OMEGA EP Short-Pulse Ratiometer


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Summary

A diagnostic has been developed to characterize transmission losses in the OMEGA EP short-pulse transport paths

- As a result of pickoff location, on-shot energy diagnostics cannot measure losses from damage or target debris in the final transport mirrors and the off-axis parabolas (OAP’s)
- The short-pulse ratiometer diagnostic was designed to provide accurate measurement and tracking of transmission performance through the final optics
- This diagnostic provides more-accurate on-target energy reports and for a more-deterministic method of specifying disposable debris shield usage

Transmission measurements are now acquired before and after all short-pulse target shot days.

Reported on-target energy is determined by the short-pulse diagnostic package near-field (SPDP NF) charge-coupled device (CCD)

- To short-pulse diagnostic package
  - SPDP NF is calibrated to slide-in grating compression chamber (GCC) calorimeters
  - GCC is calibrated to slide-in grating compression chamber (GCC) calorimeters
  - OMEGA EP target chamber
  - OMEGA EP target chamber

Short-pulse ratiometer measurements are now acquired for all target campaigns

- Initial measurements are acquired in advance of shots as part of short-pulse transport and focusing process
- Measurements are taken after all target shot days
- Process takes ~45 min after conclusion of shots
- Additional measurements required before and after disposable debris shield (DDS) installation/removal

Laser damage and target debris can significantly impact transmission of the final optics

- This is of particular concern on the OAP’s because of their close proximity to target chamber center (TCC)

OMEGA EP backlighter measurements

OMEGA EP to OMEGA (joint shot) measurements

Transmission data is now used to provide more-accurate on-target energy estimates and assess campaign impact on short-pulse optics

- Transmission data are stored in shot database tables
- Results are applied to reported “SP on target” energy
- DDS use requirements for follow-up campaigns will be derived from this data

A similar diagnostic for OMEGA EP UV beams is in development.
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- Tiled grating assemblies
- SPDP “leaky mirrors”
- Compressor alignment mirror 3 (CAM3)
- Upper compressor
- Lower compressor
- Beam combiner
- Grating compressor chamber calorimeters
- OMEGA EP target chamber
- OAP
- OAP
- BL OAP
- BL OAP
- SL OAP
- SL OAP

- Transmission measured on-shot
- Transmission calculated based on short-pulse ratiometer measurements
- Diagnostic (path)
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Images of off-axis parabolas in use on OMEGA EP

- Laser damage to coating
- Imprint from “laser-cleaning” effect
- Contamination from target shot debris
A ratiometer technique has been implemented to characterize transmission through the final OMEGA EP short-pulse optics.
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OMEGA EP backlighter measurements

UCBL: upper-compressor backlighter
LCBL: lower-compressor backlighter
OMEGA EP sidelighter measurements

![Graph showing transmission measurements over time with specific dates and values marked.](image-url)
OMEGA EP to OMEGA (joint shot) measurements

<table>
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<th>Transmission (%)</th>
<th>UC - No DDS</th>
<th>LC - No DDS</th>
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Shot days:
- 2/16/15
- 2/17/15
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