The Upgraded Thomson–Scattering System is a Robust Diagnostic Platform on the OMEGA Laser

- The Thomson–scattering system measures plasma conditions such as ion and electron temperature, electron density, and plasma-flow velocity.
- Fully reflective optical transport provides high-quality imaging for wavelengths ranging from 200 nm to 800 nm.
- Improved UV signal throughput allows for the detection of Thomson scattering from electron-plasma wave features using a 263-nm probe beam.
- Two streak-camera-coupled spectrometers and a gated optical imager are available to support a variety of experimental objectives.

A New TIM-Based Reflective Telescope Provides High-Quality Imaging of Optical Emission from 200 to 800 nm

- Diffraction limited
- f/10 collection
- Unobstructed
- Spherical optics
- All-reflective transport
- Aluminum coatings >80% reflectivity 200 to 800 nm

Initial Telescope Performance Tests Demonstrate High Spatial Resolution and Diffraction-Limited Spot Sizes

- Airy disk formed imaging
- 4-nm core single-mode fiber
- Imaged microscopy mesh grid
- Hole width: 28 nm, bar width: 23 nm
- Image magnification: 2.3 ×
- Illumination wavelength: 635 nm
- Working f/#: 23
- Calculated airy disk: 35.6 nm
- Lineout: 37 nm
- Intensity: 1000 nW

A New Instrument Platform Houses Diagnostics for Time-Resolved Spectroscopy and Gated 2-D Imaging

- Ion-acoustic wave system – high-resolution spectrometer coupled to ROSS streak camera
- Electron-plasma wave system – broadband spectrometer coupled to ROSS streak camera
- Optical imager – high-resolution gated charge-coupled-device (CCD) camera

Each of the three detector systems can be independently configured to support a variety of experimental objectives.

The Ion-Acoustic Wave System Consists of a 1-m Spectrometer Coupled to a ROSS Streak Camera

- Spectrometer focal length: 1.0 m
- Spectral resolution: 0.03 to 0.1 nm
- Spectral window: 4 to 6 nm
- Detectable wavelengths: 200 to 800 nm
- Temporal resolution: 200 ps
- Sweep speeds: 1.5 ns, 5 ns, 15 ns, 25 ns
- Maximum field of view at TCC: 370 nm
- Image magnification: 1.4 ×

The Electron-Plasma Wave System Consists of a 0.3-m Spectrometer Coupled to a ROSS Streak Camera

- Spectrometer focal length: 0.3 m
- Spectral resolution: 0.5 to 2.0 nm
- Spectral window: 75 to 375 nm
- Detectable wavelengths: 200 to 800 nm
- Temporal resolution: 100 ps
- Sweep speeds: 1.5 ns, 5 ns, 15 ns, 25 ns
- Maximum field of view at TCC: 275 nm
- Image magnification: 2.1 ×

The Optical Imager Consists of a Gated Charge-Coupled–Device Camera

- Detector Pi-Max-3 Gated CCD
- Detectable wavelengths: 200 to 800 nm
- Minimum gate duration: 3 ns
- Field of view at TCC: 1.5 mm
- Spatial resolution at TCC: 20 nm
- Image magnification: 3.2 ×

The TIM-Based Telescope Uses an Unobstructed Section of a Schwarzschild Objective

- Optical axis
- Mirror’s shared center of curvature
- Secondary mirror
- Blast window
- Primary mirror
- Thomson-scattering polychromatic diffraction modulation transfer function (MTF)

- Frequency (cycles/mm)
- Modulation 0.0
  0.2
  0.4
  0.6
  0.8
  1.0

The Upgraded Thomson–Scattering System is a Robust Diagnostic Platform on the OMEGA Laser


University of Rochester, Laboratory for Laser Energetics

OMEGA Thomson Scattering System Upgrade
Summary

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Image

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<tr>
<th>Specification</th>
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<tbody>
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<td>Sweep speeds</td>
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<tr>
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