

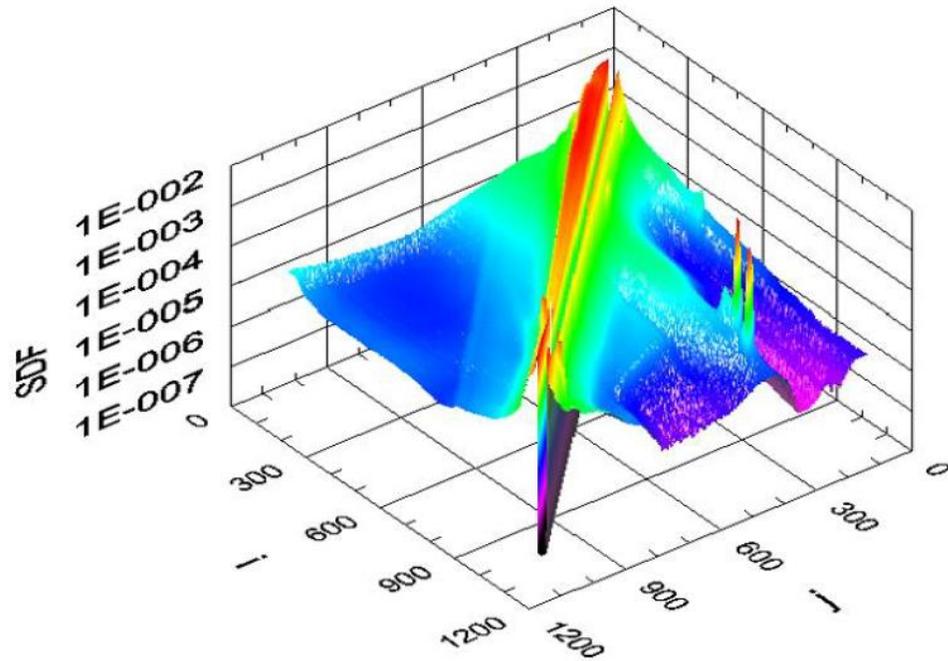
# Terminology and Calibration

# Why Terminology?

- English does not readily convey specific technical meanings
  - Example: Resolution, Stray Light, Bandpass
- Promote consistent use of terms across manufacturers and industries.
- There is some great work out there: but it needs an archive, an organizer and a lookup table.

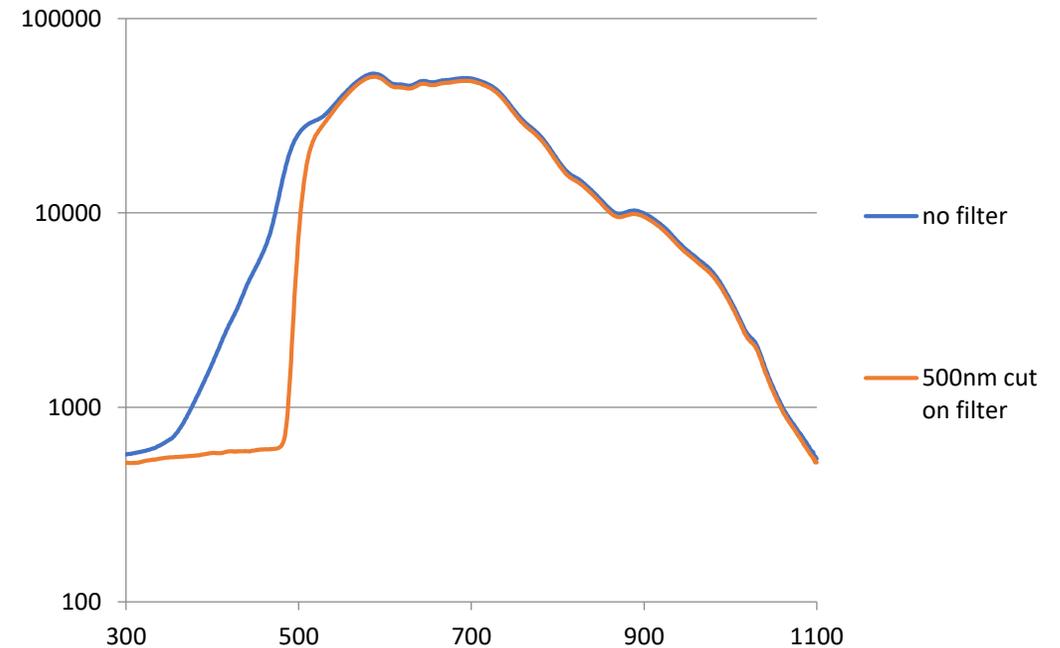
# Example – Stray Light

3-D plot of the Stray Light Distribution (SDF) matrix,  $D$



[1] Zong, Y., Brown, S. W., Johnson, B. C., Lykke, K. R., Ohno, Y., "Simple spectral stray light correction method for array spectroradiometers", Applied Optics, Vol. 45, No. 6, 1111-1119 (2006)

Raw counts from spectrograph with QTH input  
ument and the observed target



[24] Jablonski, J., Practical Implications of Standard Spectrograph Stray Light Specifications, International Symposium on Lighting 2011

# Glossary of HSI Terms & References (A Start)



- EUFARs document:
  - <https://www.eufar.net/cms/glossary-terms/>

## **Best Practices in Passive Remote Sensing VNIR Hyperspectral System Hardware Calibrations**

- 2016 HSI Calibration Paper
  - (81) HSI Specific Terms Defined
  - (76) Citations
    - Categorized & Listed for Easy Reference

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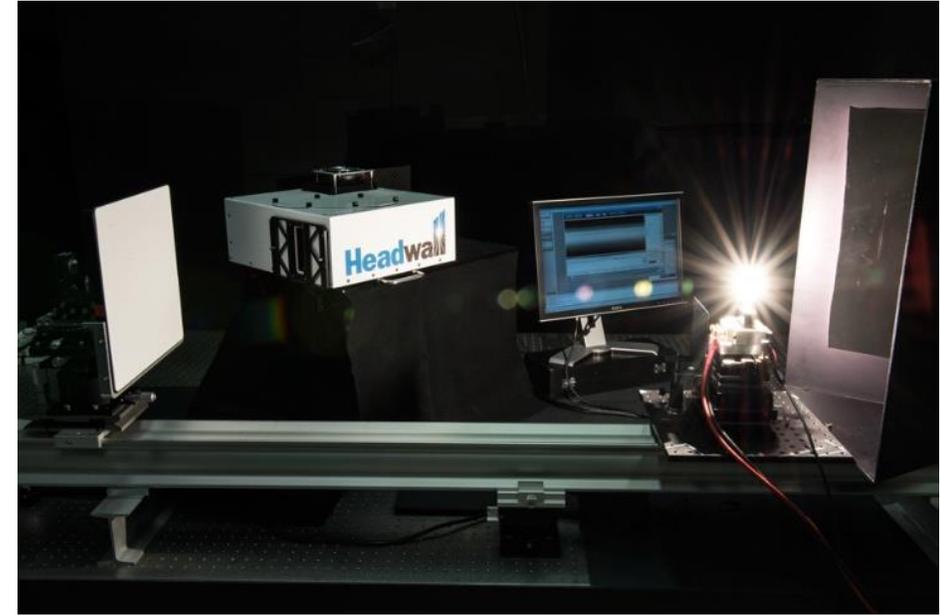
<sup>3</sup>*Headwall Photonics, Fitchburg, MA USA*

<sup>4</sup>*Aeroptic, North Andover, MA USA*

- Submissions of Terms & Definitions by Industry for consideration...

# Calibration and Characterization of HSI Instruments

- Calibration standards provide a means of comparison to recognized scales and units (SI). Traceability provides an unbroken chain of comparisons with stated uncertainties
  - <https://www.nist.gov/nist-policy-traceability>
- The use of standards facilitates the ability to compare results from different instruments, at different physical locations and times.
- National Metrology Institutes (NMIs), such as NIST play a key role in establishing and or disseminating these scales



#### Disclaimer

Certain commercial products are identified to foster understanding. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products identified are necessarily the best available for the purpose

# “Standardized” Characterization & Specification of HSI Instruments

- Characterization helps in evaluating design performance and specifying instruments based on requirements
- Suggested specification that each imager should aspire to give the user:
  - Architecture of the spectrometer: Diffraction, Prism, etc.
  - Number of Pixels / Spatial Resolution (columns and rows)
  - Spectral Range (ex: 400 to 1100 nm) – usable range
  - Signal-to-Noise over the Spectral Range
  - Spectral Sampling / Number of bands (ex: 5 nm/140 bands)
  - Spectral Resolution / Spectral Bandwidth
  - Radiance Responsivity ( $\text{W/sr-m}^2\text{-nm}$ )/(counts/sec)
  - Radiometric / Wavelength Accuracy over full range
  - Smile & Keystone, PSF

**How are each of these determined?**