

# Element™ 2

## Ultrashort Pulsed Femtosecond Oscillators



Element 2 is the newest generation of Spectra-Physics' leading ultrafast few-cycle pulsed oscillators, specifically designed for superior stability, lowest noise, and hands-free operation. When paired with the newest version of our optional carrier envelope phase stabilization (CEP4), the result is the most stable and low-noise source of ultrashort, CEP stable pulses, opening the door to the most demanding ultrafast scientific applications.

### Ultrashort Pulses with Highest Stability

With its robust design, the Element 2 oscillator family provides outstanding power stability and superior carrier envelope offset beat note power and frequency stability. With the various Element 2 models Spectra-Physics offers shortest pulses of sub-7 fs with an average power of >500 mW, and sub-10 fs pulses with an average power up to >1000 mW. The Element 2 ultrafast oscillator is pumped with an integrated Spectra-Physics Millennia® eV™ solid state green laser. The resonator is based on Dispersive Mirror (DM) technology for precise intra-cavity dispersion management and optimum stability for mode-locking.

Therefore, Element 2 guarantees highest quality, outstanding peak power, and ultrafast pulses with extraordinary spectro-temporal characteristics even for the most demanding applications.

### The Element 2 Advantage

- Ultrashort pulses with up to MW-level peak power
- Ultra-low amplitude and phase noise
- Superior power stability
- Hands-free operation; sealed cavity for long-term operation
- Active system parameter stabilization
- Integrated diagnostics
- Near transform-limited pulses
- Optional CEP4 stabilization
- Optional repetition rate stabilization (Femtolock™ 2)

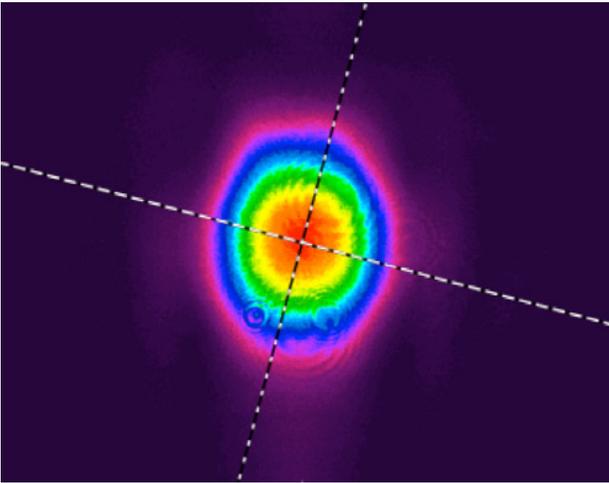
### Applications

- Amplifier seeding
- Time-resolved spectroscopy
- THz generation
- Multiphoton microscopy

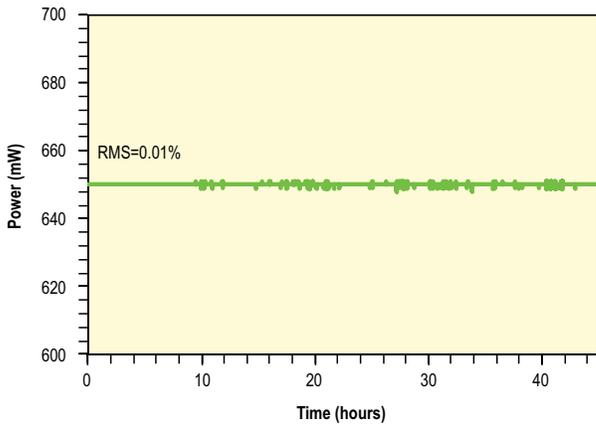


# Element 2

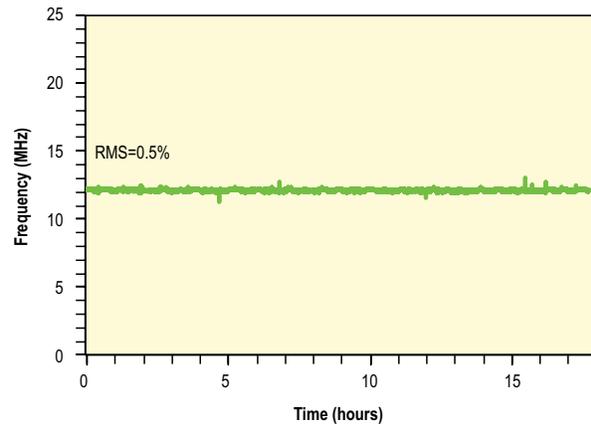
Beam Profile – Element 2 10-600



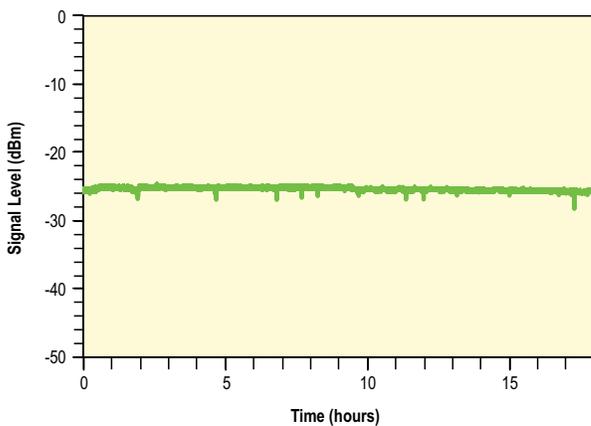
Long-term Power Stability >40 hours – Element 2 10-600<sup>1</sup>



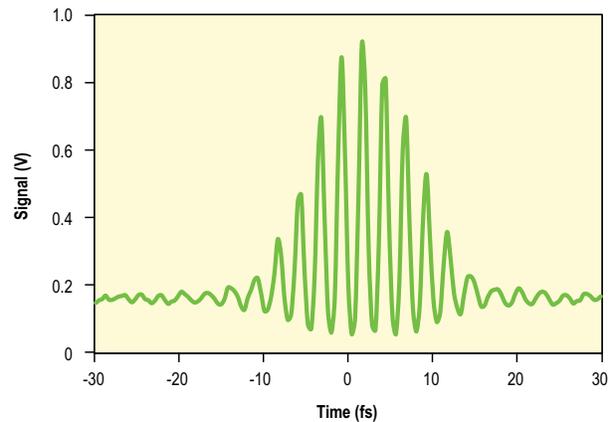
Carrier Envelope Offset Beat Note Frequency Stability >15 hours – Free Running Element 2 10-600<sup>1</sup>



Carrier Envelope Offset Beat Note Power Stability >15 hours – Free Running Element 2 10-600<sup>1</sup>



Autocorrelation – Element 2 10-600<sup>1</sup>



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

# Element 2 Specifications<sup>1,2,6</sup>

	7-500	10-600	10-1000	20-600	20-1200
Pulse Duration	<7 fs	<10 fs		<20 fs	
Bandwidth	>300 nm at -10 dB	>100 nm (FWHM)		>40 nm (FWHM)	
Average Power	>500 mW	>600 mW	>1000 mW	>600 mW	>1200 mW
Pulse Energy	>6.2 nJ	>7 nJ	>11.7 nJ	>7 nJ	>14.1 nJ
Peak Power	>840 kW	>700 kW	>1100 kW	>350 kW	>700 kW
Central Wavelength <sup>3</sup> (standard)	800 ±20 nm	800 nm ±10 nm			
Repetition Rate <sup>3</sup> (standard)	80 ±5 MHz				
Noise (1 Hz–100 kHz)	<0.5% rms				
Power Stability <sup>4</sup> (peak-to-peak)	±0.5%				
Beam Divergence	NA	<2 mrad			
M <sup>2</sup>	NA	<1.3			
Beam Diameter (1/e <sup>2</sup> )	<2 mm				
Polarization	>100:1 (horizontal)				
Femtolock 2	Optional				
CEP4	Optional <sup>5</sup>				

1. Due to our continuous product improvement program, specifications may change without notice.

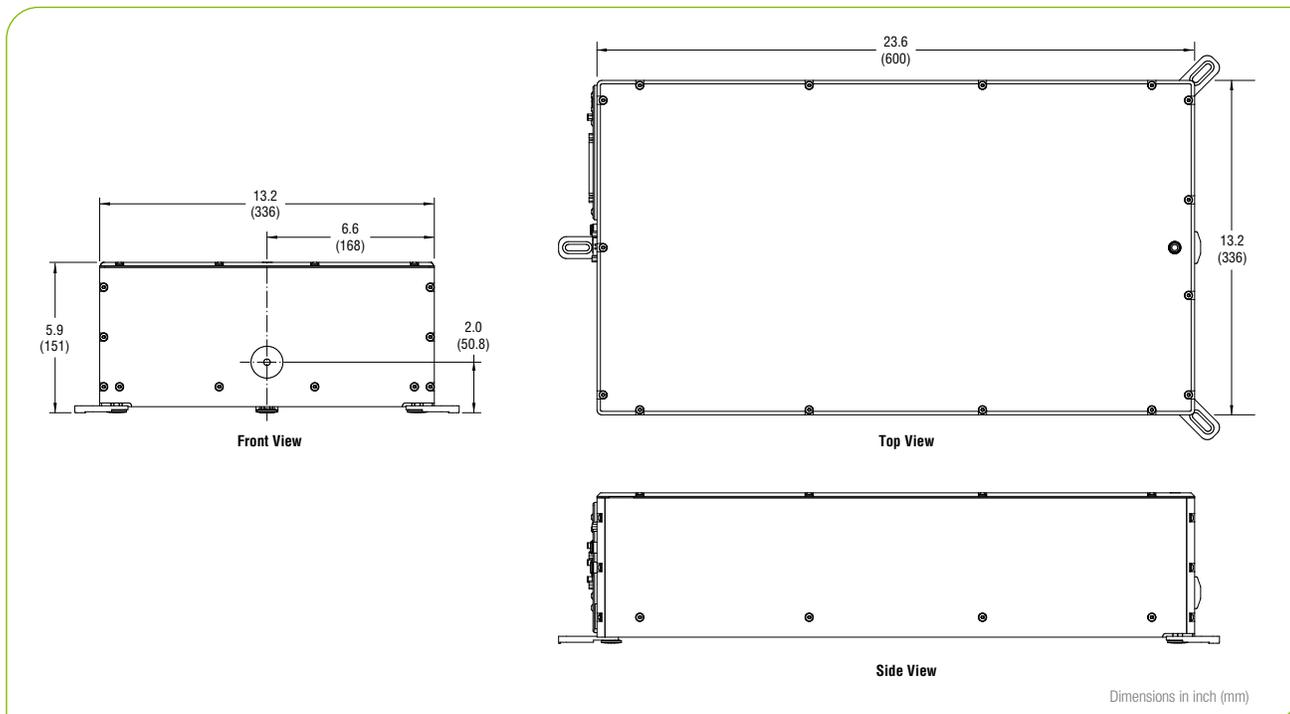
2. Specifications apply to standard wavelength and standard repetition rate.

3. For other values, please contact Spectra-Physics.

4. Measured over 24 hours at constant environmental conditions.

5. Optional for Element 2 7-500, 10-600, and 20-600. For other models, please contact Spectra-Physics.

6. Element 2 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 damage.



Element 2 Dimensions

# Element™ 2 CEP4

Carrier Envelope Phase-Stable Pulses for  
the Most Demanding Scientific Applications  
in Attosecond Science



Element 2 CEP4 is Spectra-Physics' newest milestone for carrier envelope phase stabilization of few-cycle pulses. When paired with our new ultrafast Element 2 oscillator, Element 2 CEP4 enables record-setting carrier envelope phase-stable few cycle pulses, both in terms of lowest phase noise as well as long-term stability.

With lowest CEP noise, longest phase-stable operating time and pulses with a truly constant waveform, Element 2 CEP4 is the answer to the most demanding applications in attosecond science, THz generation, and amplifier seeding.

Element 2 CEP4, Spectra-Physics' unique feed-forward CEP stabilization technology, provides noise cancellation at a higher bandwidth than any other feedback-based technology, leading to the best CEP performance commercially available.

## The Element 2 CEP4 Advantage

- Record-low CEP noise
- CEP4 feed-forward technology
- Constant waveform ultrashort pulses
- Unprecedented long-term stability

### Applications

- Attosecond science
- Amplifier seeding
- Time-resolved spectroscopy

# Element 2 CEP4 Specifications<sup>1, 3</sup>

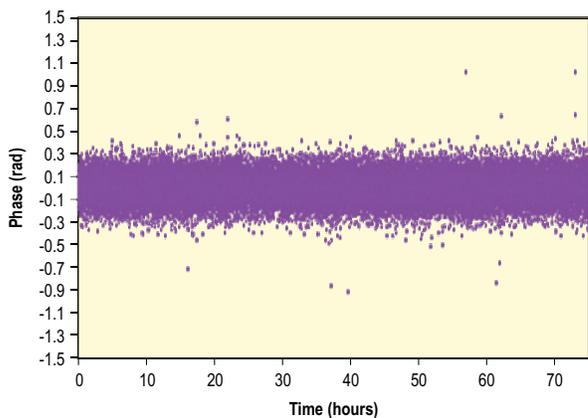
	7-500 CEP4	10-600 CEP4	20-600 CEP4
Pulse Duration	Uncompressed output		
Bandwidth	>300 nm at -10 dB	>100 nm (FWHM)	>40 nm (FWHM)
Average Power	>250 mW	>300 mW	>300 mW
Central Wavelength <sup>2</sup> (standard)	800 nm ±20 nm		
Repetition Rate <sup>2</sup> (standard)	80 MHz		
fCEO	0 Hz		
CEP Stability	<60 mrad rms (0.05 Hz–500 kHz) over 12 hours		
Beat Signal SNR	>35 dB		
Femtolock 2	Optional		

1. Due to our continuous improvement program, specifications are subject to change without notice.

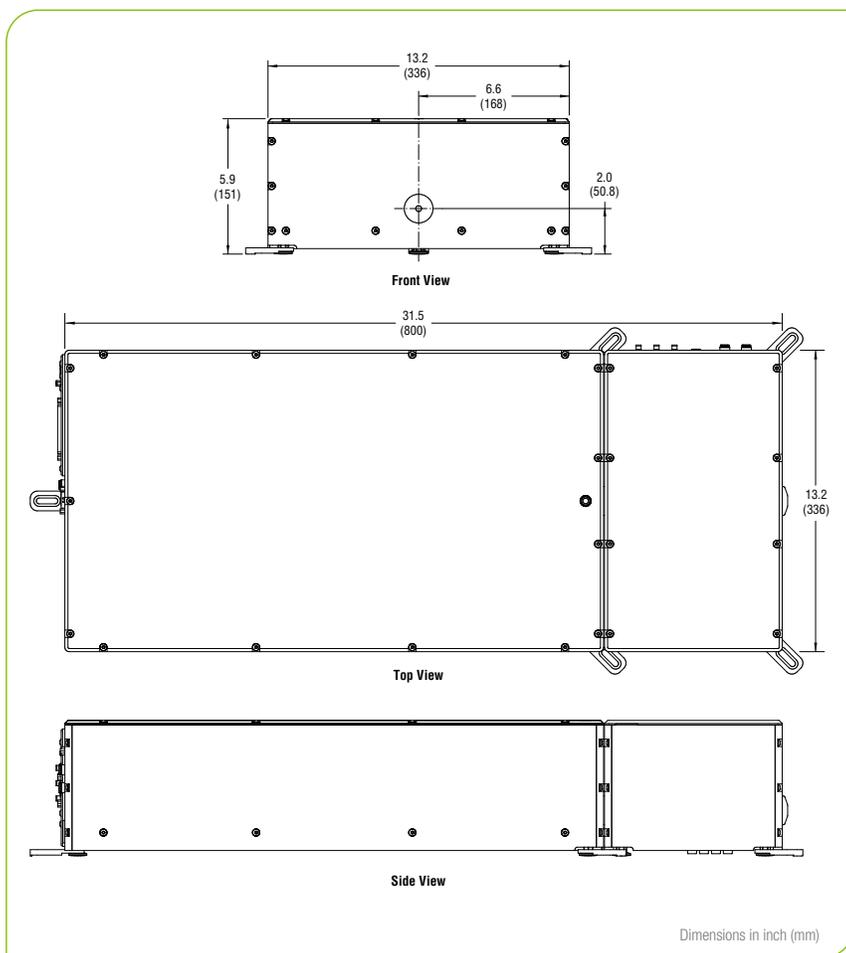
2. For other values, please contact Spectra-Physics.

3. Element 2 CEP4 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 damage.

## CEP Measurement of Amplified Pulses >70 hours<sup>1</sup>



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



Element 2 CEP4 Dimensions