

**SolsTiS**

## **Beam Alignment Optimisation**

26<sup>th</sup> Jan 2021



**WARNING:** The actions within this section fully expose the pump beam. Laser safety procedures should be followed strictly. Do not remove laser safety goggles.

This guide assumes the SolsTiS is already sufficiently aligned to achieve lasing. If this is not the case, contact M Squared for further assistance.

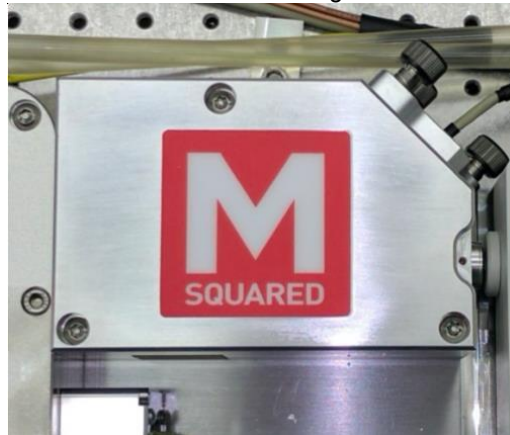
Never adjust the Z axis of either PIK M1 or PIK M2

If you discover or suspect that the pump beam is not optimally aligned to the SolsTiS laser, or you simply want to check pump beam alignment is optimised, please follow these instructions:

1. Place a powermeter head (rated up to 10W) at the SolsTiS output. Or set the VIRPO to maximum reflection and measure at the VIRPO output
2. Record the SolsTiS output power and Output PD value (found on the web interface) at 780nm, minimum of tuning range, maximum of tuning range and at user wavelengths
3. Check SolsTiS' output power is optimised at 780nm by making small ( $\leq \pm 1/4$ ) turns of the X and Y adjusts of the second PIK mirror, one at a time and observing SolsTiS' output power on the power meter

Note: To verify manual adjustment is optimised, press "one-shot" on SolsTiS interface if available.

4. Idle the pump laser and close the shutter so no light is emitted from the pump laser.



*Figure 1 -Top view of the PIK module*

5. Using a 1.5mm hex key, loosen the grub screw on the PIK beam tube, retract the tube from the PIK until it is clear from the pump laser. Tighten the grub screw to hold securely in place

6. Unscrew the 3 Torx 25 bolts of the PIK module lid and carefully lift the PIK lid straight up and place it in a safe place (on its side to prevent contamination)
7. Open the shutter and set the pump power to 100mW
8. Take images of the beam positions on PIK mirror 1, PIK mirror 2 and the lenses
9. Increase the pump power to operating power. If your pump power is >10W then only increase the pump power to a maximum of 10W

Beam walking at pump powers of >10W may cause permanent damage to the internal optical components

10. Tune to 780nm
11. Insert a 2mm hex key into the x-axis actuator of PIK mirror 1



*Figure 2 - Beam walking of PIK M1 and PIK M2 in X and Y pairs*

12. Very slowly rotate the hex key clockwise  $\frac{1}{2}$  turn, **compensate with the x-axis thumbscrew of PIK M2 to maintain the SolsTiS lasing at all times**

If the SolsTiS drops lasing and cannot be easily regained, refer to section 5 of the SolsTiS Manual for 'Pump Beam Alignment Optimisation'

13. After  $\frac{1}{2}$  turn has been completed, Check SolsTiS output power is optimised by making small ( $\leq \pm \frac{1}{4}$ ) turns of the X and Y adjusts of the second PIK mirror, one at a time and observing SolsTiS output power on the power meter
14. Record the SolsTiS output power and Output PD value at 780nm
15. If the output power is less than previously measured, then continue another  $\frac{1}{2}$  turn in the same direction to ensure that you are "over-the-hill" before returning to the previous position. If the output power increases, then continue until, again, you are over-the-hill by at least  $\frac{1}{2}$  turn of the hex key. Record the optimised output power and Output PD after each  $\frac{1}{2}$  turn
16. Repeat this for the counter clockwise direction of the x-axis until a peak power has been found. Please record the power values of the peak and at least one  $\frac{1}{2}$  turn suboptimised at either side of this peak
17. Repeat steps 11-16 for the Y-axis, using the Y-axis adjustment on the second PIK mirror to compensate
18. Once a maximum has been found, you may wish to fine tune the alignment by going in smaller steps of  $\frac{1}{4}$  turn
19. Increase the output power to the operating value, ensure PIK M2 X and Y are optimised and compare previously recorded powers
20. Take images of the new positions on the mirrors at 100mW pump power
21. These final positions may differ from that recorded on the SolsTiS final test sheet

22. Idle the pump, close the shutter, replace the lid, extend and secure the beam tube and lid screws
23. Send the images and recorded power levels to [services@m2lasers.com](mailto:services@m2lasers.com)

#### Appendix – Unbalanced Tuning Capabilities

The beam walking in the X direction directly impacts the wavelength tuning behaviour of the SolsTiS. Compare the output power of the SolsTiS at its low and high wavelength tuning capabilities to the output power at 780nm.

Compare these ratios to the ratio shown on the final test sheet tuning curve. If the power tuning curve is unbalanced i.e. there is a significantly different ratios across the power vs wavelength curve when compared to the final test sheet curve, this is indicative in which direction the beam has to be “walked” on PIK M2

- If the power in the short wavelength region needs improved - walk the beam toward the pump side of PIK M2
- If the power in the long wavelength region needs improved - walk the beam towards the SolsTiS side of PIK M2.

[END]