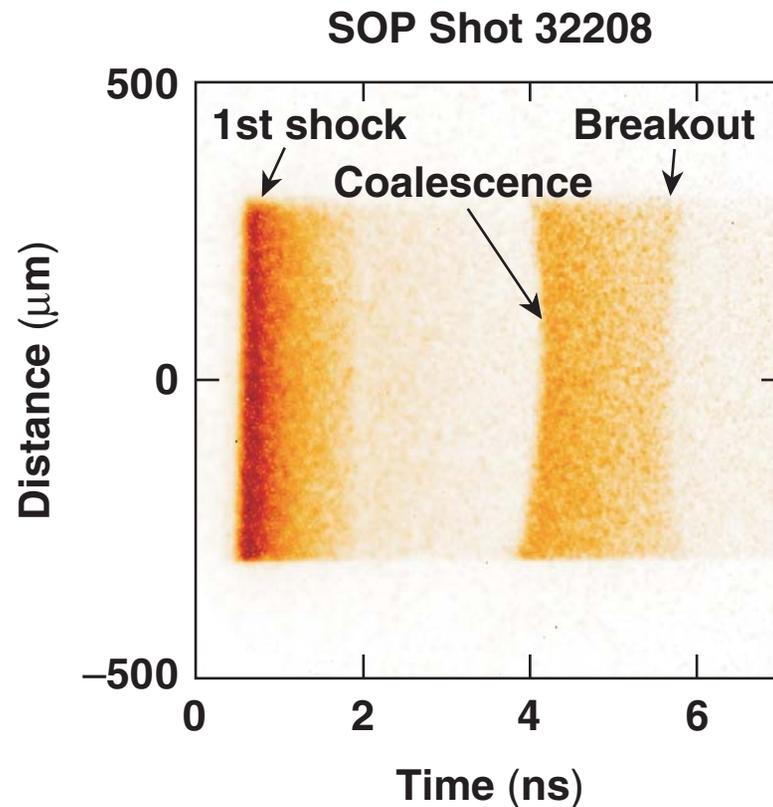


Time-Resolved Measurement of Optical Self-Emission for Shock Wave and Equation of State Studies



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Collaborators



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Lawrence Livermore National Laboratory

Summary

Simulations of cryogenic D₂ experiments agree well with observations made utilizing the SOP

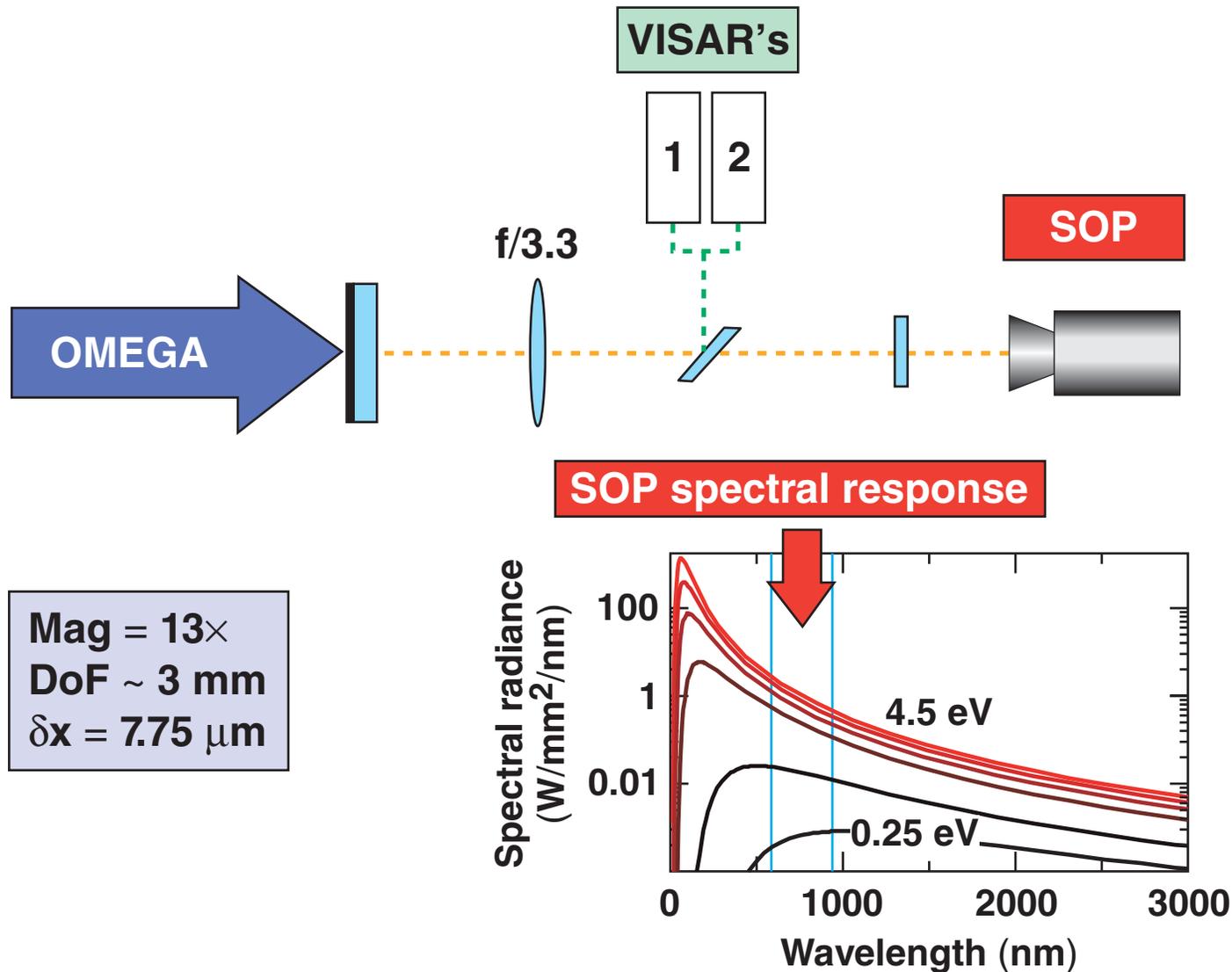


- The streaked optical pyrometer (SOP) is a time-resolved, self-emission diagnostic¹ recently configured to run simultaneously with VISAR.²
- Spatial and temporal calibration of SOP records have been verified with VISAR.
- Temperature measurements using the absolute spectral calibration are useful in evaluating EOS models.
- Optical self-emission will be a key diagnostic of future shaped-pulse work.

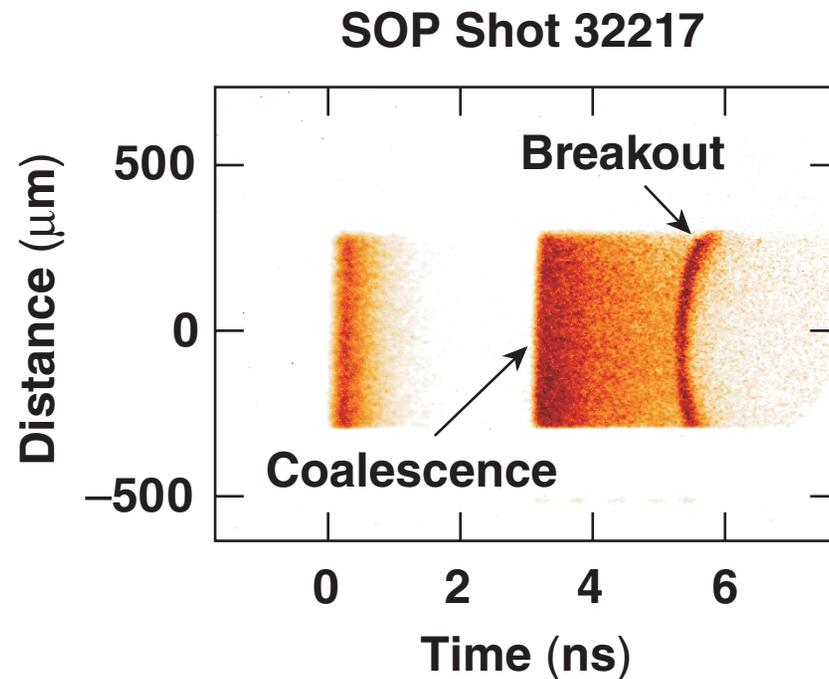
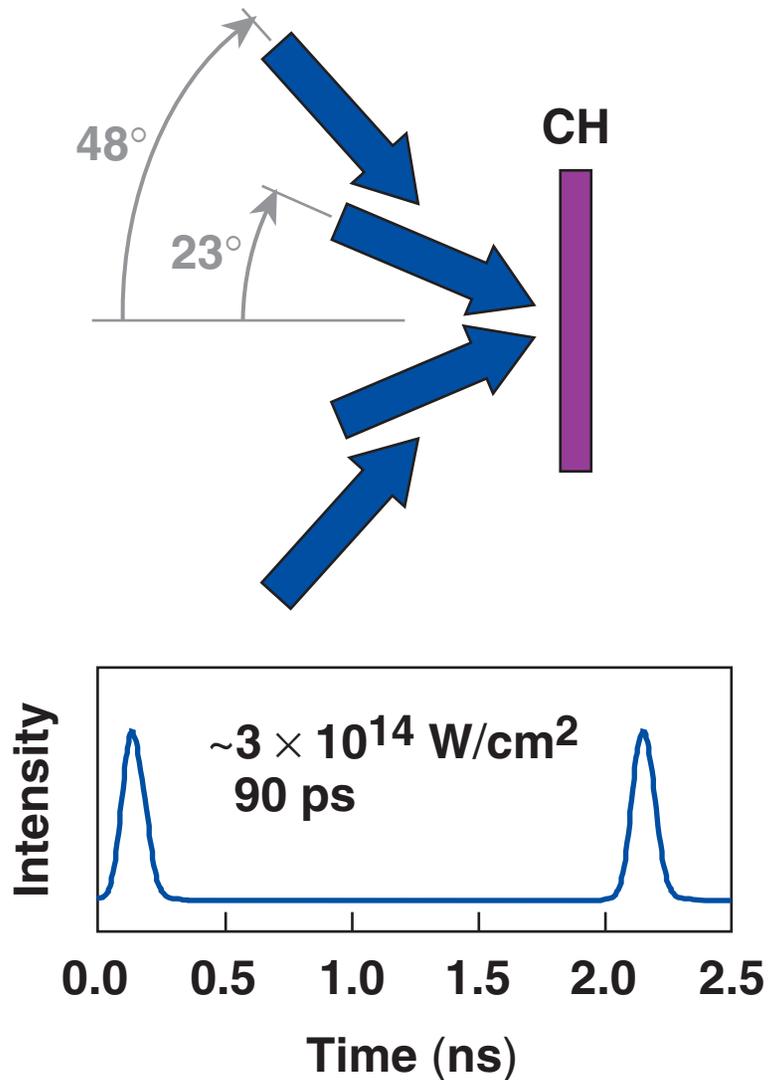
¹ J. A. Oertel *et al.*, Rev. Sci. Instrum. 70, 803 (1999).

² Velocity Interferometer System for Any Reflector

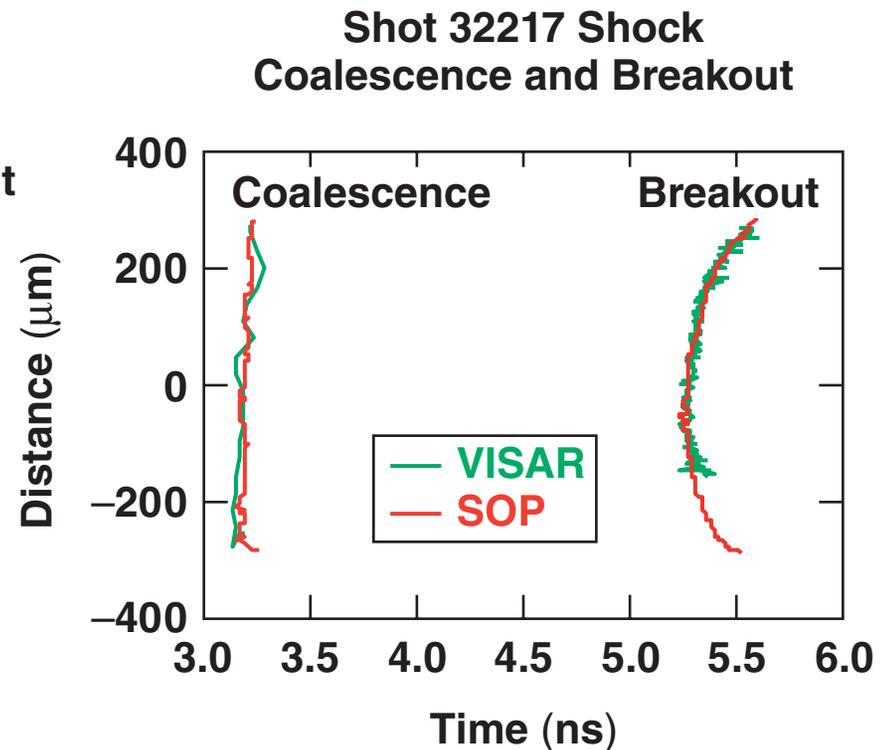
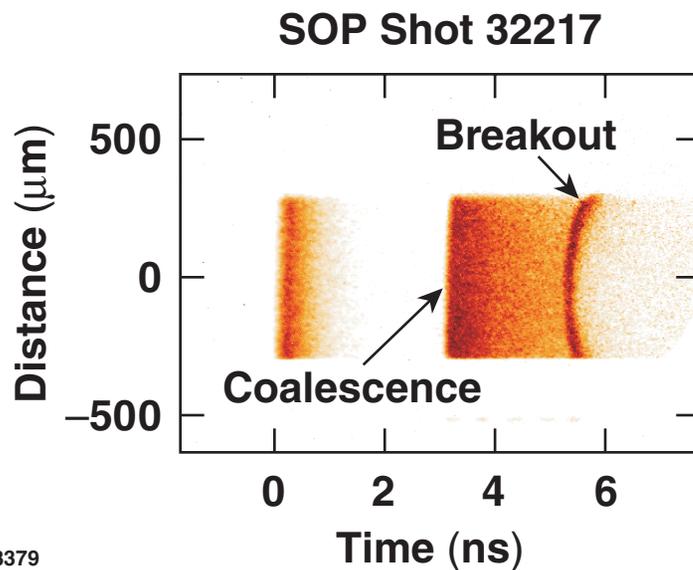
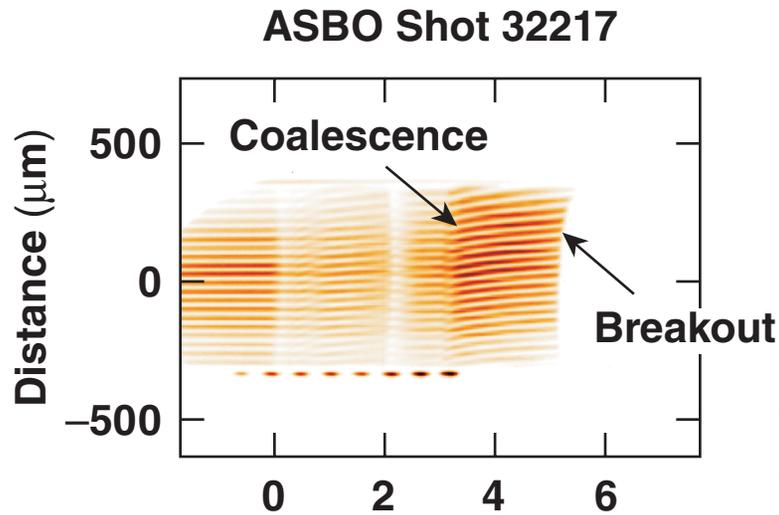
Optical self-emission data are acquired simultaneously with shock velocity from VISAR



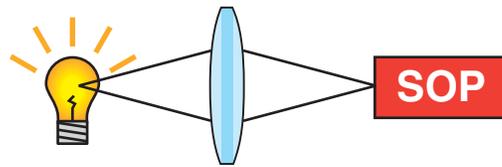
Shock coalescence in multi-shock experiments is detected in self-emission temporal records



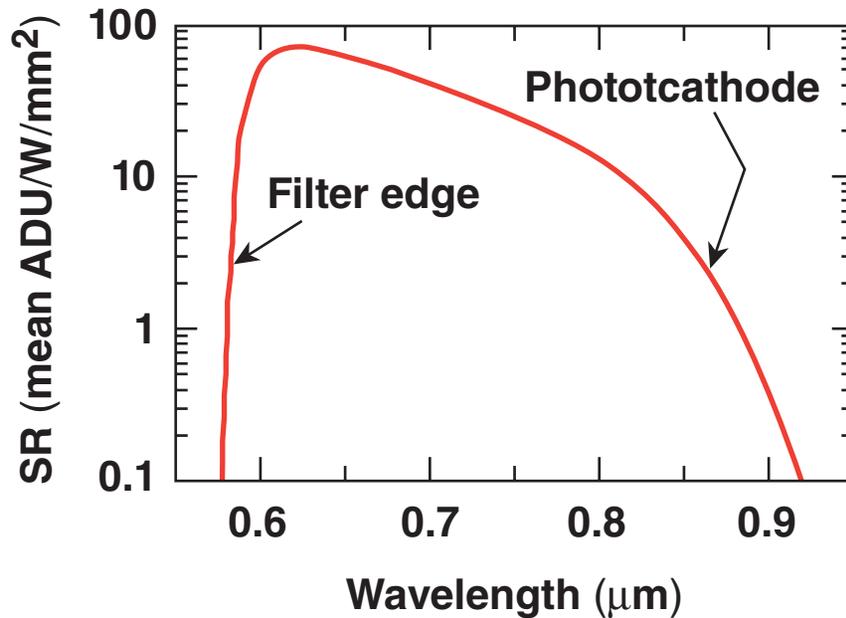
The SOP provides excellent shock timing agreement with VISAR resulting in a reliable measure of 2-D effects



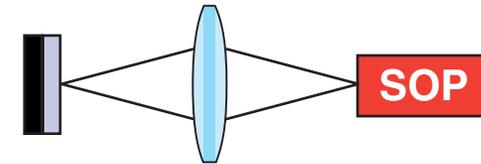
The SOP spectral response was absolutely calibrated* to relate SOP output to brightness temperature



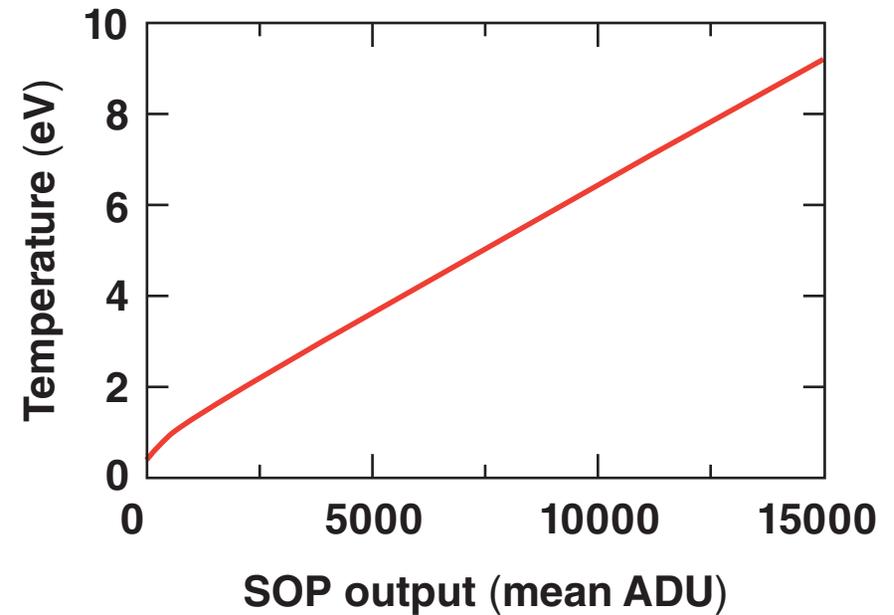
Spectral Response Function of the SOP



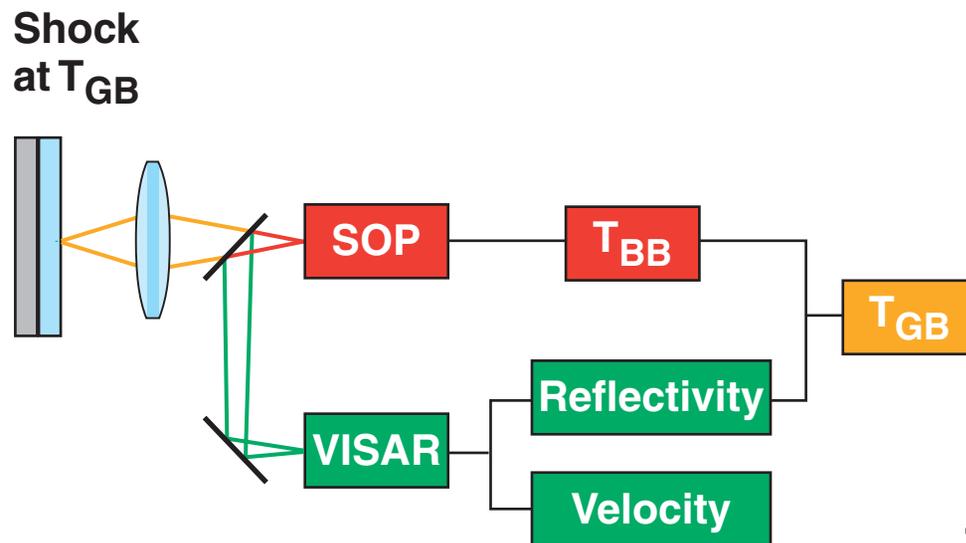
Black Body



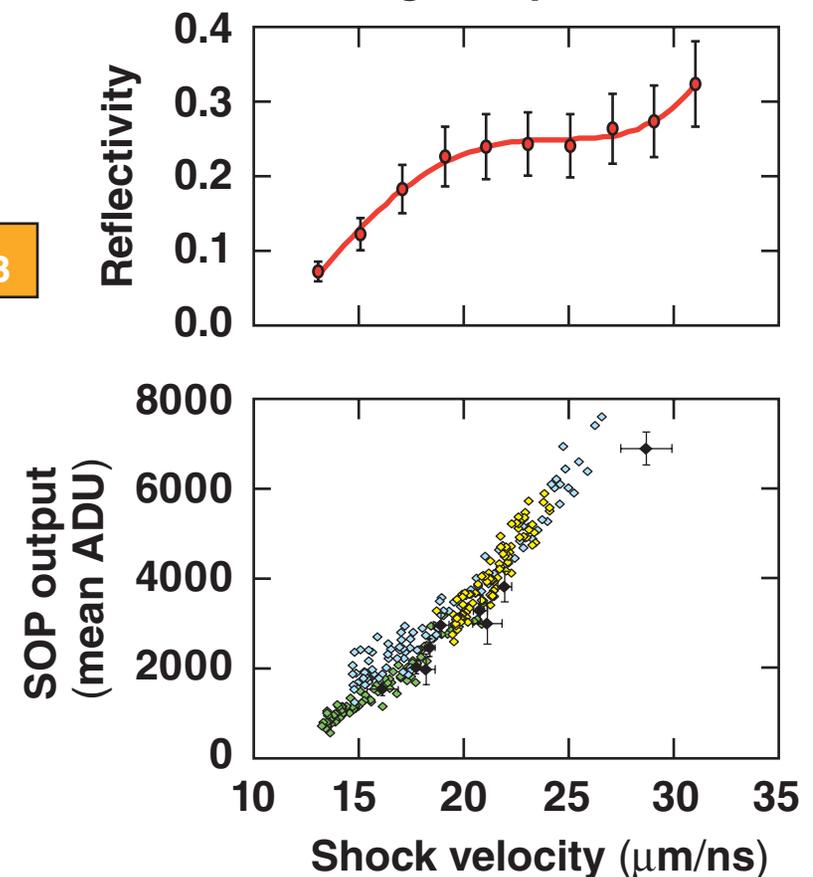
Black-Body Temperature Dependence of SOP Output



Equation of state studies involve the simultaneous measurements of reflectivity, shock velocity and self-emission data

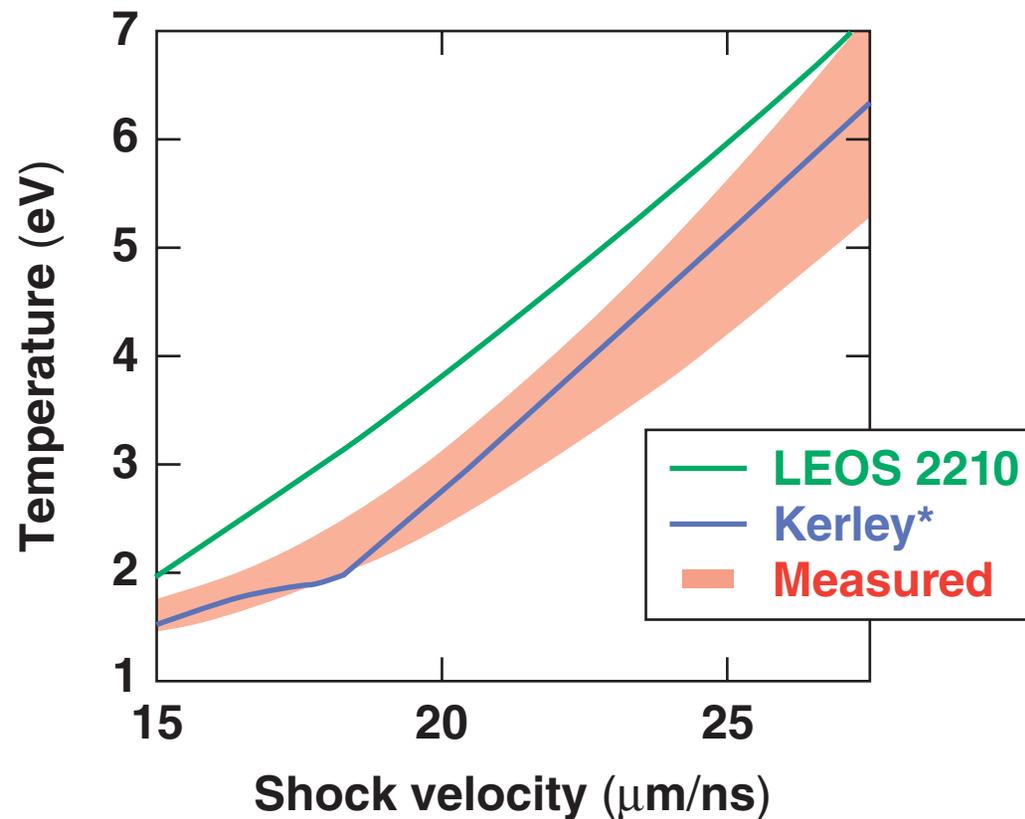


∞ - Quartz Reflectivity and SOP Output Shock Strength Dependence



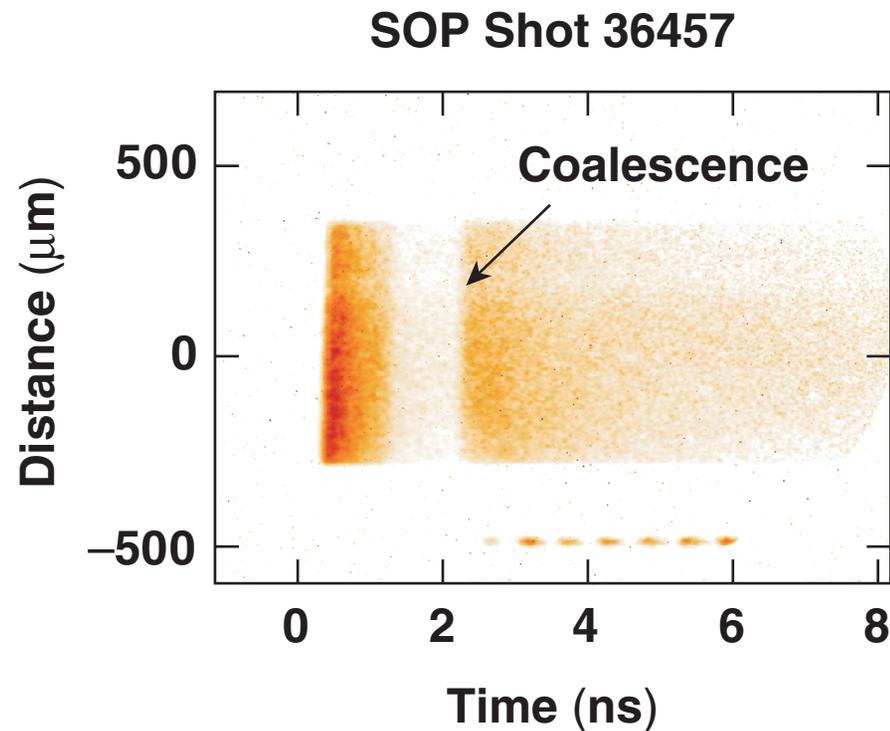
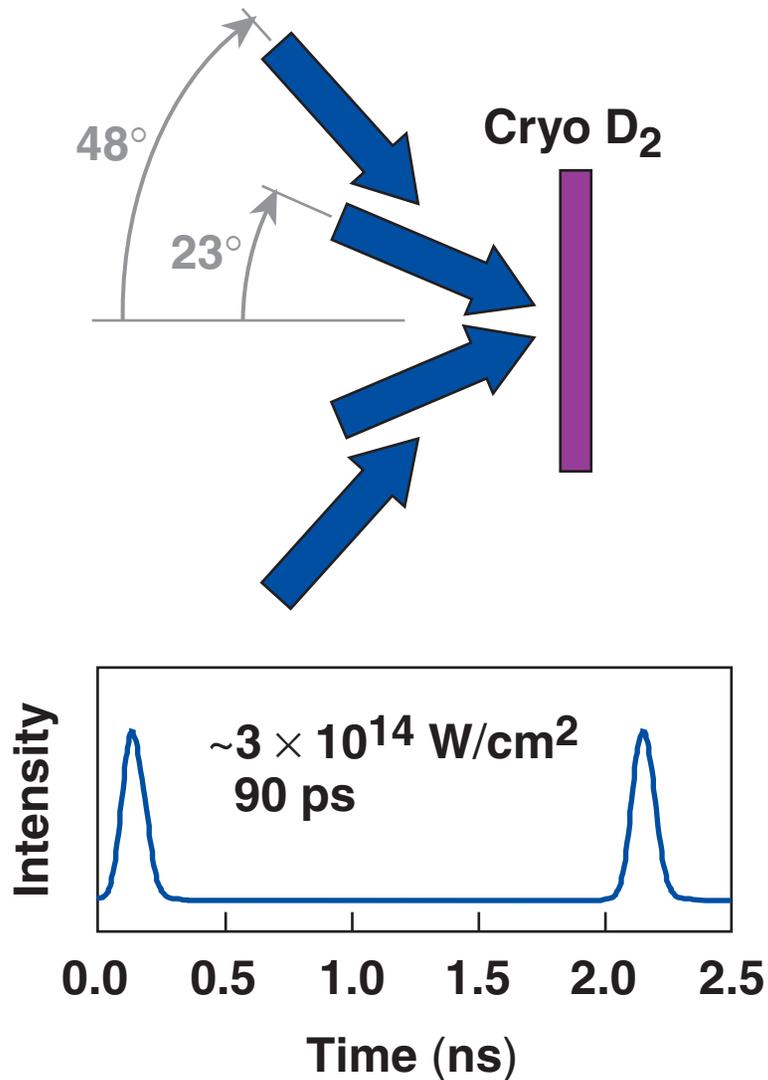
The measured shock temperature can be used to evaluate EOS models of pusher materials for shock timing experiments

α – Quartz Temperature Shock Strength Dependence

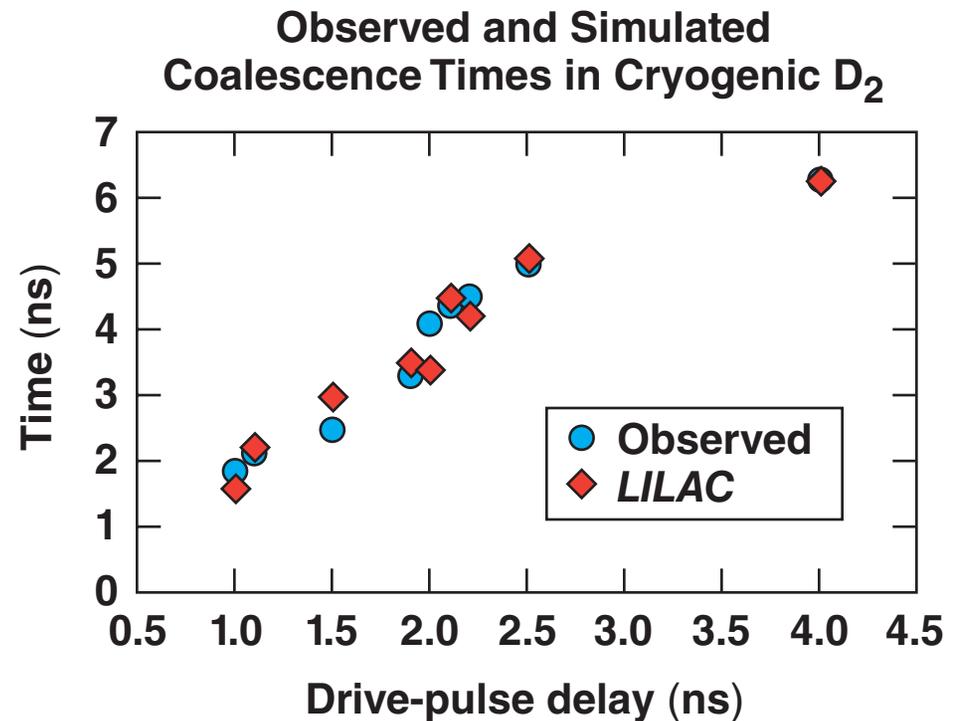
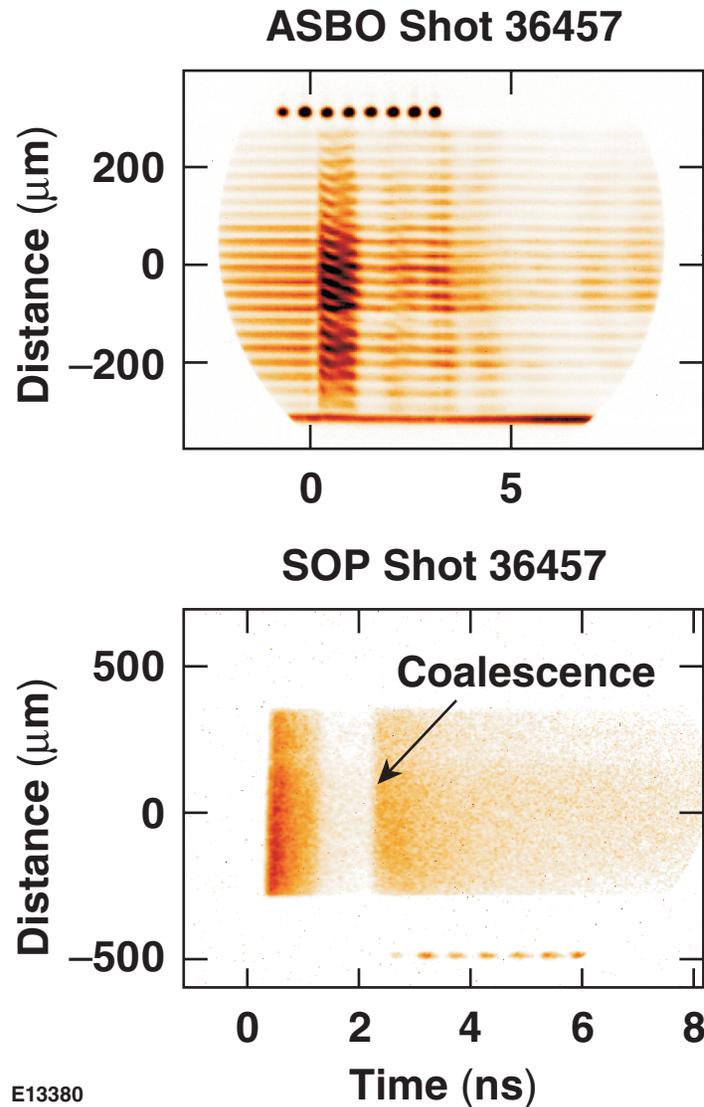


* G. Kerley, "Equations of State for Composite Materials", SANL Report KPS 99-4 (1999).

Shock coalescence in multi-shock experiments of D₂ is detected in self-emission temporal records

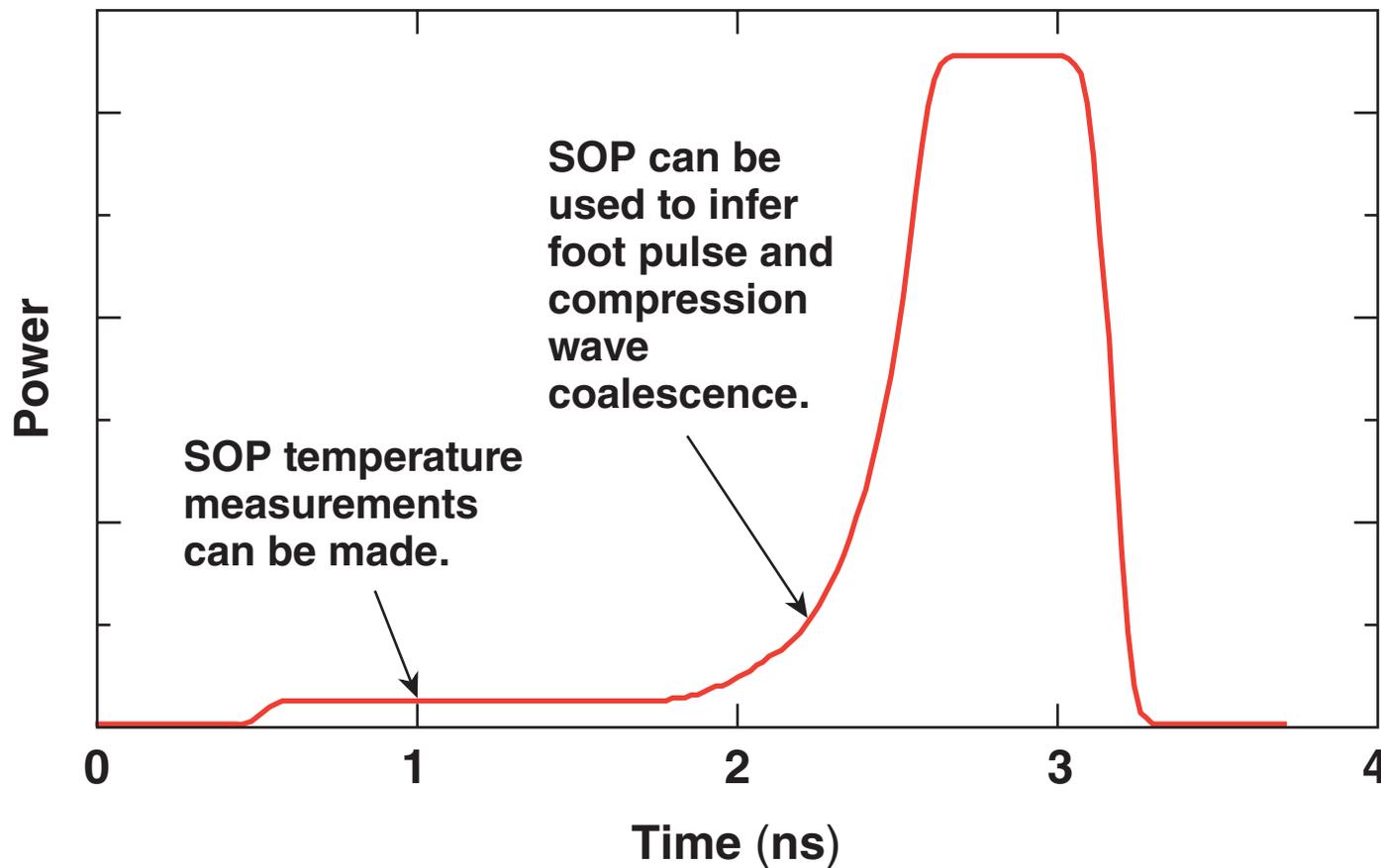


Simulations of cryogenic D₂ shock coalescence agrees well with observations made with the SOP



The SOP is a potential diagnostic for shock timing studies of ICF-relevant shaped pulses in D_2

ICF-Relevant Shaped $\alpha = 4$ Pulse



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