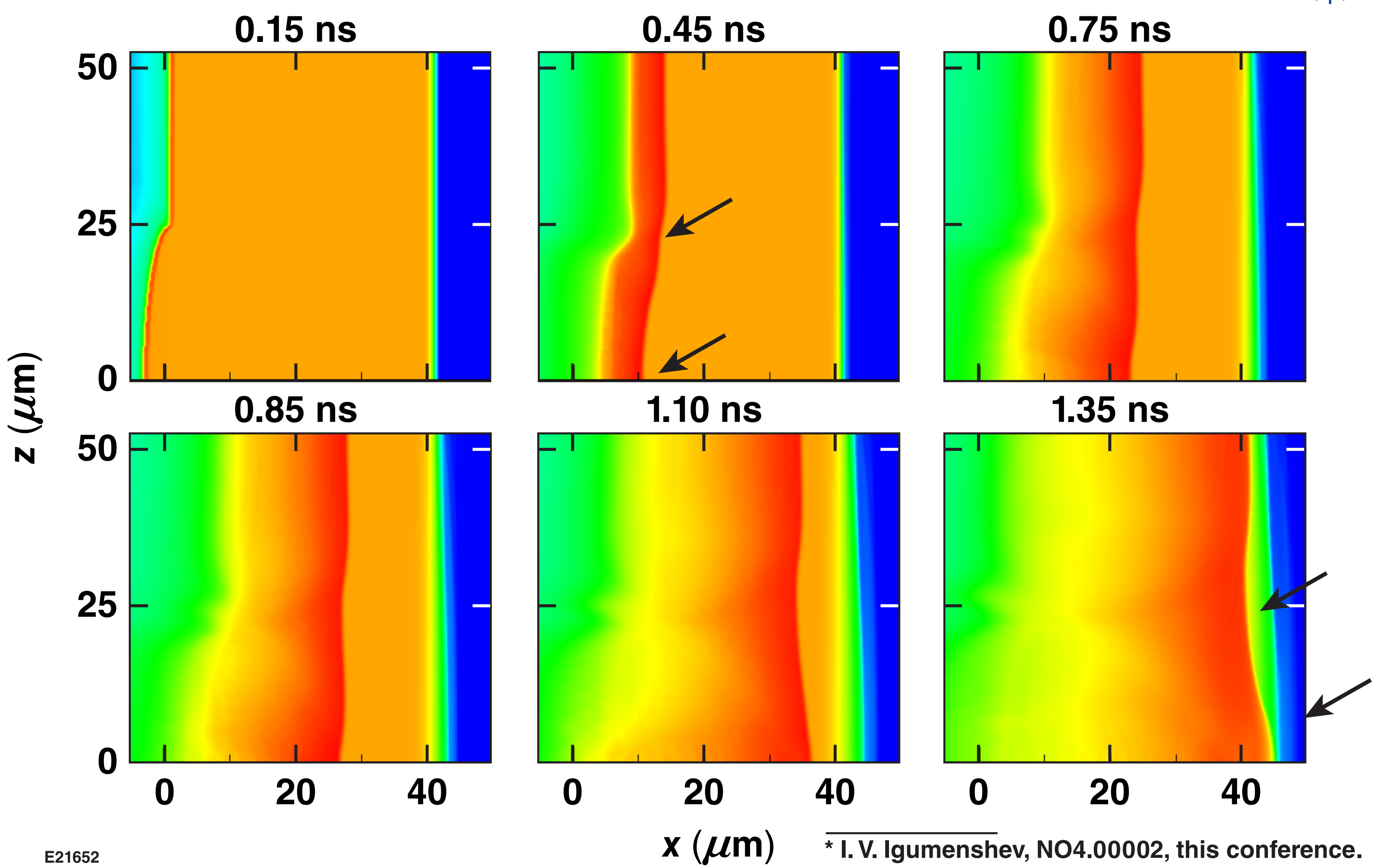
A spherical surface defect produces shock modulations at both its center and edges



* I. V. Igumenshev, NO4.00002, this conference.

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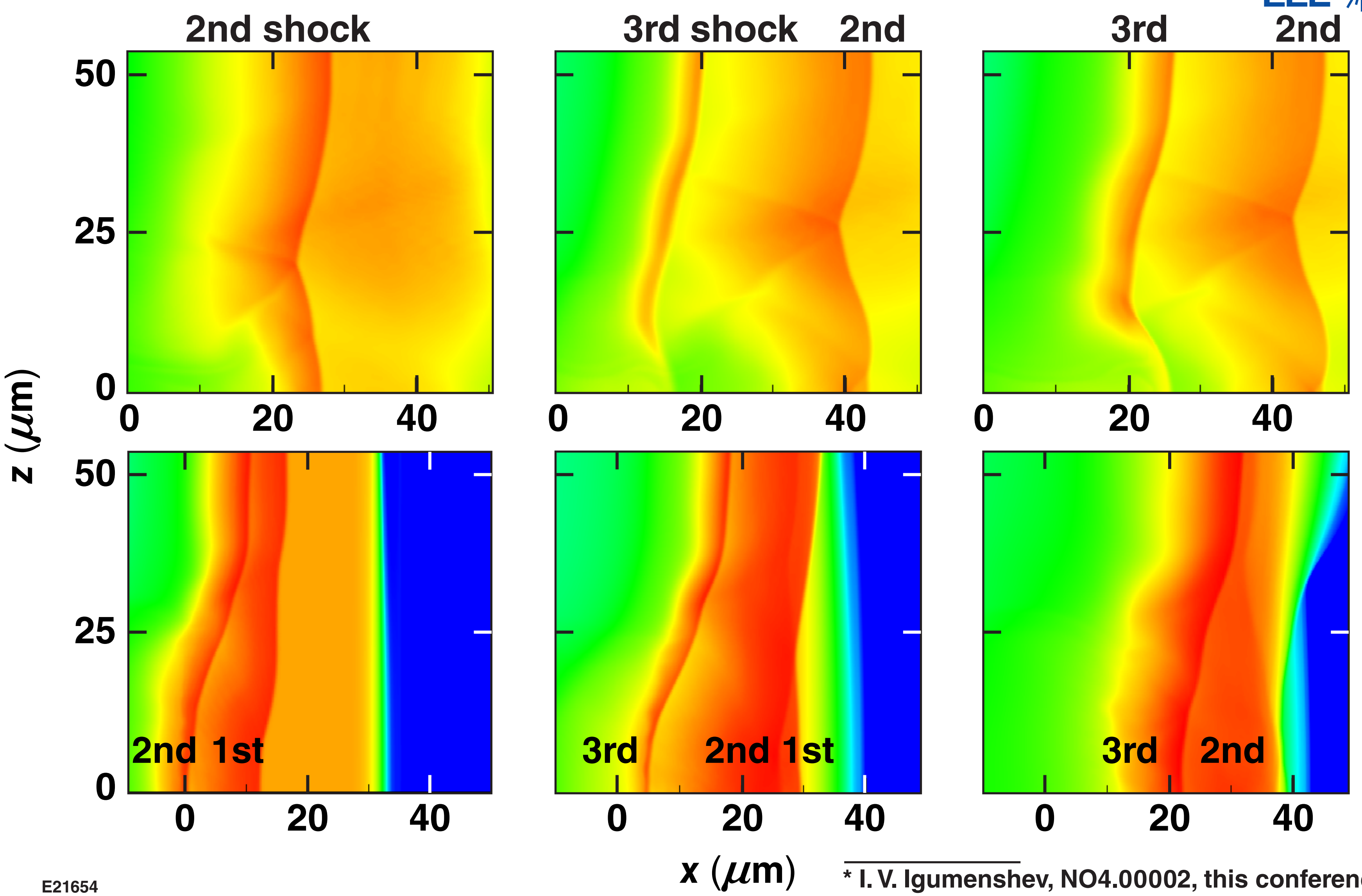
Multiple shock waves can exacerbate the effects of surface defects



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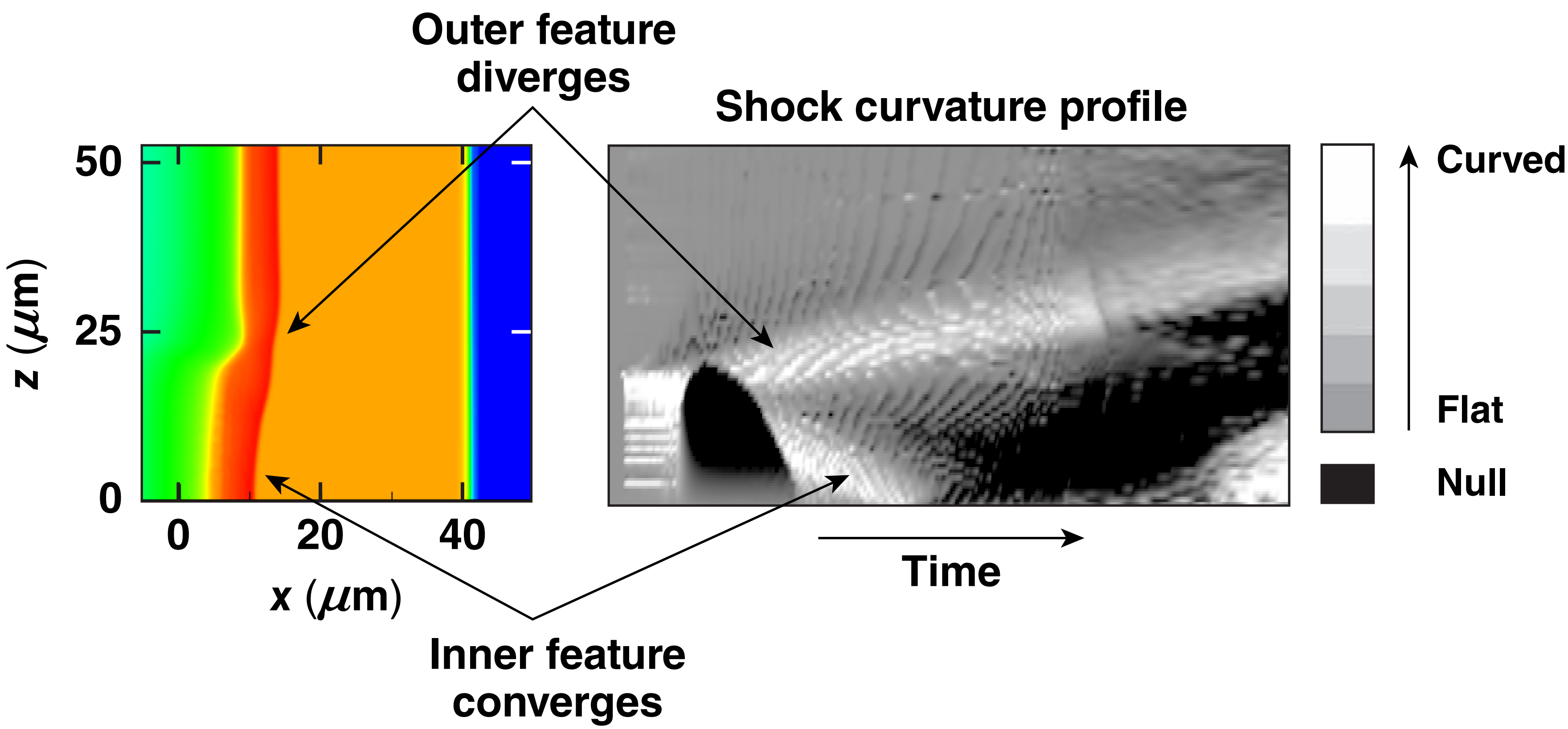
A simple analysis using shock curvature predicts two features in reflected signal

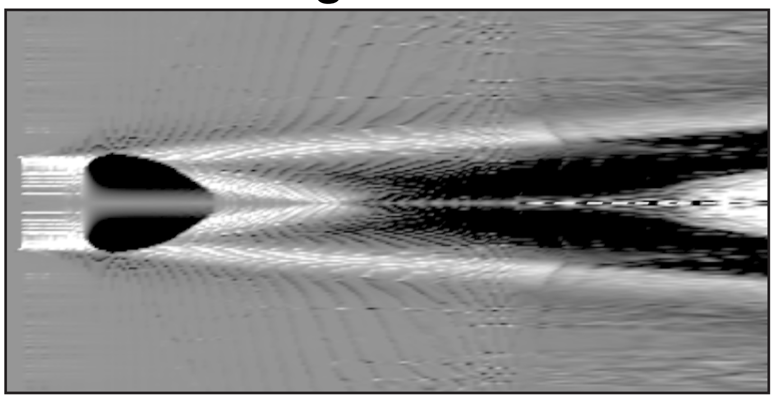


Simulations predict different behavior for multishock experiments

Contours of shock curvature

Single shock

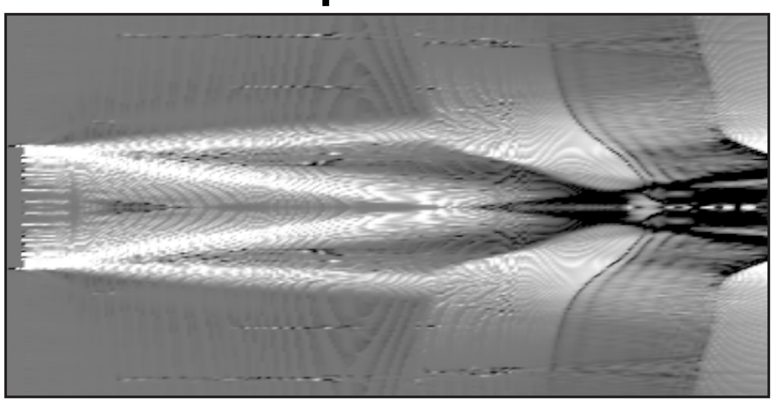
100 μm



Time ⟶

Multiple shocks

100 μm



Time ⟶

- Convergent (inner) and divergent (outer) features
- Second shock causes convergence of outer feature

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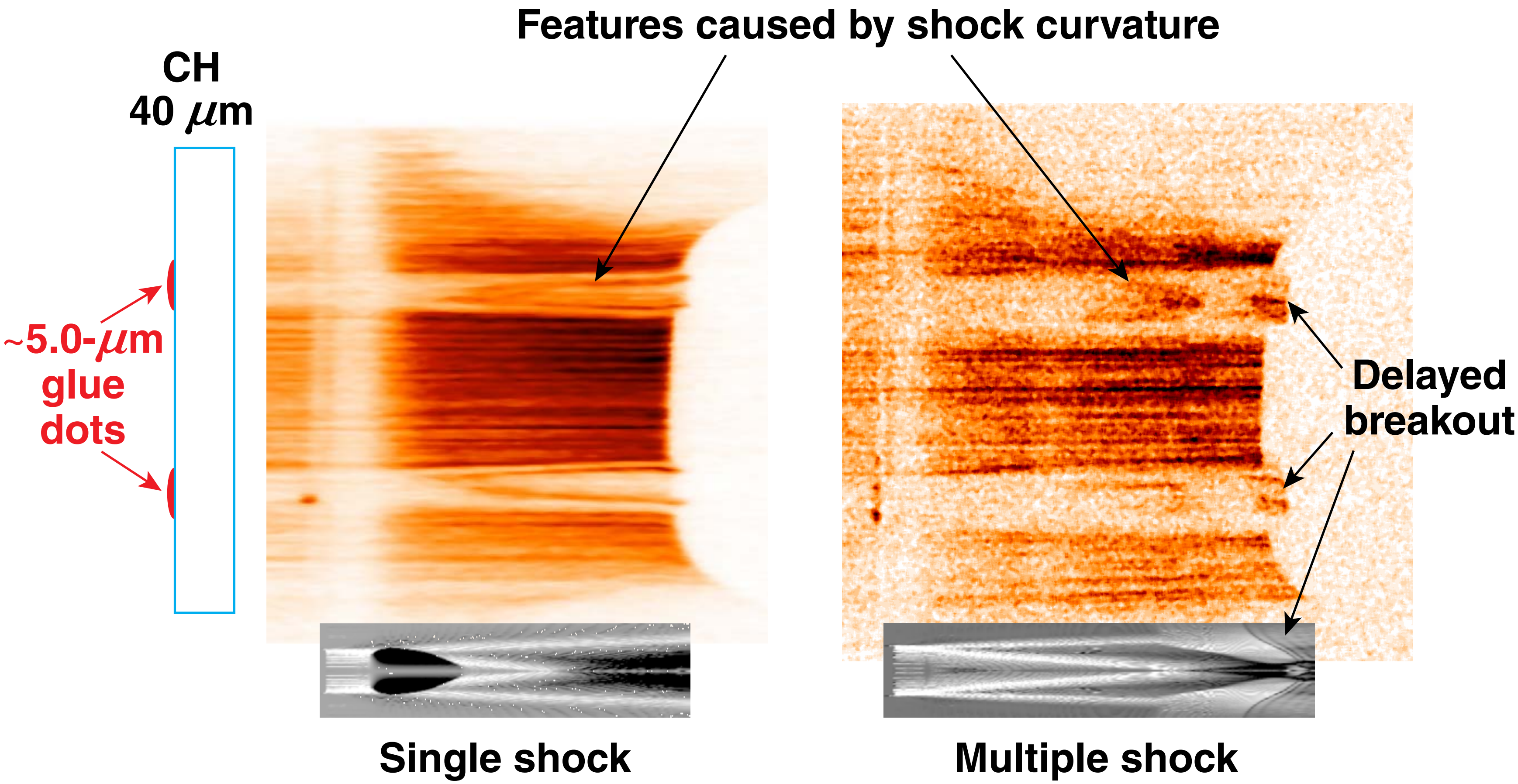
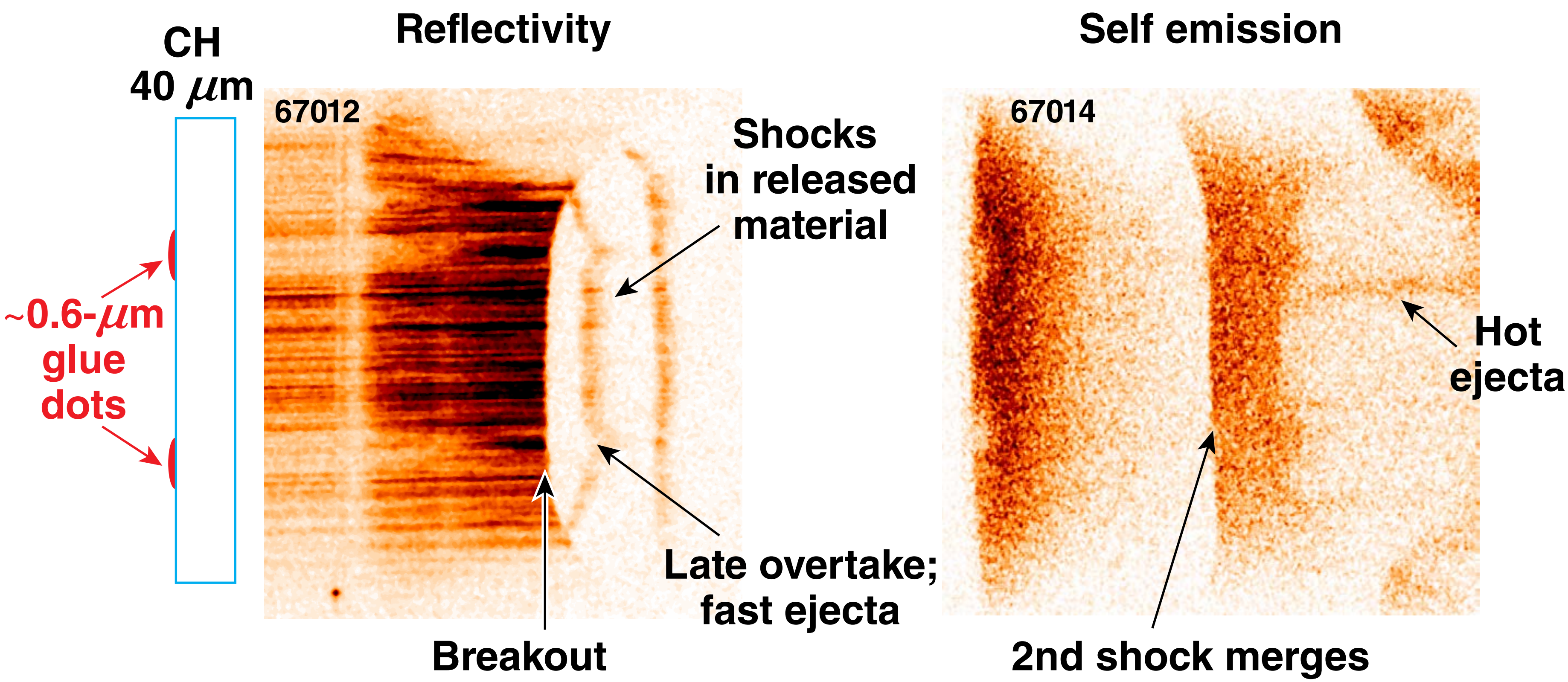
Simulations show qualitative agreement with both single and multishock experiments



Reflection and self-emission both show effects of multiple shocks in ejected material



Can observe effects of <1-μm high × ~50-μm dots!

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Summary/Conclusions

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