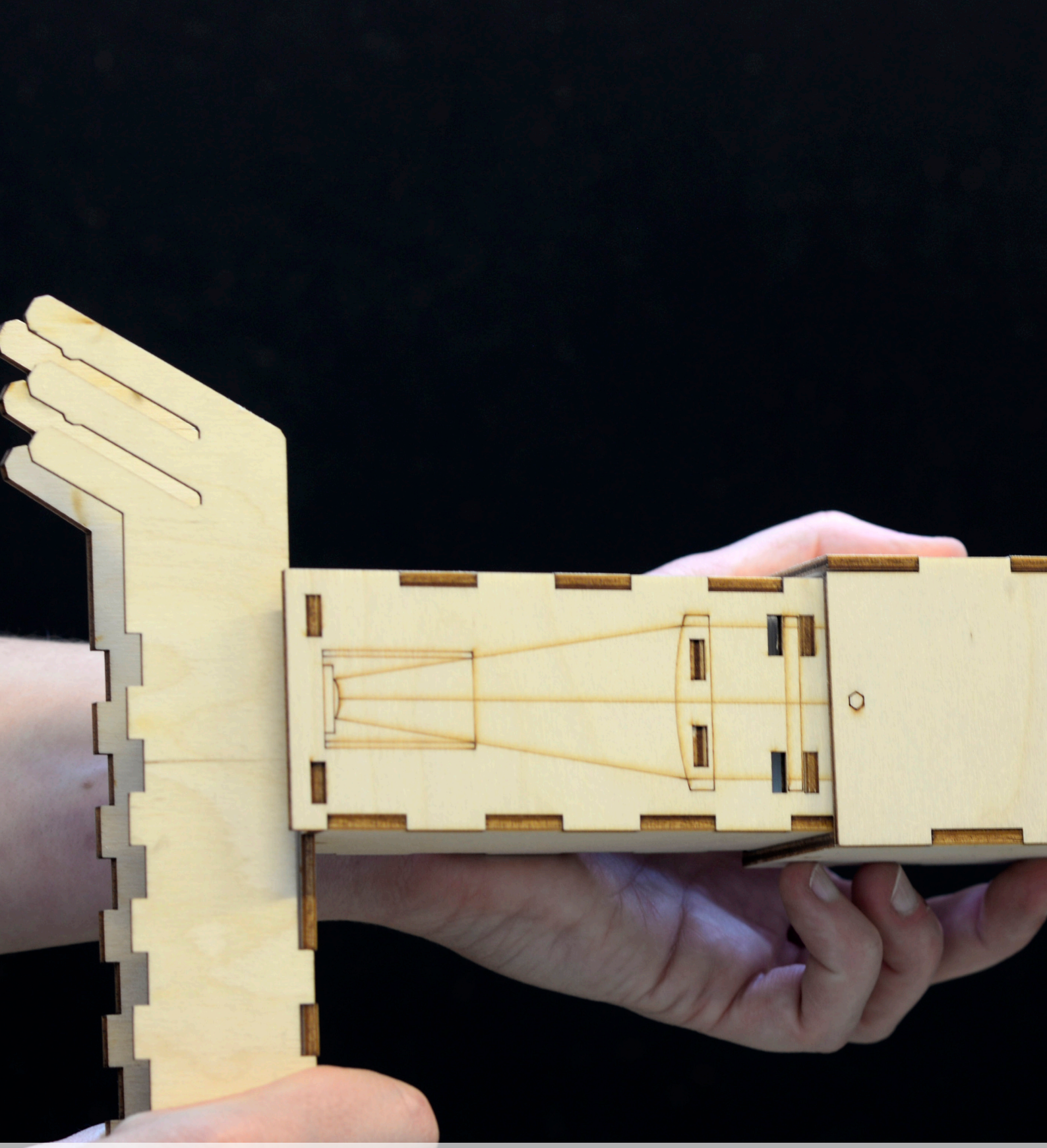

PHABLABS 4.0

PHOTONICS WORKSHOP

GOBO PROJECTOR

Project your own art in the world around you with this selfmade gobo art projector

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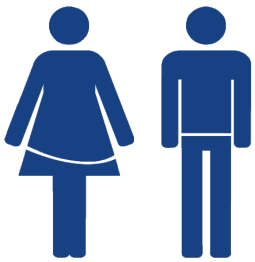
PROPERTIES OF THIS WORKSHOP

SUMMARY:

In this workshop, we are going to build an RGB lamp, which can be remote controlled by your smartphone. The lamp is centered on the Arduino-like platform WeMos, which has WLAN capability and is set up as an Access Point (AP) for your smartphone. The WeMos also has a programmable microcontroller with several inputs and outputs, which control 3 red, green and blue high-power-LEDs. The provided sketch (program code) can be manipulated using a freely available programming environment for future projects.



TARGET AUDIENCE:

Students (15-18 years old)

SUGGESTED TIME PLANNING: (Total: 2,5h)

Timing in minutes	**activity**
0-15	Introduction
15-30	Part one: soldering and assembling the handle of the art projector
30-45	Part two: assembling the sliding part
45-60	Part three: assembling the image part

TOOLS:

Laser Cutter
Soldering Iron
Rubber/plastic hammer

WEBLINK:

All needed files for lasercutting can be found on:
http://www.phablabs.eu/workshop/gobo-slide-projector
or via the QR code.

Step 1: Parts list

Collect all materials for each participant.

Photonics Parts:

Spherical lens, f = 106 mm
2 piece/prototype

High power LED
1 piece/prototype
12V, 10W

Electronic Parts:

MT3608 DC-DC step up converter
1 piece/prototype

Aluminium heatsink with adhesive
1 piece/prototype

USB-A cable
0,5 piece/prototype

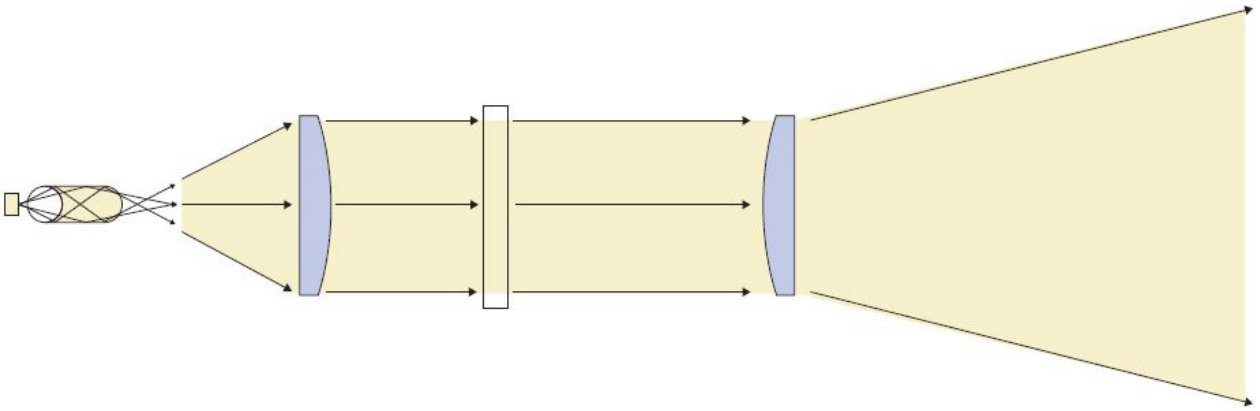
Rocker switch button (13x19mm)
1 piece/prototype

Not included:
wire and USB power bank
aluminium tape

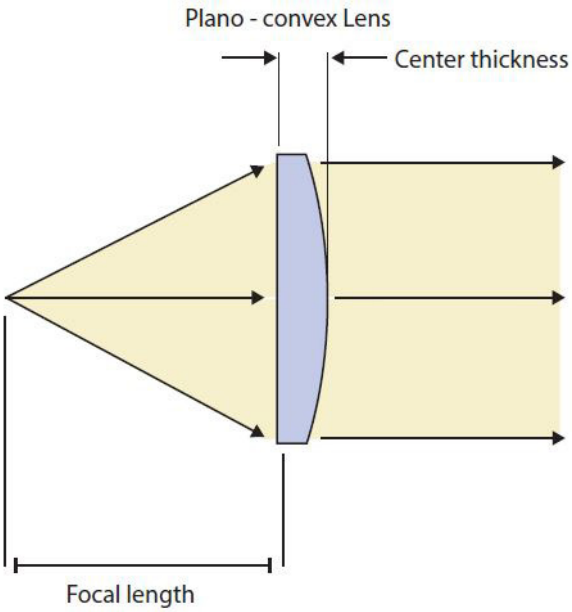
A complete toolkit is available on the www.phablabs.eu website.
Or via email: phablabs4.0@gmail.com

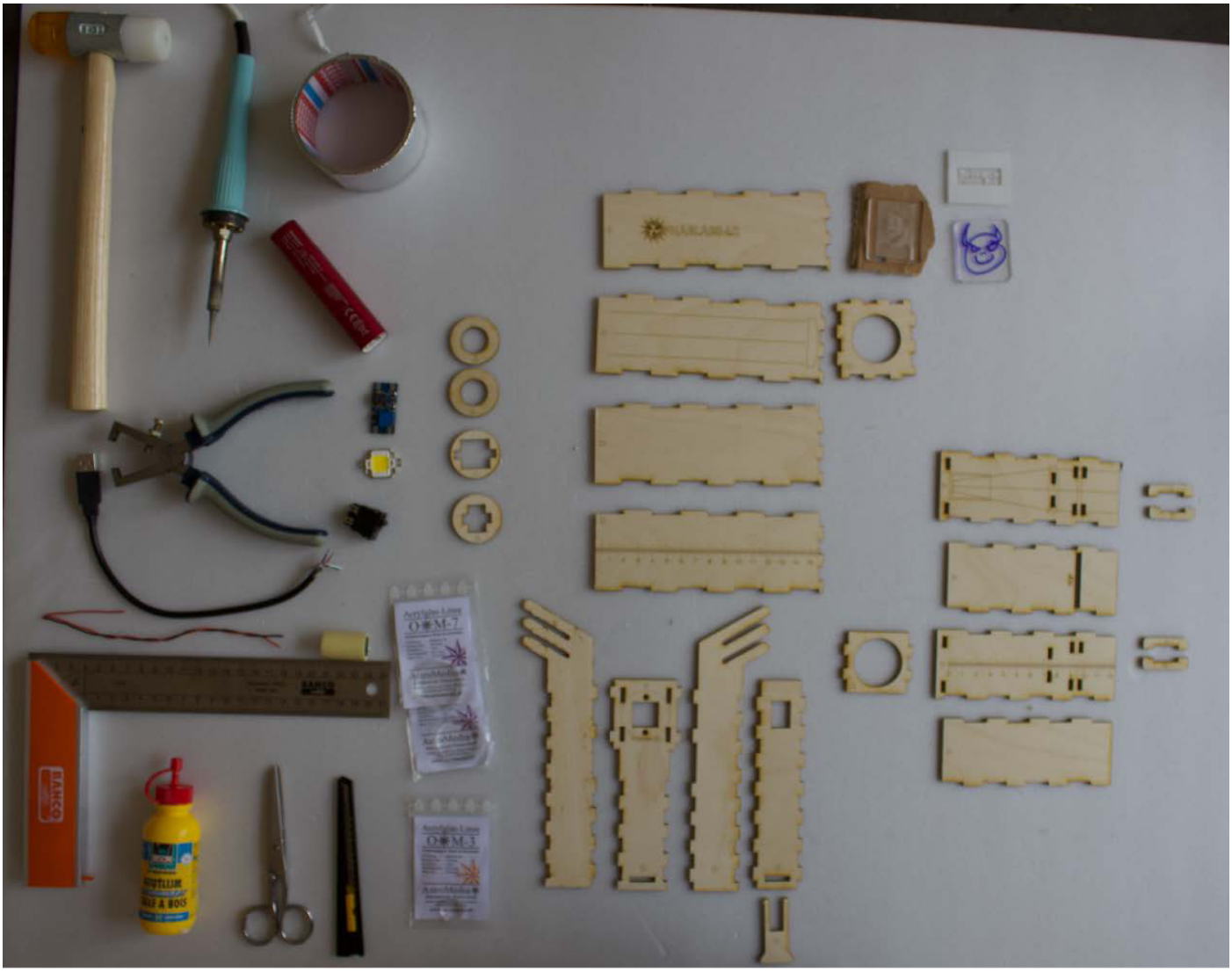
Step 2: Photonics principles of the art projector

The working of optical system based on lenses is explained during this workshop. Two lenses are used to make a slide projector. The first lens is to make the divergent light coming from the led into parallel light (collimation). This done to make sure the slide gets enough light evenly distributed over the slide. The next figure shows the lens system that is used in the Gobo slide projector.

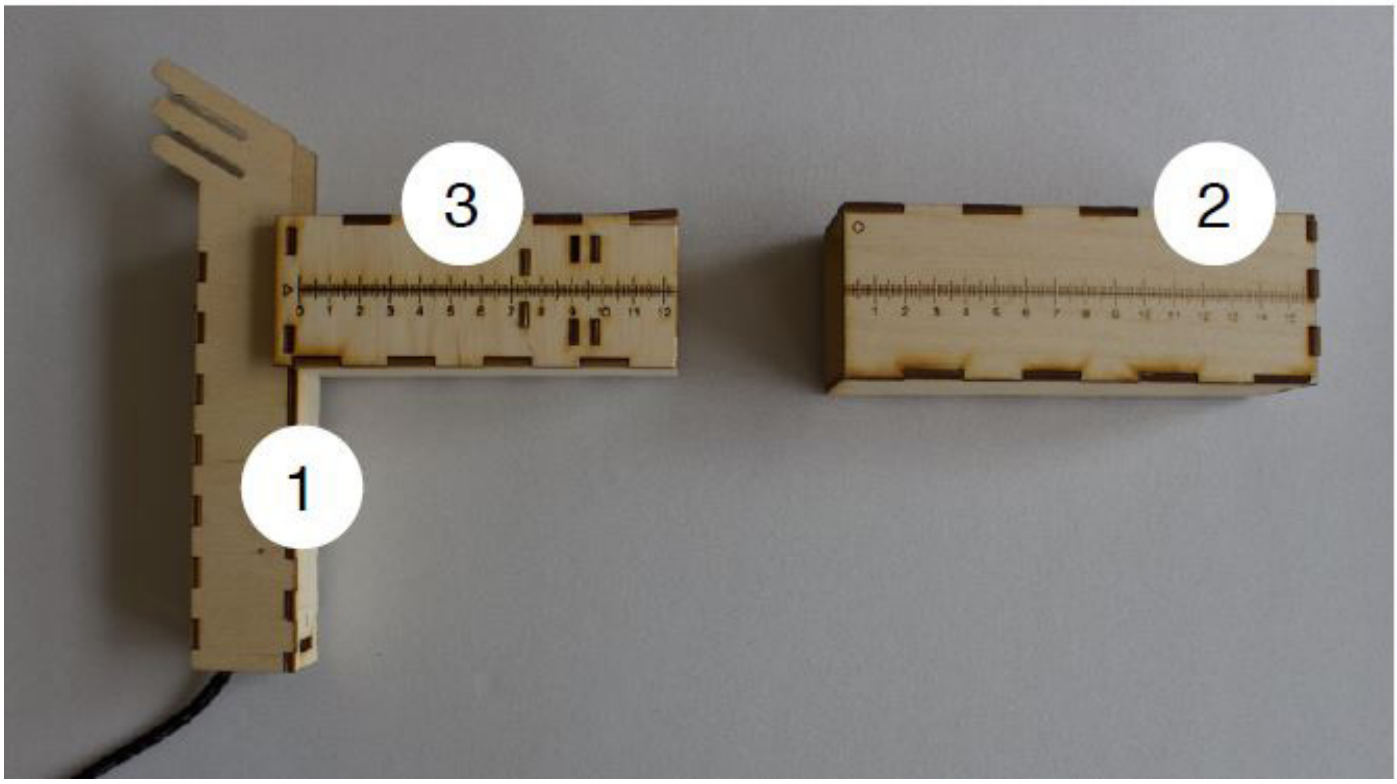


As you can see in the next figure the first lens should be place with the flat side towards the LED to make the divergent light parallel. The second lens should be placed with the convex or bulb side towards the slide to make the enlargement of the image possible.

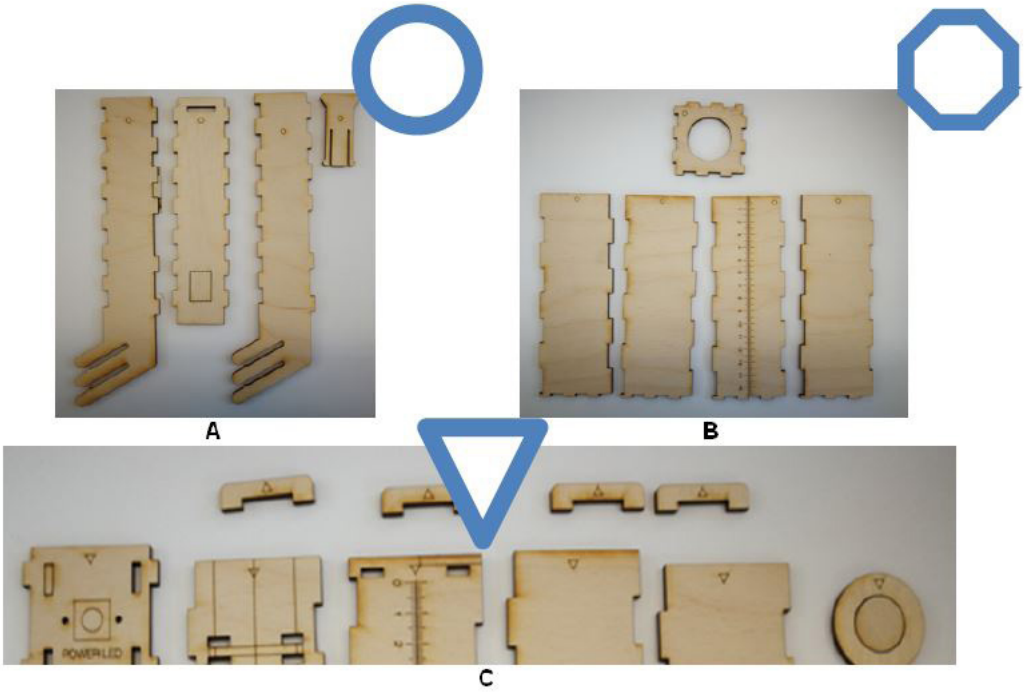




Step 2: Building of the three parts



All the parts that belong together are marked with symbols to easily recognise them. The coding system used during the construction of the GOBO projector: the circle for part 1, the pentagram for part 2, and the triangle for part 3.

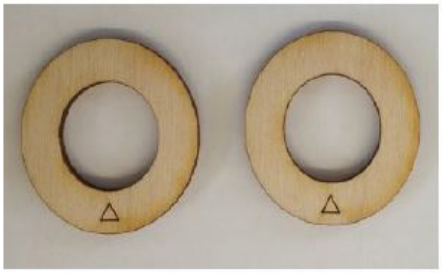


The collimator

A collimator is needed to collimate the light that is coming from the LED. In Figure 6 there are two rings displayed; take some glue and attach these two circles to each other. Take the PVC tube and place aluminium tape of the inside of the tube, with the help of a pencil or your finger.

hint: if it's to hard to fix the aluminium tape inside the tube try to make strips of aluminium tape and stick them to the inside of the tube one by one.

Take the PVC tube and a hammer to take the tube inside of the circle with a soft rubber/plastic hammer.



a

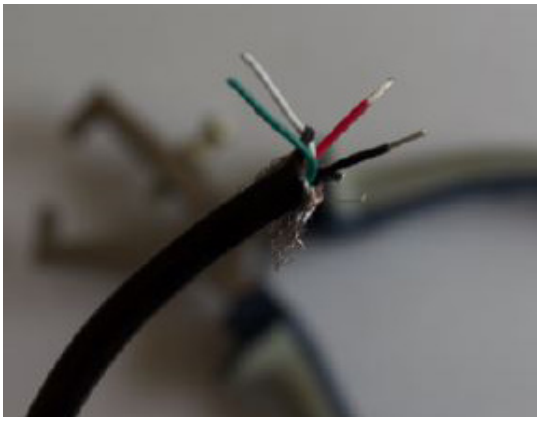
b

c

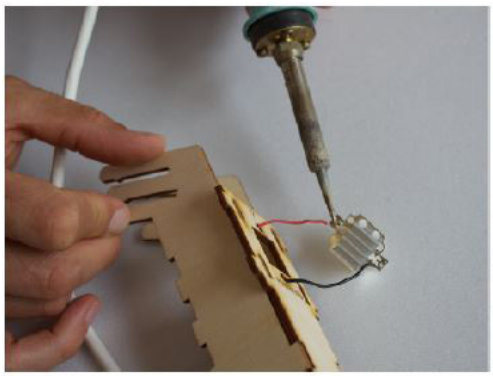
d

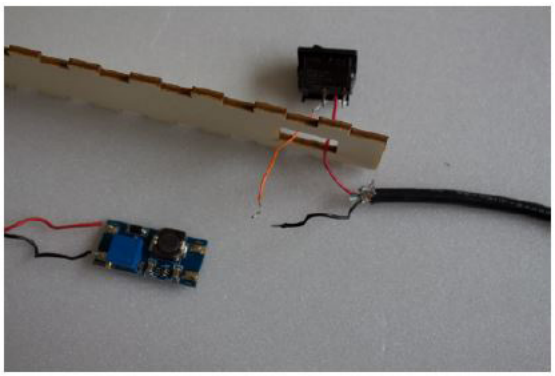
The LED & circuit

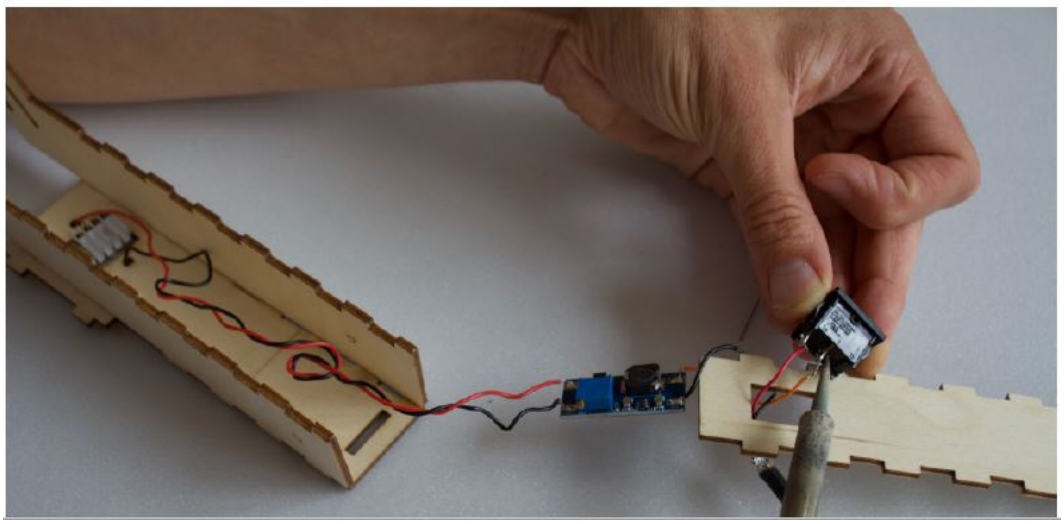
First ensemble the electrical parts before you start with the construction of the Art projector. You need some parts from group A indicated with a cylinder for this. Start with stripping the USB cable. Cut the cable in half and use the wire stripper and utility knife to take of some centimeters from the black outer jacket to release the red and black wire from the inside.

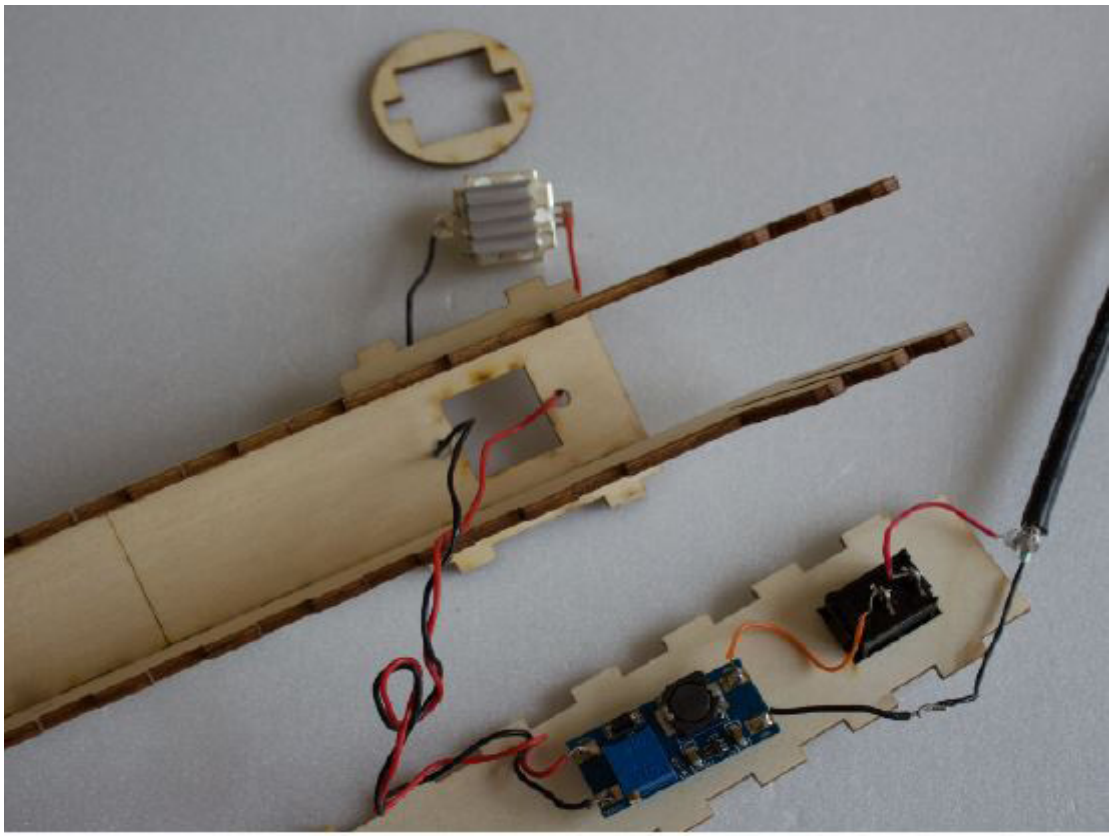


• 1 - Solder a red wire to the plus of the LED and a black wire to the minus of the LED. (the heat sink can be glued to the LED in a later phase!)
• 2 - slide the wires coming from the led through the holes (seen in picture A and C)
• 3 - Take the DC-to-DC converter and solder the red wire coming from the led to the Vout+ plus and the black wire to the Vout- minus of the LED.
• 4 - slide the red wire from the USB cable through the hole of the switch (see picture B)
• 5 - Take the stripped USB cable and solder the red cable to the switch, solder the black to the Vin- of the DC-to-DC converter.
• 6 - Take an extra cable and solder the red or orange cable to the switch and solder the other end to the the Vin+ of the DC-to-DC converter.





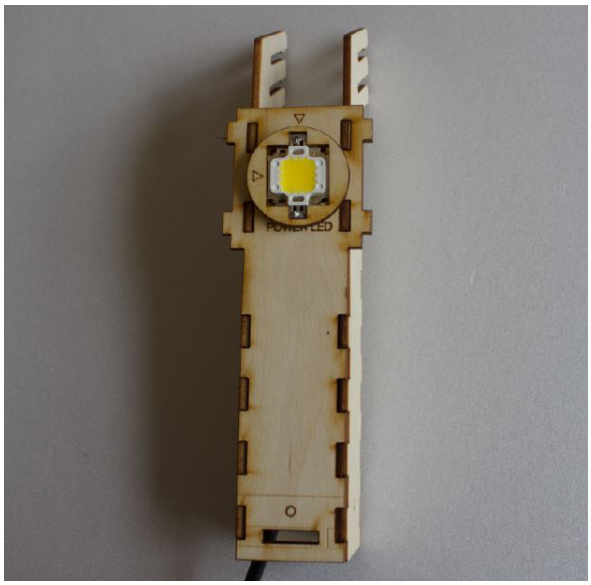




The assembled electronics parts with wires going through the holes.

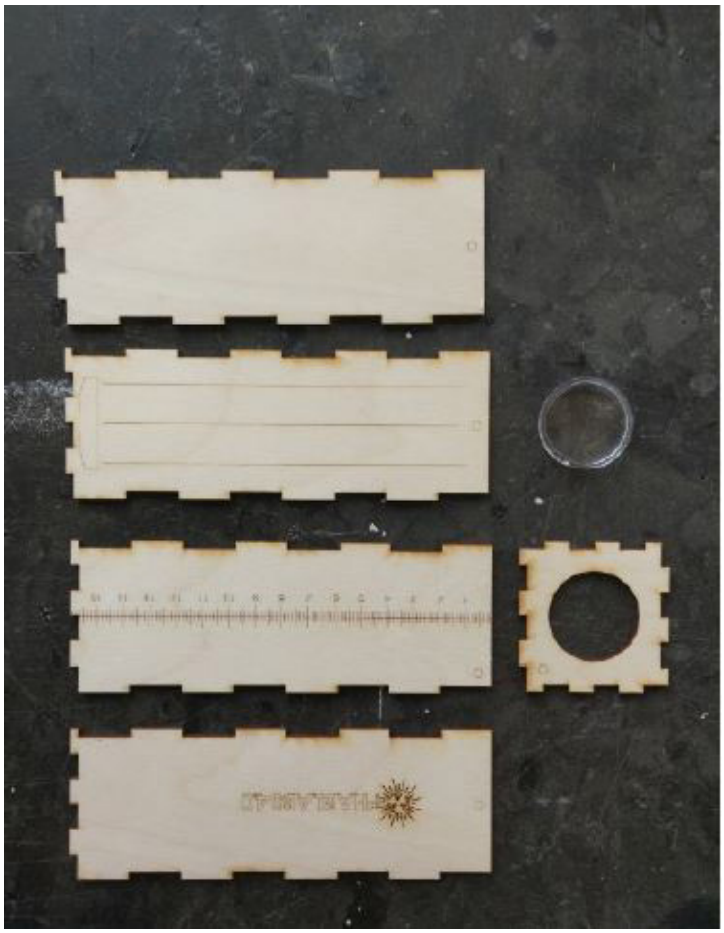
The handle of the art projector

As you have probably seen in the example pictures, the circuit was build with parts from group A indicated with a circle.
• Fix the heatsink in place at the back of the LED.
• Fix the ring fitting the LED on the front indicated by the dotted line circle of the wood with wood glue.
• If you haven't done yet you can fix the sides of the handle (with the “ears”) on the piece with LED gently with a rubber hammer.
Take the power bank for indication to see where the power bank should be situated in between the LED, switch and the DC-DC converter.
• *Optional: fix the DC-DC converter in place with double sided tape or hot glue.*



The sliding part

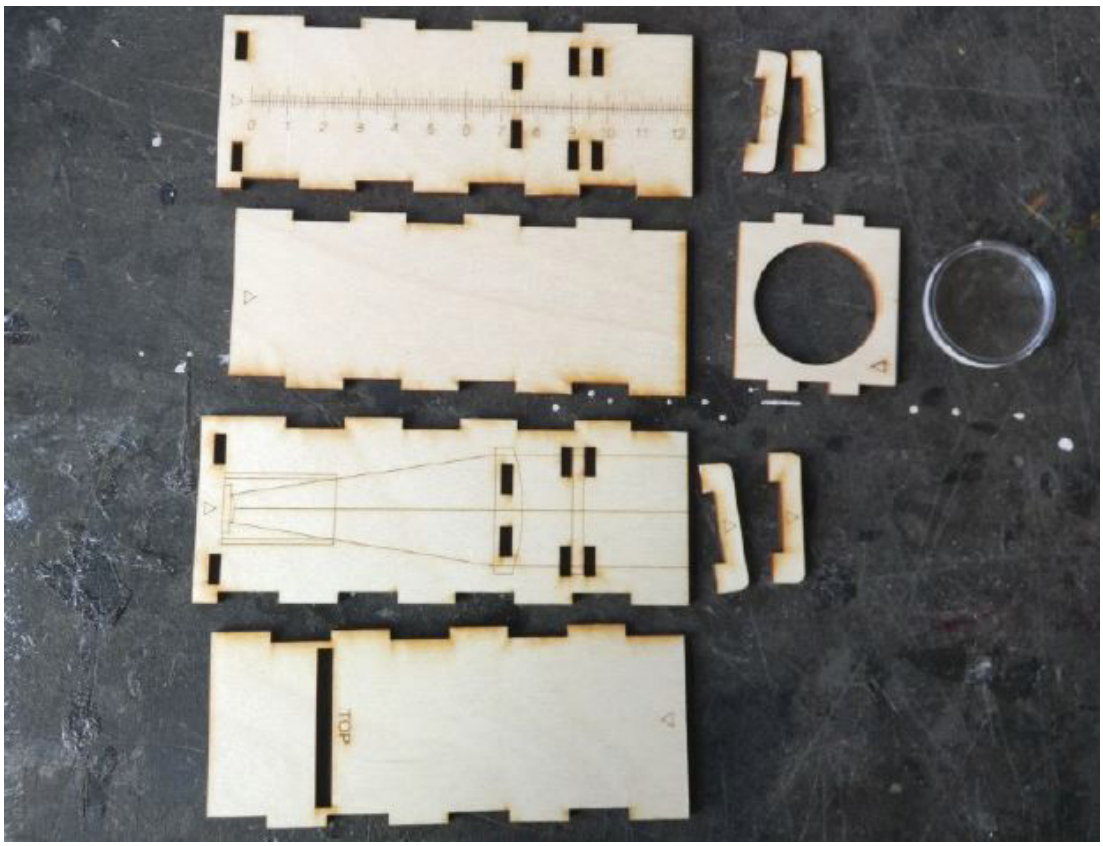
The sliding part of the Gobo projector will be constructed out of the hexagon components. Sort out all the component with the hexagon and put them together, as shown in figure below.



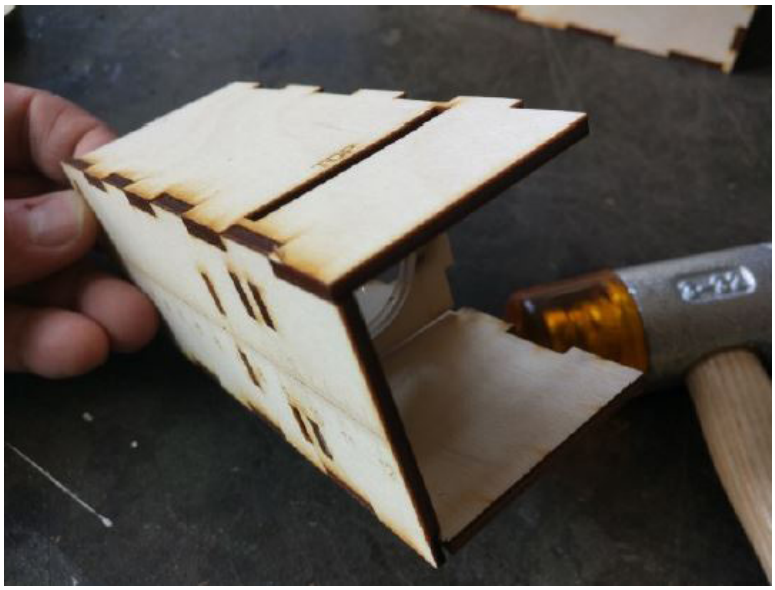
In the figure you can see the four plates, take the part without print as bottom, and the parts showing the centimeters on the side (numbers facing up). The logo should be on the top. The last plate is the other side. Place the plates as shown in he figure below. Place the final plate to make an open box as shown. Place the lens on the top of the “box“ the sliding first part of the Gobo projector.

The image part

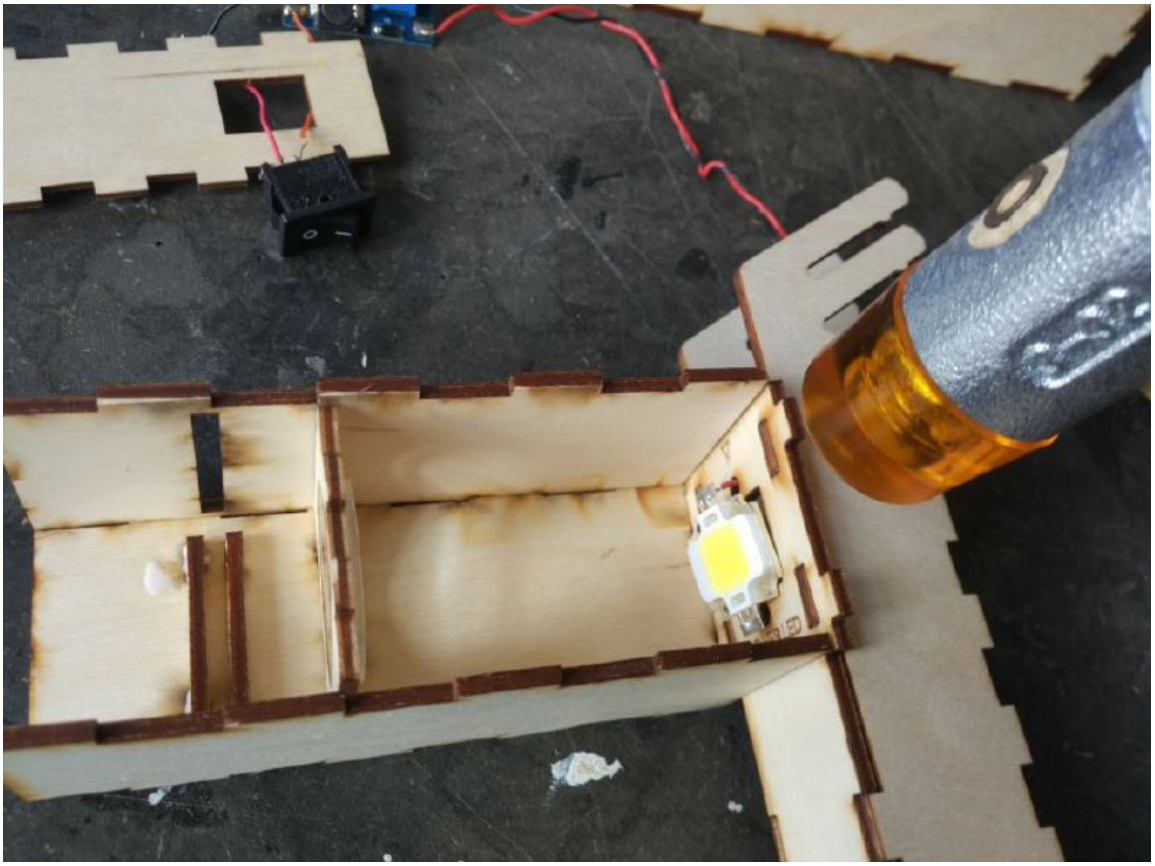
The first part of the Gobo projector is finished, to start with the second part sort out all the components with a triangle engraved on them. The small components on the left top side are going to be used to hold a slide.



Take the two plates with the holes in them and the small components to hold the slide. Place them in the holes and hammer lightly to fit them. If needed use wood glue. Then assemble the top part, the centimeter part and the bottom part.



Take the handle that you have constructed before and place the handle as shown in the figure below. Take the first lens and place it in front of the slide holders with the flat side towards the lens. Take the final plate with and insert it on the only place that is left. Check if your engravings line up nicely with the sliding part and if they are facing up (not upside down).

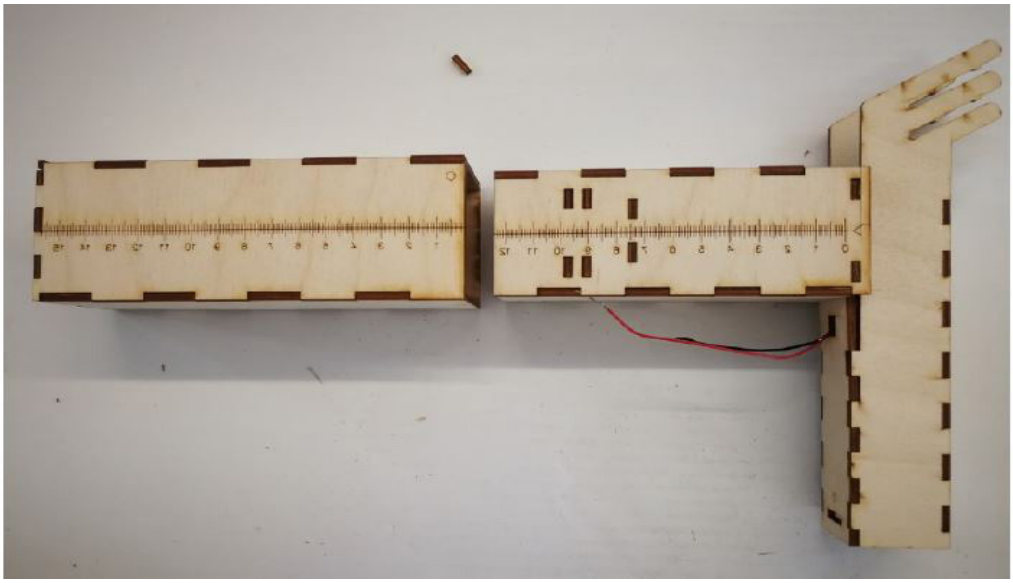


Now you just need to create the image you want to project! Take one of the acrylic slides and draw onto it with a permanent marker. The image projected is in the very centre of the slide, so don't use the whole slide to draw onto.

If you don't have a lasercutter, you can also make these slides with transparant plastic foil where you draw someting on top of it. Make sure the dimensions of the slide fit into the image part.

TIP: You can also cut an acrylic slide with the protective foil on top. By leaving the foil on or using one part as a mask to color the rest, you can make vector graphic slides.

Step 3: End product



Congratulation you have now a final Gobo projector that allow you to use your grand-pa slide or make your own design to project your sign as Batman does!

PHABLABS 4.0

PHABLABS 4.0 is a European project where **two major trends** are combined into one powerful and ambitious innovation pathway for digitization of European industry:
On the one hand the growing awareness of **photonics** as an important innovation driver and a **key enabling technology** towards a better society, and on the other hand the **exploding network of vibrant Fab Labs** where next-generation **practical skills-based learning** using KETs is core but where photonics is currently lacking.

www.PHABLABS.eu

This workshop was set up by the *Department of Imaging Physics at TU Delft* in close collaboration with *Science Centre Delft.*

TU Delft Delft University of Technology

Science Centre Delft

PHOTONICS 21

PHOTONICS PUBLIC PRIVATE PARTNERSHIP

VUB B-PHOT BRUSSELS PHOTONICS

ICFO The Institute of Photonic Sciences

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FAB FACTORY

UNIVERSITY OF Southampton

Technische Hochschule Wildau Technical University of Applied Sciences

FBH Leibniz Ferdinand Braun Institut

CENTER FOR PHYSICAL SCIENCES AND TECHNOLOGY

NUI Galway OÉ Gaillimh

JOANNEUM RESEARCH

CNR IFN Istituto di Fotonica e Nanotecnologie

TU Delft Delft University of Technology

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Eyest vzw

ECOP European Centres for Outreach in Photonics