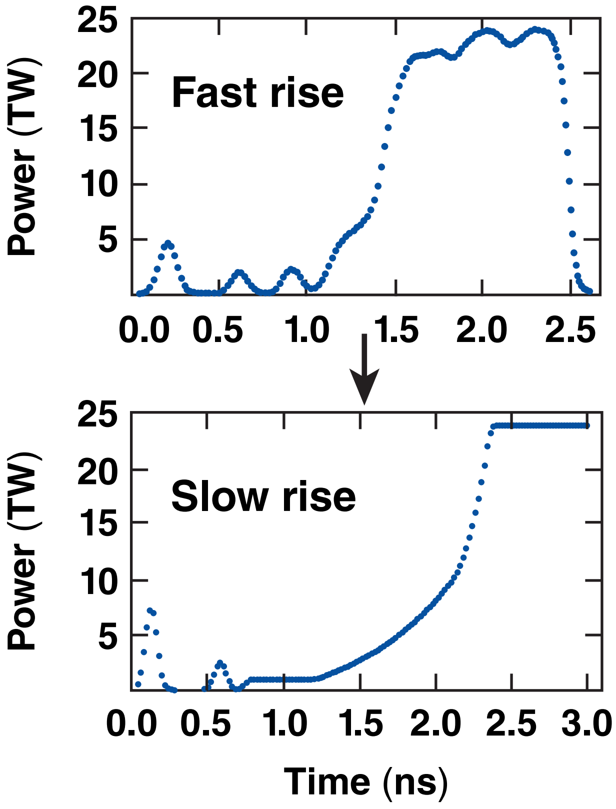
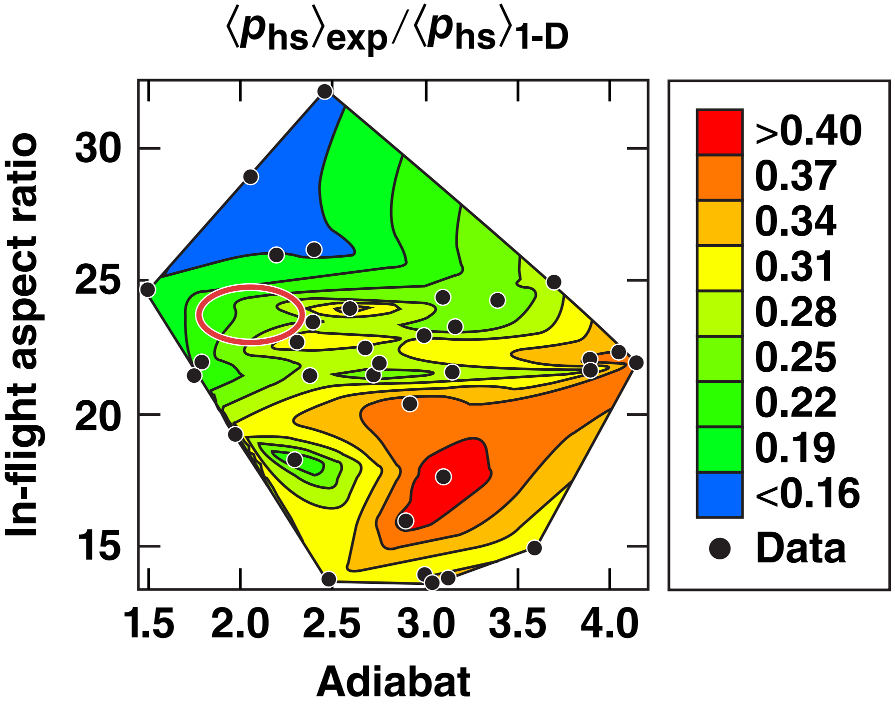
Understanding the Performance of Low-Adiabat Cryogenic Implosions on OMEGA





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Summary

Several degradation mechanisms are considered to explain the performance of low-adiabat cryogenic implosion on OMEGA

- While the moderate-adiabat ($\alpha > 3.5$) implosions are well understood using multidimensional-hydrocode simulations,* the performance of $\alpha < 3$ implosions is degraded relative to code predictions
- Degradation mechanisms include hydrodynamic-instability growth, ablator and cold-fuel mix, and 1-D dynamics
- The effect of reduced hydroefficiency observed during the main pulse rise is studied using slow-rise pulses
- The agreement of the predicted ablation-front trajectories and scattered-light spectra with the data is improved in slow-rise pulses
- The observed red-shifted feature in the scattered light indicates a potential importance of the stalk on target performance

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*V. N. Goncharov *et al.*, Phys. Plasmas 21, 056315 (2014).

Collaborators

T. C. Sangster, R. Epstein, S. X. Hu, I. V. Igumenshchev, C. J. Forrest, D. H. Froula, F. J. Marshall, R. L. McCrory, D. D. Meyerhofer, D. T. Michel, P. B. Radha, S. P. Regan, W. Seka, and C. Stoeckl

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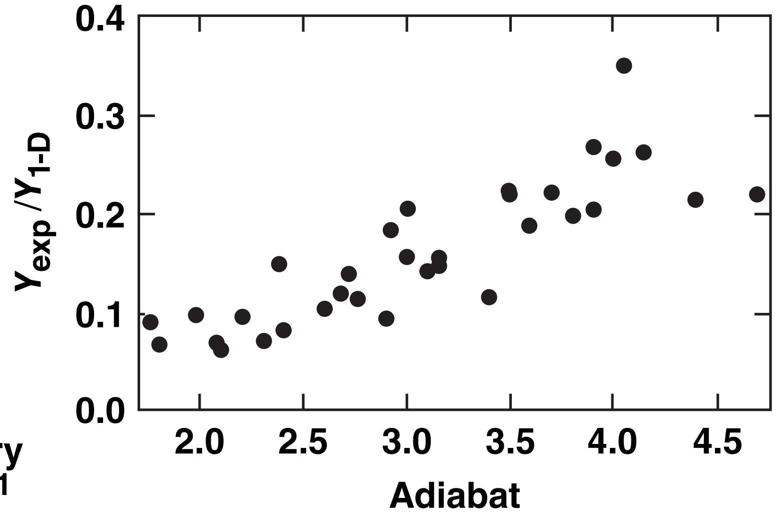
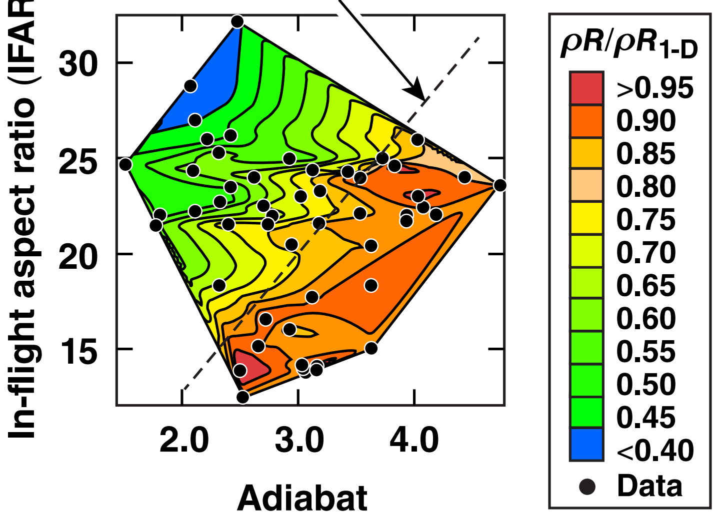
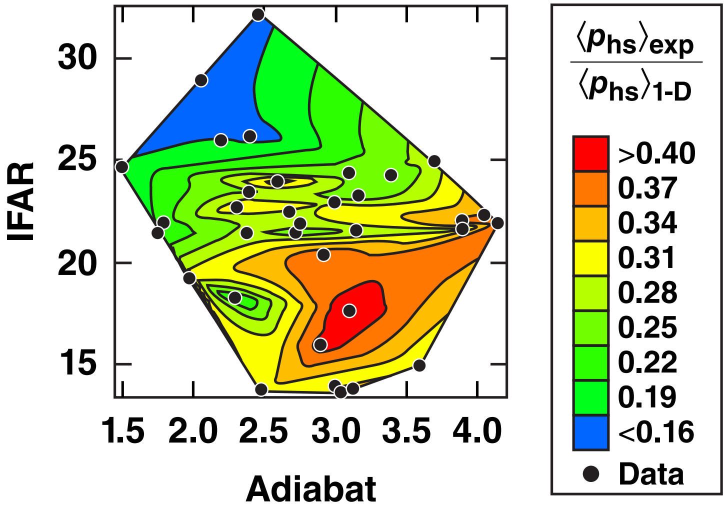
Reduced yields, areal densities, and hot-spot pressures are observed as the adiabat is reduced*







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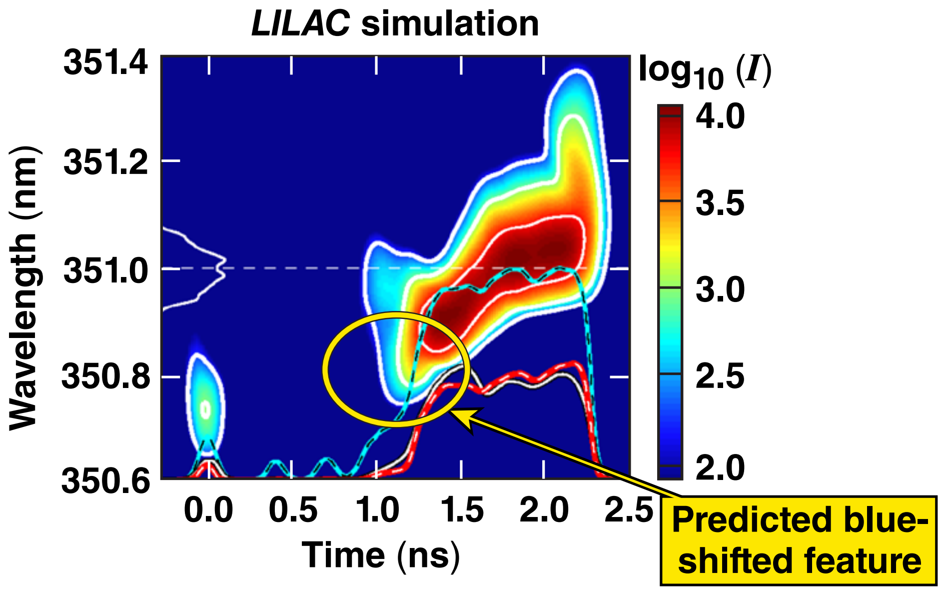
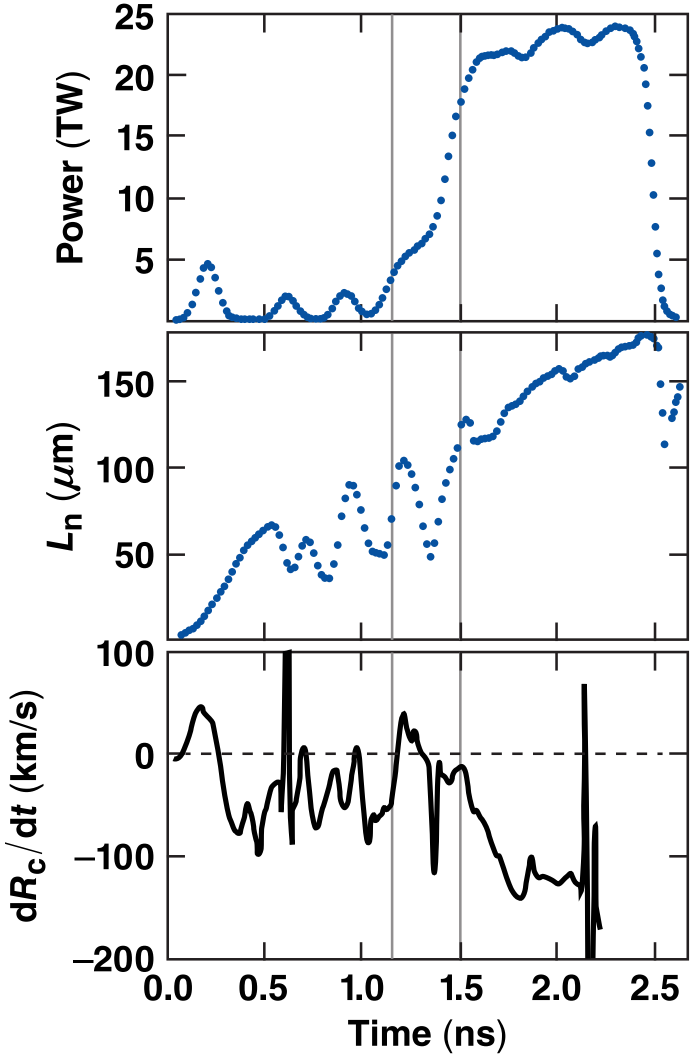
*V. N. Goncharov *et al*., Phys. Plasmas 21, 056315 (2014).

Typical drive pulses are predicted to produce fast plasma expansion at the beginning of the main drive



Predicted blue-shifted feature



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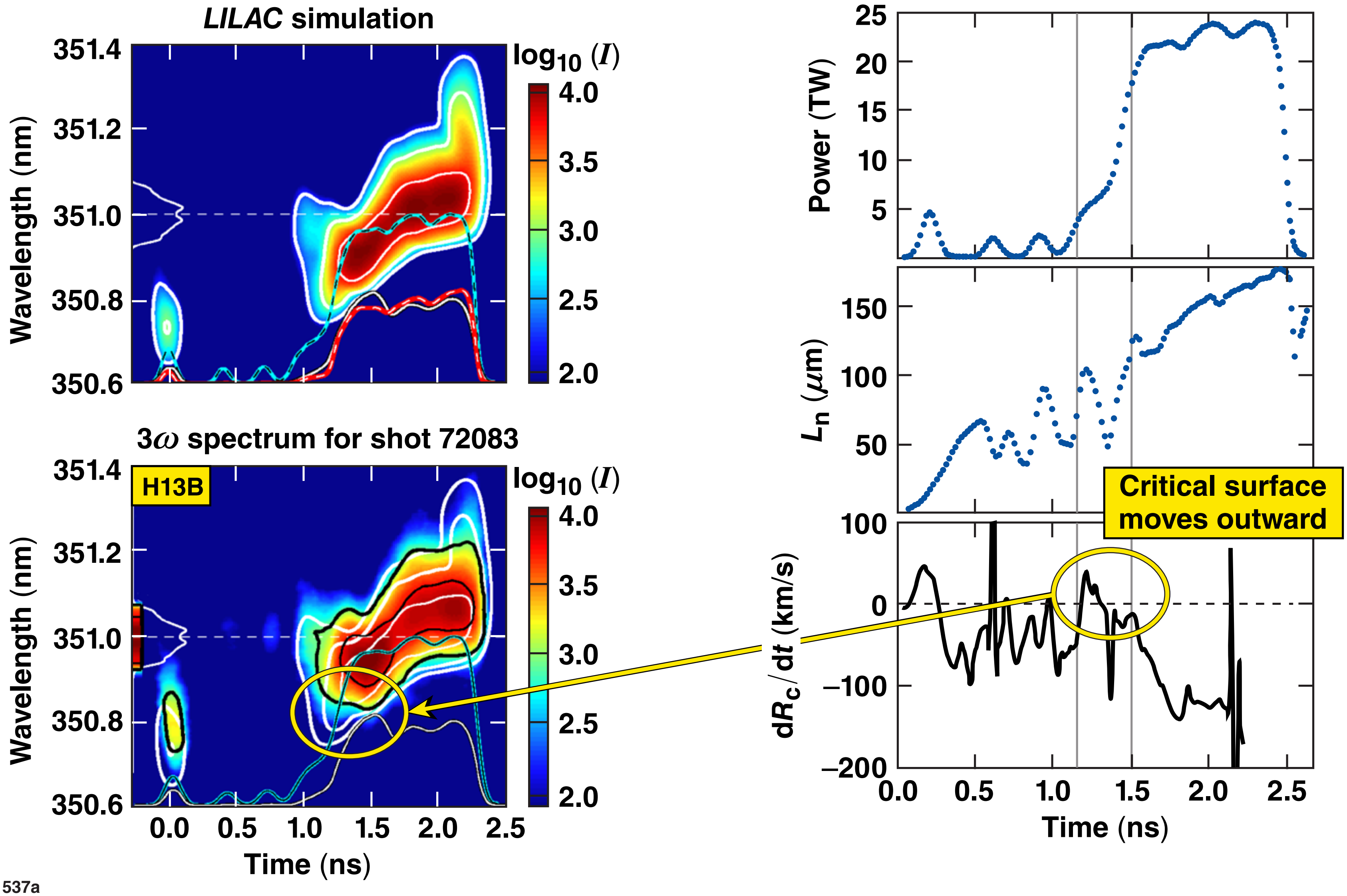
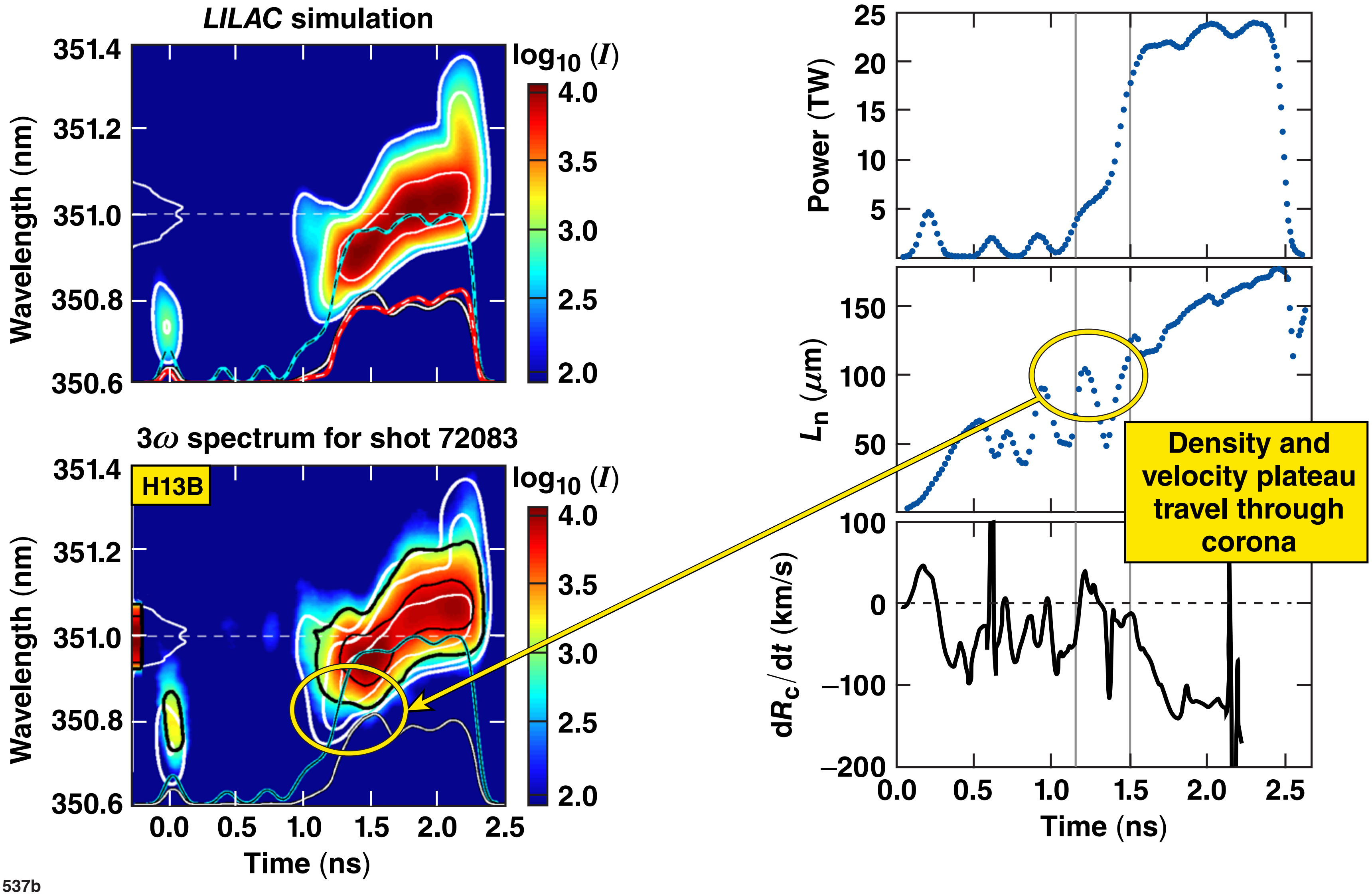


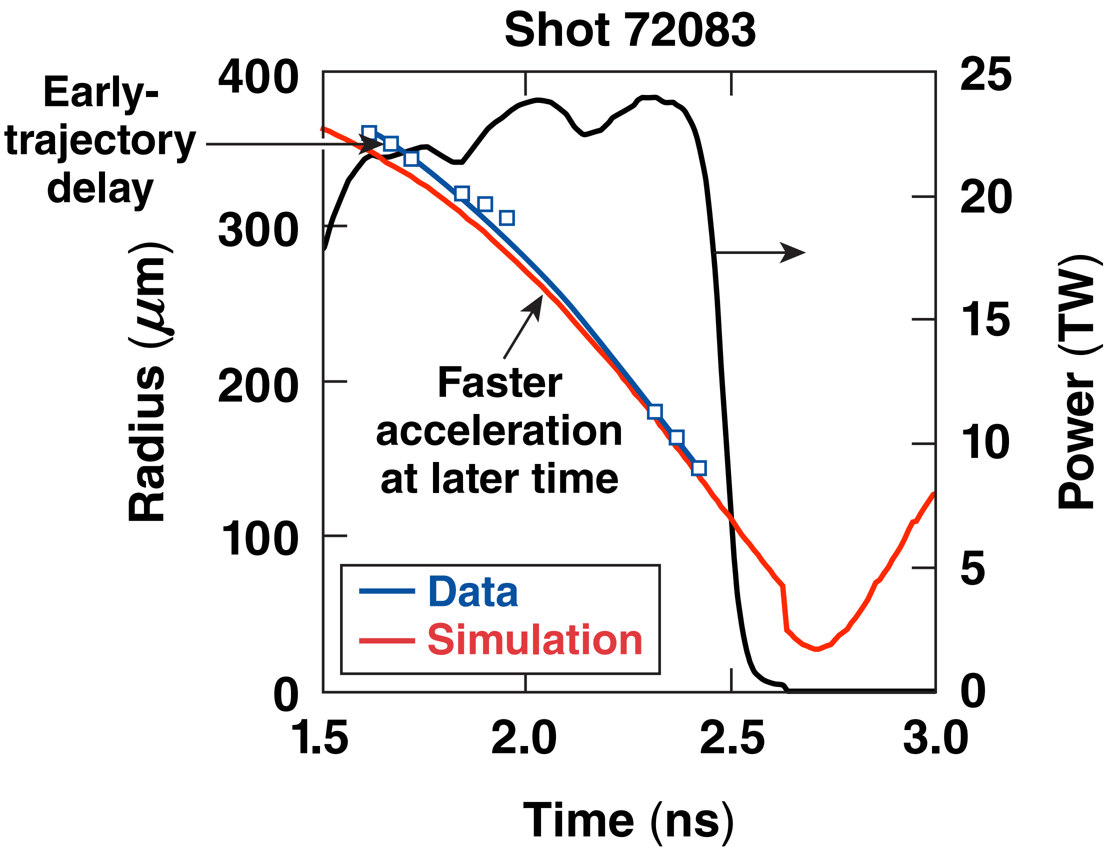
Critical surface moves outward

Typical drive pulses are predicted to produce fast plasma expansion at the beginning of the main drive

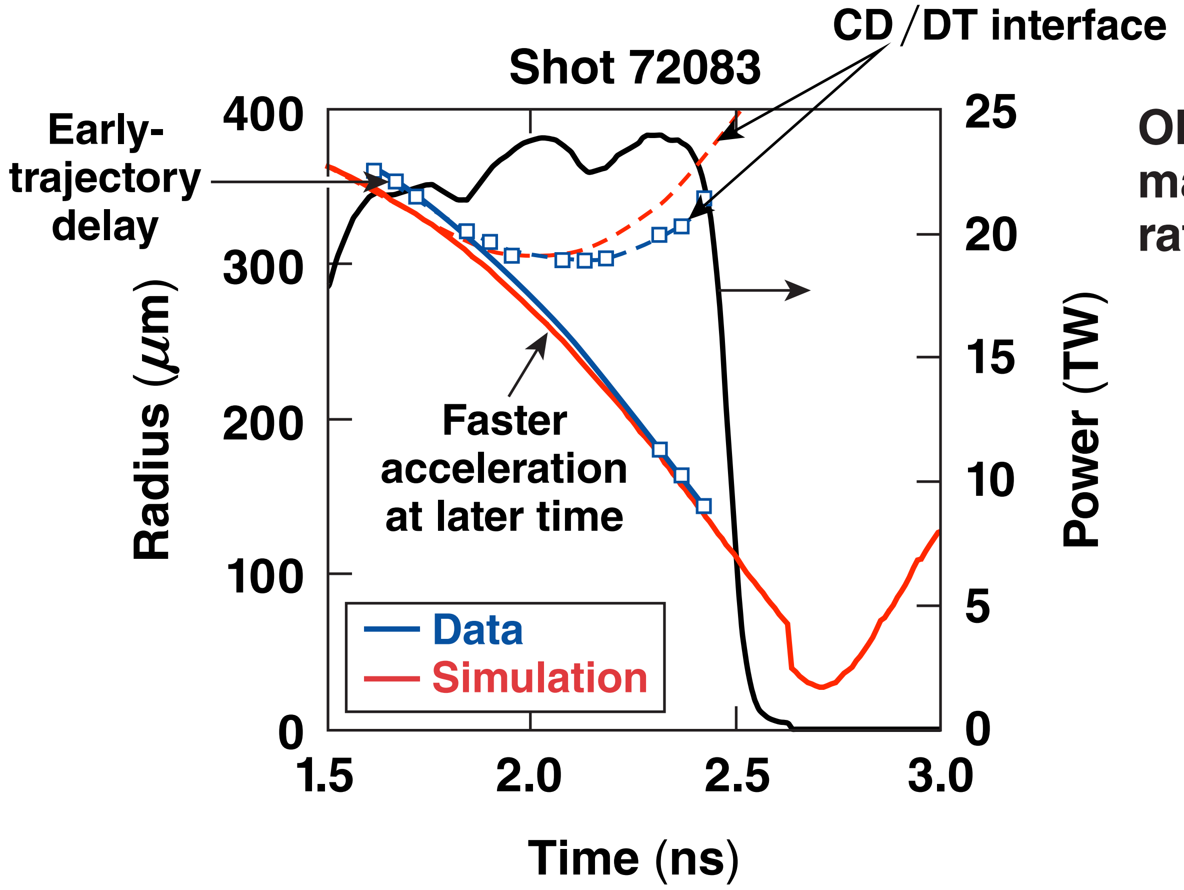


Density and velocity plateau travel through corona

Shell trajectories are delayed during the rise of the main pulse



Shell trajectories are delayed during the rise of the main pulse



Observed mass-ablation rate is reduced*

Ablation-pressure deficiency during the rise and a faster pressure increase later in the pulse may lead to secondary shocks and adiabat degradation.

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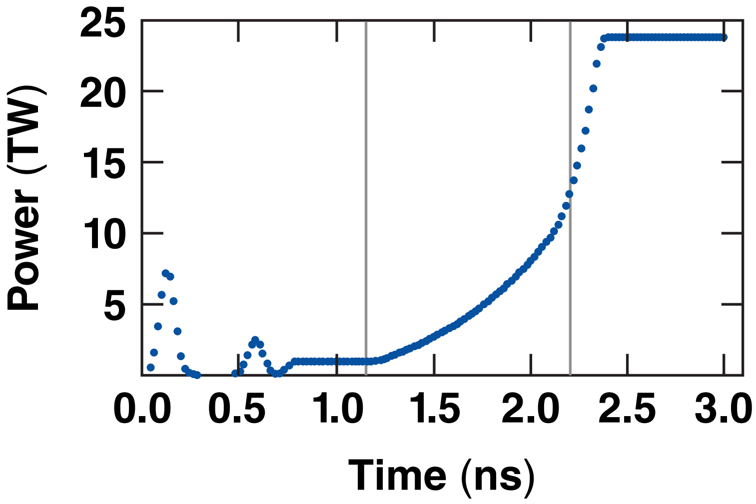
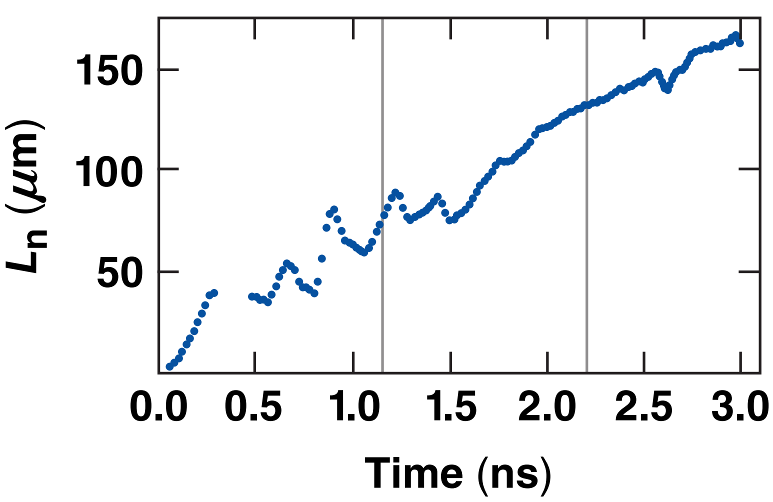
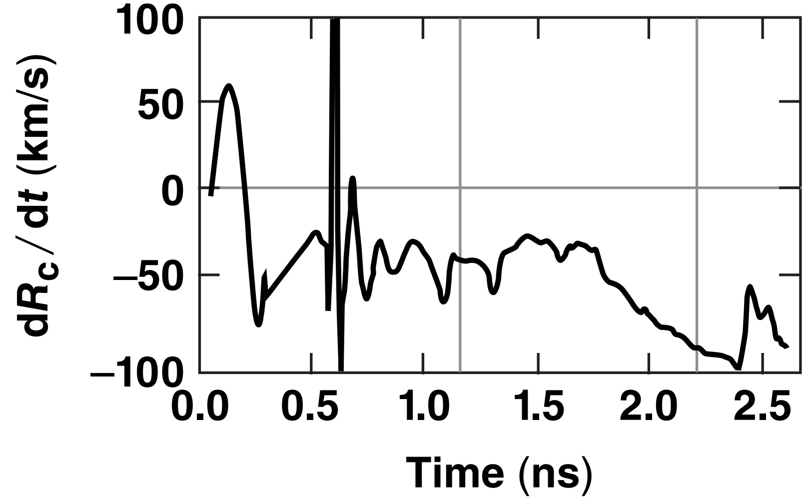
*A. K. Davis *et al*., JO4.00014, this conference.

Reducing the rate of intensity rise eliminates the blue-shifted feature, bringing simulation results closer to the data







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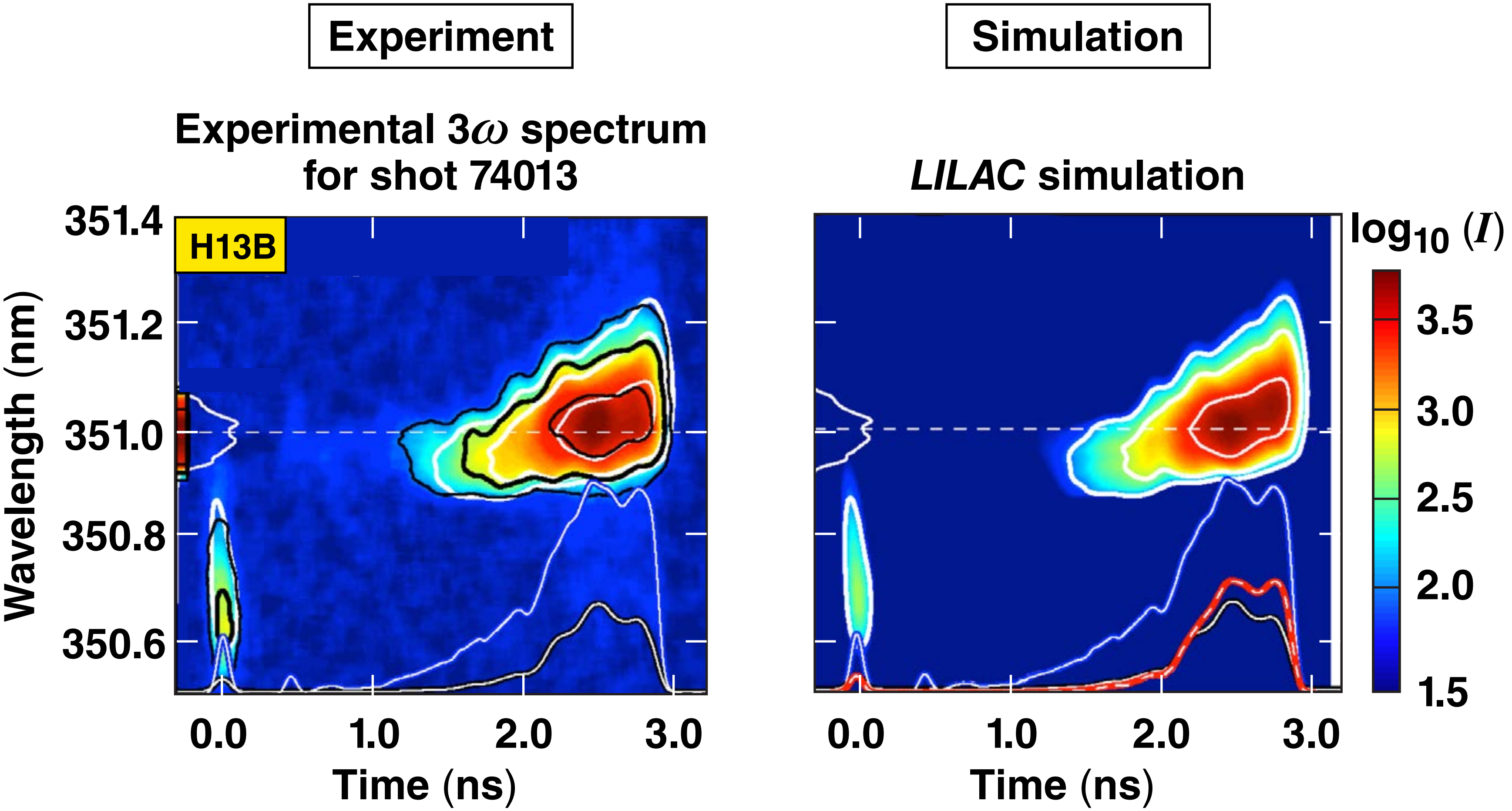
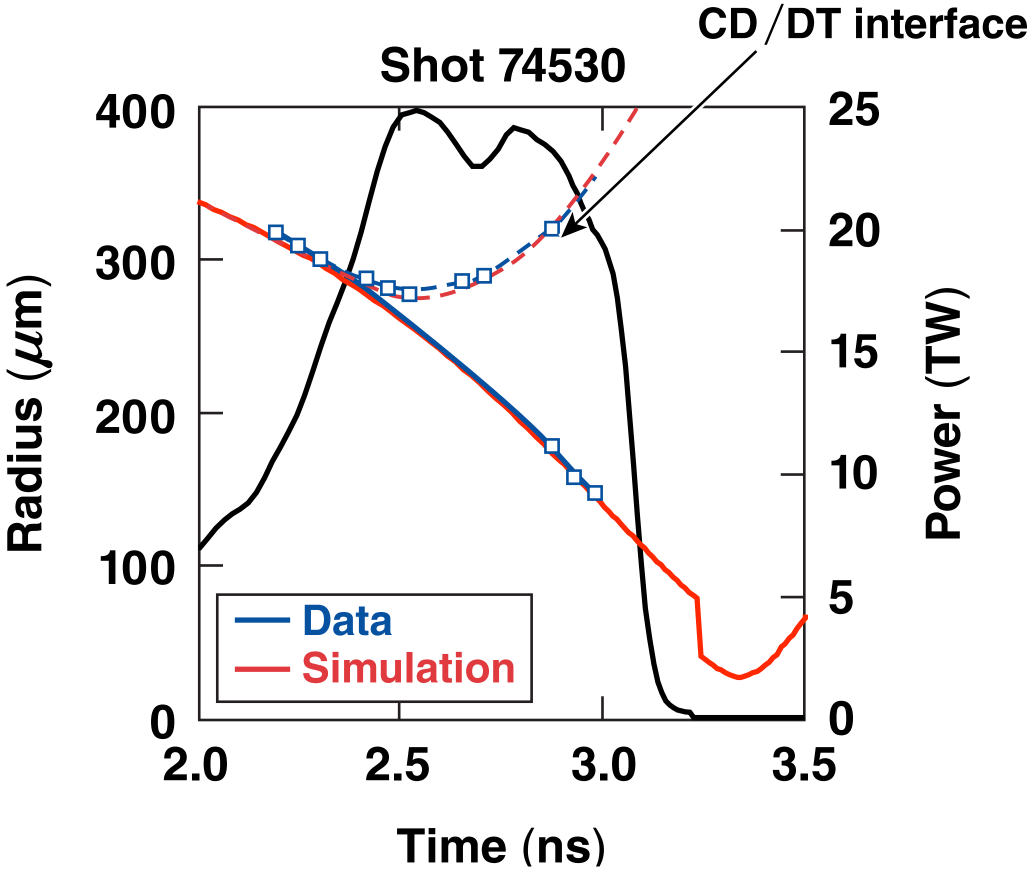
Reducing the rate of intensity rise eliminates the blue-shifted feature, bringing simulation results closer to the data (cont.)



The agreement of the predicted shell trajectories and mass-ablation rate with the data improves in slow-rise pulses*



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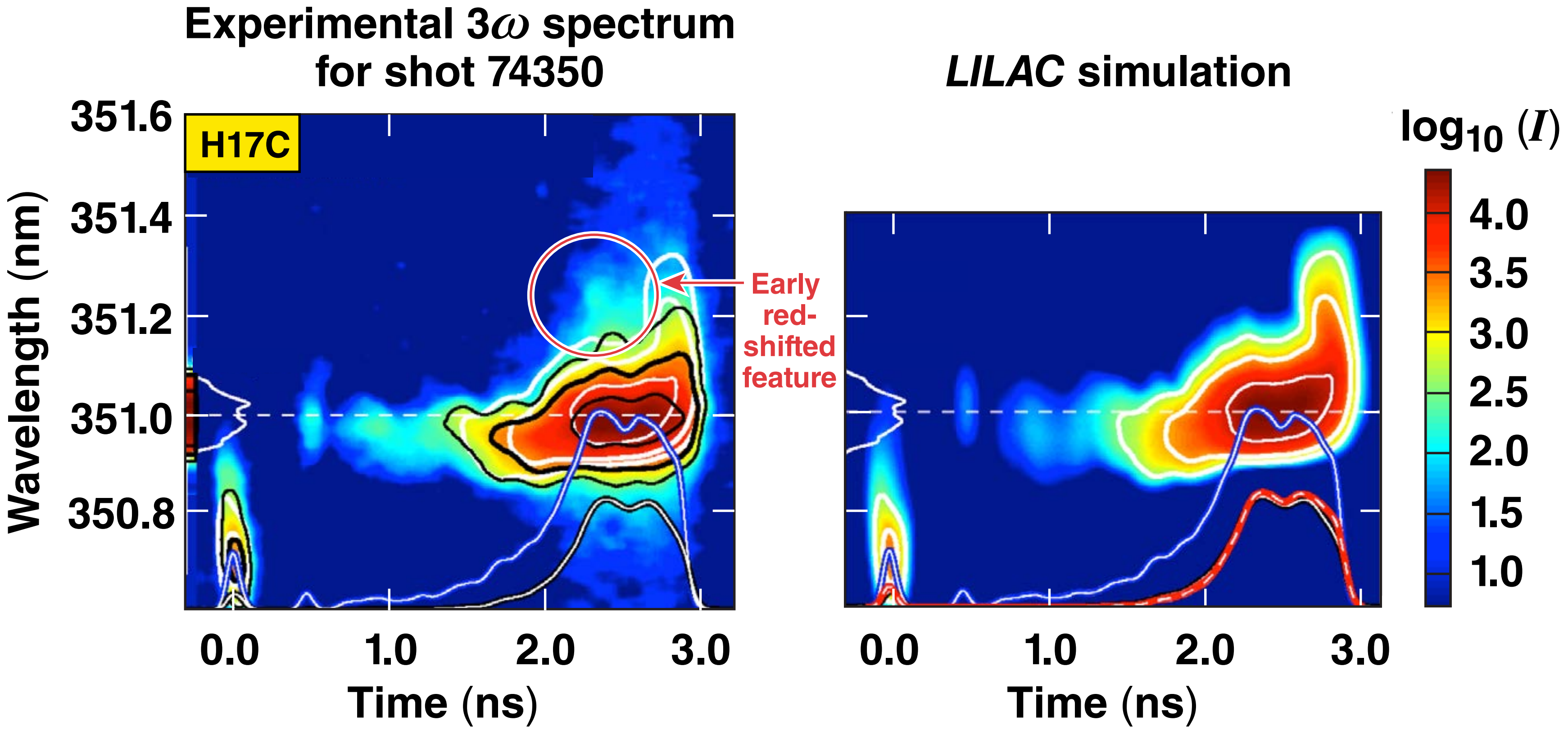
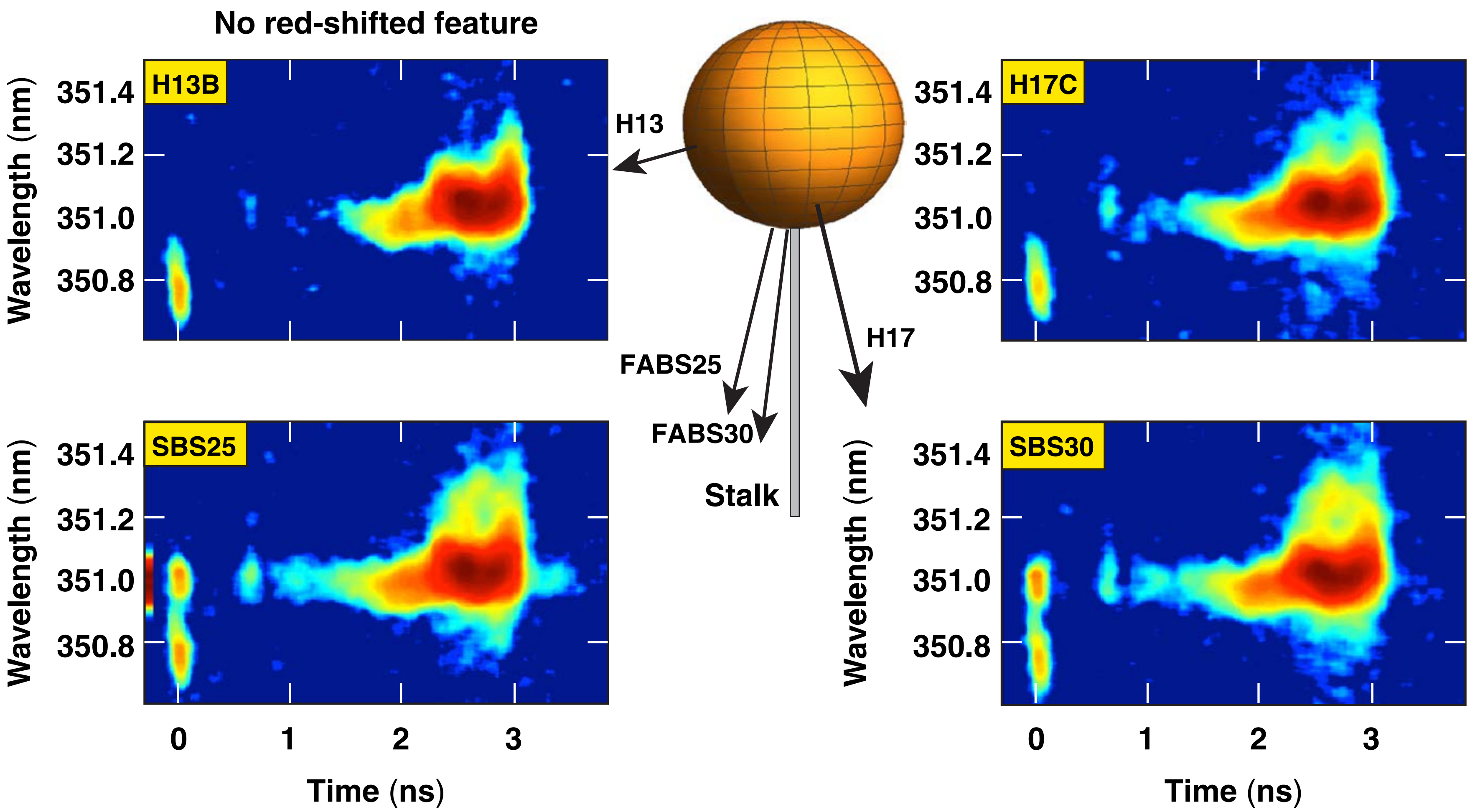
*D. T. Michel *et al.*, JO4.00009, this conference.

The early red-shifted feature in the scattered light suggests premature release of ablated DT into the plasma corona



Early red-shifted feature

The red-shifted feature is observed in detectors close to the target bottom, suggesting a correlation with the stalk



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FABS = full-aperture backscatter station

Summary/Conclusions

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