Issues with Normal Force Control During Curing

- Performing a curing test on a polymer system
- At room temperature, the normal force is held steady at ~9N
- Once the temperature increases to 149C, the normal force drops to -4N
- On cooling back to room temperature, the normal force goes as low as -23N
- Specified normal force in the procedures stays at +9N

- Similar temperature ramp on sapphire did not have any issues
  - Points to a problem with the decreasing gap
- Moving profile should not limit gap

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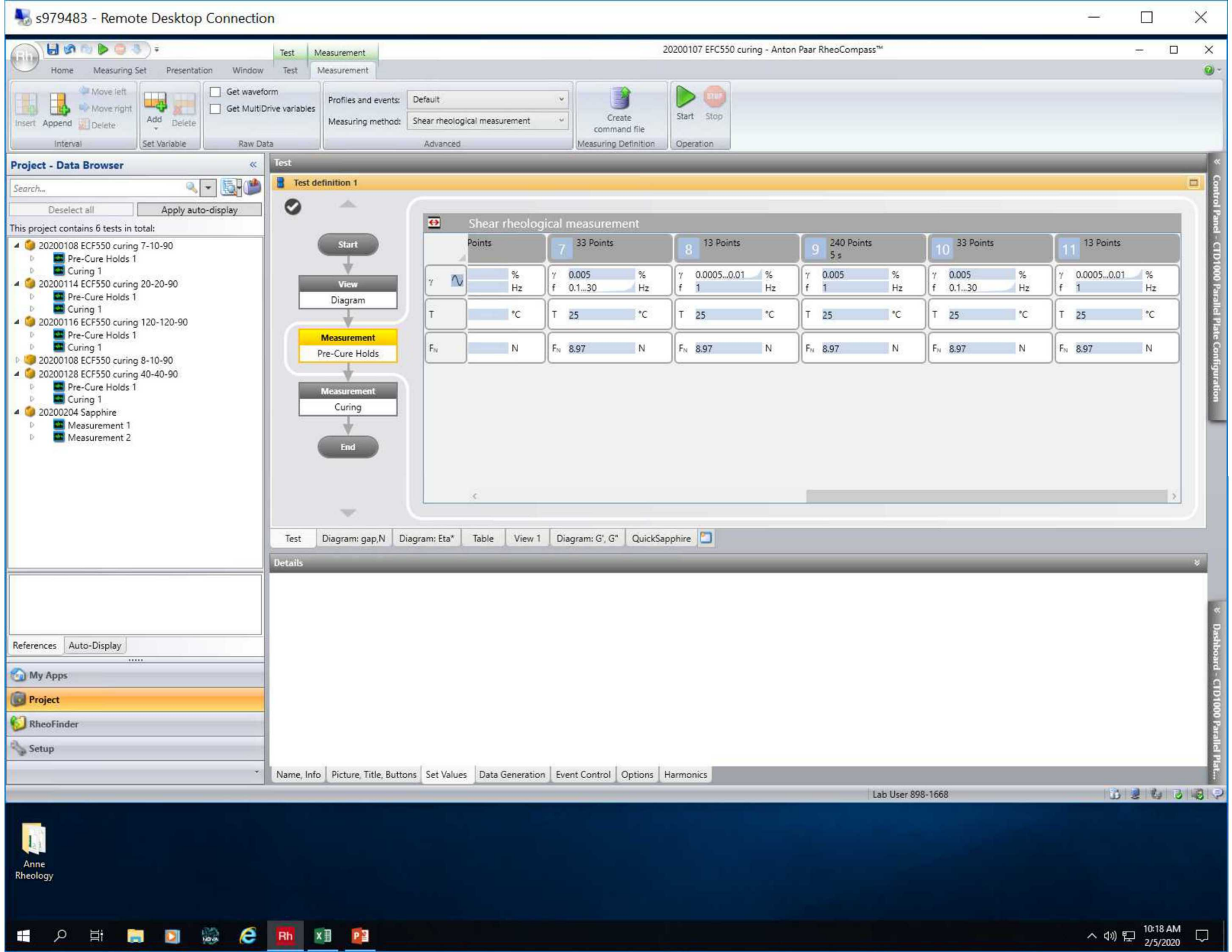
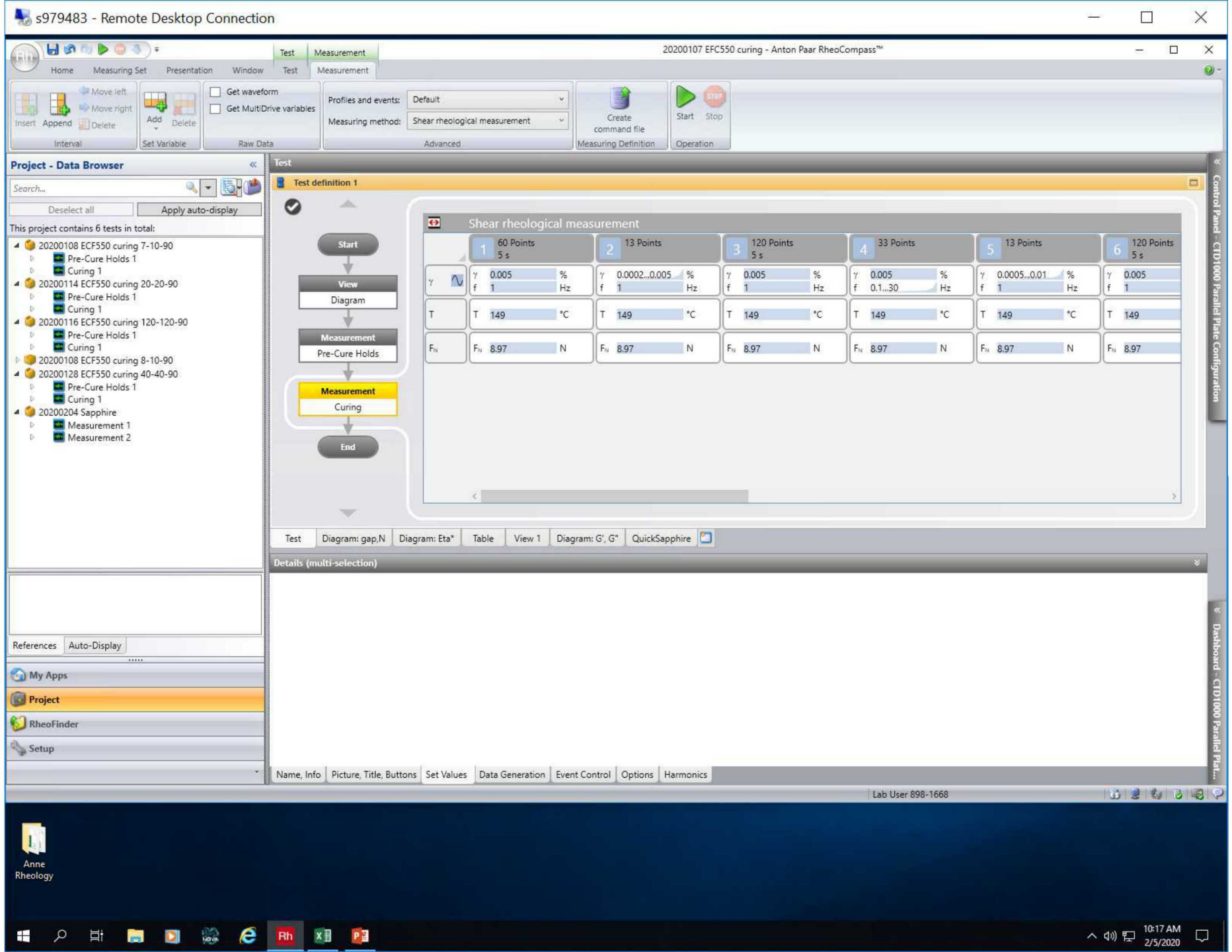

s979483 - Remote Desktop Connection
20200107 EFC550 curing - Anton Paar RheoCompass™
Home
Measuring Set
Presentation
Window
Test
Measurement
Insert
Append
Move left
Move right
Delete
Interval
Add
Delete
Set Variable
Get waveform
Get MultiDrive variables
Raw Data
Profiles and events:
Default
Measuring method:
Shear rheological measurement
Advanced
Create command file
Measuring Definition
Start
Stop
Operation
Project - Data Browser
Search...
Deselect all
Apply auto-display
This project contains 6 tests in total:
20200108 ECF550 curing 7-10-90
Pre-Cure Holds 1
Curing 1
20200114 ECF550 curing 20-20-90
Pre-Cure Holds 1
Curing 1
20200116 ECF550 curing 120-120-90
Pre-Cure Holds 1
Curing 1
20200108 ECF550 curing 8-10-90
20200128 ECF550 curing 40-40-90
Pre-Cure Holds 1
Curing 1
20200204 Sapphire
Measurement 1
Measurement 2
References
Auto-Display
My Apps
Project
RheoFinder
Setup
Test
Test definition 1
Start
View
Diagram
Measurement
Pre-Cure Holds
Measurement
Curing
End
Shear rheological measurement
Points
7 33 Points
8 13 Points
9 240 Points 5 s
10 33 Points
11 13 Points
Test
Diagram: gap,N
Diagram: Eta*
Table
View 1
Diagram: G', G"
QuickSapphire
Details
Name, Info
Picture, Title, Buttons
Set Values
Data Generation
Event Control
Options
Harmonics
Lab User 898-1668
Control Panel - CTD1000 Parallel Plate Configuration
Dashboard - CTD1000 Parallel Plat...
Anne Rheology
10:18 AM
2/5/2020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20200107 EFC550 curing - Anton Paar RheoCompass™
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Curing 1
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Measurement 1
Measurement 2
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My Apps
Project
RheoFinder
Setup
Test
Test definition 1
Start
View
Diagram
Measurement
Pre-Cure Holds
Measurement
Curing
End
Shear rheological measurement
1 60 Points 5 s
2 13 Points
3 120 Points 5 s
4 33 Points
5 13 Points
6 120 Points 5 s
Test
Diagram: gap,N
Diagram: Eta*
Table
View 1
Diagram: G', G"
QuickSapphire
Details (multi-selection)
Name, Info
Picture, Title, Buttons
Set Values
Data Generation
Event Control
Options
Harmonics
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Dashboard - CTD1000 Parallel Plat...
Anne Rheology
10:17 AM
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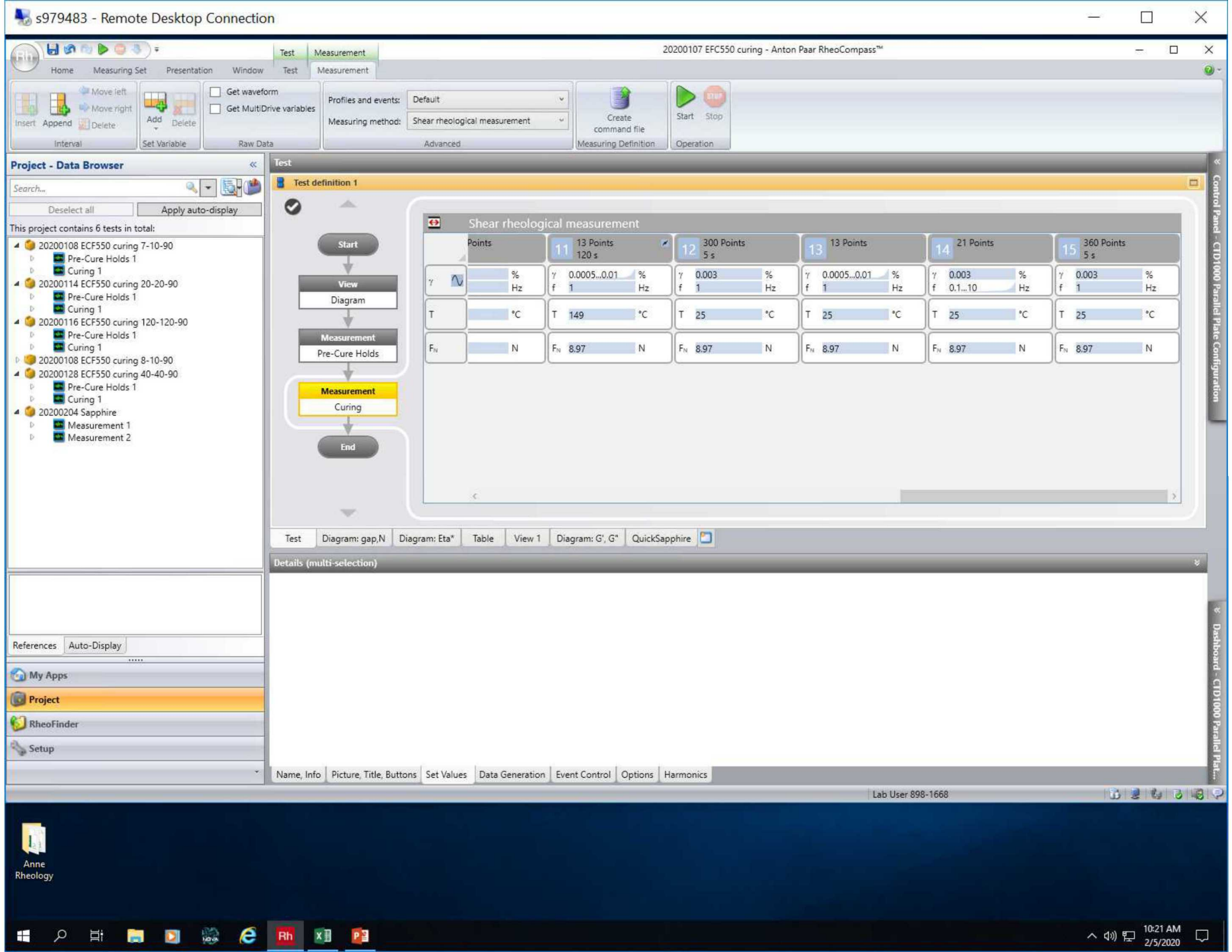
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Test definition 1
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View
Diagram
Measurement
Pre-Cure Holds
Measurement
Curing
End
Shear rheological measurement
Points
13 Points 120 s
300 Points 5 s
13 Points
21 Points
360 Points 5 s
Test
Diagram: gap,N
Diagram: Eta*
Table
View 1
Diagram: G', G"
QuickSapphire
Details (multi-selection)
Name, Info
Picture, Title, Buttons
Set Values
Data Generation
Event Control
Options
Harmonics
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Control Panel - CTD1000 Parallel Plate Configuration
Dashboard - CTD1000 Parallel Plat...
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10:21 AM
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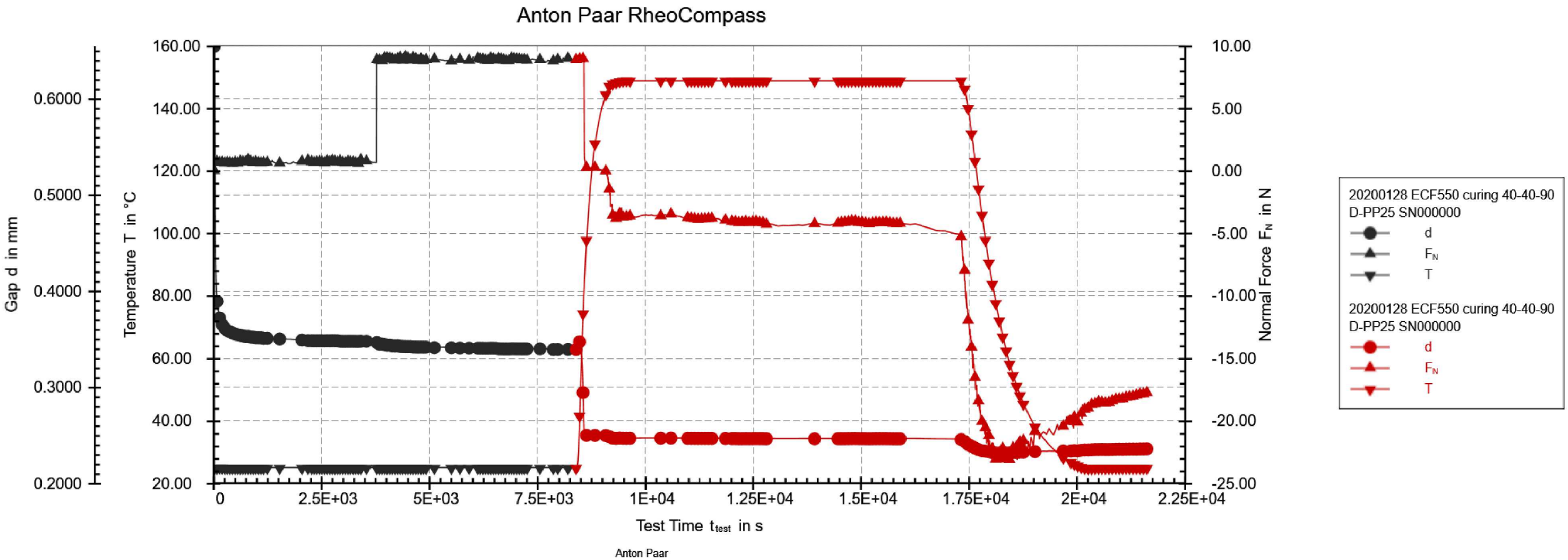
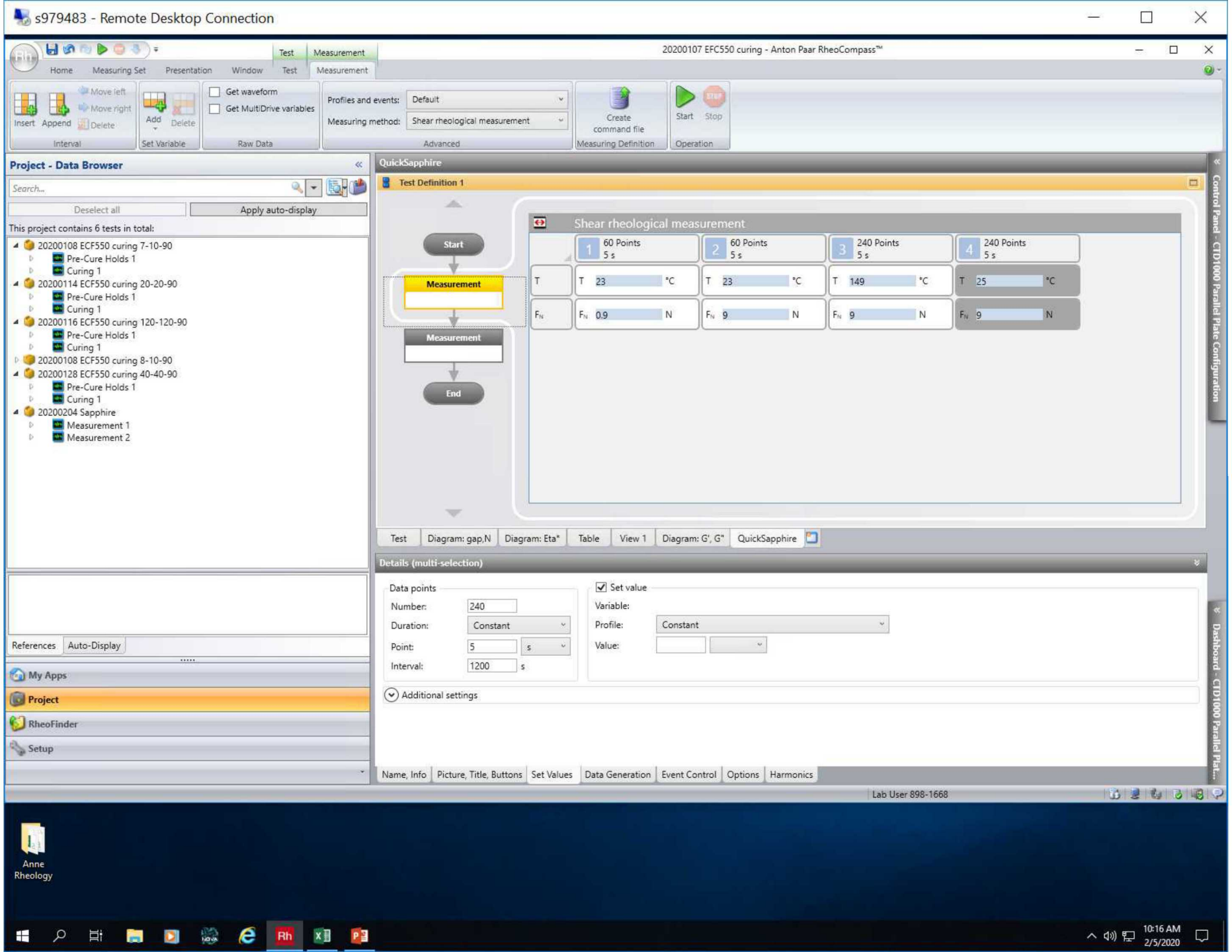
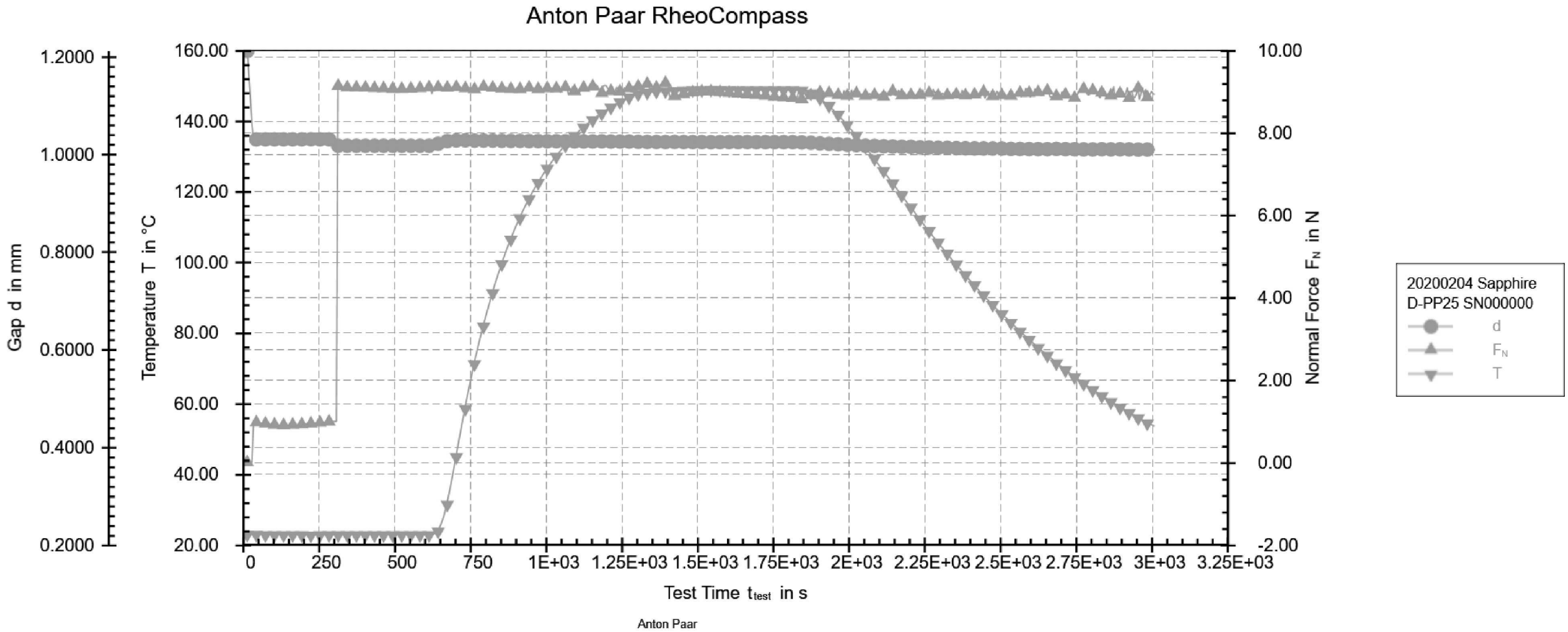

Anton Paar RheoCompass
Gap d in mm
0.6000
0.5000
0.4000
0.3000
0.2000
Temperature T in °C
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
Normal Force F_N in N
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
0
2.5E+03
5E+03
7.5E+03
1E+04
1.25E+04
1.5E+04
1.75E+04
2E+04
2.25E+04
Test Time t_{test} in s
Anton Paar
20200128 ECF550 curing 40-40-90
D-PP25 SN000000
d
F_N
T
20200128 ECF550 curing 40-40-90
D-PP25 SN000000
d
F_N
T

A 1mm sapphire disk run through the same thermal cycle easily maintains the correct normal force




Anton Paar RheoCompass
Gap d in mm
1.2000
1.0000
0.8000
0.6000
0.4000
0.2000
Temperature T in °C
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
Normal Force F_N in N
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
0
250
500
750
1E+03
1.25E+03
1.5E+03
1.75E+03
2E+03
2.25E+03
2.5E+03
2.75E+03
3E+03
3.25E+03
Test Time t_{test} in s
20200204 Sapphire
D-PP25 SN000000
d
F_N
T
Anton Paar

Nothing in the past like moving profile should have issues at these gaps