

New Dynamic Vapor Sorption

Product Launch:

Innovation in Sorption Science

Nektaria Servi

Sales Manager Western Europe





Surface Measurement Systems
World Leader in Sorption Science

Surface Measurement Systems

Surface Measurement Systems develops and engineers techniques and instrumentation for physico-chemical characterisation of complex solids. We are the world leaders in Dynamic Vapor Sorption technology and Inverse Gas chromatography instrumentation, providing professional world-class scientific and technical support for our international customers.

Our range of characterization instruments continues to help solve difficult problems in the pharmaceuticals, biomaterials, polymers catalysts, chemical, cosmetics and food industries, and are used by hundreds of leading laboratories and universities throughout the world.



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Surface Measurement Systems Ltd

DVS

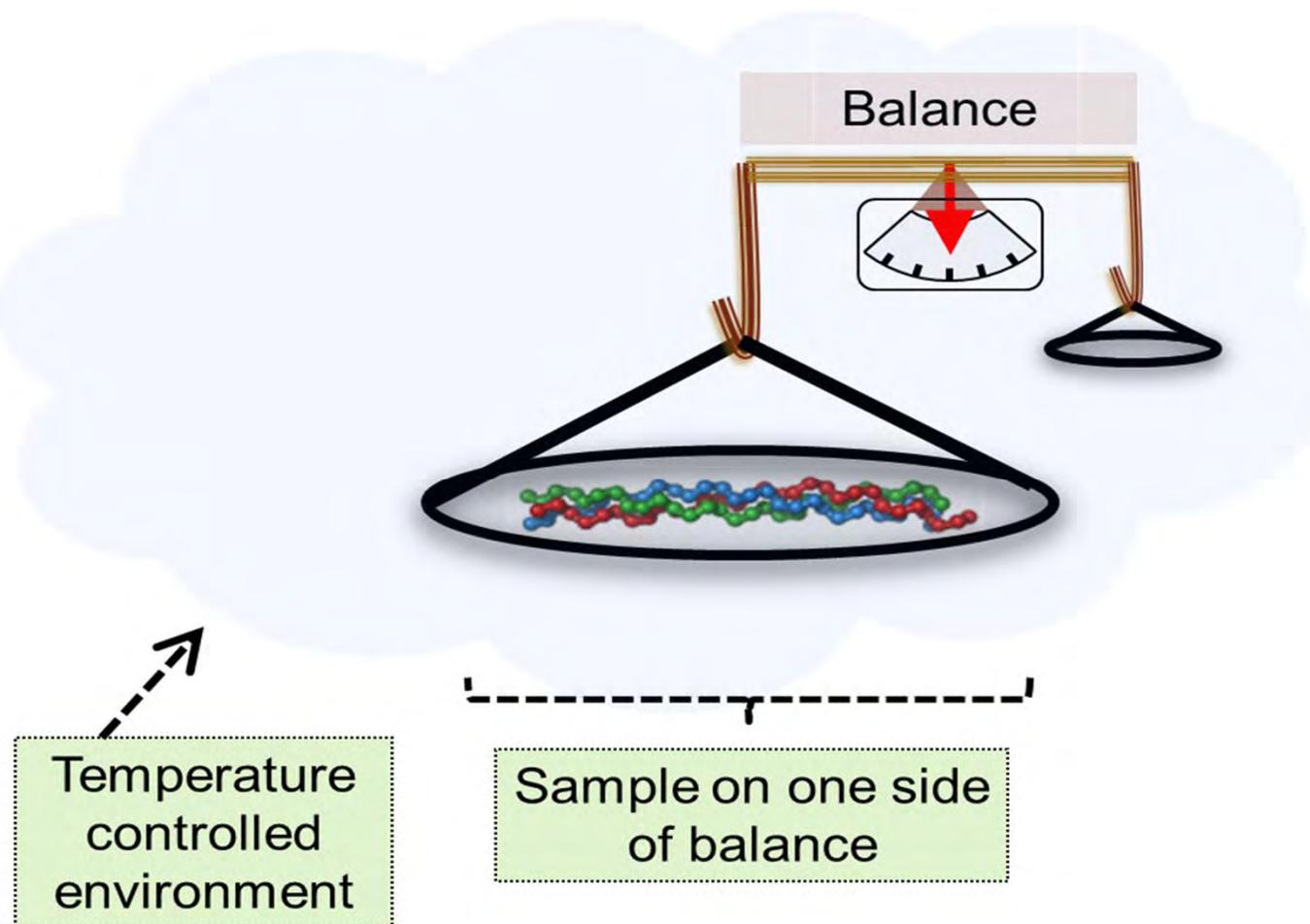
How the Dynamic Vapour Sorption Technique works

Company Confidential



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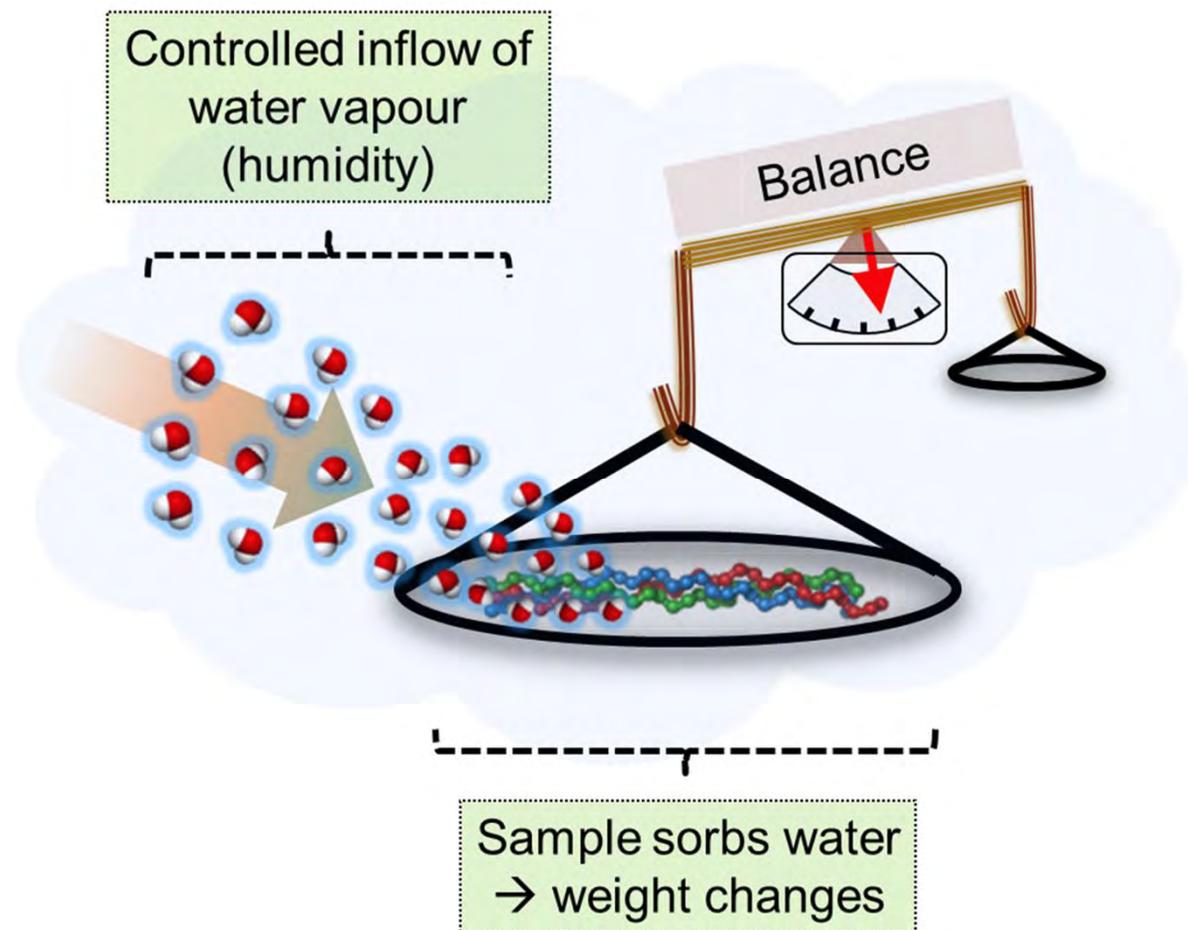
How the DVS Technique works



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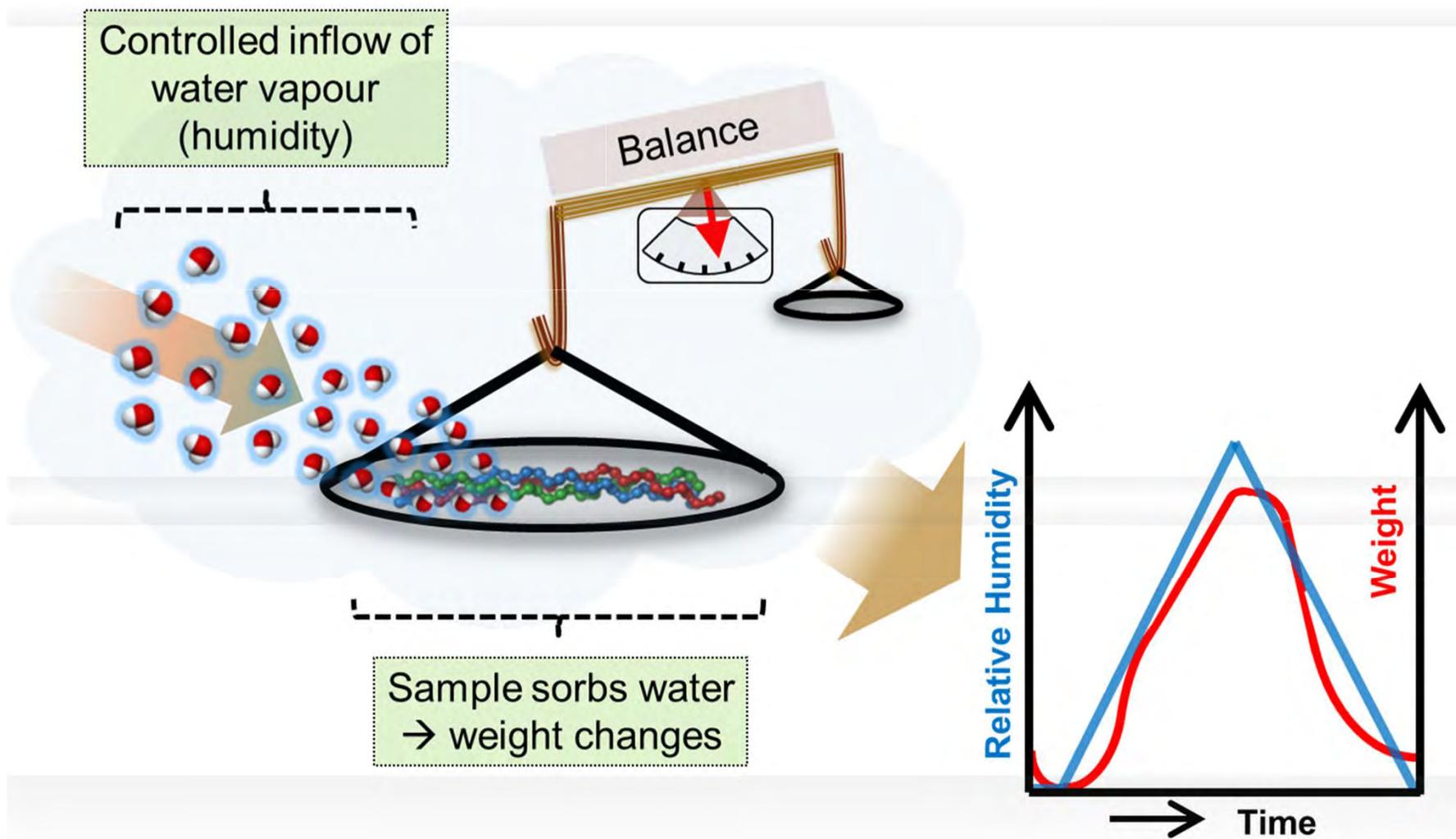


How the DVS Technique works



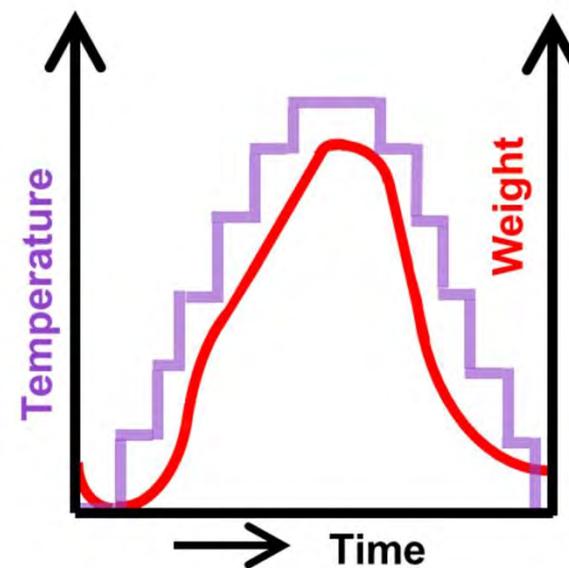
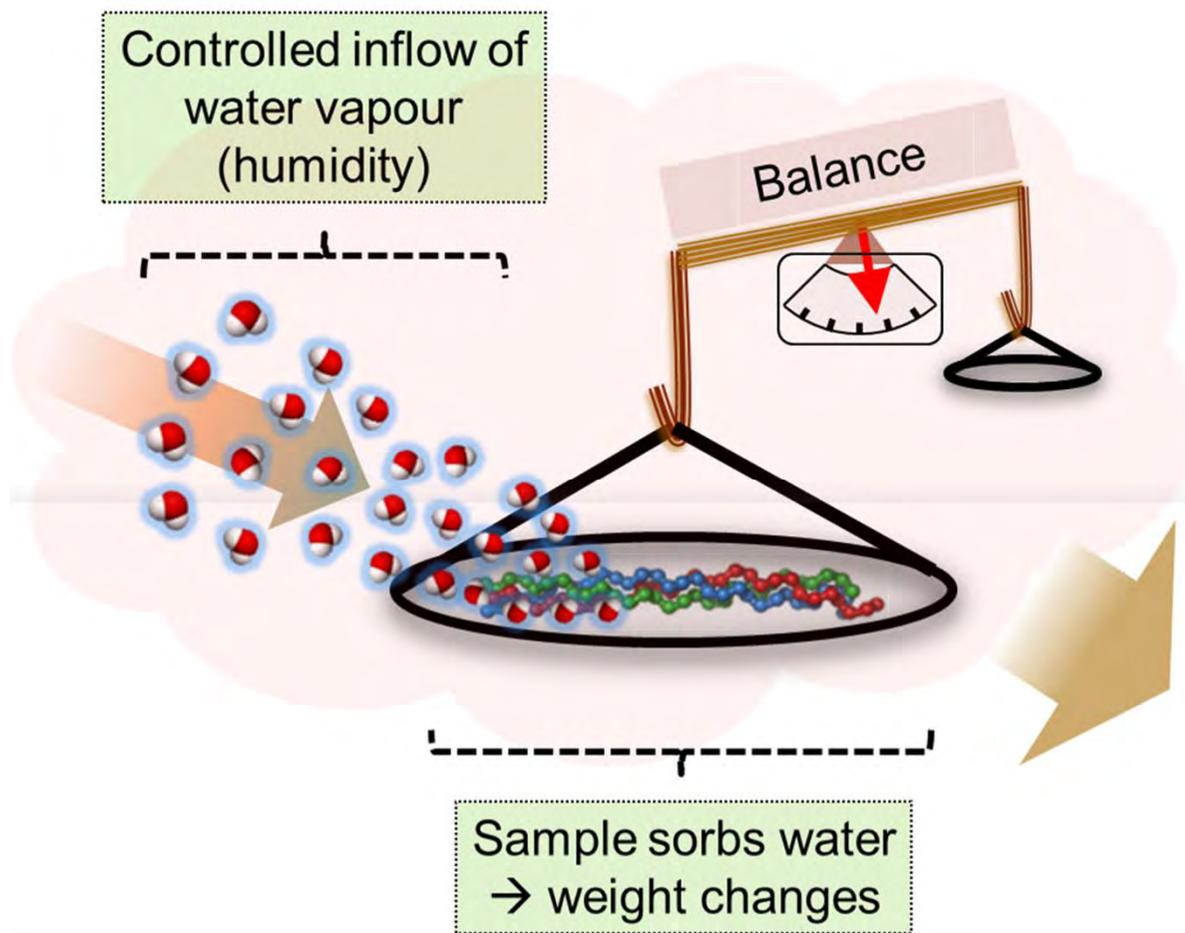


How the DVS Technique works





How the DVS Technique works





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DVS Family of Products



DVS
INTRINSIC



DVS
VACUUM



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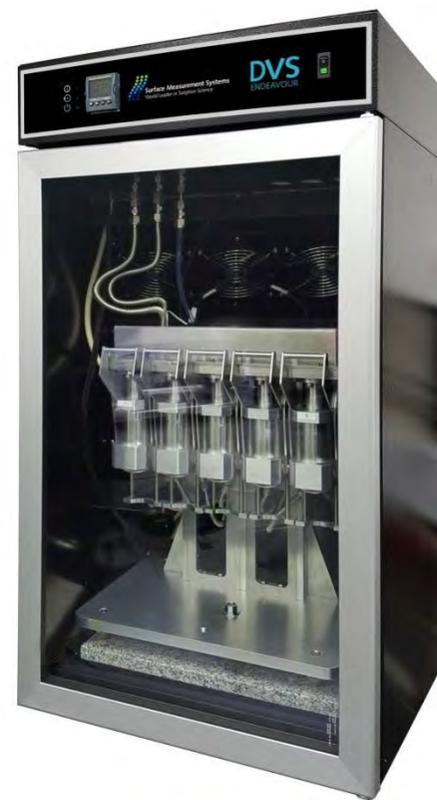
NEW DVS Products



DVS
ADVENTURE



DVS
RESOLUTION



DVS
ENDEAVOUR



New DVS Product Range

	Temperature	Water	Organic Vapors and Gases	NIR Raman Video-5MP	Sample No.	Multi-component vapours	Local Heating to 300C	Pressure Range
DVS-Adventure	5-85C	Yes	No	Option	1	No	Option	Ambient
DVS-Resolution	5-85C	Yes	Yes	Option	1	Yes	Option	Ambient
DVS-Endeavour	5-85C	Yes	Yes	Option	5	Yes	Option	Ambient
DVS-Vacuum	20-70C	Yes	Yes	No	1	Yes	Option	10 ⁻⁶ - 760 Torr
DVS-Intrinsic	20-40C	Yes	No	No	1	No	No	Ambient



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DVS Adventure

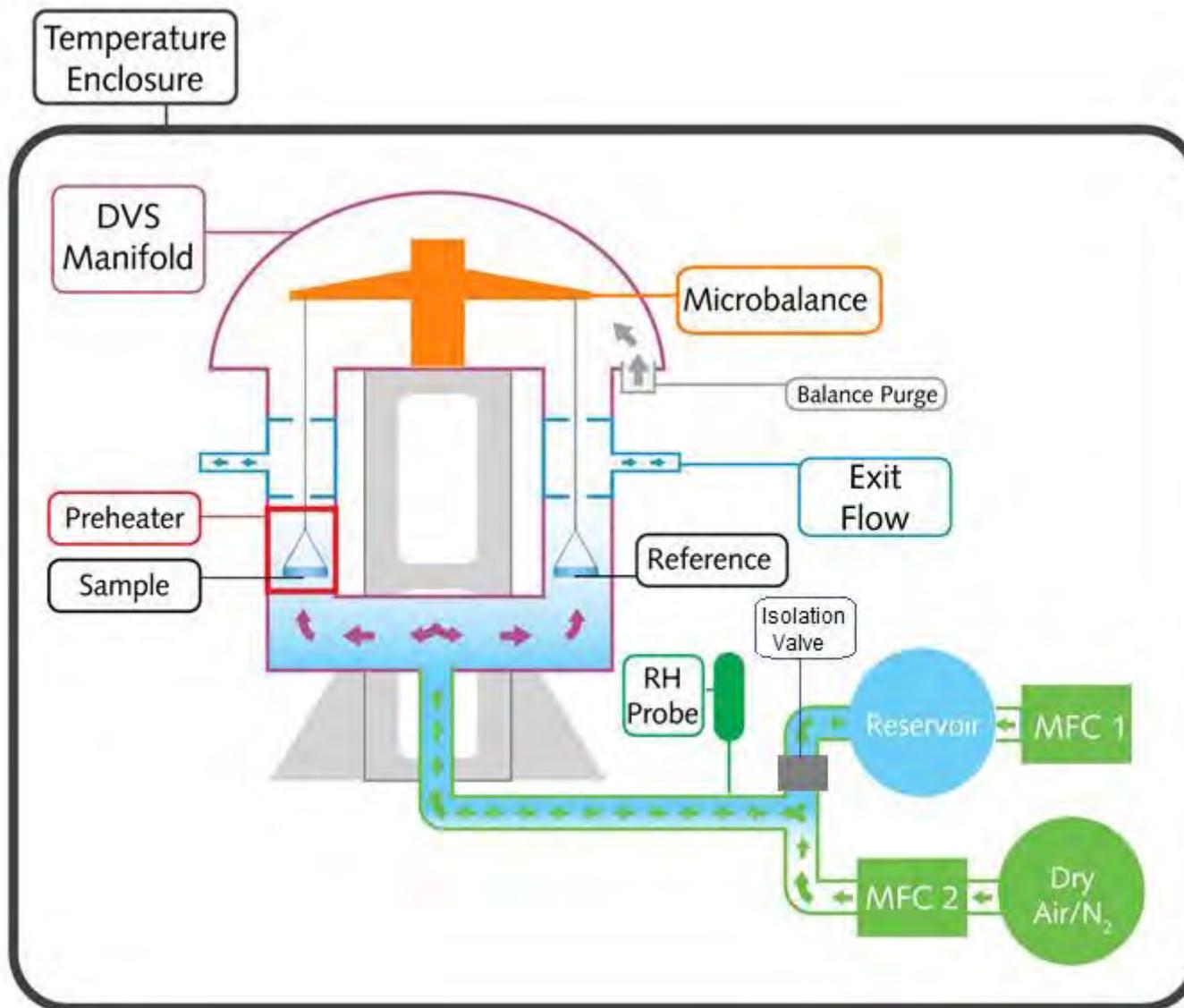
- Most advanced water sorption analyser in the market
- Temperature range: 5°C to 85°C
- Temperature stability: $\pm 0.1^\circ\text{C}$
- Optional preheater for sample drying to 300C
- Wide humidity range typically 0-98% RH
- Humidity stability $\pm 0.3\%RH$
- True0™ drying at 0.0% RH
- Active PID control of relative humidity
- Automated isotherms and isohumes
- Preheater, Raman, NIR and video options
- Upgradeable to other DVS's in family
- Small laboratory bench footprint (18")



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Schematic of DVS Adventure





150C Preheater



300C Preheater



- Open stand design with improved air flow around system stand for better temperature, humidity and balance performance
- Improved mechanism for accessing sample pan- sample and reference pans accessed individually
- Chamber fan turn off when door opened
- All-in-one design (no external control box)
- Reservoir range from 100ml to 1000ml
- Anti condensation protection
- Water sorption kinetics
- Water diffusion and permeation measurements
- Optional Fiber Optic Raman
- Optional Color Video Microscopy now 5MP
- Reservoir range from 100ml to 1000ml



DVS Adventure stand



SMS UltraBalance1™

Sample mass: between 1 and
1500mg

Resolution (precision): 0.1 μg

Peak to peak noise: $\leq 0.2 \mu\text{g}$

Mass change: $\pm 150\text{mg}$

Stability (drift): $\leq 5\mu\text{g}$

(24 hrs @ 25°C and 0% RH)

SMS UltraBalance2™

Sample mass: between 10 and
5000mg

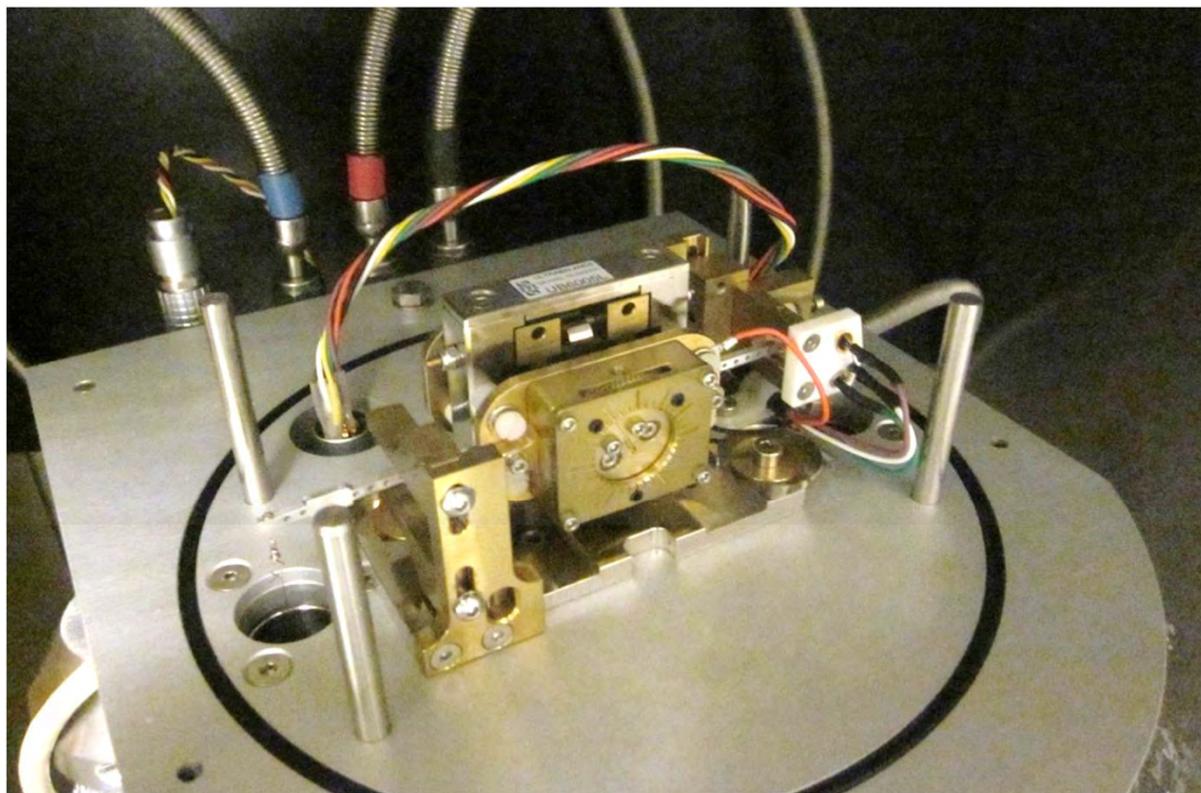
Resolution (precision): 1.0 μg

Peak to peak noise: $\leq 2.0 \mu\text{g}$

Mass change: $\pm 1000 \text{mg}$

Stability (drift): $\leq 50 \mu\text{g}$

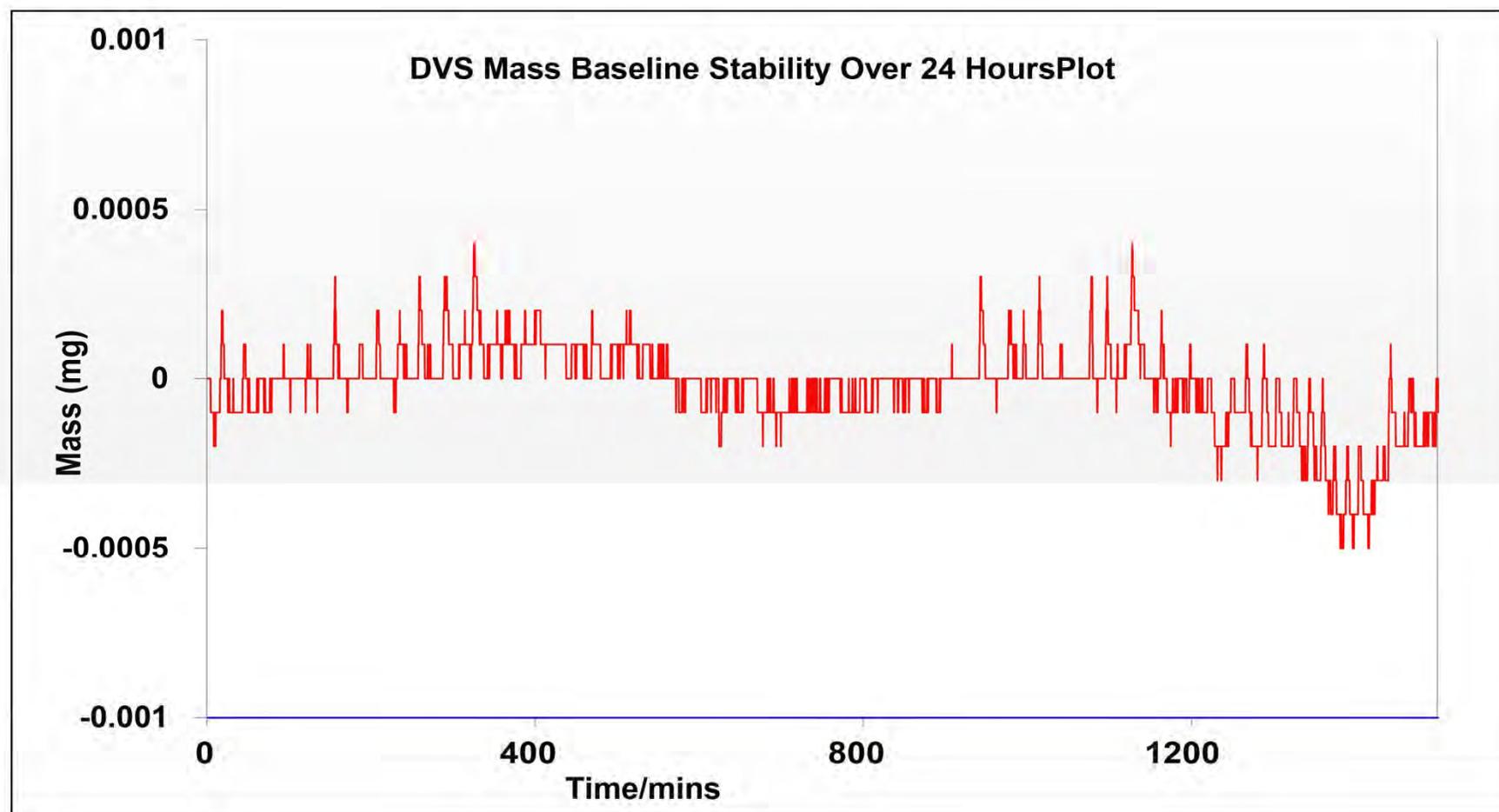
(24 hrs @ 25°C and 0% RH)





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SMS Ultra-Balance Performance



The DVS Adventure is capable of measuring mass changes at a resolution of 0.1 mg with peak to peak noise of less than or equal to 0.2 μg . The Surface Measurement Systems Ultra-Balance™ is unrivaled in its precision and accuracy.

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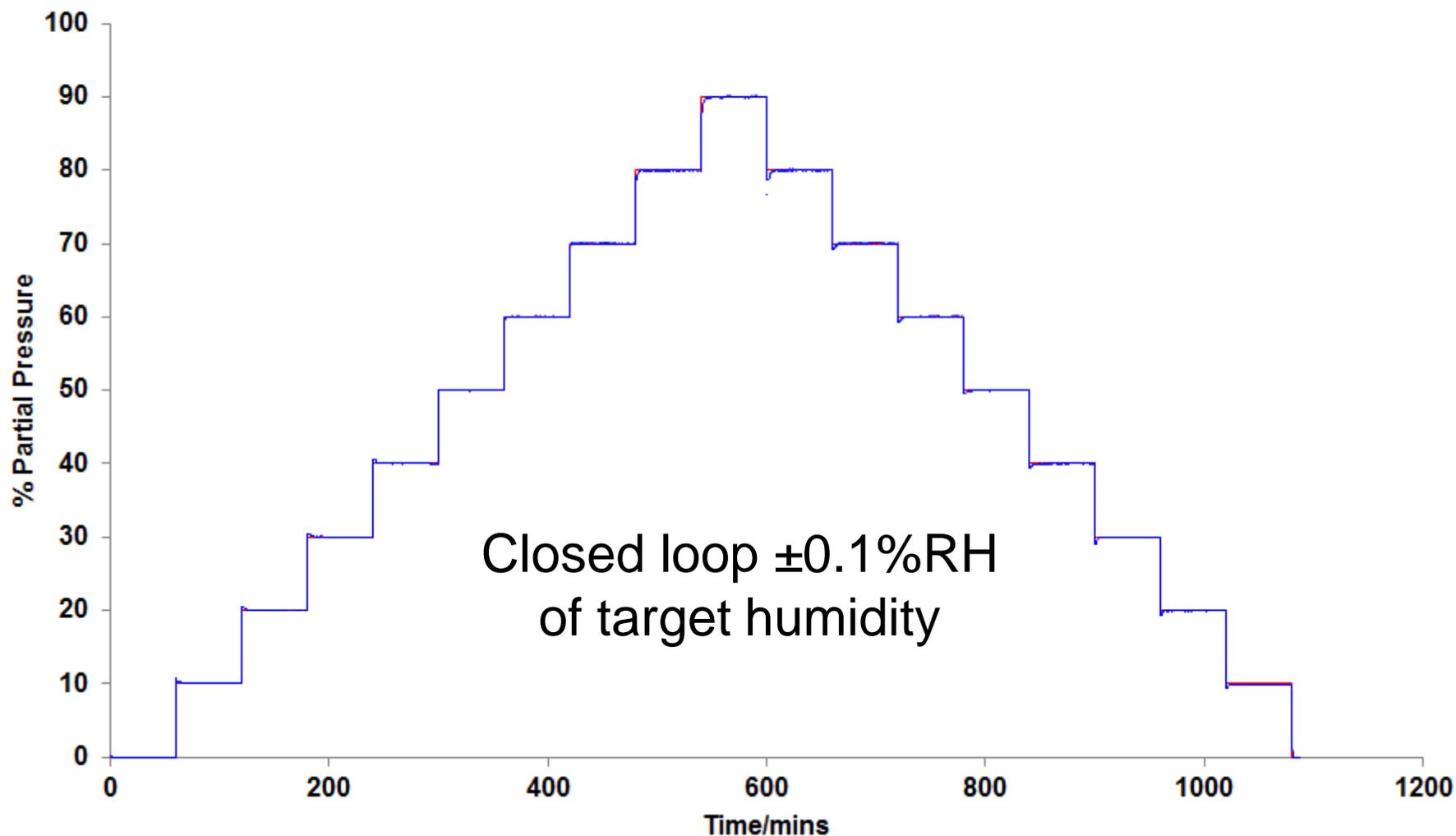


Date: 26 Mar 2016
Time: 3:22 pm
File: Sample 01-Baseline and Humidity test-2016-03-26 15-22-35a.xls

DVS Partial Pressure Plot

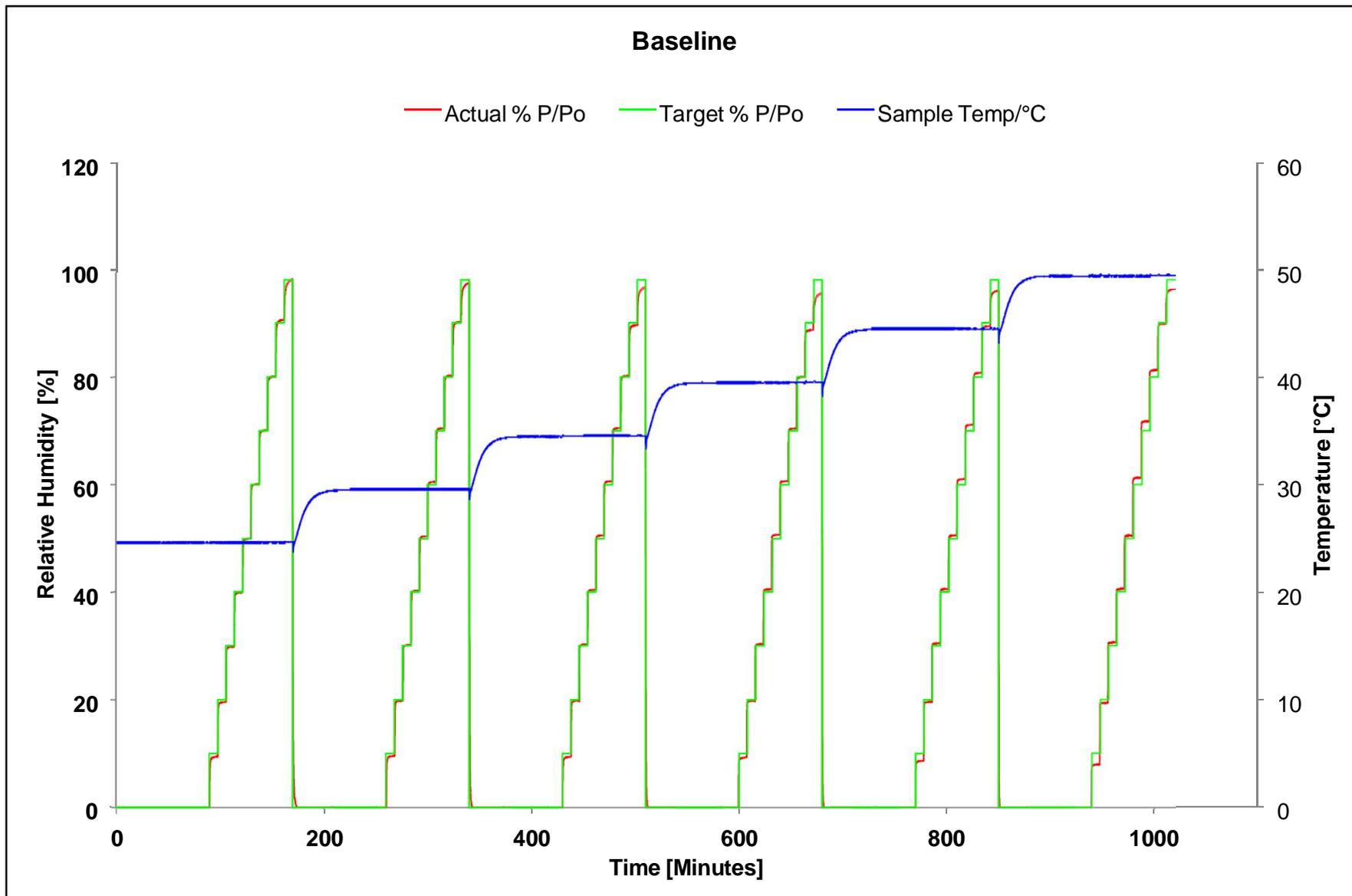
Temp: 25.0°C
Meth: N/A

— Target % P/Po — Sample % P/Po



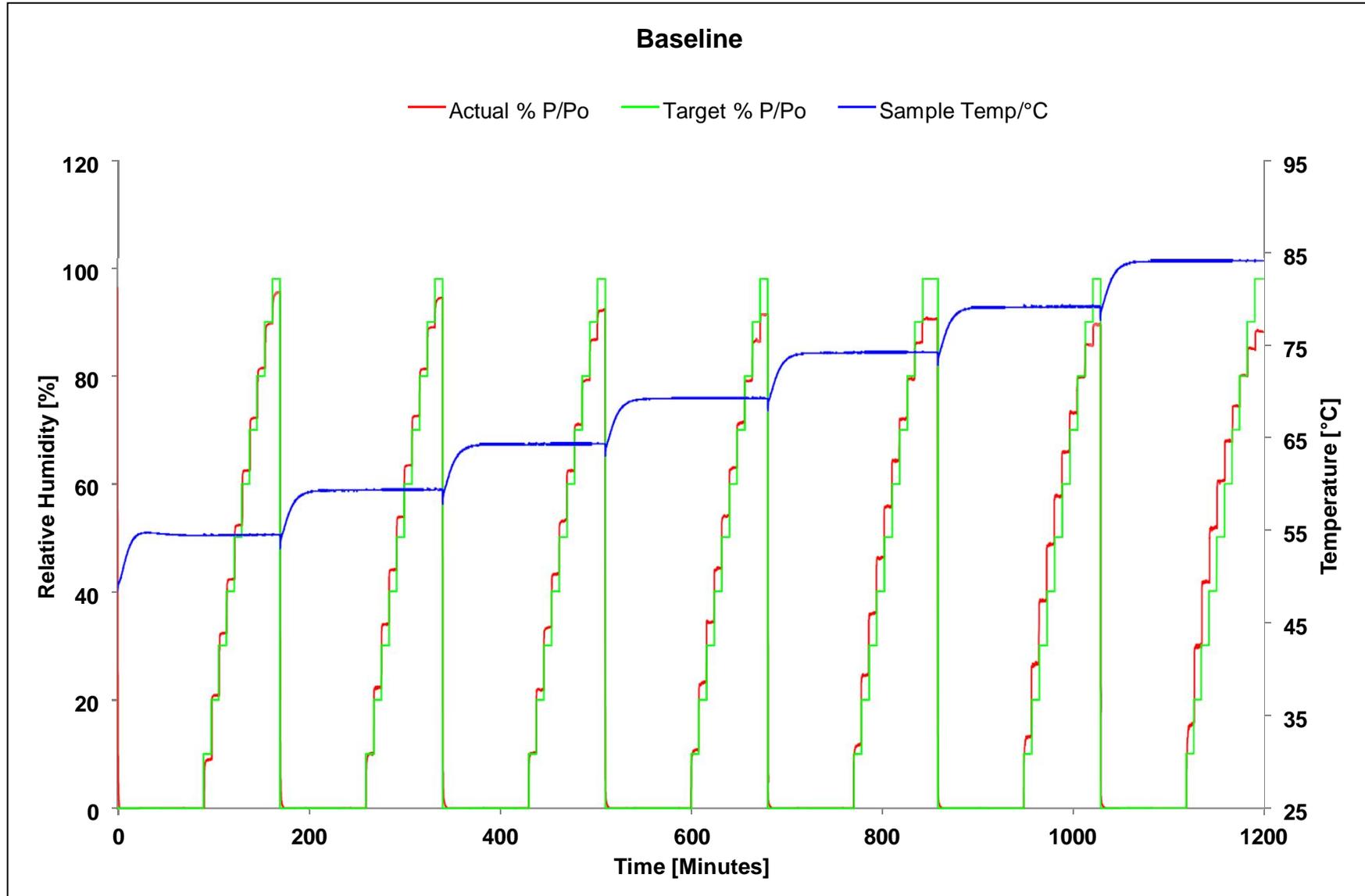


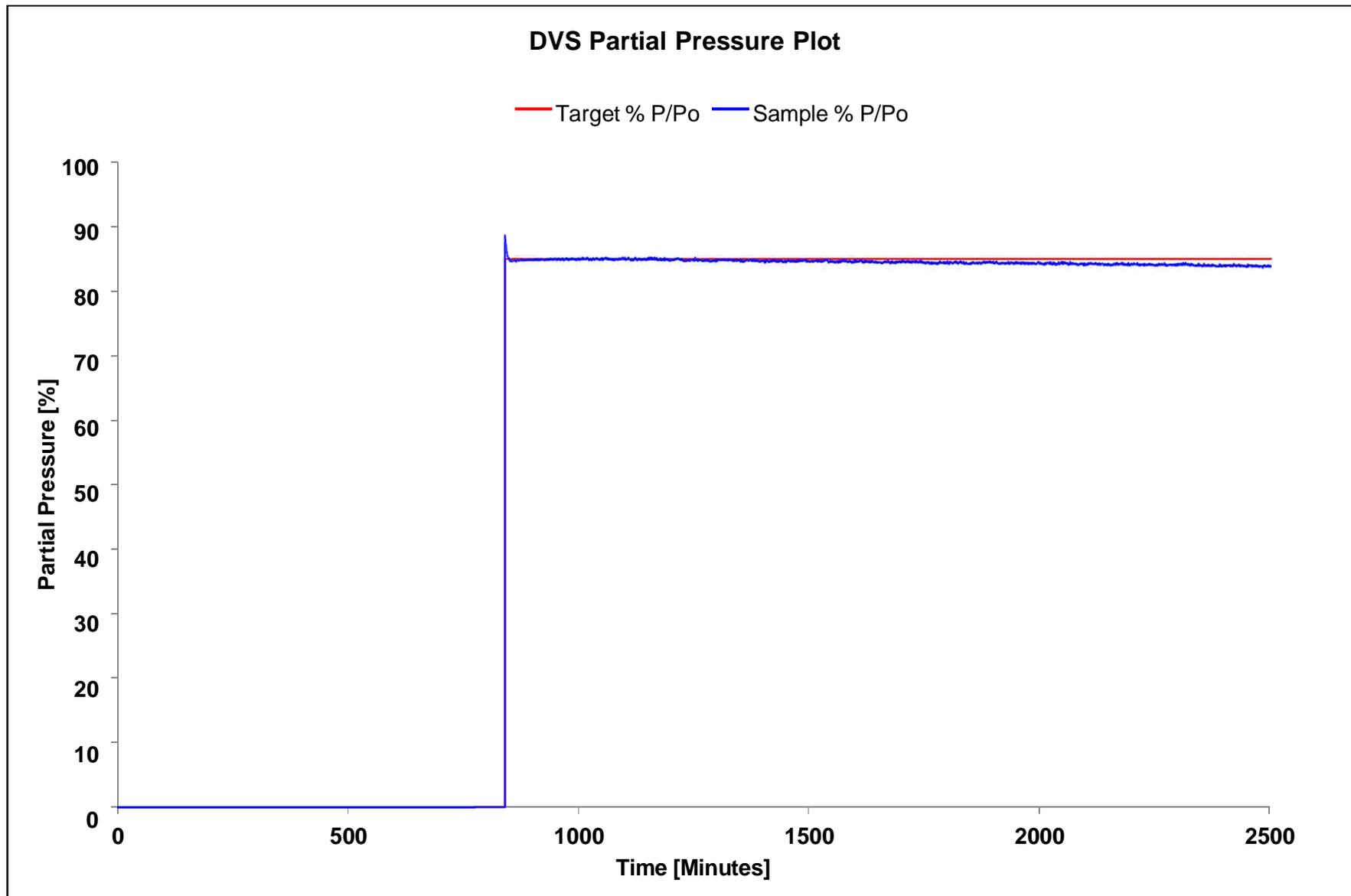
DVS-Adventure: Humidity Performance; 25-50 °C





DVS-Adventure: Humidity Performance 50 to 85 °C





IsoTherm Segment Editor

Method Stage Type

Step Time [min.]: 2

Step dm/dt [%/min.]: 0.002000

Incubator Temp. [°C]: 25.0

Options

Take Video Image

Use Raman

Cycle

Half Cycle Cycles: 1

Full Cycle # Stages: 1

Multiple Cycles

Preheater Temp. [°C]: 0.0

Active Reservoir: Reservoir A

Total Gas Flow [sccm]

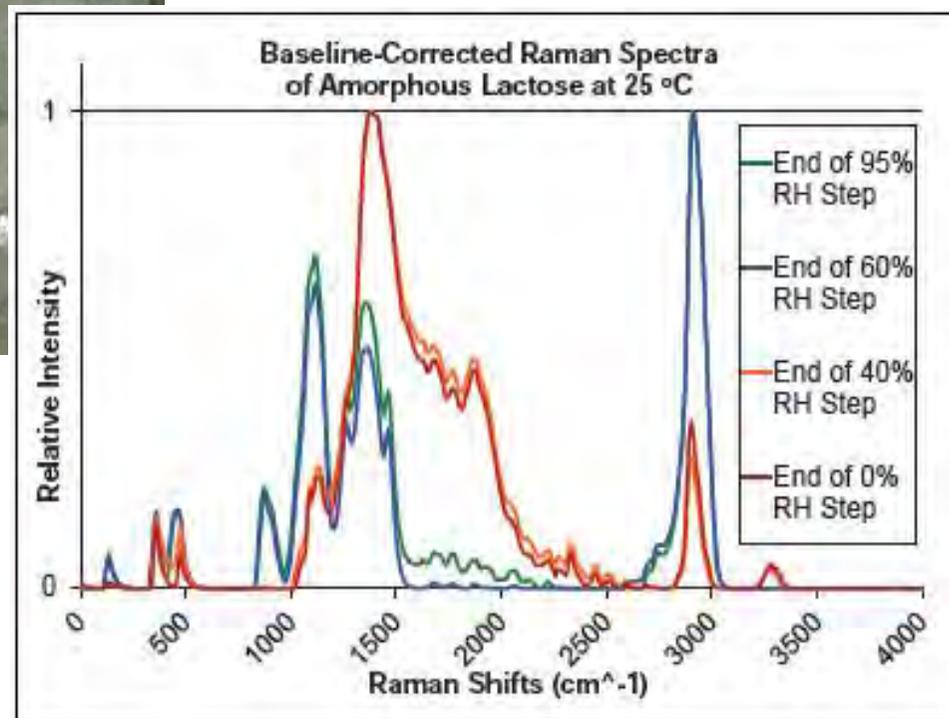
(A): 200

(B): 200

Half Cycle Definition

Seg. #	Start Partial Pressure (A) [%]	Stop Partial Pressure (A) [%]	Start Partial Pressure (B) [%]	Stop Partial Pressure (B) [%]	Step Size Partial Pressure (A) [%]	Step Size Partial Pressure (B) [%]
1	0.00	0.00	0.00	0.00	5.00	5.00

OK Cancel





Dual Vapor Sorption Analyzer

Capabilities:

- Competitive sorption of two vapors
- Organic and Water vapor sorption kinetics
- Organic vapor sorption in a fixed RH background
- Real time partial pressure measurement and control
- Water vapor sorption isotherms from 5 to 85 °C
- Organic vapor sorption isotherms from 5 to 50 °C
- In-situ drying of samples to 300 °C
- Optional Fiber Optic Raman
- Optional Color Video Microscopy
- True0™ drying at 0.0% RH



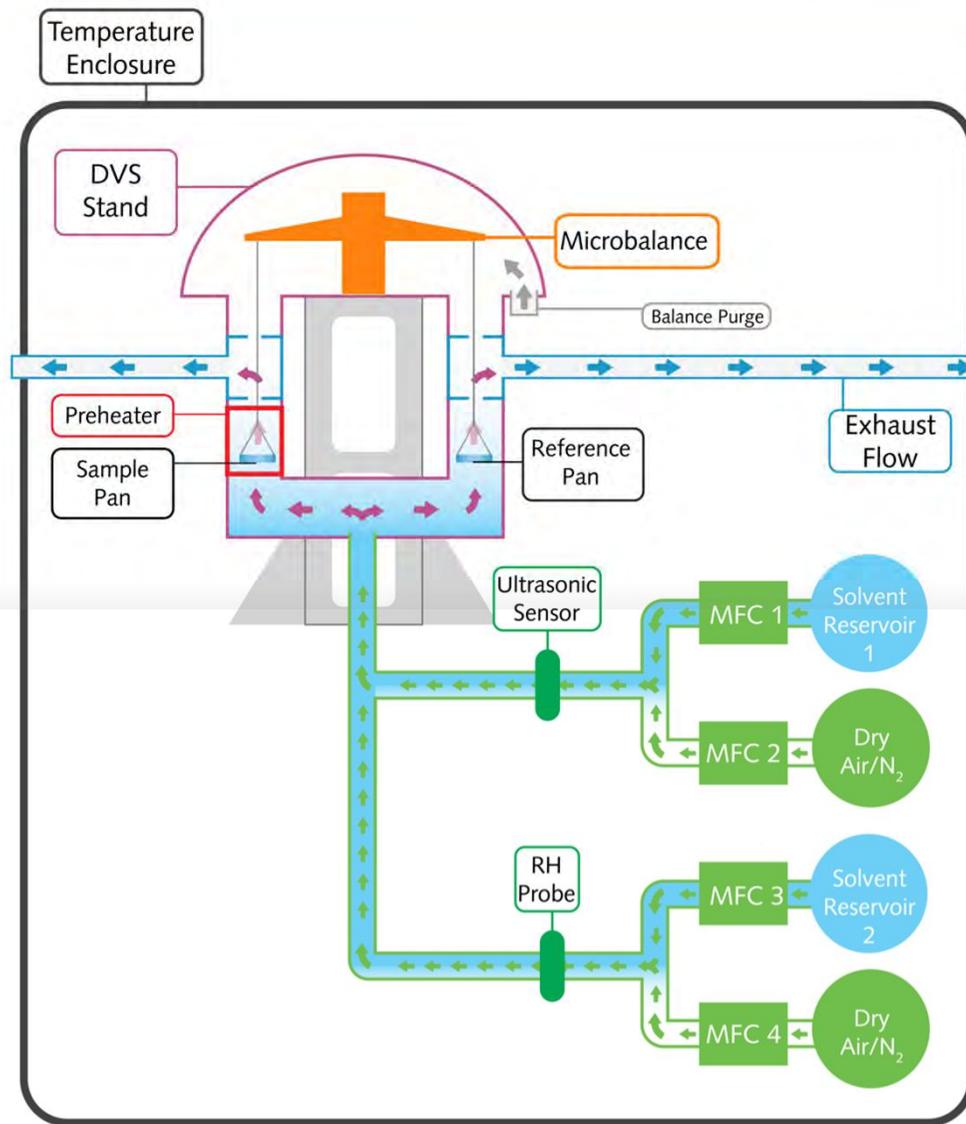


The worlds most advanced Vapour Sorption Analyser

- Can run water, organic vapour or gases
- Can also run two component mixtures such as H₂O and ethanol or CO₂ and N₂
- Can study competitive adsorption phenomena
- Upgradable to Raman, NIR, Video
- Preheaters to 300C and cooling to -40C
- High mass and low mass balances
- Upgrade route to DVS Endeavour
- 5 to 85C temperature range
- Faster install time and less calibration down time
- Factory calibrated capacitance humidity probe for
 - 25C , 35C, 45C
 - At 0%,to 90% RH in 10% steps
- SOS sensor requires no special calibration
- Less maintenance visits and more reliable instrument performance
- Small laboratory bench footprint



Schematic of DVS Resolution



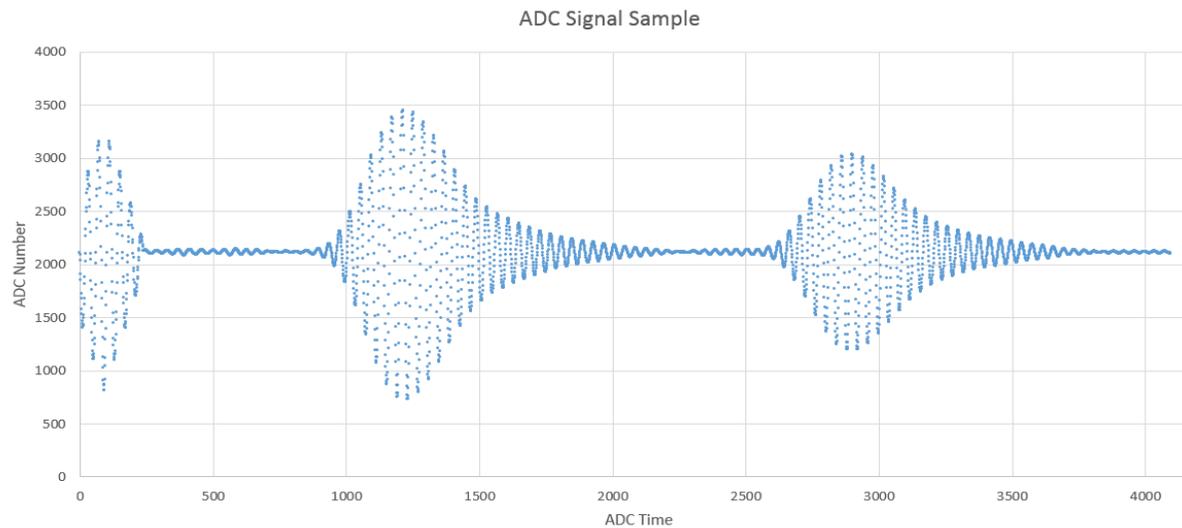
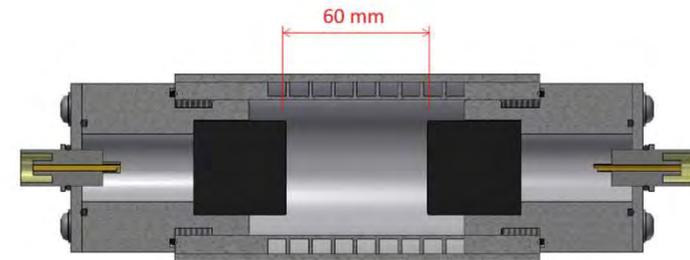


Configuration

- Pitch-Catch

Algorithm

- Parabola curve-fitting & Zero-crossings



Sectioned View



The following solvents are calibrated in air from typically 15C to 50C:

Acetone
Chloroform
Cyclohexane
Decane
1,2 Dichloroethane
DiChloromethane
Ethanol
Ethyl acetate
Ethyl benzene
Heptane

Hexane
Isopropanol
Methanol
Methyl Ether Ketone
Nonane
Octane
Toluene
Water
m-Xylene
p-Xylene

The following solvents are calibrated in nitrogen at 50C:

m-Xylene

p-Xylene

The following solvents are calibrated in air at 25C*:

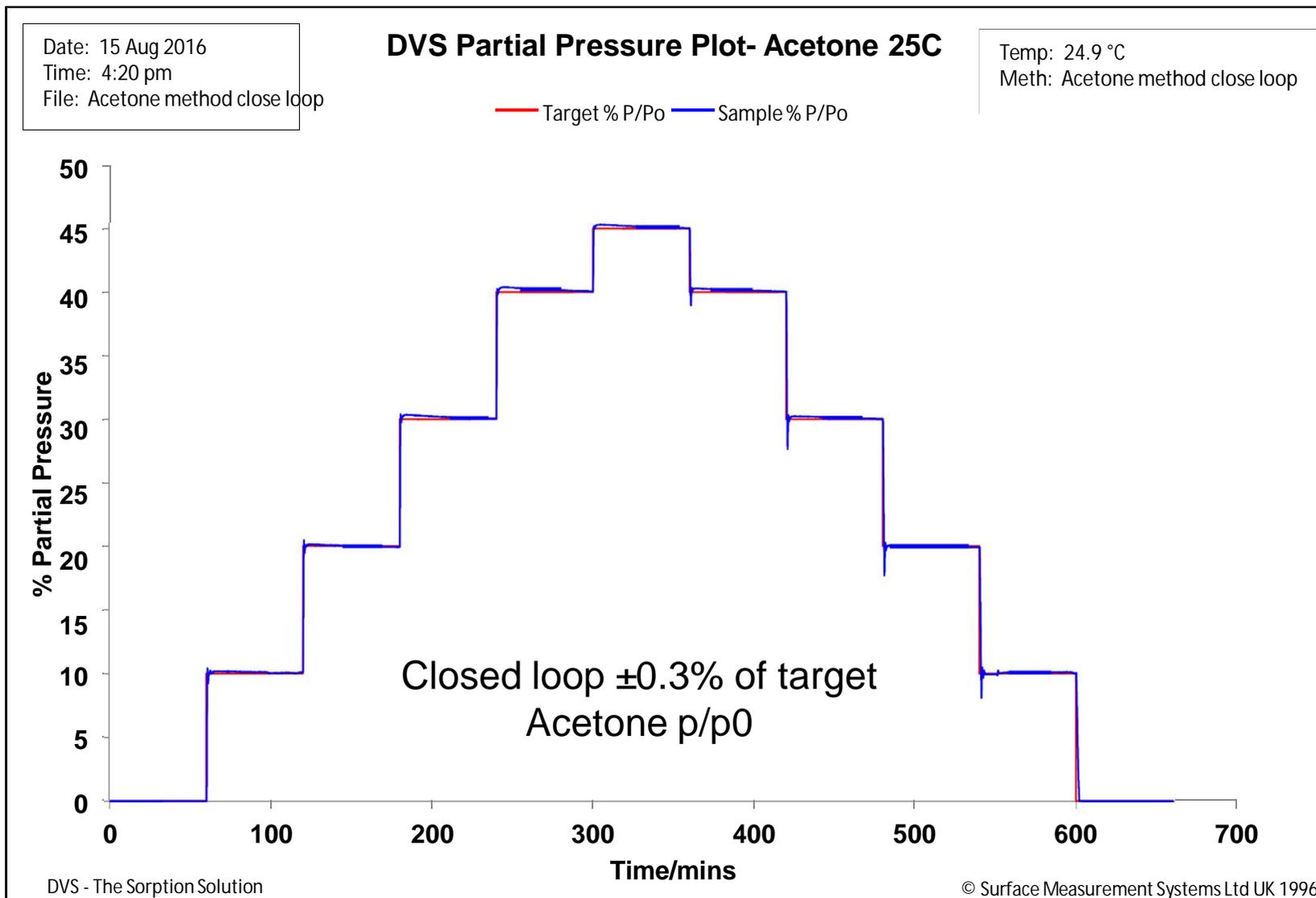
Pinene
Hexanal

Limonene
Butyl amine

The following gases are calibrated in from 10C to 50C*:

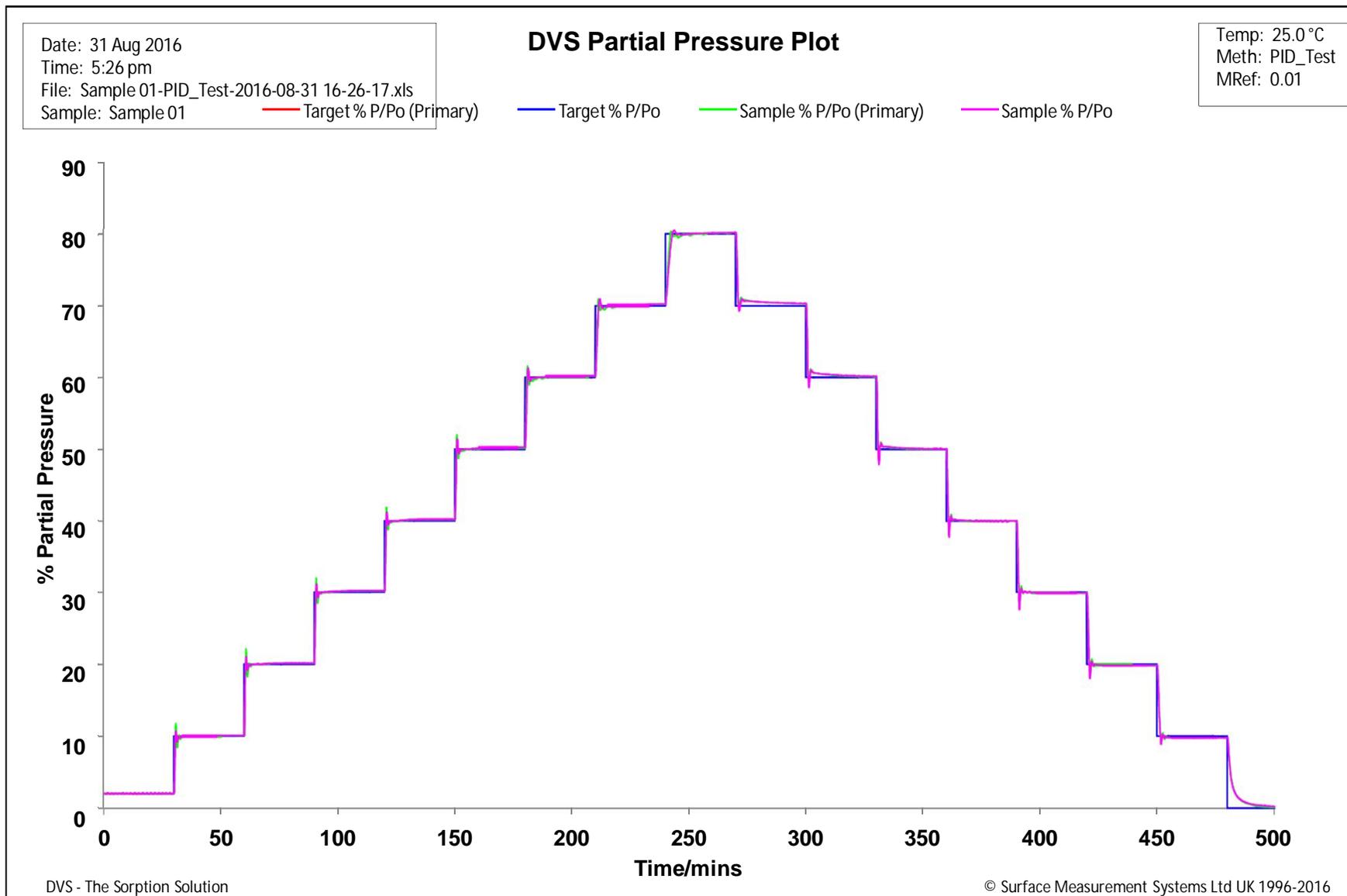
CO₂ in air

CH₄ in air





Octane Vapor: Dual Channel SOS





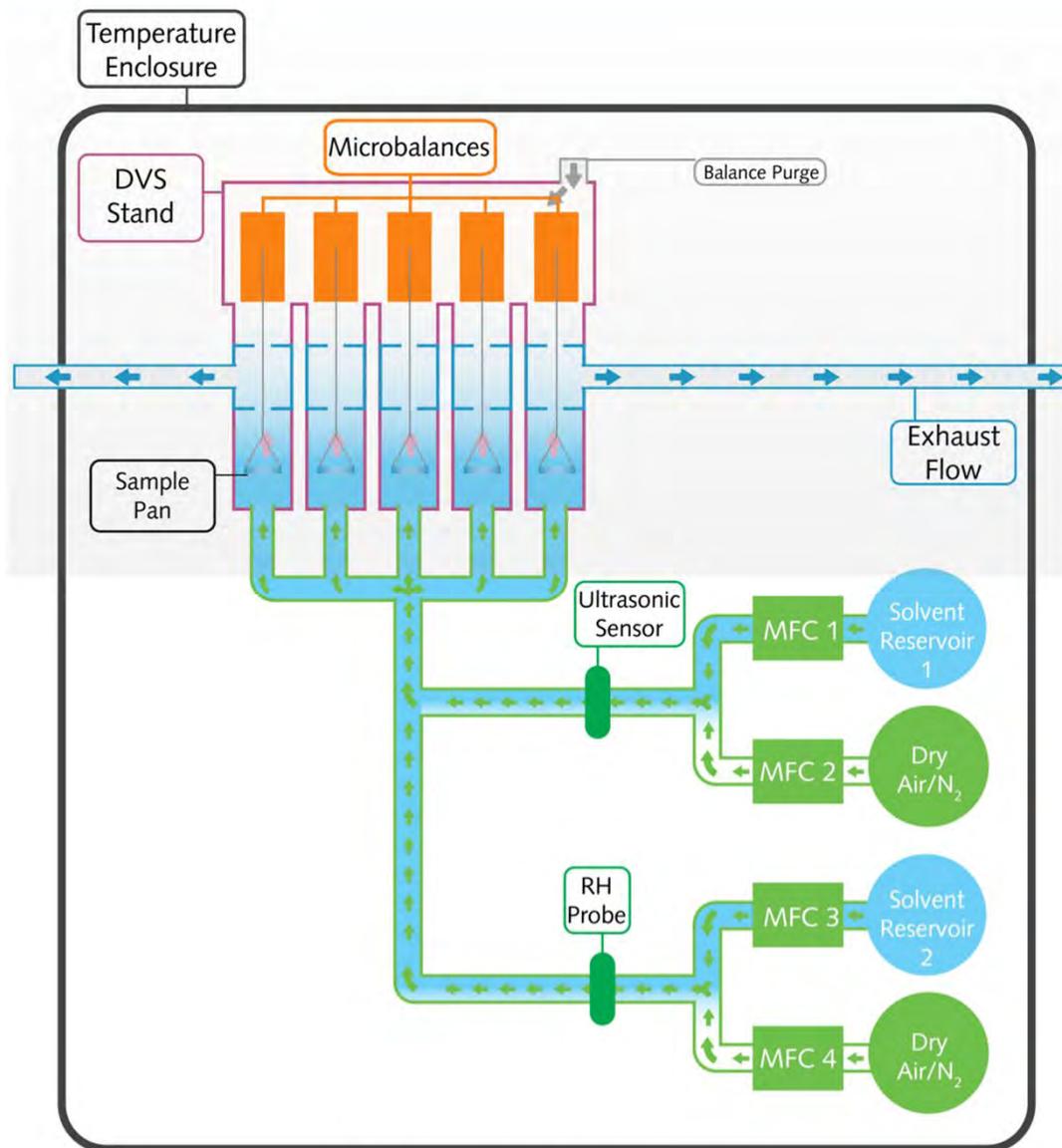
- 5 High precision Ultrabalances offer true high parallel performance- 5 samples at once- under identical humidity and temperature conditions.
- All 5 samples zone can be accessed individually
- Can run 1 to 5 samples as required by user
- All balances can be tared and calibrated simultaneously
- 5 to 85C temperature range
- Factory calibrated capacitance humidity probe for
 - 25C , 35C, 45C
 - At 0% to 90% relative humidities in 10% steps
- SOS Sensor for organic vapours and gas mixtures
- Laboratory bench footprint 450mm (18") plus PC

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Schematic of DVS Endeavor

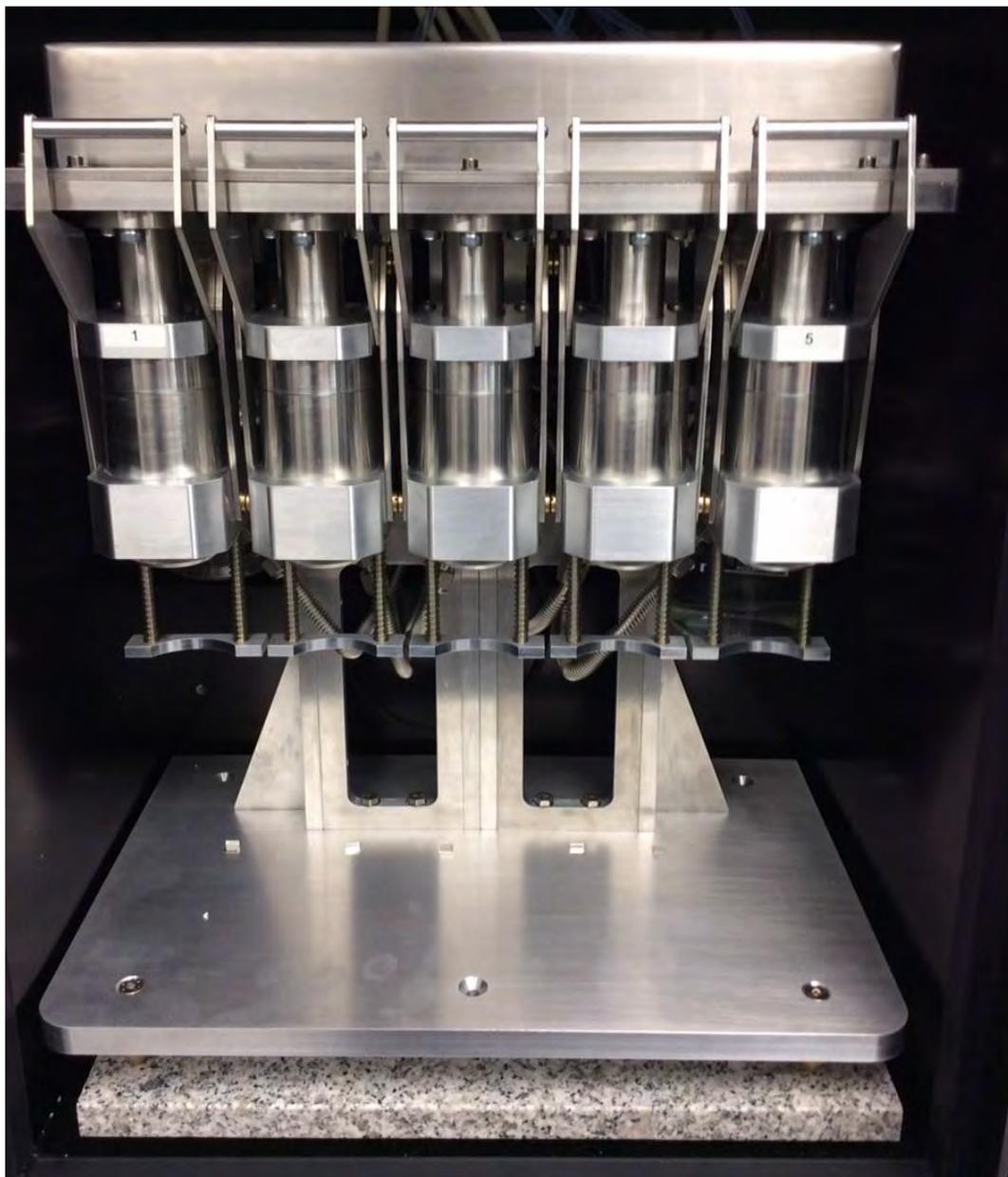


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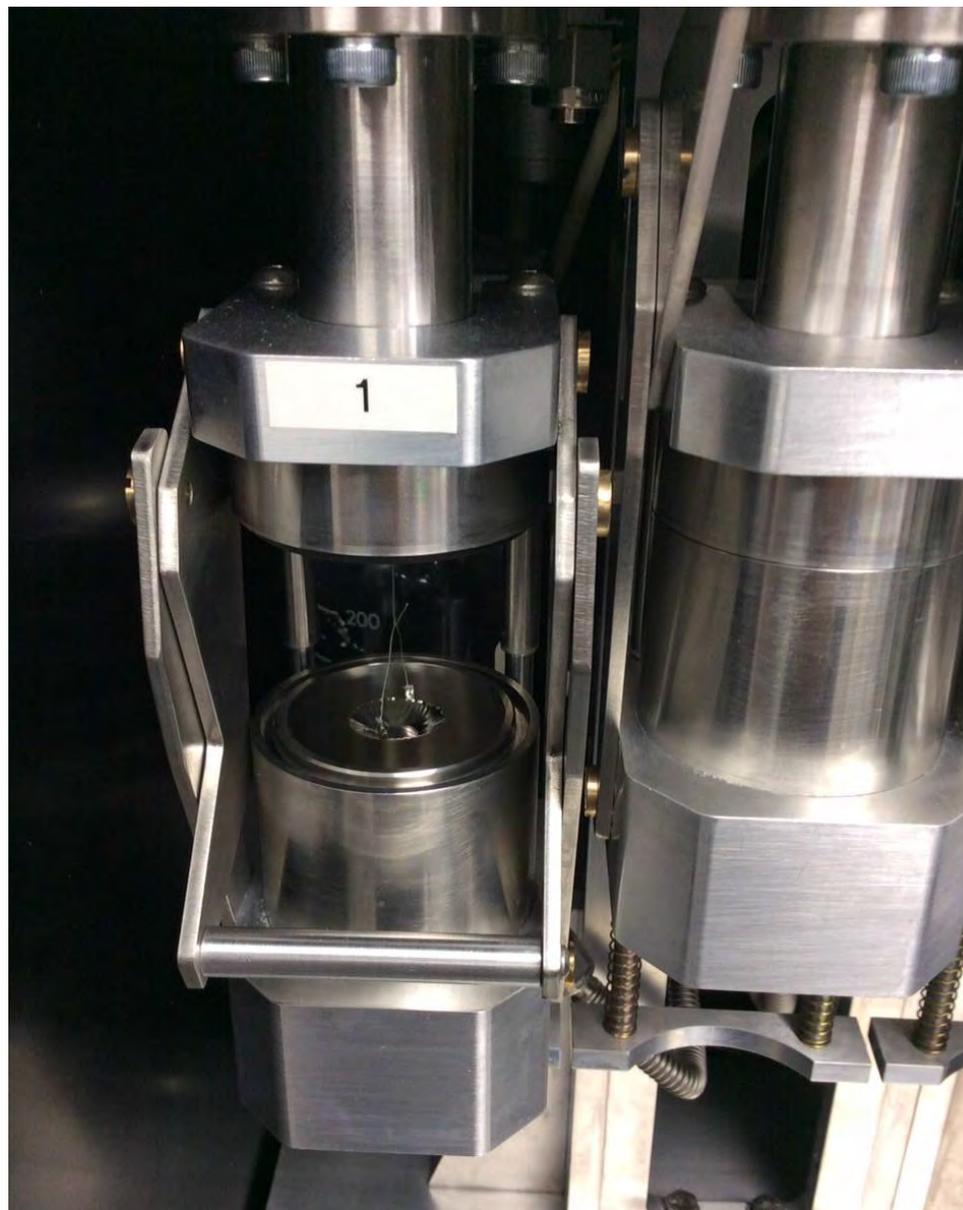
DVS-Endeavour

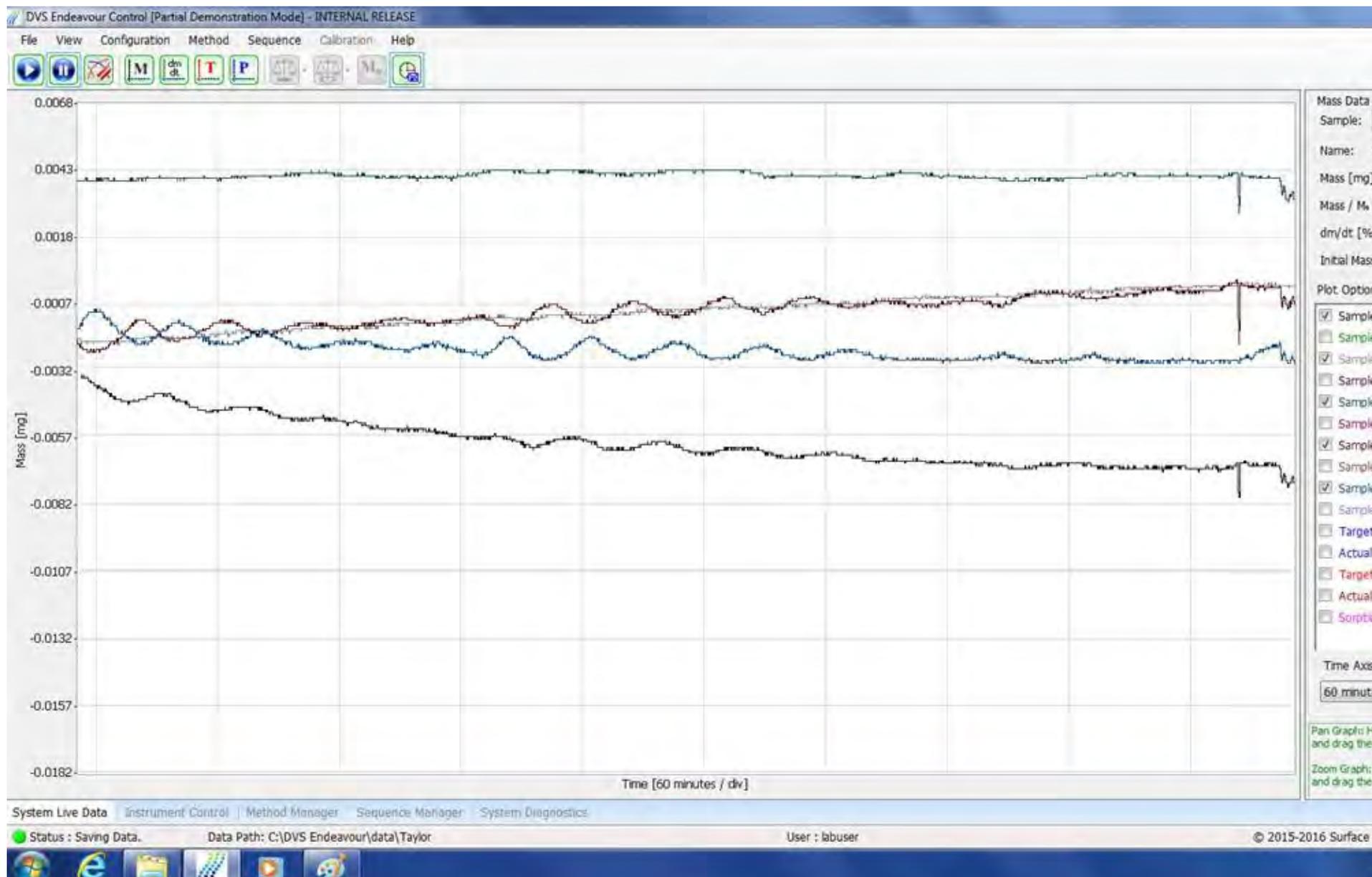




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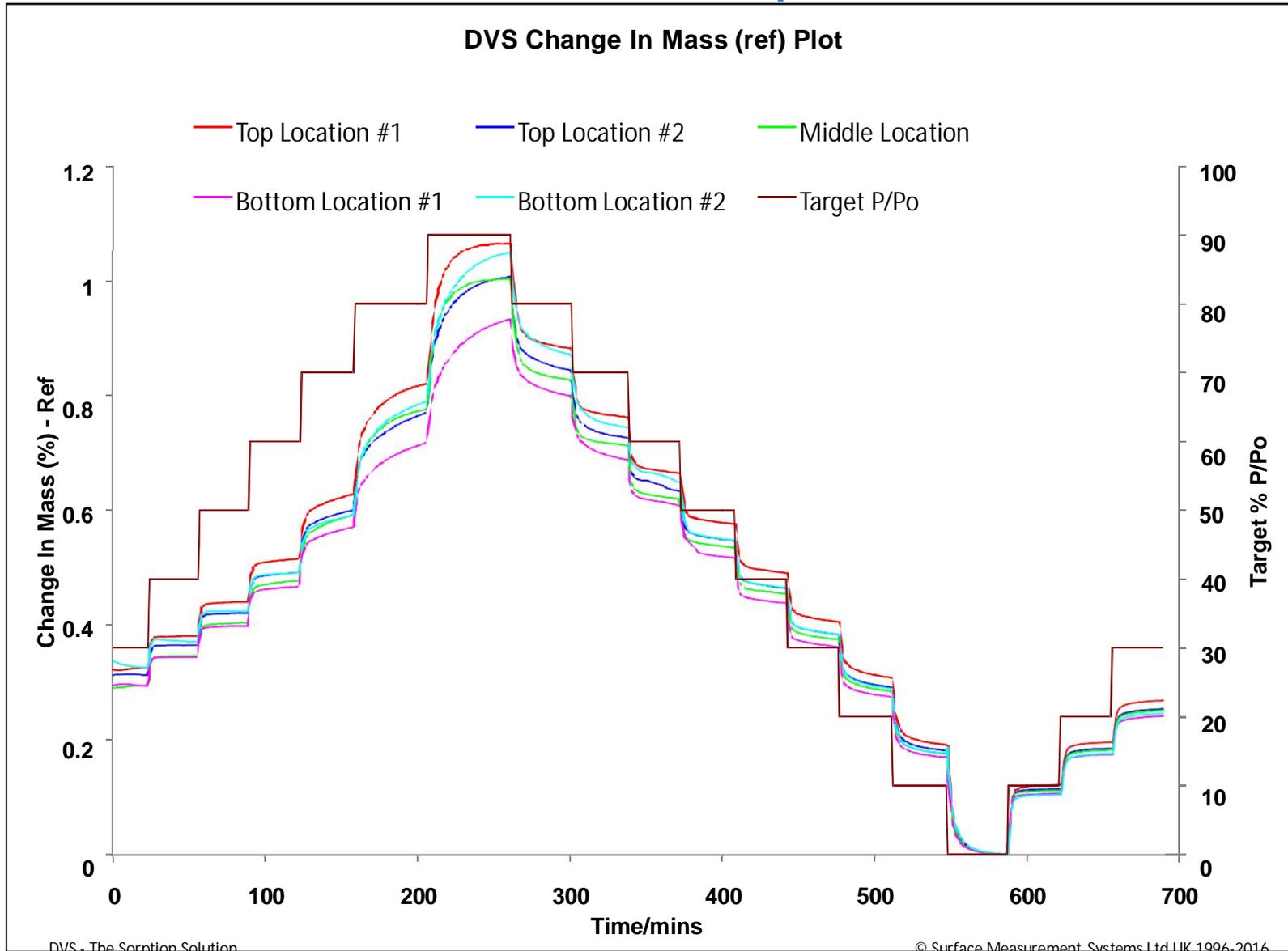
DVS-Endeavour







DVS-Endeavour – 5 Samples from API Barrel





- Common software platform used for all new DVS models
- Easy to use wizards for balance calibration
- Live view of all data
- Isotherm, Isobar, and Ramping Experiments
- Quick start method development
- Run methods and sequences
- Integrated fiber optic Raman spectroscopy capture
- Integrated color video microscopy capture
- Full system diagnostics

DVS
ADVENTURE

DVS
RESOLUTION

DVS
ENDEAVOUR



The screenshot displays the 'DVS Control [Partial Demonstration Mode]' software interface. The window title bar includes 'File', 'View', 'Configuration', 'Method', 'Sequence', 'Calibration', and 'Help' menus. The main interface is divided into several sections:

- Solvents:** Features two 3D reservoir models. 'Active Reservoir' is set to 'Reservoir A' (checked). Both 'Carrier Gas + Solvent' and 'Control Mode' are set to 'Air + Water' and 'Open' respectively.
- Partial Pressure (A) [%]:** Shows four vertical gauges for Target and Actual values for two different reservoirs. All values are currently at 0.00.
- Sorption Temp. [°C]:** A single vertical gauge showing a current value of 25.2.
- Incubator Temp. [°C]:** Shows Target and Actual gauges with values of 25.0 and 24.4.
- Preheater Temp. [°C]:** Shows Target and Actual gauges with values of 0 and 0.
- Refrigeration:** Includes radio buttons for 'On', 'Off', and 'Automatic' (selected).
- Preheater Ramp Rate [°C/min]:** A numeric input field set to 1.
- Total Gas Flow [sccm]:** Includes input fields for 'A' and 'B', both set to 200.

The bottom status bar shows 'System Live Data', 'Instrument Control', 'Method Manager', 'Sequence Manager', and 'System Diagnostics'. The system status is 'Ready', the user is 'dburnett', and the copyright notice is '© 2015-2016 Surface Measurement Systems UK Ltd.'





The screenshot displays the DVS Control software interface in 'Partial Demonstration Mode'. The interface is divided into two main panels: 'System Information' on the left and 'Hardware Information' on the right. The 'System Information' panel shows various parameters such as Partial Pressure, Temperature, MFC Flow Rate, Valve Status, and Others. The 'Hardware Information' panel shows details for various components including Control Board, Balance, Incubator Controller, Refrigeration Controller, Preheater, MFC, Valve Controller, and Partial Pressure Sensor (A). The status bar at the bottom indicates 'Status : Ready', 'User : dburnett', and '© 2015-2016 Surface Measurement Systems UK Ltd.'.

System Information	
Partial Pressure	
Reservoir [A] Target Value	0.00 %
Reservoir [A] Actual Value	0.61 %
Reservoir [B] Target Value	0.00 %
Reservoir [B] Actual Value	0.42 %
Temperature	
Incubator Target Value	25.0 °C
Incubator Actual Value	25.0 °C
Sorption	24.7 °C
Preheater Target Value	0 °C
Preheater Actual Value	0 °C
MFC Flow Rate	
Reservoir [A] Dry Flow Target Value	200.0 sccm
Reservoir [A] Dry Flow Actual Value	199.5 sccm
Reservoir [A] Wet Flow Target Value	0.0 sccm
Reservoir [A] Wet Flow Actual Value	0.0 sccm
Reservoir [B] Dry Flow Target Value	0.0 sccm
Reservoir [B] Dry Flow Actual Value	0.3 sccm
Reservoir [B] Wet Flow Target Value	0.0 sccm
Reservoir [B] Wet Flow Actual Value	0.0 sccm
Balance Purge Flow Target Value	75.0 sccm
Balance Purge Flow Actual Value	75.1 sccm
Valve Status	
Reservoir [A] Select Flow Valve	Open
Reservoir [A] Wet Flow Valve	Closed
Reservoir [B] Select Flow Valve	Not Used
Reservoir [B] Wet Flow Valve	Not Used
Others	
Door Status	Unknown
Refrigeration	On
Organic Vapour Detection Status	No Leak Detected

Hardware Information	
Control Board	
Type	UCB Plus
Firmware Version	
Status	Disabled
Balance	
Type	Simulated Balance
Raw Output	000.0474,5001
Firmware Version	
Status	OK
Incubator Controller	
Type	Simulated Controller
Firmware Version	
Status	OK
Refrigeration Controller	
Type	Simulated Controller
Firmware Version	
Status	OK
Preheater	
Type	Simulated Preheater
Firmware Version	
Status	OK
MFC	
Type	Simulated MFC
Firmware Version	
Status	OK
Valve Controller	
Type	Simulated Valve Controller
Firmware Version	
Status	OK
Partial Pressure Sensor (A)	
Type	
Firmware Version	
Status	OK





IsoTherm Segment Editor

Method Stage Type

Step Time [min.]: 2

Step dm/dt [%/min.]: 0.002000

Incubator Temp. [°C]: 25.0

Options

Take Video Image

Use Raman

Cycle

Half Cycle Cycles: 1

Full Cycle # Stages: 1

Multiple Cycles

Preheater Temp. [°C]: 0.0

Active Reservoir: Reservoir A

Total Gas Flow [sccm]

(A): 200

(B): 200

Half Cycle Definition

Seg. #	Start Partial Pressure (A) [%]	Stop Partial Pressure (A) [%]	Start Partial Pressure (B) [%]	Stop Partial Pressure (B) [%]	Step Size Partial Pressure (A) [%]	Step Size Partial Pressure (B) [%]
1	0.00	0.00	0.00	0.00	5.00	5.00

OK Cancel





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Thank you!

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