Hybrid Detector for Standard Confocal Platform

Quantum Leap in Photon Efficiency

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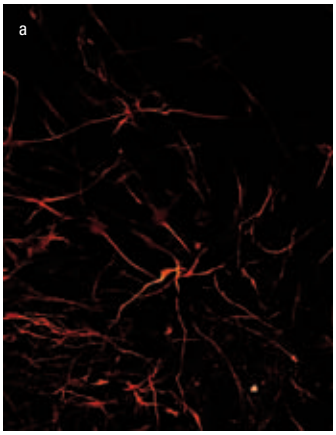
Biological imaging is changing from a qualitative to a data-driven, quantitative science as demand shifts towards quantitative annotations of genes in vivo. The goal is to unravel the underlying functional interaction networks. Biological disciplines, such as neuroscience, developmental biology, cell biology and pharmacology, to name a few, rely on confocal imaging to gain insights into the spatio-temporal organization of live cells or living organisms. Today's imaging systems need to serve as a quantitative measurement device as well as to reproduce the finest details with high fidelity. Leica Microsystems' answer is a new detection concept, as implemented in its Leica HyD hybrid detector.



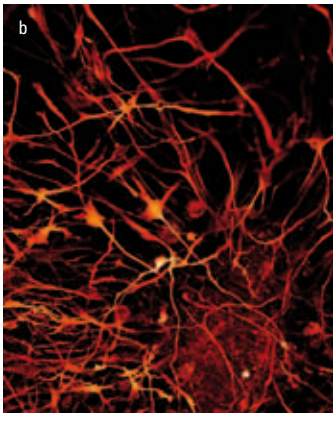
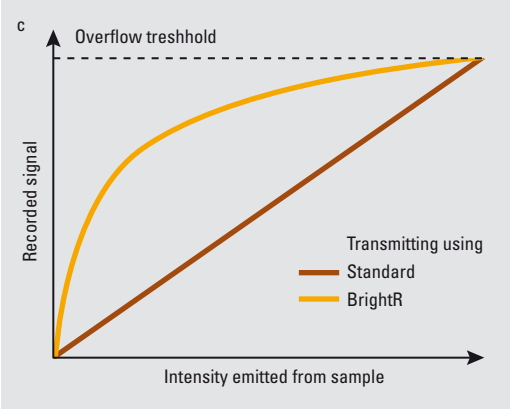


Figure 1a–c: BrightR (b) makes weak signals accessible and renders them in the same image by taking just a single exposure. This is particularly useful in situations with very dynamic samples (a). Dynamic in this case refers to the differential accumulation of dye or fluorescent protein in different structures or parts of the image. BrightR works very efficiently with neurons or similar material. Effectively, BrightR acts as a dynamics compressor for the signal (c).

Quantitative imaging made easy

With its unparalleled contrast Leica HyD delivers publication-ready images out of the box – there is no need for post-processing. All imaging tasks benefit from Leica HyD's low dark noise, high sensitivity and large dynamic range. The latter is increased even further by single photon counting. This represents the most attractive approach to image quantification, since the number of registered photons is in direct proportion to the concentration of molecules under study. Thus, biochemical information becomes accessible through single photon counting and in situ spectroscopy.



Thanks to its high quantum efficiency of typically 45% at 500 nm, its low noise and large dynamic range, the hybrid detector is the most versatile detector in our Leica TCS SP5 confocal platform. Along with Leica Microsystems' proprietary filter-free beam-splitting concept and waste-free spectral detection design not requiring any recycling loops in the beam-path, these properties make the Leica TCS SP5 ideally suited for quantitative measurements and all-purpose imaging alike.

BrightR reinforcement for highly dynamic samples

Some biological samples accumulate far more fluorescent labels in specific structures than others. Likewise, the physical size of labeled structures can vary greatly. Both result in a highly dynamic distribution of light intensity. Such samples are intrinsically difficult to record, because either the bright parts of the image are overexposed or the dim parts underexposed.

Leica Microsystems addresses this imaging problem with its innovative BrightR imaging mode (Brightness Reinforcement). With BrightR dim structures are amplified more than bright ones, resulting in an extended dynamic range capable of capturing very bright structures and intricate details in the same image. Unlike other image acquisition strategies involving a large dynamic range, this is accomplished in a single image recording. This way the sample is only exposed to light once.