BLOCK engineering

LaserScan™ Analyzer

Summary

- High Sensitivity Mid-Infrared Absorption Spectroscopy using Quantum Cascade Lasers
- Identification of substances in seconds
- Analyzes bulk materials, liquids, and vapors
- Typically detects sub-micron to 50 micron films, depending on material
- Detects surface concentrations less than 2 µg/cm^2
- Possible to measure from diffuse and highly absorbing materials
- Can detect gases @ ppb with open cell attachment
- Standoff spectroscopy in free space
- Version compatible with FTIR or fiber coupled accessories

Key Benefits & Advantages

- Comparable to FTIR with standoff, greater portability, and higher sensitivity
- Millisecond spectral scan times and 200 kHz pulsed laser
- No detonation hazard/burning of target: large, defocused 5–10 mm spot on target
- Eye-safe operation
- Portable and rugged with solid state/telecom grade components

Description

LaserScan™ detects and measures substances on surfaces from a standoff distance of 6 inches to 2 feet or can be customized to do longer standoff. LaserScan can identify bulk materials and detect sub-micron films based on their absorption characteristics. It can also analyze vapors or liquids. An alternate version of the device is designed to interface to common FTIR accessories, including liquid and gas cells, and reflectance accessories[1].

LaserScan uses infrared absorption spectroscopy, and the heart of the system is a next-generation widely tunable Quantum Cascade Laser (QCL). This gives LaserScan sensitivities that are orders of magnitude greater than alternative spectroscopy systems. The system has two different versions, one that rapidly tunes from 6-10 µm and another that covers the 7-12 µm range.

Mode of Operation & Library

The system provides high quality reflectance spectra from materials deposited on surfaces and from bulk substrates. The system can also be trained to look for samples on other more diffuse substrates. The user is guided in targeting a sample by visible pointing lasers that indicate the field of view of the system. The system is interfaced via a USB port to a computer with the LaserScan Software package.

Comparison to FTIR & Raman

LaserScan puts more energy at a specific wavelength on the sample than a Fourier Transform Infrared (FTIR) spectrometer. This creates the potential for higher sensitivity and higher power density measurements especially from diffuse and highly absorbing materials and substrates. Other advantages over FTIR include portability, ruggedness, fast analysis, and the ability to work at a distance either through free space or a fiber. FTIRs cannot offer standoff capability, making it difficult to quickly scan surfaces and avoid contamination. Whereas an FTIR takes minutes to analyze a substance, the LaserScan takes seconds.

Raman systems require near contact with the surface being tested and a powerful, non-eye safe laser beam. The LaserScan's long standoff distance and large, eye-safe, collimated beam allow for faster surface scanning and easier field operation. Furthermore, LaserScan does not create a detonation hazard and avoids sample degradation or thermal damage. In addition, LaserScan can work with darkly colored substrates.

1 The standoff version has collection optics designed to pick-up reflections at a distance. The alternate version requires a system of mirrors to send the laser light back toward the system and into the collection optic that focus the light onto its detector. The collimated beam size is compatible with most FTIR beams at the focal point.

All lasers are eye-safe

Parameter	Specification
Continuous Wavelength Coverage	LaserScan610: 6.25-10 µm (~1600-1000 cm^{-1}) LaserScan712: 7-12 µm (~1430-830 cm^{-1})
Measurement Time	A few seconds (minimum)
Laser Pulse Modulation	200 kHz (Insensitive to stray light)
SNR (100% line RMS noise)	0.1% (1000:1) (measured at 1100+/-50 cm^{-1})
Intensity Drift (100% line variation)	<0.2% over 2hrs
Wavelength Accuracy	<0.5 cm^{-1}
Wavelength Precision	< 0.2 cm^{-1} over 2 hrs
Average Power	Typically varies between 0.5 mW and 10mW across the 600 cm^{-1} tuning range
Beam Divergence	<5 mrad
Beam Diameter	2 x 4 mm Collimated
Polarization	TEM, 100:1 Extinction, Vertically Polarized
Spectral Resolution	Software Selectable 2, 4, 8 cm-1
Dimensions	25.4 x 20.3 x 12.7 cm (10 x 8 x 5 inches)
Weight	4.3 kg (9.5 lbs)
Operating Temp. Range	10 to 30 °C
Storage Temp. Range	-10 to 70 °C
Communication Interface	USB
Operating System	Win XP-SP3 or later
Electrical Interface	100-240 Volts (50/60 Hz) 2 Amp
Mechanical Interface	Collimated and centered IR output beam Standard Configuration: 3-inch collection lens (Other configurations available upon request)
Standoff Distance	Standard Configuration: 6 inches (Other configurations available upon request)
Measurement Technique	Diffuse Reflectance
Spectral Acquisition	Built in acquisition of complete spectrum across 600 cm^{-1} range using built in detection system
Internal Detector	TE cooled MCT (no LN2 required)

	Standoff/Noncontact			Sampling		
Detects	Solid	Liquid	Gas	Solid	Liquid	Gas
LaserScan	✓	✓	✓	✓	✓	✓
Handheld FTIR	✗	✗	✗	✓	✓	✓
Raman	✓	✓	✗	✓	✓	✗
IMS	✗	✗	✗	✗	✗	✓
Gas Chromatography	✗	✗	✗	✗	✓	✓

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