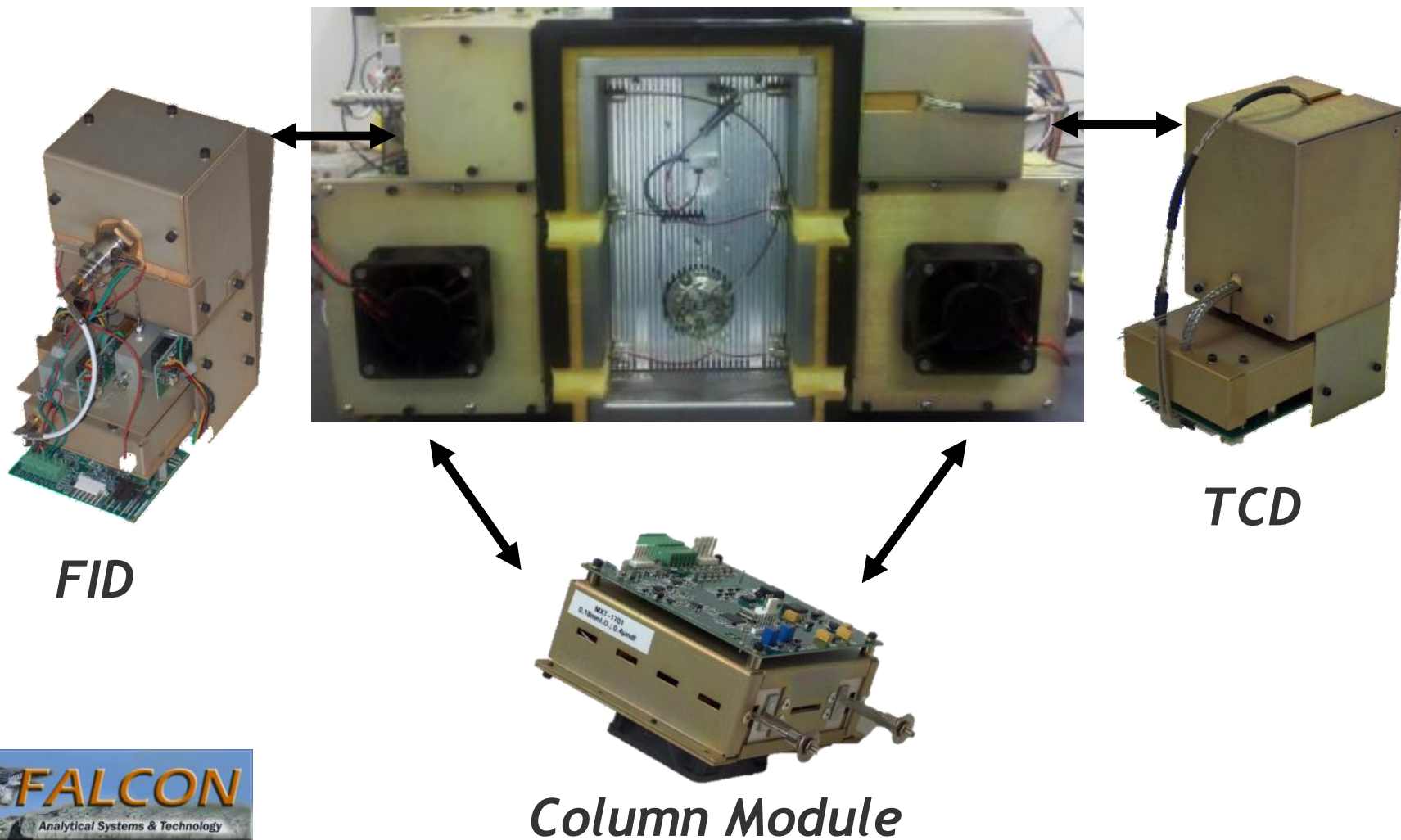




# *Not Just for Simulated Distillation: Broadly Applicable Fast GC*



# *Calidus:* *the Modular, Ultra-Compact GC*



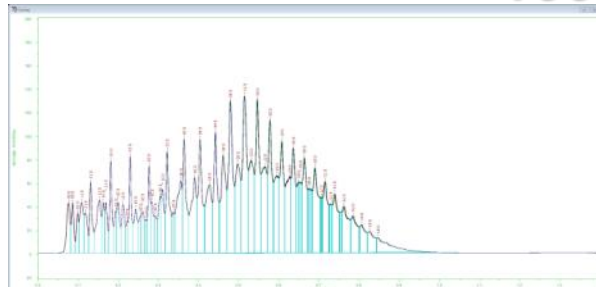
# Separation & Detector HW Specs

## 101, 101-HT, 201, 301

- **Sample Inlet**
  - 100°C - 350°C
- **Column Modules**
  - 5°C above ambient to
  - Column material limit
  - Or 400°C
  - whichever is lower
- **Detector Modules**
  - 100°C - 350°C

## CS

- **Sample Inlet**
  - 100°C - 250°C
- **Column Modules**
  - 5°C above ambient to
  - Column material limit
  - Or 400°C
  - whichever is lower
- **Detector Modules**
  - 100°C - 350°C



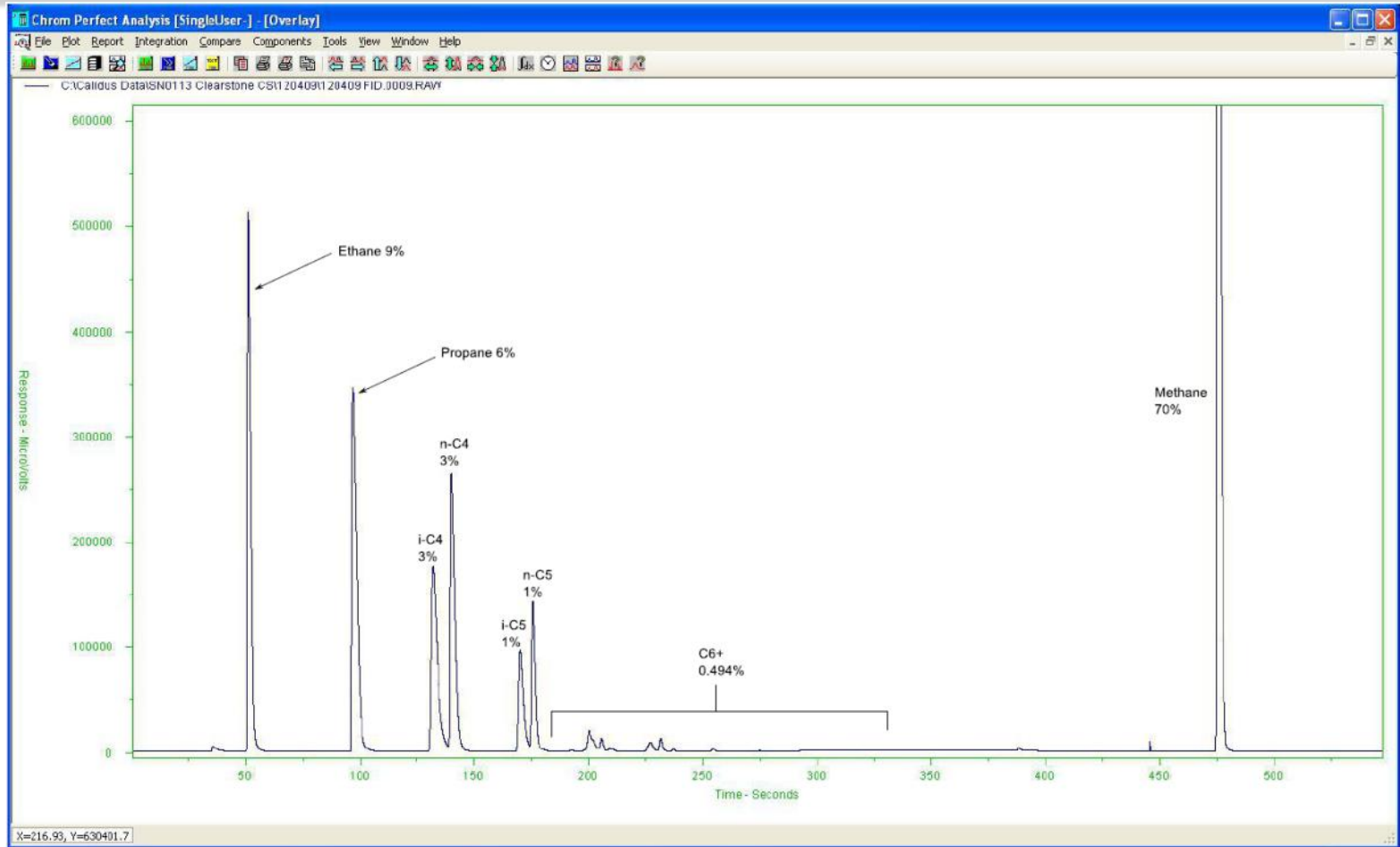
**Result: fixed gases to n-C60**



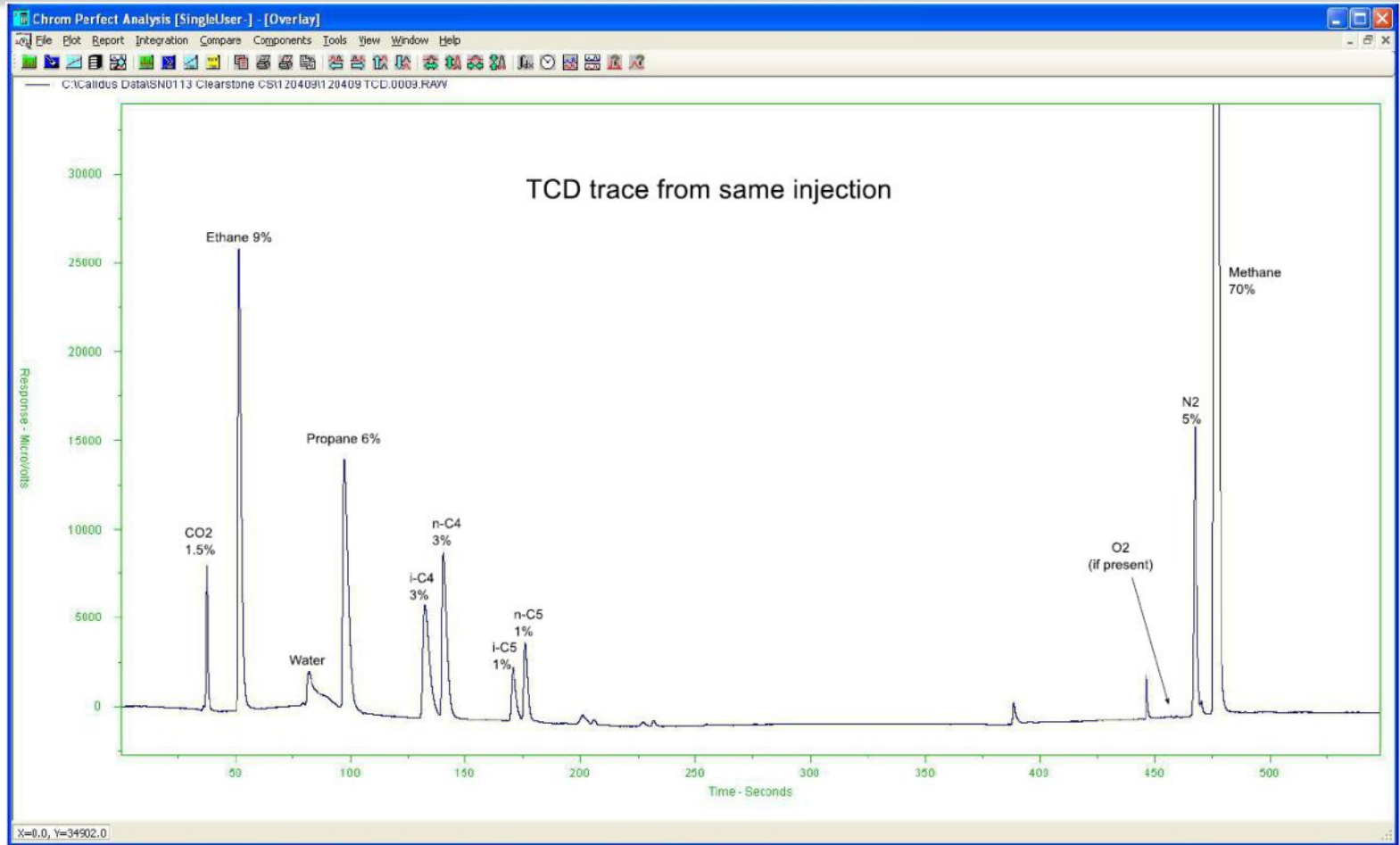
# *Extended Natural Gas with Heated Sample Valve*



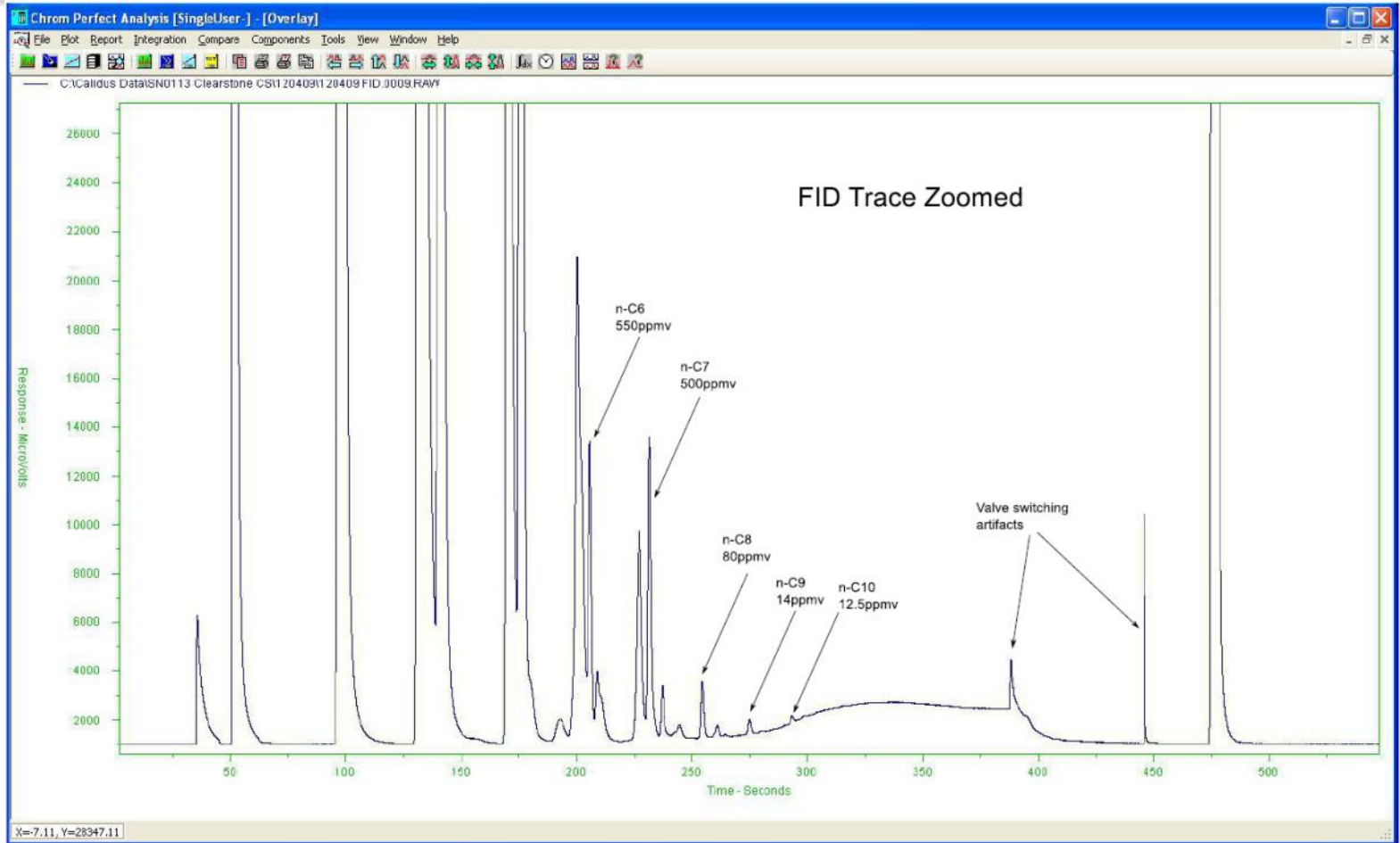
# Trap on MXT MoleSieve while Bypass through MXT QBond to the FID



# Trap on MXT MoleSieve while Bypass through MXT QBond to the TCD

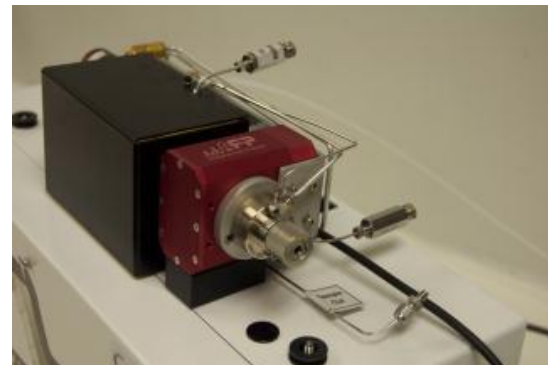


# Trap on MXT MoleSieve while Bypass through MXT QBond to the FID - Zoomed



# Expanded Application Capability to Include LPG

- **CALIDUS CS fitted with a combination inlet**
  - **Heated diaphragm/plunger gas sample valve**
  - **Unheated rotary liquid sample valve**
- **Connect pressurized samples appropriately**
  - **Vapor samples to the vapor inlet**
  - **Liquid samples to the liquid inlet**
- **Set the pneumatics switch to operate the appropriate valve**
- **It is that easy!**





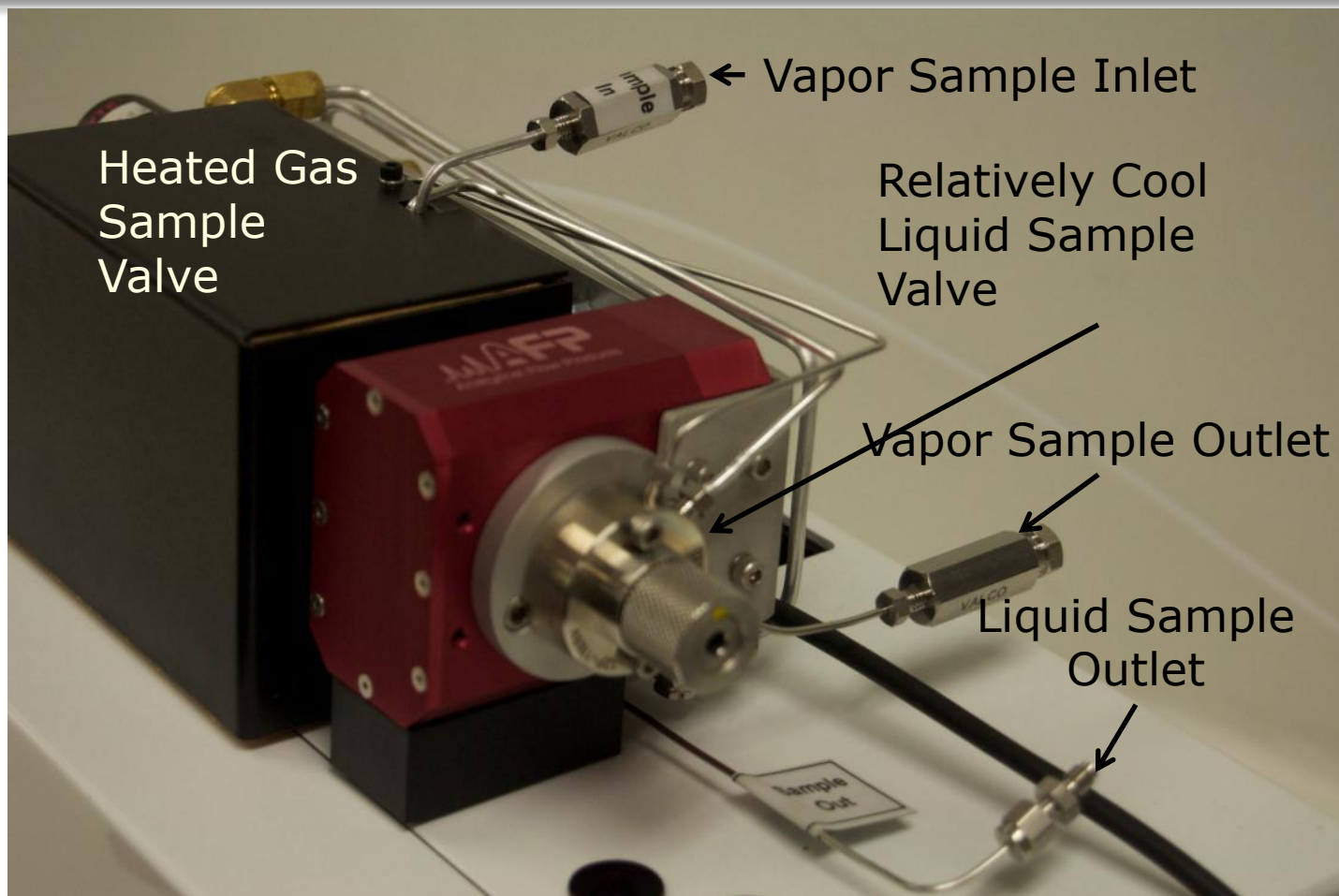
# Extended Natural Gas System

(compressed natural gas and natural gas liquids, air components to C<sub>12</sub>)

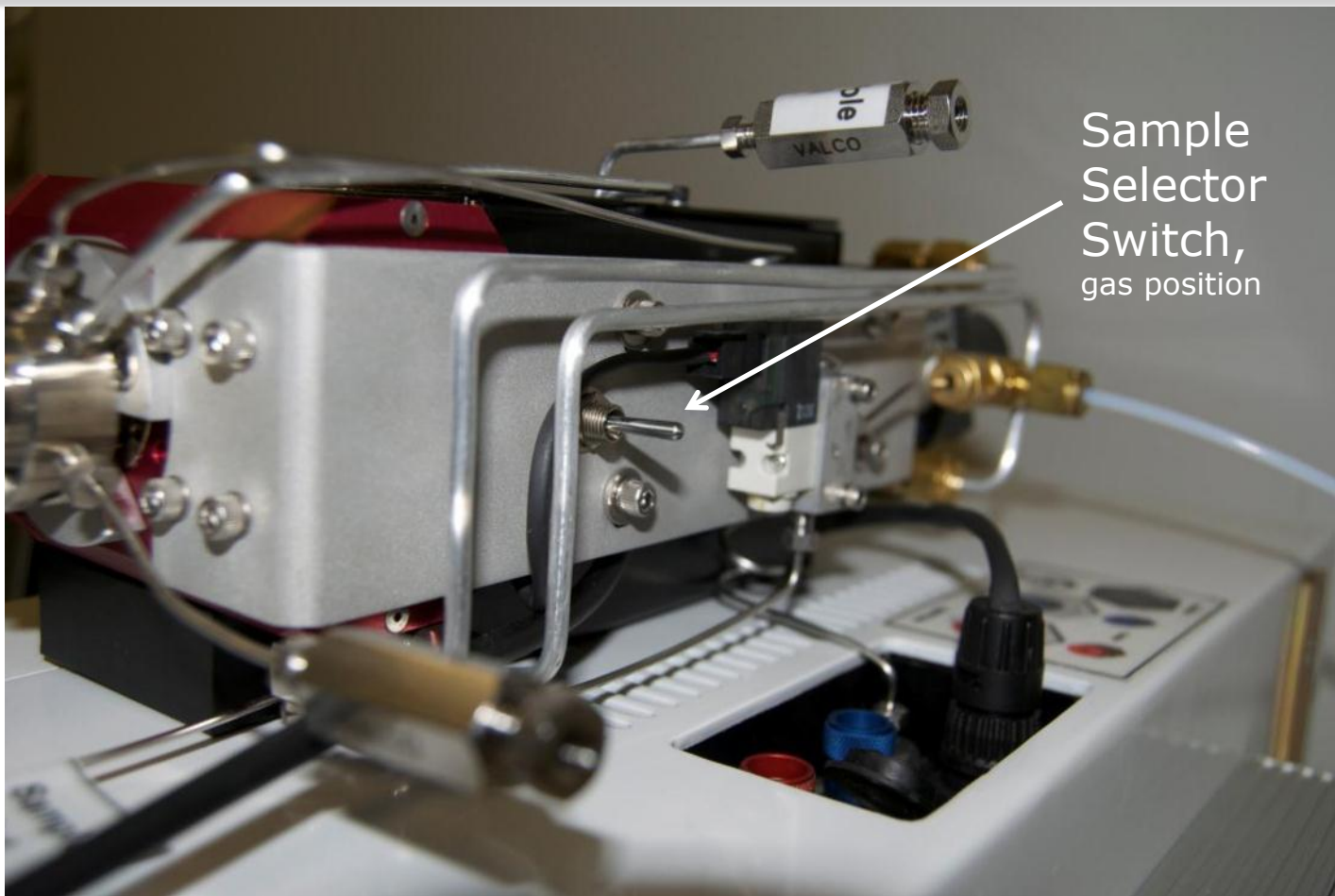


# High Pressure Vapor and Compressed Liquid Sampling

(operation selected with a switch shown on next slide)



# Gas or Liquid Selector Switch *(From the front of the GC the switch position points to the valve that will operate. Push left for gas, right for liquid. It is shown for gas sample valve operation here.)*



Sample  
Selector  
Switch,  
gas position

# ***But What about Simulated Distillation?***

- ***“Boiling Range Distribution of Petroleum Distillates With Final Boiling Points up to 535° C by Ultra Fast Gas Chromatography (UF GC)”*** draft authors Bostic, DiSanzo, Lubkowitz
- ***New method report will follow... however...***
- ***Here are current results demonstrating conformance with the existing D-2887 requirements.***

***(Repeatability & Reproducibility requirements will be the same for the new method but require < 5 minute analysis time)***



# D-2887 Report

- **Points of Interest**
  - **Chromatogram shown with BP curve and blank chromatogram overlaid**
  - **Selected BP data shown in the table.**
  - **Comparison follows**

D2887

Page: 1

Injected On: 20111107164005-0500 by

Procedure File: FalconD2887.prc

Data File: C:\Users\John Crandall\Documents\ASTM Documents\ASTM Runs 11062011111107.0032.CDF

Blank File: C:\Users\John Crandall\Documents\ASTM Documents\ASTM Runs 11062011111107.0034.CDF

Calib File: C:\Users\wayne\Documents\Falcon D2887 Demos\Marathon111107.0033.CDF

Solvent Exclusions: Mins

BaseLine Zero: 1001.00000

Quench Region: No Quenching Correction

Uncorr Total Sample Area: 2.3028E8

Corr Total Sample Area: 2.2925E8

Start Of Material (mins): 0.043

End Of Material (mins): 0.998

Sample Weight (g): 0.0000

SOM Thrsh: (0.00001000%)

EOM Thrsh: (0.00032000%)

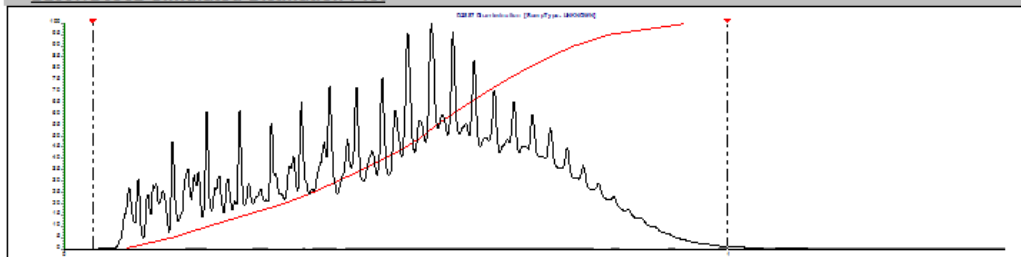
Solvent Weight (g): 0.0000

Material Search Restricted To: 1.100

Material End Forced To: NO FORCE

Warnings: EOM Accuracy may be affected by BLEED at END OF RUN

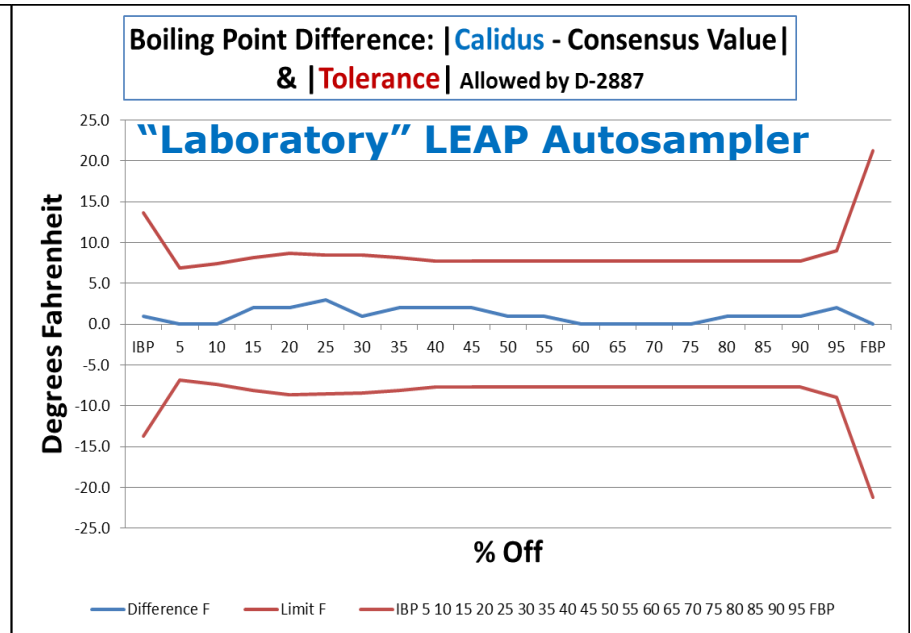
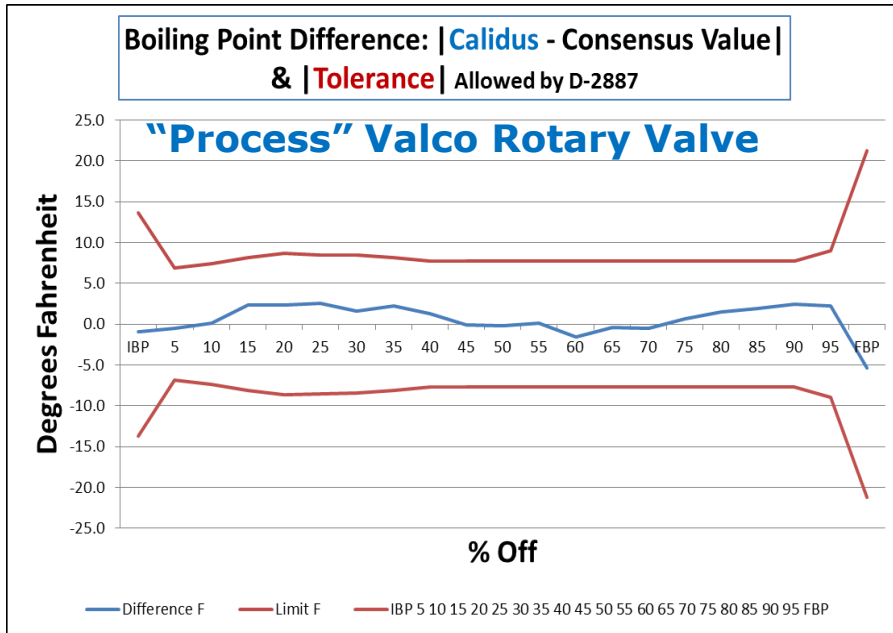
## D2887/D6352 Simulated Distillation Plot



## D2887/D6352/D7213 Boiling Point Mass Distribution

IBP ... 239.34	80.00% ... 710.94
5.00% ... 302.95	85.00% ... 735.05
10.00% ... 347.64	90.00% ... 763.54
15.00% ... 393.12	95.00% ... 803.32
20.00% ... 434.54	FBP ... 885.16
25.00% ... 468.80	
30.00% ... 497.77	
35.00% ... 525.00	
40.00% ... 551.77	
45.00% ... 575.14	
50.00% ... 592.50	
55.00% ... 608.68	
60.00% ... 627.63	
65.00% ... 647.32	
70.00% ... 667.09	
75.00% ... 688.68	

# Rotary Sample Valve (left) VS Syringe (right) Performance

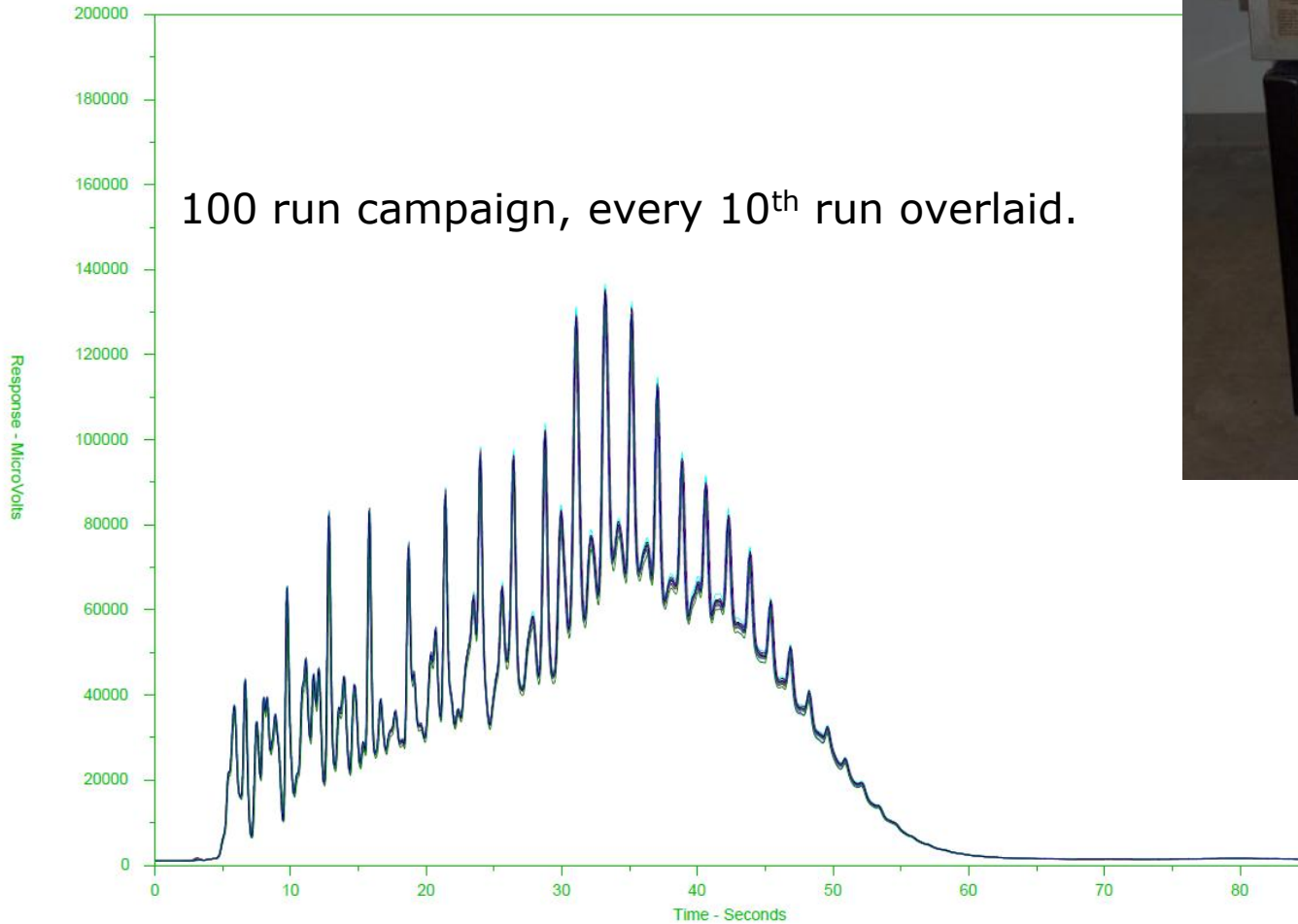


While the profiles are different both meet the requirements of the current D-2887 standard and compare favorably when thinking about the possibility of one substituting for the other.



# What about Repeatability?

Chrom Perfect Chromatogram Report



# Calidus Chrom Perfect Process Control

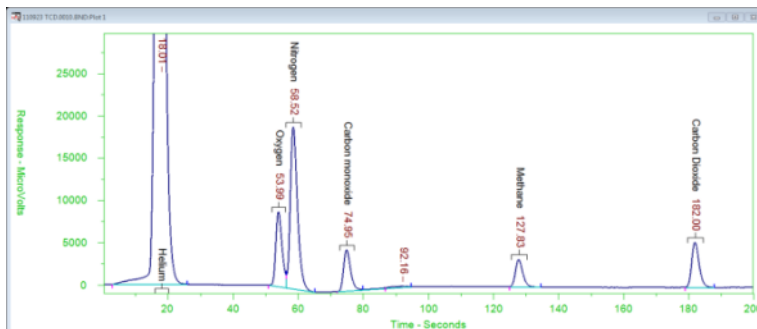
The screenshot displays the Chrom Perfect software interface, which is divided into several key sections:

- Chrom Perfect Data Acquisition on FALCONCALIDUS [SingleUser-]:** This window at the top shows a menu bar (File, Plot, View, Tools, Window, Help, Edit) and a toolbar. Below it is a data table with columns for Instrument, Control, Detector, Status, Sample Name, Raw File, Method File, Method, Calib. File, Run Time, Response, Sequence File, and Reference File. The first row shows '1A' with a status of 'Awaiting Download'.
- Chrom Perfect Analysis [SingleUser-]:** This window displays a chromatogram plot. The y-axis is labeled 'Response - Counts' (0 to 240) and the x-axis is 'Time - Minutes' (0.0 to 1.4). The plot shows a series of peaks, with the most prominent one at approximately 0.48 minutes. The peaks are labeled with their retention times.
- Process Control Monitor:** A smaller window in the foreground shows the status of the process control. It includes a message: '04/05/12 11:21:40 Error 12 connecting to Acromag unit at 0.0 0.0: Connection time-out'. Below this, it indicates 'Running since 4/5/2012 11:21:40 AM' and 'Current Time 11:27:16 AM 11:27:16'. The 'Monitor Status' is 'Waiting for next scheduled sampling' and the 'Instrument Status' is 'Awaiting Download'. There are buttons for 'Copy to Clipboard', 'Enable Streams', 'Abort Sequence', 'Dismiss Alarm', and 'Clear Process Log'.

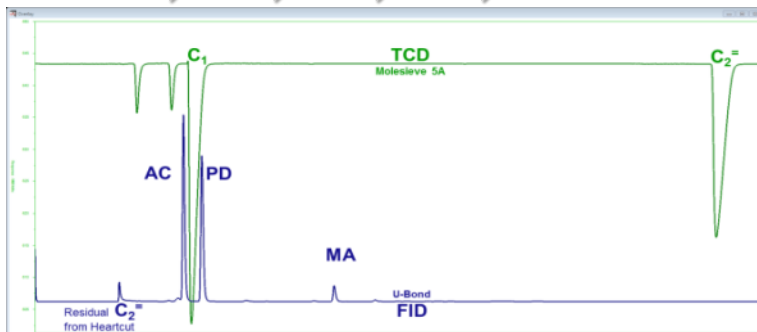
The Windows taskbar at the bottom shows the system clock as 11:25 AM on 4/5/2012, along with various application icons and system tray icons.



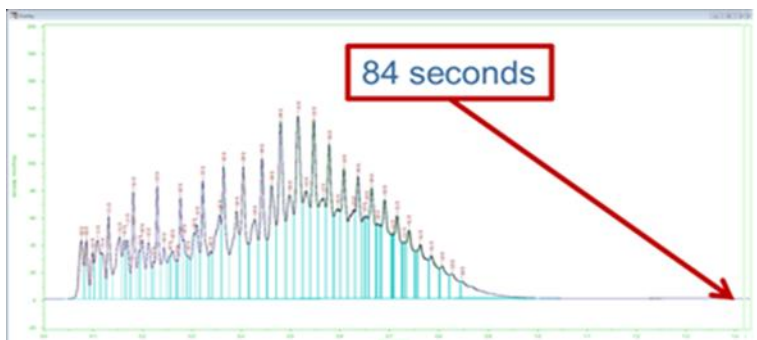
# Application Range Examples



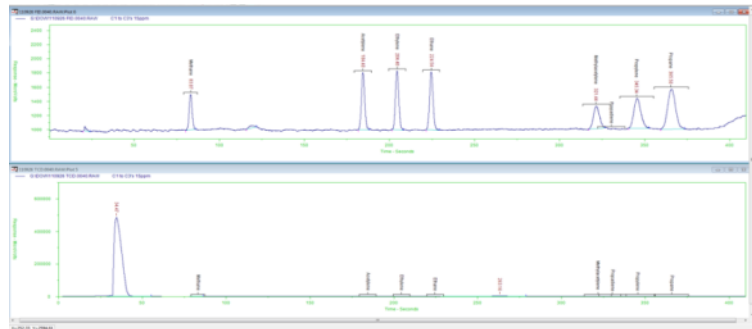
● He, O<sub>2</sub>, N<sub>2</sub>, CO, C<sub>1</sub> CO<sub>2</sub>



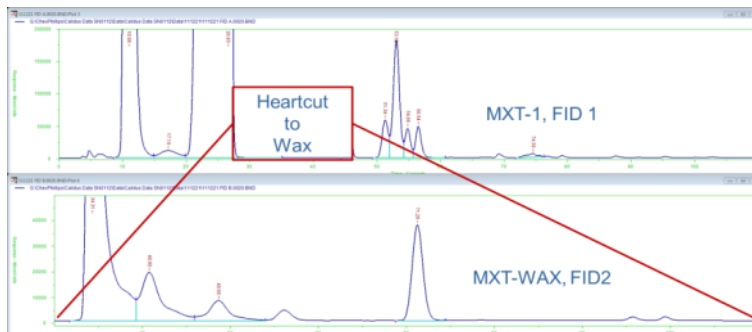
● Air, CO, C<sub>1</sub>, C<sub>2</sub>=, AC, PD, MA



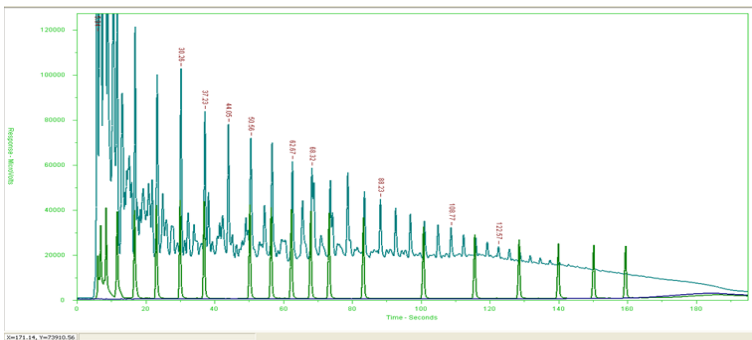
● ASTM D-2887 & UltraFast D-2887



● C<sub>1</sub>, AC, C<sub>2</sub>=, C<sub>2</sub>, MA, C<sub>3</sub>=, C<sub>3</sub>



● C<sub>6</sub> to C<sub>9</sub> Heartcut



● Crude Characterizations

*Falcon Analytical  
makers of the . . .*

**CALIDUS**  
micro GAS CHROMATOGRAPH

*in the lab...*

*in the process...*

*in the field.*



***Thank you for your  
attention.***

**10/16/2012**