



## Octavius-1G: The 1 GHz, 6 fs Ti:Sapphire Oscillator



The Octavius-1G Ti:Sa laser offers the broadest spectrum commercially available today.

The spectrum allows for carrier-offset frequency stabilization without external spectral broadening. The high repetition rate is useful for high-cycling pump-probe experiments like Asynchronous Optical Sampling (ASOPS) and frequency comb applications. High speed laser scanning microscopy set-ups also benefit from the high repetition rate as artifacts (Moiré effects) caused by a beat node between the scan frequency and the pulse repetition frequency are avoided. In addition the ratio between signal strength and photo damage is increased.

### Technology

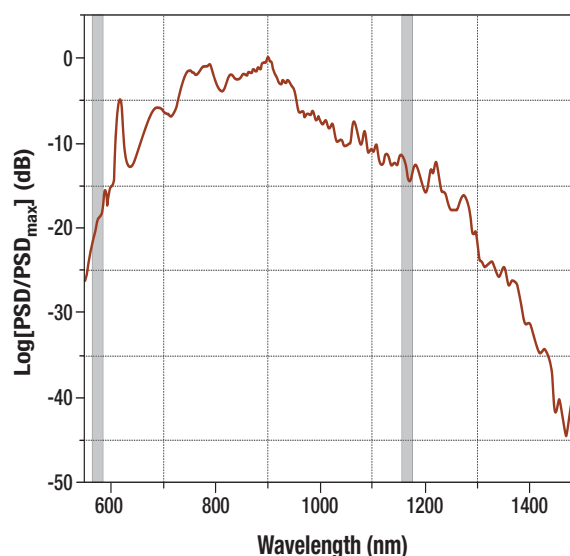
The Octavius is a soft aperture Kerr-lens mode locked (KLM) Ti:Sa. The laser cavities incorporate octave-spanning Dispersion Compensation Mirror (DCM) pairs, which are required for smooth group delay control over an octave-wide bandwidth. The design of these unique mirror pairs requires more than 200 coating layers.

The high intensity of the intra-cavity circulating laser pulses and a carefully set temporal focus are used to create additional bandwidth outside of the Ti:Sa gain bandwidth through Self-Phase Modulation in the Ti:Sa crystal. The spectral content, at one octave of bandwidth, enables long-term stability and a robust  $f/2f$  carrier envelope offset frequency beat detection with more than 30 dB signal-to-noise ratio in a 100 kHz bandwidth.

### Applications

- Frequency Metrology
- Astro Combs
- Pump-Probe Experiments
- Biological Probing and Imaging

### Output Spectrum of the Octavius-1G

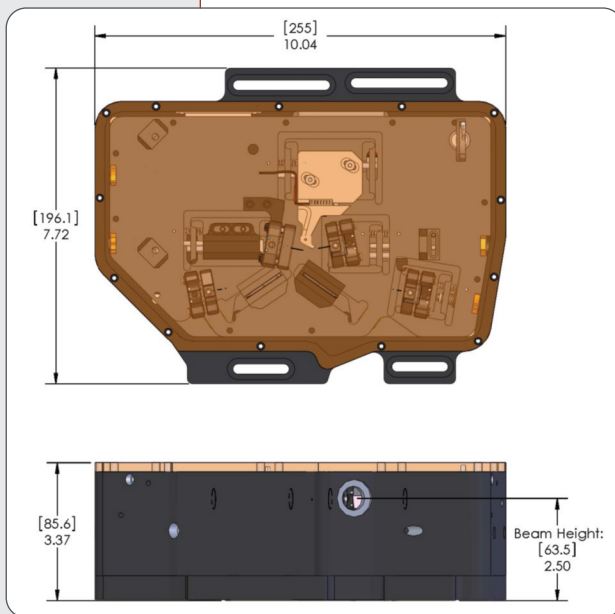




### Mechanical Design

Ease of use and mechanical robustness were at the forefront of the design for the Octavius lasers. Unlike typical laser designs, which use traditional translation stages for tuning and alignment, the alignment of the Octavius-1G is controlled using a unique flexure stage design that eliminates the various materials typically used for springs, bearings, and frames while still maintaining

unprecedented accuracy and repeatability. Custom tooling and fixtures guarantee a stress-free machining during production and therefore minimize drifts and misalignment of the laser cavity caused by stress relaxation. Two independent, all-solid-state temperature controllers for the laser cavity and the crystal further increase the long-term stability of the cavity alignment. The oscillator requires no water cooling, which reduces short-term noise due to vibration caused by turbulent water flow.



The crystal and pump lens positions, as well as the curved mirror separation, are all tracked using optical linear position encoders that offer ~1 μm resolution. Therefore, it is easy to reestablish modelocked operation and switching between multiple working configurations becomes seamless.

### Pump Laser

The Octavius-1G can be purchased separately or with a single mode, CW, diode-pumped solid-state (DPSS) pump laser that outputs either 6 W or 8 W at 532 nm. In the latter case, both the DPSS laser and the Ti:Sa oscillator are integrated on a rigid, watercooled platform.



Specifications	Ocatvius-1G	Octavius-1G-HP
Pulse Width	<6 fs	
Bandwidth @-10 dB	300 nm	
Average Out Power	300 mW @ 6 W Pump	750 mW @ 8W Pump
Divergence	<2 mrad	
Polarization	>90:1	
Power Stability Over 8 h	± 1%	
Dimensions	10.0" x 7.7" (255 mm x 196 mm)	

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