

Next generation fluorescence lifetime imaging with novel SPAD sensors

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Abstract

Time-resolved fluorescence detection is a powerful technique in fluorescence microscopy. The fluorescence lifetime encodes information about the local environment of fluorophores or can be used for single-color multiplexing. Commonly, confocal microscopes with single photon counting hardware are used for lifetime imaging, defining the state of the art of the technique. However, for certain applications widefield imaging can bring unique advantages such as higher throughput and longer observation times.

Here we show how the combination of a powerful picosecond laser and a novel SPAD camera facilitates time-resolved imaging in widefield microscopy. The SPAD512S camera from Pi Imaging Technology enables time-resolved fluorescence detection through gating with picosecond accuracy. We benchmark the camera's performance with widefield lifetime imaging on commercially available cell samples. Suitable lasers from the PicoQuant portfolio offer sufficient power to saturate the camera across the field of view on these samples. Thus, using the camera's full dynamic range enables lifetime imaging at video rate acquisition speeds while simultaneously minimizing photobleaching. This could unlock new possibilities for lifetime imaging as the technology matures, especially for applications where imaging speed is essential.