

100 kHz 2D-IR spectroscopy. Applications of a fast, sensitive spectrometer to chemical and biochemical problems

Paul Donaldson*, Greg Greetham, Rex Manurung, Tony Parker and Mike Towrie

Central Laser Facility, Science and Technology Facilities Council, Research Complex at Harwell, Rutherford Appleton Laboratory, Didcot, OX11 0QX, UK, *paul.donaldson@stfc.ac.uk

We present a new spectrometer built around two synchronised Yb:KGW laser systems, with the two-fold design aim of 100 kHz 2D-IR spectroscopy [1] and multiple probe TR-IR spectroscopy [2]. In both modes, two separately tunable probe beams are used to cover a wide range of IR wavelengths in a flexible manner (Figure 1). The spectrometer has recently been applied to a wide range of scientific problems. In this presentation we discuss recent 2D-IR applications, with an emphasis on how the instrument significantly widens the applicability of 2D-IR spectroscopy to problems in chemistry and biochemistry requiring high sensitivity and high speed. In particular, we will demonstrate how the instrument performs on ‘stopped flow’ type measurements of chemical reactions and on measurements of azido and cyano functionalised amino acid labels.

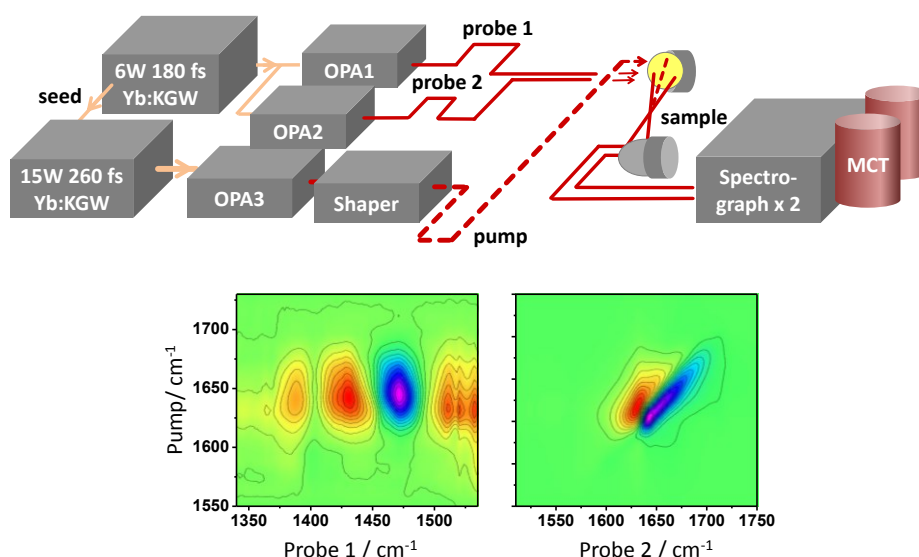


Figure 1. The LIFEtime 100 kHz Yb:KGW 2D-IR spectrometer, and 2D-IR spectra of Green Fluorescent Protein simultaneously acquired in two probe spectral regions

1. P. M. Donaldson, G. M. Greetham, D. J. Shaw, A. W. Parker, and M. Towrie, "A 100 kHz pulse shaping 2D-IR spectrometer based on Yb:KGW amplifiers," *Optics Letters* **Submitted** (2016).
2. G. M. Greetham, P. M. Donaldson, C. Nation, I. V. Sazanovich, I. P. Clark, D. J. Shaw, A. W. Parker, and M. Towrie, "100 kHz Time-Resolved Multiple-Probe Femtoseconds to Second IR Absorption Spectrometer," *Appl. Spectrosc.* **70** (2016).