New

MF²: A Revolutionary Advance in Fluorescence Spectroscopy

HORIBA Jobin Yvon introduces a new instrument: the **MF²**. Fluorescence scientists now have an important tool to help understand real-time natural processes. The **MF²** is based on unique technologies—developed at HORIBA Jobin Yvon—to increase the rate of data-collection by 10,000 times and dynamic range by 1000 times over conventional approaches!

Existing fluorescence systems offer sensitivity, selectivity, and wide time-resolution. With instruments from HORIBA Jobin Yvon, we can measure the duration of molecular events from picoseconds to nanoseconds—and longer. The two best methods for this are "Time-Correlated Single-Photon Counting" (TCSPC), and "Phase and Modulation" (frequency domain). HORIBA Jobin Yvon is in the unrivalled position of offering the highest-performing instruments using both methods. Frequency domain records the response of a photomultiplier tube, revealing the change in the phase and modulated amplitude of the sinusoidal fluorescence emission relative to the excitation beam. This measurement is repeated at several modulation frequencies to give the fluorescence lifetime. The sequential nature of this method, however, requires many minutes to complete an experiment. Clearly, an opportunity existed to improve this approach.

We at HORIBA Jobin Yvon used recent advances in frequency synthesis to develop wholly new technologies to bypass conventional limitations. By grouping multiple frequencies into one high-frequency waveform and greatly expanding the available frequency range, we decreased the time it takes to measure a fluorescence lifetime from minutes to milliseconds, a 10,000-fold change (Fig. 1). We call this revolution in instrumentation the **MF²**, which delivers previously unavailable experimental speed and performance.

HORIBA Jobin Yvon's revolutionary, *fast* MF² technique...

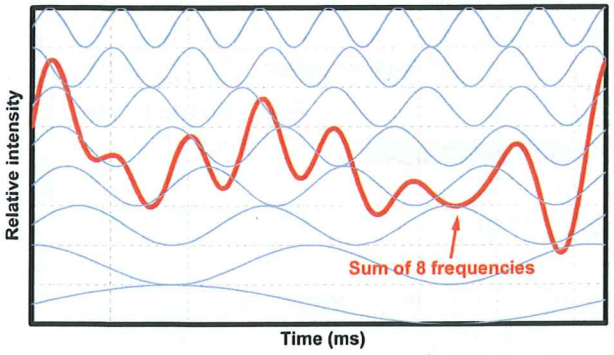

Fig. 1. Fluorescence signal (red) elicited from a modulated excitation beam composed of eight frequencies (light blue) mixed together. The new MF² uses this method of excitation to characterize fluorescence lifetimes within 10 milliseconds.

The MF² combines *speed* and *precision* for real-time kinetics measurements of fluorescent lifetimes...

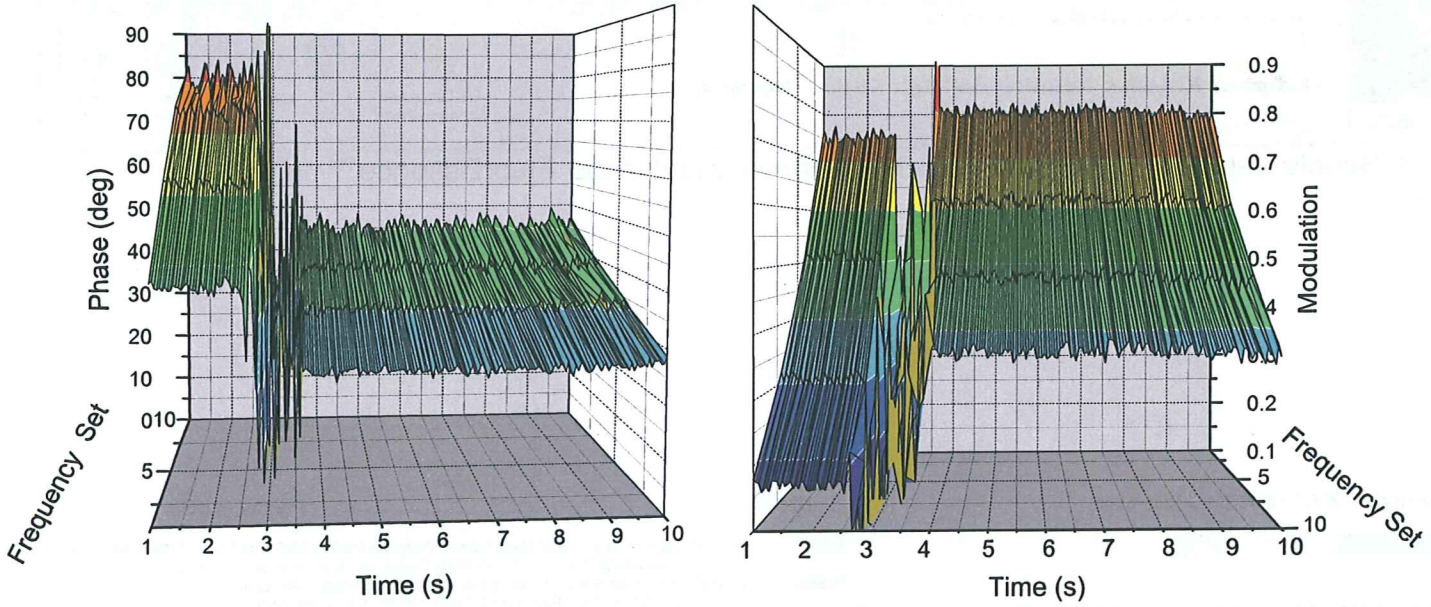

Fig. 2. Change in phase-angle (left) and modulation (right) after adding POPOP to 9-CA in MeOH. Note how the phase-angle drops, while the modulation rises, when the POPOP is added.

An actual example is shown in Fig. 2. A solution of 9-cyanoanthracene (τ = 11.8 ns) in methanol was placed in a cuvette and excited at 340 nm with four multiplexed frequencies. The fluorescence response over the course of 10 s was recorded through a long-pass Schott KV filter (λ > 370 nm). Notice the change in phase-angle and modulation after addition of POPOP (τ = 1.32 ns) in methanol. Time resolution was 50 ms per data set, giving a clear view of the mixing event. The ~ 50:50 mixture thereafter contained two lifetime components, with a concomitant change in response.

The MF^2 takes advantage of our easy and powerful FluorEssence™ software, using a single window to set up the entire spectroscopic experiment (Fig. 3). Rather than choosing the frequencies to run the experiment, the MF^2 uses an entirely new paradigm: you decide on a likely range of lifetimes, and the software chooses the frequencies for you!

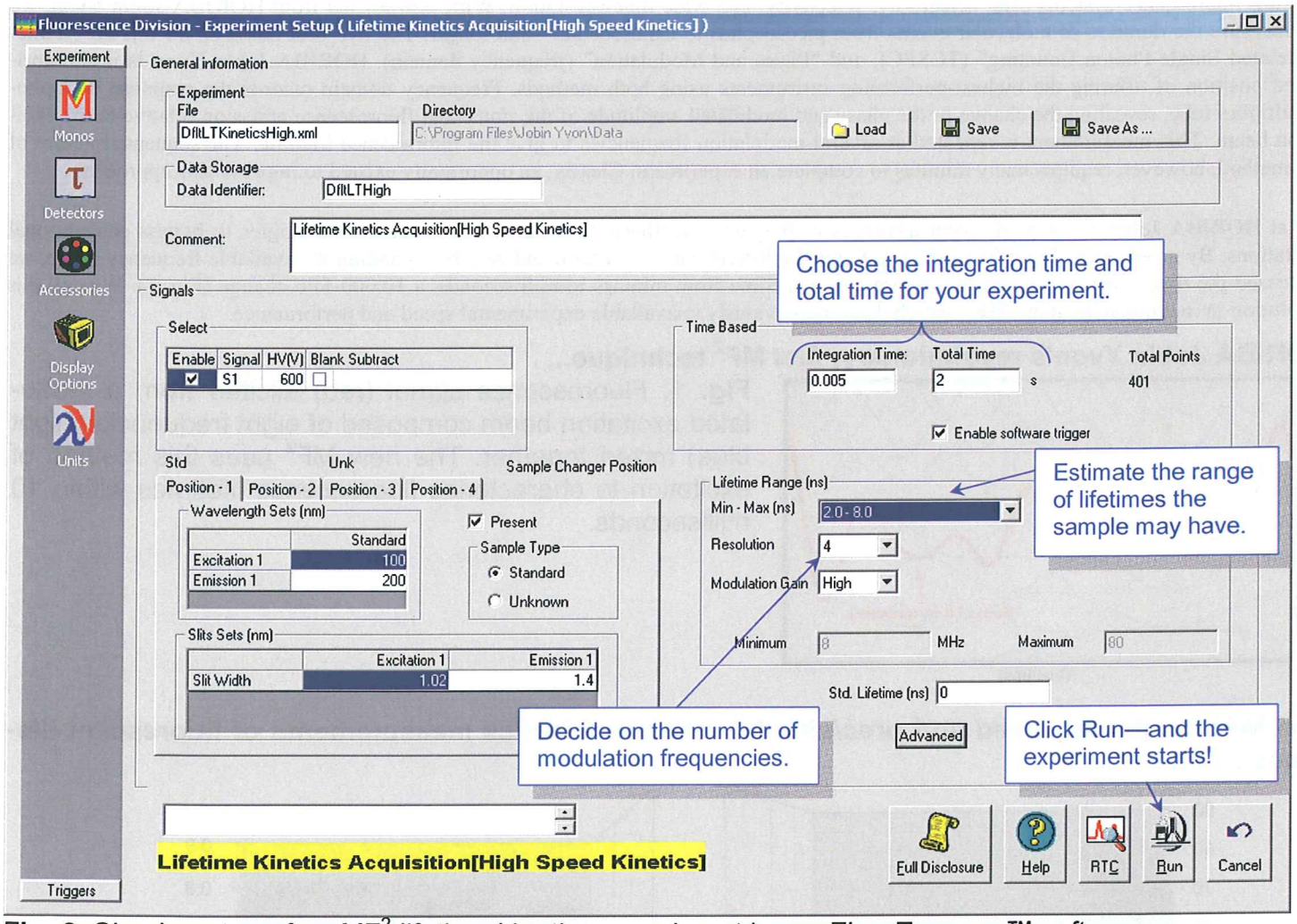

Fig. 3. Simple setup of an MF^2 lifetime kinetics experiment in our FluorEssence™ software.

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