



# A variety of Optical Luminescence Stimulation sources for lexsyg devices

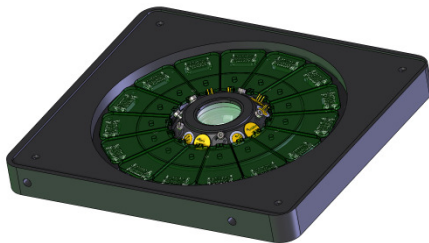
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## The Optical Stimulation (OSL) Unit

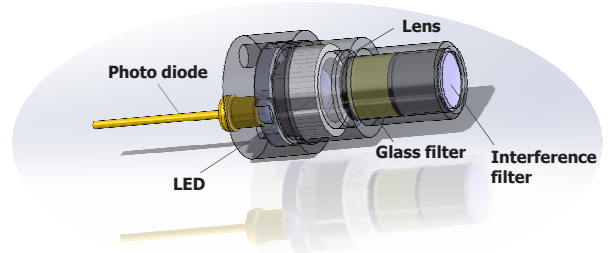
Both devices – **lexsyg**smart and **lexsyg**research - are equipped with an OSL unit containing up to three stimulation wavelengths. These are provided by high power stimulation elements optionally as LEDs or laser diodes. The integration of photodiode diodes provides the feedback for power control of each individual element, guaranteeing a stable stimulation source, independent of element aging.



**Fig. 1: Optical stimulation unit for lexsyg devices, providing maximum power stability, light homogeneity and optical power output combined with minimized PMT background and maximum signal-to-noise ratio**

The module-based setup allows changing each module within a few minutes. This interchangeability provides the possibility to use multiple OSL units per device or even a single OSL unit in different lexsyg devices.

The OSL unit holds up to 15 individual light modules, by default five per stimulation wavelength. Figure 2 illustrates the general build up of a single light module.

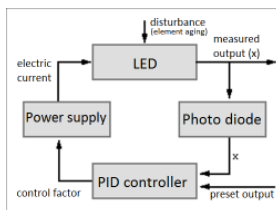


**Fig. 2: Individual light module equipped with photo diode, lens and filters**

Light output is measured by a photo diode and the light generated by each LED is collected and focused by a lens, before filtering by a combination of glass and interference filters. This provides a narrow stimulation wavelength range and minimizes the induced background by cutting the tails of emitted wavelengths.

## Power control assures stability

The optical power output is controlled by a feedback loop (figure 3) using the photo diodes next to each LED or laser diode. While the photo diode measures the emitted optical power, the software based PID controller compares and equalizes predefined and measured optical power output by **individually** adjusting the current of the corresponding LED or laser diode per millisecond. By logging and displaying the emitted optical power of each **individual** light module for all OSL measurements, the guaranteed long lasting optical power stability

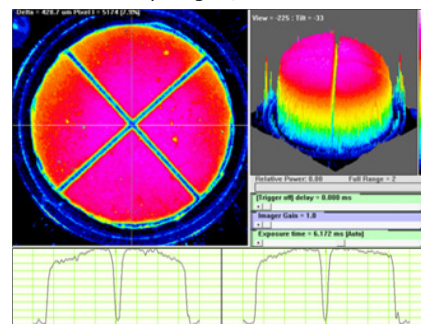


**Fig. 3: Concept of power control**

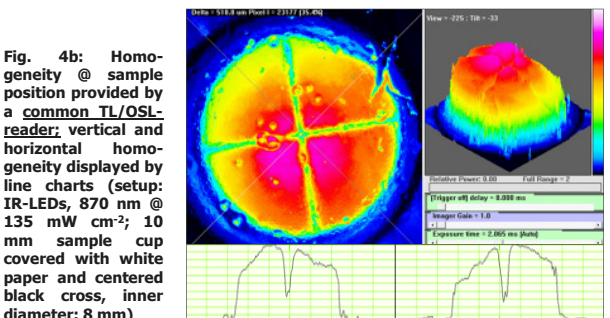
is demonstrated. Neither element aging nor external impact can influence the power controlled light module.

## Homogeneity

The quality of homogeneity, necessary to provide identical measurement conditions for each individual grain on a sample cup, can be realized by lenses in front of each light module. Figures 4a and 4b compare the homogeneity of lexsyg OSL units for 8 mm diameter to competing TL/OSL readers without lenses.



**Fig. 4a: Homogeneity @ sample position provided by lexsyg OSL unit; vertical and horizontal homogeneity displayed by line charts (setup: IR-LEDs, 850 nm @ 135 mW cm<sup>-2</sup>; 10 mm sample cup covered with white paper and centered black cross, inner diameter: 8 mm)**



**Fig. 4b: Homogeneity @ sample position provided by a common TL/OSL reader; vertical and horizontal homogeneity displayed by line charts (setup: IR-LEDs, 870 nm @ 135 mW cm<sup>-2</sup>; 10 mm sample cup covered with white paper and centered black cross, inner diameter: 8 mm)**

## Power and Wavelengths

	Violet	Blue	Green	Yellow	IR
Wavelength (nm)	405 ± 3	458 ± 5	525 ± 20	590 ± 30	850 ± 3
Optical Power (mW cm <sup>-2</sup> )	100	100	40	20	300
recommended	340 ± 13	340 ± 13	340 ± 13	340 ± 13	340 ± 13
Detection windows (nm)		365 ± 25	365 ± 25	365 ± 25	414 ± 23
			414 ± 23	414 ± 23	575 ± 12

**Tab. 1: Available stimulation sources and correspondent parameters**

## Summary and Conclusions

For scientific research reproducible measurements, provided by maximum power stability and homogeneity of optical stimulation, are essential. Those are achieved by the OSL unit for lexsyg devices using high power light modules for violet, blue, green, yellow and infrared stimulation while providing low background measurements and best signal-to-noise ratios.