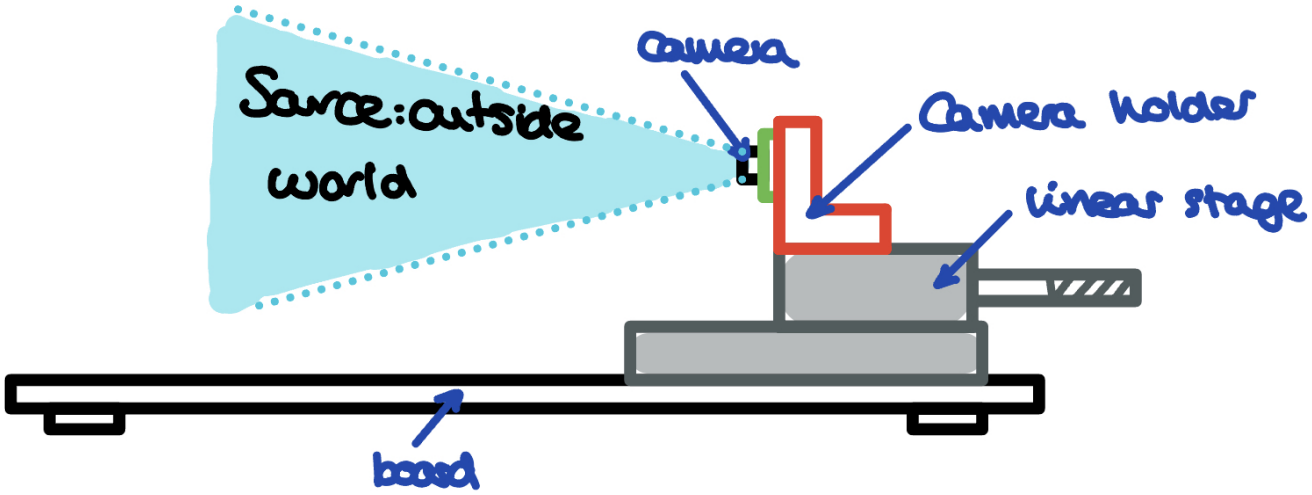
Advance Report Imaging TP1

Group A2-4, Nathann Morand, Felipe Ramirez

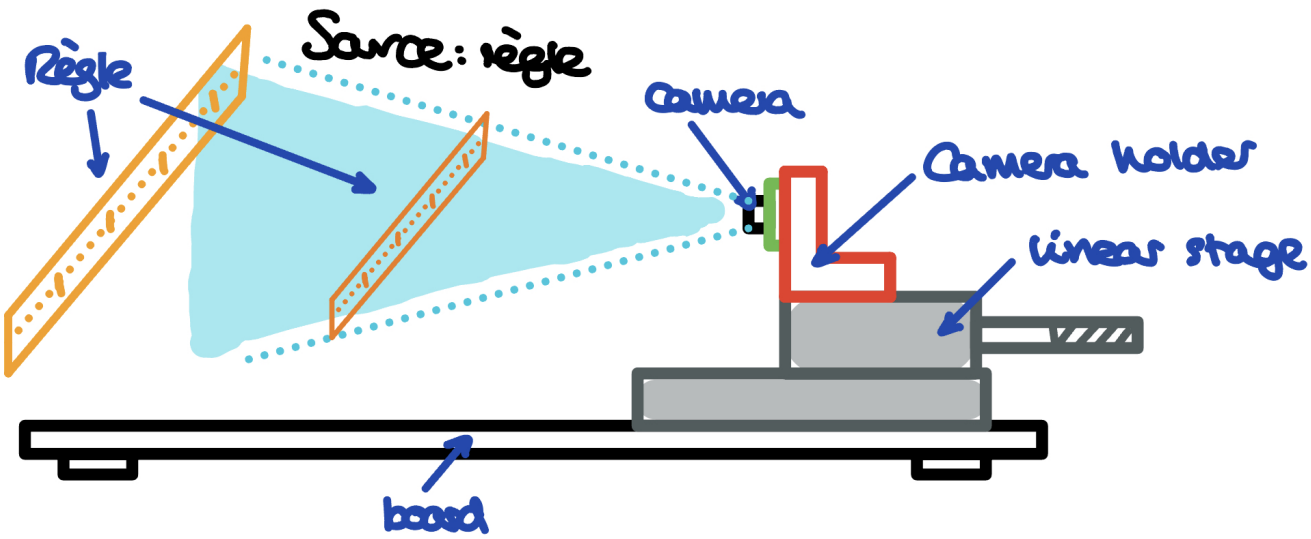
Schematics

Draw simple schematics of the (different) experiment(s) you will perform in this TP, indicate the source(s) and optical element(s):

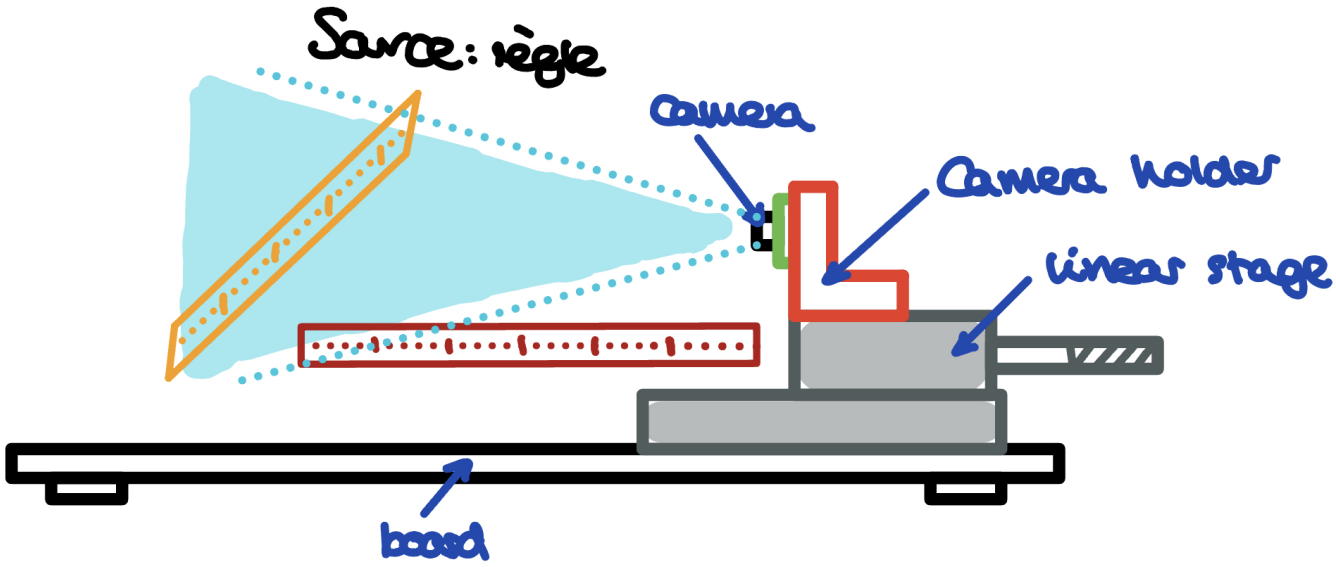
setup for saturation and the innitial setup



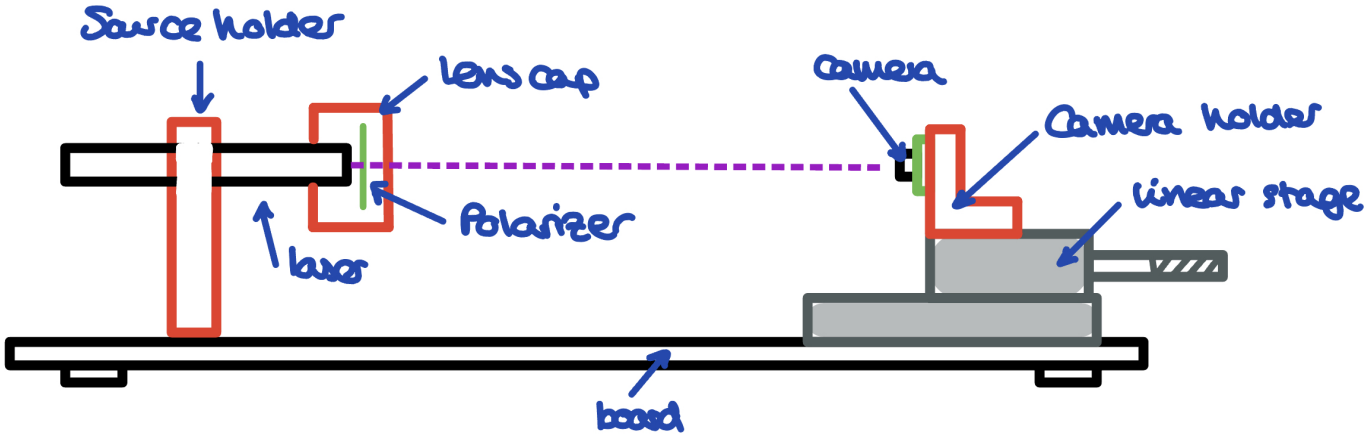
setup for measuring the focal length



setup for the measurement of the field of view



setup for the measurement of the F# number.



Goal of the experiment(s)

Describe the objective(s) of the experiment(s) you will perform today

optical setup

Mount the camera on the linear stage which is mounted on the breadboard.

Saturation and dark count

The aim is to take a few images and determine basic parameter of the camera like saturation and dark count level.

measure the focal length

Use the focus to measure the focal lenght using a ruler.

Measurement of the field of view (angle of view)

Find how large the angle of the cone that the camera see is.

Measurement of the F# number.

F number is a ratio between diameter of the entrance pupil and the focal
length of the lens. Make picture of the dot of light from a laser beam to deduce the F# number

Theoretical background

Explain briefly the theoretical background for this TP, indicate the main formulas.

optical setup

None. Follow the guide to assemble the setup as required

Saturation and dark count

Sensor measure discrete level of light, can set the sensitivity using the exposition duration
Saturation = too much light for the sensor, out of range.
The focus allow to set the distance of what we want to see sharp
Understand basic usage of the exposure and focus.

measure the focal length

PERFECT FOCUS is required
Use the focus to measure the focal length using a ruler.

$$\text{focal length} : \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\text{magnification} : m = \frac{d_i}{d_o} = \frac{h_i}{h_o}$$

$$\text{focus distance} : d = \frac{d_{ia} - d_{ib}}{m_b - m_a}$$

Measurement of the field of view (angle of view)

Basic trignometrie, thales

$$\alpha = arctan(\frac{l_o}{2d_o})$$

Measurement of the F# number.

F number is a ratio between diameter of the entrance pupil and the focal
length of the lens.

We can estimate it using the numerical aperture :

$$F\# \approx \frac{1}{2NA}$$

$$NA = sin(arctan(\frac{2\pi R}{0.5 * 10^{-3} * \theta}))$$

θ is the rotation angle of the objective

$0.5 * 10^{-3}$ is the pitch of the focus