AR Rheometer
Instrumentation, Calibration & Maintenance

Agenda

- Instrumentation
- Calibration
- Maintenance

Agenda

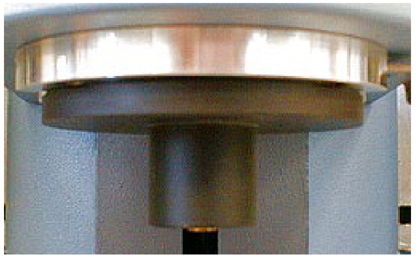
- Instrumentation
- Calibration
- Maintenance

Primary Things

1 Make sure that Air is on

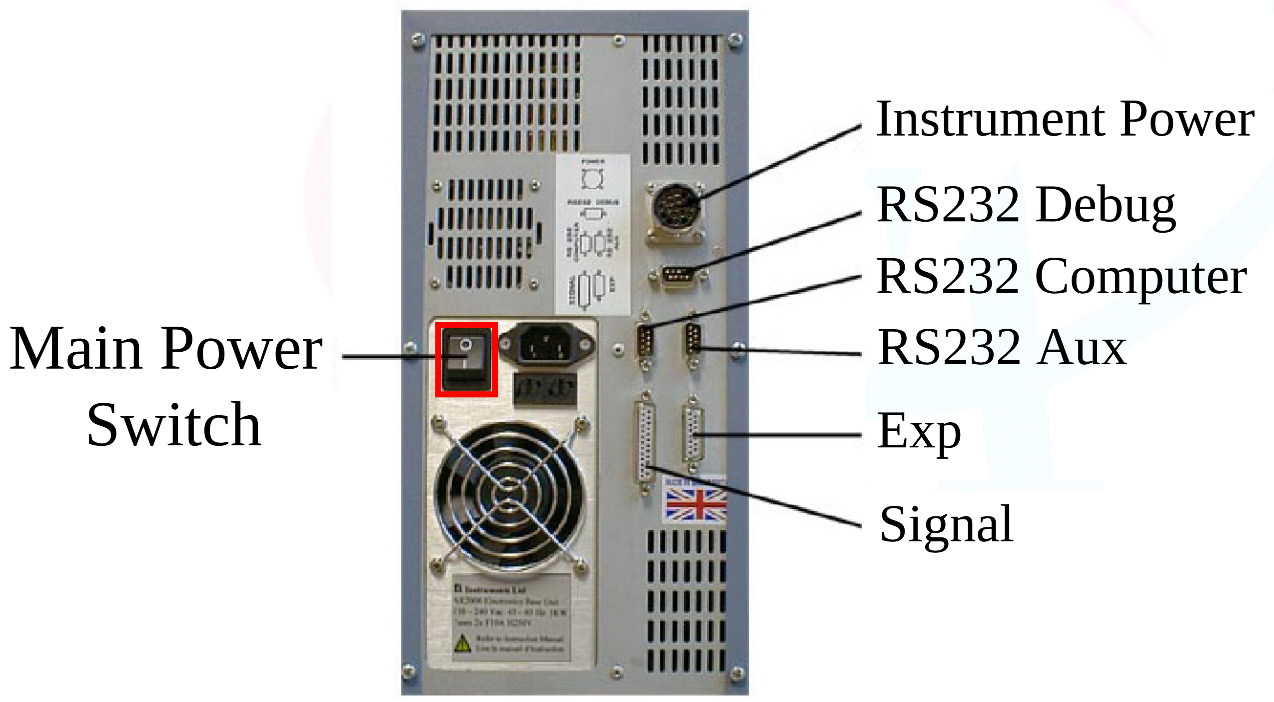
Primary Things

2 Unscrew Draw-rod to release bearing lock



Primary Things

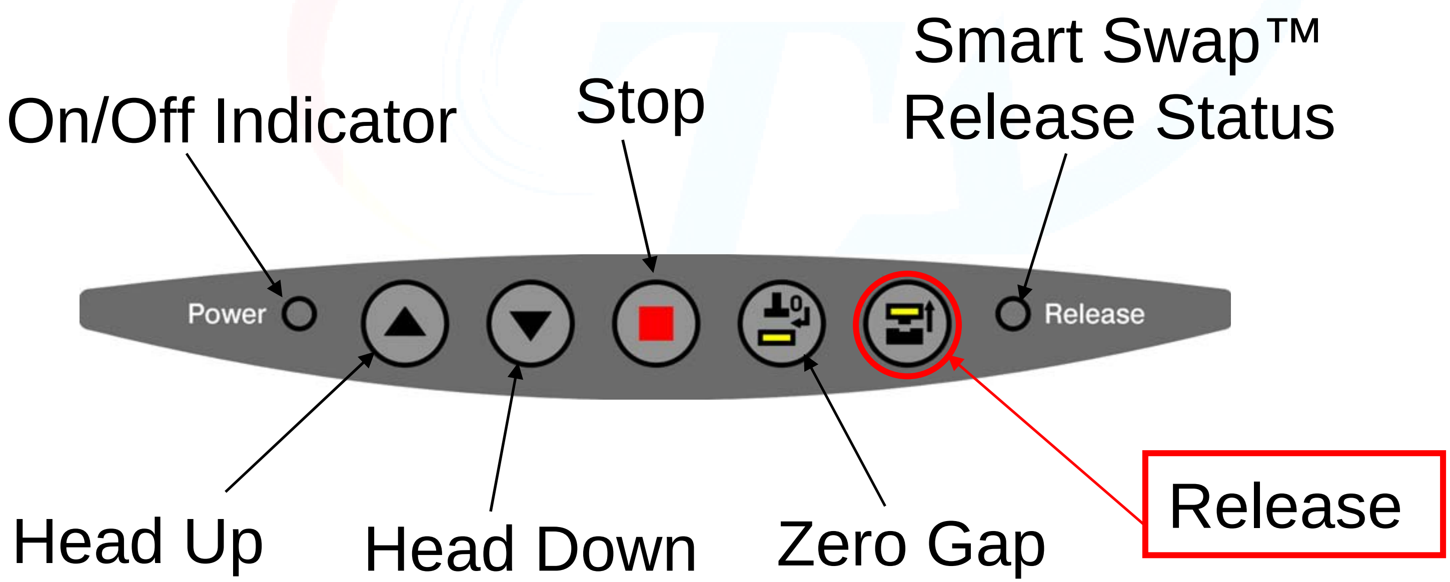
3 Power up



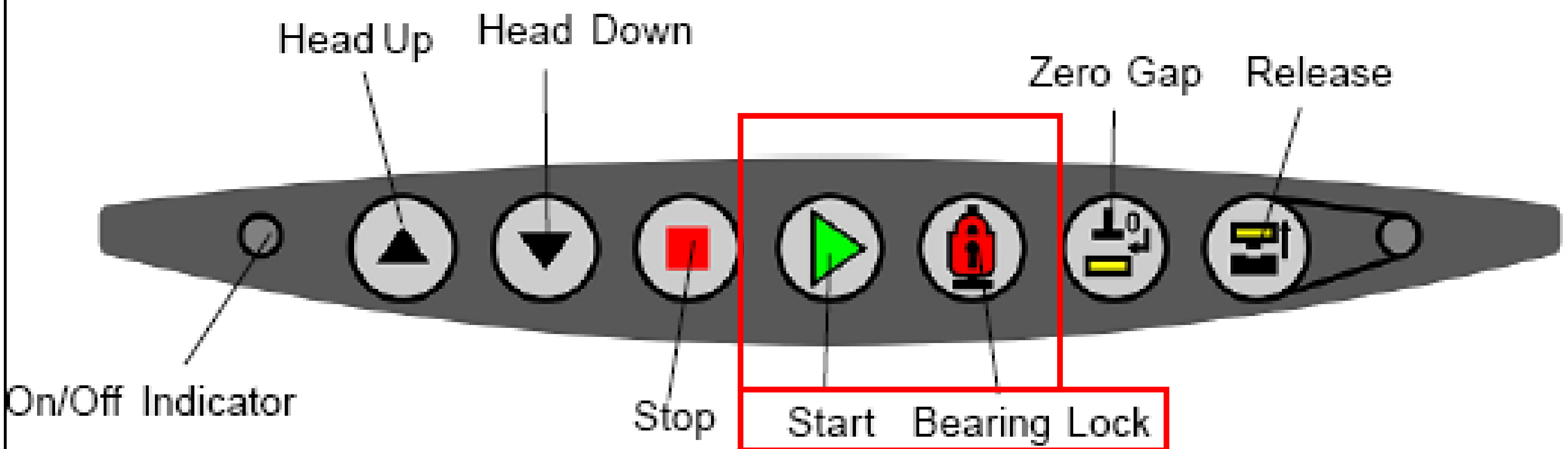
Primary Things

4 Turn on Water (Pump)
(if needed)

AR 2000 Keypad



AR G2 Keypad



The AR-G2 Rheometer (Control Panel)

Peltier Plate

- A device that actively heats and cools using reverse thermocouple junctions
- Best suited for dispersions, gels and solutions
- Heating from one direction
  - Should allow sample to equilibrate for at least 3 min.

Environmental system

The Peltier plate

The Peltier plate system is mounted directly to the smart swap base of the AR2000 and AR-G2. An upper heated compensation heater [UHP]is available to eliminate any vertical temperature gradients in the sample.

The Peltier plate has a temperature range from –20°C to 200°C. A humidity cover to pre-vent evaporation of solvent is available also.

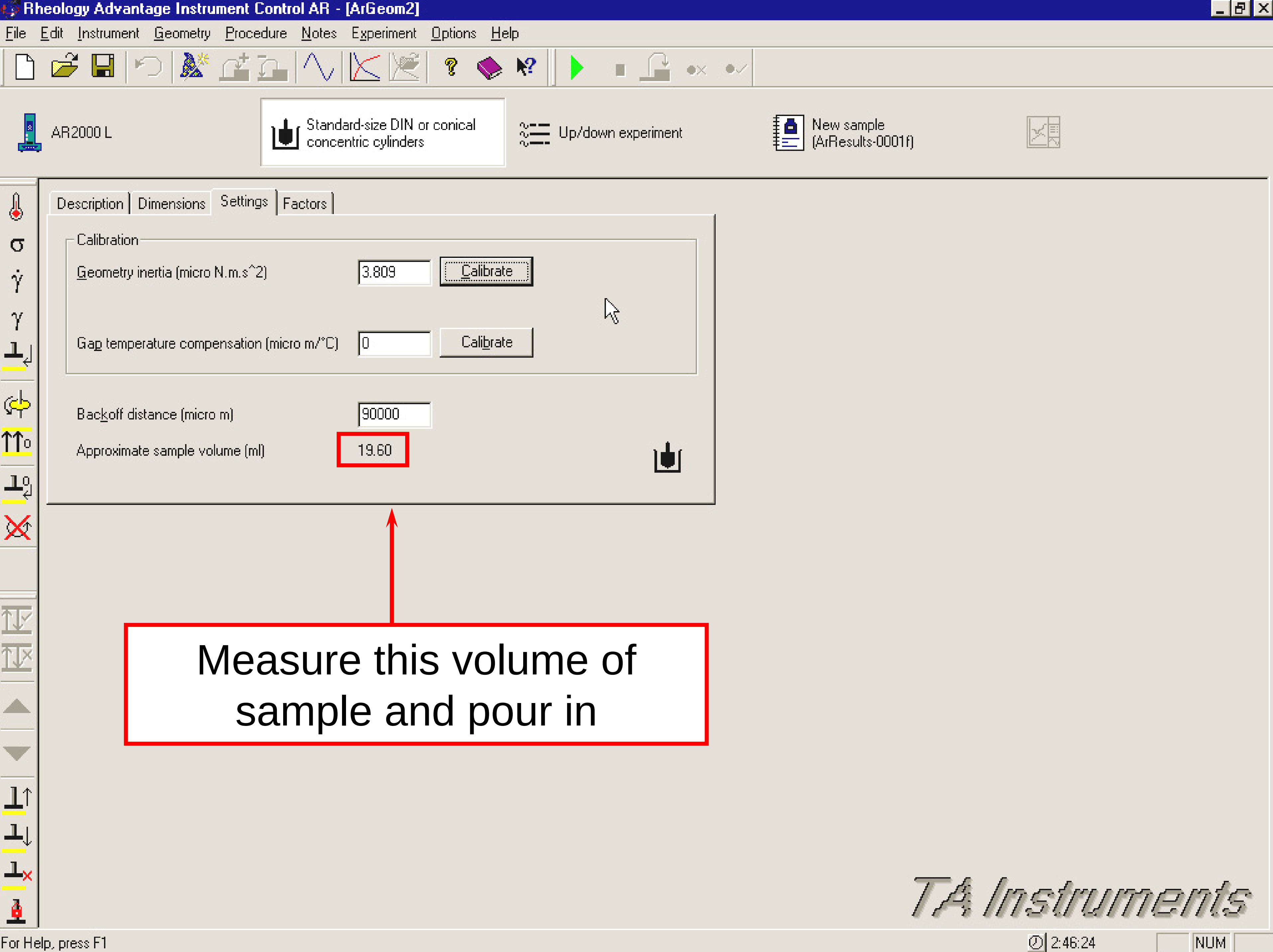
Peltier Plate

- Works as a Heat Pump
  - Needs a heat sink – usually water, either from a reservoir or a flowing supply
- Flow rate of fluid needs to be at least 0.5 L/min

Peltier		Temperature Range
		(°C)
tank & pump		-5 to 100
pumped water supply (20°C)		-20 to 200
water at 60°C		10 to 200
water at 40°C		0 to 200
water at 1°C		-30 to 180
fluid at -20°C		-40 to 160

Concentric Cylinders

- Low viscosity materials
  - < 50 cP, 0.05 Pa-s
- Sample volume crucial
- A good way to load is measuring the volume suggested in the geometry page
- Peltier heating & cooling on AR 2000 & G2



Rheology Advantage Instrument Control AR - [ArGeom2]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR2000 L
Standard-size DIN or conical concentric cylinders
Up/down experiment
New sample (ArResults-0001f)
Description
Dimensions
Settings
Factors
Calibration
Geometry inertia (micro N.m.s^2)
3.809
Calibrate
Gap temperature compensation (micro m/°C)
0
Calibrate
Backoff distance (micro m)
90000
Approximate sample volume (ml)
19.60
Measure this volume of sample and pour in
TA Instruments
For Help, press F1
2:46:24
NUM

Environmental Test Chamber (ETC)

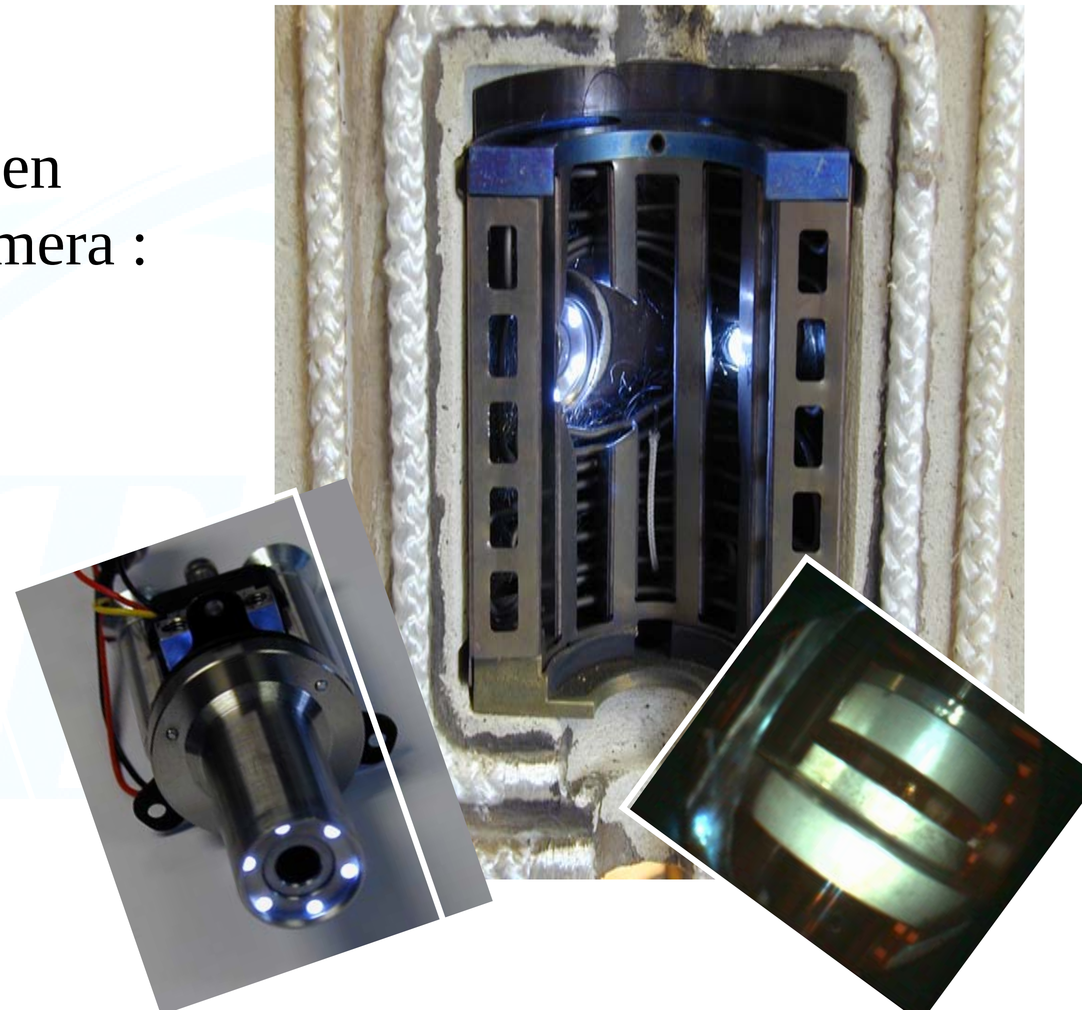
- Provides temperature control for polymer melts, and solid samples
- Lower plate assembly is attached and detached just like the Peltier plate

Environmental system – AR-G2

The radiation oven

The radiation oven has been enhanced with a video camera :

- Allows the observation of the sample during sample loading and the measurement
- Stores an image with each single data point to keep a record of the sample’s state during the measurement

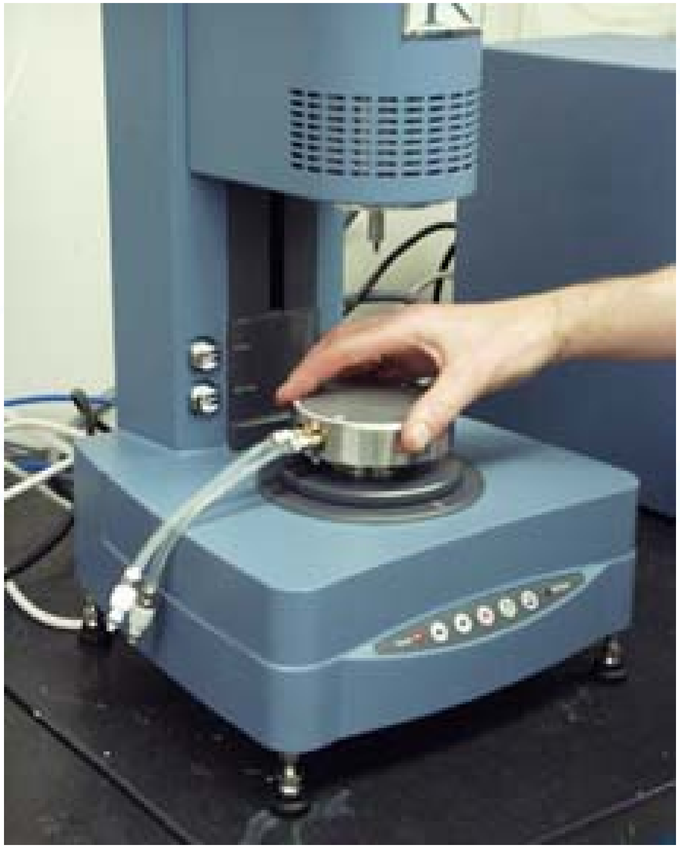


Attaching the Peltier Plate

Press ‘Release’ button

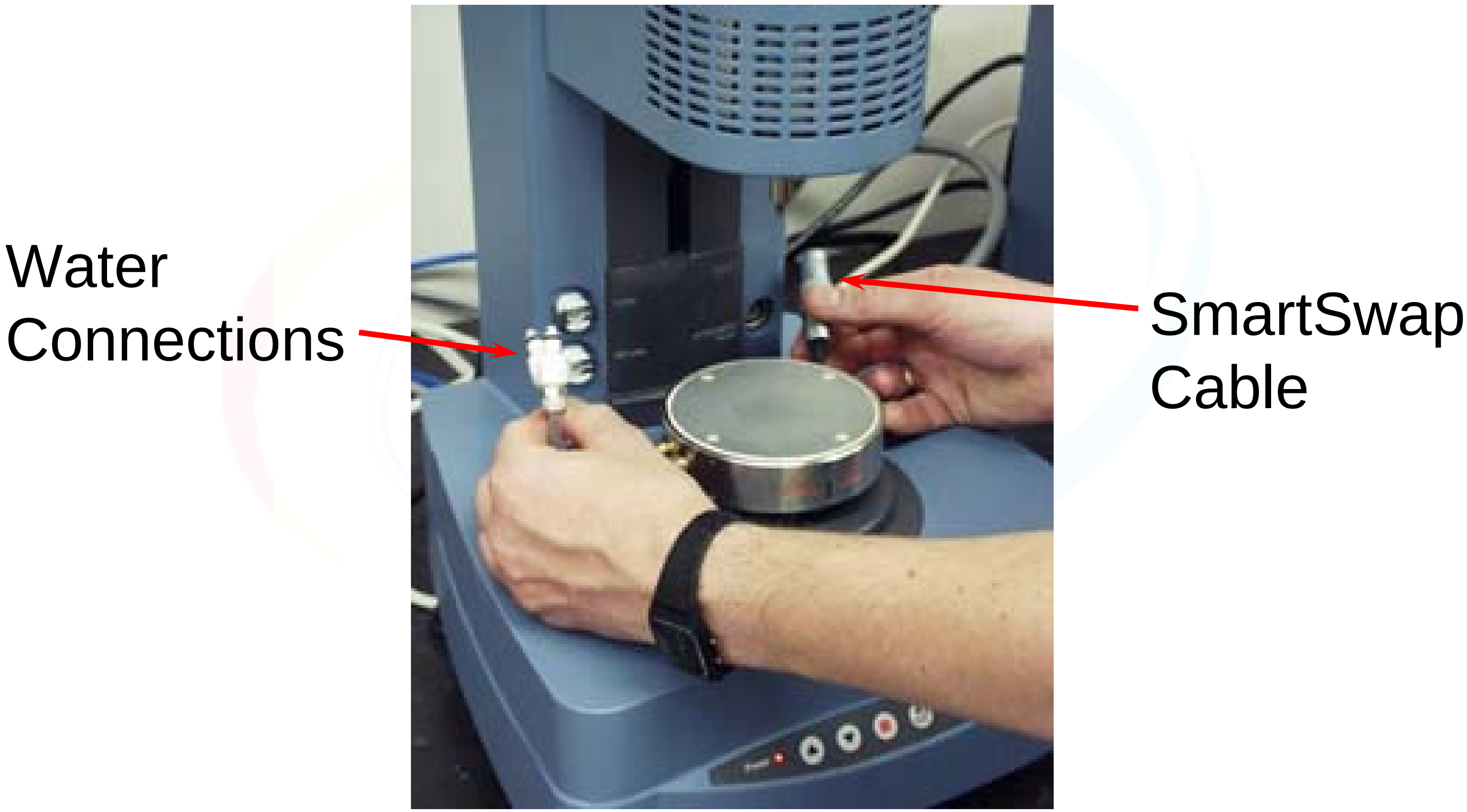
Attaching the Peltier Plate

Continuous green status light indicates attachment can be fitted...



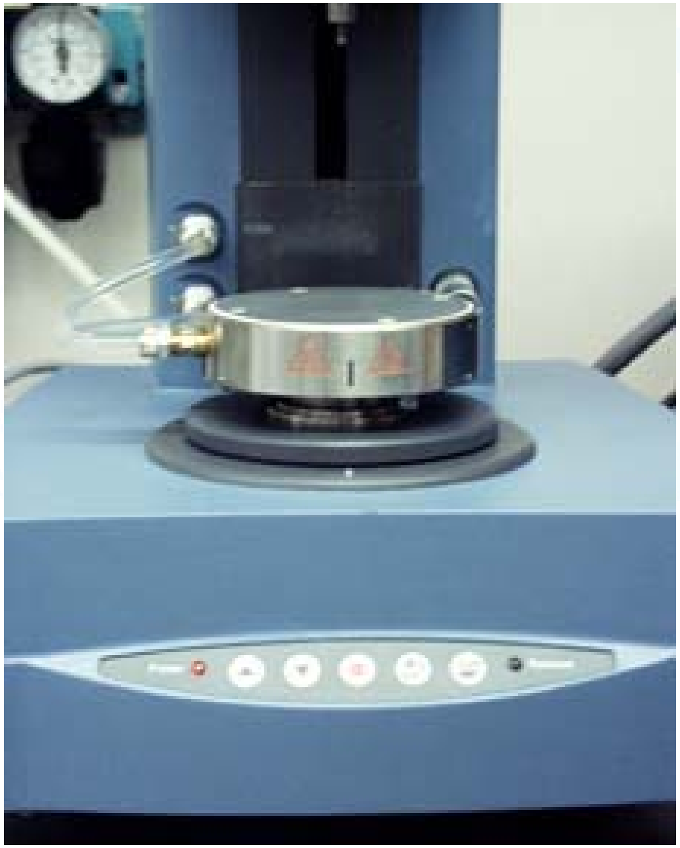
Attaching the Peltier Plate

…and plugged in

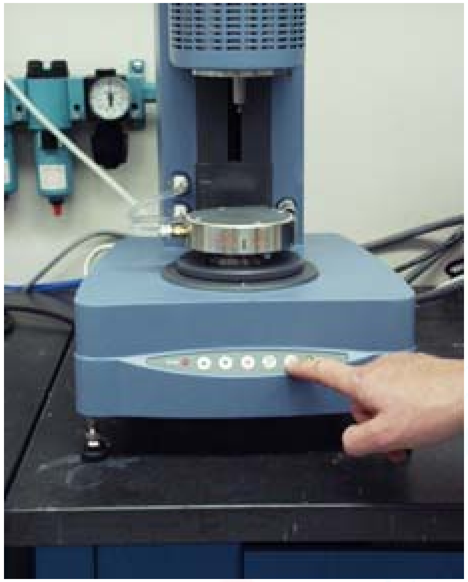


Attaching the Peltier Plate

When green status light goes out, system is ready for use



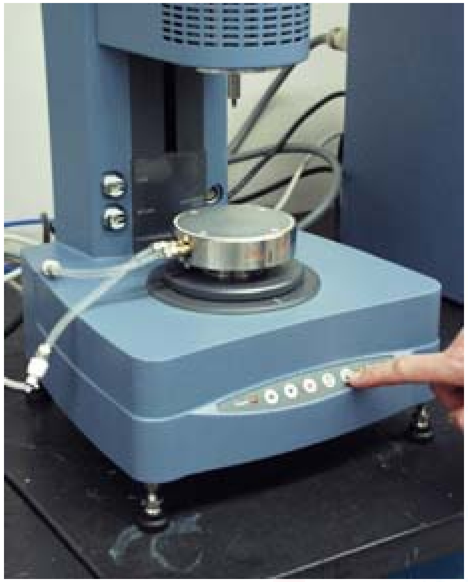
Removing the Peltier Plate



Press ‘Release’ button

Flashing green status light indicates it is safe to unplug

Removing the Peltier Plate

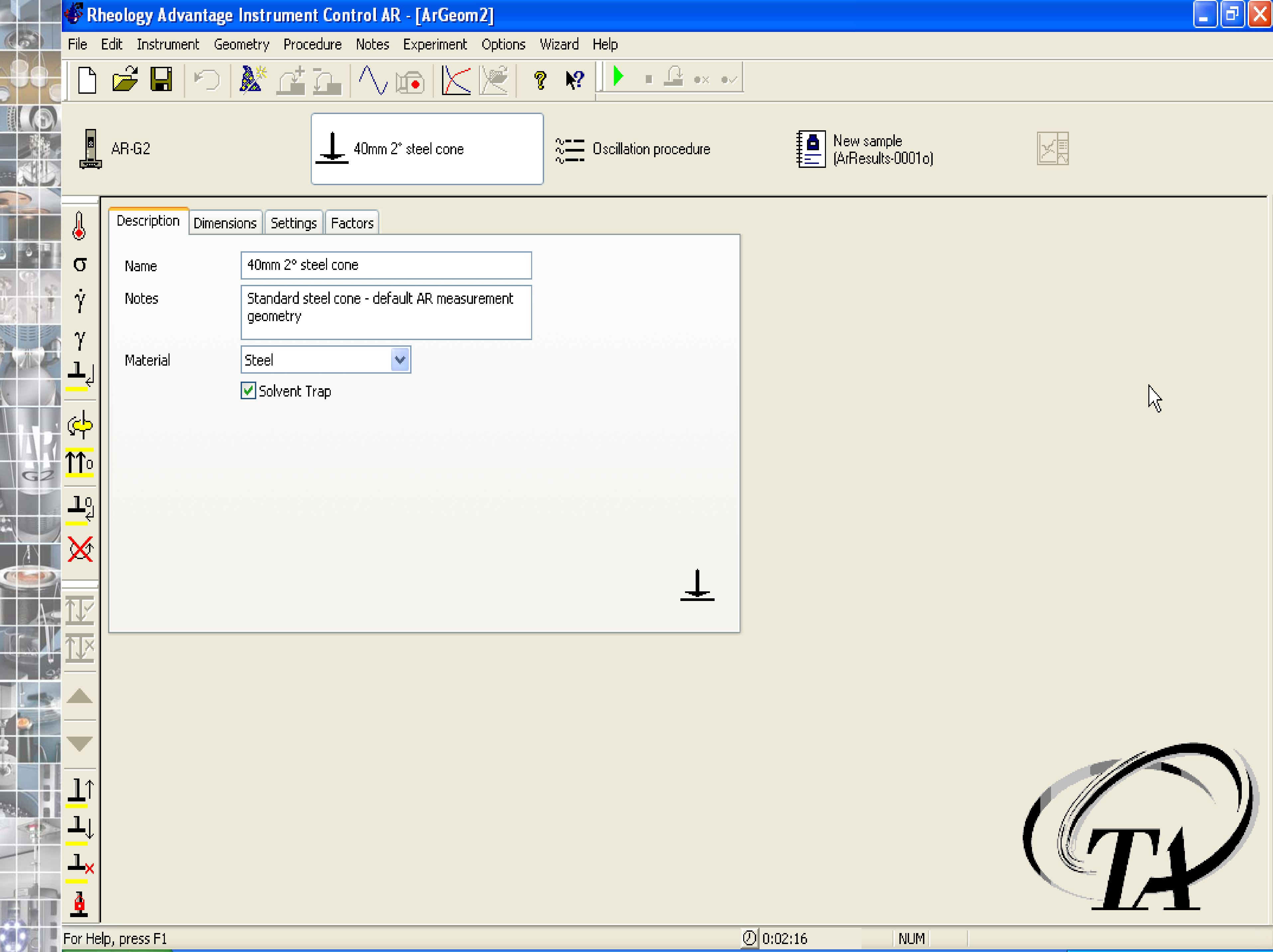


Press ‘Release’
button again

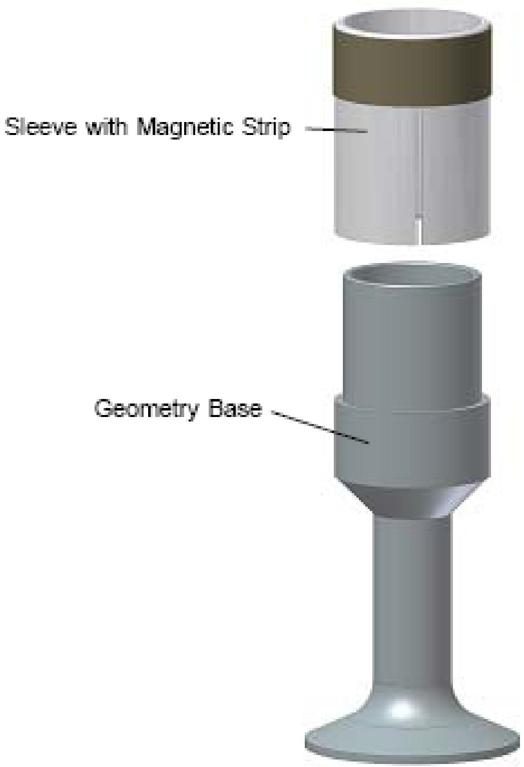
Continuous green status light
indicates attachment can be
removed

Geometries

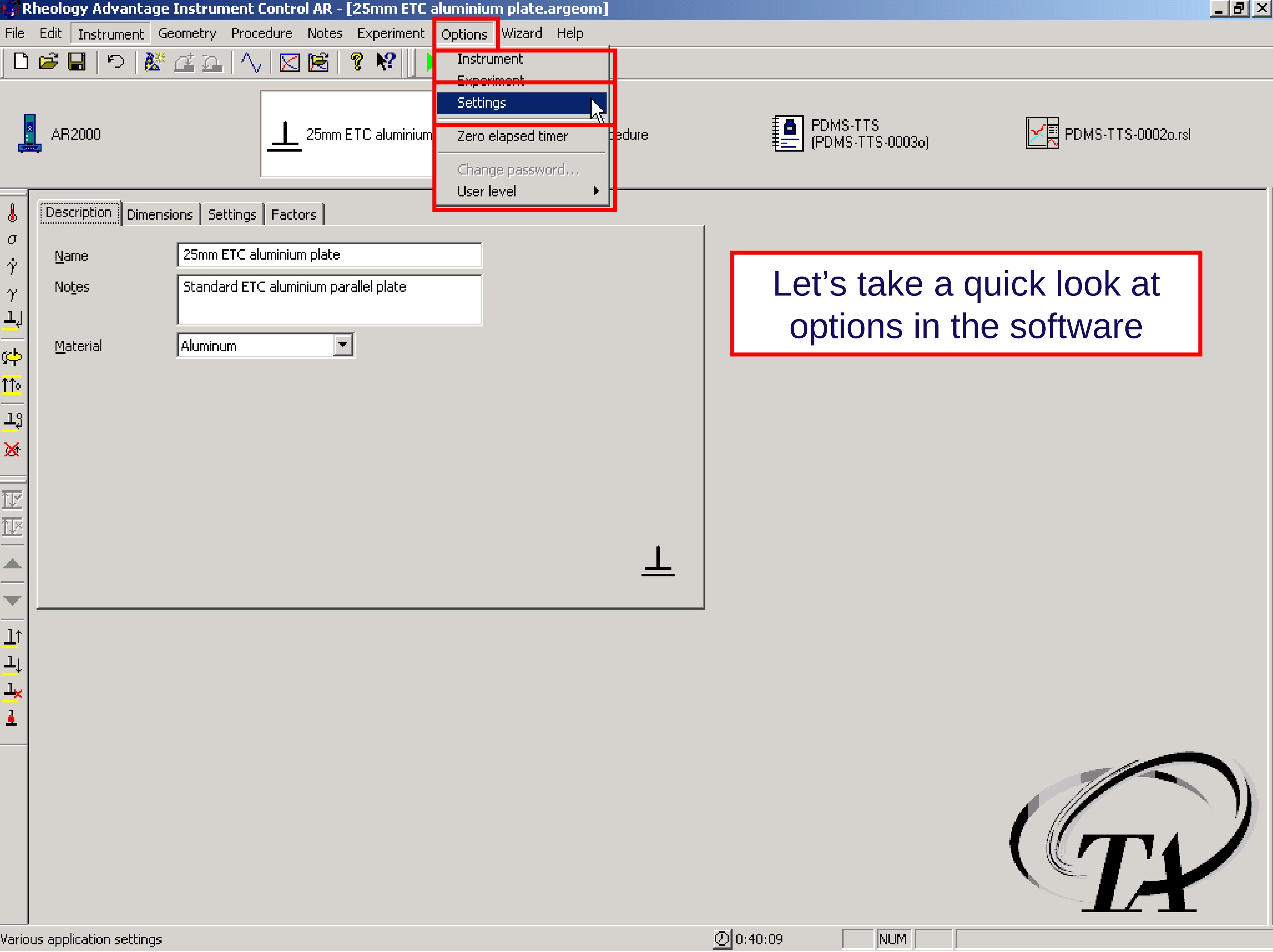
- To ensure that data is correct you must correctly describe and choose the geometry
- On AR2000 and older Rheometers this means you have to go in and select from the software
- On AR-G2 we have new Smart Swap™ geometries, that will automatically be recognized

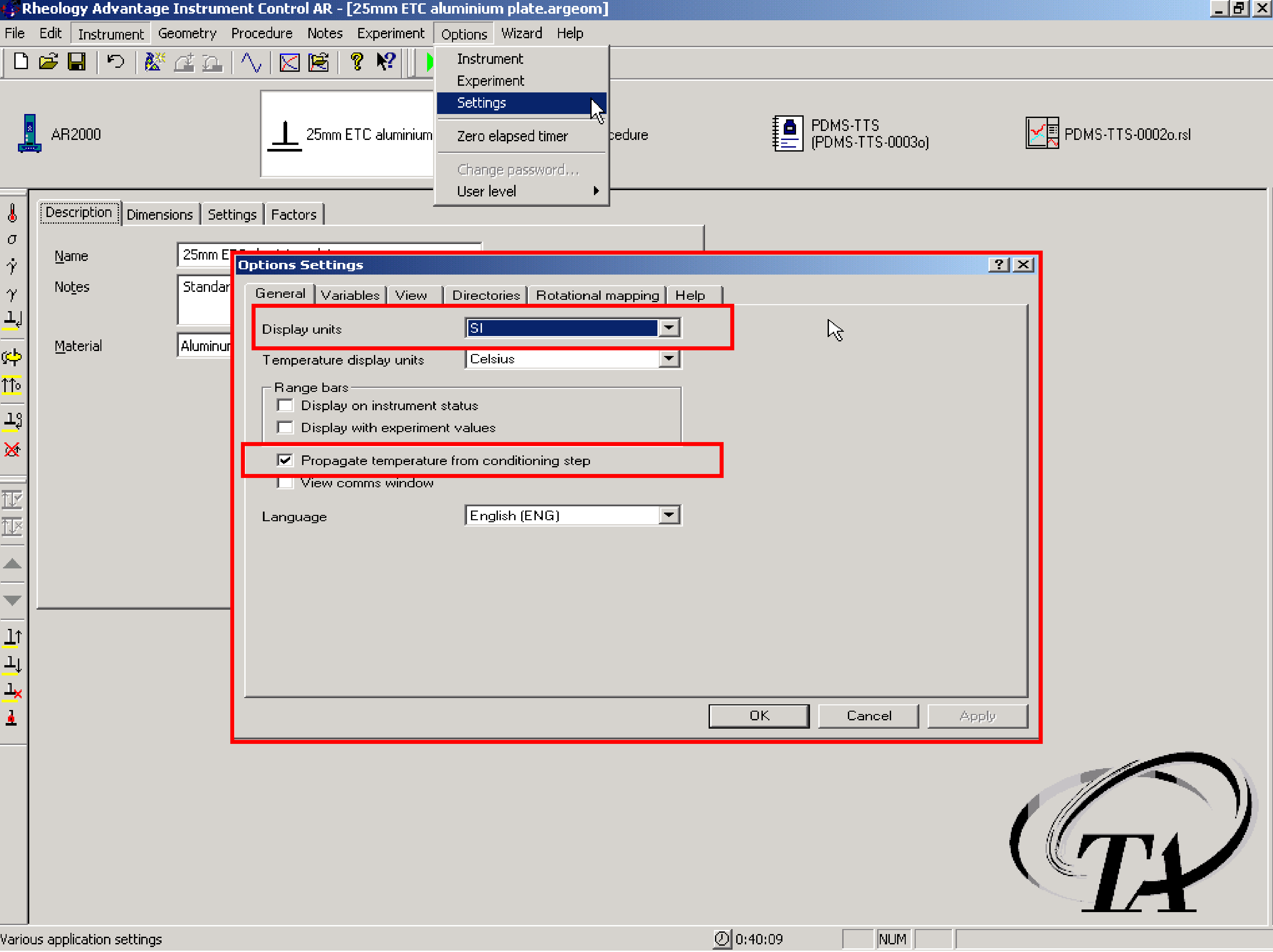

Rheology Advantage Instrument Control AR - [ArGeom2]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
AR-G2
40mm 2° steel cone
Oscillation procedure
New sample
(ArResults-0001o)
Description
Dimensions
Settings
Factors
Name
40mm 2° steel cone
Notes
Standard steel cone - default AR measurement geometry
Material
Steel
Solvent Trap
For Help, press F1
0:02:16
NUM

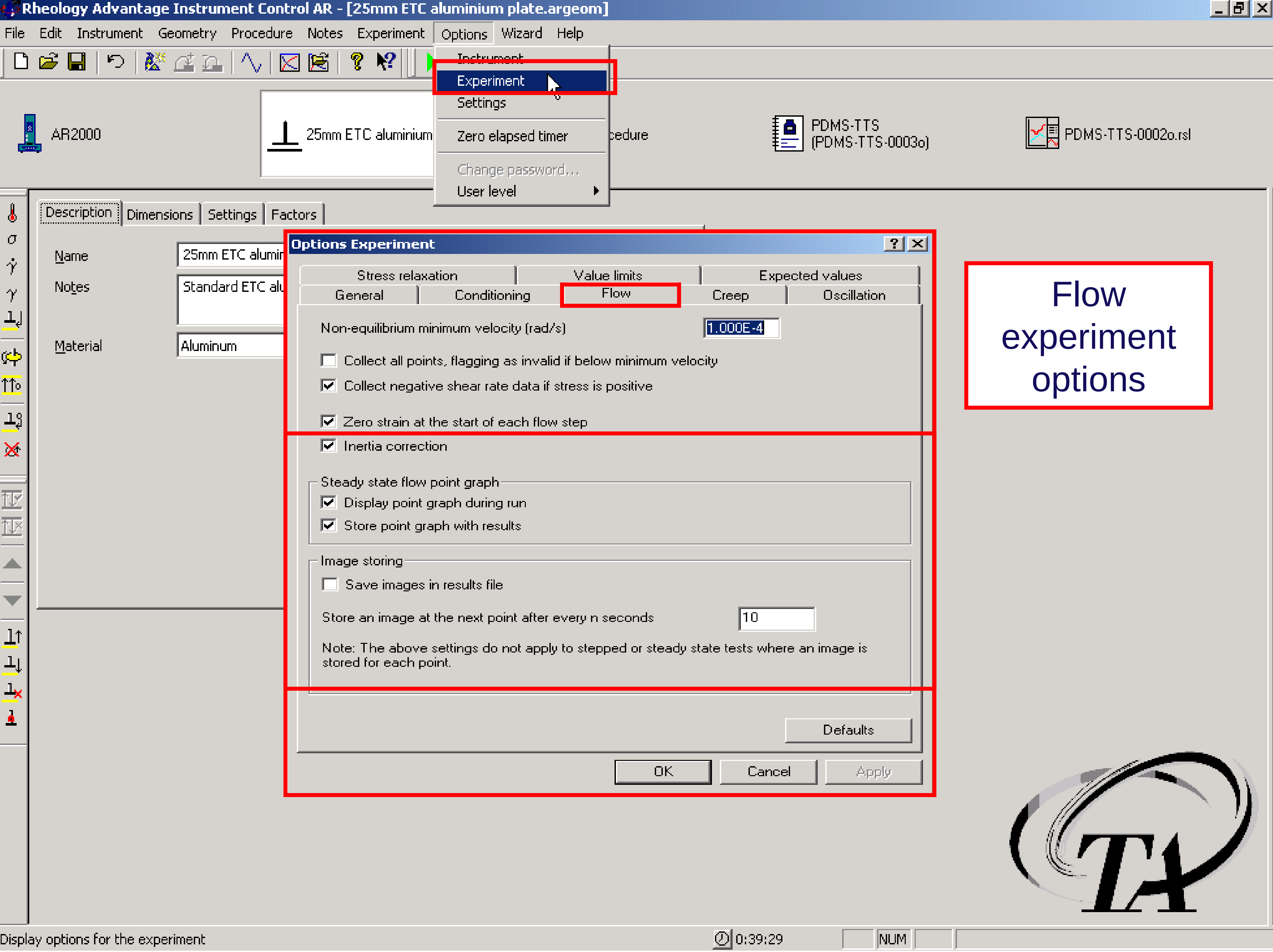
Smart Swap Sleeve -- AR-G2

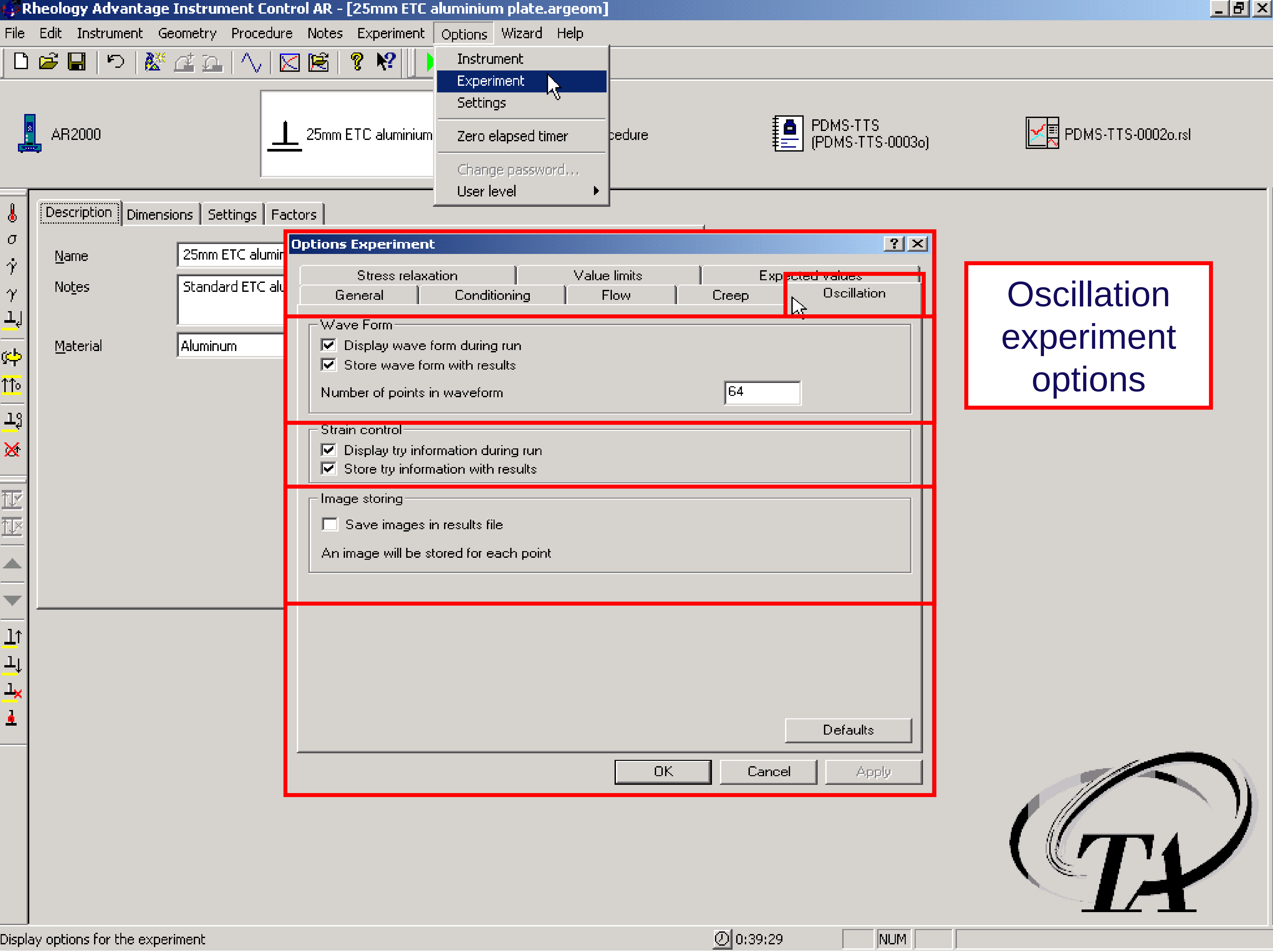


Automated system configuration due to smart swap for the environmental systems and the upper geometries


Rheology Advantage Instrument Control AR - [25mm ETC aluminium plate.argeom]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
Instrument
Experiment
Settings
Zero elapsed timer
Change password...
User level
AR2000
25mm ETC aluminium
PDMS-TTS
(PDMS-TTS-0003o)
PDMS-TTS-0002o.rsl
Description
Dimensions
Settings
Factors
Name
25mm ETC aluminium plate
Notes
Standard ETC aluminium parallel plate
Material
Aluminum
Let's take a quick look at options in the software
Various application settings
0:40:09
NUM


Rheology Advantage Instrument Control AR - [25mm ETC aluminium plate.argeom]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
Instrument
Experiment
Settings
Zero elapsed timer
Change password...
User level
AR2000
25mm ETC aluminium
cedure
PDMS-TTS
(PDMS-TTS-0003o)
PDMS-TTS-0002o.rsl
Description Dimensions Settings Factors
Name
Notes
Material
Options Settings
General Variables View Directories Rotational mapping Help
Display units
SI
Temperature display units
Celsius
Range bars
Display on instrument status
Display with experiment values
Propagate temperature from conditioning step
View comms window
Language
English (ENG)
OK Cancel Apply
Various application settings
0:40:09
NUM


Rheology Advantage Instrument Control AR - [25mm ETC aluminium plate.argeom]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
Instrument
Experiment
Settings
Zero elapsed timer
Change password...
User level
AR2000
25mm ETC aluminium
PDMS-TTS (PDMS-TTS-0003o)
PDMS-TTS-0002o.rsl
Description Dimensions Settings Factors
Name
Notes
Material
Aluminum
Options Experiment
Stress relaxation
Value limits
Expected values
General
Conditioning
Flow
Creep
Oscillation
Non-equilibrium minimum velocity (rad/s)
1.000E-4
Collect all points, flagging as invalid if below minimum velocity
Collect negative shear rate data if stress is positive
Zero strain at the start of each flow step
Inertia correction
Steady state flow point graph
Display point graph during run
Store point graph with results
Image storing
Save images in results file
Store an image at the next point after every n seconds
10
Note: The above settings do not apply to stepped or steady state tests where an image is stored for each point.
Defaults
OK
Cancel
Apply
Flow experiment options
Display options for the experiment
0:39:29
NUM

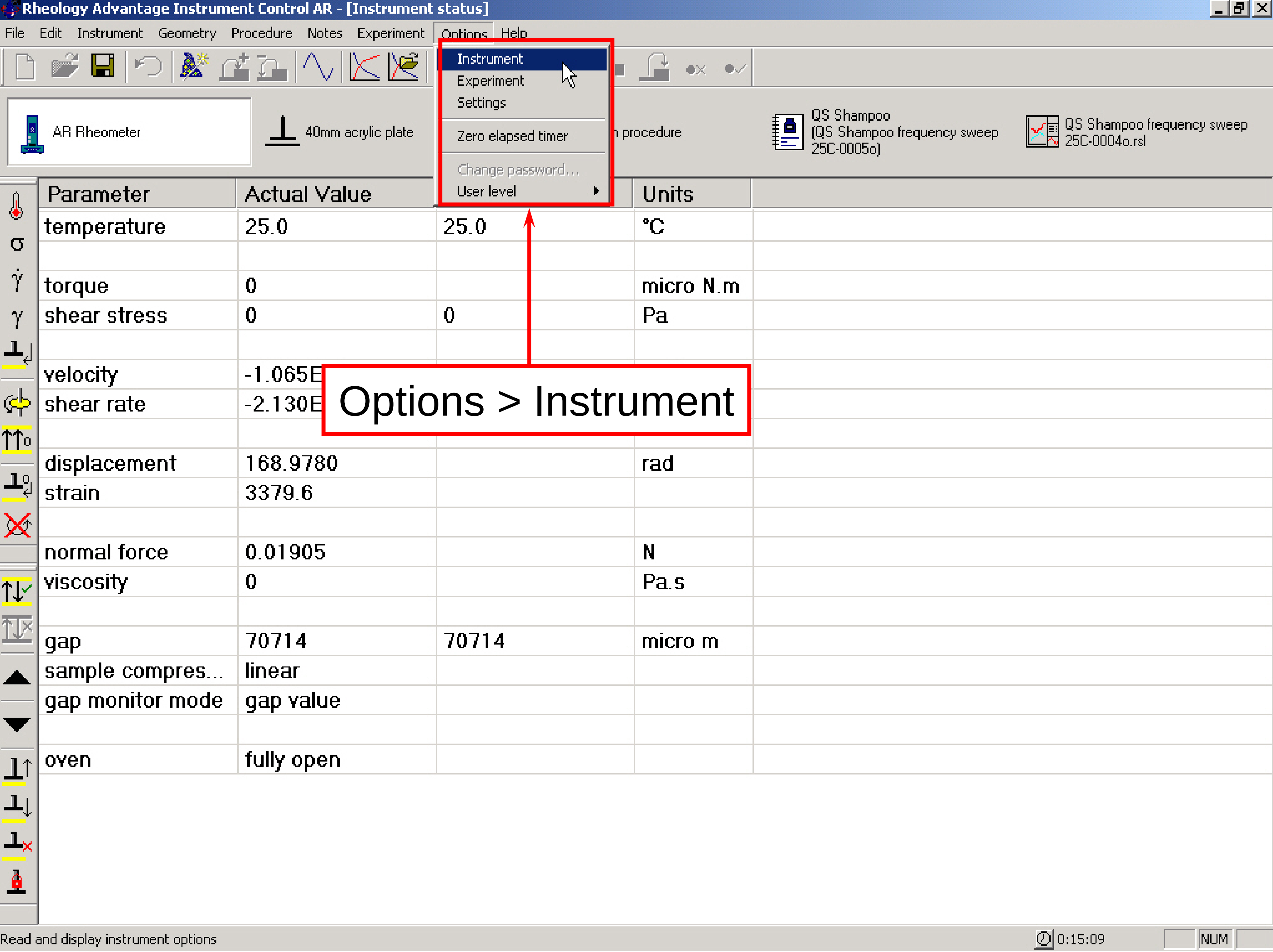

Rheology Advantage Instrument Control AR - [25mm ETC aluminium plate.argeom]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
Instrument
Experiment
Settings
Zero elapsed timer
Change password...
User level
AR2000
25mm ETC aluminium
cedure
PDMS-TTS
(PDMS-TTS-0003o)
PDMS-TTS-0002o.rsl
Description
Dimensions
Settings
Factors
Name
25mm ETC alumin
Notes
Standard ETC alu
Material
Aluminum
Options Experiment
Stress relaxation
Value limits
Expected values
General
Conditioning
Flow
Creep
Oscillation
Wave Form
Display wave form during run
Store wave form with results
Number of points in waveform
64
Strain control
Display try information during run
Store try information with results
Image storing
Save images in results file
An image will be stored for each point
Defaults
OK
Cancel
Apply
Oscillation experiment options
Display options for the experiment
0:39:29
NUM

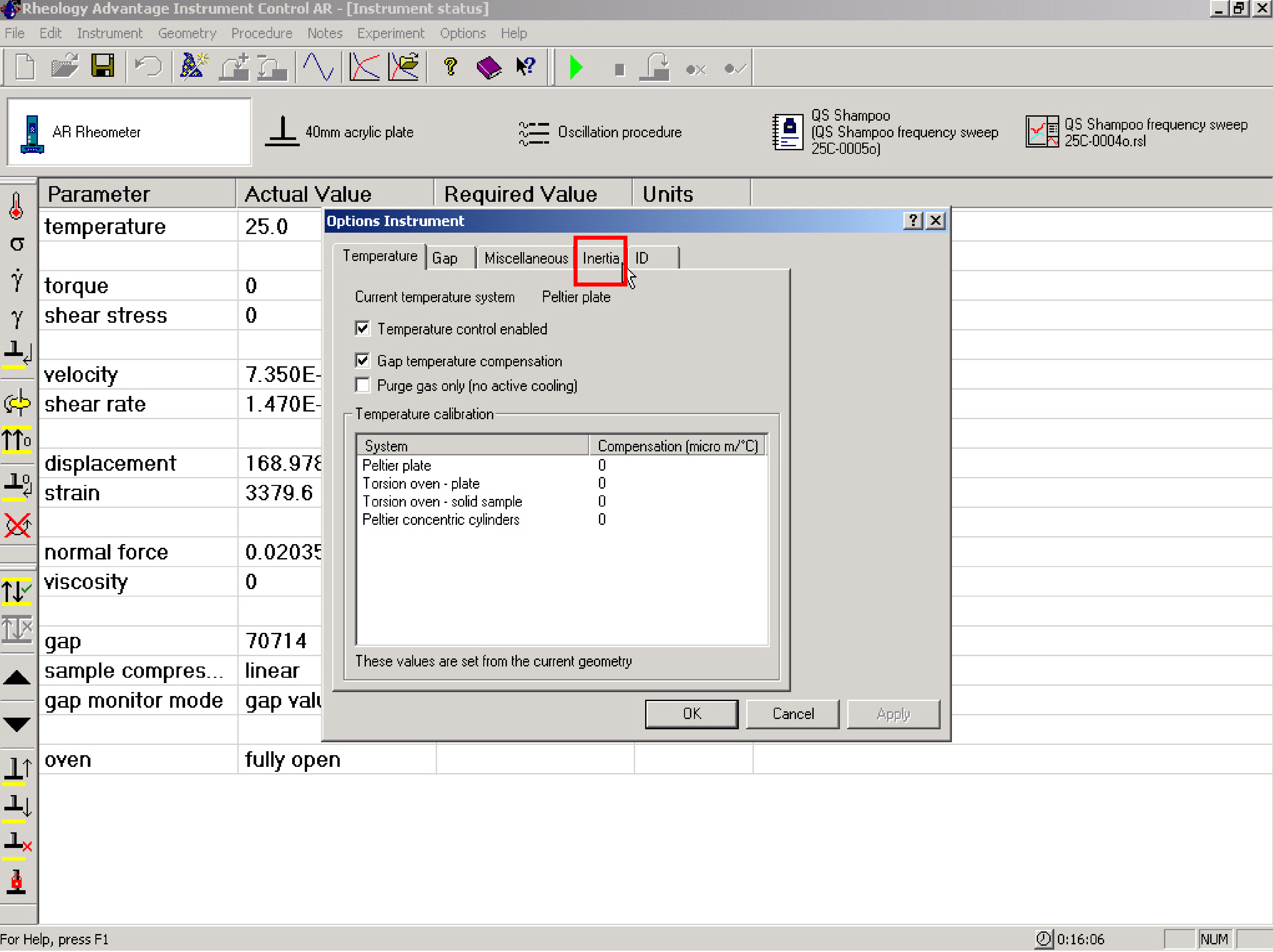
Calibrations

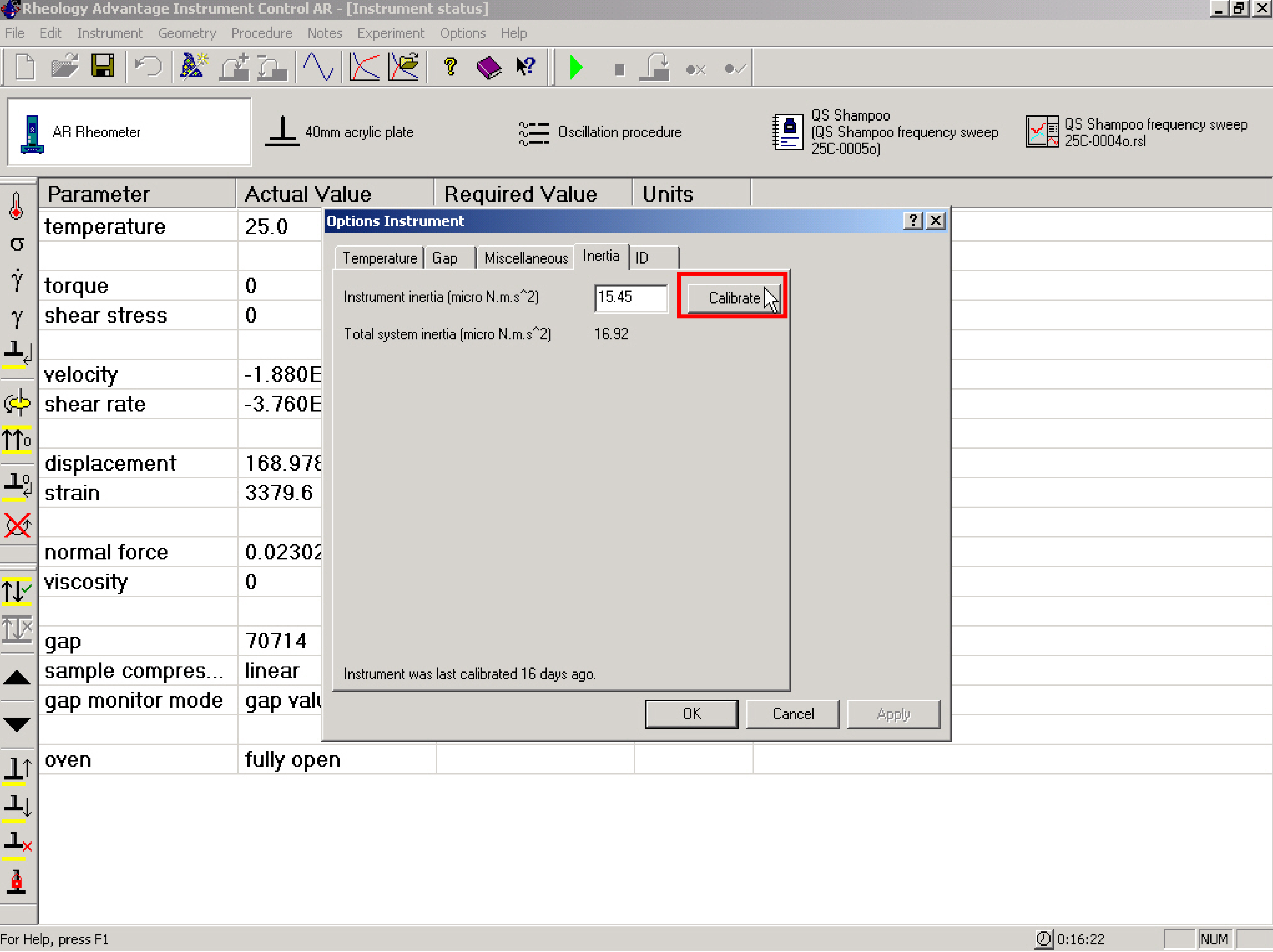
- There are two instrument calibrations that are recommended at least **once a month**
  - Instrument Inertia
  - Bearing Friction Correction
- A couple more that are recommended from time to time
  - Geometry Inertia
  - Gap Temperature Compensation
- Not really a calibration but should be done regularly
  - Mapping

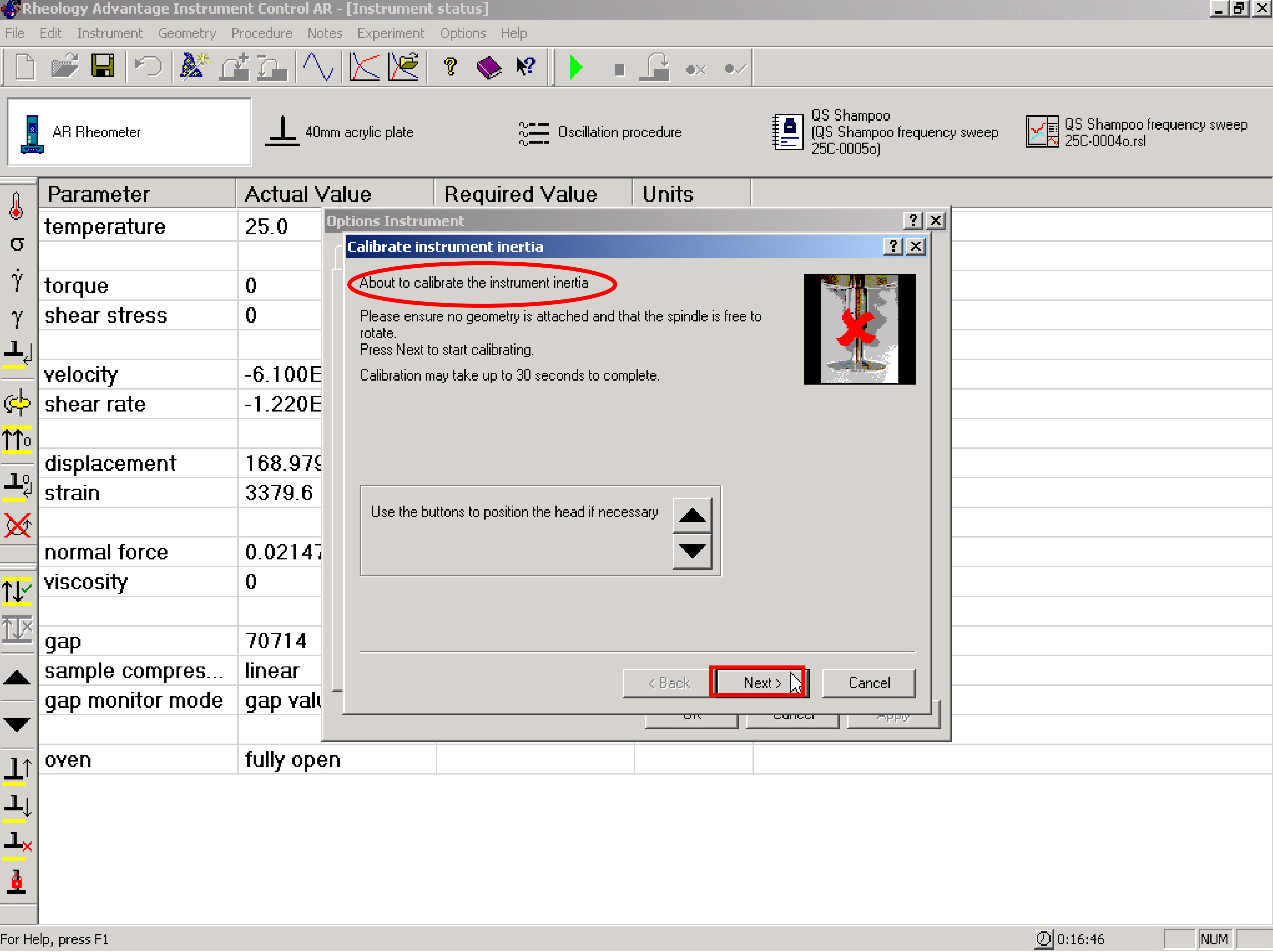
What is Inertia?

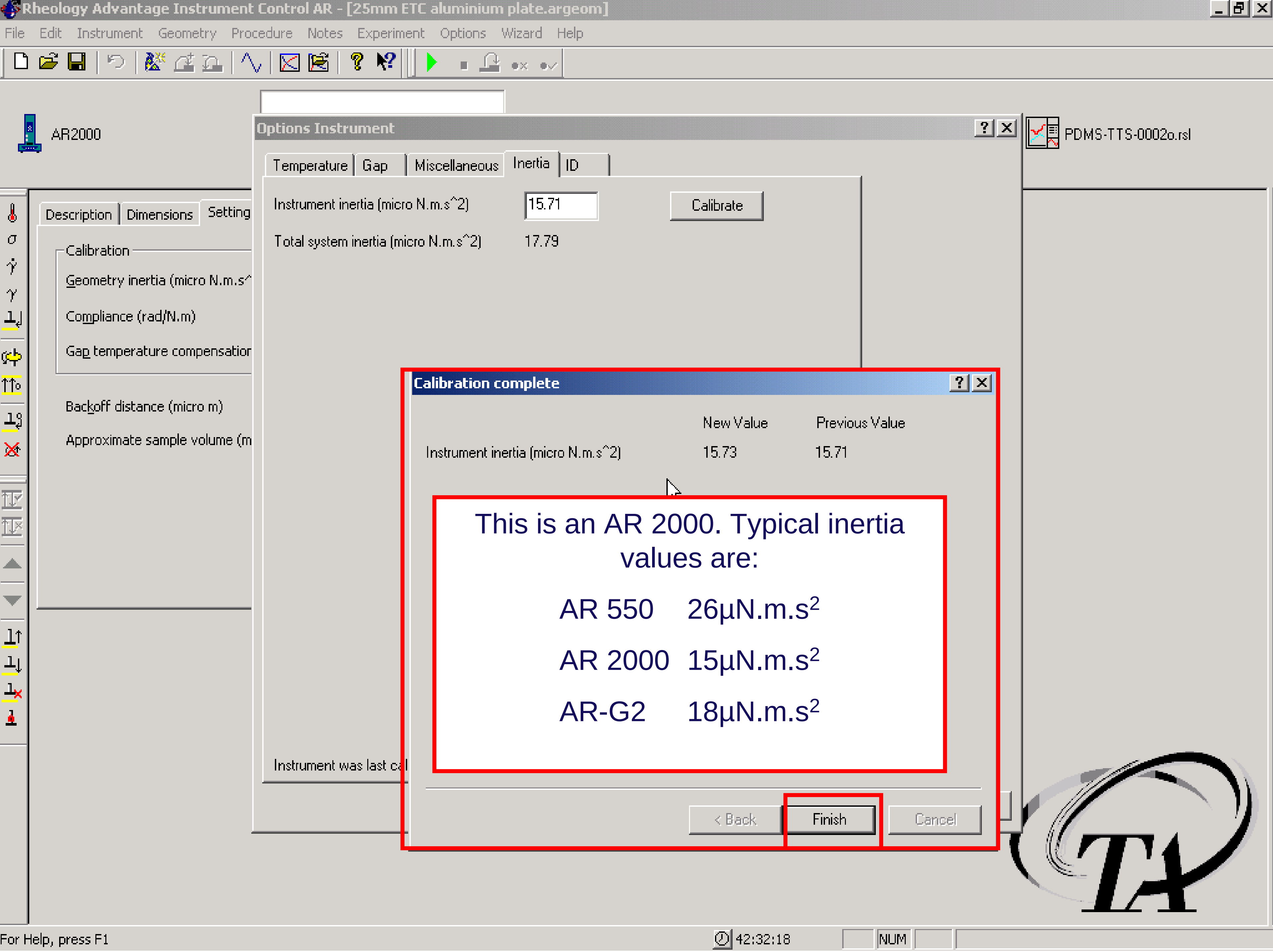
- Definition: That property of matter which manifests itself as a resistance to any change in momentum of a body
- A couple of facts
  - All motors have inertia
  - All rheometers have motors, so …….
- We can measure the inertia of the instrument and the system inertia – instrument + geometry


Rheology Advantage Instrument Control AR - [Instrument status]
File
Edit
Instrument
Geometry
Procedure
Notes
Experiment
Options
Help
Instrument
Experiment
Settings
Zero elapsed timer
Change password...
User level
AR Rheometer
40mm acrylic plate
procedure
QS Shampoo
(QS Shampoo frequency sweep 25C-0005o)
QS Shampoo frequency sweep 25C-0004o.rsl
Parameter
Actual Value
Units
temperature
25.0
25.0
°C
torque
0
micro N.m
shear stress
0
0
Pa
velocity
-1.065E
shear rate
-2.130E
Options > Instrument
displacement
168.9780
rad
strain
3379.6
normal force
0.01905
N
viscosity
0
Pa.s
gap
70714
70714
micro m
sample compres...
linear
gap monitor mode
gap value
oven
fully open
Read and display instrument options
0:15:09
NUM


Rheology Advantage Instrument Control AR - [Instrument status]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo (QS Shampoo frequency sweep 25C-0005o)
QS Shampoo frequency sweep 25C-0004o.rsl
Parameter
Actual Value
Required Value
Units
temperature 25.0
torque 0
shear stress 0
velocity 7.350E-
shear rate 1.470E-
displacement 168.978
strain 3379.6
normal force 0.02035
viscosity 0
gap 70714
sample compres... linear
gap monitor mode gap valu
oven fully open
Options Instrument
Temperature
Gap
Miscellaneous
Inertia
ID
Current temperature system Peltier plate
Temperature control enabled
Gap temperature compensation
Purge gas only (no active cooling)
Temperature calibration
System
Compensation (micro m/°C)
Peltier plate 0
Torsion oven - plate 0
Torsion oven - solid sample 0
Peltier concentric cylinders 0
These values are set from the current geometry
OK
Cancel
Apply
For Help, press F1
0:16:06
NUM


Rheology Advantage Instrument Control AR - [Instrument status]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
25C-0005o)
QS Shampoo frequency sweep
25C-0004o.rsl
Parameter
Actual Value
Required Value
Units
temperature 25.0
torque 0
shear stress 0
velocity -1.880E
shear rate -3.760E
displacement 168.978
strain 3379.6
normal force 0.02302
viscosity 0
gap 70714
sample compres... linear
gap monitor mode gap valu
oven fully open
Options Instrument
Temperature
Gap
Miscellaneous
Inertia
ID
Instrument inertia (micro N.m.s^2)
15.45
Calibrate
Total system inertia (micro N.m.s^2)
16.92
Instrument was last calibrated 16 days ago.
OK
Cancel
Apply
For Help, press F1
0:16:22
NUM


Rheology Advantage Instrument Control AR - [Instrument status]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo (QS Shampoo frequency sweep 25C-0005o)
QS Shampoo frequency sweep 25C-0004o.rsl
Parameter
Actual Value
Required Value
Units
temperature 25.0
torque 0
shear stress 0
velocity -6.100E
shear rate -1.220E
displacement 168.979
strain 3379.6
normal force 0.02147
viscosity 0
gap 70714
sample compres... linear
gap monitor mode gap valu
oven fully open
Options Instrument
Calibrate instrument inertia
About to calibrate the instrument inertia
Please ensure no geometry is attached and that the spindle is free to rotate.
Press Next to start calibrating.
Calibration may take up to 30 seconds to complete.
Use the buttons to position the head if necessary
< Back
Next >
Cancel
For Help, press F1
0:16:46
NUM



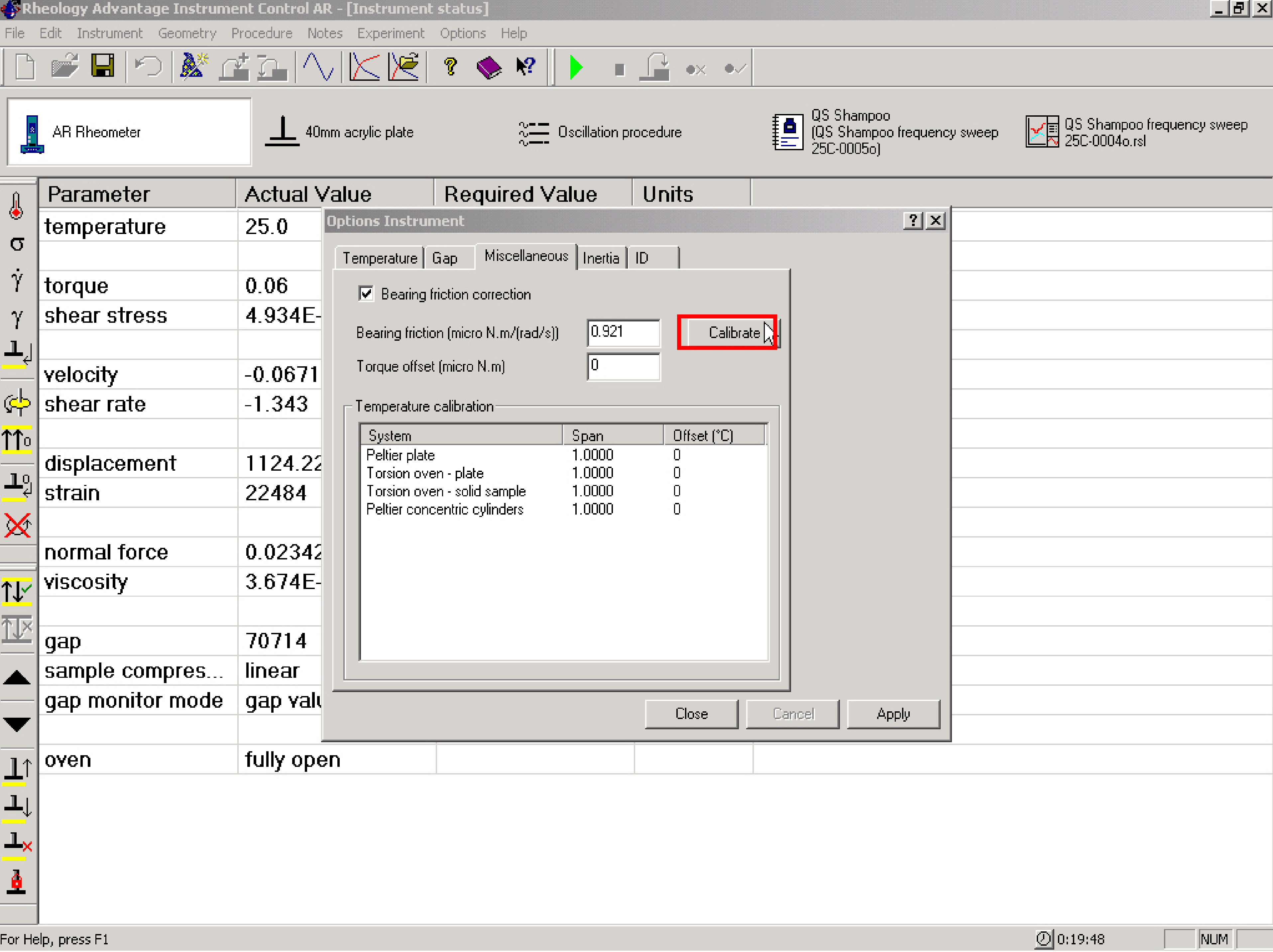
Rheology Advantage Instrument Control AR - [25mm ETC aluminium plate.argeom]
File Edit Instrument Geometry Procedure Notes Experiment Options Wizard Help
AR2000
PDMS-TTS-0002o.rsl
Options Instrument
Temperature Gap Miscellaneous Inertia ID
Instrument inertia (micro N.m.s^2) 15.71
Calibrate
Total system inertia (micro N.m.s^2) 17.79
Description Dimensions Setting
Calibration
Geometry inertia (micro N.m.s^
Compliance (rad/N.m)
Gap temperature compensation
Backoff distance (micro m)
Approximate sample volume (m
Instrument was last ca
Calibration complete
New Value
Previous Value
Instrument inertia (micro N.m.s^2) 15.73 15.71
This is an AR 2000. Typical inertia values are:
AR 550 26µN.m.s²
AR 2000 15µN.m.s²
AR-G2 18µN.m.s²
< Back
Finish
Cancel
For Help, press F1
42:32:18
NUM

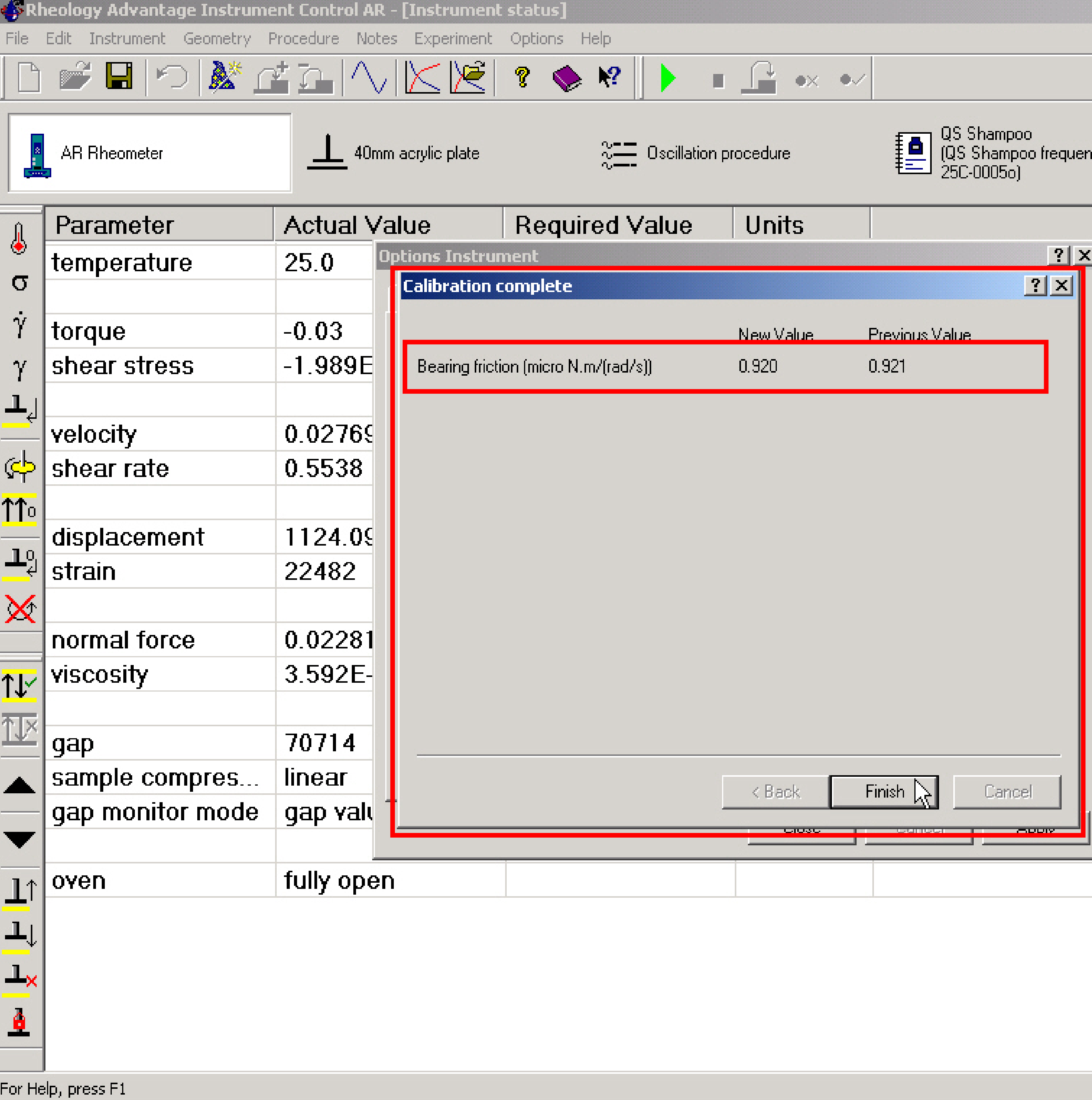
Calibrations

- There are two instrument calibrations that are recommended at least **once a month**
  - Instrument Inertia
  - **Bearing Friction Correction**
- A couple more that are recommended from time to time
  - Geometry Inertia
  - Gap Temperature Compensation
- Not really a calibration but should be done regularly
  - Mapping

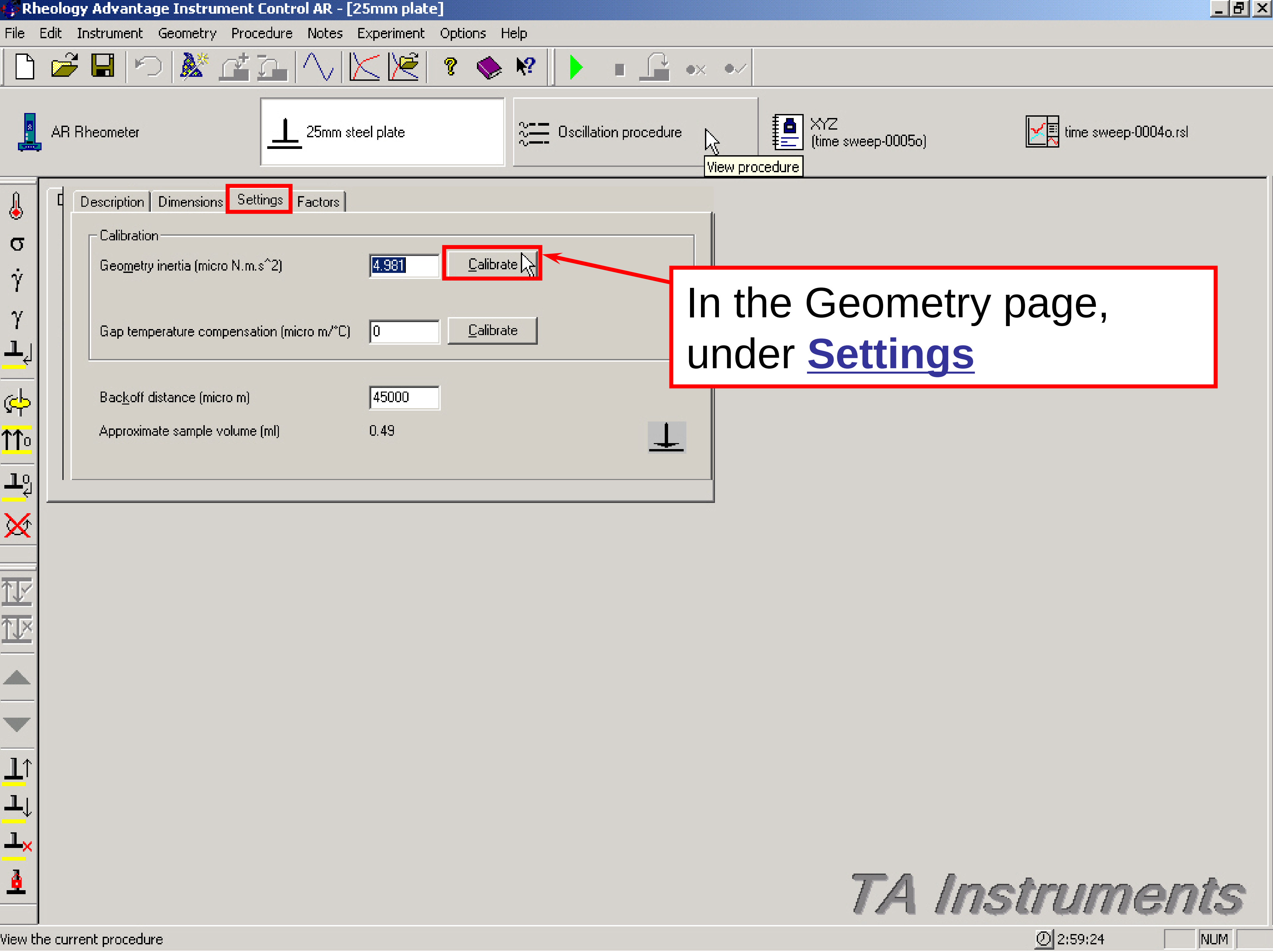
Bearing Friction

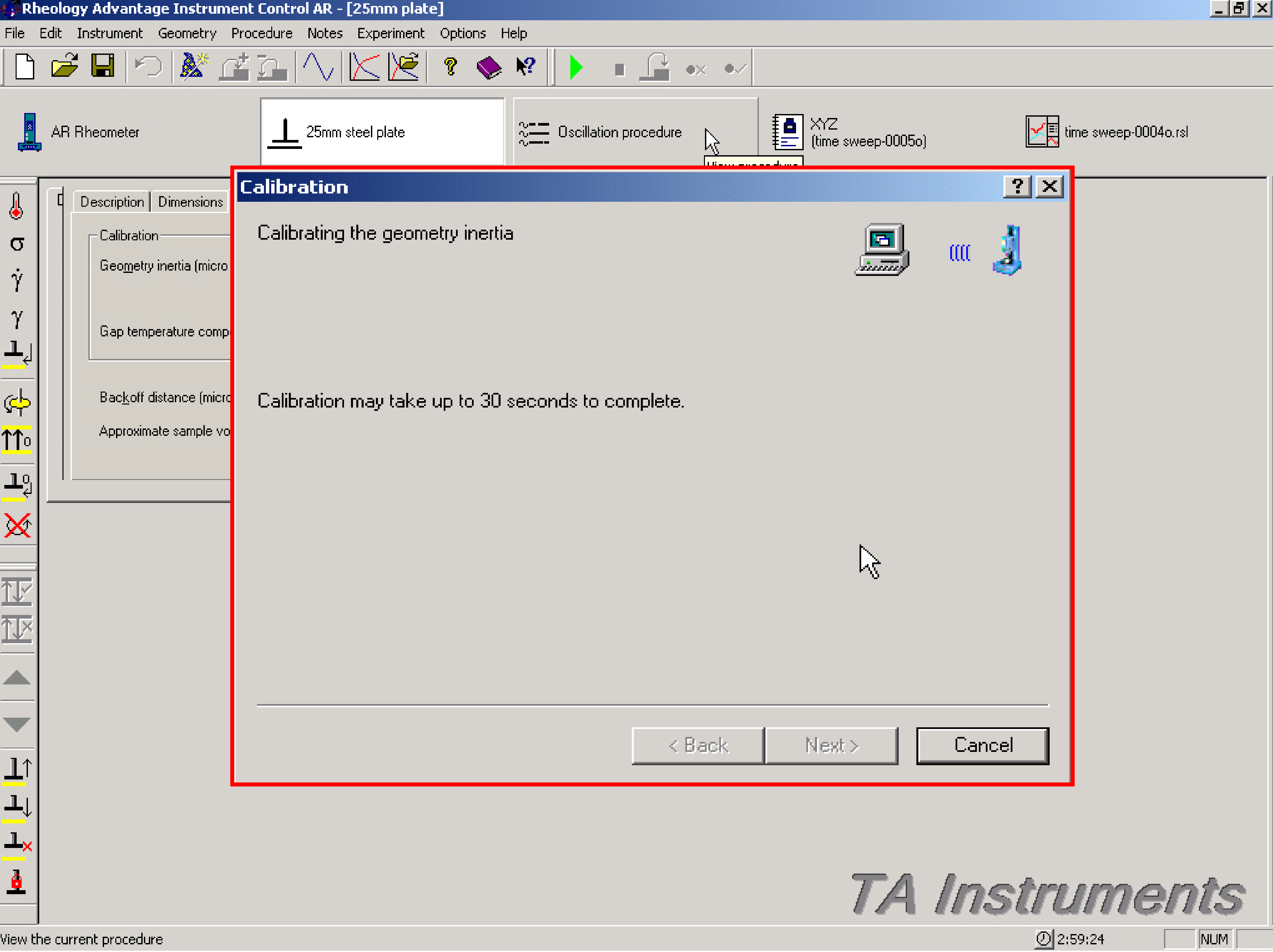
- Nobody has created a frictionless bearing
- The lower the friction, the better the low torque performance
- Bearing friction can vary depending on gap of thrust bearing and type of bearing

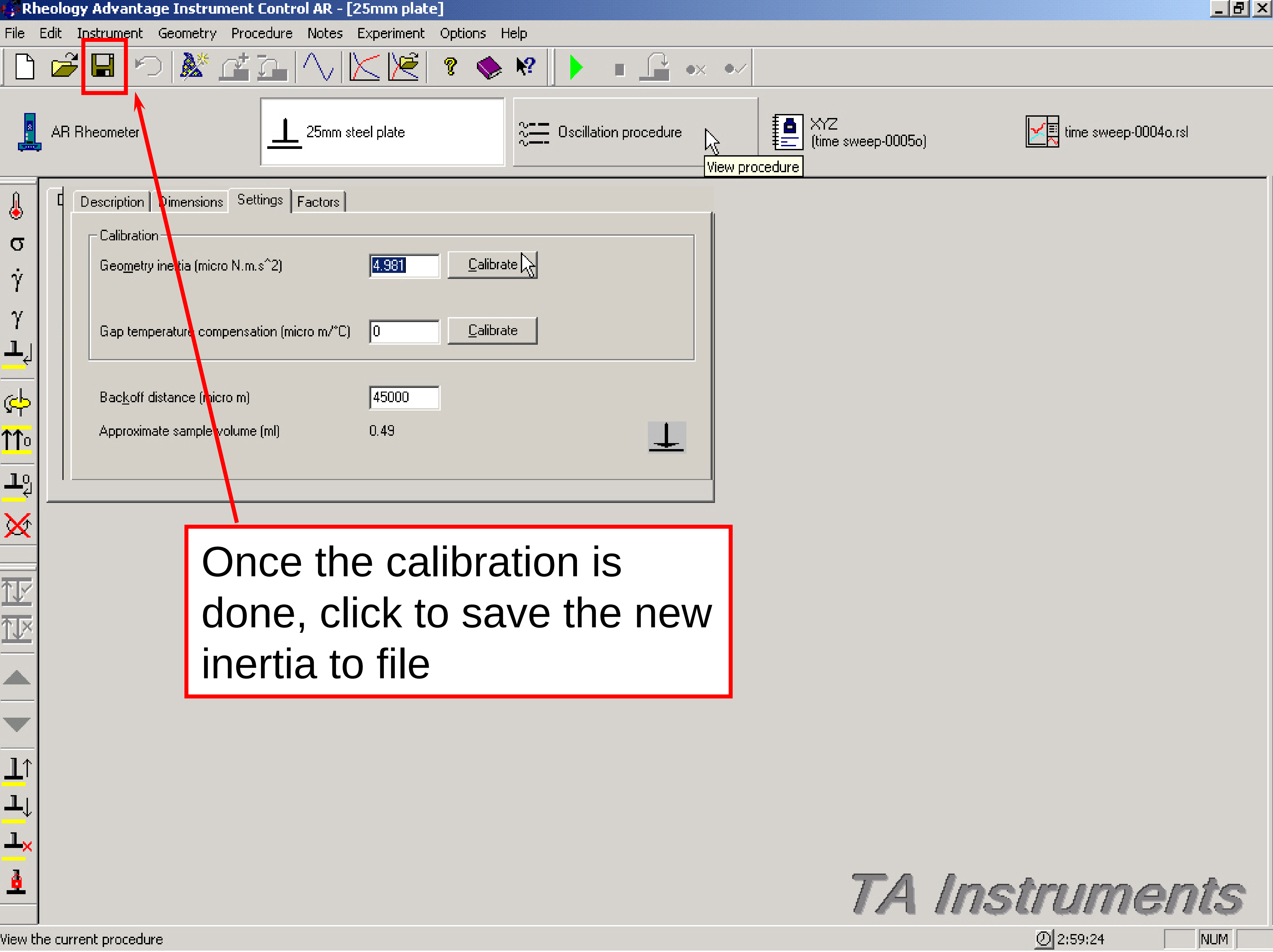

Rheology Advantage Instrument Control AR - [Instrument status]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
25C-0005o)
QS Shampoo frequency sweep
25C-0004o.rsl
Parameter
Actual Value
Required Value
Units
temperature
25.0
torque
0.06
shear stress
4.934E-
velocity
-0.0671
shear rate
-1.343
displacement
1124.22
strain
22484
normal force
0.02342
viscosity
3.674E-
gap
70714
sample compres...
linear
gap monitor mode
gap valu
oven
fully open
Options Instrument
Temperature
Gap
Miscellaneous
Inertia
ID
Bearing friction correction
Bearing friction (micro N.m/(rad/s))
0.921
Calibrate
Torque offset (micro N.m)
0
Temperature calibration
System
Span
Offset (°C)
Peltier plate
1.0000
0
Torsion oven - plate
1.0000
0
Torsion oven - solid sample
1.0000
0
Peltier concentric cylinders
1.0000
0
Close
Cancel
Apply
For Help, press F1
0:19:48
NUM



This is for an AR 2000. Bearing friction for an AR G2 is approximately 0.3 – 1/3 of the AR 2000 due to the lower friction of the G2's magnetic bearing. The AR 550 is approximately the same value as the AR 2000.


Rheology Advantage Instrument Control AR - [25mm plate]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
25mm steel plate
Oscillation procedure
View procedure
XYZ
(time sweep-0005o)
time sweep-0004o.rsl
Description
Dimensions
Settings
Factors
Calibration
Geometry inertia (micro N.m.s^2)
4.981
Calibrate
Gap temperature compensation (micro m/°C)
0
Calibrate
Backoff distance (micro m)
45000
Approximate sample volume (ml)
0.49
In the Geometry page,
under Settings
TA Instruments
View the current procedure
2:59:24
NUM


Rheology Advantage Instrument Control AR - [25mm plate]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
25mm steel plate
Oscillation procedure
XYZ
(time sweep-0005o)
time sweep-0004o.rsl
Description
Dimensions
Calibration
Geometry inertia (micro
Gap temperature comp
Backoff distance (micro
Approximate sample vo
Calibration
Calibrating the geometry inertia
Calibration may take up to 30 seconds to complete.
< Back
Next >
Cancel
TA Instruments
View the current procedure
2:59:24
NUM


Rheology Advantage Instrument Control AR - [25mm plate]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
25mm steel plate
Oscillation procedure
View procedure
XYZ
(time sweep-0005o)
time sweep-0004o.rsl
Description
Dimensions
Settings
Factors
Calibration
Geometry inertia (micro N.m.s^2)
4.981
Calibrate
Gap temperature compensation (micro m/°C)
0
Calibrate
Backoff distance (micro m)
45000
Approximate sample volume (ml)
0.49
Once the calibration is done, click to save the new inertia to file
TA Instruments
View the current procedure
2:59:24
NUM

Typical Inertia's

Diameter (mm)	Acrylic	Stainless Steel
20	0.43	2.8
40	1.34	6.92
60	3.03	23.32

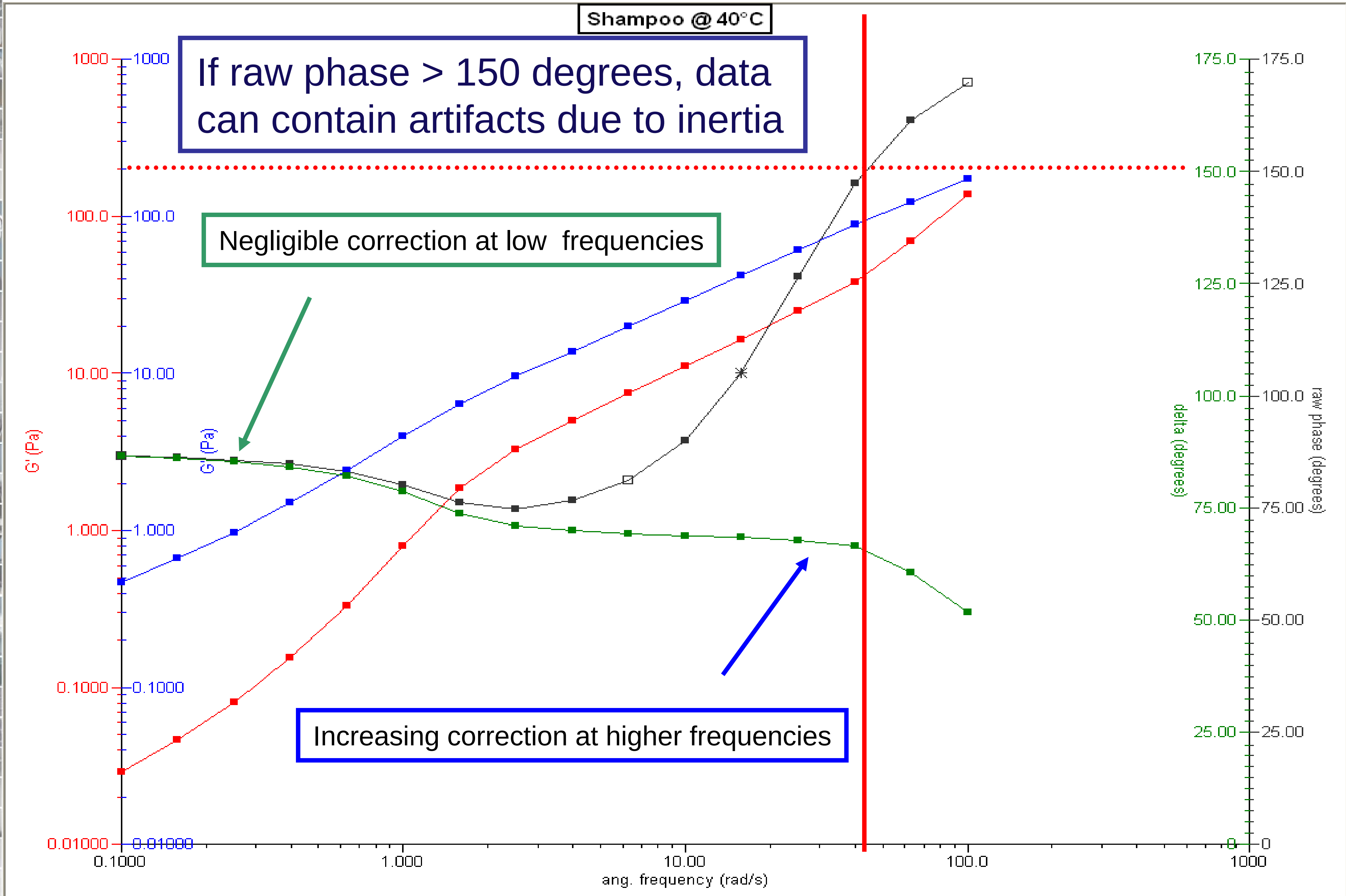
System inertia in AR Rheometer

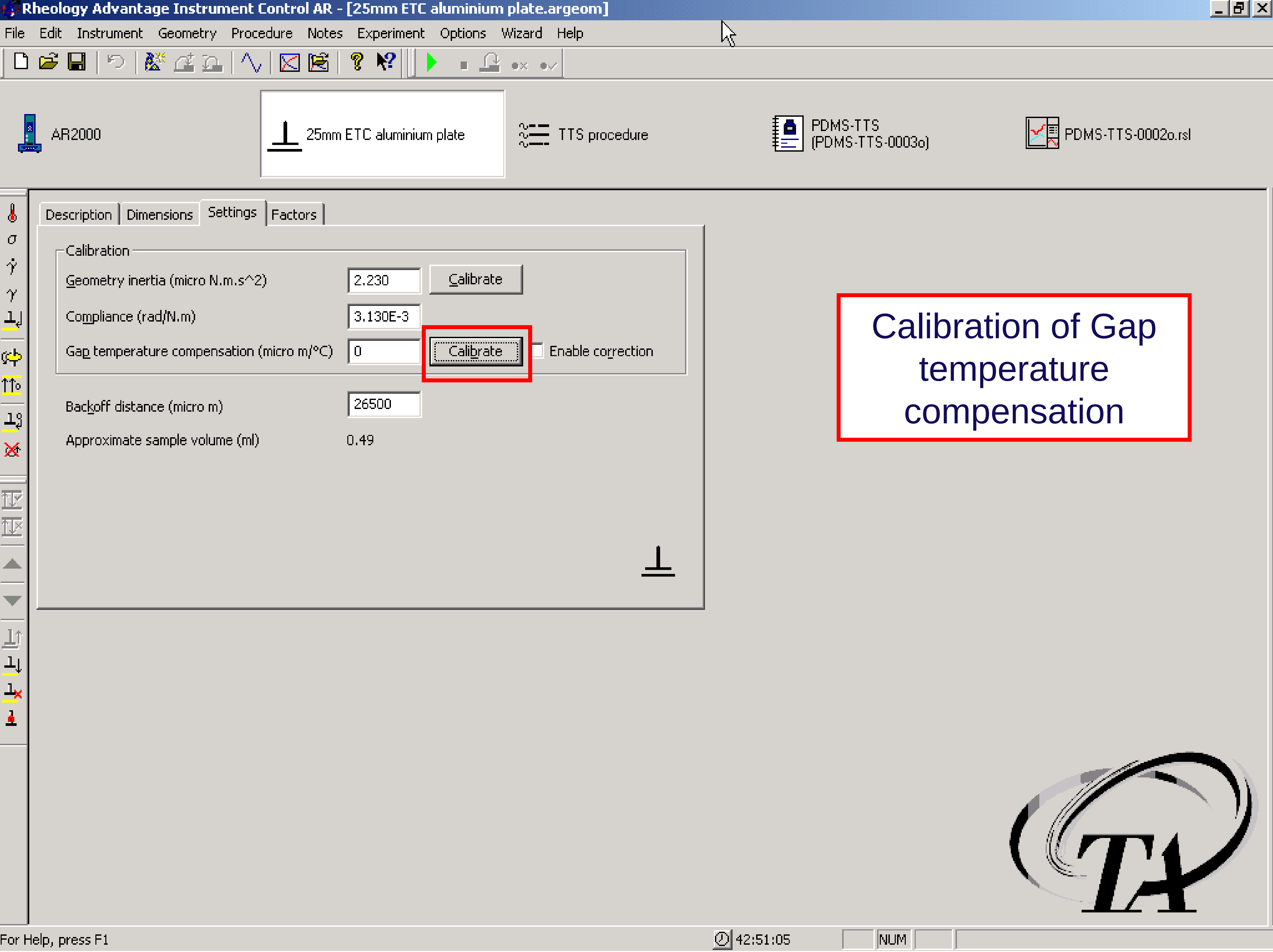
- The contribution of system inertia can be observed by plotting ***Raw Phase***

  raw phase * Inertia Correction = delta

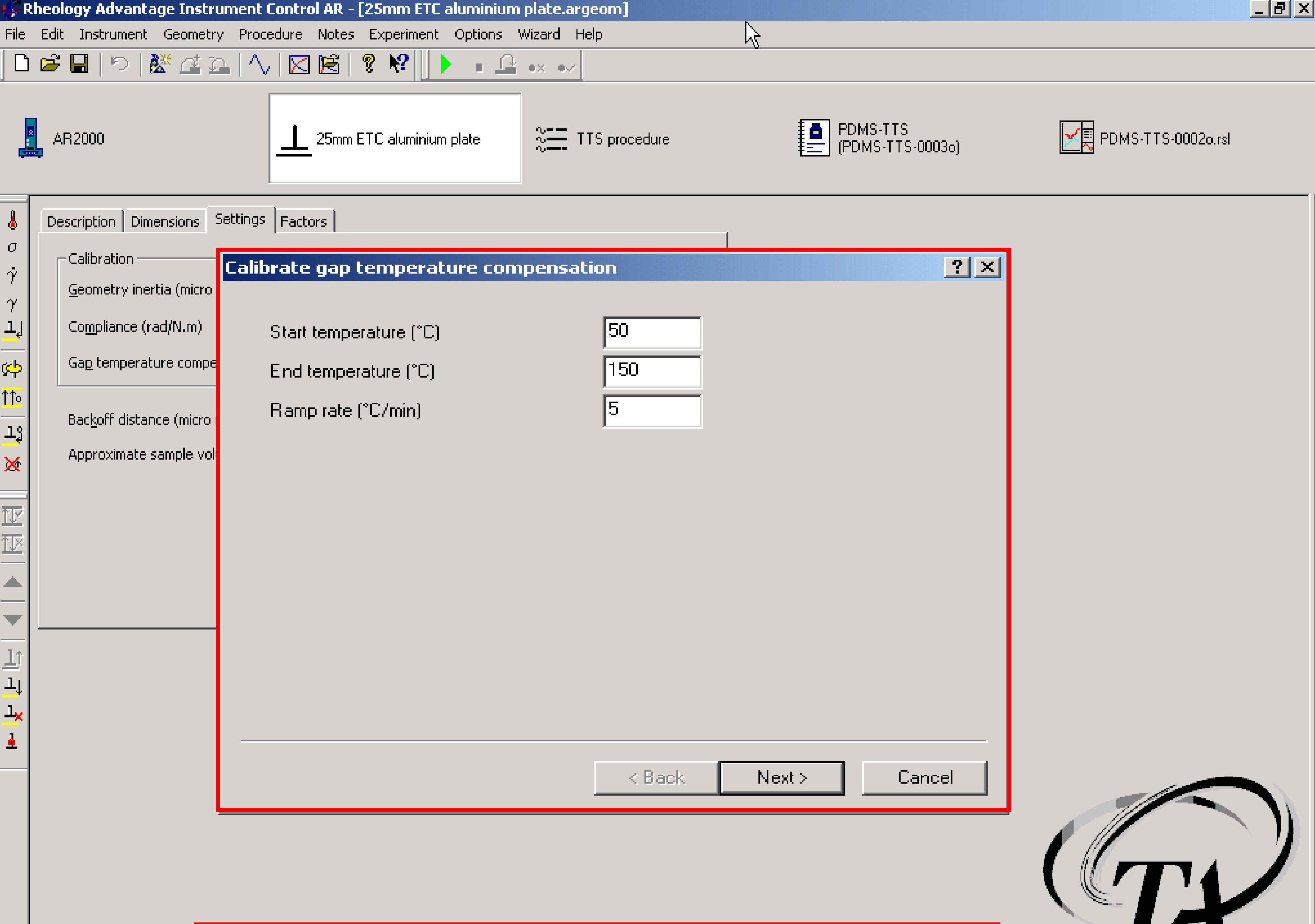
- Raw phase is the uncorrected phase angle for inertia
- When raw phase is greater than 150 degrees, the contribution of the instrument (system inertia) in the measurement is greater than from the sample

AR Correction for Inertia

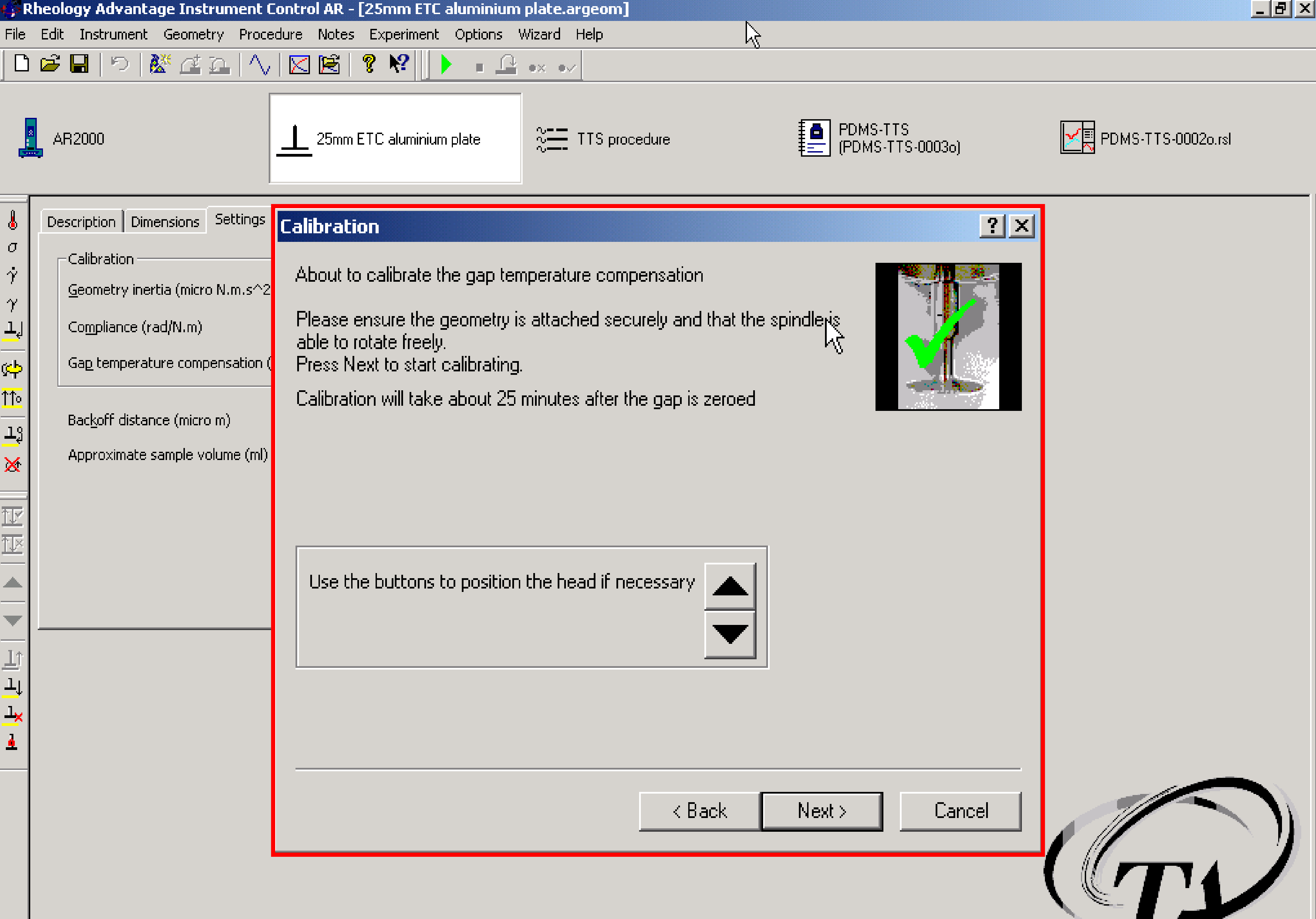




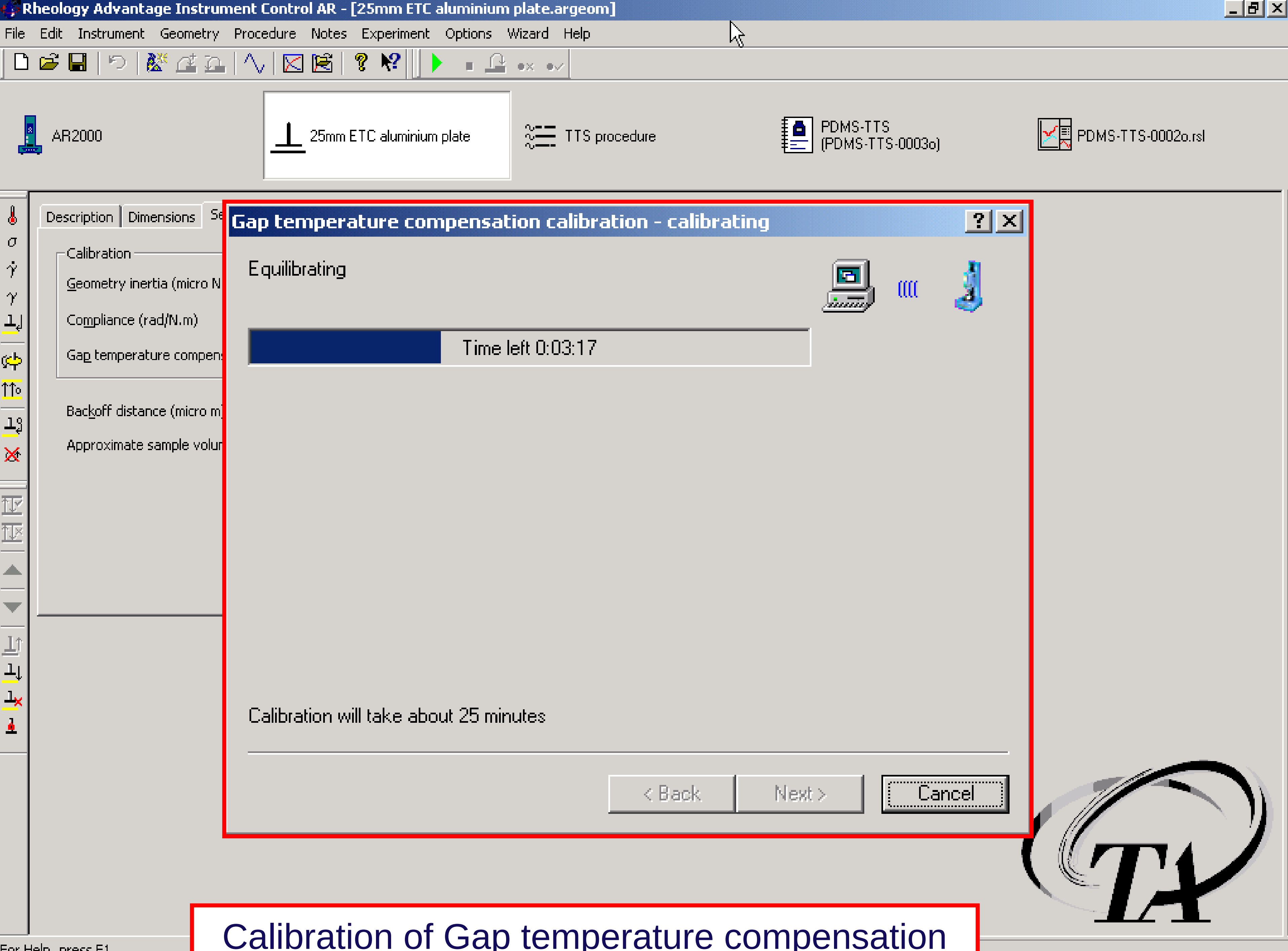
Calibration of Gap temperature compensation



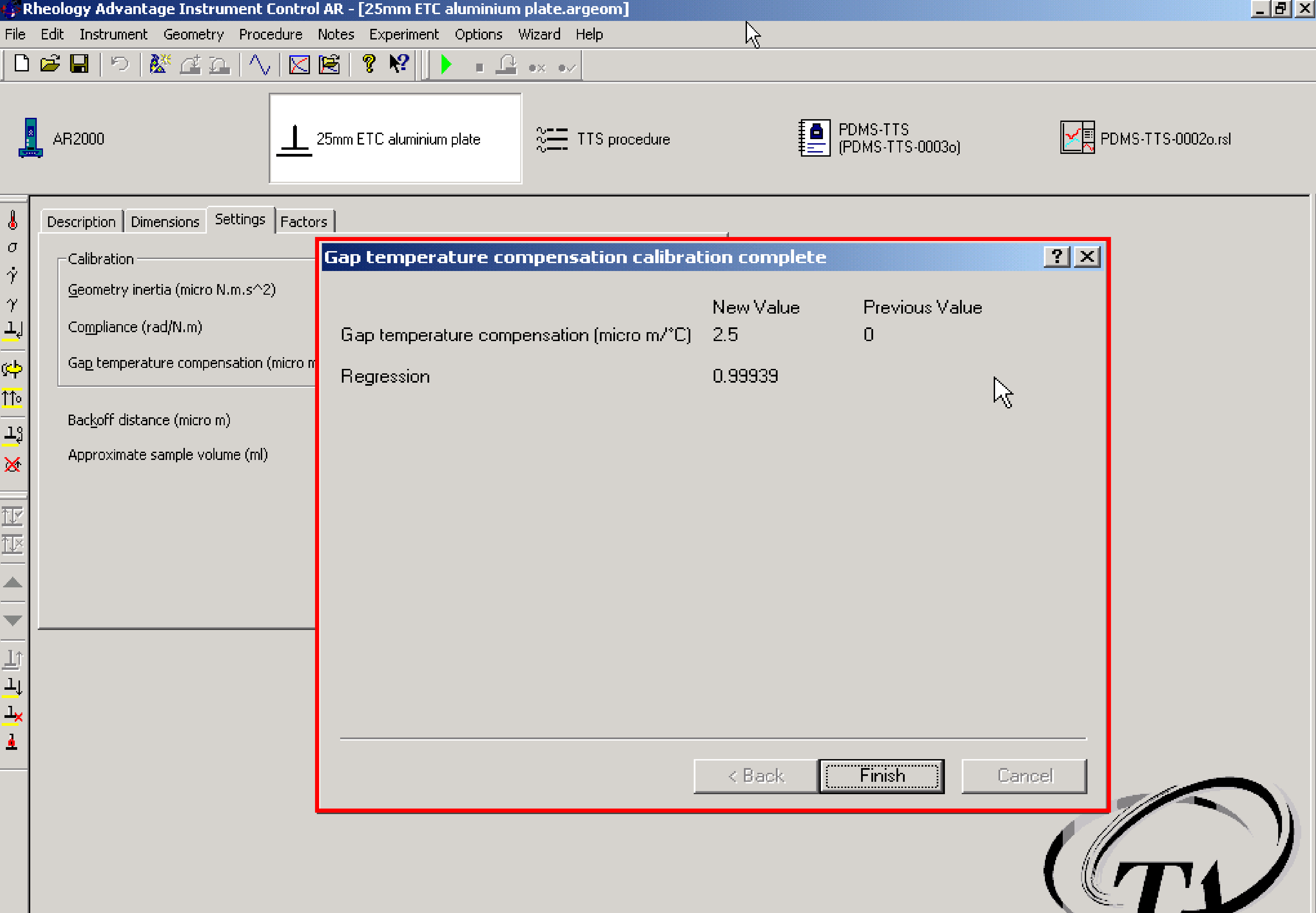
Calibration of Gap temperature compensation



Calibration of Gap temperature compensation



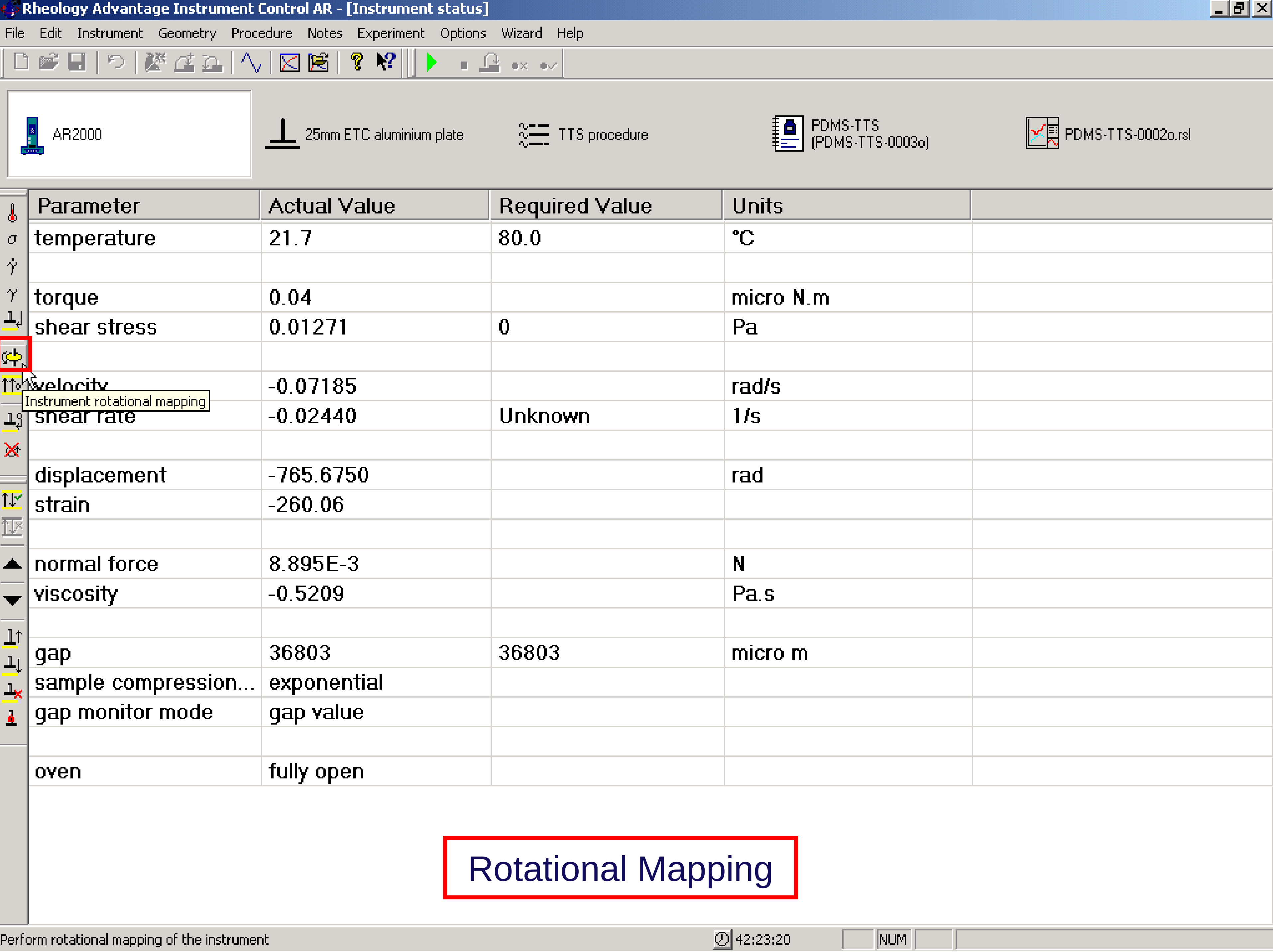
Calibration of Gap temperature compensation



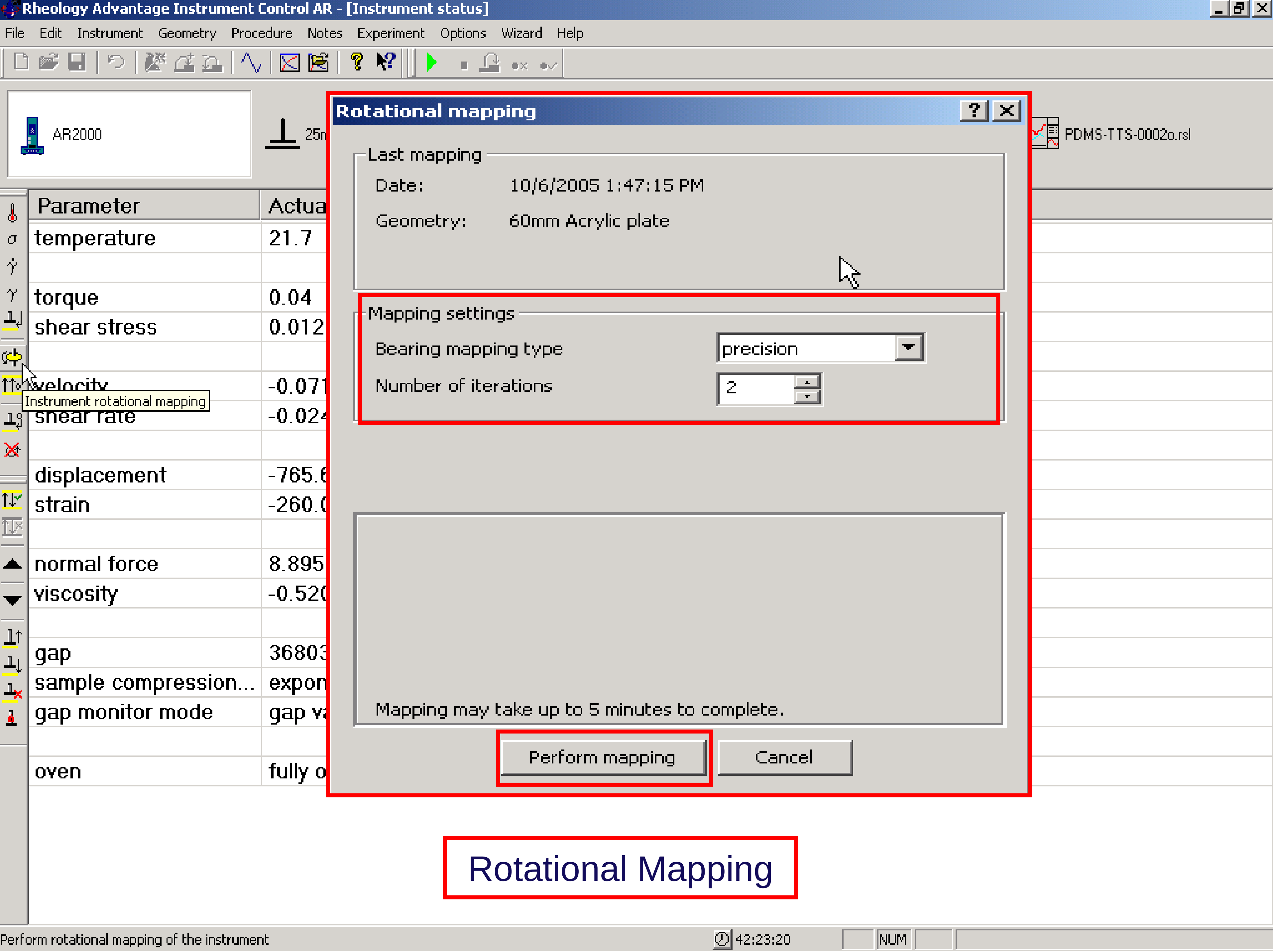
Calibration of Gap temperature compensation

Calibrations

- There are two instrument calibrations that are recommended at least **once a month**
  - Instrument Inertia
  - Bearing Friction Correction
- A couple more that are recommended from time to time
  - Geometry Inertia
  - Gap Temperature Compensation
- Not really a calibration but should be done regularly
  - **Mapping**



Rotational Mapping

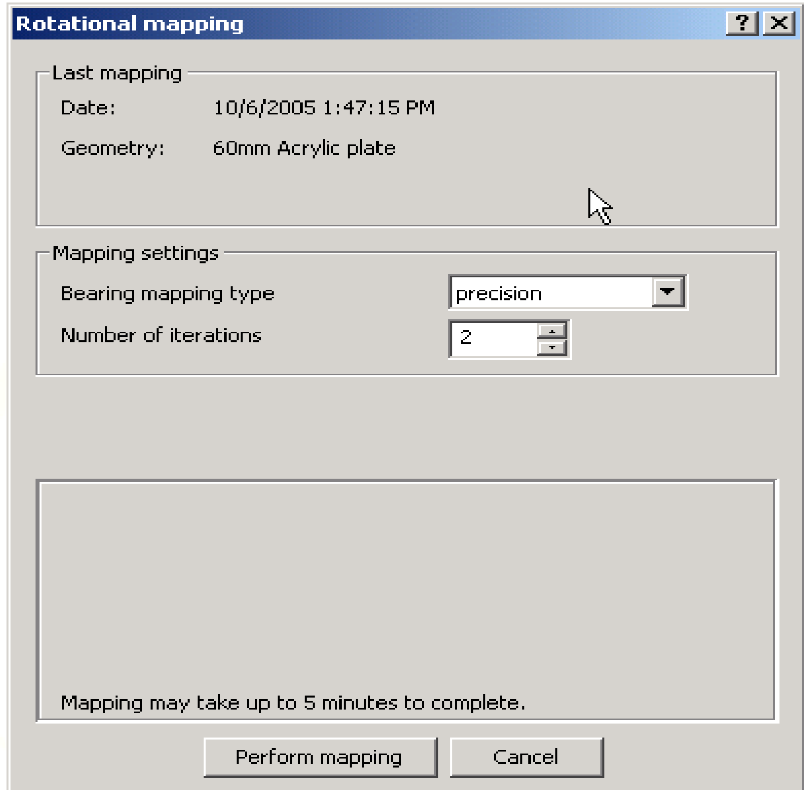


Rotational Mapping

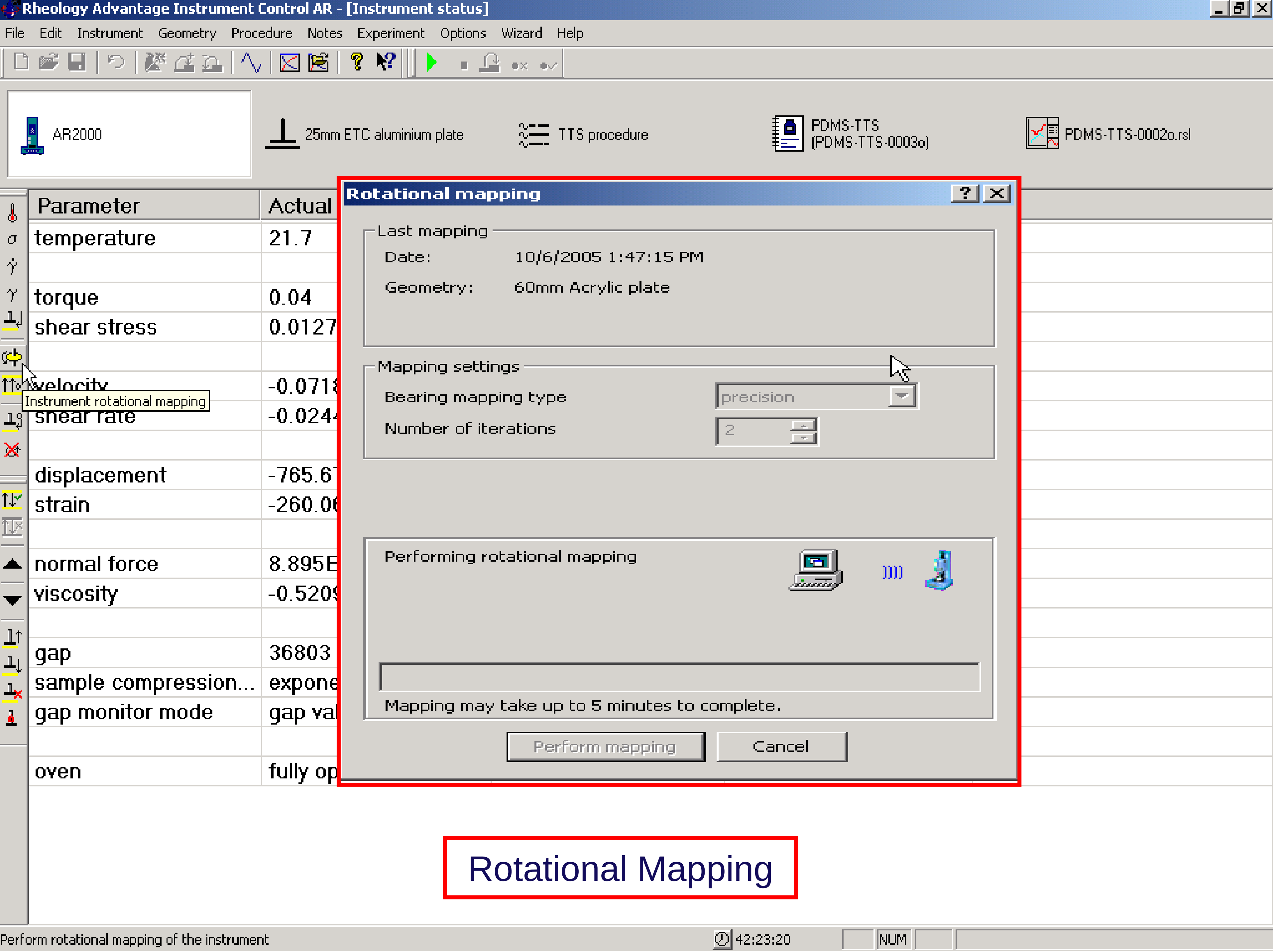
Mapping Types

- Standard
  - Approx 1 min to complete
- Fast
  - Approx 45 sec to complete
- Precision
  - Takes about 2 min to complete
- Extended (AR 2000 only)
  - Best low torque/velocity performance

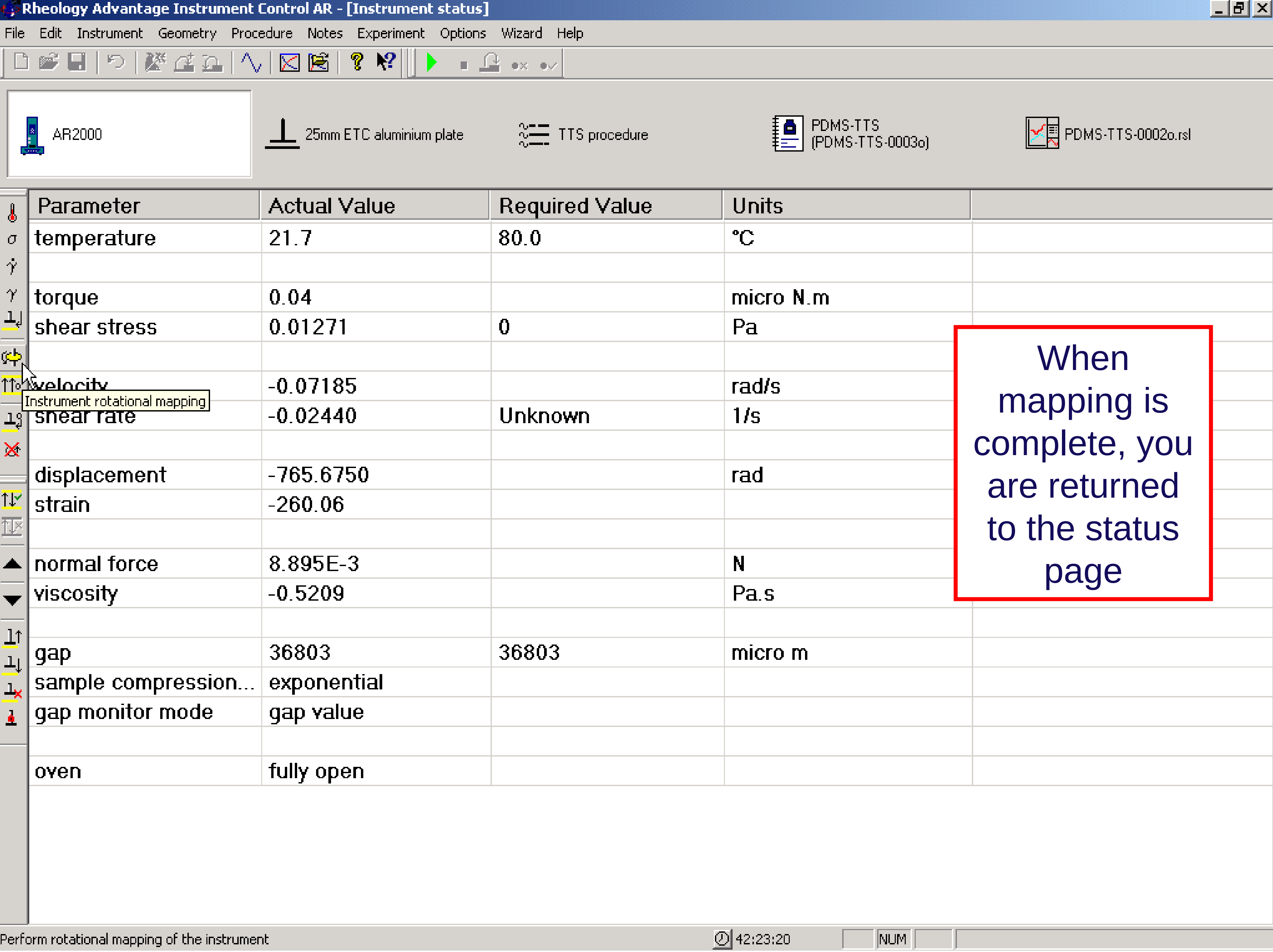
Mapping Iterations



- The more iterations the better to a point. Improvement is reduced after 2 iterations.

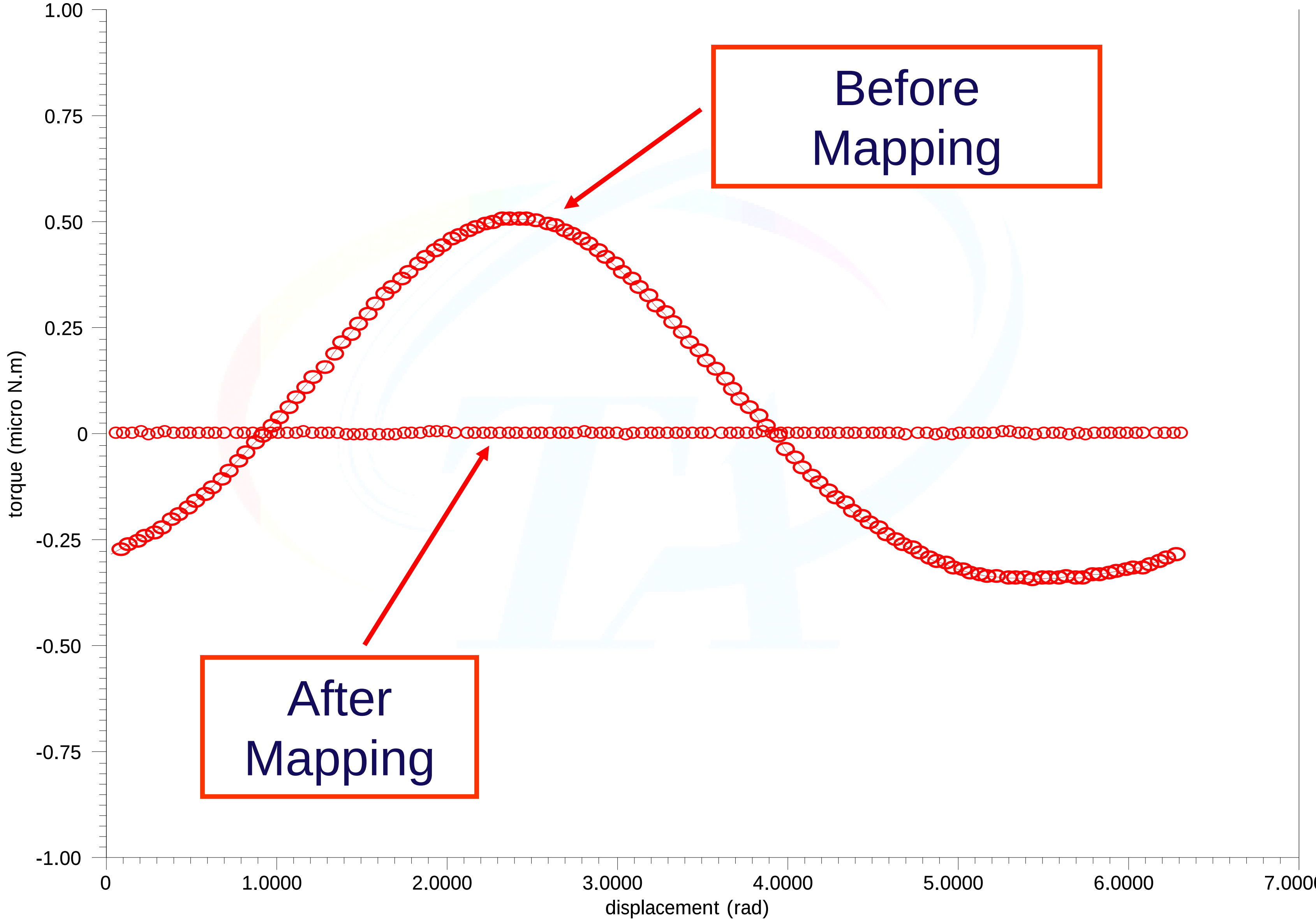


Rotational Mapping



When mapping is complete, you are returned to the status page

Residual Torque Before & After Mapping



System Verification

- Attach a 60 mm 2° cone (if available, if not then use the largest cone available)
- Zero
- Load sample of certified standard oil
- Carry out a 2 min flow test over as wide a range as possible
- Determine Newtonian viscosity. If it is more than 5% different from certified value repeat the experiment. If the results are still in error contact TA for advice

Sources of Error

- Over or underfilling of gap
  - Ensure that you have a standard method of sample loading
- Temperature error
  - Verify the temperature against a certified digital thermometer
- Gap Setting
  - Ensure that the gap was correctly zeroed and that the correct truncation is being used

Maintenance

- Check air filter and regulators for proper functioning
- If air must be turned off, then make sure that the bearing lock is fastened prior to turning air off
  - NOTE: **<u>Do not</u>** rotate drive-shaft if air goes off
- Confidence check: Cannon certified viscosity standards
  - 250024.001: Low viscosity standard oil
  - 250024.002: High viscosity standard oil

Check Air Filters

- Air supply should be clean and dry
- Check for moisture and contaminates at least once a month

Manual & Help files in RA

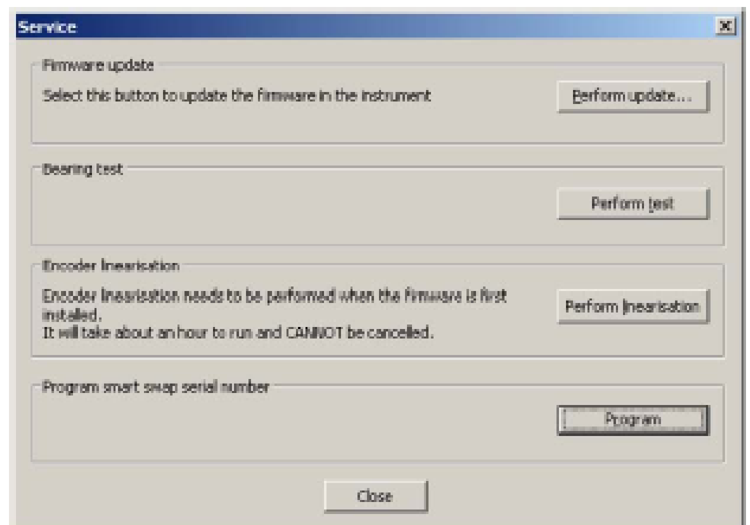
- The online help manual is an excellent source of information
  - *.pdf files, with information installation, operation and some basic theory
- In the Rheology Advantage, Click on Help

Operators Manual

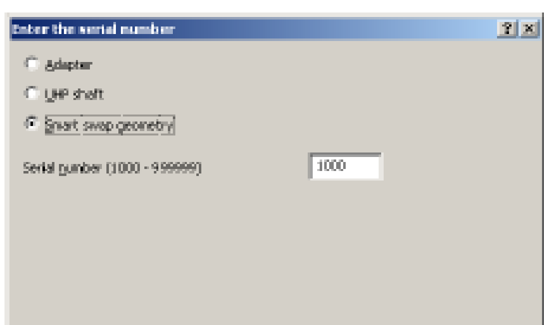
Reprogramming the Serial Number

An attempt to reprogram the serial number can be made by following these steps.

1. Select Options/Instrument/ID and click on the Service button the dialog shown to the right is displayed.



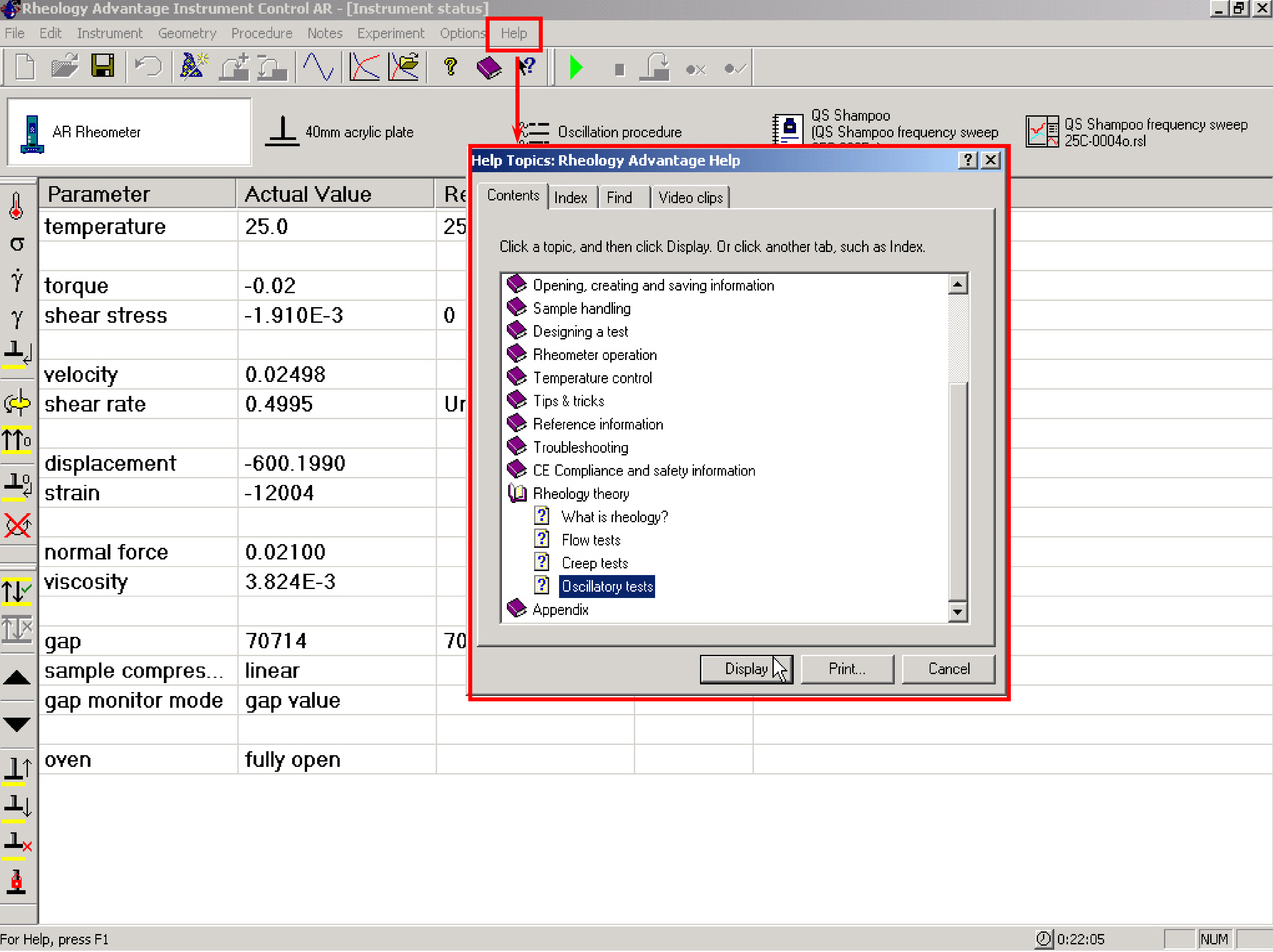
2. Select the Program button. The dialog shown below is displayed.



3. Select the Smart swap geometry radio button. The instrument will attempt to read the existing serial number and will return a value of 1000, if nothing can be read.

4. Enter the serial number of the geometry (located on

From the AR-G2 manual


Rheology Advantage Instrument Control AR - [Instrument status]
File
Edit
Instrument
Geometry
Procedure
Notes
Experiment
Options
Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
QS Shampoo frequency sweep
25C-0004o.rsl
Parameter
Actual Value
temperature
25.0
torque
-0.02
shear stress
-1.910E-3
0
velocity
0.02498
shear rate
0.4995
displacement
-600.1990
strain
-12004
normal force
0.02100
viscosity
3.824E-3
gap
70714
sample compres...
linear
gap monitor mode
gap value
oven
fully open
Help Topics: Rheology Advantage Help
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Click a topic, and then click Display. Or click another tab, such as Index.
Opening, creating and saving information
Sample handling
Designing a test
Rheometer operation
Temperature control
Tips & tricks
Reference information
Troubleshooting
CE Compliance and safety information
Rheology theory
What is rheology?
Flow tests
Creep tests
Oscillatory tests
Appendix
Display
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Cancel
For Help, press F1
0:22:05
NUM

Oscillatory tests

We learn at an early age that materials may be gases, liquids or solids. But this is an oversimplification. Many industrial materials show behaviour which is neither completely liquid nor completely solid, but is somewhere between the two. Such materials are termed viscoelastic. Typical examples are polymer solutions and melts, and particulate dispersions such as paints, inks, drilling fluids, creams and lotions, and many types of foodstuffs.

It is viscoelasticity which is responsible, at least in part, for the handling properties of these materials, and it is important that they should exhibit it in the correct degree. For example if a printing ink is too elastic (solid) it will fail to enter the nip, whereas if it is too liquid it will show poor dot definition. There are several ways of examining the viscoelastic properties of materials, but the commonest, and most versatile, is to use oscillatory rheology.

If a sinusoidal stress, σ (force acting over an area), is placed on a *solid* sample, a sinusoidal displacement (strain, γ) will result which is in phase with the applied stress. The modulus, or stiffness, of the material can be obtained by dividing the amplitude of the stress, σ_0, by the amplitude of the strain, γ_0 (Figure 1):

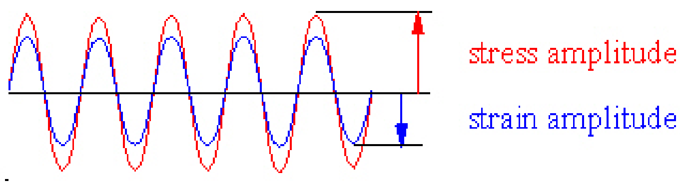


Figure 1 strain response to a sinusoidally applied stress for a solid material

If a sinusoidal stress is applied to a *liquid* sample, the stress is in phase with the rate of change of strain, and a phase lag of 90° is therefore introduced between the stress and the strain (Figure 2):

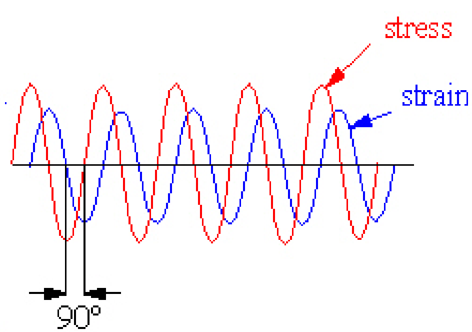


Figure 2: strain response to a sinusoidally applied stress for a liquid material

Rheology Advantage Instrument Control AR - [OscProc9]

File Edit Instrument Geometry Procedure Notes Experiment Options Help

AR Rheometer | 40mm acrylic plate | Oscillation procedure | QS Shampoo (QS Shampoo frequency sweep 25C-0005o) | QS Shampoo frequency sweep 25C-0004o.rsl

Name: Oscillation procedure

Steps
- [x] Conditioning Step
- [x] Frequency sweep step
- [x] Post-Experiment Step

Notes

Rheology Advantage Help

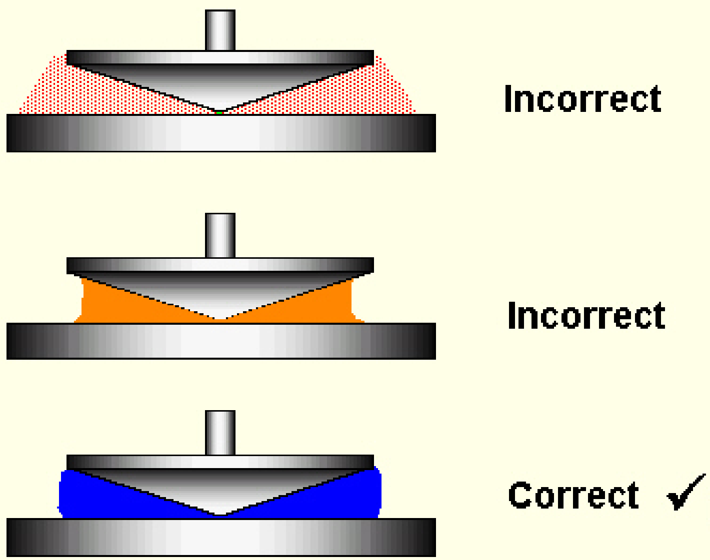
Help Topics | Back | Options

Sample loading

Ensuring that the sample is loaded correctly and the gap is properly filled is probably one of the most important aspects to consider in any rheological experiment.

You will find that you will become quite adept at judging the right amount of sample to use depending upon the geometry diameter and gap size. In some cases, you can calculate the exact volume or weight of sample needed. However, care must be taken if you intend using a pipette or syringe to deliver the correct amount. Samples that are delicately structured will be adversely affected by the high shear-rate regime encountered in syringes or pipettes.

If the gap is not correctly filled, certain types of error can occur. The magnitude of the errors will be entirely sample dependent, but generally over filling is less of a problem than under filling. Such errors are called *edge effects*



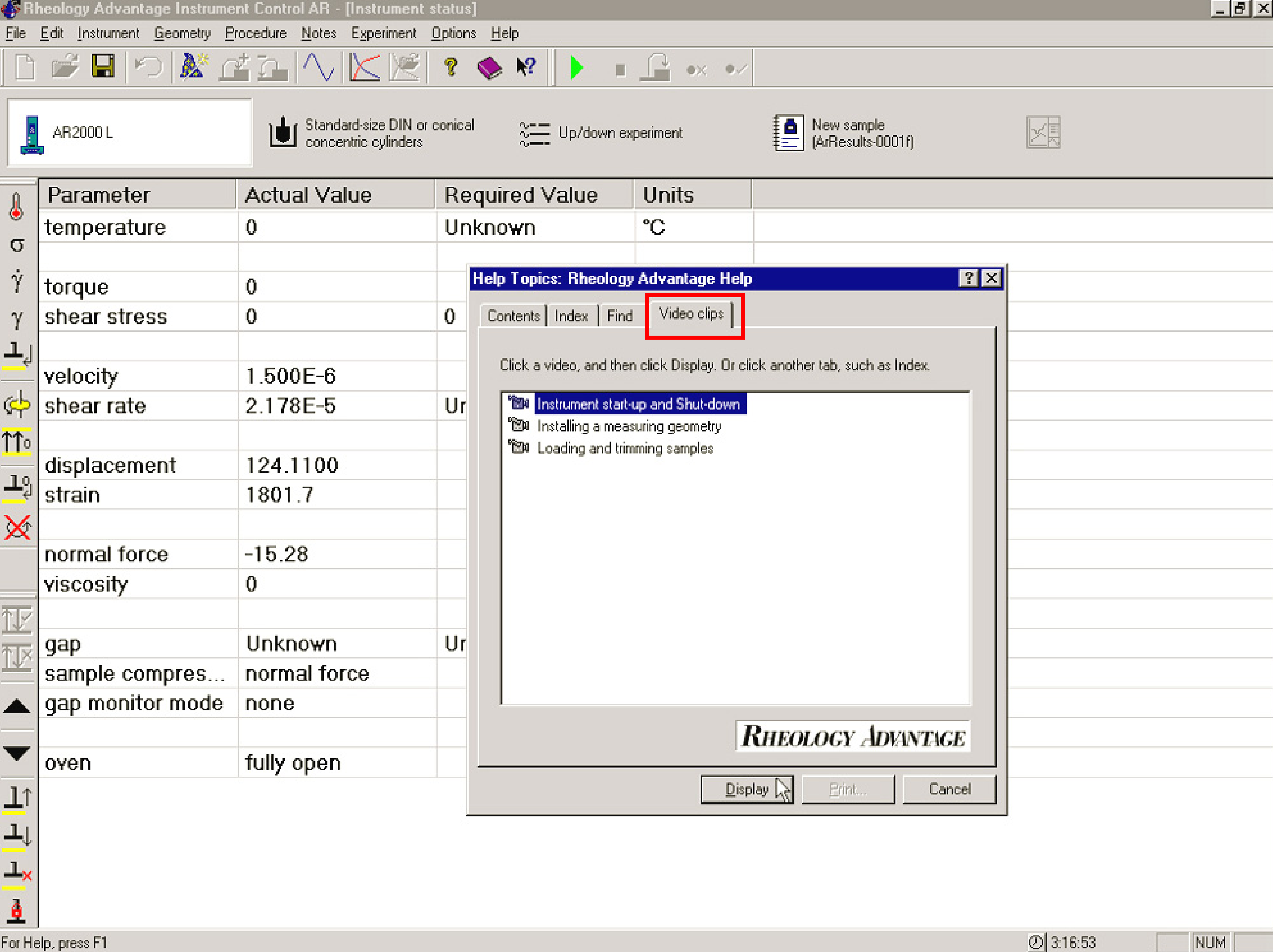
If the gap is overfilled, there is the likelihood of some of the excess sample migrating to sit on top of the geometry. If, however, the sample is of low viscosity this is not likely to happen the errors are much reduced.
If the gap is under filled, you are effectively altering the diameter of the geometry. This will inevitably introduce large errors and you should definitely avoid this situation.

Loading the sample correctly is a skill that you will learn with time. It is advisable to spend some time initially simply loading and reloading a sample. The correct loading is vital to accurate and meaningful results.

RHEOLOGY ADVANTAGE

TA Instruments

For Help, press F1 | 0:14:01 | NUM


Rheology Advantage Instrument Control AR - [Instrument status]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR2000 L
Standard-size DIN or conical concentric cylinders
Up/down experiment
New sample (ArResults-0001f)
Parameter | Actual Value | Required Value | Units
temperature | 0 | Unknown | °C
torque | 0
shear stress | 0 | 0
velocity | 1.500E-6
shear rate | 2.178E-5
displacement | 124.1100
strain | 1801.7
normal force | -15.28
viscosity | 0
gap | Unknown
sample compres... | normal force
gap monitor mode | none
oven | fully open
Help Topics: Rheology Advantage Help
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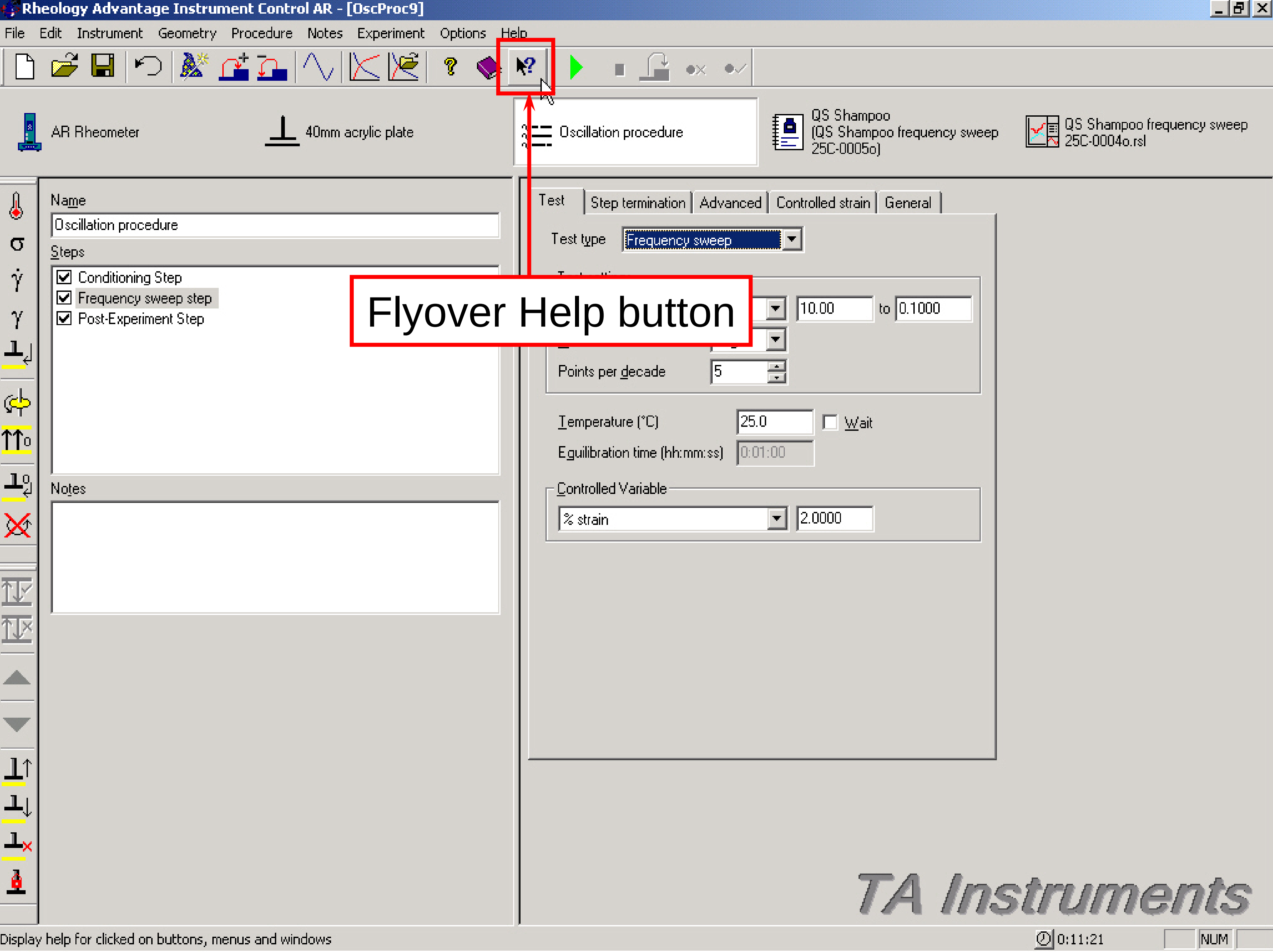
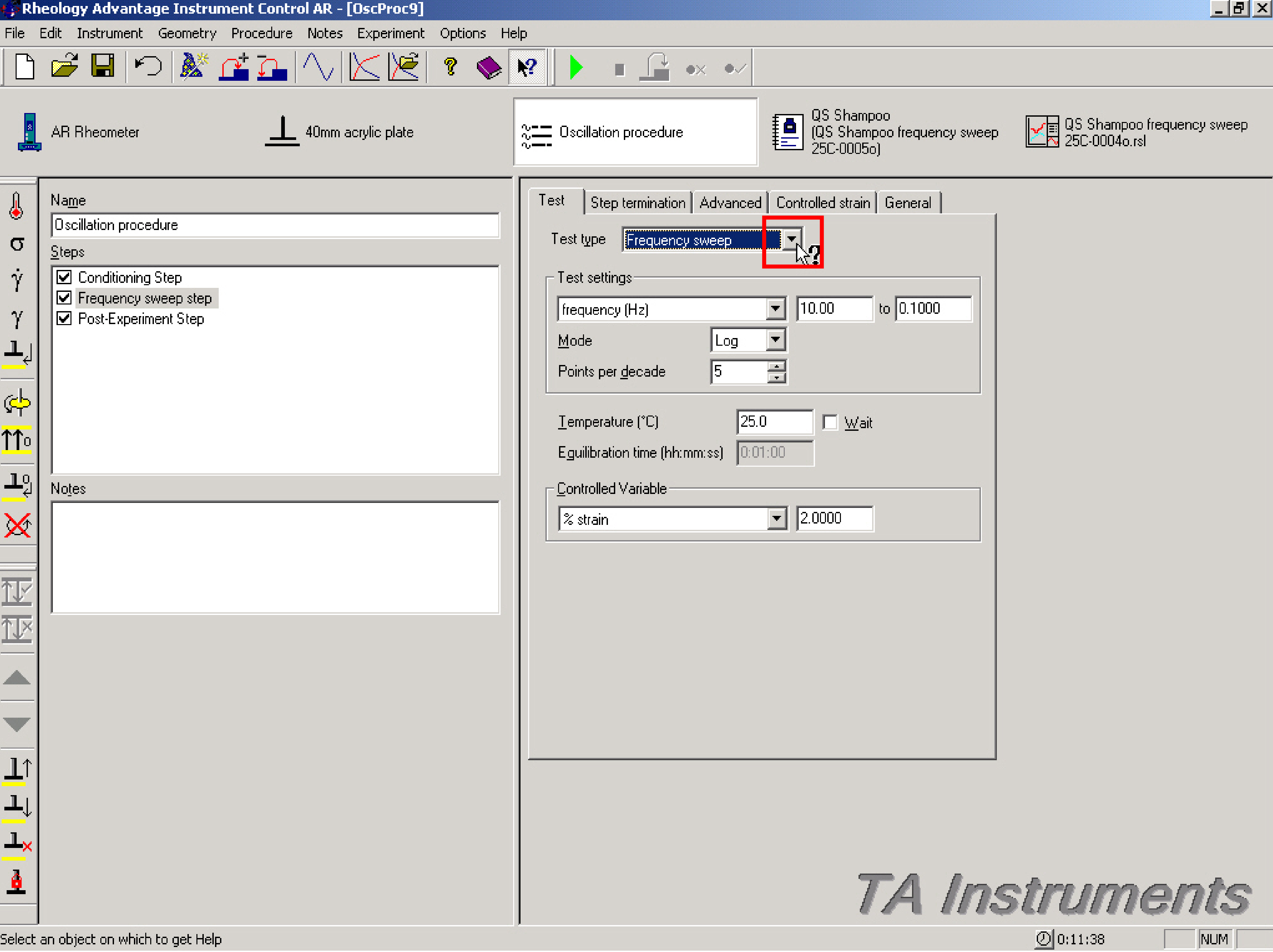
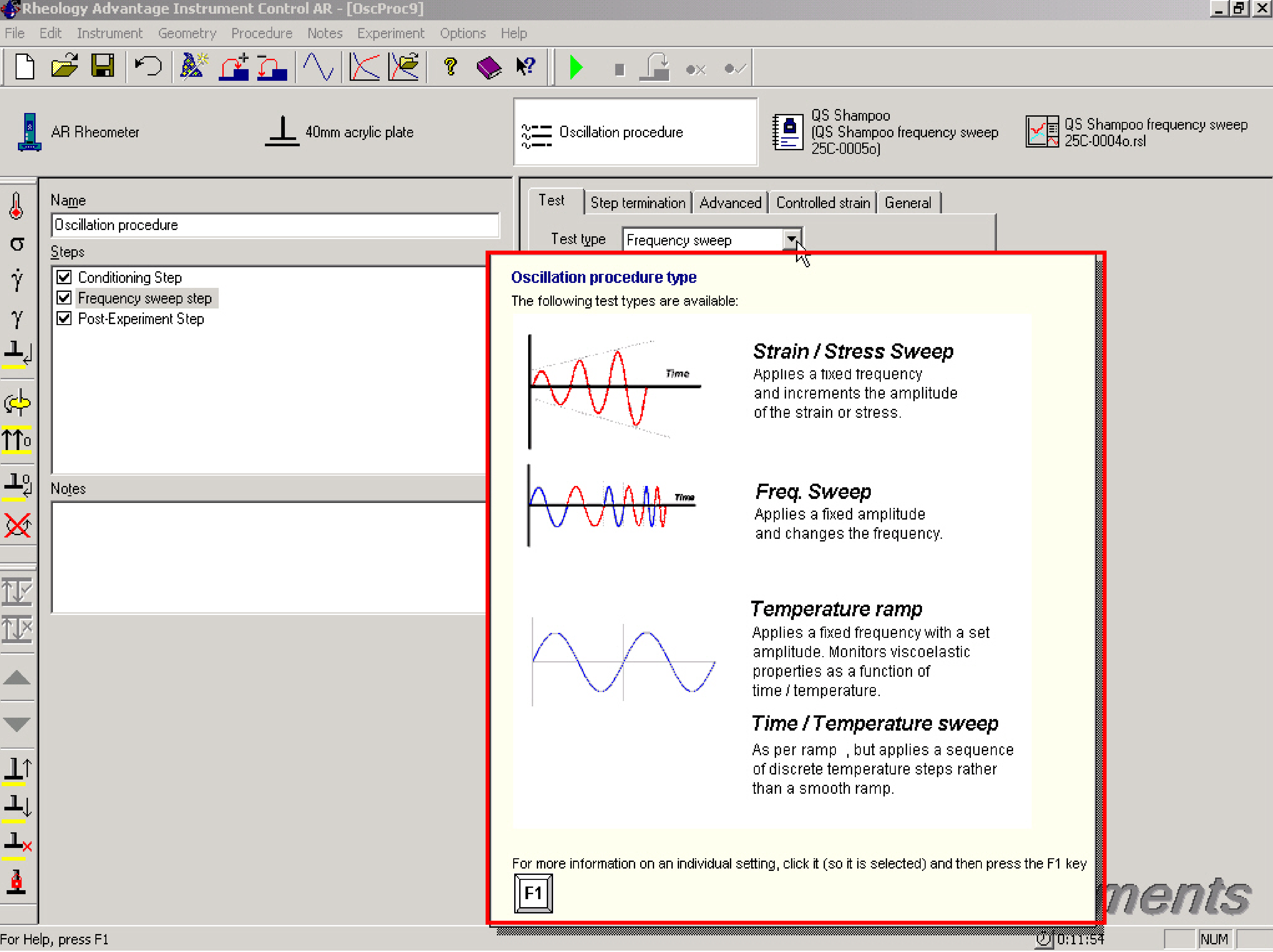
Click a video, and then click Display. Or click another tab, such as Index.
Instrument start-up and Shut-down
Installing a measuring geometry
Loading and trimming samples
RHEOLOGY ADVANTAGE
Display
Print...
Cancel
For Help, press F1
3:16:53
NUM


Rheology Advantage Instrument Control AR - [OscProc9]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
25C-0005o)
QS Shampoo frequency sweep
25C-0004o.rsl
Name
Oscillation procedure
Steps
Conditioning Step
Frequency sweep step
Post-Experiment Step
Notes
Test
Step termination
Advanced
Controlled strain
General
Test type
Frequency sweep
10.00
to
0.1000
Points per decade
5
Temperature (°C)
25.0
Wait
Equilibration time (hh:mm:ss)
0:01:00
Controlled Variable
% strain
2.0000
Flyover Help button
TA Instruments
Display help for clicked on buttons, menus and windows
0:11:21
NUM


Rheology Advantage Instrument Control AR - [OscProc9]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
25C-0005o)
QS Shampoo frequency sweep
25C-0004o.rsl
Name
Oscillation procedure
Steps
Conditioning Step
Frequency sweep step
Post-Experiment Step
Notes
Test
Step termination
Advanced
Controlled strain
General
Test type
Frequency sweep
Test settings
frequency (Hz)
10.00
to
0.1000
Mode
Log
Points per decade
5
Temperature (°C)
25.0
Wait
Equilibration time (hh:mm:ss)
0:01:00
Controlled Variable
% strain
2.0000
TA Instruments
Select an object on which to get Help
0:11:38
NUM


Rheology Advantage Instrument Control AR - [OscProc9]
File Edit Instrument Geometry Procedure Notes Experiment Options Help
AR Rheometer
40mm acrylic plate
Oscillation procedure
QS Shampoo
(QS Shampoo frequency sweep
25C-0005o)
QS Shampoo frequency sweep
25C-0004o.rsl
Name
Oscillation procedure
Steps
Conditioning Step
Frequency sweep step
Post-Experiment Step
Notes
Test
Step termination
Advanced
Controlled strain
General
Test type
Frequency sweep
Oscillation procedure type
The following test types are available:
Time
Strain / Stress Sweep
Applies a fixed frequency
and increments the amplitude
of the strain or stress.
Time
Freq. Sweep
Applies a fixed amplitude
and changes the frequency.
Temperature ramp
Applies a fixed frequency with a set
amplitude. Monitors viscoelastic
properties as a function of
time / temperature.
Time / Temperature sweep
As per ramp , but applies a sequence
of discrete temperature steps rather
than a smooth ramp.
For more information on an individual setting, click it (so it is selected) and then press the F1 key
F1
ments
For Help, press F1
0:11:54
NUM

Do

- Ensure a clean dry air supply at a stable pressure. Use a filter and dryer
- Check filter bowls for water & contaminants at least monthly
- Replace the air-bearing clamp before turning the air off
- Ensure air supply is on before turning the instrument on
- Take advantage of the training opportunities offered

Don’t

- Operate instruments without air
- Touch the spindle without air being on – if air is inadvertently turned off make sure power is turned off and wait till air turns back on before placing clamp on or turning power back on
- Operate without a water supply if using the Peltier
- Hesitate to contact us if you have any questions