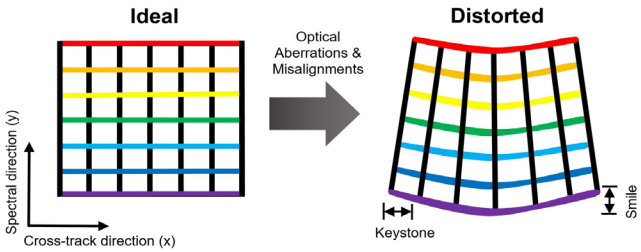
HORIBA Scientific

Hyperspectral Imaging Distortions: Keystone and Smile

Definitions:

The **KEYSTONE** property is a band-to-band magnification that changes with wavelength. This involves mixing of spectra from adjacent field positions.

The **SMILE** property is a wavelength shift caused by a change in dispersion with field position [1].



Schematic showing an ideal image compared to a real image with optical distortions [2]

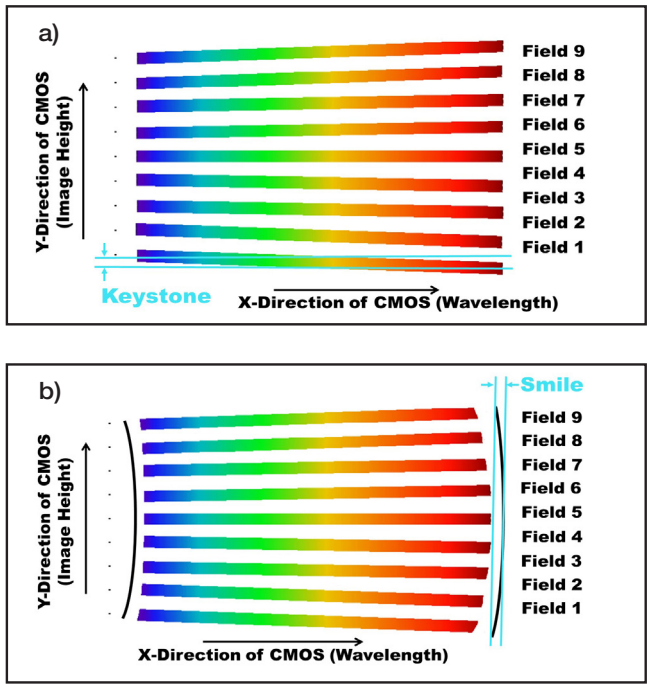
Lλ= Pixel center location of each Field Identifier slit at a given wavelength

Keystone = $(L_{\lambda max} - L_{\lambda min})$

Cλ= Center pixel location of a given wavelength at each Field Identifier location

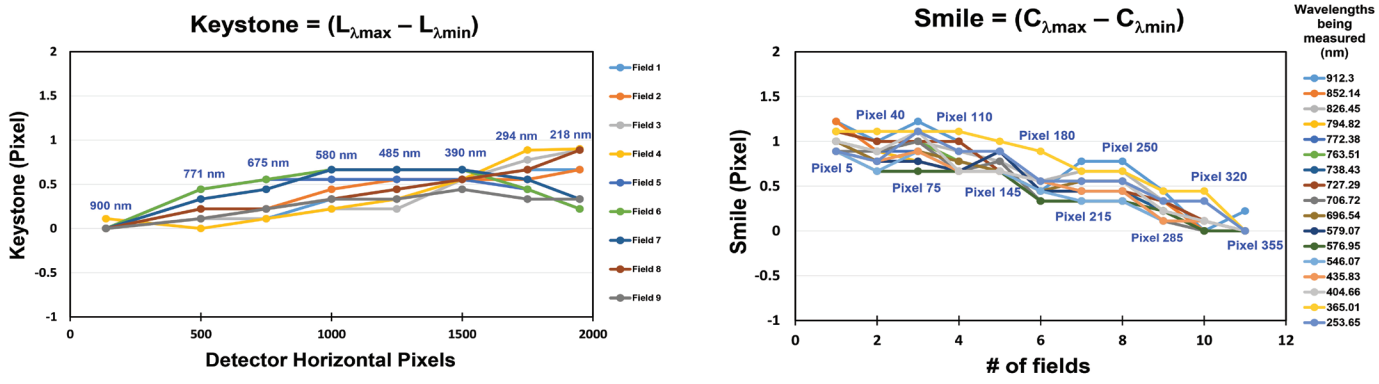
Smile = $(C_{\lambda max} - C_{\lambda min})$

KEYSTONE is measured by calculating the maximum displacement a field slit makes as it moves across the entire spectrum and the **SMILE** is measured by calculating the maximum displacement a wavelength makes as it moves across the entire height of the region of interest.



The method Horiba uses to measure a) Keystone and b) Smile

Excellent optical performance for PoliSpectra MultiTrack system showing keystone and smile smaller than 1.5 pixels



An example of the production testing for HORIBA's hyperspectral/multichannel spectroscopy systems based on the method described above.

[1] J. Fischer, M. Baumback, J. Bowles, J. Grossmann, and J. Antoniades, "Comparison of low-cost hyperspectral sensors," Proc SPIE, Vol. 3438, pp. 23-30, 1998.

[2] N. Yokoya, N. Miyamura, and A. Iwasaki, " Detection and correction of spectral and spatial misregistrations for hyperspectral data using phase correlation method ," Applied Optics, vol. 49, no. 24, pp.4568-4575, 2010.