NEW
7890B Gas Chromatograph
+ 5977 Single Quadrupole

Today's Challenges

Economic - Routine -

- Productivity
- Investment Protection
- Cost of Ownership
- Ease-of-Use

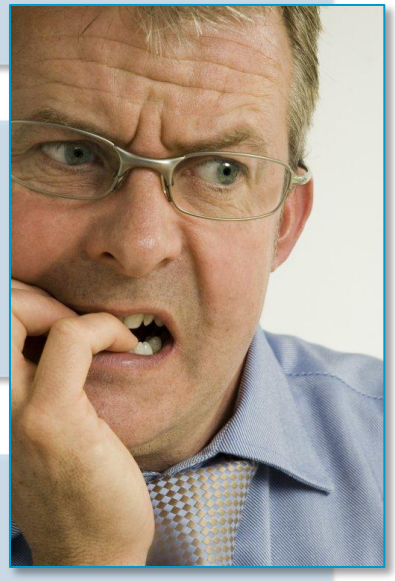
Integrated GC/MSD Communications
OpenLAB, MassHunter

Economic - Method - Development

- Time = Money
- Skilled Resources … Harder to Find

Sensitivity

- Trend – Lower LOD's
- "Imperfect" Samples



Improve Asset Utilization

Leverage and Protect Your Investment Better

5977A → 7890B

During MSD vent…

→ Increases GC carrier gas flows, Cools MSD faster

→ ***40% Faster Vent Times (280C→100C)***

In event of MSD Failure…

→ Stops GC Flows

→ Don't waste expensive He

→ Don't build-up H_2

5977A ← 7890B

GC monitors GC/MSD connection.

If communication lost…

→ GC shuts down various (GC) thermal zones

Integrated GC-MSD Communication

Faster Maintenance, better asset protection, safer H2 use

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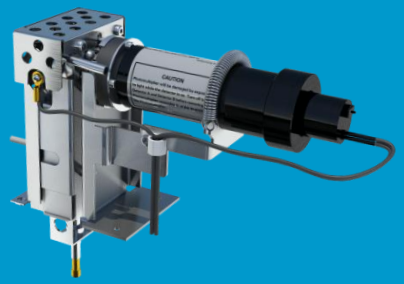
5977A MSD
GC FPD „PLUS"

Expanded Laboratory Capability

Increasing Asset Flexibility

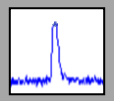
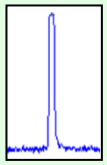
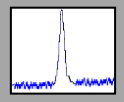
FPD Plus



Advanced components

UltiMetal Deactivation

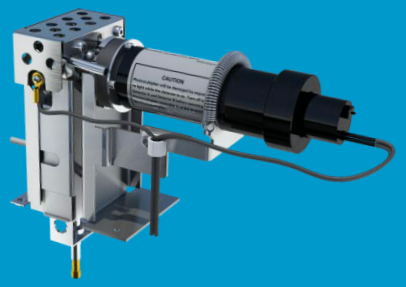
Design Improvements for enhanced performance

	7890A FPD	7890B FPD Plus	
Max Temp	250C	400C	Higher Tmax
MDL pg/s			
S	 3.6	2.5 	Higher Response
P	 60	45	Lower Noise

Expanded Laboratory Capability

Increasing Asset Flexibility

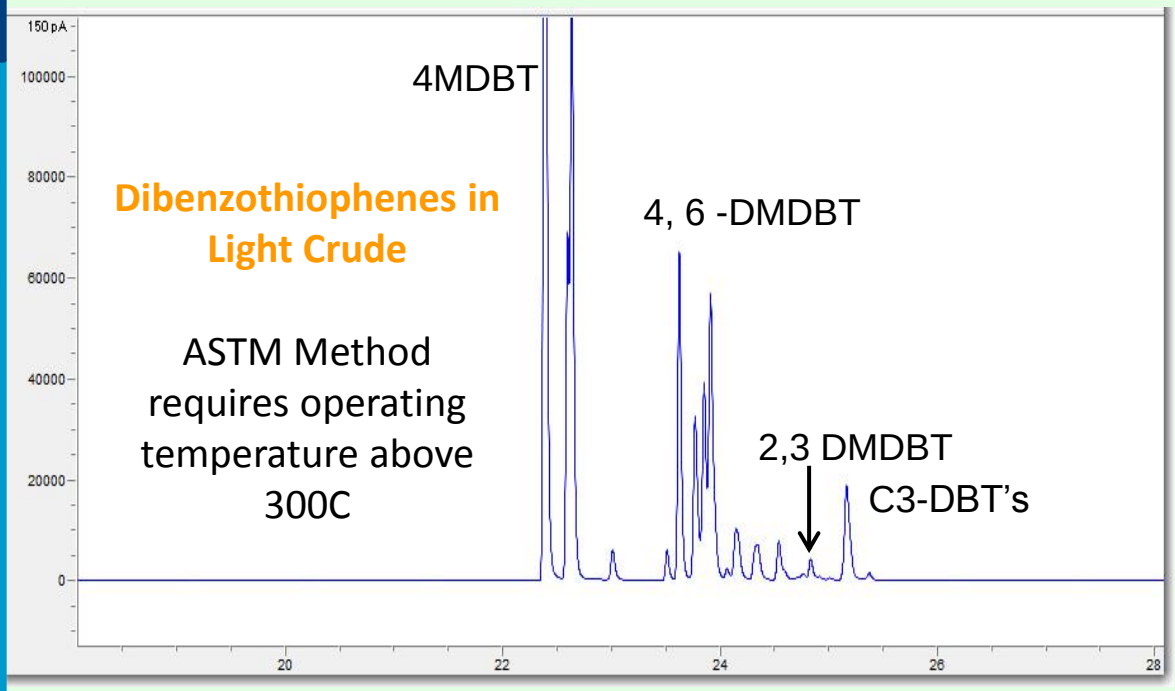
FPD Plus



Advanced components

UltiMetal Deactivation

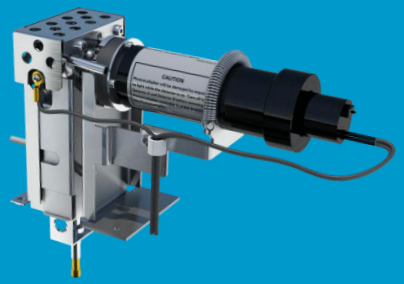
Design Improvements for enhanced performance



Expanded Laboratory Capability

Increasing Asset Flexibility

FPD Plus

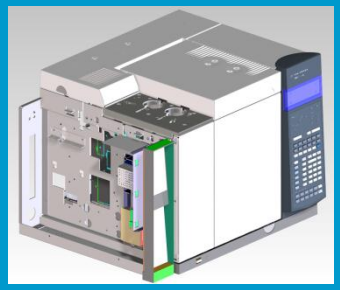


Advanced components

UltiMetal Deactivation

Design Improvements for enhanced performance

ECD 3rd Detector



Allows Cl-containing pesticides in environmental and food samples to be detected along with an FPD and FID installed

Dual MMI

Used commonly for high throughput Mineral Oil/Total Petroleum Hydrocarbon (TPH) environmental analysis

7890B GC Detector Specifications

		Agilent 7890B	Agilent 7890A
FID	MDL	1.4 pg C/sec	1.5 pg C/sec
	Linear range	10e7	10e7
TCD	MDL	< 400 pg/mL Propane	< 400 pg/mL Propane
	Linear range	10e5	10e5
ECD	MDL	4.5 fg/sec	5.5 fg/sec
	Linear range	> 5 x 10e4	> 5 x 10e4
NPD (BLOS)	MDL for N	0.08 pg N/sec	0.1 pg N/sec
	MDL for P	0.01 pg P/sec	0.03 pg P/sec
	N Linear Range	10e5	10e5
	P Linear Range	10e5	10e5
FPD	MDL for S (FPD)	< 2.5 pg S/sec (FPD Plus)	< 3.6 pg S/sec
FPD	MDL for P (FPD)	< 45 fg P/sec (FPD Plus)	< 60 fg P/sec
FPD	S Linear range	10e3	10e3
FPD	P Linear range	10e4	10e4
PFPD	MDL for S (PFPD)	<1 pg S/sec	<1 pg S/sec
PFPD	MDL for P (PFPD)	<100 fg P/sec	<100 fg P/sec
PFPD	S Linear range	Ca 10e3	Ca 10e3
PFPD	P Linear range	Ca 10e3	Ca 10e3
SCD	MDL for S (SCD)	< 0.5 pg/s	< 0.5 pg/s
SCD	S Linear range	10e4	10e4

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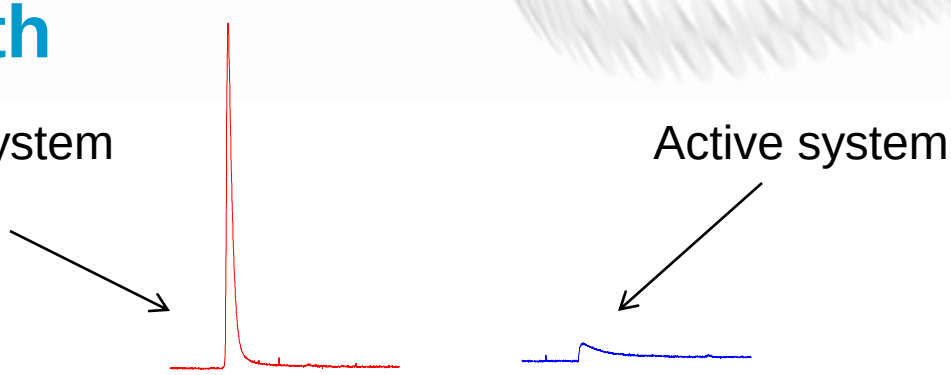
5977A MSD
GC FPD „PLUS"

Inert Flow Path

Improving Performance: Focus on sample flowpath



Active or contaminated components in the flow path, before the detector, can reduce the overall sensitivity of the system

Consider the following:

- Inlet liner
- Gold seal
- SSL inlet (weldment)
- Column
- Capillary Flow Device
- Detector

Technologies that matter: Only from Agilent

Agilent has developed core competency in chemical vapor deposition surface deactivation resulting in proprietary processes to dramatically improve GC inertness.

Deactivation processes for:

- Glass
- Steel
- Gold
- Glass wool

Agilent Inert Flowpath SSL Inlet Option

Proprietary UltiMetal-Plus Treatment

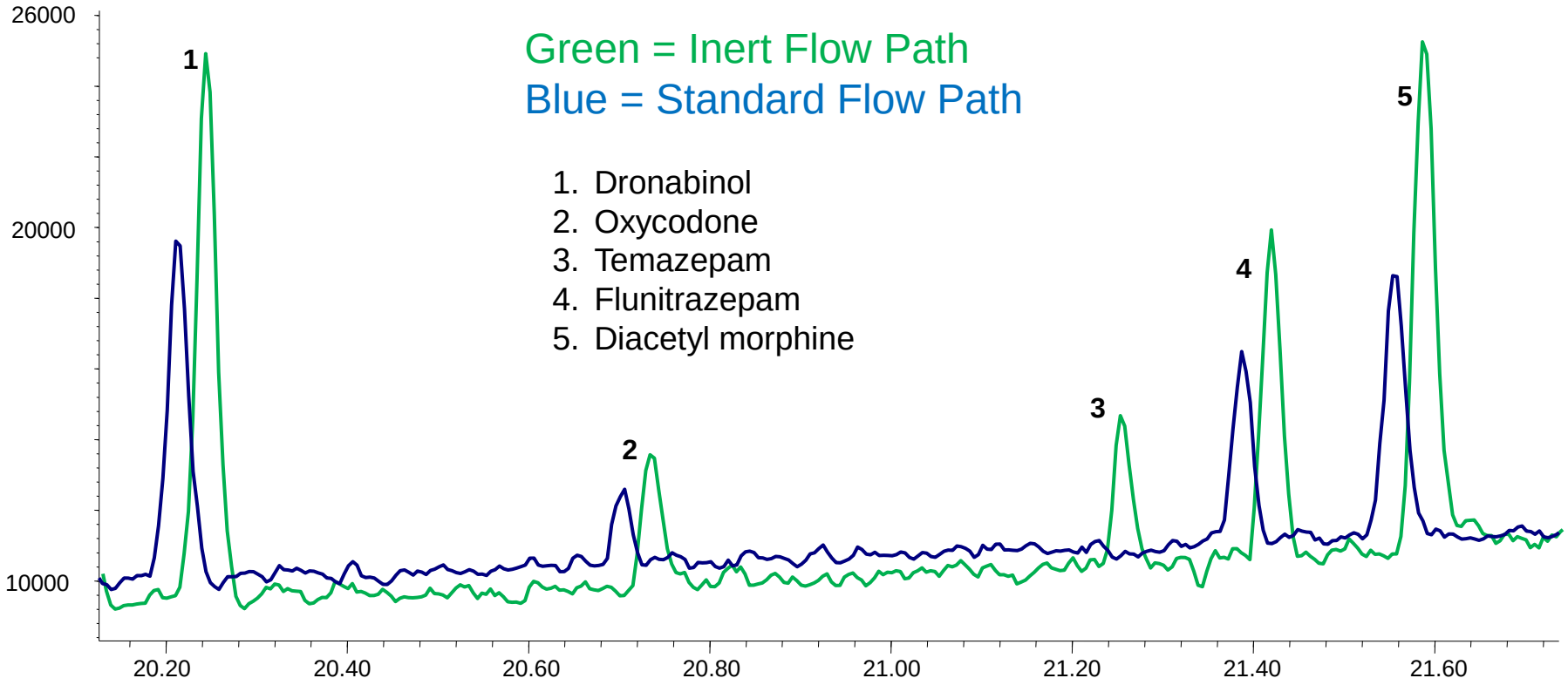
Enhanced performance for trace GCMS and GC-ECD analysis of pesticides and drugs of abuse

Protects labile analytes contacting injector metal structure during high volume injections

Available as 7890B Inert Flowpath option #114 or upgrade G3453B for 7890A/B

Putting it all together – Inert Flow Path
Inert Flow Path verses 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 um
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 t0 450 m/z, 230 °C source temp, 150 °C Quad temp, 310 °C transfer line

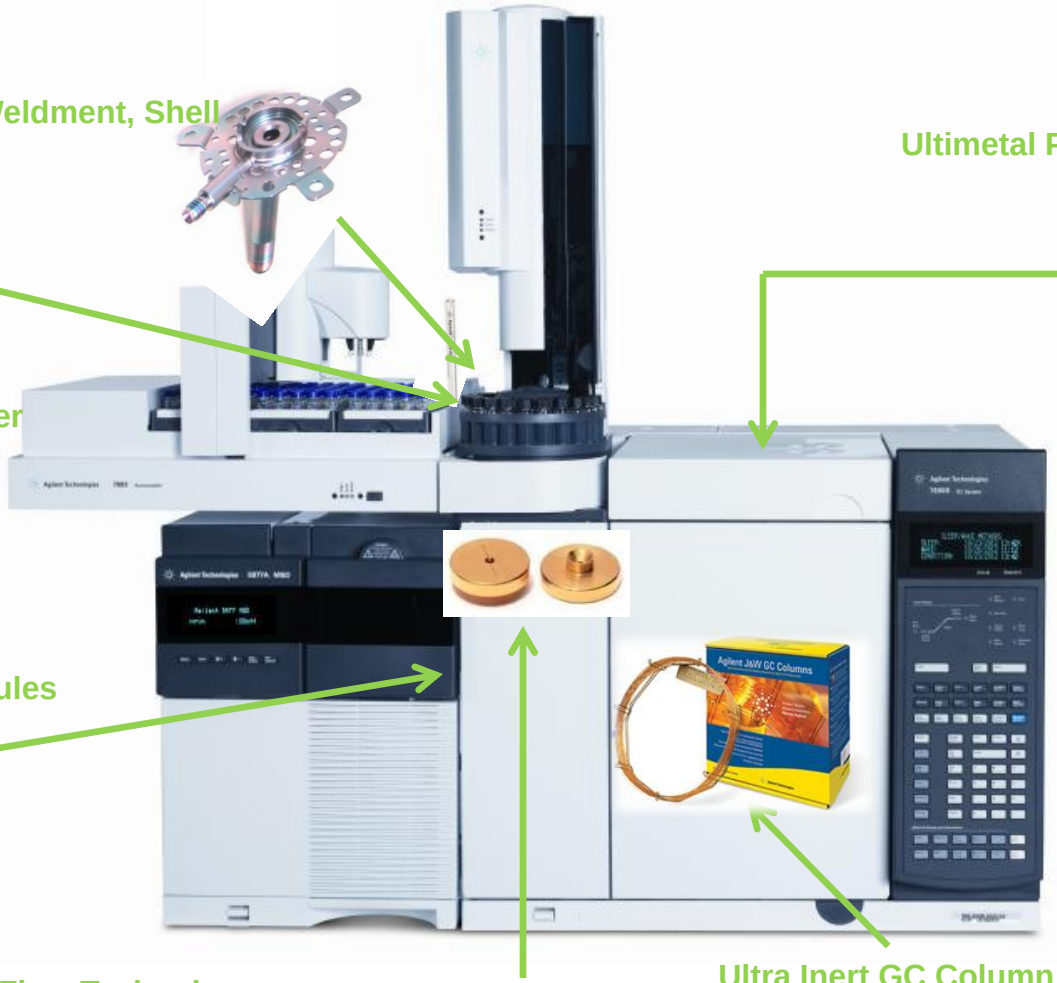
Agilent Inert Flow Path Solution

Ultimetal Plus Inlet Weldment, Shell and Transfer Lines

Ultra Inert Inlet Liner

Ultimetal Plus Ferrules

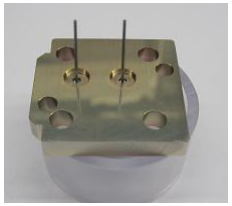
Ultimetal Capillary Flow Technology Devices, Ultimate Union

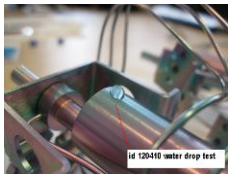


Ultra Inert Gold Seal

Ultra Inert GC Column

Ultimetal Plus– TCD, FPD, NPD/FID Jets





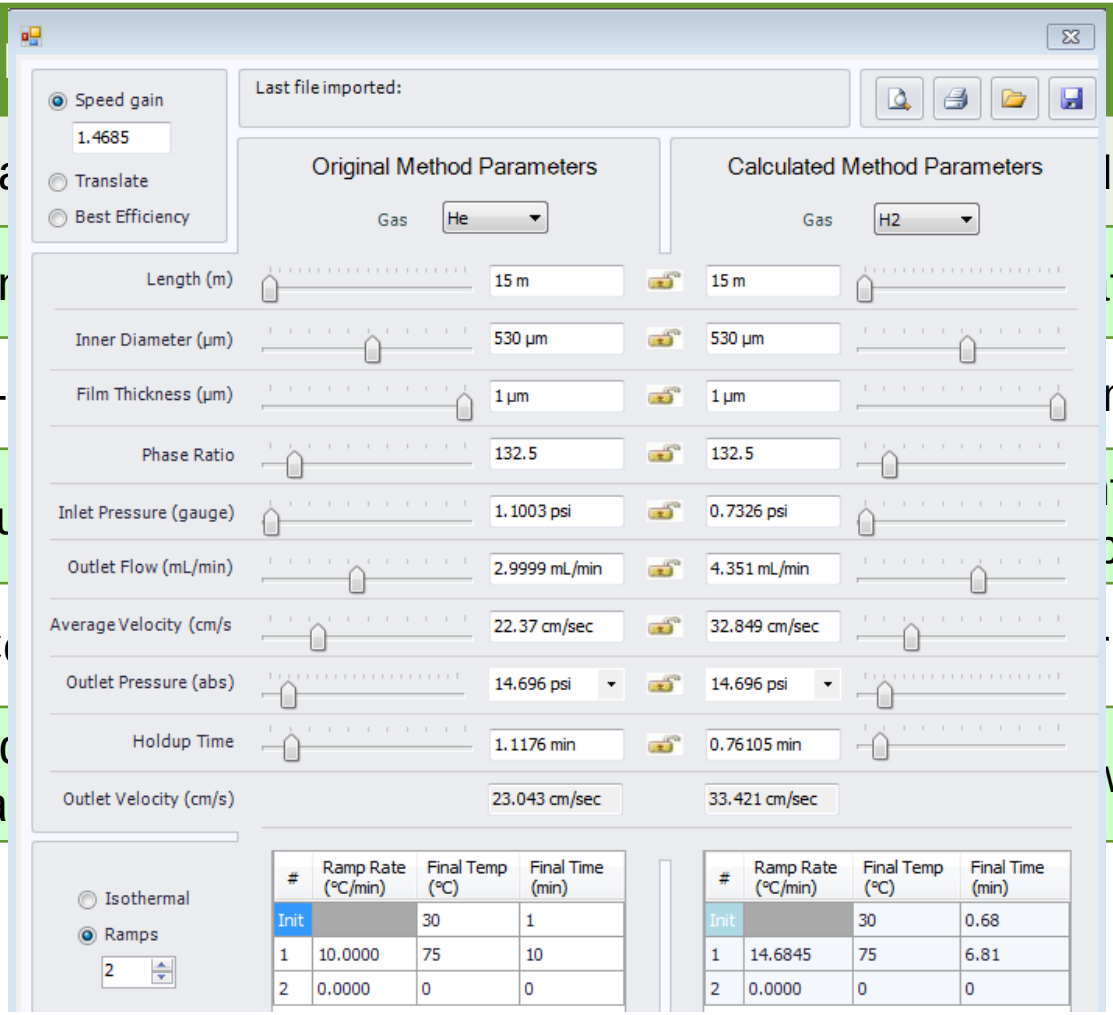
Today's Challenges

Economic - Routine -	• Productivity • Investment Protection • Cost of Ownership • Ease-of-Use	Integrated GC/MSD Communications OpenLAB, MassHunter
Economic - Method - Development	• Time = Money • Skilled Resources … Harder to Find	Integrated Intelligence
Sensitivity	• Trend – Lower LOD's • "Imperfect" Samples	5977A MSD GC FPD „PLUS" Inert Flow Path

Method Translation Tools A Smarter GC System

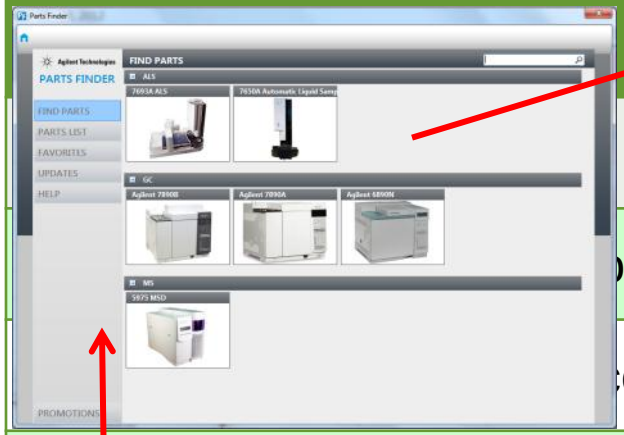
Completely Updated with AutoImport to Method

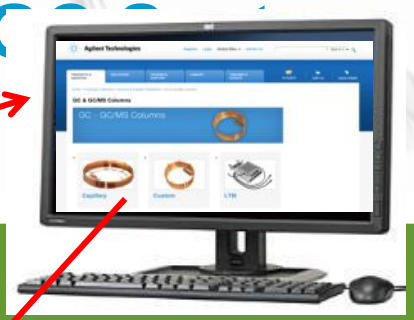
Integrated Intell	
Integrated GC ca	ls easier
Barcode Scannir	tion
Integrated early-	more efficiently
GC:MSD commu	t better
3D Interactive C	& order easier
Sleep-Wake Mo … Also coordina	vnership



Increased Productivity … A Smarter G

Faster and easier method development





Benefit
velop methods easier
sier configuration
nage assets more efficiently
ster MSD vent otect system better
&
Lower cost of ownersh

GC/MSD communication

e and Pa

977A MSD

Bar Code Scanning Option

AutoInput column, liner and septum information into method. Integrated with Parts Finder for seamless consumables management.

Integrated Intelligence: A Smarter GC System

Avoid Unplanned Downtime

Integrated Intelligence

Optimize your maintenance plan

Integrated GC calculators
- You determine your maintenance schedule, not your instrument

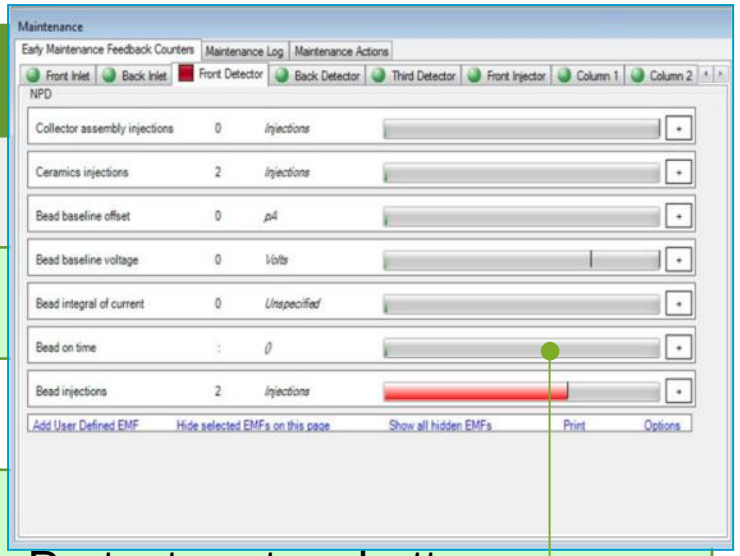
Barcode Scanning with Auto-Input
- Use only the consumables you need, when you need them

Integrated early-maintenance-feedback
- A maintenance SOP built into your GC

GC:MSD communication

3D Interactive Consumable and Parts Finder

Sleep-Wake Modes
… Also coordinated with 5977A MSD



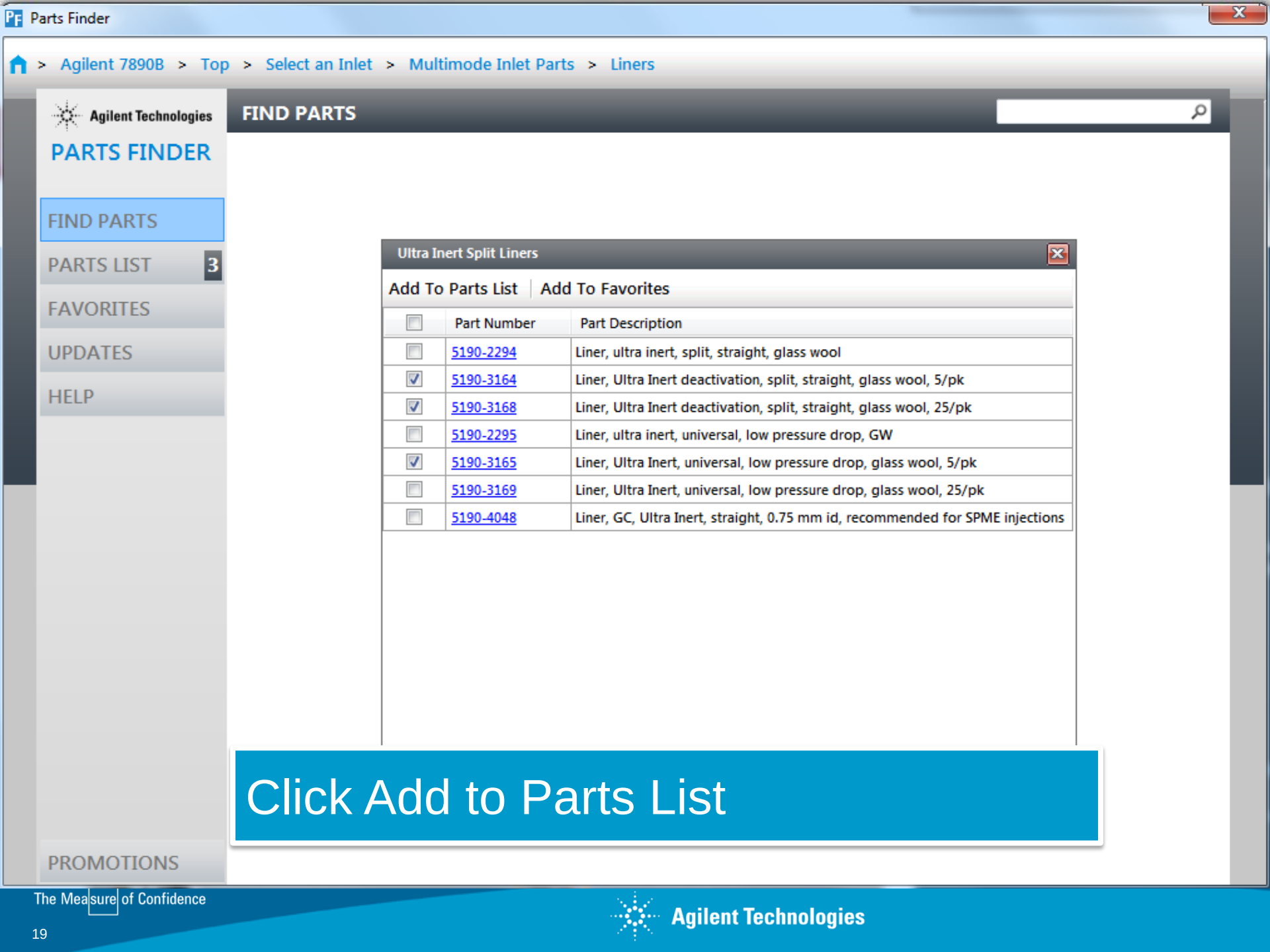
Protect system better

Early Maintenance Feedback

Find parts faster & order easier

When production or shipment decisions are on the line, unplanned downtime can cost $1000's

Lower cost of ownership


Parts Finder
> Agilent 7890B > Top > Select an Inlet > Multimode Inlet Parts > Liners
Agilent Technologies
PARTS FINDER
FIND PARTS
PARTS LIST 3
FAVORITES
UPDATES
HELP
PROMOTIONS
FIND PARTS
Ultra Inert Split Liners
Add To Parts List | Add To Favorites
Part Number
Part Description
5190-2294 Liner, ultra inert, split, straight, glass wool
5190-3164 Liner, Ultra Inert deactivation, split, straight, glass wool, 5/pk
5190-3168 Liner, Ultra Inert deactivation, split, straight, glass wool, 25/pk
5190-2295 Liner, ultra inert, universal, low pressure drop, GW
5190-3165 Liner, Ultra Inert, universal, low pressure drop, glass wool, 5/pk
5190-3169 Liner, Ultra Inert, universal, low pressure drop, glass wool, 25/pk
5190-4048 Liner, GC, Ultra Inert, straight, 0.75 mm id, recommended for SPME injections
Click Add to Parts List

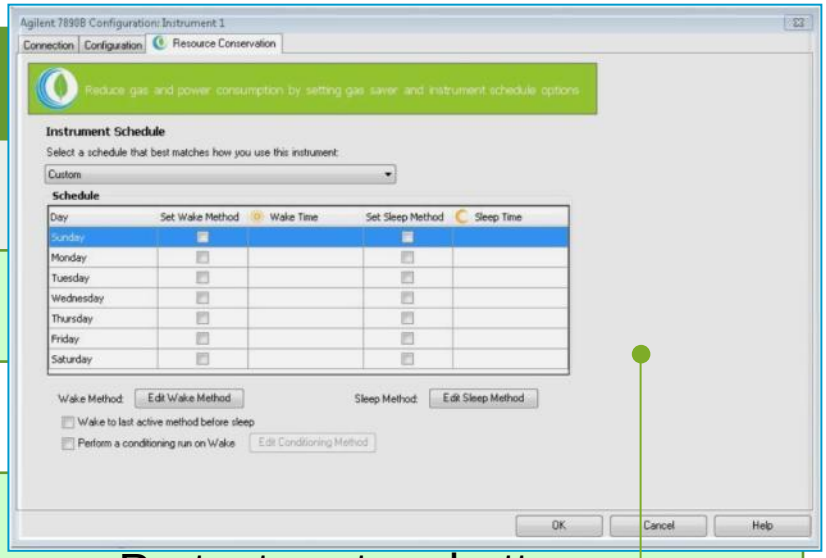
Reducing Dependence on He — A Smarter GC System

Reducing Dependence on He

Integrated Intelligence

Manage He Use Optimally

- Integrated GC calculators
  - Set time to sleep
  - Set time to wake
- Barcode Scanning with Auto-Input
  - Choose to condition GC before first run
- Integrated early-maintenance-feedback
  - Use only the gas you need
- GC:MSD communication
- 3D Interactive Consumable and Parts Finder
- Sleep-Wake Modes
  … Also coordinated with 5977A MSD



Protect system better

Sleep-Wake Function

Find parts faster & order easier

Can save as much as 15% in gas usage – up to $4,000 per year per instrument for many labs

Lower cost of ownership

Today's Challenges

Economic - Routine -	• Productivity • Investment Protection • Cost of Ownership • Ease-of-Use	Integrated GC/MSD Communications OpenLAB, MassHunter Gas/Power Resource Managment OpenLAB, MassHunter
Economic - Method - Development	• Time = Money • Skilled Resources … Harder to Find	Integrated Intelligence
Sensitivity	• Trend – Lower LOD's • "Imperfect" Samples	5977A MSD GC FPD „PLUS" Inert Flow Path

Introducing the 7890B Gas Chromatograph

Re-defining Premium Gas Chromatography

Improved Performance Specifications

Best-in-class package of performance specifications

New & Expanded Accessories & Options

Improved FPD-Plus detector
ECD as 3rd detector option
New Inert Flowpath option
Dual MMI inlets

Integrated Intelligence Functions

GC-MSD communication
Sleep-wake function
Method development calculators
3D Interactive Graphical Parts Finder
Early Maintenance Feedback
Barcode Scanning with Auto-Input

New Agilent 5977 Series GC/MSD

The 5977 is the new Agilent GC/MSD platform and replaces the 5975C and 5975E systems

- Improves performance with high sensitivity **Extractor Ion Source**
- **MassHunter GC/MS Acquisition**
- **MassHunter** and **MSD ChemStation** data analysis
- Integration of **new Agilent Vacuum Pumps** brings intelligent operation
- **Direct Communication** between 7890B and 5977A for more productivity

New Agilent 5977 Series GC/MSD

What is the same as 5975?

- ✓ Quality
- ✓ Reliability
- ✓ Proven core technology since 5973/5975
  - Inert Ion Source
  - Heatable Gold Quartz Quadrupole
  - Triple Axis Detector
  - High Energy Diode
  - Triple Channel EM Detector
  - Productivity Software (MSD ChemStation Data Analysis)

New Agilent 5977 Series GC/MSD

What is new with 5977?

- ✓ Better Performance
  - High Sensitive Extractor Ion Source
  - Improved Agilent Vacuum Pump
- ✓ More Productivity
  - Direct Communication 7890B⇔5977A
    - Protect system
    - Vent the system faster
    - Power save (Sleep/Wake)
  - MassHunter Software
    - Data Acquisition (Method/Sequence)
    - Data Analysis

New Extractor Ion Source for 5977

Why the Extractor EI Source?

Increase in ion count

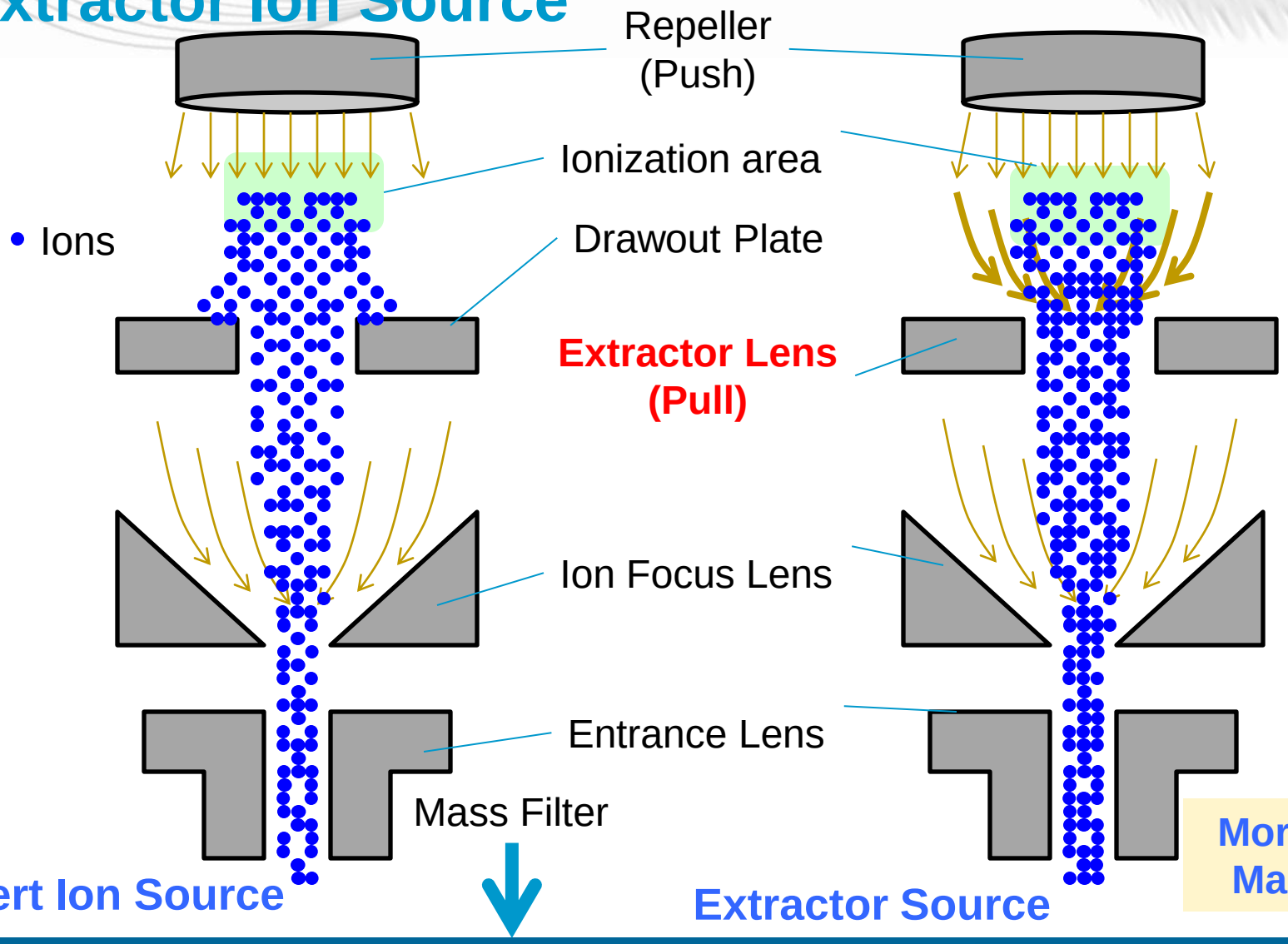
- ✓ True increase in sensitivity

Better trace level precision

- ✓ Lower IDL and MDL

Proven sensitivity increase demonstrated with over 1500 7000 Series GC/TQ!

Comparison between Inert Ion Source and Extractor Ion Source

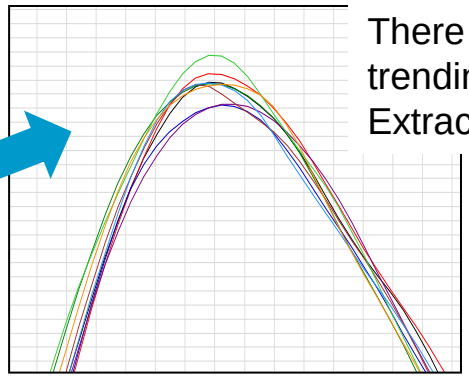


More improvements on 5977's Extractor Ion Source: Improved Thermal Profile

Why is this important?

Better performance of **high boilers**
i.e. PAH even at lower concentration!

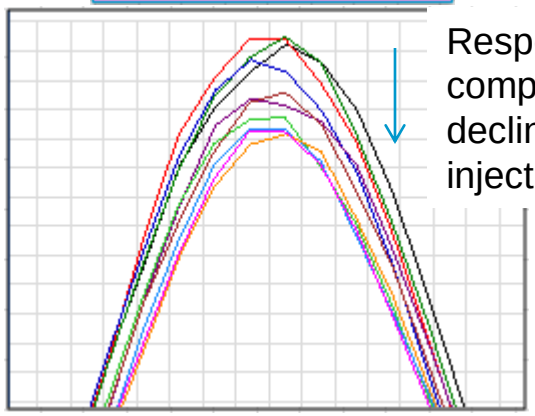
5977 result



There is no response trending with new 5977 Extractor Source

5ppb PAH

5975 result
Two years ago



Response of high boiling compounds (PAH) was declining over sequential injections

200ppb PAH

10 Injections
80 min analysis

Improvement for better Mass Spectrometer of Gas Chromatograph

New Agilent 5977 Series GC/MSD

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  - Improved Agilent Vacuum Pump
- ✓ More Productivity
  - Direct Communication 7890B⇔5977A
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    - Data Acquisition (Method/Sequence)
    - Data Analysis

Better HW Features: Agilent Turbo Pump (V304)

TwisTorr 304 FS

Innovation for:

- **Higher pumping performance**
  - especially for He and H_2
- **High reliability**
  - lower cost of operation

Agilent Quality Standard

Press release : http://www.agilent.com/about/newsroom/presrel/2012/19dec-ca12077.html

Better HW Features: Agilent Rough Pumps

New DS42i

High performance
Energy saving design
"Inverter" mode not active with diff pump

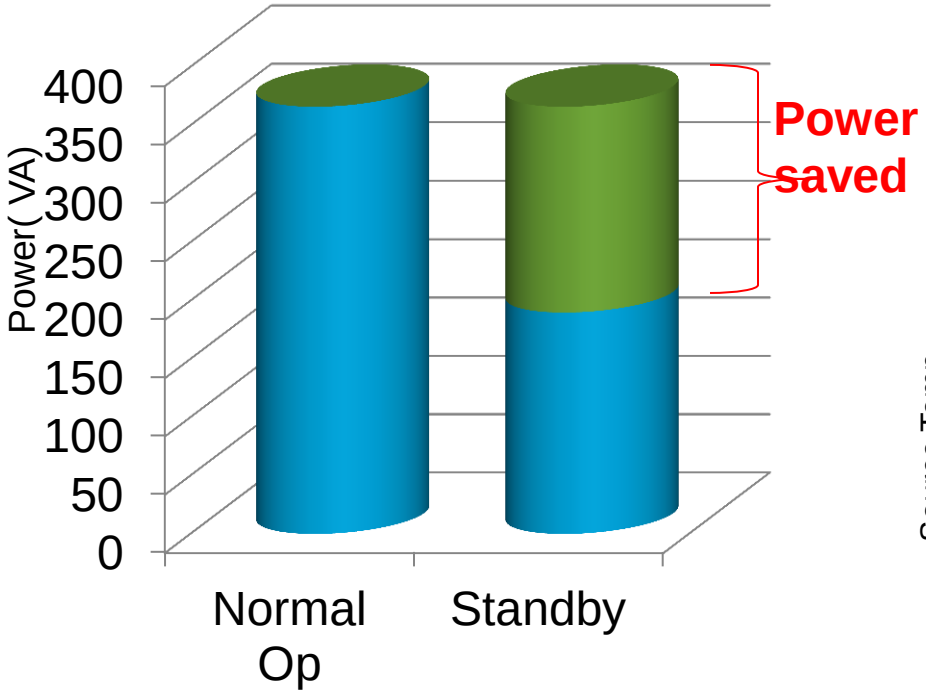
New IDP-3c

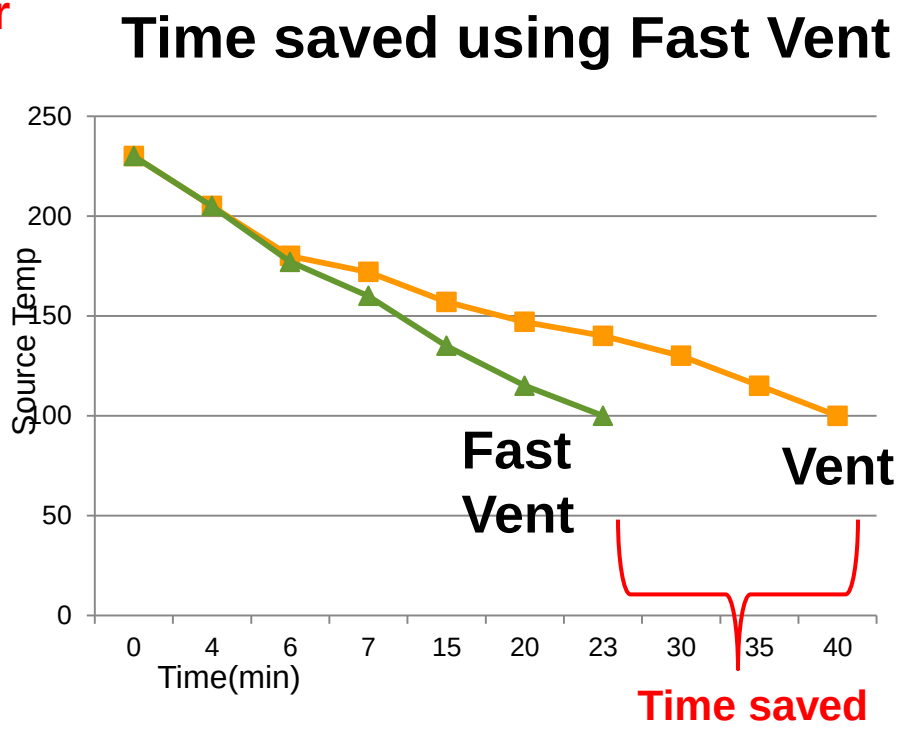
High performance
Oil-free scroll pump
NH_3 CI compatible

with Agilent Quality Standards

Saving Energy and Time

Power Consumption - 5977





Example of Cost simulation of saving power with Agilent 7890B/5977A at Environmental Lab

Assumptions

- GC/MSD cycle time: 40 minutes (30min for data acq./10 min for cool down & prep)
- Sample: 30 samples/day
- Working day: 5 days/week, no operating on Sat/Sun

GC/MSD **wake time** = 40 min/sample * 30 samples * 5 days/week
= 6,000 min/week = **100 hours/week**
= 32 kWh

GC/MSD **sleep time** = 168 hours/week – 100 hours/week = **68 hours/week**
= 13 kWh

Total Power usage (1 week) = 45 kWh (with Sleep mode)

Total Power Usage (1 week) = 54 kWh (without Sleep mode)

Weekly MS Power saving per instrument = 9kWh (17%)

New Agilent 5977 Series GC/MSD

What is new with 5977?

- ✓ Better Performance
  - High Sensitive Extractor Ion Source
  - Improved Agilent Vacuum Pump
- ✓ More Productivity
  - Direct Communication 7890B⇔5977A
    - Protect system
    - Vent the system faster
    - Power save (Sleep/Wake)
  - MassHunter Software
    - Data Acquisition (Method/Sequence)
    - Data Analysis

Key features of “Direct Communication” between 7890B and 5977A

Sleep/Wake mode

- In sleep mode, MSD will go to the Power save mode (320W → 190W)

  ➔ Laboratory Operating Cost Reduction (see the previous slide for detail)

Safety Control

- If 5977A MSD Pumps fail, 7890B will shut off the gas supply for protecting GC/MSD system.

  ➔ Helium Carrier gas : This prevents wasting gas.

  ➔ Hydrogen Carrier gas: This reduces the risk of explosion in MSD.

Cool Down MSD Faster (FastVent)

- When MSD Vent Cycle started, GC will cool down MSD analyzer at the optimum gas flow to MSD.
- ➔ Less time to wait for cooling down MSD analyzer (40 min → 25 min when cooling down from 280C to 100C)

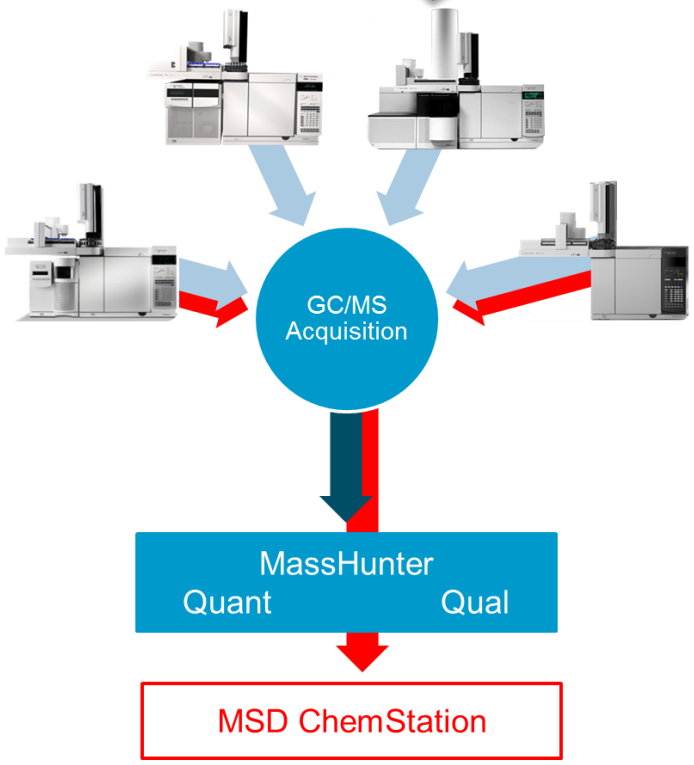
New Agilent 5977 Series GC/MSD

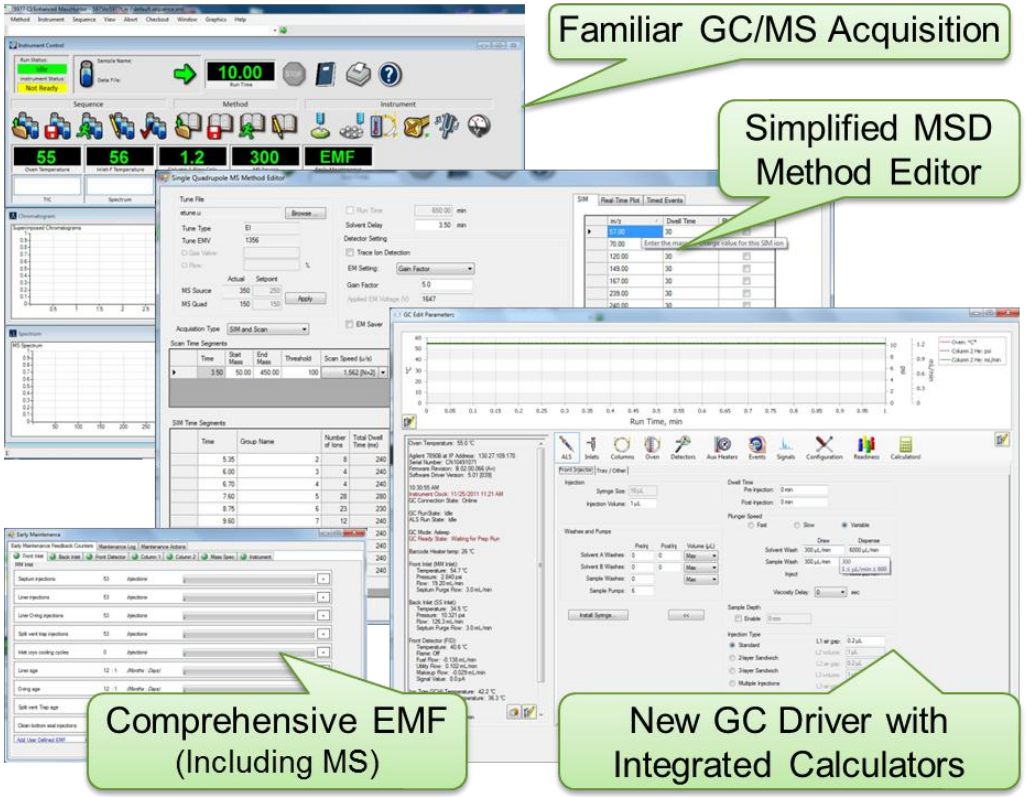
What is new with 5977?

- ✓ Better Performance
  - High Sensitive Extractor Ion Source
  - Improved Agilent Vacuum Pump
- ✓ More Productivity
  - Direct Communication 7890B⇔5977A
    - Protect system
    - Vent the system faster
    - Power save (Sleep/Wake)
  - MassHunter Software
    - Data Acquisition (Method/Sequence)
    - Data Analysis

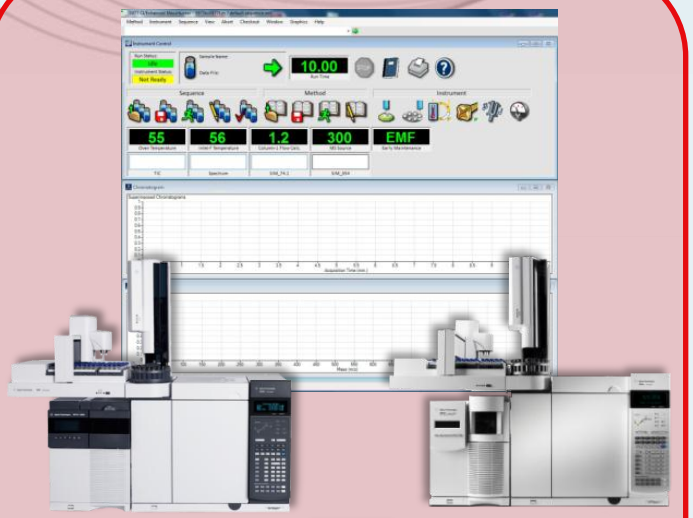
MassHunter GC/MS Acquisition for GC/MSD

Unified GC/MS Acquisition and MassHunter Data Analysis; with MSD ChemStation workflow for GC/MSD

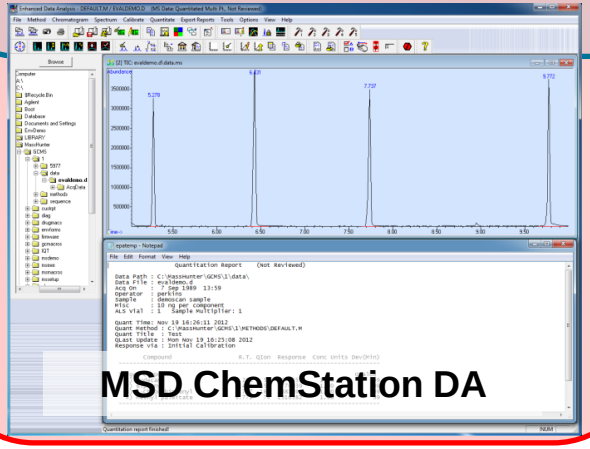




GC/MSD Software

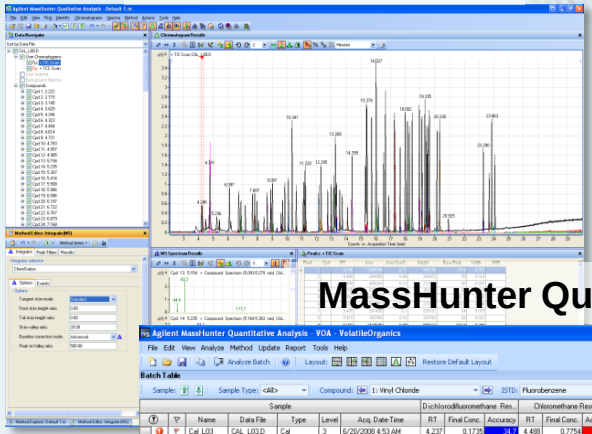


CS

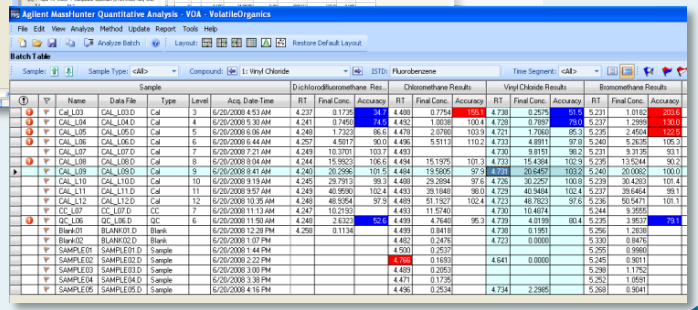


MH

MassHunter Qual



MassHunter Quant



MassHunter GC/MS Acquisition

<u>And Use Either</u>

MassHunter Data Analysis

<u>OR</u>

MSD ChemStation Data Analysis

G1701FA

MSD Productivity ChemStation OR MassHunter?

1-Year Software Maintenance Agreement

MSD ChemStation

Established Agilent GC/MSD User

- Adding instrument to routine production
- Established workflows
- **Macros, Macros, Macros**

DRS or Screener DB

EnviroQuant User

- Uses the US EPA workflow, especially reports and QA/QC criteria.
- *MassHunter EnviroQuant targeted for late 2013*

MassHunter

Look and feel of modern software

Superior Quantitation

21CFR11 & Other Regulated Labs

Multi disciplinary MS lab

- Have Agilent Triple Quad or (Q-)TOF
- LC/MS, ICP-MS, & GC/MS
- MS and MS/MS

The Value of G1701FA Software

All Inclusive G1701FA Software Package

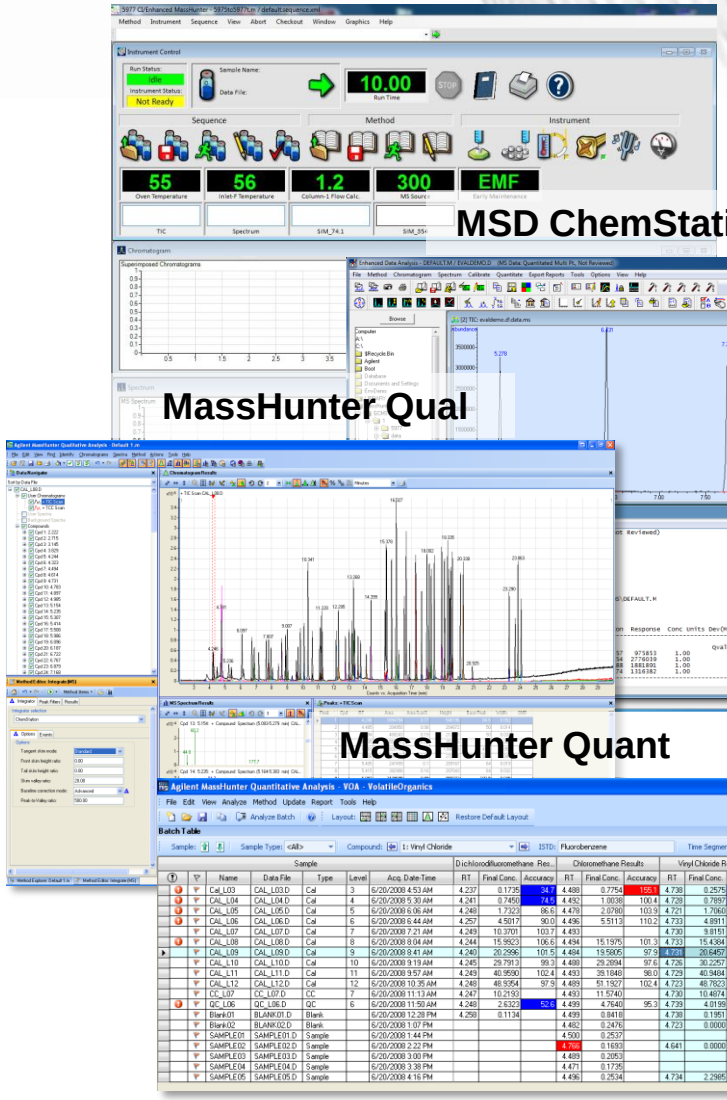
- MassHunter GC/MS Acquisition
- MassHunter Quantitative Analysis
- MassHunter Qualitative Analysis
- MSD ChemStation Data Analysis
- 21CFR11 Compliance tools (Acquisition and MH Quantitative Analysis)
- GC/MS and LC/MS Translators

Collated User Information

- Workflow guides, Video Tutorials, all in one location

Support

- 1yr Upgrade, Updates, and Phone Support
- Training and Familiarization options



Expanded Capabilities: 7890B/5977A

Improving the Industry Standards for GC/SQ

Higher Ion Count

- *Extractor EI source*
  - *Increased ion count*
  - *S/N > 1500:1*
  - *IDL < 10 fg (industry first)*
  - *Improved thermal profile*

Better Vacuum by Agilent Pump

- *New Agilent V304 Turbo*
  - *TwisTorr*
    - *Molecular Drag technology*
  - *Improved pumping light gases*
    - *H_2 (220 L/s); He (255 L/s)*
  - *Agilent Floating Suspension*
    - *Longer life*
    - *Quiet operation*

Safety/Protection

- *Vacuum failure → Shut off gas (He or H2)*

Save Time & Energy

- *Sequence Scheduler*
  - *"Standby" post run*
  - *"Ready to run" from standby*
  - *"Bake Mode" as needed*
- *Factory backflush option*
- *Fast Vent capability*
- *DS42i rough pump"standby" power reduction*

Faster Scanning

- *20,000 u/s*
  - *But never equal to the 7200 Q-TOF speed or 'scan' sensitivity*

7890B GC Features

- *EMF, calculator, etc.*

All of 5975's features also built in 5977, such as "Gold Quad", SIM/Scan, Gain tuning, Triple-Axis Detector, Trace Ion Detection, Auto CI, etc..