

Transportable Fast Gas Chromatography for Pipeline Product Interface Detection and Flare Controls

Shane Stewart, Ronnie Williams, Expro Americas, LLC



EXPRO



Abstract

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Product interface detection in pipeline product transmission is an important application for both cost minimization and environmental compliance. Switching from one product to the next product requires flushing the system of the first product before beginning the new shipment. This flushing is often done with nitrogen. Thus, the first product becomes contaminated with nitrogen as does the next product as it follows the nitrogen flush. Everything between pure product shipments must be flared, a costly process. Thus minimizing the time for analysis to make sure that nitrogen reaches 100% and then returns to 0% reduces the amount of product on either end that is flared. In addition, the flare must be kept operational during flushing. LPG is used to keep the BTU content of the flare gas above certain levels and conforming with environmental emissions requirements.

A Calidus Ultrafast Gas Chromatograph is deployed in the trailer based flare system. Sampling occurs automatically with 3 minute cycles. Previously samples were extracted and taken to a contract laboratory with as much as 4 hour turnaround. The savings of product is obviously quite large. But additional savings include reduced fuel usage, elimination of contract lab costs and the lag time for transportation and result generation. This paper will describe the application and the system uses and experience to date.



Our Mission

Expro's mission is well flow management.
We provide services and products that...
measure, improve, control and process.



Providing industry-leading portable flaring instrumentation unit



Pipeline Product Interface Detection

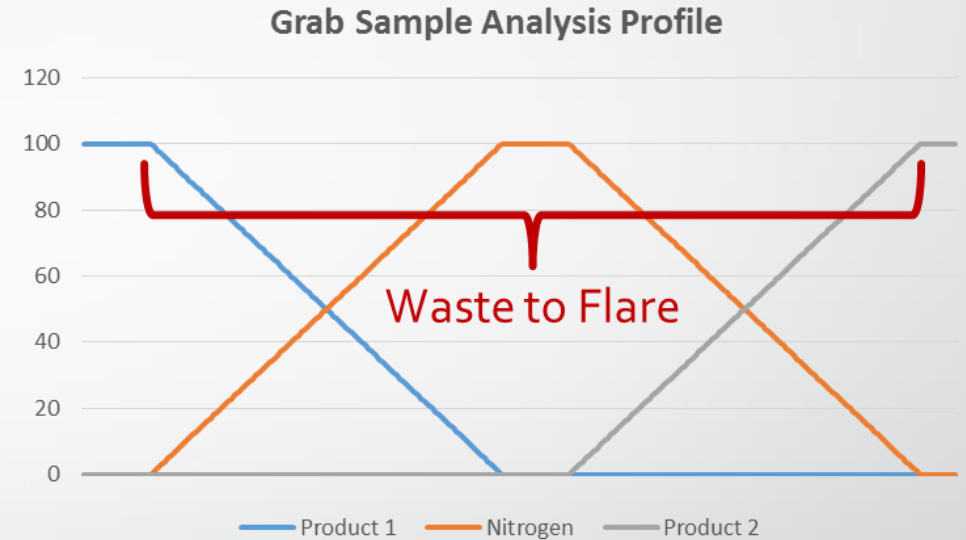
- Interface detection is directly in line with our mission
 - **Measure** the appearance of flushing material
 - Detect disappearance of Product 1 and appearance of nitrogen
 - Detect disappearance of nitrogen and appearance of Product 2
 - **Improve** the process by minimizing waste
 - Onsite, fast gas chromatography delivers near real-time indication of interface condition (nitrogen)
 - Enormous improvement over grab sample and remote lab technique
 - **Control** flare emissions
 - Flare supported by supplemental propane fuel to keep the flare operating and within regulatory compliance
 - Proper combustion of nitrogen contaminated product in transition from one product to the next
 - **Process** the transition from product to product
 - Flare the waste Product 1 at first nitrogen appearance
 - Stop flaring when nitrogen approaches zero and Product 2 approaches 100%



The Interface Problem: N₂ Analysis Time too Long

Too Much Waste to the Flare and Emissions

- Products 1 and 2 must not be contaminated with one another nor with nitrogen flushing agent
- The transition material must be flared
 - Wastes both products
 - Requires nitrogen consumption
 - Creates CO₂ emissions
 - Loses transportation time
- Composition analysis required to
 - Detect appearance and disappearance of nitrogen and
 - Keep the flare operating and in compliance
- The measurements are for nitrogen and BTU
 - Grab sample analysis could be > 4 hours for nitrogen
 - BTU obtained by online calorimeter



Just three N₂ measurements
could be 12 hours... and
LOTS of wasted products.

The Solution:

Add Near Real-time Nitrogen Analysis to the Rig

Requirements

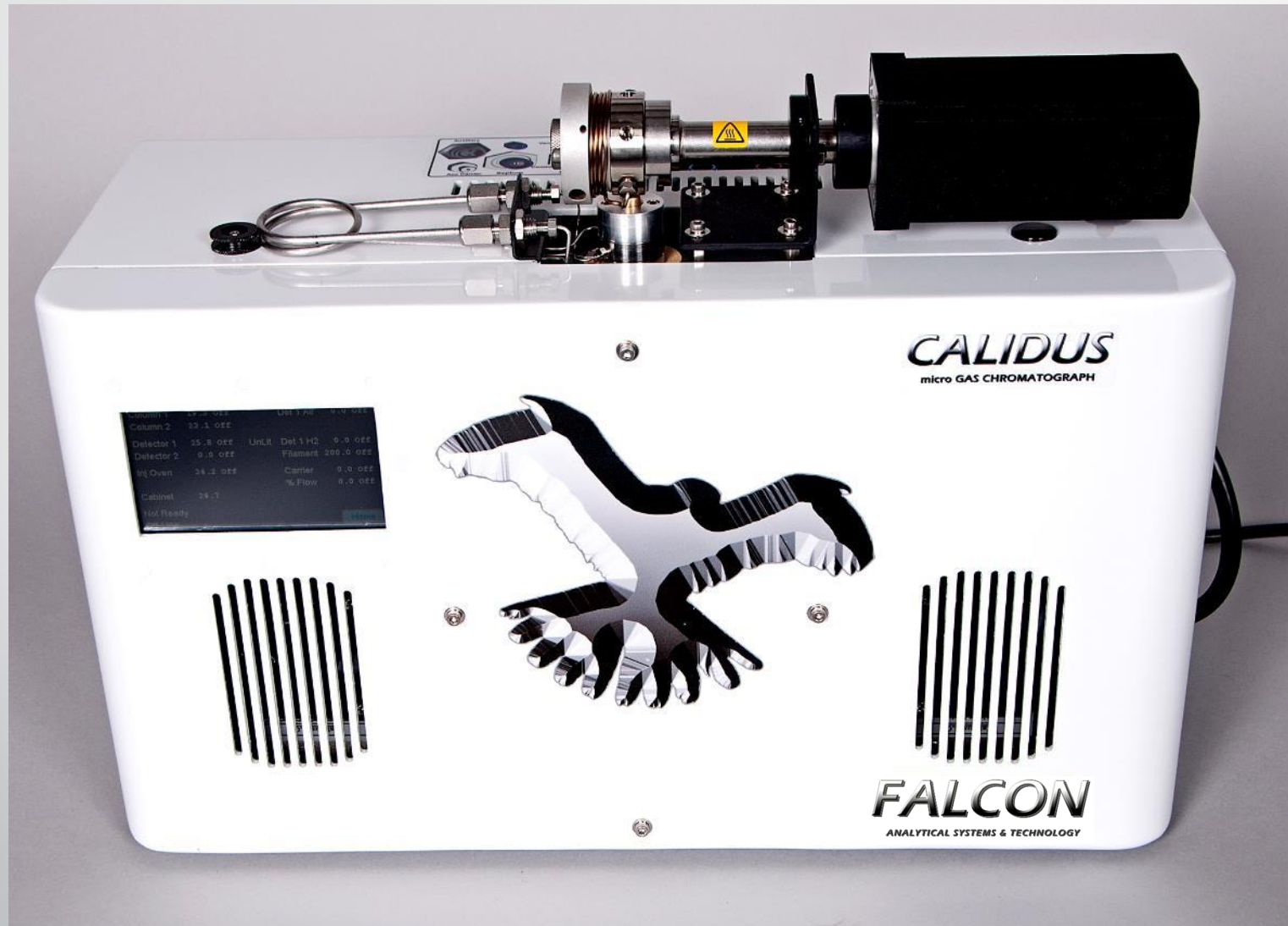
- Fast interference free analysis (<5 minutes)
- Sensitivity down to 100 ppm nitrogen
- Transportability
 - Low utilities (power & gas supplies)
 - Small footprint
- Reliability
- Ease of use
- Technical support

Calidus Fast GC

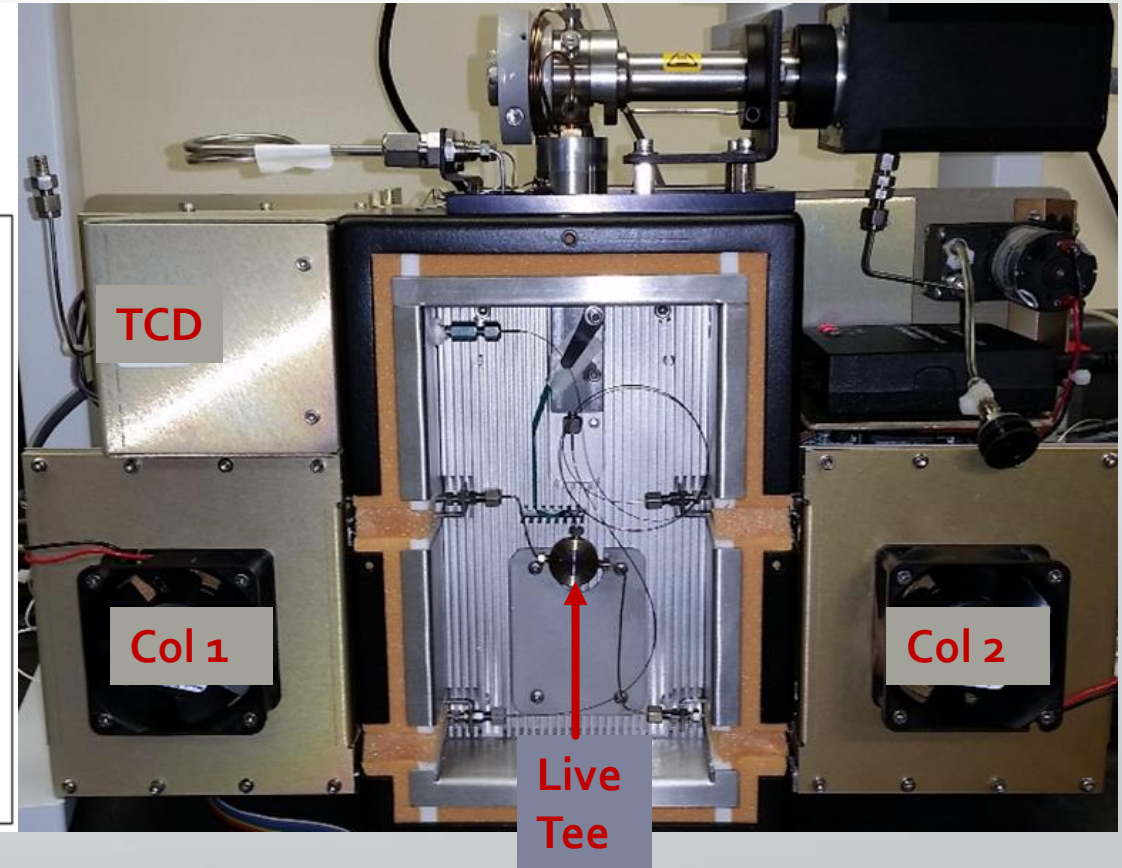
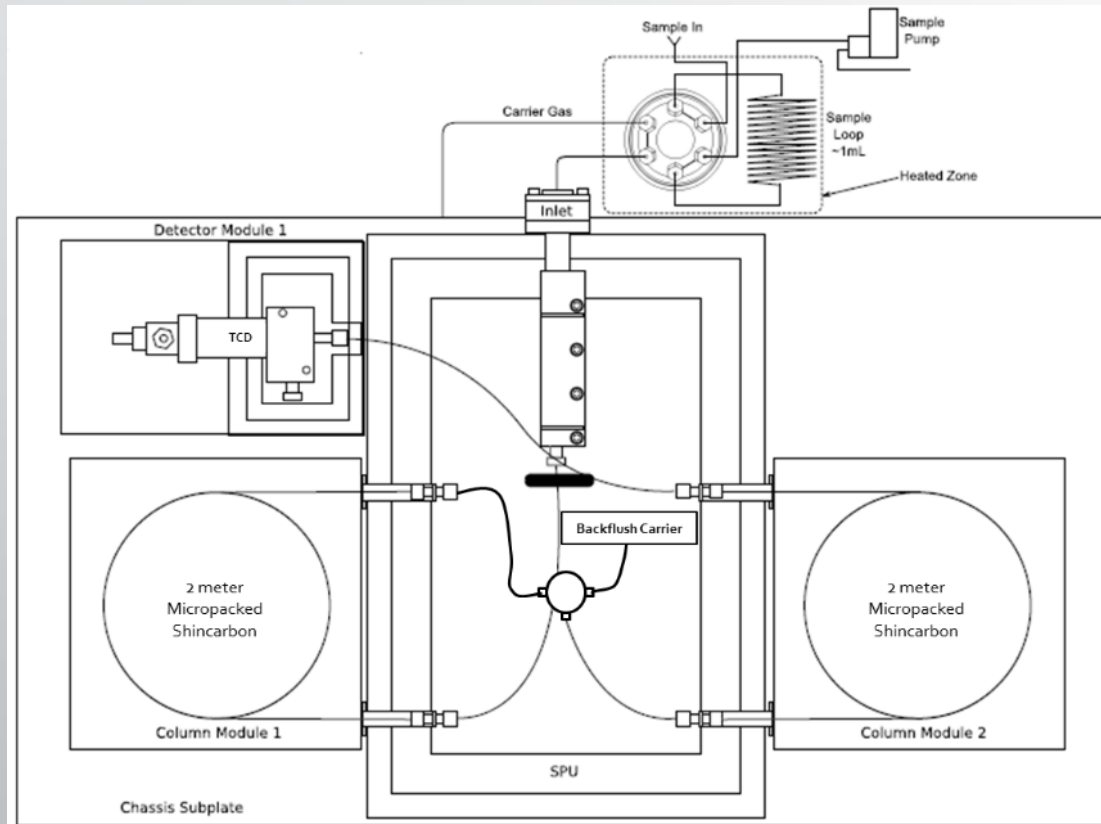
- < 5 minute cycles
- < 100 ppm limit of detection
- Highly transportable
 - < 250 watts
 - ~18"x12"x9"
- High reliability in the rig
- Touchscreen and laptop PC controls
- Falcon corporate & Felder Analytical local services



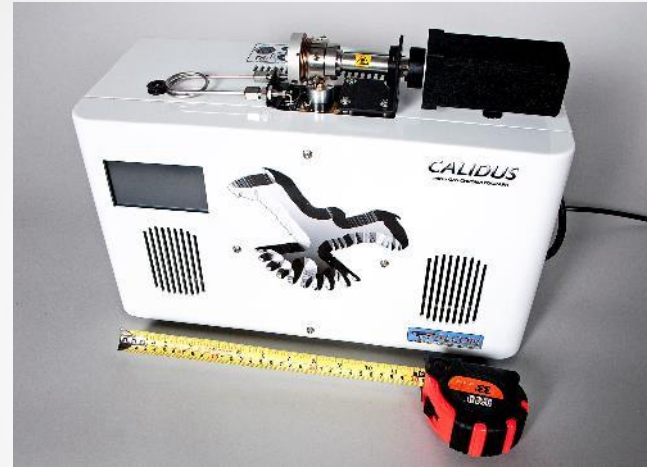
The Solution: Fast Gas Chromatography



Calidus 201 with Live Tee Backflush



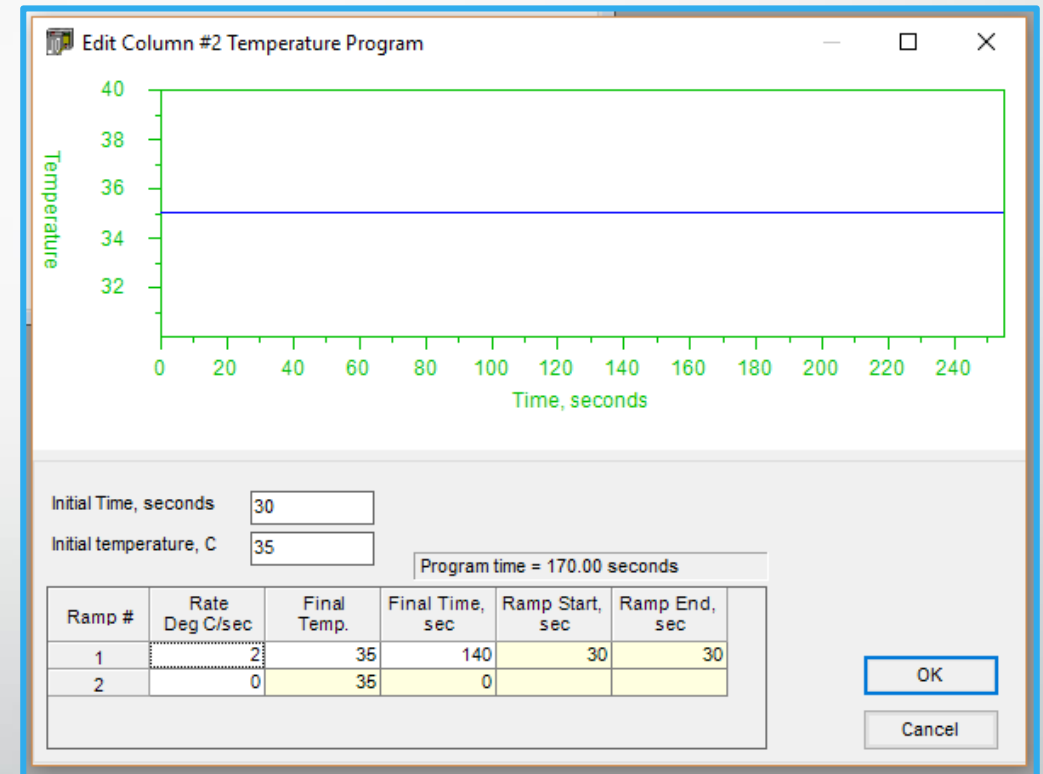
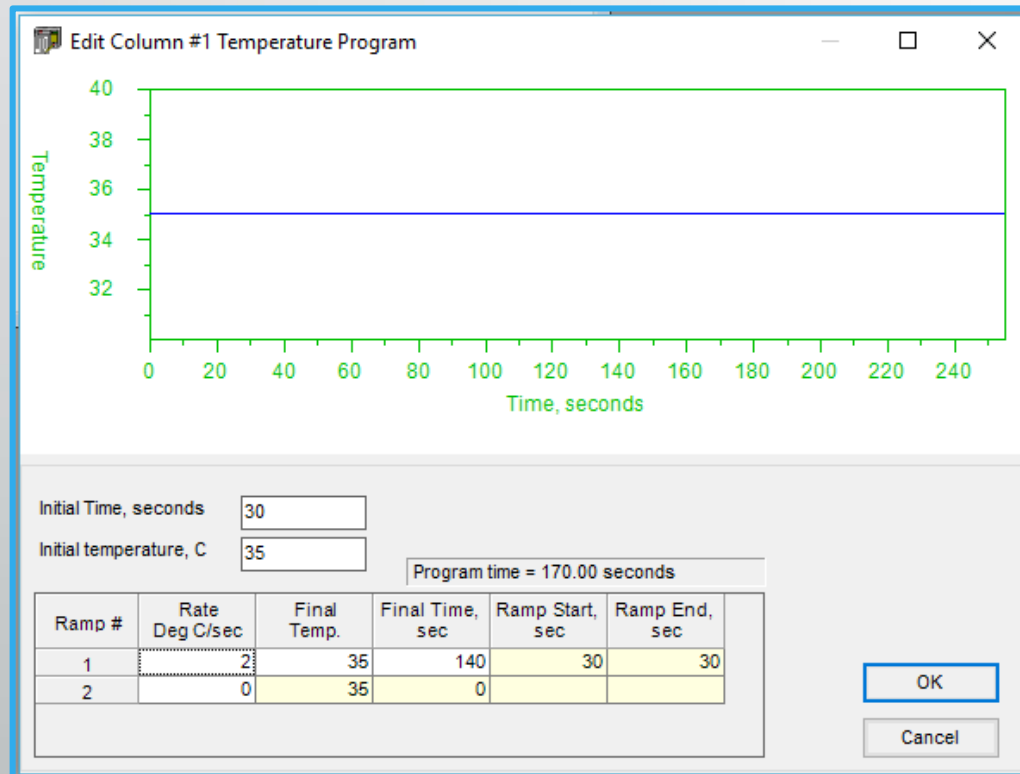
Fits in the Rig



Operating Column Temperature Profiles

Column 1: Isothermal @ 35° C

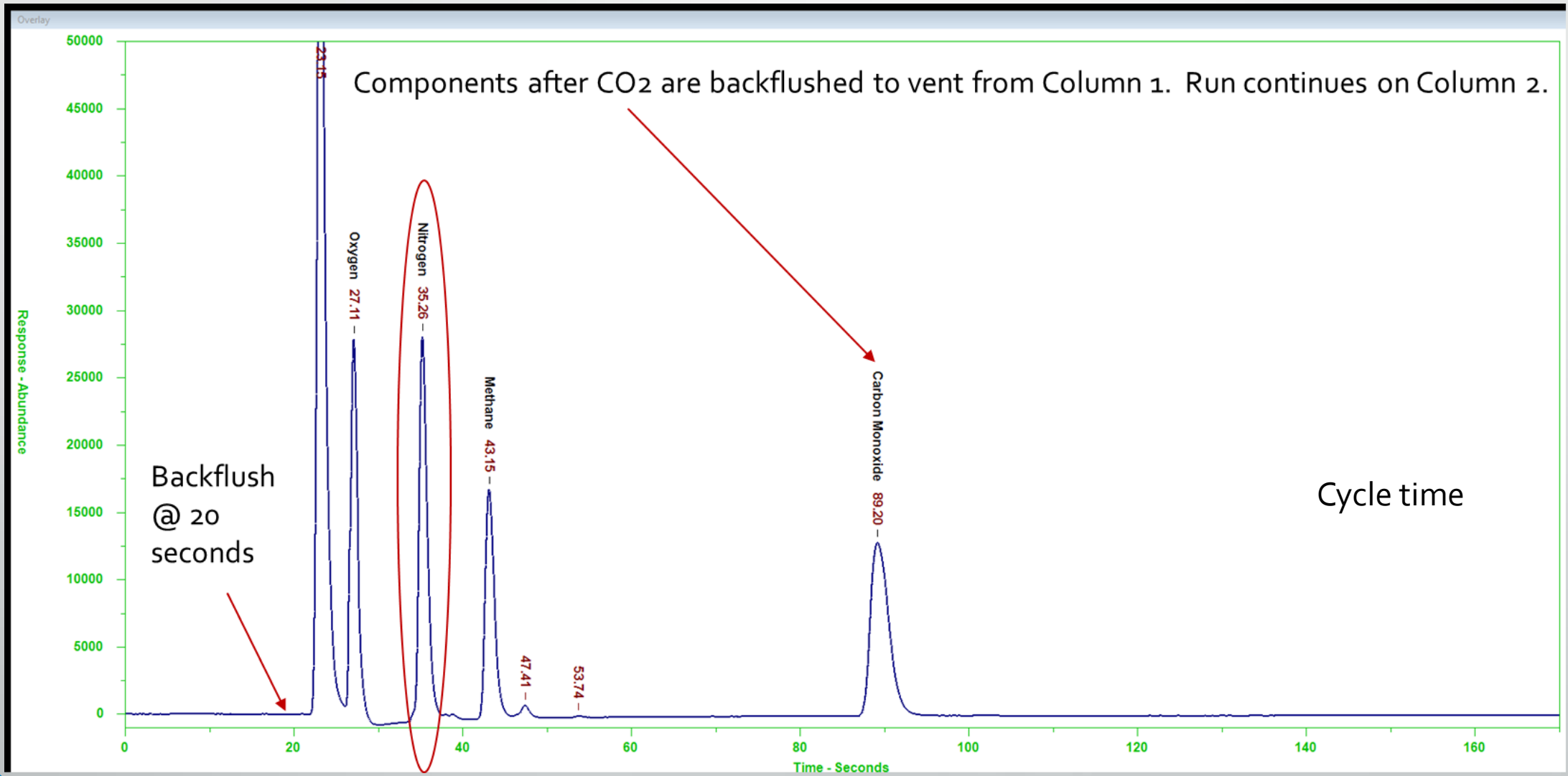
Column 2: Isothermal @ 35° C



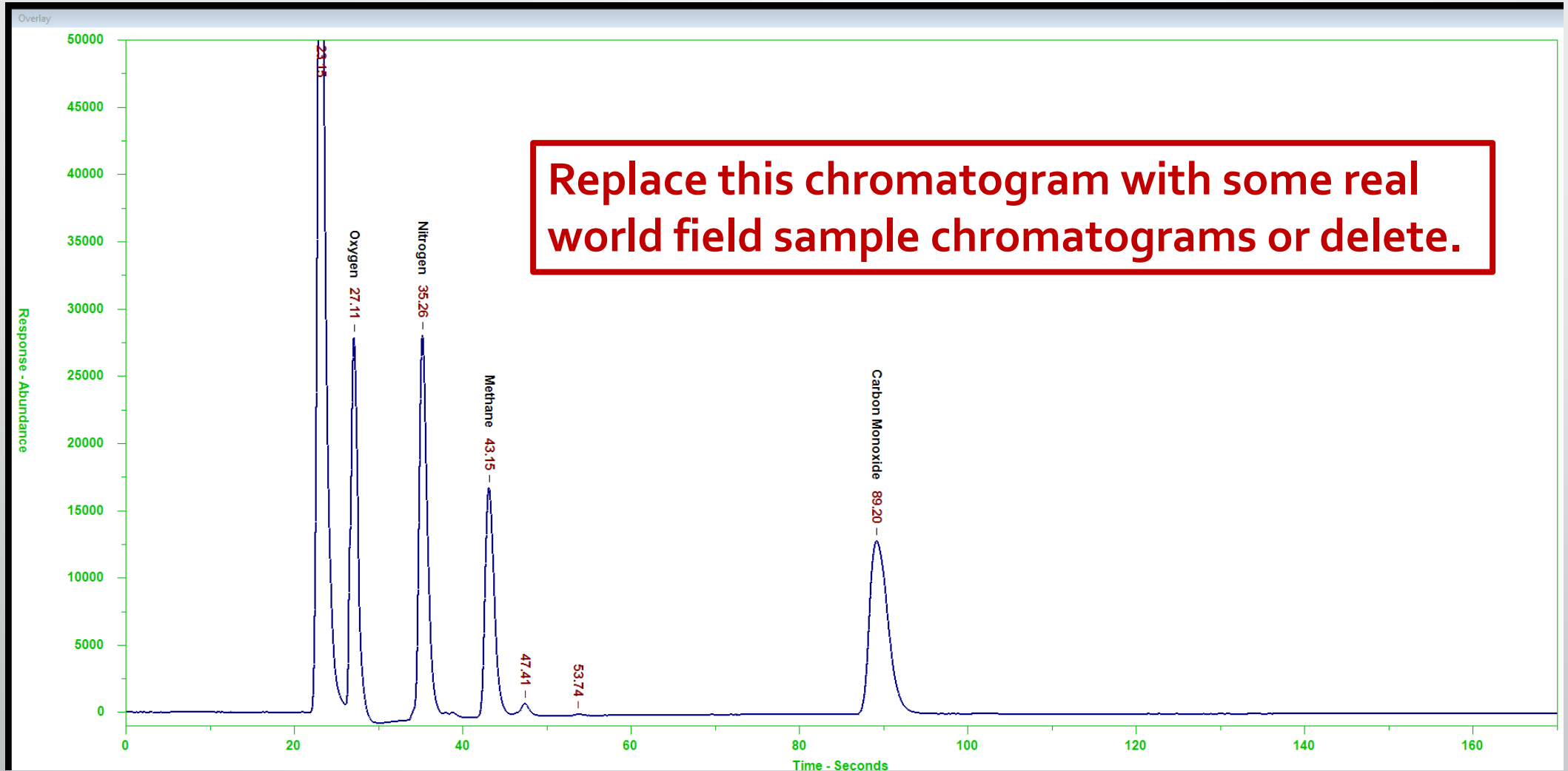
Backflush @ 20 Seconds

Cycle Time is 170 Seconds

Interference Free N₂ @ 35 Seconds

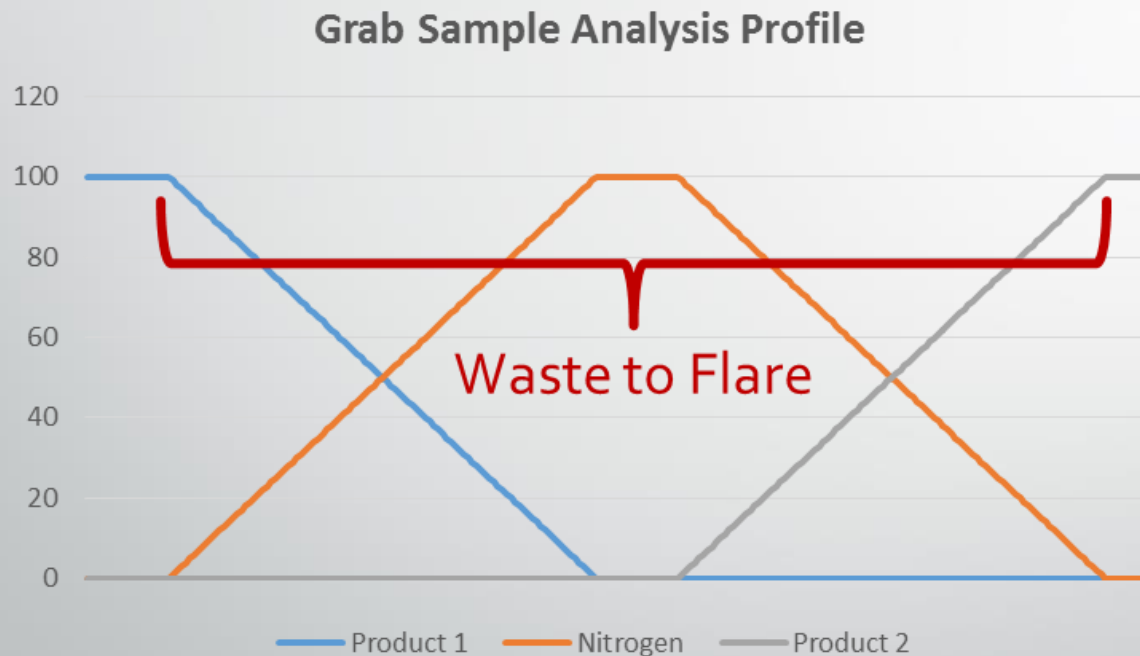


Typical Field Analysis



The Result: 170 Second Resolution for Determining Flare Start & Stop Timing

Before Online N₂ Analysis



After Online N₂ Analysis



Far less wasted Product 1 & 2
& Nitrogen

As Deployed in the Rig

- Online Calidus Nitrogen analyzer bottom left
- PC & Controls top left
- Online Calorimeter right



What's Next?

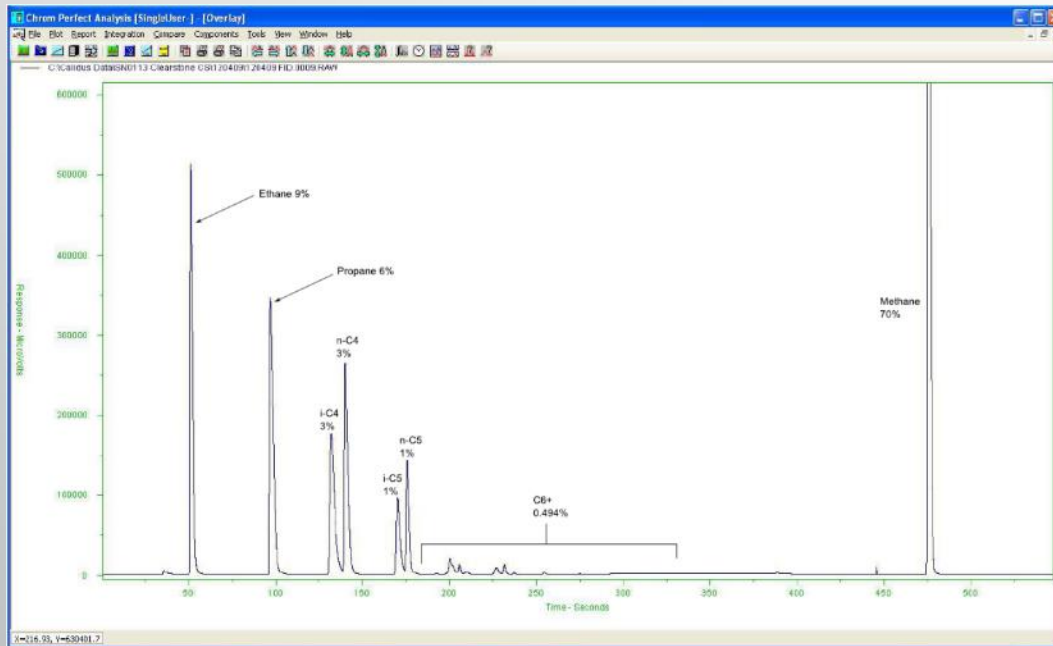
Combine N₂ and BTU Analysis into a Single Calidus CS

- Calidus CS configured for N₂, O₂, CO, CO₂ and Methane to n-C₁₂
 - Retains the interference free nitrogen measurement
 - Expands capability to
 - Complete composition analysis
 - Enables calculation of BTU from composition analysis (currently from the calorimeter)
 - Enables monitoring of Product 1 disappearance and Product 2 appearance as well as nitrogen
- ~300 second cycles, still fast enough with added composition data
- And this approach frees up space, reduces power and weight for the rig

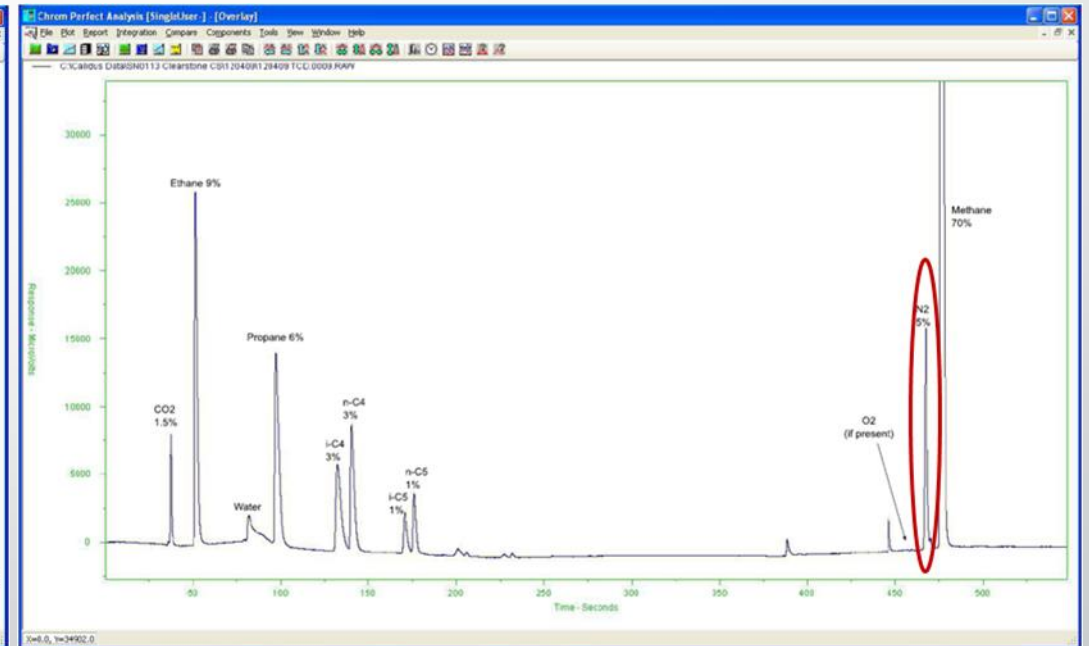


Example of Expected Chromatography

FID for Higher Hydrocarbon Sensitivity



TCD for Nitrogen Sensitivity



Questions?

Thank you for your attention.

Thanks to our Partners

Our Customers
Southern Analytical
Felder Analytical
Falcon Analytical



The Rig and Our Team