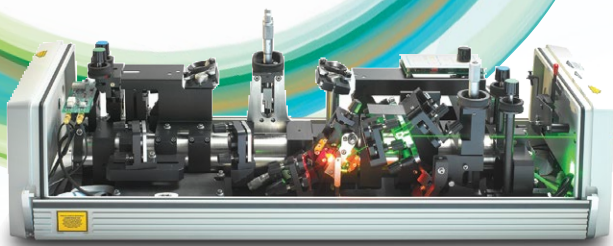


Tsunami® Series

TI:SAPPHIRE ULTRAFAST OSCILLATORS

The Tsunami Advantage

- High-performance optics (XP and HP models) offer the broadest tuning range of 700 nm – >1080 nm
- High peak power of >500 kW efficiently drives non-linear optical processes
- Regenerative mode locking for long-term stability
- Stable mode locking at the edges of tuning range
- Capable of long pulses >100 ps
- Invar tube-based construction for temperature stability and rigidity



The Tsunami® ultrafast Ti:Sapphire oscillator series combines operational simplicity with flexibility, plus unmatched tuning capability and pulse duration range. The Tsunami series' regenerative mode-locking mechanism sustains pulses, even during perturbation of the cavity, and enables coverage of long wavelengths and very long picosecond pulses¹.

High Average Power

The new Tsunami XP models offer >4.0 W average power at 800 nm (when pumped with the Millennia® eV™ 25) with a full tuning range² of 700 to 1080 nm from a single optics set. Tsunami XP is the highest average power Ti:Sapphire laser commercially available.

Short Pulse Width

The short pulse Tsunami systems use the latest generation of high-performance optics to allow >65 nm of bandwidth for <30 fs in pulse width. When pumped by the Millennia eV 10, the Tsunami 3941-30-X15 typically achieves >800 mW of average power with >350 kW of peak power.

The superior design of the Tsunami prism dispersion compensation enables shorter, transform-limited pulses. A unique I-track prism movement enables excellent beam pointing as the laser is tuned. The use of slits for wavelength selection in femtosecond operation, combined with advanced dispersion compensation allows wide pulse duration adjustment³ over the femtosecond range from <60 fs – >900 fs. The Tsunami laser can then be easily converted to picosecond mode to cover <2 ps – 100 ps with the appropriate GTI.

The Tsunami laser pulses can be synchronized to other lasers or laboratory equipment with the optional Lok-to-Clock® accessory that actively stabilizes cavity length. Lok-to-Clock electronics also provide high-speed input that can be used to slave the laser to a reference pulse train from another laser.

When the Tsunami oscillator is combined with the broad range of Spectra-Physics harmonic generators and optical parametric oscillators, such as the Inspire™ OPO, wavelength coverage spans from 210 nm – 5 µm. Pulse picking can offer repetition rate flexibility from single shot to 8 MHz, while still providing enough pulse energy for demanding fluorescence lifetime applications.

1. Standard pulse duration is <2 ps. Pulse durations >100 ps are available with the use of appropriate GTI.

2. Tuning range is specified as 700 nm – 1080 nm with Millennia eV 25 pump laser. Optional optics sets are available that can extend coverage to 685 nm to 1100 nm.

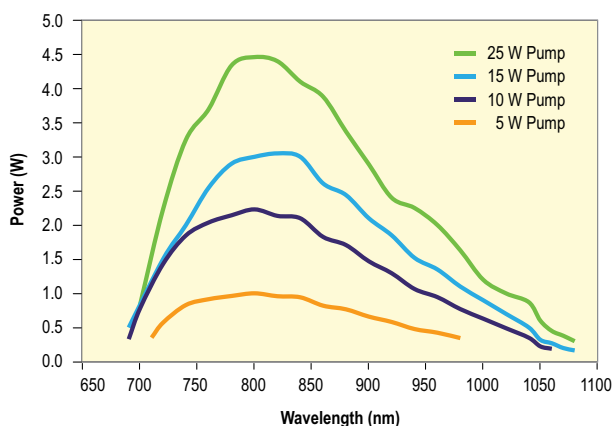
3. Pulse durations between 120 fs and 900 fs require the use of GTI in combination with slits and prisms.

Applications

- Time-resolved spectroscopy
- Seed source for high-energy amplifiers
- High harmonic generation
- Deep-penetration multiphoton imaging
- Ultrafast tissue ablation
- Micromachining

Tsunami® Series

Tsunami Typical Performance¹



1. Typically measured performance; not a guaranteed or warranted specification.

Tsunami XP Specifications¹

Tsunami XP fs 25 W Pump	
Output Characteristics	
Tuning Range	700–1080 nm ²
Average Power ³	>4.0 W at 800 nm
Pulse Width ^{3,4}	<100 fs
Peak Power ³	>500 kW at 800 nm
Pulse Energy	~50 nJ
Tsunami XP Models	3960C-25XP 3941C-25XP

Tsunami HP Specifications¹

	Tsunami HP fs 15 W Pump	Tsunami HP ps 15 W Pump	Tsunami HP fs 10 W Pump	Tsunami HP ps 10 W Pump
Output Characteristics				
Tuning Range	700–1080 nm ²	700–1000 nm	700–1050 nm	700–1000 nm
Average Power ³	>2.7 W at 800 nm	>2.9 W at 800 nm	>1.4 W at 800 nm	>1.5 W at 800 nm
Pulse Width ^{3,4}	<100 fs	<2–100 ps	<100 fs	<2–100 ps
Peak Power ²	>337 kW at 800 nm	–	>170 kW at 800 nm	–
Pulse Energy	~34 nJ	~36 nJ	~15 nJ	~19 nJ
Tsunami HP Models	3960C-15HP 3941C-15HP	3950-15HP 3960C-15HP ⁵	3960-10HP 3960C-10HP 3941-10HP 3941C-10HP	3950-10HP 3960C-10HP ⁵

Tsunami® Series

Tsunami Broadband Specifications¹

	Tsunami Broadband fs 10 W Pump	Tsunami Broadband ps 10 W Pump	Tsunami Broadband fs 5 W Pump	Tsunami Broadband ps 5 W Pump
Output Characteristics				
Tuning Range	700–1000 nm	700–1000 nm	700–980 nm	700–980 nm
Average Power ³	>1.4 W at 800 nm	>1.5 W at 800 nm	>0.7 W at 800 nm	>0.7 W at 800 nm
Pulse Width ^{3,4}	<100 fs	<2–100 ps	<100 fs	<2–100 ps
Peak Power ²	>170 kW at 800 nm	–	>85 kW at 800 nm	–
Pulse Energy	~14 nJ	~15 nJ	~8 nJ	~8 nJ
Tsunami Broadband Models	3960-X1BB 3941-X1BB	3950-X1BB 3960-X1BB5	3960-M1BB 3941-M1BB	3950-M1BB 3960-M1BB ⁵

Standard Tsunami Specifications¹

	Tsunami-S fs 10 W Pump	Tsunami-S ps 10 W Pump	Tsunami-S fs 5 W Pump	Tsunami-S ps 5 W Pump	Tsunami-X fs 10 W Pump	Tsunami-X ps 10 W Pump
Output Characteristics						
Tuning Range	720–850 nm	720–850 nm	720–850 nm	720–850 nm	970–1080 nm	970–1080 nm
Average Power ³	>1.1 W at 800 nm	>1.3 W at 800 nm	>0.7 W at 800 nm	>1.0 W at 800 nm	>0.25 W at 1050 nm	>0.25 W at 1050 nm
Pulse Width ^{3,4}	<100 fs	<2–100 ps	<100 fs	<2–100 ps	<100 fs	<2–100 ps
Peak Power ²	>170 kW at 800 nm	–	>85 kW at 800 nm	–	>170 kW at 800 nm	–
Pulse Energy	~15 nJ	~15 nJ	~8 nJ	~8 nJ	~8 nJ	~8 nJ
Standard Tsunami Models	3960-X1S 3941-X1S	3950-X1S 3960-X1S ⁵	3960-M1S 3941-M1S	3950-10HP 3960C-10HP ⁵	3960-X1X 3941-X1X	3950-X1X 3960-X1X ⁵

Short Pulse Tsunami Specifications¹

	Sub 30 Tsunami 10 W Pump	Sub 30 Tsunami 5 W Pump	Ultra Short Pulse Tsunami 10 W Pump	Ultra Short Pulse Tsunami 5 W Pump
Output Characteristics				
Tuning Range	780–820 nm	780–820 nm	780–850 nm	780–850 nm
Average Power ³	750 mW at 800 nm	400 mW at 800 nm	900 mW at 800 nm	500 mW at 800 nm
Pulse Width ^{3,4}	<30 fs	<30 fs	<50 fs	<50 fs
Peak Power ²	>310 kW at 800 nm	>160 kW at 800 nm	>225 kW at 800 nm	>125 kW at 800 nm
Pulse Energy	~9 nJ	~5 nJ	~11 nJ	~6 nJ
Tsunami HP Models	3941-30-X1S	3941-30-M1S	3960-X1S-USP 3941-X1S-USP	3960-M1S-USP 3941-M1S-USP

1. Due to our continuous product improvement program, specifications may change without notice. Specifications only apply when the specific Tsunami model is pumped by a Spectra-Physics Millennia eV 25 W, 15 W, 10 W or 5 W solid state laser and the entire Tsunami Environmental Package is installed.

2. Requires Lok-to-Clock. Tuning range without Lok-to-Clock is 700–1050 nm.

3. Specification applies to 800 nm only.

4. A sech² pulse shape (0.65 deconvolution factor) is used to determine the pulse width as measured with a Newport PulseScout®.

5. The Tsunami model 3960 requires additional components to run in picosecond mode (sold separately).

Tsunami® Series

General Tsunami Specifications⁴

General Characteristics

Repetition Rate (nominal) ¹	80 MHz
Noise ²	<0.2
Stability ³	<5%
Spatial Mode	TEM ₀₀
Beam Diameter (1/e ²)	<2 mm
Beam Divergence, full angle	<1 mrad
Polarization	>500:1 vertical

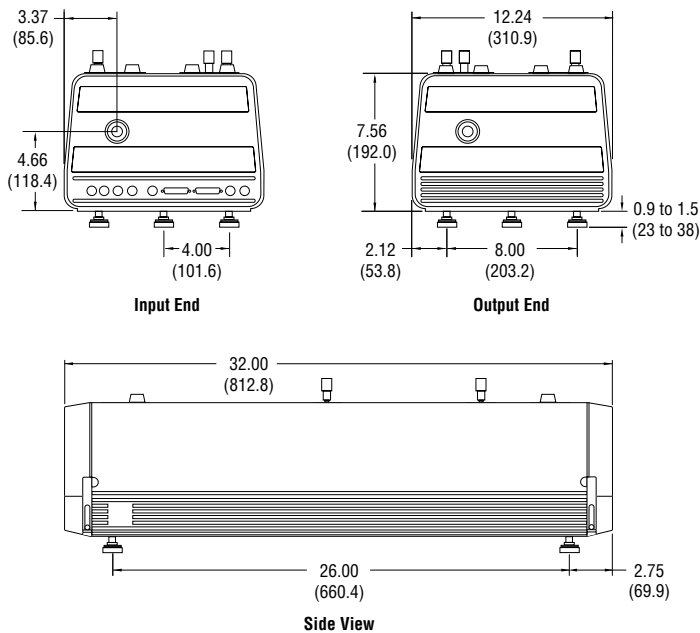
1. Laser operation is specified at a nominal repetition rate of 80 MHz.

2. Specification represents rma noise measured in a 10 Hz to 2 MHz bandwidth.

3. Percent power drift in any two-hour period with $\pm 1^\circ\text{C}$ temperature change after a one-hour warm up.

4. Tsunami is a Class IV – High-Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

Tsunami Dimensions



Dimensions in inch (mm)



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