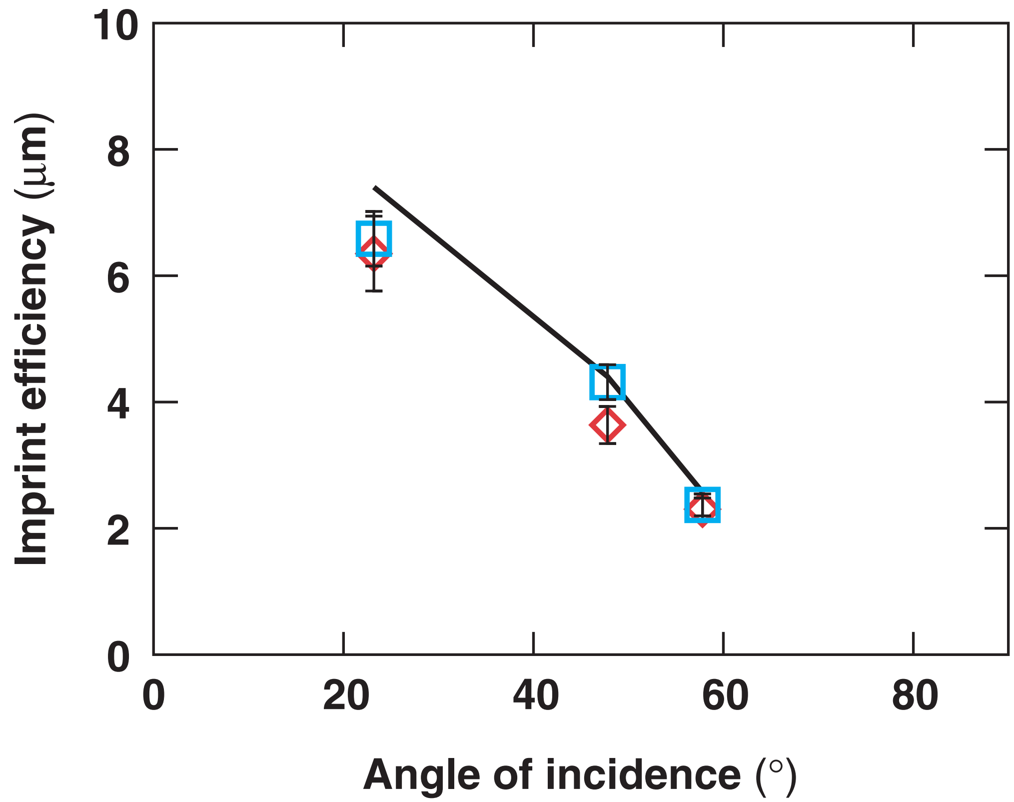
Measurements of Imprinting with Laser Beams at Various Angles of Incidence in Planar CH Foils



V. A. Smalyuk, V. N. Goncharov, T. R. Boehly,
D. Li, J. A. Marozas, D. D. Meyerhofer,
S. P. Regan, and T. C. Sangster
University of Rochester
Laboratory for Laser Energetics

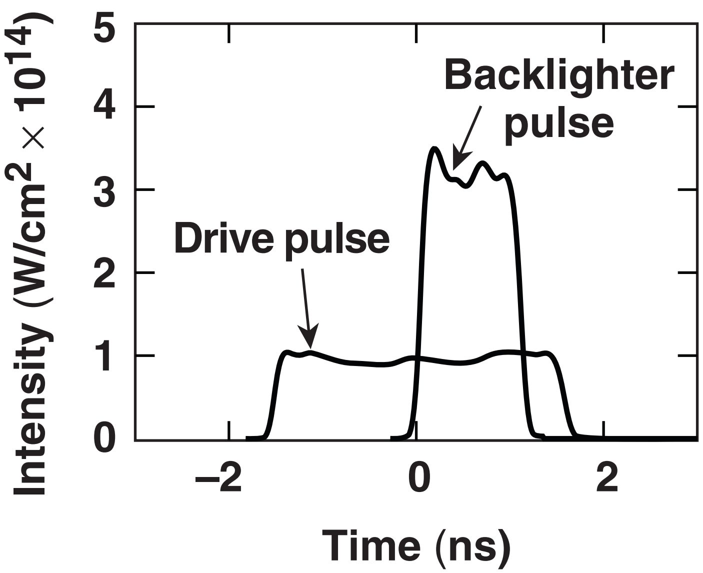
46th Annual Meeting of the
American Physical Society
Division of Plasma Physics
Savannah, GA
15–19 November 2004

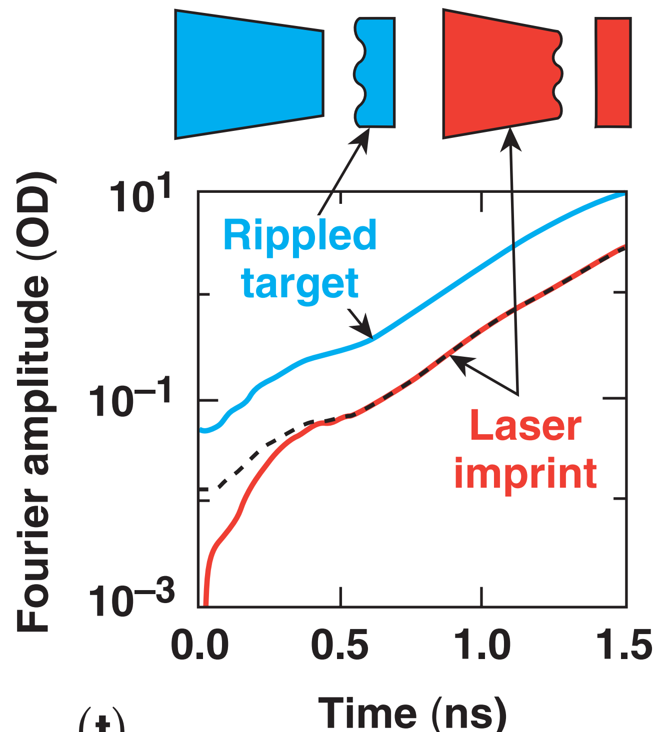
Summary

Imprinting decreases as the beam angle of incidence increases

- Experiments used 20-μm-thick CH targets driven by six overlapped beams at ~10^{14} W/cm^2.
- Beam mistiming significantly increases the imprinting; when the imprint beam was advanced by ~50 ps it increased imprinting by up to eight times.
- Imprinting was reduced by ~3 times when the imprint beam angle of incidence was increased from 20° to 60°.

Imprint efficiency is determined from the ratios of imprinted to preimposed optical-depth modulations





Imprint efficiency: $$IE = \frac{\frac{a_{impr}(t)}{a_{preim}(t)} \times a_0}{\frac{\delta I}{I}}$$

- Targets are 20-μm thick CH foils.

T. R. Boehly *et al.*, Phys. Plasmas 8, 2331 (2001).

E12843

Predictions of the imprinting model* are used to compare with experimental data

UR LLE

Equation for imprinted amplitude η evolution.

$$\underbrace{d_t^2\eta + 4k\,V_a\,d_t\eta}_{\text{Fire polishing}} + \underbrace{k^2\,V_{bl}\,V_a\,\eta}_{\text{Dynamic overpressure}} = \underbrace{\frac{2}{5}k\frac{\delta I}{I}C_s^2\,e^{-kD_{ac}(t)}}_{\text{Accelerational modulation}} + \underbrace{d_t\left[\frac{C_s}{\sqrt{5}}\frac{\delta I}{I}e^{-kD_{ac}(t)}\right]}_{\text{Post-shock velocity modulation}}$$

Parameters simulated by the 1-D code *LILAC*.

C_s = sound speed

V_a = ablation velocity

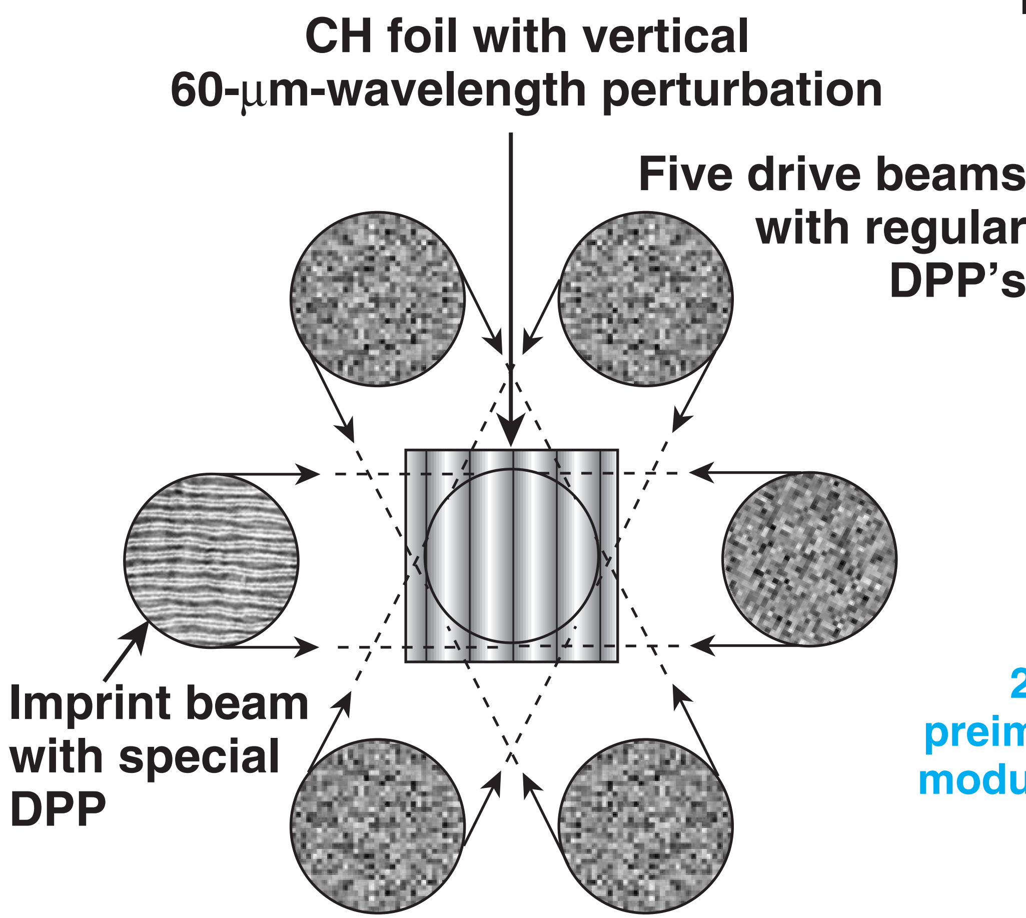
V_{bl} = blow-off velocity, $V_{bl} = V_a/2kL_o$

L_o = density scale length

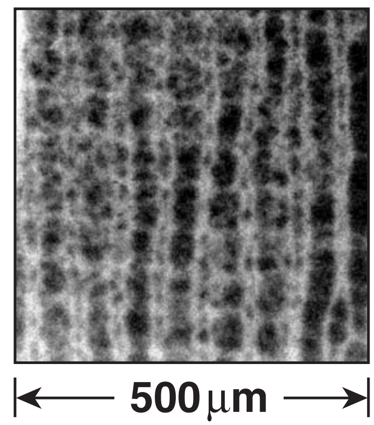
D_{ac} = distance between ablation and critical surfaces

*V. N. Goncharov *et al.*, Phys. Plasmas 7, 2062 (2000).

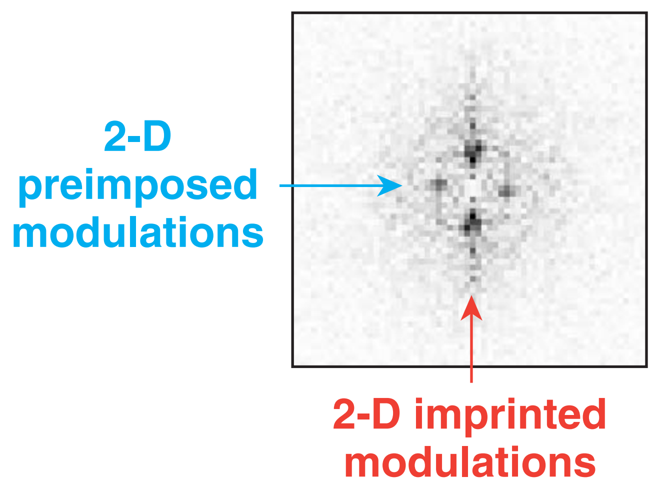
A special DPP with a 2-D 60-μm wavelength perturbation is used in imprint efficiency measurements



Shot 34561
Imprint beam 49 advanced by 10 ps

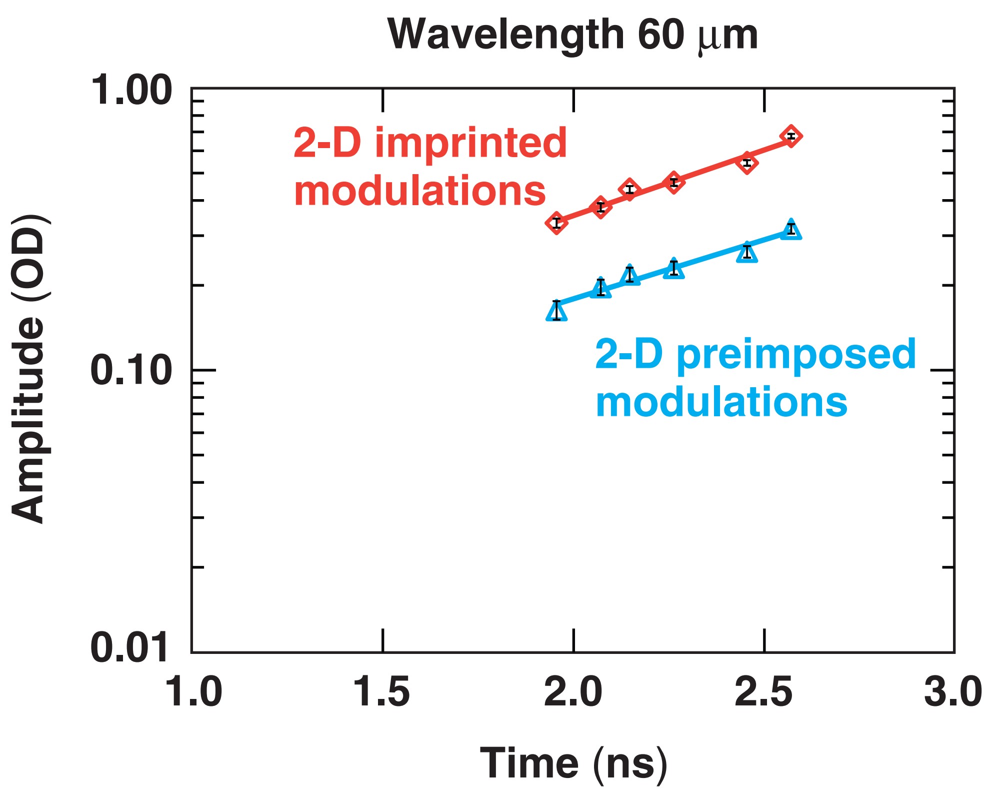


Fourier-plane image



E13410

Imprint efficiency is determined from the ratios of measured imprinted and preimposed optical-depth modulations

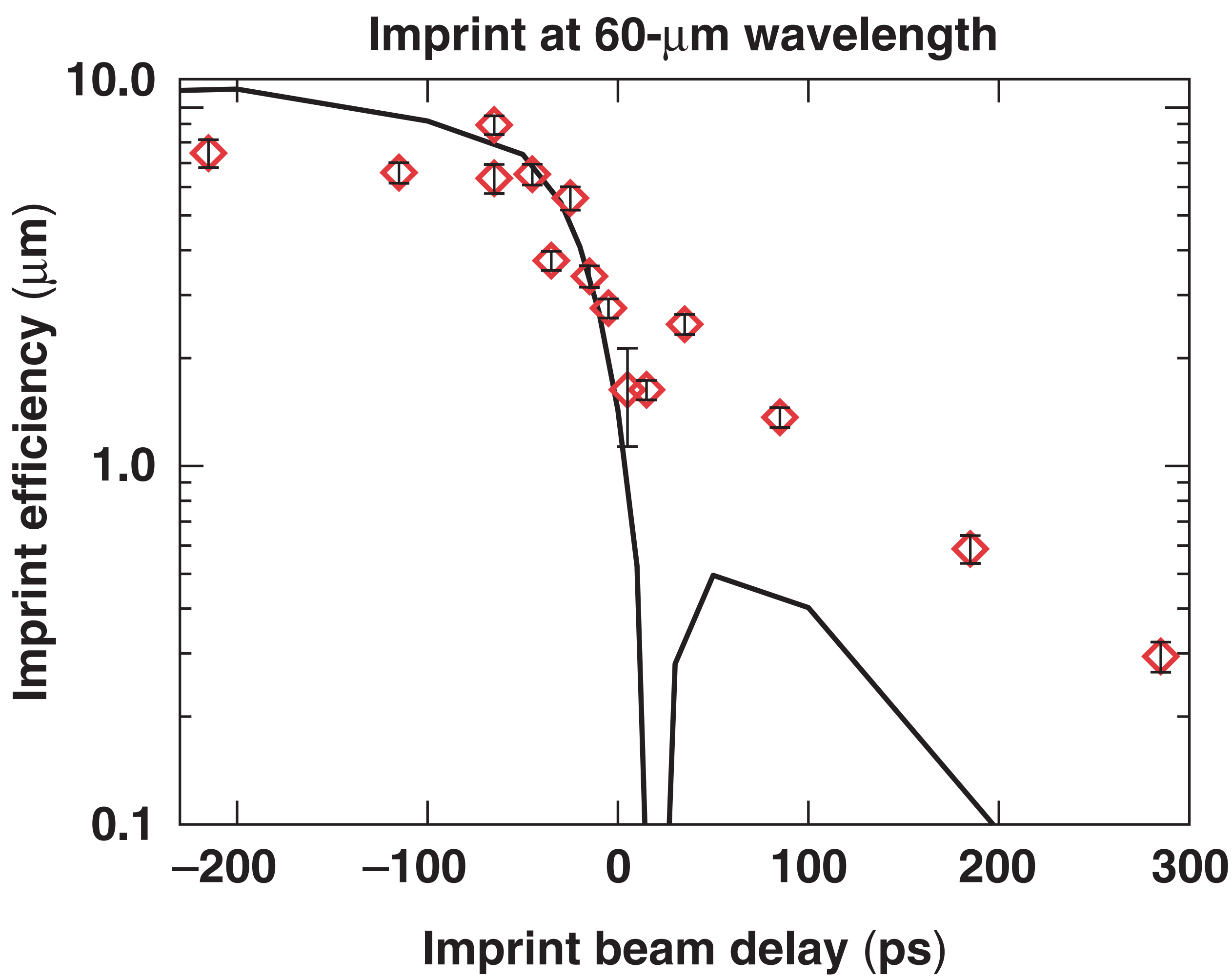


$$IE = \frac{\frac{a_{impr}}{a_{preim}} \times 0.125\ \mu m}{\frac{\delta I}{I}}$$

$$\frac{\delta I}{I} = 0.093$$

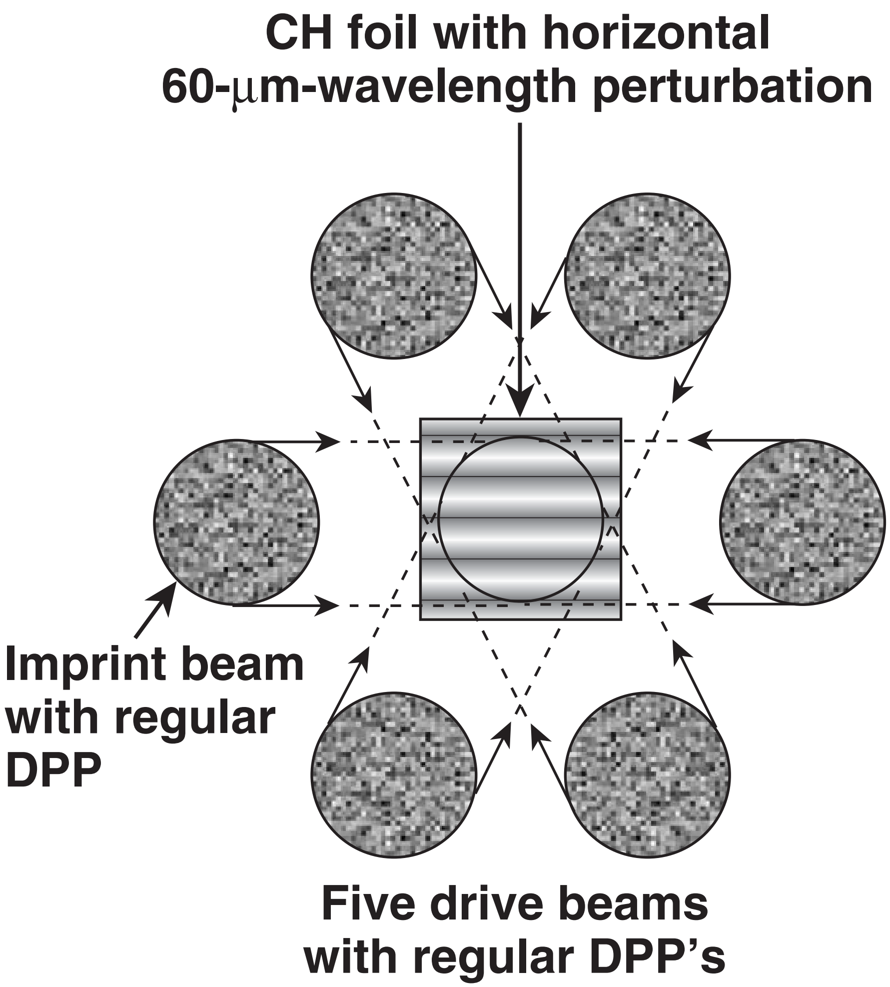
E12846

Imprinting is very sensitive to beam mistiming

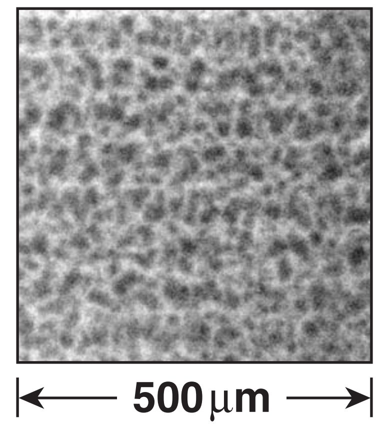


E13155

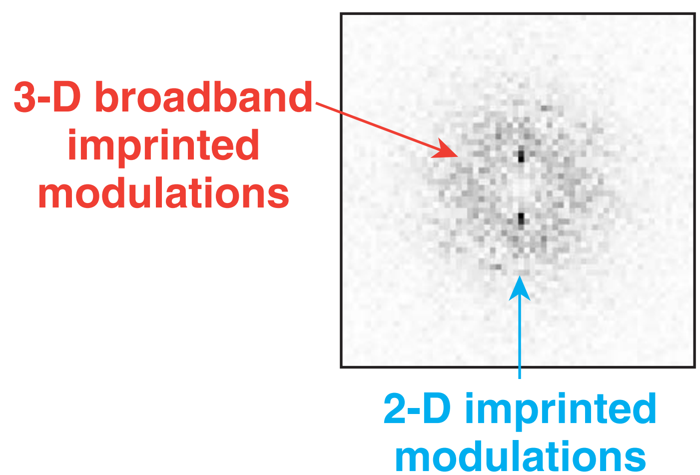
The imprint efficiency of broadband modulations is measured with all drive beams having SG8 DPPs



Shot 35124

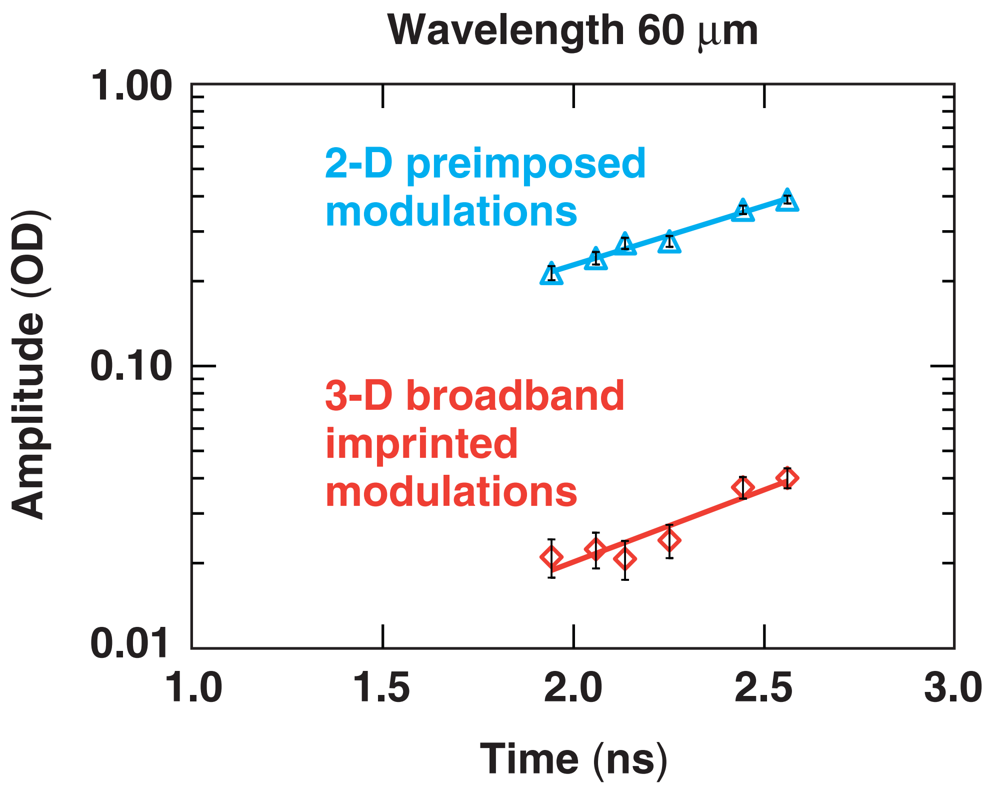


Fourier-plane image



E13411

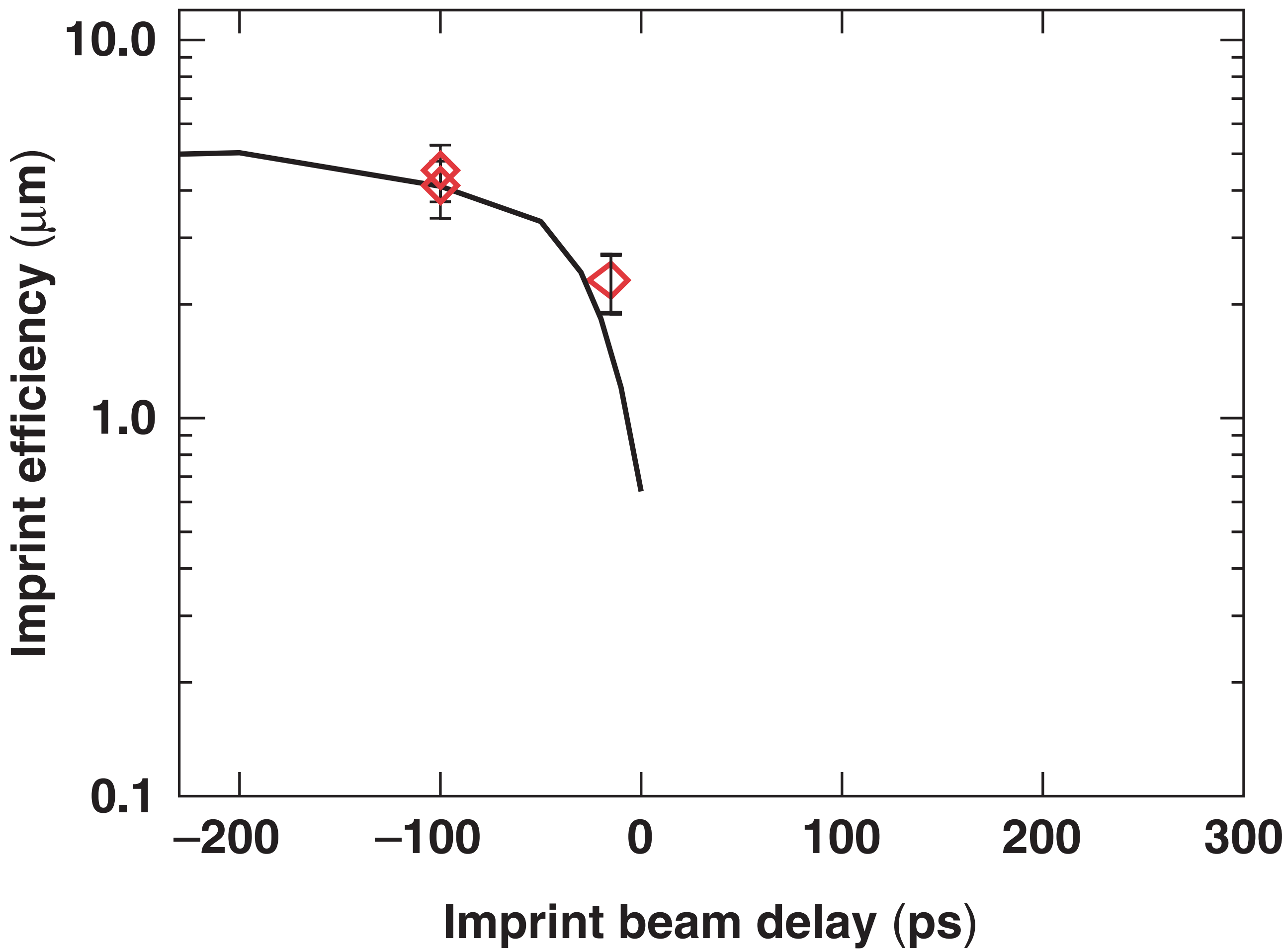
The imprint efficiency of 3-D broadband modulations is determined using the ratios of azimuthally-averaged imprinted modulations to 2-D preimposed modulations



$$IE = \frac{\dfrac{\bar{a}_{impr}}{a_{preim}} \times 0.125\ \mu m}{\dfrac{\delta I}{I}} \qquad \frac{\delta I}{I} = 0.0051$$

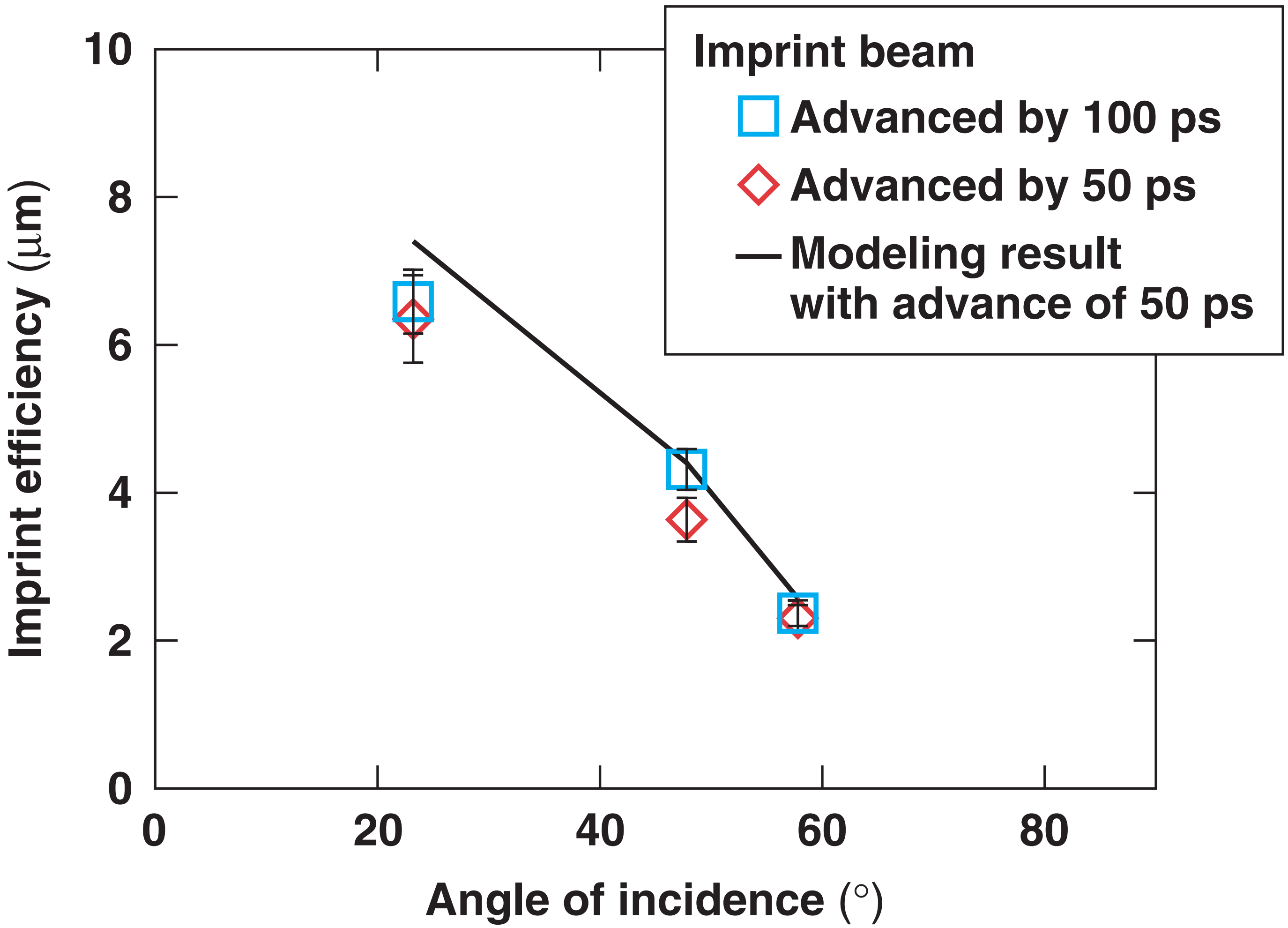
E12849

The imprinting of broadband modulations increase with beam mistiming



E13157

Imprinting is reduced in beams with higher angles of incidence



E13158

Summary/Conclusions

Imprinting decreases as the beam angle of incidence increases

- Experiments used 20-μm-thick CH targets driven by six overlapped beams at ~10^{14} W/cm^2.
- Beam mistiming significantly increases the imprinting; when the imprint beam was advanced by ~50 ps it increased imprinting by up to eight times.
- Imprinting was reduced by ~3 times when the imprint beam angle of incidence was increased from 20° to 60°.