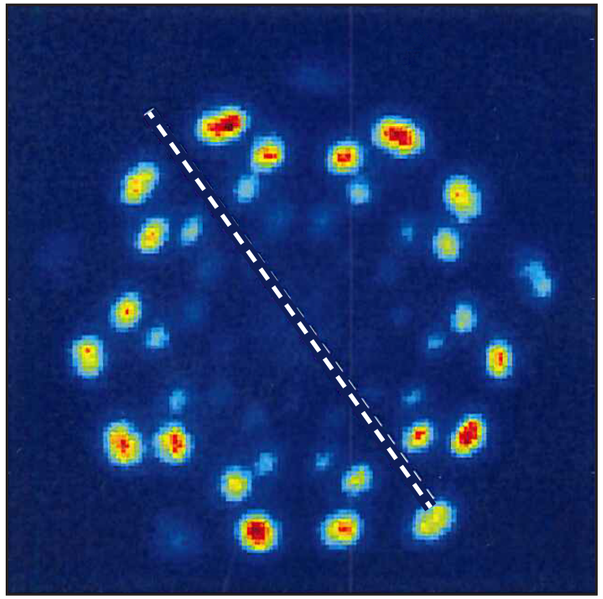
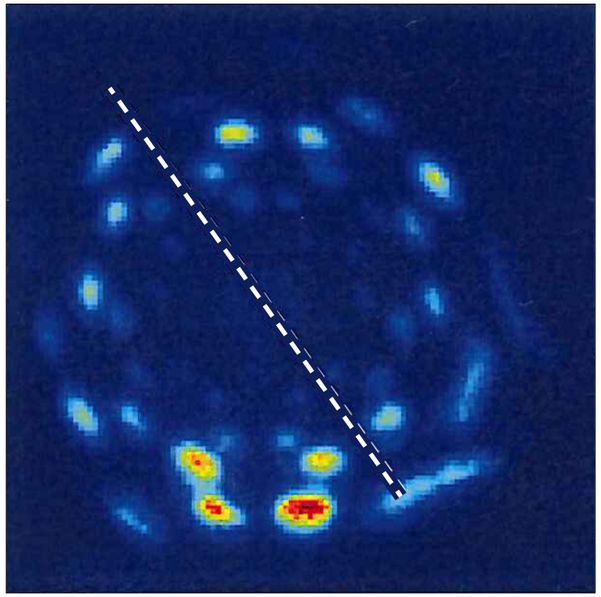
3-D Modeling of Polarization Effects on Cross-Beam Energy Transfer in OMEGA Implosions

Polarization smoothed



Linear polarization



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58th Annual Meeting of the
American Physical Society
Division of Plasma Physics
San Jose, CA
31 October–4 November 2016

Summary

Polarization effects in cross-beam energy transfer (CBET) have been observed in direct-drive implosions on OMEGA

- Polarization effects are observed with the CBET beamlets diagnostic when the beams are linearly polarized
- The CBET polarization effects alter the polarization itself during CBET
- 3-D CBET ray-based modeling has been extended to include polarization effects on CBET and now predicts asymmetric beamlets images when beams are linearly polarized

Collaborators

R. K. Follett, J. Katz, J. F. Myatt, J. Shaw, and D. H. Froula

University of Rochester
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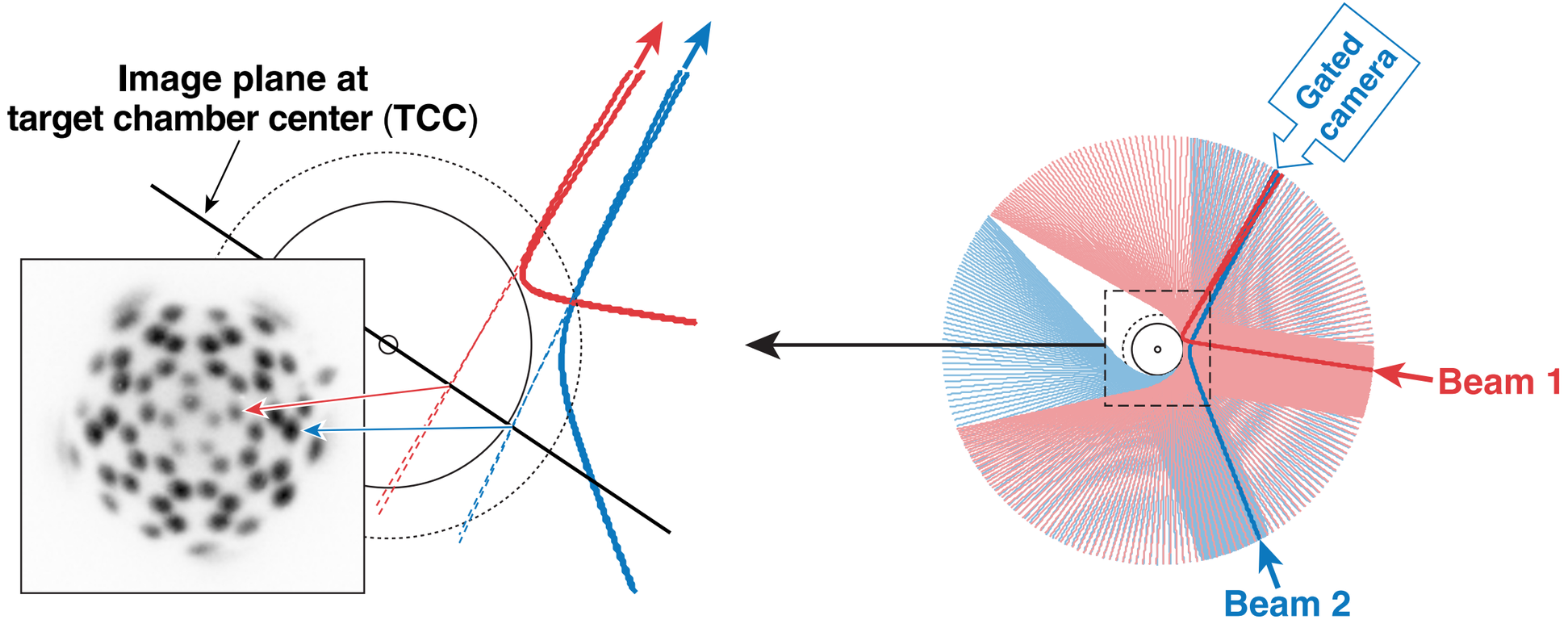
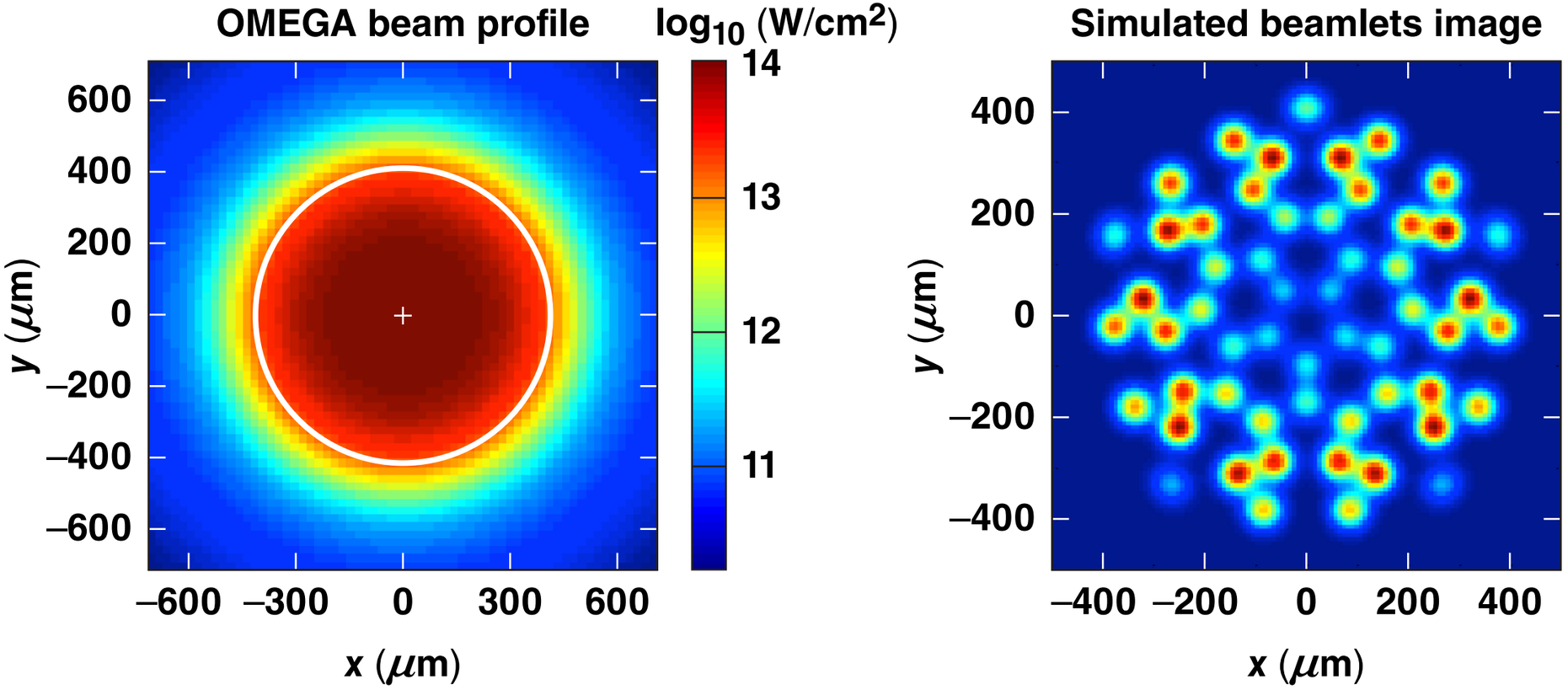
The CBET beamlets diagnostic records scattered-light intensities, each from a unique light path and each from a different OMEGA beam



- A specific bundle of light from a beam follows a specific path through the plasma and is referred to as “beamlet”
- Each beam can be considered to be composed of many beamlets, but only one specific beamlet from each beam is recorded

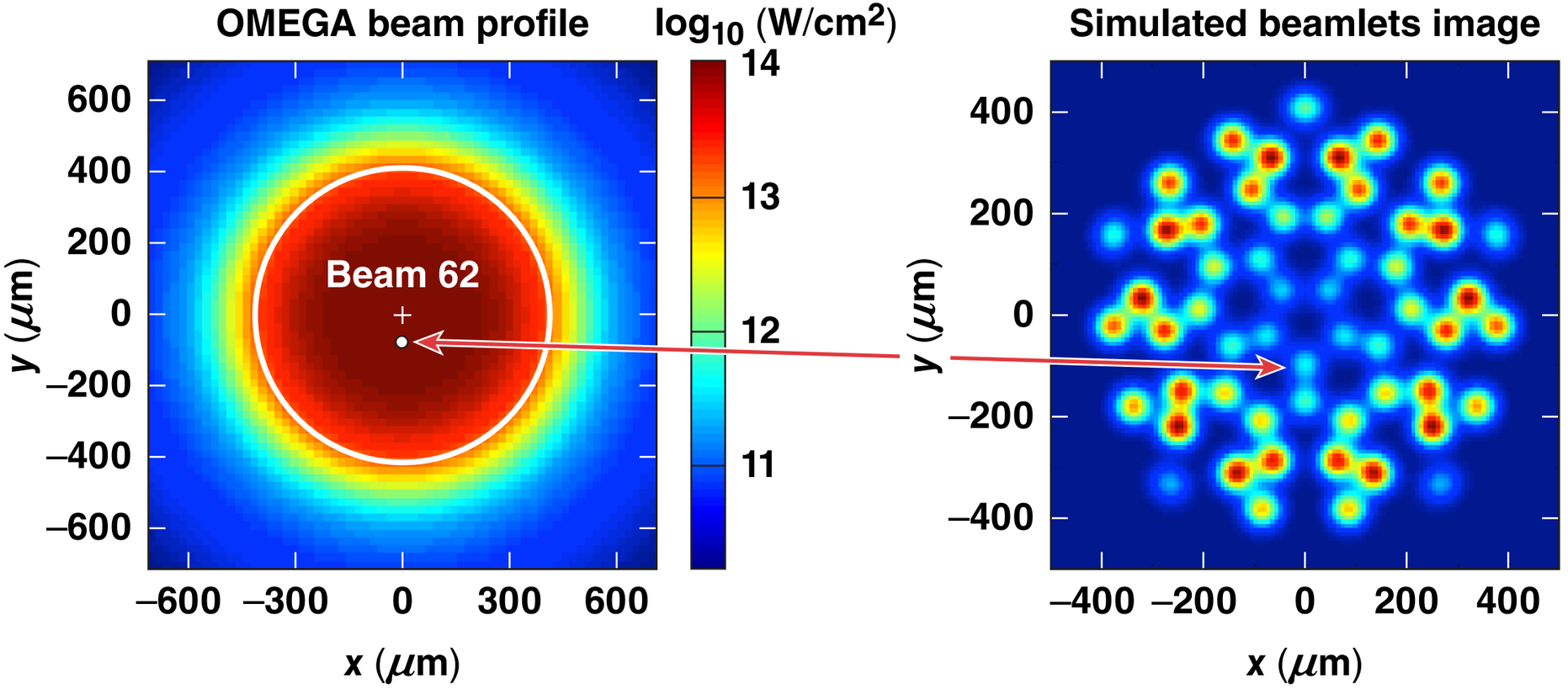
E25651

CBET affects each beamlet differently because the unique path of each beamlet crosses the 60 OMEGA beams differently



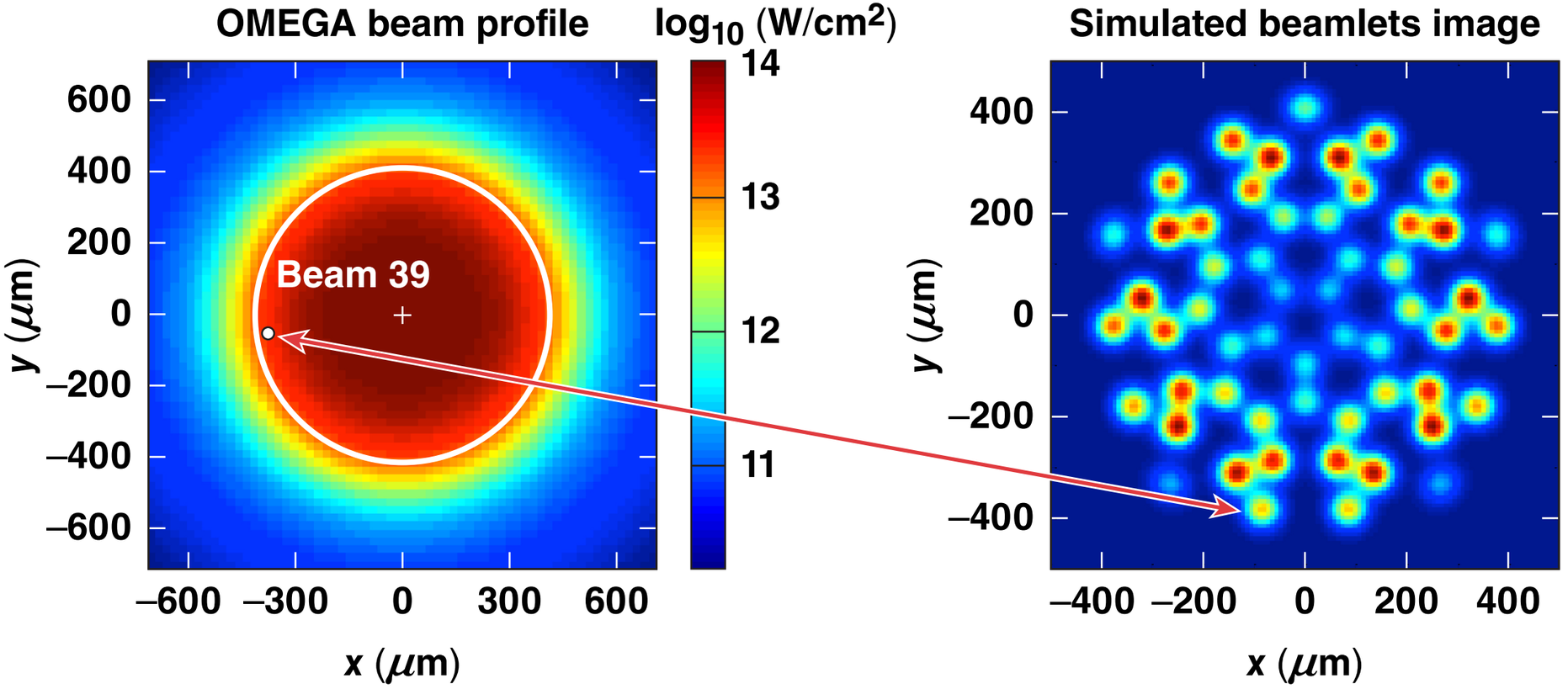
E24259c

CBET affects each beamlet differently because the unique path of each beamlet crosses the 60 OMEGA beams differently



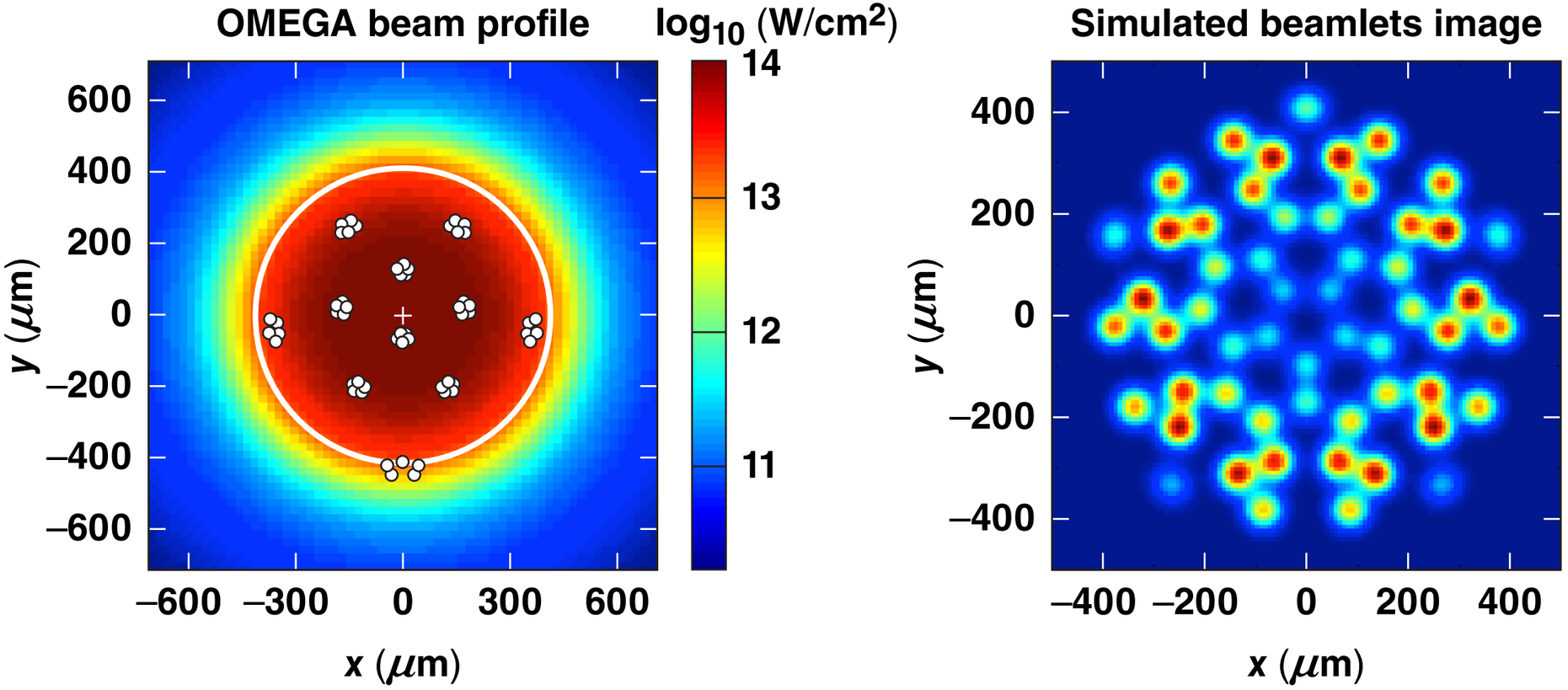
E24260c

CBET affects each beamlet differently because the unique path of each beamlet crosses the 60 OMEGA beams differently



E24261c

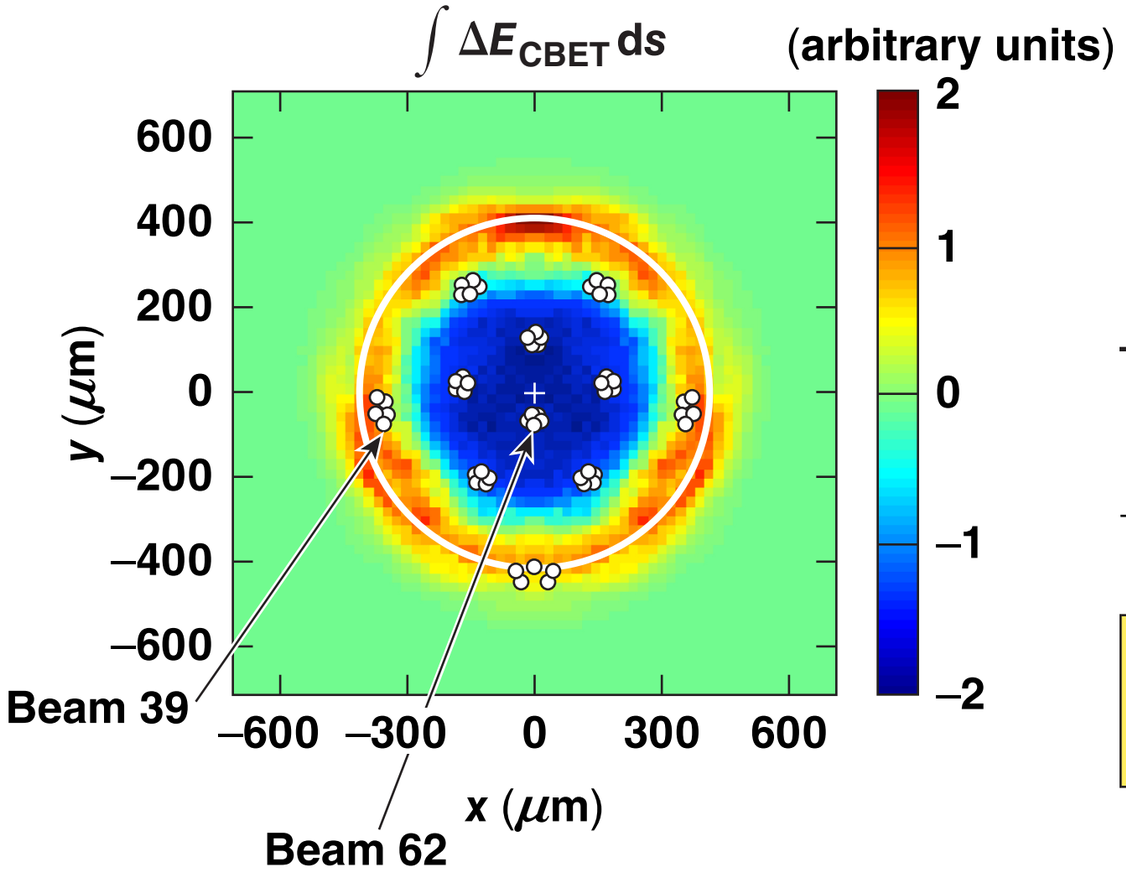
CBET affects each beamlet differently because the unique path of each beamlet crosses the 60 OMEGA beams differently

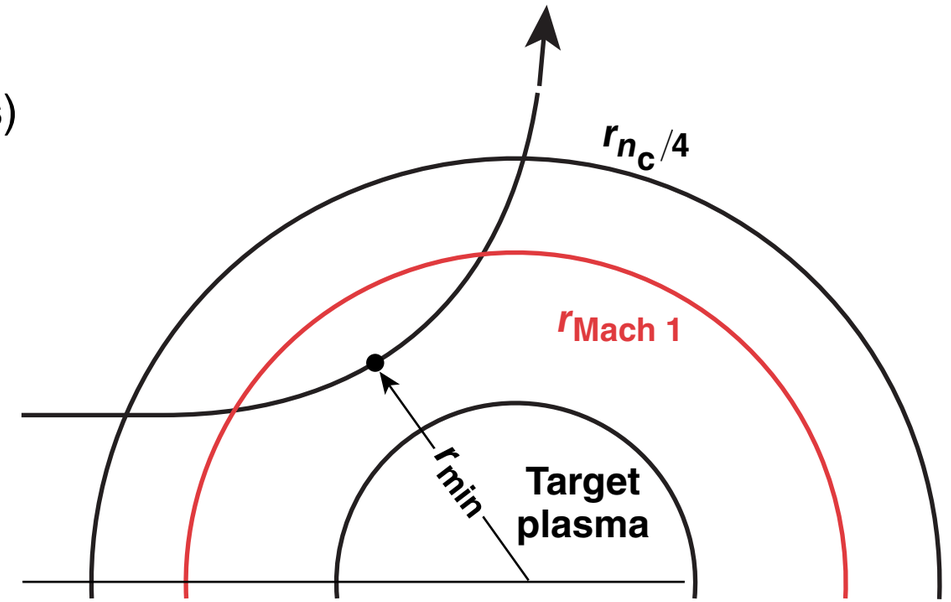


60 identical beams sample CBET along many unique paths in a beam.

E24262c

CBET affects each beamlet differently because the unique path of each beamlet crosses the 60 OMEGA beams differently



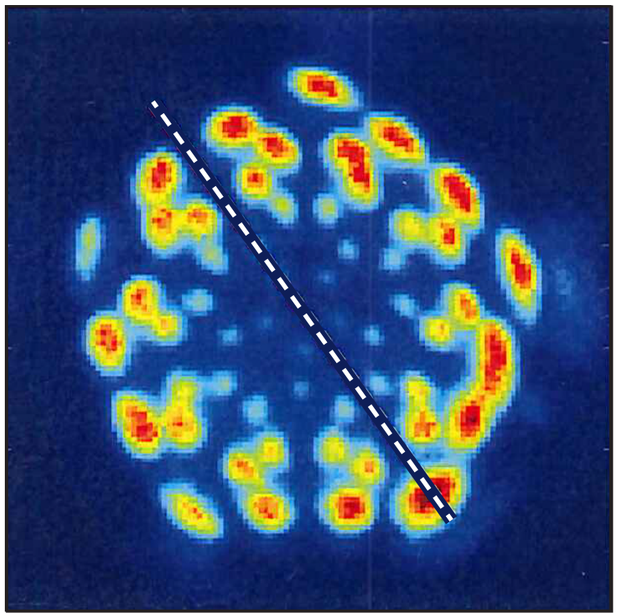


Some of the recorded beamlets experience net loss because of CBET, while others experience a net gain.

E17999d

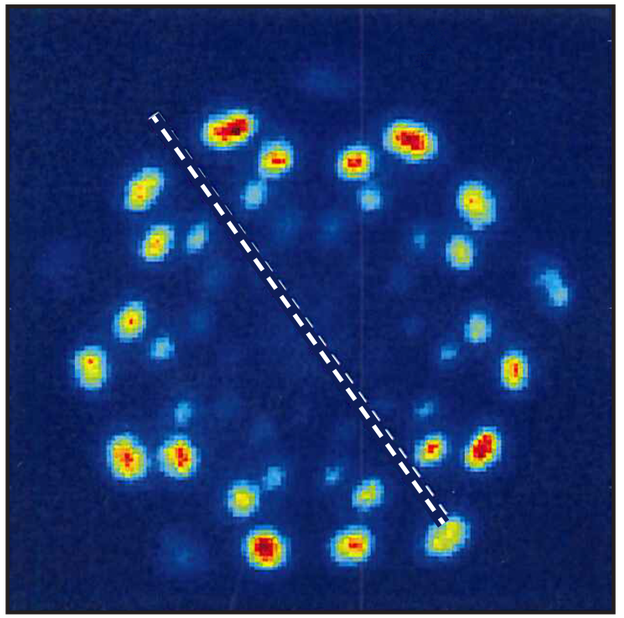
Beams with polarization smoothing produce fairly symmetric beamlet spot images

Early-time, little CBET



DPR's in

Late-time, strong CBET

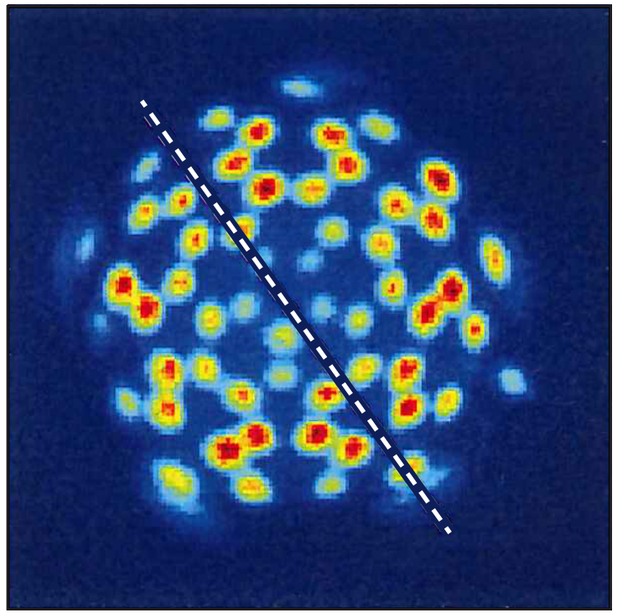


- Distributed polarization rotators (DPR's) split each beam into two co-propagating orthogonal polarizations with slightly different k vectors

E24744c

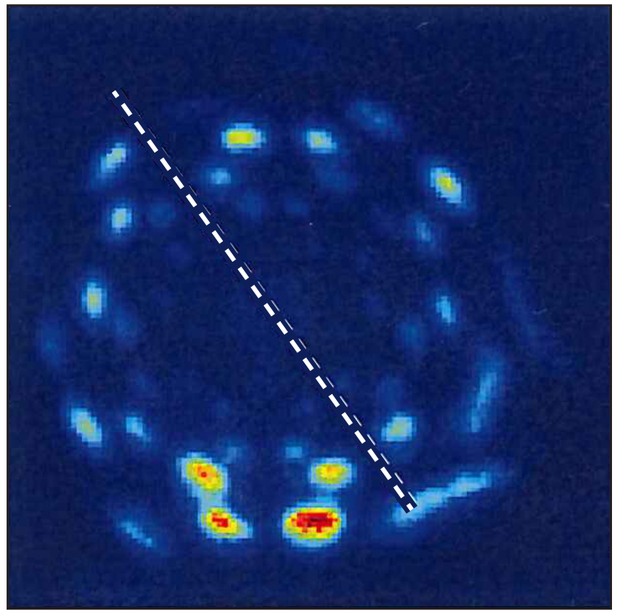
Polarization effects on CBET are believed to cause asymmetric images with linearly polarized beams

Early-time,
little CBET



DPR's
out

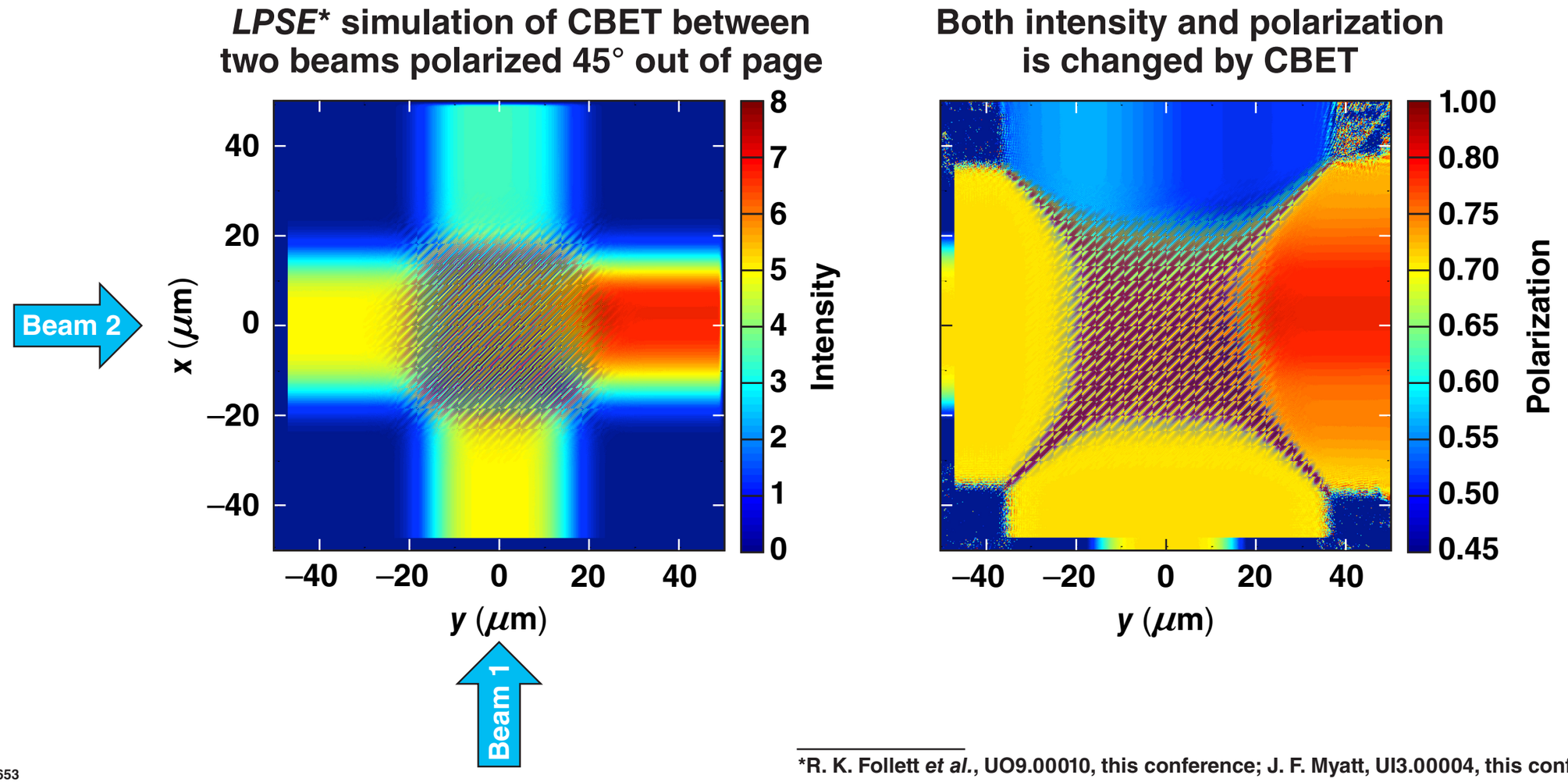
Late-time,
strong CBET



*P. Michel *et al.*, Phys. Plasmas 20, 056308 (2013).

E24744d

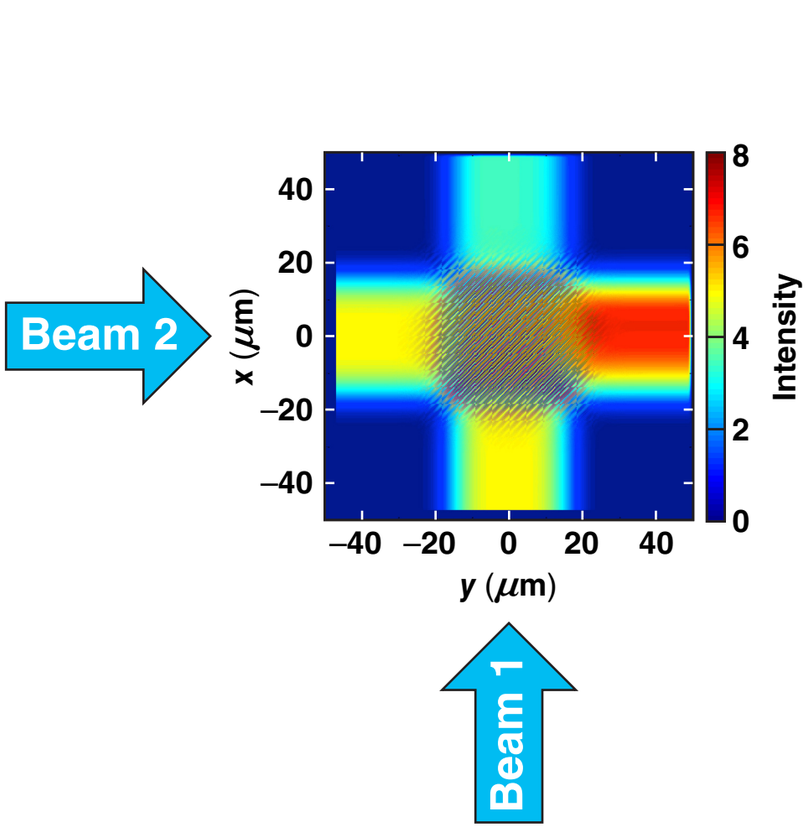
Polarization strongly affects CBET between crossing beamlets since only the shared electric-field component of polarization gains/loses energy

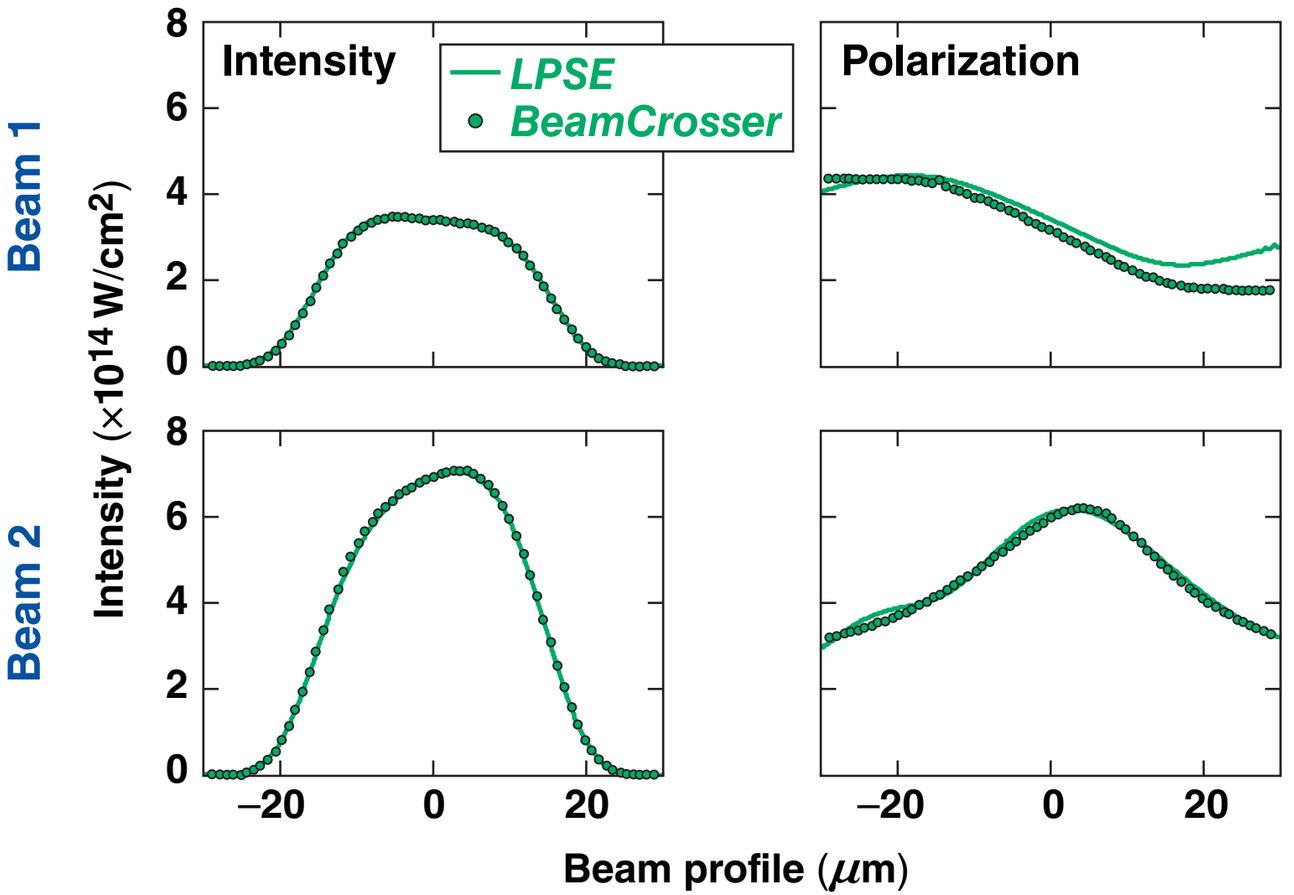


*R. K. Follett *et al.*, UO9.00010, this conference; J. F. Myatt, UI3.00004, this conference (invited).

E25653

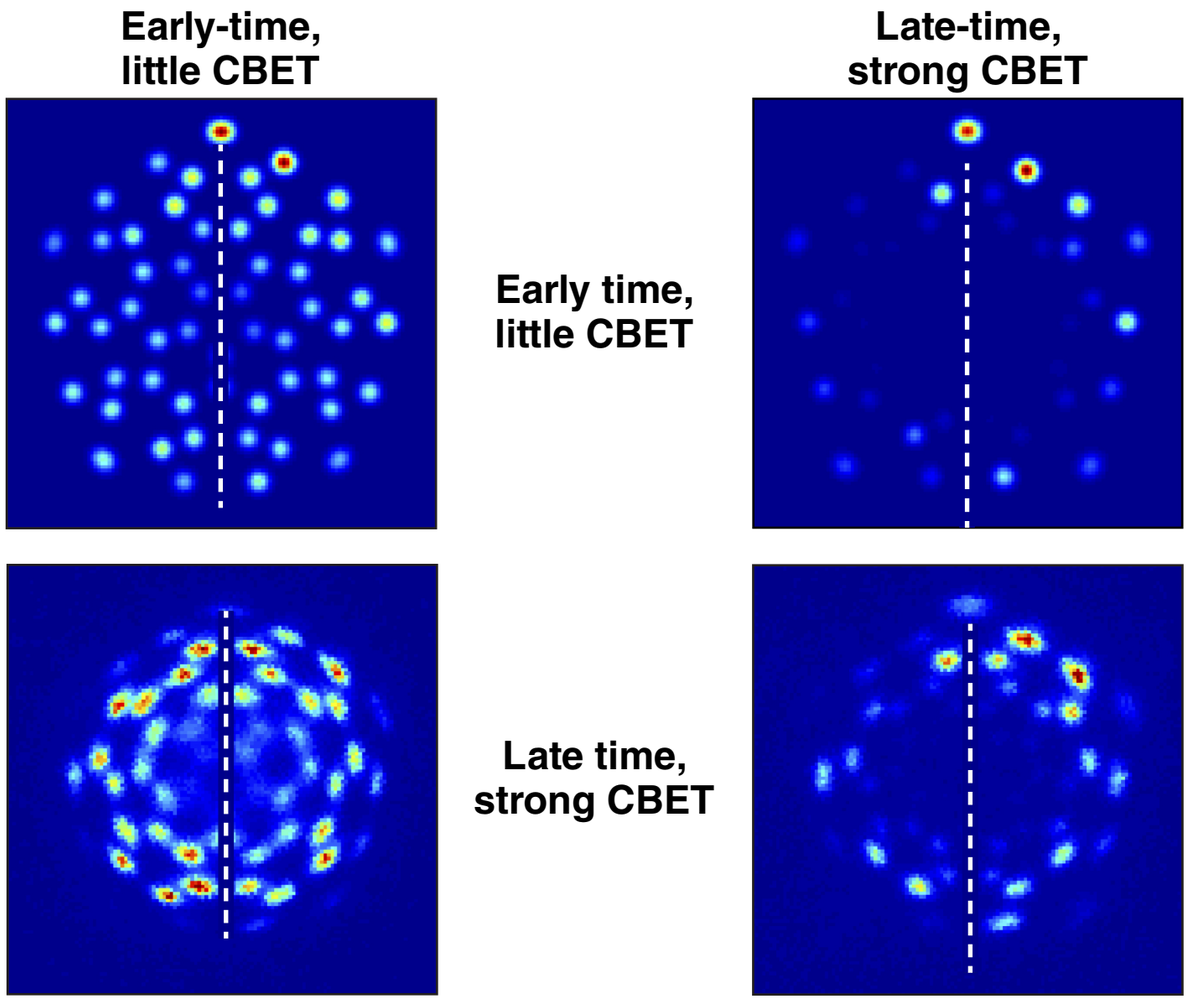
Polarization effects have now been incorporated into *BeamCrosser*, a ray-based, fully 3-D CBET model postprocessor for hydrodynamics codes





E25654

Asymmetric spot images are predicted when polarized beams are modeled in the CBET calculations



E25047a

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E25650