

Laser Beam Divergence



General Aim

To verify that the profile for a laser beam is Gaussian and determine its characteristics.

Method

Laser Source-Photodiode Method

Learning Objectives (ILOs)

- Define the profile of a laser beam.
- Set up an experiment to study the laser beam profile.
- Determine the laser beams' diameter.
- Prove that the laser does not obey the inverse square law.

Theoretical Background/Context

Most low-intensity laser sources emit laser beam with gaussian distribution

$$I(r) = I_0 e^{-r^2/\omega_z^2}$$

in the transverse direction. where $2\omega_z$ is the beam diameter at which the beam intensity falls to I_0/e^2

Also, due to the coherent property of laser, it shouldn't obey the inverse square law obeyed by ordinary light.

Principle of Work

By measuring the laser beam intensity using a photodiode sensor, as a function of the distance from the center of the beam in the transverse direction, we obtain the profile for the laser beam which should be Gaussian. Hence, the beam diameter could be found. plotting the beam profile at different distances from the source could be done and determine the beam divergence which proves that the laser does not obey the inverse square law.