Forensic Blood Alcohol Determination with the Intuvo 9000 GC

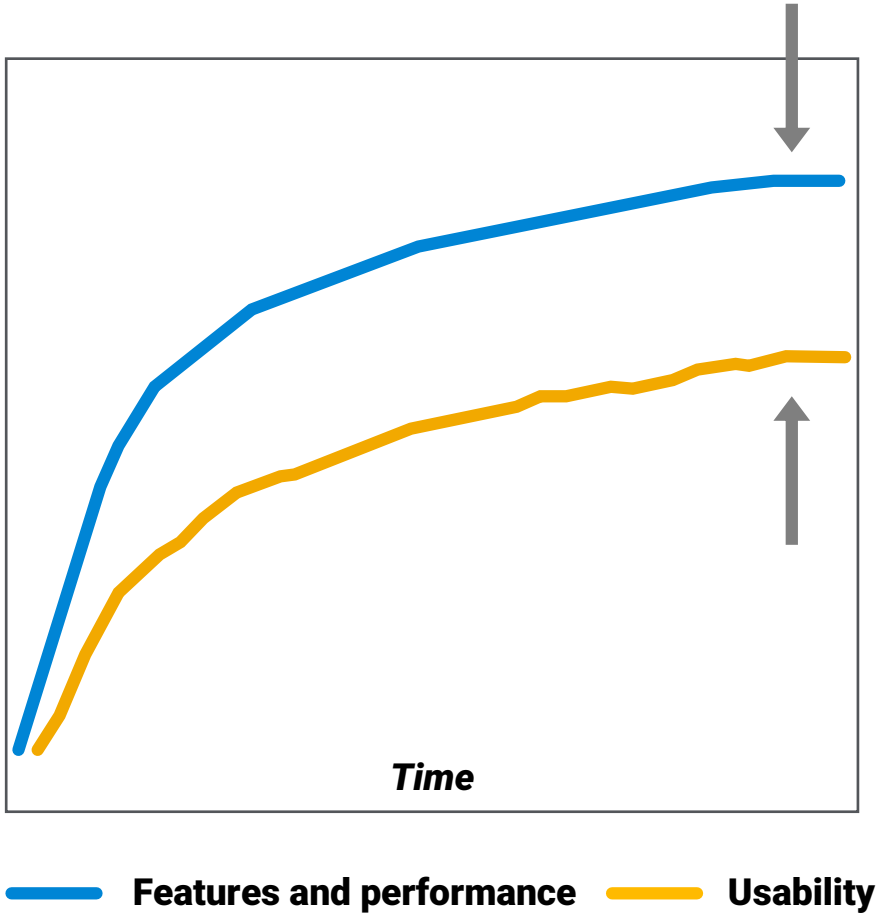
Rebecca Veeneman, Ph.D
Applications Chemist

Agilent
Trusted Answers

For Forensic Use

The GC Usability Gap

Usability lags features and performance



- Over the years, GC features and performance have matured and largely serve today's needs
- Usability has lagged and does not meet today's expectations, especially as expertise more scarce

A Time for Change

Shifting Demographics

- Seasoned operators retiring; highly skilled replacements harder to find
- GC troubleshooting skills not necessarily located at point of use
- Operators assuming multiple responsibilities

Challenging Economics

- Budgets squeezed, expectations increased
- Capital purchase decisions made on business NOT technical basis

The GC Community Voice

We listened and responded

Improve the User Experience

- Install and setup
- Use and maintain
- Make GC more practical for today's busy forensic lab enterprise

Prepare for Next Generation of Users

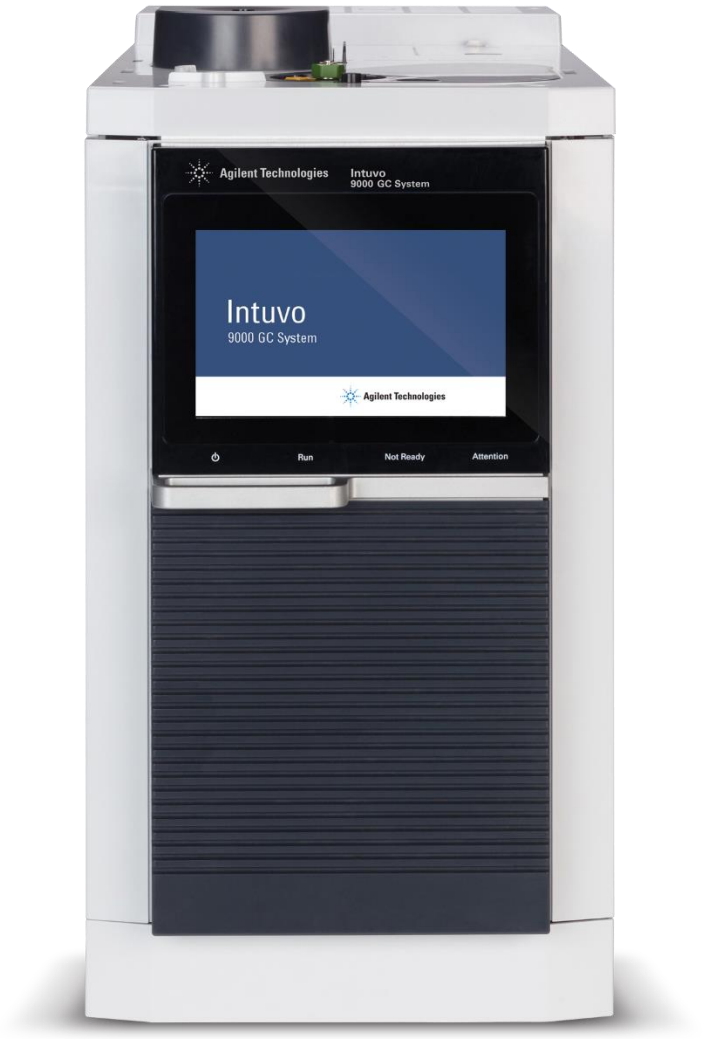
Its not only about better analytical performance – its about better lab outcomes

Make GC Easier

Innovating a New Path to GC Productivity

A whole new way to GC

- Easier
- Faster
- Smaller
- Smarter
- Greener



Innovating a New Path to GC Productivity

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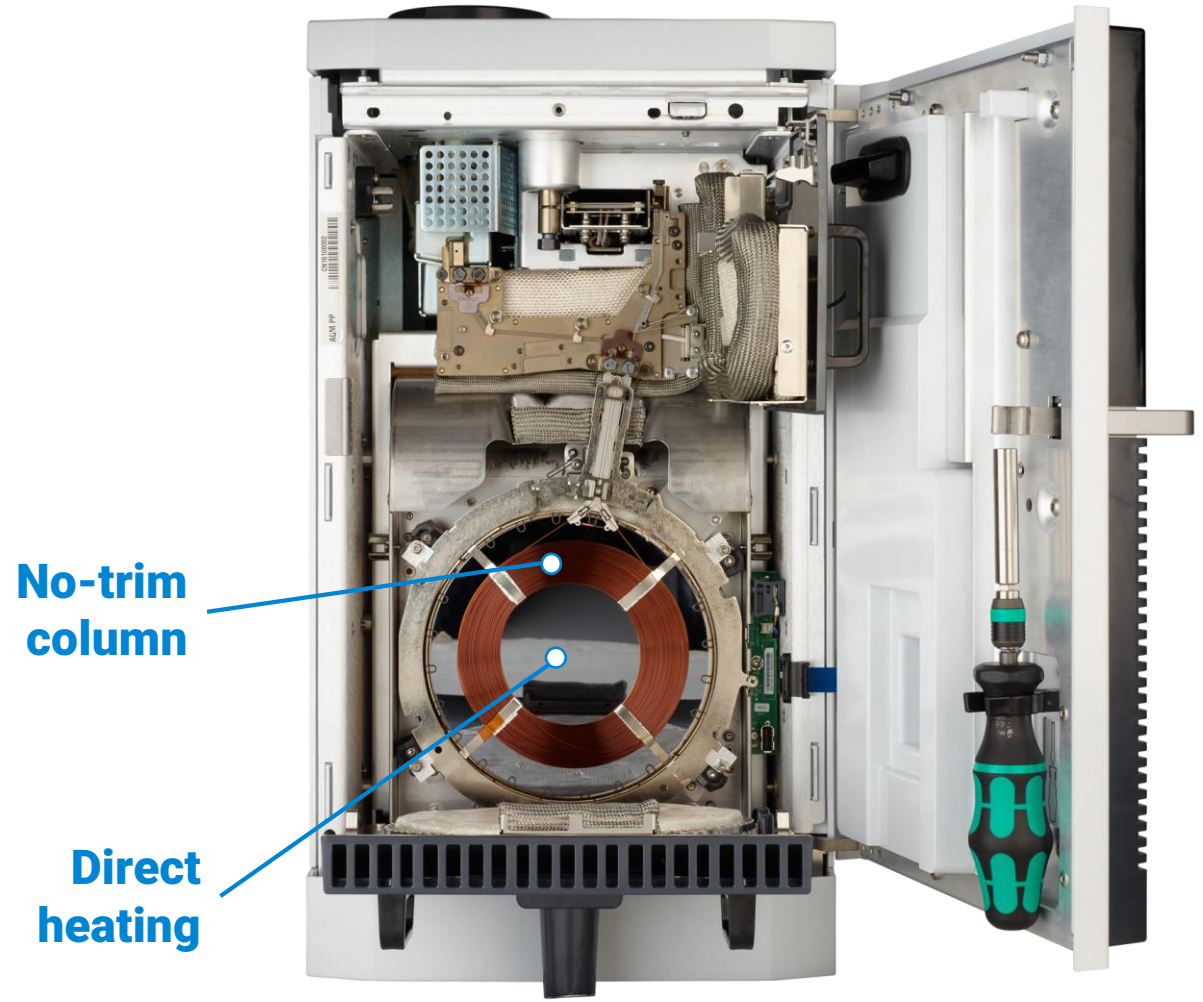


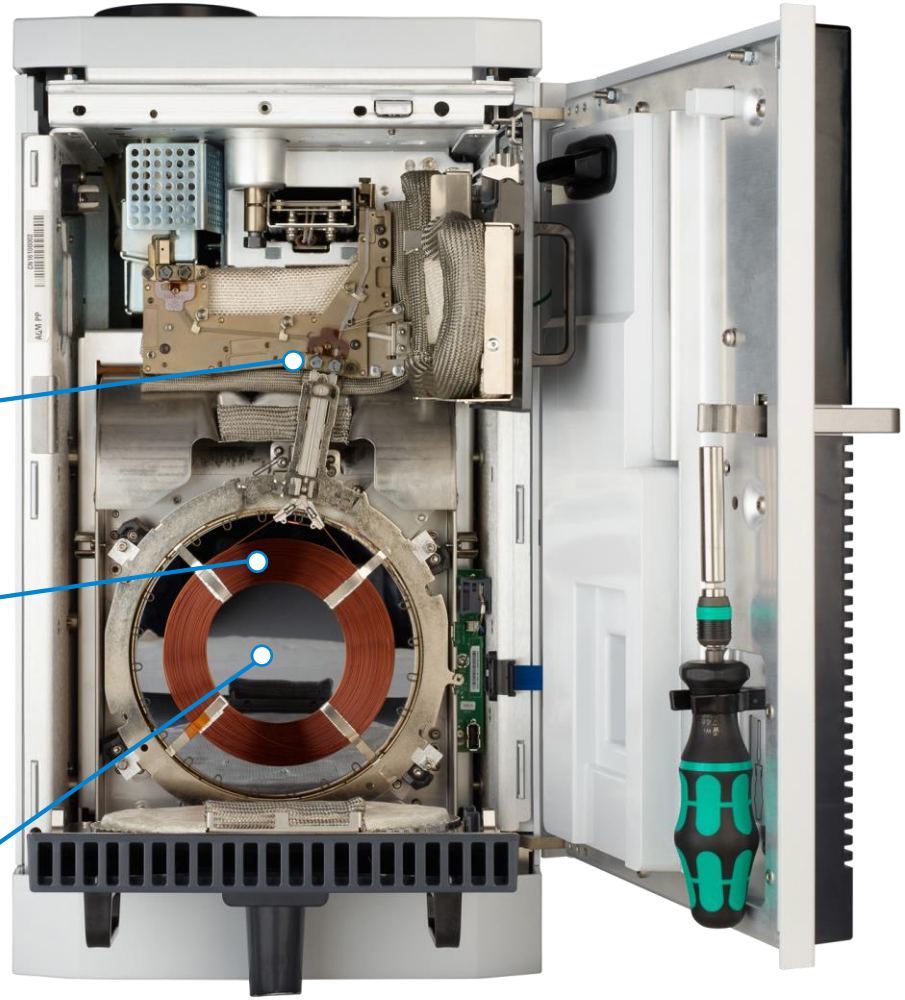
Innovating a New Path to GC Productivity

A whole new way to GC

Ferrule-free click-and-run connections

No-trim column

Direct heating



Innovating a New Path to GC Productivity

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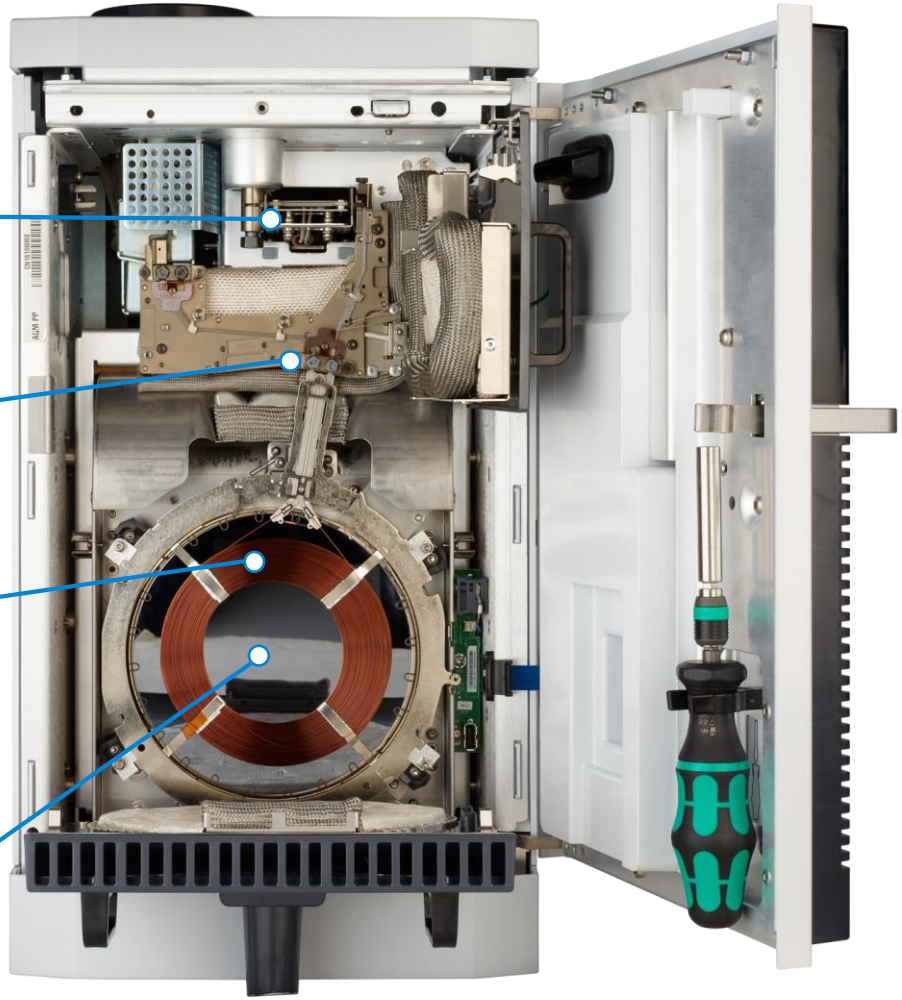
Disposable Guard chip

Ferrule-free click-and-run connections

No-trim column

Direct heating



Innovating a New Path to GC Productivity

A whole new way to GC

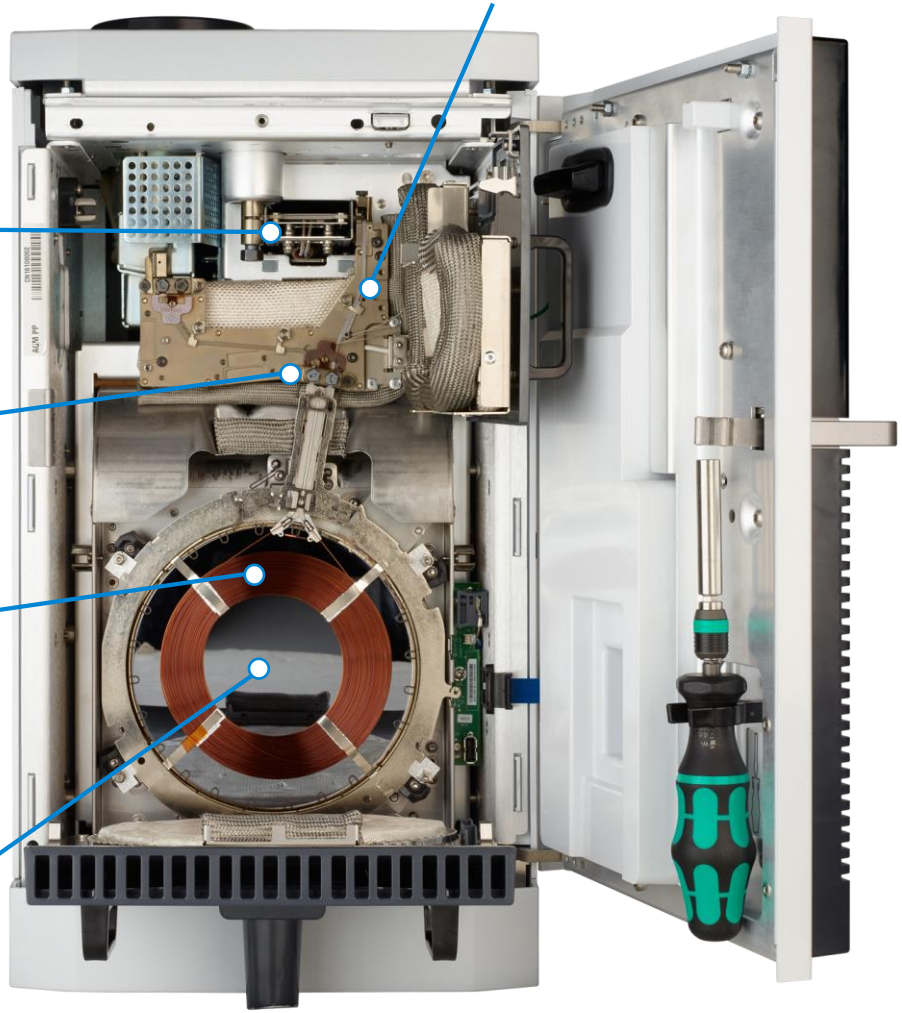
Disposable
Guard chip

Modular
Intuvo flow chips

Ferrule-free click-and-
run connections

No-trim
column

Direct
heating

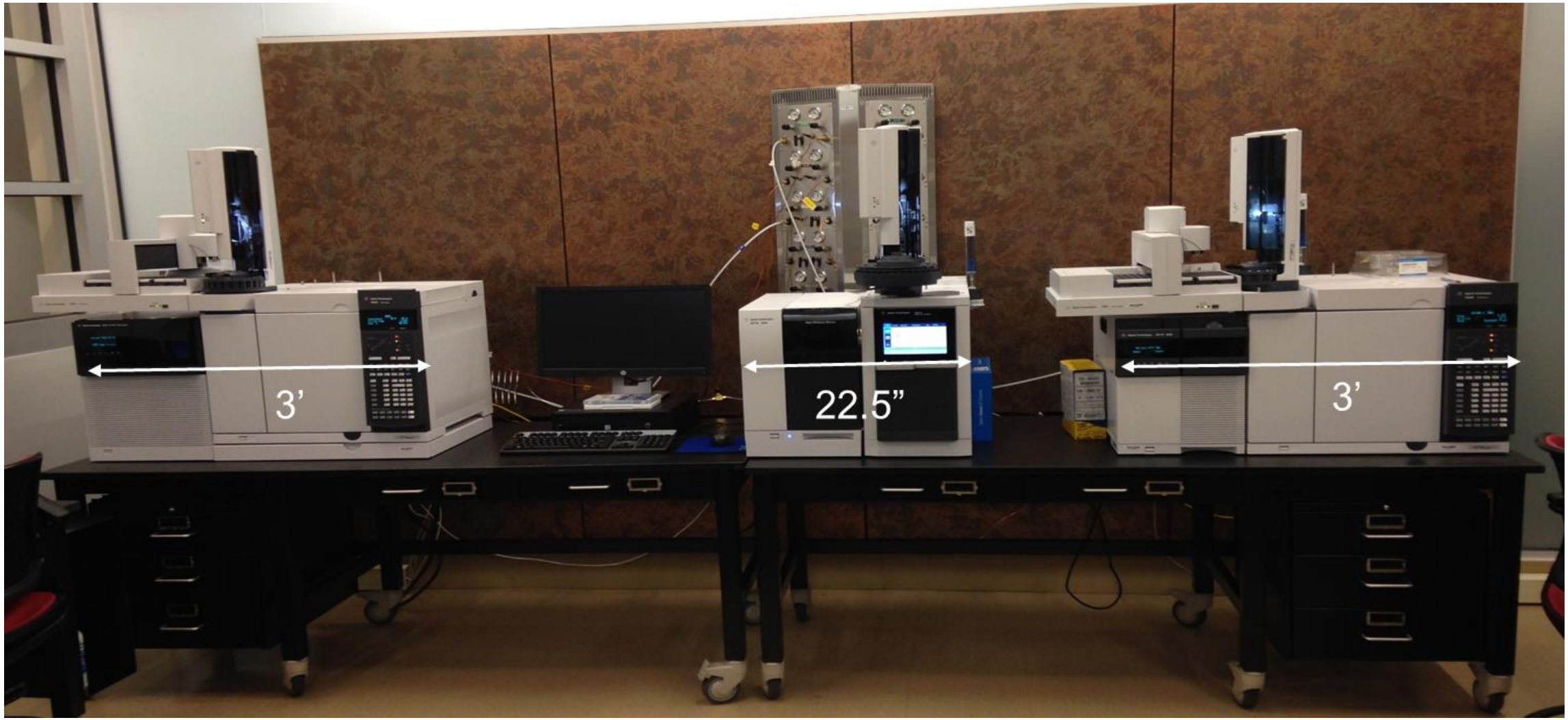


Flexible Compatible Design

Configurable to any application

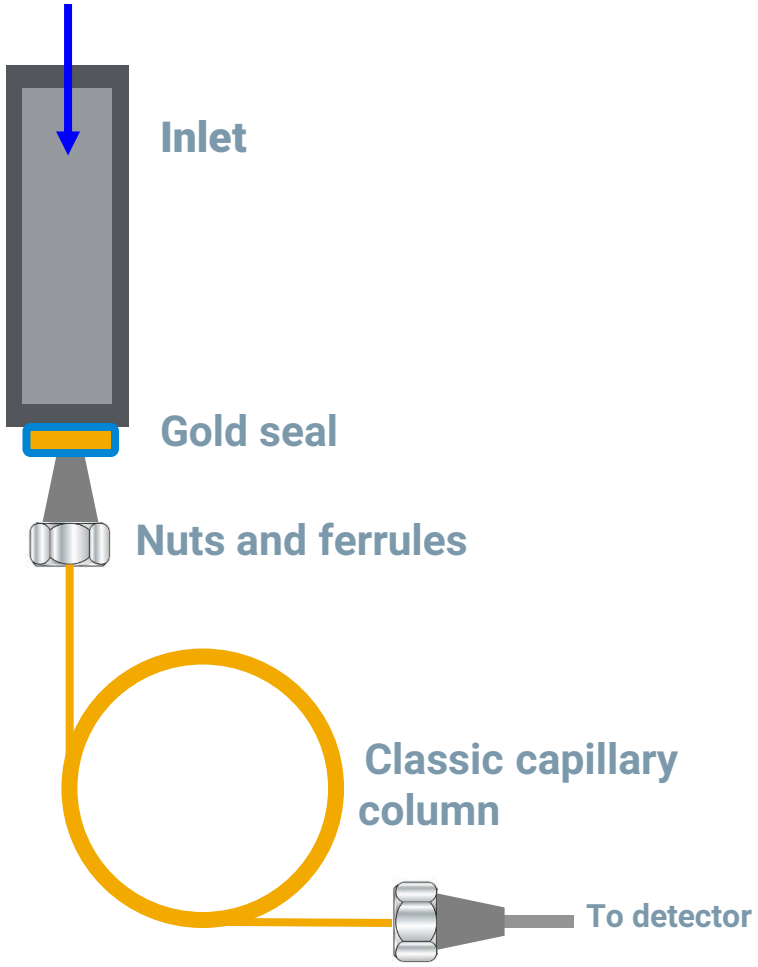
- SSL, MMI, GSV, LSV inlets
- FID, TCD, ECD, NPD, FPD, NCD, SCD detectors
- SQ and TQ mass spectrometers
- Headspace, thermal desorption, purge and trap samplers
- 16-, 50-, 150-position auto-injectors and trays
- Software: OpenLAB and MassHunter

Little Falls Delaware Center of Excellence (COE)



Innovating the GC Flow Path

Conventional flow path



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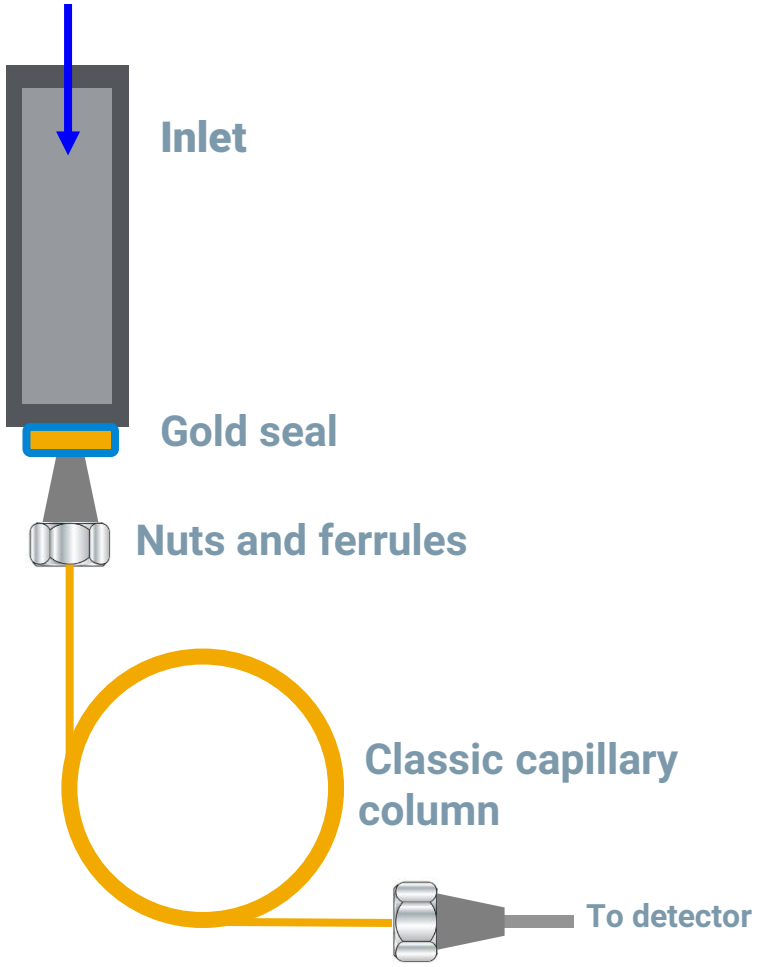
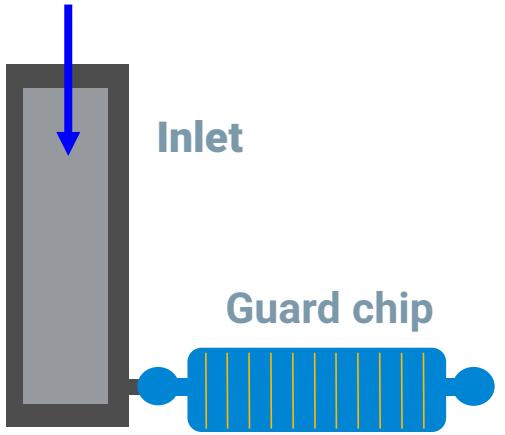


Intuvo flow path



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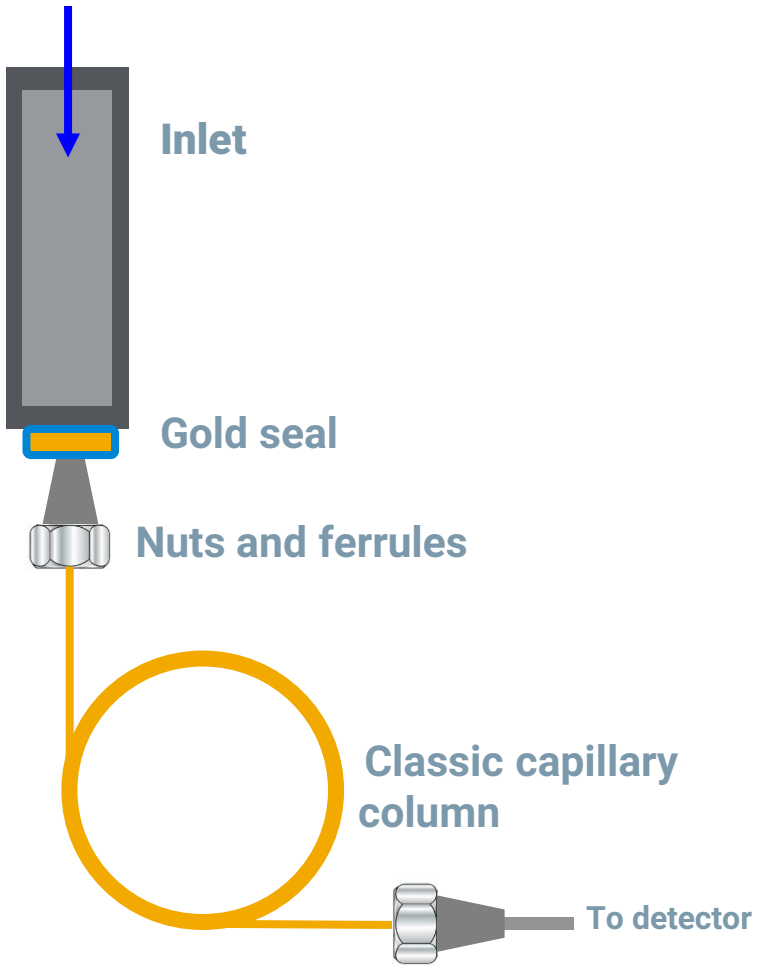
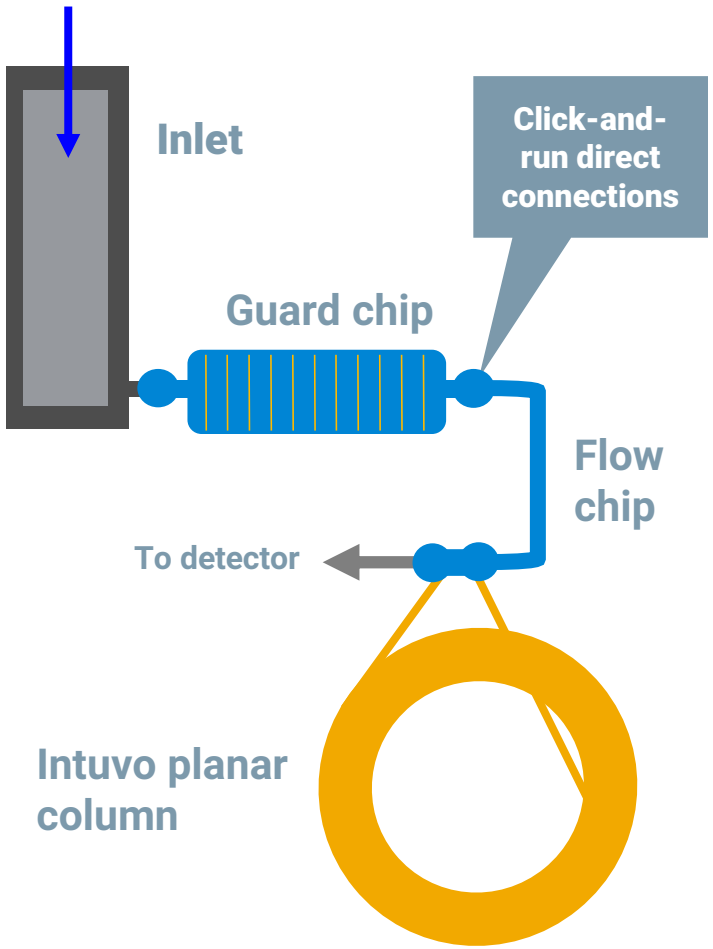
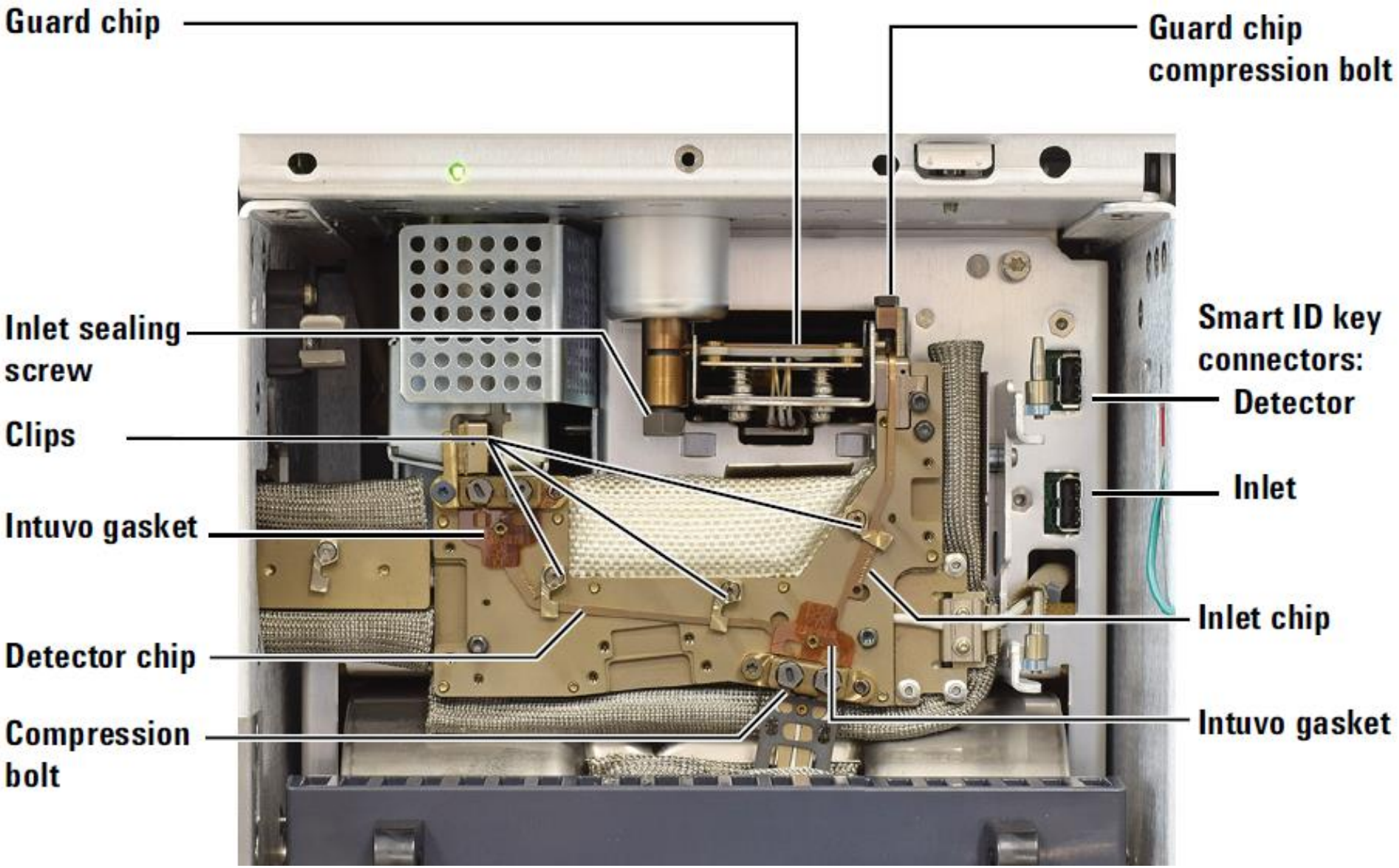


Intuvo flow path

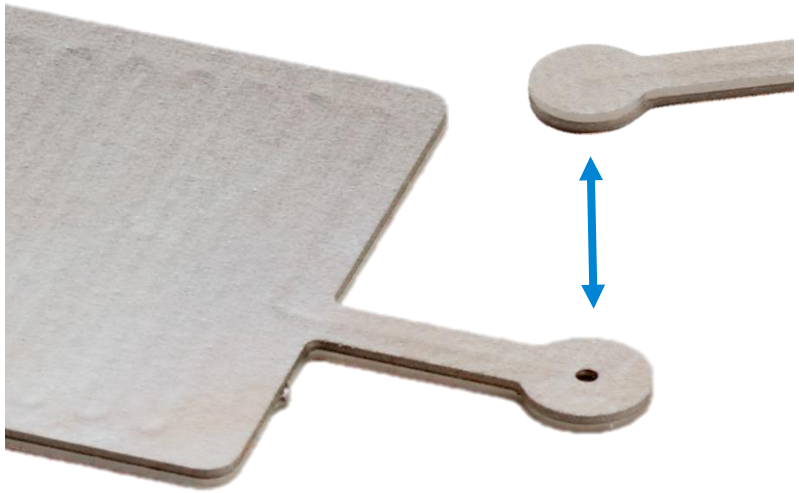


The Intuvo Chips Installed



Click-and-Run Direct Connections

Eliminating connection uncertainty



- No more ferrules
- Direct face seal connections
- Audible and tactile click lets you know connection is made

- Easier to train
- Less unplanned downtime
- Fewer batch reruns and precious samples lost

Intuvo Guard Chip and No-trim Columns

Running more, maintaining less

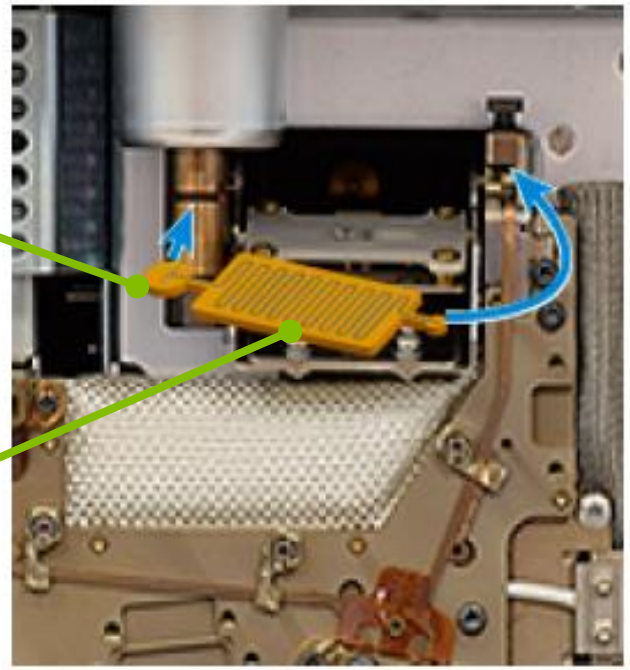
- Simple disposable design
- No column trimming
- Retention time reproducibility

- Less maintenance time
- Less recalibration and requalification
- Less unplanned downtime

Install The Guard Chip

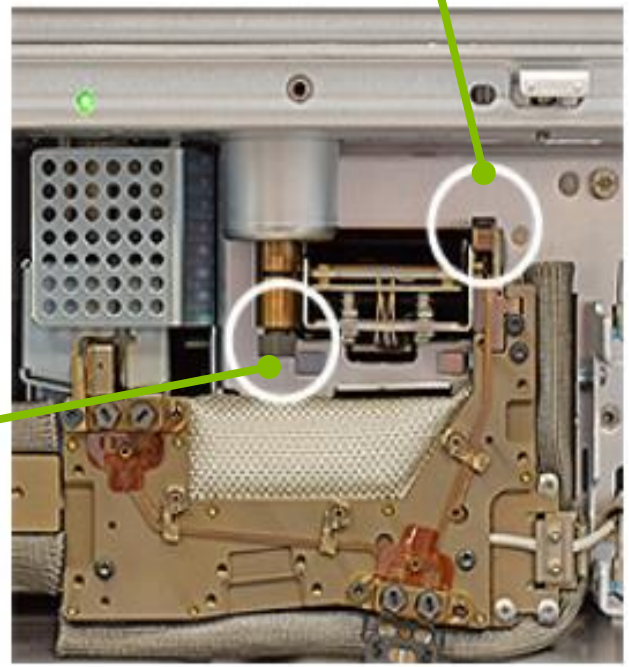
Replaces Gold Seal

Acts as a Guard Column



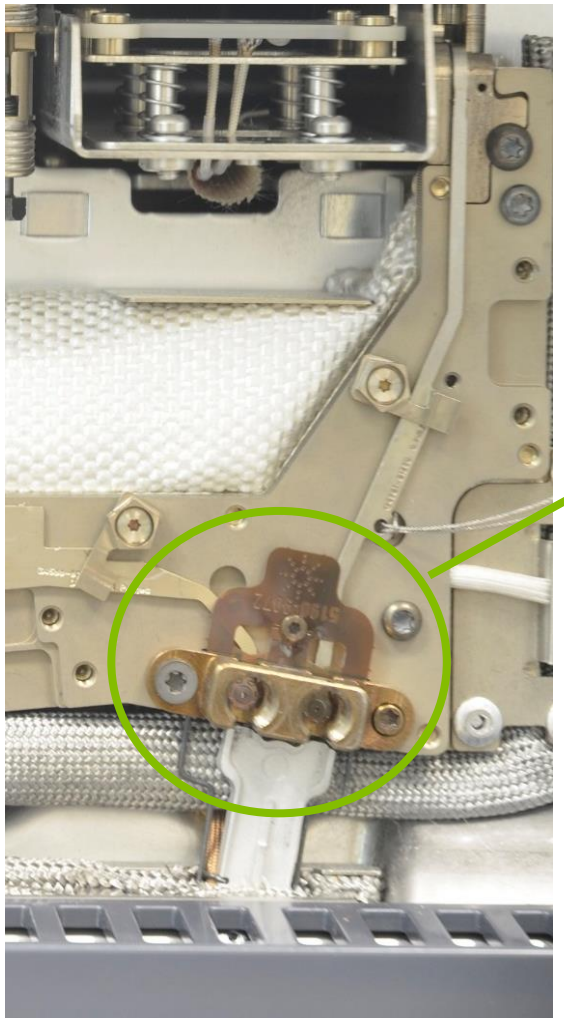
Use Torque Screwdriver

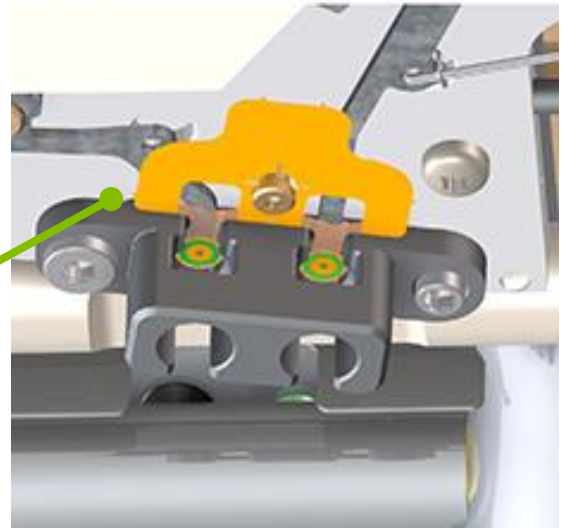
Use two wrenches for MMI

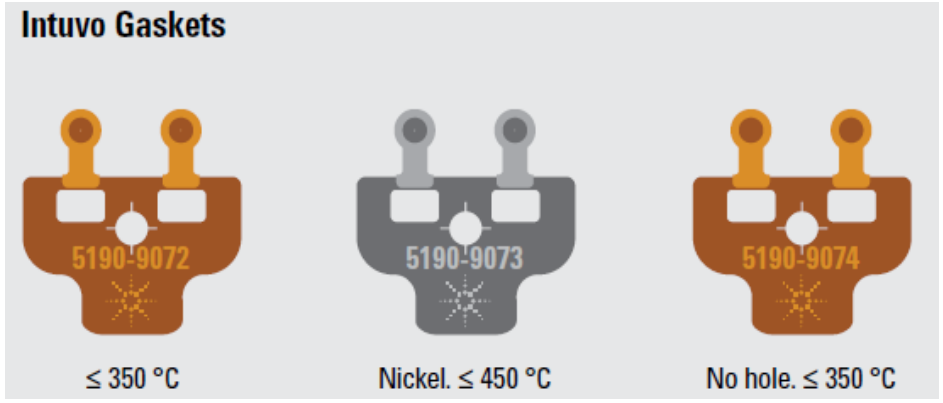


Install The Column Gasket

Install a new Gasket…

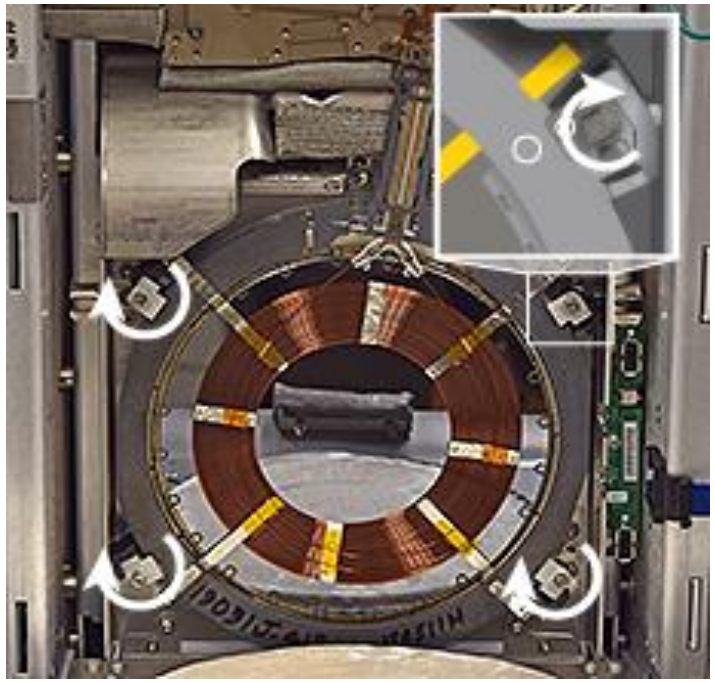


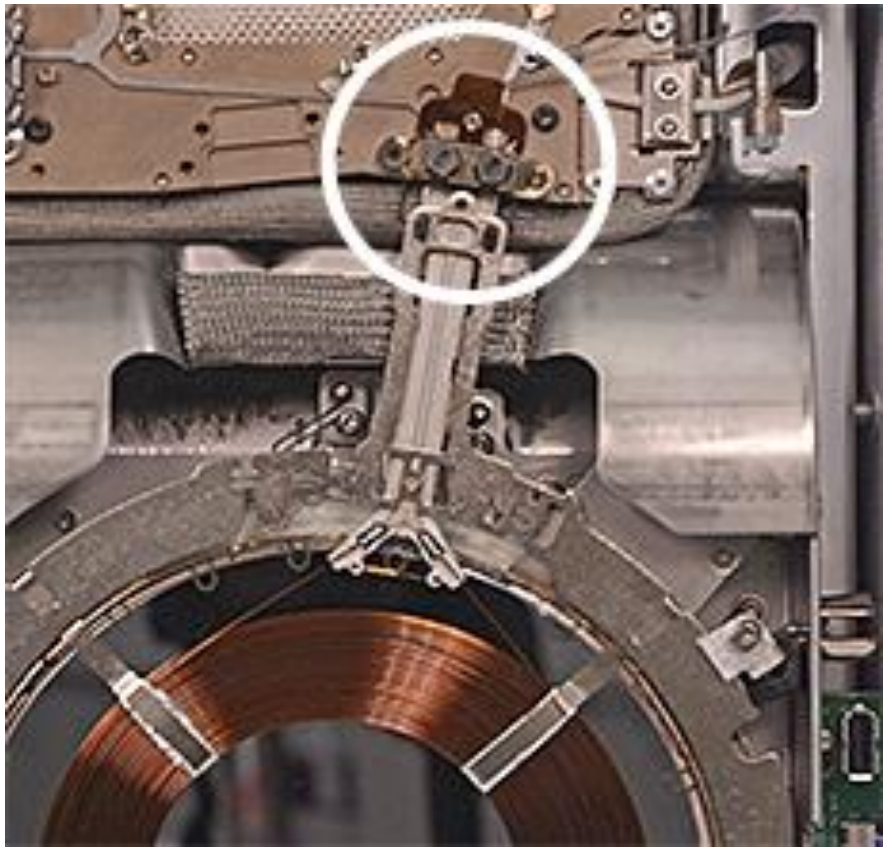




Install The Column

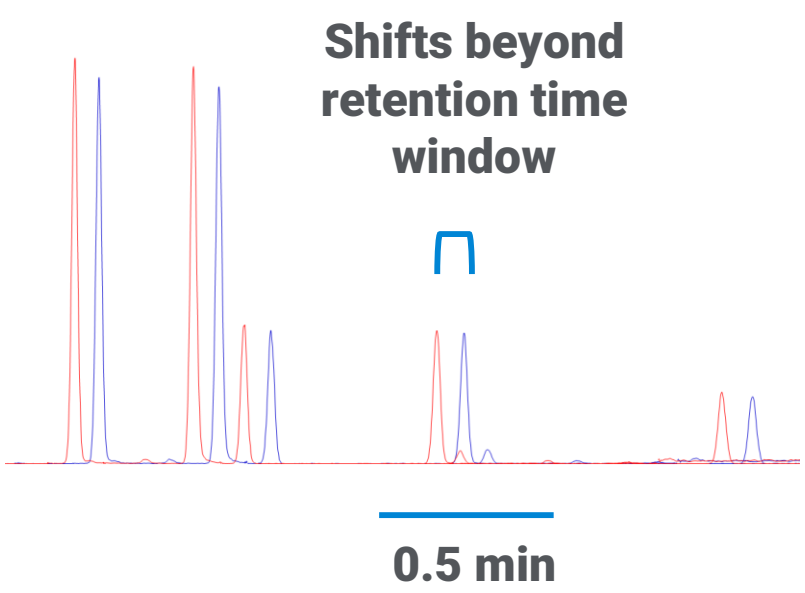
- Place the column into position
- Insert the Smart ID in the lower Column 1 Connector
- Use the Torque screwdriver to tighten the “Click and Run” connectors
- Secure the Column Clamps





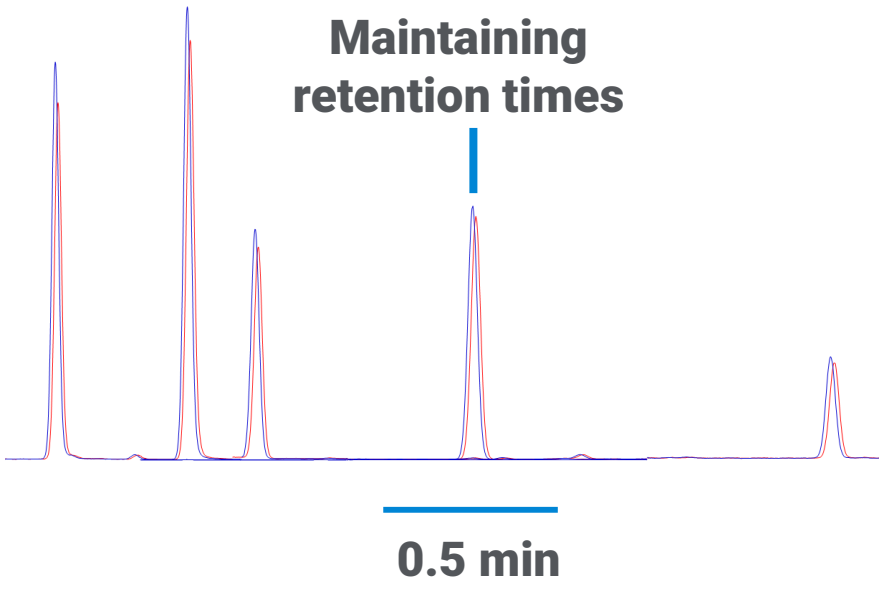
Intuvo Guard Chip and No-trim Columns
No retention time shifts after maintenance

Conventional Column



Pesticide mix injected before and after 300 mm column trim

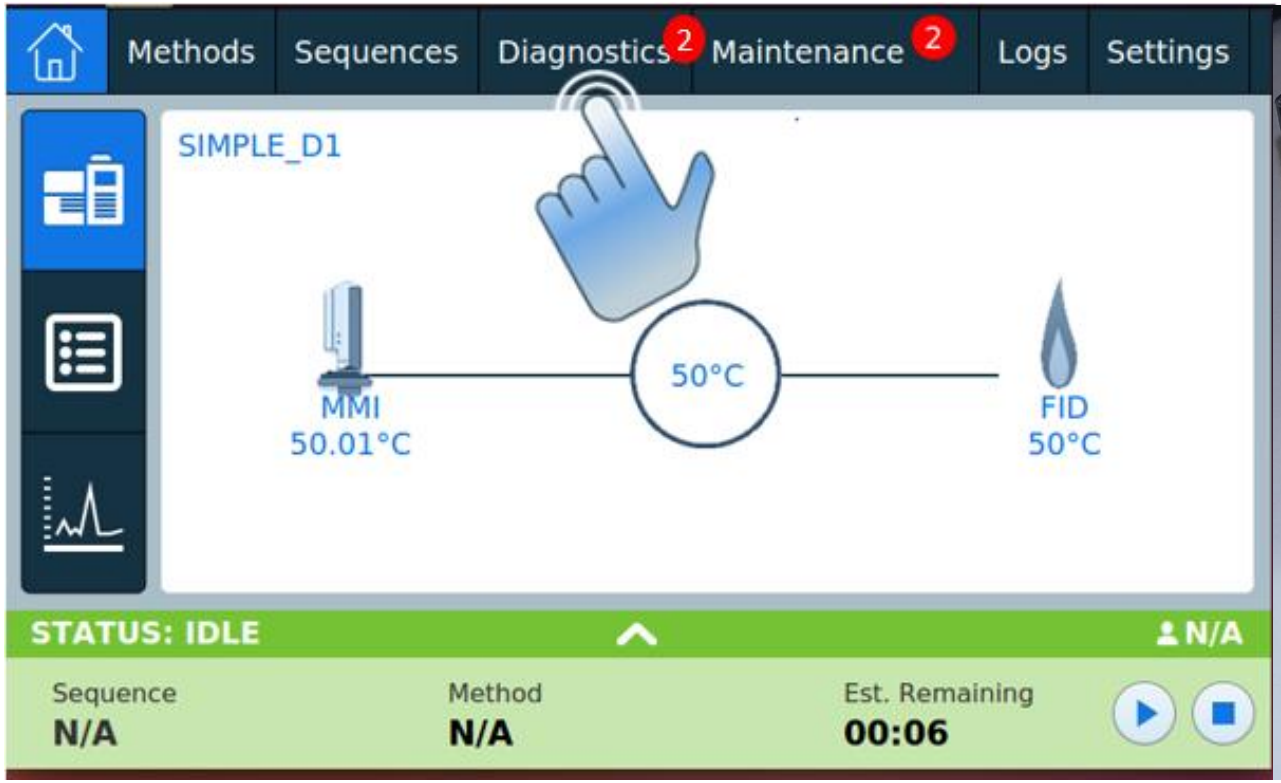
Intuvo Column



Pesticide mix injected before and after guard chip change

Autonomous Leak Checking

Avoiding unplanned downtime



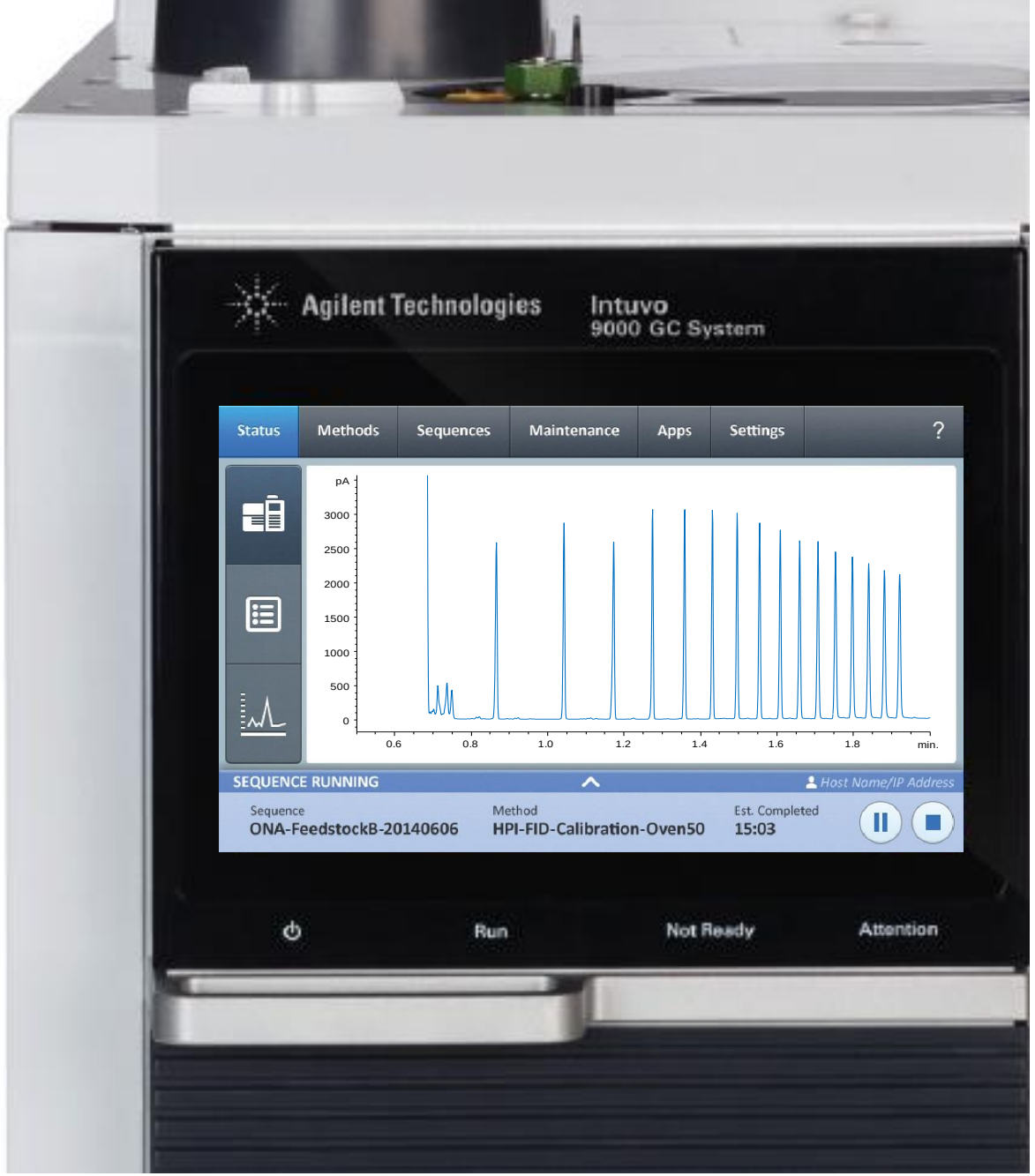
Microfluidic-enabled 6th generation EPC modules allow hands-free leak checking to confirm and document leak-free operation autonomously.

Intuvo Graphical User Interface

- System status

Intuvo Graphical User Interface

- System status
- Real-time chromatograms



Intuvo Graphical User Interface

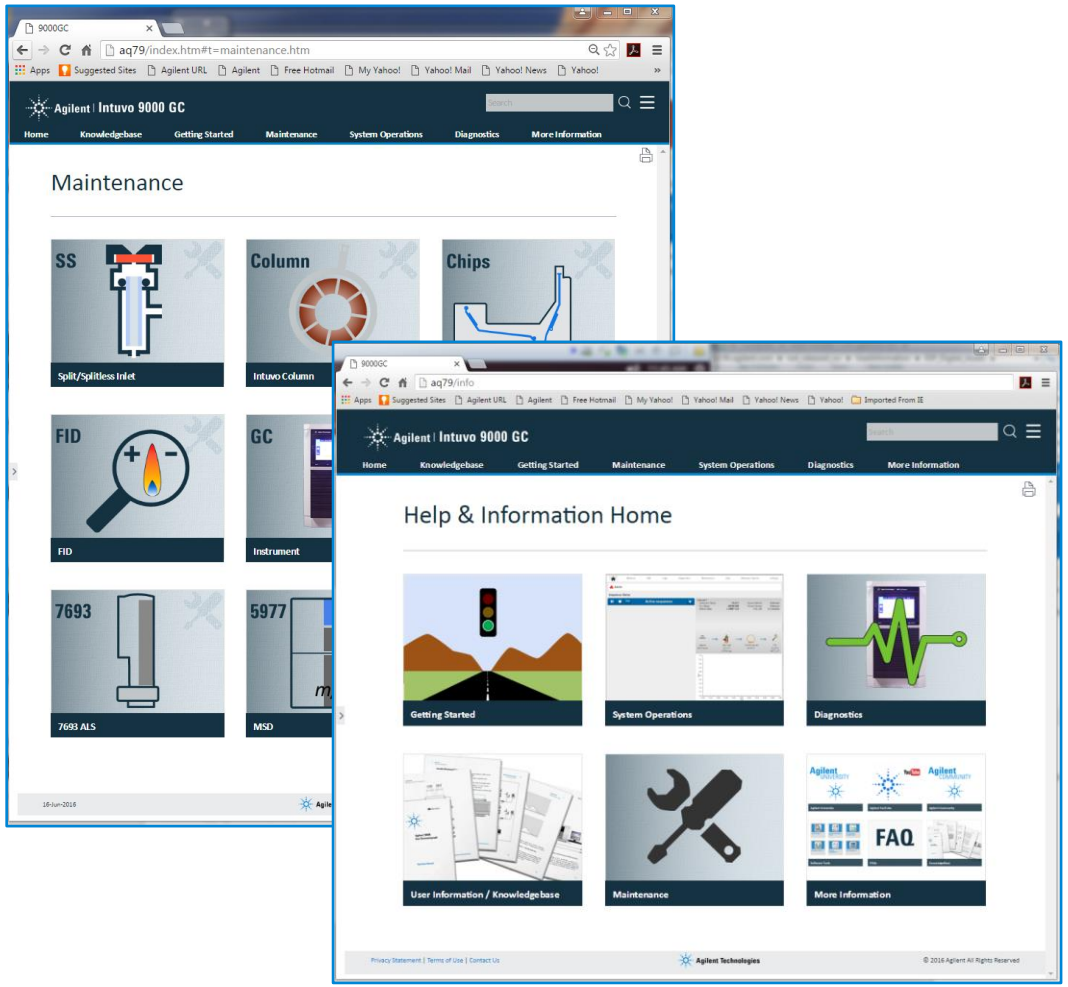
- System status
- Real-time chromatograms
- Step-by-step user maintenance and troubleshooting

Intuvo Graphical User Interface

- System status
- Real-time chromatograms
- Step-by-step user maintenance and troubleshooting
- Finding parts fast

Internet of Things

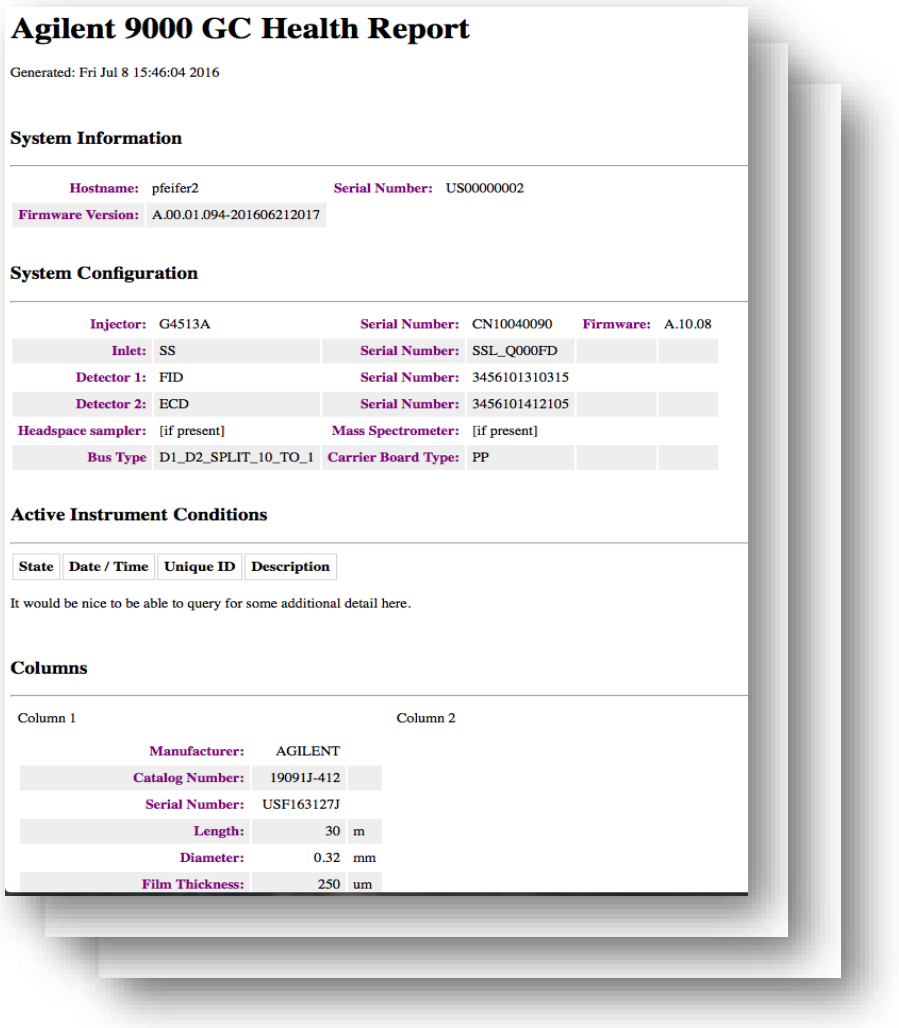
A full suite of customer support



- Intuvo serves up a web homepage
- User help for Maintenance, troubleshooting and diagnostics
- Accessible through any approved PC or mobile device securely on internal network

Agilent CrossLab Services for Intuvo

A streamlined service experience



Agilent 9000 GC Health Report

Generated: Fri Jul 8 15:46:04 2016

System Information

Hostname:	pfeifer2	Serial Number:	US00000002
Firmware Version:	A.00.01.094-201606212017		

System Configuration

Injector:	G4513A	Serial Number:	CN10040090	Firmware:	A.10.08
Inlet:	SS	Serial Number:	SSL_Q000FD		
Detector 1:	FID	Serial Number:	3456101310315		
Detector 2:	ECD	Serial Number:	3456101412105		
Headspace sampler:	[if present]	Mass Spectrometer:	[if present]		
Bus Type	D1_D2_SPLIT_10_TO_1	Carrier Board Type:	PP		

Active Instrument Conditions

State	Date / Time	Unique ID	Description

It would be nice to be able to query for some additional detail here.

Columns

Column 1

Manufacturer:	AGILENT	
Catalog Number:	19091J-412	
Serial Number:	USF163127J	
Length:	30	m
Diameter:	0.32	mm
Film Thickness:	250	um

Column 2

- **Intuvo 9000 GC Health Report**
- **Installation and familiarization**
- **Compliance services**
- **Education**

BAC Dual FID configuration

Blood Alcohol Concentration Forensic Application Requirements

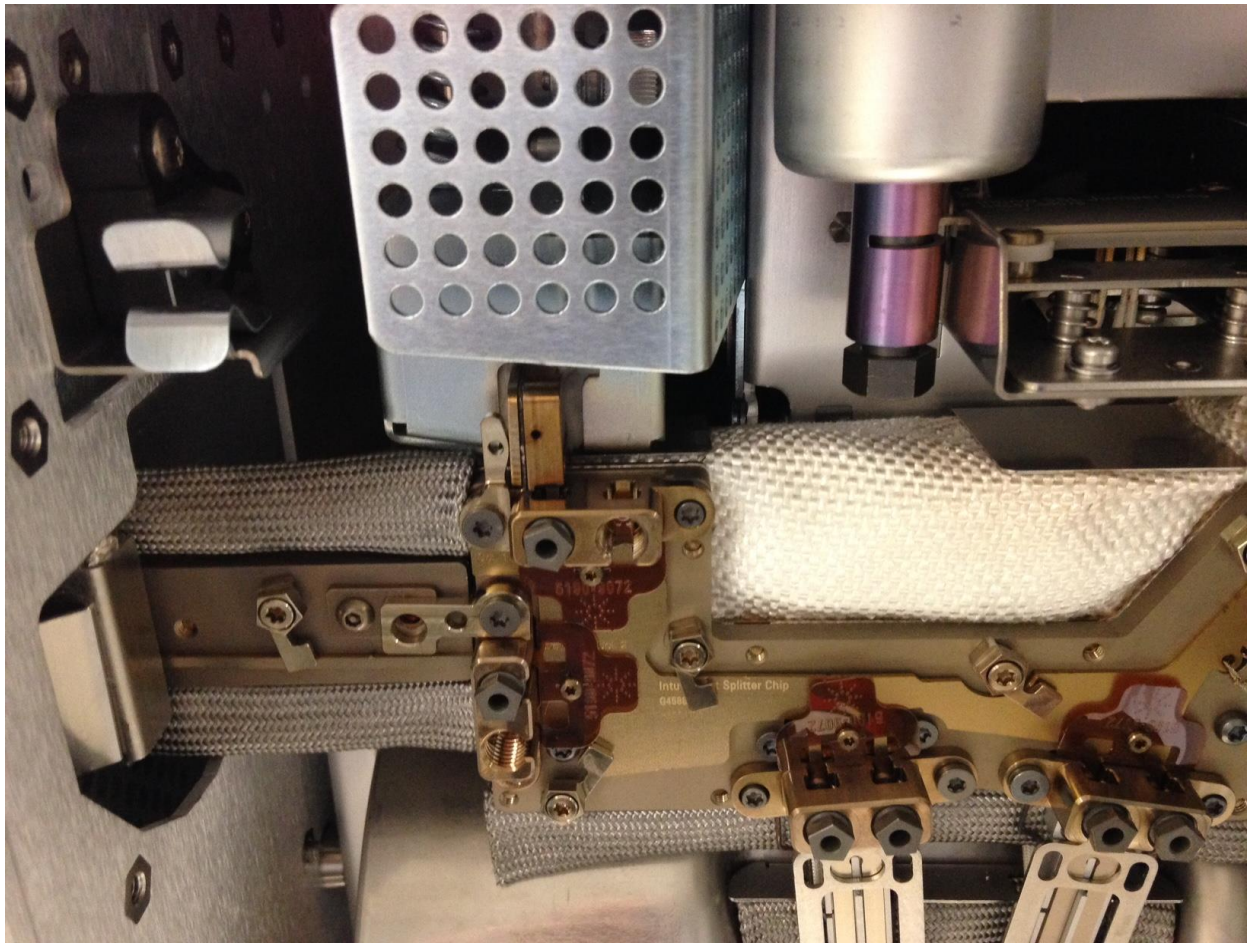
Determination of blood alcohol concentration requires rigorous control.

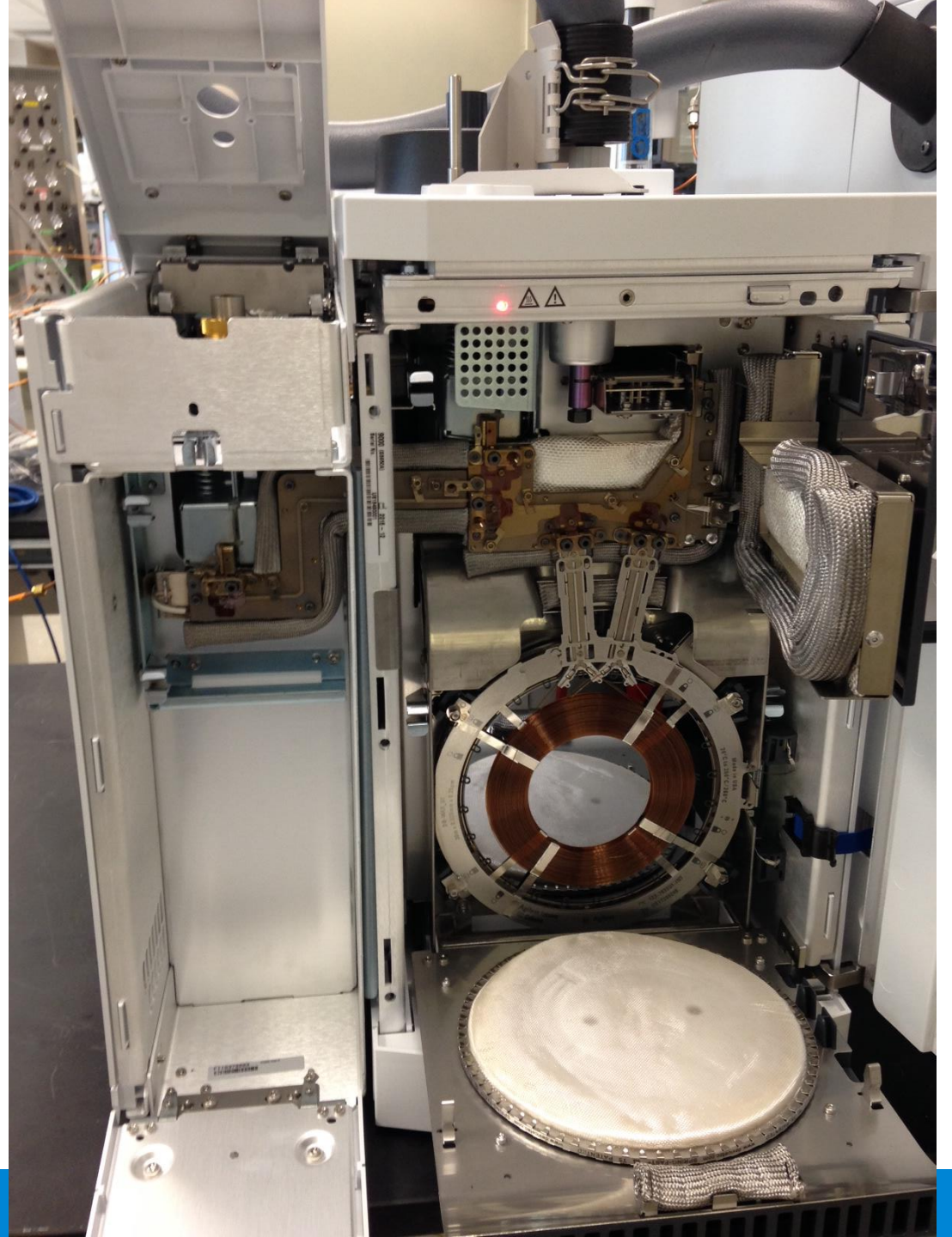
- **Many forensic labs use flame ionization detection (FID) which lacks identification capabilities**
- **Often a second system with a column having different retentive properties is used to confirm analyte identification**

Blood alcohol concentration determination and confirmation can be achieved simultaneously with the Intuvo 9000 GC.

- **An Intuvo 9000 GC system was equipped with a 7697A Headspace Sampler and configured with an inlet splitter allowing dual column, dual FID analysis.**
- **NEW BAC UI columns (123-9334UI-INT and 123-9434UI-INT) were used which improve resolution of critical analytes**

Intuvo Dual Flow Path





7697 Headspace parameters

7697 Headspace Sampler	Set point
Oven	70°C
Loop	70°C
Transfer line	90°C
Vial equilibration time	7min
Injection duration	0.5min
Vial size	20mL
Vial shaking	off
Vial fill mode	Default (50mL/min to 15psi (0.1min))
Vial fill pressure	15psi
Loop ramp rate	30psi/min
Loop final pressure	1.5psi
Loop equilibration time	0.05min

Intuvo Parameters

Intuvo 9000 GC	Set point
Oven	40°C (6.5min)
Split/Splitless Inlet	Split 10:1, 110°C
DB-BAC1 UI (123-9334UI-INT) 30m x 320µm x 1.8µm	Constant pressure 21psi
DB-BAC2 UI (1230-9434UI-INT) 30m x 320µm x 1.2µm	Controlled by column 1
FID (Front and Back)	250°C
H2	30mL/min
Air	400mL/min
N2 (makeup)	25mL/min
Jumper chip	110°C
Bus	Default (On 200°C)
Front/Back Signal	20Hz

Jumper chip set to the inlet temperature

Bus temperature set to default

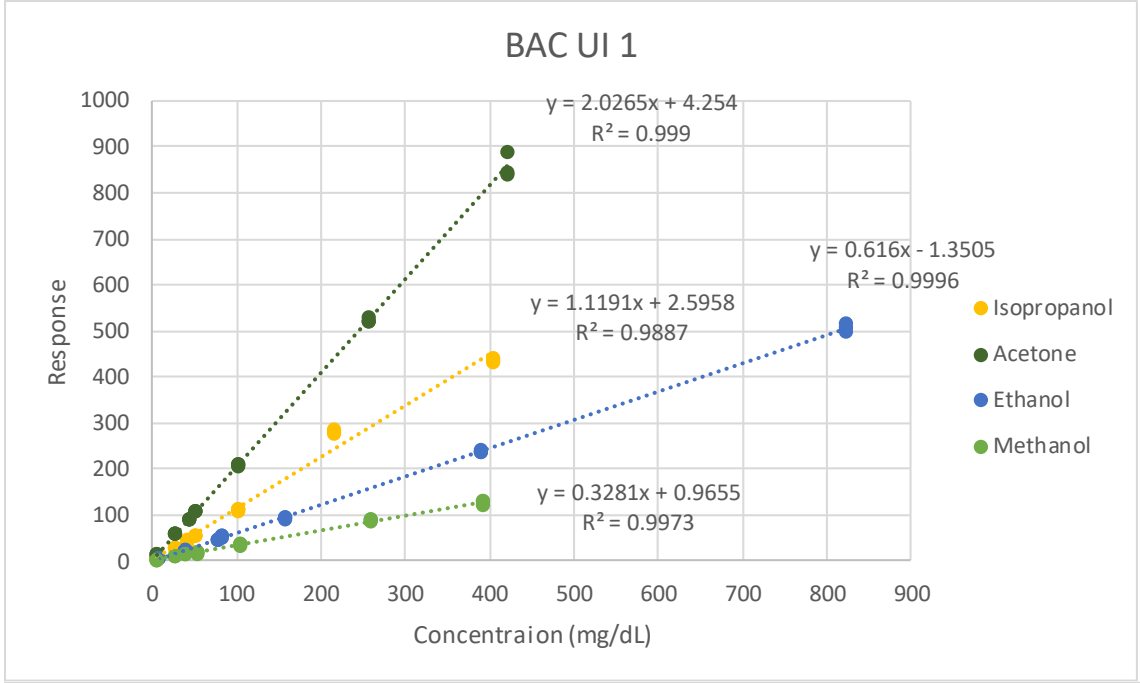
Calibration Results

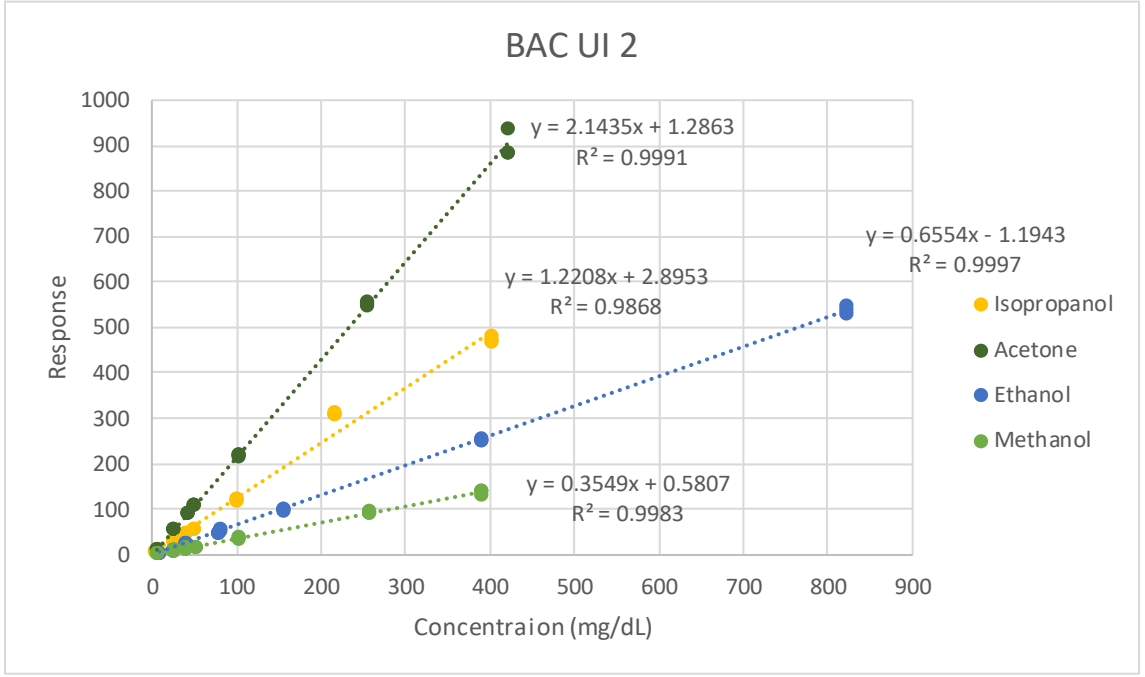
Calibration standards were made in house

- **0.8% to 0.01%**
- **methanol, acetaldehyde (not quantified), acetone, ethanol, and isopropanol.**
- **Headspace vials were made in triplicate at each level consisting of 450 µL of internal standard (0.3% n-propanol) and 50µL of standard.**

Calibration curves for methanol, ethanol, acetone, and isopropanol are shown right.

- **Ethanol calibration curves yield 0.9996 or better for the dual column ensemble.**
- **Slope difference between the two column/detector pairs is 6.3%**





Calibration Accuracy Verification

- **Agilent Ethanol Standards were evaluated on the Intuvo 9000 GC.**
- **The concentration of the ethanol standards were calculated based on the calibration curves and compared to the expected concentration.**
- **Pass or fail was determined with ± 6% error tolerance.**

Ethanol Standard	Calculated Concentration DB-BAC1 UI	Pass/Fail	Calculated Concentration DB-BAC2 UI	Pass/Fail
20mg/dL (5190-9756)	19.8mg/dL	Pass	19.3mg/dL	Pass
50mg/dL (5190-9757)	50.0mg/dL	Pass	47.1mg/dL	Pass
80mg/dL (5190-9758)	79.3mg/dL	Pass	76.8mg/dL	Pass
100mg/dL (5190-9759)	96.7mg/dL	Pass	94.4mg/dL	Pass
150mg/dL (5190-9760)	152mg/dL	Pass	149mg/dL	Pass
200mg/dL (5190-9761)	197mg/dL	Pass	193mg/dL	Pass
300mg/dL (5190-9762)	302mg/dL	Pass	302mg/dL	Pass
400mg/dL (5190-9763)	384mg/dL	Pass	386mg/dL	Pass

Area Repeatability

Area repeatability for the 80mg/dL standard as well as the Agilent Blood Alcohol Checkout mix (5190-9765) was determined for five replicate headspace vials.

Analyte	DB-BAC1 UI	DB-BAC2 UI
Ethanol 80 mg/dL standard	3.70%	2.80%
Methanol	4.10%	1.40%
Acetaldehyde	2.80%	3.00%
Ethanol	2.30%	1.10%
Isopropanol	3.30%	1.90%
T-butanol	2.80%	2.70%
Propanal	3.40%	3.00%
N-propanol	3.10%	2.10%
Acetone	3.40%	2.90%
Acetonitrile	2.30%	2.80%
2-butanol	2.00%	3.00%
Ethyl acetate	3.20%	3.10%
2-butanone	3.10%	3.00%

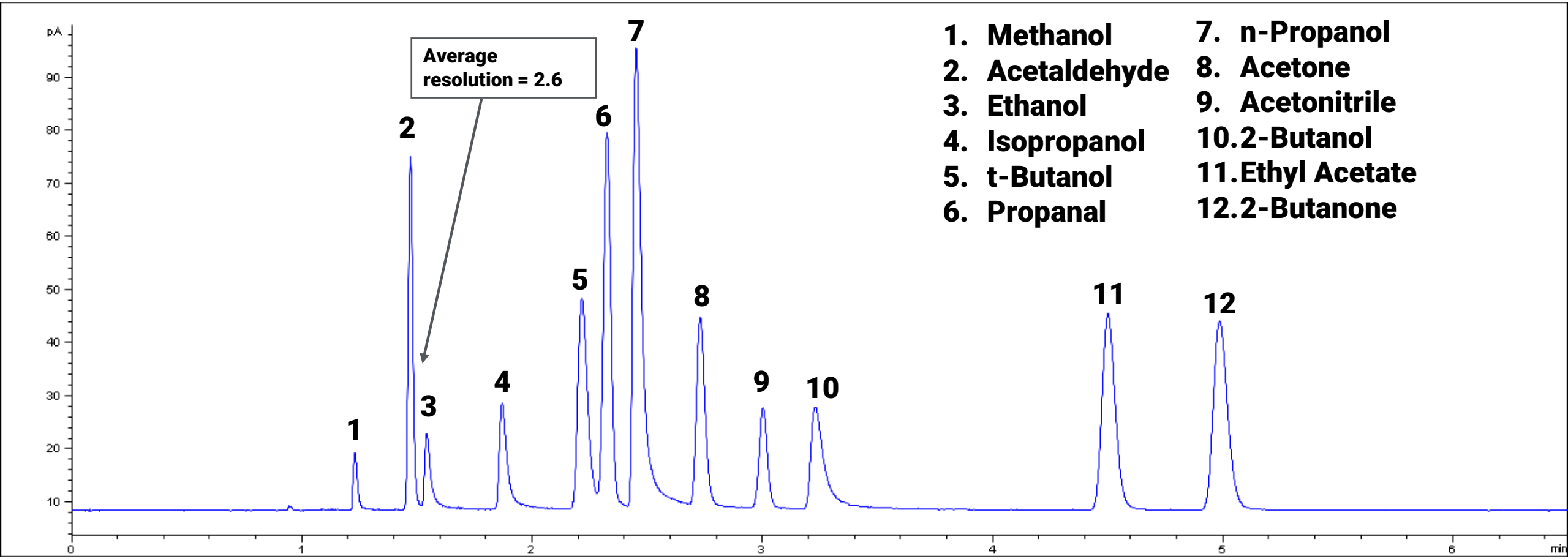
Retention Time Repeatability

Retention time repeatability for the 80mg/dL standard and the Agilent Blood Alcohol Checkout mix (5190-9765) was determined for five replicate headspace vials.

Analyte	DB-BAC1 UI	DB-BAC2 UI
Ethanol 80 mg/dL standard	0.04%	0.10%
Methanol	0.01%	0.02%
Acetaldehyde	0.01%	0.02%
Ethanol	0.02%	0.05%
Isopropanol	0.02%	0.04%
T-butanol	0.03%	0.04%
Propanal	0.01%	0.02%
N-propanol	0.03%	0.04%
Acetone	0.02%	0.03%
Acetonitrile	0.02%	0.03%
2-butanol	0.04%	0.04%
Ethyl acetate	0.02%	0.03%
2-butanone	0.02%	0.03%

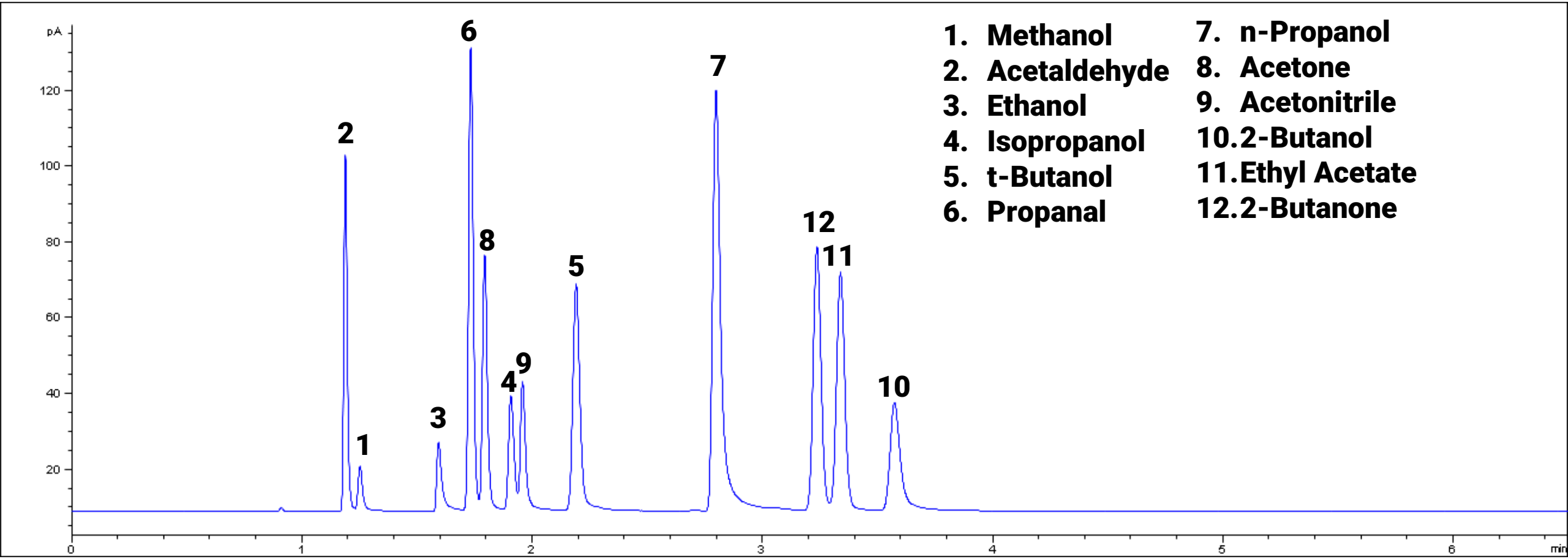
DB-BAC1 UI Blood Alcohol Checkout Mix

New columns resolve t-butanol and n-propanol from forensic analytes of interest



DB-BAC2 UI Blood Alcohol Checkout Mix

Elution order changes allow confirmation of forensic analyte identification



Conclusions

- **Forensic Analysis of blood alcohol can be easily accomplished with Intuvo**
  - **Inlet splitting capability enables analysis and confirmation in a single run on two columns of different phases**
  - **Can be configured as an Agilent Analyzer as well**
    - **Includes a factory method and report template**
- **New blood alcohol columns (DB-BAC 1 UI and DB-BAC 2 UI) yield excellent resolution of all forensic analytes of interest in the sample**
- **Excellent linearity, retention time repeatability, and area repeatability were achieved**

5977B/9000GC Intuvo

Bulk Drug Analysis

Kirk E. Lokits, Ph.D
GCMS Applications Chemist

December 5, 2017

Agilent
Trusted Answers

For Forensic Use

Intuvo Parameter Optimization

- Starting point for new temperature zones (Guard Chip, Chip Buss)
- How inert is the flow path
- Semi-fast GC method for sample throughput
- General conditions (inlet temp, flow, column type)
- Does atune.u and stune.u respond similarly with Intuvo
- Can background/carryover be reduced via draw out diameter
- How does source temperature affect Intuvo chromatography

Fast Method Parameters for Drugs on Intuvo

Ramp	°C/min	°C	Hold min
Initial Temperature		100	1.0
Ramp 1	150	325	2.5

Runtime	5.0 min

Inlet	Split/Splitless
Temperature	250 °C
Mode	Split, Constant Flow
Flow rate	1.2 mL/min
Head pressure	7.1 psi
Average velocity	49.63 cm/sec
Split Flow	48 mL/min
Split Ratio	40:1

Column	DB-5MSUI part # (122-5512UI) 15m x 0.25 mm id x 0.25 µm film
Liner	Split, straight 990 µL ultra inert 5190-2294

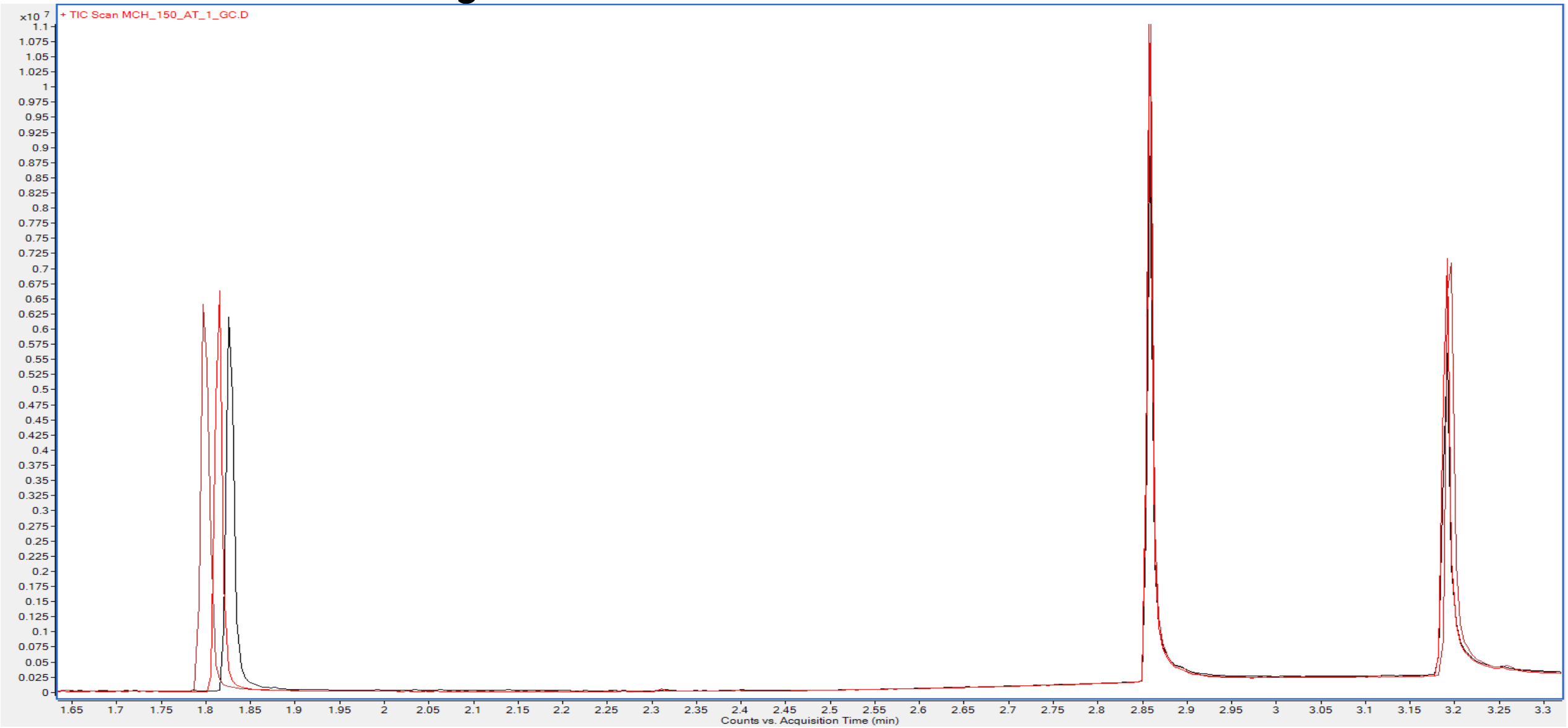
Injection volume	1.0 µL

MSD	5977B Extractor Source
Solvent Delay	1.5 min
Acquisition Mode	Scan
Scan Range	40 to 500
Threshold	150
Sampling	2
TID	OFF
Quad Temp	150 °C
Source Temp	320 °C
Transfer Line	280 °C
Tune	Stune.u Gain = 1.0

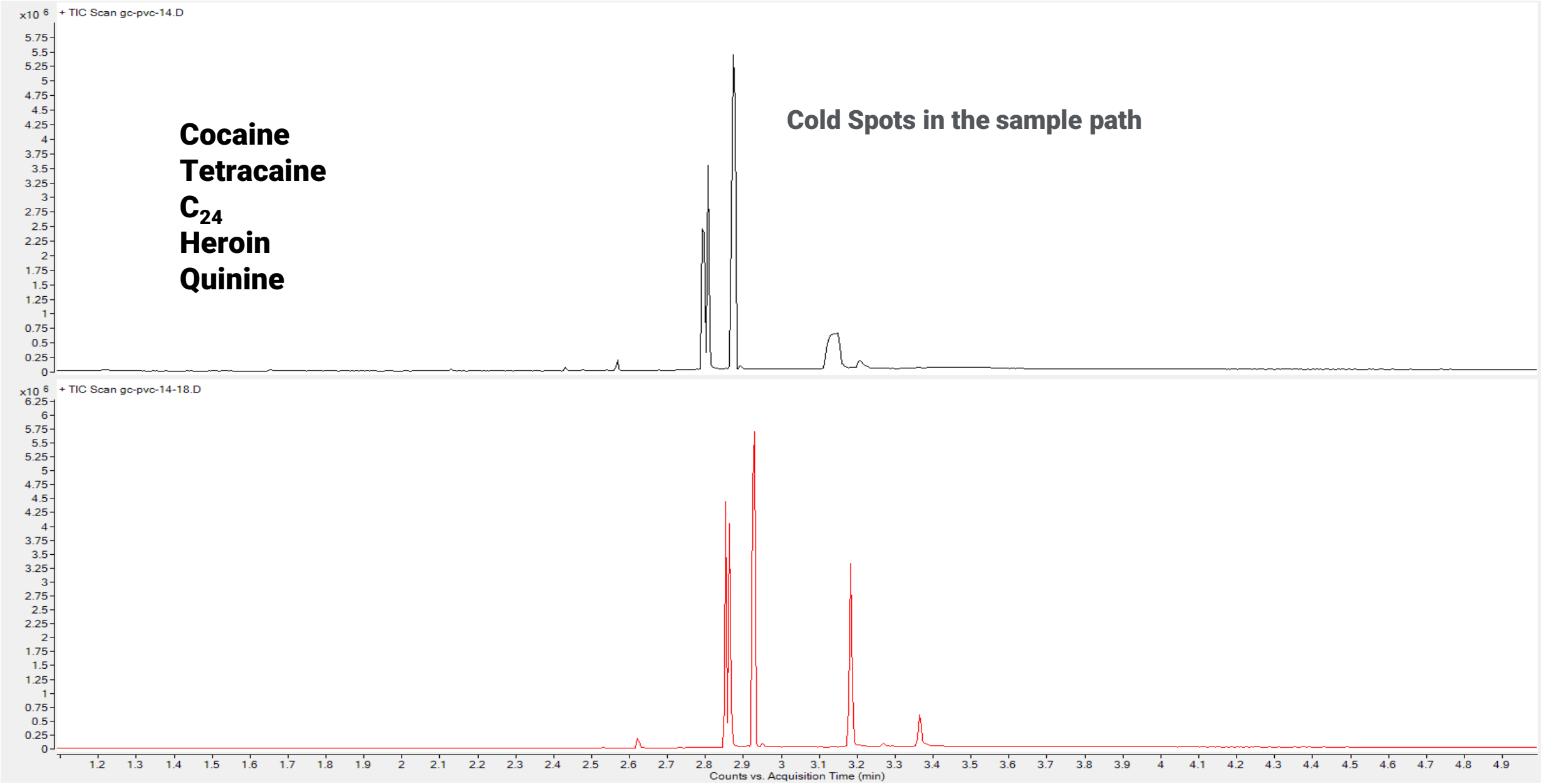
Guard Chip	250 °C Isothermal
Flow Chip Bus	Isothermal 300 °C

Intuvo Guard Chip Temperature Settings

Tracking Oven MCH **250 °C Isothermal MCH**



Intuvo GCMS Interface Temperature Settings



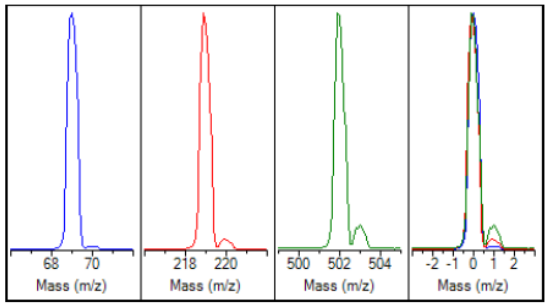
5977B EI Extractor Source Tune Settings

Atune.u

Autotune - 5977

Tune timestamp: 6/21/2017 9:48 AM (UTC-04:00) — Intuvo 5977

D:\MASSHUNTER\GCMS\1\5977\atune_320.u — US1711M035



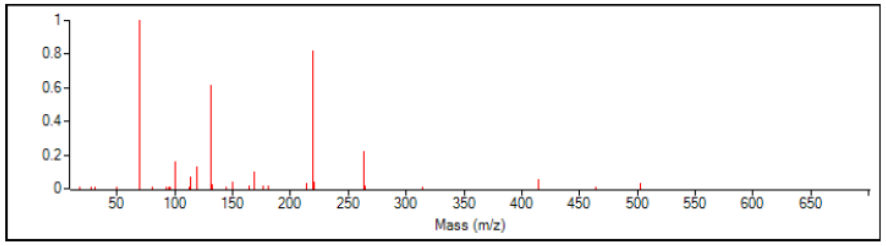
Ion Polarity	Pos	PFTBA	Open
Emission	34.6	Mass Gain	137
Electron Energy	70.0	Mass Offset	-26
Filament	1	Amu Gain	2533
Repeller	32.11	Amu Offset	137.13
Ion Focus	90.3	Width219	-0.018
Entrance Lens	20.2	DC Polarity	Pos
Ent Lens Offset	13.23	HED Enable	On
Ion Body	0.00	EM Volts	907.9
Post Extractor 1	0	Extractor Lens	0.00
Post Extractor 2	0	Scan Speed	3
JetClean Flow	0	Averages	3

Actual m/z	Abund	Rel Abund	Pw50
69.00	456,555	100.0%	0.60
218.90	386,520	84.7%	0.60
501.90	14,517	3.2%	0.58

Temperatures and Pressures

MS Source	320	Turbo Speed	100.0
MS Quad	150	Hi Vac	N/C

Low	High	Step	Speed	Threshold	Peaks	Base	Abundance	Total Ion
10.00	701.00	0.10	3	100	145	69.00	441,344	1,575,380



Target m/z	Actual m/z	Abund	Rel Abund	Iso m/z	Iso Abund	Iso Ratio
69.00	69.00	441,344	100.0%	70.00	4,944	1.1%
219.00	219.00	359,616	81.5%	220.00	15,211	4.2%
502.00	502.10	13,097	3.0%	503.10	1,247	9.5%

Air/Water Check: H20 ~0.6% N2 ~0.6% O2 ~0.2% CO2 ~0.2% N2/H20 ~98.6%

Column(1) Flow: 1.20 Column(2): 0.00 ml/min Interface Temp: 280

Ramp Criteria:

Ion Focus maximum 90 volts using ion 502; Electron Multiplier Gain 44432.000

Repeller maximum 35 volts using ion 219; Gain Factor 0.4443

Mass Gain Values(Scan Speed): 150(3) 149(2) 162(1) 173(0) 226(FS1) 225(FS2)

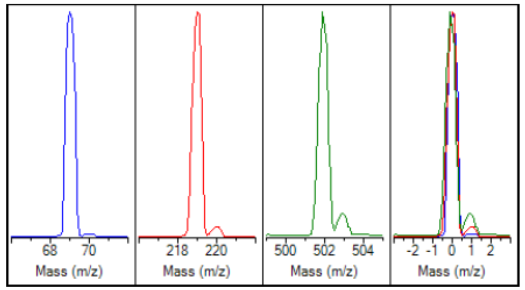
TARGET MASS:	50	69	131	219	414	502	1050
Amu Offset	137.1	137.1	137.1	137.1	137.1	137.1	137.1
Entrance Lens Offset	13.2	13.2	13.2	13.2	13.2	13.2	13.2

Stune.u

Target Tune - 5977

Tune timestamp: 6/21/2017 10:02 AM (UTC-04:00) — Intuvo 5977

D:\MASSHUNTER\GCMS\1\5977\stune_320.u — US1711M035



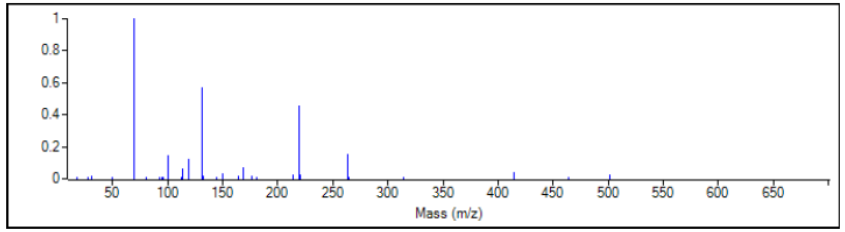
Ion Polarity	Pos	PFTBA	Open
Emission	34.6	Mass Gain	133
Electron Energy	70.0	Mass Offset	-25
Filament	1	Amu Gain	2496
Repeller	19.96	Amu Offset	141.25
Ion Focus	79.5	Width219	0.000
Entrance Lens	0.0	DC Polarity	Pos
Ent Lens Offset	Dynamic	HED Enable	On
Ion Body	0.00	EM Volts	911.9
Post Extractor 1	0	Extractor Lens	0.00
Post Extractor 2	0	Scan Speed	3
JetClean Flow	0	Averages	3

Actual m/z	Abund	Rel Abund	Pw50
69.00	249,359	100.0%	0.57
219.00	114,066	45.7%	0.56
501.90	5,848	2.3%	0.58

Temperatures and Pressures

MS Source	320	Turbo Speed	100.0
MS Quad	150	Hi Vac	N/C

Low	High	Step	Speed	Threshold	Peaks	Base	Abundance	Total Ion
10.00	701.00	0.10	3	100	97	69.00	240,448	704,890



Target m/z	Actual m/z	Abund	Rel Abund	Iso m/z	Iso Abund	Iso Ratio
69.00	69.00	240,448	100.0%	70.00	2,682	1.1%
219.00	219.00	108,416	45.1%	220.00	4,908	4.5%
502.00	502.00	5,388	2.2%	503.00	636	11.8%

Air/Water Check: H20 ~0.8% N2 ~0.9% O2 ~0.2% CO2 ~0.3% N2/H20 ~122.7%

Column(1) Flow: 1.20 Column(2): 0.00 ml/min Interface Temp: 280

Ramp Criteria:

Ion Focus maximum 90 volts using ion 502; Electron Multiplier Gain 48004.858

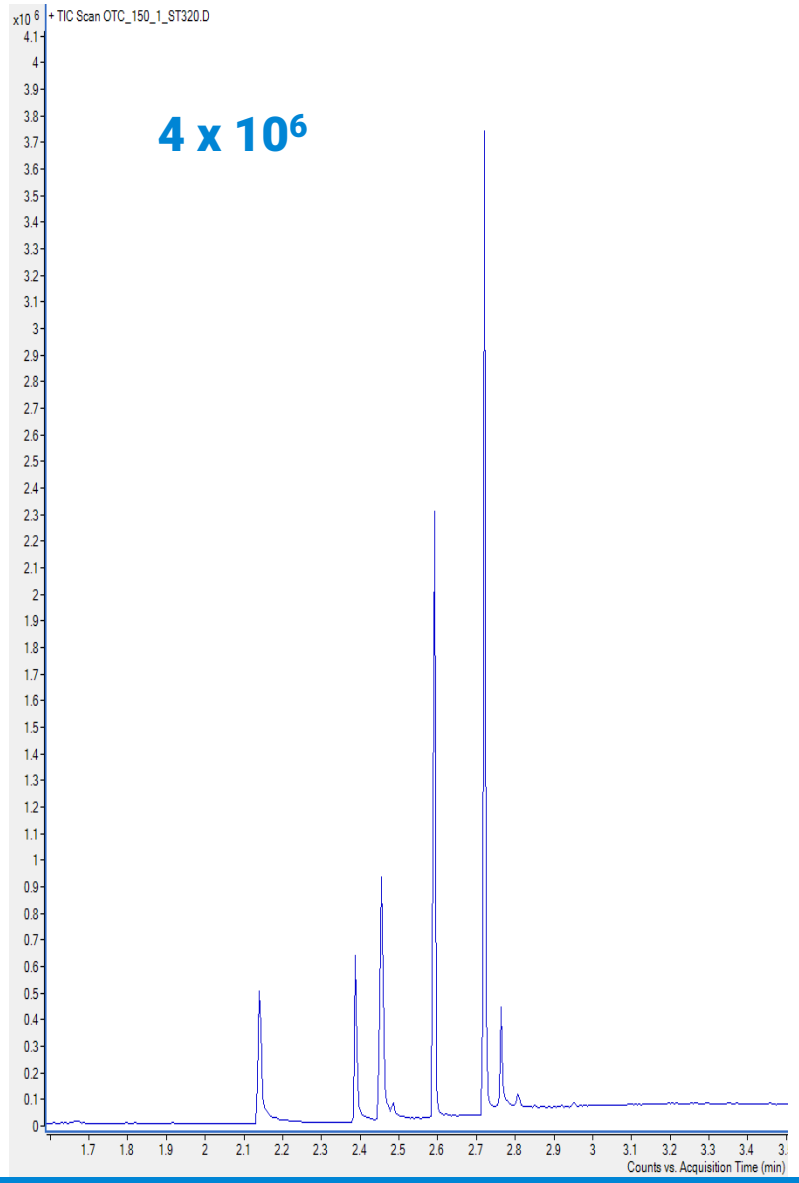
Repeller maximum 20 volts using ion 219; Gain Factor 0.4800

Mass Gain Values(Scan Speed): 147(3) 157(2) 173(1) 208(0) 269(FS1) 339(FS2)

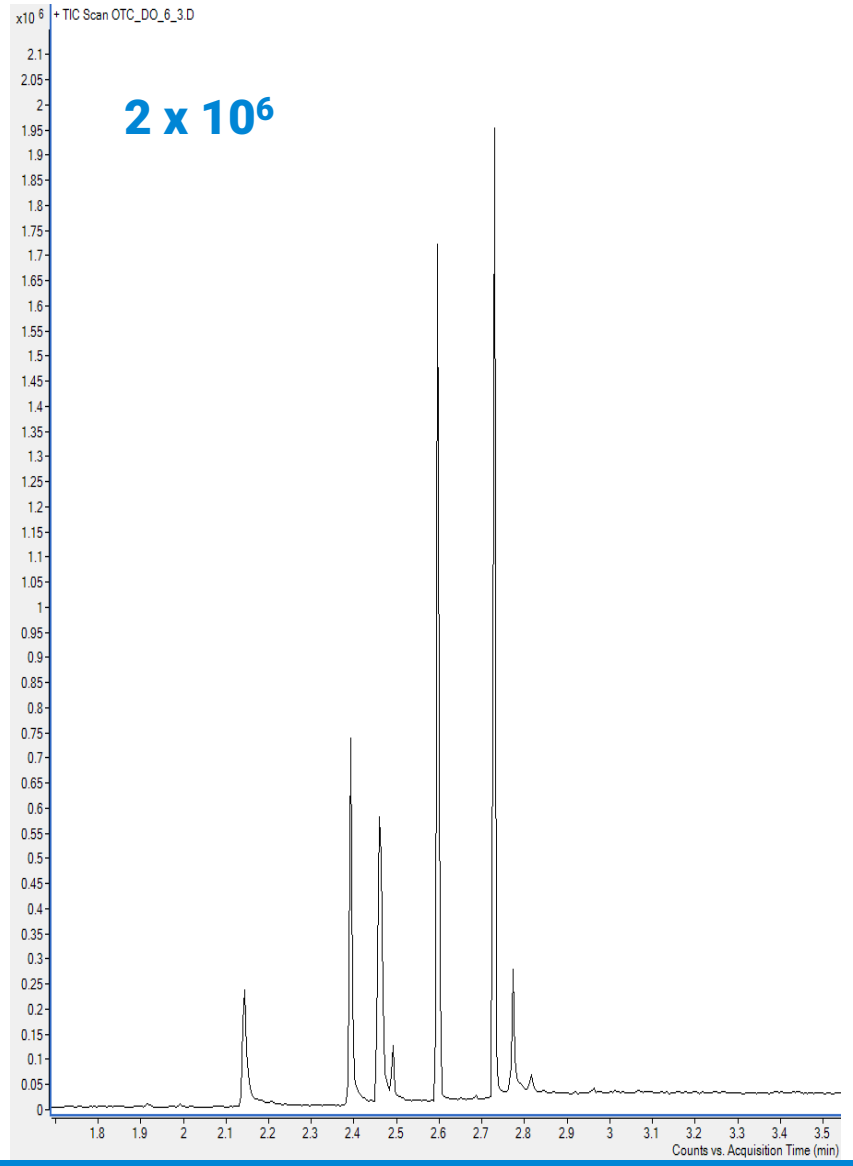
TARGET MASS:	50	69	131	219	414	502	1050
Amu Offset	141.3	141.3	141.3	141.3	141.3	141.3	141.3
Entrance Lens Offset	5.6	5.0	6.4	6.9	13.1	17.6	17.6
Target Abund (%)	1.0	100.0	55.0	45.0	3.5	2.5	
Actual Tune Abund (%)	0.9	100.0	56.5	45.1	3.8	2.2	

Draw Out Lens Comparison 3, 6, and 9 mm Diameters

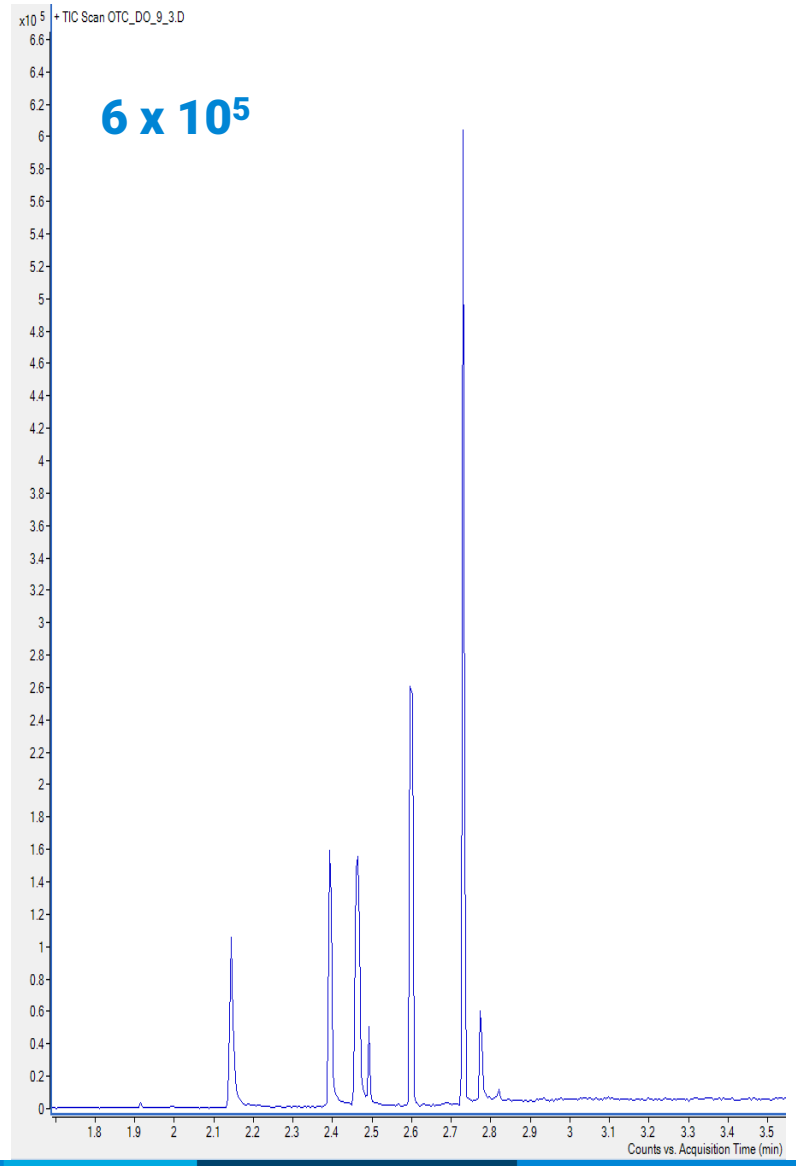
3 mm



6 mm

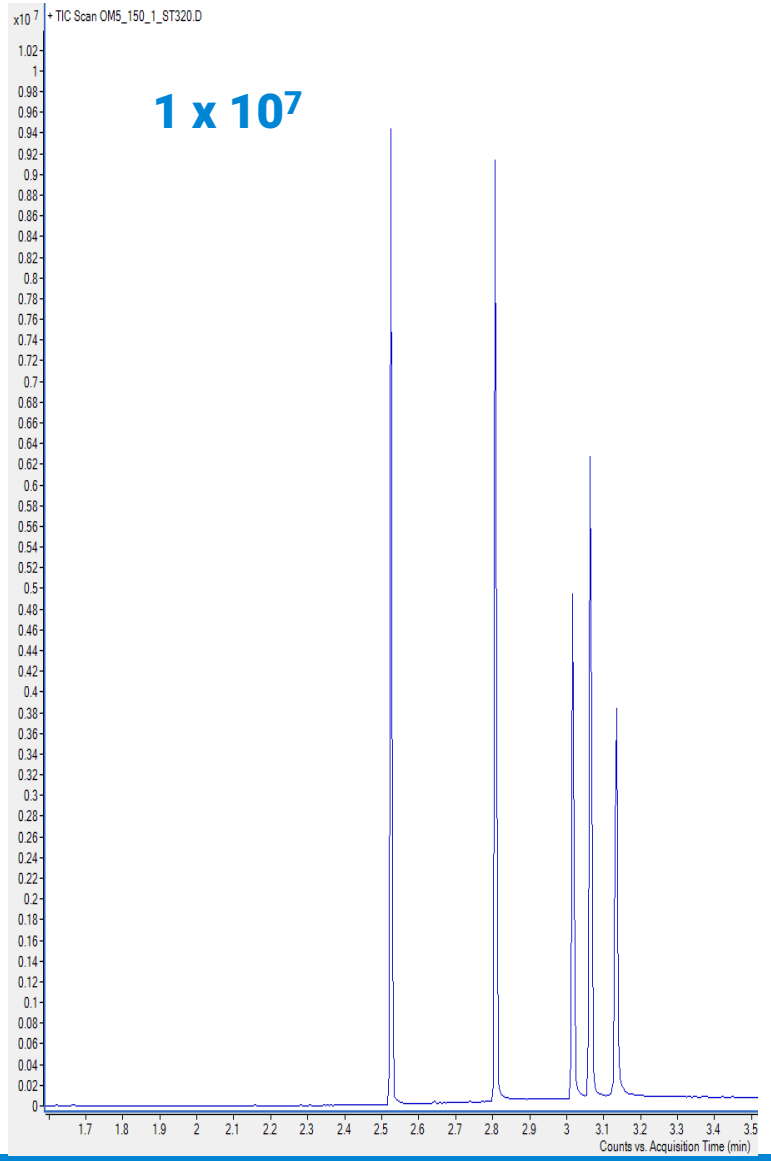


9 mm

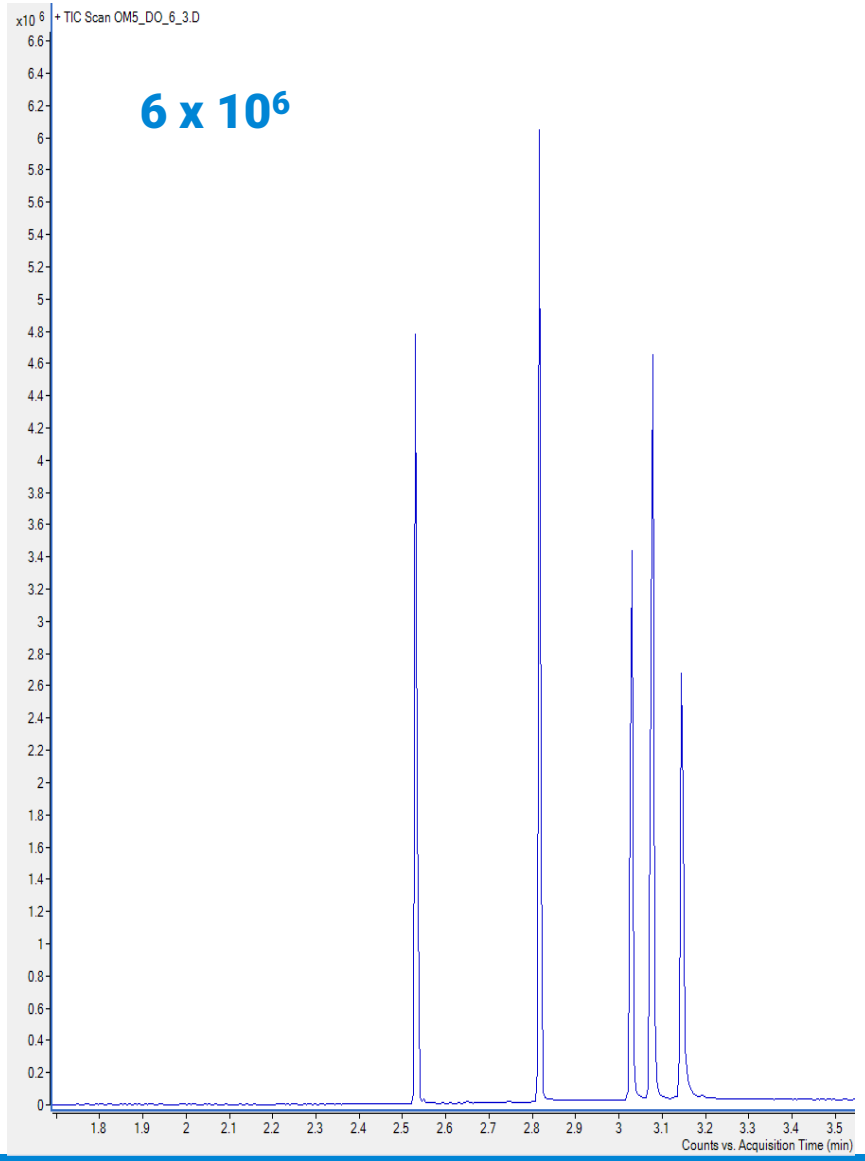


Draw Out Lens Comparison 3, 6, and 9 mm Diameters

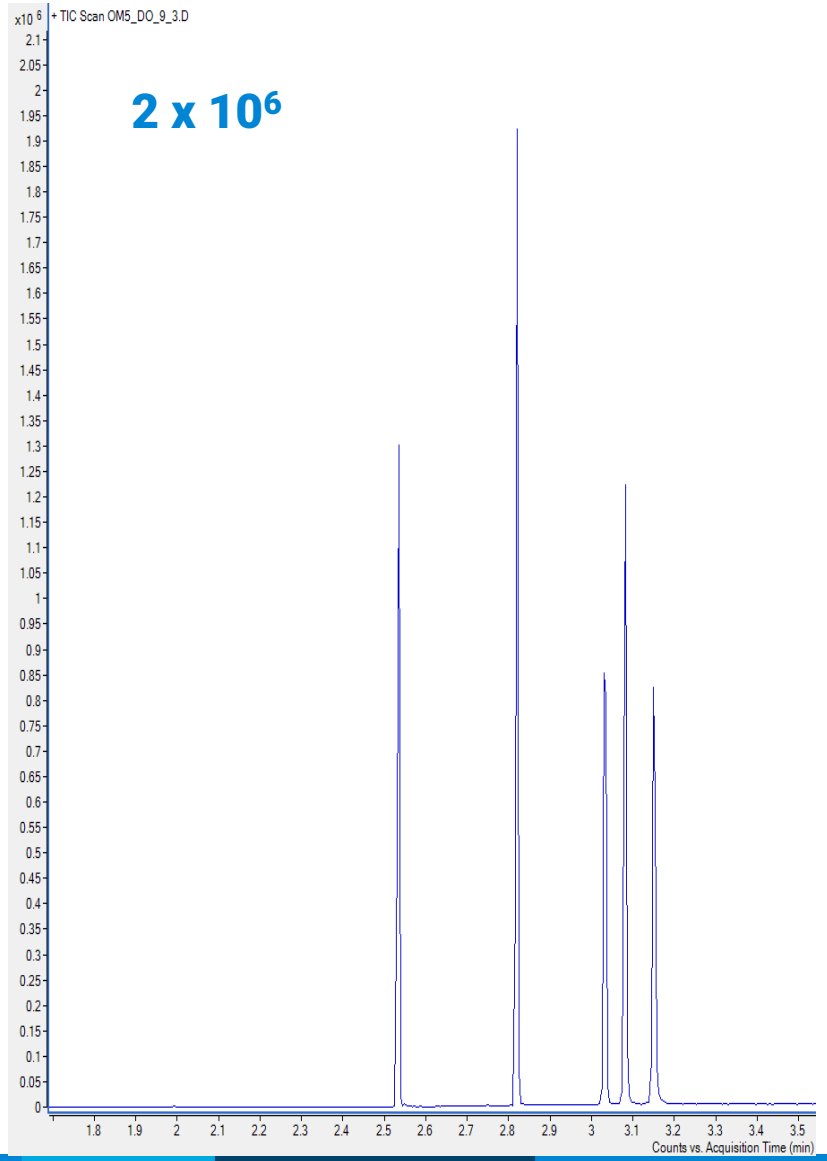
3 mm



6 mm

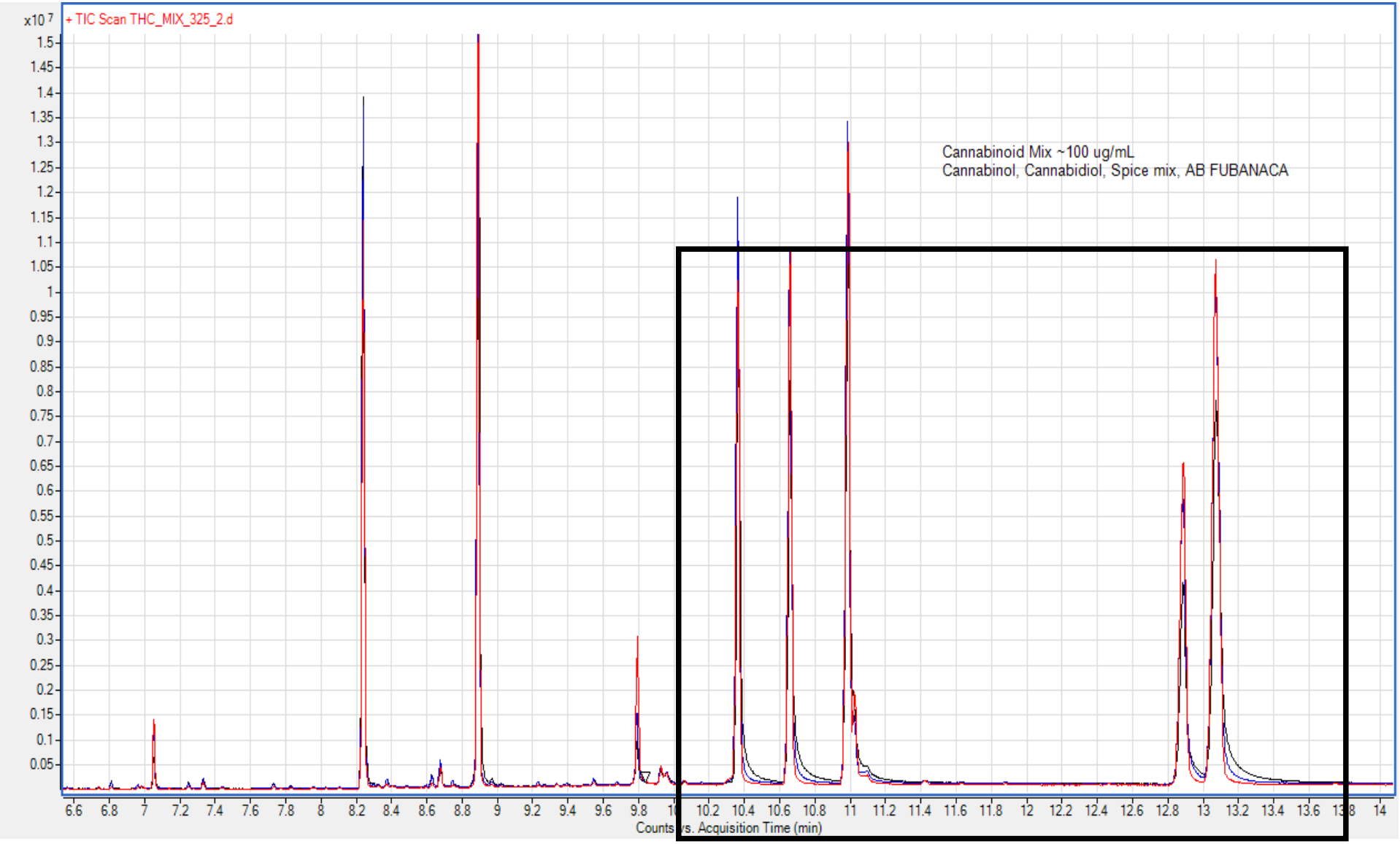


9 mm

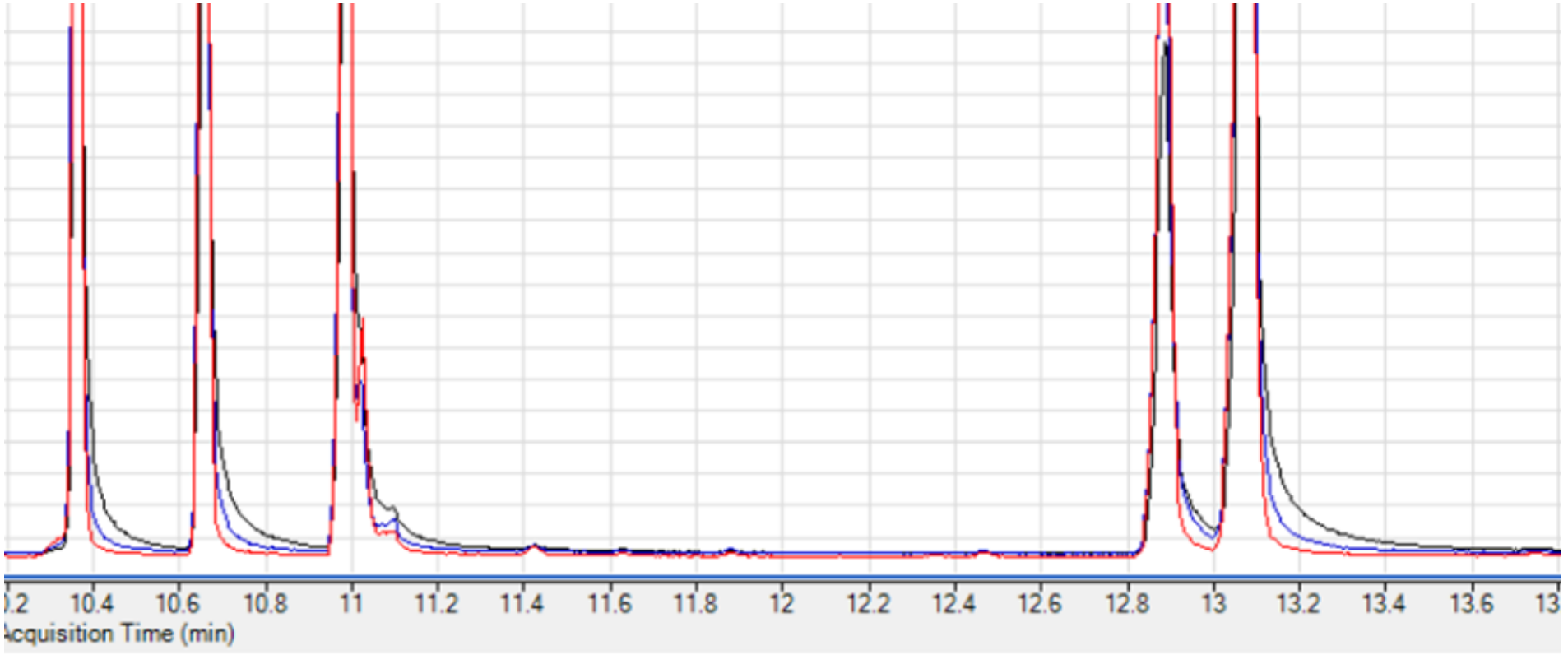


Source Temperature Comparison (225, 275, 325°C)

Cannabinoid Mix



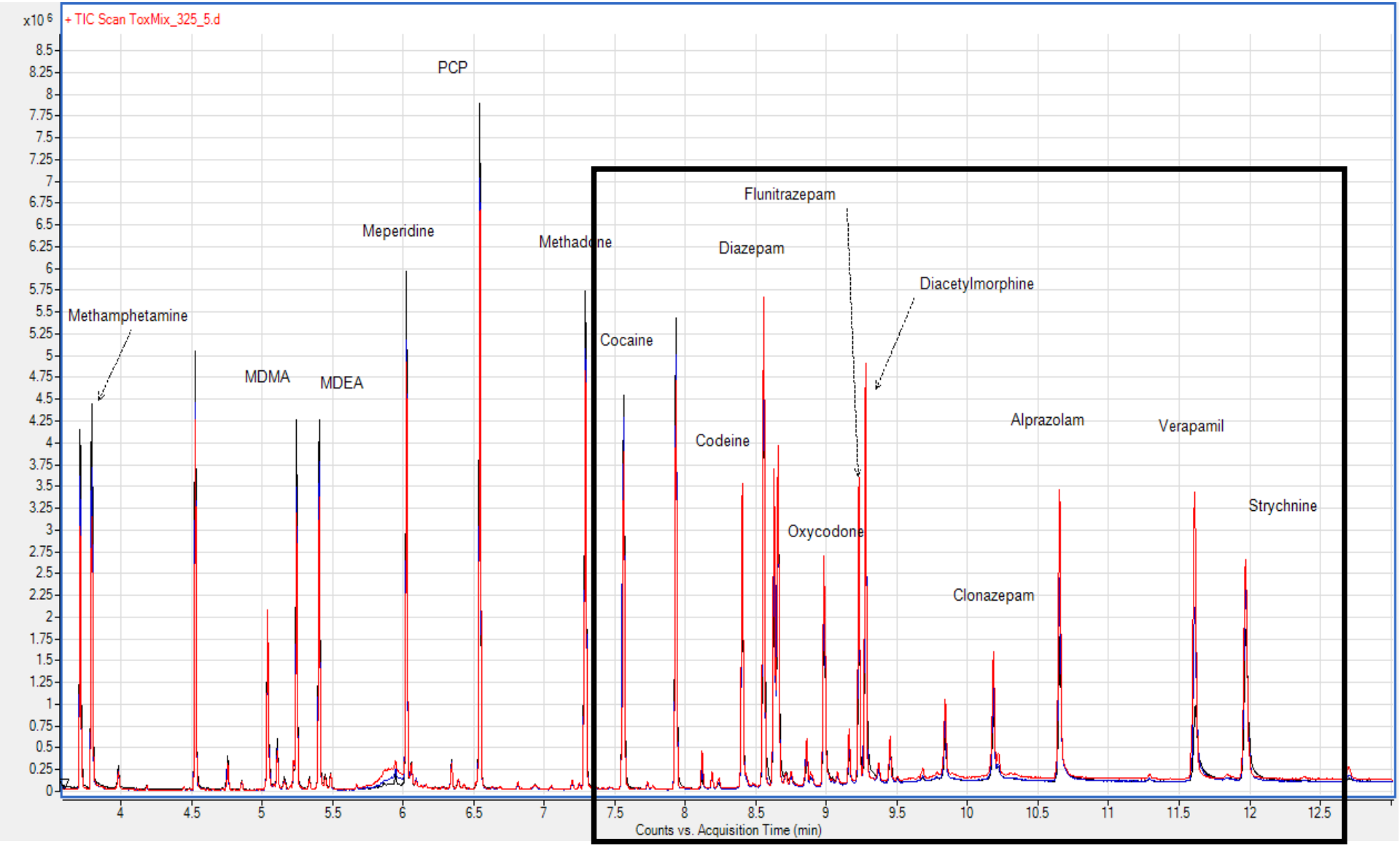
Better chromatography



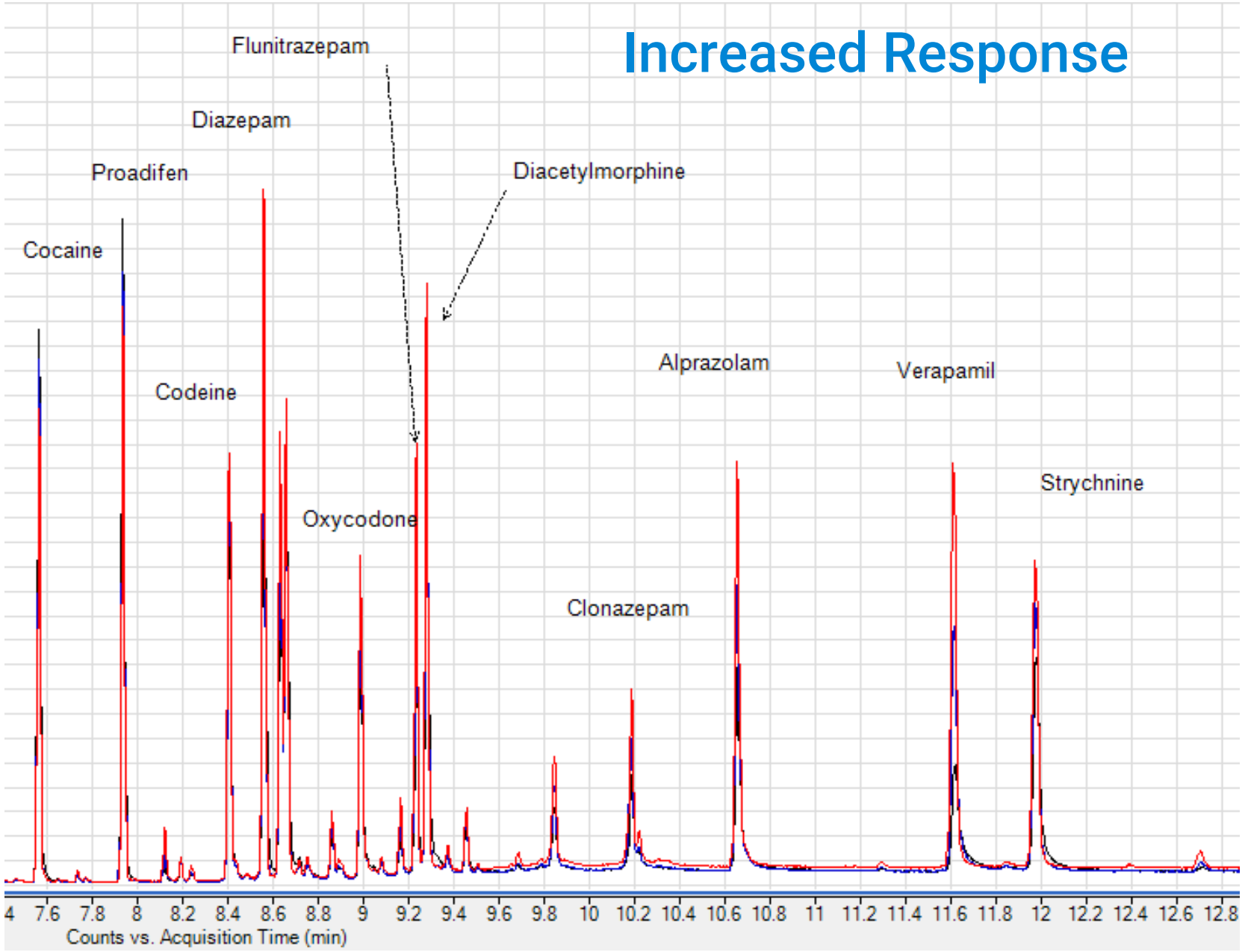
325°C 275°C 225°C

Source Temperature Comparison (225, 275, 325°C)

Toxicology Checkout Standard 5 ng/µL on column



Increased Response



325°C

275°C

225°C

Fire Debris Analysis with the Intuvo 9000 GC and 5977B MSD

Kirk E. Lokits, Ph.D
GCMS Applications Chemist

Agilent
Trusted Answers

December 5, 2017

For Forensic Use

Method Parameters for Accelerants on Intuvo

Ramp	°C/min	°C	Hold min
Initial		40	2.0
Ramp 1	5	120	0.0
Ramp 2	12	300	5.0
Runtime	38 min		

Inlet	Split/Splitless
Temp	250 °C
Mode	Split, Constant Flow
Flow	1.2 mL/min
Inlet Press	11.06 psi
Septum Purge	3.0 mL/min
Purge Flow	24 mL/min (Split Ratio 20:1)

Column	DB-1MSUI part # (122-0132UI) 30m x 0.25 mm id x 0.25 µm film
Liner	Single taper w/wool 900µL ultra inert 5190-2293

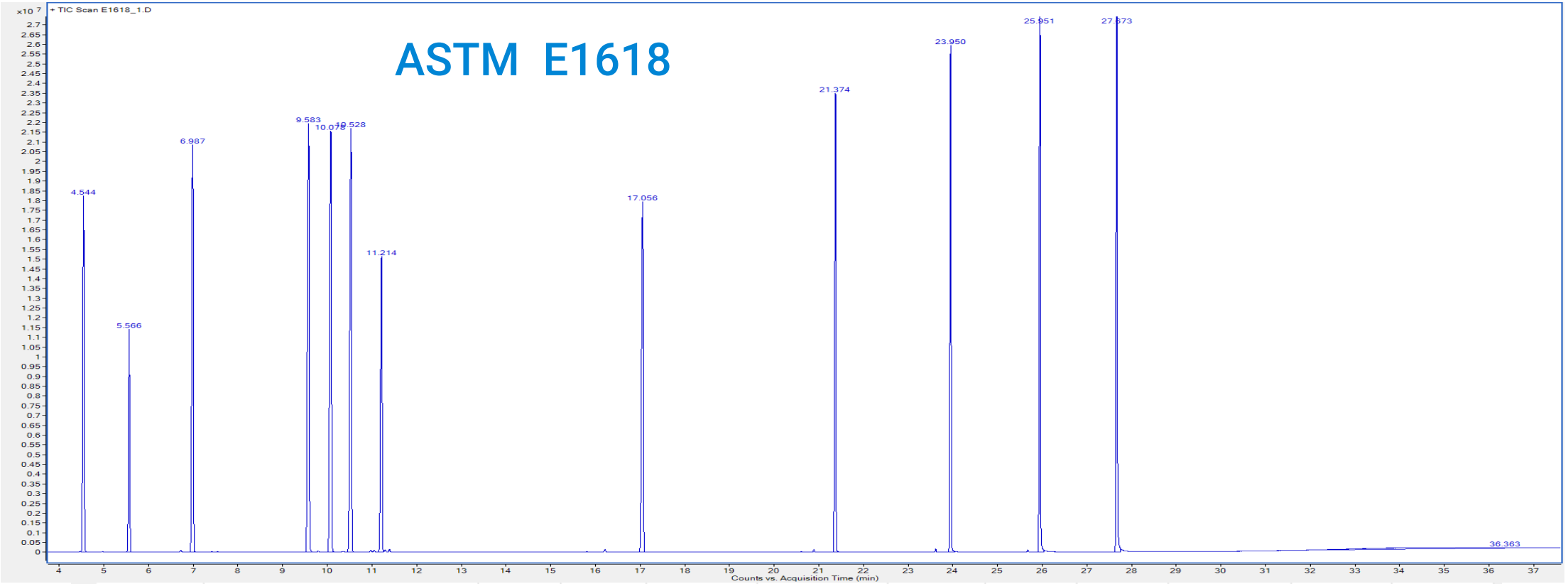
MSD	5977B Extractor Source
Solvent Delay	3.0 min
Acquisition Mode	Scan
Scan Range	33 to 300 a.m.u.
Threshold	150
Sampling	2
TID	OFF
Quad Temp	150 °C
Source Temp	230 °C
Transfer Line	280 °C
Tune	etune.u Gain = 1.0

Guard Chip	Tracking Oven Ramp Initial Temperature 65 °C
Flow Chip Bus	Isothermal 300 °C

Injection volume 1.0 µL

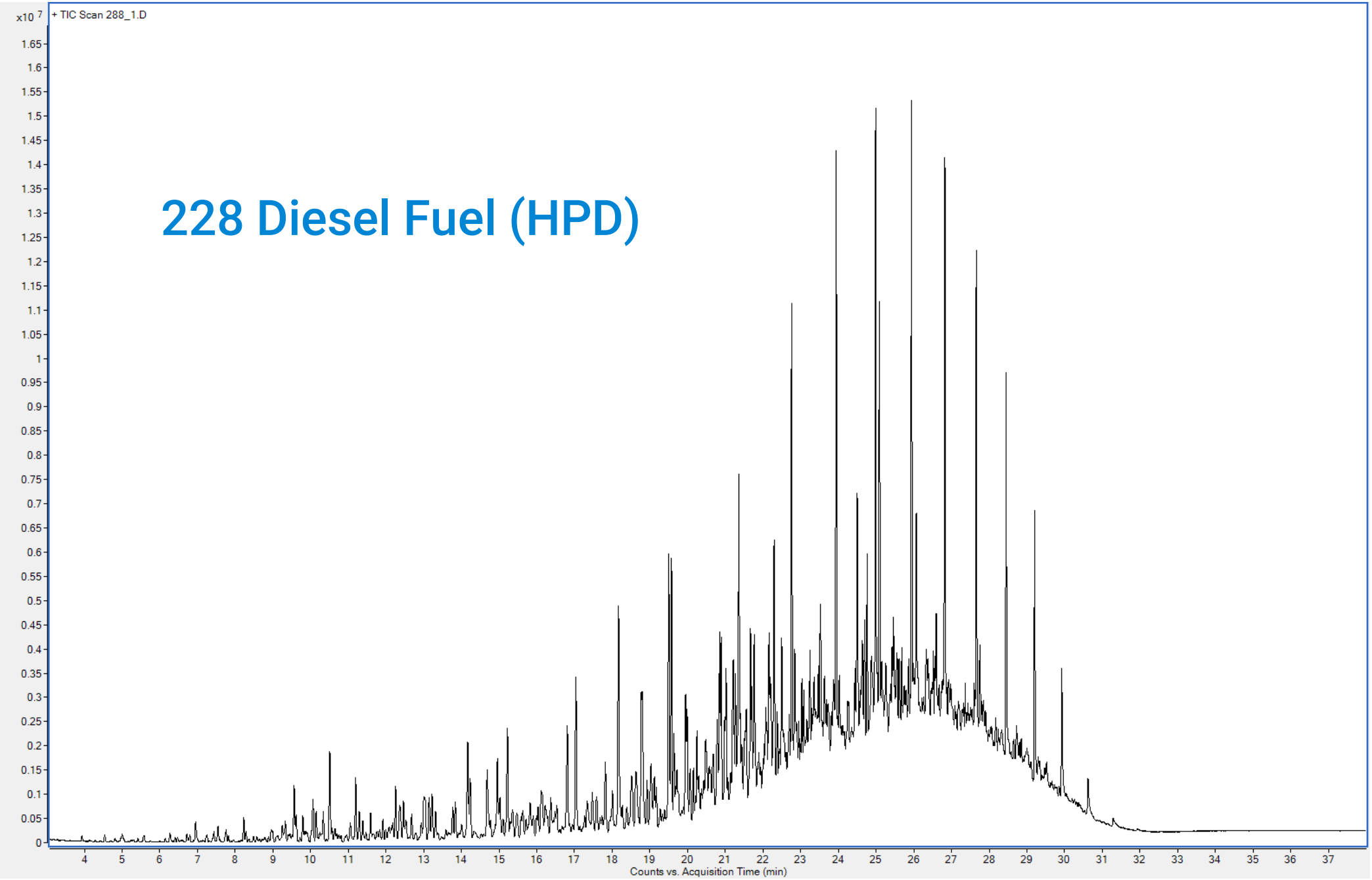
Complete cycle time between injections 2 minutes
GC Equilibration Time 0.1 min

ASTM E1618

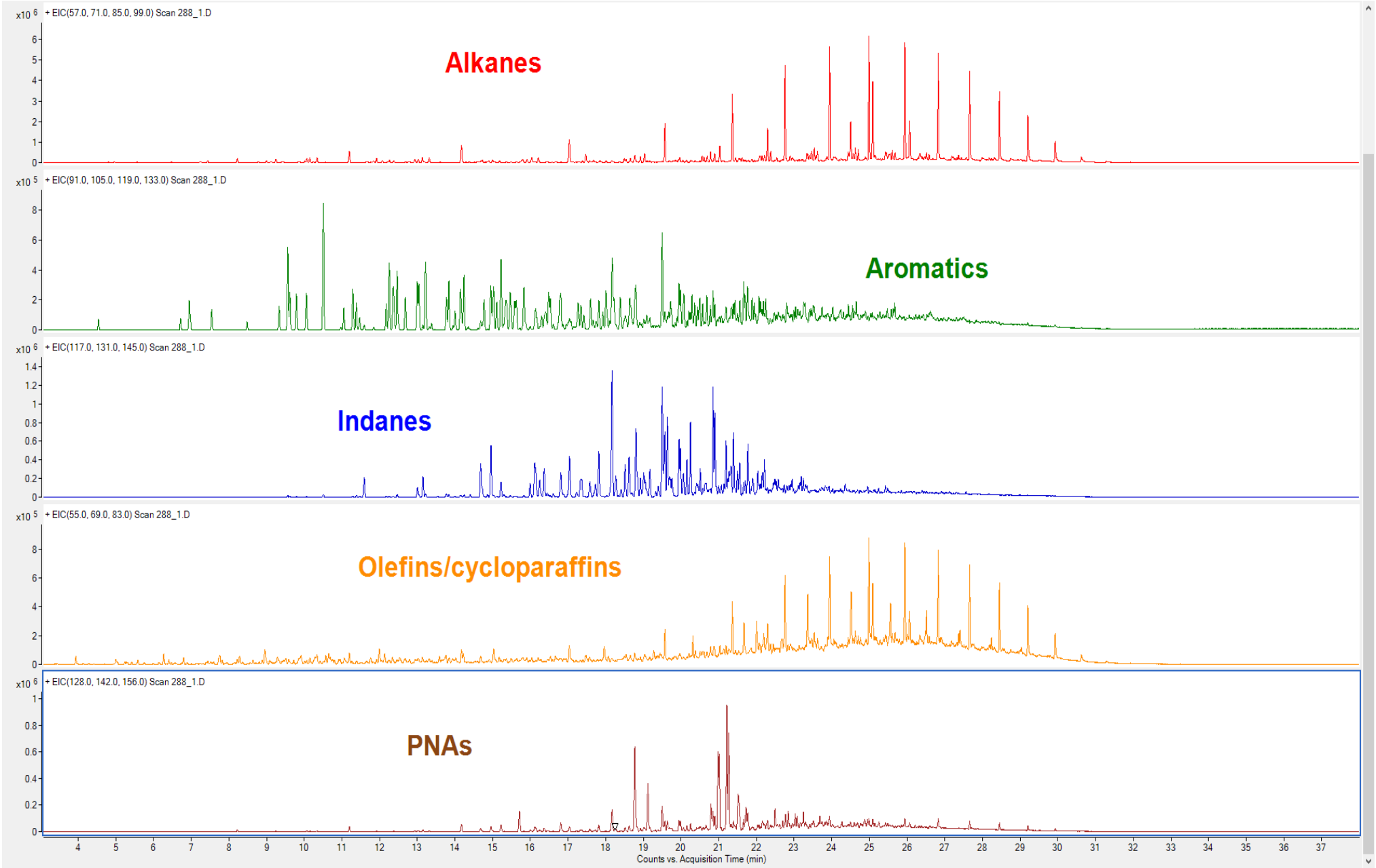


Cpd	Label	CAS	RT	Formula	Score (Lib)	Height	Width	Area	ID Source	File	Library
1	Cpd 1: Toluene	108-88-3	4.544	C7H8	97.85	18218612	0.146	41208103	LibSearch	E1618_1.D	NIST14.L
3	Cpd 3: p-Xylene	106-42-3	6.987	C8H10	97.78	20859558	0.188	50511553	LibSearch	E1618_1.D	NIST14.L
2	Cpd 2: Octane	111-65-9	5.566	C8H18	94.02	11401560	0.139	23350708	LibSearch	E1618_1.D	NIST14.L
4	Cpd 4: Benzene, 1-ethyl-2-methyl-	611-14-3	9.583	C9H12	97.04	21938561	0.178	60387452	LibSearch	E1618_1.D	NIST14.L
5	Cpd 5: Benzene, 1-ethyl-2-methyl-	611-14-3	10.078	C9H12	96.8	21557617	0.201	60752780	LibSearch	E1618_1.D	NIST14.L
6	Cpd 6: Benzene, 1,2,4-trimethyl-	95-63-6	10.528	C9H12	97.57	21703331	0.201	61557621	LibSearch	E1618_1.D	NIST14.L
7	Cpd 7: Decane	124-18-5	11.214	C10H22	94.22	15120449	0.12	37056010	LibSearch	E1618_1.D	NIST14.L
8	Cpd 8: Dodecane	112-40-3	17.056	C12H26	96.9	17927646	0.191	50540392	LibSearch	E1618_1.D	NIST14.L
9	Cpd 9: Tetradecane	629-59-4	21.374	C14H30	95.33	23480818	0.152	49814475	LibSearch	E1618_1.D	NIST14.L
10	Cpd 10: Hexadecane	544-76-3	23.95	C16H34	94.77	25940594	0.152	50770216	LibSearch	E1618_1.D	NIST14.L
11	Cpd 11: Octadecane	593-45-3	25.951	C18H38	95.8	27674331	0.129	55919985	LibSearch	E1618_1.D	NIST14.L
12	Cpd 12: Eicosane	112-95-8	27.673	C20H42	94.79	27724986	0.13	58593225	LibSearch	E1618_1.D	NIST14.L

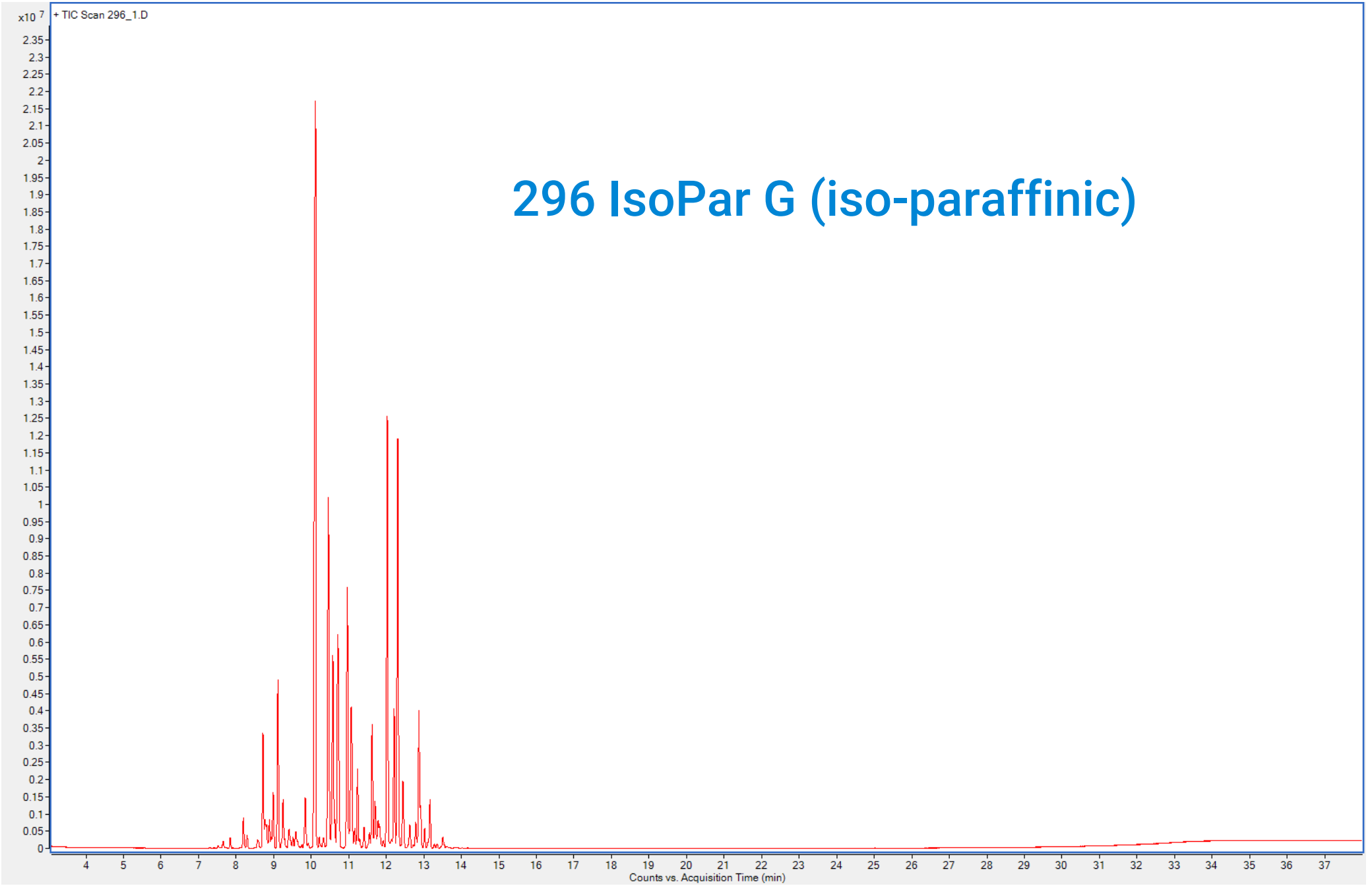
228 Diesel Fuel (HPD)



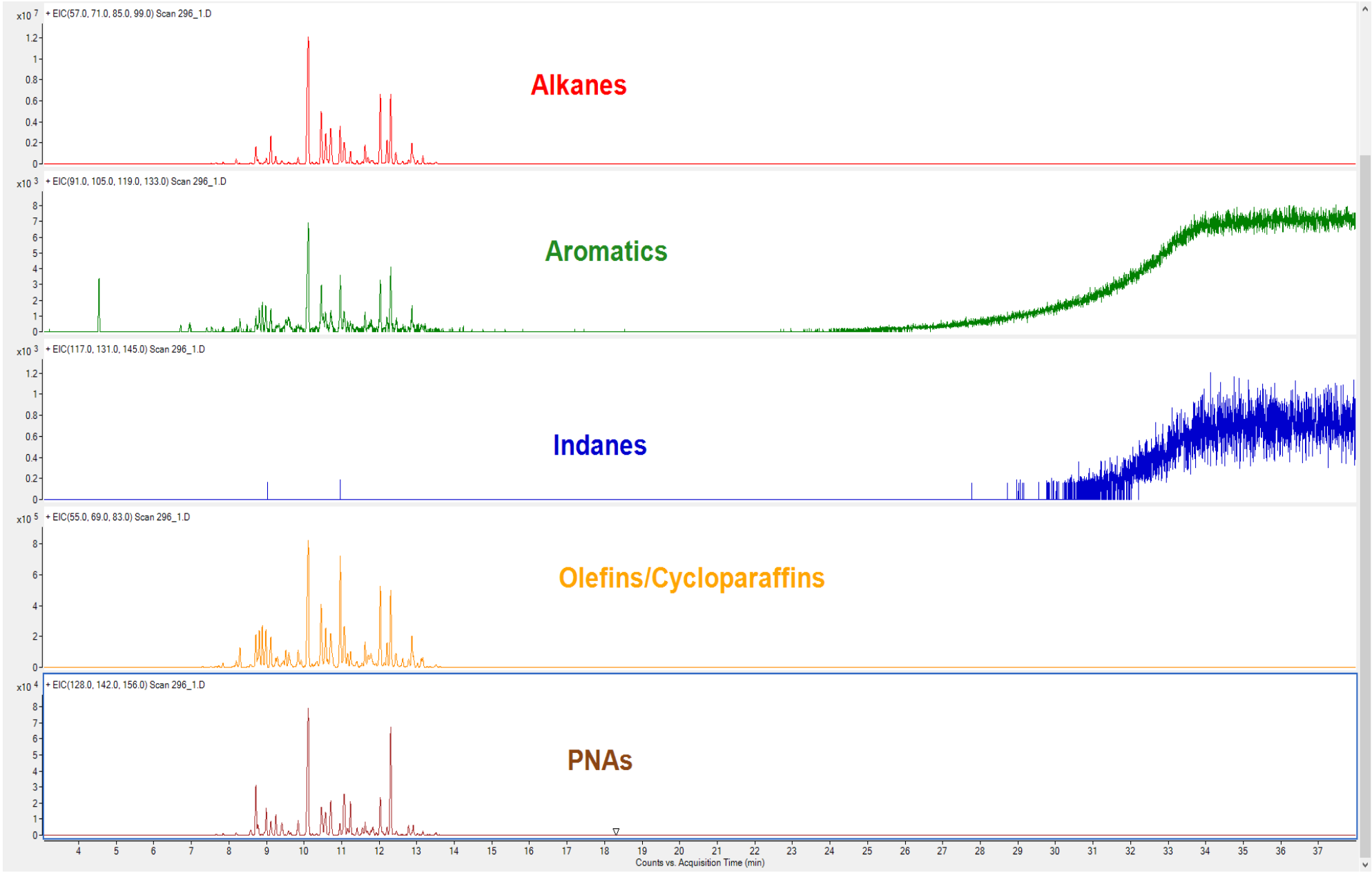
Extracted Ion Profiles



296 IsoPar G (iso-paraffinic)



Extracted Ion Profiles



RT Reproducibility of 6 alkylbenzenes on multiple instruments, guard chips, and column installations

Castle Peaks	Conventional Retention Time			Fast Retention Time		
n=8	Range	Average	%RSD	Range	Average	%RSD
n-propylbenzene	9.3340 - 9.3660	9.3493	0.14	4.7280 - 4.7790	4.7486	0.48
3-ethyltoluene	9.5640 - 9.6030	9.5828	0.15	4.8430 - 4.8890	4.8615	0.42
4-ethyltoluene	9.6190 - 9.6580	9.6375	0.15	4.8700 - 4.9150	4.8883	0.42
1,3,5-trimethylbenzene	9.8060 - 9.8870	9.8460	0.32	4.9560 - 4.9990	4.9739	0.39
2-ethyltoluene	10.0590 - 10.1500	10.0901	0.26	5.0870 - 5.1280	5.1036	0.35
1,2,4-trimethylbenzene	10.5090 - 10.5570	10.5321	0.15	5.3100 - 5.3440	5.3258	0.27

Energetics Analysis with the Intuvo 9000 GC and 5977B MSD

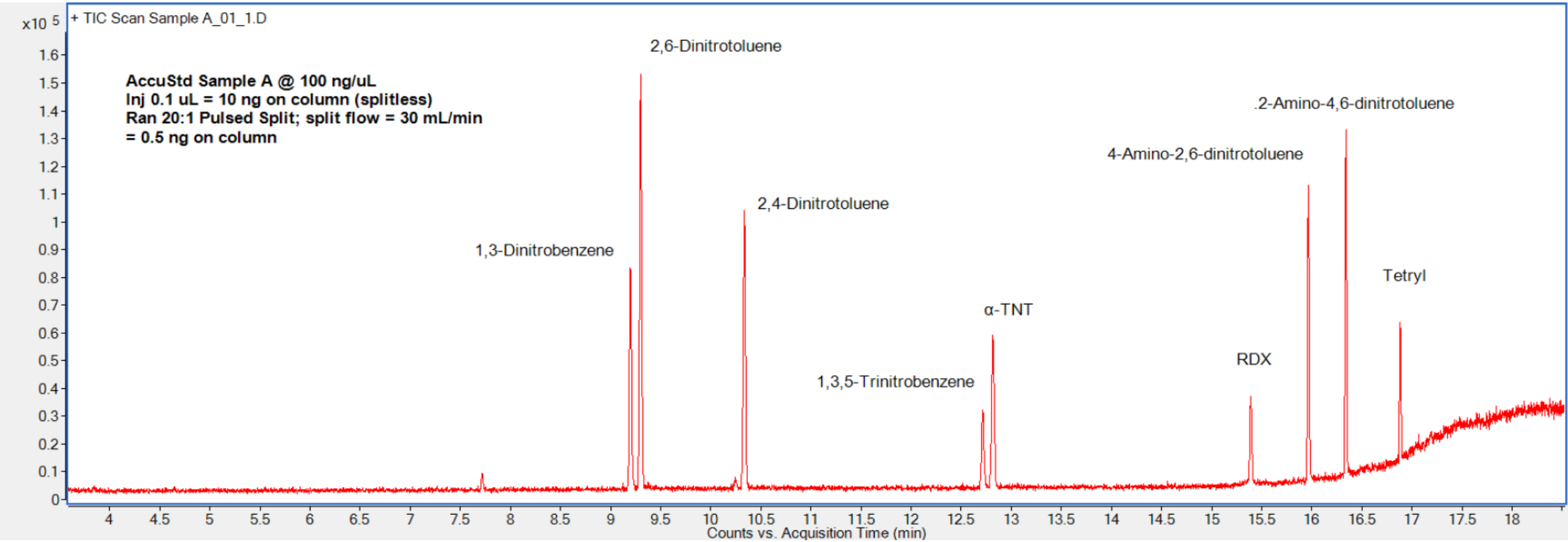
Kirk E. Lokits, Ph.D
GCMS Applications Chemist

Agilent
Trusted Answers

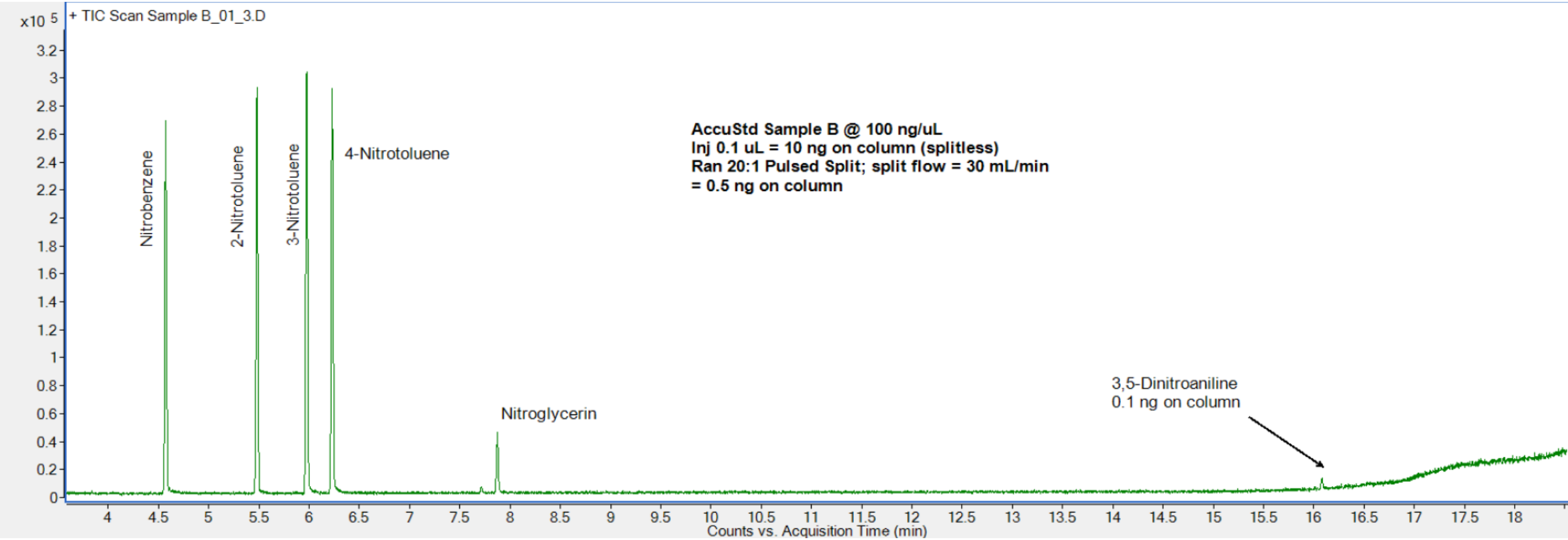
December 5, 2017

For Forensic Use

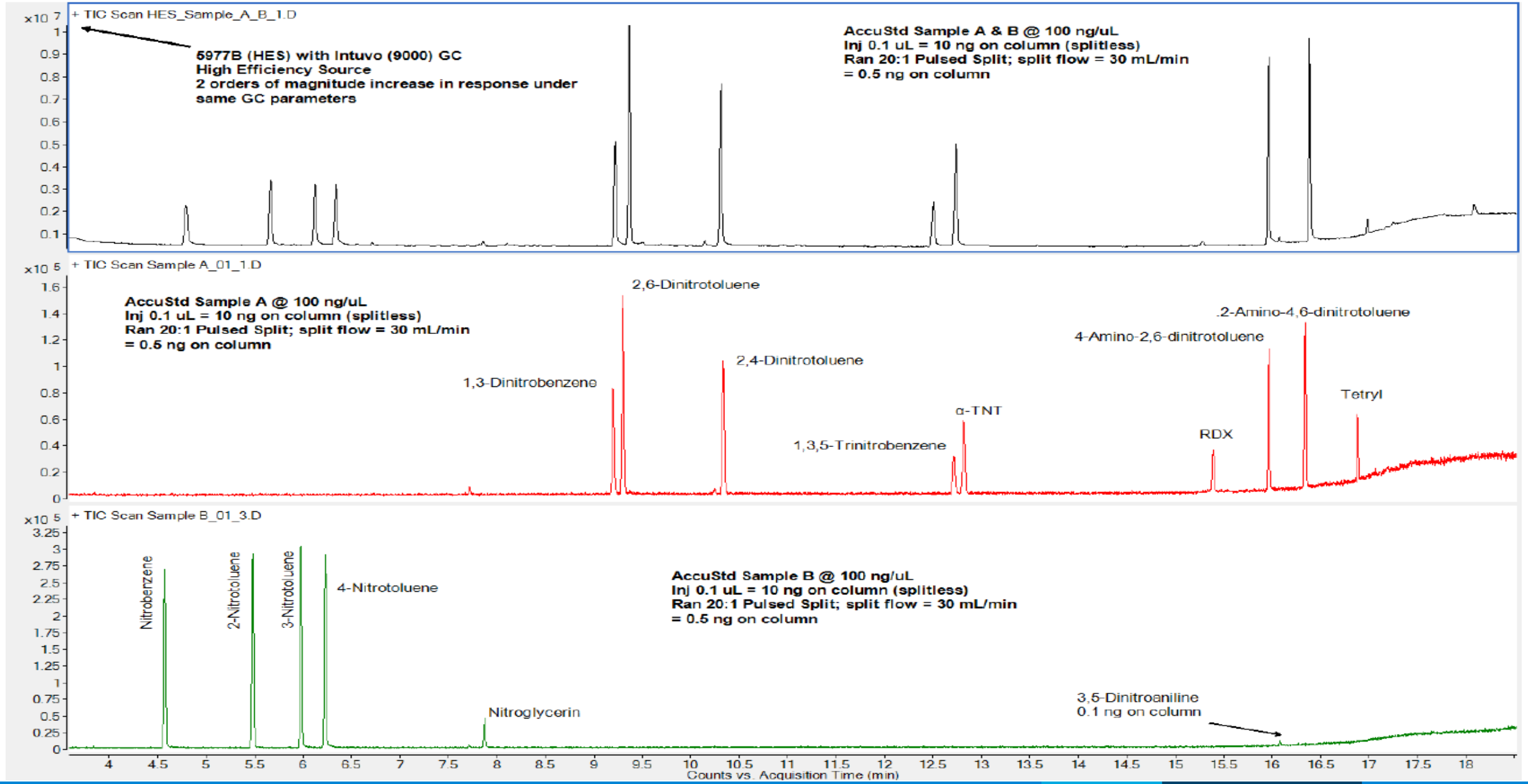
AccuStandard Energetics Sample A Extractor Source/7890



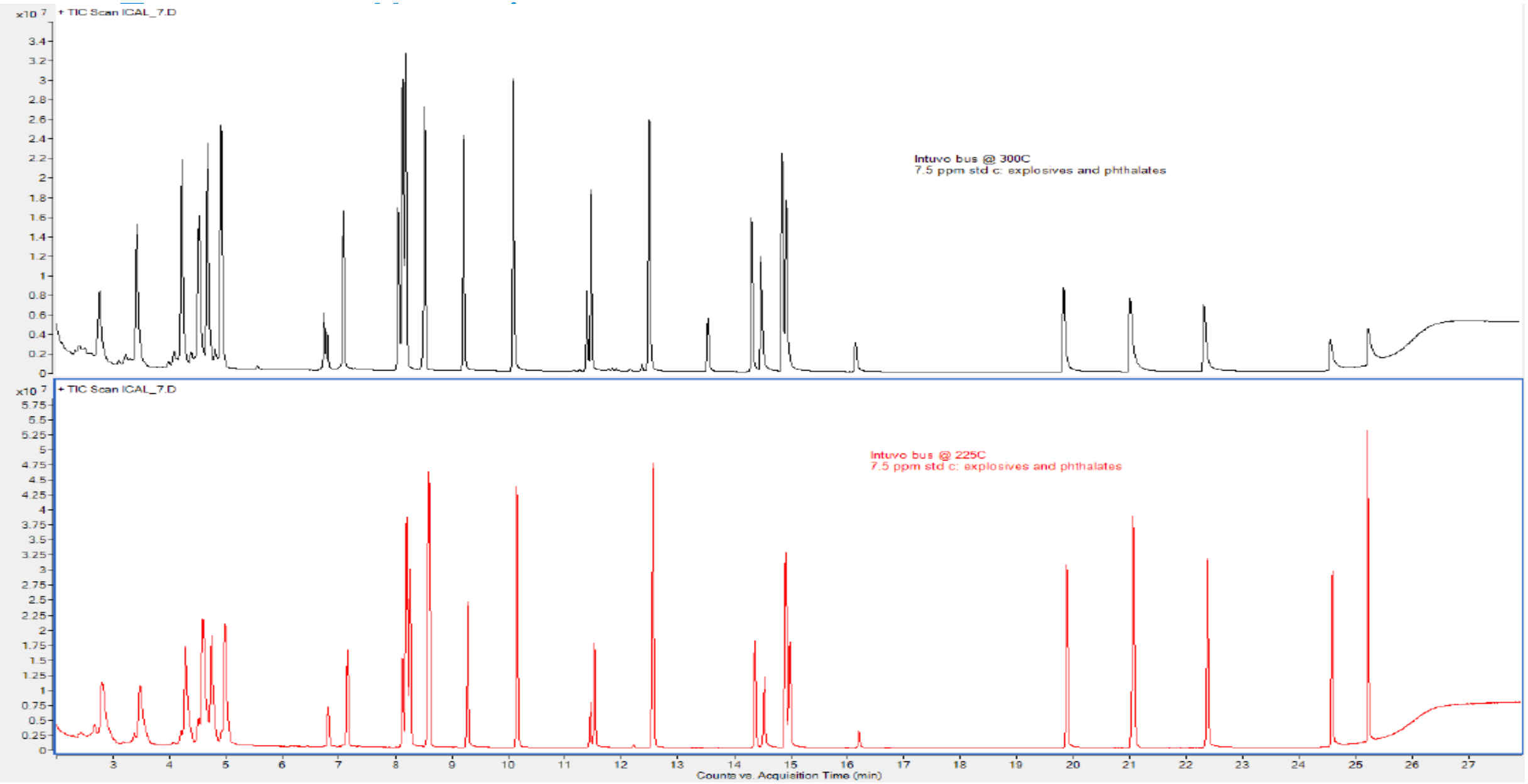
AccuStandard Energetics Sample B Extractor Source/7890



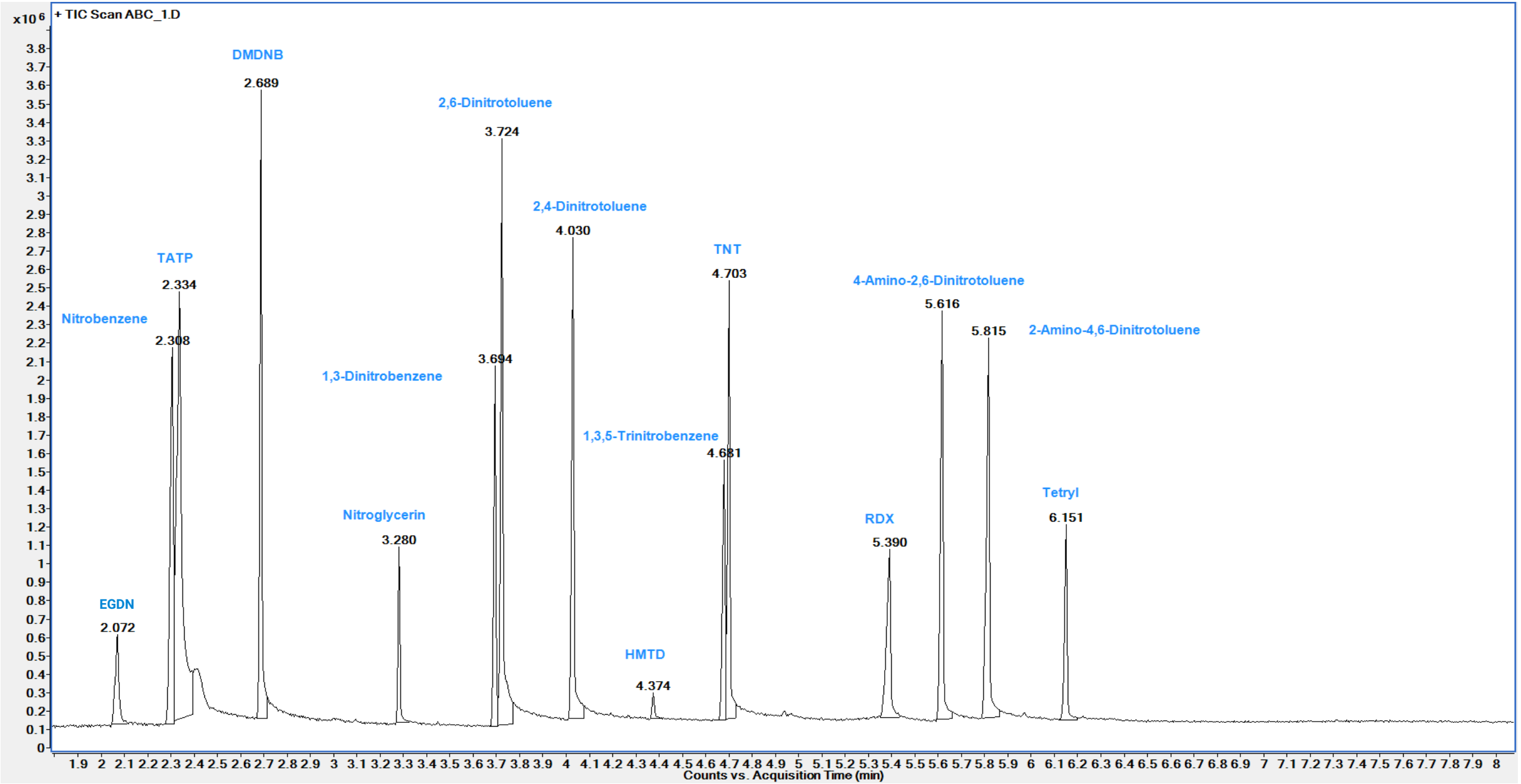
Extractor Source/7890 compared to High Efficiency Source (HES)/Intuvo



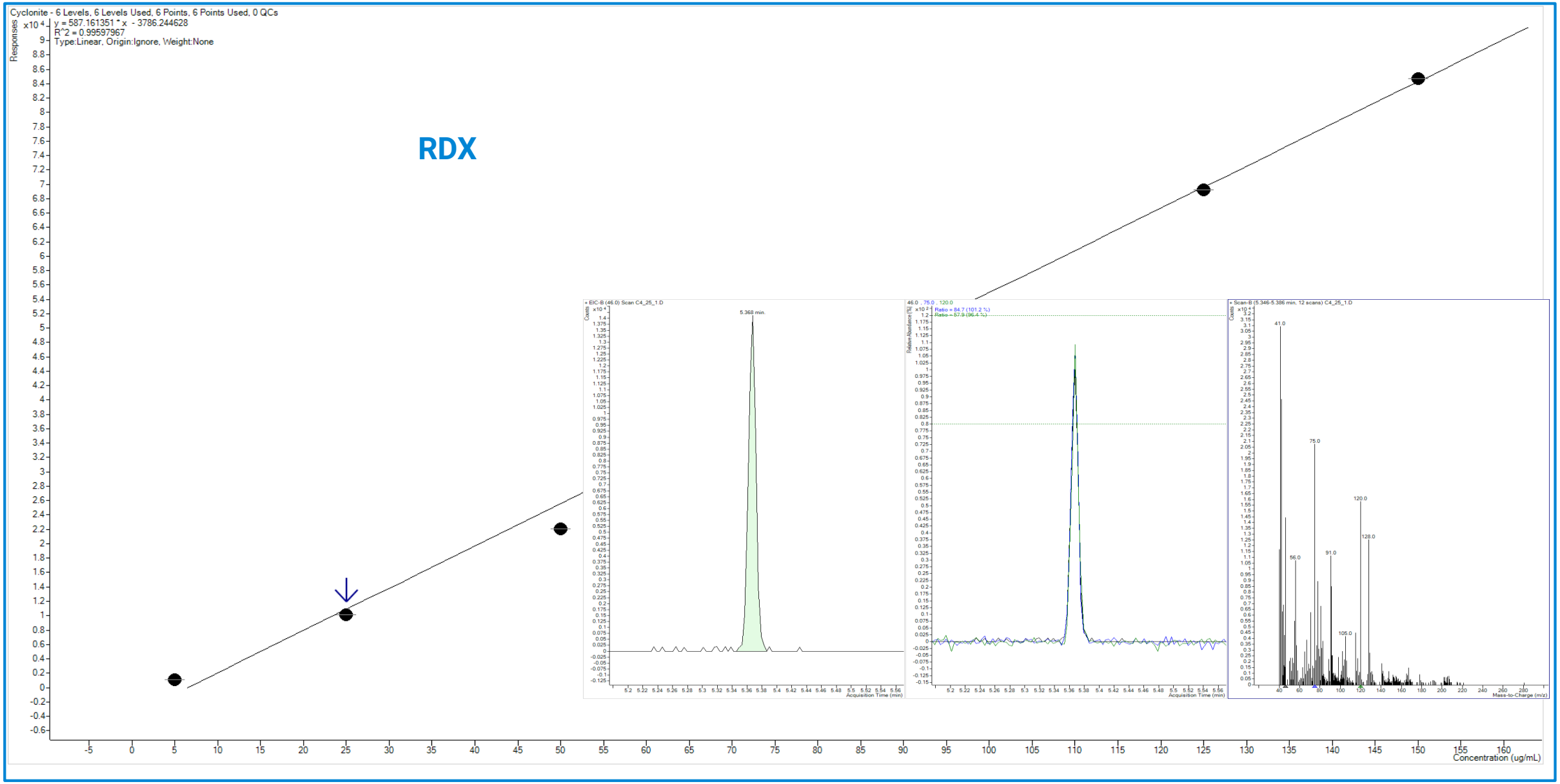
7 ppm Cerilliant energetics standard with varying Guard Chip



Restek Energetic Standard @ 100 ppm H_2 carrier gas



Calibration Curve of Cyclonite (RDX) 5 -150 ppm H_2 carrier gas



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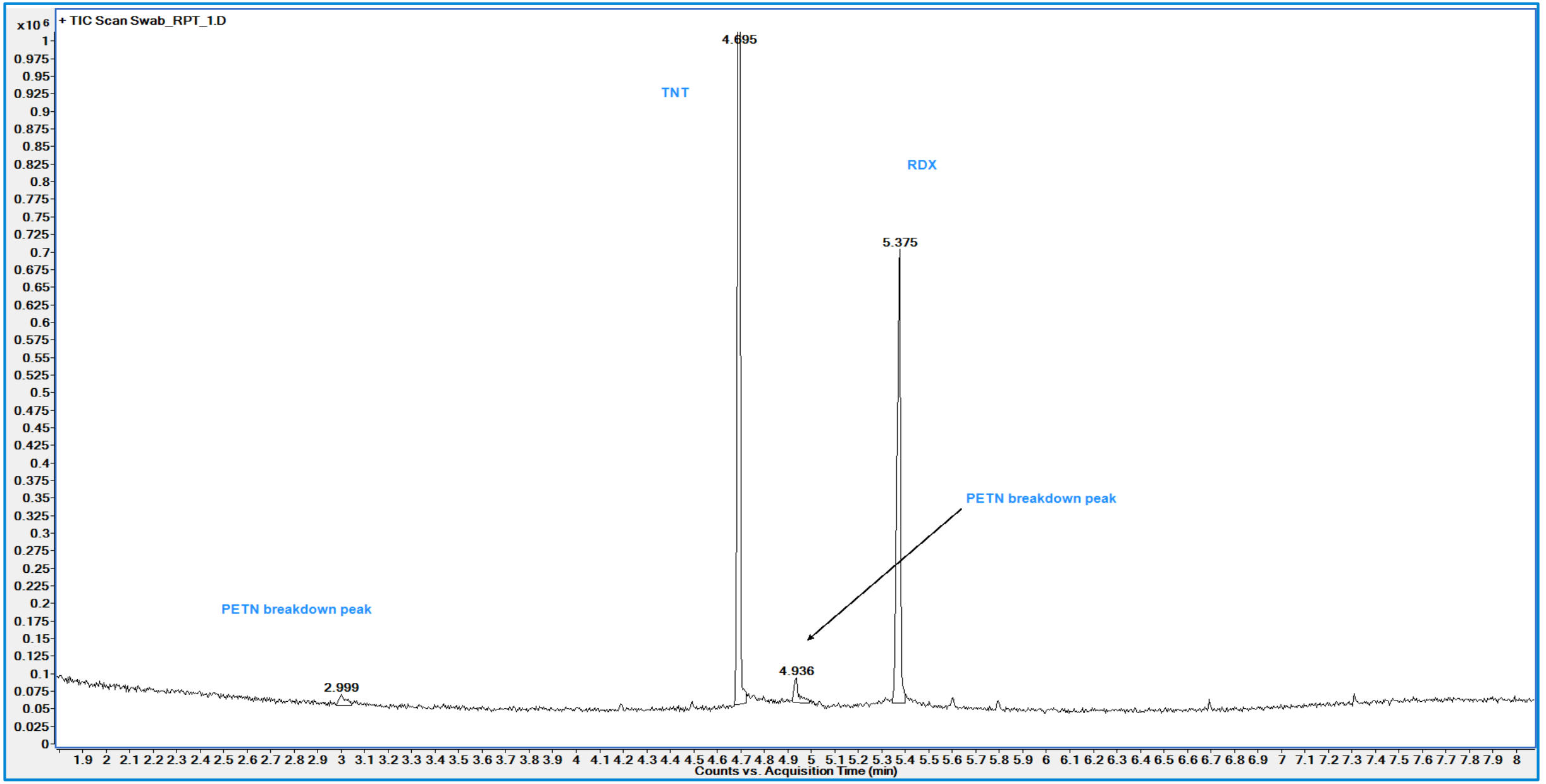
Cotton Swab Sample Matrix Spiked (RDX, TNT, PETN) Extracted 1 mL Acetone



Summary

Intuvo was able to achieve separation/resolution, reproducibility, and sensitivity, analyzing components of forensic interest (volatiles BAC, street drugs, ignitable liquids, and energetics)

Guard chip doesn't interfere with early eluting peaks or peak shape but can be controlled to produce better chromatography on early eluting peaks similar to a retention gap or pre-column

Intuvos (Multi-mode inlet) MMI cycle time reached 35°C equilibration in 4 minutes and ready for the next injection and the 7890 MMI took 7 minutes to come ready

Intuvo was able to achieve separation of energetics in a helium and hydrogen carrier gas environment

Intuvo was able to run under fast chromatographic conditions (150°C oven ramp) without additional voltage or special oven shroud (120 Vac 15 amp plug)

Retention time differences of 6 alkylbenzene compounds were monitored and found to have maintained <0.5% RSD while being analyzed on 2 different Intuvo 9000 GCs, multiple column installations multiple guard chip replacements, as well as routine inlet maintenance replacing septa and liners

Thank you for your attention