

# gigajet oscillators

## Femtosecond oscillators



- Repetition rates up to 1GHz
- Up to 2W average power
- High speed ASOPS



## Overview

The **gigajet** series femtosecond oscillators offer unique high repetition rates of up to 1GHz and deliver up to 1.8W of average power in pulses that can be as short as 15fs. They offer a remarkable compactness and the robust design allows them to serve as reliable tools in scientific and industrial applications. Additionally, any two oscillators can be combined on a single temperature-stabilised monolithic platform to form a **gigajet TWIN**.

The repetition rate of a single oscillator is long-term stable to within 500Hz and residual repetition rate fluctuations of the free-running oscillators are highly synchronous. Therefore, active stabilisation at equal repetition rates or at a fixed detuning is straightforward and easy. This allows for an extraordinary compact realisation of spectroscopy techniques that use two femtosecond lasers.

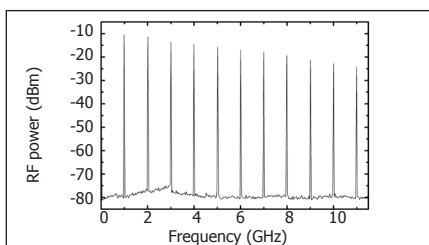


Fig.1 RF spectrum of the signal from the high bandwidth repetition rate measurement photodiode in the **taccor** (PD option). The noise floor is given by the spectrum analyser.

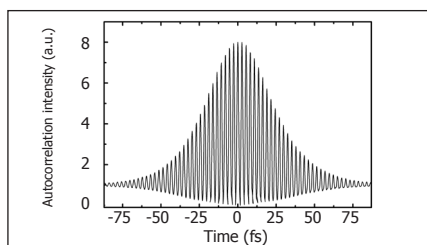


Fig.2 Autocorrelation trace of a **gigajet one** indicating emission of pulses with 30fs duration.

## Applications

### Precision metrology and spectroscopy

At 1GHz repetition rate, the **gigajet** oscillators offer a ten times larger mode spacing and power per mode than conventional systems and thus support higher signal to noise ratios. Our products have supported a true revolution in precision optical metrology and serve as the clockwork in novel optical atomic clocks.

### Nonlinear microscopy

The ability to reduce pulse energy and maintain the same level of non-linear signal is key to reduced dye bleaching and cell damage needed for nonlinear microscopy. This allows for increased imaging times for living samples, e.g. neurons with no loss in resolution or image quality.

### High-speed asynchronous optical sampling (ASOPS)

Pioneered by Laser Quantum GmbH, high speed ASOPS is a superior ultrafast time-domain and THz spectroscopy technology that relies on a frequency offset rather than a slow mechanical delay line. The **gigajet TWIN** enables high-speed ASOPS with <60fs time resolution in combination with our TL-1000-ASOPS offset stabilisation unit.

### Fourier-transform infrared spectroscopy (FTIR)

Similar to high-speed ASOPS, dual comb FTIR is a Fourier-transform spectroscopy method, the **gigajets** eliminate the need for a mechanical delay line, permitting faster and more precise data acquisition.

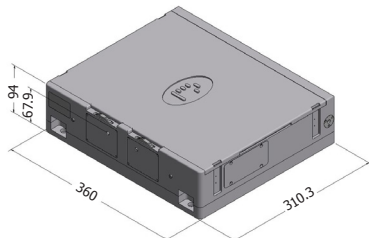
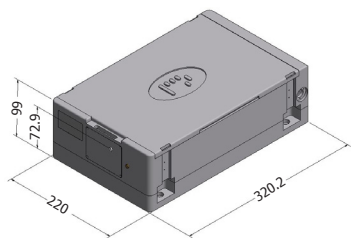
### Two-colour ultrafast time-domain spectroscopy

Employing two **gigajet** oscillators in combination with the TL-1000 repetition rate stabilisation unit, the **gigajet TWIN** supports two-colour pump-probe spectroscopy.

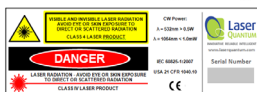
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## Dimensions (mm)



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



## Optional features

### Cavity length control

Control of the repetition rate and active feedback is enabled by cavity mirrors mounted on a fast and/or slow piezo crystal. The piezos can be driven by our **TL-1000** unit or customer supplied electronics.

### Repetition rate stabilisation

The repetition rate stabilisation units **TL-1000** and **TL-1000-ASOPS** permit stabilisation to an external signal with timing jitter below 100fs or offset stabilisation to a second oscillator from the gigajet series to enable high-speed ASOPS with <60fs time resolution.

### High power extension

The **gigajet** series oscillators can be configured to operate with 10W of pump power, capable of delivering up to 2W of output power.

## Specifications\*

Any two of the below **gigajet** series oscillators can be combined at equal repetition rate to form a **gigajet TWIN**.

|                             | gigajet  | gigajet tune   | gigajet ultra  |
|-----------------------------|--|--|--|
| Average power output        | 800mW to 1.8W  | 700mW to 1.4W  | 750mW to 1.5W  |
| Central wavelength          | nominal 800nm (+/- 20nm)   | 750 to 850nm (tunable) <sup>1</sup>                                | nominal 800nm (+/- 20nm)   |
| Spectral output (FWHM)      | >23nm  | ~20nm  | > 46nm   |
| Pulse duration <sup>2</sup> | ≤30fs  | ≤50fs  | ≤15fs  |
| Repetition rate             | 500MHz or 1000MHz <sup>3</sup>                                     | 1000MHz  | 1000MHz  |
| Pulse energy                | 0.8nJ to 3.6nJ   | 0.7nJ to 1.4nJ   | 0.75nJ to 1.5nJ  |
| Beam diameter (FWHM)        | 0.8mm +/- 0.3m   |  |  |
| Spatial mode                | near TEM <sub>00</sub>   |  |  |
| Beam divergence             | 2.0mrad +/- 0.5mrad  |  |  |
| M-squared                   | M <sup>2</sup> ≤1.2 (sag plane)<br>M <sup>2</sup> ≤1.2 (tan plane) | M <sup>2</sup> ≤1.2 (sag plane)<br>M <sup>2</sup> ≤1.6 (tan plane) | M <sup>2</sup> ≤1.2 (sag plane)<br>M <sup>2</sup> ≤1.2 (tan plane) |
| Polarisation                | >100:1   |  |  |
| Polarisation direction      | Horizontal   |  |  |
| Operating temperature       | 21°C +/- 5°C   |  |  |
| Dimensions                  | 320mm x 200mm x 106mm  |  |  |
| Pump laser req.             | 5W, 532nm in TEM <sub>00</sub> beam, vertical pol.                 |  |  |
| Cooling water req.          | flow 0.5 - 1.5 l/min.<br>temp. ~20°C, stable to +/- 0.5°C          |  |  |

<sup>1</sup> Tuning accomplished manually, suitable spectrometer for monitoring must be provided by customer.

<sup>2</sup> After appropriate extracavity dispersion compensation (not included).

<sup>3</sup> Select when ordering.

\* Laser Quantum operates a continuous improvement programme which can result in specifications being improved without notice. The **gigajet** oscillators are supplied without a pump laser. We recommend the **finesse** or **finesse pure** lasers, due to their long lifetimes, low noise and industry leading warranty.

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