Optimizing a Time-Resolved Spectrometer for all time scales

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Time-resolved fluorescence spectroscopy is a spectroscopist's most valuable tool for the investigation of excited state dynamics in molecules, complexes, or semi-conductors. In recent years, the study of luminescence properties has gained in popularity in many scientific fields, including Chemistry, Biology, Physics, as well as in Life, Materials or Environmental Sciences.
The investigations to be carried out in each of these fields impose different requirements. On one side, monitoring dynamic processes in the excited state necessitates high time resolution that can be achieved by fast pulsed lasers and detectors along with appropriate time-correlated single photon counting (TCSPC) units and small monochromators. On the other hand, high spectral resolution is desirable for fluorophore characterization, requiring detectors with high quantum efficiencies, flash lamps for phosphorescence measurements and large monochromators. Up to now, spectrometers have been usually targeted towards either one of these two specifications.

Spectrometers equipped with hybrid detectors, versatile TCSPC cards with optional longer time ranges, and pulsed lasers capable of working in a burst mode can offer a combined solution, covering most of the demands of either high time or spectral resolution. We will demonstrate the performance of such a spectrometer in terms of its time resolution, the ability to measure long decays and record time-gated spectra using laser drivers with burst capabilities. This type of instrument is of great value for analytical facilities in research centers, as it offers a wide range of possible spectroscopic applications in a single, easy to use instrument.