Take Gas Analysis Mobile — *Without Sacrificing Results*

LIVE WEBCAST: Tuesday, July 23, 2013 at 9:00 am EDT

Register free at www.chromatographyonline.com/gasanalysis

Key Learning Objectives:

- Learn how to determine composition and calorific value of natural gas
- Learn how to take typical laboratory analysis mobile and get reproducible results
- Learn how to configure analysis in accordance with ASTM, GPA, and ISO methods

Who Should Attend:

- (lab) technicians in (petro)chem and natural gas performing gas chromatographic analysis and in particular gas analysis
- (lab) managers in (petro)chem and natural gas in charge of (contract) labs performing gas chromatographic analysis and in particular gas analysis
- R&D personnel developing solutions where they have a need to analyze gases
- Academics developing solutions in alternative fuels, fuel cells etc having the need to analyze gases

Event Overview:

The natural gas (NG) market is broken into four discrete segments: exploration, liquefaction, transportation, and regasification. All four of these segments require diligent and accurate characterization of the NG to ensure maximum efficiency in investment and operational expenditures.

Come learn about and discuss the most critical characterizations of NG characterization utilizing a gas chromatograph (GC). Since the two key aspects of characterization are diligence and accuracy, the benefits taking the analysis onsite with micro GC analysis can offer unprecedented performance in both of the two critical aspects mentioned.

The following applications will be discussed in detail and supported by real-world data:

- Exploration: mud logging characterization; up to C12 qualification and quantification
- Liquefaction: calorific value determination
- Transportation: gas composition during loading
- Regasification: calorific value validation and odorant addition monitoring

Presented by LC|GC

Sponsored by Agilent Technologies

Presenters:

Coen Duvekot
Product Manager, Micro GC

Thomas Szakas
Mobile Measurement Business Development & Commercialization Manager

Moderator:

Laura Bush
Editorial Director, LCGC

For questions contact Kristen Farrell at kfarrell@advanstar.com

LC GC

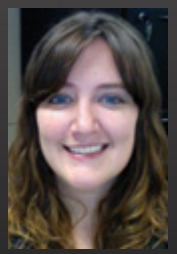
Agilent Technologies

TAKING GAS ANALYSIS MOBILE

Without Sacrificing Results

Speakers:

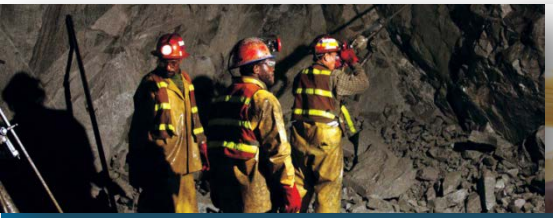
Thomas Szakas
Mobile Measurement Business Development & Commercialization Manager



Moderator
Meg Evans
Managing Editor LC/GC

Agilent Lab Quality… When and Where You Need It

What if you could take your laboratory equipment to the sample?



The Agilent 490 Micro GC Family

490 Micro GC Family

Basic cabinets, 19” rack and Field Case

490 Micro GC Basic cabinets

2-Channel and 4-channel

The field case provides “on-the-go” measurements

Natural Gas

- Permanent gases
- Hydrocarbons
- Odorants

Compound	Typical Concentration (%) [1]
Methane	70 - 90
Ethane	0 - 20
Propane	
Butane	
Carbon dioxide	0 – 8
Oxygen	0 – 0.2
Nitrogen	0 – 5
Hydrogen sulphide	0 – 5
Other: Helium, Argon, Neon, Xeon, Hydrogen	Traces

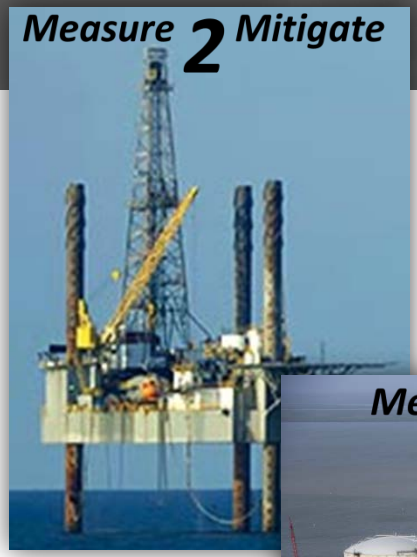
Reference [1]: http//:naturalgas.org

Micro-Gasifier for Liquefied Natural Gas (LNG) sample introduction

Measure 2 Mitigate

What are we measuring?

What are we trying to mitigate?


Measure 2 Mitigate


Measure 2 Mitigate


Measure 2 Mitigate


Measure 2 Mitigate


Explore
Pipeline
Measure 2 Mitigate
Transport
Distribute

Importance of Accurate Testing Throughout the Process?

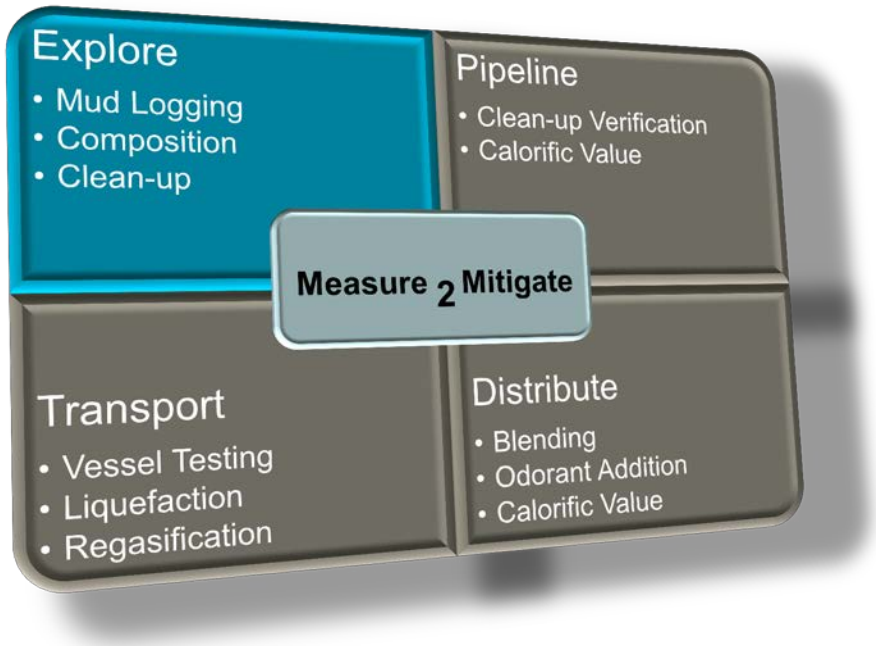
Pricing/Profitability Determination

1. Quantity of gas
2. Amount of processing to make it ‘pipe’ ready
3. Amount of transportation

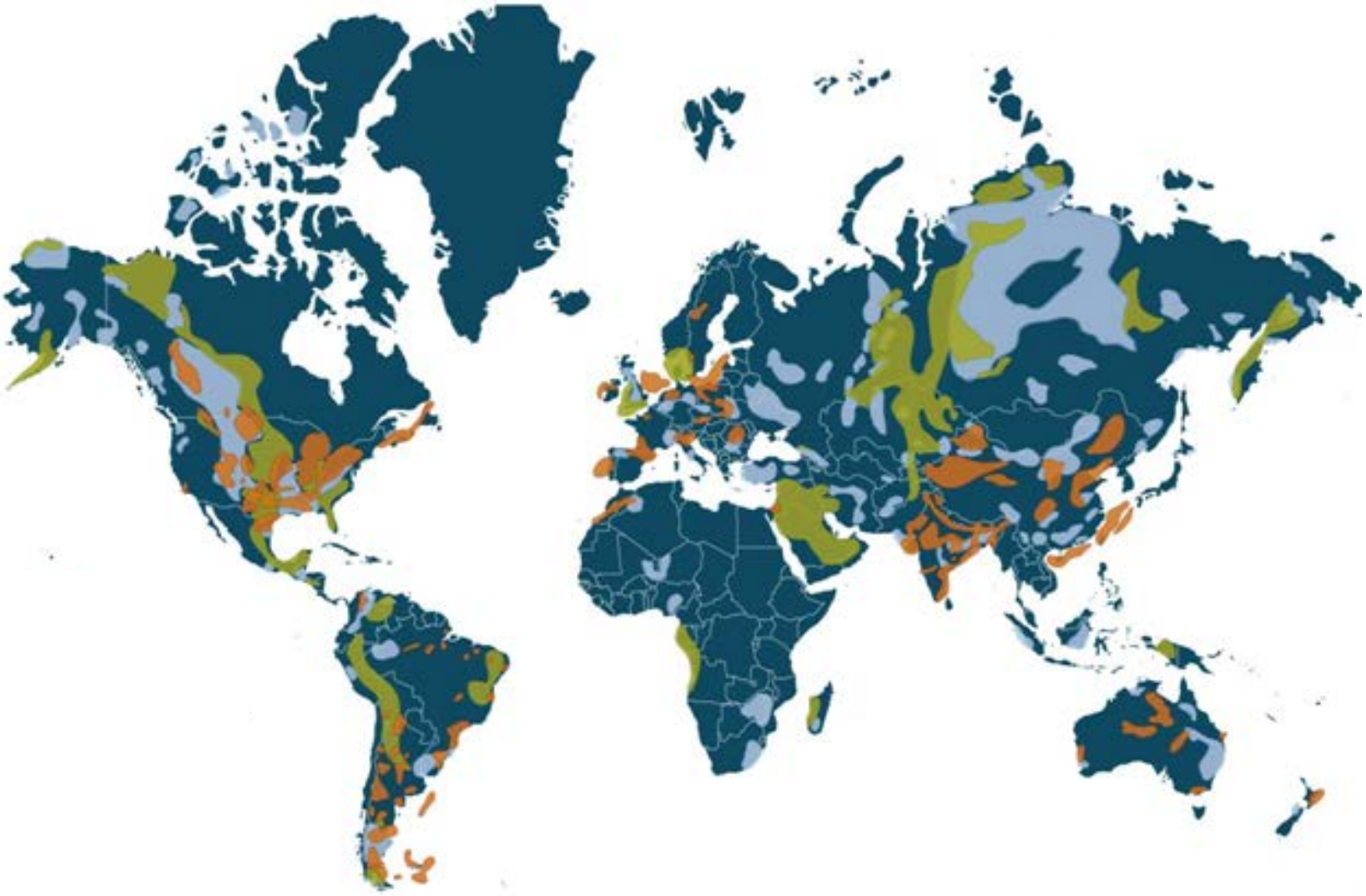
For example:

- lowest will be ‘well head’ customers
- Highest will be ‘residential’ customers

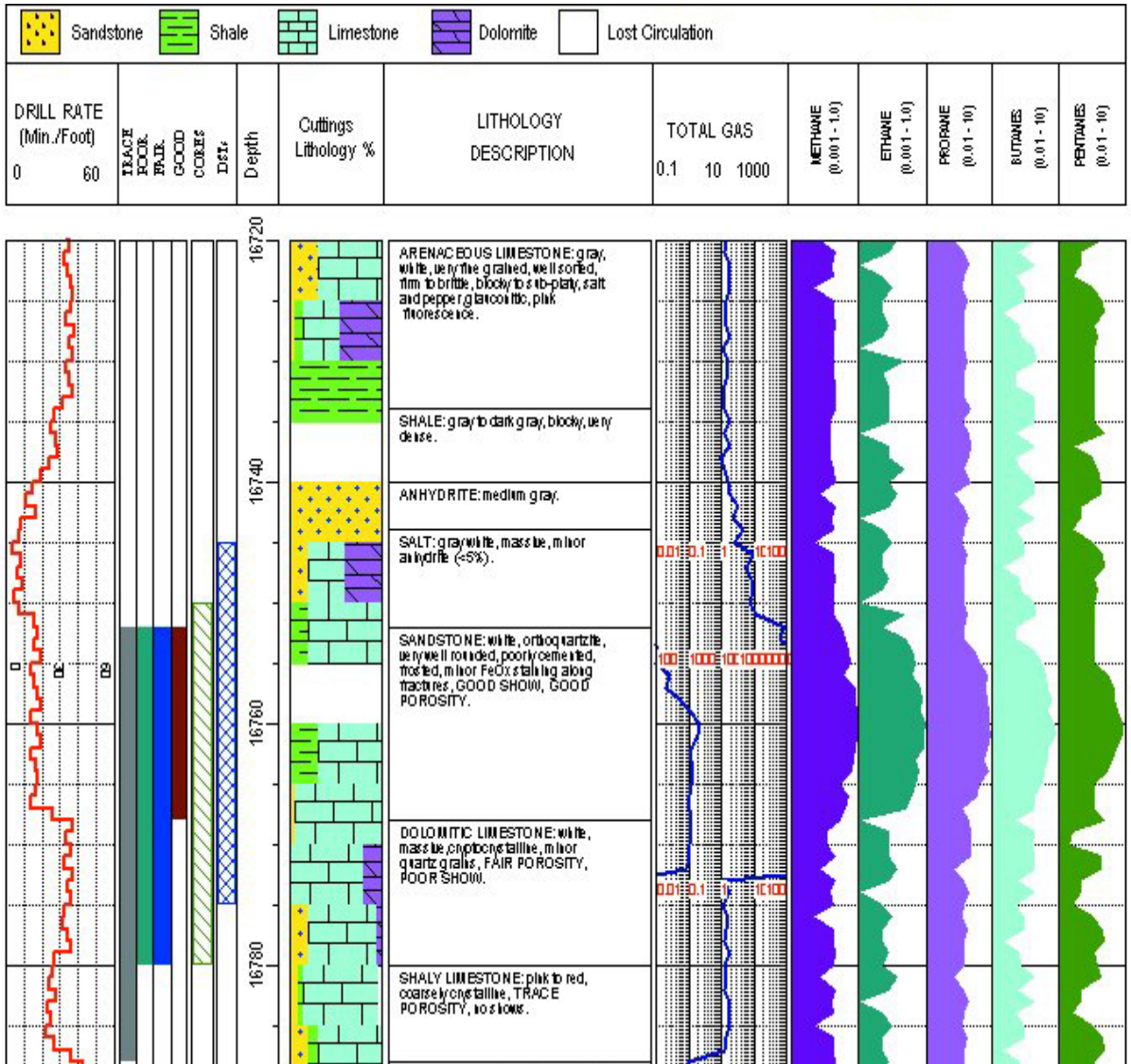
Phase 1 – Exploration



Where is the Starting point?



Mud Logging



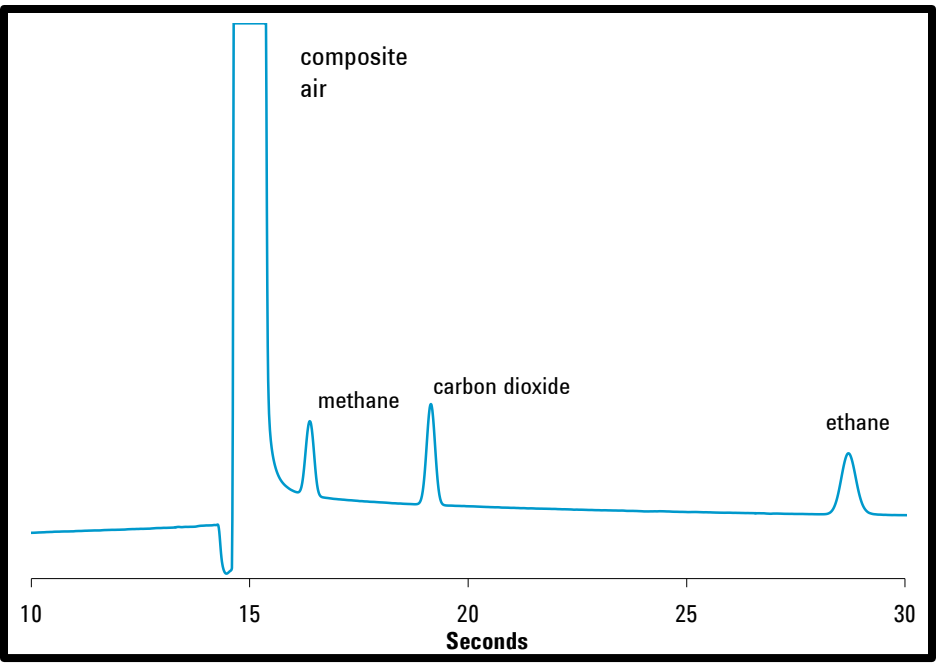
Fast

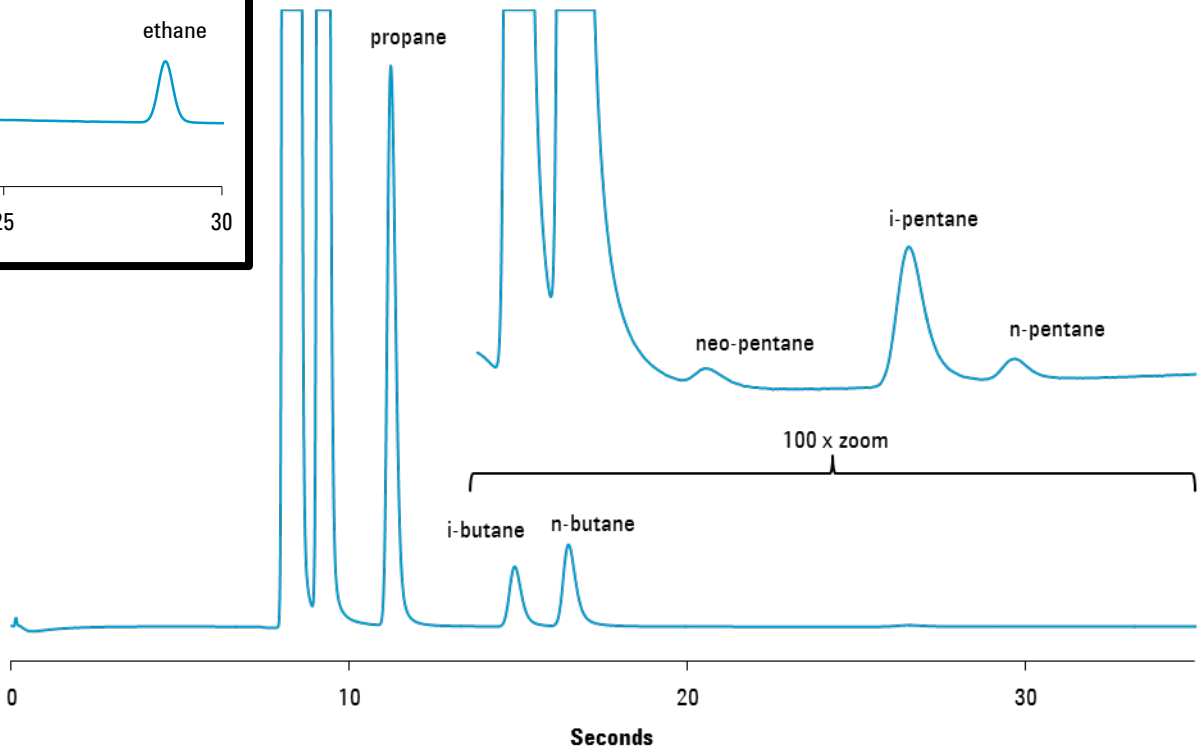
Accurate

Robust

Simple

What can you do in 30 Seconds?





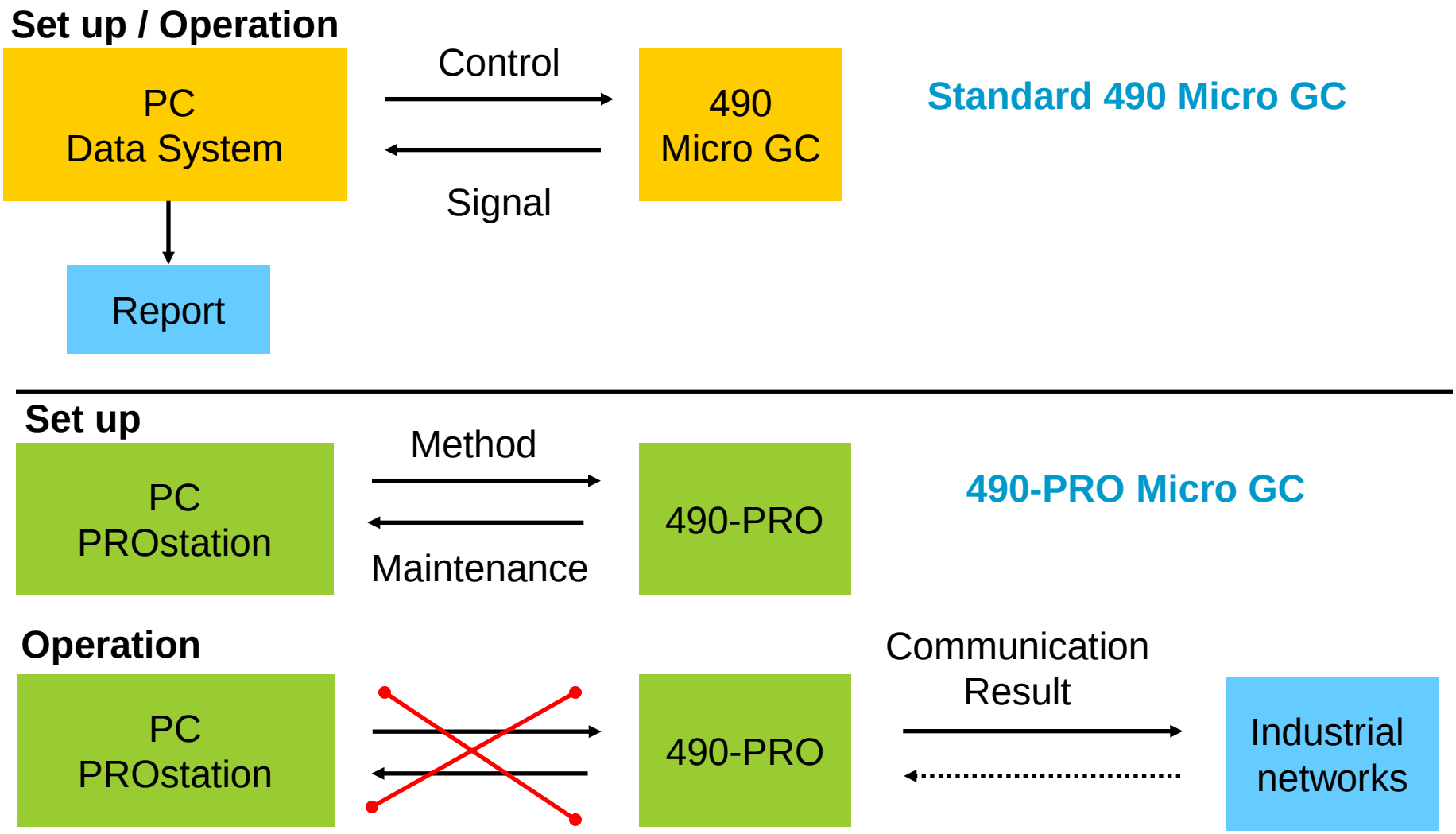
Agilent Technologies

490-PRO Micro GC

A Fast, Small Form Factor, High Performance Gas Measurement Platform Designed for Unattended Operation and supports Industrial networks

Same hardware as the 490 Micro GC

490 Micro GC versus 490-PRO



490-PRO Micro GC

OBDH

Automation

Application

Modbus

FTP client

PROstation

External I/O devices

Local display
(optional)

On Board Data Handling

Built into the 490-PRO Micro GC:

- Peak integration
- Peak identification
- Peak calibration
- Peak grouping

This means that for routine measurements:

- Full autonomous operation (no operator required)
- No external data handling software required
- No PC needed to generate results

490-PRO Micro GC – *Fully Automated Operation*

Sequential measurement runs that include:

- sample type
- valve/sample position
- flush time
- calibration level

Calibration and/or verification analysis

- after a desired # of samples
- based on a specific time
- on demand via remote command
- automatic (re)calibration if verification values “fail”

490-PRO Micro GC – Fully Automated Operation

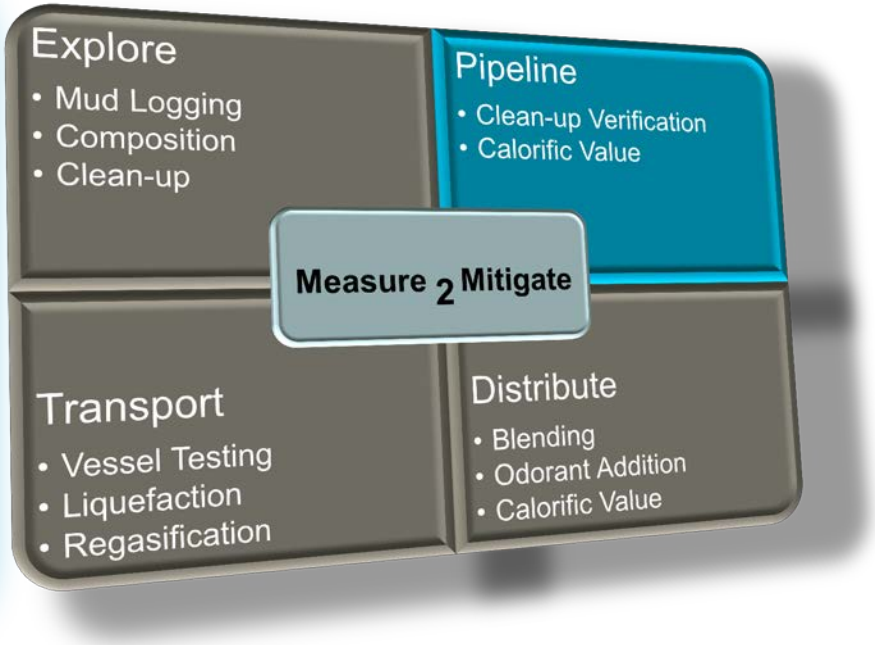
Stream selection and control:

- Electrically actuated multi-position valves
- Solenoids based stream selectors

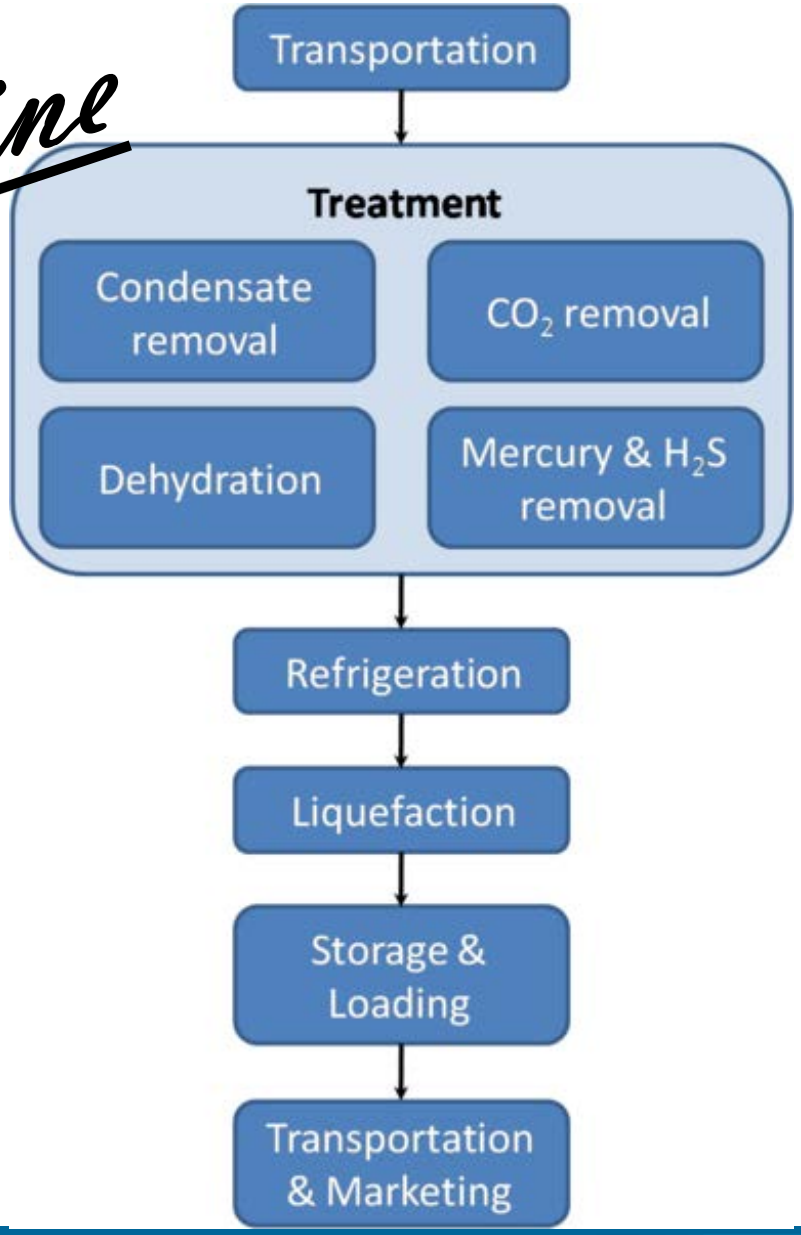
Remote Communication:

- MODBUS
- Digital input
- 4-20 mA
- ftp server

Phase 2 – Pipeline



Pipeline

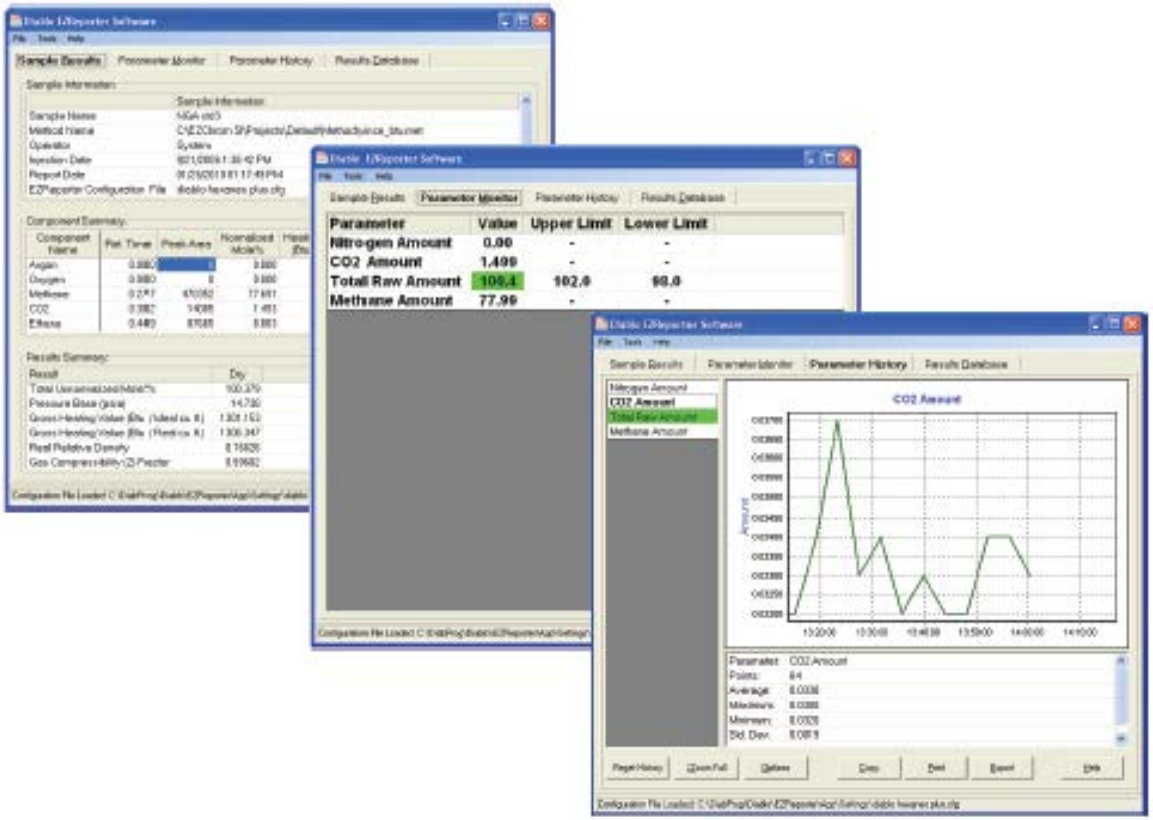

Transportation
Treatment
Condensate removal
CO_2 removal
Dehydration
Mercury & H_2S removal
Refrigeration
Liquefaction
Storage & Loading
Transportation & Marketing

Calorific Value = MJ/m^3

- The CV of natural gas is measured continually using process gas chromatographs.
- Process gas chromatographs separate natural gas into its constituent compounds (i.e. methane, ethane, carbon dioxide, etc.) and measure the amount of each in the gas. The physical characteristics of each component, as defined by ISO 6976, are programmed into the chromatograph and an overall CV is derived from the measured composition.
- The determination of the CV of gas is carried out in accordance with international standards
- The calorific value of natural gas is measured at reception terminals
- All domestic customers and most industrial customers are billed on the basis of the daily CV averages

EZReporter for calorific value calculations

- Option number G3582A#105
- External software compatible with Agilent CDS
- Key parameters available:
  - In printed format
  - As an export
  - For monitoring incl min/max values
  - For trend analysis



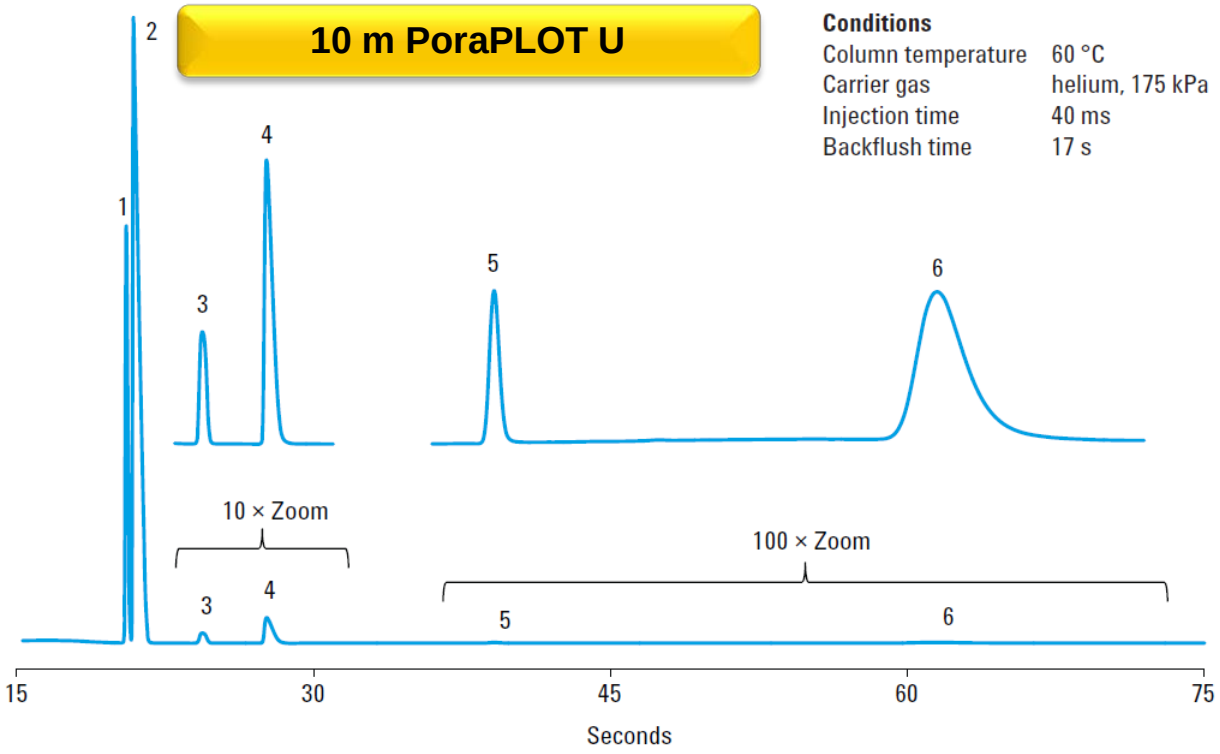
Product description	Compatible with	Supported standards
EZReporter for calorific value / BTU calculations	Agilent EZChrom 3.3.2., Agilent OpenLAB CDS EZChrom Edition and Agilent OpenLAB CDS ChemStation Edition	GPA 2172-09 ASTM D 3588-98 (2003) ISO 6976 (1995)

Natural Gas Analyzer portfolio

Analyzer characteristics	Natural Gas Analyzer A	Natural Gas Analyzer A Extended	Natural Gas Analyzer B	Natural Gas Analyzer B Extended
Option number	G3882A#120	G3882A#121	G3882A#122	G3882A#123
Micro GC cabinet	Dual with 2 channels	Quad with 3 channels	Dual with 2 channels	Quad with 3 channels
Column channels installed	HayeSep A 40 cm, without back flush CP-Sil 5 CB 6 m, without back flush	HayeSep A 40 cm, with back flush CP-Sil 5 CB 4 m, with back flush CP-Sil 5 CB 8 m, without back flush	PoraPLOT U 10 m, with backflush CP-Sil 5 CB 6 m, without back flush	CP-MolSieve 5A 10 m, with backflush and retention time stability option PoraPLOT U 10 m, with backflush CP-Sil 5 CB 6 m, without back flush
Analysis	Hydrocarbons C1-C9 Carbon dioxide, Air	Hydrocarbons C1-C12 Carbon dioxide, Air	Hydrocarbons C1-C9 Carbon dioxide, Air Hydrogen sulfide	Hydrocarbons C1-C9 Carbon dioxide, Air Hydrogen sulfide Permanent gases (N_2, O_2, He & H_2)
Typical analysis time	100 s (until C7) 400 s (until C9)	100 s (until C7) 240 s (until C12)	75 s (until C7) 400 s (until C9)	75 s (until C7) 400 s (until C9)

Natural Gas Analyzer B

- **Natural gas**; composition primarily CH_4, Air, CO_2, C2 – C9 hydrocarbons
- Dual channel cabinet with 2 column channels
- Heated sample line and injectors
- PPU equipped with Backflush functionality
- UltiMetal treated sample lines: ready for H2S analysis
- Part number **G3582A + G3582A#122**



Conditions

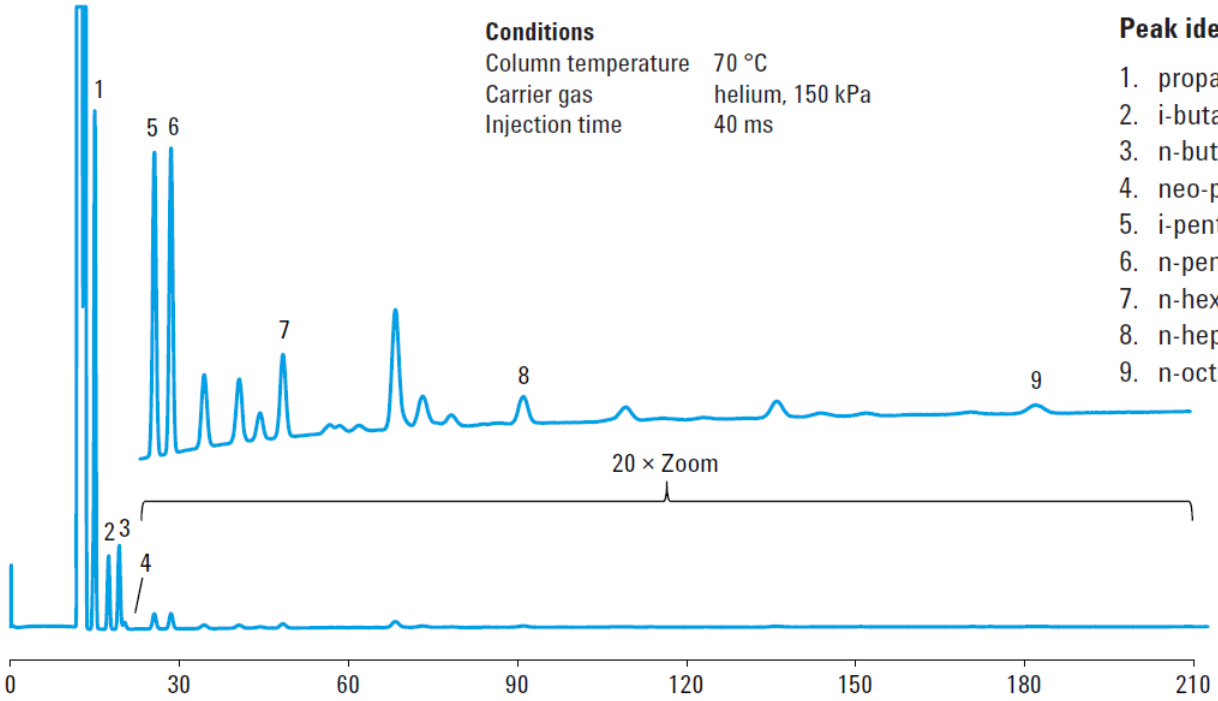
Column temperature	60 °C
Carrier gas	helium, 175 kPa
Injection time	40 ms
Backflush time	17 s

Peak identification

1. composite air peak
2. methane
3. carbon dioxide
4. ethane
5. hydrogen sulfide
6. propane

Natural Gas Analyzer B

6 m CP-Sil 5 CB

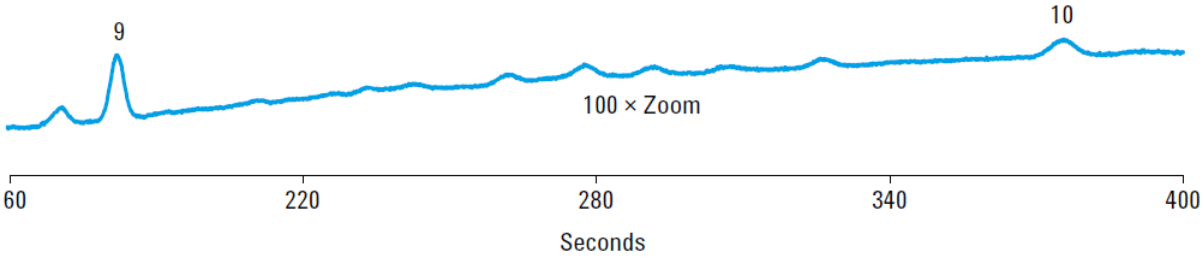


Conditions

Column temperature	70 °C
Carrier gas	helium, 150 kPa
Injection time	40 ms

Peak identification

1. propane
2. i-butane
3. n-butane
4. neo-pentane
5. i-pentane
6. n-pentane
7. n-hexane
8. n-heptane
9. n-octane



Peak identification

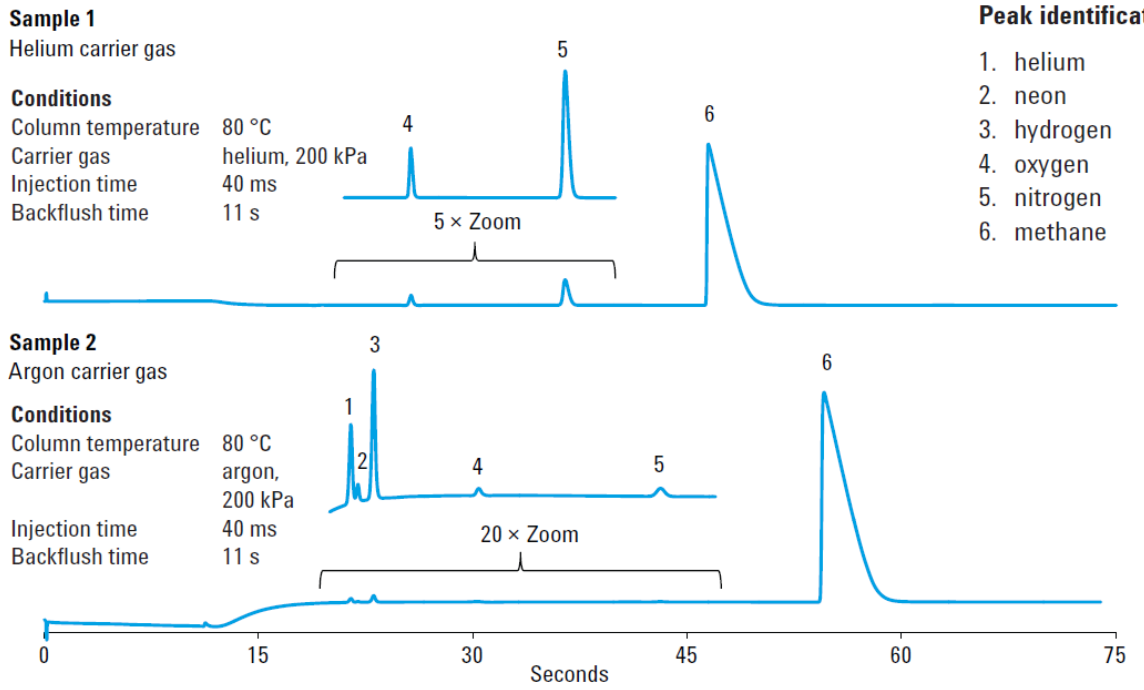
9. n-octane
10. n-nonane

Natural Gas Analyzer B Extended

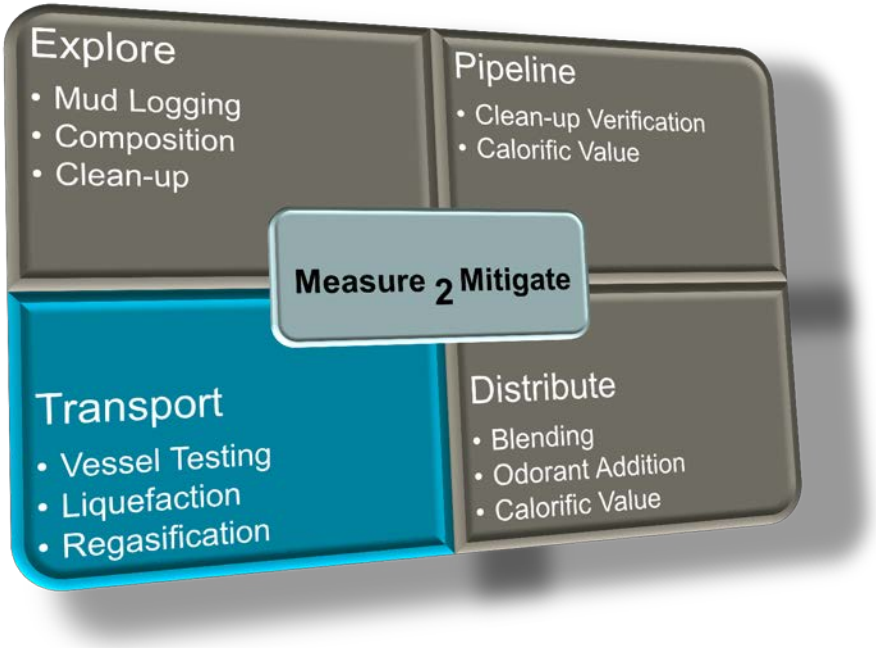
- Natural gas with **detailed Permanent Gas Analysis**
- Quad channel cabinet with 3 column channels

- Channel 1 & 2 identical to Natural Gas Analyzer B (#122)
- Separate carrier gas inlet to have the flexibility to change between helium and argon
- Part number **G3582A + G3582A#123**

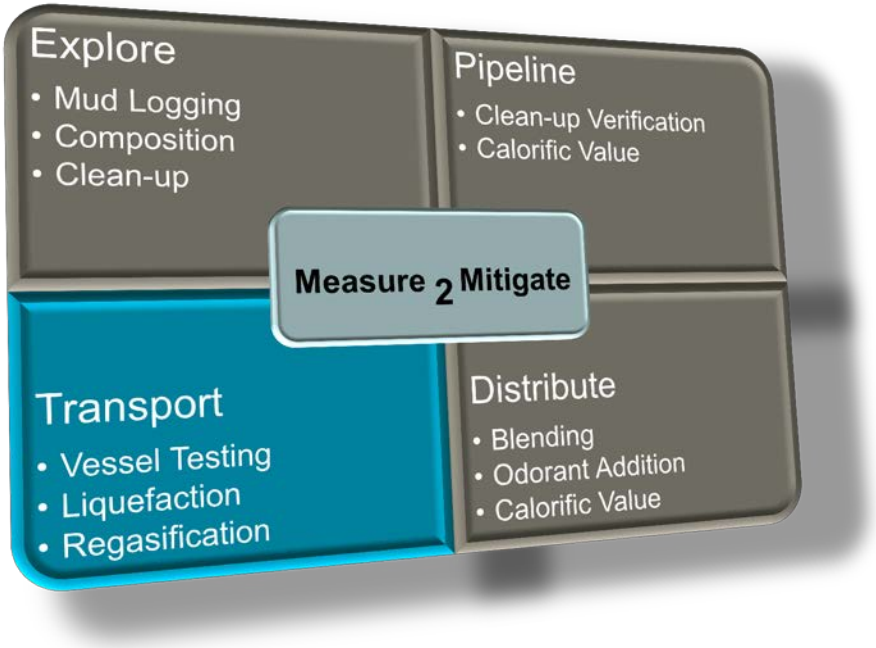
10 m MolSieve 5A



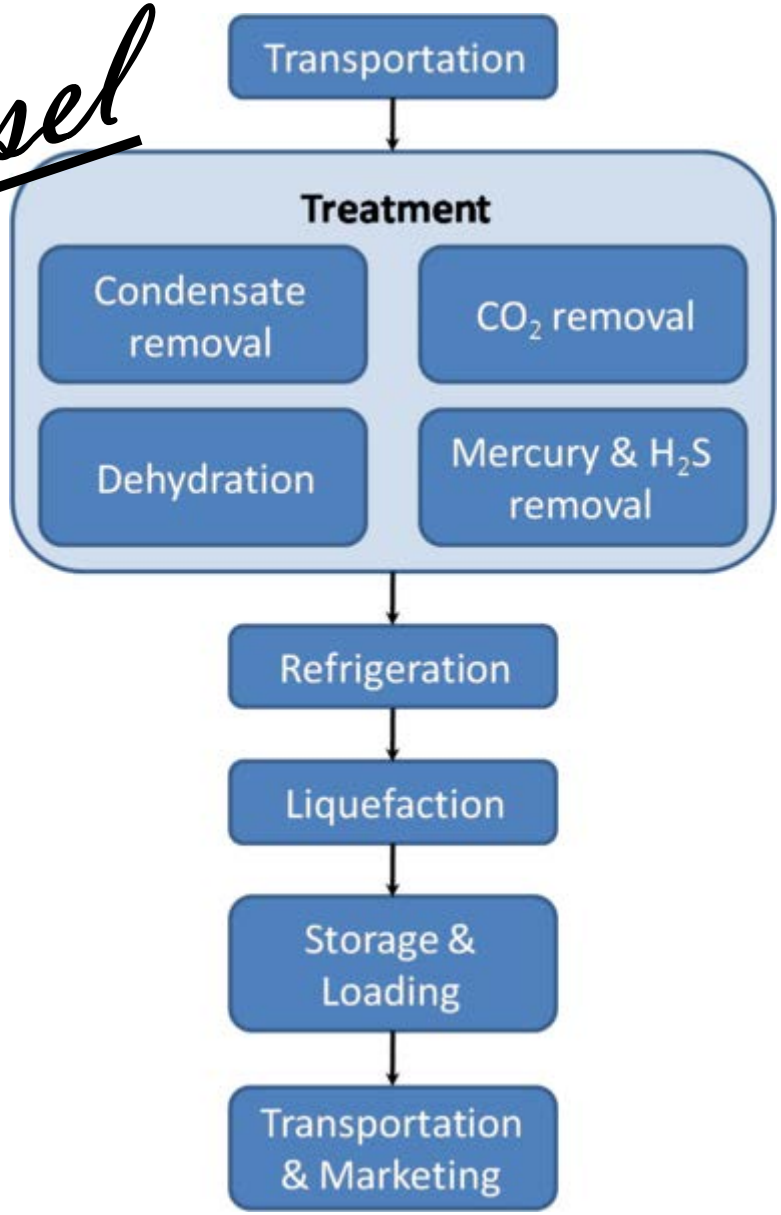
Phase 3 - Transportation



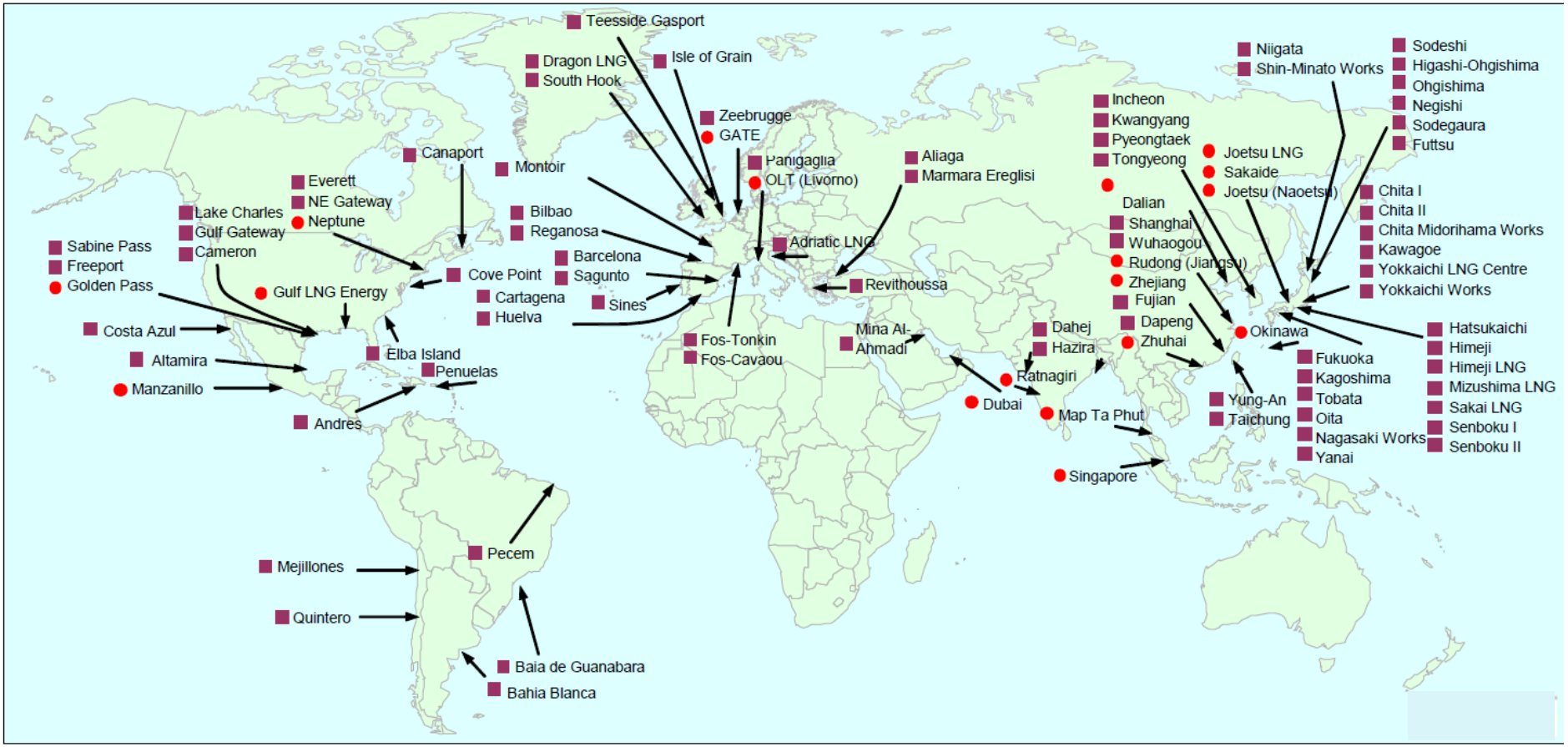
Phase 3 - Transportation



Vessel


Transportation
Treatment
Condensate removal
CO_2 removal
Dehydration
Mercury & H_2S removal
Refrigeration
Liquefaction
Storage & Loading
Transportation & Marketing

Where are the vessels coming from and going to?



Gas composition analysis during tank loading

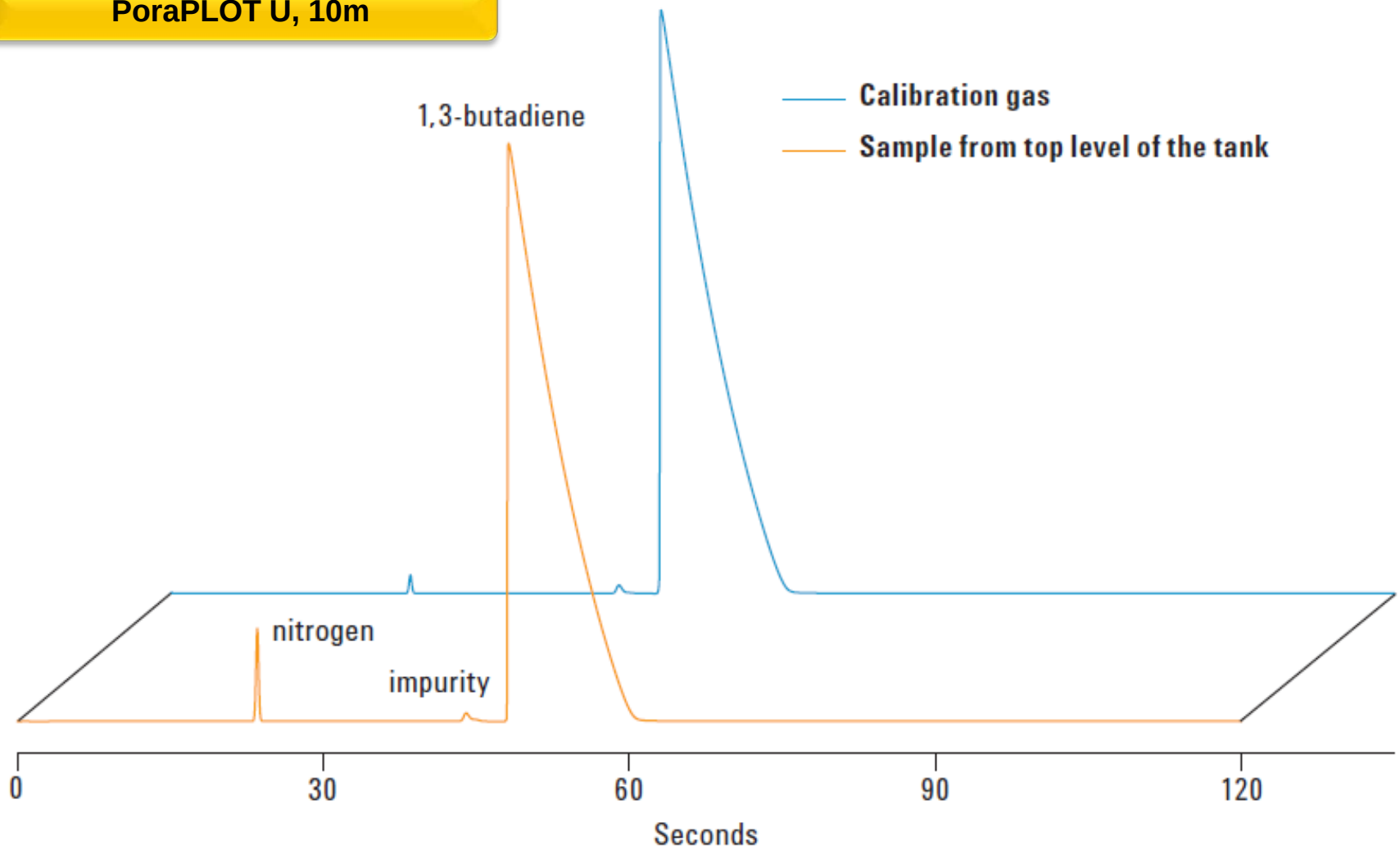
- Tank flushed with nitrogen
- Gaseous compounds loaded (heavier than nitrogen, sinks to the bottom)
- Micro GC analysis to check tank is 100 % filled
- Tank chilled and filled with liquefied compound

MAERSK TANKERS

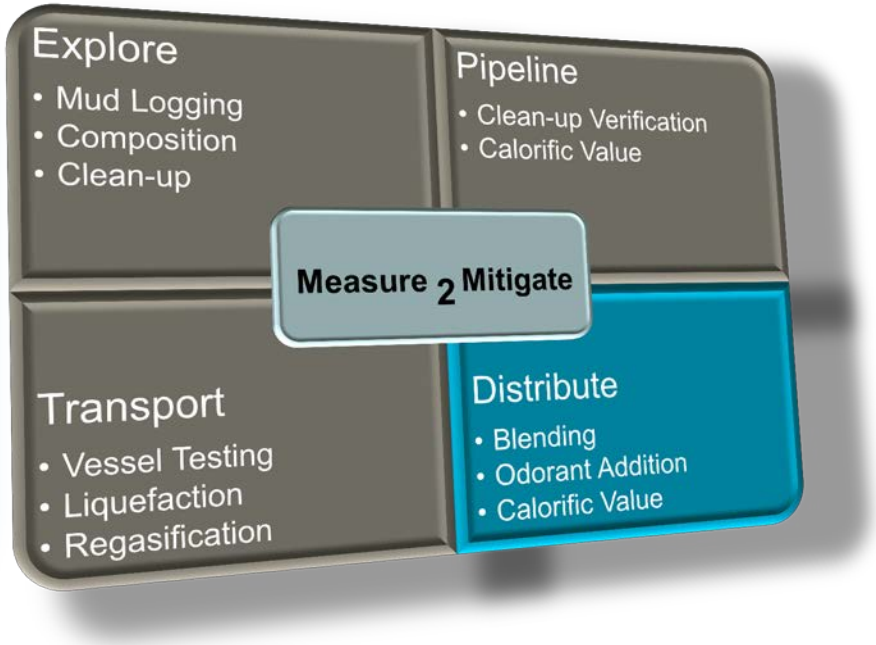
- Samples from three stages in the tank are taken with 10 ml gas tight
- Injection on the (optional) luer-lock front inlet
- Micro GC equipped with portable field case

Gas composition analysis during tank loading

PoraPLOT U, 10m



Phase 4 - Delivery

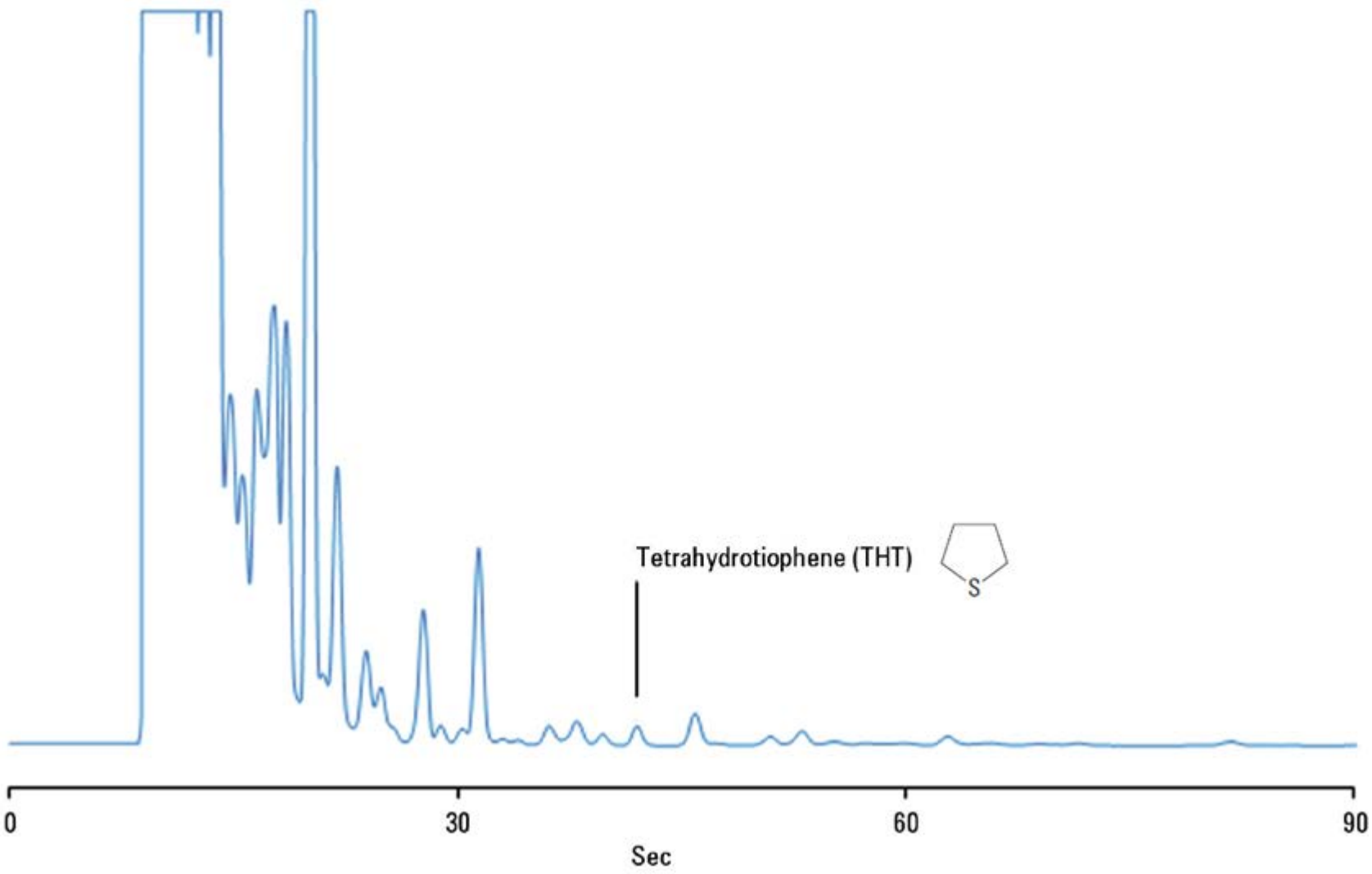


Delivery

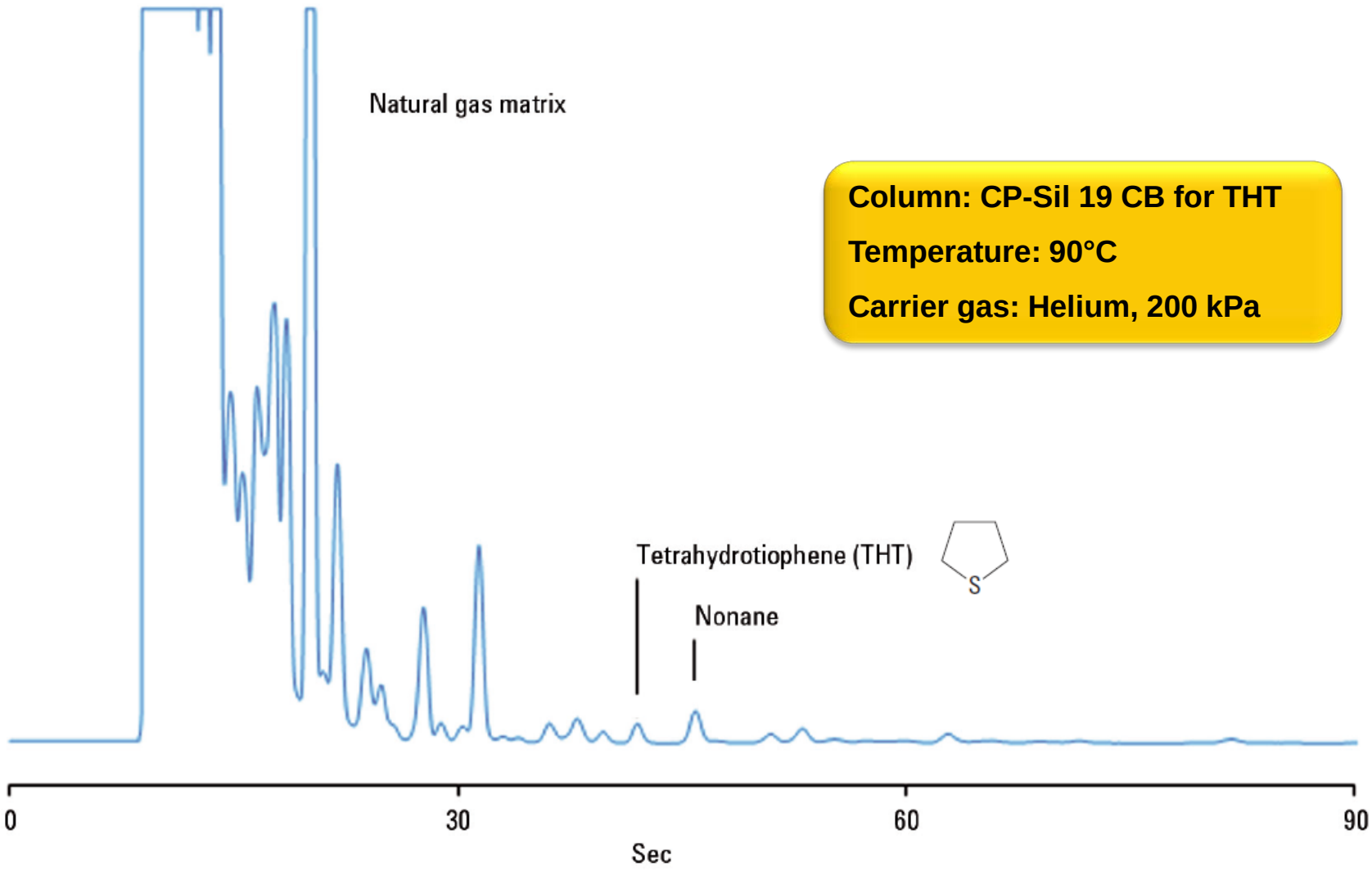
On its way out of the terminal, the gas undergoes any number of treatment processes needed to bring its specifications in line with regulatory and end user requirements.

Its heating value, for example, may be adjusted by altering nitrogen, butane or propane content or blending it with other gases.

Natural Gas: *THT (odorant)*



Natural Gas: *THT (odorant)*

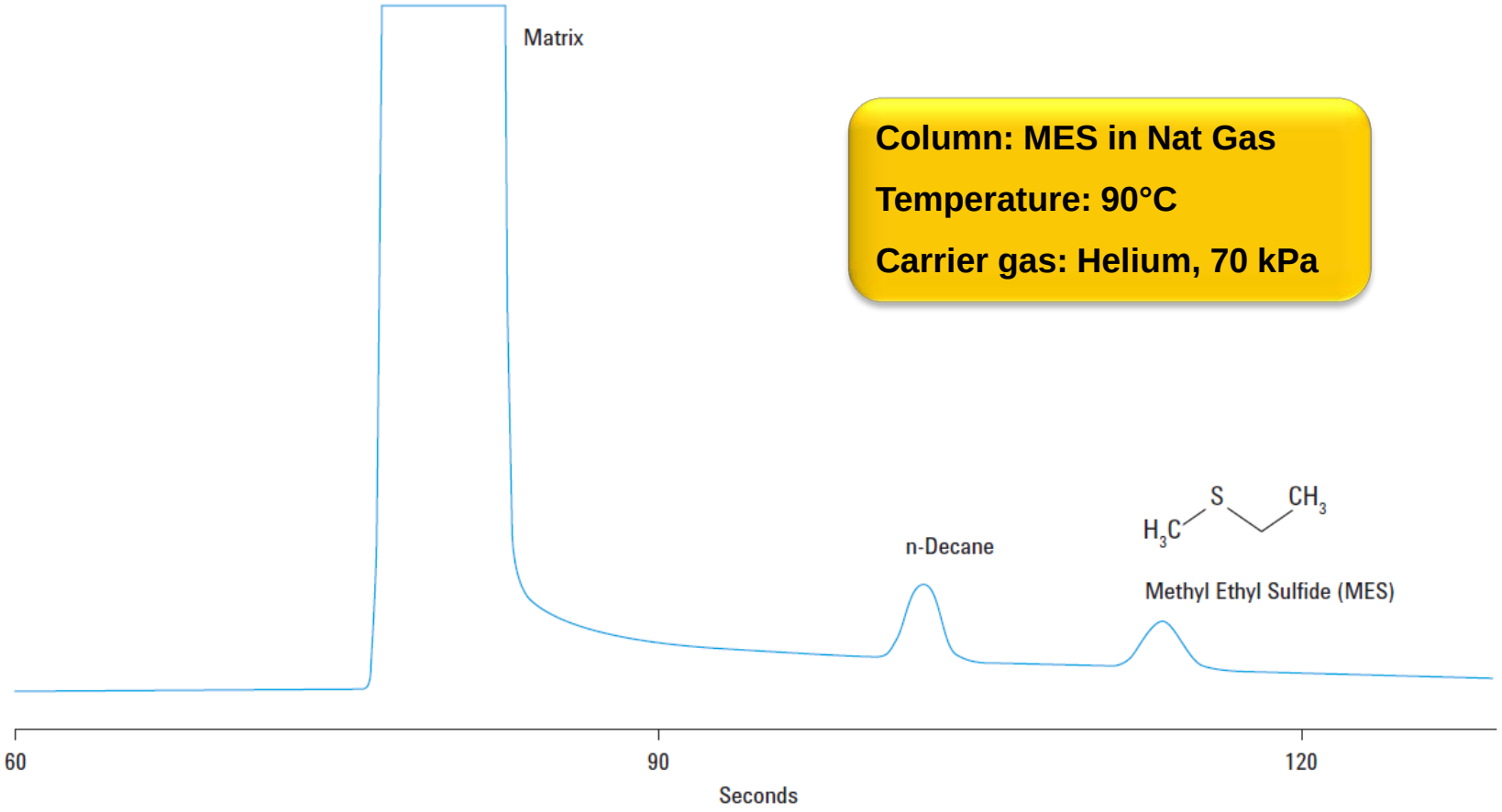


Column: CP-Sil 19 CB for THT

Temperature: 90°C

Carrier gas: Helium, 200 kPa

Natural Gas: *MES*

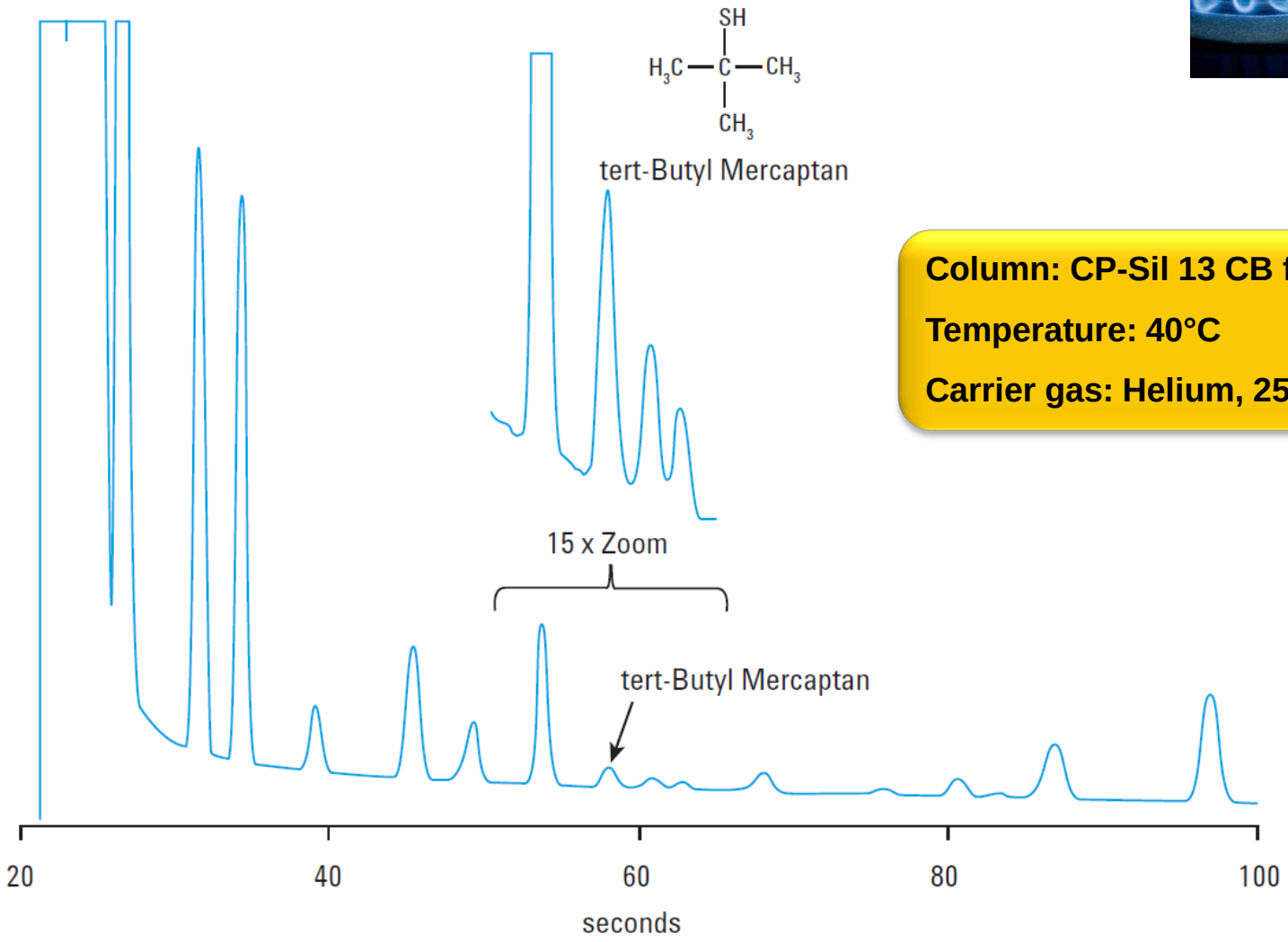


Column: MES in Nat Gas

Temperature: 90°C

Carrier gas: Helium, 70 kPa

Natural Gas: *Tert-Butyl Mercaptan (TBM)*

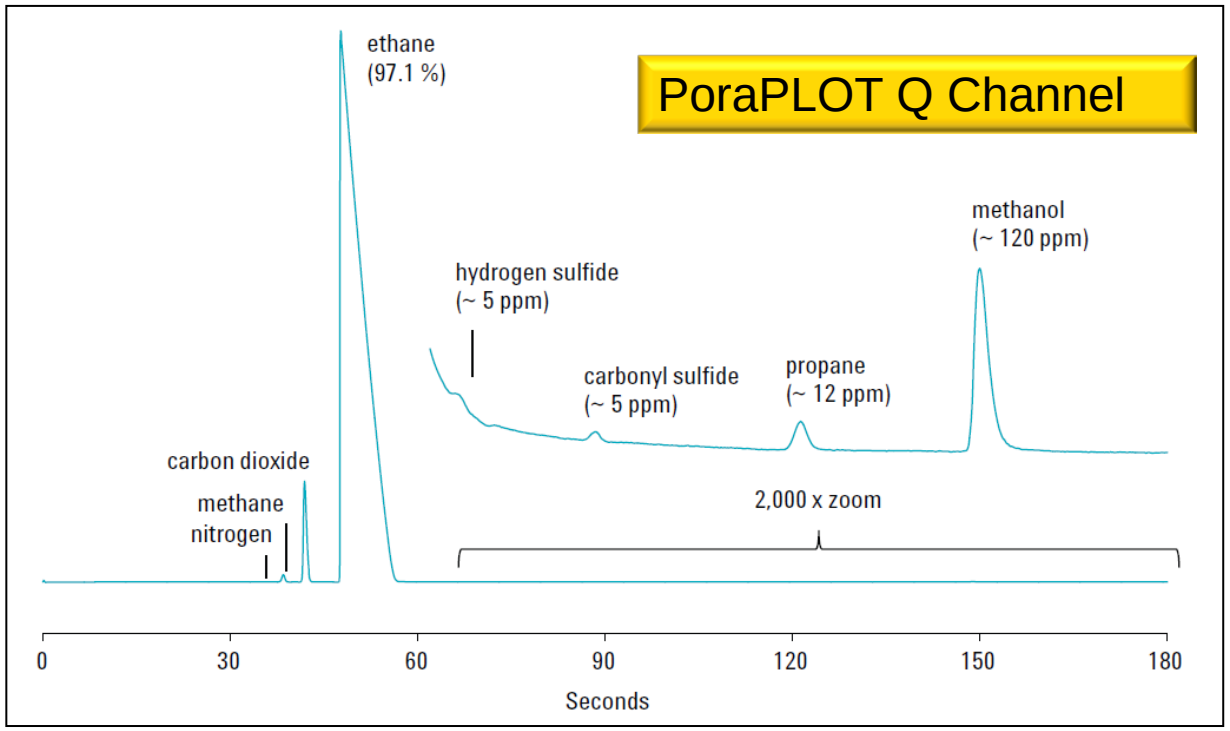


Column: CP-Sil 13 CB for TBM

Temperature: 40°C

Carrier gas: Helium, 250 kPa

Liquefied ethane stream



Single analysis for:

- Composition analysis
- Trace levels of H2S for pipeline corrosion
- Trace levels methanol for catalyst protection
- Auto ranging micro TCD → high and low levels in single run

QC LAB INC.
407 - Forge Rd S.E. Calgary, AB T2H 0S9

"The 490-PRO Micro GC provides outstanding accuracy and longevity, requiring no maintenance over long periods of time. Two Micro GC's, installed by QC LAB in 1994, are still functioning and providing over 450 analyses per day, without any repair or loss of service."

Serge Syz, QC LAB Inc, Calgary, Canada

Document number: 5991-1817EN

Versatility of Multi-Channel Simultaneous Analysis

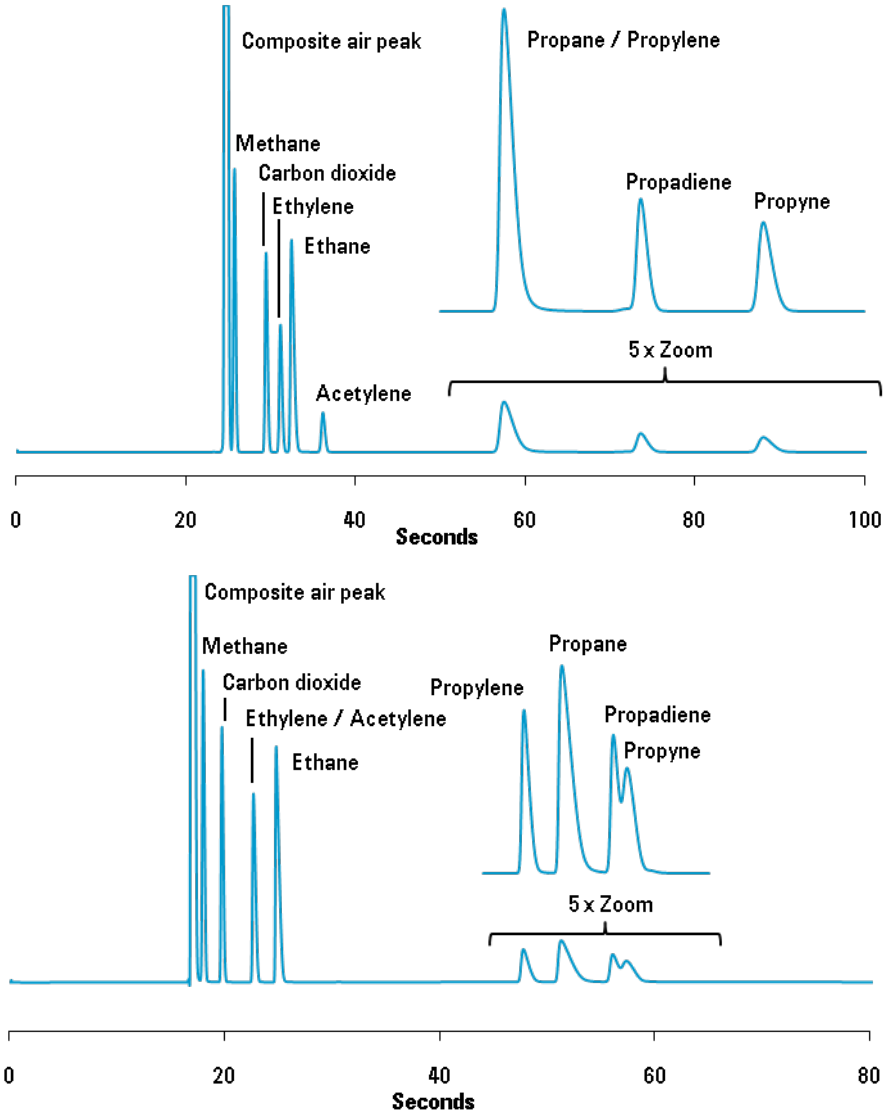
CP-PoraPLOT U

- Separate ethane, ethylene and acetylene
- Propane and propylene will co elute

CP-PoraPLOT Q

- Propane and propylene separated
- Co elution of ethylene and acetylene

Array of chemistry to fit unique application

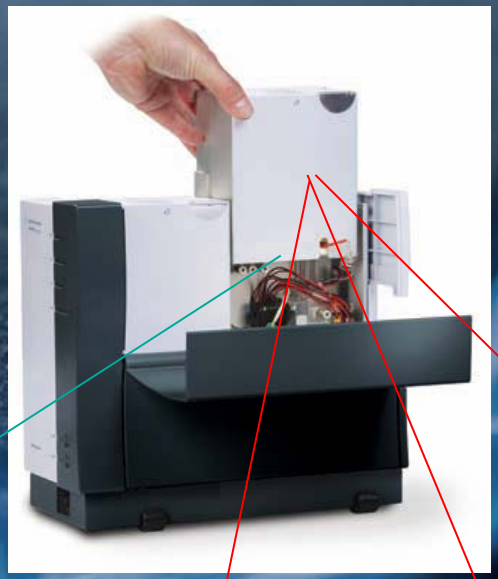


Document number: 5990-9165EN

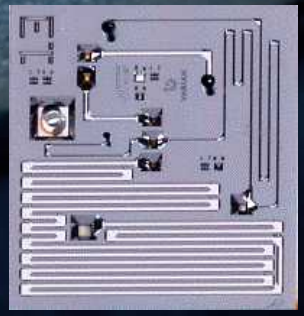
Advantages of Using a Micro GC in the Nat Gas Market

- Micro GCs offer unprecedented speed
- Micro GCs can be deployed throughout the entire process
- Micro GCs are flexible and can be ‘fit for purpose’
- Data is used for both compliance and control
- The data is actionable AND defendable

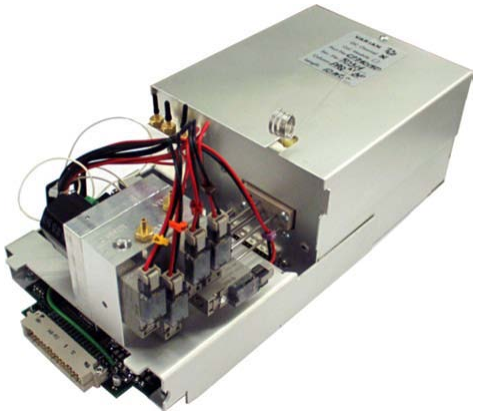
Unique Features of a Micro GC

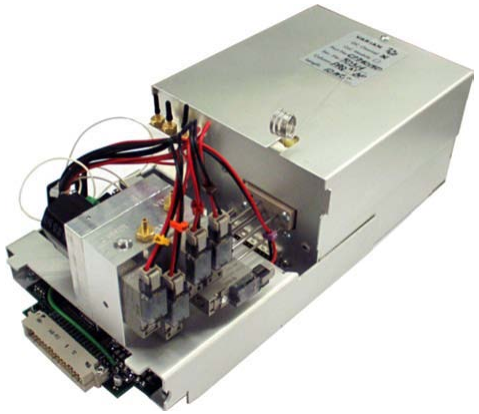


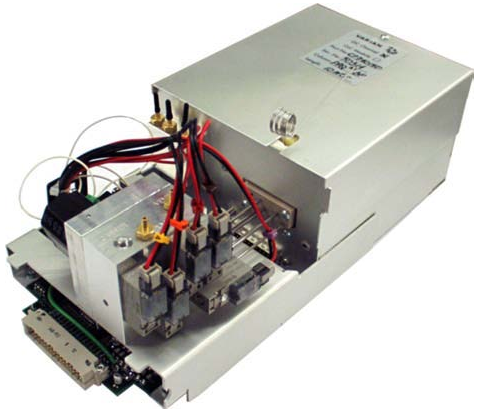
MICRO EGC → CHIP INJECTOR → GC COLUMN → MICRO TCD



Flexibility is Essential







Agilent 490 Micro GC column type overview

Application overview		
Column short name	**Column type**	**Application**
MS5A	CP-MolSieve 5Å	Permanent gases (N_2 / O_2 separation), methane, CO, (20m required for O_2 / Ar baseline separation). Natural gas and Biogas analysis.
HSA	Hayesep A	Hydrocarbons C1-C3, N_2, CO_2, air, volatile solvents, Natural gas analysis.
5CB	CP-Sil 5 CB	Hydrocarbons C3-C10, aromatics, organic solvents, SO_2. Natural gas analysis.
19CB	CP-Sil 19 CB	Hydrocarbons C4-C10, volatile solvents, BTEX.
52CB	CP-Wax 52 CB	Polar volatile solvents, BTEX.
AlOx	CP-Al_2O_3	Light hydrocarbons C1-C5 saturated and un-saturated. Refinery gas analysis.
PPU	PoraPLOT U	Hydrocarbons C1-C6, halocarbons/freons, anesthesia gases, H_2S, CO_2, volatile solvents. Biogas analysis. Separation of ethane, ethylene and acetylene.
PPQ	PoraPLOT Q	Hydrocarbons C1-C6, halocarbons/freons, anesthesia gases, H2S, CO_2, volatile solvents. Separation propylene and propane, coelution of ethylene and acetylene.
COX	CP-COX	CO, CO_2, H_2, Air (coelution of N_2 and O_2), CH_4.
19CB THT	CP-Sil 19 CB for THT	THT and C3-C6 $^+$ in Natural gas.
13CB TBM	CP-Sil 13 CB TBM	TBM and C3-C6$^+$ in Natural gas.
MES NGA	MES for NGA	MES in Natural gas.

Agilent GC Portfolio

Micro GC

GC

GC-MS

Sample Handling

Column Technology

We stand ready!