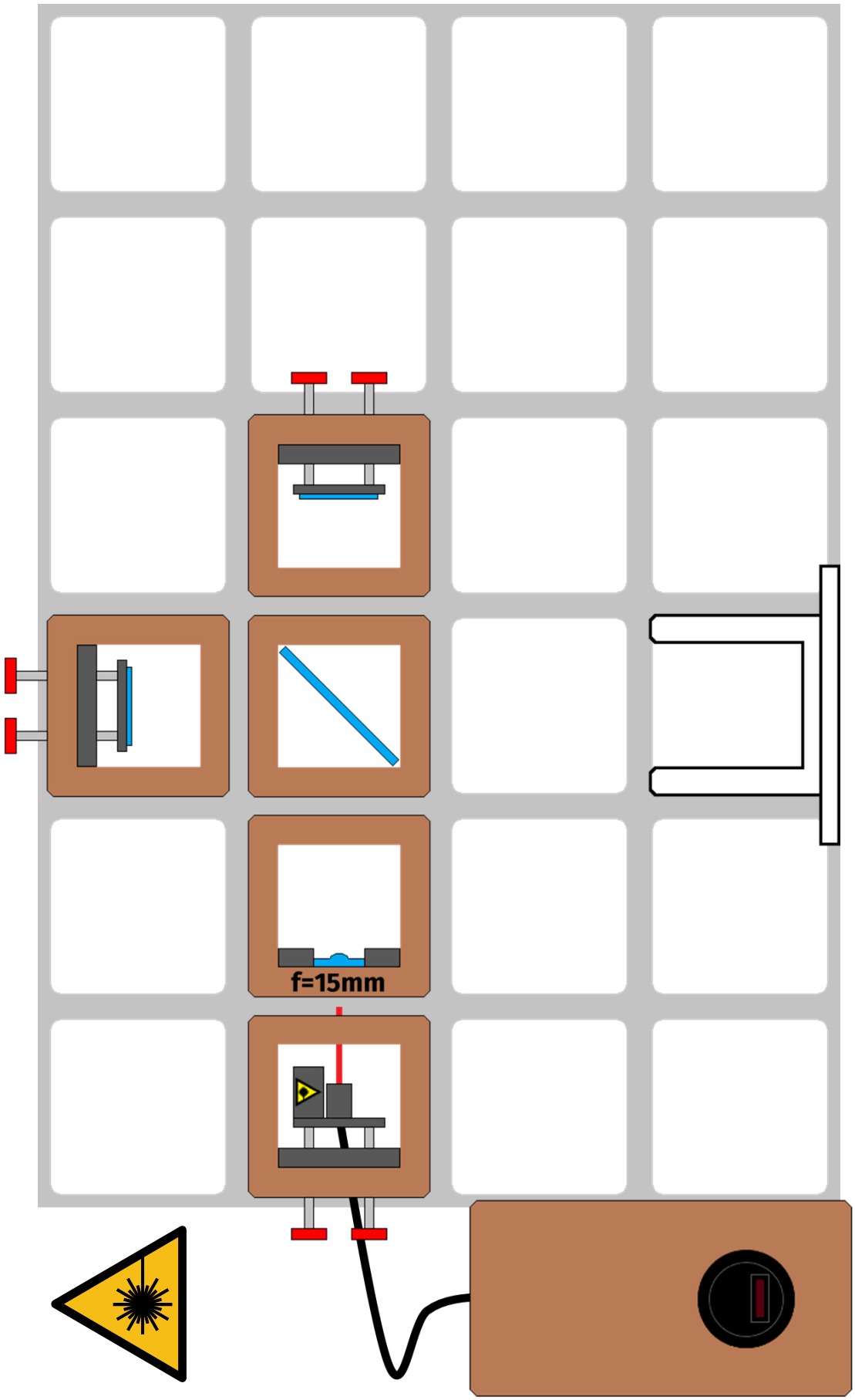
Michelson Interferometer

O3Q.de
FH Münster – Uni Münster

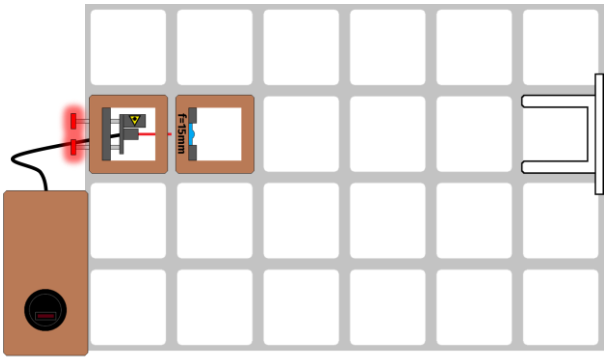


Michelson Interferometer

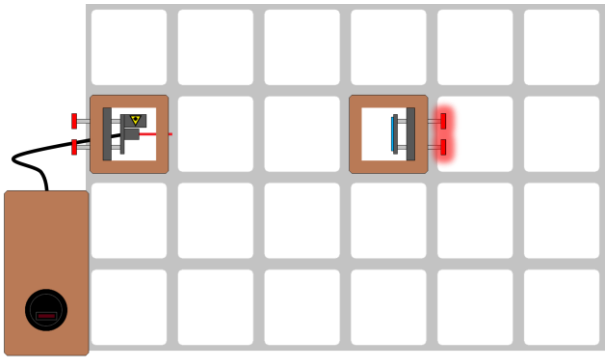
Safety precautions

- Caution: Laser Class II
- The laser may only be used for experiments
- The laser must be switched off prior to repositioning
- The beam path must be controlled bevor switching on the Laser
    - Does the beam leave the setup?
    - NEVER experiment on eye level
- Avoid reflections: No watches, finger rings, bracelets or smartphones near the setup

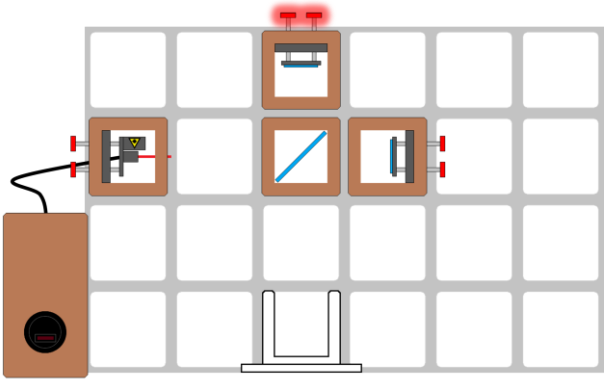
1. Adjust the laser so that the beam hits the lens center. Then remove the lens from the setup.



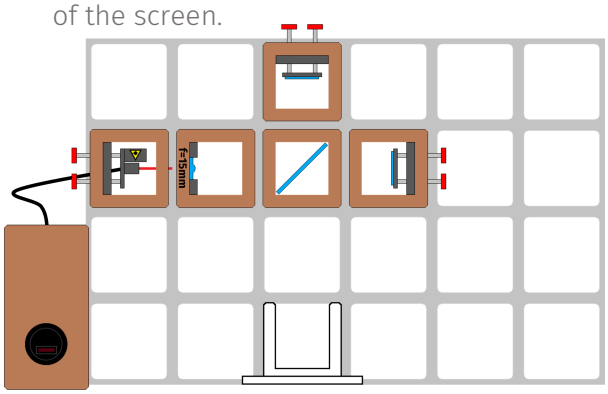
2. Adjust the mirror so that the beam ist reflected directly back into the Laser.



3. Adjust the second mirror so that both parts of the beam overlap on the screen.



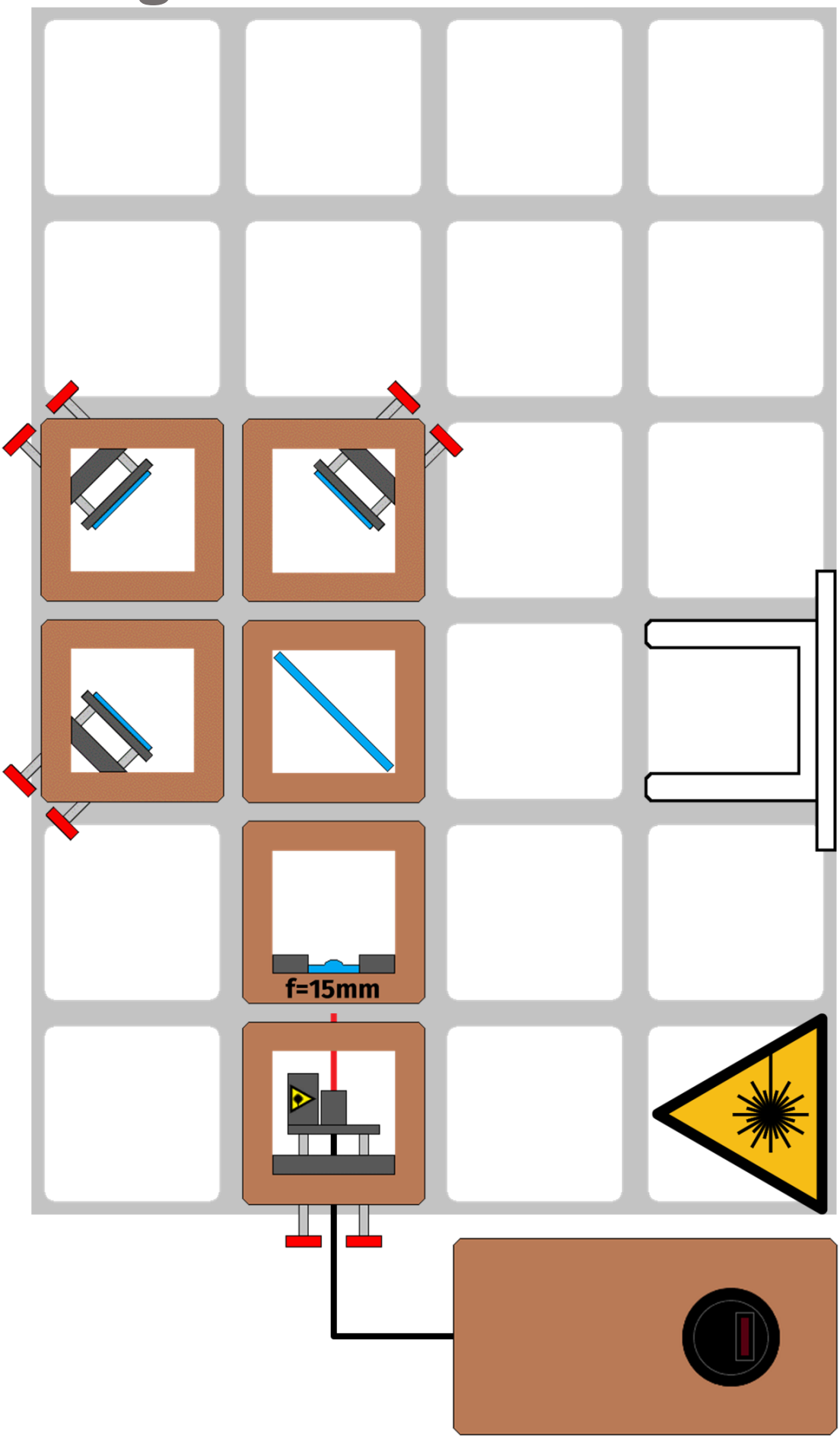
4. Put the lens back in place. If needed, you can carefully adjust the mirrors so that the center of the pattern is in the center of the screen.



If no fringe pattern is visible

- Take you arms and hands of the table to reduce vibration
- Look closely, sometimes the pattern is only visible on second look.
- Check if all components are correctly positioned and turned.
- Remove the lens and check if both beams overlap. Positioning the screen further away makes checking easier.

Sagnac Interferometer

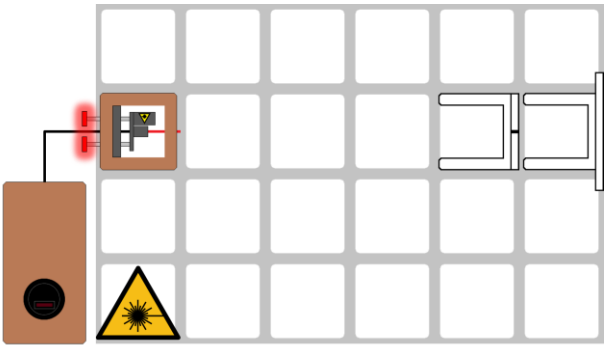


Sagnac Interferometer

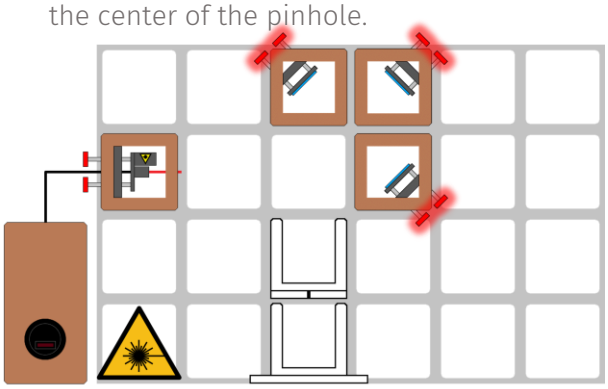
Safety precautions

- Caution: Laser Class II
- The laser may only be used for experiments
- The laser must be switched off prior to repositioning
- The beam path must be controlled bevor switching on the Laser
    - Does the beam leave the setup?
    - NEVER experiment on eye level
- Avoid reflections: No watches, finger rings, bracelets or smartphones near the setup

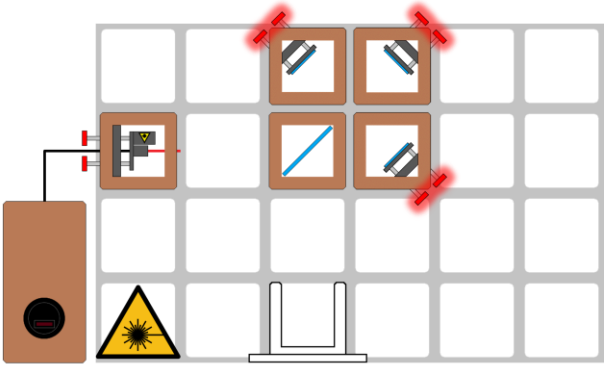
1. Adjust the Laser so that the beam hits the center of the pinhole.



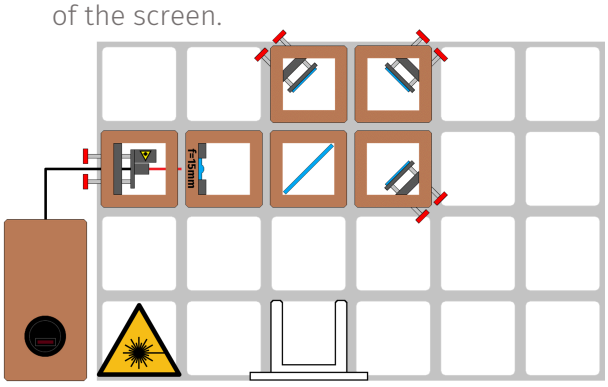
2. Add three 45°-mirrors to the setup and adjust the mirrors so that the beam hits the center of the pinhole.



3. Add a beamsplitter and adjust the mirrors so that both parts of the beam overlap on the screen.



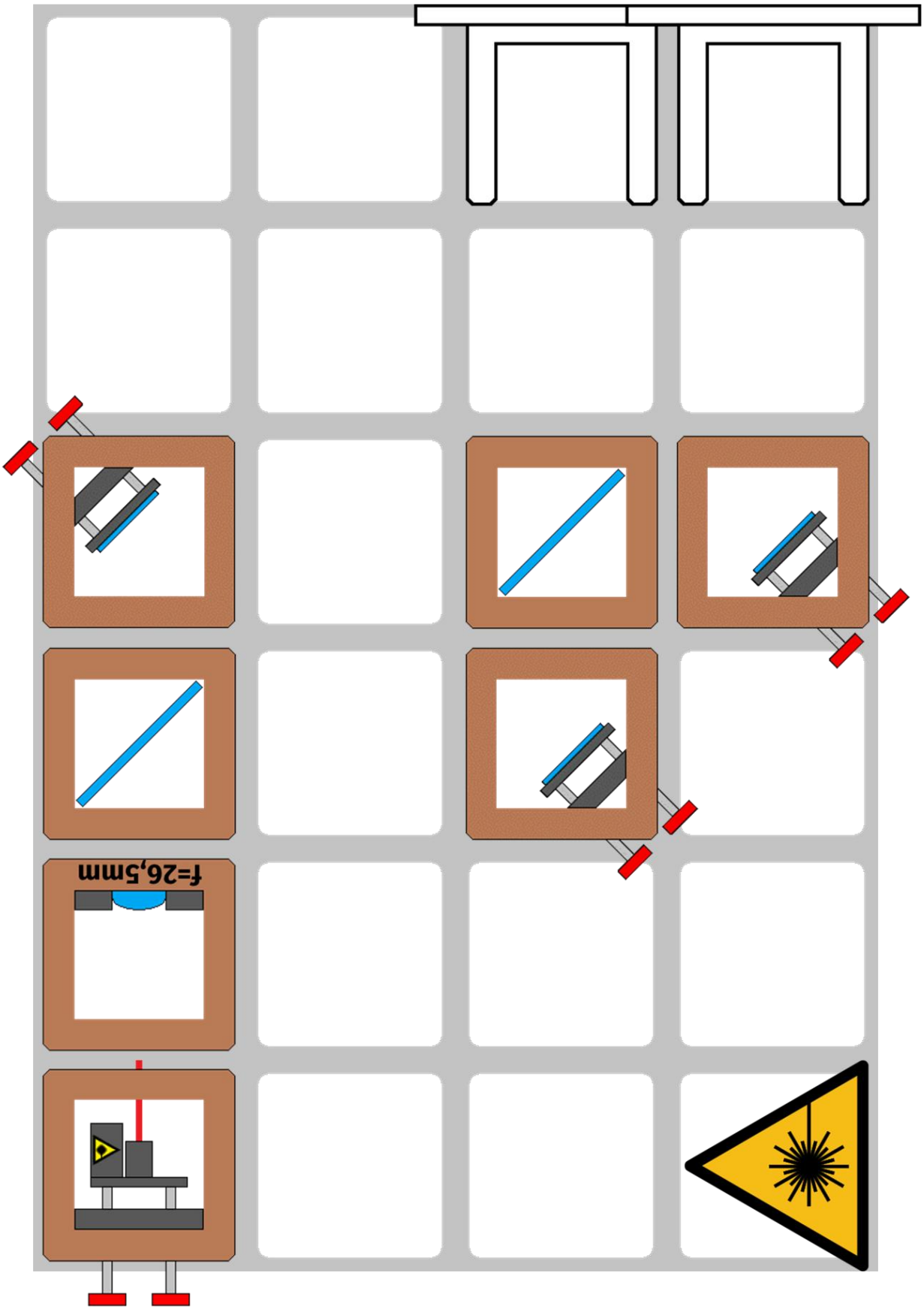
4. Put the lens back in place. If needed, you can carefully adjust the mirrors so that the center of the pattern is in the center of the screen.



If no fringe pattern is visible

- Take you arms and hands of the table to reduce vibration
- Look closely, sometimes the pattern is only visible on second look.
- Check if all components are correctly positioned and turned.
- Remove the lens and check if both beams overlap. Positioning the screen further away makes checking easier.

Mach-Zehnder Interferometer



Mach-Zehnder Interferometer

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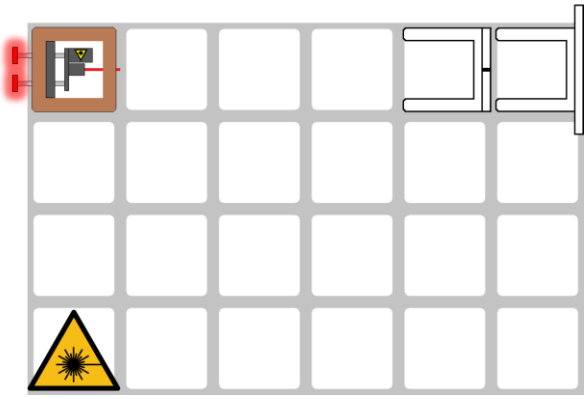
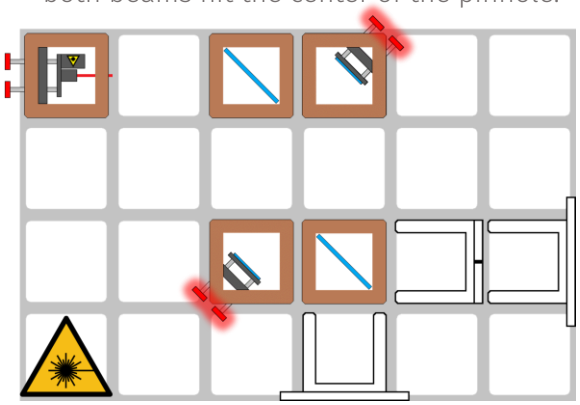
Safety precautions

- Caution: Laser Class II
- The laser must be switched off prior to repositioning
- The beam path must be controlled bevor switching on the Laser
- Avoid reflections: No watches, finger rings, bracelets or smartphones near the setup

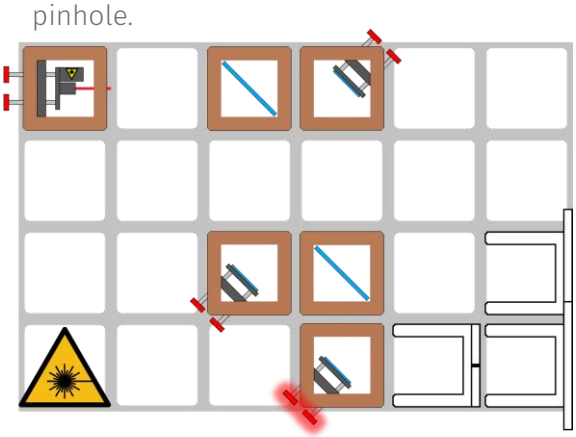
1. Adjust the Laser so that the beam hits the center of the pinhole.



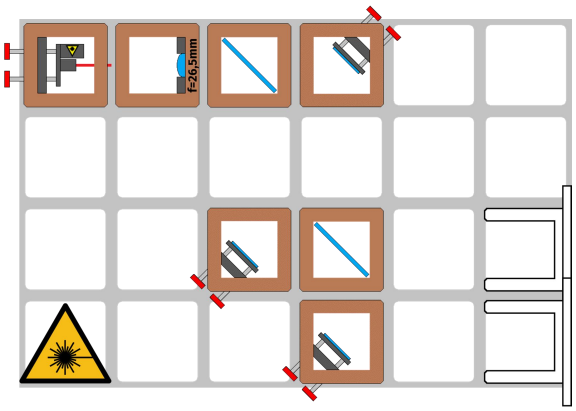
2. Add two 45°-mirrors and two beamsplitters to the setup and adjust the mirrors so that both beams hit the center of the pinhole.



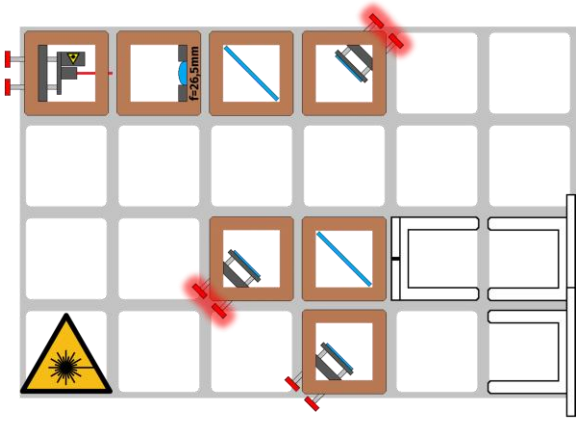
3. Add another 45°-mirror and adjust it so that the beams hit the center of the pinhole.



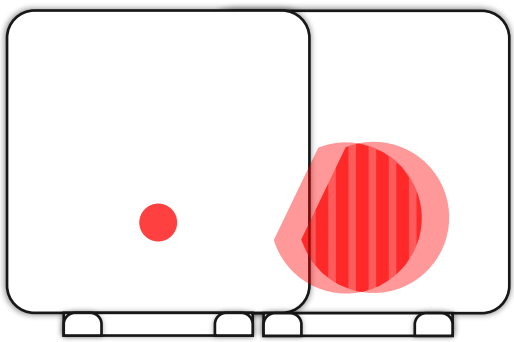
4. Position a lens (f=26,5mm) behind the Laser A fringe pattern might already be visible.



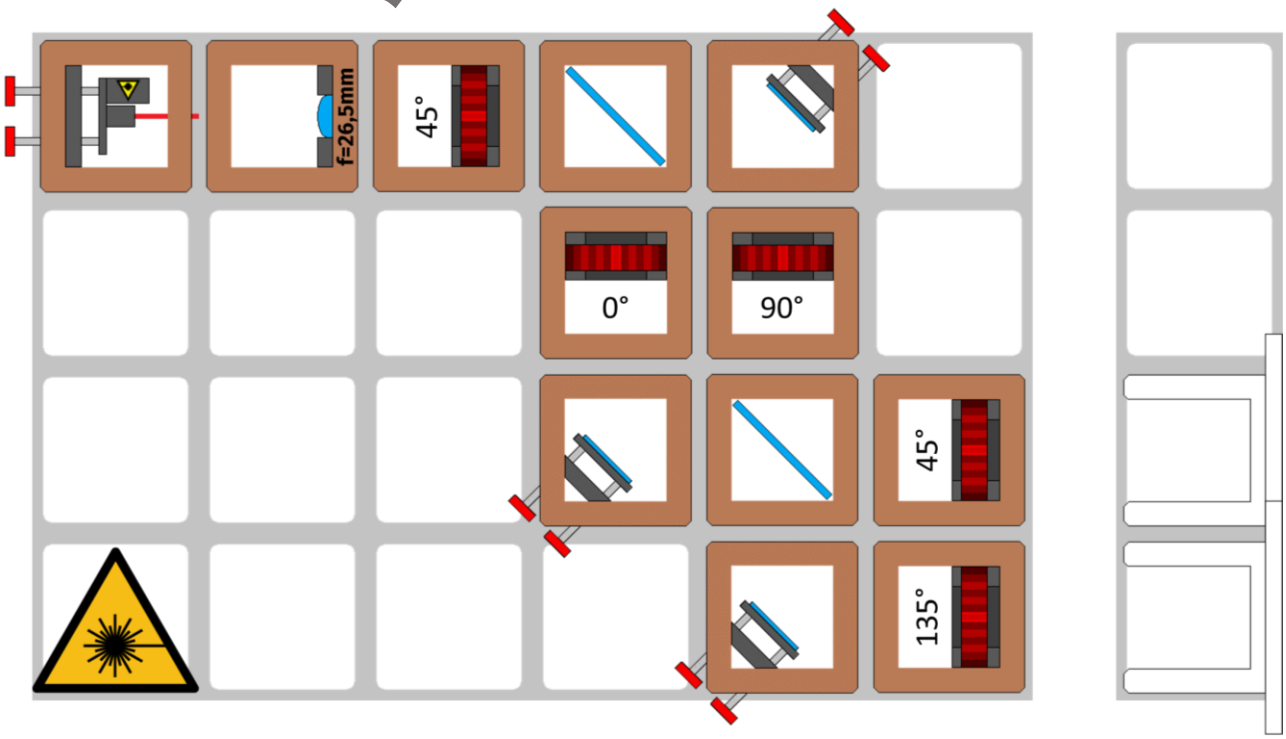
5. Position the pinhole in one of the outputs of the interferometer. Position the screen behind the pinhole further away (~1m) for easier adustment.



6. Adjust the mirrors so that both parts of the beam hit the screen behind the pinhole exactly on top of each other. Take out the pinhole if fringe pattern is visible



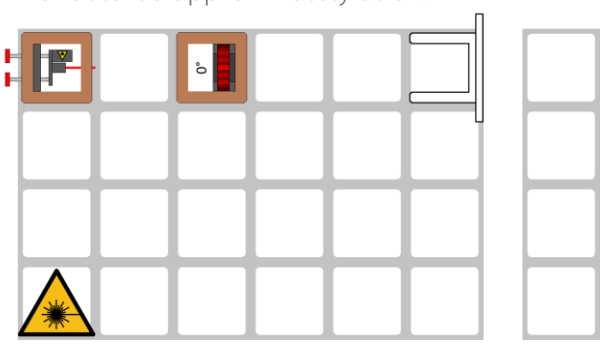
Quantum Eraser



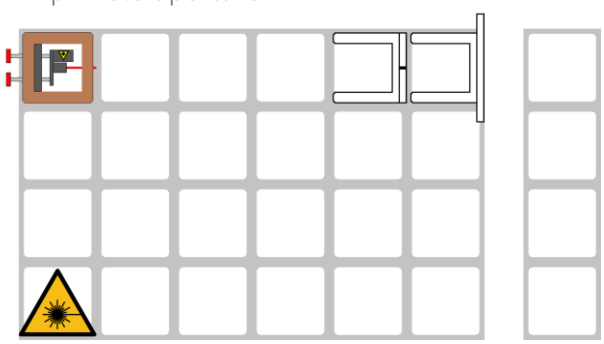
Safety precautions

- Caution: Laser Class II
- The laser must be switched off prior to repositioning
- The beam path must be controlled bevor switching on the Laser
- Avoid reflections: No watches, finger rings, bracelets or smartphones near the setup

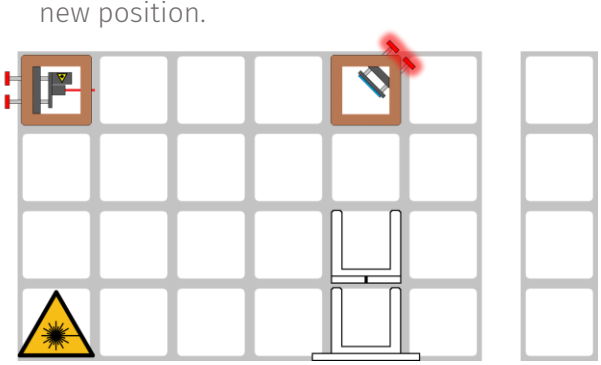
1. Check the polarization of the laser diode. It should be approximately at 0°.



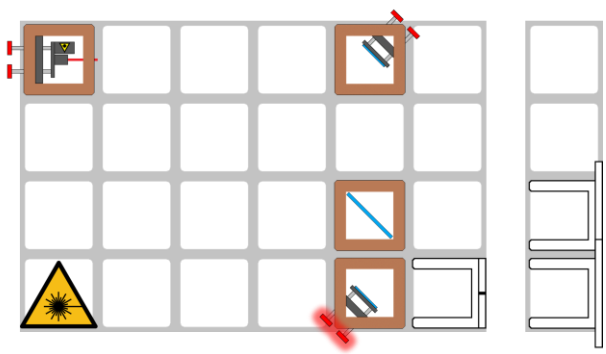
2. Align the laser so that it hits the hole of the pinhole aperture.



3. Add a 45° mirror and adjust it so that the laser beam hits the pinhole aperture at its new position.

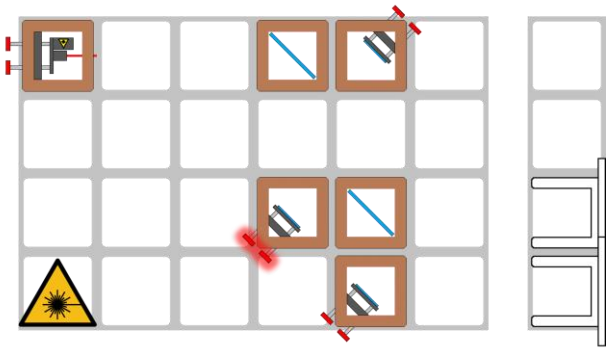


4. Add a beam splitter and another mirror and align it as before.

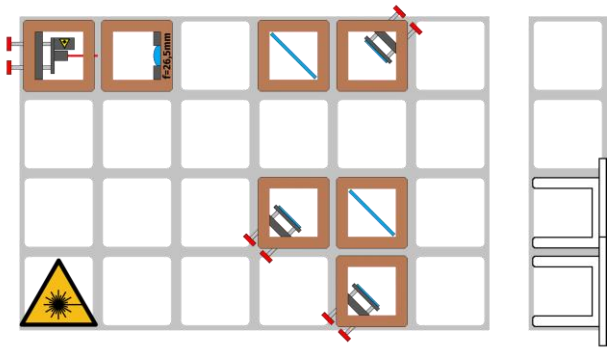


Quantum Eraser

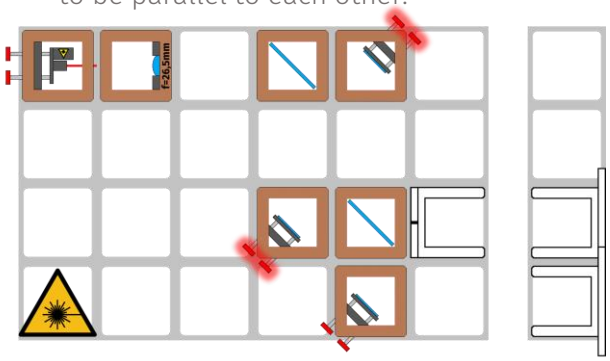
5. Add a second beam splitter and another mirror, and adjust the mirror so that both beams overlap on the screen.



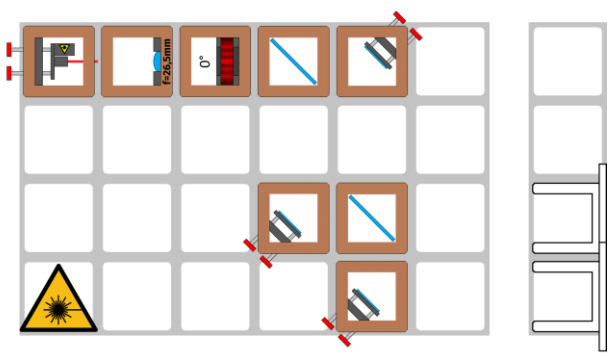
6. Place a lens (f = 26.5 mm) in the beam path. Fringe patterns may already be visible.



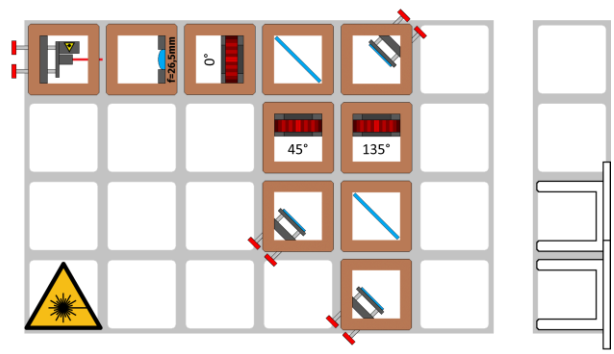
7. If no fringe pattern is visible, a pinhole aperture can help align both partial beams to be parallel to each other.



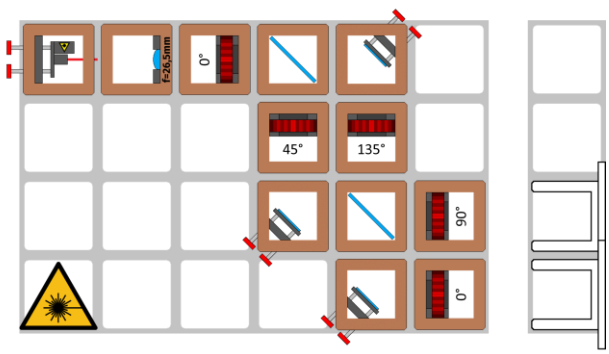
8. Add a first polarizing filter and check whether the fringe pattern is still visible.



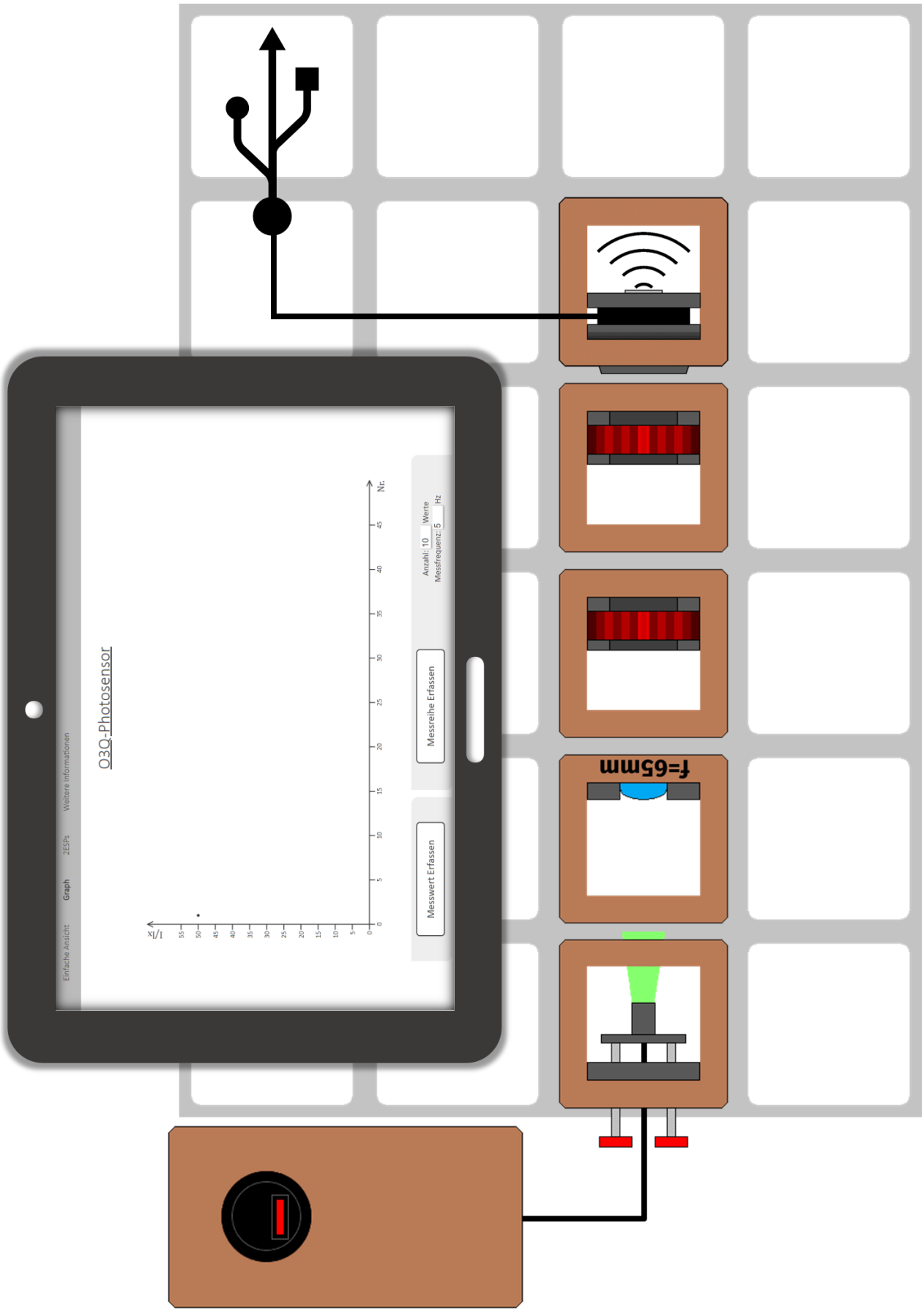
9. Add a second and third polarizing filter in the partial beam paths. Test different polarization settings.
Note: In the depicted setup, no fringe pattern can be observed.



10. Add additional polarizing filters before both outputs. Test different polarization settings. In the depicted setup, fringe patterns should be observable again.

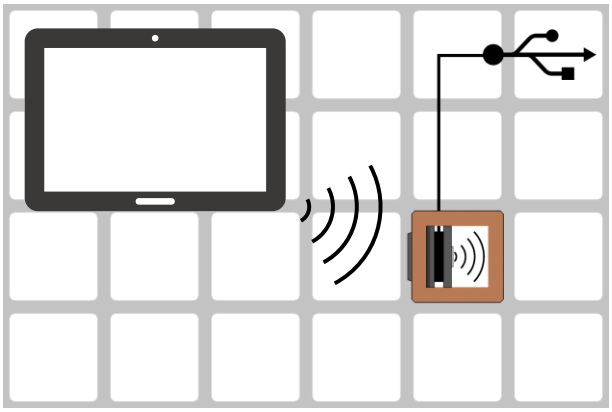


Malus's law


f=65mm
O3Q-Photosensor
Einfache Ansicht
Graph
2ESPs
Weitere informationen
Messwert Erfassen
Messreihe Erfassen
Anzahl: 10 Werte
Messfrequenz: 5 Hz
Nr:
1/x

Malus's law

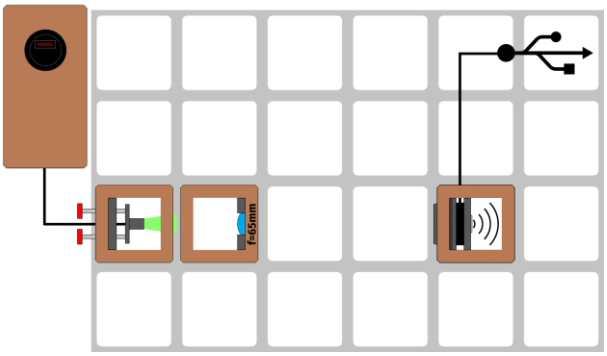
1. Connect the light sensor to a power source via USB and connect to the Wi-Fi network indicated on the sensor. *On smartphones, mobile data may need to be disabled.*



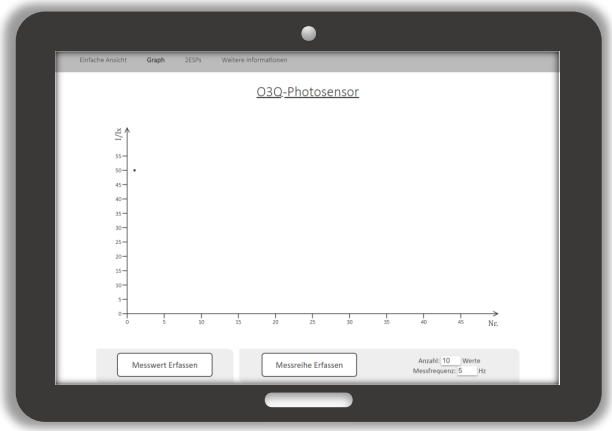
2. Access the local website http://o3q.local/ (e.g. by scanning the QR code).

http://o3q.local/

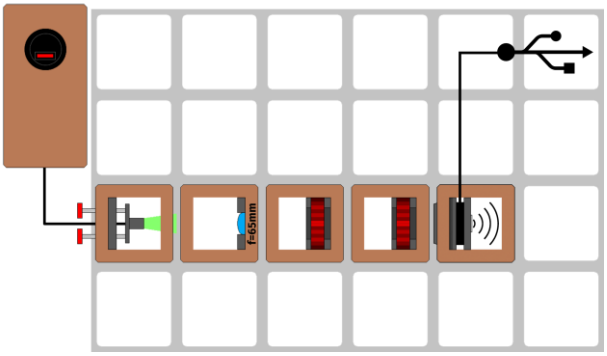
3. Adjust the LED so that the light cone hits the light sensor approximately in the center.



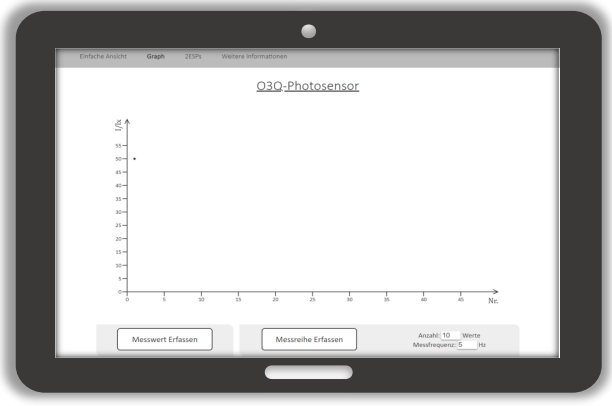
4. Confirm that the indicated light level varies when the LED is switched on and off.



5. Insert two polarizing filters between the LED and the sensor and set both to 0°.



6. Vary the angle of one of the polarizing filters and record data to illustrate Malus' law.



User interface hints

- Under 'Display Options', you can change the axis labels, e.g., to 'a/°.
- You can also adjust the x-axis spacing to match the angles at which you are measuring.
- Under 'Download Measurements', you can download your measurement series in.csv format.