Compact NIR DPSS lasers for optical tweezers

Figure 1. shows a setup consisting of a steerable laser trap. The setup was geared towards calibration of trap stiffness and made use of a Cobolt Rumba™ 1064 nm, 500 mW laser to generate the trap.

The laser performed very well, allowing the customer to form a stable trap using only a low-cost and relatively low NA oil-immersion lens. The laser was used to trap and steer small (1µm) polystyrene microspheres in aqueous solution and close to the flowcell surface.

The translation stage on which the oil-immersion trapping objective (O1) is mounted is visible, but not the oil-immersion lens itself, as it is hidden by the X-Y sample stage (S1). The objective used to collect light after the trap (O2) is followed by a second dichroic mirror (D2) used to reflect light into a position-sensitive detector (PSD).

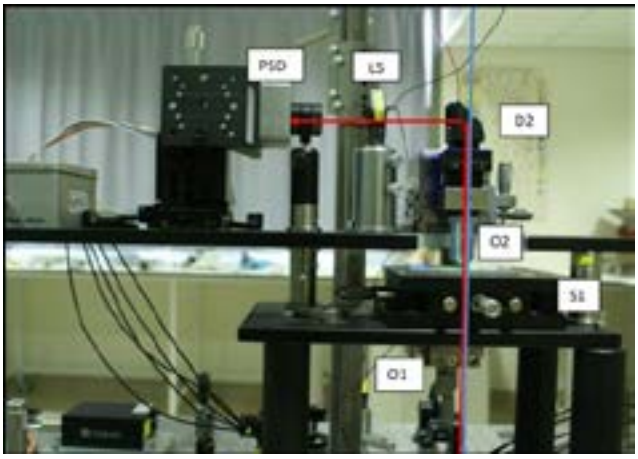
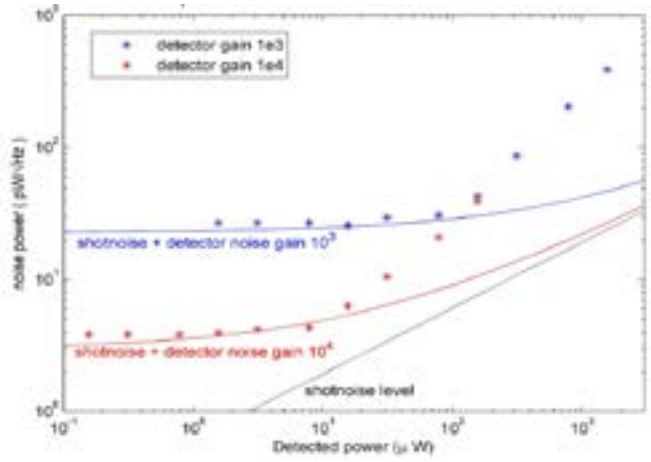


Figure 1. Cobolt Rumba™ 1064 nm in a steerable laser trap, stage and detection assembly. (Co of Terence Strick).

The Cobolt Rumba™ is a compact NIR DPSS laser offering up to 2 W output powerat precisely 1064 nm from a hermetically sealed package, with very low intensity noise, and in a high quality TEMoo-mode and low-divergent beam.

Fig. 2. Cobolt Rumba™ 1064nm

Typical noise performance of the Cobolt Rumba™ while temperature cycling from 20-50°C, is <0.5 % pk to pk and <0.1 % rms, making it an ideal laser source for particle trapping experiments.



The above graph shows that the noise scales linearly with power. The optical noise is a factor of 4-8 larger than shot noise in the tested range of powers.

The graph below shows frequency dependence of the optical noise.(The data was taken with detector: Femto InGasAs PIN diode, DHPCA-S and Lockin-detector: Stanford research system, SR844, courtesy of a Cobolt customer, doing optical tweezers experiments.)