

HIGH ENERGY kHz PIV LASERS

Incorporating cutting edge performance with robust, industrial grade packaging, Quantronix Particle Image Velocimetry (PIV) lasers are designed to excel in diverse industrial and scientific applications. Quantronix offers both Nd:YAG and Nd:YLF dual-pulse models to best match the needs of the experiment.



**COMPACT, SINGLE-BOX
DIODE-PUMPED SOLID STATE LASERS**



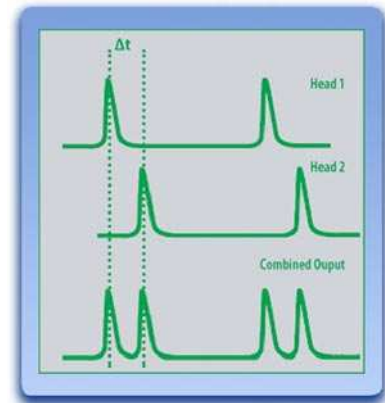
**HIGH POWER
DUAL HEAD LASERS**



Operation Principle

All Quantronix PIV Lasers operate with a dual cavity approach, allowing each oscillator to be independently triggered with a timing jitter of less than 2 ns. The outputs of these two oscillators are then combined to give two pulses for PIV applications. The dual cavity approach allow for full control of each laser pulse, including the pulse energies, polarizations, beam collimation and spatial overlap. The time delay between the two pulses is adjustable and can even be temporally overlapped. The time intervals between each of the laser pulses can be directly controlled by the programmable trigger pulses from the PIV system. This is critical for automated high-speed applications where full control of the timing on a sub-microsecond timescale is required.

Quantronix offers several different kHz PIV laser solutions in the IR, green, and UV with total energy >60 mJ and power >200 W.



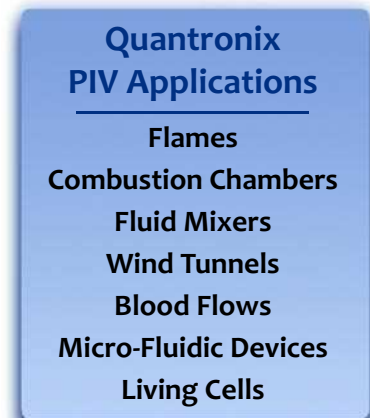
Dual Cavity Advantages

- 1. Mode Quality:** Each cavity of a dual cavity system produces a smooth output profile with precise spatial overlap to produce high quality PIV images. In contrast, a single cavity system's first pulse preferentially extracts the laser gain from the center of the rod. The second pulse in a single cavity system then has a different gain distribution at the start of the pulse and a different spatial output. Having identical laser pulses in a PIV system is critical for high quality flow visualizations.
- 2. Delay Settings:** With a dual cavity PIV laser any time delay (from 0 to 1 millisecond) with a resolution of 25 ns can be set. A single cavity system limits the minimum delay between the pulses.
- 3. Timing Accuracy:** Accurate timing is critical for the determination of velocities in PIV applications. The independent laser cavities allow for very stable timing between the laser pulses, with a timing jitter below 2 nanoseconds. With a single cavity system, the presence of residual laser light from the first pulse can affect the build-up time of the second pulse. This uncertainty in build-up time results in noisy timing stability.
- 4. Thermal Management:** The laser pump power and subsequent thermal load is distributed between two independent cavities, and thermal lensing in the laser rods is easier to control. Stable thermal lensing allows for more stable mode quality and beam pointing stability. A dual cavity system allows for the same pulse parameters for all delays, with the flexibility of independently manipulating each cavity's pulse.



Quantronix Lasers PIV Applications

Quantronix lasers, combined with an imaging system, allow for high speed quantitative in-situ measurements. Particle imaging provides information about size, shape, position and velocity (and their distributions). Typical applications include analysis of flames, combustion chambers, fluid mixers, wind tunnels, blood flows, micro-fluidic devices, and living cells.



Models

Quantronix offers Nd:YLF and Nd:YAG high speed pulsed green lasers in “Duo” and “Dual” models. The “Duo” models have two independent oscillators and integrated beam combination. The “Dual” models use two independent laser heads and external beam combination.

Duo-Series

Based on Quantronix’s proven Darwin laser series, the Darwin-Duo is a dual oscillator/single head, high repetition rate, diode-pumped Nd:YLF laser. The Darwin-Duo offers the ultimate in flexibility for PIV and other dual output applications. The combination of two independent oscillators allows complete control of pulse separation and pulse energy. Both oscillators in the Darwin-Duo are identical in optical design, giving temporally and spatially matched pulses for the highest degree of cross-correlation possible. Each oscillator can be externally triggered via TTL inputs. The Darwin-Duo features computer controlled operation through our Laser Commander software with a user-friendly GUI interface.



- Duo-Series Models**
- ▶▶ *Darwin-Duo* – Nd:YLF, 1-10 kHz
 - ▶▶ *Hawk-Duo** – Nd:YAG, 1-10 kHz



Dual Series

In the Dual series models, the beam combination optics are located outside of the laser head. This allows full control of the beam characteristics and provides easy access during the application. With the attached Quantronix beam combination box, the following laser parameters can be easily tuned:

- Dual Series Models**
- ▶▶ *Dual Darwin*
 - ▶▶ *Dual Hawk** – up to 250 W
 - ▶▶ *Dual Osprey** – high repetition rates
 - ▶▶ *Dual Condor** – up to 200 W (lamp-pumped system)

- ▶▶ Beam overlap and collimation of each beam
- ▶▶ Polarization control: control the polarization of each of the pulses to give best illumination on the studied event.
- ▶▶ Energy control: attenuate the output of each of the beams without changing other properties so that the same operation parameters can be used for alignment and experiments.

*For further information on these models, please contact Quantronix

	Darwin-Duo-40-M Dual-Darwin-40-M	Darwin-Duo-60-M Dual-Darwin-60-M	Darwin-Duo-80-M Dual-Darwin-80-M	Darwin-Duo-100-M Dual-Darwin-100-M
Wavelength	527 nm			
Total Energy	>30 mJ	>40 mJ	>50 mJ	>60 mJ
Avg. Power @ 3 kHz	>40 W	>60 W	>75 W	>90 W
Rep. Rate	0.1 to 10 kHz			
Pulse Width	120 ns			
Energy Stability	<1% rms			
Beam Quality	$M^2 < 25 / M^2 < 16$ (Dual Series)			

Contact us about possible customizations!

Integration

Quantronix PIV lasers excel as standalone systems, yet are also designed for easy integration into full PIV solutions. Whether you are building your own system or working with an integrator, our PIV lasers provide a solid foundation on which to build an integrated PIV solution.

Integration advantages:

- ▶ Single control unit for both oscillator systems
- ▶ Internal or external triggering for full control of pulse timing
- ▶ User-configurable software drivers

Customer Service

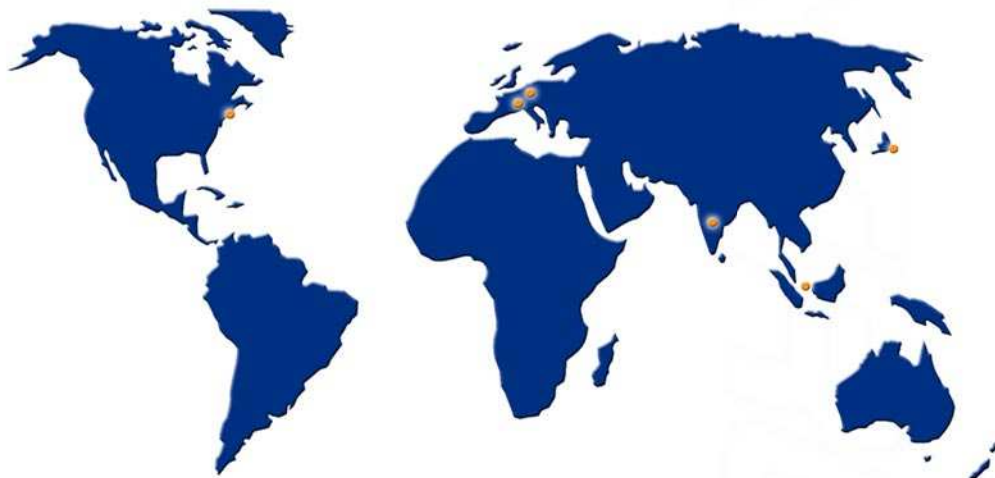
A global team of factory trained engineers and technicians are available throughout the US, Europe, Japan, South-East Asia, and South Asia to offer our customers a choice of programs including installation, on-site upgrades, after sales service, and training. At Quantronix, we pride ourselves in customer satisfaction and the quality of our products and services.

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