

BEAM ANALYSIS OF A  
Nd:YAG MARKING LASER  
by  
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**Laser: Nd:YAG**  
**Wavelength: 1064nm**  
**Manufacturer:**  
**Maximum Power/Energy: 90 Watts**  
**Operating Power/Energy: Reduced (Variable)**  
**Focusing Lens: 160mm**  
**Application: Marking parts**  
**Symptom/Problem: Non-uniform marking of parts**

Summary of testing conducted on a 90 Watt Nd:YAG laser used for marking of high quality, high value-added parts. The laser produced unequal marking on the surface from side to side. This made the part unfit for sale, costing a serious loss of profitability. Beam profiling was performed at different power levels to attempt to identify differences at various settings commonly used in processing.

Pictured below are representative samples of the beam profile at various settings. The heights of the peaks correspond to the intensity level.

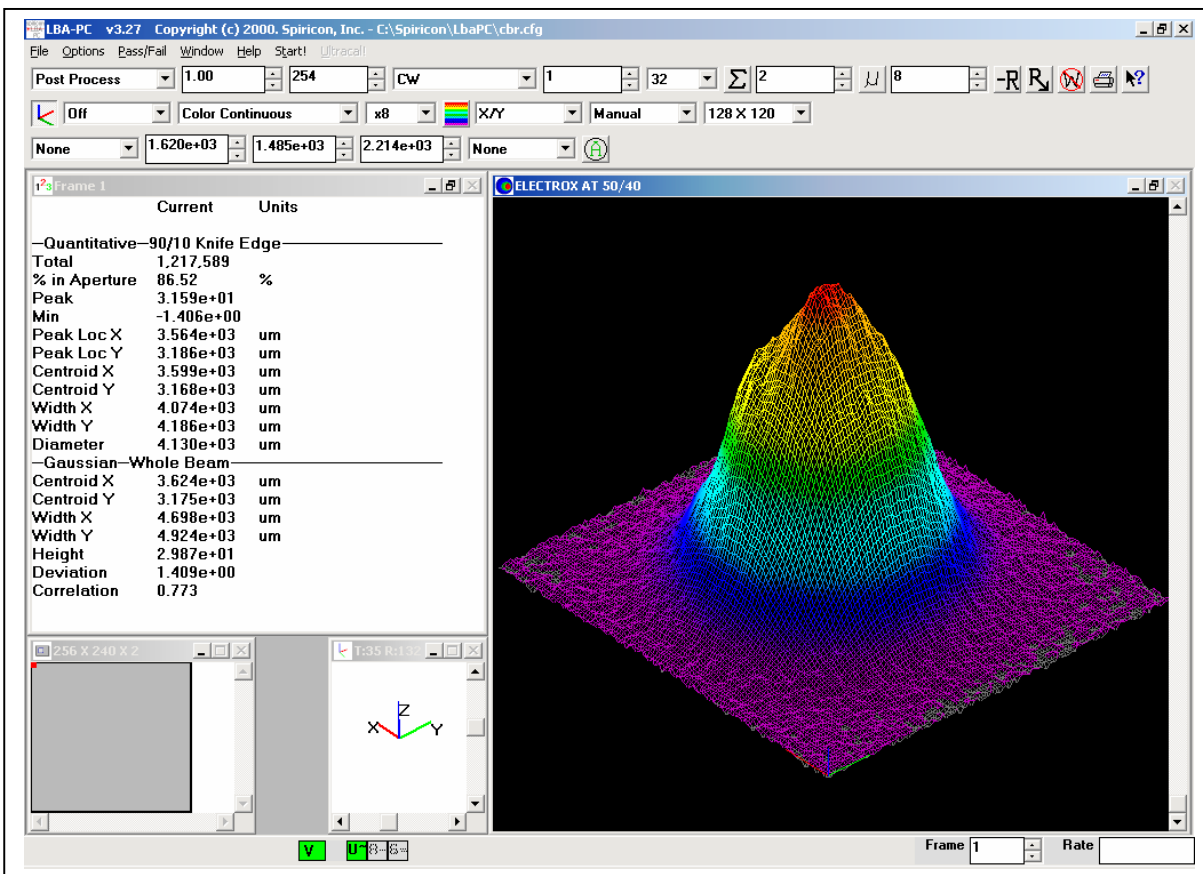


Figure 1. Beam profile at 50/40 setting. Note that beam profile is almost Gaussian in shape. There is only one peak. (The calculation pane on the display shows a 0.77 correlation). Processing with this setting will result in sharply defined edges

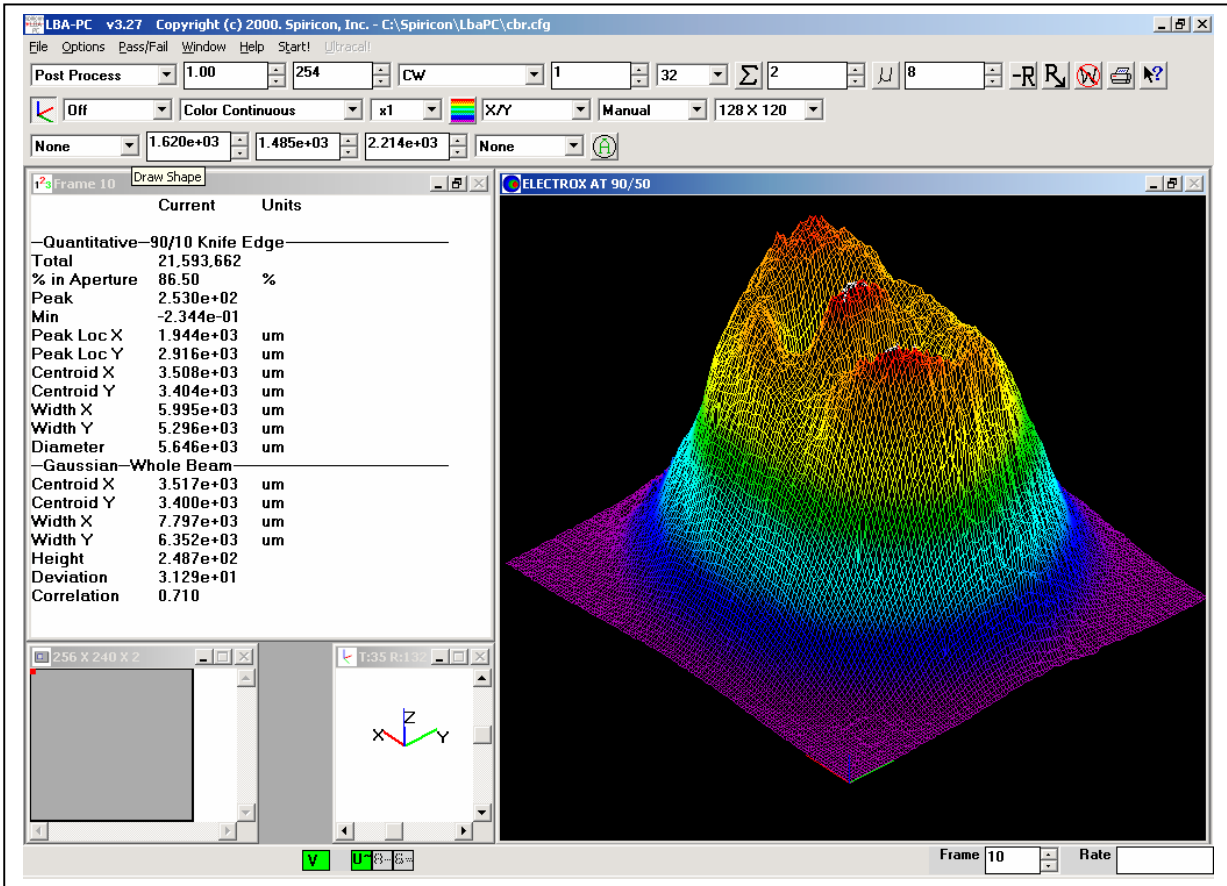


Figure 2. Beam Profile at 90/50 setting. Note that the beam profile has changed dramatically, indicating a changed mode structure of the beam. Peaks have appeared at the "left and right" edges as well as in the "center" of the beam, with additional "cold" spots in the middle of the peaks. Processing at this setting will be different than processing conducted with the beam profile at the first setting.

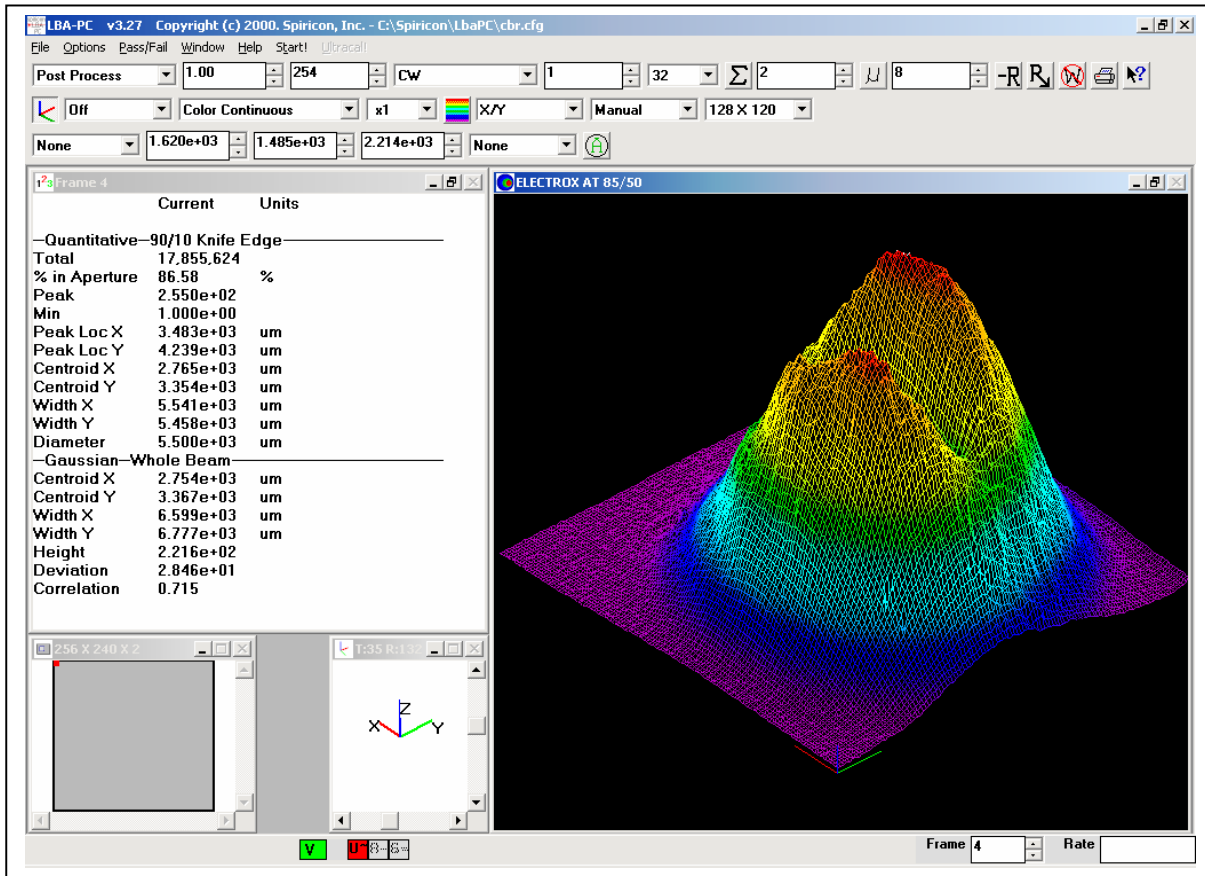


Figure 3. Beam Profile at 85/50 setting. Note that this setting produces a totally different beam profile than the first two settings. The two peaks at the "leading and trailing" edges of the beam will produce deeper cuts than at the "left and right" sides of the beam.

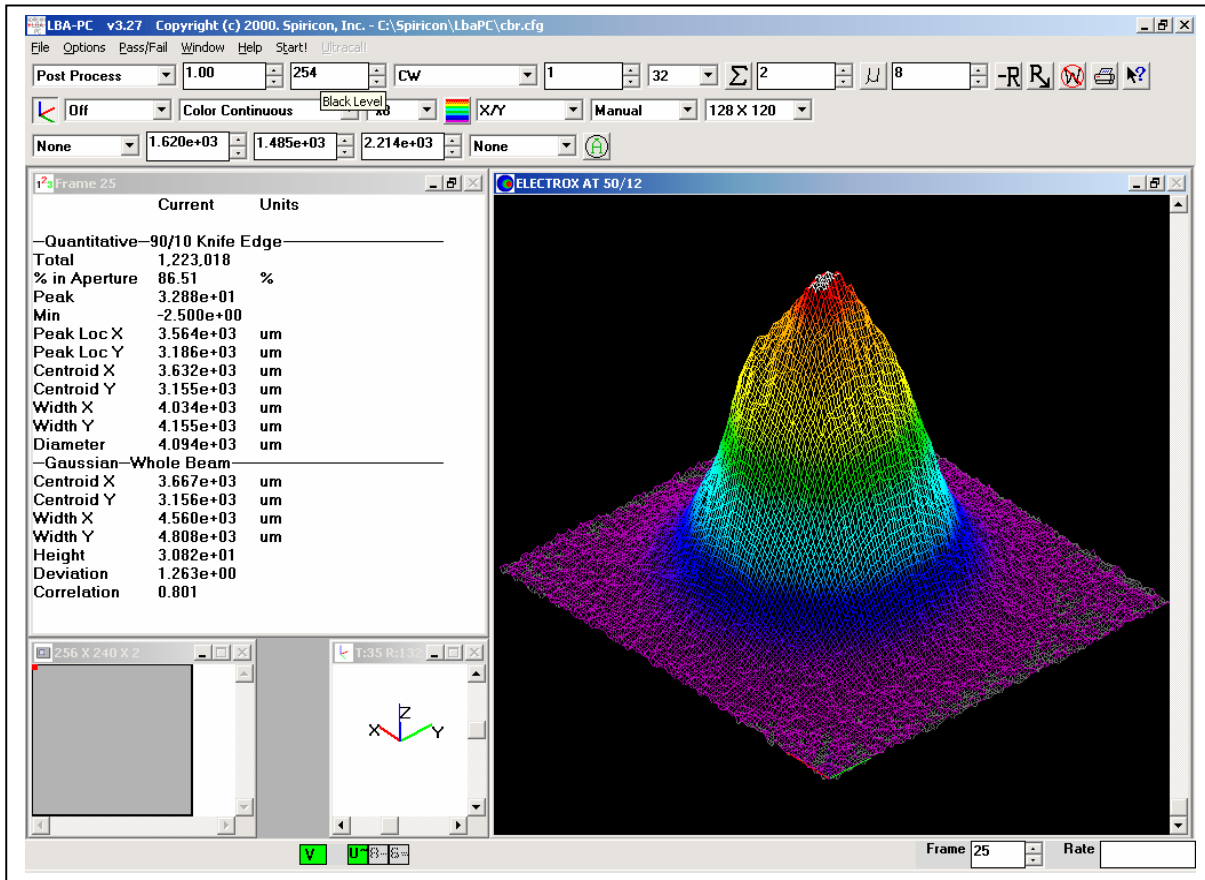


Figure 4. Beam Profile at 50/12 setting. The single peak mode reappears, but inspection of the real time images reveals a constant change in energy intensity. If processing is performed at this setting, differences in quality may be observed.

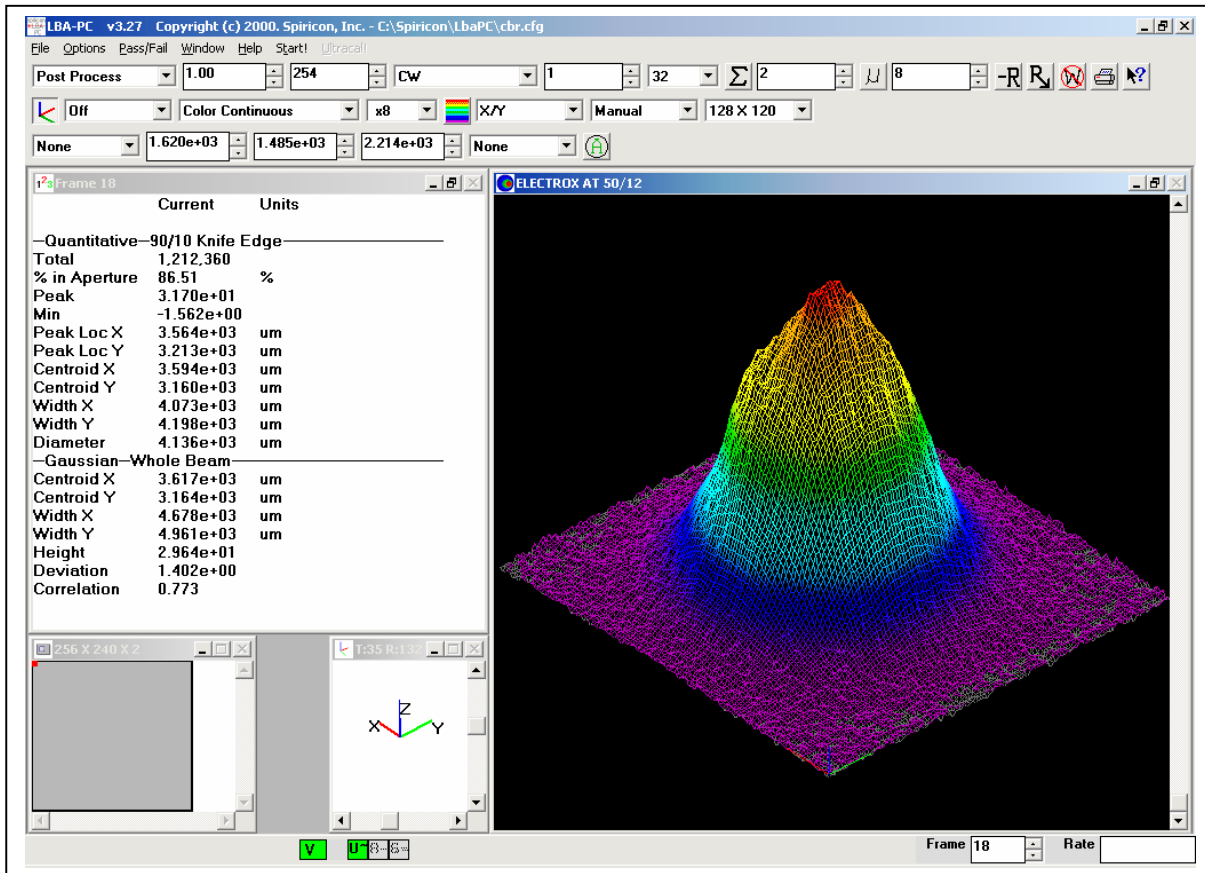


Figure 5. Another beam profile at 50/12 setting. Single peak still is visible, and the variation in beam energy seems to be less pronounced.

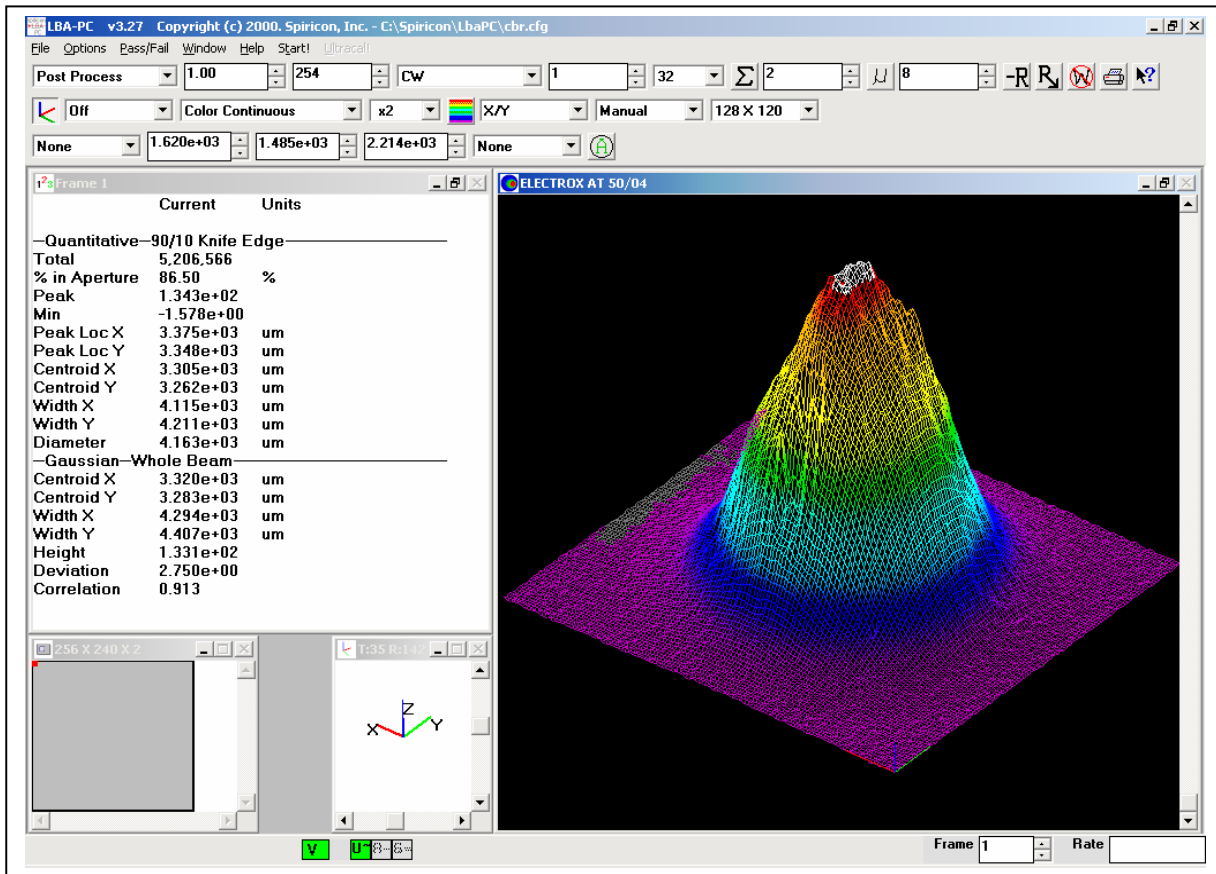


Figure 6 Beam Profile at 50/04 setting. The beam has a single peak, and the Gaussian correlation is high (.913).

**SUMMARY:** Beam profiling conducted of this Nd:YAG marking laser clearly shows that different laser settings produce dramatically different beam profiles, both from a spatial profile standpoint as well as energy stability vs. time perspective.

Spiricon Laser Beam analysis software is also capable of determining the pointing stability of the beam over time, which is equally important when processing on the scale required by this user. It is obvious from this representative study that laser beam profiling can demonstrate the differences in the beam profile, and that these differences may be directly related to the differences in processing of the users Logo, as well as the quality issues of the other markings on the product.