



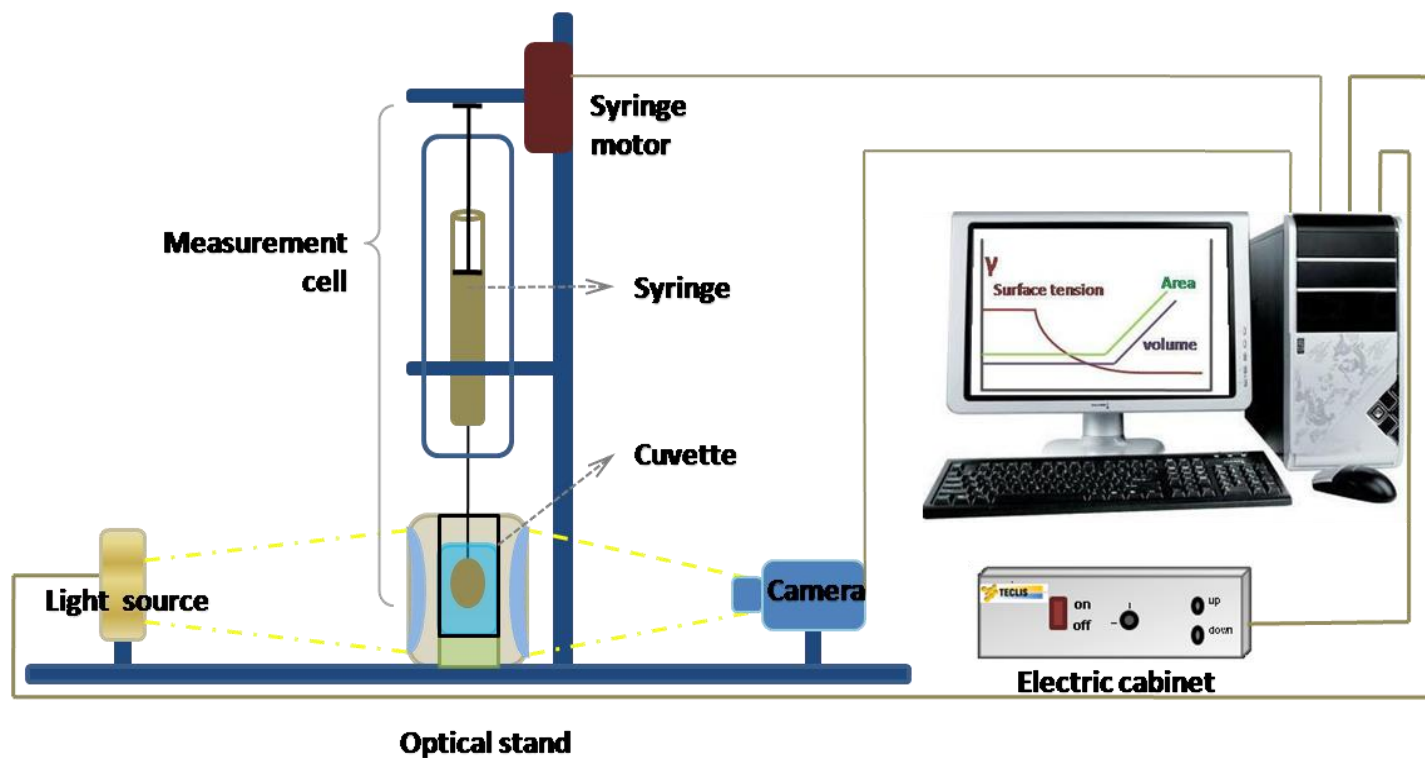
QUICK REFERENCE GUIDE: TRACKER

Tracker



- Overview
- Tracker Calibration
- Cleanness of the apparatus
- Tension measurement
- Contact angle measurement

Overview



Tracker Set up



1. Turn on the computer
2. Turn on the electronic unit
3. Launch the WinDrop software
4. Choose a *.cfg file

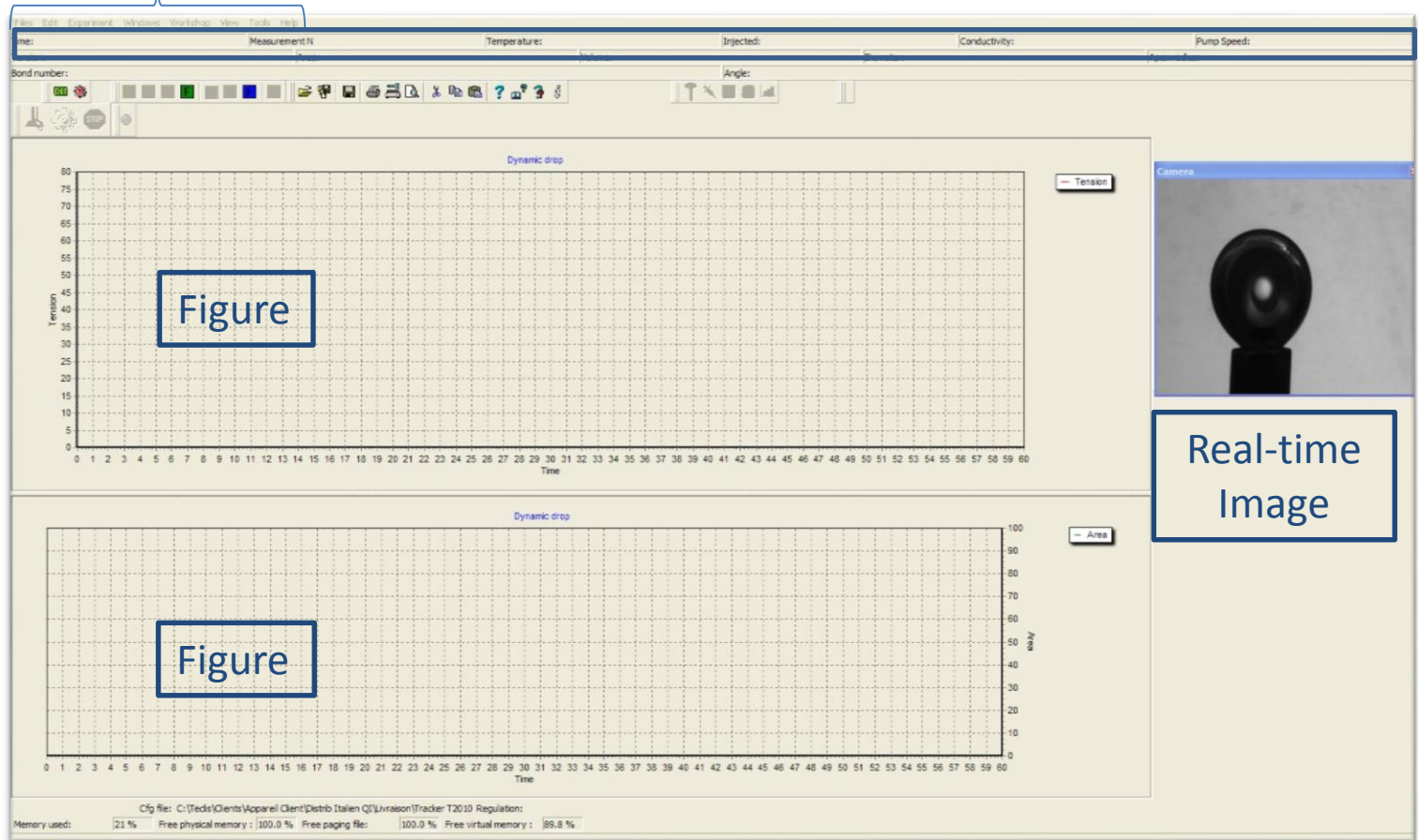
Note: All parameters are saved in the configuration file

Software



Menu

Real-time calculation



Tracker

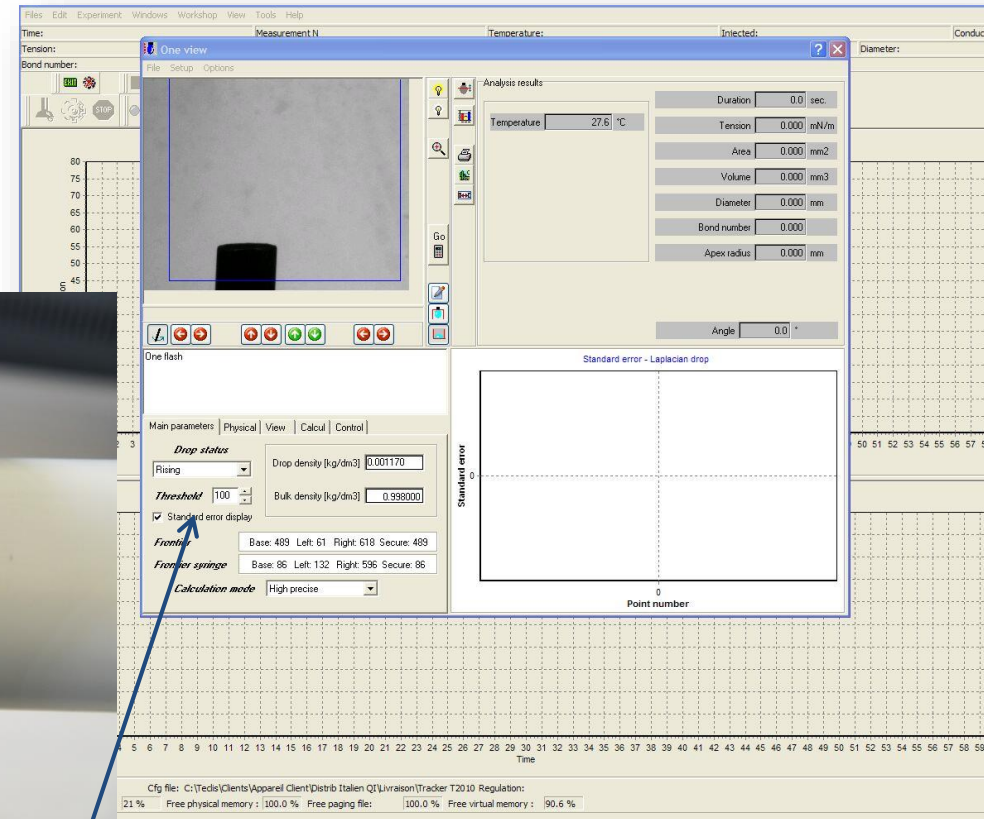
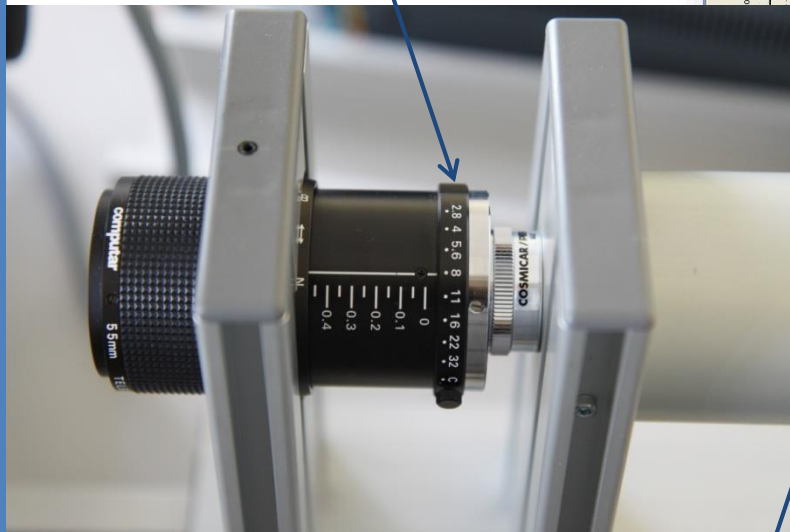


- Overview
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Check before measurement

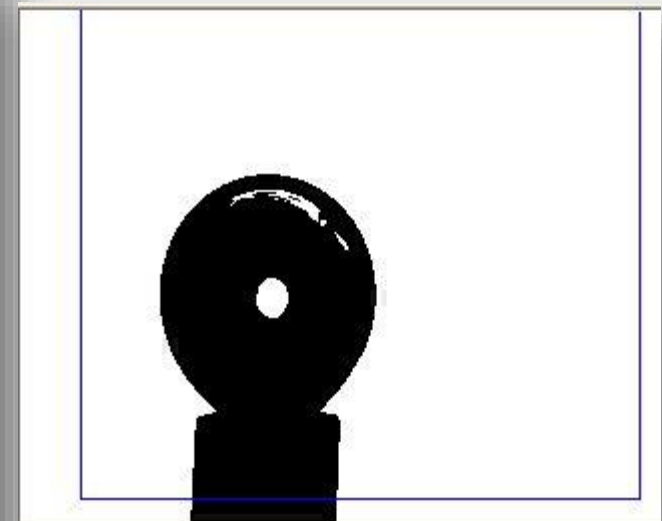
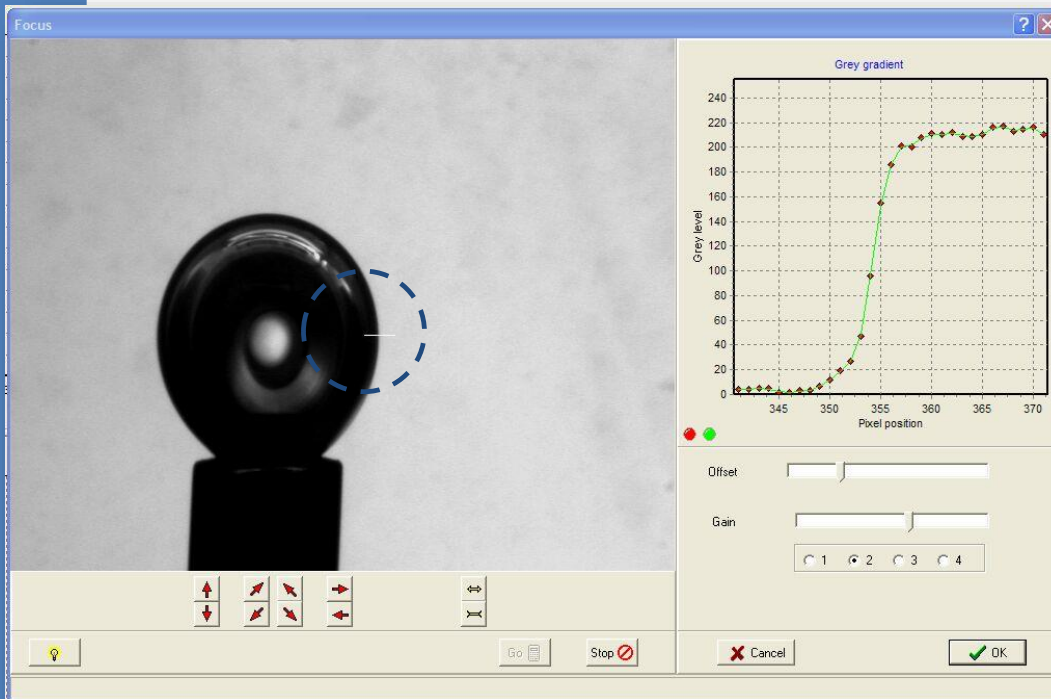


Lens aperture (between 8 and 16)



Threshold: 100

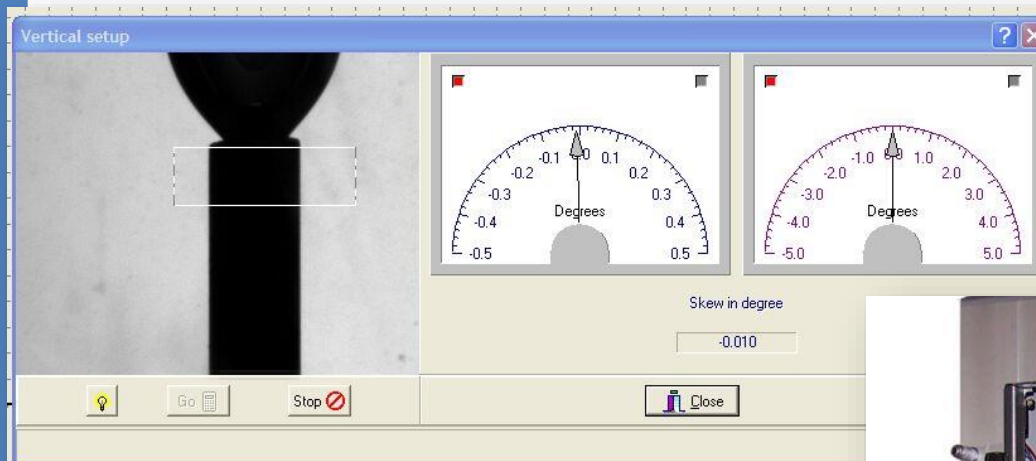
Focus



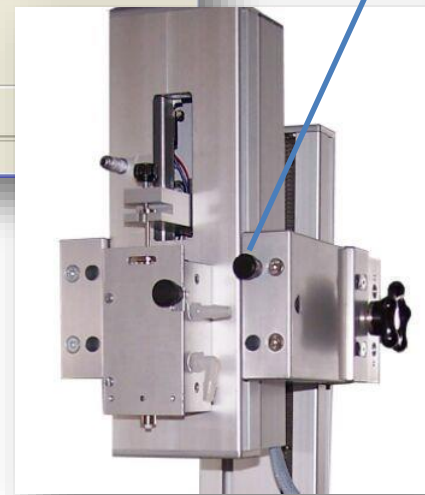
Black-and-white camera

Focus is very important for bubble contour extraction
The black must have a gray level between 0-20
The white must have a gray level between 200-220
The slope must be as abrupt as possible (sharpness)

Needle verticality



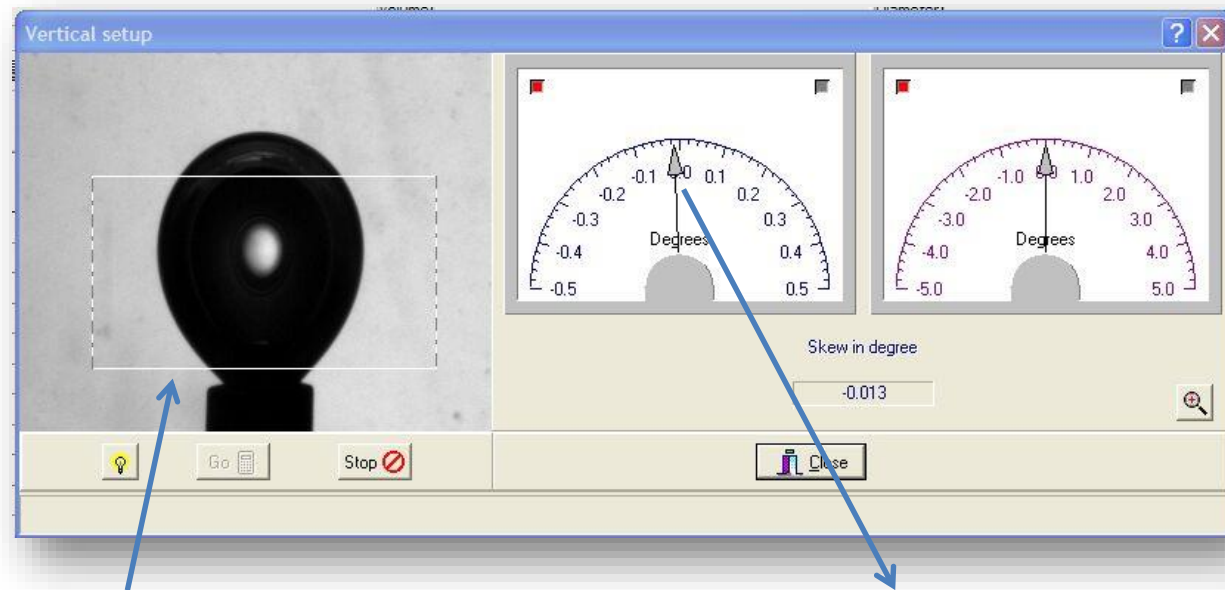
Knob to adjust the verticality of the syringe driver



Tracker Level



Control the camera level with an air bubble



Draw a rectangle around the bubble without touching the needle as shown on the picture

Level the base by adjusting the screw behind the unit until the angle reaches 0

Tracker Level



Tracker adjustment

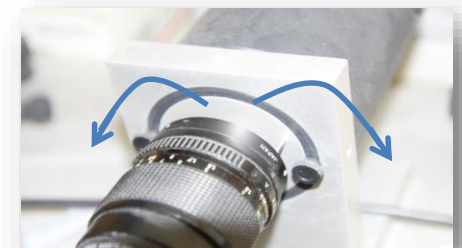


Screw



On new models

On old models

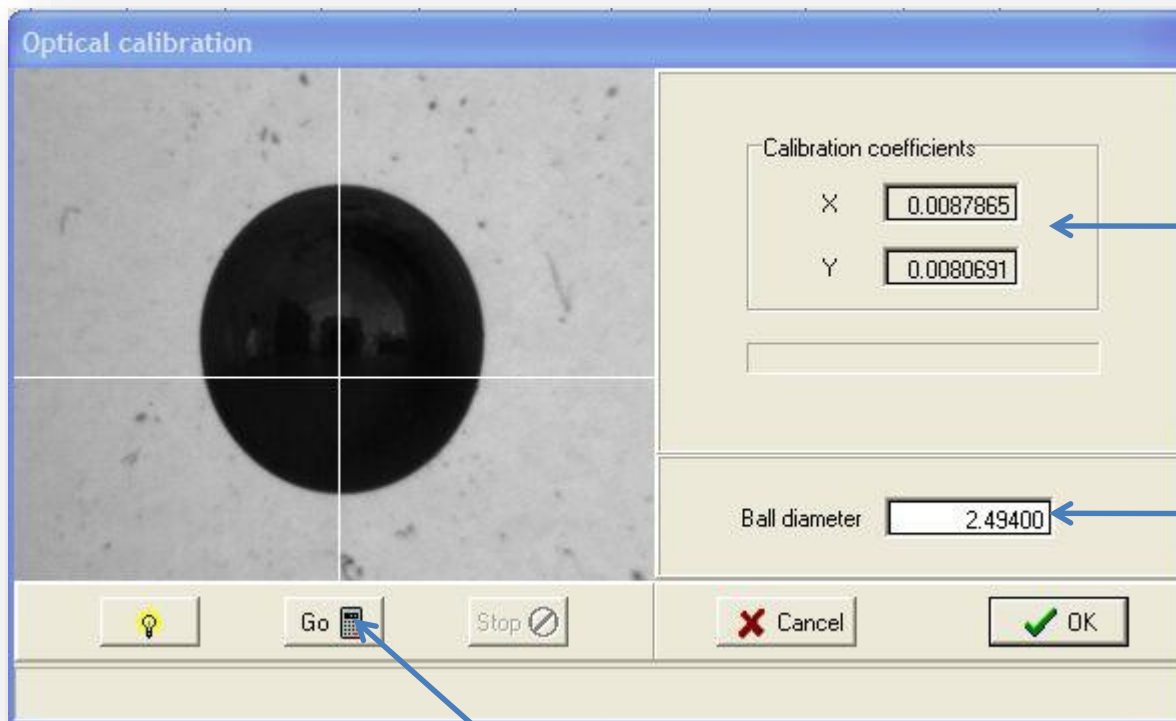


Optical Calibration



The bright axis must be placed at any point in the black area

The calibration must be performed after any change of the lens setting or if the apparatus is moved

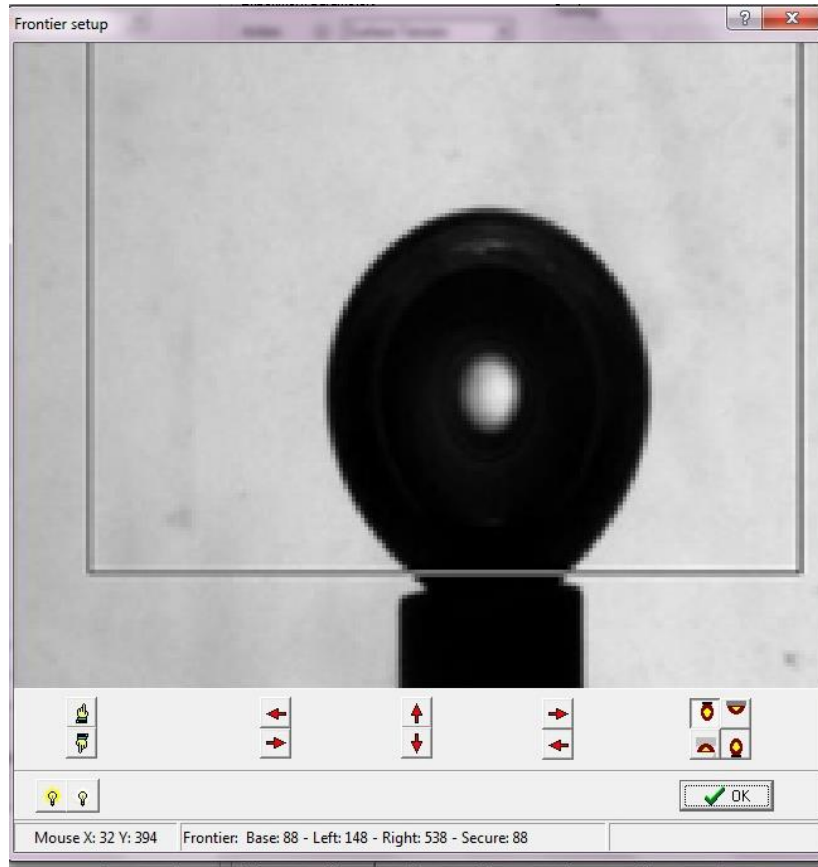


Pixel Size

Ball diameter

To launch the calibration

Frontier Setup

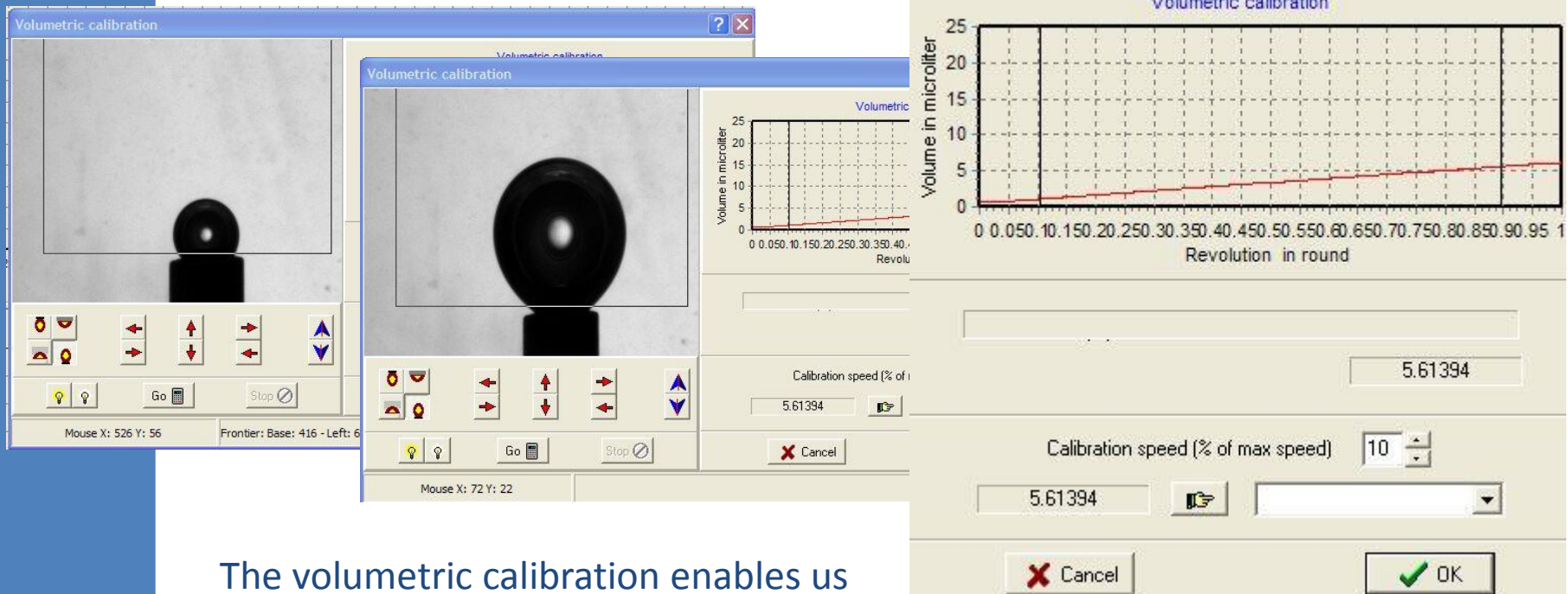


Depending on the configuration chosen, the frontier has to be set up around the bubble without touching the needle as shown on the picture

Volumetric calibration



Determine the drop volume according to motor rotation rate and the syringe used



The volumetric calibration enables us to control the amplitude when volume oscillations are applied.

Tracker



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Cleanness of the apparatus



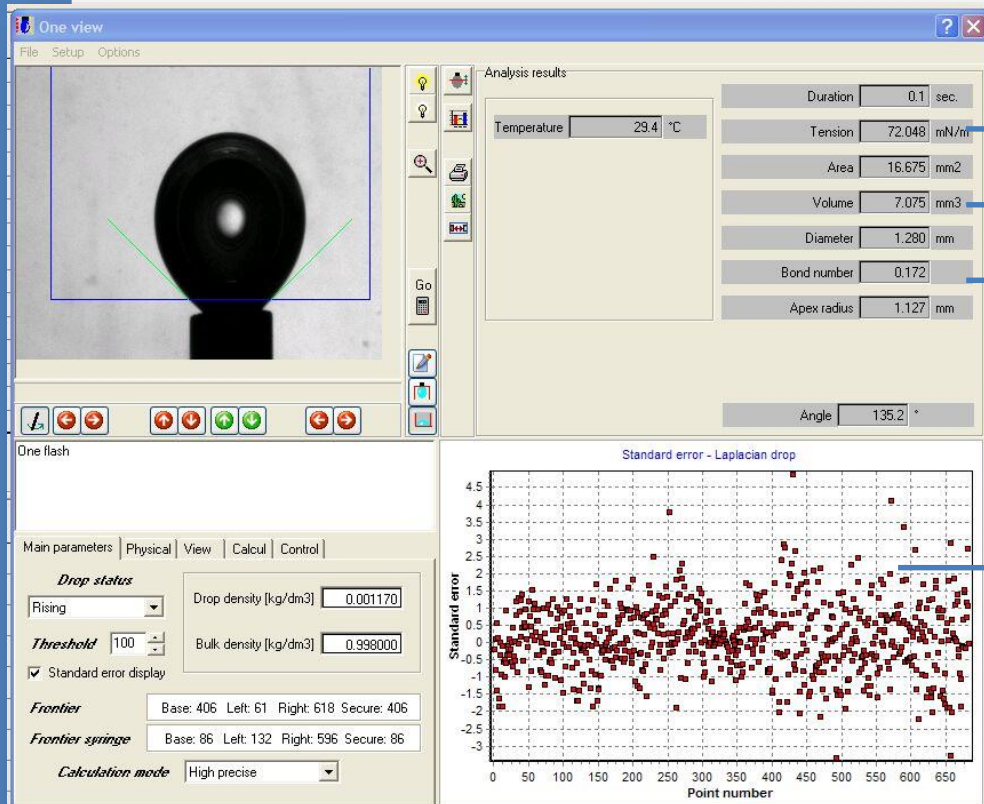
Test: Rising bubble in water

- Create an air bubble in water
- In « one measurement » calculation, check:
 - Surface tension is around 72 mN/m
 - Standard error is correct (homogeneous points cloud)
- Start an experiment
- Perform oscillations during 10' minimum

Cleanness of the apparatus



One measurement:
– Surface tension calculation



Surface tension of water

Initial volume

Bond number larger than 0.1

Homogeneous cloud
(Laplacian drop)

Cleanness of the apparatus



Drop configuration (Rising)

Density

Action(surface tension)

Initial Volume

Volume > Sinusoidal Profile

The screenshot shows the 'Measurement board' software interface with the following sections and values:

- Physical parameters:** Drop status: Rising; Drop density (g/cm³): 0.001170; Bulk density (g/cm³): 0.998000.
- Experiment parameters:** Action: Surface Tension; Initial volume: 10 µl after 1 Drop; Injected volume: Syringe 1, 5.36321 microliters; Control parameters: Stop on time after 0.24 seconds; Stop on eject: unchecked.
- Graphic parameters:** Top: Tension; Bottom: Area; Select graph: 2.
- Volume profile sinusoidal:** Amplitude: 1 µl; Period: 10 sec; Shift: 0; Active cycles: 5; Blank cycles: 5; Oscillation sampling: 0.
- Buttons:** Expert, Help, Cancel, and OK (circled in red).

Cleanness of the apparatus



Tension measurement	Oscillations	Results
Around 72mN/m	No variation in tension	System clean
Decreasing with time	Variation in tension	System not clean

Tracker



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- Contact angle measurement

Tension measurement: TIPS



Advantages :

- No Evaporation
- 100% wet
- Less vibration

Disadvantage :

- We cannot use too turbid solutions

Tension measurement: TIPS



For turbid solution:

1. Increase the brightness

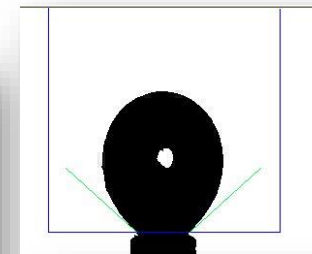
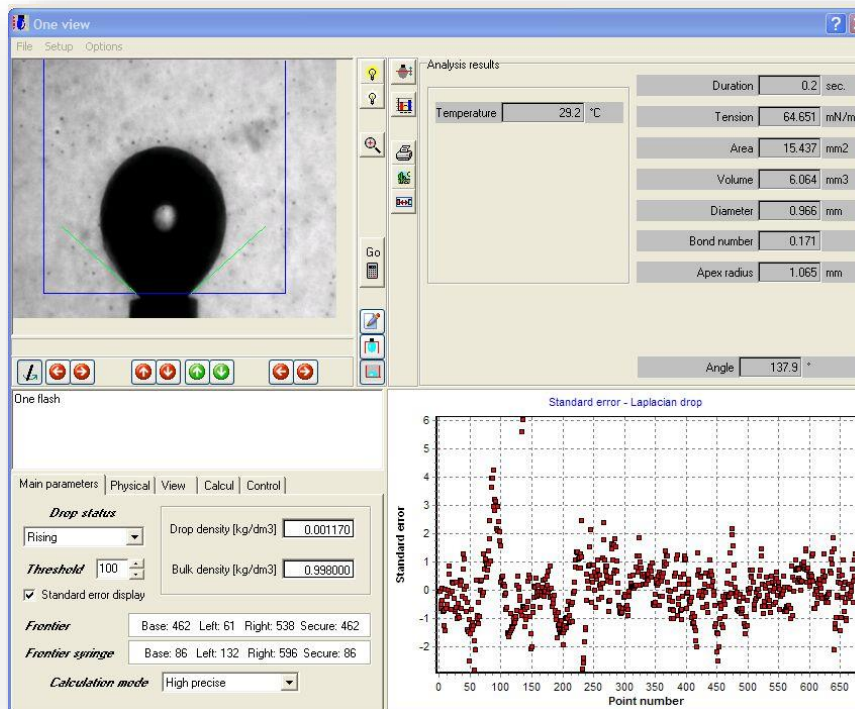


Increase the power of the light source

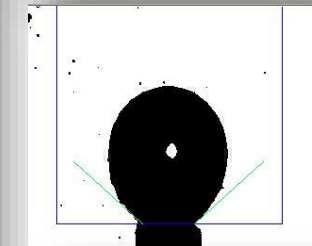
Tension measurement: TIPS



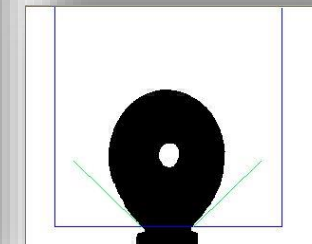
2. Change the value of « Threshold »



Threshold
100



Threshold
130



Threshold
50

Tension measurement: TIPS

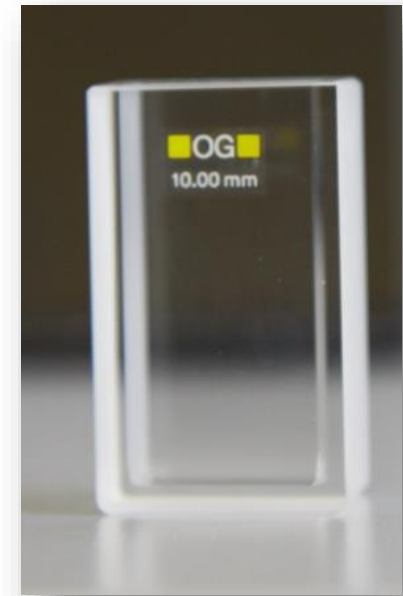


3. Change the size of the cuvette



Big cuvette

Small cuvette



Test with pendant drop

Basic experiment



Sampling mode

Shortcuts

Measurement board

Physical parameters
Drop status: Rising
Drop density (g/cm³): 0.001170
Bulk density (g/cm³): 0.998000

Sampling parameters
Sampling Mode: Fixed (selected), Variable
time 1: 10 sec, time 2: 50 sec
Sampling: 1.00 sec, Fast
End samp.: 1.00 meas/sec, Free, Fast

View parameters
Threshold setup, Vertical setup, Frontier setup, One image analysis
Temperature: Off, Lens N 0

Calculation parameters
Calculation mode: High precise
Standard error display (checked), Drop the drop (unchecked)

Experiment parameters
Action: Surface Tension
Initial volume: 10 µl after 1 Drop
Automatic position of the sessile drop frontier? (unchecked)
Drop formation...
Injected volume (checked)
Syringe: 1, 5.36321 microliters
Control parameters: Stop on time after 0.25 seconds, Stop on eject (unchecked)

Regulation option
None | Tension | Area | Volume | Dynamic Angle

Saving
Data (checked), Images (unchecked)
Synchronize (checked), Periodic saving (unchecked), At the end (unchecked), Without saving (unchecked)
Data all: 1 minutes, Images all: 0 measurements
Saving image on aberration (unchecked)

Graphic parameters
Top: Tension, None
Bottom: None, Volume
Select graph: 2
Zoom: Automatic (checked), Without aberration (unchecked), Fixed (unchecked)
Time scale: All meas. on graph (checked), Compressed X 2 (unchecked), Page mode (unchecked), Fixed scale (unchecked)

Scale Transfer setup
Expert, Help, Cancel, OK

Select directory: C:\Teclis\Clients\Aparell Client\Distrib Italien QI\Livraison\Tracker

Calculation Mode

Tips: Generally, one or two drops are expelled before the drop formation, in order to clean the needle tip.

Sampling mode



Sampling parameters

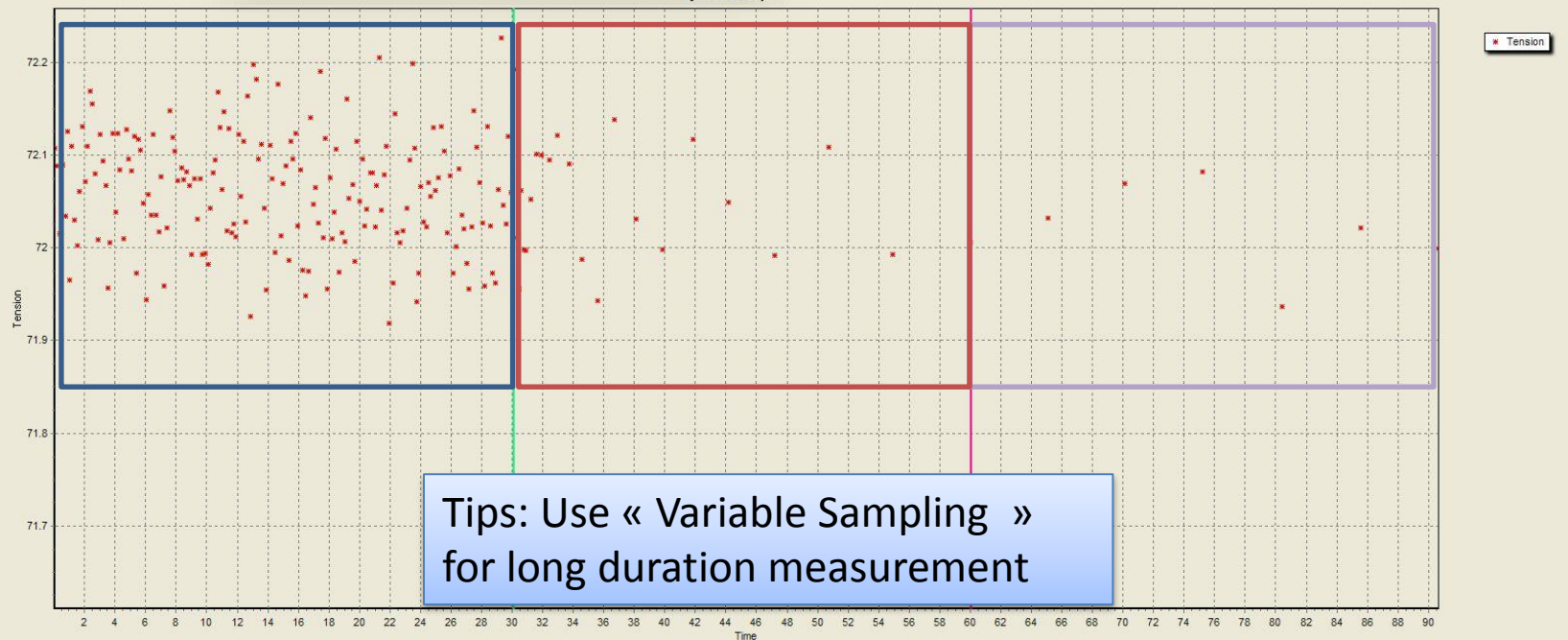
Sampling Mode
 Fixed Variable

time 1: 30 sec.
time 2: 60 sec.

End samp. 5.00 sec

Per. Fast Fast

- From 0 to T1, we get all the points
- Between T1 and T2, we get less points
- From T2 to the end of the measurement, we get points every 5s.



Regulation mode



Regulation of Area/volume

Control parameters:

Stop on time after seconds Start regulation with experiment

Start regulation after sec.

Stop on eject

None | Tension | Area | Volume | Dynamic Angle

PID | Sinusoidal

Area PID

End point mm² Automatic

KP dimensionless

KI dimensionless

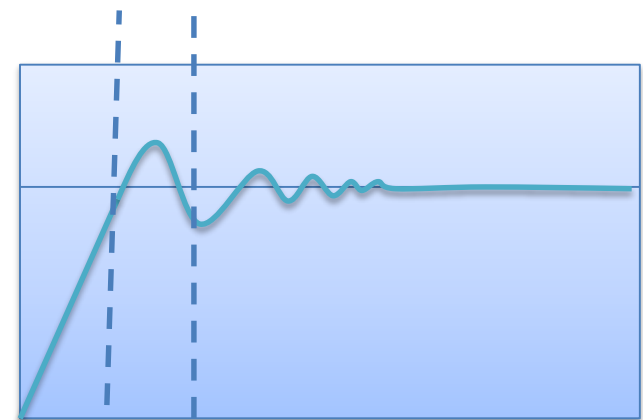
KD dimensionless

Start regulation with the experiment or after a delay

Set point

Proportional coefficient

Control Area



Oscillations mode



1. Volume mode (Advantage : less vibration)

Control parameters

Start regulation with experiment

Stop on time after seconds

Start regulation after sec.

Stop on eject

None | Tension | Area | Volume | Dynamic Angle

PID | Linear Profile | Sinusoidal Profile | Pulse Profile

Volume profile sinusoidal

Amplitude μl

Period sec.

Shift °

Active cycles number

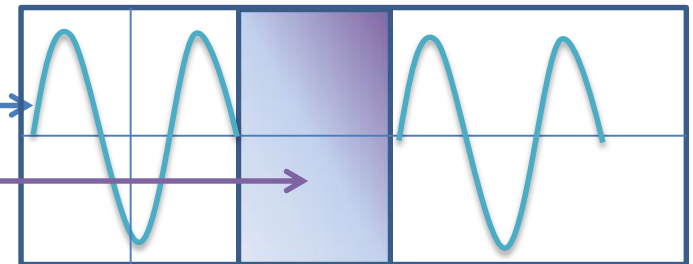
Blank cycles number

Oscillation sampling sec.

Start the regulation at the beginning of measurement

We usually use $dV/V=5-10\%$

Start the oscillation by expansion or compression



Oscillations mode



2. Area mode sinusoidal: the amplitude and the mean value of the area are kept constant (Advantage : the measurements are done with a constant dA/A).

None | Tension | Area | Volume | Dynamic Angle

PID | Sinusoidal

Area profile sinusoidal

Mean mm² Automatic

Amplitude mm²

Period s Oscillation Delay s

Active cycles number KP

Blank cycles number

KP Sin dimensionless

Oscillation sampling sec.

Regulation during the blank cycles

Regulation during the oscillation

Pulse Profile

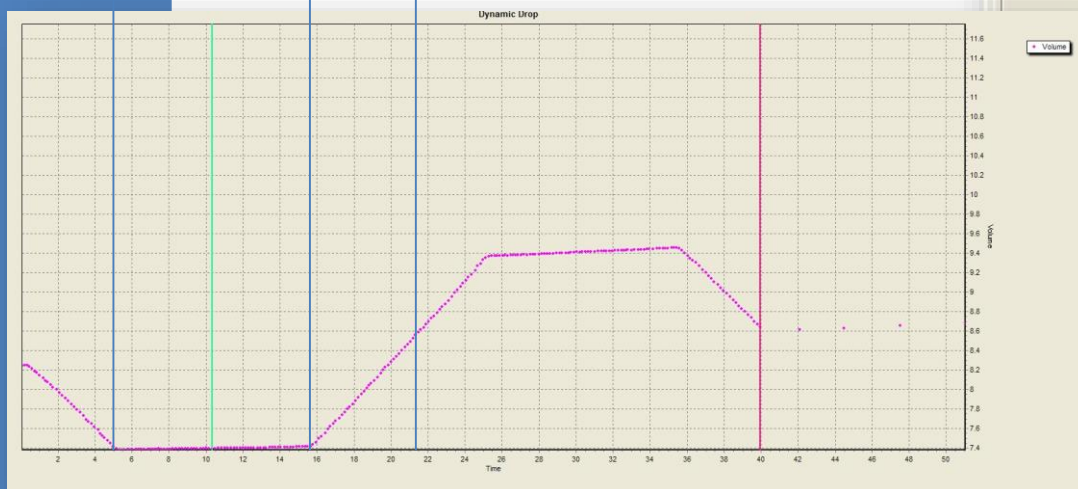


To get information of the surfactant behavior during a fast increase/decrease of the area.

T1

T2

T3



None | Tension | Area | Volume | Dynamic Angle

PID | Linear Profile | Sinusoidal Profile | Pulse Profile

Volume profile pulse

Amplitude μl

Time 1 s

Time 2 s

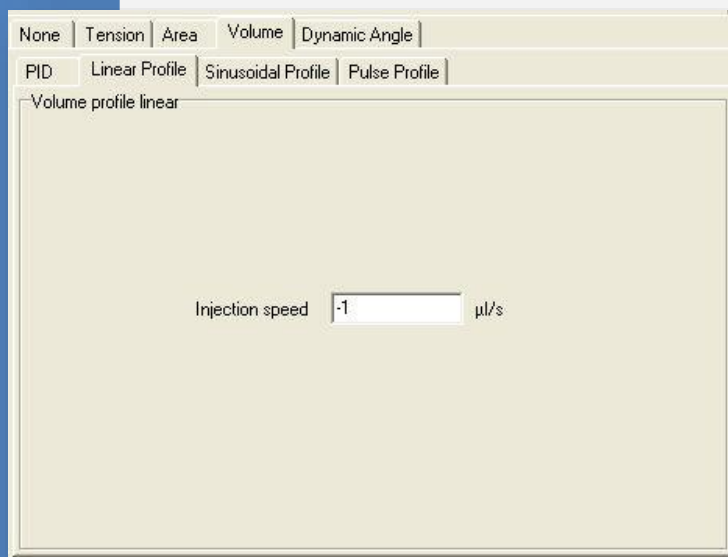
Time 3 s

Active cycles number

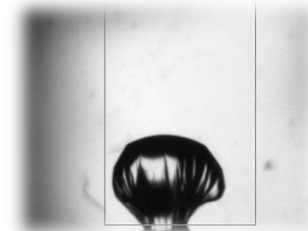
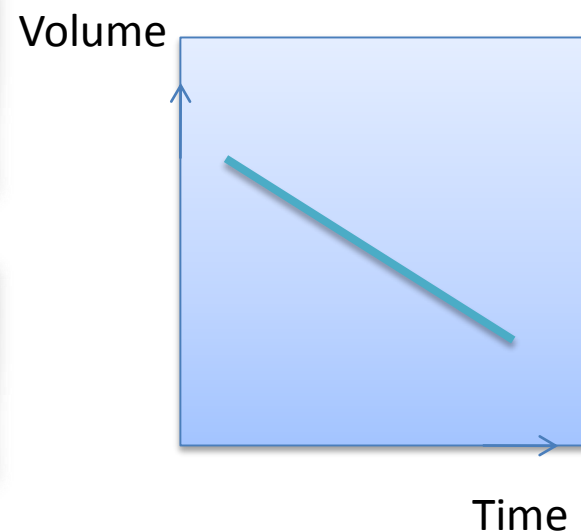
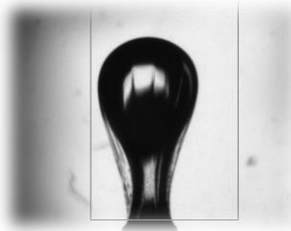
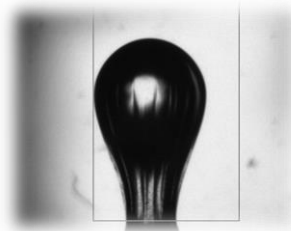
Blank cycles number

Oscillation sampling sec.

Linear Profile



Tips: use Linear Profile to highlight the presence of a membrane



A toluene drop containing asphalten in water

Data Analysis

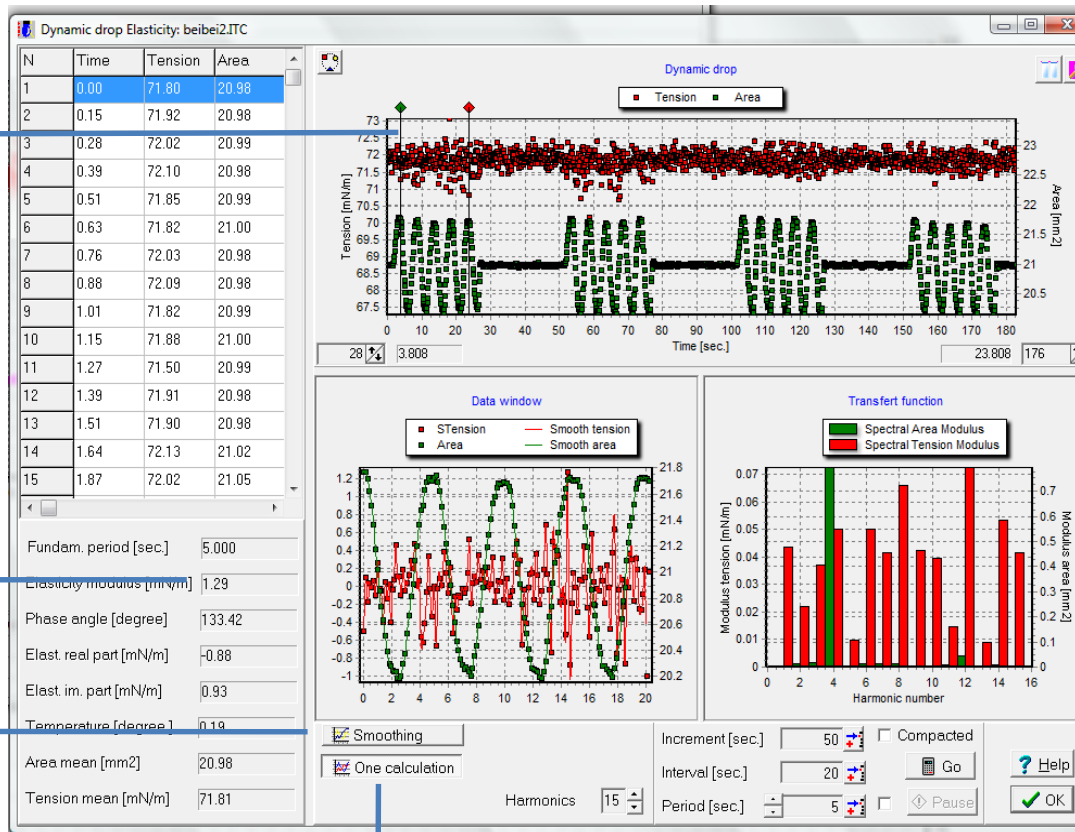


1. Viscoelastic Modulus (ex: air bubble in water)

Adjust
cursors

Low
modulus

Smooth
sinusoidal



Start the measurement

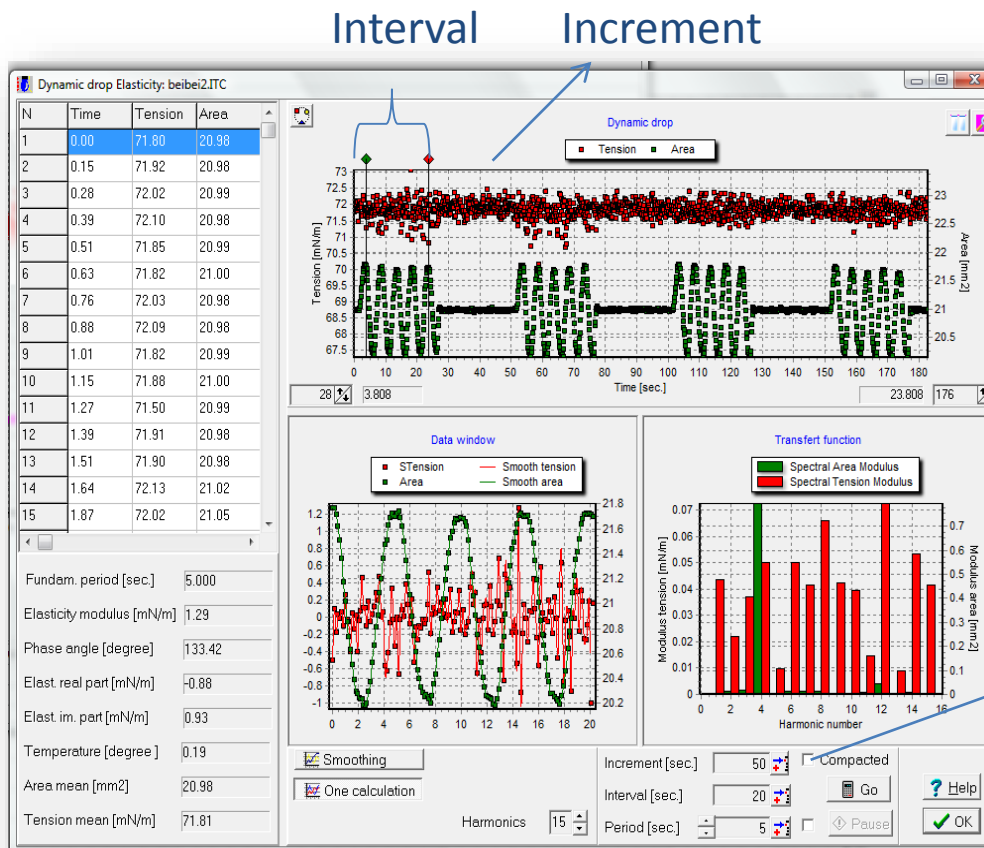
Period

Principal
Harmonic

Data Analysis



2. Dynamic viscoelastic modulus



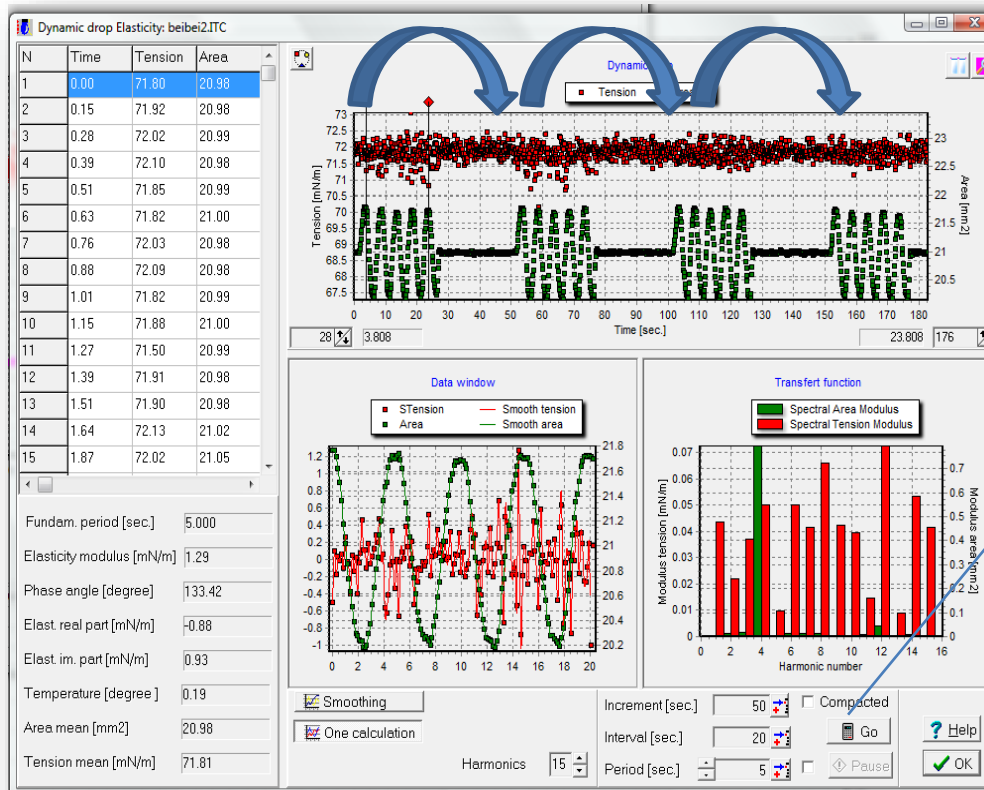
- ✓ Period: 5 s
- ✓ 5 Active cycles
- ✓ 5 Blank cycles

Value after skipping
the blank cycles
(Here we input 50
(2*25))

Data Analysis



Save a *.elt file (open with Tracker software or with a spreadsheet software)



Click the button « GO »
-> the calculation
values are saved as
*.elt file (...)

Data Analysis



3. Rigidity Modulus

- Calculation method is the same as the viscoelastic modulus.
- If module > 1.5 , we have a non liquid surface.

Data Analysis



3. Rigidity Modulus :

Typically, a pendant drop has rigidity=1.4. However, if a membrane forms at the interface, the variation of volume and area will no longer maintain a constant proportion, and rigidity will begin to increase.

$$\text{Rigidity} = \frac{\frac{\partial V}{V}}{\frac{\partial A}{A}}$$

For a sphere,

$$V = \frac{4}{3} \pi r^3$$

$$\Delta V = 4\pi r^2$$

$$A = 4\pi r^2$$

$$\Delta A = 8\pi r$$

For a sphere, rigidity=1.5

Tracker



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Drop Deposit



Materials:

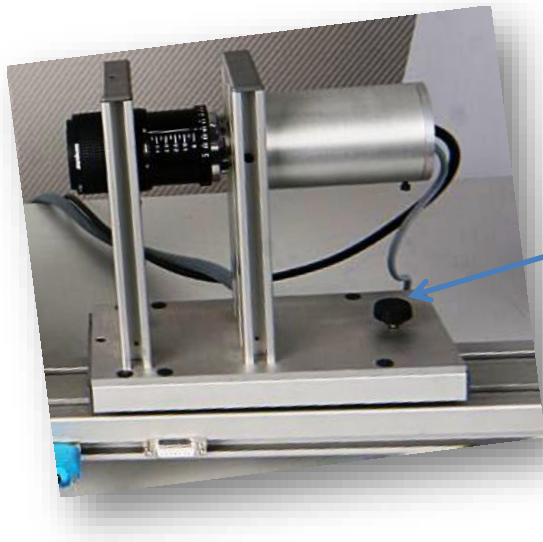
- Goniometer
- Needle (20G to 32G)
- Solid support



Equipment setup



Adjust Camera and Goniometer



Tilt the camera to see reflection on the support

Parameter Setup



Measurement board

Physical parameters

Drop status:

Drop density (g/cm³): Bulk density (g/cm³):

Experiment parameters

Action: Deposit (contact angle)

Initial volume: μ l after: Drop

Automatic position of the sessile drop frontier ?

Drop formation...

Injected volume

Syringe: microliters

Saving

Data Images

Synchronize Periodic saving At the end Without saving

time 1: sec. time 2: sec.

Sampling parameters

Sampling Mode: Fixed Variable

End samp.: meas/sec

Data all: minutes

Images all: measurements

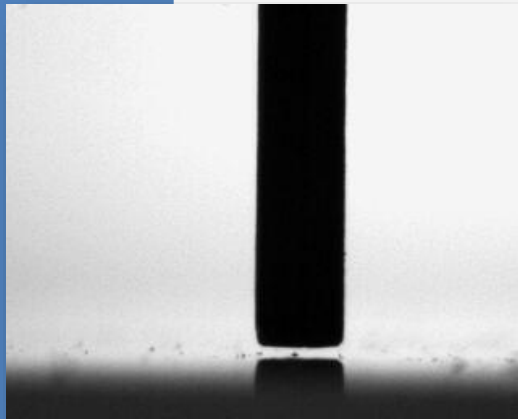
Saving image on aberration

Status of sessile down

Action : Deposit
(contact angle)

Record images

Frontier Setup



Solid/Liquid
Frontier

Pendant Drop
Frontier

The screenshot displays the 'One view' software window with the following components:

- Analysis results:**
 - Temperature: 27.2 °C
 - Duration: 0.0 sec.
 - Tension: 0.000 mN/m
 - Area: 0.000 mm²
 - Volume: 0.000 mm³
 - Diameter: 0.000 mm
 - Bond number: 0.000
 - Apex radius: 0.000 mm
 - Angle: 0.0 °
- Main parameters:**
 - Drop status: Sessile Down
 - Threshold: 100
 - Standard error display:
 - Drop density [kg/dm³]: 0.001170
 - Bulk density [kg/dm³]: 0.998000
 - Frontier: Base: 430 Left: 61 Right: 618 Secure: 430
 - Frontier springe: Base: 86 Left: 132 Right: 596 Secure: 86
 - Calculation mode: High precise
- Graph:** A plot titled 'Standard error - Laplacian drop' with 'Standard error' on the y-axis and 'Point number' on the x-axis. The plot area is currently empty.

Calculation Methods



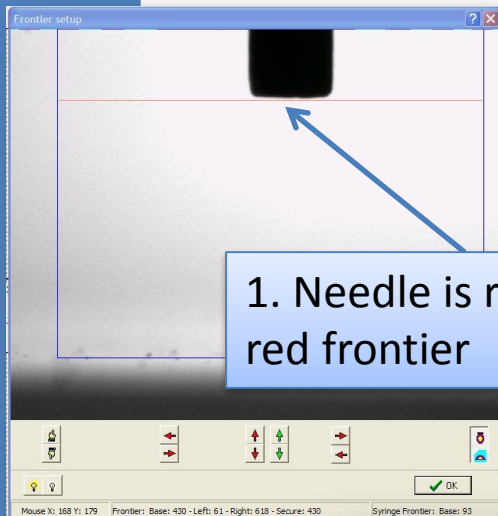
Direct Calculation

- Check that the Frontier setup is correct

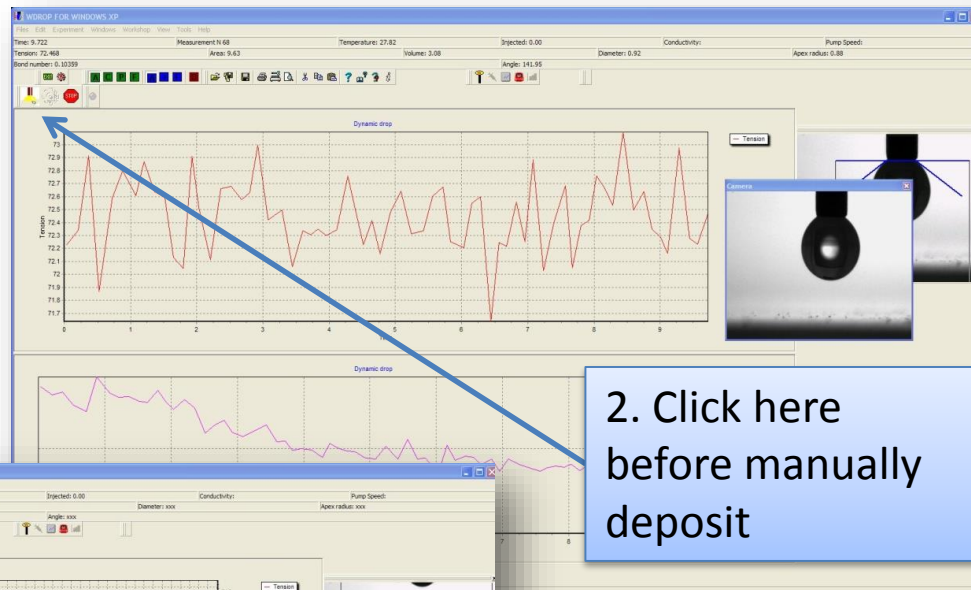
Calculation on images

- For samples that wet the surface quickly
- Up to 50 images/second

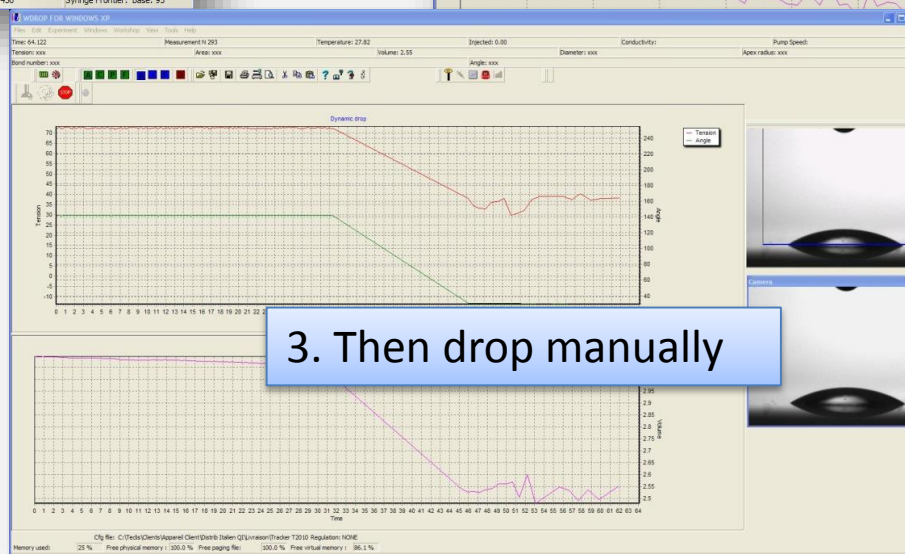
Operating Direct Calculation



1. Needle is raised to red frontier



2. Click here before manually deposit



3. Then drop manually

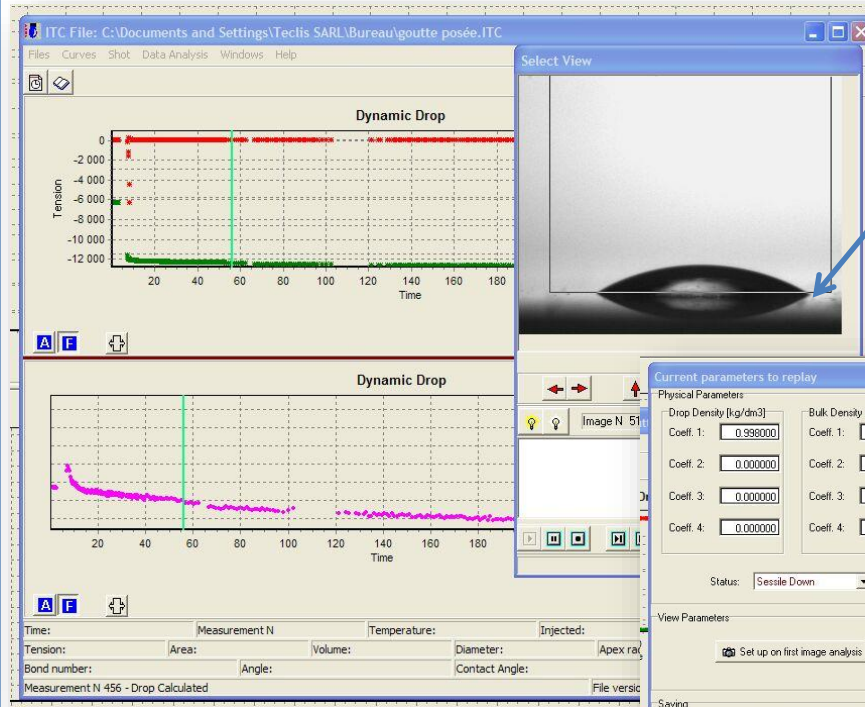
Operating Calculation on images



Step 2: Click “SPEED” to save all images. This feature only acquires images

Step 1: Click to activate the recording images function

Operating Calculation on images



Before calculating, check that the Frontier setup is correct

Select mode
Curve > Calculation

Current parameters to replay

Physical Parameters		Graphic Parameters	
Drop Density [kg/dm ³]	Bulk Density [kg/dm ³]	Top/Left	Tension
Coef. 1: 0.998000	Coef. 1: 0.001170	Angle	Injected
Coef. 2: 0.000000	Coef. 2: 0.000000	Top/Right	Diameter
Coef. 3: 0.000000	Coef. 3: 0.000000	Bottom/Left	None
Coef. 4: 0.000000	Coef. 4: 0.000000	Bottom/Right	Volume

Status: Sessale Down

View Parameters

Set up on first image analysis

Saving

Data Image Std.Error

Calculation Parameters

Calculation Mode: High precise

With Qualit Crop the drop

Files Directory Default

C:\Teclis\Clients\Appareil Client\Distib Italien QI\L'raison\Tracker T2010609 Distributeur

Tout Help Cancel OK

Build file from: goutte posée. ITC

No Interlaced OK

Note: By checking the box « No Interlaced », we can acquire up to 50 images/second)



Customer support



For any other concerns, don't hesitate to contact us:

Valerie.lelong@teclis.fr