Oxygen Biosensing Using FLIM and ICCDs

Overview

When using fluorescent bio- and nanosensors, the signal acquisition can take advantage of the quenching of the fluorescence signal (intensity change), a shift in the wavelength of fluorescent emission or changes in the fluorescence decay lifetime. In order to work within their targeted environment, nanosensors must be the right size alongside having the correct chemical and physical properties.

Researchers around Xu-dong Wang from Fudan University in China have published a paper where they describe measurements of oxygen in cells using fluorescent, functionalized nanoparticles and a fast system for fluorescent (or phosphorescent) lifetime imaging (FLIM or PLIM). Oxygen obviously plays a fundamental role in the cells metabolism and precise measurements give new insights into the workings of cells that can be used in biology and medical applications.

The experiments relied on nanoparticles with changing fluorescent decay times in the presence of oxygen. The FLIM setup is realized using a pulsed laser, microscope and a PI-MAX4-1024i camera. This setup allows for rapid measurements of fluorescent decay times using a rapid lifetime determination (RLD) algorithm utilizing a measurement scheme of overlapping gates. More details on the RLD algorithm are described in a PI app note (Novel Time-Resolved FLIM Measurements Method).

The researchers found that this method is orders of magnitudes faster and has similar accuracy than using methods relying on time correlated single photon counting (TCSPC) that need to scan an image point by point. The analysis for the RLD algorithm for single exponential decays has been implemented for this group by our TPI China team directly in LightField using the LightField formulas.

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