Proving that a GCMS system is fully functional

Running a standard mix

13Dec2018

Agilent
Trusted Answers

Functional or Operational?

Functional

Meets or exceeds applicable published specifications for the system on the date of shipment.

Is there a **hardware** problem?

Operational

Runs your application.

Your application may **be** the problem!

Proving Functionality

An Agilent GCMS system is functional when:

It completes the EI autotune specific for the EI source installed

- ATUNE.U, ETUNE.U, HES_Atune.U, atunes.eiex.tune.xml, atunes.eihs.tune.xml, atunes.ei.tune.xml, etc.
- **NOT** STUNE.U, BFB.U, DFTPP.U, Target.U, Manual tune, Quicktune, etc**.**
  - These tune types detune the source for specific criteria and do not necessarily provide valid troubleshooting information

The autotune meets the published autotune criteria for the specific system.

Typically:

Base Peak should be 69 or 219
Position of 69:70, 219:220, 502:503 (+/- 0.1 amu)
Ratio of 219 to 69 >35% ; Ratio of 502 to 69 >2%

Ratio of 70 to 69 (0.5-1.6%) ; Ratio of 220 to 219 (3.2-5.4%) ; Ratio of 502 to 503 (7.9-12.3%)

Mass 69 precursor <= 3%, 219 precursor <=6%, 502 precursor <=12%
Air/Water: 18 to 69 <20%, 28 to 69 <10%

Proving Functionality

An Agilent GCMS system with EI capability is functional when:

The GCMS system passes published IDL criteria on the date of shipment for the specific system using:

Helium carrier << hydrogen carrier gas on GCMS systems is not supported by Agilent.
Ultra Inert double tapered liner in S/Sl or MMI
Agilent GCMS checkout column
Proper column installation
Automatic Liquid Sampler (Instrument Detection Limit or S:N)
Manual Injection (S:N)
Agilent Acquisition and Data Analysis methods
Agilent Sequence

If the system does not have an Automatic Liquid Sampler it is functional when it passes the published S:N criteria on the date of shipment for the specific system using manual injection.

Not supported does not mean it won't work!

- It means that there are no performance specifications using H2 carrier.
- It means that there are different requirements which might lead to different outcomes.
- It means that if there are problems, Agilent will ask you to run it on helium first.

We will be glad to send a quote for help with your applications.

Proving Functionality

An Agilent GCMS system with Chemical Ionization capability is functional for CI when:

PCI Autotune finishes
PCI passes BZP S:N specifications published on the date of shipment for the specific system using:

- Helium carrier << hydrogen carrier gas on GCMS systems is not supported by Agilent.
- Methane CI gas << other CI gases are not used for checkout
- Ultra Inert double tapered liner in S/Sl or MMI
- Agilent GCMS checkout column
- Proper column installation
- Agilent PCI S:N Acquisition and Data Analysis methods

NCI Autotune finishes
NCI passes OFN S:N specifications published on the date of shipment for the specific system using:

- Helium carrier << hydrogen carrier gas on GCMS systems is not supported by Agilent.
- Methane CI gas << other CI gases are not used for checkout
- Ultra Inert double tapered liner in S/Sl or MMI
- Agilent GCMS checkout column
- Proper column installation
- Agilent NCI S:N Acquisition and Data Analysis methods

If a system with CI passes all the EI tests there is nothing wrong with any **non-CI** portion of the system!

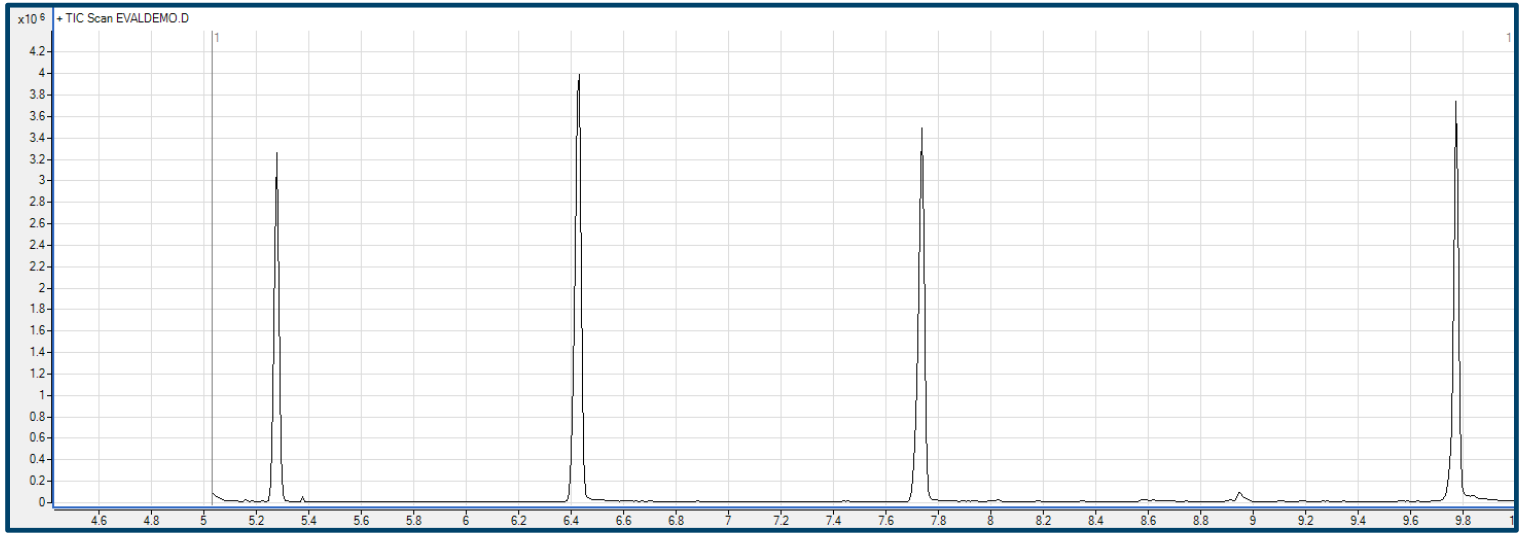
Proving Functionality

The best way to prove functionality is to run a known sample.

Agilent sells a GCMS Checkout Sample 05970-60045.

Solution of dodecane, biphenyl, p-cholorodiphenyl, and methyl palmitate in isooctane.

Six 1.0 mL ampoules: 4 at 10 ng/µL, 1 at 100 ng/µL, 1 at 100 pg/µL.



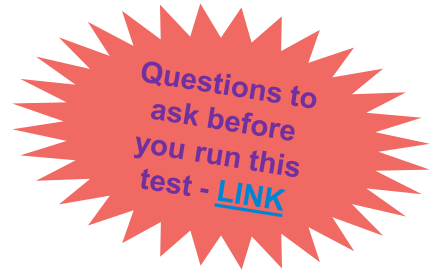
Proving Functionality

What if you could run it on a column that is already installed and equilibrated?

Most of the columns sold and used in GCMS systems are:

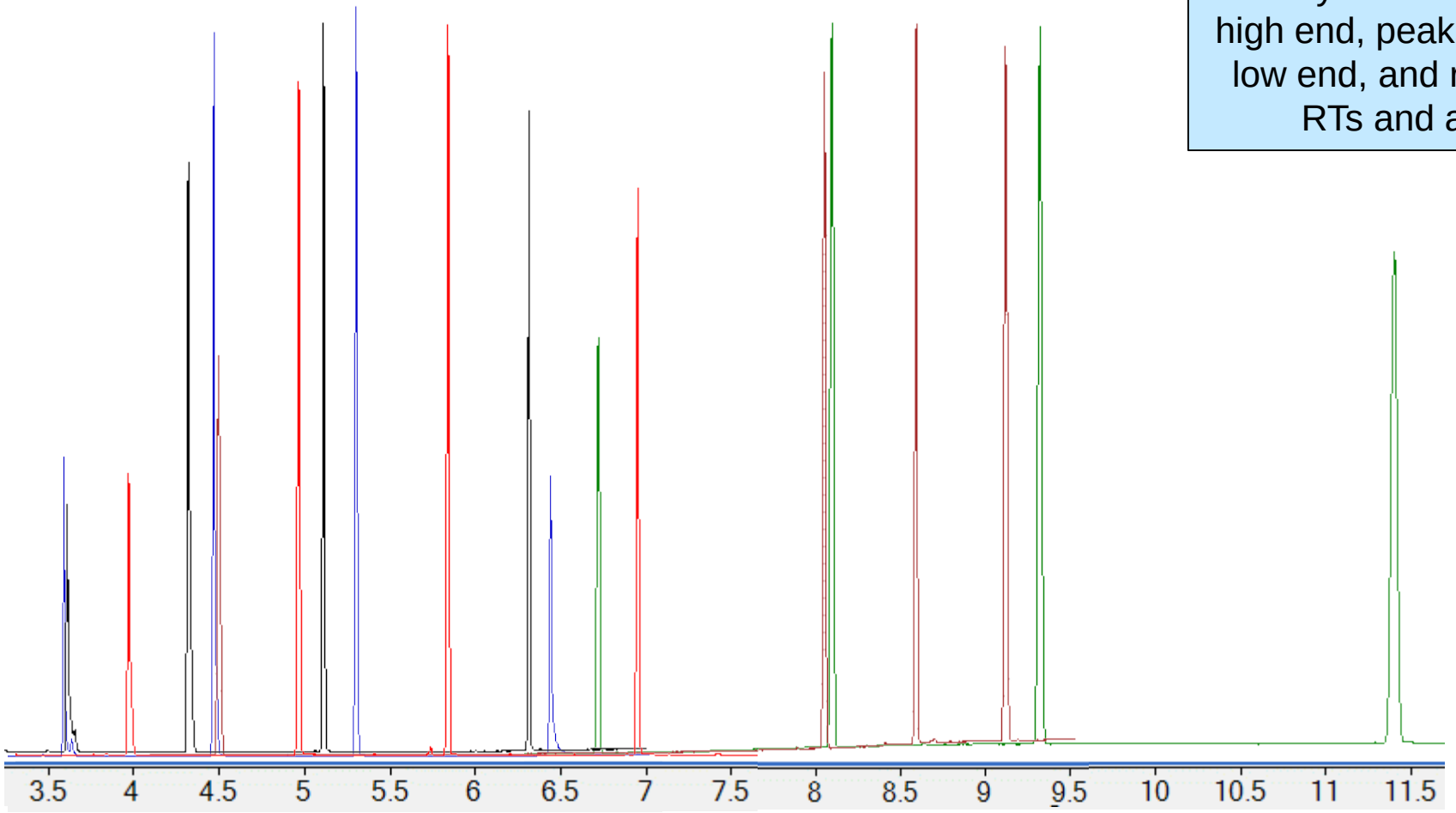
30 meter x 0.25 mm i.d. x 0.25uM film thickness

- DB-5msUI, DB-5ms, DB-5ht, DB-5, HP-5msUI, HP-5ms, HP-5ms Semivolatiles, HP-5, DB-5.625, VF-5ms, VF-5ht, VF-5 Pesticides, VF-5, Ultra 2
- HP-1msUI, HP-1ms, HP-1, DB-1msUI, DB-1ms, DB-1ht, DB-1, VF-1ms, Ultra 1
- DB-WAX, DB-WAXetr, HP-INNOWax, DB-FFAP, HP-FFAP, DB-WaxFF, DB-HeavyWax
- DB-624, HP-624, VF-624ms
- DB-8270D
- Others



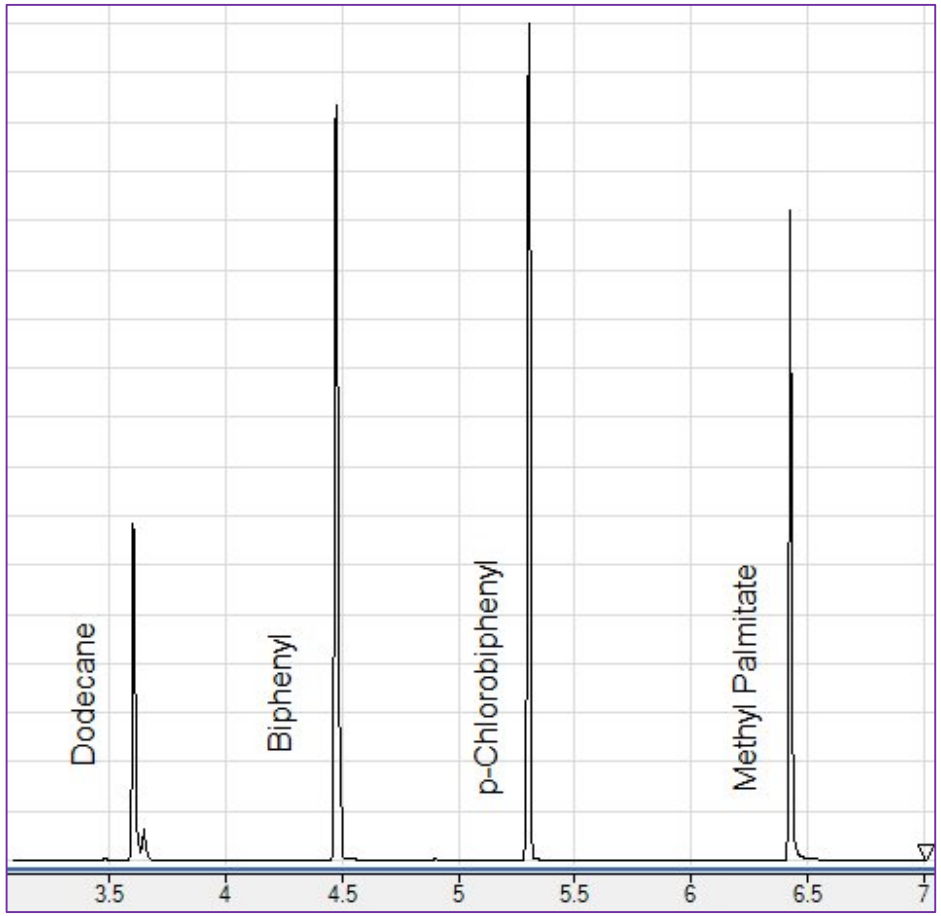
Proving Functionality

Do not get bogged down trying to get your system's retention times to match these examples! Worry about saturation at the high end, peaks too small at the low end, and reproducibility of RTs and area counts.

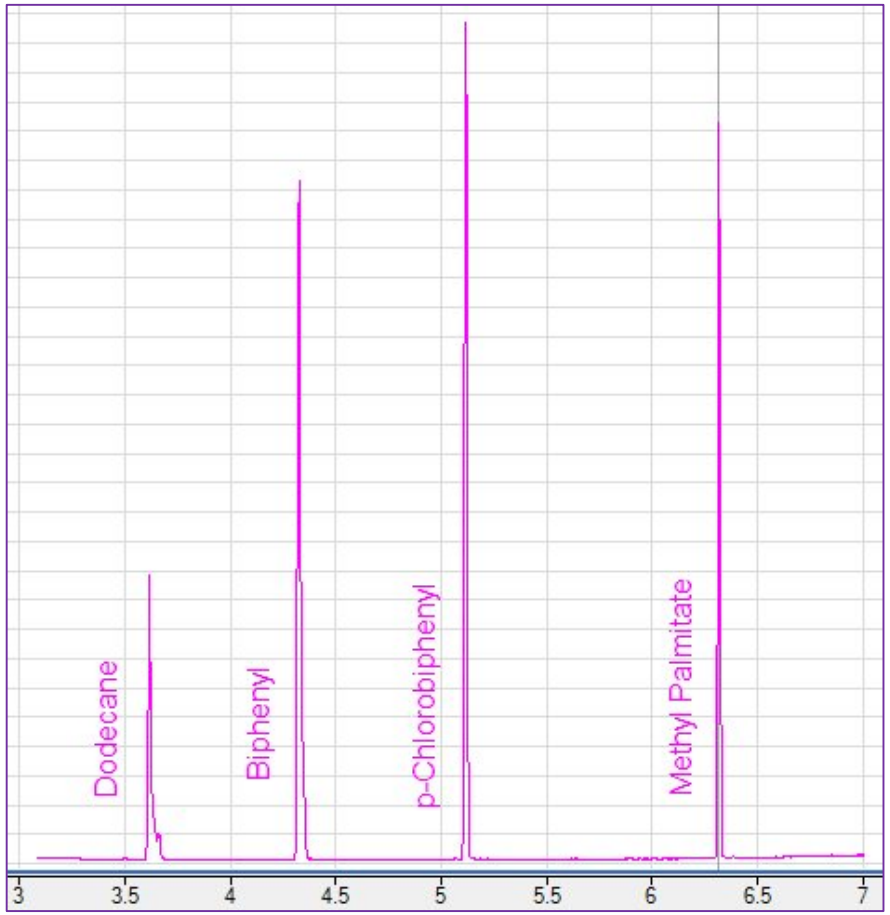


Proving Functionality

xx-5 Columns

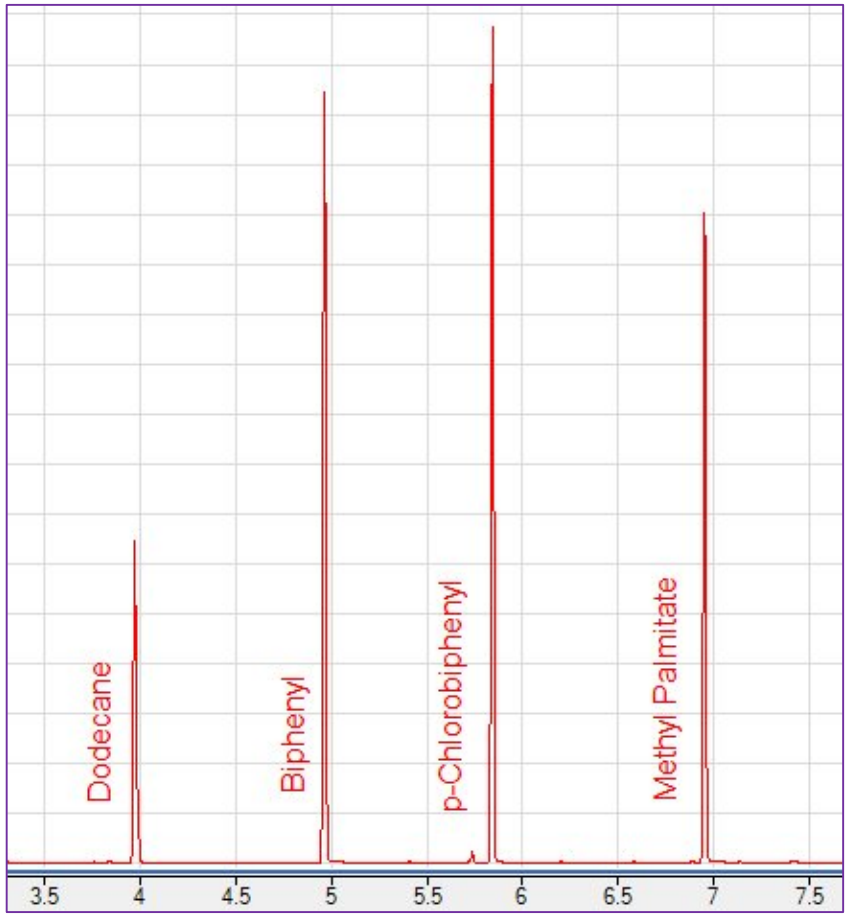


xx-1 Columns



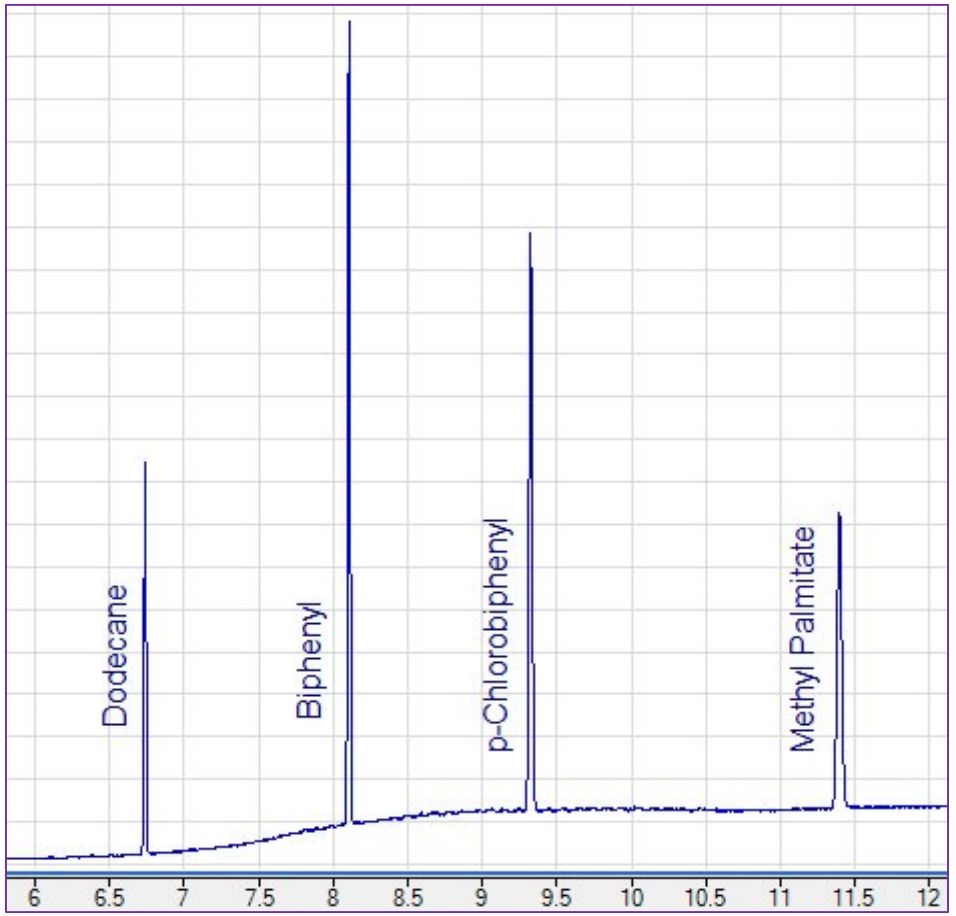
Proving Functionality

8270 Columns



624 UI 1.4uM film

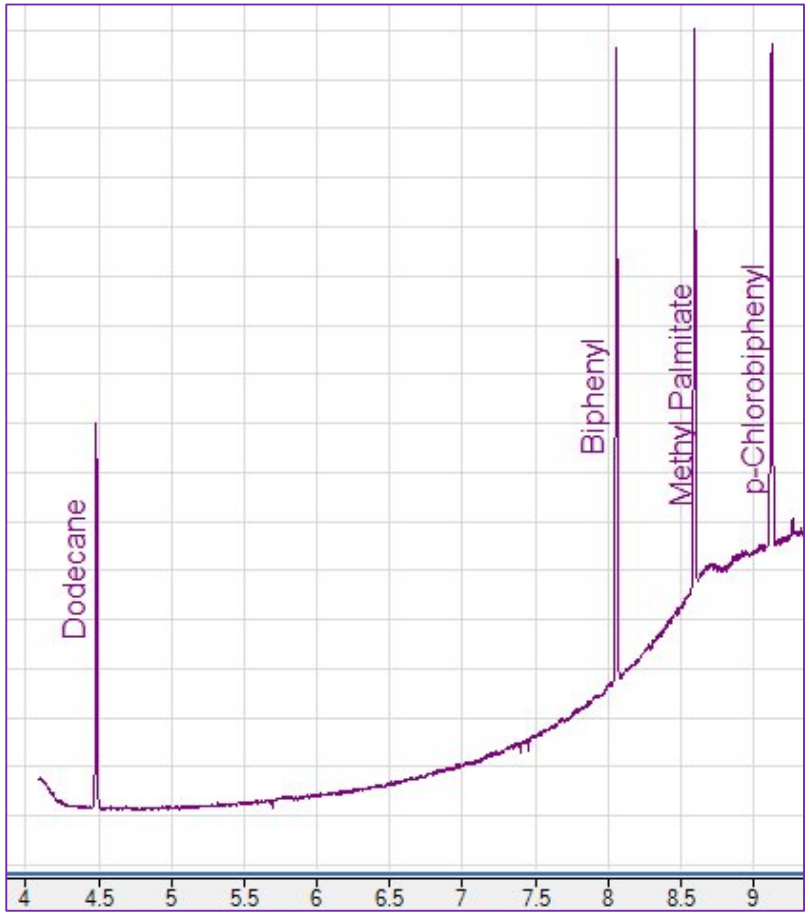
260 oven max and thick film



Proving Functionality

HeavyWax

Notice the Methyl Palmitate is now between the Biphenyl and p-Chlorobiphenyl



The oven program went to 280 on this column.

Proving Functionality

The test can be run three different ways.

- If the perceived issue is signal loss over time or run-to-run reproducibility, run one concentration multiple times, typically the 10ng.
- If the perceived issue is linearity, run the three concentrations – you may have to adjust the MS parameters for 100ng – or three injection volumes.
- If the application uses SPLIT, run the three split ratios.

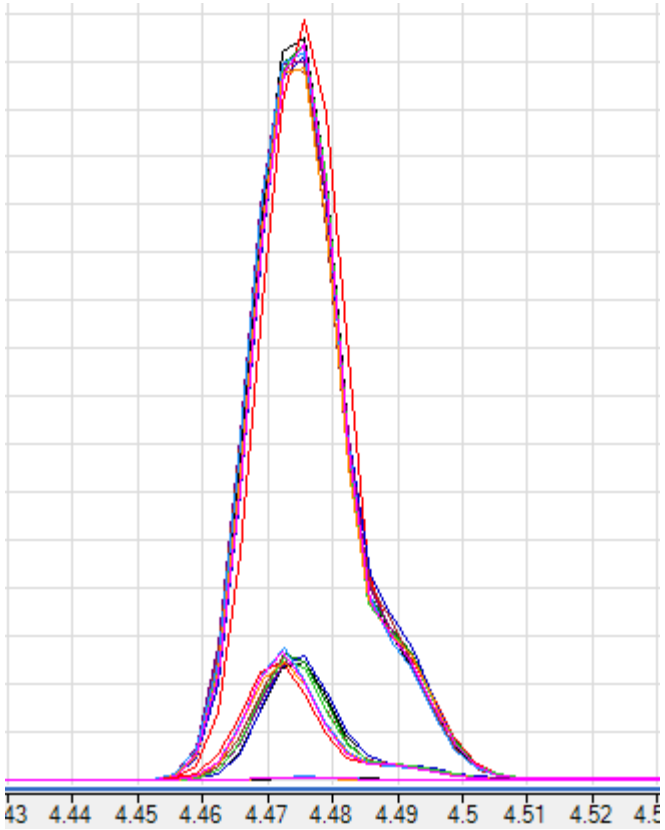
- 100fg, 10ng, 100ng ← The three concentrations in the 05970-60045 box
- 0.3uL, 0.6uL, 0.9uL ← Three injection volumes of 10ng as there are 4 vials of it in the box
- 80:1, 40:1, 20:1 split ratios ← Three split ratios to see if the split is linear using 10ng

Observed Linearity

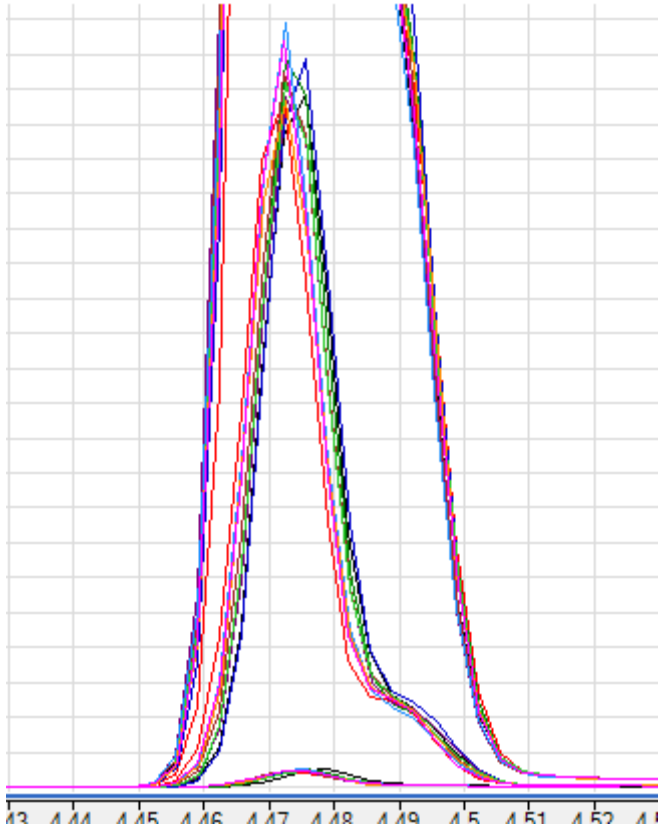
	Three concentrations	Three injection volumes	Three split ratios
Dodecane	0.998	0.998	0.998
Biphenyl	0.994	0.999	0.998
p-Chlorobiphenyl	0.996	0.999	0.999
Methyl Palmitate	0.999	0.991	0.993

Single Quad. Ten runs each at three concentrations. This is the biphenyl peak.

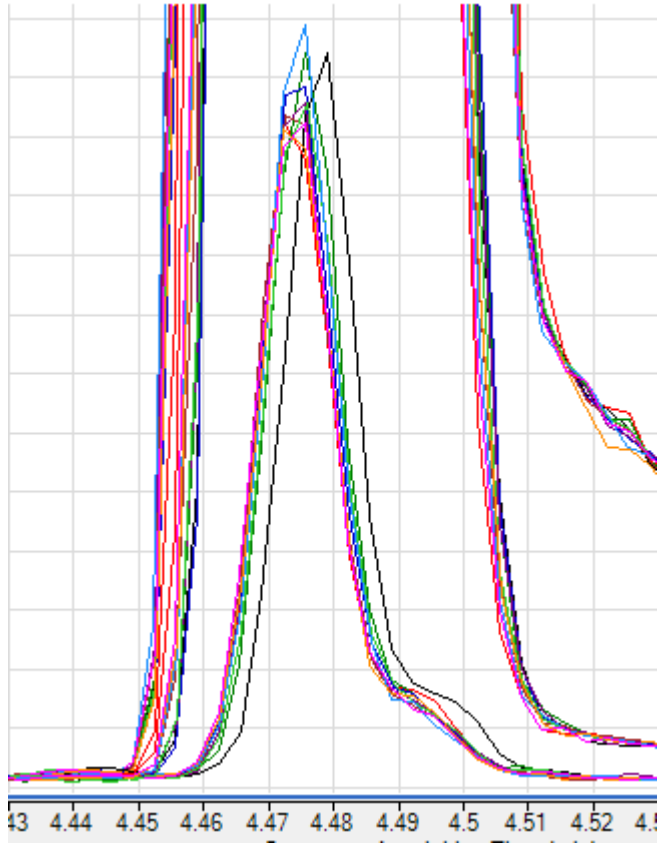
Scaled to 100ng
~3.2 x 10^7



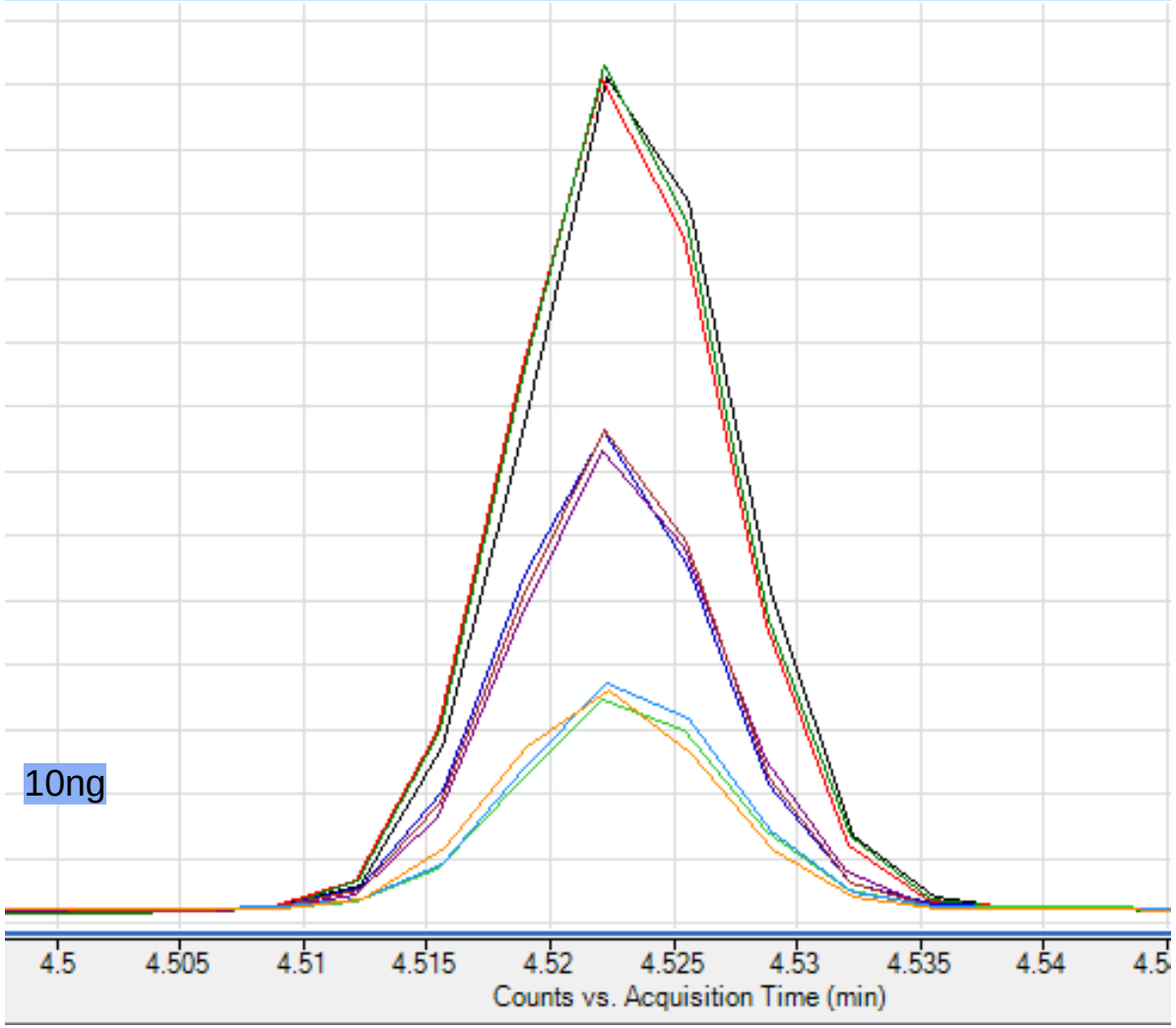
Scaled to 10ng
~5.5 x 10^6



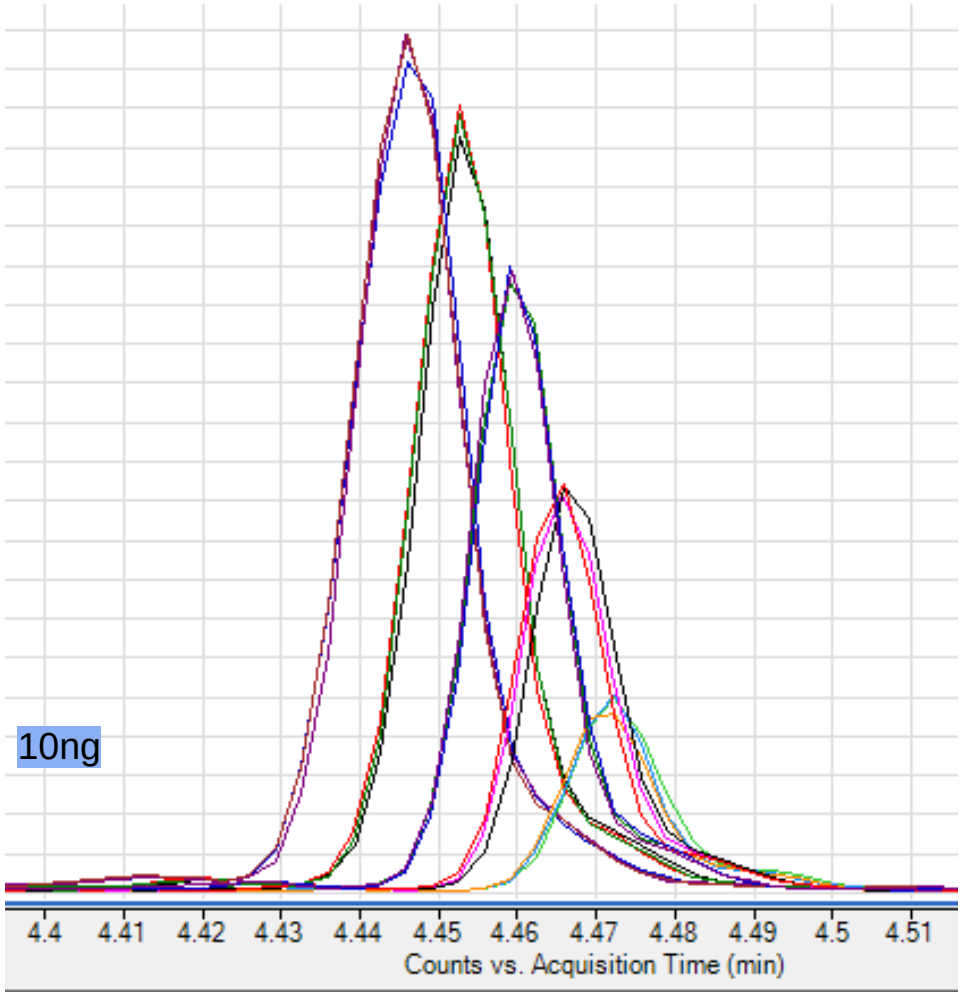
Scaled to 100pg
~1.3 x 10^5



Three runs each at three split ratios:
80:1, 40:1, 20:1.
Scale is ~7.0 x 10^5



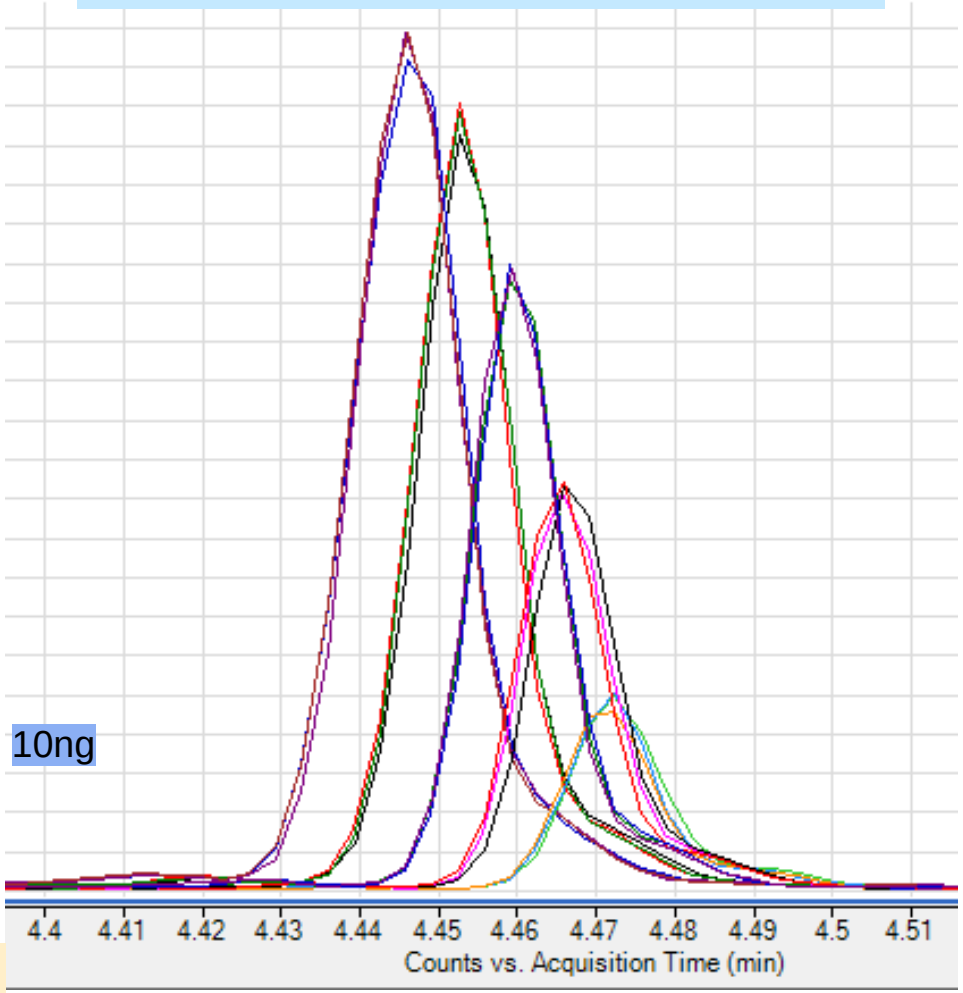
Three runs each at five injection volumes:
0.3, 0.6, 0.9, 1.2, 1.5 uL.
Scale is ~5.5 x 10^5



Three runs each at five injection volumes:
0.3, 0.6, 0.9, 1.2, 1.5 uL.
Scale is ~5.5 x 10^5

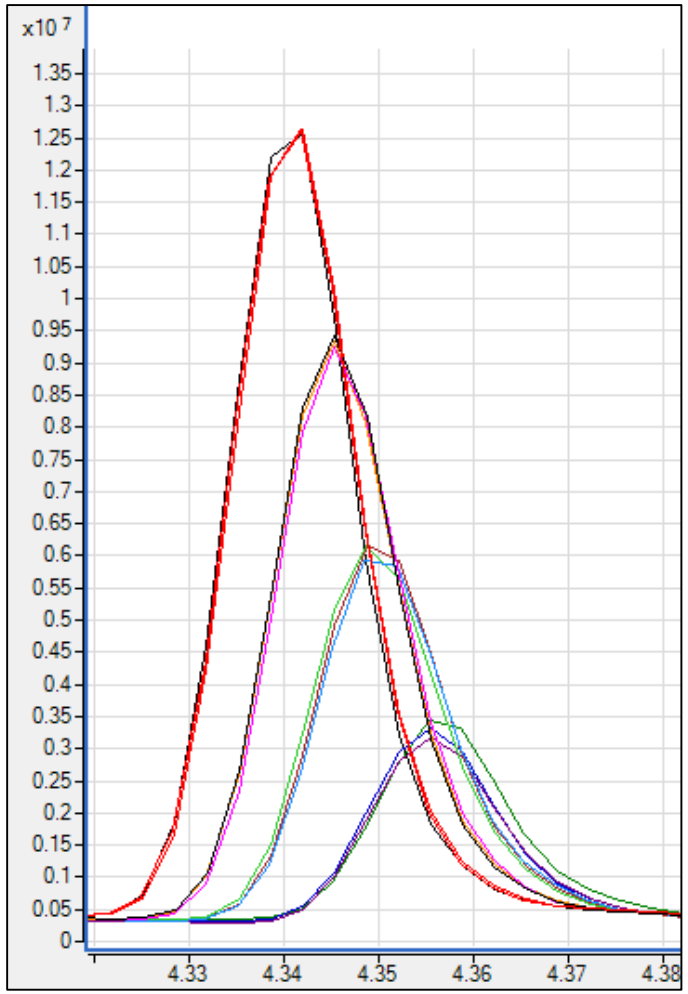
In split, one reason the RTs move forward as more is injected is because of the higher instantaneous pressure in the inlet caused by the larger volume of solvent vapor created. It looks interesting here, but the difference from 0.3uL to 1.5uL is only 0.03 minutes at 4.45 minutes --- 1.8 seconds.

RT shift with different injection volumes is also related to a solvent effect – with larger injection volumes you're introducing a lot more solvent, which can start to have an effect on analyte solubility in the stationary phase and thus affect retention. Most customers don't see this because they stick with stable split and injection volumes (as they should), but retention behavior is a function of the whole method which includes how much solvent is introduced to the system. This is really only observable for peaks eluting in the neighborhood (relatively) of the solvent peak; real high boilers eluting at the end of the run will not show much impact due to their ability to cold trap and chromatograph much more slowly through the system, well after the solvent has been sent on its way.



The linearity for the four peaks at five injection volumes is: 0.999, 0.999, 0.999, 0.999

Tandem Quad – 7010x. This is the biphenyl peak.



Three runs each at four injection volumes:
0.3, 0.6, 0.9, 1.2.
Scale is ~1.3 x 10^7

The linearity for the four peaks at four injection volumes is:
0.998, 0.999, 0.999, 0.999

System prep:

- Visually verify which column is installed and that it looks like the correct diameter and length.
- Check the column configuration and identification in MassHunter.
- Check the gases. Make sure that there is enough in the tank(s) to complete the testing.
- Cool off the inlet and the oven. Wait until they are both <60 degrees.
- Change the septum, liner, o ring, and verify that the column is installed high enough above the ferrule.
- Wait at least five minutes after reconnecting everything to purge out any oxygen before heating it up again.
- Be patient at this step while the system is equilibrating! The inlet temperature requires some time for best thermal stability – 15 min or more.
- Set column flow to 1.2 ml/min of helium.

S/Sl **6-7mm** up from ferrule
MMI **14-15mm** up from ferrule

- Oven at…200 to 275…hotter oven helps with setting the low inlet pressure, low column flow. Do not exceed the column max, of course.
- Set the inlet mode to SPLIT – it does not matter which liner is installed.
- Set the inlet pressure about as low as it will maintain pressure… 1.3 psi? 1.6psi ? This depends on the column installed, carrier gas configured, and oven temperature. This will be ~0.2 ml/min or so.
- Set the split flow high – say 300 ml/min or so.
- Open the 100ng Sample A vial. Inject 8 uL of it into the inlet at least eight or ten times. Don't slam it in, just push it in while pondering about vaporization over time.
- This rinses out the liner and the inlet around the liner.
- Reload the Sample A method to reset the flow parameters.

Then set the oven to the final GCMS Checkout Sample run oven temperature, typically 275 but not higher than the installed column maximum, and wait ten minutes or so before continuing. All the peaks that were put in the column should have eluted by then.

GC Method Parameters: Use these for three concentrations or three injection volumes

On SQ, typically 10ng, since there are four vials in the box

GC Summary	
Run Time	7.25 min
Post Run Time	2 min
Oven	
Temperature Setpoint	On
(Initial)	65 °C
Hold Time	1 min
Post Run	275 °C
Program	
#1 Rate	70 °C/min
#1 Value	125 °C
#1 Hold Time	0 min
#2 Rate	30 °C/min
#2 Value	275 °C
#2 Hold Time	0.4 min
Equilibration Time	1 min

ALS	
Front Injector	
Syringe Size	5 µL or 10 µL
Injection Volume	**0.3 µL**
Solvent A Washes (PreInj)	4
Solvent A Washes (PostInj)	0
Solvent A Volume	3 µL
Solvent B Washes (PreInj)	2
Solvent B Washes (PostInj)	0
Solvent B Volume	3 µL
Sample Washes	4
Sample Wash Volume	3 µL
Sample Pumps	8
Dwell Time (PreInj)	0 min
Dwell Time (PostInj)	0 min
Solvent Wash Draw Speed	300 µL/min
Solvent Wash Dispense Speed	3000 µL/min
Sample Wash Draw Speed	300 µL/min
Sample Wash Dispense Speed	3000 µL/min
Injection Dispense Speed	6000 µL/min
Viscosity Delay	2 sec
Sample Depth	Disabled
Injection Type	Standard
L1 Airgap	0 µL
Solvent Wash Mode	A, B

Front SS Inlet He		
Mode	Pulsed Splitless	
Heater	On	275 °C
Pressure	On	11.367 psi
Total Flow	On	79.2 mL/min
Septum Purge Flow	On	3 mL/min
Gas Saver	On	20 After 2 min mL/min
Injection Pulse Pressure	20 psi Until 0.5 min	
Purge Flow to Split Vent	75 mL/min at 1 min	

Thermal Aux 3 (MSD Transfer Line)	
Temperature Setpoint	On
(Initial)	250 °C

Column	
Column #1	
Flow Setpoint	On
(Initial)	**1.2 mL/min**
Post Run	1.2 mL/min
Agilent Column	30 m x 0.25 mmid x 0.25 µm
In	Front SS Inlet He
Out	MSD
(Initial)	75 °C
Pressure	11.367 psi
Flow	1.2 mL/min
Average Velocity	40.402 cm/sec
Holdup Time	1.2376 min
Column Outlet Pressure	0 psi

Ultra Inert double tapered liner
5190-3983
S/Sl column **7mm** up from ferrule
MMI column **15mm** up from ferrule

0.3uL for three concentrations
0.3, 0.6, and 0.9 for three volumes.
Might want to use a 5uL syringe.

GC Method Parameters: Use these for three split ratios

On SQ, typically 10ng, since there are four vials in the box

GC Summary	
Run Time	8.75 min
Post Run Time	2 min
Oven Temperature	
Setpoint	On
(Initial)	65 °C
Hold Time	2.5 min
Post Run	275 °C
Program	
#1 Rate	70 °C/min
#1 Value	125 °C
#1 Hold Time	0 min
#2 Rate	30 °C/min
#2 Value	275 °C
#2 Hold Time	0.4 min
Equilibration Time	1 min

ALS	
Front Injector	
Syringe Size	5 µL or 10 µL
Injection Volume	**0.3 µL**
Solvent A Washes (PreInj)	4
Solvent A Washes (PostInj)	0
Solvent A Volume	3 µL
Solvent B Washes (PreInj)	2
Solvent B Washes (PostInj)	0
Solvent B Volume	3 µL
Sample Washes	4
Sample Wash Volume	3 µL
Sample Pumps	8
Dwell Time (PreInj)	0 min
Dwell Time (PostInj)	0 min
Solvent Wash Draw Speed	300 µL/min
Solvent Wash Dispense Speed	3000 µL/min
Sample Wash Draw Speed	300 µL/min
Sample Wash Dispense Speed	3000 µL/min
Injection Dispense Speed	6000 µL/min
Viscosity Delay	2 sec
Sample Depth	Disabled
Injection Type	Standard
L1 Airgap	0 µL
Solvent Wash Mode	A, B

Front SS Inlet He		
Mode	Split	
Heater	On	275 °C
Pressure	On	8.6221 psi
Total Flow	On	100.2 mL/min
Septum Purge Flow	On	3 mL/min
Gas Saver	On	20 After 2 min mL/min
Split Ratio	**80 :1**	
Split Flow	96 mL/min	

Thermal Aux 3 (MSD Transfer Line)	
Temperature Setpoint	On
(Initial)	250 °C

Column	
Column #1	
Flow Setpoint	On
(Initial)	**1.2 mL/min**
Post Run	1.2 mL/min
Agilent Column	30 m x 0.25 mmid x 0.25 µm
In	Front SS Inlet He
Out	MSD
(Initial)	75 °C
Pressure	8.6221 psi
Flow	1.2 mL/min
Average Velocity	45.049 cm/sec
Holdup Time	1.1099 min
Column Outlet Pressure	0 psi

Ultra Inert low resistance split liner
5190-2295
S/Sl column **7mm** up from ferrule
MMI column **15mm** up from ferrule

80:1, 40:1, and 20:1
for three split ratios
Might want to use a 5uL syringe.

Single Quad MS Method Parameters:

Use for three concentrations, three injection volumes, or three split ratios

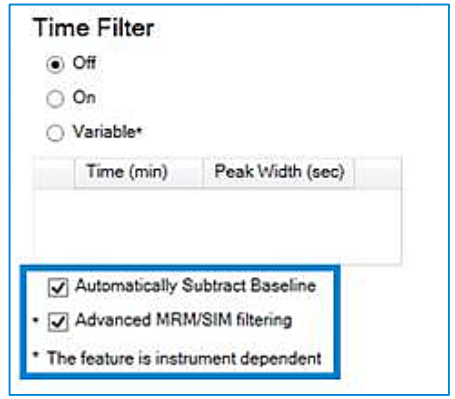
MS Information			
General Information			
Acquisition Mode		Scan	
Solvent Delay (minutes)		**3**	<< Might need to shorten this to see the first peak if the column has been cut numerous times
Tune file	D:\MassHunter\GCMS\3\5977\atune.u		<< The proper and current EI autotune file
EM Setting mode Gain		**1**.000000	
Normal or Fast Scanning		Normal Scanning	
Trace Ion Detection		Off	
[Scan Parameters]			
Start Time		3	<< Same as solvent delay
Low Mass		50	<< If there are any concerns about air/water/gas contamination, start scanning at 25 amu
High Mass		325	
Threshold		75	<< It depends! Higher or lower may be necessary to get data at every chromatographic point.
A/D Samples		**2^1**	<< 2^1 to get enough scans across the peak for good quantitation
[MSZones]			
MS Source	230 C	maximum 300 C	<< Or higher, as long as the tune is done at the same temperature and has equilibrated long enough
MS Quad	150 C	maximum 200 C	<< There are very few applications that need to run the quad higher than 150.

Tandem Quad MS Method Parameters:

Use for four injection volumes of 100pg (0.3, 0.6, 0.9, 1.2 uL) pulsed splitless on a 7000x or 7010x

MS Information		
Acquisition Mode	**MS2 Scan**	
Solvent Delay (minutes)	**3**	
Tune file	atunes.eiex or atunes.eihs	
EM Setting mode Gain	**0.2**	
Normal or Fast Scanning	Normal Scanning	
Trace Ion Detection	Off	
[Scan Parameters]		
Start Time	3	<< Same as solvent delay. May need to be shorter to see the first peak.
Low Mass	50	<< If there are any concerns about air/water/gas contamination, start scanning at 25 amu
High Mass	300	
Scan Time (ms)	200	<< May need to go to 150 ms/scan to get enough scans across the peak
Step size (amu)	0.1	
Threshold	100	<< It depends! Higher or lower may be necessary to get data at every chromatographic point
[MSZones]		
MS Source	230 C maximum 300 C	<< Or higher, as long as the tune is done at the same temperature and has equilibrated long enough
MS Quad	150 C maximum 200 C	<< There are very few applications that need to run the quad higher than 150.

Collision Cell Gases:		
7000X	N2: 1.5 ml/min	Helium: 2.25 ml/min
7010X	N2: 1.5 ml/min	Helium: 4 ml/min



Tandem Quad MS Method Parameters: If you want to test the collision cell

Use all the parameters from the previous slide except make three time segments. The first and last ones will still be MS2 scan to see dodecane, biphenyl, and methyl palmitate. The second one will be an MRM segment. Set the times appropriately.

Time Segments

	Time (min)	Scan Type	Electron Energy (eV)	Delta EMV (V)	Calculated EMV (V)	Gain	Data Saved	# of Ions
1	0	MS2 Scan	70		1012.7	.2	☑	
2	5	MRM	70		1012.7	.2	☑	2
3	5.8	MS2 Scan	70		1012.7	.2	☑	

Collision Cell Gases:

7000X	N2: 1.5 ml/min	Helium: 2.25 ml/min
7010X	N2: 1.5 ml/min	Helium: 4 ml/min

Time Filter

- ◉ Off
- ○ On
- ○ Variable*

Time (min)	Peak Width (sec)

☑ Automatically Subtract Baseline
* ☑ Advanced MRM/SIM filtering
* The feature is instrument dependent

Scan Segments

	Compound Name	ISTD	Precursor Ion	MS1 Resolution	Product Ion	MS2 Resolution	Dwell (ms)	CE (eV)
1	ChlorBiphenyl_0	☐	188.1	Wide	188.1	Widest	50	60
2	ChlorBiphenyl	☐	188.1	Wide	152	Widest	50	60

At 60 eV CC energy, the two chlorines are blown off of p-chlorobiphenyl. You will not see 188.1 in the MRM but will see 152. The full scan data will still show the typical spectrum for the peak.

And at the bottom enable Full MS2 Scan as well.

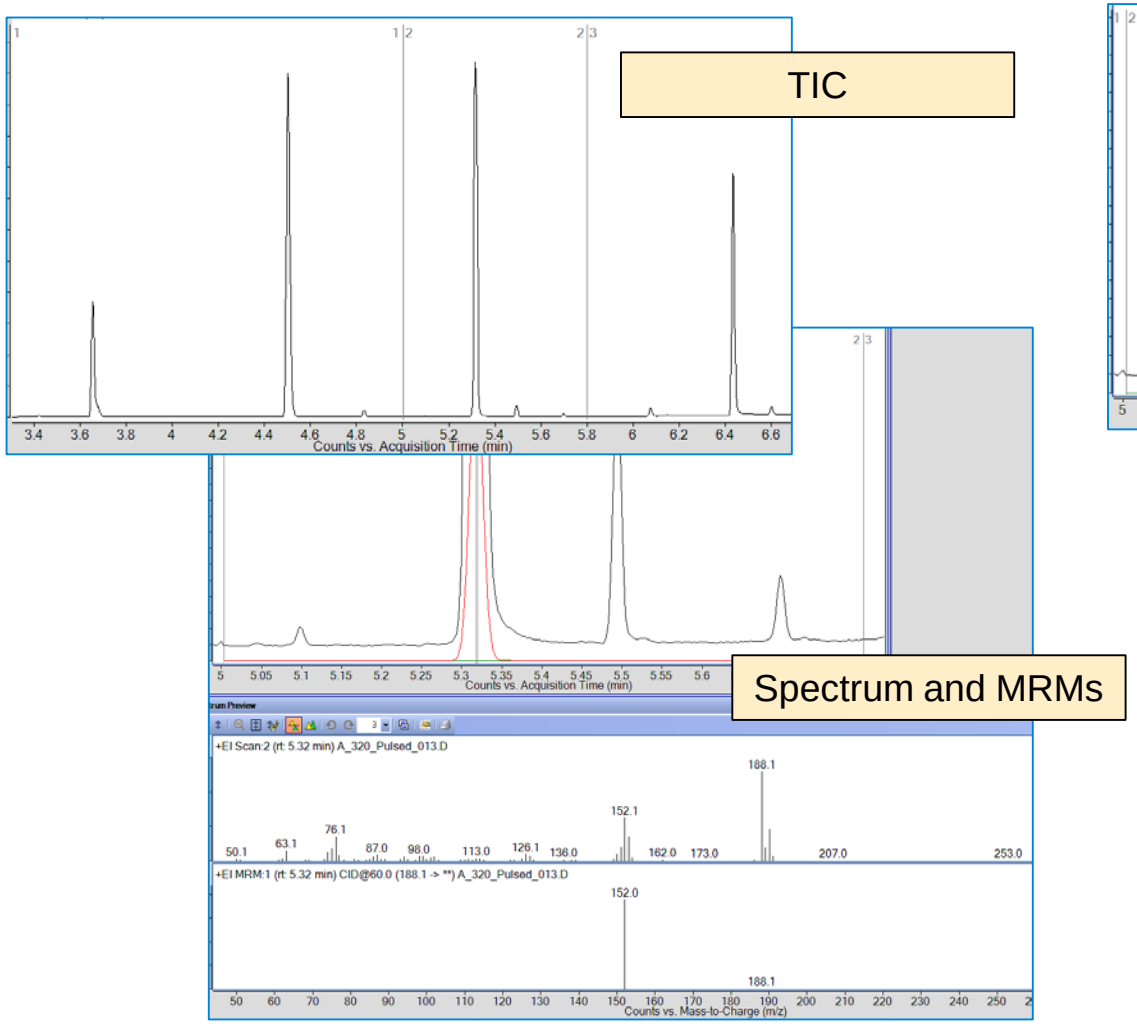
Full Scan Parameters

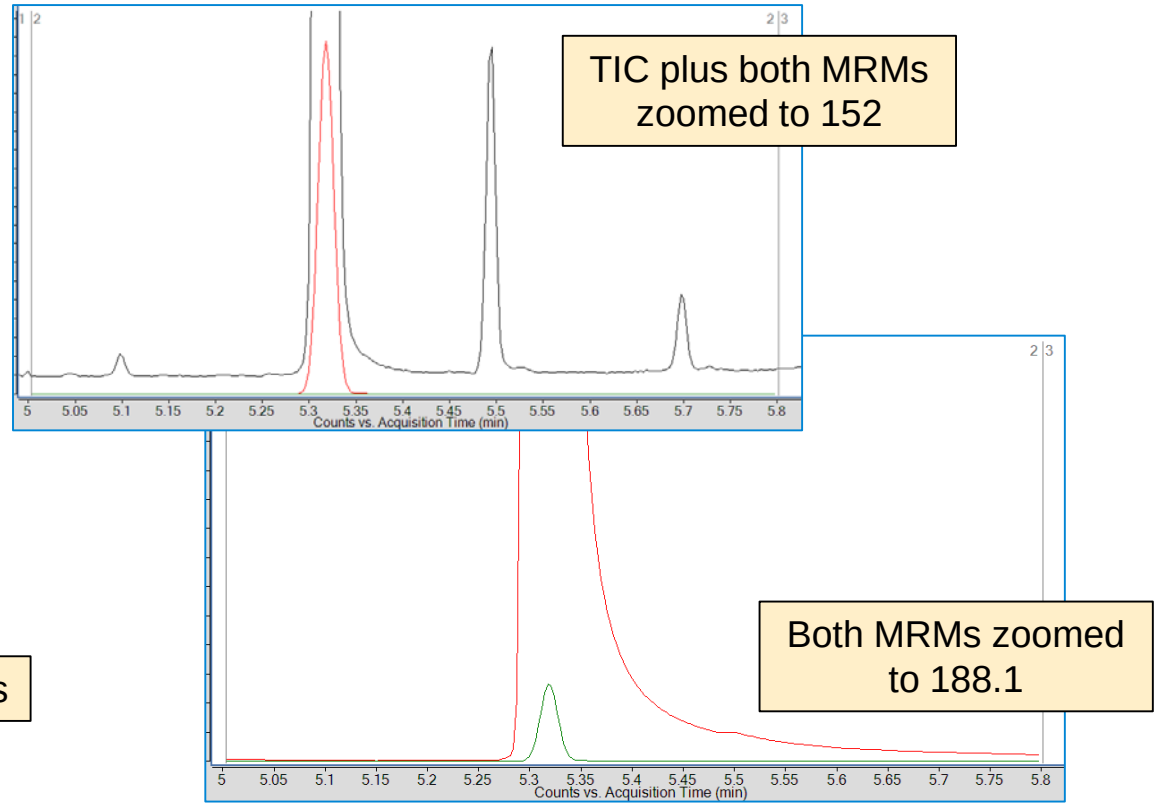
☑ Enable ○ MS1 Scan ◉ MS2 Scan

	Start Mass	End Mass	Step size (amu)	Threshold	Profile Data	Data Samples	Expected ScanTime (ms)
▶	50	300	0.1	25	☐	2	81

Tandem Quad MS Method Parameters: If you want to test the collision cell

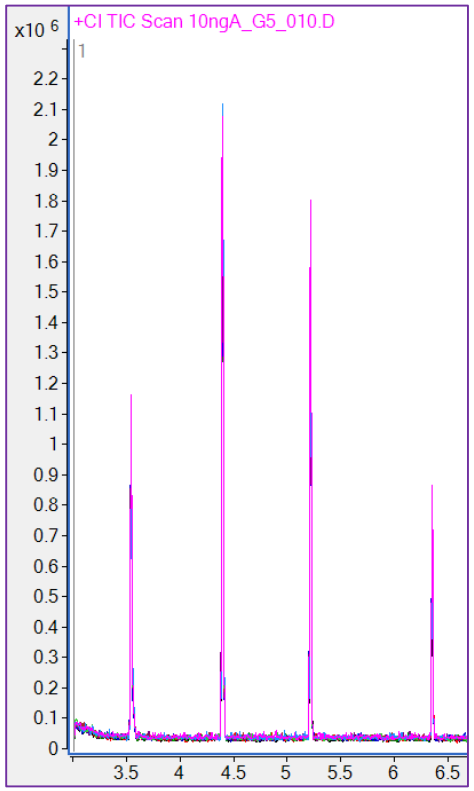
Use all the parameters from the previous slide except make three time segments. The first and last ones will still be MS2 scan to see dodecane, biphenyl, and methyl palmitate. The second one will be an MRM segment. Set the times appropriately.



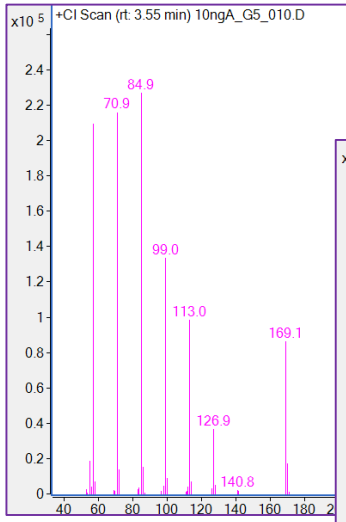


The spectrum is p-chlorobiphenyl. The MRM shows that the collision cell is working because 188.1 is essentially gone.

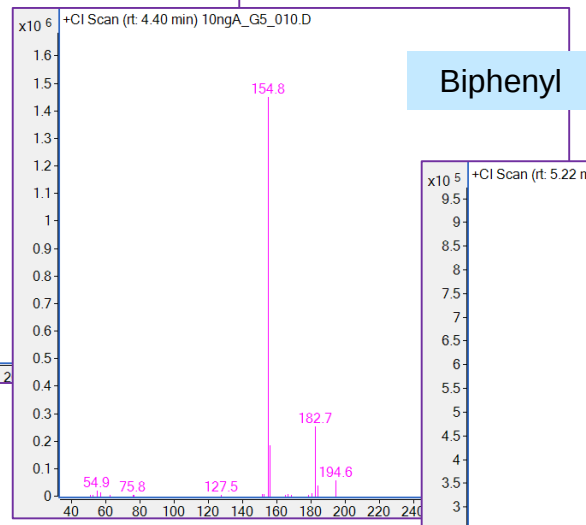
This may also be used to test Positive CI: Use the GC parameters from the previous slides. Source at 300 degrees. Perform the PCI tune using methane. The MS parameters are scan (either MSD Scan or QQQ MS2 Scan) 50-325, MSD 2^1, QQQ 125 ms scan speed. These runs were 10ng, double tapered liner, pulsed splitless, 1uL injection volume, gain 5.



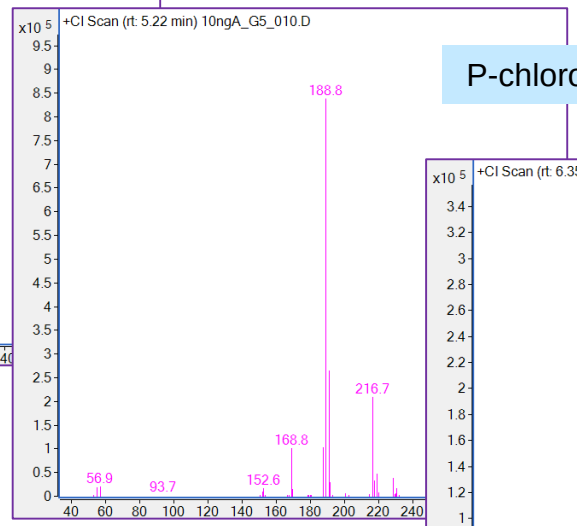
9 runs overlaid



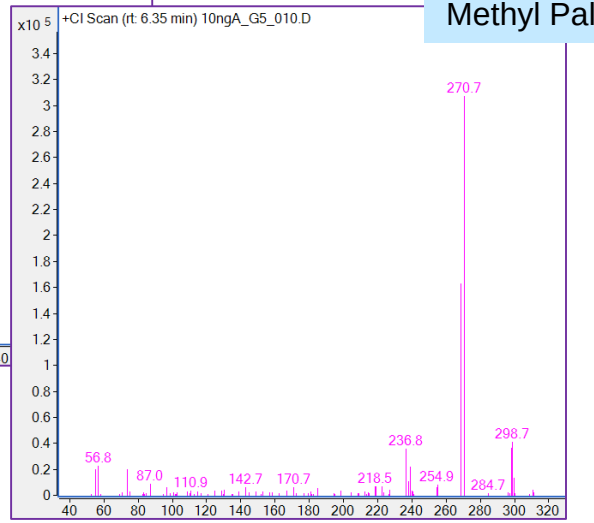
Dodecane



Biphenyl



P-chlorobiphenyl



Methyl Palmitate

Adjustable parameters

Don't change:

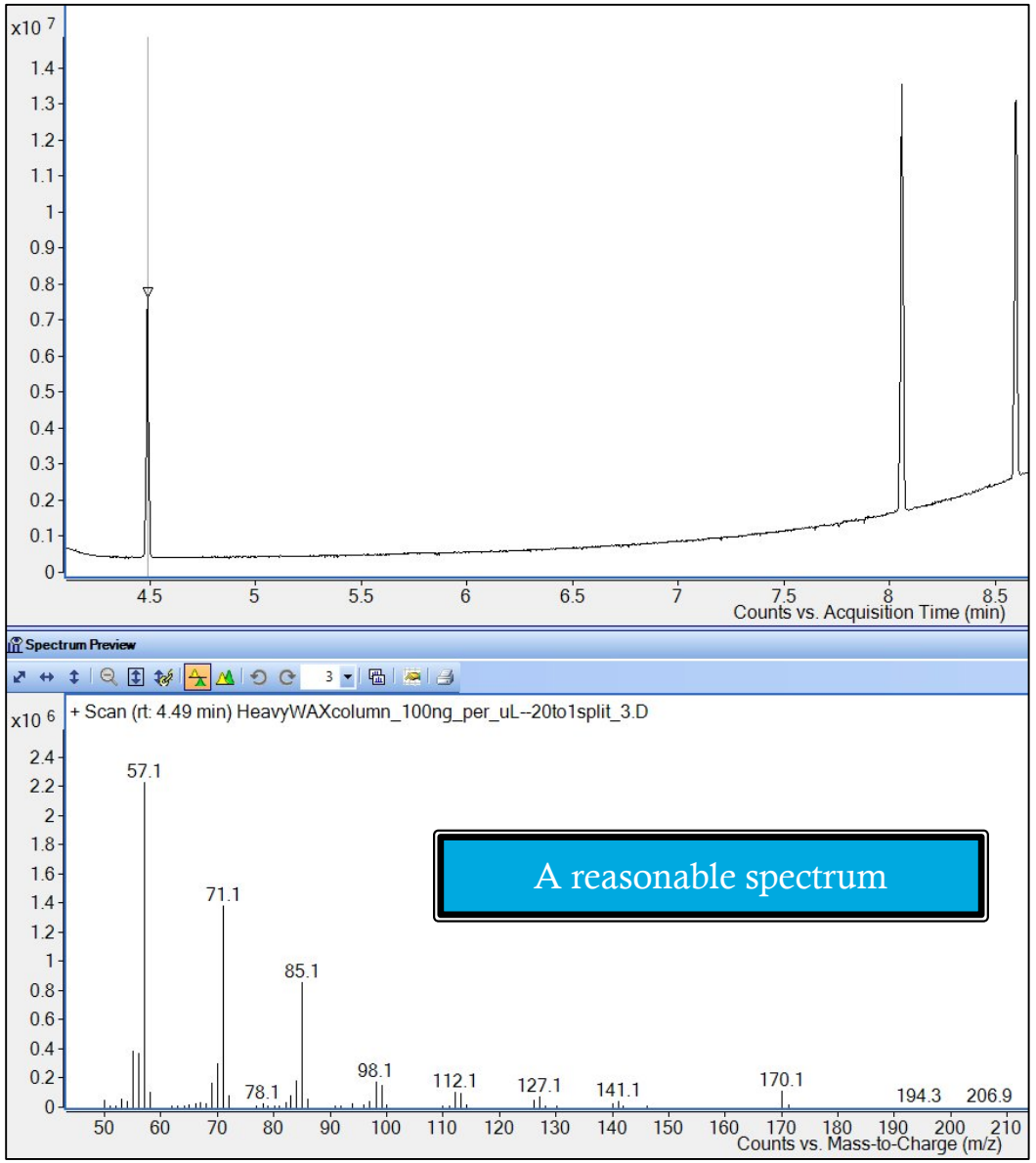
- Oven equilibration time
- Oven initial temperature and ramps
- Injection port, transferline, source, and quad temperatures
- Injection pulse pressure and vent timing
- Required liner
- Column flow
- ALS syringe viscosity delay
- Save method with Data

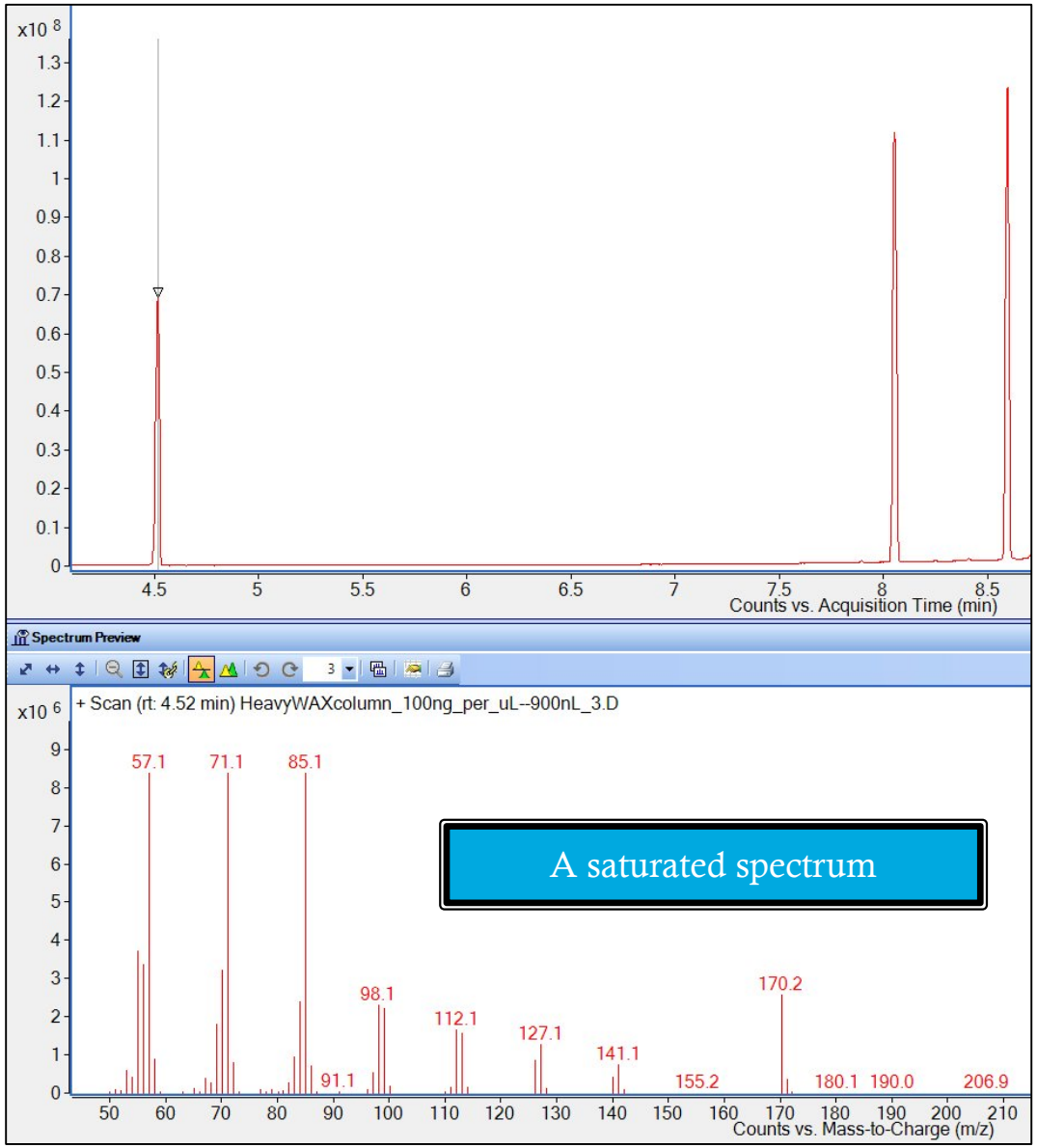
You might need to change:

- Oven final temperature – do **not** exceed the column max!
- Oven final time – shorten or extend to get the 4th peak out.
- Solvent delay – shorten to see the first peak or lengthen to make sure solvent is gone before the filament turns on.
- MS gain – high enough to see the:
  - Lowest concentration 100fg
  - Smallest injection volume 0.3uL
  - Highest split ratio 80:1

  Without saturating at the highest concentration, volume, or lowest split ratio.
- MS threshold – low enough to have some background at every data point and high enough to eliminate most of the tiny stuff. It could be as low as ~75 and as high as some thousands.

Do not saturate the detector! You may have to turn down the gain.

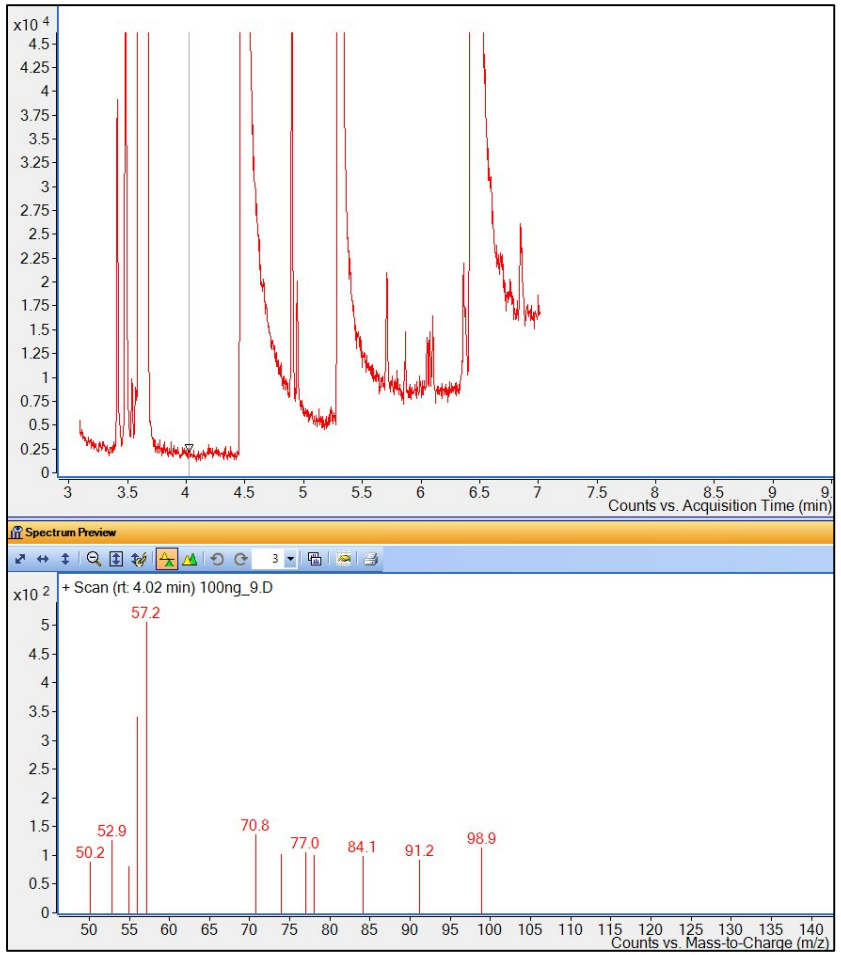




Threshold

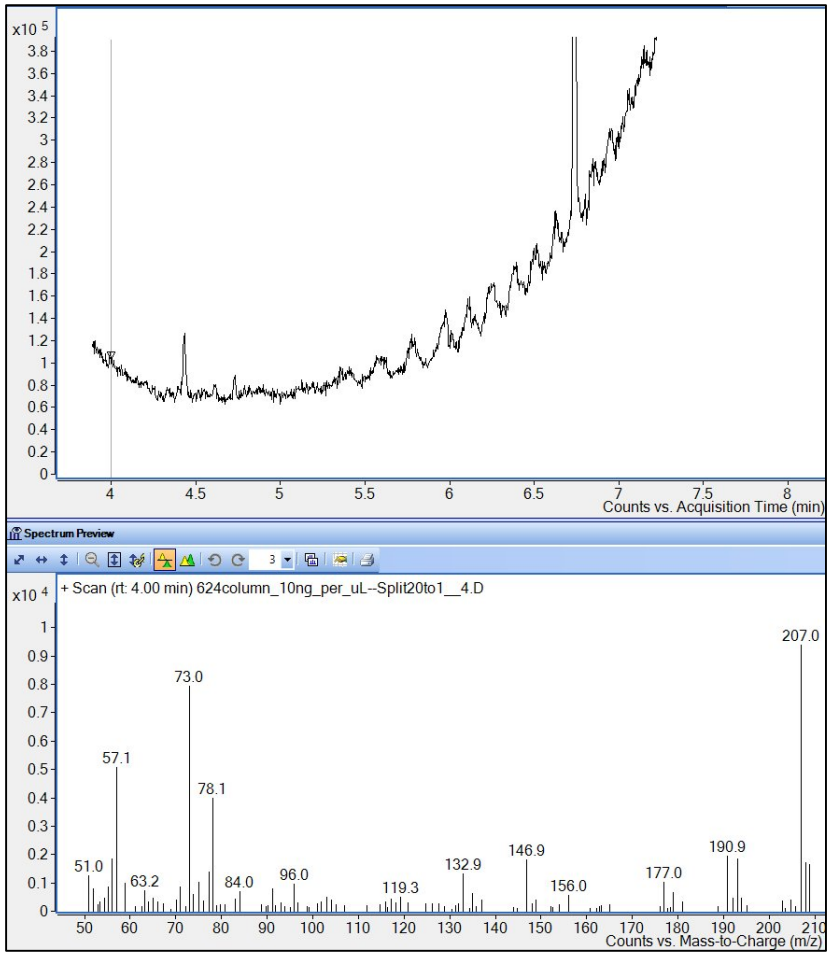
Threshold 75

No empty data points, so it's fine.



Threshold 75

Could have been set higher – 1000 to up to 2000 or so.



The steps to take:

S/Sl **6-7mm** up from ferrule
MMI **14-15mm** up from ferrule

1. Enter all the parameters, verify they are correct, and save the method as FUNCTIONALITY.M
2. Reload the method or download the method to the GC
3. Tune the MS.
4. Evaluate the tune. Make sure that the air/water are acceptable.
5. Verify the syringe size and that it can actually pick up and dispense sample/solvent
6. Load the samples.
7. Run the highest concentration, largest injection volume, or lowest split ratio. Make sure that the run time is long enough for all four peaks to elute. Make sure that the EM Gain is set so that none of the peaks or ions are saturating.
8. Run the lowest concentration, smallest injection volume, or highest split ratio. Make sure that all four peaks are at least 2x the noise.
9. Setup and run a sequence of three or more runs for each concentration, injection volume, or split ratio.
10. Evaluate the data and/or call Agilent to discuss it. (MH Qual overlay the chromatograms. MH Quant create cal table and batch)

Load the samples.

- Do not use a plastic pipette. Use new glass pipettes only or pour the sample into new Agilent vials.
- Some vial caps will introduce siloxanes into the sample. If this is a worry:
  - Pry the septum out of the vial cap, and then put just the plastic cap on and use it that way.
  - Pry the septum out of the vial cap, put a piece of aluminum foil over the vial, and then the plastic cap.
  - Disconnect the ALS tray and put the uncapped vial into the ALS turret.
- If you see siloxane peaks in the chromatogram, you may need to start again with new samples in new vials and flush the inlet again. (see slide 17)

Proving Functionality

If the data shows that all four peaks are there, have run-to-run reproducibility, acceptable RT stability, and the three concentrations, three injection volumes, **or** three split ratios are linear…

The system is not broken!

A top tip is to run this test regularly to help identify issues.

Appendix

Questions to ask since repair parts are not required:

Has the mass spectrometer completed autotune properly?
Are the tunes stable over the last few days?
What is the specific complaint?
    Does it sound like chromatography/methodology/application?
    Sensitivity or reproducibility?
Has **all** of the required normal user maintenance been performed on schedule?
    Inlet, Column, Source cleaning, Source part replacement as needed
    EMV replacement if necessary (the EM is a normal user maintenance part and not covered for use or just because it's worn out or noisy)
What about on the other filament? New filaments – both replaced at the same time?
Does the GC inlet pass the automated tests?
    [Service Mode], scroll to Front inlet leak check or Back inlet leak check, then press [Enter].
    [Service Mode], scroll to Front inlet trap check or Back inlet trap check, then press [Enter].
Does a new column have the exact same symptom? Is it an Agilent column? (if not, install the Agilent checkout column and retest)
How old is the column? (replace it if >18 months to 2 years or more)
Has the column been calibrated for length?
If the application is SIM or MRM, run in SCAN mode to see if there are other peaks coming out?
QQQ, QTOF collision cell gases are correct and flowing?
Is the instrument configuration correct?
Is the column configuration correct? Especially if a CFT device (PUU, Deans Switch, Splitter) is installed
The correct method is loaded?
Is the method pointed at the current/proper tune file?
Has anything been changed lately? Gas tank, plumbing, maintenance, operator, method, etc
Try making a new method, one from another instrument (don't copy methods), one from another lab, from an application note?

When to prove functionality rather than replacing parts:

All the correct gases are present and the required grade, have the proper traps, and indicating traps are not full.
(Traps are not replaced for free except during the PM when included with the PM checklist.)
There are no leaks in the plumbing before the instrument (Agilent sells a G3388B leak detector)
All the modules in the GC are configured properly for the gases and the gases are flowing properly.
The inlet passes the leak tests.
The column is installed properly, high enough in the inlet and the cut is acceptable.
The column has been calibrated for length.
The proper method is loaded.
The method parameters are proper/typical.
Is the column configuration correct? Especially if a CFT device (PUU, Deans Switch, Splitter) is installed.
Is/are the column flow(s) correct? Especially with backflush.
If the system has an ion gauge, what is the vacuum with column flow on? <<do **not** run an SQ above ~$6x10^{-5}$ or QQQ above ~$9x10^{-5}$
It passes autotune.
The proper tune file is in the method.
The chromatographic background is typical.
In Scan, there are no points with zero data – the threshold is set low enough to always have peaks.
You don't trust what has been done so far by yourself or anyone else
Before you think about replacing any major parts like:
The inlet Electronic Pneumatic Control module if there are no leaks and the pressures and flows control properly
The inlet weldment(s)
The entire inlet subsystem
The source
The EM
The HED
The MS analyzer

S/SI **6-7mm** up from ferrule
MMI **14-15mm** up from ferrule

What is the difference between functional and operational?

Functional

Terms and Conditions of **Sale** – the legal document LINK

“Meets or exceeds applicable published specifications for the system on the date of shipment.”

- “Specifications” means technical information about Products published by Agilent and in effect on the date Agilent ships the order.
- For Products with installation included in the purchase price, acceptance occurs when the Product passes Agilent’s installation and test procedures.
- Agilent warrants the Agilent hardware Product against defects in materials and workmanship and that the Product will conform to Specifications.

What is the difference between functional and operational?

Functional

Terms and Conditions of **Warranty** – the legal document LINK

“The above warranties do not cover defects resulting from improper or inadequate maintenance, installation, repair or calibration performed by Customer or a third party not authorized by Agilent; Customer or third party supplied hardware or software, interfacing or supplies; unauthorized modification; improper use or operation outside of the Specification for the Product; abuse, negligence, accident, loss or damage in transit; or improper site preparation.”

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What is the difference between functional and operational?

Functional

Terms and Conditions of **Service** – the legal document LINK

“Service Agreements do not cover any damage, defects or failures caused by: use of non-Agilent media, supplies and other products; site conditions that do not conform to Agilent´s site specifications; or neglect, improper use, fire or water damage, electrical disturbances, transportation, work, or modification by non-Agilent employees or subcontractors, or other causes beyond Agilent´s control.”

What is the difference between functional and operational?

Operational

Runs your application

Agilent sells operational services as paid consulting.

Links

Agilent CrossLab Services and Support Portfolio

Method & Application Consulting

Onsite Consulting Request Form

Crosslab Method Restoration Services

Parts listing.

They are normal operator replaceable consumables.

05970-60045	GC/MS Check out sample. Six 1.0 mL ampules: 4 at 10 ng/µL, 1 at 100 ng/µL, 1 at 100 pg/µL.
5190-2278	Screw Top MS Analyzed Vial Kit, Clear with write-on spot PTFE/red silicone septa, blue cap (package of 100)
5190-3983	Splitless Double Tapered UI Liner (package of 1)
5190-2295	Split Low Pressure Drop UI Liner with glass wool (package of 1)
5188-5365	Liner O rings (package of 10)
5190-6144	Gold seal UI w/washer
5182-3413	Septa
G4513-80206	Blue Line 5uL tapered fixed needle with fitted plunger syringe or
5181-1273	Gold Standard 5uL tapered fixed needle syringe
G4513-80204	ALS 10uL syringe
5181-3323	Injection port ferrules 0.25 (package of 10)
5181-8830	GC inlet column nut
5062-3508	MS ferrules 0.21 & 0.25 (package of 10)
05988-20066	MS transfer line nut
5181-8836	Ceramic column cutter (package of 4)
05980-60051	Cloths, clean (package of 15)
5080-5400	Cotton swabs (package of 100)


Agilent Technologies
5301 Stevens Creek Blvd.
Santa Clara, CA, USA 95051
Tel: 1-800-227-9770
www.agilent.com/chem/sds
GC/MS Checkout Sample
(Dodecane, biphenyl, p-chloro-diphenyl, and methyl palmitate)
Part No: 05970-60045
GC/MS Checkout Sample, 10 ng/µL (4 x 1 mL)
GC/MS Checkout Sample, 100 pg/µL (1 x 1 mL)
GC/MS Checkout Sample, 100 ng/µL (1 x 1 mL)
Lot No and Expiration:
Lot 6468500
Lot 6553800
Lot 6469500
Expiration Date 7/31/20
Storage: Ambient
Danger – Contains isooctane
Highly flammable liquid and vapor. Causes skin irritation. May be fatal if swallowed and enters airways. May cause drowsiness or dizziness. Very toxic to aquatic life with long lasting effects.
Wear protective gloves. Wear eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid release to the environment. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower.
Made in USA


Agilent Technologies
Part No: 05970-60045
GC/MS Check out sample
Made in US (USA)
Contents: 1
15111017 2810 2810 CP
US
www.agilent.com/chem/supplies