

Real Time Laser Beam Quality (BQ) Sensor

Technology Utility

This technology builds on the high energy laser (HEL) target spot radiometer, which determines if an HEL beam aimed at a distant target is actually hitting that target or not.

Once a hit has been confirmed, it is highly desirable to assess the quality of the beam incident on the target. This is the intended utility of the real time beam quality (BQ) sensor.

BQ is important because it is a measure of how tightly a laser beam can be focused. One way to measure BQ is the M^2 factor, defined as the beam parameter product (beam radius at the beam waist times the far-field beam divergence) divided by the corresponding product for a diffraction-limited Gaussian beam with the same wavelength, as follows:

$$M^2 = \left(\frac{D_m \Theta_m}{d_0 \theta_0} \right)^2$$

where D_m is the measured beam waist diameter, Θ_m is the measured full-angle divergence, d_0 is the theoretical beam diameter, and θ_0 is the theoretical diffraction-limited divergence.

The best possible BQ is achieved for a diffraction-limited Gaussian beam, having $M^2 = 1$.

Technology Highlights

OPC has developed a method for estimating BQ based on the statistical properties of the signal return from the target. When combined with target trajectory information, the method has an accuracy of 5-10% above 1 degree elevation above the horizon from an air platform.