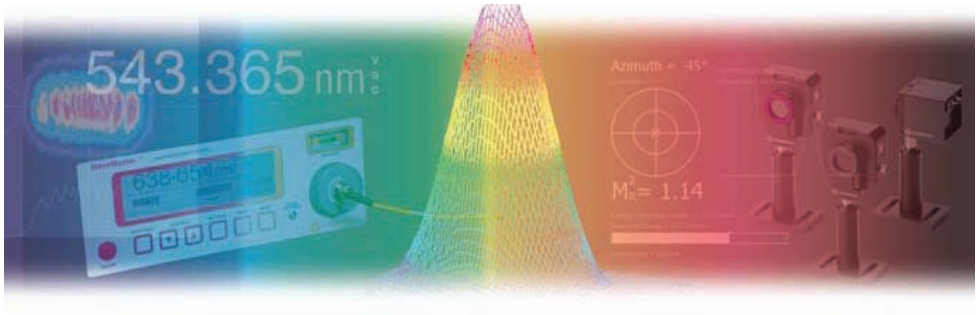
10 Tips For Selecting a Beam Diagnostics System

Knowing these things about laser beam diagnostics will help you make a better equipment choice



1 Improve process performance and save money.

Characterizing laser beam parameters leads to better process performance and saves money. For example, the efficiency of fiber coupling is a function of beam quality. In laser cutting, drilling, welding and micromachining, process speed and efficiency vary strongly with beam profile.

2 There's more to know than laser power.

The four most commonly measured laser parameters are beam diameter, intensity spatial distribution, mode structure and divergence. Determining which beam parameters are most important in your application is a key part of selecting the right beam diagnostic system for your particular needs.

3 Improve the effectiveness of your process.

Expanding, contracting or focusing a laser beam changes its power density, but not its total power. And, in most applications, the power density determines the precise nature and effectiveness of the laser process.

4 Understand the dynamics of your laser.

While theory can predict how a given laser's beam should look, only measurement will tell you how it actually does look. Real world manufacturing tolerances in laser components plus ambient conditions in the laser cavity affect beam parameters. These variations make laser beam measurement essential for many processes.

5 Determine beam divergence fast and easy.

Laser beam profilers are typically used to measure beam diameter and spatial intensity distribution. By measuring beam profile at more than one location, they can also provide the information needed to calculate beam divergence.

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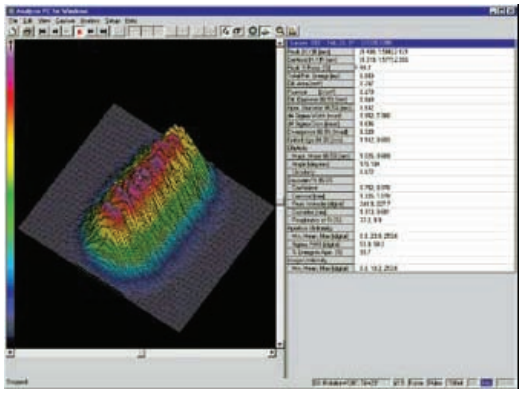
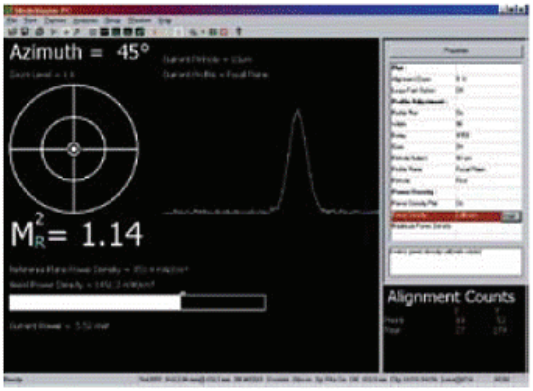


Beam Profiler



M² Measurement

6 Beam quality factor M² and how your beam propagates.

Mode structure, divergence and the beam quality factor, M², can be measured directly with a beam propagation analyzer. Knowing M² enables you to predict how the beam will propagate, how it will look like elsewhere along the beam path and, how well it can get focused.

7 Different types of beam profilers at your choice.

Both, camera-based and knife edge-scanners are used for beam profile measurements. Each has advantages and disadvantages, and specific applications for which they work best.

8 Which type of profiler works best for you?

The primary factors which determine the type of beam profiler to use are beam size, laser power and operating mode (CW or pulsed). Knife-edge scanners are most useful with very small beams, CW lasers and high power lasers. Camera-based systems work with larger beams, and either pulsed or CW lasers. Due to the saturation levels associated with camera based systems, some type of laser beam attenution is always required whereas with knife edge systems, additional attenuation is typically required at the higher power levels.

9 Attributes of a camera-based profiler.

Camera-based systems are particularly useful for profiling pulsed lasers at low repetition rates, and can identify dynamic changes in beam intensity, such as hot spots, as they actually occur.

10 Attributes of a knife-edge profiler.

Knife-edge scanners only measure one or two dimensions at a time. Consequently, their three dimensional representations must be calculated, and the accuracy of the reconstruction depends on the algorithm used in the instrument. For best results, they should be used only with circularly symmetric and near Gaussian beams.