# Dioxins and Furans

## Analysis

CC Columns for GC applications

### What are Dioxins ?

Dioxins and PCBs belong to the group of compounds known as Persistent Organic Pollutants (POPs). They are known to bio accumulate due to their lipophilic nature and, therefore, have health implications. As a result their emission into the environment and food chain is strictly controlled. Samples that are analysed, amongst others, are foodstuffs like fish, fish feed, and stack emissions from waste incineration sites. Limits are published by the World Health Organisation (WHO) and local authorities. As a consequence, low levels of contamination have to be detected, providing a challenge to sample preparation and detection systems.

The term 'Dioxin' covers a wide range of halogenated aromatic compounds, including polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs and PCDFs). These compounds are formed as a result of incomplete combustion of hydrocarbons in the presence of chlorine e.g. metal processing, domestic waste incineration, etc. They have high melting points and are stable to acids and bases; these characteristics make them very persistent in the environment. PCDD/Fs can be found in many environmental matrices such as soils, sediments, air, and water.

In this work we present the use of our new GC-MS column, the CC-5 MS Xil, with a 0.15mm ID, 30m configuration, that will provide enhanced separation of almost all highly toxic 2,3,7,8-PCDD/Fs from other isomers, while also significantly speeding up the GC-HRMS analysis of Dioxins and Furans, with exceptional peak shape thank to our unsurpassed inertness of our surface treatment.

Abbreviatons:

| | |
|---|---|
| PCDDs | Polychlorinated Dibenzo-p-dioxins |
| PCDFs | Polychlorinated Dibenzofurans |
| TCDD | Tetrachloro Dibenzo-p-dioxin |
| HRMS | High Resolution Mass Spectrometry |

CC-5 MS Xil GC column meets the USP G27 and G36 requirements

Accredited Methods:

EPA Method 1613b
EPA Method 1668
EPA Method 8280, 8290

EN 1948-1
EN 1948-2
EN 1948-3

JSA JIS K 0311:2005
JSA JIS K 0312



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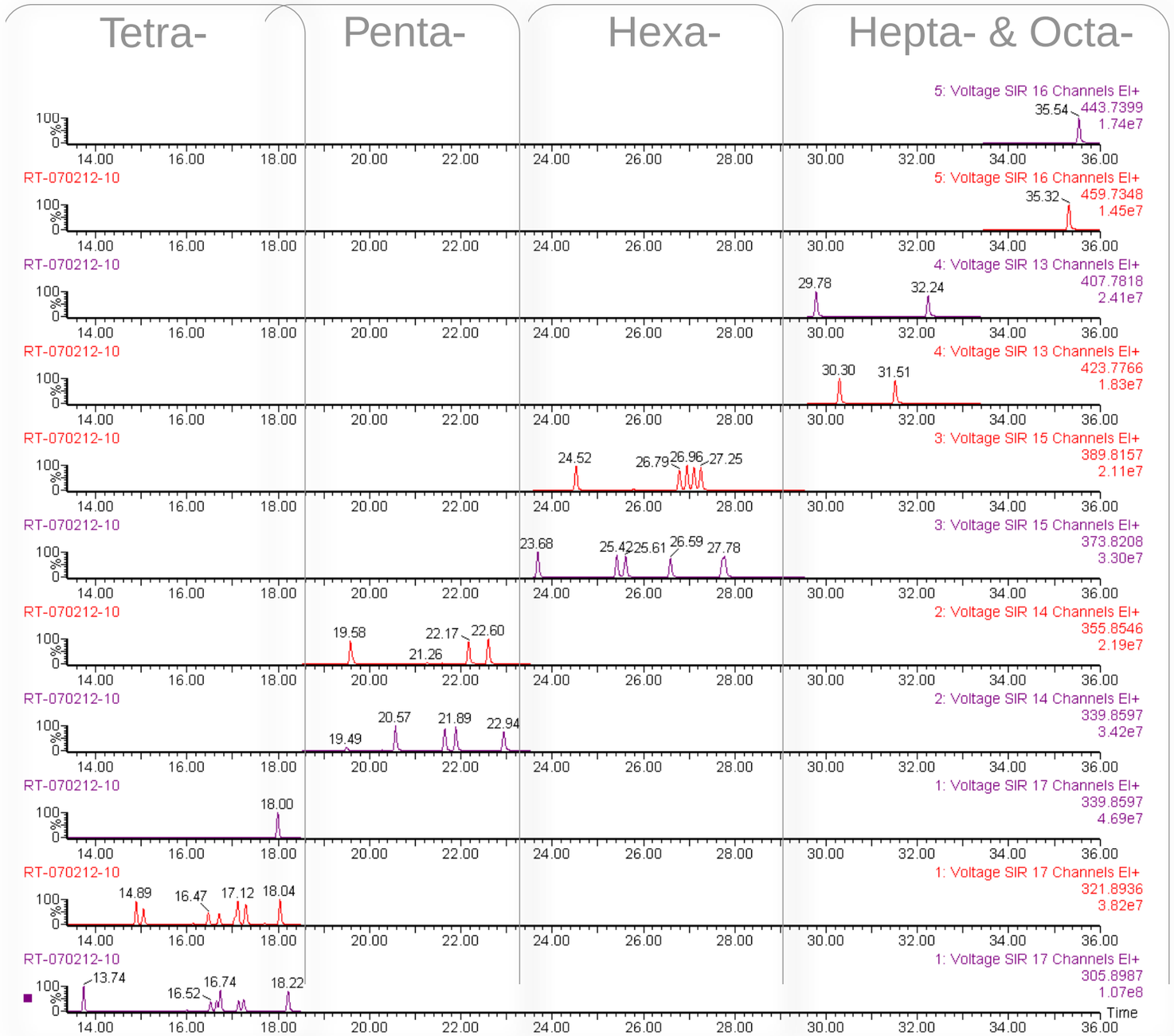
# PCDDs & PCDFs

isomers

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Click on each part of the chromatogram to zoom in.

Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

Legend

Furans isomers (PCDFs)

Dioxins isomers (PCDDs)




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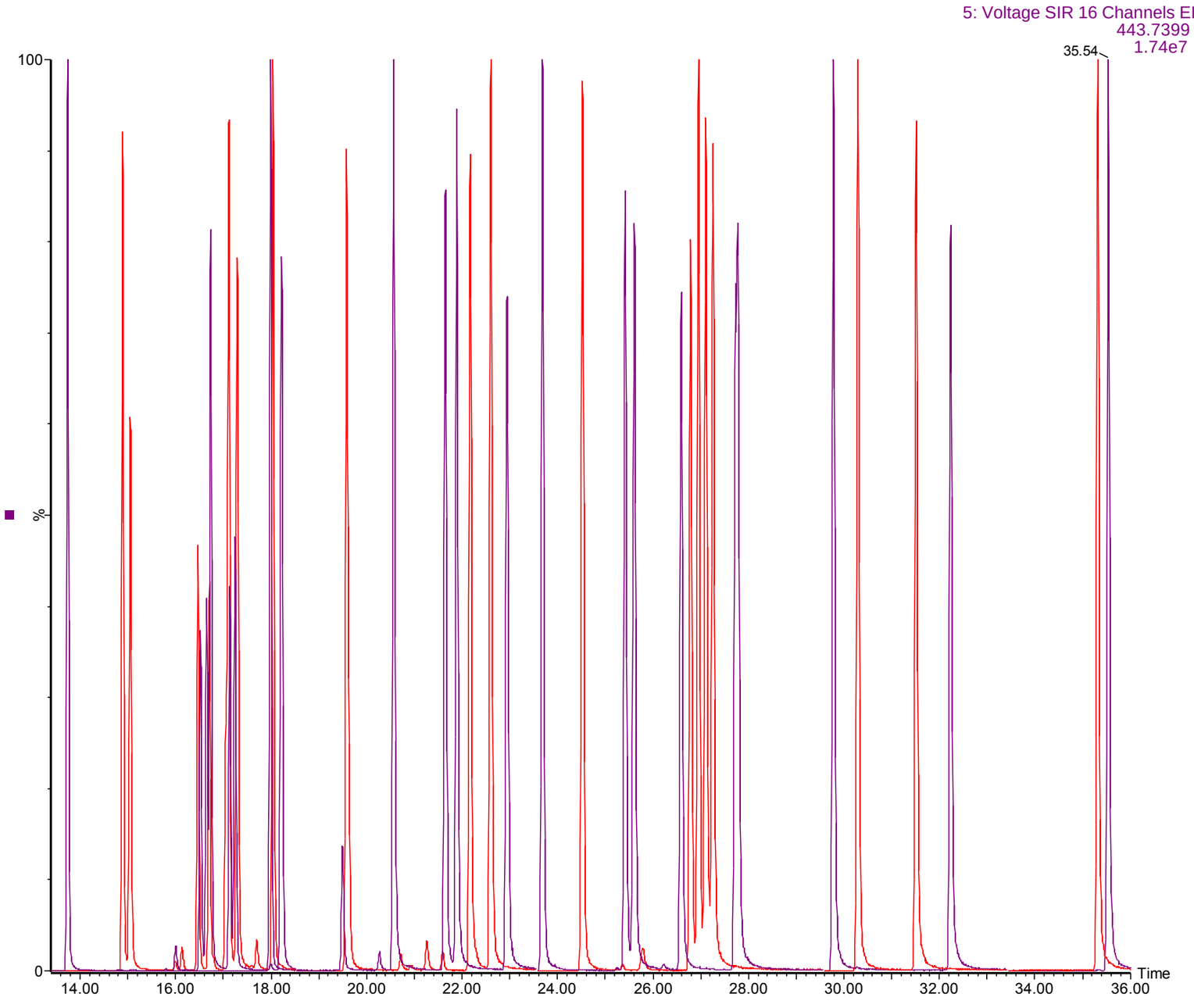
# PCDDs & PCDFs

## isomers




This chromatogram represents an overlay of the SIM Groups projections of the previous slide.

Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

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Legend

Furans isomers (PCDFs)
Dioxins isomers (PCDDs)



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# TCDDs & TCDFs

## isomers

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Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

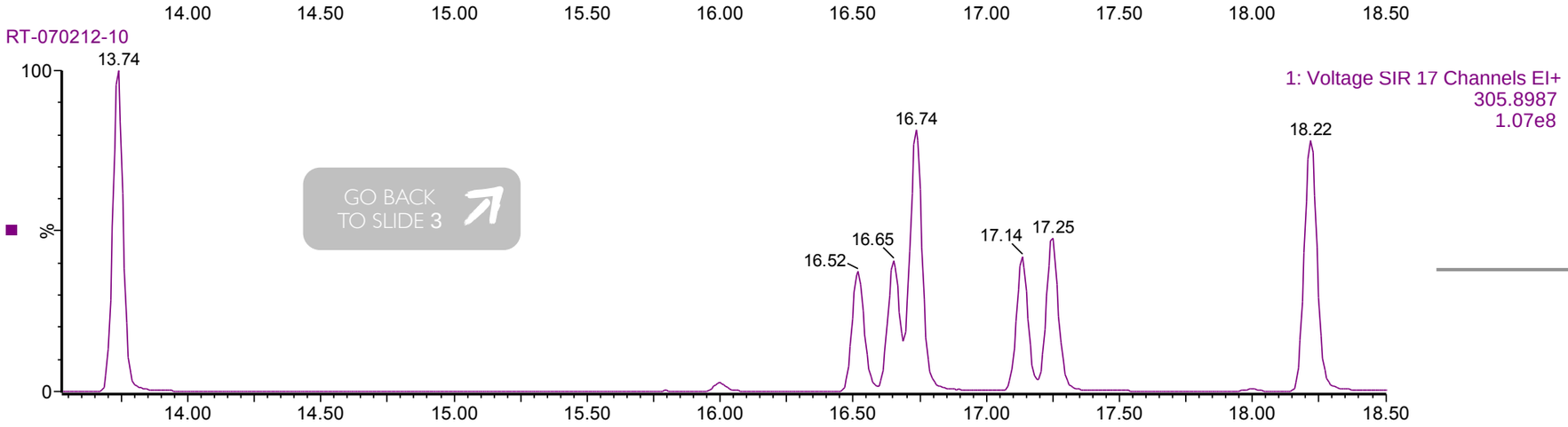
P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:
Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

Legend

Tetra-Furans isomers (TCDFs)

Tetra-Dioxins isomers (TCDDs)




13.74 - 1,3,6,8 - TCDF
16.52 - 2,3,4,7 - TCDF
16.65 - 2,3,4,8 - TCDF
16.74 - 2,3,7,8 - TCDF
17.14 - 1,2,6,9 - TCDF
17.25 - 1,2,3,9 - TCDF
18.22 - 1,2,8,9 - TCDF

14.89 - 1,3,6,8 - TCDD
15.05 - 1,3,7,9 - TCDD
16.47 - 1,4,7,8 - TCDD
16.71 - 1,2,3,4 - TCDD

17.12 - 1,2,3,7 + 1,2,3,8 + 1,2,3,9 - TCDDs
17.29 - 2,3,7,8 - TCDD
18.04 - 1,2,8,9 - TCDD

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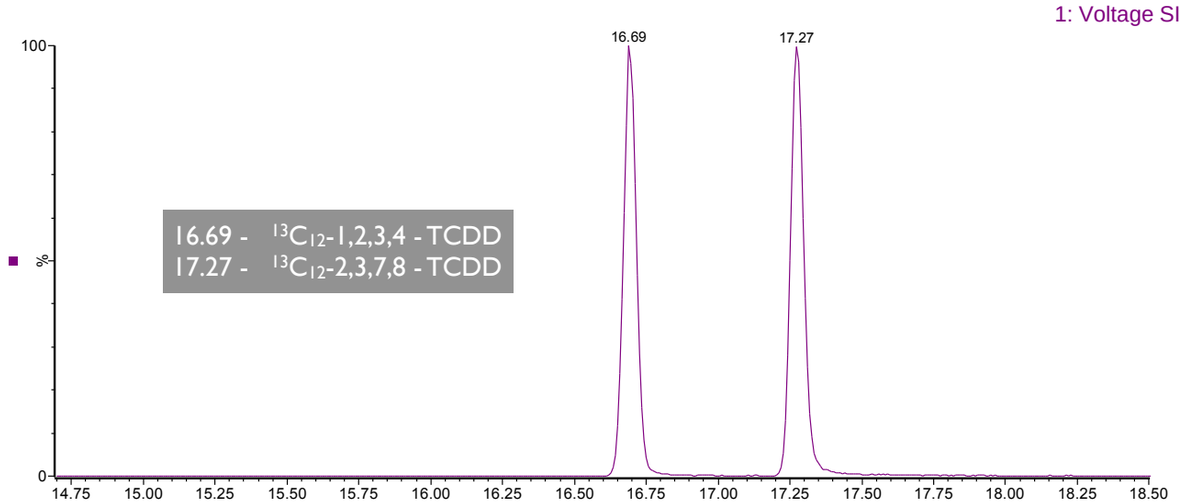
# TCDDs

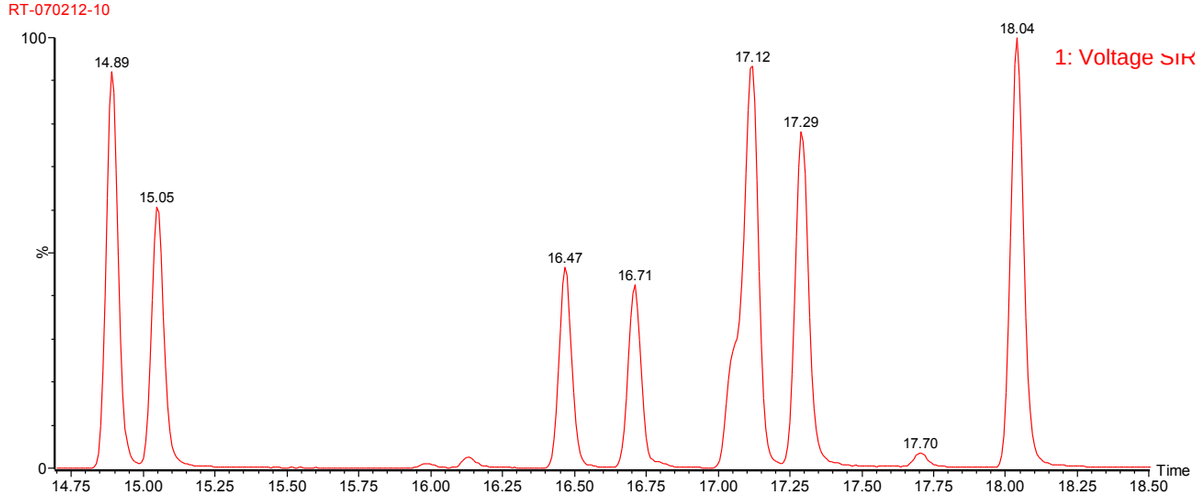
## isomers

Column: CC MS Xil - 30m, 0.15mm, 0.10µm
with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:
Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.




meets and far exceeds the
EPA method 8280 resolution criteria

14.89 - 1,3,6,8 - TCDD
15.05 - 1,3,7,9 - TCDD
16.47 - 1,4,7,8 - TCDD
16.71 - 1,2,3,4 - TCDD

17.12 - 1,2,3,7 + 1,2,3,8 + 1,2,3,9 - TCDDs
17.29 - 2,3,7,8 - TCDD
18.04 - 1,2,8,9 - TCDD

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# PeCDDs & PeCDFs

## isomers

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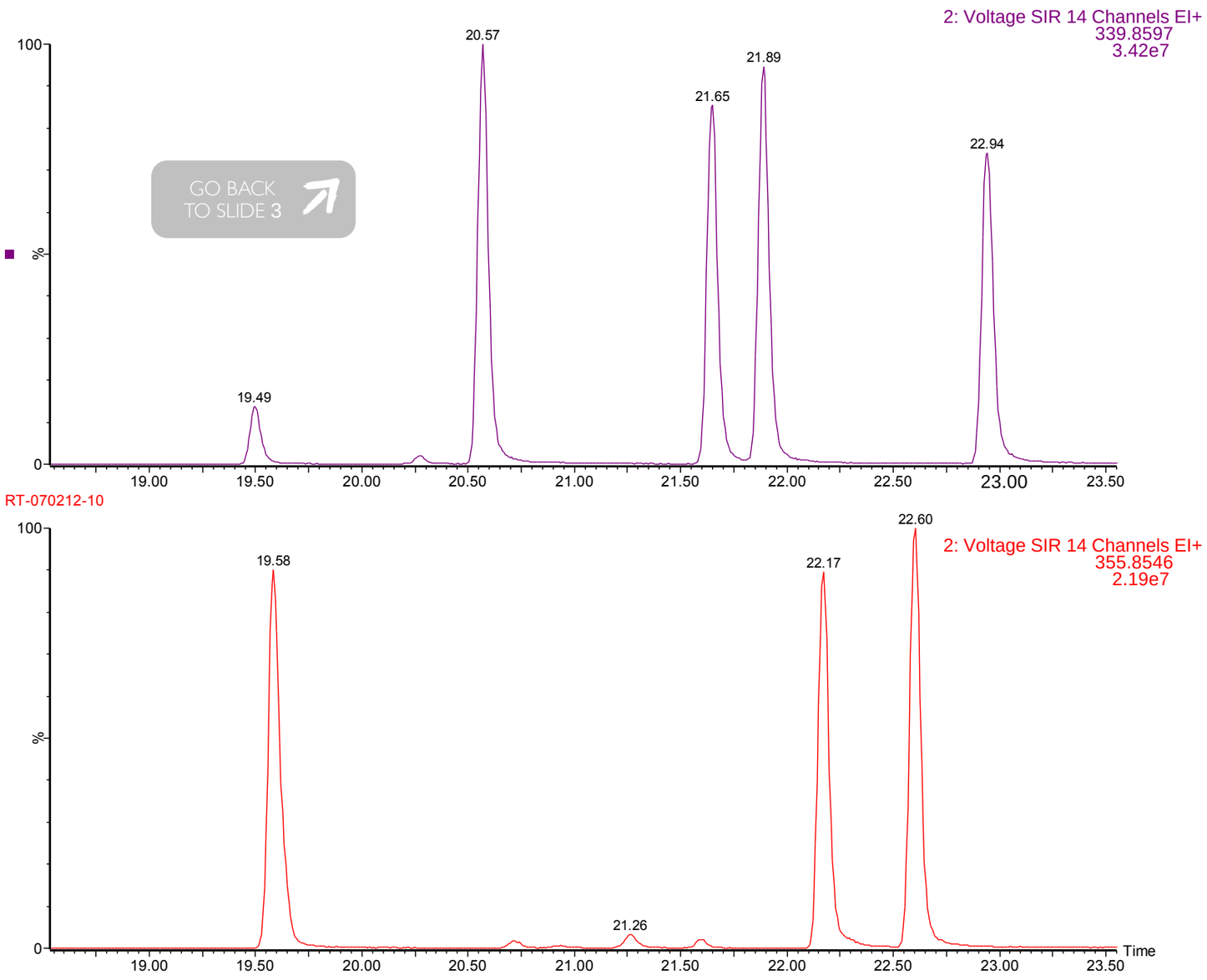


Column: CC MS Xil - 30m, 0.15mm, 0.10µm
with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

19.49 - 1,2,3,6,8 - PeCDF
19.58 - 1,2,4,7,9 - PeCDD
20.57 - 1,2,3,7,8 - PeCDF
21.65 - 2,3,4,6,7 - PeCDF
21.89 - 2,3,4,7,8 - PeCDF
22.17 - 1,2,3,7,8 - PeCDD
22.60 - 1,2,3,8,9 - PeCDD
22.94 - 1,2,3,8,9 - PeCDF

Legend

Penta-Furans isomers (PeCDFs)
Penta-Dioxins isomers (PeCDDs)




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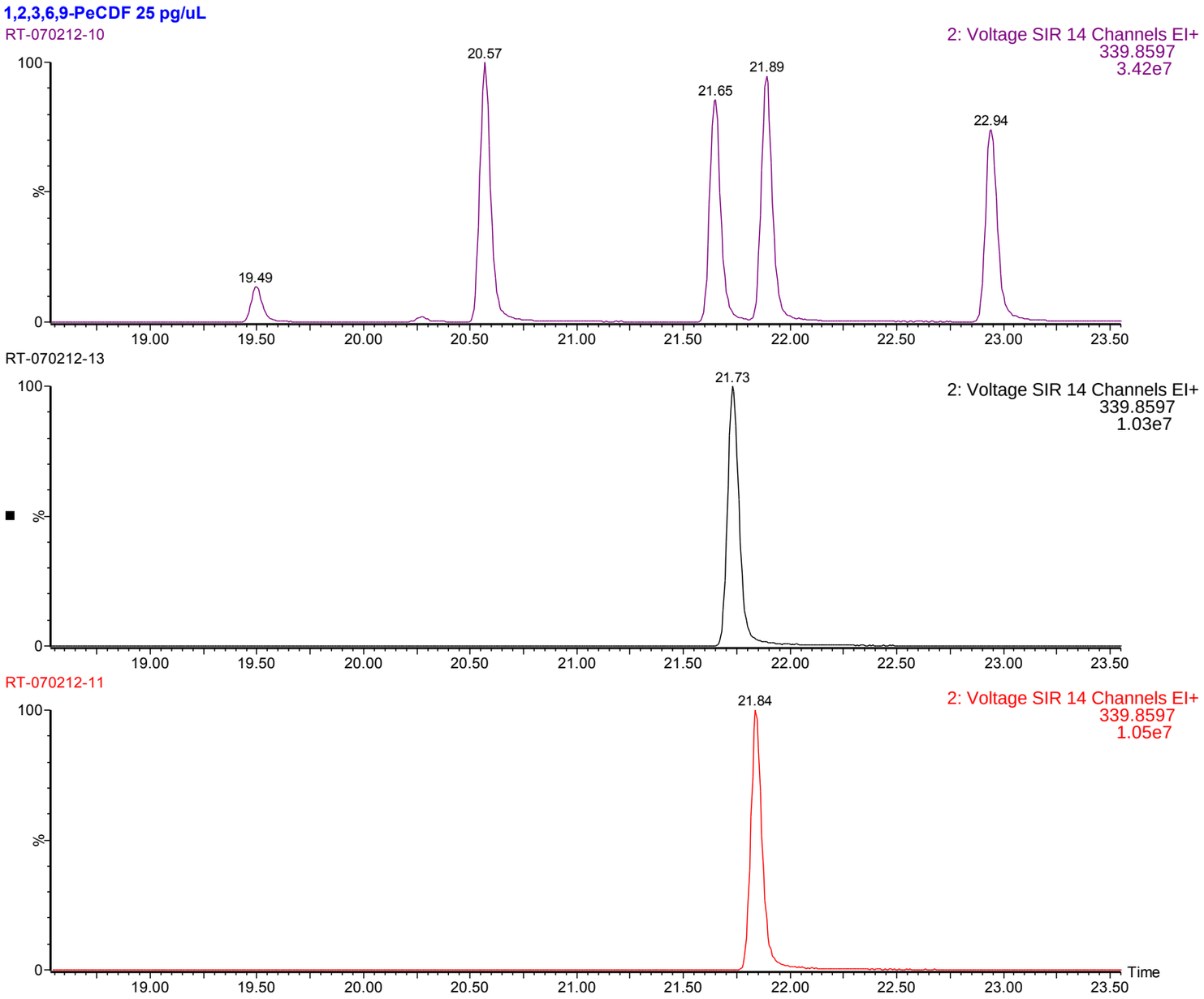
# PeCDFs

## isomers




Column: CC MS Xil - 30m, 0.15mm, 0.10µm
with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

19.49 - 1,2,3,6,8 - PeCDF
20.57 - 1,2,3,7,8 - PeCDF
21.65 - 2,3,4,6,7 - PeCDF
21.73 - 1,2,3,6,9 - PeCDF
21.84 - 1,2,4,8,9 - PeCDF
21.89 - 2,3,4,7,8 - PeCDF
22.94 - 1,2,3,8,9 - PeCDF

Sample

All TCDFs presents in Wellington Laboratories capillary column performance test mixture (Wellington Labs. catalog code: TDTFWD), except:

1,2,3,6,9 – PeCDF (@ 25 pg/uL in nonane)
1,2,4,8,9 – PeCDF (@ 25 pg/uL in nonane)

from Cambridge Isotope Labs.



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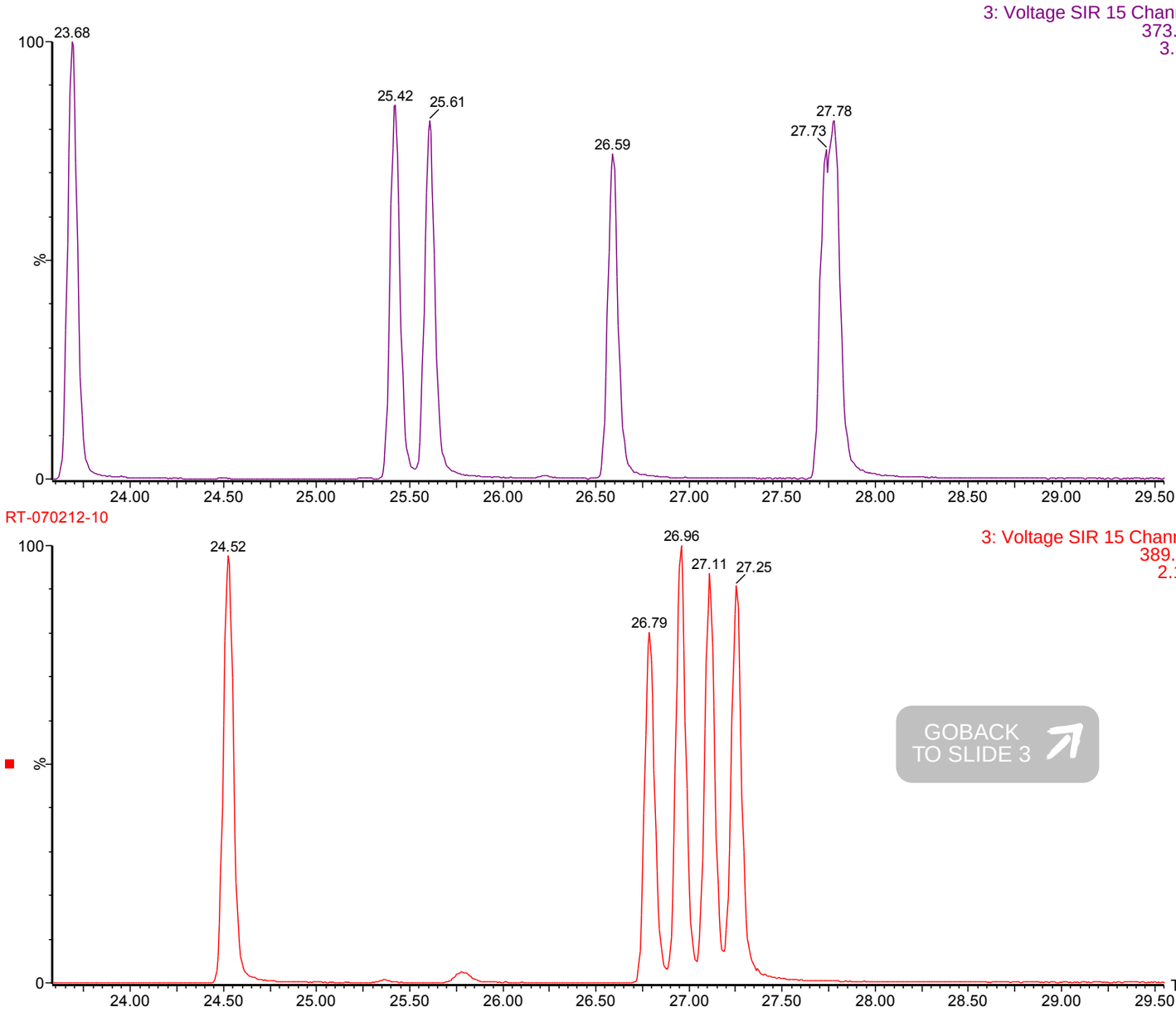
# HxCDDs & HxCDFs

## isomers




GOBACK TO SLIDE 3

Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

23.68 - 1,2,3,4,6,8 - HxCDF
24.52 - 1,2,4,6,7,9 - HxCDD
25.42 - 1,2,3,4,7,8 - HxCDF
25.61 - 1,2,3,6,7,8 - HxCDF
26.59 - 2,3,4,6,7,8 - HxCDF
26.79 - 1,2,3,4,7,8 - HxCDD
26.96 - 1,2,3,6,7,8 - HxCDD
27.11 - 1,2,3,4,6,7 - HxCDD
27.25 - 1,2,3,7,8,9 - HxCDD
27.73 - 1,2,3,7,8,9 - HxCDF
27.78 - 1,2,3,4,8,9 - HxCDF

Legend

Hexa-Furans isomers (HxCDFs)
Hexa-Dioxins isomers (HxCDDs)



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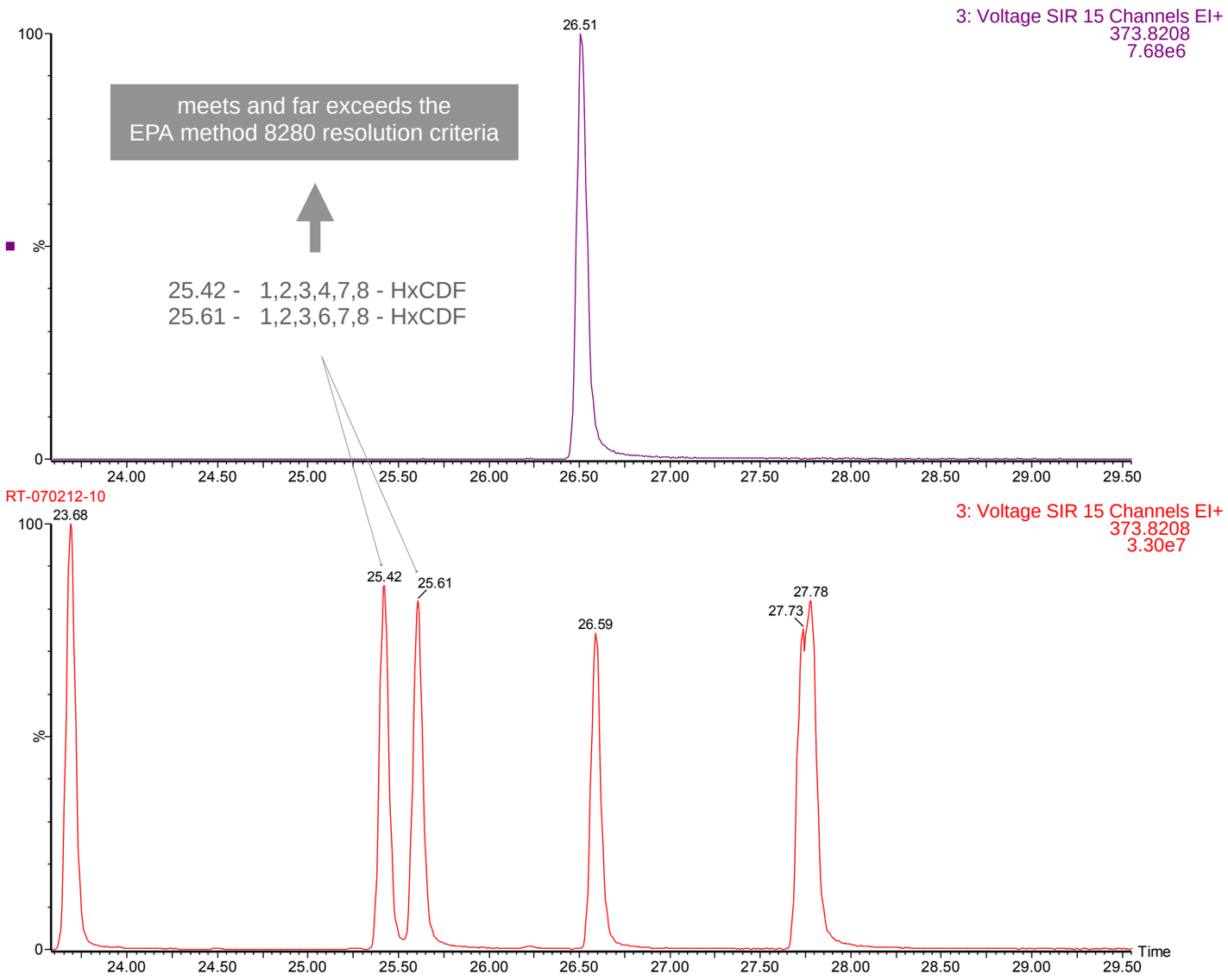
# HxCDFs

## isomers




Column: CC MS Xil - 30m, 0.15mm, 0.10µm
with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

23.68 - 1,2,3,4,6,8 - HxCDF
25.42 - 1,2,3,4,7,8 - HxCDF
25.61 - 1,2,3,6,7,8 - HxCDF
26.51 - 1,2,3,6,8,9 - HxCDF
26.59 - 2,3,4,6,7,8 - HxCDF
27.73 - 1,2,3,7,8,9 - HxCDF
27.78 - 1,2,3,4,8,9 - HxCDF

Sample

All TCDFs presents in Wellington Laboratories capillary column performance test mixture (Wellington Labs. catalog code: TDTFWD), except:

1,2,3,6,8,9 – HxCDF (@ 25 pg/uL in nonane)

from Cambridge Isotope Labs.

# Hepta- & Octa-

*PCDDs & PCDFs isomers*

CC Columns for GC applications

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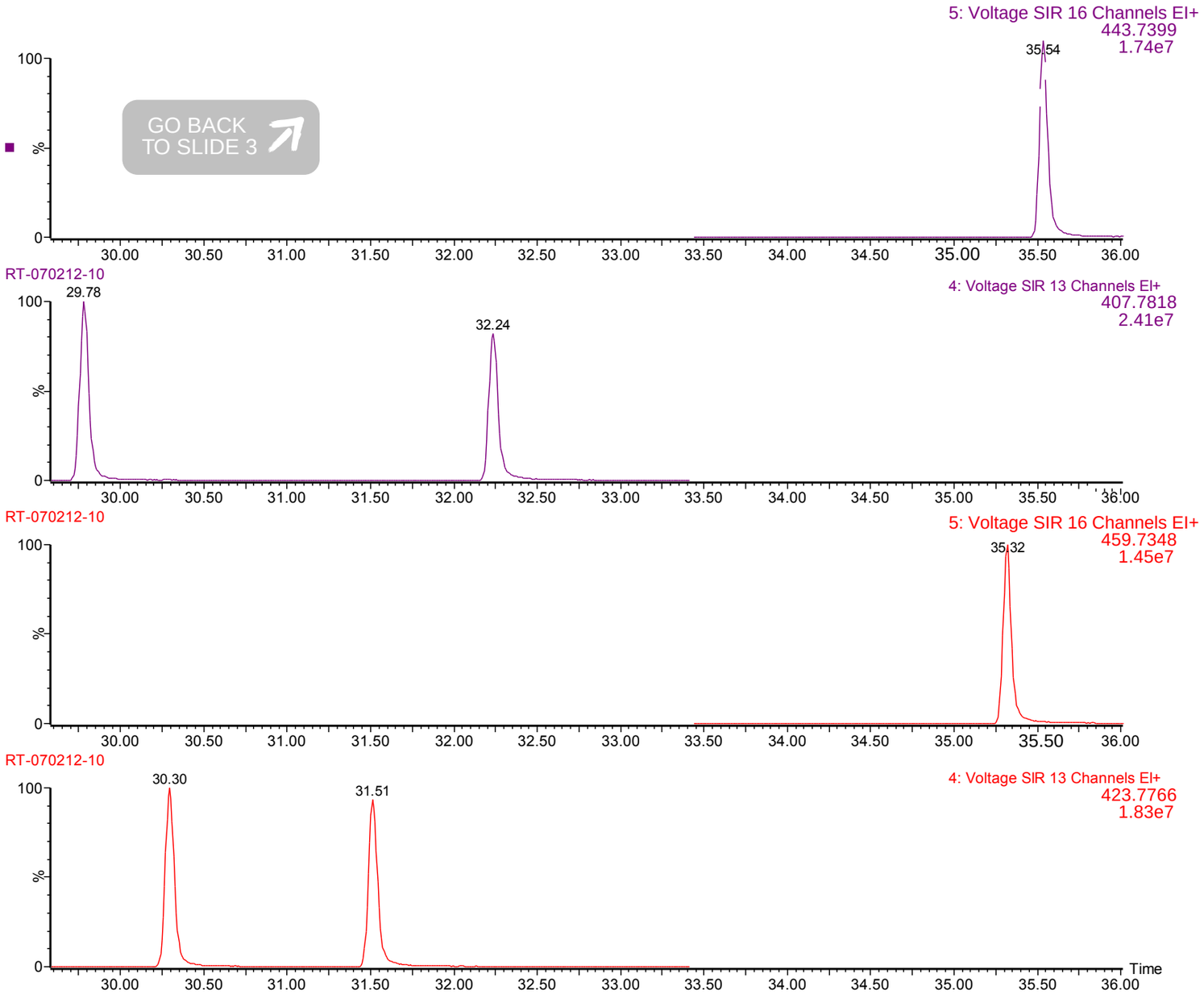


Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.

Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.

Injector: direct deactivated glass liner, heated @ 260°C.

29.78 - 1,2,3,4,6,7,8 - HpCDF
30.30 - 1,2,3,4,6,7,9 - HpCDD
31.51 - 1,2,3,4,6,7,8 - HpCDD
32.24 - 1,2,3,4,7,8,9 - HpCDF
35.32 - OCDD
35.54 - OCDF

Legend

Furans isomers (HpCDFs & OCDF)

Dioxins isomers (HpCDDs & OCDD)




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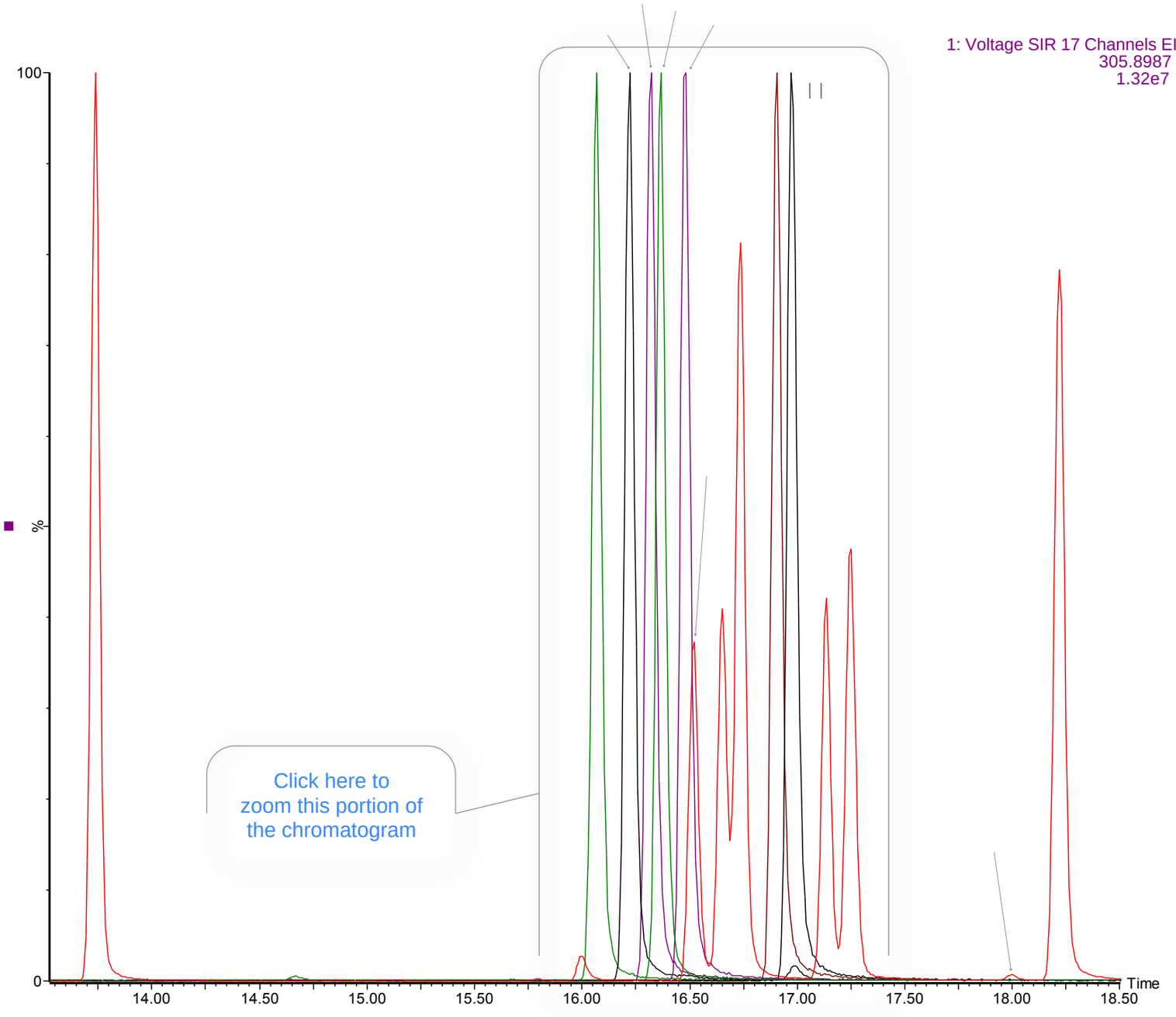
# TCDFs






Column: CC MS Xil - 30m, 0.15mm, 0.10µm
with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

Sample

All TCDFs presents in Wellington Laboratories capillary column performance test mixture (Wellington Labs. catalog code: TDTFWD), except:

2. 1,3,4,9 – TCDF (@ 25 pg/uL in nonane)
3. 1,2,6,7 – TCDF (@ 25 pg/uL)
4. 2,3,4,6 – TCDF (@ 25 pg/uL)
5. 1,2,4,9 – TCDF (@ 25 pg/uL)
6. 1,2,7,9 – TCDF (@ 25 pg/uL)
10. 3,4,6,7 – TCDF (@ 25 pg/uL)
2,3,6,7 – TCDF (@ 25 pg/uL)

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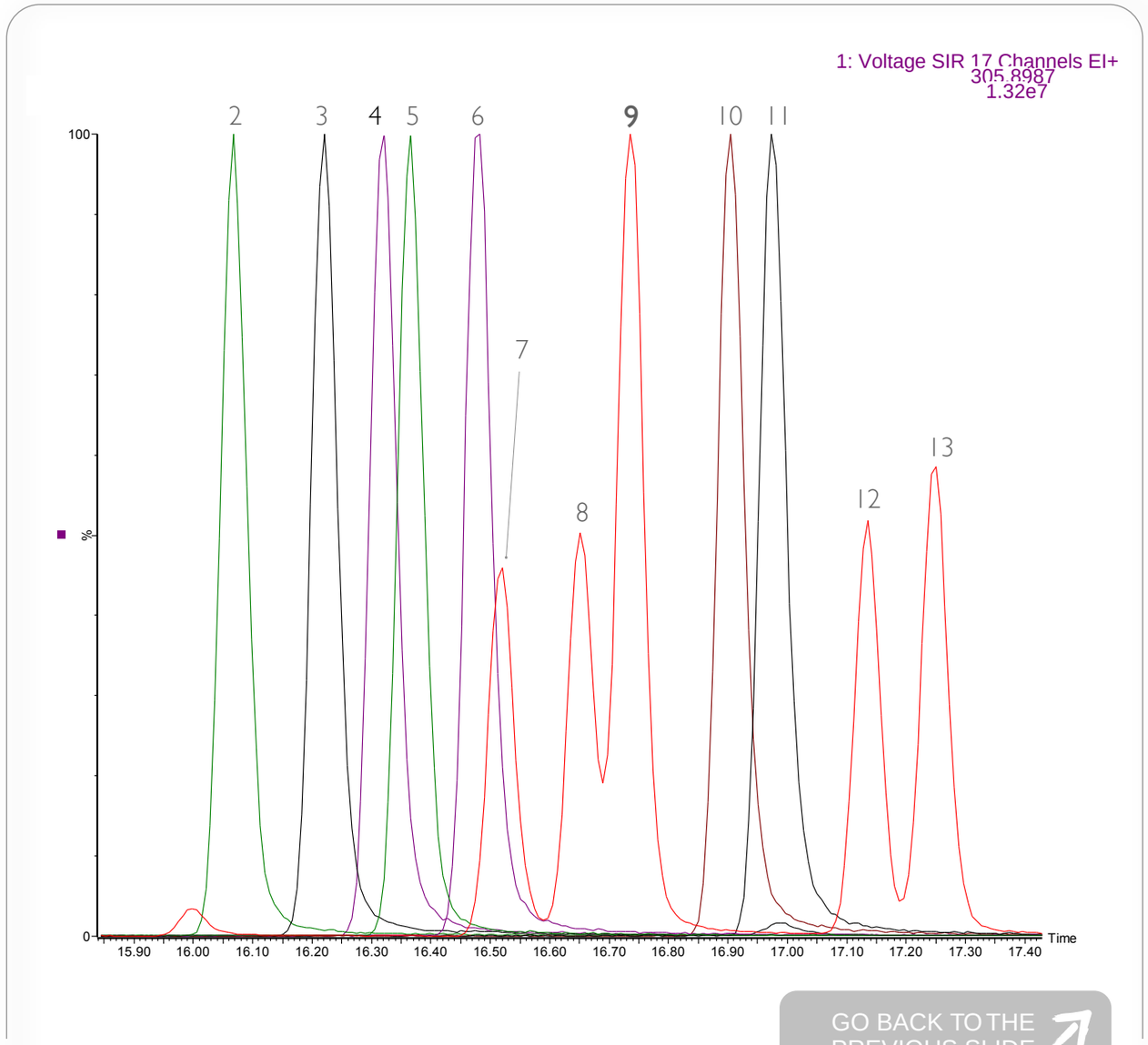
# TCDFs






GO BACK TO THE PREVIOUS SLIDE

Column: CC MS Xil - 30m, 0.15mm, 0.10µm with retention gap integrated

P/N: CC-5MS-XIL-30-015-010/2.5mt

Conditions:

Oven Program: 160°C, 10°C/min, 190°C, 2.5°C/min, 255°C, 4°C/min, 310°C.
Carrier Gas: Helium pressure programmed from 400kPa to 526kPa @ 3kPa/min.
Injector: direct deactivated glass liner, heated @ 260°C.

2. 1,3,4,9 - TCDF
3. 1,2,6,7 - TCDF
4. 2,3,4,6 - TCDF
5. 1,2,4,9 - TCDF
6. 1,2,7,9 - TCDF
7. 2,3,4,7 - TCDF
8. 2,3,4,8 - TCDF
9. 2,3,7,8 - TCDF
10. 3,4,6,7 - TCDF
11. 2,3,6,7 - TCDF
12. 1,2,6,9 - TCDF
13. 1,2,3,9 - TCDF

# CC Columns
## for GC applications

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