NEW
7890B Gas Chromatograph
+ 5977 Single Quadrupole

January 2013

Today's Challenges

Economic - Routine -

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

Economic - Method - Development

- Time = Money
- Skilled Resources … Harder to Find

Sensitivity

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

Agilent's Response - 7890B GC & 5977A MSD - OpenLAB & MassHunter

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

7890B ⇔ 5977A Direct, 2-Way (LAN) Communication … Enhances and Protects Your GC/MSD Investment

5977A → 7890B

If the MSD vents

→ Increases GC gas flows

→Cools MSD faster

→ ***40% Faster Vent Times***

If a Pump Event/Failure

→ Stops GC Flows

→ Don't waste expensive He

→ Don't build-up H_2

5977A ← 7890B

GC monitors GC/MSD connection

If communication is lost…

→ GC shuts down various (GC) thermal zones

7890B – Better GC Selective Detector MDL Specs … uECD, NPD

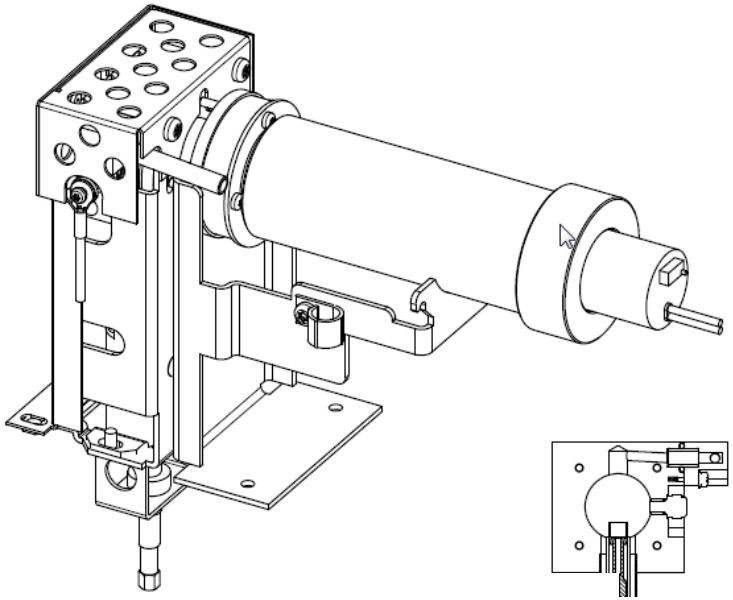
- No Changes in Designs
- Improved Manufacturing Processes/Controls

→ Less Variability
→ Lower MDL Specifications Guaranteed

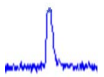
uECD	fg/sec	5.5 → 4.5
NPD	pg N/sec	0.1 → 0.08
	pg P/sec	0.03 → 0.01

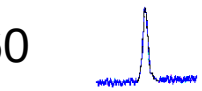
New FPD “Plus”

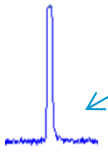
- **Advanced Photomultipliers**
- **Deactivation Treatments**
- **Design Improvements**

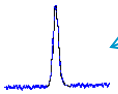


	7890A FPD	7890B FPD+
Max Temp:	250C	400C
Sulfur MDL (pg S/sec)) :	3.6	2.5
Phosphorus MDL (fg P/sec):	60	45







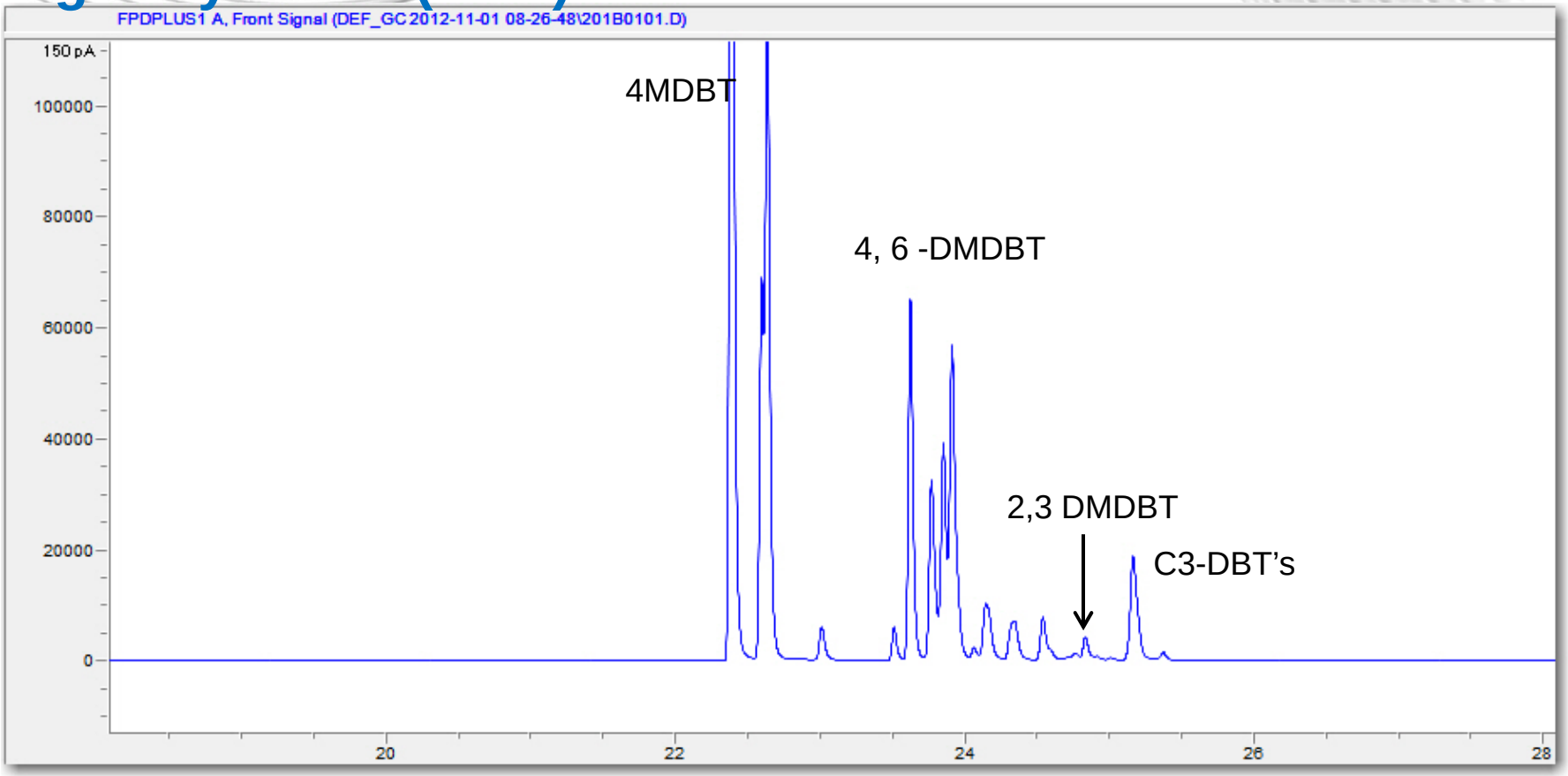


Higher Sulfur Response

Lower Noise

[Agilent SCD = 0.5 pg S/sec]

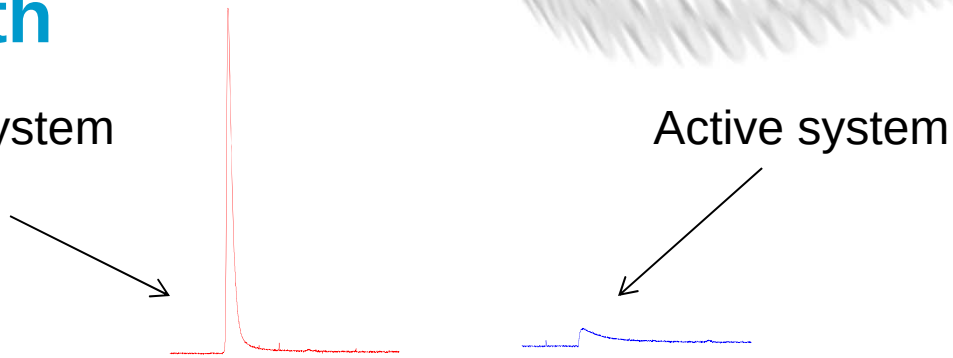
Analysis of Substituted Dibenzothiophenes in Light Cycle Oil (LCO)



- **The detector must be operated at temperatures above 300 C**

- **Agilent FPD Plus' higher temperature /improved sensitivity expands S-applications addressable by the easy-to-use FPD**

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

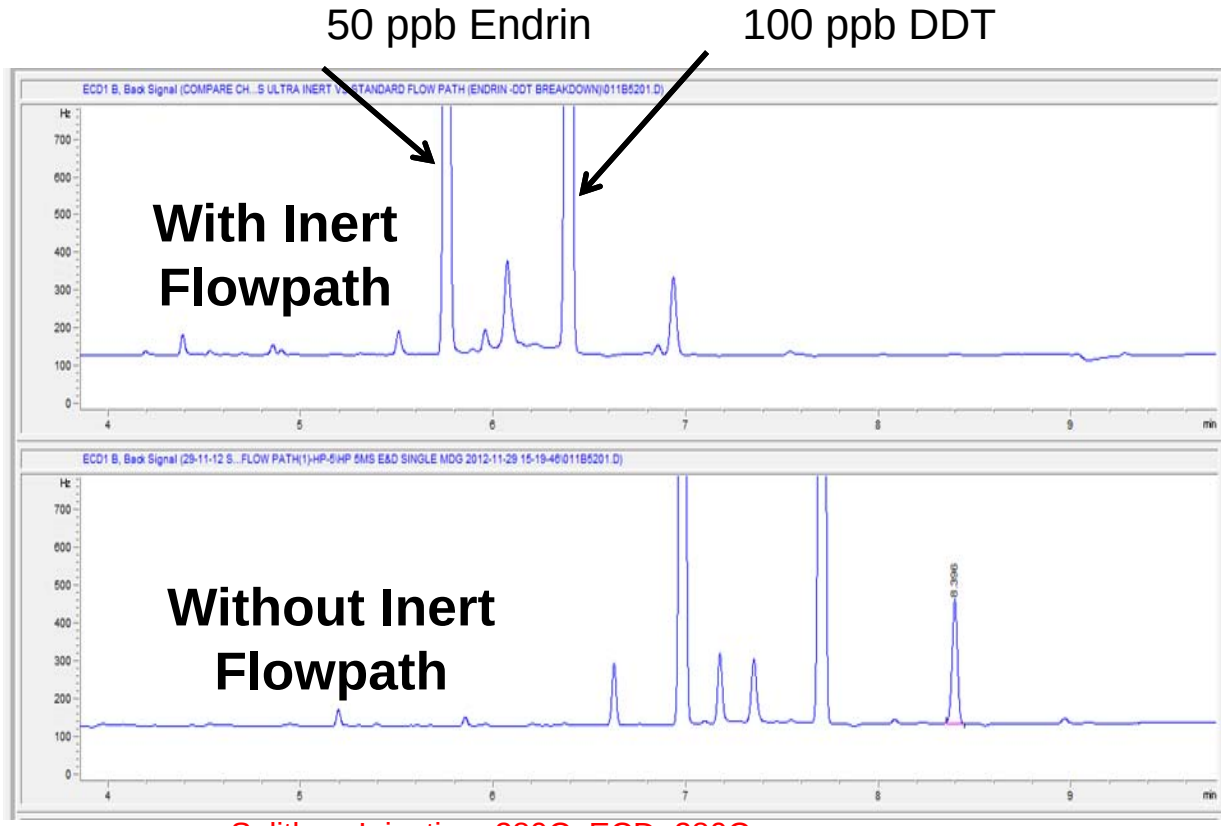
Agilent Inert Flow Path … From Injection to Detection

Ensures superior performance for trace level analysis

Agilent's Inert Flowpath..*From Injection to Detection*

Clearly less breakdown of a ppb level standard after 100 injections!

<u>Consider the following</u>:
Inlet liner
Gold seal
Inlet weldment
Column
Capillary Flow Device
Detector

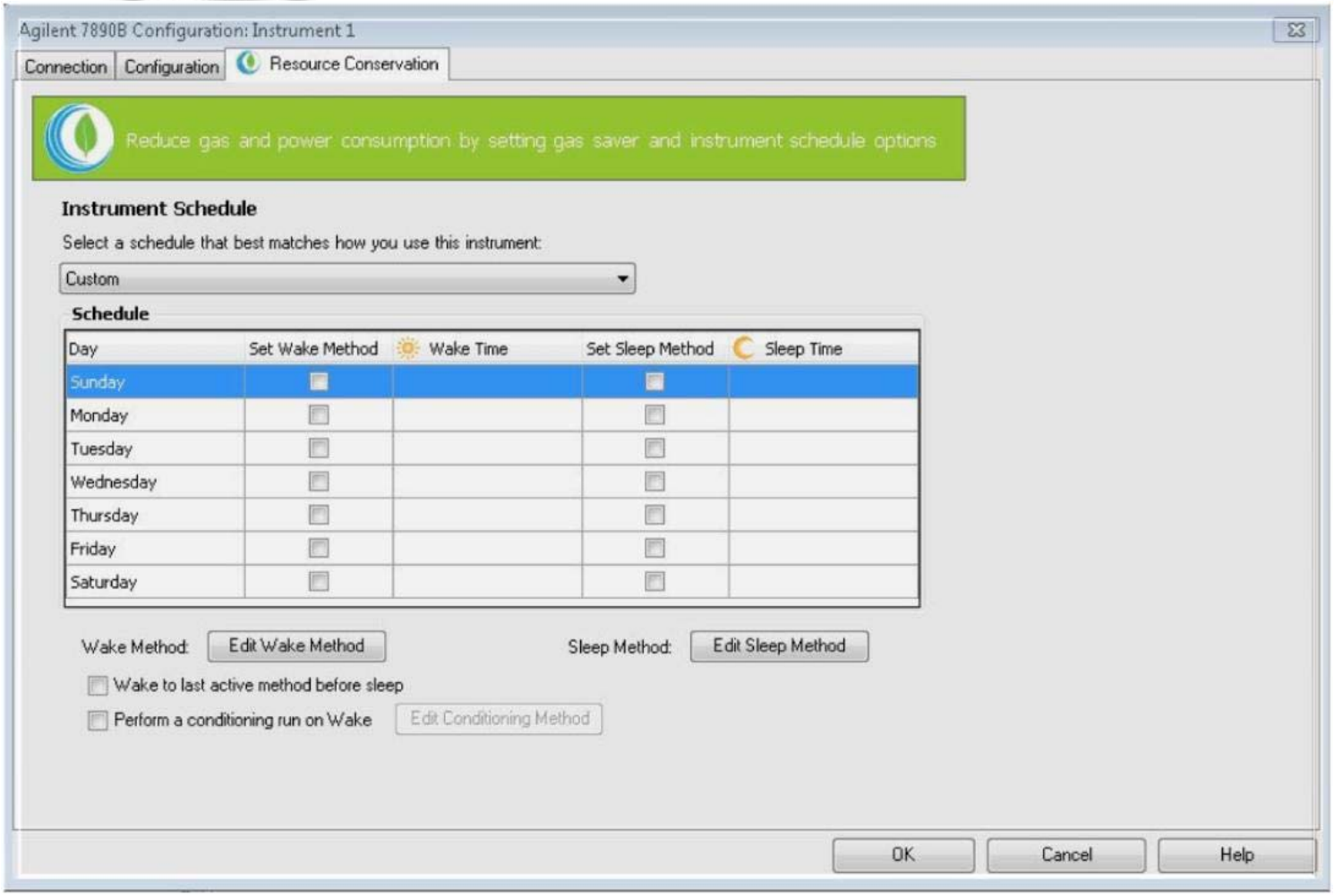


Splitless Injection, 280C, ECD, 280C

Integrated Intelligence … A Smarter GC System

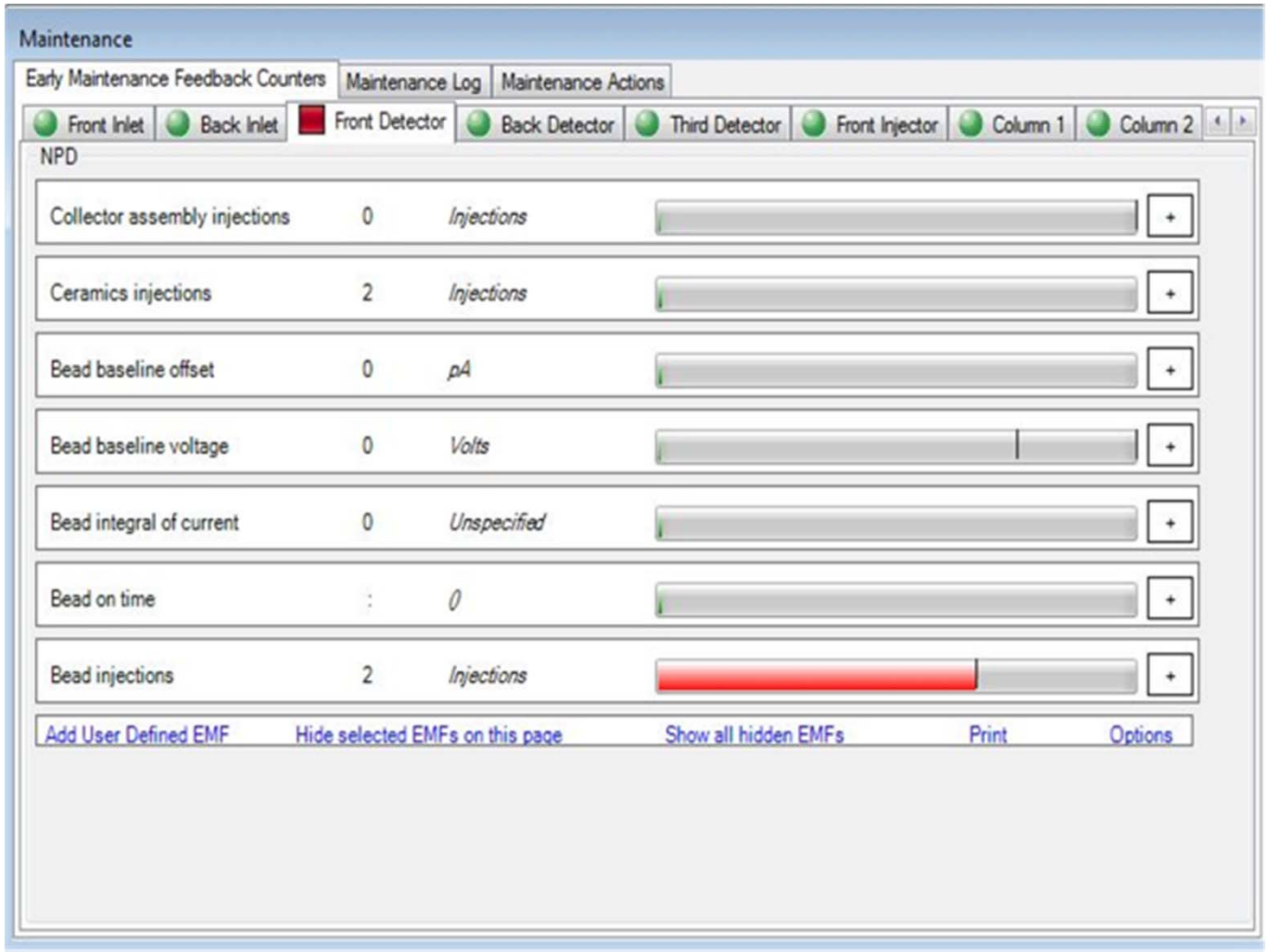
Integrated Intelligence	Benefit
Integrated GC calculators	Develop methods easier
Barcode Scanning with Auto-Input	Easier configuration
Integrated early-maintenance-feedback	Manage assets more efficiently
GC:MSD communication	Faster MSD vent Protect system better
3D Interactive Consumable and Parts Finder	Find parts faster & order easier
Sleep-Wake Modes … Also coordinated with 5977A MSD	Lower cost of ownership

7890B Sleep/Wake Modes →Reduce Power/Gas Costs



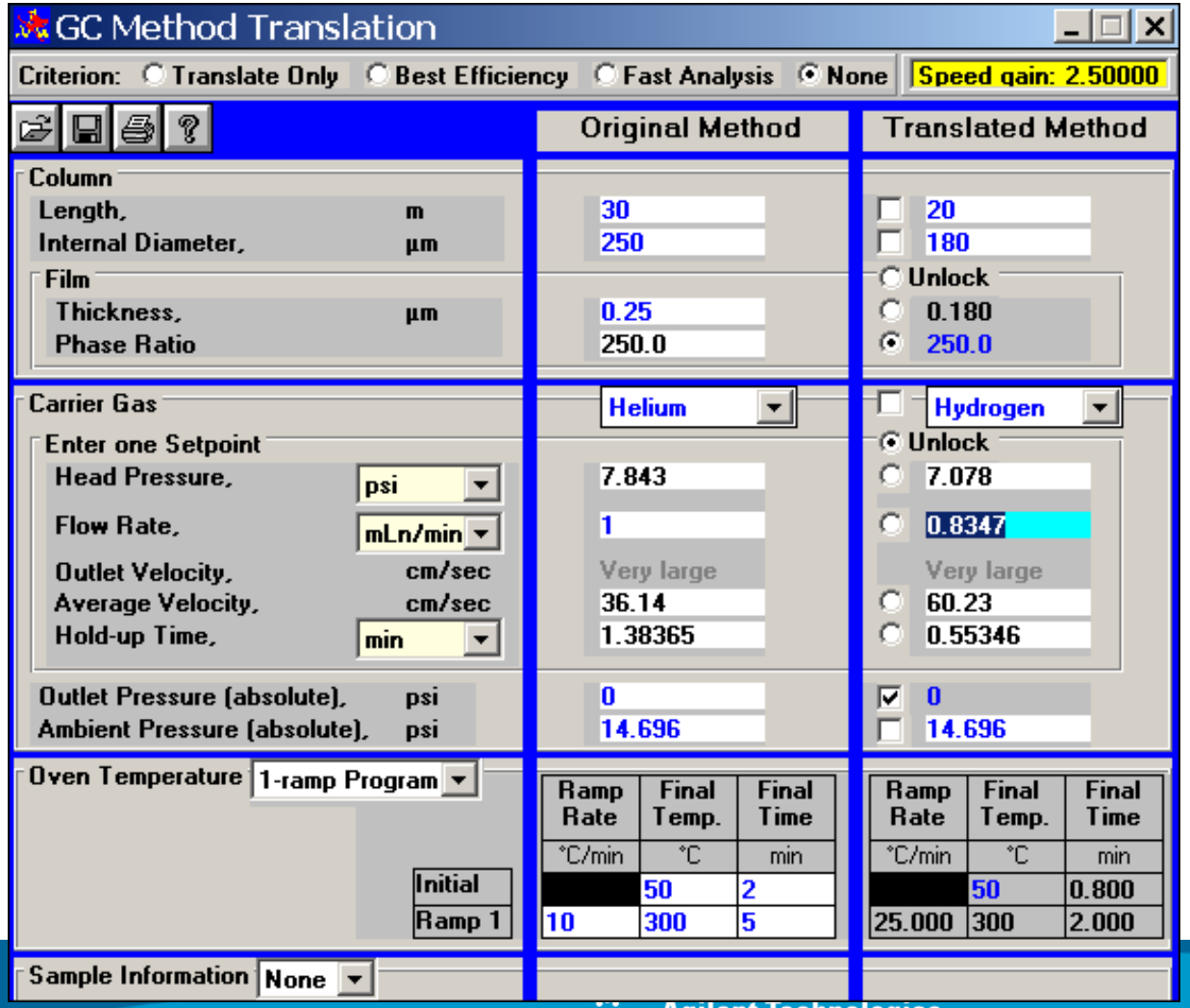
Early Maintenance Feedback

Improving Operational Efficiency

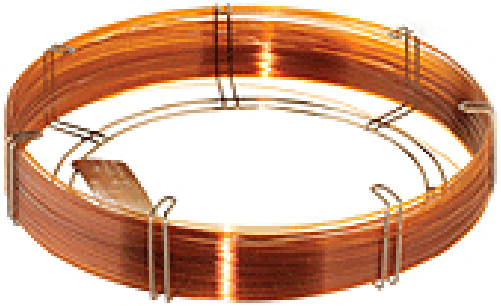


Method Translation Tools

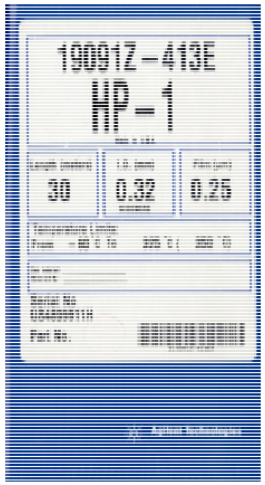
Completely Updated with AutoImport to Method

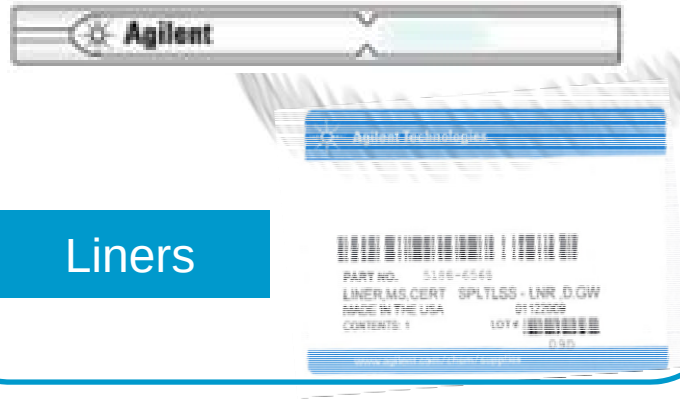


Barcode Scanning Input



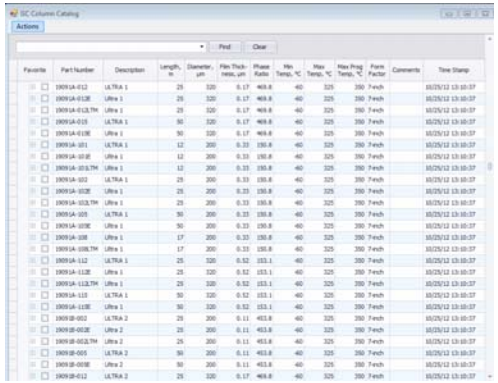
Columns





Liners

Barcode in the columns, liners, and syringes right into the Agilent data system method



*Also syringes

Parts Finder

Agilent Technologies

PARTS FINDER

FIND PARTS

PARTS LIST

FAVORITES

UPDATES

HELP

PROMOTIONS

FIND PARTS

ALS

7693A ALS

7650A Automatic Liquid Samp

GC

Agilent 7890B

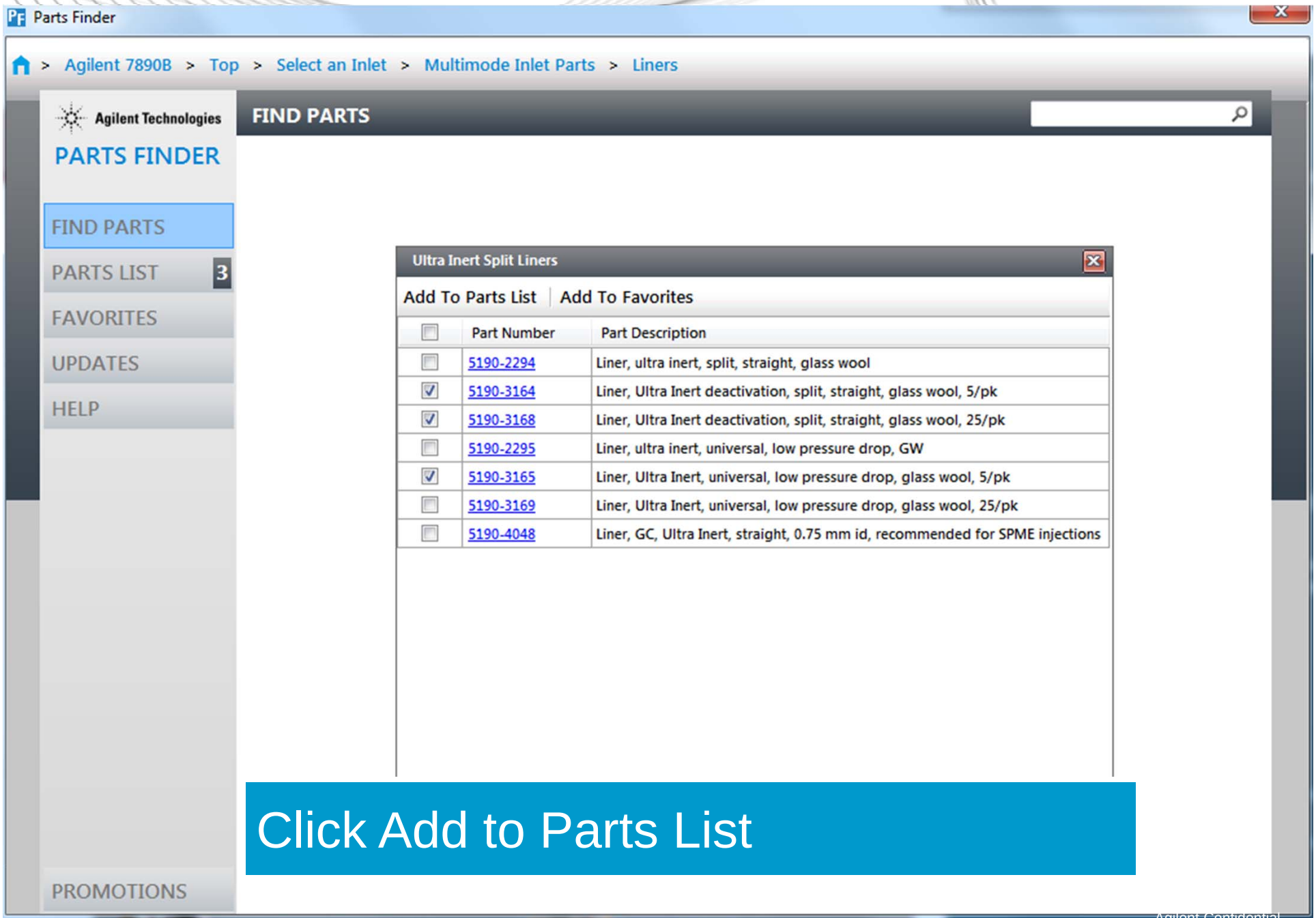
Agilent 7890A

Agilent 6890N

MS

5975 MSD

Select the instrument


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

7890A Enhancements Kit

7890A Logic Board Enhancement Kit

- Makes a 7890A GC ready for most (but not all*) 7890B GC features

- **"Integrated Intelligence" features:**
  - Early Maintenance Feedback (EMF), Sleep/Wake modes
  - Method Translation Calculator
  - Enable 2-way GC/5977A MSD communication

- **Agilent Serial Port:**
  - 2nd communication port for Remote Advisor
  - Optional Bar Code Reader connects directly to GC
    [also a version for USB/PC]

- **FPD Plus**

*** 7890B Only**

- 2nd MMI on GC, 3rd Detector as uECD

Agilent's Response - 7890B GC & 5977A MSD - OpenLAB & MassHunter

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

Agilent 5977 MSD Overview

New GC/MSD Introduction

January 2013

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

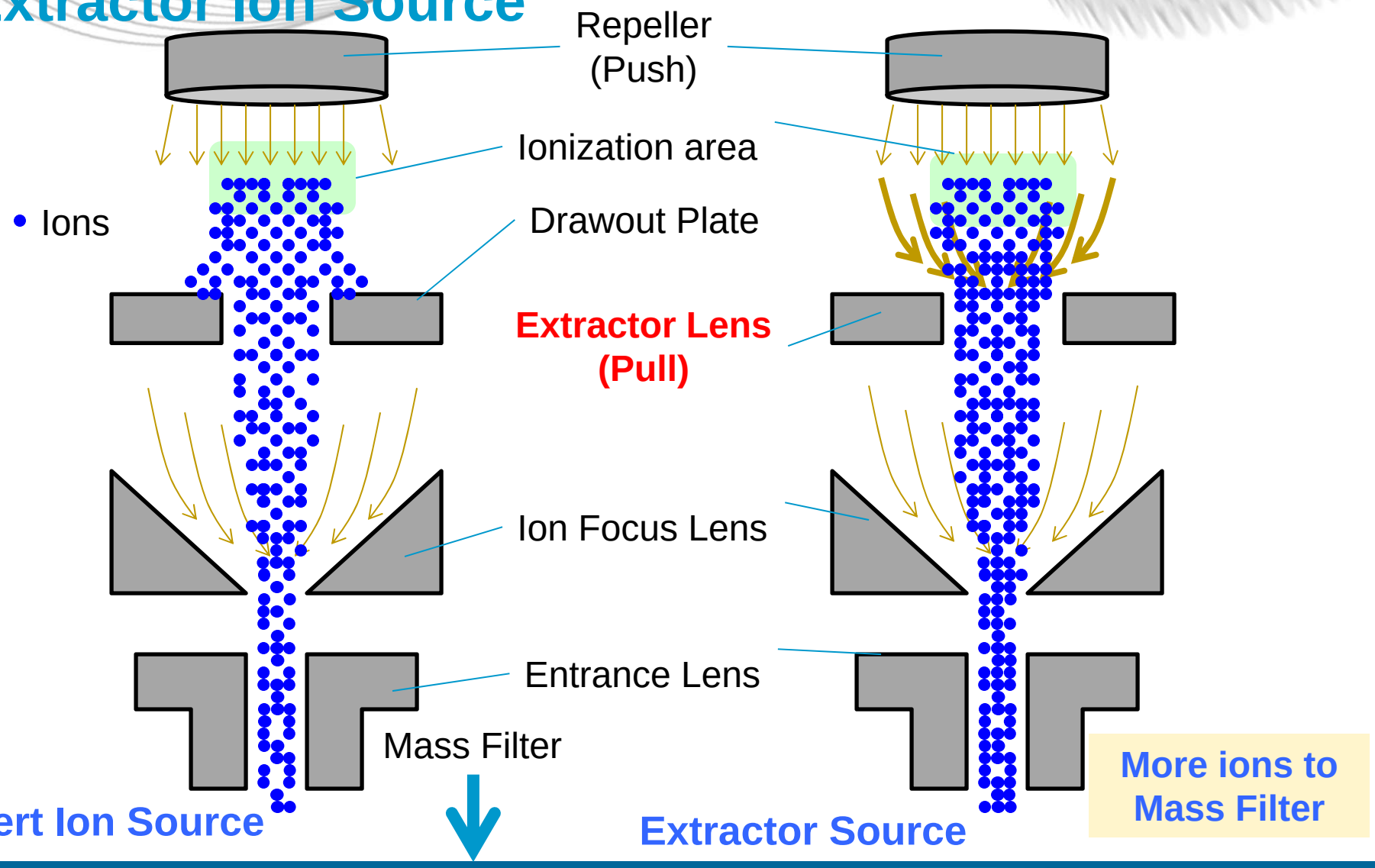
- ✓ True increase in sensitivity

Better trace level precision

- ✓ Lower IDL and MDL

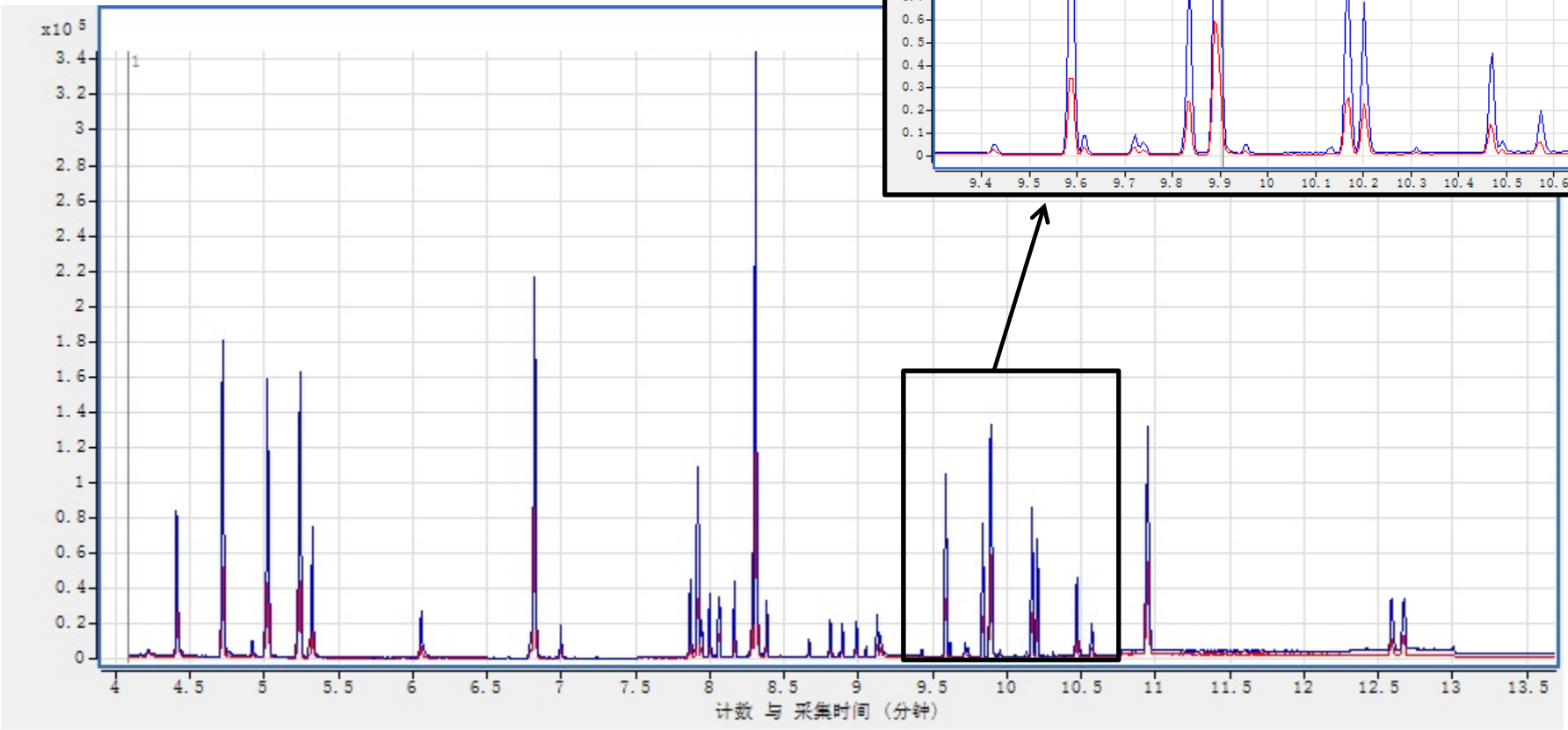
Proven sensitivity increase demonstrated with over 1500 7000 Series GC/TQ!

Comparison between Inert Ion Source and Extractor Ion Source



How Extractor Ion source with “Etune” be seen in the Chromatogram?

Blue – Extractor 40ppb solution (SVOC)
Red – Standard 40ppb solution (SVOC)



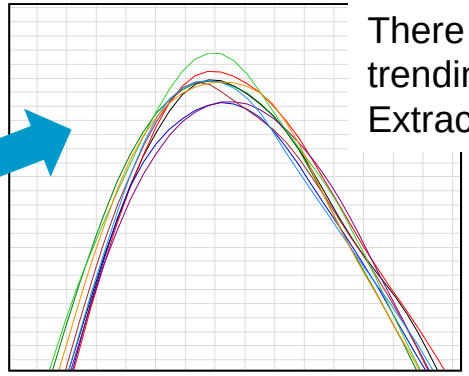
More improvements on 5977's Extractor Ion Source: Improved Thermal Profile

Why is this important?

Better performance of **high boilers**

i.e. PAH even at lower concentration!

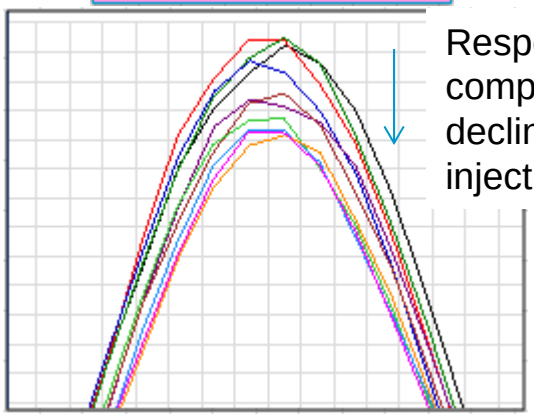
5977 result



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

Sensitivity Specification of 5977

Signal-to-noise (S/N) specification has been used as the sensitivity specification of GC/MS for long years.

Agilent 5977 has highest S/N (1500:1) in Extractor Ion Source among Single Quadrupole GC/MS system.

Agilent 5977A introduces *new* sensitivity specification of Instrument Detection Limit (IDL), which shows the detectability of trace compounds of the GC/MS system.

Why IDL specification is useful for 5977?

- S/N ***can be*** higher when the Noise is too low, such as SIM acquisition.
- S/N can only show the sensitivity performance of Single-shot injection. It doesn't indicate reproducibility of system performance.
- IDL uses statistic calculation to estimate the detection limit of the instruments (the same calculation of Method Detection Limit; MDL) both sensitivity and reproducibility.

You will get more accurate sensitivity performance of GC/MS system from IDL than single-shot S/N.

5977A GC/MSD IDL Specificaiton

IDL is represented in the concentration of the compound with the confidence level.

For example, Agilent 7890B/5977A with Auto Liquid Sampler (ALS) has following specification at 99% confidence level with 8 repeated injections.

Ion Source type	High Vacuum pump type	IDL of OFN by 8 replicates of ALS
Extractor Source	Turbo Pump	10fg
Inert Source	Turbo Pump	24fg
	Diffusion Pump	30fg

Meaning of IDL

10 fg IDL specification of 5977A Extractor Ion Source with Turbo Pump means that the GC/MSD with ALS will detect 10fg OFN or lower at 99% confidence from 8 repeated injections.

For accurate estimation of IDL, accurate sample injection to GC/MSD system is critical.

Agilent only have IDL specification for ALS system. (7693 Auto injector or CTC sampler)

The GC/MSD system without ALS has S/N specification.

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

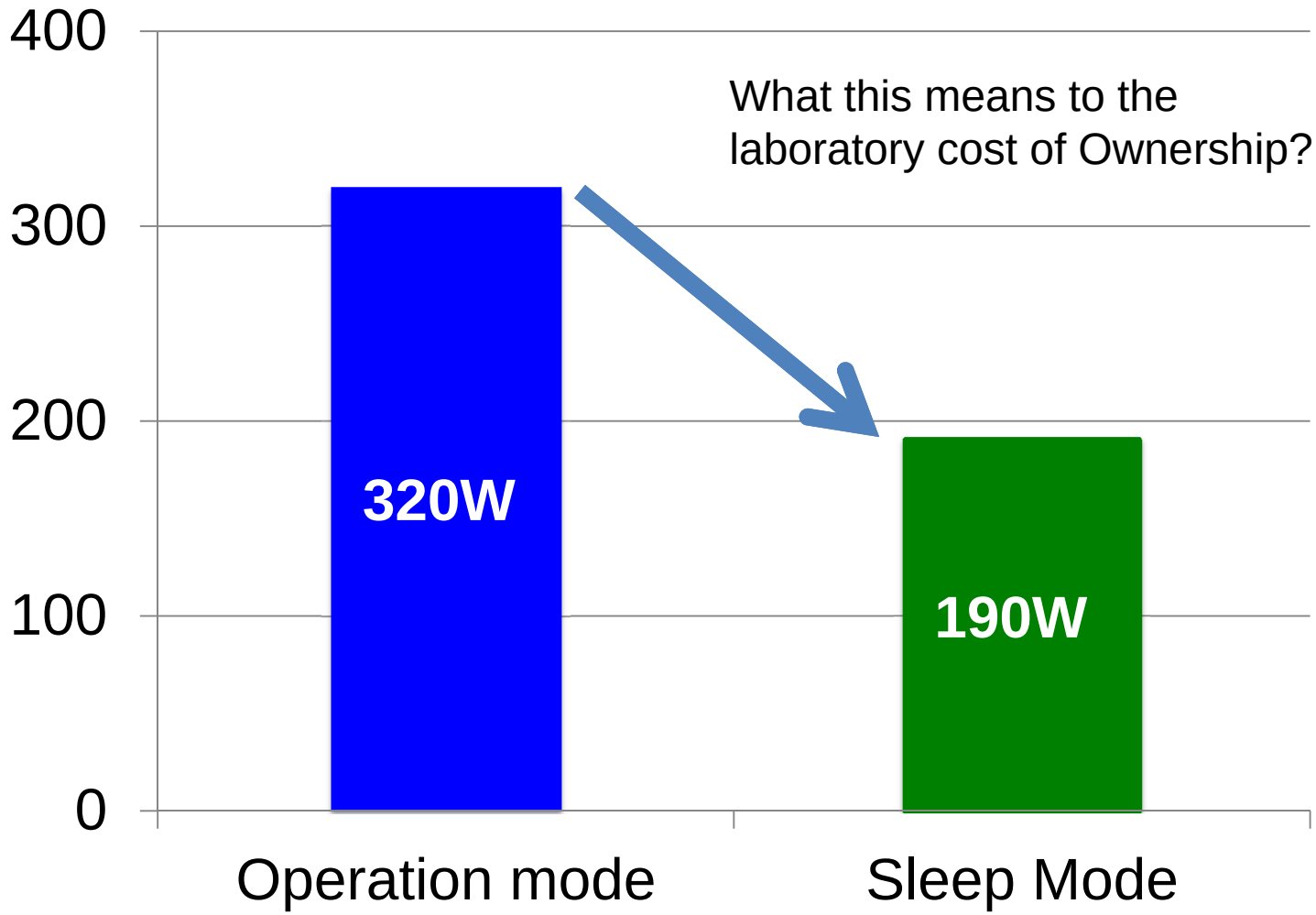
High performance
Energy saving design
"Inverter" mode not active with diff pump

New IDP-3c

High performance
Oil-free scroll pump
NH_3 CI compatible

with Agilent Quality Standards

Better HW Features: Power consumption saving of MSD by Inverter Pump (DS42i)



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%)

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)

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..


RESOLVE
YOUR SEARCH
FOR VALUE