



Introduction

Large expensive multiline lasers have become increasingly impractical to replace on MoFlo Legacy and MoFlo XDP cell sorters. New continuous wave solid-state lasers present a unique opportunity to add versatility to the aging MoFlos by easily swapping one or more lasers and by dramatically reducing the cost of laser replacements. This upgrade expands the excitation capabilities of these instruments to accommodate the detection of a wider range of fluorophores, keeping these sorters relevant deep into their golden years.

We adapted the approach of Kween et al. but went one step further by bypassing the cytometer's optical tower.

Approach

The original Coherent Innova 302C Krypton Multiline laser was 49 inches long and 10.5 inches high and needed a water-cooled heat exchanger with a dedicated power circuit (208V 3PH 50A).

Upon failure it would have cost \$40,000 to replace it with an equivalent model. Instead we decided to use in its place a Coherent OBIS 405nm LX 100mW laser.

This replacement laser could be quickly swapped with another Coherent OBIS laser (i.e. 552nm) bolted to two top mounting plates.

Material and Methods

- Coherent OBIS 405nm LX 100mW laser system (part number 1284372)
- 2 x Thor Labs complete 3" x 3" kinematic base [top and bottom plates] (part number KB3X3)
- Thor Labs 7"x4" heavy duty lab jack (part number L490)
- Laser tubes (for laser safety)
- Stilts (for lab jack)



Kinematic base (top and bottom)



Lab jack

Installation Workflow

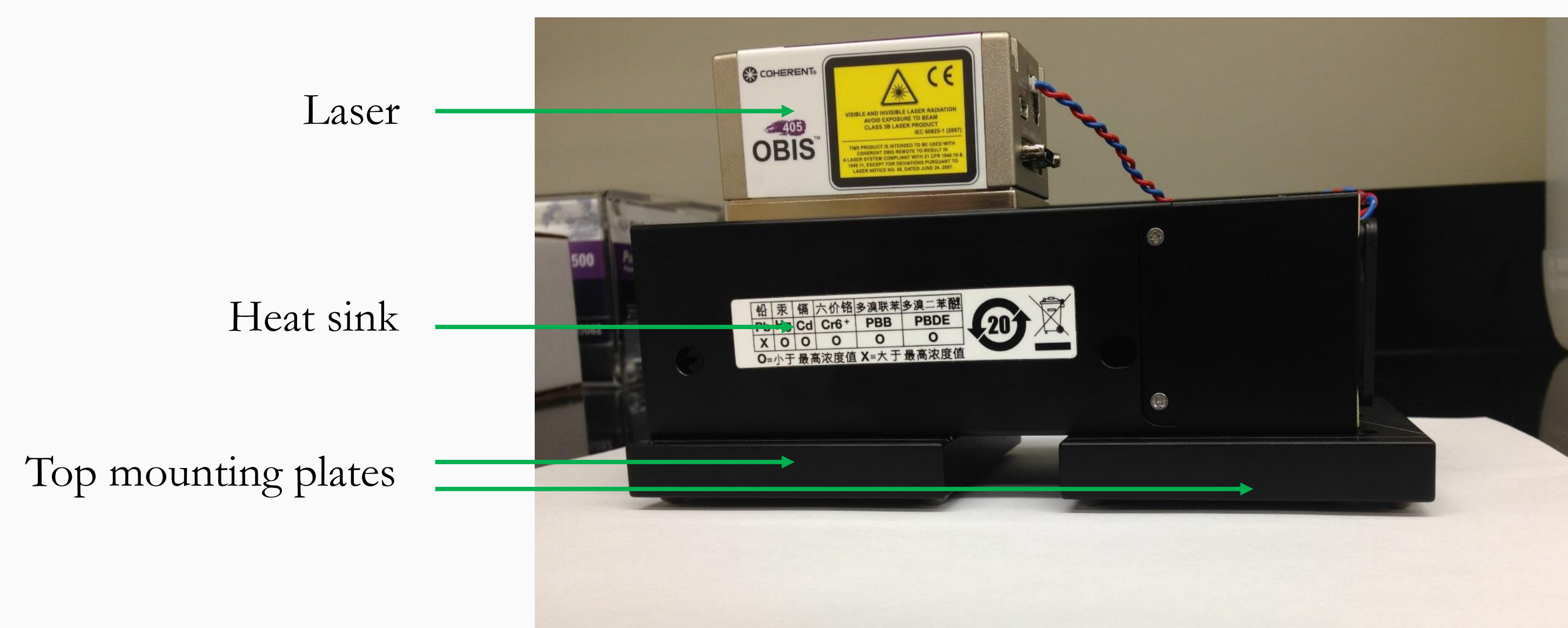


Figure 1. Laser/heat sink on top mounting plates.

The laser is affixed to its heat sink and is then bolted to the top mounting plates of two 3"x3" kinematic bases.

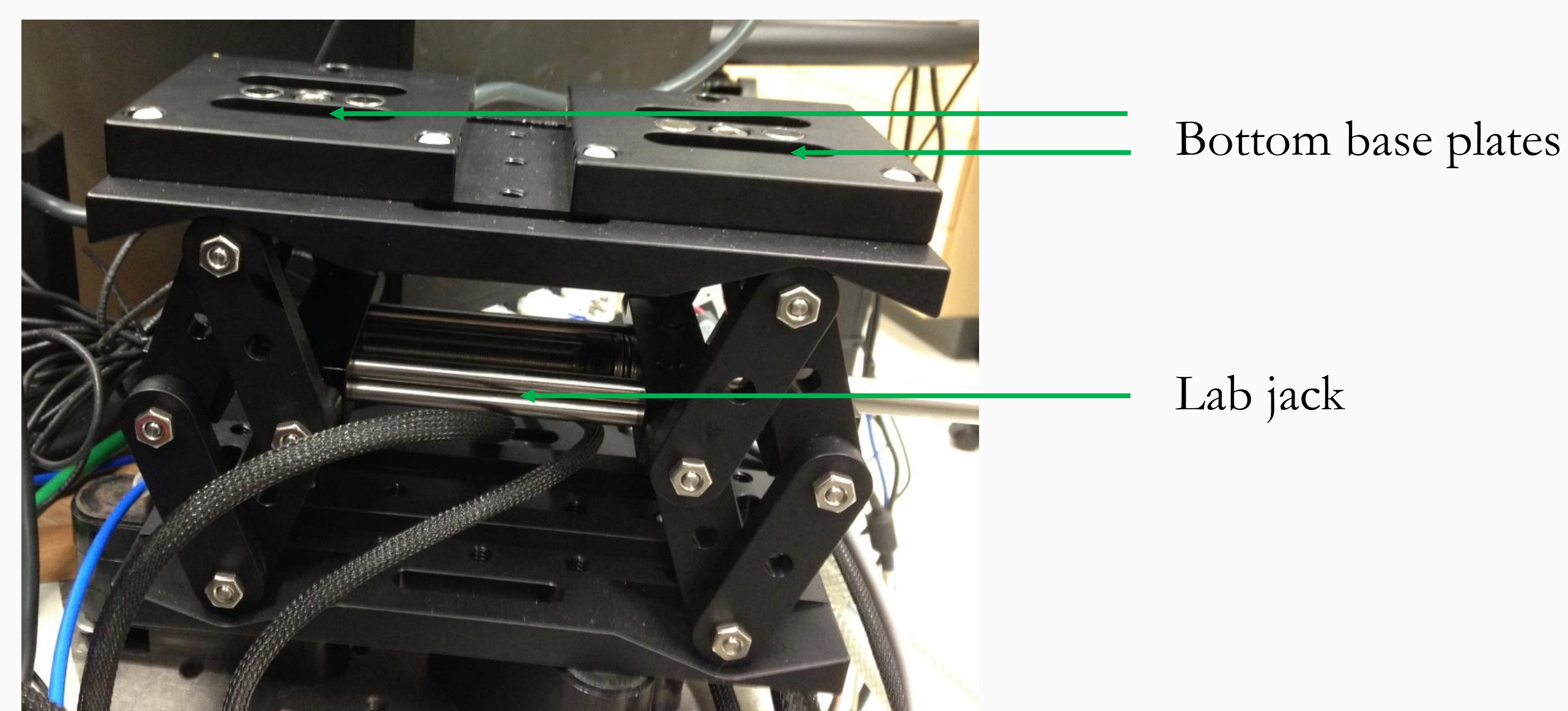


Figure 2. Lab jack loaded with bottom base plates.

The two bottom base plates are bolted to the top of the 7"x4" heavy duty lab jack.

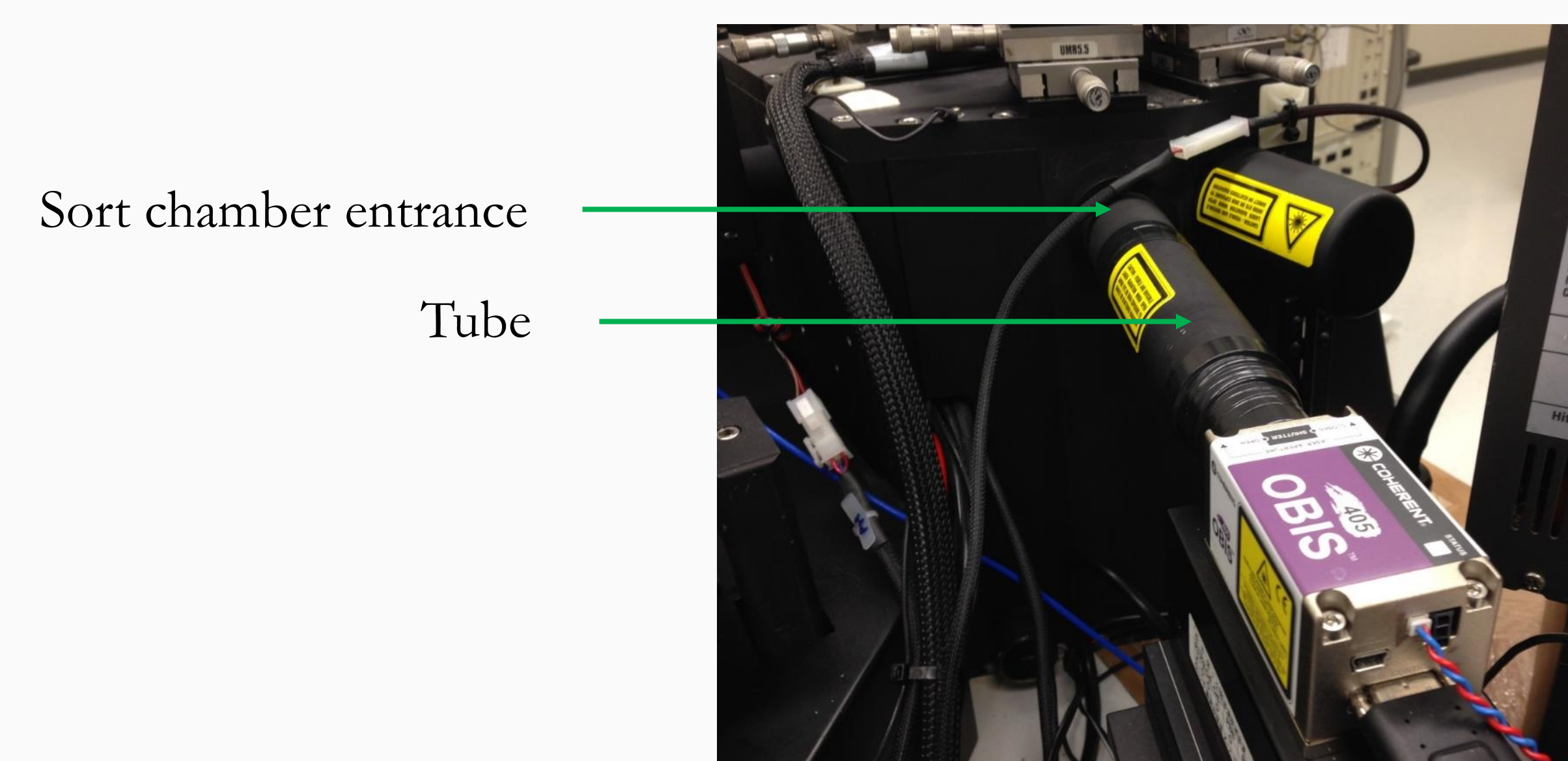


Figure 3. Laser emitting through the sort chamber.

The elements from figure 1 and 2 are magnetically connected. The lab jack is first affixed to the optical bench through stilts and then its height is adjusted to let the laser beam enter the sort chamber.

A tube is connected between the laser head and the sort chamber for safety.



Figure 4. Size comparison of the original laser and its replacement with heat sink.

Quality Control Results

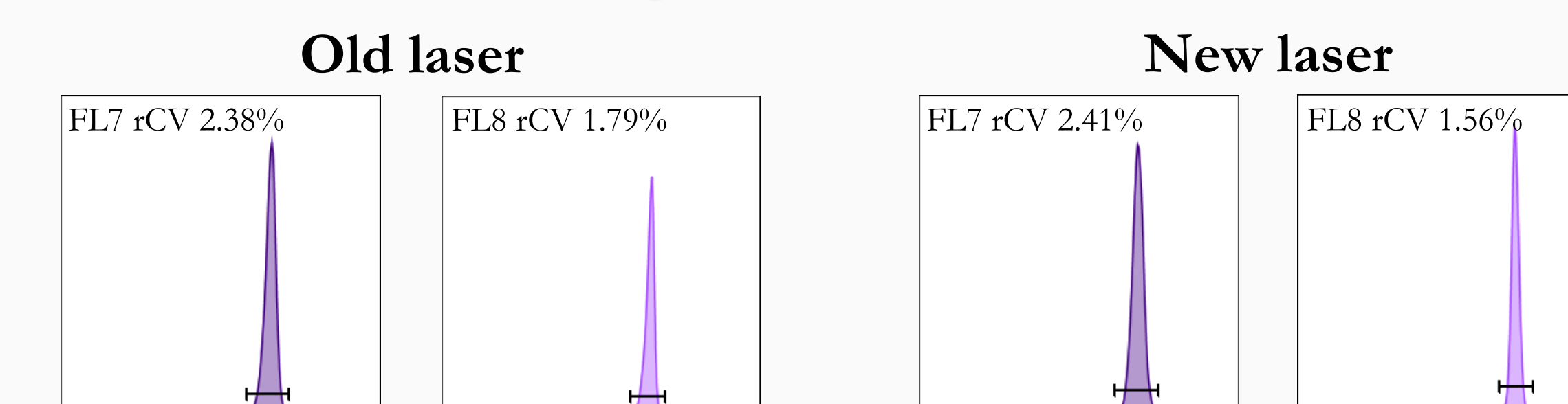


Figure 5. rCVs of signals demonstrate similar inter-laser sensitivity.

Conclusion

Our solution utilizes a 100mW Coherent OBIS 405 LX laser attached to a kinematic magnetic base plate mounted on a heavy-duty precision lab jack. Once affixed to the cytometer optical bench, the lab jack provides a stable mounting platform for the laser(s) and permits easy laser swapping with minimal re-alignment necessary (beam-shaping optic adjustment).

It also bypasses the optical tower as the lab jack/laser combination is small enough to fit near the opening of the sort chamber, allowing a direct illumination of the stream and therefore minimizing laser power losses. Lastly this upgrade method costs only ~\$5,500.

Note that this procedure does not require the assistance of a service engineer which drastically reduces cost. However be sure to follow laser safety guidelines.

References

Laser-Reconfigurable Legacy MoFlo: A Versatile 5-Laser Solution. Kweens M., Byrne P.R., Baumgartner T., Hendrikx P.J.. Memorial Sloan-Kettering Cancer Center, New York, NY. CYTO 2014 Poster 389