

Product Note M103-01/10

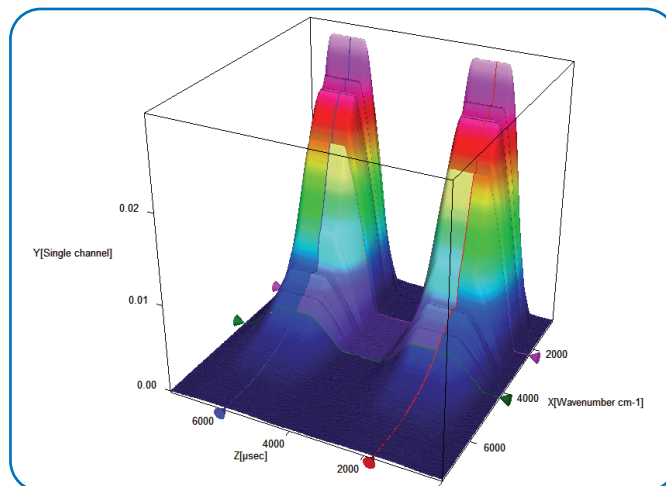
Time Resolved Spectroscopy (TRS): components and options for VERTEX series and INVENIO FTIR spectrometers

In order to investigate a rapidly changing chemical or physical system, mainly two techniques are available to the modern scientist.

Rapid-Scan TRS

One technique that provides several advantages is time-resolved spectroscopy (TRS) using a Fourier Transform Infrared (FTIR) spectrometer. FTIR offers high sensitivity and specificity for monitoring almost any given species, and because it is a broadband experiment, several species can be monitored simultaneously, for example, the decay of one chemical species and the simultaneous production of another. Also, for any physical or chemical phenomenon that can not be electronically triggered and is not many-times reproducible, rapid-scan with a fast scanning interferometer is the right solution.

The precondition for a successful temporal resolved Rapid-Scan application is that the FTIR spectrometer is equipped with a liquid nitrogen cooled MCT detector. Besides its higher sensitivity compared to a room temperature DTGS detector, it provides the advantage of a much higher detection speed without reduced responsivity. With the INVENIO and the VERTEX 70v spectrometers up to 70 spectra/sec and with the VERTEX 80-80v series more than 110 spectra/sec are achieved at 16 cm^{-1} spectral resolution. For more information see the related Rapid-Scan product note.



Step-Scan TRS

For higher temporal resolution the Step-Scan technique is the right solution for repetitive and reproducible considerable kinetics experiments. During the last few years it attracted interest for research and developmental application and led to many scientific publications. In the mean-time step scan TRS has already been applied to kinetic studies of e.g. organo-metallic complexes, ferroelectric liquid crystals, crystalline laser material, semiconductor material and to photo-biological systems.

In case INVENIO or the VERTEX spectrometer is equipped with the Step-Scan option and fast liquid nitrogen cooled MCT detector a temporal resolution in the low micro-second range is achieved. The two-channel 24 bit analog digital converter (ADC) allows AC- and DC-coupled data acquisition in parallel. For faster kinetics experiments the spectrometer can be equipped – or later on upgrade – with an ultra-fast photo voltaic MCT detector and a PC-based external transient recorder board (TRB). In this configuration an extreme temporal resolution in the low nano-sec range will be achieved for repetitive kinetic experiments.

For the definition of the optimum instrument configuration dedicated options and components for the R&D spectrometer series VERTEX and INVENIO are available. In the following table (see on the reverse side) the available Rapid- and Step-Scan TRS components are listed which will help in the selection of the right items for the specific customer needs.

| TRS components | | | | |
|-----------------------|---|---|---|---|
| | | INVENIO R | VERTEX 70v | VERTEX 80-80v |
| Rapid Scan | S129/x | | | |
| Standard | | VEL=80 kHz; 20 interferograms/sec | VEL=80 kHz; 20 interferograms/sec | VEL=160 kHz; 65 spectra/sec @16cm ⁻¹ spectral resolution |
| Option S129/x | | S129/IR: VEL=160 kHz; 70 spectra/sec @16cm ⁻¹ spectral resolution; DigiTect detector position required (W105/I) | S129/Z: VEL=160 kHz; 70 spectra/sec @16cm ⁻¹ spectral resolution | S129/8: VEL=320 kHz; 110 spectra/ sec @16cm ⁻¹ spectral resolution; requires optical filter F321-H |
| Trigger functionality | Basic | Option E516/B (send/ receive TTL) | Option E516/B (send/ receive TTL) | Option E516/B (send/ receive TTL) |
| | Advanced | Standard (functionality of E517/Z included) | Option E517/Z; included in step scan option S510/Z | Standard (functionality of E517/Z included) |
| | External trigger box | Option E525/Z | Option E525/Z; requires E517/Z | Option E525/Z |
| | Detectors | Fast MCT, e.g. D3xx/B | Fast MCT, e.g. D3xx/B | Fast MCT, e.g. D3xx/B |
| Software | | OPUS O/3D-N | OPUS O/3D-N | OPUS O/3D-N |
| | | | | |
| Step Scan | S510/x | | | |
| Option S510/x | | S510/IR | S510/Z | S510/8 |
| Optical Filters | | F321-H and/or F311-H | F321-H and/or F311-H | F321-H and/or F311-H |
| Trigger functionality | Advanced trigger functions | Standard (functionality of E517/Z included) | E517/Z included in Option S510/Z | Standard (functionality of E517/Z included) |
| | External trigger box | Option E525/Z | Option E525/Z; requires S510/Z | Option E525/Z |
| ADC speed | Internal ADC | 6 µsec, 24-bit, 2 channels | 6 µsec, 24-bit, 2 channels | 6 µsec, 24-bit, 2 channels |
| | Detectors | MCT D3xx/B, InSb and InGaAs D4xx/B or Si diodes D5xx/B (DigiTect detector position required); D4xx/M InGaAs and D5xx/M Si diodes MultiTect™ detec- tors | MCT D3xx/B, InSb and InGaAs D4xx/B, or Si diodes D5xx/B | MCT D3xx/B, InSb and InGaAs D4xx/B, or Si diodes D5xx/B |
| | External transient recorderboard (TRB), PCI-bus | Option S522-20 with 100 nsec or S522-400x, 14 bit with 2.5/4 nsec, two channels | Option S522-20 with 100 nsec or S522-400x, 14 bit with 2.5/4 nsec, two channels | Option S522-20 with 100 nsec or S522-400x, 14 bit with 2.5/4 nsec, two channels |
| | Detectors | MCT D317/BF (1x1 mm ² element, 20 MHz) and InGaAs D424/BF (1x1 mm ² element, 20 MHz); requires DigiTect detector position | MCT D317/BF (1x1 mm ² ele- ment, 20 MHz) and InGaAs D424/BF (1x1 mm ² element, 20 MHz) | MCT D317/BF (1x1 mm ² ele- ment, 20 MHz) and InGaAs D424/BF (1x1 mm ² element, 20 MHz) |
| Software | | OPUS O/3D-N | OPUS O/3D-N | OPUS O/3D-N |