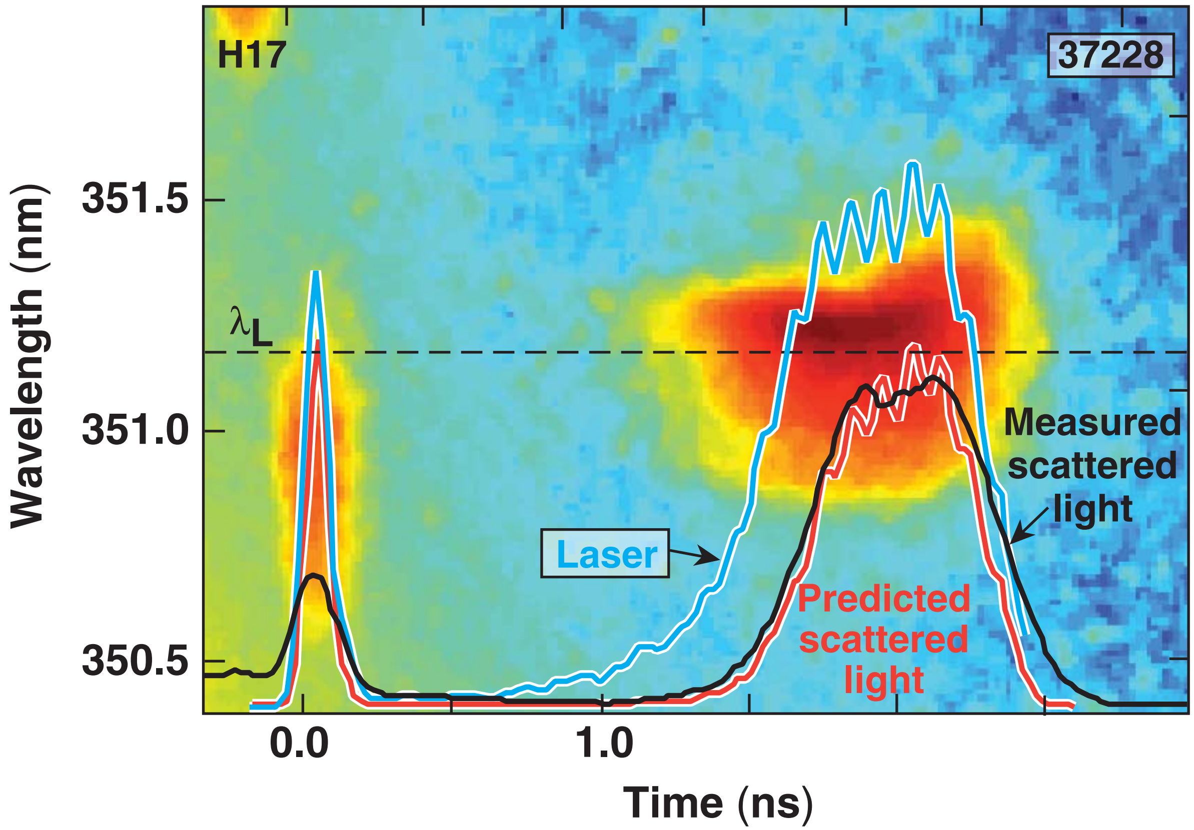
Absorption Measurements in Spherical Implosions on OMEGA



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Summary

Experimental absorption measurements agree within ~6% rms (~2% SEM) with simulations for cryogenic target shots with various pulse shapes

- Absorption measurements are used for calibrating hydrocode simulations.
- Measured and simulated absorption agree less well for warm plastic shell targets and some strongly shaped pulses.
- There is some evidence for stimulated Brillouin scattering (SBS) in the scattered light spectra (energetically unimportant).

Motivation

Accurate knowledge of absorbed laser power is essential for hydrodynamic simulations

- Hydrodynamic codes need to be calibrated against a multitude of experimental data (e.g., absorption, neutron "bang" time, shock timing, etc.).
- Hydrocodes model linear absorption and refraction.
  - If nonlinear interaction processes are affecting our data, we need to identify the sources and assess their importance.
  - Electron transport model in the codes may influence absorption.

Accurate absorption measurements require careful analysis of intrinsic sources of errors

- Scattered light measurements
  - All 60 beams contribute to the signal collected at any location around the target chamber.
  - Light scattered from other diagnostics can lead to double counting of scattered light contributions.
  - Full-aperture backscatter stations (FABS) are sensitive to blow-by around the target.
- Plasma calorimeters
  - Absolute calibration is difficult.
  - Secondary plasma blow-off from nearby diagnostics can influence measurements.

Experimental Details

Photographs of imploding targets using scattered UV light allow identification of all 60 beams

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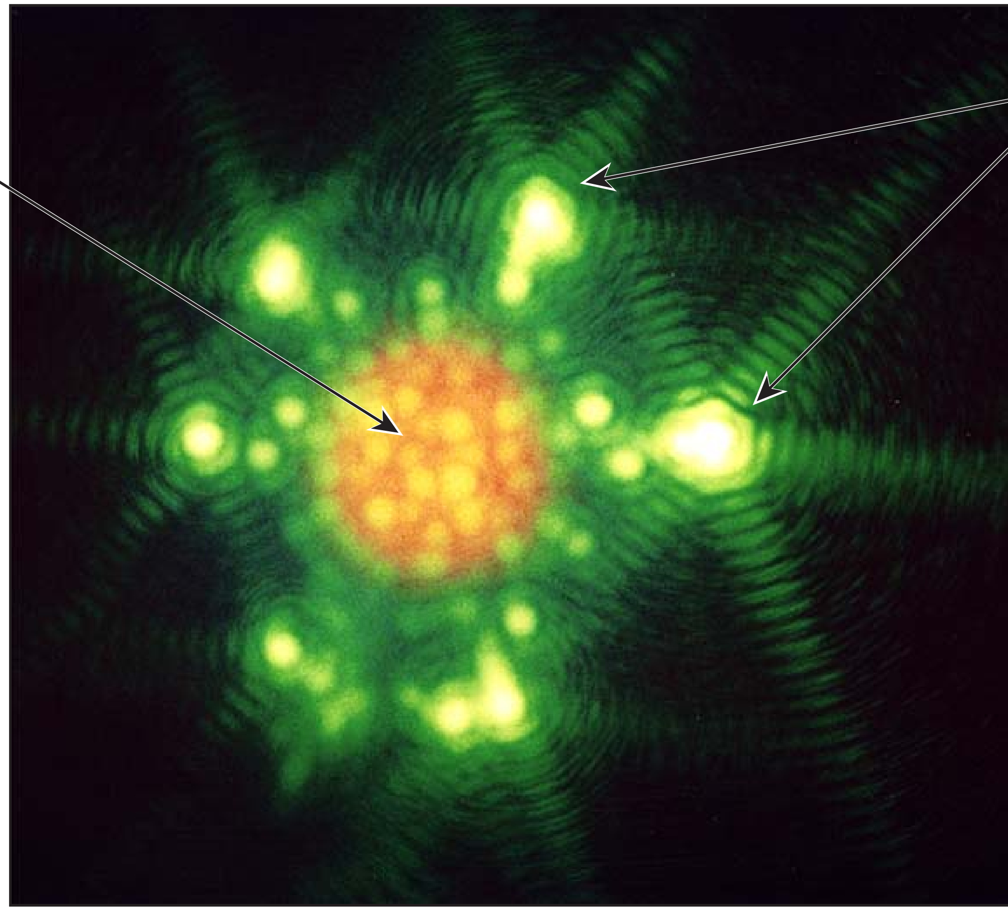
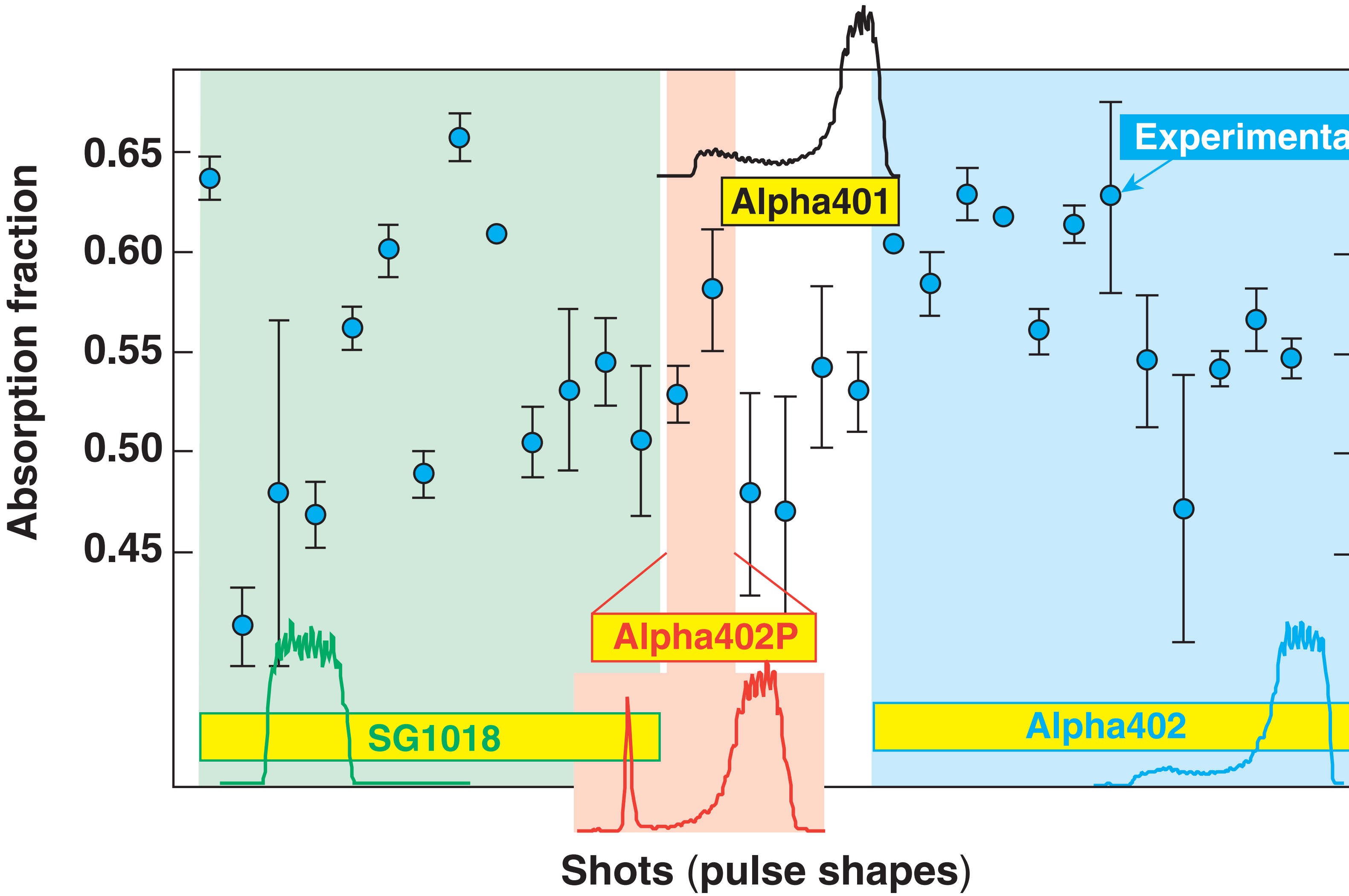
Beams near view port



Beams opposing view port

Photographs taken from off center location

A large number of cryogenic D_2 implosions have been diagnosed over the past 18 months



Plasma calorimeters agree well with scattered light measurements

E13458

Absorption measurements for cryogenic D_2 shots agree well with *LILAC* predictions for all pulse shapes

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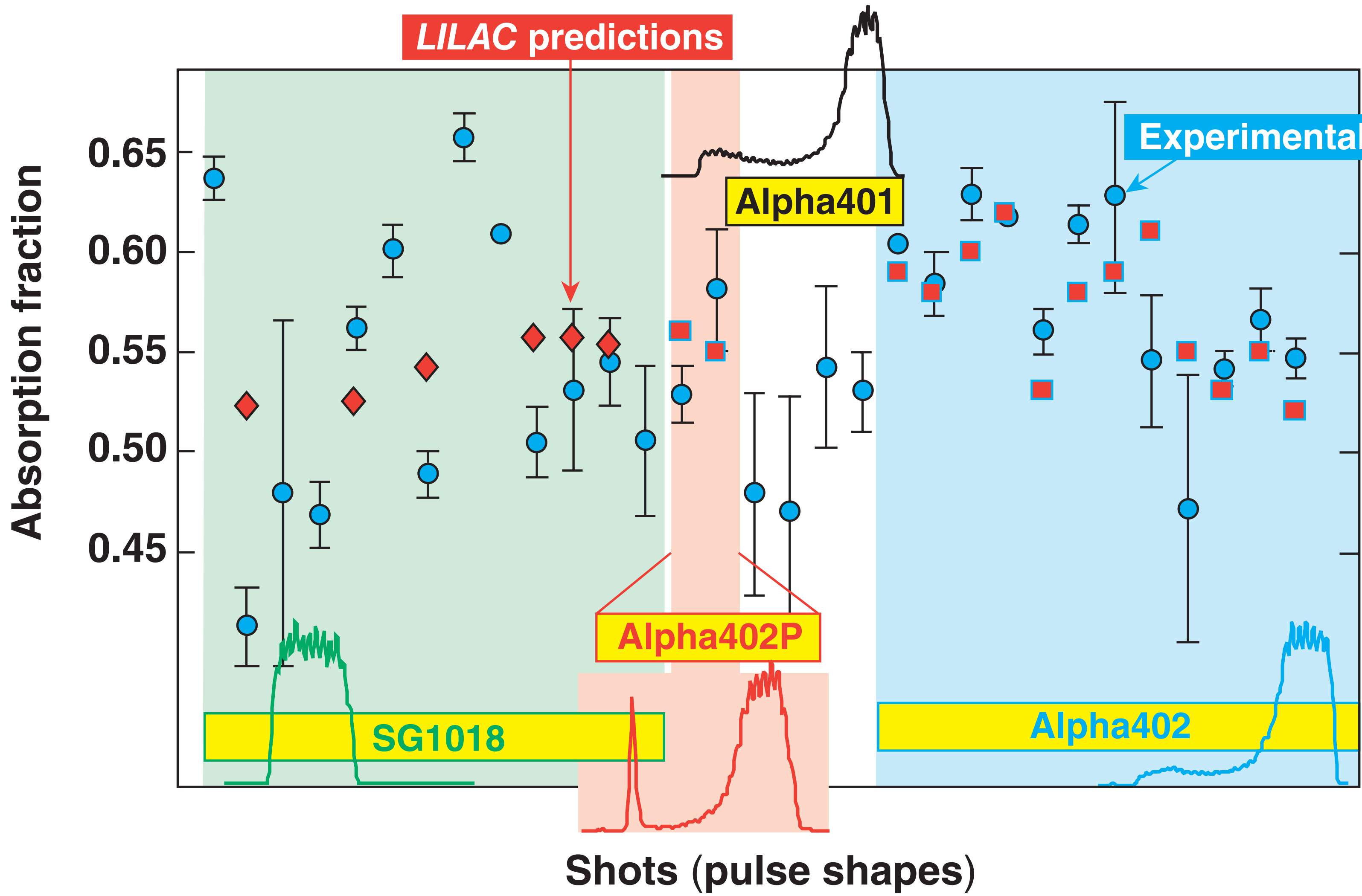
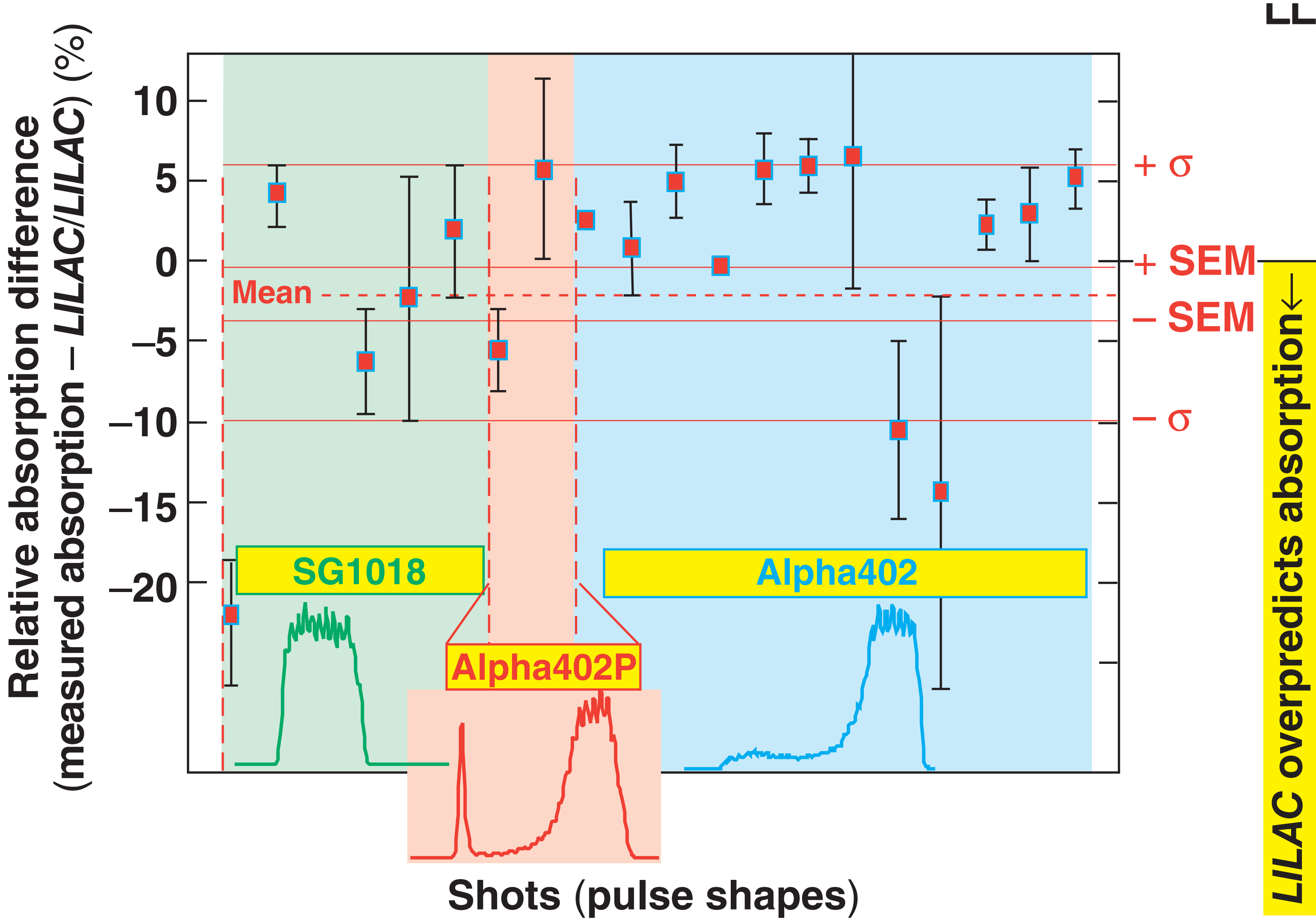


Plasma calorimeters agree well with scattered light measurements.

E13459

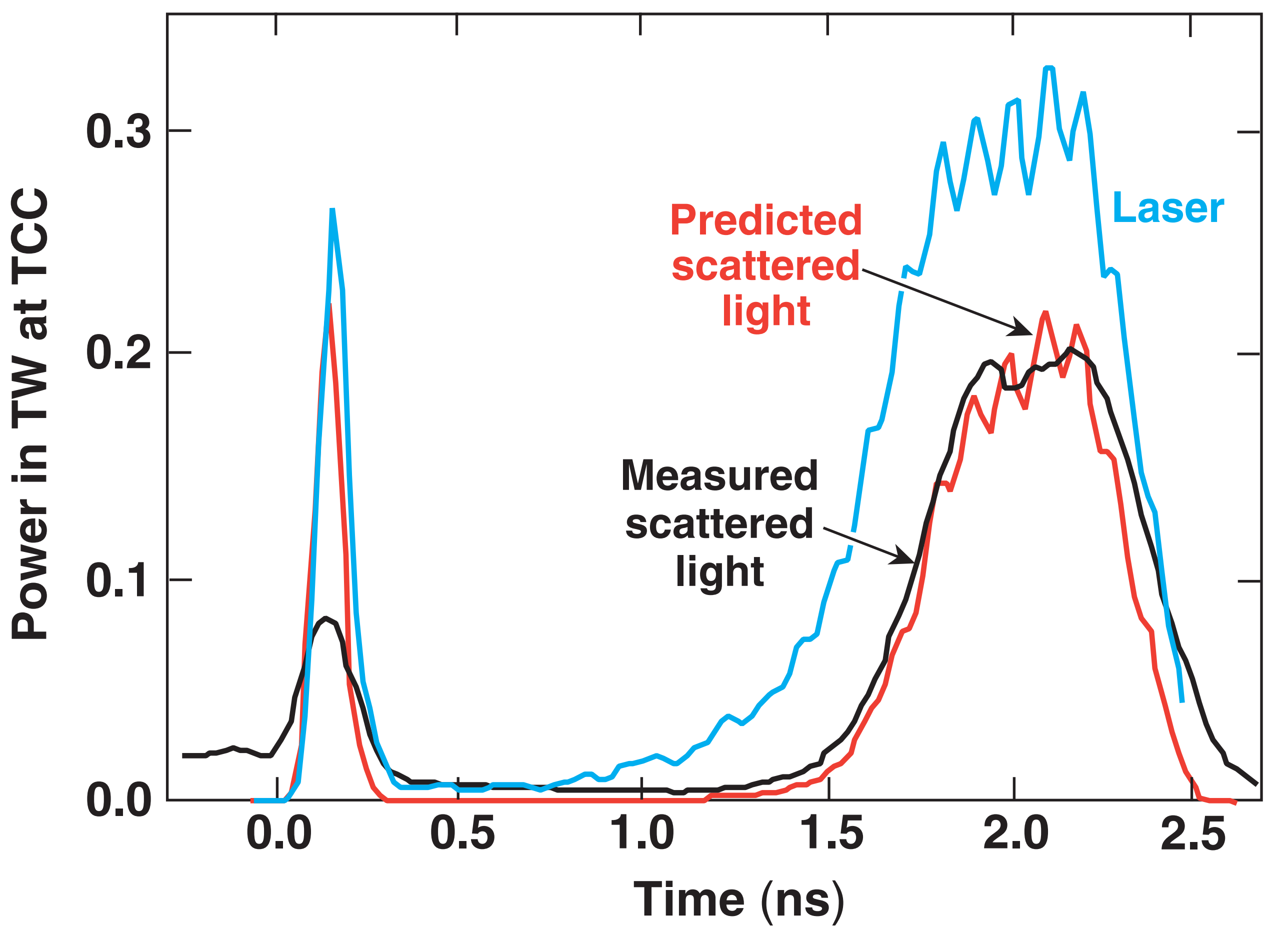
Measured and predicted absorption for cryogenic D_2 implosions lie within 6% rms (≈ 2% SEM) for all pulse shapes



- Cryogenic D_2 target shots between shot numbers 32129 and 37228

E13460

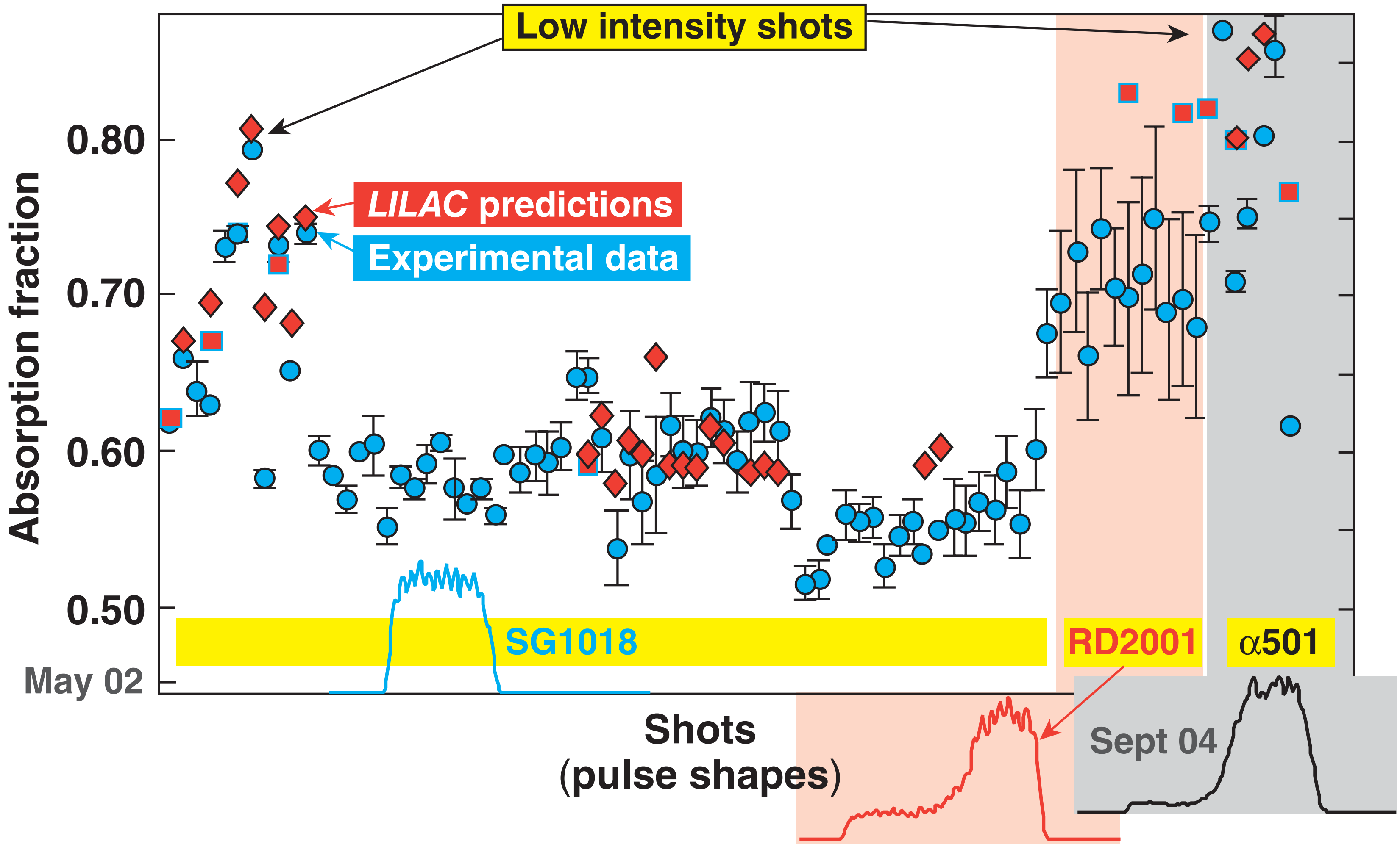
The measured scattered power histories for cryo shots and complex pulse shapes agree well with *LILAC* predictions



E13456

Absorption measurments for warm implosion shots agree well with *LILAC* predictions for 1-ns pulse shapes

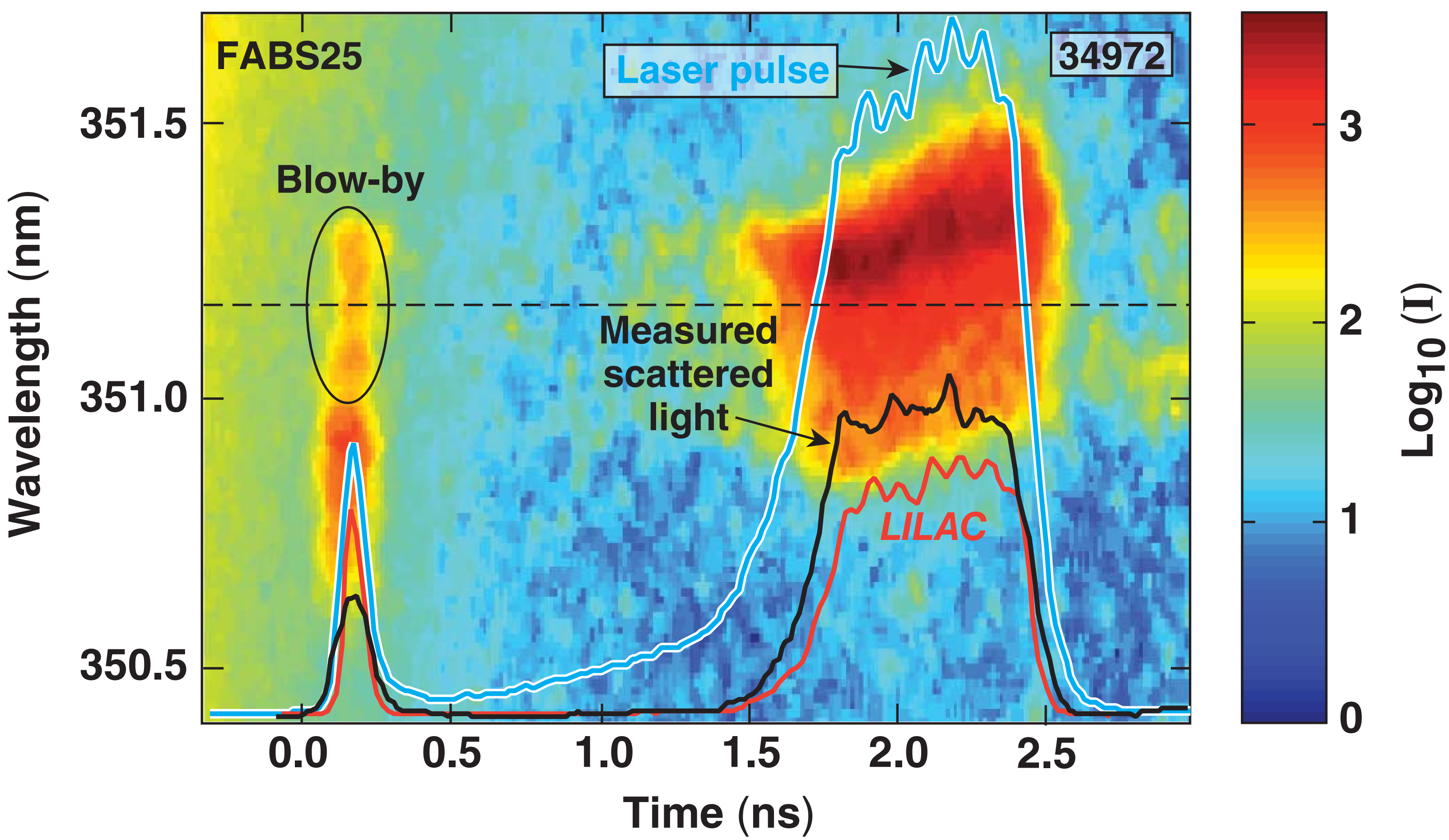
UR LLE



For complex pulse shapes, *LILAC* overpredicts the absorption for warm target implosions.

E13461

For shaped long pulses *LILAC* overpredicts the absorption

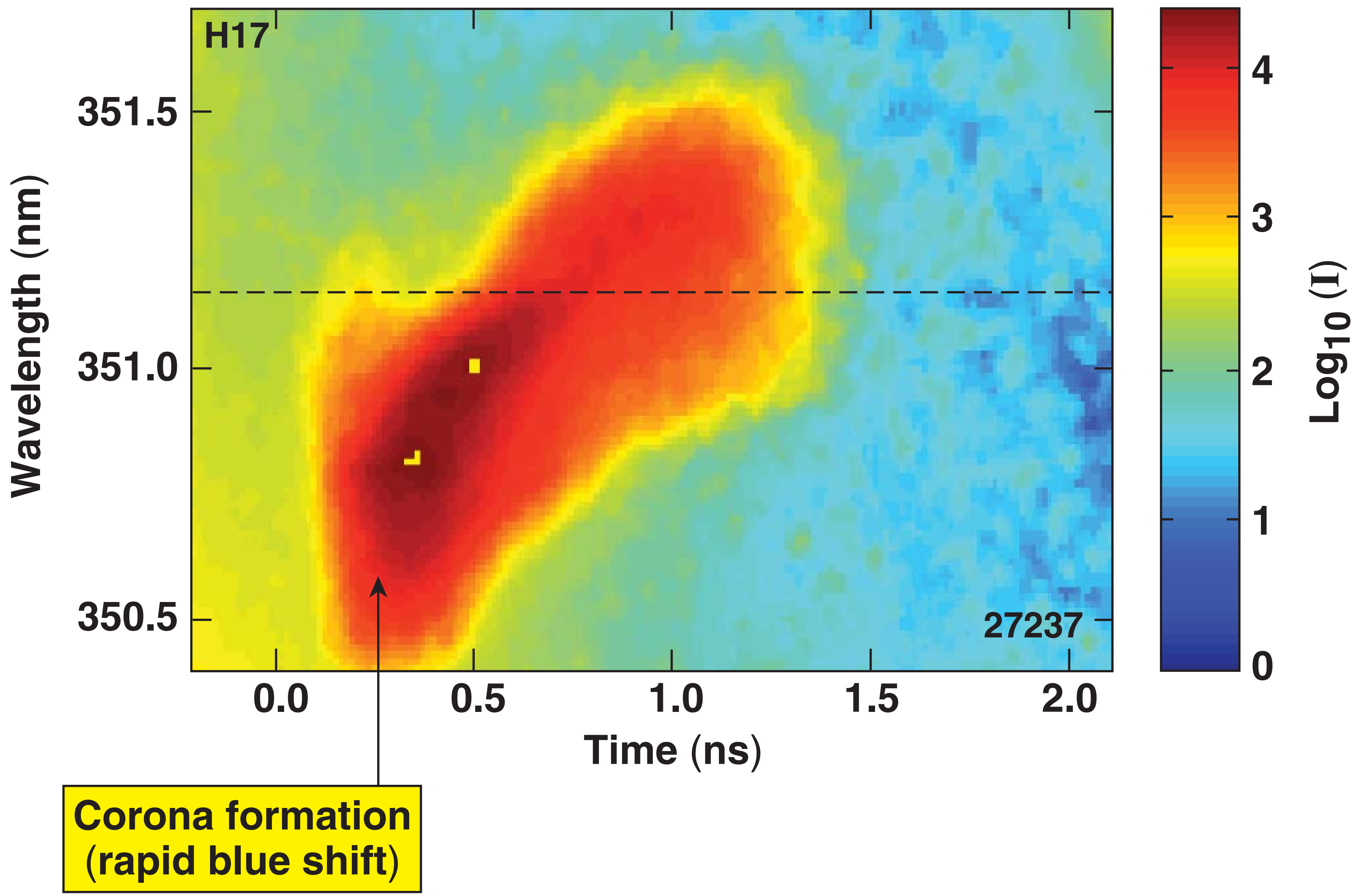


- **Target: 860-μm foam shell 60-beam implosion**

E13518

Time-resolved spectroscopy shows corona formation, start of target implosion, and nonlinear interaction effects

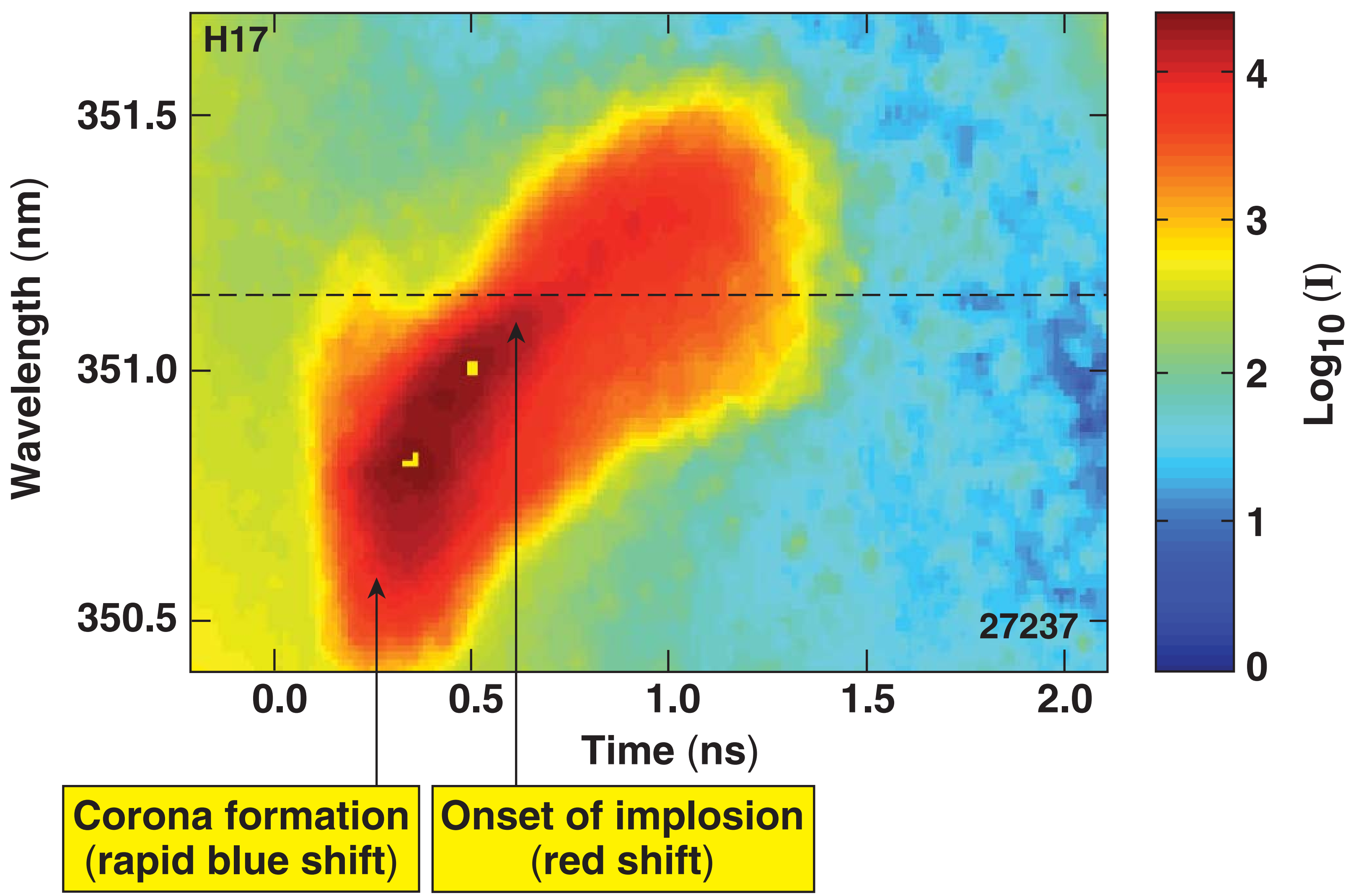
UR LLE



- Target: 940-μm CH shell; 60-beam implosion

E13516a

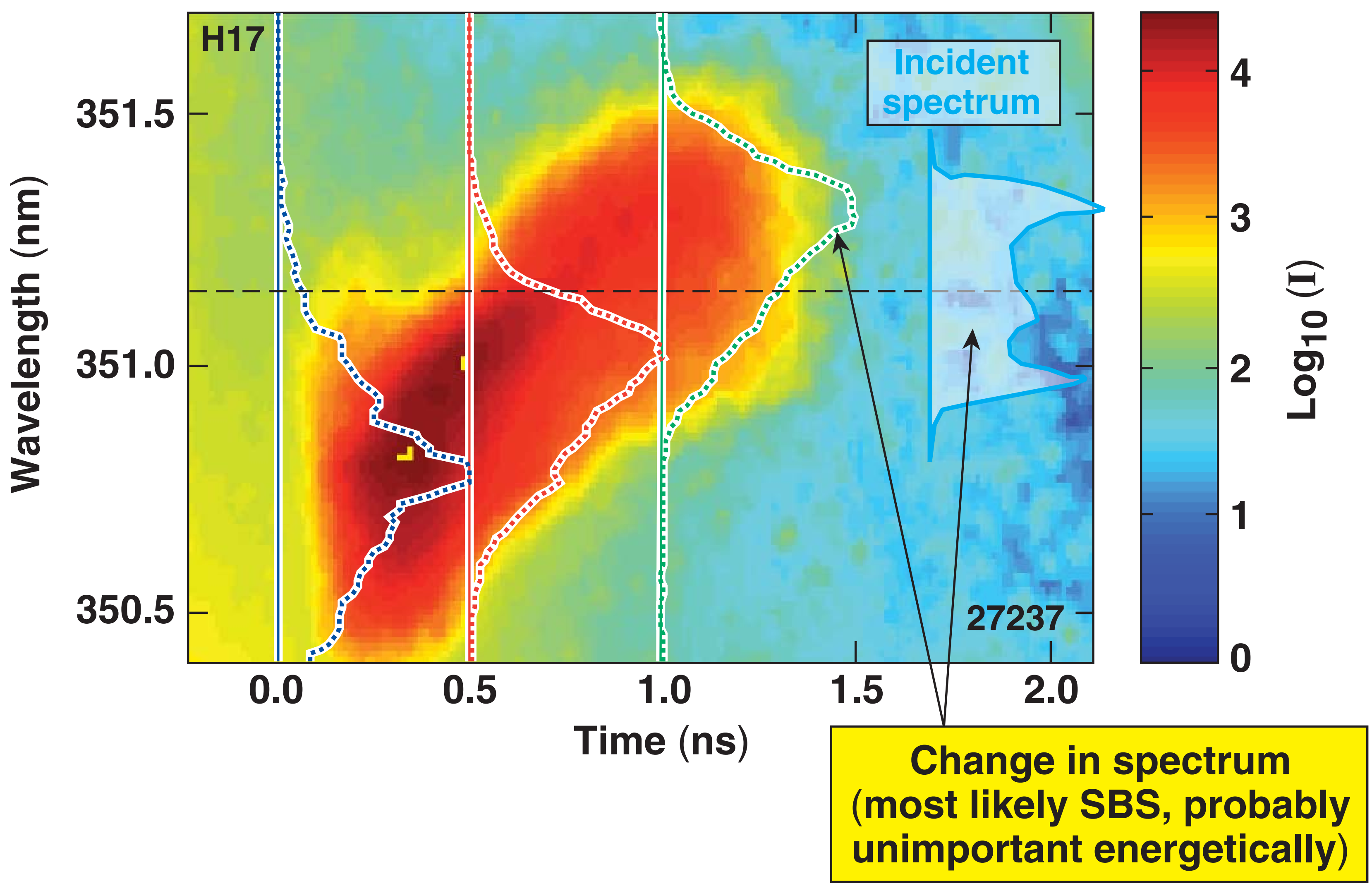
Time-resolved spectroscopy shows corona formation, start of target implosion, and nonlinear interaction effects



- Target: 940-μm CH shell; 60-beam implosion

E13516b

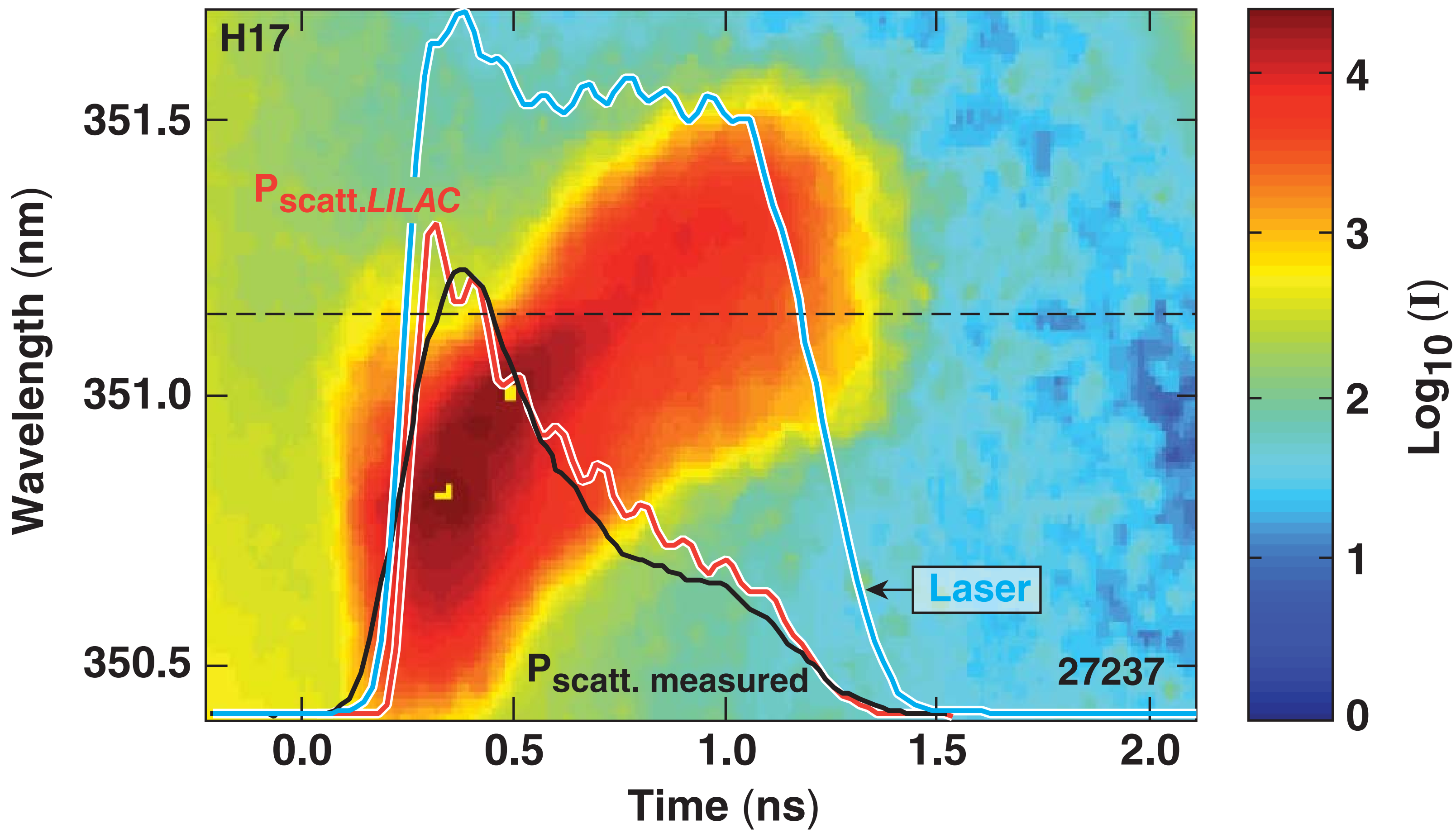
Time-resolved spectroscopy shows corona formation, start of target implosion, and nonlinear interaction effects



E13516c

- Target: 940-μm CH shell; 60-beam implosion

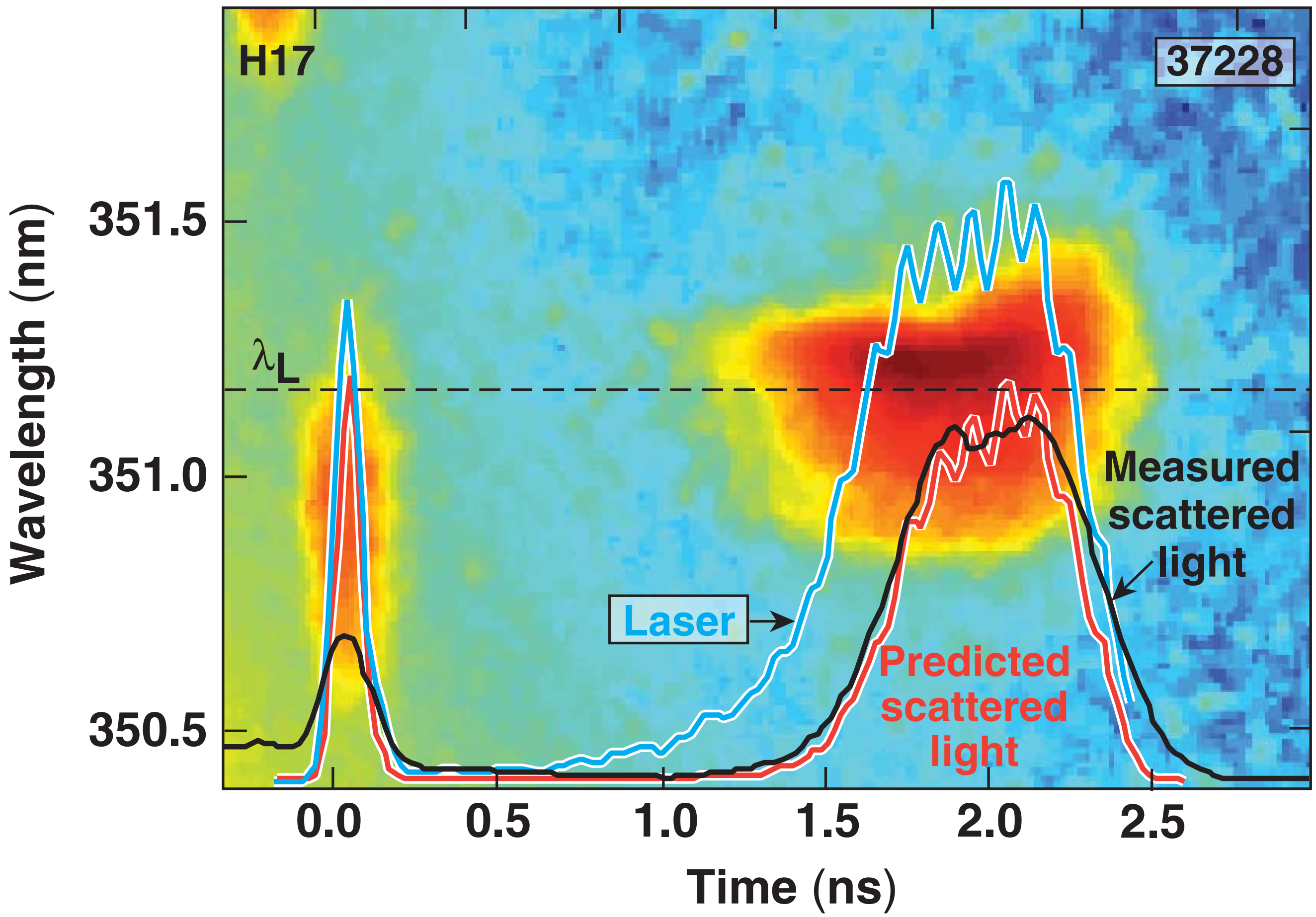
Time resolved spectroscopy shows corona formation, start of target implosion, and nonlinear interaction effects



For 1-ns square-top pulses, the 1-D *LILAC* hydrodynamic simulations agree very well with the scattered light measurements.

- **Target: 940-μm CH shell; 60 beam-implosion**

For cryo shots, the measured scattered power histories agree well with *LILAC* for pulse shapes



E13519

Summary/Conclusions

Experimental absorption measurements agree within ~6% rms (~2% SEM) with simulations for cryogenic target shots with various pulse shapes

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