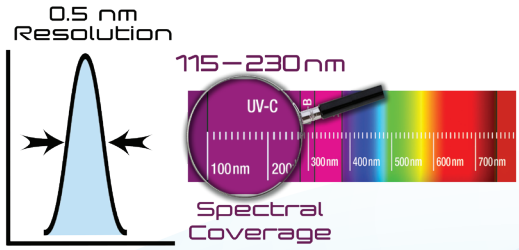
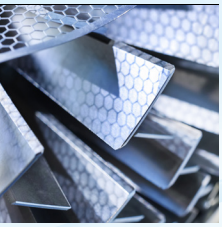
HORIBA
Scientific

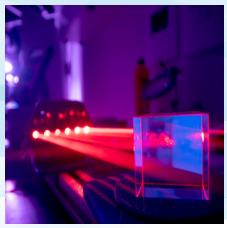
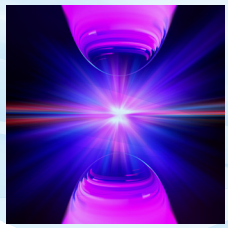


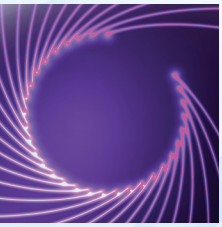
VU90 Spectrometer

Most Compact Far UV CCD Spectrometer







For OEM VUV
Industrial Applications

JOBIN YVON
Technology

horiba.com/oem

VU90 Most Compact Vacuum UV/Far UV Back-Illuminated CCD Spectrometer

Overview

HORIBA has developed a compact size Vacuum Ultraviolet (VUV) Spectrometer with a dedicated deep-cooled CCD camera, Syncerity-VUV, all manufactured in its NJ facility. This unique system features a special CCD sensor with high sensitivity in the far UV wavelength range with capability to measure from 115 nm with a resolution better than 0.5 nm under vacuum, or high purity nitrogen. The system's internal optical cavity can be black coated for ultimate suppression of stray light.

Far UV Applications (Vacuum UV or N_2 purge)

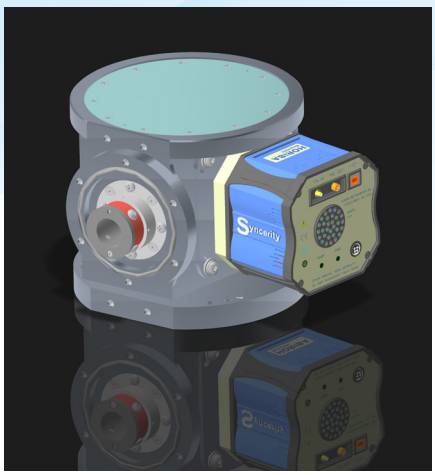
- VUV Emission & Fluorescence
- VUV Transmission & Reflectance
- GC-VUV: Alternative to conventional gas chromatography

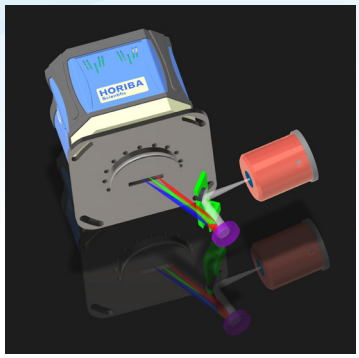
Examples:

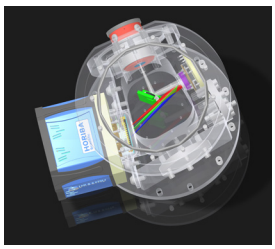
- Metrology
- Photolithography
- Petrology
- Environmental Monitoring
- Flavors & Fragrances
- Food & Beverage Safety

Optical and Mechanical Layout

Based on concave holographic grating







High sensitivity and very low stray light are achieved in a short focal length (90 mm) CCD spectrometer

Features

First portable and most affordable VUV spectrometer

Deep-cooled CCD with high quantum efficiency

High resolution of 0.5 nm selectable resolution and throughput

Ultra-high throughput combined with unmatched low stray light performance

Ultra high throughput combined with unmatched low stray light performance

Extendable wavelength coverage from Far UV to UV-VIS-NIR

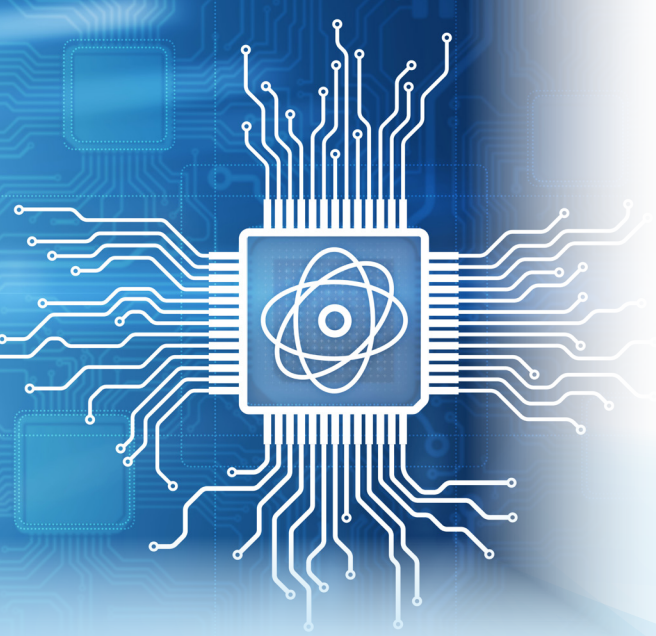
General Spectrometer Specifications

Spectral Coverage	115 - 230 nm; full coverage on CCD: 115 - 320 nm (No order sorting filter available)
Spectral Resolution	0.5 nm with 22 µm pinhole, 0.75 nm with 40 µm pinhole
Spectral Dispersion	12 nm/mm; 0.17 nm/pix
Focal Length	90 mm
VUV Optics	MgF_2 coated grating and mirror
Vacuum or Nitrogen-purged Mode	~ 10^{-6} Torr with turbomolecular pump. Helium leak test performed at factory. N_2 high purity nitrogen constant purge required
Options	Selection of different heights of VUV CCDs Kinematic mounts to interchange pinholes (or slits) Bare metal finish is standard; Optional super black coating reduces stray light
F/#	~ F/10
Software	LabVIEW acquisition software for initial evaluation (DLLs provided for software integration)

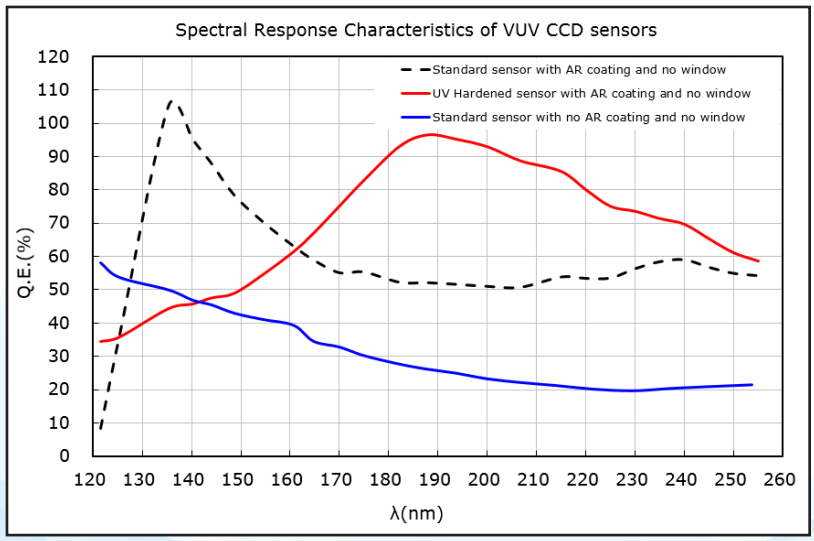
Vacuum Camera Specifications (Syncerity® VUV 2048 pixel BI Sensor)*

Quantum efficiency at 20° C (See plots on next page)	Standard	Special
CCD Sensor Format	2048 x 70	Optional increased CCD sensor heights available
CCD Pixel Size	14 µm x 14 µm	
CCD Height	1 mm	
CCD QE	3 options - refer to graphs below	
Camera Window	2 options - no window for lowest VUV response or MgF_2 window	
Deep Thermoelectric Cooling	-45° C under vacuum (10^{-6} mbar) with +25° C ambient or -25° C under N_2 purging	
Single Pixel Well Capacity	50 000 e^-/pixel (minimum); 60 000 e^-/pixel (typical)	
Serial Register Full Well Capacity	250 000 e^-/pixel (minimum); 500 000 e^-/pixel (typical output register saturation)	
Scan Rates	45 kHz and 500 kHz	
Readout Noise (at 45 kHz and at –45° C)	10 e^- (typical) to 14 e^- (maximum)	
Readout Noise (at 500 kHz and at –45° C)	20 e^- (typical) to 25 e^- (maximum)	
Maximum Spectral Rate	20 Hz at 45 kHz scan rate; 189 Hz at 500 kHz scan rate	
Digitization	16-bit ADC	
Dynamic Range (Typical for Single Pixel)	50,000:1	
Non-linearity (Measured on Each Camera)	< 0.15% (typical) at 45 kHz (0.4% maximum)	
	< 0.20% (typical) at 500 kHz (1% maximum)	
Dark current at –45° C Note: Pixel size = 14 µm	0.1 e^-/pixel/s (typical)	
Software-adjustable Gains	2, 4, and 10 e^-/count at –45° C	
Communication	USB 2	
Environmental Conditions	Operating temperature 15° C to 40° C ambient	
	Relative humidity < 70% (non-condensing)	
	Storage temperature -25° C to 45° C	
Power Requirements AC/DC power supply (provided)	90-264 VAC, 47–63 Hz	

*Specifications, form factor, and spectrometer cover subject to change without notice. No LabVIEW license is needed to run our acquisition software.

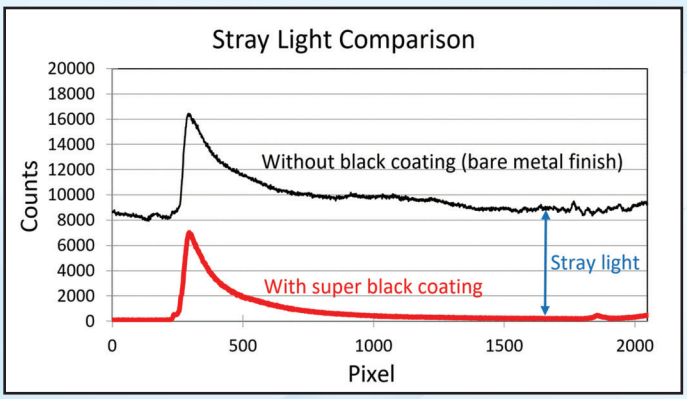


CCD Quantum Efficiency

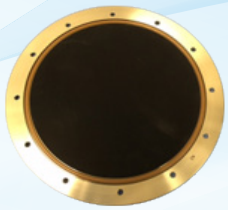


UV hardened sensor provides increased lifetime, however no warranty is provided on any sensor exposed to VUV.

The Only Commercial VUV System Using a Super Black Coating

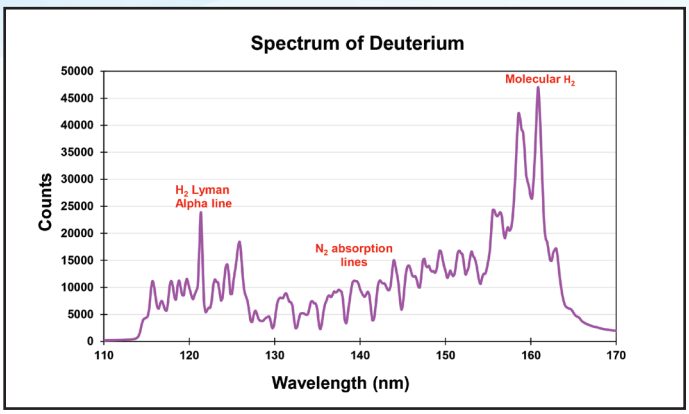


Stray light comparison between uncoated and coated cavity (Super Black) measured by far field illumination using tungsten lamp – zero order

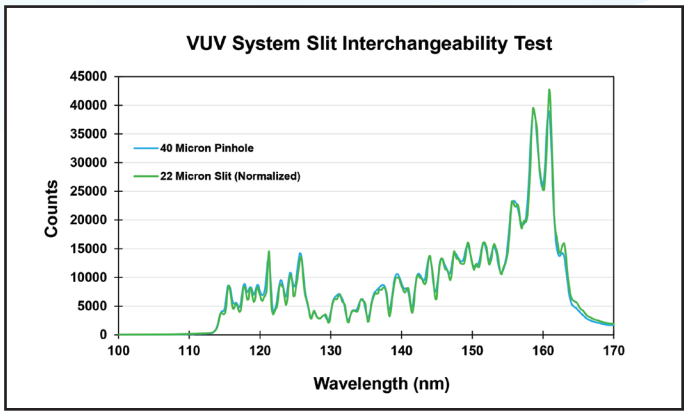


Housing Lid

Baffle treated with super black coating



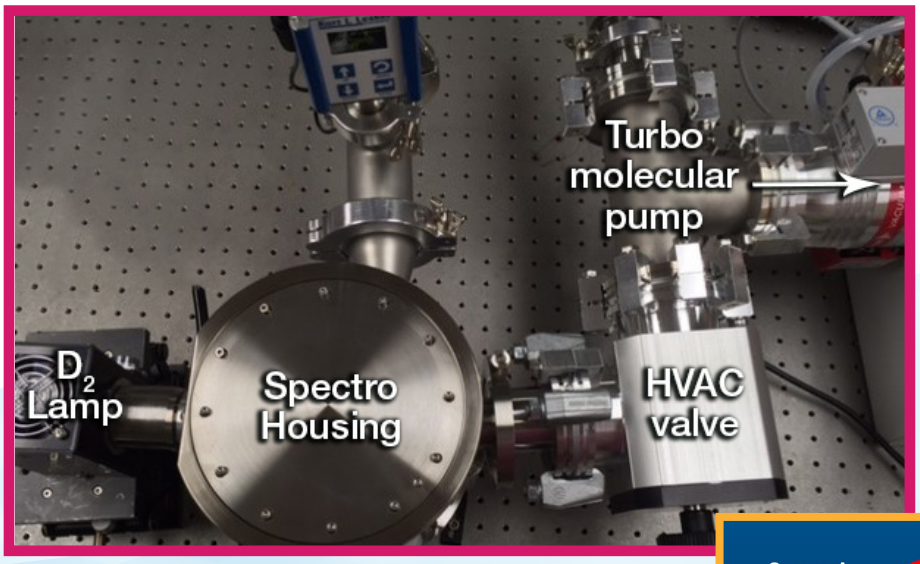
Spectrum of deuterium lamp shows enhanced sensitivity starting from 113 nm with 22 µm slit (0.45 nm resolution)

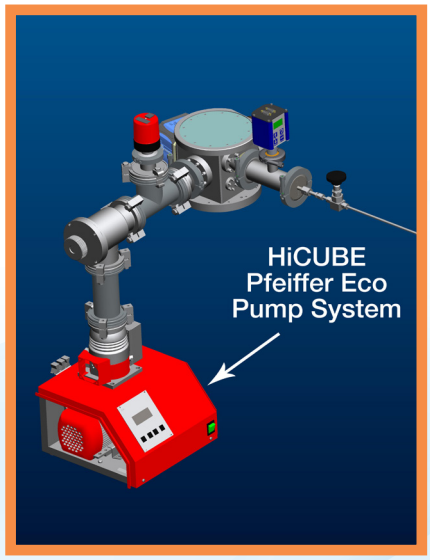


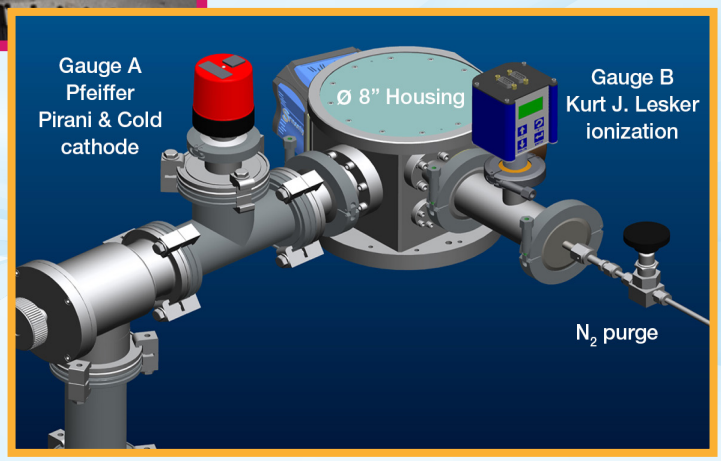
VUV system slit interchangeability test with 40 µm pinhole and 22 µm slit

Illustrations of Different Setups of FUV System

Config #1: High vacuum setup with turbo pump CCD temp: -45° C







Config #2: Nitrogen-purged CCD temp: -25° C

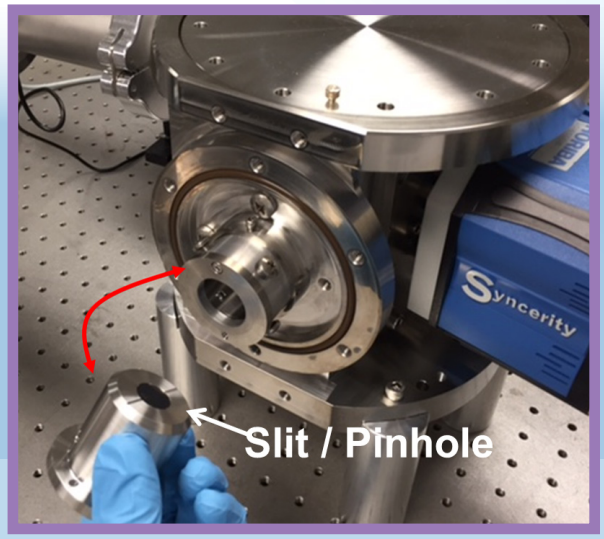
N_2-purged set-up shown with Hamamatsu: L10366 VUV light source

Adjustable Resolution and Throughput

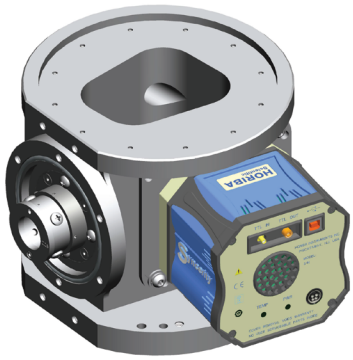
Resolution and throughput are adjustable by exchanging optional slit & pinhole holders.

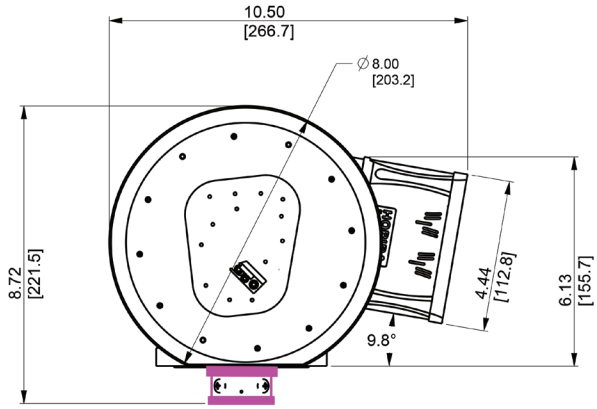
Pinhole sizes:	22 and 40 µm diameter
Slit sizes:	22 and 40 µm width

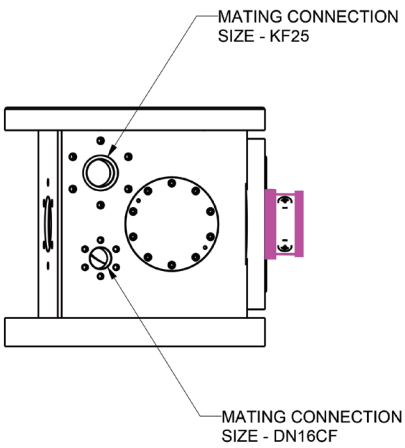
Kinematic interchange is achieved if all components are ordered and pre-aligned at factory.

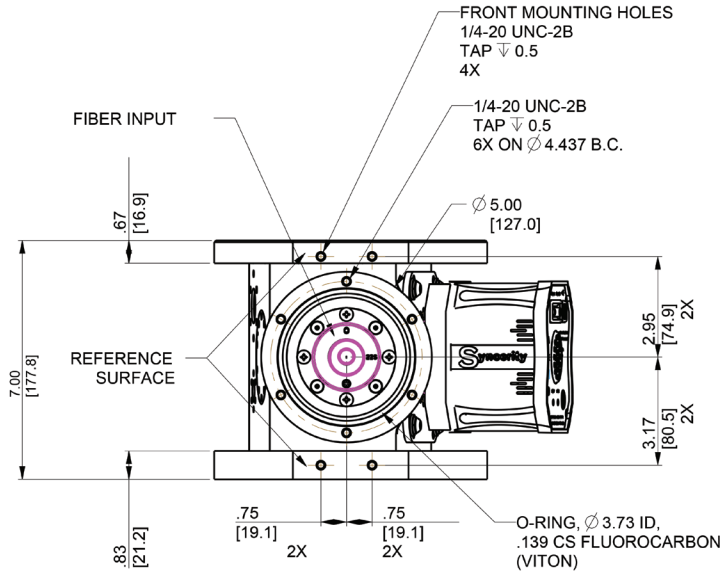


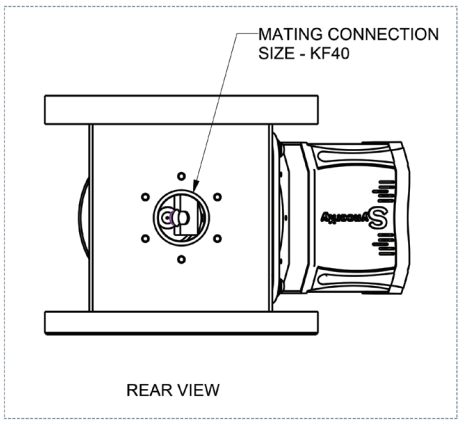
System Mechanical Drawings

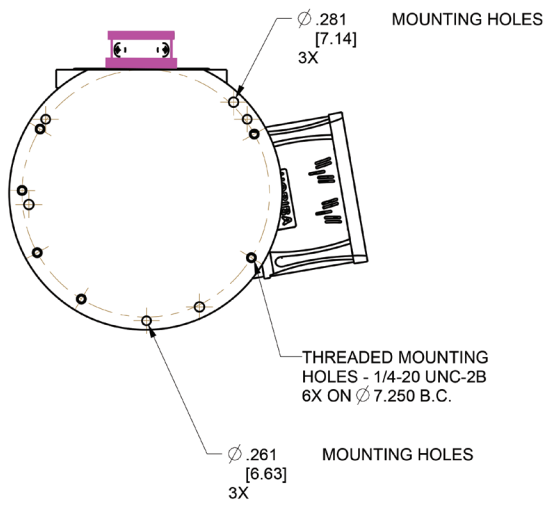












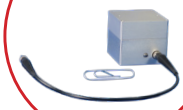
UNITS IN INCHES [MM] UNLESS NOTED

Best Selling Miniature Spectrometers for OEM Industrial Applications

Fiber-coupled USB Spectrometers:

MiniVS20 Spectrometer with Linear UV-VIS CMOS or NIR InGaAs Sensor

5 nm resolution



OEM hand-held spectrometer covering 190 to 1,700 nm for various low stray light applications

- Aberration-corrected concave holographic grating options
- VIS configuration featuring a 1.7" x 1.9" x 2" size combined with full F/2.3 optics for high signal-to-noise
- High throughput, compactness and long term reliability

MiniVS70 VIS Spectrometer with FI CMOS or BI CCD

1 nm resolution

NEW miniaturized VS70 configuration

- Based on high performance aberration-corrected concave gratings fitted with a custom order-sorting filter to eliminate higher orders
- Low cost combined with high performance and low stray light
- Long term opto-mechanical stability and choice of front-illuminated linear CMOS or back-illuminated CCD sensors

VS70 UV-VIS-NIR Spectrometer with Uncooled / TE-cooled CCD

1-2 nm resolution

Compact, versatile most popular VS70 OEM spectrometer and OES configurations

- Based on high performance aberration-corrected concave gratings with full F/2.3 aperture
- Affordable, high throughput, robust and stable
- Electronics drivers ranging from **USB-2 to Ethernet and EtherCAT**

CiCi-Raman-NIR with Scientific Camera Optimized for 785 nm

6 cm^{-1} resolution

Most compact OEM Raman spectrometer with aberration-corrected holographic grating

- Covers 150-3,300 cm^{-1}
- High efficiency and low stray light
- Available in F/2.3 and in compact F/5 configurations
- -50° C deep-cooled scientific CCD camera with minimized etaloning and high NIR QE

PoliSpectra® Quad Spectrometer for Simultaneous Acquisition of 4 VIS Spectra

1 nm resolution

CCD spectrometer for simultaneous acquisition from 4 fiber inputs (470-730 nm)

- High-speed electronics (as fast as <1.5 msec readout time for 4 spectra)
- QUAD-channel high throughput system (f/2.3) and ultra-low stray light
- Industrial low-light applications from low light fluorescence to reflectance

PoliSpectra® M116 8-32 Channel MultiTrack UV-VIS-NIR CMOS Spectrometer

1 nm resolution

Fiber-coupled multi-spectra system with 8- to 32-channel simultaneous measurements

- Concentric optical design with UV extended spectral range provides minimized crosstalk
- High throughput USB-3 system featuring a fast 2D scientific BI CMOS running at 94 to 188 frames per second, acquiring 8, 16 or 32 simultaneous spectra (2048 pixels per spectrum)

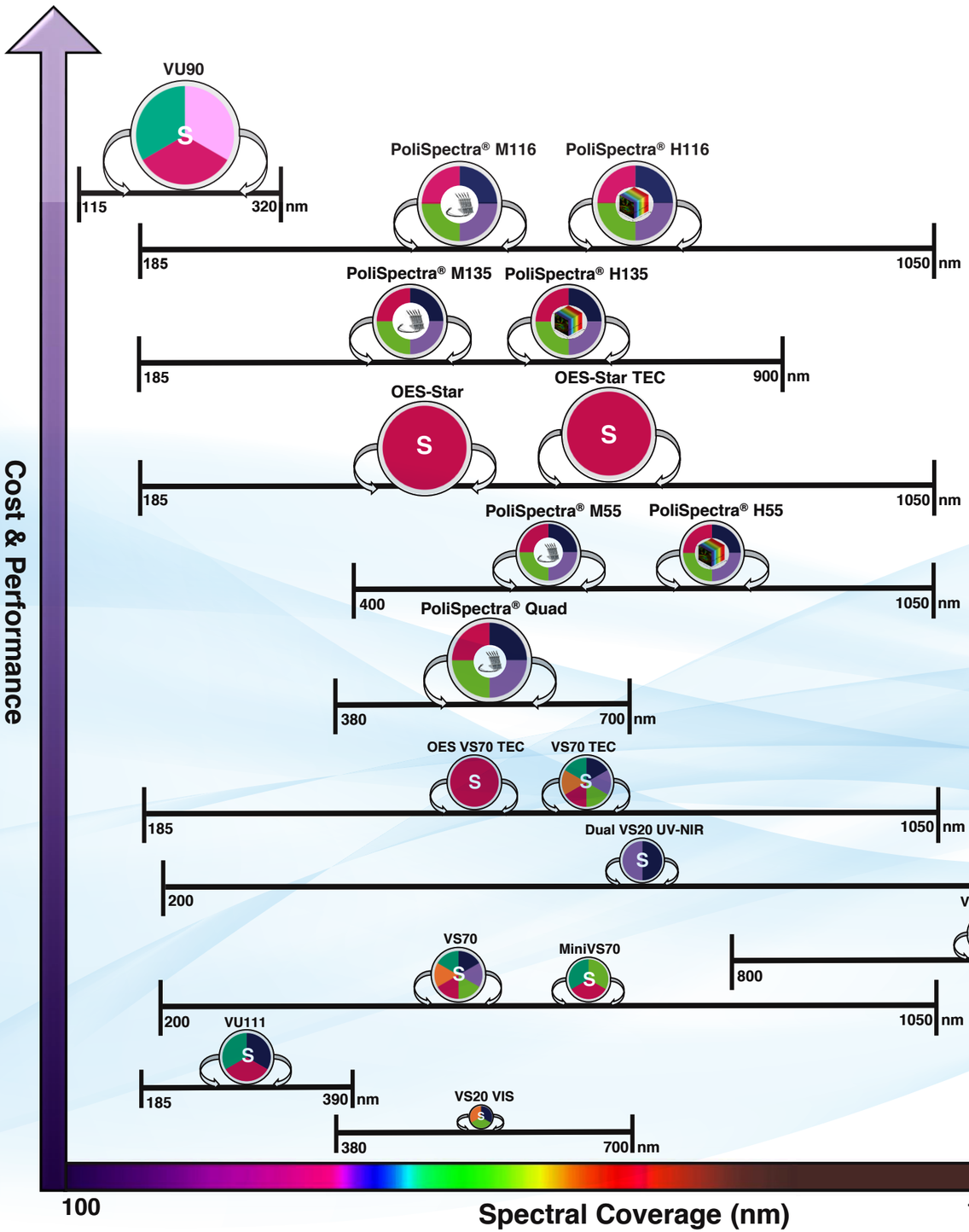
PoliSpectra® H116 Imaging Spectrometer for Hyperspectral Work from UV to NIR

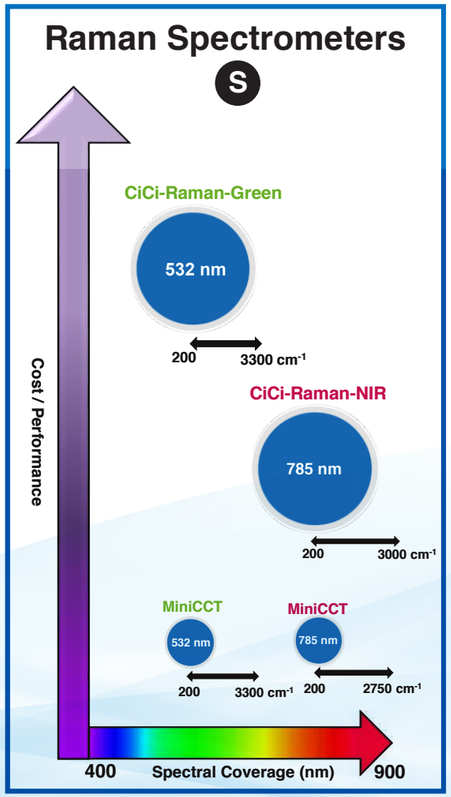
Free-space coupled
1 nm & 40 µm resolution

Ultra-high performance rugged spectrometer for hyperspectral imaging with a 2D sCMOS Camera

- For line-image scanning, in a push-broom hyperspectral configuration
- High throughput, USB-3 system featuring a fast 2D scientific BI CMOS with rolling shutter, running at 94 (HDR) to 188 (Standard Mode) frames per second (2048 pixels per spectrum)

OEM Spectrometer Selection Guide





Legend

Spectrometer Input Type

- S — Single-fiber Input
- Multi-fiber Input
- Hyperspectral Imager

Technique & Application

- Emission (OES)
- Absorbance
- Fluorescence
- Reflectance
- Raman
- Metrology
- Photoluminescence
- Colorimetry

Spectrometer Size

- ≤ 10.5x9x7 inches
- ≤ 8x8x8 inches
- ≤ 7.5x4.5x5 inches
- ≤ 7.5x4.5x3 inches
- ≤ 6x6x7.5 inches
- ≤ 5x5x5 inches
- ≤ 5x5x2 inches
- ≤ 2x2x2 inches

Family of Vacuum Monochromators and CCD Spectrometers

Most popular models: H20UVL, H30UVL and TGS300

Typical applications: High Harmonic Generation, Plasma Characterization

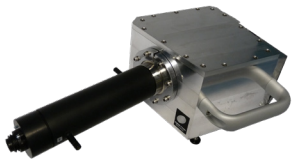
HORIBA Scientific provides a wide variety of vacuum monocharomators, spectrographs and VUV cameras. We can cutomize these VUV designs for OEM volume applications.

We cover a large spectral range from a few nanometers to a few hundred nanometers. Based on toroidal, spherical or plane diffraction gratings, our systems provide unequalled throughput with competitive spectral resolution for Soft X-Ray, EUV, FUV and DUV applications.

Spectral range (nm)		Energy range (eV)		Model	Focal Length (nm)	Grating Rotation	Single Chamber Detector	Array Detector	Replica Available	VLS Grating Connection
Min	Max	Min	Max						x	
9.5	110	11.3	135.5	TGS300	300			x	x	x
50	300	4.1	24.8	H30-UVL	300	x	x	x	x	x
100	300	4.1	12.4	H20-UVL	200	x	x	x	x	x

VUV Monochromators

VUV Systems



VUV Accessories

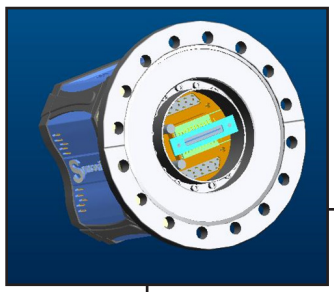
VUV Syncerity: The latest addition to our growing family of scientific CCD Cameras with 2 available flange options

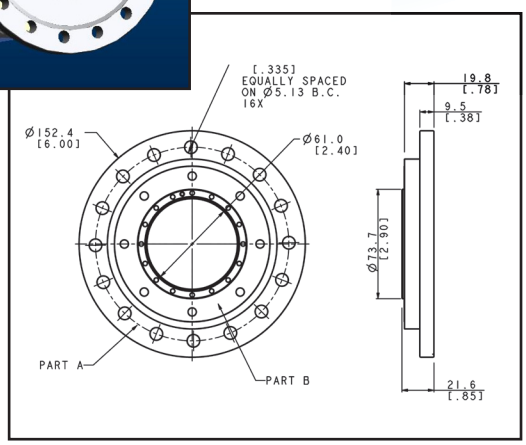
VUV Syncerity® with HORIBA VUV flange

Up to 2048 x 512 Pixels

- Low Cost OEM Solution
- Available as a Stand Alone Camera
- High QE in VUV Range 58% @120 nm (no ARC)
- Attachable to High Vacuum Chamber with Viton® O-Ring, down to <10^{-6} Torr
- TE-cooled to -50°C (vacuum) or -25°C with N_2 purge

VUV Syncerity® with Commercial flange





OEM Philosophy and Mission

3 Centers of Excellence Dedicated to OEM Spectroscopy and Camera Solutions in US, EU, and Asia

Our mission is to provide a complete development and manufacturing experience, from optical simulations to opto-mechanical design and prototyping of spectroscopic and camera systems extending to, and including, electronics, firmware, software design and first articles.

Our products provide superior performance, reliability and stability, combined with robust cost reduction. Capable of flexible high volume production capacity in quantities of hundreds to thousands per year, we offer full confidentiality providing "Black Boxes" or private labelling, using your logo or graphics.

Unmatched customer service is provided by our exceptionally experienced workforce featuring on-time delivery and flexibility, allowing scheduling modifications.

Adhering to Copy Exactly! (CE!) processes, our fully trained staff from engineering to manufacturing form a dedicated OEM engineering force that supports you over the lifetime of the product.

Scientific Segment - OEM Products and Capabilities:

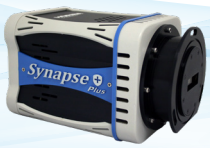
- Custom master optical diffraction gratings
- Diffraction grating replicas (concave, convex and flat)
- Spectrometers, optical assemblies with pre-aligned sensors (CCD, PDA, CMOS, InGaAs) using either customers' or HORIBA's OEM electronics
- OES spectrometers
- Spectroscopy systems or modular engines, such as mini fluorometers and mini Raman systems
- Single and double scanning monochromators
- Imaging spectrographs and spectrometers with CCD or CMOS cameras
- Multispectra spectrometers with multiple fiber inputs / MultiTrack spectroscopy
- Hyperspectral system with HORIBA or customer provided camera (Push-broom configurations)
- Cameras: Spectroscopic deep-cooled scientific cameras (1D and 2D CCD & InGaAs – FI and BI)
- OEM electronics for opto sensors ranging from PD and PDA to CCD and CMOS sensors
- Imaging cameras: Uncooled and cooled with FI and BI high-end scientific CMOS
- VUV/FUV spectrometers and CCD vacuum and N_2-purged cameras

Scientific Deep Cooled CCD, InGaAs and CMOS Cameras

Syncerity®

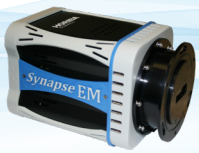
Low Cost -50˚ C
Air-cooled OEM Camera

Synapse® Plus



Deep-cooled -80˚ C to -100˚ C
Air- or Water-cooled Camera

Synapse® EM



EM CCD
Deep-cooled Camera

VUV Syncerity®

TE-cooled to -50˚C (Vacuum)
or -30˚ C with N_2 purge

Sylent®

Ultra-compact 4.2 MP
monochrome sCMOS sensor

Synapse® InGaAs

Deep-cooled NIR Camera
to -75˚ C (Water-cooled)

Contact us in one of our centers of excellence	USA & Canada	Japan	Europe & Asia
	OEM.US@horiba.com	OEM.JAPAN@horiba.com	OEMSALES.JYFR@horiba.com
	+1 732 494 8660 Ext. 7733	+81 (75) 313 8121	+33 (0) 1 69 74 72 00

HORIBA Scientific

Horiba.com/VUV