Setting the Standard for Automation™

Improving Analysis through Innovations in Gas Sampling

Tony Wimpenny

Orbital Gas Systems, UK

Standards

Certification

Education & Training

Publishing

Conferences & Exhibits

Presenter: Tony Wimpenny

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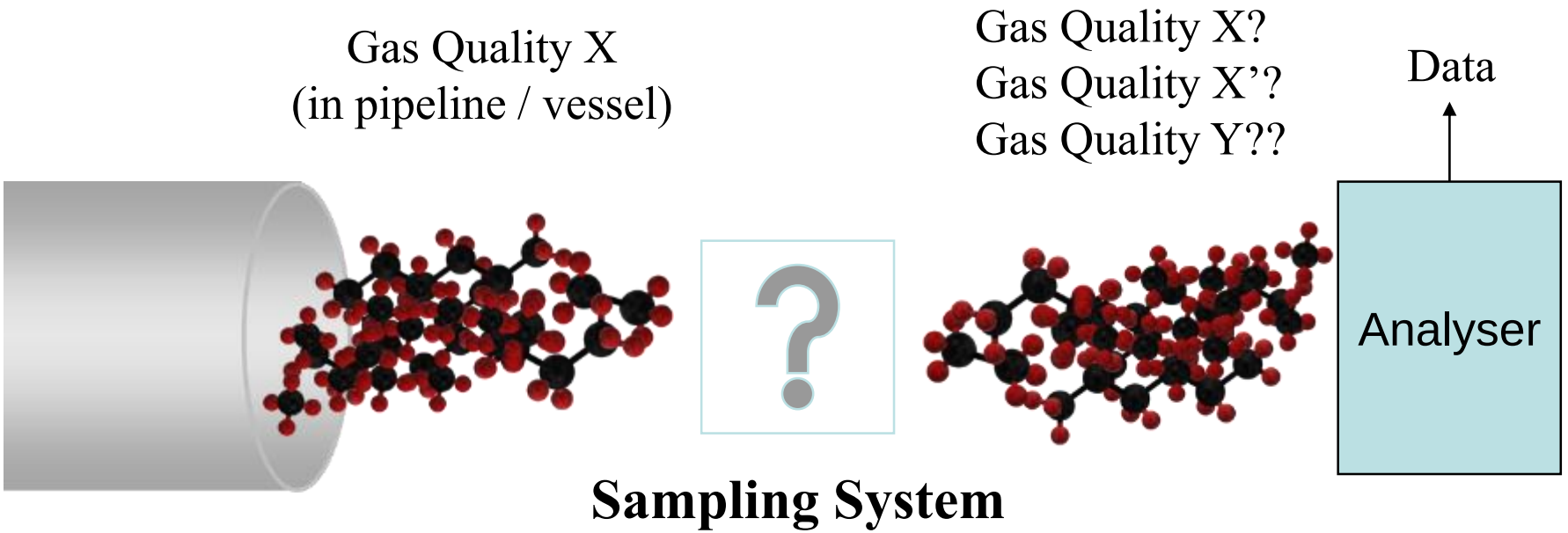
- Beng, Msc from University of Bath, Manchester
  - Specialising in materials
- 7 years Aerospace Engineering
  - Including 4 years in Bristol, UK and 3 years in Toulouse, France
- 1 year Production & Export @ EnDet / VE Technology
  - Produced and exported new advanced gas sampling technology
- 4 years (and counting!) International Sales @ Orbital
  - Manage global sales network and responsible for growth of sales of two patented product lines: VE Technology® and GasPT®

ORBITAL

Basics of Sampling
A Simple Illustration



Achieving Good Measurement

How to Achieve Good Measurement:

- I just need to buy the best (most accurate) analyser, right? (wrong!)

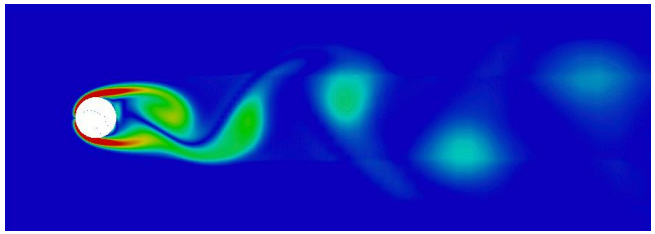
- Need to safely deliver gas from process to analyser:
  - Sample probe
  - Filtration
  - Pressure reduction
  - Sample transport tubing

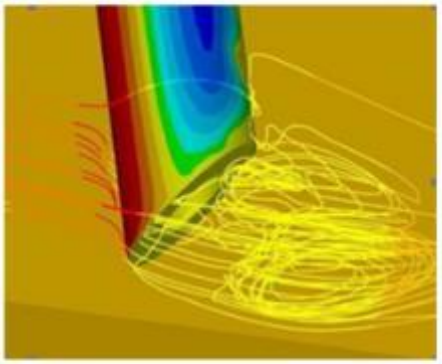
- Sampling system is as critical as the analyser in achieving good measurement

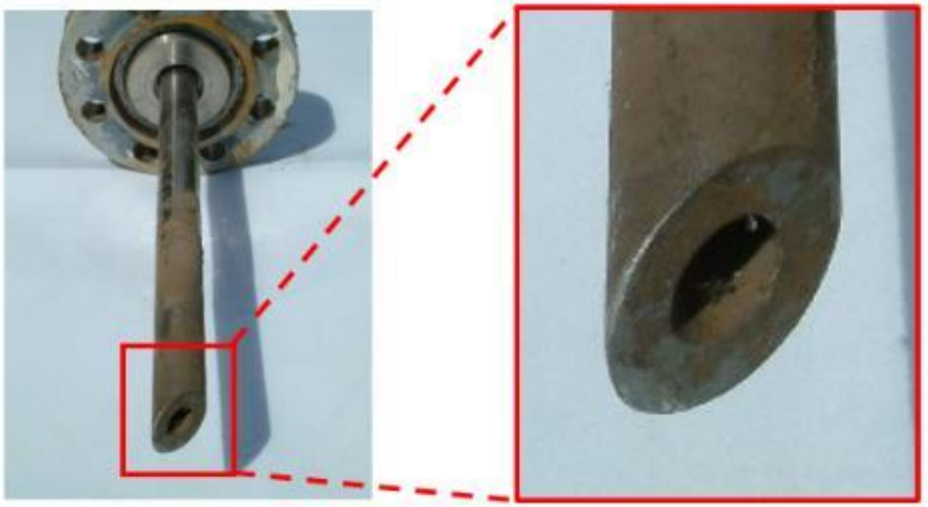
Typical Probe Design
Pipeline Type

Probe Design: In Pipeline

- Wake frequency headaches
- Gas disturbance issues at probe tip
- Contamination issues
- Surfaces and volumes







Typical Probe Design
Pipeline Type

Illustration: Aerodynamic versus Non-Aerodynamic Shapes

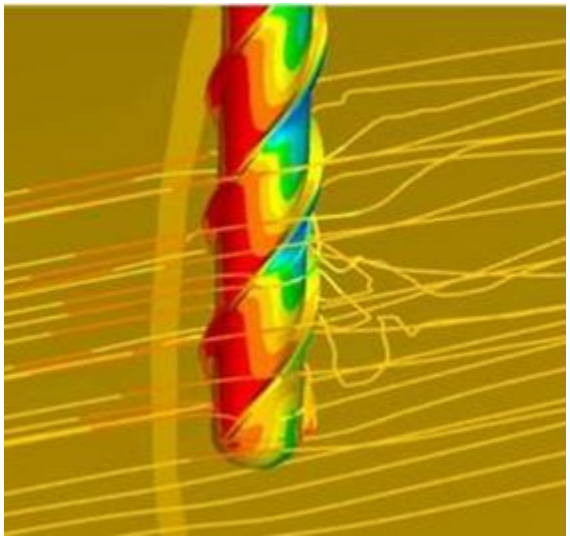
Typical Probe Design
Pipeline Type

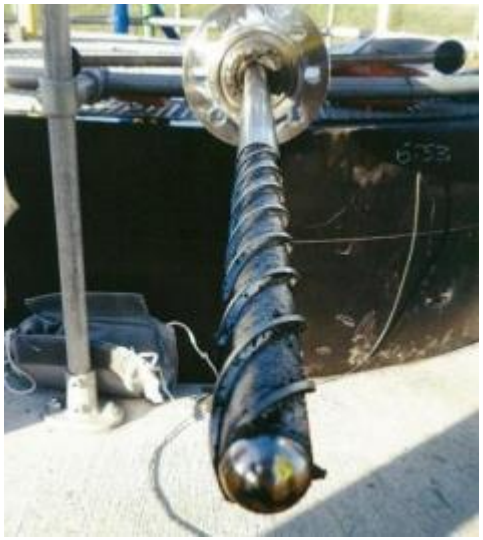
Illustration: Localised Disturbance NOT Representative

Alternative Probe Design
Pipeline Type

Probe Design: In Pipeline

- Wake frequency headaches → solved!
- Gas disturbance issues at probe tip and contamination issues → solved!
- Surfaces and volumes → best available for measurement performance!

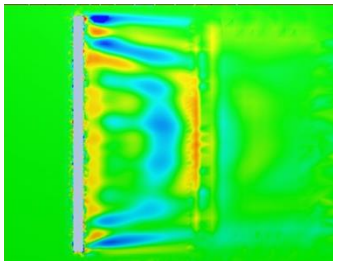


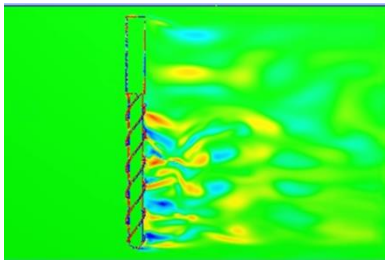


*see www.orbitalgas.com/patents for more information

Helical Strakes Supporting Info Numerous Papers & Studies

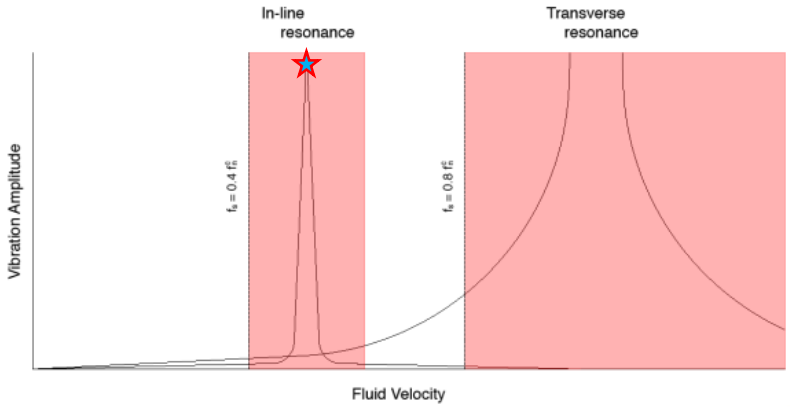
- **White Paper on Elimination of VIV by T. Knight, A. Wimpenny, Z. He** *(available for distribution)*
- **Scruton, C., Walshe, D.E.J., 1957. A means for avoiding wind-excited oscillations of structures with circular or nearly circular cross section, Nat. Phys. Lab. Aero. Rep. 335.**
- **Woodgate, L., Maybrey, J.F.M., 1959. Further experiments on the use of helical strakes for avoiding wind excited oscillations of structures of circular or nearly circular section, National Physical Laboratory, Aero Report Number 381.**
- **CFD Studies – by Daily Thermetrics Corp.** *(available for distribution – June 2017)*
- **Lab Studies – by Bath University and University of Manchester** *(available for distribution)*
- **Practical Study – SwRI® in the High Pressure Loop at the Metering Research Facility in San Antonio** *(available for distribution)*





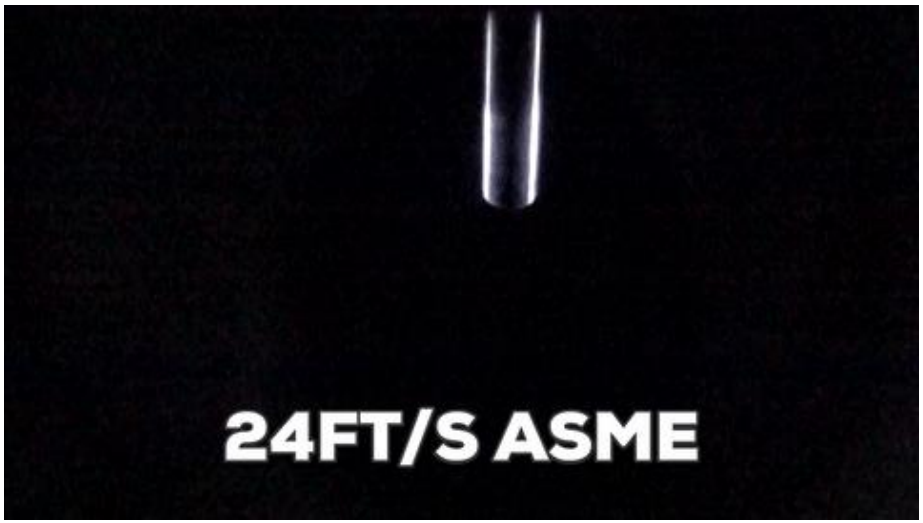
12” Line Findings 0.4-0.6 WF Ratio In-Line Resonance

12” Line
7.625” Immersion Depth
Natural Gas



US PATENT 8424396 B2, US 9,528,917 B2 US PAT. APPLN. 15/386616 AND WORLDWIDE PATENTS AND APPLNS. PENDING

12” Line Findings 0.8-1.0 WF Ratio Transverse Resonance



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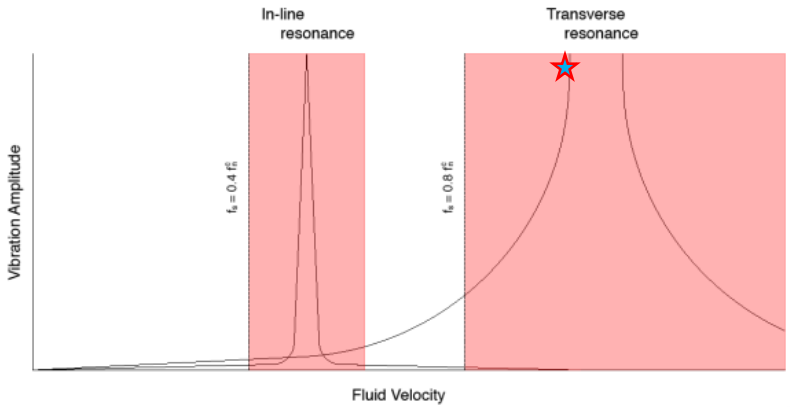
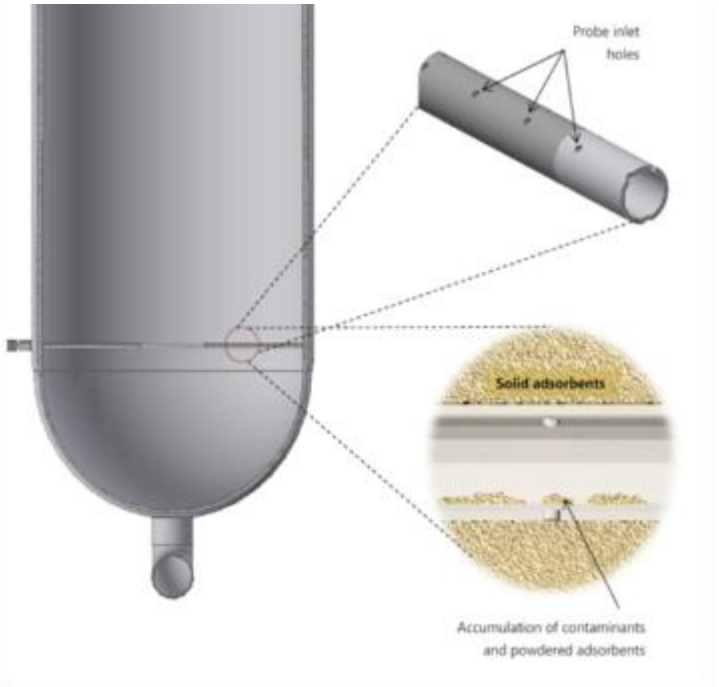


US PATENT 8424396 B2, US 9,528,917 B2 US PAT. APPLN. 15/386616 AND WORLDWIDE PATENTS AND APPLNS. PENDING

Typical Probe Design
In-bed Type

Probe Design: In Bed

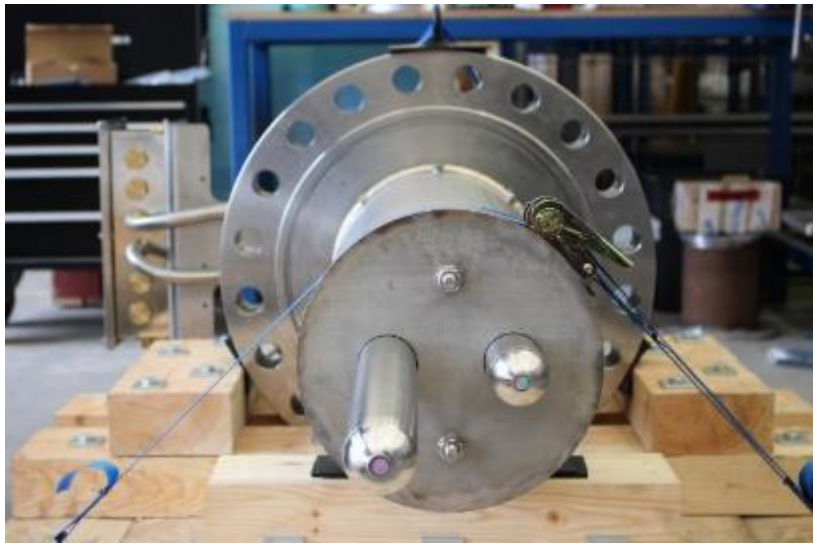
- Unhelpful – doesn't deliver timely or accurate results
- Unreliable – subject to contamination issues

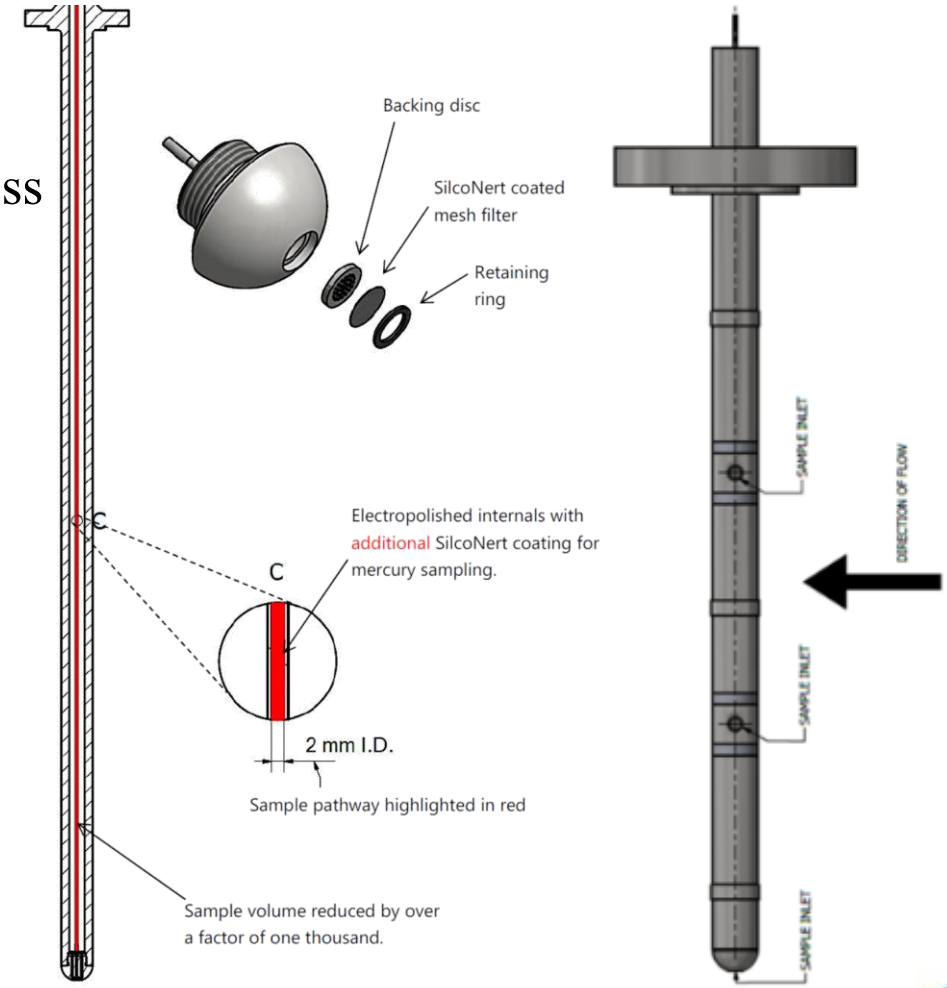


Alternative Probe Design
In-bed Type

Probe Design: In Bed

- Small internal volume
- Electropolished (and inert) surfaces
- Tip design eliminates particulate ingress
- Combined sampling and temperature





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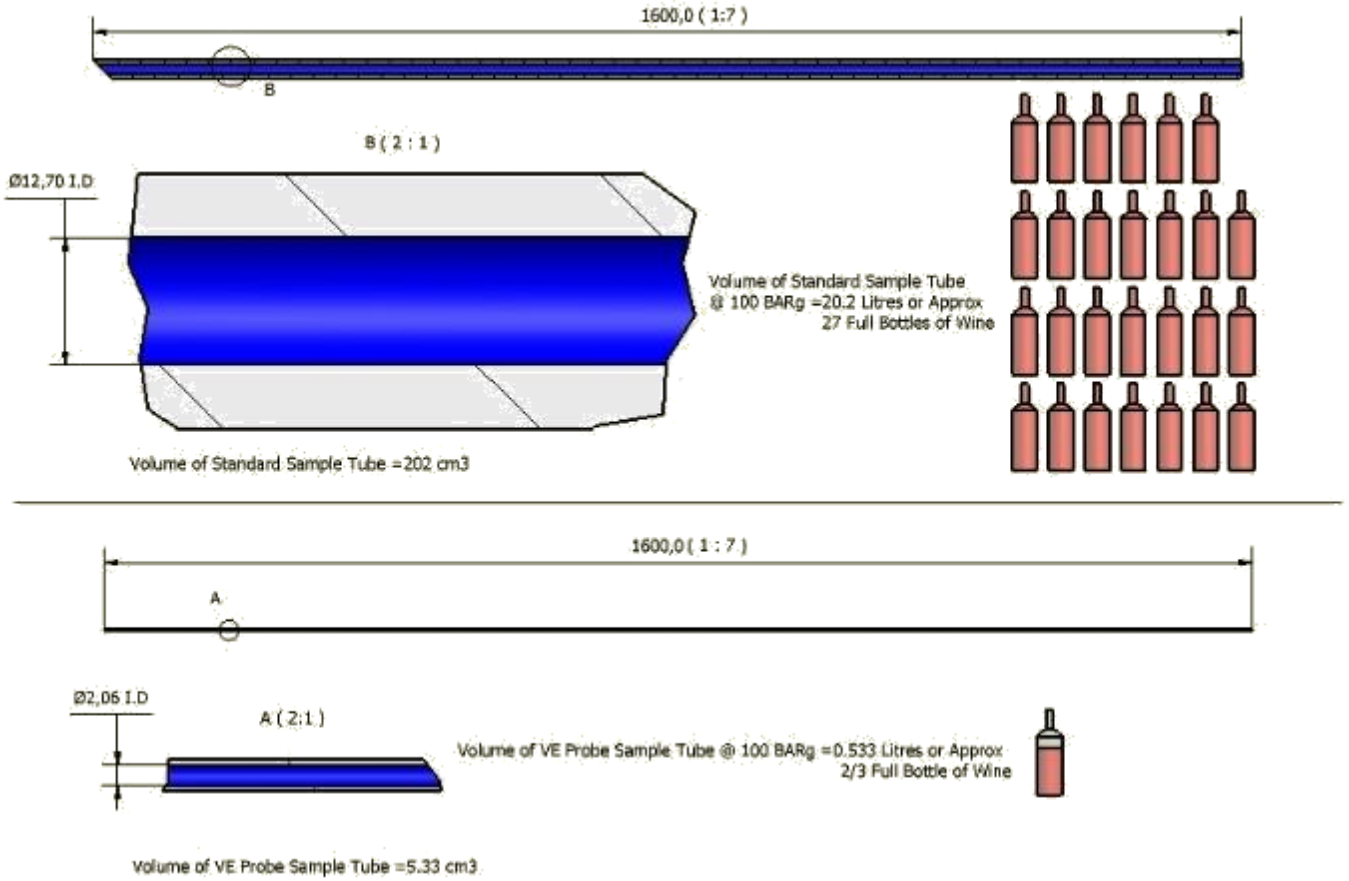
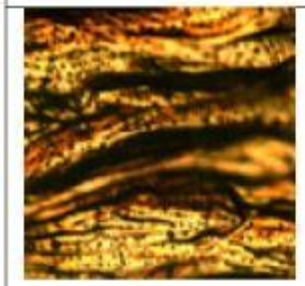
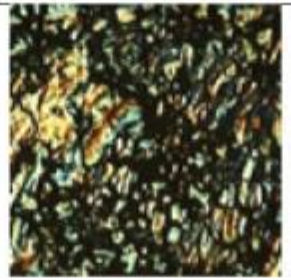
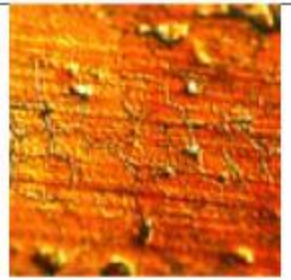
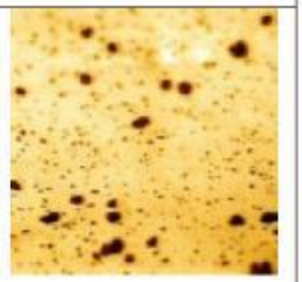
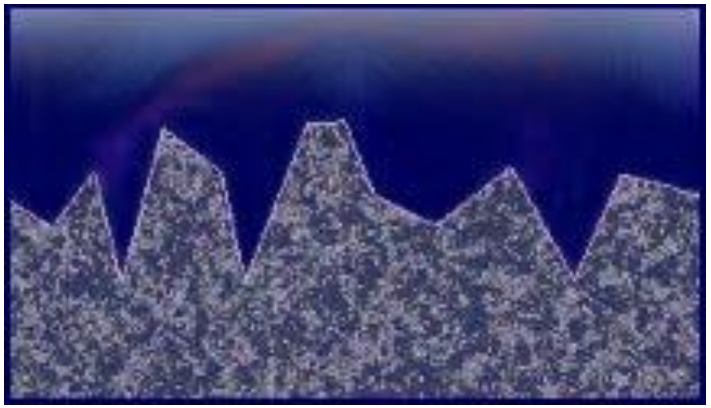
Surfaces and Volume Effects on Sampling and Analysis

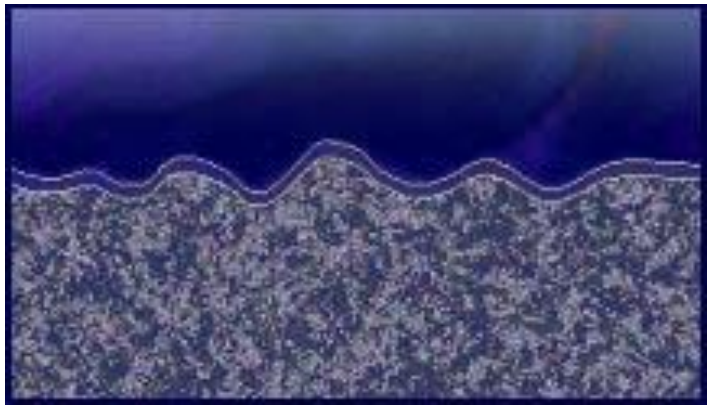


Impact on purge time / analytical response, filtration, anti-JT heating, emissions!

Surfaces and Volume Effects on Sampling and Analysis

Conventional 316 SS	SilcoSteel on Conventional	Chemically Passivated	Electropolish	Electropolished And Sulfinert
				





Images courtesy of Phil Harris (upper), Anipol (lower)

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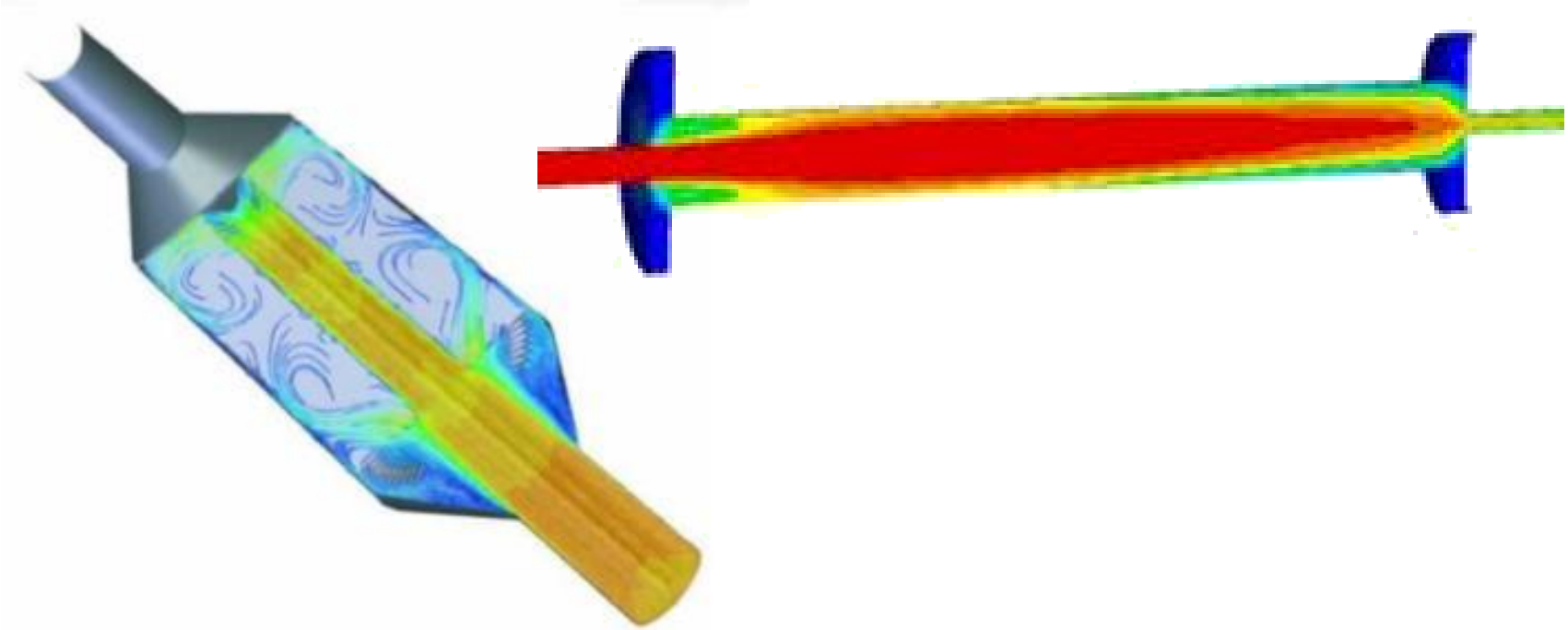
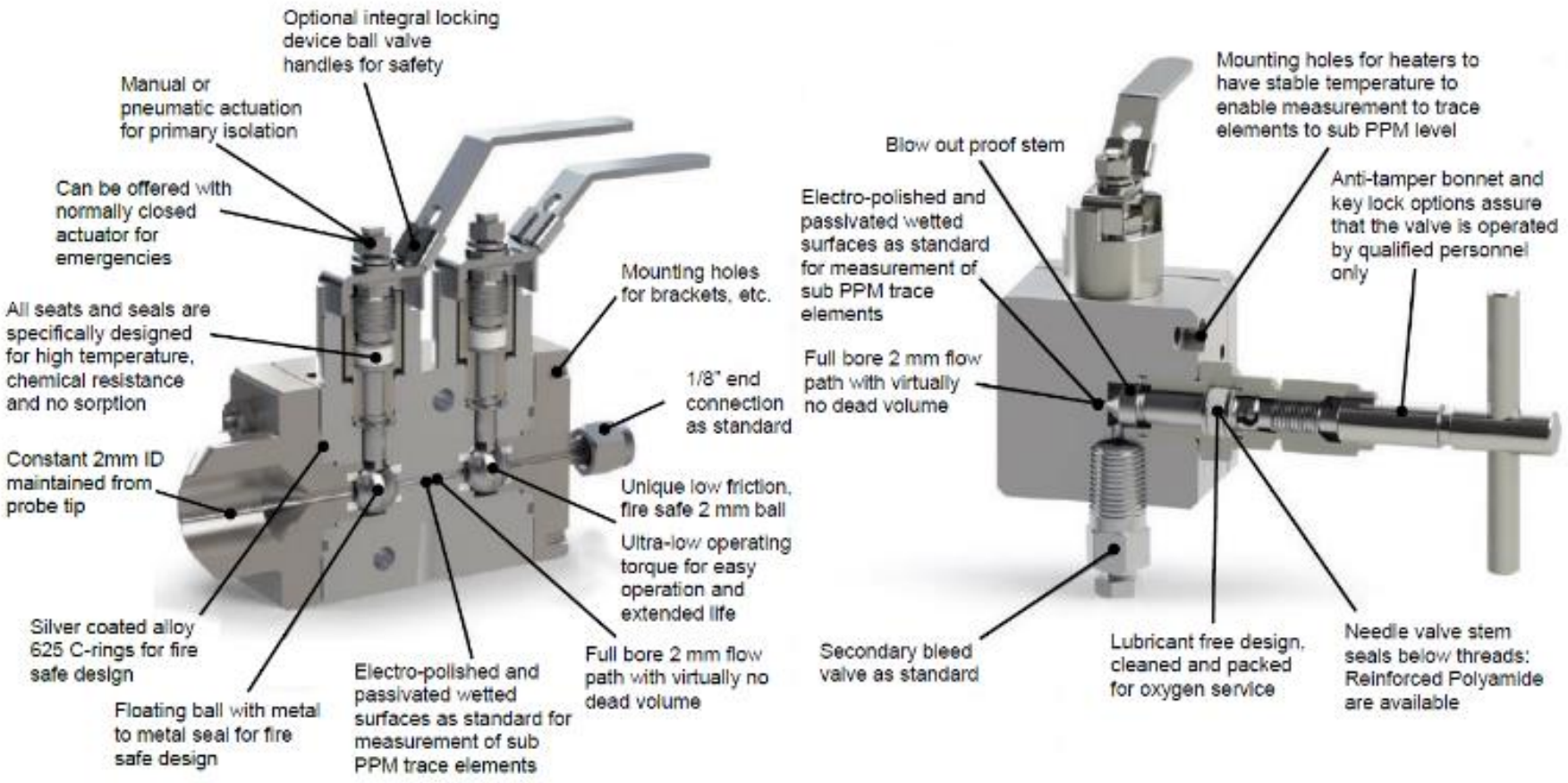


Mixing volumes increase lag times and affect measurement accuracy / response!

Valve Design

Mixing volumes increase lag times and affect measurement accuracy / response!

Alternative Valve Design



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Filtration

Filtration: To collect contamination to prevent it reaching (damaging) the analyser

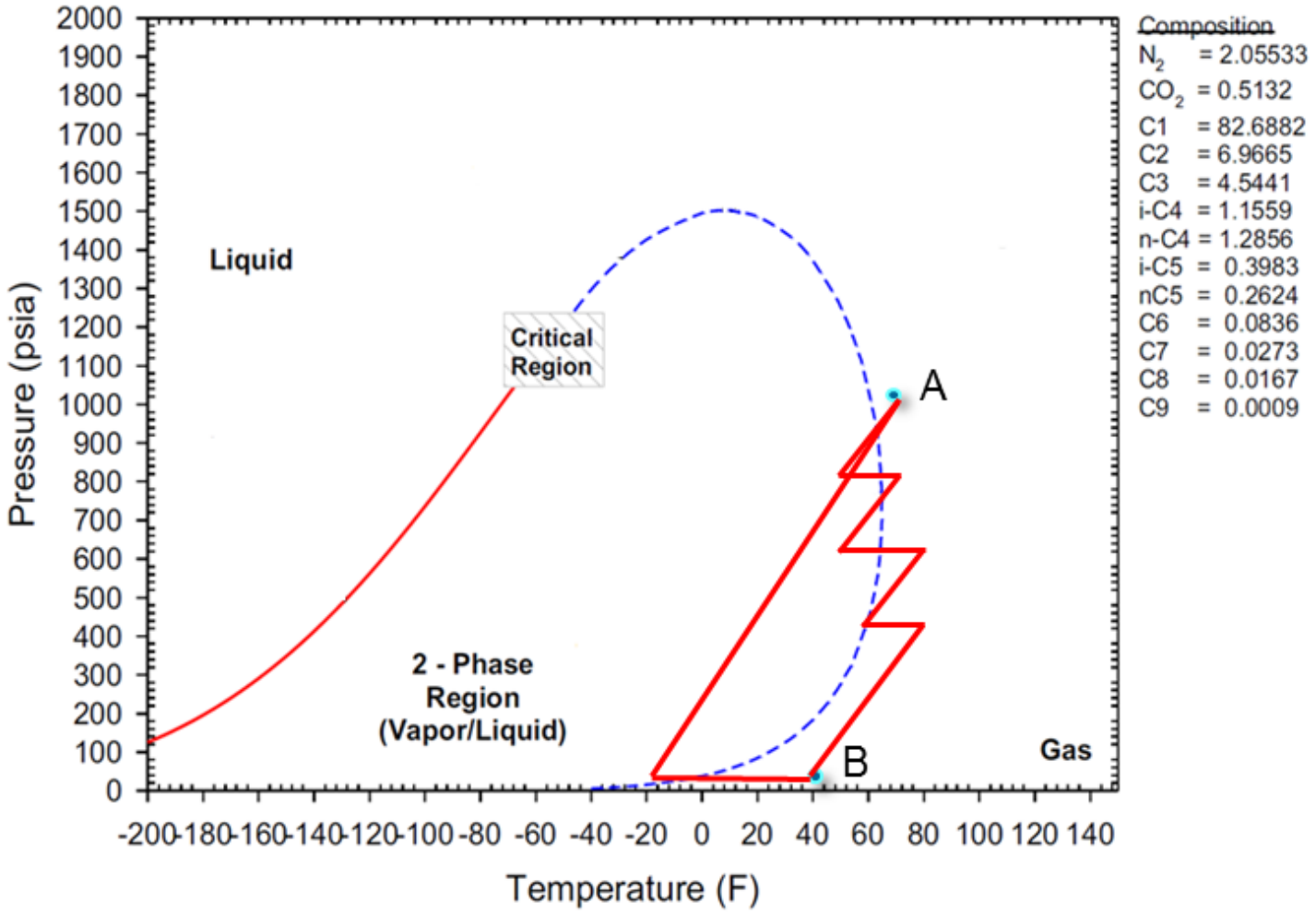
- Various types
- Typically a mixing volume and large surface area
- Accumulate significant contamination which alters chemical identity of fresh sample
- Changing a filter cartridge may leave residual contamination in filter housing

Alternative Filtration

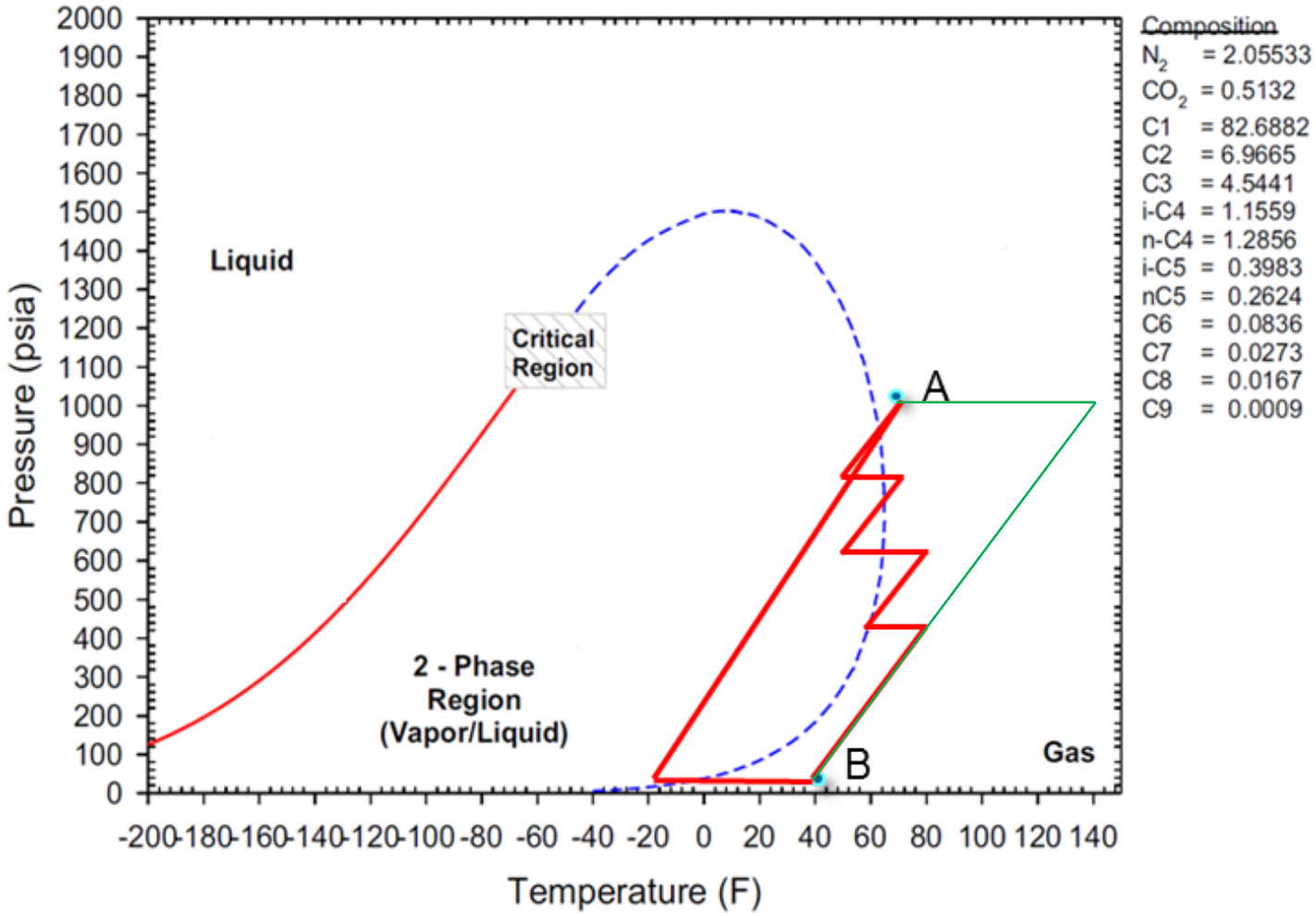
Filtration: To collect contamination to prevent it reaching (damaging) the analyser

- Aerodynamic probe tip prevents contamination even entering the system!
- In-line filter improves flow path and eliminates mixing volumes
- Sintered stainless steel design ensures similar material chemistry, can be inert coated
- When filter is changed, all contamination is removed

Pressure Reduction / Monitoring



Pressure Reduction / Monitoring Alternative Method



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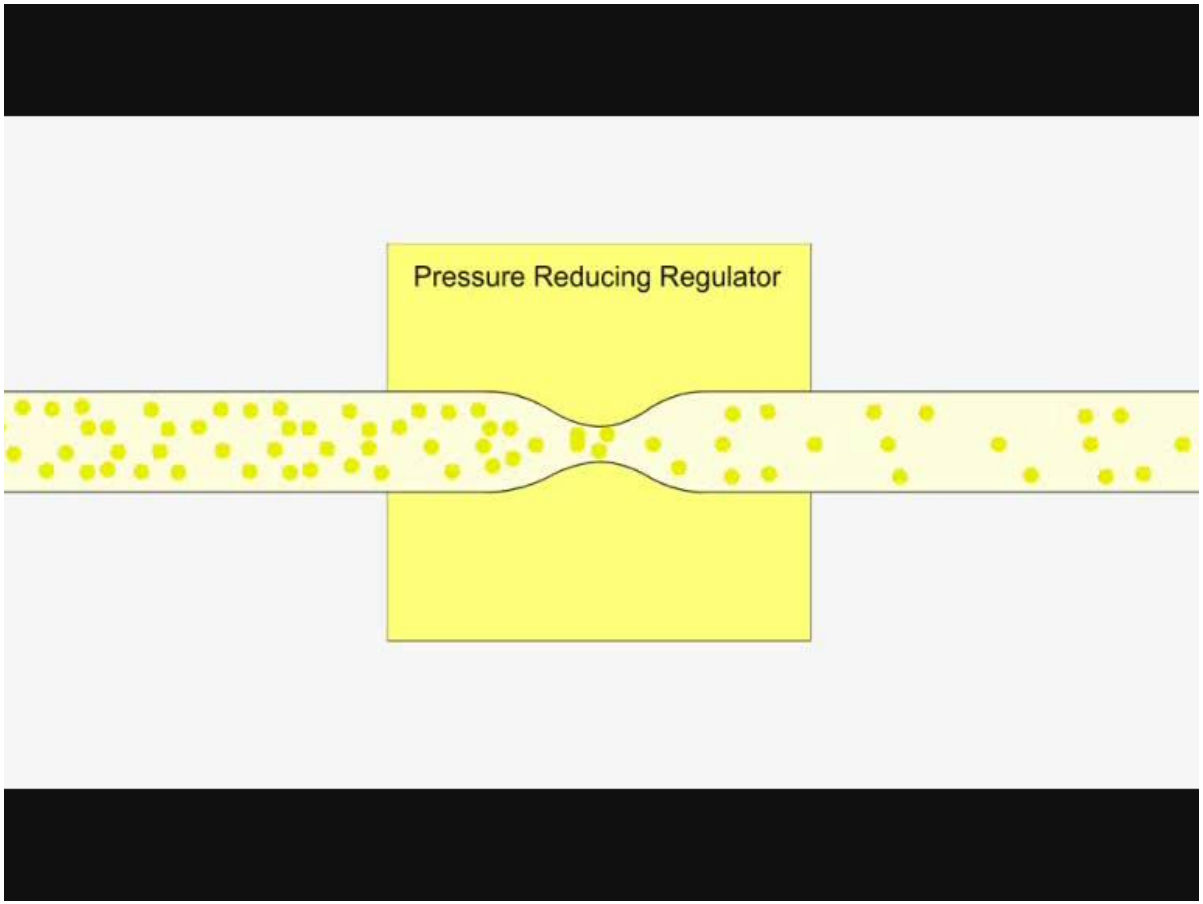

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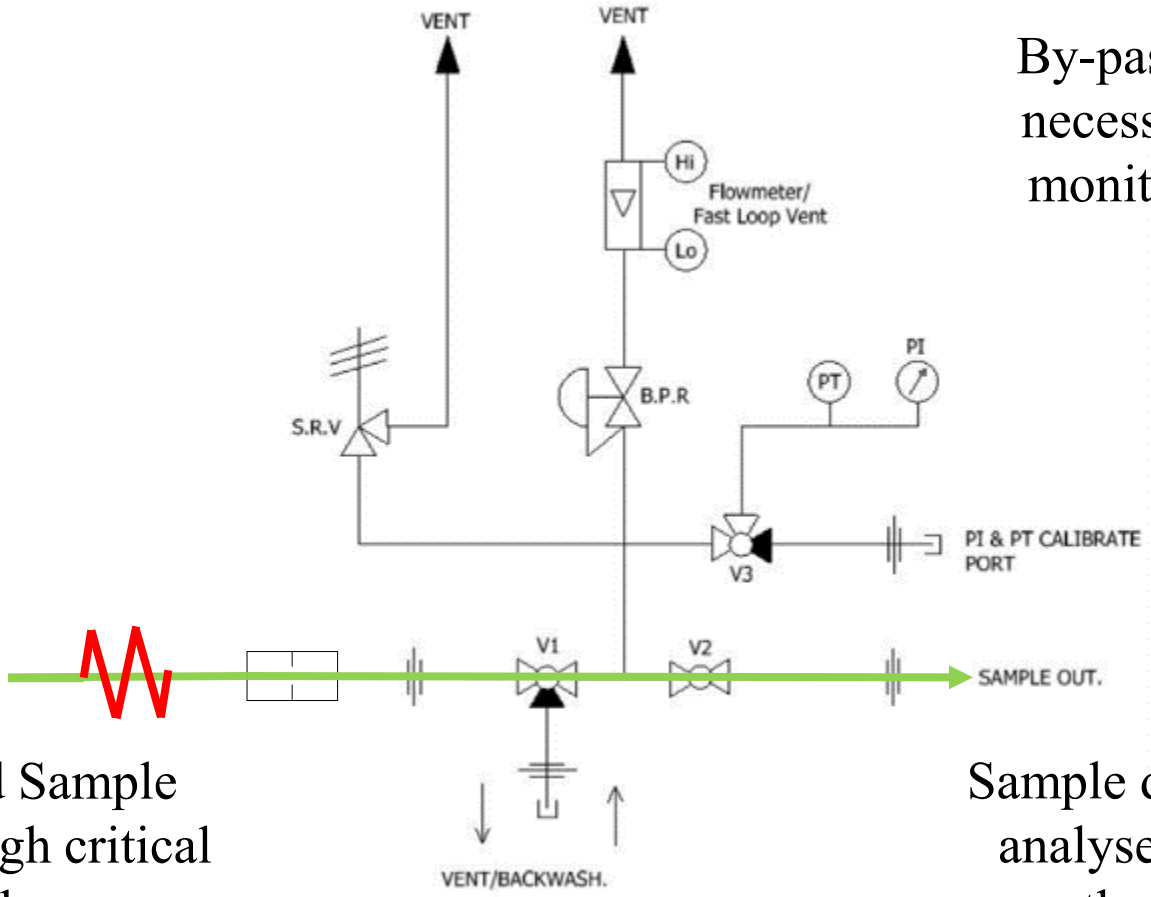
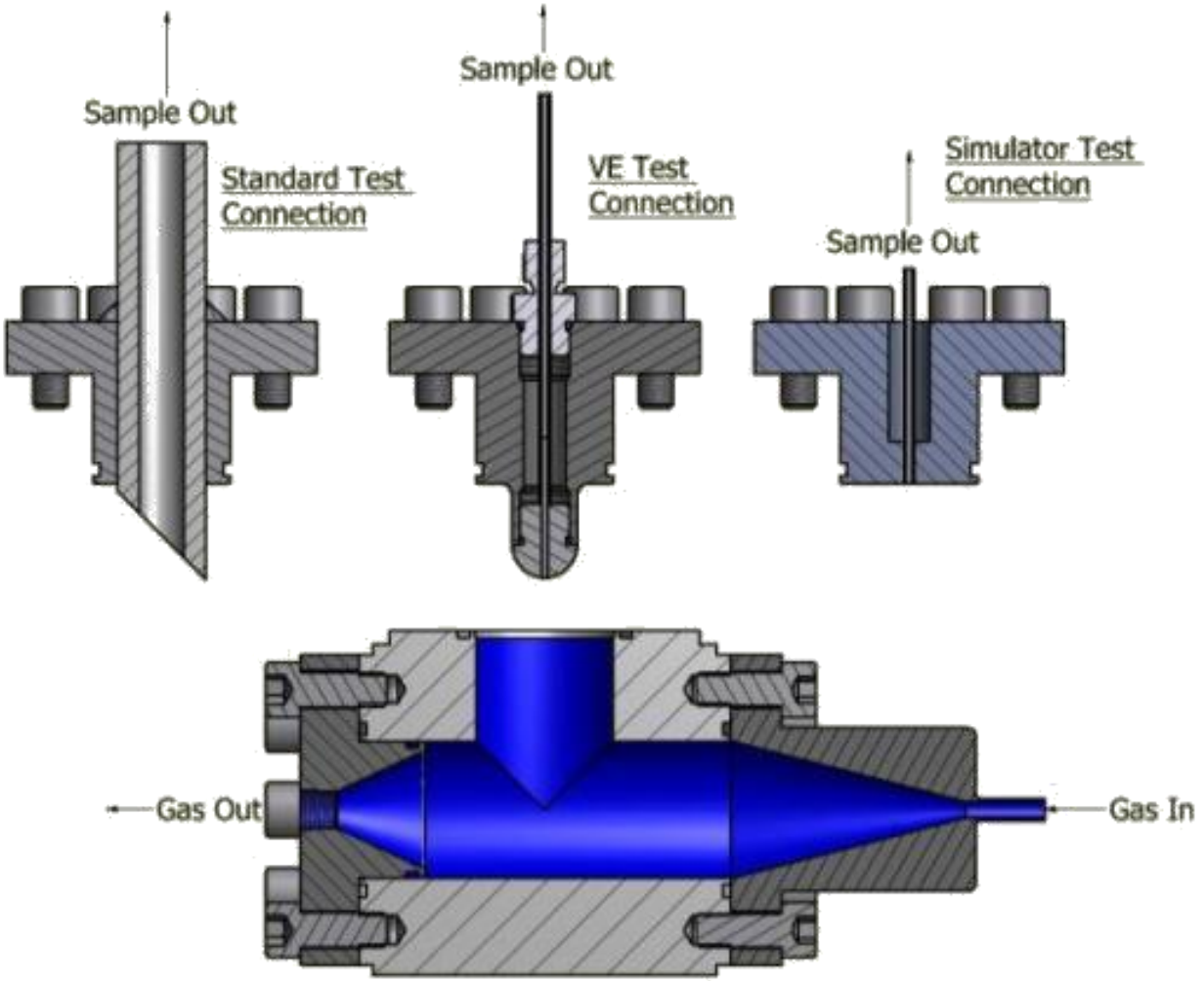


By-pass loop contains necessary control and monitoring functions

Pre-Heated Sample passed through critical orifice to cut the pressure

Sample delivered directly to analyser, without passing through regulator

Sample System Comparison
Typical v Alternative, using H_2S



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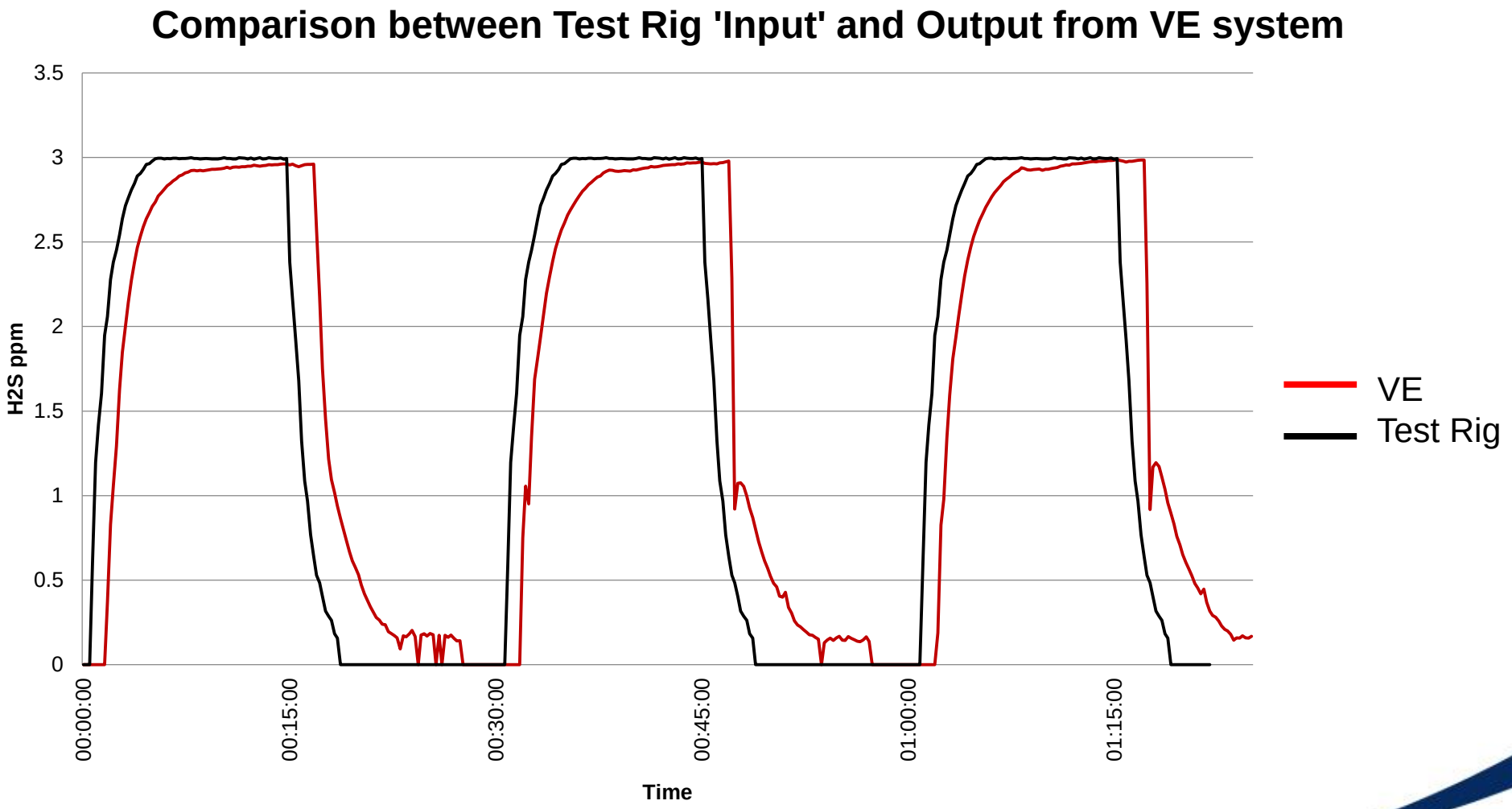

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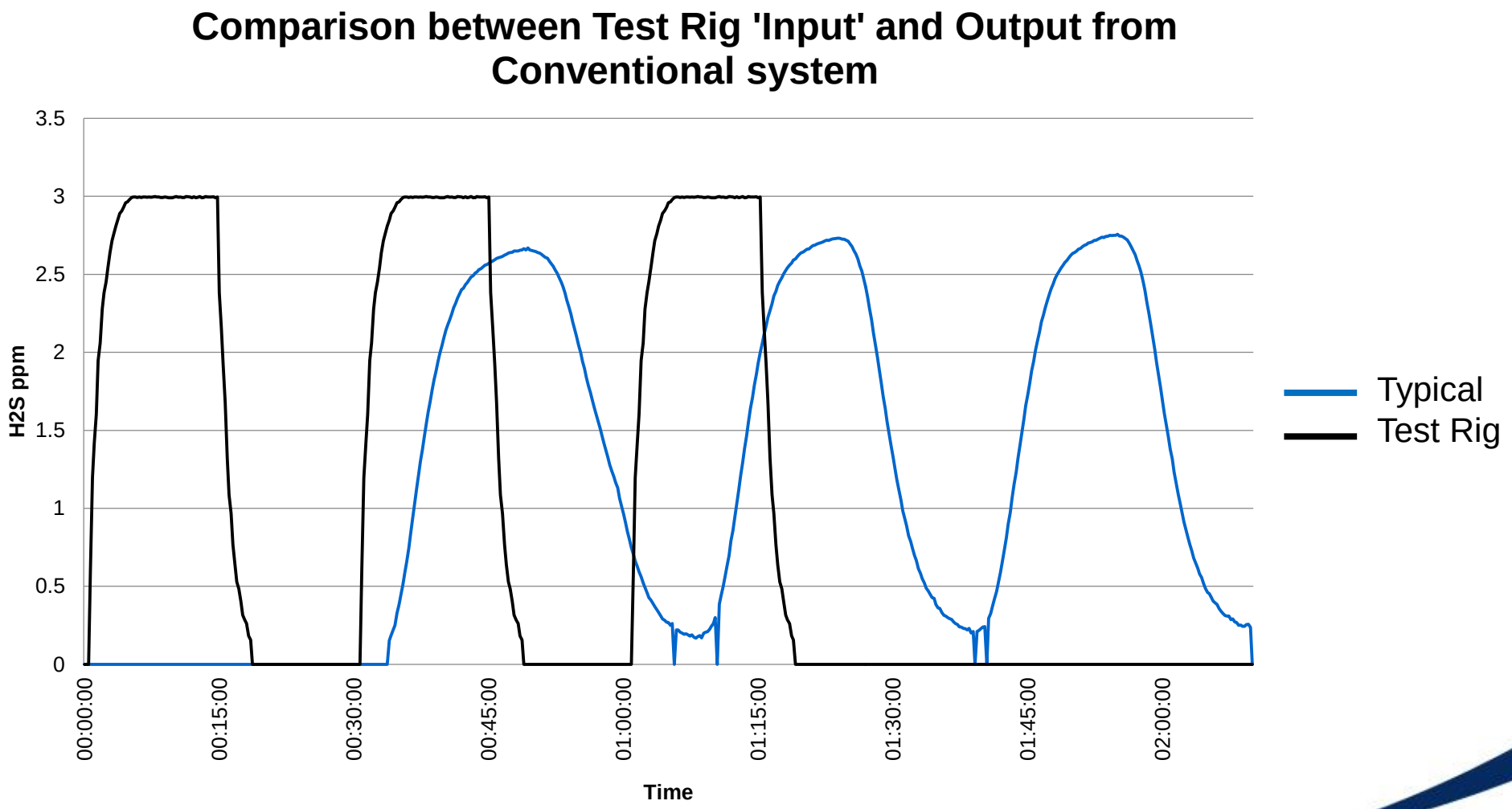

Closing Remarks
The Importance of Sampling for Analytics

- The sampling aspect of process measurement is much more scientific and much more complex than is often perceived (view), but is critical to safe and efficient gas management
- Alternative sample system design delivers significant benefits in a number of aspects, each or all of which may be your project or corporate priority:
  - **Safety**
  - **Measurement performance** (sometimes with safety implication also)
  - **Ongoing costs** (reliability, maintenance, efficiency)
  - **Ease of use** (simple installation, minimal maintenance)
  - **Environment** (low volume, efficient)
- Sampling can and will affect your daily operations!

Thank you for your time and attention