P4001 SG-1 Upcoming meetings

Andrei Fridman
Focus on spatial misregistration

...and image sharpness

Spectral misregistration can be specified in a similar way (hopefully).

We have 4 approaches to characterizing spatial misregistration
What is spatial misregistration

Spatial pixel dispersed into spectrum

Spectral channels

\(\lambda_1\)
\(\lambda_2\)
\(\lambda_n\)

Image of a polychromatic point source in the ideal case.
Keystone

Spatial pixel dispersed into spectrum

Spectral channels

\( \lambda_1 \)
\( \lambda_2 \)
\( \cdots \)
\( \lambda_n \)
Keystone

Spatial pixel dispersed into spectrum

\[ \lambda_1, \lambda_2, \ldots, \lambda_n \]

Energy

Spectral channel

True spectrum

Captured spectrum

HySpex
by neo
PSF difference

Spatial pixel dispersed into spectrum

$\lambda_1$

$\lambda_2$

$\lambda_n$

Energy

Spectral channel

True spectrum

Captured spectrum
Keystone + PSF difference

Spatial pixel dispersed into spectrum

Spectral channels
\( \lambda_1 \)
\( \lambda_2 \)
\( \lambda_n \)

Energy

True spectrum
Captured spectrum

Spectral channel

Hyspex
by neo
Approach 1

• Measures keystone

• Easy to understand, easy to implement

• Used in some form in many places (at least at some point in time)

• Suggested for the standard by Kari Kataja and Hannu Holma (SPECIM)
KEYSTONE

- Keystone = spatial misregistration
- Keystone is affected by the spectrograph and fore lens as well.
- With airborne system the target is narrow subpixel size slit which is centered to the measured pixel in Goniometer. This is time consuming.
- In industrials spectral cameras target is also a slit but Goniometer is not used. Slit targets are at specific distance and keystone and FWHM data is taken with single shot.
- In this example Gaussian curve is fitted to the data points.
- Keystone and FWHM is calculated in similar manner as with Smile
Approach 2

• Takes into account different misregistration factors, combines them into a single value

• Published in 1990 by JPL, California Institute of Technology

• Explanation and analysis of the method published by Torbjørn Skauli (FFI) in 2012

• Suggested for the standard by Torbjørn Skauli (University of Oslo, FFI)
Sampling PSF
Sampling PSF
Sampling PSF
Sampling PSF
Sampling PSF
Sampling PSF
Approach 2 (misregistration)

Figure by Torbjorn Skauli (FFI)
Approach 3

- Measures keystone
- Takes into account asymmetry of SPSF
- Uses scanning (but only a few steps)
- Suggested for the standard by Andreas Baumgartner (DLR)
Approach 3

Figure by Andreas Baumgartner (DLR)
Approach 4

- Takes into account different misregistration factors, combines them into a single value
- Uses scanning
- Suggested for the standard by Gudrun Høye and Andrei Fridman (HySpex)
Approach 4.
Quantifying performance: how much of the energy ends up in the correct pixel
Approach 4

HySpex SWIR 384 prototype camera

Production-standard HySpex SWIR 384 camera
Approach 4.
Effective pixel count

Pixels

- Total 384
- Effective 301
Next meetings

- #11 on March 4
- #12 on March 18