venteon *dual*

Dual output OPCPA seed laser

Laser Quantum
A Novanta Company

- 800 nm and 1030 nm outputs
- Ideal for OPCPA amplification or seeding
- Upgrade options for future application development
- Integrated pump laser

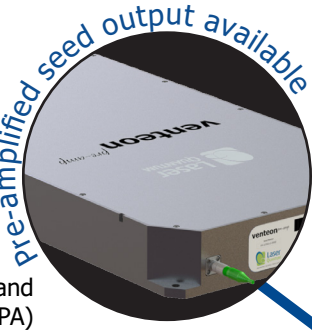
Overview

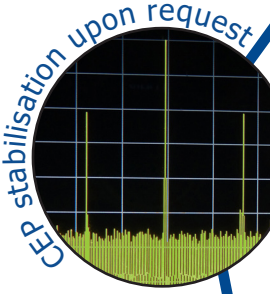
The **venteon dual** represents the ideal front end for broadband few-cycle Optical Parametric Chirped Pulse Amplifier (OPCPA) applications. The spectral bandwidth of this laser allows for the generation of broadband (<6 fs) pulses as a signal for a subsequent NOPA stage and provides additional sufficient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

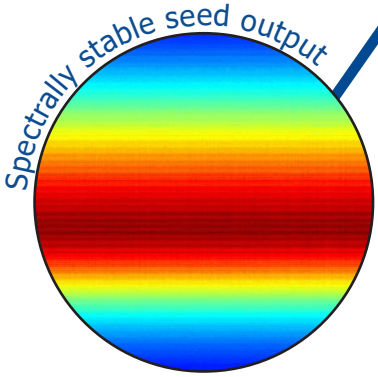
The first output provides the broadband signal pulses and a duration <6 fs . The pulses can be optionally CEP stabilised with the typical performance of the **venteon CEP5** laser systems.

The second output at 1030 nm delivers - without any additional broadening - 625 pJ in a spectral bandwidth of approx. 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.

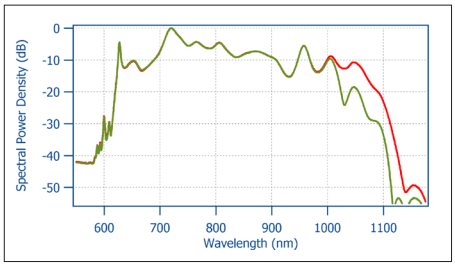
Laser Quantum supports clarity in reporting pulse duration and detailing whether our figures are theoretical values based on Fourier transform calculations or actual measured durations using **SPIDER** technology and instrumentation. In the case of the **venteon dual**, the Fourier transform specification is <5.5 fs , with a measured pulse of <6 fs . The small difference between these two values demonstrates the excellent phase control of the laser.



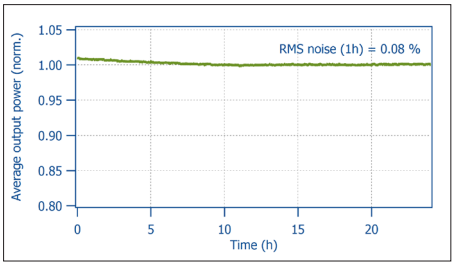




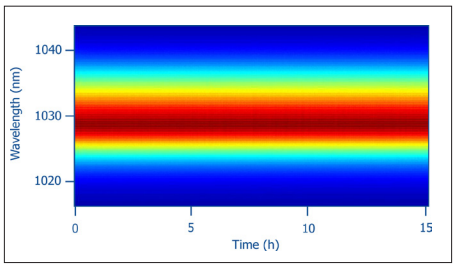
Typical venteon dual data



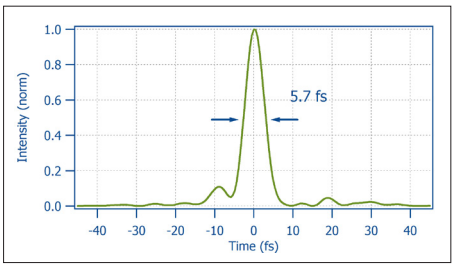
Typical **venteon dual** usable output spectrum (green) and spectrum without filtering for the 1030 nm seed radiation (red).



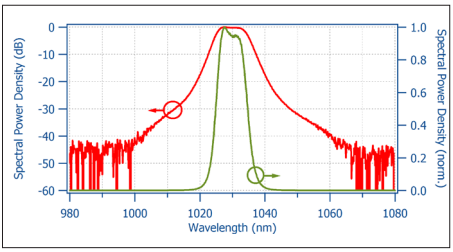
Long-term track of the broadband output of the **venteon dual** laser system shown for 24 hours.



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



Typical **SPIDER**-measured few-cycle pulse emitted by a **venteon dual** laser system.



1030 nm seed spectrum as provided by a **venteon dual** laser system with applied bandpass filter centered @1030 nm, shown on logarithmic scale (red) and linear scale (green).

The **venteon dual** laser system features a set of remote control capabilities including starting, adjustment and dispersion control. Together with the provided user-control software, the laser system can be handled, monitored and maintained on a day-to-day basis without manual intervention. Upon installation our service engineers will provide detailed training on the laser system and all associated components. If service is required, the user control software allows our service engineers to connect to the laser system to remotely check and optimise the laser, ensuring speedy and efficient help and support.

Options and upgrades

CEP ready: Incorporates pump and components to allow future CEP stabilisation upgrade.

CEP upgrade: Upgrade to CEP stabilised output, including f-to-2f interferometer. (Requires CEP ready option). Average output power will reduce to 180 mW; specifications for CEP lock similar to CEP5 laser system.

PST option: Preparation for repetition rate stabilisation, including a slow and fast piezo motor unit to add fine control of cavity length and repetition rate.

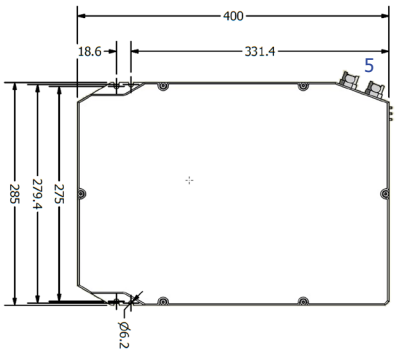
TL-1000 timing stabilisation: Locking electronics, photodiode, RF analyser and oscilloscope needed for full timing stabilisation of the laser system (requires PST option).

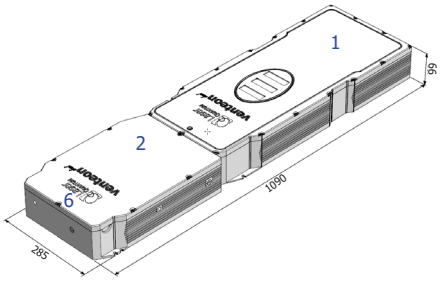
dual pre-amp 1: Energy scaling amplification from 30 pJ to 1 nJ.

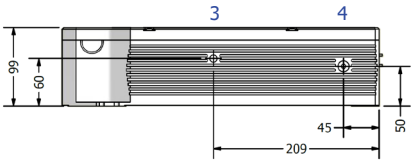
dual pre-amp 2: Energy scaling amplification from 30 pJ to > 0.5 nJ with variable repetition rate.

Dimensions (mm)

1 **venteon** oscillator
2 **venteon** module
3 Broadband output
4 Fiber-coupled 1030 nm output
5 Electrical and water connections
6 Alternative front-side outputs (choose upon order)







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

Other information

- Weight (head + f-to-2f module only): 47 kg
- Cooling system included
- 2 years/5000 hours (PSU 'on' time) full specification warranty

Specifications*

	venteon dual
Average power output	>200 mW
Pulse energy	>2.5 nJ
Central wavelength[1]	830 nm ± 30 nm
Spectral bandwidth (@-10 dBc)	>300 nm
Pulse duration[2] (Measured)	<6 fs
Pulse duration (FTL)	<5.5 fs
RMS noise[3]	<0.1 %
Beam diameter[4]	1.2 mm ± 0.3 mm
Divergence	<3 mrad
M-squared	<1.2
Power stability (RMS within 24 hrs)	<1 %
Repetition rate[5]	80 MHz
1030 nm output average power[6]	>0.5 mW
1030 nm output pulse energy[6]	>6.25 pJ
1030 nm output pulse duration (FTL)	<250 fs
1030 nm output RMS noise[3]	<0.5 %
Polarisation direction	horizontal
Polarisation ratio	>100:1
Operating temperature	21 °C +/- 3 °C
Warm-up time	<20 min
Weight (head only)	33 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] FWHM beam diameter at laser exit.
[5] Repetition rate accuracy +/-100 kHz. Other repetition rates available upon request.
[6] Measured after single mode fiber coupling.

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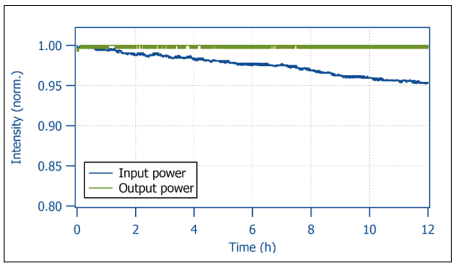
Pre-amps

The **venteon pre-amp** modules have been developed for the amplification of low energy pulses (~10 pJ) to significantly higher power levels. Designed for amplifying the narrowband 1030 nm output of the **venteon dual** laser system, the alignment-free preamplifier modules can also be used as an independent amplification module for other laser systems.

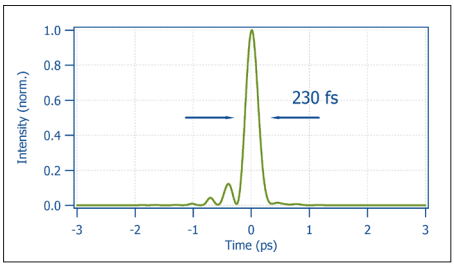
The different versions of the **venteon pre-amp** modules allow for a simple scaling of the pulse energy (**pre-amp 1**) and a reduction of the fundamental repetition rate of the seed oscillator using a fibre-coupled pulse-picker directly implemented within the amplifier module (**pre-amp 2**).

The control electronics contain several interlock functions as well as output power stabilisation technology to ensure reliable long term operation. Therefore the **venteon pre-amp** modules are best suited for seeding high power stages such as ROD-Type fibre amplifiers, regenerative amplifiers or slab amplifiers.

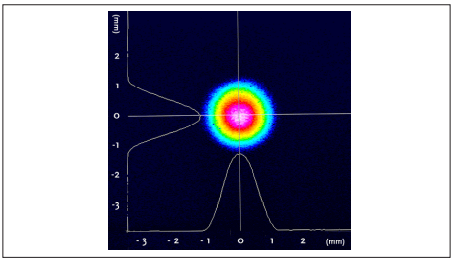
Typical performance



Typical output power of a preamplifier module measured over 12 hours. The output power is stabilised and therefore independent of seed power fluctuations in a range up to 20%.



Example of an externally compressed pulse of **pre-amp 1** using a grating compressor (Treacy configuration) measured with a **venteon SPIDER**. The pulse duration is as short as 230 fs.



Measured output beam profile of a **venteon pre-amp 1**.

Specifications

	venteon pre-amp1	venteon pre-amp2
Center wavelength[1]	1030 nm	1030 nm
Spectral bandwidth (FWHM)	>8 nm	>8 nm
Average output power	depending on repetition rate	depending on repetition rate
Repetition rate	determined by seed oscillator	0.3 - 80 MHz (variable)
Pulse energy	1 nJ	>0.5 nJ
Pulse duration (Measured)[2]	>10 ps	>10 ps

Input parameters: Pulse duration >150 fs, Spectral bandwidth (FWHM) >10 nm, Repetition rate >50 MHz

[1] Other wavelength up to 1064 nm available upon request

[2] Output is streched

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