Novanta

FUSIONultra CONFIGURABLE MULTI-WAVELENGTH LASER LIGHT ENGINE

DISCOVER HIGH DYNAMIC RANGE EXCITATION, ULTRA-STABLE OUTPUT, & SEAMLESS INTEGRATION

We drive innovation, delivering substantial value to the Life Sciences and Scientific R&D communities, The new FUSIONultra takes illumination to the next level with faster acquisition speeds and unmatched image quality. Our OEM-ready, modular multi-watt laser light engine incorporates proprietary technologies and optional components to resolve fine cellular and sub-cellular structures.

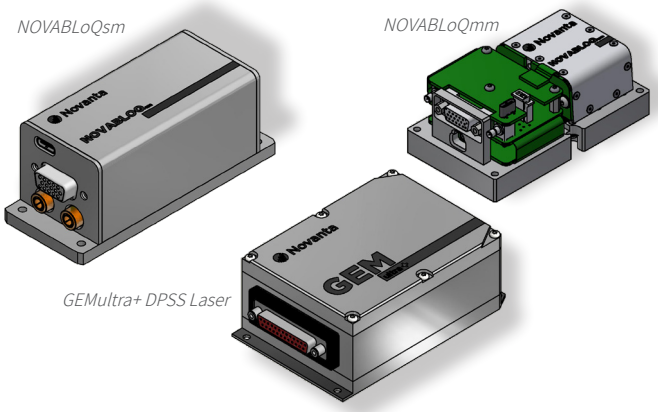
The NEW FUSIONultra platform offers:

- Broad spectral breadth to excite an equally broad range of fluorophores
- Scalable multi-Watt output per laser line for both diode and DPSS based modules
- Dynamic power switching
- Ultra-stable laser sources and proprietary ULTRALOQ™ technology
- Enhanced spatial coherence and minimal modal dispersion
- Optimal mode scrambling
- Single and multi-mode fiber configuration options
- Optional built-in beam shaping and despeckling modules

We offer an impressive line-up of advanced diode pumped solid state lasers and single or multiple mode diode lasers that can be configured in any combination and precisely positioned into a single, protective housing.

ADVANCED BUILDING BLOCK TECHNOLOGY

FUSIONultra is a flexible, modular platform that incorporates any combination of our DPSS lasers and single or multiple mode diode lasers with optional beam shaping and despeckling modules to optimize complex analysis and experiment results. Purpose-built for OEM integration to accelerate throughput, maximize illumination uniformity, and eliminate artifacts. FUSIONultra combines ULTRALOQ™ technology with high-power output to deliver consistent results with unmatched reliability.



UNIQUE FEATURES

Enable high throughput with faster acquisition speeds, unmatched imaging quality and seamless integration with a modular laser light engine platform capable of scalable multi-watt output per laser line.

Excite a wide range of fluorophores for complex analyses and experiments with a broad range of wavelength and power level options, including higher power levels for the challenging 561 nm wavelength.

Eliminate spatial noise to enhance quantification accuracy across the entire sample with uniform illumination and consistent signal fidelity with our integrated despeckling solution.

Boost image contrast and eliminate artifacts with multiple ultra-stable laser sources and our proprietary ULTRALOQ™ technology that ensures performance stability throughout a broad range of operating temperatures.

Resolve fine cellular and sub-cellular structures with enhanced spatial coherence and minimal modal dispersion—enabled by a compact 50 µm multi-mode fiber core.

Maximize illumination uniformity and suppress modal artifacts with a selection of non-circular fiber cores engineered for optimal mode scrambling

Enable high-speed fluorescence testing with dynamic power switching—delivering stable performance and expanded signal range for precise proteomic and sequencing control

Add versatility and flexibility to testing and analysis capabilities with both single and multi-mode fiber configuration options.

Achieve precise illumination control with built-in beam shaping—refining beam output to enhance uniformity, reduce background noise, and improve signal-to-noise ratio in fluorescence imaging applications.

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INTEGRATED FEATURES

FUSIONultra's integrated features and optional components that bring it to the forefront of light engine performance and reliability…

Modular, Highly Configurable Design

As a configurable illumination solution, each FUSIONultra light engine is purpose built, and can incorporate any combination of Novanta DPSS lasers and diode modules.

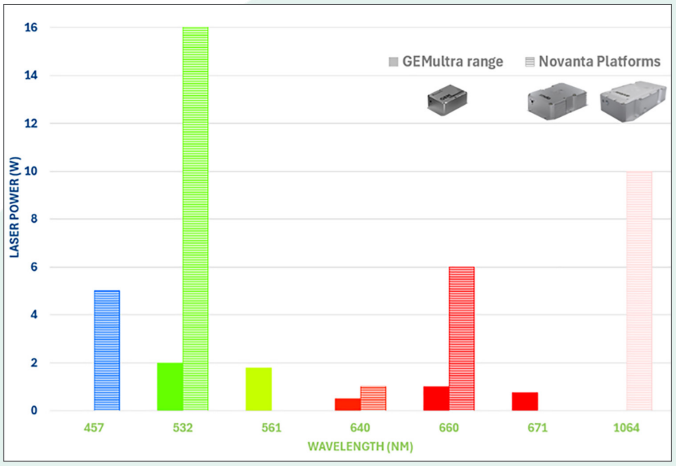

Fig 1: Power range of integratable Novanta DPSS lasers including GEMultra platform

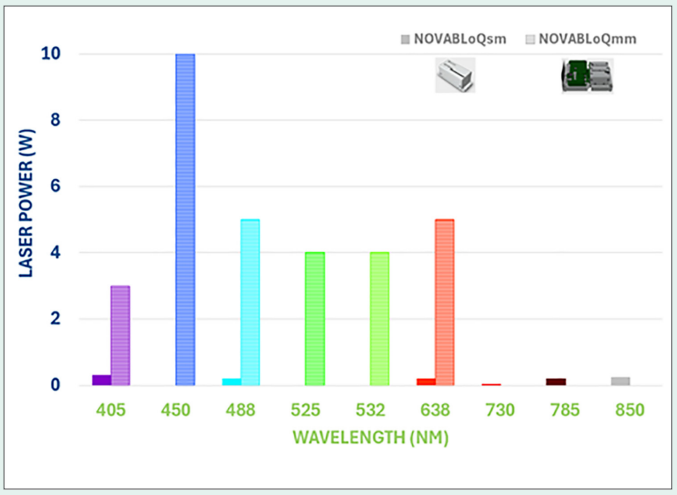

Fig 2: Power range of integratable Novanta single mode and multimode diode modules

Unmatched Power Modulation for Precise Control

Enable high-speed fluorescence testing with dynamic power switching, delivering stable performance and expanded signal range for precise proteomic and sequencing control. Our advanced power modulation allows for precise measurements and fast data acquisition to optimize testing processes without damaging sensitive samples.

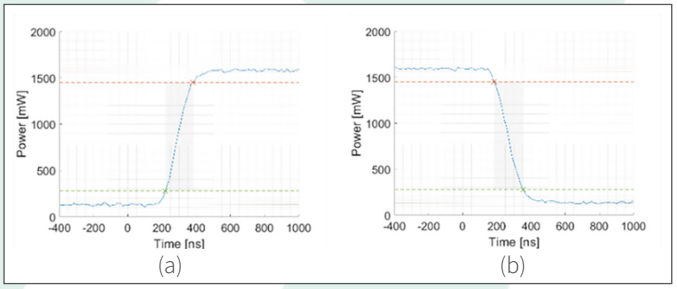

Fig 3: a) Rise time demonstration measuring < 200 ns rise time for 561 nm line within the 4-colour light engine. b) Fall time demonstration measuring <200 ns for 561 nm line within the 4-colour light engine

ULTRALOQ™

Rapidly changing ambient temperatures can stress laser cavities, causing unstable laser output, resulting in false positives, unplanned downtime and reduced lifespan. Novanta's ULTRALOQ™ technology features a meticulously engineered material system designed specifically to endure extreme temperatures and rapidly changing environments while supporting fully automated manufacturing processes. ULTRALOQ'™ technology is applied to both laser modules and beam combining optics. The result is a consistent, ultra-stable laser platform that maximizes uptime, enhances quality and minimizes long term ownership costs.

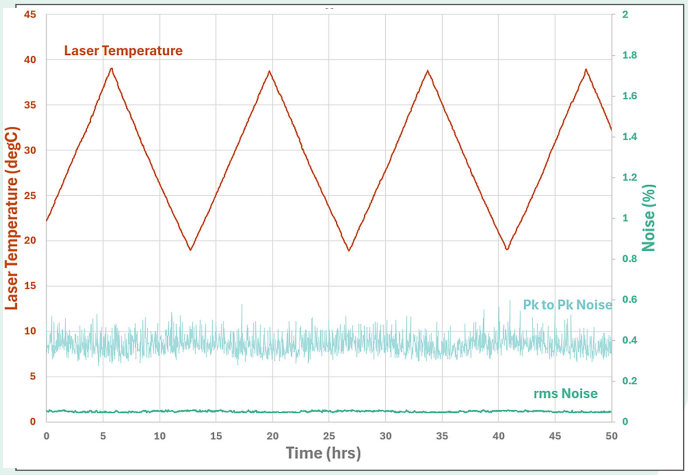

Fig 4: Impact of ULTRALOQTM technology on GEMultra platform performance

Despecking Eliminates Spatial Noise

Our integrated despeckling technology eliminates spatial noise to enhance quantification accuracy across the entire sample with uniform illumination and consistent signal fidelity. The independent despeckling module is securely mounted into the light engine housing, eliminating the need for a secondary unit and simplifying integration into complex instruments and systems.

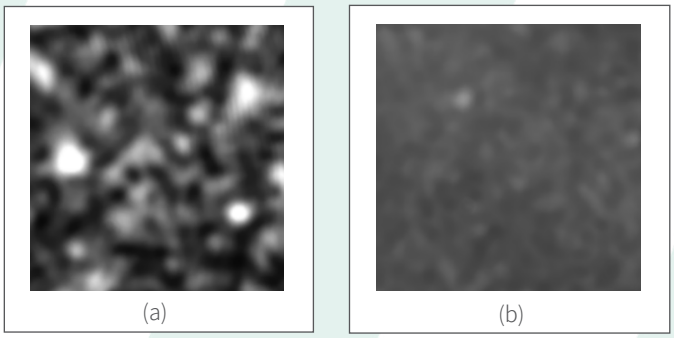

Fig 5: Novanta despeckling technology in action: 561 illuminated 50 um fibre tip re-imaged with (a) despeckle turned off and (b) despeckle turned on

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INTEGRATED FEATURES (cont.)

High Dynamic Ranage via Integrated Variable Optical Attenuation

Meeting high performance specifications across a wide range of power levels is challenging, and often requires separate attenuators, leading to added cost and integration challenges for OEMs. By incorporating an onboard VOA in Novanta's DPSS laser lines , achieving a maximum attenuation of up to OD3 ensures stability and adherence to performance specifications, even during power changes, enhancing operational flexibility while reducing integration complexity and cost.

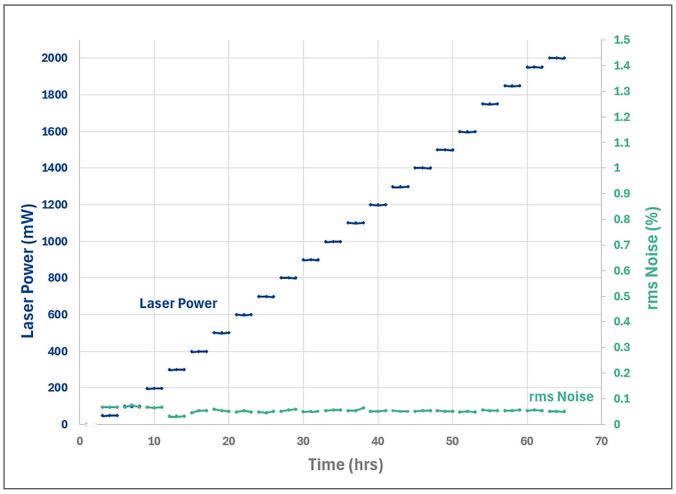

Fig 7: A GEMultra laser demonstrating how specifications are being held down to more than OD2 attenuation

Enhance Illumination Uniformity

Our configurable platforms allow for beam shaping either through dedicated beam shaping modules or through various fiber core geometries and diameters as small as 50 µm for multimode fibers. The ULTRALOQ™ technology ensures exceptionally stable and consistent fiber coupling even in the ever demanding single mode / polarization maintaining fibers. Our configurable Light Engine platform design enables precise illumination control to refine beam output to lines, rectangles, or square shapes reducing background noise, optimize uniformity, and improving signal-to-noise ratio in fluorescence imaging applications. The uniformity prevents over or under exposure in processing providing more accurate scientific data.

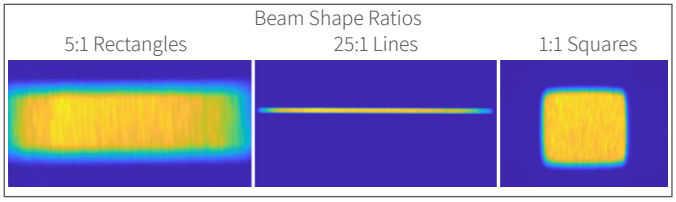

Fig 8: Various shapes of beams through our customizable beam shaping modules

SPECIFICATIONS

Description	Specification Typical 4 laser line configuration	Specification Optional offerings
Wavelength & Power*	See fig1 & fig2 for available powers Talk to our Sales Representatives with your exact power requirements.	
Number of Laser Lines	4	FUSIONultra modular architecture allows combining up to 10 laser lines in configurable Light Engine envelope
Power Stability (Peak to Peak)	< 4% pk to pk	
Dynamic Range	10% - 100%	High Dynamic range down to OD2.7 attenuation available
Modulation Frequency	Digital and Analogue modulation available Talk to our Sales Representatives about your exact modulation requirements.	
Rise/Fall Time	< 1 ms	
Fiber Type	MM SM/PM Talk to our Sales Representatives with your exact fibre core requirements.	Free Space output available
Smallest Fiber Core (MM)	50 µm	3.5µm for SM/PM fibers
Volume	200x300x145 mm^3	Configurable Platform
Beam Shaping Options	Talk to our Sales representatives about your beam shaping and uniformity requirements.	
Despeckling	< 10%	

** Wavelength and power are determined by the selected DPSS laser. Specifications listed here are for the most popular FUSIONultra configurations.*

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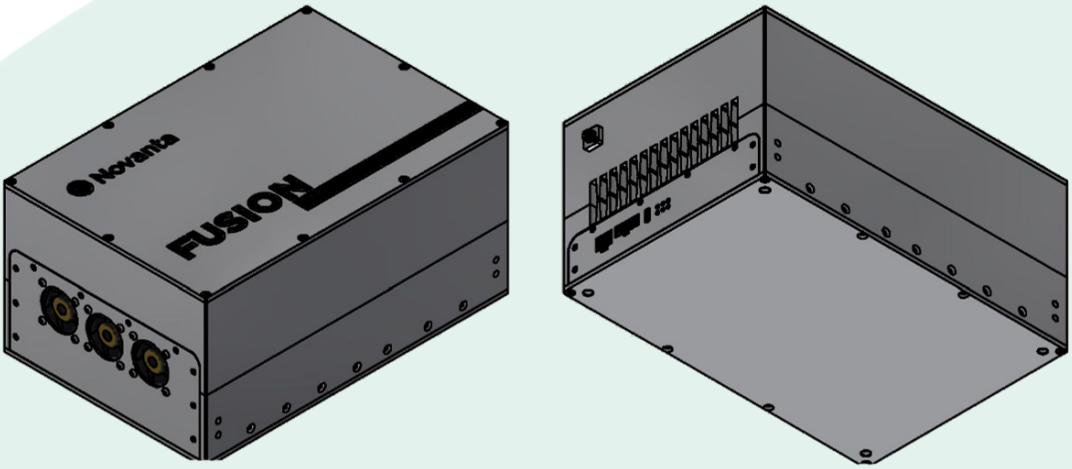
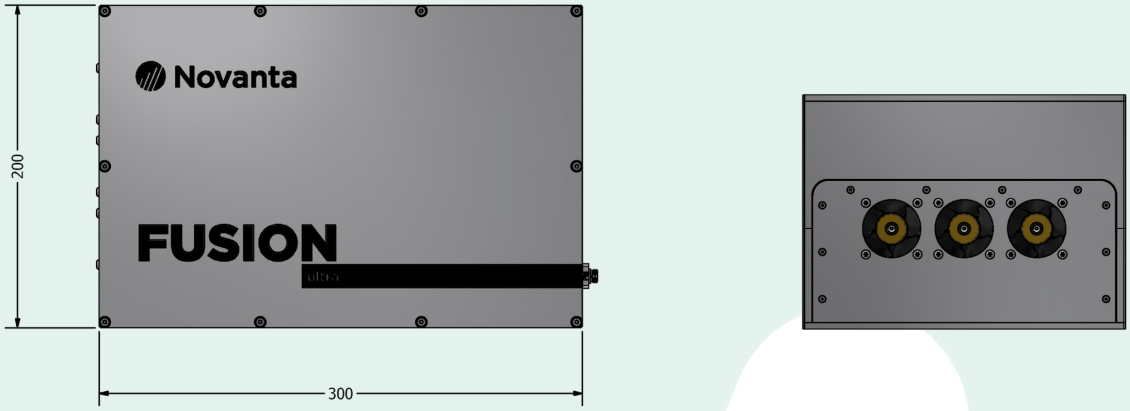
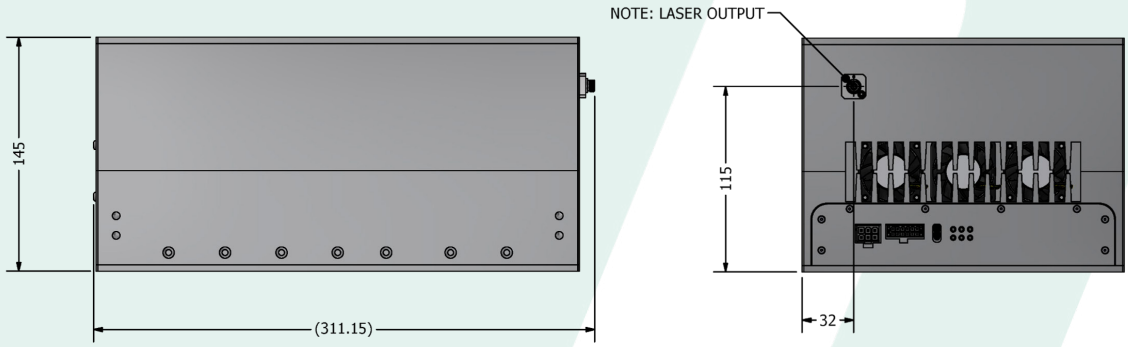
DIMENSIONS (mm)

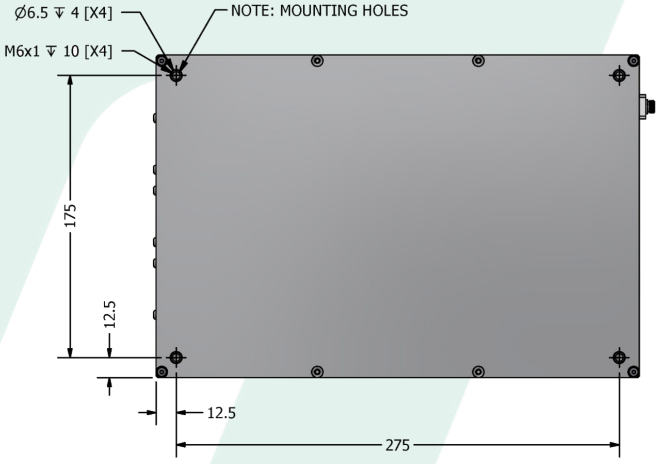
Drawings are for illustrative purposes only, please contact us for complete engineer's drawings.

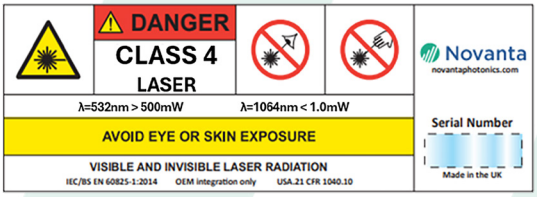
FUSIONultra 4C - 4 Color Variant Example











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DIMENSIONS (mm)

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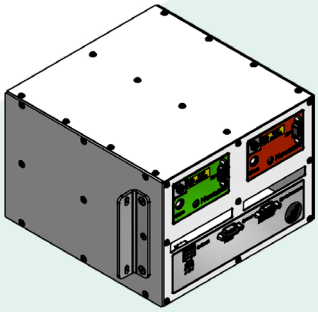
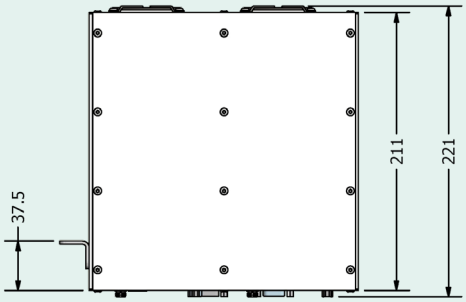
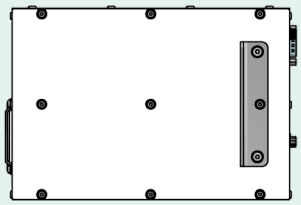
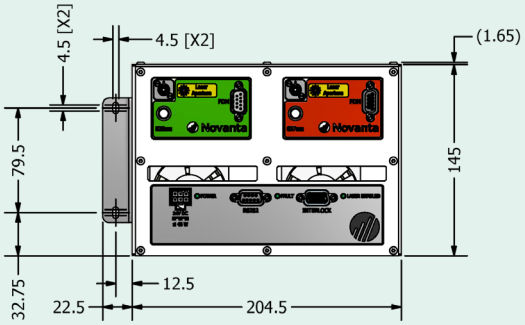
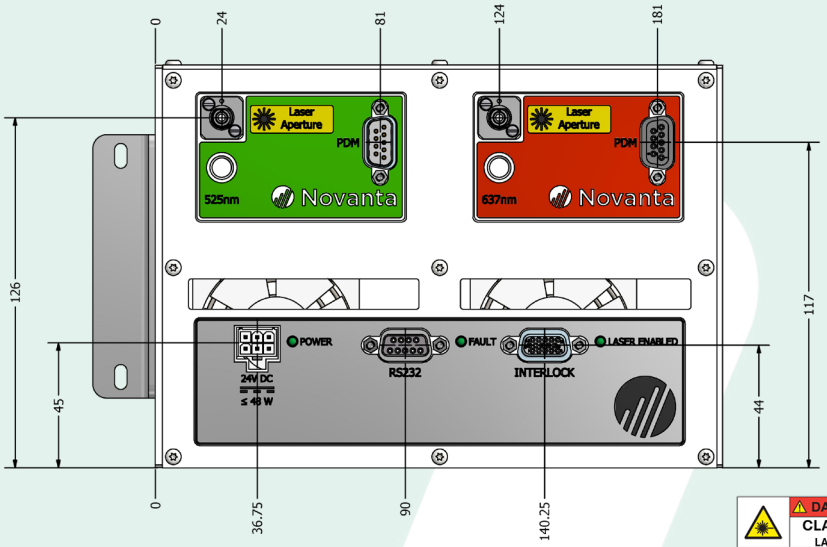
FUSIONultra 2C - 2 Color Variant Example



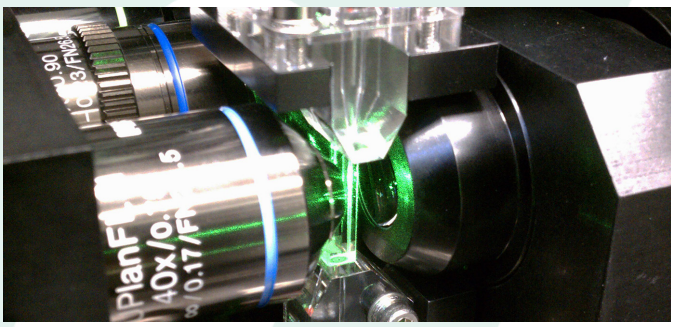








KEY APPLICATIONS



FLOW CYTOMETRY & CONFOCAL MICROSCOPY

Simultaneously excite and measure multiple fluorescence signals for comprehensive analysis of cell populations. The extreme dynamic range of FUSIONultra ensures that even dim fluorescent signals from single cells can be detected and quantified. Results are accurate and repeatable due to the stability of the proprietary ULTRALOQ technology that is guaranteed to maintain performance specifications.

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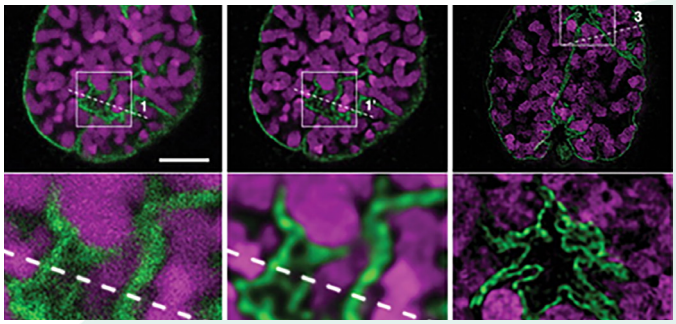
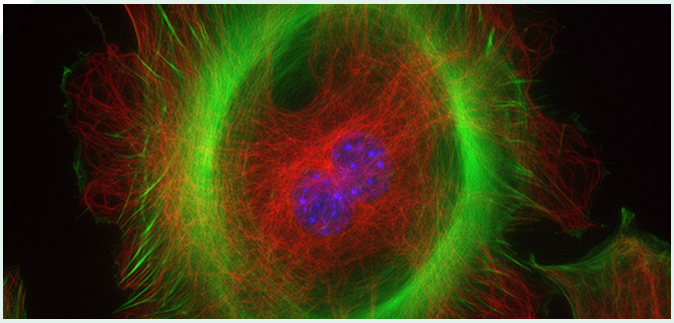
KEY APPLICATIONS (cont.)



HIGH-THROUGHPUT IMAGING

FUSIONultra offers higher power levels than typically found in laser light engines. Advanced proprietary laser platform technology enables Novanta to deliver a new laser light engine with scalable multi-watt output per laser line. The higher power level enables high throughput with faster acquisition speeds, and unmatched image quality.

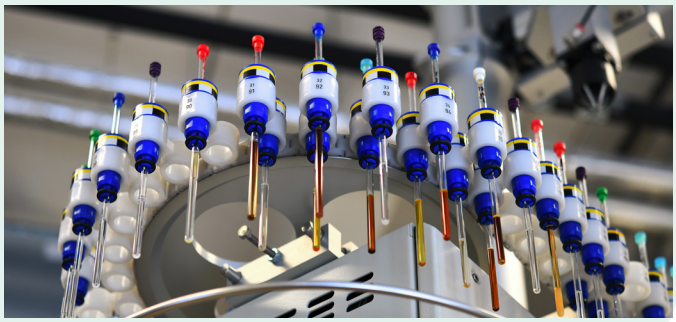


FLUORESCENCE MICROSCOPY

Avoid skewed results caused by spatial noise with an integrated despeckling solution that eliminates noise to enhance qualification accuracy across the entire sample with uniform illumination and signal fidelity. Image quality is improved, and artifacts are eliminated with ultra-stable laser sources and our proprietary ULTRALOQ technology that ensures performance throughout a broad range of operating temperatures.

OPTOGENETICS

Activate light-sensitive proteins in genetically modified cells or neurons with focused, high-power laser light over selected wavelengths. Target specific locations with unmatched modulation capabilities to resolve structures with enhanced spatial coherence and minimal modal dispersion enabled by a 50 µm-core multi-mode fiber. Maximize illumination uniformity and suppress modal artifacts with a selection of non-circular fiber cores engineered for optimal mode scrambling.



RAMAN SPECTROSCOPY

Enable high throughput with faster acquisition speeds for inline processing. Unmatched imaging quality and seamless integration with a modular laser light engine platform capable of scalable multi-watt output per laser line. FUSIONultra offers a broad range of wavelength and power level options, including higher power levels for the challenging 561 nm wavelength, for complex analyses and experiments.

CONTACT US

Americas, Asia Pacific

Novanta Headquarters
Bedford, USA
P +1-781-266-5700
Photonics@Novanta.com

Europe, Middle East, Africa

Stockport, United Kingdom
P +44-161-975-5300

Novanta Europe GmbH
Wackersdorf, Germany
P +49 9431 7984-0

Milan, Italy
P +39-039-793-710

Photonics@Novanta.com

China

Novanta Sales & Service Office
Shenzhen, China
P +86-755-8280-5395

Suzhou, China
P +86-512-6283-7080

Photonics.China@Novanta.com

Japan

Novanta Service & Sales Office
Tokyo, Japan
P +81-3-5753-2460

Photonics.Japan@Novanta.com

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