

SHAKTI PR-1000 RAMAN ANALYZER

The latest in spectrometer, probe and diode laser design and technology are combined to produce this affordably priced, high performance, *process ready* Raman spectrometer system.

Applications in the Pharmaceutical Industry

- Raw material ID
- Coating Content
- Polymorph Screening
- Determine amorphous content
- Process induced transformations
- Measure drug concentration in dissolution medium and
- Quantitate solid phase transformations *in situ*
- Determination of hydration mechanisms *in situ*
- Analyze solid phase transformations during fluidized bed drying

System Features

- *Patented calibration and referencing scheme*
- High resolution
- Wide spectral range
- High Sensitivity
- Short integration times
- Back thinned 2DCCD
- Auto-calibrating
- Adjustable spot size
- Adjustable working distance
- Focusing not required
- Large sample volume
- Non-invasive
- Non-destructive (low to no sample heating)
- Fiber coupled
- Narrow line-width, stable excitation source

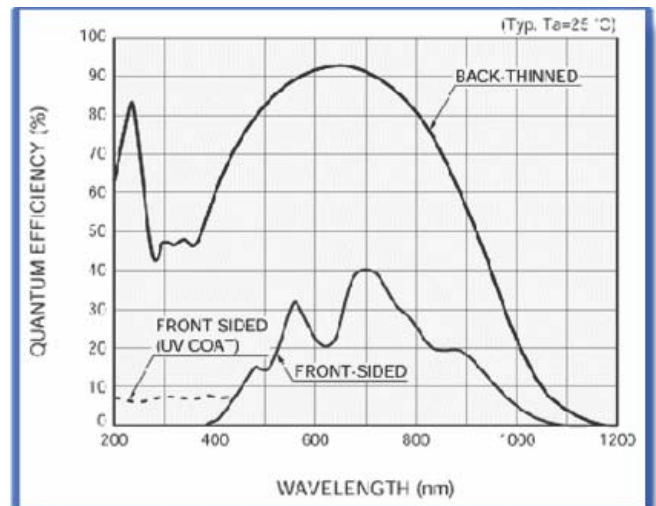


Spectrometer

The spectrometer is based on a patented, retro-reflective concentric configuration – an innovative, high reciprocal dispersion design. This optical design yields high optical efficiency and imaging resulting in superior resolution, photometric accuracy, and improved quantitative analysis across extended spectral ranges. Each spectrometer has an original convex, aberration-corrected, very high efficiency holographic diffraction grating which uniquely controls all diffracted rays to dramatically reduce stray light. High throughput, f/2.4 optics ensure high spectral resolution across extended spectral ranges while achieving high signal to noise ratios. This enables detection of weak signals or reduced integration times. The spectrometer is rugged, with no moving parts.

Detector

- Thinned, back illuminated, full frame transfer 2DCCD
- 1024 x 256 element CCD (24 micron pitch) or
- High Quantum Efficiency in the NIR region
- Ideal for low light applications
- Good linearity



Fiber Optic Probe



Our fiber optic probe, with an adjustable spot size and working distance, is very user friendly. You can sample a large area or volume, non-destructively, without heating the sample. No focusing required. The probe is compact and rugged. *Our patented calibration and referencing scheme* uses a NIST traceable wavelength calibration source and white reference that is built into the probe head. All calibrations can be done with the probe in use, without having to take off of vessel.

High Performance Diode Laser

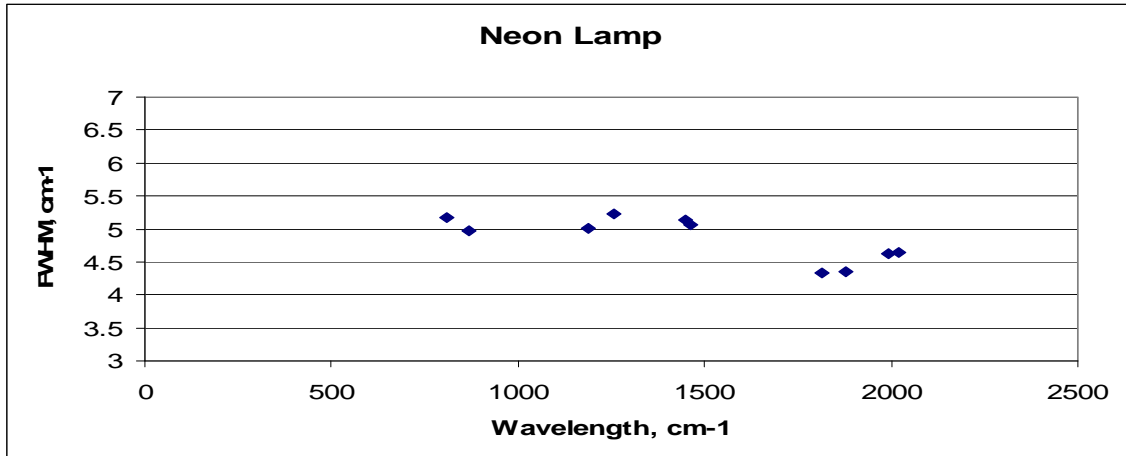
Our laser features high output power with narrow spectral bandwidth. The laser's stabilized peak wavelength remains "locked" regardless of case temperature (-10°C to +55°C). These lasers feature high side mode suppression ratios, providing extremely high signal to noise ratios.



Specifications:

Spectrometer

- Effective f/#: f/2.4
- Spectral Coverage: 130 cm⁻¹ to 2400 cm⁻¹
- Spectral Resolution
 - 4 to 5 cm⁻¹ FWHM with 1024 x 256 element detector, 24 micron pitch



Resolution of Spectrometer with 1024 X 256 element array

- Holographic Grating: High efficiency, aberration corrected original
- Maximum stray light: 10^{-4}

Probe

- 90 fiber bundle pickup, resulting in a ~ 6mm tall image
- Variable spot (sample) size, with inter changeable lenses
- 200 micron laser coupling fiber
- $> 10^{-8}$ Laser rejection, option for additional filter and greater rejection

Detector

- | | |
|----------------------|--|
| • Array Geometry | 024 X 256 (24 micron pitch) |
| • Pixel binning | |
| • Low read out noise | ~8 electron rms |
| • Dark current @ 0°C | ~200 e ⁻ /pixel/s* |
| • Wide dynamic range | ~50,000:1** |
| • Cooled operation | One stage T.E. cooler (optional 2 stage) |
| • Full well capacity | Vertical: 300,000 electrons
Horizontal: 600,000 electrons |

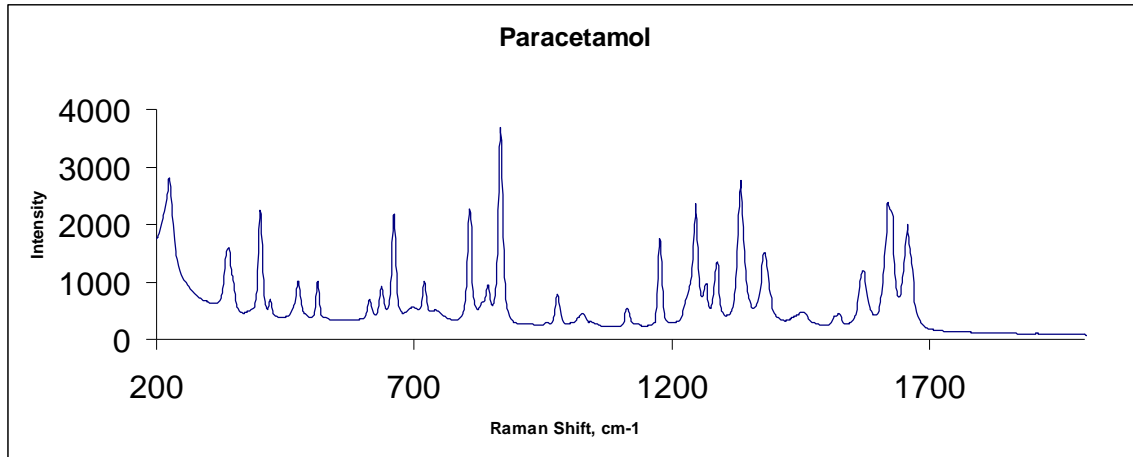
*Dark current nearly doubles for every 5 to 7°C increase in temperature

** Dynamic range = Full Well/Readout noise

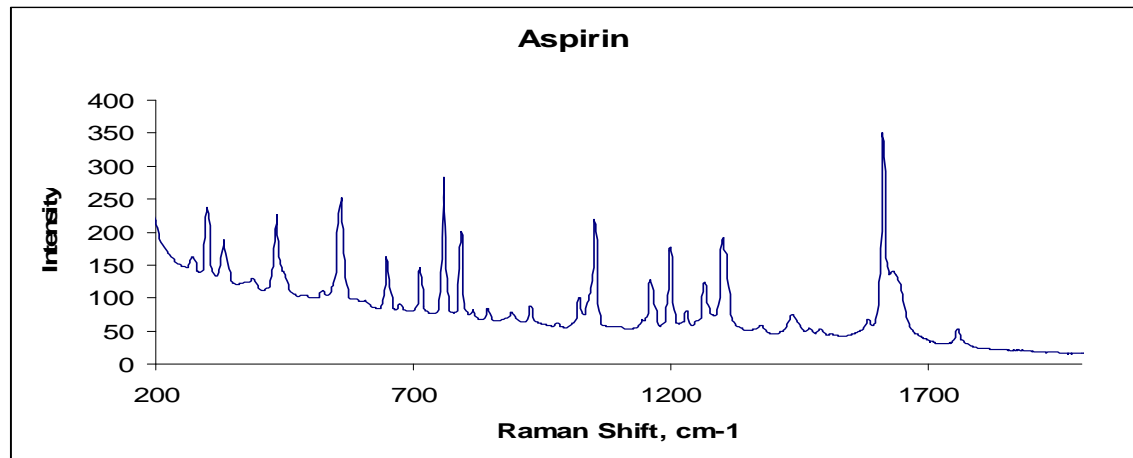
Laser

- Up to 400 mW coupled output power
- Spectral line width $< 0.07\text{nm}$ (1 cm^{-1})
- Temperature stabilized spectrum ($< 0.007\text{ nm}^\circ\text{C}$)
- Low power consumption ($< 5.5\text{W}$)
- 40 dB SMSR typical

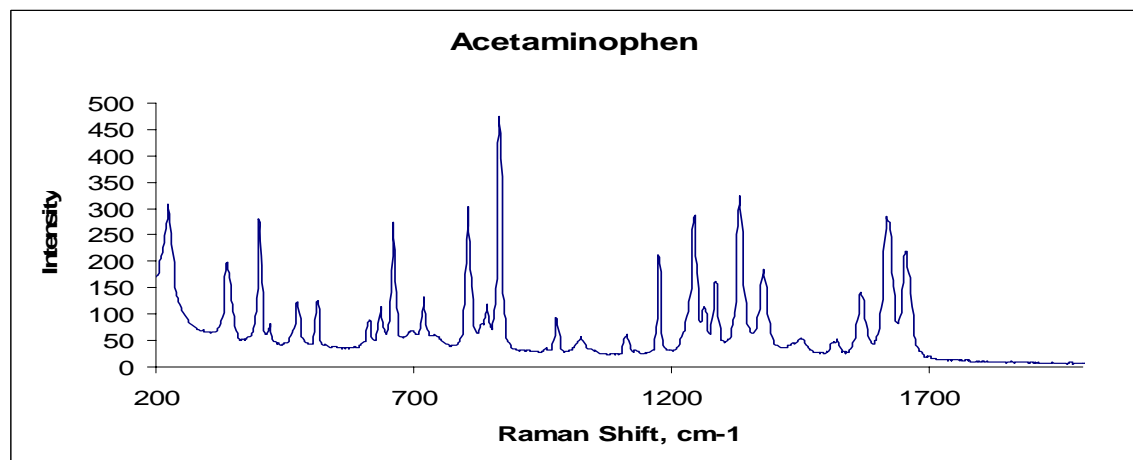
Sample Spectra



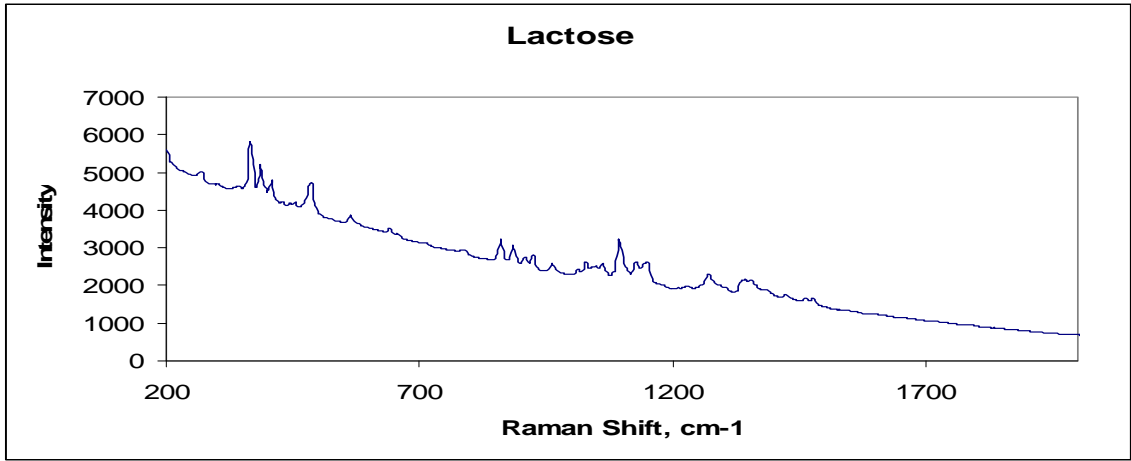
1 second acquisition time



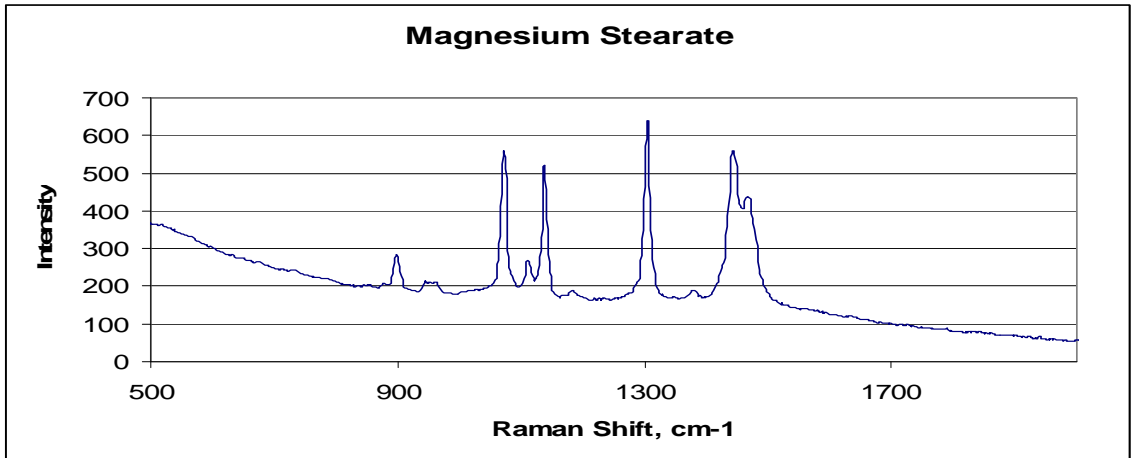
50 milliseconds acquisition time



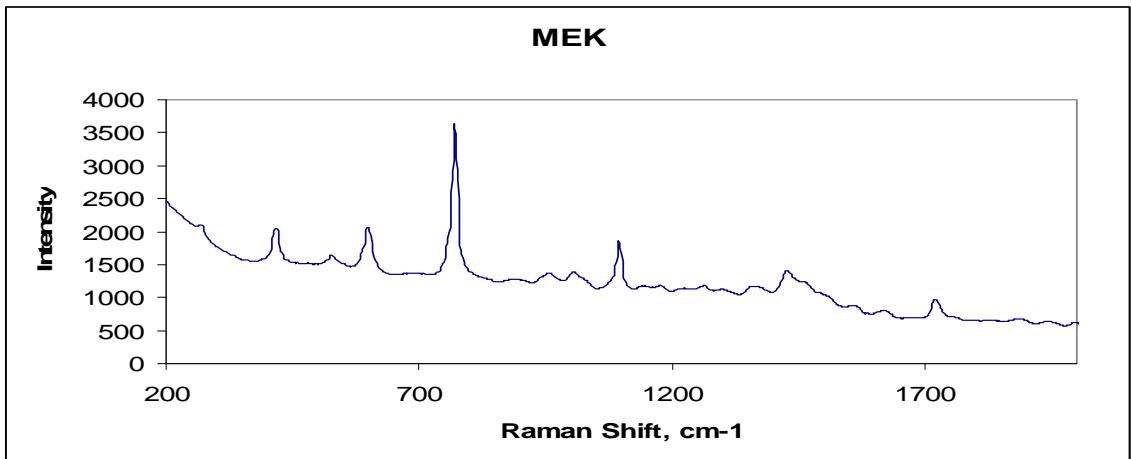
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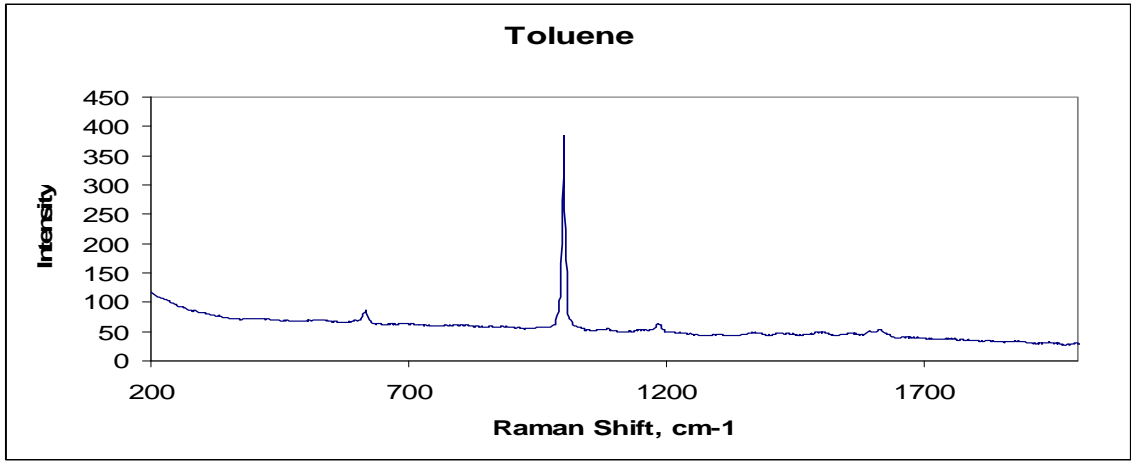
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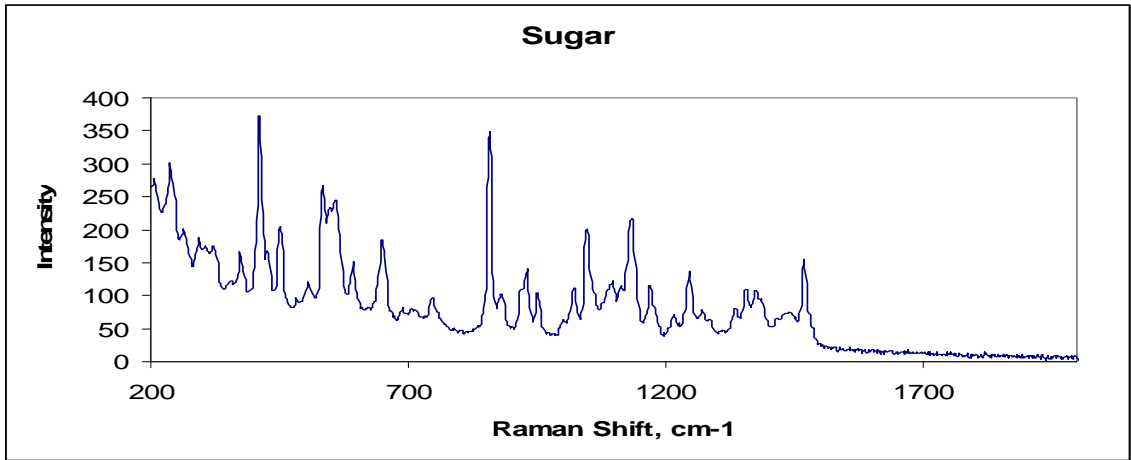
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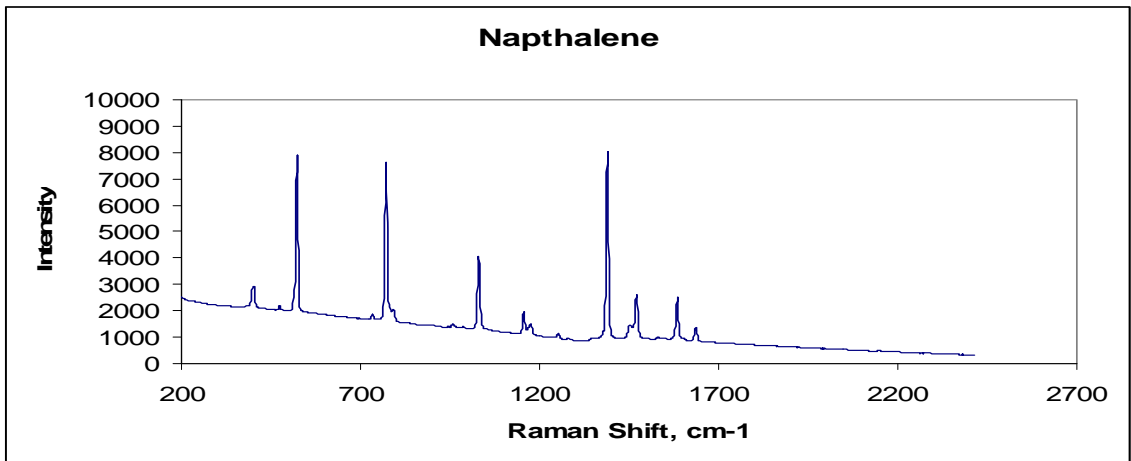
1 second acquisition time



50 milliseconds acquisition time



50 milliseconds acquisition time



50 milliseconds acquisition time