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Advanced Solid State Lasers for Space Tracking

A new generation of completely diode pumped solid state lasers including a pico-second (ps) pulse width system for Satellite Laser Ranging and a nano-second (ns) pulse width high energy system for tracking space debris has been developed with all the design specifications and development objectives achieved. The ps pulse width system consists of a mode-locked oscillator, a regenerative amplifier with a standing wave cavity, a power amplifier and a high efficiency (~70%) second harmonic generator. It can generate 10 ps pulse width, pulse energy up to 20 mJ, beam quality $M^2 \sim 2$, and repetition rate 10–100 Hz. The ns pulse width high energy system consists of a pulsed single frequency oscillator, pre-amplifiers, power-amplifiers, SBS cell and image relay optics with spatial filters in vacuum cells. It is capable of generating 6–20 ns pulse width, pulse energy up to 4.7 J, beam quality $M^2 \sim 3$, and repetition rate 100–200 Hz. Both systems are fully automated and have been in 24/7 operation for a number of years with excellent performance and reliability.