

Finding Focus Plane with CalWizard on Black Anodized Sheet Metal

1 Introduction

There are several materials that can be used for determining flat field focus: burn paper, stainless steel sheet metal, and black anodized sheet metal. This technical bulletin will describe how to find focus plane with black anodized aluminum sheet metal.

Typically, burn paper is used with CO₂ lasers when there is approximately 1mm focus depth. In high power fiber laser applications where 500W to 1000W laser power is used, black anodized sheet metal (5005 or 5205) is better, as it can handle higher power; burn paper would burn up. The depth of focus on a fiber laser is significantly tighter, in the range of 100µm to 200µm, so the incremental step in focus should be smaller than this range. The challenge when incrementing these small steps is resolving the difference between the focused squares, which can be difficult on the black anodized aluminum.

A third option is using stainless steel sheet metal (SS316 or SS312), which melts less than aluminum and can help resolve the depth of focus difference between the small focus increments.

2 Best Focus is Between the Two White Squares

During CalWizard focus calibration, the marking test for the adjustment to the focus plane is normally performed with burn papers, where the whitest square is typically the most focused; however, when the marking test is performed with black anodized sheet metal (typically when laser energy is too high for burn paper), the darker squares represent the optimized focus plane.

Shown in Figure 1, when focusing on black anodized sheet metal, the best focus is not at the most white (as for burn paper), but IN BETWEEN the two white squares. Thus, the darker squares are at better focus.

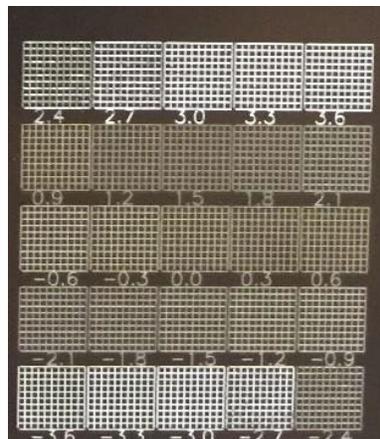


Figure 1 - Best focus is in between the two white squares

2.1 Example - Flat Focus with an IPG YLR 1000

When using a high power 1KW laser, typically the lowest CW (continuous wave) energy of the 1000W is about 10% of the maximum power, i.e. at 100W, which is still too much power for burn paper to be effective. Thus, the next best option is to use anodized sheet metal. As shown in Figure 2 below, the white effect on the focus squares occurs because the laser energy is vaporizing (burning off) the black anodize from the surface of sheet metal. Yet, between the white focus squares, the darker squares are where the laser energy penetrates deeper into the metal, near the 0.0 center focus mark, which can be interpreted as the best 'melting' welds. The challenge is to resolve the minimal color difference between the other square patterns near the center and to distinguish precisely the best focus with small focus step increment ($300\mu\text{m}$).

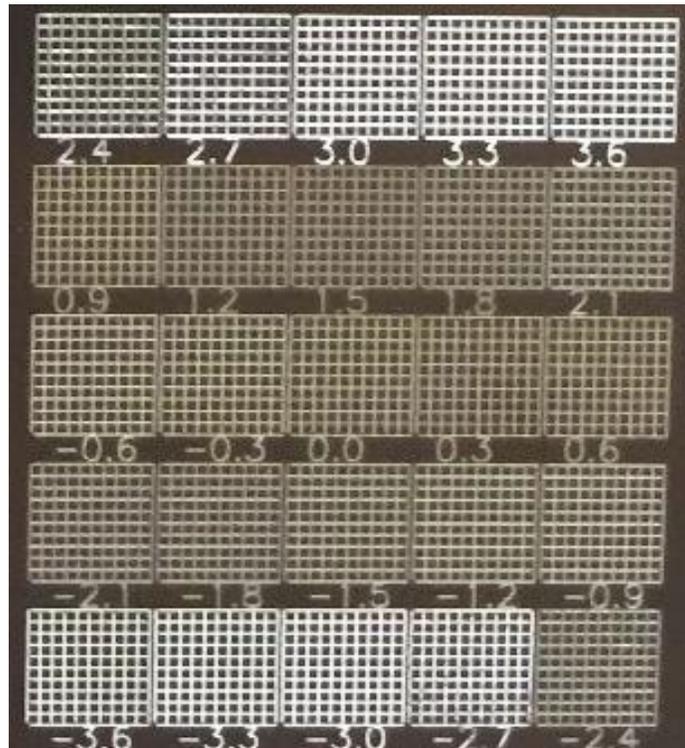


Figure 2 - The darker focus square at 0.0 center is incremented in $300\mu\text{m}$ steps

A microscope can be used to help discern the focus quality of each square, by observing the melted line widths of the focus squares. The example squares shown in Figure 2 are observed to have about $80\mu\text{m}$ line width near the center 0.0 square.

NOTE: Considering this particular 3-axis system was set up for a working distance (WD) of about 210mm with a 200mm field, the focus spot is expected to be about $20\mu\text{m}$ (assuming ideal alignment and laser conditions). However, even with an anticipated tighter spot, the metal at the melting surface reacts in various ways so the line width can be wider than the spot size.

3 Black Anodized and SS316 Sheet Metal (order information)

3.1.1 General description of various types of sheets

www.mcmaster.com (enter “standard aluminum sheets” in search field)

- 3.1.2 **Color-anodized 5005/5205 aluminum (BLACK, GOLD, or SILVER)**
www.mcmaster.com/#standard-aluminum-sheets
- 3.1.3 **Black anodized aluminum 6 x 6 x 0.040 (P/N 6062K16)**
www.mcmaster.com/#6062K16 (may need to enter “6062K16” in search field)
- 3.1.4 **Black anodized aluminum 12 x 12 x 0.040 (P/N 6062K51) and stainless steel (P/N 88885K13)**
www.mcmaster.com/#6062K51
www.mcmaster.com/#standard-316-stainless-steel-sheets
- 3.1.5 **Black anodized aluminum 24 x 24 x 0.040 (P/N 6062K53)**
www.mcmaster.com/#6062K53

4 **Black Burn Paper (order information)**

- 4.1.1 **Bindakote hi-gloss silver 1-side cover 8-1/2x11 12pt 100/pkg (P/C: BKSIL11)**
Manufacturer Sku: CCSIL11
<http://paperworks.com/store/products/bindakote-hi-gloss-silver-1-side-cover-8-12x11-12pt-100pkg>
- 4.1.2 **50 sheets of CCBLK40 cut to 12 x 18.5. 4 out yield 200 (P/C: ZZCCBLK)**
Manufacturer Sku: ZZCCBLK
<http://paperworks.com/store/products/50-sheets-ccblk40-cut-12-x-185-4-out-yield-200>