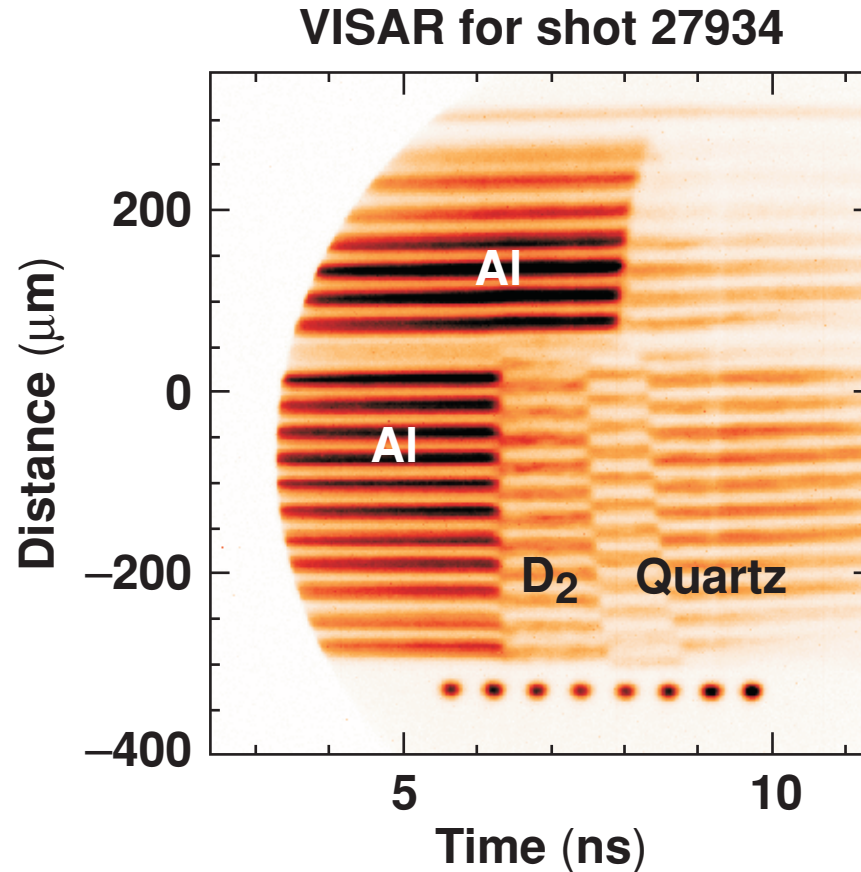


Quartz Equation-of-State Measurements at the OMEGA Laser Facility



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Division of Plasma Physics
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Summary

Quartz plays a critical role in our study of deuterium equation of state (EOS)

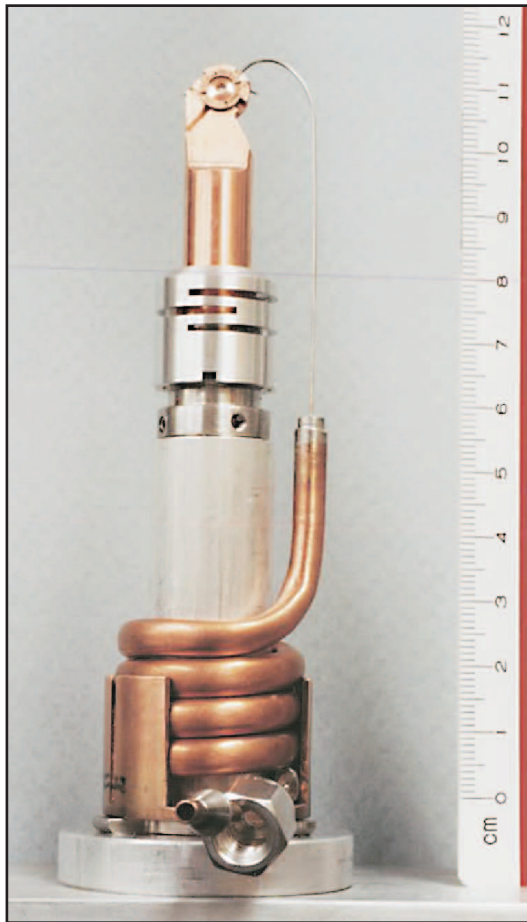


- Re-shock¹ experiments present advantages in discerning between EOS models.
- Quartz was used as a transparent “anvil” in deuterium re-shock EOS experiments.
- The EOS for quartz was measured at pressures of 3 to 15 Mb using aluminum as standard.
- Impedance-match data for shocks in aluminum-quartz provides the basis for a novel high-precision technique.

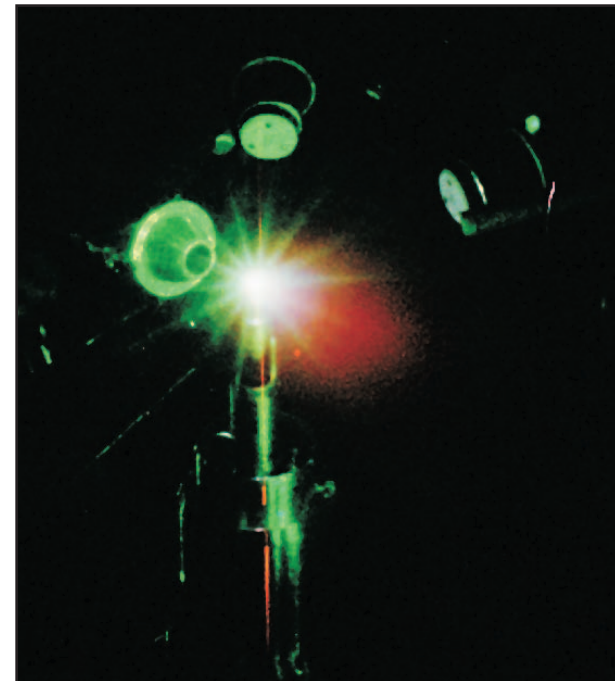
Many people contributed to the design, implementation, and execution of cryogenic-target experiments



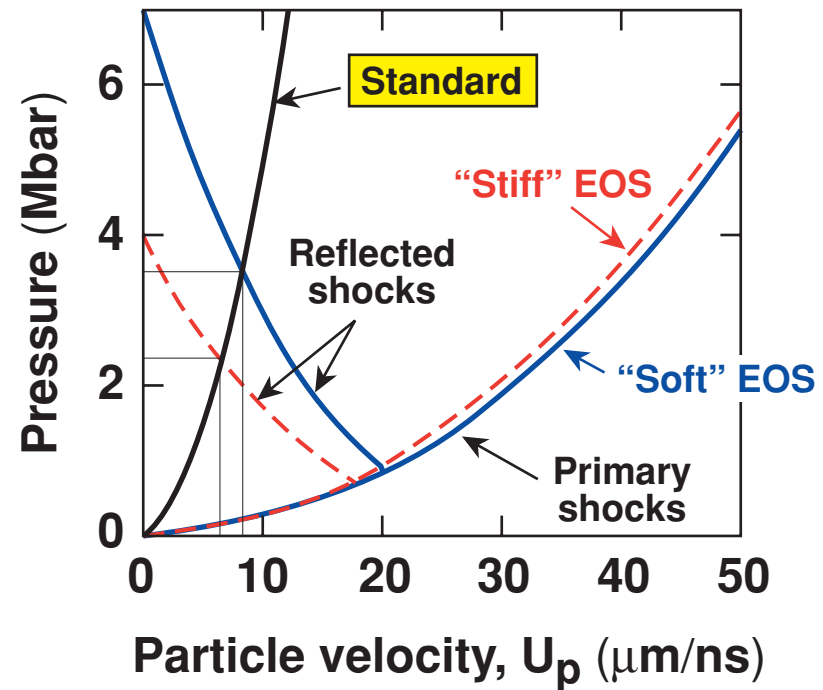
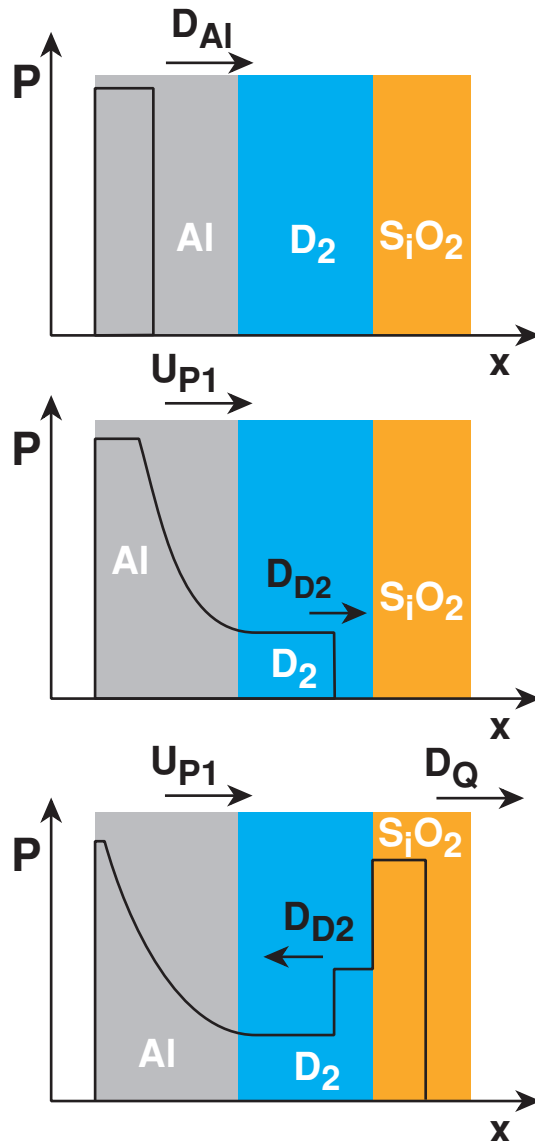
D. G. Hicks*, P. M. Celliers*, G. W. Collins*, T. Collins, J. Eggert*, M. Foord*, S. Moon



- D. G. Hicks*
- E. Vianello
- D. D. Meyerhofer
- R. Cauble*
- W. Unites*
- D. Jacobs-Perkins
- R. Earley
- M. Bonino
- J. Armstrong
- S. Noyes
- D. Turner
- D. Guy
- S. Scarantino
- T. Lewis
- F. Rister
- L. Lund
- Experimental Ops
- Ω - Ops

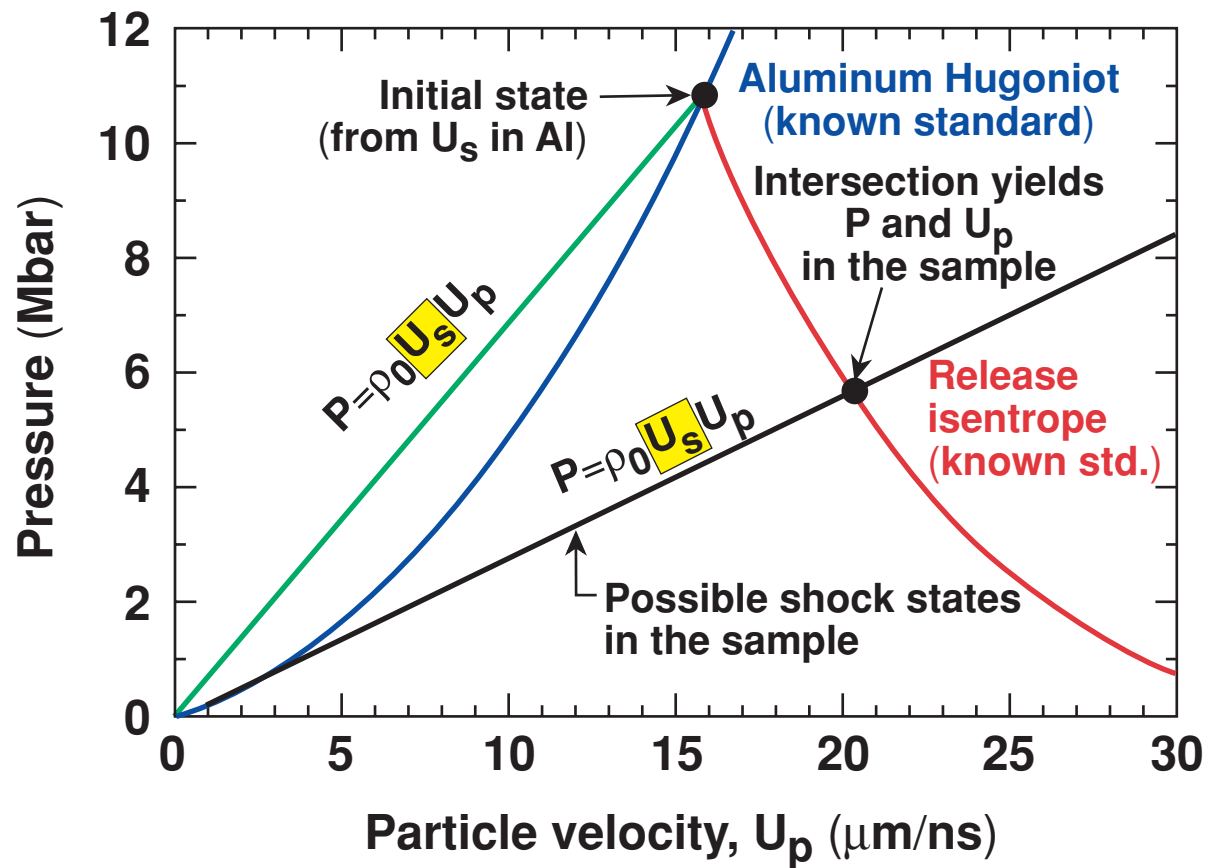
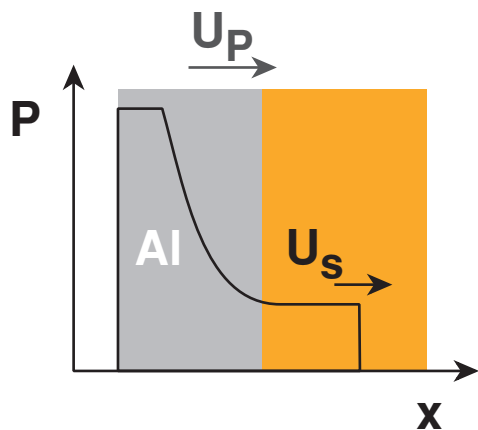
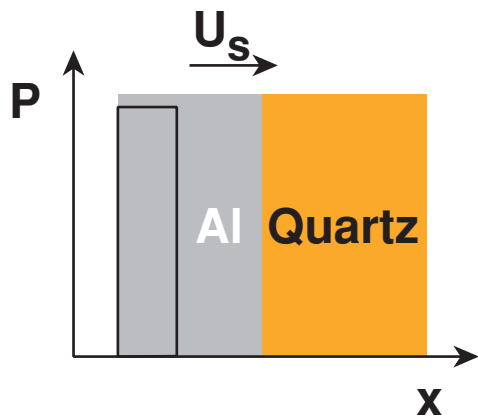


Reshock¹ experiments are useful for resolving different models for D₂ EOS

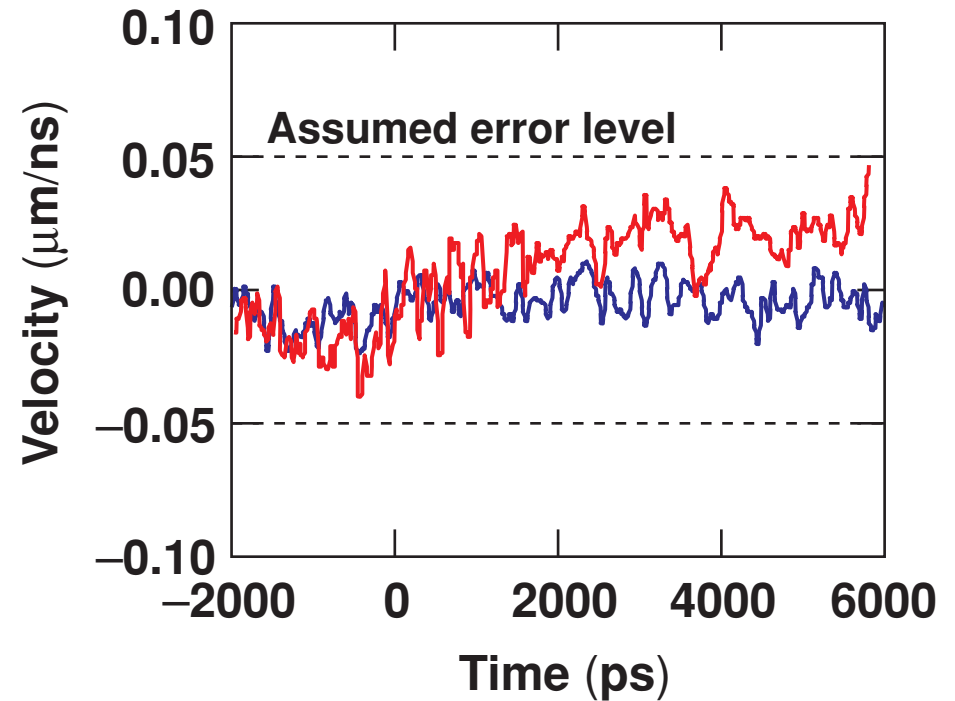
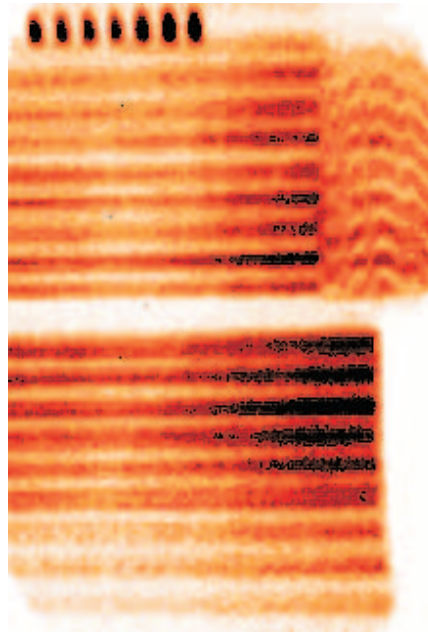
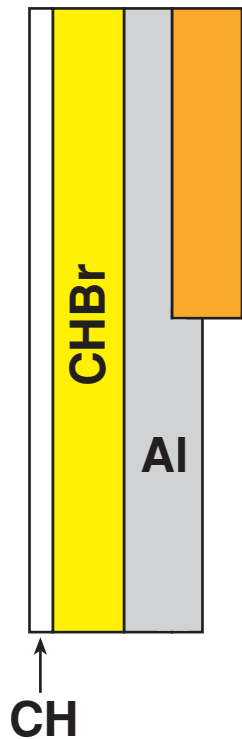


¹ A. Mostovych *et al.*, PoP 8, 2281 (2001).

The impedance-match method relies on the shock and release behaviors of a known standard

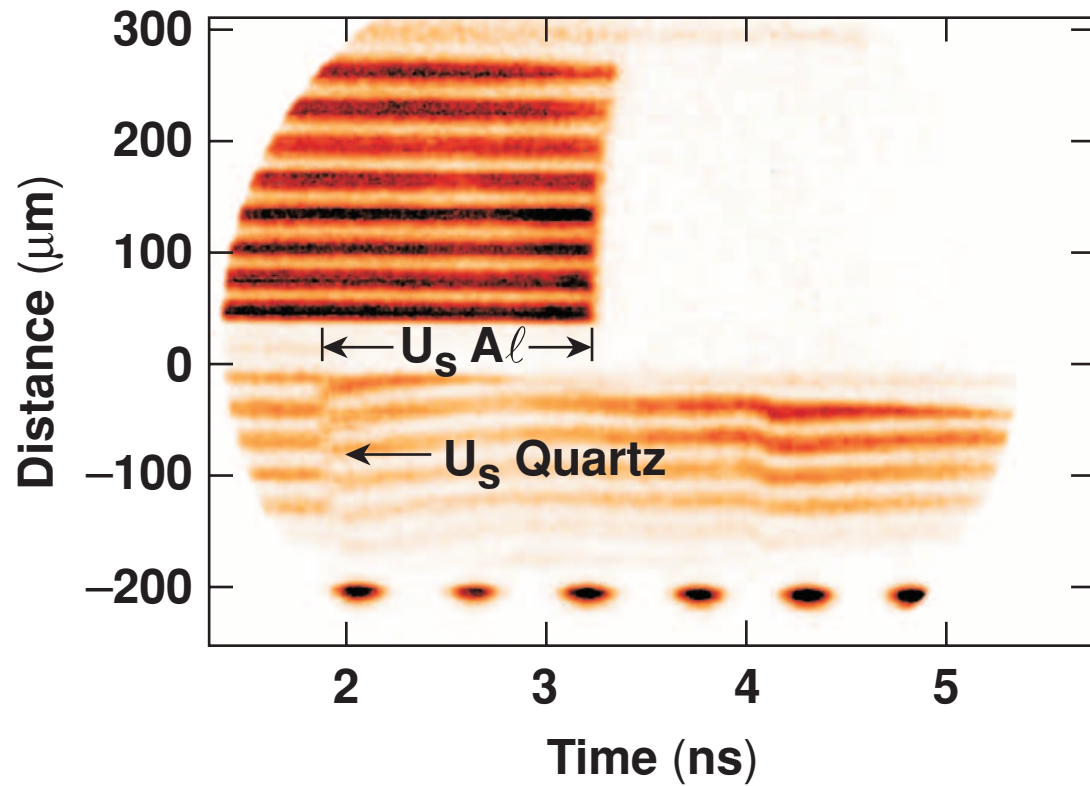
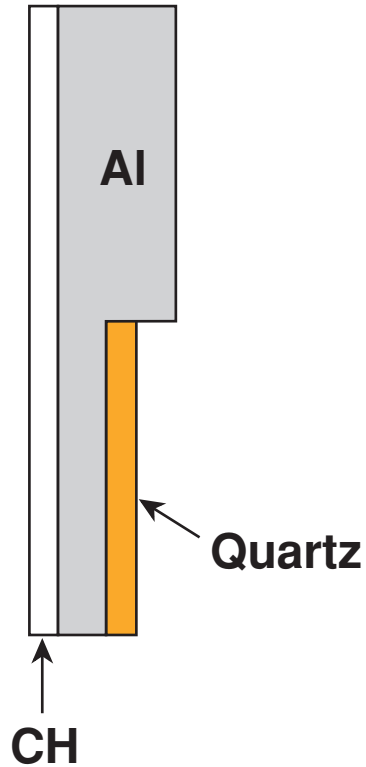


Highly sensitive velocity measurements indicate negligible preheat at the rear side of the Al pusher

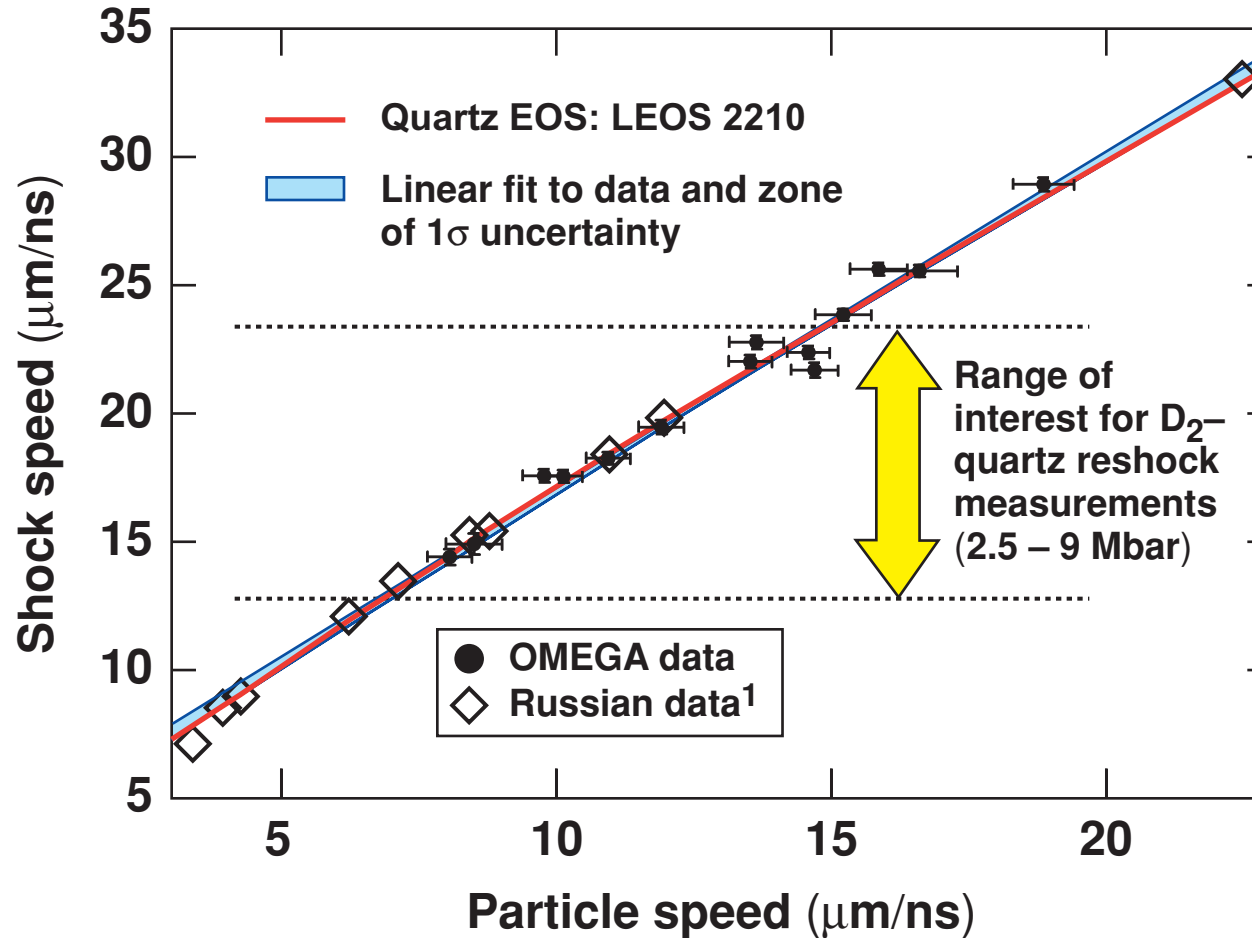


Typical sock velocity = $\sim 20 \mu\text{m/ns}$

Quartz EOS is determined from impedance-matching with aluminum

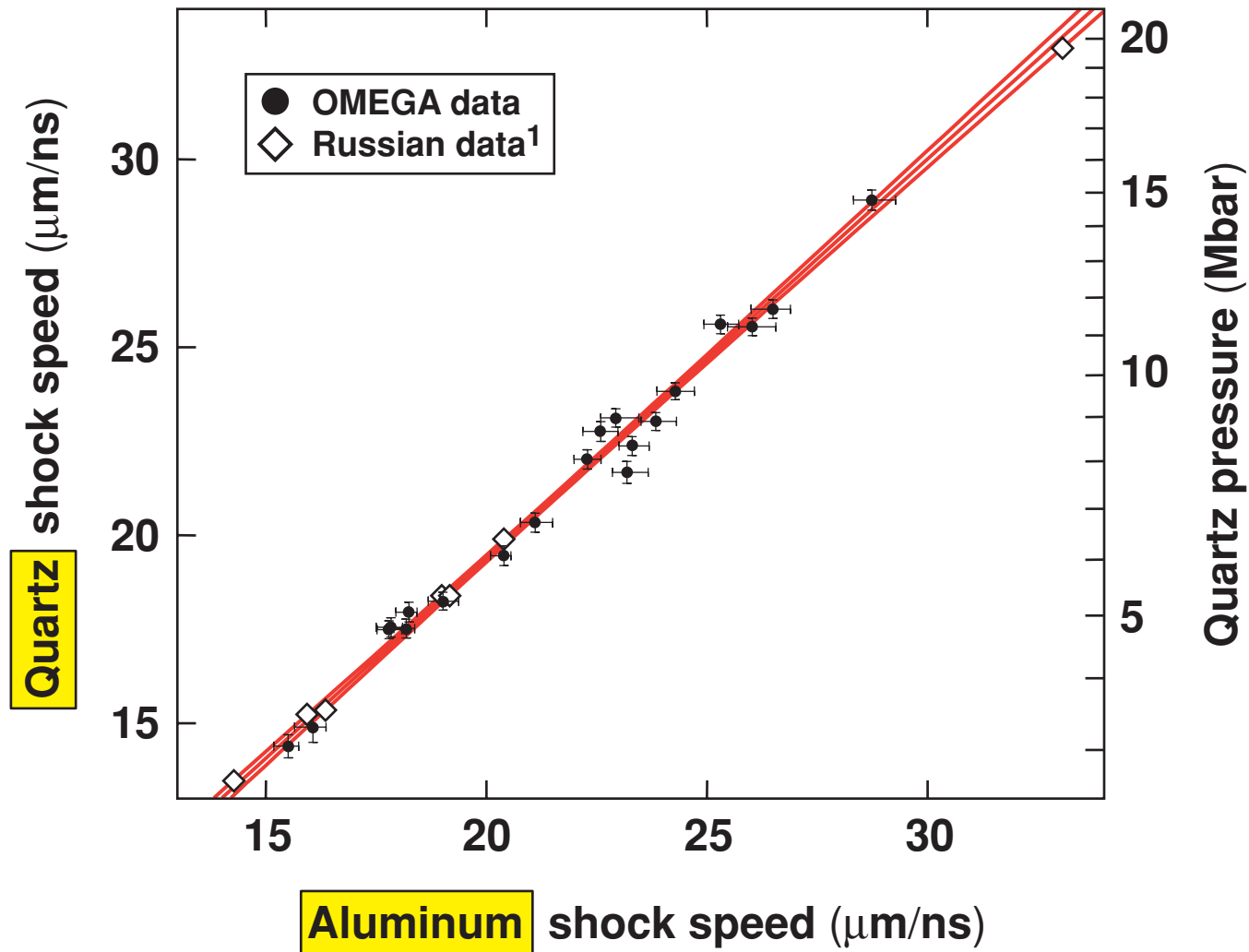


The measured EOS for quartz matches established measurements and models

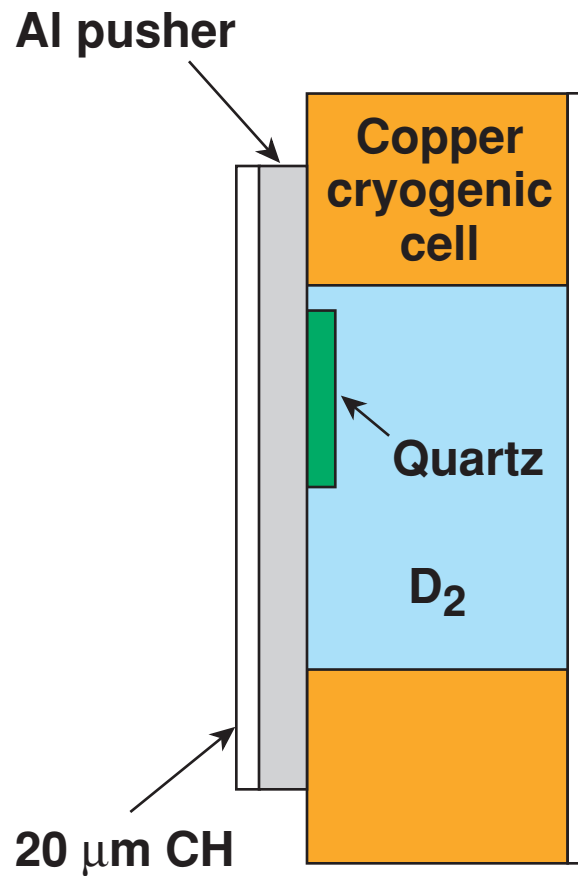


• Individual errors of $\sim 3.5\%$ are reduced to $\sim 1.5\%$ when ensemble is considered.

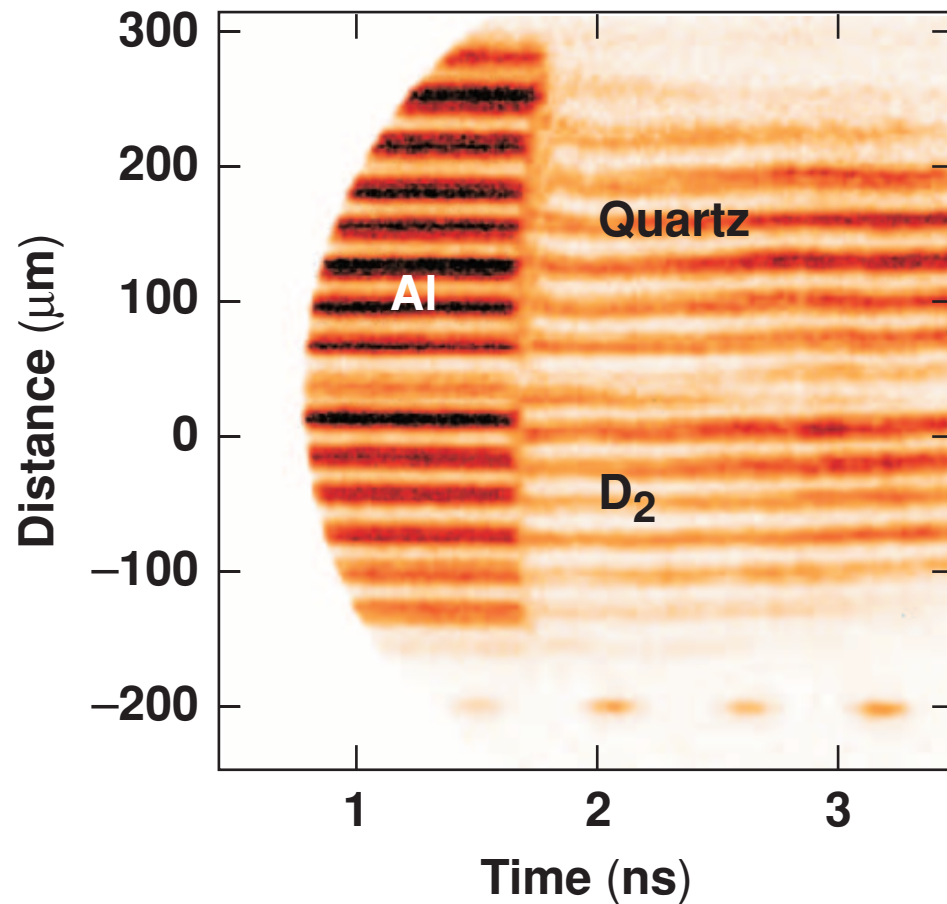
Relationship between U_s (Al) and U_s (quartz) provides the basis for a new technique



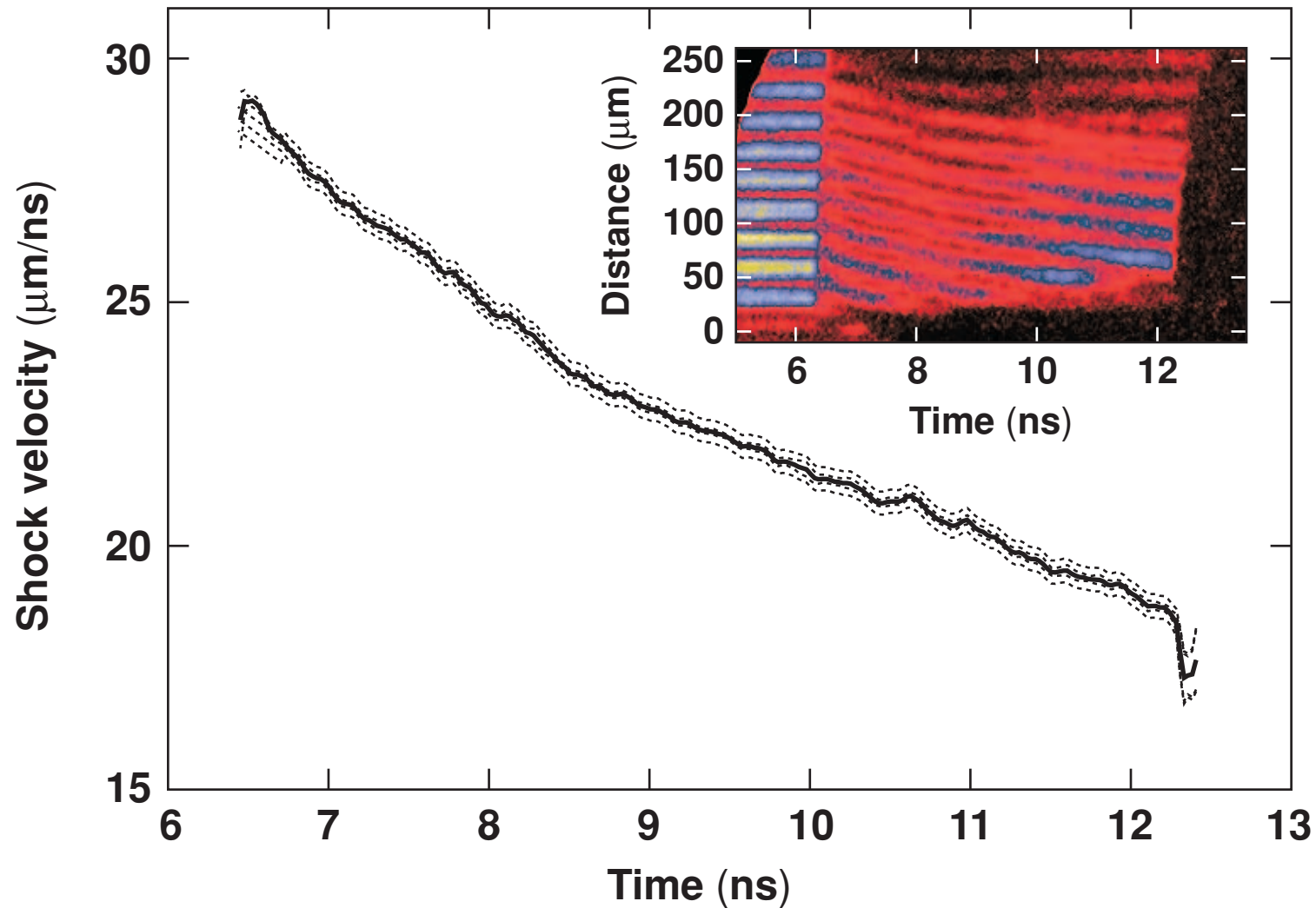
A quartz witness provides Al pressure for impedance matching in cryogenic deuterium



VISAR for shot 32254



Monotonic form of decaying velocity profile suggests no phase transitions present



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