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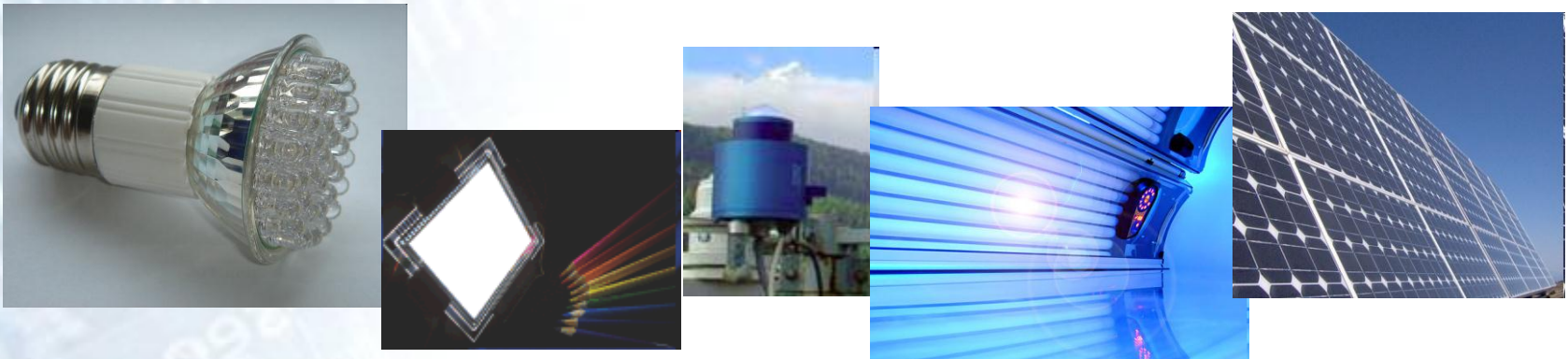
Stability of array spectroradiometers and their suitability for absolute calibrations

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- Introduction
 - Minimum requirements for the instruments to be used for absolute calibrations
 - Examples on the evaluation of the stability and the calibration capability
 - Reproducibility (entrance optics)
 - Long-term stability, possible effects of humidity
 - Temperature effects
 - Linearity
 - Stray light
 - Conclusions
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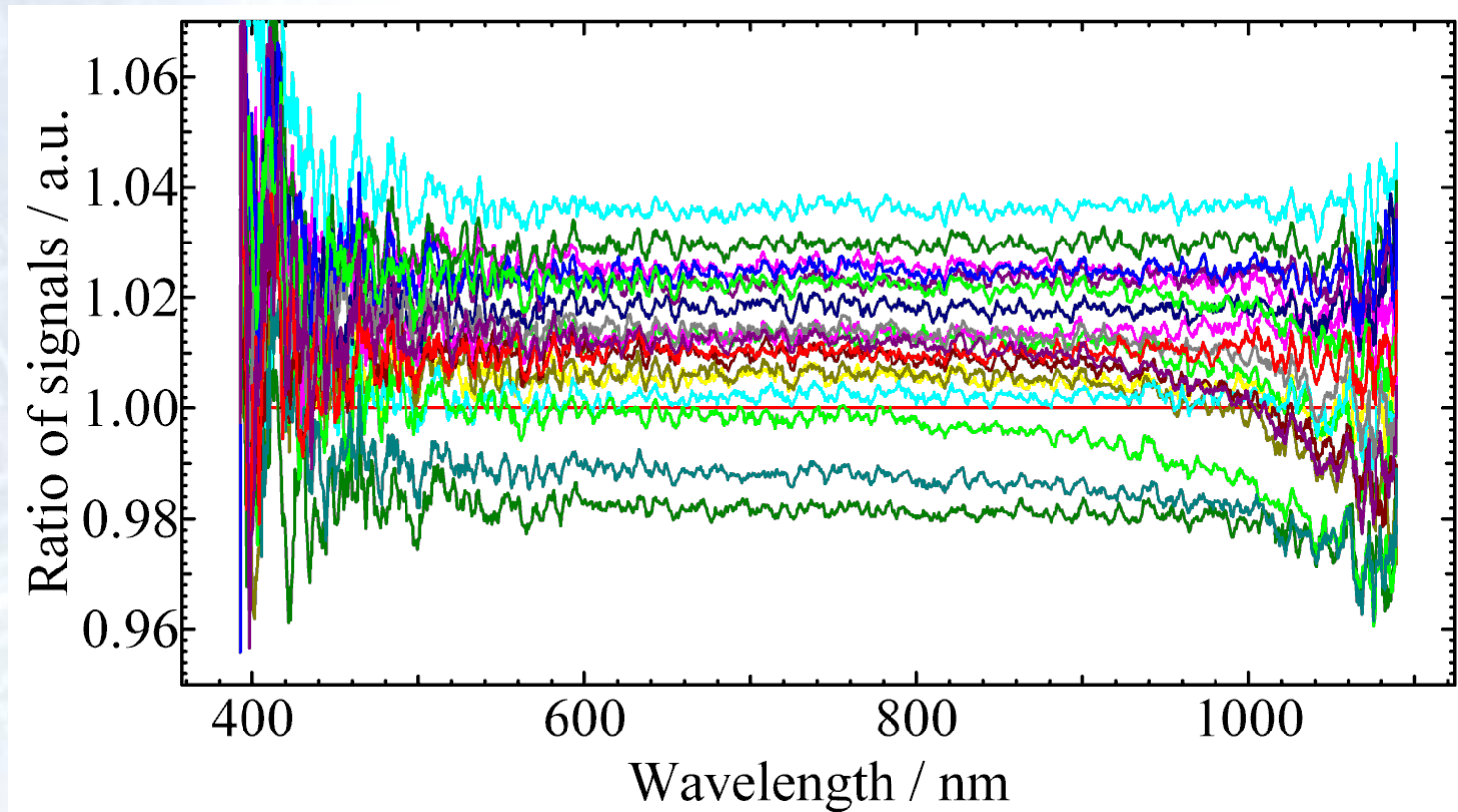


- Compact array spectroradiometers increasingly used for a variety of radiometric and photometric applications
- Calibration of the instruments typically accomplished immediately before/after the measurement
- “... can you quote a calibration for a spectroradiometer (traceable to SI)?”
 - instrument suitability (qualification) for the calibration
 - a number relevant characteristics to be considered

- To be suitable for absolute calibrations, array spectroradiometers should have:
 - Appropriate entrance optics
 - Stable and reproducible characteristics
 - Immunity with respect to ambient conditions (air temperature & humidity)
 - Linear (-ized) response with respect to the measured radiometric quantity
 - Adequate stray light suppression properties, bandpass, etc.

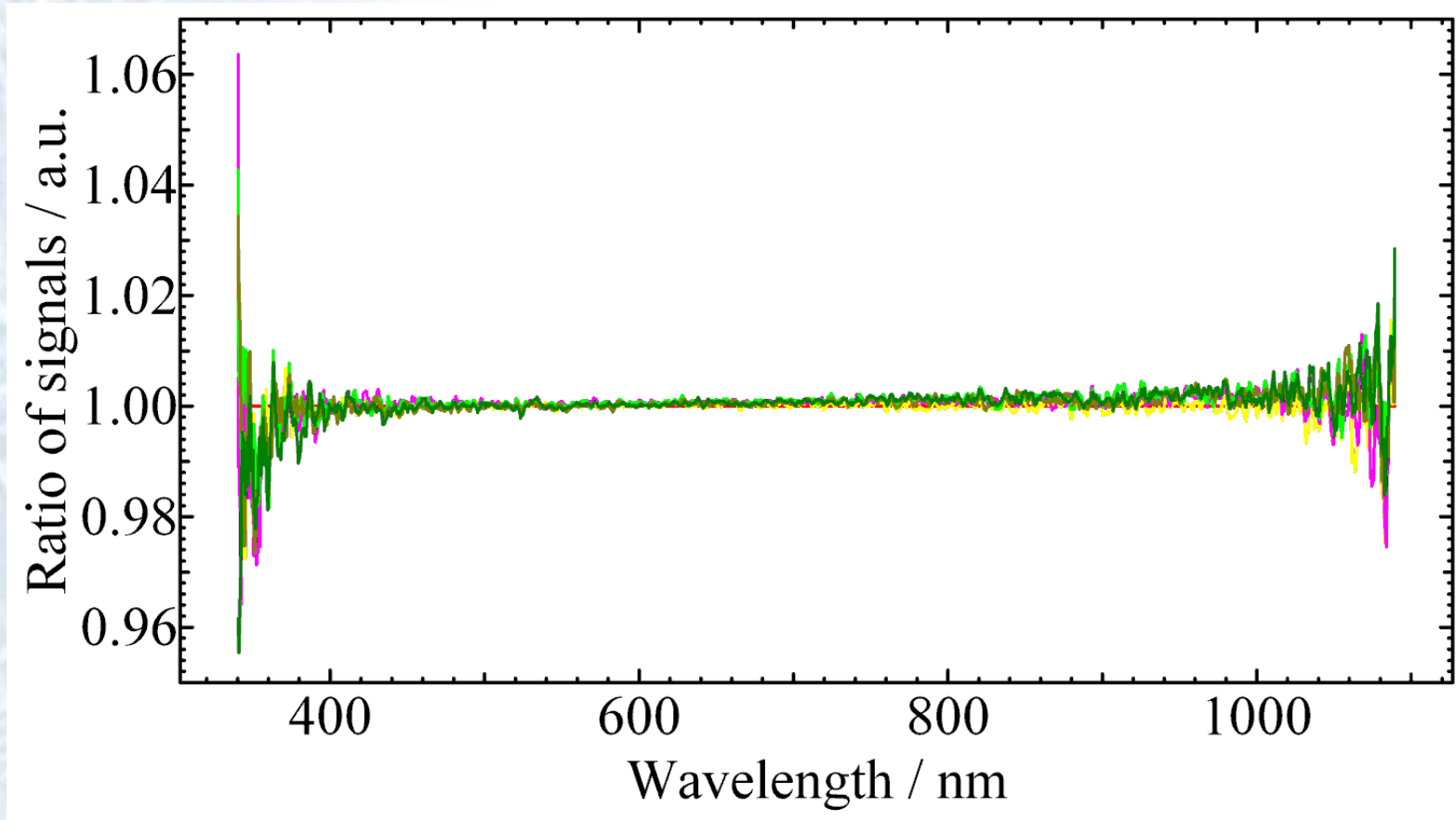
Reproducibility

- Entrance optics is typically fibre-based
- Reproducibility of a low-end array spectroradiometer using standard SMA-type adapter:



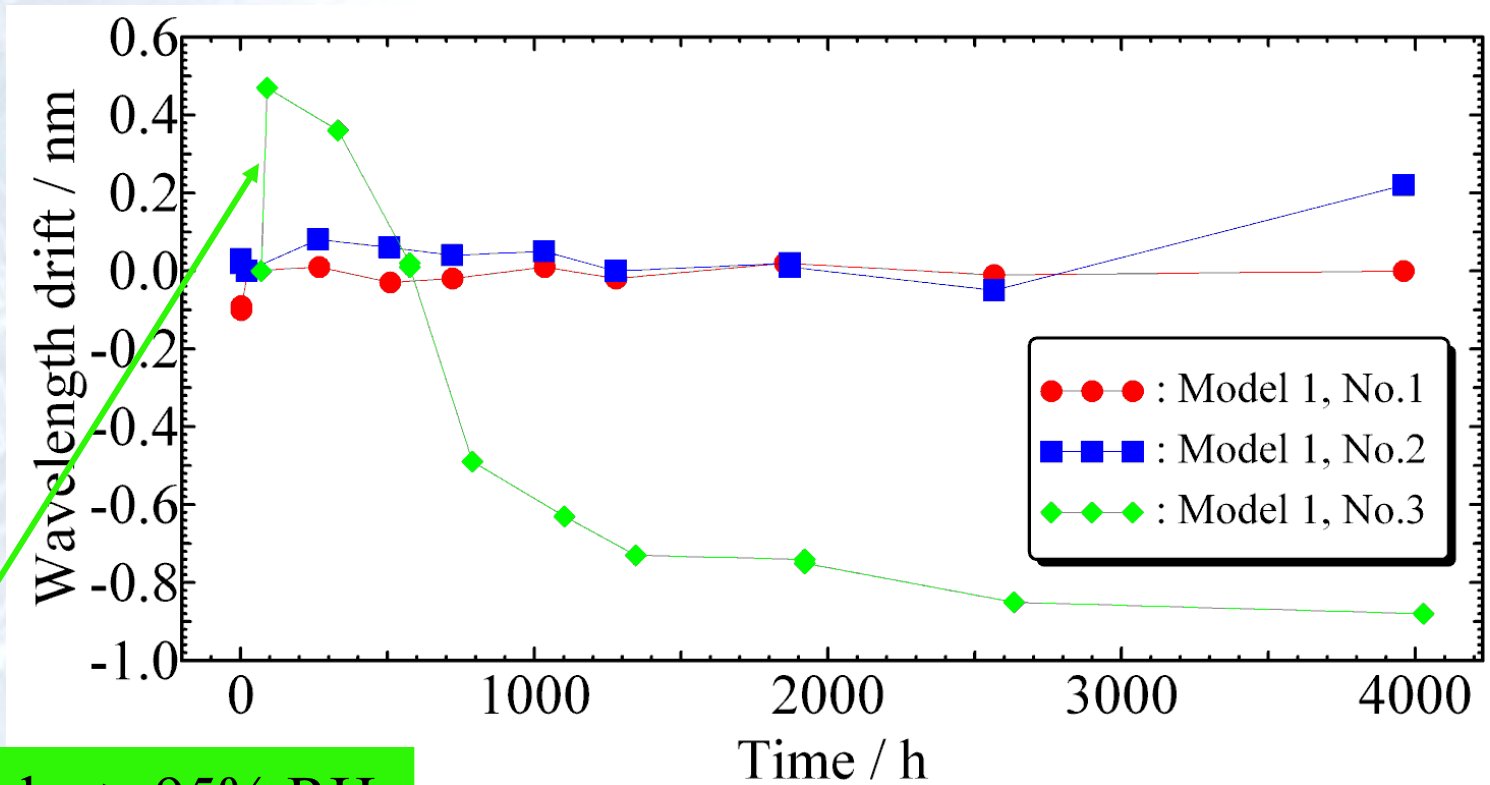
Reproducibility

- Reproducibility of a low-end array spectroradiometer with FC-type adapter:



Long-term stability

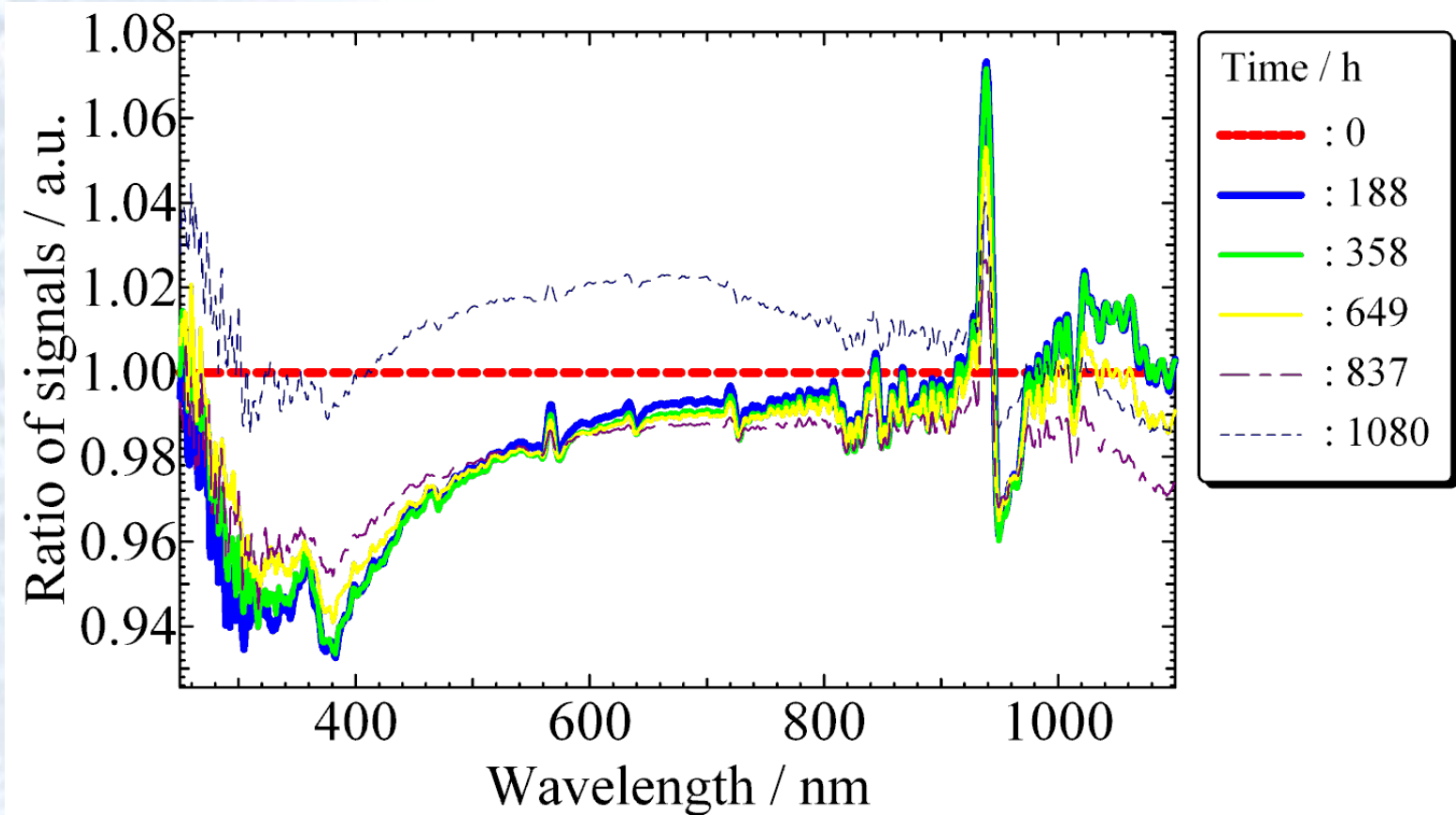
- Humidity may have an effect on the stability
- Wavelength stability of 3 same model instruments:



60 h under > 95% RH

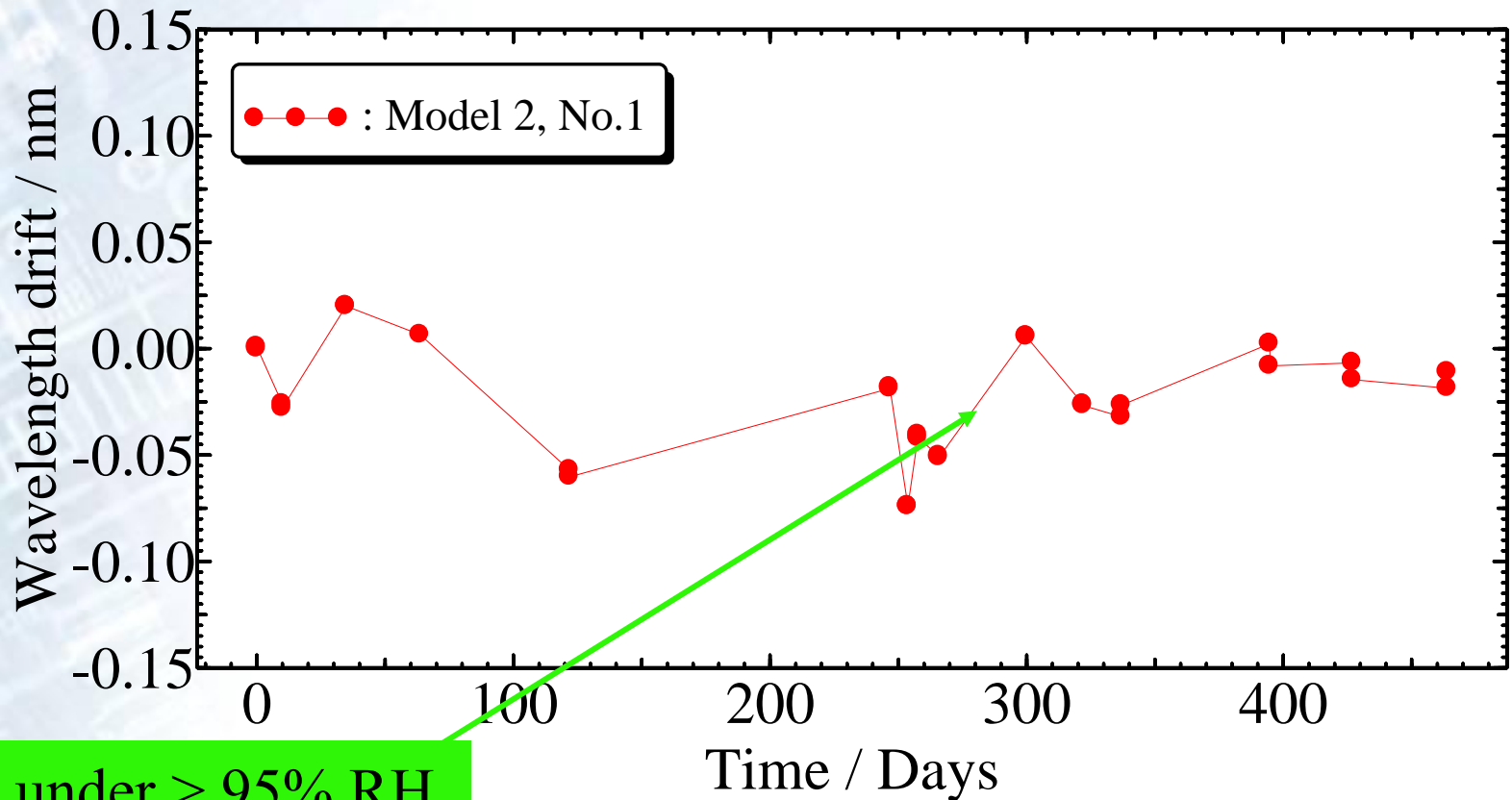
Long-term stability

- Effect of humidity on the response stability of the array spectroradiometer:



Long-term stability

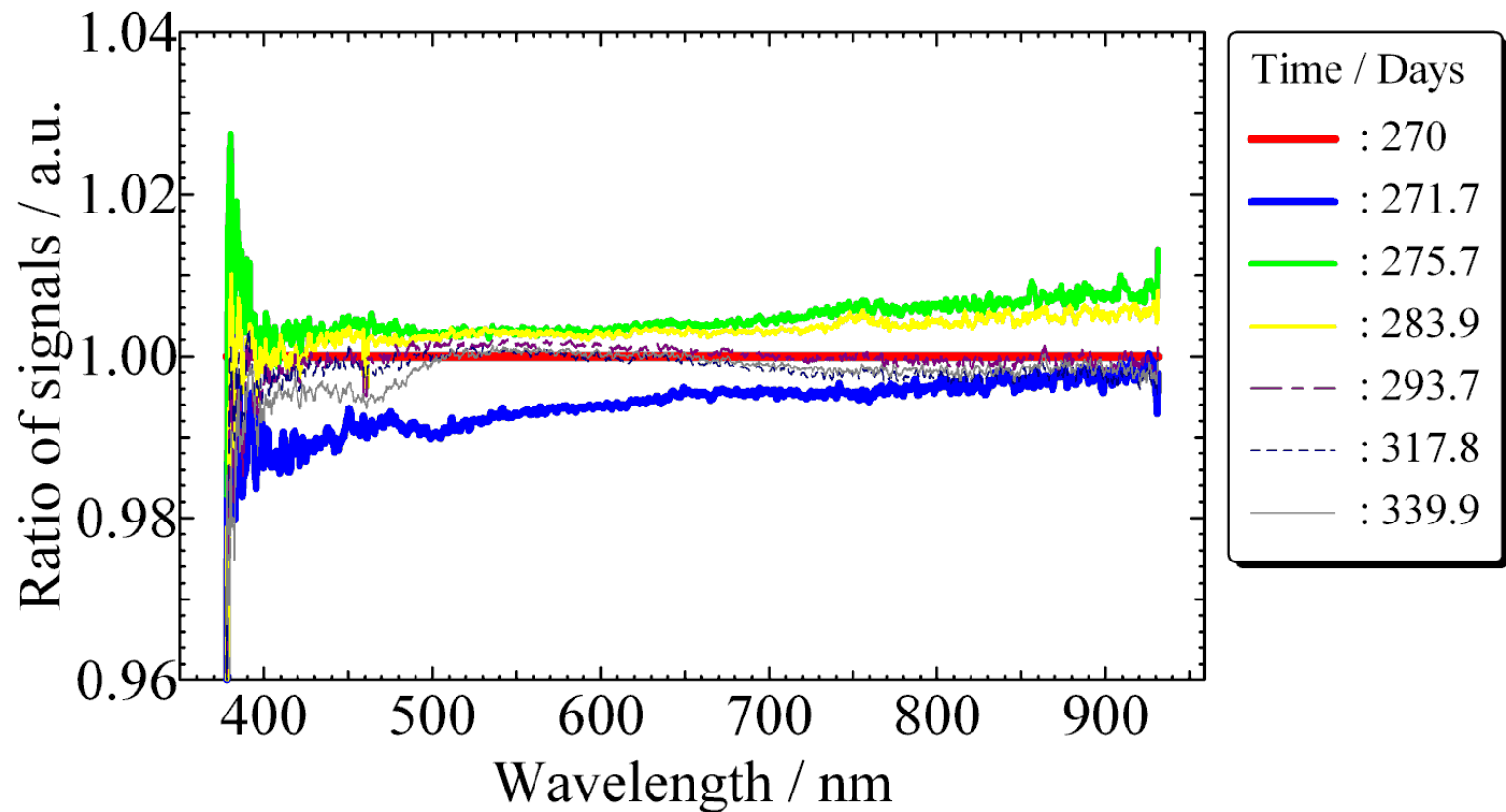
- Wavelength stability of a low-end array spectroradiometer of model 2:



40 h under > 95% RH

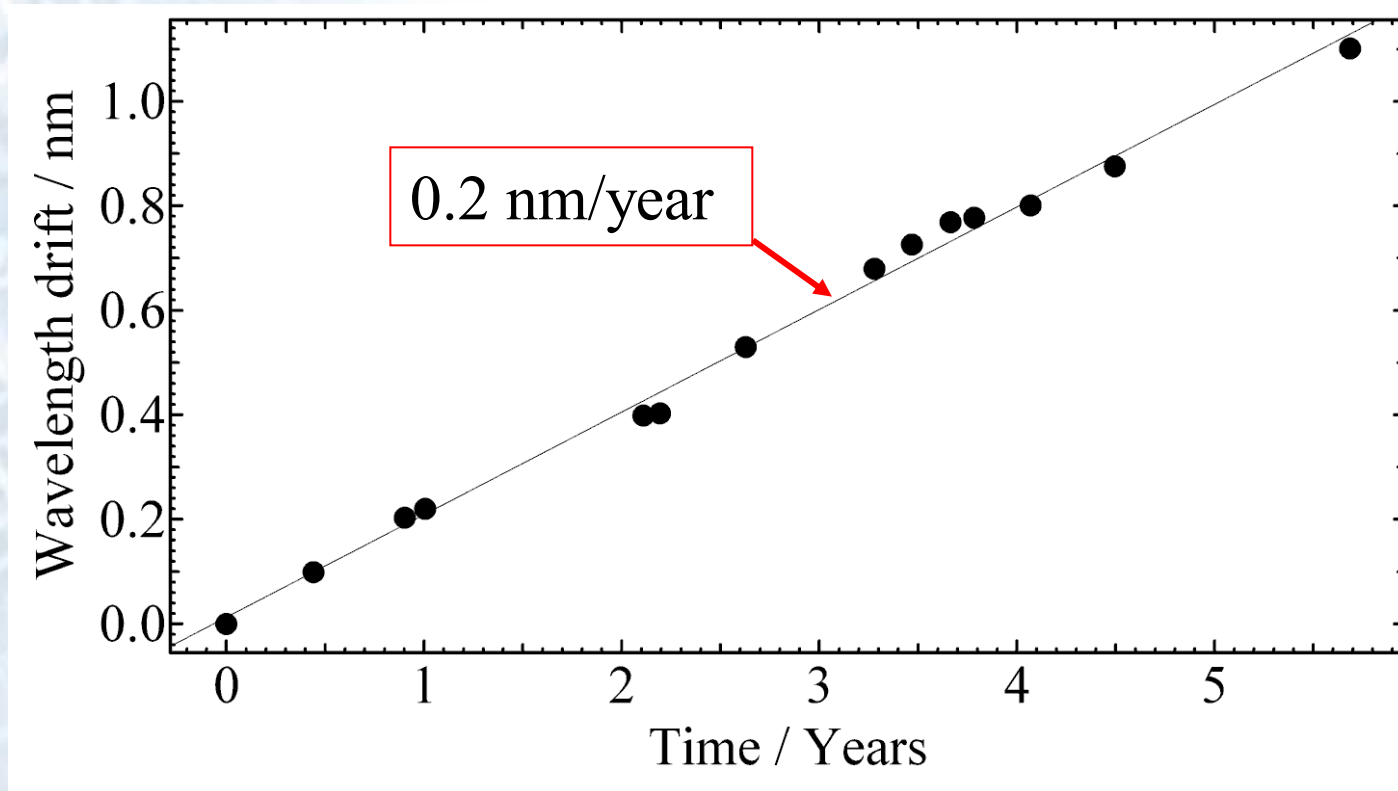
Long-term stability

- Effect of humidity on the response stability of the array spectroradiometer of model 2:



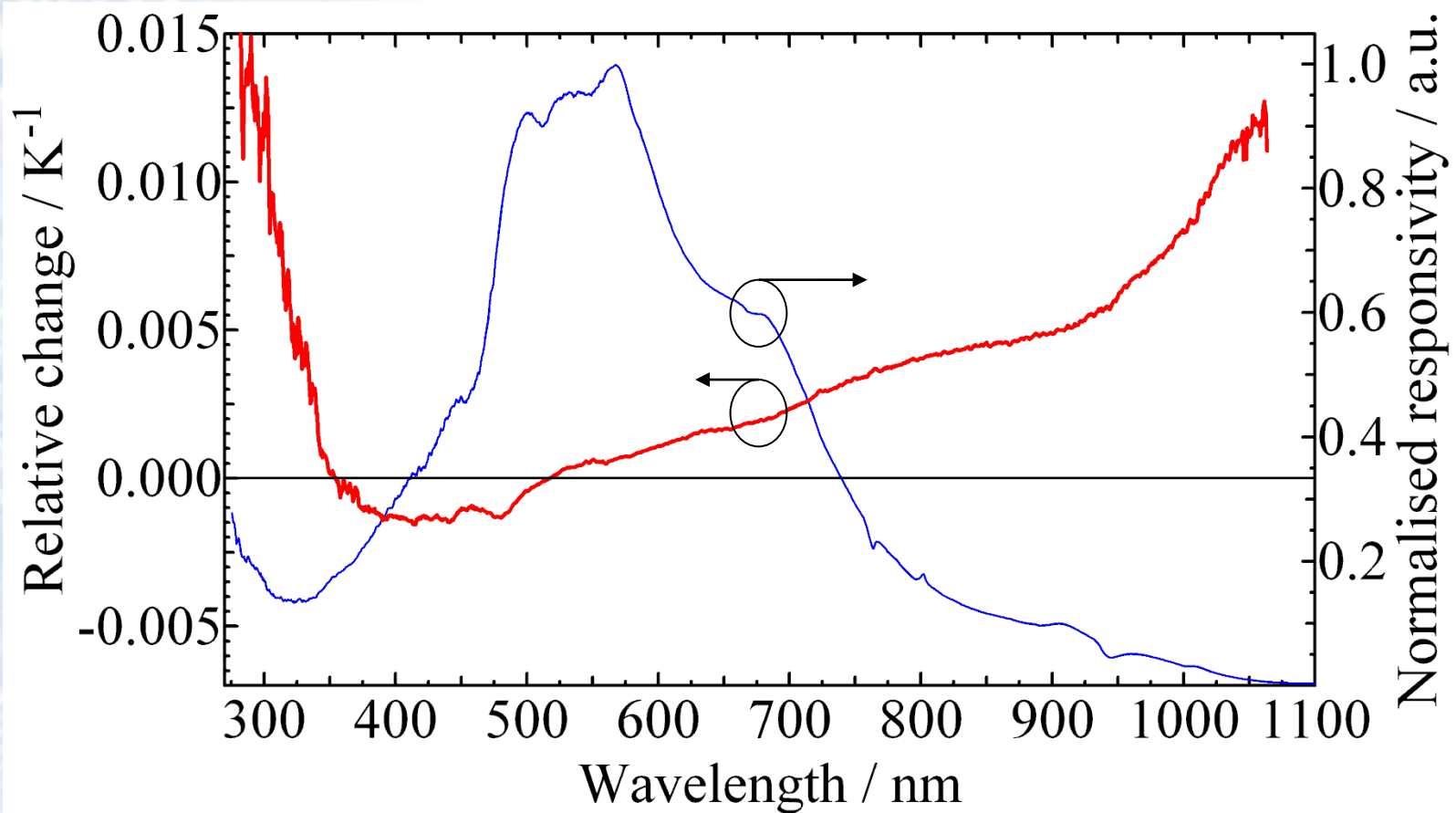
Long-term stability

- Long-term wavelength scale stability of a high-end array spectroradiometer:



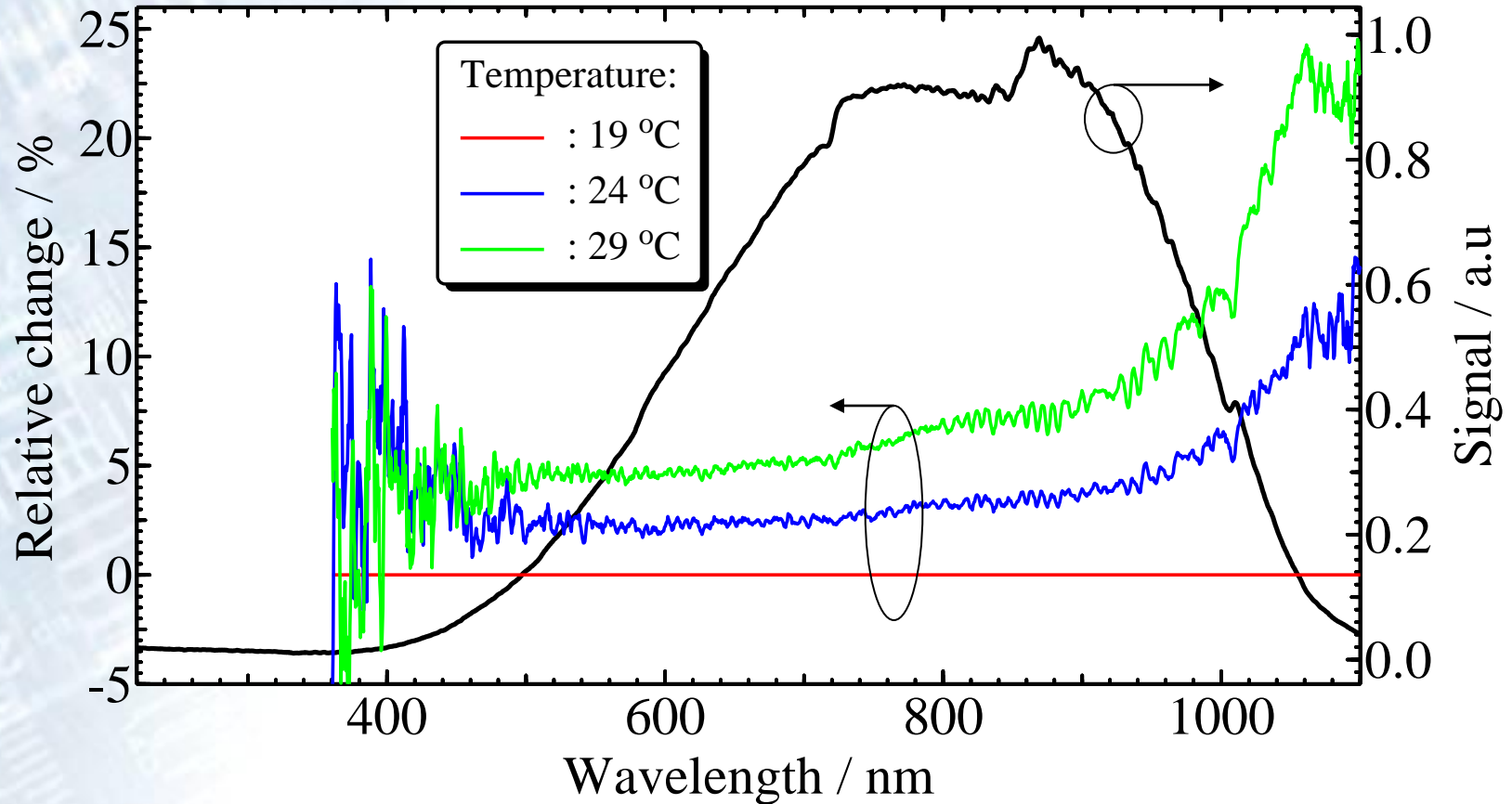
Temperature effects

- Temperature dependent responsivity of a low-end array spectroradiometer:



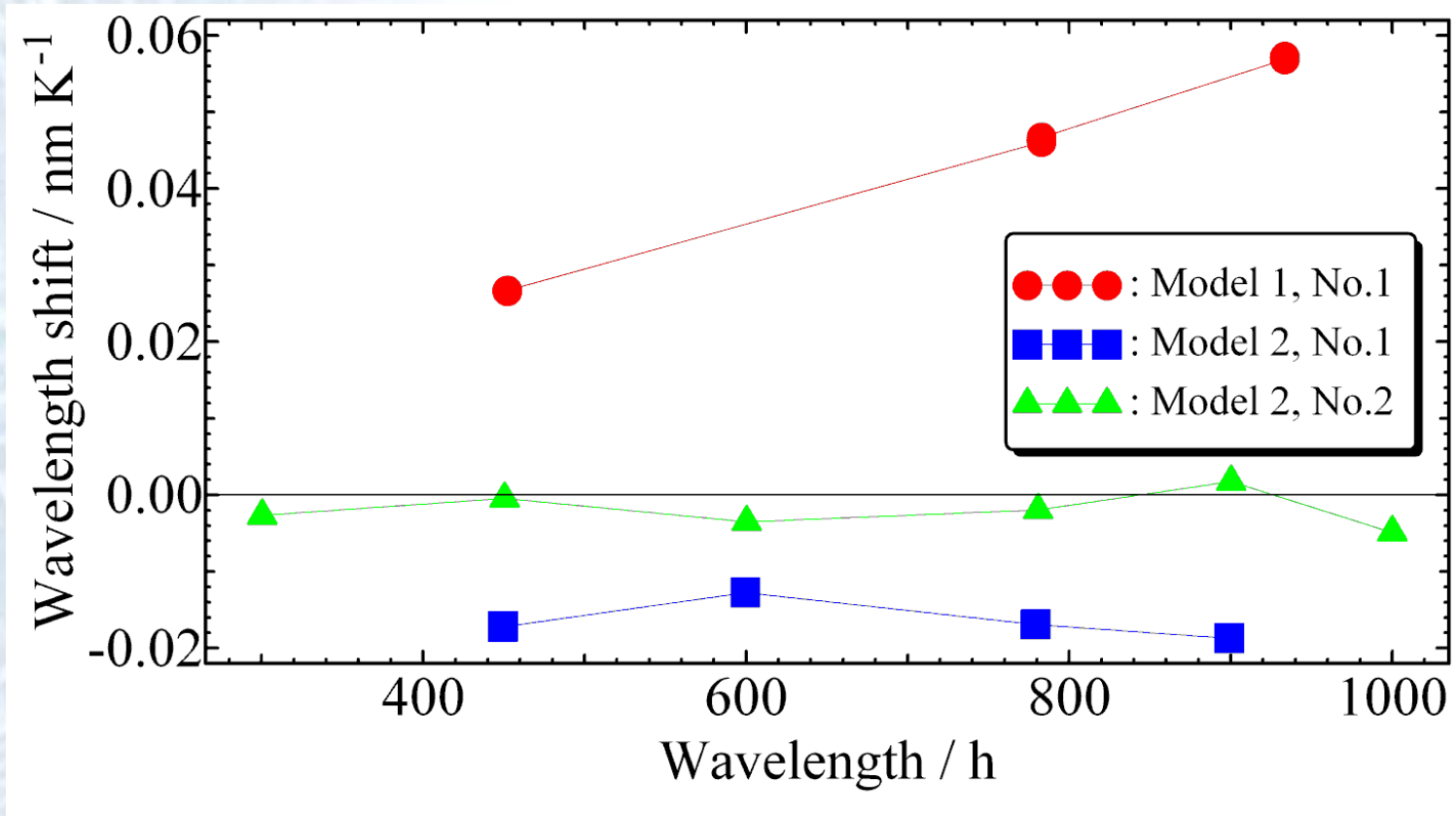
Temperature effects

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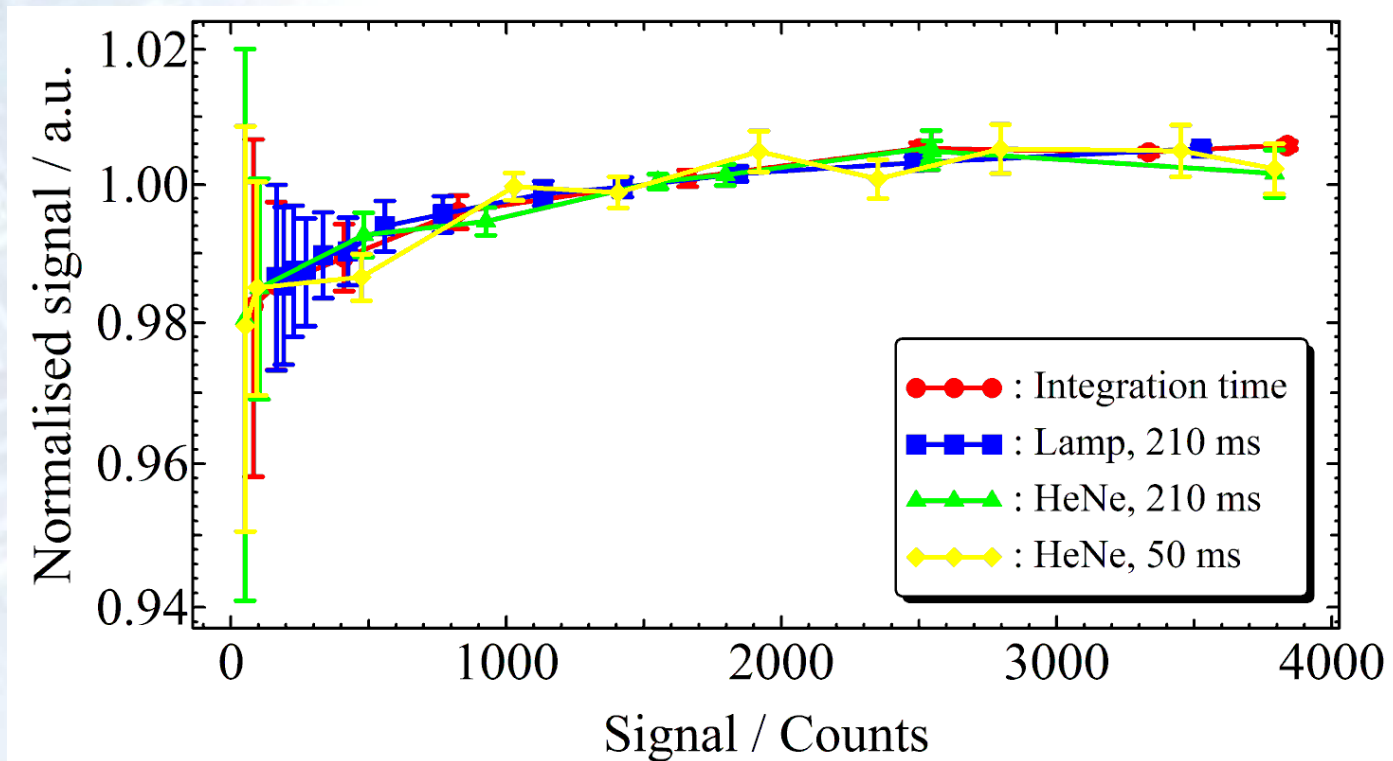
Temperature effects

- Temperature effect on the wavelength calibration of three low-end array spectroradiometers:



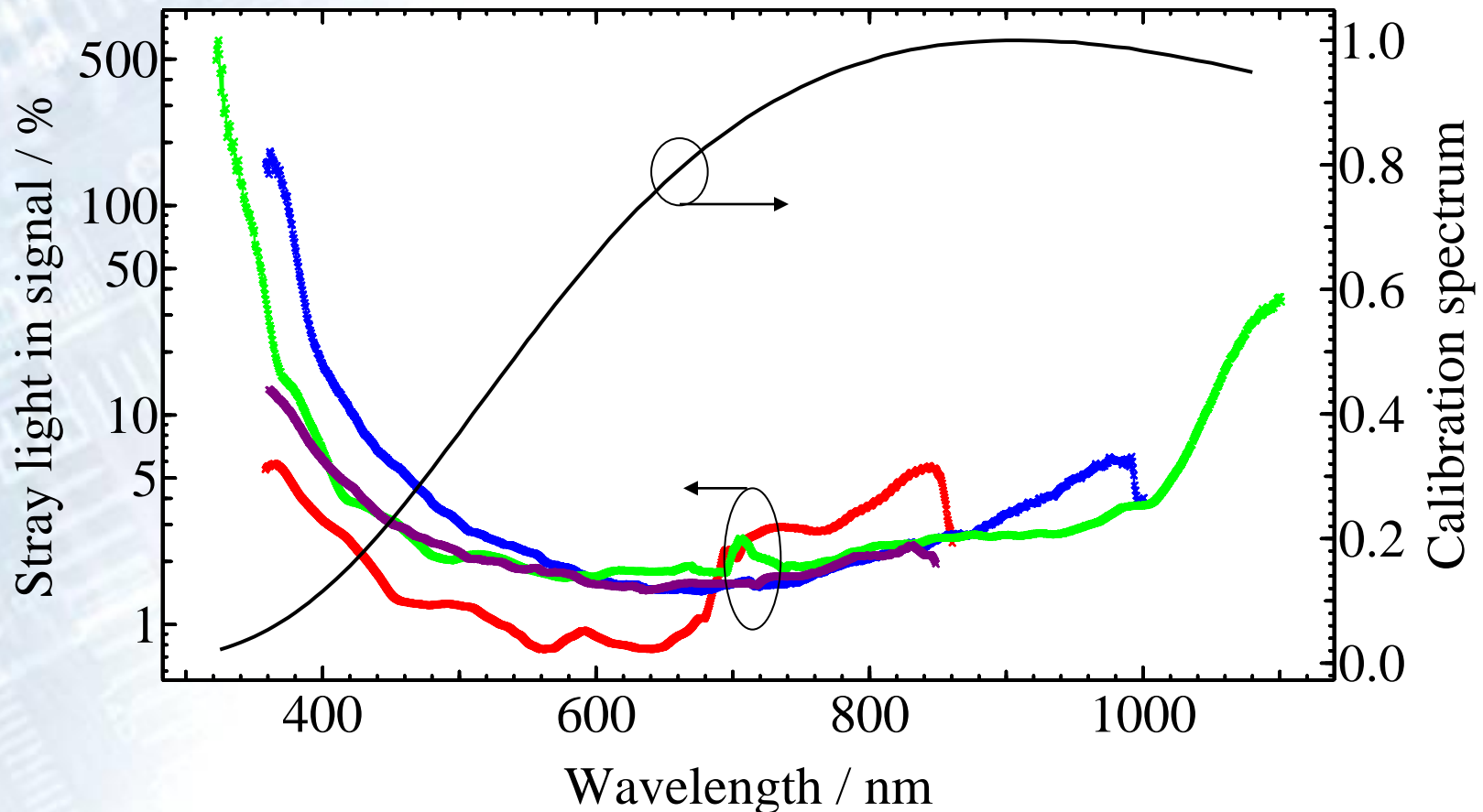
Linearity

- Response of CCD array spectroradiometers is typically nonlinear
- The corrections are often provided (refer to ADC counts)
=> account for the nonlinearity of the readout electronics only
- Should be checked using radiometric methods



Stray light properties

- Spectral power distributions of sources used for calibration and being measured differ => stray light effects



- Array spectroradiometers of different models characterized and monitored throughout a time interval of up to five years
- Large differences observed among the instruments owing to their individual construction
- Evaluation of the suitability for absolute calibration requires a comprehensive characterisation
- The characterisation is also needed for the uncertainty analysis