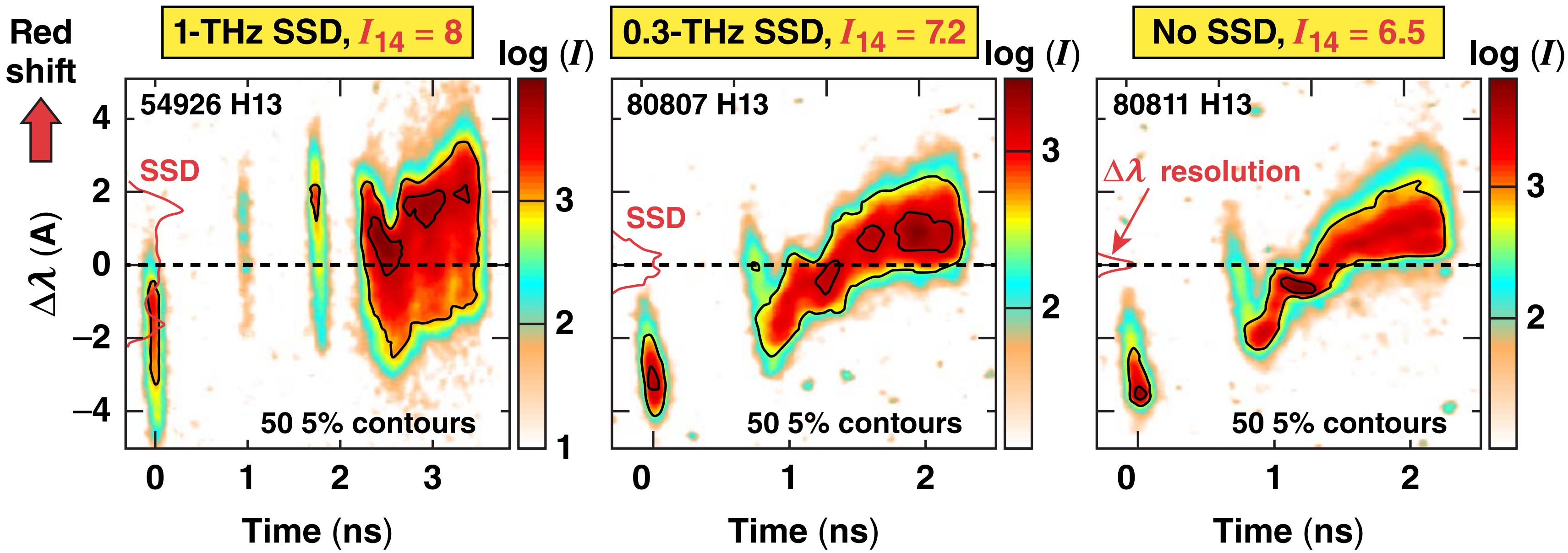
The Influence of Smoothing by Spectral Dispersion on Cross-Beam Energy Transfer



OMEGA cryogenic implosions: ~860 μm diam, 8 to 10 μm CH, ~60 μm DT ice

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Summary

Scattered-light powers and absorption are essentially unaffected by smoothing by spectral dispersion (SSD) bandwidth

- Scattered-light spectra are qualitatively affected by large SSD bandwidth (1 THz)
- Scattered-light spectra for $\lesssim$0.3-THz SSD bandwidth are only minimally affected
- Hydrodynamic (*LILAC*) predictions for scattered-light powers and absorption are very close to experimental observations
- Predicted scattered-light spectra for $\lesssim$0.3 THz are close to experimental observations
- For 1-THz SSD the measured spectral shifts indicate cross-beam energy transfer (CBET) occurs at higher densities without affecting scattered powers and absorption

Collaborators

J. F. Myatt, V. N. Goncharov, R. Betti, S. P. Regan, D. H. Edgell, A. V. Maximov, J. A. Delettrez, R. E. Bahr, A. A. Solodov, M. J. Rosenberg, A. Bose, and R. W. Short

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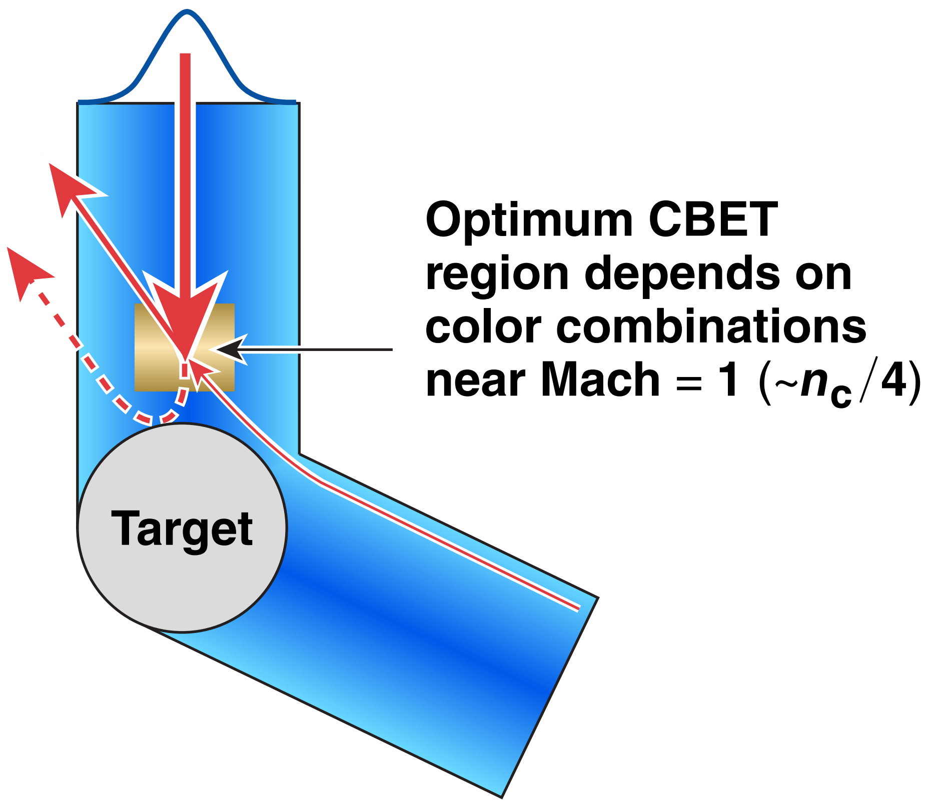
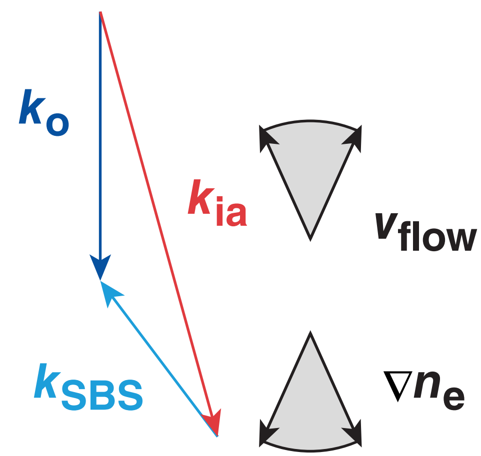
Broadband SSD can influence the CBET interaction region (density)

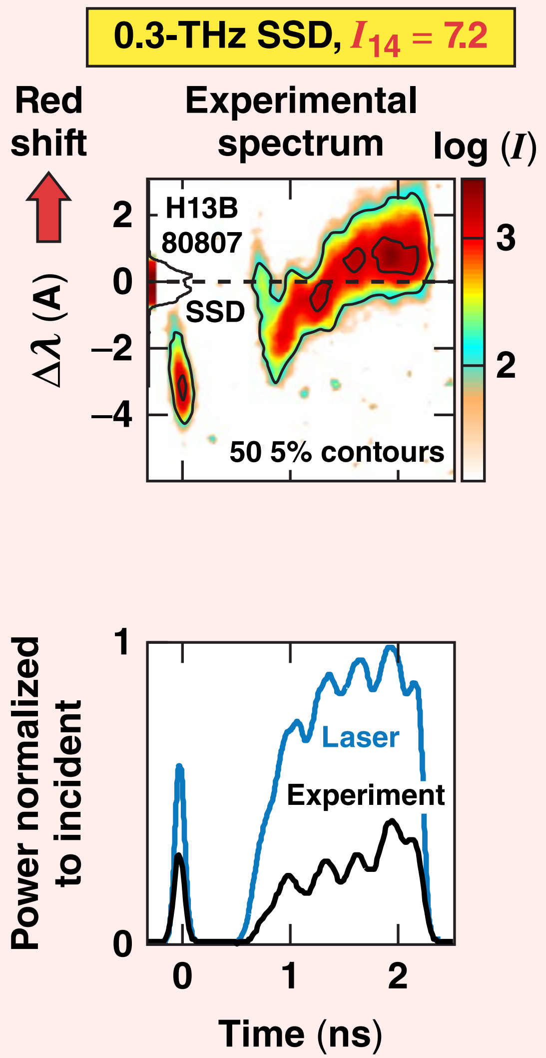


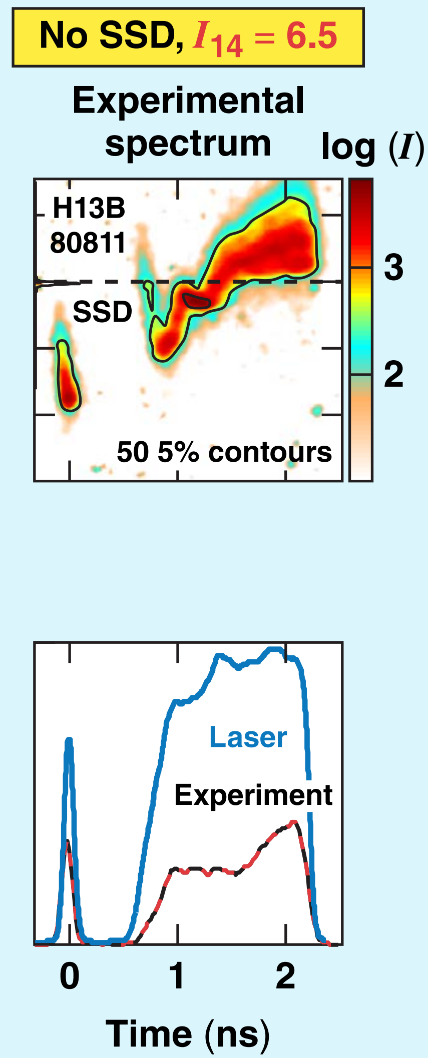


- Flow and density gradient are generally antiparallel
- As a result of electromagnetic (EM) seeding, only very small stimulated Brillouin scattering (SBS) gains are required

E25110

SSD at 0.3 THz smooths the scattered-light spectra but hardly affects the overall spectral shapes or scattered-light powers





Experimental scattered-light spectra are inherently broadened by the plasma by

- **Dewandre shifts caused by different time-dependent ray paths in the corona (most effective at early times)**
- **Self-phase modulation, SBS forward scattering, filamentation, etc., in the plasma**

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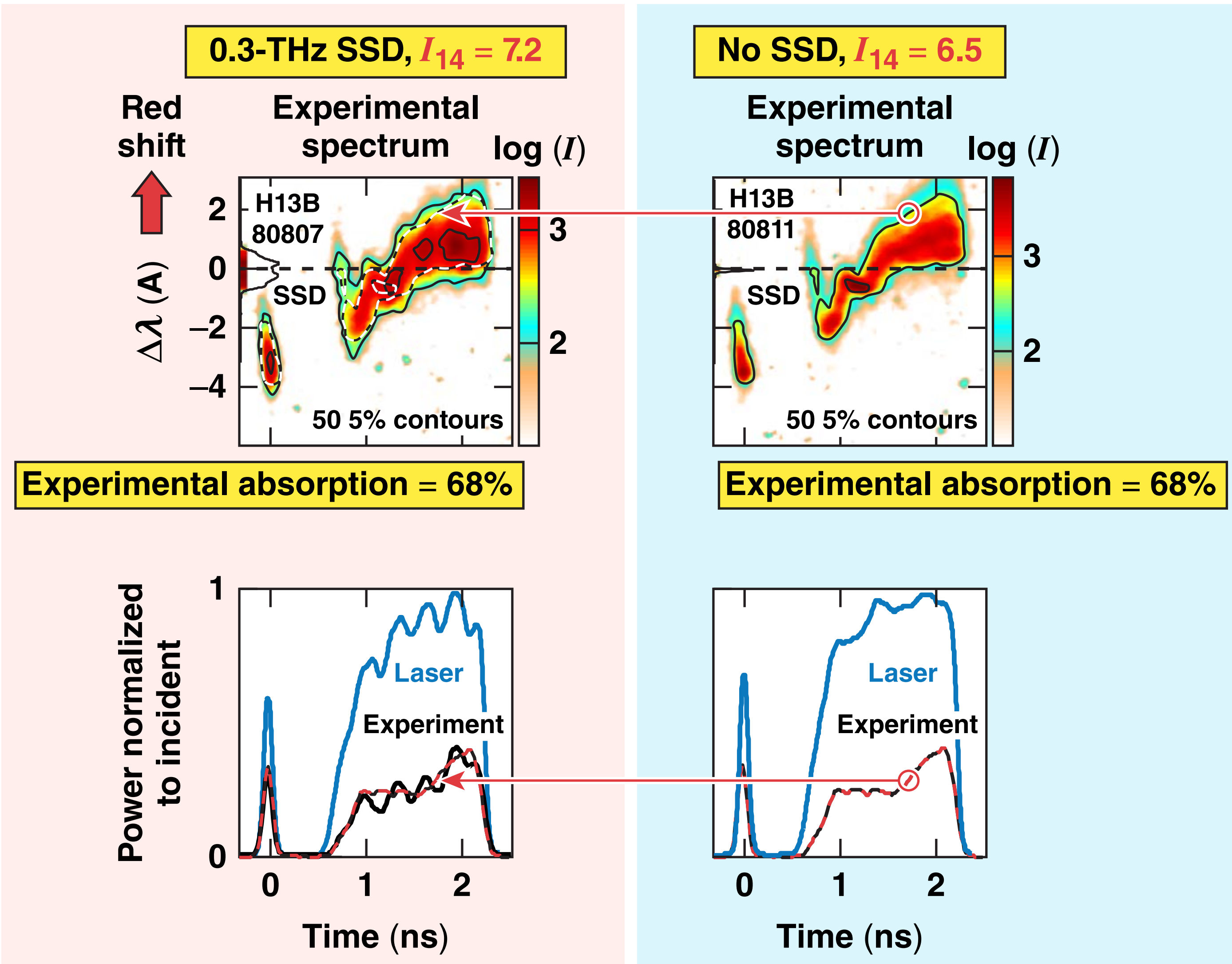
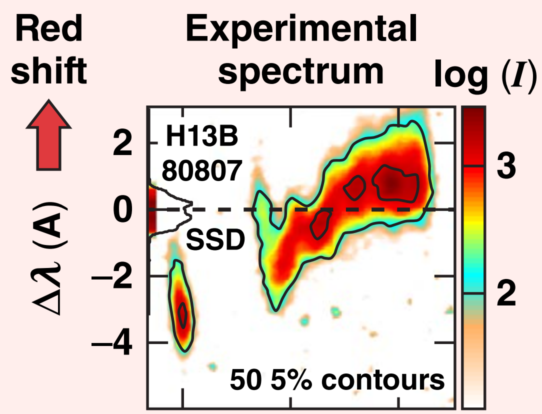
Basically, 0.3-THz SSD does not affect the measured spectral shapes, powers, or integrated absorption values



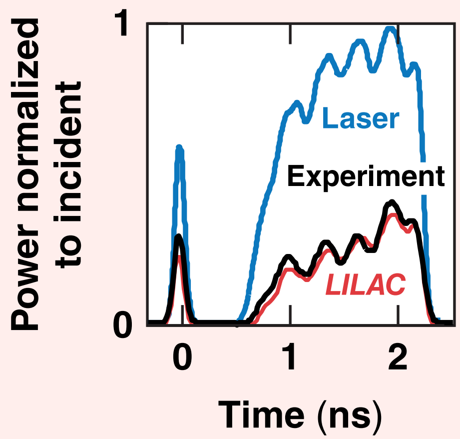
E25112

One-dimensional hydrodynamic simulations (*LILAC*) very well reproduce scattered-light powers and energies

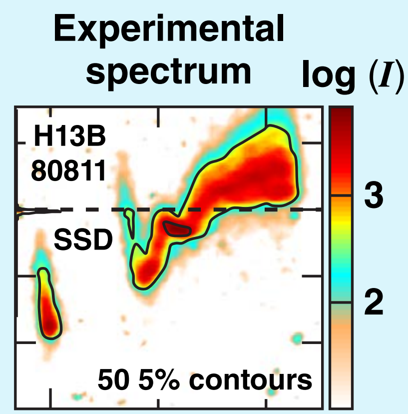
0.3-THz SSD, I_{14} = 7.2



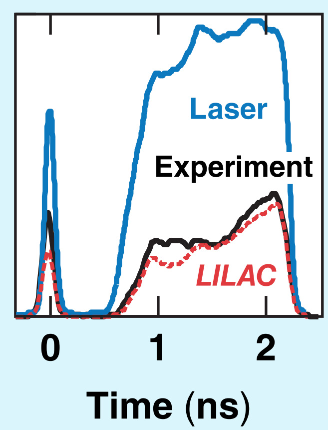
Experimental absorption = 68%
***LILAC* absorption = 70%**



No SSD, I_{14} = 6.5



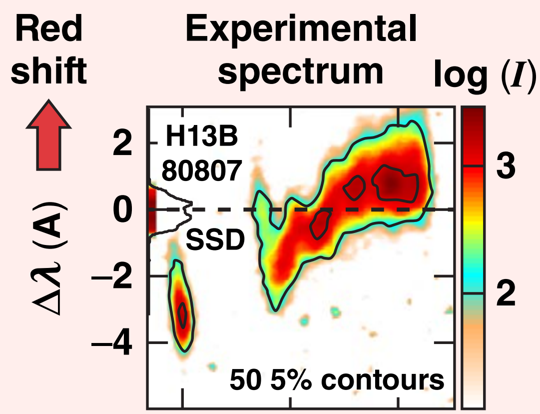
Experimental absorption = 68%
***LILAC* absorption = 72%**



E25113

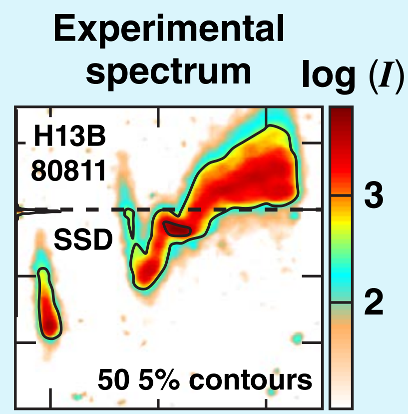
Scattered-light powers for 0.3- and 0-THz SSD are practically indistinguishable

0.3-THz SSD, I_{14} = 7.2



Experimental absorption = 68%
LILAC absorption = 70%

No SSD, I_{14} = 6.5



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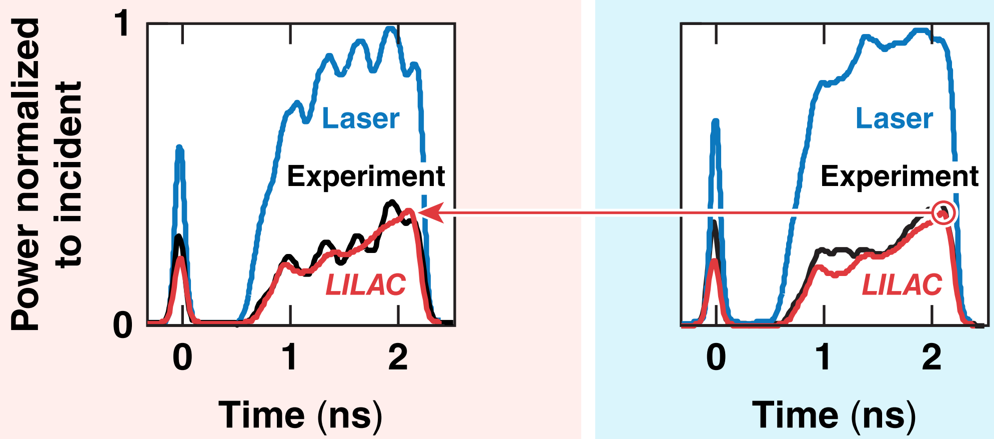

LILAC also very well reproduces the scattered-light spectra for 0- and 0.3-THz SSD

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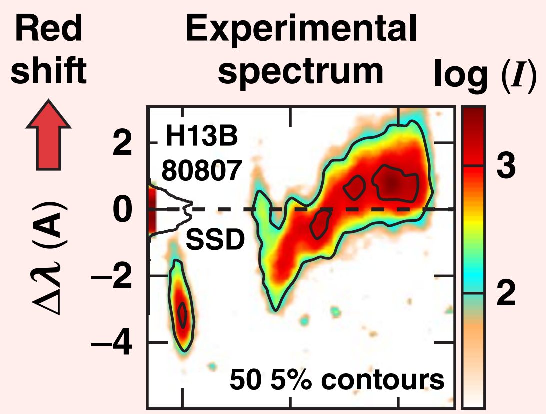
0.3-THz SSD, I_{14} = 7.2



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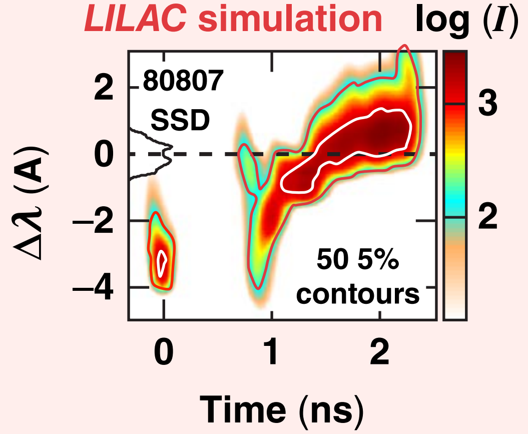
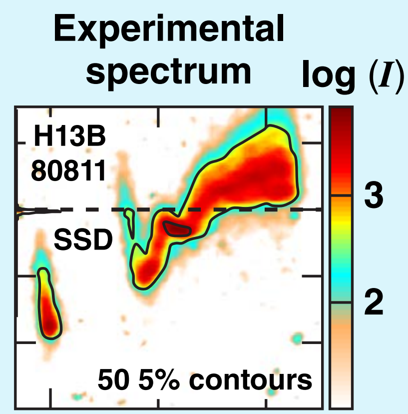
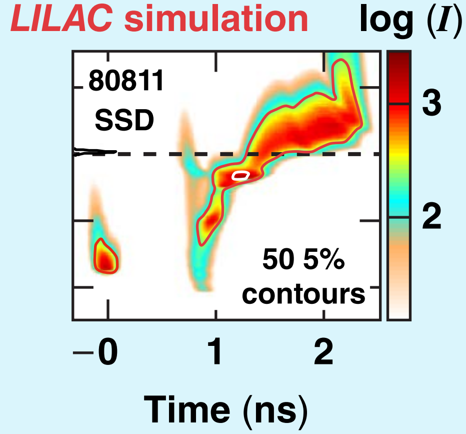


No SSD, I_{14} = 6.5

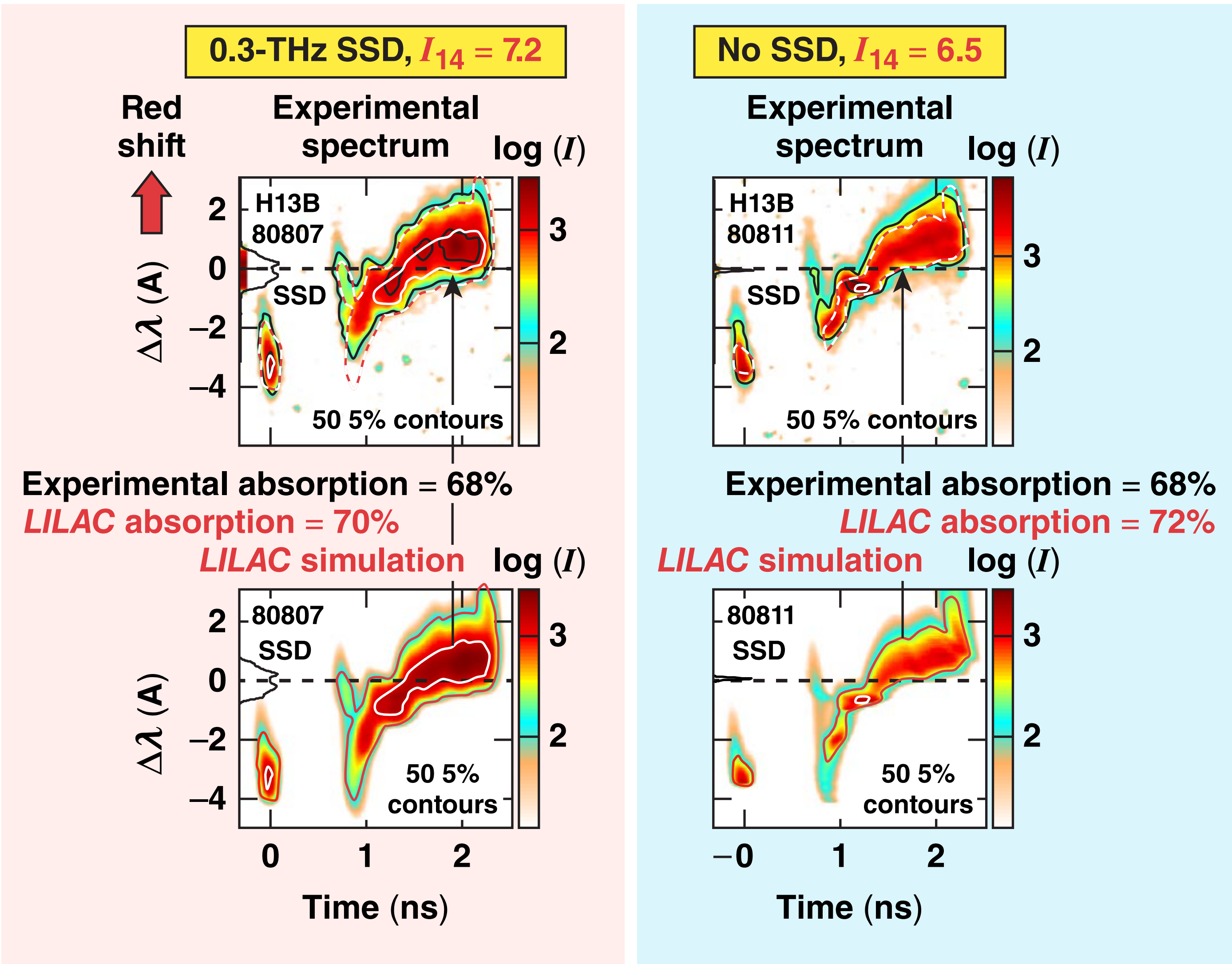


Experimental absorption = 68%
LILAC absorption = 72%



E25115

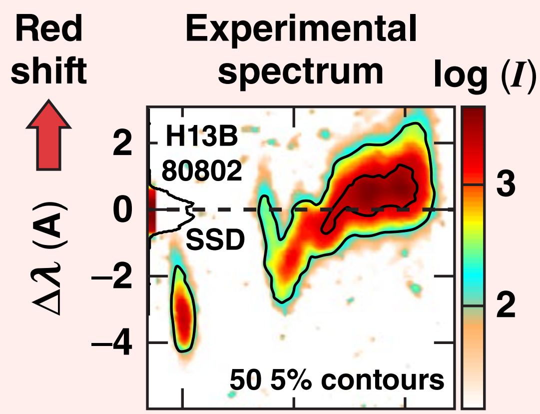
LILAC also very well reproduced the scattered-light spectra for 0- and 0.3-THz SSD



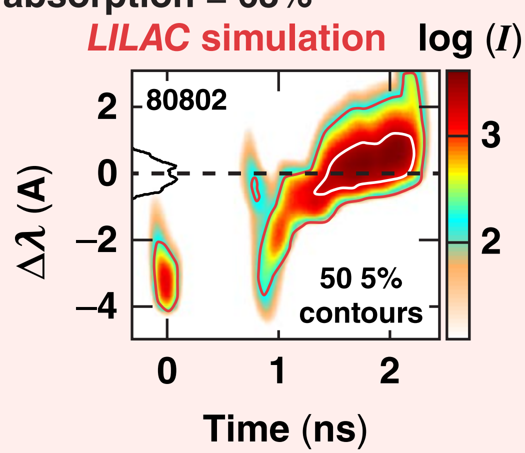
E25116

Experimental and simulated scattered-light spectra are very close for medium (7×10^{14})- and high (10^{15})-irradiation intensities

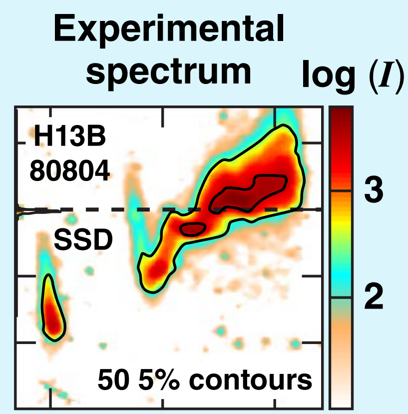
0.3-THz SSD, I_{14} = 10.3



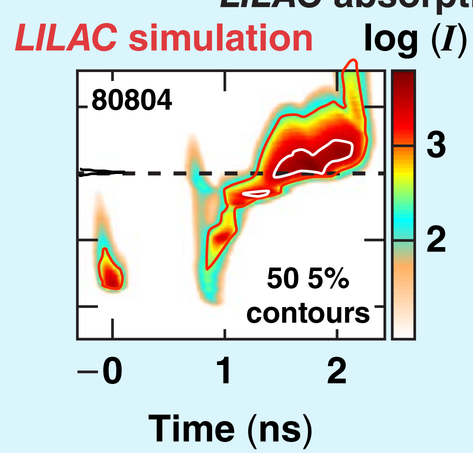
Experimental absorption = 62 + 3%
LILAC absorption = 63%



No SSD, I_{14} = 10.1



Experimental absorption = 64%
LILAC absorption = 65%



E25117

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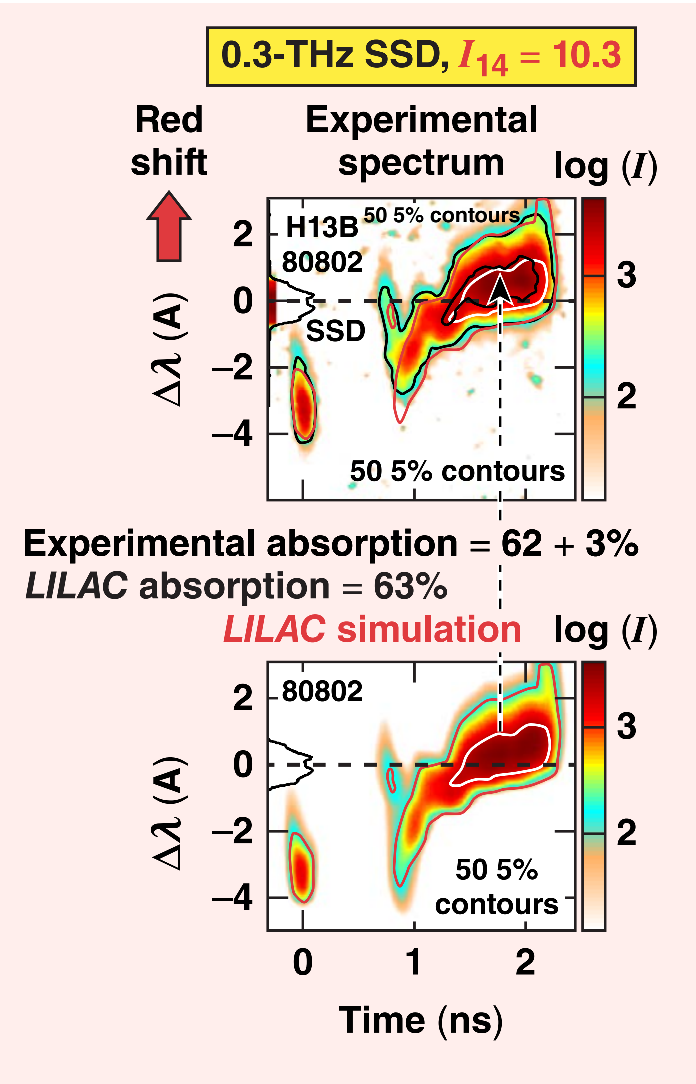
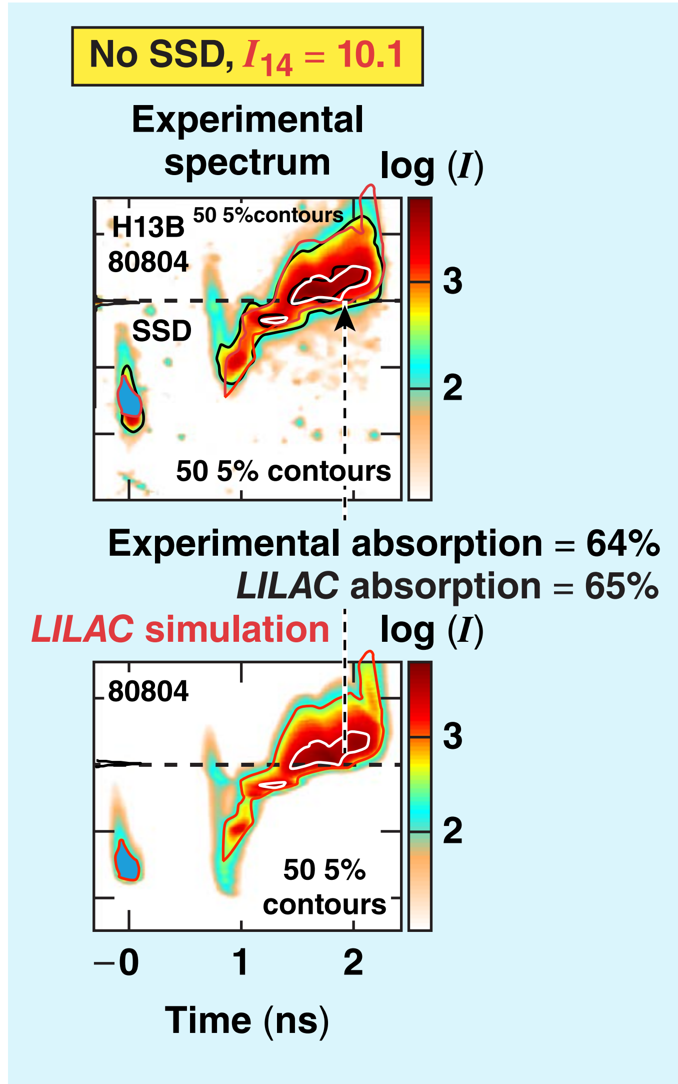
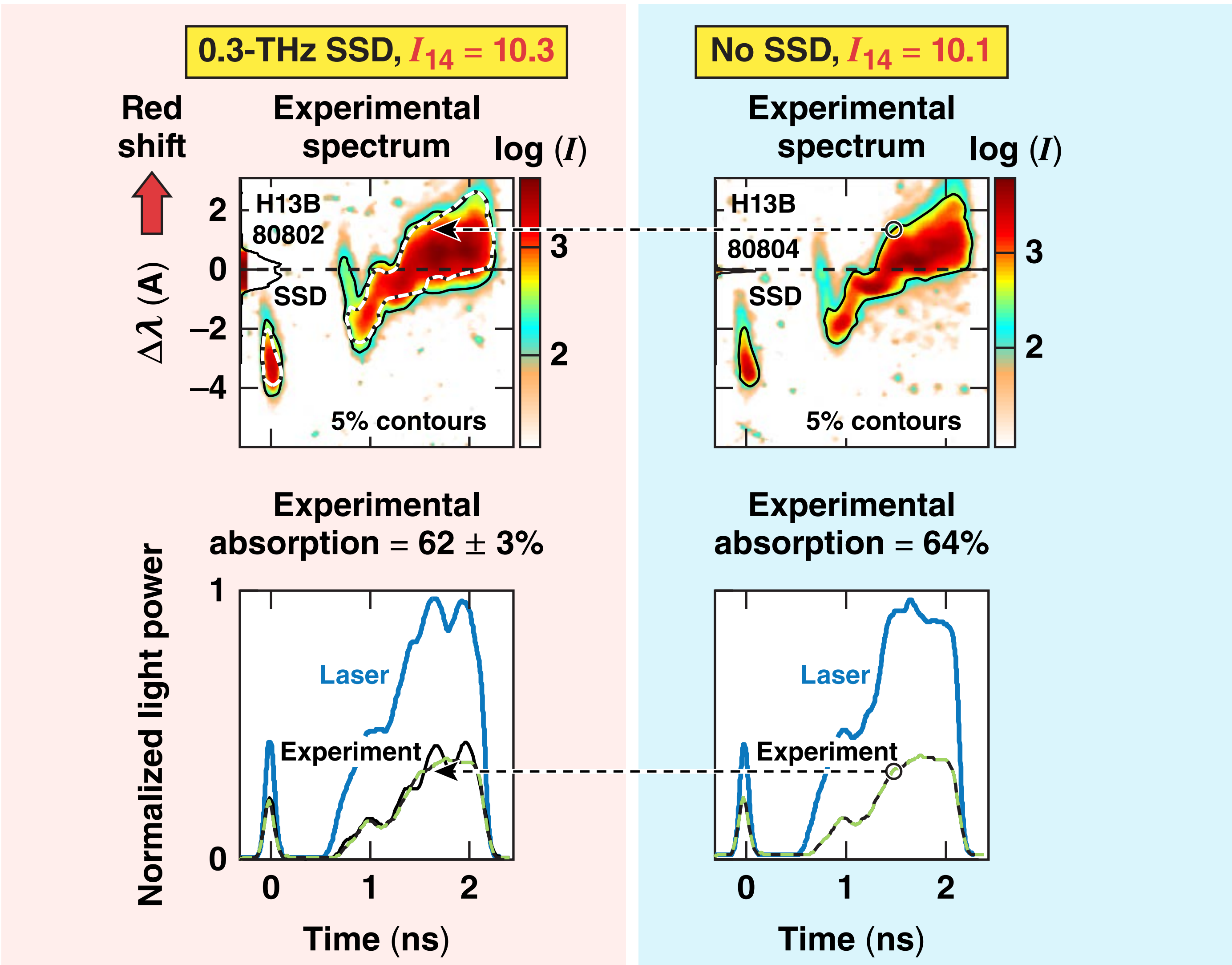




E25118

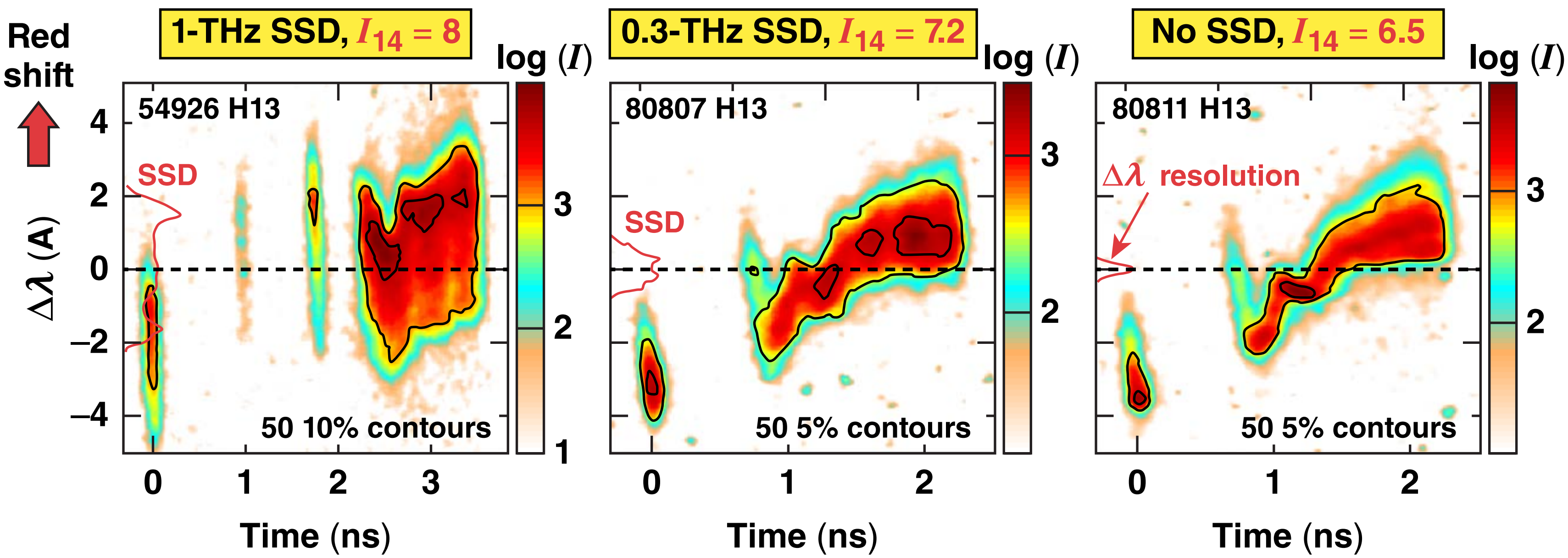
Scattered-light spectra, powers, and absorption depend very weakly on SSD bandwidth ($\lesssim$0.3 THz) even at higher intensities



- The spectral widths of scattered-light spectra are only slightly larger for 0.3-THz SSD compared 0 THz
- Time-integrated absorption does not depend on SSD bandwidth
- The scattered-light powers with and without SSD are basically identical

E25119

CBET spectra are sensitive to density at the interaction region for high SSD bandwidths

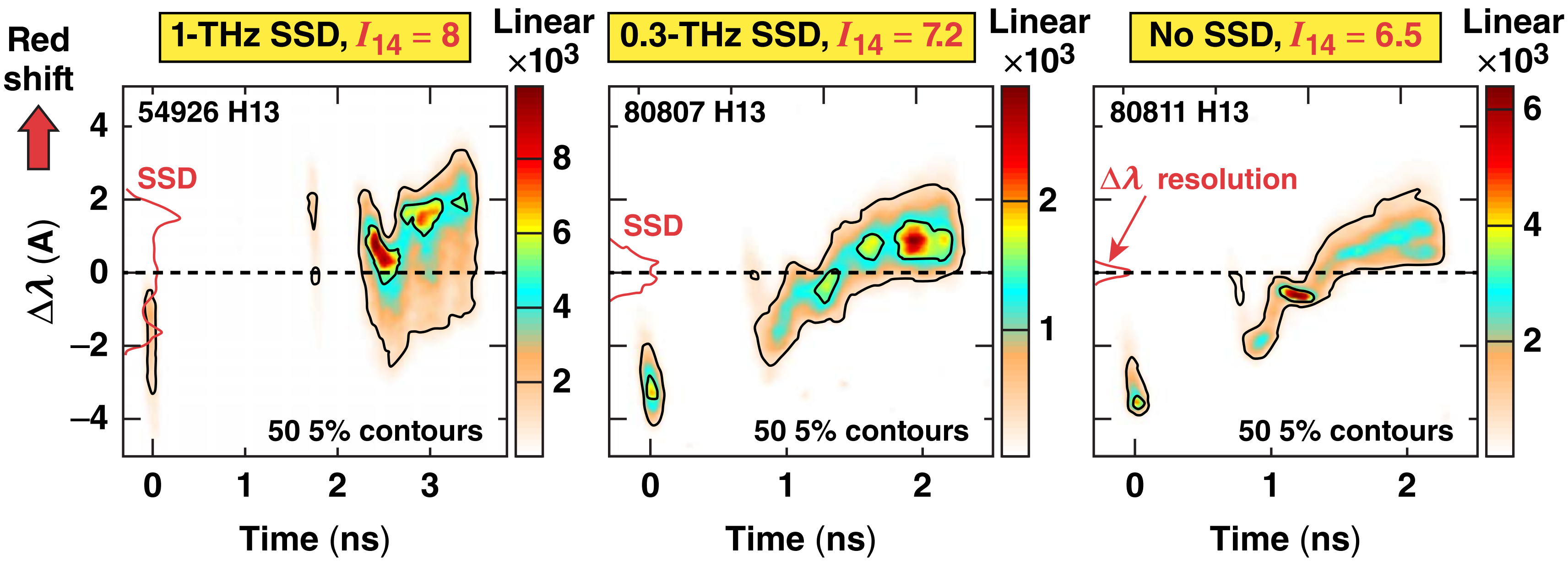


864 μm (9.7-μm wall, 66-μm ice) CD target	877 μm (8-μm wall, 51-μm ice) CH target	877 μm (8-μm wall, 51-μm ice) CH target

Standard OMEGA cryogenic implosions

E25120

1-THz SSD shows sensitivity of scattered light spectra to the density in the CBET interaction region



864 μm (9.7-μm wall, 66-μm ice) CD target	877 μm (8-μm wall, 51-μm ice) CH target	877 μm (8-μm wall, 51-μm ice) CH target

Standard OMEGA cryogenic implosions

E25121

The scattered-light powers and absorption are surprisingly independent of SSD bandwidth (0 versus 1 THz)

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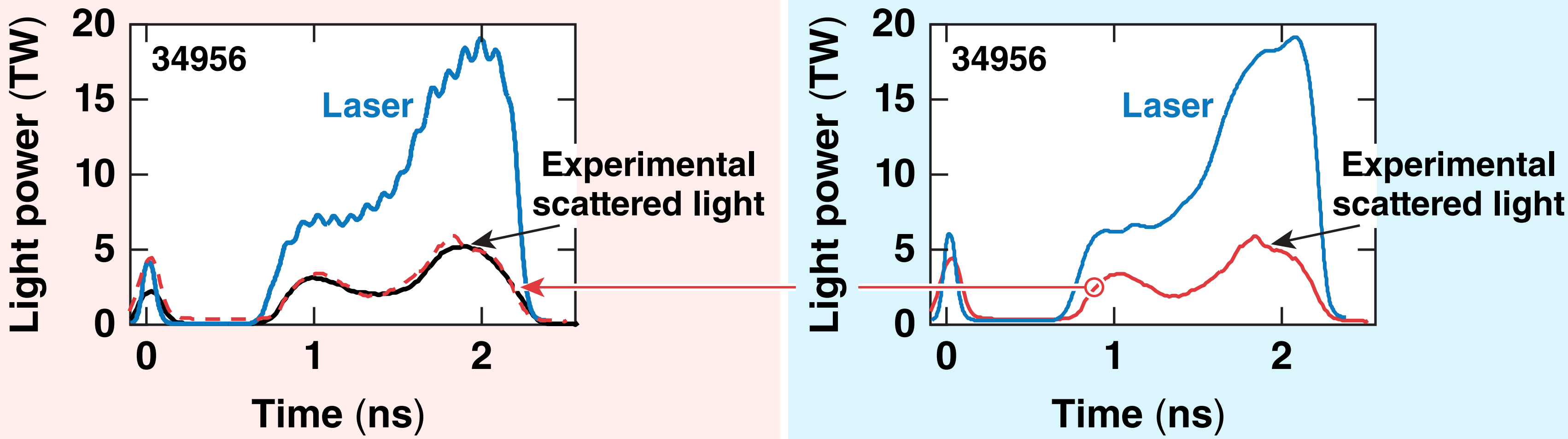
1-THz SSD, $I_{14} = 8$

1-THz SSD, $I_{14} = 8.1$



Experimental absorption = 71%

Experimental absorption = 69%

SG4, 868 (33)-μm CH target, 17.1 kJ

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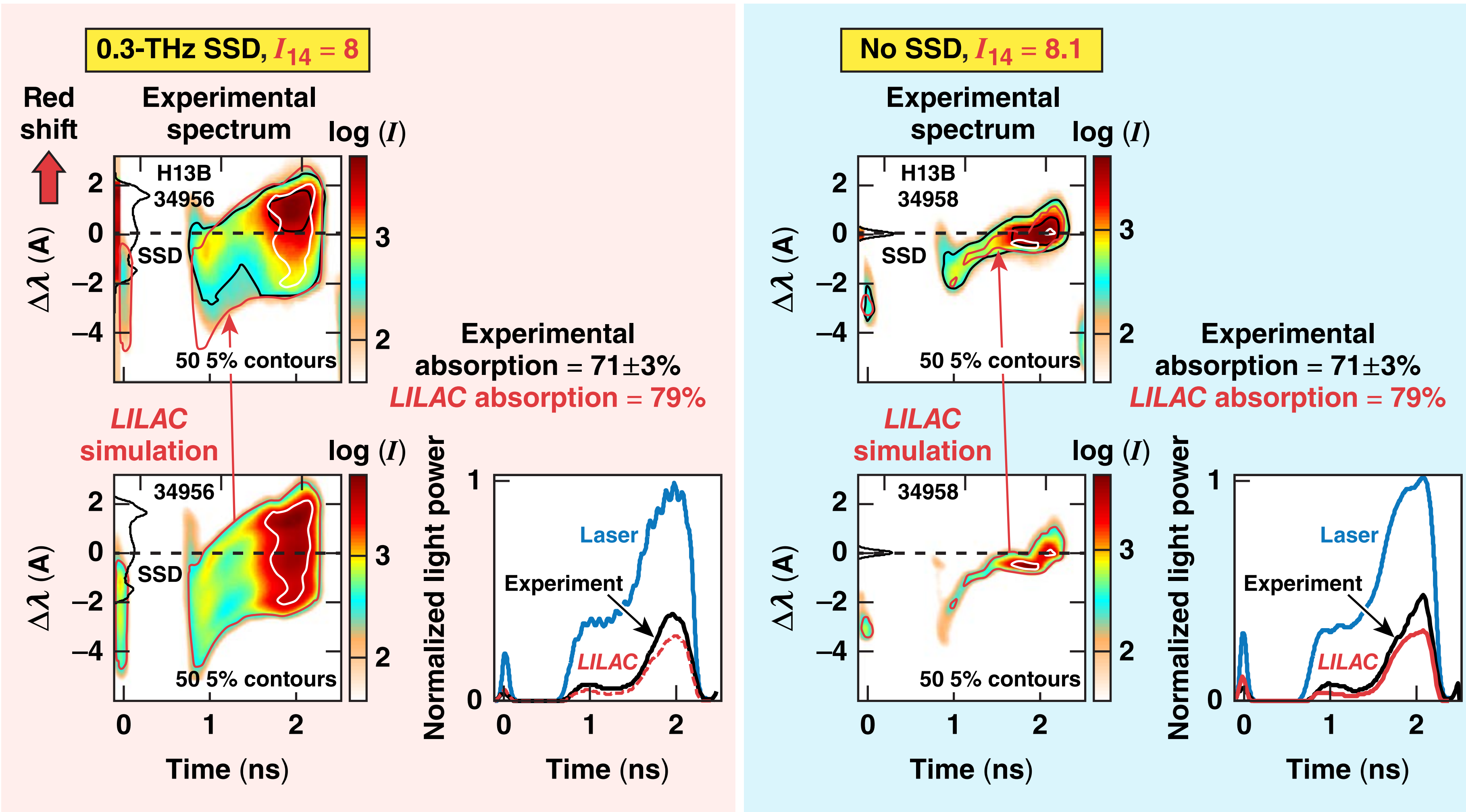
E25122

For 1-THz SSD, the centroid of the scattered-light spectrum is shifted but the 5% contour is extremely well modeled by *LILAC*



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UR LLE

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E25109