

File F: **Alignment ideas**

Initial safety steps

Remove the two eyepieces and cover the trinocular head with foil (no holes). Tape it all up. Take off shiny jewelry. Use laser goggles, turn wavelength first to 730 then to 700.

Replace main laser with small laser

Align two pinholes, very far apart, very carefully with the Mai Tai laser beam. Screw them down.

Turn off the laser and put in the leveling laser, aligned very carefully.

Align the internal (beam expanding) eyepiece

Kohler align the condenser, including centering the field diaphragm.

Remove side panels and scan mirrors.

Focus on pollen grains through eyepieces

Screw in the lens all the way on the internal (beam expanding) eyepiece.

Put the internal eyepiece in and move it back and forth to focus on the pollen grains.

Mark this position and remove the internal eyepiece.

Aligning the galvos

I call the bottom (paddle /bigger/M3S) mirror the galvo mirror and the other one (CRS) the resonator mirror.

Measure the height of the center screws of the tube lens

Put the axel of the resonant mirror to this height.

Bring the laser beam horizontally into the box at the height of the galvo mirror.

Measure the beam height at several locations as it crosses the box. Keep the beam parallel to the breadboard holes. Draw a line under the beam on tape to show its path. Use a business card edge to locate the line.

Make a tube lens target.

Draw a straight line across a business card about one inch from one end.

To find the center, carefully bisect this line one inch from each end.

Wedge the card between the screws holding the tube lens. Align the line with the screws.

Put the galvos in place. They should already be perpendicular to each other and the correct height.

Turn on the galvo control power. Set the image height (galvo mirror) to 0. Set the image width (resonator mirror) to zero. Set the mirror position control to 500.

The beam should hit the galvo mirror in the middle and bounce straight up.

Possible adjustments to get this condition are: 1. Adjust the galvo mirror on its axis with the set screws. 2. Change the mirror position control from 500. 3. Adjust the beam height coming into the box.

Line up the whole mirror assembly with the holes in the breadboard and the beam. Now the beam should hit the galvo mirror, go straight up, hit the resonator mirror, go horizontal over to the tube lens and hit it in the center.

Adjust the axis of the resonator mirror. Slide the axis in and out to squarely intercept the beam as it bounces off the galvo mirror. Tape a piece of lens tissue over the mirrors to see what light gets around the resonator mirror. Rotate the axis to hit the tube lens target on the horizontal line. Tighten the set screws.

Rotate and translate the mirror assembly (around the vertical axis keeping it on the breadboard surface) to hit the tube lens target in the center (horizontally).

Check that the beam travels down the center of the row of breadboard holes over to the tube lens. Use the edge of a credit card to intercept the beam and to see where it is on the bottom.

Recheck:

The incoming beam hits the galvo mirror squarely.

The lens tissue on top shows if the resonator mirror intercepts the beam well.

The beam leaves the resonator mirror horizontally and down the center of the breadboard holes.

The beam hits the tube lens target in the center horizontally and vertically.

Make a chart of image height and mirror position settings. See f: scan resolution –Mirror position page.

Put a piece of black metal over the mirror assembly to block laser beam that misses the resonator mirror from going up.

Align the dichroic

Make sure the condenser is Kohler aligned. Remove the tube lens target, pollen slide and the objective lens. Slide the dichroic until the laser beam is centered in the illuminated field circle.

Put back the internal (beam expanding) lens. Realign the marks that you made before. Loosen the set screws on the bottom and adjust the lens to center the beam on the tube lens target.

Set the scanning potentiometers.

Suggestions: image width 385 image height 500 mirror position 440

More safety steps

Recheck the pinhole alignment of the leveling laser.

Remove the leveling laser.

Check that all the targets and lens tissue is removed.

Close the shutter letting the laser into the box.

Turn the ND wheel to 50%

Move the objective lens up.

Put on **all** the covers.

Again cover up the eyepieces. Tape it all up.

Use laser goggles.

Restart the Mai Tai laser at 730

Once it is working turn wavelength to 700.

Open laser shutter and check alignment on pinholes
Close the shutter and reinstall the beam guards.
Reopen the laser shutter. Check the alignment everywhere.
With goggles on look at reflection off box laser shutter.
Then open that shutter and look at light coming out of objective

Put laser wavelength longer than????
Put jewelry back on.