Around the GC System in 60 minutes

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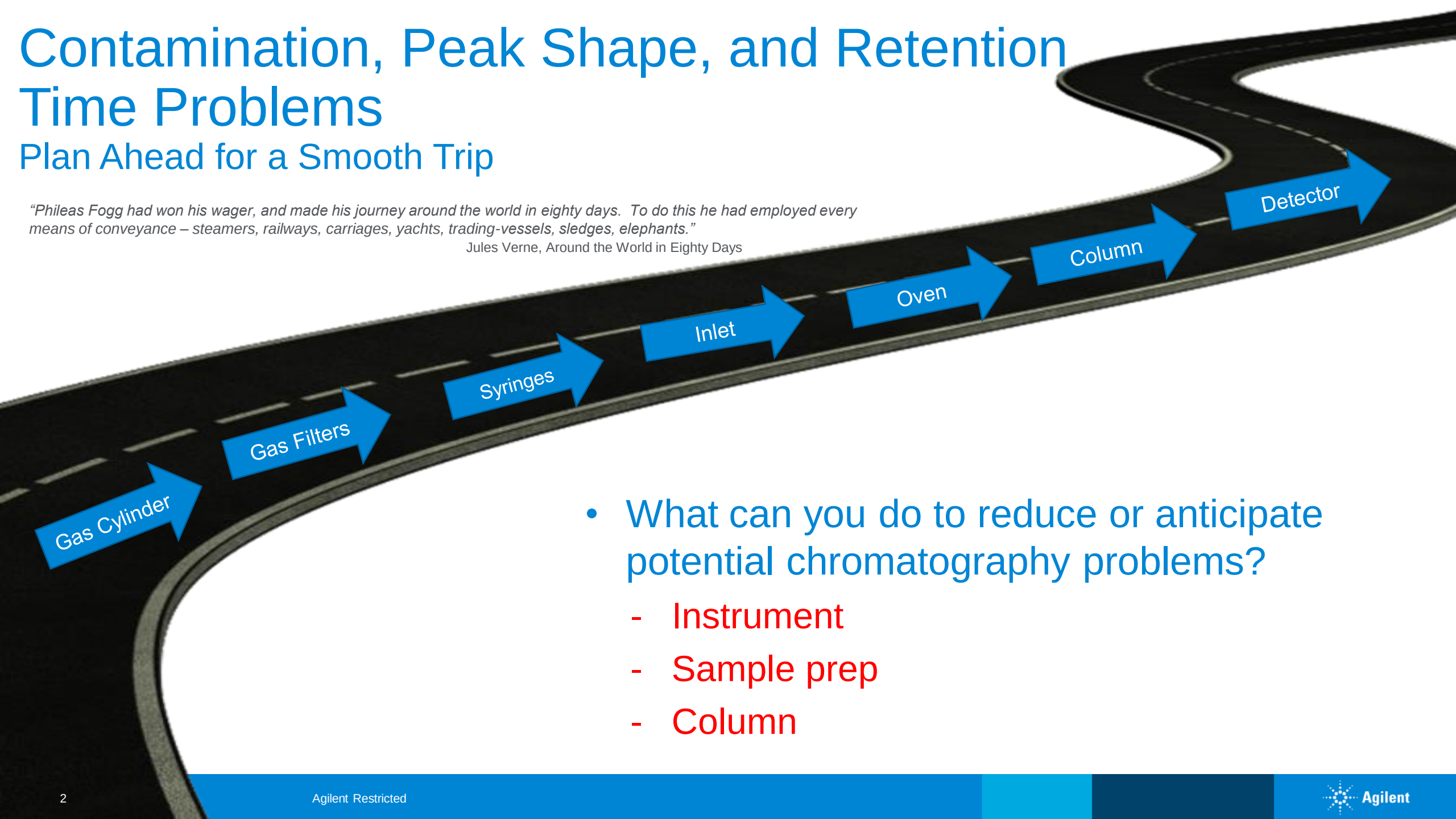
Contamination, Peak Shape, and Retention Time Problems

Plan Ahead for a Smooth Trip

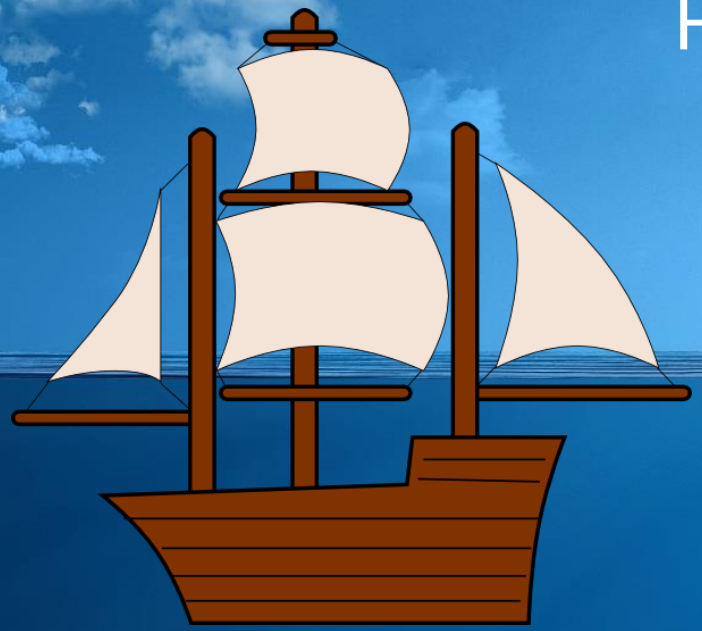
"Phileas Fogg had won his wager, and made his journey around the world in eighty days. To do this he had employed every means of conveyance – steamers, railways, carriages, yachts, trading-vessels, sledges, elephants."

Jules Verne, Around the World in Eighty Days



- What can you do to reduce or anticipate potential chromatography problems?
  - Instrument
  - Sample prep
  - Column

Hidden Hazards of GC



Leaks

Dirty Samples

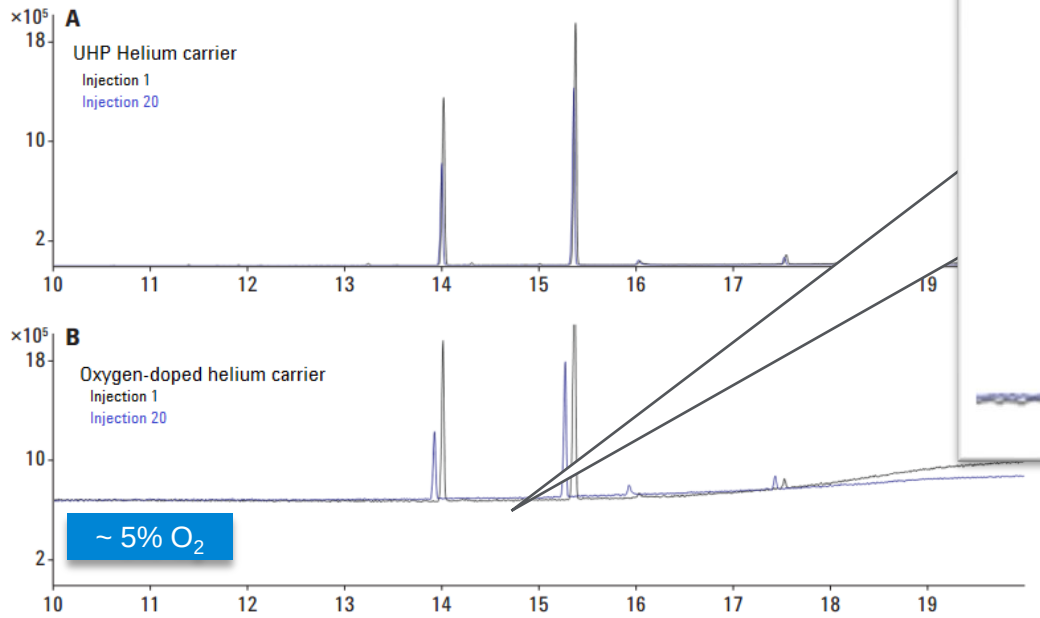
Inlet Contamination

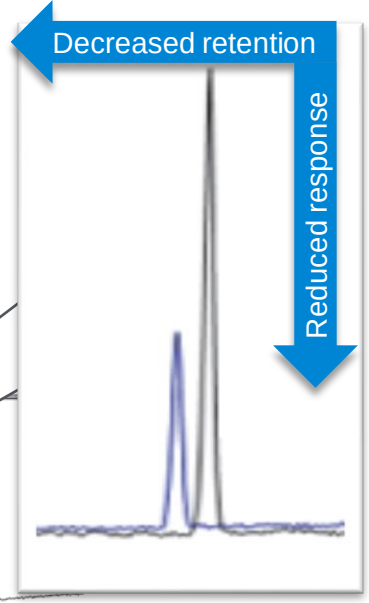
Bad Gas

Wrong Column Choice

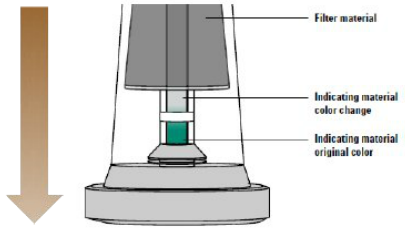
Bad Gas Stinks!

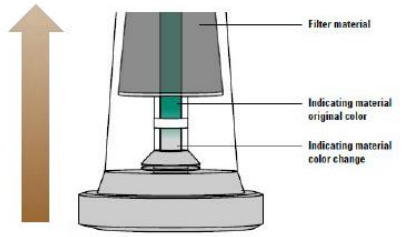
- Use ultra-high purity carrier gas (99.9995% or greater)
- Use the appropriate gas traps
- Oxygen in carrier gas is detrimental to GC, resulting in:
  - Reduced response
  - Elevated background
  - Irreversible column damage
  - Premature filament failure
  - Excessive source maintenance
- Agilent has a wide range of gas filters
  - GasClean oxygen and moisture filters have indicators
    - Replace when needed
    - Correct any leaks present





Indicator changes color from the top down
If the indicating material changed color from the top down there is a leak upstream of the filter in your gas line, or your gas quality is poor. Check for leaks at the cylinder, regulator, and fittings, and check your gas quality.





Indicator changes color from the bottom up
If your filter's indicator changes color from the bottom up shortly after installation this indicates a leak downstream of the filter in your gas line. Check for leaks between the filter and your instrument.

GC/MS filter
Agilent P/N CP17973

Other Gas Traps Available

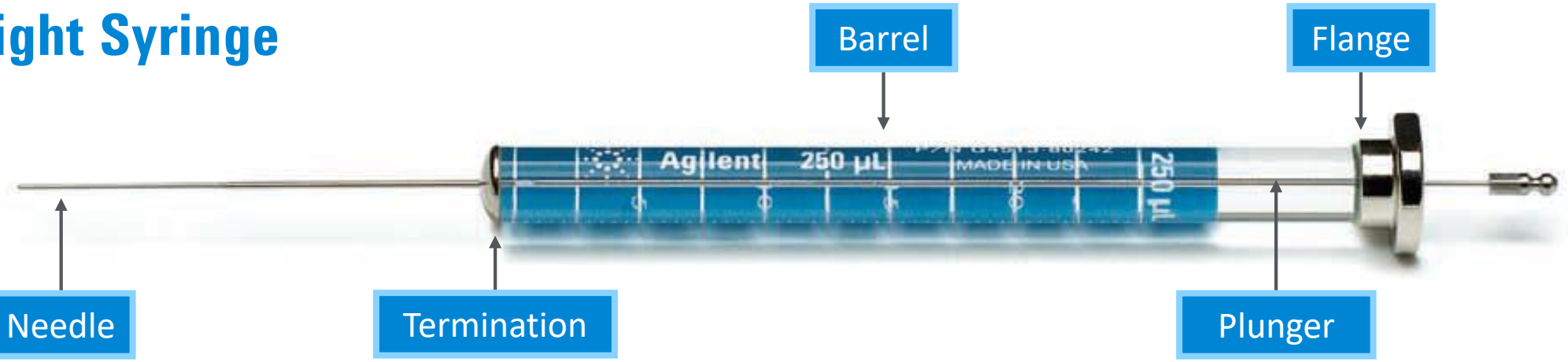
In-Line Large Traps

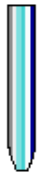
Refillable Moisture Traps

Renewable Gas Purification System

Please contact us at GC-column-support@agilent.com for assistance with setting up gas filters!

Choosing the Right Syringe





Cone Tip/PS AS (shown)
Used in Agilent autosamplers for optimum performance and reliability by reducing septum coring,

Bevel Tip/PS 2
General purpose, excellent choice for transferring liquids from ampoules or vials. For manual GC injections, a bevel tip is preferred for optimum septum penetration with minimal coring.

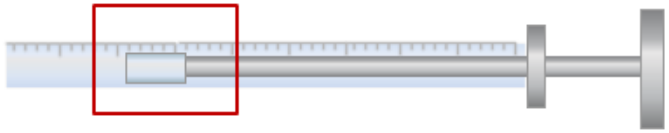
Side Hole Tip/PS 5
Recommended for thin gauged septa and large volume- or gas injections.

Fixed Needle Syringes (shown)
- Typically abbreviated FN
- Needle "cemented" to barrel using epoxy
- Typically used in autosamplers
- Preferred for applications requiring trace level samples
- Recommended for use where probability of needle bending is minimal
- Can be heated up to 70°C

Removable Needle Syringes
- Typically abbreviated RN
- Allows use of various needle point styles
- Threaded connection with PTFE sealing ferrule that can be tightened to compensate for wear
- Can be heated up to 120°C
- Can be prone to leakage
- Recommended for chlorinated solvents

Standard plungers
- Fit tightly within syringe barrel
- Limit loss of volatile sample
- Individually fitted to the syringe
- Not replaceable/Not interchangeable
- Recommended for analysis of liquid samples

PTFE-tipped (shown)
- Limit sample deposit adsorption
- **Forms gas-tight seal**
- Replaceable
- Requires maintenance to maintain PTFE seal
- Recommended for:
  - "Dirty" samples
  - Highly volatile samples
  - Gas injections
  - Chlorinated solvents



Vials

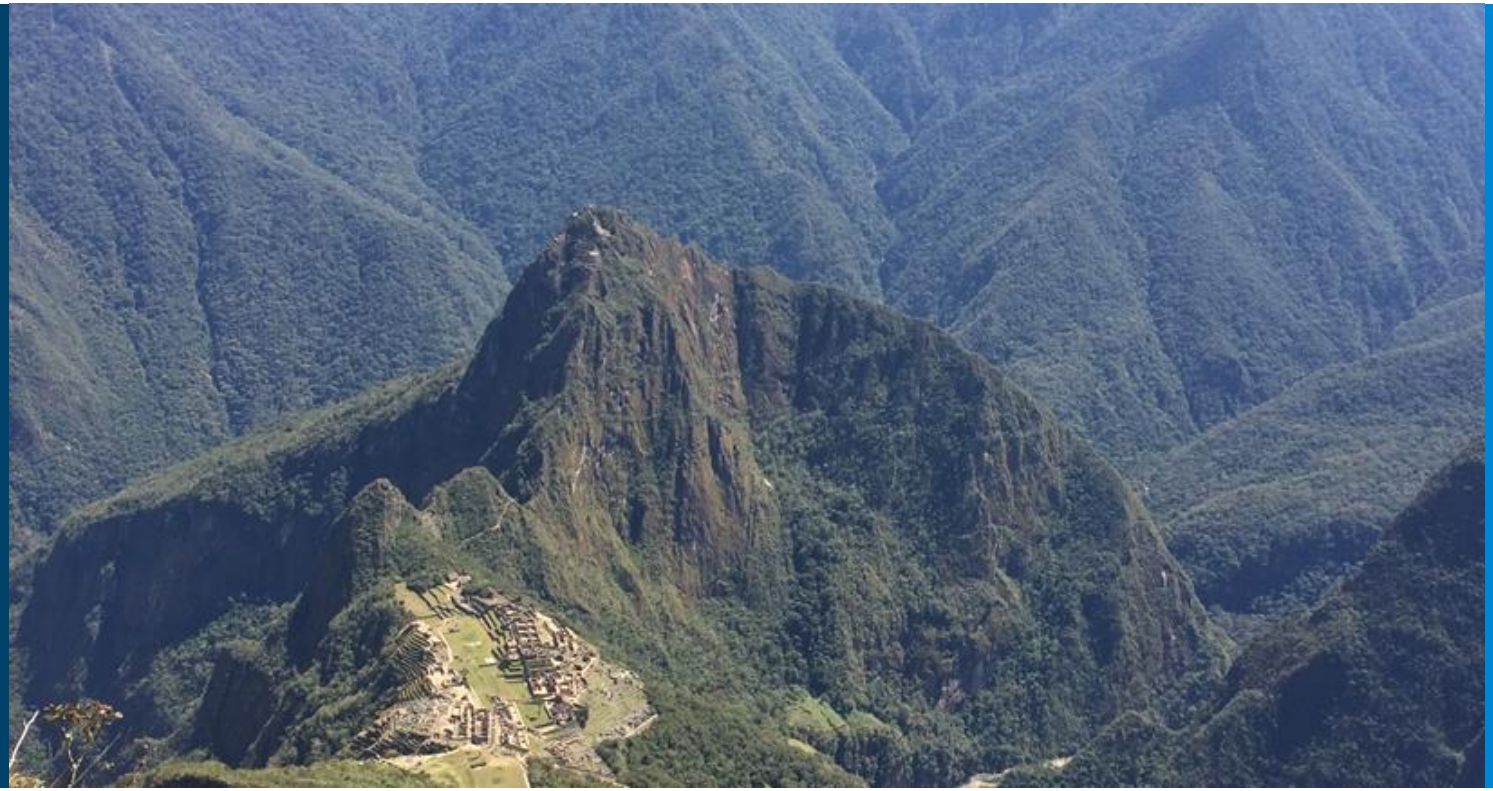
- Choose high quality vials and caps
  - Poorly constructed vial septa → siloxanes → bleed peaks
  - Low quality vial → leach contaminants into sample
  - Choose the right cap/septa for your solvent

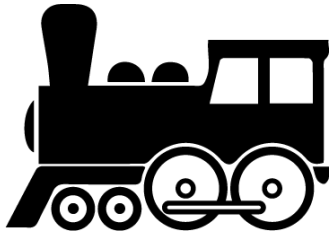
	High performance septa	Thin PTFE	PTFE/Silicone*	PTFE/Silicone/PTFE*	PTFE/Red rubber	Flouroelastomer	Butyl
Temperature range	40 °C to 300 °C**	Up to 260 °C	–40 °C to 200 °C	–40 °C to 200 °C	–40 °C to 90 °C	–40 °C to 260 °C	–50 °C to 150 °C
Use for multiple injections	No	No	Yes	Yes	No	No	No
Price	More expensive	Very economical	Economical	Most expensive	Very economical	Economical	Economical
Resistance to coring	Excellent	None	Excellent	Excellent	None	None	None
Recommended for storage	No	No	Yes	Yes	No	No	No
Best for	High temperature headspace applications	Superior chemical inertness, short cycle times, and single injections	Most common HPLC and GC analyses, not as resistant to coring as P/S/P	Superior performance for ultra trace analysis, repeat injections, and internal standards	Chlorosilanes, more economical option for single injections	Chlorinated solvents, higher temperatures	Organic solvents, acetic acids, impermeable to gases

* Agilent silicone is platinum cured (versus peroxide cured), making it more inert and less likely to interact with samples.
** For up to 1 hour.

Sample Clean-Up

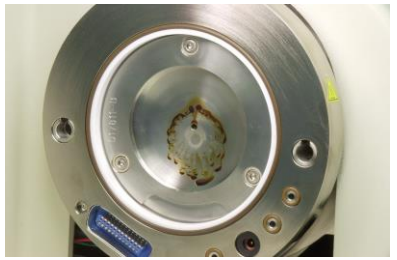
Filtration, Solid Phase Extraction, QUECHERS, and more!





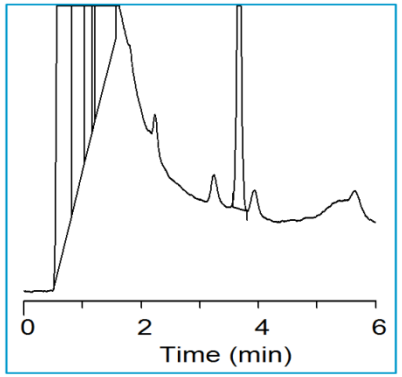
Why perform Sample Clean-Up?

- To acquire desired sensitivity/selectivity
- To reduce contamination/carryover issues
- Use of sensitive and expensive instruments: *Protect your investment!!!*

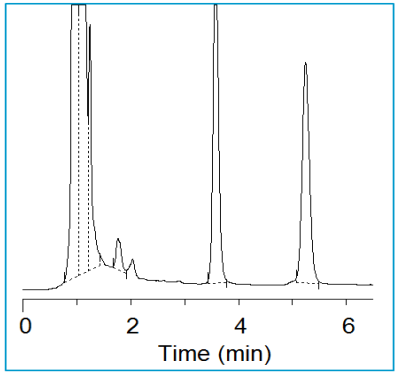


Curtain plate after injection of 25 samples with extractions from raisins without cleanup

Pesticides in Avocado *without* SP



Pesticides in Avocado with SP



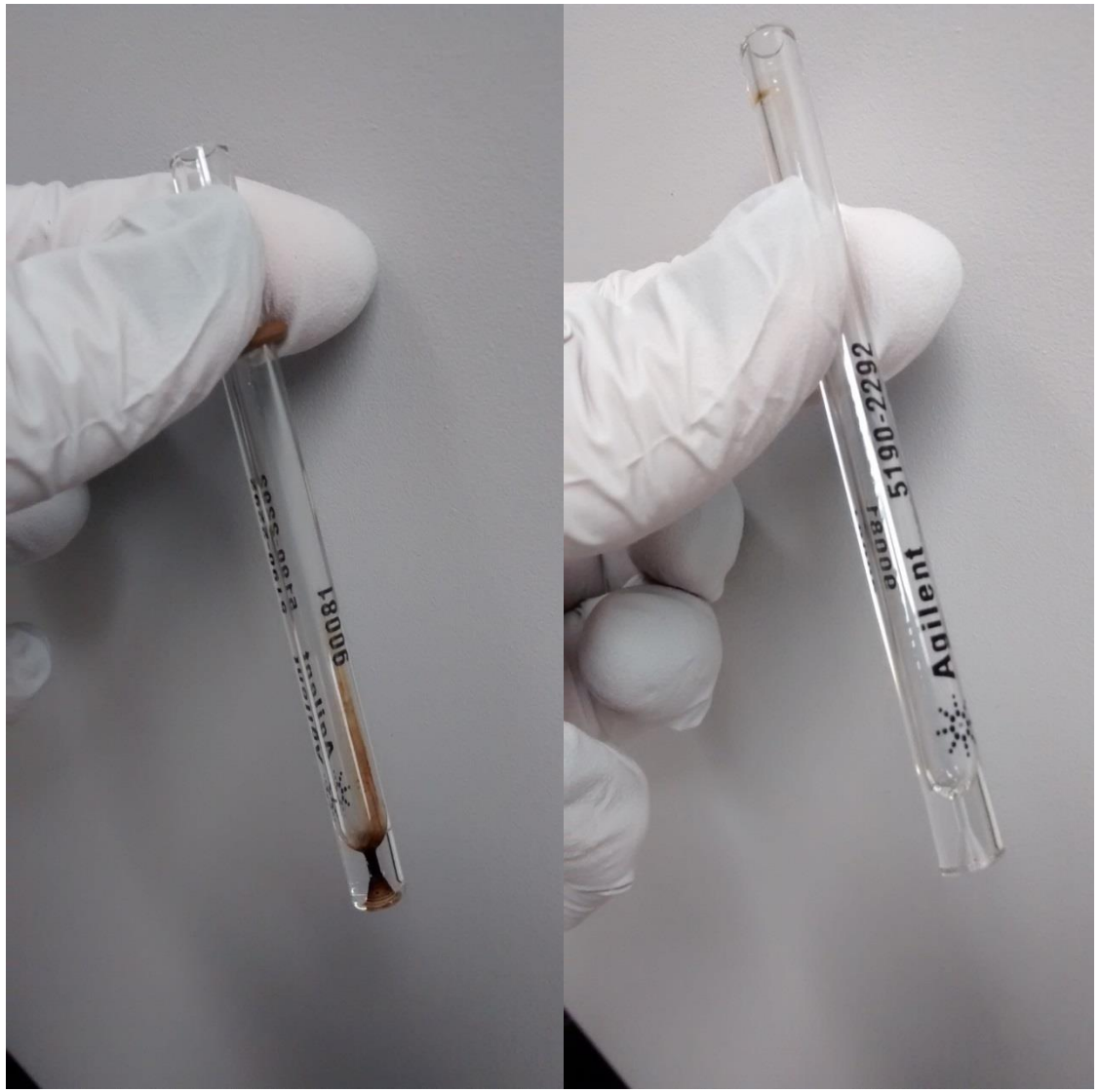
Challenge: Instrument Contamination

GC System Component Contamination

GC Inlet Liner

GC Inlet Seal

"I'm emailing in regards to the QuEChERS kits my lab has recently begun using. We thought we'd send along a couple pictures of the difference they have made in our biological sample clean-up process. This is a comparison of the GC inlet liner after a run of approximately 50 samples with and without using the kits. Enjoy!
Those samples were extracted from adipose tissue, for reference."

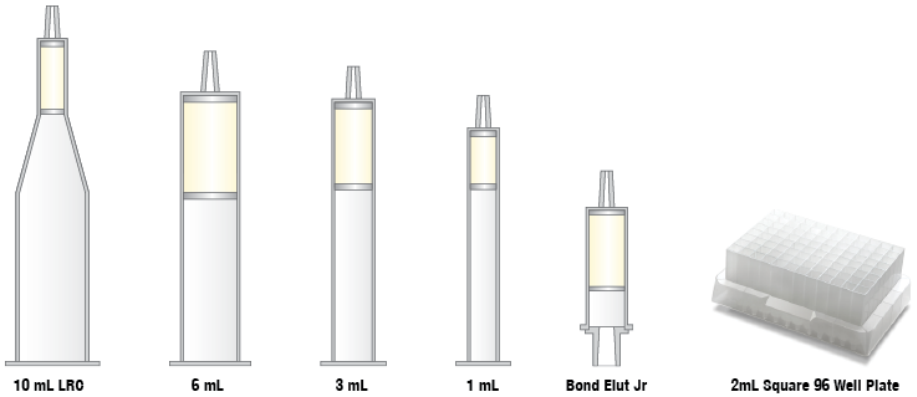


BEFORE

AFTER

Sample Clean-up Tools to Help you on your Journey

Solid Phase Extraction Cartridges and Plates



QUECHERS

Filtration Cartridges and Plates

Syringe Filters

Captiva EMR Lipid

Captiva EMR-Lipid

the Analytical Scientist Innovation Awards 2017

- One of Agilent's newest products with a 2 in 1 benefit of removing proteins and lipids
- Simple pass-through format
- Solvent-retention frit in 1 mL cartridge/96-well plate format for in well protein precipitation (*in situ*)
  - Unique cartridge/well construction minimizes clogging – and **ensures protein and lipid removal** (no cloudy samples)
- 3 and 6 mL cartridge format for larger samples
  - Do not contain solvent retain frit which allow for gravity flow
  - Protein precipitation performed offline (QUECHERS, etc.)
- Unique cartridge/well construction minimizes clogging – and **ensures protein and lipid removal** (no cloudy samples)
- High analyte recoveries
- Effective use will reduce ion suppression, increase analyte sensitivity, and detection, and extend the lifetime of your analytical column

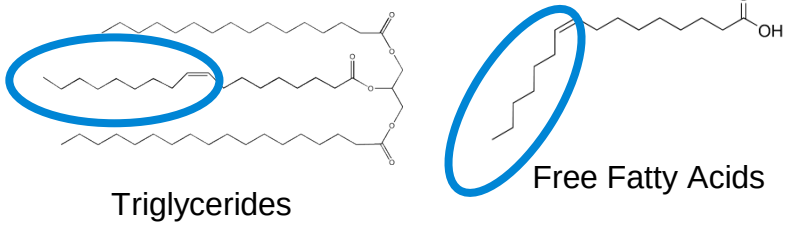
Enhanced Matrix Removal: EMR-Lipid

EMR-Lipid = Finger Trap

Finger = carbon chain of lipids

EMR-Lipid sorbent technology effectively traps lipids through two mechanisms:

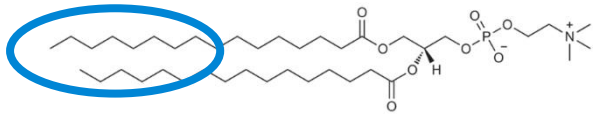
- ✓ **Size exclusion** – Unbranched hydrocarbon chains (lipids) enter the sorbent; bulky analytes do not
- ✓ **Sorbent chemistry** – Lipid chains that enter the sorbent are trapped by hydrophobic interactions

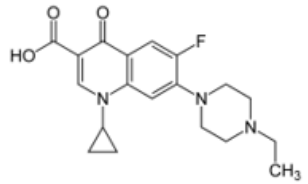


Triglycerides

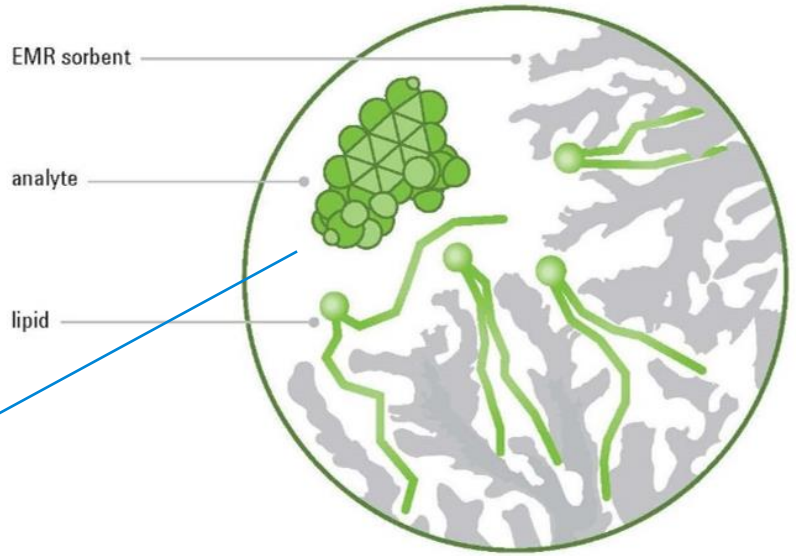
Free Fatty Acids

Phospholipids

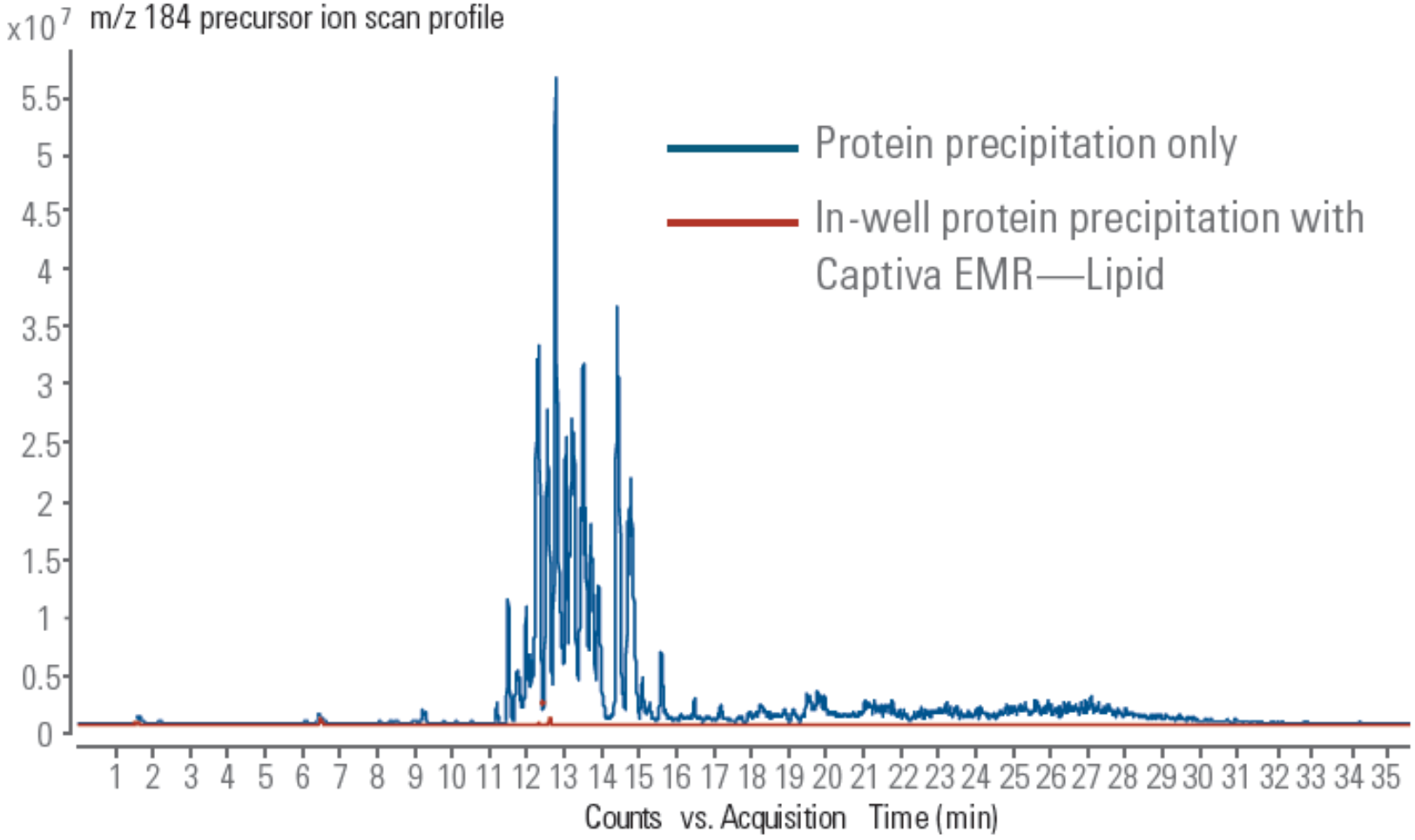




Fluoroquinolones

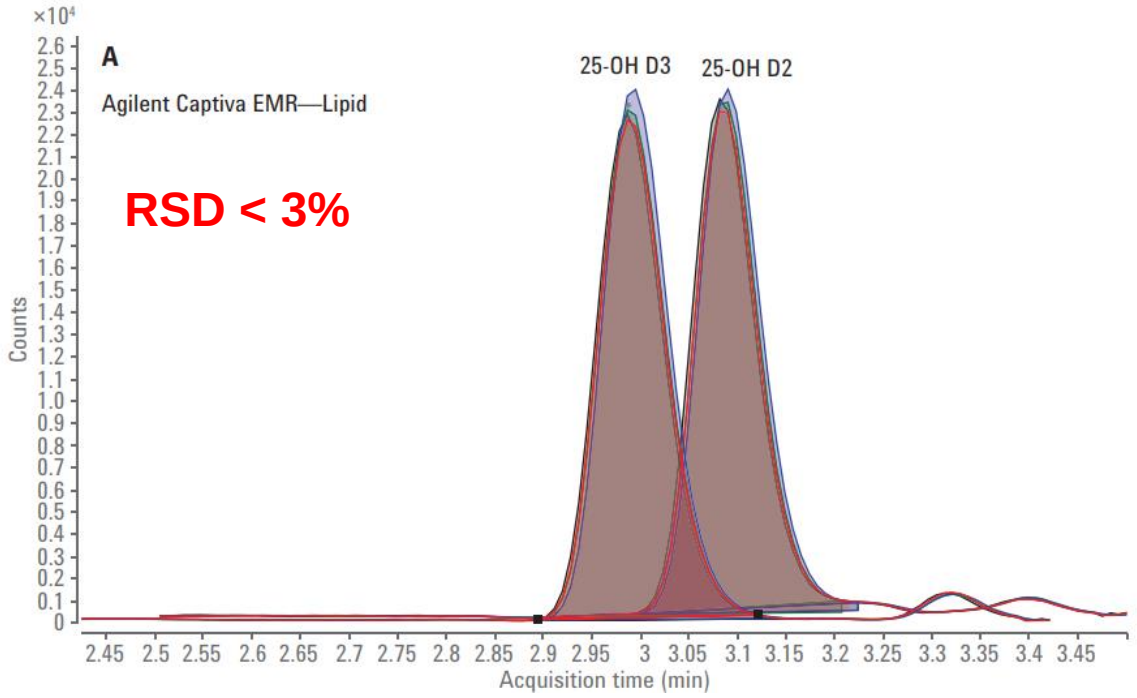


Effective phospholipid removal

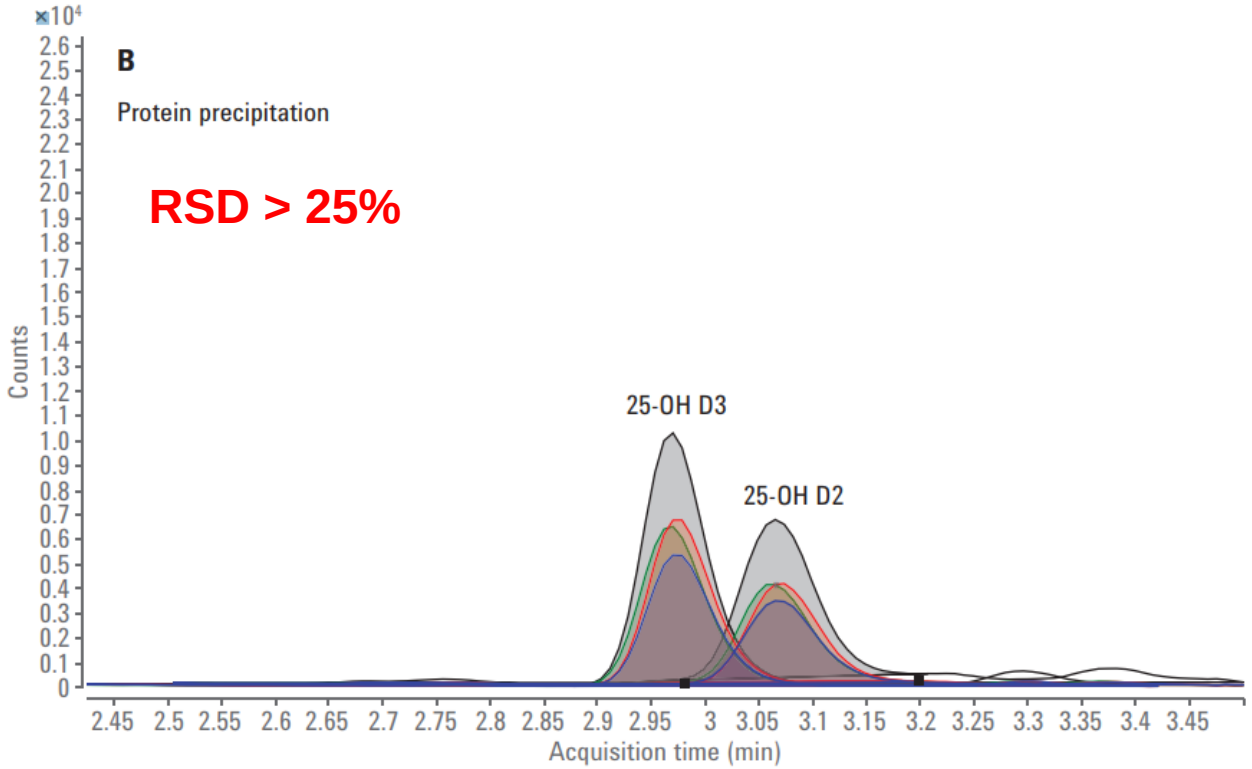


Protein Precipitation vs. Captiva EMR-Lipid RSD and Peak Area

Captiva EMR-Lipid



Protein Precipitation



Lipids cause reproducibility problems resulting in high RSD values

Using Captiva EMR-Lipid → low RSD values and higher peak areas

Higher peak area due to less ion suppression → can lead to lower detection limits

QuEChERS

Easy
Effective
Safe
Quick
Cheap
Rugged

Screening of pesticide residues in fruit and vegetables

- Developed to make sample cleanup of food faster, simpler, less expensive, and greener

Now used with other matrices and compound classes as well

Commercially available kits allow for ease of use and convenience leading to increased throughput

Consists of two steps, and thus **2 kits**:

Step 1: Liquid Extraction

Step 2: Dispersive SPE / Interference Removal

What are the Benefits of QuEChERS?

- QuEChERS Approach: **Extract +250** compounds at one time
- QuEChERS methodology is non-selective technique, does not remove all the matrix
- Final extract amenable to GC/MS or LC/MS
- **Reduced solvent and labor, increased lab productivity**

QuEChERS Approach Advantages
~30 minutes to extract multiple samples at once
Minimal solvent usage per sample: 10-15 mL
Chlorinated Solvents: None

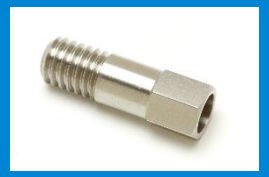
If you can weigh, pipette, shake and your lab has a centrifuge, you can perform QuEChERS

Productivity Benefits with Sample Preparation

More Matrix Removal = Less Matrix Entering System = Time and Cost Savings!

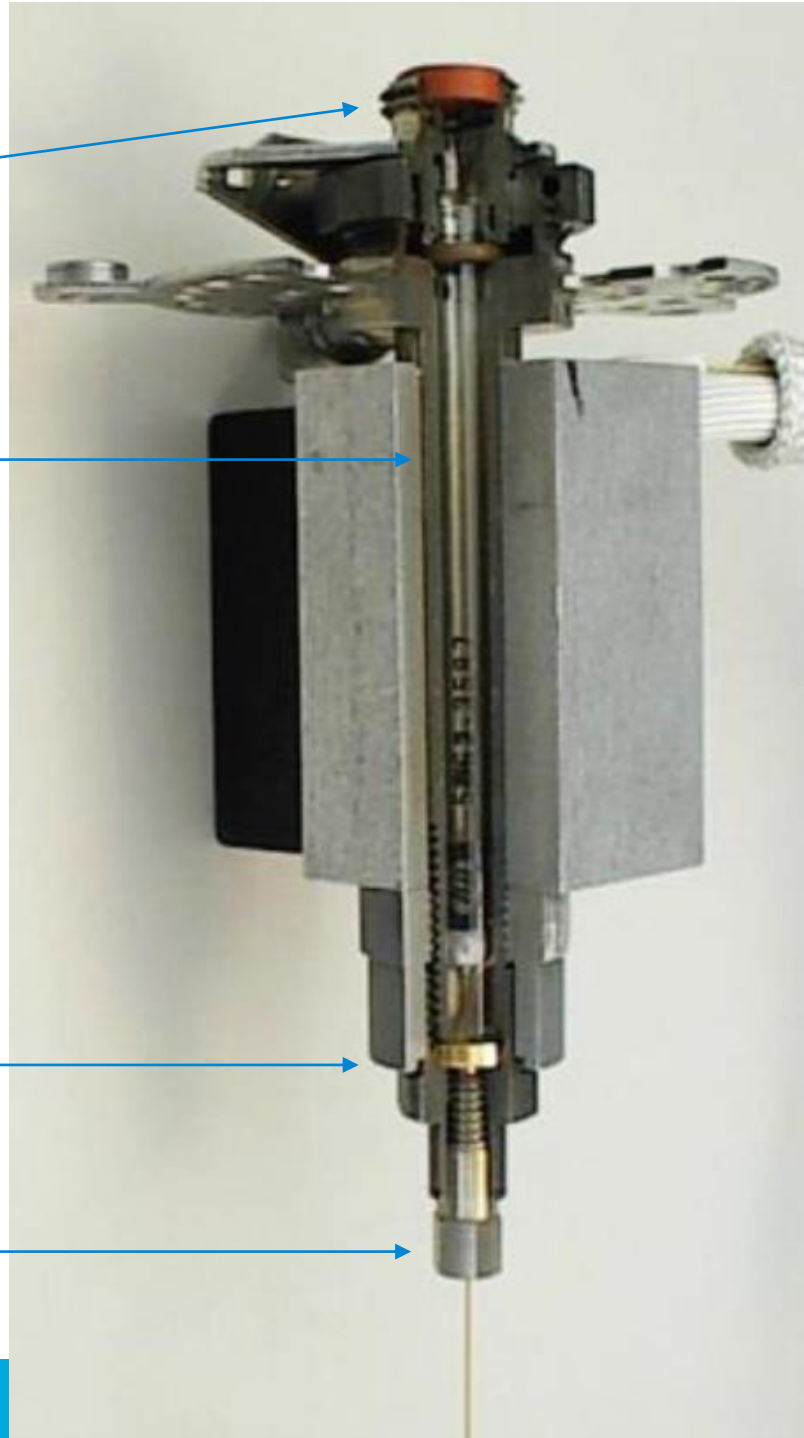
- ✓ Less matrix build-up
  - Less interferences
  - Improved S/N
  - Better reproducibility
- ✓ Better chromatography
  - Less time spent on data analysis/manual integration
  - Less time spent on re-runs/recalibrations
- ✓ Less maintenance
  - Less instrument down-time
  - Saves $$ on consumables/services
- ✓ Less troubleshooting
  - “Is it my column or my MS”?
  - Less instrument down-time

Inlet and Supplies



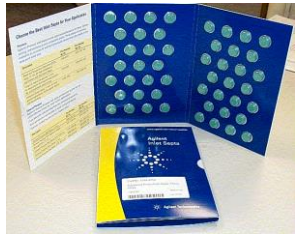
Inlet

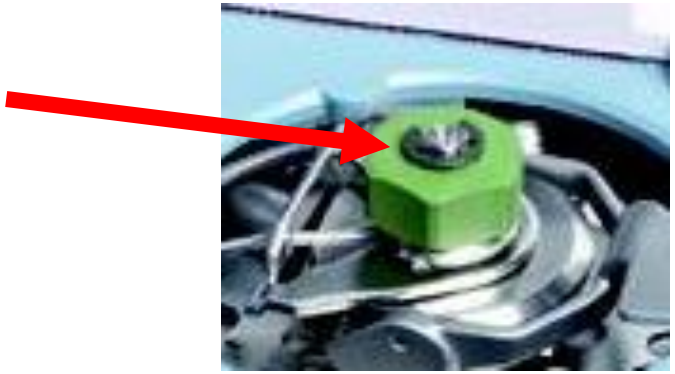
- Injection Efficiency:
  - Main function of the inlet is to produce a narrow sample band at the head of the column
  - One of the most important aspects to any high resolution GC method
- Must be reproducible
- The liner volume must be large enough to accommodate the solvent's phase transformation into a vapor (Back-Flash)
- The vast majority of chromatography problems are "front-end" related
- Many consumables to replace: septa, liner, gold seal
- Inlet body must be cleaned/solvent rinsed periodically (**No steel brushes please!**)

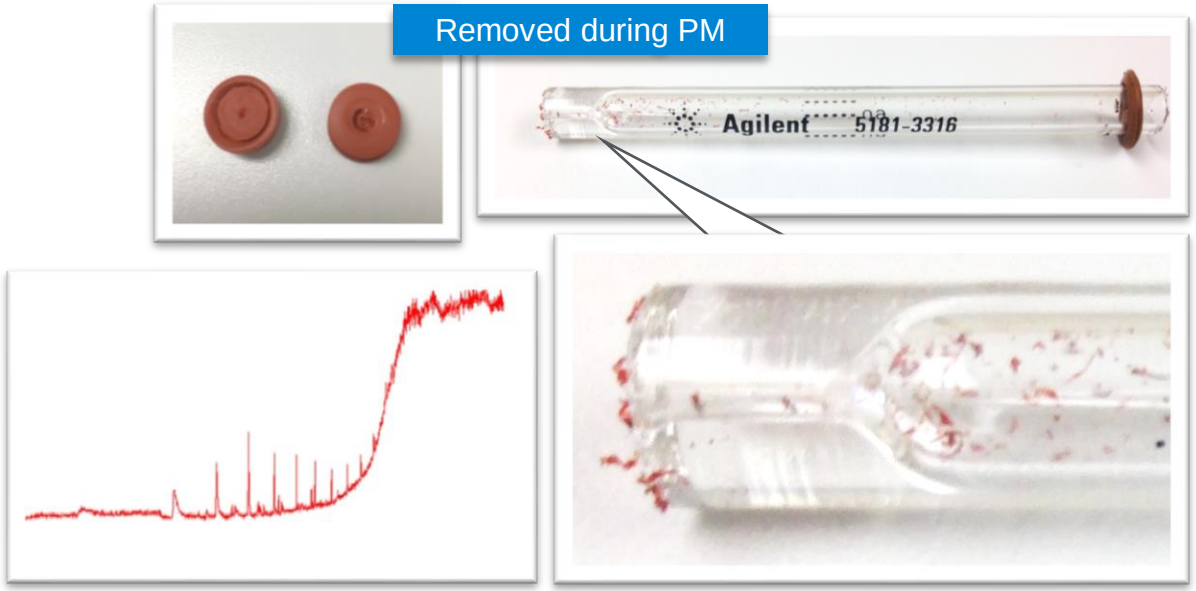


Septa

- Typical cost of 1 Premium Septum (list), $1.25
- Typical cost of 1 GC Column, 30 m x 0.25 mm ID, $450.
- “Don’t step over a dollar to pick up a dime!”
- Proactively change inlet septa.
- Agilent’s packing eliminates contamination of septa
- “centerguide septa” puts less train on syringe compared to solid septa
- Do not overtighten septum nut- septum can begin to “bulge” out
- Should tighten nut until c-clamp on top stops turning, then ½ to ¾ turn more



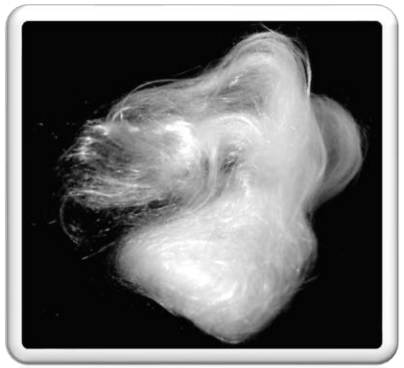




Liner Characteristics

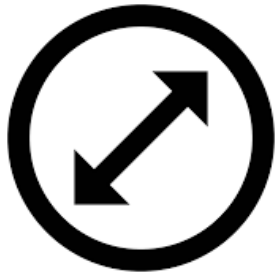
What is glass wool used for?

Filtration	• Prevents nonvolatile matrix from entering column
Vaporization	• Provides volatilization surface for liquid injections, promotes mixing with carrier gas
Needle wiping	• Increases reproducibility by wiping needle after injection



Does liner diameter have an effect?

Inner diameter	• Small inner diameter for gas analysis • Larger inner diameter for liquid analysis
Outer diameter	• Large od ideal for splitless injections • Slower transfer, snug fit directs flow within liner



Straight or tapered?

Bottom taper	• Focuses sample on the head of the column • Minimizes contact with metal inlet parts
Center taper	• Holds wool in place
Top taper	• Reduces sample backflash

Split liners:

Split/splitless liner with glass wool, low pressure drop

Split injections have higher carrier gas flow through liner to help split sample

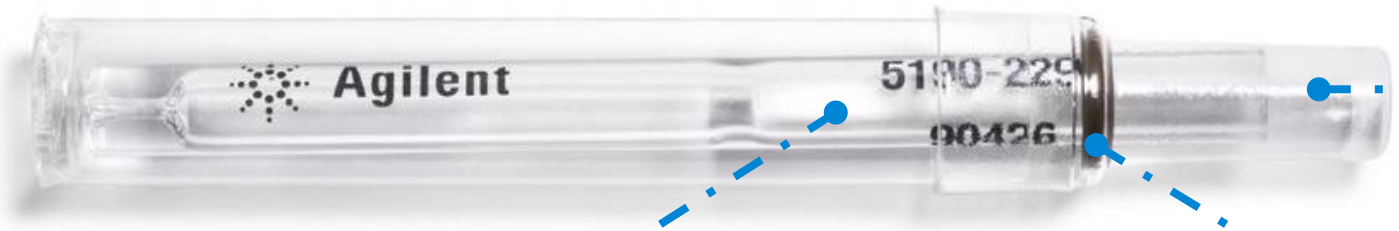
- Faster transfer onto column
- Split liners have a smaller outer diameter than splitless liners to help flow circulate

If potential exists for sample discrimination between low and high boiling components

- Use a liner with wool

Ultra Inert liners enable excellent peak shapes for tricky analytes

- 5190-2295 is recommended liner- Single taper, low pressure drop



Touchless packaging ensures contamination-free installation

Preinstalled o-ring

Glass wool plug in upper position wipes needle, avoids sample discrimination improves P&A, and collects septum particulate

Low pressure drop bead promotes better carrier gas flow for split injections

Splitless liners

Single Taper with or without wool

Splitless has lower flows through liner

- Splitless liners are typically wider for a more snug fit
  - Ensures all available flow funnels through the liner, not around
- Do NOT do split injections on a splitless liner
  - Poor reproducibility, not enough room for flow

Ultra Inert liners enable excellent peak shapes for tricky analytes

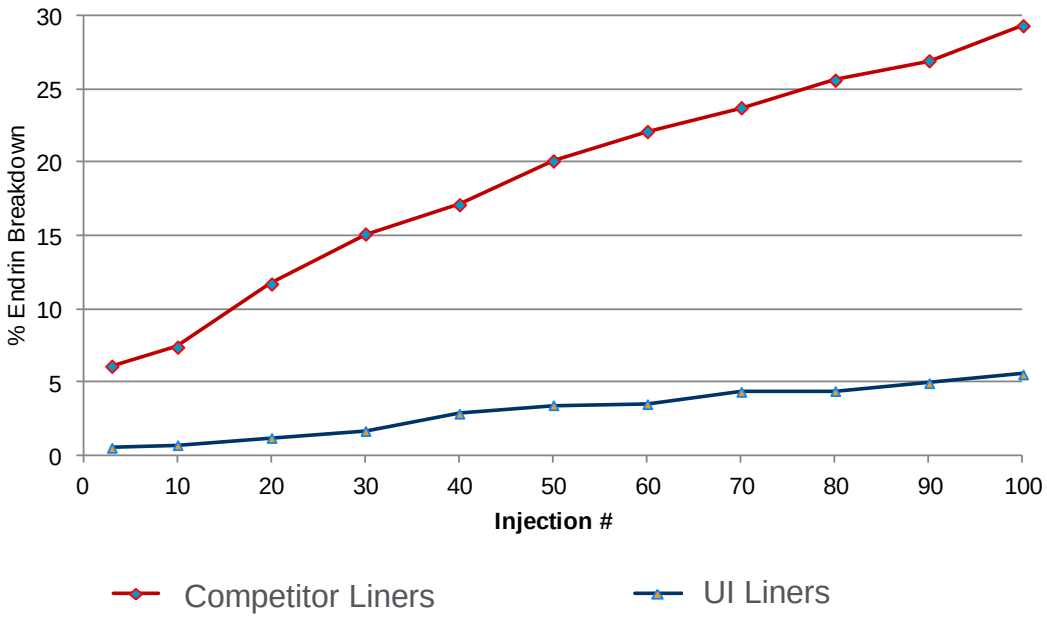
- 5190-2293 is recommended splitless liner- Single taper, with wool

In low carrier gas flow splitless analysis, a **bottom taper** helps focus analytes onto head of column

Small plug of **glass wool** near bottom of liner filters matrix

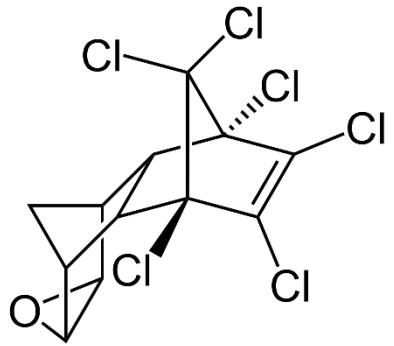
Ultra Inert Inlet Liners:

1. Ultra Inert deactivated inlet liners provide higher response for sensitive compounds
2. Ultra Inert **Glass wool liners** deliver benefits of glass wool w/o loss of active compounds
3. QC tested & certified for consistent performance



Productivity:

Touchless packaging with pre-installed o-ring: quick & easy hassle free installation

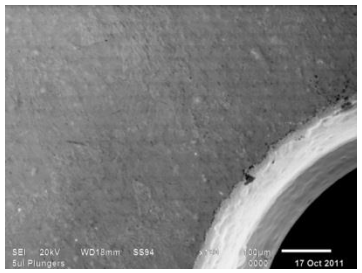


Liner Selection

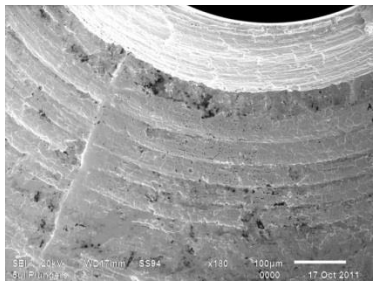
- Liner is where sample is volatilized so selection is important
- Liner Variables
  - Liner volume
  - Liner treatments or deactivation
  - Special characteristics (glass wool, taper, etc.)
- When choosing a liner for your application, consider all three aspects to give you the best chromatography
  - what type of inlet is your GC?
  - What is the application?
  - Injection technique (split, splitless, etc.)?
- You may need to experiment with several liner types to find the best one for your method.

Agilent UI Gold Seal: Deactivated gold surface

- Soft gold plating is essential for proper sealing
- Ultra Inert chemistry blocks active sites (gold is NOT inert)
- Smooth surface doesn't leak (Injected molded)
- Advantage Agilent



Agilent MIM seal



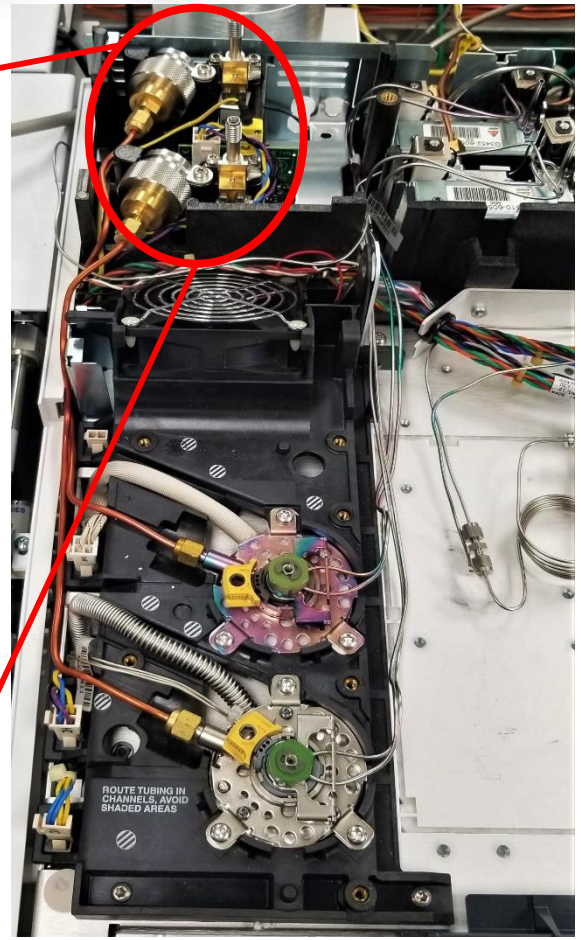
Competitor's machined seal

Reliable ppb and ppt measurements require attention to the little things!

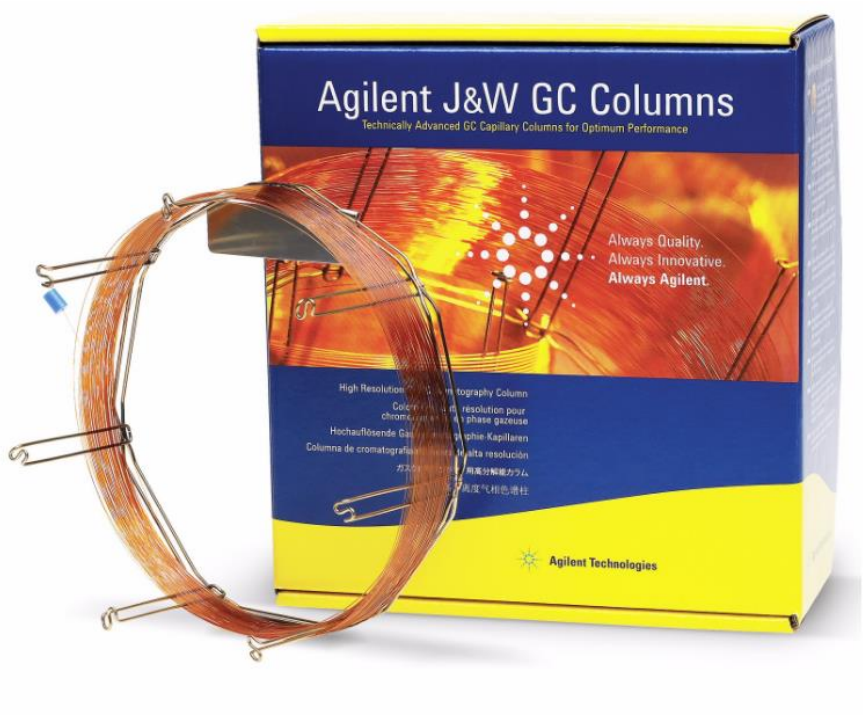
Split/Splitless Inlet: The Split Vent Trap

What is it???

Where is it??? On a 7890 GC

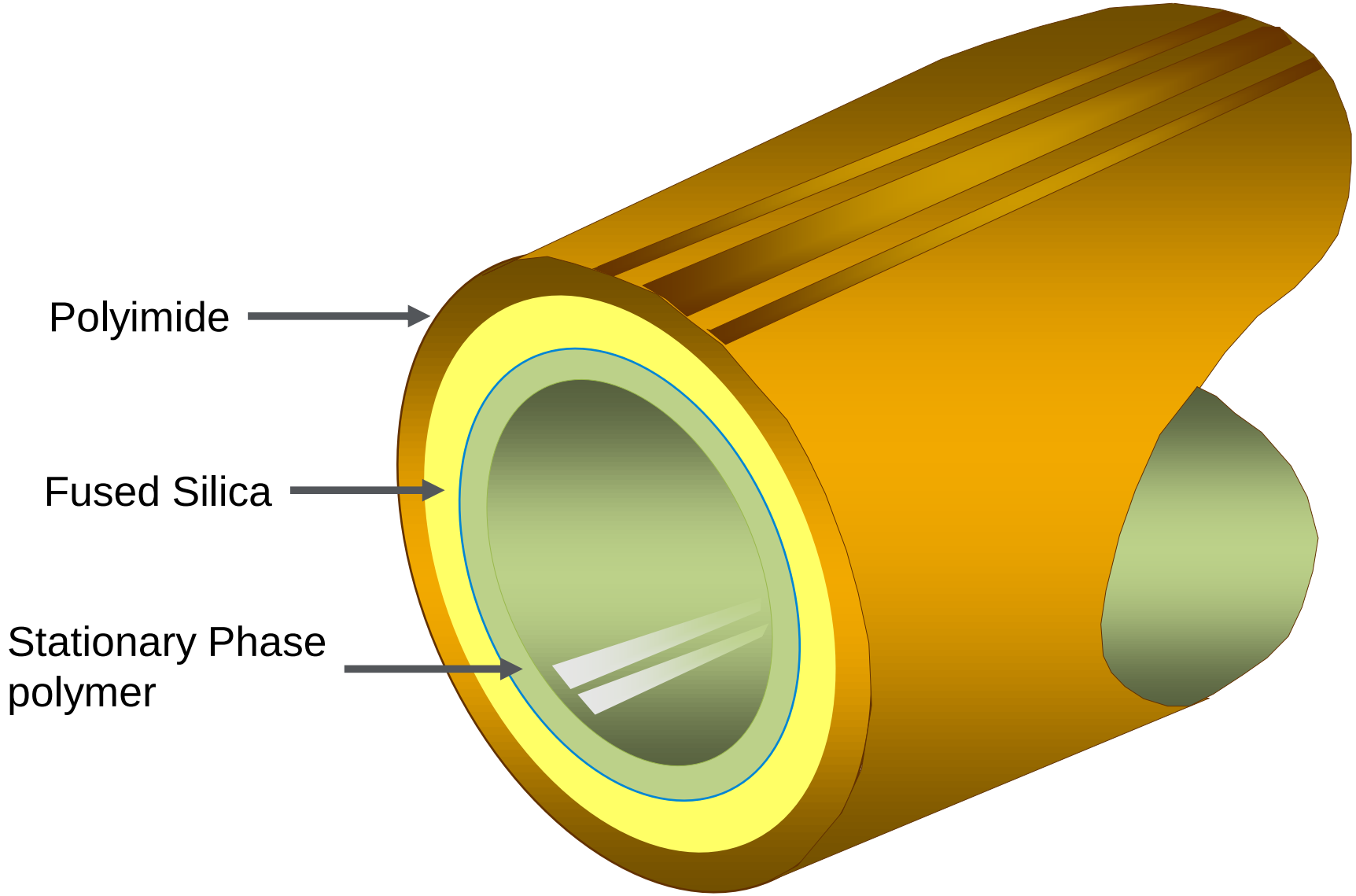


COLUMNS!


Agilent J&W GC Columns
Technically Advanced GC Capillary Columns for Optimum Performance
Always Quality.
Always Innovative.
Always Agilent.
Agilent Technologies


Agilent Intuvo
GC Columns

Anatomy of a Capillary GC Column



Column Installation & Tools

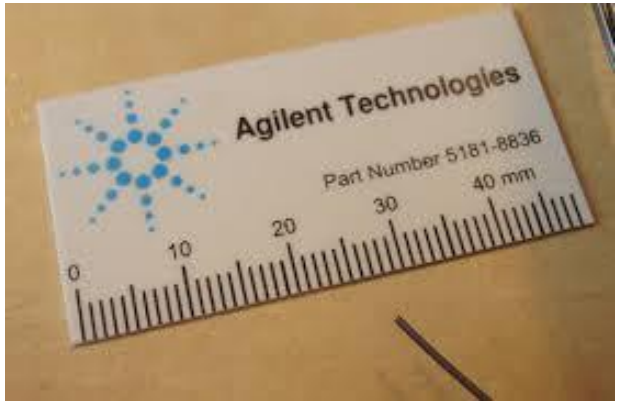
Gently scribe through the polyimide coating.
Do not attempt to cut the glass.

<u>Recommended tools:</u>

Diamond or carbide tipped pencil; or sapphire cleaving tool, ceramic wafer
Ocular

<u>Do not use:</u>

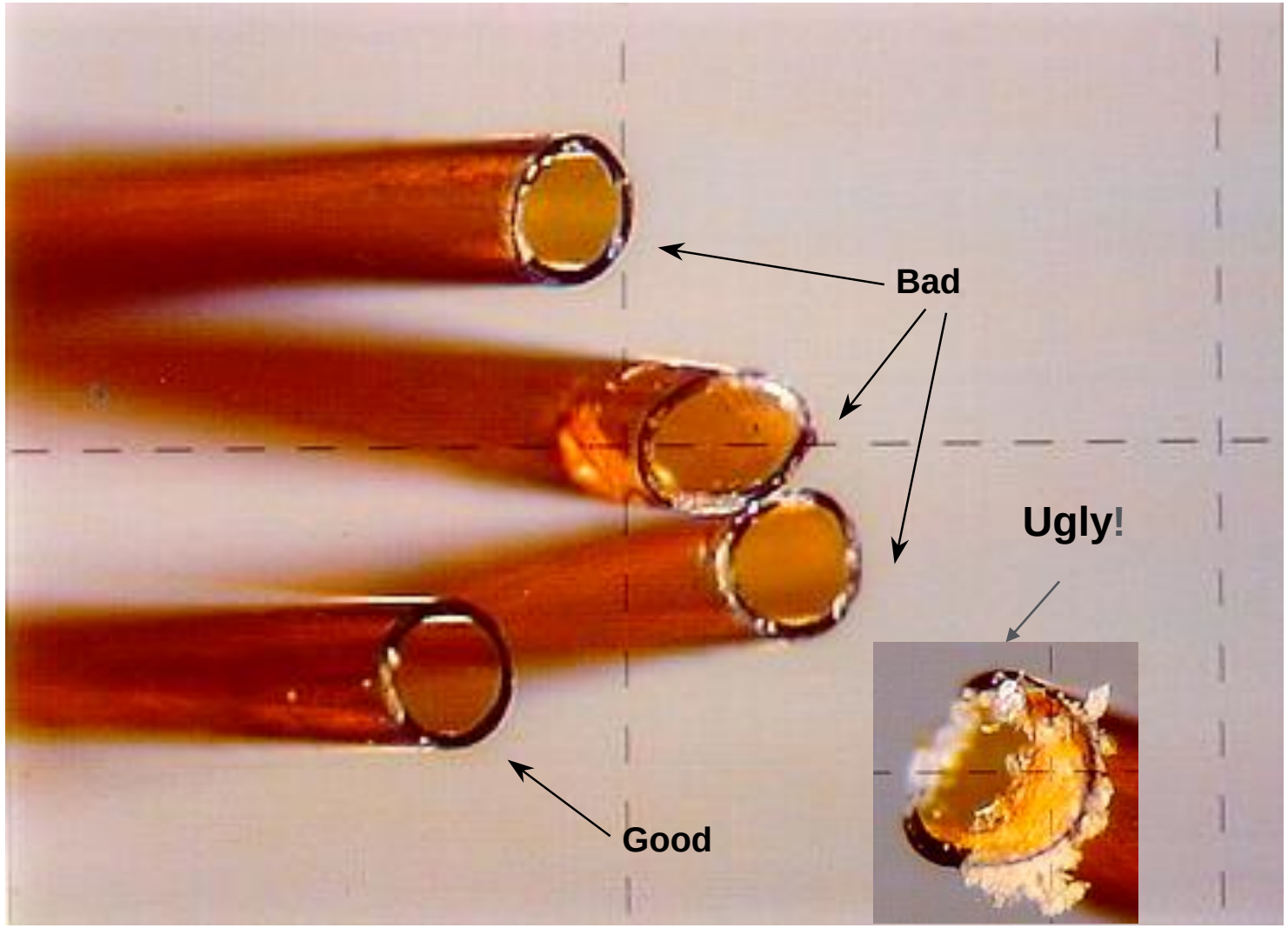
Scissors, file, etc.

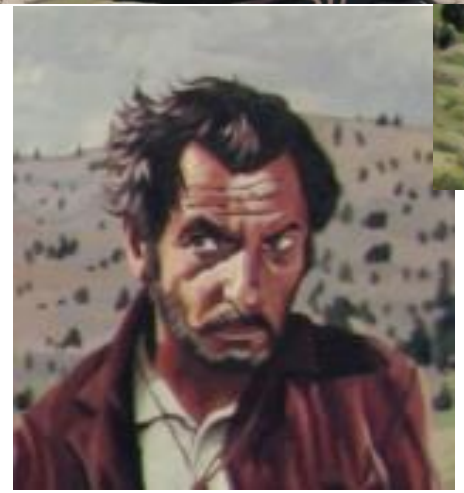


5181-8836 (4/pk)

Column Installation: Good Cuts and Clean Hands

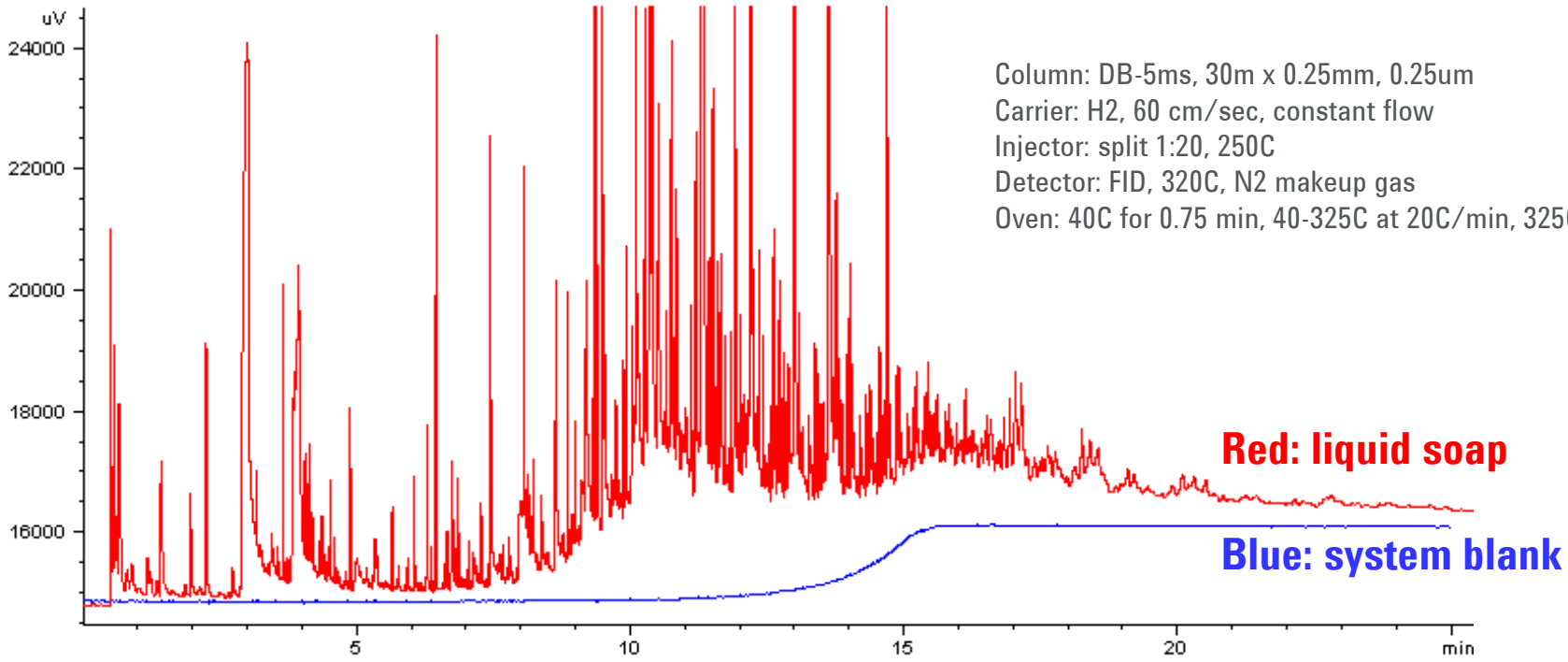
Examples of Column Cuts-The GOOD the BAD and the UGLY!





Don’t overtighten!!!

Contamination from Liquid Soap



Column: DB-5ms, 30m x 0.25mm, 0.25um
Carrier: H2, 60 cm/sec, constant flow
Injector: split 1:20, 250C
Detector: FID, 320C, N2 makeup gas
Oven: 40C for 0.75 min, 40-325C at 20C/min, 325C for 30 min

Procedure:

(1) One very small drop of liquid placed on one fingertip.
(2) Fingertip was wiped with paper towel to remove as much of the offending material as possible.
(3) Lightly touched the part of the column sticking up above the ferrule.
(4) Installed column into injector.
(5) Set oven temperature to 40C.
(6) Started oven temperature program as soon as oven reached 40C.

Ferrules

Vespel

Vespel/graphite

Graphite

Ultimetal ferrules

Composition	Max T	Use	Limitation
Vespel	280	Easy seal	Leaks after T cycle, iso only
Vespel/graphite	350	MS	Retighten after T cycle
Graphite	450	Not MS	Contamination, leakages
Ultimetal Plus Flexible Metal Ferrules	450	MS, CFT	Overtightening can damage fitting

Dial packaging

“Short” ferrules for detector and inlet configurations on Agilent GC’s, provide a robust seal.

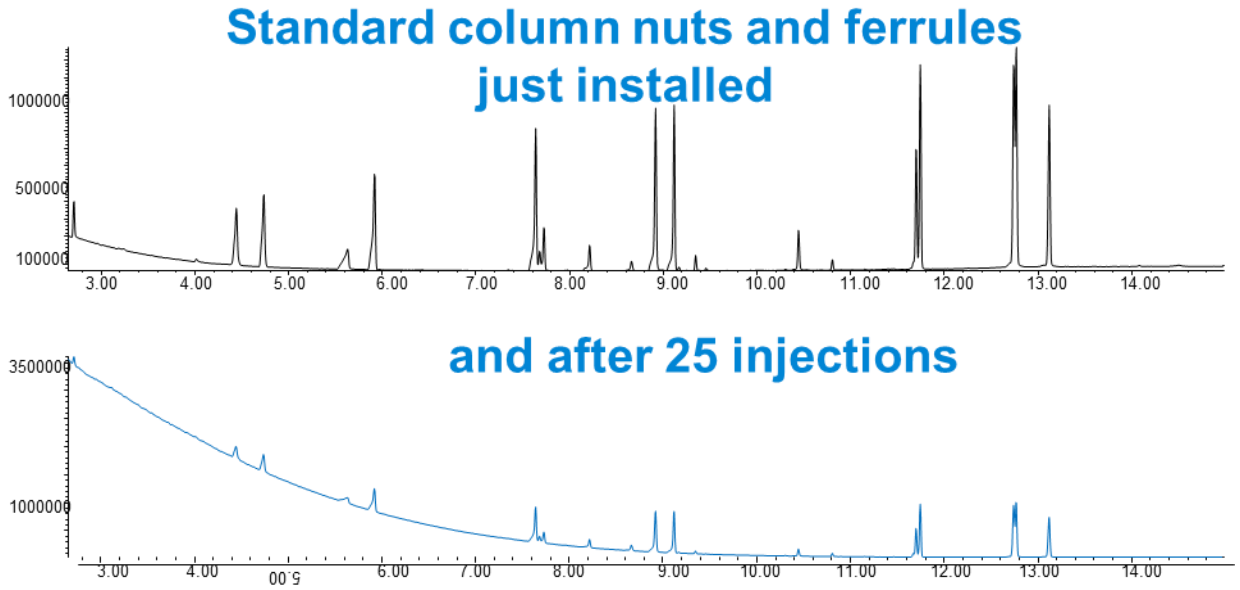
“Long” ferrules for MS transfer lines and MS interface nut

Graphite / Polyimide blend capillary ferrules

Unfortunately … leak following normal temperature program runs

Studies show the leaking continues with use of the ferrules -

Not just after the first one or two runs



Frequent re-tightening of the fitting is needed to maintain a leak-free seal – and system performance and productivity

Better Connections: Self Tightening Column Nuts

Designed for use with *short* graphite/polyimide blend ferrules –both at the inlet and the MS interface – so only one type of ferrule needed for both ends of the column!

For inlet or detector
P/N 5190-5233

For mass spec transfer line
P/N 5190-6194

Short ferrule exposes more thread of the fitting for better sealing

How do Self Tightening Column Nuts work?

- Ease of use – install in dark, small space in GC oven without wrenches
- Wing design for finger tight installation with graphite/polyimide blend ferrules
- No tools dramatically reduces force preventing over tightening or damage
- Robust stainless steel construction

Plus….

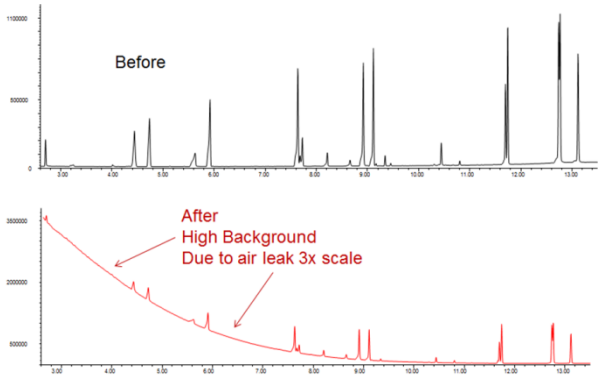
- Novel **spring driven piston** design that

  continuously presses against the ferrule

  to **maintain a leak-free fitting**

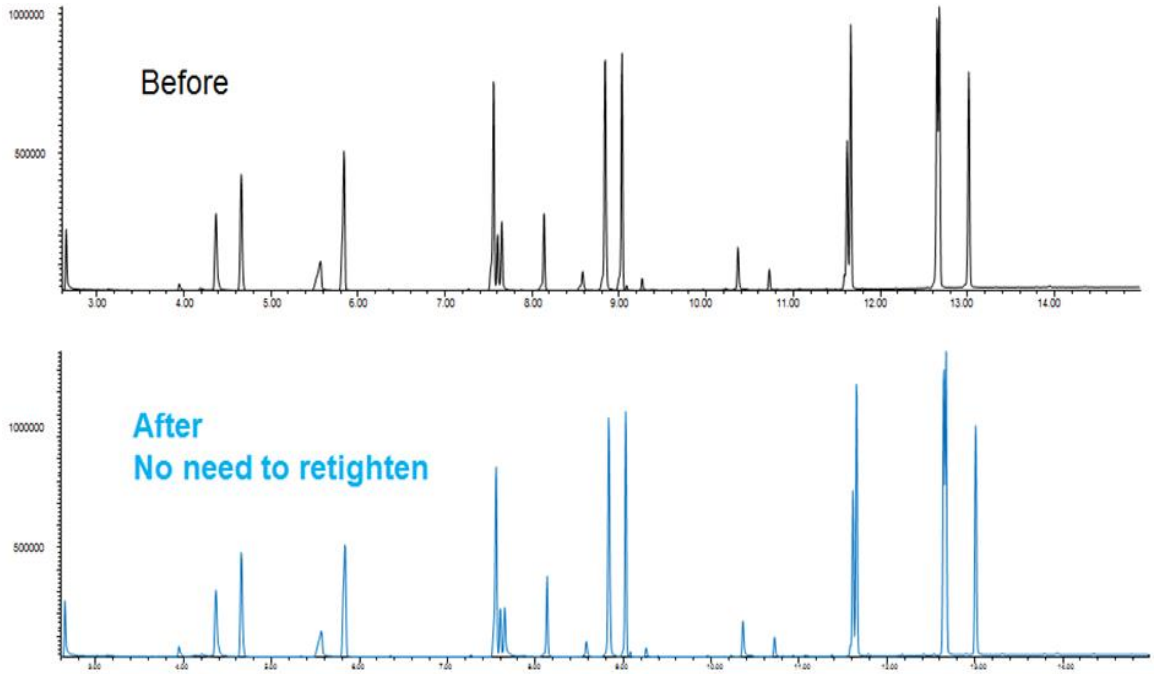
  even when the ferrule shrinks during temperature program!

Benefit of Self-Tightening Column Nuts



Take you from this….

…. to this!



Without retightening, the baseline remains flat after 400 runs with no indication of leaks when using the Self tightening Column Nut

Ref. Tech note: 5991-3612EN

When do I change what?

Item	Typical Schedule	Comments
Septum Nut	3-6 months	Septum nut can get warn and shed metal particle into the liner. Replace to minimize activity in the inlet/liner.
Syringe	Every 3 months	Check movement of plunger and replace if it does not move freely and cannot be cleaned.
Gold Seal	Monthly	At a minimum replace when trimming the front end of the column
Split Vent Trap	6 months-1 year	Often forgotten. Can also cause retention instability.
Liner	Weekly	The liner takes the brunt of the sample load/residues. Replace often to help prevent unwanted down time.
Trim/Replace column	Weekly-Monthly	When experiencing chromatographic problems trim ½ to 1 meter of the front end of the column. Replace liner, septum and gold seal.
Inlet Setpa	100-200 injections	Depends a bit on septum type and manual/auto injections.

Schedule is an approximation of average usage requirements. Actual frequency is application and sample specific. Use your chromatography as a guide to developing a normal maintenance schedule.

Column Installation

Leak Check

DO NOT USE SNOOP

Electronic leak detector
IPA/Water
Inject a non-retained peak

G3388B Leak Detector

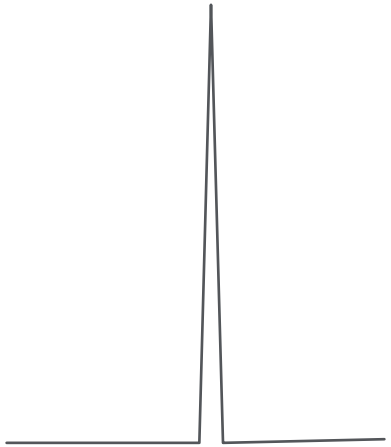
Leak and Installation Check

Inject a non-retained compound vs DB-1

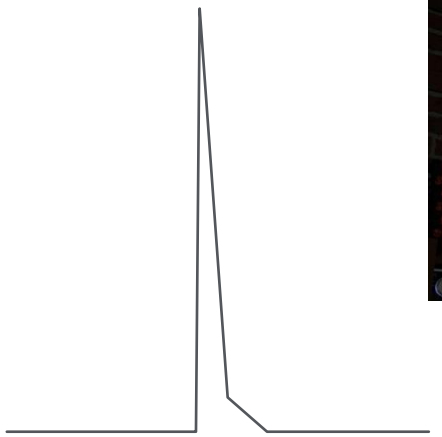
Detector	Compound
FID	Methane or Butane
ECD	$MeCl_2$ (headspace or diluted)
NPD	CH_3CN-acetonitrile (headspace or diluted)
TCD	Air
MS	Air or Butane

The peak should be sharp and symmetrical

Non-Retained Peak Shapes



Good Installation



Improper Installation or Injector Leak

Check for: -Too low of a split ratio

-Injector or septum leak

-Liner problem:

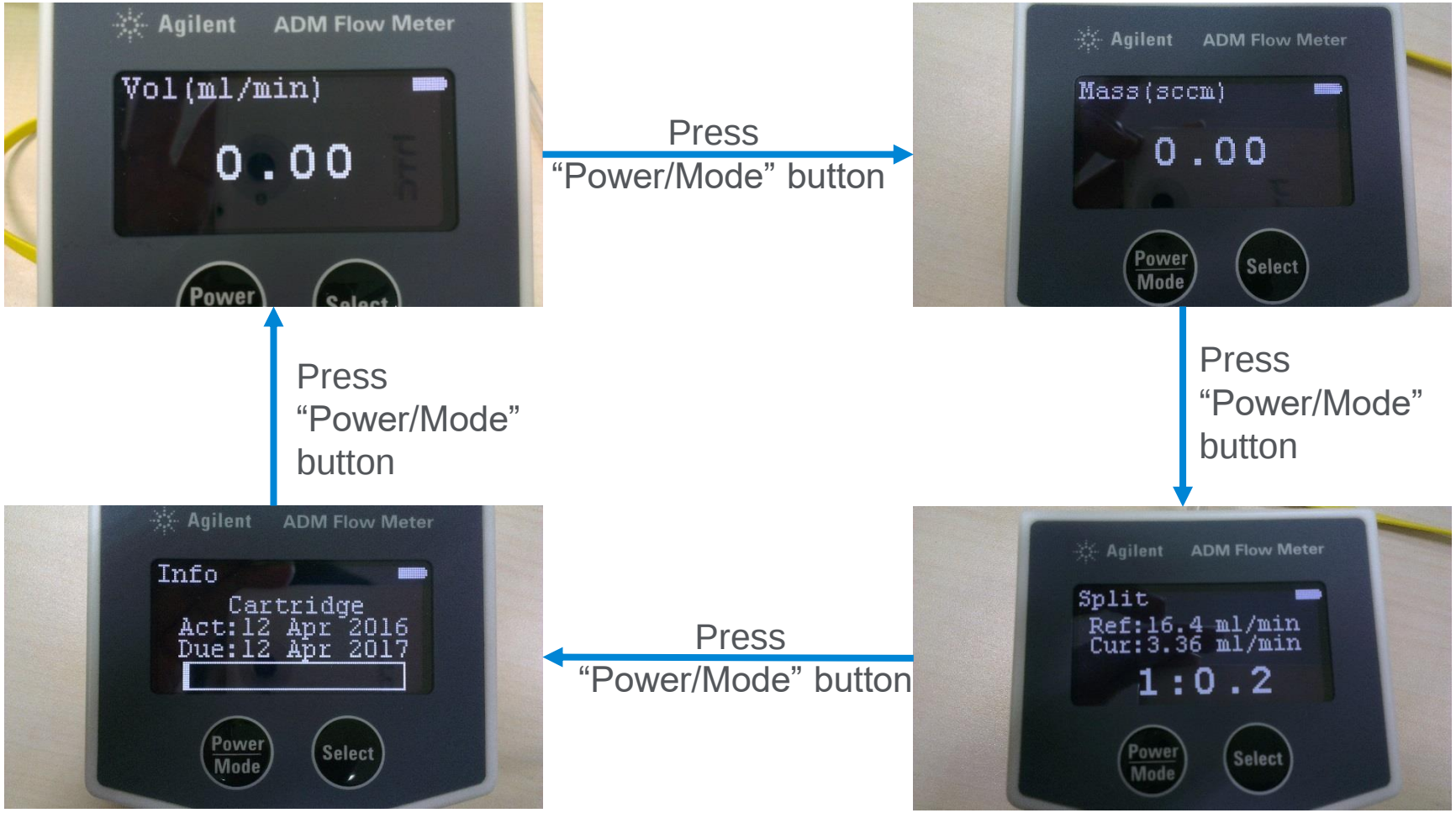
(broken, leaking, misplaced)

-Column position in injector and detector

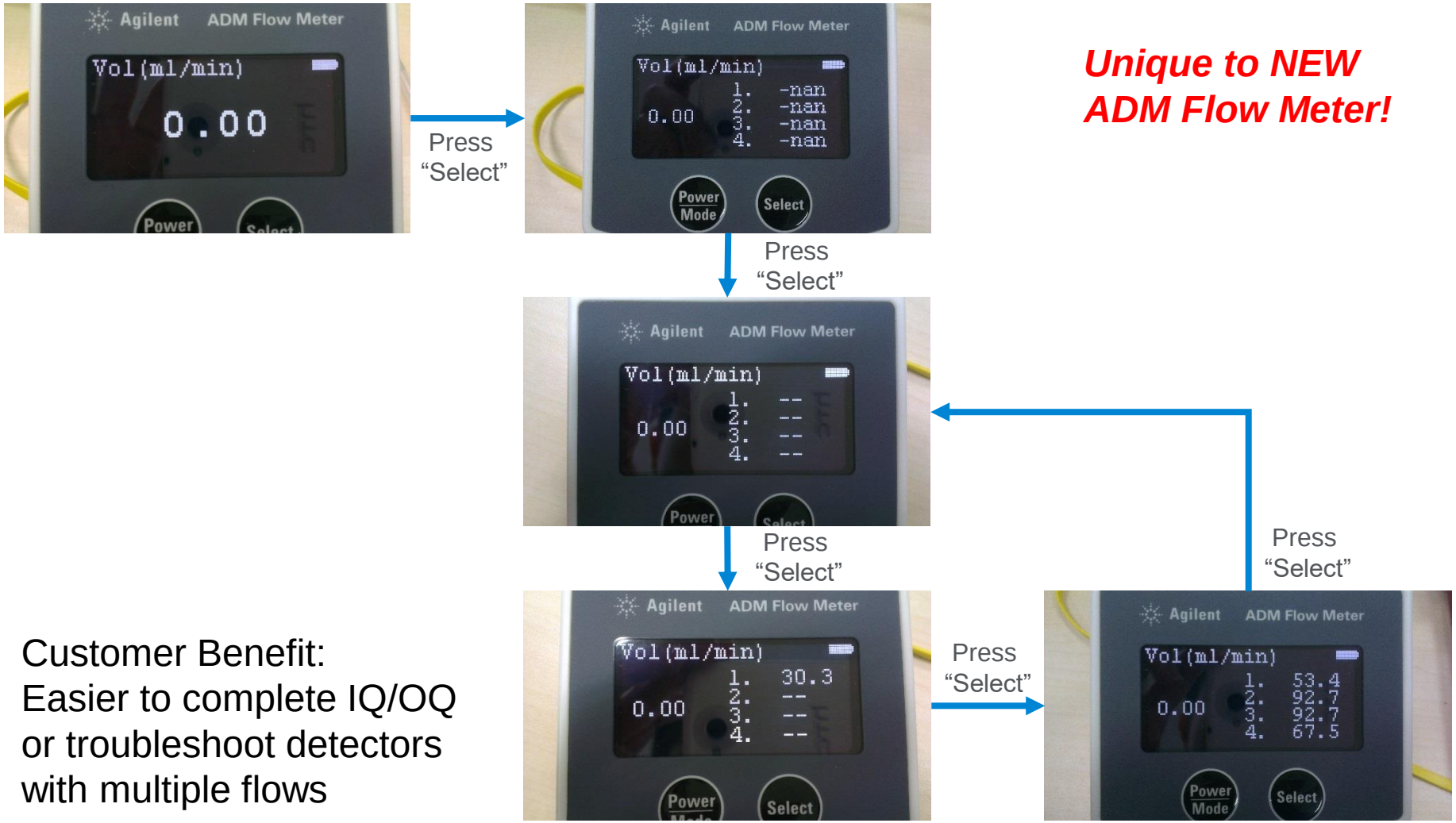
ADM Flow Meter

- Replaceable Calibration Cartridge
- Automatic Notification of Cartridge Replacement
- Ergonomic and robust design
- Universal 3AA or USB power
- USB connects to web interface for added functionality
- Easy to view OLED Screen
- Kickstand

Modes of Flow Measurement



New Record Feature!



Unique to NEW ADM Flow Meter!

Customer Benefit:
Easier to complete IQ/OQ or troubleshoot detectors with multiple flows

Column Conditioning

System must be leak free before conditioning column

Condition with the column connected to the detector so response can be monitored

Heat the column to the lower of:

- Isothermal maximum temperature OR
- 20° to 30°C above highest operation temperature
- Temperature programming is not necessary

Stop conditioning when the stable baseline is obtained:

- ~1 hour in most cases

Column Installation to MSD

- Best to condition the column attached to the MSD
  - By conditioning into the MSD you can observe for leaks and correct them prior to ever elevating oven temperature (high temp + O2 will quickly kill a column).
    - MSD is a perfect leak detector, why not take advantage of this capability?
  - Normal bleed products will not harm or dirty source
  - If you condition not connected to the MSD and oxidize the phase from a leak, the column will bleed; customers then blame column.
  - Oxygen WILL back diffuse into the column which will oxidize the last 6 – 12 inches
- Open source door and set column distance according to the service manual (1 – 4 mm)
- Tighten self-tightening column nut
- Close source door and pump down
- Press firmly against source door until vacuum takes over; do not tighten the source door nut / shipping clamp bolt

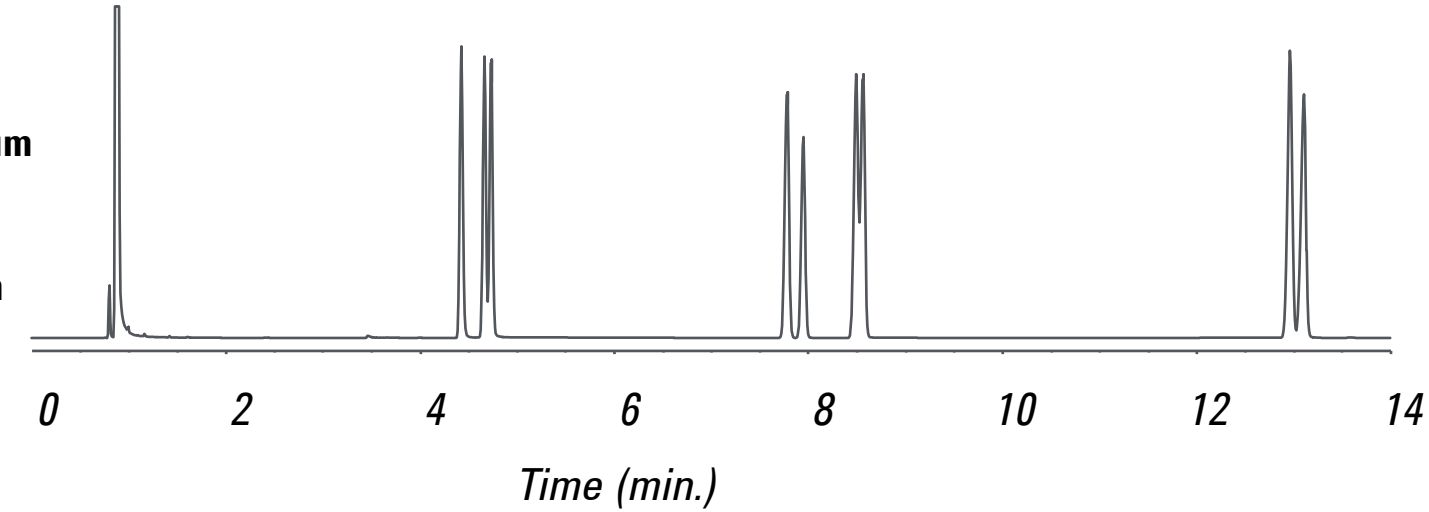
JW Column Portfolio- DB, HP, CP, VF

Low Polarity			Mid Polarity			High Polarity		
CP-Sil 2	DB & HP-1MS UI	DB & HP-5MS UI	DB-XLB	DB-225MS	DB-ALC1	HP-88	DB-WAX	CP-TCEP
DB-MTBE	DB & HP1-MS	DB & HP5-MS	VF-XMS	DB-225	DB-Dioxin	CP-Sil 88	DB-WAX ETR	
CP-Select CB MTBE	VF-1MS	VF-5MS	DB-35MS UI	CP-Sil 43 CB	DB-200	DB-23	HP-INNOWax	
	DB & HP-1	DB & HP-5	DB & VF-35MS	VF-1701 MS	VF-200MS	VF-23 MS	VF-WAX MS	
	CP-Sil 5 CB	CP-Sil 8 CB	DB & HP-35	DB-1701	DB-210		CP-WAX 57 CB	
	Ultra 1	Ultra 2	DB & VF-17MS	CP-Sil 19 CB	DX-4		DB & HP-FFAP	
	DB-1HT	VF-DA	DB-17	HP-Blood Alcohol			DB-WAX FF	
	DB-2887	DB-5.625	HP-50+	DB-ALC2			CP-FFAP CB	
	DB-Petro/PONA	DB & VF-5HT	DB-17HT	DX-1			CP-WAX 58 FFAP CB	
	CP-Sil PONA CB	CP-Sil PAH CB	DB-608				CP-WAX 52 CB	
	DB-HT SimDis	Select Biodiesel	DB-TPH				CP-WAX 51	
	CP-SimDis	SE-54	DB-502.2				CP-Carbowax 400	
	CP-Volamine		HP-VOC				Carbowax 20M	
	Select Mineral Oil		DB-VRX				HP-20M	
	HP-101		DB-624				CAM	
	SE-30		VF-624MS					
			CP-Select 624 CB					
			DB-1301					
			VF-1301MS					
			CP-Sil 13 CB					

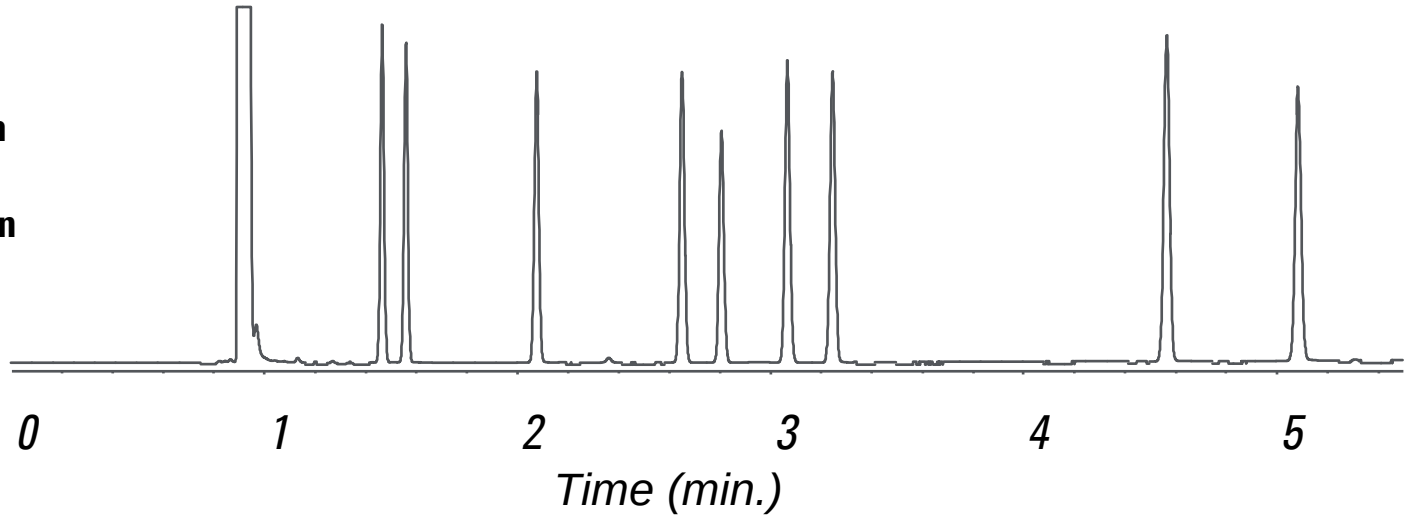
Agilent J&W has over 50 different stationary phase offerings

The Power of Selectivity: Start with the right phase

DB-1
15m x 0.32mm, 0.25µm
Oven:
40°C for 2 min
40-120°C at 5°C/min

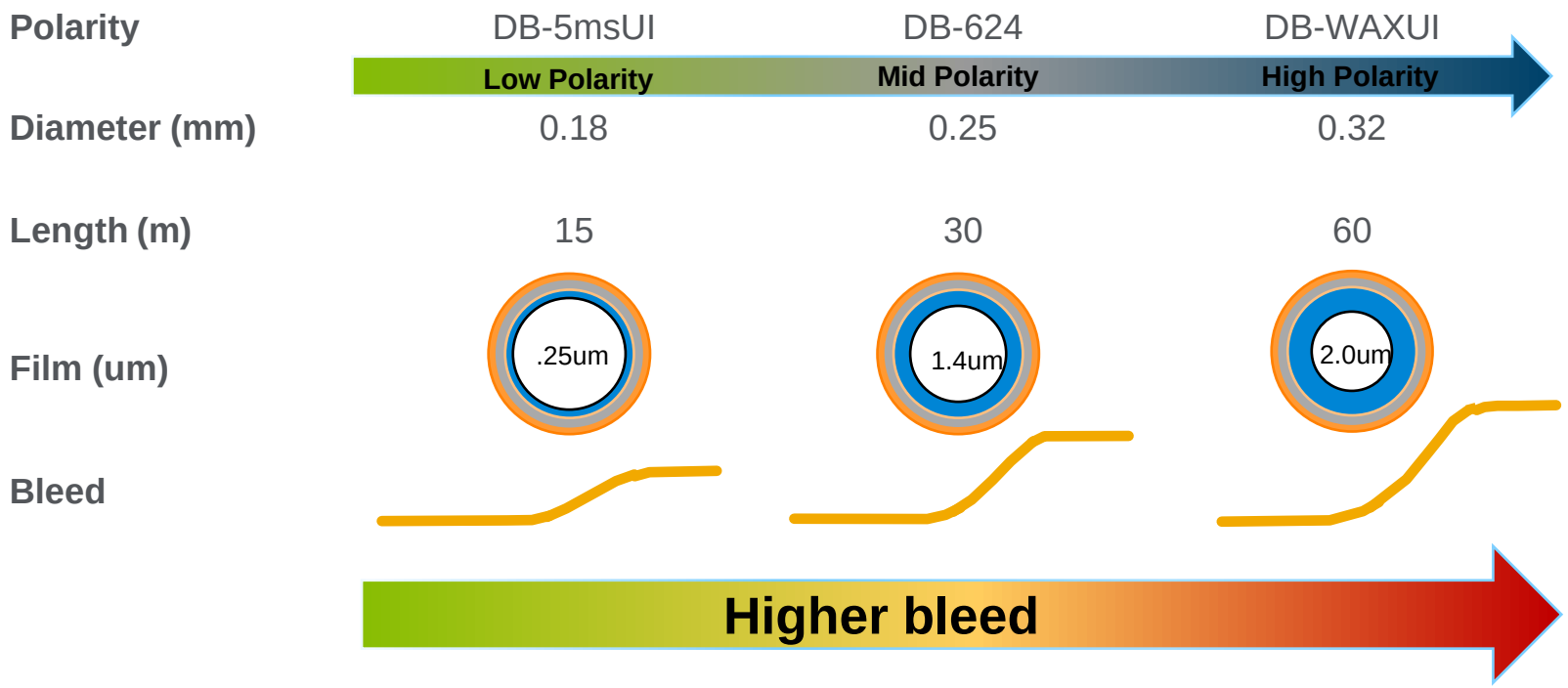


DB-Wax
15m, 0.32mm, 0.25µm
Oven:
80-190°C at 20°C/min

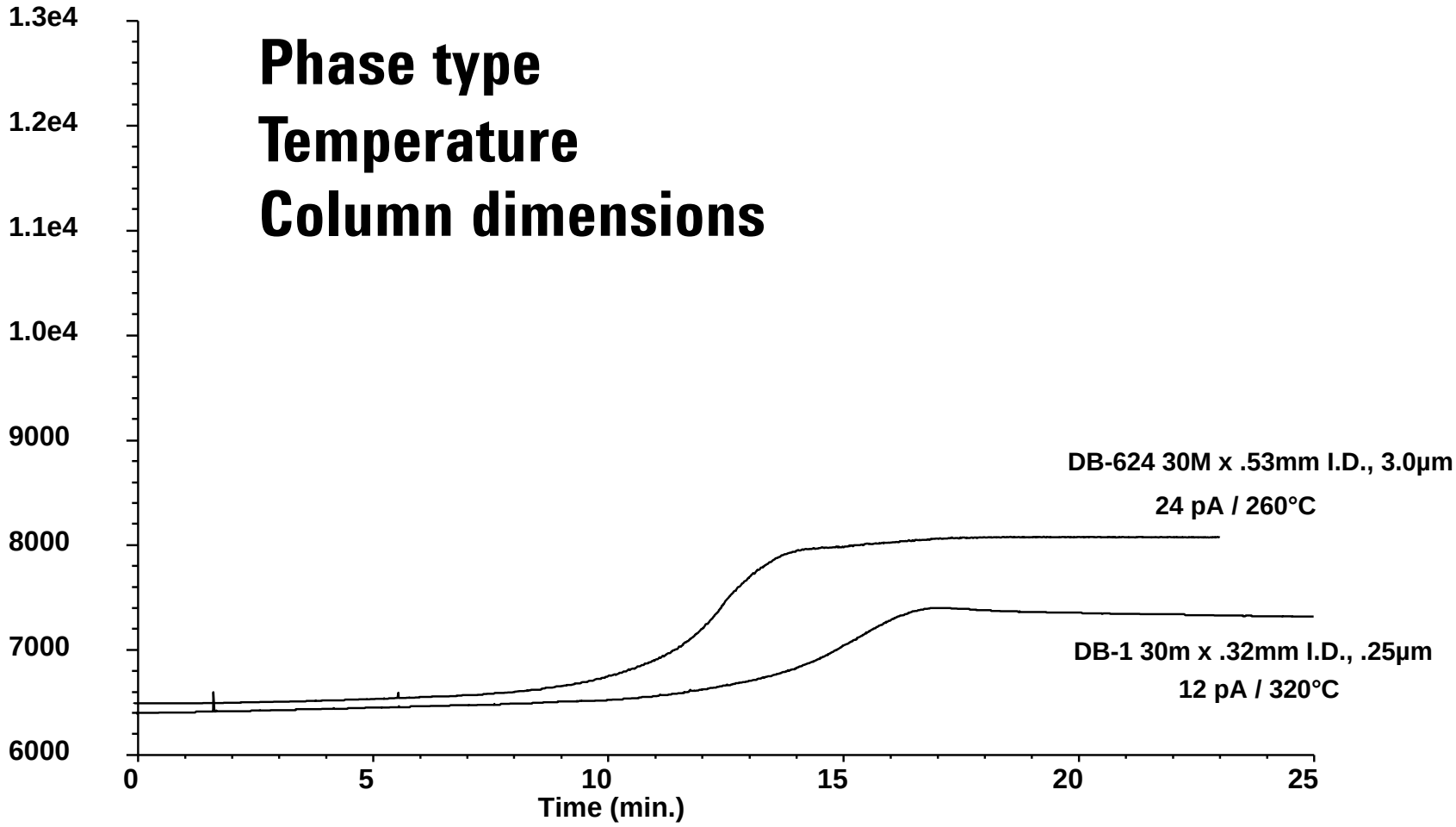


Which column types/dimensions produce higher bleed?

- Polarity: More polar = higher bleed
- Low polarity = More thermally stable
  - look at temperature limits as a general indicator of thermal stability
- The more total mass of polymer in the column the higher the bleed (within a given phase)
  - Larger diameters
  - Longer columns
  - Thicker films



Column Bleed is Influenced by:



Column Inertness: What does it mean?

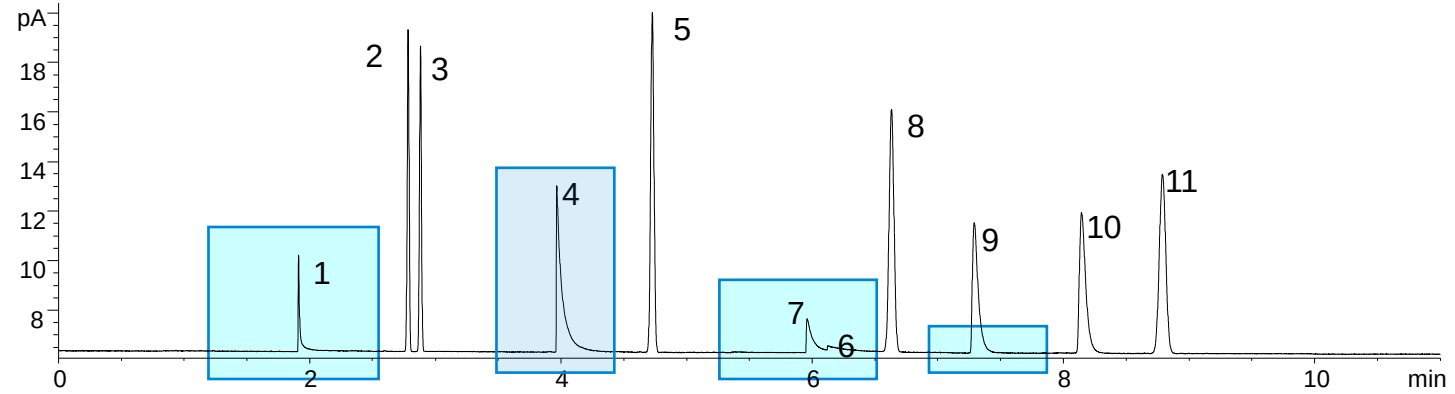
- Easier to describe “lack of inertness”
  - Peak Tailing (reversible interaction)
  - Loss of compound all together (irreversible interaction)

- A high level of flow path inertness will produce peaks from active compounds that are not degraded and will look “normal”/symmetrical

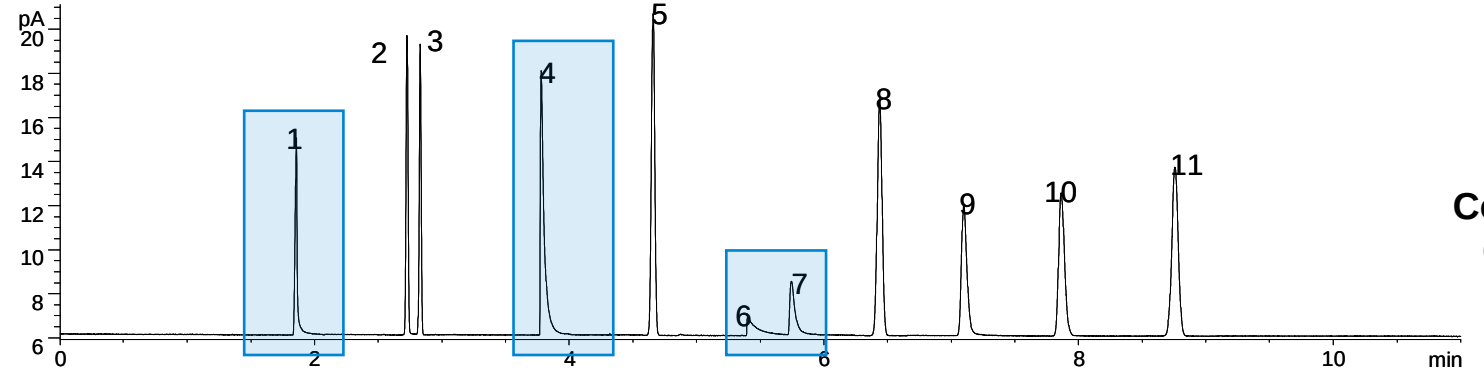
- The negative effects the column has towards challenging compounds
  - Acids
  - Bases
  - Hydrogen Bonding
  - i.e. 2,4-DNP, Endrin, DOA, Etc.

Ultra Inert Test Mix – DB-5MS Ultra Inert v. Competitors

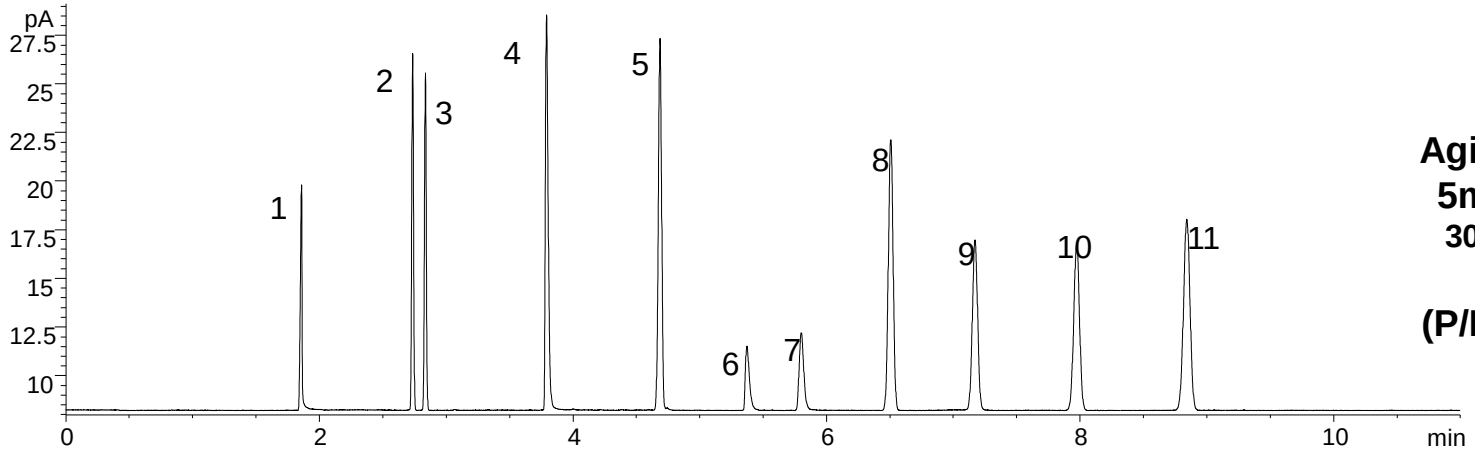
1. 1-Propionic acid
2. 1-Octene
3. n-Octane
4. 4-Picoline
5. n-Nonane
6. Trimethyl phosphate
7. 1,2-Pentanediol
8. n-Propylbenzene
9. 1-Heptanol
10. 3-Octanone
11. n-Decane



Competitor Column



Competitor Column



Agilent J&W DB-5ms Ultra Inert
30m x 0.25mm x 0.25um
(P/N 122-5532UI)

Ultra Inert Phases

DB-1ms UI

HP-1ms UI

DB-5ms UI

HP-5ms UI

DB-624 UI

DB-Select 624 UI 467

DB-Wax UI

DB-35ms UI

DB- BAC1 UI

DB-BAC2 UI

UI columns use engineered proprietary deactivation and are QC tested with VERY demanding probes that will exploit weaknesses in inertness

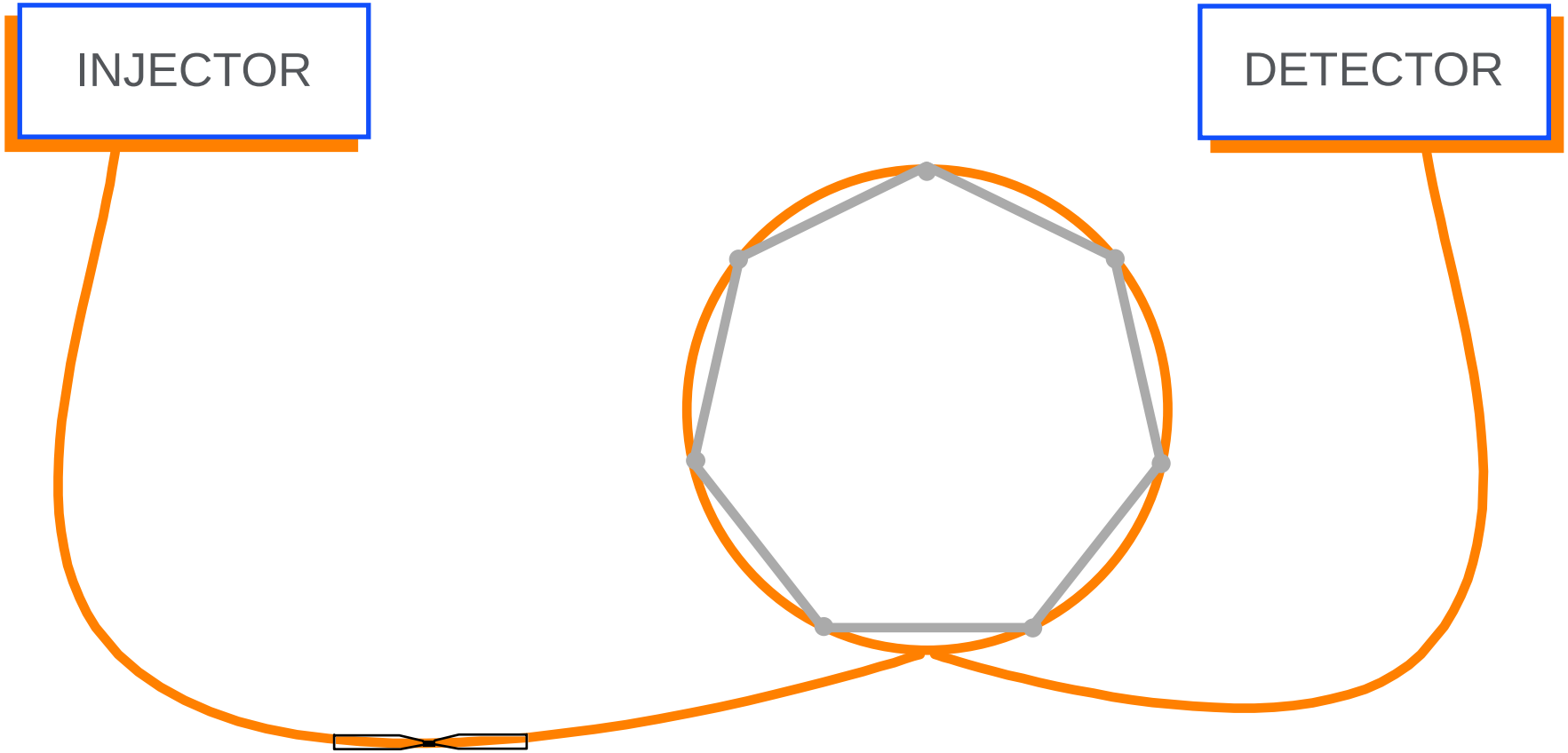
Same Selectivity, more Inertness!

The Best Type of Column for GC/MS

- Low bleed
  - “ms” phases are best but not required
  - ms and msUI phases have same bleed

- Low flow
  - ≤2 ml/min for HES and Diffusion pumps
    - This includes during pressure pulse
  - ≤4 mL/min for Turbo
    - ≤ 2 is still best for optimum performance
  - Maximum diameter 0.32mm,
    (however 0.25mm ID or smaller is best)
  - 30m x 0.25mm by far most common

Guard Column or Retention Gap



The guard column is 3 - 5 meters of deactivated fused silica tubing with the same diameter as the analytical column. It is connected with a zero dead volume union.

Integrated Guards - DuraGuard

- No union
- Possible for any DB column 0.18mm and larger
- Limited offering “off-the-shelf”

DuraGuard

Phase	ID (mm)	Length (m)	Film (µm)	Guard Length (m)	Part No.
DB-1	0.25	30	0.25	10	122-1032G
DB-XLB	0.25	30	0.25	10	122-1232G
DB-5ms	0.25	30	0.25	10	122-5532G
			0.50	10	122-5536G
			1.00	10	122-5533G
		60	0.25	10	122-5562G
	0.32	30	1.00	10	123-5533G
	0.53	30	0.50	10	125-5537G
DB-5.625	0.18	20	0.36	5	121-5622G5
	0.25	30	0.25	5	122-5631G5
DB-1701	0.53	30	1.00	10	125-0732G
DB-624	0.53	30	3.00	5	125-1334G5

Misc Tools- ferrule removal, pre-swagers

RFT-2500

RFT-5300

Capillary and Megabore ferrule tools

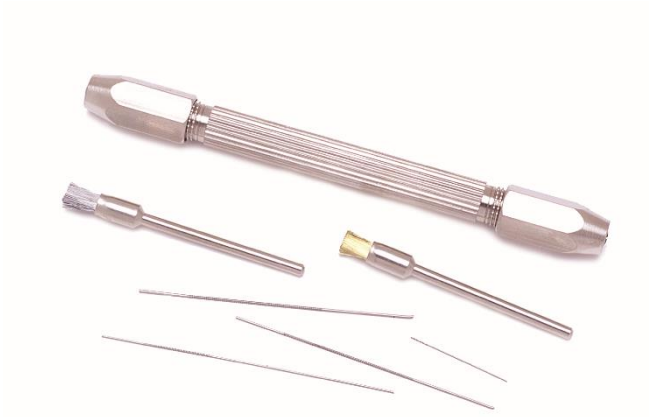
Metal Ferrules, G3440-80218

Graphite Ferrules, G3440-80217

RMP-5005

430-1020
20 x magnifier

9301-0985



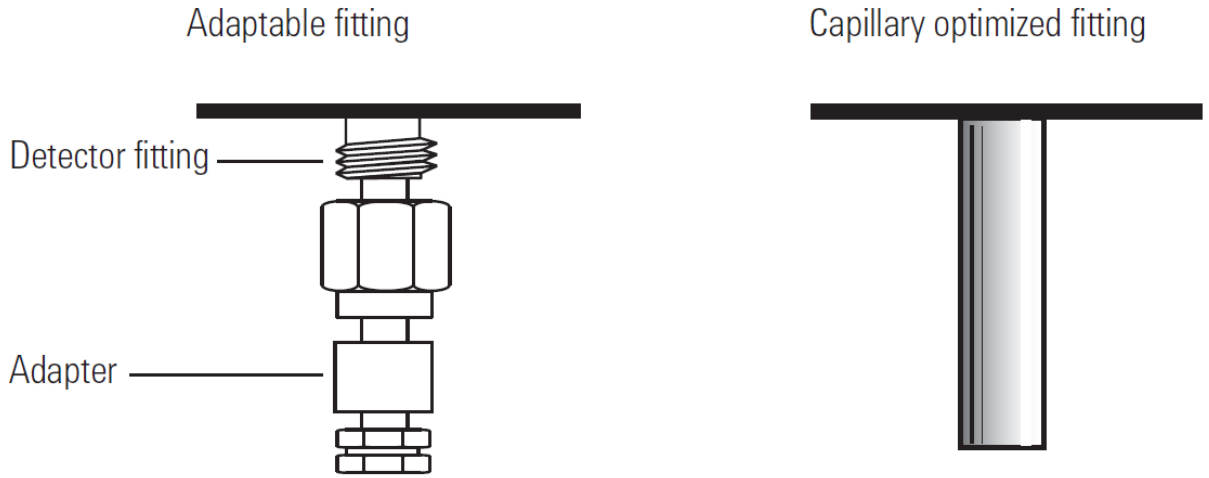
UltiMetal Plus Flexible Metal ferrules

Pre-swaging tool, G2855-60200

Detectors

- FID – Most common; will detect anything that will “burn” in the flame to produce ions…anything organic
- TCD – Universal detector, non-destructive; choice of carrier gas determines sensitivity
- MSD – Qual and quant
- ECD – Halogens; extremely sensitive

FID



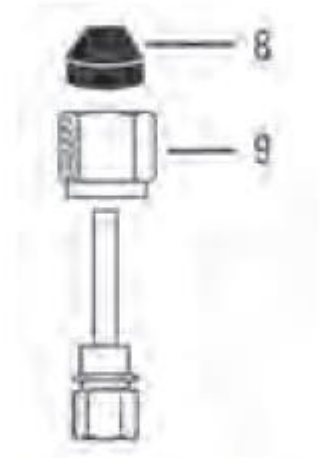
FID Jets

Item	Description	Part No.
1	Jet, 0.011 in/0.29 mm id tip, capillary dedicated	G1531-80560
2	Jet, 0.018 in/0.47 mm id tip, capillary optimized	G1531-80620
3	Jet, capillary adaptable, 0.011 in id tip	19244-80560
4	Jet, packed, high temperature, 0.018 in id tip	19244-80620
5	Jet, packed standard, 0.018 in id tip	18710-20119
6	Jet, packed wide-bore, 0.030 in id tip (for high-bleed applications)	18789-80070

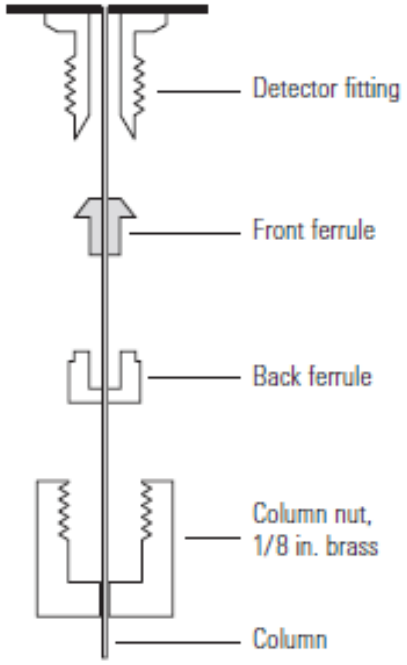
Cleaning kit
Other consumables like ignitor

Ignitor glow plug assembly,
19231-60680

TCD – 2 types of connections for column



Standard design



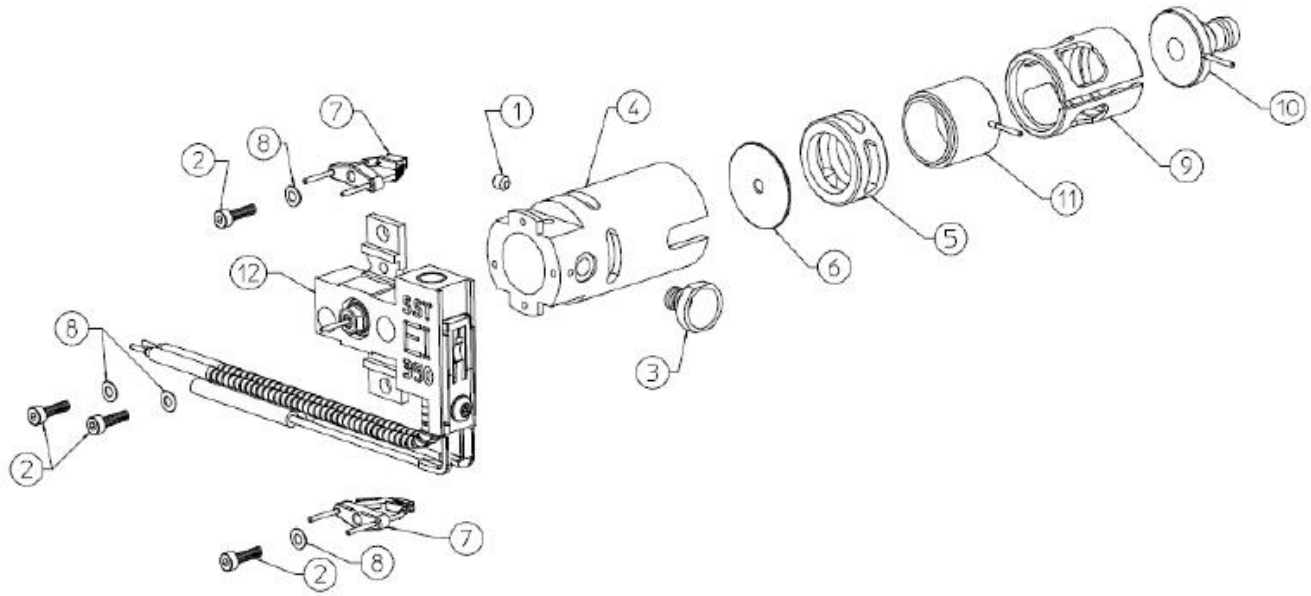
TCD Ferrules

Column ID (mm)	Back Ferrules	Front Ferrules 10/pk
0.53	5182-3477	5182-9673
0.32	5182-3477	5182-9676
0.25/0.2/0.1	5182-3477	5182-9677
No hole	5182-3477	5182-9679
TCD back ferrule for 1/8 in. detector fitting, 10/pk	5180-4103	

MS – SST/Inert, Extraction, HES, CI….

SST /Inert Ion Source Assembly

Item	Description	Part number
1	Gold plated set screw	G1999-20022
2	Gold Plated Screw	G3870-20021
3	Interface socket	G1099-20136
4	Ion Source body for SST	G1099-20130
	Ion Source body for Inert	G2589-20043
5	Draw out Cylinder	G1072-20008
6	Draw out plate for SST - 3mm	05971-20134
	Draw out plate for SST - 6mm	G3163-20530
	Draw out plate for Inert - 3mm	G2589-20100
	Draw out plate for Inert - 6mm	G2589-20045
	Draw out plate for Inert - 9mm	G3440-20022
7	4-turn filament	G7005-60061
8	Spring Washer	3050-1374
9	Lens insulator for SST EI/Inert EI	G3170-20530
10	Entrance Lens	G3170-20126
11	Ion focus Lens	05971-20143
12	350 Repeller Assembly SST EI	G3870-67172
	350 Repeller Assembly Inert EI	G3870-67173



Summary

You can reduce or prevent problems by thinking ahead

Some instrument parts should be replaced on a regular basis, before there is a problem

Develop a maintenance routine that works for you

Sample clean-up is a powerful tool in addressing common chromatography and mass spectrometry challenges

Choose the best column for your sample and conditions

Contact Agilent Chemistries and Supplies Technical Support

1-800-227-9770 Option 3, Option 3:

Option 1 for GC/GCMS Columns and Supplies

Option 2 for LC/LCMS Columns and Supplies

Option 3 for Sample Prep Products, Filtration and QuEChERS

Option 4 for Spectroscopy Supplies

Available in the USA 8-5 all time zones

gc-column-support@agilent.com ← GC columns and supplies

lc-column-support@agilent.com

spp-support@agilent.com

spectro-supplies-support@agilent.com