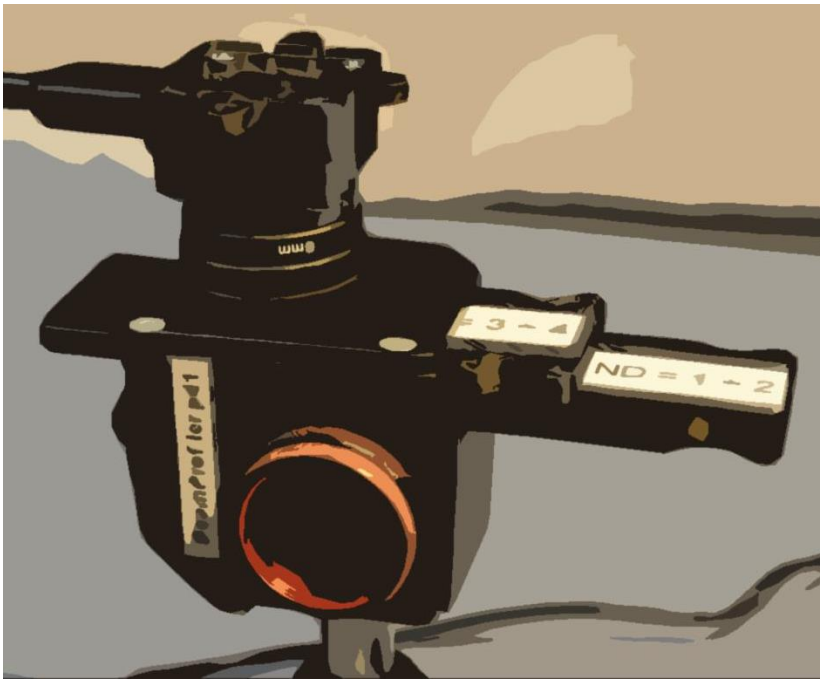
BeamProfiler pd1©

Manual



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SETUP of the BeamProfiler pd1©

The BeamProfiler pd1© allows to measure laser beams with diameters up to 4 mm. It is controlled by a Raspberry Pi, a small single-board computer with an adapted 7” touch display (Fig. 1). With the help of a self developed software it is possible to visualize and measure the $1/e^2$ diameter (width and height) of laser beams.

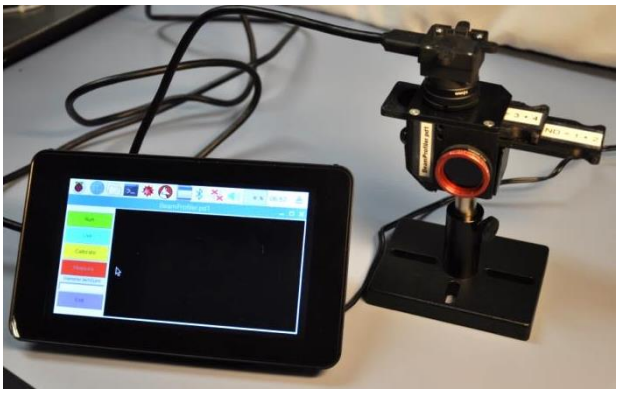

Fig. 1: BeamProfiler pd1© connected to a small single-board computer Raspberry Pi

The beam splitter is designed so that the preferential polarization selection effect of a single wedge is cancelled out and the resulting beam image is polarization corrected to restore the polarization components of the original beam. The beam splitter operates by reflecting the incoming beam from the front surface of a pair of wedge prisms through 90 degrees into the camera (Fig. 2). Approximately 99 % of the beam is transmitted through the beam splitter with 0,01 % passed on to the camera. A set of adjustable ND filters (ND = 1, 2, 3, 4) performed as slides are provided to make final intensity adjustments to the beam before it reaches the camera sensor.

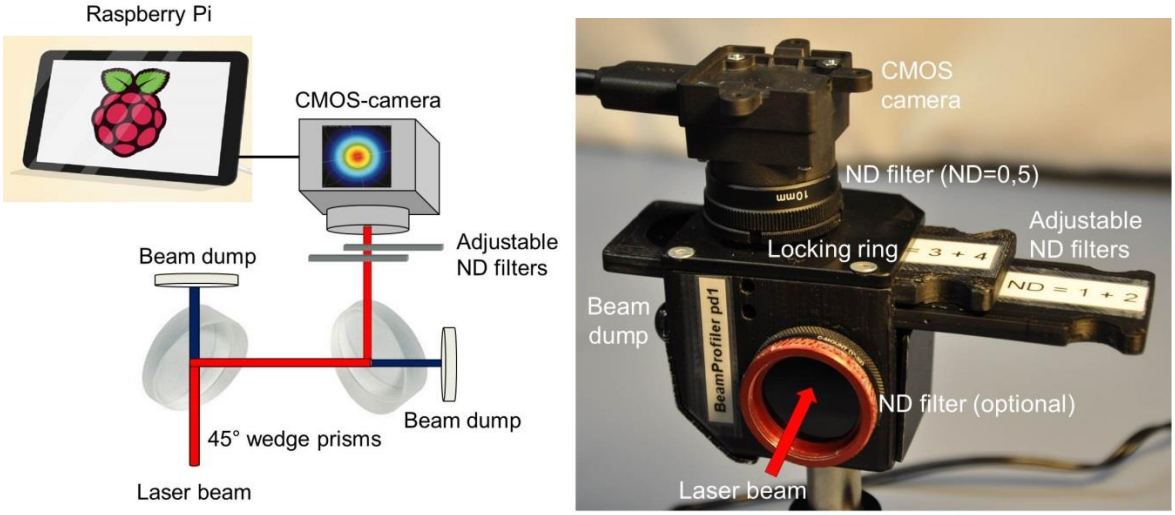

Fig. 2: Setup of the beam splitter

OPERATION of the BeamProfiler pd1©

1. Avoiding a damage of the camera sensor

- The sensor of the BeamProfiler pd1© is very sensitive and the danger of a damage is very high. That's why the measurements should do very carefully especially when the laser has to be measured in the focus of a lens.
- To avoid a damage of the sensor the laser has to attenuate to a suitable range. The main part of the beam power is transmitting the pair of wedge prisms and is so absorbed by two beam dumps. Furthermore one ND filter with ND = 0,5 is permanent attached in front of the camera entrance. For very low signal it can be removed. The other ND filters with ND = 1, 2, 3, 4 can be used as slides optional in front of the camera.

2. Adjustment of the BeamProfiler pd1©

- If you want to measure the laser beam profile at a special position (i.e. in the focus), you have to consider the distance between the entrance of the beam splitter until the sensor of the camera. The distance from the entrance of the beam splitter until the sensor is about 88 mm. So you have to put the BeamProfiler pd1© 88 mm before the position where you want to measure the beam profile.
- It is recommended to adjust the laser through the beam splitter primarily without camera to find the weak signal behind the wedges. For that hold on the locking ring and turn off the camera together with the locking ring carefully from the beam splitter. Put a white card or a diffusion disk onto the exit of the beam splitter instead of the camera and adjust the beam splitter (with attention to the laser safety!) until you see the laser beam in the center of the beam splitter exit.

3. Operating the BeamProfiler pd1©with the Raspberry Pi

- Connect the camera with the single-board computer Raspberry Pi by a Micro USB cable.
- The Raspberry Pi has no power switch. That's why you have to connect the power cable and the Raspberry Pi will start up.
- Start the shell "BeamProfiler.sh" in the top left of the desktop and press **Ausführen** to start the software.

4. Measurement of a laser beam profile

- **RUN:** For visualization of the laser beam press the **RUN** button (Fig. 3). Adjust the laser with lowest power and start with maximum attenuation by ND filters to avoid a damage of the camera sensor. With the ND filter slides make final intensity adjustments to the beam for a good signal modulation and dynamic range.
- **LIVE & MEASURE:** For preliminary measurements press the **LIVE** button. The software will measure the beam profile in a live mode. Only one image will be used to calculate the beam profile. In the software output you will get the $1/e^2$- width and the height of the laser beam. At the position of the $1/e^2$ decrease of the laser intensity there will be signed a circle or an ellipse in the laser beam profile.
- **CALIBRATE:** For precise measurements previously a background correction is necessary. For that reason switch off or block the laser and press the **CALIBRATE** button. The software asks for the desired number of measurements. These number of background images are accumulated to correct the following precise measurements.
- **MEASURE:** For precise measurements press the **MEASURE** button. The software accumulates the desired number of images. After finishing there will be an output with the calculated $1/e^2$ diameter (stated in width and height) of the laser beam. There is also the possibility to **save** the image with the beam profile. The images are saved in "/home/pi/.BeamProfiler/images/image_'date+time'" on the Raspberry Pi. You should know the Raspberry Pi has not a battery buffered clock. That's why date and time are not correct in the filename. To copy the images on your USB stick you find the USB device under the following directory: "/media/pi/88F1-2BCF"
- **EXIT:** For finishing the BeamProfiler software press the **EXIT** button. To shut down the Raspberry Pi press **Shutdown** under the raspberry drop down menu at the top left.

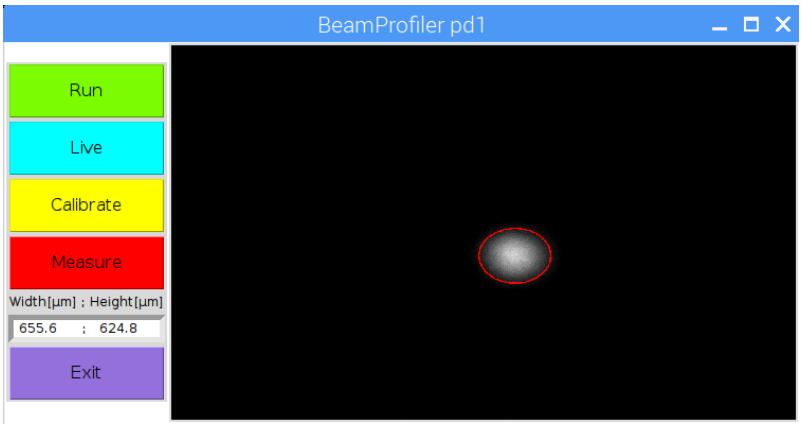

Fig. 3: Software of the BeamProfiler pd1