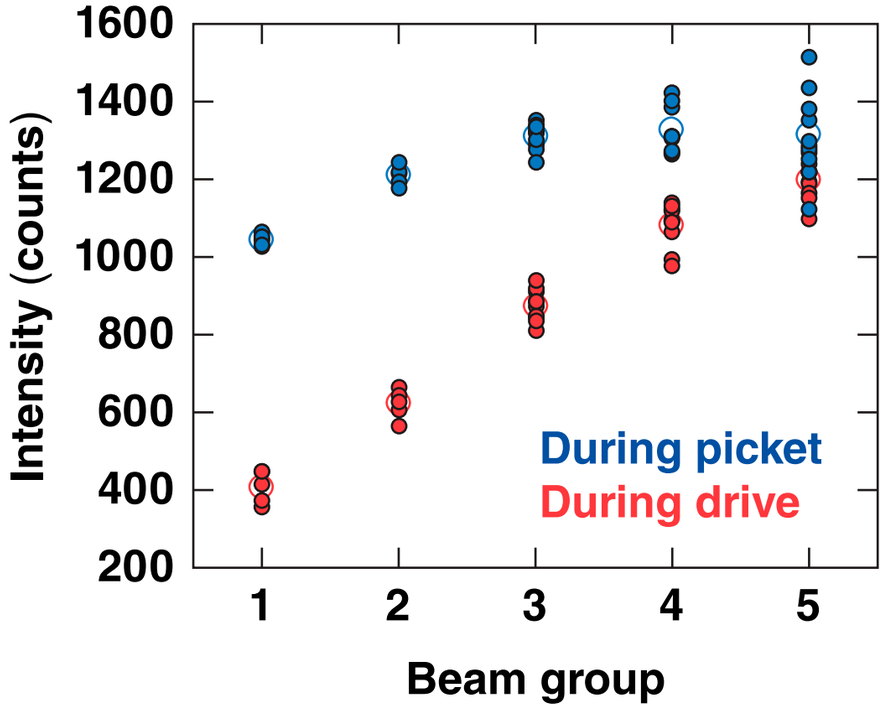
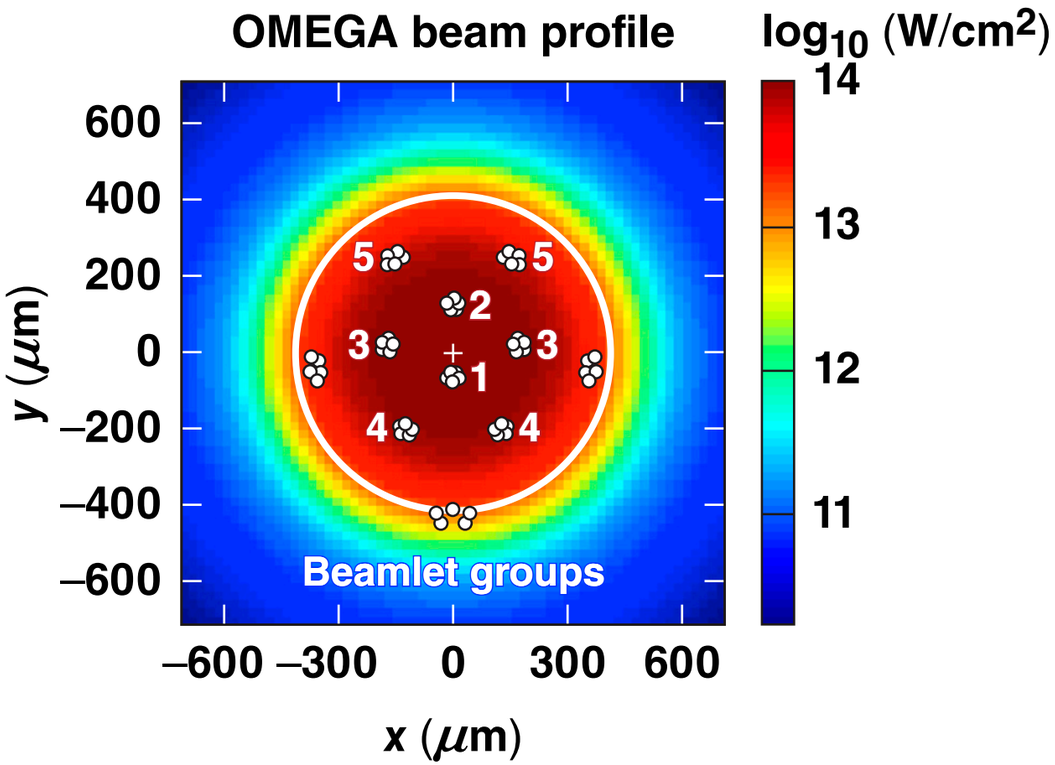
# Analysis of Unabsorbed Light Beamlet Images on OMEGA

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Laboratory for Laser Energetics

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Absorption Conference
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Summary

# The crossed-beam energy transfer (CBET) beamlets diagnostic provides multiple discrete measurements of absorption and CBET for laser light originating from different points over a beam profile

- The diagnostic has provided the first evidence of polarization rotation resulting from CBET in direct-drive symmetric implosions
- The beamlet location in the image provides a measure of the density profile in the corona
- The beamlet intensity can be used to verify CBET mitigation with the new TOP9 variable wavelength beam

# Collaborators

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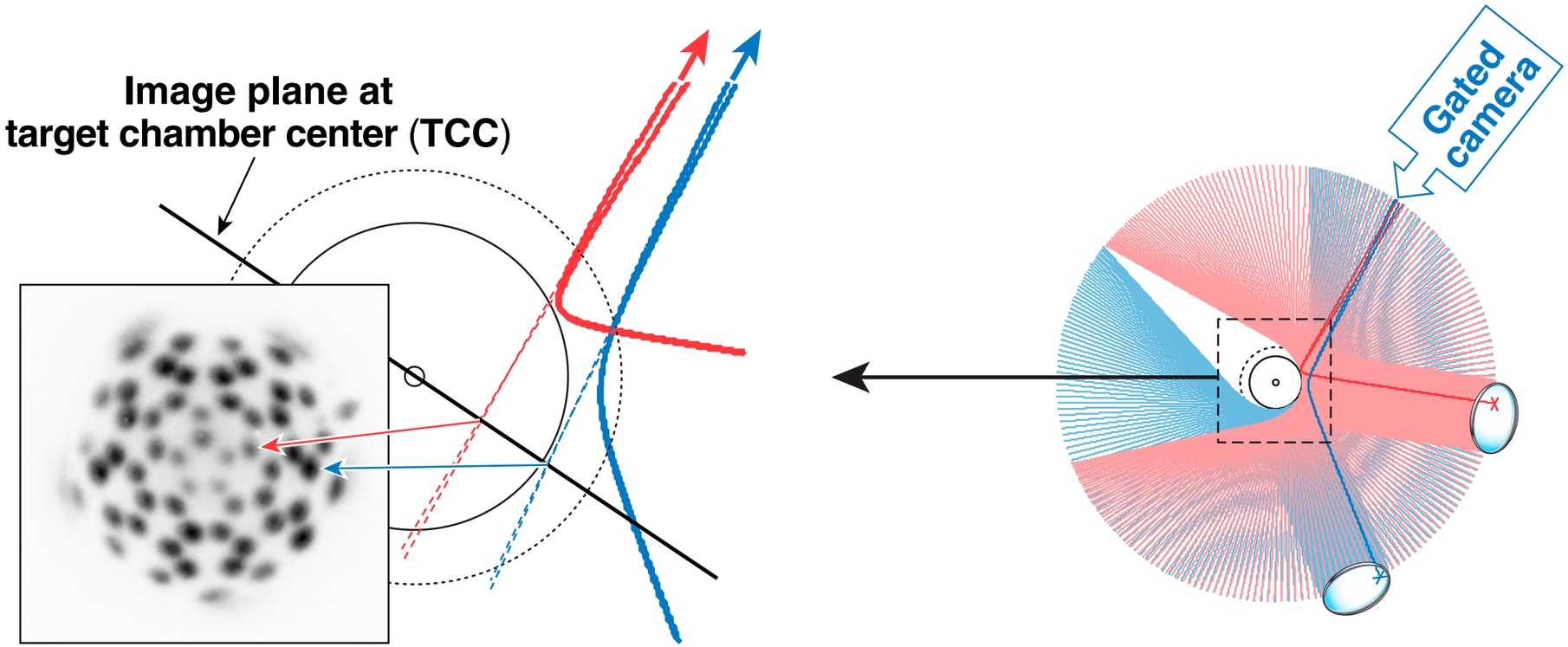
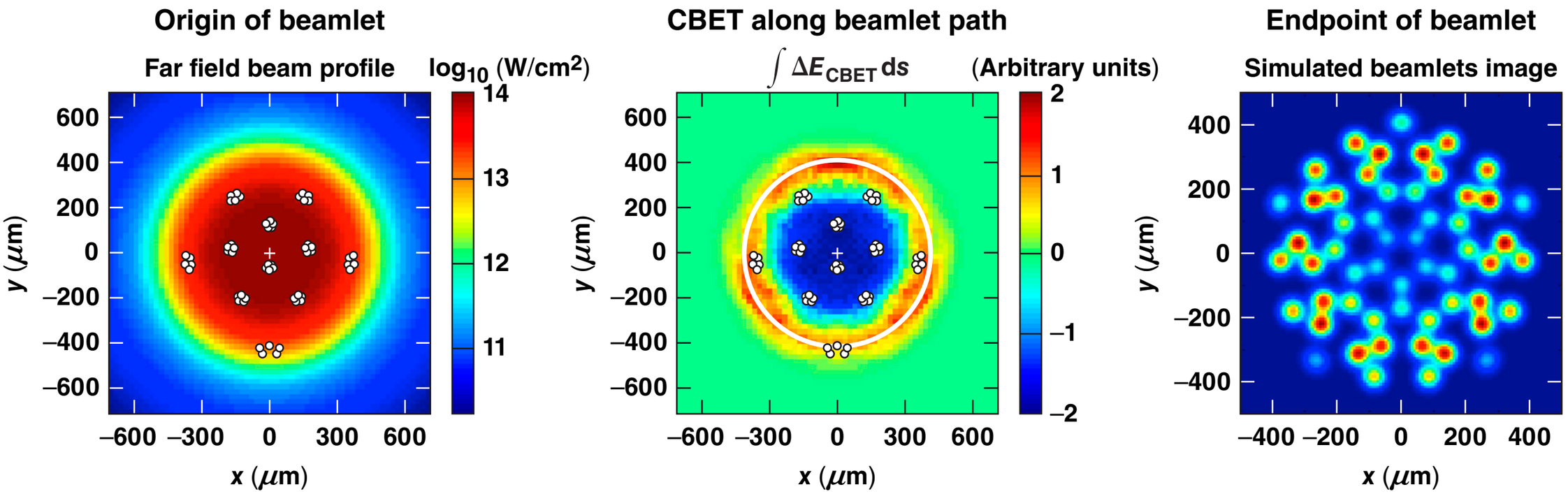
**University of Rochester**
**Laboratory for Laser Energetics**

# CBET beamlets are an imaging diagnostic that records scattered-light intensities seperately from each OMEGA beam



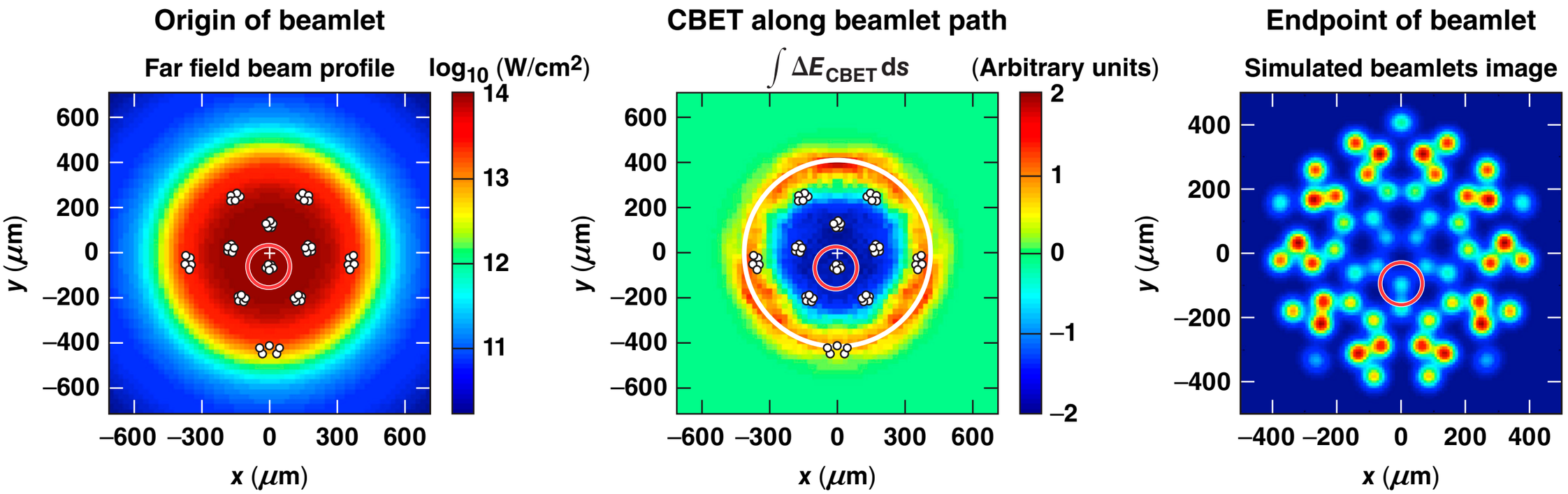

E25651d

# Each spot is the endpoint of a beamlet originating from a specific location of the beam profile and experiencing CBET differently because their unique paths




E24262e

# Each spot is the endpoint of a beamlet originating from a specific location of the beam profile and experiencing CBET differently because their unique paths

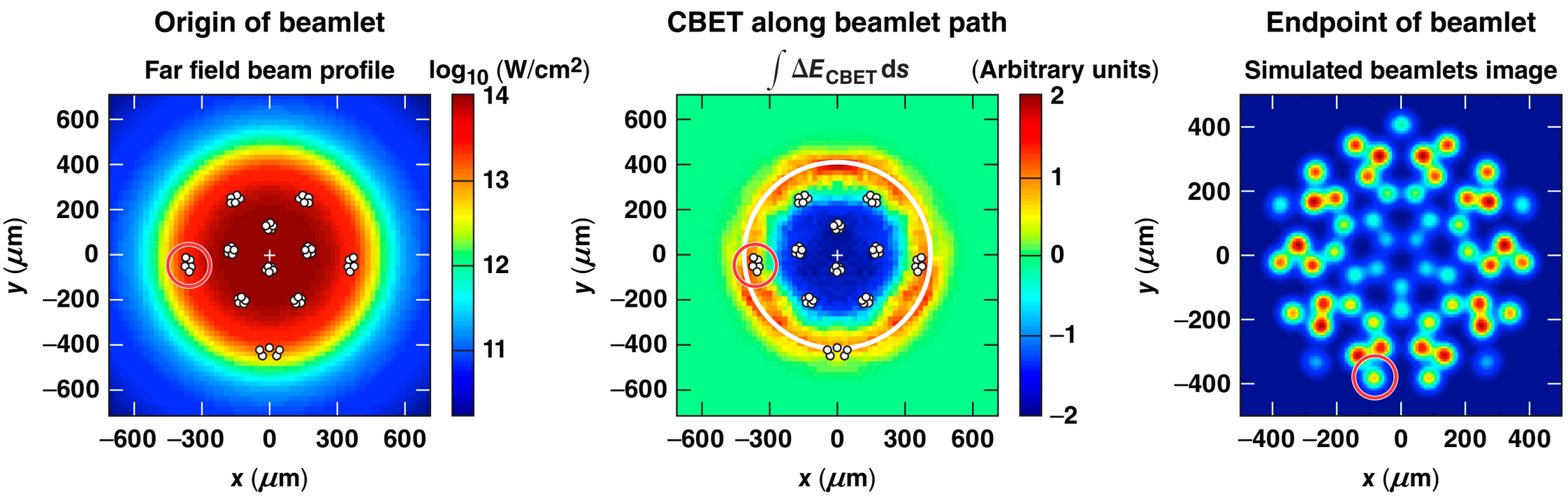



Beam 62

- Each beamlet crosses the 60 OMEGA beams differently

E24262f

# Each spot is the endpoint of a beamlet originating from a specific location of the beam profile and experiencing CBET differently because their unique paths

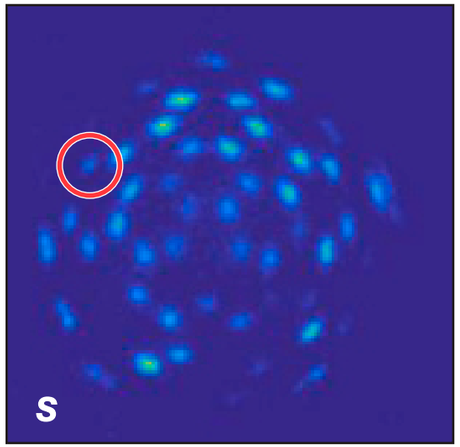


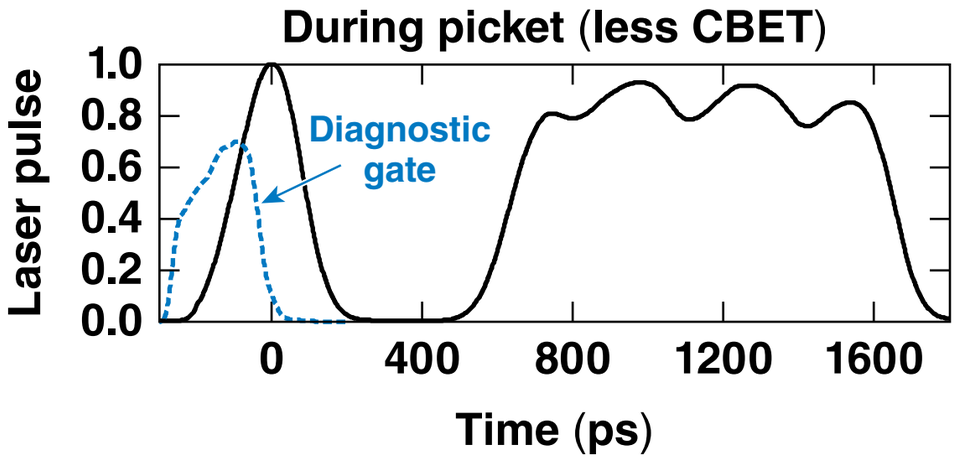

Beam 39

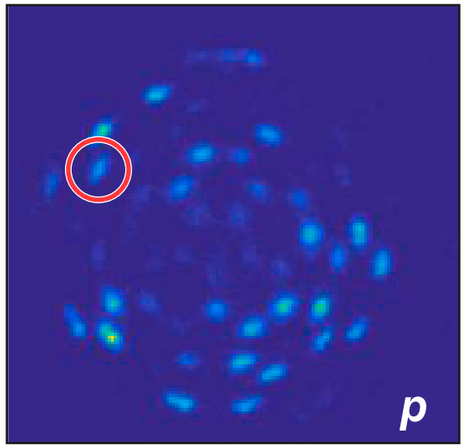
- Each beamlet crosses the 60 OMEGA beams differently

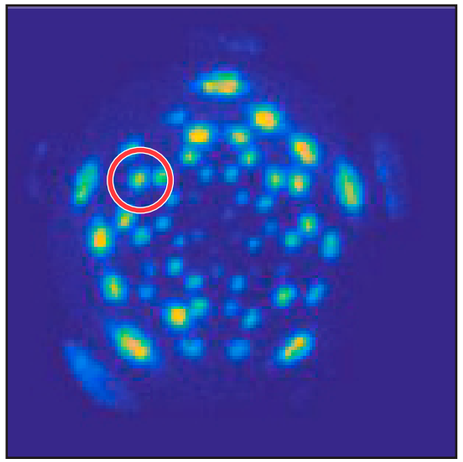
E24262g

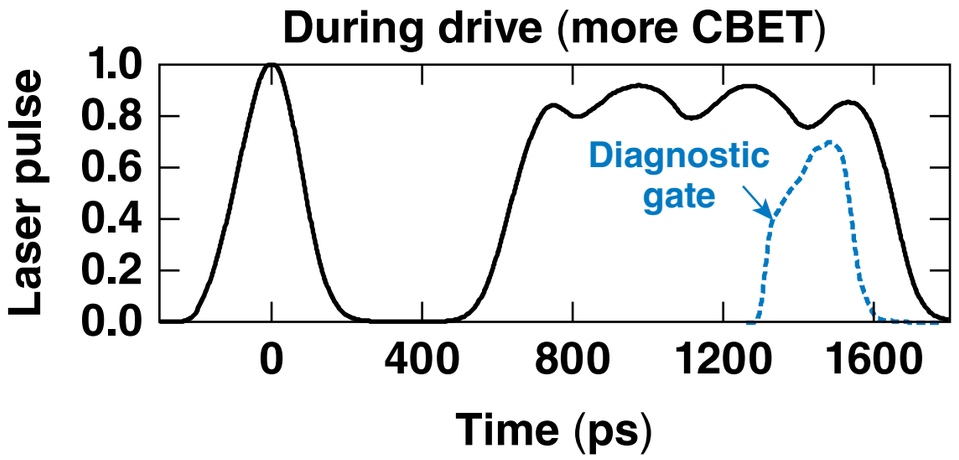
# Beamlet polarization is measured using simultaneous separate images for *s* and *p* polarizations

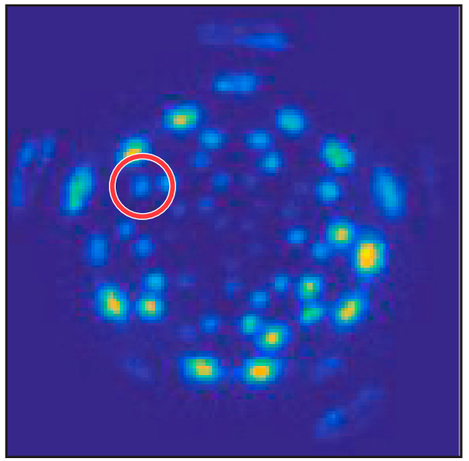


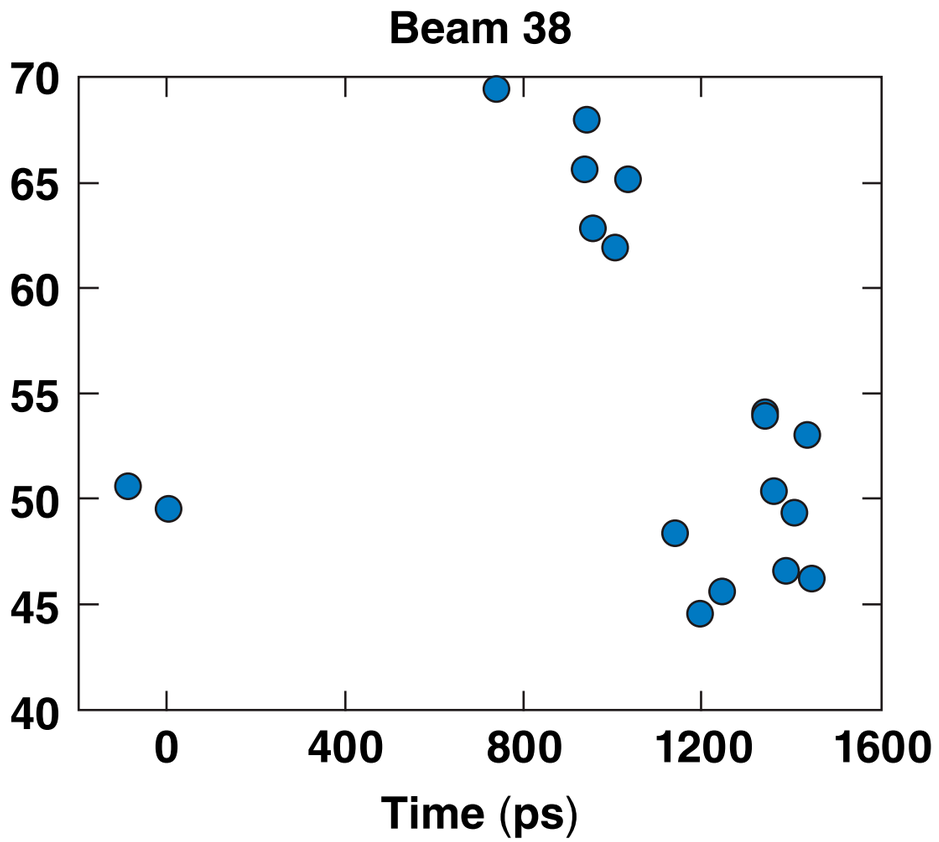


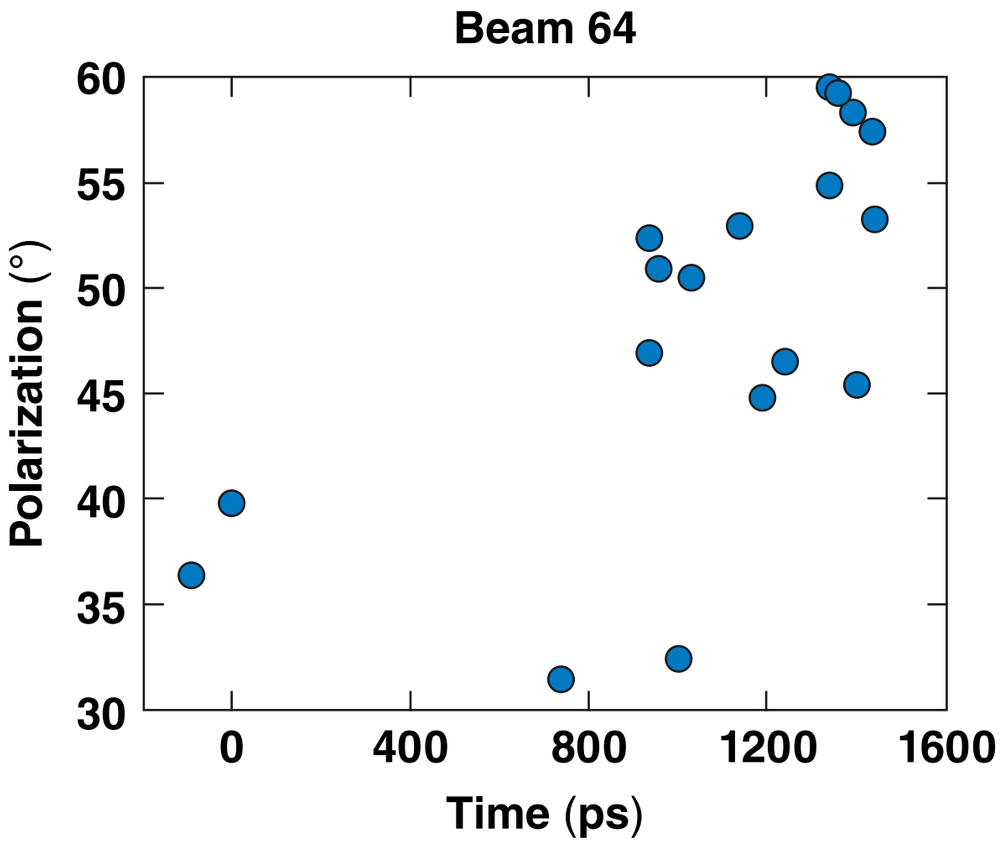



E26607a

P. Michel *et al.*, Phys. Rev. Lett. 113, 205001 (2014).

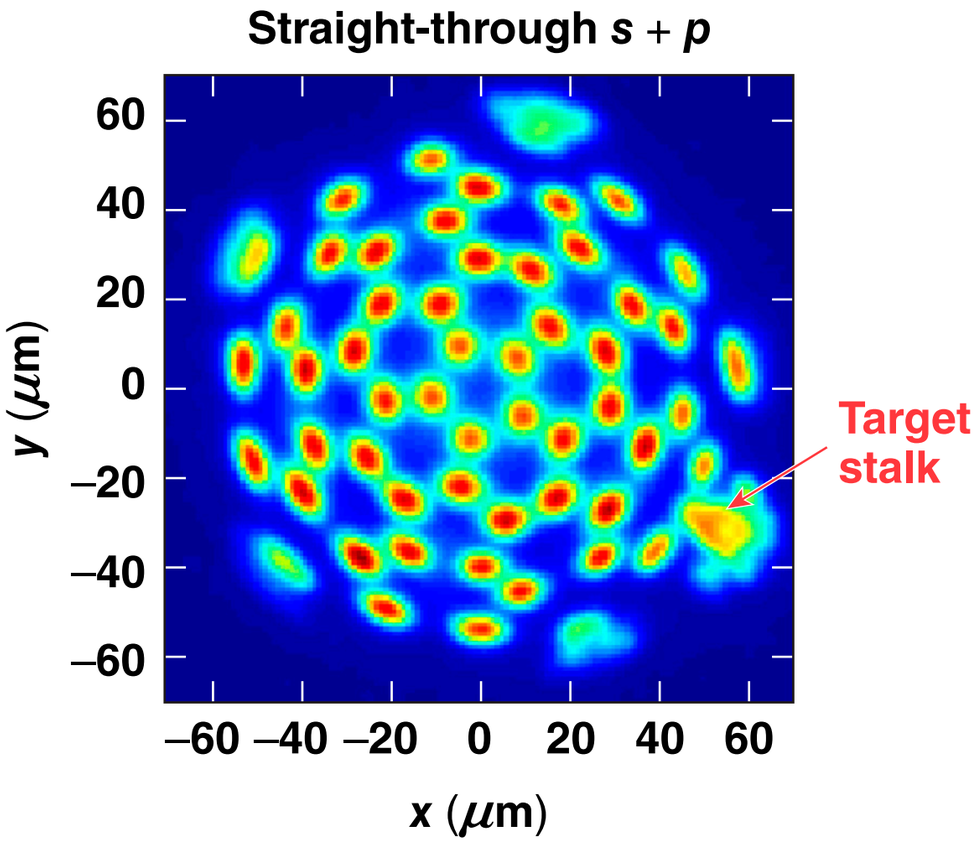
# Polarization changes caused by CBET have been measured during the laser drive pulse

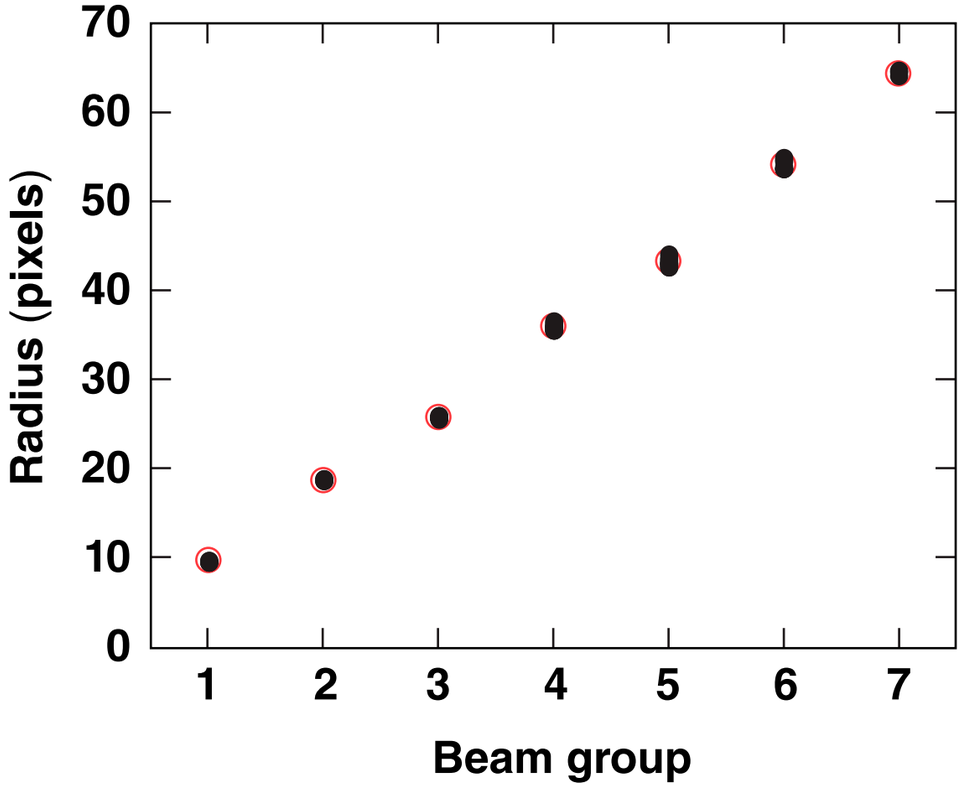



E26848b

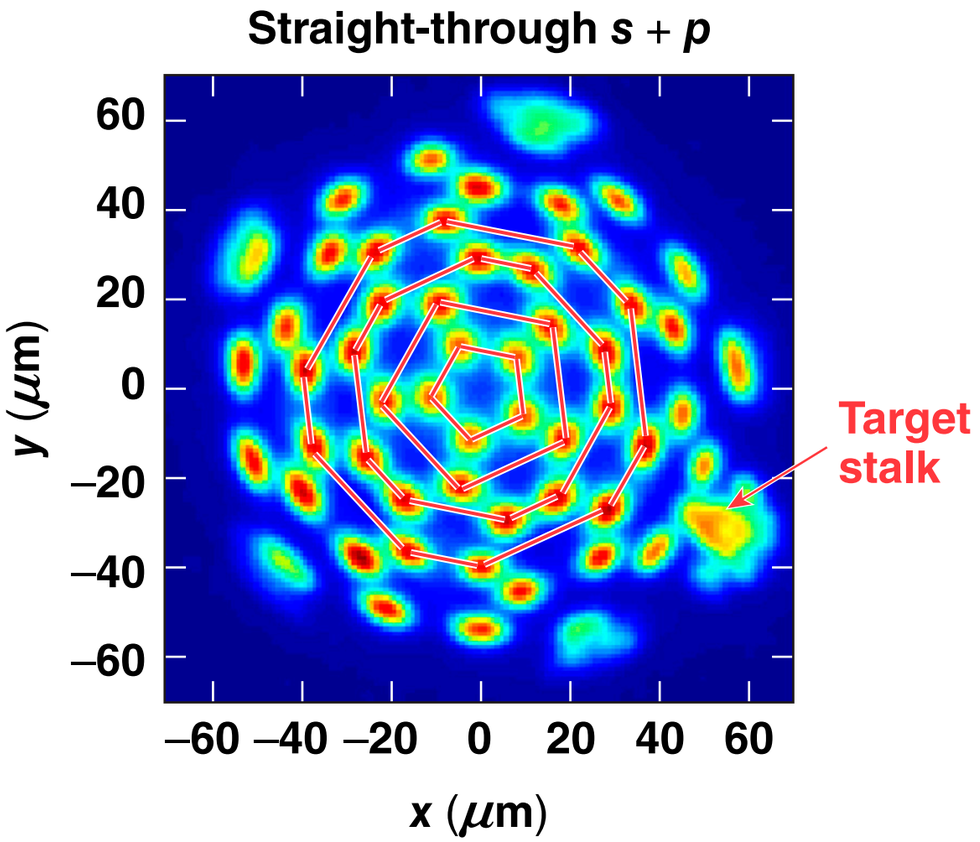
# The beamlet pattern is very symmetric with respect to the diagnostic location

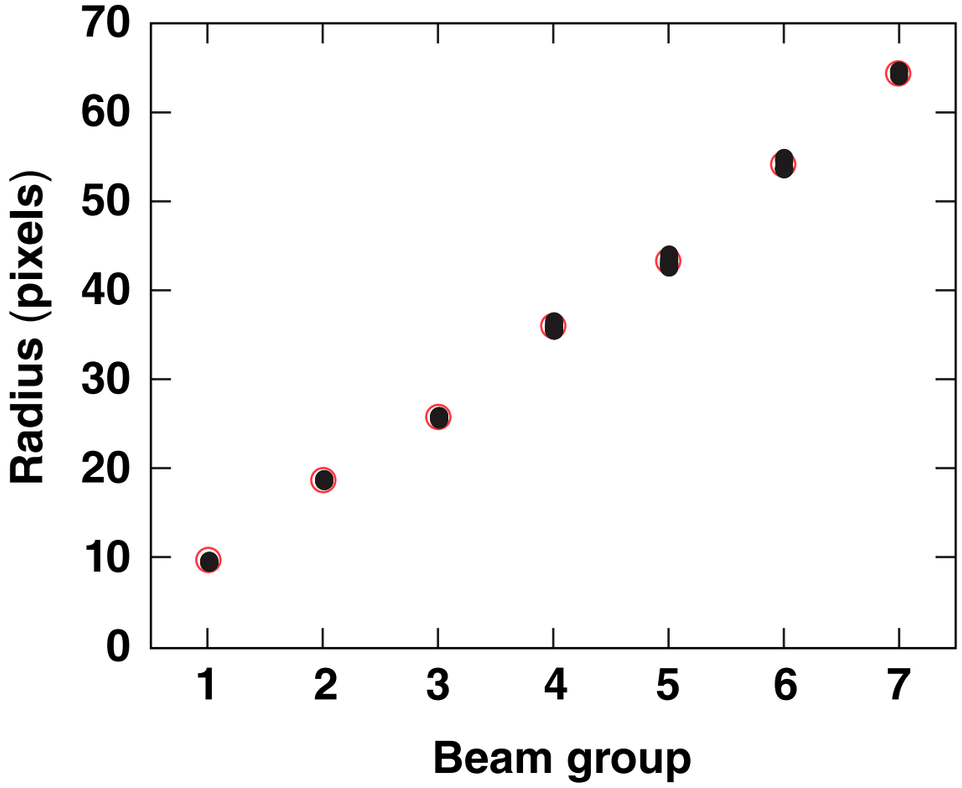



E27558

# The beamlet pattern is very symmetric with respect to the diagnostic port

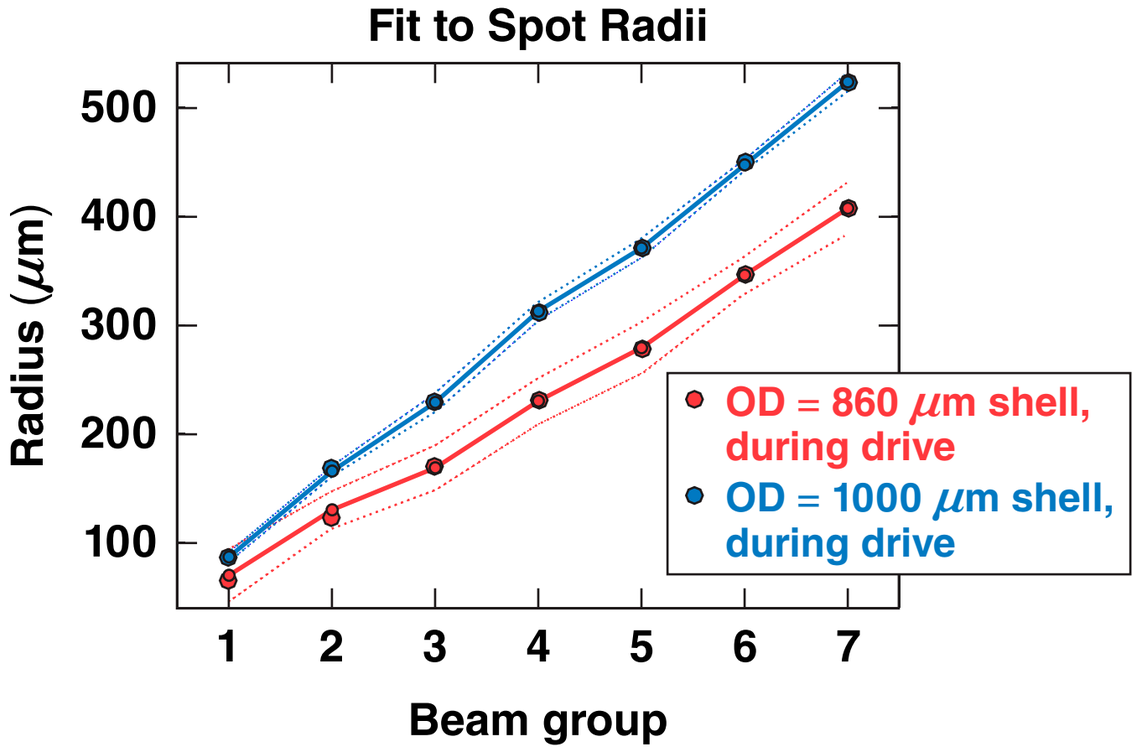


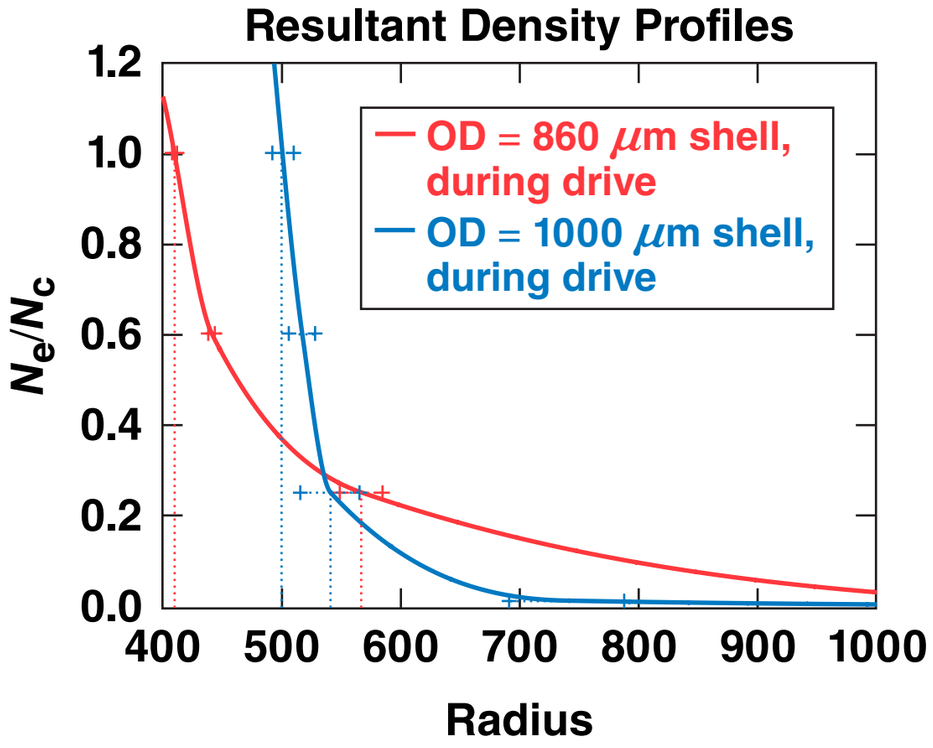




- All the spots in a beamlet group are recorded at the same radius from the image center
- This uniformity allows a density profile to be fit to their position

E27558a

# Beamlet locations provide a measure of the density profile near critical density

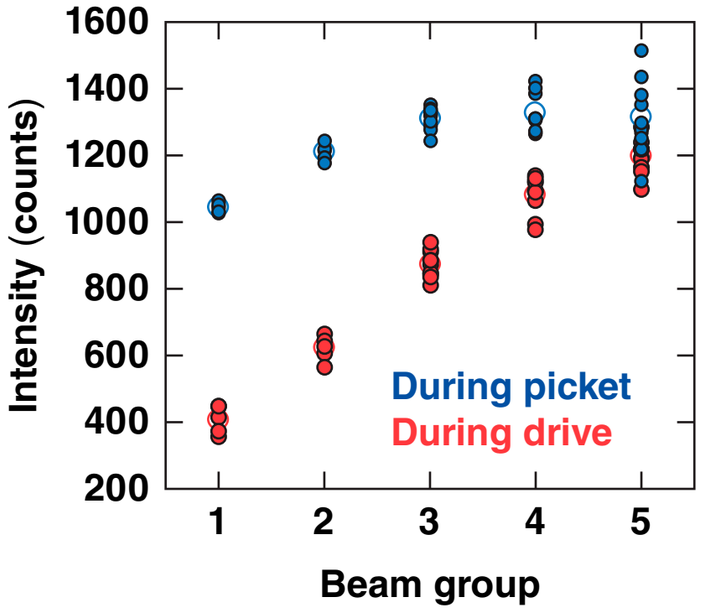


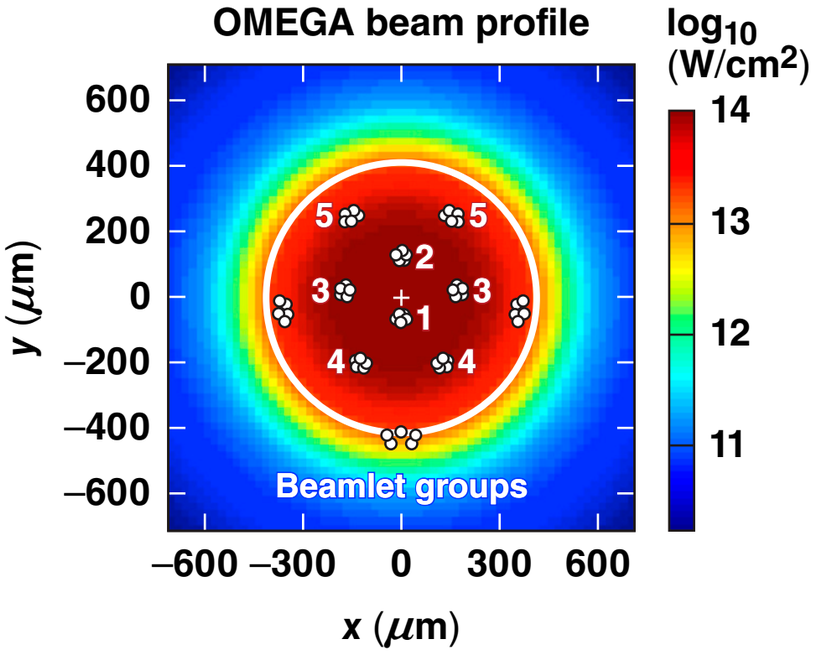




| Target | Critical radius | Quarter-critical radius |
|---|---|---|
| 860-$\mu$m shell | 410 $\mu$m | 567 $\mu$m |
| 1000-$\mu$m solid sphere | 500 $\mu$m | 541 $\mu$m |

E27608

# The intensity of each beamlet group is a measure of the absorption over a beam profile

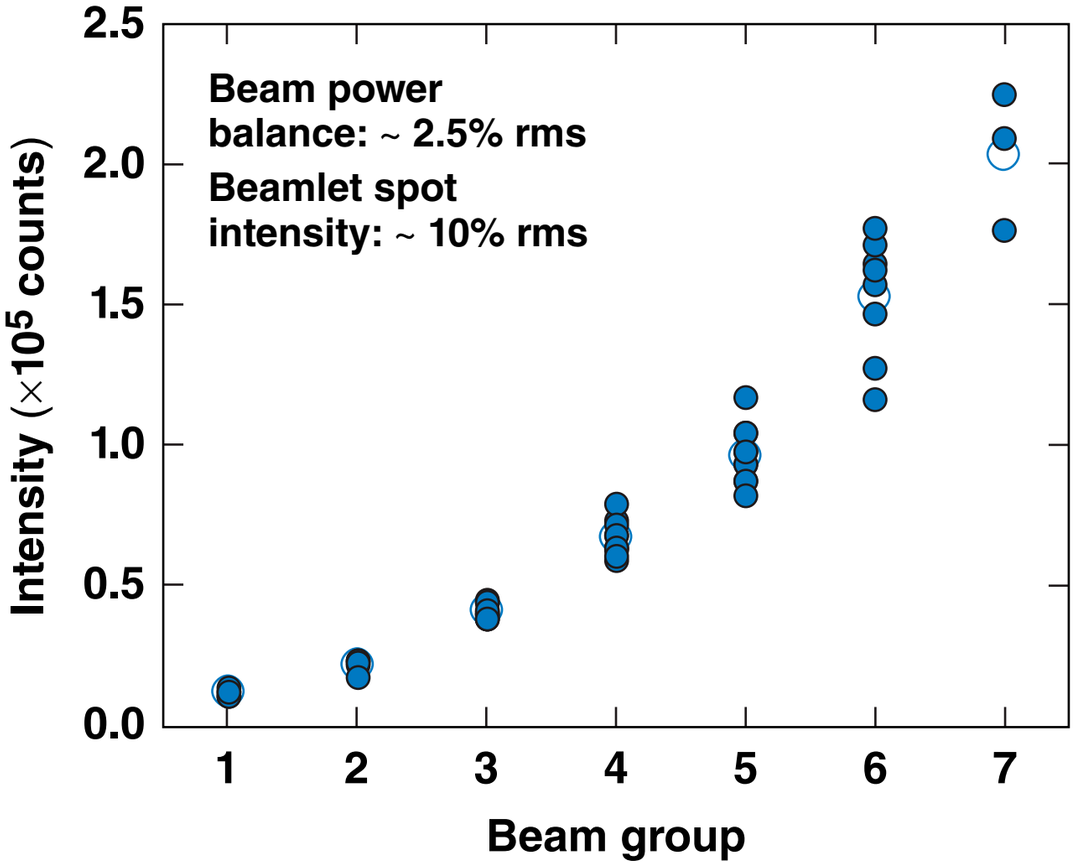



- During the drive the beamlets from the interior of the beam profile had reduced intensities as a result of increased absorption and CBET

E27560

# The variation in spot intensity is greater than can be attributed to beam power balance

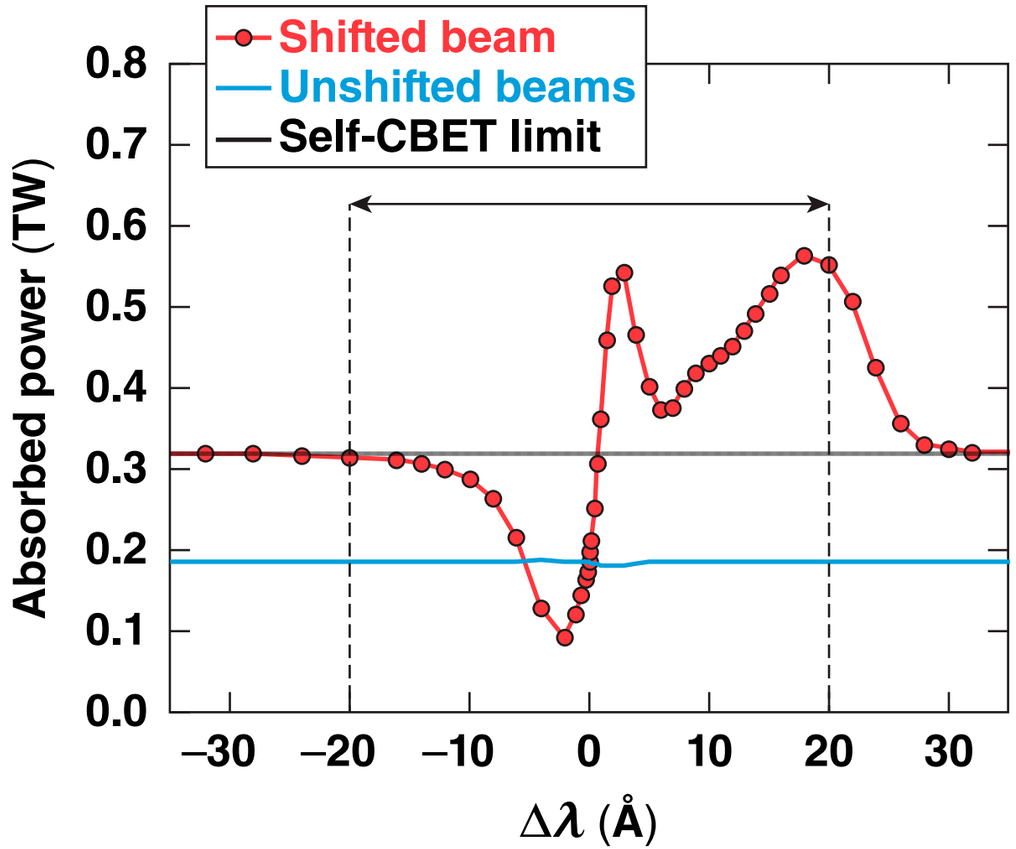



**Sensitivity is good enough to study CBET mitigation using wavelength detuning.**

E27561

Future Work

# CBET mitigation by wavelength separation will be diagnosed using beamlet images on upcoming OMEGA implosions using the wavelength variable TOP9 beam

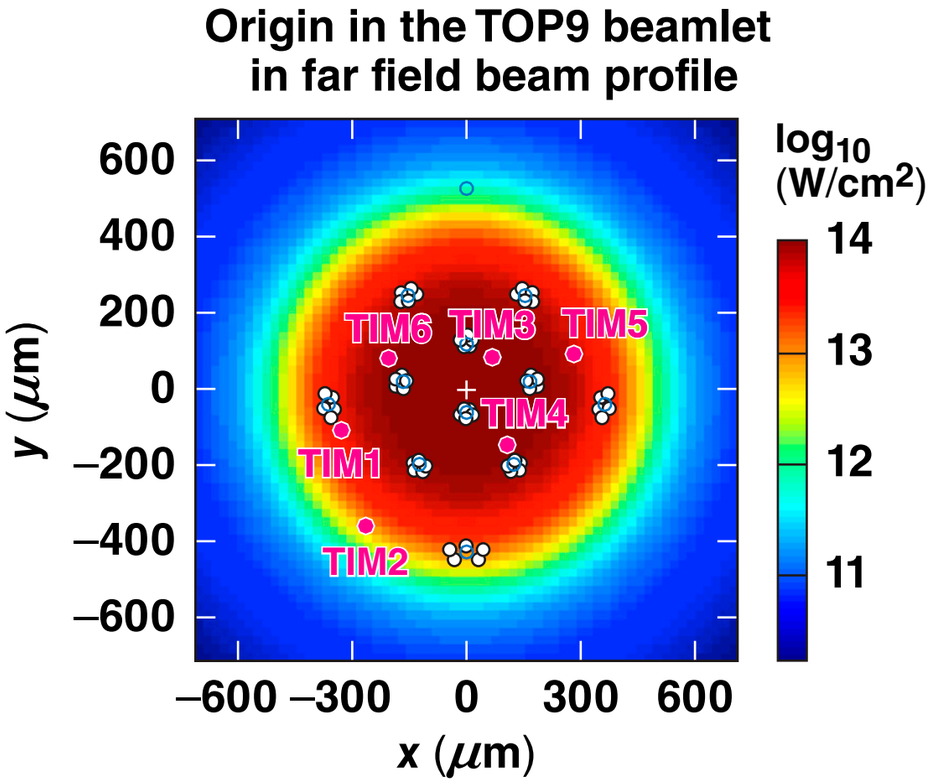


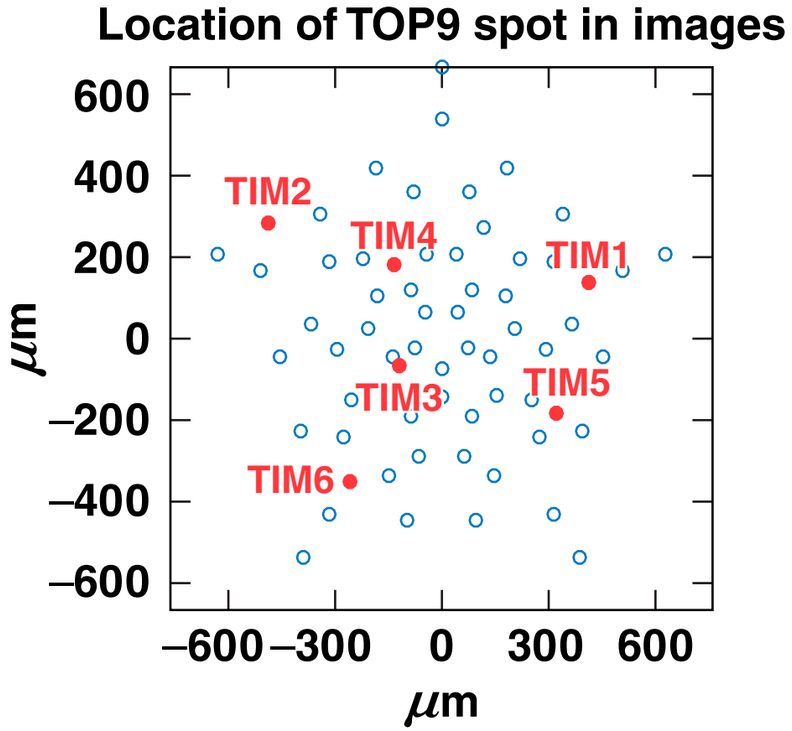

- Modeling predicts a large change in absorption for a single OMEGA beam that is wavelength shifted from the other 59 beams
- A variable wavelength beam (TOP9) will soon to be deployed on OMEGA with a tunable range of $\Delta\lambda \cong \pm 20$ Å
- The change in intensity of the TOP9 beamlet spot will be used to diagnose changes in TOP9 absorption caused by wavelength shifting

E25958a

Future Work

# Beamlets diagnostics in all six TIM's diagnostic ports will sample absorption across the TOP9 beam profile




Can measure position varying changes in absorption from CBET mitigation using wavelength detuning.

E27607

Summary/Conclusions

# The crossed-beam energy transfer (CBET) beamlets diagnostic provides multiple discrete measurements of absorption and CBET for laser light originating from different points over a beam profile

- The diagnostic has provided the first evidence of polarization rotation resulting from CBET in direct-drive symmetric implosions
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E27557