

The **BEST** new light in fluorescence illumination:

Lumencor's light engines employ **SOLID STATE** technologies to provide:

- ▶ powerful
- ▶ pure
- ▶ discrete
- ▶ stable
- ▶ robust
- ▶ long lived
- ▶ facile, fast outputs.

Lighting designed to reduce photodamage to biological samples.

A light engine is the smart illumination choice

Now you can image all the common fluorescent dyes, proteins and conjugates with a lighting subsystem that has been optimized to maximize fluorescent response as well as to offer stable, robust lighting performance. Lumencor light engines embody novel solid state lighting solutions to give you optimal power throughout the visible spectrum and the added performance you need for live cell imaging:

►Up to **SEVEN** discrete bands for all the most important fluors:

DAPI, Hoechst,CFP, GFP, FITC, YFP, TRITC, Cy3, Texas Red, mCherry, Cy5, and others

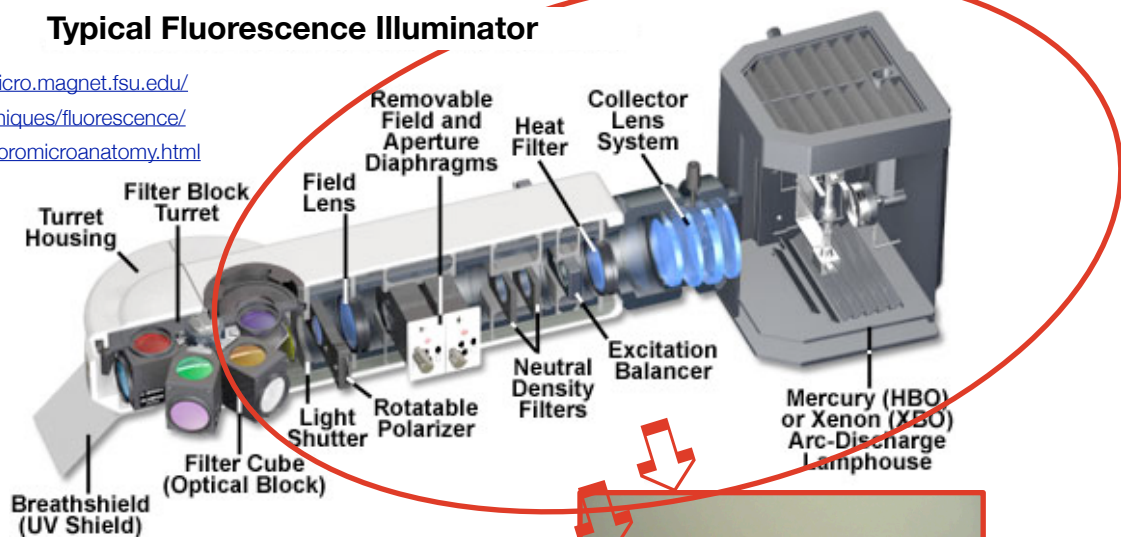
- Spectral & power stability
- Spectral purity, no out of band light
- Completely flat illumination
- 100x faster switching than filter wheels- microseconds
- No external filters, shutters
- Quiet and no heat generation
- Ideal for electrophysiology & systems sensitive to electrical noise
- Controllable by common microscopy automation software
- Long life > 10,000 hours
- Easy to use

Value, Easy to Use and Low Cost -compared to today's illuminators

Lumencor's light engine is unique in today's market where lighting for microscopy and life science applications has required the design of a complete illumination subsystem. Now one can **replace the entire ensemble of sources, excitation filters, filter wheel, field diaphragm, aperture, shutter and controllers** with a simple, easy to operate unit.

Typical Fluorescence Illuminator

ref: <http://micro.magnet.fsu.edu/primer/techniques/fluorescence/anatomy/fluoromicroanatomy.html>

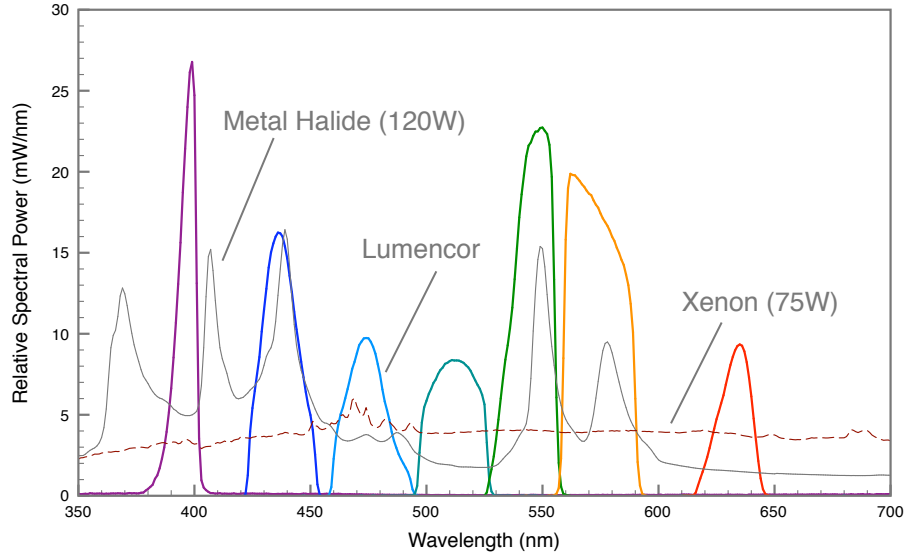


The Lumencor light engine is a complete optical train replacement.



Spectrally Pure Outputs

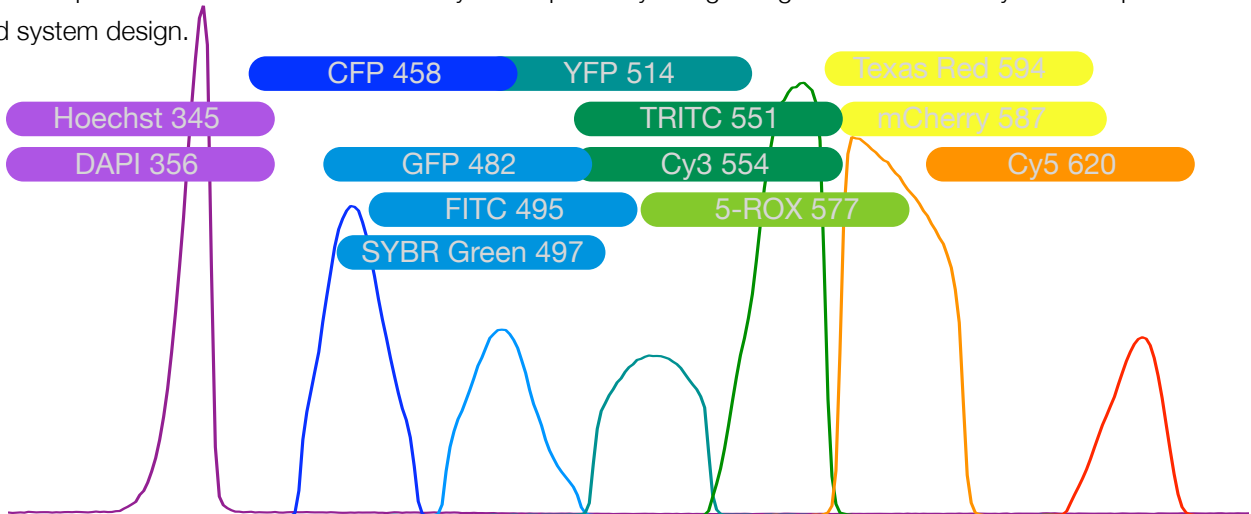
An ensemble of solid state sources in each light engine produce the user defined multicolor output bands. Light engine power levels in each discrete color band match or beat those of comparable metal halide and xenon lamps. Light engine outputs require no compromise in power while offering the added benefits of stability, durability and ease of



use. Performance exemplified by the light engine outputs in this spectral plot are constant and stable. Unlike traditional lamps, they will not decay significantly with time, or during the course of a multi-day experiment. Researchers and tool designers alike can attain constant, spectrally pure and powerful bands with no need for external filters, filter wheel, shutters, controllers that other light sources require.

Discrete Colorband Options

Choose from Lumencor's palette of **standard outputs or define your own** optimal wavelengths and bandpasses. Lumencor will work with you to optimize your light engine to best match your fluorophores and system design.



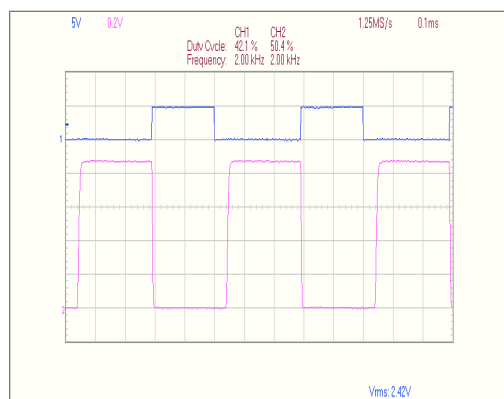
Colors	Violet	Blue	Cyan	Cyan	Teal	Green	Green	Yellow	Red	Red
Output, nm	390	438	475	485	513	549	560	575	632	650
Width, nm >90%	18	24	28	20	17	15	25	25	22	13
Power, mW	250	325	225	225	110	750	750	650	225	200

Note: All nominal wavelengths and bands are customizable, please inquire

Features and Benefits

Features	Benefits
Product is a light engine not a light source	Product functions as entire illumination subsystem: sources, excitation filters, filter wheel, shutter, controller, field diaphragm
High performance output: UV-Vis-NIR	Excitation subsystem to employ for numerous bioanalytical instruments including fluorescence microscopy
Up to seven colors in a fully integrated, compact box	Multicolor analysis with optimal wavelengths to achieve efficient fluorophore excitation; standard and custom wavelengths
Intensity of 1 - 10 W/cm² per output band	High intensity operation, fast time experimental protocols
Output power independently selectable for each band	Employ outputs simultaneously or sequentially
Direct couple to major scopes; liquid light guide; optical fiber or fiber bundle	Easy to implement with any commercial microscope, adaptors for many instrument architectures available
Pre-aligned outputs	No alignment required, coaxial illumination in all colors
Fast switching times (5 - 10 kHz) for each output, no external shutter required	Fast exposure times for photosensitive applications and high throughput requirements
Flat illumination field	Superior uniformity across entire sample/s
Computer or manual control	Remote/automated control of color, intensities, switching speeds
Safe to operate	No training required and easy implementation
Minimal heat output	No addition thermal management required
Long lifetime	No maintenance cost

Fast Color Switching



Independent control: Each color operates independently

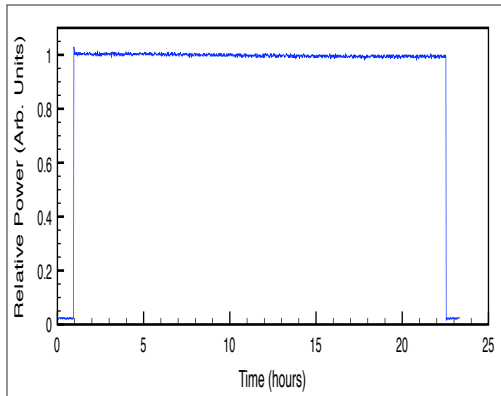
On/Off switching: Trigger via TTL, RS232, USB

Intensity control: Choice of RS232, USB

Switching rates: Up to 5 kHz

Fast rise and fall times: $t_{\text{rise}} < 10 \mu\text{s}$, $t_{\text{fall}} < 5 \mu\text{s}$

Stability and Lifetime



DC Powered: No RF Noise, no arc wander

Peak to Peak Noise: 2% for 24 hours continuous operation

Short term stability: 1.0 ms ~ 0.5% & 0.1 ms ~ 0.05%

Power monitoring option: For ratioing and feedback functions

MTBF: ~ 10000 hours

Proprietary Illuminator

Lumencor builds lighting subsystems, light engines, to facilitate individual research efforts as well as to support OEM's new and existing instrument designs. Light engines are hybrid solid state optical subsystems. Sources for submodules are designed around a variety of solid state technologies, each optimized for the spectral output of interest. Key to Lumencor's performance is the light pipe technology highlighted in a white paper on the website, www.lumencor.com. Lumencor provides the hardware to support pure, powerful, stable lighting for a broad array of bioanalysis tools including fluorescent microscopes. Moreover, our highly technically trained staff supports the integration and implementation of these lighting subsystems in an optimal manner for your application.

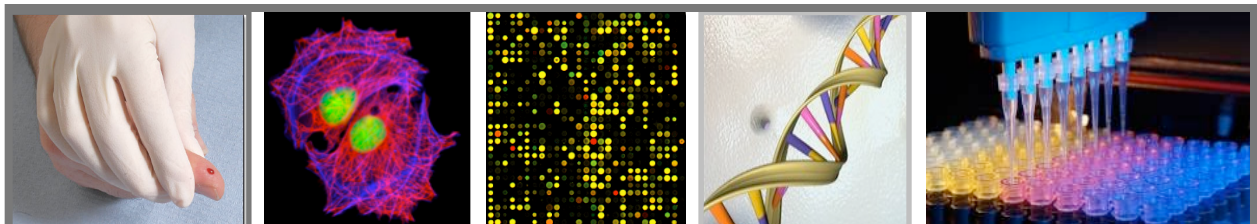
Products and Common Applications

LUMA light engine™
 blood typing
 environmental sensors
 sequencing

AURA light engine®
 endoscopy
 gene expression analysis
 live and fixed cell imaging

RETRA light engine®
 diagnostic tools
 gene expression analysis
 microarray scanners

SPECTRA light engine®
 broadband lamp replacement
 digital pathology
 high content screening



Specifications

Metric	Value
Spectral bands	380 nm to 700 nm, NIR upon request
Power 3 mm, 0.3 NA	150 - 750 mW per band, function of wavelength and bandpass
Switching speed	5 kHz with turn on/off ~ 10 μsec
Stability	< 2% peak to peak
Out of band rejection	> 10 ⁻⁶ with no IR or UV
Field uniformity	< 5% peak to peak
MTBF	~ 10000 hours
Output adapter	Köhler, critical, direct, light guide
Power monitoring	instantaneous or dosage
Computer interface	TTL, RS232, USB
Software platforms	ImageProPlus, iVision-Mac, IQ, MatLab, MetaMorph, MicroManager, Elements, Slidebook
Power requirements	120 W, 24 volt, 5 Amp
Weight, Dimensions	three to seven colors: 3.6 - 4.5 kg, 9 x 18 x 28 cm
Certifications	TUV Certified, CE label
Warranty	36 months, no replaceable parts during light engine lifetime

Light Engine Options and Accessories

SPECTRA X light engine: All the features of the SPECTRA 7, now with user-exchangeable filters.

Remote Control Accessory (RCA): Gives users the ability to easily control the SPECTRA light engine with real-time display of light engine settings and no need for a separate computer or third-party software.

Camera Interface Accessory (CIA): Offers synchronization capabilities for the SPECTRA light engines with third party equipment such as cameras, eliminating unnecessary illumination of biological samples to minimize photo-bleaching and photo-toxicity.

Simultaneous Output Option: Higher voltage power supply enables users to operate up to six color channels simultaneously.