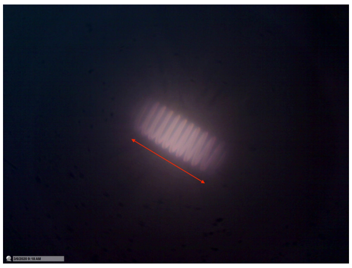
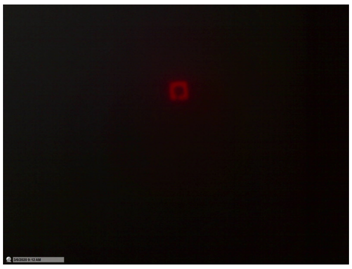
Sources

5. Summary of tasks of the experimental work

4.2 Source size measurement

Present for each source an image in a 4f setting (**3 images** similar to Fig. 20). Give the approximate dimension in pixel on the detector and in mm in the object space (image space/magnification=1). Make an error estimation. Find the datasheet value and comment.

Picture 1 – Halogen	Picture 2 – LED	Picture 3 – Laser
		

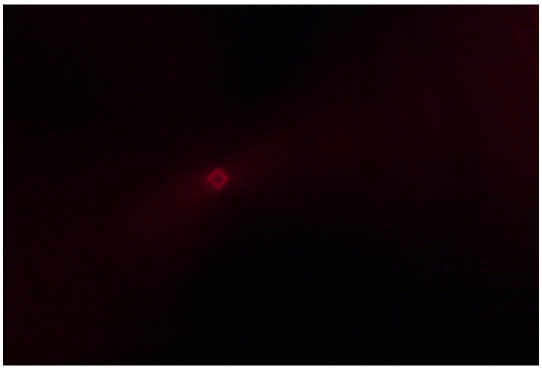
Source	Measured size (4f) pixel	Measured size (4f) mm (1px = 2.835 um)	Error (%) $\frac{estimate\ error}{measured\ size}$	Datasheet value (mm)
Halogen	434	1.23	3.5	1.2
LASER	14	0.04	21.3	1.6 (packaging)
LED	84	0.24	11.8	1.7 (packaging)

Comments:
We measured a value for halogen source very similar to the size given in the datasheet. We also have low error due to the relative high length of the halogen source.

For the laser and the LED, we find small size values so that the relative error is higher than for the halogen source because more precision is needed. We didn't find source size dimension in the datasheets so that we decided to take the packaging values. Finally we can just say that the measured size of the sources are much smaller than the packaging dimension which is normal.

4.3 Light distribution for different image sizes with LED

Present an image for each of the two different measurement conditions: with double lens and single lens under identical exposure and gain (avoid saturation) **(two images).** Evaluate the integral intensity in the image for both cases and give the ratio. Calculate the theoretical difference between the optical signals and compare with your measurement.

Picture 1 – double lens – infinity configuration	Picture 2 – single lens – 4 f configuration
	

Double lens configutration

Distance camera first lens (red)	25 mm
Distance lens - lens	60 mm
Distance second lens (blue) source	20 mm
Distance source camera	105 mm

4 f configuration (single lens)

Distance camera first lens (red)	65 mm
Distance lens - source	40 mm

	Single lens	Double lens
Integral intensity	1 262 111	588 906

Intensity ratio measured: double/single = 0.47

The theoretical intensity ratio is based on the brightness theorem. If the image area is identical (what we assume) only the different solid angles contribute. The theoretical difference is therefore the ratio of solid angles for the infinity (double lens) and 4f (single lens) configuration.

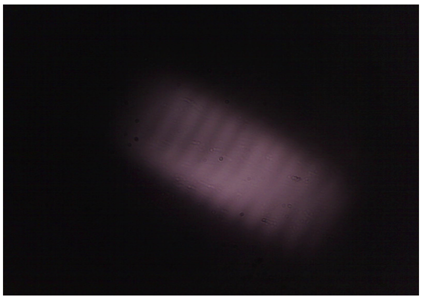
Theoretical value: $\frac{1-\cos(\theta_{doublelens})}{1-\cos\,(\theta_{singlelens})} = \frac{1-\cos(arctg(\frac{D}{2*f}))}{1-\cos(arctg\left(\frac{D}{4*f}\right))} = 3.54$

With $D = 1'' = 25.4\ mm$ the diameter of the lens,
And $f = 25.4\ mm$ the focal distance.

Comments: We see that the integral intensity of the single lens configuration is better than the double lens configuration. It's not normal, the double lens configuration should have more intensity because the first lens is closer to the source than in the single lens so that it should redirect more light; like the theoretical value shows. We explain the differences in the source size measurements by bad manipulation and incorrect lens placement.

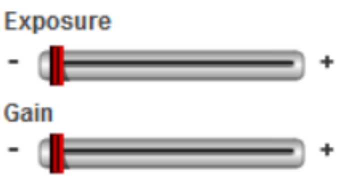
4.4. Spectral matching

Present an image for each of the two different measurement conditions of the halogen lamp (without and with IR filter) **(two images).** Show the exposure data! Discuss the influence of polarizer, IR filter and source spectra on the result by making **ONE GRAPH** (can be hand drawn) that shows transmission of all components against wavelength!

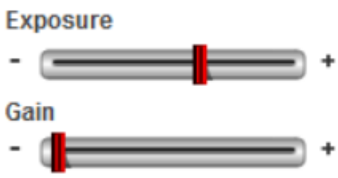
Picture 1 – without IR filter	Picture 2 – with IR filter
	

Exposure data (prints screen or value)

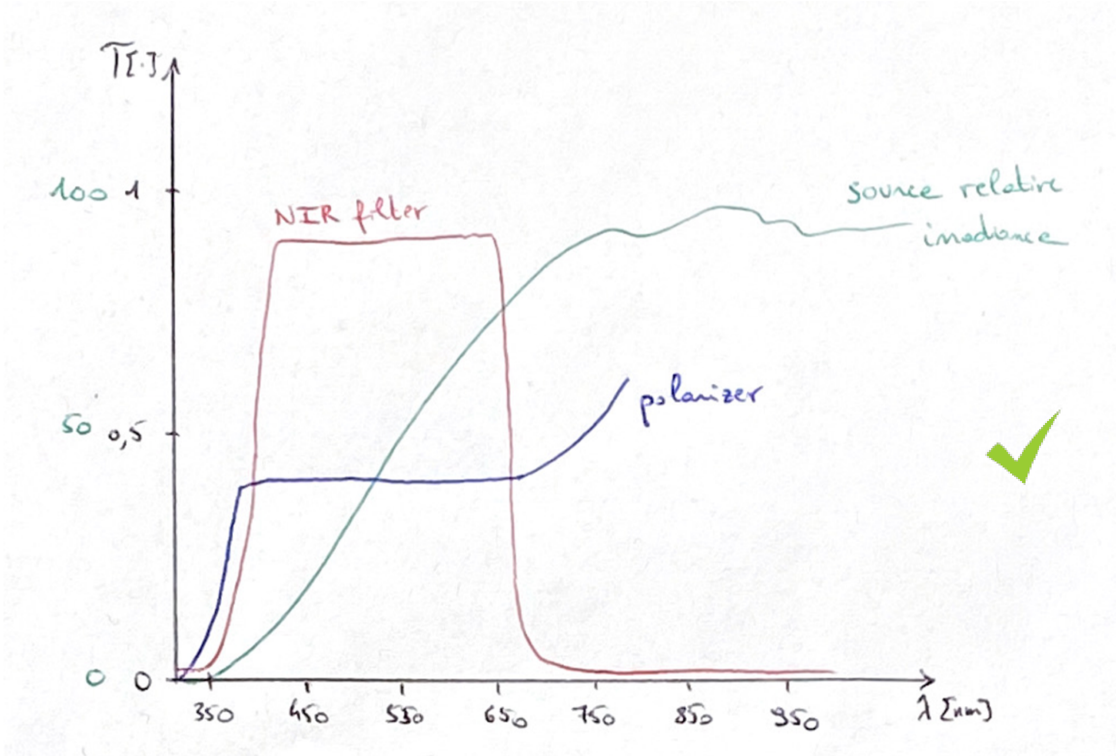
Without IR filter



With IR filter



Graph of spectral behavior of different components



Transmission in function of wavelength

Comments: The NIR filter is included in the camera because this filter lets pass visible colors of the wavelength spectrum. It's useful to not detect IR light, humans are not capable to see, so that the picture looks very similar to our perception of the world. The polariser is useful to filter light intensity without losing colors. It's also useful to suppress glare from the source and manage reflections. We see that the source given delivers much more power in higher wavelengths than in low wavelengths.

All data from the graph comes from the TP description.

4.5. Web examples

Have a look on the website of the lamp manufacturer Osram (or similar). Find an example of a source with particular optical properties and its datasheet. Find in the datasheet its principle parameters (working principle, spectral bandwidth, emission area, temporal behavior and if possible solid angle of emission and brightness) and add it to your lab notebook. Cite correctly. What is special about your source? Add a photo of the source!

EXAMPLE:

Source:
https://www.osram.com/ecat/Advanced%20Power%20TOPLED%C2%AE%20LA%20G6SP/com/en/class_pim_web_catalog_103489/global/prd_pim_device_2190608/

Product features

Advanced Power TOPLED features a compact package with a wide brightness range and high luminous efficiency.

This is a very compact LED measuring 1.7x31mm and weights 40mg, made with thin films technology.

Spectral Bandwidth: 617 ± 18nm
Viewing angle: 120°
Emission area: $0.36mm^2$

Brightness group DA at 140mA:
luminous intensity 4.5 to 5.6cd
luminous flux 15.1 lm

Features:

- Package: white SMT package, colorless clear silicone resin
- Chip technology: Thinfilm
- Typ. Radiation: 120° (Lambertian emitter)
- Color: λ_{dom} = 617 nm (● amber)
- Optical efficacy: 84 lm/W
- Corrosion Robustness Class: 3B
- Qualifications: AEC-Q102 Qualified with RV-level 1
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)

Personal feedback:

Was the amount of work adequate? No ~6h spent, had no idea about the coherence of our values

What is difficult to understand?

What did you like about it? We got to browse the osram page for truck headlights

How can we do better? We felt the absence of the little introductory speech