Using Magnetic Sector DFS with DualData XL in a Commercial Dioxin Lab

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- Pacific Rim Laboratories Inc.
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Overview

- History
- DualData – What is it?
- DualData XL – Why?
- DualData XL – Practical Applications
- Conclusions

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Who Am I?

- Analytical Chemist
  - P.Chem. – ACPBC
  - Past-President, Canadian Council of Independent Laboratories
  - Owner, Lab Director, Quality Assurance Officer, Pacific Rim Laboratories
- I am not
  - Toxicologist
  - Consultant

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My Business Partner and co-founder

- Patrick Pond
- Chief Technical Officer
- GC and HRMS instrument specialist

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VG70 arrives!

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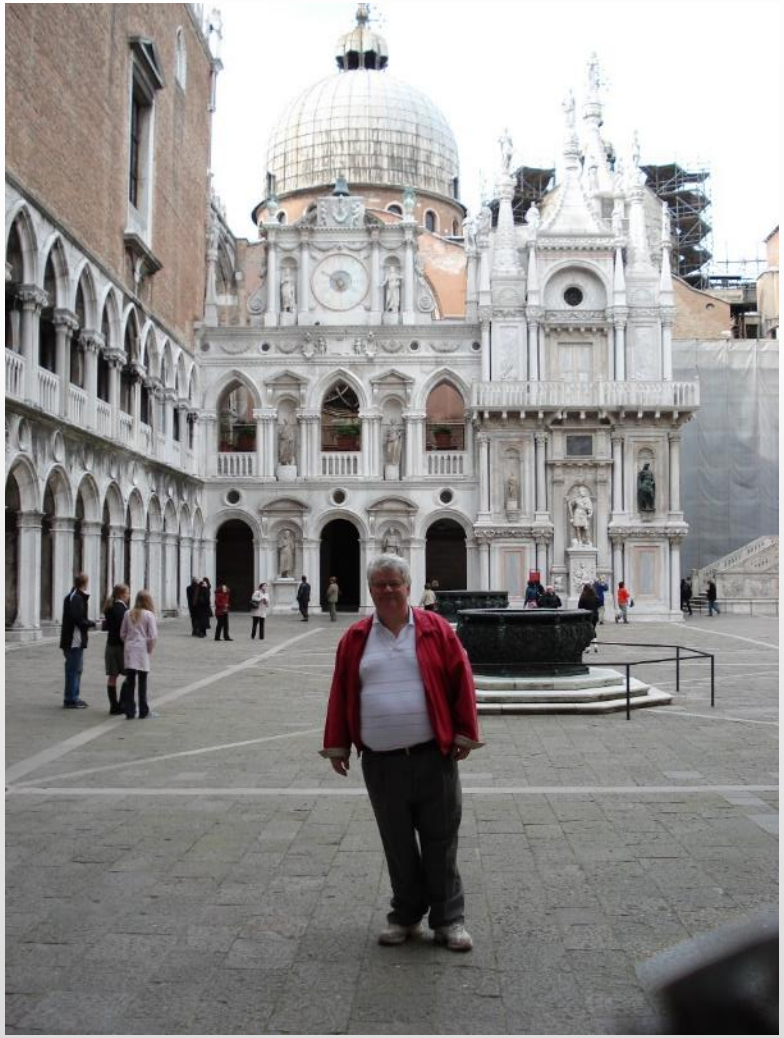
Beginnings

Dioxin 2005 - Toronto

Thermo POPs Symposium– Venice 2007



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More business means more instruments

First DFS (2007) – 1450 samples per year;
2250 tests – staff of 7

Second DFS (2010) – 2530 samples per year;
3500 tests – staff of 9

TSQ8000Evo (2014) – 3500 samples per year;
4450 tests – staff of 11

Third DFS (2015) – 4600 samples per year;
6750 tests – staff of 15

DualDataXL installed on DFS – projecting
6500 samples

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Pacific Rim Laboratories Inc.
Scientific Research and Experimental Development

- We thrive on innovation
  - PBDE method in 2005
  - 209 congener PCBs in 2005
  - Sub-ppb PAH analysis food in 2006
  - Published 2009 congener PCB by SGE HT8 column (2009)
  - Cape Tech column clean-up (2012)
  - OCPs by HRMS (2012)
  - Improved clean-up methods for dioxins/PCB (2014)
  - Rocket evaporator (2015)
  - Single run PAH and alkylated PAH on TSQ8000Evo (2015)

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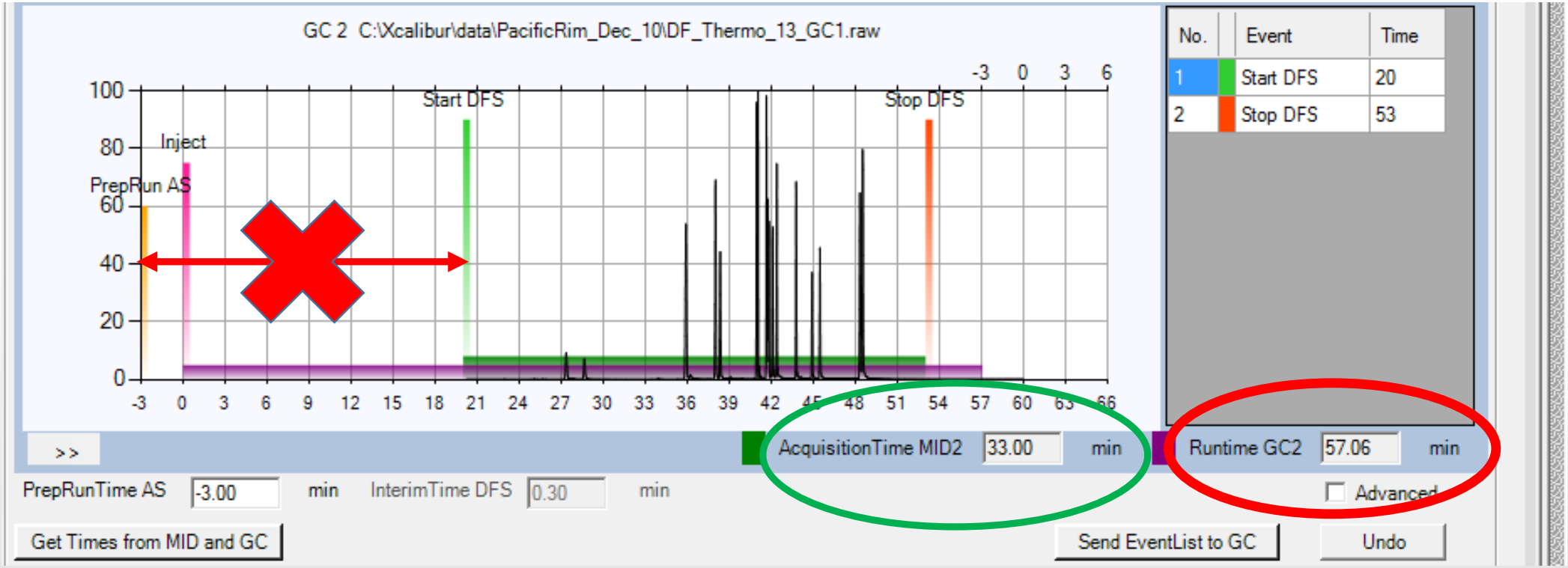
What is Dual Data? PCDD/F analysis
EPA 1613b – TCDD must elute >25 minutes



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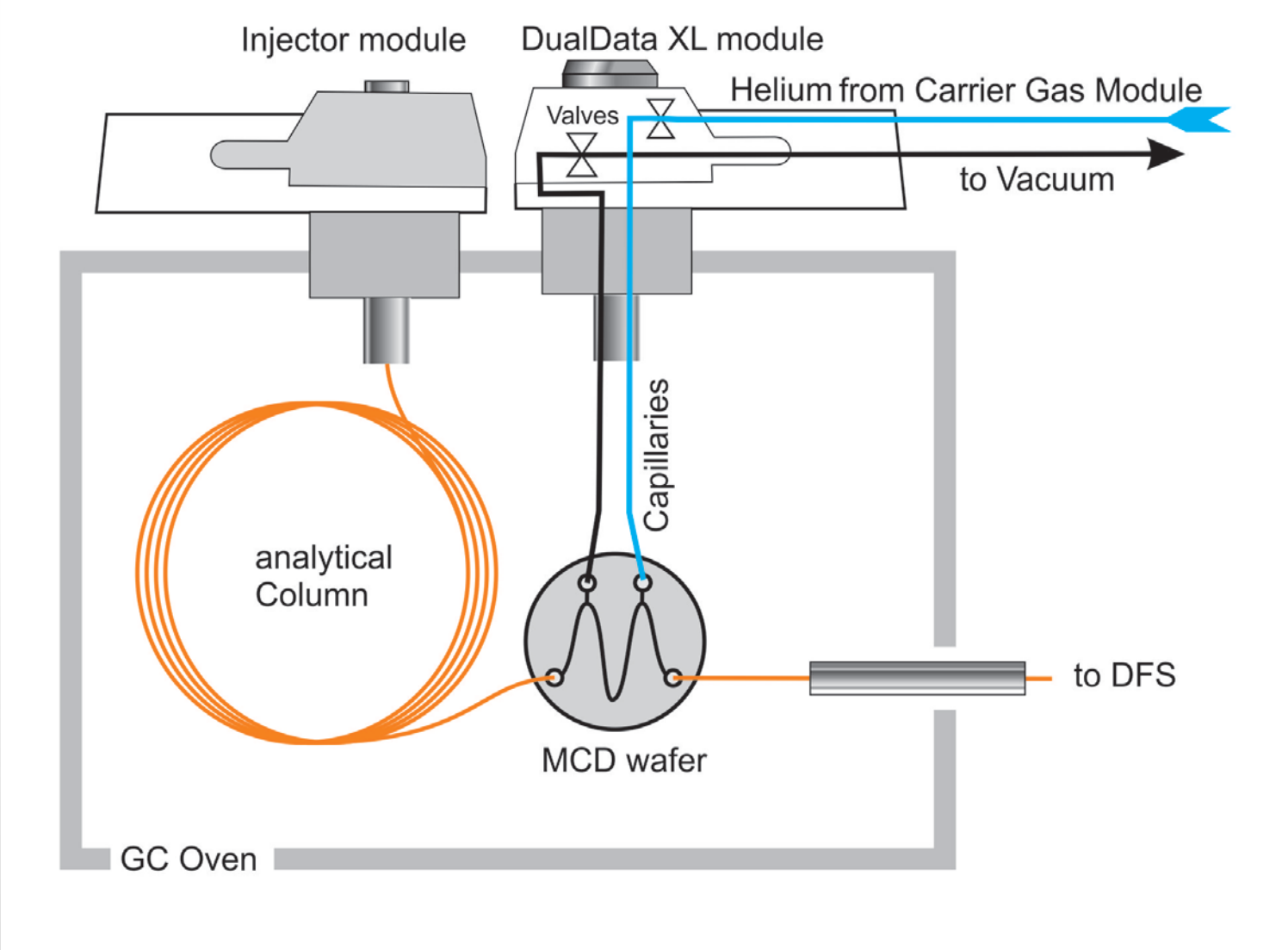

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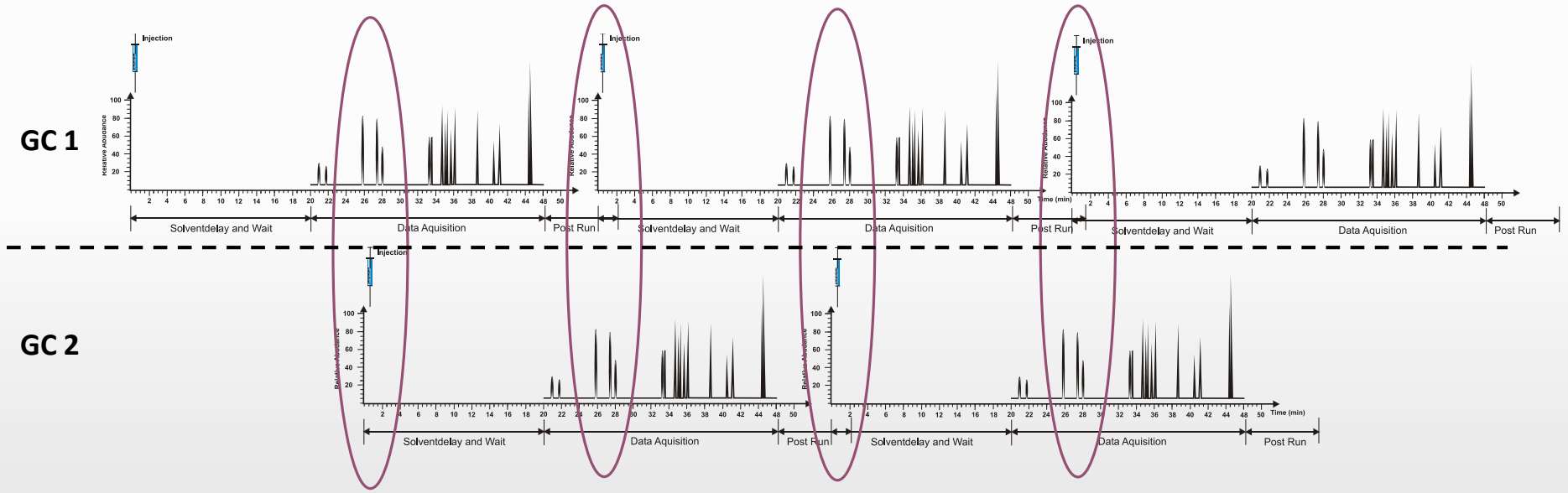
DFS DualData XL: Staggered Injection

- Both GCs are running simultanously.
- The injection on GC 2 is performed during the aquisition of GC 1 and vice versa.



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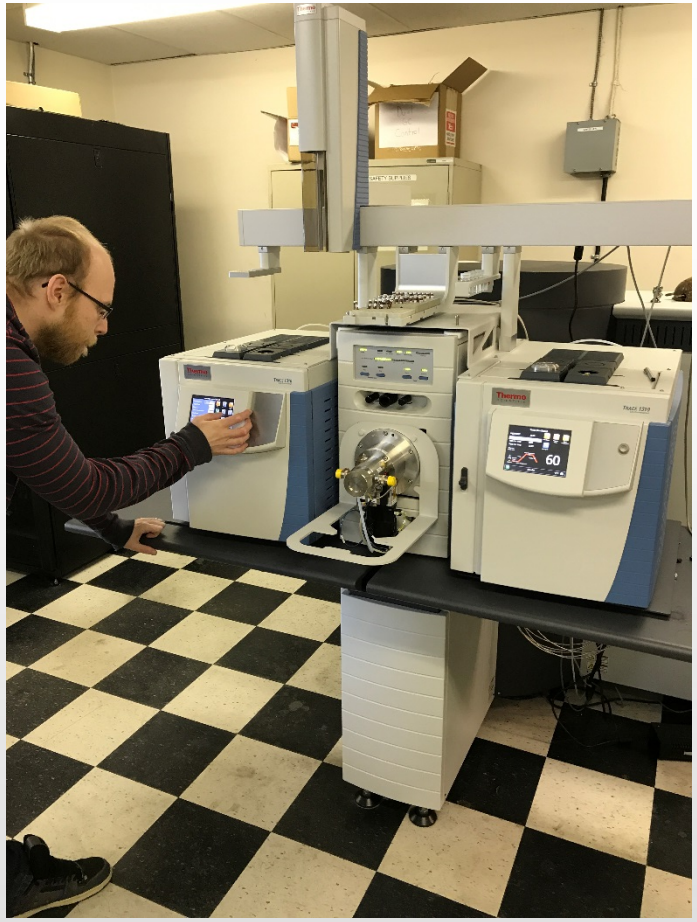
Why DualData XL?



- Cheaper than buying new instrument
- No additional floor space required
- No additional electrical considerations
- Autosampler ready to inject as soon as we get ready signal
- Can double our through put with mixed chemistries

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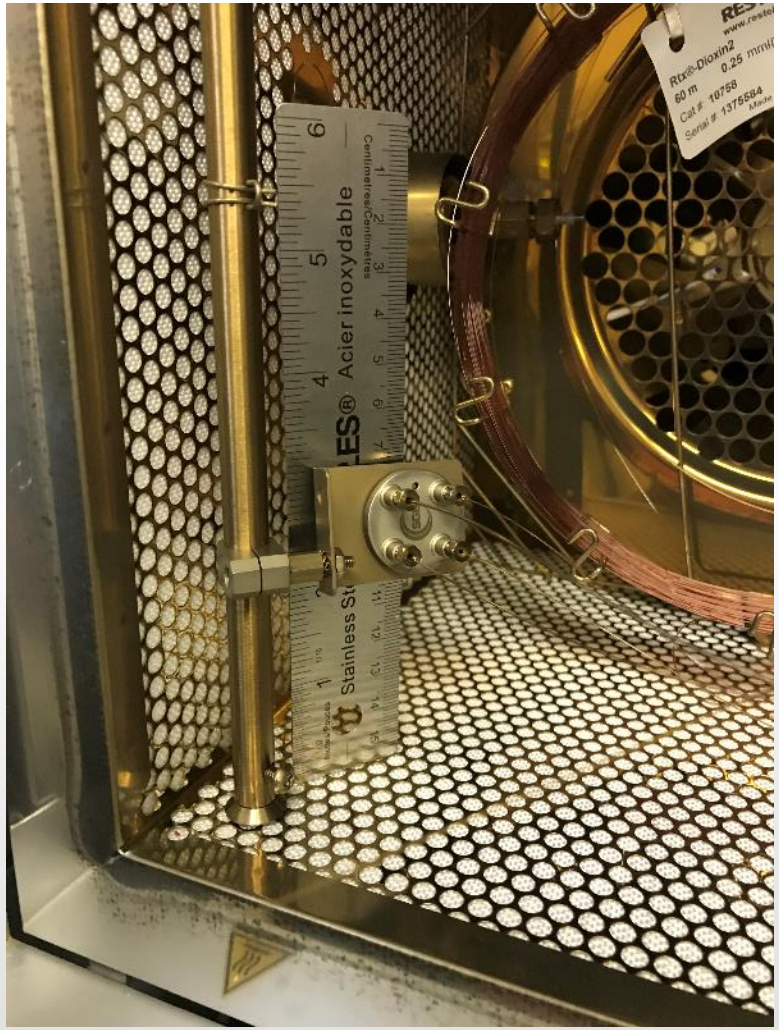
Requirements

- DFS with dual 1310 GCs
- Older DFS can be converted, but cannot use Trace GCs.
- Will add a 4-way valve to control gases



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Requirements

- DFS with dual 1310 GCs
- Older DFS can be converted, but cannot use Trace GCs.
- Will add a 4-way valve to control gases
- A gas module is installed next to your injector.

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Requirements

- DFS with dual 1310 GCs
- Older DFS can be converted, but cannot use Trace GCs.
- Will add a 4-way valve to control gases
- A gas module is installed next to your injector.
- New software

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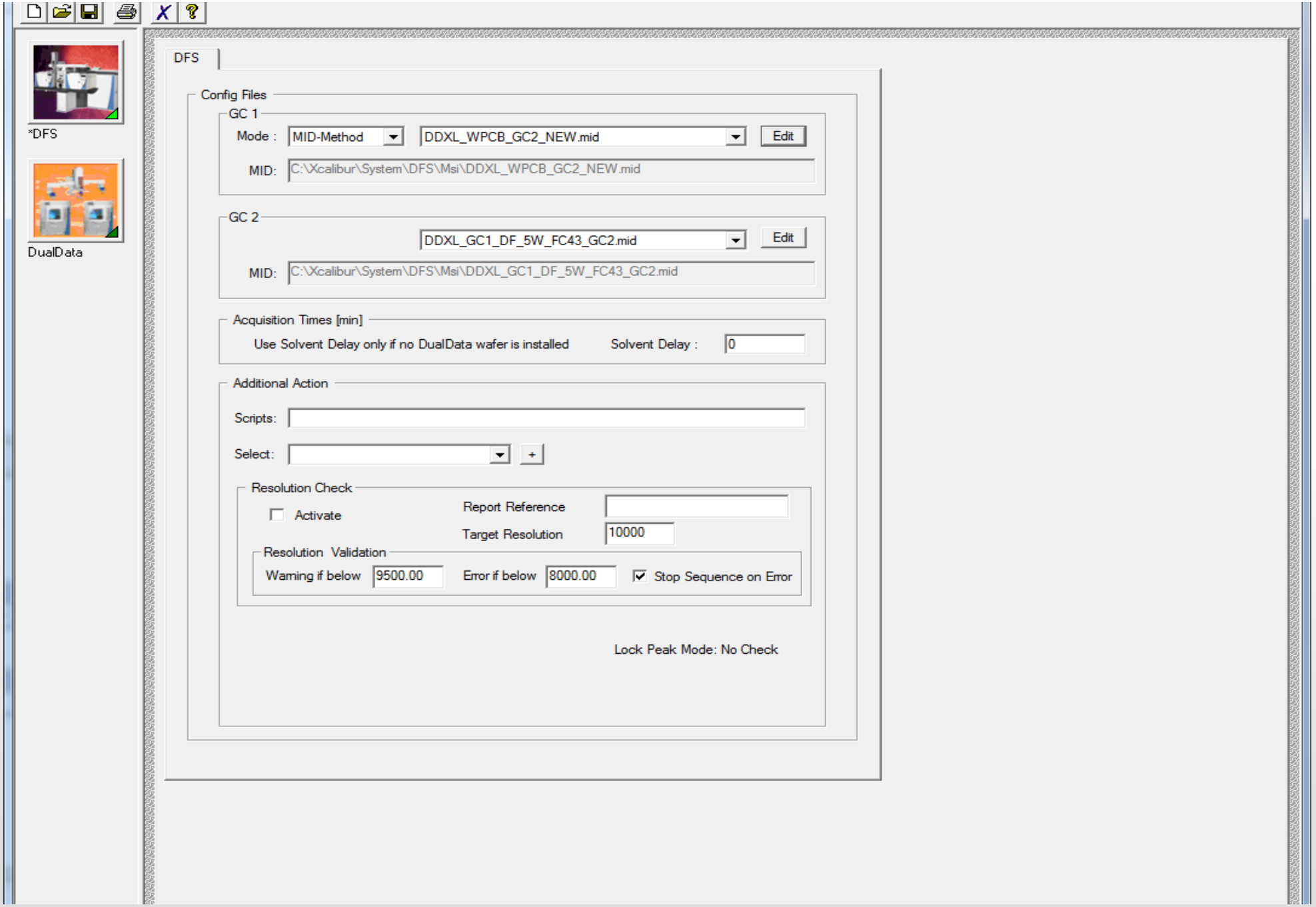

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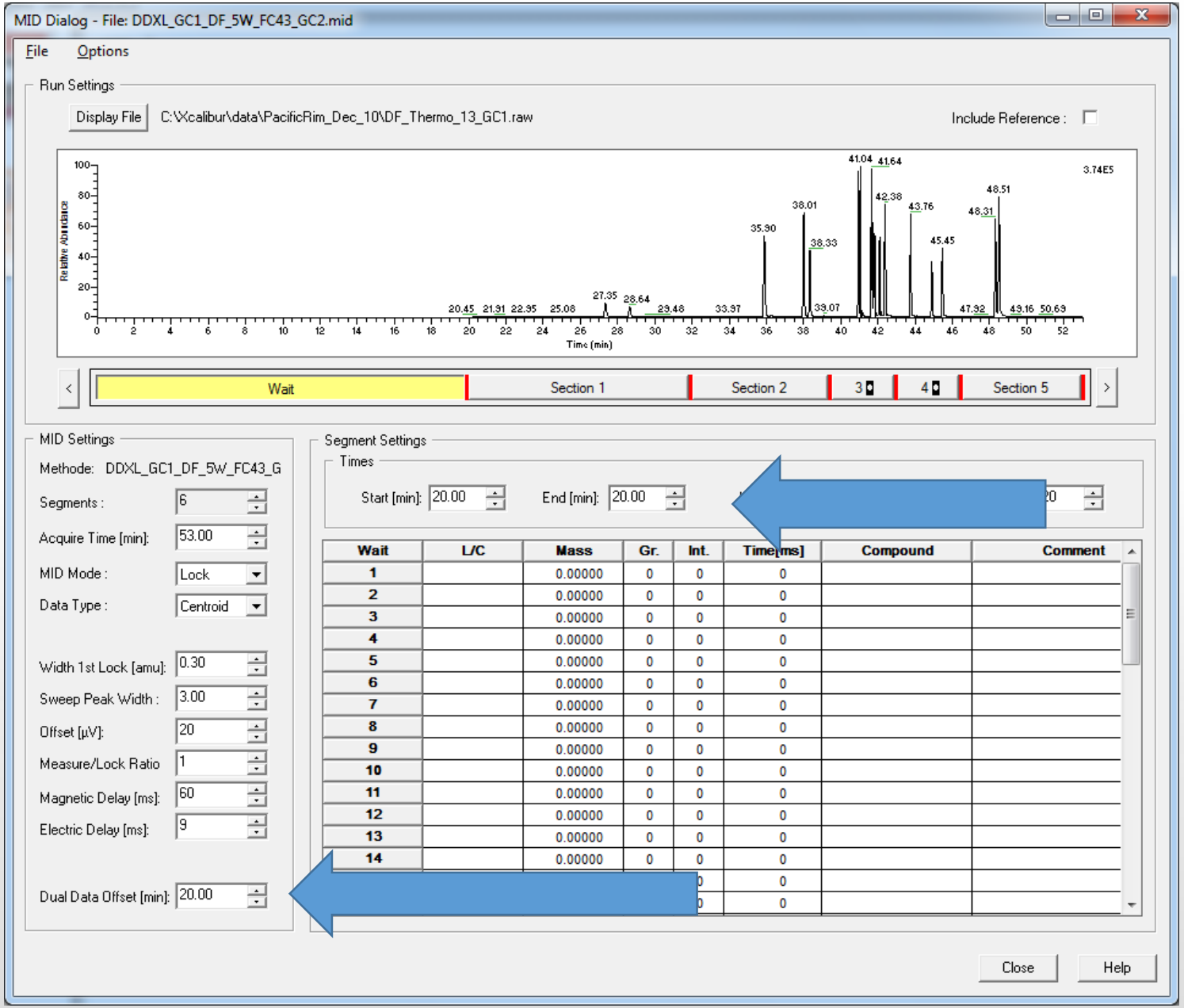

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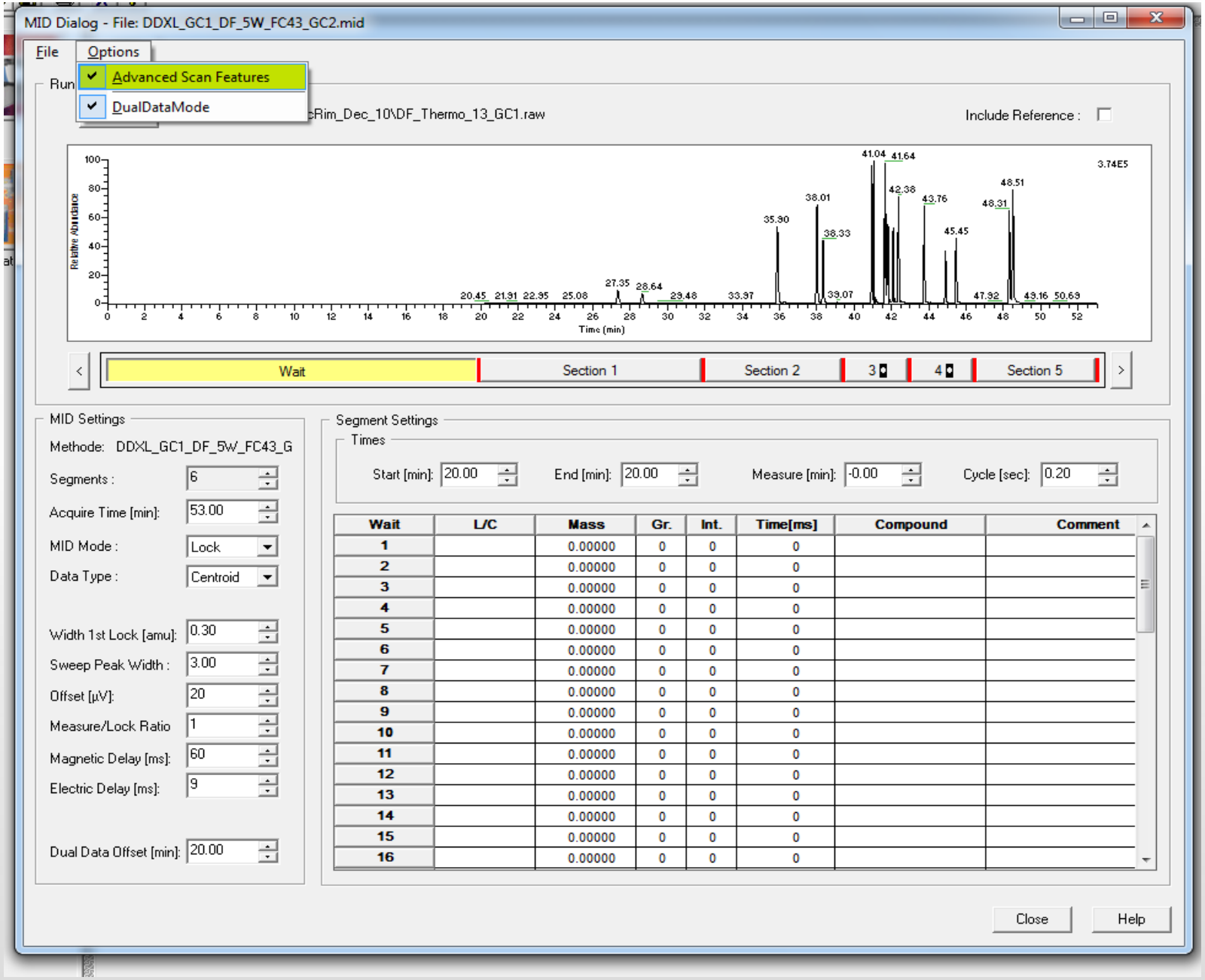

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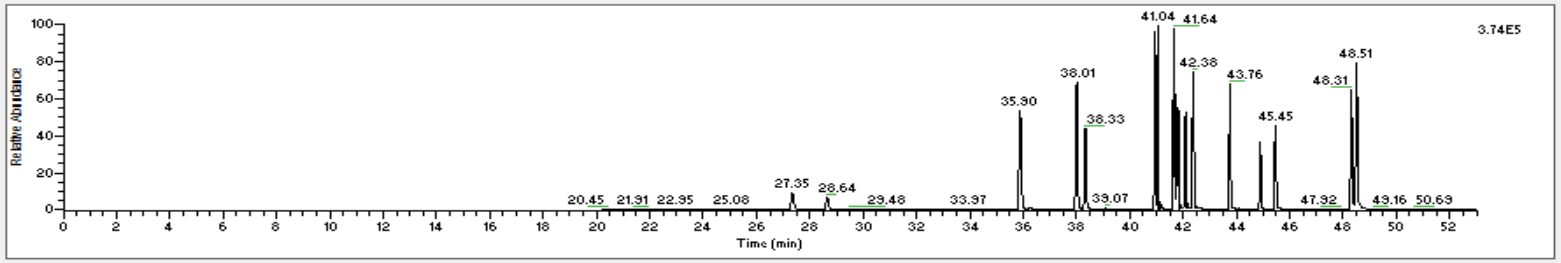
MID Dialog - File: DDXL_GC1_DF_5W_FC43_GC2.mid

File Options

Run Settings

Display File | C:\Xcalibur\data\PacificRim_Dec_10\DF_Thermo_13_GC1.raw | Include Reference :



Wait | Section 1 | Section 2 | 3 | 4 | Section 5

MID Settings

Methode: DDXL_GC1_DF_5W_FC43_G

Segments :	6
Acquire Time [min]:	53.00
MID Mode :	Lock
Data Type :	Centroid
Width 1st Lock [amu]:	0.30
Sweep Peak Width :	3.00
Offset [µV]:	20
Measure/Lock Ratio	1
Magnetic Delay [ms]:	60
Electric Delay [ms]:	9
Dual Data Offset [min]:	20.00

Segment Settings

Times

Start [min]: 46.50 | End [min]: 53.00 | Measure [min]: 6.50 | Cycle [sec]: 0.80

Section 5	L/C	Mass	Gr.	Int.	Time[ms]	Compound	Comment
1		441.74280	1	1	134		
2		443.73980	1	1	134		
3		457.73710	1	1	134		
4		459.73770	1	1	134		
5	Lock	463.97378	1	10	13		
6		469.77800	1	3	44		
7		471.77500	1	3	44		
8	Cali	501.97059	1	20	6		
9		513.67750	1	3	44		
10		0.00000	0	0	0		
11		0.00000	0	0	0		
12		0.00000	0	0	0		
13		0.00000	0	0	0		
14		0.00000	0	0	0		
15		0.00000	0	0	0		
16		0.00000	0	0	0		

Close | Help

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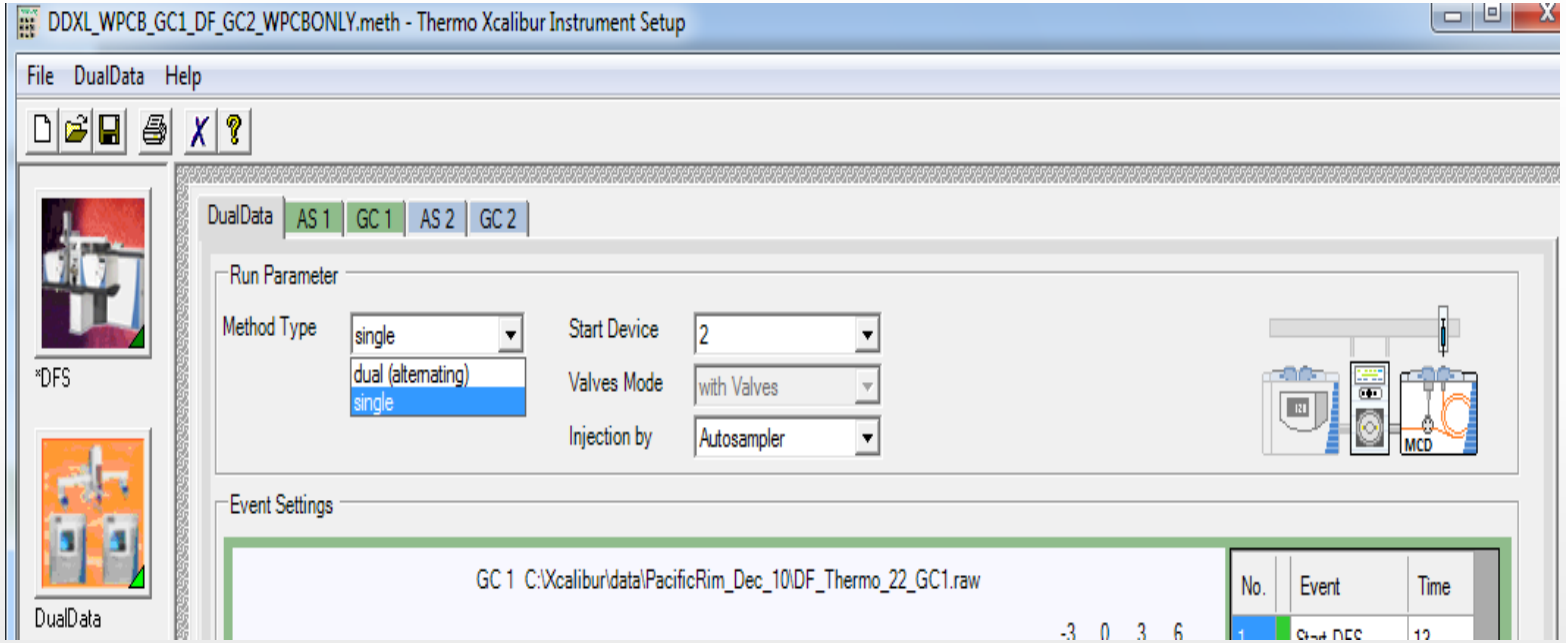

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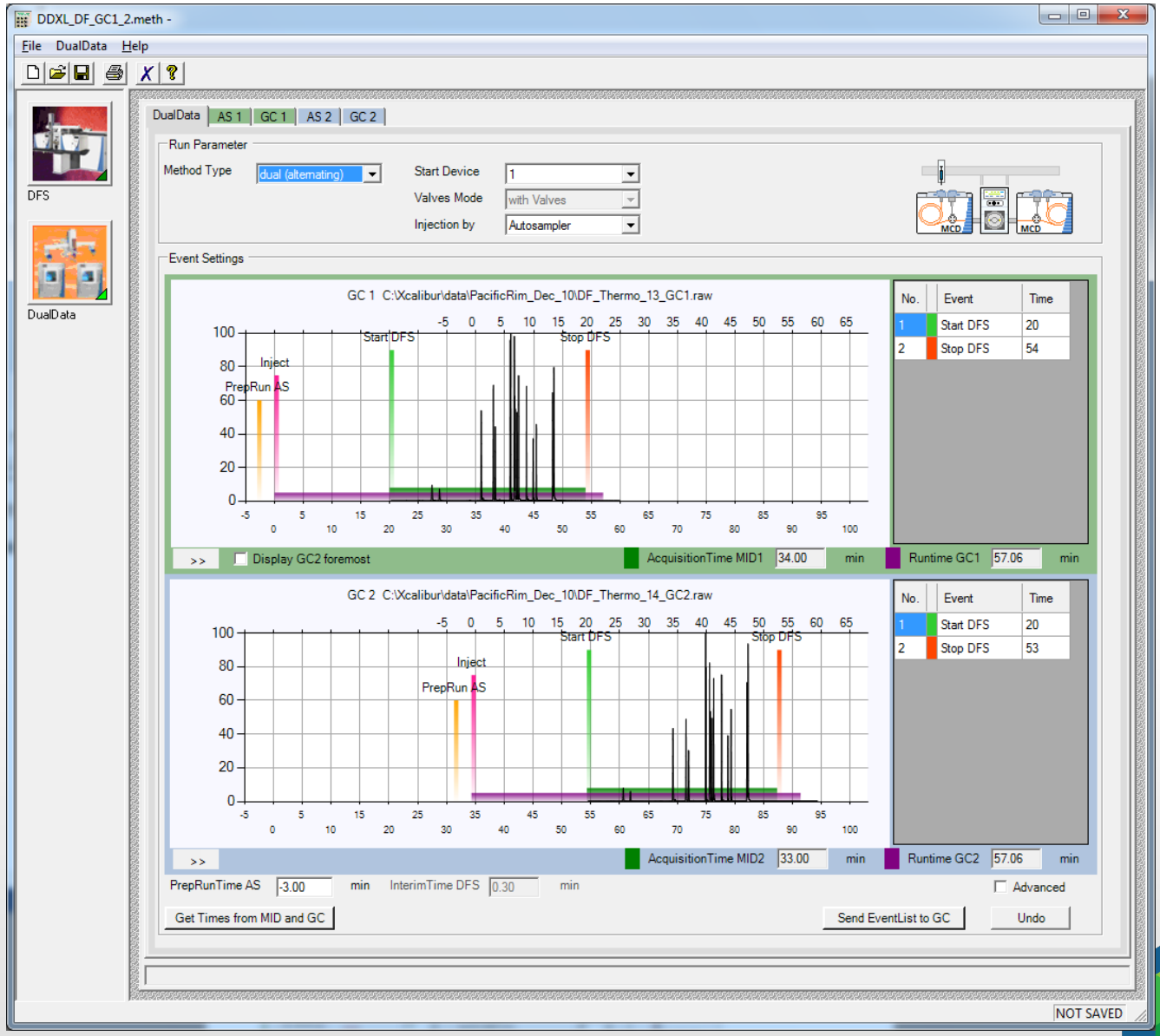
Dual PCDD/F

Runtime DFS – 62 minutes or 23 inj/day

Runtime DualData XL – 67 minutes to complete cycle for both GCs

42 injections in 24 h!

82% more samples!



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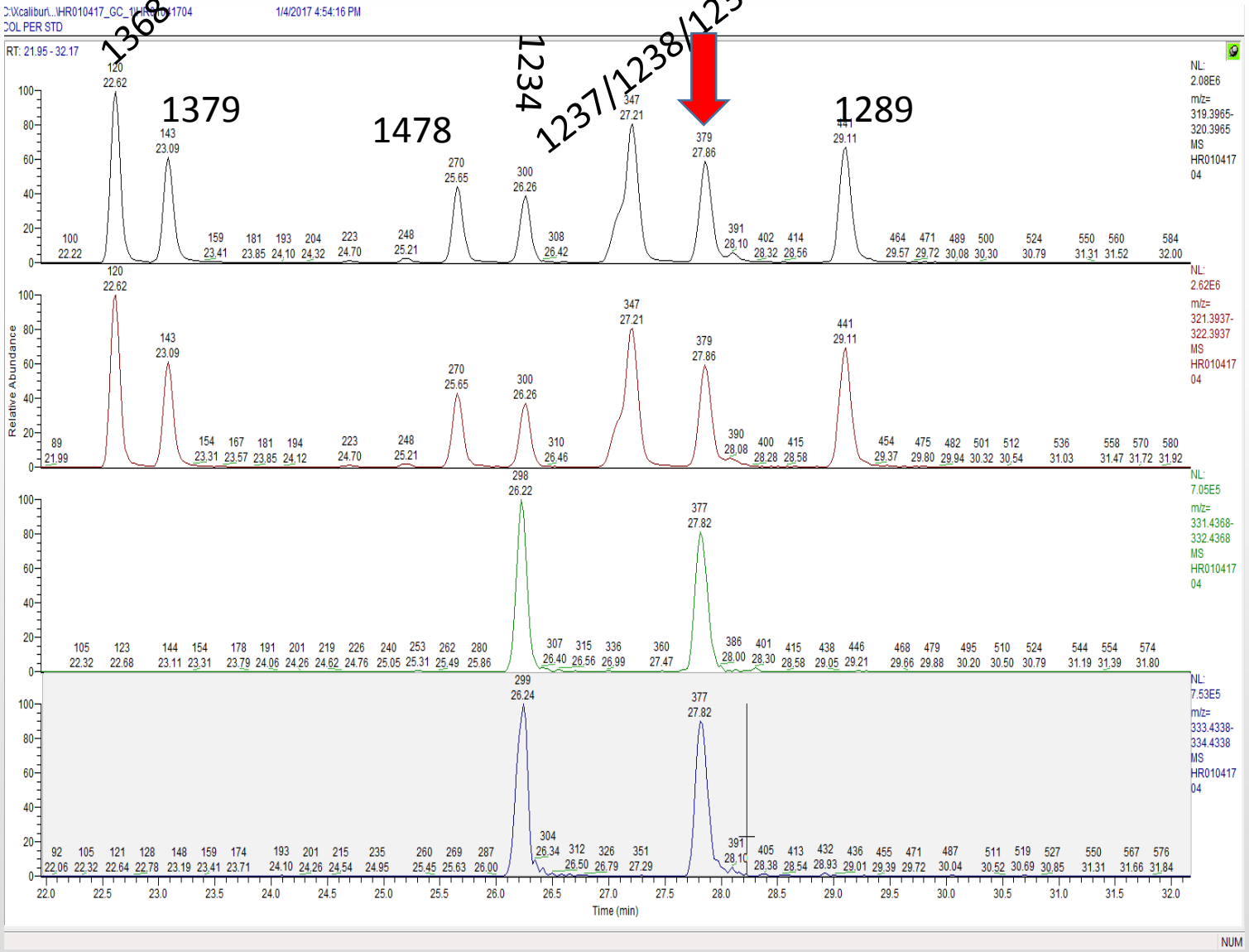
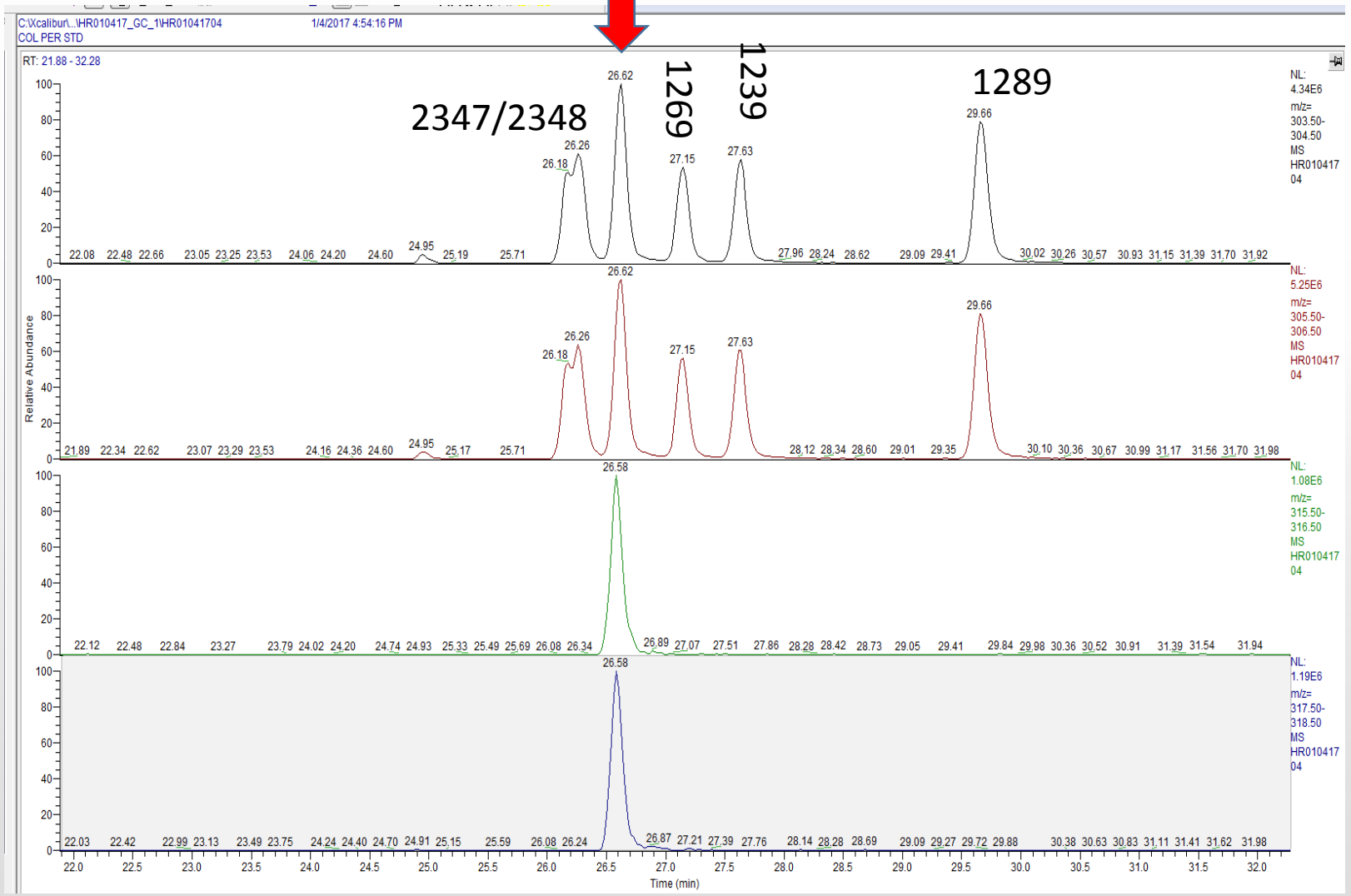
Column Resolution - TCDD



Resolution - TCDF



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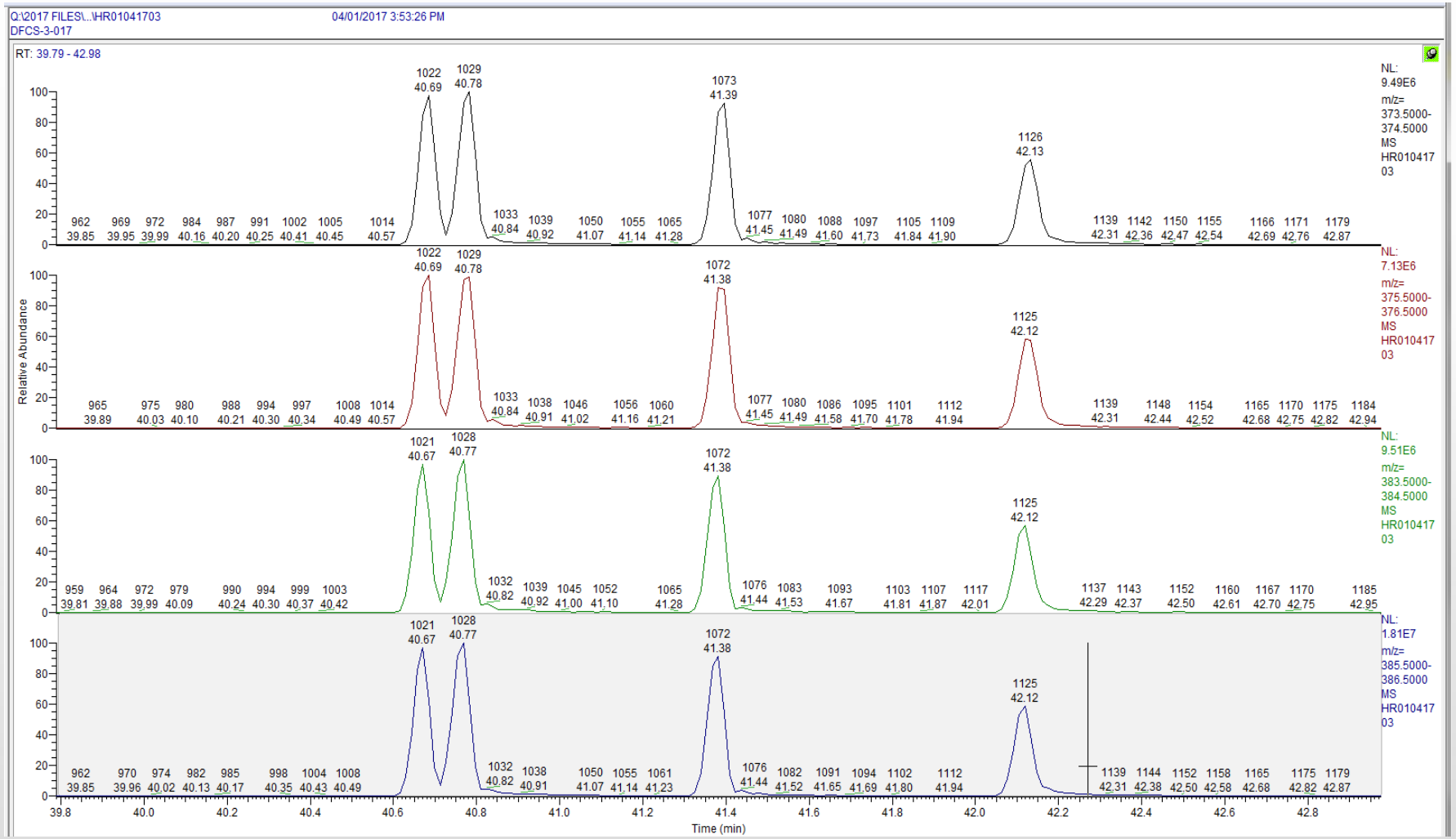
HxCDF resolution



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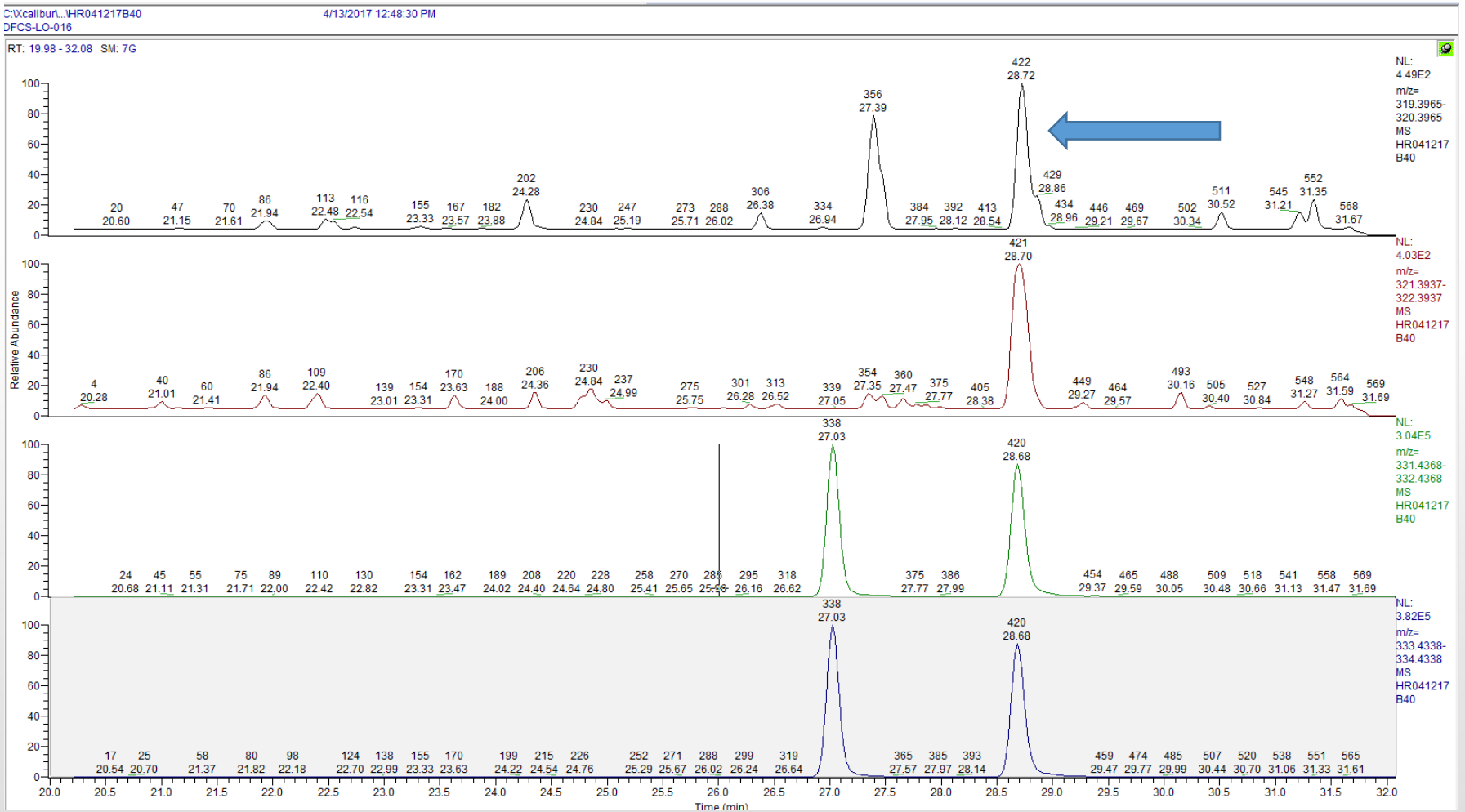
TCDD - CS-Lo 0.1 pg injected



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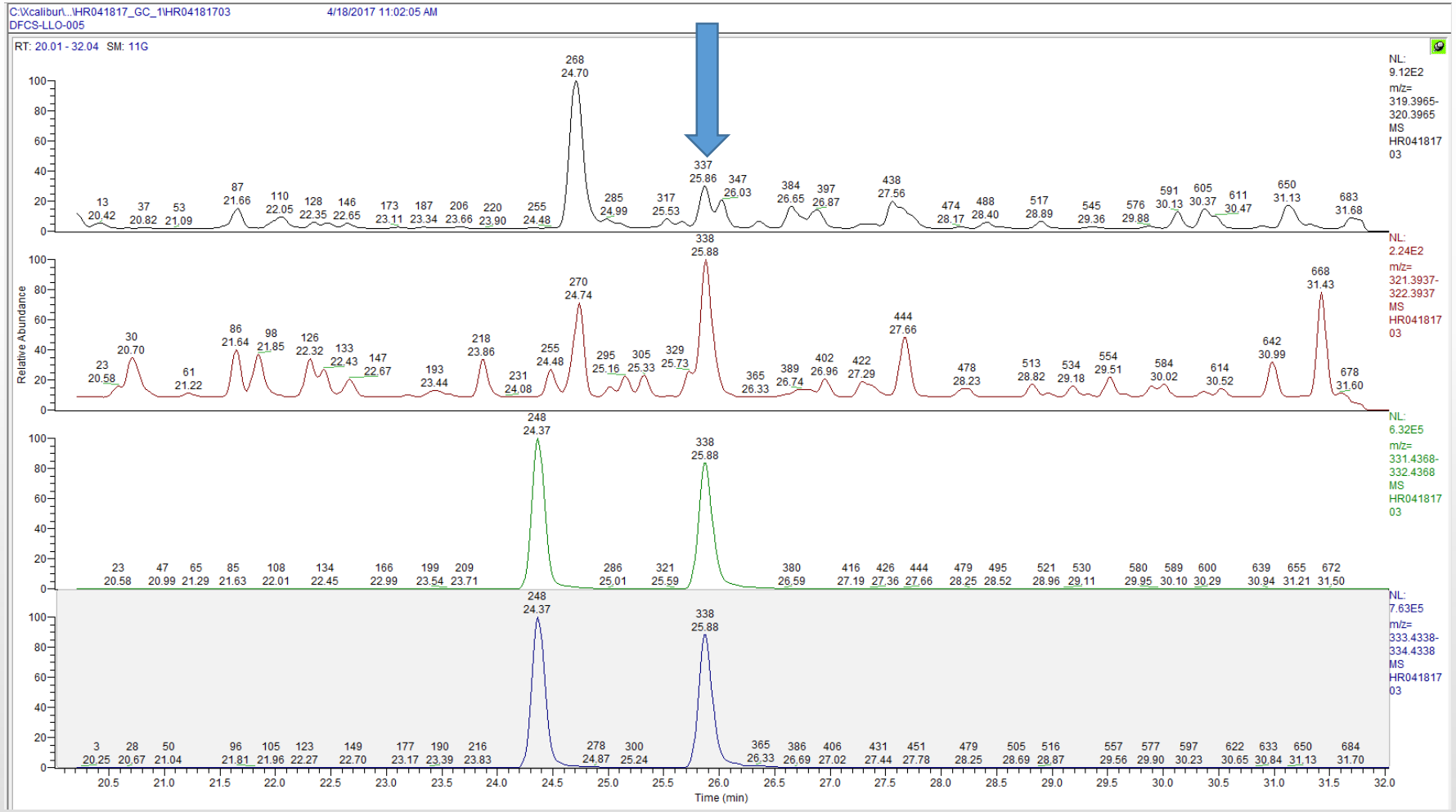
TCDD – CS-LoLo! 20 fg injected



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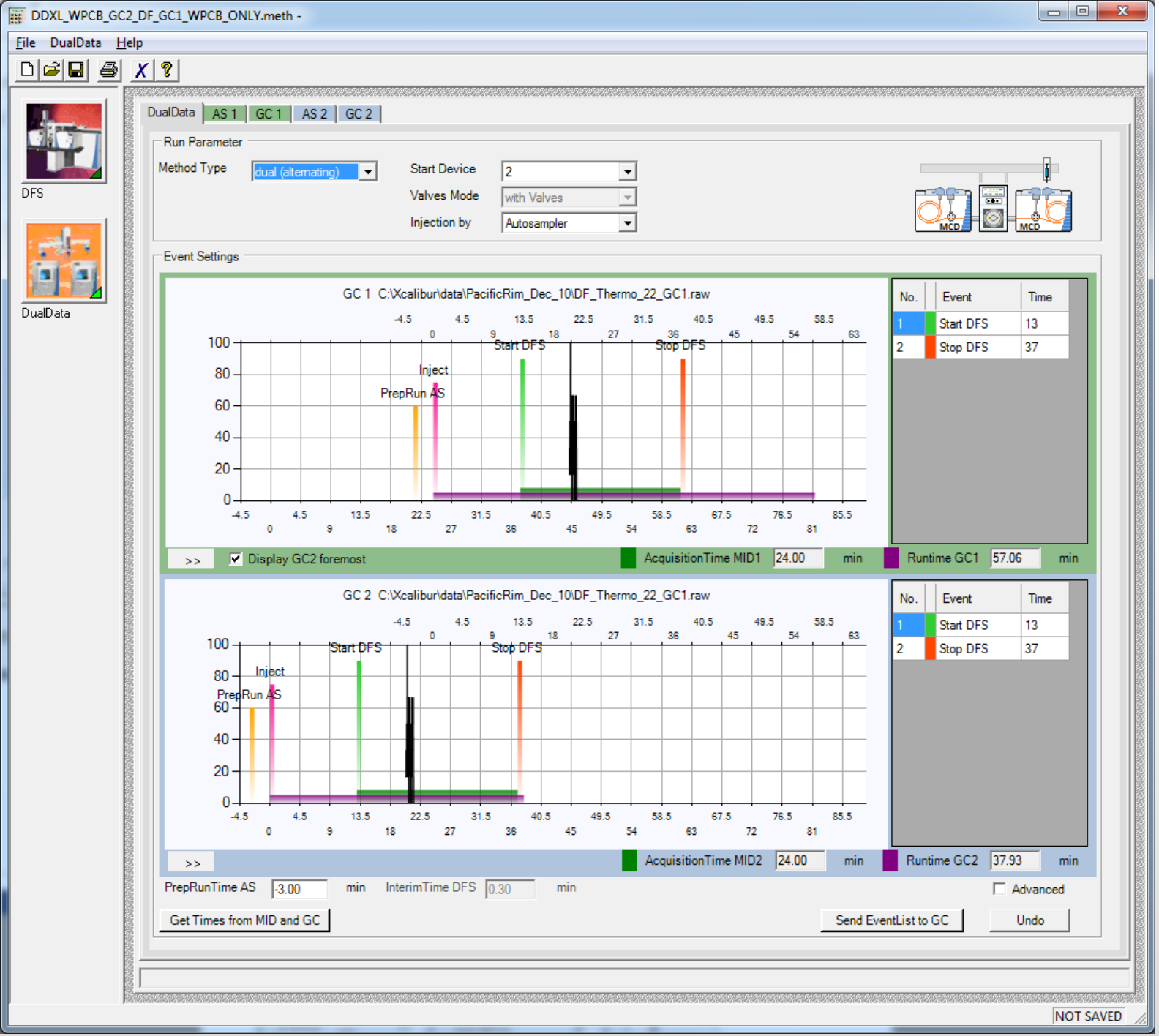

Dual PCB

Runtime DFS – 68 minutes (21 inj/day)

Runtime DualData XL – for dioxin-like PCBs 74 minutes to complete cycle for both GCs

38 inj/day

82% more analyses

Runtime DualData XL – for 209 congener PCBs 94 minutes to complete cycle for both GCs

30 inj/day

43% more analyses

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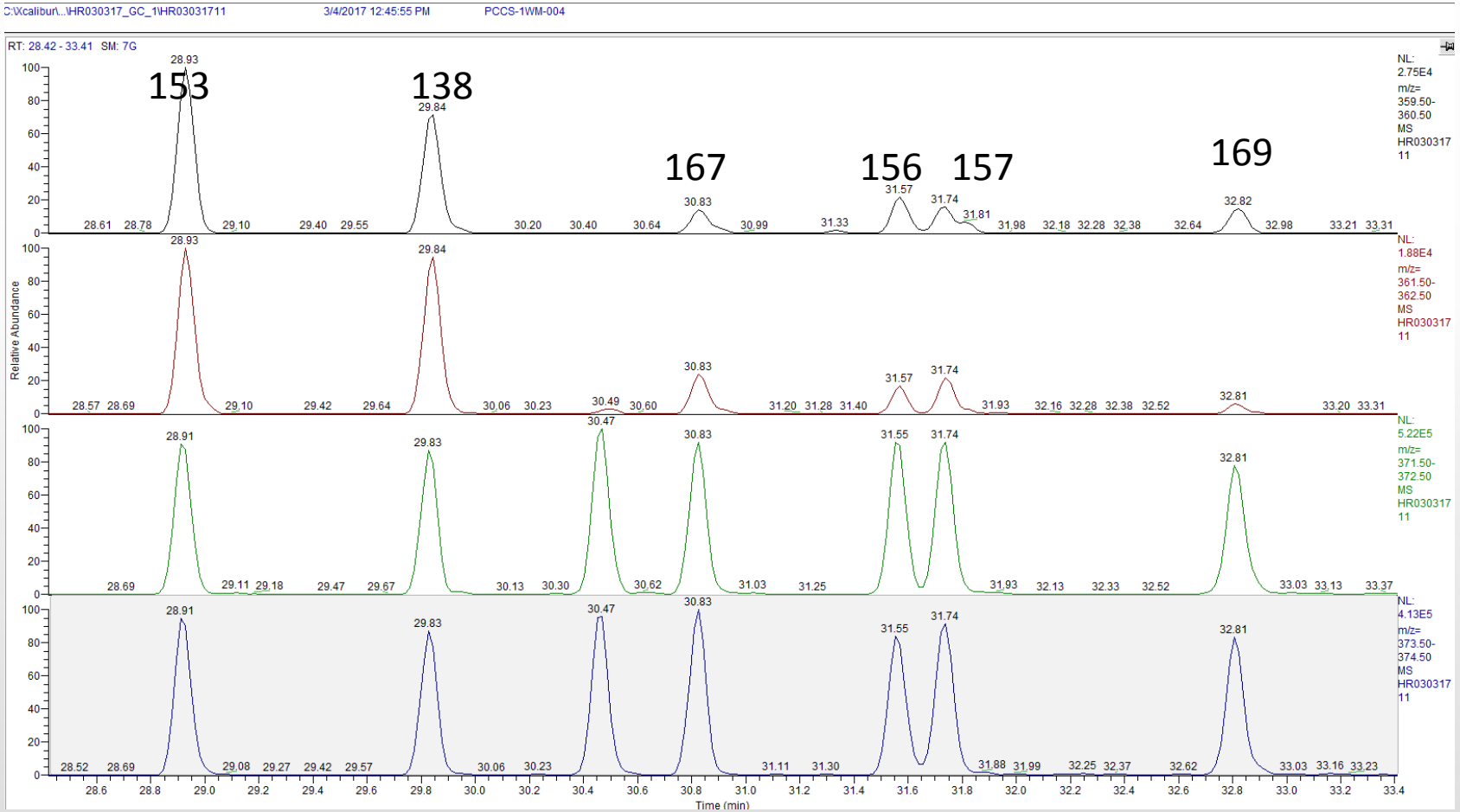
HxCB @ 0.1/0.5 pg injected



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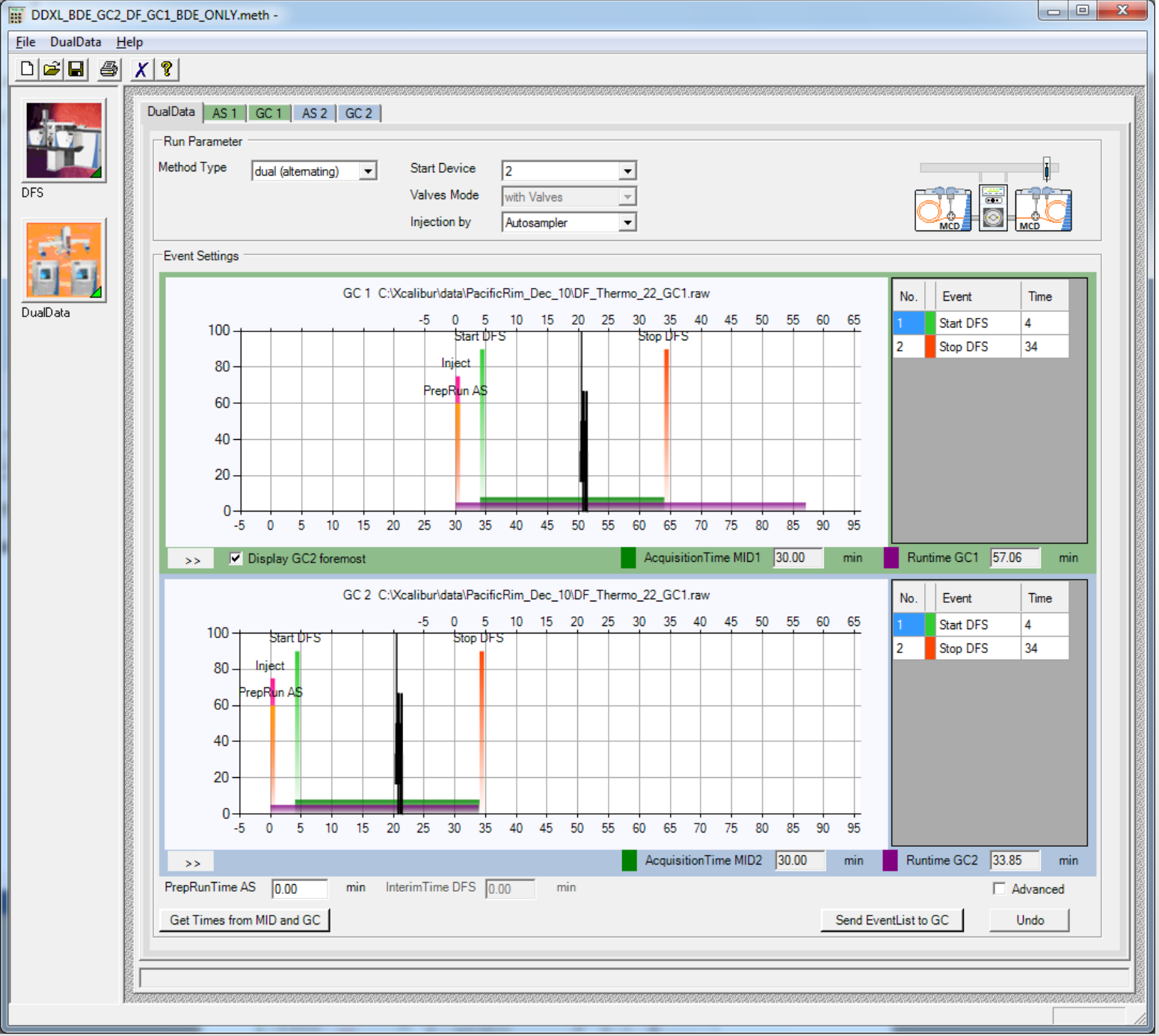

Dual BDE

Runtime DFS – 41 minutes (35 inj/day)

Runtime DualData XL – 60 minutes to complete cycle for both GCs

47 inj/day

34% more runs!

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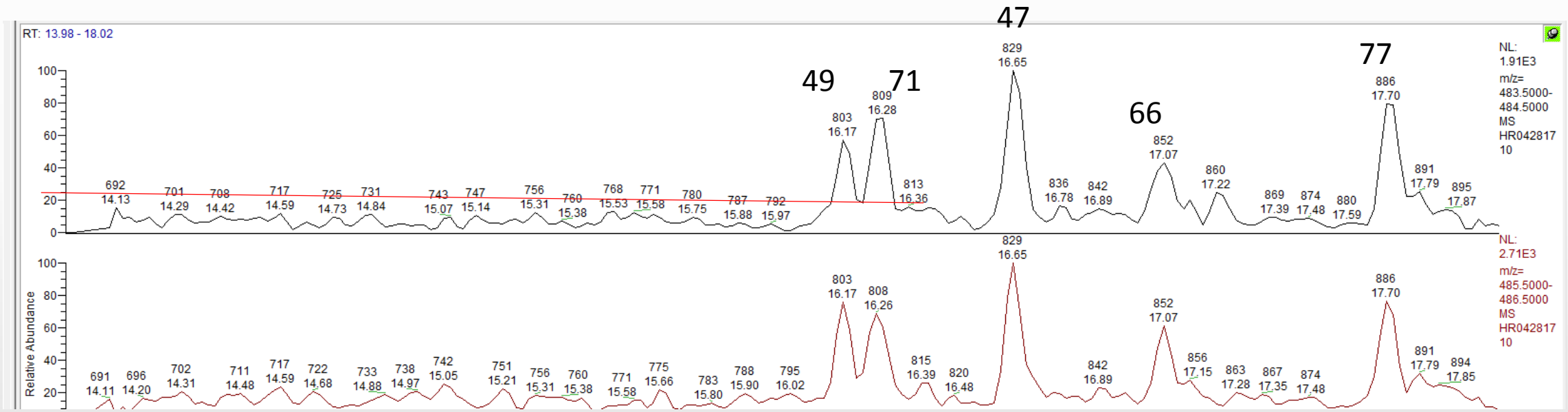
TeBDE @ 0.5 pg injected



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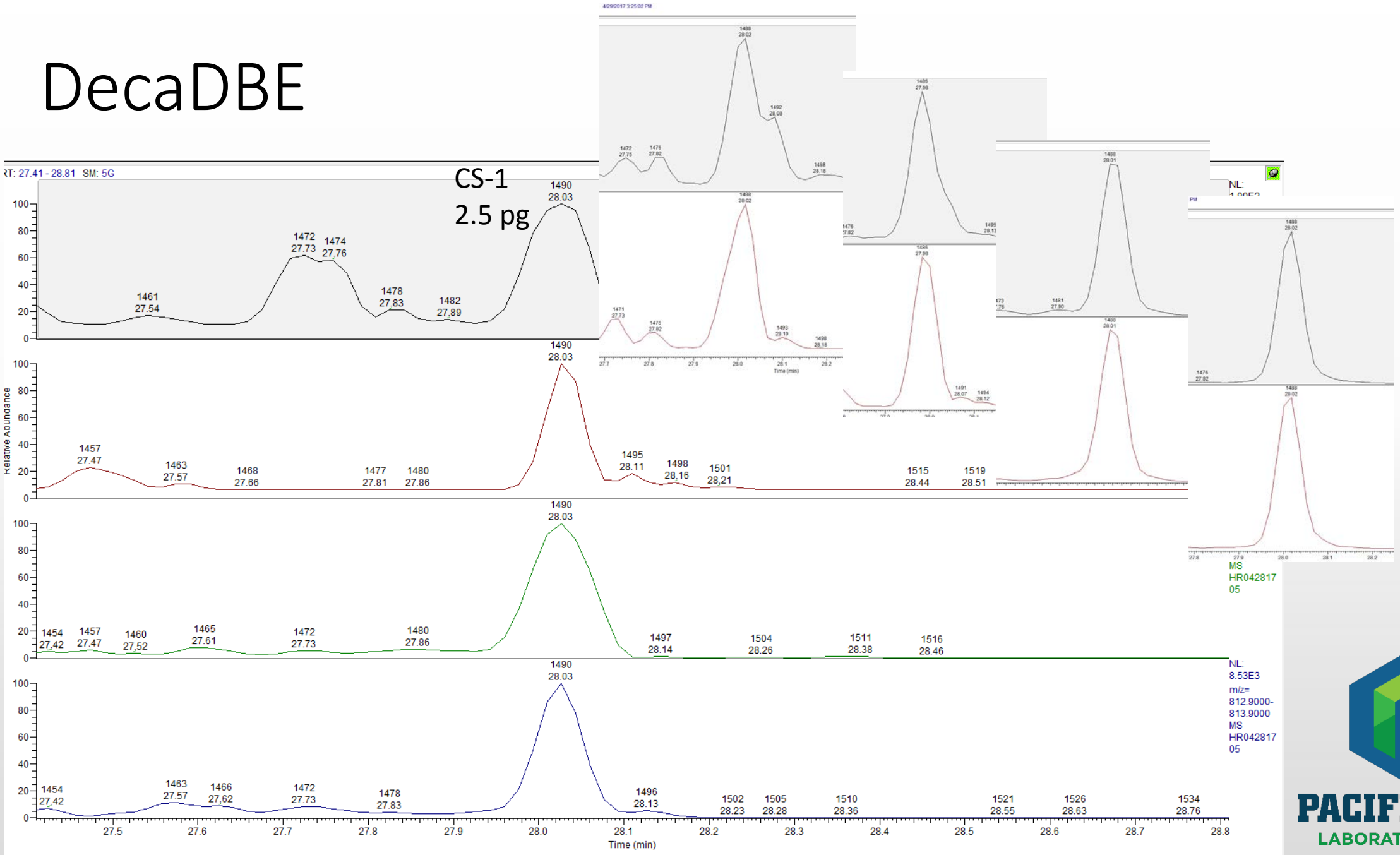
DecaDBE



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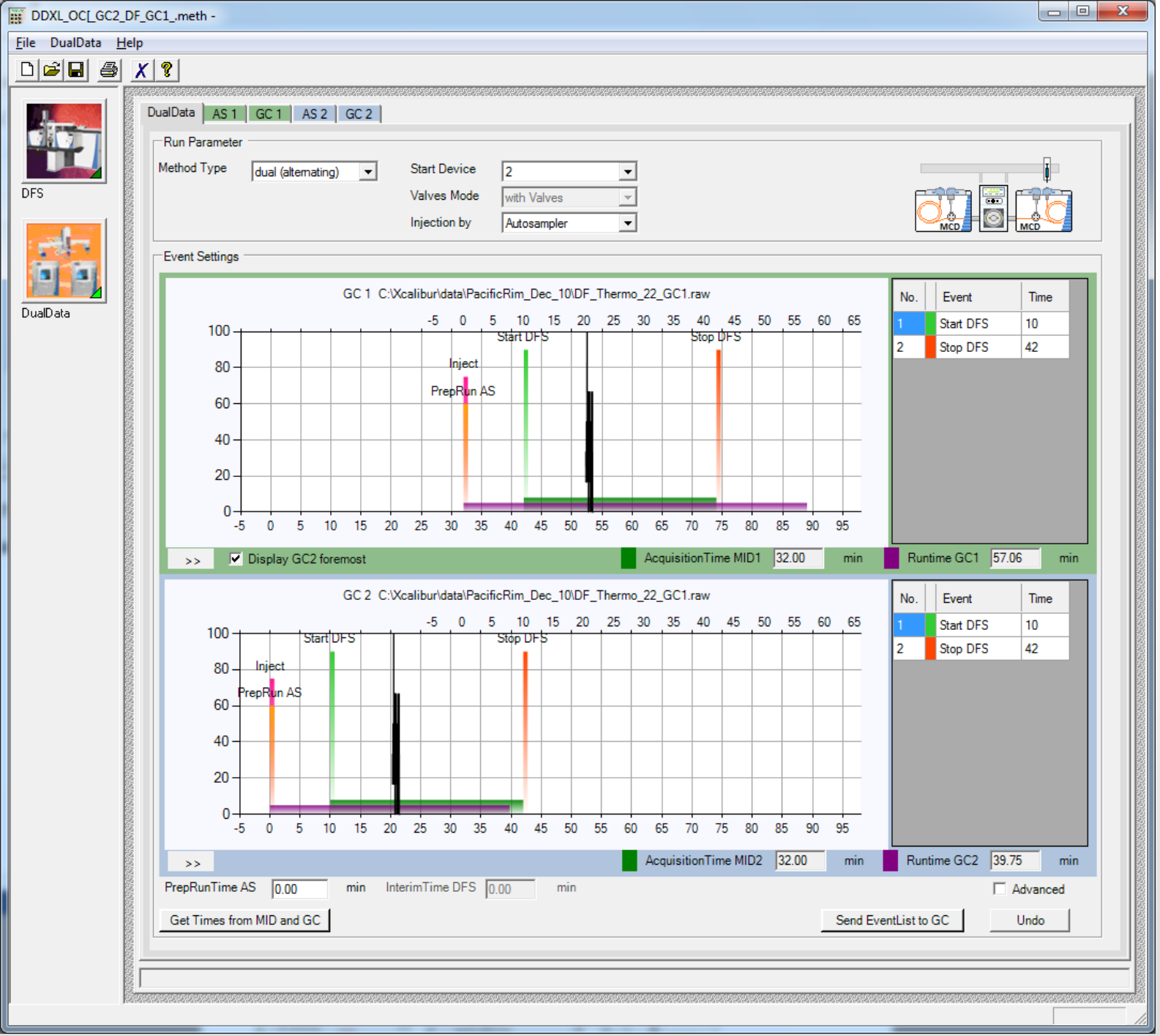

Dual OCP

Runtime DFS – 51 minutes (28 inj/day)

Runtime DualData XL – 64 minutes to complete cycle for both GCs

44 inj/day

57% more analyses

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Our workload is not just dioxins

- PCDD/F 21%
- PCB 23%
- PAH* 35%
- OCP 6%
- TBT* 7%
- PBDE 2%
- Other* 6%
  - *mix of HRMS and MS/MS

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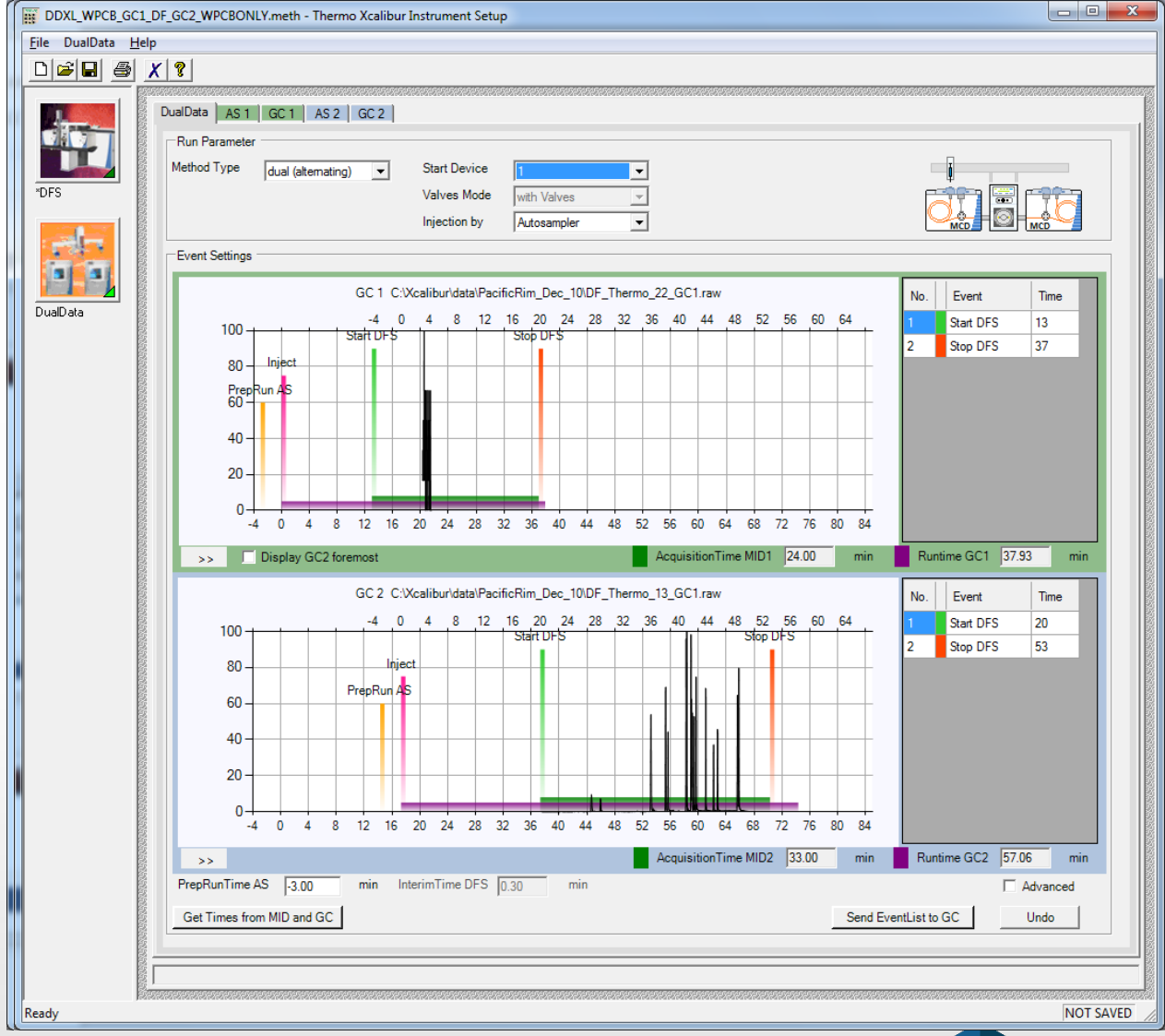
PCDD/F & dlPCB

PCDD/F Runtime DFS – 62 minutes

PCB Runtime DFS – 48 minutes

Runtime DualData XL – 57 minutes to complete cycle for both GCs

Therefore, you can run dioxins and PCBs together in less time than it takes to run one dioxin sample!!!



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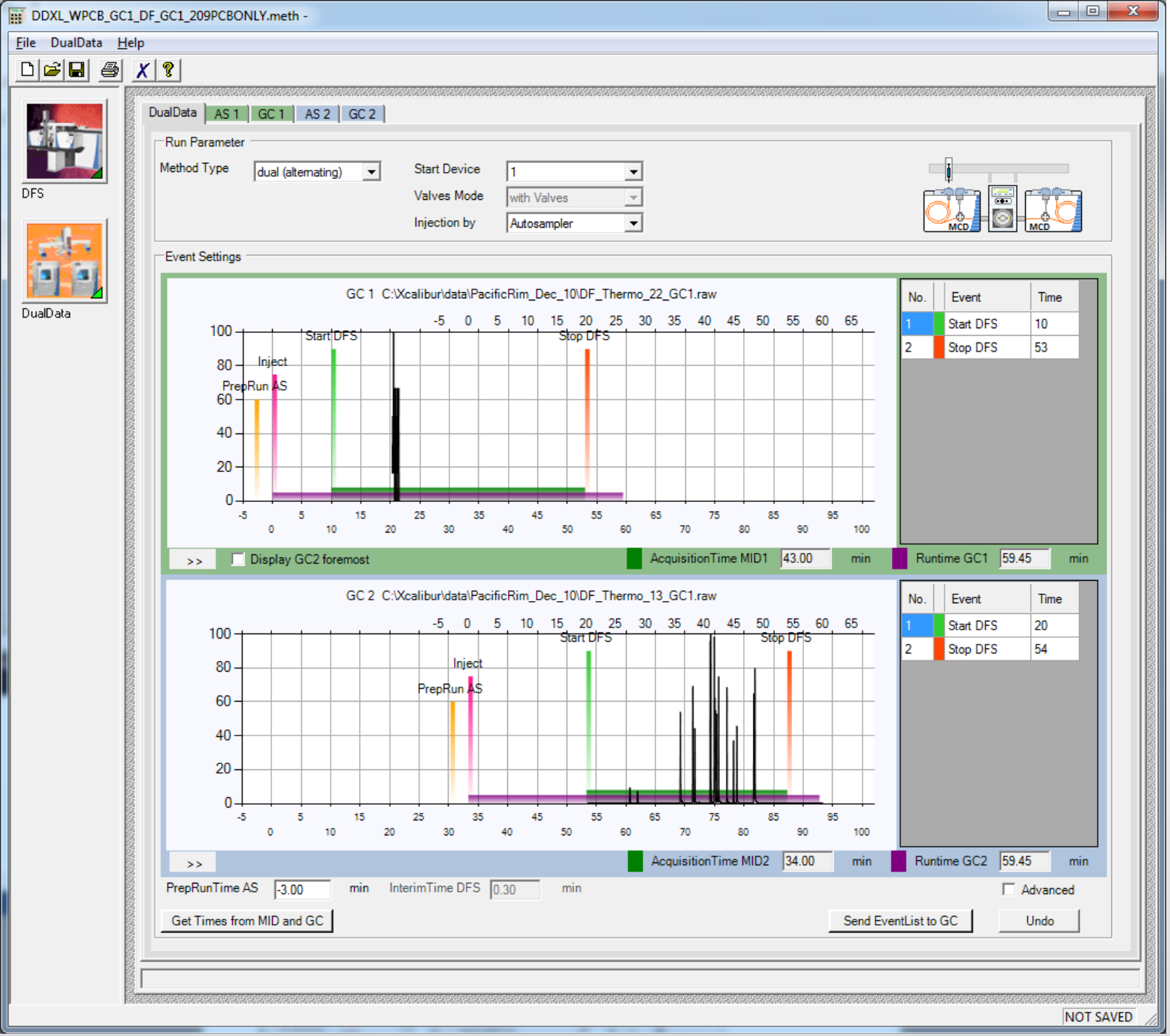

PCDD/F and 209 congener PCB

PCDD/F Runtime DFS – 62 minutes

PCB Runtime DFS – 69 minutes (EPA1668C: PCB209 cannot elute before 55 minutes)

Runtime DualData XL – 77 minutes to complete cycle for both GCs

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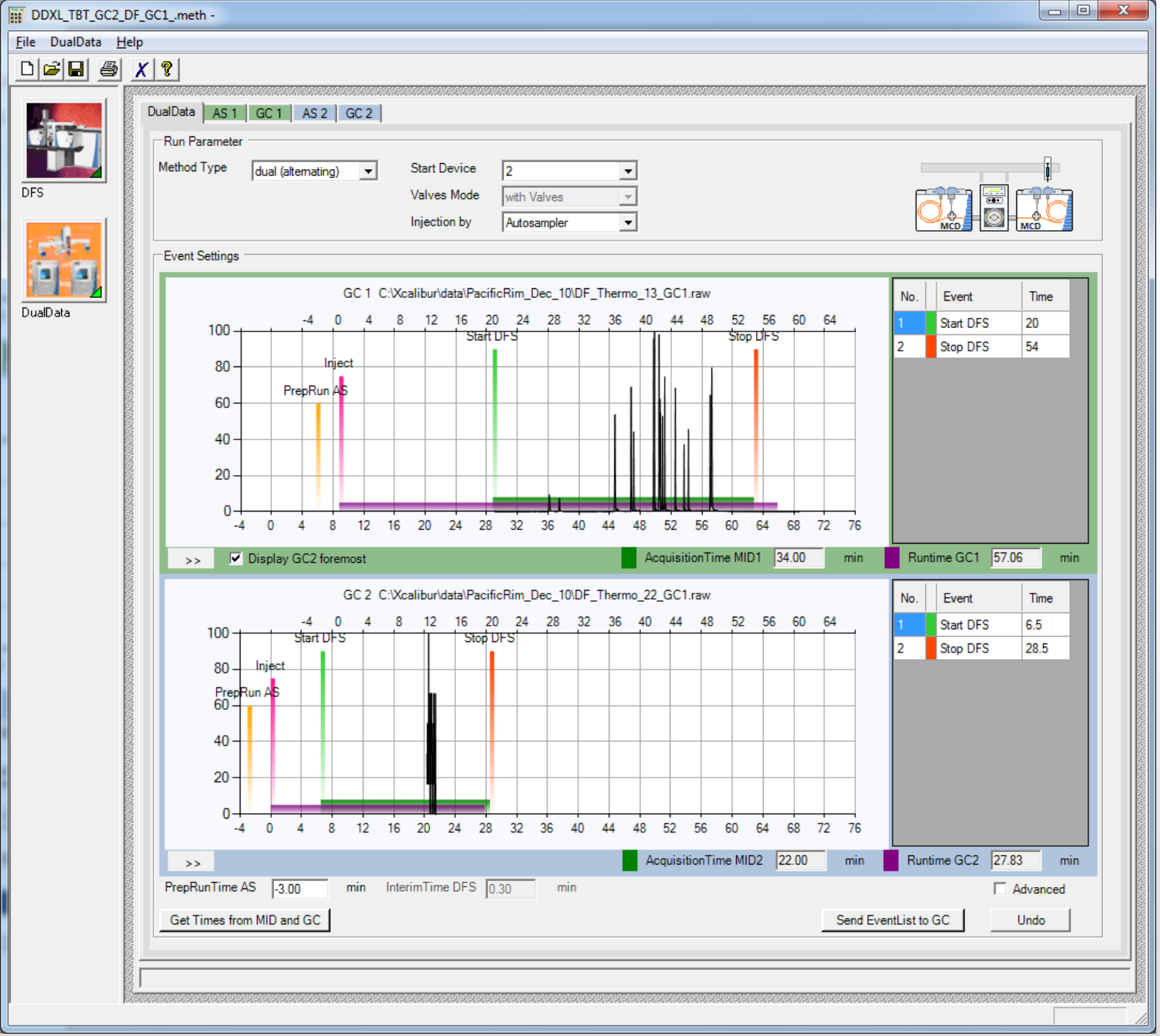

PCDD/F & TBT

PCDD/F Runtime DFS – 62 minutes

TBT Runtime DFS – 30 minutes

Runtime DualData XL – 56 minutes*

* This takes less time than running dioxins by themselves!!

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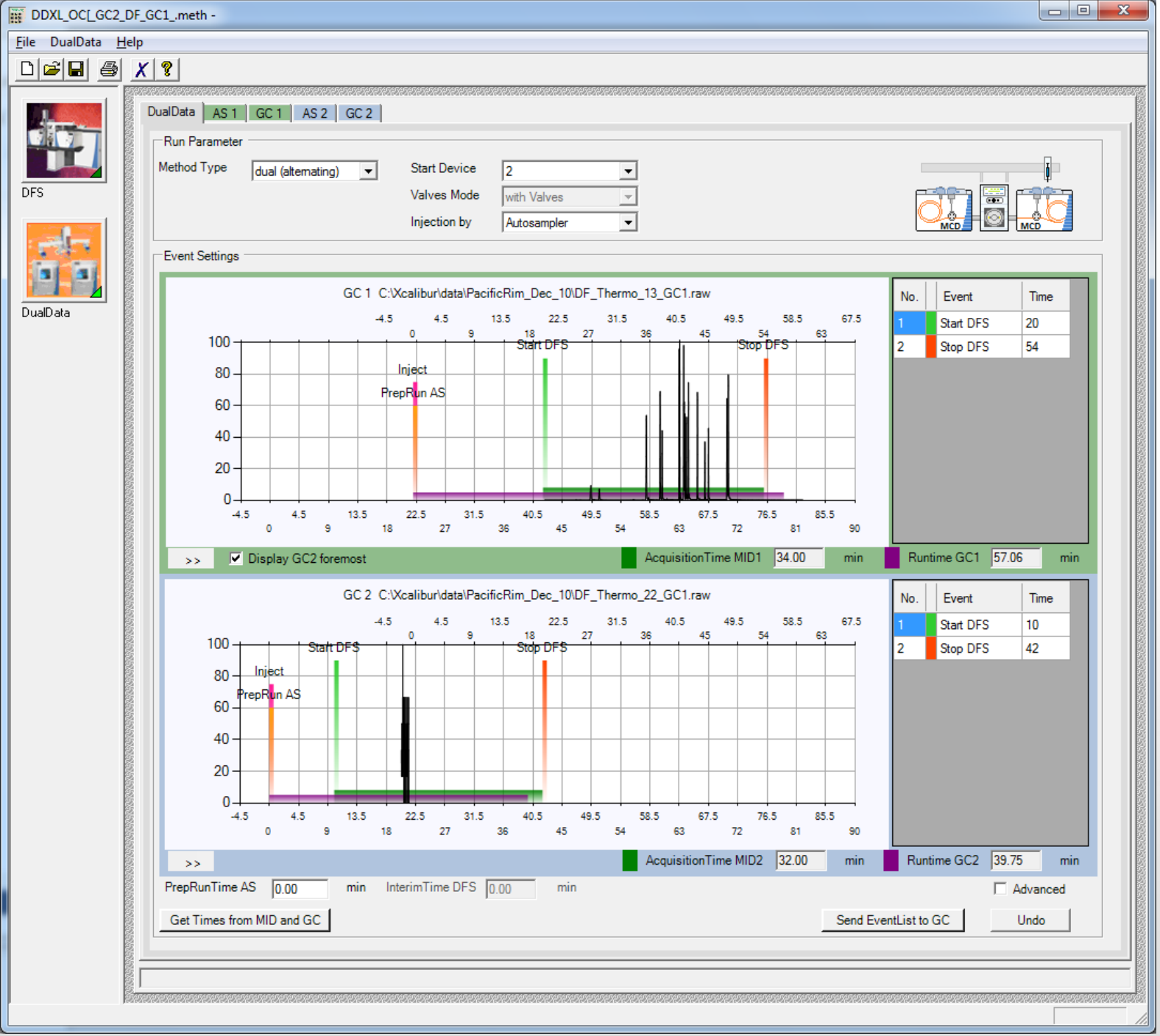

PCDD/F & OCP

PCDD/F Runtime DFS – 62 minutes

OCP Runtime DFS – 51 minutes

Runtime DualData XL – 66 minutes

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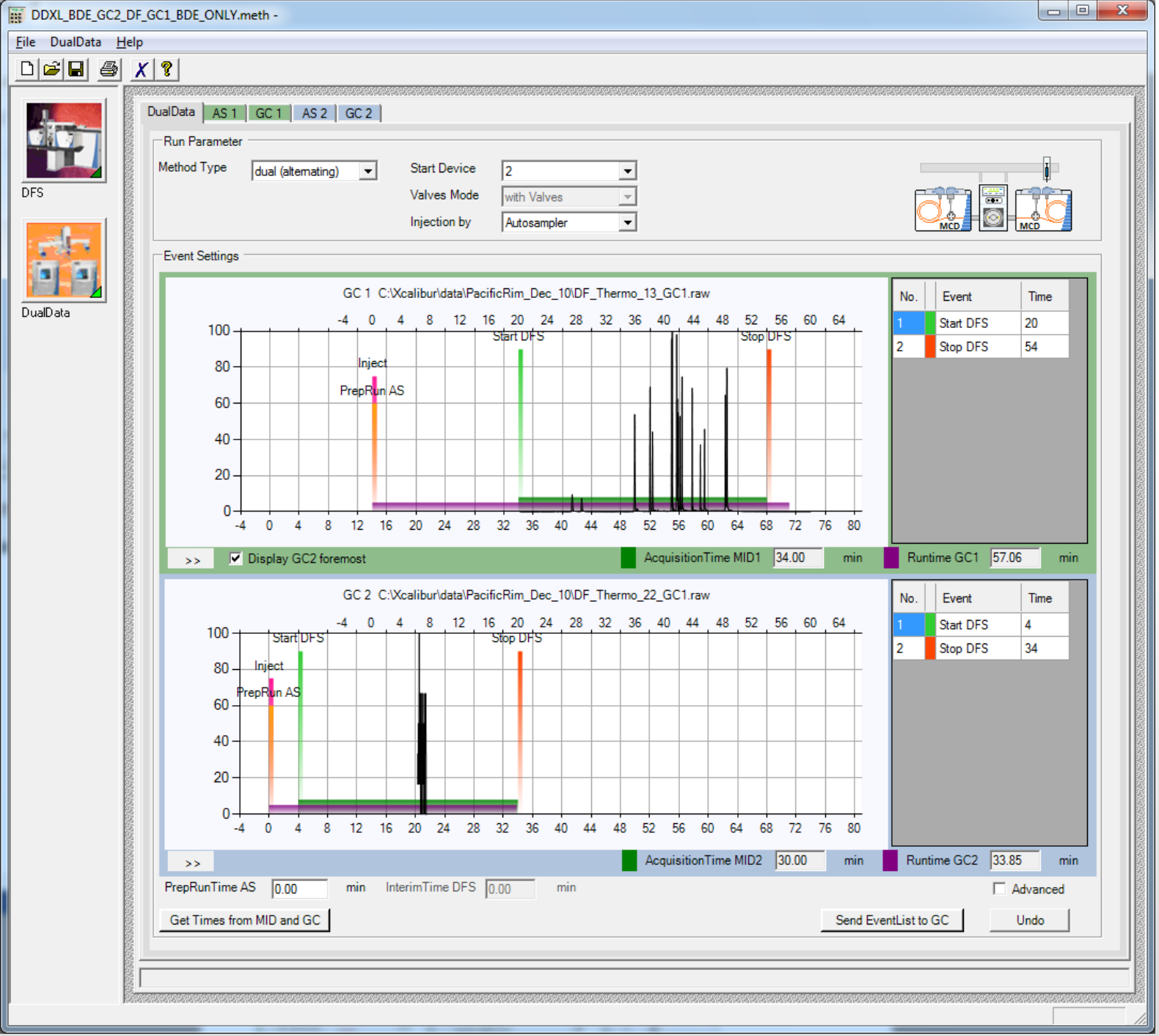

PCDD/F and PBDE

PCDD/F Runtime DFS – 62 minutes

PBDE Runtime DFS – 41 minutes

Runtime DualData XL – 64 minutes

Note – you must run PBDE at 10,000 resolution

In our lab we use different tuning compound for PBDE v dioxin, so would never run together. This is just an example of what could be done.

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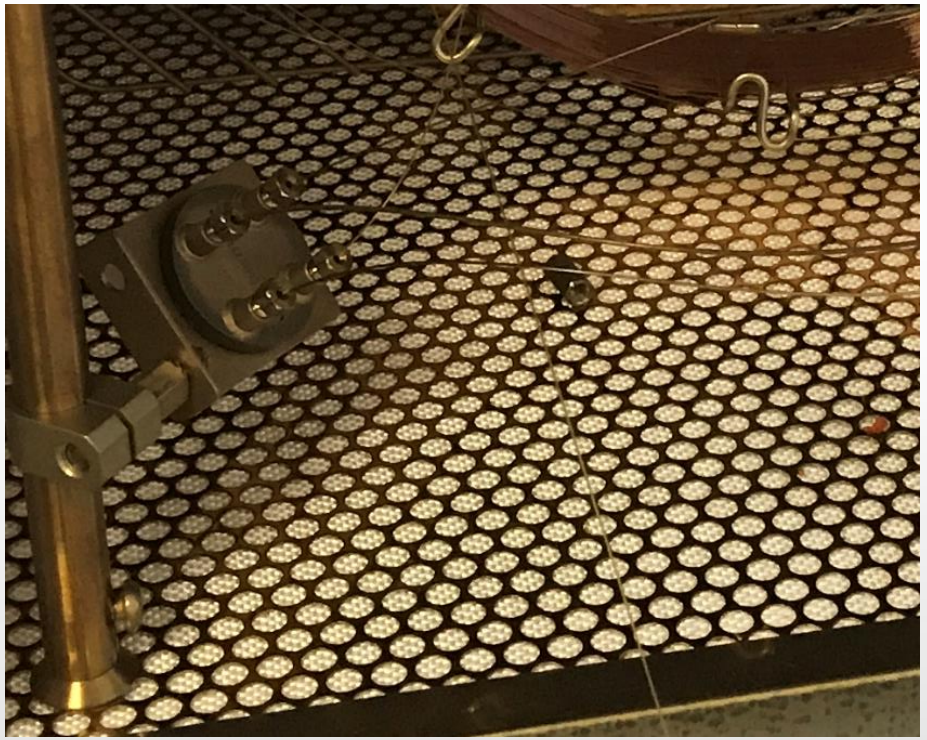
Conclusions

1. DualData XL saves time, even when running in single GC mode
2. Not limited to running the same column/program in each GC
3. Source changes less frequent as “burn off” being vented to air
4. Wafers are a consumable, but are cleanable too!
5. Source does not need to be vented when changing columns



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Thank you from Pacific Rim Labs.

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