Method for quantifying image quality in push-broom hyperspectral cameras

Gudrun Høye, Trond Løke, Andrei Fridman

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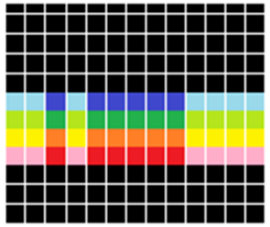
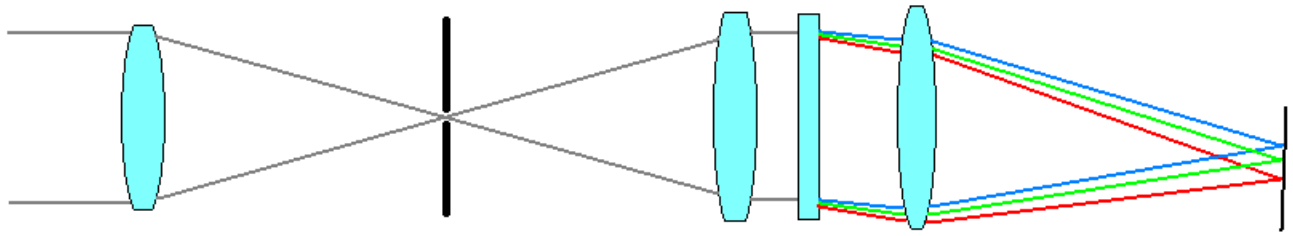
Camera layout





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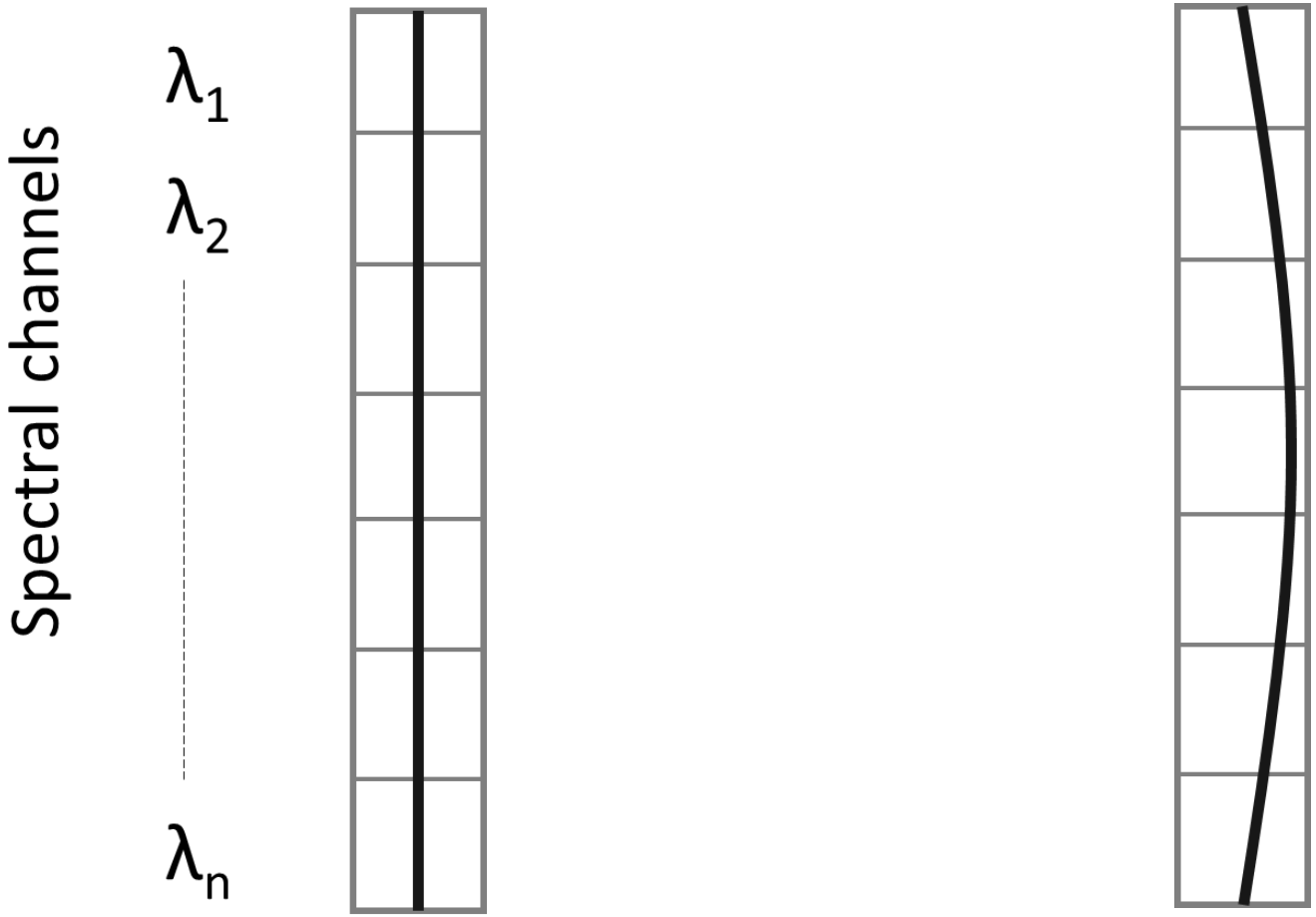
Keystone



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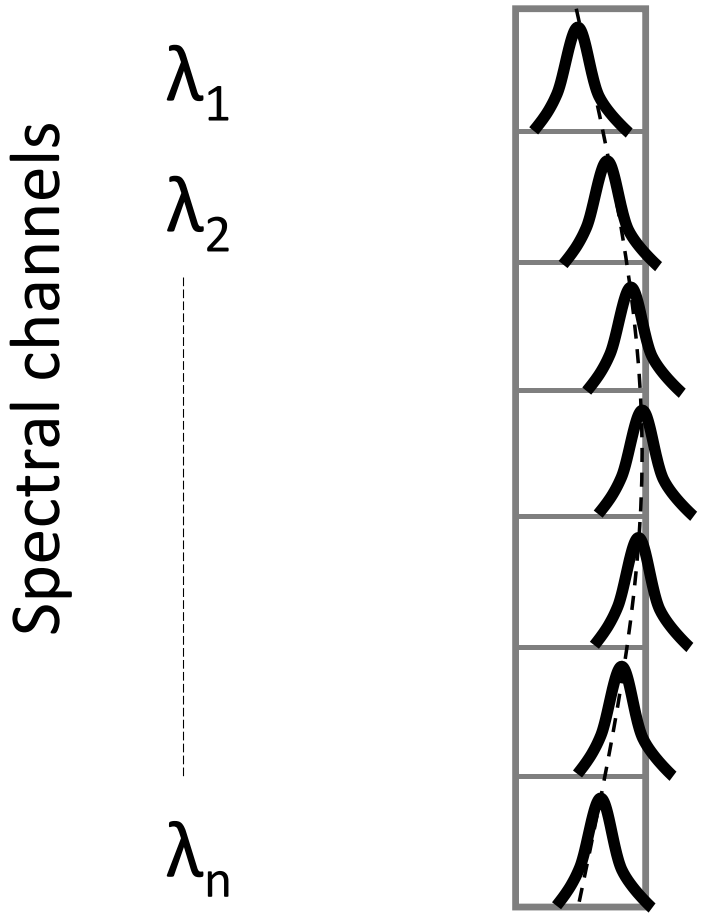
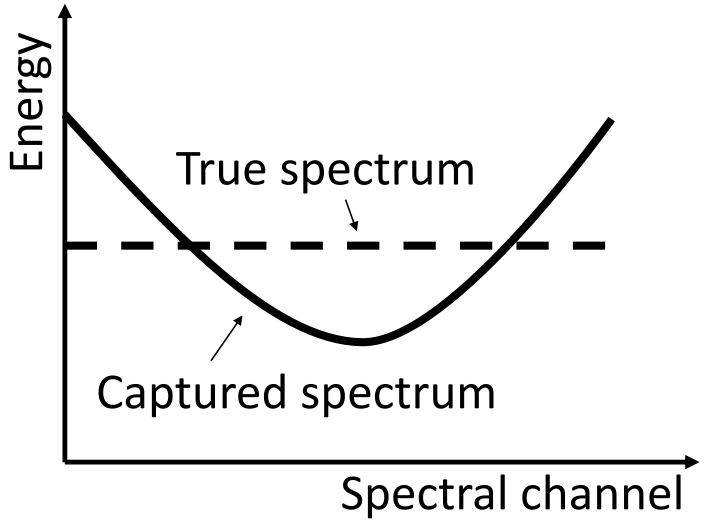
Keystone





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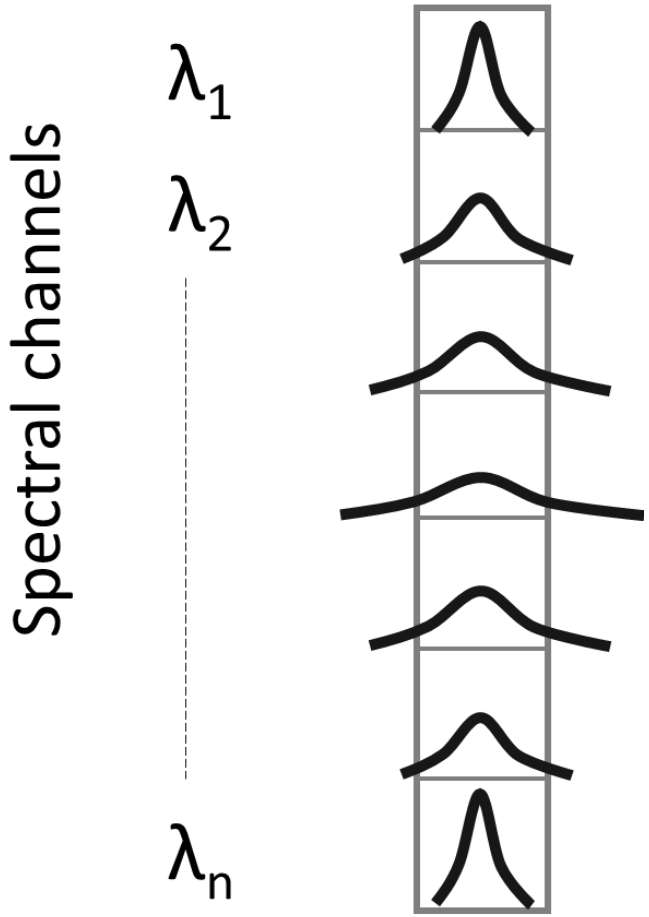
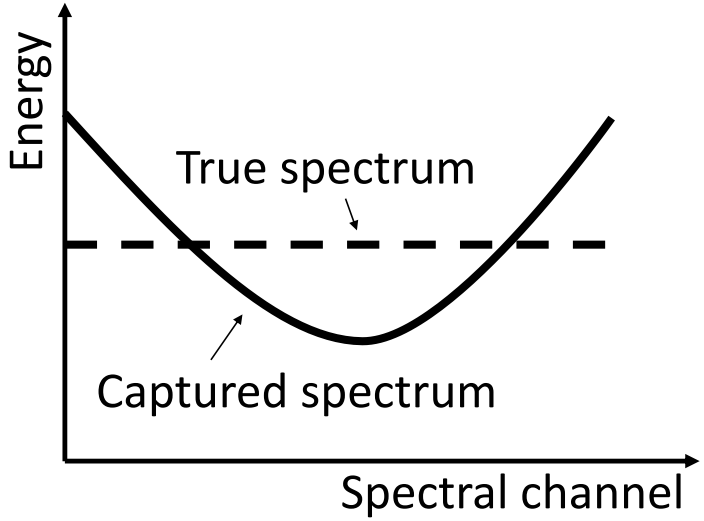
PSF variations





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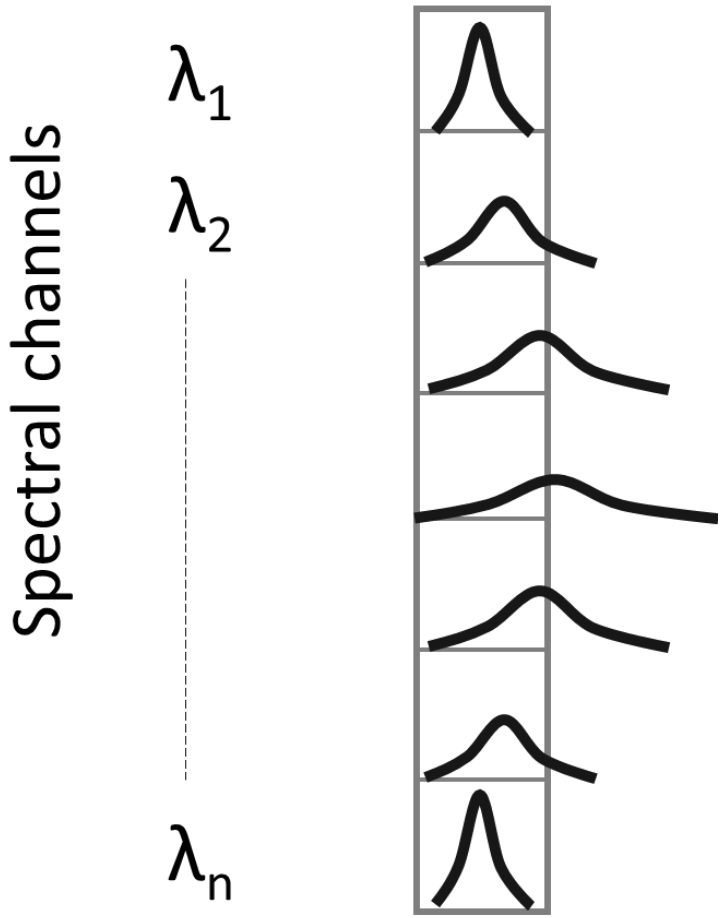
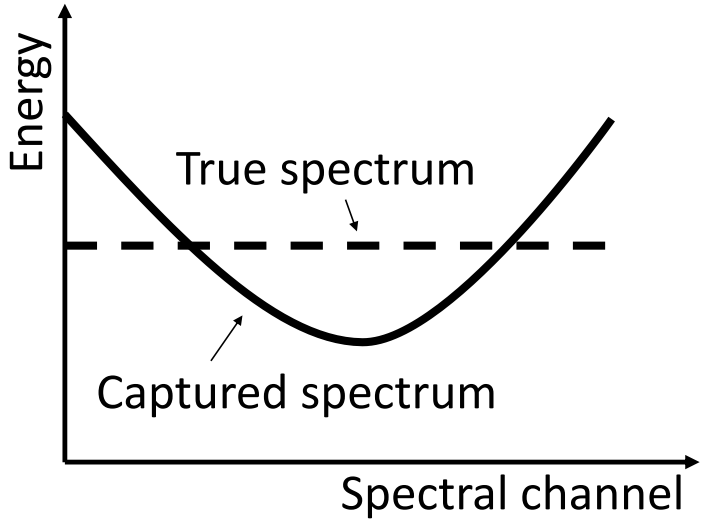
Keystone + PSF variations





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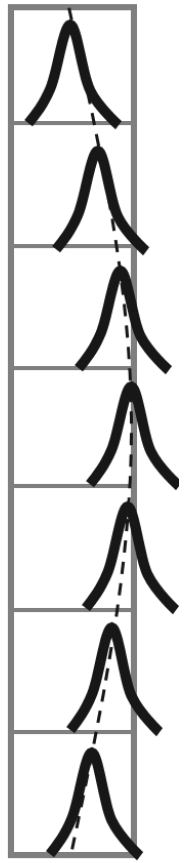
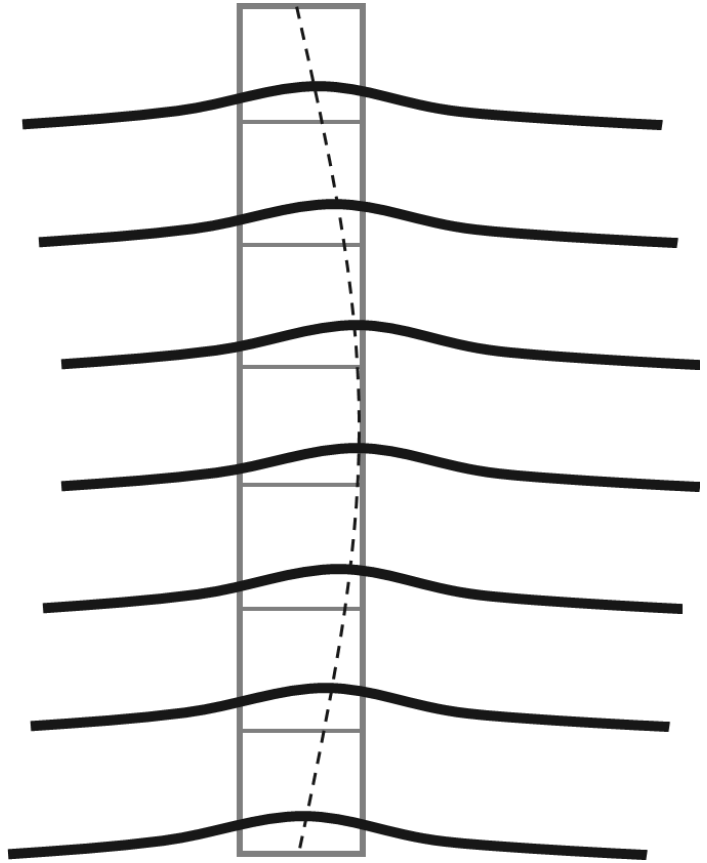
Sharpness

λ_1

λ_2

λ_n





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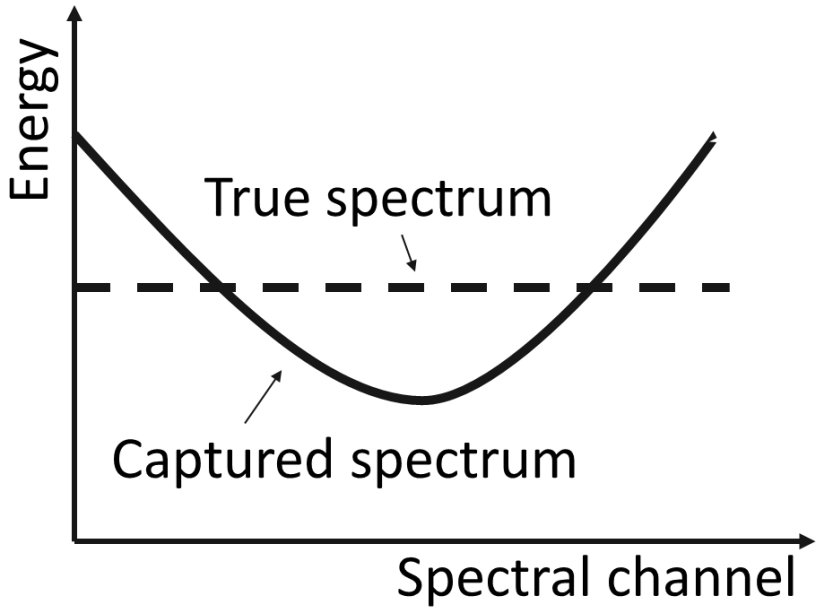
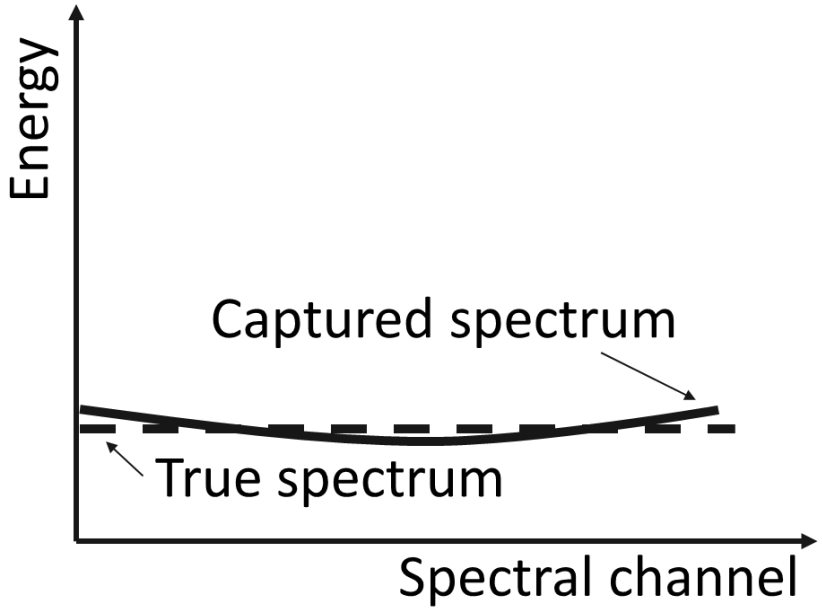
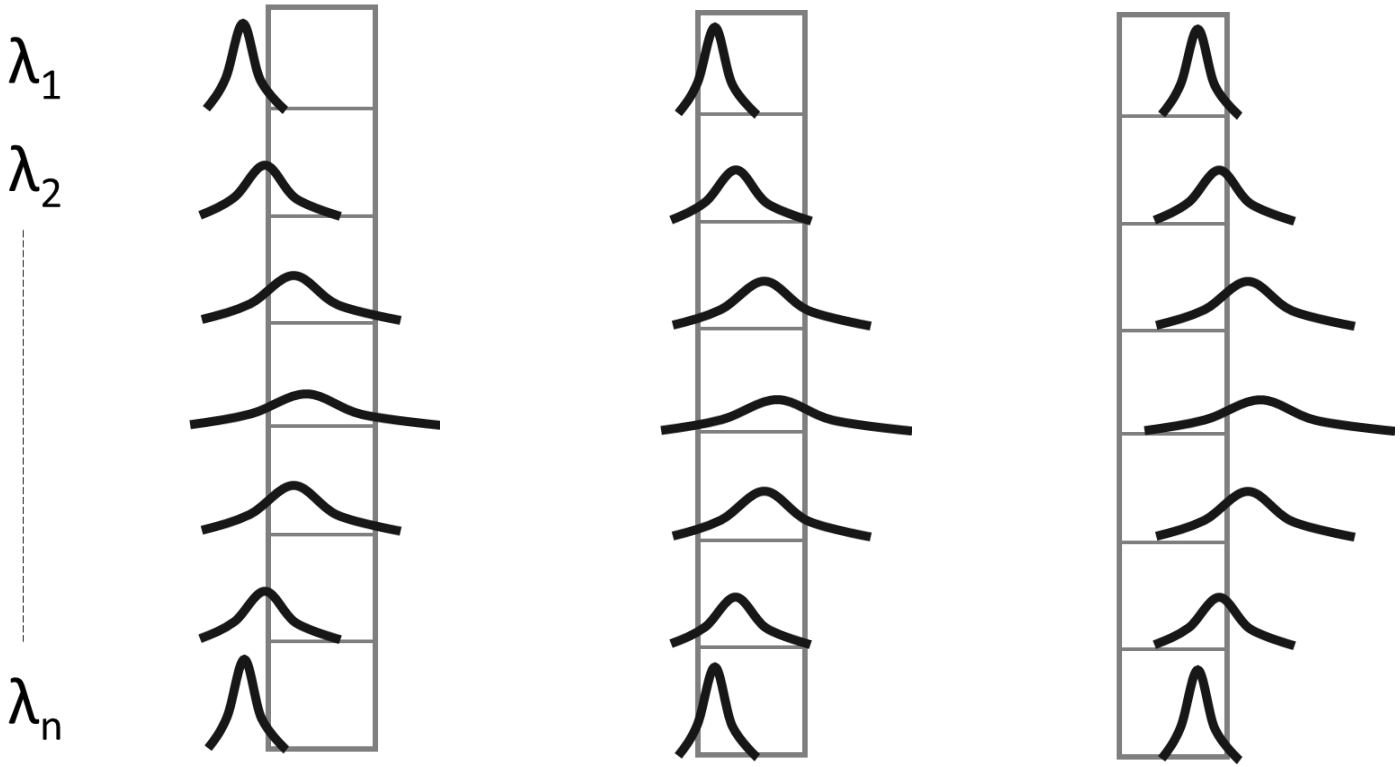
Sharpness


Energy
True spectrum
Captured spectrum
Spectral channel


Energy
Captured spectrum
True spectrum
Spectral channel

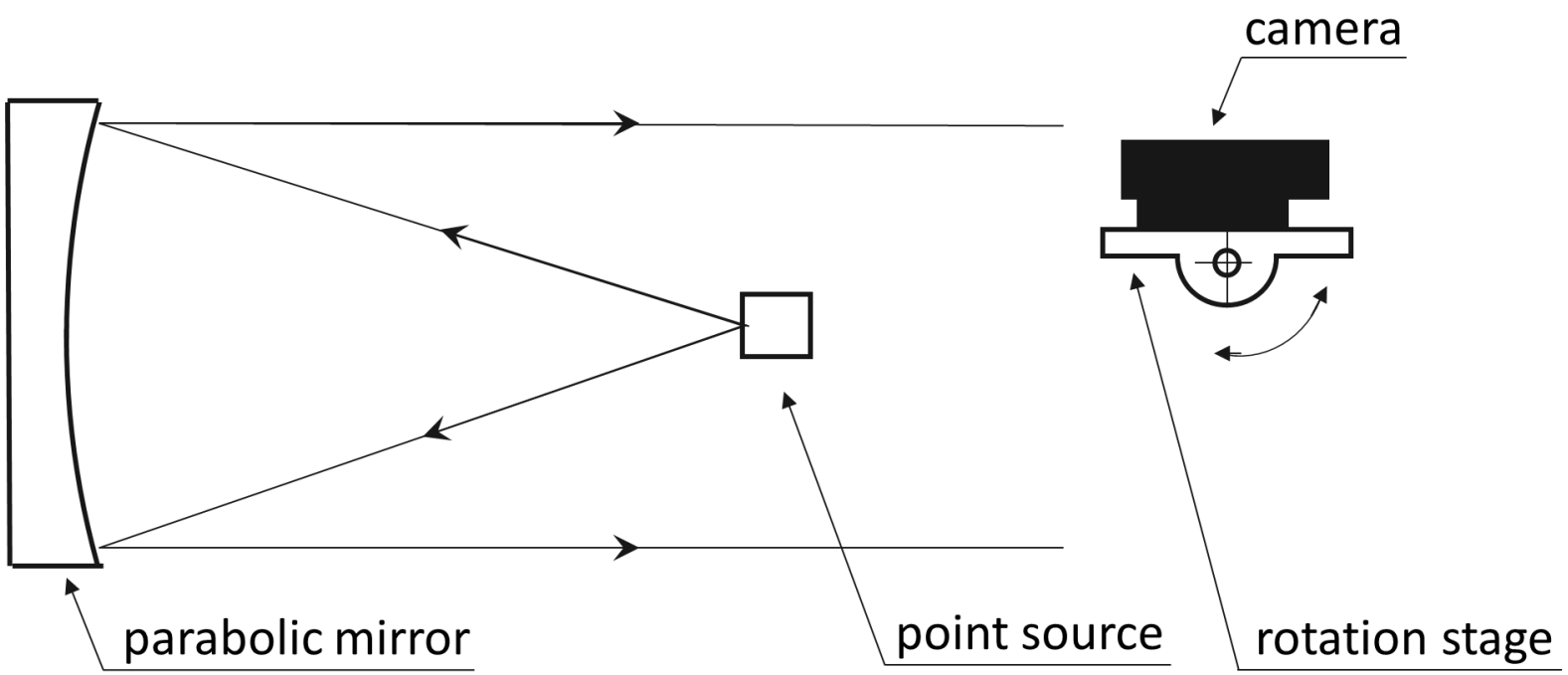
Quantifying performance: how much of the energy ends up in the correct pixel



Quantifying performance: how much of the energy ends up in the correct pixel

- Sharpness
- Maximum misregistration
- Standard deviation of misregistration

Lab setup



SWIR camera prototype

- 384 spatial pixels
- 16 degrees field of view
- 288 spectral channels
- 900nm – 2500nm spectral range
- F2.0 optics

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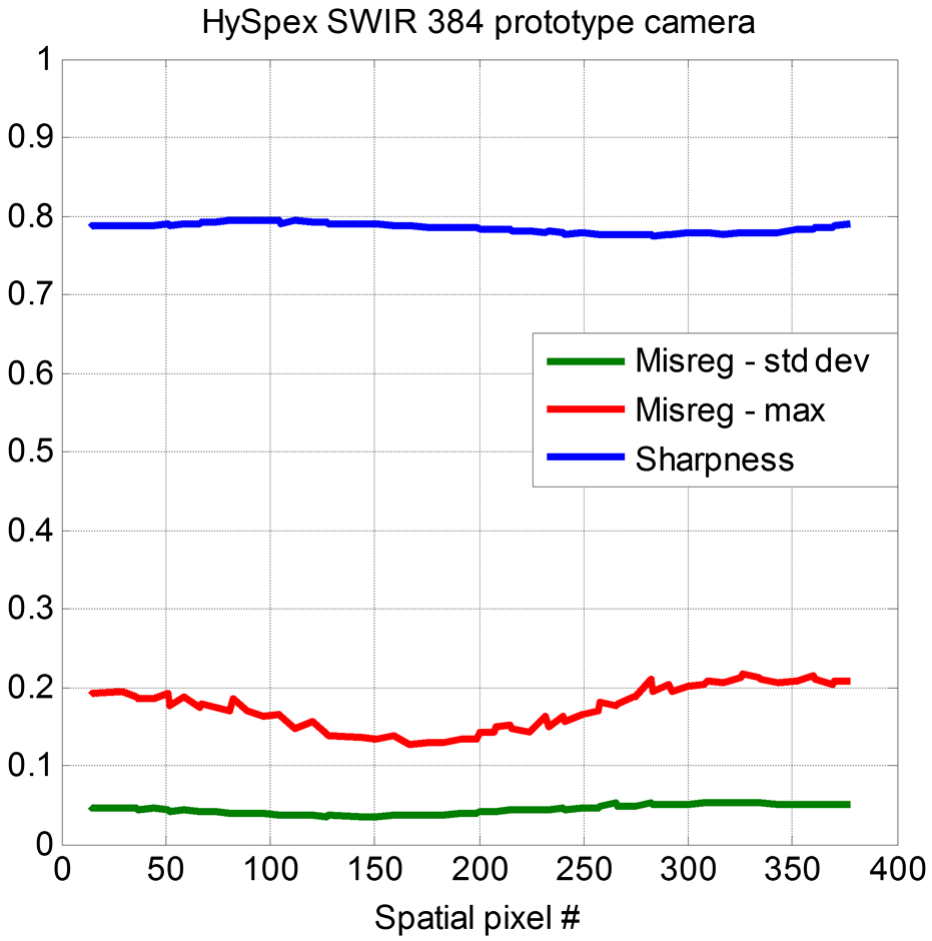
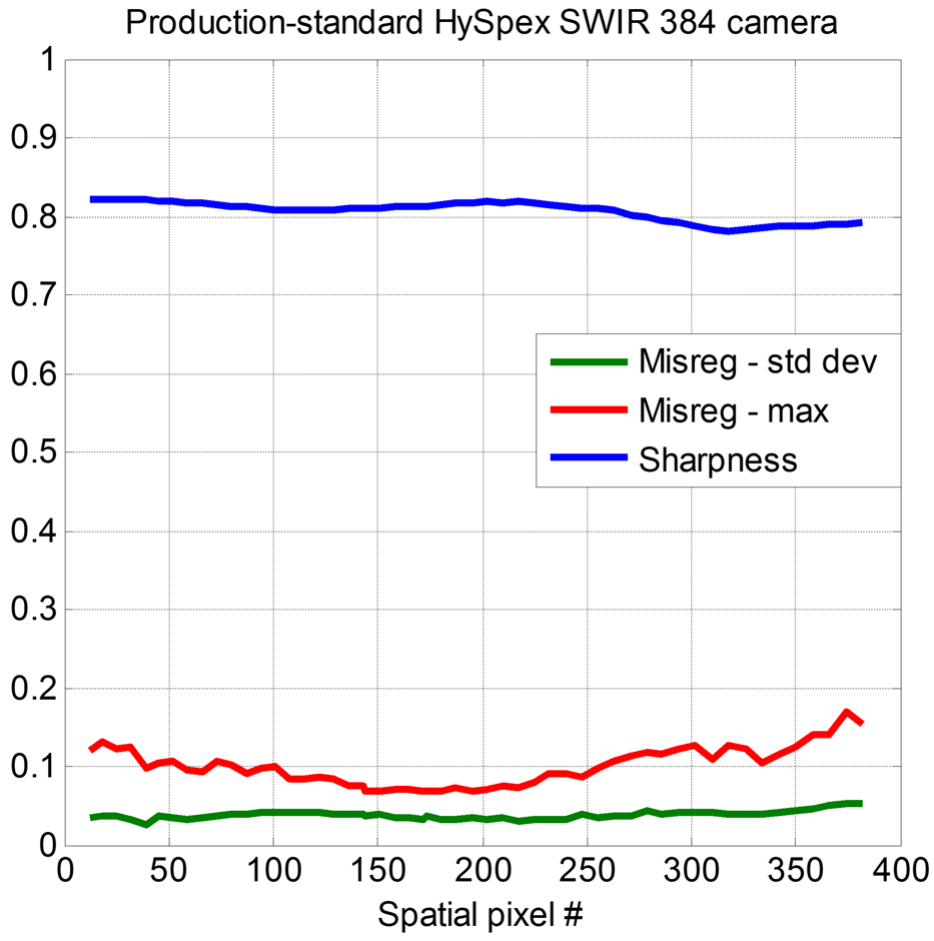
Results





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The same approach can be used for measuring:

- Spectral misregistration and sharpness
- Spatial misregistration and sharpness in the along track direction (or other directions)

Conclusions

- The method uses the most basic object (a point source) for testing.
- The method is easy to implement and the measurements don’t take too much time.
- User friendly
  - Easy to understand
  - Fast and easy to compare cameras
- The method is used on the final datacube

More information about the method

An open access paper in Optical Engineering:

“Method for quantifying image quality in push-broom hyperspectral cameras”

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Thank you!