



Flex-attach alignment tool

Alignment issues at gluing step

- Columns are used to fix the position of the flex onto the gluing jig.
- Suction is applied through a pump to immobilise the flex
- Columns are removed to proceed gluing.
Flex can be lifted up and **gets displaced**.

Consequences are important at the **wire-bonding procedure**.

The bonding machine's algorithm must be adapted to **compensate for the displacement**.

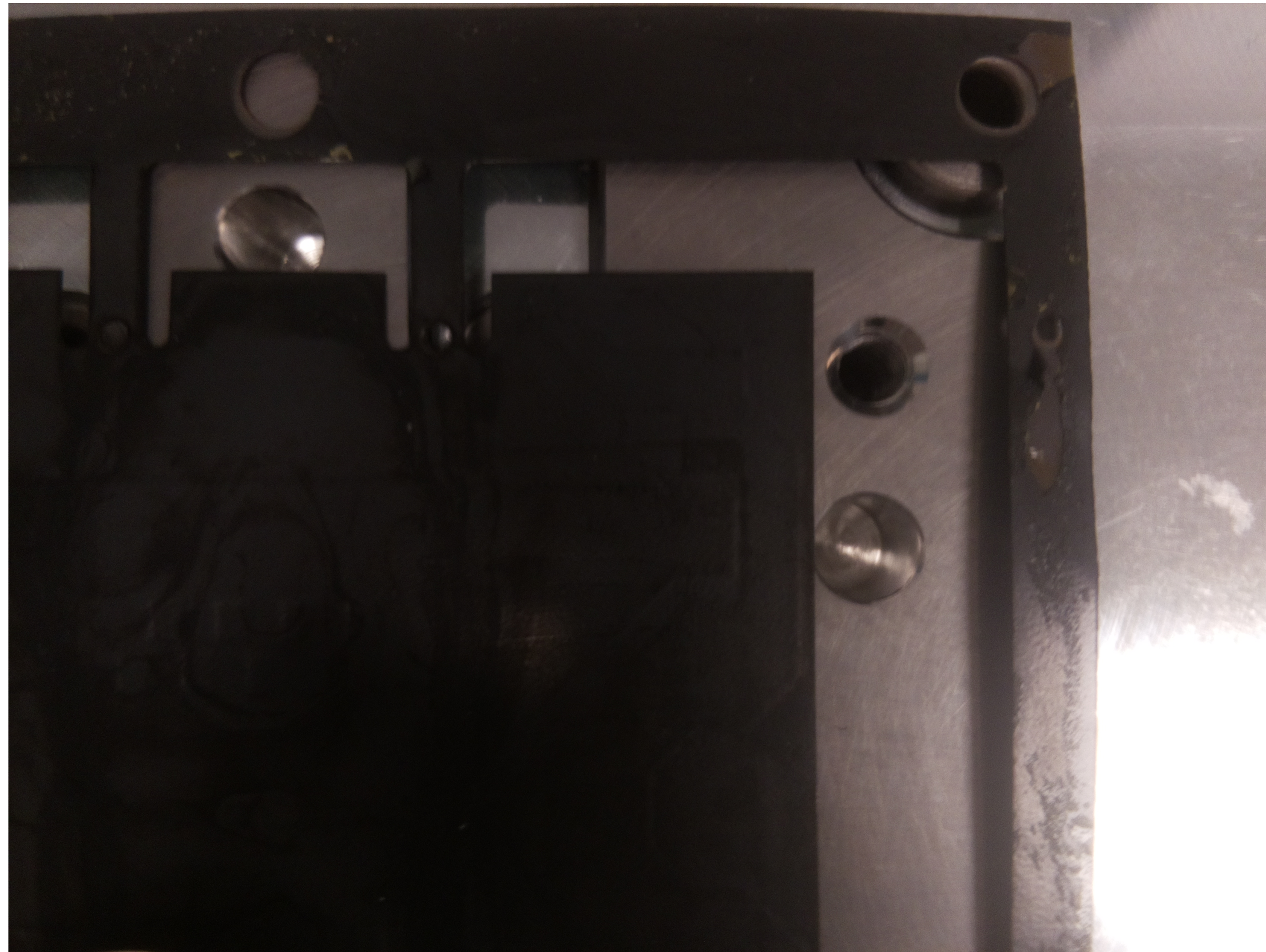
Visual inspection software to check the alignment

- Raspberry-pi 4 setup with camera at the gluing workstation.
- **Camera support** that embeds directly into the **gluing jig**.
Easy for user + fixed camera POV
- Python script shows user image with the detected points of interest (for validation) and **calculated angle displacement**.
- **If the displacement is too important :**
Stop suction
Reposition the flex ...

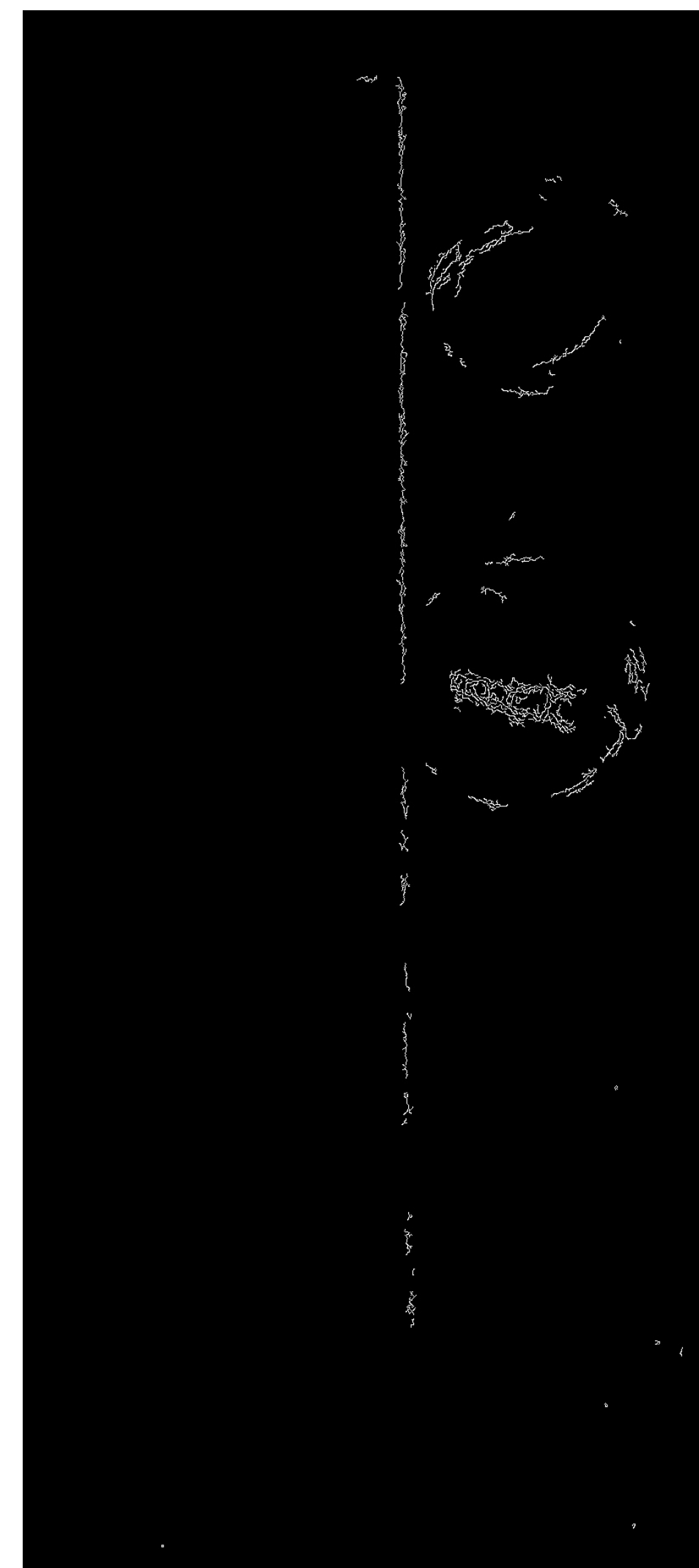
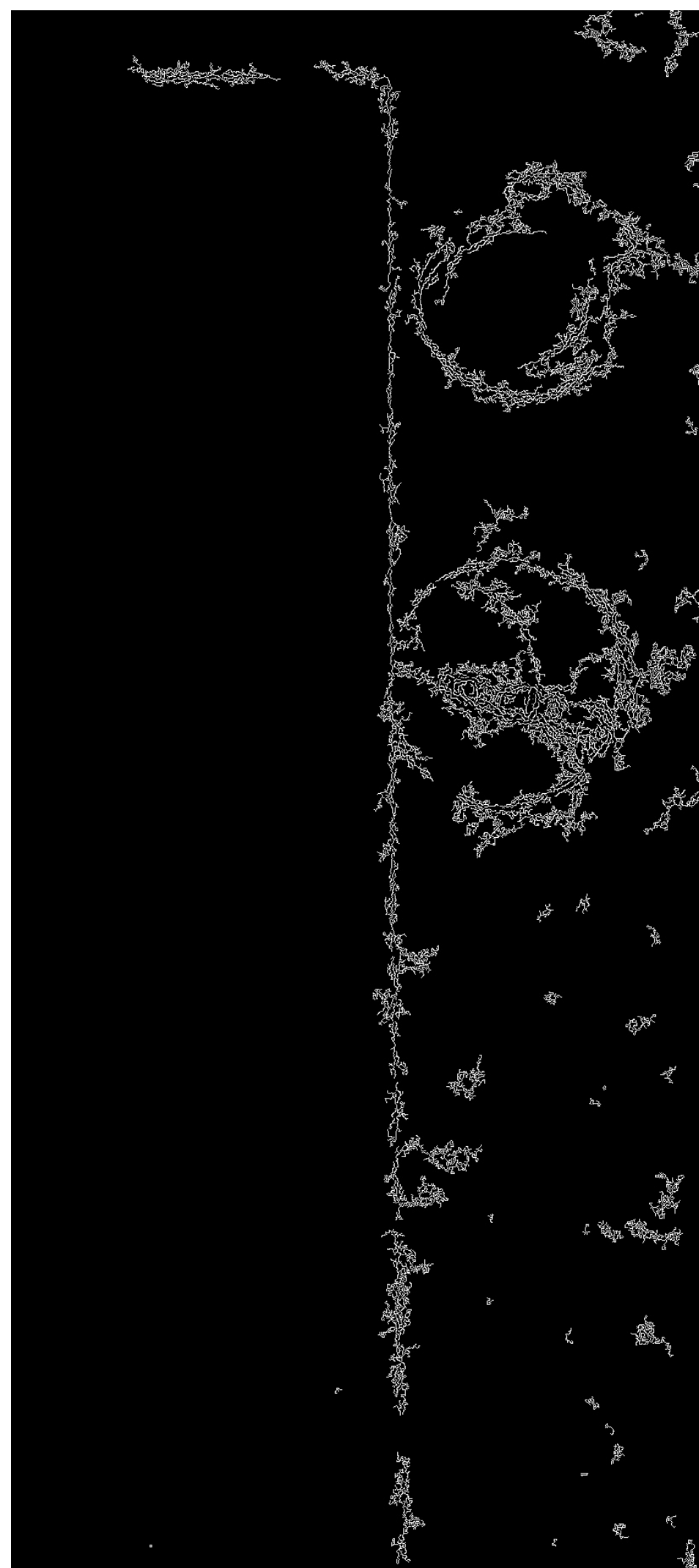
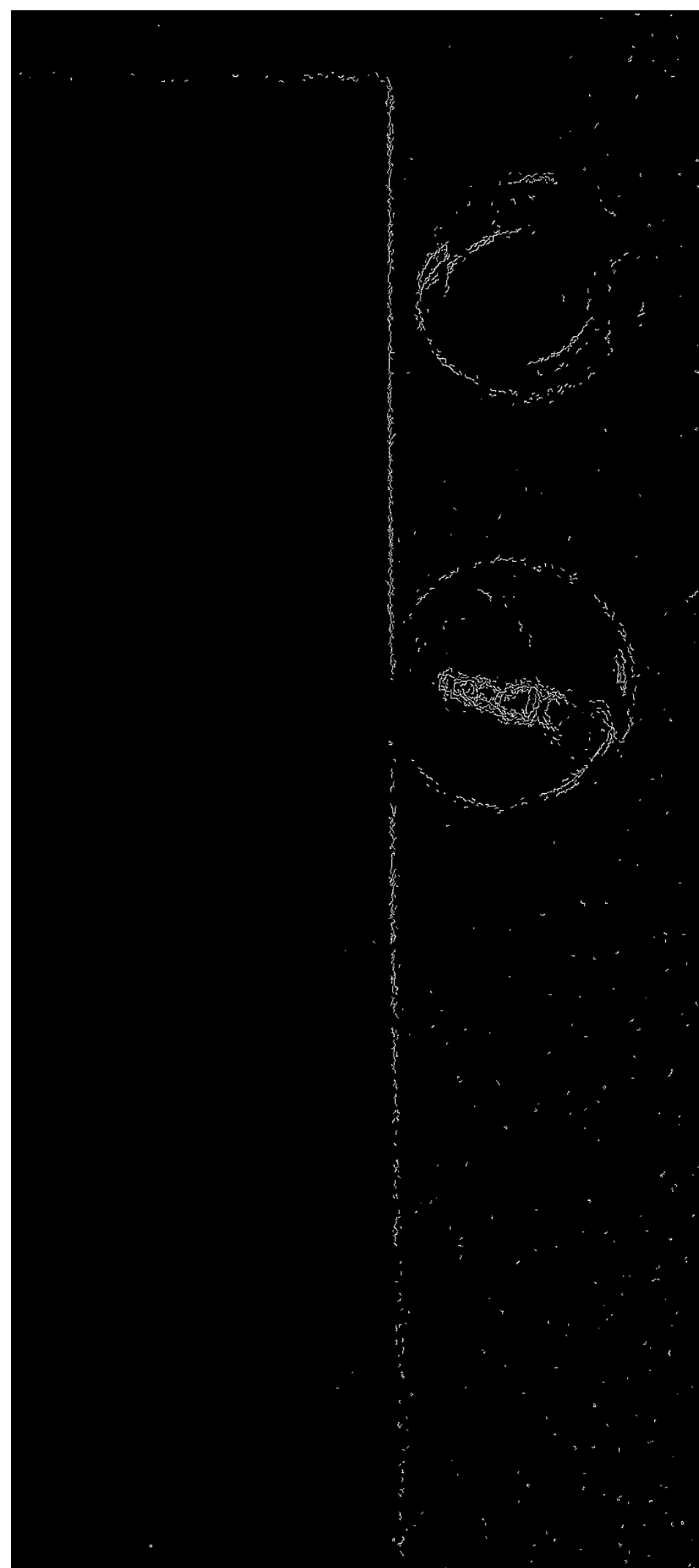
Script's main steps

- Takes a picture
- Builds window around pre-defined ROI
- Uses Canny edge detection algorithm (commonly used in digital image processing)
- Uses a line detection algorithm
- Uses a circle detection algorithm
- Selects the « best » lines and circles using predefined criteria
- Calculates angle between flex's border and points of interest on the jig

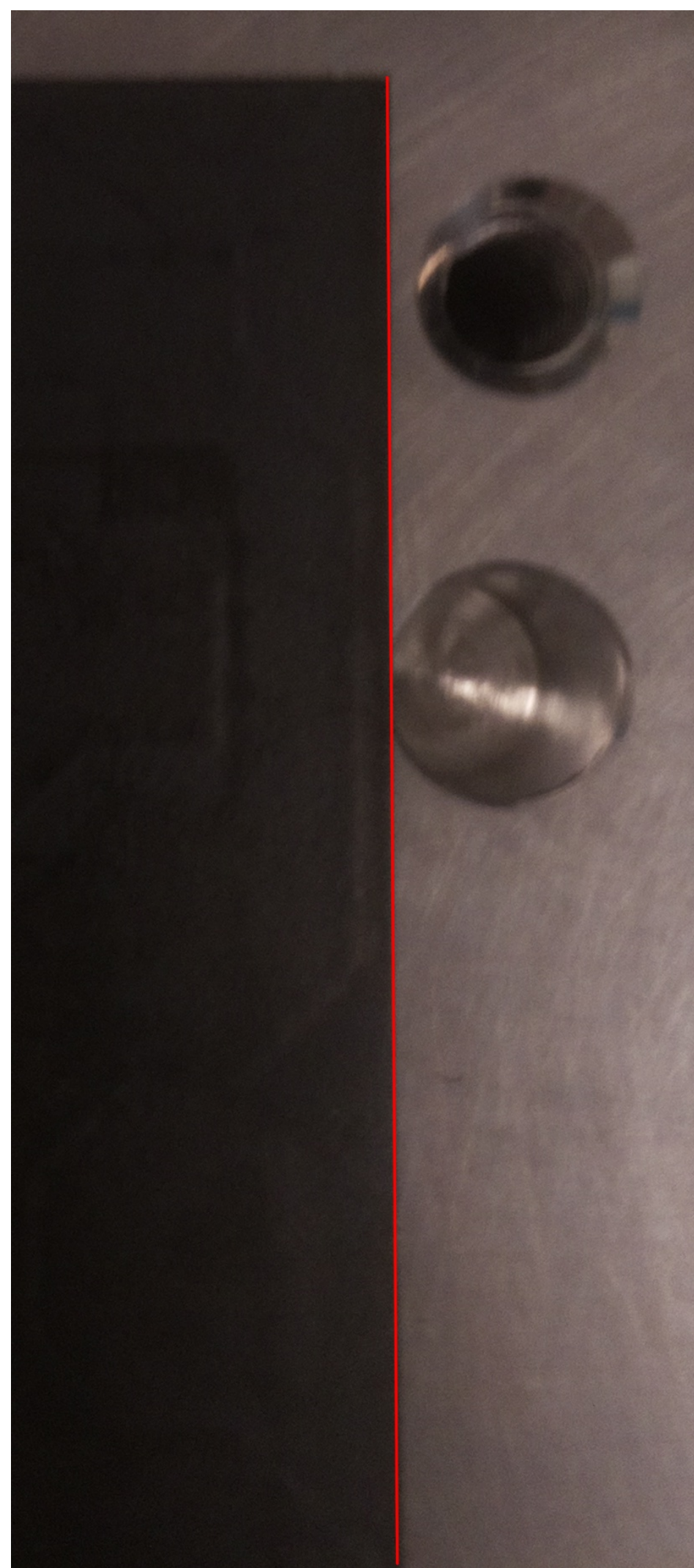
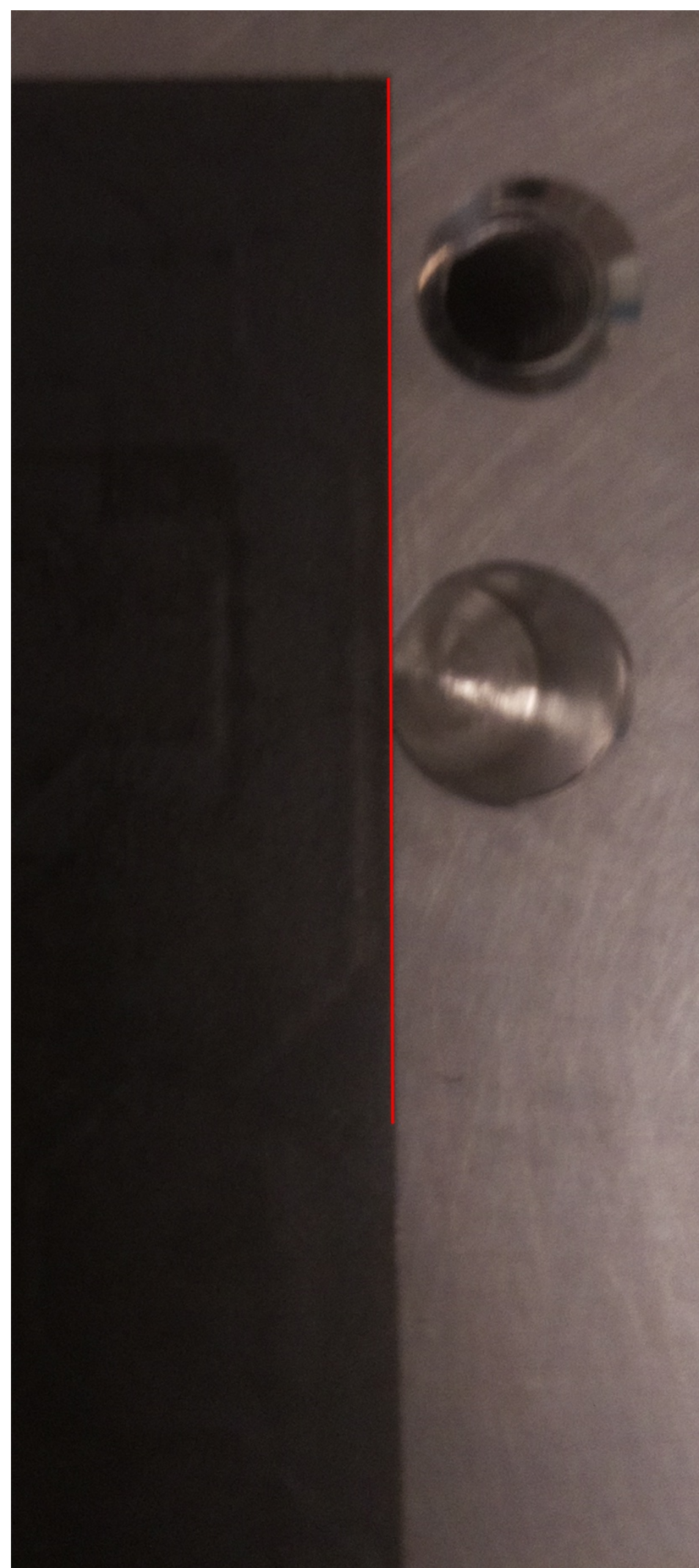
Picture example (taken by hand ...)



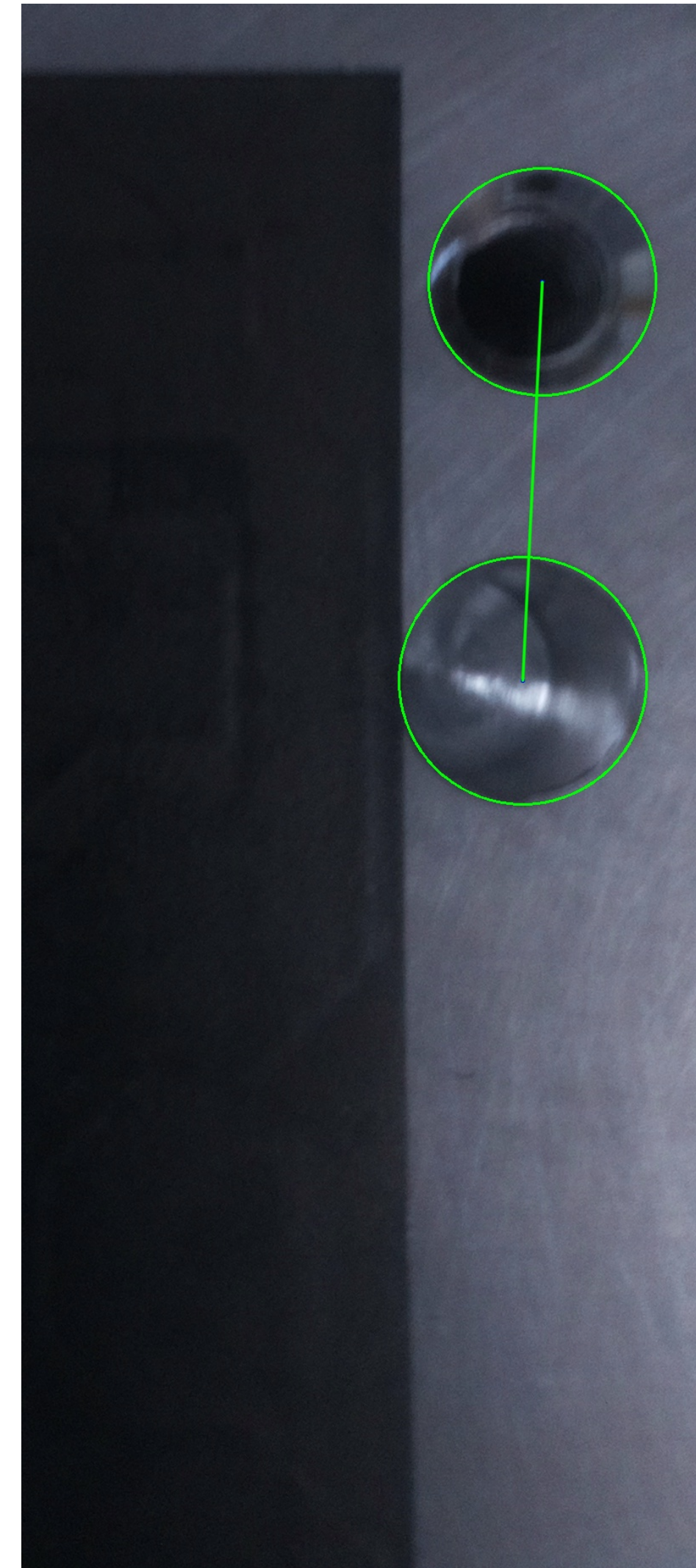
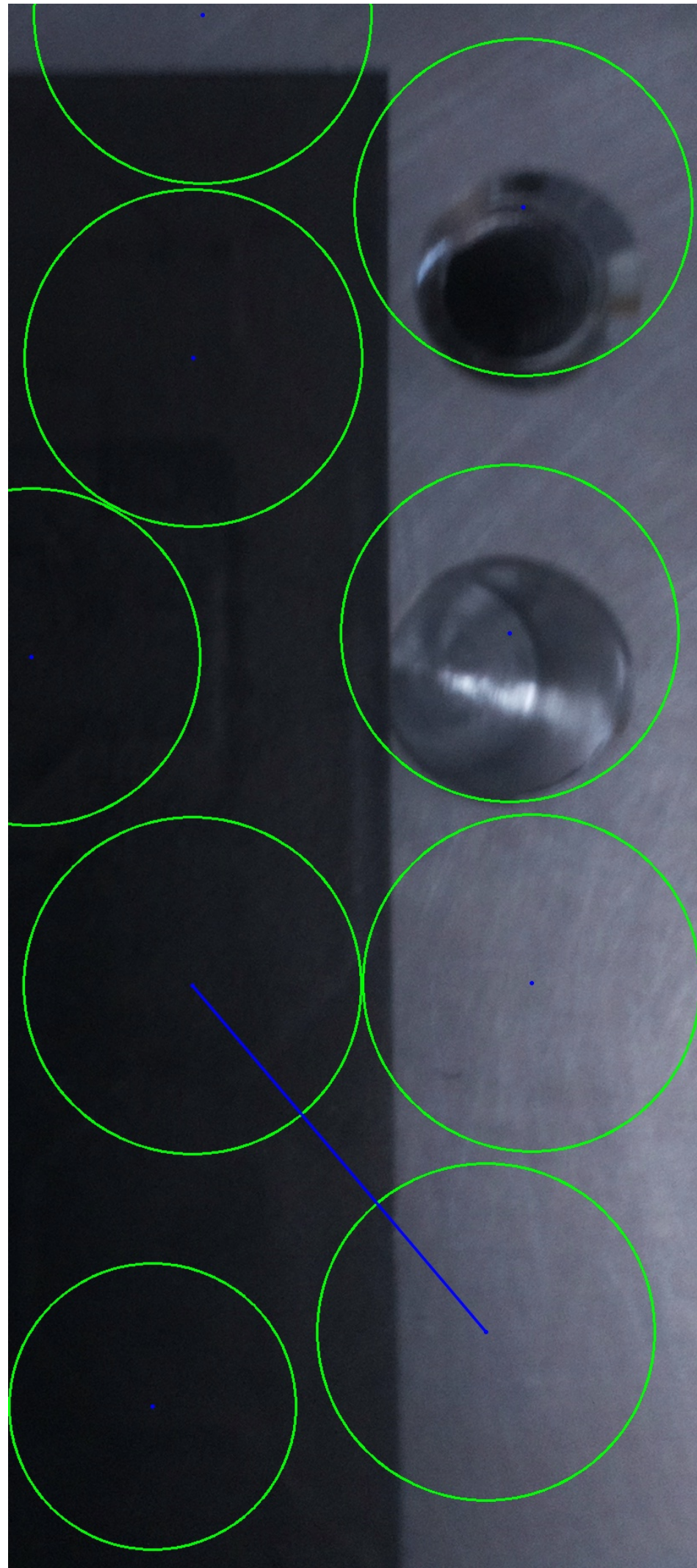
Edge detection (different threshold values)



Associated best line (different threshold values)

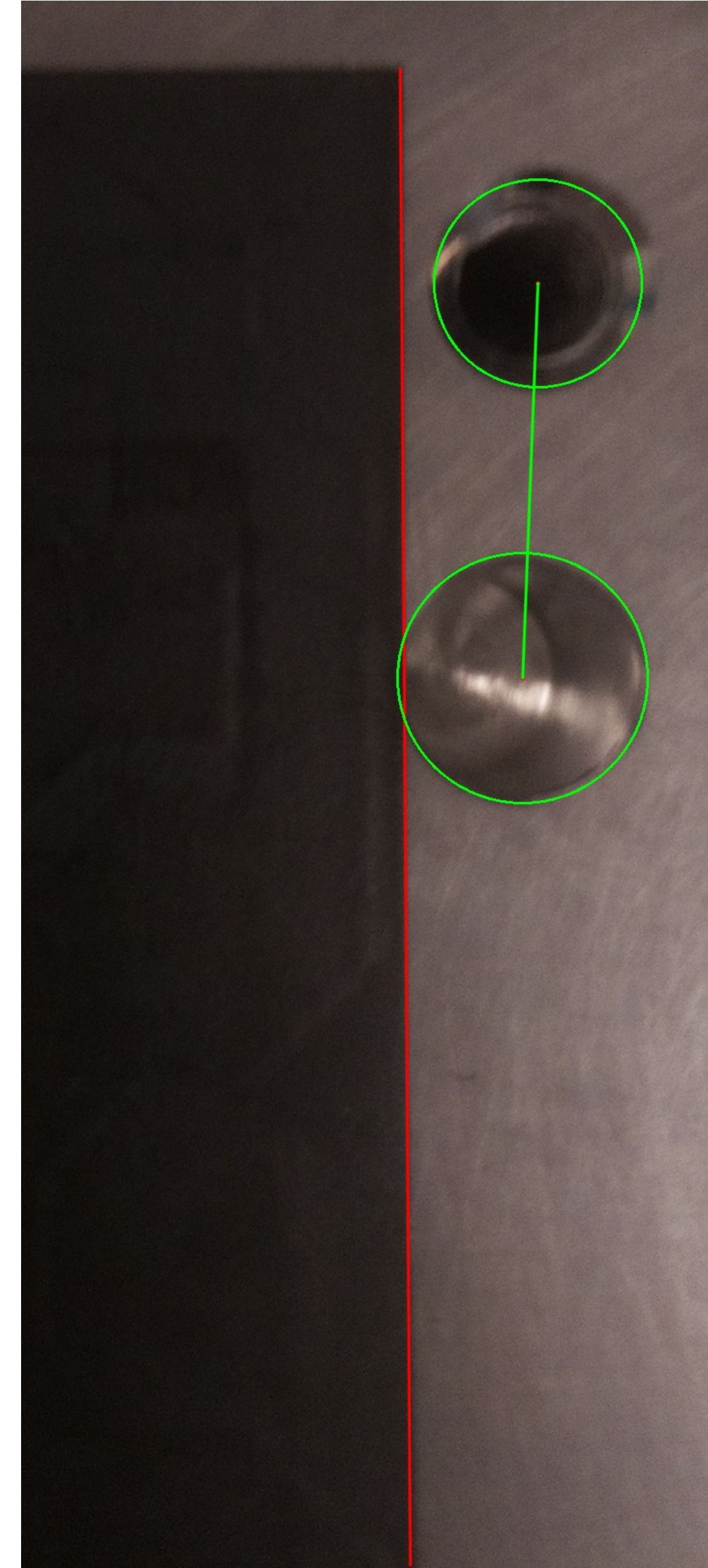


Circle detection (more sensitive parameters)



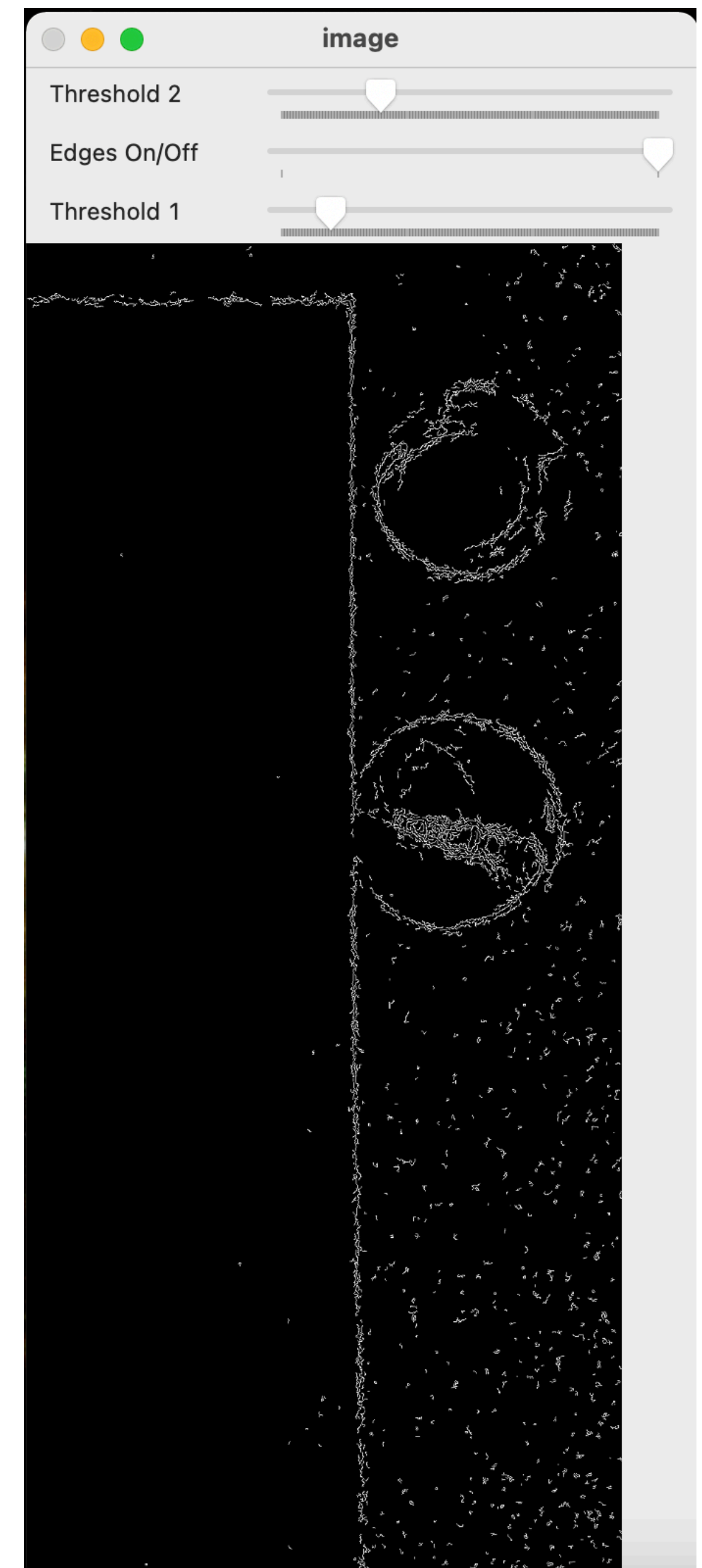
Angle calculation

- Image prompted to the user for validation
- Calculated angle = **1.83 °**
What is the maximum acceptable angle ?
- This step is to make sure that :
No visual inspection problem happened
Angle is being calculated on the correct reference points
- Given the **reproducibility of the picture taking**, there should practically never be such problems.



Edged detection threshold GUI

- If there is a **problem** it is more likely to come from a change in the **image quality** (light, flex/jig color contrast) which would change the edge detection's ideal thresholds
- **User friendly interface** to adapt the thresholds and see directly the impact
- The values of the final thresholds are printed in the terminal
- If these changes are to be implemented permanently the user can change the default values inside the script

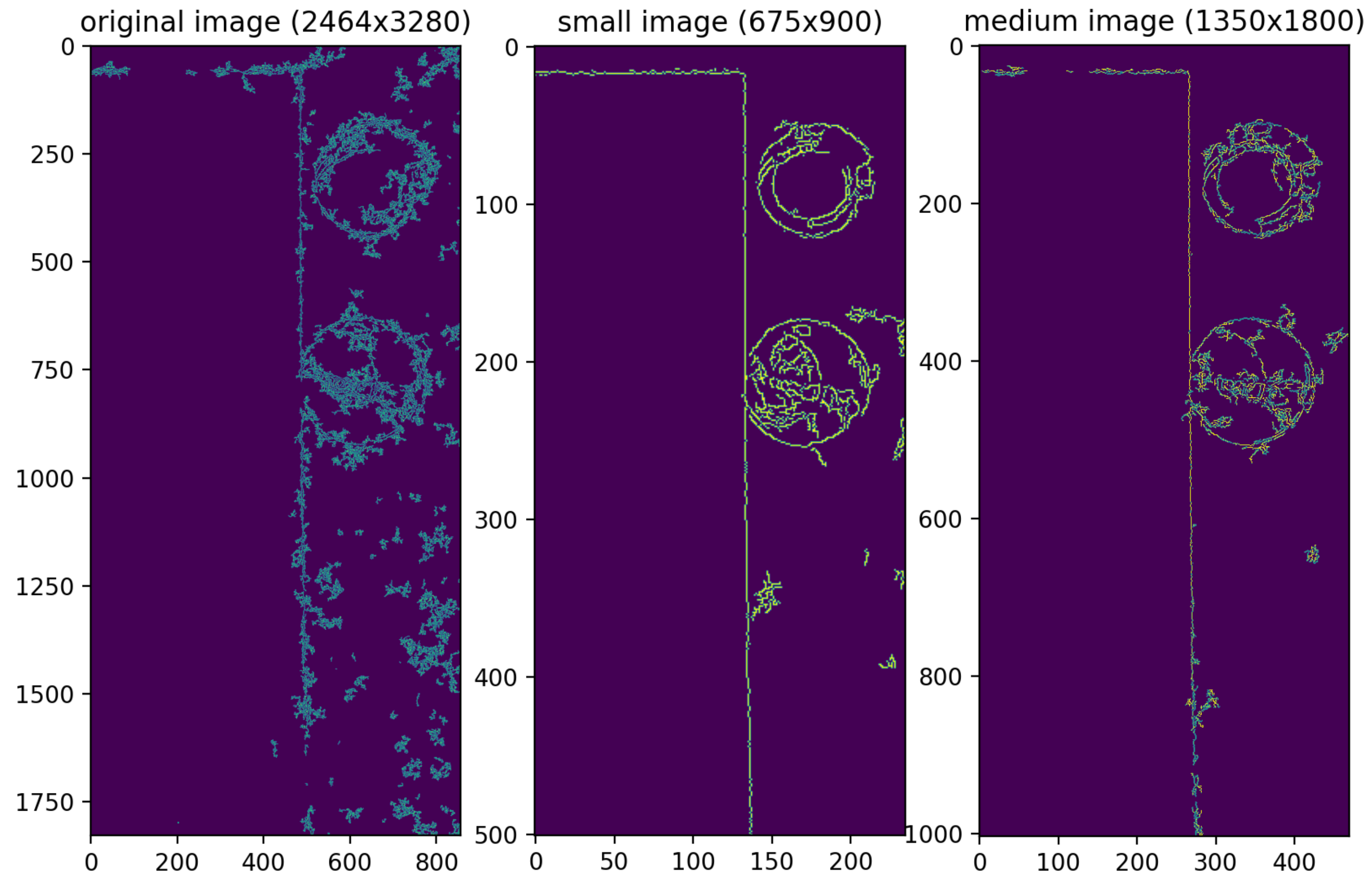


Objectives

- Adapt the software to the POV of camera support
- **Upgrade the camera lens ?**
- Implement more to the user interface :
 show the detected lines/circles while thresholds are being changed
- Make a practical setup for a good gluing workflow
- Understand when to consider the displacement acceptable
- Make the script more readable and user friendly

Resolution research (thresholds for original)

Same canny with same intensity thresholds applied on :



Resolution research (thresholds for small)

Same canny with same intensity thresholds applied on :

