

The utilization of hyperspectral imaging for in-line inspection of poultry, fruits, vegetables, and specialty crops holds exceptional potential for increasing the quality and safety of the foods we eat. The technology also offers a significant financial return for food processors by increasing throughput and yield at their facilities.

While machine vision technology has been a standard approach to many food inspection and safety applications, hyperspectral imaging offers the incremental benefit of analyzing the chemical composition of food products. Hyperspectral imaging solutions can be deployed at different process-points, including in-line inspection and in the laboratory. With the overall objective being significant increases in production yields and quality, food products can be analyzed with hyperspectral sensing for disease conditions, ripeness, tenderness, grading, or contamination.

When Hyperspec® imaging sensors are deployed early in the inspection process, food products can be segregated and sorted according to pre-established criteria and routed efficiently along the production line. Optimized for in-line processing, Hyperspec® Inspector is fully-capable of processing at very high speeds based on spectral regions and wavelengths of interest.

Key advantages of hyperspectral imaging for equipment manufacturers & food producers include:

- Derive the spectral signature for every point within the field of view for material classification
- Color-render the image within the field of view based on an established library of known spectral signatures
- For high volume production, generate wavelength-specific criteria for high speed quality control over the production process line.

Headwall Photonics is a US Department of Agriculture CRADA research and development partner.



- Agricultural Research
- Crop Management
- Disease Detection
- In-Line Inspection
- Advanced Machine Vision
- Precision Agriculture

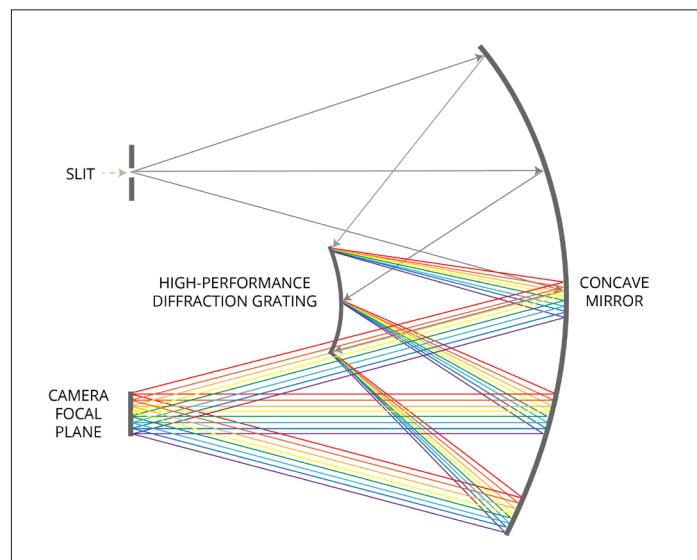
Headwall is the world's leading manufacturer of hyperspectral imagers (Hyperspec®) for a wide range of industries including remote sensing, advanced machine vision, precision agriculture, and others. The Company also manufactures OEM spectrographs and spectral engines that are exceptionally precise with respect to high spectral and spatial resolution and signal throughput.

The core technology fundamental to these products is the holographic diffraction grating, which Headwall manufactures to exacting dimensions and tolerances and to customer specification. This allows for small and rugged

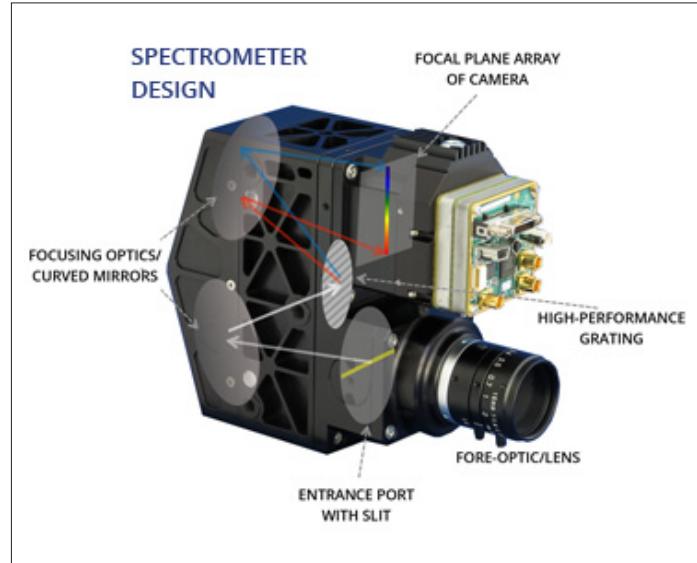
optical imaging instruments that deliver aberration-corrected performance and a very wide field-of-view. Used in Headwall's *concentric-style* imagers along with mirrors, the designs are simple yet elegant and feature no moving parts.

In addition to hyperspectral, Headwall also manufactures Raman imaging instruments that are available in a wide range of laser excitation wavelengths. Raman Explorer and Raman Discovery are very well suited for chemical imaging applications as well as biotechnology and medical applications.

Hyperspectral Ranges	
UV-VIS	250-825nm
VNIR	380-1000nm
Extended VNIR	550-1700nm
NIR	900-1700nm
SWIR	950-2500nm
MWIR*	3-5 microns
LWIR*	8-12 microns
<small>*MWIR and LWIR available upon request</small>	



Raman Explorer	
248nm	single input
355nm	single input
532nm	single input
532nm/658nm	dual input
642nm	single input
785nm	single input
785nm	dual input
830nm	single input
Raman Discovery	
532nm	dual input



About Headwall Photonics: Headwall is the leading designer and manufacturer of imaging spectrometers and spectral instrumentation for industrial, commercial, and government markets. Headwall's high performance spectrometers, spectral engines, and holographic diffraction gratings have been selected by OEM and end-user customers around the world for use in critical application environments. As a pioneer in advanced, patented optics technology, Headwall enjoys a market-leading position through the design and manufacture of spectral instrumentation that is customized for application-specific performance.

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