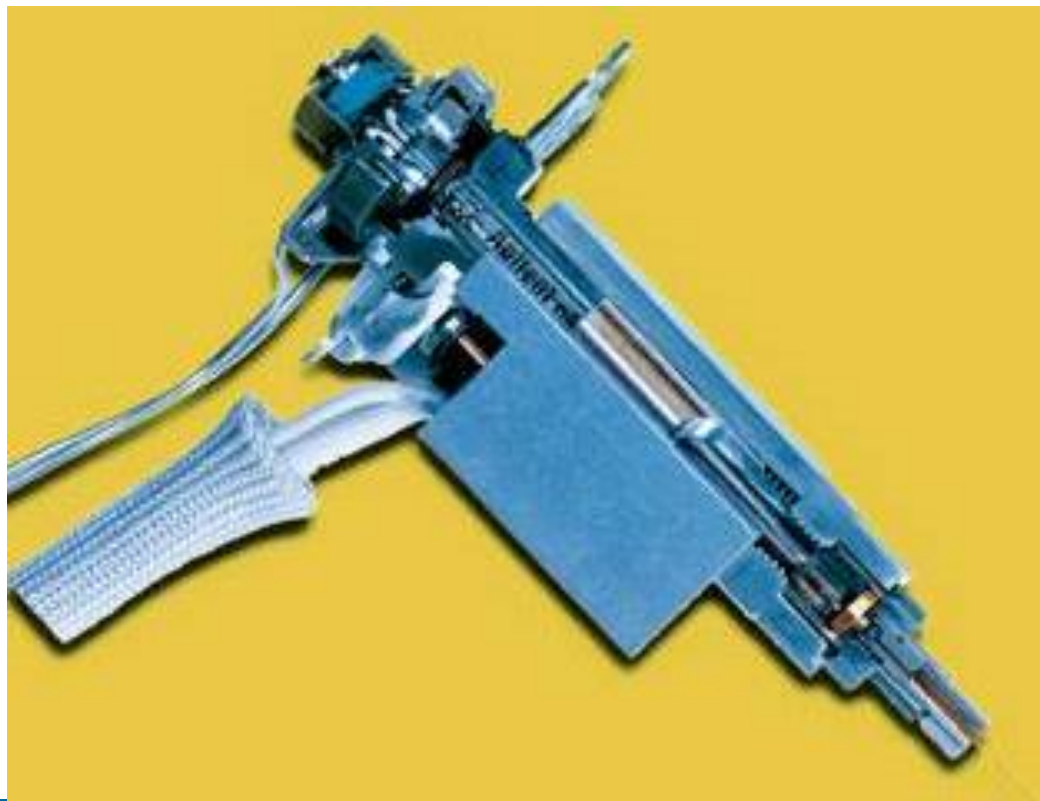


# Maintaining Your Agilent GC's Split/Splitless Injection Port

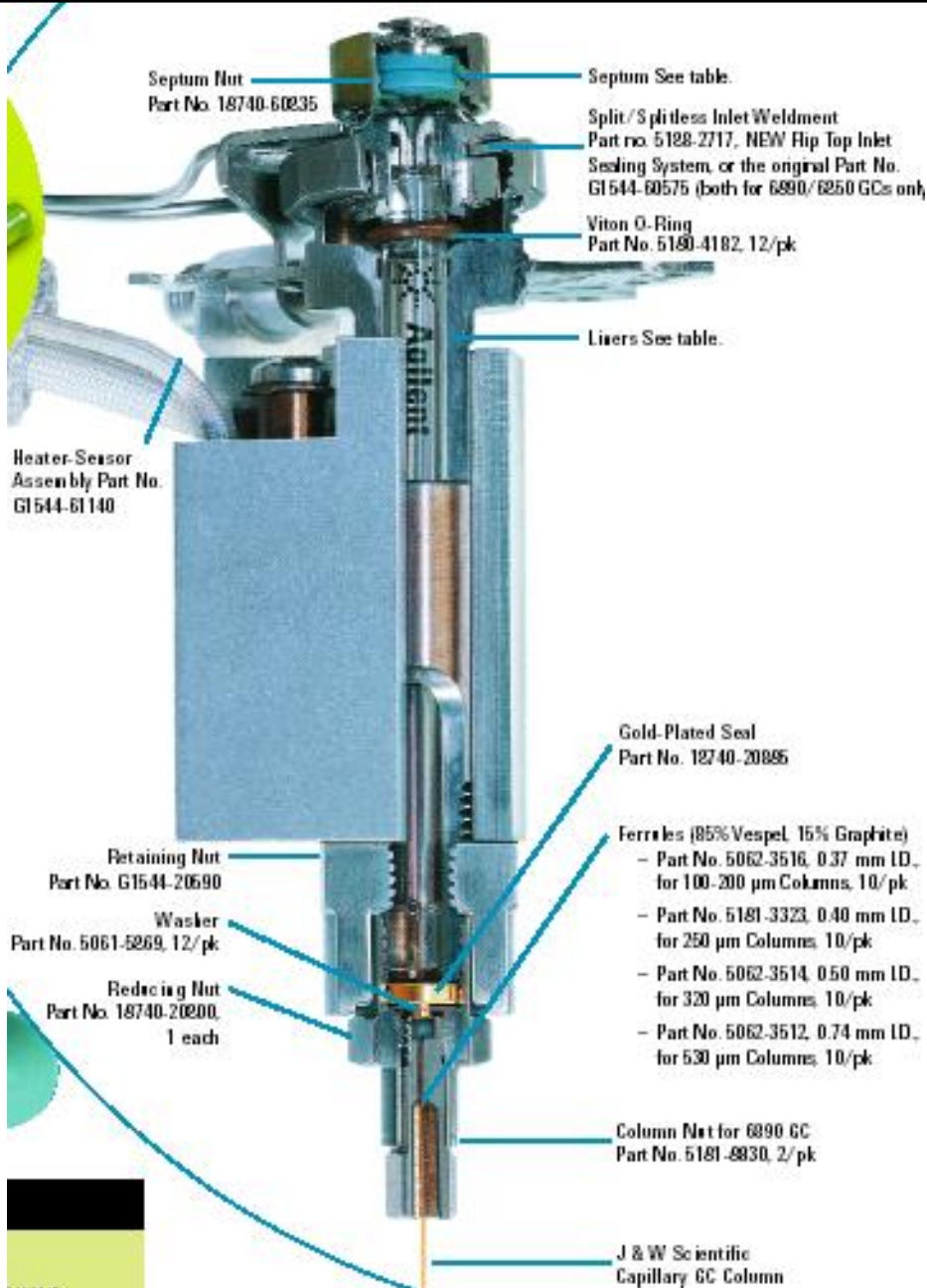


# So, Why Do I Have To Do Maintenance?

1. Things get dirty – liners, column, gas lines, traps, etc.
2. Things wear out – septa, syringes, nuts, ferrules, o-rings, etc.



# Split/Splitless Injector Parts



# Septum & Septum Nut

Septum Nut  
Part No. 18740-60235

Septum See table.

Split/Splitless Inlet Weldment  
Part no. 5128-2717, NEW Flip Top Inlet  
Sealing System, or the original Part No.  
G1544-60575 (both for 6890/6250 GCs only)

Viton O-Ring  
Part No. 5180-4182, 12/pk

## Viton O-Ring & Weldment Nut (or Flip-Top)

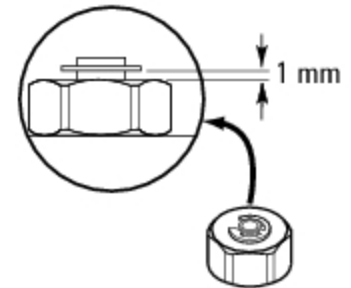
# Leaks Due to Septum Nut

- With repeated use, conical needle guide gets worn, out of round, and needs replacement as septum can begin to “bulge” out, especially with excessive tightening,
- Septa fail faster because needle is not guided with as much precision.



Under or Over tightening—tighten nut until c-clamp on top stops turning, then  $\frac{1}{2}$  to  $\frac{3}{4}$  turn more.

- Non-Agilent septa may be too thin, too thick, or out of round like die-cut septa and may not seal as well.
- “Use Environments” that decrease lifetime, like using non-Agilent Autosamplers (ours are precisely aligned), manual injection, larger gauge syringes
- Replace septum nut annually for peace of mind.



# Turn Top Inlet Sealing System on NEW 7890



- Fast/Easy Split/Splitless  
Inlet Maintenance

... changing liners has never been easier



# For Easy Liner Maintenance on 5890/6890

**NEW!!**

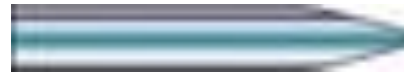
## **Flip Top** for Split/Splitless injection ports

- 30 sec liner change out
- No more hunting for that “funny looking” wrench!
- Saves fingers from getting burned
- Increases instrument up time



# Tips to Maximize Septum Life, Minimize Septum Leaks

- Use Agilent Gold Standard, HP Point, 23-26 gauge taper syringes. The point style cores septa significantly less when used with CenterGuide Septa. Taper minimizes septum coring/wear.



**HP-Point Style**

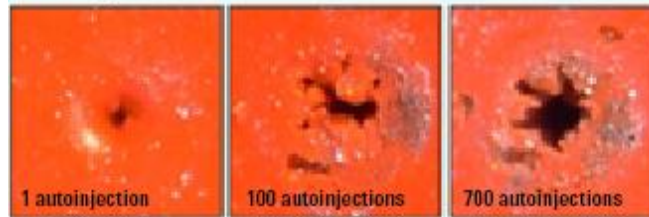
- Use Agilent CenterGuide Septa. The molded hole minimizes septa coring, counter-intuitive, but true.

**Solid Septum**

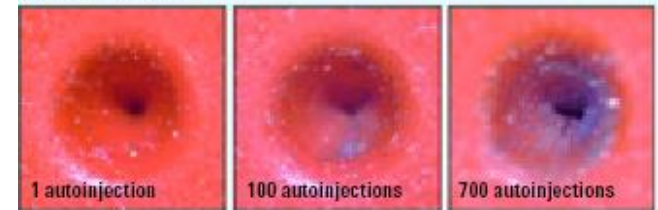
**CenterGuide Septum**



High-Temperature Septa Without CenterGuide: Major Coring Before 100 Autoinjections



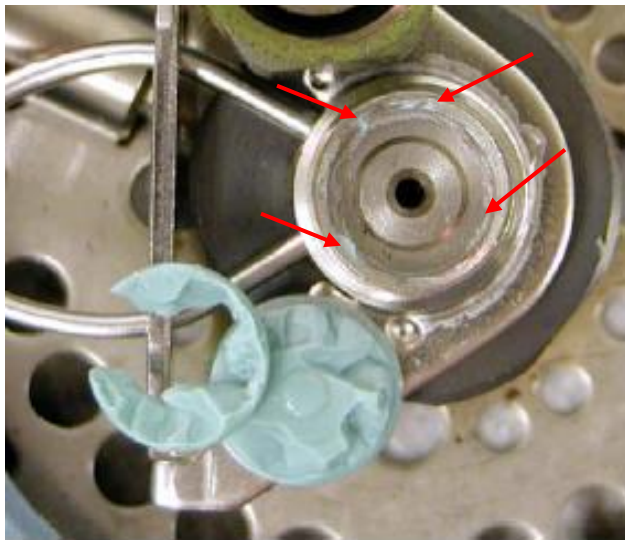
Agilent BTO Septa With CenterGuide: Very Little Coring Even After 700 Autoinjections



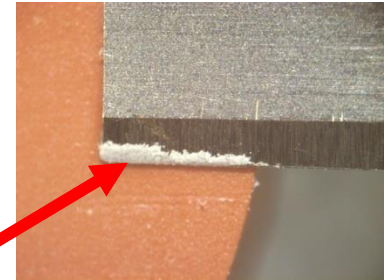


# Tips to Maximize Septum Life, Minimize Septum Leaks

- Use Non-Stick septa, especially Agilent's Centerguide Septa with Proprietary Plasma Treatment

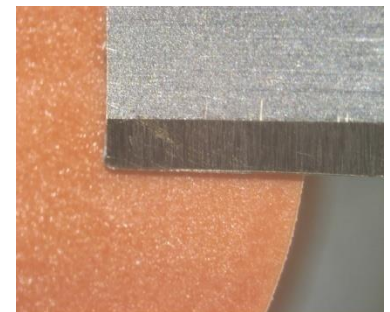


**Their's**  
**Talcum Powder!**



**NEW!**

**Our's**



- Stuck septa particles can cause sealing problems on next septum installation. Talc can cause activity/trap plugging problems

# Other Benefits of Agilent's “Centerguide” Septa

- Packaging eliminates contamination of septa,
  - “first is as good as the last”
- Less Strain on Syringe compared to solid septa
- Bleed/Temperature Optimized, (to 400C, **trace analysis**),  
p/n 5183-4757
- Advanced Green, (to 350C, **good for general purpose**),  
p/n 5183-4759
- Long Life, (to 350C, **more injections before failure**),  
p/n 5183-4761
- Above are 50 packs, 100 packs also available.



# Septa vs GC Column Costs

- Typical cost of 1 Premium Septum (list), **\$1.25**
- Typical cost of 1 GC Column, 30 m x 0.25 mm ID, **\$450.**
- No accurate leak rate detector at sub 1 mL/min flow rates.
- “Don’t step over a dollar to pick up a dime!”
- Proactively change inlet septa.



# Or Go Septumless! – Merlin Microseal

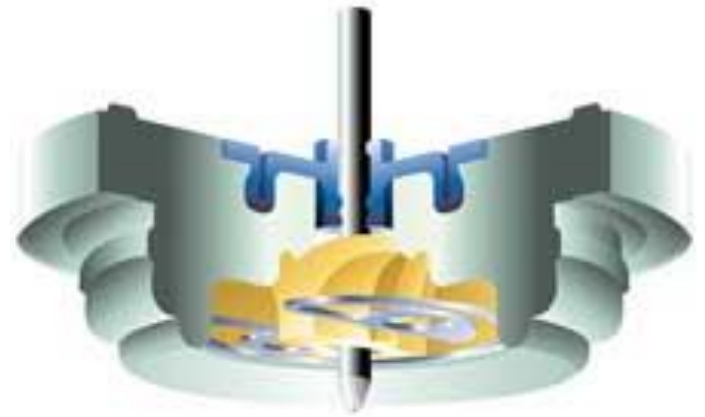
Low bleed, longer life alternative to standard septa for split/splitless injection

More than 2000 injections, depending on samples and operating conditions

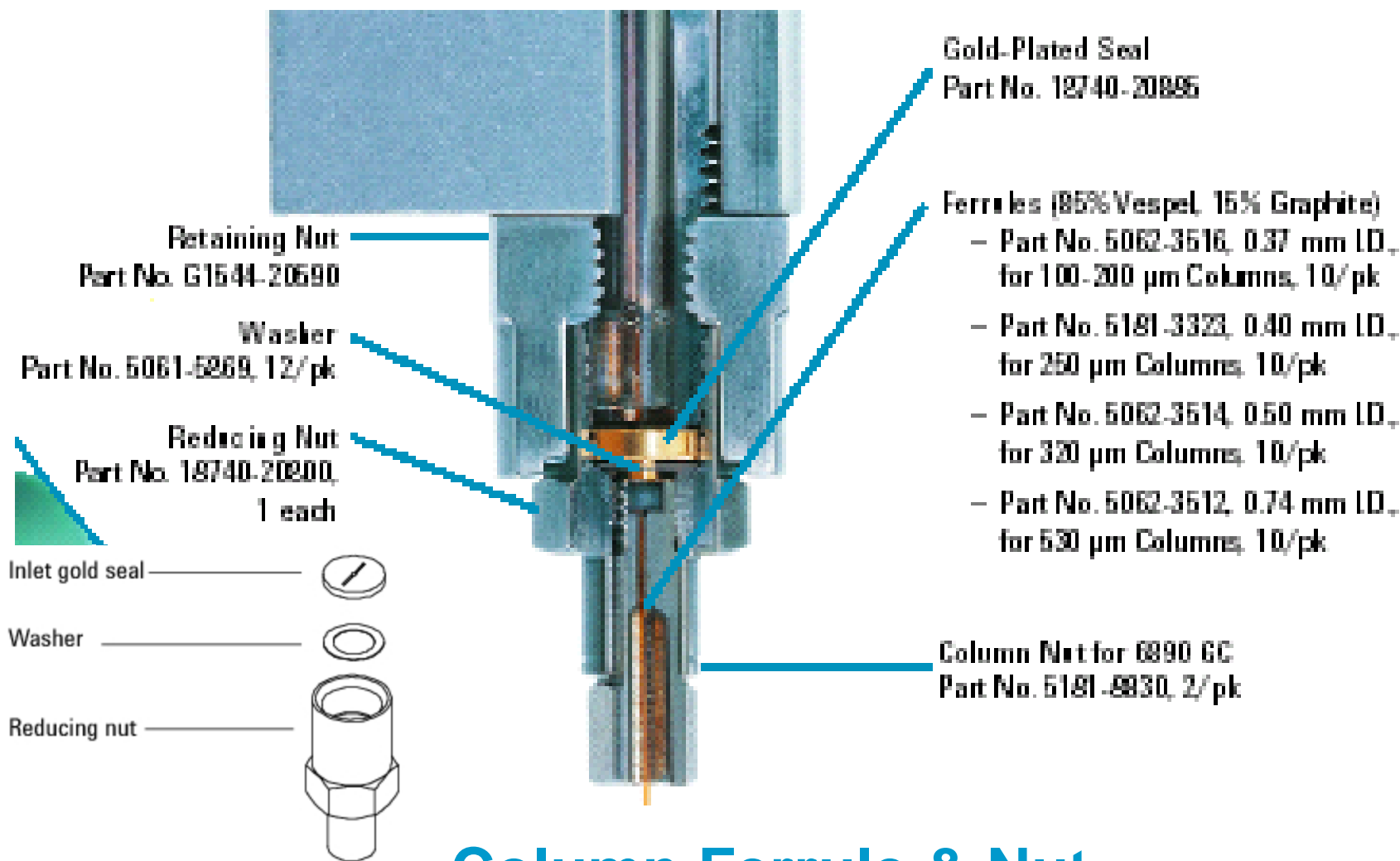
Almost zero downtime for septa changes and injection port liner changes due to septa particulates

Double O-ring type seal around the syringe needle

Spring assisted duckbill to seal the injection port



# Gold Seal & Washer

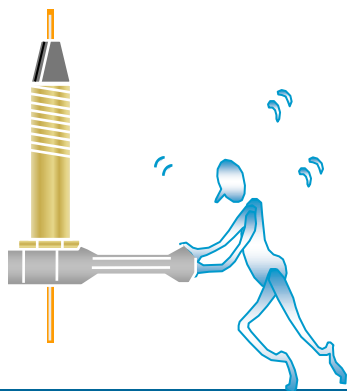


## Column Ferrule & Nut

# Replace Because...Most Common Causes of Leaks

## Re-use and mis-installation.

- Leak from O-ring, Gold Seal, ferrules, column nuts
- O-rings are elastomer compression fittings designed for one use, not perfectly elastic.
- Gold seals are designed for one use, knife edge cuts into gold layer giving leak tight seal w/o shrinkage or potential organic contaminants from polyimide out-gassing/degradation.
- Re-using could result in overlap in seal rings, resulting in a leak.
- Over-tightening of fittings



Certified gold inlet seal, 5188-5367

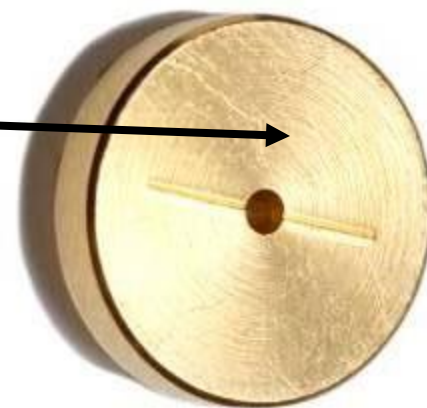




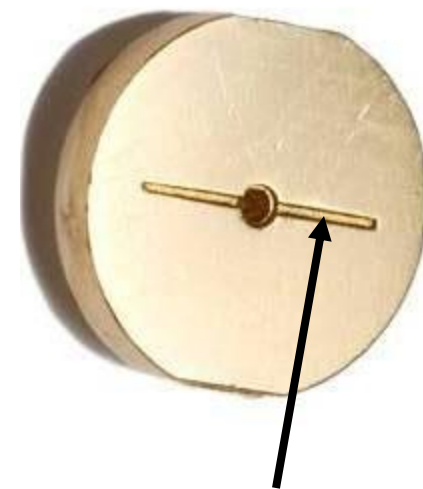
# Gold Seal

- New Agilent Gold Plated Seal
  - Metal Injection Molded with consistently smooth surface – no radial grooves – with reproducible furrow.
- New Gold Seal Kit 5188-5367
  - Includes the washer.

Radial grooves



furrow



# Ferrule Pre-swaging & MS Interface Installation Tools

- Ensures proper length of column into the fittings, every time
- For graphite or metal ferrules



Metal ferrule tool  
G3440-80218



Graphite ferrule tool  
G3440-80217



# Graphite Ferrules Have a Down Side Too!

## Pros

- High temperature range (450C)
- Low Cost
- Soft, easily conforms

## Con

- Can flake, fall apart or extrude
- Permeable

NOT recommended with MS or ECD

Active sites in the flow path



Extensive inlet maintenance needed



# Leak Test

- Pressure Test
- MS – Air/Water
- Leak Detector
  - Portable, handheld unit – only 310g/11oz
  - Fast detection – 1 second
  - Audible and visual alerts for 12 gases
  - Minimum detection limit of 0.01 mL/minute for hydrogen and helium
  - Rechargeable NiMH battery with over 5 hours of life



## What if you ...

- ✓ Could install the column easily
- ✓ Finger tighten, without tools that cause over tightening
- ✓ And make leak free connections
- ✓ Which don't need to be retightened
- ✓ Every time?



# Self-Tightening Column Nuts

- **Reliable performance:** Innovative spring-driven piston continuously presses against ferrule – maintaining a leak-free seal
- **Less wasted time:** No retightening needed after repeated thermal cycles
- **Ease of use:** Finger-tight, consistent connections *without tools*
- **Faster maintenance:** Low-torque seal prevents sticking or crumbling during removal
- **Leak Free = Lower column bleed:** Longer column life



Video at [agilent.com/chem/STnutvideo](https://www.agilent.com/chem/STnutvideo)



# Self Tightening Column Nuts



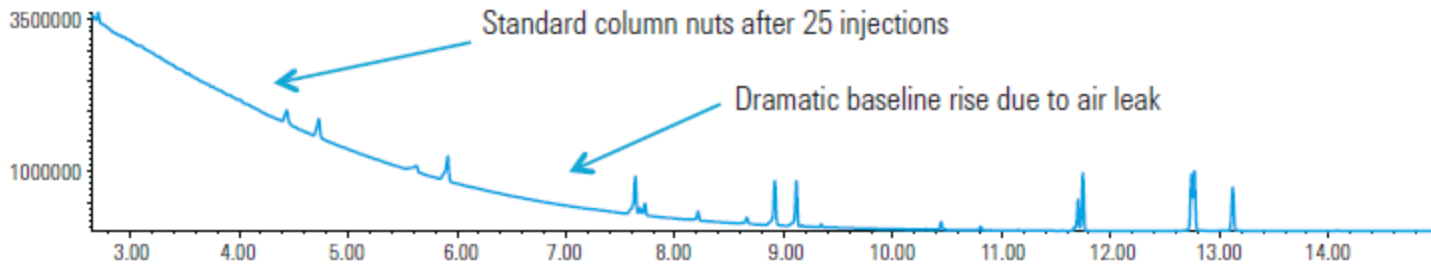
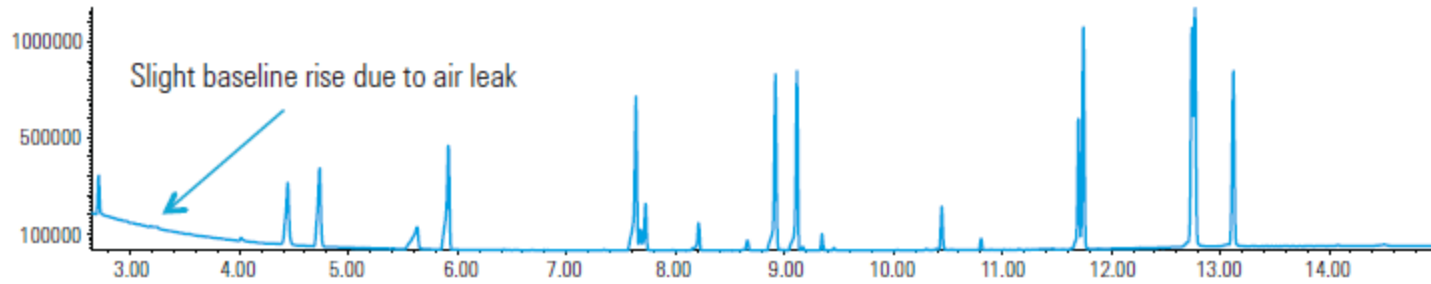
For inlet or detector  
p/n 5190-6194



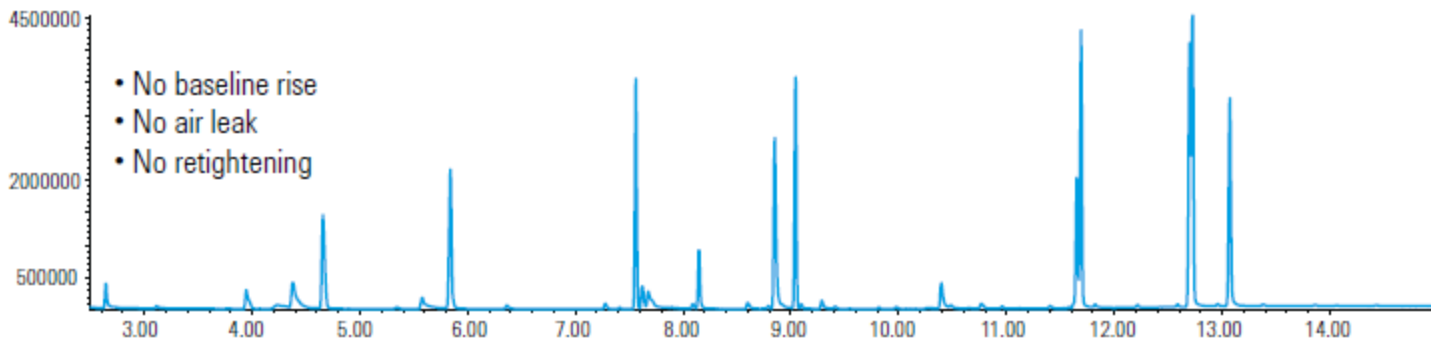
For mass spec transfer line  
p/n 5190-5233

# Self-Tightening Column Nuts

**Standard column nuts new fitting**



**Agilent Self Tightening Column Nuts after 400 injections**



# The BIGGEST Problem in GC is...

There are more things that DON'T go through a GC than DO!

....therefore, don't inject anything and you'll never have problems.

OK, inject, but realize that everything just got dirty...deal with it!

# Where Does it Get Dirty?

Here

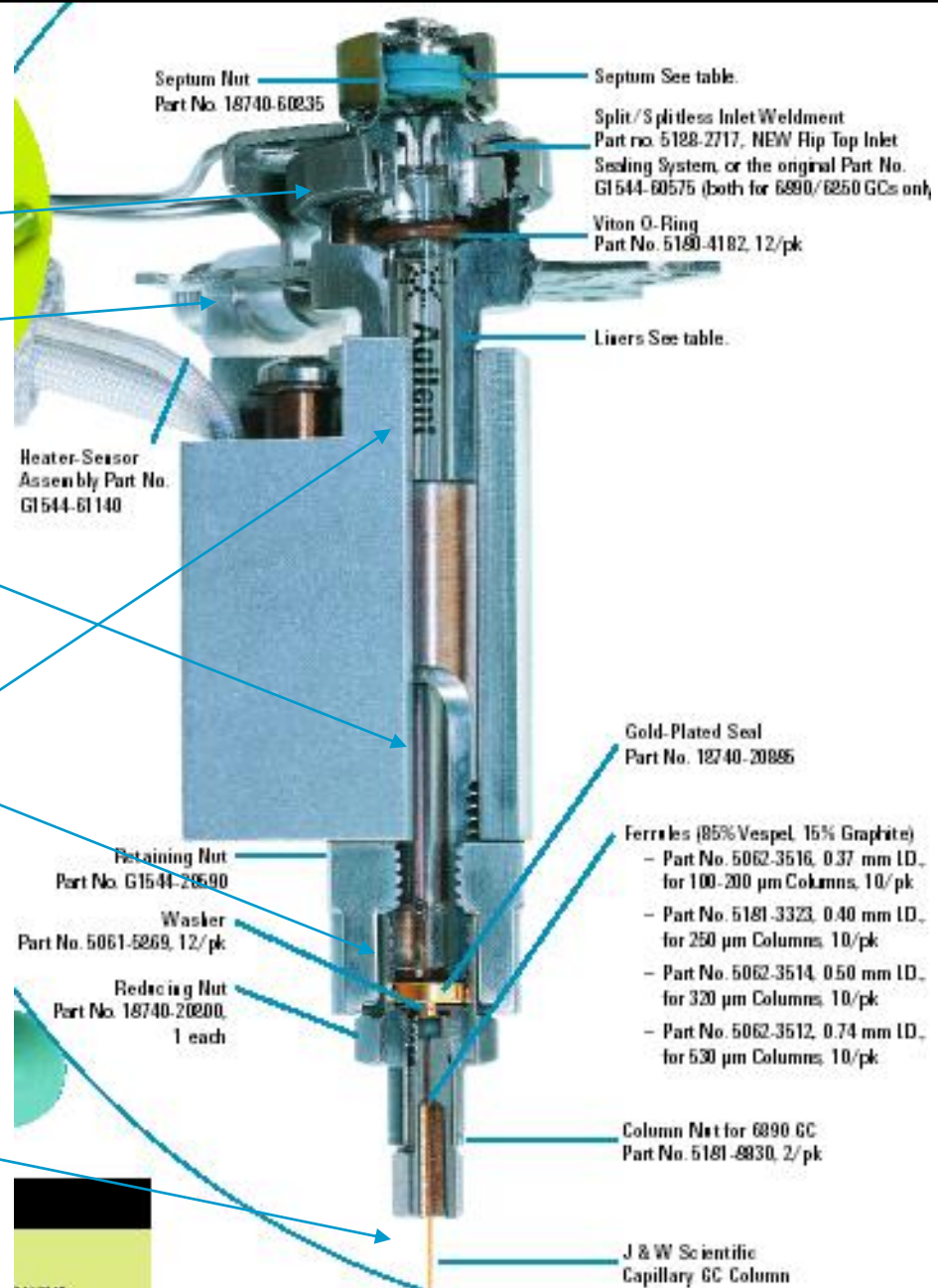
Here

Here

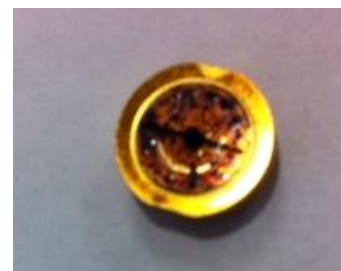
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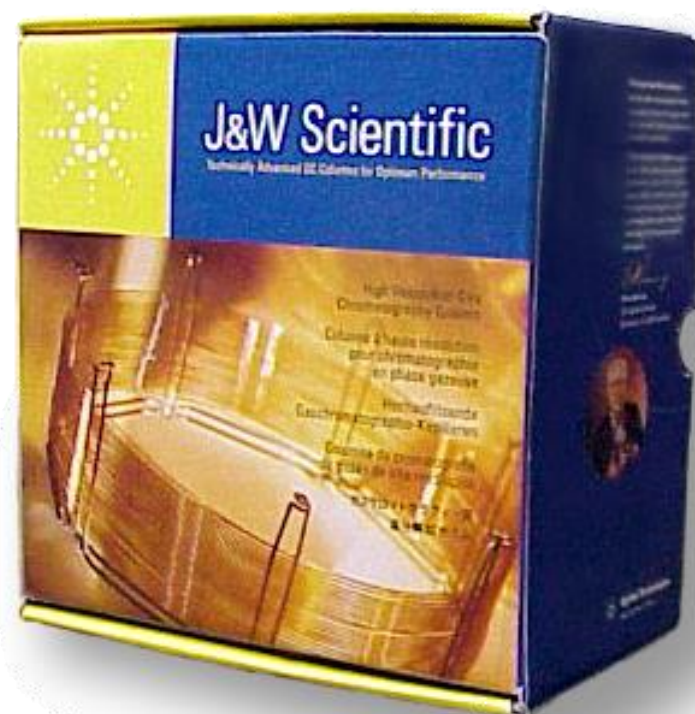
Here



# What Are You Injecting!?



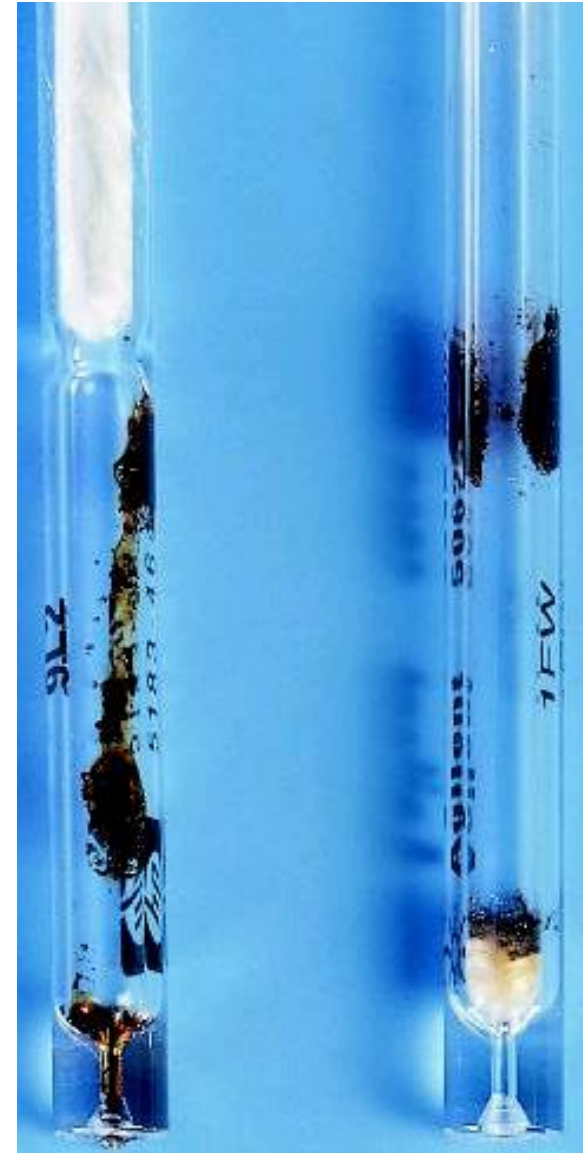
# Time to talk about Liner & Column





# Liner Maintenance

- Liners become contaminated with use, collecting non-volatiles, salts, excess reagents, etc., or become damaged/cracked.
- Should inspect and replace liners often.
- Handle with gloves and forceps.
- Insert into or remove liners only from cool injection ports.
- Replacing with a new liner is recommended, to ensure reproducibility



# AND Ultra Inert Liners

- **Touchless packaging**
- Easy installation of new, clean liner
  - without risk of contamination from touching
- Includes non-stick plasma treated O-ring



## Instructions for Use



**1** Squeeze cap sides tightly to hold liner as you remove plastic tube.

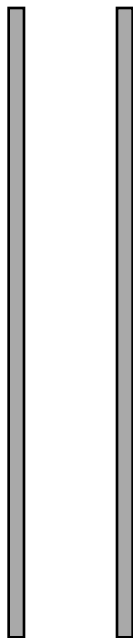


**2** Align liner with inlet and gently release.

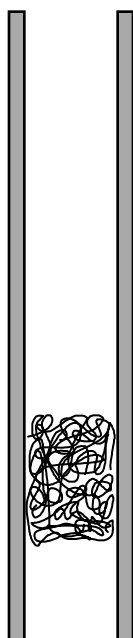


**3** Use cap edge to press liner all the way down.

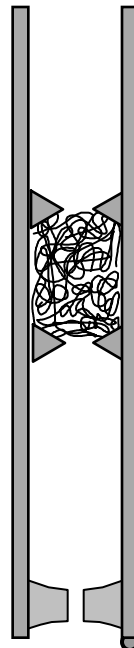
# Split Liners – What's What?



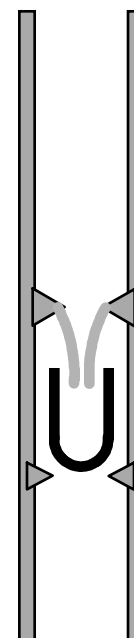
Straight tube



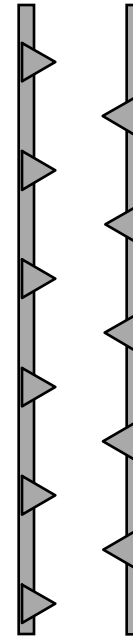
Straight tube with glass wool



Fixed glass wool



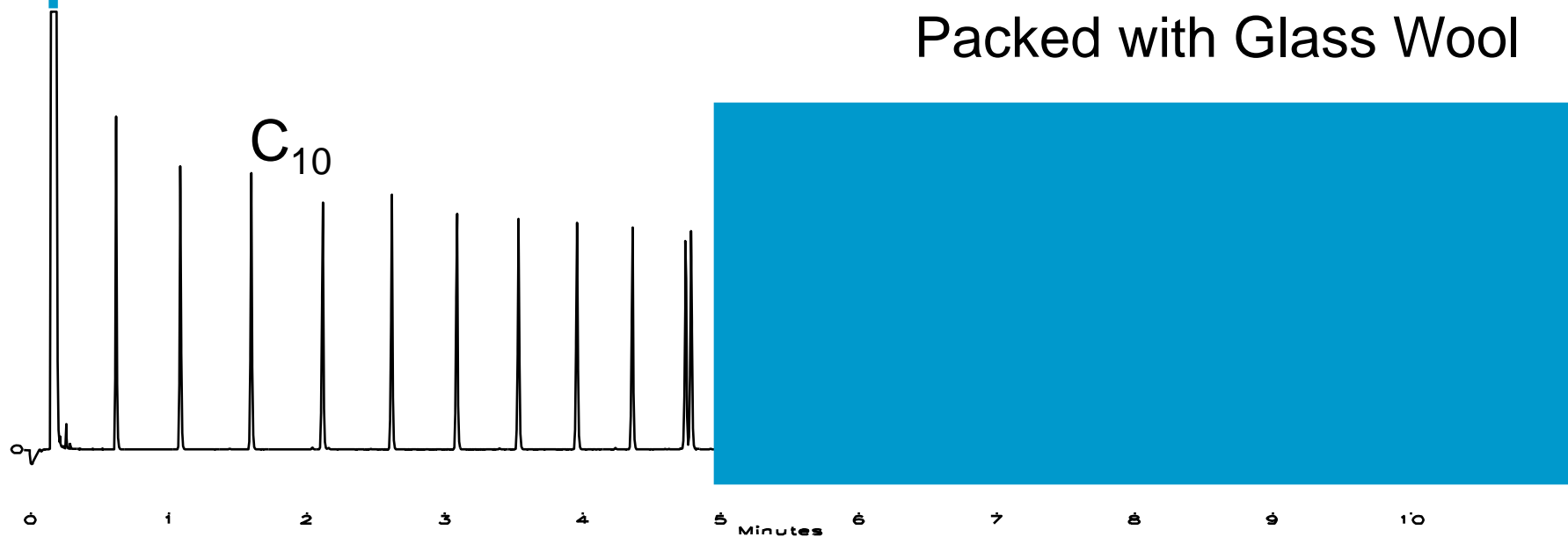
Inverted cup



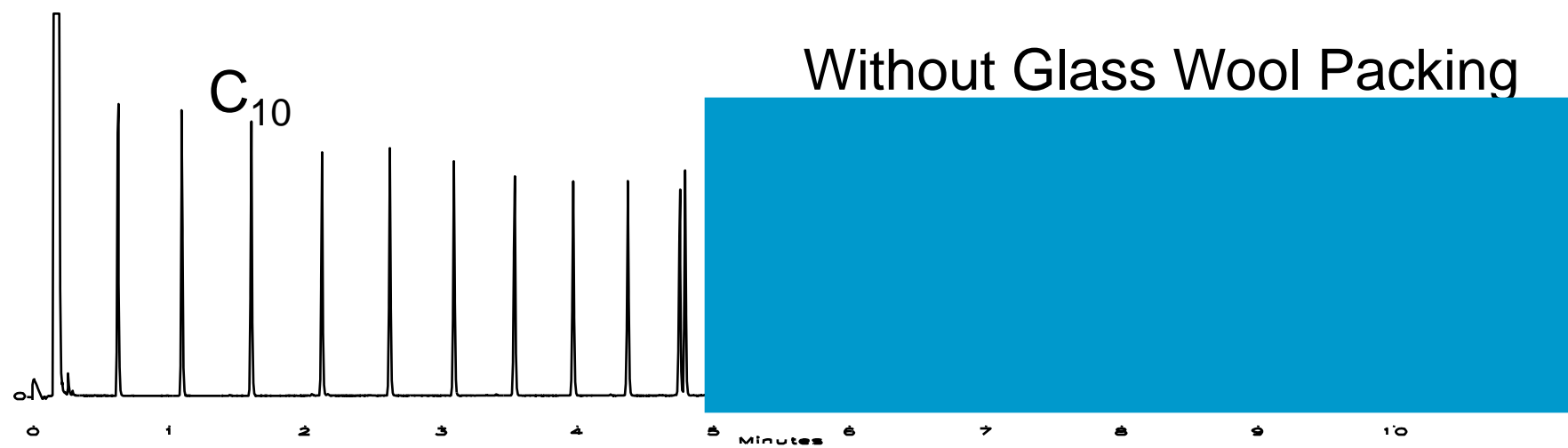
Baffle

# Split Liner

Packed with Glass Wool

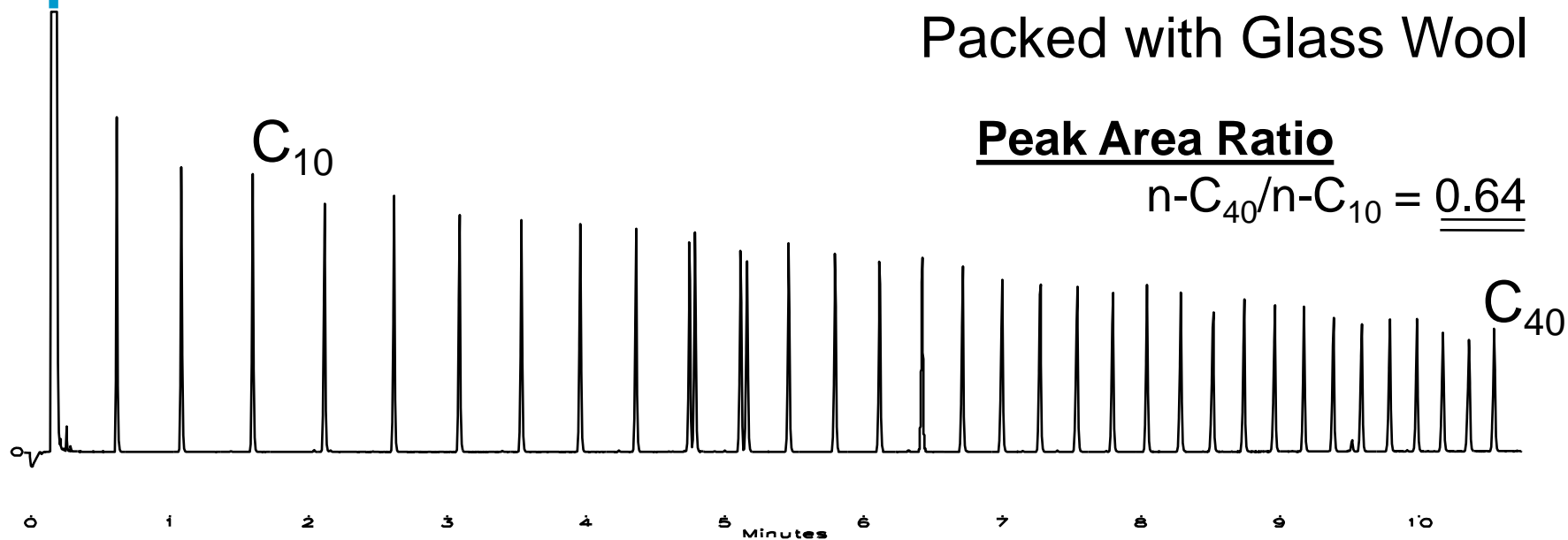


Without Glass Wool Packing

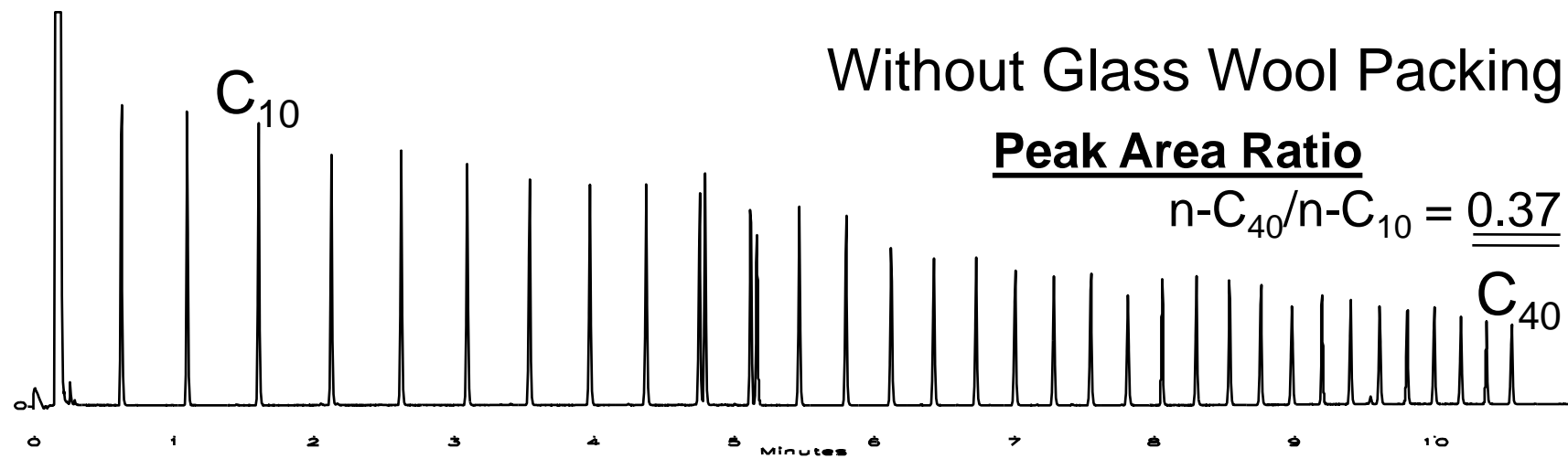


# Split Liner

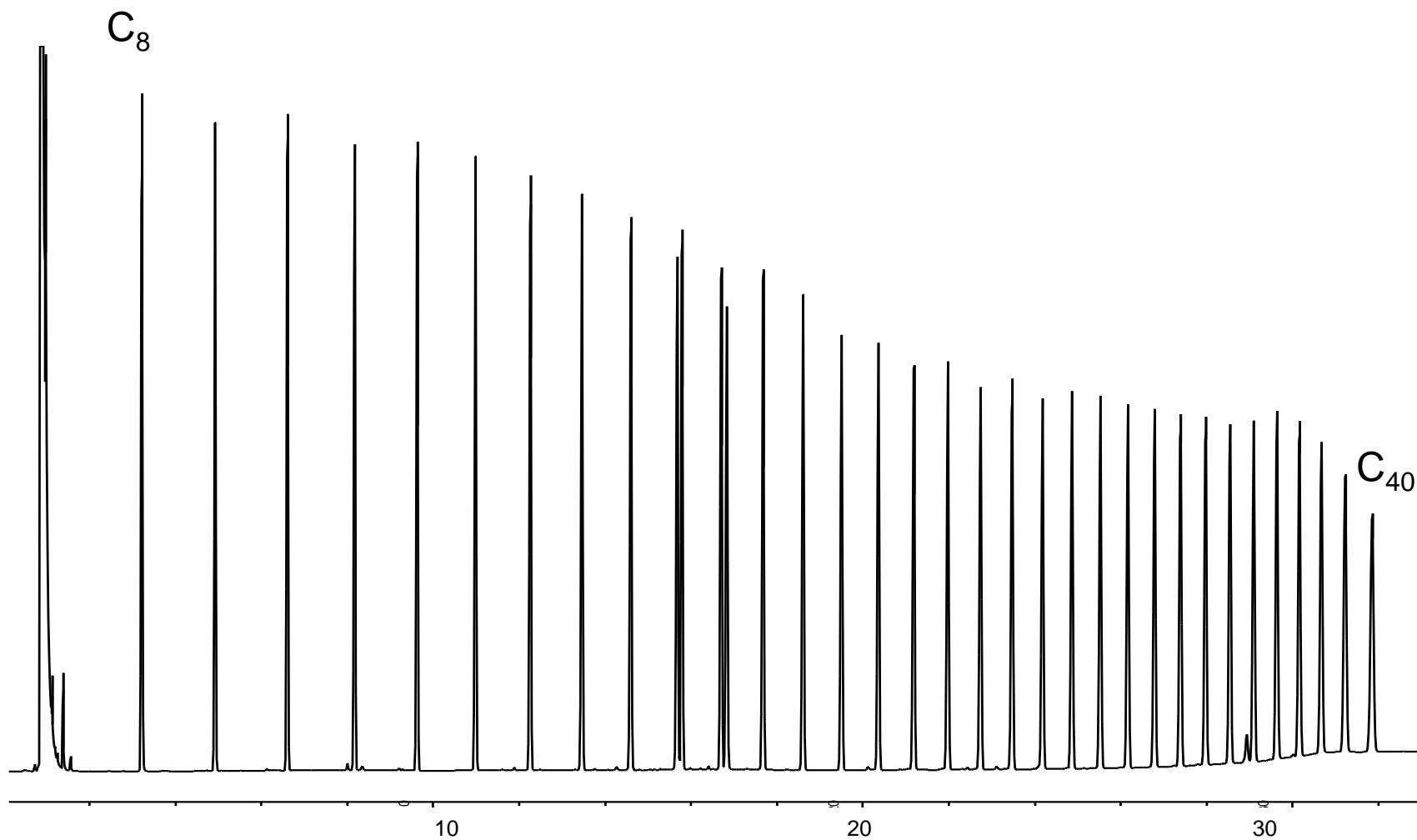
Packed with Glass Wool



Without Glass Wool Packing



# Larger Plug of Glass Wool in the Liner



Oven: 35°C for 4 min, 35-320°C at 10°/min, 320°C for 5 min

Carrier Gas: Helium at 9.5 mL/min

# GLASS WOOL

## Placement in Liner

### Near top of liner:

- Wipes syringe needle of sample
- Can improve injector precision
- Helps to prevent backflash

### Near bottom of liner:

- Helps in volatilization of high MW components
- Increases mixing




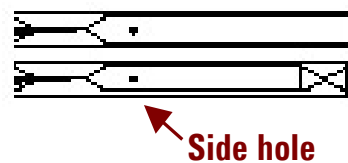


# GLASS WOOL

## Liner Packing Recommendations

- Amount, size and placement must be consistent for consistent results
- Can be broken upon installation into the liner, exposing active sites
- Liner deactivation with glass wool plug in place is ideal

# Splitless Injection Liners

Liner	Part No.	Comments
	<p><b>5181-3316</b></p>	<p>Single taper, deactivated, 900<math>\mu</math>L volume. Taper isolates sample from metal seal, reducing breakdown of compounds that are active with metals. For trace samples, general application.</p>
	<p><b>5062-3587</b></p>	<p>Single taper, deactivated, with glass wool, 900<math>\mu</math>L volume. Glass wool aides volatilization and protects column. For trace (dirty) samples.</p>
	<p><b>5181-3315</b></p>	<p>Double taper, deactivated, 800<math>\mu</math>L volume. Taper on inlet reduces chance for backflash into carrier gas lines. High efficiency liner for trace, active samples.</p>
 <p>Side hole</p>	<p><b>G1544-80730</b> <b>G1544-80700</b></p>	<p>Direct connect liners, single and dual taper, deactivated. Capillary column press fits into liner end, eliminating sample exposure to inlet. Ultimate protection for trace, active samples. Side hole permits use with EPC.</p>

# Causes of Short Column Life

Breakage/damage to the polyimide (rare)

Stationary phase exposed to oxygen

Exceeding upper temperature limits

Chemical damage to the stationary phase

Non-volatile residues (contamination)

# Common Care and Maintenance Scheme for GC Columns

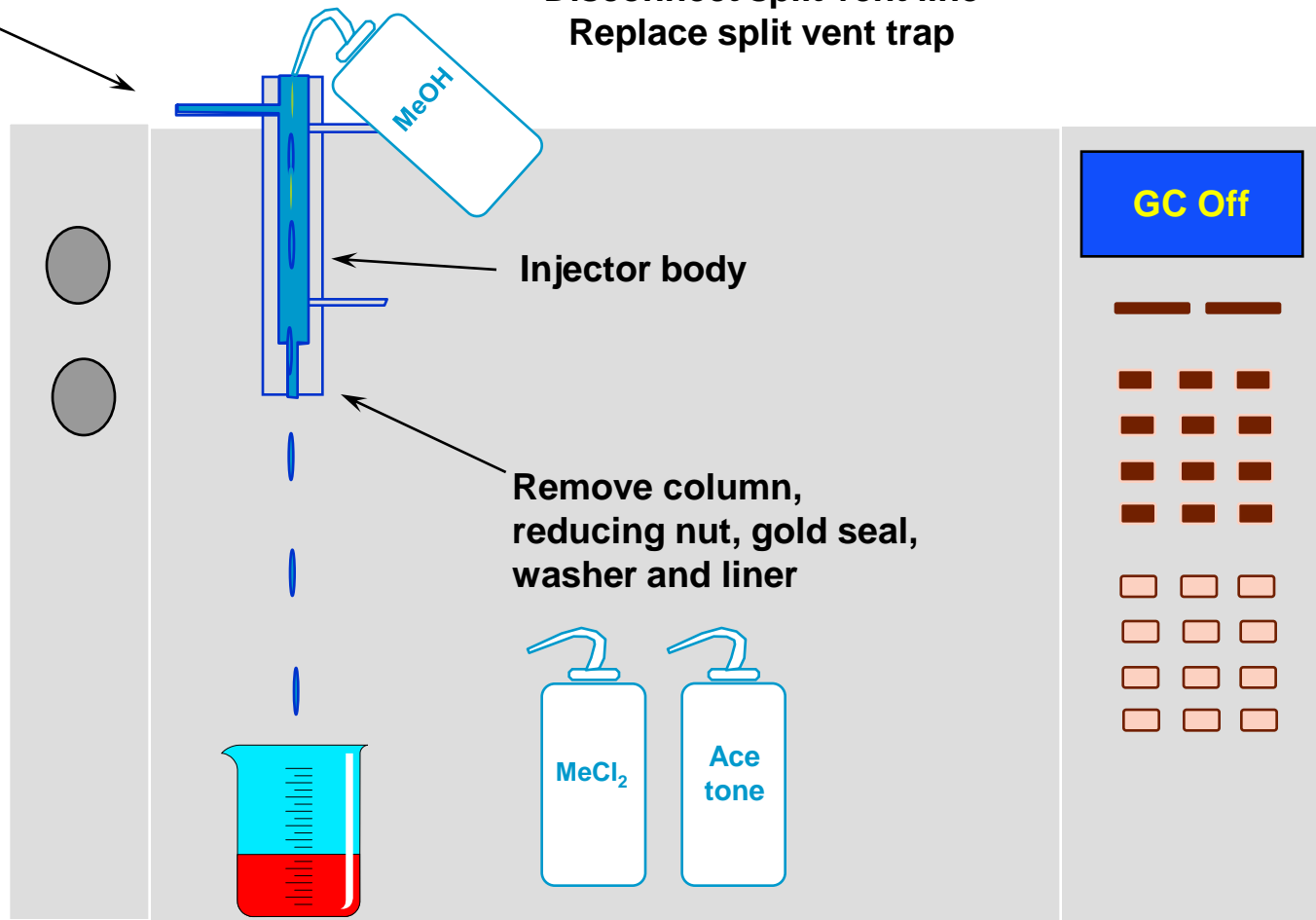
1. Bake out the column for no more than 2 hours.
2. Cut off 6"-1ft of the inlet end of the column.
3. Cut off more column. (repeat as necessary)



# Cleaning the Split/Splitless Injector

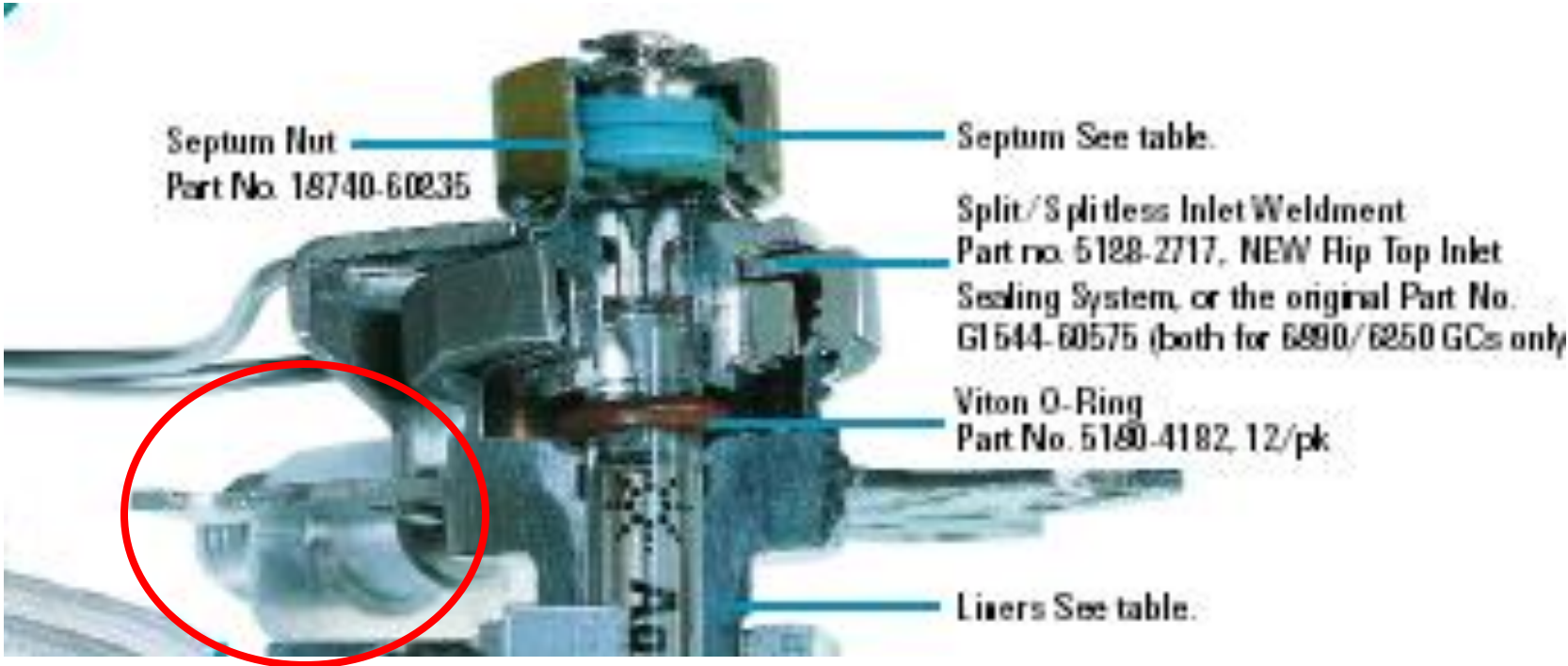
Carrier gas flow off

Disconnect split vent line  
Replace split vent trap



# Finding the Split Vent Trap

Follow the split vent line back to the EPC



# Finding the Split Vent Trap

Remove cover at Split Vent





# Replacing the Split Vent Trap

Finger Tight Knurled Nut



G1544-80530



# Be Careful When Doing Maintenance...

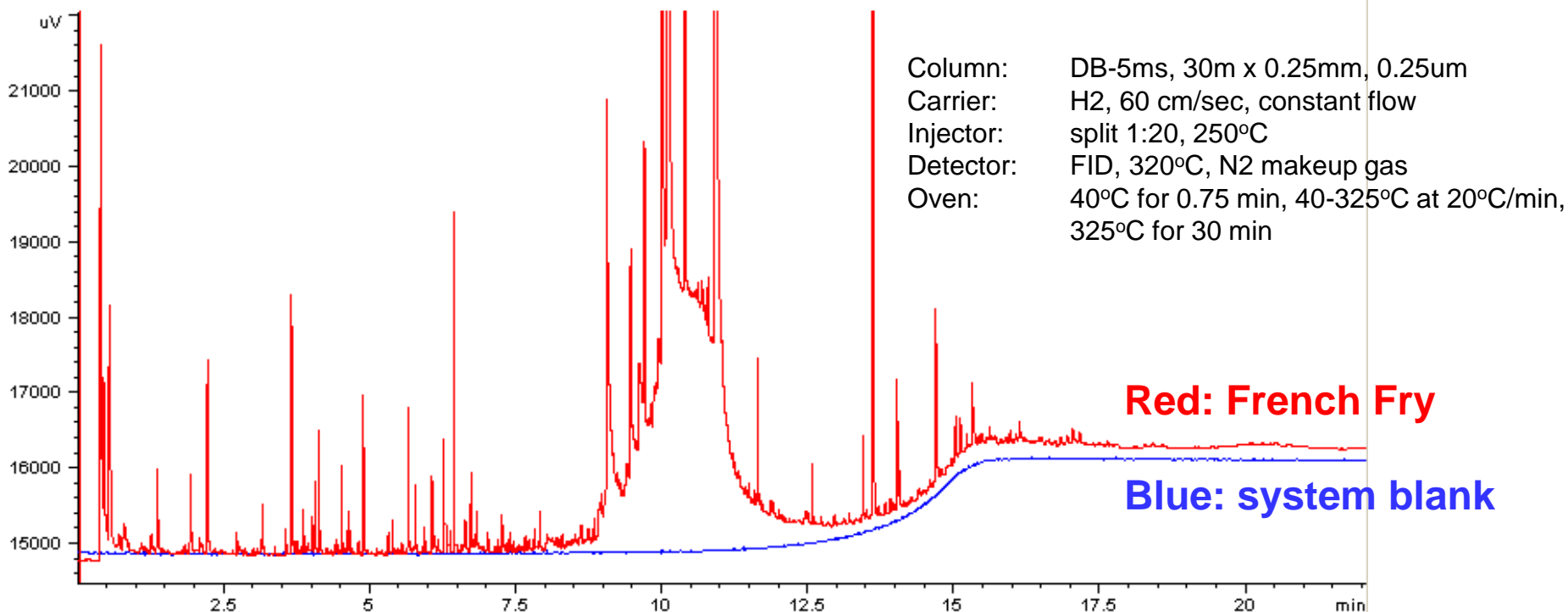
**You may be the CONTAMINATOR!**



# Contamination of system by residue on fingers during column installation

ADC1 B, ADC1 CHANNEL B (C:\JASON\BLANKC.D)

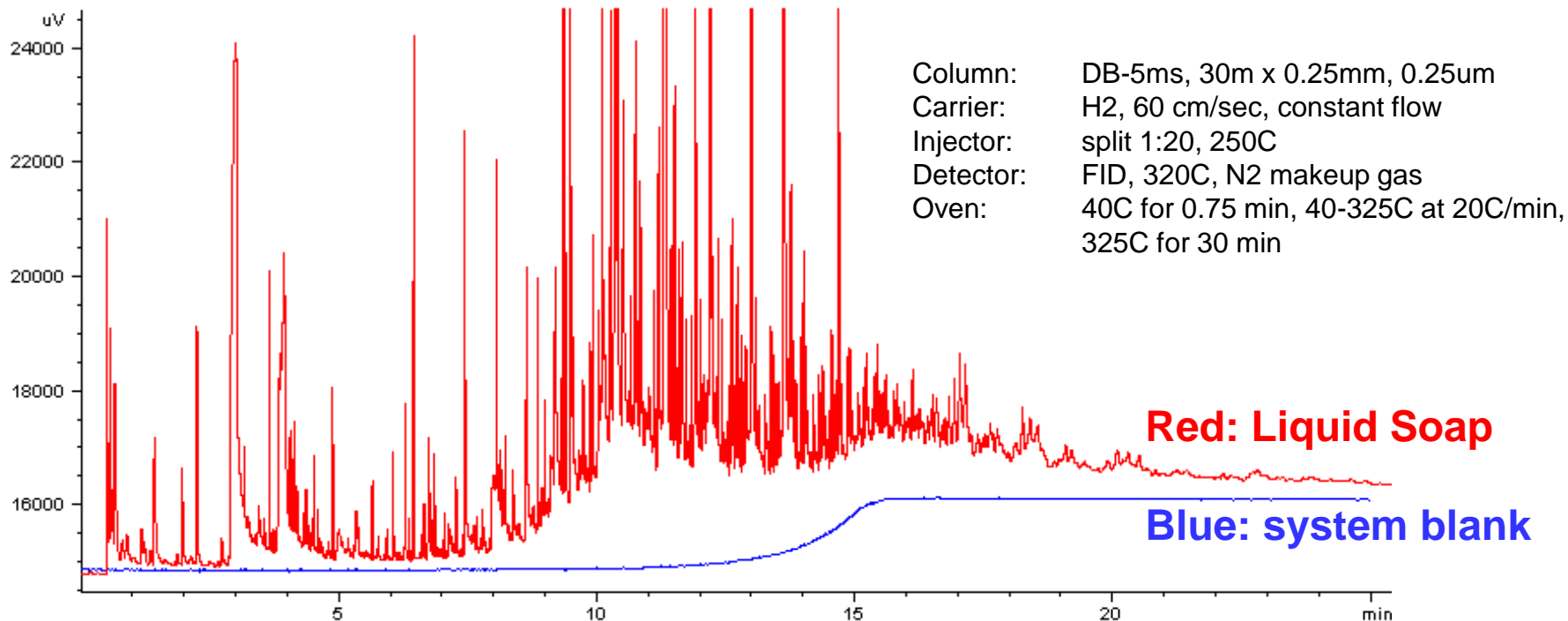
ADC1 B, ADC1 CHANNEL B (C:\JASON\GREASE.D)



## Procedure:

- (1) Held French fry for 5 seconds.
- (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 40°C.
- (6) Started oven temperature program as soon as oven reached 40°C.

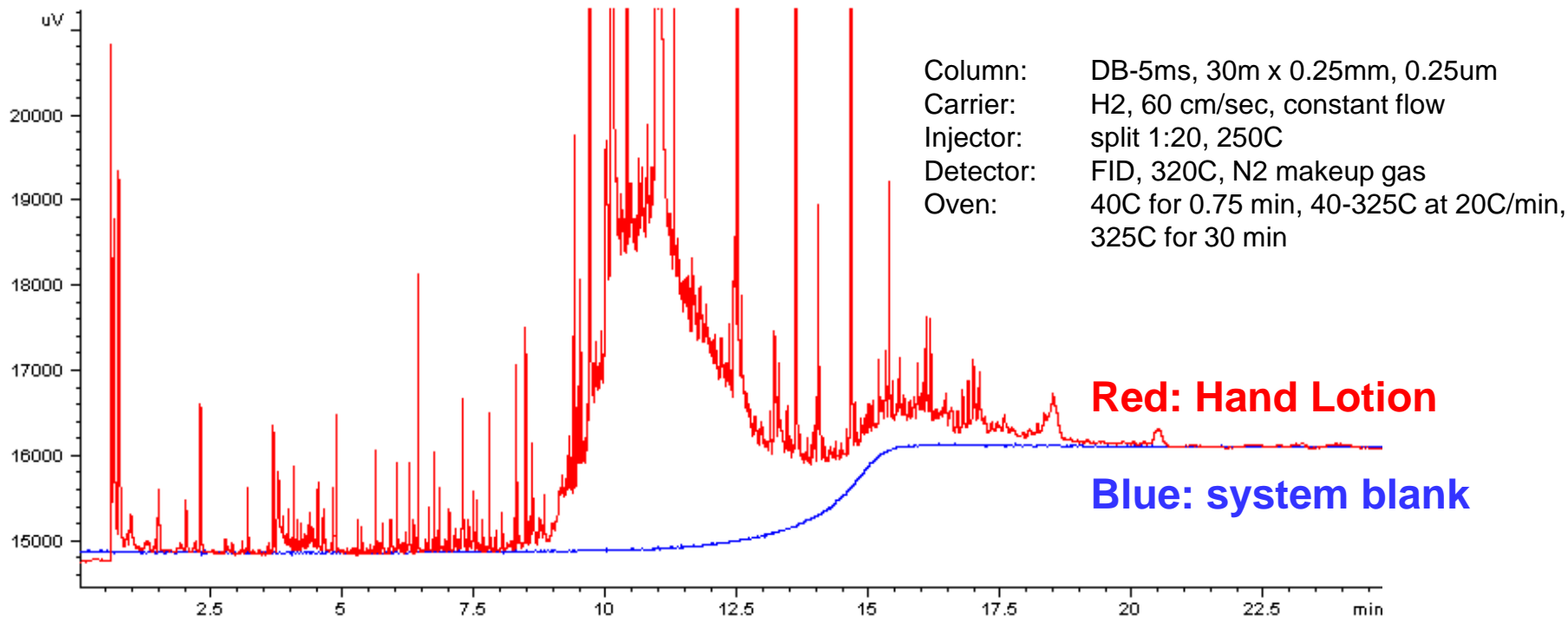
# Contamination from Liquid Soap



## Procedure:

- (1) One very small drop of liquid soap 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.

# Contamination from Hand Lotion

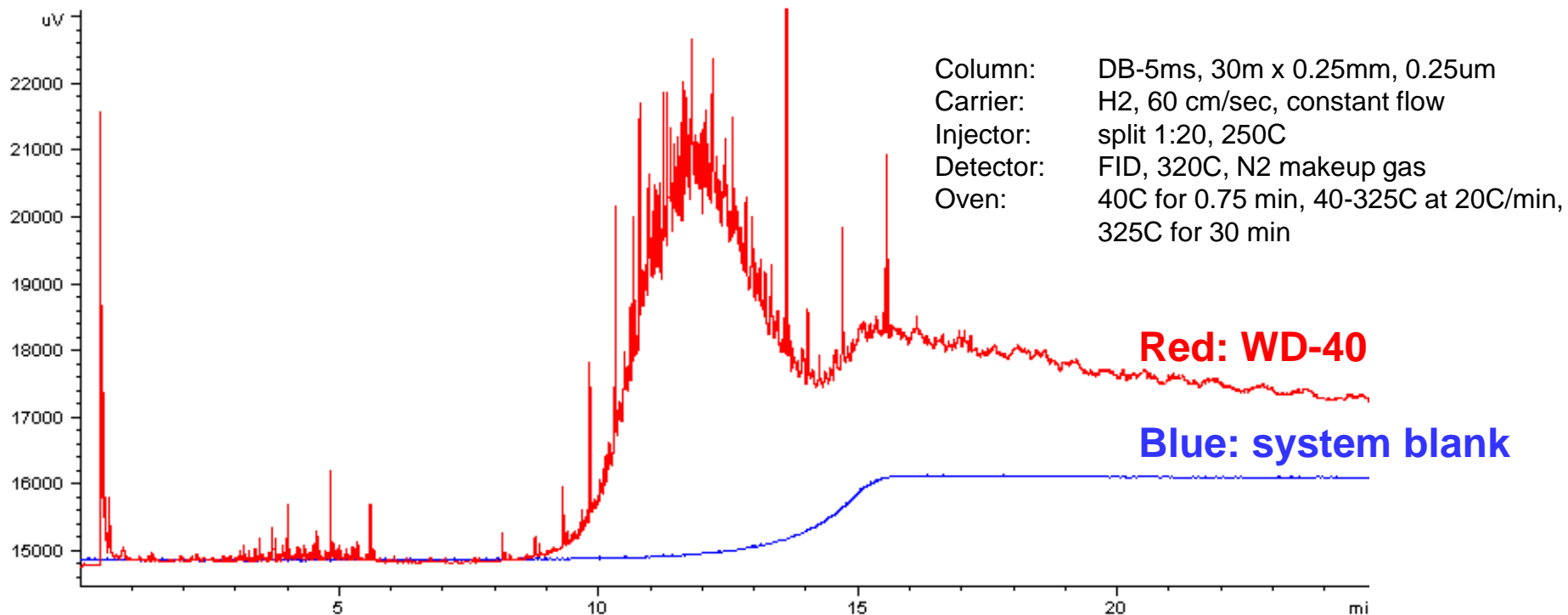


## Procedure:

- (1) One very small drop of hand lotion 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.



# Contamination from Lubricant



## Procedure:

- (1) One very small drop of WD-40 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.







# Conclusions for a Problem Free GC

- Start With High Quality Consumables (UI?)
- Never Have a Leak (no oxygen)
- Never Inject Anything (dirty or reactive)
- Don't Touch Anything
- Do Routine Inlet Maintenance Often

# TECHNICAL SUPPORT

**1-800-227-9770, #3**

**1-972-699-6423 (Daron)**

**1-866-912-6701 (toll free)**



**E-mail:  
Daron\_Decker@Agilent.com**