

A microscopic image of a neuron, showing its cell body and branching processes. Several bright, colorful laser beams (red, orange, and green) are directed at the neuron, illustrating the application of femtosecond lasers in life sciences research.

Femtosecond Lasers for Life Sciences

The Industrial Revolution in Ultrafast Science

Superior Reliability & Performance

COHERENT

Your Partner in Multiphoton Excitation Microscopy.

Over the past decade, the capability and variety of non-linear imaging techniques have flourished almost beyond imagination.

Coherent pioneered femtosecond laser technology and developed the Chameleon laser in response to demand from the life sciences community for a hands-free, tunable laser.

The advent of advanced in-vivo microscopy techniques and functional imaging is now inspiring a new generation of femtosecond laser technologies.

While the Chameleon family of Ti:Sapphire lasers continues to be the workhorse of Multiphoton Excitation (MPE) Microscopy, newer ultrafast laser technologies address the most advanced applications of today and tomorrow.



A microscopic image of neurons, with a prominent green neuron in the foreground. Several red laser beams are directed at the neurons, creating bright spots of light. The background is dark, highlighting the intricate structure of the neural network.

Coherent can enable your next achievements in
SHG or SRS
Deep brain imaging
Optogenetics

Chameleon Discovery

Dual Output, Broadly Tunable Laser with Dispersion Precompensation

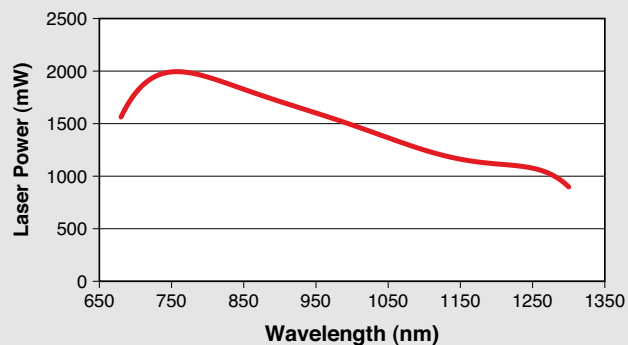


Chameleon Discovery is an ultrafast tunable laser with performance that truly redefines possibilities for non-linear imaging.

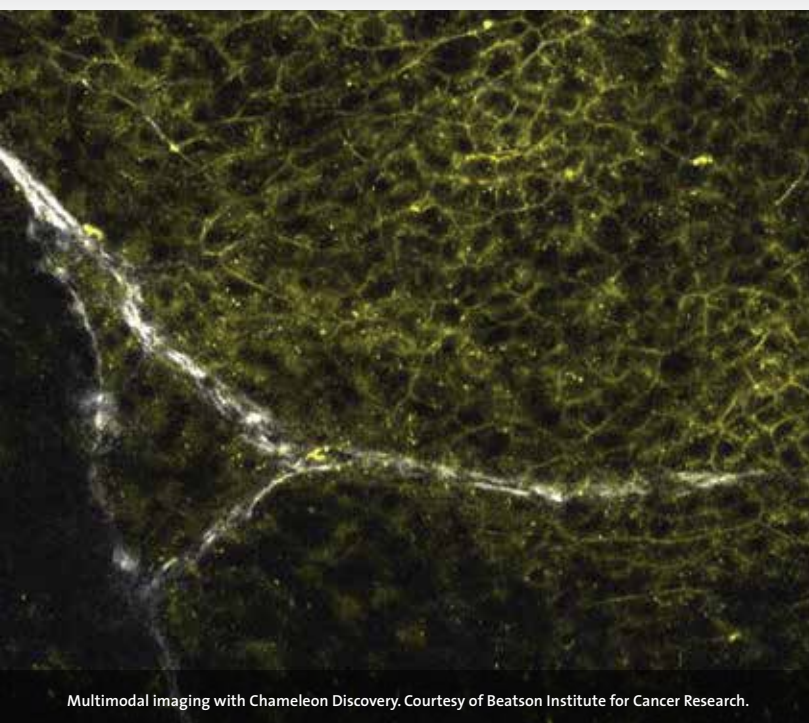
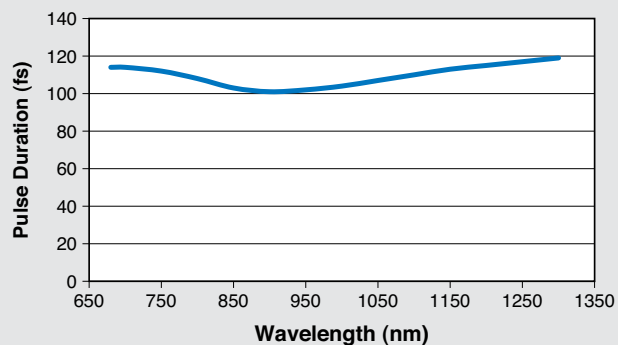
High average power across a wide tuning range and short pulses delivered right to the sample plane enables deep in-vivo excitation of all popular fluorescent probes. High peak power with dispersion precompensation ensures optimized performance for label-free techniques such as SHG and THG. A high power, 1040 nm secondary output further allows simultaneous, multi-wavelength excitation of multiple fluorescent markers or photoactivation of optogenetics probes.

The two outputs of the laser have phase-locked pulse trains, both with low intensity noise characteristics, making Chameleon Discovery an ideal source for CARS and SRS microscopy.

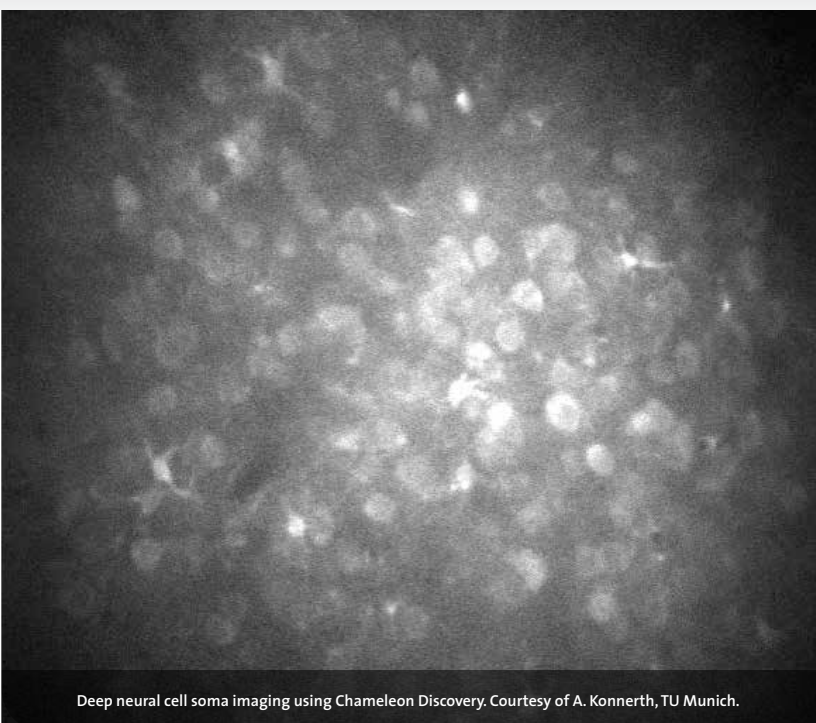
Chameleon Discovery Typical Laser Power



Chameleon Discovery Typical Pulse Duration



Multimodal imaging with Chameleon Discovery. Courtesy of Beatson Institute for Cancer Research.

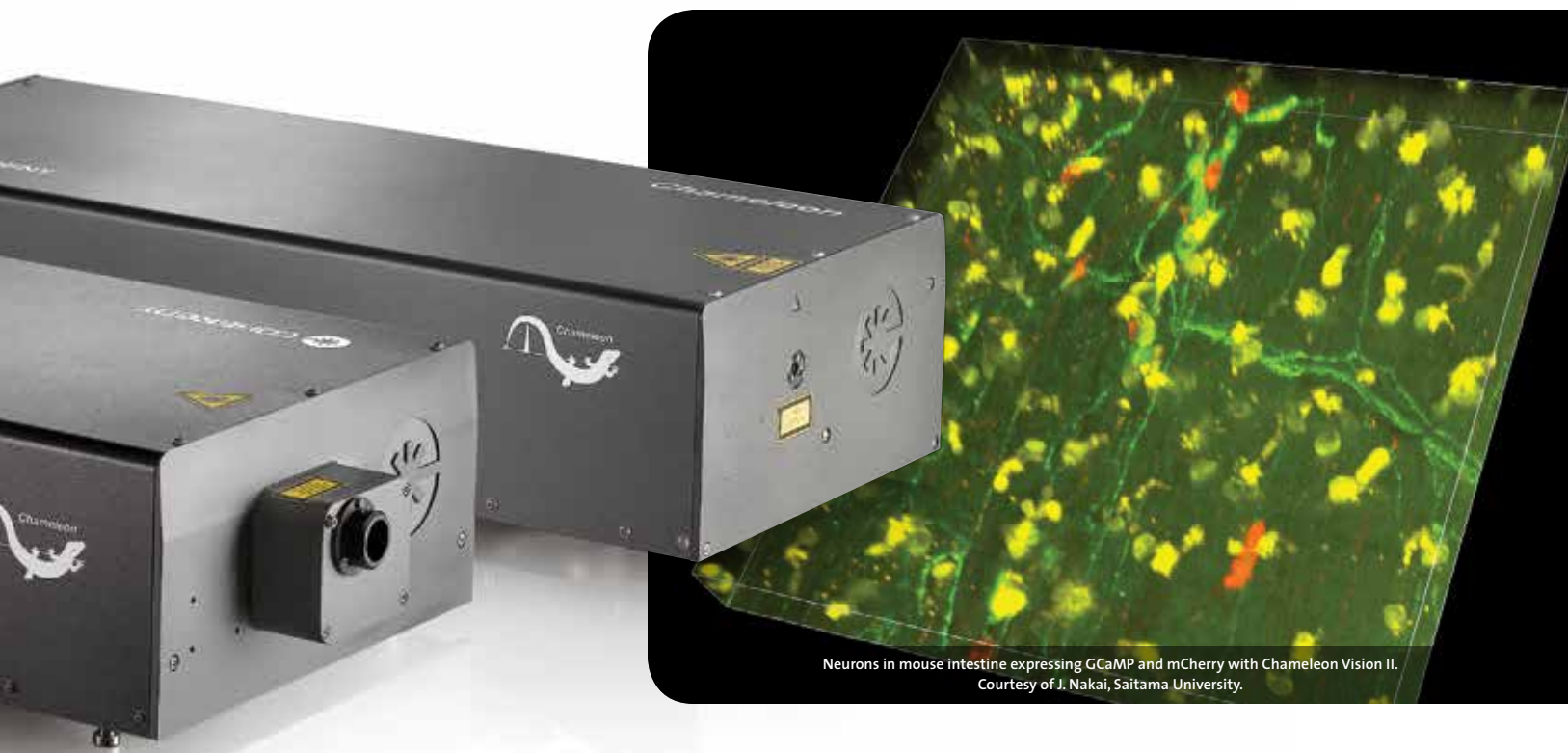


Deep neural cell soma imaging using Chameleon Discovery. Courtesy of A. Konnerth, TU Munich.

Chameleon Discovery	Optical Output A	Optical Output B
Wavelength Range (nm)	680 to 1300	1040 (fixed)
Max Output Power (mW)	>1400 at 800 nm	>1500
Repetition Rate (MHz)	80 ± 0.5	80 ± 0.5
Pulse Duration (fs, sech ²)	100 at 900 nm	140
Beam Mode	M ² < 1.2	M ² < 1.2
Astigmatism (%)	< 10 at 900 nm	< 10
Automated Dispersion Precompensation	Yes	Optional
Average End-End Tuning Speed (nm/s)	> 50	NA

Chameleon Ti:Sapphire Lasers

Tunable, High Power, Hands-free Femtosecond Lasers for Non-linear Imaging



Neurons in mouse intestine expressing GCaMP and mCherry with Chameleon Vision II.
Courtesy of J. Nakai, Saitama University.

With more than 2500 installations worldwide, Chameleon lasers are recognized as the genuine workhorses of the multiphoton imaging community. The highest average power in the market enables deep imaging with the fastest scanning technologies. Additionally, the Chameleon offers the widest tuning range, ensuring efficient excitation of all popular probes. Wavelengths beyond 1080 nm are accessible with the Chameleon MPX, multiphoton wavelength extension.

Chameleon MPX

Multiphoton Microscopy Wavelength Extension

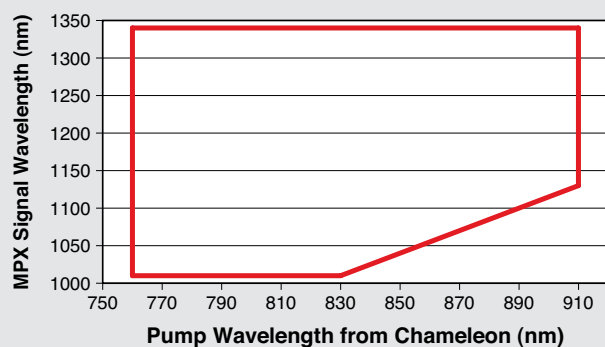


Specifically designed and engineered for non-linear imaging techniques, Chameleon MPX extends the wavelength range of Chameleon Vision and Ultra Ti:Sapphire lasers.

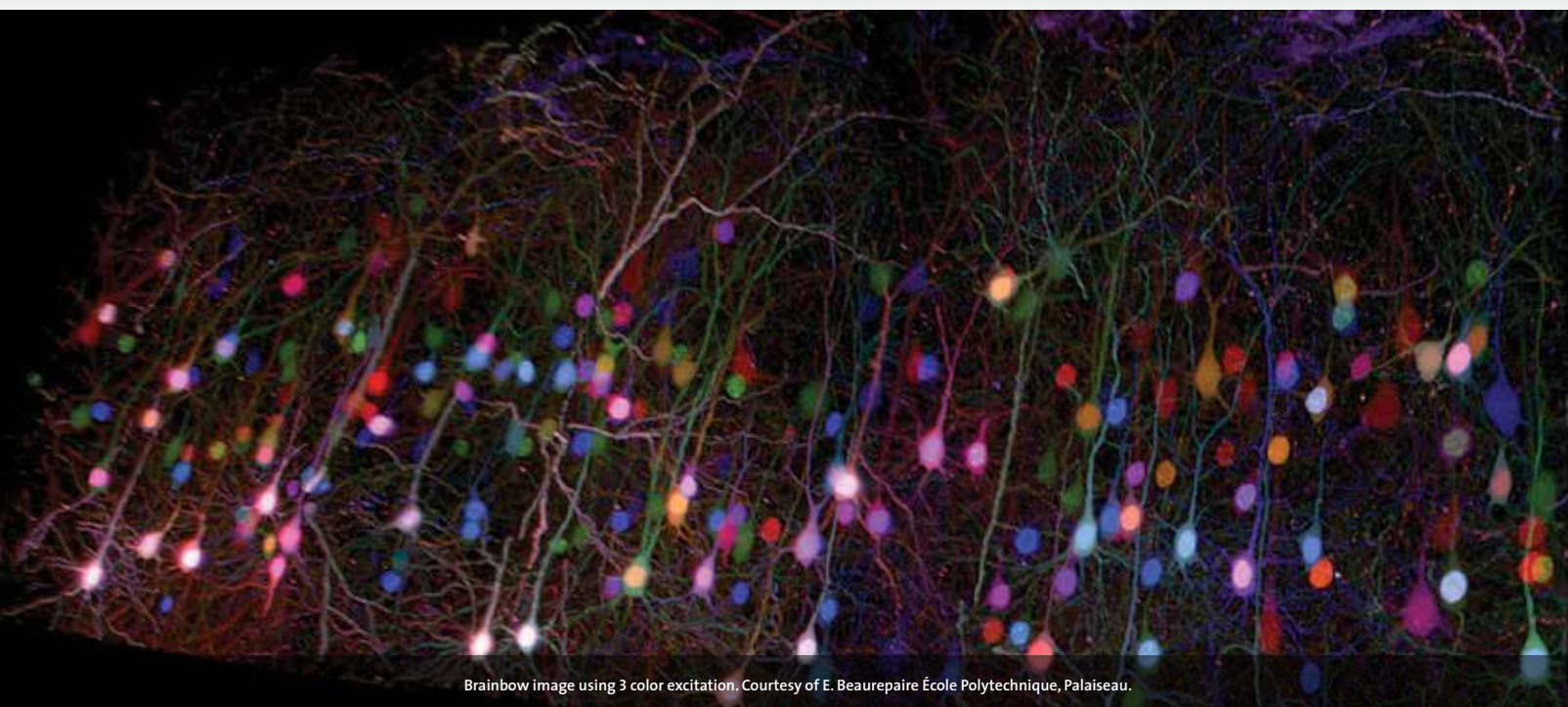
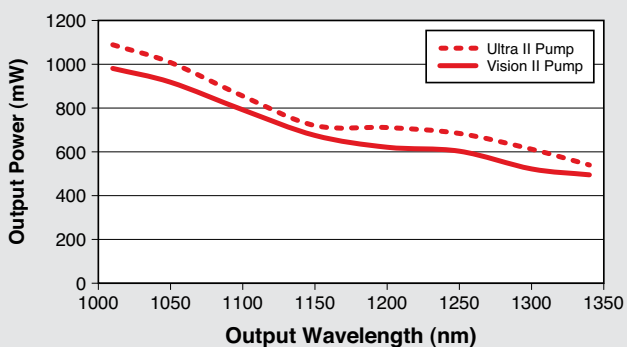
Employing the latest generation of fan-poled OPO technology, the fully automated Chameleon MPX delivers high peak power to the sample plane with short pulses and dispersion compensation optimized for typical commercial microscope systems. Featuring a wide pump tuning range, the Chameleon MPX offers independently tunable dual beam excitation of popular fluorescent probes (e.g. eGFP, mCherry), enabling powerful and truly flexible multimodal imaging.

Optional wavelength configurations extend the tuning range to 4 microns.

Chameleon MPX Dual Tuning Range



Chameleon MPX Typical Output Power



Pumped by	Chameleon Ultra II	Chameleon Vision II
Complete Tuning Range with Chameleon (nm)	680 to 1340	680 to 1340
Dual Beam Mode Tuning Ranges (nm)	760 to 910 and 1010 to 1340 (see chart above)	760 to 910 and 1010 to 1340 (see chart above)
Max Output Power (mW)	>750	>700
Pulse Duration (fs)	130	130
Negative GVD Range (fs ²)	0 to 6000	0 to 6000

Fidelity

High Power Fiber Lasers for Non-linear Imaging and Optogenetics Photoactivation



In-vivo Calcium imaging of RCaMP2 at 1070 nm using Fidelity 2. Courtesy of F. Haiss, University Aachen.

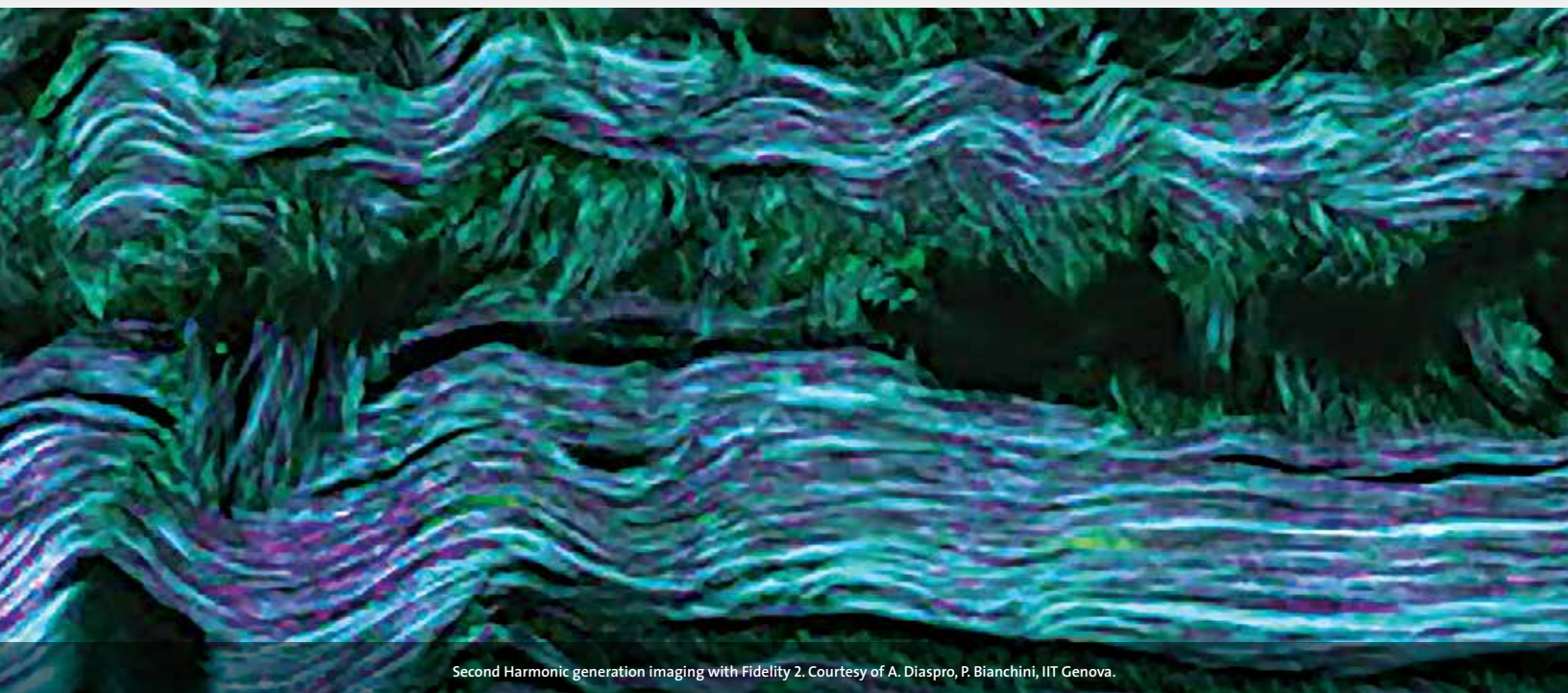
The Fidelity fiber laser family offers unprecedented power in the near infrared. This enables a new generation of techniques in imaging red shifted fluorescent proteins, dyes and Calcium indicators as well as photo-activation of opsins such as C1V1.

Fidelity 2

Fidelity 2 provides a truly unique combination of high average power and extremely short pulses in a simple to operate, air-cooled, maintenance-free and compact package. 1070 nm is ideally suited to probes such as tdTomato and mCherry, red shifted genetically encoded calcium indicators, and optimal activation of red shifted opsins.

Fidelity HP

The latest fiber laser technology from Coherent heralds a revolution in ultrafast fiber laser capability. High average power combined with short pulses and dispersion pre-compensation opens new windows into the field of optogenetics. Larger and more significant neural populations can be now photoactivated using a number of the latest scanning and scanless imaging techniques.

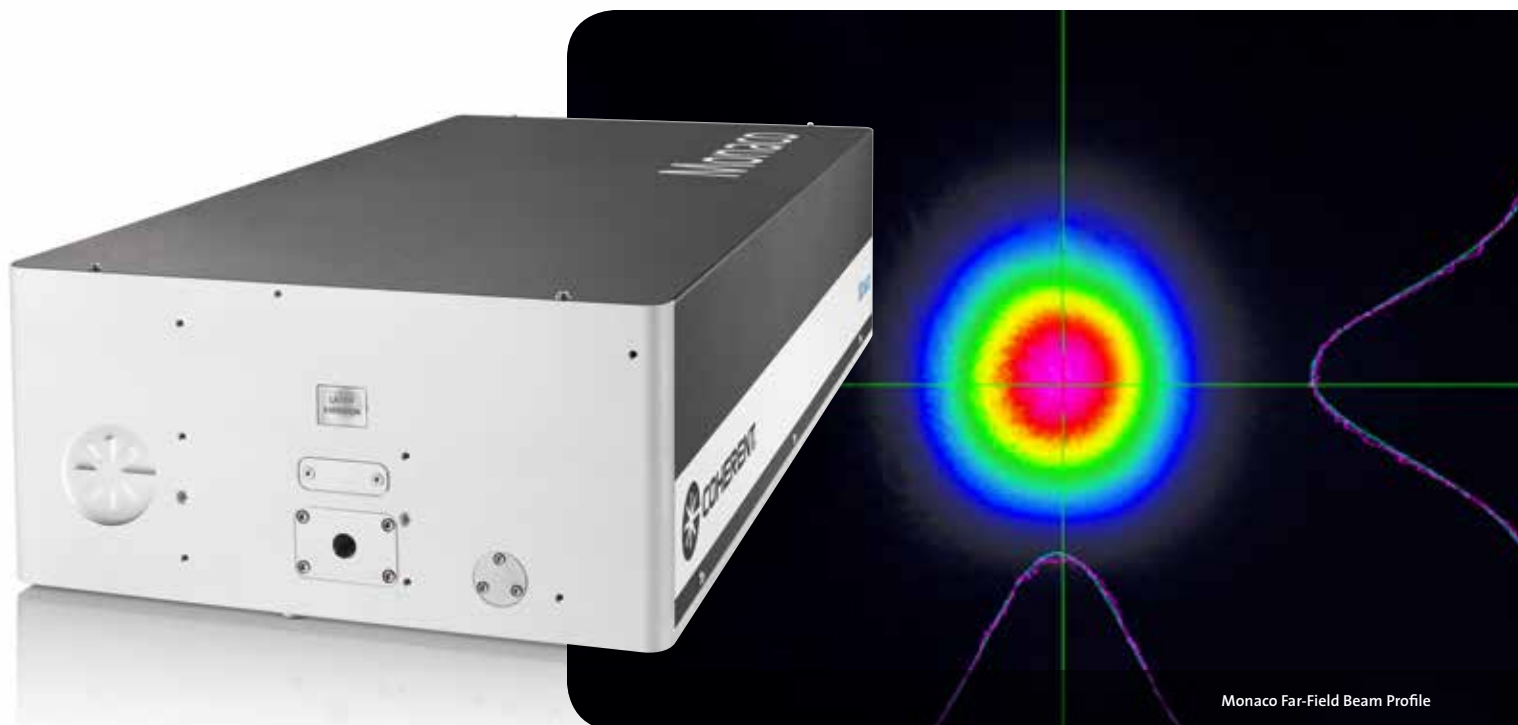


Second Harmonic generation imaging with Fidelity 2. Courtesy of A. Diaspro, P. Bianchini, IIT Genova.

	Fidelity 2	Fidelity HP	
		Fidelity 10	Fidelity 18
Center Wavelength (nm)	1070	1040	1040
Average Power (W)	>2	>10	>18
Pulse Duration (fs, at 800 nm)	55	140	140
Repetition Rate (MHz)	72	80	80
Negative GVD Range (fs ²)	0 to 30,000	0 to 30,000	0 to 30,000

Monaco

Diode-Pumped Femtosecond High-Energy Laser



Engineered for industry but equally at home in the laboratory, Monaco addresses important and novel applications in optogenetics and Calcium imaging for neuroscience. And it does it with unparalleled reliability.

Novel imaging techniques like multiphoton light sheet, wide-field microscopy, and scan-less microscopy/photo-activation with spatial light modulators (SLMs) require lasers operating in unconventional pulse formats. Rather than the 70-80 MHz train of pulses commonly used for MPE microscopy, Monaco produces an energetic, low-repetition train of microjoule level pulses at 1 and 4 MHz that is ideal for applications where many arbitrarily chosen points of the sample must be excited simultaneously.

High-Energy/High Repetition Rate

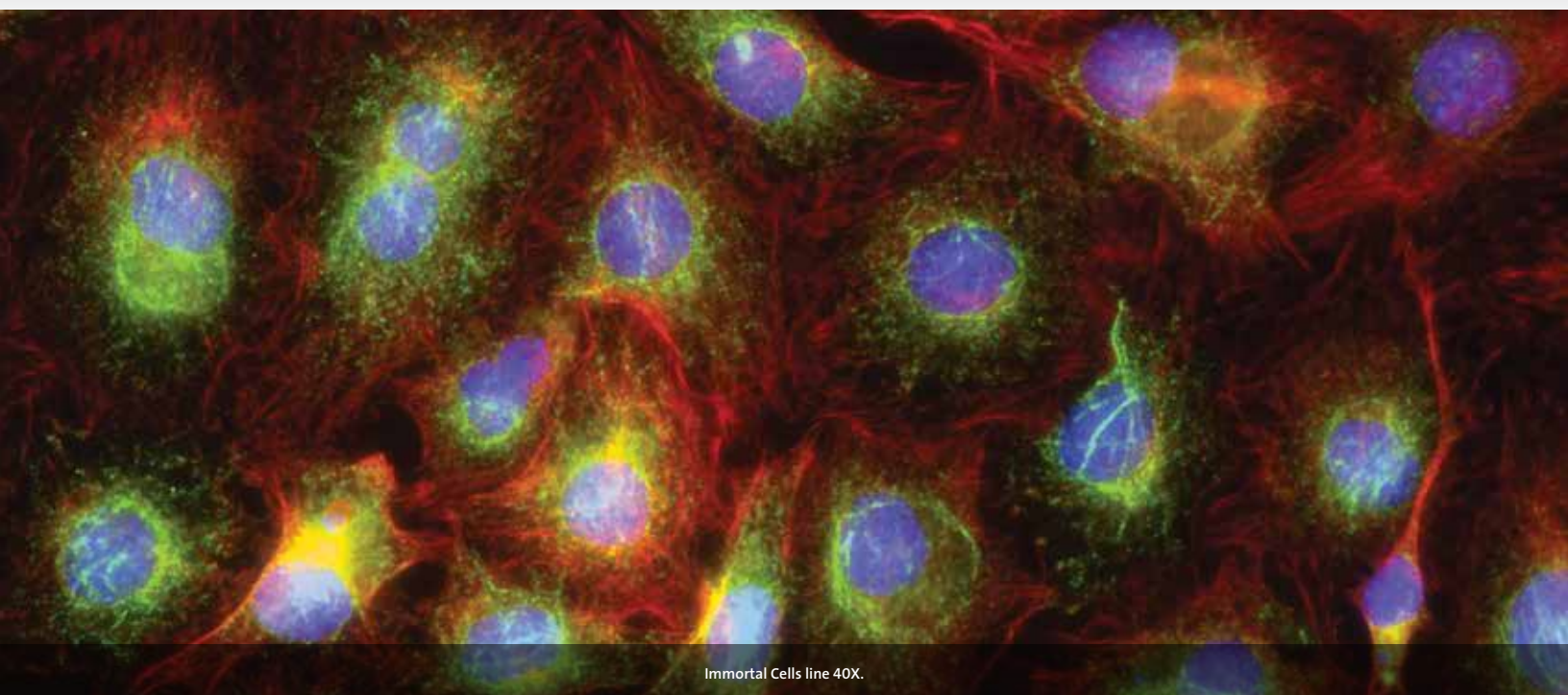
Monaco's energy per pulse—hundreds of times higher than other lasers—enable fast activation/imaging of neuron populations expressing red shifted optogenetic probes or Calcium indicators.

OPA Pumping

Monaco's high energy is powerful enough to pump tunable wavelength converters like Optical Parametric Amplifiers (OPAs) and achieve spectral coverage of all the probes in use for non-linear imaging and optogenetics.

HALT Designed/HASS Verified

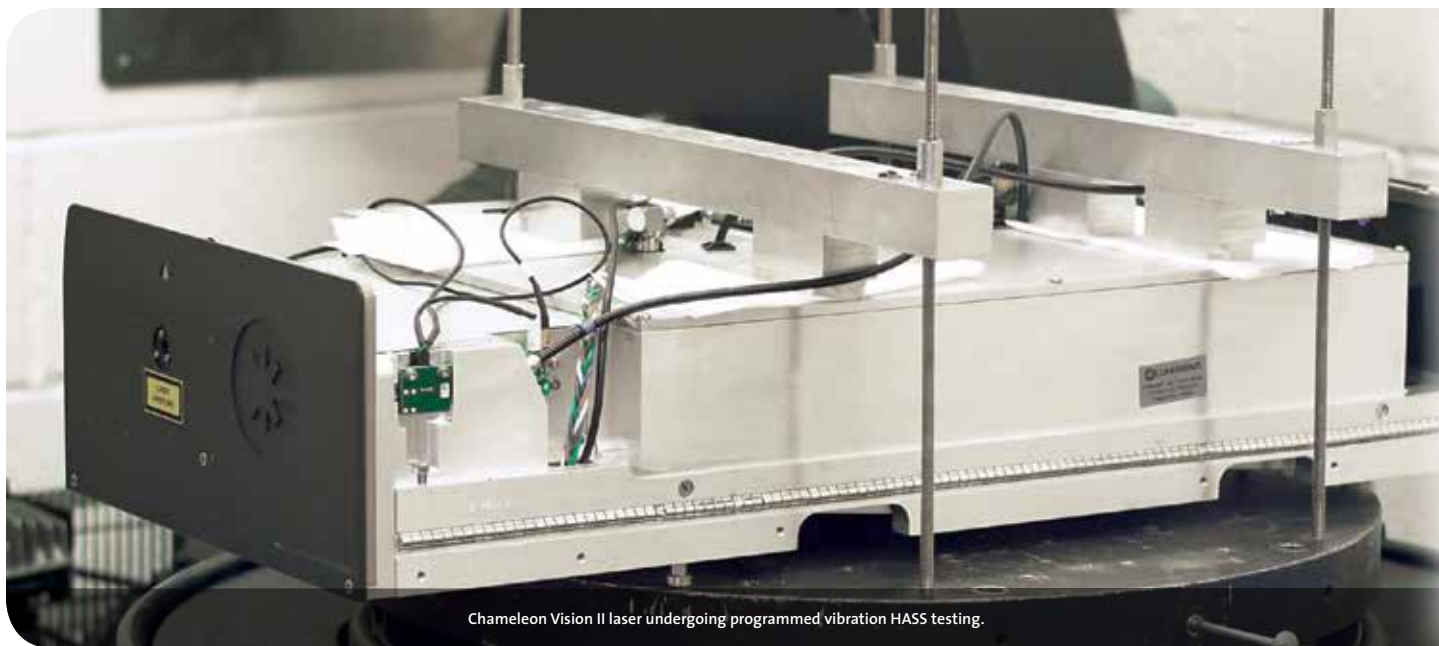
Monaco's reliability is assured through the HALT (Highly Accelerated Life Test) and HASS (Highly Accelerated Stress Screen) protocols employed during development and throughout production. Coherent pioneered HALT/HASS, bringing unrivaled standards of reliability and quality to femtosecond applications.



	Monaco 1035-40-1	Monaco 1035-10-4
Center Wavelength (nm)	1035	1035
Average Power (W)	40	40
Energy/Pulse (μ J)	40	10
Pulse Duration (fs)	<400	<400
Repetition Rate	Single-shot to 1 MHz	Single-shot to 4 MHz

The Industrial Revolution in Ultrafast Science

HALT Designed/HASS Verified

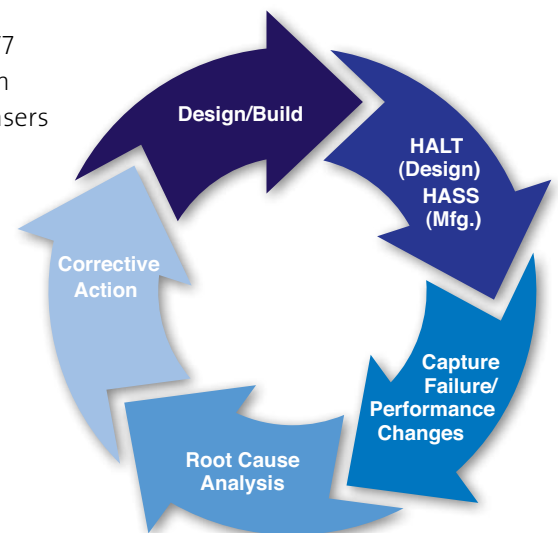


Learning from demanding industrial laser markets, where reliable 24/7 operation is mandatory, Coherent initiated the Industrial Revolution in Ultrafast Science – an approach to designing and building ultrafast lasers without compromise.

Unique HALT/HASS Testing

- HALT (Highly Accelerated Lifetime Testing) design process
- HASS (Highly Accelerated Stress Screening) manufacturing verification

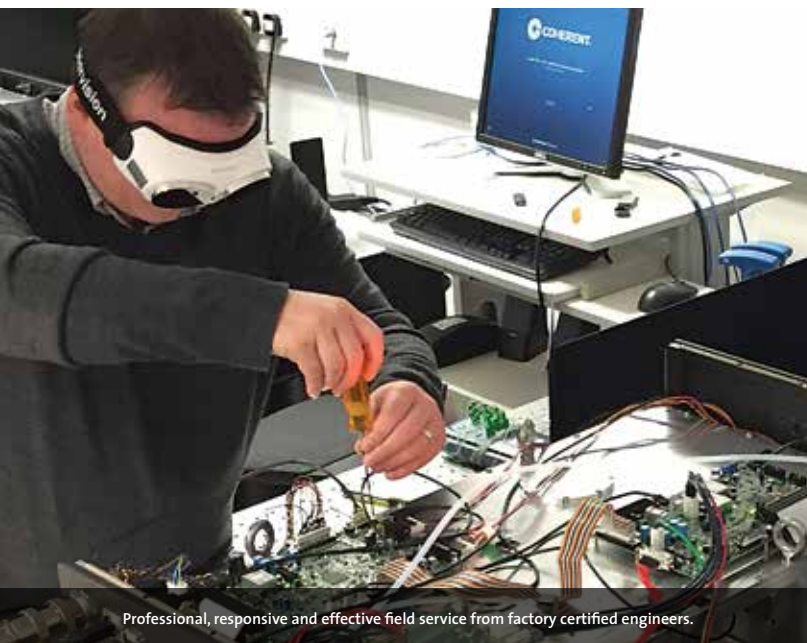
Unrivaled, industrial-grade laser performance means more time for what matters most – your application.



Industrial Design and Testing

The Coherent Service Advantage

Sustainable Performance



All Chameleon lasers in Coherent's non-linear imaging portfolio benefit from a three-level rapid response program which maximizes system uptime.

- Remote Service gives customers immediate access to an engineer for rapid system diagnosis. Your laser can be diagnosed and optimized to full specification without additional interruption to your work.
- Our Field Service team is trained to resolve remedial service issues the first time.
- Coherent's Advance Replacement Service puts factory certified, "equivalent to new" lasers in your laboratory in advance of your system going hard down. This ensures lowest system downtime for your crucial imaging needs. All parameters, including beam profile, pulse duration and dispersion are fully characterized in a Class 10,000 cleanroom to ensure repeatable performance.



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