lumencor®

LIGHT FOR LIFE SCIENCES

Technology Overview

BRIGHT. CLEAN. GREEN.

LIGHT ENGINES

MERCURY-FREE

LIGHT FOR LIFE SCIENCES

The BEST new light in fluorescence illumination.

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

- Powerful and intense light
- Spectral breadth and purity
- Fast switching speed
- Long lived, stable outputs
- Mercury-free, efficient products
- Cool, clean, compact & easy-to-use box

Mercury **FREE** Microscopy™

lumencor®

a light engine

IS A HYBRID OF SOLID STATE TECHNOLOGIES

Lumencor's proprietary light engines are excitation subsystems.
They Include:

- A maximum of six light sources combined into a single output
- The option to include a NIR source in place of a VIS source
- Mirrors and optics to direct the light and define the spectral output
- An optical adapter to couple the light to an instrument (i.e., a microscope)
- Electronics to support spectral, temporal and quantitative control of the light

Multiple Light Engine Sources

NOTE: Optional NIR source available.

The optics and mechanics of coupling are optimized for a microscope, high content screener, gene expression chip reader or for a customized instrument. All these elements combined constitute a light engine. They are considered in each design and included in the purchase price.

Lumencor's technology incorporates the use of a variety of solid state sources in one optical train. Any one light engine can embody as many as three types of sources: LED, light pipe and laser. Lumencor employs these sources in customized designs to meet the wide array of spectral and power demands on the part of the end user. This flexibility means optical designs can readily be tailored to provide outputs from 370 to 900 nm. Lasers are employed as needed or specified by the user. Laser speckle patterns are eliminated. Modular in design, lighting systems are tailored to best meet the requirements and configuration needs of the user.

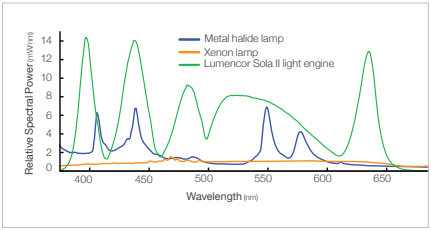
LUMENCOR
manufactures both spectrally pure outputs and bright white lamps

Lumencor's illuminators are designed to support the broad and varied need for high performance lighting in the life sciences. Discrete color bands are available for exciting numerous fluorophores; and bright, white light is produced as a mercury-free replacement for the arc lamp.

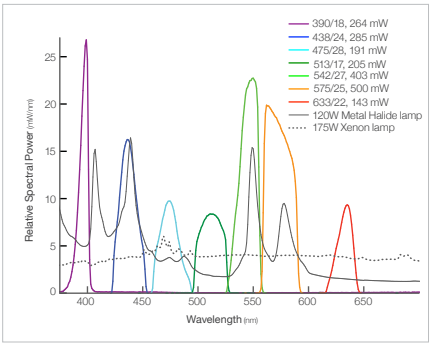
- SOLA light engines require filtering; filters and mirrors are all external to the light engine.
- SPECTRA light engines contain excitation filters.
- SPECTRA X light engines allow the user to exchange its excitation filters.
- Off-the-shelf and tailored lighting solutions are available.

Light engine outputs, shown in these spectral plots, are both constant and stable. Unlike lamps, they do not decay significantly over time. Researchers and tool designers alike can attain constant, spectrally pure and powerful light - all without the need for the external filters, filter wheel, shutter and controllers that arc lamps require.

SOLA light engine



SPECTRA light engine



A document is available that summarizes Lumencor's full list of filter band offerings and corresponding optical output power (mW) and intensity (mW/cm2).

colorband options

Light engine power matches or bests that of the mercury, metal halide and xenon lamp, in any comparable spectral band. Particularly in the green, yellow and red regions, Lumencor provides more light. Examples of some common excitation bands, matched to commerically available dichroics and emission filters are shown below. Numerous customer specified filters are accommodated; custom filters are available upon request. Please speak to your Lumencor sales representative to confirm the best filter prescription for your intended use.

filter options

A sample of filter options; many others and custom filters available upon request.

			Recommended Chroma Product	
Color Band (nm)	Fluor	Light Engine Outputs (nm)	Dichroic (nm)	Emission Filter (nm)
Violet (380-410)	DAPI, Hoechst	395/25	T425lxpr	ET460/50m
Blue (420-450)	CFP	440/20	T455lp	ET480/40m
Cyan (460-490)	GFP, FITC	470/24	T495lpxr	ET525/50m
Teal (500-520)	YFP	510/25	T525lpxr	ET545/30m
Green (535-600)	TRITC, Cy3	550/15	T565lpxr	ET605/70m
Yellow (535-600)	mCherry	575/25	593	641/75
Red (620-750)	Cy5	640/30	T660lpxr	ET700/75m
NIR	Cy7	740/13	T760lpxr	ET810/90m

		Recommended Chroma Product	
Analysis	Light Engine Outputs (nm)	Dichroic (nm)	Emission Filter (nm)
DAPI/FITC/TRITC/Cy5	395/25; 470/24; 550/15; 640/30	t390/475/515/630rpc	ET435/510/595/705m

fast switching speed options

Fast switching is needed in illuminators designed to support live cell imaging and high throughput analysis. Lumencor's products have electronic switching and shuttering between color bands and among intensities, on the order of 10's of microseconds or less. In contrast, 100 ms is typically required to rotate a filter wheel between positions. The fastest timing of Lumencor's light engines can only be fully exploited with multiband dichroics and emission filters. They eliminate the mechanical constraints of timing tied to filter movement. One recommended polyband mirror and filter to support a common fluorophor combination is listed here. Many others can be used, please inquire.

LIGHT ENGINE
features and benefits

Features	Benefits
Light Engine not a light source	Product is complete illumination subsystem: sources, excitation filters and wheel (SPECTRAs), shutter, controller, field diaphragm
High performance output: UV-Vis-NIR	Spectrally pure or white outputs for numerous bioanalytical instruments including fluorescence microscopy
Up to seven colors in a fully integrated, subsystem	Multicolor analysis with optimal wavelengths to achieve efficient fluorophore excitation; standard and custom wavelengths
Intensity of 1-10 W/cm^2 per output band	High intensity operation means fast (live cell) and high throughput experimental protocols
Output power independently selectable for each band	SPECTRA light engine operates in serial (sequential) or parallel modes
Light guide or direct couple to all major microscopes	Easy to implement with any commercial microscope, with many customizations
Pre-aligned outputs	No alignment required, coaxial illumination in all colors
Electronic control	Many light engine models offer electronic control via TTL, RS232 and/or USB as well as compatibility with numerous software platforms
Fast switching times (5 kHz) for each output, no external shutter required	Fast exposure times for photosensitive applications and high throughput requirements, essentially no warm-up time
Flat illumination field	Superior uniformity across entire sample and field of view
Computer or manual control	Remote/automated control of color, intensities, switching speeds
Safe to operate	No training required for easy implementation
Clean technology and sustainable	CE certified, RoHS and REACH compliant, Mercury free
Minimal heat output	No thermal management required
Long lifetime	No maintenance costs; > 20,00 hours of use

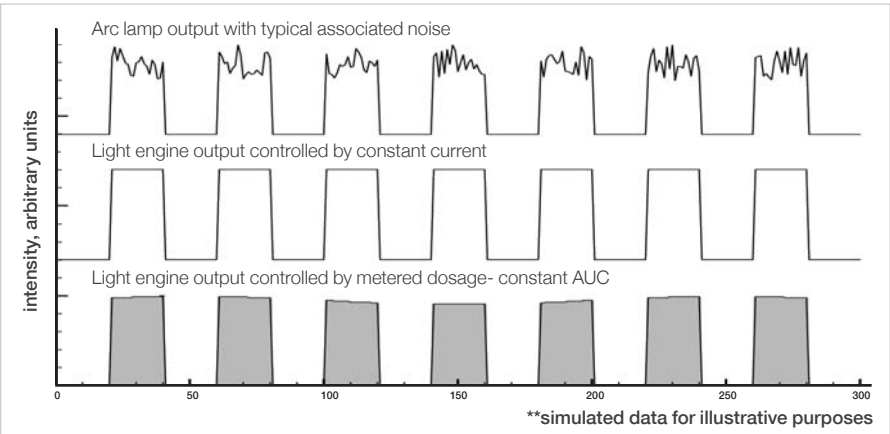
quantitation

Lumencor light engines are uniquely well suited for quantitative fluorescence analysis. Light outputs may be read as photon counts which are proportional to photon number, not intensity or power. Pulse-to-pulse reproducibility is excellent: standard deviations are typically less than 0.1%. The thermalized light engine output increases linearly in time or pulse width. All the light delivered can be monitored in real time and measured electronically. This capacity to titrate photon number in a given experiment provides an unprecedented level of precision. Therefore experimental control of light is similar to measuring reagents in a chemical reaction.

Light engine outputs can be controlled by a variety of means in order to overcome the influence of environmental changes and any light engine performance variation on the optical output. Three closed loop options exist:

- Constant current
- Metered dosage
- Constant intensity

These closed loop options are important for controlling inter-assay reproducibility but also for monitoring inter-instrument reproducibility. Metered dosage offers the most control in that the actual number of photons is known, impervious to temperature fluctuations and thus extremely reproducible. Using metered dosage OEMs (for production purposes) or large laboratories can calibrate numerous light engines, enabling all instruments to deliver precisely the same optical output power.



No other lighting technology can offer this level of quantitation and control.

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