

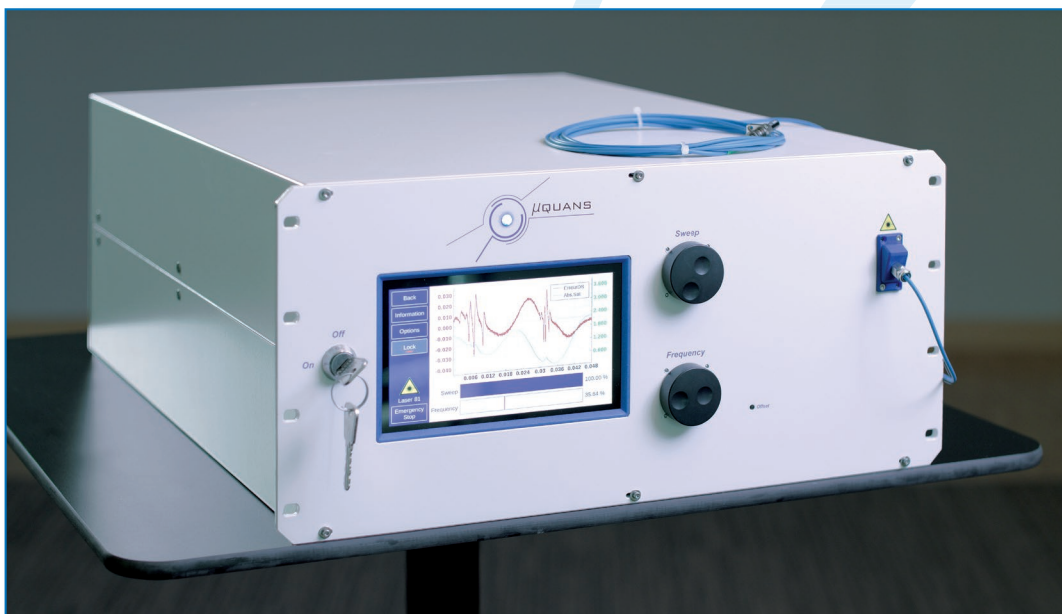


μQUANS

PRECISION QUANTUM SENSORS

High-power frequency-stabilized laser system

Flexible and reliable laser systems dedicated to atom/ion manipulation, quantum information sciences, and spectroscopy



This unique laser technology has been qualified to support ultra-stable high-precision quantum measurements. Muquans routinely uses these laser systems to operate its cold-atom based gravimeter and atomic clock.

Main scientific features

- Unique spectral features: linewidth of 40 kHz, long-term frequency stability of 100 kHz
- Robust and long-term frequency stabilization on an atomic transition (plus auto-lock auto-relock features)
- High output power (more than 1 W)
- Excellent power and polarization stability
- PM Fibered output presenting remarkable beam quality

Main operational features

- Long lifespan optical components (industry standard qualification)
- All-fibered components: no alignment nor optics cleaning required
- Superior robustness with respect to environmental conditions
- Access to several physical parameters for monitoring purposes
- User-friendly interface and simple operation

Specifications

► Optical specifications

Central wavelength	780 nm (other wavelengths like 767 nm available in option)
Maximum output power	> 1 W
Power stability	1% rms over 2 h
Linewidth at 780 nm	300 kHz FWHM typ. (DFB seed laser) 40 kHz FWHM typ. (ECDL seed laser)
Tunability range (unlocked)	1 nm typ. (DFB seed laser) 8 GHz typ. (ECDL seed laser)
Frequency stability (locked)	< 100 kHz rms over one week
Polarization	Linear, Polarization Extinction Ratio: 20 dB (higher PER available in option)
Beam quality	TEM ₀₀ , M ² < 1.1

► General specifications

Physics package dimensions	483 mm x 222 mm x 500 mm (rack 5 U)
Supply voltage	100-240 VAC, 50-60 Hz
Operating conditions	[15°C; 35°C] (controlled environment)
PM fiber output	Panda type, L = 4 m
Air-cooling	

Options

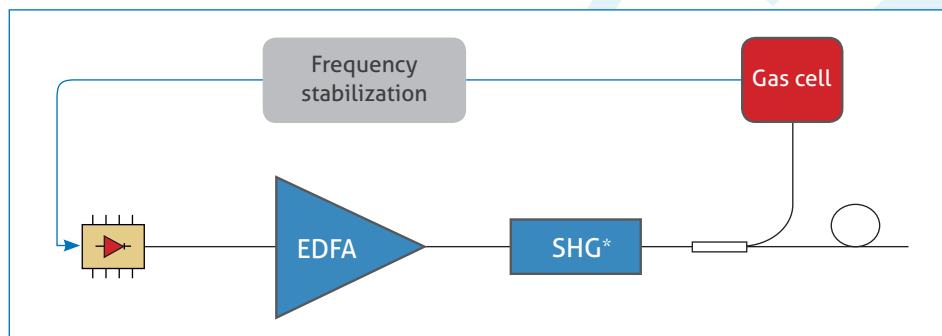
- Laser system also available without the frequency-stabilization module
- Deported optical head for increased polarization and power stabilization
- Various number of fibered outputs available

These turnkey laser solutions have been validated on our cold-atom gravimeter and atomic clock. We were able to achieve molasses with temperatures down to 1.6 μ K, atomic SNR > 1000, and excellent long term stability.

High reliability, fibered laser technology

The laser systems developed by Muquans are based on C-band optical telecom seed lasers, which are then frequency-doubled to generate the required wavelength. Thanks to the technological efforts conducted by the telecom industry, this approach gives access to high performance fibered optical components, which present unique features such as:

- fibered components: no optical alignment nor optics cleaning required
- extreme optical and electrical performances
- compliance with Telcordia qualification procedures (extended temperature range)
- extremely long lifetime and remarkable reliability.



*Second Harmonic Generation

► The seed module

The current version of our laser system can include a DFB laser diode or an ECDL as a seed laser. We developed dedicated ultra low-noise electronics to achieve ultimate spectral features.

► The amplification module

A specific EDFA was developed for these laser systems. Strong R&D efforts were conducted to optimize several key parameters such as Amplified Spontaneous Emission, wall-plug efficiency, polarization characteristics, and power stability.

► The frequency doubling module

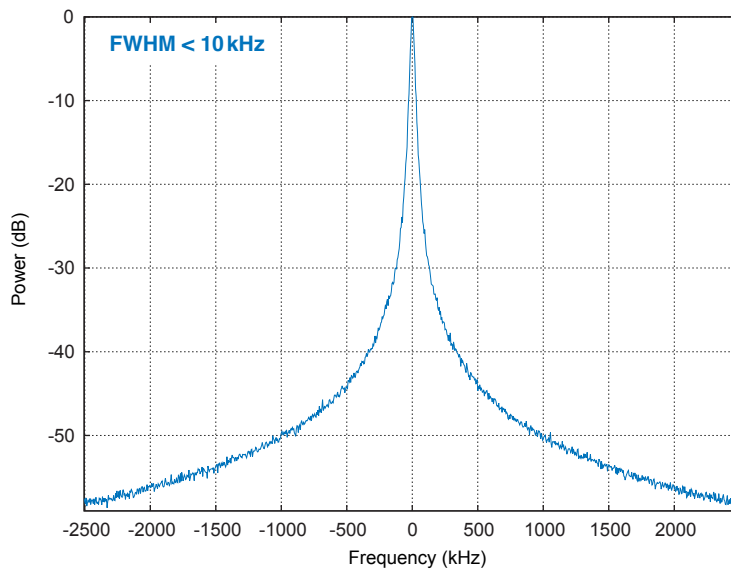
Second harmonic generation is obtained with a PPLN waveguide crystal qualified for high power operation. This component also offers a very high conversion efficiency which loosens constraints on power requirements and management of thermal effects.

► The frequency-stabilization module

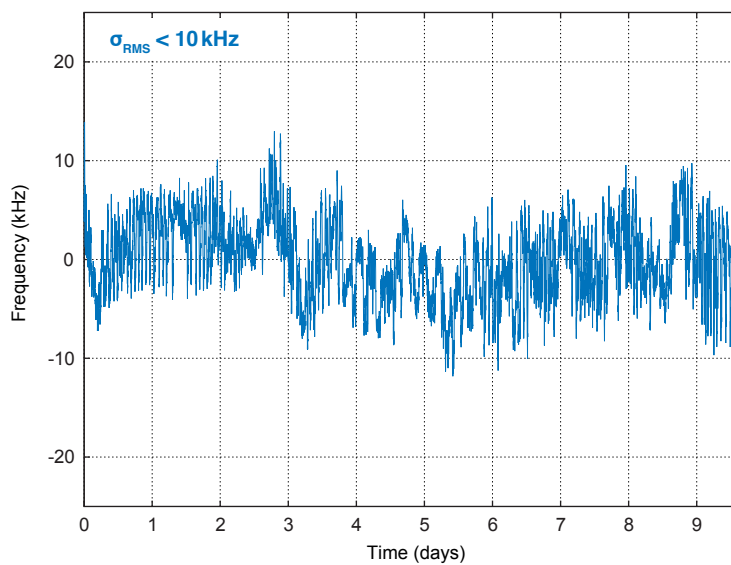
The frequency of the laser is stabilized on an atomic transition thanks to an optimized saturated absorption spectroscopy technique. Our design is based on a heated and magnetically shielded gas cell, and includes specific ultra low-noise frequency-lock electronics. This allows to keep the laser frequency locked on the atomic transition over several months. In addition, the locking of the laser frequency is automated and does not require any optimization from the user.

Optical characteristics

Typical spectral linewidth of our frequency-stabilized ECDL seed laser at 1560 nm

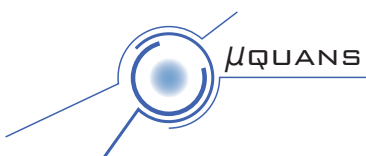


Long-term frequency stability of our laser system



Other related products offered by Muquans

- Ultra-stable high-power 780 nm or 1560 nm fibered beam splitters/combiners
- High-performance and agile micro-wave synthesizers
- Ultra low-noise electronics modules
- Highly stable mechanical shutters



Contact

Should you have any inquiry regarding our products or our technologies, please feel free to contact us.

sales@muquans.com

www.muquans.com