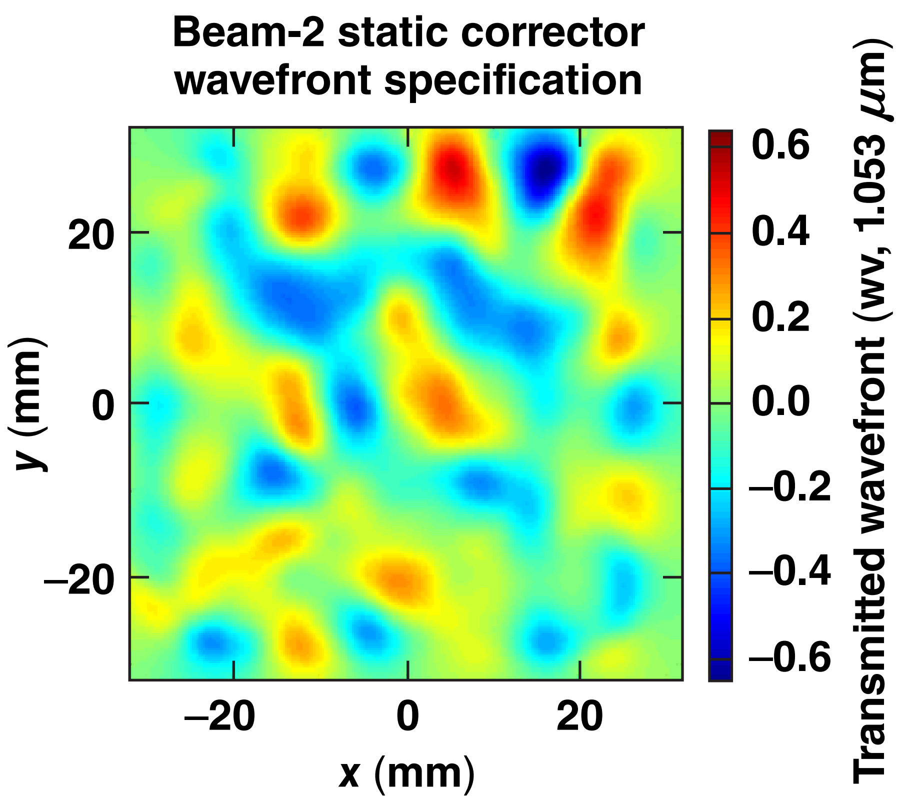
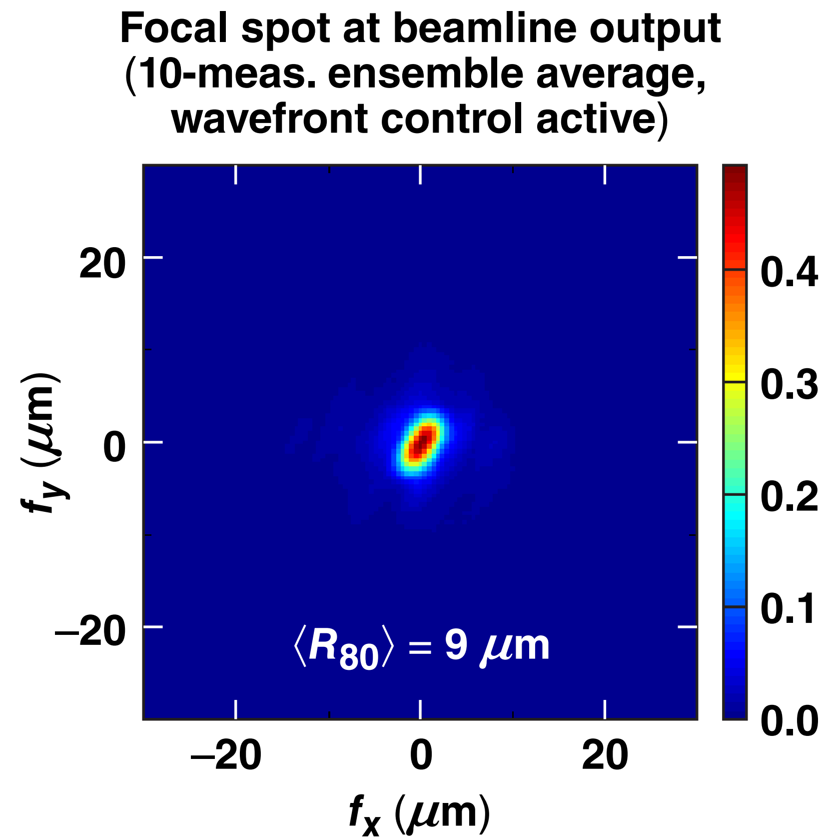
Status of the OMEGA EP Laser System





53rd Annual Meeting of the
American Physical Society
Division of Plasma Physics
Salt Lake City, UT
14–18 November 2011

D. D. Meyerhofer
University of Rochester
Laboratory for Laser Energetics

Summary

LLE continues to improve the performance of the OMEGA EP Laser System

UR LLE

- A static wavefront corrector on an OMEGA EP high-energy petawatt (HEPW) beamline reduces the focal-spot diameter by 25%
- New ultraviolet optics have increased the available UV beam energies
- An engineered diffuser will improve the temporal measurement of 8- to 250-ps pulses

Further discussion of OMEGA EP performance and improvements at tonight's Omega Laser Users' Group Meeting – 1730–1900 in room 151 ABCG.

Collaborators

S.-W. Bahk, J. Bromage, C. Dorrer, J. H. Kelly, B. E. Kruschwitz, S. J. Loucks, R. L. McCrory, S. F. B. Morse, J. Qiao, C. Stoeckl, L. J. Waxer, and J. D. Zuegel

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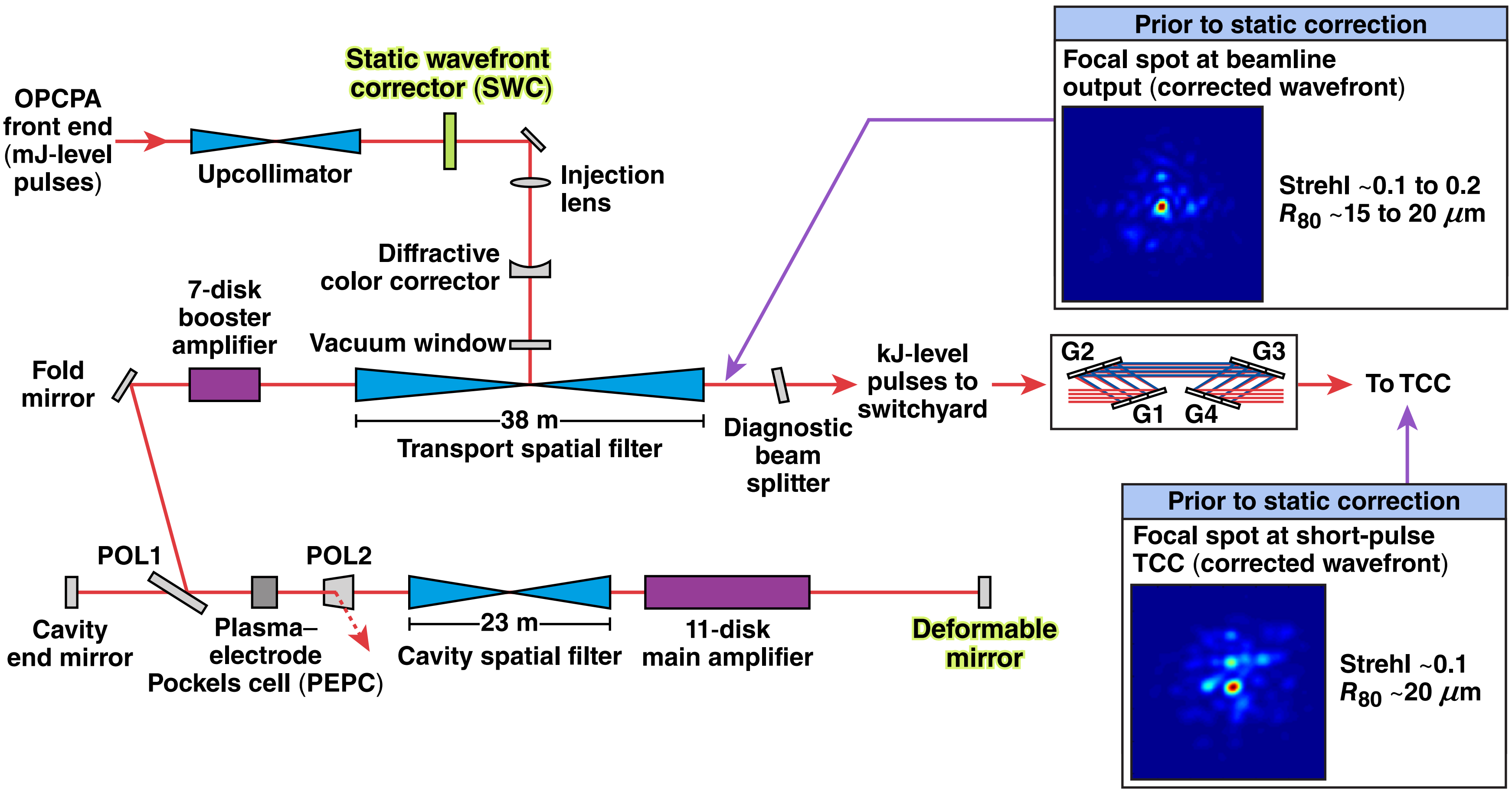
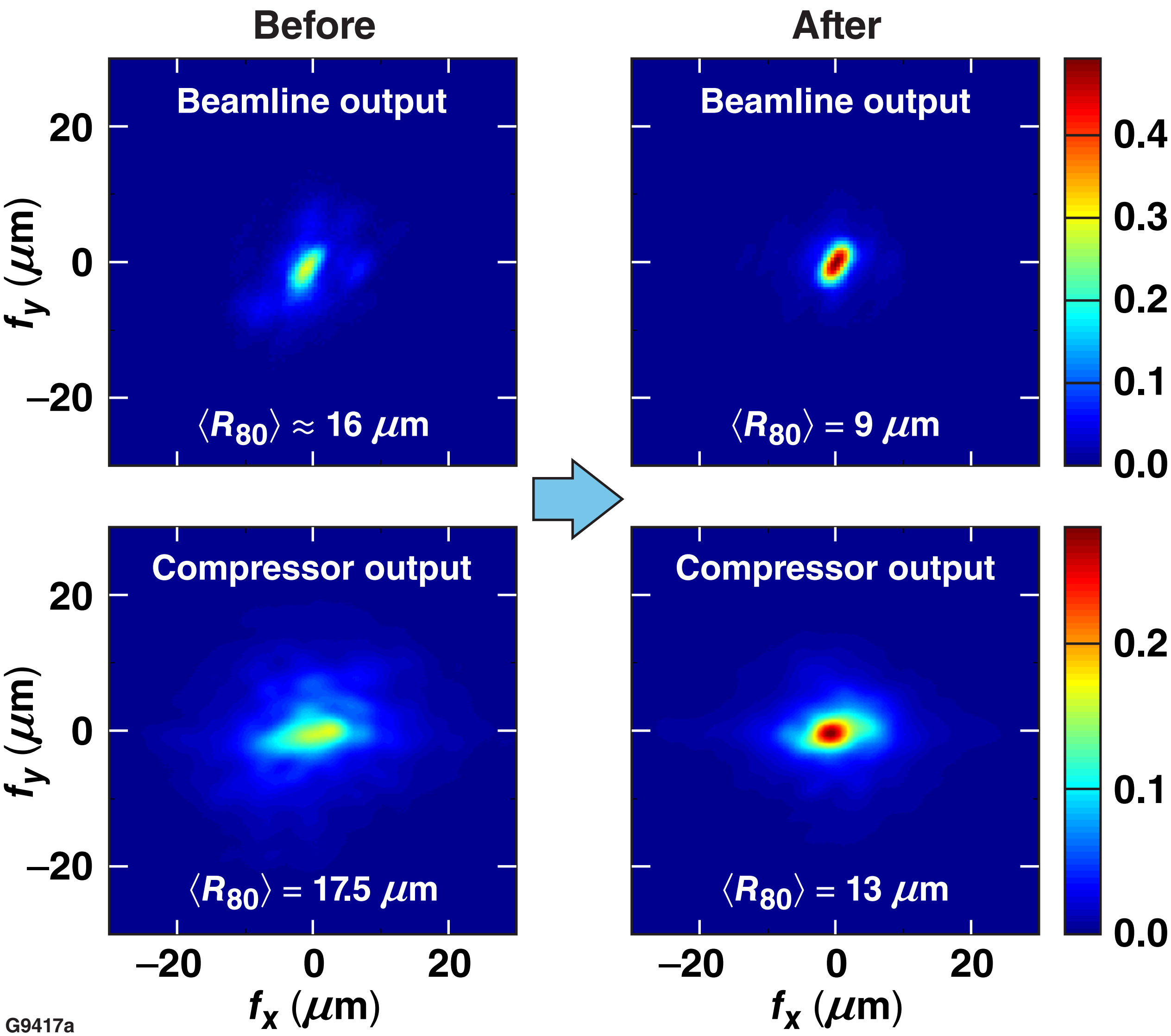
Static wavefront correction is used to reduce high-order residual wavefront error in the IR beamlines after active correction



The static wavefront corrector compensates for wavefront errors in the IR beamlines only (not compressor or UV sections).

G7793o

Focal-spot improvement with active wavefront control was confirmed at beamline and compressor outputs



Ensemble averages of ten measurements each are shown

Shot-to-shot pointing changes were removed

G9417a

Target-plane focal-spot performance has been improved with the SWC; disk heating is the next challenge

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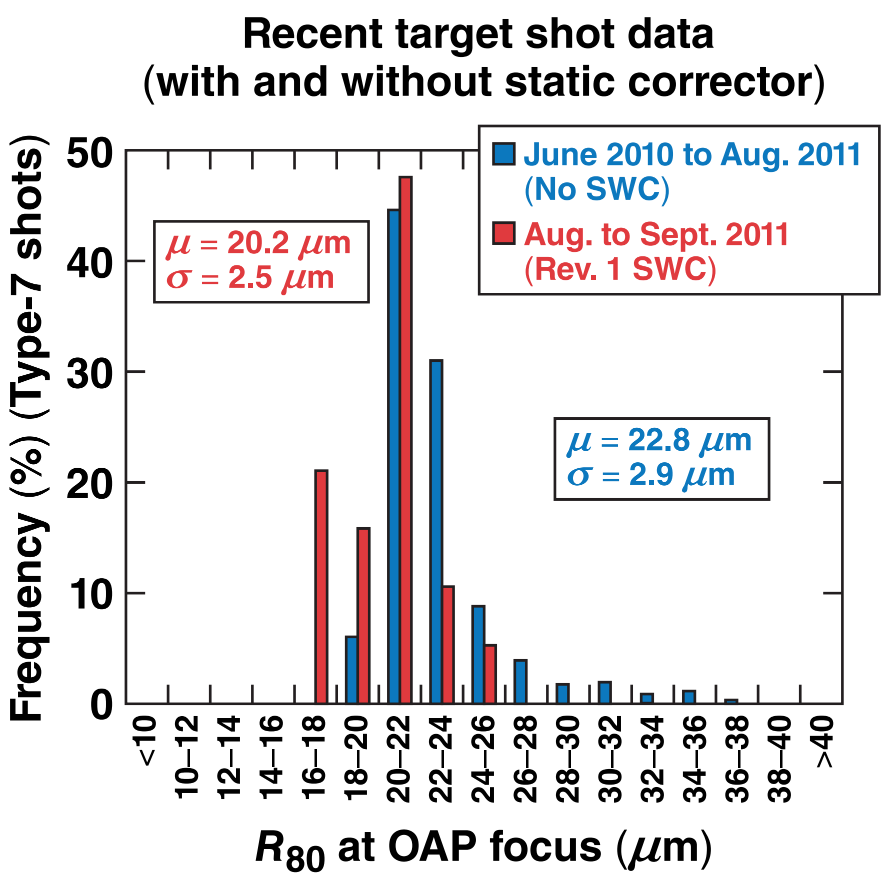

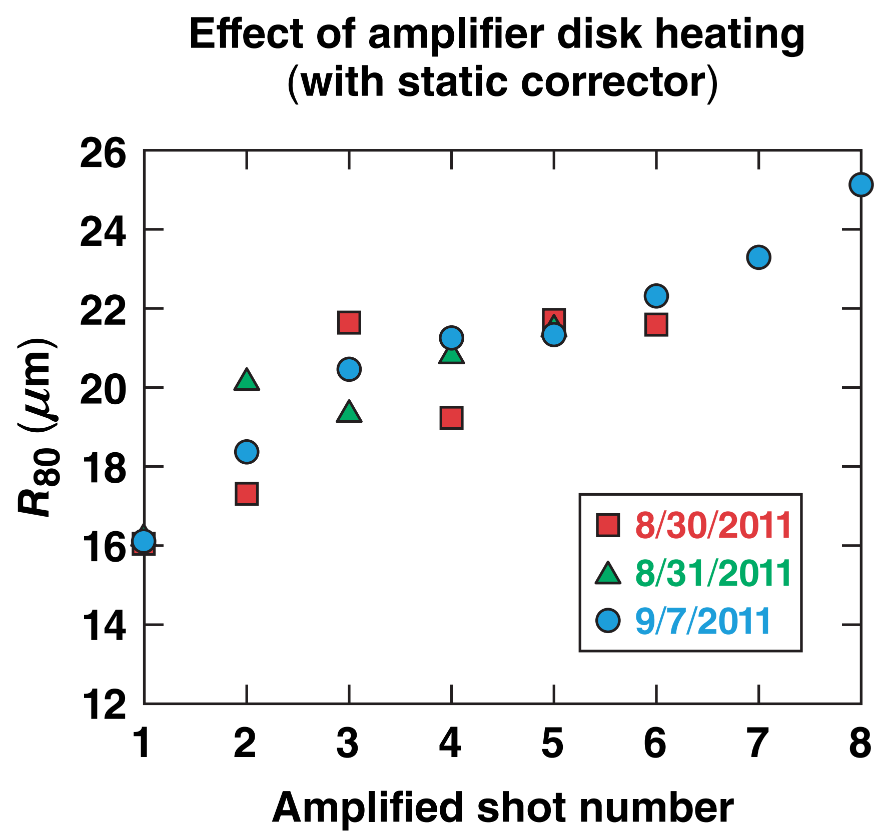

An upcoming revision of the static corrector will compensate for disk heating effects to optimize performance for the 3rd to 4th shot of the day.

G9418

OMEGA EP UV maximum energy was increased in FY11 after a damage-threshold campaign was completed

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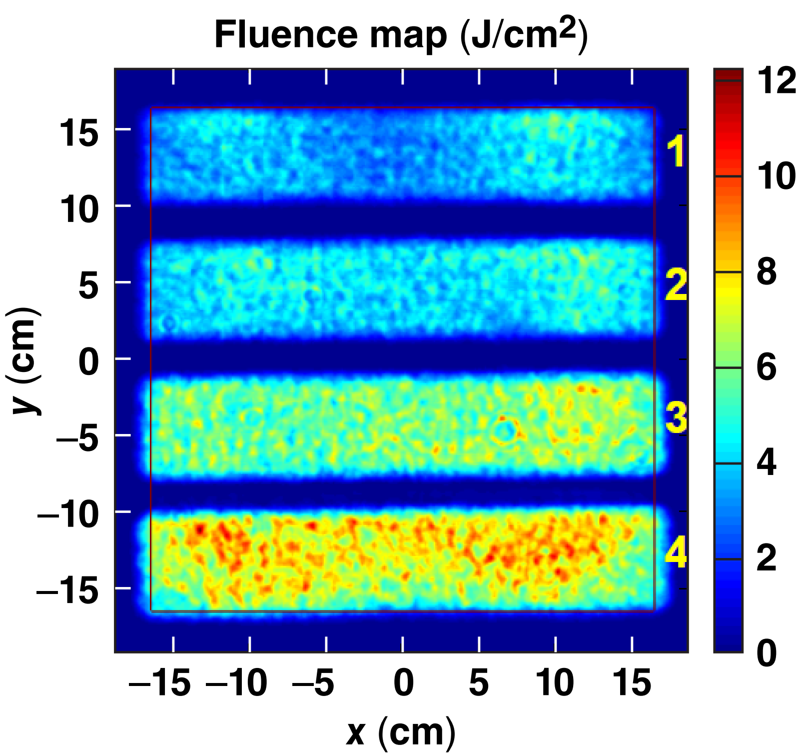
- **Damage testing on BL4 led to a determination of the operational fluence for new optics**
- **A four-segment beam was launched to increase the efficiency of the measurement**



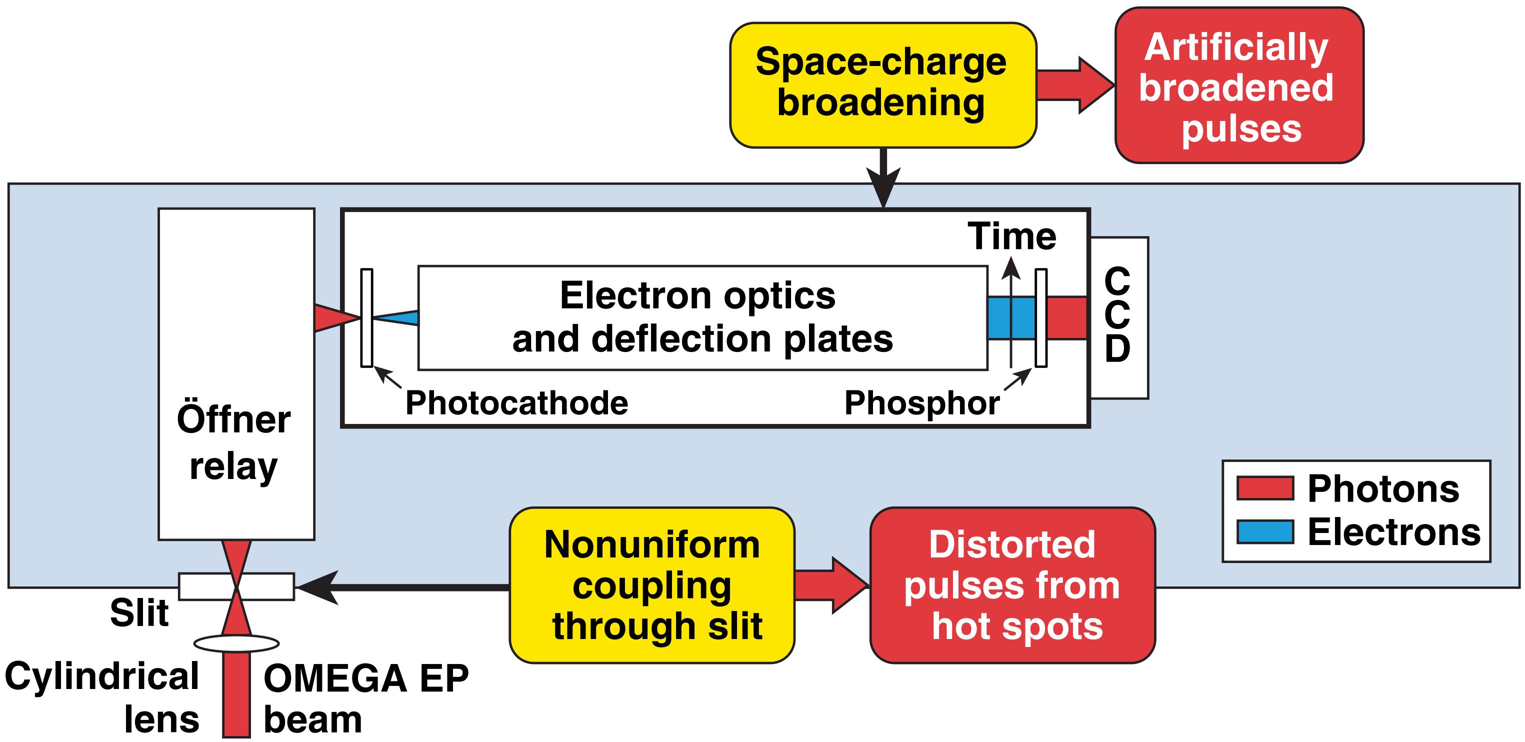
- **Four-fold increase in data collected allowed for a sufficient number of shots at each fluence to ensure initiation and growth of damage**
- **Damage observed early on segment 4 caused the segment to be blocked before continuing the campaign**

Updated energy table at www.epops.lle.rochester.edu

G9439a

The high-speed Rochester Optical Streak System (ROSS) is used to measure pulse widths from 8 to 250 ps

Short-pulse measurement using a streak camera is sensitive to beam quality and space-charge–broadening effects



- Wavefront aberrations create modulations in the far field
- Hot spots in the foci exacerbate space-charge broadening
- Shot-to-shot pulse measurement is compromised by the pointing variations

G9394a

A 10° × 0.4° anamorphic diffuser has been developed to homogenize the far-field image in space

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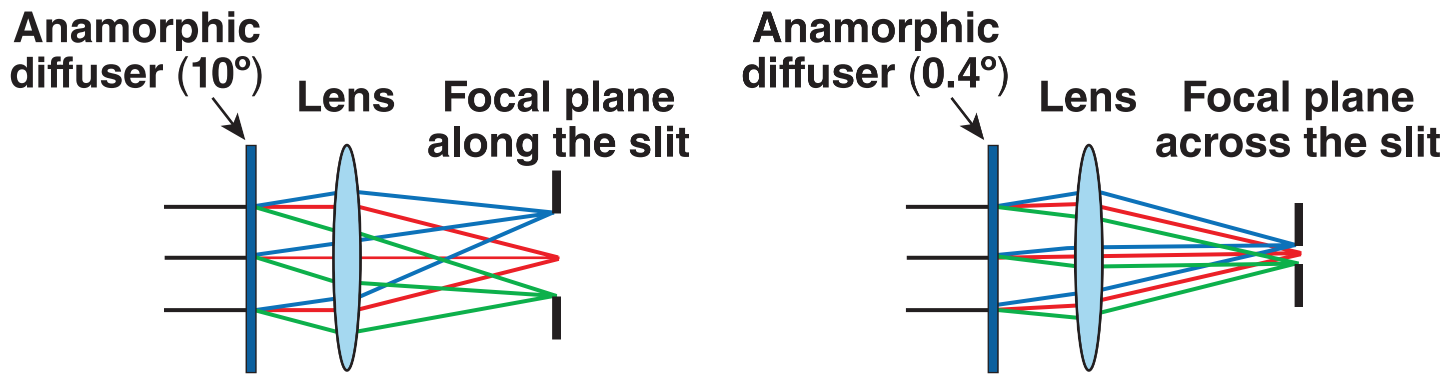
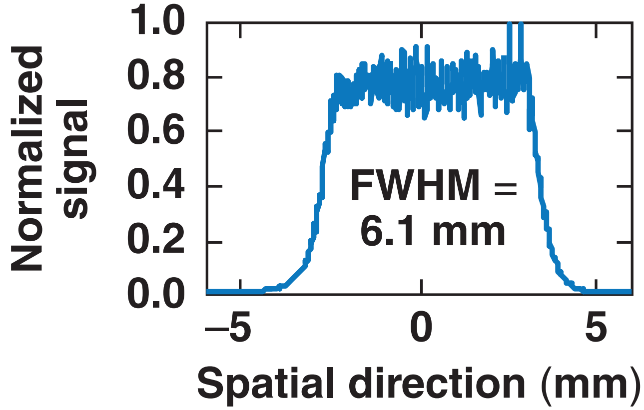
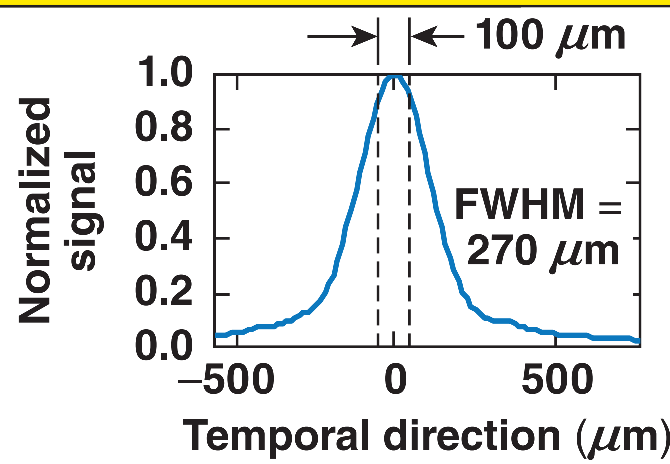
- Provides different divergence angles in two orthogonal directions
- All points on the diffuser plane contribute to the energy collected at each location on the focal plane



cw measurement at 1053 nm using a charge-coupled device (CCD) camera





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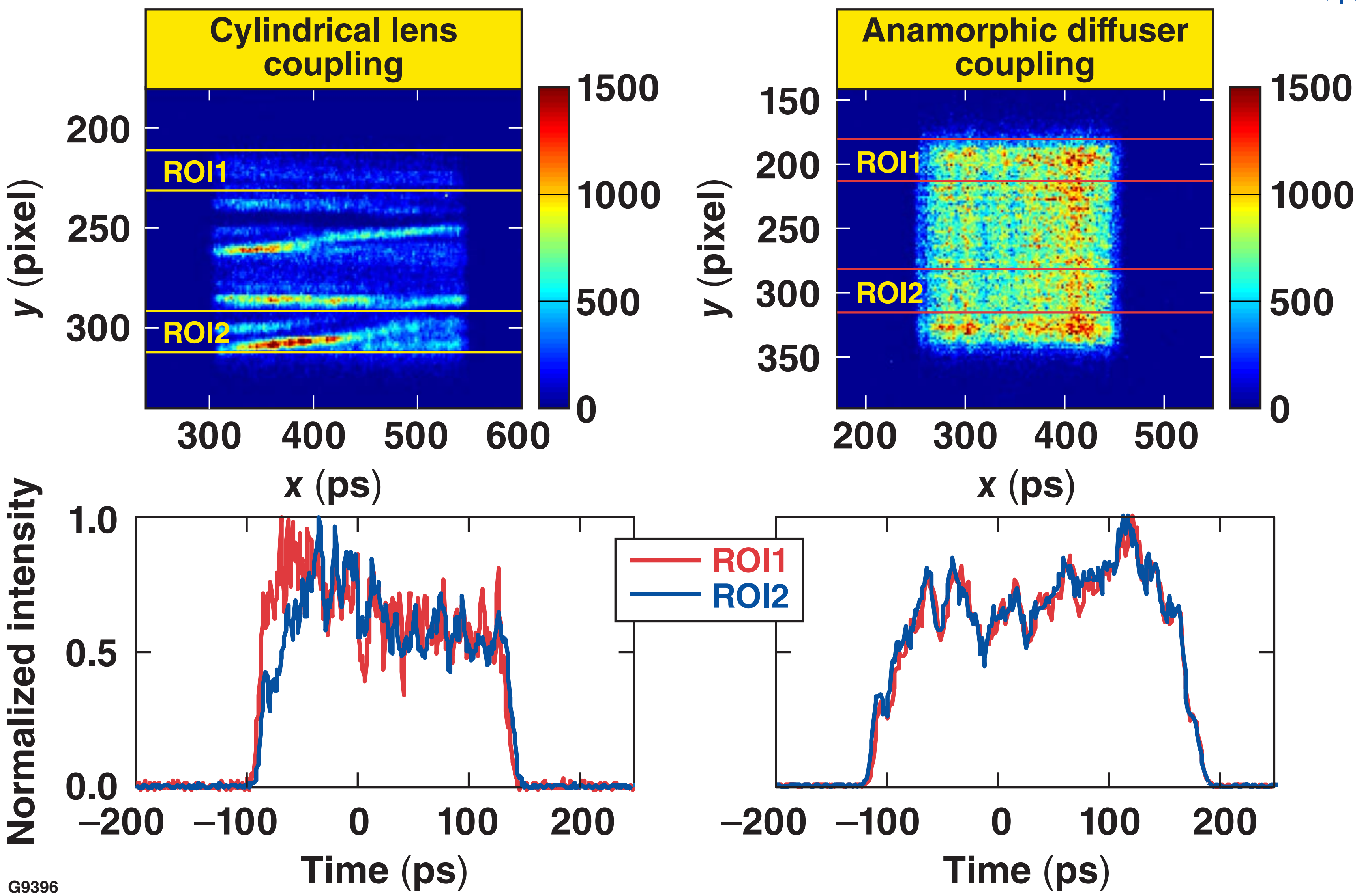
The improved illumination mitigated the temporal distortion induced by the hot spots



Summary/Conclusions

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