



Contact Angle Goniometer

User Manual

Manual version: 1.1.A

Product code: L2004A1

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Software version: 1.2

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1. Safety

1.1 Warning

To avoid safety hazards, obey the following:

- Do not look directly into the backlight.
- Turn the backlight off when the system is not in use.

1.2 Caution

- Only use the device for the purposes intended (described in this document).
- If using within a shared workspace, position the backlight to point away from others.
- Take care to avoid trapping fingers while adjusting the tilt stage position.

2. Introduction

The Ossila Contact Angle Goniometer provides a fast, reliable, and easy method to measure the contact angle of a droplet on a surface. With its low price, compact size, and intuitive PC software - the barrier-to-entry is lowered, enabling more researchers than before to perform this useful and versatile measurement.

2.1 Component List

- Contact Angle Goniometer
- Tilt Stage Assembly
- 12V Power Supply
- USB cable
- Ossila Contact Angle Measurement Software

2.2 Specifications

2.2.1 Measurement Specifications

Angle range	5° to 180°
Max measurement speed	33 ms (30 fps)

2.2.2 Physical Specifications

Stage Dimensions	50 mm x 50 mm
Maximum Sample Width	25 mm
Overall Product Dimensions	Width: 95 mm Height: 170 mm Depth: 320 mm

2.3 Requirements

The system requires a computer running Windows (Vista or newer) with an available USB (recommended) or network port. Further details are given below:

Supported Operating Systems	<ul style="list-style-type: none"> Windows Vista, 7, 8, or 10
Monitor Resolution	<ul style="list-style-type: none"> The software requires a monitor resolution of at least 1920 x 1080
Power	<ul style="list-style-type: none"> The system requires a 12 V DC power supply. A power supply fitting this description is provided along with the system.
USB	<ul style="list-style-type: none"> To use the USB, your controlling device should support USB communication. A USB-B to USB-A cable is supplied with system. <p><i>NOTE: The USB connection does not supply power to the backlight.</i></p>

3. Getting Started

Connect the system to your computer using the USB cable provided. Next, plug in the power supply for the system and check that the backlight turns on.

3.1 Software Installation

- Run the file 'Ossila-Contact-Angle-Installer-1-2-x-x.exe' on the USB drive provided and follow the on-screen instructions to install the Contact Angle Software.
 - I. Alternatively, the software may be downloaded from:
<https://www.ossila.com/pages/software-drivers>

4. Recording a Video

Video recording is performed in the 'Capture' Tab located in the top left of the software.



Figure 4.1 Software Tabs (Capture and Analyse)

4.1.1 Recording Overview

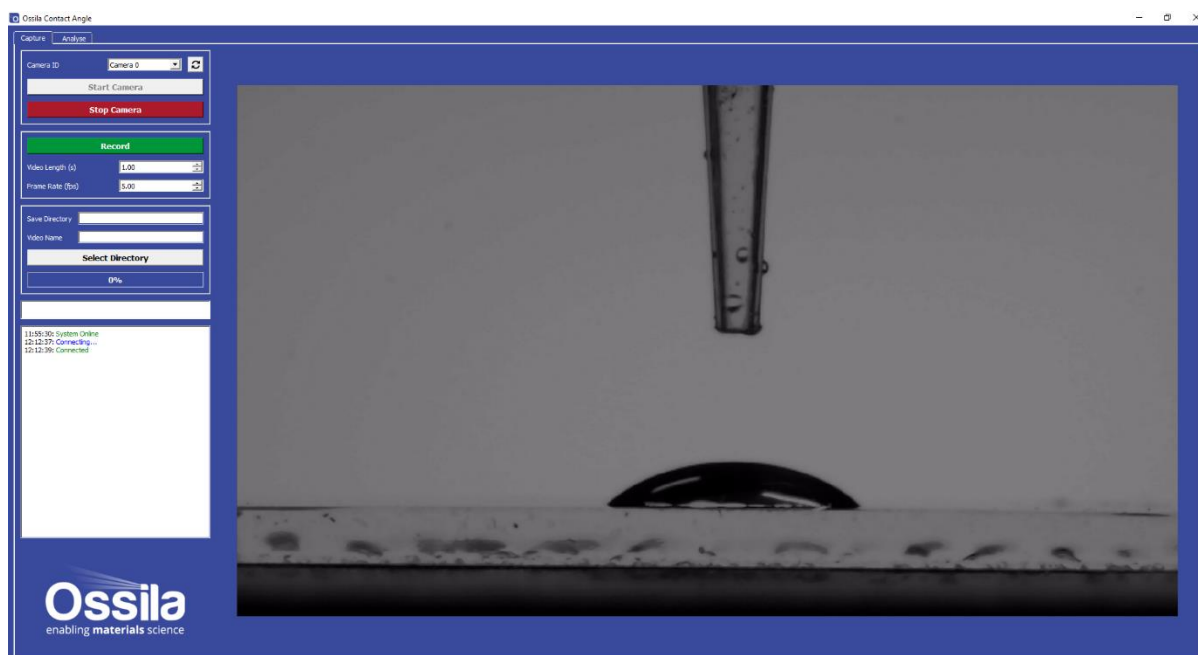


Figure 4.2 Capture Tab

To record a video, follow the instructions below. For more detailed information on individual settings, please see later in this section.

1. Open the Ossila Contact Angle software.
2. Click 'Start Camera'.
3. The image should appear on the right of the screen.
 1. If the image appears to be from another camera connected to your PC, simply select the next camera in the drop-down camera list.
4. Place your sample in the centre of the vertical tilt stage.
5. Adjust the stage height until sample can be seen in the bottom half of the image.
6. Twist the camera lens until the sample is in focus on the display.
7. Set a recording time and speed.
 1. Make sure that your video length takes into account the time it will take to dispense the droplet and any spreading time that you wish to observe.
8. Choose a save directory and video name.
9. Prepare to dispense a droplet.
10. Click record in the controls.
11. Dispense the droplet.
12. When you are finished taking recordings, press 'Stop Camera' to turn the camera off.

4.1.2 Camera Settings

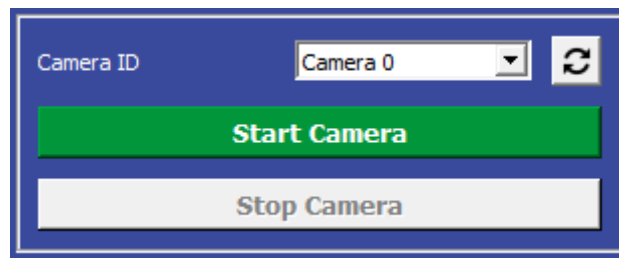


Figure 4.3. Camera settings.

(I) Camera ID

- Select the type of camera you are using.
 - I. The program will choose 0 (zero) by default, as it assumes that no other USB camera is connected to your computer

(II) Start Camera

- Attempts to connect and begin displaying video.

(III) Stop Camera

- Stops the video and disconnects from the camera

4.1.3 Recording Settings

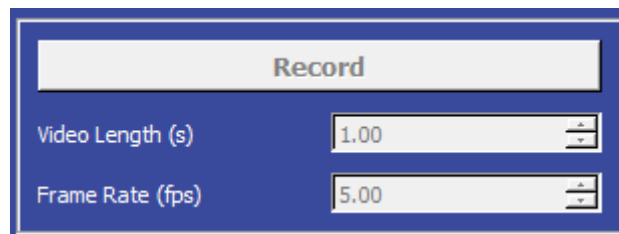


Figure 4.4 Recording Settings

(I) Record Button

- Begins recording.
 - I. Will save a set number of frames determined by the chosen video length and the frame rate.

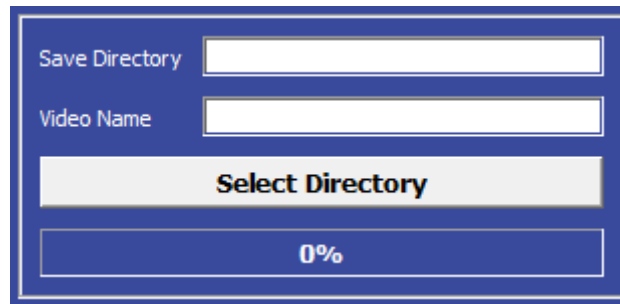
(II) Video Length

- Sets the total length of time to record for.
 - I. Default is 1 second.

(III) Frame Rate

- Sets the frame rate in frames per second.
 - I. Default is 5 frames per second.

4.1.4 Video Saving



The image shows a software dialog box for video saving settings. It has a blue border and contains the following elements from top to bottom: a text input field labeled 'Save Directory', another text input field labeled 'Video Name', a button with the text 'Select Directory', and a progress bar at the bottom showing '0%'.

Figure 4.5. Video Saving Settings

(I) Save Directory

- Sets the directory in which videos are saved.
 - I. Directory can be input manually, or selected using the 'Select Directory' button.
 - II. A folder named 'Videos' is automatically created in the chosen save directory.
 - III. Video files are saved as .avi files.

(II) Video Name

- Sets the name of the video file.
 - I. Video files are saved with the date and time included their file name, so videos recorded with the same 'Video Name' will not overwrite each other.

(III) Select Directory

- Opens a dialogue for choosing the save directory.

5. Measuring Contact Angle

Contact angle measurements are performed in the 'Analyse' tab located in the top left of the software.



Figure 5.1 Analyse Tab

5.1.1 Measurement Overview

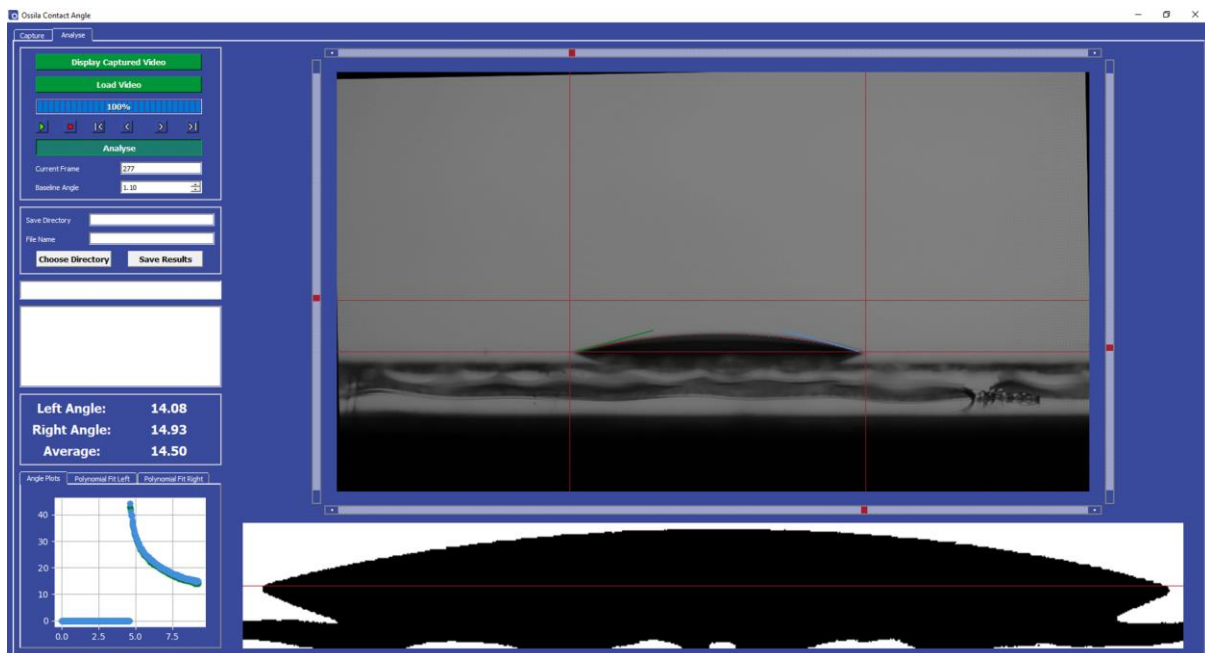


Figure 5.2 Droplet Analysis

To take a contact angle measurement, follow the instructions below. For more detailed information on individual settings, please see later in this section.

1. Open the 'Analyse' tab.
2. Select 'Display Captured Video' to display the most recently captured video, or 'Load Video' if you want to load a video from file.
3. The image will appear in the centre of the screen.
4. Use the video controls to navigate to a frame that has a droplet.
5. Adjust the sliders until the droplet is within the region of interest (ROI).
 - I. The baseline position magnified and displayed in the beneath the main video display.
 - II. Make sure that the bottom line is level with the base of the droplet.
 - III. If the image is slanted, or the stage was not completely level, you can adjust the baseline angle using the video controls.
 - IV. For further instructions on setting region of interest, see section 6 of this user manual.
6. Click 'Analyse'.
 - I. The software will fit a polynomial to the edges of the droplet within the ROI
 - II. The gradient of the fitted polynomial is compared with the baseline to calculate the contact angle
7. Click the play button.
 - I. The program will cycle through the frames in the video and fit a contact angle to the droplet in each frame.
 - II. The calculated angles are shown in the bottom left corner of the screen as a contact angle vs time plot.
8. Choose a directory and save the results.
 - I. The results are saved in a .csv file, which can easily be opened in any data analysis program.

5.1.2 Controls

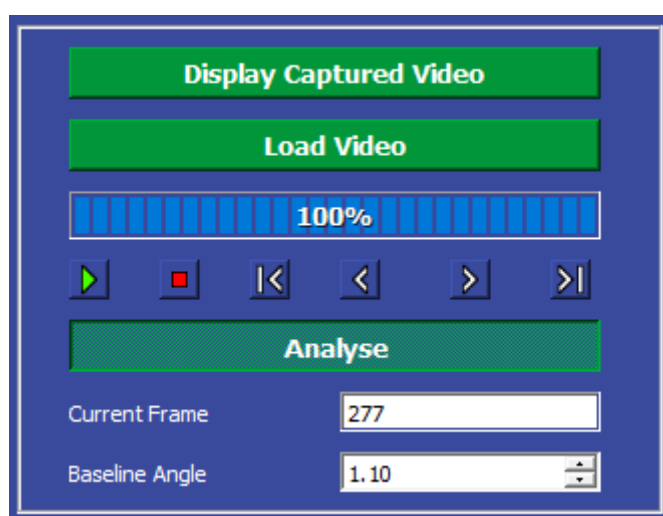


Figure 5.3 Video Controls

(I) Display Captured Video

- This displays the video that was taken in the capture section of the measurement. To load previously recorded videos, see the 'Load Video' section.

(II) Load Video

- This opens a dialogue box where you can select a video to load for analysis. Videos recorded using the Contact Angle software are saved in the .avi format.
 - I. Loading progress is displayed in the bar beneath the 'Load Video' button.

(III) Frame Controls



Figure 5.4 Frame Controls.

1. Play
 - I. Cycles through every frame in the video.
 - II. If 'Analyse' button is checked, the contact angle will be measured for each frame
2. Stop
 - I. If pressed after 'Play', the video will stop at the current frame
3. First
 - I. Displays to the first frame in the video
4. Previous
 - I. Displays to the last frame in the video
5. Next
 - I. Displays to the next frame in the video
6. Last
 - I. Displays the last frame in the video

(IV) Analyse

1. Toggles contact angle measurement for the displayed frames.

(V) Current Frame

1. Displays the index number of the frame being displayed.
 - I. The first frame in the video has an index of 0.

(VI) Baseline Angle

1. Rotates the image, effectively changing the angle between the horizontal baseline and the image on display.

5.1.3 Video Display

(I) ROI Sliders (Top, Left, Right, Bot)



- Sets the region of interest for the Contact Angle measurement.
 - This is displayed in the threshold area of the display.

(II) Video Display

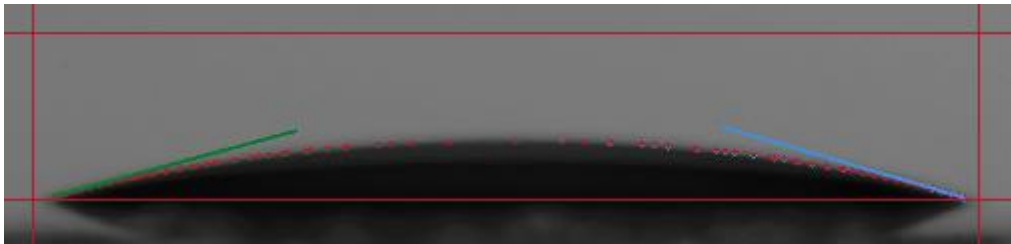


Figure 5.5 Video display with contact angle measurements shown.

- Displays the current frame of the video.

(III) Region of Interest (ROI)

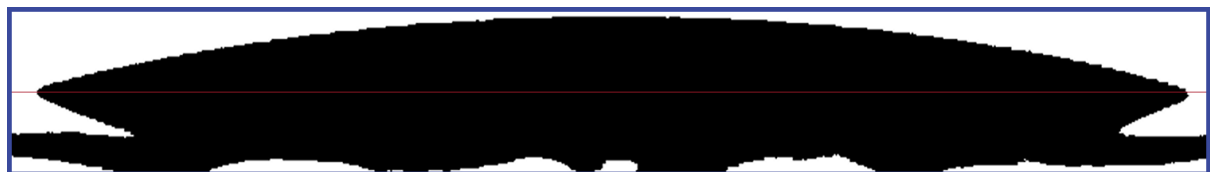


Figure 5.6 Region of interest.

- Displays the area above and below the baseline. A black and white threshold is applied for ease of use.

5.1.4 Data Saving

Save Directory

File Name

Choose Directory **Save Results**

Figure 5.7 Saved data destination controls.

(I) Save Directory

- Sets the directory in which videos are saved.

- I. Directory can be input manually, or selected using the 'Select Directory' button.
- II. A folder named 'Results' is automatically created in the chosen save directory.
- III. Result files are saved as .csv files.

(II) File Name

- Sets the name of the csv file.
 - I. Result files are saved with the date and time included their file name, so videos recorded with the same file name will not overwrite each other.

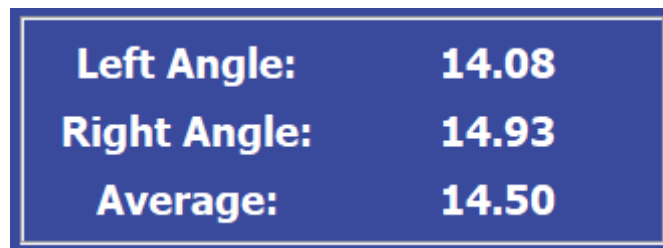
(III) Choose Directory

- Opens a dialogue for choosing the save directory.

(IV) Save Results

- Saves the results to file.

5.1.5 Results Display



The image shows a screenshot of a software window with a dark blue background and white text. The window displays three rows of data: 'Left Angle: 14.08', 'Right Angle: 14.93', and 'Average: 14.50'. The text is bold and centered within the window.

Left Angle:	14.08
Right Angle:	14.93
Average:	14.50

Figure 5.8 Contact angles display.

(I) Left Angle, Right Angle

- Shows the measured contact angle in the current frame for the left and right sides of the droplet.

(II) Average

- Shows mean average of the left and right angles.

5.1.6 Result Plots

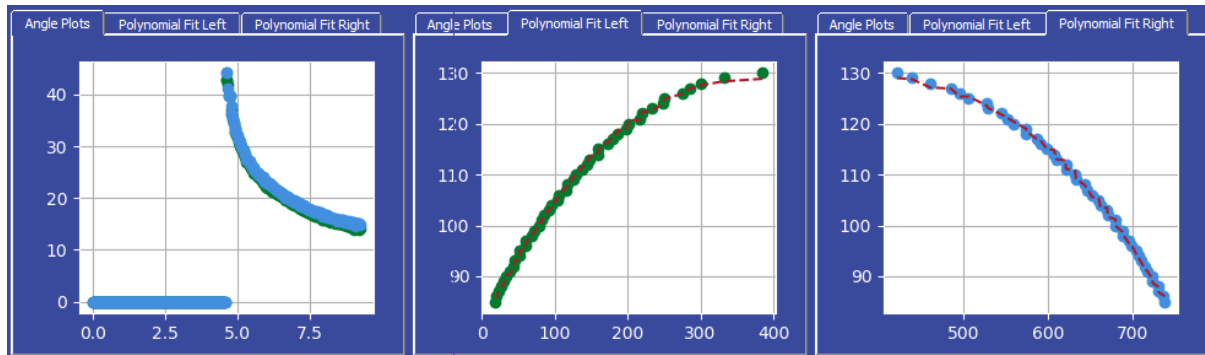


Figure 5.9 Result plots. From left to right: Contact angle vs time, left angle polynomial fit and edge detection, right angle polynomial fit and edge detection.

(I) Angle Plots

- Plots the angles measured vs time for the currently selected video.

(II) Polynomial Fit Left, Polynomial Fit Right

- Plots the detected edge of the droplet in XY coordinates, along with its polynomial fit for the current frame.

6. Advanced Guide

6.1 Region of Interest (ROI)

The region of interest is set using the four sliders in the 'Analyse' tab. Figure 6.1 shows the sliders as they appear on a droplet image. The sliders can be dragged over large distances, and fine-tuned using the arrows on either end of the slider bars.

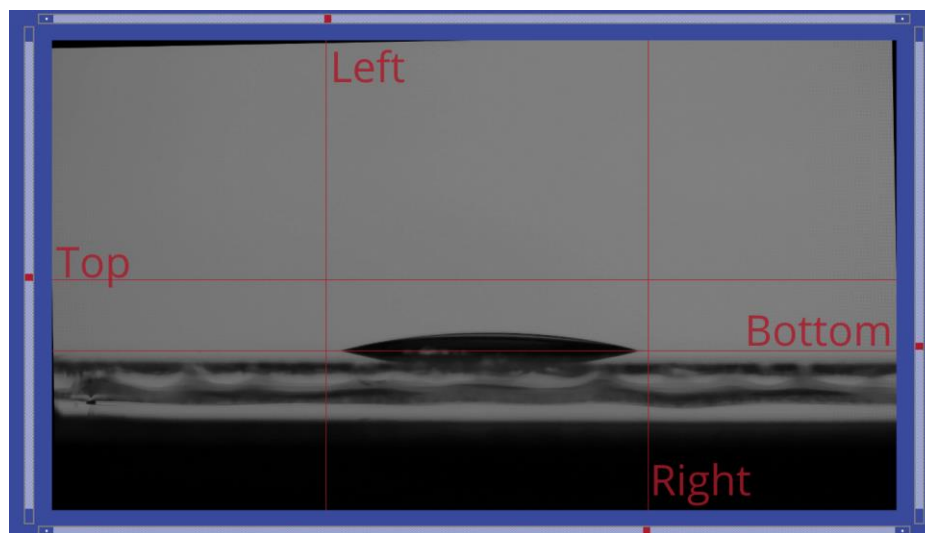


Figure 6.1 Region of interest sliders.

6.1.1 Bottom Slider

The most important line is the bottom, as this defines the baseline of the measurement. A useful method for determining baseline position is to use the point of reflection of a droplet on a surface. Figure 6.2 shows a droplet reflecting on its substrate. The corners of this image are used to position the baseline. Only the part of the image above the baseline will be used in the polynomial fitting and resultant contact angle calculations.



Figure 6.2 Baseline fitting using the reflection of a droplet.

6.1.2 Left and Right Sliders

The left and right sliders are mainly used to exclude any unwanted features from the image. If there is a second droplet on the same substrate for instance, this should not be inside the region of interest.

6.1.3 Top Slider

The top slider is used to tweak the polynomial fit onto a droplet. For droplets with larger angles, the curvature of the droplet edge can result in a poor polynomial fit. To prevent this, the top slider can be lowered beneath the top of the droplet. The polynomial fit can be seen on both the main image and the plots in the bottom left of the screen.

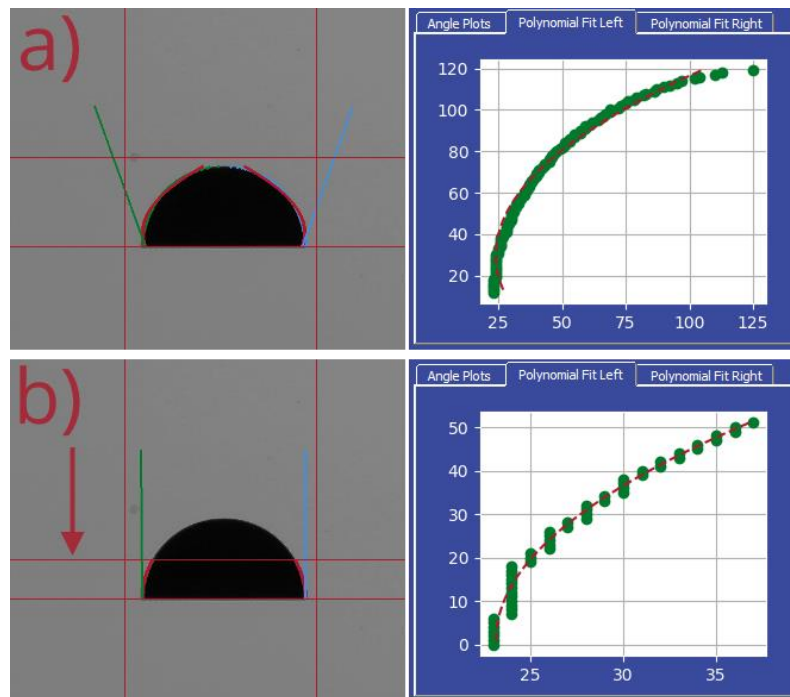


Figure 6.3 The effect of top slider placement, showing a) a poor polynomial fit of the entire droplet edge and b) a good polynomial fit, due to a lowered top slider.

7. Troubleshooting

Before we send you your system, we run extensive tests to verify that it is stable and working. However, sometimes you may have issues connecting to and using the system. Most of the issues that may arise will be detailed here. Please don't hesitate to contact us by email at info@ossila.com and we will respond as soon as possible.

Problem	Possible Cause	Action
Backlight not turning on.	The power supply may not be connected properly.	Ensure the system is firmly plugged into the power supply and the plug is connected to both the adaptor and a working power socket.
	The power supply adaptor has a fault.	Contact Ossila for a replacement power supply adaptor.
Software does not start	The wrong version of Windows is installed on the computer.	Install the software on a computer with Windows Vista or newer.
	The software has not installed properly.	Try reinstalling the software.
Cannot detect the camera.	The USB cable may not be connected properly.	Ensure the USB cable is firmly plugged in at both ends.
	The USB cable may not be connected to a working USB port.	Try connecting the system to a different USB port on the computer.
	The USB cable is defective.	Try using a different USB cable (any should work) and contact Ossila if necessary.

8. Revision History

Rev	Date	Description
A	Sep 2018	Initial version.