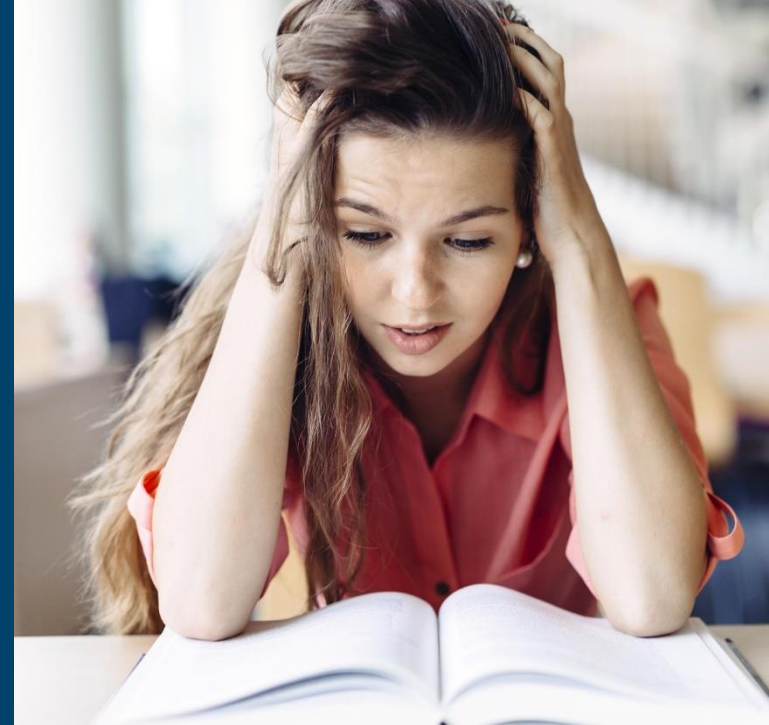


# When Should I Change That? Ensuring Proper Instrument Performance for GC

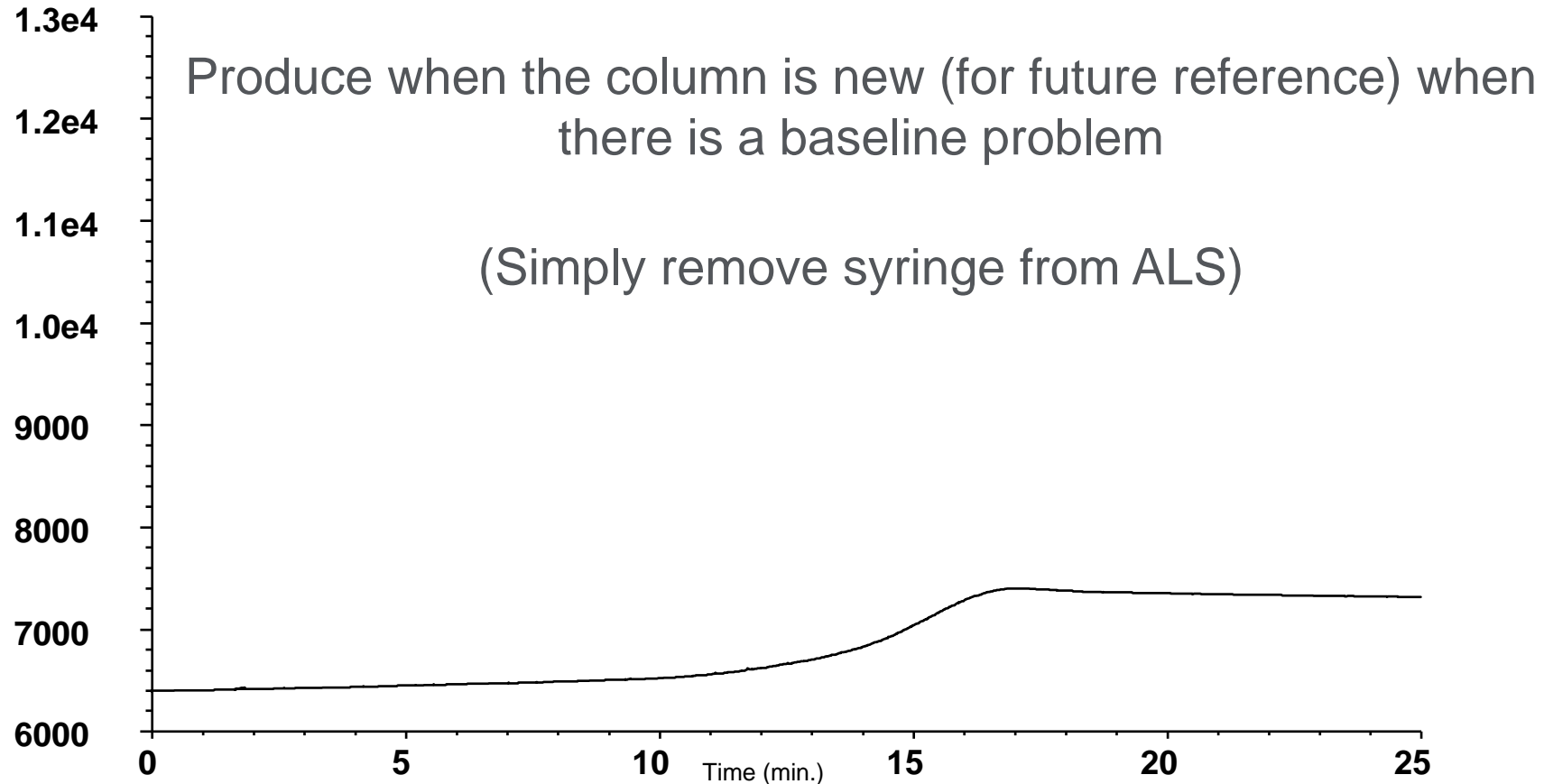
Alexander Ucci  
Online Application Engineer  
December 14, 2021



# The Million Dollar Question – How Long Will My Consumables Last?

- One of the most common questions in technical support
- Highly dependent on many factors
  - How often do you use your instrument?
  - How contaminated is your sample?
  - Leaks present?
  - Using proper supplies to begin with?
- With experience you will observe the signs and symptoms of when it is time to replace a consumable
- It's important to have something to compare to
  - Instrument blank
  - Clean standard injection

# Know What your Baseline Should Look Like – the Instrument Blank

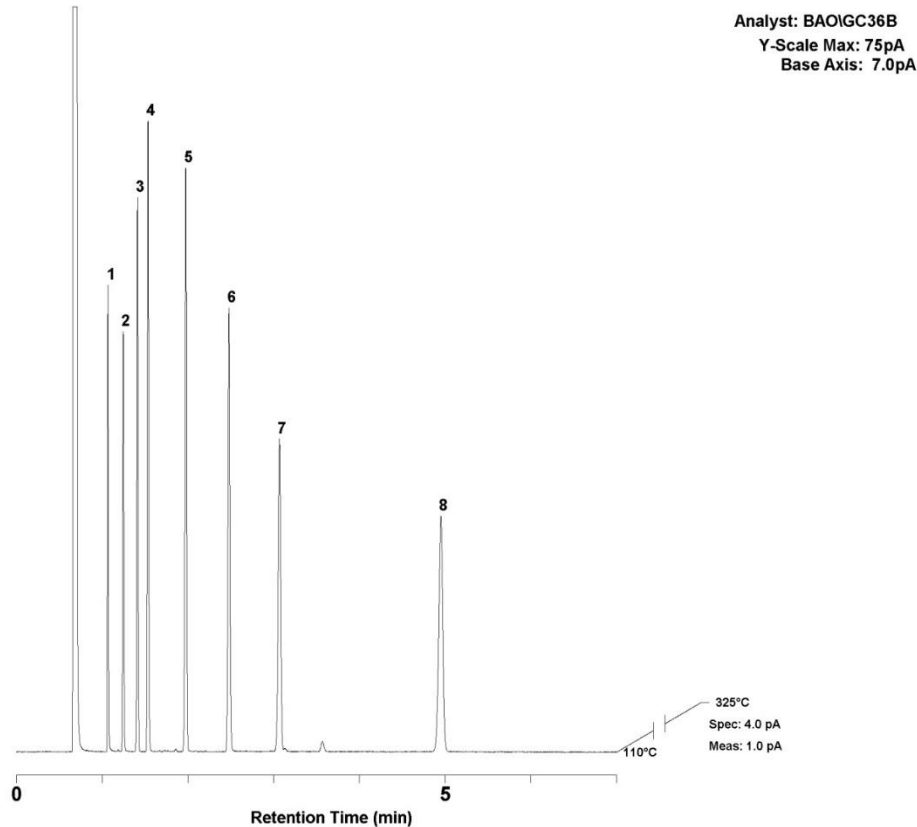


Agilent J&W DB-1, 30 m x 0.32 mm id, 0.25  $\mu$ m  
Temperature program: 40 °C, hold 1 min // 20 °C/min to 320 °C,  
hold 10 min.

# Inject a Clean Test Mix

A test mix is used to determine how “good” the column is, or whether the problem is related to the chemical properties of the analytes.

It is simplest to use your own standard.



Compound	Purpose
Hydrocarbons	Efficiency retention
Alcohols	Activity
FAMEs, PAHs	Retention
Acids	Acidic character activity
Bases	Basic character activity

Test Conditions	
Inlet:	Split (250 °C)
Detector:	FID (320 °C)
Flow:	37.3 cm/s (1.8 mL/min)
Carrier gas:	Hydrogen
Holdup compound:	Methane (0.671 min)
Temperature program:	Isothermal (110 °C)

# ULTRA Scientific is Now Part of Agilent Technologies

Agilent ULTRA Chemical Standards have:

- Best in class online search, compare, and ordering capabilities
- Rapid shipping: 99.9% of orders are dispatched within 24 to 48 hours (continental U.S. only, currently)
- Custom standard solutions including our online custom quoting tool, enabling customers to upload recipe formulations and to modify the recipe before submitting it
  - Tool will allow customers to see the quote pricing instantly and allow them to check quote based on quantity range
  - Check it out at [www.agilent.com/en/product/chemical-standards](http://www.agilent.com/en/product/chemical-standards)
- Rigorously tested and manufactured under ISO 9001, ISO 17025, and ISO 17034 accreditations
- Sample preparation materials, columns, supplies, instrumentation, and reference materials are all from a single source



# When to Change your Standards?

All standards come with an expiration date and storage conditions

- **Information** is listed on the Certificate of Analysis (CofA)
- **Expiration** date depends on the stability of the analytes in the solvent
- Standards are guaranteed to this date for unopened ampoules or bottles


Standards made with volatile solvents and analytes should only be used once

- **It is too risky and the concentrations of the analytes may not match the certificate once opened**

If not highly volatile, stability of the standard and any stock solutions, calibration standards, or verification standards must be monitored by the end user

Agency methods will often have guidelines for usage, storage, and stability of standards and stock solutions.

ISO 17034



Trusted Answers

### Reference Material Certificate

**Product Name:** PAH Analyzer Calibration Sample #2      **Lot Number:** 0006646719  
**Product Number:** G3440-85009-2      **Lot Issue Date:** 28-Oct-2021  
**Storage Conditions:** Store at Room Temperature (15° to 30°C).      **Expiration Date:** 31-Oct-2023

Component Name	CERTIFIED VALUES		CAS#	Analyte Lot
	Concentration	Expanded Uncertainty		
naphthalene-d8	50.0 ± 0.3 µg/mL	001146-65-2	RM12698	
acenaphthene-d10	50.2 ± 0.3 µg/mL	015067-26-2	RM13902	
phenanthrene-d10	50.0 ± 0.3 µg/mL	001517-22-2	RM06967	
chrysene-d12	50.0 ± 0.3 µg/mL	001719-03-5	RM15976	
perylene-d12	50.1 ± 0.3 µg/mL	001520-96-3	RM12612	

**Matrix:** acetone

**Description:**  
This document is prepared in accordance with ISO 17034 and Guide 31. This analytical reference material standard was manufactured and verified in accordance with an ISO 9001 registered quality system and analyte concentrations were verified by an ISO 17025 accredited laboratory. The concentration and uncertainty value at the 95% confidence level for each analyte, determined gravimetrically, is listed above.

**Traceability:**  
The balances used for these measurements are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z540.3, ISO 9001, ISO 17025, and ISO 17034. Calibrated Class A glassware is used for volumetric measurements. Thermometers are calibrated against a NIST traceable thermometer in accordance with NIST Special Publication 1088.

**Homogeneity:**  
This analytical reference standard was unitized according to an in-house procedure and is guaranteed to be homogeneous. There is no minimum sub-sample size required.

**Instructions for Use:**  
Sample aliquots for analysis should be withdrawn at 20°C to 25°C immediately after opening the container and should be processed without delay for the certified values to be valid within the stated uncertainties.

**Safety:**  
Refer to the Safety Data Sheet on [www.agilent.com](http://www.agilent.com) for information regarding this analytical reference material.

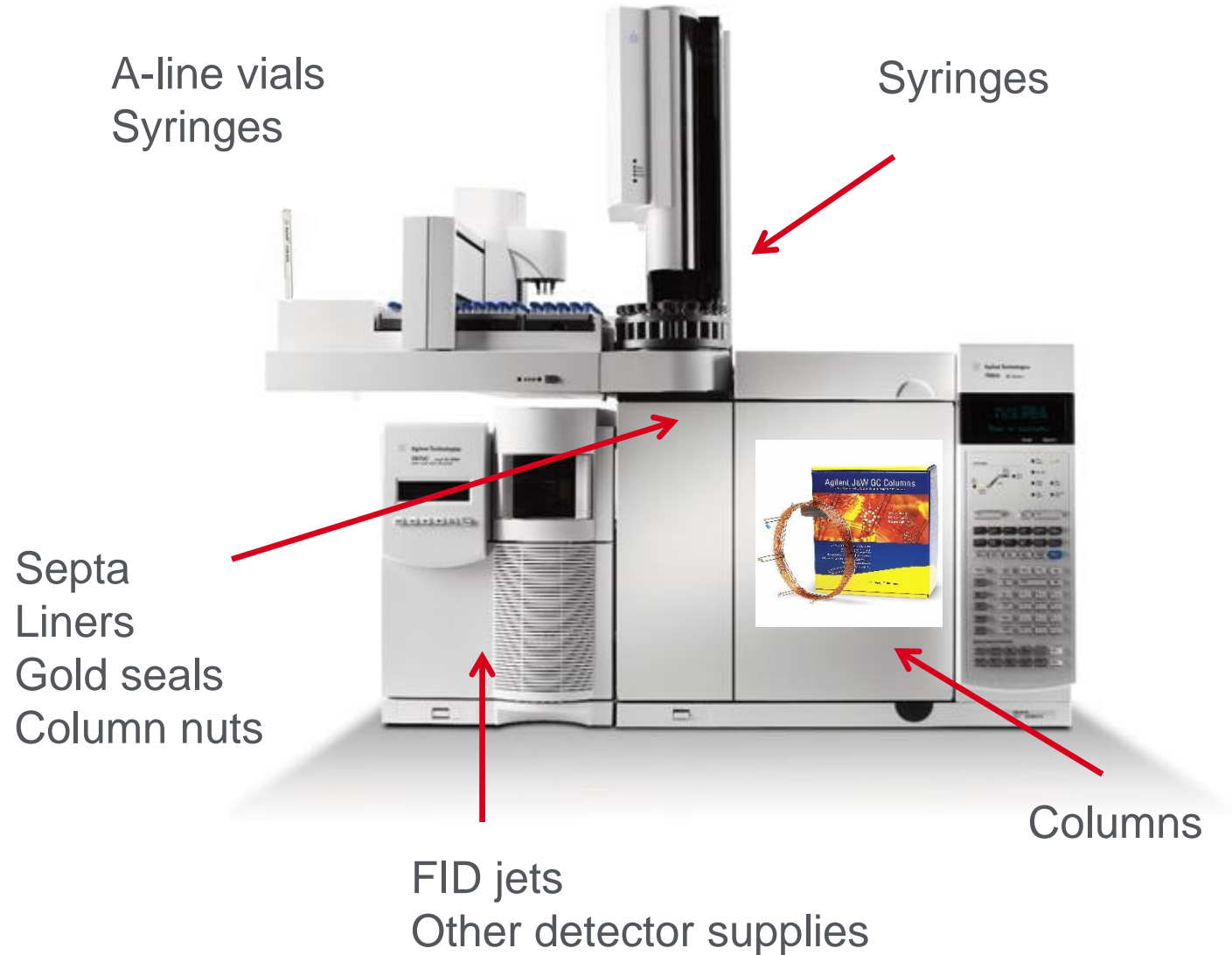
**Intended Use:**  
This analytical reference standard is intended for the preparation of working reference samples for use in routine laboratory analyses, calibration of instruments, validation of analytical methods, assessments of measurement methods, and continuing calibration verification.

**Expiration of Certification:**

Page: 1 of 2  
CSD-QA-015.1

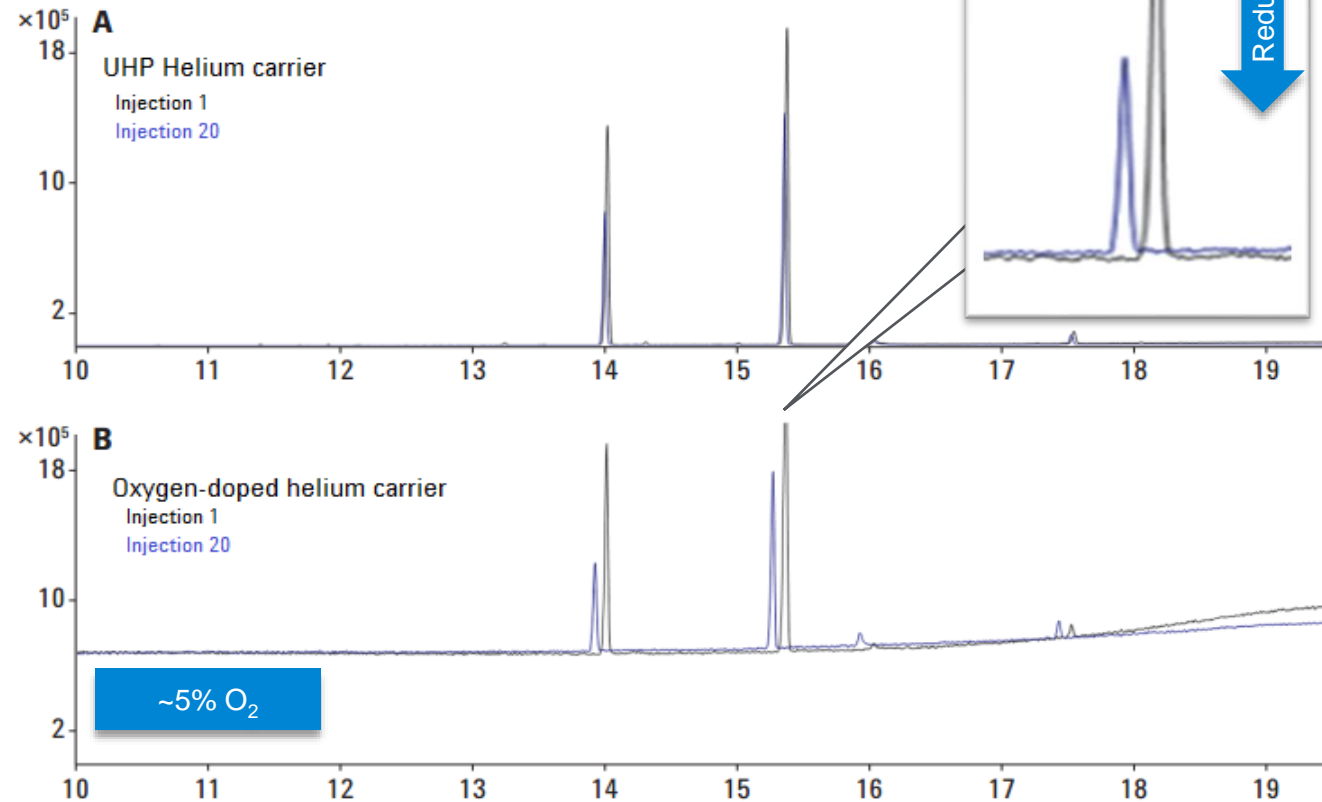
# An Overview of the Commonly Changed GC Supplies

Gas traps  
Standards



# Let's Talk About Gas Quality and Filters

- Oxygen in carrier gas is detrimental to GC/MS
  - Reduced response
  - Elevated background
  - Irreversible column damage
  - Impaired electron multiplier function
  - Premature filament, liner lifetime
- Use UHP carrier gases
  - 99.9995% or greater
- Use Gas Clean carrier gas filters

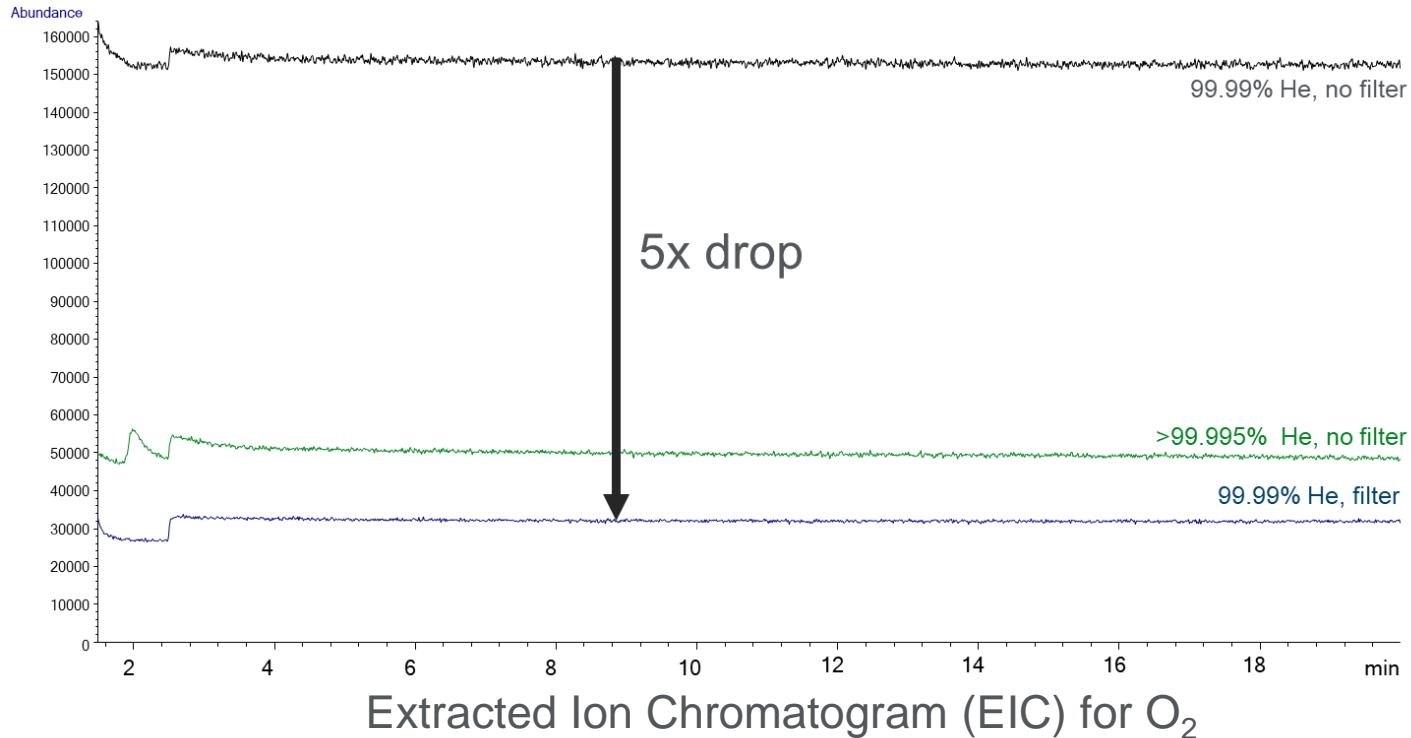


GC/MS filter  
Agilent p/n  
CP17973



# Let's Talk About Gas Quality and Filters

If you used lower quality gases, how much O<sub>2</sub> could the filter clean up?

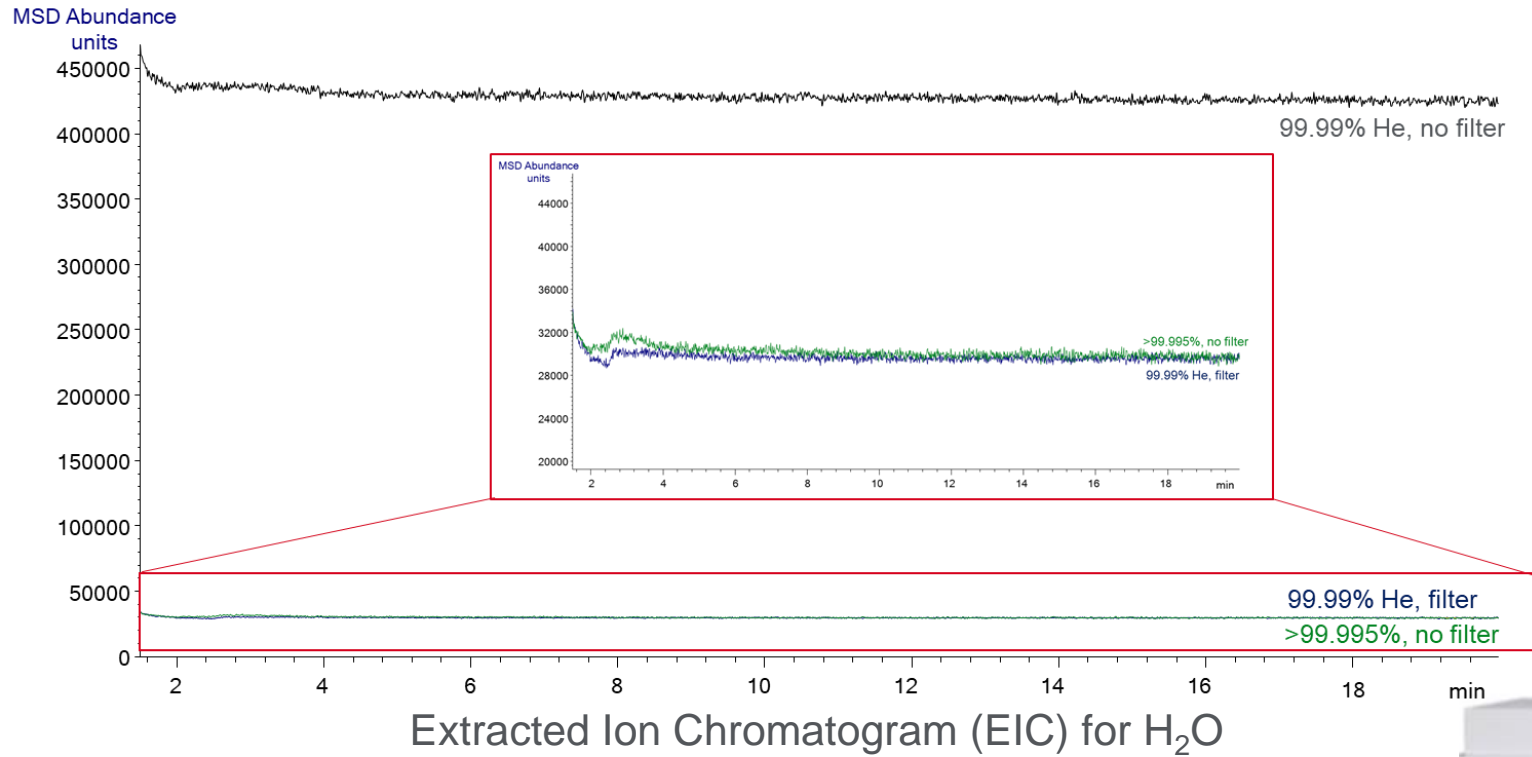


Installing (and properly purging) the Gas Clean carrier gas filter lowers the O<sub>2</sub> signal by a **factor of 5**.



# Let's Talk About Gas Quality and Filters

If you used lower quality gases, how much H<sub>2</sub>O could the filter clean up?



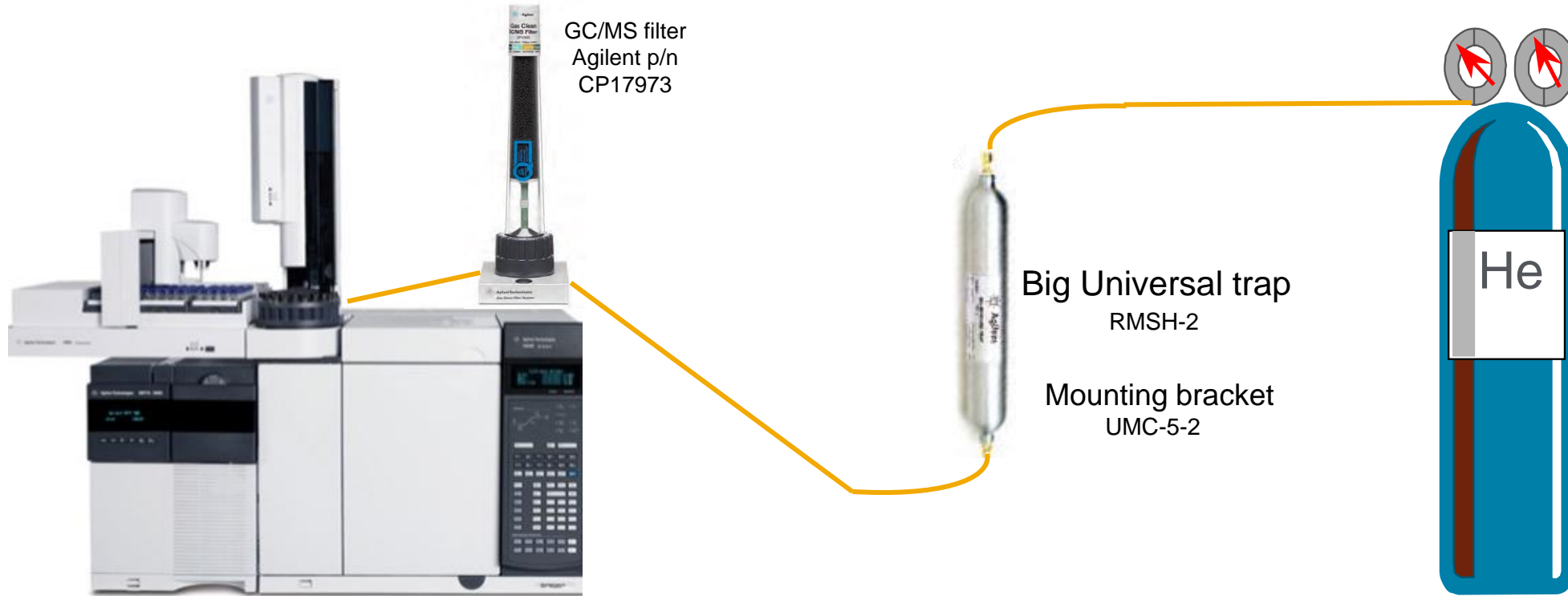
Gas Clean filter lowered the H<sub>2</sub>O signal by a **factor >10**

You can further increase Gas Clean and column lifetime by installing the universal filter before the Gas Clean filter.



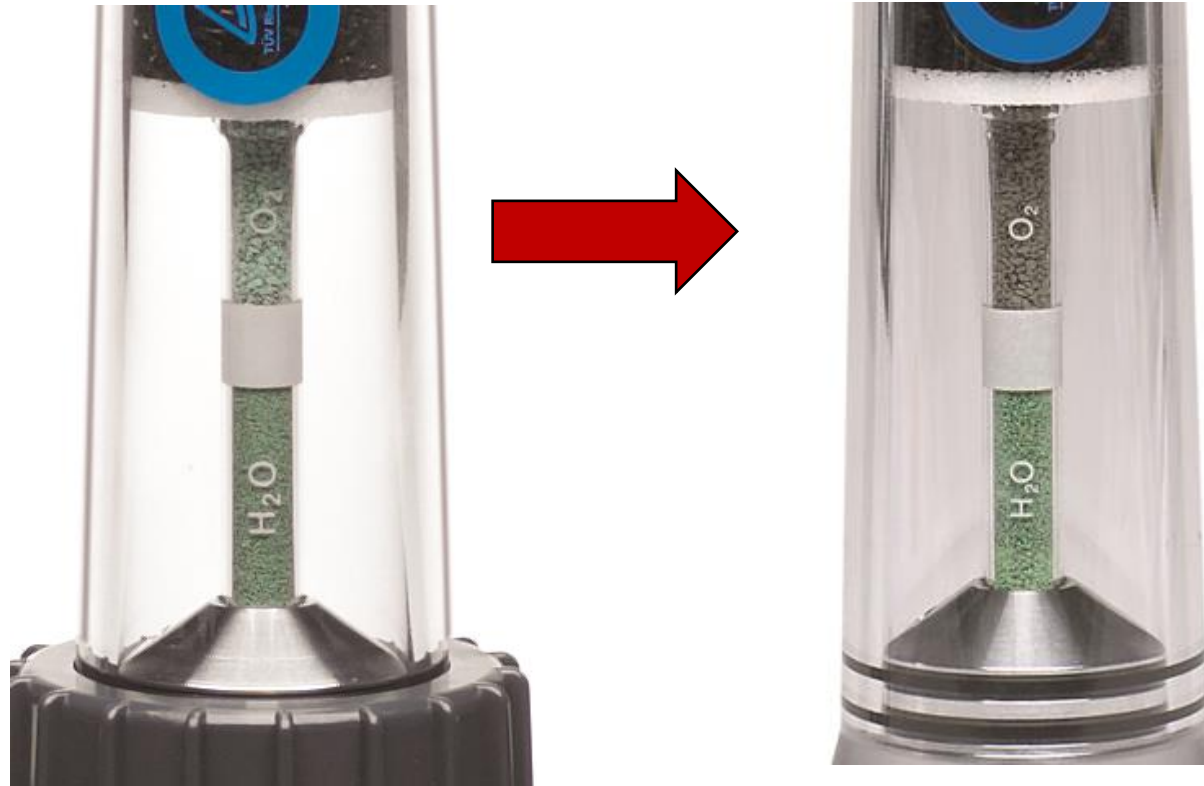
# Let's Talk About Gas Quality and Filters

If lower quality gases were used, how much background could the filter clean up?



- Install the Universal trap vertically – use the mounting bracket(s)
- Extend the lifetime of your Gas Clean (indicating) filter **and** your column

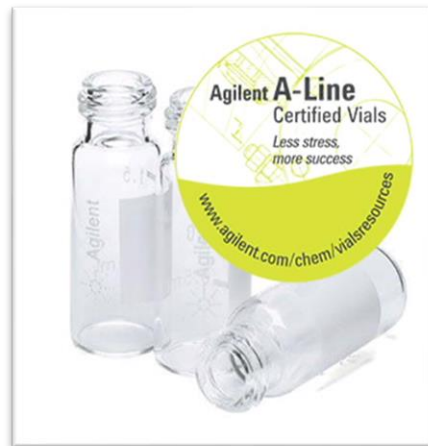
# Gas Trap Indicators Help Tell You When it's Time to Change Them



If there are no indicators, then change them periodically or according to your SOP.

# Vials – Only Use Once

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

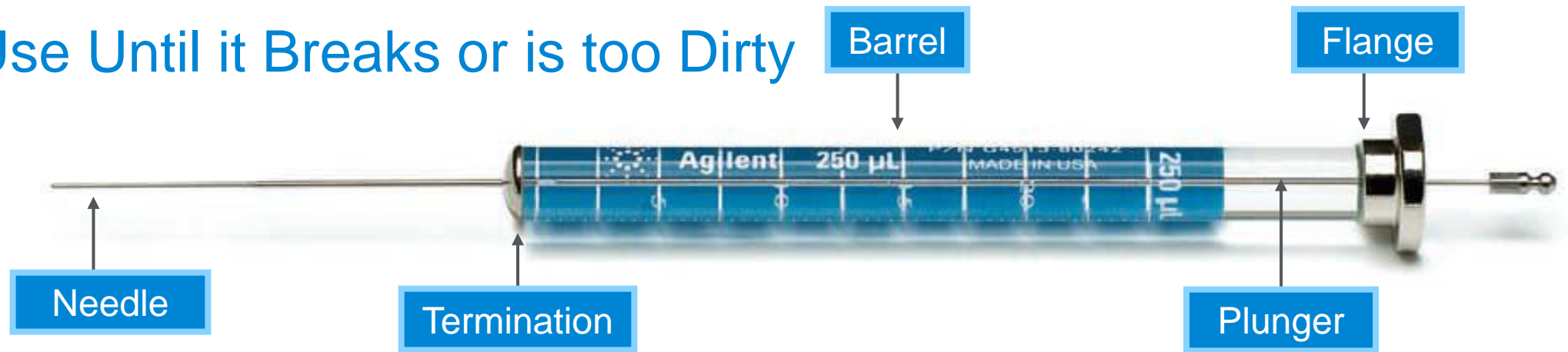


	High performance septa	Thin PTFE	PTFE/Silicone*	PTFE/Silicone/PTFE*	PTFE/Red rubber	Flouroelastomer	Butyl
Temperature range	40 °C to 300 °C**	Up to 260 °C	–40 °C to 200 °C	–40 °C to 200 °C	–40 °C to 90 °C	–40 °C to 260 °C	–50 °C to 150 °C
Use for multiple injections	No	No	Yes	Yes	No	No	No
Price	More 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.

# Syringes – Use Until it Breaks or is too Dirty

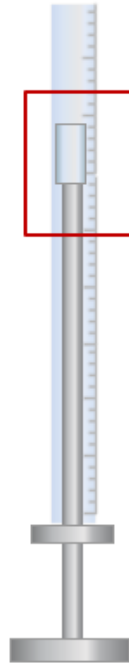


## Standard plungers

- Fit tightly within syringe barrel
- Limit loss of volatile sample
- Individually fitted to the syringe
- Not replaceable or 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



# Troubleshooting



# Troubleshooting

## Problem: Bent Plunger or stuck syringe

### Possible causes:

- Particles such as dust, salts, metal, leftover sample, or glass can fill the narrow gap between the plunger shaft and the inside wall of the barrel.
- Overtightened septum nut compresses septa, causing excessive resistance during injection

### Suggested actions:

- Switch to a syringe with PTFE-tipped plunger
- Avoid using 5  $\mu$ L syringes where possible
- If plunger movement feels “gritty”, carefully remove plunger from barrel, flush with solvent, and wipe dry with lint-free cloth. Carefully reinsert plunger into barrel. Finally, submerge needle tip into container of solvent and cycle plunger to pull solvent into and out of the barrel.
- Never cycle the plunger in a dry syringe
- Do not “mix-and-match” plungers and barrels
- Immediately clean syringes after use
- Loosen septum nut





# Troubleshooting

## Problem: Bent needle

### Possible causes:

- Improper needle alignment
- Narrow gauge needles (26 g) bend more easily than larger gauge (23 g) needles
- Needles tend to bend when inserted into sample vial, not the inlet. This can be caused by septa that are too “rough”.
- Needles bent during installation into the autosampler are more likely to bend when pushed through the sample vial cap septum.
- Oncolumn inlets – wrong needle gauge
  - Use correct needle support

### Suggested actions:

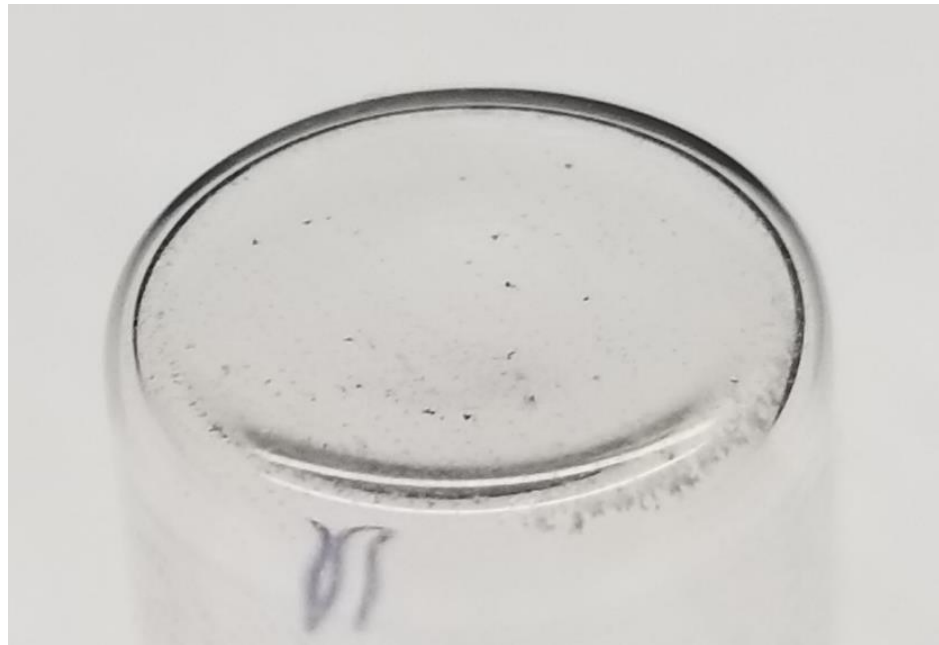
- Use syringes with 23 to 26 gauge tapered needles
- Realign autosampler
- Check septum nut is not over-tight



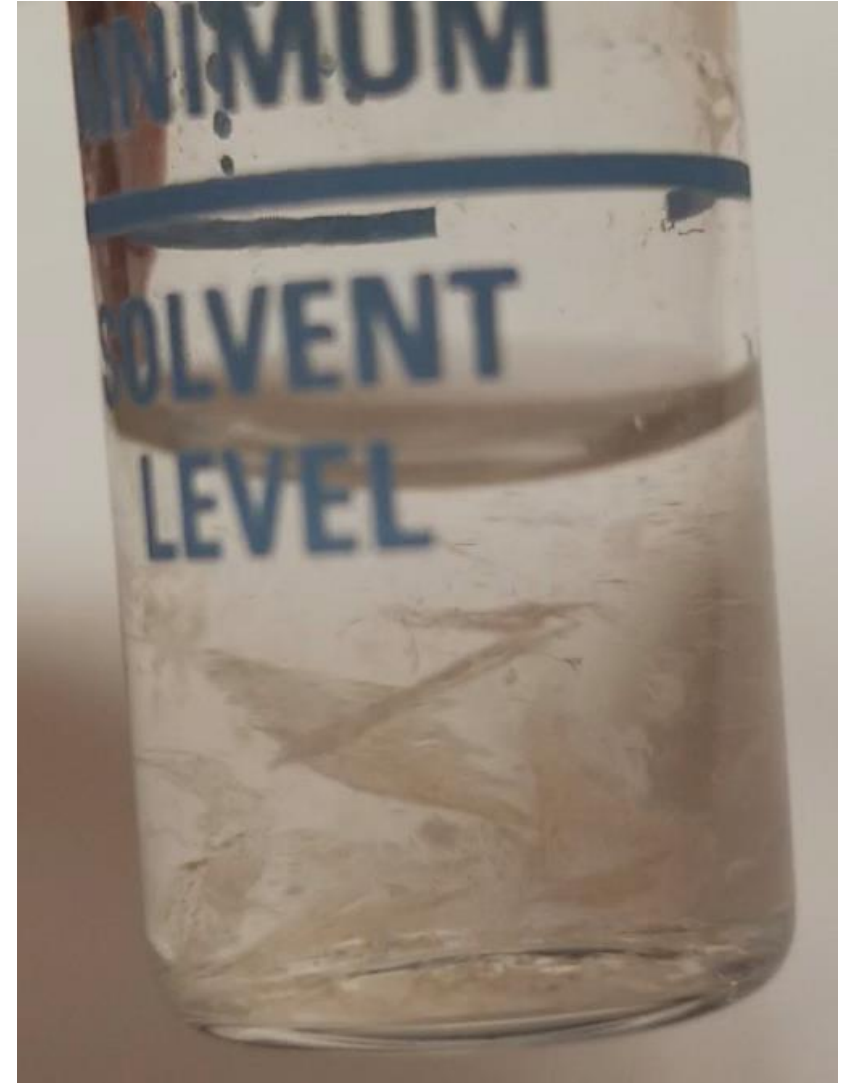
# Washes and Pumps: Solvents

Frequently clean or replace wash vials

- Traces of previous samples will accumulate over time
- Do not refill or “top-off” the vial, instead empty, rinse, and replace solvent
- Use a cotton swab to remove particulates from the glass surface



Contaminated wash vial bottom



Contaminated wash solvent

# Washes and Pumps: Solvents

Choose a wash solvent or a series of solvents that make sense for the analysis

- Is the analyte soluble in the solvent?
- Wash solvent = sample solvent when possible
- If wash solvent  $\neq$  sample solvent, are they miscible?
- If using a binary wash system, make sure solvents are miscible and rinse with the sample solvent last just before the sample
- Do not use acidic or alkaline solvents with syringes
- What other solvents are used/analytes determined in methods on the same GC?

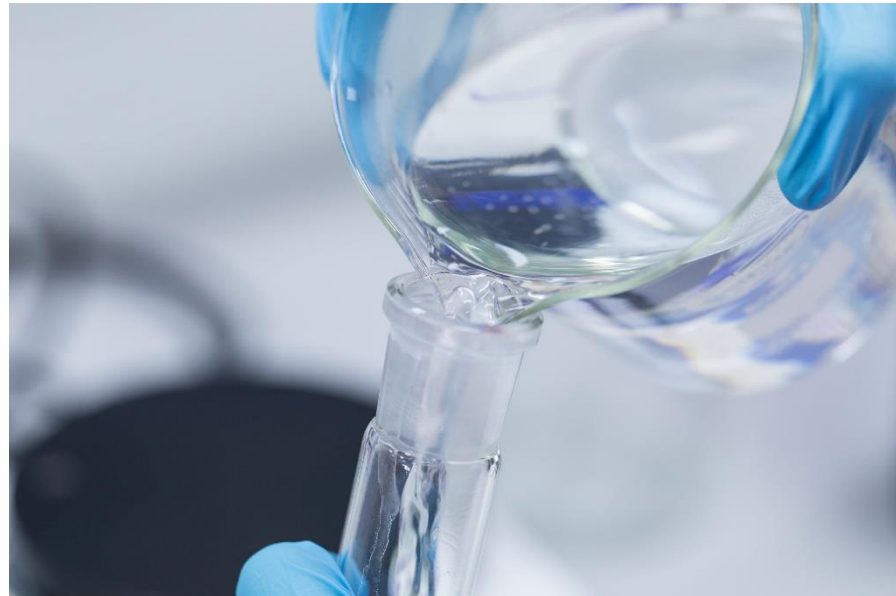


Use both A and B wash vials  
**Second** wash vial will be cleaner than first  
**Second** wash vial should never be water (rust)



Avoid viscous solvents and solvents with high vapor expansion volumes. Use the vapor volume calculator to make sure it will not overload the inlet liner.

# Miscibility Chart



	Acetone	Acetonitrile (ACN)	<i>n</i> -Butyl Alcohol	Chloroform	Cyclohexane	Dichloromethane (DCM)	<i>N,N</i> -Dimethylformamide	Dimethyl Sulfoxide (DMSO)	1,4-Dioxane	Ethyl Acetate	Ethyl Alcohol	Ethyl Ether	Ethylene Dichloride	Heptane	Hexane	Iso-Octane	Isopropanol (IPA)	Methanol	Methyl <i>t</i> -butyl Ether	Methyl Ethyl Ketone	Pentane	Tetrahydrofuran (THF)	Toluene	Water	<i>o</i> -Xylene	
Acetone	Miscible																									
Acetonitrile (ACN)		Miscible																								
<i>n</i> -Butyl Alcohol			Miscible																							
Chloroform				Miscible																						
Cyclohexane					Miscible																					
Dichloromethane (DCM)						Miscible																				
<i>N,N</i> -Dimethylformamide							Miscible																			
Dimethyl Sulfoxide (DMSO)								Miscible																		
1,4-Dioxane									Miscible																	
Ethyl Acetate										Miscible																
Ethyl Alcohol											Miscible															
Ethyl Ether												Miscible														
Ethylene Dichloride													Miscible													
Heptane														Miscible												
Hexane															Miscible											
Iso-Octane																Miscible										
Isopropanol (IPA)																	Miscible									
Methanol																		Miscible								
Methyl <i>t</i> -butyl Ether																			Miscible							
Methyl Ethyl Ketone																				Miscible						
Pentane																					Miscible					
Tetrahydrofuran (THF)																						Miscible				
Toluene																							Miscible			
Water																								Miscible		
<i>o</i> -Xylene																									Miscible	

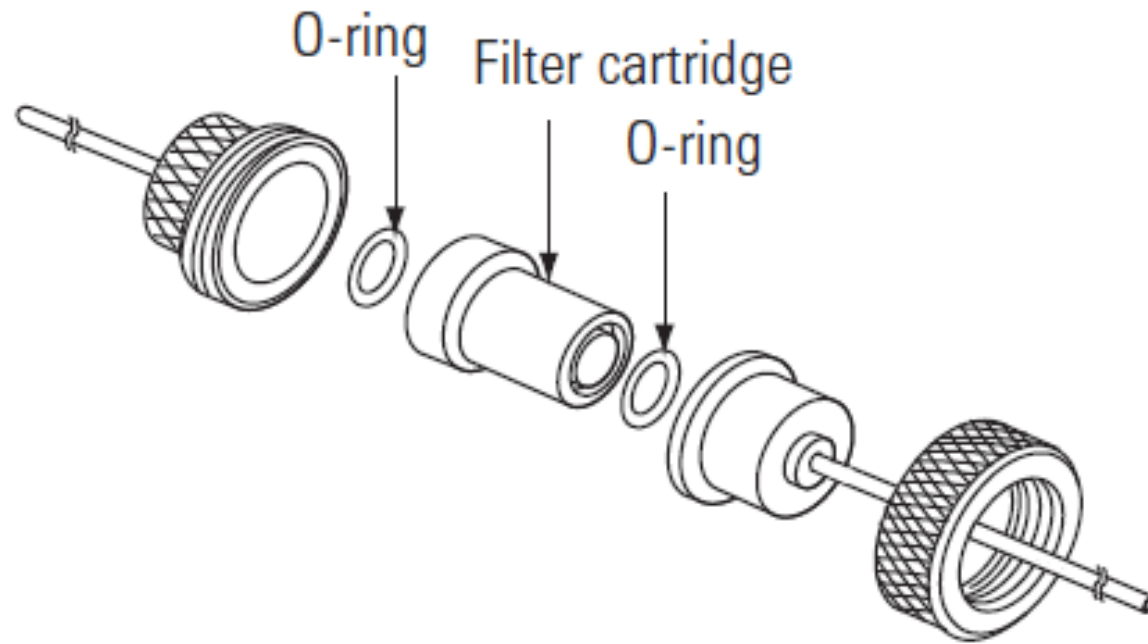
# Wash Vials

- 4 mL wash vials: 5182-0551
- Diffusion inserts: 07673-40180



# Split Vent Trap: The Forgotten Consumable

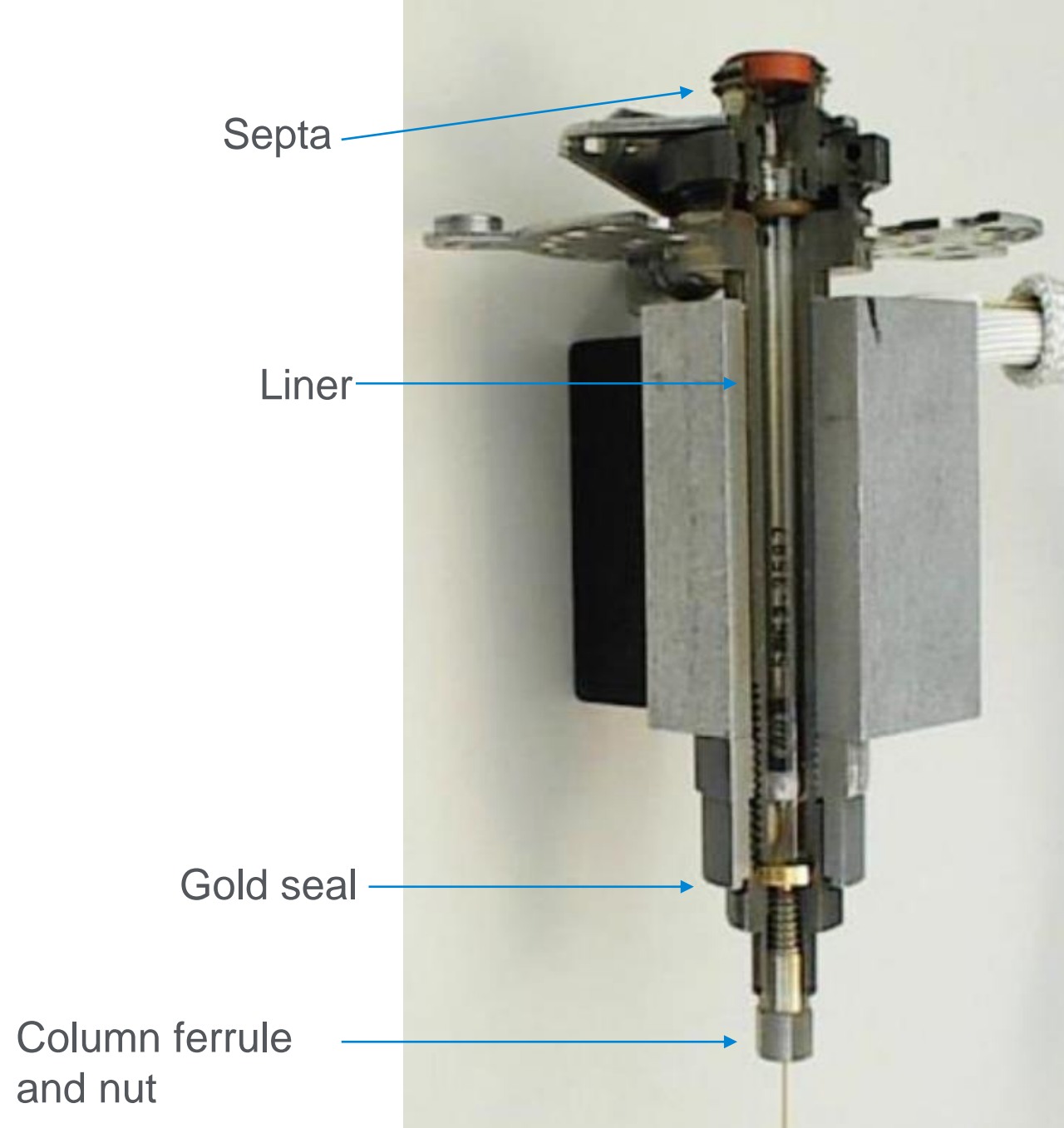
Change every 6- 12 months



Split vent trap, 5188-6495

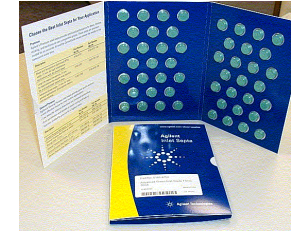
# Inlet

- 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 of 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 (backflash)
- Most chromatography problems are “front-end” related
- **There are** many consumables to replace: septa, liner, gold seal
- Inlet body must be cleaned/solvent rinsed periodically (**no steel brushes, please**)

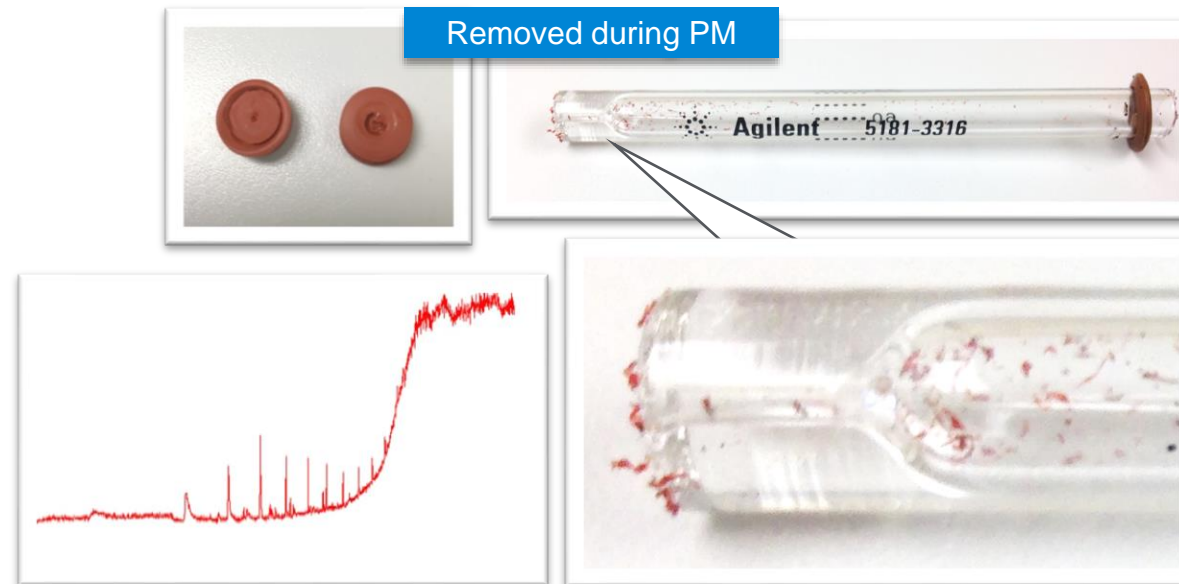


# Septa

- Typical cost of one premium septum (list), \$1.25
- Typical cost of one GC column, 30 m x 0.25 mm id, \$600
- Proactively change inlet septa
- Agilent packing eliminates contamination of septa
- “CenterGuide septa” puts less strain 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  $\frac{1}{2}$  to  $\frac{3}{4}$  turn more



Septum nut





# Septum maintenance: Septum coring

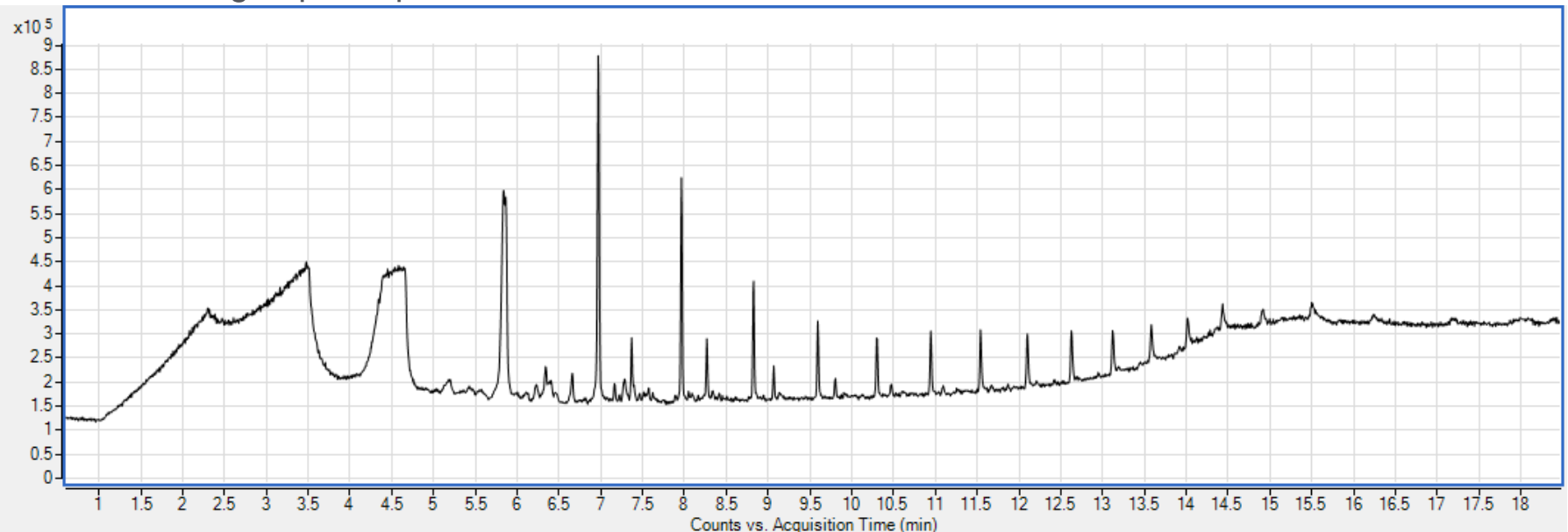
After many injections, pieces of rubber from the septum may break off and fall into the inlet liner.

- This is called septa coring
- Replace the inlet septa and liner frequently to prevent septa contamination
- Use a cone-tipped syringe to reduce the chance of tearing the septum
- This is also very common when making multiple injections from the same vial
- (it is not column bleed even though it looks like it spectrally)












Septum core placed in a clean liner, and a blank injection is performed.

- Inlet: 320 °C, split mode, 10:1 split ratio
- Oven: 35 °C to 300 °C at 20 °C per minute
- Detector: Single quadrupole EI Scan, 35 to 500 amu



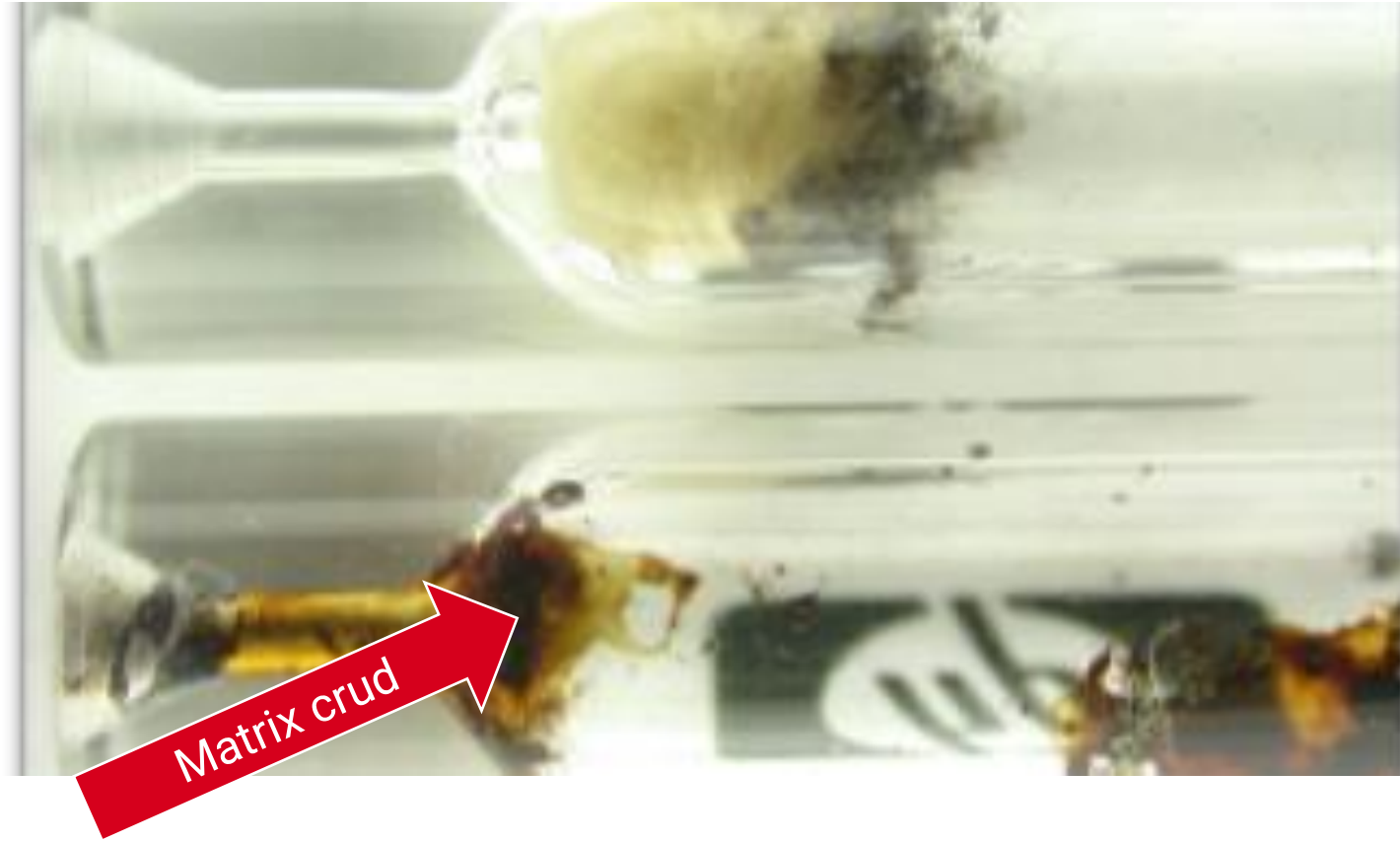
# Liners – Change as Needed

## Agilent Ultra Inert Liners

Description	Volume (μL)	ID (mm)	1/pk	5/pk	25/pk	100/pk*
<b>Split Inlet Liners</b>						
 Low pressure drop, Ultra Inert Liner with glass wool	870	4	5190-2295	5190-3165	5190-3169	5190-3173
 Straight, Ultra Inert Liner with glass wool	990	4	5190-2294	5190-3164	5190-3168	5190-3172
<b>Splitless Inlet Liners</b>						
 Single taper, Ultra Inert Liner	900	4	5190-2292	5190-3162	5190-3166	5190-3170
 Single taper, Ultra Inert Liner with glass wool	900	4	5190-2293	5190-3163	5190-3167	5190-3171
 Splitless, double taper Ultra Inert Liner, no wool	800	4	5190-3983	5190-4007		
 Dimpled, splitless, Ultra Inert Liner	200	2	5190-2297	5190-4006		
 Splitless, straight, Ultra Inert Liner	250	2	5190-6168			
 Straight, Ultra Inert Liner	60	1	5190-4047			
 Straight Ultra Inert Liner for SPME	35	0.75	5190-4048			

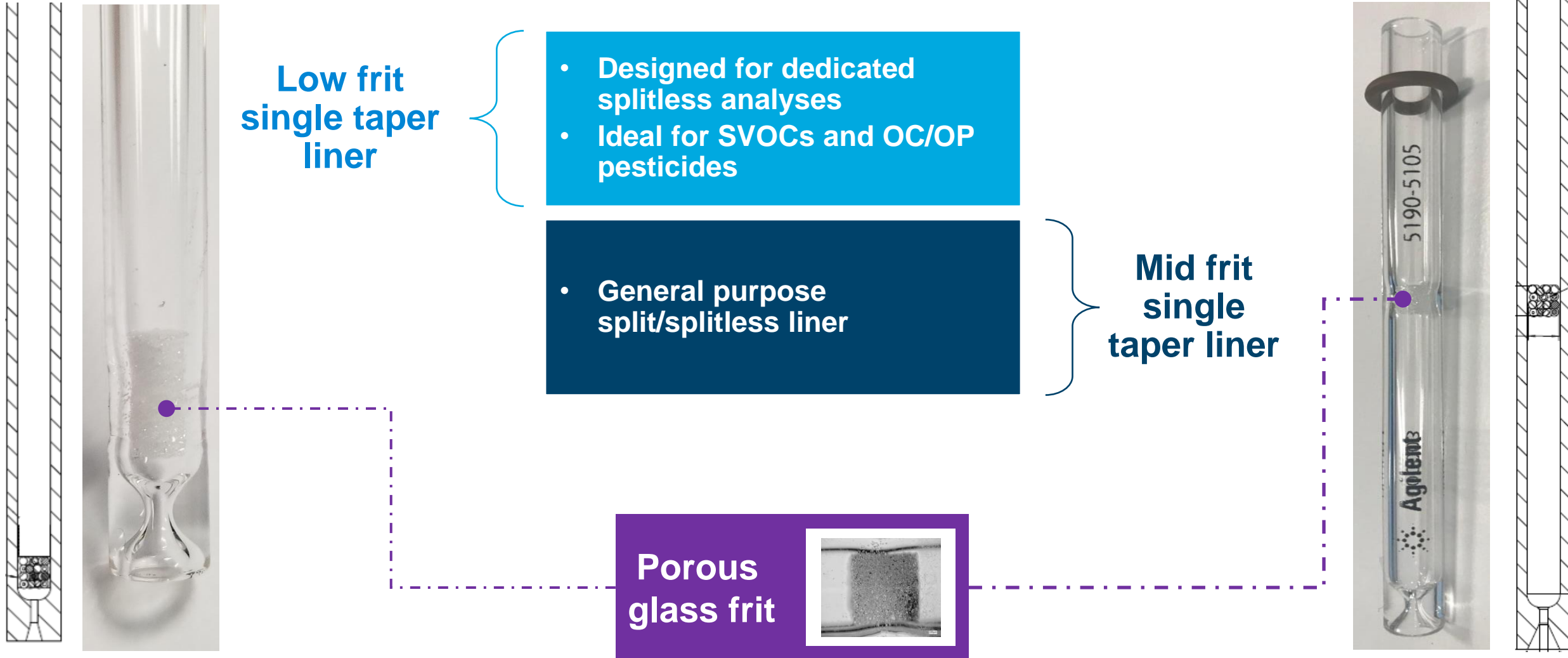
\*The 100/pk is not in the Touchless packaging. O-rings must be purchased separately, p/n 5190-2269.

# Liner Contamination



# What's New? Glass Wool Alternative Liners

## Ultra Inert liners with sintered glass frits



# Packaging, Ease, and Productivity



Individual liner



Convenient 5/pk in  
Touchless packaging

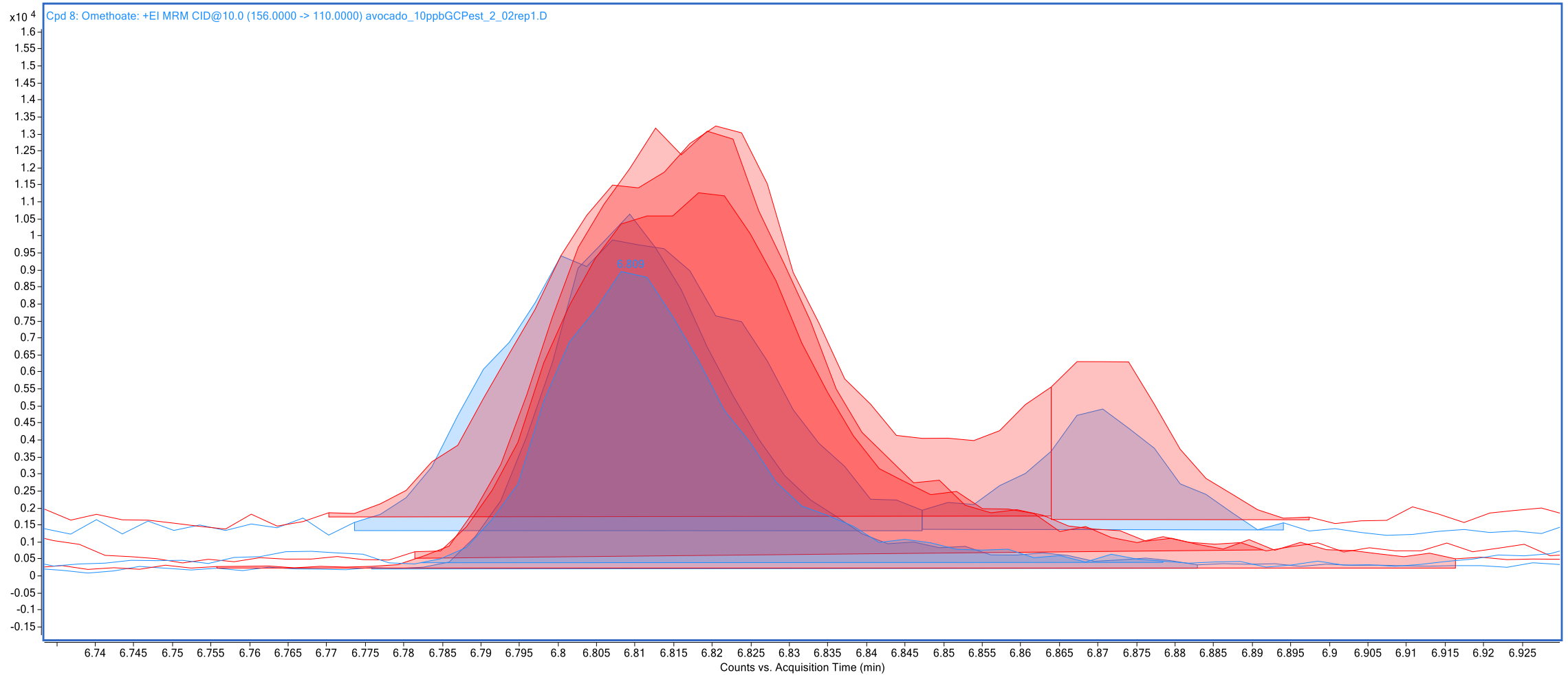


25/pk in Touchless  
dispenser  
High throughput

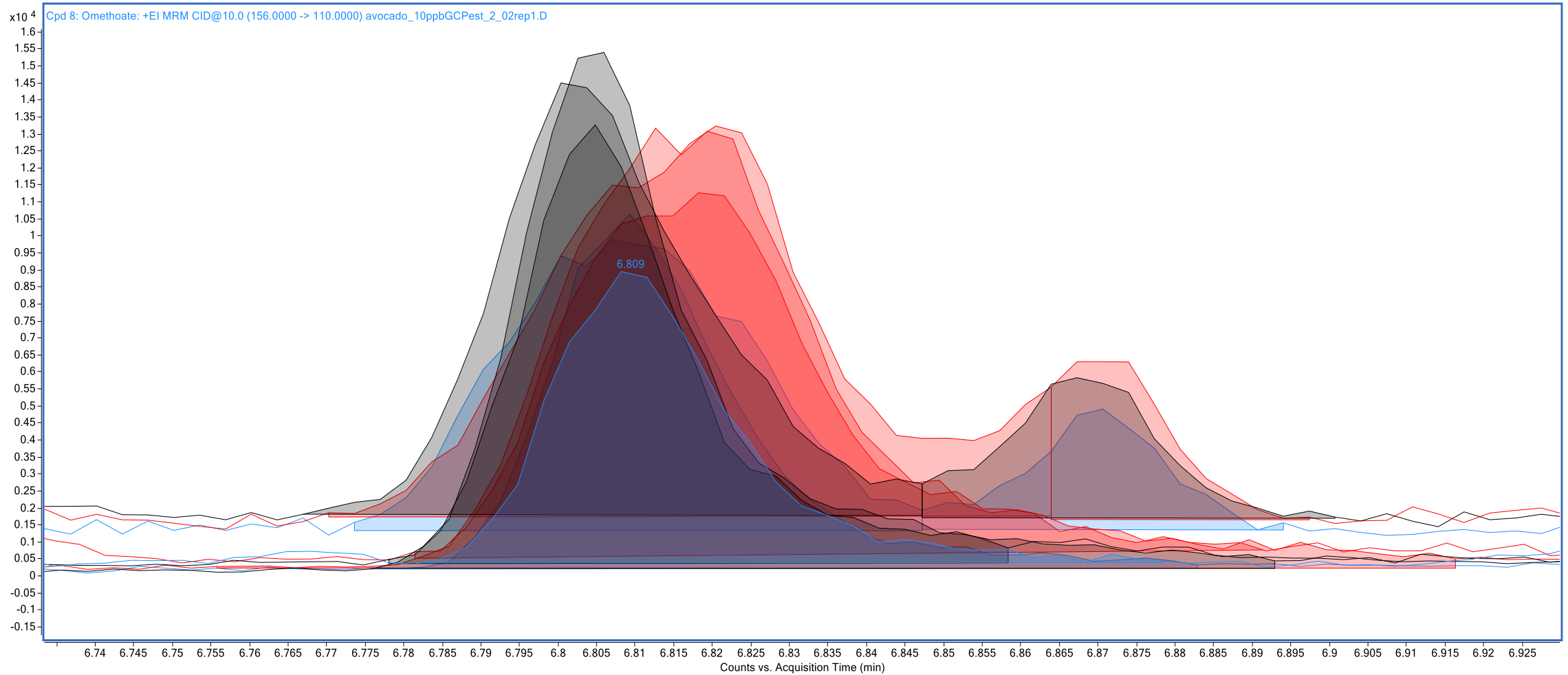


100/pk, bulk, blister  
(no O-ring)  
High throughput

# Peak Broadening: Omethoate in Avocado in Run 1 versus Run 65

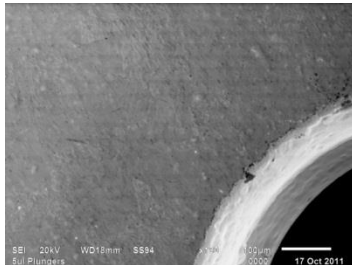


# Peak Broadening: Recover Peak Shape with New Liner

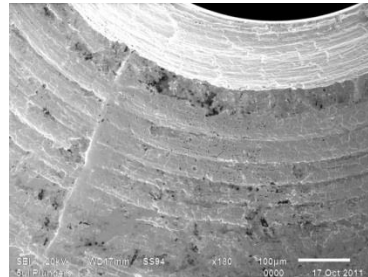


# Agilent UI Gold Seal: Deactivated Gold Surface

- Soft gold plating is essential for proper sealing
- Ultra Inert chemistry blocks active sites (gold is **not** inert)
- Smooth surface doesn't leak (injection molded)
- Part numbers 5190-6144 (ea) 5190-6145 (10/pk), 5190-6149 (50/pk)



Agilent MIM seal



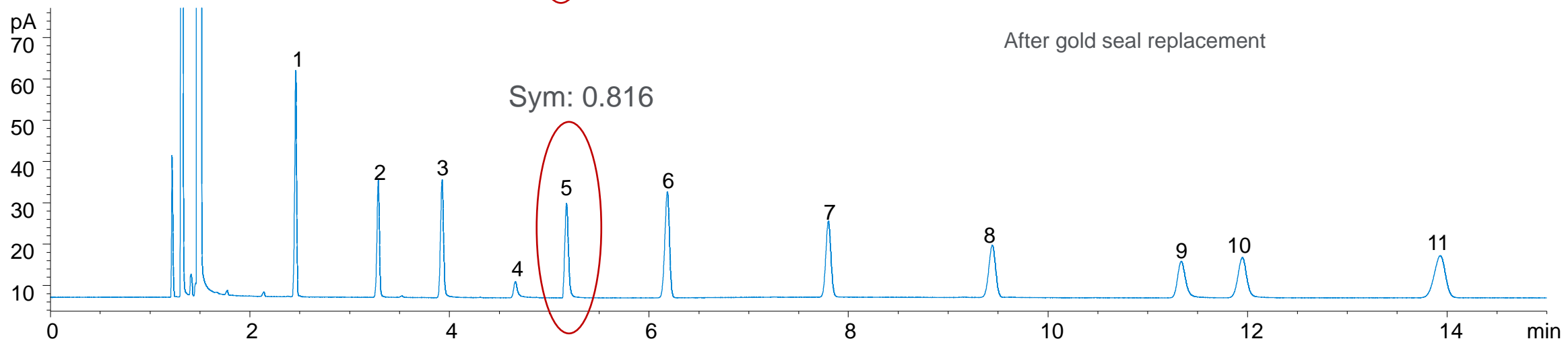
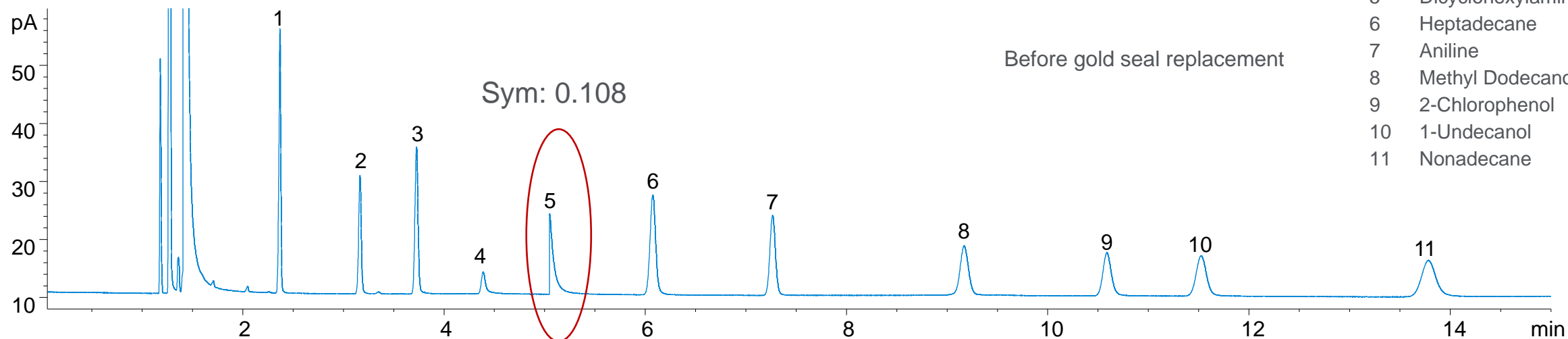
Competitor's  
machined seal

Reliable ppb and ppt  
measurements require  
attention to the little things



# Peak Tailing from Contaminated Consumables

	Peak
0	Methane
1	2-Nonanone
2	Decanal
3	2,3-Butanediol
4	Ethylene Glycol
5	Dicyclohexylamine
6	Heptadecane
7	Aniline
8	Methyl Dodecanoate
9	2-Chlorophenol
10	1-Undecanol
11	Nonadecane



# Column Installation

What type of ferrule should I use?



Polyimide



Graphite



Polyimide/  
graphite



Flexible  
Metal

Composition	Re-use	Max Temperature (°C)	Use	Limitation
Polyimide (Vespel)	Yes	280	Easy seal	Can shrink after heating, causing leaks after thermal cycle; isothermal only
Graphite	Yes	450	FID, NPD, inlets	Contamination, permeable to air – not for oxygen-sensitive detectors
Polyimide/graphite (85% / 15%)	Limited	350	MS, ECD, inlets	Can still shrink after thermal cycles, creating leaks; need to retighten regularly
Flexible Metal	No	450	Capillary flow technology (backflush, splitters)	May not seal well with damaged fittings or rough surfaces



“Short” ferrules for inlet and detector configurations on Agilent GCs



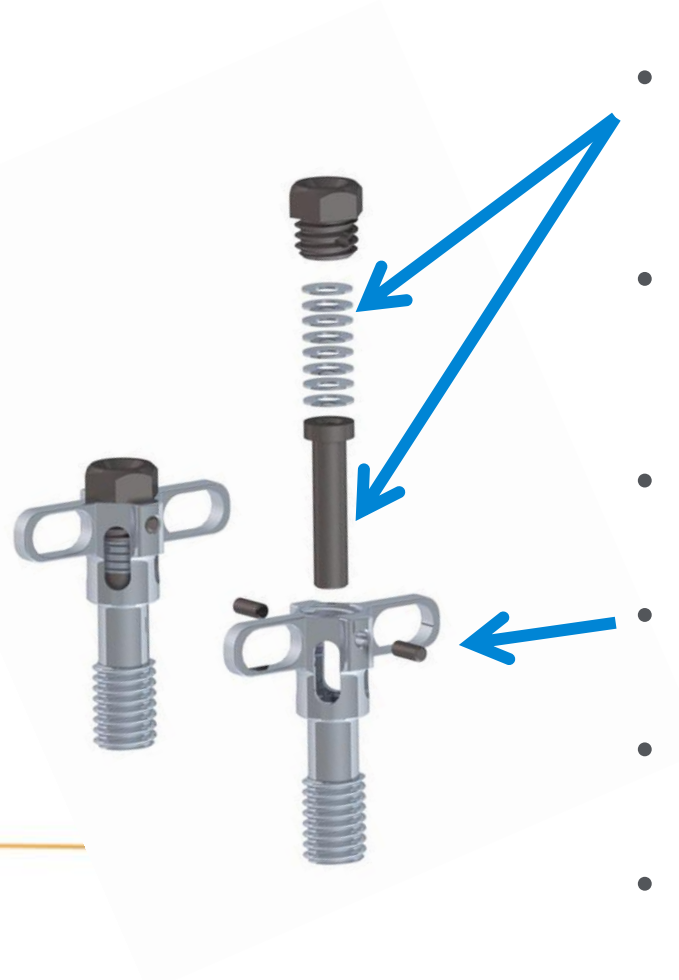
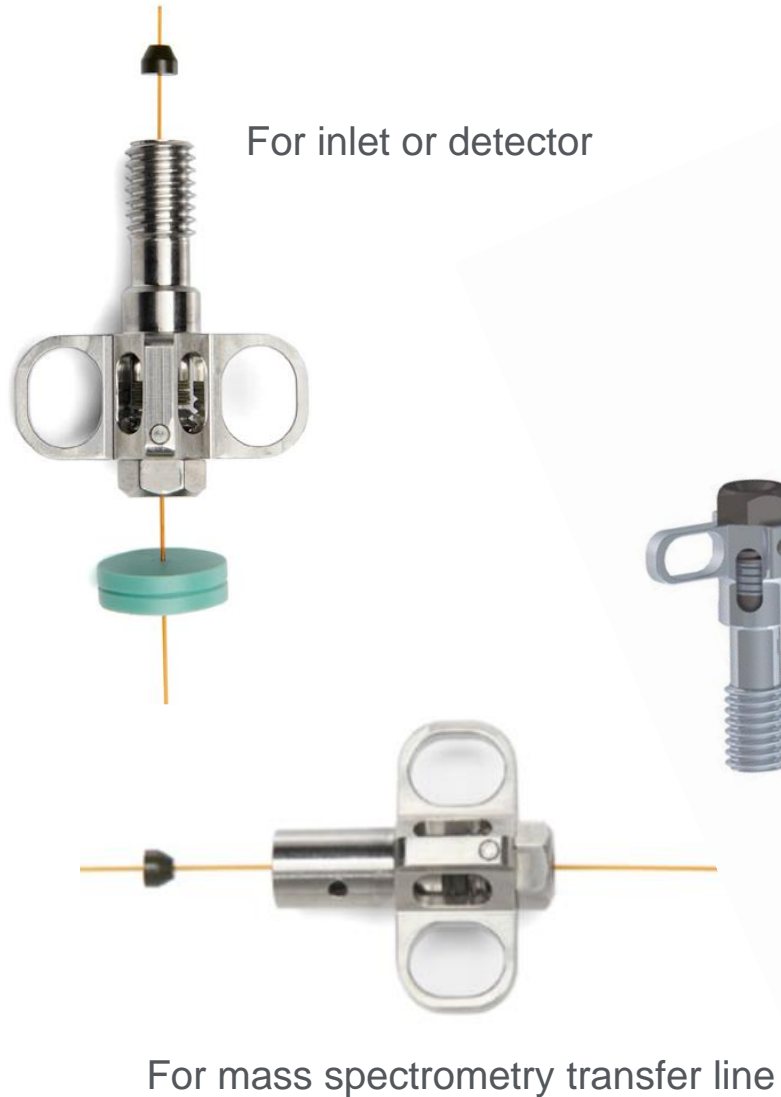
“Long” ferrules for MS transfer lines and MS interface nut

# General Ferrules – Use Only Once

## Capillary Column Ferrules – for use with most brands of column, including DB, HP, CP, VF and Select columns

Column ID (mm)	Ferrule Nom ID	UltiMetal Plus Flexible Metal Ferrule Part No.	Graphite Short Ferrule Part No.	Polyimide Short Ferrule Part No.	85% Polyimide/15% Graphite Short Ferrule Part No.	Pre-Conditioned Long Ferrule 85% Polyimide/15% Graphite for MSD connection Part No.
0.025-0.05	0.4		500-2114	5062-3515	5062-3516	5062-3507
0.075	0.4		500-2114	5062-3515	5062-3516	5062-3507
0.1-0.25	0.4	G3188-27501	500-2114	5181-3322	5181-3323	5062-3508
0.1-0.25*	0.5		5080-8853	5062-3513	5062-3514	5062-3508
0.32	0.5	G3188-27502	5080-8853	5062-3513	5062-3514	5062-3506
0.45	0.8	G3188-27503	500-2118	5062-3511	5062-3512	5062-3538
0.53	0.8	G3188-27503	500-2118	5062-3511	5062-3512	5062-3538

# Column Installation: Self-Tightening Column Nut

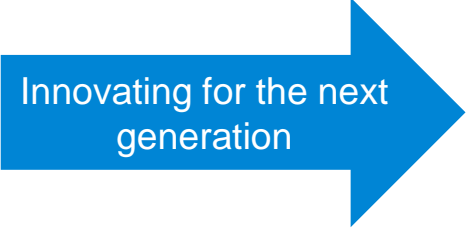


- Spring driven piston continuously presses against the ferrule
- Automatically retightens when ferrule shrinks
- No leaks, no downtime, no frustration
- Wing design for finger tightening
- No tools needed
- No polymer materials for durability
- Compatible with **only** short graphite/vespel ferrules

# Increasing Ease-of-Use Through Continued Innovation: Self-Tightening Nuts



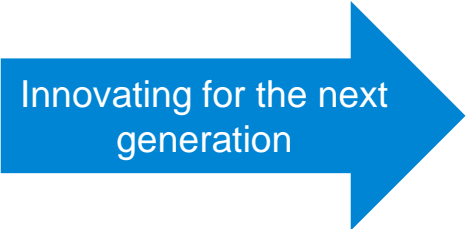
For GC inlet or detector



- Easier and faster to install
- Collar holds column in place
- Single-hand installation into inlet
- No tools needed



For mass spectrometry transfer line



# Self Tightening Nuts: No Leaks, No Downtime, No Frustration



- Spring-driven piston continuously presses against the ferrule
- Automatically retightens when ferrule shrinks
- Wing design for finger tightening
- No tools needed
- Works only with graphite/vespel ferrules

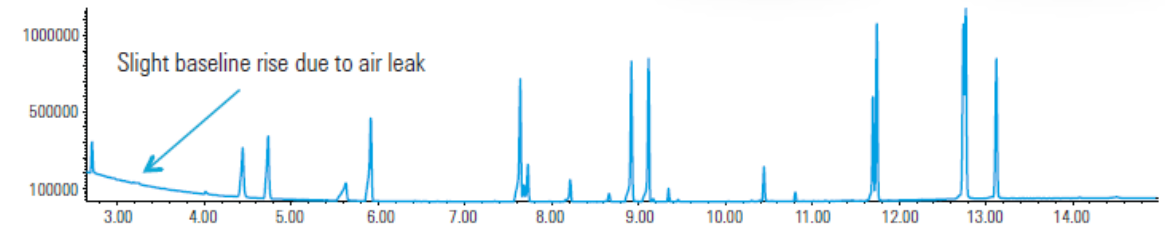
Part Number	Description
G3440-81013	Column Nut, Collared Self-Tightening MSD
G3440-81011	Column nut, Collared Self Tightening Inlet/Detect
G3440-81012	Collar for Self Tightening Nut

<https://www.agilent.com/en/video/gc-supplies-innovation>

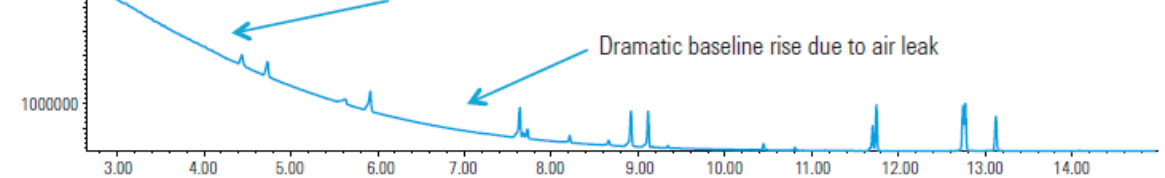
<https://www.agilent.com/en/video/stcn-inlet-detector>

<https://www.agilent.com/en/video/stcn-mass-spec>

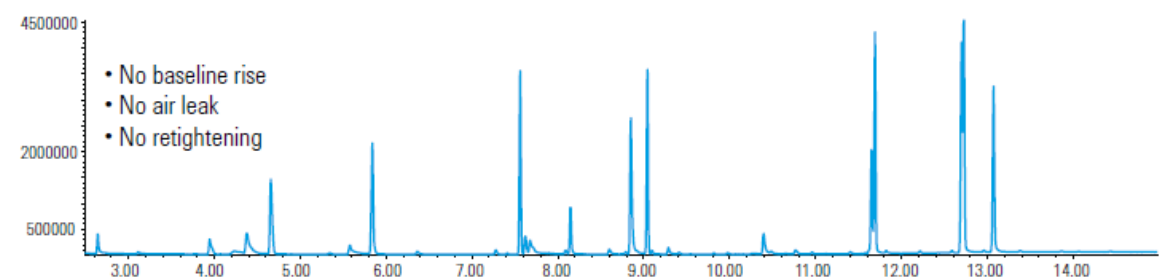
Standard column nuts new fitting



Standard column nuts after 25 injections



Agilent Self Tightening Column Nuts after 400 injections



400 injections

# How Long Will My Column Last?

- If you never use a column, it will last forever
- Lifetime is dependent on:
  - How dirty your sample is
  - Thermal damage?
  - Oxygen damage?
  - Physical damage?
  - How often you use **the column**
- Run **an** instrument blank and an injection of a clean standard to evaluate column performance
- Cut column to remove any nonvolatile contamination
- Bake out column to remove **semivolatile** contamination

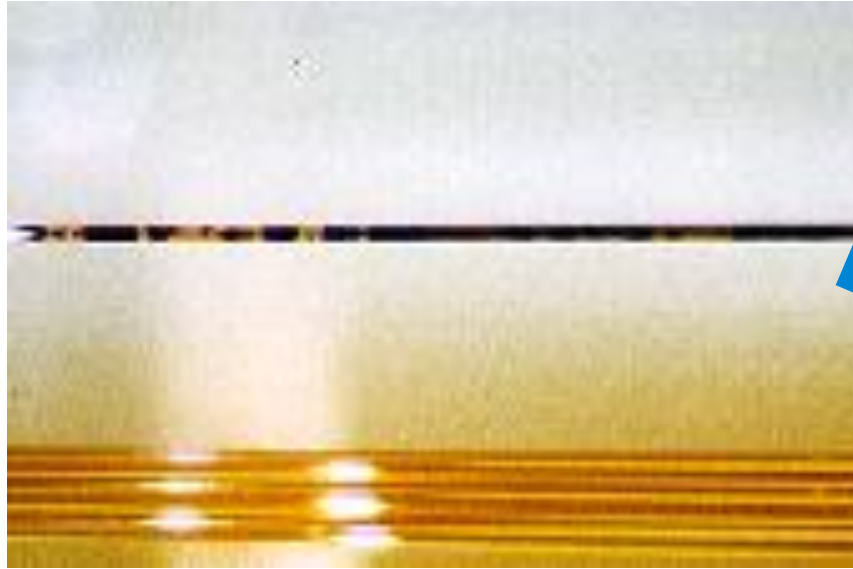
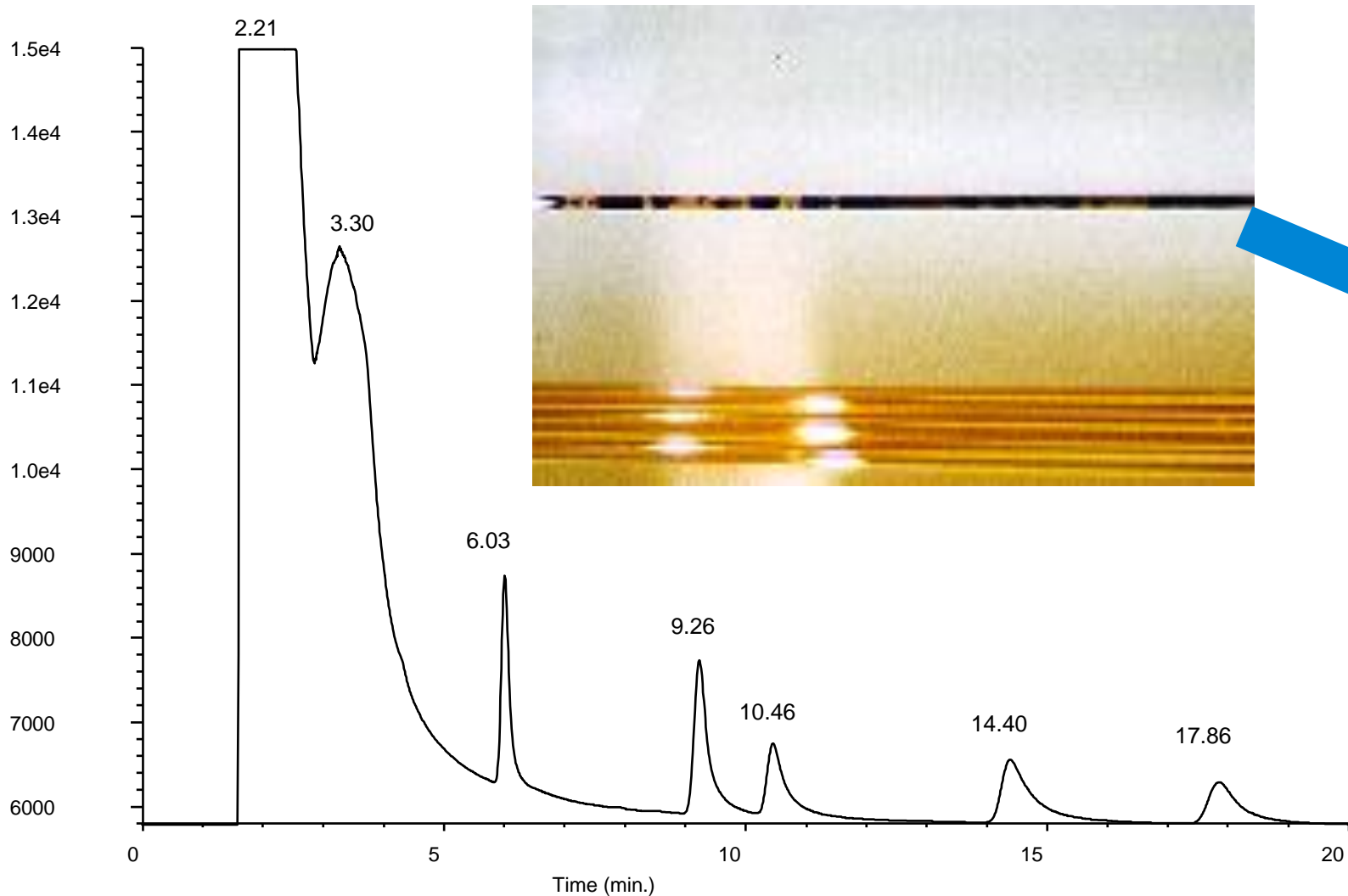
# Agilent J&W Column Portfolio – DB, HP, CP, VF

Low Polarity			Mid Polarity			High Polarity		
CP-Sil 2	DB and HP-1MS UI	DB and HP-5MS UI	DB-XLB	DB-225MS	DB-ALC1	HP-88	DB-WAX	DB-WAX UI
DB-MTBE	DB and HP1-MS	DB and HP5-MS	VF-XMS	DB-225	DB-Dioxin	CP-Sil 88	DB-WAX ETR	DB-HeavyWAX
CP-Select CB MTBE	VF-1MS	VF-5MS	DB-35MS UI	CP-Sil 43 CB	DB-200	DB-23	HP-INNOWax	DB-FATWAX UI
	DB and HP-1	DB and HP-5	DB and VF-35MS	VF-1701 MS	VF-200MS	VF-23 MS	VF-WAX MS	
	CP-Sil 5 CB	CP-Sil 8 CB	DB and HP-35	DB-1701	DB-210		CP-WAX 57 CB	
	Ultra 1	Ultra 2	DB and VF-17MS	CP-Sil 19 CB	DX-4		DB and 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 and 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-TCEP	
			CP-Select 624 CB					
			DB-1301					
			VF-1301MS					
			CP-Sil 13 CB					

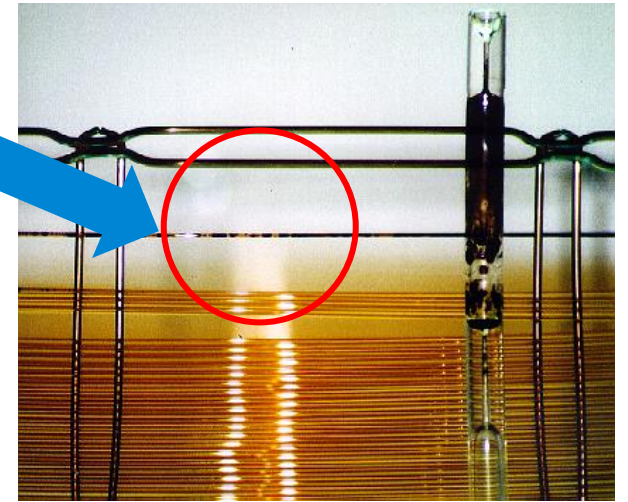
**Agilent J&W columns have over 50 different stationary phase offerings**



# Example of Column Contamination and Broad Peaks



Agilent J&W DB-624 QC test mix  
After 75 injections of oily sample



\*Temperature program: 35 °C hold 1.5 min // 30 °C/min to 65 °C, hold 10 min

# Cutting the Column

Gently scribe through the polyimide coating

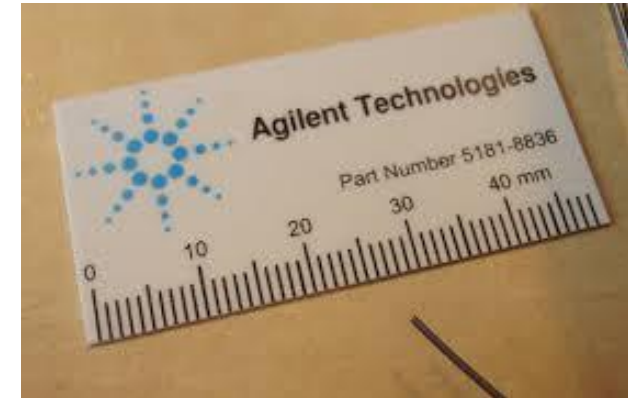
- Do not attempt to cut the glass

## Recommended tools

- Diamond or carbide-tipped pencil, or sapphire cleaving tool
- Ceramic wafer
- Ocular

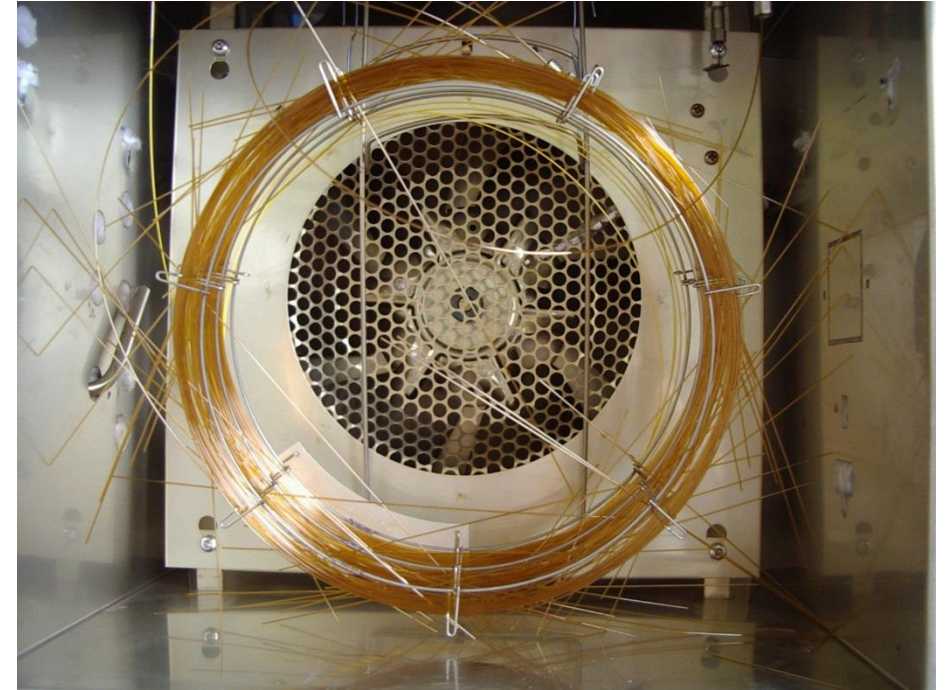
## Do not use

- Scissors, file, and so on



# Physical Damage to the Polyimide Coating

- The smaller the tubing diameter, the more flexible it is
- Avoid scratches and abrasions
- Immediate breakage does not always occur upon physical damage



# Thermal Damage

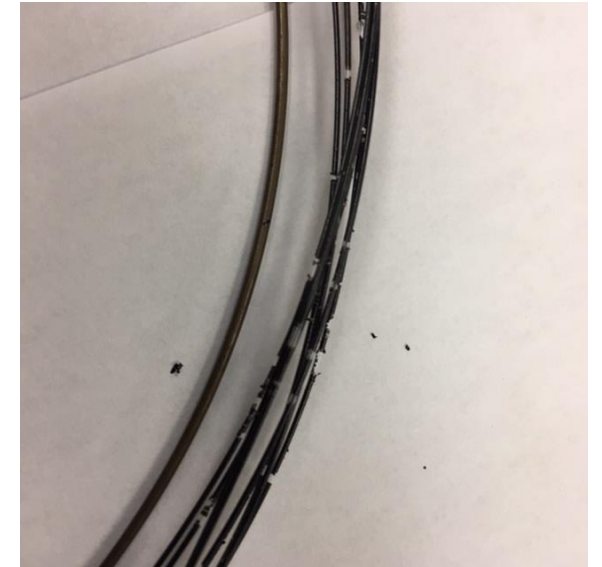
Degradation of the stationary phase is increased at higher temperatures

- Rapid degradation of the stationary phase (breakage along the polymer backbone) **can be** caused by excessively high temperatures

Isothermal limit = indefinite time

Programmed limit = 5 **to** 10 minutes

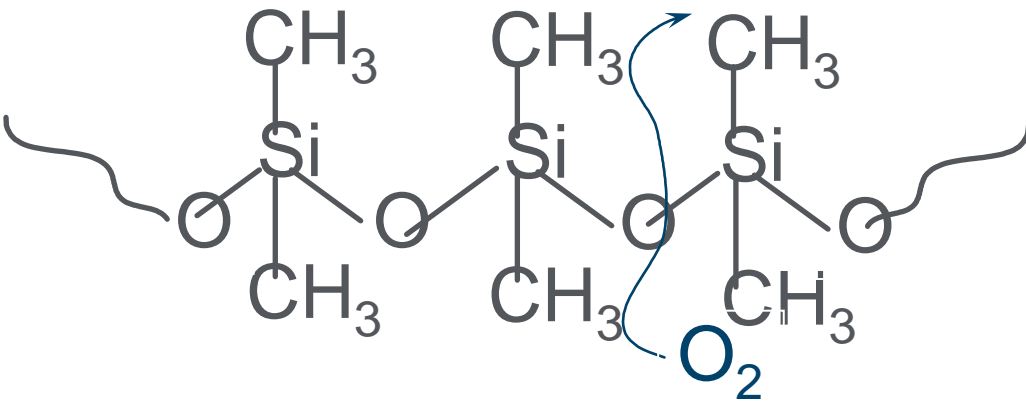
- Temporary "column failure" below lower temperature limit
- If this happens:
  - Disconnect column from detector
  - "Bake out" overnight at isothermal limit
  - Remove 10 **to** 15 cm from **the** column end



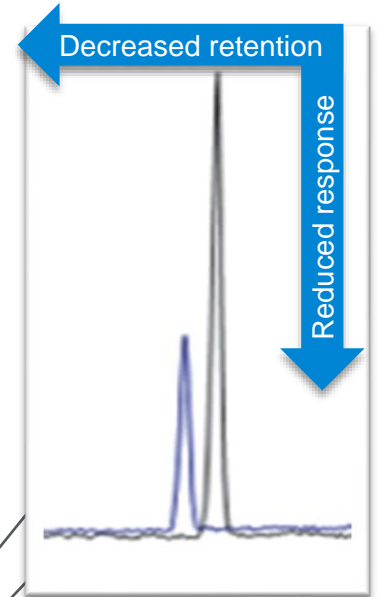
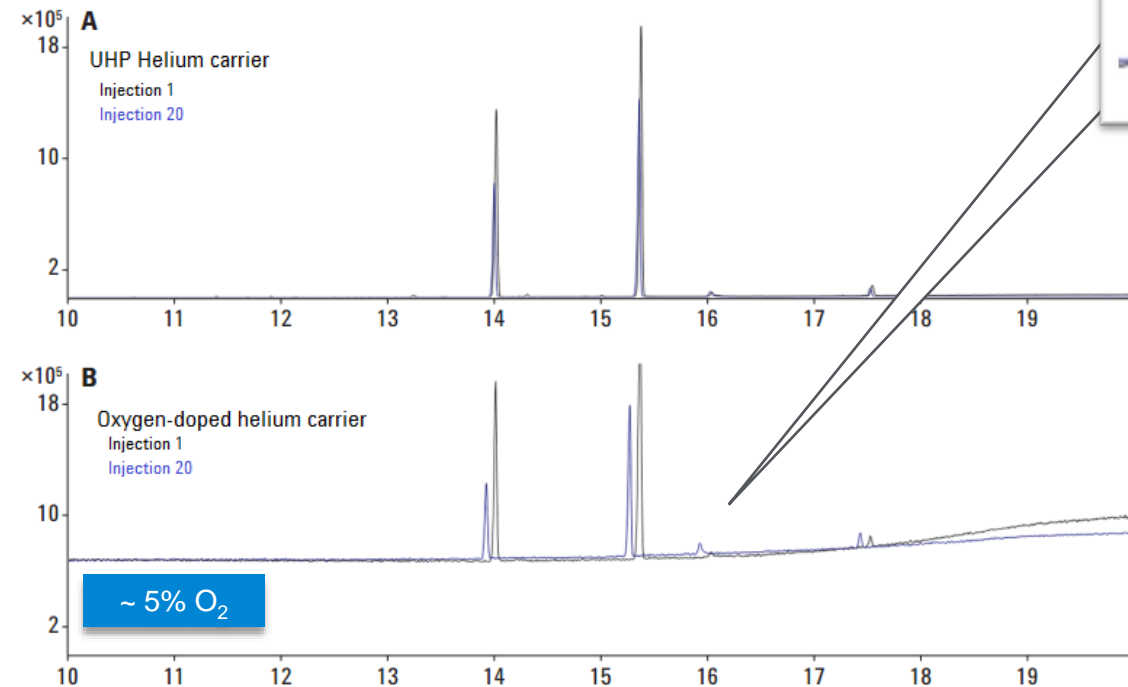
Column continuously exposed to temperatures above its temperature limit

# Oxidation (O<sub>2</sub> Damage)

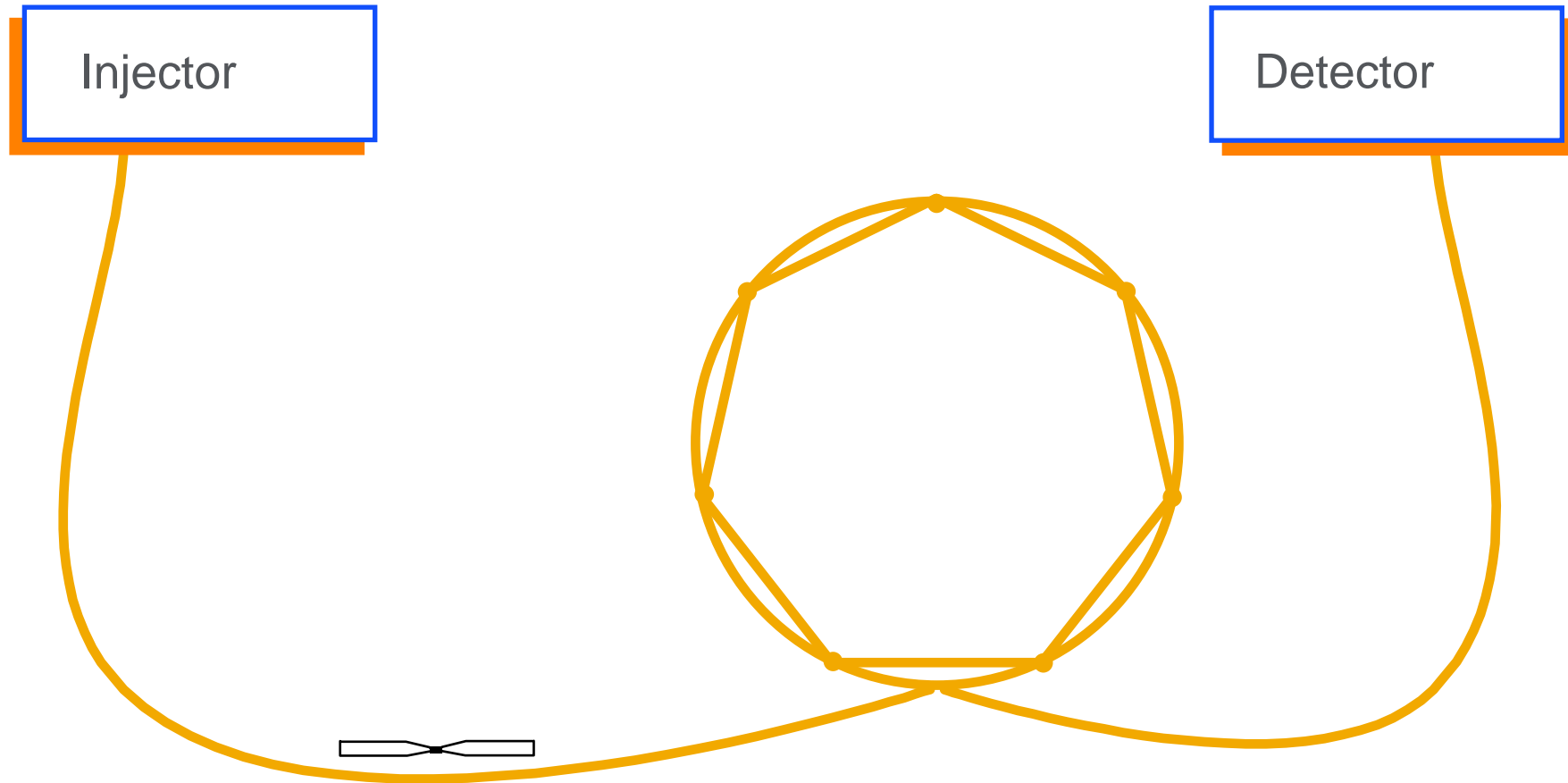
Oxygen in the carrier gas rapidly degrades the stationary phase. The damage is accelerated at higher temperatures. Damage along the polymer backbone is irreversible. (Premature filament failure/excessive source maintenance.)



Dimethylpolysiloxane



# Guard Column or Retention Gap



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

# Better Connections: Ultra Inert Press Fits or Ultimate Union

## Ultra-inert press fits:

- Join retention gap or guard column to analytical column
- Dependable inertness performance at a lower cost
- Batch certified inertness
- Improved packaging and installation instructions
- Easier to use – transparent deactivation gives visibility of the column connection

## Ultimate union

- More robust
- Reusable
- Recommended for users with MS



# Integrated Guards – DuraGuard

- No union
- Possible for any DB column 0.18 mm 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	



# Introducing the Agilent 8890 GC System

Flexible and expandable to meet your needs today and tomorrow



## Future-proof: Ready for anything

- Powerful, next-generation electronic architecture
- Expanded smart-connected functionality
- Full suite of inlets, detectors, and accessories, CFT, Deans switch, backflush, GC x GC, dual simultaneous injection
- Six valves, eight heated zones, plus LVO
- Generation 6 precision EPC
- Smart keys
- 7-inch color touch display



# Agilent 8890 GC System

## Smart-connected GC

### Modern intuitive interface

#### 7-inch color touch screen

- Configuration
- Status
- Methods
- Sequence info
- Troubleshooting, diagnostics, and help

#### Real-time chromatographic evaluation

- Blank evaluation
- Detector evaluation

# GC Columns with Smart Key (for the Agilent 8890 GC only)

For immediate identification and usage monitoring of your GC column

- Available with the Agilent 8890 GC only
- Can track the use of a GC column
- Smart key contains GC column information, including:
  - Part and serial numbers
  - Number of injections/runs
  - Time at/above temperature limits
  - Date installed
  - Temperature limits – GC columns
    - If more than one column is installed, the temperature is determined by lowest column smart key installed (DB-WAX vs DB-5)
  - Column length/trimming is done in “column maintenance mode” in the software and rewritten to the smart key
  - S/N ratio of last instrument installed if it was in an 8890 GC

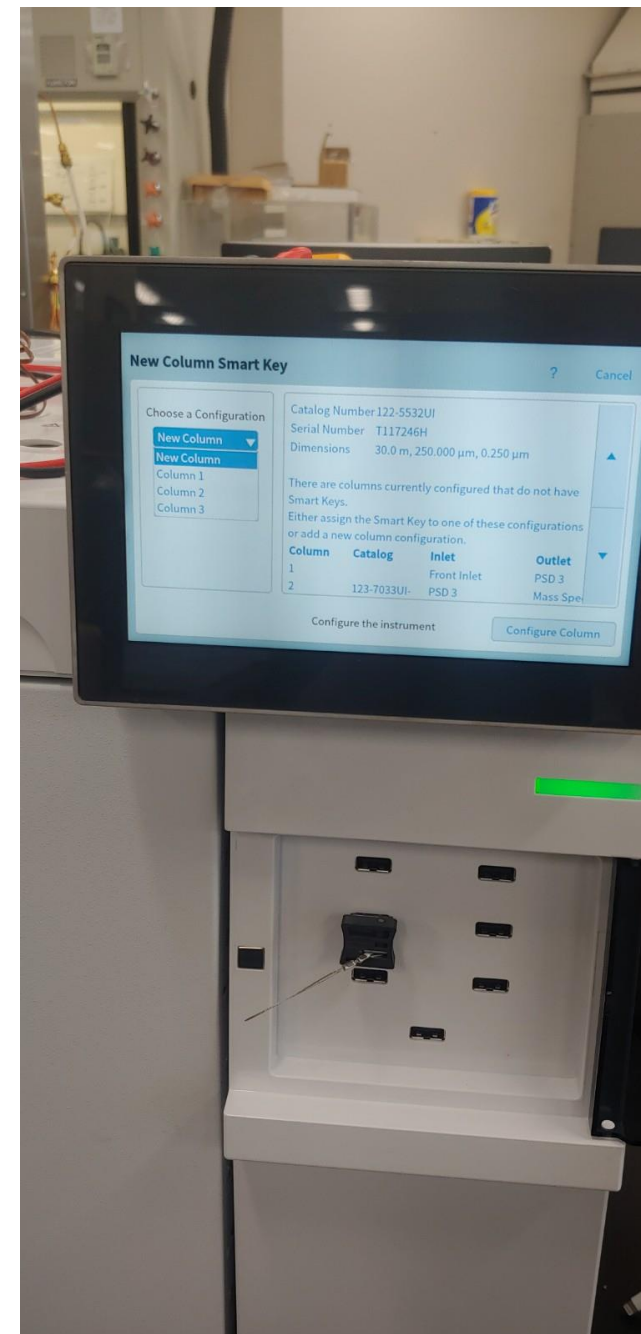


# GC Columns with Smart Key

## Feature, advantages, and benefits

Feature	Advantage	Benefit	Economic Benefit
<p>Smart key included with the GC column (p/n must include "KEY")</p> <p>Designation example *122-5532UI-KEY*</p>	<ol style="list-style-type: none"> <li>Reduce possible errors from manual input of method parameters</li> <li>Optimize maintenance schedules with usage tracking</li> </ol>	<ol style="list-style-type: none"> <li>Better data quality as the system is aware of the configuration</li> <li>Ease-of use</li> <li>Ability to better plan preventive maintenance before issues occur</li> </ol>	<ol style="list-style-type: none"> <li>Ease-of-use, no risk of faulty information in the GC, fewer reruns</li> <li>Limited downtime as preventive maintenance is easier to plan</li> </ol>

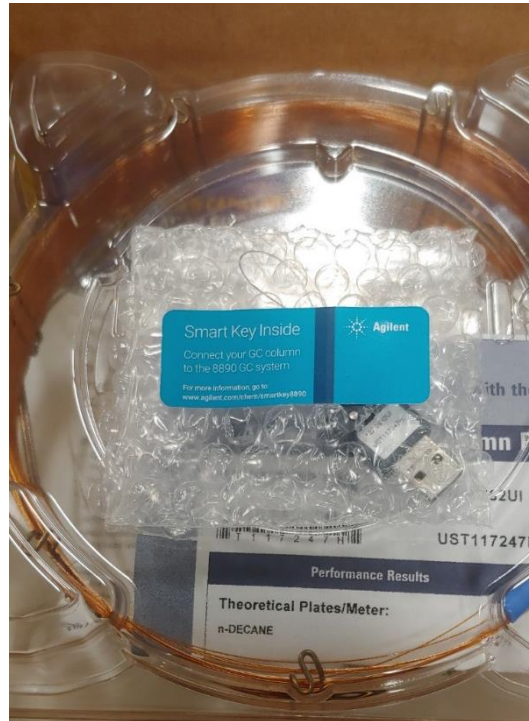
	Literature	Web Page
1	Agilent 8890 GC brochure	<a href="https://www.agilent.com/cs/library/brochures/brochure-gc-8890-5994-0476en-agilent.pdf">https://www.agilent.com/cs/library/brochures/brochure-gc-8890-5994-0476en-agilent.pdf</a>
2	Smart key product page (not for ordering smart keys)	<a href="http://www.Agilent.com/chem/smartkey8890">www.Agilent.com/chem/smartkey8890</a>
3	Instruction sheet	<a href="https://www.agilent.com/cs/library/instructionsheet/public/insert-smart%20key-8890-5994-0700en-agilent.pdf">https://www.agilent.com/cs/library/instructionsheet/public/insert-smart%20key-8890-5994-0700en-agilent.pdf</a>



# GC Columns with Smart Key

## Smart key clarifications

- It is not a USB flash drive. It comes preprogrammed from the factory with specific information about the GC column it belongs to.
- It is not tethered to the GC column, neither is it connected through Wi-Fi or Bluetooth.



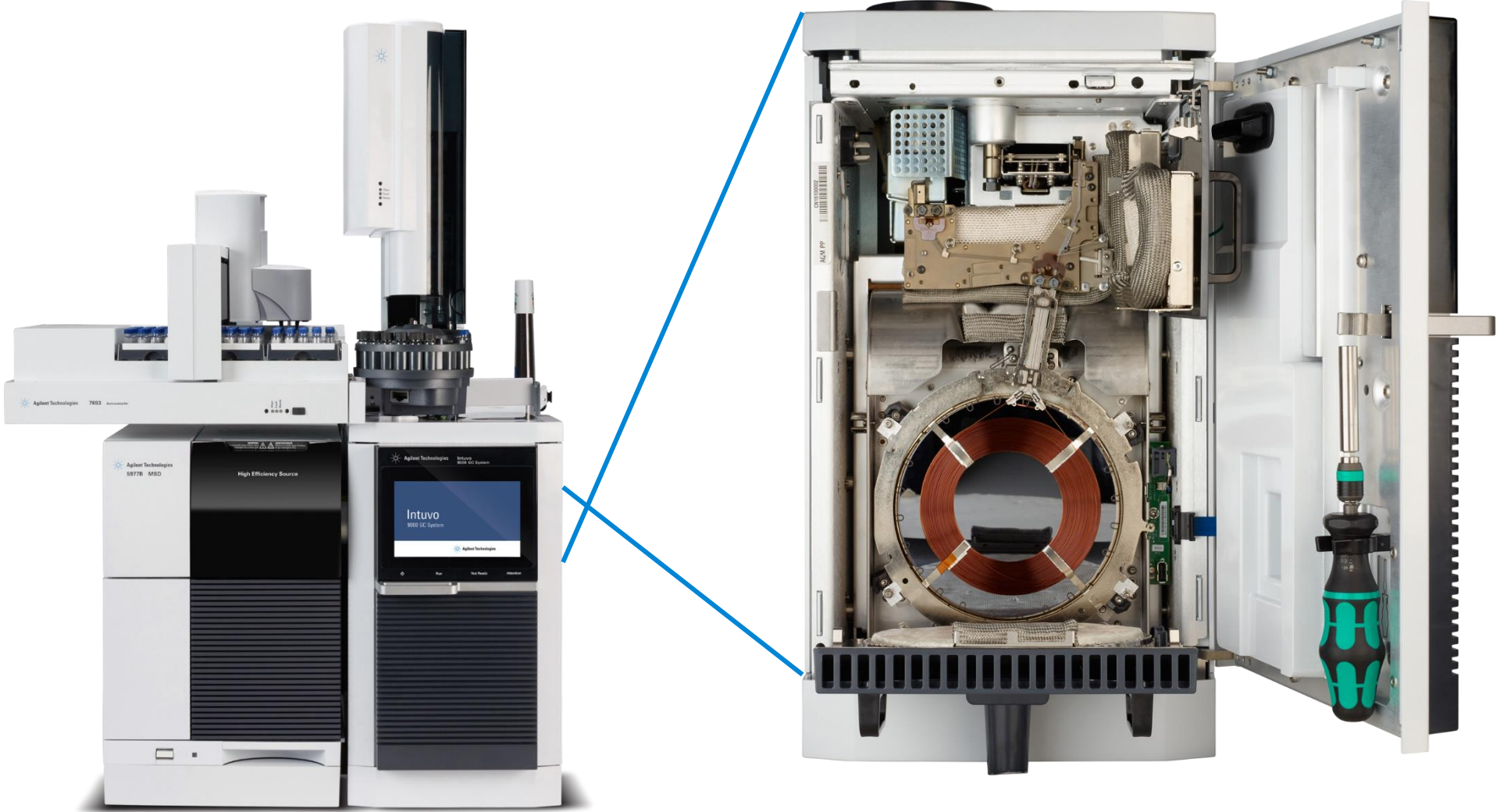
# New Agilent Universal Fit GC Detector Jets

- Easier column installation and jet replacement, reducing the risk of column damage
- Lubricant-free threads, reducing the risk of contamination
- Made from strong material, reducing the risk of deforming
- Universal – fits in both capillary column and packed column (adaptable) FID detectors

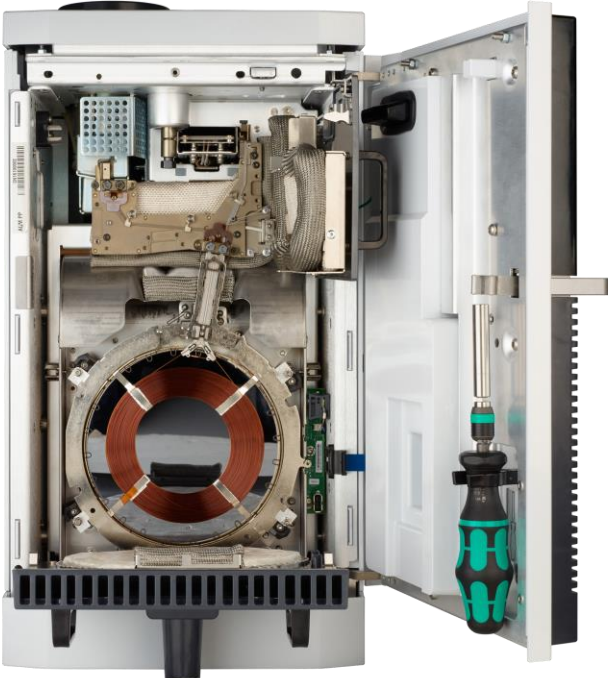







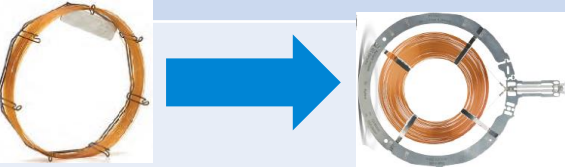
Previous Jets				New Universal Fit Jets			
Previous Jet PN	Jet Orifice ID (inch/mm)	Jet Length (inch/mm)	Fit of Detector Fitting Type	New Jet PN (use for re-order)	Jet Orifice ID (inch/mm)	Jet Length (inch/mm)	Fit of Detector Fitting Type
19244-80560	0.011 / 0.29	2.4 / 62	FID, Adaptable	5200-0176	0.011 / 0.29	1.2 / 31	FID, Capillary & Adaptable
G1531-80560	0.011 / 0.29	1.7 / 43	FID, Capillary				
18710-20119	0.018 / 0.47	2.5 / 64	FID, Adaptable	5200-0177	0.018 / 0.47	1.2 / 31	FID, Capillary & Adaptable
19244-80620	0.018 / 0.47	2.4 / 62	FID, Adaptable				
G1531-80620	0.018 / 0.47	1.7 / 43	FID, Capillary				
18789-80070	0.030 / 0.76	2.5 / 64	FID, Adaptable	5200-0178	0.030 / 0.76	1.2 / 31	FID, Capillary & Adaptable
G1534-80580	0.011 / 0.29	2.0 / 52	NPD, Capillary	5200-0179	0.011 / 0.29	1.6 / 40	NPD, Capillary & Adaptable
G1534-80590	0.011 / 0.29	2.8 / 71	NPD, Adaptable				

# Agilent Intuvo 9000 GC System



# GC Flow Path Comparison

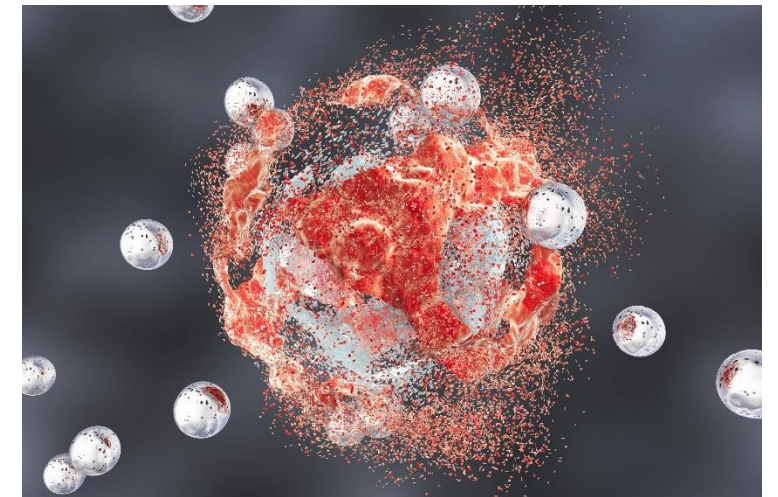


Consumable	5890 / 6890 / 7820 / 7890 / 8860 / 8890	Intuvo 9000	When to Change?	
Septum →	Same	Same	As needed	
Liner →	Same	Same	As needed	
Ferrules →	Graphite / Graphite-Vespel	Gaskets	Single use with column installation	
Gold seal →	Standard or UI	Guard Chip	As needed	
Guard Column / Column trim	Fused silica	Guard Chip	As needed	
Column	Standard 7 in cage	Unique	As needed	



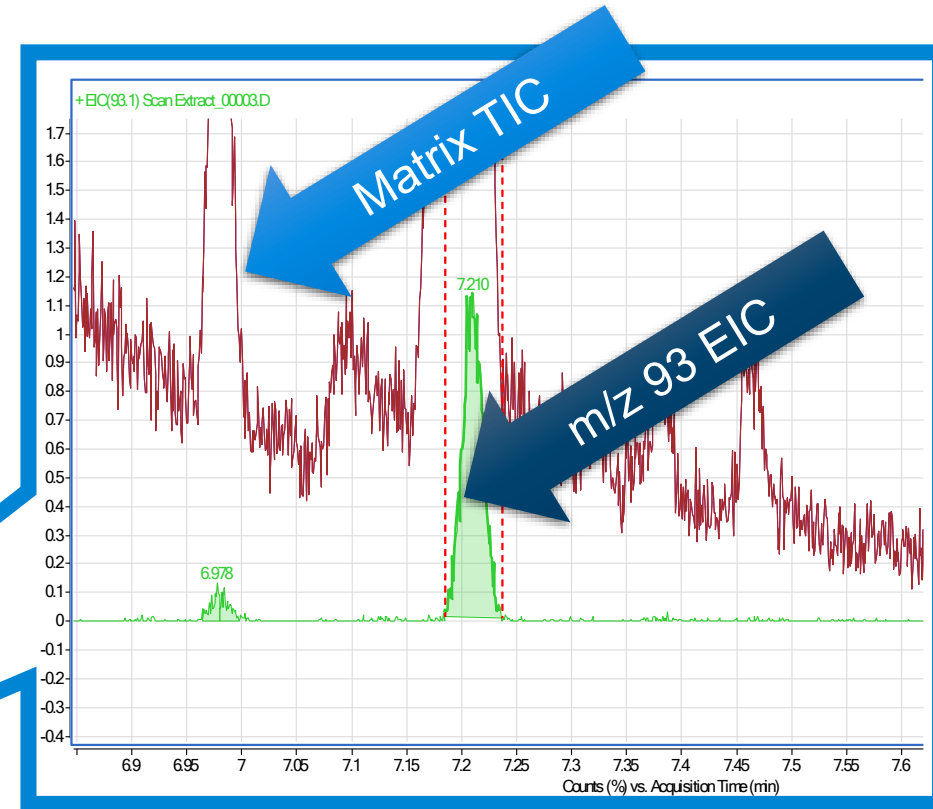
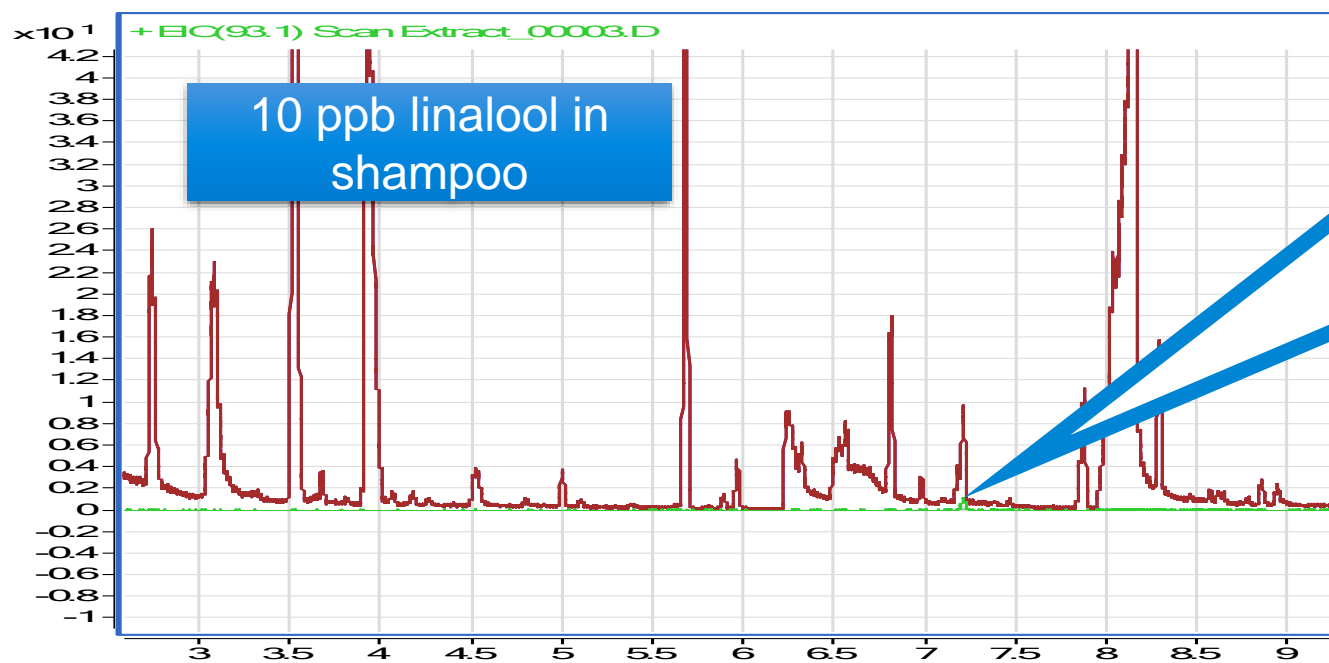
# How Can I Get More Lifetime Out of My Liners, Gold Seals, and Columns?

How did it become contaminated in the first place?



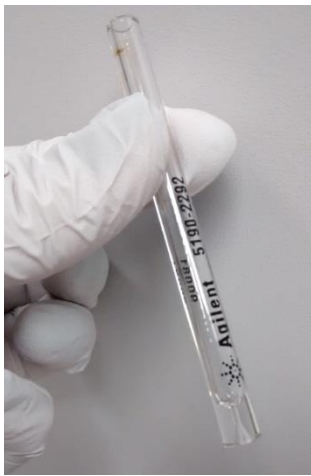
# The Matrix

If your target ions are buried beneath matrix peaks, it might be time to trim the column or do sample cleanup

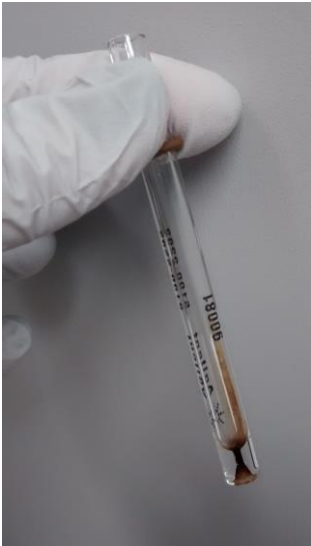


(Or improve your sample cleanup)

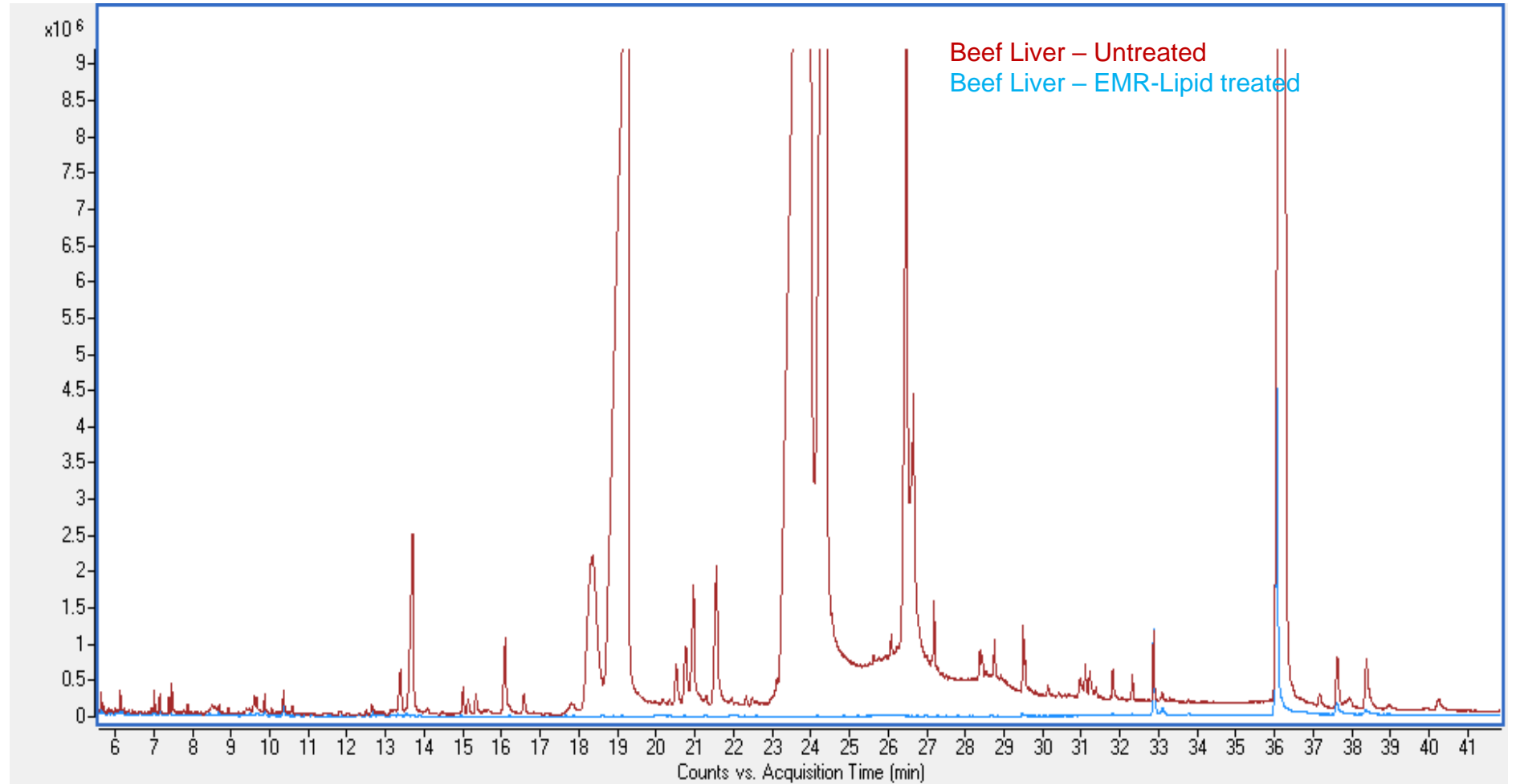
# The Importance of Sample Cleanup



50 samples  
with cleanup



50 samples  
without cleanup

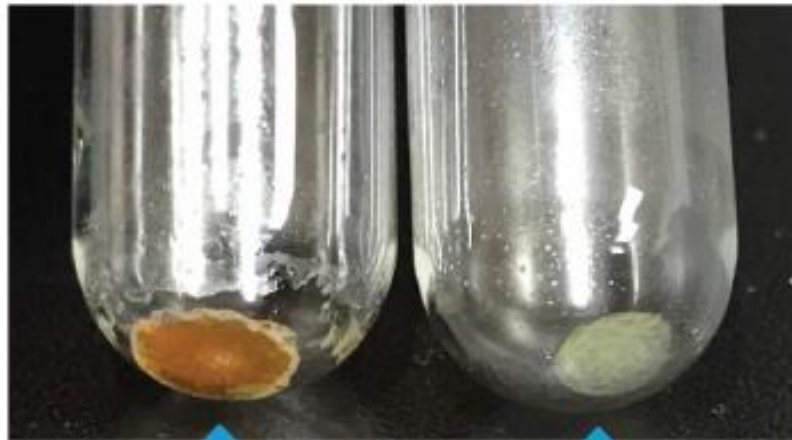


For sample cleanup help, please contact us at [spp-support@agilent.com](mailto:spp-support@agilent.com).

# Determination of 19 Polycyclic Aromatic Hydrocarbon Compounds in Salmon and Beef

Using Captiva EMR-Lipid cleanup by GC/MS/MS

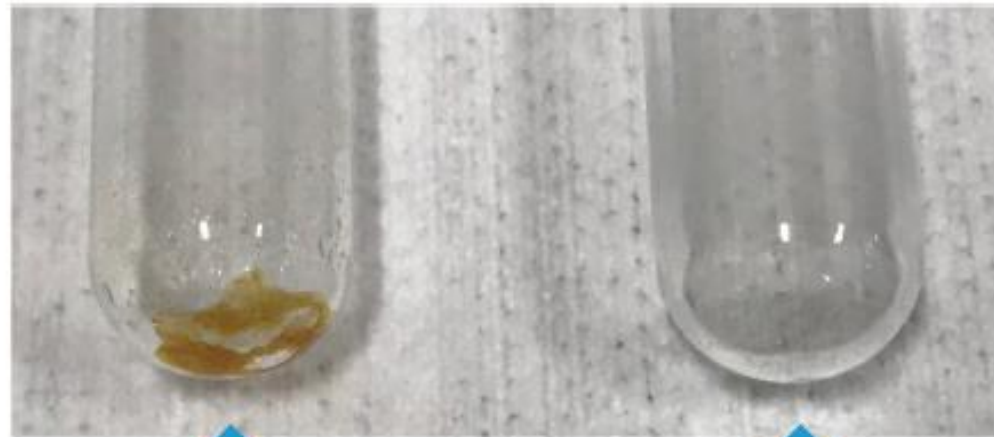
Salmon dried residue



No cleanup

Captiva EMR-Lipid  
cleanup

Beef dried residue

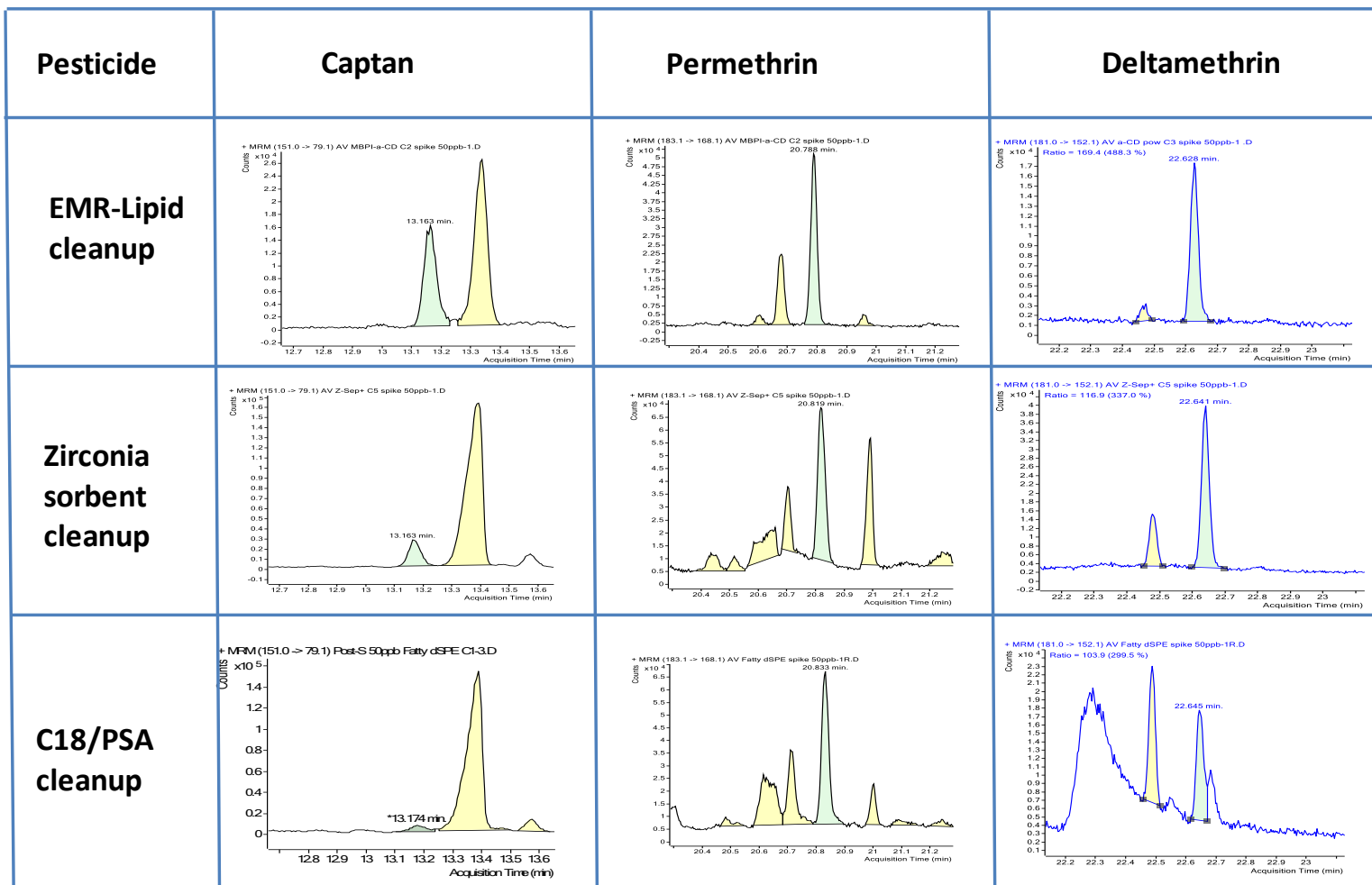


No cleanup

Captiva EMR-Lipid  
cleanup

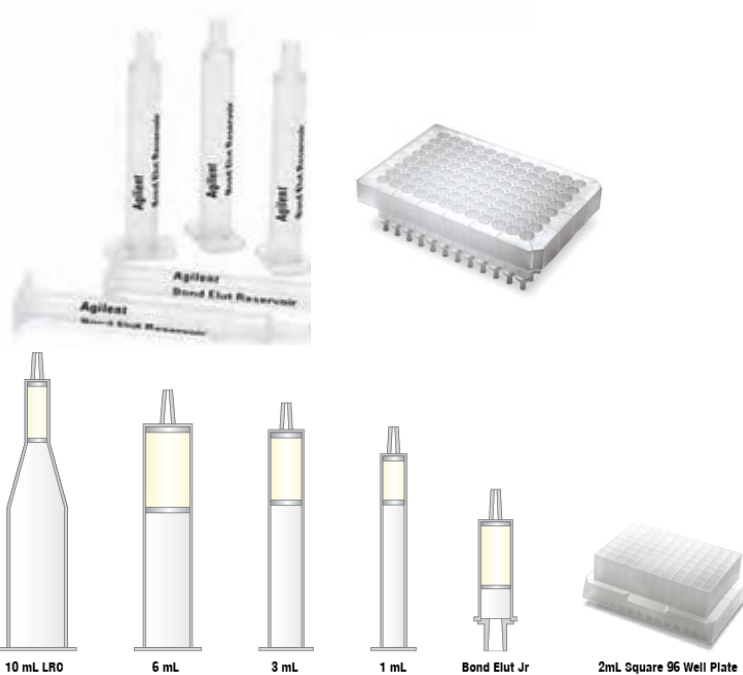
5994-0553EN

# Captiva EMR-Lipid Cleanup Improves Analyte S/N Ratio and Integration Accuracy on GC/MS(/MS)



5994-0405EN

# Offline Options for Sample Matrix Removal



Bond Elut Solid Phase Extraction cartridges and plates



Captiva syringe filters



QuEChERS



Captiva EMR-Lipid filtration cartridges and plates



Filter vials



Synthetic Chem Elut S

# When Do I Change Specific Parts?

Item	Typical Schedule	Comments
Septum Nut	3-6 months	Septum nut can get worn 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.

# Agilent University

## Why training? What can we help with?

### Agilent University:

- Trained over 38K students in 2019
- 98% customers recommend
- 4.6 out of 5 for customer satisfaction
- 94% excellent and very good

Labs who want faster and more efficient learning options to help overcome training challenges

Overtasked staff

Staff turnover

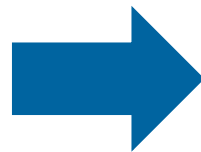
Pressure to improve quality and productivity

Daily consistency with output and results

Reduce costs associated with lab operations

### Virtual training

Flexible and convenient training options when and where you need them



Virtual instructor led



eLearning self-paced

### In-person training



Classroom



On-site or virtual on-site

Trust Agilent for answers with up-to-date knowledge and generally accepted practices for all your training needs



# Contact Agilent Chemistries and Supplies Technical Support



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

[Option 1 for GC and GC/MS columns and supplies](#)

Option 2 for LC and LC/MS columns and supplies

Option 3 for sample preparation, filtration, and QuEChERS

Option 4 for spectroscopy supplies

Option 5 for chemical standards

**Available in the U.S. and Canada, 8–5, all time zones**



[gc-column-support@agilent.com](mailto:gc-column-support@agilent.com)

[lc-column-support@agilent.com](mailto:lc-column-support@agilent.com)

[spp-support@agilent.com](mailto:spp-support@agilent.com)

[spectro-supplies-support@agilent.com](mailto:spectro-supplies-support@agilent.com)

[chem-standards-support@agilent.com](mailto:chem-standards-support@agilent.com)