

TCMPC-1270 Product Presentation

Singlet Oxygen Luminescence Detection System



$^1\text{O}_2$ kinetics at one click.

Highest sensitivity.

Flexible modular options.

The TCMPC1270 is the world's first commercially available table-top device for measurements of photosensitized singlet oxygen luminescence kinetics. The TCMPC1270-LED combines the cost effectiveness of the SHB Analytics patented LED excitation with the highest sensitivity of the Hamamatsu NIR photomultiplier H10330. The TCMPC1270-LED makes the challenging direct detection of singlet oxygen now as easy as absorption spectroscopy.

Singlet oxygen

Singlet molecular oxygen ($^1\text{O}_2$) is a reactive oxygen species that participates in many chemical reactions and is especially important in biological systems due to its ability to detrimentally oxidize a variety of biomolecules. Singlet oxygen can cause cell damage, induce apoptosis or necrotic cell death.

Singlet oxygen in medical therapy

In photodynamic therapy of cancer (PDT) the photosensitized generation of $^1\text{O}_2$ is used for highly specific treatment of cancers. In photo-dermatology the process of photosensitized cell death via $^1\text{O}_2$ generation is used as therapeutic tool. The investigation of singlet oxygen as mediator of the therapeutic effect allows an assessment of the quality of the photosensitizer and the success of the therapy.

In medical applications the observation of $^1\text{O}_2$ inside the target is essential in diagnosis and treatment optimization. The unperturbed and quantitative measurement of $^1\text{O}_2$ *in vivo* or *in situ* is practical only by the observation of its phosphorescence at 1270 nm. However, this is extremely challenging due to the very low phosphorescence emission efficiency of 10^{-5} - 10^{-7} and very short lifetime of about 1 μs in biological systems.

Advantages of direct time resolved measurements

Direct and time resolved detection of singlet oxygen has several advantages. Due to the direct detection no perturbation of the investigated system occurs. With time resolved data the singlet oxygen kinetics can be evaluated yielding valuable data about the interaction of singlet oxygen with its environment. The kinetics provide information about the efficiency of generation and interaction of singlet oxygen with the environment. Additionally the structure of the microenvironment where the singlet oxygen is generated can be determined. Due to the short diffusion length of singlet oxygen in biological surroundings of less than 100 nm a highly localized information can be obtained.

The SHB Analytics TCMPC1270

... is the first Table-Top Setup for time resolved detection of $^1\text{O}_2$ phosphorescence. Its high sensitivity exceeds the most recent benchmark regarding sensitivity of $^1\text{O}_2$ phosphorescence detection.

It consists of a main body and stackable modular components. The modular design with different customized optical filters and different LED-excitation modules with different excitation

wavelengths give high flexibility for many applications.

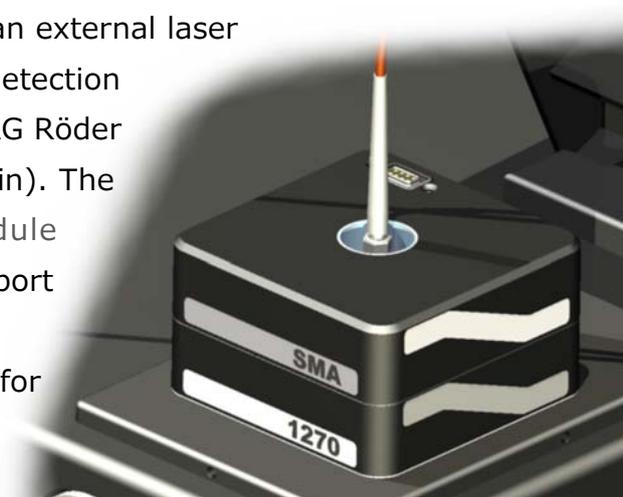


LED excitation modules can quickly be exchanged in a real plug and play manner to adapt the excitation wavelength to the sample.

Spectral discrimination modules are optimized for highest detection efficacy. The module for singlet oxygen detection is optimized for a wavelength of 1270 nm. Other modules, e.g. at 1210 nm are available for experiments proofing $^1\text{O}_2$ as signal source. Almost any wavelength is available for a high flexibility regarding phosphorescence detection in the NIR.

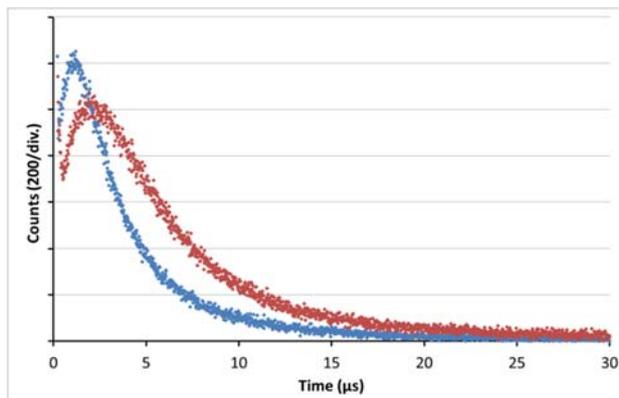
The field of applications is constantly extended in cooperation with the user. One example is the possibility to couple a fiber into the TCMPC1270 and trigger an external laser

Synchronously with the detection cycle (cooperation with AG Röder Humboldt University Berlin). The SMA fiber coupling module provides an optical fiber port for $^1\text{O}_2$ detection and the trigger signal, necessary for an external laser.



Example measurements

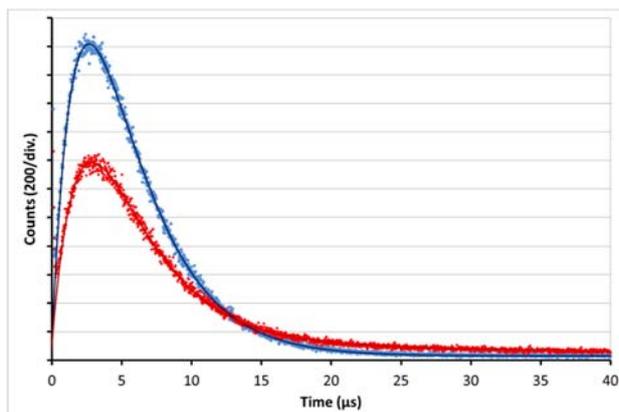
PS in eucariotic cells



Singlet oxygen kinetics in Jurkat cells incubated with Foscan (3µM in the medium for 24h)

- 2 mio cells in 1ml
 - 2mW@ 400nm (LED)
 - 12 kHz, 140 ns Pulses
 - 20 s measurement
- first measurement (blue)
after exposure to 2J/cm² (red)*

PS in bacteria



e-coli (sure2) in PBS with 2 µM TMPyP

- 2 mio cells in 1ml
 - 2mW@ 400nm (LED)
 - 12 kHz, 140 ns Pulses
 - 10 s measurement
- first measurement (blue)
after exposure to 30J/cm² (red)*

More examples in the near future...

TCMPC 1270 Product features

- Highest sensitivity of the Hamamatsu H10330-45 detector
- Custom patented optics for maximum detection efficiency
- Comparable to the world's leading laboratory set-ups regarding time resolution and sensitivity
- Compact table top design
- LED-Excitation for a variety of excitation wavelengths
- Future-proof modular optics with several excitation and detection wavelengths
- Customized control and detection electronics – optimized timing resolution
- Convenient usability – an embedded system is controlling the measurements, no expertise on the measurement process is needed
- Easy-to-use software for control of the measurement process
- Software for the evaluation of singlet oxygen kinetics based on long term experience in research