Whitepaper

# The difference between IRmadillo™ FTIR and standard FTIR spectroscopy

## What is FTIR?

FTIR stands for "Fourier Transform Infrared", operating in the mid-infrared region of the light spectrum. Spectroscopy is the study of the interaction between this light and chemicals. The IRmadillo™ is an FTIR spectrometer that uses a novel, advanced optical design that is rugged and resistant to vibration. The IRmadillo™ is a unique spectrometer, fundamentally different to every other FTIR product currently on the market.

## How is standard FTIR carried out?

The traditional FTIR spectrometer, based on a Michelson interferometer, is over a century old. Moving mirrors create an "interferogram", which is converted to a spectrum using a mathematical technique called a Fourier transform (FT). Over time, this evolved - adding lasers, nitrogen cooling and electronic upgrades. However, the core is consistently a moving mirror (or two), rendering the instrument vulnerable to vibration in industrial environments.

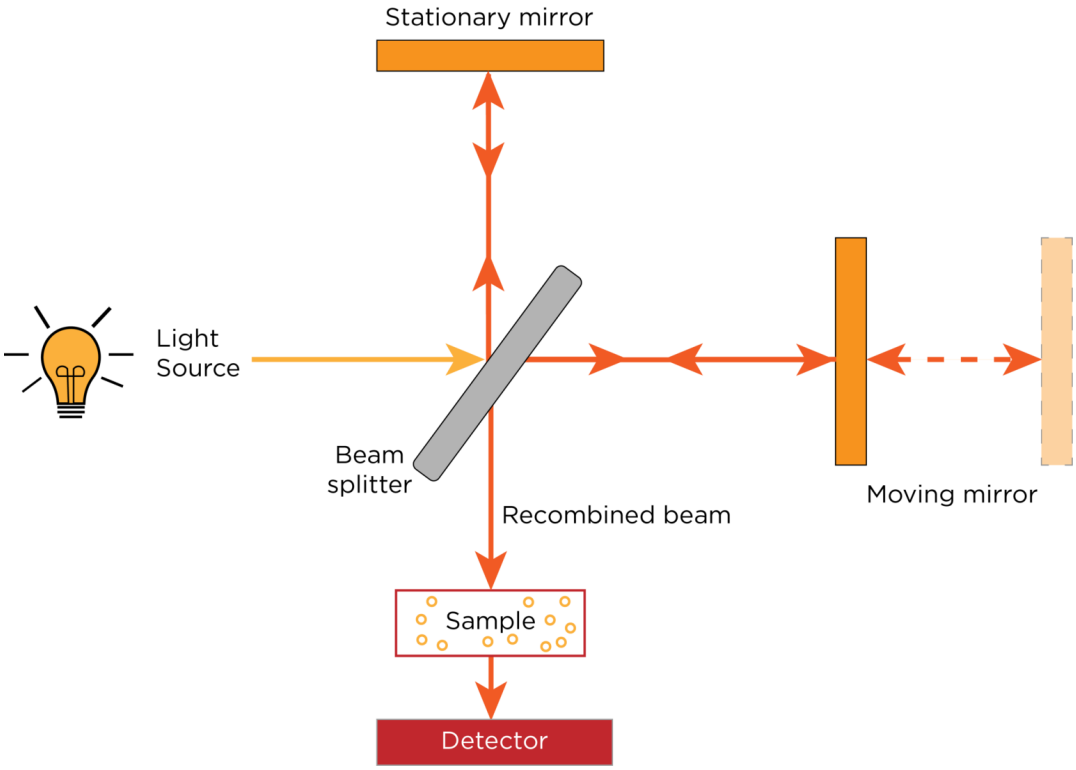


*Figure 1: A typical Michelson interferometer setup*

## The process of standard FTIR in detail

The Michelson interferometer consists of a light source, projected onto a beam splitter, as in *Figure 1*. Half of the light is reflected onto one mirror and the other half transmitted through the beam splitter onto the other. The beams are then reflected directly back onto the beam splitter, where they are recombined to create an interferogram based on time (using mirror movement). The recombined beam then passes through the sample and creates an interference pattern on the detector to be measured.

## Benefits of the Michelson design

This technology is simple to manufacture as a single pixel detector and straightforward to set up. Results can be precise, if done correctly. It can be configured in various ways for different applications and measure a range of parameters. It is non-destructive, able to measure without damaging the subject.

## Drawbacks of the Michelson design

As a complex instrument, it requires careful alignment and needs maintenance. Due to the moving mirror/s, the Michelson interferometer is vulnerable to vibration, impacting measurement accuracy. The cheapest version of this technology reflects 50% of light back to the source, reducing data reliability. It can be slow to measure and can only measure across small distances.

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## How is the IRmadillo™ FTIR different?

Our design is based on the Sagnac interferometer, a common-path design. It uses static mirrors to create an interferogram in space (instead of time, as with the Michelson). Light is sent through the sample to the beam splitter, then directed at two static curved mirrors. The beam is sent both clockwise (reflected) and anticlockwise (refracted), creating a loop. The beams recombine at a slight angle at he detector. The Sagnac loop concept was not practical for use in instruments until the IRmadillo™ was developed. See *Figure 2*.

## Benefits of our design

The IRmadillo™ is resistant to vibration, due to its geometry, static mirrors and durable shell. This means it is equipped to survive industrial environments. Simple to install, it minimises disruption to your processes and we calibrate the device remotely. To accelerate calibration, we include historical data from other measurements within your industry. Stability significantly improves over time, even when the environment is benign, as the IRmadillo™ continuously gathers data.

## Drawbacks of our design

Our technology has lower spectral resolution than a lab Michelson. However, we have proven this does not affect measuring ability of liquids when using chemometric techniques. Our instrument is used where it is not possible to use lab instruments.

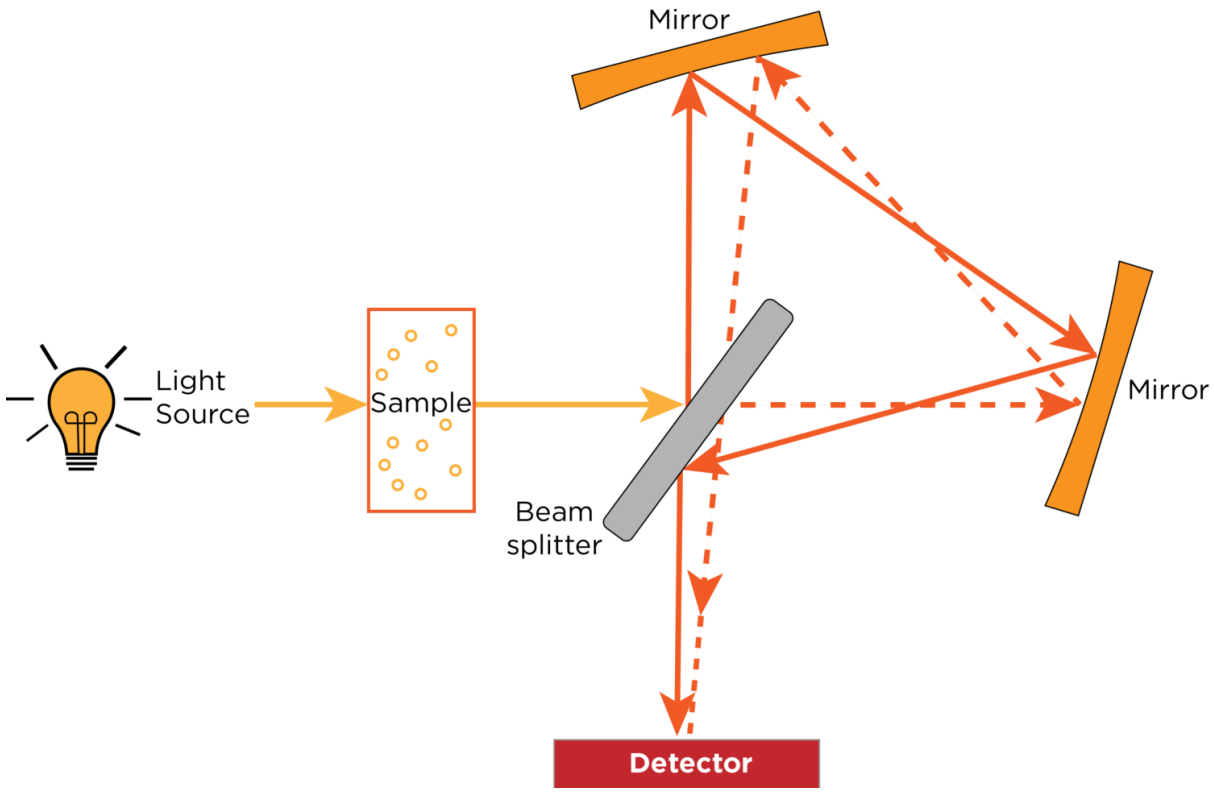


*Figure 2: The IRmadillo™ FTIR setup*

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+44 (0) 1235 431260

(Sales) enquiries@keit.co.uk

(Product Support) support@keit.co.uk

www.keit.co.uk

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4 Zephyr Building, Eighth Street, Harwell Campus, Didcot, Oxfordshire, OX11 0RL, United Kingdom