

A High Power Laser Ranging Facility at JPL's TMO

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This paper describes a new facility for laser ranging using high power CW lasers. We describe the facility we've assembled at JPL's TMO facility that works at 1.06 μ m, with a laser amplifier that can transmit an average 1.1KW. We amplitude modulate the laser at a few 100Mhz to \sim 1 Ghz with a 50% duty cycle. The signal processing resembles a chirped range doppler radar system with the RF signal modulating a high power laser. The receiver is a photon counting detector. The other mode of operation is a fully coherent laser radar, but now limited to 50W transmitted power. The seed laser for coherent operation will be a Menlo Systems stabilized laser with $1e-14$ df/f linewidth. The coherent receiver is standard heterodyne receiver using an InGaAs photodiode and \sim 100 uW local oscillator, operating in the shot noise/quantum limit. Full coherent operation would be a complete optical version of range doppler radar. Because of the short wavelength of light (vs RF) the doppler measurement can be extremely precise. Another way to look at coherent operation is this is laser interferometry where one of the mirrors is a retroreflector on a satellite.

In the incoherent mode, the modulation is 50% duty cycle. As a result the average number of photons detected per pulse is quite low \sim 1e-3 or lower. We'll briefly describe the signal processing to measure the phase of the modulation, and as the modulation freq is chirped and how the group delay or absolute distance is then measured.