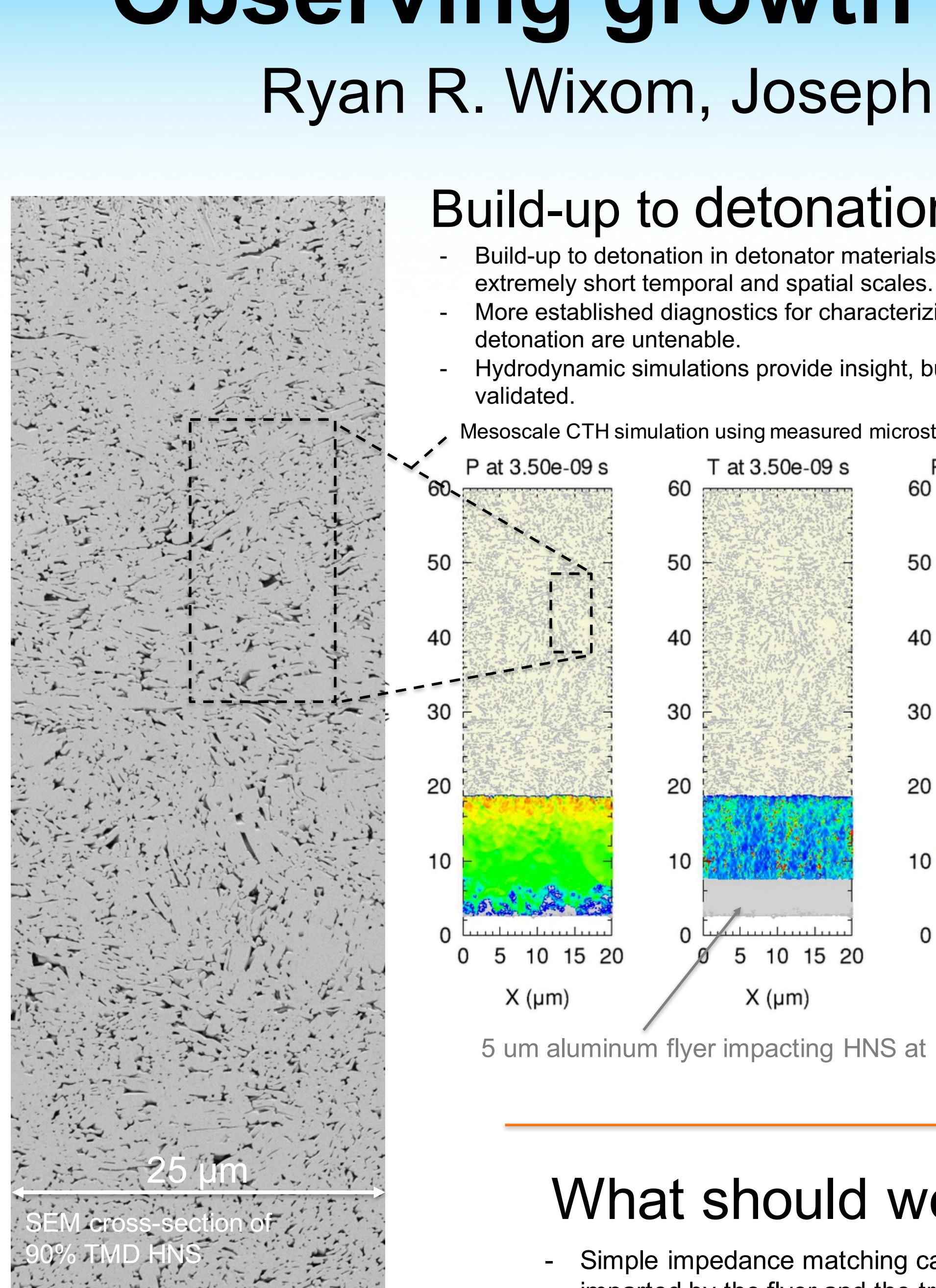
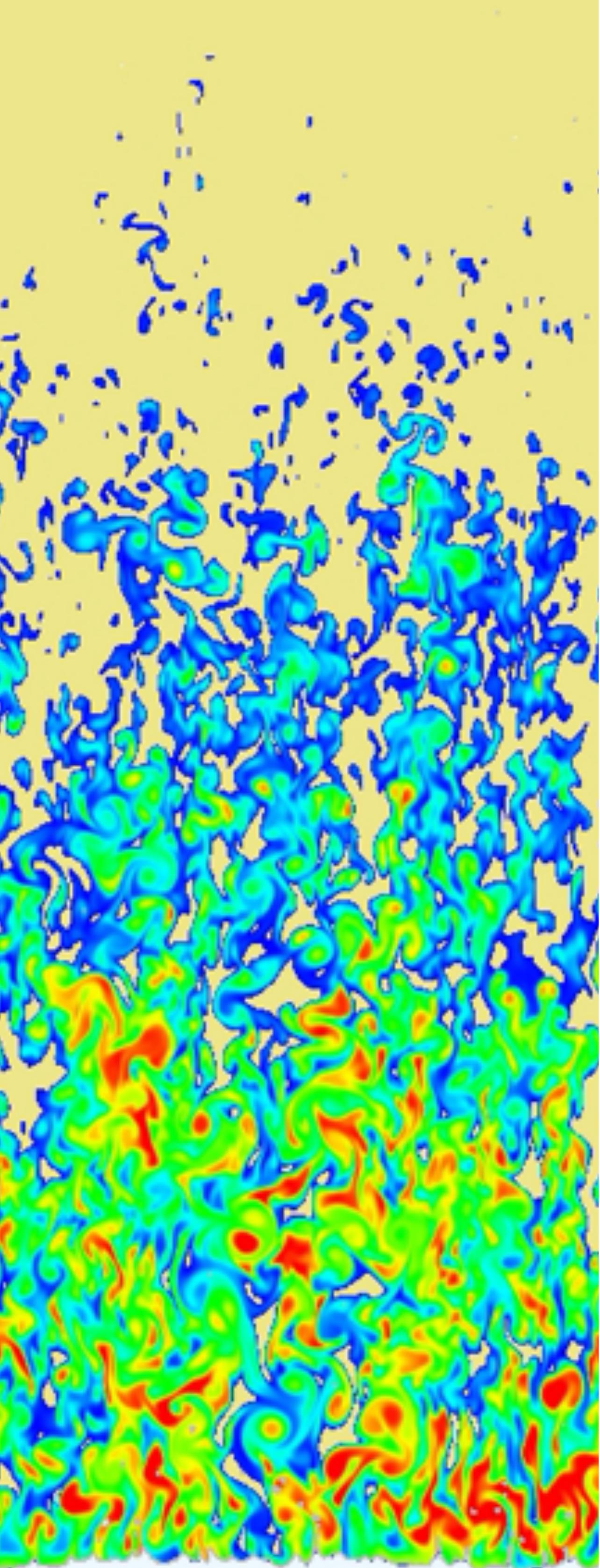
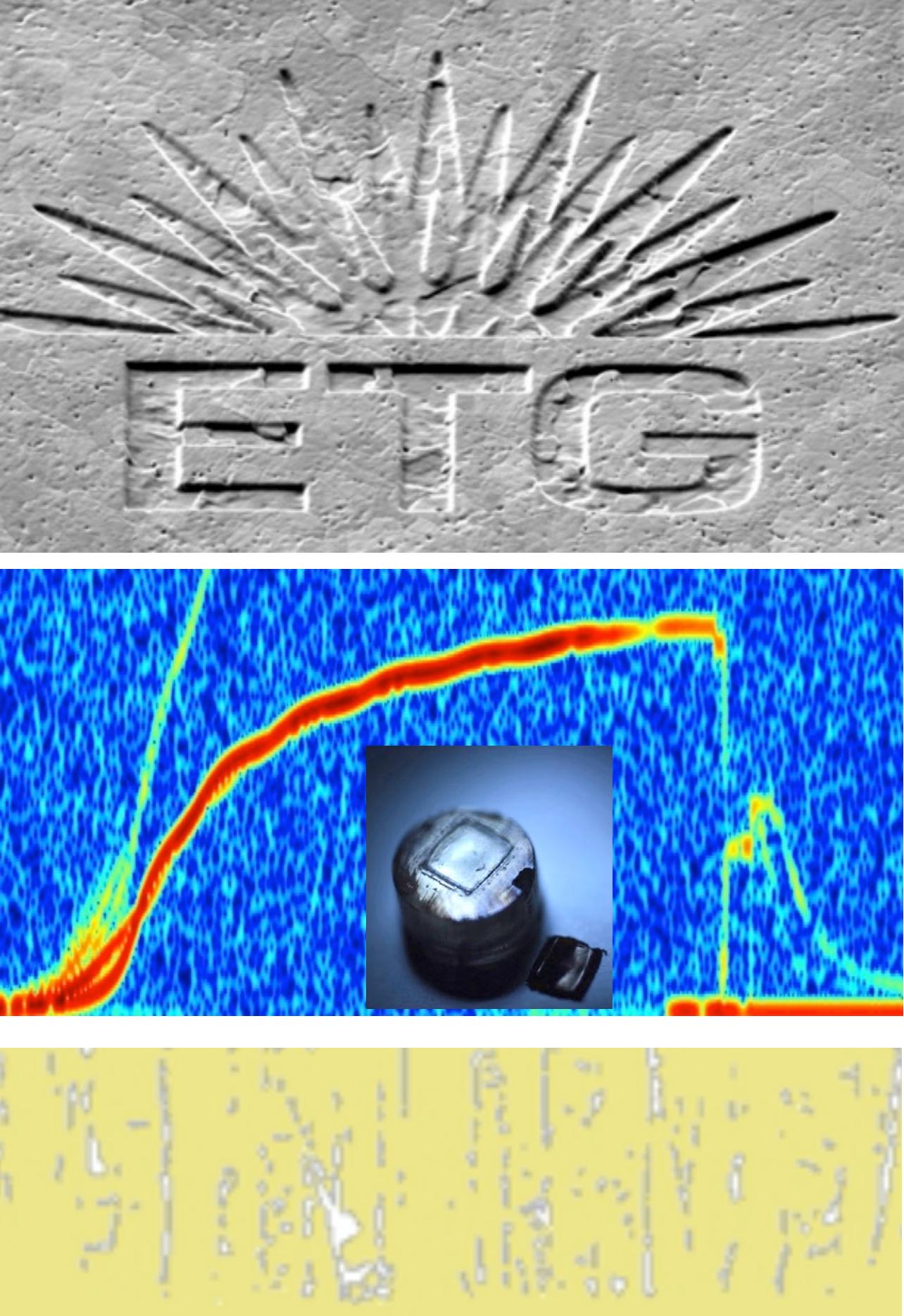


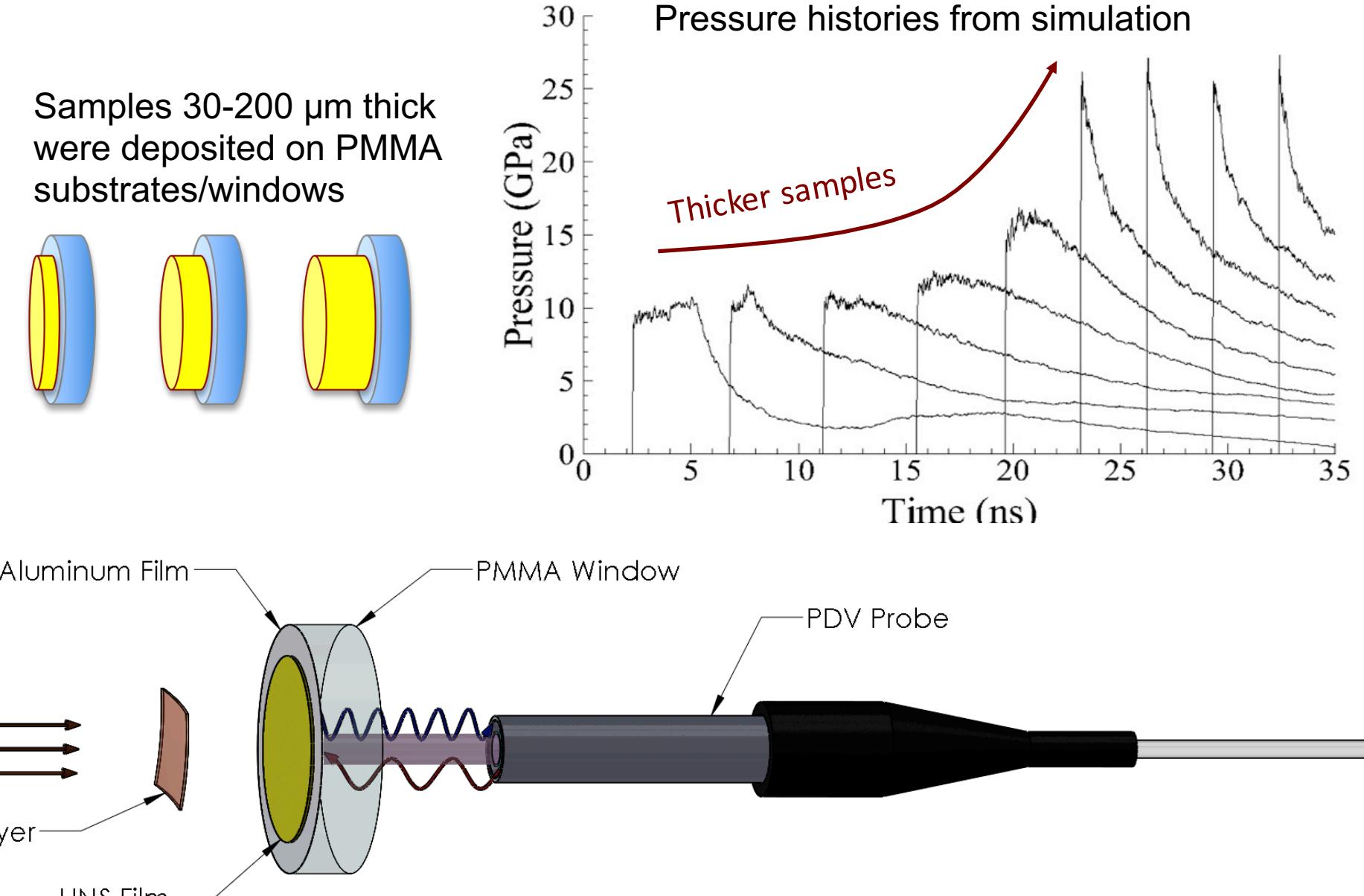
Observing growth to detonation using photonic Doppler velocimetry

Ryan R. Wixom, Joseph D. Olles, Robert Knepper, Alexander S. Tappan, and Cole D. Yarrington

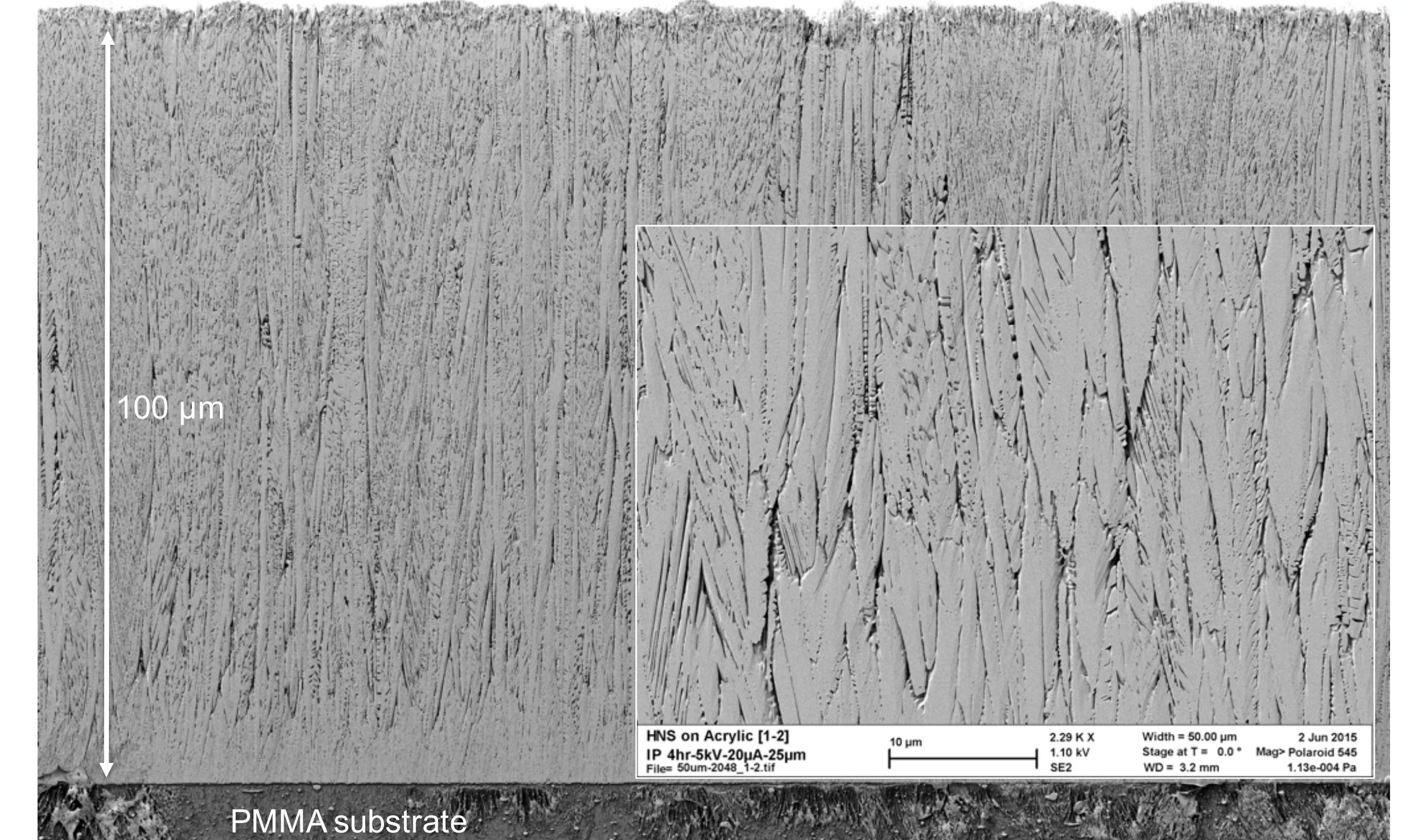


Composite particle velocity history

Photonic Doppler velocimetry (PDV) and novel samples have made it possible to do a series of 'thin-film cutback' experiments. The data will be used to validate/calibrate hydrocode simulations and advance our understanding of how an inert shock builds to detonation in materials like hexanitrostilbene (HNS).

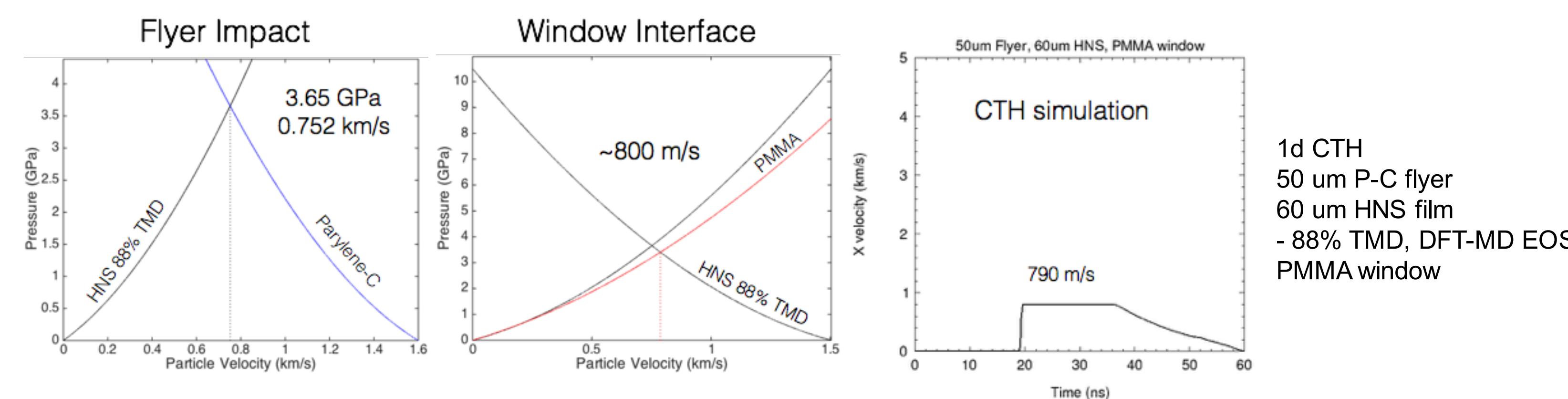


Samples: Vapor deposited HNS



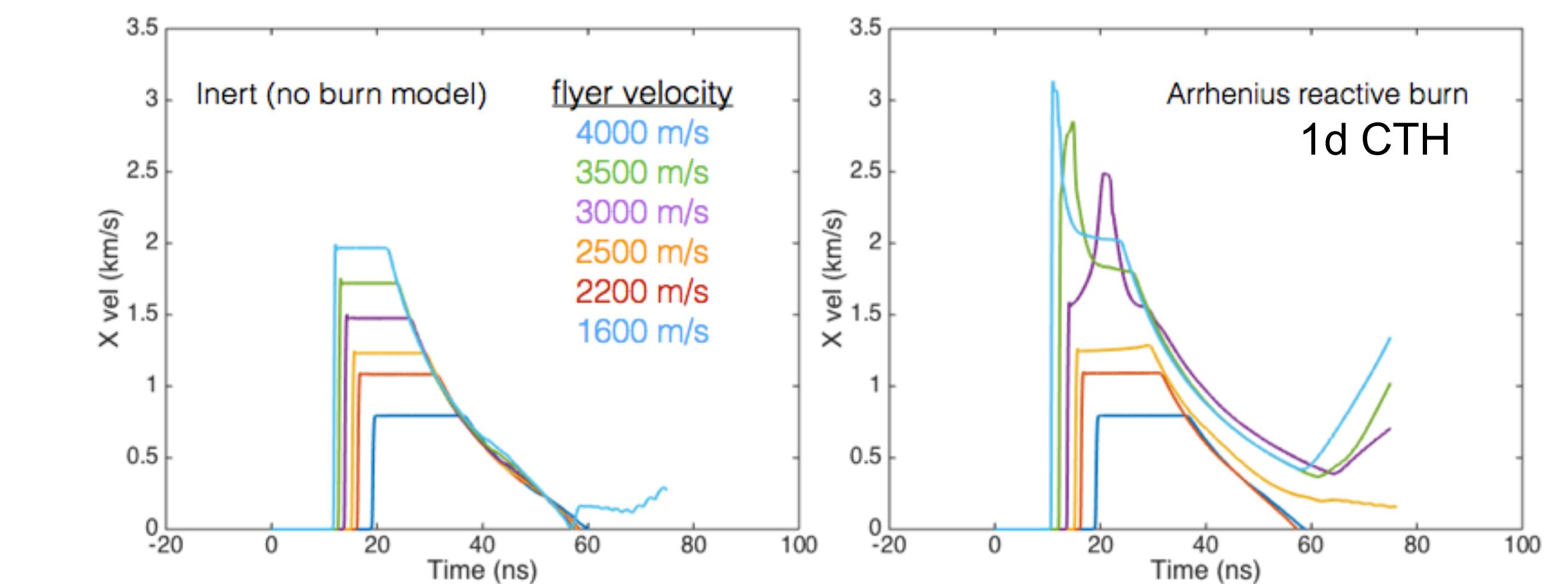
What should we expect to see?

- Simple impedance matching can predict the shock pressure imparted by the flyer and the transfer of an inert shock across the HNS/PMMA interface.
- A 1d CTH simulation predicts the same magnitude for the observed shock pulse in the window.



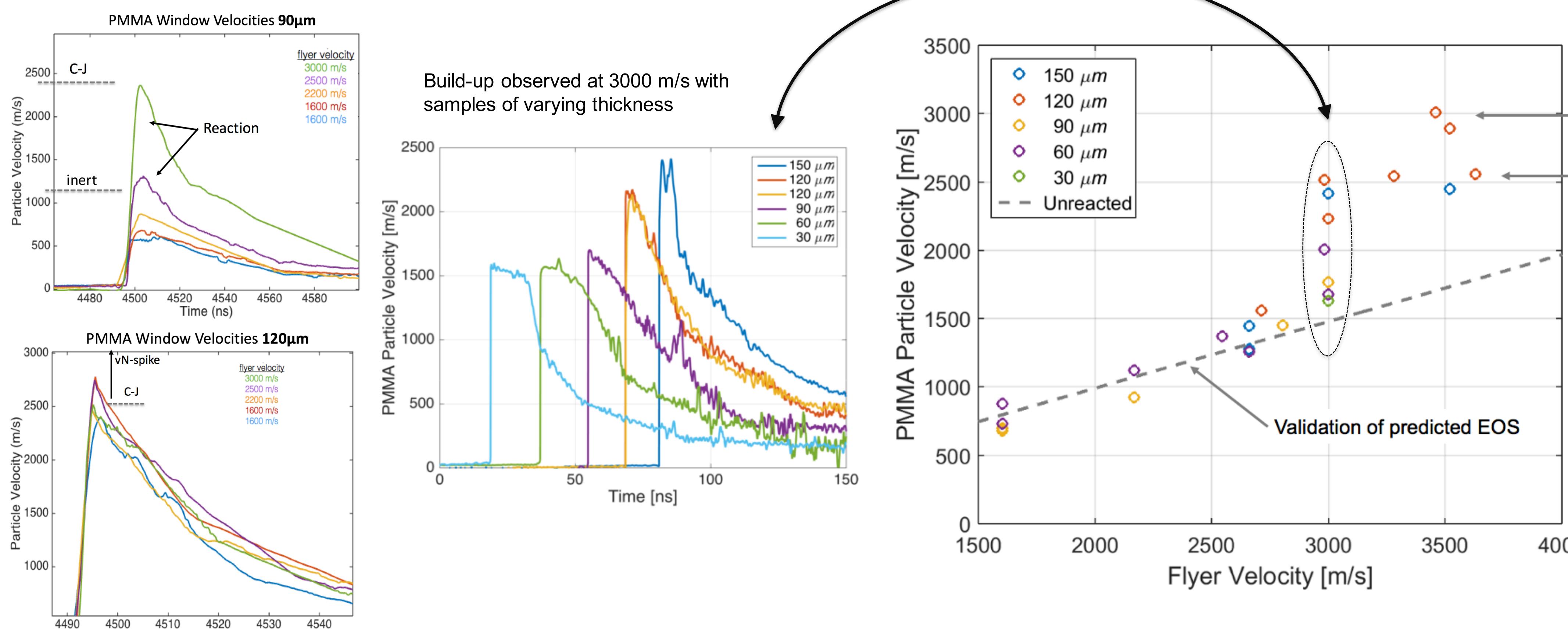
How do we know it is detonating?

- CTH simulations with and without a chemistry model help determine when the shock is inert or reacting.
- Observed particle velocities greater than the predicted inert response are an indication of shock-induced chemical reaction

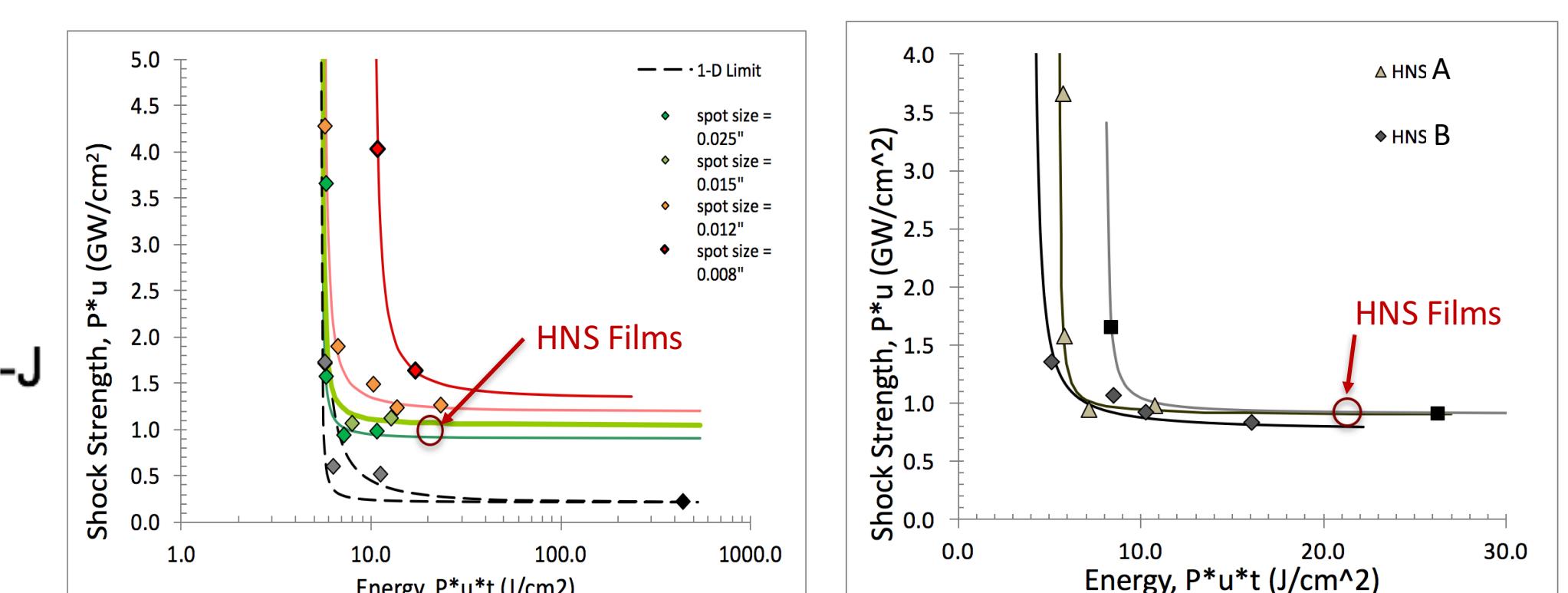


Results

The measured particle velocity histories show clear indication of inert, reacting, and fully detonating waves depending on impact velocity or thickness of sample. Using five different thicknesses of HNS and a single flyer velocity (3 km/s) provides a view of build-up to detonation that can be directly compared to simulations results.



Comparison with previously published HNS initiation data



Conclusions / Summary

Novel samples and advances in PDV have enabled observation of the build-up to detonation in HNS. This data has validated a previous prediction of the unreacted Hugoniot of HNS and will be used to calibrate a reactive-burn model.

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