Agilent GC/MS Hardware, Software, and Consumables optimized for the Analysis of US EPA Method 8270

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GCMS Applications
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Agilent Technologies

Agenda

Hardware – New GC and MSD: 7890B / 5977A

- Higher sensitivity – More Inert – Still very robust

Performance Data

- Chromatography – Initial Calibration

Software – Both Chemstation and Mass Hunter

- Added capabilities – Universal cross training

Ultra Inert Sample Pathway Components

- Inlets – Columns – Liners – Source

Helium Shortage

- Choices – Hydrogen carrier or Helium Conservation

7890B / 5977A GCMS

Ultimetal Inert Inlets
Helium Conservation Mode
Easy Switch to H2 Carrier

New Pumps
Extractor Source
Low Energy Sleep Mode
Low Femtogram Detection Limits

New Extractor Ion Source for 5977

Increase in ion count

- ✓ True increase in sensitivity

Better trace level precision

- ✓ Lower IDL and MDL

Performance Data:
Many Different 8270 Methods

Different compound lists

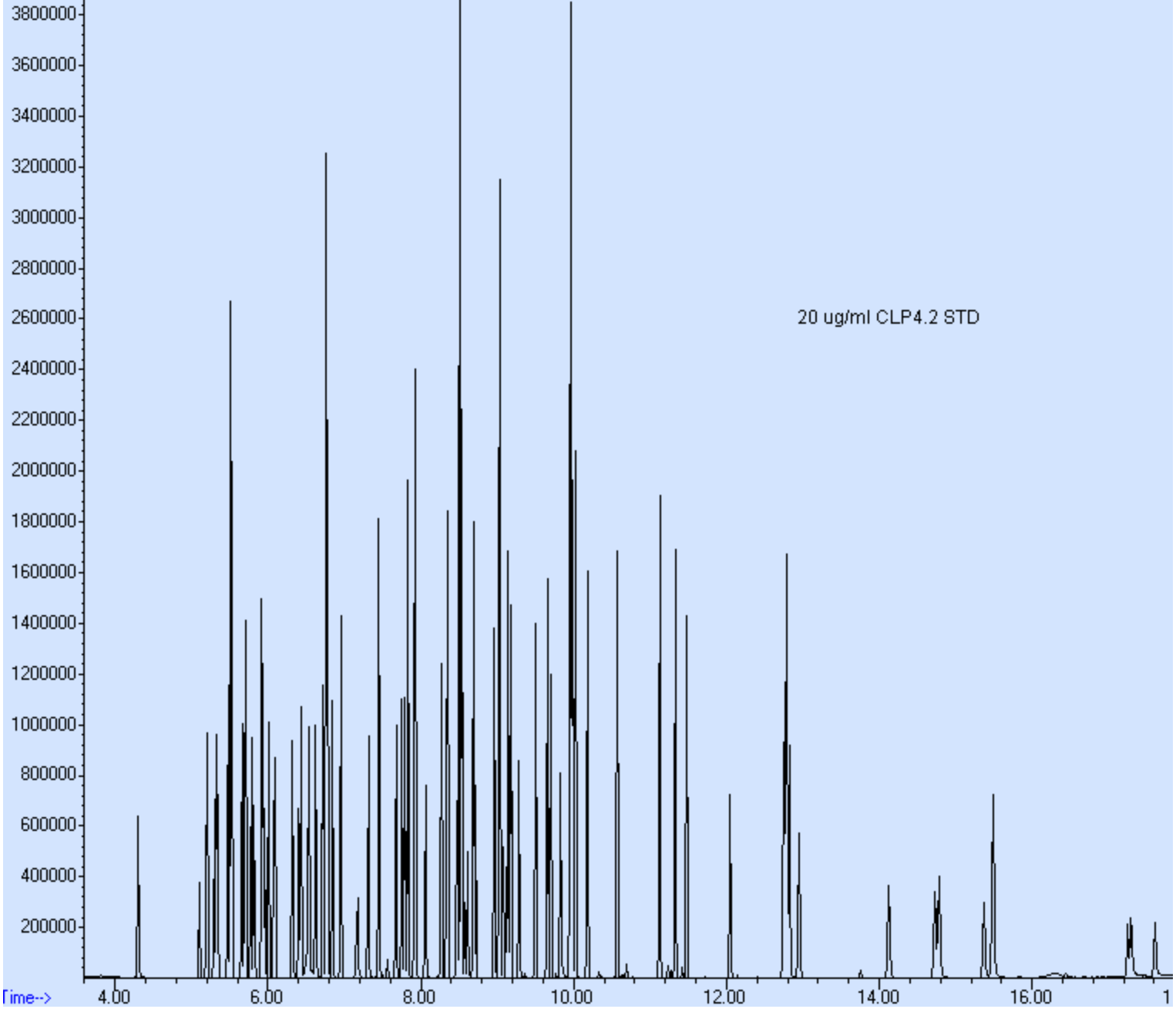
Different calibration ranges

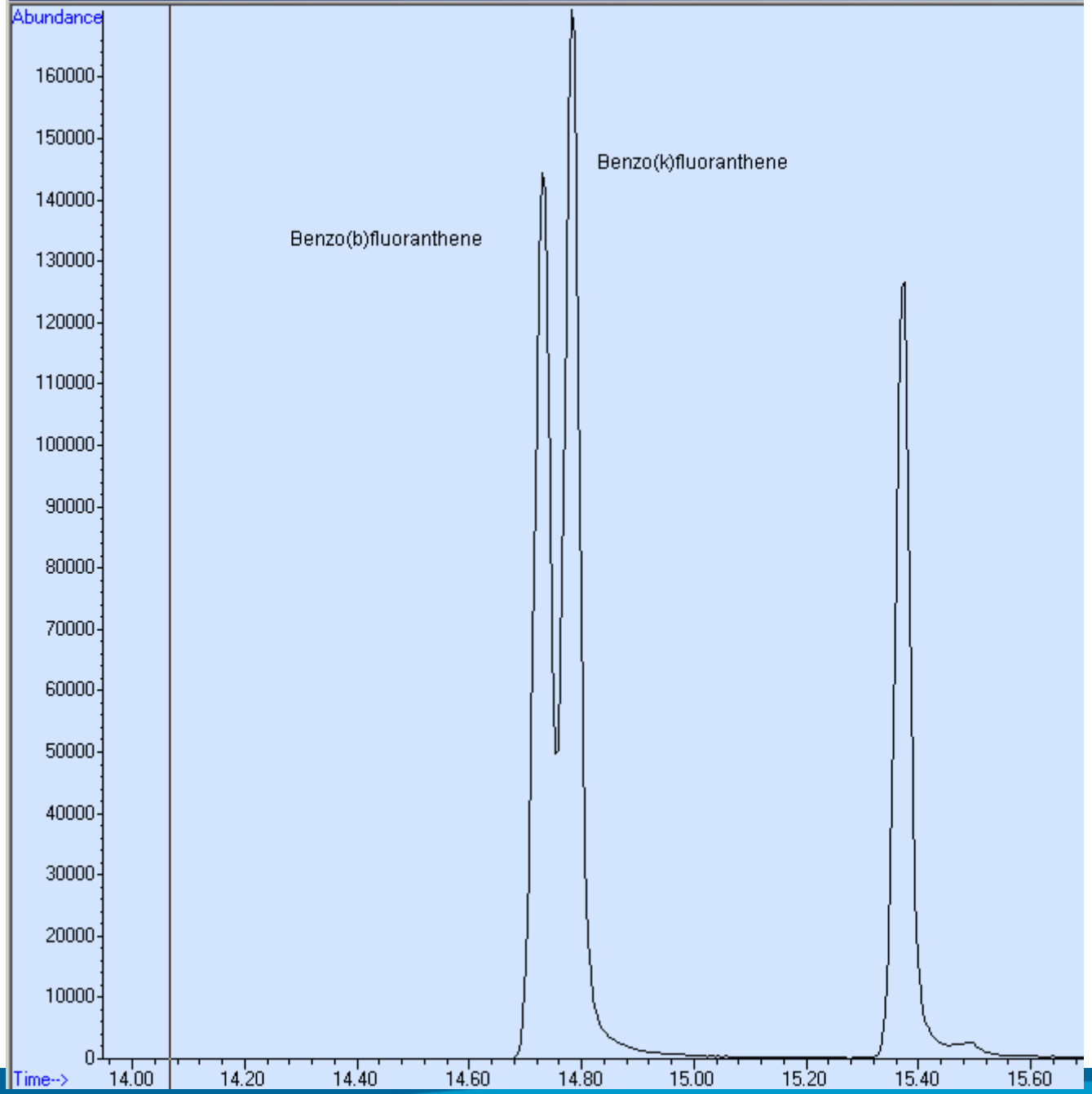
For example: High 2 – 100 ug/ml

Low 0.1 – 10 ug/ml

Different reporting limits

Data shown is from EPA Region 6 Lab in Houston


20 ug/ml CLP4.2 STD
3800000
3600000
3400000
3200000
3000000
2800000
2600000
2400000
2200000
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
Time-->
4.00
6.00
8.00
10.00
12.00
14.00
16.00


Abundance
160000
150000
140000
130000
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Time-->
14.00
14.20
14.40
14.60
14.80
15.00
15.20
15.40
15.60
Benzo(b)fluoranthene
Benzo(k)fluoranthene

Performance Data – most critical: ical & Perf Eval

	Compound	100	80	50	20	10	5	2	Avg	%RSD
1)	I 1,4-Dichlorobenzen...	----------	----------	----------	ISTD	----------	----------	----------		
2)	SCP 2-Fluorophenol...	1.013	1.001	0.994	0.999	1.000	1.013	0.983	1.000	1.04
3)	SCP Phenol-d5 (surr2)	1.237	1.221	1.231	1.247	1.225	1.235	1.233	1.233	0.68
4)	MCP Phenol	1.275	1.288	1.289	1.301	1.304	1.310	1.315	1.297	1.09
5)	SCP 2-Chlorophenol...	1.179	1.161	1.168	1.177	1.177	1.172	1.169	1.172	0.53
6)	TCP bis(2-Chloroet...	1.071	1.081	1.077	1.088	1.089	1.084	1.111	1.086	1.16
7)	MCP 2-Chlorophenol	1.200	1.219	1.213	1.216	1.209	1.222	1.223	1.215	0.65
8)	TCP 1,3-Dichlorobe...	1.399	1.417	1.412	1.418	1.407	1.439	1.447	1.420	1.22
9)	MCP 1,4-Dichlorobe...	1.406	1.427	1.439	1.440	1.453	1.442	1.472	1.440	1.42
10)	TCP Benzyl Alcohol	0.904	0.905	0.900	0.873	0.852	0.838	0.834	0.872	3.60
11)	SCP 1,2-Dichlorobe...	0.832	0.844	0.842	0.861	0.861	0.875	0.893	0.858	2.45
12)	TCP 1,2-Dichlorobe...	1.326	1.353	1.366	1.369	1.376	1.385	1.398	1.368	1.70
13)	TCP 2-Methylphenol	0.959	0.972	0.975	1.000	0.988	0.972	1.000	0.981	1.60
14)	TCP bis(2-Chlorois...	1.110	1.153	1.174	1.209	1.203	1.219	1.266	1.191	4.23
15)	TCP Acetophenone	1.539	1.535	1.541	1.577	1.554	1.569	1.618	1.562	1.89
16)	TCP 3-&/or 4-Methy...	1.284	1.293	1.287	1.310	1.287	1.301	1.299	1.294	0.73
17)	MCP N-Nitroso-di-p...	0.748	0.759	0.758	0.769	0.754	0.754	0.781	0.761	1.46
18)	TCP Hexachloroethane	0.487	0.505	0.505	0.502	0.501	0.512	0.518	0.504	1.91
19)	I Naphthalene-d8 (IS...	----------	----------	----------	ISTD	----------	----------	----------		
20)	SCP Nitrobenzene--...	0.294	0.297	0.297	0.298	0.305	0.303	0.307	0.300	1.60
21)	TCP Nitrobenzene	0.299	0.304	0.308	0.307	0.317	0.317	0.319	0.310	2.48
22)	TCP Isophorone	0.548	0.547	0.543	0.541	0.549	0.547	0.556	0.547	0.93
23)	TCP 2-Nitrophenol	0.177	0.182	0.180	0.174	0.171	0.165	0.154	0.172	5.78
24)	TCP 2,4-Dimethylph...	0.265	0.268	0.266	0.255	0.260	0.264	0.264	0.263	1.58
25)	TCP bis(2-Chloroet...	0.354	0.357	0.358	0.359	0.361	0.365	0.368	0.360	1.34
26)	TCP Benzoic Acid	0.165	0.193	0.178	0.144	0.097	0.060	0.032	0.124	50.01#
27)	TCP 2,4-Dichloroph...	0.292	0.293	0.290	0.284	0.282	0.276	0.268	0.283	3.20
28)	MCP 1,2,4-Trichlor...	0.333	0.336	0.337	0.333	0.341	0.340	0.342	0.337	1.13
29)	TCP Naphthalene	0.900	0.919	0.928	0.938	0.954	0.972	0.987	0.943	3.23
30)	TCP 4-Chloroaniline	0.374	0.376	0.374	0.369	0.359	0.347	0.304	0.357	7.23
31)	TCP Hexachlorbutad...	0.210	0.211	0.210	0.207	0.210	0.212	0.213	0.211	0.89
32)	TCP Caprolactam	0.068	0.068	0.079	0.076	0.073	0.069	0.065	0.071	7.15
33)	MCP 4-Chloro-3-met...	0.260	0.258	0.254	0.248	0.241	0.235	0.235	0.247	4.26
34)	TCP 2-Methylnaphth...	0.556	0.562	0.564	0.560	0.565	0.565	0.585	0.565	1.68

Software – Both Chemstation and Mass Hunter

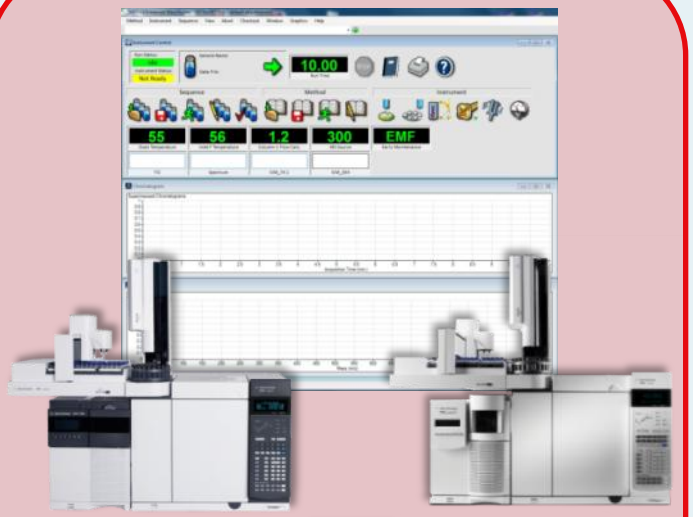
Chemstation - Enviroquant

- Classical tools for analysis and reporting

Mass Hunter

- New platform with new capabilities
- Batch mode calibration tools
- All Agilent MS platforms (GCMS, GC-QQQ, LCMS, ICP-MS)

GC/MSD Software



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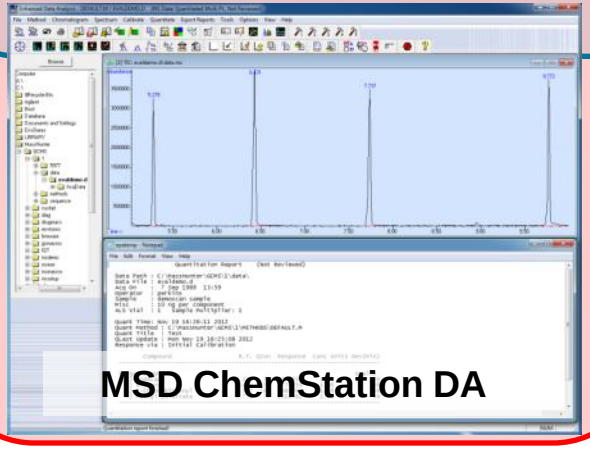
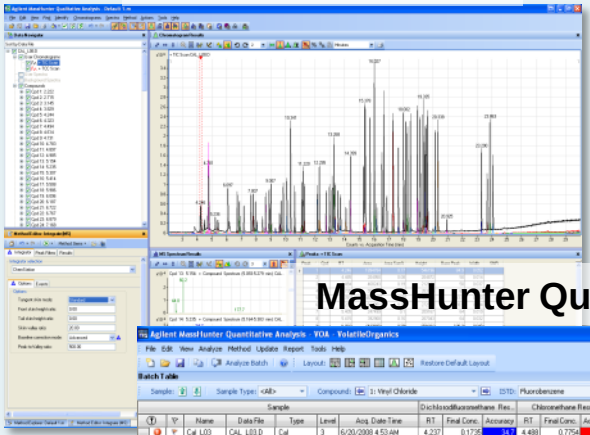


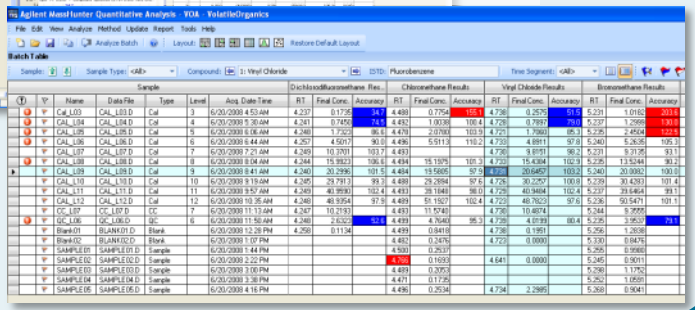
MSD ChemStation DA

MH

MassHunter Qual



MassHunter Quant



MassHunter GC/MS Acquisition

<u>And Use Either</u>

MassHunter Data Analysis

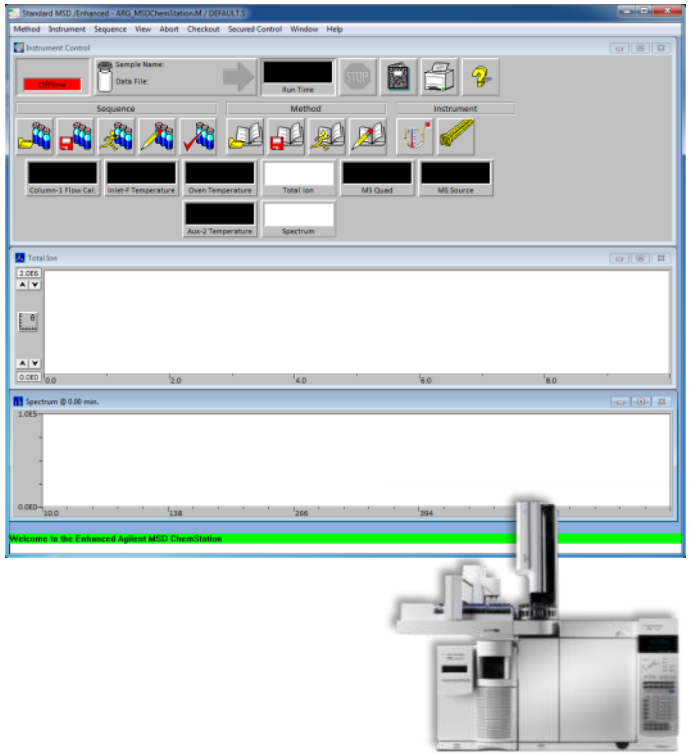
<u>OR</u>

MSD ChemStation Data Analysis

G1701FA

GC/MSD Acquisition Methods

MSD Productivity ChemStation



MassHunter GC/MS Acquisition

GC/MS Acquisition Methods are Transparent
from MSD ChemStation to MassHunter GC/MS (Except PAL Autosampler)

Migrate Quantitative Methods to MassHunter Format

MassHunter Quant

GC MSD ChemStation Quant Method Translator

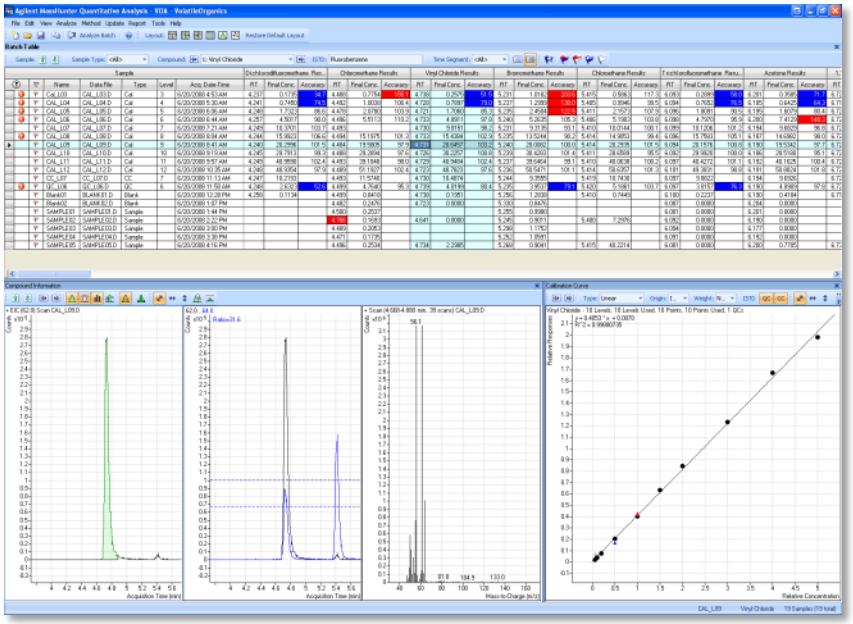
Method

MSD ChemStation (QDB.MTH)

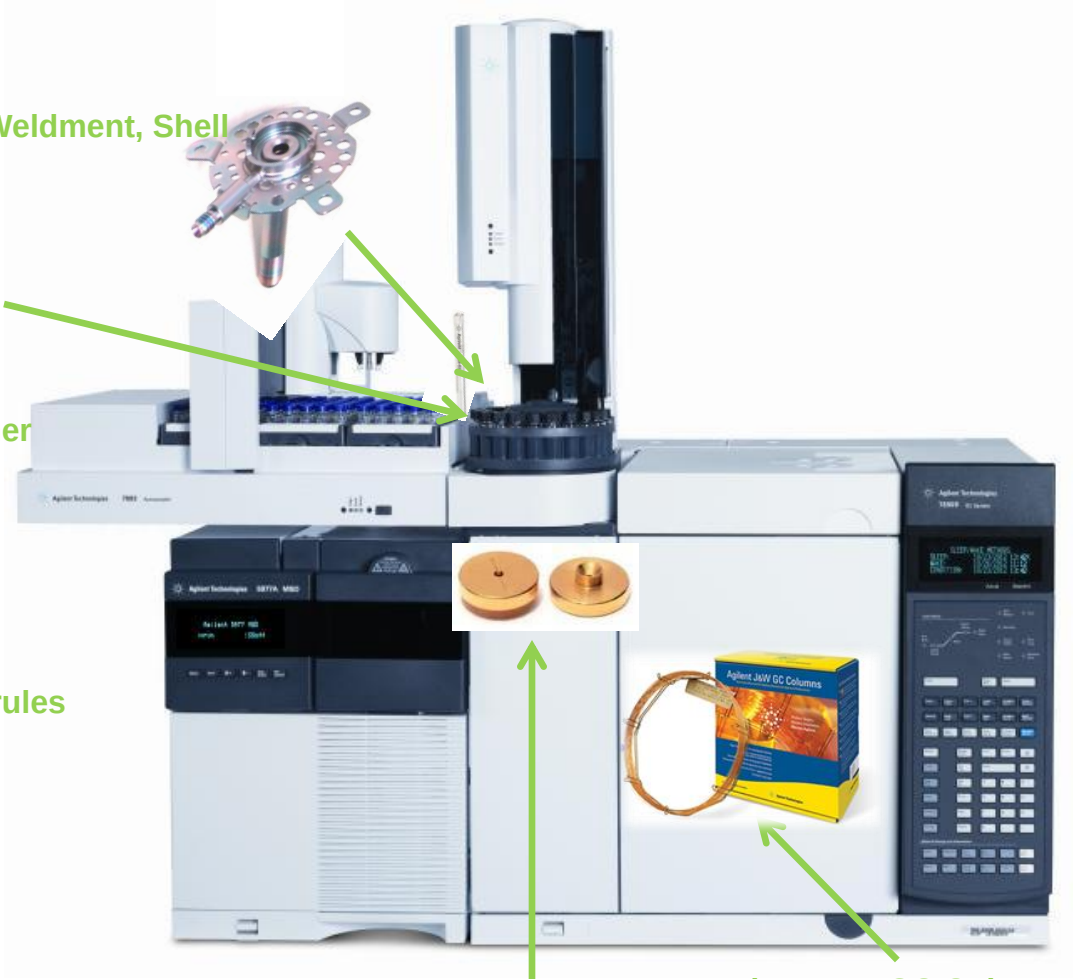
MSWS Quant Method Translator

Method

WorkStation (.mth)



Agilent Inert Flow Path Solution



Agilent Technologies

Inert Flow Path Split/Splitless Inlet

UltiMetal Plus treatment creates inert surface 7890 inlet weldment & shell

- Limit adsorption / degradation active analytes in contact with hot metal
- Target trace GC/MS active compound analysis
- Combine with Agilent's UI Liners, UI gold seals, UI GC columns

UltiMetal Plus surface treatment

Helium Shortage Issue

What can we do?

- There are only two realistic choices:
  - Switch to a different carrier gas such as Hydrogen
  - Implement Helium conservation measures

Hydrogen Carrier – brief summary

Agilent has advised H2 carrier for 8270 for over 15 years

- Mainly for faster runs and better GC resolution
- Easy to convert with a little guidance
  - Use a 20m x 0.18 column with 0.5 ml/min flow
  - Set inlet temp to 230C (avoids HCl formation with MeCl2)

EPA Region 8 in Golden, Co has been using H2 for over a year

- Both for VOA's and 8270

But methods have to be re-validated – new RT's

New Approach: Helium Conservation

While the GC is just sitting there, it is blowing gas out the vents 24/7

- Minimum flow is about 25 ml/min per S/SL inlet
- 1440 min/day x 25ml = 36,000 ml/day = 36 liters/day per inlet

If the GC is idle, you can switch to a cheaper standby gas such as nitrogen

- Helium cost is 17 cents per cubic foot, N2 is 0.03 cents per cubic foot (prices vary by area)
- Cheapest source of N2 is liquid LN2 dewars

Nitrogen Switching

  - Manual valve (any GC)
  - Electronic valve (5890, 6890, 7890)
  - Fully Automatic EPC (7890B option) (7890A in July)

Helium Conservation Tools

Helium Conservation

- Smarter helium use with new hardware/software tools
- No need to revalidate existing GCMS methods
  - RT's are the same
  - Performance is the same

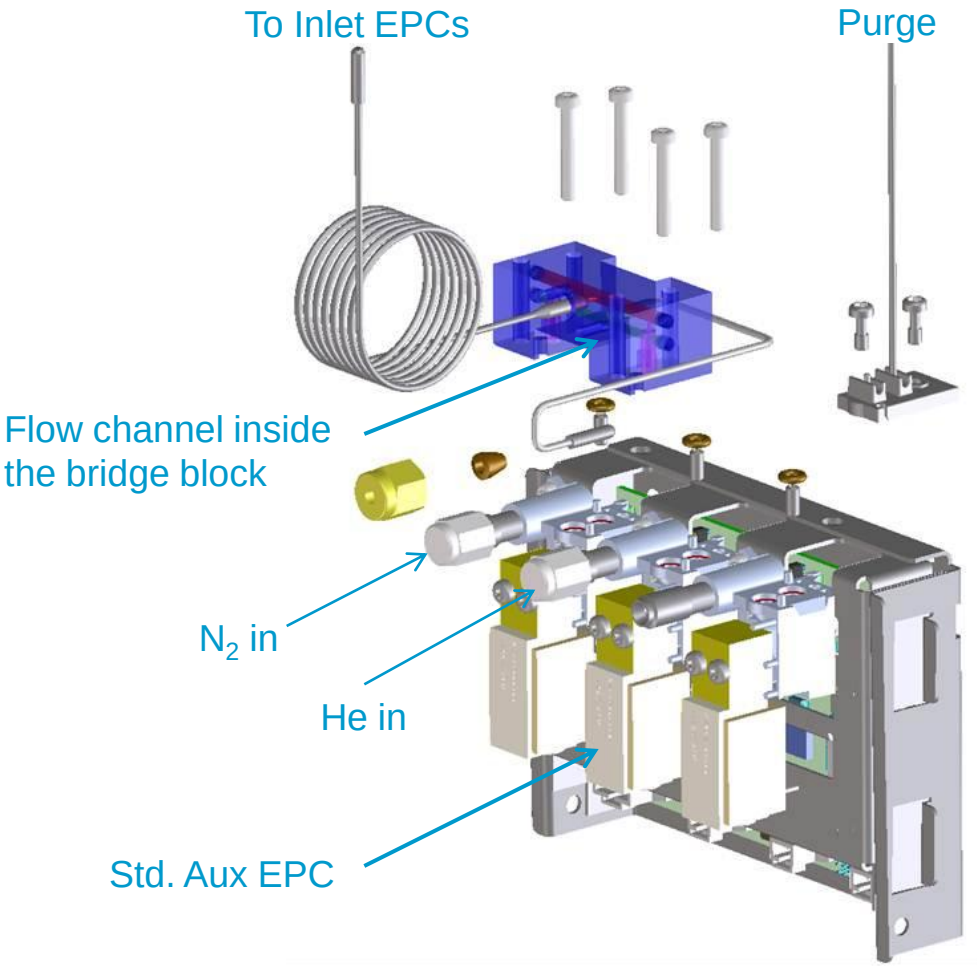
Reducing Helium Use With Conservation

New 7890B Helium Conservation Module

- Automatically switches carrier gas supply to N_2 Standby during idle time
- Integrates into the new 7890B Sleep and Wake function
- Combined with Helium Gas Saver to ***GREATLY*** reduce helium consumption

Helium Conservation Module

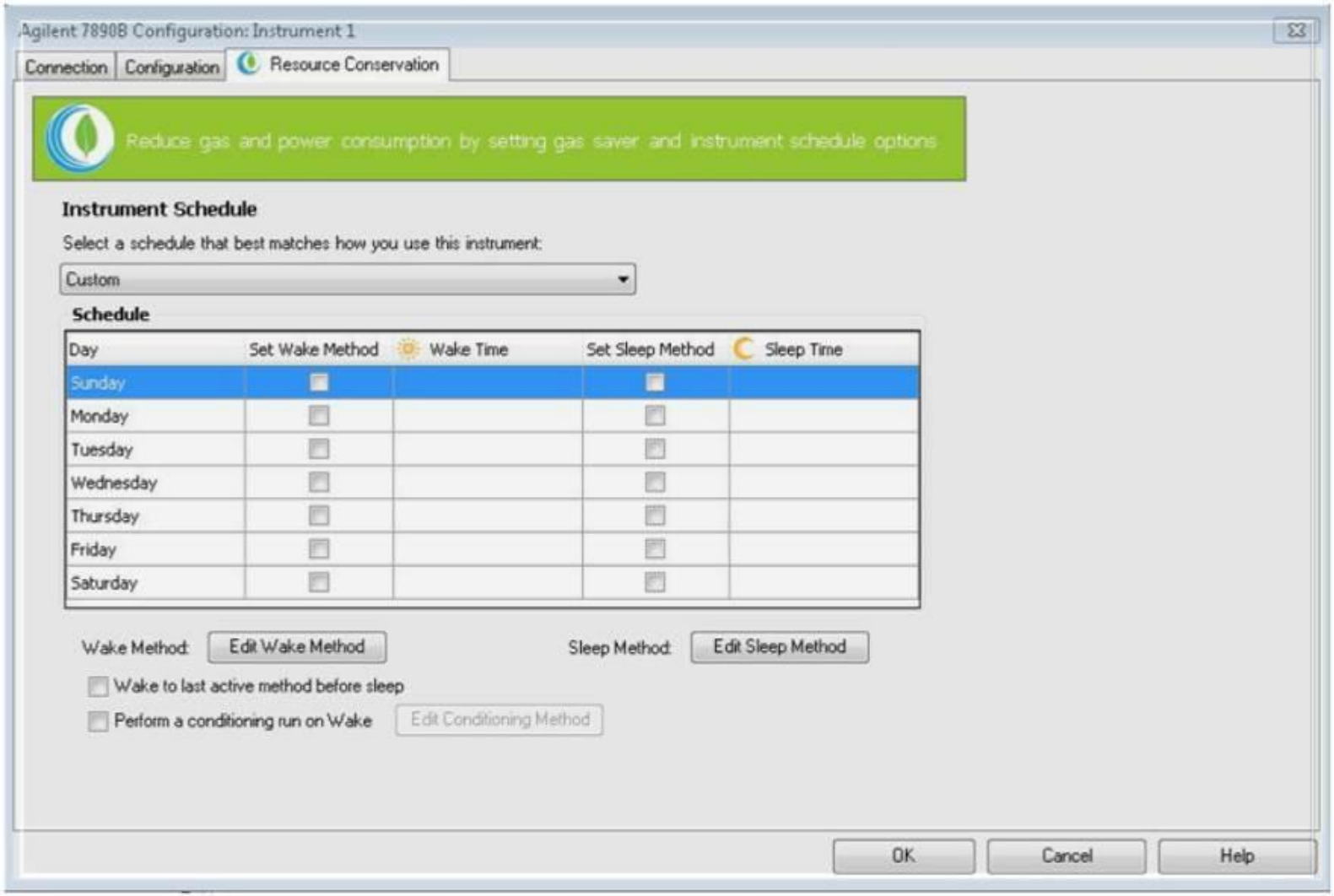
Seamlessly integrated onto 7890 GC hardware and software



- Based on EPC module
- Fully controlled by Agilent data systems
- Precise pressure control between tank and GC
- Switch between gases within 2-5 min depending on flow setting

How It Works: Configuring Sleep/Wake Operation

Simple, Straight Forward Setup



Future Developments

Self-cleaning ion source

Improved PAH peak shape at 1.0 picogram levels

Micro-extraction with LVI

Acknowledgements

David Spencer, Diane Gregg	EPA Region 6 Houston, Tx
Vince Marti	EPA Region 8 Golden, Co

Call or email me for specific guidelines:

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