Spatial Chirp Smoothing Within Temporal-Pulse Compression

T. J. KESSLER* and H. HUANG

University of Rochester, Laboratory for Laser Energetics

*jude@lle.rochester.edu

Summary

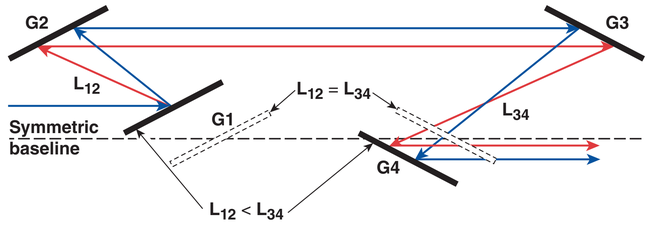
Time-integrated and time-instantaneous laser-beam smoothing is predicted for spatial chirp smoothing (SCS) on CPA laser pulses

- SCS increases beam uniformity by converting spatial modulation into local temporal broadening.
- SCS provides laser-beam spatial filtering without decrease of focal-spot fluence.
- SCS has been implemented on two short-pulse beamlines of the OMEGA EP laser

E17241

H. Huang and T. J. Kessler, Opt. Lett. 32, 1854 (2007).

The asymmetric compressor leaves a residual lateral color shift after the final grating



$$I_4(\mathbf{x}) = \int d\omega I(\omega, \mathbf{x}')$$

$$\mathbf{x}' = \mathbf{x} + d\theta/d\omega \times (L_{12} - L_{34}) \times (\omega - \omega_0)$$

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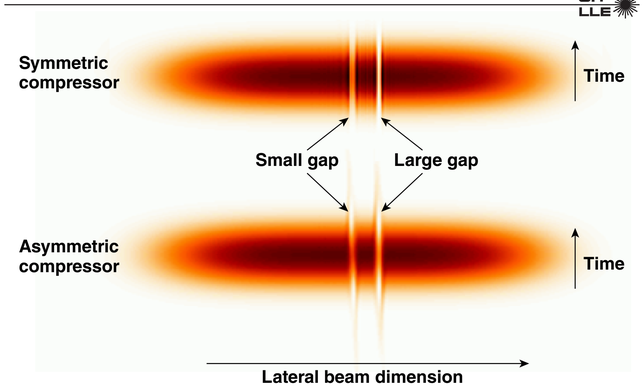
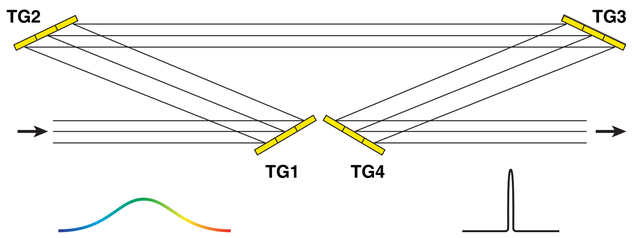
Pulse broadening is observed at the position of the obscuration for an uncompensated grating compressor



Instantaneous irradiance is reduced by pulse broadening.

E17239

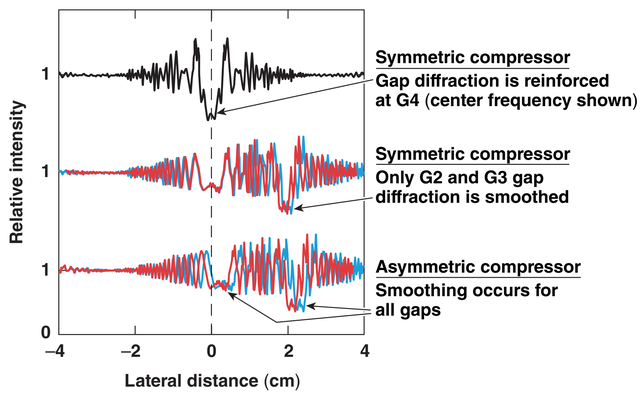
Tiling reduces the size of the unit grating and decreases the expense of replacement



Diffraction from tiling gaps must be controlled.

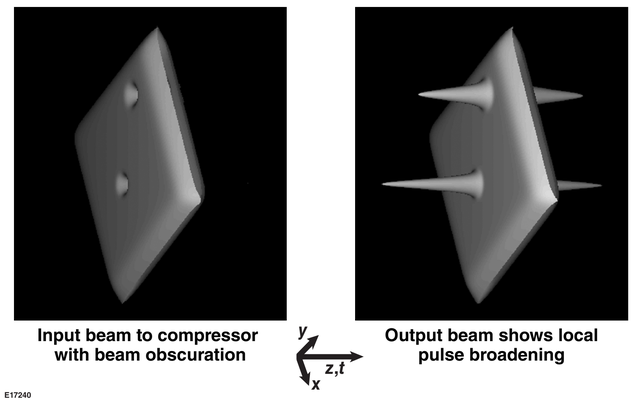
E12351g

Spatial chirp smoothing (SCS) involves a 1-D spectral convolution across the beam



E15389

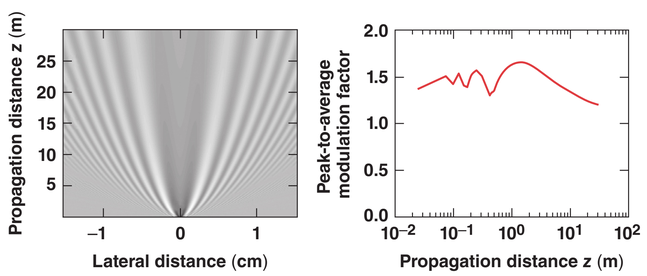
The instantaneous irradiance is reduced by SCS due to pulse broadening near the modulation source



E17240

Beam obscurations cause high-fluence modulation that persists over long distances from the source

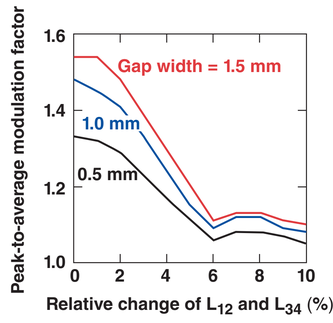
Simulations of a 1-mm-wide grating gap

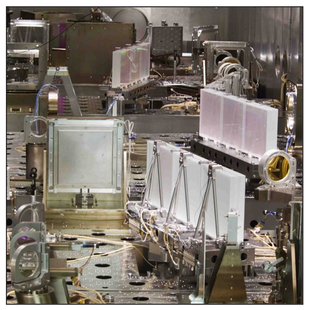


E15388

OMEGA EP compressors have the alignment flexibility to benefit from SCS

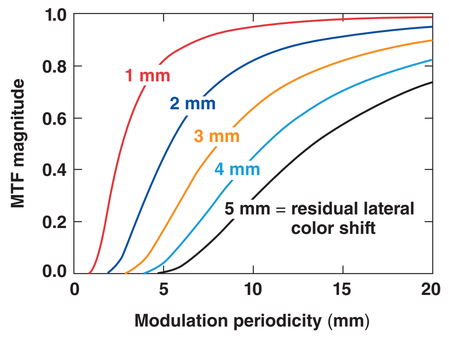
- Time-integrated laser-beam smoothing reduces the peak fluence after the final grating





E16408a

SCS provides laser-beam spatial filtering without decreasing focal-spot fluence



E15391