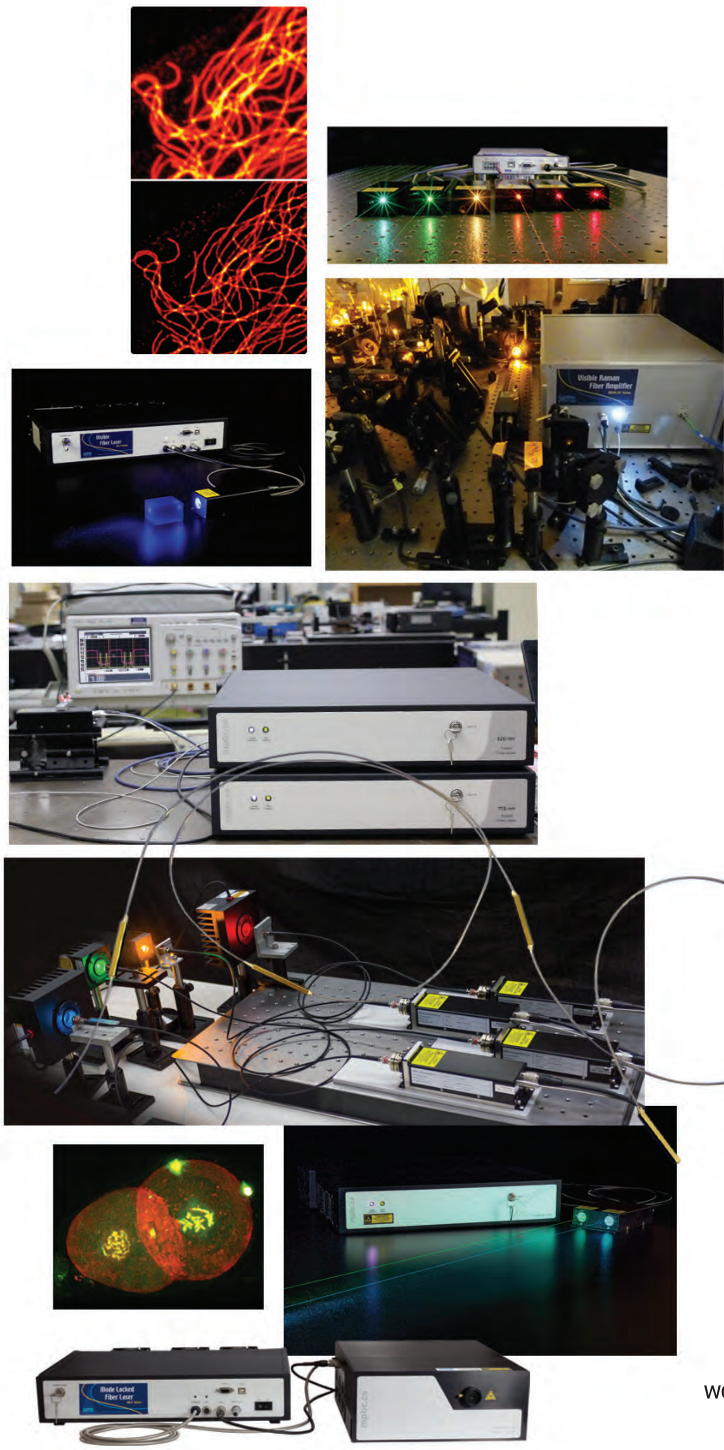
Visible Fiber Lasers For Bioscience



MPB launched the first visible fiber laser at Photonics West in 2006. During the conference, this compact 1-Watt 560-nm laser, with exceptional beam characteristics, quickly became known as a product "looking for an application".

It didn't take long for application ideas to find us. However, as with any new application, feasibility had to be proven. The best way forward? Take on the challenge of developing lasers for specific applications by working closely with the scientific community. A low power 580-nm laser was developed in conjunction with Dr. William Telford for the NIH National Cancer Institute Core Flow Cytometry Facility; a 592 nm laser for Nobel Laureate Dr. Stefan Hell at Max Planck Institute for STED microscopy; 488-, 532-, 560 - and 642- nm laser for Light Sheet Microscopy for Nobel Laureate Dr. Eric Betzig at HHMI; a 22-W 589-nm single frequency system for the European Southern Observatory's "Next Generation" Guide Star....

Our laser portfolio now includes these visible fiber lasers along with dozens of commercially available wavelengths in the visible and NIR range. With various output powers, multimode or single-frequency, modulated or pulse variants, all lasers have a reputation for unsurpassed beam quality, reliability and stability. We have evolved from "looking for an application" to becoming the "go-to" company for leading researchers and industrial laser users worldwide.

MPB
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Visible Fiber Lasers

brilliant power and performance

MPB's Fiber Laser Product line has grown out of its highly reliable Raman Fiber Laser deployed for 20+ years in telecom fiber optic systems. Exceptional performance is achieved based on an all-fiber architecture, which draws on MPB's telecom design practices. The all-fiber laser design eliminates the need for alignment as no bulk components are used, provides unprecedented wavelength and output power stability, and ensures a diffraction-limited linearly-polarized output.

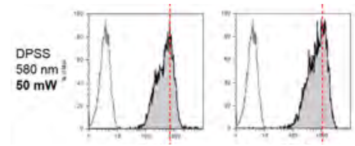
MPB is able to offer a variety of wavelengths based on similar architectures by employing its own fiber Bragg gratings to lock the laser wavelength. Built-in intelligence allows control and monitoring through a user-friendly graphical user interface via an RS-232 or USB port and features automatic power control for excellent power stability.

Some Collaborations

2004-2005

Our first Visible Fiber Laser - a 200 mW 560-nm developed for Harvard University Department of Chemistry

2006-2007



Low power 580 nm laser in conjunction with William Telford, NIH National Cancer Institute Core Flow Cytometry Facility

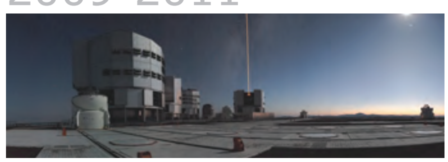
2007-2008

Development of low power 592 nm laser for testing in conjunction with Vladislav Verkhusha, Albert Einstein College of Medicine

2008-2009

Development of the 592 nm 1.5 W laser for Nobel Laureate Dr. Stefan Hell, STED System, Max Planck Institute

2009-2011



Development of 20 W single frequency laser for the Very Large Telescope Guide Star, European Southern Observatory

2010-2011

Development of the high power lasers for Light Sheet Microscopy for Nobel Laureate Dr. Eric Betzig, Howard Hughes Medical Institute

2010-2012

Development of a suite of single frequency lasers for Atom Cooling, Prof. Martin Zwierlein, MIT

2012-2014

Development of externally triggered pulsed lasers for Nobel Laureate Dr. Stefan Hell, next generation STED platform, Max Planck Institute

2013-2014

Development of 750 nm CW 500 mW laser for STORM applications, Harvard University

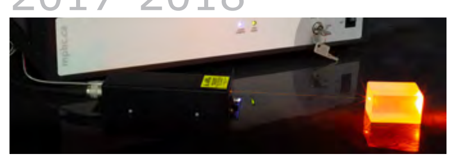
2015-2016

Development of an internally / externally triggerable pulsed 631 nm laser for Max Planck Institute Gottingen Germany

2016-2017

Development of Single Mode Fiber Coupled Lasers with powers up to 1.3 W for Richard Terry Wyss Institute at Harvard University

2017-2018



Development of a High Power 607 nm CW laser for Nobel Laureate Eric Betzig

2014-2015

On-going development of fiber lasers for microscopy applications for Dr. Gael Moneron & Dr. David DiGregorio, Institut Pasteur Paris

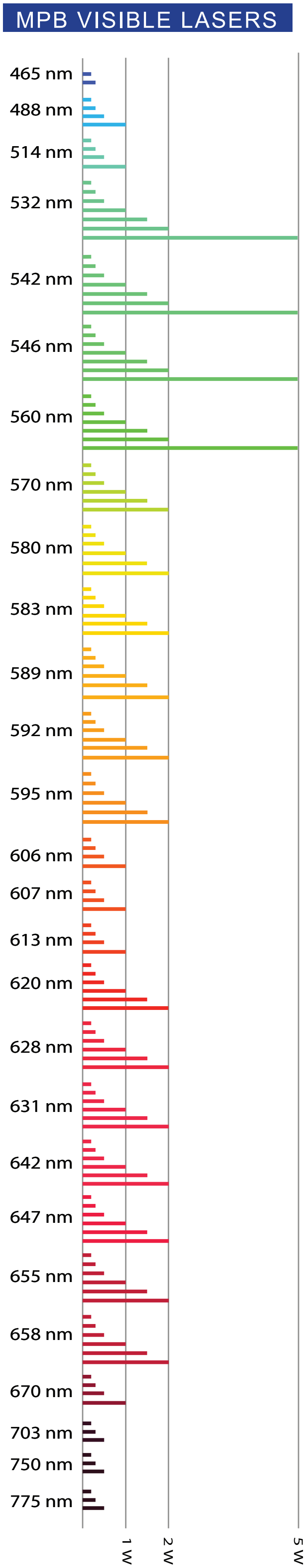
2014-2015

100 W 1178 nm Raman Fiber Amplifier for the European Southern Observatory for next generation Guide Stars and to assist in resolving the resolution of the atmospheric turbulence problem experienced in uplinks in Optical Ground Station installations.

2019-2020

Development of a high power 1040 nm femto-second fiber laser featuring an all-fiber design (no bulk optics) for Dr. Arjun Krishnaswamy of McGill University's Life Sciences Complex

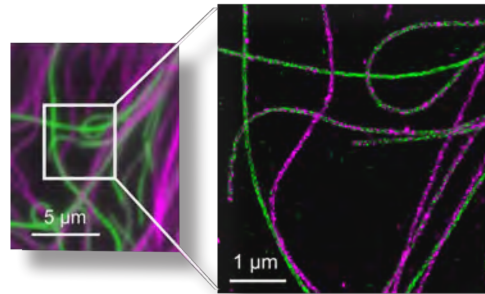
Lasers In The Field



STORM - *The images show two-color microtubule staining in a fixed and immunolabeled* ***B-SC-1 cell*** *that has been* ***stained for tyrosinated (magenta) and detyrosinated (green) tubulin*** *using antibodies. Close inspection reveals a hollow feature on quite a few segments of the microtubules, which is only possible to see when the system and samples are done really well. You can see from the image how much better* ***STORM*** *does than conventional microscopy.*

Courtsey Joshua C. Vaughan, Ph.D., Assistant professor, Department of Chemistry, University of Washington

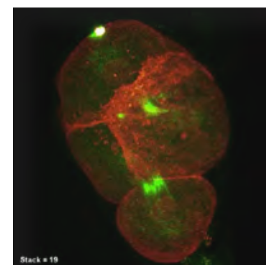
using MPB 750 & 647-nm Lasers



LATTICE LIGHT SHEET - *Localization of the chromosomal passenger protein AIR-2 during the first few cell divisions of the early C. elegans embryo (cf., Fig. 6A, fig. S12).*

Courtesy Betzig Lab, HHMI/Janelia Research Campus, Bembenek Lab, University of Tennessee

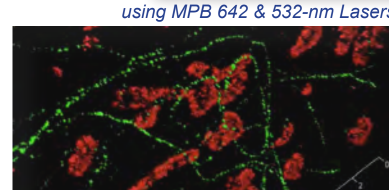
using MPB 642, 560, 532 & 488-nm Lasers



Ground State Depletion Microscopy - GSD *COS cells stained for microtubules with Alexa 647 and mitochondria with Alexa 555.*

Courtesy Leica Microsystems
Prof. Ralf Jacob, Philipps-University Marburg

using MPB 642 & 532-nm Lasers

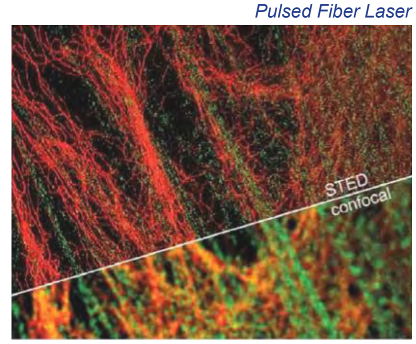


"Next generation" STED - *The* ***STED*** *laser is a frequency-doubled pulsed fiber laser* ***(PFL1-1000-775, MPB Communications)*** *providing 1 ns pulses of up to 30 nJ pulse energy at a wavelength of 775 nm. The STED laser can be triggered electronically over a wide frequency range (25–40 MHz) which greatly simplifies the synchronization of the excitation and STED pulses.... STED beams at 775 nm wavelength are quite efficient for STED of fluorophores having peak emissions between 600 nm and 700 nm, a fact which can be used for multicolor recordings using a single-wavelength STED beam.*

Courtesy Max Planck Institute for Biophysical Chemistry

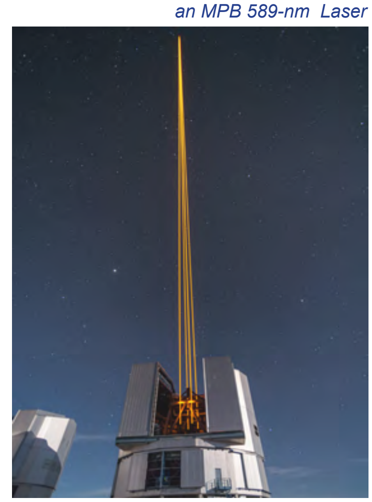
*Gorlitz , Frederik, Patrick Hoyer, Henning J. Falk, Lars Kastrup, Johann Engelhardt and Stefan W. Hell - "***A STED Microscope Designed for Routine Biomedical Applications.***" Progress In Electromagnetics Research, Vol. 147 (2014) pp. 57–68.*

using MPB 775-nm Frequency-Doubled Pulsed Fiber Laser



In this "next generation" Laser Guide Star, installed at the European Southern Observatory in Paranal, Chile, ***narrow-band 1178-nm emission from a 25-mW diode laser*** *is amplified to the 40-W level and then frequency doubled in a resonant cavity doubler to provide* ***22 W*** *at the desired sodium resonance wavelength of* ***589 nm.*** *The novel technology developed to achieve such high power amplification of an extremely narrow-band seed is the* ***polarization-maintaining (PM) Raman fiber amplifier (RFA)*** *developed by MPB. The 4 Laser Guide Star Facility (4LGSF), using four such lasers, is the most powerful laser guide star system in the world.*

using an MPB PM RFA and an MPB 589-nm Laser



F. Kamphues/ESO

Visible & NIR Fiber Lasers

Features

- Narrow Linewidth
- Beam Characteristics: TEM_{00}, M^2<1.1
- Active Power Stabilization to ensure longterm power stability of < 2%
- Excellent wavelength stability (± 0.02 nm)
- Graphical User Interface for easy command and control
- Compact laser head
- Tunable output power (from 20% to 100% of nominal) to adapt to application-specific requirements
- High reliability
- Maintenance-free

Applications

- Flow Cytometry
- Fluorescence Microscopy
- Structured Illumination Microscopy
- Super Resolution Microscopy
- Light Sheet Microscopy
- Atom Cooling
- Dual Photon Microscopy
- 3rd Generation DNA Sequencing
- Micromachining
- Optical Tweezers
- Holography
- Entertainment
- Military and Scientific Research
- Environmental Sensing

About MPB

MPBC is a leading supplier of innovative, high performance fiber laser and fiber amplifier systems and subsystems to the international high tech industry.

The company is privately held and self-financed. It has maintained its technological leadership through an on-going commitment to R&D, investing approximately 20% of annual revenues back into research and development. MPB Communications Inc. is a Certified Women's Business Enterprise, and part of the WEConnect International's Global eNetwork.

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Laser Heritage

MPB's ***Flight Sensor Demonstrator****, currently aboard ESA's PROBA-2 marks the* ***first time a fiber laser incorporated into an all-fiber-optic sensing system on a satellite is in space.*** *The system has been operating successfully since the satellite was eployed in 2009.*

Three innovative FBG sensors are included in the ***PROBA-2*** *systems. The custom FBG gratings were manufactured using MPB's proprietary FBG writing facility.*

MPB's ***patented Super Raman technology****, based on third-order pumping techniques, is recognized throughout the telecommunications industry as a key enabling technology which appreciably augments the distance and channel counts of unrepeatered systems. The award-winning Super Raman Fiber Laser was first introduced in 2002.*

In 1992, MPB introduced the **first commercially available Er^{3+} fiber laser.** *This was followed in 1994 by the introduction of the* ***award-winning tunable single-frequency Er^{3+} fiber laser****; the lowest-phase-noise source of any kind available commercially at the time.*

From 1977 and for over 20 years, MPB offered a ***GN-Series CO_2 Laser System.*** *Their long lifetime (most over 10 years), exceptional stability and excellent mode quality were unmatched in the industry.*

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