

# Improving Your Analysis by Treating Your Flow Path with Agilent's NEW Ultra Inert Technology

**Abby Folk GC Technical Support**

# GCMS Inert Flow Path

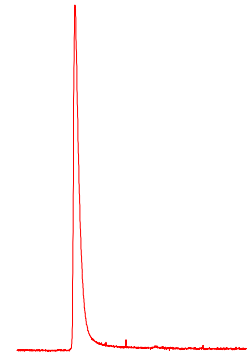
Agilent's inert flowpath components improve the results, efficiency and throughout in GC/MS labs doing trace analysis in Environmental, Food pesticide and Forensic toxicology testing labs.



# Agilent Inert Flow Path Technology

- Aim for improved *sensitivity* for trace analyses
- Are dealing with *troublesome, active* compounds
- Battle with *tailing* peaks
- Want *more reliable data* at low concentration levels
- Higher productivity with *less troubleshooting*
- Want *avoid wasting time* with re-runs

# Trace analysis in CAG labs



Why are the method detection limits so low?

- Our regulated world
- Scientific advancement
- Protecting our lives, environment and food supply

Why is it so challenging?

- Complex mixtures
- Active analytes
- System activity

What are the external challenges?

- Time
- Profit
- Skill level and training

# GC/MS Trace Analysis

Why do we focus on columns and supplies for improved trace analysis? Shouldn't a bigger, better, more sensitive GC/MS give you all the sensitivity you need?

It does! It just isn't enough anymore. For most analyses the gains from improving the chromatographic performance are also required to meet and maintain method requirements.

Consider this:

***What new 7890B features will have the greatest impact to your analyses?***

The **Inert Flowpath**, Improved GC detector specs, better GC/MS communications. All the above!



# Laboratory challenges:

“Critical” compounds?

Tailing peak shape? (specific compounds?)

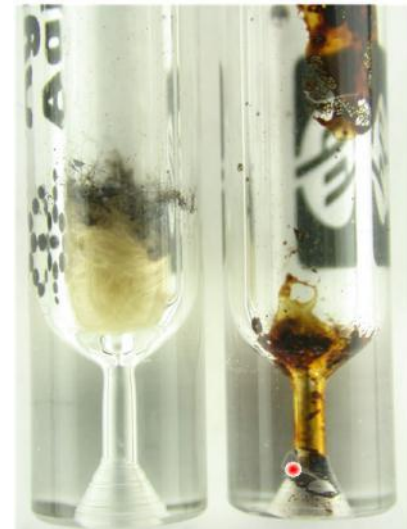
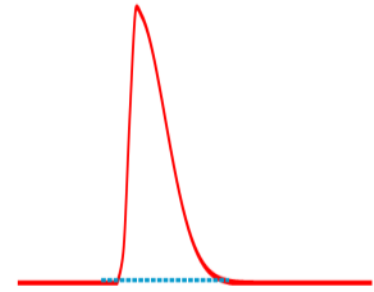
Difficulty detecting lower limits?

Breakdown?

Gradual loss of response?

Matrix influence?

Short liner lifetimes?



**The Technical Argument is Very Compelling**

# How can Agilent's Technology help?

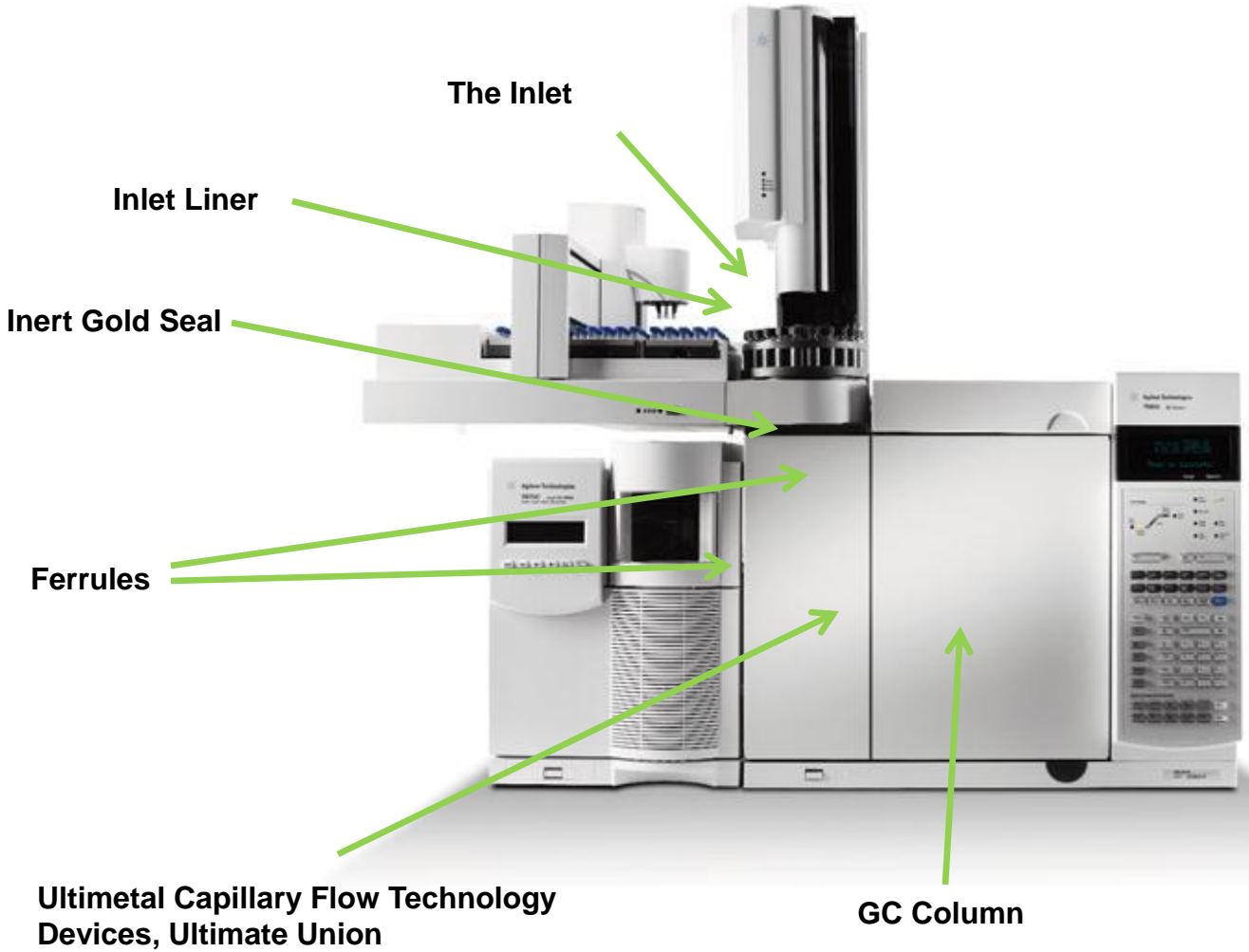
Agilent's approach to improving trace GC/MS lab performance?

- Failures from contamination
- Solving bleed problems
- “Active” solutes and “active” surfaces



Where are the active surfaces in the flowpath? Which are heated?

# GC surfaces that touch the sample





# Thirty years of R&D focused on surface deactivation

Two unique chemistries were developed to treat the surfaces in a GC flowpath. Agilent trade secrets!

## UltiMetal Plus

- Inorganic vapor deposition in Middelburg
- CFT device
- Ultimate union
- Flexible Metal ferrule
- Inlet welding
- Detector parts
- GC Tubing



## Ultra Inert

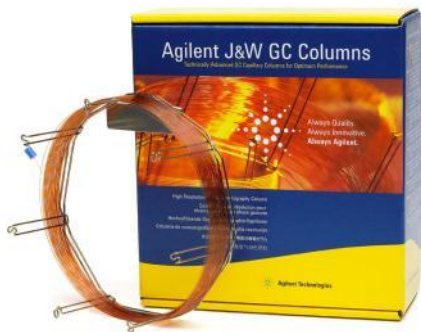
- Organic vapor deposition in Folsom
- UI GC columns:
  - Arylene/phenyl
  - Phenyl/cyanopropyl
- Ultra Inert liners
- Ultra Inert Gold seal

# Which Products are the Focus of this Solution?

All supporting the GC/MS performance

## Columns

- J&W Ultra Inert GC/MS columns



## Sample Preparation Products

- Bond Elut SPE (Enviro, Forensic Tox)
- QuEChERS (Food Pesticides)

## Supplies

- Ultra Inert Inlet Liners
- Flexible Metal Ferrules
- Deactivated Inlet weldment
- Ultra Inert Gold Seal
- Gas Clean Filters
- GC/MS Quiet Cover



# Activity GC Flow Path Components that Influence Compound Response

- |                        |                               |
|------------------------|-------------------------------|
| 1. GC column           | Largest surface area          |
| 2. Inlet liner         | Continuously high temperature |
| 3. Ferrules            | Small surface area, important |
| 4. Gold seal           | Gold is not inert             |
| 5. Unions, CFT devices | Active metal base             |
| 6. Inlet weldment      | Metal activity (backflash)    |
| 7. Tubing              | Backflash, diffusion          |

# Benefits of Agilent Inert Flowpath

| An Inert Flowpath means          | →   | →  |   |
|----------------------------------|---|--|---|
| <b>Sharper peaks</b>             | <b>More sensitivity<br/>Better resolution</b>   | <b>Stays calibrated<br/>Higher quality data,<br/>easier analysis</b> | <b>Saves time<br/>Confidence in results</b> |
| <b>Staying calibrated longer</b> | <b>Less maintenance and less re-runs</b>        | <b>Increased time analyzing real samples</b>                         | <b>Saves time and Improves throughput</b>   |
| <b>Less false negatives</b>      | <b>Less compounds adsorbed by the system</b>    | <b>Higher data quality</b>   | <b>Confidence in results</b>                |
| <b>Cleaner components</b>        | <b>Faster maintenance<br/>Less interference</b> | <b>Easier interpretation<br/>Improved data quality</b>               | <b>Saves time<br/>Confidence in results</b> |

# Inert Flowpath Story: What Agilent brings

1. Not one, but two proprietary Chemistries to deactivate surfaces and sustain ultimate inertness
2. Unique consumable products that work better and are designed to keep the GC and GC/MS delivering ultimate performance easier and longer.
3. Packaging that maintains cleanliness while in the drawer and during installation and supports fast error free installation.
4. Agilent brings products that make the GC/MS lab a nice place to work.
5. Agilent brings purifiers to keep O<sub>2</sub> out of the system and maintain inertness and performance longer
6. Finally Agilent brings sample prep technologies that keep the system clean and delivers better results.
7. Everything from Agilent

# Agilent Inert Flow Solution

Ultimetal Plus Inlet Weldment, Shell and Transfer Lines



Ultra Inert Inlet Liner



Ultimetal Plus Ferrules



Ultimetal Capillary Flow Technology Devices, Ultimate Union

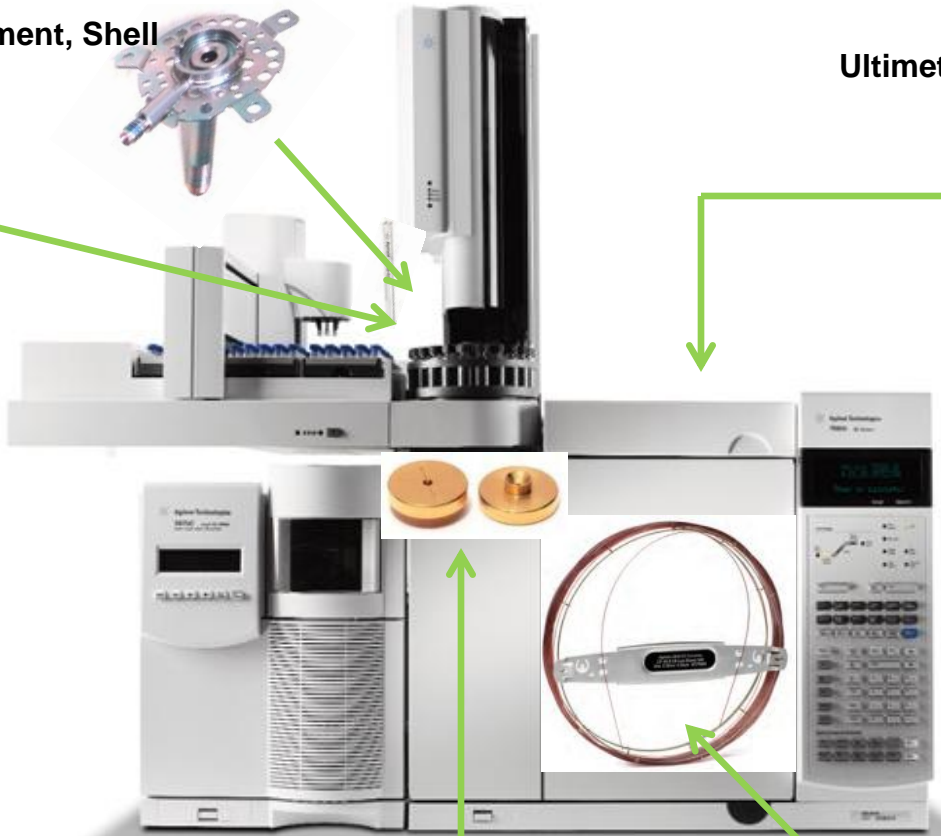
Ultimetal Plus- TCD, FPD, NPD/FID Jets



Ultra Inert Gold Seal

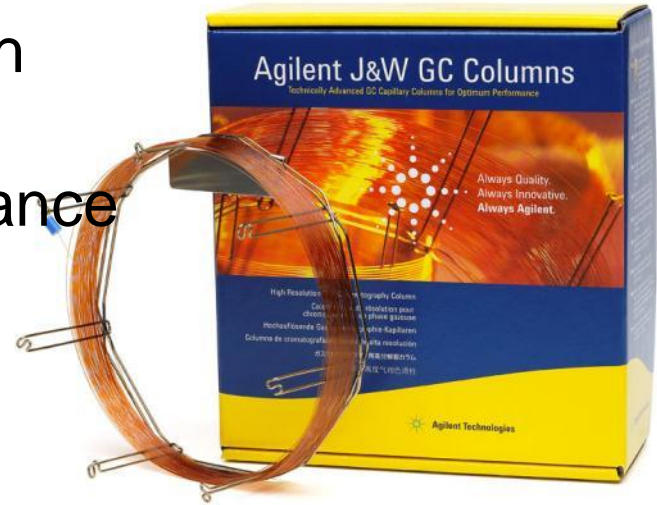


Ultra Inert GC Column

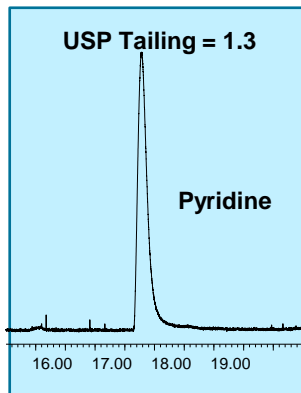


# Current IFP Product: Ultra Inert GC Columns

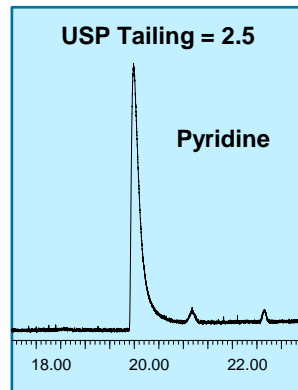
- Largest surface area in the flow path
- Improved peak shape at low levels
- Reliable, verified inertness performance
- DB, HP selectivity
- Expanding offering



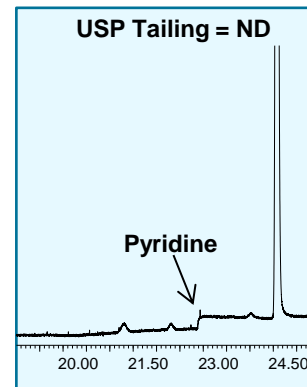
**Agilent 624 UI**



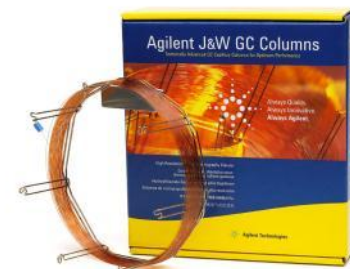
**Competitor 624**



**Cheap 624**



# UI GC Columns: The Right Chemistry

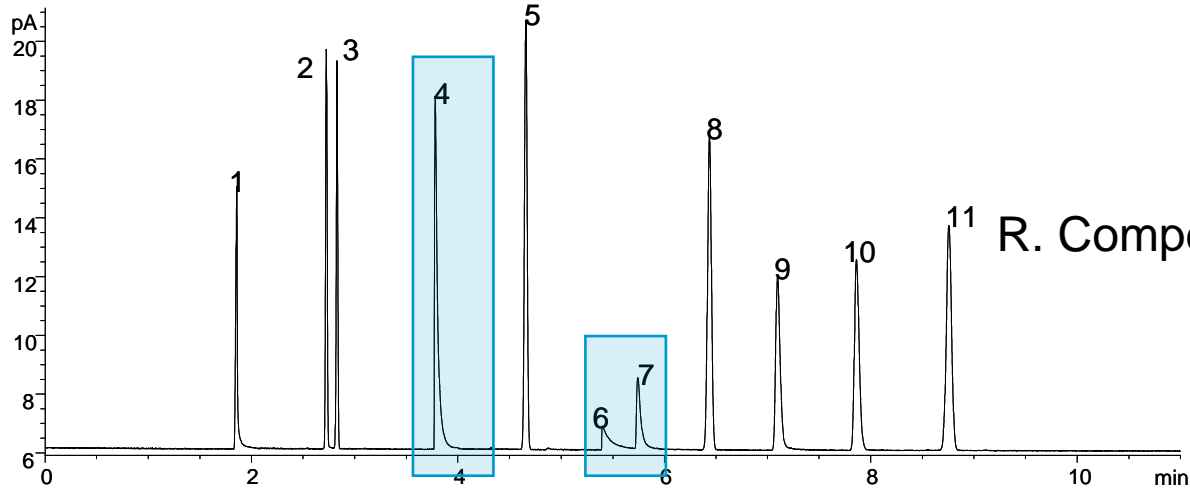


| GC Column Phase         | Characteristic                       | Application  | Faster analysis configurations |
|-------------------------|--------------------------------------|--|--------------------------------|
| DB-1MS UI,<br>HP-1MS UI | General low polarity                 | General separations,<br>hydrocarbons                 | yes                            |
| DB-5MS UI,<br>HP-5MS UI | General low polarity                 | first choice for trace<br>applications               | Yes                            |
| DB-35MS UI              | Mid polar                            | excellent for pesticide analysis,<br>drug analysis   | Yes                            |
| DB-624MS UI             | Mid polar                            | choice for volatiles and<br>solvents                 | Yes                            |
| DB-UI 8270D             | Application specific<br>low polarity | Specific for semi volatile<br>environmental analysis | yes                            |

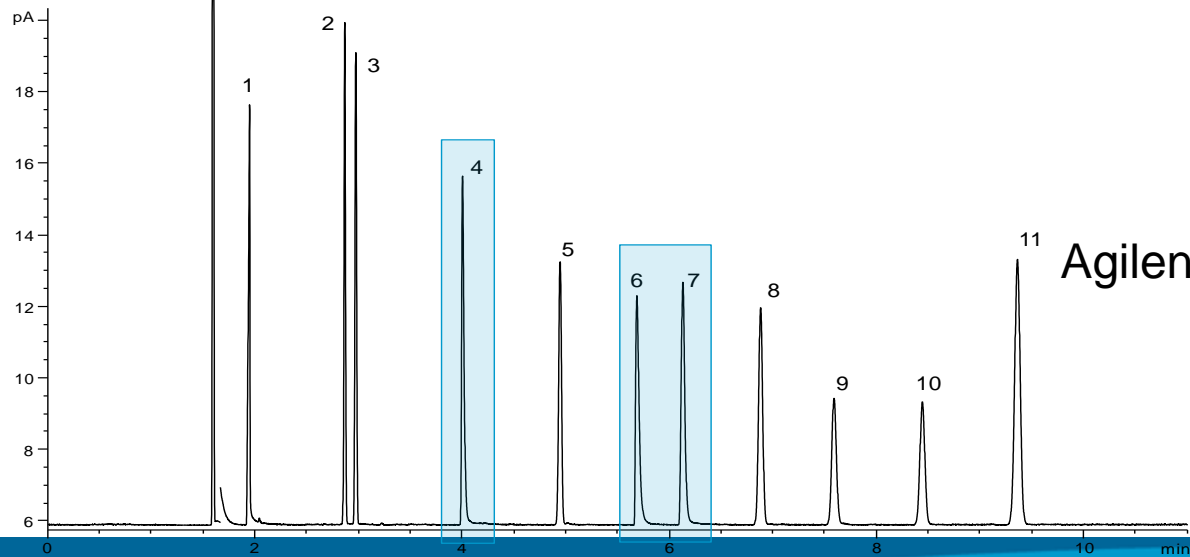


# DB-5ms Ultra Inert

- Ultra Inert deactivation technology
- Demanding testing to ensure performance



R. Competitor Column

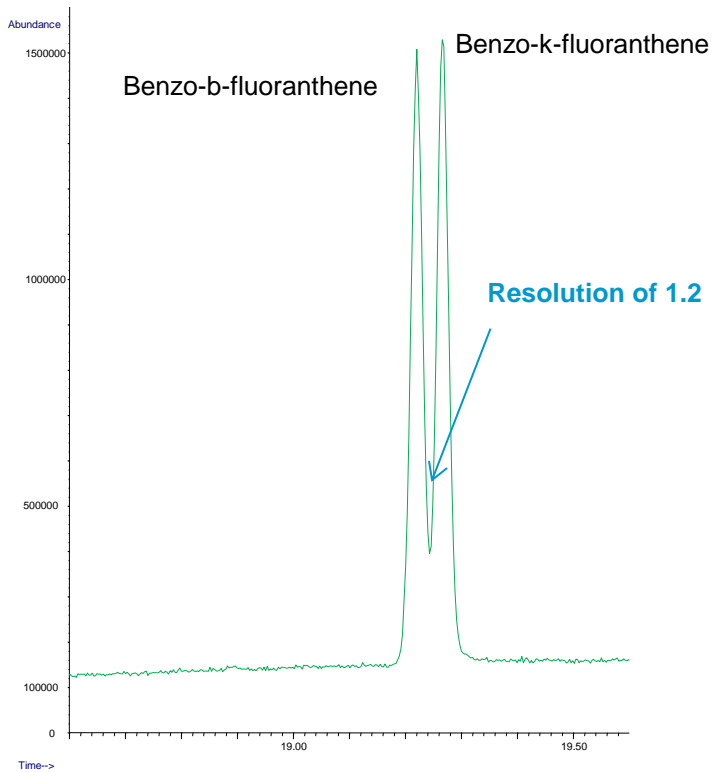


Agilent Column

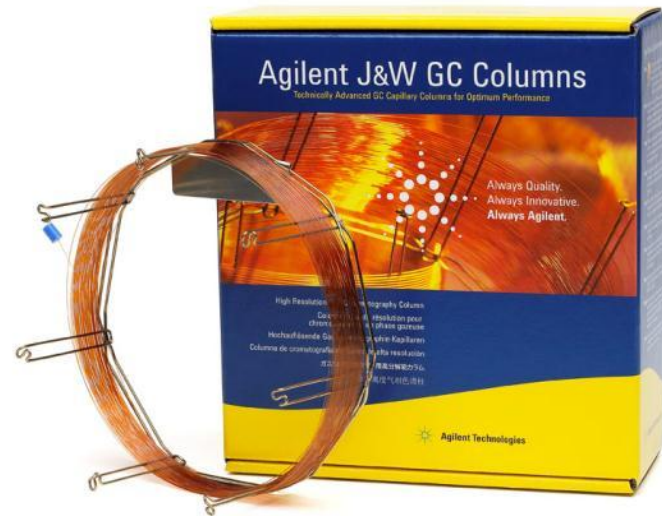
1. 1-Propionic acid
2. 1-Octene
3. n-Octane
4. 4-Picoline
5. n-Nonane
6. Trimethyl phosphate
7. 1,2-Pentanediol
8. n-Propylbenzene
9. 1-Heptanol
10. 3-Octanone
11. n-Decane

# DB-UI 8270D: Resolution of benzo-b & k fluoranthene isomers

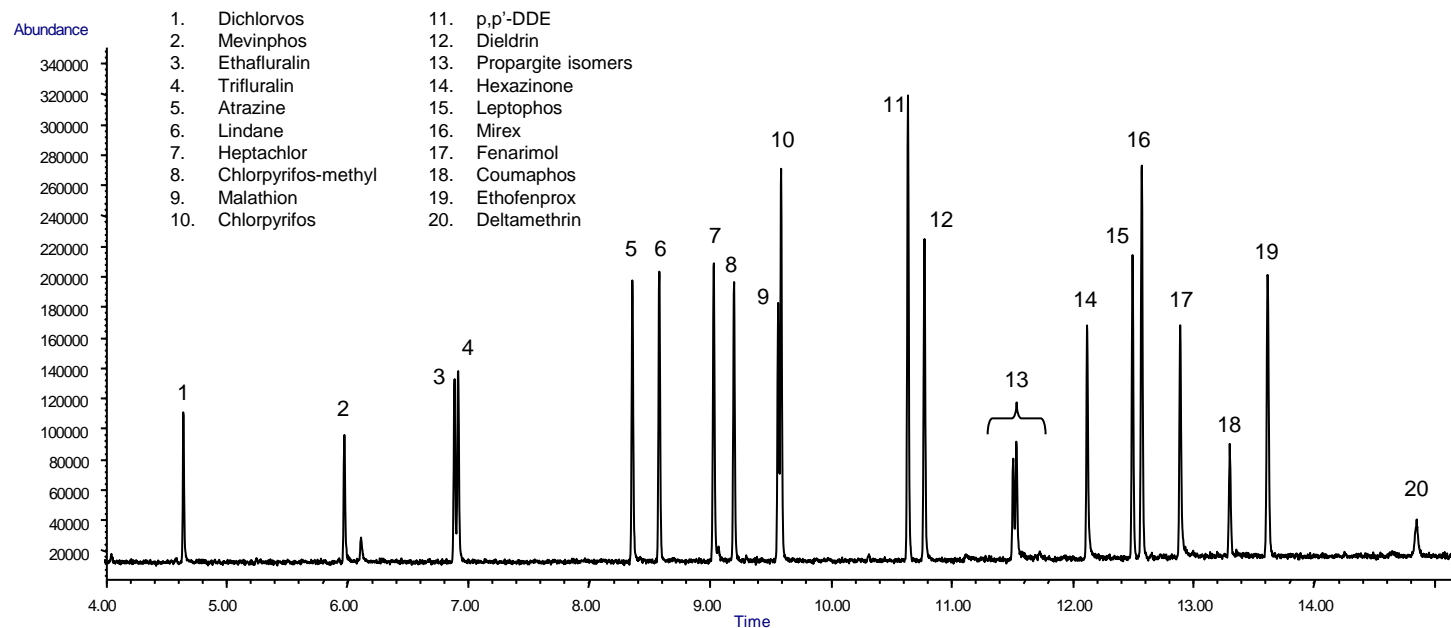
## Positional isomers



- Tested to ensure key environmental separations
- Excellent for “active” pesticide compounds



# Separation of Pesticide Analyzer Checkout Solution: DB-35ms UI



## GC/MS Chromatogram of 1 ng on column loading of pesticides

Sample: 1 µg/mL Pesticide Analyzer Checkout solution (Agilent part #5190-0468)

GC/MSD: 7890/5975B with purged ultimate union

Column: **DB-35ms UI 20 m 0.18 mm 0.18 µm (Agilent part #121-3822UI)**

MMInlet: 1µL, splitless, 50°C (0.02 min), 400°C/min to 250°C  
 purge flow 50mL/min at 1.5 min  
 gas saver 30mL/min at 2.25 min

Carrier: Helium, 1.3 mL/min cnst flow

Oven: 50°C (1.3 min) to 135°C (50°C/min),  
 15°C/min to 200°C, 20°C/min to 310°C (2.35 min)

Restrictor: 0.7m x 0.15mm ID Deactivated capillary column tubing

PCM 1: 3.8 psi constant pressure

Backflush: Post column, Postrun backflush 5 min @310°C  
 70 psi Backflush Pressure

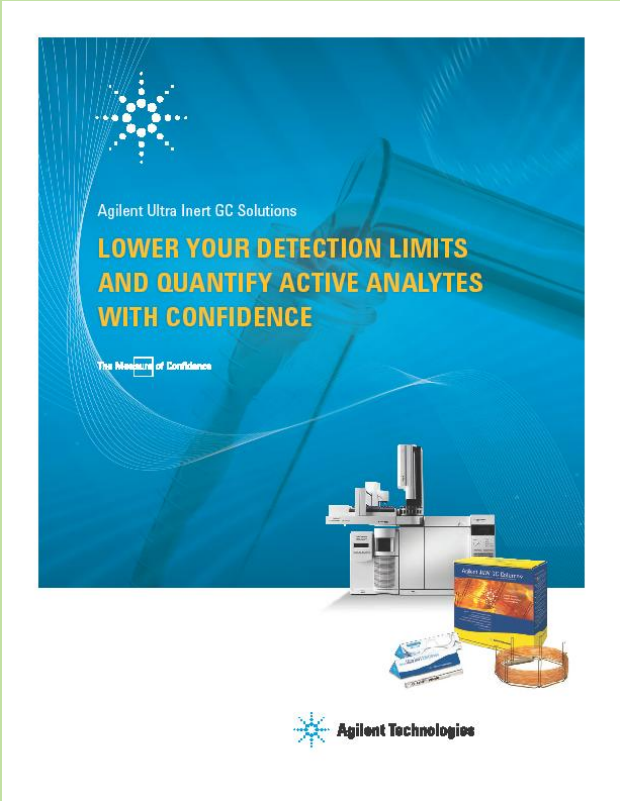
2 psi Inlet Pressure during Backflush

MSD: Transfer line 320°C Source 320°C Quad 150°C

Application note 5990-6595EN

# Ultra Inert and Environmental GC Column Brochures

## Ultra Inert GC columns

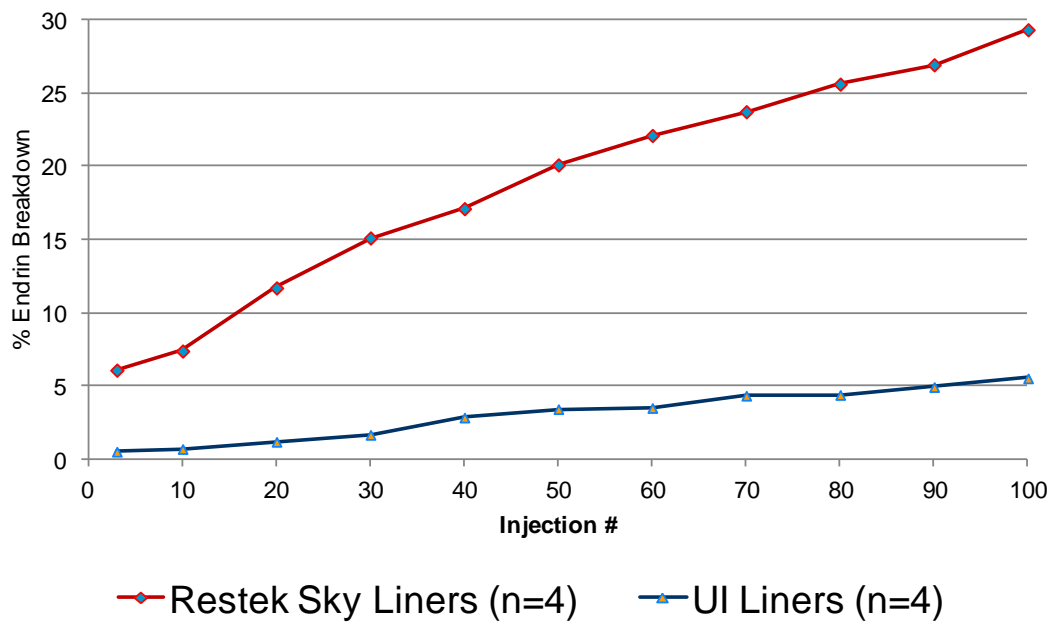


## Environmental columns



# 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



# Agilent Assurance

UI liner Lot QC with demanding test probes

(dinitrophenol)

Assurance of consistent performance

Label for p/n, batch and lot testing

Traceability

Deactivation Lot number is on Certificate

- Liner lot number (and part number) etched on glass

## *Certificate of Performance*

**5190-2293 Ultra Inert Liner**

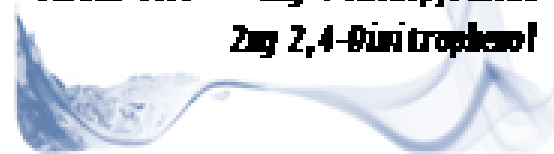
Splittless, Sngl taper, Glass Wool

Liner Body Lot: 0023A

Deactivation Lot: B11002

**Tested for: 2ug 4-Aminopyridine**

**2ug 2,4-Dinitrophenol**



# Packaging, Ease and Productivity



**Individual liner**



**Convenient 5 pack in Touchless package**



**CrossLab 5 pack in blister (no o-ring)**



**25 pack in Touchless Dispenser  
High throughput**



**100 bulk pack in blister (no o-ring)  
High throughput**

# Ferrules



Vespel



Vespel/graphite



Graphite



Siltite

| Composition     | Re-use  | Max T | Use       | Limitation                    |
|-----------------|---------|-------|-----------|-------------------------------|
| Vespel          | yes     | 280   | Easy seal | Leaks after T cycle, iso only |
| Vespel/graphite | limited | 350   | MS        | Retighten after T cycle       |
| Graphite        | yes     | 450   | Not MS    | Contamination, leakages       |
| Siltite         | yes     | 450   | MS, CFT   | Column breakage               |



“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



Dial packaging



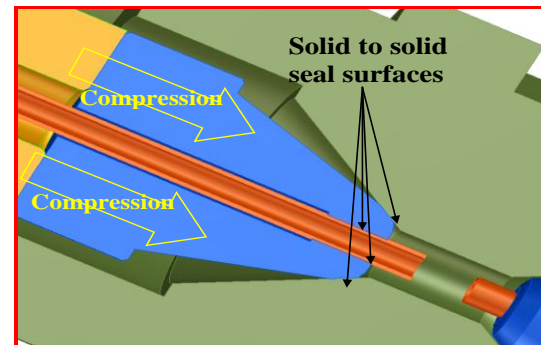
# Metal (Siltite) Ferrules in Agilent Systems

- Fastest growing family of GC ferrules
- Connections with Capillary Flow Technique devices
- Secure leak free connections LTM columns
- GC/MS transfer lines

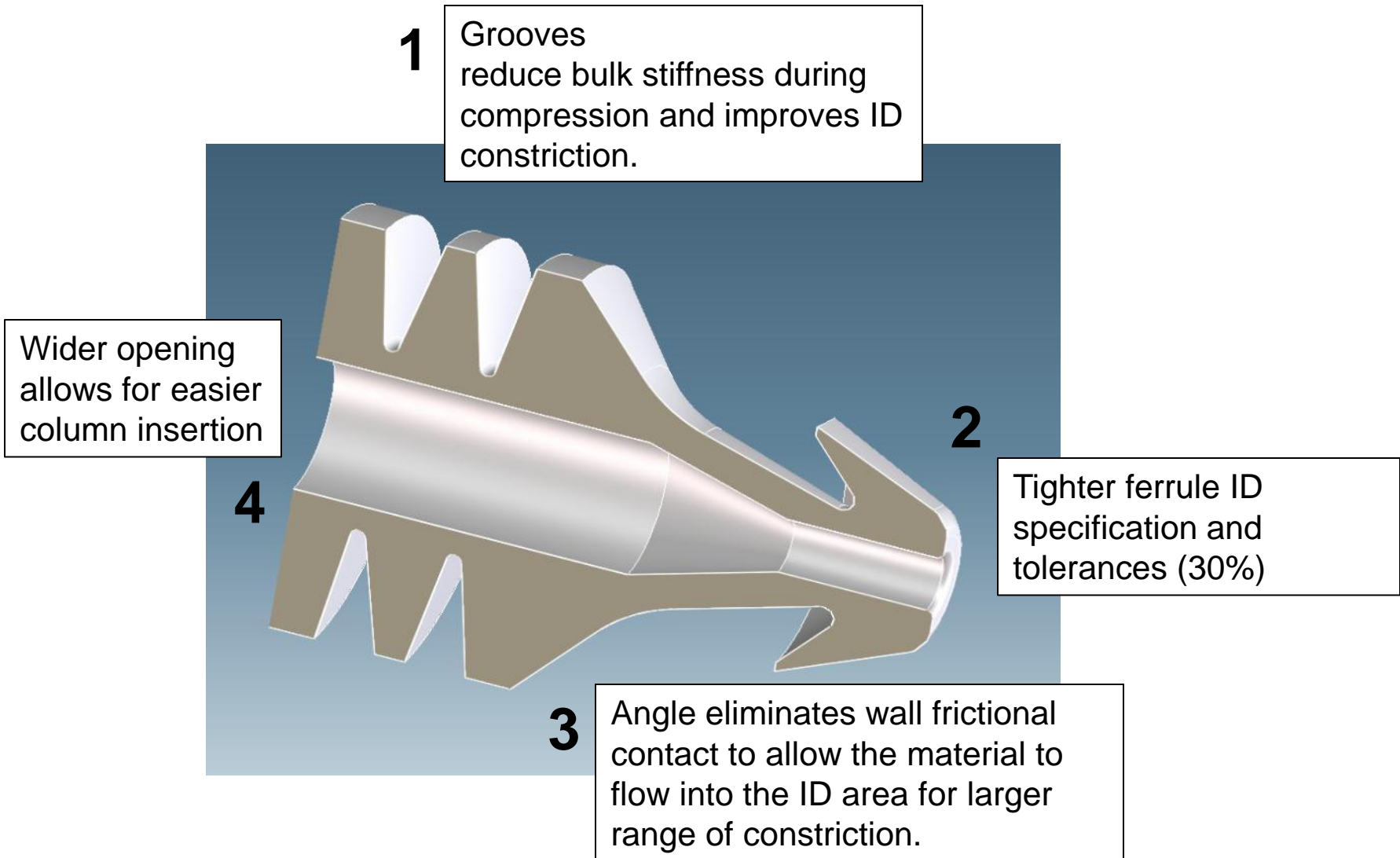
**We experience high failure rate due to non-fitting ferrules for LTM (Low Thermal Mass modules)**

## ***Computer aided theoretical modeling of Siltite design***

- ***Design flaw identified***
- ***ID spec and tolerance recommendations made to supplier but was considered too costly***



# Flexible Metal Ferrule Design Features



# Compare current vs new Agilent ferrule

## Current Ferrule

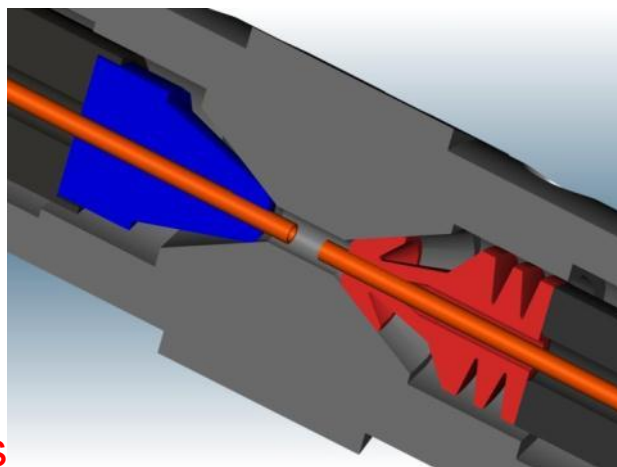
Stiff, prone to cause  
**damage to column  
or fitting**

Small ID compression  
(40 to 60um) – **leaks**

Tolerances poorly  
controlled

Quality issues

- mixed inventory
- not-fitting
- column crushing
- leaking



## Agilent

### Flexi-Metal Ferrule

Computer aided Design  
Finite Element Analysis

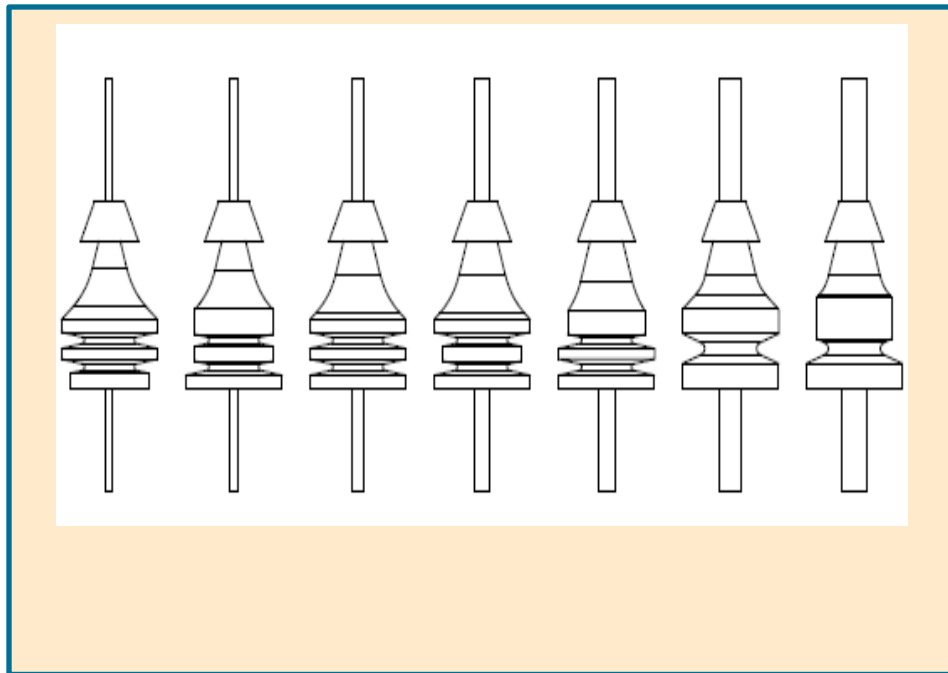
More flexible

Less column damage

Large range of  
ID compression  
(100 to 120um) – less leaks

Agilent design alleviates current  
quality issues

# More Added Value



Family of ferrules for range columns  
Folsom and Middelburg including  
UltiMetal columns, and a no hole plug

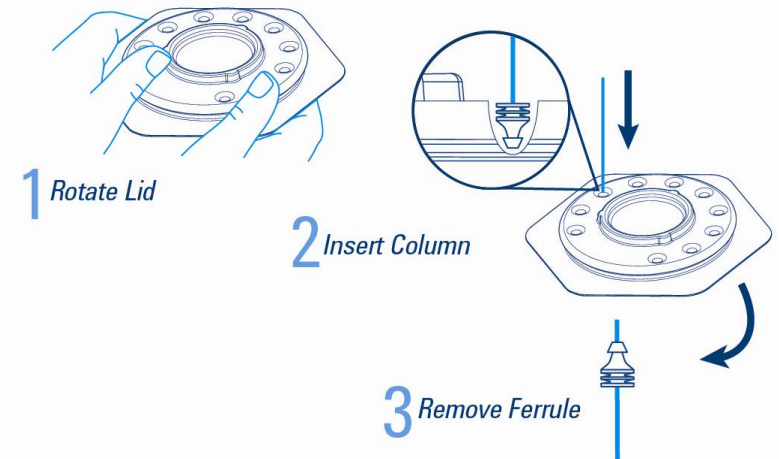
New UltiMetal Plus surface treatment  
provides excellent ferrule inertness  
exceeding Siltite performance

Each ID has its own unique design  
Ease of recognition, no mix-ups

Agilent Intellectual Property:  
Utility patent & Design patent  
applications  
Exclusive Agilent product

# New Touchless Dial Packaging

- Easy column insertion
- No lost ferrules
- No contamination risks

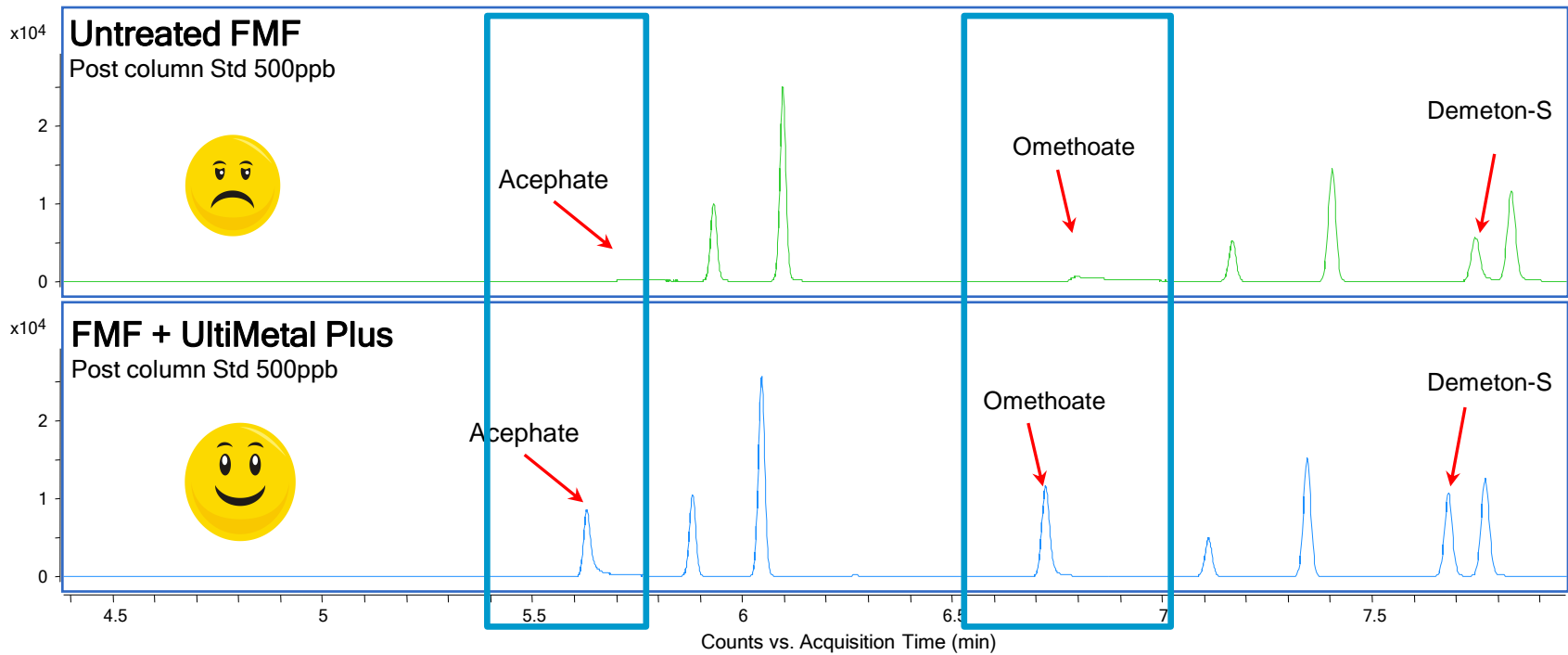


Clear installation instructions

# UltiMetal Plus on Flexible Metal Ferrule

## Is deactivation needed for such small surface?

Enlarged chromatograms for sensitive pesticides



# Flexible Metal Ferrules Positioning

Substitute for Siltite ferrules in

- ❑ All CFT devices  
QuickSwap  
Backflush
- ❑ Ultimate union
- ❑ LTM



“Long” ferrule applications

*Not optimized for regular Agilent inlet / detector connections  
**but possible!** Graphite/vespel ferrules allow more  
economical column trimming and re-tightning*

“Short” ferrules

# Flexible Metal Ferrules: What are Customers Saying?

*“We have tested them in our facilities. Can you also give me the part numbers for the 0.5 mm and 0.8 mm as well? We are planning to implement the technology swiftly to replace the Silitite ferrules.”*

*Lab Director at a large chemical company*





# Summary

## Agilent Flexible Metal Ferrule

Family of novel, **patentable design** capillary column metal ferrules  
Capillary Flow Technology fittings  
Agilent GC inlets and detectors  
MS interface.

- Reduces risk of over tightening and breaking column
- Leak free seal after repeated temperature cycles
- UltiMetal Plus chemistry prevents loss of active analytes

### Ease of Use

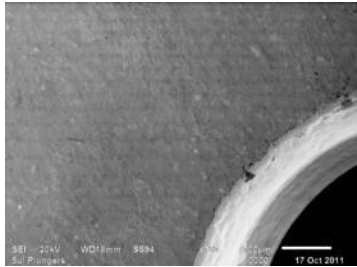
- Easy assembly and tighten to give a leak free seal (“forgiving”)
- Ferrule ID identification by design
- Quick installation due to design & packaging



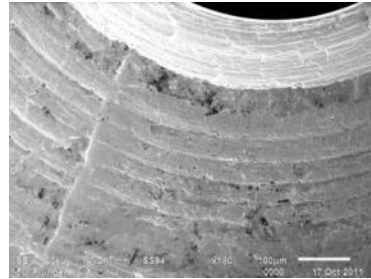
*...and there's a video!*

# 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



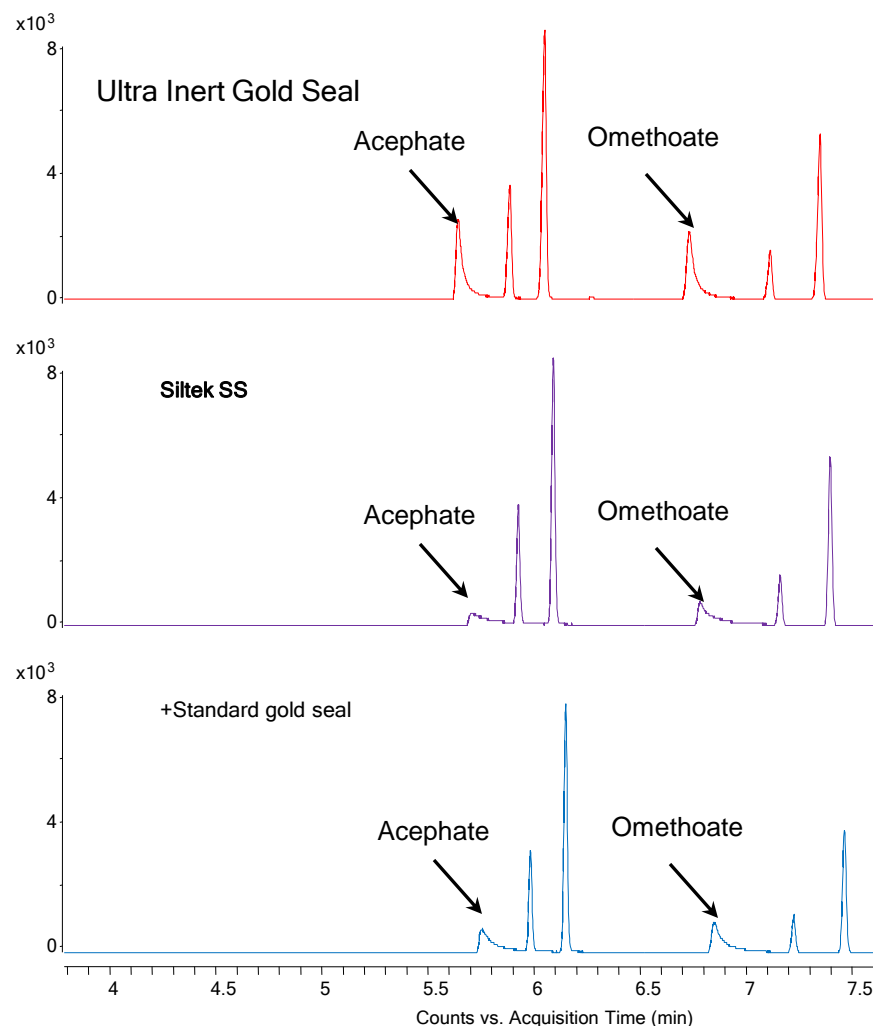
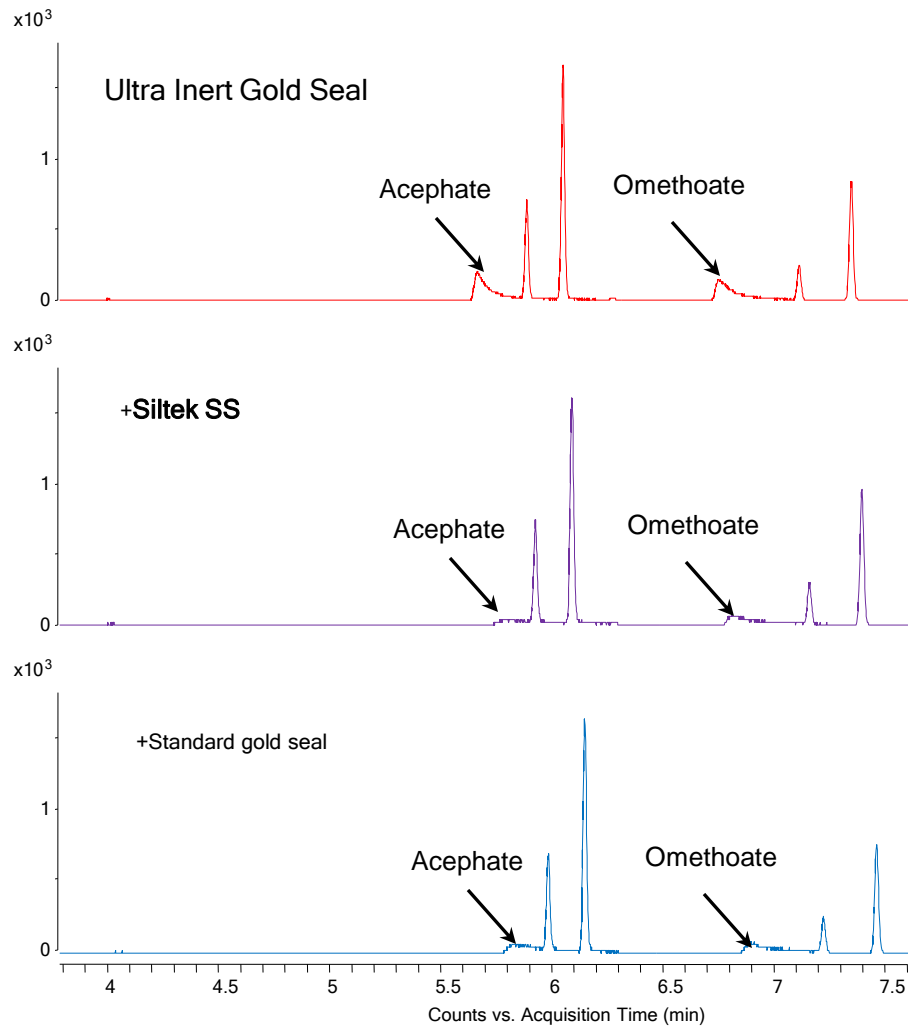
Competitor's  
machined seal

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

# Results – Peak Shape Comparison for Sensitive OPs ( Std GS vs New UIGS vs Siltek SS)

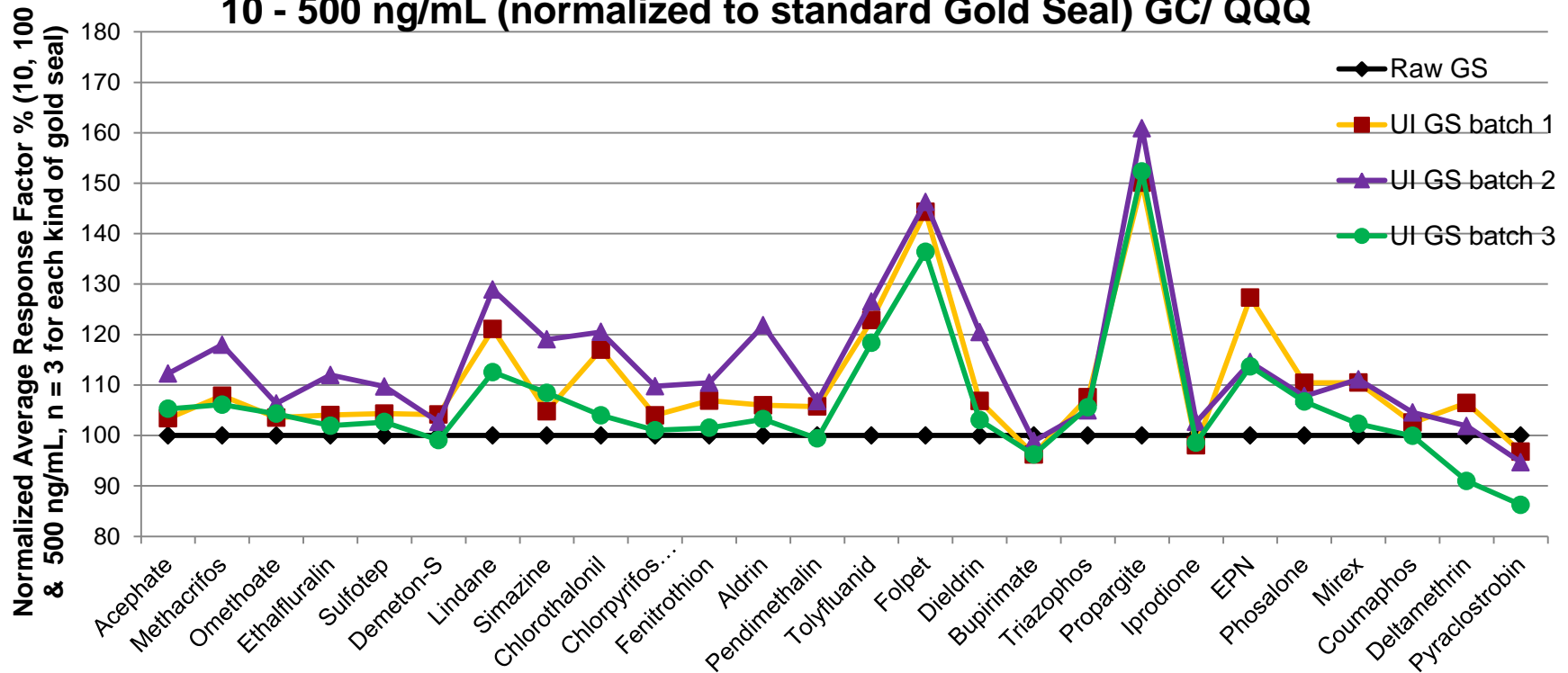
100 ppb STD

500 ppb STD



# Ultra Inert Gold Seal - Pesticides Test (analytes responses)

Average Response Factor standard vs Ultra Inert Gold Seals  
10 - 500 ng/mL (normalized to standard Gold Seal) GC/ QQQ



- Pesticides responses (average response factor over 10 - 500 ng/mL) by using UI gold seal were higher (10-15%) than those by using Standard gold seal;
- 30-50% higher responses were achieved for several pesticides by using UI gold seal; and only two of 26 pesticides gave out a little bit lower responses, but the results may be linked to system performance

# New Product: Agilent Inert Inlet

***UltiMetal Plus*** treatment  
creates inert surface 7890 inlet weldment & shell

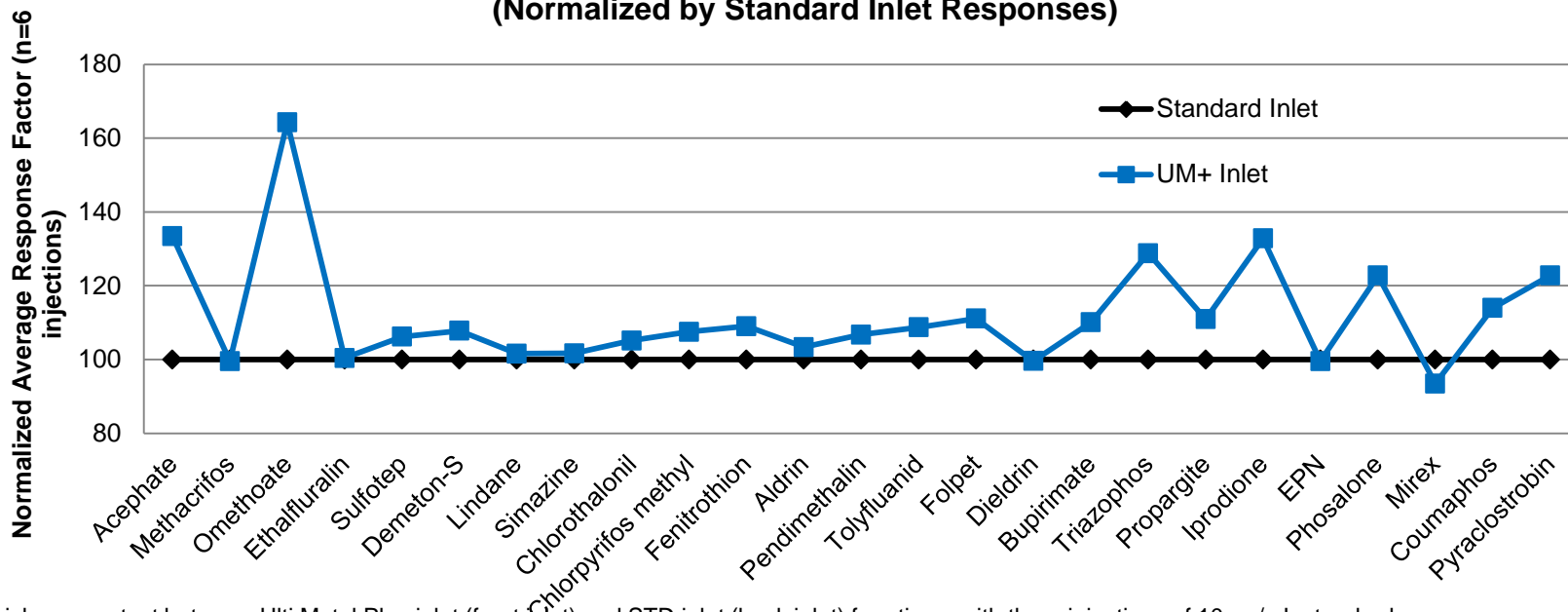
- Limit adsorption / degradation active analytes in contact hot metal parts.
- Target trace GC/MS and GC-ECD pesticide analysis
- Combine with Agilent's UI Liners, UI gold seals, UI GC columns
- Inert Flowpath option on the 7890B (#114 ) or upgrade existing 7890's in the field



***Agilent's proven  
proprietary UltiMetal Plus  
surface treatment***

# Inlet Weldment – Analytes Response Comparison

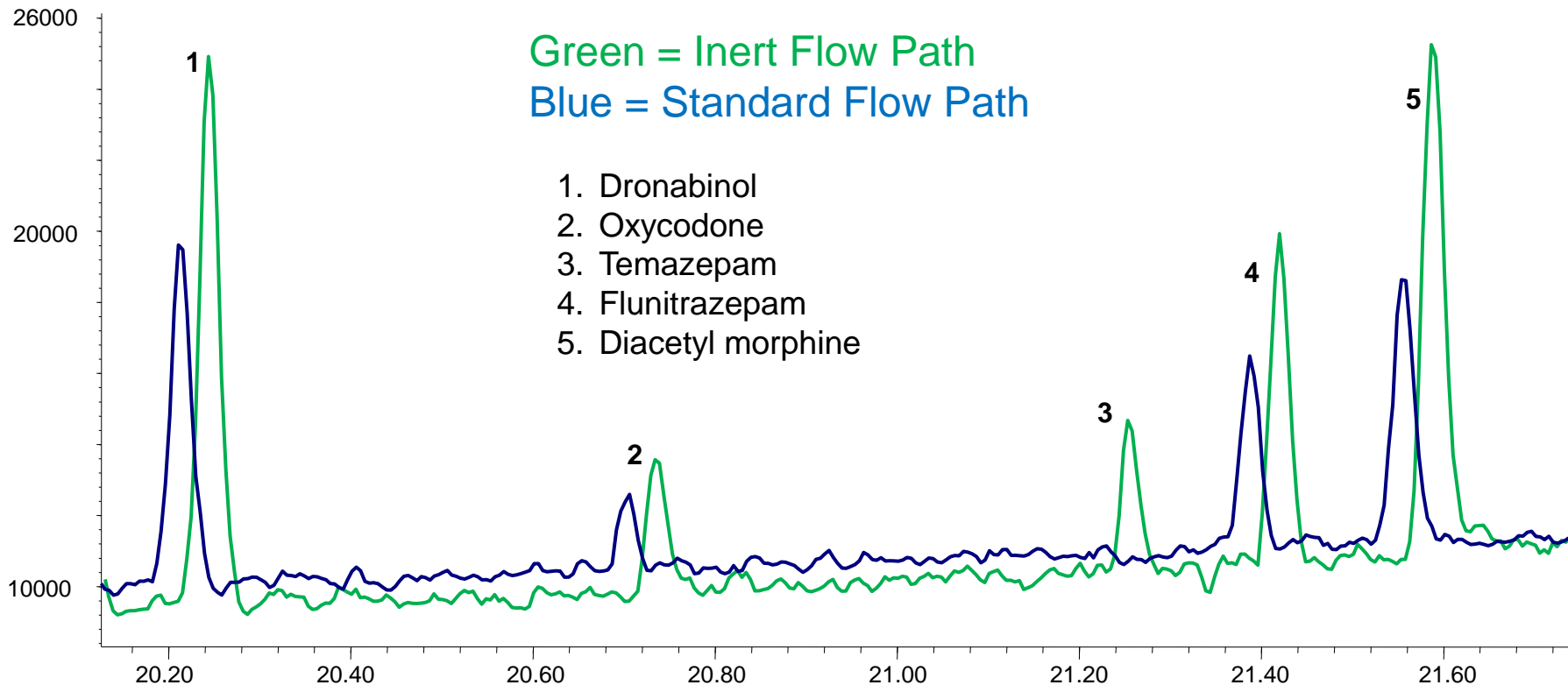
10 ng/mL Average Response: UM+ Inlet vs STD Inlet  
(Normalized by Standard Inlet Responses)



- Quick swap test between Ulti Metal Plus inlet (front inlet) and STD inlet (back inlet) four times with three injections of 10 ng/mL standards
- Column switched in between without trimming, and column was installed purposely with shorter protrusion to increase the contact.
- UI single taper split/splitless liner without wool was used and switched in between.
- Standard gold seals (from same batch) were used in both inlet.
- Inlet weldments in general have very limited direct contact surface to liquid sample injection, therefore the inertness improvement impact is relatively hard to detect.
- When column is installed correctly and a liner with wool is used, basically there's no difference founded between UM+ inlet and Standard inlet weldments. Basically, UM+ inlet is equivalent to Standard inlet for pesticides analysis.

# Putting it all together – Inert Flow Path versus Standard Flow Path

Drugs of Abuse 500 ppb using HP-5ms UI



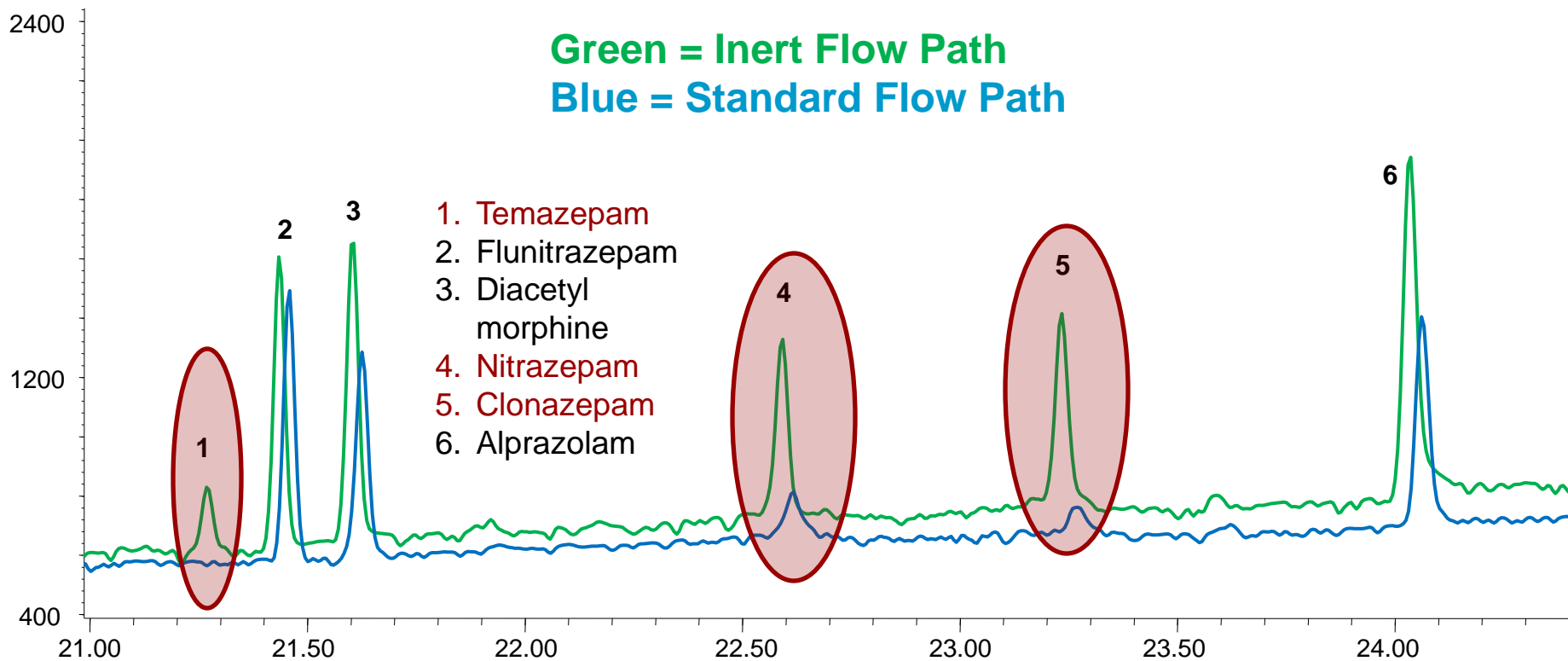
Column: Agilent J&W HP-5ms UI 30 m x 0.25 mm x 0.25  $\mu$ m  
Oven: 100°C 4 min hold, 10°/min to 280°C, 6 °/min to 300°C (4.67 min hold),  
Carrier : Helium 52.7 cm/s (2 mL/min) set at 100°C, EPC-Constant Flow  
Inlet: Pulsed Splitless 35 PSI pulse until 0.73 min, 0.75 min purge 50 ml/min, gas saver 20, ml/min at 2 min  
Inlet liner: Ultra Inert with wool / Standard single taper liner with wool (p/n 5190-3165)  
Gold Seal: UI Gold Seal / Standard gold seal  
Detector: MSD Scan mode 40 to 450 m/z, 230 °C source temp, 150 °C Quad temp, 310 °C transfer line



# Putting It All Together — Agilent Inert Flowpath

## Dramatic Improvement at Low Levels

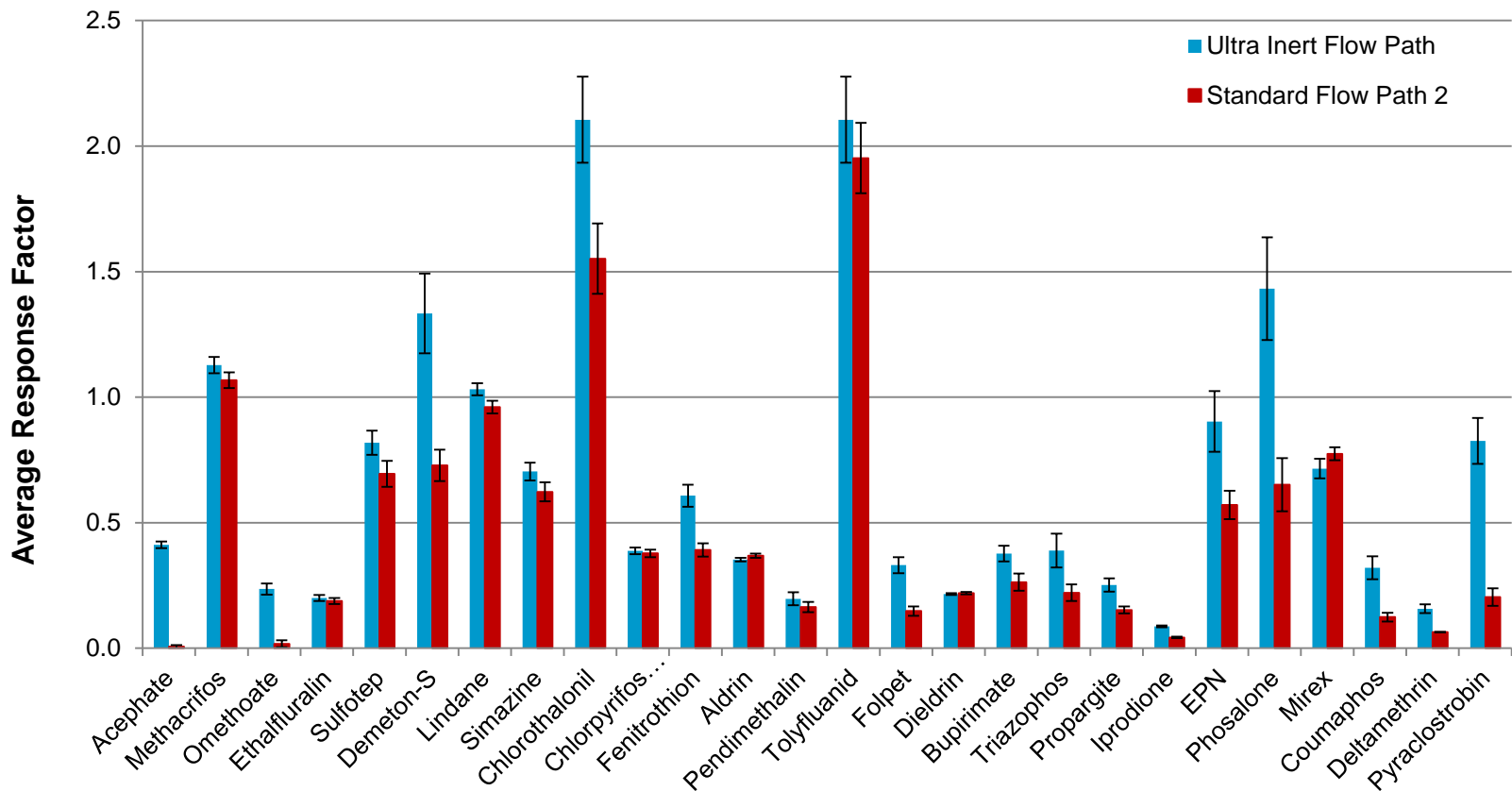
Drugs of Abuse 0.25 ng Column SIM Mode





# Putting it All Together: Pesticides Responses Improvement

## Overall Average Response Factor Comparison

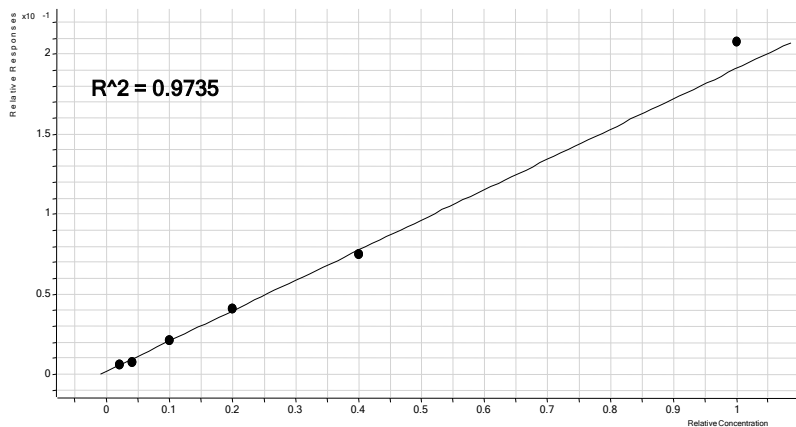


Overall Average Response Factor: the average response factor of 10, 100 and 500 ng/mL standards (n=4 for each level) for each analyte.

# Putting it All Together: Linearity Improvement

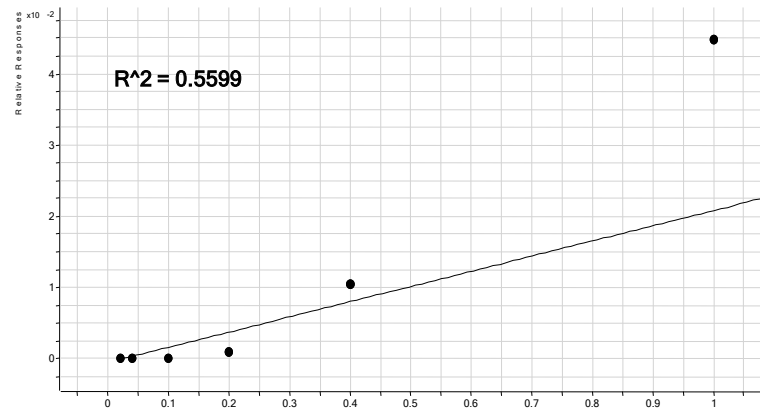
## Ultra Inert Flow Path

Omethoate - 6 Levels Used

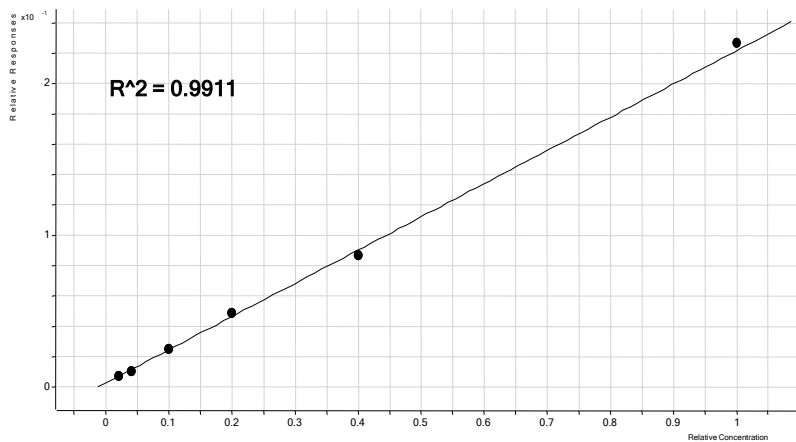


## Standard Flow Path

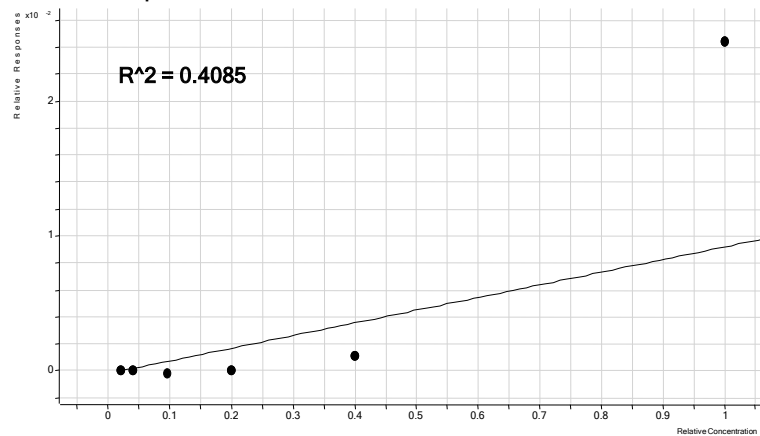
Omethoate - 6 Levels Used,



## Acephate - 6 Levels Used

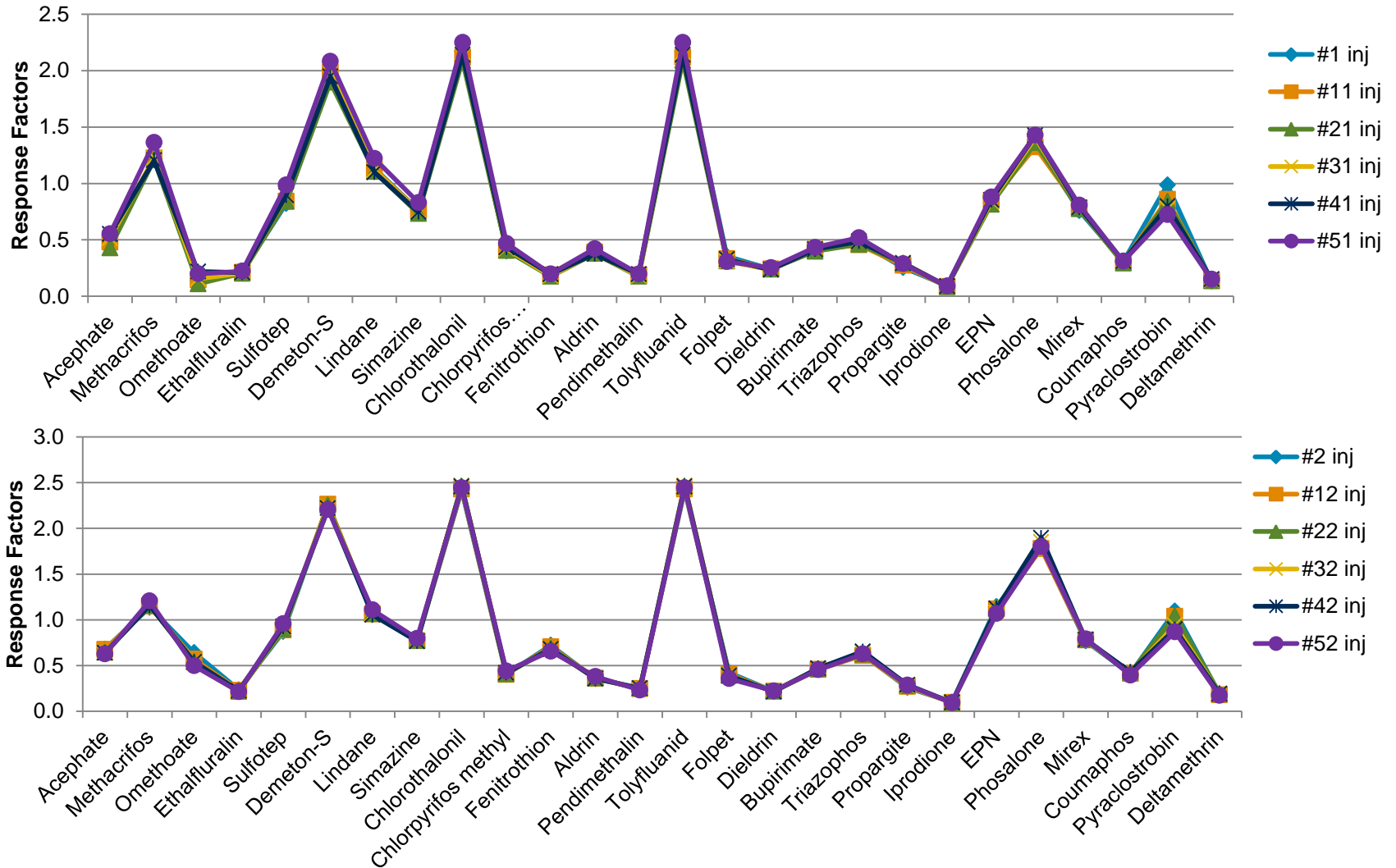


## Acephate - 6 Levels Used



# Putting it All Together: Flow Path Reproducibility

Six injections of Standard 50 ng/mL (top) and 500 ng/mL (bottom) over 50 sample injections

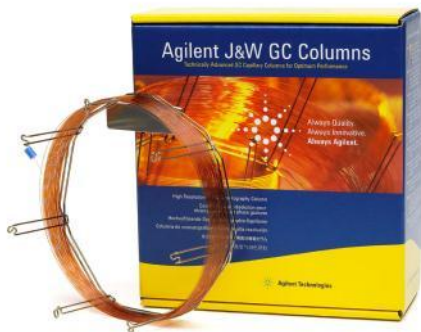


# So together this is a complete solution

## All supporting the GC/MS performance

### Columns

- J&W Ultra Inert GC/MS columns



### Sample Preparation Products

- Bond Elut SPE (Enviro, Forensic Tox)
- QuEChERS (Food Pesticides)

### Supplies

- Ultra Inert Inlet Liners
- Flexible Metal Ferrules
- Deactivated Inlet weldment
- Ultra Inert Gold Seal
- Gas Clean Filters
- GC/MS Quiet Cover



# What about GC/MS/MS?



GC triple quads, such as the Agilent 7000, achieve incredible sensitivity for target analysis because the selectivity of the analyzer carefully removes the noise in the mass analyzer. The result is dramatically improved signal to noise because the noise contribution is diminished.


Some believe that because the spectrometer can't see the noise that it's not there.

Nothing could be farther from the truth.

For GC triple quads, TOF's and other high resolutions systems the same rules apply:

1. Sharper peaks mean more sensitivity and better resolution.
2. Contaminates and non-volatile materials introduce activity that diminishes inertness and system performance.
3. The Agilent Inert Flowpath improves performance on *ALL* GC systems for trace analysis of active analytes


# Agilent Ultra Inert Solutions Brochure and Poster



**Lower your detection limits and quantify active analytes with confidence**

Food Testing | Environmental | Process/Training

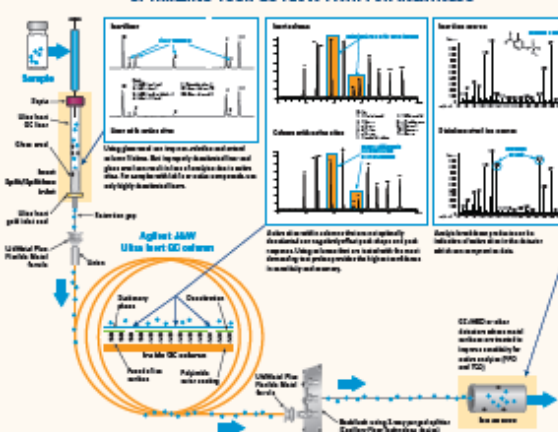
Agilent Ultra Inert Solutions



The Measure of Confidence

Agilent Technologies

### OPTIMIZING YOUR GC FLOW PATH FOR INERTNESS



**Ensuring an inert GC flow path has never been more critical**

As available sample becomes smaller, increasingly active, and more complex, you simply cannot afford inefficiencies caused by flow path activity.

- A non-inert flow path can cause peak tailing and signal loss. It can mask or hide active compounds, which can result in non-detection of sensitive analytes present in the sample.
- Repeating or retesting suspect analyses wastes resources, hinders productivity, and hits your bottom line.
- Unreliable results can have catastrophic consequences in terms of environmental safety, food quality, and accurate drug abuse accusations.

This poster provides vital information to help you lower your detection limits and confidently quantify active analytes by ensuring the most inert flow path.

**Top 5 TIPS for GC flow path inertness**

1. **Minimize flow path volume**
2. **Reduce sample heat of injection**
3. **Inject in column with split flow**
4. **Remove flow path restriction**
5. **Use a gas purifier**

**Agilent JMW Ultra Inert GC columns**

Agilent JMW Ultra Inert GC columns offer superior inertness and lower detection limits for active analytes. They are available in a variety of lengths and diameters to meet your specific needs.

**Agilent JMW Ultra Inert GC with oven, flow, and split ratio**

Agilent JMW Ultra Inert GC columns are designed to provide the highest level of inertness and lowest detection limits for active analytes. They are available in a variety of lengths and diameters to meet your specific needs.

**Agilent JMW Ultra Inert GC with flow and split ratio**

Agilent JMW Ultra Inert GC columns are designed to provide the highest level of inertness and lowest detection limits for active analytes. They are available in a variety of lengths and diameters to meet your specific needs.

**Agilent GC and GC/MS best practices**

Agilent GC and GC/MS best practices are designed to provide the highest level of inertness and lowest detection limits for active analytes. They are available in a variety of lengths and diameters to meet your specific needs.

**Ensuring peak performance on 4 productivity**


Agilent GC and GC/MS best practices are designed to provide the highest level of inertness and lowest detection limits for active analytes. They are available in a variety of lengths and diameters to meet your specific needs.

The Measure of Confidence

Agilent Technologies

Follow more about making the most from flow path. Visit [www.agilent.com/chem/flowpath](http://www.agilent.com/chem/flowpath).

# New CSD Application Notes




## Evaluating Inert Flow Path Components and Entire Flow Path for GC/MS/MS Pesticide Analysis

**Application Note**  
Food Testing & Agriculture


**Author**  
Limian Zhao  
Agilent Technologies, Inc.

**Abstract**  
Flow path inertness plays a critical role in pesticide analysis accuracy and precision, especially for active analytes such as organophosphate pesticides. The Agilent Inert Flow Path, including Ultra Inert columns and liners, Ultra Inert gold seal split/splitless inlet, provides excellent surface inertness throughout the entire flow path, prevents loss of analyte response and peak shape distortion, and provides reliable qualitative and quantitative analysis of pesticides. Other inert technologies including UltiMetal Plus flexible metal ferrules and capillary flow technology devices, are also highly recommended for pesticide analysis in complex matrices.

**Introduction**  
Flow path inertness plays a critical role in accurate, precise and reliable pesticide analysis, especially for sensitive pesticides at trace levels. Active sites along the flow path surface can cause adsorption and degradation of active compounds, resulting in poor peak shape, loss of response, inaccurate integration, and poor precision. It is critical to minimize interaction of active analytes along the GC flow path, starting with the injector, to the column, and finally to the detector. The inlet liner contributes more than 90% of the contact surface after a sample is injected into the GC system. Other surfaces that the sample can contact include inlet weldments, ferrules, capillary flow technology (CFT) devices, and detector. These surfaces can cause interaction with active analytes, resulting in inaccurate results. To achieve the best inertness of the entire flow path, it is important to use an inert column and liner in combination with other inert supplies.



5991-1860EN




## Agilent Inert Flow Path Enhancements Improve Drugs of Abuse Testing

**Application Note**  
Forensics & Drug Testing


**Author**  
Ken Lynn  
Agilent Technologies, Inc.

**Abstract**  
An evaluation of Silite versus Agilent UltiMetal Plus Flexible Metal ferrules installed in an Agilent Ultimate Union showed improved benzodiazepine peak shape and response for UltiMetal Plus Flexible Metal ferrules by FID. An Agilent 7890/5975C GC/MS Inert Flow Path equipped with a split/splitless inlet showed peak shape and response improvements for the benzodiazepine class of drugs when compared to a standard flow path split/splitless inlet in both SCAN and SIM modes. Example forensic/toxicology check-out mix chromatograms and overlays are shown.

**Introduction**  
Drugs of abuse are chemically active substances that readily bind and adsorb onto active sites anywhere in the flow path of a modern GC/MS system. In gas phase analysis, analytes must survive the passage from injection to detection. This is difficult to achieve when active analytes are compounds of interest, are tracked at low levels, and when the flow path has surface activity. As GC/MS detection limits are pushed lower, the need for a suite of inert flow path components to line the flow path that analytes must travel through becomes ever more critical. Activity anywhere in the flow can lead to poor peak shape, poor quantitation, or missed analytes. Previous efforts to eliminate active sites throughout the flow path have focused on column and liner deactivation strategies [1, 2]. These strategies have been successful to the point where a focus on additional components in the flow path is the next logical step toward achieving a totally inert flow path. Inlet weldments, gold ferrules, and ferrules used to make gas tight connections are all flow path components that come in contact with analytes of interest [3].



5991-1859EN




## Endrin and DDT Breakdown Evaluation Using an Agilent Inert Flow Path Solution

**Application Note**  
Environmental

**Abstract**  
Flow path inertness plays a critical role in pesticide analysis for accuracy and precision, especially for analytes subject to degradation in a hot inlet such as endrin and DDT. Catalytic endrin and DDT breakdown products were tracked as part of an inert flow path performance evaluation. The results indicate that the Agilent Inert Flow Path Solution provides superior inertness and lower breakdown than standard flow path split/splitless inlets.

**Introduction**  
The analysis of active compounds by gas chromatography (GC) continues to be challenging in areas such as pesticides, foods, environmental, and drug analysis. To achieve reliable and solid results for active compounds, it is critical to minimize the interaction of active analytes along the GC flow path, starting from the injector to the column, and finally to the detector. All parts in this flow path play a key role in influencing the inertness of the flow path. Active sites in the flow path can lead to the degradation or adsorption of active analytes, resulting in poor linearity of calibration curves and loss of sensitivity. Therefore, it is critical to deactivate the entire sample flow path to make it fully inert. Minimizing surface activity throughout the flow path is essential to achieve consistent results.



5991-1862EN

# A New GC and MS from Agilent

## Introducing the 7890B and the 5977

### 7890B

- Inert Flow Path
- New FPD
- Integrated Intelligence
- Parts Finder



### 5977

- Extractor Ion Source more sensitivity
- New vacuum systems
- Direct communication
- Quiet cover

*Show video and Parts Finder*



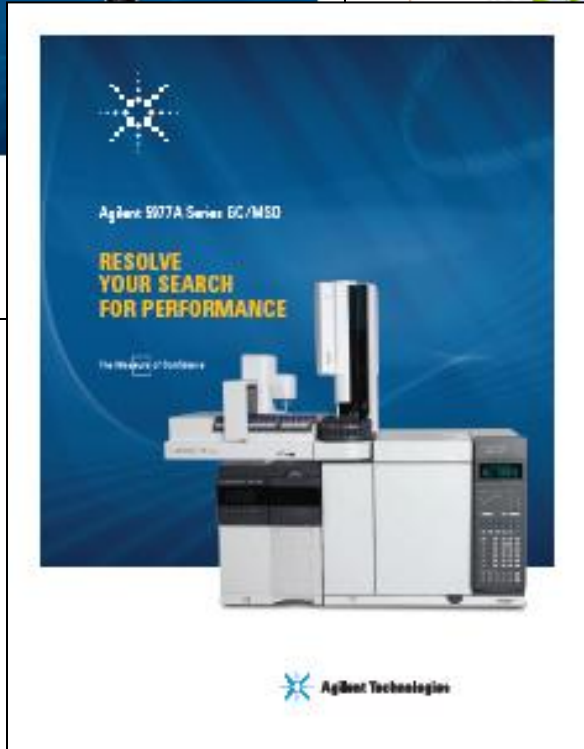
# Inert Flowpath in Instrument Brochures



Agilent 7890B Gas Chromatograph

**RESOLVE YOUR SEARCH FOR RELIABILITY**


The Measure of Excellence



Agilent 507A Series GC/MSD

**RESOLVE YOUR SEARCH FOR PERFORMANCE**

The Measure of Excellence



**Agilent Technologies**

Resolve your search for integration  
Smart features take supportability, performance, and safety to new heights

**Integrated two-way GC ↔ MSD Communication and Safety Controls**  
Direct two-way communication between the 7890B GC and 507A MSD enhances and protects your investment.

- If the MSD vents, the system increases the flow of carrier gas, shortening vent times.
- If the pump fails, the system shuts off the carrier gas, saving expenses before or avoiding hydrogen build-up.
- If communicators are lost, the system shuts down the GC heated zones.

**Save time**

- Columns and supplies database with optional bar code reader make it easy to keep track of these items.
- Parts ID tool quickly identifies parts and part numbers for easy ordering.



**Environmentally friendly**

- Can also be used with hydrogen or nitrogen carrier gas to reduce operating costs.
- Sleep mode reduces helium gas and energy consumption.

Work smarter with integrated GC, MSD, and software technologies

**Integrated GC ↔ MSD communication and safety controls**

- Direct communication between GC and MSD helps detect faults—preventing lost resources.
- If the DPC drops, the system shuts down the MSD heater.
- If the pump fails, the system shuts off the carrier gas.
- Configured to higher carrier gas, so you can switch from helium to less expensive carrier gases for faster analyses and greater resolution.

**40% less power**

**Power Save**

**Eco-friendly operation**

- Switch to lower cost gas quickly, easily, or in large quantities.
- "Smart start" helps pump start-up.
- High sensitivity screen helps reduce the need for excessively slow column flow during sample prep.

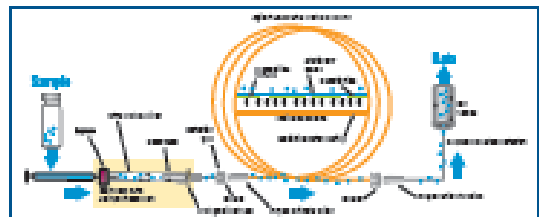


**Ensuring an inert flow path has never been more critical**

As samples become smaller, more volatile, and more complex, you simply cannot afford to lose space or ligand flow path stability.

For success, looking to speed, correctly support analysis and ensure reliable detection, finding productivity and time your instruments. As with many elements of a flow analysis, your single instrument gas and control balance, because there might be more complex in the sample.

Agilent Inert Flow Path applications help you ensure the best flow path stability, allowing analysis to safety pass from injection to detection.



**The integrated approach to instrument**  
**The Agilent advantage**

As the GC industry grows, the measurement equipment offered is not only growing but is also becoming more complex and more difficult to use. The performance of your sample, as you can achieve the best performance in your analysis.

- **Agilent 7890B** flow GC systems are tested at the highest inlet pressures to ensure maximum flow rates and maximum flow stability.
- **Agilent flow control** delivers a more consistent and reliable flow to your sample, with no venting gas and.
- **Low split injection** helps you provide an even more consistent flow to the sample path.

- **Flow path** design features the stainless steel piping and high stability flow.
- **Structural stability** the flexible metal hoses are compatible with Capillary Flow Technology, providing a safe flow path to the sample inlet and reduce the risk of column breakage.
- **The clean flow system** also the cleanest possible gas, reducing column damage, sensitivity loss, and detection.

For the Agilent Inert Flow Path, look for the **Agilent Inert Flow Path** in the **Agilent Inert Flow Path** brochure.

For more information about creating an inert GC system, visit [www.agilent.com/inert](http://www.agilent.com/inert).

## Inert Flow Path

# Expanding the Opportunity: Maintaining GC/MS system performance

**SPP and purifiers: for the rest of the lab!**



Maintaining the advantages of an inert flowpath is important:

- Contamination from samples
- Oxygen contamination

# Sample Preparation Products: Maintaining Performance



## Environmental Labs

- Role of LLE
- SPE for many applications

## Food Labs

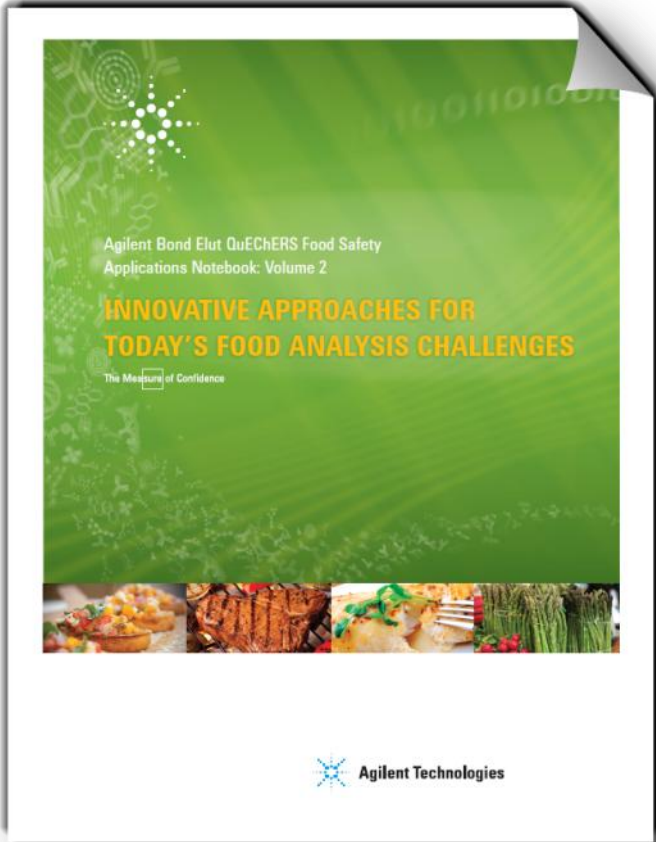
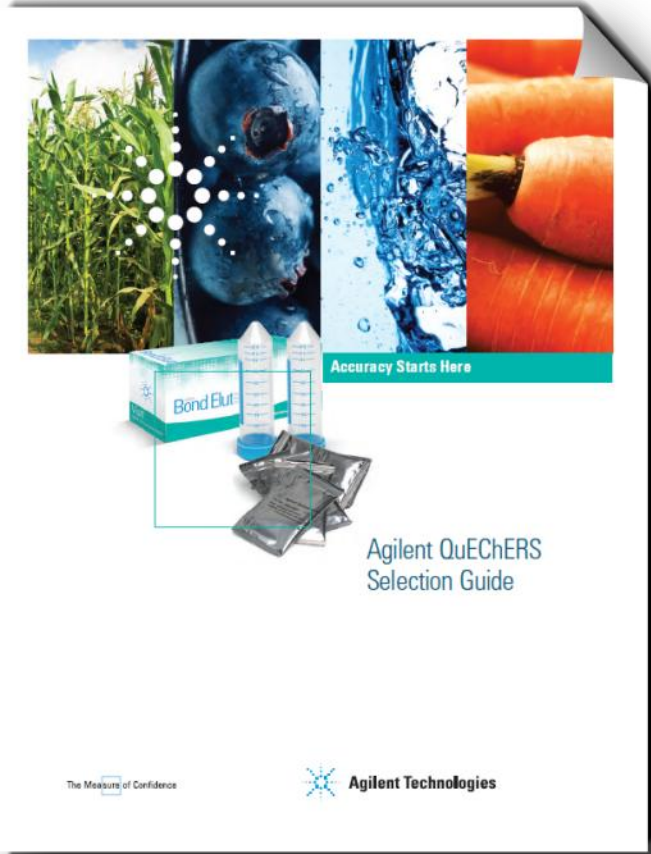
- Trend for QuEChERS
- Still a role for SPE

## Forensics labs

- High volume SPE labs



# Bond Elut QuEChERS Applications Notebook and Selection Guide



# Gas Clean GC/MS Filter

## Optimizes your GC/MS performance

- Single combination Filter, optimized to remove oxygen, moisture and hydrocarbons from GC/MS carrier gas
- Improved GC/MS filter design provides **faster stabilization** time to enhance productivity and reduce helium gas consumption
- Increased GC/MS sensitivity with more accurate data
- Prevents column damage, lowering column replacement costs
- Reduces instrument down-time



# Modular Design, Quick Installation



Remove plugs  
before installation



**Efficient, fast, easy**

# Agilent Inert Flow Path Technology

**Innovative and proprietary deactivation technologies improve GC and GC/MS performance**

- Sensitivity
- Productivity
- Reliability

**Columns and supplies from Agilent add value to system performance**

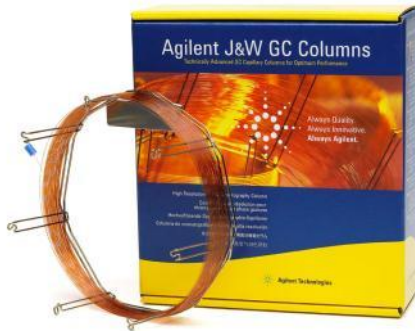
- Better product consistency and quality control
- Excellent availability and faster delivery
- Skilled and responsive technical support

# A Complete Solution from Agilent

## All supporting the GC/MS performance

### Columns

- J&W Ultra Inert GC/MS columns



### Sample Preparation Products

- Bond Elut SPE (Enviro, Forensic Tox)
- QuEChERS (Food Pesticides)

### Supplies

- Ultra Inert Inlet Liners
- Flexible Metal Ferrules
- Deactivated Inlet weldment
- Ultra Inert Gold Seal
- Gas Clean Filters
- GC/MS Quiet Cover





# Conclusion

- Flow path inertness is critical to the success of pesticides analysis, especially for the active pesticides at low ppb level.
- Comparing to standard flow path, Agilent Ultra Inert flow path improves sensitive pesticides responses and peak shapes, thus improves the quantitation results.
- Agilent Ultra Inert flow path is highly recommended for the accurate and precise pesticides analysis.

# TECHNICAL SUPPORT

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

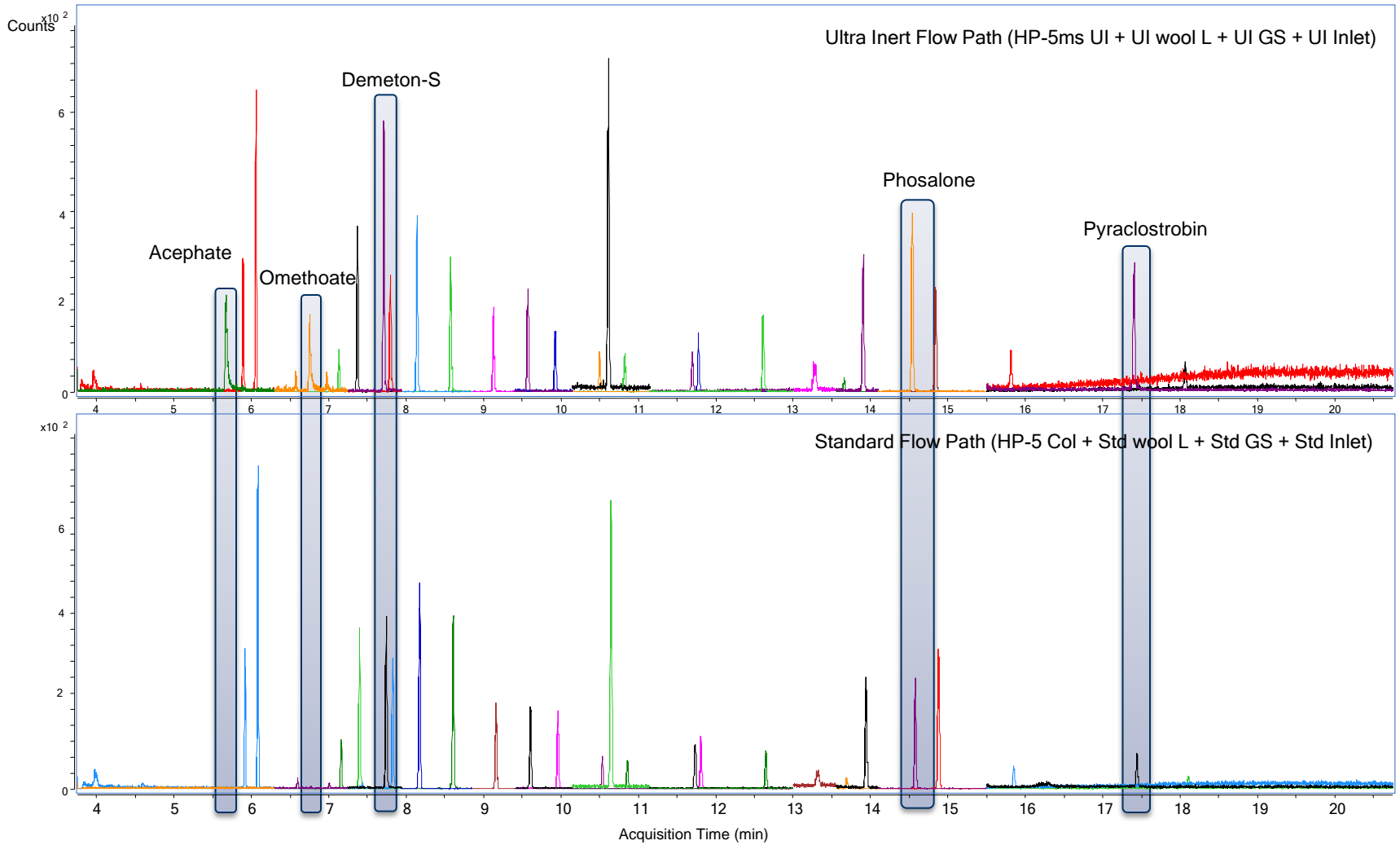
E-mail: [gc-column-support@agilent.com](mailto:gc-column-support@agilent.com)



# Additional Data

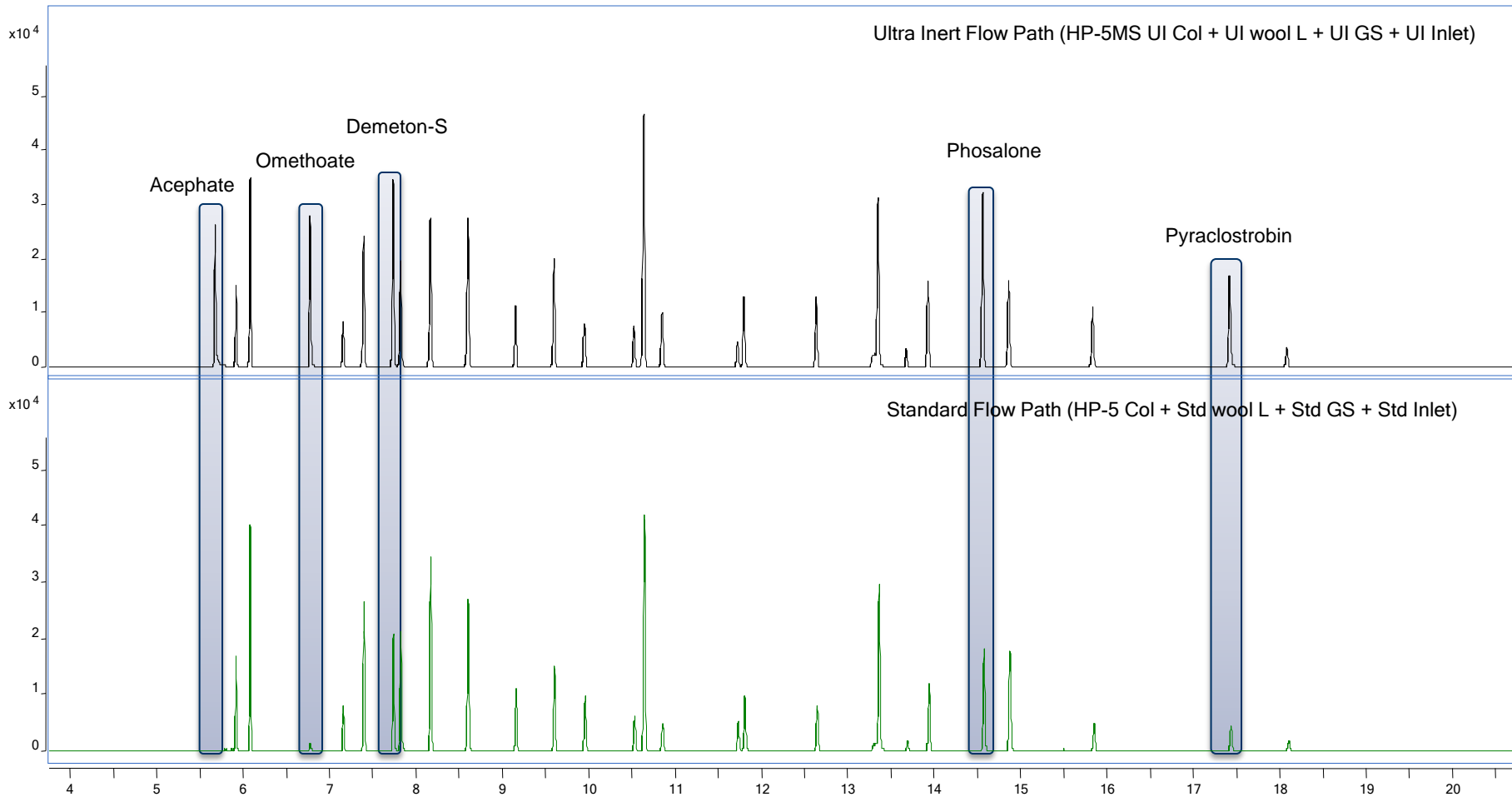
# Flow Path Test – Chromatographic Improvement

## UI Flow Path vs Standard Flow Path (10 ppb pesticides standard)



# Flow Path Test – Chromatographic Improvement

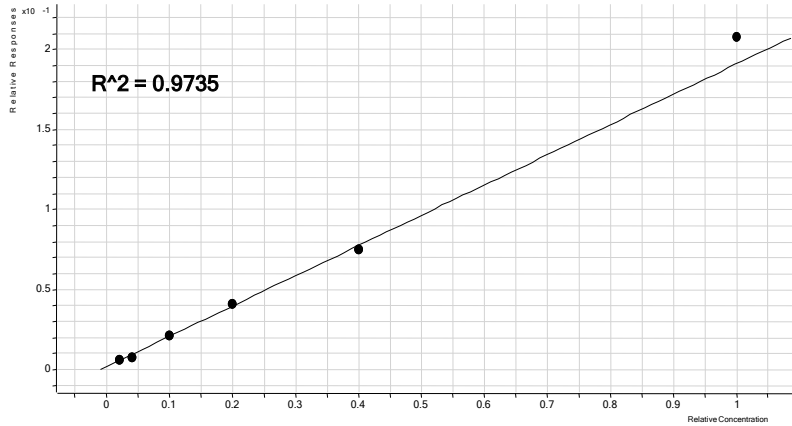
UI Flow Path vs Standard Flow Path (500 ppb pesticides standard)



# Flow Path Test – Calibration Linearity Improvement

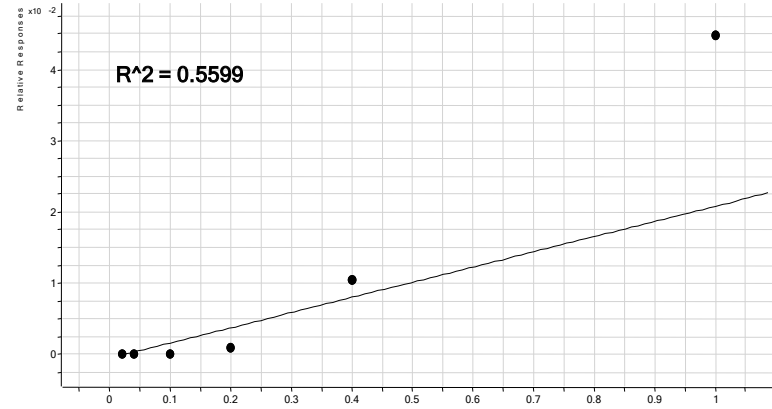
## Ultra Inert Flow Path

Omethoate - 6 Levels Used

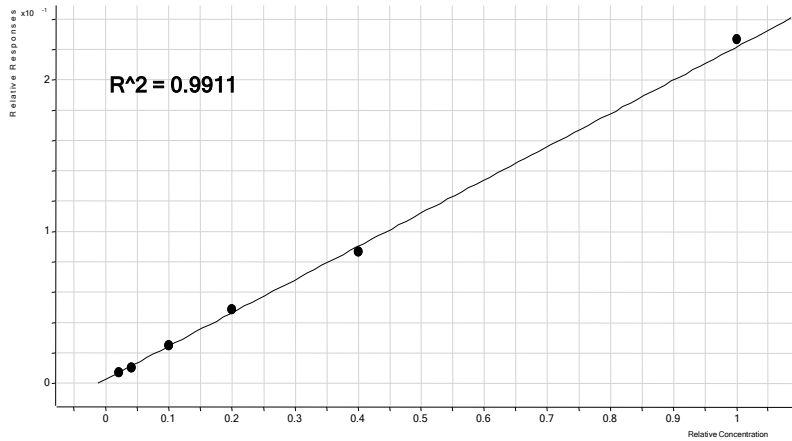


## Standard Flow Path

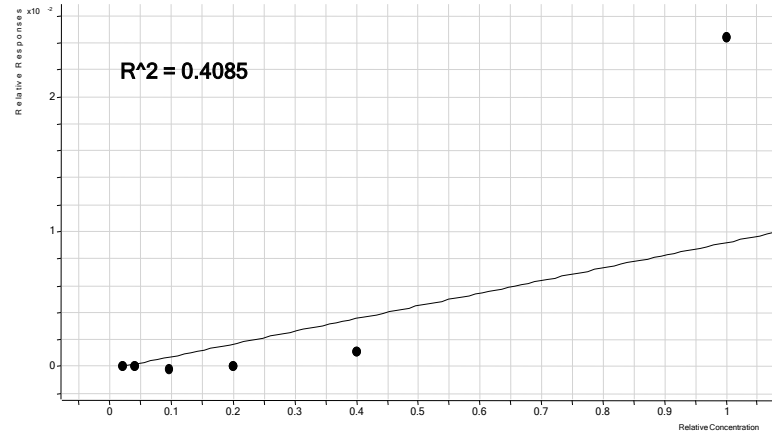
Omethoate - 6 Levels Used,



Acephate - 6 Levels Used

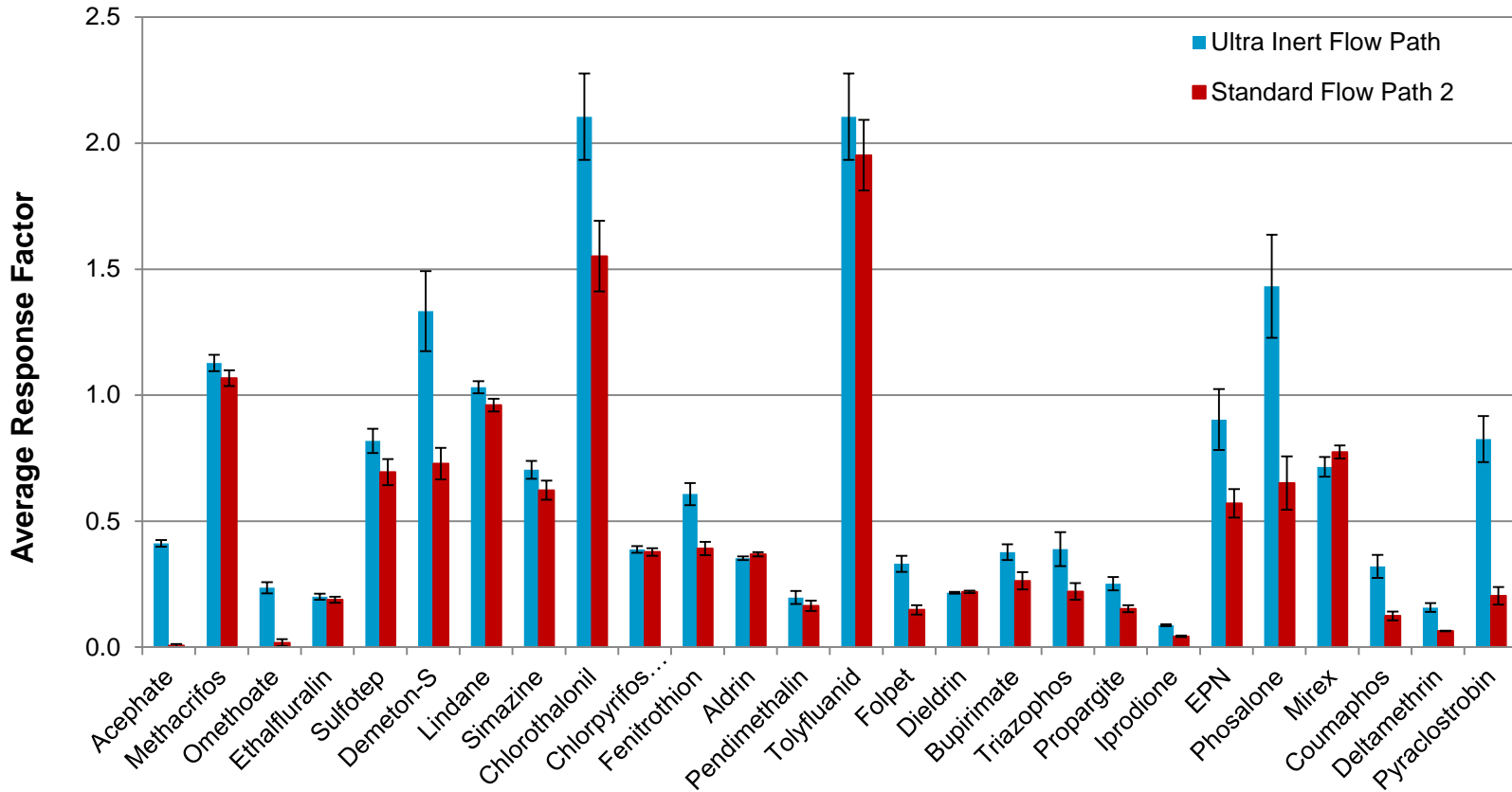


Acephate - 6 Levels Used



# Flow Path Test – Overall Responses Improvement

## Overall Average Response Factor Comparison



Overall Average Response Factor: the average response factor of 10, 100 and 500 ng/mL standards (n=4 for each level) for each analyte.

# Results and Discussion – Flow Path Reproducibility

Six injections of Standard 50 ng/mL (top) and 500 ng/mL (bottom) over 50 sample injections

