Detection of Picogram and Sub Picogram Semi Volatile Compounds by Full Scan GC/MS Using the High Efficiency Source
" A Game Changer"

Dale R Walker
GCMS Applications Specialist
Environmental Market Specialist

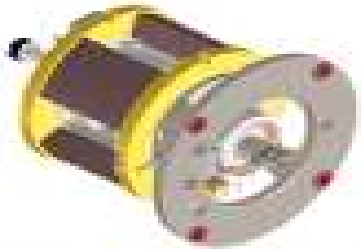
Objectives

- Evaluate new HES capability to produce scan detection limits for SVOCs that were formerly only approached by SIM.
- Determine instrument detection limits (IDLs) for a few SVOCs across the classes of compounds typical to this analysis.
- Tentatively identifying unexpected unknowns in samples that would escape SIM,
- Included in a target analyte lists for GC/MS methods such as EPA methods 8270, 625 and 525 methods

The Source of New Possibilities

The Most Powerful EI GC/MS Source

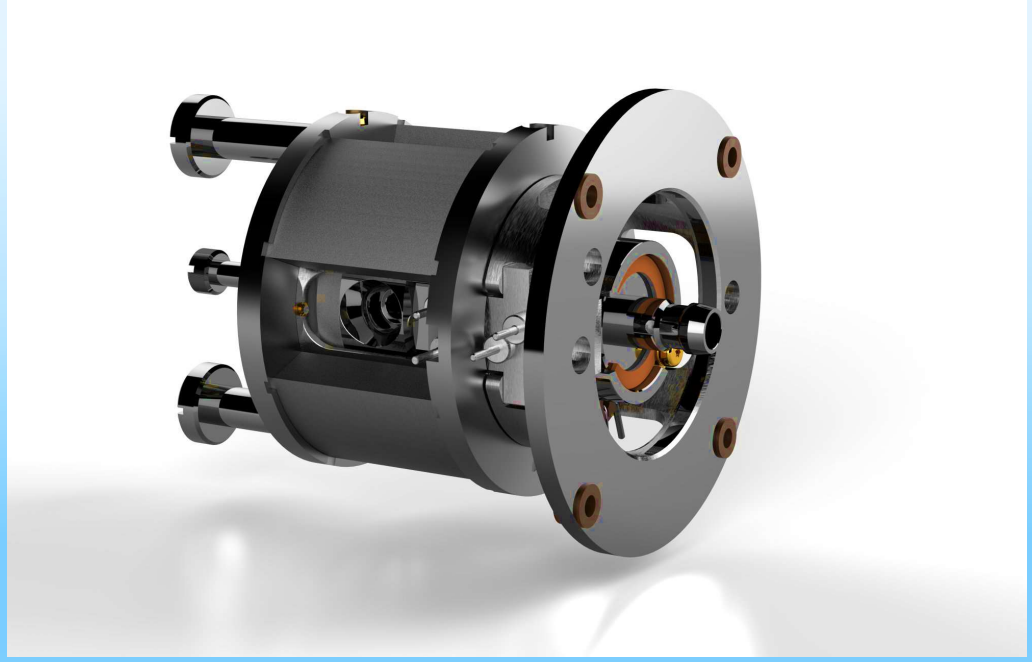
5977A Extractor Source



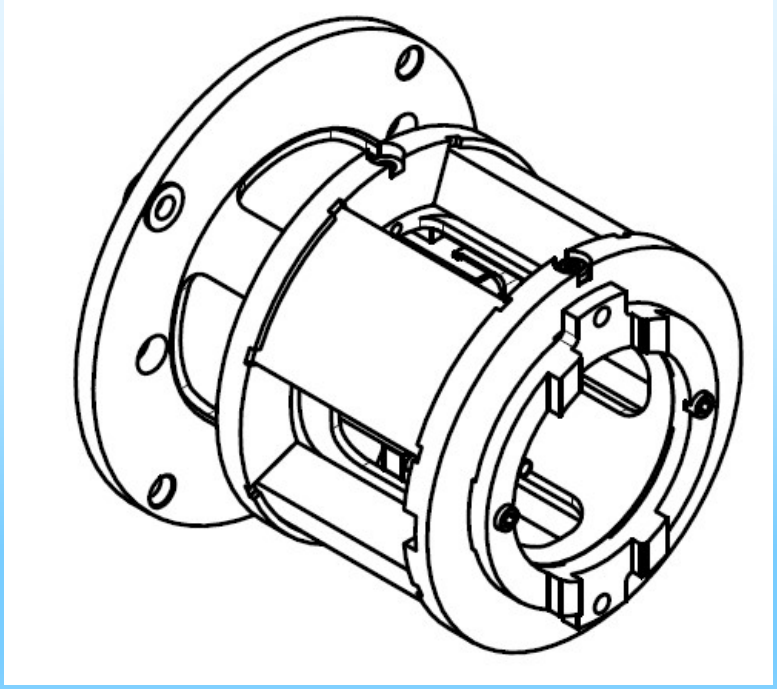
NEW! 5977B High Efficiency Source

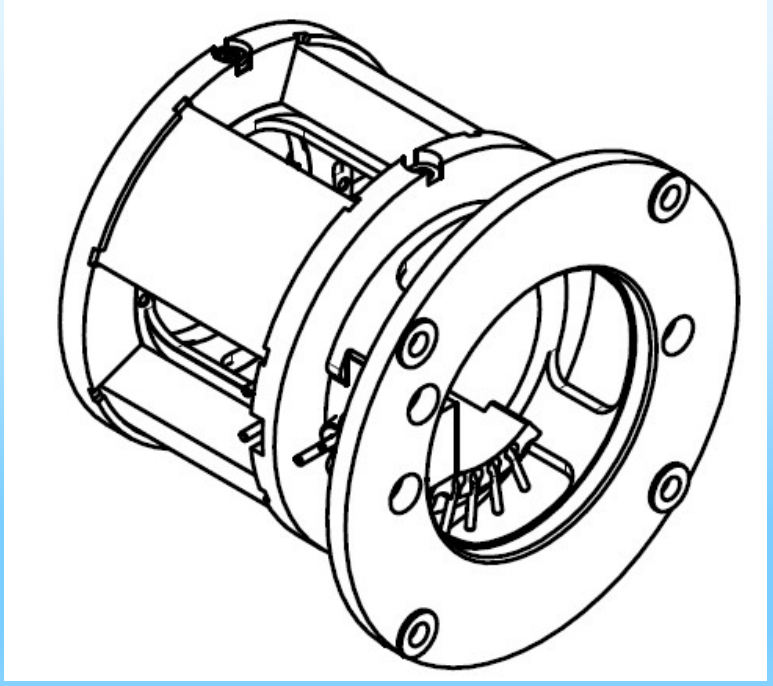
5977B High Efficiency Source with Magnet Removed

More intense electron beam...
Times a longer path length for electron beam/effluent interaction
Yields up to 20x More Ions Produced



Source Radiator Assembly





Additional lenses improve ion Transition and Focusing

This analysis was performed using the 5977B GC/MS with the HES.

The system tested a mixture of Semi volatile compounds which were purchase from Supelco^{tm}. The standards were prepared following a standard dilution scheme. The extended calibration range of 2.5 µg/L – 1000 µg/L shows superior dynamic range.

The system acquired a ten point calibration curve using the following concentrations; 5, 10, 20, 40, 50, 80, 100, 200, 500, 800, 1000 µg/l.

Following the analytical curve the system acquired eight replicate injections at the low point of the curve to produce a MDL typical for an analytical laboratory.

Analysis of Semi-Volatile Compounds

GC Summary

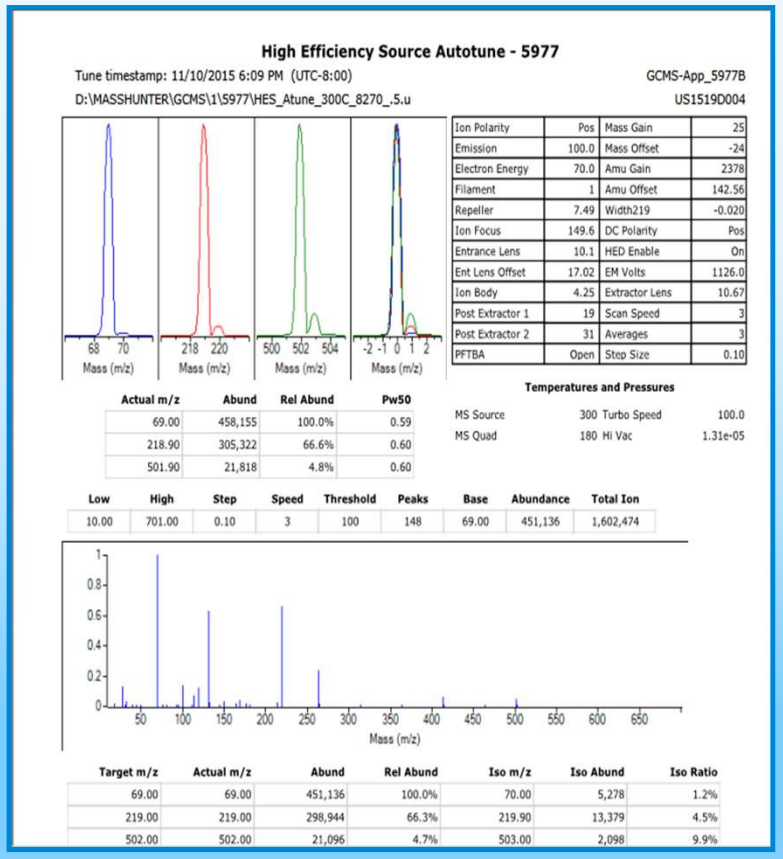
Run time	25 min.		
Oven Temperature			
(Initial)	40°C	Hold time	0.5 min.
Post run	40°C	#1 Rate	10°C/min.
#1 Value	100°C	#1 Hold Time	0 min.
#2 Rate	25°C/min.	#2 Value	260°C
#2 Hold Time	0 min.	#3 Rate	10°C/min.
#3 Value	280°C	#3 Hold Time	0 min.
#4 Rate	25°C/min.	#4 Value	320°C
#4 Hold Time	8.5 min.		

Agilent 5190-2293: 900 µL (splitless, single taper, ultra inert)

MS Parameters

Acquisition Mode	Scan	Normal or Fast Scanning	Normal Scanning
Solvent Delay	3.0 min.	EM Setting Mode Gain	0.1
Trace Ion Detection	On		
[Scan Parameters]			
Start Time	3.0 min.		
Low Mass	50	High Mass	550
Threshold	75	A/D Samples	4
MS Source	350°C	Maximum	350°C
MS Qual	180°C	Maximum	200°C

Parameters for SVOC analysis



Ion Polarity	Pos	Mass Gain	25
Emission	100.0	Mass Offset	-24
Electron Energy	70.0	Amu Gain	2378
Filament	1	Amu Offset	142.56
Repeller	7.49	Width219	-0.020
Ion Focus	149.6	DC Polarity	Pos
Entrance Lens	10.1	HED Enable	On
Ent Lens Offset	17.02	EM Volts	1126.0
Ion Body	4.25	Extractor Lens	10.67
Post Extractor 1	19	Scan Speed	3
Post Extractor 2	31	Averages	3
PFTBA	Open	Step Size	0.10

Actual m/z	Abund	Rel Abund	Pw50
69.00	458,155	100.0%	0.59
218.90	305,322	66.6%	0.60
501.90	21,818	4.8%	0.60

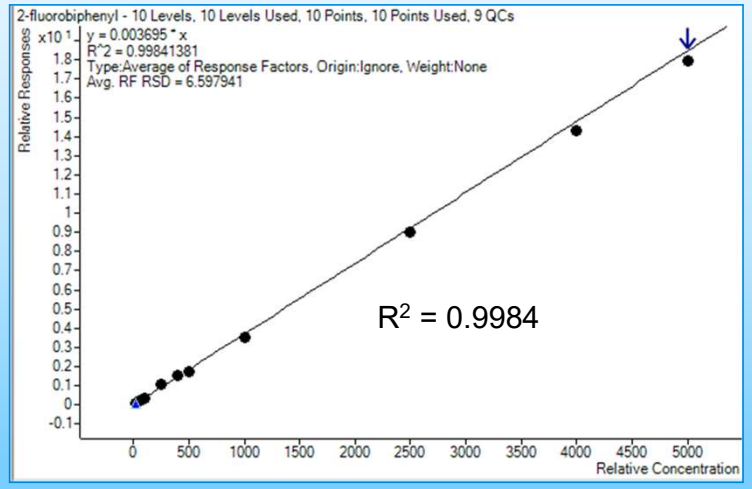
Low	High	Step	Speed	Threshold	Peaks	Base	Abundance	Total Ion
10.00	701.00	0.10	3	100	148	69.00	451,136	1,602,474

Target m/z	Actual m/z	Abund	Rel Abund	Iso m/z	Iso Abund	Iso Ratio
69.00	69.00	451,136	100.0%	70.00	5,278	1.2%
219.00	219.00	298,944	66.3%	219.90	13,379	4.5%
502.00	502.00	21,096	4.7%	503.00	2,098	9.9%

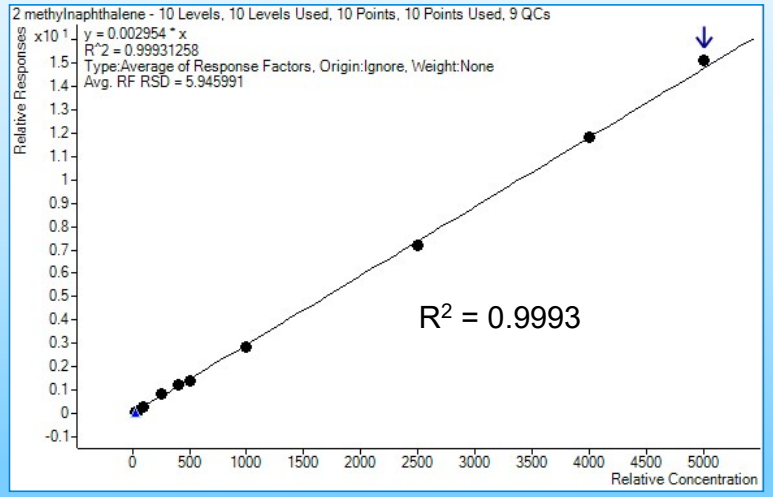
HES Autotune

Linearity: Semi-Volatiles Analysis

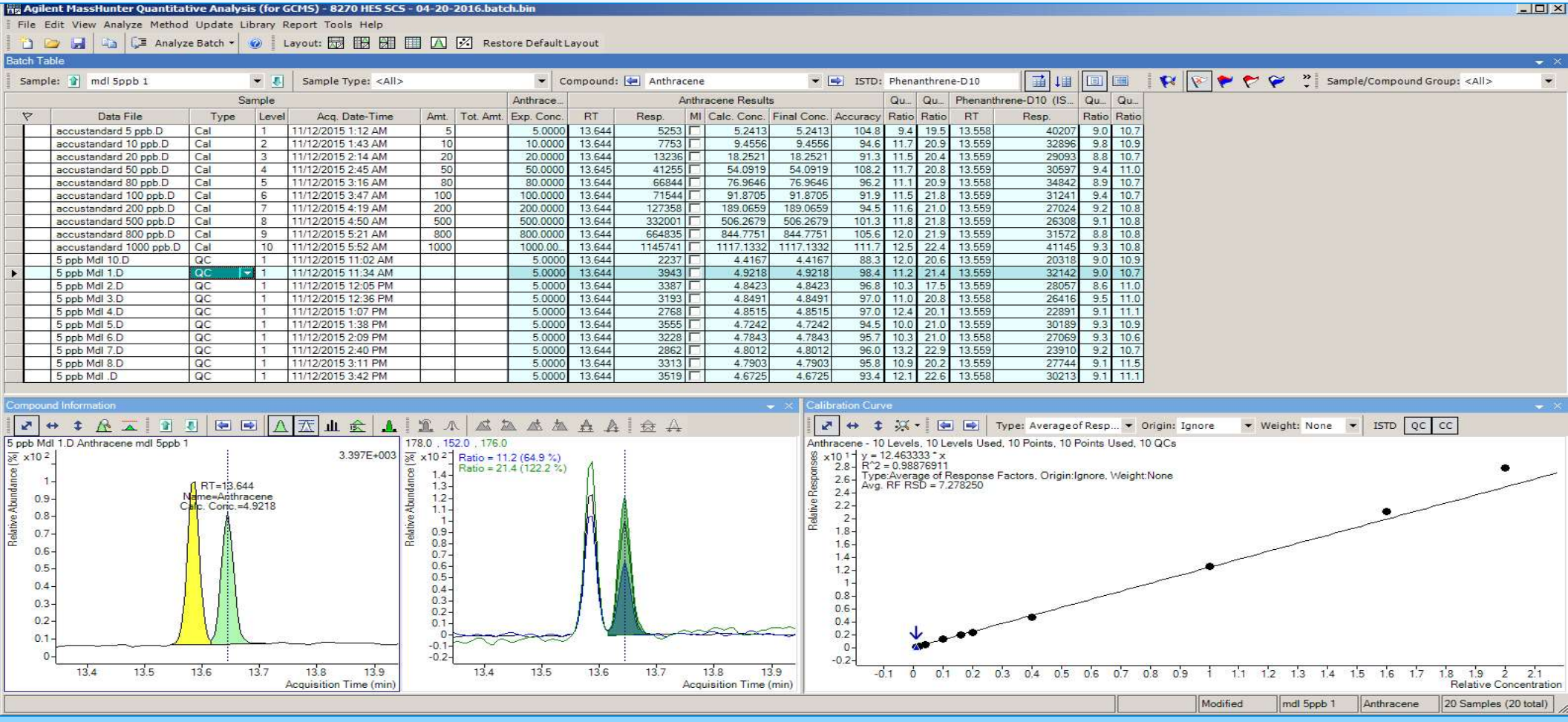
2-fluorobiphenyl



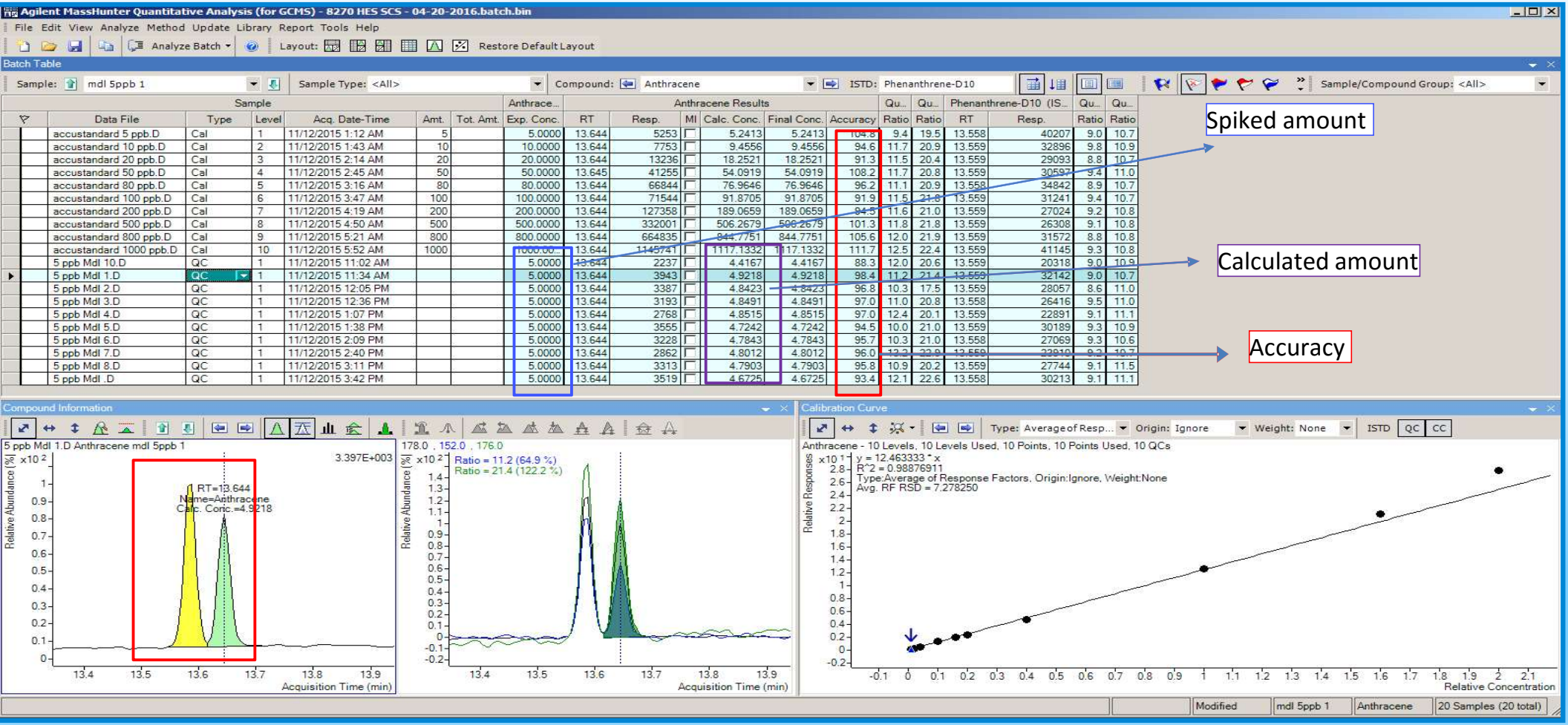
2-methylnaphthalene



Semi-Volatiles Analysis: Anthracene

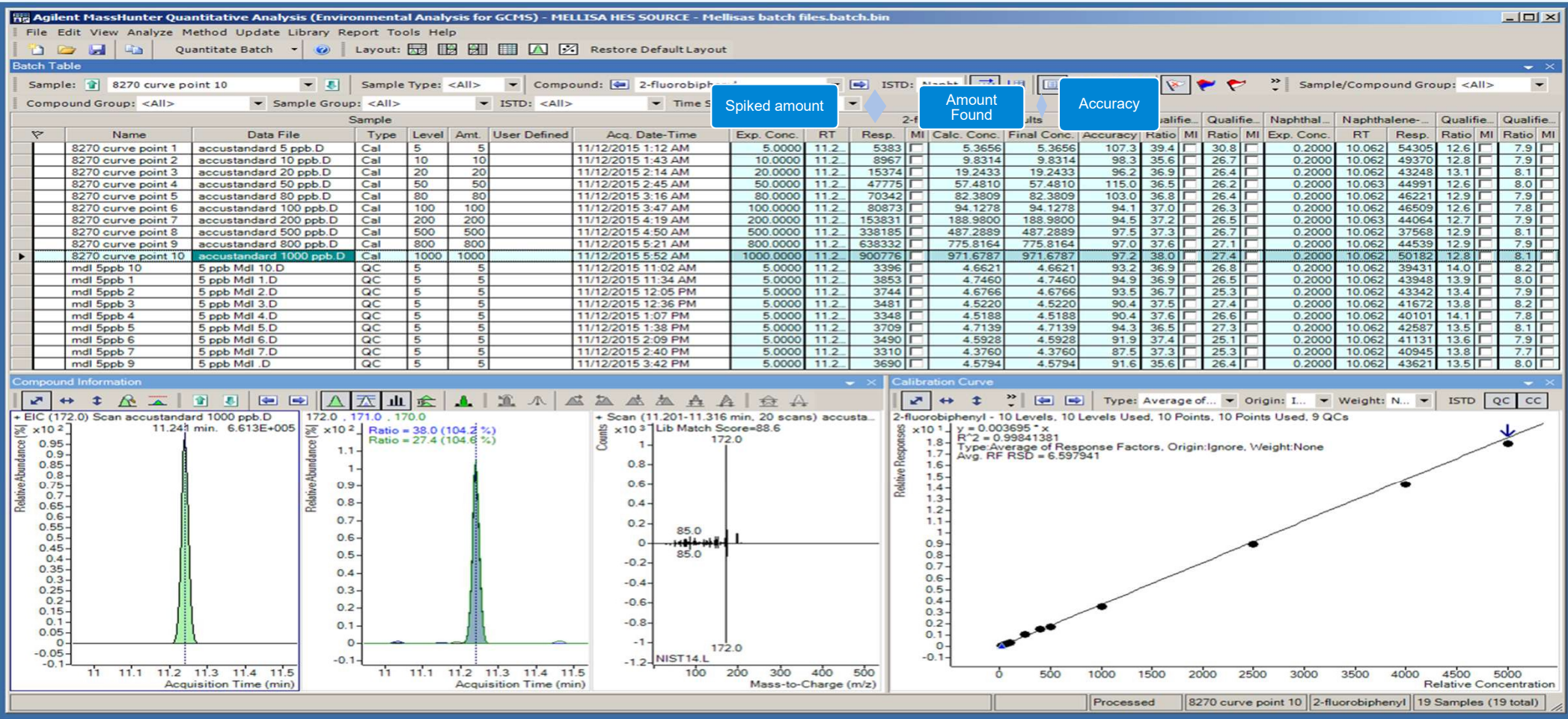


Semi-Volatiles Analysis: Anthracene



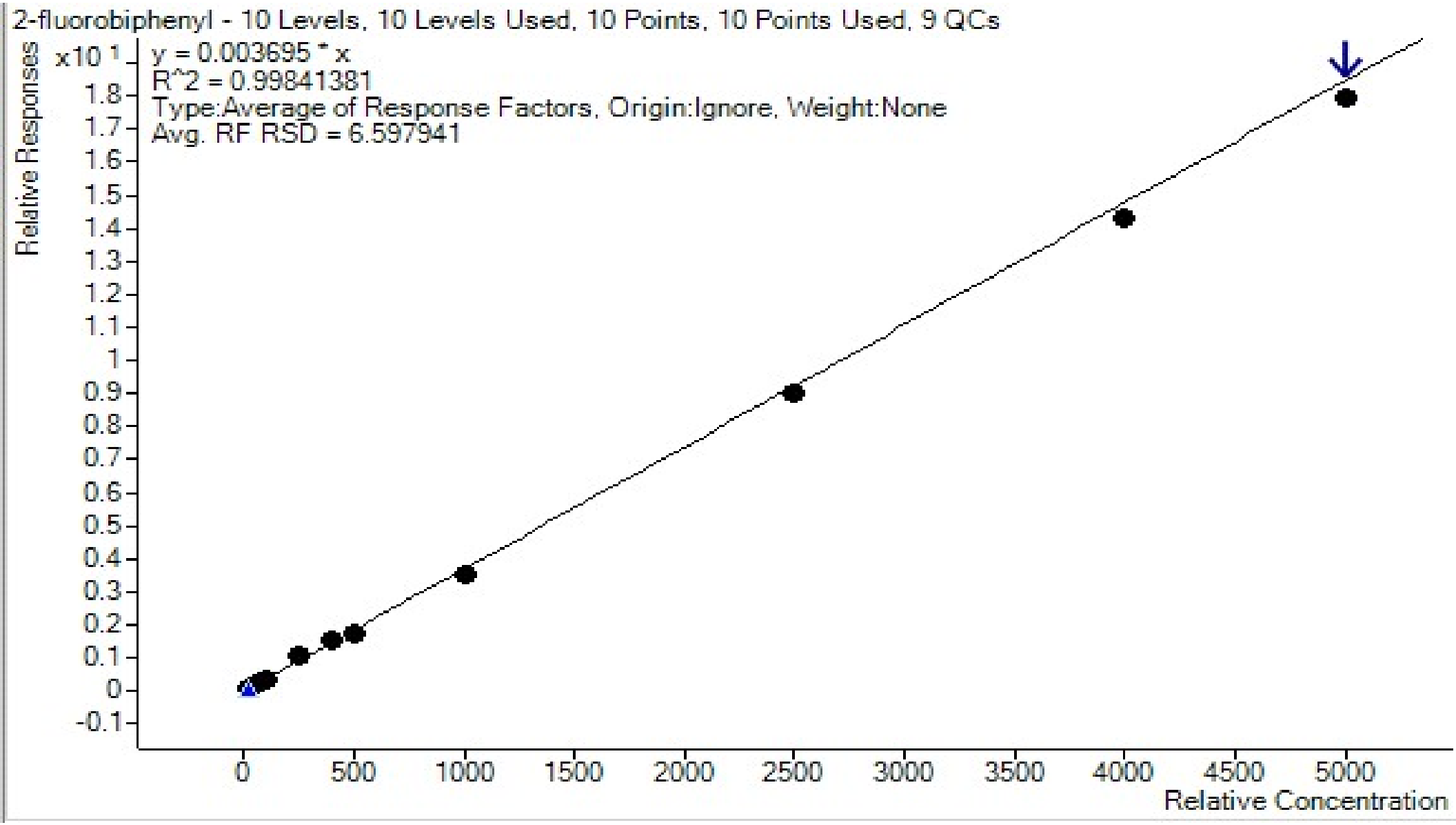
Data File	Type	Level	Acq. Date-Time	Amt.	Exp. Conc.	RT	Resp.	Calc. Conc.	Final Conc.	Accuracy
accustandard 5 ppb.D	Cal	1	11/12/2015 1:12 AM	5	5.0000	13.644	5253	5.2413	5.2413	104.8
accustandard 10 ppb.D	Cal	2	11/12/2015 1:43 AM	10	10.0000	13.644	7753	9.4556	9.4556	94.6
accustandard 20 ppb.D	Cal	3	11/12/2015 2:14 AM	20	20.0000	13.644	13236	18.2521	18.2521	91.3
accustandard 50 ppb.D	Cal	4	11/12/2015 2:45 AM	50	50.0000	13.645	41255	54.0919	54.0919	108.2
accustandard 80 ppb.D	Cal	5	11/12/2015 3:16 AM	80	80.0000	13.644	66844	76.9646	76.9646	96.2
accustandard 100 ppb.D	Cal	6	11/12/2015 3:47 AM	100	100.0000	13.644	71544	91.8705	91.8705	91.9
accustandard 200 ppb.D	Cal	7	11/12/2015 4:19 AM	200	200.0000	13.644	127358	189.0659	189.0659	94.5
accustandard 500 ppb.D	Cal	8	11/12/2015 4:50 AM	500	500.0000	13.644	332001	506.2679	506.2679	101.3
accustandard 800 ppb.D	Cal	9	11/12/2015 5:21 AM	800	800.0000	13.644	664835	844.7751	844.7751	105.6
accustandard 1000 ppb.D	Cal	10	11/12/2015 5:52 AM	1000	1000.00...	13.644	1145741	1117.1332	1117.1332	111.7
5 ppb Mdl 10.D	QC	1	11/12/2015 11:02 AM		5.0000	13.644	2237	4.4167	4.4167	88.3
5 ppb Mdl 1.D	QC	1	11/12/2015 11:34 AM		5.0000	13.644	3943	4.9218	4.9218	98.4
5 ppb Mdl 2.D	QC	1	11/12/2015 12:05 PM		5.0000	13.644	3387	4.8423	4.8423	96.8
5 ppb Mdl 3.D	QC	1	11/12/2015 12:36 PM		5.0000	13.644	3193	4.8491	4.8491	97.0
5 ppb Mdl 4.D	QC	1	11/12/2015 1:07 PM		5.0000	13.644	2768	4.8515	4.8515	97.0
5 ppb Mdl 5.D	QC	1	11/12/2015 1:38 PM		5.0000	13.644	3555	4.7242	4.7242	94.5
5 ppb Mdl 6.D	QC	1	11/12/2015 2:09 PM		5.0000	13.644	3228	4.7843	4.7843	95.7
5 ppb Mdl 7.D	QC	1	11/12/2015 2:40 PM		5.0000	13.644	2862	4.8012	4.8012	96.0
5 ppb Mdl 8.D	QC	1	11/12/2015 3:11 PM		5.0000	13.644	3313	4.7903	4.7903	95.8
5 ppb Mdl .D	QC	1	11/12/2015 3:42 PM		5.0000	13.644	3519	4.6725	4.6725	93.4

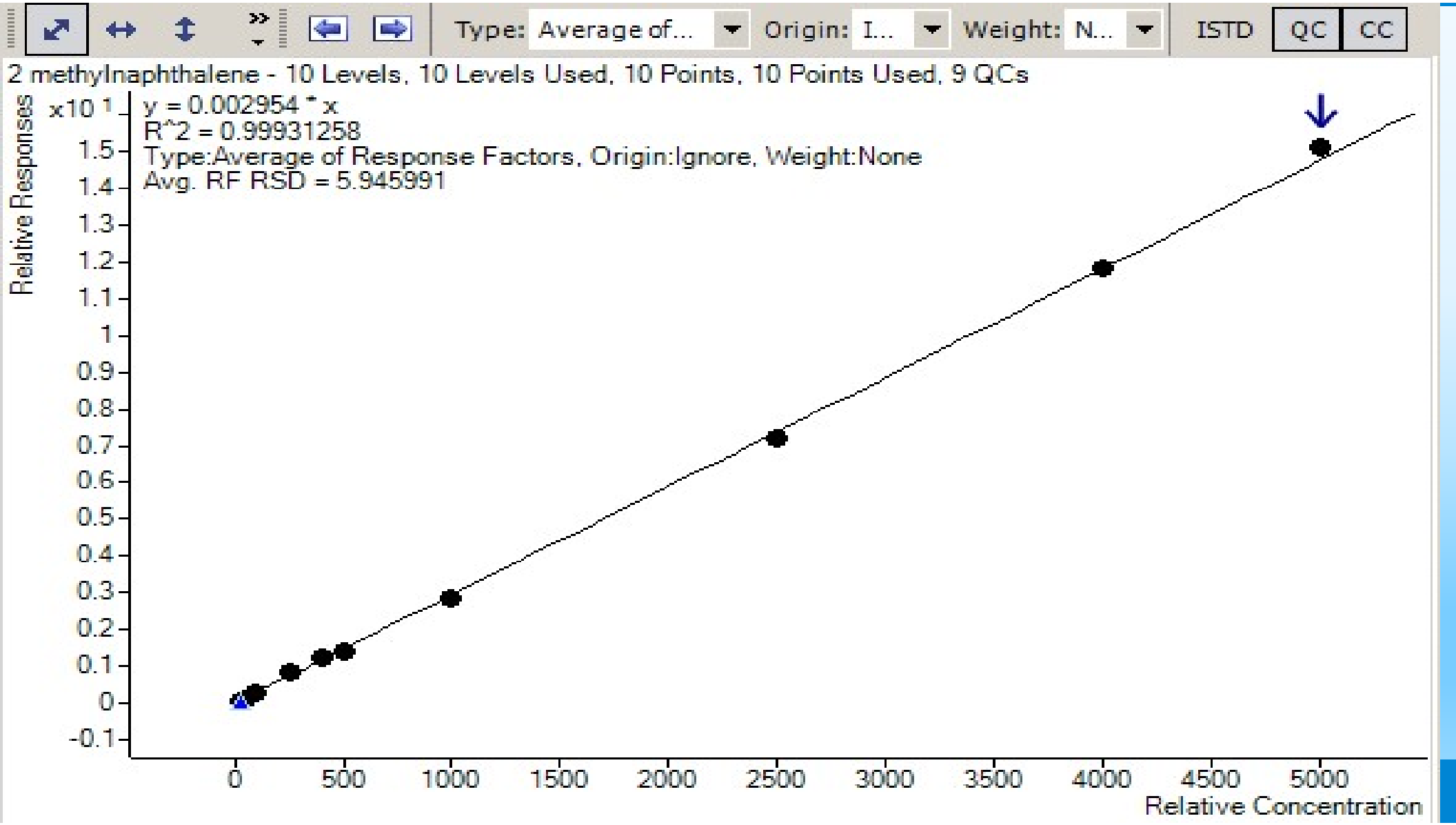
Semi-Volatiles Analysis: 2-Fluorobiphenyl

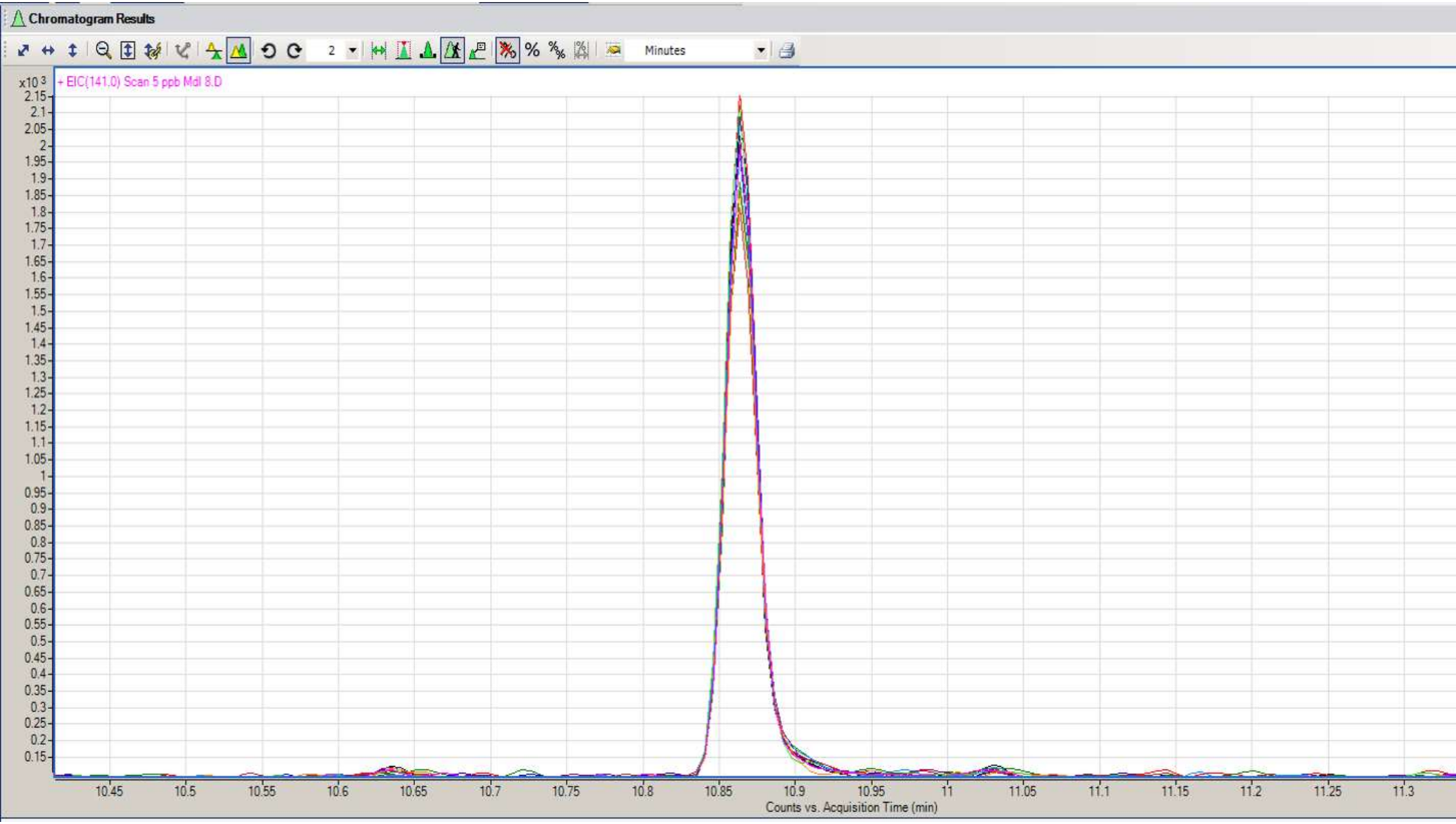


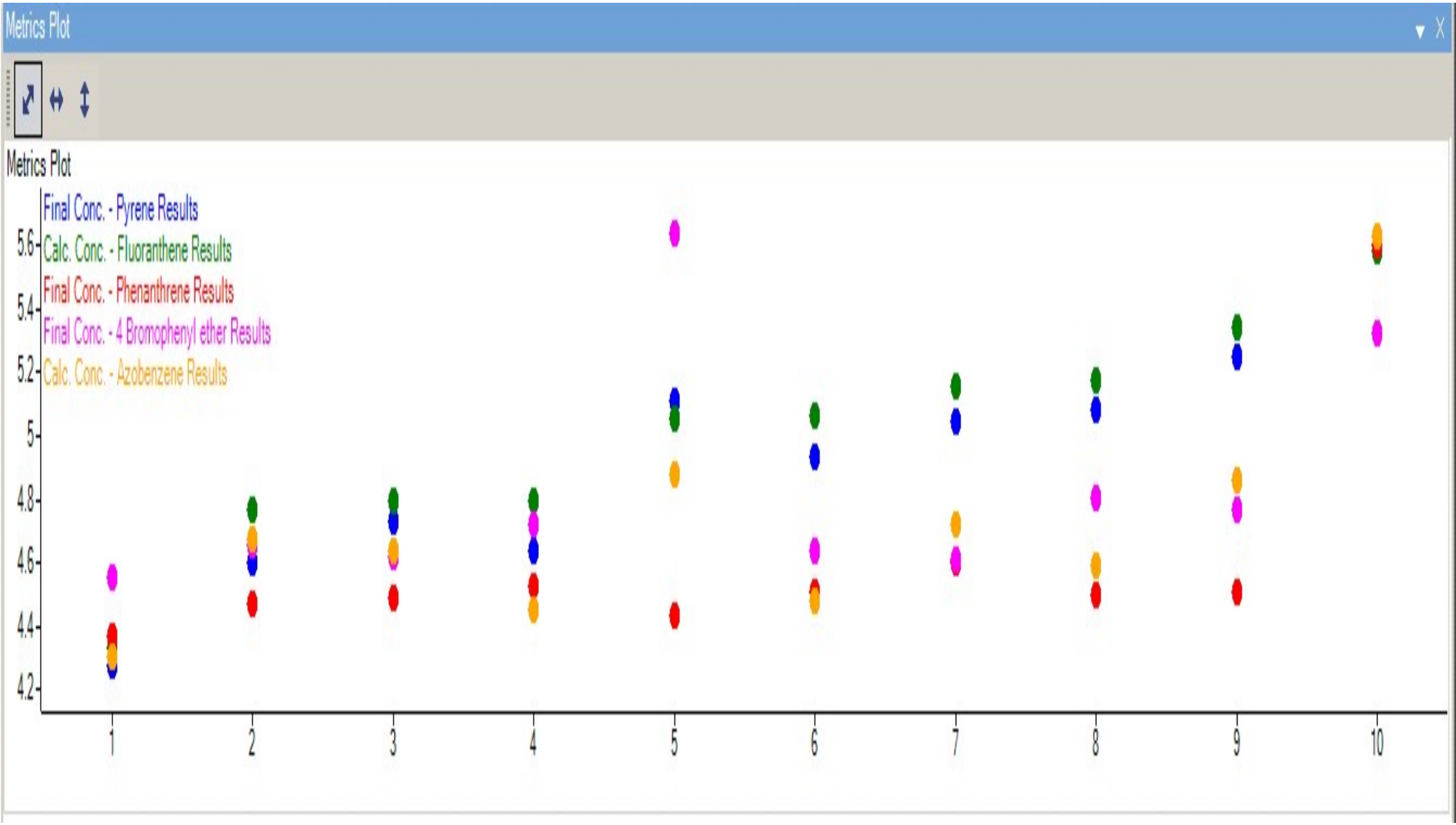
Slide 12

W(2 WALKER,DALE (A-SantaClara,ex1), 7/24/2016


2-fluorobiphenyl - 10 Levels, 10 Levels Used, 10 Points, 10 Points Used, 9 QCs
y = 0.003695 * x
R^2 = 0.99841381
Type:Average of Response Factors, Origin:Ignore, Weight:None
Avg. RF RSD = 6.597941
Relative Responses
x10 1
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Relative Concentration


Type: Average of...
Origin: I...
Weight: N...
ISTD
QC
CC
2 methylnaphthalene - 10 Levels, 10 Levels Used, 10 Points, 10 Points Used, 9 QCs
y = 0.002954 * x
R^2 = 0.99931258
Type:Average of Response Factors, Origin:Ignore, Weight:None
Avg. RF RSD = 5.945991
x10 1
Relative Responses
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Relative Concentration


Chromatogram Results
2
Minutes
x10 3
+ EIC(141.0) Scan 5 ppb Mdl 8.D
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
10.45
10.5
10.55
10.6
10.65
10.7
10.75
10.8
10.85
10.9
10.95
11
11.05
11.1
11.15
11.2
11.25
11.3
Counts vs. Acquisition Time (min)


Metrics Plot
Metrics Plot
Final Conc. - Pyrene Results
Calc. Conc. - Fluoranthene Results
Final Conc. - Phenanthrene Results
Final Conc. - 4 Bromophenyl ether Results
Calc. Conc. - Azobenzene Results
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
1
2
3
4
5
6
7
8
9
10

MDLS: Semi-Volatiles Analysis

Name	RT	Transition	Avg Conc.	Std. Dev.	Avg Conc./Std. Dev.	Conc. RSD	MDL	LOQ	LOD	Avg Height	Avg. Resp	Resp. RSD
1,4-dichlorobenzene	8.477	146	2.5604	0.0507	50.54	2	0.133	0.5066	0.152	1447	2634	5.9
1,2-dichlorobenzene	8.68	146	2.5889	0.0744	34.82	2.9	0.1951	0.7435	0.2231	1390	2503	5.8
Anthracene	13.662	178	2.3763	0.0471	50.49	2	0.1235	0.4707	0.1412	1960	3029	15.9
Benz[a]anthracene	17	228	2.894	0.094	30.79	3.2	0.2467	0.94	0.282	919	1600	23.3
2-fluorophenol	6.354	112	1.8707	0.1018	18.38	5.4	0.2671	1.0177	0.3053	371	1036	10.3
Phenol-d5-	7.853	99	2.0789	0.1061	19.59	5.1	0.2785	1.061	0.3183	585	1353	9.2
Phenol	7.872	94	2.0978	0.0753	27.85	3.6	0.1977	0.7533	0.226	605	1406	4.7
Aniline	7.968	93	2.0027	0.1123	17.83	5.6	0.2948	1.1232	0.337	974	1854	8.1
Bis(2-chloroethyl) ether	8.044	93	2.4595	0.1975	12.45	8	0.5183	1.9747	0.5924	836	1856	7.5
2-chlorophenol	8.149	128	1.8842	0.1333	14.13	7.1	0.3499	1.3333	0.4	412	942	9.7
1,3-dichlorobenzene	8.378	146	2.5532	0.0566	45.14	2.2	0.1485	0.5657	0.1697	1399	2575	5.9
Dibenz[a,h]anthracene	22.325	278	5.8961	0.4339	13.59	7.4	1.1388	4.3391	1.3017	224	970	23.9
Benzyl alcohol	8.604	108	2.6224	0.6737	3.89	25.7	1.768	6.7365	2.021	337	857	26.3
Dibenzofuran	12.202	168	2.6192	0.0787	33.28	3	0.2066	0.7871	0.2361	2574	3904	10.5
o-Cresol	8.732	108	2.9833	0.9942	3	33.3	2.6092	9.9416	2.9825	535	1434	34.2
Bis(2-chloro-1-methylethyl) ether	8.79	121	3.72	0.1907	19.51	5.1	0.5005	1.9072	0.5722	241	684	8.9
p-Cresol	8.924	108	2.4153	0.653	3.7	27	1.7138	6.5301	1.959	489	1153	27.4
N Nitroso-di-n-propylamine	8.953	70	2.8614	0.4659	6.14	16.3	1.2227	4.6589	1.3977	524	1448	20.4
Hexachloroethane	9.14	117	2.4922	0.1367	18.24	5.5	0.3586	1.3665	0.41	503	798	5.8
Nitrobenzene-D5	9.166	82	2.2607	0.0589	38.4	2.6	0.1545	0.5887	0.1766	861	1688	6.2
Nitrobenzene	9.192	77	2.1995	0.1304	16.87	5.9	0.3422	1.3038	0.3911	816	1458	9.3
Isophorone	9.484	82	2.0293	0.0875	23.2	4.3	0.2295	0.8746	0.2624	1078	1899	8.5
2,4-dimethylphenol	9.602	107	1.808	0.0766	23.61	4.2	0.2009	0.7657	0.2297	531	897	8.5
bis(2-chloroethoxy)-methane	9.721	93	2.2003	0.0797	27.62	3.6	0.2091	0.7968	0.239	1142	1805	4.6
2,4-dichloro-phenol	9.87	162	1.3744	0.1568	8.76	11.4	0.4116	1.5684	0.4705	253	457	16.6
1,2,4-trichlorobenzene	9.984	180	2.5619	0.0646	39.65	2.5	0.1696	0.6462	0.1939	1337	2057	6.7
Naphthalene	10.086	128	2.5072	0.033	76.08	1.3	0.0865	0.3295	0.0989	3723	5908	6.4
4-Chloroaniline	10.117	127	2.141	0.256	8.36	12	0.6718	2.5596	0.7679	795	1720	14.4
Hexachlorobutadiene	10.219	227	2.002	0.4507	4.44	22.5	1.1828	4.5068	1.352	553	621	25.5
4-chloro-3-methyl-phenol	10.629	142	2.6386	0.3667	7.2	13.9	0.9625	3.6673	1.1002	256	540	18.5
2 methylnaphthalene	10.863	141	2.4774	0.2275	10.89	9.2	0.597	2.2747	0.6824	1857	2953	7.5
2-fluorobiphenyl	11.24	172	2.2854	0.0579	39.49	2.5	0.1519	0.5787	0.1736	2365	3421	7.8
2 chloronaphthalene	11.396	162	2.3329	0.057	40.96	2.4	0.1495	0.5695	0.1709	1889	2857	8.4
2-Nitroaniline	11.472	65	2.0706	0.3219	6.43	15.5	0.8448	3.2188	0.9657	179	294	17.7
Dimethyl phthalate	11.635	163	2.2032	0.0793	27.8	3.6	0.208	0.7925	0.2378	1601	2510	6.9
2,6 Dinitrotoluene	11.71	89	2.3394	0.3694	6.33	15.8	0.9696	3.6943	1.1083	143	200	18.3
Acenapthylene	11.845	152	2.5816	0.2025	12.75	7.8	0.5315	2.0252	0.6076	2327	3699	7.6
3-Nitroaniline	11.896	92	0.465	0.3278	1.42	70.5	0.8603	3.2781	0.9834	119	215	25.8
Acenaphthene	12.024	152	2.9098	0.4256	6.84	14.6	1.117	4.2561	1.2768	1163	1805	11.4
2,4-dinitro-toluene	12.135	165	10.127	0.2458	41.2	2.4	0.6451	2.4578	0.7373	142	208	18.4
Diethyl Phthalate	12.358	149	5.1659	0.9011	5.73	17.4	2.3648	9.0105	2.7032	3467	4979	21.6

IDL's Extractor vs HES

		MDL (pg)	
		Extractor	HES
3	2-Fluorophenol (surr1)	3.59	0.94
4	Phenol-d5 (surr2)	2.30	0.86
5	Phenol	1.85	0.80
6	bis(2-Chloroethyl)ether	3.07	0.96
7	2-Chlorophenol	2.15	0.74
8	1,3-Dichlorobenzene	2.62	0.28
9	1,4-Dichlorobenzene	2.14	0.56
10	Benzyl alcohol	3.24	0.63
11	1,2-Dichlorobenzene	1.47	0.20
12	2-Methylphenol	4.10	0.55
13	Bis(2-chloroisopropyl)ether	5.57	0.48
14	3 &/or 4-Methylphenol	2.11	0.49
15	N-Nitrosodi-n-propylamine	1.13	0.66
16	Hexachloroethane	3.71	0.78
17	Nitrobenzene--d5 (surr5)	1.55	0.53
18	Nitrobenzene	4.35	0.49
19	Isophorone	1.34	0.61
20	2-Nitrophenol	7.94	0.89
21	2,4-Dimethylphenol	1.49	0.94
22	Bis(2-chloroethoxy)methane	3.79	0.17
23	2,4-Dichlorophenol	4.69	0.80
24	1,2,4-Trichlorobenzene	1.46	0.34
25	Naphthalene	1.57	0.14
26	4-Chloroaniline	2.71	0.56
27	Hexachlorobutadiene	2.05	0.30
28	4-Chloro-3-methylphenol	3.75	0.66
29	2-Methylnaphthalene	1.66	0.25
30	Hexachlorocyclopentadiene	3.18	1.11
31	2,4,6-Trichlorophenol	3.07	0.89

IDL's Extractor vs HES

32	2,4,5-Trichlorophenol		5.05	1.95
33	2-Fluorobiphenyl (surr6)		1.16	0.19
34	2-Chloronaphthalene		1.51	0.31
35	2-Nitroaniline		9.69	0.96
36	Dimethyl phthalate		1.20	0.39
37	Acenaphthylene		2.02	0.70
38	2,6-Dinitrotoluene		7.25	1.58
39	3-Nitroaniline		12.46	2.69
40	Acenaphthene		1.59	0.34
41	Dibenzofuran		1.91	0.18
42	2,4-Dinitrotoluene		15.13	2.23
43	Fluorene		2.11	0.28
44	Diethyl phthalate		2.37	0.68
45	4-Chlorophenyl phenyl ether		1.58	0.29
46	4-Nitroaniline		17.58	3.42
47	N-Nitrosodiphenylamine		3.65	0.60
48	2,4,6-Tribromophenol (surr7)		9.41	1.00
49	4-Bromophenyl phenyl ether		1.88	0.65
50	Hexachlorobenzene		1.70	0.63
51	Pentachlorophenol		3.79	2.00
52	Phenanthrene		1.18	0.18
53	Anthracene		1.93	0.87
54	Carbazole		1.71	0.41
55	Di-n-butyl phthalate		3.22	1.40
56	Fluoranthene		2.14	0.32
57	Pyrene		2.79	1.66
58	d14-Terphenyl (surr8)		2.15	1.56
59	Butyl benzyl phthalate		6.58	3.14
60	Benzo (a) anthracene		2.55	1.27
61	3,3'-Dichlorobenzidine		6.06	2.24
62	Chrysene		2.57	0.72
63	Bis(2-ethylhexyl)phthalate		6.70	3.00

IDL's Extractor vs HES

63	Bis(2-ethylhexyl)phthalate		6.70	3.00
64	Di-n-octyl phthalate		7.18	3.01
65	Benzo (b) fluoranthene		2.46	1.48
66	Benzo (k) fluoranthene		4.39	0.83
67	Benzo (a) pyrene		3.40	1.04
68	Indeno (1,2,3-cd) pyrene		10.82	2.58
69	Dibenzo (a,h) anthracene		6.63	3.18
70	Benzo (g,h,i) perylene		5.43	2.86

These results suggest a significant improvement in linearity and system stability at the lowest concentration level.

The HES of the Agilent 5977B GC/MSD offers the possibility of performing fewer analysis by eliminating the need to perform SIM reanalyze samples which would have been undetectable using a standard system. The detection limits are superior when compared to previous systems.

The signal improvement provided a more stable platform to perform day to day analysis over a wide dynamic range even at Sub picogram levels.

Three additional benefits for you as an instrument operator.

1. The ability to use smaller extraction volumes for liquid samples due to the increased sensitivity of the new HES source design.

2.The ability to use small volume injections which reduces the need for inlet maintenance

3. The Ability to Use high split ratios which allows you to use the system for analyzing samples at the levels typically used in an environmental laboratory

Improved Linierity Using, the Agilent 5977B GC/MSD, and a High-Efficiency Source For Organic Analysis

Harry Prest, Melissa Churley And Dale Walker

[1]Agilent Technologies Inc., 5301 Stevens Creek Blvd., Santa Clara, CA 95051 USA

ASMS 2016
xxxxx

Agilent Technologies

Introduction

This poster demonstrates the use of the High Efficiency Source (HES) with its newly designed lenses, ion path, and magnet. These improvements provide for better system stability for multiple sample types, including both Volatile and Semi Volatile analysis. This source is available on multiple instrument platforms.

The 5977B HES was used to analyze these samples. The data shows the benefits of the HES when used to perform typical Semi Volatile laboratory analysis.

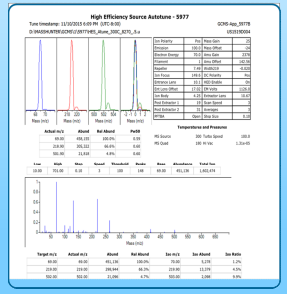
The Overall Linearity for the Semi Volatiles are shown here. The curve concentrations performed on the 5977B HES shows a wide dynamic linear range as well as excellent low level stability for all compounds.

Method

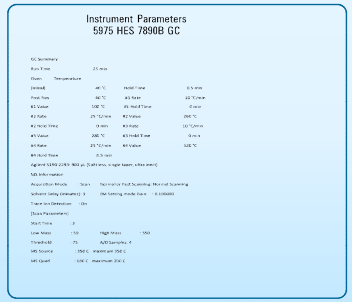
This analysis was performed using the 5977B GC/MS with the HES. The system tested a mixture of Semi volatile compounds which were purchase from Supelco™. The standards were prepared following a standard dilution scheme. The extended calibration range of 2.5 µg/L – 1000 µg/L shows superior dynamic range.

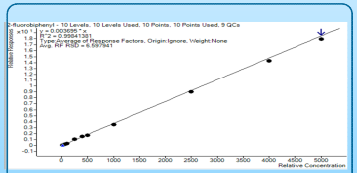
The system acquired a ten point calibration curve using the following concentrations; 5, 10, 20, 40, 50, 80, 100, 200, 500, 800, 1000 µg/l.

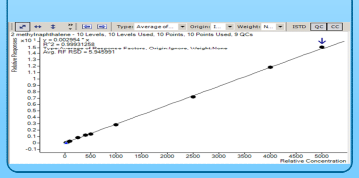
Following the analytical curve the system acquired eight replicate injections at the low point of the curve to produce a MDL typical for an analytical laboratory.



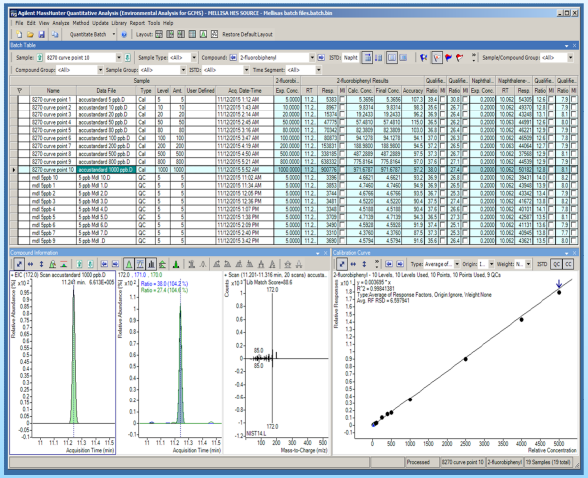
Method, cont.

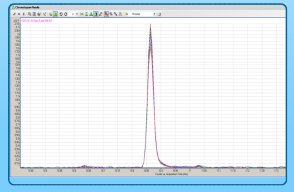






Better instrument linearity means more flexibility





Excellent linearity and stability

Name	RT	Transition	Avg Conc.	Std. Dev.	Avg Conc./Std. Dev.	Conc. RSD	MDL	LOQ	LOD	Avg Height	Avg. Resp	Resp. RSD
1,4-dichlorobenzene	8.477	146	2.5604	0.0507	50.54	2	0.133	0.5066	0.152	1447	2634	5.9
1,2-dichlorobenzene	8.68	146	2.5889	0.0744	34.82	2.9	0.1951	0.7435	0.2231	1390	2503	5.6
Anthracene	13.662	178	2.3763	0.0471	50.49	2	0.1235	0.4707	0.1412	1960	3029	15.9
Benz[a]anthracene	17	228	2.894	0.094	30.79	3.2	0.2467	0.94	0.282	919	1600	23.3
2-fluorophenol	6.354	112	1.8707	0.1018	18.38	5.4	0.2671	1.0177	0.3053	371	1036	10.3
Phenol-d5-	7.853	99	2.0789	0.1061	19.59	5.1	0.2785	1.061	0.3183	585	1353	9.2
Phenol	7.872	94	2.0978	0.0753	27.85	3.6	0.1977	0.7533	0.226	605	1406	4.7
Aniline	7.968	93	2.0027	0.1123	17.83	5.6	0.2948	1.1232	0.337	974	1854	8.1
Bis(2-chloroethyl) ether	8.044	93	2.4595	0.1975	12.45	8	0.5183	1.9747	0.5924	836	1856	7.5
2-chlorophenol	8.149	128	1.8842	0.1333	14.13	7.1	0.3499	1.3333	0.4	412	942	9.7
1,3-dichlorobenzene	8.378	146	2.5532	0.0566	45.14	2.2	0.1485	0.5657	0.1697	1399	2575	5.9
Dibenz[a,h]anthracene	22.325	278	5.8961	0.4339	13.59	7.4	1.1388	4.3391	1.3017	224	970	23.9
Benzyl alcohol	8.604	108	2.6224	0.6737	3.89	25.7	1.768	6.7365	2.021	337	857	26.3
Dibenzofuran	12.202	168	2.6192	0.0787	33.28	3	0.2066	0.7871	0.2361	2574	3904	10.5
o-Cresol	8.732	108	2.9833	0.9942	3	33.3	2.6092	9.9416	2.9825	535	1434	34.2
Bis(2-chloro-1-methylethyl) ether	8.79	121	3.72	0.1907	19.51	5.1	0.5005	1.9072	0.5722	241	684	8.9
p-Cresol	8.924	108	2.4153	0.653	3.7	27	1.7138	6.5301	1.959	489	1153	27.4
N Nitroso-di-n-propylamine	8.953	70	2.8614	0.4659	6.14	16.3	1.2227	4.6589	1.3977	524	1448	20.4
Hexachloroethane	9.14	117	2.4922	0.1367	18.24	5.5	0.3586	1.3665	0.41	503	798	5.8
Nitrobenzene-D5	9.166	82	2.2607	0.0589	38.4	2.6	0.1545	0.5887	0.1766	861	1688	6.2
Nitrobenzene	9.192	77	2.1955	0.1304	16.87	5.9	0.3422	1.3036	0.3911	816	1456	9.5
Isophorone	9.484	82	2.0293	0.0875	23.2	4.3	0.2295	0.8746	0.2624	1078	1899	8.5
2,4-dimethylphenol	9.602	107	1.808	0.0766	23.61	4.2	0.2009	0.7657	0.2297	531	897	8.5
bis(2-chloroethoxy)-methane	9.721	93	2.2003	0.0797	27.62	3.6	0.2091	0.7968	0.239	1142	1805	4.6
2,4-dichloro-phenol	9.87	162	1.3744	0.1568	8.76	11.4	0.4116	1.5684	0.4705	253	457	16.6
1,2,4-trichlorobenzene	9.984	180	2.5619	0.0646	39.65	2.5	0.1696	0.6462	0.1939	1337	2057	6.7
Naphthalene	10.086	128	2.5072	0.033	76.08	1.3	0.0865	0.3295	0.0989	3723	5908	6.4
4-Chloroaniline	10.117	127	2.141	0.256	8.36	12	0.6718	2.5596	0.7679	795	1720	14.4
Hexachlorobutadiene	10.219	227	2.002	0.4507	4.44	22.5	1.1828	4.5068	1.352	553	621	25.5
4-chloro-3-methyl-phenol	10.629	142	2.6386	0.3667	7.2	13.9	0.9625	3.6673	1.1002	256	540	18.5
2 methylnaphthalene	10.863	141	2.4774	0.2275	10.89	9.2	0.597	2.2747	0.6824	1857	2953	7.5
2-fluorobiphenyl	11.24	172	2.2854	0.0579	39.49	2.5	0.1519	0.5787	0.1736	2365	3421	7.8
2 chloronaphthalene	11.396	162	2.3329	0.057	40.96	2.4	0.1495	0.5695	0.1709	1889	2857	8.4
2-Nitroaniline	11.472	65	2.0706	0.3219	6.43	15.5	0.8448	3.2188	0.9657	179	294	17.7
Dimethyl phthalate	11.635	163	2.2092	0.0793	27.8	3.6	0.208	0.7925	0.2378	1601	2510	6.9
2,6 Dinitrotoluene	11.71	89	2.3394	0.3694	6.33	15.8	0.9696	3.6943	1.1083	143	200	18.3
Acenaphthylene	11.845	152	2.5816	0.0025	12.75	7.8	0.5315	2.0252	0.6076	2327	3699	7.6
3-Nitroaniline	11.896	92	0.465	0.3278	1.42	70.5	0.8603	3.2781	0.9834	119	215	25.8
Acenaphthene	12.024	152	2.9098	0.4256	6.84	14.6	1.117	4.2561	1.2768	1163	1805	11.4
2,4-dinitro-toluene	12.135	165	10.127	0.2456	41.2	2.4	0.6451	2.4578	0.7373	142	208	18.4
Diethyl Phthalate	12.358	149	5.1659	0.9011	5.73	17.4	2.3648	9.0105	2.7032	3467	4979	21.6

Conclusions

These preliminary results suggest a significant improvement in linearity and system stability at the lowest concentration level. The HES of the Agilent 5977B GC/MSD offers the possibility of performing fewer analysis by eliminating the need to dilute and reanalyze samples which would have been over range on previous systems. The signal improvement provided a more stable platform to perform day to day analysis over a wide dynamic range.

Agilent Technologies