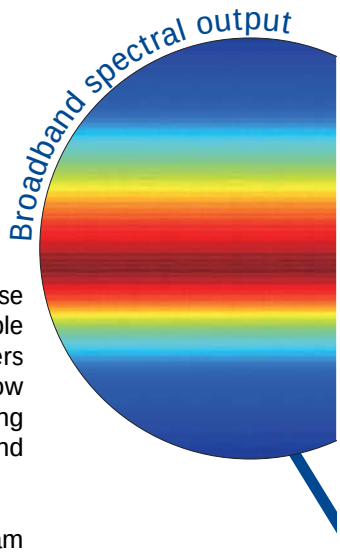
venteon

Ultra-short pulse lasers

- Few-cycle femtosecond pulses
- Stable performance with minimal intervention
- Measured pulses approaching transform limit
- Broadest spectral bandwidth commercially available
- Integrated pump laser



Overview

The **venteon** range of femtosecond lasers uses ultra-short pulse laser technology and offers the shortest commercially available pulses at <5 fs (FTL), bandwidths >400 nm and average powers >560 mW. The compact monolithic design is optimised for low pump thresholds and contains an integrated pump laser. With long operational lifetimes, these instruments are highly reliable and extremely robust.

All **venteon** lasers show an exceptional stability (Fig. 1) and beam shape (Fig. 2).

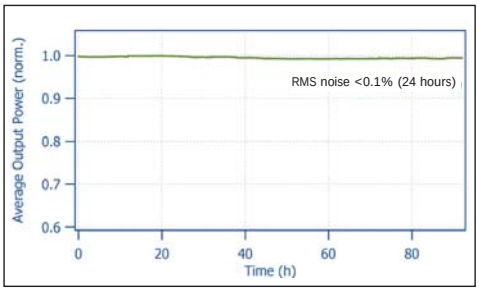


Fig. 1 Exceptional stability of the **venteon ultra** laser system resulting from the optimised thermal and mechanical design.

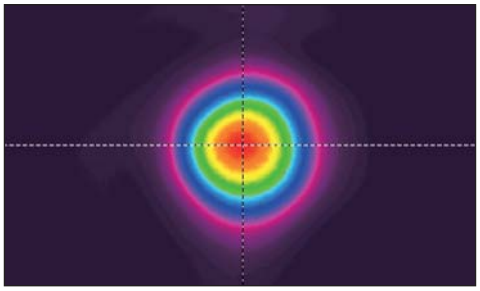
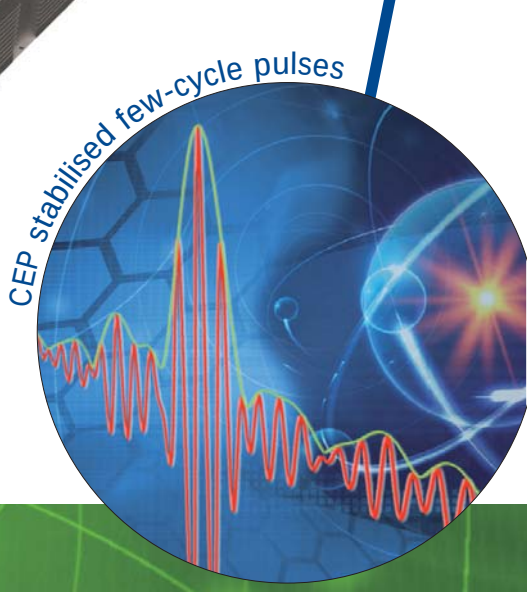


Fig. 2 Typical beam profile of the **venteon ultra** laser system measured with a CCD camera.

The **venteon** cavity exclusively uses DCM mirrors that are created by ion beam sputtering techniques to ensure unsurpassed phase control and pulses that approach the theoretical values available. Laser Quantum supports clarity in reporting pulse duration and we always detail whether our figures are theoretical values based on Fourier transform calculations, or actual measured durations using **SPIDER** technology and instrumentation.



venteon one

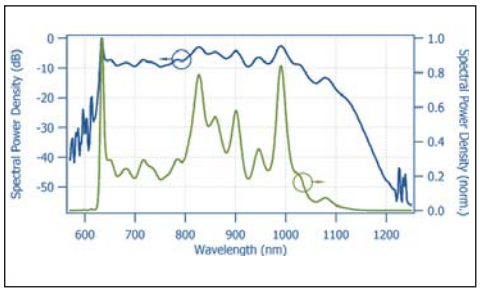
The **venteon one** laser system is a versatile and robust option as an entry level to few cycle ultra-short pulses. Highly compact, with a footprint of 285 x 690 mm, it offers a wide spectral bandwidth of >200 nm leading to measured pulse durations of <8 fs. It is ideally suited to microscopy, spectroscopy and pump probe experiments that require a reliable, simple, turn-key laser solution for ultra-short pulses with a moderate power.

venteon power

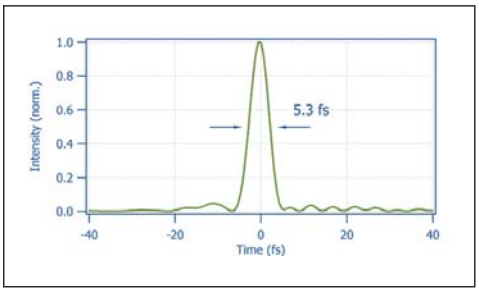
The **venteon power** laser system has been optimised to provide the highest power available from the **venteon** range of ultra-short pulse lasers. The **venteon power** can be supplied with CEP stabilised performance or state-ready for a CEP upgrade. It can also be equipped with a piezo transducer/stepper motor that allows for resonance free repetition rate locking to a suitable radio frequency reference source with locking bandwidths of up to 30 kHz.

venteon ultra

The **venteon ultra** laser system delivers >240 mW of <5.5 fs short pulses with an unrivalled spectral bandwidth ranging from 600 nm to 1200 nm specified with >400 nm @-10 dBc. Due to this octave spanning output spectrum, the **venteon ultra** can be used for direct CEP stabilisation without any additional spectral broadening. The system can be purchased as a fully CEP stabilised laser, or with the necessary components to allow CEP upgrade at a later date.



Typical **venteon ultra** spectrum spanning from >600 nm up to 1200 nm. This spectrum supports the shortest pulses commercially available and is ideally suited e.g. for a direct CEP stabilisation.

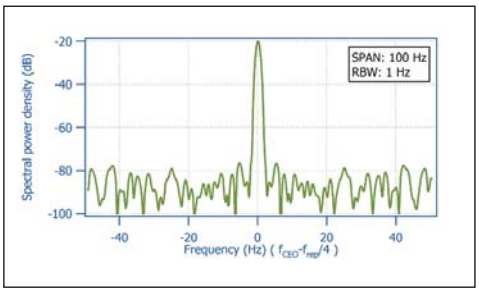


Typical **venteon ultra** pulse of <5.5 fs, measured with a **venteon SPIDER**.

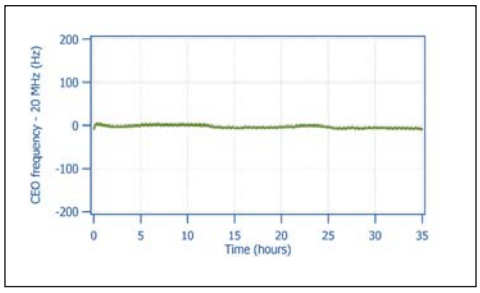
venteon CEP5

The **venteon CEP5** is a fully configured ultra-short pulse carrier envelope phase (CEP) stabilised laser system. Comprising the **venteon ultra** octave spanning laser, the **venteon CEP5** system includes an f-to-2f interferometer for f_{CEO} beat generation, the ultra-low noise **finesse pure CEP** pump laser, featuring CEPLoQ™ technology that enables CEP stabilisation without AOM power modulation, and all the electronic controls necessary.

The spectral bandwidth of this laser system supports pulse durations of <5.5 fs directly from the oscillator. Its octave-spanning output is sufficiently broad for a direct CEP stabilisation of the pulses, realising the f-to-2f beating without any additional spectral broadening by either a PCF or PPLN device. Only 10% of the output power is used by filtering the edges of the output spectrum, leaving >220 mW for subsequent experiments. This is the most natural, direct and reliable approach for achieving a CEP stabilisation without distorting the laser output beam and giving an excellent long-term locking performance.



Zoomed-in stabilised CEP beat note recorded with 1 Hz resolution bandwidth.



Long-term tracking of the stabilised CEP beat; The automated wedge control enables the **venteon CEP5** to operate CEP locked over days.

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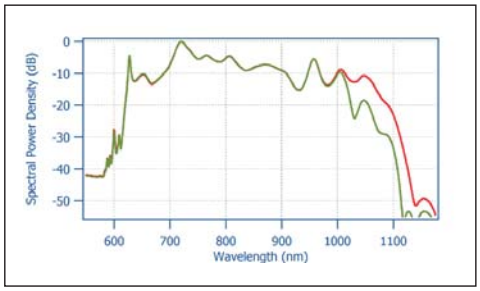
venteon dual

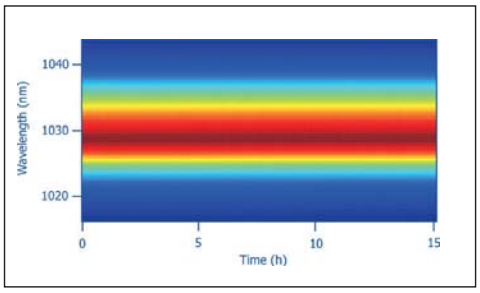
The **venteon dual** represents the ideal front end for broadband few-cycle Optical Parametric Chirped Pulse Amplifier (OPCPA) applications. The spectral bandwidth of this laser allows for the generation of broadband <6 fs pulses as a signal for a subsequent NOPA stage and provides additional sufficient pulse energy (~20 pJ @1030 nm) for seeding a Yb-based amplifier pump stage. The pulses are delivered by two separate output ports and are intrinsically self-synchronised with ultra-low timing jitter.

The first output provides the broadband signal pulses and a duration of <6 fs. The pulses can be optionally CEP stabilised with the typical performance of the **venteon CEP5** laser systems.

The second output at ~1030 nm delivers - without any additional broadening - ~20 pJ in a spectral bandwidth of 10 nm (FWHM) and is ideally suited as a narrowband seed for pump amplifiers. This output can be optionally ordered pre-amplified, delivering pulses with an energy >1 nJ.



Typical **venteon dual** usable output spectrum (green) and spectrum without filtering for the 1030 nm seed radiation (red).



Spectral stability of the 1030 nm seed output shown for 15 hours. The measurement was performed using a single mode fibre.

Options and upgrades

Pulse train monitoring
An integrated high bandwidth (>10 GHz) photodiode can be used for repetition rate monitoring and to supply a signal to a **TL-1000** unit or external electronics.

Repetition rate control
Control of the repetition rate and active feedback is enabled by cavity mirrors mounted on piezoelectric actautors enabling rapid feedback and long-term drift control simultaneously. In combination with the **TL-1000** repetition rate stabilisation unit, timing jitter <100 fs can be achieved. Alternatively, the piezos can be driven by customer supplied electronics.

Active locking of repetition rate and pulse timing
The **TL-1000** is an optional supporting unit that enables tight phase-locking of the repetition rate to an external reference with a residual timing jitter <100 fs.

CEPLoQ™ technology for the venteon CEP5
CEPLoQ™ technology directly modulates the pump power to maintain phase stabilisation without the use of an AOM. This leads to faster and more stable responses.

The **venteon** family is compatible with the Laser Quantum RemoteCom software that allows connection to the Laser Quantum support team for monitoring laser performance, diagnosing opportunities and carrying out laser optimisation.

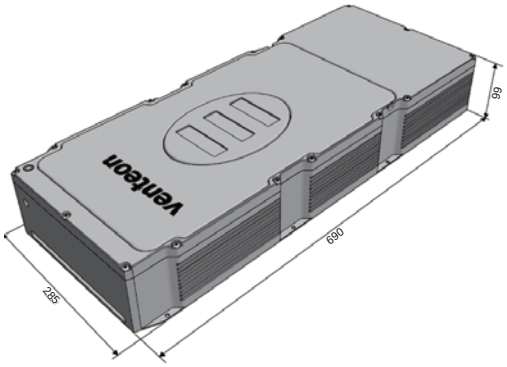
Pump power modulation
Modulation access to the pump power with a bandwidth of >100 kHz and modulation depth up to ±1% is provided for feedback purposes.

Upgrades

	venteon one	venteon power	venteon ultra	venteon CEP5	venteon dual
Photodiode option	✓	✓	✓	✓	✓
Repetition rate stabilisation option	✓	✓	✓	✓	✓
CEP stabilisation		✓	✓		✓
CEP-zero stabilisation			✓	✓	✓

venteon

Dimensions (mm)



Other information

- Weight: 33 kg
- Water cooling included
- 2 years full specification warranty

Drawings are for illustrative purposes only. Please contact Laser Quantum for complete engineer's drawings.

Specifications*

	venteon one	venteon power	venteon ultra	venteon CEP5	venteon dual
Average power output	>240 mW	>560 mW	>240 mW	>220 mW	>200 mW
Pulse energy (@80MHz)	>3 nJ	>7 nJ	>3 nJ	>2.75 nJ	>2.5 nJ
Central wavelength[1]	780 nm +/- 30 nm	780 nm +/- 30 nm	830 nm +/- 30 nm	830 nm +/- 30 nm	830 nm +/- 30 nm
Spectral bandwidth (@-10dBc)	>200 nm	>200 nm	>400 nm	>380 nm	>300 nm
Pulse duration (Measured)[2]	<8 fs	<8 fs	<5.5 fs	<6 fs	<6 fs
Pulse duration (FTL)	<7.5 fs	<7.5 fs	<5 fs	<5.5 fs	<5.5 fs
RMS noise[3]	<0.2 % non-pure pump	<0.1 %	<0.1 %	<0.1 %	<0.1 %
Integrated pump	**opus** 4W	**finesse pure** 6W	**finesse pure** 6W	**finesse pure** 6W	**finesse pure** 6W
Divergence	<2 mrad	<2 mrad	<2 mrad	<1 mrad	<1 mrad
CEP phase noise[4]				<100 mrad	
M-squared	<1.2				
Power stability (RMS within 24hrs)	<1 %				
Repetition rate[5]	80-94 MHz				
Polarisation direction	horizontal				
Polarisation ratio	>100:1				
Operating temperature	18-24 °C				
Warm-up time	<20 min				
Weight (head only)	~30 kg				

* Laser Quantum operates a continuous improvement programme which can result in specifications being improved without notice.
[1] Measured as the spectral centroid.
[2] Achieved using optional extra cavity dispersion compensation.
[3] Noise bandwidth 1 Hz to 1 MHz.
[4] Noise bandwidth 3 Hz to 1 MHz derived from RF side-band analysis.
[5] Repetition rate accuracy +/-100 kHz. Other repetition rates available upon request.

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