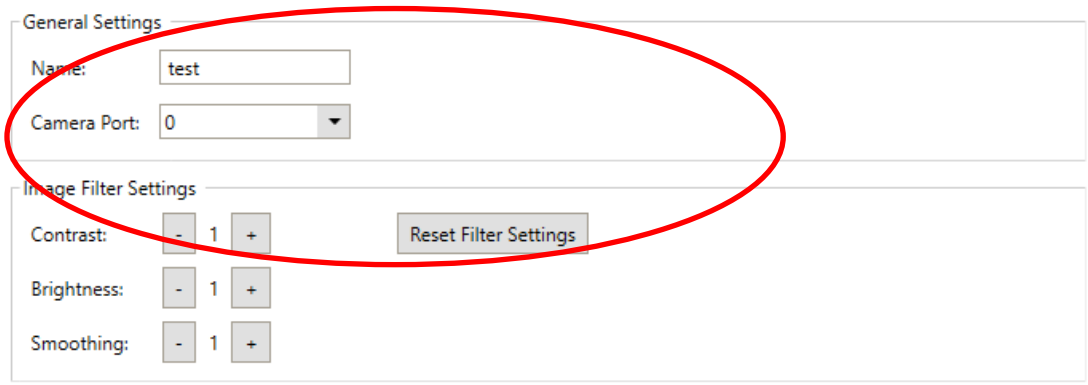
# Vision App – User Manual

# V 1.0 17.2023

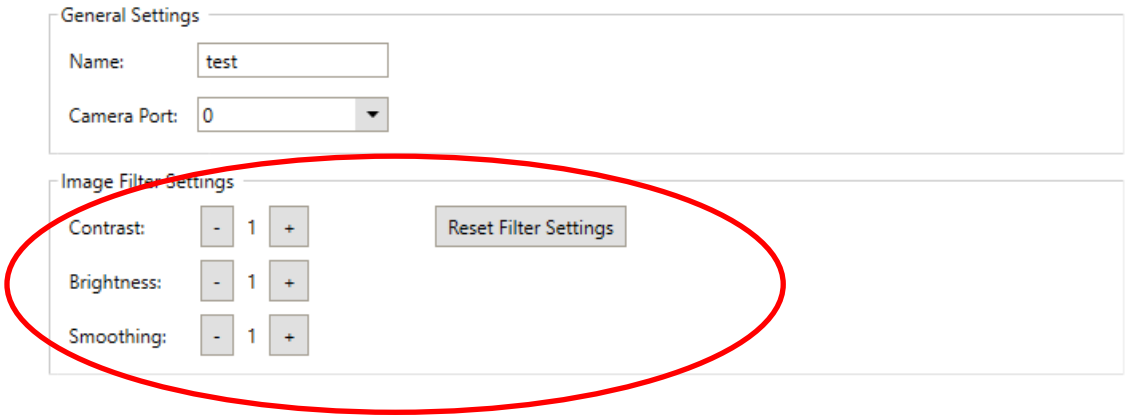
## 1. General Settings

In the general Settings you add a name of the application and chose the right USB Port. If you chose the right USB Port you should see the video of your camera.



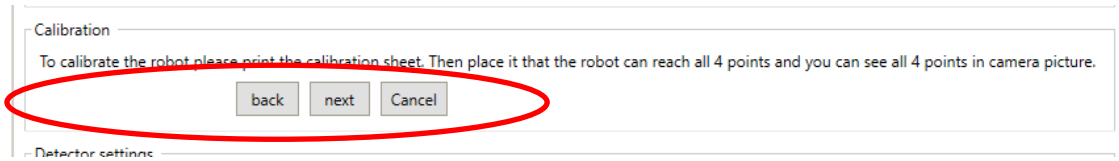

## 2. Image filter settings

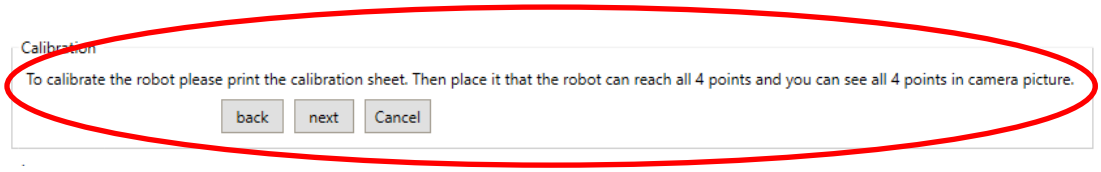
Under the general settings you find the image filter settings. Here you can change contrast, brightness, and smoothness of the picture.



## 3. Calibration

You can start the calibration by clicking on the “Start Calibration” Button.



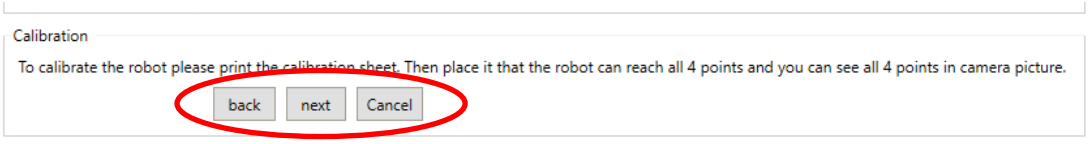



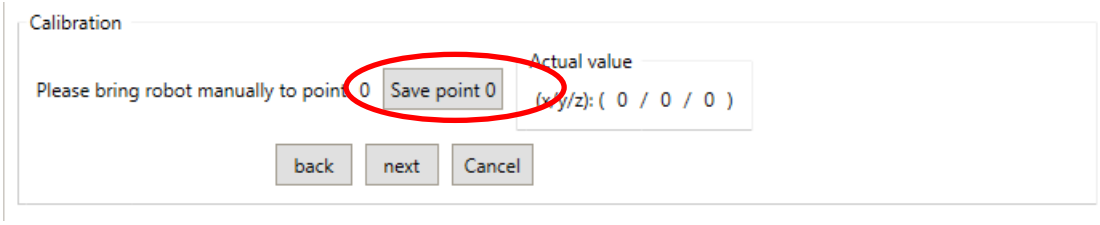

Now you can follow the instructions. The calibration sheet can be downloaded in the wiki:

https://wiki.cpr-robots.com/index.php/Apps_for_the_Robot_Control. Place the sheet under the camera and check

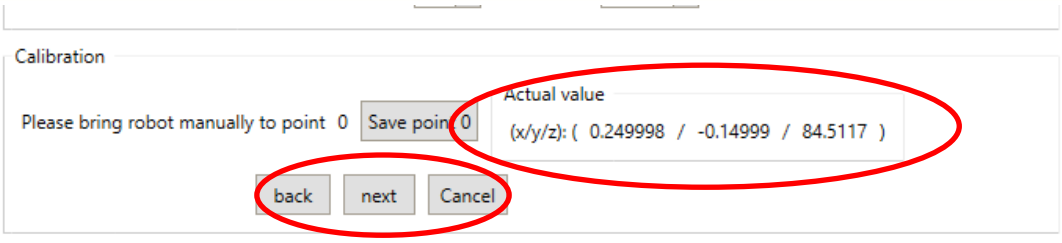
- Do you see all 4 points in the camera picture?
- Can the robot reach all 4 points with the TCP?

If you checked both, you can navigate to the next step.

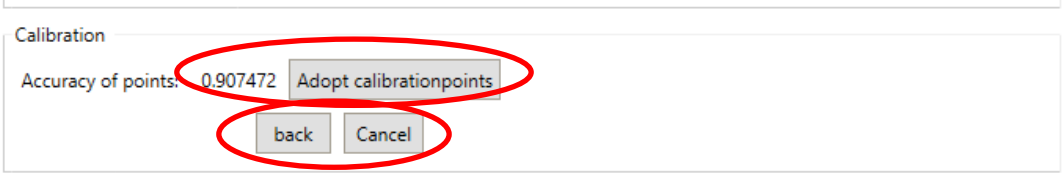


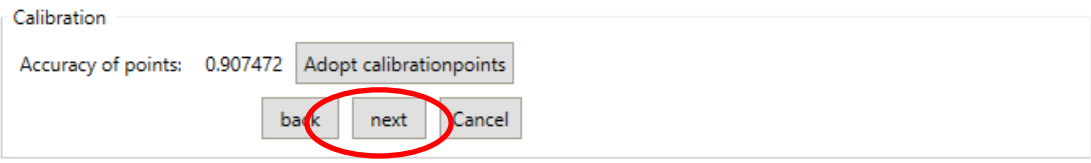

Follow the instructions and bring the robot to point 0 on the calibration sheet. Click save point if the TCP is on point 0. The coordinates will change and show the position.



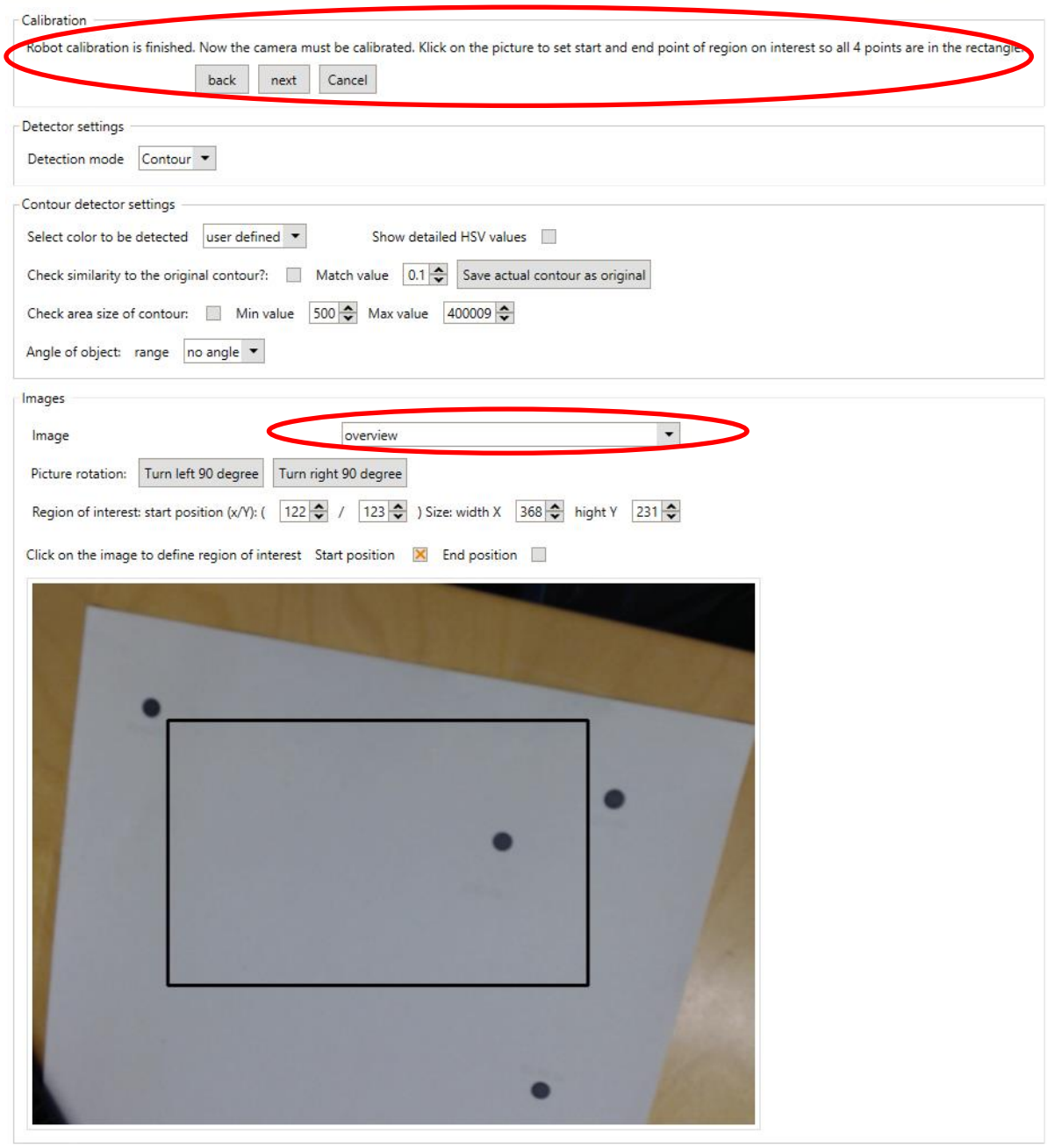

You can navigate to the next point by clicking on the Button “next”. To the same with the other 3 points.



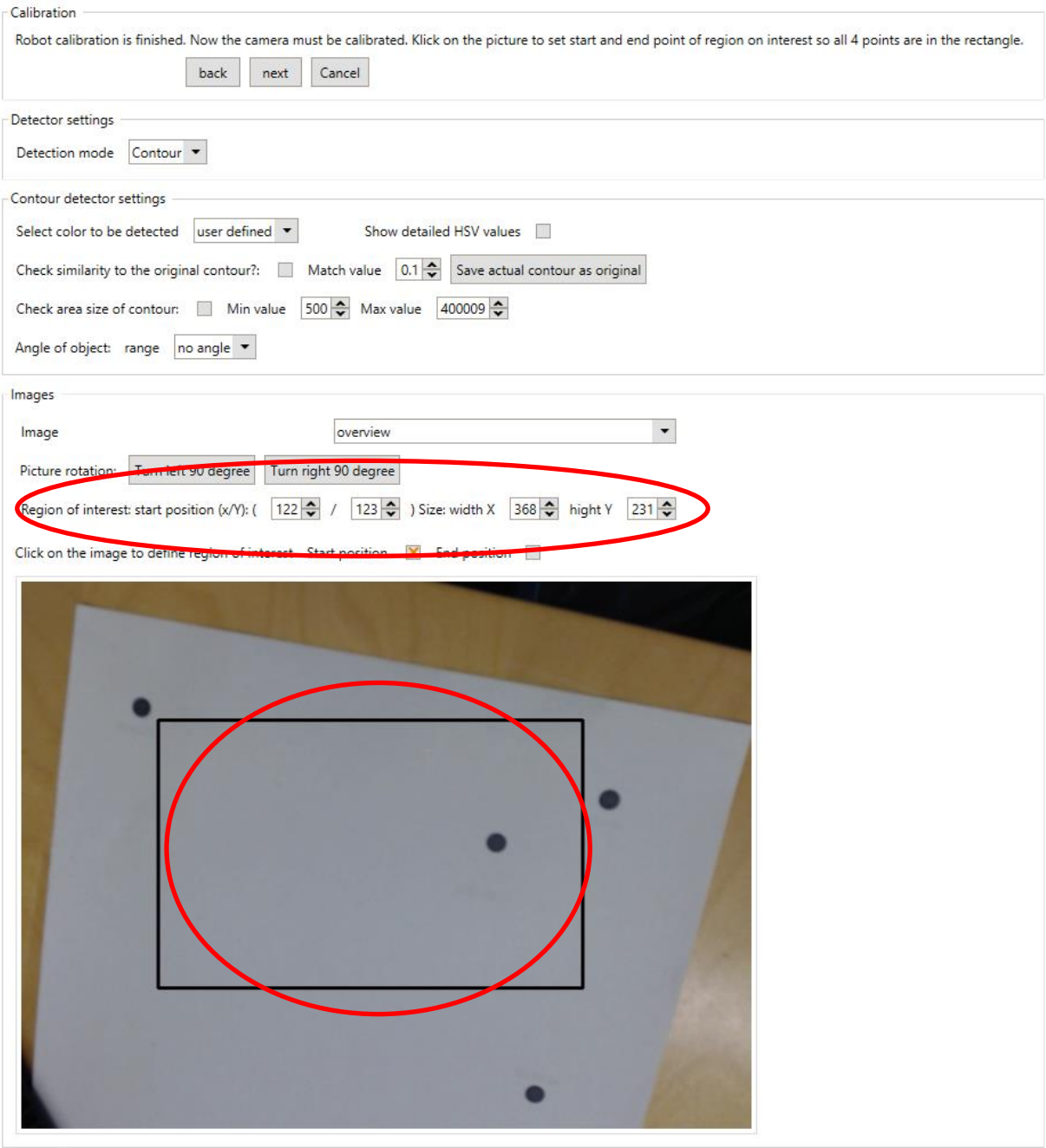

After all 4 points are calibrated you get an accuracy. This should be close to 1, otherwise you will get problems with positions later. You can navigate “back” if you want to correct some points to get a better accuracy. Click “Adopt calibrationpoints” to save the points. The button “next” will appear. If the button next does not appear, your Accuracy is to bad. Please check your points.

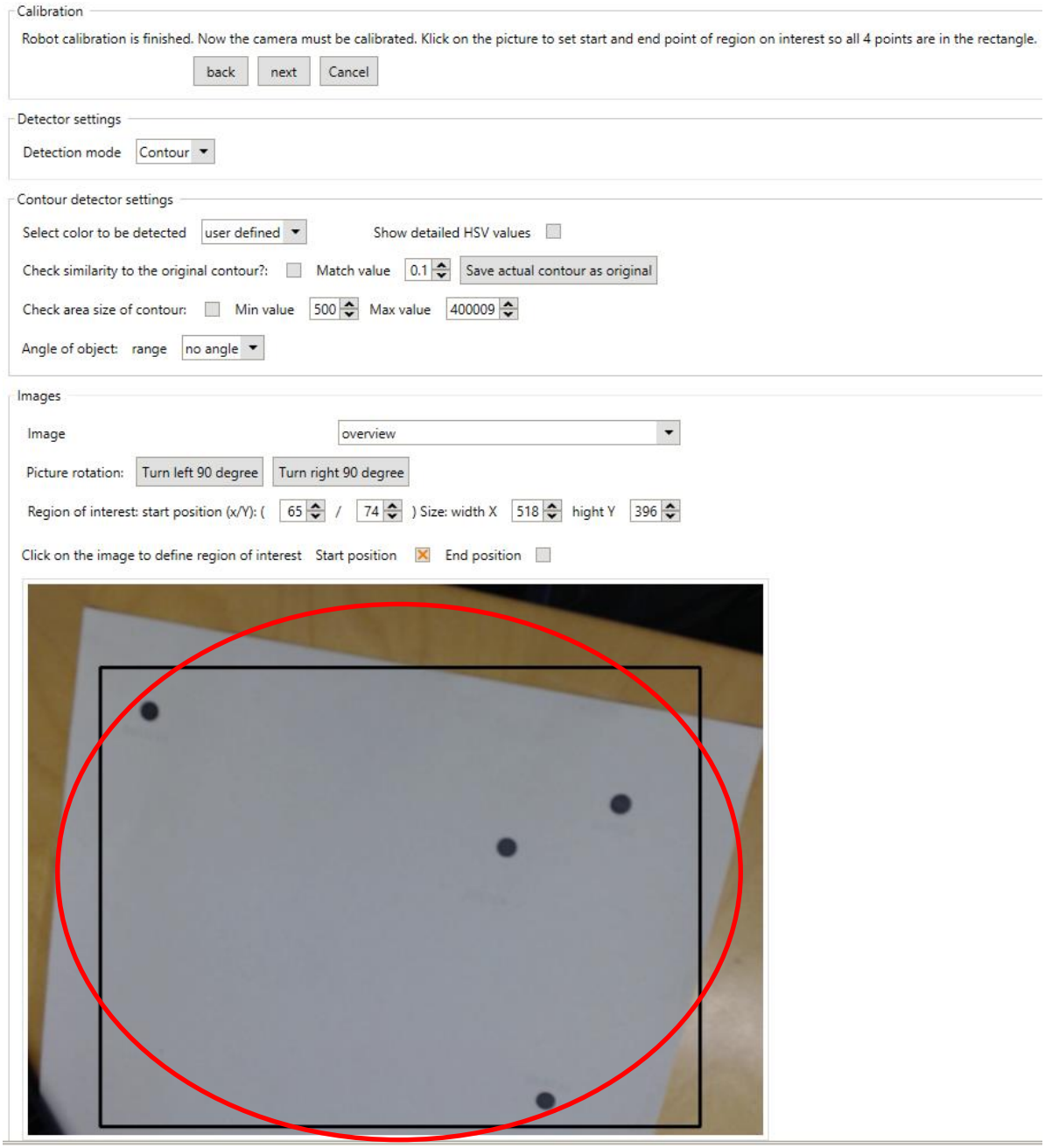



Now the calibration of the robot is finished, you need to calibrate the camera now. By clicking next, the image will change to “overview”.



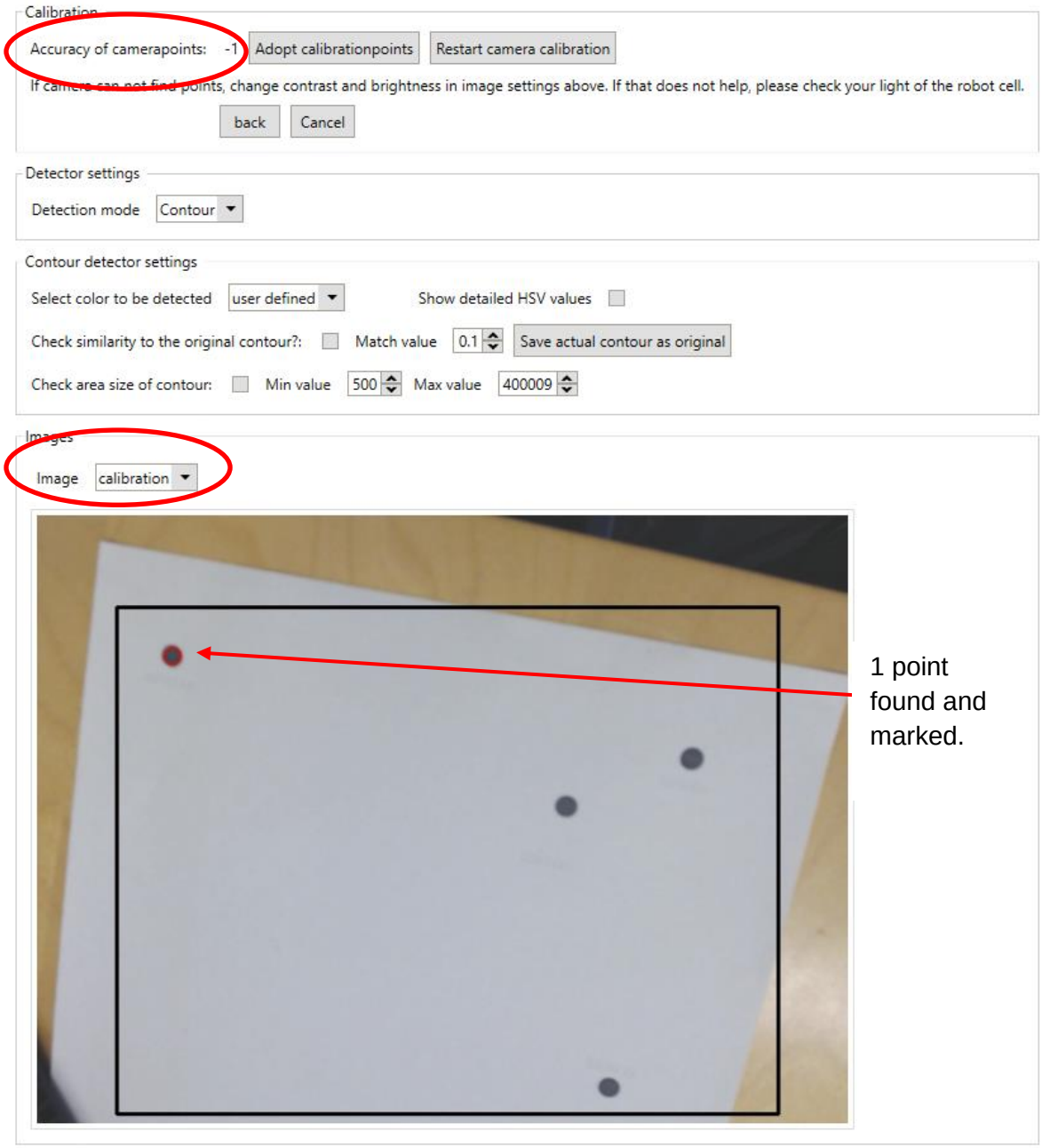

Follow the instructions and put all 4 points into the region of interest rectangle. You can do this by clicking on the picture. First the start position will be set, then the end point will be set. You can change which point will be set by checking the checkbox. It is possible to change the size and position of the region of interest if you change values “start position” and “size”.


Calibration
Robot calibration is finished. Now the camera must be calibrated. Klick on the picture to set start and end point of region on interest so all 4 points are in the rectangle.
back
next
Cancel
Detector settings
Detection mode
Contour
Contour detector settings
Select color to be detected
user defined
Show detailed HSV values
Check similarity to the original contour?:
Match value
0.1
Save actual contour as original
Check area size of contour:
Min value
500
Max value
400009
Angle of object: range
no angle
Images
Image
overview
Picture rotation:
Turn left 90 degree
Turn right 90 degree
Region of interest: start position (x/Y): (
122
/
123
) Size: width X
368
hight Y
231
Click on the image to define region of interest
Start position
End position

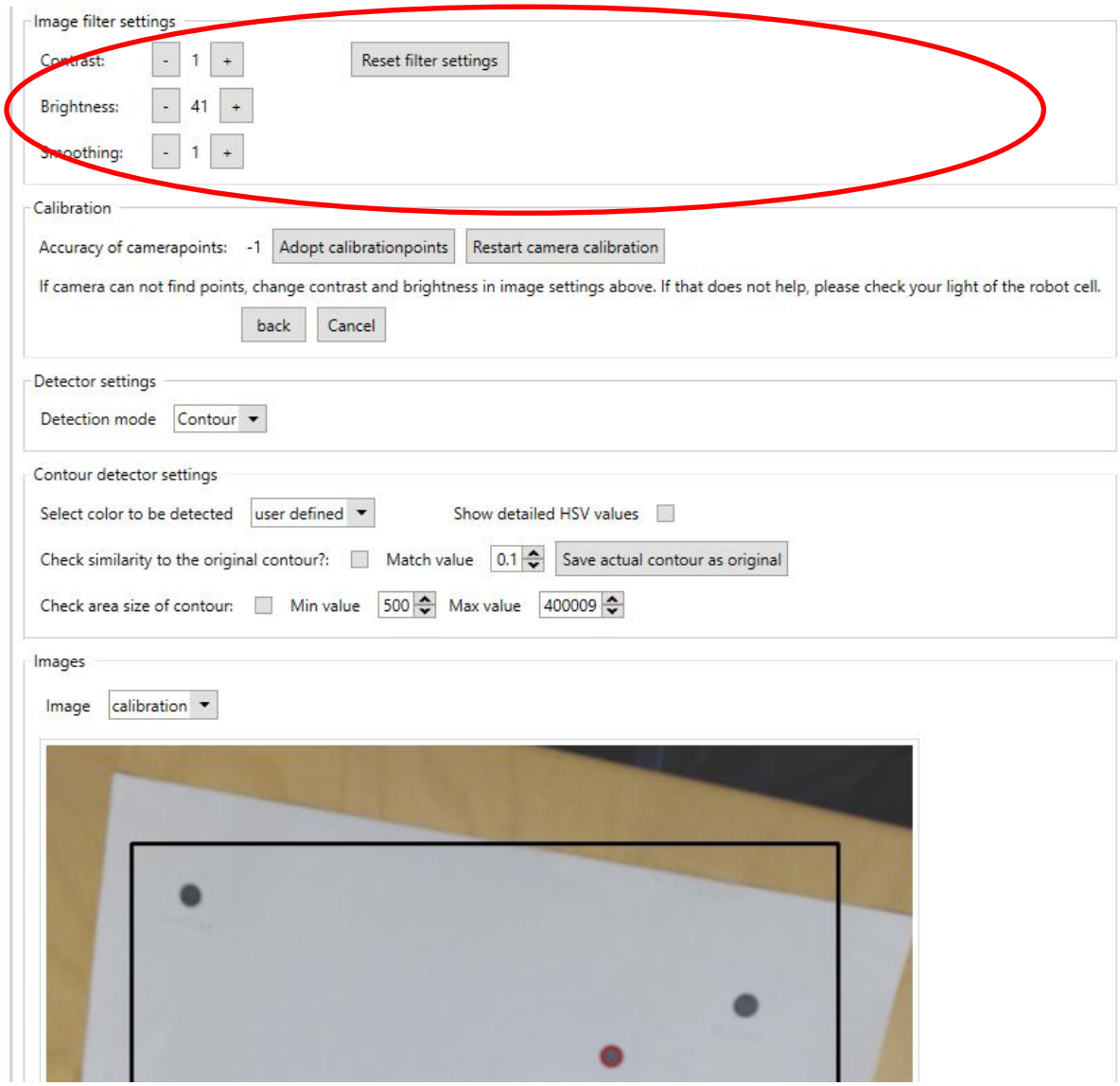



If all 4 points are in region of interest, click next.

The camera will search for the 4 black points. All found points will be marked with a red circle. If the camera can not find all 4 Points, like in the picture below, change the settings of brightness and contrast until all 4 points are detected. The image automatically change to calibration and the accuracy is -1 until 4 points are found.

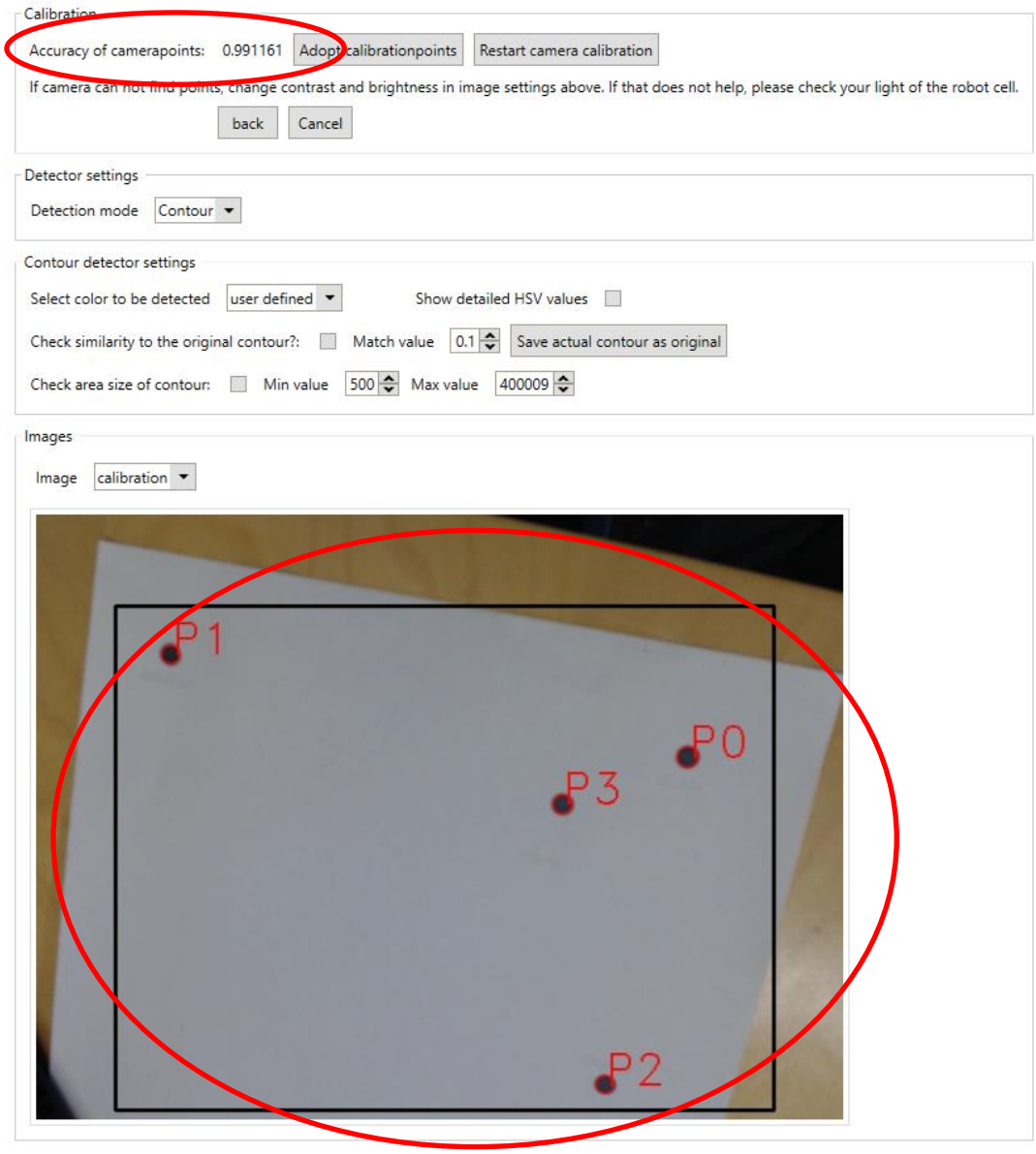



1 point found and marked.

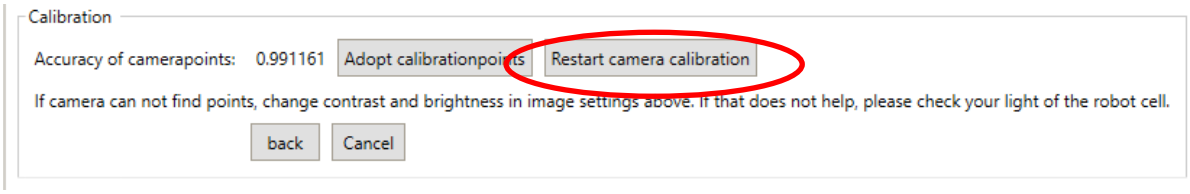



If you still get problems, you can check you light and background. Be careful, if you change position of calibration sheet, you need to restart and save the 4 points with the robot again.

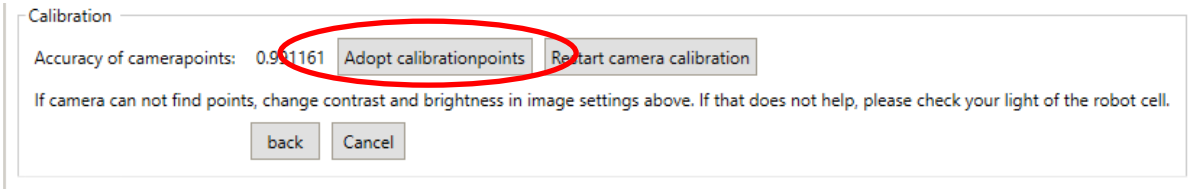
If the camera detected 4 Points, they get a number and you should check, if the points are marked correctly.

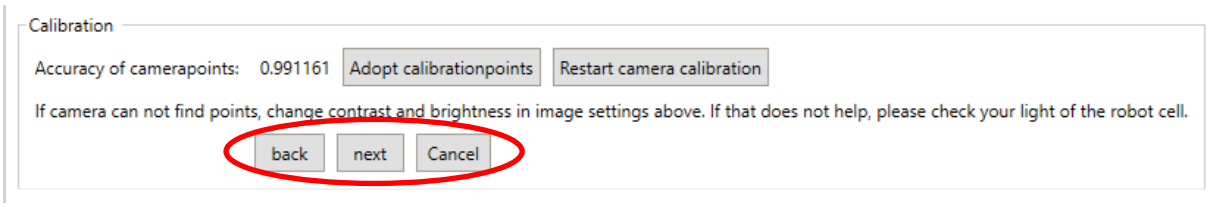



Like the robot configuration, you get an accuracy of the points. This should be near 1 as well. If the points are not marked correctly or the accuracy is not good, you can click “restart camera calibration”. If you get wrong points, e.g. because of dark background, please light up your background by e.g. some empty sheets of paper.




Save the calibration points by clicking “Adopt calibration”. The Button next will appear.



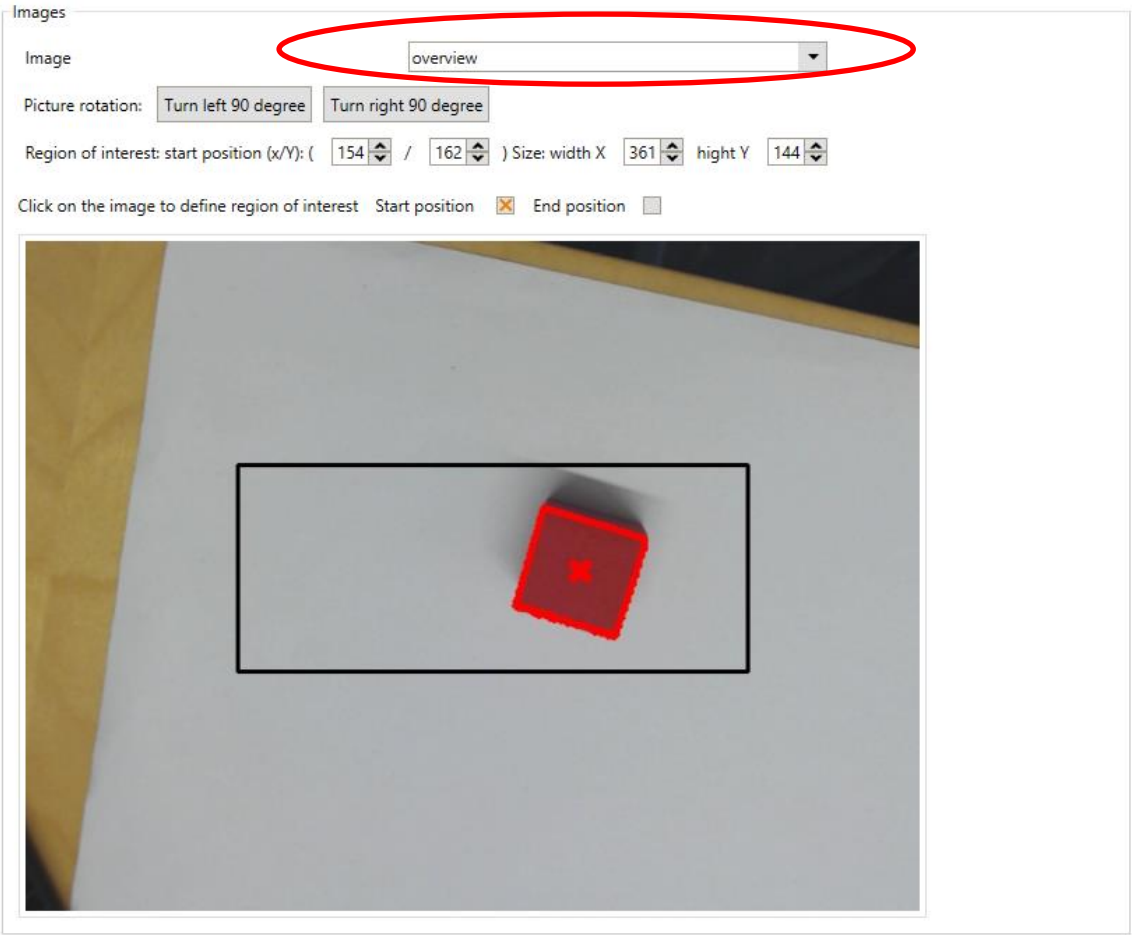


You can end the calibration by clicking “finished”.

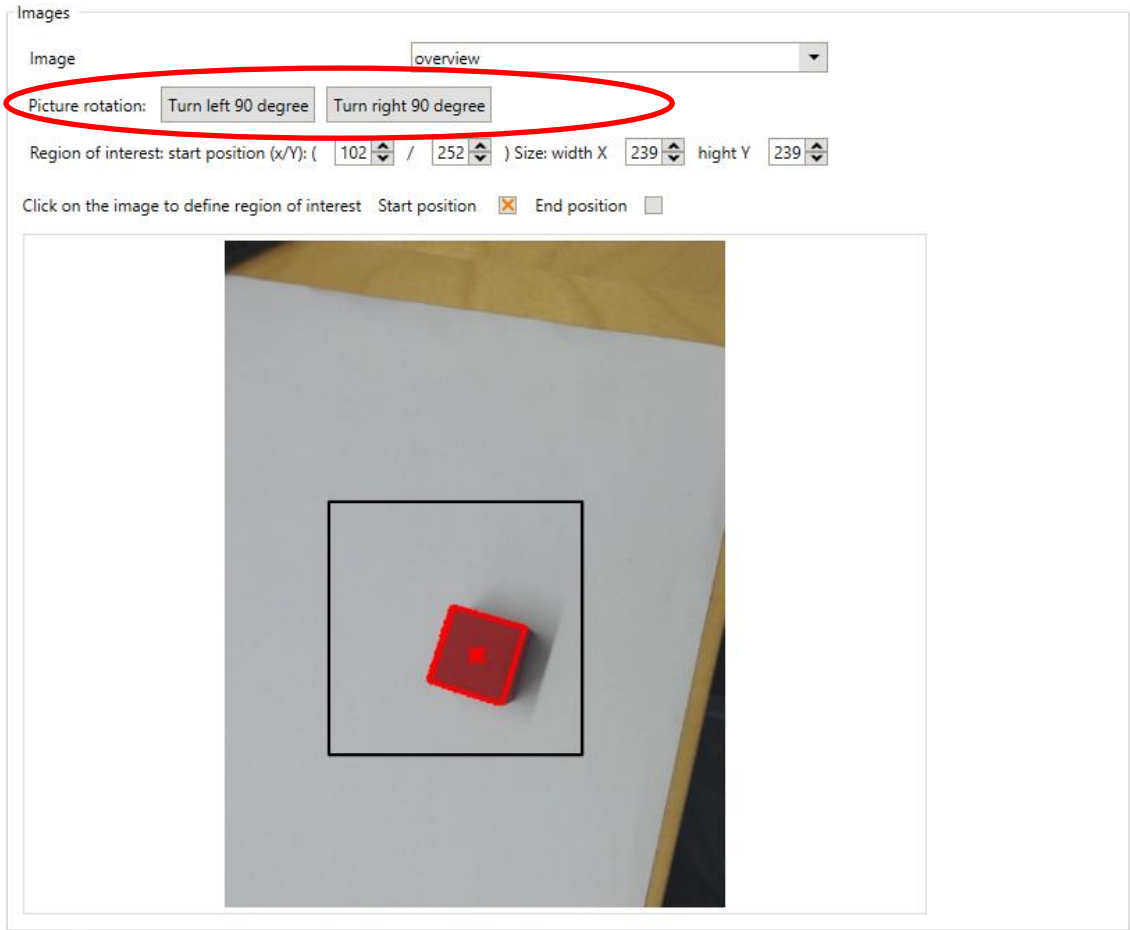
# 4. Images

## 4.1 Overview

In the image overview you get the whole camera frame. Marked is the region of interest. The selected settings like brightness and contrast are shown. If there is a object detected it is marked with a red x on the grip point and a red colored contour.

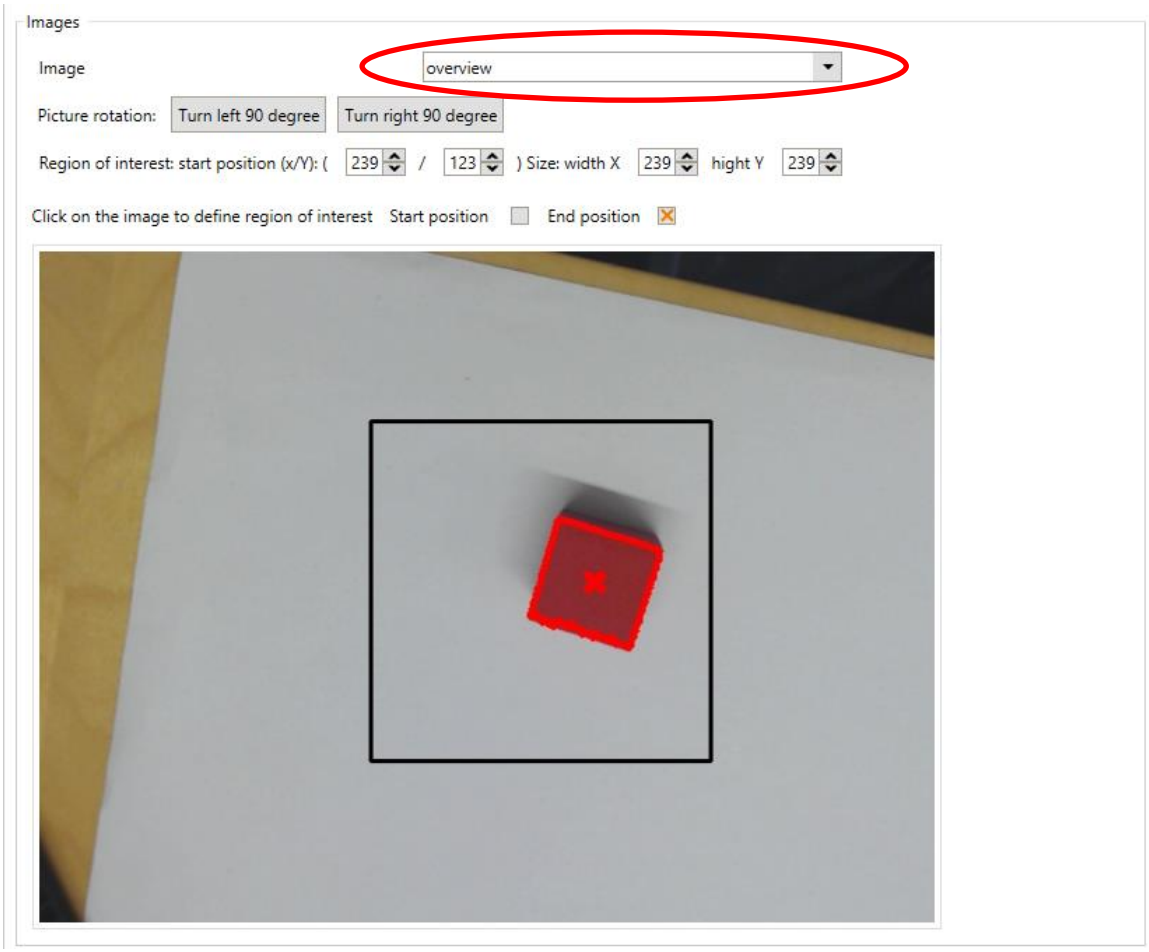



You can rotate the image if you have a different orientation of the camera.

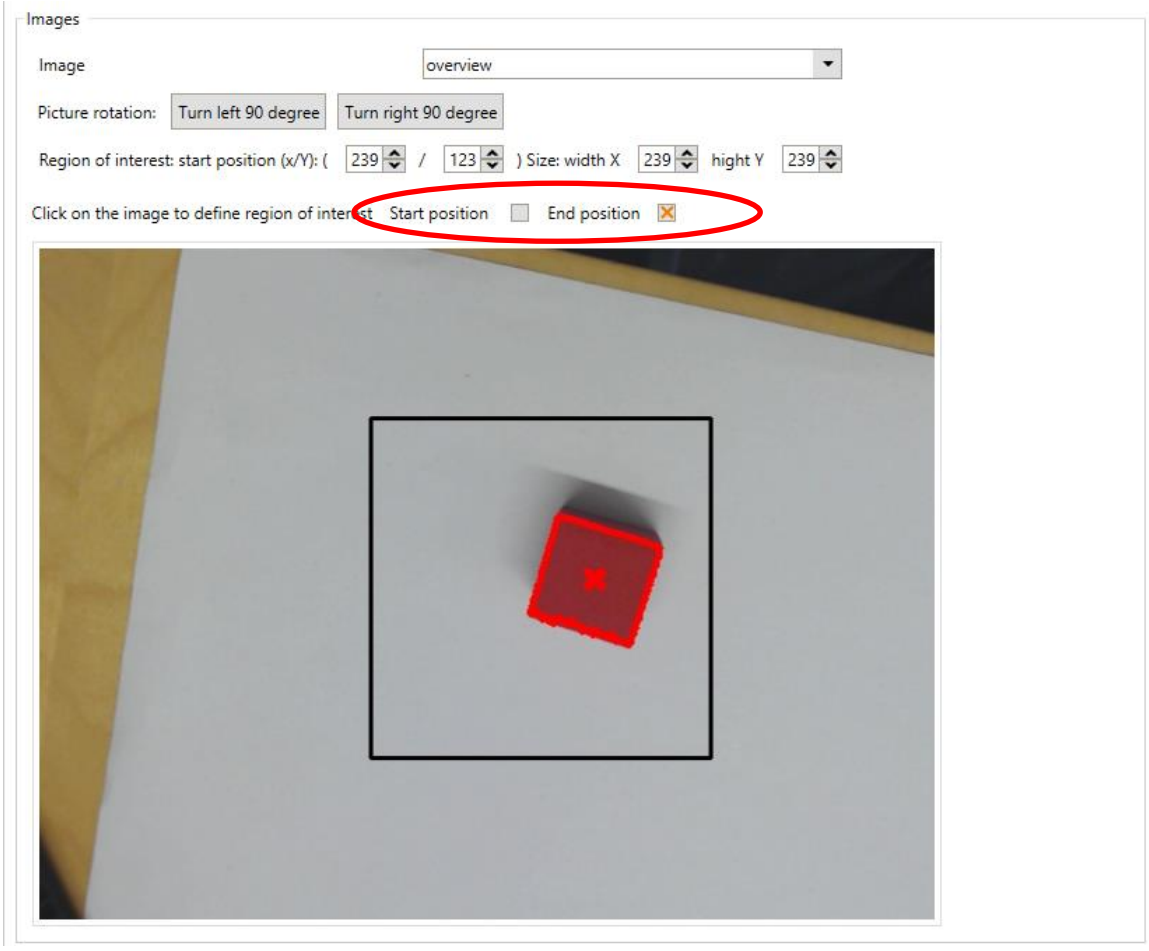



### *4.1.1 Set region of interest*

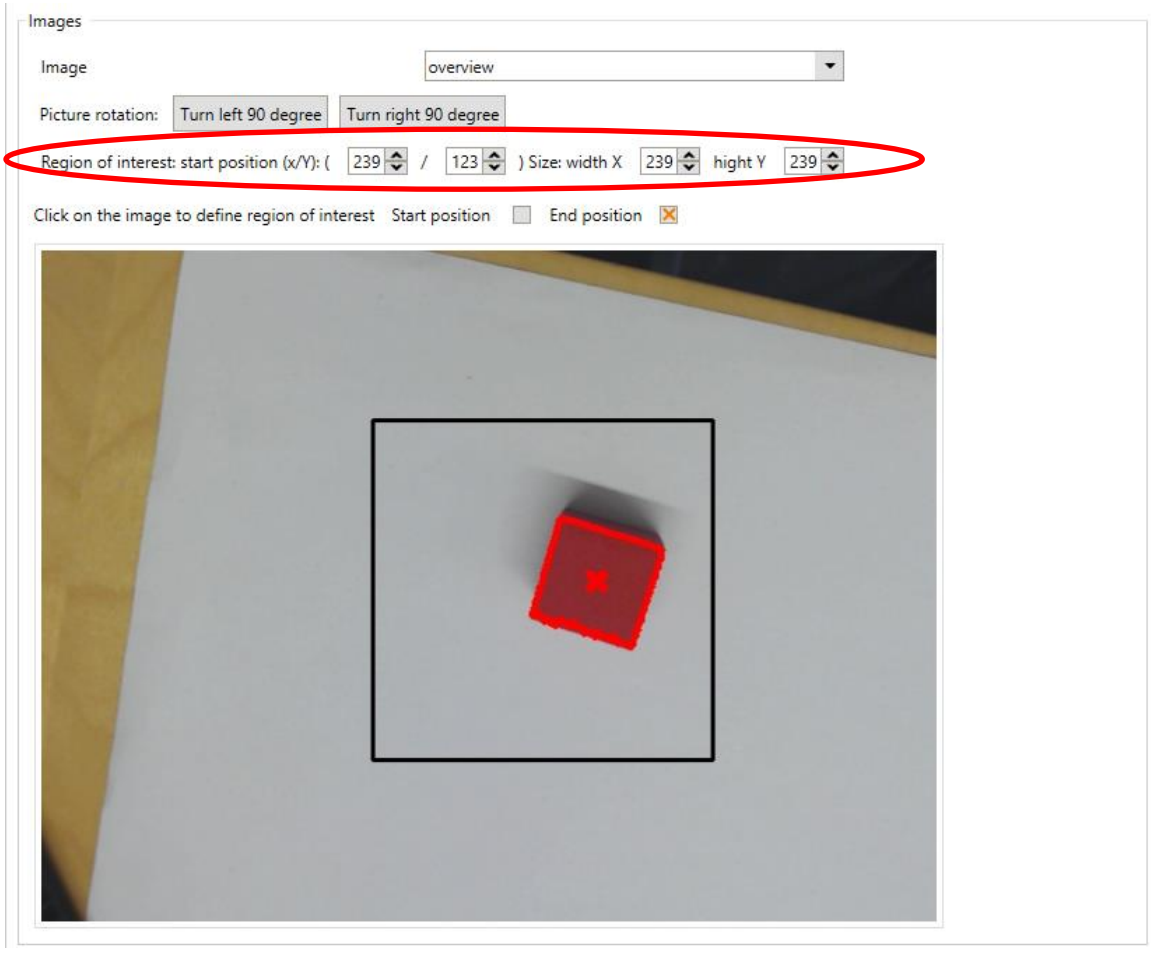
The object only will be detected if it is in the region of interest. This is marked with the black rectangle. You can change the region of interest in the image “overview”.




If you want to change the region of interest, you can click in the image. Depending on the selection “Start position” or “End position” the start or end position will be set. After setting the start position, automatically end position will be set.

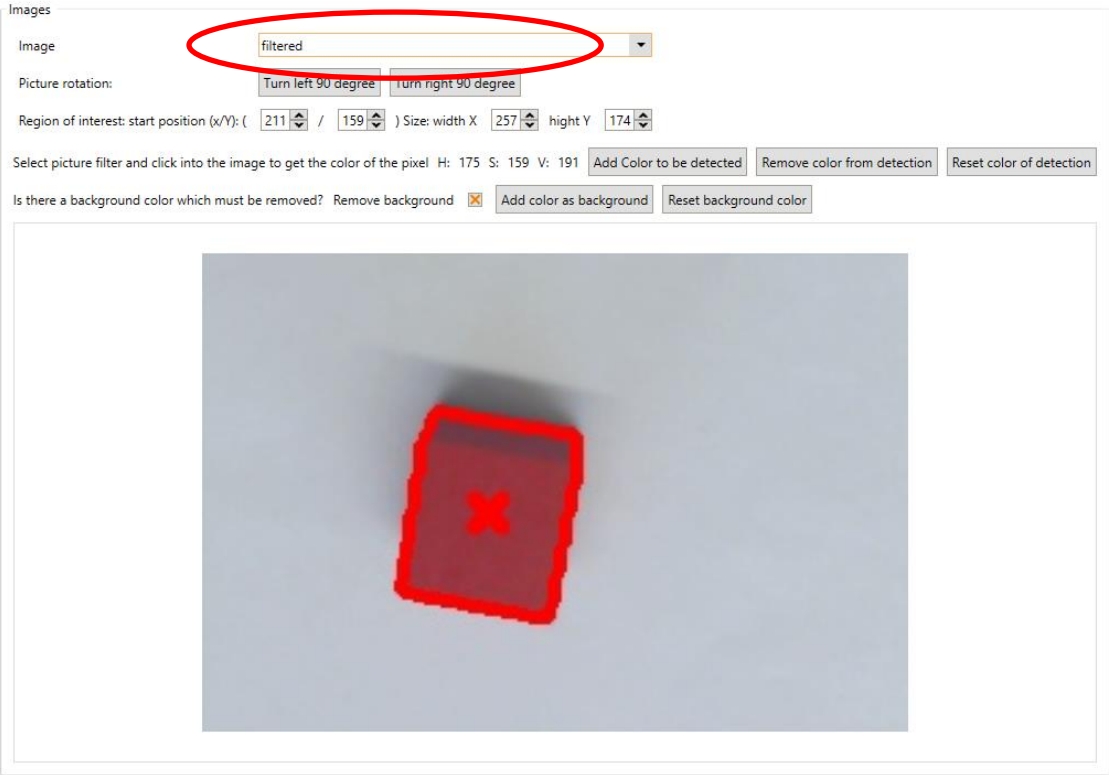



Another possibility is to change the region of interest by changing the values “start position” and “width”/”hight”.

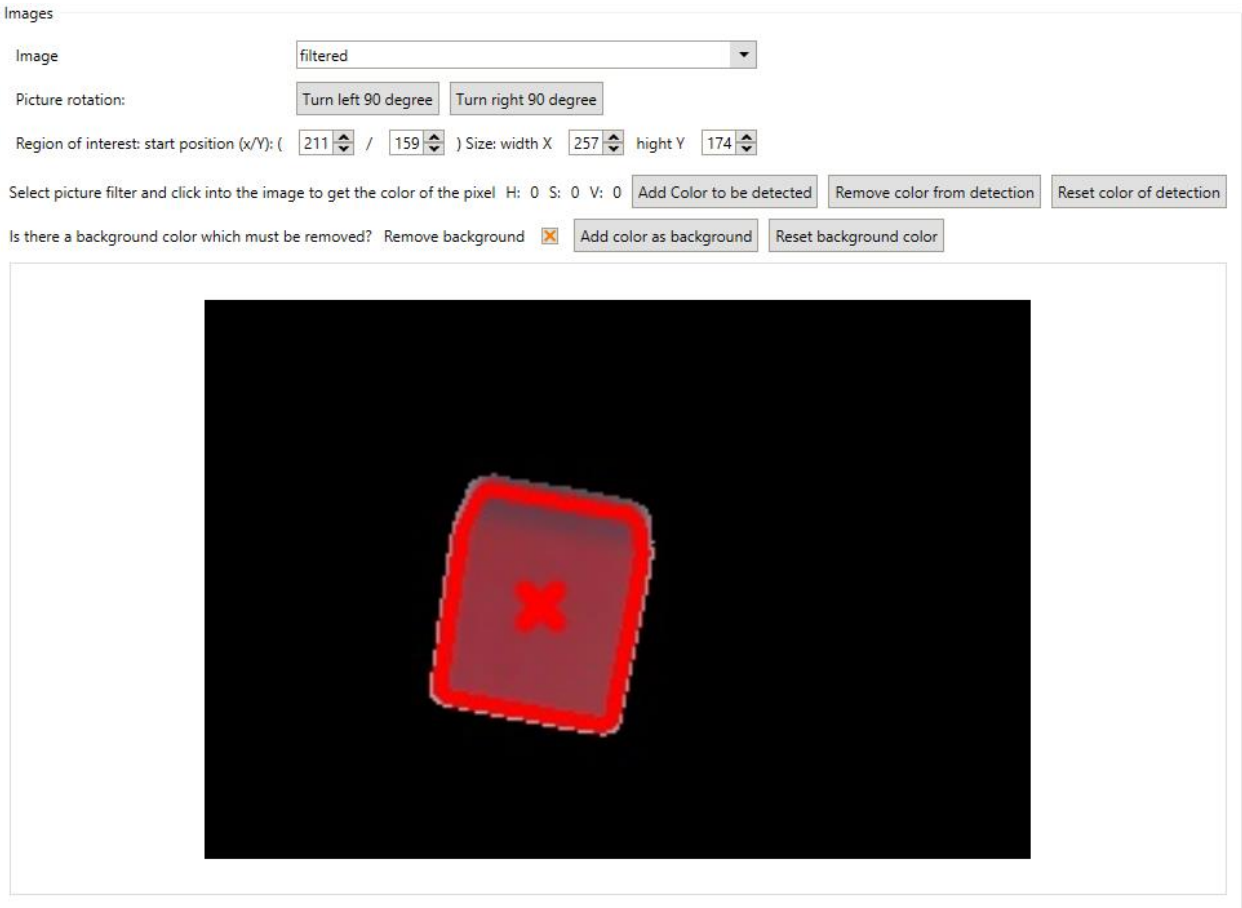



## 4.2 Filtered

The imge filtered shows the region of interest.




If a contour/ Blob is found, it will be marked. It is possible to rotate the image like in “overview”. If you click on the image, you will get the pixel color and can add or remove it to the color to be detected or the background(only in Contour detection). A detailed explanation for setting detection color you will find in 5.1.1. In 5.2 you will find an explanation how to set the background color. If you selected a background color, all areas with this color will be marked black. Note that this is only possible if you chose contour detection.




## 4.3 Calibration

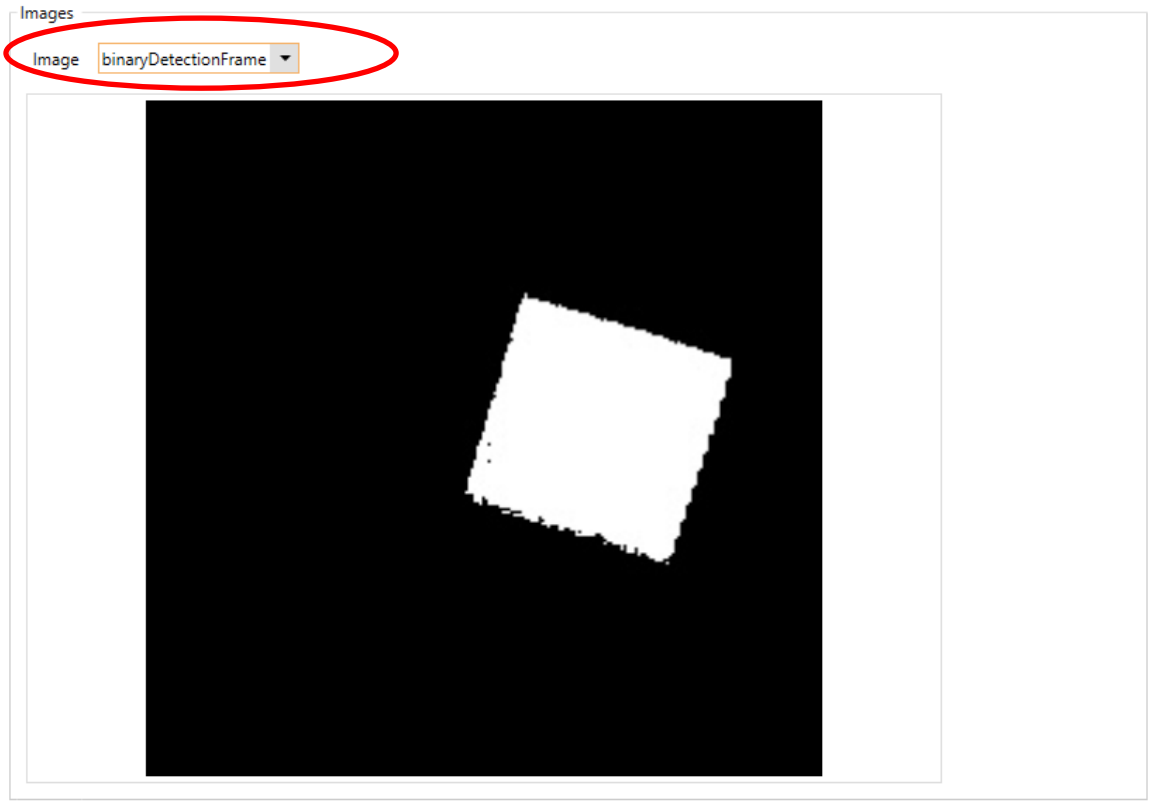
If you select „calibration“, the image of calibration will be shown, if you already calibrated your robot. Otherwise, the picture will be white. How to calibrate your robot is explained in 2.

## 4.4 Original contour

The „original contour“ shows the saved original contour. If you don’t have a original contour, the picture will be white. In chapter 5.4 you find a detailed explanation how to save contours.

## 4.5 Binary Detection Frame

If you chose the image “binary detection frame” you will get a binary picture, which is used to define the contour. The white pixels are the object to be detected, the black pixels are the background. If you have problems with detection, check which area of your object is white and which is still black. Check the background as well.




## 5. Contour Detection

For contour detection select “contour” as detection mode.


In the following the different settings for contour detection are explained.

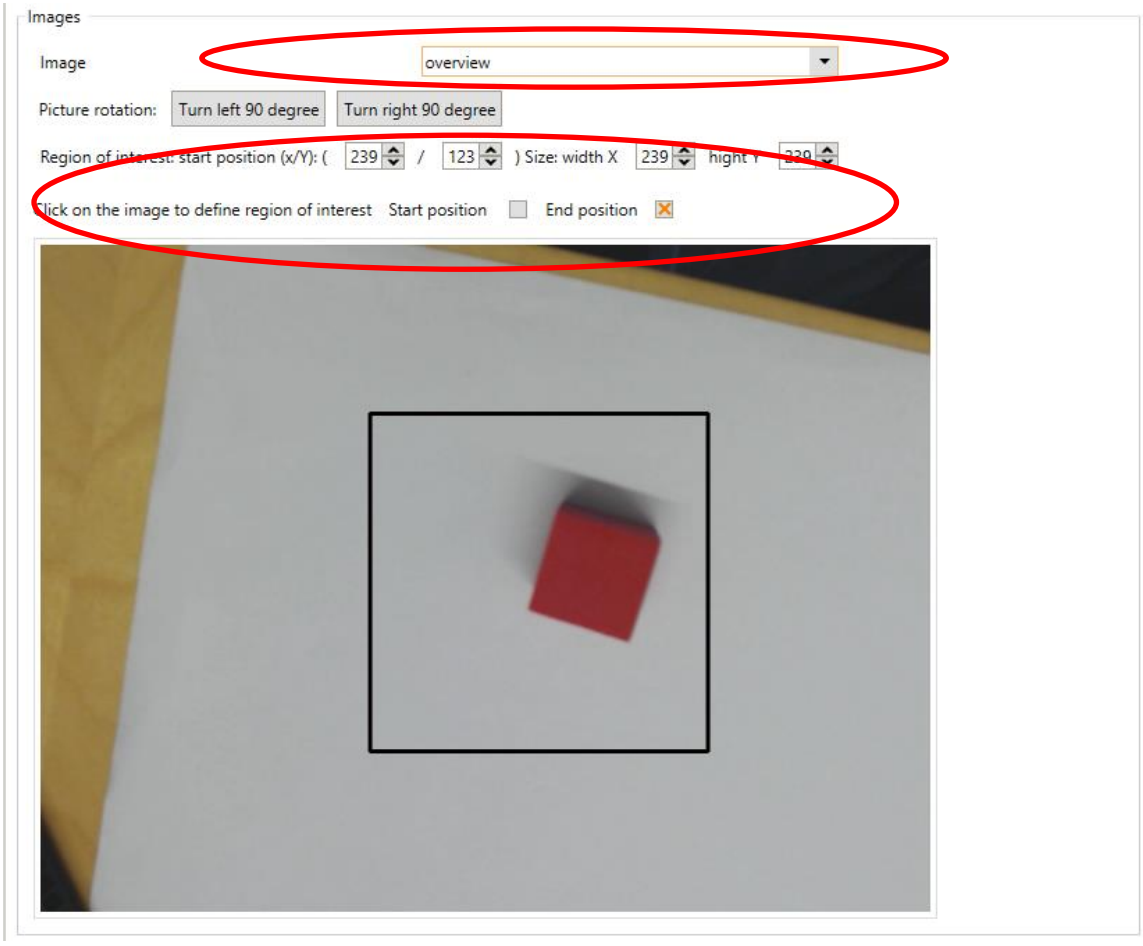
### 5.1 Set color of object

There are three different opportunities to set color of the object which should be detected.

1. Pic color form image
2. Select predefined value
3. Define HSV values

#### *5.1.1 Pic color from image*

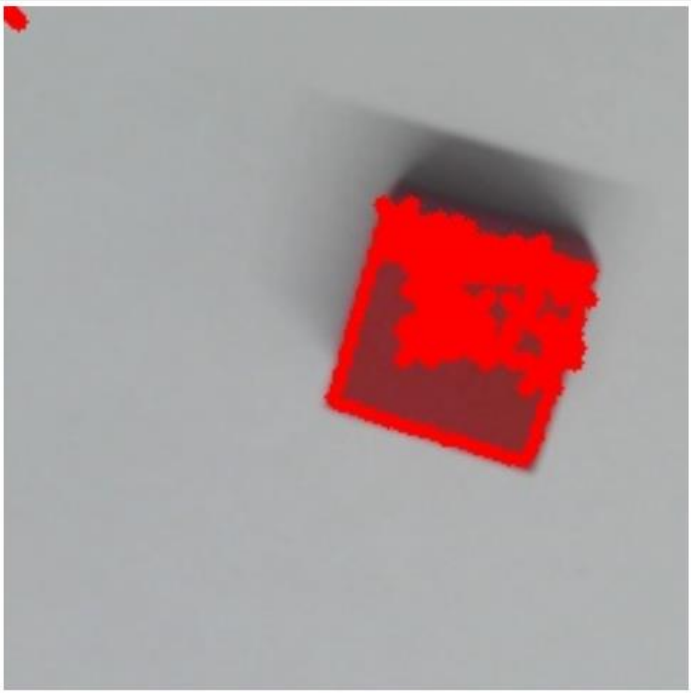
First the Region of interest must be set. This is possible in the image “overview” by clicking on the image.



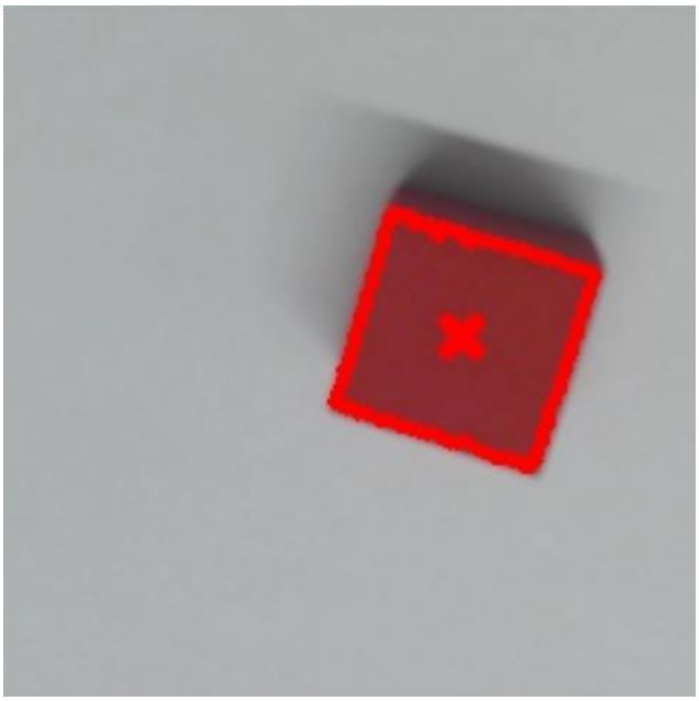

If the object is in the rectangle the picture “filtered” must be selected.


If you click on the image, the color of the pixel will be shown. Now you can click the button “Add Color to be detected” to add the color for detection. You can add serval colorpixel to be detected. If a colorarea is detected, the center and contour will be marked.

The following picture shows how the detection could look after adding the first color. A lot of small areas are detected and marked.



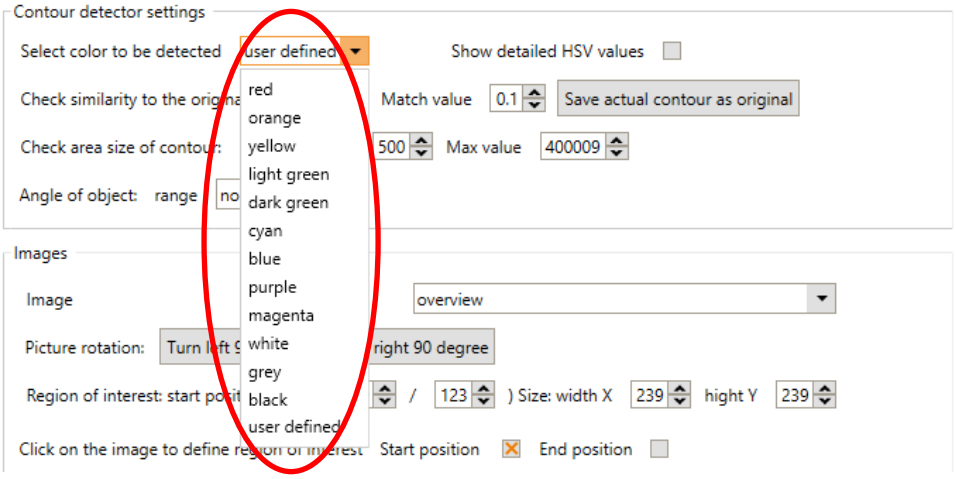
After adding more colors by clicking on the pixels and “Add Color to be detected” the area is getting bigger and in the end you have only one area with the center marked with a red x. This is shown in the following picture.



If you added a lot of pixels and still get more than one area, you can set the values of min and max area. This is explained in 5.3.

### *5.1.2 Select predefined value*

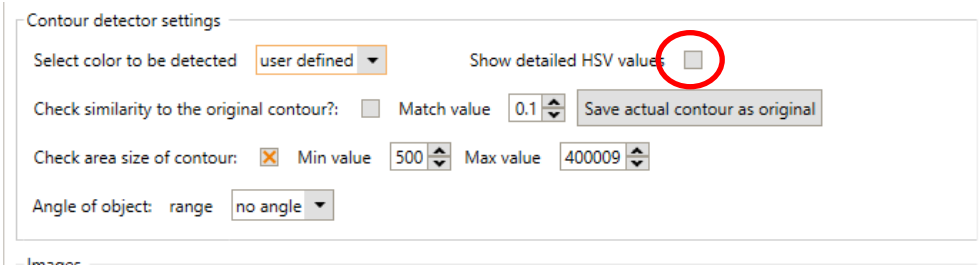
It is possible to select a color of a list with predefined colors. You can select the color in the drop-down menu.

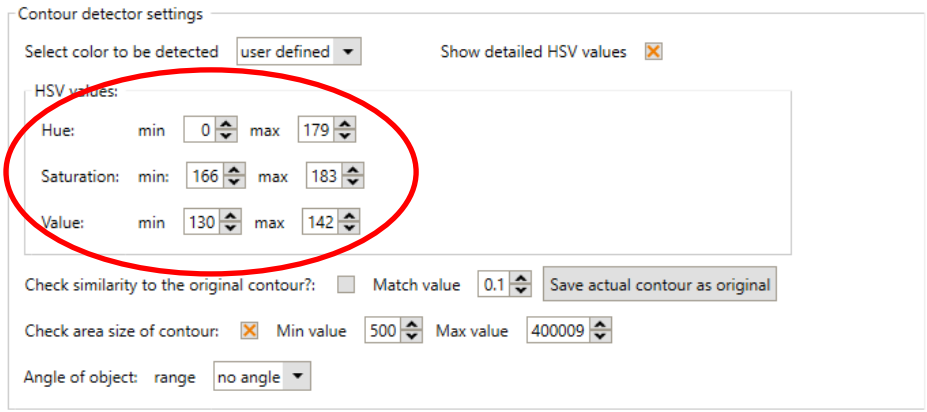



Please notice that it can be possible that your object will not be detected even if you chose the right color. This depends on different brightness and contrast, depending on light and camera. If the color can not be detected, add the color manually as explained in 5.1.1.

### *5.1.3 Define HSV values*

You can change the HSV values manually. Check the button „Show detailed HSV values" to show the values. All colors between the min and max area will be detected.



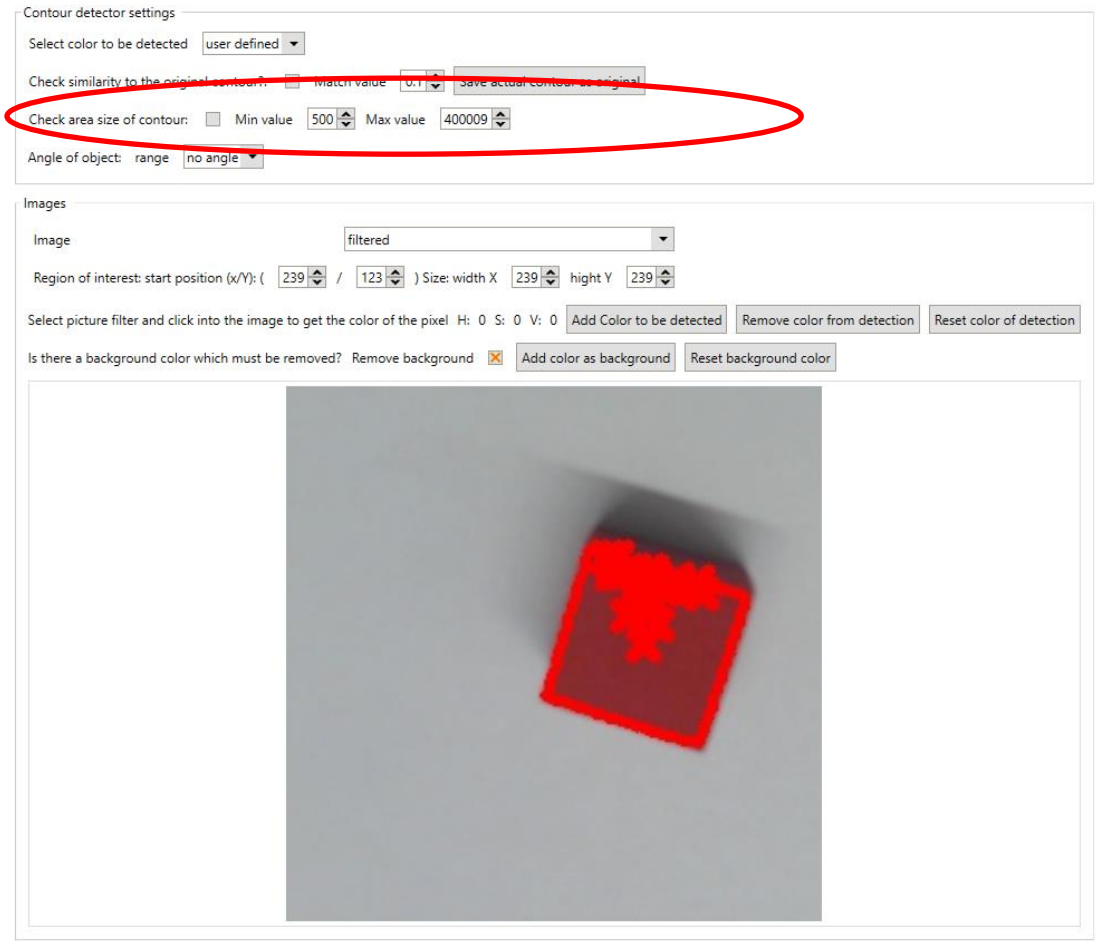



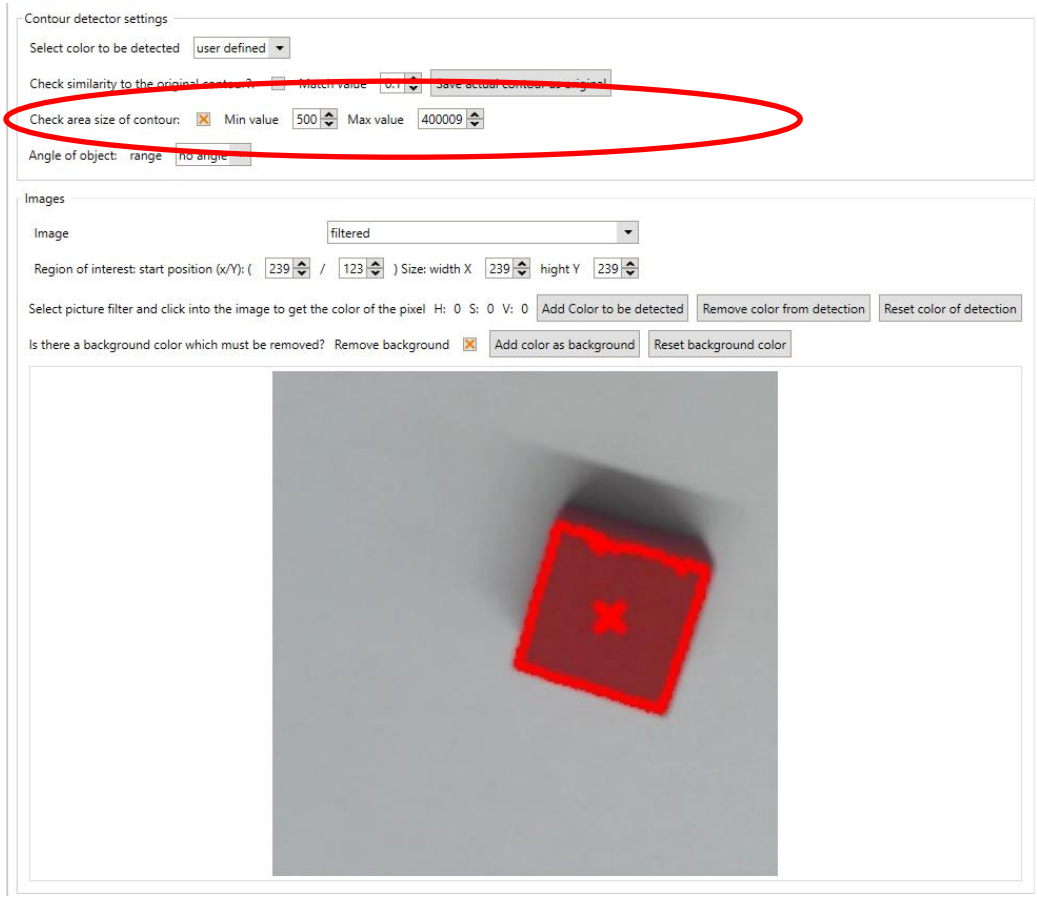
## 5.2 Define background color

In addition to the color that is detected, a background color can also be defined, which should be hidden. This is helpful if you have a multicolored object be recognized or the background is colored. You can activate the background removement by checking “Remove Background”. Afterwards you can add colors to the background by clicking on the pixel, like adding the colors to be detected, explained in 3.1.1.


## 5.3 Filter Object Size

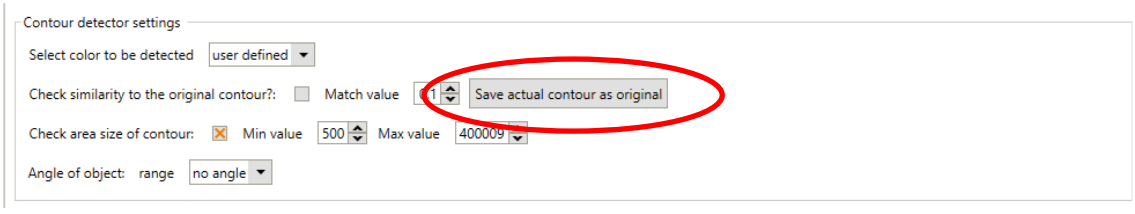
Contours can be filterd by area. Only contous which are between the min and the max area will be shown. If you want to activate this filter you have to check the checkbox. On the first picture you the contours are not filtered by area. On the second picture the contours are filtered to small contours will not be detected anymore.


Contour detector settings
Select color to be detected
user defined
Check similarity to the original contour?
Match value
0.7
Save actual contour as original
Check area size of contour:
Min value
500
Max value
400009
Angle of object:
range
no angle
Images
Image
filtered
Region of interest: start position (x/Y): (
239
/
123
) Size: width X
239
hight Y
239
Select picture filter and click into the image to get the color of the pixel
H: 0 S: 0 V: 0
Add Color to be detected
Remove color from detection
Reset color of detection
Is there a background color which must be removed?
Remove background
Add color as background
Reset background color

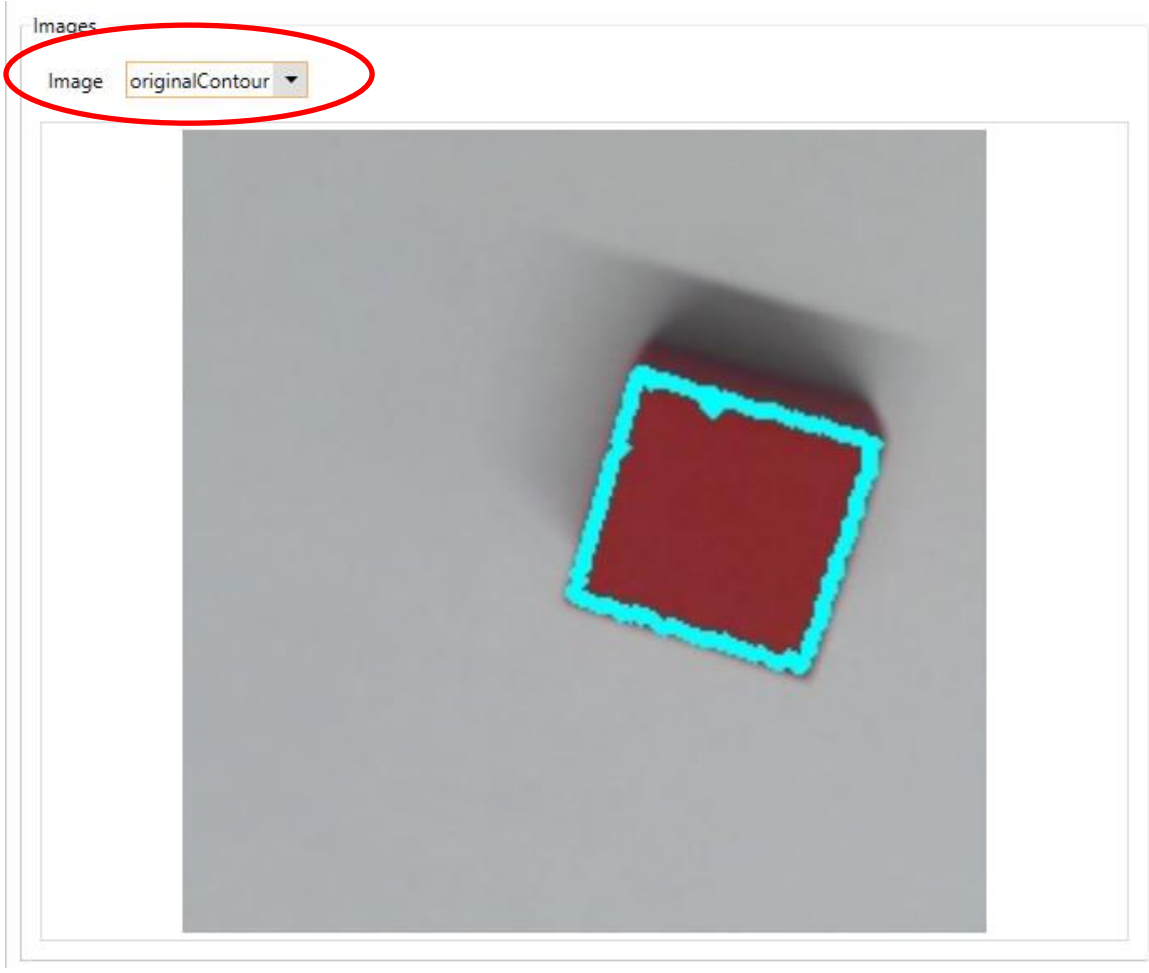



## 5.4 Define contours

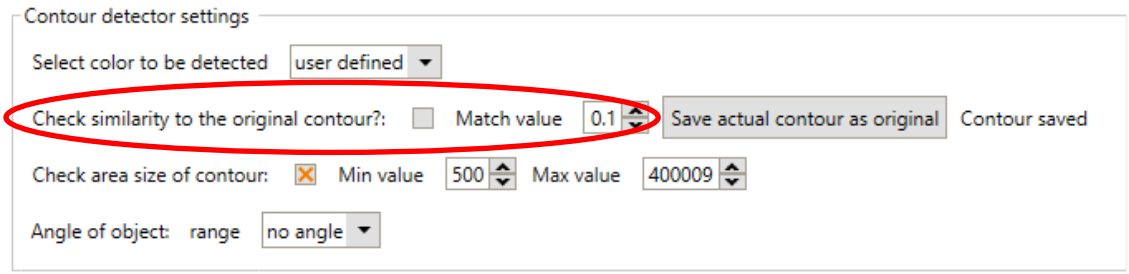
You can define contours and only search for contours, which are like the original contour. First you must save the original contour. Put the object under the camera and change the settings, like brightness, contrast, and color, until only the original contour is detected. Now click “Save actual Contour“.




“Contour saved“ will be shown if the contour is saved successfully. If you want to look at the save original contour select the image “original contour”.




Now you can compare every found countour with the original contour. Therfore you have to check „Check similarity to the original contour?". Afterwards only the contours which are like the original contour will be shown. You can change the match value to define how close the similariy must be. If the match value is close to 0, the founded objects must be nearly identical to be found.

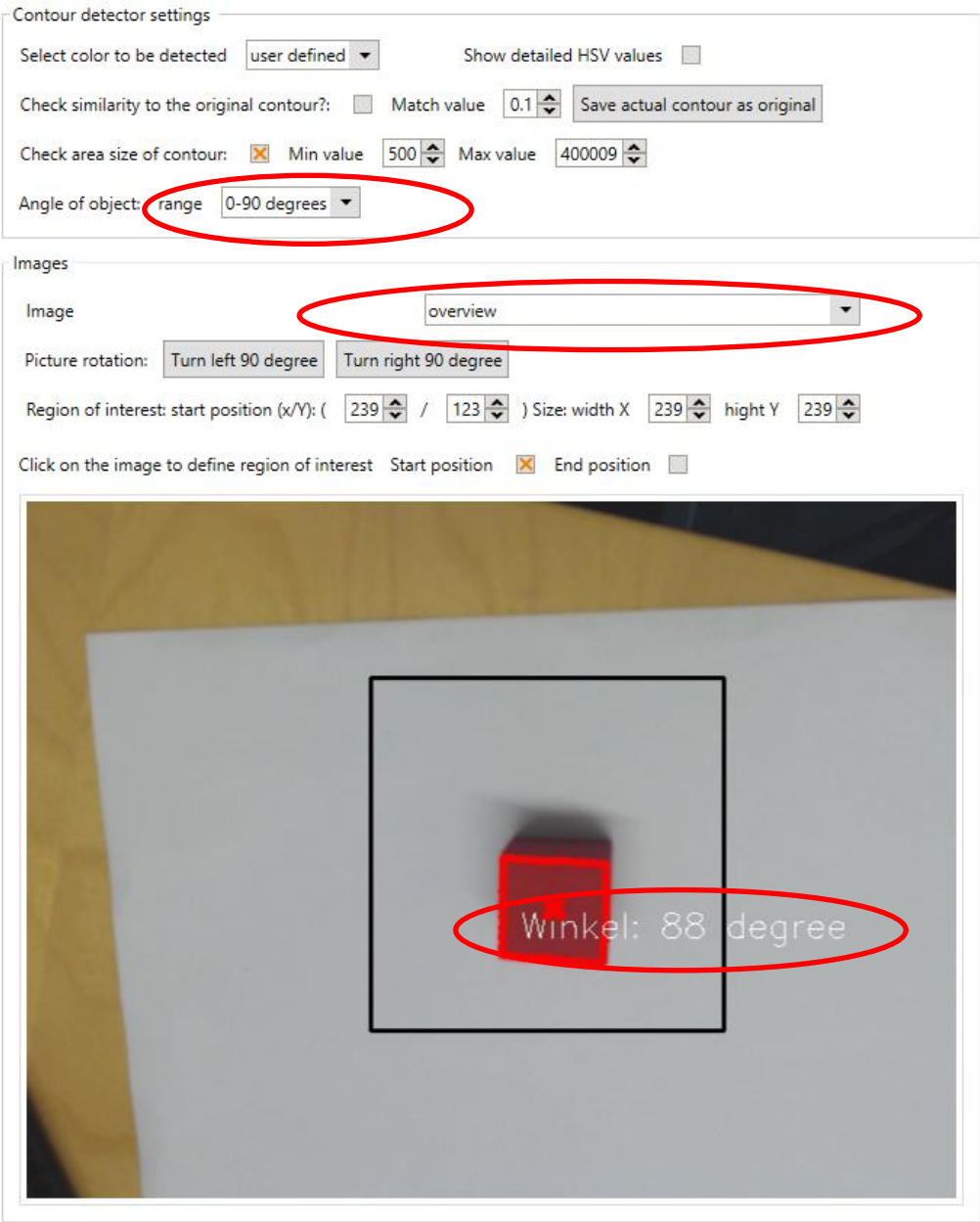



If no original contour is saved and you check the box, the box will be automatically unchecked after a short time.

## 5.5 Angle

If you need the angle of the object, you can select the range of the angle. If the object is symmetrical e.g. like a dice in 2D select 0-90 degrees, if it is symmetrical like a rectangle select 0-180 degrees. If you need the angle between 0-360 degrees because there are not any symmetries,

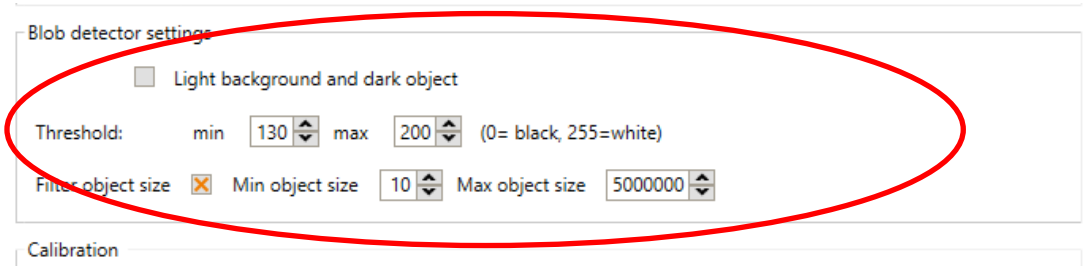
choose 0-360 degrees. Note that this setting is only possible if a original contour is saved (See 5.4). If you save the original contour, 0 degrees will be the position where the contour is saved.




## 6. Blob Detection

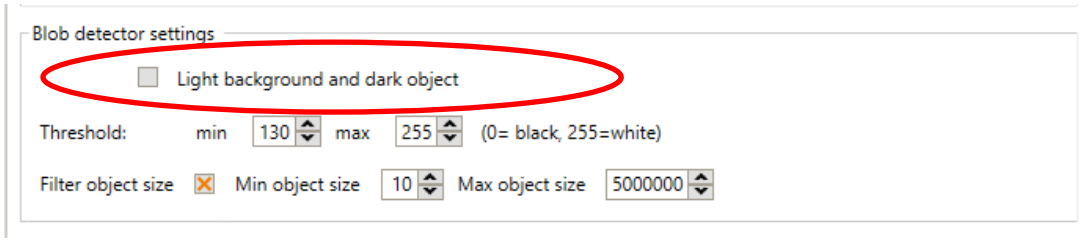
With Blob Detection you can detect Blobs same Greyscale Colors. If you want to use Blob Detection, you must choose Blob as Detection Mode.


The Blob Settings will appear.

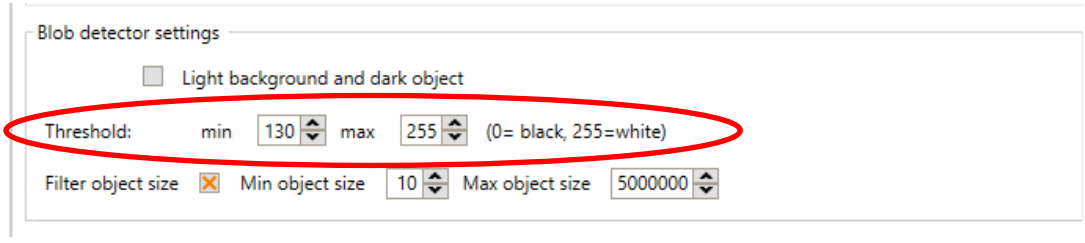



## 6.1 Color Settings

First you must choose, if you have a light object on dark background or a dark object on a light background. If you have a dark object and a light background, the image colors will be inverted.




The next Setting is the Threshold value of Detection. You have a Min and a Max Threshold.

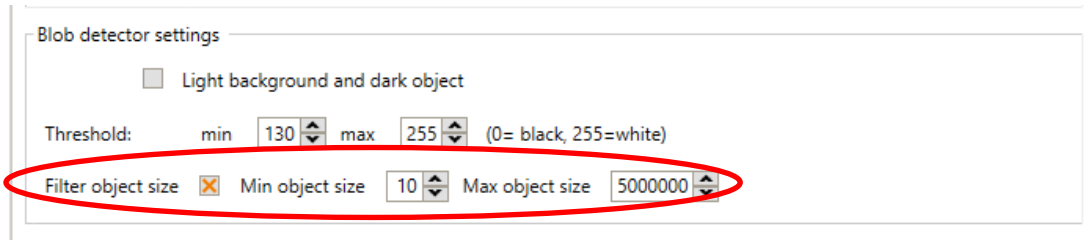



To Detects Blobs, the picture is converted to a binary image with the threshold value as limit. Every Pixel in the Picture lower the Threshold value is colored black, every value higher Threshold is colored white. Then the center of the white area is calculated. In the first iteration the threshold value is the min Threshold. In the second iteration the Threshold is minThreshold + 10. In the third iteration minThreshold +20 and so on. The Last Threshold used is MaxThreshold. For every created binarary picture the center of the white areas is calculated. If a center of an area in one picture is close to a center of an area in another picture this will be marked as a blob.

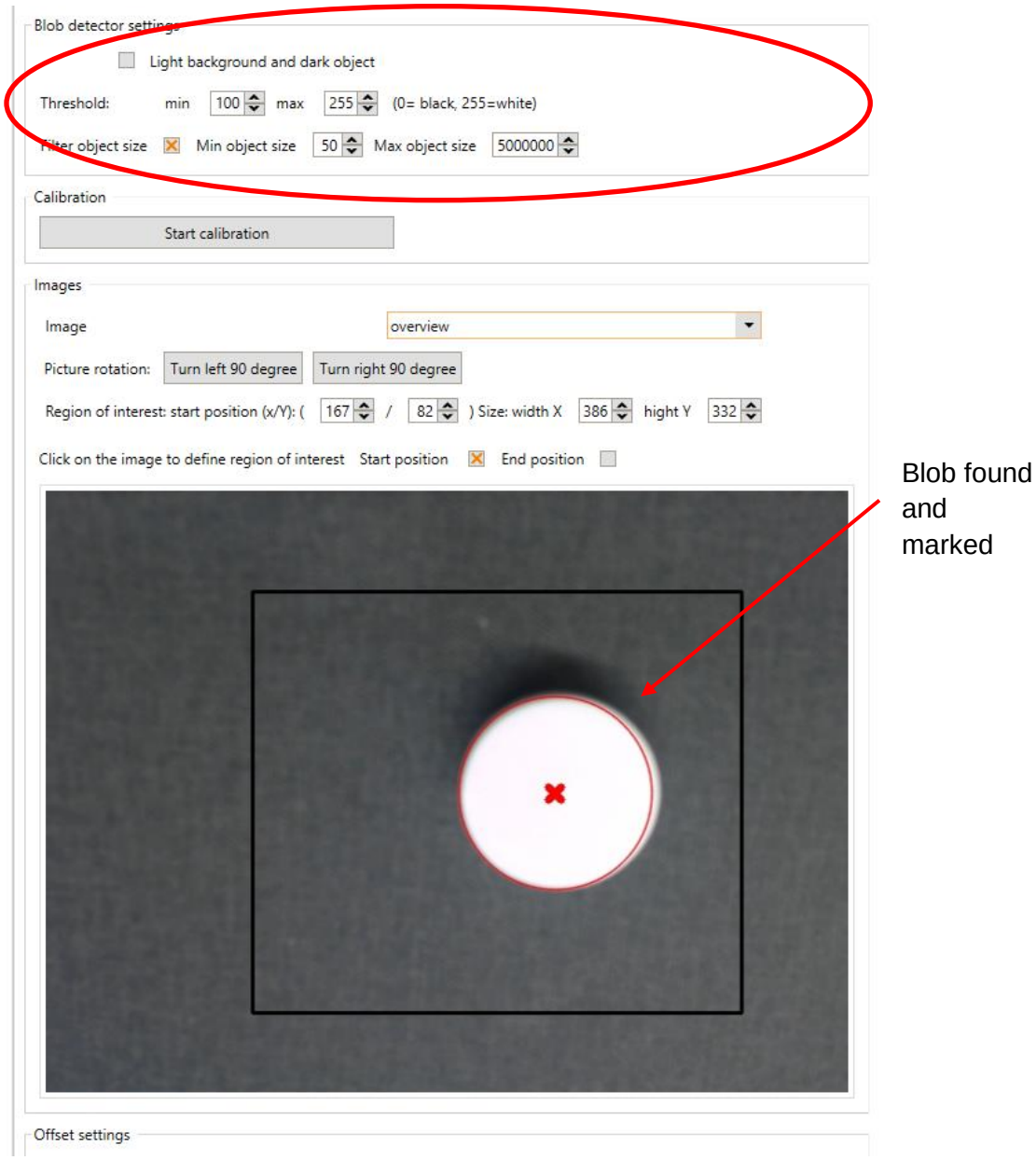
Another possibility to set Color is as described in Contour Detection by clicking on the image. This is described in 5.1.1.

## 6.2 Filter Object Size

The Last parameter you can change is the Filter of Object Size. If you want to filter the blobs with size, you can select the option and change the min and max object size. Afterwards only blobs with size between min and max will be shown.

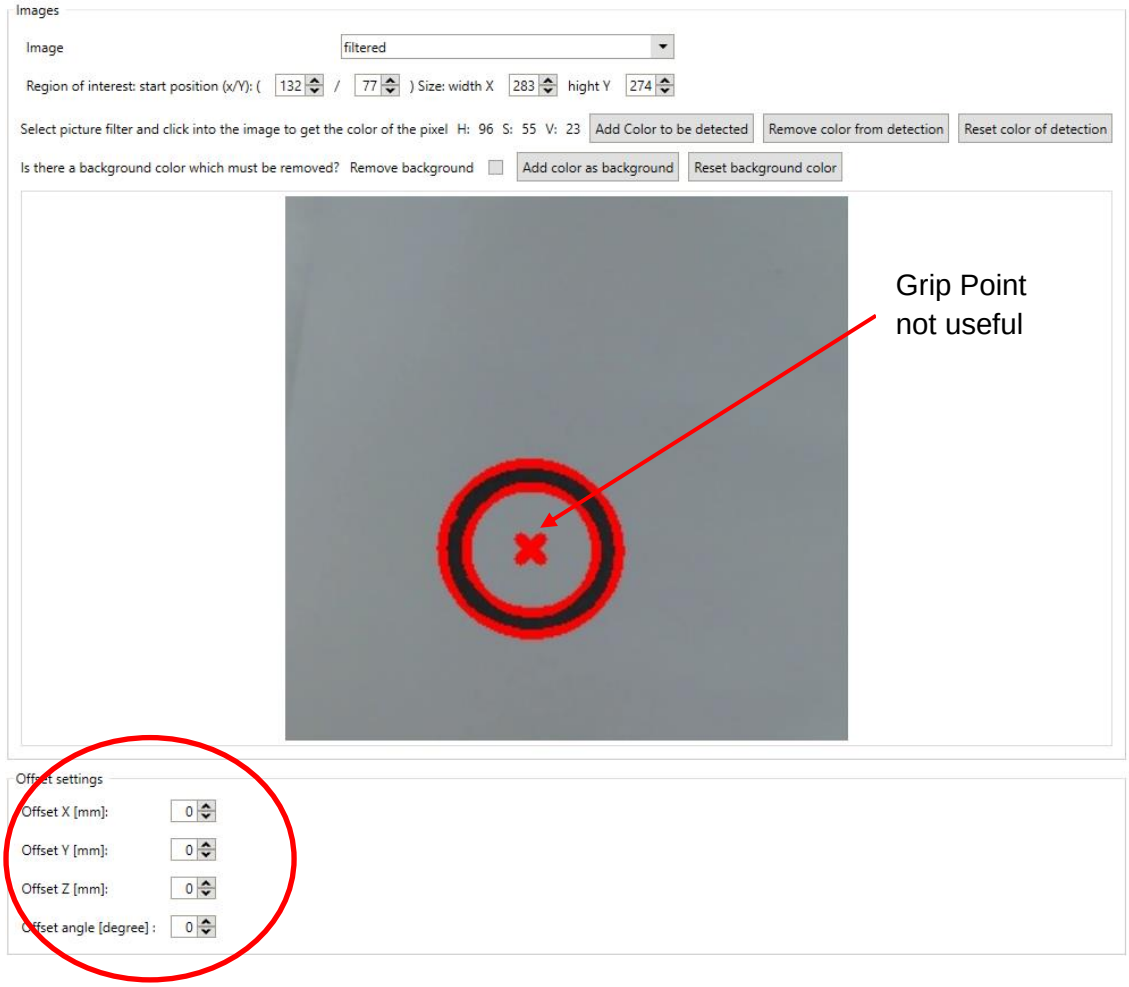


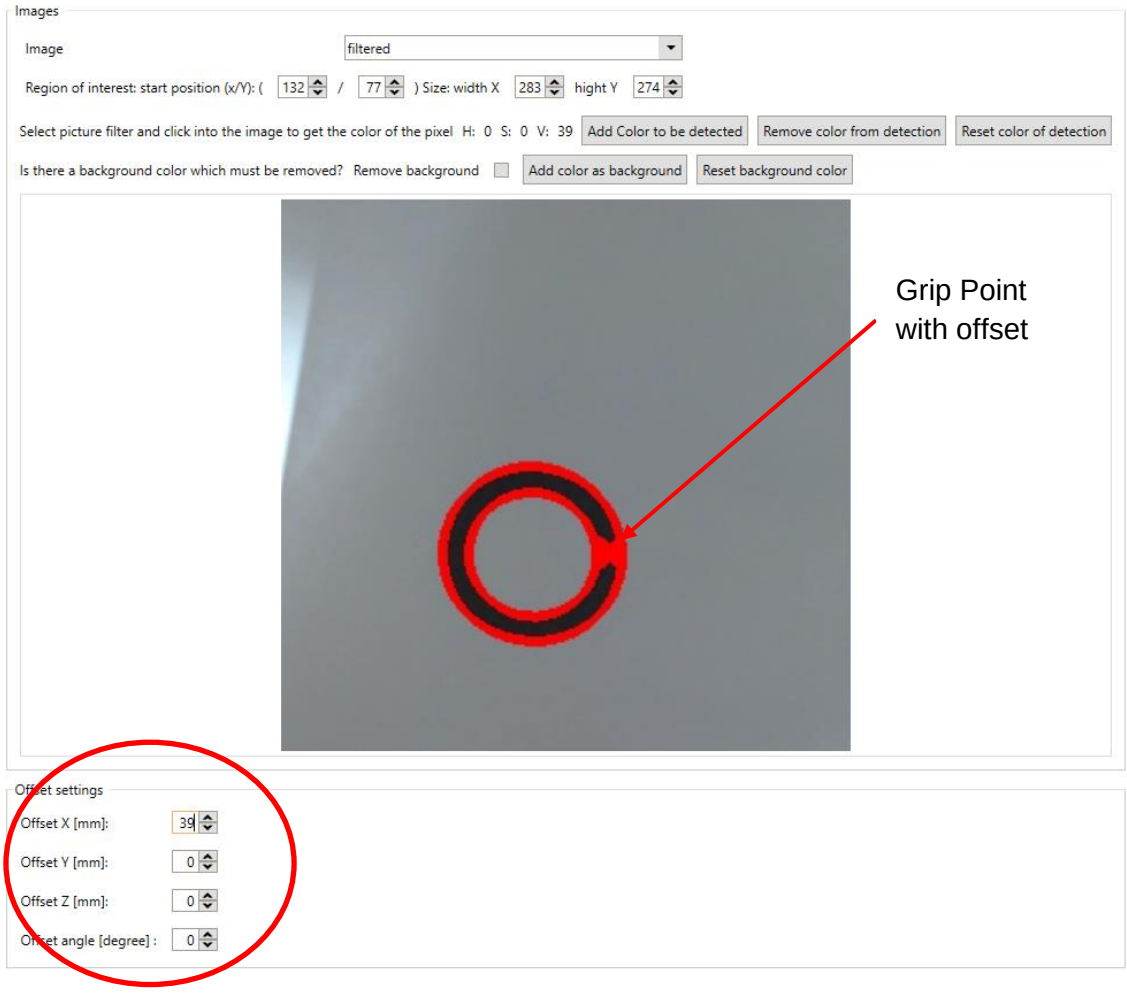

In the following picture you can see an example how to detect a white box on dark area.



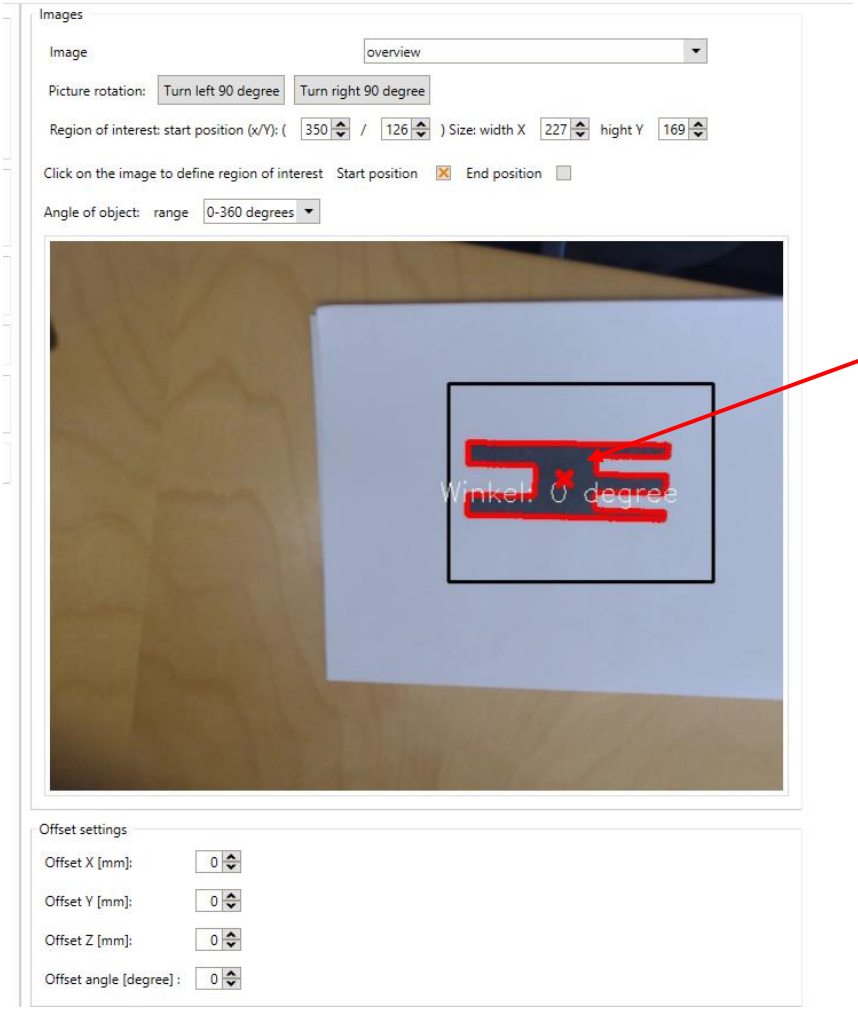
## 7. Offset

The dection gives you the center of the detected object. Sometimes objects can not be taken in the middle of the object, because there is a hole such as a ring. In that case it is necessary to change the Point with an offset. The offsets can be set in Group “Offset”. This offset will be added to your point.

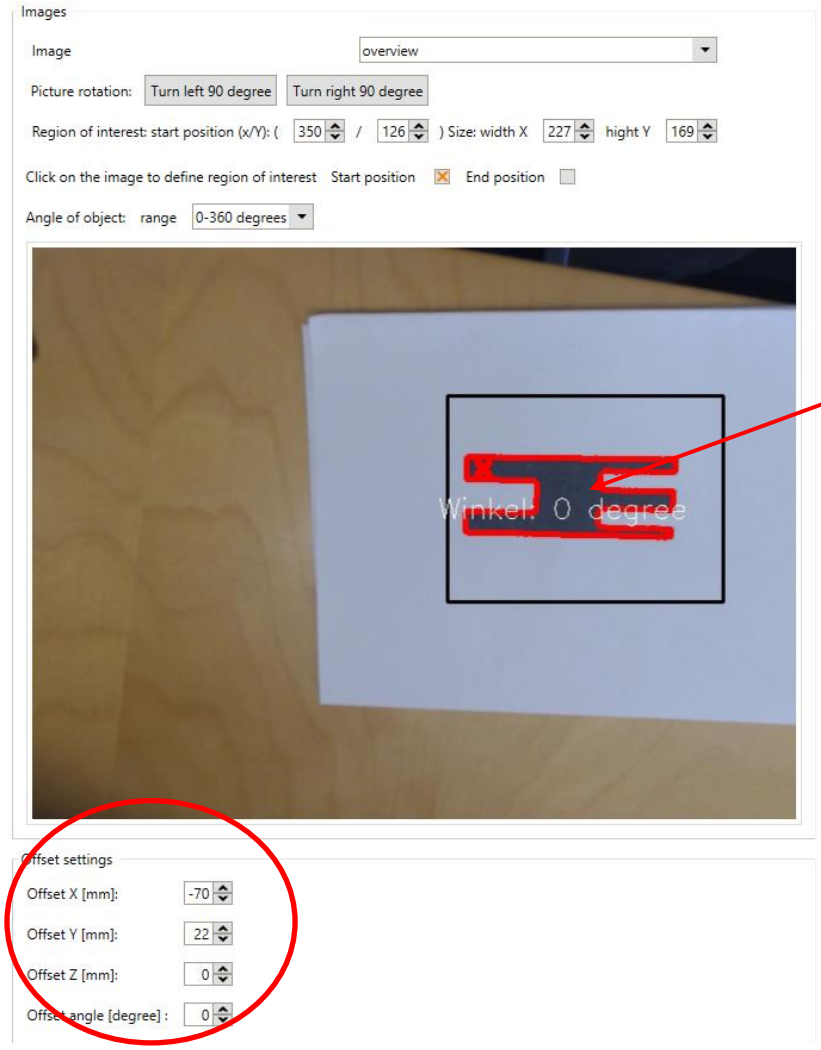




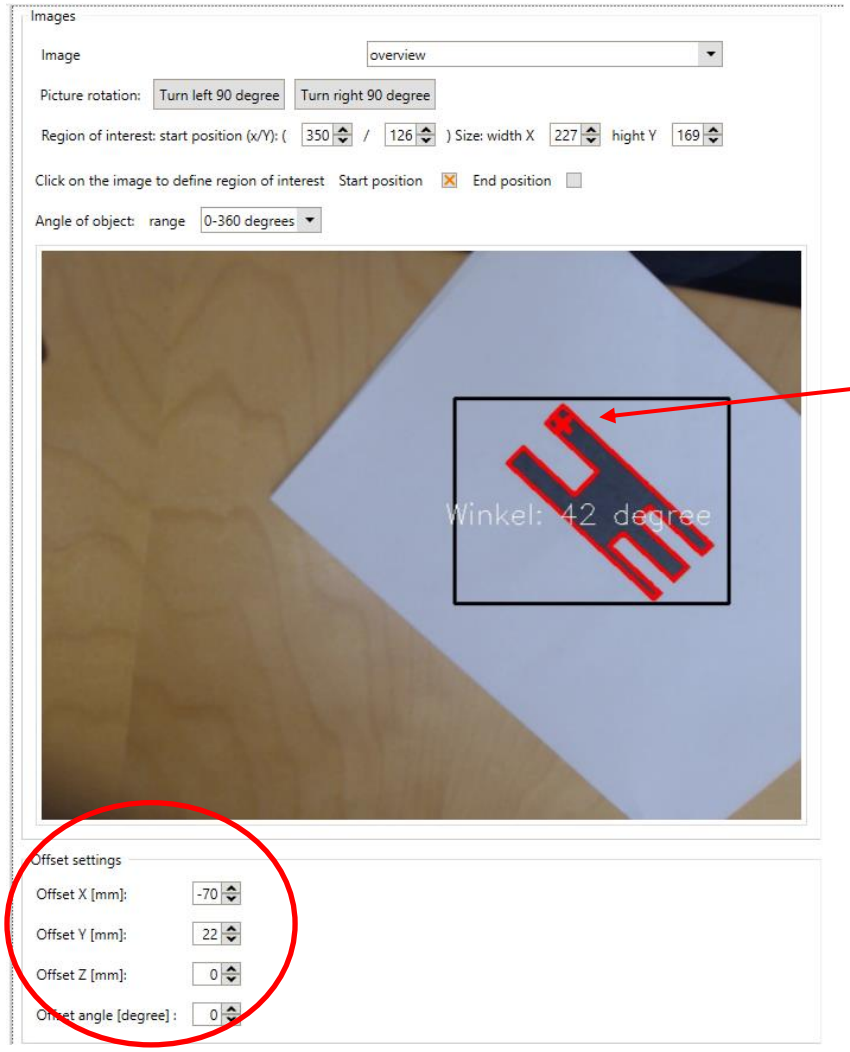

You can use this offset for z as well, if the calibration had a different z value as the object. If you select an angle, the Rotation of the object will be considered. This is shown in picture below.




Grip Point without offset



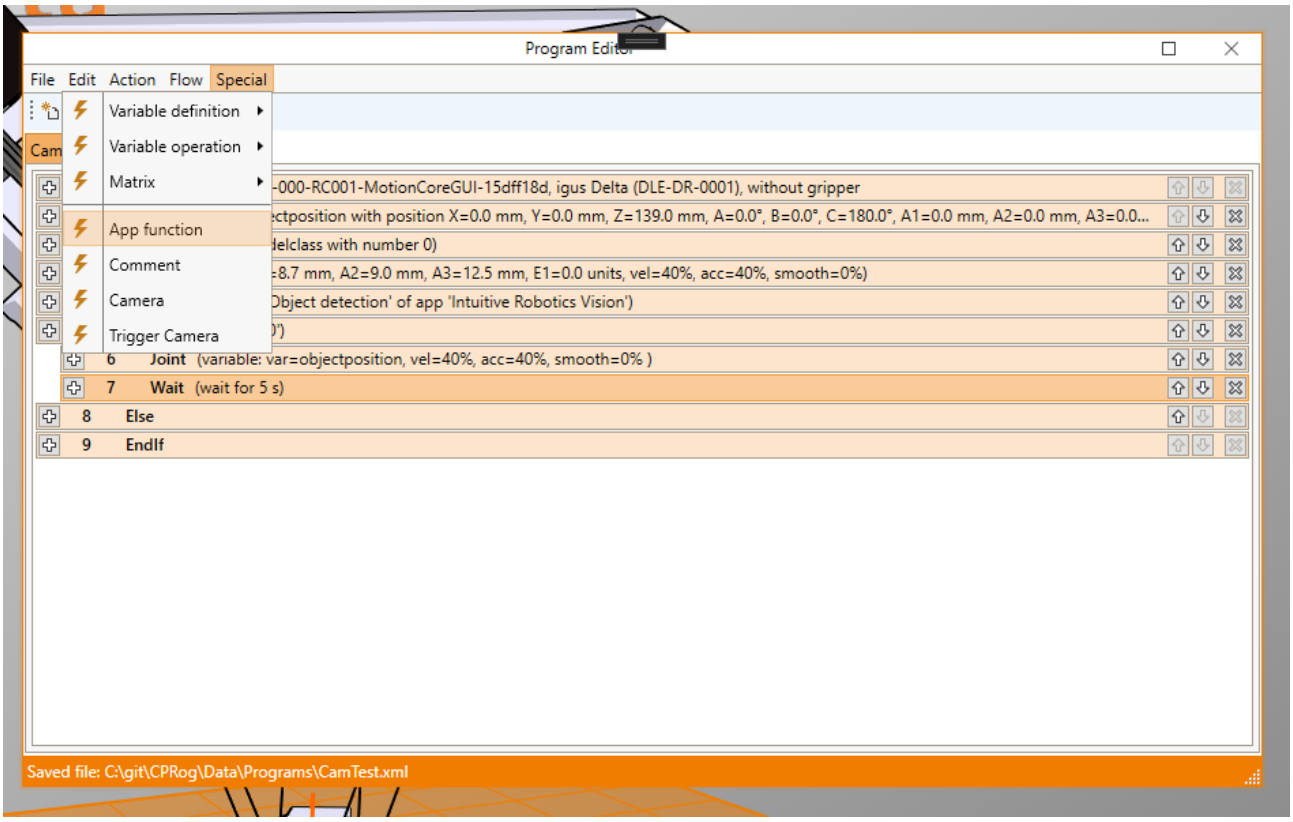

Grip Point with offset without rotation



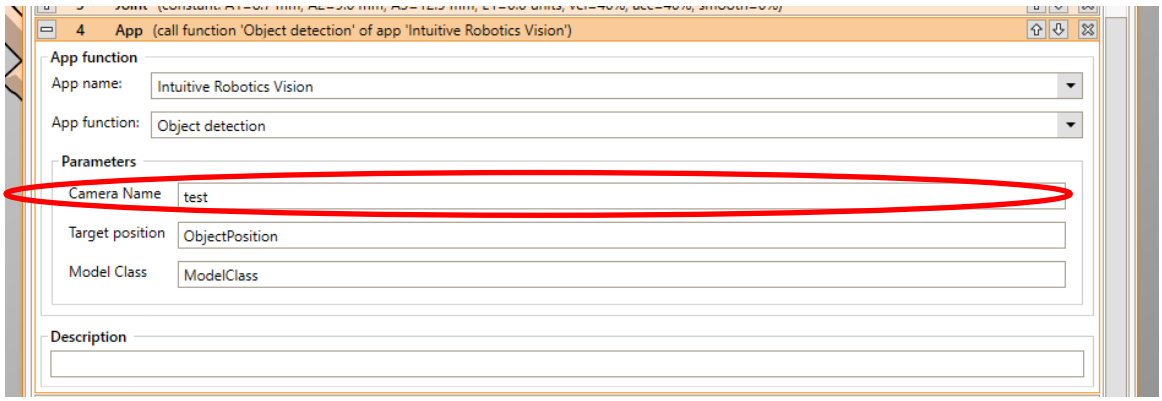

Grip Point with offset and rotation

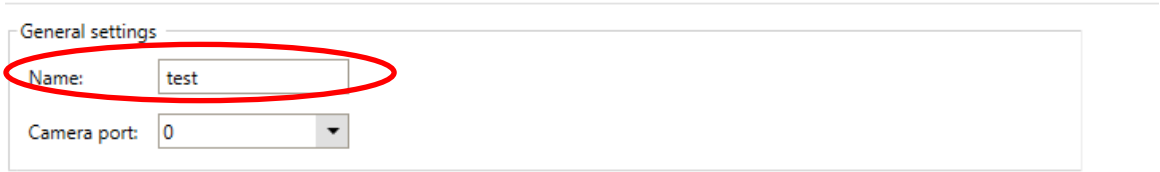
## 8. Programm

You can use the camera by adding a camera command.




There you can chose App and add Parameters. It is important that the Camera Name is the same as configured in the app.




The variable ObjectPosition gets the position with the configured Offset (see chapter 7) of the object if an Object is found. The Model Class is 1 if an Object is found.

Here is a short example where the robot moves to the position of the object, if an object is found.