B&W TEK INC.

Your Photonics Partner

*i*nnoRam™ Raman Solution

Portability with Lab Grade Results

Features:

- Spectral Resolution of 2cm^{-1}
- 65cm^{-1} of the Raleigh Line
- Detector Cooled to -20°C
- Double Pass Transmission Optics
- Integrated Touch Screen Computer
- Network and Bluetooth Capabilities

Raman Spectrum of Acetone

*i*nnoRam

The *i*nnoRam™ is the first Raman spectrometer system featuring an integrated touch screen computer with research grade performance. The combined portability and versatility this system features will provide you with the tools needed to tackle the dynamic Raman spectroscopy industry in a lab or a mobile environment.

Excitation Wavelength

Laser

Creating Raman Scatter

In Raman spectroscopy, it is essential to utilize a clean, narrow bandwidth laser due to the fact that the quality of the Raman peaks are directly affected by the sharpness and stability of the delivered light source. The *i*nnoRam™ spectrometer system features a patented CleanLaze™ technology with linewidth as narrow as 0.01nm when equipped with a 785nm laser. This technology results in the correct center wavelength and avoids the phenomenon of "mode hopping." In addition, the laser output power can be adjusted in the software from 0 - 100%, allowing you to maximize the signal-to-noise ratio and minimize integration time. Our standard automatic shutter will reduce photobleaching for a variety of different sample types.

CleanLaze™

0.01nm

784.6   785.00nm   785.4

Laser lifetime of 10,000 hours ensures quality data for years to come
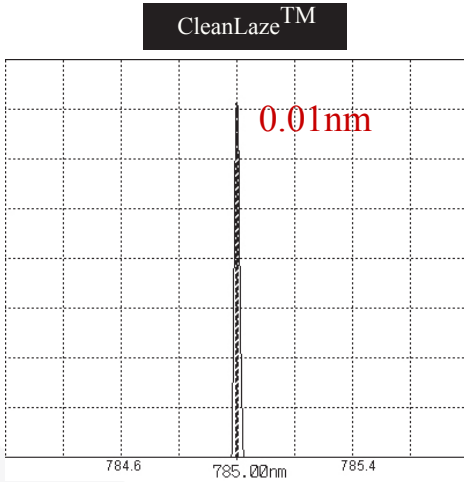
Near-Excitation Raman

Filter

Collect Data within 65cm⁻¹ of the Raleigh Line

The center wavelength of the laser line is precisely maintained even when the peak power is increased by utilizing a series of high end filters. A laser line filter is used to clean up any side bans and ensure a narrow excitation is delivered to the sample by removing all secondary excitation lines before exciting the sample. The light collected from the sample is then filtered via a notch filter. Finally, an ultra steep long pass filter further removes lingering laser line to allow accurate measurement of Raman peaks as close as 65cm⁻¹ from the Raleigh line.
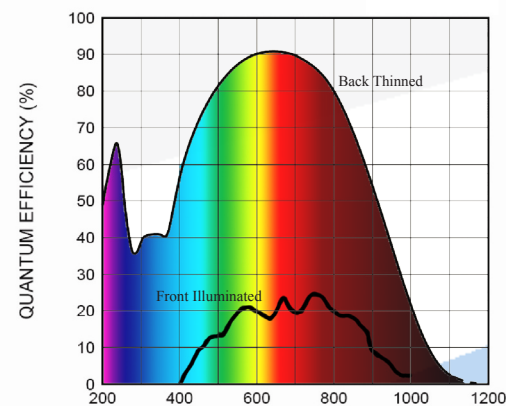
Sensitivity

Detector

Digitization of Photons

For demanding low-light applications, a sensitive detector must be utilized. The *i*nnoRam™ features a two dimensional charge coupled device to detect the dispersed Raman signal. The detector is TE Cooled to -20°C to maximize dynamic range by reducing dark current. A back-thinned CCD comes standard to attain 90% QE via collection of incoming photons at wavelengths that would not pass through a front illuminated CCD. The *i*nnoRam™ is the solution that will provide maximum photon collection for your low-light application needs.

Back Thinned

Front Illuminated

QUANTUM EFFICIENCY (%)

200 400 600 800 1000 1200

Sharp Resolution

Spectrometer

Optimized for Raman Spectroscopy

The spectrometer design is dedicated for Raman applications. You can customize your spectrometer by choosing from a variety of excitation wavelengths. In addition, each configuration can be further customized for your individual detection needs. Choose from wider spectral range or high resolution optimized systems. Research grade spectral resolution of 2cm⁻¹ can be achieved with our double pass transmission optics. Most Raman applications do not require such tight resolution, for those more general applications, a system that provides a wider spectral range is your solution. The high-throughput optical layout of all *i*nnoRam™ configurations are ideal for those low light level Raman applications.

Cyclohexane

Relative Intensity

Raman Shift (cm-1)
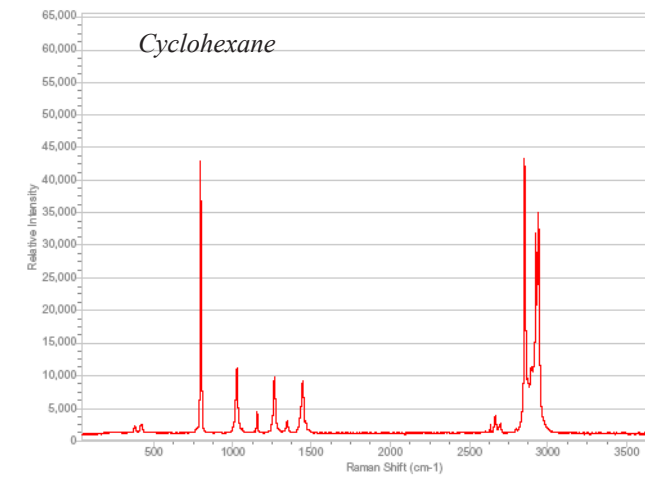
Easy Sampling

Probe

Easy Transition Between Sample Types

Taking measurements is easy - just point and "trigger!" By enabling the trigger option, the probe allows for measurement of various materials in the form of liquids, gels, powders, or solids under both lab conditions (Lab Grade) or demanding environmental conditions (Industrial Grade). Constructed with state of the art telecom packaging techniques, the probe has a flexible fiber coupling encased in a durable protective jacketing material which delivers Rayleigh scatter rejection as high as 10 photons per billion. Available for use with two excitation wavelengths: 785nm and 532nm. Custom wavelength excitation probes available.

Interface

Integrated Computer

State-of-the-Art Touch Screen

The *i*nnoRam™ system incorporates an integrated computer so there is no need for a separate laptop or desktop, making it ideal for applications needing bench-top portability. Featuring an embedded version of Windows XP and a 5.7" VGA touch screen with LED backlighting, the intelligent GUI is easy to use and Bluetooth capable. With an AMD Geode LX-800 500MHz CPU, Compact Flash 8GB Hard Drive, 1GB RAM, 2 USB and 2 Ethernet ports this system provides a total solution for Raman spectroscopy applications.

Why Choose Raman?

- **No sample preparation required**
- **Measure through glass, quartz, plastic (non-contact)**
- **Samples can be solid, liquid or gas, transparent or opaque**
- **Small sample size to reduce cost**
- **Wide spectral coverage for diversity of applications**
- **Spectra that is more clean and precise than FTIR or NIR**

We offer comprehensive software packages that provide solutions for your application needs.
Powerful calculations, easy data management, and user friendly!

BWSpec™

The foundation for all B&W Tek, Inc. software platforms, BWSpec™ is ideal for broad Raman applications

BWID™

Built on the proven BWSpec™ platform, BWID™ is optimized for identification and verification of materials

BWID™-PHARMA

For industrial Raman applications that require federal compliance: BWID™-Pharma supports FDA 21 CFR Part 11 Compliance

BWSpec™

BWSpec™ is a spectral data acquisition software developed by B&W Tek, Inc. for use with our spectrometers, systems, and accessories. It is included with the purchase of any product which uses it to operate. The software delivers a wide range of features designed to allow complex measurements and calculations to be done at the click of a button. BWSpec™ features multiple data formats and the capability to optimize scanning parameters such as integration time and laser output power control. With powerful data acquisition and data processing, other features include automatic dark removal, spectrum smoothing, and manual/auto baseline correction. The software also contains OCX interface for users to collect spectrum in GRAMS/AI®.

Key Features
  * Compatible with our spectrometers, systems, and accessories (if applicable)
  * Raman measurements
  * Continuous and single scan acquistion
  * Dark subtract
  * Spectral file format: txt, spc
  * Spectral file exportable to Excel®
  * Manual and automatic baseline correction
  * Peak smoothing algorithms: FFT, Savitzky-Golay, Boxcar
 * GRAMS/AI® OCX control interface
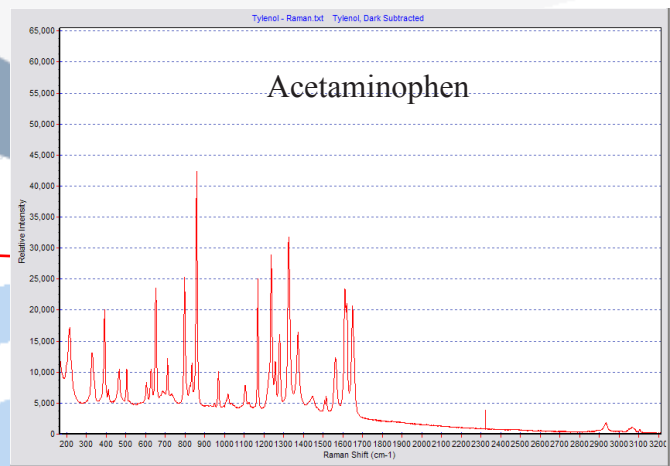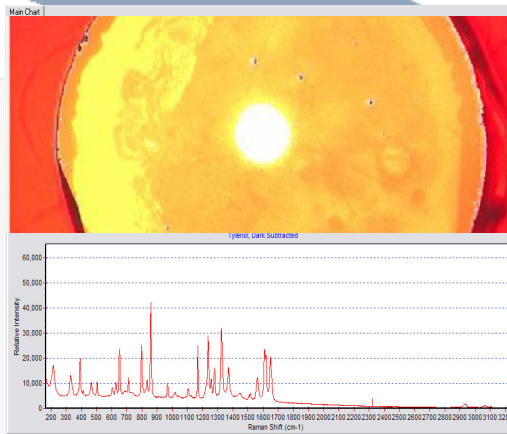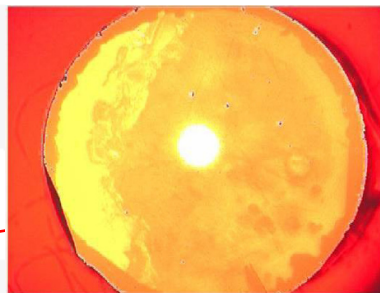
BWID™

BWID™ has been designed specifically for Raman spectroscopy. This software will rapidly identify and verify materials stored in your own personal easy-to-create library or an easy-to-load third-party library. One click is all you need to create or expand a Raman library. The combination of BWID and any of B&W Tek's Raman spectrometer systems unite to create a powerful and effective solution for identification and verification of materials. The reporting capability enables a user to save, view, and print any analysis report.

Key Features
  * Fast identification of unknown materials with "MATCH" or "NO MATCH" results
  * Fast verification of known materials with "PASS" or "FAIL" results
  * User-definable method for automated sequences of testing
  * Facilitates inspection of incoming raw materials
  * Build user-defined spectral libraries
  * Supports third-party libraries
  * Seven search algorithms
  * Capable of automatic performance test
  * Simplified menu driven GUI
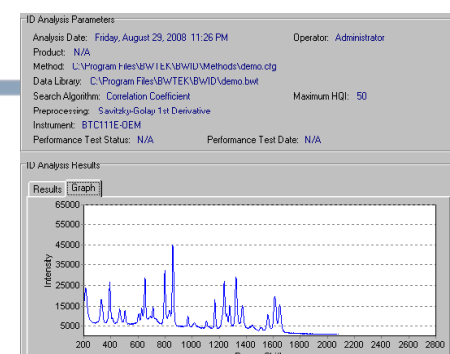 * Save, View and Print Analysis Reports
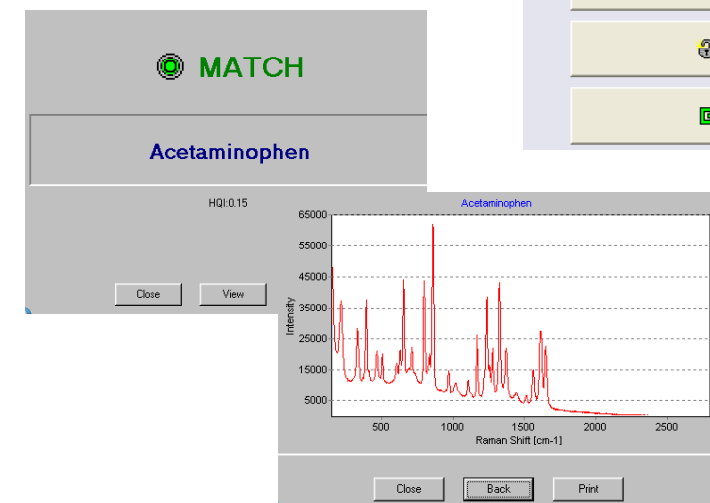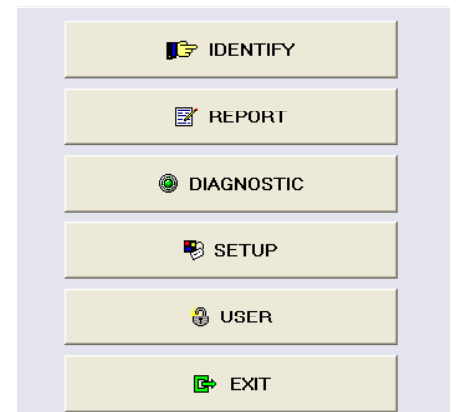
BWID™-PHARMA

BWID™-PHARMA is designed for pharmaceutical manufacturing facilities that are facing the increasing need for 100% inspection of incoming raw materials. In addition to all the features provided in BWID, BWID™-PHARMA provides enhanced system access security and an audit trail of data activities that support compliance with the FDA 21 CFR Part 11 regulation for Electronic Records and Electronic Signatures. It is of great benefit for pharmaceutical system validations including IQ and OQ procedures.

Key Features
  * Includes all BWID features
  * FDA 21 CFR Part 11 Regulation Compliance: Electronic Records and Electronic Signatures
  * Three user levels: Administrator, Developer, Operator
  * System Access Security
  * Audit Trails
  * Pharmaceutical System Validations - IQ and OQ Procedures

Applications & Experience

Bioscience and Medical Diagnosis

- Subtle changes within biomolecules, such as drug interactions, tissue healing, cosmetics, disease diagnosis
- Intercellular SERS localization and interaction. Identification of drug binding to cells for Drug-DNA and cellular interaction analysis.
- Investigation of microorganisms in single cells; yeast cell classifications, single bacterium
- Oxygenation measurements of blood and tissue
- Molecular level cancer detection (cervical, lung, etc.)
- Cardiovascular disease diagnosis (atherosclerosis)

Pharmaceutical Industry

- Analysis of tablets, liquids, and gel caps
- High throughput screening techniques
- Crystallization, end point detection
- Process Analytical Technology (PAT) on-line, at-line monitoring and control: real-time monitoring of drying, coating, and blending
- Identification and analysis of API, additives, and excipients
- Drug identification control device: Purity and Quality
- Raw materials inspection: 100% incoming material identification & verification

Raman Microscopy

- Pharmaceutical drug analysis: micro-Raman and localized molecular species analysis in complex drug mixtures, such as beta carotene in multivitamins
- Material science thin film analysis, such as diamond film quality characterization
- Trace forensic evidence analysis, including fibers, fabrics, pigments, inks, etc.,

Polymers and Chemical Processes

- Quality Control: Incoming/Outgoing
- Identification of contaminants during manufacturing
- Real time monitoring of polymerization
- Predicting the morphological properties of polymers
- Multivariate Analysis/Chemometrics to predict physical properties: glass transition temperature, crystallization temperature, etc.
- Chemical composition analysis

Environmental Science

- Water pollution detection using SERS technology
- Identification of contaminants in water
- Petrochemical analysis
- Identification and analysis of sediments in water

Forensic Analysis

- Nondestructive drug and narcotic drug identification
- Explosives: exact chemical compositions of materials, PETN, RDX and binding agents within explosive materials
- Identification and analysis of toxic solvents and bio-warfare agents
- Trace forensic evidence analysis, including fibers, fabrics, pigments, inks, etc., by Raman microscopy

Gemology

- Non-invasive gemstone identification and examination
- Identify unknown gemstone by unique Raman signal
- Identification of isomorph or subspecies of gemstone
- Analysis of gemstone origin through Raman microscopy analysis of inclusions
- Anti-counterfeiting, such as identification of diamond from zircon

Geology and Mineralogy

- Identification of geological materials
- Examination of inclusions in minerals
- Analysis of cement clinker by Raman microscopy
- Ancient fossil analysis

Food & Agriculture Industry

- Measuring the unsaturated fatty acid in food oils
- Detecting bacteria and/or contaminants in food products
- Identification of additive drugs: nutraceuticals and fruit drinks
- Analysis of components in grain kernel

Semiconductor & Solar Industry
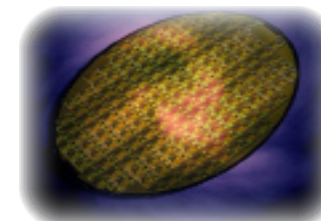
- Characterization of silicon crystallinity: Monitoring of the Raman band shift as silicon crystallinity changes from amorphous to a polycrystalline structure
- Analysis of micron sized particles in situ to provide information on potential contamination
- Mechanical stress monitoring for semiconductor process

Raman Probe Options

Two Raman probe options are available to allow sampling of various materials in the form of liquids, gels, powder, or solids under lab conditions (Lab Grade) or demanding environmental conditions (Industrial Grade).

Lab Grade

Industrial Grade

|	Lab Grade (BAC100)	Industrial Grade (BAC101)
Excitation Fiber	105μm core w/ FC/PC connector	
Collection Fiber	200nm core with SMA 905 male connector	
Fiber Length	1.5m	
Excitation Wavelength	785nm, 532nm, Other options available	
Laser Blocking	OD6 default, OD8 optional	
Shaft Material	SS 316L	SS 316L, Hastelloy C-276, Titanium
Shaft Diameter	9.5mm	12mm
Shaft Length	76.2mm	76.2mm - 203.2mm (Custom lengths available)
Window Material	Standard flat quartz	Fused Silica, Sapphire, Sapphire Ball Lens
Seal Material	Adhesive sealed	Kalrez® O-ring, Custom
Working Distance	5.90mm	5mm, 10mm, 20mm
Spot Size	85μm	85μm
Maximum Pressure	30 PSI	300 PSI
Maximum Temperature	80°C	300°C at probe tip

Innovative Signal Enhancement

BCR100A*

Our Enhanced Raman Cuvette Holder (BCR100A) is a uniquely designed sampling device that can increase Raman signal up to 3x's in comparison to a standard cuvette holder by utilizing a precise focusing mechanism, featuring a three point locking mechanism for reproducibilty. The enhanced Raman cuvette holder can be used with any standard 12.5mm x 12.5mm size cuvette to hold liquid or powder samples.

The BCR100A brings many advantages to Raman measurements; High Stability, Repeatability, Enhanced Raman Signal.
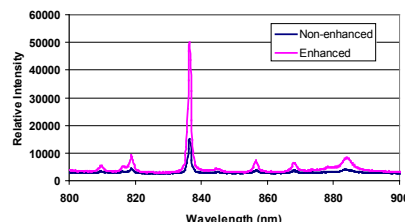
Liquid Sample Flow Cell

Liquid sample flow cell is a sampling device designed for Raman on-line process monitoring. It provides a sampling platform with high throughput and stability.

Our Flow Cells are constructed with your choice of three different cell materials, 316 SS, Titanium, or Teflon. Window options include Quartz or Sapphire. The BAC160 uses a Kalrez® O-ring which creates a chemical resistant sampling device.

Custom cell material and window construction available upon request.

Cell Material	316 SS or Titanium
Fitting	0.5in Swagelok
Tubing OD	0.5in – 2in
O-ring Material	Kalrez® O-ring Other materials on request
Window Material	Quartz Sapphire Other materials on request
Working Distance	Fixed
Excitation Wavelength Range	300nm – 2500nm
Maximum Temperature	150°C
Maximum Pressure	150 PSI
Weight	0.5 lbs

BAC160*

(*probe not included)

Easy and Precise Sampling

BAC150*

With a small laser spot size of 85μm, laser focus at the sample area becomes critical in all dimensions. The BAC150 precision probe mount accessory provides coarse and fine adjustment knobs for the X, Y, and Z axes. Z-axis adjustment allows for laser focusing on the desired plane in order to maximize the Raman signal.

Raman Microscopy Made Simple

BAC151*

The BAC151 is a visual assisted sampling platform that utilizes video precision spot sampling at a fraction of the cost of a typical Raman Microscope. The digital camera and LED illuminator allows for precise target and focusing of the spot size by way of an on screen display via BWSpec™ software or an added external monitor. Standard objectives from 10x's - 100x's can be utilized and sample images can be easily recorded and saved. Both coarse and fine adjustment knobs are available for the X, Y, and Z-axis control. Bright and dark field illumination optimizes the light required for various sample surfaces. Compatible with our Lab and Industrial Grade Raman probes, this video microscope system provides advantages of Raman microscopy at a fraction of the cost compared to similar research instruments.

Third-party Software - GRAMS/AI®

GRAMS/AI® Lab software package: for processing and managing spectroscopy data

PLSplus/IQ for GRAMS/AI 8: for creating qualitative and quantitative chemometric calibration models

Spectral ID for GRAMS/AI 8: for qualitative material identification through spectral library search

Laser Safety Goggles

Raman spectrometer systems use Class IIIb lasers. Class IIIb lasers produce radiation that can cause damage to the eyes when viewed directly or indirectly. B&W Tek, Inc. recommends Laser Safety Goggles for Raman spectrometer systems.

Carrying Case

Black suitcase with wheels and custom cut foam inserted for transporting your specific Raman spectrometer systems.

Suitcase	Dimensions
MiniRam™ II	58.4cm (H) x 38.1cm (W) x 27.9cm (D) {23in (H) x 15in (W) x 11in (D)}
i-Raman™	61cm (H) x 42cm (W) x 35cm (D) {24in (H) x 16.5in (W) x 13.8in (D)}

Extended Warranty

Ask about our Extended Warranty Program for our Raman Spectrometer Systems

(*probe not included)

innoRam™ Specifications

Lasers

532nm Excitation	Yes
785nm Excitation	Yes
Laser Power Control	Yes

Spectrometer

Spectral Range (785nm Laser)	65cm^{-1} - 3070cm^{-1}
Spectral Range (532nm Laser)	65cm^{-1} - 3250cm^{-1}
Spectral Resolution	2.0cm^{-1} - 4.5cm^{-1}
Stray Light Rejection	0.07% at 800nm

Detector

Detector Type	TE Cooled, Back-thinned, 2D Binning CCD
Pixel Number	2048
TE Cooling Temperature	-20°C
Max Quantum Efficiency	90%
Well Depth	200,000 Electrons
Dynamic Range	30,000:1 (minimum)
Digitization Resolution	16-bit or 65,535:1
Readout Speed	250kHz
Integration Time	27ms - 16 minutes

Electronics

USB	2 External Ports 2.0 / 1.1
Trigger Mode	5V TTL I/O
Power Input	110 - 240VAC, 50 - 60Hz
Bluetooth	Yes
Ethernet	2 External Ports

Power Options

AC	Standard
DC	N/A
Battery	N/A

Physical

Dimensions	41 x 22 x 30.3cm (16.1 x 8.7 x 11.9in)
Weight	~9.98 kg (~22 lbs)

innoRam™ Ordering Information

Model	Description
innoRam-785S	Standard *innoRam* with 785nm excitation, Spectral Range: 65 – 3070cm^{-1}, Spectral Resolution (FWHM): 4.5cm^{-1}, Laser Output Power: < 300mW
innoRam-785H	High resolution innoRam with 785 nm excitation, Spectral Range: 65 – 2565cm^{-1}, Spectral Resolution (FWHM): 2.0cm^{-1}, Laser Output Power: < 300mW
innoRam-532S	Standard innoRam with 532 nm excitation, Spectral Range: 65 – 3250 cm^{-1}, Spectral Resolution (FWHM): 4.5cm^{-1}, Laser Output Power: < 50mW
innoRam-532H	High resolution innoRam with 532 nm excitation, Spectral Range: 65 – 2645cm^{-1}, Spectral Resolution (FWHM): 2.0cm^{-1}, Laser Output Power: < 50mW

Accessories

Name	Model	Description
Raman Probe - Lab Grade	BAC100-532	Lab Grade Raman probe for 532nm excitation
	BAC100-785	Lab Grade Raman probe for 785nm excitation
Raman Probe - Industrial Grade	BAC101-532	Industrial Grade Raman probe for 532nm excitation
	BAC101-785	Industrial Grade Raman probe for 785nm excitation
Raman Cuvette Holder	BCR100A	Sample Cuvette Holder for use with B&W Tek, Inc. Raman probes. Raman Signal enhancement up to 3x's compared to standard cuvette holders
Raman Probe Holder	BAC150	Probe holder for use with B&W Tek, Inc. Raman probes. Coarse and Fine adjustments for X, Y, and Z axes.
Video Microscope Sampling System	BAC151-532	Video microscope sampling system for 532nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes
	BAC151-785	Video microscope sampling system for 785nm excitation for use with B&W Tek, Inc. Lab and Industrial Grade Raman probes
Raman Flow Cell	BAC160-Ti	Raman Flow Cell, Titanium, designed for on-line process monitoring
	BAC160-SS	Raman Flow Cell, Stainless Steel, designed for on-line process monitoring
	BAC160-TF	Raman Flow Cell, Teflon, designed for on-line process monitoring
Raman Probe Immersion Shaft	RIS100-FS	Immersion shaft for B&W Tek Lab Grade Raman probe, Stainless Steel body. Fused Silica Window, for taking Raman measurements immersed in liquids.
	RIS100-SA	Immersion shaft for B&W Tek Lab Grade Raman probe, Stainless Steel body, Sapphire Window for taking Raman measurements immersed in liquids.
Replacement Shaft	RSS100	Replacement shaft for Lab Grade Raman probe (BAC100)
Raman Probe Microscope Adaptor	PMA100	Probe microscope adapter for Lab Grade Raman probe (BAC100). Compatible with industry standard microscope objective lenses.
	PMA101	Probe microscope adapter for Industrial Grade Raman probe (BAC101). Compatible with industry standard microscope objective lenses.
Laser Safety Goggles	BAC063-532	Laser Safety Goggles for 532nm Class IIIB lasers only
	BAC063-785	Laser Safety Goggles for 785nm Class IIIB lasers only

Software

Name / Model	Description
BWSpec™	Operation software for B&W Tek, Inc. Raman Spectrometer Systems
BWID™ Standard	Material identification software for B&W Tek, Inc. Raman spectrometer systems
BWID™ Pharma	Material identification software for B&W Tek, Inc. Raman spectrometer systems. For use in Pharmaceutical Industry. FDA 21 CFR Part 11 Regulation Compliance: Electronic Records and Electronic Signatures
IQ/OQ package	Installation Qualification and Operator Qualification package for BWID-Pharma
BAC083	GRAMS/AI® 8 Lab Pack
BAC084	PLSplusIQ for GRAMS/AI® 8
BAC085	Spectral ID for GRAMS/AI® 8

Service Plan

Name / Model	Description
Service Plan	Extended one year warranty for B&W Tek, Inc. Raman spectrometer systems

Extended Warranty

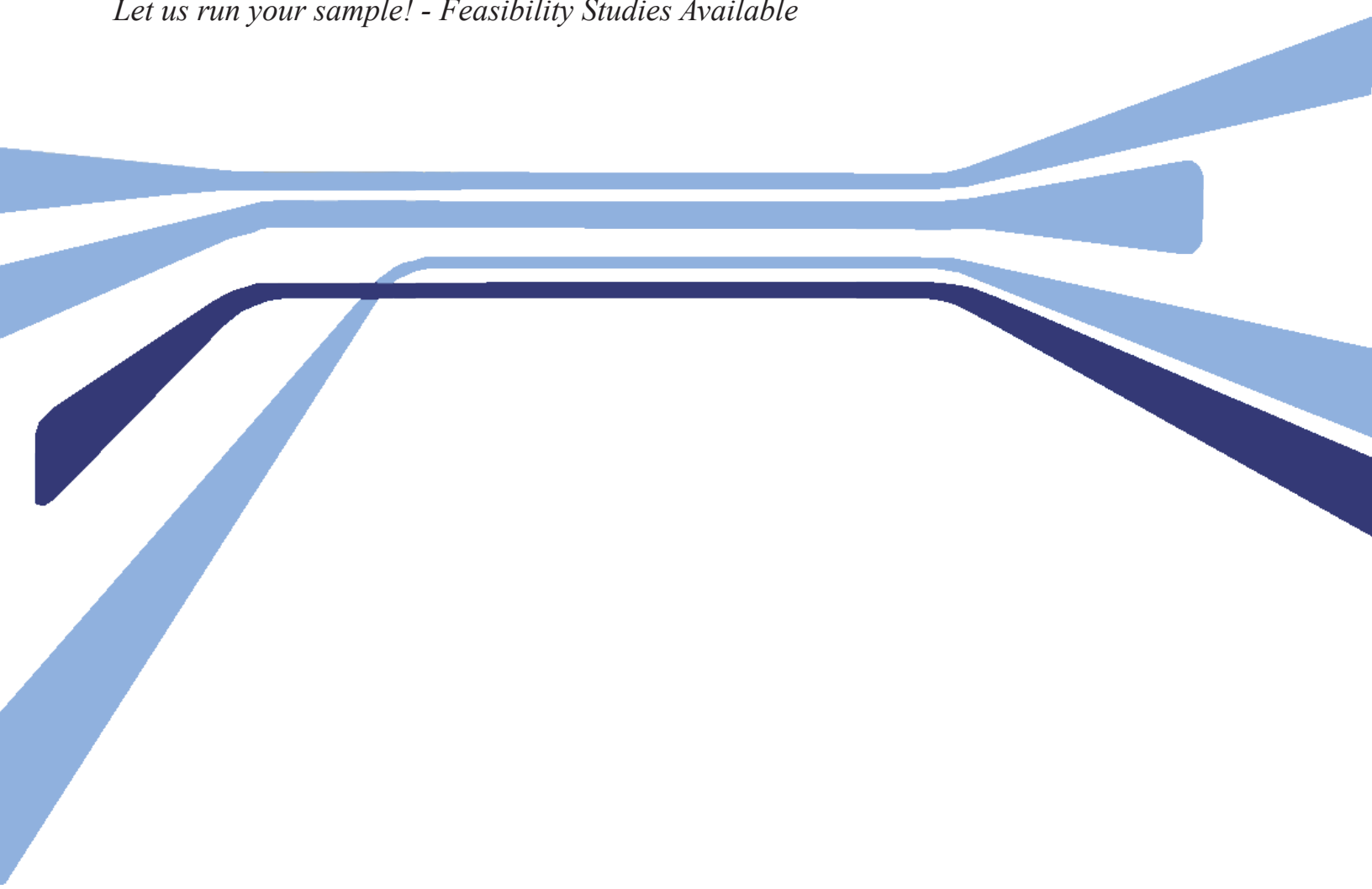# To find out more:

Contact our Application Team for your unique solution

Let us run your sample! - Feasibility Studies Available