



A Non-Contact Method of Profiling Lasers using Rayleigh Scattering Imaging

Derrick Peterman



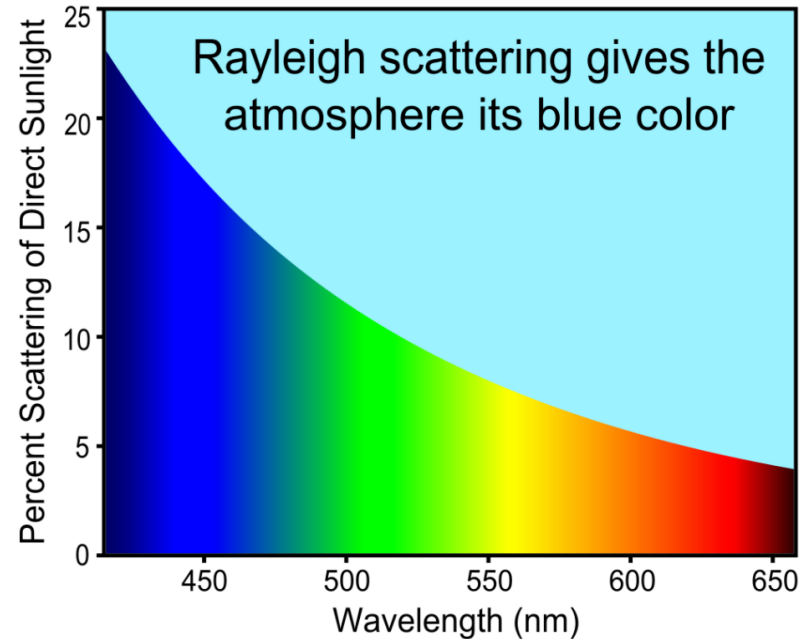
Rayleigh Scattering: Why is the sky blue?

Rayleigh Cross Section

$$\sigma_s = \frac{2\pi^5}{3} \frac{d^6}{\lambda^4} \left(\frac{n^2 - 1}{n^2 + 2} \right)^2$$

d=particle size

n = index of refraction

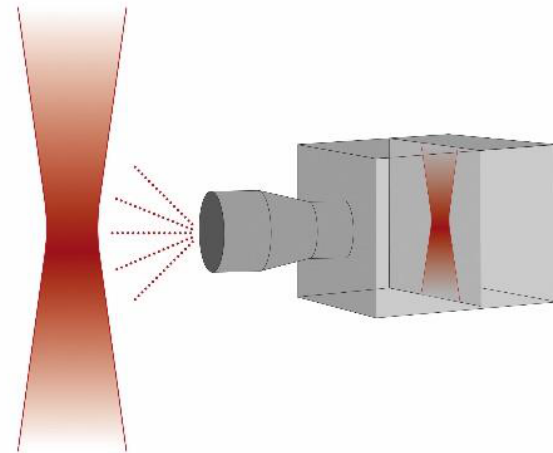


Imaging a Beam Waist

At 980-1100 nm wavelengths, a power density of 1 Mega Watts/ cm² creates enough Rayleigh scattered intensity to be imaged using a lens and Silicon CCD sensor which is achieved in many industrial laser applications

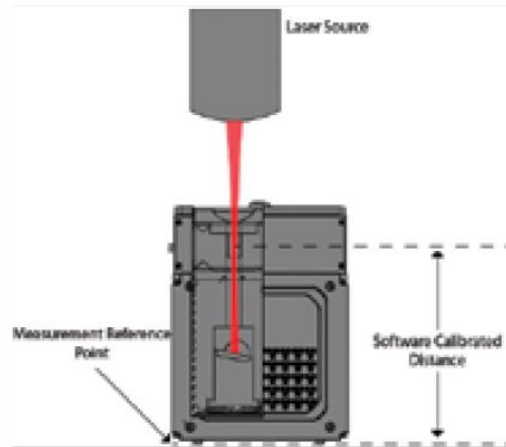
Advantages of this technique:

- Non contact, no complicated beam attenuation required
- Real Time Analysis of Entire Beam Waist Caustic
- Beam passes though undisturbed
- Quantifies focal shift distance



BeamWatch AM for Additive Manufacturing

- Non-contact Laser Beam Analyzer Based on Rayleigh Scatter
- NIST Traceable Power Measurement
- Measures the entire caustic @ 1-2 Hz.



Calibrated beam path for precise focus spot location

