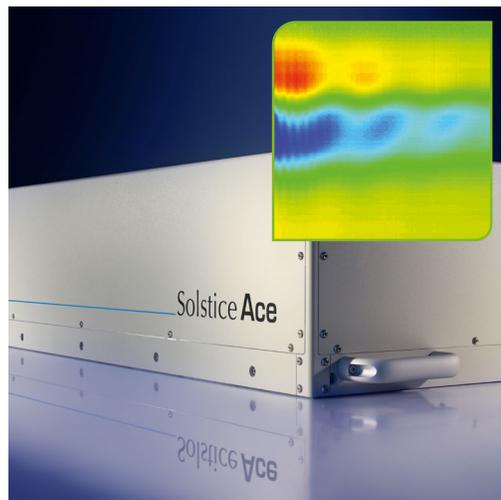


#1 IN ULTRAFAST

EXPERTISE. INNOVATION. RESULTS



SPECTRA-PHYSICS #1 IN ULTRAFAST

LEADING IN ULTRAFAST INNOVATION

#1 in Ultrafast means providing the broadest portfolio of cutting edge ultrafast lasers to ensure the right solution to meet your requirements. It means having the expertise to serve the widest scope of ultrafast applications with the world's largest install base. It means access to the most experienced global support team in the industry.

Choosing the #1 in Ultrafast means confidence in making the right ultrafast decision.



1990 • Tsunami®
First Mode-Locked Ti:Sapphire Laser



1993 • Spitfire®
First Ti:Sapphire CPA (Chirped-Pulse Amplifier)



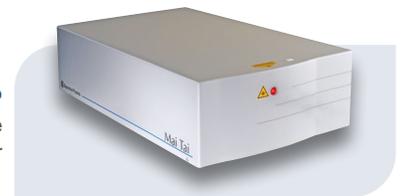
1996 • Millennia® + Tsunami
First DPSS (Diode-Pumped Solid State) Ultrafast Laser



1999 • Mai Tai®
First Automated Tunable Ultrafast Laser



2007 • Mai Tai DeepSee™
First One-box, Automated Dispersion Compensation



2009 • Mai Tai SP
First Automated Adjustable Bandwidth Short Pulse Seeder



2011 • InSight® DeepSee™
First One-box Widely Tunable (680–1300 nm) Ultrafast Laser for Multiphoton Imaging



2012 • Millennia eV™
First 25 W Green CW DPSS Laser for Ti:Sapphire Pumping

WIDEST SCOPE OF ULTRAFAST APPLICATIONS

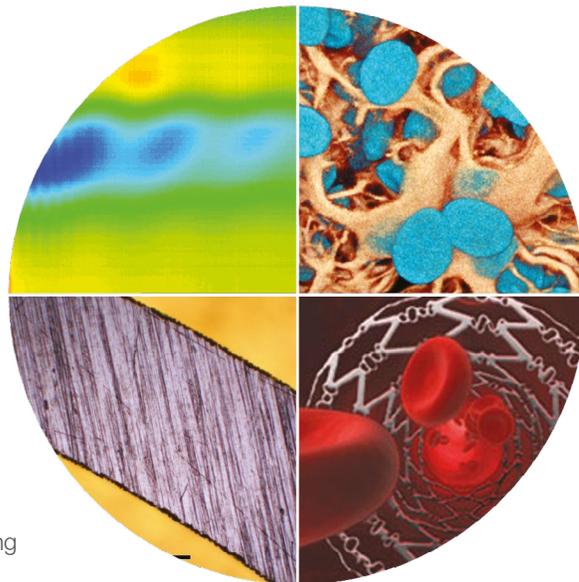
Spectra-Physics ultrafast lasers enable new applications in a wide range of research, medical and industrial fields every day.

- Our high energy amplifiers are the light source of choice for leading scientists conducting cutting edge research in physical chemistry, high energy physics, material science, optoelectronics and other advanced applications
- Our widely tunable femtosecond lasers are integrated in most commercial and home-built multiphoton microscopes, advancing neuroscientists' knowledge of the human nervous system
- Our high repetition rate turn-key ultrafast lasers are increasingly used in various medical applications such as novel eye surgery procedures, and high finesse precision micromachining of critical materials including medical devices

If your application calls for an ultrafast laser, we have the right solution for you

Scientific Research

- Transient absorption
- OPA pumping
- High Harmonic generation, EUV
- Fluorescence upconversion
- Multidimensional spectroscopy
- THz spectroscopy
- Coherent control
- CARS, SRS



Industrial

- Flat panel display manufacturing
- Thin films micromachining
- Two-photon polymerization
- Precision micromachining

Biological Imaging

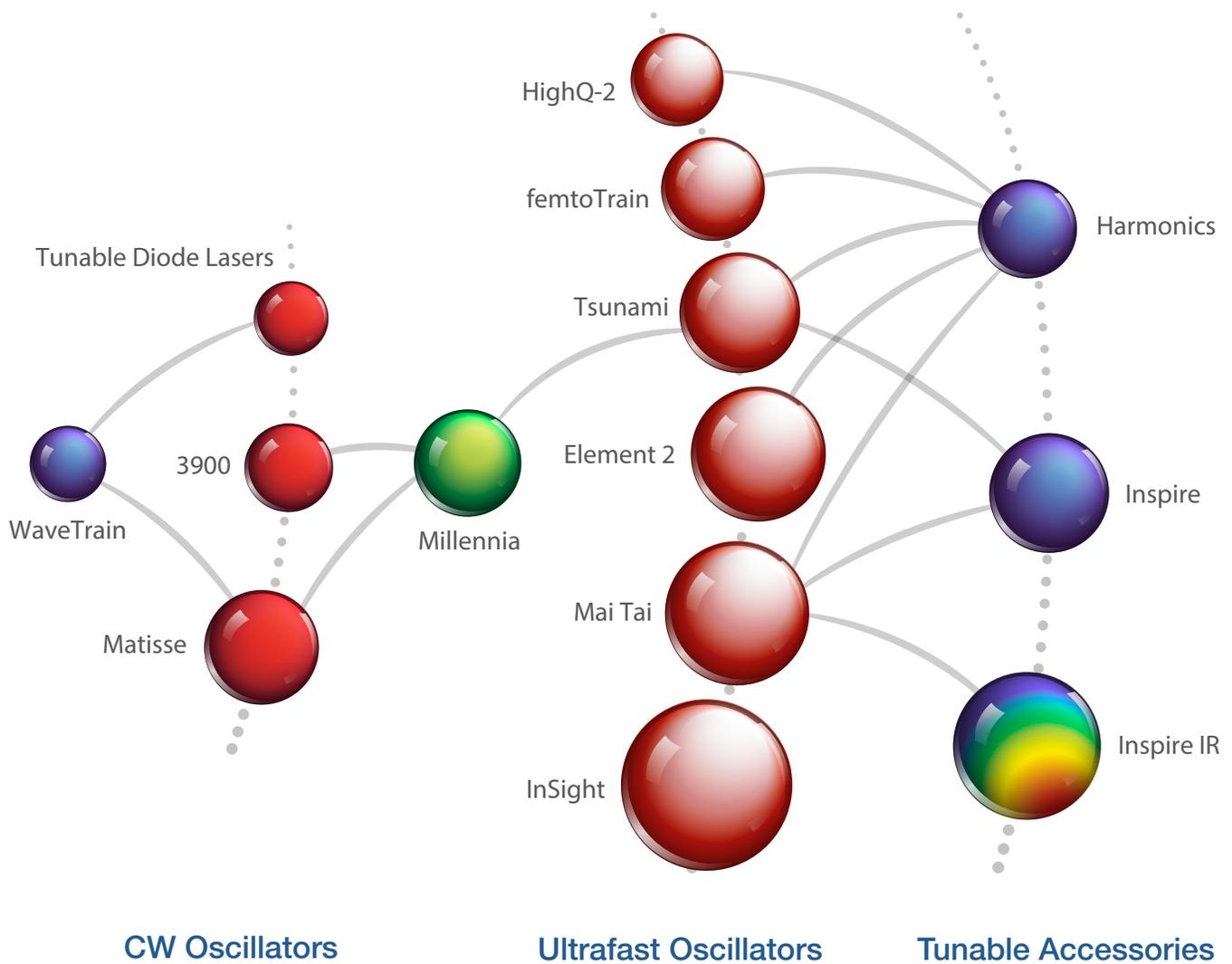
- Multiphoton microscopy
- Multimodal imaging
- CARS, SRS
- SHG / THG
- 3-Photon Imaging
- OCT
- STED

Medical

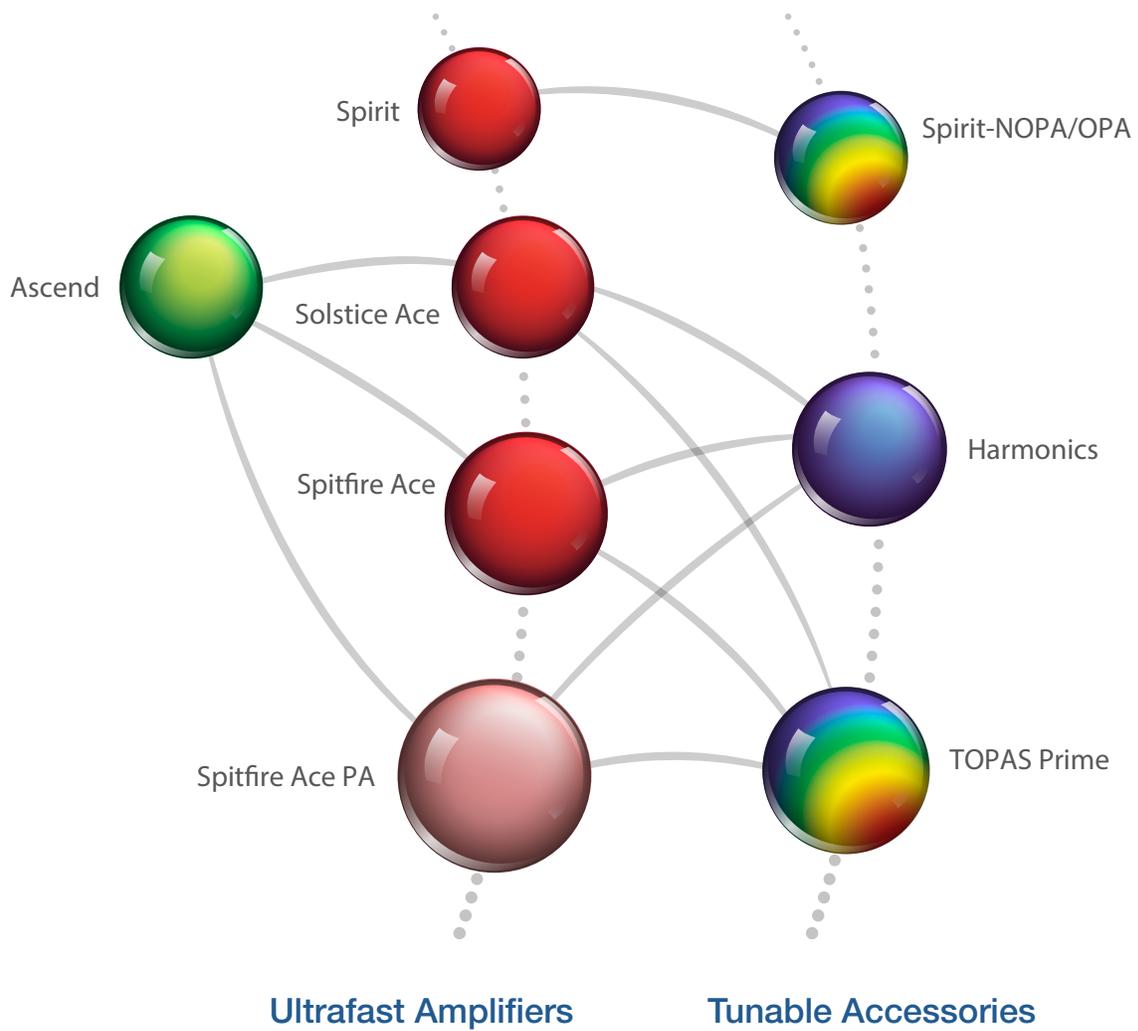
- Medical device fabrication
- Cardiovascular stent manufacturing
- Laser eye surgery

BROADEST PORTFOLIO OF ULTRAFAST TECHNOLOGIES

OSCILLATOR SELECTION



AMPLIFIER SELECTION



ULTRAFAST OSCILLATORS

Spectra-Physics offers a comprehensive selection of high performance ultrafast oscillators and accessories, enabling breakthroughs in time-resolved spectroscopy, biological imaging, cutting-edge physics and industrial applications.

- The InSight® series and Mai Tai®/Mai Tai DeepSee™ series have the widest wavelength tunability, flexibility and high peak power necessary for all multiphoton and multimodal imaging techniques
- Mai Tai SP, Element™ and Synergy™ are market-leading ultrafast seed lasers for ultrafast amplifiers
- Based on direct diode-pumped technology, HighQ-2™ and femtoTrain™ lasers combine compactness and ease of use for imaging and industrial applications
- Tsunami® provides pulse width flexibility in the femtosecond and picosecond regimes with high average powers

| Laser | Highlights | Featured Applications |
|---|---|---|
| <p>InSight</p>  | <ul style="list-style-type: none"> • High peak power • >600 nm tunability • Dispersion compensation | <ul style="list-style-type: none"> • Multimodal imaging • CARS, SRS, SHG, THG • Deep tissue multiphoton imaging |
| <p>Mai Tai / Mai Tai DeepSee</p>  | <ul style="list-style-type: none"> • High peak power • >300 nm tunability • Dispersion compensation | <ul style="list-style-type: none"> • Multiphoton imaging • Pump probe experiments • THz spectroscopy and imaging |
| <p>Mai Tai SP</p>  | <ul style="list-style-type: none"> • Turn-key operation • Computer adjustable bandwidth • Industry leading environmental stability | <ul style="list-style-type: none"> • Ultrafast amplifier seeding • Time-resolved fluorescence • Time-resolved spectroscopy |
| <p>Element 2</p>  | <ul style="list-style-type: none"> • High peak power • Optional CEP stabilization • Ultra-low amplitude and phase noise | <ul style="list-style-type: none"> • THz generation • Amplifier seeding • Time-resolved spectroscopy |
| <p>HighQ-2 / femtoTrain</p>  | <ul style="list-style-type: none"> • Compact • Turn-key operation • Diode-pumped technology | <ul style="list-style-type: none"> • Two-photon polymerization • THz spectroscopy and imaging • Fixed wavelength multiphoton imaging |
| <p>Tsunami</p>  | <ul style="list-style-type: none"> • Flexible platform • High average power • Adjustable pulse width fs/ps | <ul style="list-style-type: none"> • Pump probe experiments • Time-resolved fluorescence • THz spectroscopy and imaging |

ULTRAFAST AMPLIFIERS

With the broadest portfolio commercially available, Spectra-Physics ultrafast amplifiers cover a wide range of available energies and deliver industry-leading stability for applications ranging from nonlinear optics and femto-chemistry to femtosecond micromachining.

- Spitfire® Ace delivers ultrafast pulses with mJ level energies and kHz repetition rates. Its beam quality and best-in-class stability make it the ideal ultrafast tool, which can be easily customized to your specific experimental requirements
- Solstice® Ace™ delivers mJ level energies and kHz repetition rates. Its one-box architecture provides exceptional environmental stability
- Spirit® series features direct diode pumping technology and offers user adjustable, high repetition rate for high speed data acquisition and micromachining processing

| Laser | Highlights | Featured Applications |
|--|---|--|
| <p>Spitfire Ace</p>  | <ul style="list-style-type: none"> • Excellent stability • Highly configurable • Highest power, shortest pulse width | <ul style="list-style-type: none"> • Nonlinear optics • Coherent control • Pump probe spectroscopy |
| <p>Solstice Ace</p>  | <ul style="list-style-type: none"> • Highly configurable • Stable reliable operation • Compact one-box design | <ul style="list-style-type: none"> • Nonlinear optics • Time-resolved fluorescence • Multicolor pump probe spectroscopy |
| <p>Spirit</p>  | <ul style="list-style-type: none"> • High average power • Compact, turn-key operation • User adjustable high repetition rate | <ul style="list-style-type: none"> • Ophthalmic applications • Medical device fabrication • Femtosecond micromachining |

ULTRAFAST OPOs, OPAs, AND HARMONIC GENERATORS

Many ultrafast applications require broad, efficient wavelength tunability from the deep UV to the mid IR. To serve these needs and augment our leading portfolio of ultrafast oscillators and amplifiers, Spectra-Physics offers market-leading Optical Parametric Oscillators (OPOs) and Optical Parametric Amplifiers (OPAs).

- Pumped with either our Mai Tai or Tsunami oscillators, the Inspire™ OPOs feature ultra-broad, gap-free tuning from UV to mid-IR wavelengths
- The TOPAS Prime is the industry standard for automated amplifier output wavelength conversion from deep UV to mid IR
- Spirit-OPA/Spirit-NOPA® provides widely tunable, gap-free output from UV to mid-IR
- Multiple configurations are available such as pumping a single OPA/NOPA for maximum output energy or simultaneously pumping multiple OPAs/NOPAs for multi-beam, multi-color time-resolved experiments
- High performance tunable second (SHG), third (THG) and fourth (FHG) harmonic generation are also available for our portfolio of oscillators and amplifiers

| Laser | Highlights | Featured Applications |
|--|--|--|
| Inspire  | <ul style="list-style-type: none"> • Multiple output ports • Computer controlled operation • Wide, gap-free UV to IR mid tuning | <ul style="list-style-type: none"> • CARS imaging • Materials research • Pump probe spectroscopy |
| Inspire IR  | <ul style="list-style-type: none"> • High IR output power • Tunable pump wavelength • Fully automated, sealed enclosure | <ul style="list-style-type: none"> • CARS imaging • Multiphoton imaging • Carrier dynamic studies |
| TOPAS Prime  | <ul style="list-style-type: none"> • High output power • Computer controlled tuning • Deep UV to mid IR wavelengths | <ul style="list-style-type: none"> • Nonlinear optics • Coherent control • Multicolor pump probe spectroscopy |
| Spirit-OPA / Spirit-NOPA  | <ul style="list-style-type: none"> • UV to mid IR wavelengths • High repetition rate tuning • Computer controlled operation | <ul style="list-style-type: none"> • Nonlinear optics • Single molecule studies • Time-resolved spectroscopy |

PUMP LASERS FOR ULTRAFAST LASERS

Cutting edge ultrafast oscillators and amplifiers require reliable, high performance pump lasers. Spectra-Physics offers a broad selection of Q-switched pulsed and high output power CW.

- Millennia® eV™ provides CW green power performance with the highest commercially available output power
- Ascend® Q-switched green lasers are used to reliably pump our portfolio of ultrafast amplifiers

| Laser | Highlights | Featured Applications |
|--|---|--|
| Millennia eV  | <ul style="list-style-type: none">• Low cost per Watt• Compact, rugged design• Highest 532 nm CW power | <ul style="list-style-type: none">• Pumping solid state lasers• Laser doping of selective emitters (LDSE) |
| Ascend  | <ul style="list-style-type: none">• High pulse energy• Industrial grade platform• High pulse-to-pulse stability | <ul style="list-style-type: none">• Pumping of high energy ultrafast amplifiers |

TUNABLE CW LASERS

With the widest portfolio for quantum applications, Spectra-Physics CW tunable lasers provide the tuning range, power, and line width required for challenging quantum applications.

- The Matisse® C is a compact, and fully automated single-frequency tunable ring laser featuring the industry's highest output power, the narrowest external linewidth, the broadest tuning range
- The WaveTrain® 2 resonant ring frequency doubler features patented triangle shaped cavity configuration that maximizes efficiency to achieve greater than 35% harmonic conversion
- The MixTrain is an innovative sum frequency mixing (SFM) solution providing up to 2.5 W in the visible region of the spectrum without requiring a dye laser or out to the near-IR via difference frequency mixing (DFM)

| Laser | Highlights | Featured Applications |
|---|---|---|
| Matisse 2  | <ul style="list-style-type: none"> • Narrowest linewidth • Highest output power available • Ti:Sapphire to dye conversion kit | <ul style="list-style-type: none"> • Quantum Physics • Bose-Einstein condensates • High-resolution spectroscopy |
| Matisse C  | <ul style="list-style-type: none"> • Narrowest linewidth • Highest output power available • Compact, sealed, fully automated | <ul style="list-style-type: none"> • Atomic cooling • Quantum Physics • High-resolution spectroscopy |
| WaveTrain 2  | <ul style="list-style-type: none"> • High doubling efficiencies • Easy exchange of cavity optics • Input wavelength range 410 to 1600 nm | <ul style="list-style-type: none"> • Quantum Physics • Tunable UV experiments • High-resolution UV spectroscopy |
| MixTrain  | <ul style="list-style-type: none"> • Highest available power • Near-IR wavelengths via DFM • UV and Visible wavelengths via SFM | <ul style="list-style-type: none"> • Quantum Physics • High-resolution spectroscopy • Tunable visible/IR experiments |
| 3900S  | <ul style="list-style-type: none"> • Easy to align cavity • Up to 3.5 W TEM₀₀ output • Tunable from 675 to 1100 nm | <ul style="list-style-type: none"> • Fiber laser research • Data communications • Ultrafast spectroscopy |

TUNABLE CW LASERS

- The Venturi is a swept-wavelength tunable laser capable of the highest wavelength scanning speeds
- The Velocity offers wide mode-hop free tuning in an easy to use turnkey system, with industrial grade reliability
- The Vortex Plus is engineered for exceptional wavelength stability, with piezo fine tuning to exactly match and lock to resonances and transitions in AMO physics and quantum applications
- The VAMP tapered amplifier boosts output from an input seed from mW to W levels, while maintaining the narrow linewidth of the seed source. It is compatible with both Velocity and Vortex Plus

| Laser | Highlights | Featured Applications |
|--|--|--|
| Venturi TLB-8800  | <ul style="list-style-type: none"> • Easy to program scan routines • Stepped or swept wavelength tuning • Coherence control minimizes speckle | <ul style="list-style-type: none"> • Fiber sensing • Fiber optics testing • Silicon photonics testing |
| Velocity  | <ul style="list-style-type: none"> • Fiber coupled option • Easy-to-use wavelength control • True mode-hop-free wide tuning | <ul style="list-style-type: none"> • Spectroscopy • Quantum Physics • Micro-cavity resonators |
| Vortex Plus  | <ul style="list-style-type: none"> • Fiber coupled option • True mode-hop-free tuning • Excellent wavelength stability | <ul style="list-style-type: none"> • Metrology • Spectroscopy • Quantum Physics |
| VAMP  | <ul style="list-style-type: none"> • Low seed power safety shut-off • Active power stabilization option • Accepts fiber coupled seed input | <ul style="list-style-type: none"> • Quantum Physics • Atomic spectroscopy • Magneto-optic trapping (MOT) |

CW AND QUASI-CW LASERS

Spectra-Physics continuous-wave (CW) lasers provide continuous light output for bio-imaging, material processing, metrology and other research applications. Quasi-CW lasers are pulsed lasers which operate at MHz frequencies or faster. For many applications, these frequencies are higher than the sample response time which provides CW-like response. Pulse energies are kept low to avoid thermal effects.

- The Excelsior® One™ is a new line of UV, visible, and near IR CW lasers based on our with the laser head and controller combined in a single, compact package
- Excelsior® of low-power continuous wave (CW) solid state lasers offer a comprehensive range of wavelengths and power levels, providing state-of-the-art performance with the smallest footprint in their class
- The Millennia eV is the next generation Millennia, extending the highly successful product family of CW DPSS green lasers to unprecedented power levels and versatility
- Vanguard™ Quasi-CW Lasers are modelocked DPSS lasers designed to produce reliable output at 355 nm or 532 nm with low noise and excellent TEM₀₀ mode quality

| Laser | Highlights | Featured Applications |
|---|--|--|
| <p>Excelsior One</p>  | <ul style="list-style-type: none"> • 14 wavelengths from UV to IR • Free space and fiber-coupled models • High brightness direct diode technology | <ul style="list-style-type: none"> • Flow cytometry • Confocal microscopy • Semiconductor inspection |
| <p>Excelsior</p>  | <ul style="list-style-type: none"> • High-quality TEM₀₀ beam • 14 wavelengths from UV to IR • Full suite of OEM and Scientific models | <ul style="list-style-type: none"> • Flow cytometry • Confocal microscopy • Semiconductor inspection |
| <p>Millennia eV</p>  | <ul style="list-style-type: none"> • Low cost of ownership • Industry leading power • Compact, rugged design | <ul style="list-style-type: none"> • Materials processing • Ultrafast spectroscopy • Laser doping of solar cells |
| <p>Vanguard</p>  | <ul style="list-style-type: none"> • Outstanding power stability • High power, Quasi-CW UV output • High power, mode-locked 532 nm output | <ul style="list-style-type: none"> • Rugged industrial platform • Closed-loop power control • Near diffraction-limited output |

EXPERIENCE

For over 60 years, Spectra-Physics Lasers innovations have provided an invaluable tool for advancement of scientific research, biological imaging, fine material processing and medical applications.

Today, Spectra-Physics has more ultrafast lasers installed and actively used worldwide than any other laser manufacturer. Our support team has the most experienced and skilled service engineers. As a Spectra-Physics laser user, it means you can always rely on direct, local support—a key advantage towards fast tracking your ultrafast application.

MKS GLOBAL SERVICE LOCATIONS

SPECTRA-PHYSICS



For more information, please visit:

www.spectra-physics.com

www.mksinst.com

WHY MKS?

CRITICAL TECHNOLOGIES

World-class technology and development capabilities for leading-edge processes



PROVEN PARTNER

Recognized leader delivering innovative, reliable solutions for our customers' most complex problems



OPERATIONAL EXCELLENCE

Consistent execution across all aspects of our business



COMPREHENSIVE PORTFOLIO

Largest breadth of product and service solutions for the markets we serve



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www.spectra-physics.com

Spectra-Physics is a brand within the MKS Instruments Light & Motion division. The Spectra-Physics product portfolio consists of a broad spectrum of lasers for precision industrial and scientific research applications. Spectra-Physics products combine groundbreaking laser technologies with deep applications expertise to deliver disruptive performance and lower total cost of ownership. From the manufacturing floor and semiconductor fab to the research laboratory, Spectra-Physics lasers enhance our customers' capabilities and productivity in the semiconductor, industrial technologies, life and health sciences, and research markets.

For more information, visit www.spectra-physics.com

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