Dual channel liquid chromatography: a versatile technique to improve quality and sample throughput

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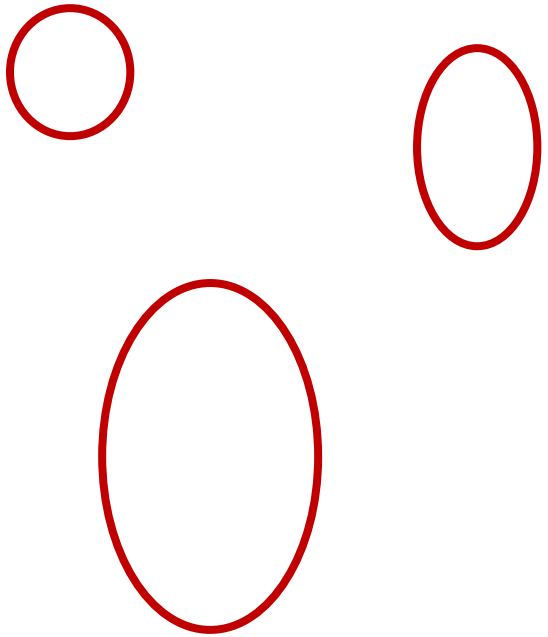
PESTICIDES IN FRUITS AND VEGETABLES



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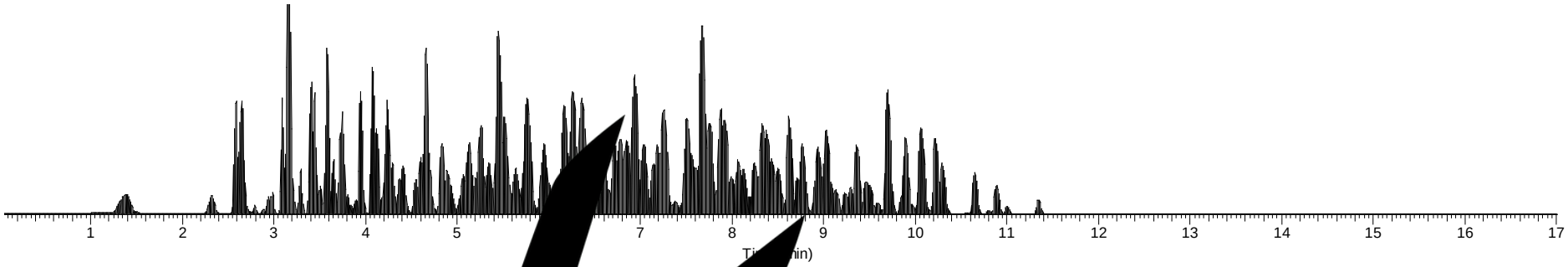
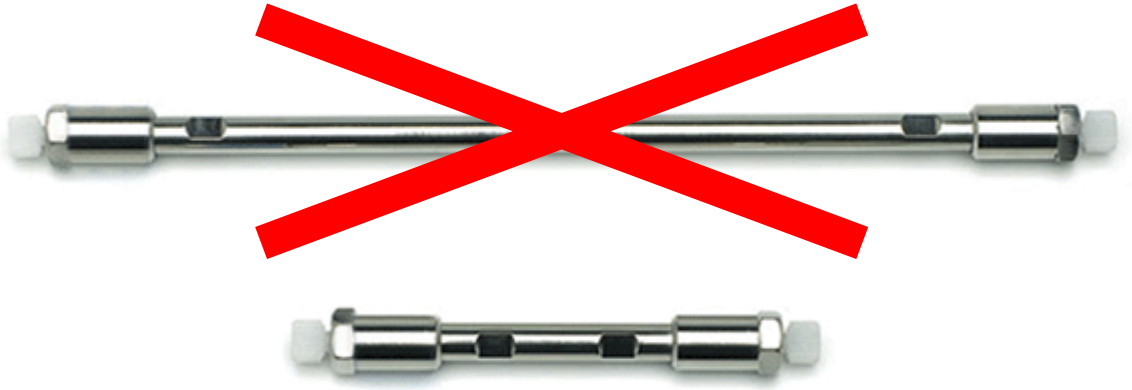
How to reduce the analysis time?





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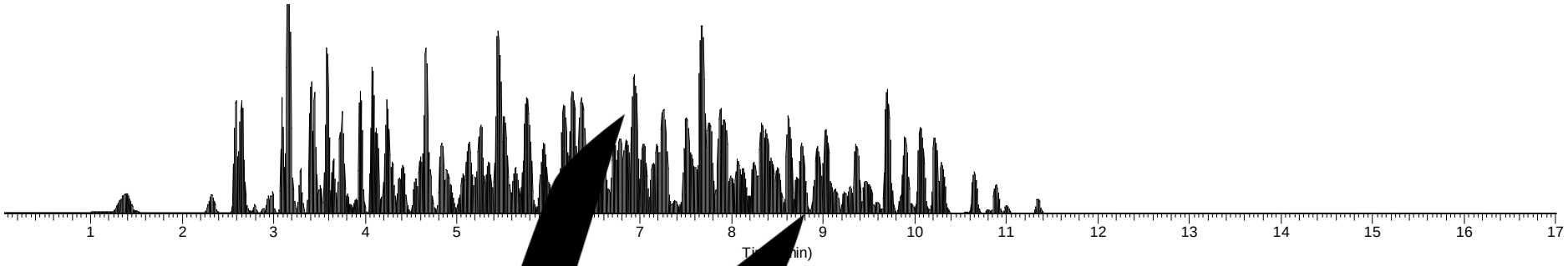

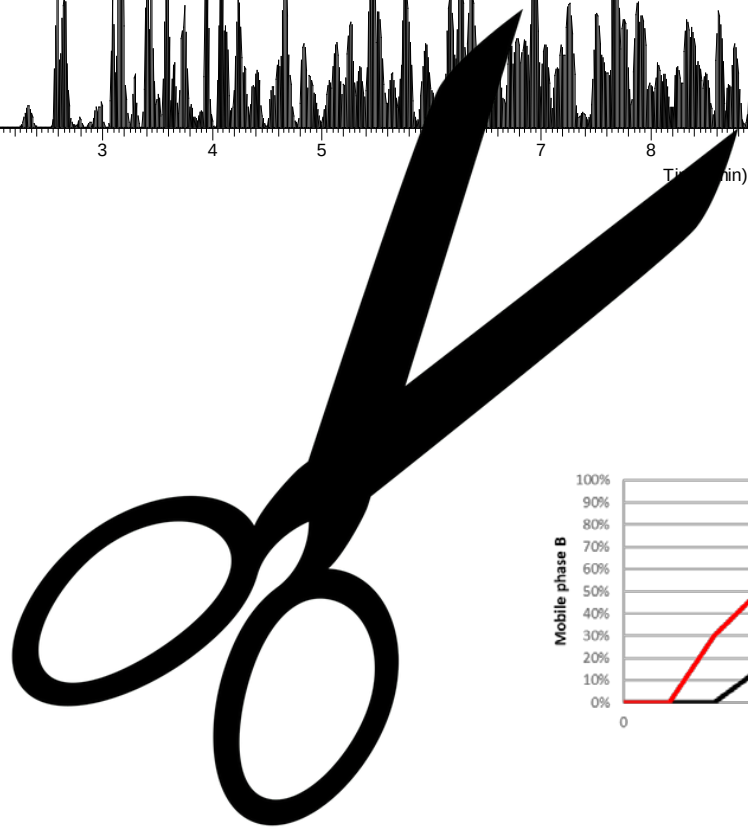

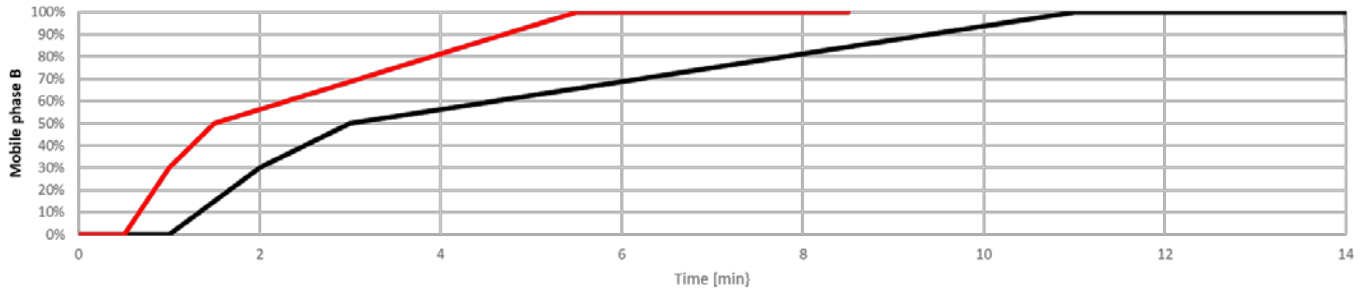

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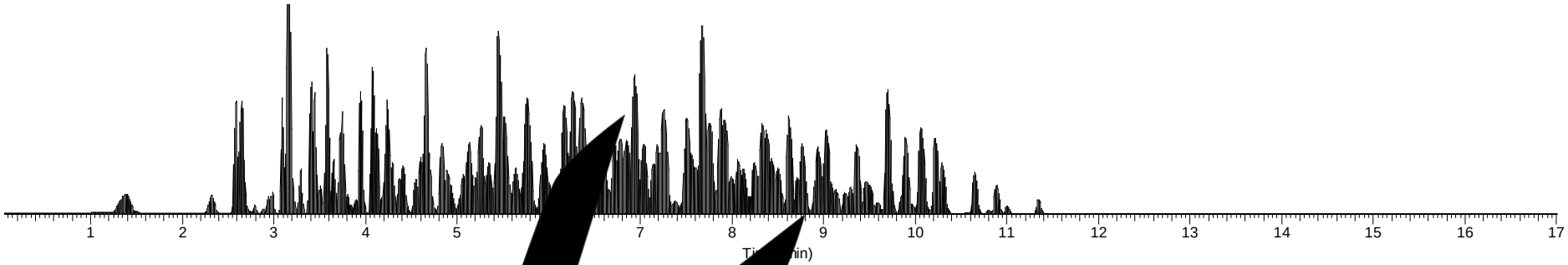
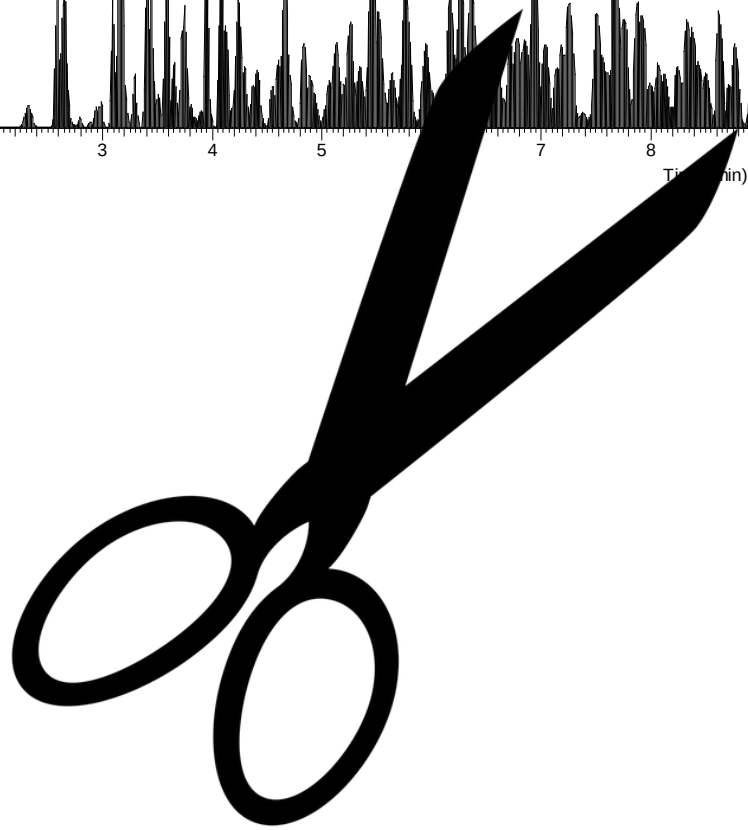
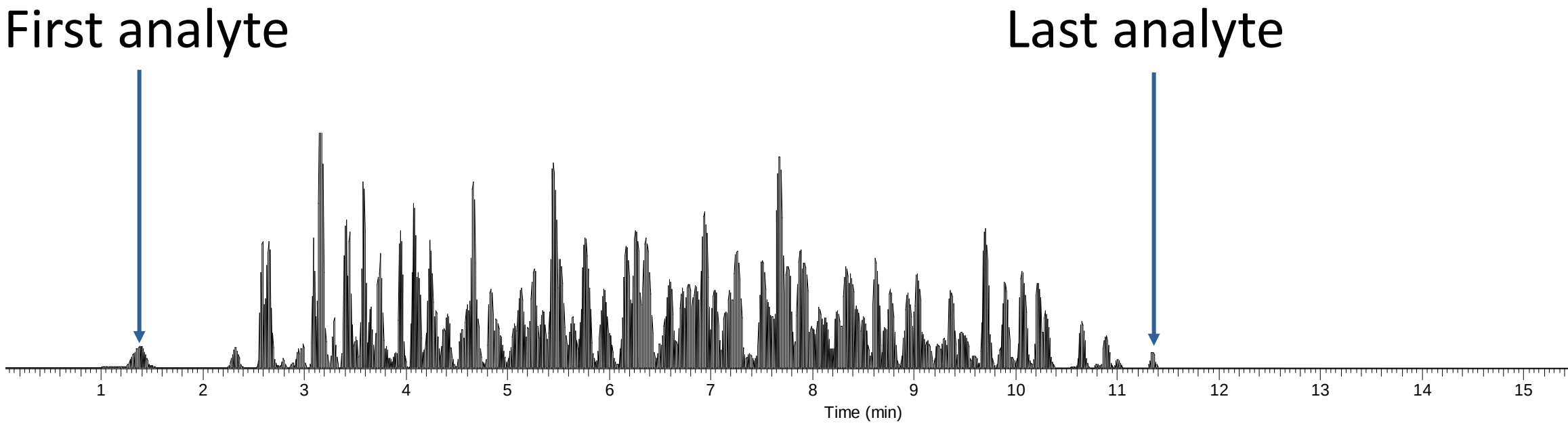




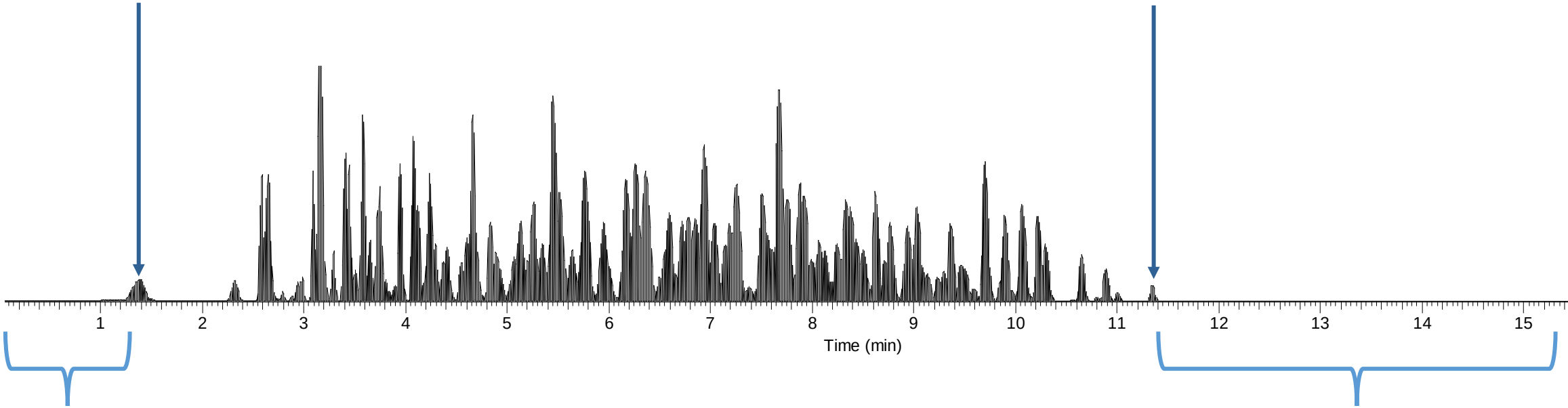
Another option to reduce the analysis time



Another option to reduce the analysis time

First analyte

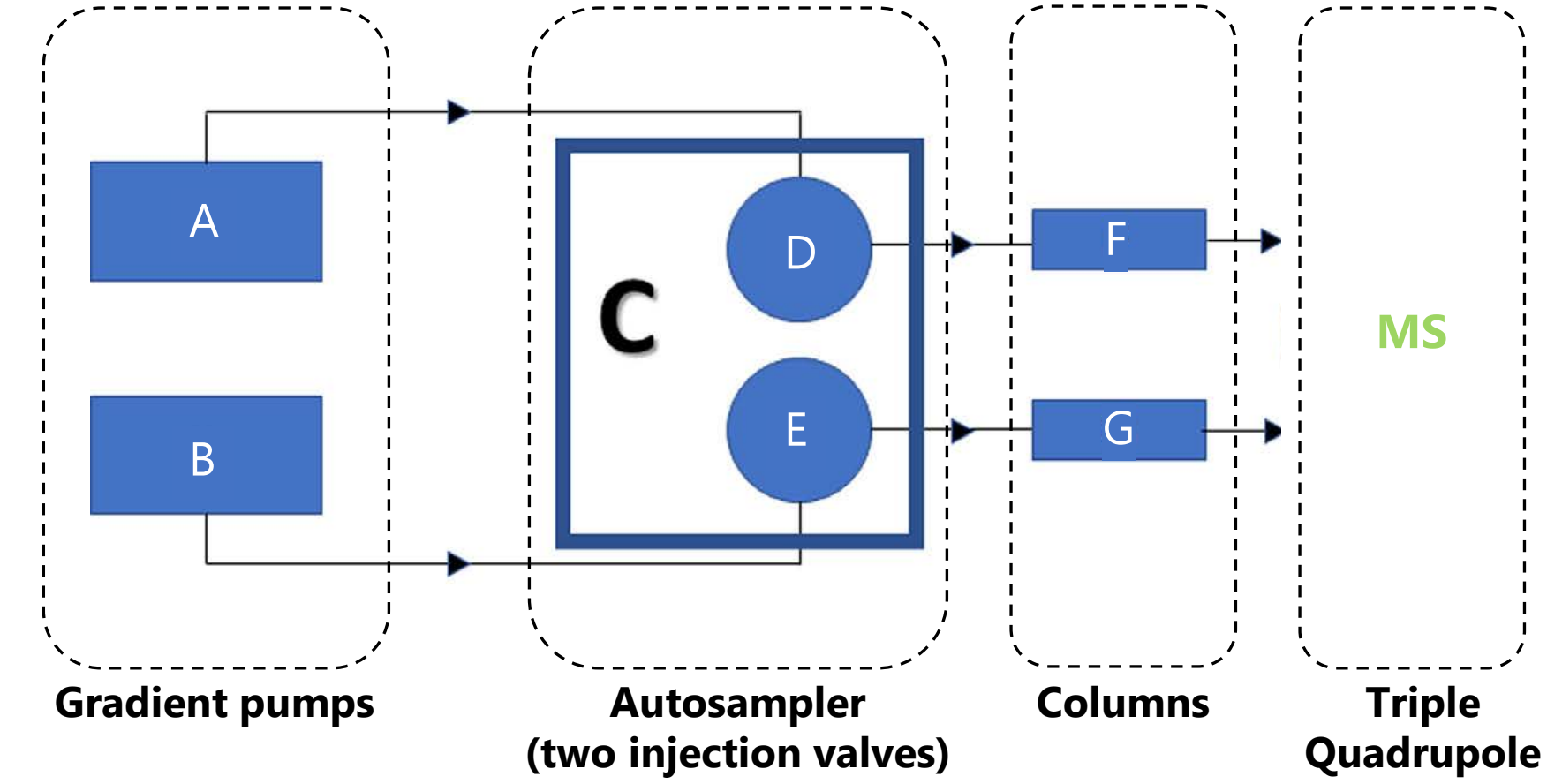
Last analyte



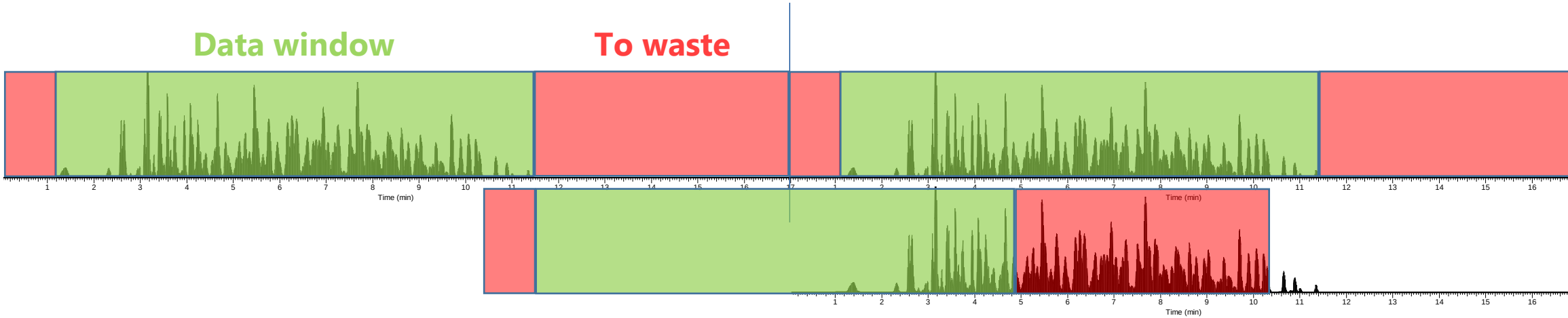
MS is idle

MS is idle

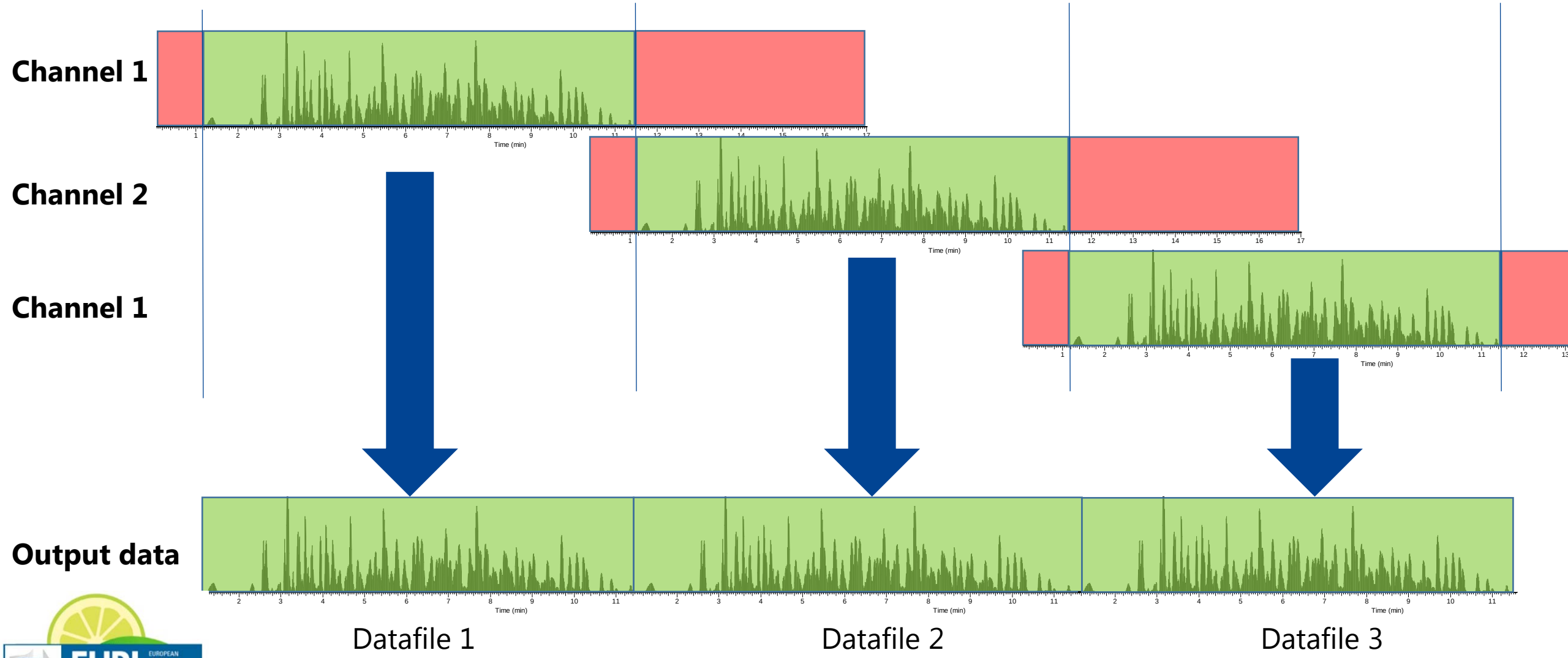
Dual-Channel LC-MS/MS: general diagram



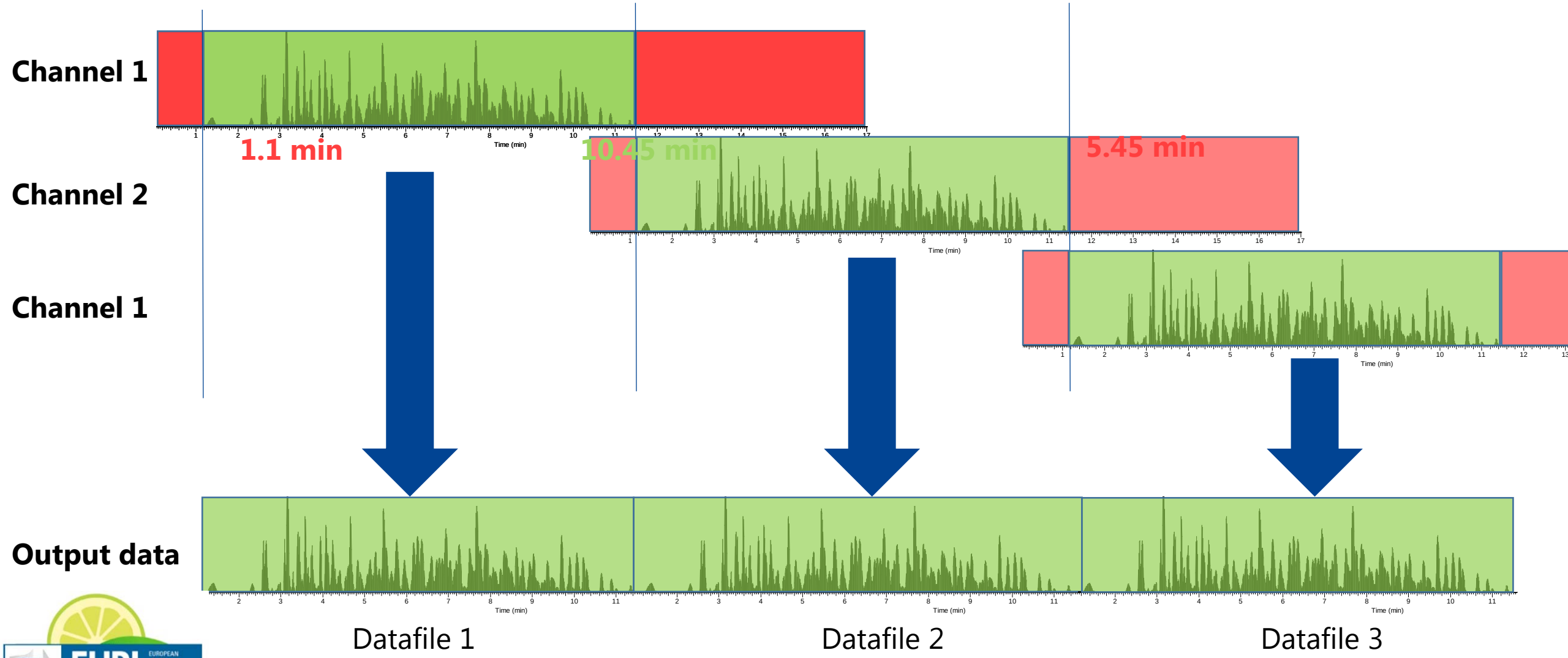
Dual-Channel LC-MS/MS: sample throughput



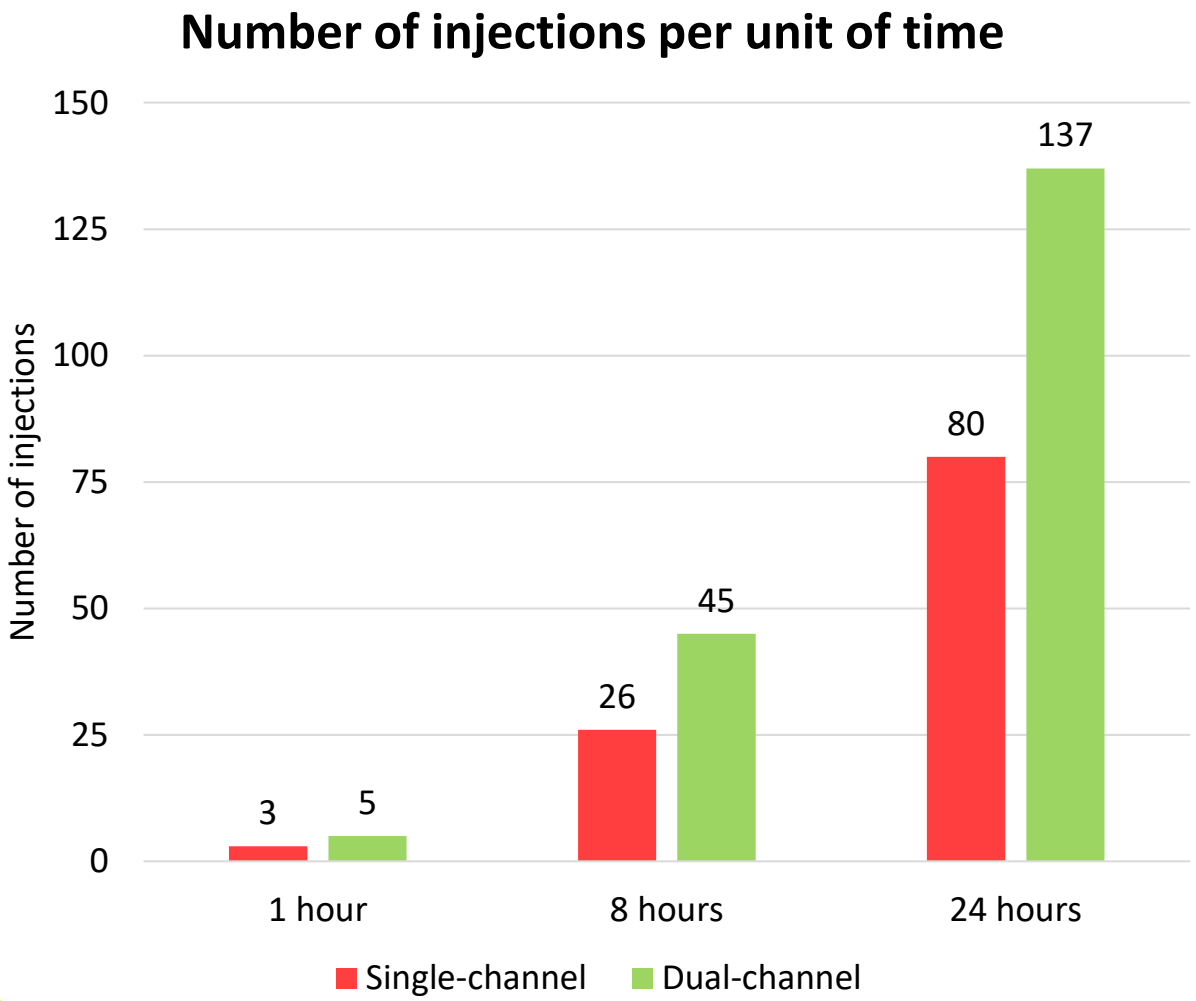
Dual-Channel LC-MS/MS: sample throughput



Dual-Channel LC-MS/MS: sample throughput



Dual-Channel LC-MS/MS: sample throughput



- With Dual-Channel chromatography, pre-acquisition and post-acquisition MS-idle times are removed
- Sample throughput is increased over 70 %
  (45 injections in an 8 hr period)

Dual-Channel LC-MS/MS: strategies

1

Channel 1

Channel 2

- Same column
- Same mobile phases
- Same method
- Different samples injected in each channel

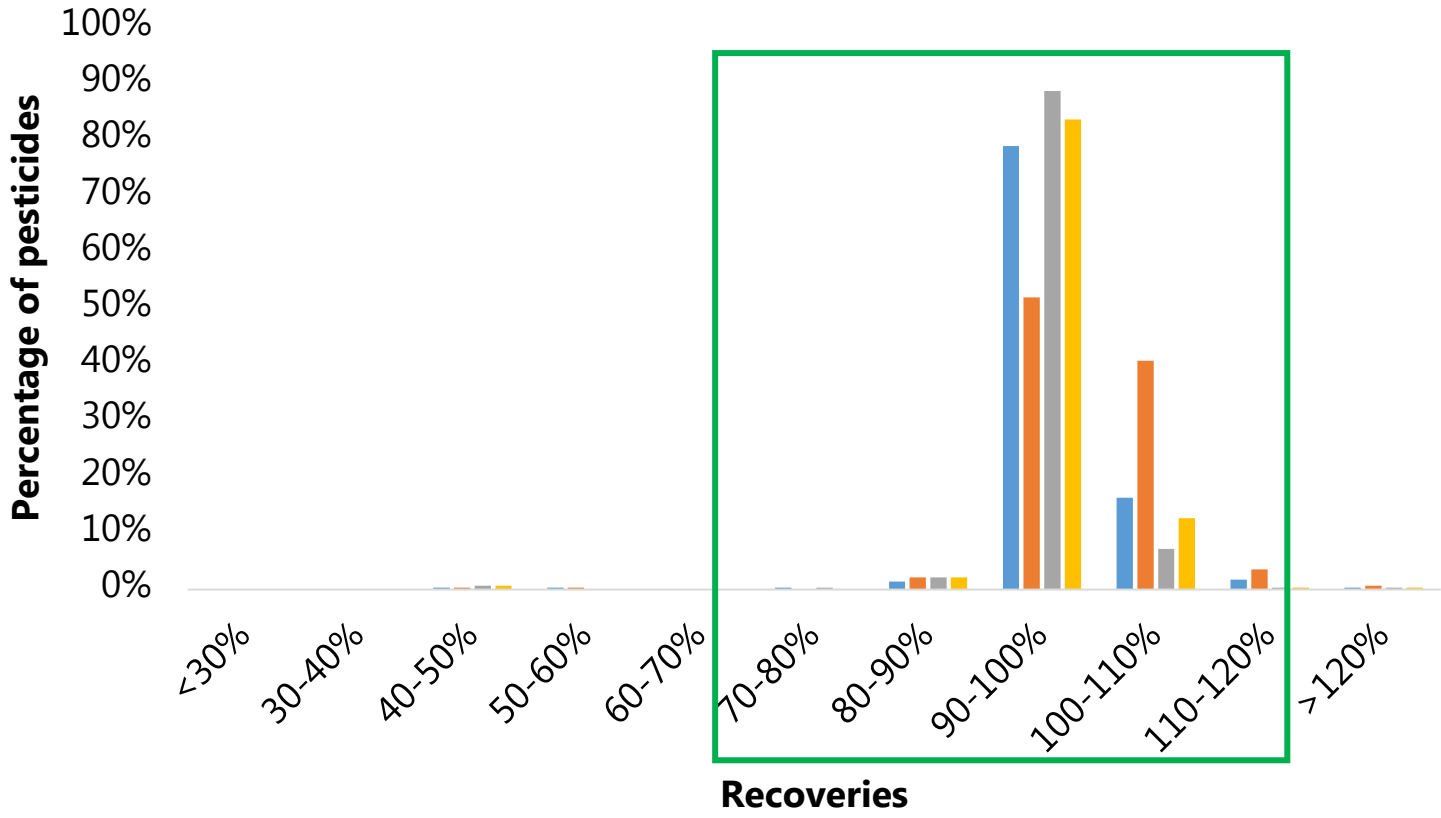
Reduce time of analyses

Single and Dual-Channel validation

- Validation experiments were performed employing **single channel** and **Dual-Channel**
- A total of **273 LC-amenable pesticide residues** were evaluated
- **Three matrices** belonging to two different commodity groups were studied
- Samples were extracted employing citrate-buffered QuEChERS method
- Validation criteria as per the Document Nº SANTE/12682/2019

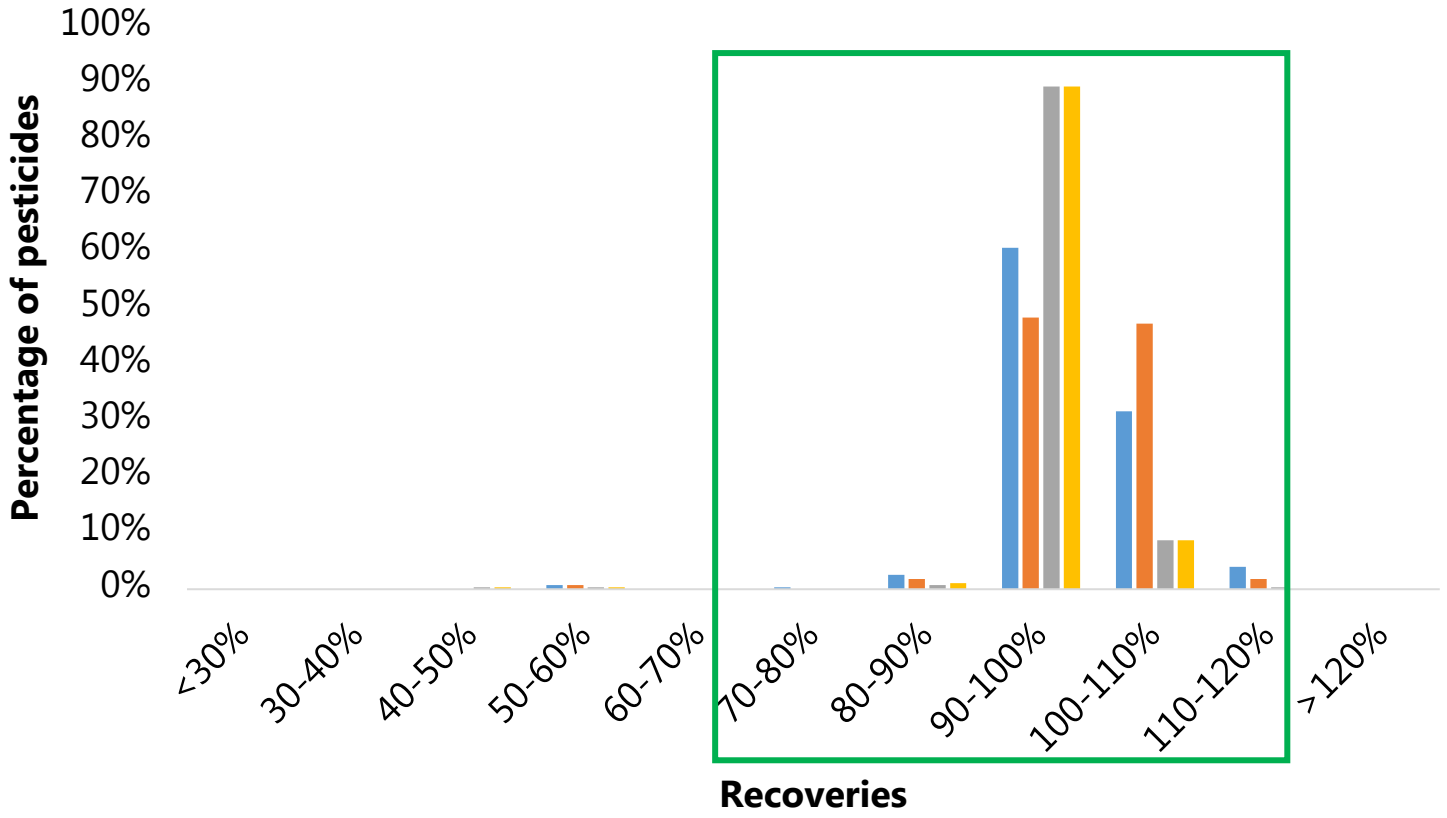
Single and Dual-Channel validation: apple

Technique	<70%	70-120%	>120%
Single channel 0.01 mg/kg	2	269	2
Dual-Channel 0.01 mg/kg	2	270	1
Single channel 0.1 mg/kg	2	270	1
Dual-Channel 0.1 mg/kg	2	270	1



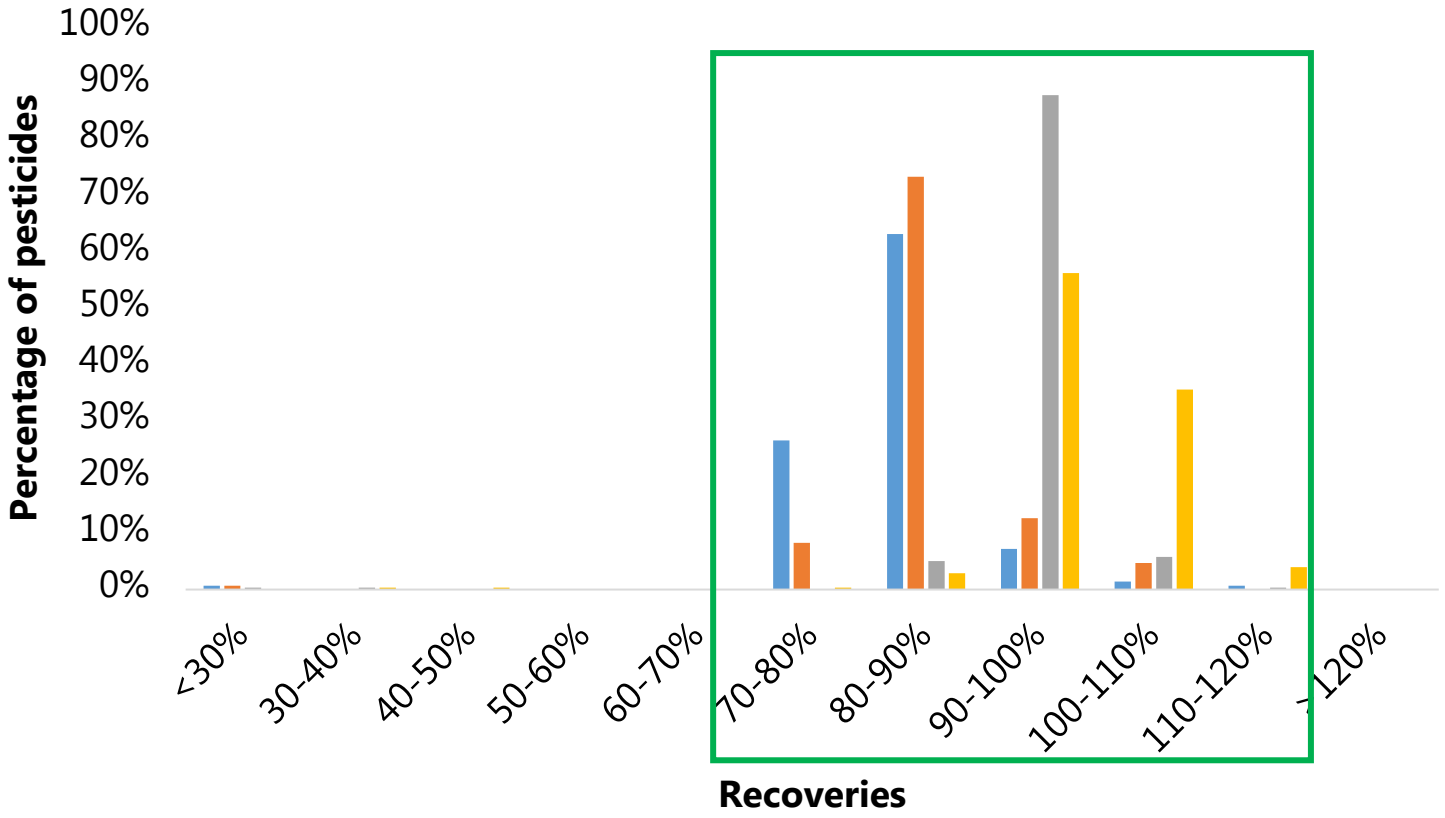
Single and Dual-Channel validation: bell pepper

Technique	<70%	70-120%	>120%
Single channel 0.01 mg/kg	2	271	-
Dual-Channel 0.01 mg/kg	2	271	-
Single channel 0.1 mg/kg	2	271	-
Dual-Channel 0.1 mg/kg	2	271	-



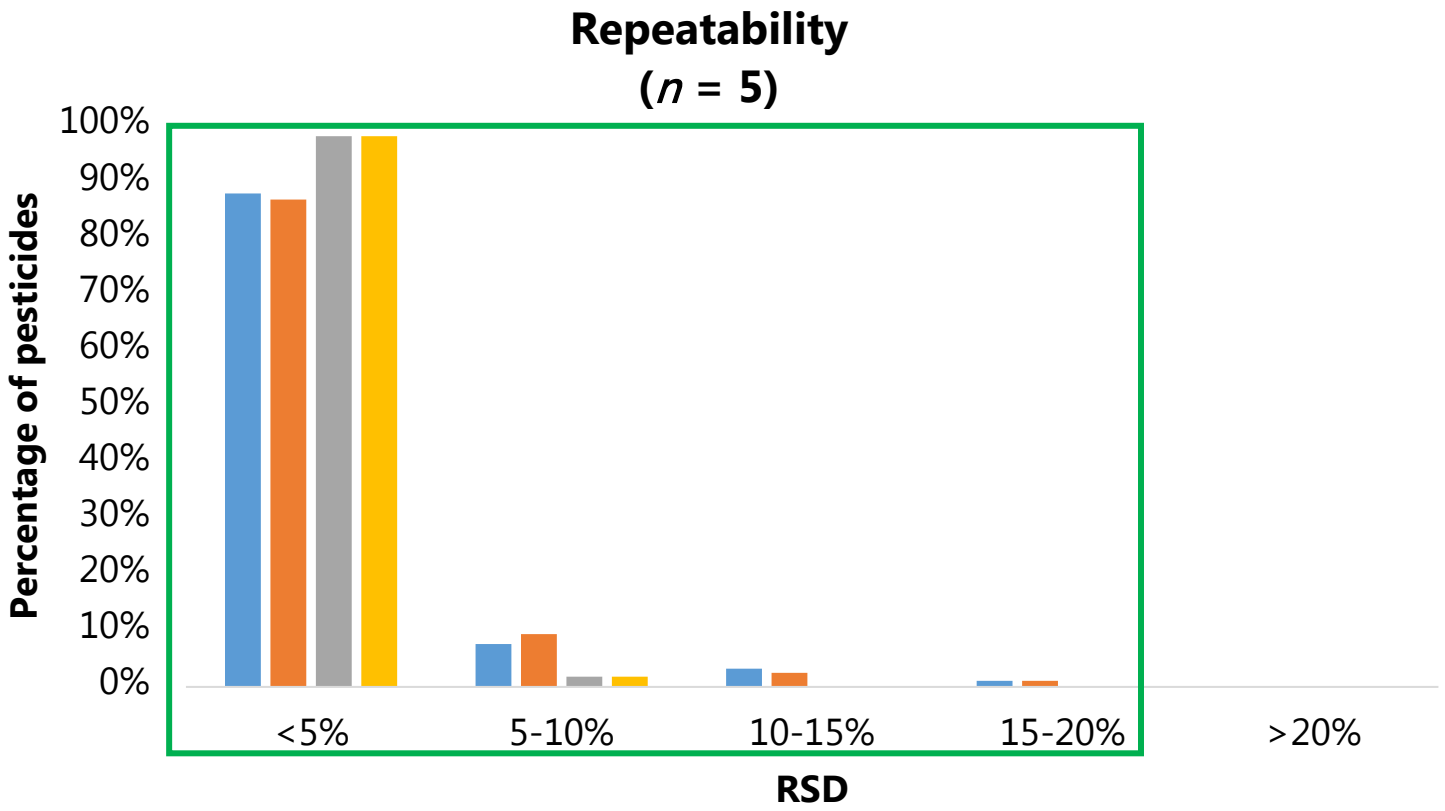
Single and Dual-Channel validation: orange

Technique	<70%	70-120%	>120%
Single channel 0.01 mg/kg	2	271	-
Dual-Channel 0.01 mg/kg	2	271	-
Single channel 0.1 mg/kg	2	271	-
Dual-Channel 0.1 mg/kg	2	271	-



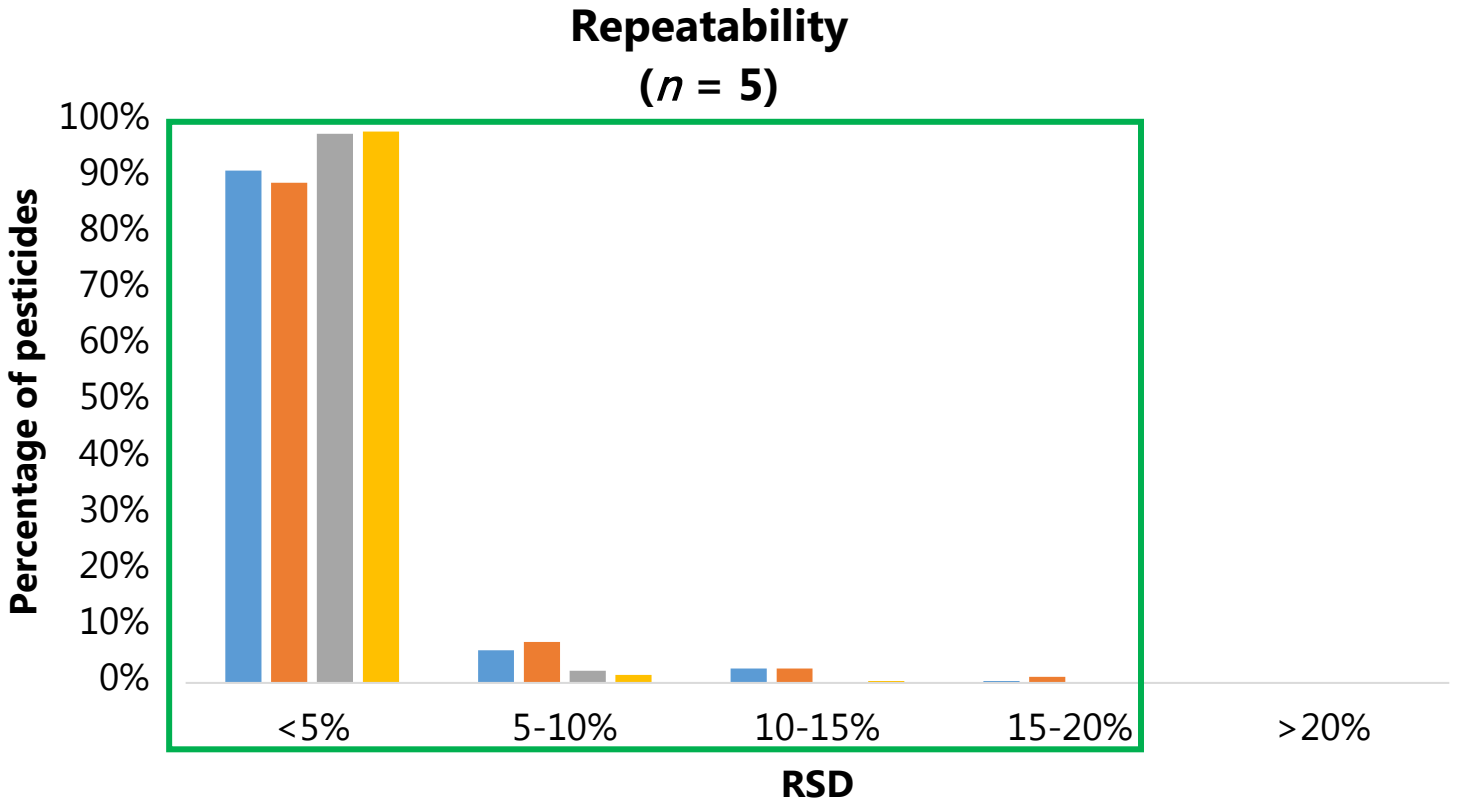
Single and Dual-Channel validation: apple

Technique	<5%	5-20%	>20%
Single channel 0.01 mg/kg	87%	13%	-
Dual-Channel 0.01 mg/kg	88%	12%	-
Single channel 0.1 mg/kg	98%	2%	-
Dual-Channel 0.1 mg/kg	98%	2%	-



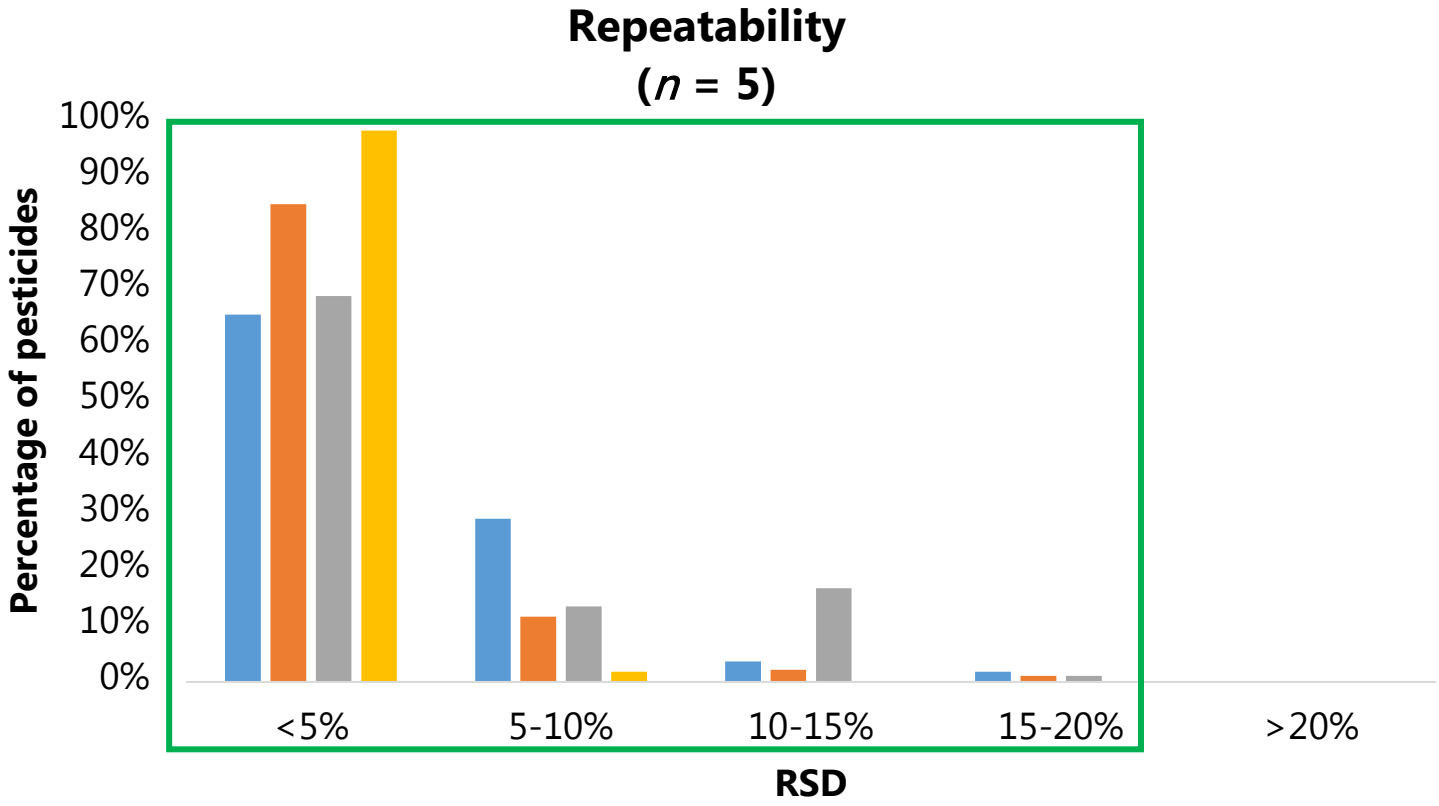
Single and Dual-Channel validation: bell pepper

Technique	<5%	5-20%	>20%
Single channel 0.01 mg/kg	89%	11%	-
Dual-Channel 0.01 mg/kg	91%	9%	-
Single channel 0.1 mg/kg	98%	2%	-
Dual-Channel 0.1 mg/kg	98%	2%	-

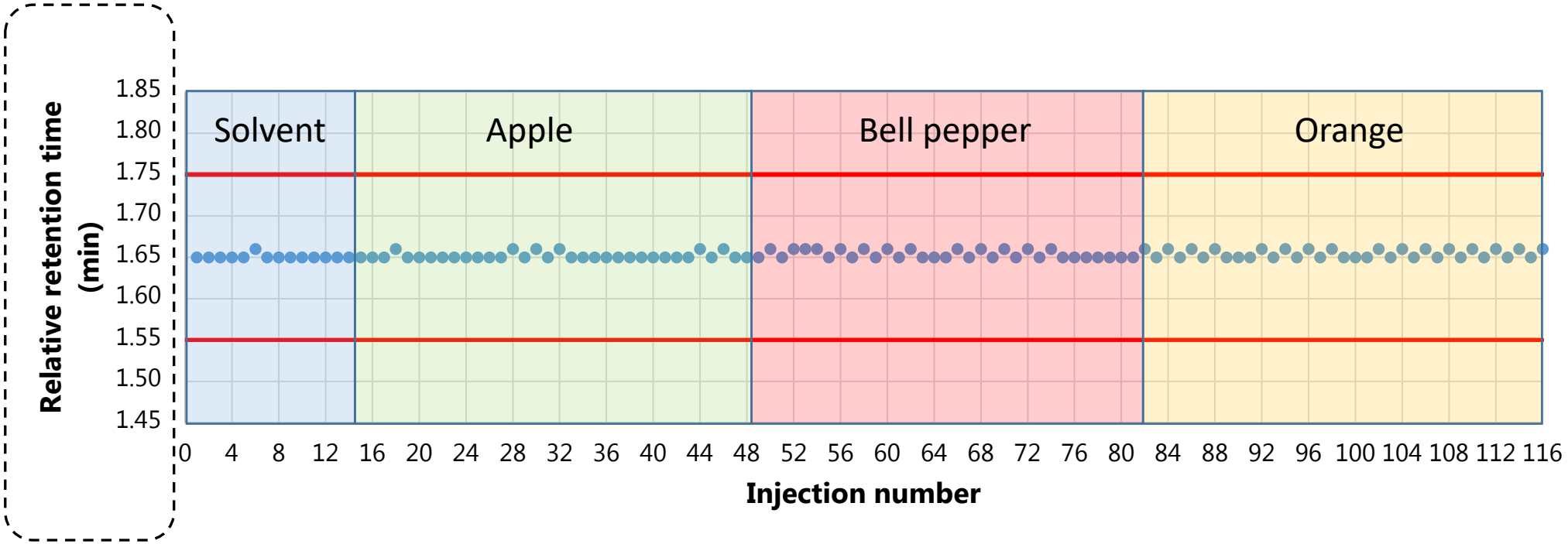


Single and Dual-Channel validation: orange

Technique	<5%	5-20%	>20%
Single channel 0.01 mg/kg	85%	15%	-
Dual-Channel 0.01 mg/kg	65%	35%	-
Single channel 0.1 mg/kg	98%	2%	-
Dual-Channel 0.1 mg/kg	69%	31%	-



Dual-Channel LC-MS/MS: retention time stability

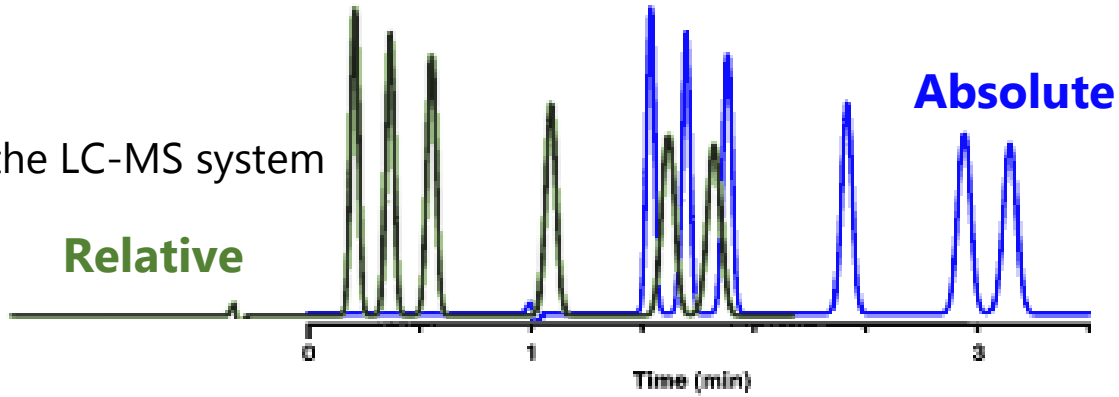


Retention time stability of pymetrozine. A sequence of 116 injections, alternate injections on channel 1 and channel 2. Red horizontal lines represent the ±0.1 min tolerance specified in the DG SANTE Document.

Dual-Channel LC-MS/MS: retention time

- Retention time is **measured differently** in single channel compared to Dual-Channel

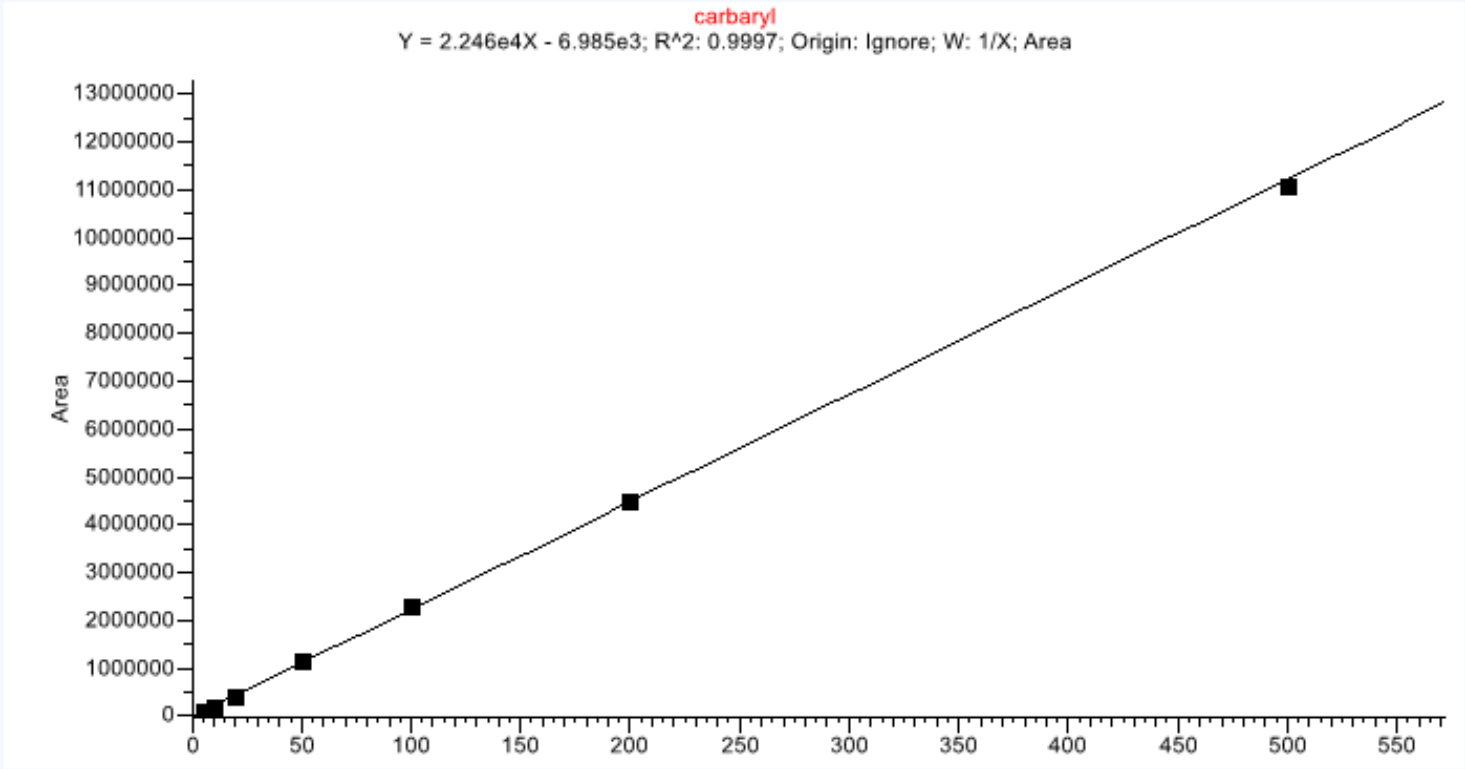
- **Single channel:**
  - Sample injection → 0.0 min
  - Retention time (absolute) → time an analyte spends on the LC-MS system



- The chromatographic process is the same in both cases

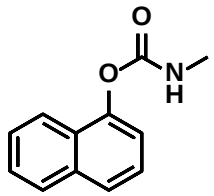
Dual-Channel LC-MS/MS: (cross-channel) calibration

- Calibration standards can be injected using one channel, two channels, or either channel



Channel 1

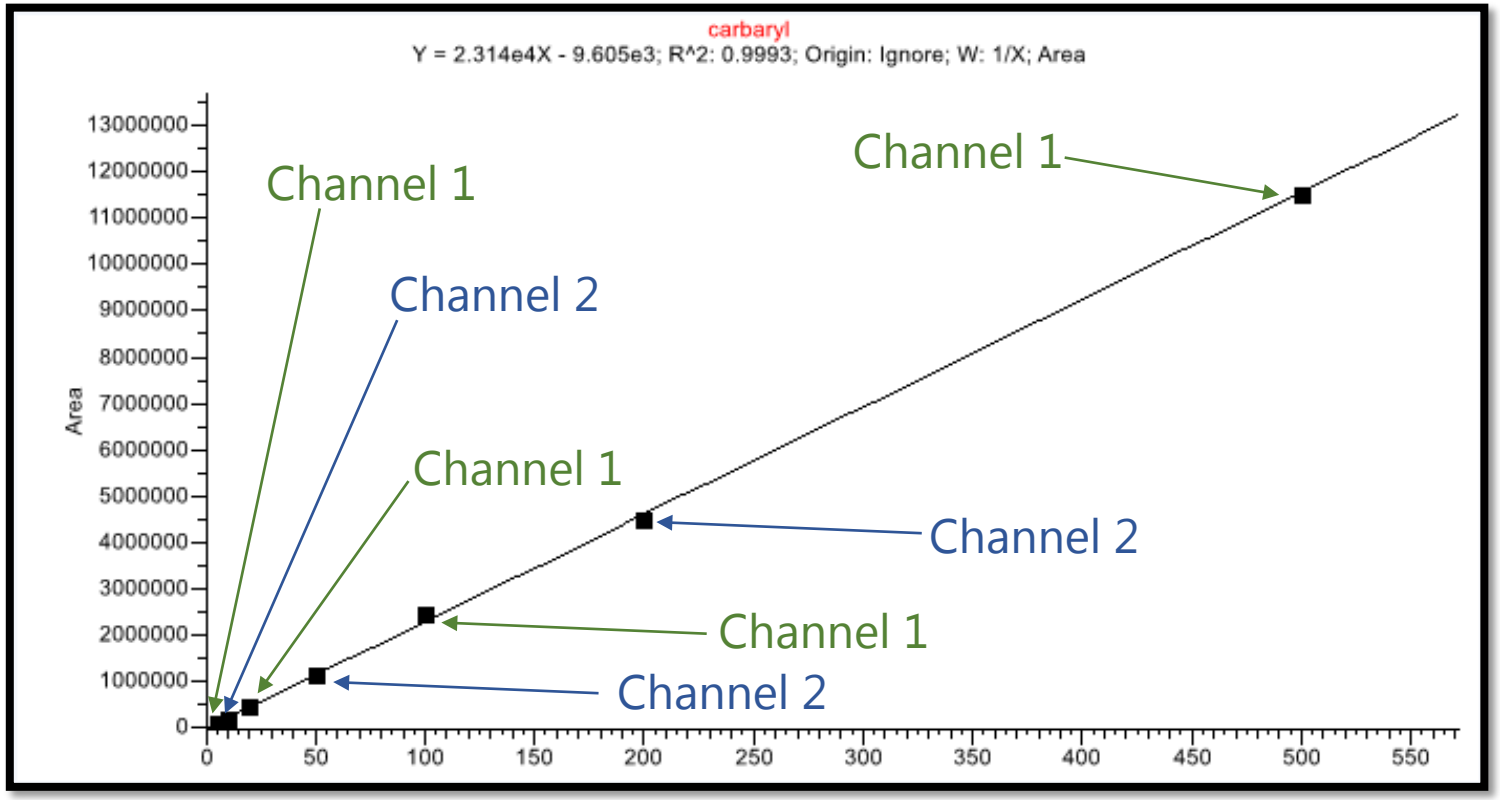
R^2 = 0.9995



Carbaryl

Dual-Channel LC-MS/MS: (cross-channel) calibration

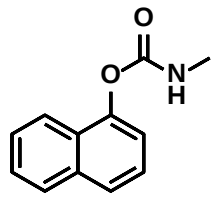
- Calibration standards can be injected using one channel, two channels, or either channel



Channel 1
R^2 = 0.9995

Channel 1 & 2
R^2 = 0.9993

Channel 2
R^2 = 0.9997



Carbaryl

Single and Dual-Channel validation

EUPT-FV 17 (broccoli)

|z scores|

Compound	In-channel calibration/sample injected on channel 1	In-channel calibration/sample injected on channel 2	Cross-channel calibration/sample injected on channel 1	Cross-channel calibration/sample injected on channel 2
Bupirimate	0.2	0.1	0.2	0.2
Carbendazim	0.0	0.1	0.0	0.0
Diazinon	0.5	0.0	0.5	0.0
Difenoconazole	0.2	0.4	0.4	0.2
Diflubenzuron	0.2	0.2	0.1	0.3
Methoxyfenozide	0.7	1.0	0.8	0.9
Pendimethalin	0.5	0.1	0.6	0.1
Permethrin	0.7	0.7	0.6	1.0
Spinosad	0.6	0.6	0.1	0.0
Thiabendazole	0.5	0.4	0.5	0.4
Trifloxystrobin	0.0	0.2	0.3	0.1

Cal.: Channel 1 **Sample:** Channel 1

Cal.: Channel 2 **Sample:** Channel 2

Cal.: Cross-Channel **Sample:** Channel 1

Cal.: Cross-Channel **Sample:** Channel 2

Single and Dual-Channel validation

EUPT-FV 13 (mandarin)

|z scores|

Compound	In-channel calibration/sample injected on channel 1	In-channel calibration/sample injected on channel 2	Cross-channel calibration/sample injected on channel 1	Cross-channel calibration/sample injected on channel 2
Carbendazim	0.7	0.7	0.7	0.6
Chlorpyrifos	0.5	0.6	0.4	0.5
Diazinon	0.6	0.7	0.6	0.7
EPN	0.1	0.2	0.0	0.3
Imazalil	0.1	0.1	0.1	0.1
Indoxacarb	0.7	0.5	0.7	0.5
Malathion	0.6	0.5	0.5	0.5
Methidathion	0.4	0.3	0.4	0.3
Methomyl	0.2	0.2	0.2	0.3
Oxamyl	1.3	1.6	1.4	1.6
Pendimethalin	0.2	0.3	0.2	0.3
Phosalone	0.7	0.8	0.6	0.7
Prochloraz	0.7	0.8	0.8	0.9
Pyriproxifen	0.5	0.4	0.4	0.3
Spinosad	0.7	0.6	0.8	0.6
Thiabendazole	0.1	0.2	0.1	0.3

Single and Dual-Channel validation

EUPT-FV 16
(bell pepper)

|z scores|

Compound	In-channel calibration/sample injected on channel 1	In-channel calibration/sample injected on channel 2	Cross-channel calibration/sample injected on channel 1	Cross-channel calibration/sample injected on channel 2
Acetamiprid	0.2	0.2	0.2	0.1
Buprofezin	0.0	0.0	0.1	0.0
Chlorpyriphos	0.3	0.2	0.3	0.2
Cyprodinil	0.4	0.2	0.4	0.2
Diazinon	0.2	0.3	0.2	0.4
Difenoconazol	0.3	0.4	0.4	0.4
Fenamiphos	0.8	0.9	0.8	1.0
Fenamiphos Sulfone	0.6	0.5	0.6	0.5
Fenamiphos Sulfoxide	0.6	0.5	0.7	0.5
Fenhexamid	0.5	0.5	0.6	0.6
Fludioxonil	0.5	0.6	0.4	0.6
Methoxyfenozide	0.5	0.5	0.5	0.5
Pirimicarb	0.1	0.1	0.1	0.1
Pyridaben	0.3	0.4	0.4	0.4
Spinosad	0.3	0.3	0.2	0.1
Tetraconazole	0.1	0.2	0.0	0.1

Single and Dual-Channel validation

EUPT-FV 18 (spinach)

|z scores|

Compound	In-channel calibration/sample injected on channel 1	In-channel calibration/sample injected on channel 2	Cross-channel calibration/sample injected on channel 1	Cross-channel calibration/sample injected on channel 2
Chlorantraniliprole	0.4	0.4	0.4	0.4
Difenoconazole	0.3	0.4	0.3	0.5
Diflubenzuron	0.6	0.2	0.0	0.2
Dimethoate	0.3	0.3	0.7	0.7
Dimethoate (dimethoate+omethoate)	1.1	1.1	1.1	1.1
Famoxadone	0.2	0.4	0.1	0.5
Fluopyram	0.3	0.2	0.3	0.2
Imidacloprid	0.4	0.7	0.4	0.6
Indoxacarb	0.3	0.3	0.3	0.5
Metalaxyl	0.1	0.1	0.3	0.1
Omethoate	0.9	0.9	0.9	0.9
Thiaclorpid	0.3	0.3	0.3	0.3
Triadimenol	0.5	0.3	0.4	0.4

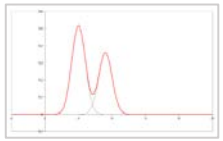
Dual-Channel LC-MS/MS: strategies

2

Channel 1

Channel 2

- Same column
- Same mobile phases
- Same method
- Different samples injected in each channel

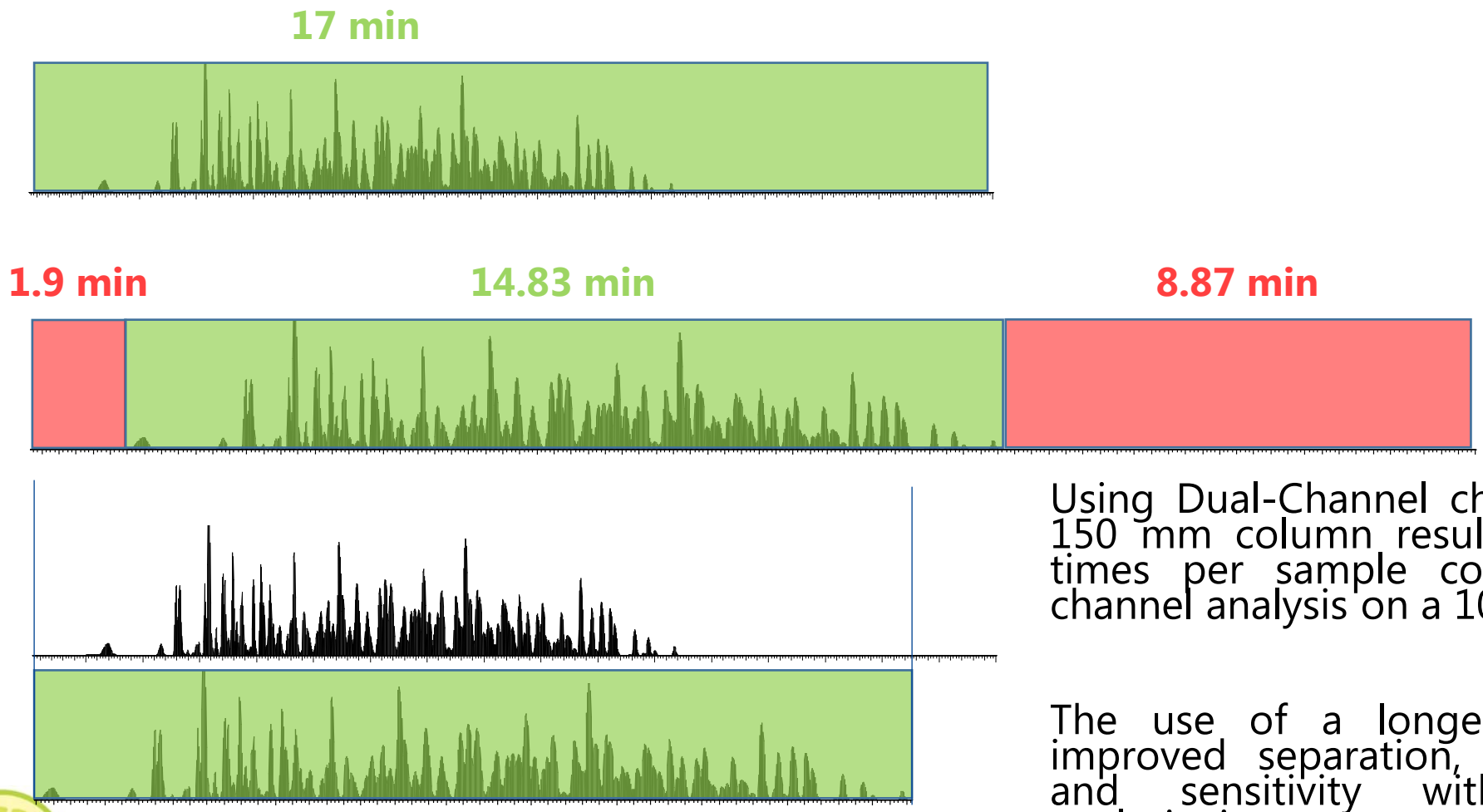


Better separation with longer columns, increase sensitivity and/or selectivity.

Dual-Channel LC-MS/MS: longer column length

- Chromatographic columns of **100 mm** and **150 mm** in length were compared
- **Remaining properties** were kept identical (porosity, particle size, type)
- 1.5x length → 1.5x increase in each **gradient** step
- **Elution time** also increased 1.5x, 14 min → 21 min
- **Data window** 14.83 min (TSQ Altis) and 15.85 min (Thermo Scientific™ Q Exactive™ Focus system)
- **Longer analysis** time of longer columns compensated by Dual-Channel time savings

Dual-Channel LC-MS/MS: longer column length



Using Dual-Channel chromatography and a 150 mm column results in shorter analysis times per sample compared to a single channel analysis on a 100 mm column

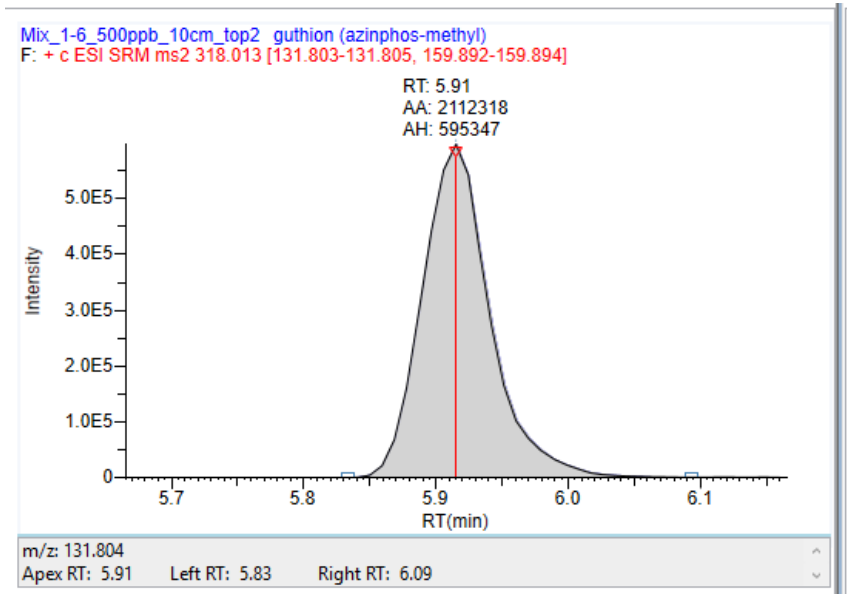
The use of a longer column results in improved separation, increasing selectivity and sensitivity without compromising analysis time

Dual-Channel LC-MS/MS: longer column length

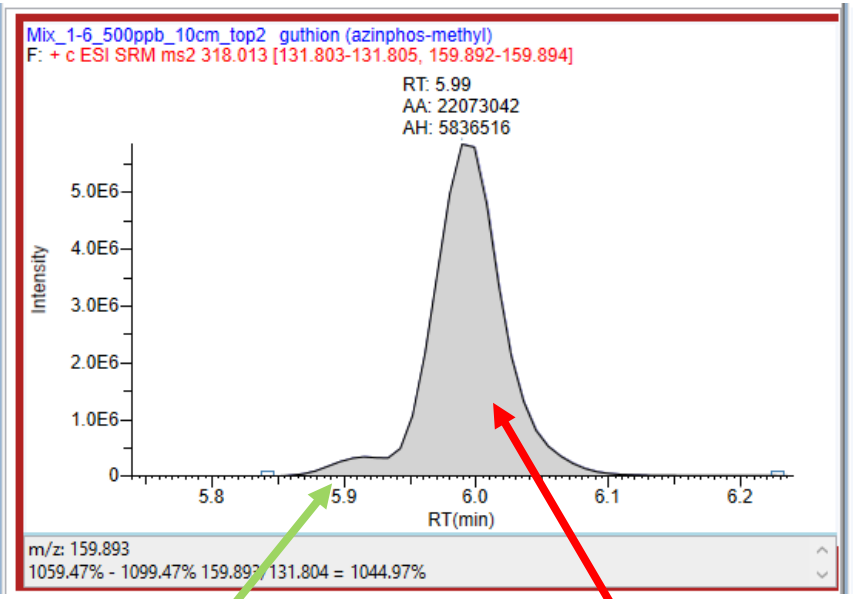
Azinphos methyl & phosmet coelution

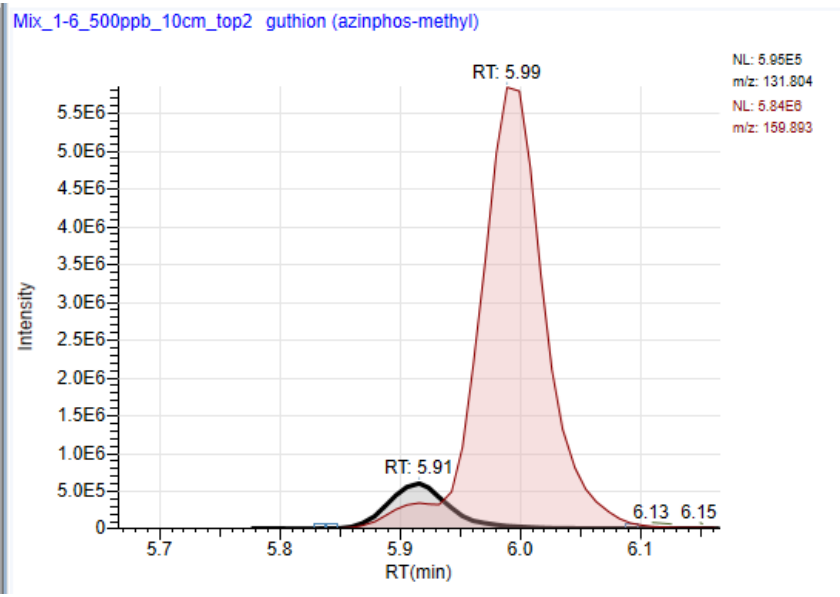
TSQ Altis
Triple quadrupole
100 mm column

***m/z* 318 -> 132**



***m/z* 318 -> 159**





Azinphos methyl

Interfering transition of phosmet

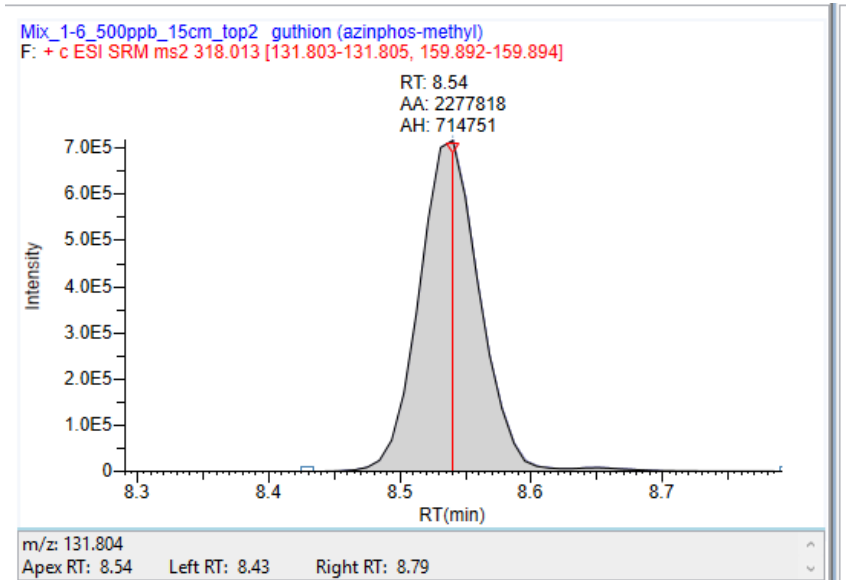
Dual-Channel LC-MS/MS: longer column length

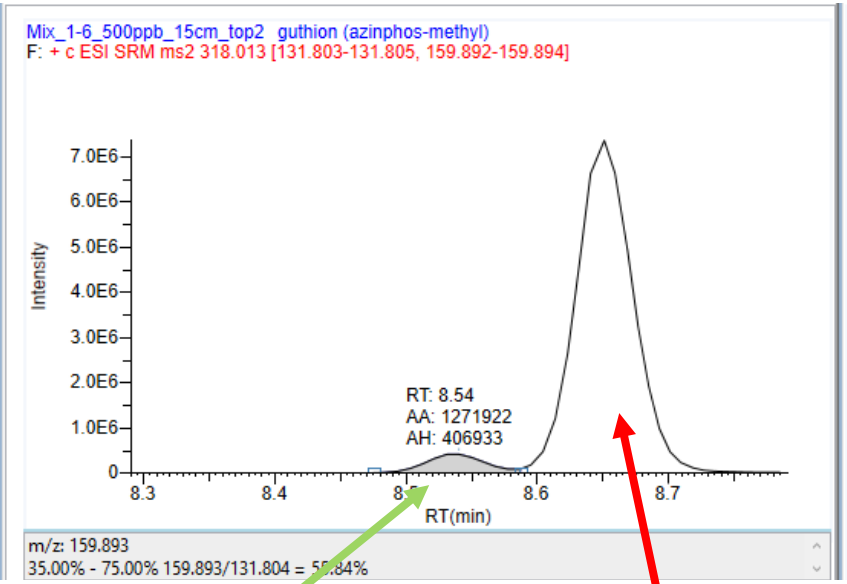
Azinphos methyl & phosmet coelution

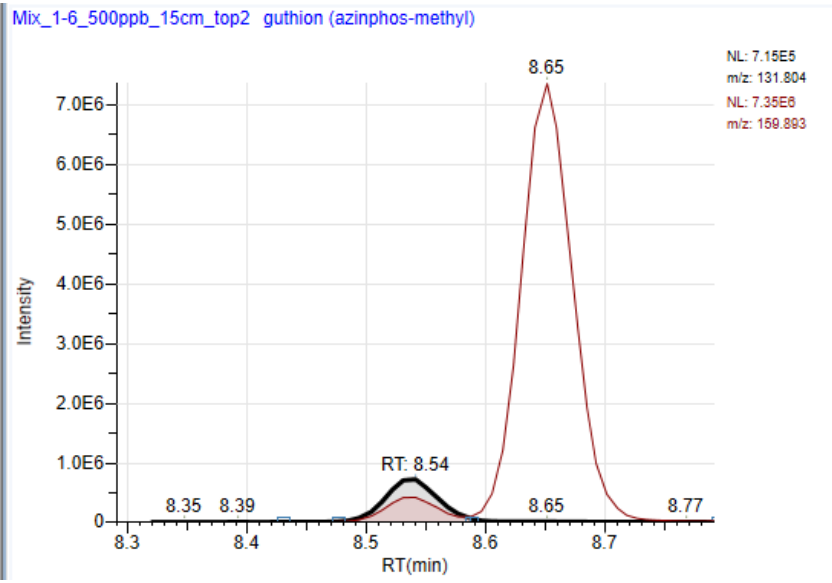
TSQ Altis
Triple quadrupole
150 mm column

***m/z* 318 -> 132**

***m/z* 318 -> 159**



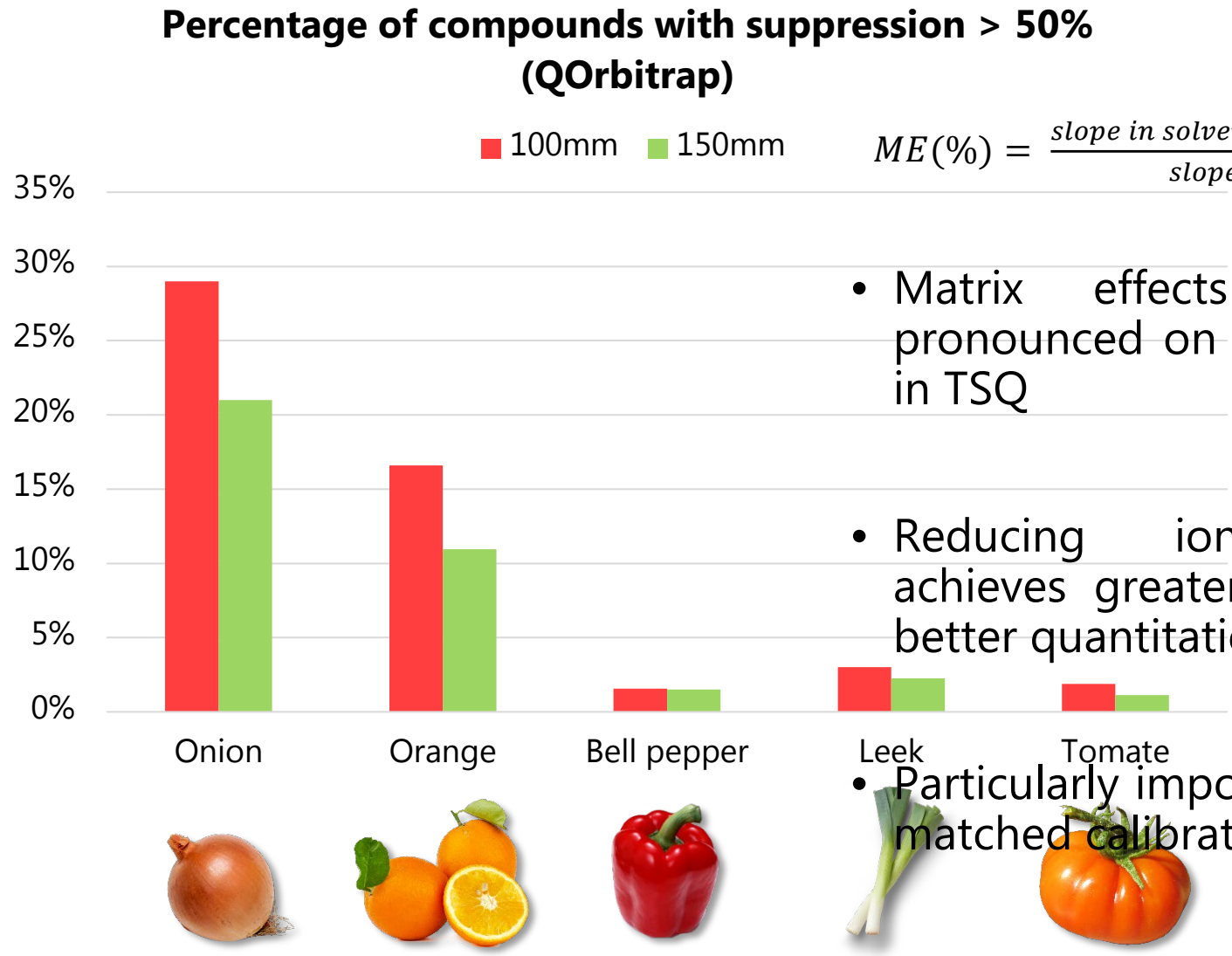




Azinphos methyl

Phosmet is separated from azinphos methyl

Dual-Channel LC-MS/MS: longer column length



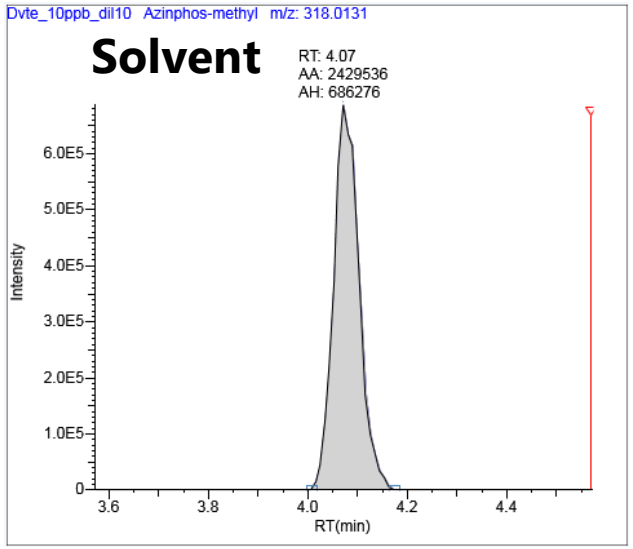
$$ME(\%) = \frac{slope\ in\ solvent - slope\ in\ matrix}{slope\ in\ matrix} \cdot 100$$

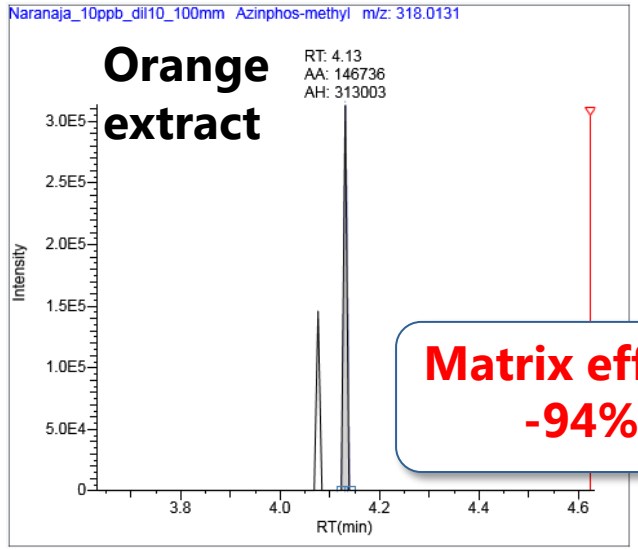
- Matrix effects were more pronounced on Q-Orbitrap than in TSQ
- Reducing ion suppression achieves greater sensitivity and better quantitation
- Particularly important for matrix-matched calibration

Dual-Channel LC-MS/MS: longer column length

QExactive Focus
High-resolution MS
100 mm column

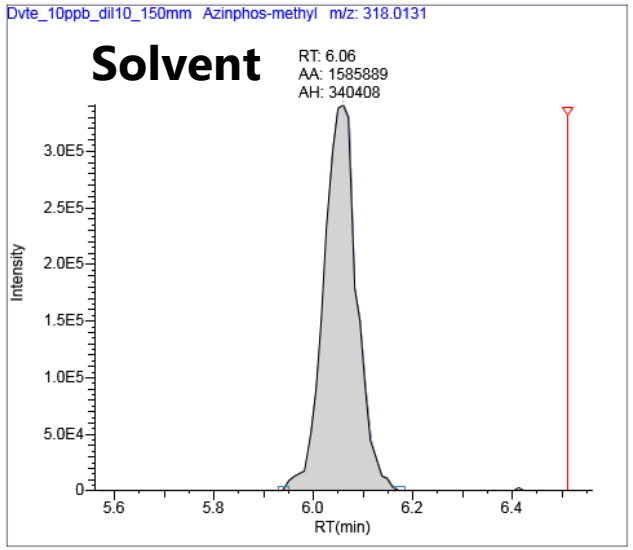
0.01 mg/kg of azinphos-methyl
Full Scan MS
***m/z* 318.0131 ± 5 ppm**

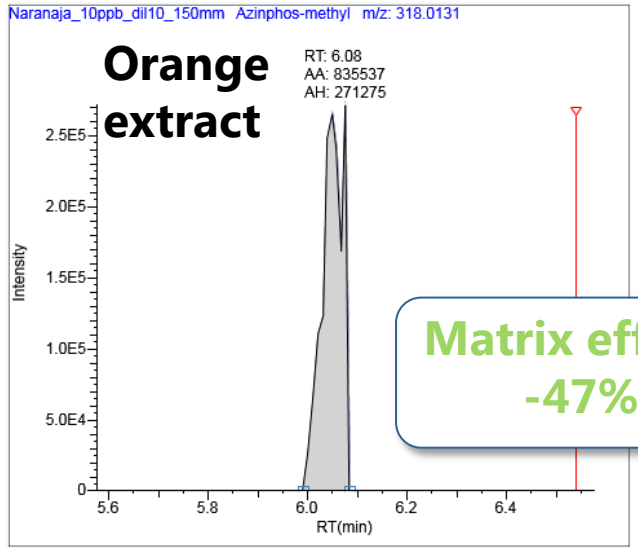




Matrix effects -94%

QExactive Focus
High-resolution MS
150 mm column

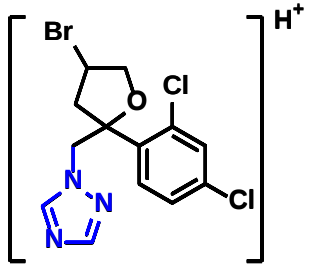




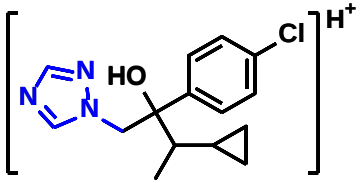
Matrix effects -47%

Dual-Channel LC-MS/MS: longer column length

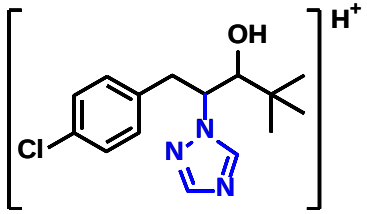
Bromuconazole (first peak)
Full scan MS
375.9614 ± 5 ppm

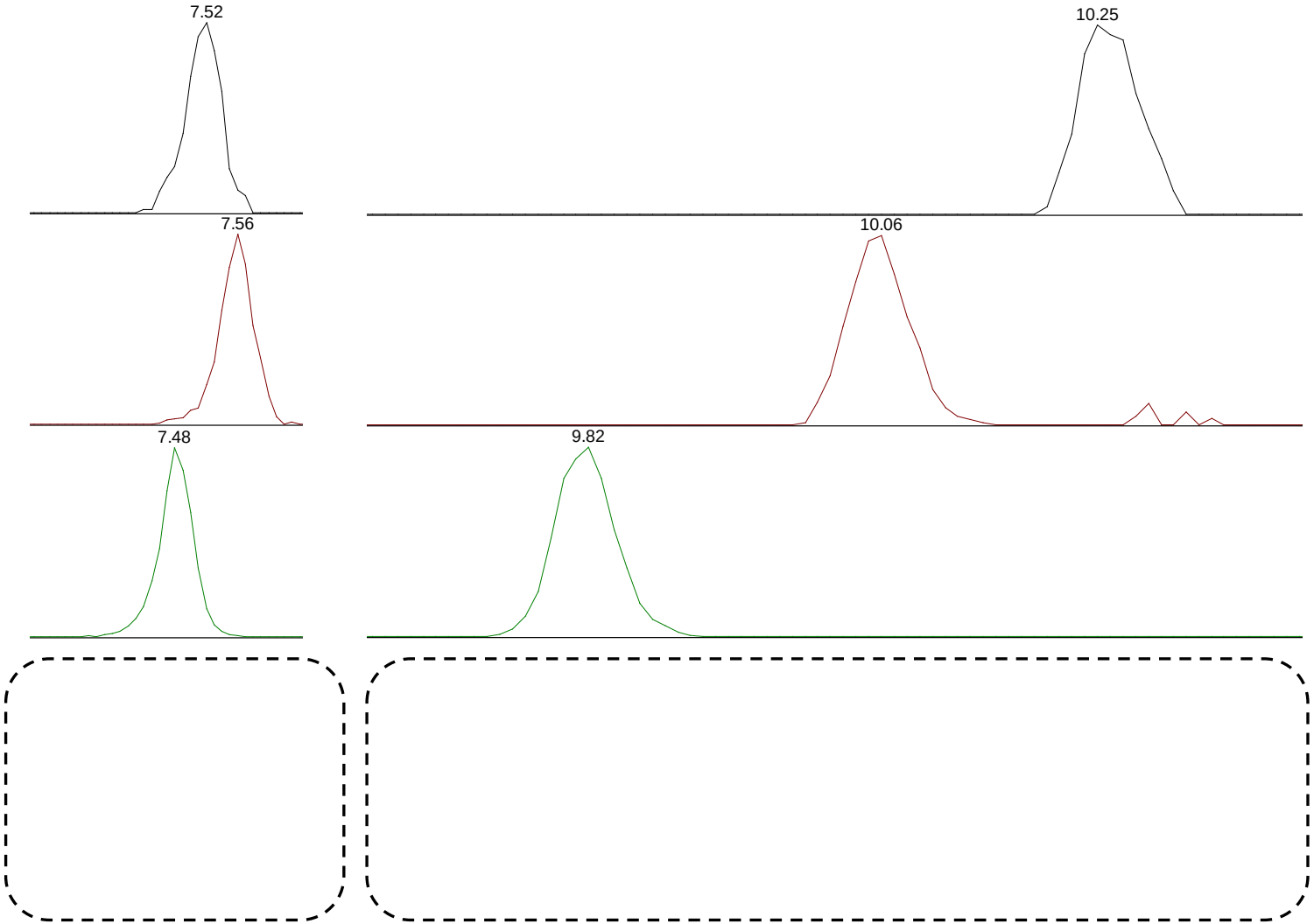


Cyproconazole (first peak)
Full scan MS
292.1211 ± 5 ppm



Paclobutrazole
Full scan MS
294.1368 ± 5 ppm



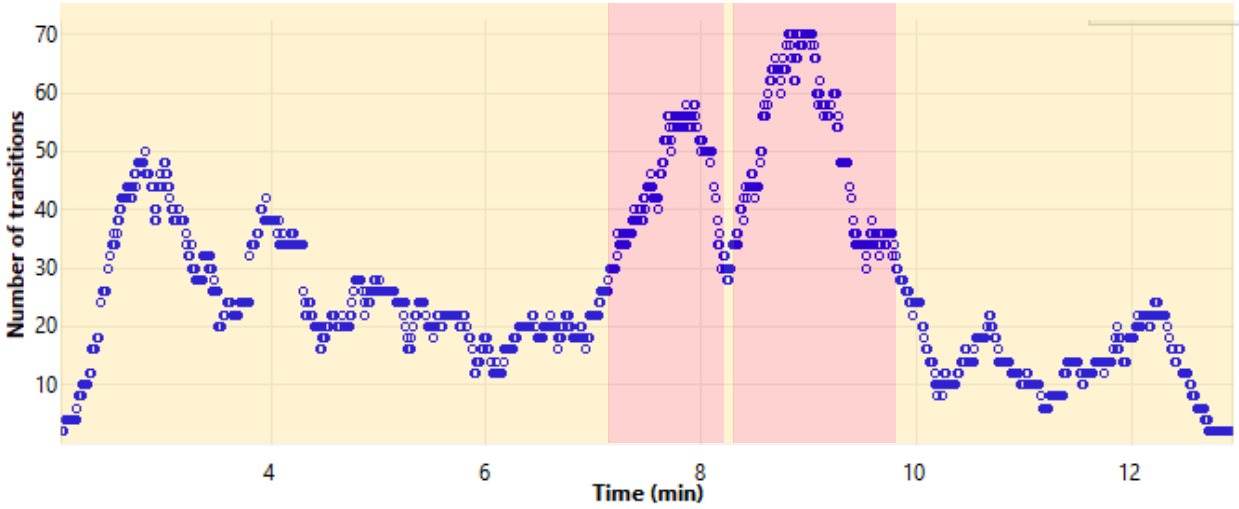


Dual-Channel LC-MS/MS: longer column length

300 pesticides / 600 transitions

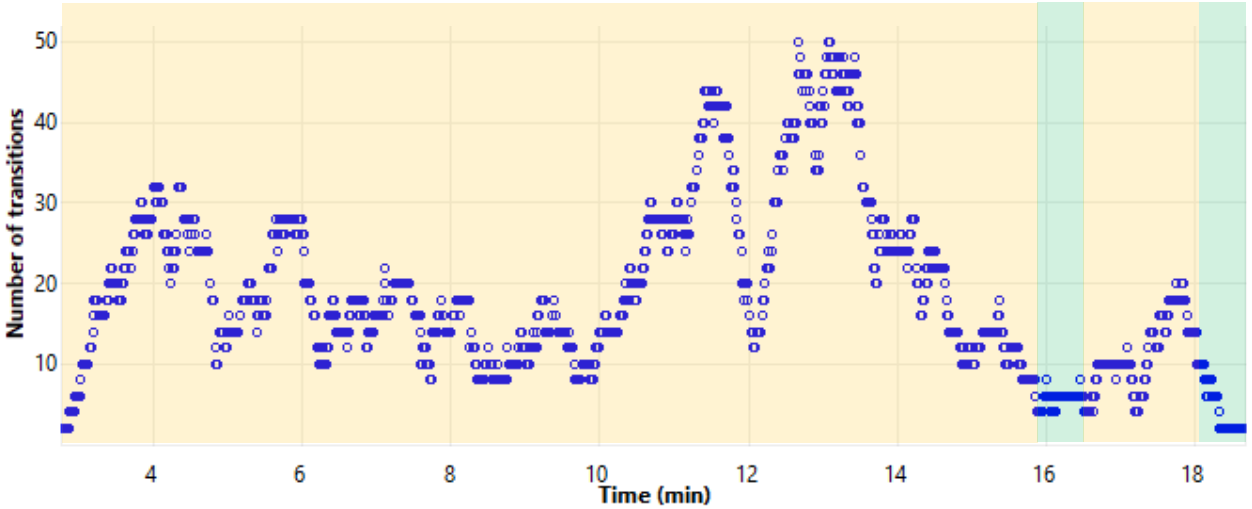
100 mm column

Number of transitions per cycle



150 mm column

Number of transitions per cycle



Dwell time < 10 ms

Dwell time 10 – 50 ms

Dwell time > 50 ms

A longer column separates better the analytes.
The dwell times can be increased without increasing the duty cycle.

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Dual-Channel LC-MS/MS: strategies

3

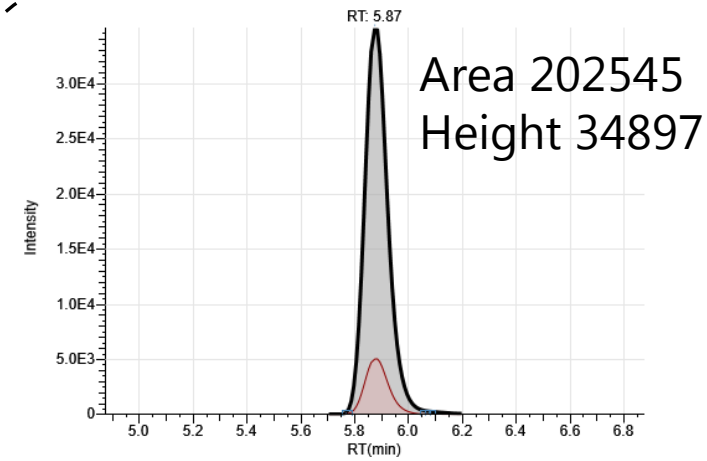
Channel 1 +

Channel 2 -

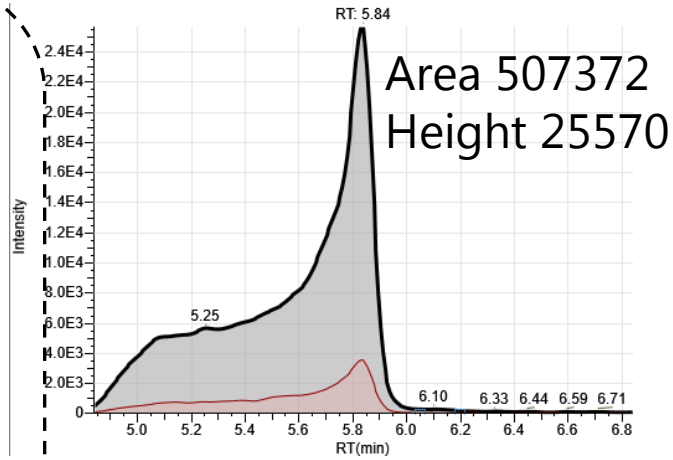
Improve sensitivity

- Same column
- Different mobile phases
- Different method
- Same sample injected in each channel

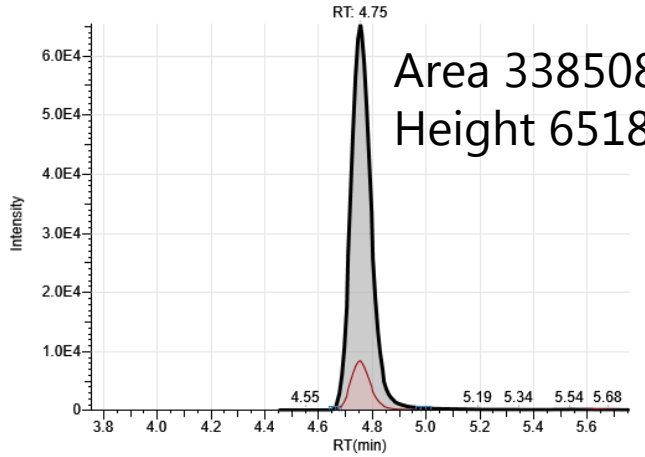
Dual-Channel LC-MS/MS: different mobile phases



Water/MeOH/formic acid/ammonium formate

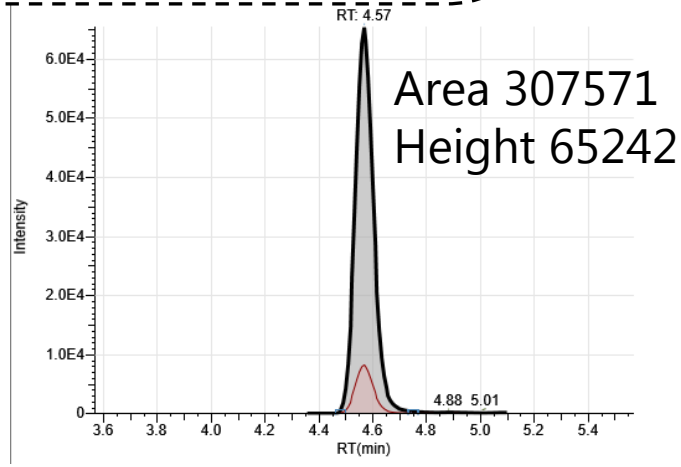


Water/AcN



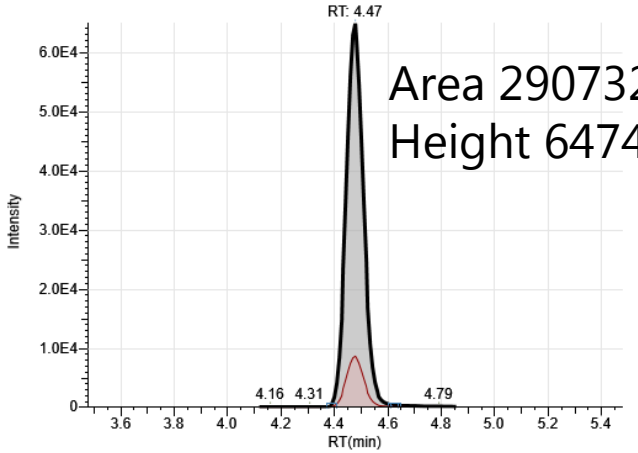
Water/AcN + 0.01 % acetic acid

Gradient 1



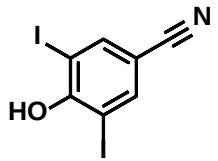
Water/AcN + 0.02 % acetic acid

Gradient 2



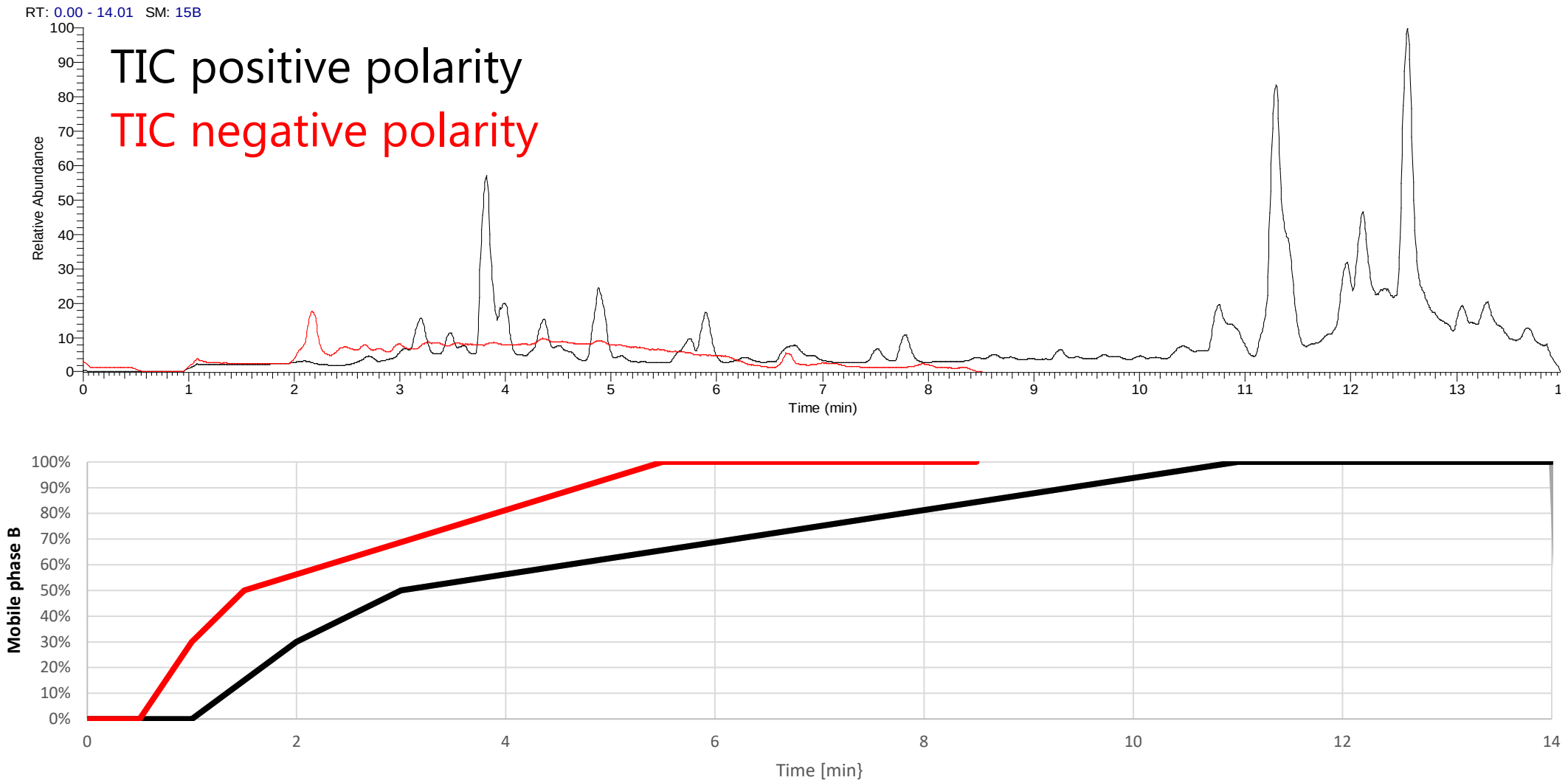
Water/AcN + 0.05 % acetic acid

Ioxynil



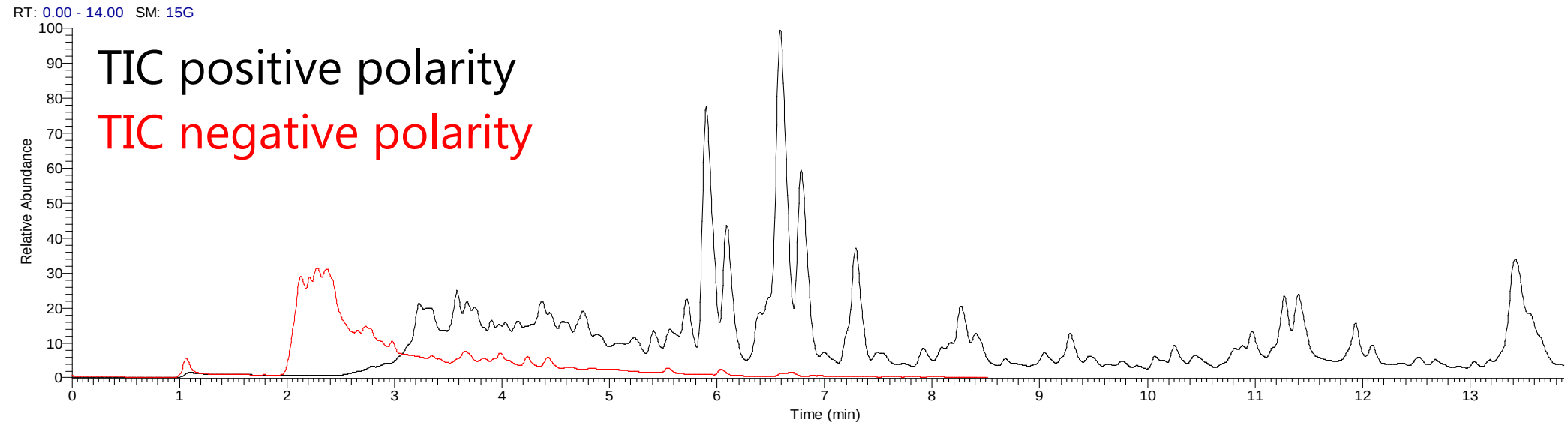
Dual-Channel LC-MS/MS: different mobile phases

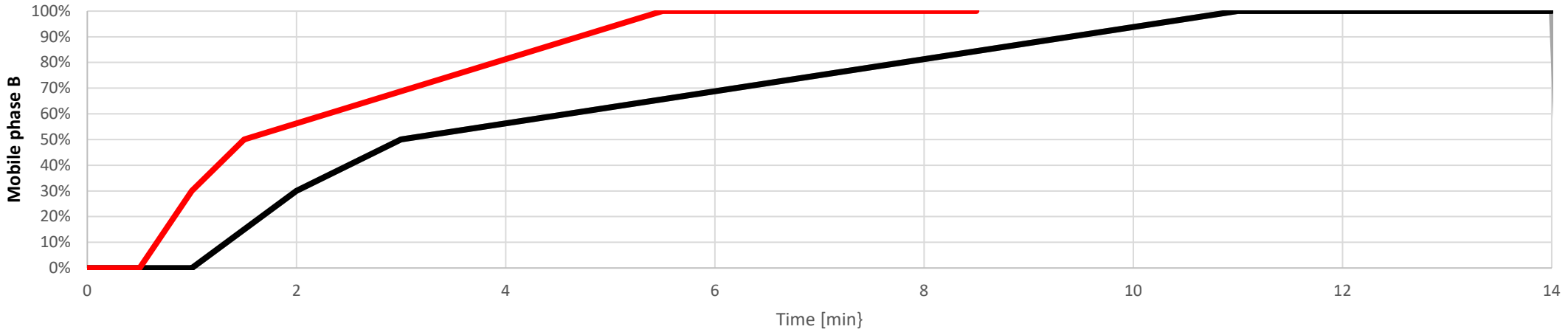
Tomato



Dual-Channel LC-MS/MS: different mobile phases

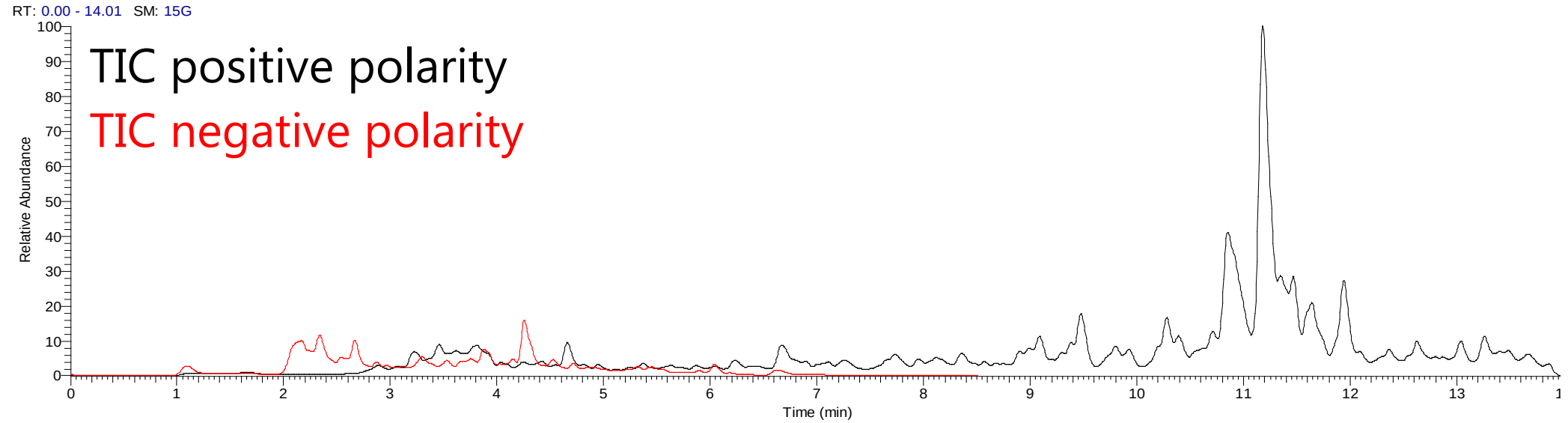
Orange

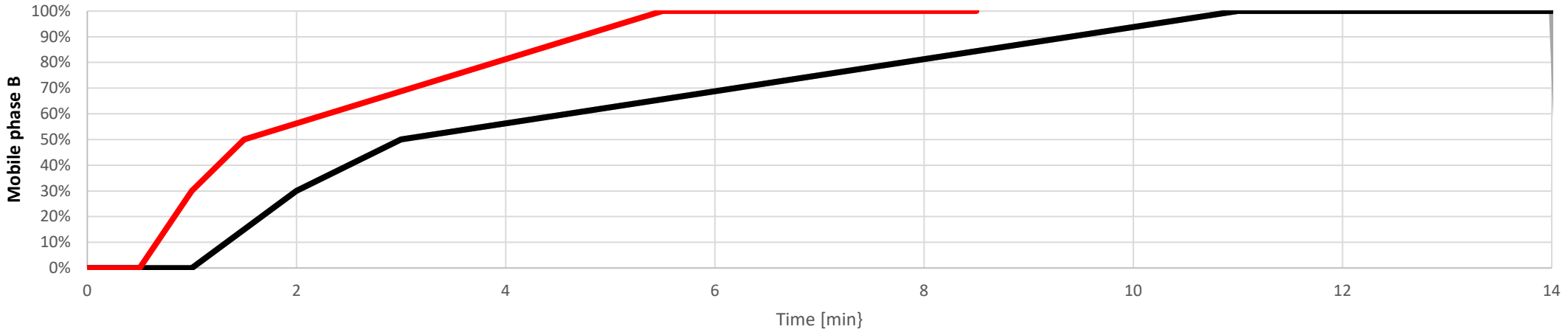




Dual-Channel LC-MS/MS: different mobile phases

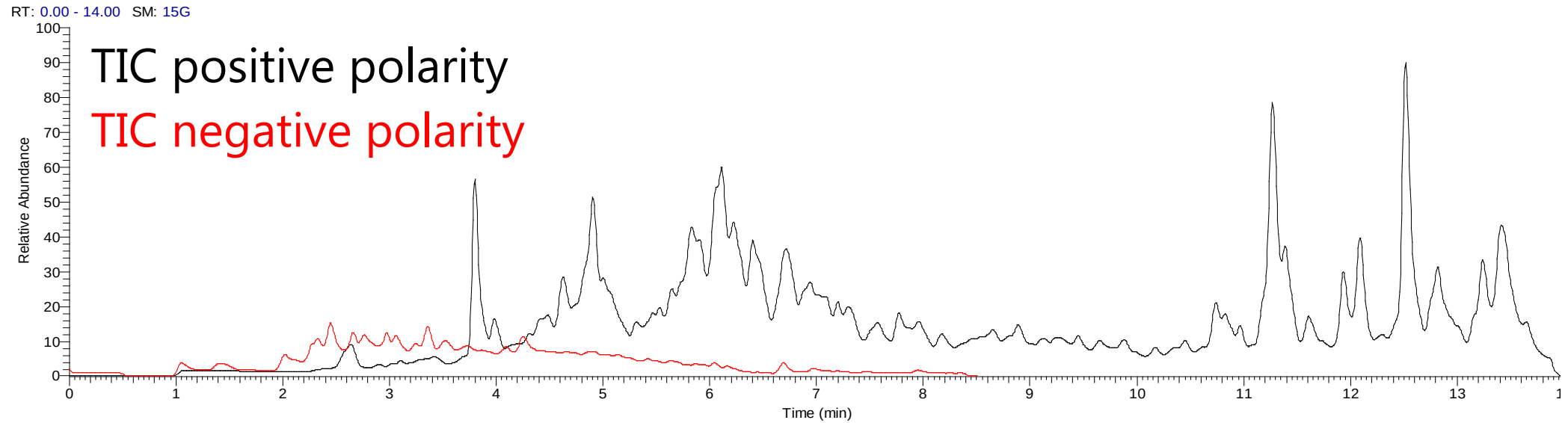
Avocado

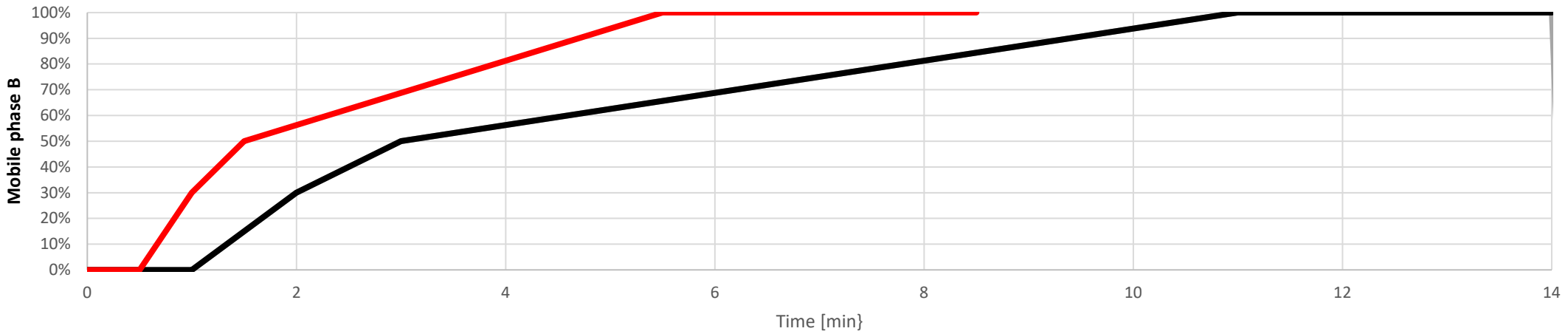




Dual-Channel LC-MS/MS: different mobile phases

Onion

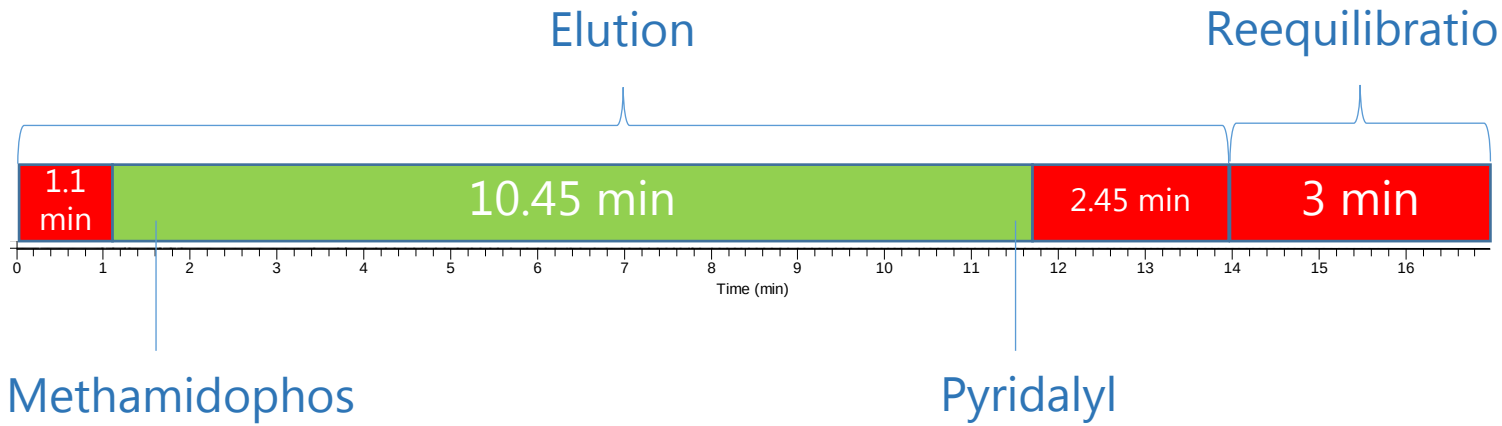




Dual-Channel LC-MS/MS: different mobile phases

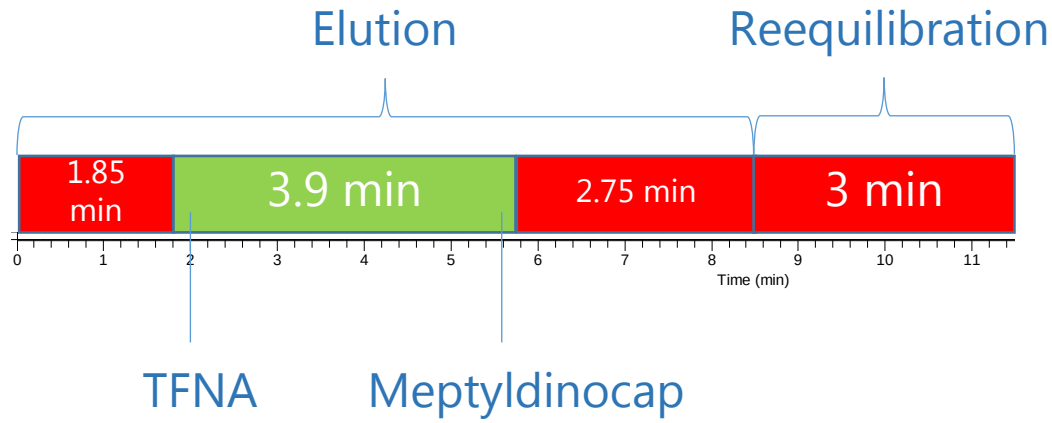
Positive polarity Gradient 1

Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)



Negative polarity Gradient 2

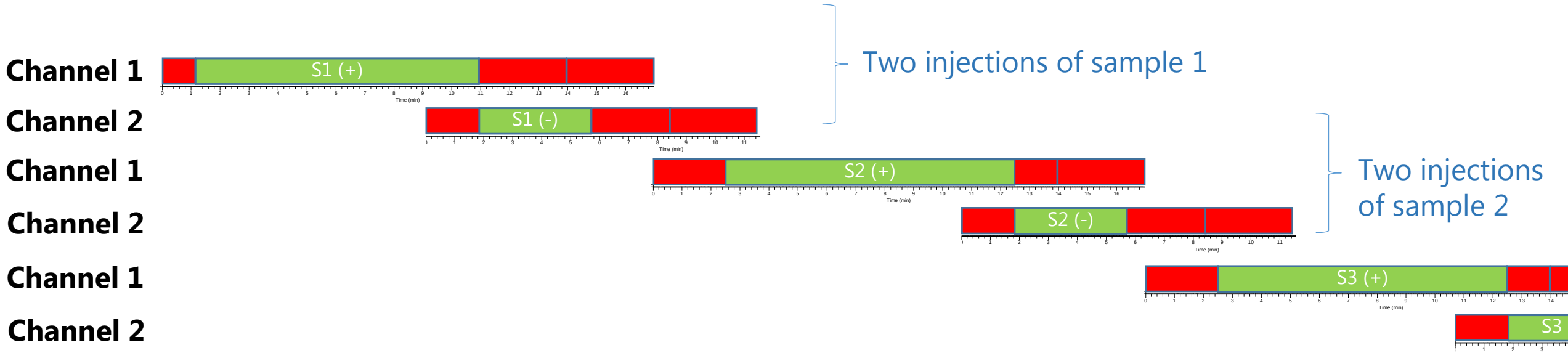
Water:AcN
Acetic acid (0.05 %)



To waste

To MS

Dual-Channel LC-MS/MS: different mobile phases

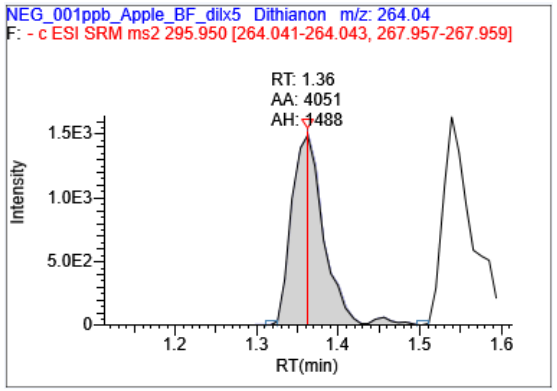


Output data

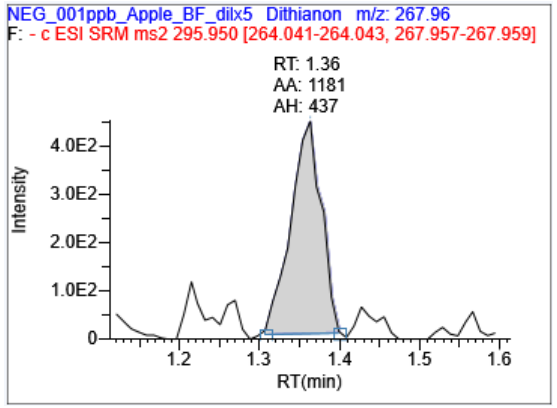
18.00 min | 18.00 min | 18.00 min

On a single channel instrument with polarity switching only one analysis in 18 min

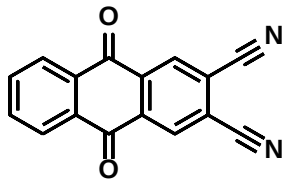
Dual-Channel LC-MS/MS: different mobile phases

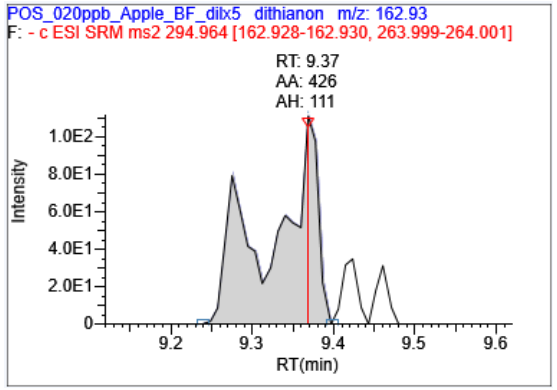


0.001 mg/kg

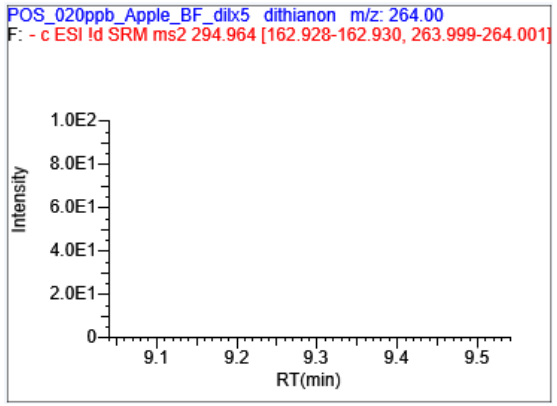


Dithianon





0.020 mg/kg



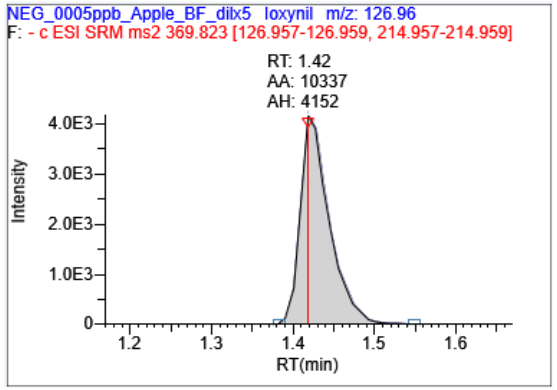
Dual-channel Gradient 2

Water:AcN
Acetic acid (0.05 %)

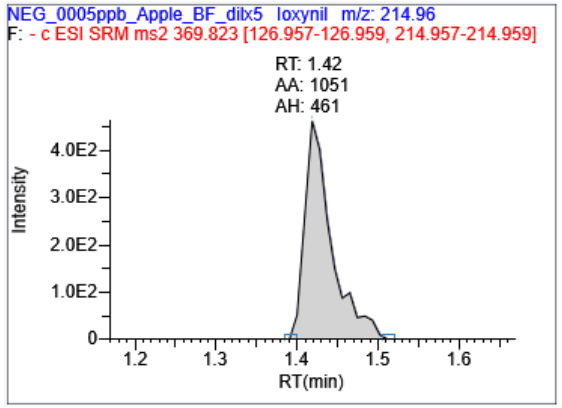
Single channel Gradient 1

Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)

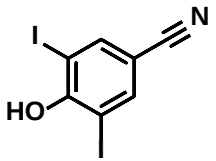
Dual-Channel LC-MS/MS: different mobile phases

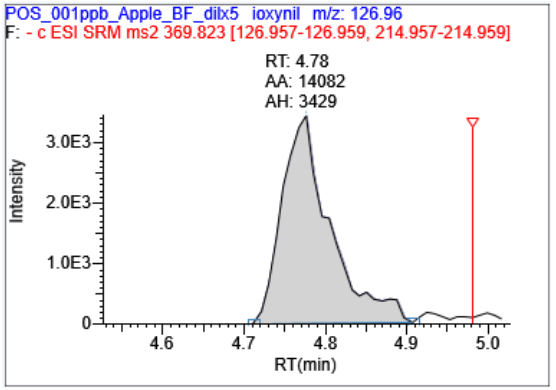


0.0005 mg/kg

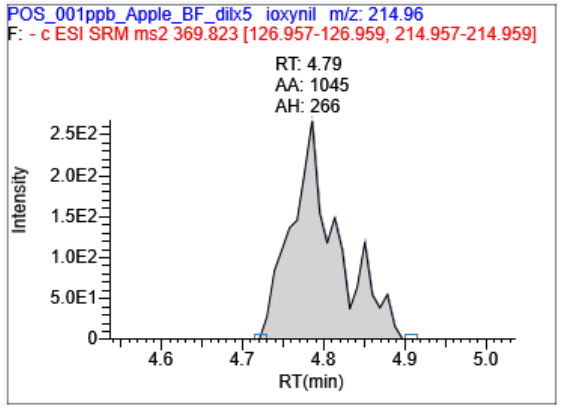


Ioxynil





0.001 mg/kg



Dual-channel Gradient 2

Water:AcN
Acetic acid (0.05 %)

Single channel Gradient 1

Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)

Dual-Channel LC-MS/MS: apple baby food validation

Single channel Gradient 1

Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)

Dual-channel Gradient 2

Water:AcN
Acetic acid (0.05 %)

Compound	Recoveries 0.003 mg/kg	RSD 0.003 mg/kg	Recoveries 0.006 mg/kg	RSD 0.006 mg/kg	Lowest calibration level (mg/kg)	Highest calibration level (mg/kg)
2,4-D	97 %	11 %	109 %	6 %	0.006	0.02
Bromacil	100 %	5 %	104 %	4 %	0.0005	0.02
Dithianon	96 %	3 %	96 %	3 %	0.0005	0.02
Diuron	103 %	5 %	101 %	2 %	0.0005	0.02
Fensulfothion	102 %	5 %	104 %	3 %	0.0005	0.02
Fensulfothion-oxon-sulfone	104 %	4 %	103 %	4 %	0.0005	0.02
Fipronil	103 %	4 %	102 %	3 %	0.0005	0.02
Fipronil-desulfinyl	101 %	2 %	100 %	2 %	0.0005	0.02
Fipronil-sulfone	103 %	2 %	103 %	2 %	0.0005	0.02
Flubendiamide	104 %	21 %	97 %	12 %	0.0005	0.02
Fludioxonil	105 %	6 %	102 %	6 %	0.0005	0.02
Haloxyfop	97 %	15 %	103 %	6 %	0.003	0.02
Hexaflumuron	94 %	5 %	104 %	11 %	0.0005	0.02
Ioxynil	101 %	2 %	103 %	6 %	0.0001	0.02
Lufenuron	103 %	26 %	105 %	30 %	0.0005	0.02
MCPA	114 %	7 %	99 %	13 %	0.003	0.02
MCPB	-	-	115 %	10 %	0.006	0.02
Meptyldinocap	86 %	14 %	118 %	29 %	0.006	0.02
(*E*)-Metaflumizone	103 %	2 %	85 %	6 %	0.0001	0.02
(*Z*)-Metaflumizone	104 %	1 %	102 %	2 %	0.0001	0.02
Penthiopyrad	100 %	2 %	101 %	1 %	0.0005	0.02
Prothioconazole	107 %	12 %	110 %	11 %	0.0005	0.02
Prothioconazole-desthio	106 %	8 %	104 %	5 %	0.0005	0.02
Teflubenzuron	107 %	9 %	105 %	2 %	0.0001	0.02
TFNA	-	-	98 %	7 %	0.006	0.02
TFNG	106 %	28 %	101 %	9 %	0.003	0.02

Dual-Channel LC-MS/MS: banana & orange validation

Single channel Gradient 1

Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)

Dual-channel Gradient 2

Water:AcN
Acetic acid (0.05 %)

Compound	Recoveries 0.003 mg/kg	RSD 0.003 mg/kg	Recoveries 0.006 mg/kg	RSD 0.006 mg/kg	Lowest calibration level (mg/kg)	Highest calibration level (mg/kg)
2,4-D	94 %	10 %	124 %	6 %	0.003	0.02
Bromacil	105 %	6 %	105 %	4 %	0.0005	0.02
Dithianon	81 %	6 %	86 %	6 %	0.003	0.02
Diuron	106 %	4 %	100 %	2 %	0.0005	0.02
Fensulfothion	99 %	4 %	104 %	2 %	0.0005	0.02
Fensulfothion-oxon-sulfone	105 %	4 %	101 %	3 %	0.0005	0.02
Fipronil	97 %	2 %	103 %	0 %	0.0005	0.02
Fipronil-desulfinyl	97 %	0 %	105 %	1 %	0.0005	0.02
Fipronil-sulfone	99 %	1 %	102 %	1 %	0.0005	0.02
Flubendiamide	78 %	14 %	104 %	2 %	0.00015	0.02
Fludioxonil	102 %	10 %	102 %	8 %	0.00015	0.02
Haloxyfop	102 %	4 %	103 %	10 %	0.003	0.02
Hexaflumuron	95 %	6 %	84 %	36 %	0.00015	0.02
Ioxynil	103 %	2 %	102 %	2 %	0.0005	0.02
Lufenuron	95 %	17 %	103 %	20 %	0.00015	0.02
MCPA	102 %	74 %	98 %	10 %	0.003	0.02
MCPB	-	-	115 %	18 %	0.006	0.02
Meptyldinocap	93 %	16 %	119 %	14 %	0.006	0.02
(*E*)-Metaflumizone	89 %	20 %	96 %	12 %	0.0005	0.02
(*Z*)-Metaflumizone	102 %	5 %	108 %	8 %	0.0005	0.02
Penthiopyrad	99 %	2 %	104 %	2 %	0.0005	0.02
Prothioconazole	98 %	5 %	108 %	12 %	0.00015	0.02
Prothioconazole-desthio	107 %	5 %	106 %	2 %	0.0005	0.02
Teflubenzuron	145 %	15 %	109 %	17 %	0.00015	0.02
TFNA	-	-	99 %	3 %	0.006	0.02
TFNG	96 %	9 %	95 %	5 %	0.003	0.02

Dual-Channel LC-MS/MS: strategies

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Channel 1

SRM

Channel 2

MRM

Reduce time of analyses

- Different columns
- Different mobile phases
- Different methods
- Different extracts of the same sample injected in each channel

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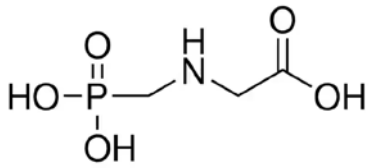
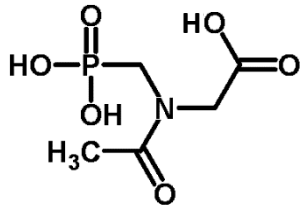
Dual-Channel LC-MS/MS: MRM and SRM compounds

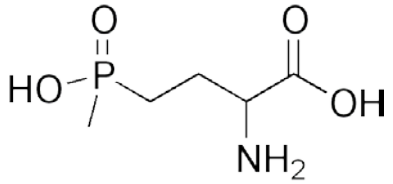
List of SRM compounds



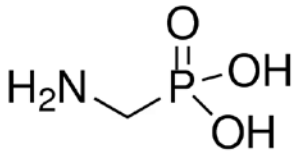
Glyphosate



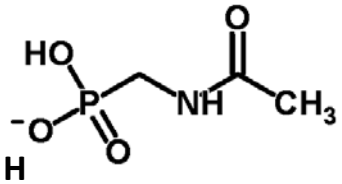
N-acetyl glyphosate



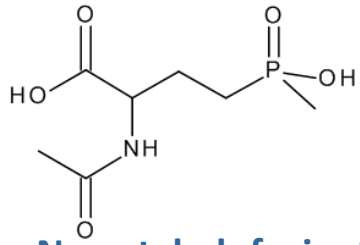
Glufosinate



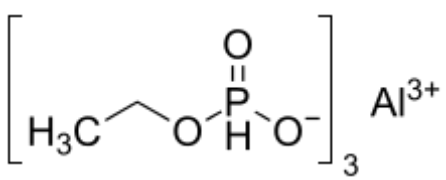
AMPA



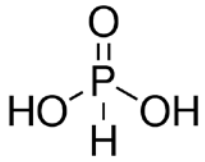
N-acetyl -AMPA



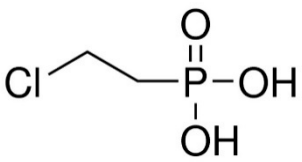
N-acetyl-glufosinate



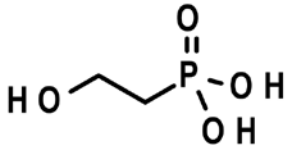
Fosetyl-aluminium



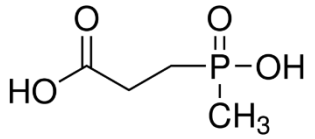
Phosphonic acid



Etephon



HEPA



MPPA

Dual-Channel LC-MS/MS: MRM and SRM compounds

Extraction SRM compounds

5 g sample

9 mL H_2O
+ 10 mL MeOH

Shake & Centrifuge

2 g sample

9 mL H_2O + 10 mL MeOH
+ 1 mL EDTA (10% m/V)

Shake, & Centrifuge

Automated µSPE
50 mg SAX

SAX clean-up

1 mL MeOH

1 mL
(MeOH-diluted extract)

0.6 mL MeOH

0.4 mL
MeOH : HCl (1M) (90:10)

Manual SPE
500 mg Hypercarb

Hypercarb clean-up

5 mL MeOH + 5 mL H_2O

Condi-tioning

6 mL
(H_2O-diluted extract)

Sample Loading

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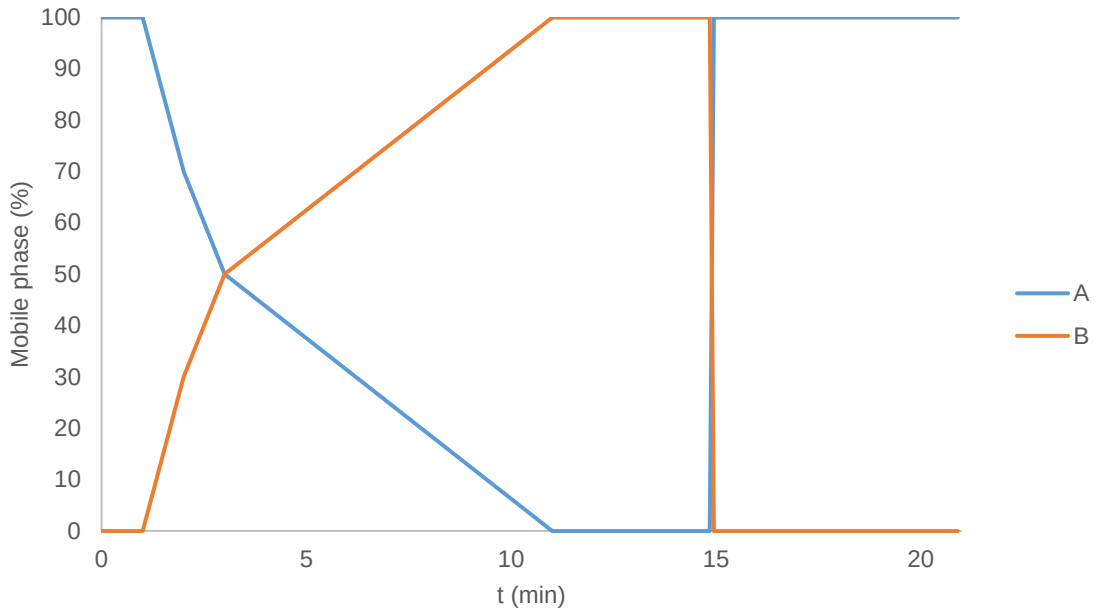
Dual-Channel LC-MS/MS: MRM and SRM compounds

C18 column

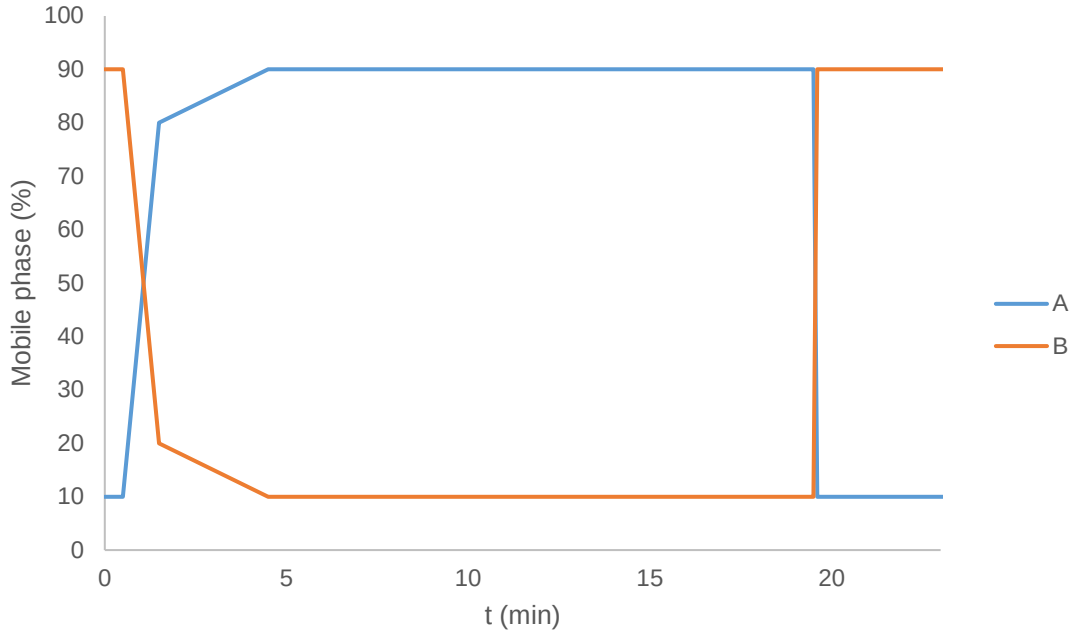


Mobile phase A: Water (2% MeOH, 0.1 % formic acid, 5 mM ammonium formate)

Mobile phase B: MeOH (2% water, 0.1 % formic acid, 5 mM ammonium formate)

Flow: 0.35 mL/min **Injection volume:** 2.5 µL

HILIC column



Mobile phase A: Water 1.2% formic acid

Mobile phase B: Acetonitrile 0.5% formic acid

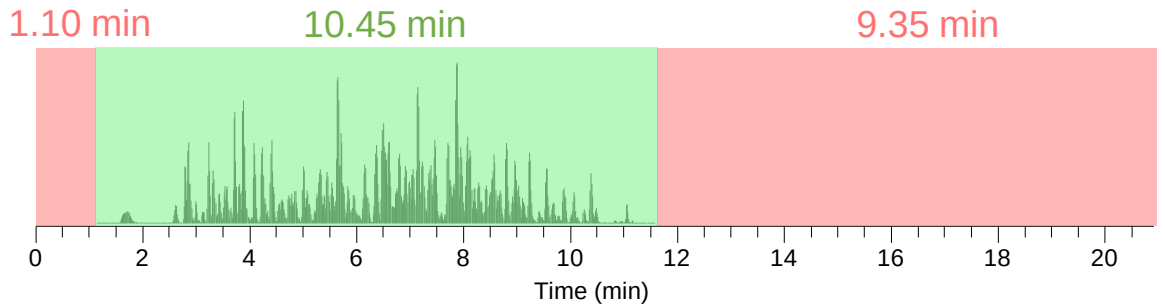
Flow: 0.5 mL/min

Injection volume: 10 µL

Dual-Channel LC-MS/MS: MRM and SRM compounds

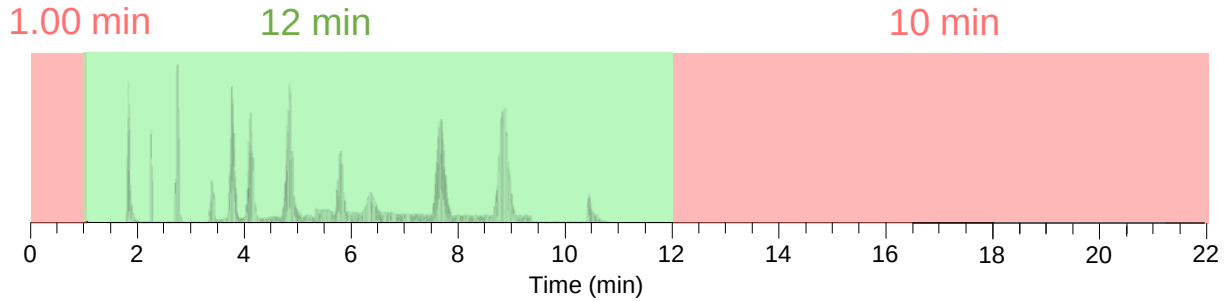
MRM Compounds
C18 Column

Gradient 1
Water:MeOH
Formic acid (0.1 %)
Ammonium formate (5 mM)



Highly polar pesticides
HILIC Column

Gradient 2
Water 1.2% formic acid
AcN 0.5% formic acid

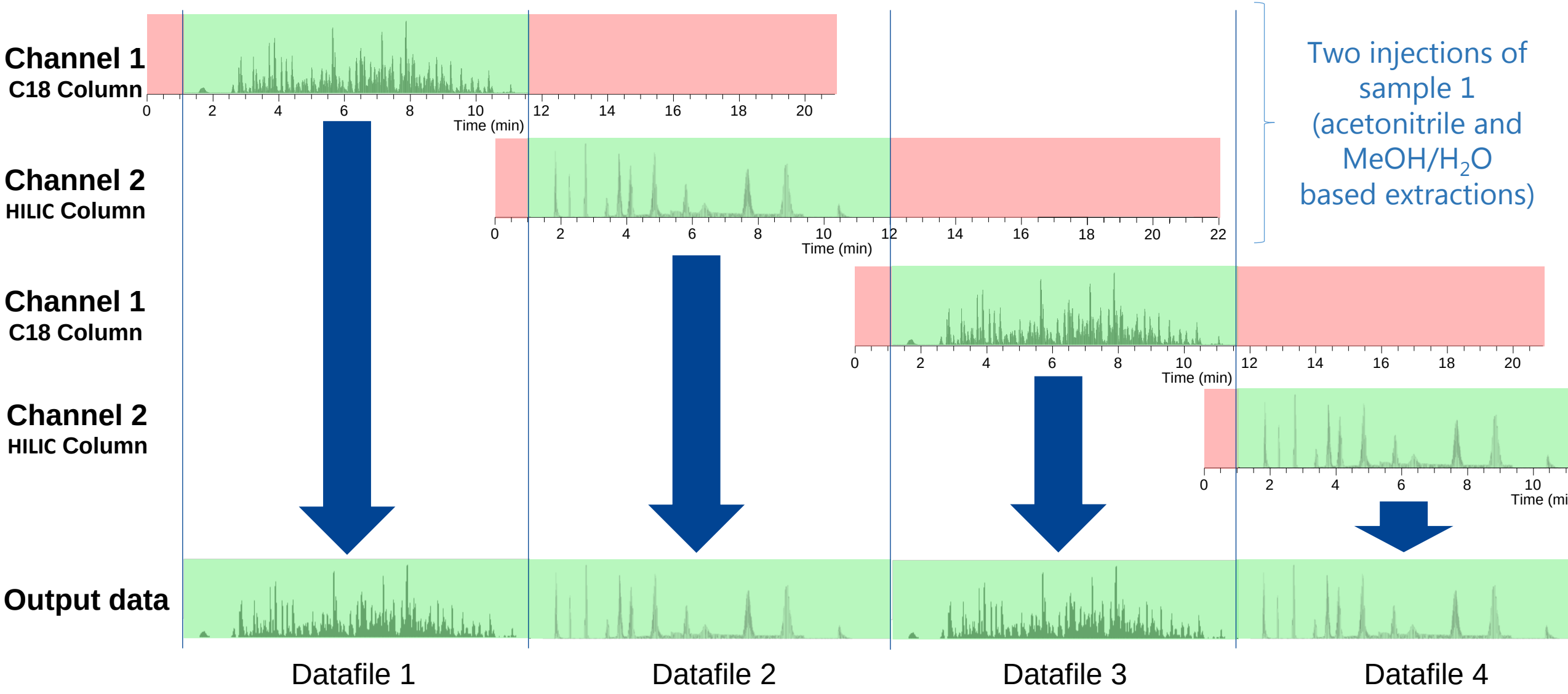


Using Dual-Channel chromatography and 2 different columns allows the simultaneous analysis of MRM and SRM compounds

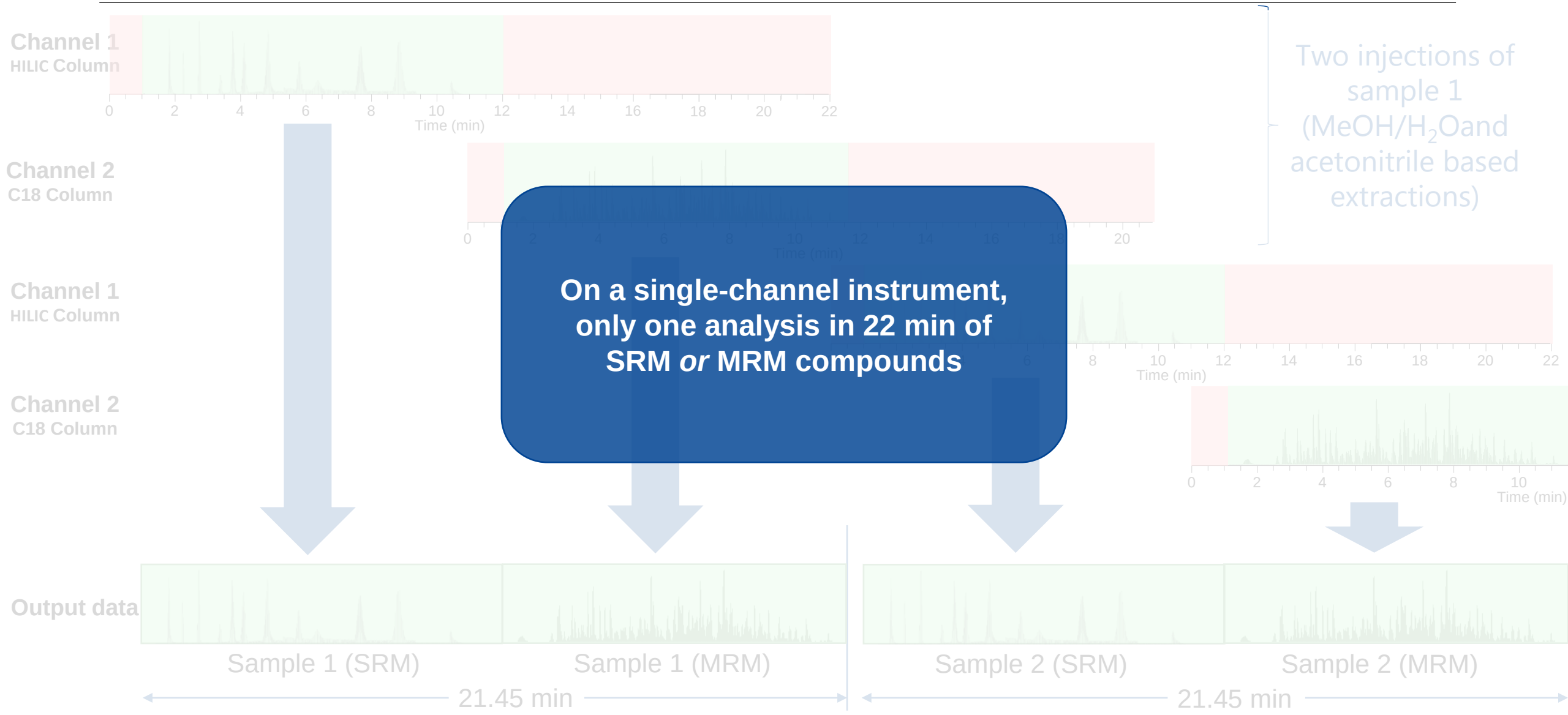
To waste

To MS

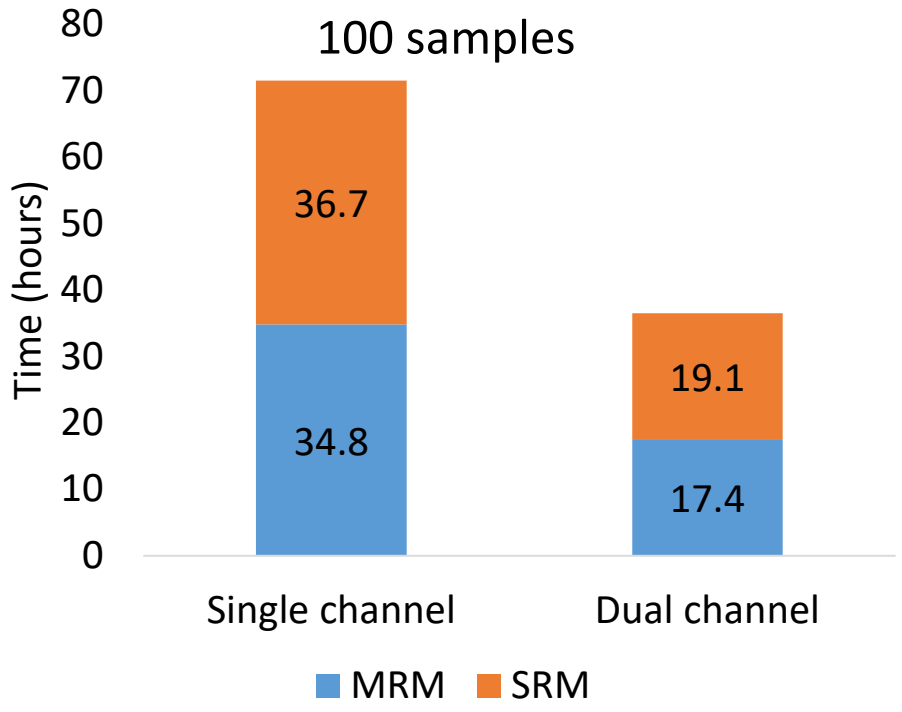
Dual-Channel LC-MS/MS: MRM and SRM compounds

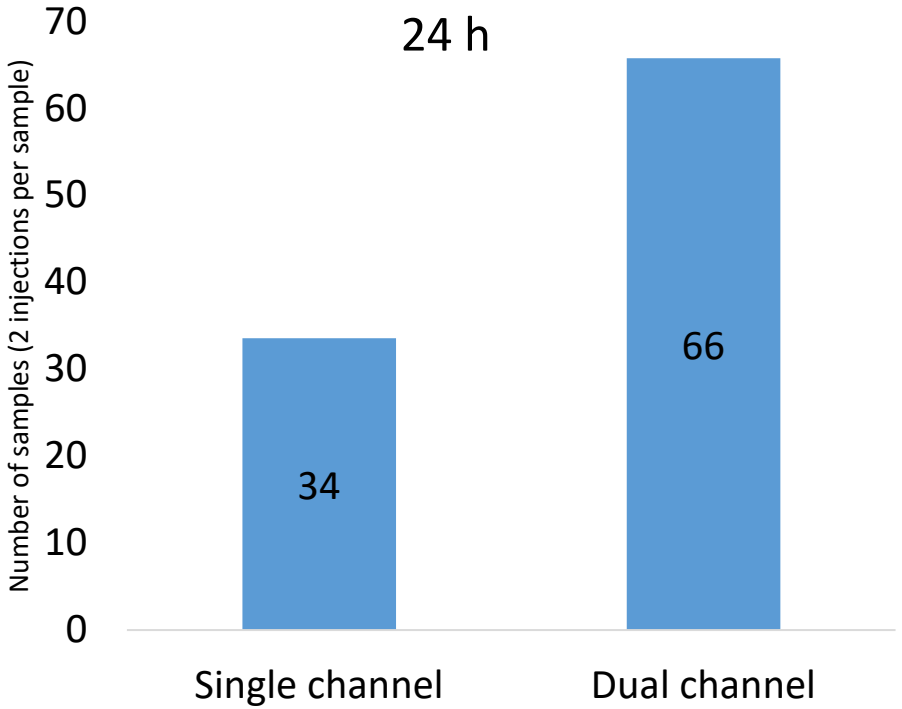


Dual-Channel LC-MS/MS: MRM and SRM compounds



Dual-Channel LC-MS/MS: MRM and SRM compounds





Dual-Channel LC-MS/MS: MRM and SRM compounds

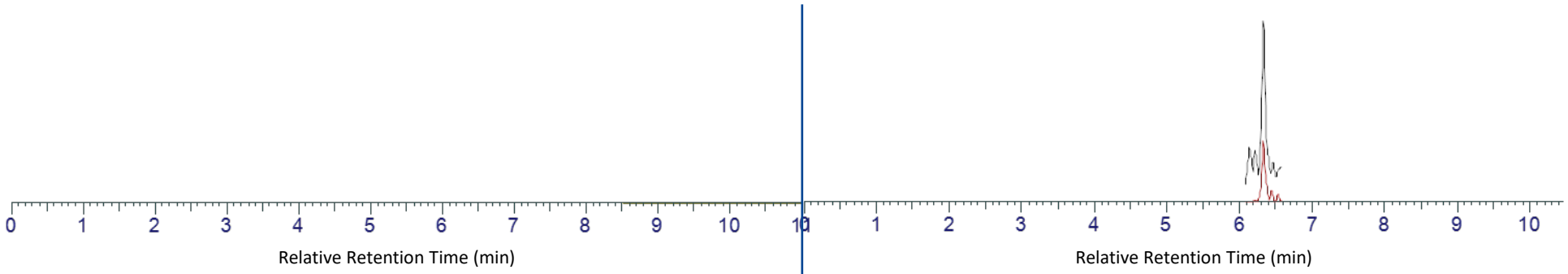
Analysis of real samples

Channel 1
APP Column
SRM analysis

Channel 2
C18 Column
MRM analysis

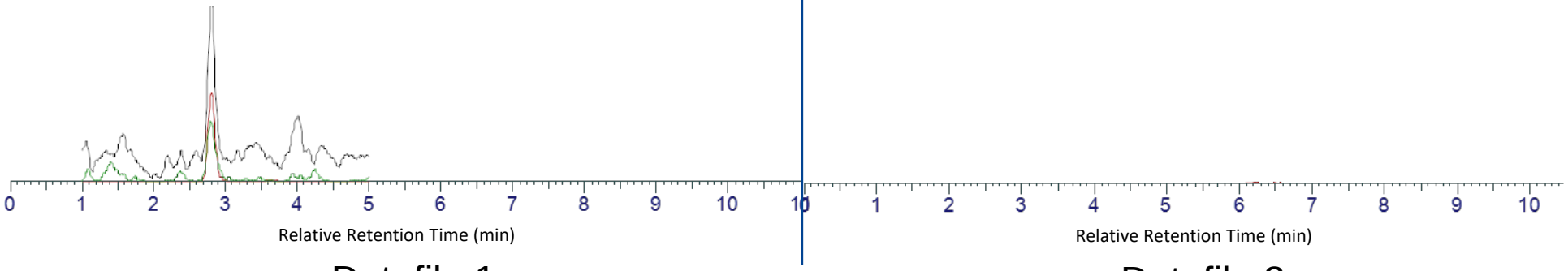
Sample 1

Epoxiconazole
2 ppb



Sample 2

Glyphosate
14 ppb



Datafile 1

Datafile 2

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PESTICIDES IN FRUITS AND VEGETABLES

Dual-Channel LC-MS/MS: MRM and SRM compounds

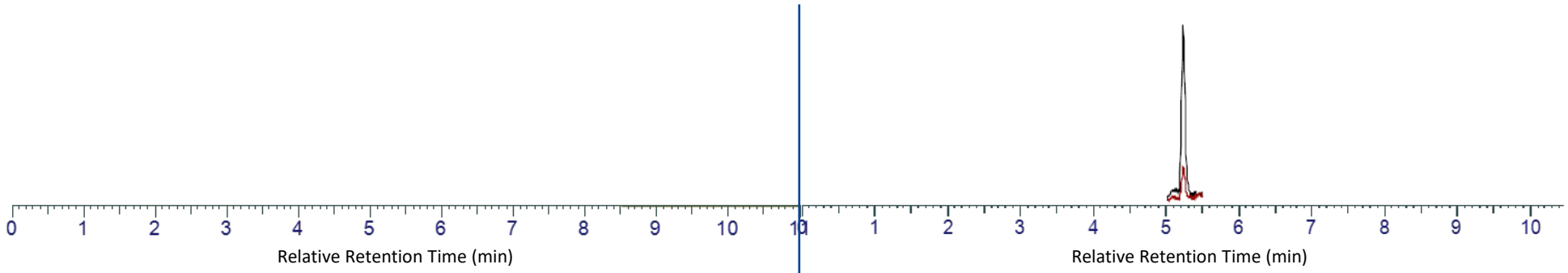
Analysis of real samples

Channel 1
APP Column
SRM analysis

Channel 2
C18 Column
MRM analysis

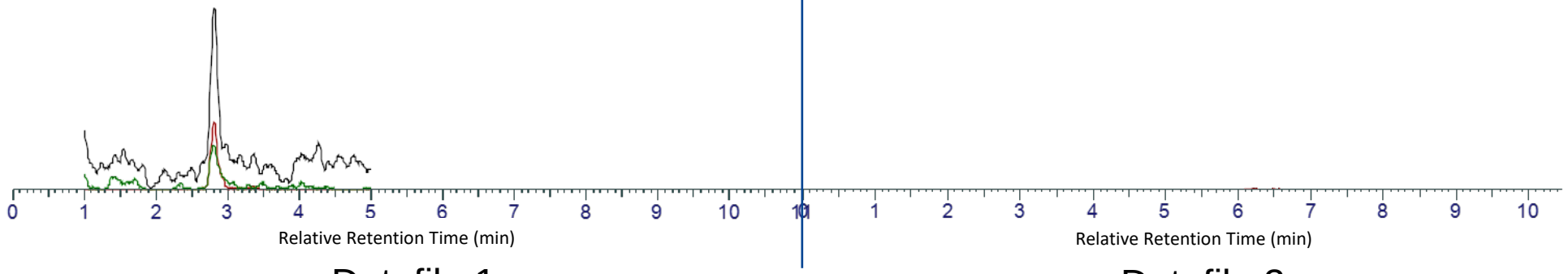
Sample 3

Azoxystrobin
6 ppb



Sample 4

Glyphosate
15 ppb



Datafile 1

Datafile 2

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PESTICIDES IN FRUITS AND VEGETABLES

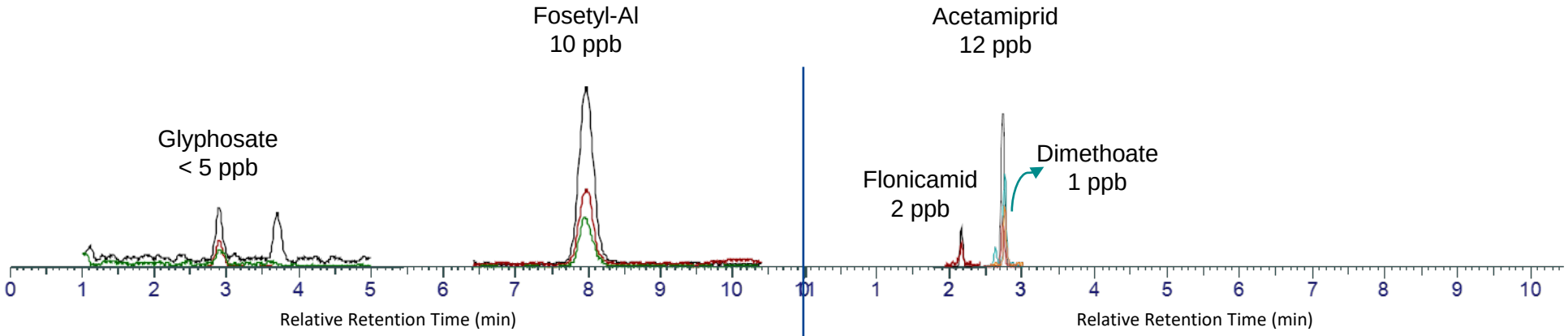
Dual-Channel LC-MS/MS: MRM and SRM compounds

Analysis of real samples

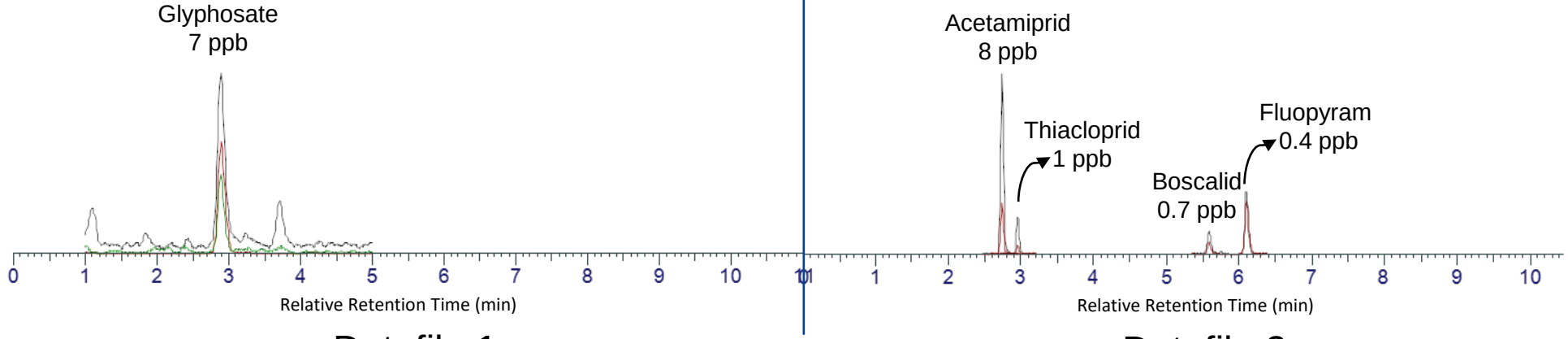
Channel 1
APP Column
SRM analysis

Channel 2
C18 Column
MRM analysis

Sample 1



Sample 2



Datafile 1

Datafile 2

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PESTICIDES IN FRUITS AND VEGETABLES

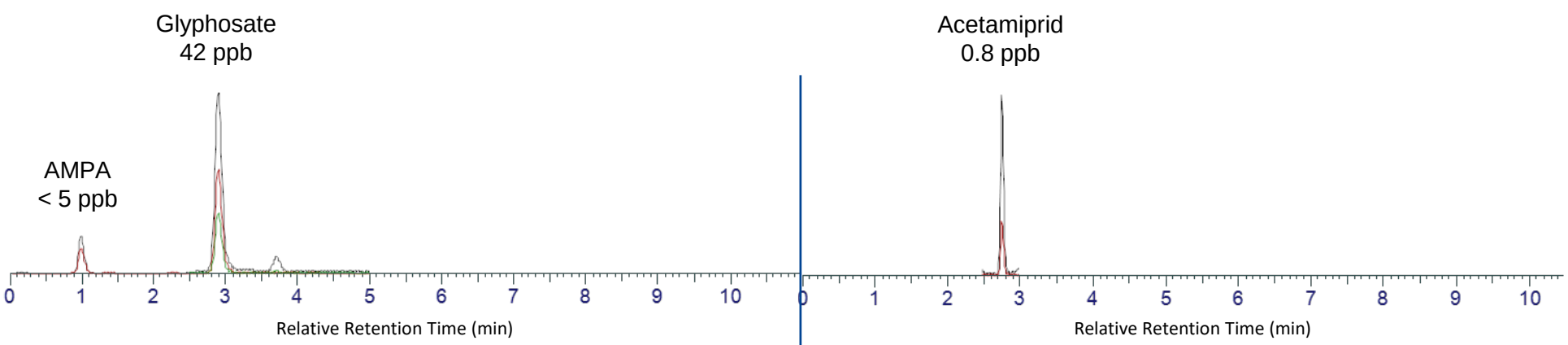
Dual-Channel LC-MS/MS: MRM and SRM compounds

Analysis of real samples

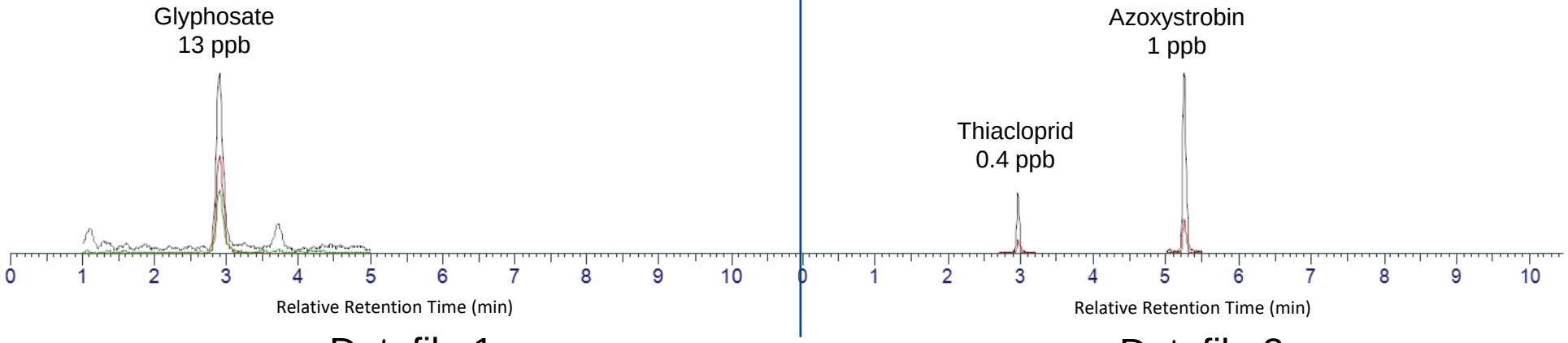
Channel 1
APP Column
SRM analysis

Channel 2
C18 Column
MRM analysis

Sample 3



Sample 4



Datafile 1

Datafile 2

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Conclusions

- Dual-Channel LC-MS can be used to increase **sample throughput**
- This technique can also be used to **improve selectivity** without sacrificing analysis time
- The possibility of using **two different mobile phases** allows better **sensitivity** for some analytes
- Dual-Channel LC-MS showed very good results when used for the **simultaneous analysis of SRM and MRM compounds**

References

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Dual-channel chromatography a smart way to improve the analysis efficiency in liquid chromatography coupled to mass spectrometry

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Cutting-edge approach using dual-channel chromatography to overcome the sensitivity issues associated with polarity switching in pesticide residues analysis

Francisco José Díaz-Galiano , Łukasz Rajski , Carmen Ferrer , Piedad Parrilla Vázquez , Amadeo Rodríguez Fernández-Alba *

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Thank you for your attention