Nunavut™ Camera/Detectors

New:
InGaAs/CCD cameras, lower cost, fast lead-times

SOLID STATE   HIGH RESOLUTION   LONG-TERM SEAL   COST-EFFECTIVE
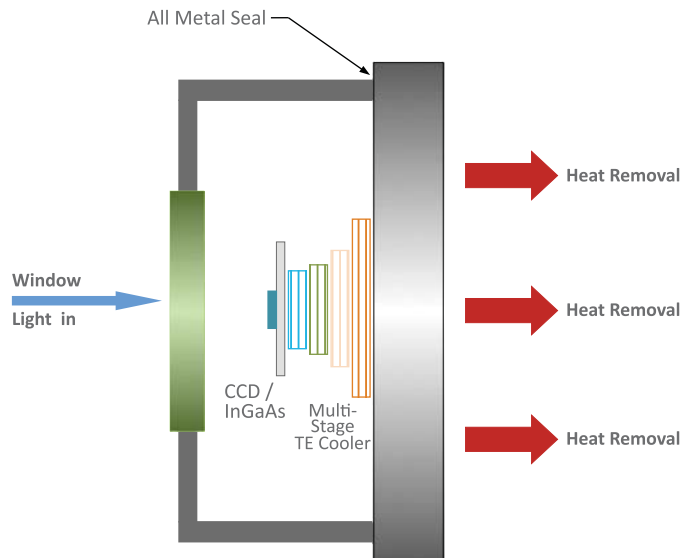
BAYSPEC

Pervasive Spectroscopy

www.bayspec.com

Introduction

Instrumentation professionals have long recognized great potential for spectroscopic analyzers in many application areas ranging from lab analysis to portable field monitors. Until now, however, UV-VIS-NIR and Raman process analytical instrumentation were too big, too expensive, too fragile, and so sophisticated they required highly trained operators for "real-world" application use. One of the main drawbacks preventing the full potential realization of these spectroscopic applications owes itself to the photo detectors requiring deep cooling to achieve high sensitivity and high dynamic range. A key component for resolving many of the practical problems associated with measurement and diagnostics is related to the availability of ruggedized, sensitive, high dynamic range, yet low cost photo detectors that can operate at various environmental conditions and without the use of liquid nitrogen (LN2) cooling.

High volume optical telecom device manufacturing has driven recent advances in the hermetic sealing process, thus, presenting a disruptive new picture today.

Example of Deep-cooled InGaAs detector with BaySpec high-throughput VPG-based spectrograph

All Metal Seal

Heat Removal

Window
Light in

Heat Removal

CCD / InGaAs   Multi-Stage TE Cooler

Heat Removal

**Schematic Diagram-
Thermo Electric Cooling Process**

APPLICATIONS GUIDE	CCD	DD-CCD	InGaAs
UV-VIS Absorption-Transmission-Reflectance Spectroscopy	▪	▪	
NIR Absorption-Transmission-Reflectance Spectroscopy			▪
Fluorescence/Photoluminescence	▪	▪	▪
Raman Spectroscopy	▪	▪	▪
Surface Enhanced Raman Scattering (SERS) & Spatially Offset Raman Spectroscopy (SORS)	▪	▪	
Raman Microscopy	▪	▪	▪
Fluorescence Microscopy	▪	▪	▪
Multi-track Spectroscopy		▪	
Hyperspectral Imaging		▪	

Nunavut™ *Near Infrared* (InGaAs) Deep Cooled Detectors

Nunavut™ series Deep-Cooled InGaAs cameras are designed to meet real-world challenges for low-noise, high QE, long-term reliability, and compact size. Benefiting from experience manufacturing high-volume optical devices for the telecommunications industry, BaySpec's InGaAs cameras utilize low-cost field proven components. For the first time in instrumentation history an affordable, accurate and ruggedized spectral detector is a reality.
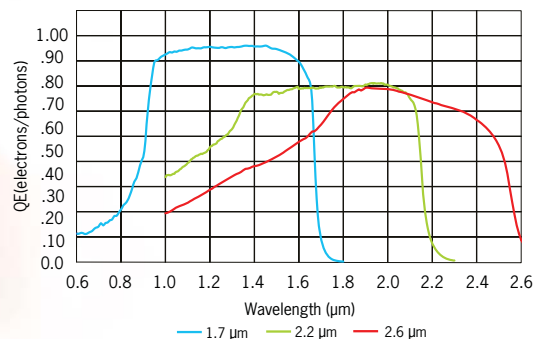
KEY FEATURES

- Real-time spectral data acquisition
- Hermetic/Vacuum-sealing ensures reliable operation over time
- Air Deep-Cooling to -60°C
- Water cooling optional to -100°C
- Covers wavelength ranges: 900-1700nm, 1100-2200nm and **now 1250-2500nm**
- Single 5 volt power supply

The Nunavut™ Series employs the latest in opto-electrical components to bring you the very best capability at a very affordable price. When matched to the Nunavut Raman spectrograph or photoluminescence spectrograph you have a light weight, very high performance, cost effective instrument. Each camera is calibrated in the factory after extensive thermal cycling. The control electronics read out the processed digital signal to extract required information. Both the raw data and the processed data are available to the host.

Key design benefits:

- Solid-state electronics
- Hermetic/vacuum sealed for long lifetime
- Compact size
- Flexible, powerful software
- Easy adoption to spectrograph
- USB 2.0 output

Applications:

- Low light NIR spectroscopy
- Laser light measurement
- Reduced fluoresence imaging
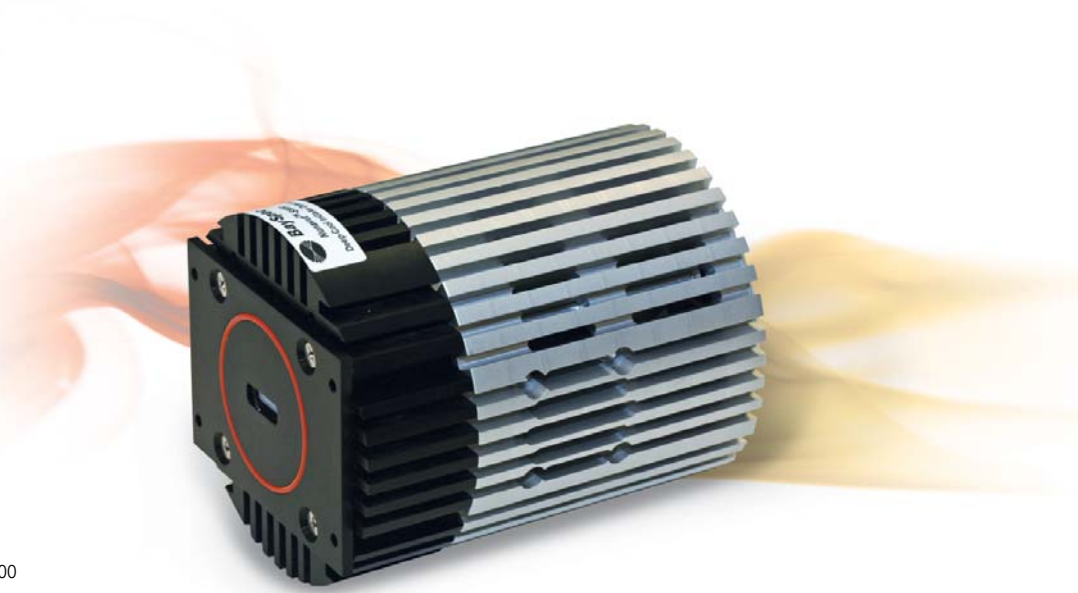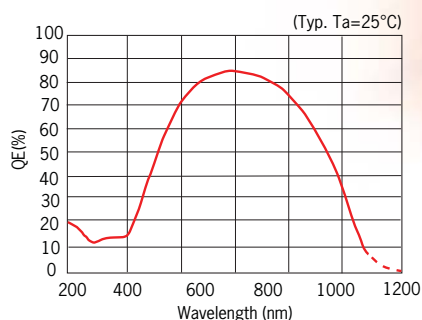- SERS/SORS
- Raman Microspectroscopy
- Raman Spectroscopy
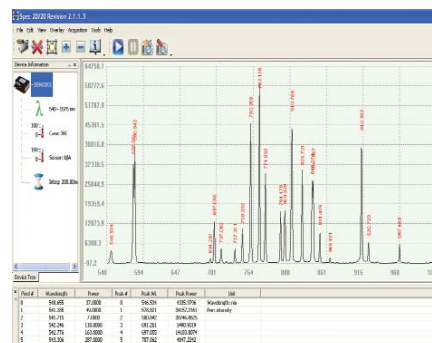
BaySpec "Spec 2020" Software included for ease of integration.

Visible-NIR Nunavut™ *Deep Cooled* CCD Detector
Back-Thinned 200-1100nm

Nunavut™ Series Back-Thinned CCD Detector/Cameras are designed to meet real-world challenges for low noise, high QE, long-term reliability, and compact size. Benefiting from experience manufacturing high-volume optical devices for the telecommunications industry, BaySpec's CCD cameras utilize low-cost field proven components. For the first time in instrumentation history an affordable, accurate and ruggedized spectral device is a reality.

(Typ. Ta=25°C)

KEY FEATURES

- Real-time spectral data acquisition
- Hermetic/vacuum-sealing ensures reliable operation in harsh environments
- Deep cooling to -60°C
- Water cooling optional to -100°C
- Covers wavelength ranges from 200-1100nm

The Nunavut™ Series employs the latest in opto-electrical components to bring you the very best capability at a very affordable price. When matched to the Nunavut Raman spectrograph or photoluminescence spectrograph you have a compact, high performance, cost effective instrument. Each camera is calibrated in the factory after extensive thermal cycling. The control electronics read out the processed digital signal to extract required information. Both the raw data and the processed data are available to the host.

A Custom 532nm Raman Spectrometer equipped with the deep cooled CCD detector

Key design benefits:

- Solid-state electronics
- Hermetically sealed
- Compact size
- Lower power consumption
- Life time vacuum
- Flexible, powerful software
- USB 2.0 Output

Applications:

- Raman Spectroscopy
- Fluorescence/Photo Lummesence Spectroscopy
- VIS-NIR Spectroscopy
- Low Light Detection
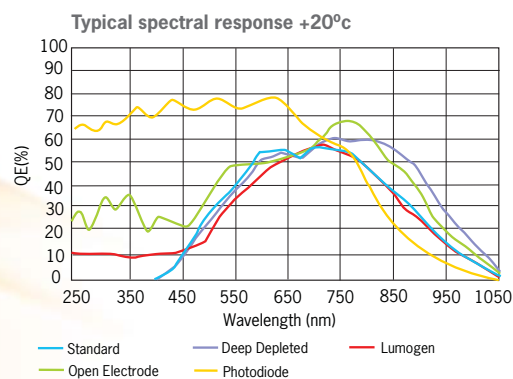- UV-VIS absorption transmission reflective spectroscopy

Visible-NIR Nunavut™ DD-CCD Camera

Deep Depletion Back-Thinned 400-1100nm

Nunavut™ series Deep-Depletion CCD cameras are designed to meet real-world challenges for low noise, high QE, long-term reliability, and compact size. Benefiting from experience manufacturing high-volume optical devices for the telecommunications industry, BaySpec's CCD cameras utilize low-cost field proven components. For the first time in instrumentation history an affordable, accurate and ruggedized spectral device is a reality.

Shown here with BaySpec SuperGamut™ Spectrograph

Typical spectral response +20⁰c

- Standard
- Open Electrode
- Deep Depleted
- Photodiode
- Lumogen

The Nunavut Series employs the latest in opto-electrical components to bring you the very best capability at a very affordable price. When matched to the Nunavut Raman spectrograph or photoluminescence spectrograph you have a light weight, very high performance, cost effective instrument. Each camera is calibrated in the factory after extensive thermal cycling. The control electronics read out the processed digital signal to extract required information. Both the raw data and the processed data are available to the host.

KEY FEATURES

- Real-time spectral data acquisition
- Hermetic/vacuum-sealing ensures reliable operation
- Deep cooling to -60°C
- Water cooling optional to -100°C
- Covers wavelength ranges from 400-1100nm

Key design benefits:

- Solid-state electronics
- Hermetically/vacuum seal for long life
- Compact size
- Flexible, powerful software
- USB 2.0 Output

Applications:

- Raman Spectroscopy
- Fluorescence Spectroscopy
- VIS-NIR Spectroscopy
- Ultra-low Light Detection
- Astronomy
- High Throughput Screening
- Laser Induced Fluorescence
- Hyper Spectral Images

RamSpec-785™ Raman Instrument with Nunavut™ Deep-Cooled Detectors

Specifications:

Model	NIR Nunavut CCD Camera	Visible-NIR Nunavut DD-CCD Camera	Near Infrared Nunavut 900-1700nm	Near Infrared Nunavut 1000-2200nm	Near Infrared Nunavut 1000-2500nm
PERFORMANCE					
Wavelength range	200-1100nm	400-1100nm	900-1700nm	1000-2200nm	1000-2500nm
Signal/Noise	6000:1	8000:1	500:1	500:1	500:1
Integration time	5 ms to 30 seconds	10 µs to 300 seconds	5 ms to 30 seconds	5 ms to 30 seconds	5 ms to 300 seconds
Dimensions	118 x 118 x 162 mm³	118 x 118 x 162 mm³	118 x 118 x 162 mm³	118 x 118 x 162 mm³	118 x 118 x 162 mm³
OPTICS					
Window	Sapphire AR coated window	Sapphire AR coated window	Sapphire AR coated window	Sapphire AR coated window	Sapphire AR coated window
DETECTOR SPECS					
Detector array	2048 x 64 - 14µ x 14µ	1024 x 256 - 26µ x 26µ	256 x 50µ, 512 x 25µ or1024 x 25µ	256 x 50µ or 512 x 25µ	256 x 50µ
Quantum Efficiency @ïpk Min.	75%	47%	85%	75%	70%
Dark Current	20 counts rms @25C	20 counts rms @ 25°C	50 counts rms @ 25°C	80 counts rms @ 25°C	100 counts rms @ 25°C
Readout noise	8	10	50	100	100
Detector	4 stage TE deep cooled CCD	4 stage TE deep cooled deep depletion CCD	4 stage TE deep cooled InGaAs	4 stage TE deep cooled InGaAs	4 stage TE deep cooled InGaAs
A/D converter	16bit	16bit	16bit	16bit	16bit
Power	1A@5v detector 8A TE cooler max. average 5A	1A@5v detector 8A TE cooler max. average 5A	1A@5v detector 8A TE cooler max. average 5A	1A@5v detector 8A TE cooler max. average 5A	1A@5v detector 8A TE cooler max. average 5A
COMPUTER					
PC Connectivity	USB 2.0	USB 2.0	USB 2.0	USB 2.0	USB 2.0
Trigger modes	Software Controlled	Software Controlled	Software Controlled	Software Controlled	Software Controlled
Software	BaySpec "Spec 20/20"	BaySpec "Spec 20/20"	BaySpec "Spec 20/20"	BaySpec "Spec 20/20"	BaySpec "Spec 20/20"
Operating System	Windows 2000 or later	Windows 2000 or later	Windows 2000 or later	Windows 2000 or later	Windows 2000 or later
Voltage (Out, In)	12V, 100~240V	12V, 100~240V	12V, 100~240V	12V, 100~240V	12V, 100~240V
OPERATION & STORAGE					
Min. Detector Temperature	-60°C	-60°C	-60°C	-60°C	-60°C
Operating Temperature	-20 to 40°C	-20 to 40°C	-20 to 40°C	-20 to 40°C	-20 to 40°C
Relative Humidity	75% (non condensing)	75% (non condensing)	75% (non condensing)	75% (non condensing)	75% (non condensing)
Storage Temperature	-25 to 60°C	-25 to 60°C	-25 to 60°C	-25 to 60°C	-25 to 60°C

Examples of OEM camera/detectors and spectral engine designs

Spec 20/20 software

Spec 20/20 graphical user interface (GUI) is a Windows-based application program for interfacing with BaySpec's UV-VIS-NIV and Raman spectral engines. It can perform the following tasks: acquire and analyze spectra, calibrate wavelength, verify and identify substances, and manage user-built spectral libraries. Spec 20/20 is provided with a full Software Development Kit and dll support (sample code for C/C++ and Labview) included with each each system purchase.
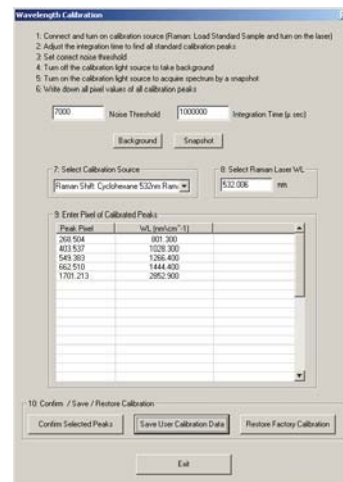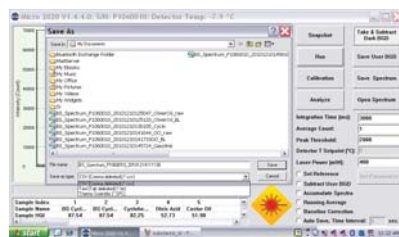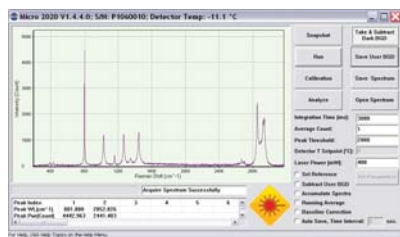
**Intuitive Graphical User Interface (GUI):**
Important setup parameters, spectrum display, and real-time status indicators are all on a single, easy-to-see screen. Especially designed for touch screen operations. (Pane 1: Spectrum window, Pane 2: Data viewer, Pane 3: Control panel)

Flexible, Multiple Data Formats:
Can save and open data files in ASCII (.txt), Excel (.csv), or Grams/AI (.spc) to allow user the maximum flexibility in data storage and retrieval and interfacing to third party software packages.

Automated Calibration Procedure:
Built-in, automated calibration procedure leads users through easy-to-follow steps to accomplish Raman shift calibration in less than 30 seconds.
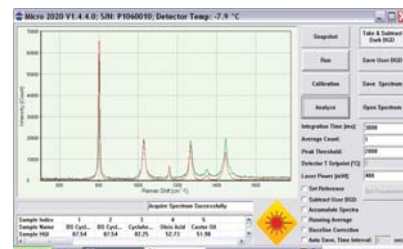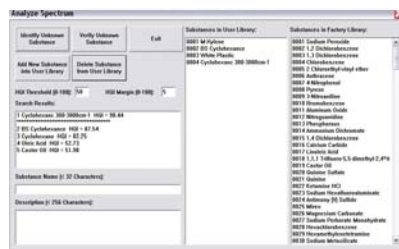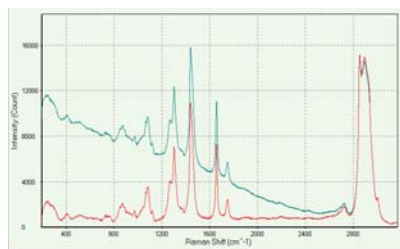
Intelligent Baseline Correction Function:
Baseline constructed from a multi-segment, smoothed polynomial allows effective removal of fluorescence background and slanted baseline with minimal artificial bias.

Tailored Substance Libraries:
With Spec 20/20 the user can quickly and easily build his/her own compound libraries to meet his/her specific identification needs, or can import libraries from third party vendors.

Powerful Substance Identification Functions:
Whether the library is user built or imported from third parties, Spec 20/20 can identify unknown substances instantaneously and report quantitatively the match quality. It can even be trained to recognize mixtures.

Founded in 1999 with support from some of the leading corporations and venture capital firms in Silicon Valley, BaySpec is a vertically integrated spectral sensing company. The company designs, manufactures and markets advanced spectral instruments, from UV-VIS spectrometers to handheld and portable NIR and Raman analyzers, for the biomedical, pharmaceuticals, chemical, food, semiconductor, homeland security, and the optical telecommunications industries.

Engineering and Product Development

- Shortest product development cycle in the industry
- Extensive Intellectual Property covering key aspects of our products
- In-house capabilities encompassing all the important and critical components, from lasers to gratings and state-of-the-art detectors

Production

- 48,000 square foot production facility, including 9,000 square foot Class 10,000 clean room
- History of producing and delivering more than 30,000 spectral engines of all types
- 100% made in the USA

Quality Control

Dedicated team, established procedures to ensure consistent and reliable product delivery

Safety and Environment

At BaySpec the safety of our employees and customers is our utmost concern. Rigorous training programs are implemented for laser, electrical, and hazardous materials safety. All products we release are extensively reviewed for any potential safety hazard. Every precaution is exercised, whether via hardware design or software control, to prevent safety issues from occurring. BaySpec is committed to green manufacturing techniques and processes. We strive to minimize or eliminate the use of hazardous materials in every manufacturing step, thus benefitting the health and well being of our employees and the environment. Our spectral sensing products are compact, and energy efficient and do not generate hazardous waste during normal usage.

BAYSPEC

Pervasive Spectroscopy

Contact info:

BaySpec, Inc.
1101 McKay Drive
San Jose, California 95131
USA

Tel: +1 (408) 512-5928
Fax: +1 (408) 512-5929
Web: www.bayspec.com
email: sales@bayspec.com

All BaySpec products are made in the USA