Calibration of the sky-scanner using pollution spectrometer

Version 17.1.2023

Devices:

- Radiometrically calibrated pollution spectrometer
- Stable continuous surface light source, e.g. white wall illuminated by the integration sphere

Comments:

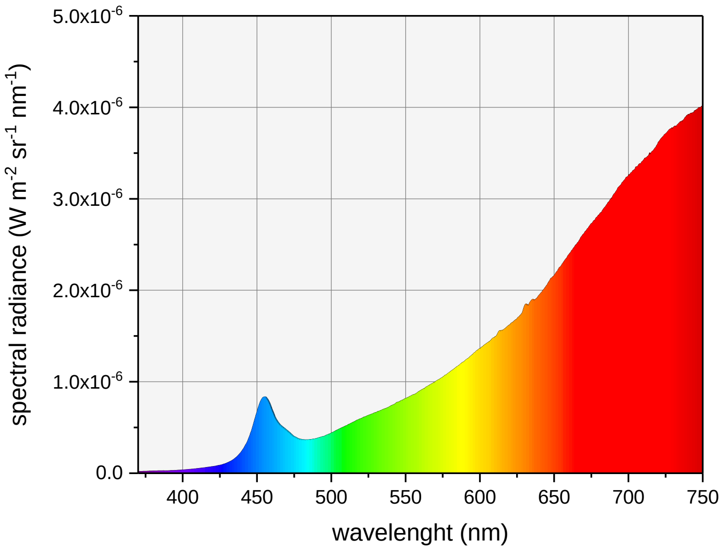
- For wavelengths 400 nm – 750 nm only

Step 1. Preparing the surface light source:

1. Use the integration sphere with a blue LCD display (wavelength 450 nm).
2. Illuminate a white wall from the distance about 2 m.

Step 2. Measurement of the spectrum:

1. Measure the spectrum of the illuminated wall using radiometrically calibrated pollution spectrometer (values in $W/m^2/sr/nm$).

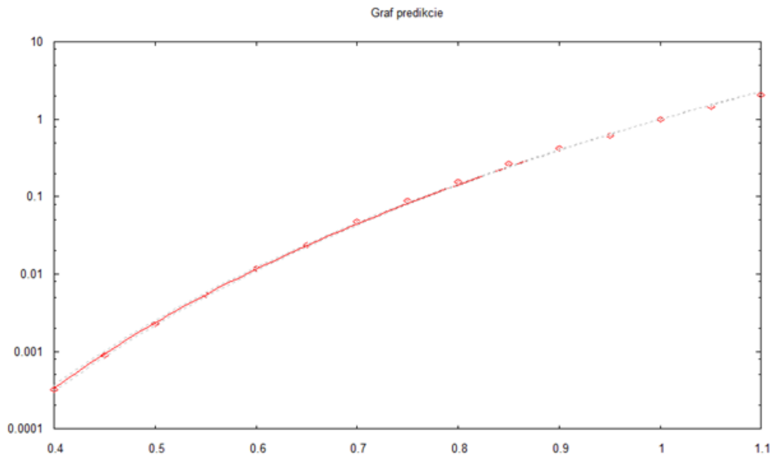


2. Find the averaged values of the spectrum (+/- 5 nm for 10nm filters or +/- 20 nm for 40 nm filters) for wavelengths 400 nm, 450 nm, …., 700 nm (e.g. 4.377×10^{-7} at 500 nm).

Step 3. Finding the dependence of the sensitivity of the sky-scanner on the control voltage (CV)

1. Set the control voltage to the maximum value of 1.1 V and set a suitable filter from the blue region to achieve the signal voltage as high as possible (for example: filter 400 nm, signal 0.1318V).
2. Record the signals for CV = 1.10, 1.05, 1.00, …., 0.400 V. If the signal starts to be small, try to set the next filter toward the red (the signal should be not overloaded (maximum 3V), e.g. 0.0280 V using 400 nm filter and 2.9410V using 450 nm filter. Calculate the light intensity change (e.g. 2.9410/0.0280 = 105.035) and recalculate the signal using this constant (e.g. 2.9410V/105.035=0.0280V). Do the same (change the filter and recalculate the signal) if the signal at lover CV starts to be small again.
3. Calculate relative values of the signal (relative to the signal at CV=1.000V).

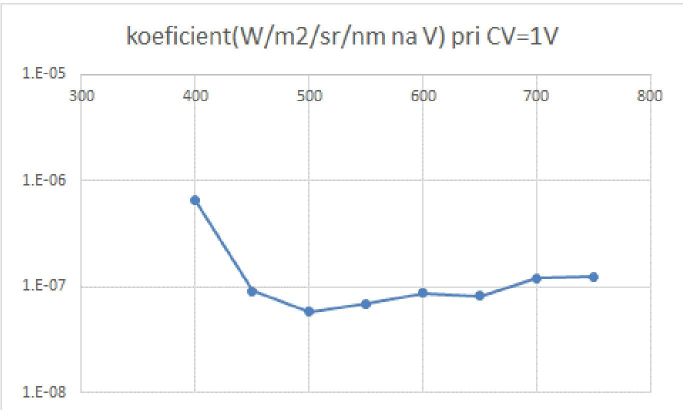
4. Plot the signal vs. CV plot and fit it with power function signal = $(CV)^n$ (signal = $(CV)^{8.73358}$ in our case):



5. **Use this calibration curve in the future for recalculating the signals recorded at any CV (divide the signal by the value of $CV^{8.73358}$), to obtain the signal as to be for CV=1.000V.**

Step 4. Finding the spectral sensitivity of the sky-scanner

1. Measure the signal using all colour filters. Set the control voltage (CV) to the appropriate value (e.g. 0.3316 V at CV=0.7000 V for 500 nm).
2. Recalculate the signal values to the CV=1.000V using the relation found in Step 3.5 (e.g. $0.3316V/0.7000^{8.73358}=7.473V$).
3. Divide the spectral radiance of the source (Step 2.2) by the signal to obtain **the conversion coefficient between the signal and the radiance** (e.g. $4.377\times10^{-7}/7.473$ = **5.857×10^{-8} W/m2/sr/nm/V at 500 nm**)
4. **Find these conversion coefficients for all wavelengths and use them in the future to recalculate signal voltage to the radiance**:



Remark: **Use "kalibruj_spektrum_skyscanner.xlsx" EXCEL-sheet for easy calibration of the spectrum obtained using sky-scanner.**