The FISBA READYBeam™ — Robust, Compact Turnkey Three-Laser Source

Reliable Multi-wavelength Source Optimizes System Design, Assembly, and Operation

The FISBA READYBeam™ is a plug-and-play light source tailored to any application requiring three independent moderate-power collinear laser beams. The READYBeam is a small, efficient, three-diode assembly with integrated electronic and thermal control systems. The three laser outputs are coupled into a single-mode polarization-maintaining optical fiber, providing maximum flexibility for life science, food industry, industrial metrology, projection and display, and other applications.

The READYBeam is the latest embodiment of the FISBA legacy of precision Swiss engineering — a legacy that spans more than 60 years.

The FISBA READYBeam™ is a compact multi-wavelength laser source.

During those decades, FISBA has built a reputation for producing high-quality standard and custom-designed products to strict specifications. FISBA's robust design and fabrication processes ensure that stringent requirements are met at delivery and throughout the entire product life cycle. The READYBeam carries on that tradition, delivering maximum customer value.

A Truly Complete Light Engine

The module combines beam-shaping optics, electronic drivers, and thermal controls in a compact, robust assembly. Beam quality and output stability meet the demands of challenging industrial and life science applications.

The optical alignment and mechanical stability eases system design and assembly. Fabricating multi-wavelength optical systems is a delicate task. Whether the system is intended for research use or industrial-scale production, coaligning individual sources is a painstaking process. Maintaining that alignment is an equally important task. For those applications that demand polarization control, the task becomes even more complex. The READYBeam's fiber-coupled outputs create three intrinsically aligned laser sources, with their polarization axes precisely defined.

The integrated electronic drivers simplify beam output control. Optical alignment puts the beams where they're needed, but that's only the first step. Each of the beams must also be present when it's needed, and at the right output power. The electronic drivers included in the READYBeam make that task simple: the output power and temporal characteristics are all controlled through a standard RS-485 interface. Internal optical power monitors provide closed-loop control, providing "set it and forget it" simplicity.

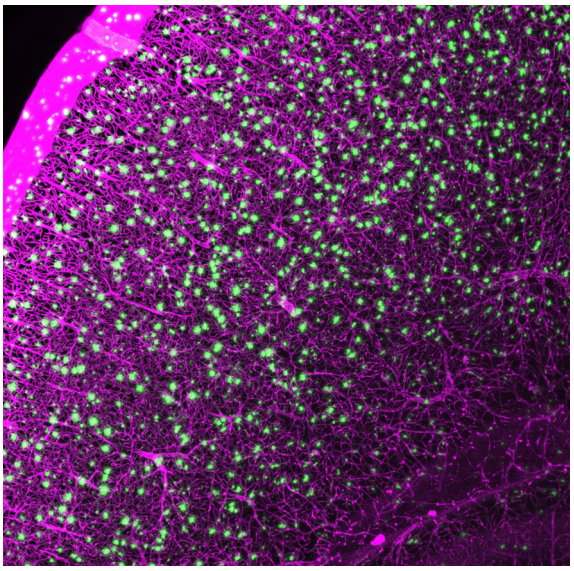
The READYBeam's included thermoelectric control system provides maximum stability, reliability, and lifetime. Laser diode characteristics are strongly dependent on temperature, therefore this parameter requires special attention. In addition, diode lifetime is maximized if the temperature is maintained within a given range. Temperature control requires proper design, accurate temperature measurement, and efficient feedback loops.

The READYBeam outputs are single mode, with excellent stability. Ease-of-use is the primary benefit of an integrated light engine, but maximum customer value only comes with outstanding beam quality. The 3 µm fiber core delivers a TEM00 beam profile, with an M2 less than 1.1. The fully integrated turnkey concept removes many of the headaches of instrument design for engineers, but does not compromise on quality.

The READYBeam covers a broad range of life science and industrial applications. The standard READYBeam bio outputs are at 405, 488, and 638 nm, wavelengths that match common fluorescent dyes. The standard READYBeam ind outputs are at 450, 520, and either 660 nm (ind1) or 638 nm (ind2). Those wavelengths are targeted towards projection and display, industrial metrology, and object recognition applications. Furthermore, individual diode combinations can be requested, providing wavelengths to meet unique customer needs.

READYBeam Simplifies Life Science Applications

Fluorescence microscopy



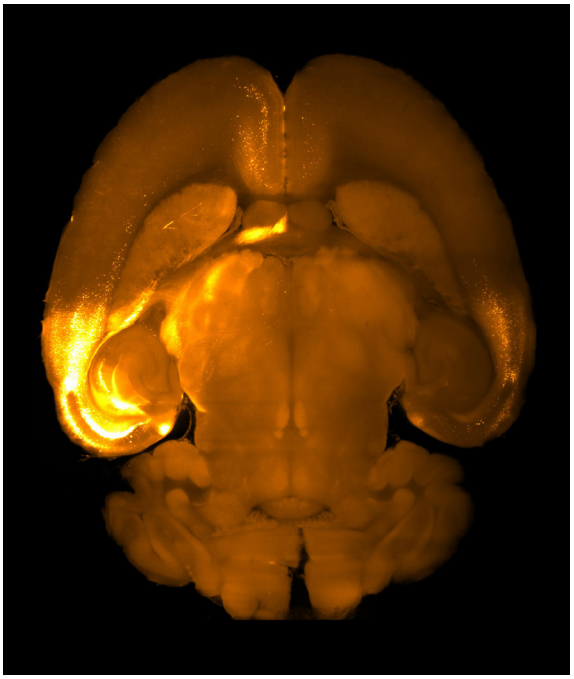
Alzheimer plaques and blood vessels in a cleared mouse brain. Anna-Maria Reuss (Neuropathology, University Hospital Zurich). Fabian Voigt (Brain Research, University of Zurich) using a mesoSPIM light-sheet microscope (mesospim.org).

The READYBeam is explicitly designed to streamline fluorescence microscopy for biological and biomedical applications. The standard wavelengths are in the excitation windows for typical fluorophore families. 405 nm, for example, excites DAPI, blue fluorescent protein and its derivatives, and DyLight 405. 488 nm excites Cy2, YOYO-1, and Alexa Fluor 488. 638 nm is a good excitation wavelength for fluorophores such as Cy5, TOTO-3, and allophycocyanin. That means the READYBeam comes out of the box ready to help streamline fluorescent microscopy applications.

For standard fluorescence microscopy, where the entire imaging volume is illuminated, the READYBeam offers the possibility of acquiring simultaneous or sequential imaging of each fluorophore. The READYBeam sources can be both digitally or analog-modulated, and the "off" mode provides a true dark state — minimizing unnecessary fluorophore excitation and decreasing bleaching.

In confocal fluorescence microscopy, the excitation source and the emitted light are each propagated through pinholes. The pinholes are optical conjugates of one another, which allows imaging of a single point of the specimen. As the conjugate points move, a different spot within the sample is imaged. The images are then reconstructed to create a two- or three-dimensional model of fluorophore distribution. To create an image of more than one fluorophore, multiple excitation sources need to be sent through the same pinhole; and to create high-quality images, the output power at each wavelength must be consistent throughout the imaging process. The READYBeam comes out of the box with three wavelengths from a single mode fiber, providing that output power stability.

Light sheet microscopy is a variant of fluorescence microscopy, that allows imaging and 3D reconstruction of large specimens.



GFP-labeled neurons in a cleared mouse brain.

Yasir Gallero-Salas, Fabian Voigt (Brain Research, University of Zurich) using a mesoSPIM light-sheet microscope (mesospim.org).

Flow Cytometry

Flow cytometry is a method of rapidly classifying cells and other microscopic entities. The cells of interest are channeled through a narrow microfluidic device. Light beams are sent through the channel, and the scattered and fluorescent light is collected. With multiple light sources, the ratio between the intensity emitted at different wavelengths can be used to collect multiple parameters of interest simultaneously, enabling rapid classification of large numbers of cells. Because the READYBeam is compact, self-contained, and robust, it is well-positioned to be the light source of choice for portable flow cytometry instruments.

High Throughput Screening

High Throughput/High Content Analysis and Screening is the umbrella term for methods that rapidly interrogate small samples and evaluate their response to a given stimulus. For example, pharmaceutical researchers may screen 1536-well plates of cell cultures to identify their response to different small-molecule drug candidates. Speed is key. The READYBeam can be digitally modulated at rates up to 1 MHz, with rise and fall times of 11 ns, meaning each compartment of a 1536-well plate can be independently interrogated with each of the three wavelengths as fast as the plate can be moved.

The READYBeam in Industrial Applications

Displays

The output power of each of the three READYBeam sources is independently controlled, which means the color of the combined beam can be adjusted anywhere within the gamut of the three laser diodes. With 40 mW of output in the red and blue, and 30 mW in the green, analog modulation frequency up to 20 kHz, and digital modulation as fast as 1 MHz, the READYBeam is prepared to be at the heart of display and projection applications.

Advanced Optical Inspection

Optical metrology and machine vision techniques have proved their ability to improve the speed and efficiency of industrial operations. Measuring shape, angle, position, color, and distance are key elements of automated processes and quality control on the factory floor. The READYBeam opens new horizons: adding multi-wavelength capabilities is now as simple as replacing existing monochromatic sources.

A Light Engine for the Future

The READYBeam is conceptually simple: a complete optomechanical, electronic, and thermal package that provides high-quality, highly polarized output beams at three distinct wavelengths. The value of the READYBeam is in precision engineering and quality manufacturing, and the result is a dependable, stable optical source ready to be integrated with ease into future instrumentation. Those qualities are built into every FISBA Laser, both the standard products and custom-designed versions. Designers who incorporate the READYBeam into their systems are already ahead of the game: As a true turnkey solution and as an OEM product the READYBeam facilitates the integration into existing instrumentation as well as their technological development and evolution.

FISBA RGBeam™: When Precision Optical Alignment is Enough

The turnkey READYBeam is the optimum solution for those looking to focus their development efforts on the applications of a multi-wavelength source. For those looking only to apply the powerful functionality of an adjustable three-wavelength source while providing their own electronic and thermal control, the RGBeam is the right solution. It contains three diodes in either a fiber-coupled or free-space design. The package is compact and optomechanically stable; designers need only to mechanically attach the package, manage the thermal interface, and furnish electrical power and electronic control to the diodes.

Like the READYBeam, the RGBeam is available in standard packages with wavelengths suited for life science and industrial applications and can also be customized for unique situations. It also offers complete control over the composition and temporal characteristics of the output light.

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