Applications of Step Scan TRS

The rapid scan technique is a conventional linear scan experiments at high mirror velocities. It can be used to study any time-dependent processes that are slower than 20 ms and will not be discussed any further in this section.

Step scan TRS can be used to collect spectral and kinetic information on *repeatable* processes that are typically initiated by:

- electric pulse (LC, LED, laser diodes)
- laser pulse (photochemistry, biophysics)
- temperature jump (biophysics)
- rapid mixing (stop-flow kinetics)

Irreversible chemical or physical processes can also be studied by step scan TRS technique if the process can be regenerated by elaborate schemes. Such examples include the use of mapping stage of a microscope to move the fresh sample to the beam for each step or flow cell for irreversible chemical reactions in solution.

Some specific applications of TRS measurements in different areas are listed below:

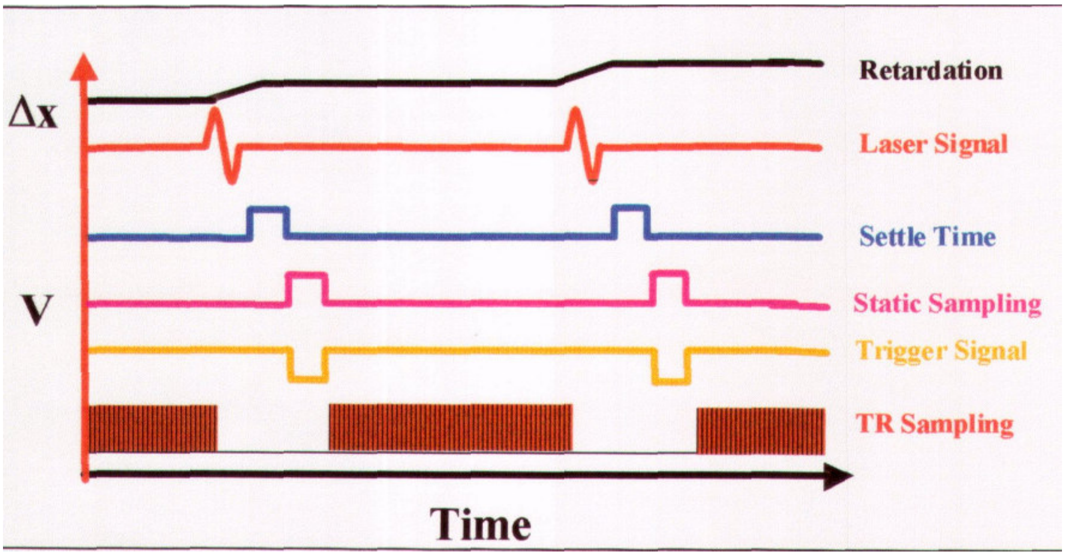
Material Science
- Liquid crystals and polymer-dispersed liquid crystals
- Characterization of LED's or laser diodes
- Polymer stretching

Biology and Biophysics
- Protein conformational changes induced photochemically or by temperature-jump
- Bacteriorhodopsin

Photochemistry
- Excited states of metal complexes
- Photochemical reactions in condensed or gaseous phase

TRS Data Collection and Processing

The data collection for step scan TRS was mentioned briefly previously. The timing scheme for step scan TRS data collection are illustrated below:



Settle Time: Time allowed for mirror to stop and for detector to recover.

Static Sampling: Time interval to collect static (reference) interferogram.

Trigger Signal: A TTL pulse for synchronization of the spectrometer and the perturbation that initiates the process under study.

TR Sampling: Time-resolved dynamic interferograms at different times.

The sequence of the event for step scan TRS experiments are summarized below:

- The mirror is stepped to a predetermined position and hold stationary, allowed to settle down and stabilize_for the amount of time set by *settle time.*
- The static interferogram is recorded from DC output of the detector preamplifier. The signal is averaged over the amount of time set by *Static Sampling.*
- A synchronized TTL pulse *(Trigger Signal)* is provided as a trigger for the external excitation sources such as a laser or a pulse generator that initiates the time-dependent process under study.
- The AC output from the preamplifier of the detector measures the *change* in spectral intensity. The dynamic interferograms at different times are collected over a given period of time at intervals set by users.

- Then the mirror is moved to the next position and the whole process is repeated.

The *static interferogram* is similar to the conventional linear scan interferogram. It is Fourier transformed to obtain the reference single beam spectrum and the phase spectrum. This phase spectrum is then used in the Fourier transform of the *dynamic interferograms.*

The dynamic interferograms are three dimensional interferograms with the additional dimension being *time.* Each interferogram at a given time is Foureir transformed to obtain the difference (single beam) spectra.