Benefits of Using the New Transportable INFICON Micro GC Fusion with Fast Column Temperature Ramping for Fixed Gas and Hydrocarbon Analysis

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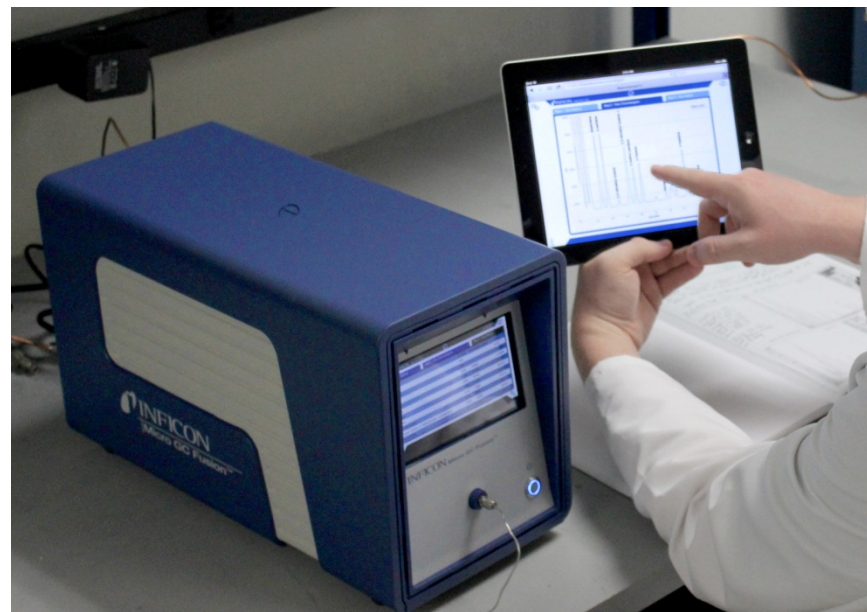
INFICON

Gulf Coast Conference

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Outline

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  - **Known performance meets new technology**
  - **Fusion Architecture**
- **Micro GC Fusion Features**
  - **User interface**
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  - **Isothermal vs. temperature ramping**
- **Micro GC Fusion Applications**
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Micro GC Fusion Introduction

Known Performance Meets New Technology

- **Micro GC Fusion builds on proven microelectromechanical systems (MEMS) based 3000 Micro GC technology**

- **Micro GC Fusion new features include:**
  - **Fast temperature ramping**
  - **Front panel LED display**
  - **Solid-state hard drive for data storage**
  - **Web-based interface**
  - **Optional integrated sample conditioner**
  - **USB ports**

Micro GC Fusion Architecture

- **Micro GC Fusion utilizes a modular architecture**

- **Each module contains:**
  - **MEMs based injectors**
  - **Resistively heated fused silica capillary columns**
  - **MEMs based micro thermal conductivity detector (µTCD)**

GCC-5
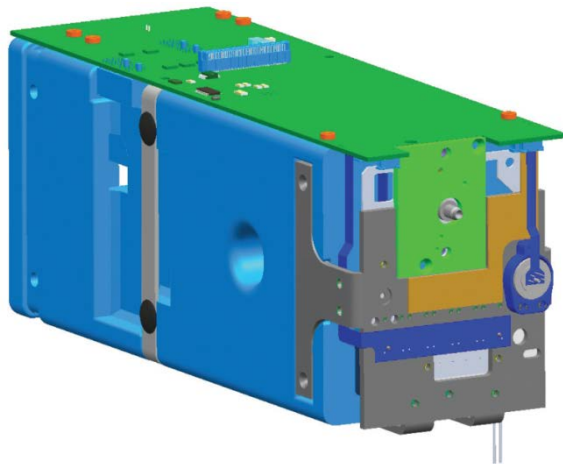
Micro GC Fusion Injectors

- **Backflush**
  - **Prevents contaminants from entering the column**
 - **Reduces run time**
  - **Prevents ghost peaks**

- **Variable Volume**
  - **General analysis from 10 ppm to 100%**

- **Large Variable Volume**
  - **For analysis down to 1 ppm**

- **Fixed Volume**
  - **Offers the best precision for components above 500 ppm**

Micro GC Fusion Columns

- **Micro GC Fusion supports two types of columns:**

  - **Porous Layer Open Tubular (PLOT)**
    - **Solid particles coated on the surface of the tubing**
    - **Molsieve 5A, PLOT U, PLOT Q, Alumina, Carbon**

  - **Wall Coated Open Tubular (WCOT)**
    - **Liquid phase bonded to the surface of the tubing**
    - **Polydimethylsiloxane (OV-1)**

- **Columns can be temperature programmed or operated isothermally**

Open (Capillary)

Wall Coated
Open Tube
(WCOT)

Porous Layer Open Tube
(PLOT)
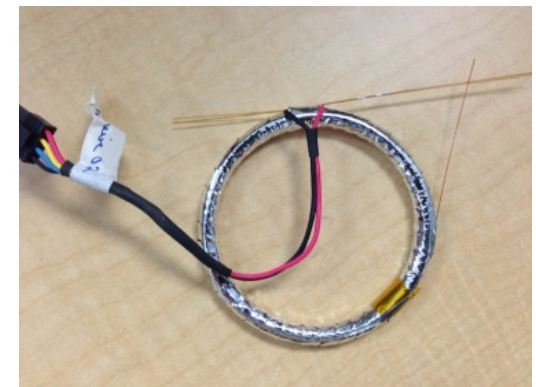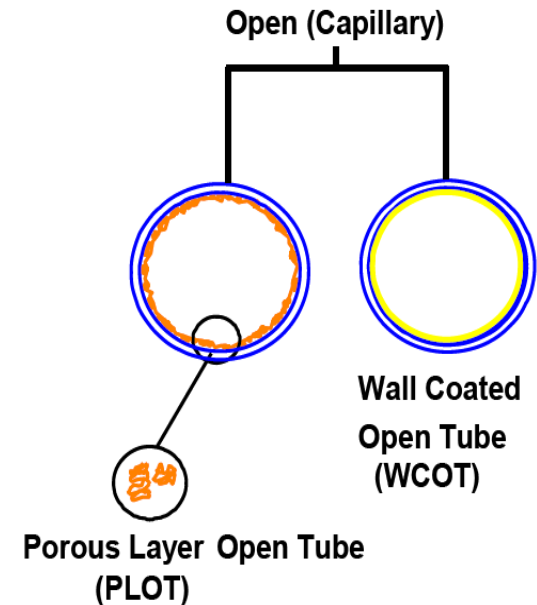
Resistively heated capillary column

Micro GC Fusion Detector

- **Micro GC Fusion uses a MEMS Thermal Conductivity Detector (TCD)**

- **Compares the thermal conductivity of the gas from the reference column vs. the gas from the analytical column**
  - **Uses a Wheatstone bridge design**

- **Linear from low parts-per-million (ppm) to 100%**
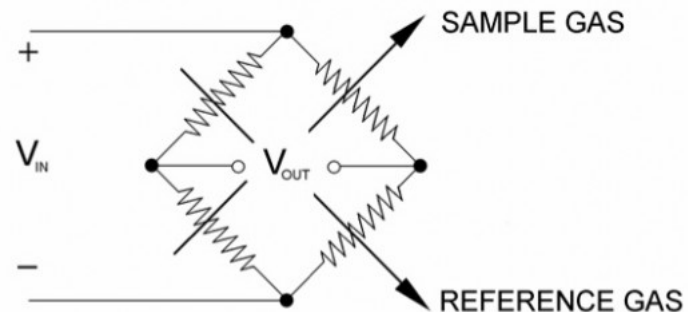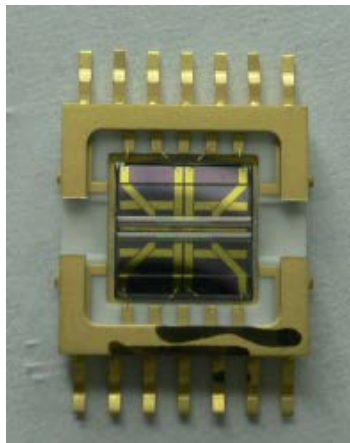
Micro GC Fusion Features

User Interface

- **Micro GC Fusion utilizes an LED front panel display with on-board data storage**
  - **Operate the instrument without a PC**
  - **Multi-touch LED display can handle simple operations and status updates**

- **Connect wirelessly through Wi-Fi to an external computing device**

- **Or, connect directly via Ethernet**

User Interface

- **Web-based graphical user interface (GUI) is independent of operating system and license free**

Integrated Sample Conditioner

- **An optional integrated sample conditioner can be configured**

- **The sample conditioner allows for:**
  - **Sample pressures up to 1000 psi**
  - **Sample temperature control at 100°C**
  - **Filtering of particulates**


- **A quick connect replaces the standard 1/16" inlet**

GCC-12
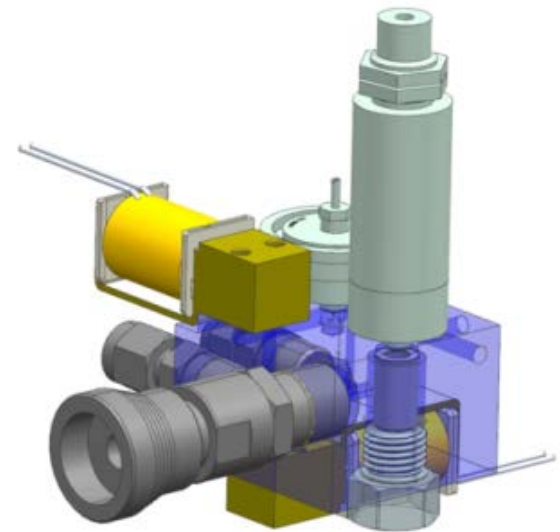
Temperature Programming

- **Temperature ramping based on resistive column heating allows for:**
  - **Faster runs**
  - **Rapid column cleaning**
  - **Sharper peaks**
  - **Expanded application range (ex. extended natural gas analysis)**

- **Ramping profile is independently optimized for each module**

- **Cooldown time is optimized to achieve short cycle times**

GCC-13
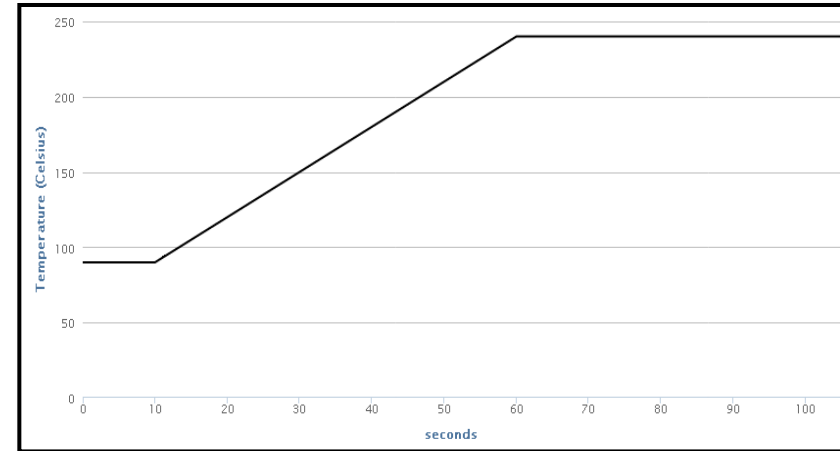
Isothermal vs. Temperature Programming

- **Isothermal runs result in broad, late eluting peaks**

- **Fast temperature ramping improves peak shape, run time, and column cleaning**

- **Example – Propane**
  - **Isothermal ~160 seconds**
  - **Temperature ramping ~50 seconds**
  - **Increase in peak height**

Column: PLOT Q
Injector: Variable
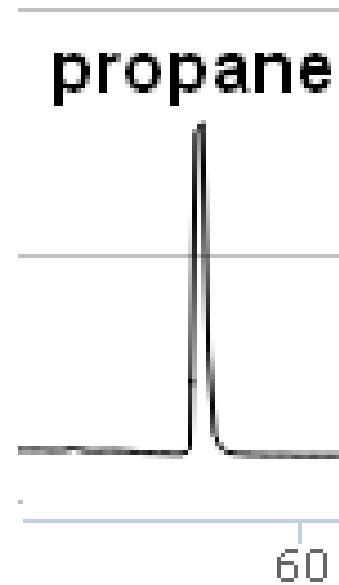Ramp: 50°C →90°C→240°C (2°C/s, 2.2°C/s)
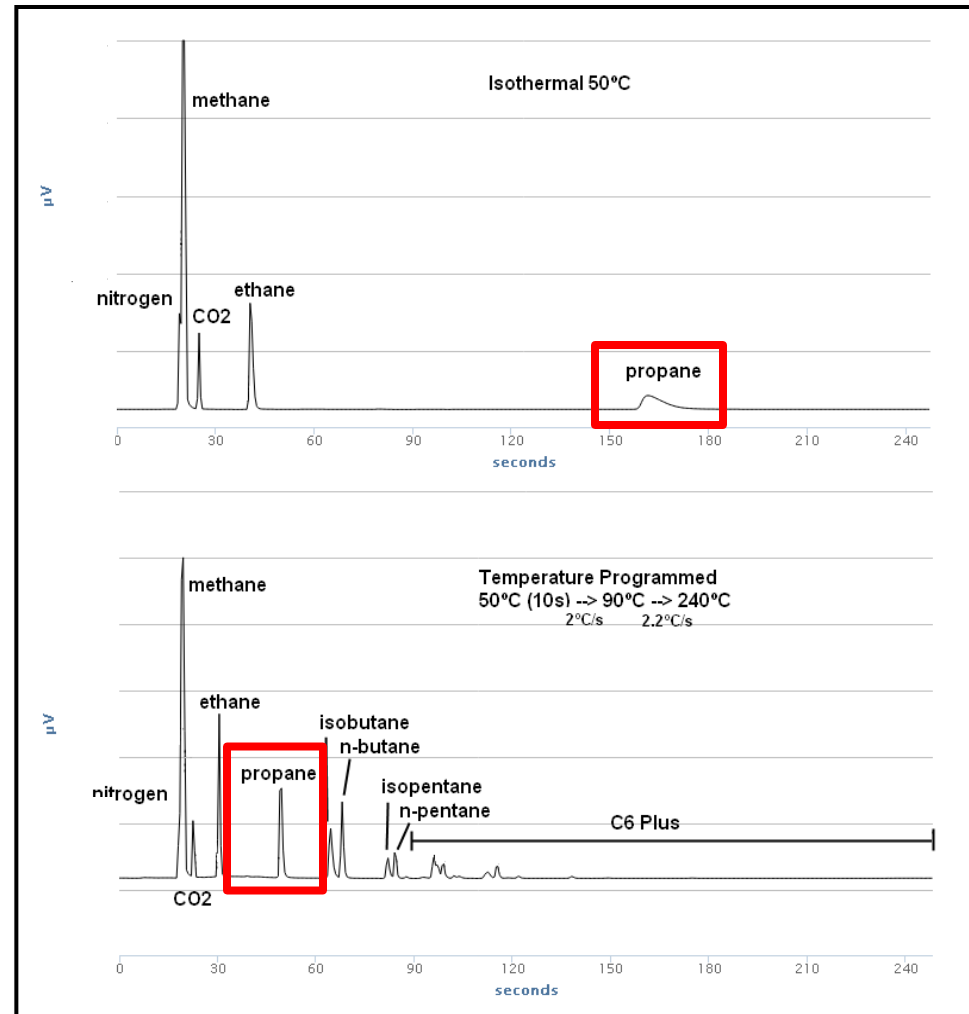
Improved Peak Shape

Column: PLOT Q
Injector: Variable

Isothermal

Temperature Programming

Micro GC Fusion Applications

Micro GC Fusion Applications by Column

- **The chart below highlights some of the columns available for the Fusion**

| Column	Components
Molsieve 5A	H_2, O2, N2, methane, CO
PLOT U	Air, methane, CO_2, ethane, ethylene, acetylene, propane/propylene, 1,2-propadiene, methyl acetylene, H_2S
PLOT Q	Air, methane, CO_2, ethane, ethylene/ acetylene, propane, propylene, C4-C8 hydrocarbons, H_2S
Alumina	C4 and C5 hydrocarbons and olefins, 1,3-butadiene
Carbon PLOT	H_2, air, methane, CO, CO_2, ethane, ethylene, acetylene
PDMS (OV-1)	C4-C12 hydrocarbons, H_2S, VOCs

PLOT column

WCOT column
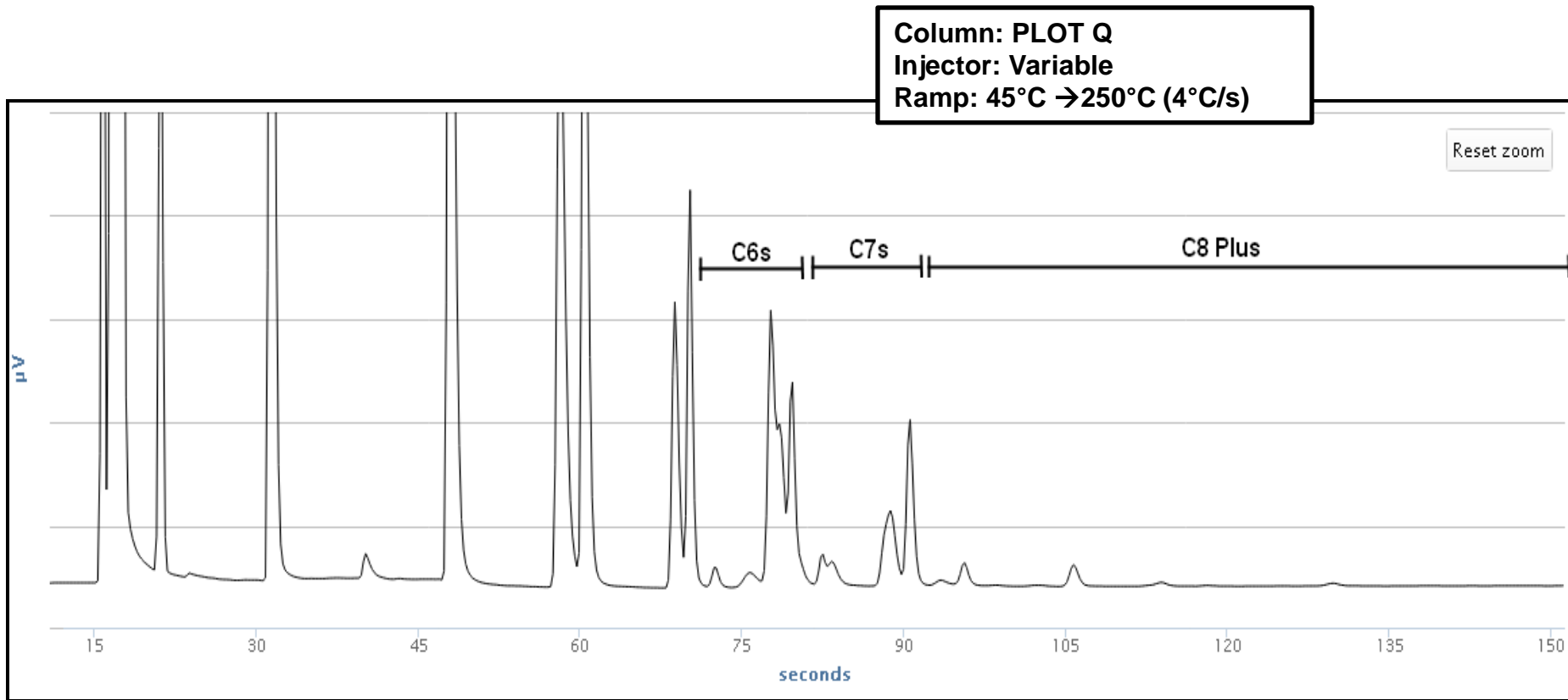
Expanded Application Range

- **Traditionally, the PLOT Q is used for C1-C3 analysis**
- **Using temperature programming, one module can be used for C1-C8 Plus analysis**

Column: PLOT Q
Injector: Variable
Ramp: 45°C →250°C (4°C/s)

GCC-18
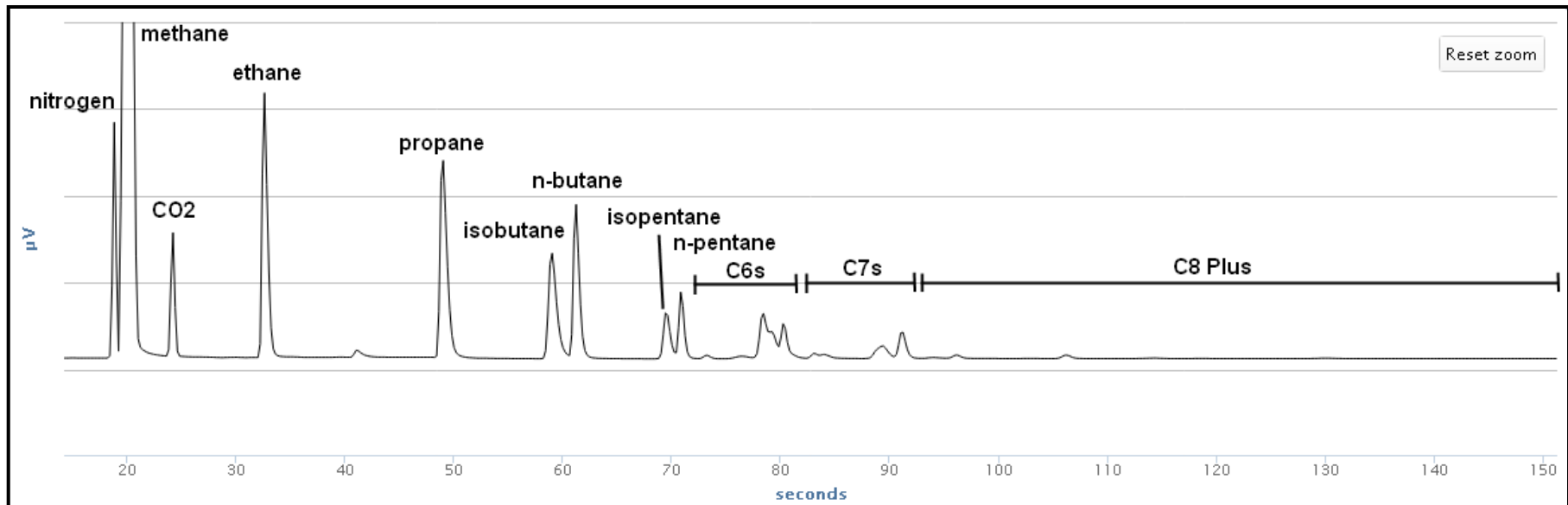
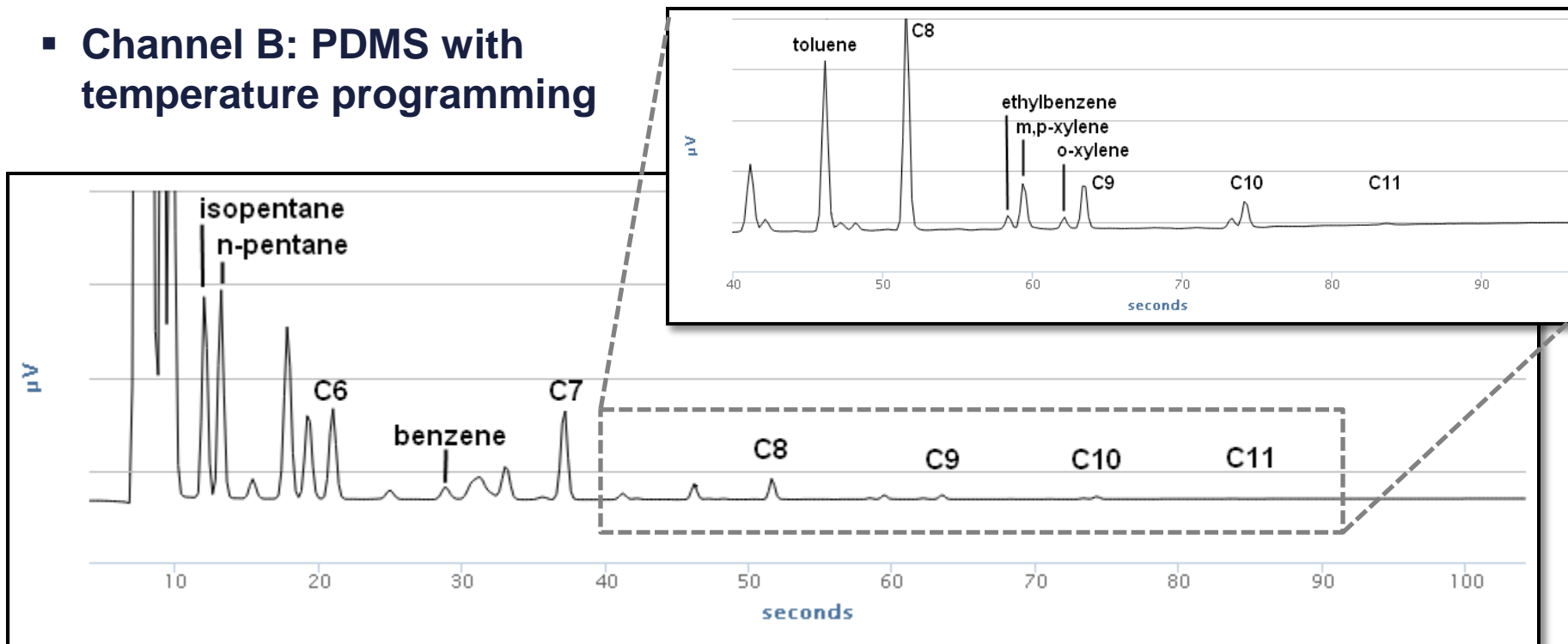# Expanded Application Range

- **Expanded view of C6-C8 Plus compounds**

Column: PLOT Q
Injector: Variable
Ramp: 45°C →250°C (4°C/s)

GCC-19

Natural Gas Analysis Extended

- **The second channel for natural gas analysis is suited for extended hydrocarbon analysis**
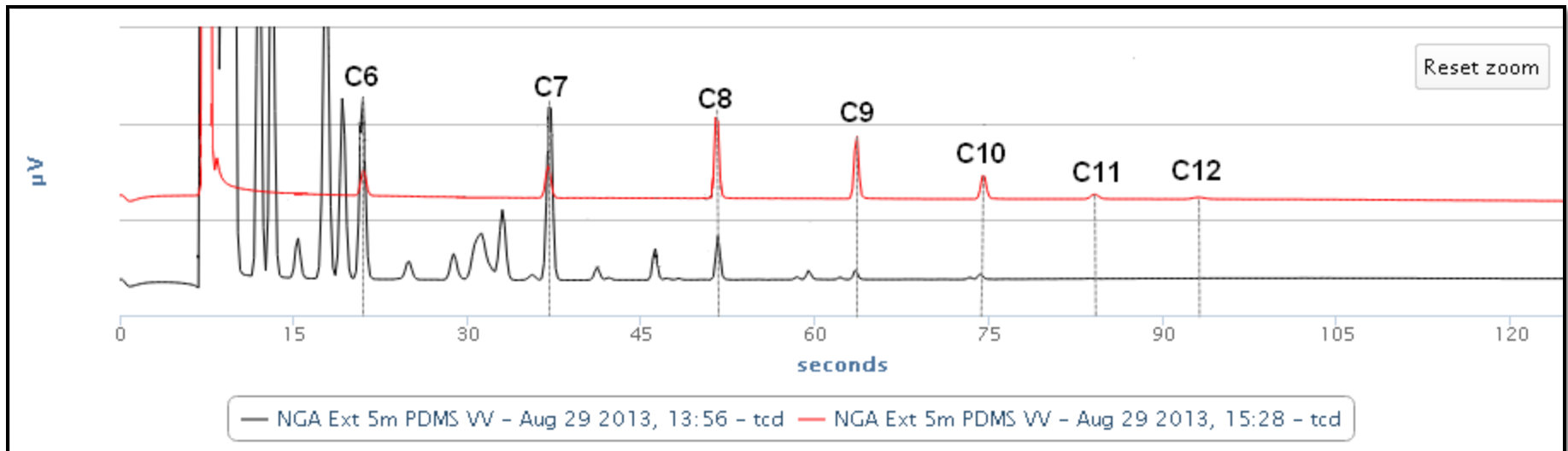
- **Channel B: PDMS with temperature programming**

Column: PDMS
Ramp: 50°C → 130°C → 280°C (2°C/s, 5°C/s)

Natural Gas Extended Analysis

- **Channel B: PDMS with temperature programming**
  - **Straight chain hydrocarbons (C6 to C12) overlaid with extended natural gas calibration gas cylinder**
  - **Heated sample**

Column: PDMS
Ramp: 50°C →130°C→280°C (2°C/s, 5°C/s)

Reset zoom

μV

C6 C7 C8 C9 C10 C11 C12

0   15   30   45   60   75   90   105   120
seconds

— NGA Ext 5m PDMS VV – Aug 29 2013, 13:56 – tcd   — NGA Ext 5m PDMS VV – Aug 29 2013, 15:28 – tcd
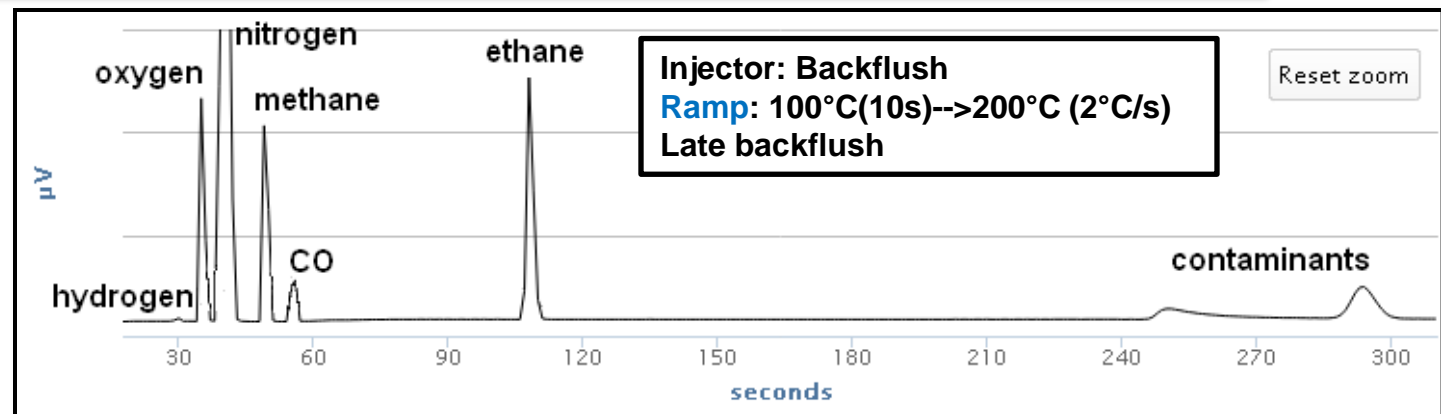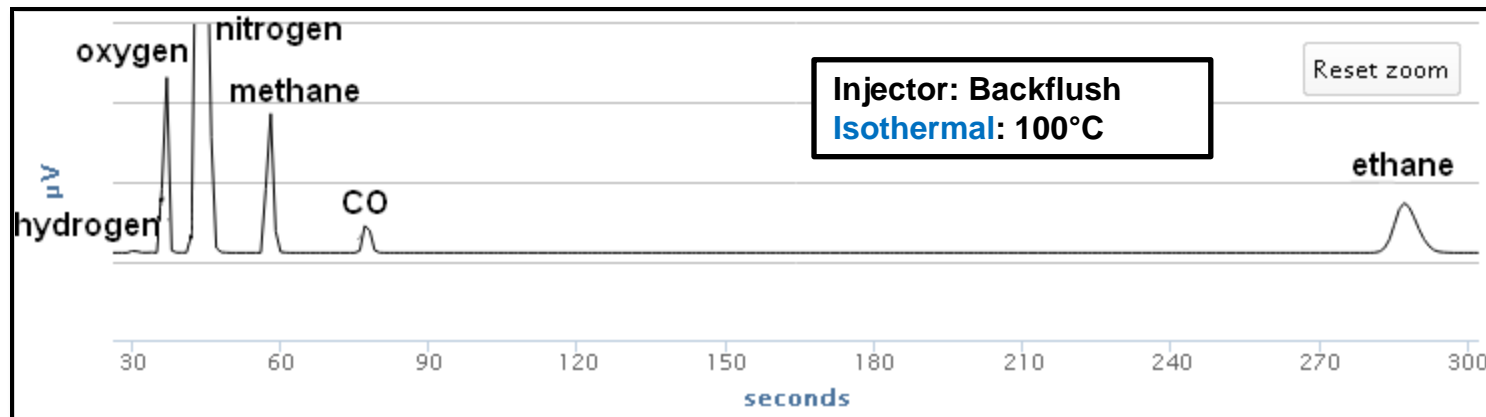
Dissolved Gas Analysis

- **The Carbon PLOT column analyzes typical dissolved gases or transformer oil gases**

- **Channel: Carbon PLOT with temperature programming**

Column: Carbon PLOT
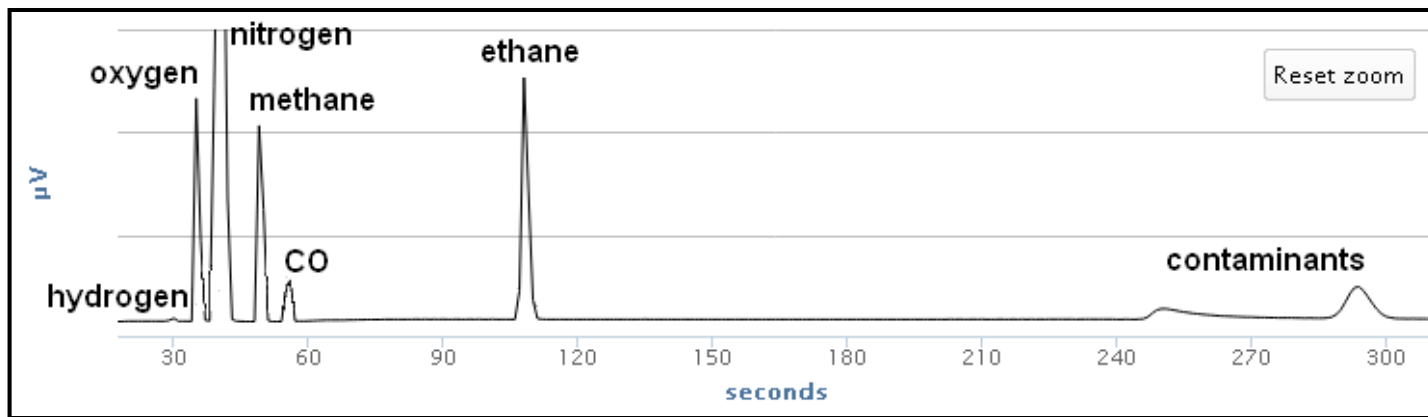Injector: Large Variable Volume
Ramp: 90°C →240°C (3°C/s)
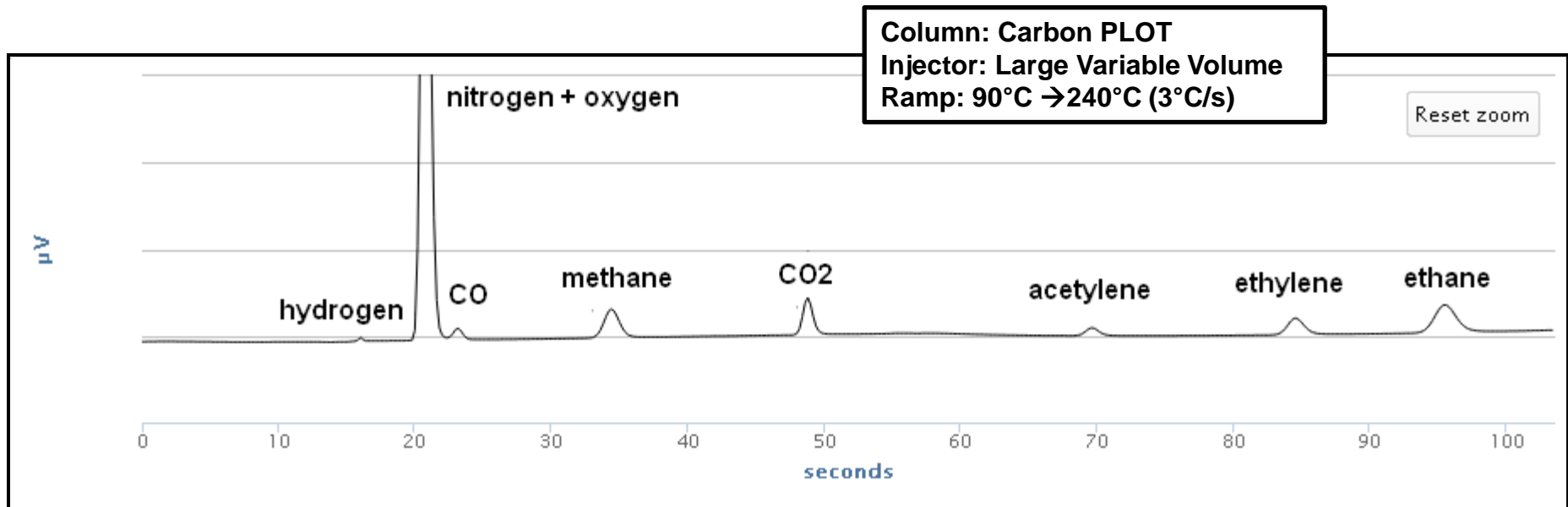
Fixed Gas Analysis

- **The Molsieve column analyzes typical fixed gases found in syngas, landfill gas, fuel cell gases, and refinery gases**
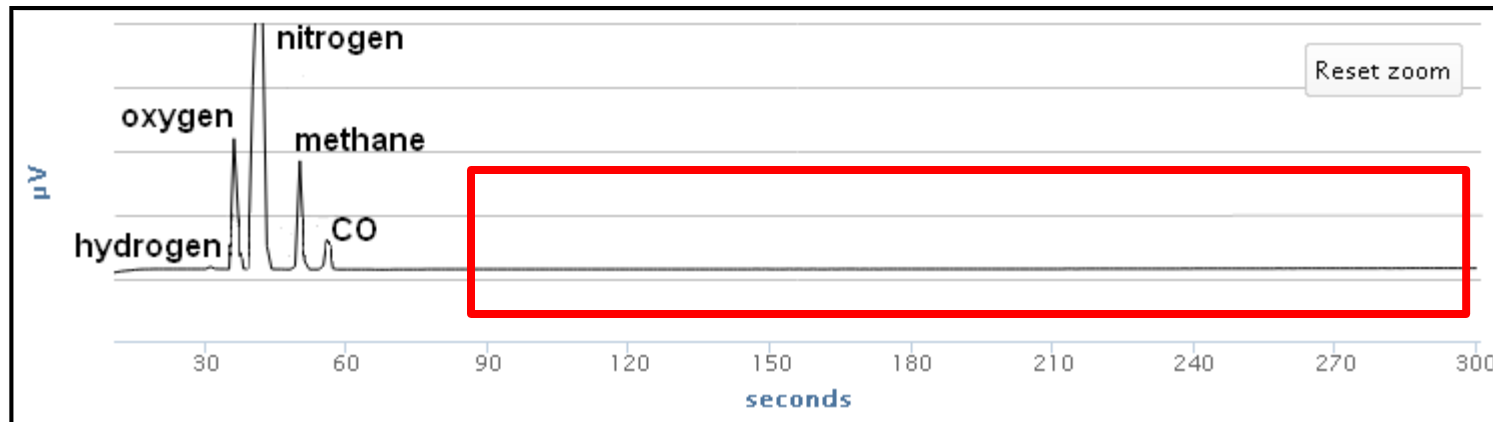- **Channel: Molsieve 5A PLOT**

Injector: Backflush
Isothermal: 100°C

Injector: Backflush
Ramp: 100°C(10s)-->200°C (2°C/s)
Late backflush

Backflush Capabilities
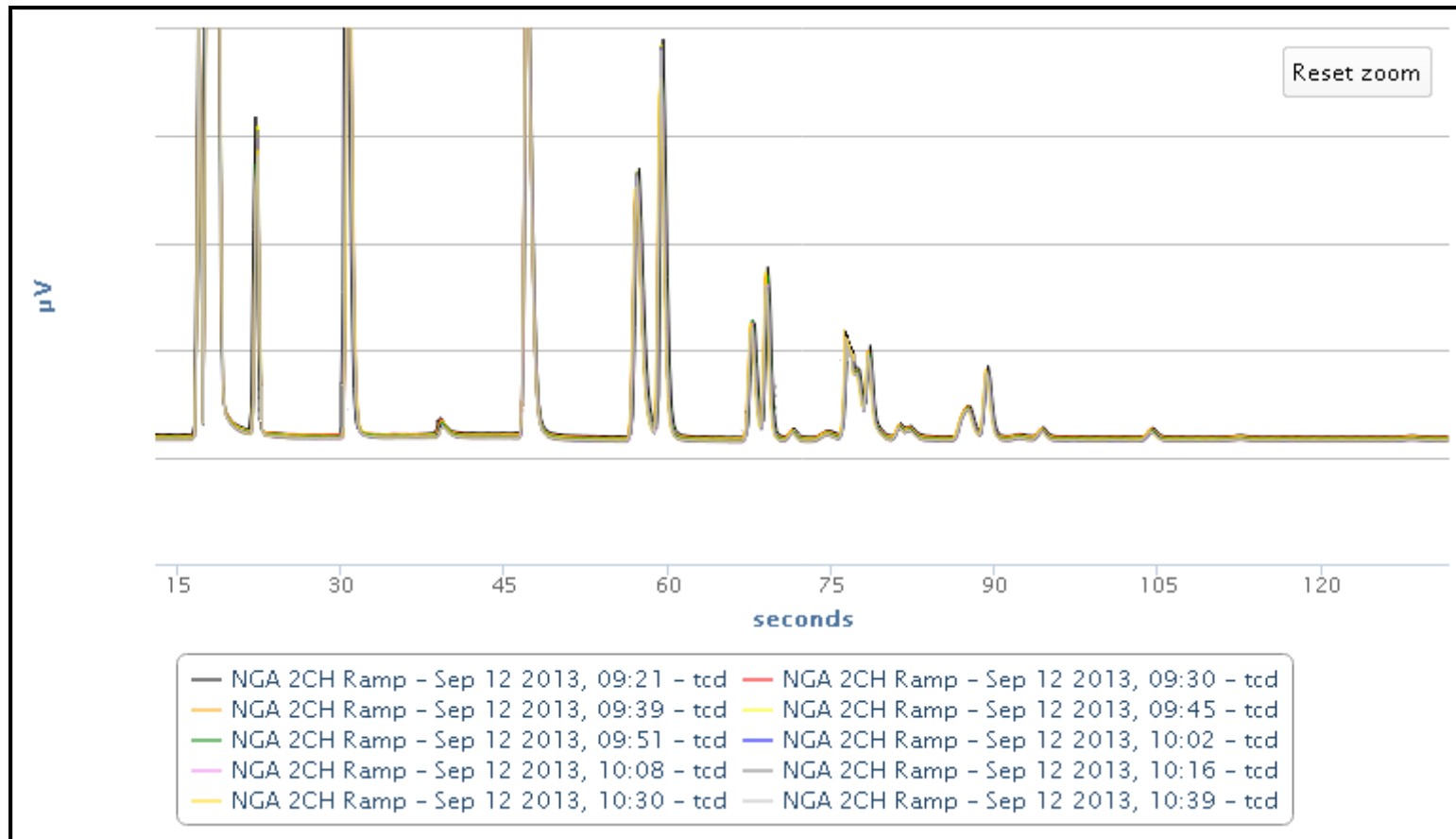
- **Without backflush optimization:**

- **With backflush optimization**
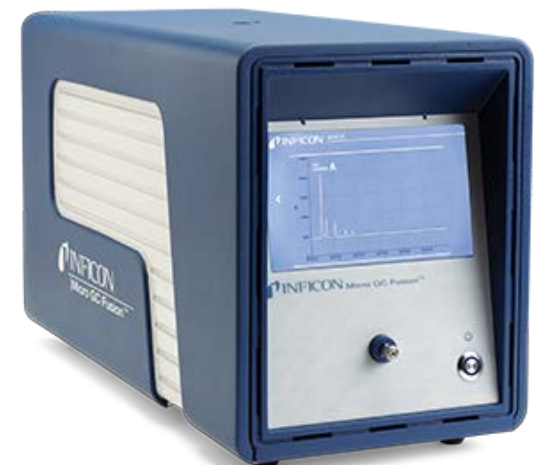
Ten Run Overlay

- **PLOT Q**

Conclusion

- **Micro GC Fusion combines new features with proven technology**

- **Rapid temperature ramping is ideal for fast analysis, column cleaning, and expanded application range**

- **The new user interface and GUI allow for communication to any web-enabled device without relying on operating system compatibility**

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