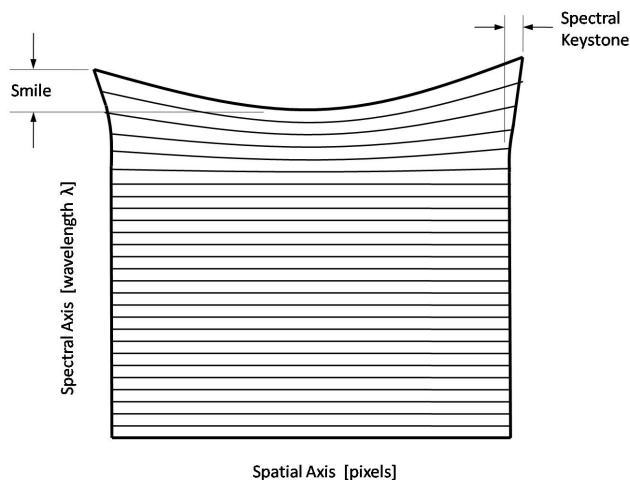


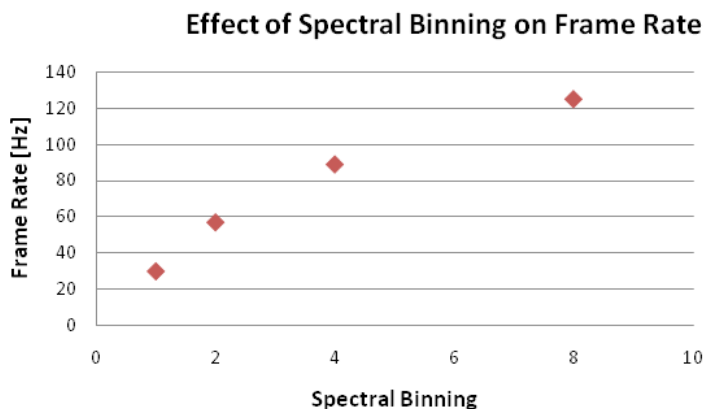
GLOSSARY

Aberrations Aberrations are departures of the performance of an optical system from the ideal optical behavior. **Smile** is an optical aberration defined as the bending of the spectral lines across the spatial axis due to the change of dispersion angle with field position, thus projecting a curve (smile) rather than a straight line onto the detector. This can cause non-uniform and non-linear spectral variation along the spatial axis of the detector. **Keystone** is a spatial aberration defined as a wavelength-dependent pixel shift along the spatial axis. These distortions can limit sub-pixel discrimination and detection.

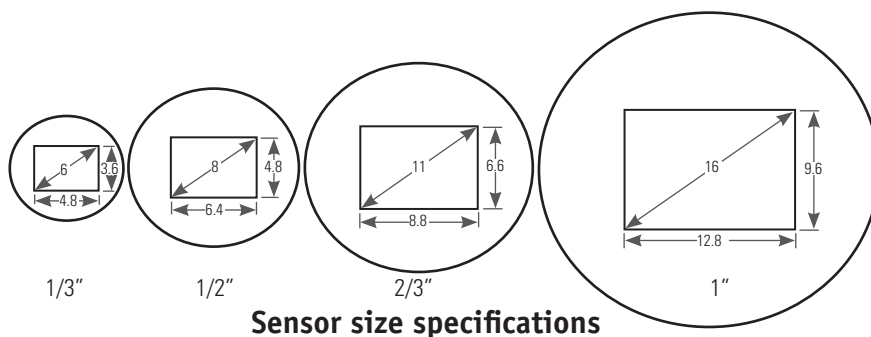
Astigmatism occurs when perpendicularly propagated rays of an optical system have different foci.



Binning Binning is the averaging of neighboring pixels in the spatial and/or the spectral axes. Binning will reduce the frame size (by reducing spatial and/or spectral resolution), and increase the signal to noise. Many cameras perform binning inside the camera, thus the reduced amount of data to be communicated increases the maximum frame rate. The chart on the right shows a typical maximum frame rate of a CCD-based hyperspectral camera as a function of binning in both dimensions. Some cameras have different speed improvements depending on binning in x or y directions.



Camera Sensor Size For hyperspectral cameras, the lens must focus onto the slit, so the slit width determines the width of the sample area viewed by the camera. The actual dimensions of the slit widths to be used for the calculations are noted in the Camera and Spectrograph chapters. In the slit length direction, however, the determining factor for the length of the image is the sensor dimension, not the physical slit length, because the width of the sensor is usually shorter than the slit length. In the case of a 2/3" sensor, the slit length is limited to 8.8 mm, and this length should be used for the calculations.



Chemical Imaging Chemical imaging usually refers to hyperspectral imaging in the NIR or SWIR wavelength ranges, where spectra of the chemicals display unique peaks relating to the molecular bonds in the chemical.



Chromophore The part of a molecule responsible for its color. It absorbs certain wavelengths of light and transmits others.

Deuterium Lamp A low-pressure gas-discharge light source often used in spectroscopy when a continuous spectrum in the ultraviolet region is needed.

Diffraction Grating An optical device used for diffracting a beam of light into its wavelength components; the main component of diffraction spectrographs.

Distortion Divergence from rectilinear projection caused by a change in magnification with increasing distance from the optical axis or an optical system.

Downwelling Irradiance The amount of light or other radiant energy directed toward the earth's surface from the sun or the atmosphere,

Fiber Optics An optical fiber is a thin, flexible, transparent element that acts as a waveguide, or "light pipe", to transmit light between the two ends of the fiber. They can be used in communication or for illumination that carries light a long distance.

F-Number The ratio of the focal length to the lens aperture. It is a measure of the brightness of a lens, the smaller F-number is brighter.

Focal Plane Array (FPA) cameras Image sensing devices consisting of an array (typically rectangular) of light-sensing pixels at the focal plane of a lens. FPAs operate by detecting photons at particular wavelengths and construct an image of the object or scene.

Fore Lens The main objective lens located at the front of a camera for viewing a pre-determined field of view.

FPS Frames per second, used to describe camera speed.

Hypercube The 3-D dataset that results from a scan with a hyperspectral camera. The three dimensions are two spatial (x, y) and one spectral.

Hyperspectral Imaging The process of measuring a complete spectrum at each spatial point of a sample with a hyperspectral camera.

Imaging Spectrograph See definition for Spectrograph.

Indium-Gallium-Arsenide (InGaAs) FPA A two-dimensional detector array for the near infrared region. The InGaAs camera in this catalog detects light in the 1000-1700 nm range.

Keystone A spatial aberration in imaging devices. (See Aberrations for more details)

Non-Uniformity Correction Sensitivity of pixels varies across the sensor for certain camera types, and this correction attempts to correct for lack of uniformity among pixels.

Machine Vision An industrial or manufacturing system that uses a computer to interpret and analyze visual data from a camera.

Mercury-Cadmium-Telluride (MCT) FPA A two-dimensional detector array for the short-wave infrared (SWIR) region. The MCT SWIR camera in this catalog detects light in the 1000-2500 nm range. Mid-infrared (LWIR) MCT arrays also used for hyperspectral imaging

Monochrome matrix array sensor A monochrome camera sensor.

Multispectral image An image that contains intensity information at more than one wavelength. A RGB image is a multispectral image because it includes information from three different wavelengths. The term hyperspectral image is used when many wavelengths covering an entire wavelength region (visible, NIR, etc.) are included.

OEM Original Equipment Manufacturer. This term is also used to refer to the uncased hyperspectral cameras in this catalog.

Photometric Linearity A proportional relationship of light intensity and detected signal. The amount of detected light, measured in absorbance scale, has a linear relationship with concentration and path length. The goal of spectroscopic measurements is to determine the amount of specific materials or their concentration; therefore, the photometric linearity affects the accuracy of such measurements. In imaging, pixels may have slightly different photometric characteristics, therefore it is advantageous to normalize their sensitivity (See non-uniformity correction).

Push-Broom Hyperspectral Imaging The method of data acquisition with a hyperspectral camera that collects information at all of the wavelengths simultaneously for one spatial line of the object. To build the whole image, either the camera or the object is moved past the other. Please see the Hyperspectral Imaging chapter for a more detailed explanation and a comparison to the staring array method.

Remote Sensing Acquisition of information of an object or phenomenon, by the use of device(s) that are not in physical or intimate contact with the object (such as by way of aircraft, spacecraft, satellite, or ship). Hyperspectral cameras may be used in ground-based or airborne remote sensing applications.

RMS Spot Size The radius of the image of a point by a lens that is not diffraction limited.

Smile A spectral aberration in imaging spectroscopy. (See Aberrations for more details.)

Spectral Imaging A combination of imaging and spectroscopy. In a spectral image each spatial point contains information about two or more spectral regions.

Spectral Purity Performance of spectral devices to provide true wavelength information by separating the wavelengths properly.

Spectrograph A device which separates incoming light into its wavelength components producing spectra

Spectrometer A device for measuring the intensity of absorbed, reflected, or emitted electromagnetic radiation as a function of wavelength.

Spectroscopy The study of light as a function of wavelength (spectrum) which has been transmitted, emitted, or reflected from a solid, liquid or gas sample.

Spectrum Intensity of light as a function of wavelength, which can be displayed on an emission, reflectance, absorption, or transmission scale.

Staring Array Hyperspectral Imaging A type of camera or method of hyperspectral imaging in which the object and camera are stationary and the entire object is imaged at the same time. To acquire spectral information at multiple wavelengths, a tunable filter is used to scan through the wavelengths. Please see the Hyperspectral Imaging chapter for a more detailed explanation and a comparison to the push-broom method.

Transmission Grating An optical device used for diffracting a beam of light into its wavelength components; the main component of line scan spectrographs.

Wavelength Calibration A calibration for a specific camera that specifies the wavelength that corresponds to each pixel.