



FAST - GC
solutions

improve Your FAST-GC analysis

since
1980 

What is FAST-GC.

FAST-GC is a technique that allows you to reduce the analysis time while keeping an adequate resolution power, thus increasing your throughput.

FAST-GC can be applied to medium-to-high complexity mixtures analysis and provides 3-10x faster analysis compared to conventional GC.

What you need to make FAST-GC.

To accomplish the FAST-GC you will simply need:

- a shorter column with a smaller internal diameter (so-called “narrow-bore” columns). Typically a 100µm ID x 5 or 10m length columns are used.
- an high temperature rate (usually more than 15°C/min) and a fast acquisition frequency on your detector (see Figure 1 to see how the acquisition frequency does affect the peak shape in FAST-GC).

Just contact us at info@mega.mi.it to have more information.

Some fundamental theoretical notion to better understand FAST-GC.

The parameter that best describes the theoretical separation power of a gas-chromatographic capillary column is the **number of the theoretical plates (N)**.

N is calculated as:

$$N = \frac{L}{H}; \quad (H \sim ID)$$

where L is the column length and H is the height of the theoretical plates that can be approximated very well with the column's internal diameter (ID).

Is then easy to calculate that a conventional column 0.25mm ID x 25m has 100000 theoretical plates (N). But reducing the internal diameter of the column, we can keep constant the value of N reducing the length of the column. In fact a 100µm ID x 10m has as well 100000 theoretical plates that is the same separation power provided by a conventional GC column.

Narrow bore short columns consent to use high temperature rates and high linear velocities maintaining optimal conditions during the practical usage. That is why, to reduce columns sizes allows to speed up your analysis while retaining a proper separation level.

The importance of the selectivity of the stationary phase in FAST-GC.

The selectivity of the stationary phase is a **key parameter** in gas-chromatography. It takes an even more important role in FAST-GC, where it helps to compensate a natural compression of the peaks, in particular of critical pairs of peaks, in the very short “fast” analysis time.

Have the right selectivity gives the way to solve even very difficult analytical problems but keeping all the advantages of the FAST-GC technique.

In the following pages you will find some application notes where the selectivity of the stationary phase has been investigated and where its role is emphasized.

Conventional GC

Column:

usually columns 0.25mm/0.32mm I.D. x 25m, 30m or 50m length.

Temperature Rates:

1 - 15°C/min.

Injection:

using standard injection techniques, is possible to inject quite large quantities (typically 1 - 2µL of a diluted solution with a split ratio of 1:20).

Carrier Gas:

typical flows are not less than 0.8mL/min with head pressures of 40 - 130kPa depending on column dimensions and carrier gas type (visit the "support-download" page on www.mega.mi.it to see and download the table with the recommended pressures and flows).

Peak Width:

2 - 5 seconds.

Detector:

any type of detector for GC can be used.

Analysis Time:

20 - 60 min.

FAST-GC

Column:

usually columns 0.05mm/0.10mm I.D. x 2.5m, 5m or 10m length.

Temperature Rates:

15 - 60°C/min.

Injection:

the injected quantity has to be at least 10x less than conventional GC. Usually split ratio of 1:100 or higher are used with diluted solutions (< 100ppm).

Carrier Gas:

typical flows do not exceed 0.9 - 1 mL/min with higher head pressures (until 200-250kPa for 0.10mm I.D. columns, and until 300kPa or more for 0.05mm I.D. columns) anyway depending on column dimensions and carrier gas type (visit the "support-download" page on www.mega.mi.it to see and download the table with the recommended pressures and flows).

Peak Width:

0.5 - 2 seconds.

Detector:

any type of detector for GC can be used. It is only necessary that the acquisition frequency is at least 50Hz (see page 4, Figure 1).

Analysis Time:

1 - 10 min.

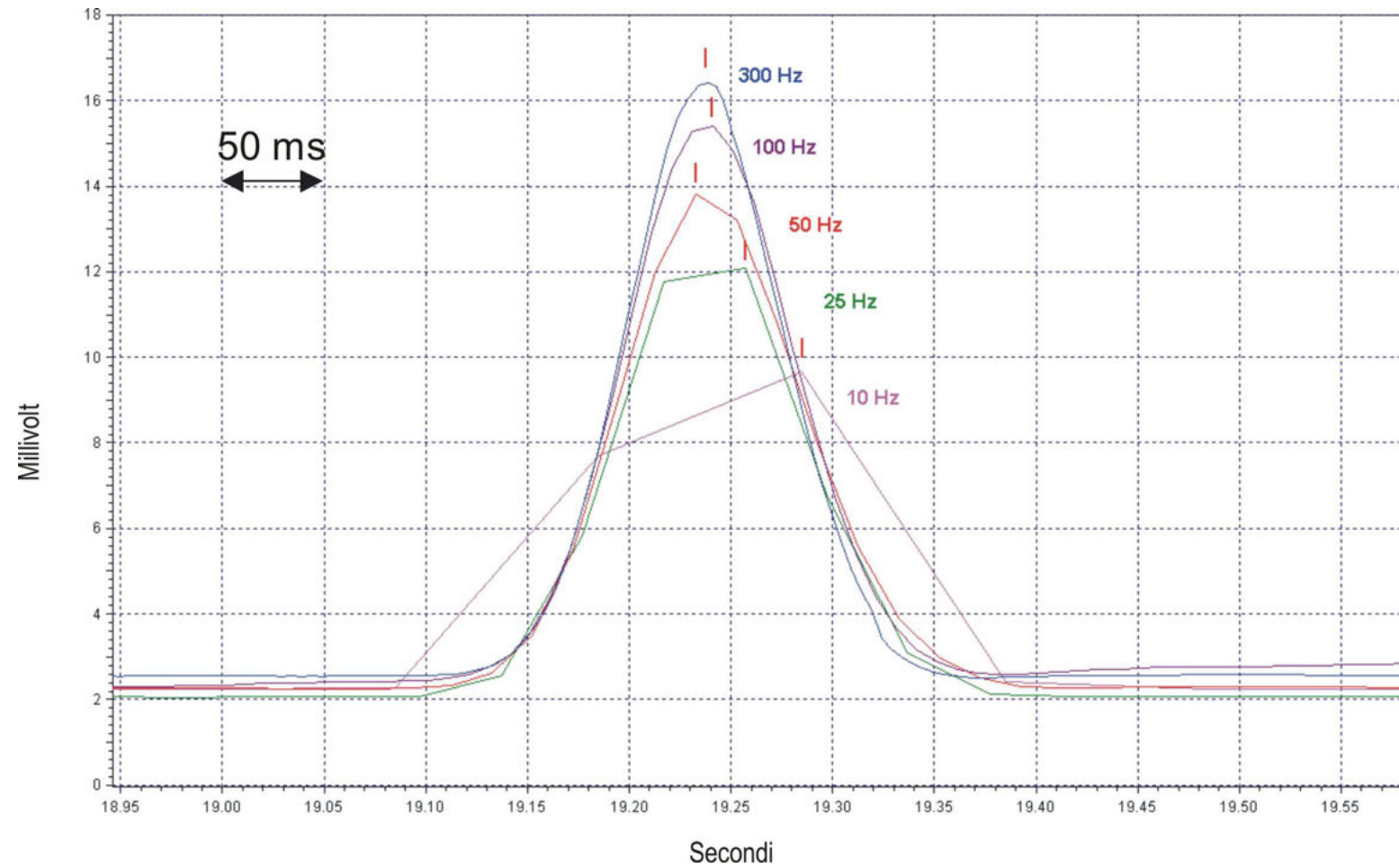
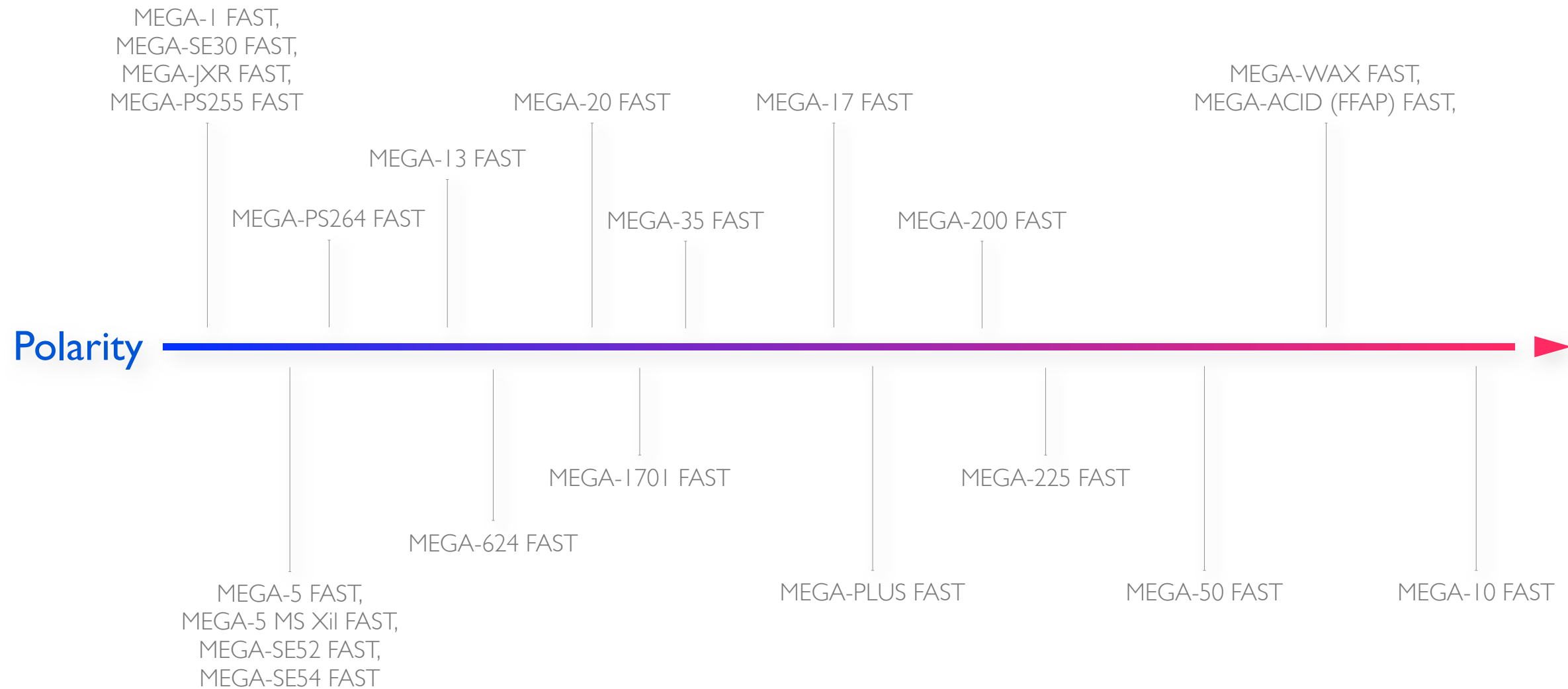


Figure 1 - Effect of the acquisition frequency on the peak shape. In FAST-GC, peaks could have very narrow width (even less than 500ms). For this reason is important to have an “high-speed” detector able to collect at least 10 points for every peak, thus to correctly describe the peak itself. In this way the peak can be properly integrated and quantified. **In FAST-GC an acquisition rate of at least 50Hz is recommended.**

Internal Diameter	Length	Film Thickness	Theoretical Plates (N)
50 μ m	2.5m	0.05 μ m, 0.10 μ m	50000
	5m		100000
100 μ m	5m	0.10 μ m, 0.20 μ m	50000
	10m		100000

Ask us for completely custom sizes and products. From over 30 years we offer ad-hoc personalized solutions for your particular GC analytical problem.
Just contact us!



And even more...our [MEGA-VOC 1 & 2 FAST](#) , [MEGA-POF 1 & 2 FAST](#) unique stationary phases, [MEGA-TNT 8095 FAST](#) and our exclusive [MEGA-DEX chiral columns FAST](#) line. Visit our website to find all our stationary phases and you can also ask us for custom solutions.

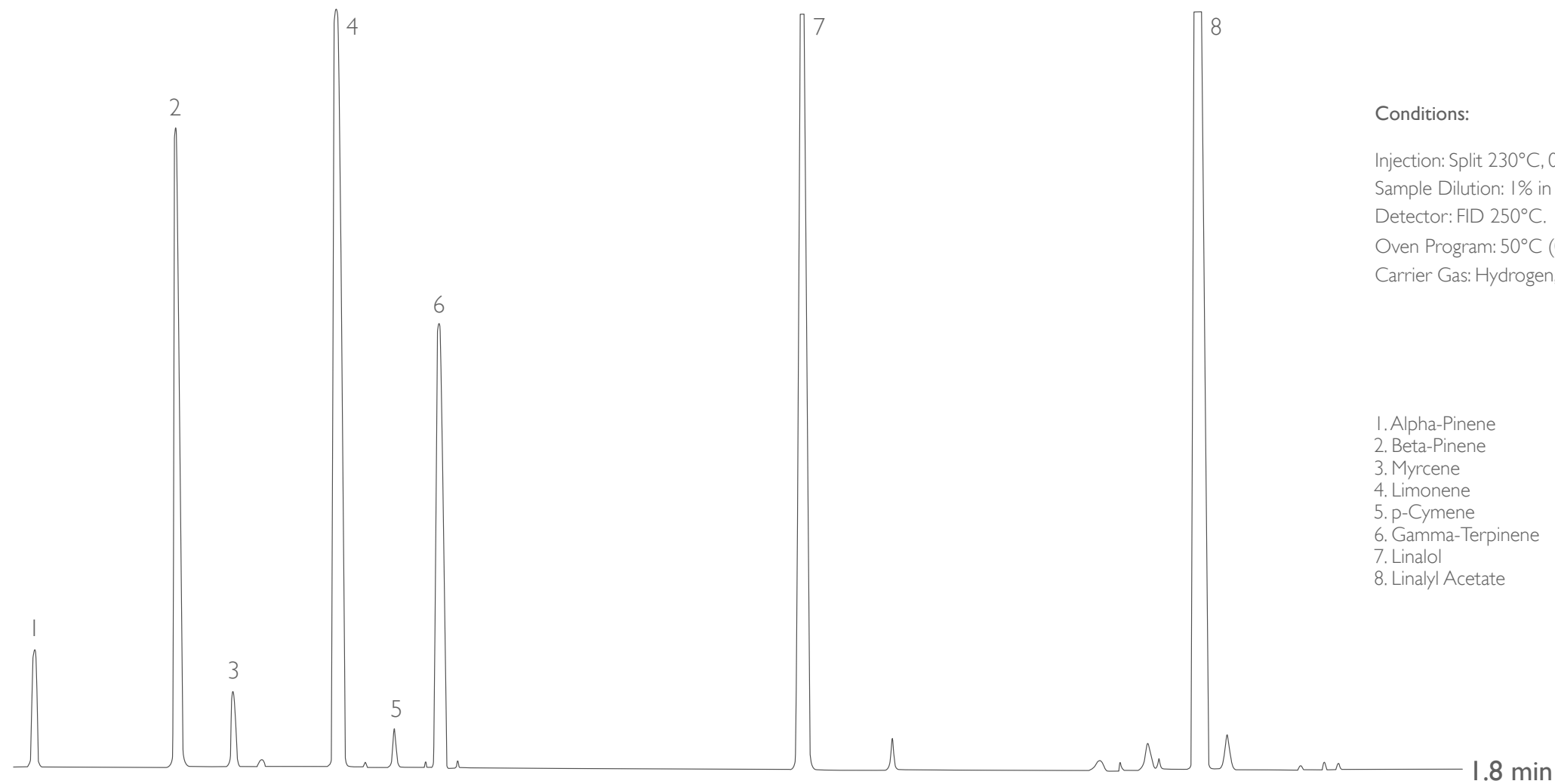
Considering the importance of the selectivity in FAST-GC, MEGA can offer more than 30 different stationary phases for your FAST-GC analysis. We are also able to tune the selectivity for your specific analytical needs with our MEGA-2D technology and using our experience in the mixed phases works [1], [2].

Bergamot Essential Oil

FAST-GC
solutions



Column: **MEGA-1701 FAST** - 0.10mm, 0.10µm, 5m
Catalog Code: F-1701-010-010-5



Conditions:

Injection: Split 230°C, 0.5µL, 1:250 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 50°C/min, 250°C.

Carrier Gas: Hydrogen, 0.5mL/min.

1. Alpha-Pinene
2. Beta-Pinene
3. Myrcene
4. Limonene
5. p-Cymene
6. Gamma-Terpinene
7. Linalol
8. Linalyl Acetate

Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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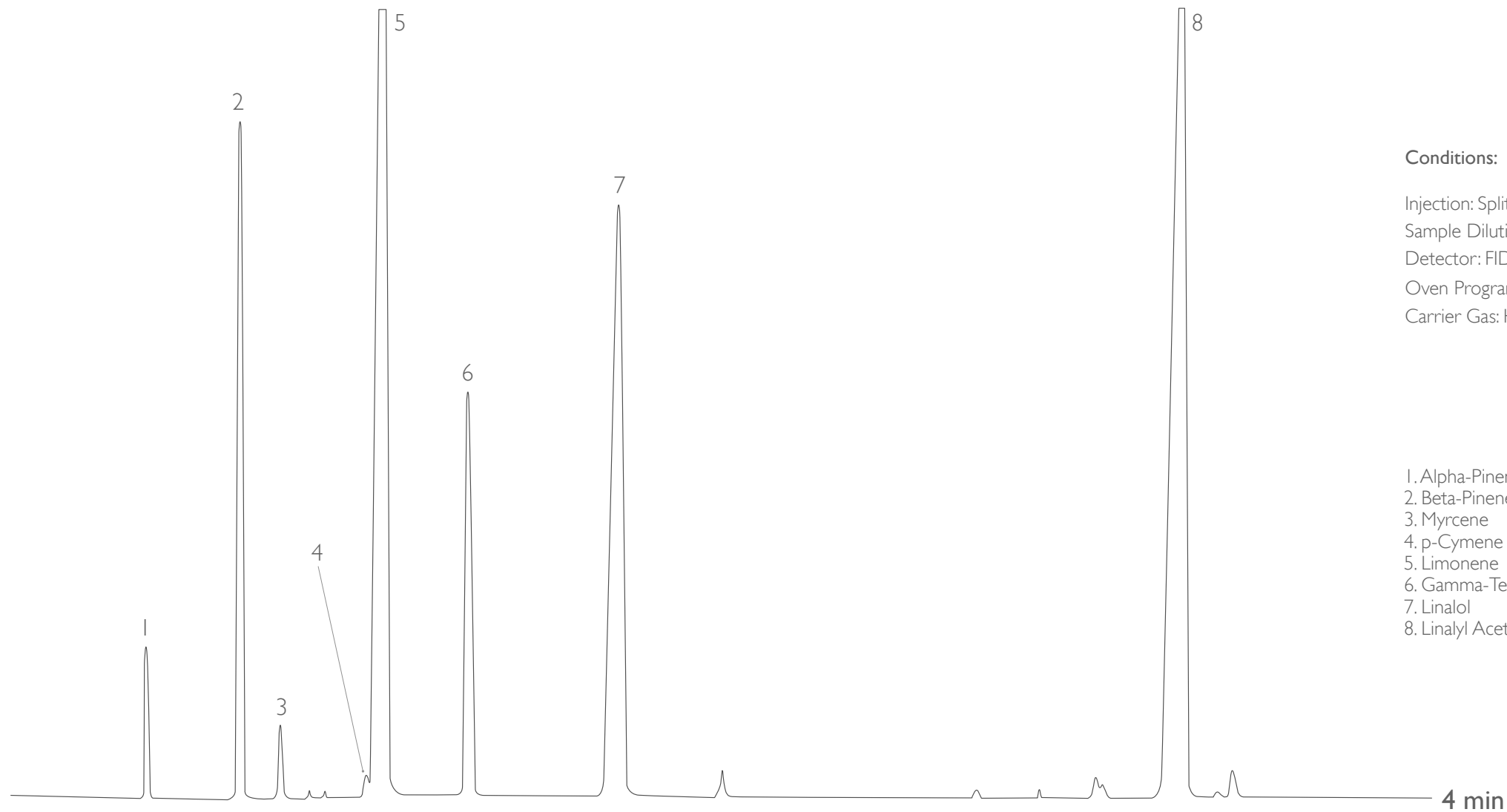
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Bergamot Essential Oil

FAST-GC
solutions



Column: **MEGA-SE54 FAST** - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-SE54-010-010-5



Conditions:

Injection: Split 230°C, 0.5 μ L, 1:250 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 30°C/min, 250°C.

Carrier Gas: Hydrogen, 0.5mL/min.

1. Alpha-Pinene
2. Beta-Pinene
3. Myrcene
4. p-Cymene
5. Limonene
6. Gamma-Terpinene
7. Linalol
8. Linalyl Acetate

Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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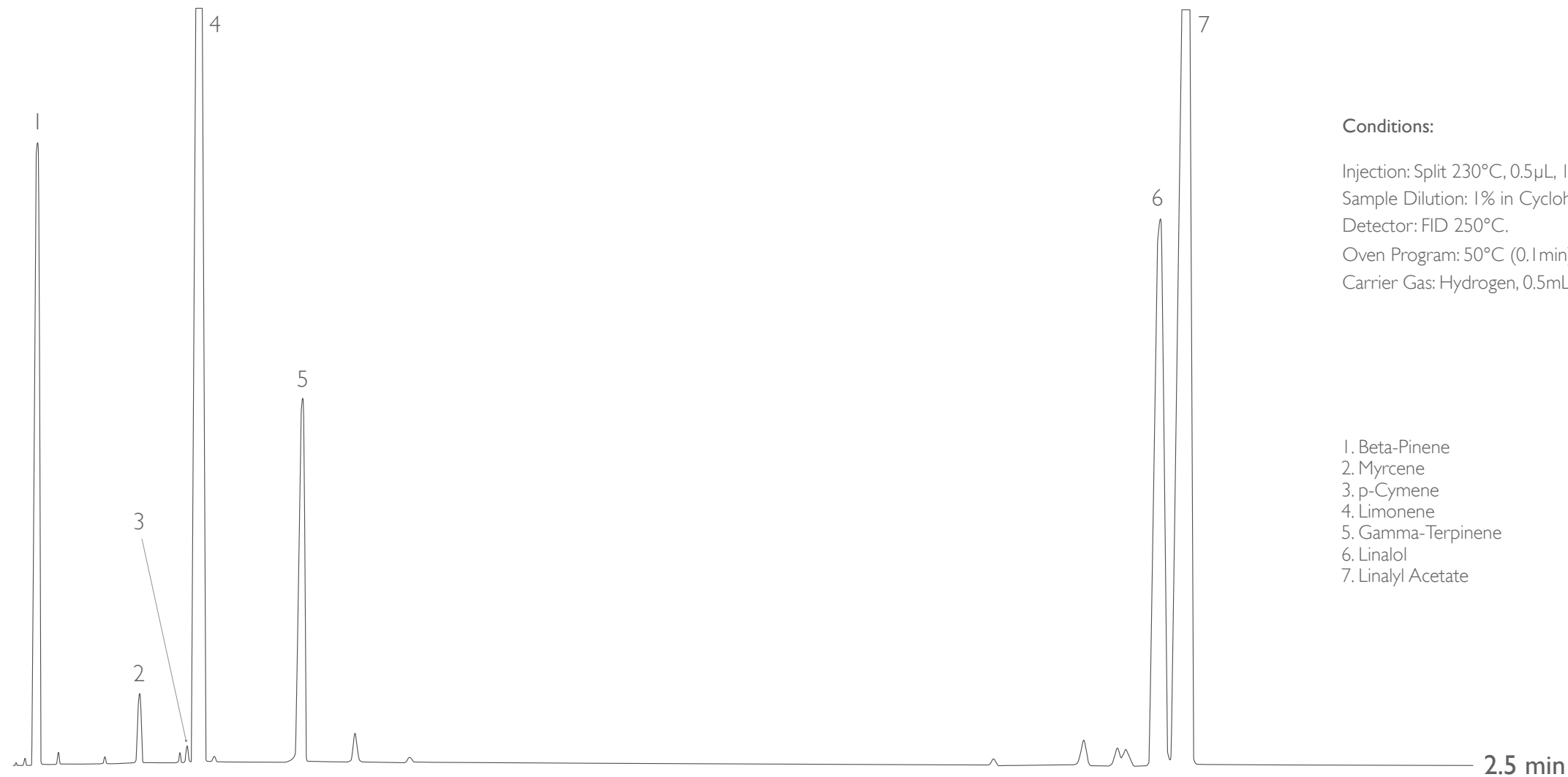
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Bergamot Essential Oil

FAST-GC
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Column: **MEGA-WAX FAST** - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-WAX-010-010-5



Conditions:

Injection: Split 230°C, 0.5 μ L, 1:250 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 30°C/min, 250°C.

Carrier Gas: Hydrogen, 0.5mL/min.

1. Beta-Pinene
2. Myrcene
3. p-Cymene
4. Limonene
5. Gamma-Terpinene
6. Linalol
7. Linalyl Acetate

Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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Chamomile Essential Oil

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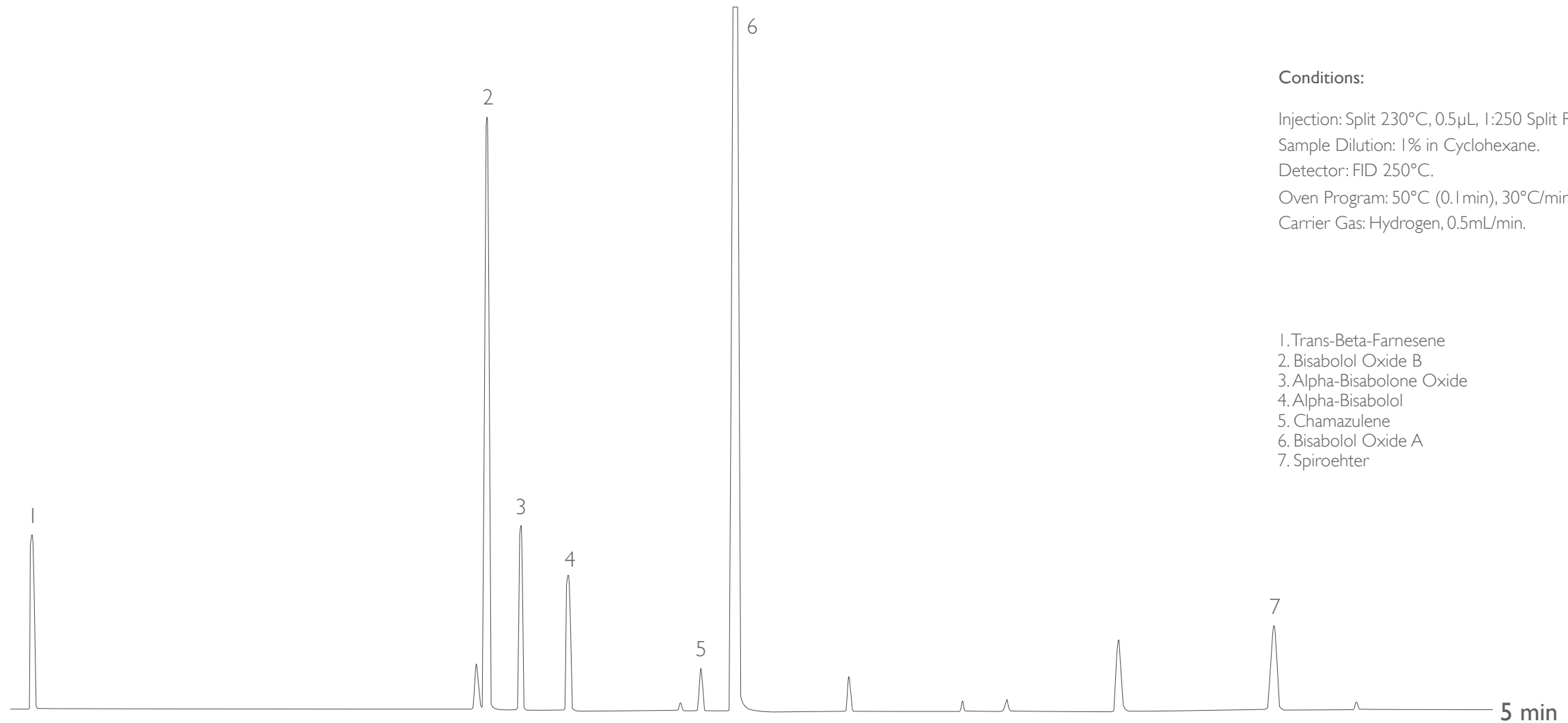


Column: **MEGA-WAX FAST** - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-WAX-010-010-5

Conditions:

Injection: Split 230°C, 0.5 μ L, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1 min), 30°C/min, 250°C.
Carrier Gas: Hydrogen, 0.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolone Oxide
4. Alpha-Bisabolol
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroether



Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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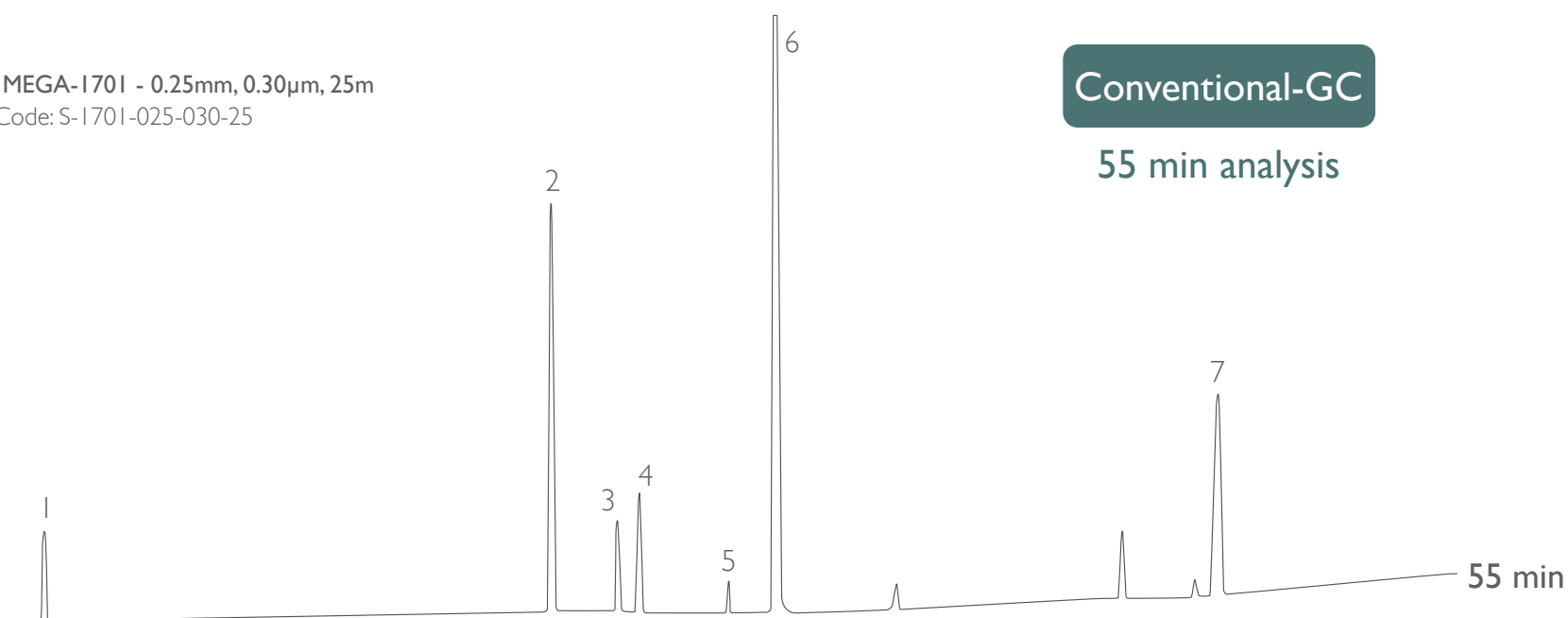
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Chamomile Essential Oil

FAST-GC
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Column: **MEGA-I701 - 0.25mm, 0.30 μ m, 25m**
Catalog Code: S-I701-025-030-25

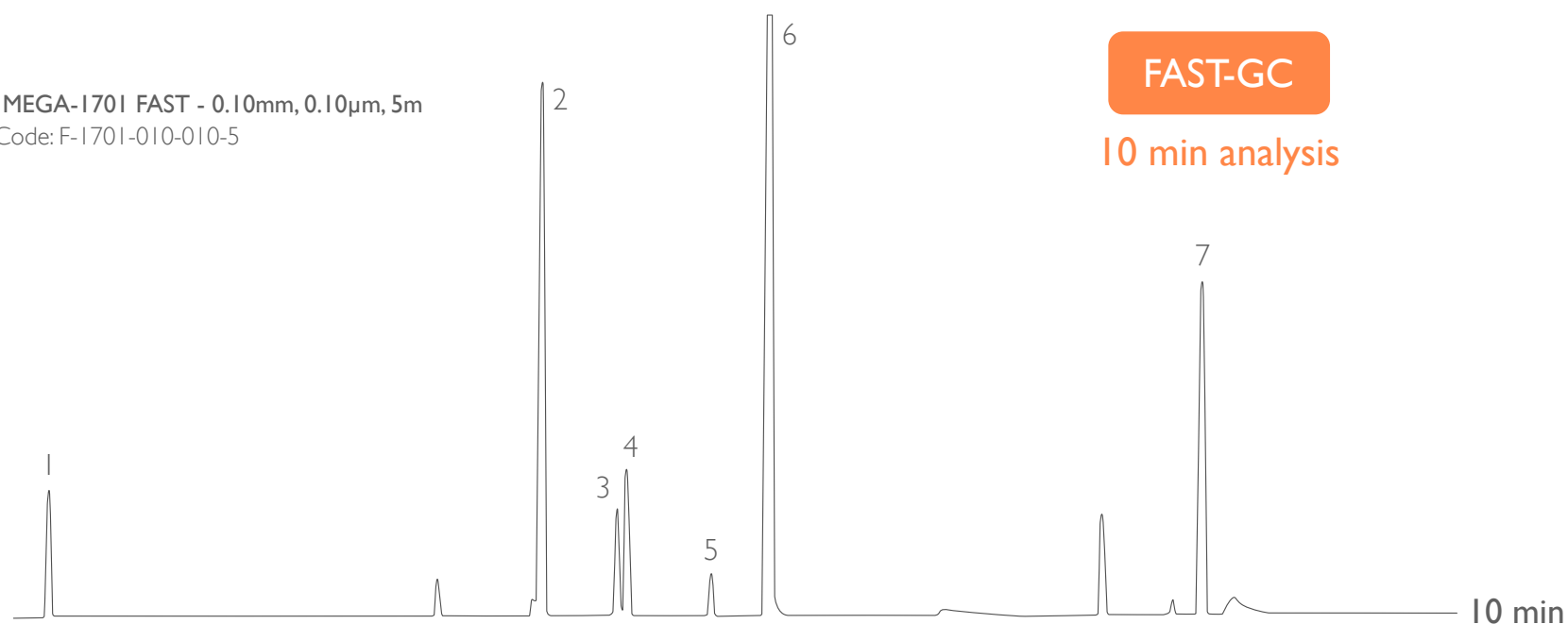


Conventional-GC Conditions:

Injection: Split 230°C, 1 μ L, 1:50 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1 min), 3°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 1.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolol
4. Alpha-Bisabolone Oxide
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroether

Column: **MEGA-I701 FAST - 0.10mm, 0.10 μ m, 5m**
Catalog Code: F-I701-010-010-5



FAST-GC Conditions:

Injection: Split 230°C, 0.5 μ L, 1:250 Split Ratio.
Sample Dilution: 1% in Cyclohexane.
Detector: FID 250°C.
Oven Program: 50°C (0.1 min), 50°C/min, 250°C (5min).
Carrier Gas: Hydrogen, 0.5mL/min.

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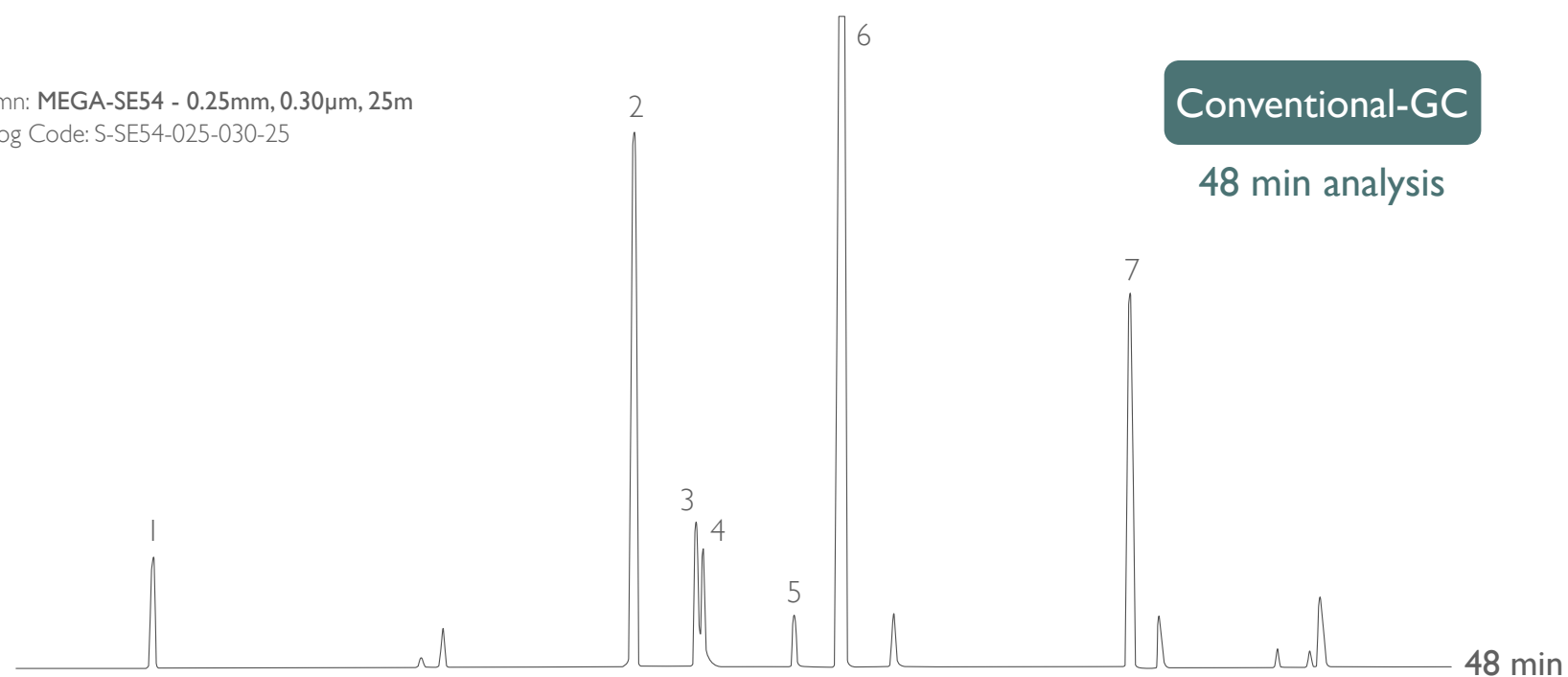
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Chamomile Essential Oil

FAST-GC
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Column: MEGA-SE54 - 0.25mm, 0.30 μ m, 25m
Catalog Code: S-SE54-025-030-25



Conventional-GC

48 min analysis

Conventional-GC Conditions:

Injection: Split 230°C, 1 μ L, 1:50 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

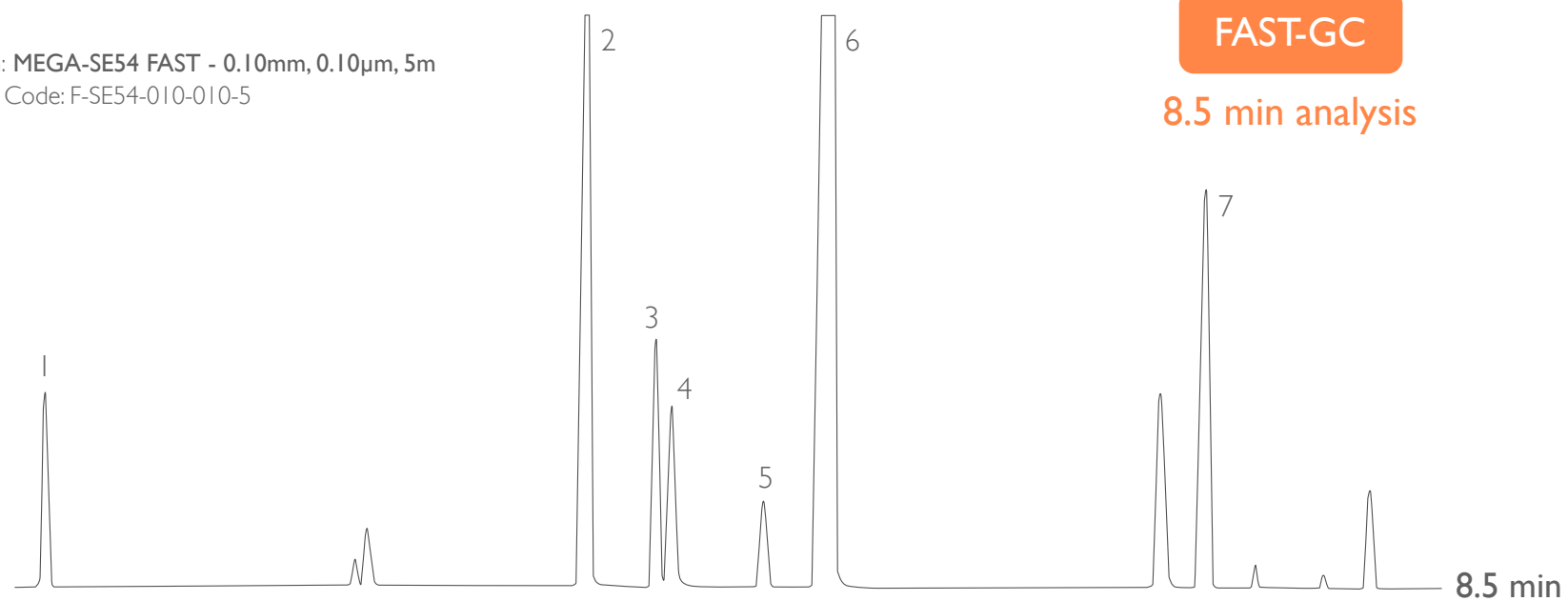
Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 3°C/min, 250°C (5min).

Carrier Gas: Hydrogen, 1.5mL/min.

1. Trans-Beta-Farnesene
2. Bisabolol Oxide B
3. Alpha-Bisabolone Oxide
4. Alpha-Bisabolol
5. Chamazulene
6. Bisabolol Oxide A
7. Spiroether

Column: MEGA-SE54 FAST - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-SE54-010-010-5



FAST-GC

8.5 min analysis

FAST-GC Conditions:

Injection: Split 230°C, 0.5 μ L, 1:250 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 50°C/min, 250°C (5min).

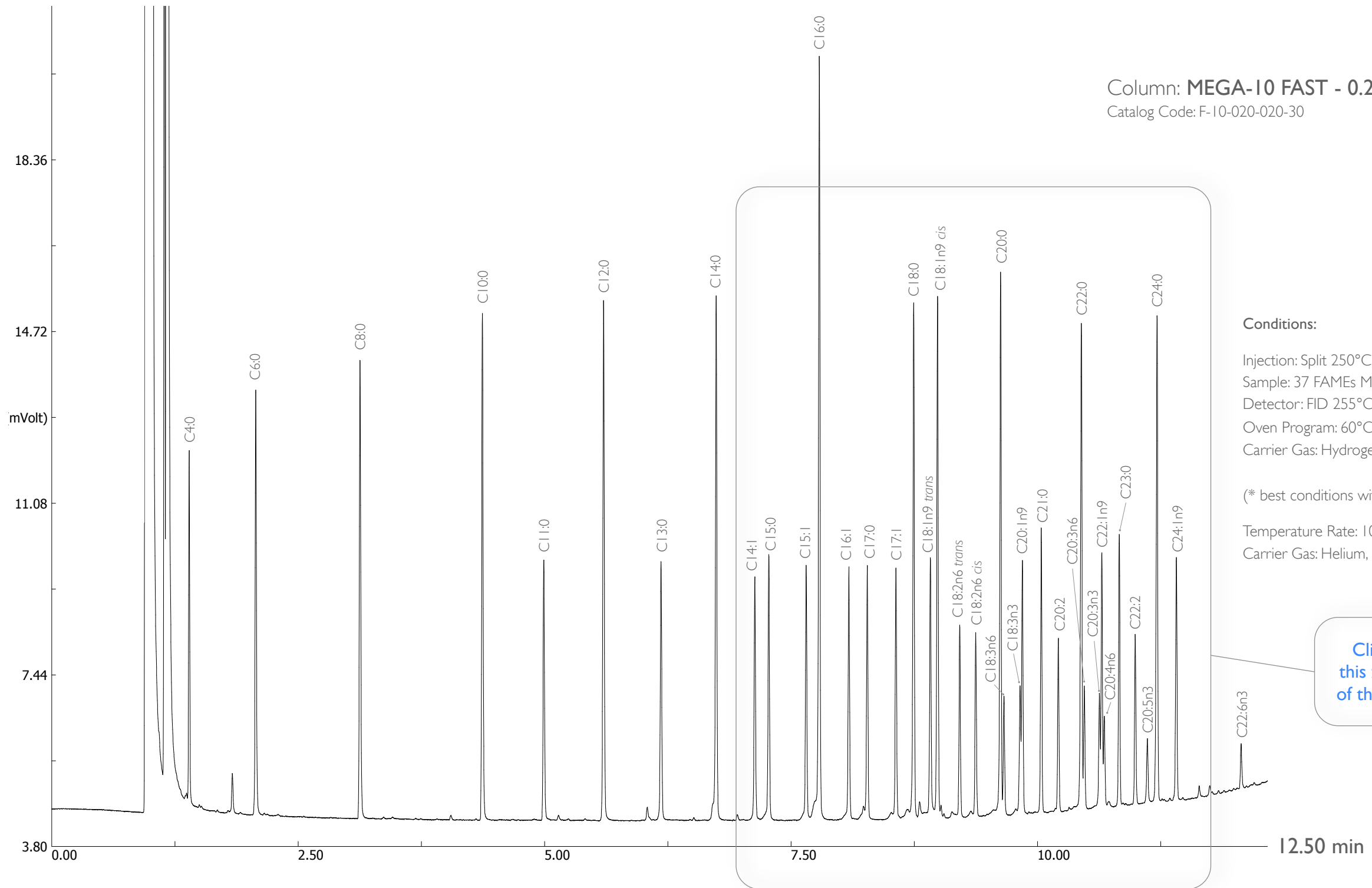
Carrier Gas: Hydrogen, 0.5mL/min.

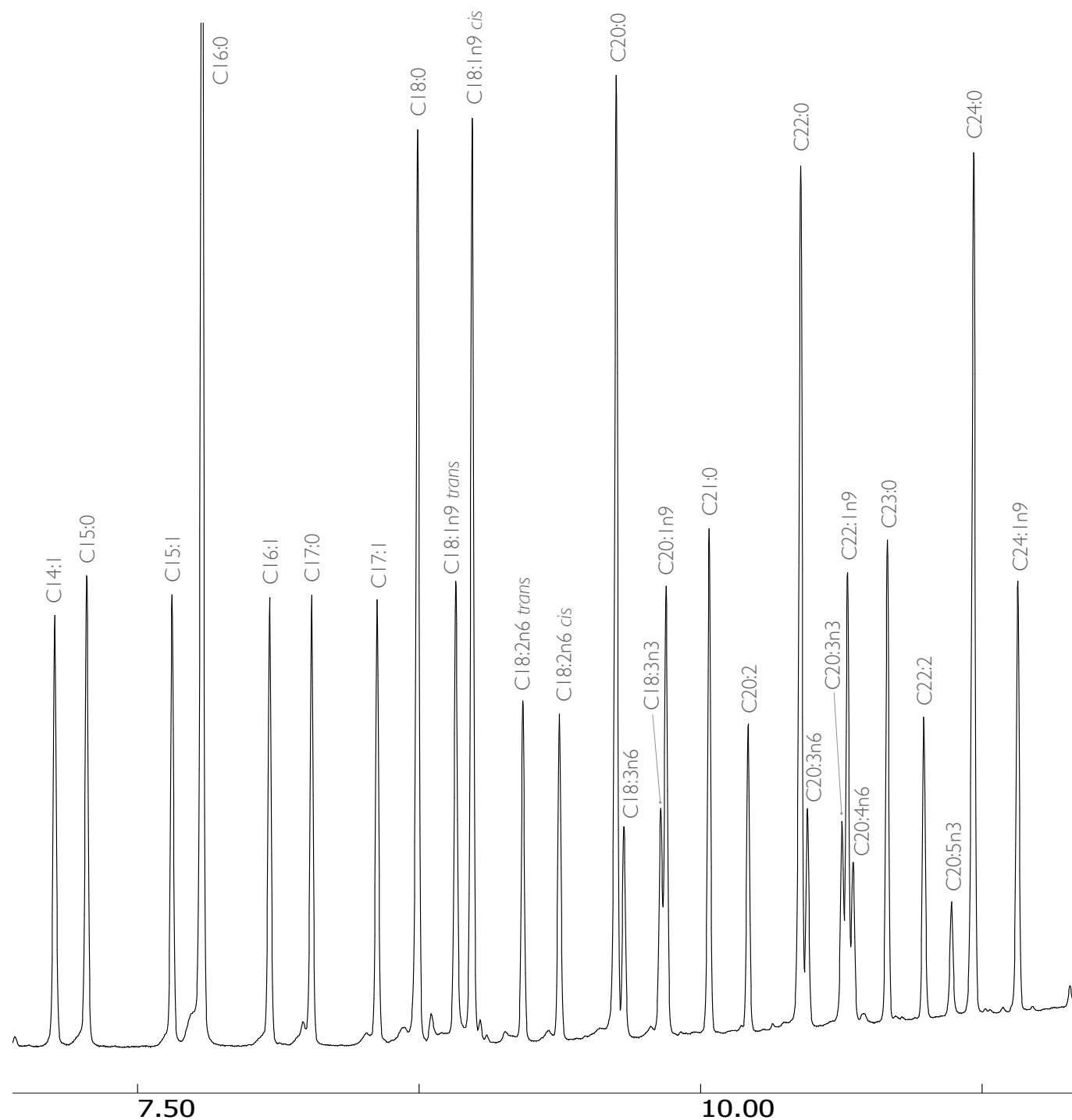
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FAMEs *cis-trans* isomers





Column: **MEGA-10 FAST** - 0.20mm, 0.20 μ m, 30m
Catalog Code: F-10-020-020-30

Conditions:

Injection: Split 250°C, 0.5 μ L, 1:250 Split Ratio.
Sample: 37 FAMEs Mix (Supelco cat. #: 47885-U).
Detector: FID 255°C.
Oven Program: 60°C, 15°C/min, 250°C.*
Carrier Gas: Hydrogen, 150 kPa.*

(* best conditions with Helium Carrier Gas:

Temperature Rate: 10 - 12°C/min.
Carrier Gas: Helium, 180 - 200 kPa.)

[Click here to go to the previous page and see the complete chromatogram](#)

Fragrance Allergens

FAST-GC
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Column: **MEGA-1701 FAST - 0.10mm, 0.10µm, 5m**

Catalog Code: F-1701-010-010-5

Conditions:

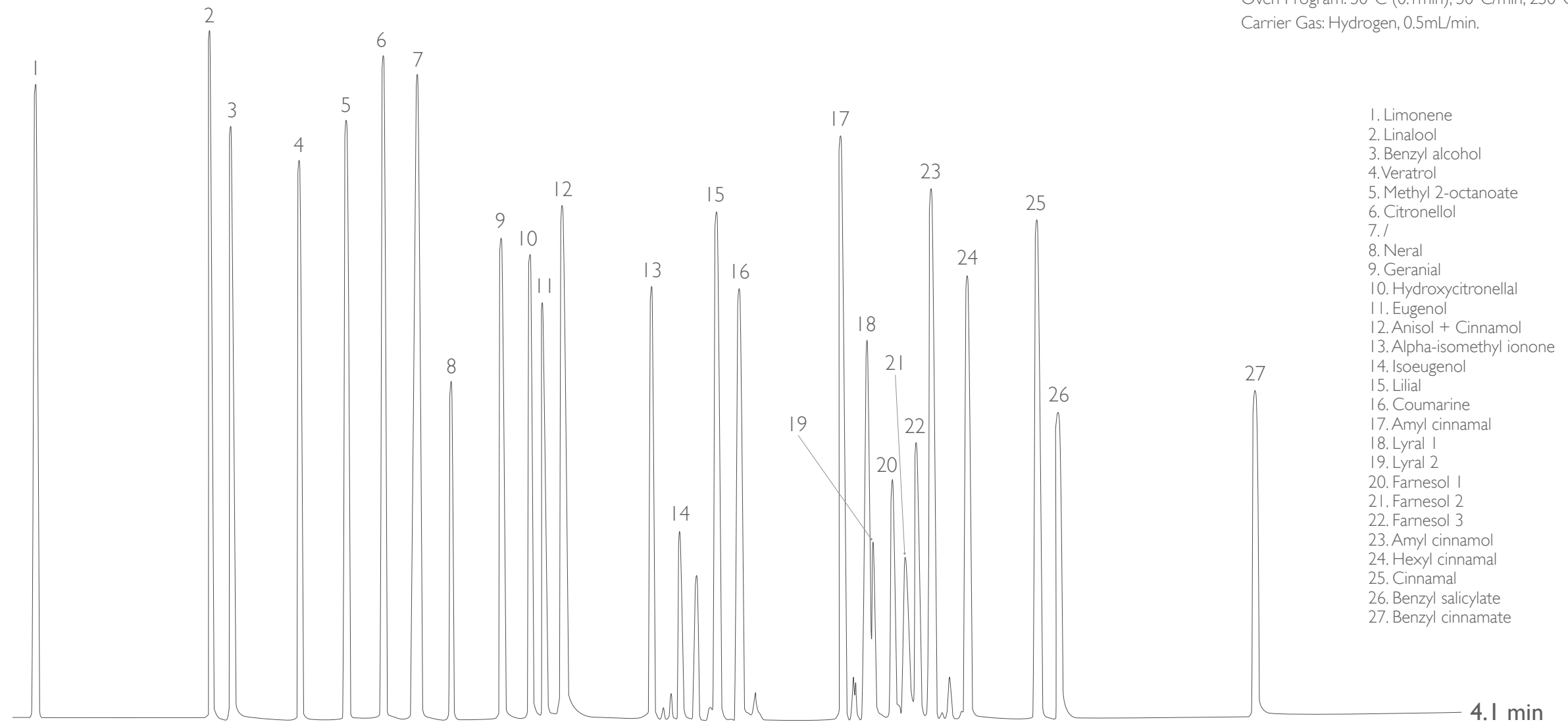
Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 50°C/min, 250°C (5min).

Carrier Gas: Hydrogen, 0.5mL/min.



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Fragrance Allergens

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solutions



Column: **MEGA-SE54 FAST - 0.10mm, 0.10µm, 5m**

Catalog Code: F-SE54-010-010-5

Conditions:

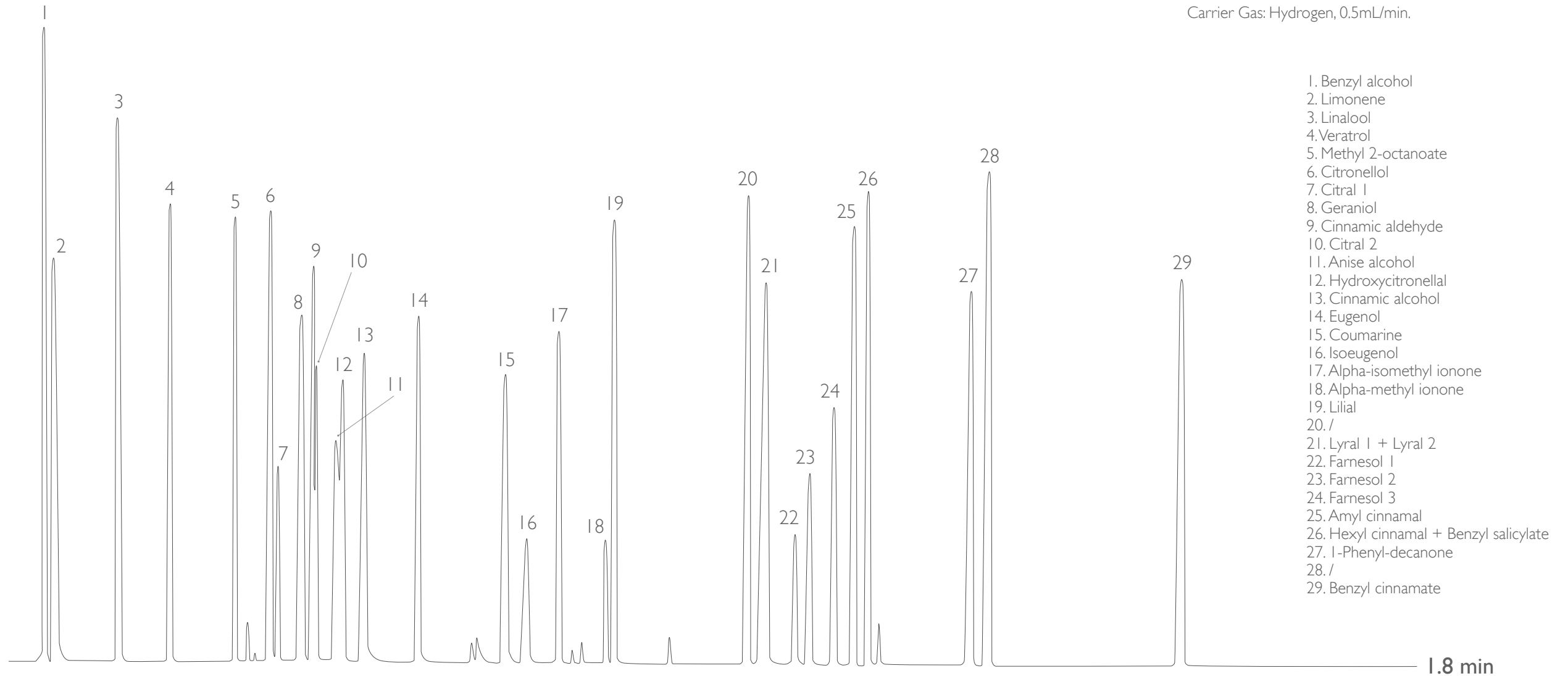
Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 50°C/min, 250°C (5min).

Carrier Gas: Hydrogen, 0.5mL/min.



1. Benzyl alcohol
2. Limonene
3. Linalool
4. Veratrol
5. Methyl 2-octanoate
6. Citronellol
7. Citral 1
8. Geraniol
9. Cinnamic aldehyde
10. Citral 2
11. Anise alcohol
12. Hydroxycitronellal
13. Cinnamic alcohol
14. Eugenol
15. Coumarine
16. Isoeugenol
17. Alpha-isomethyl ionone
18. Alpha-methyl ionone
19. Linal
20. /
21. Lyrat 1 + Lyrat 2
22. Farnesol 1
23. Farnesol 2
24. Farnesol 3
25. Amyl cinnamal
26. Hexyl cinnamal + Benzyl salicylate
27. l-Phenyl-decanone
28. /
29. Benzyl cinnamate

Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.

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Column: **MEGA-WAX FAST - 0.10mm, 0.10µm, 5m**

Catalog Code: F-WAX-010-010-5

Conditions:

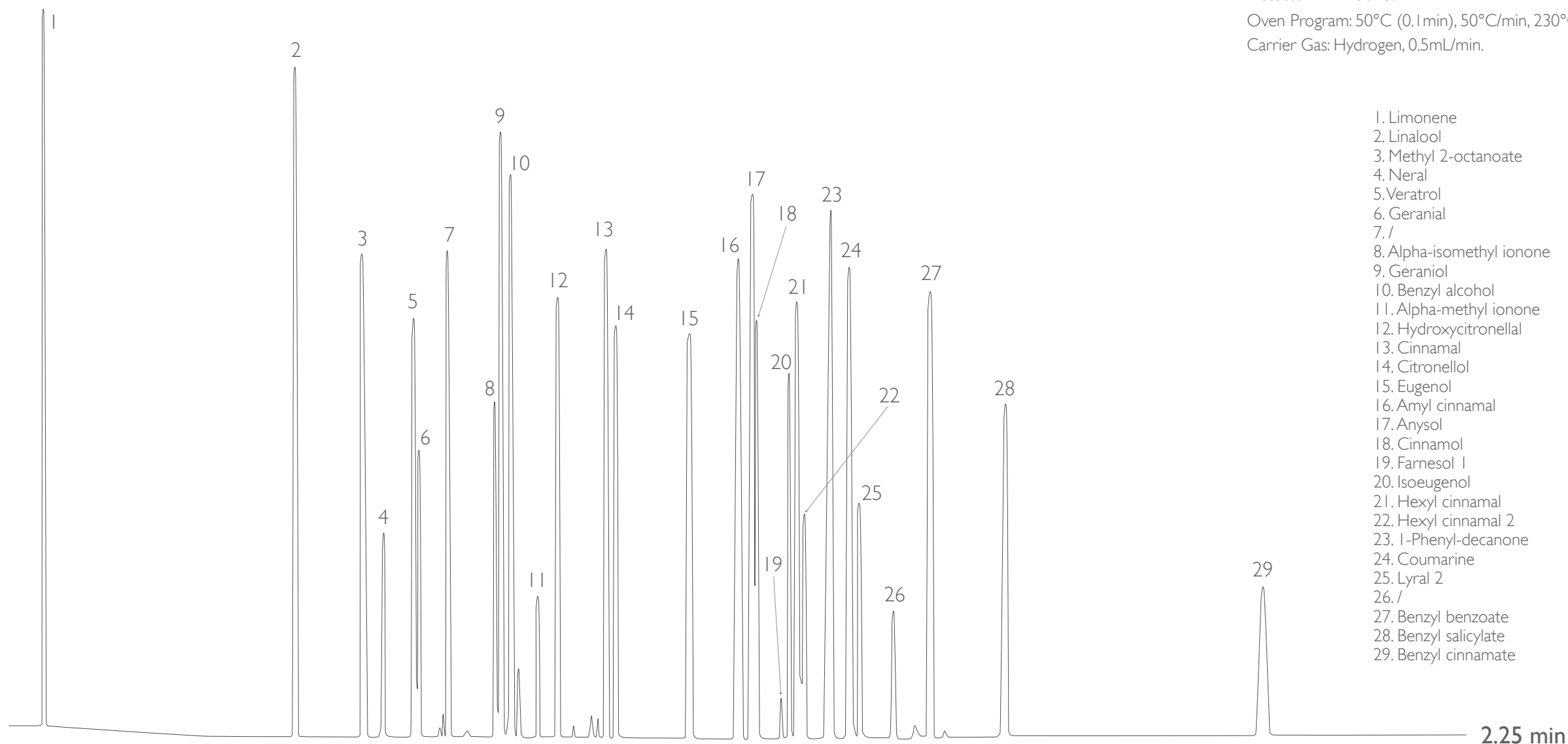
Injection: Split 230°C, 0.5µL, 1:300 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1 min), 50°C/min, 230°C (2min).

Carrier Gas: Hydrogen, 0.5mL/min.



1. Limonene
2. Linalool
3. Methyl 2-octanoate
4. Neral
5. Veratrol
6. Geraniol
7. /
8. Alpha-isomethyl ionone
9. Geraniol
10. Benzyl alcohol
11. Alpha-methyl ionone
12. Hydroxycitronellal
13. Cinnamal
14. Citronellol
15. Eugenol
16. Amyl cinnamal
17. Anisol
18. Cinnamol
19. Farnesol I
20. Isoeugenol
21. Hexyl cinnamal
22. Hexyl cinnamal 2
23. 1-Phenyl-decanone
24. Coumarine
25. Lyral 2
26. /
27. Benzyl benzoate
28. Benzyl salicylate
29. Benzyl cinnamate

Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.



Column: **MEGA-1701 FAST** - 0.10mm, 0.10µm, 5m
Catalog Code: F-1701-010-010-5

Conditions:

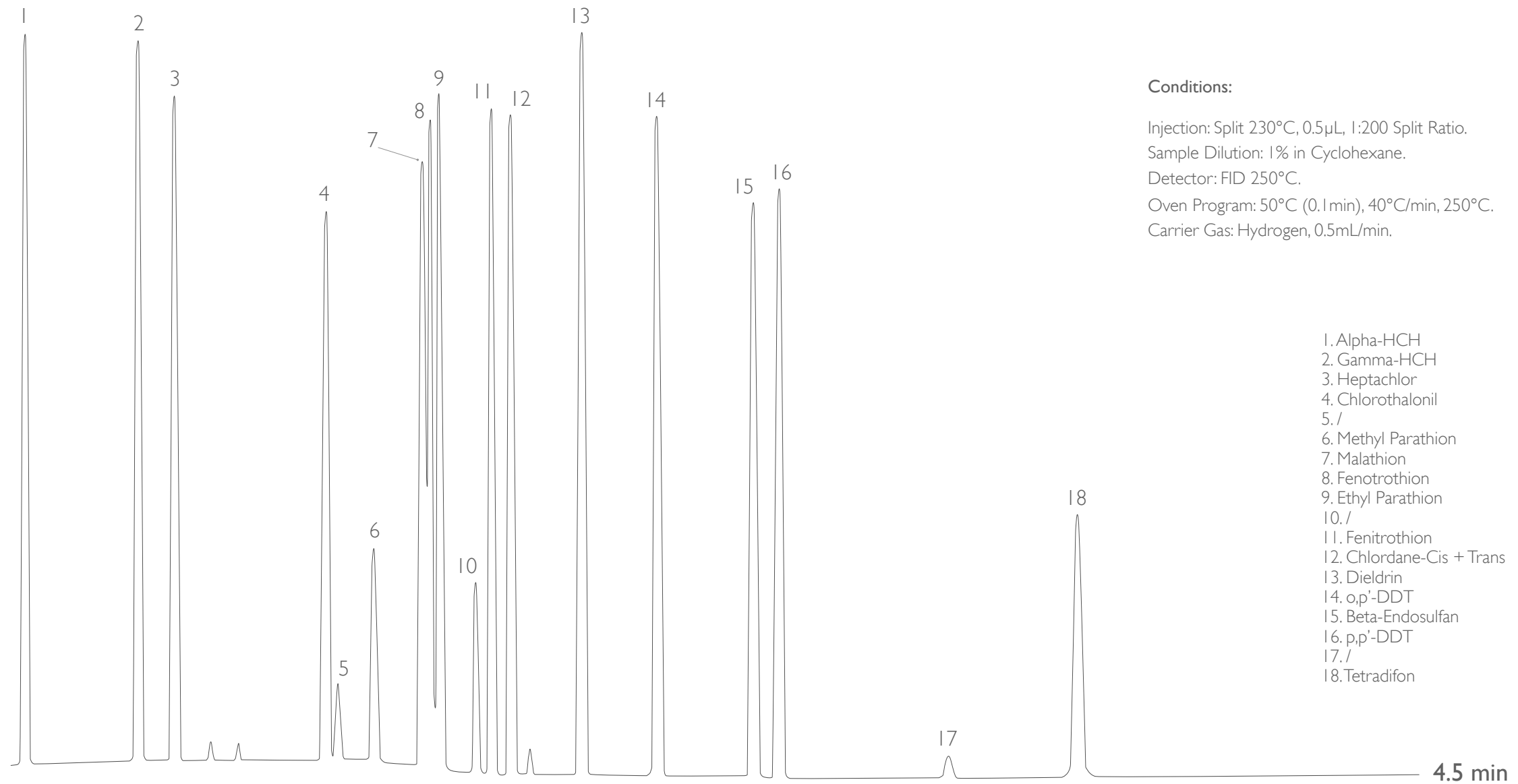
Injection: Split 230°C, 0.5µL, 1:200 Split Ratio.

Sample Dilution: 1% in Cyclohexane.

Detector: FID 250°C.

Oven Program: 50°C (0.1min), 40°C/min, 250°C.

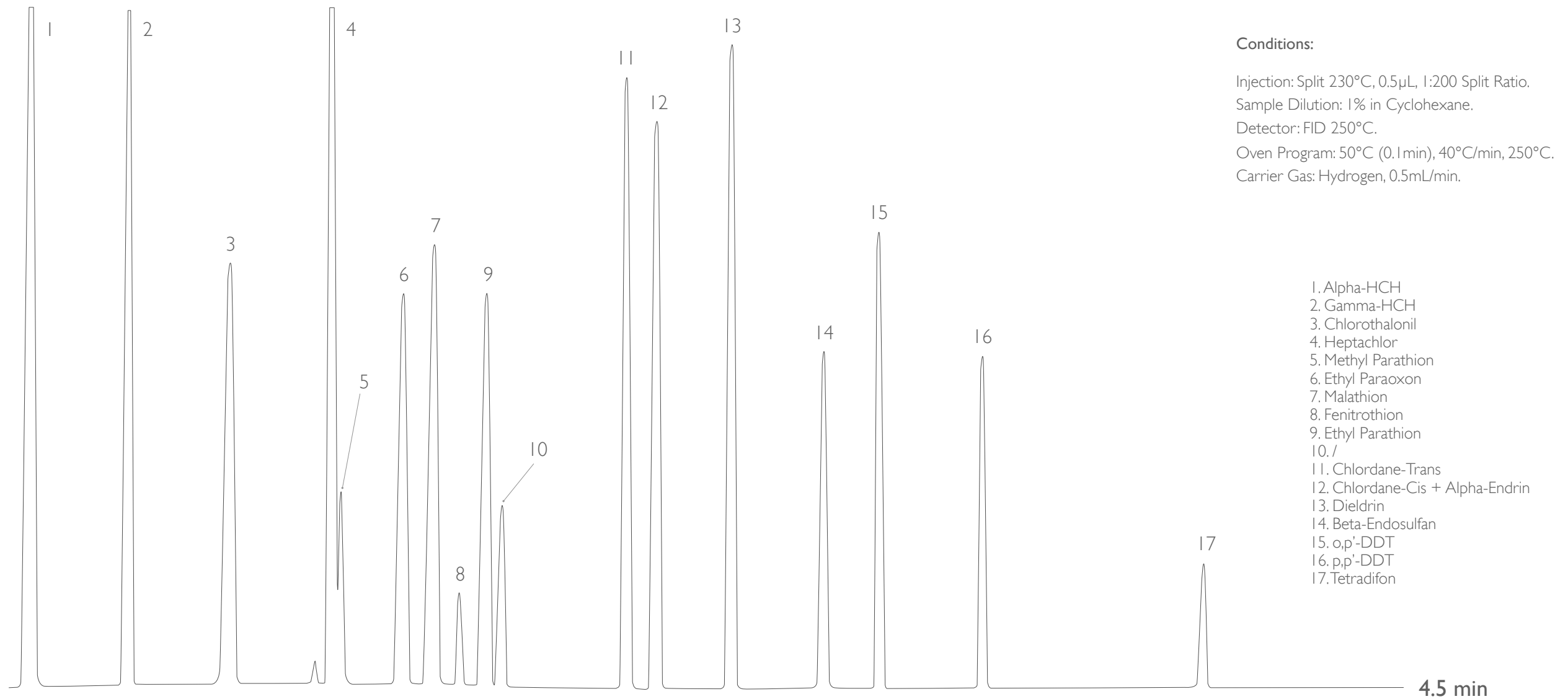
Carrier Gas: Hydrogen, 0.5mL/min.



Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.



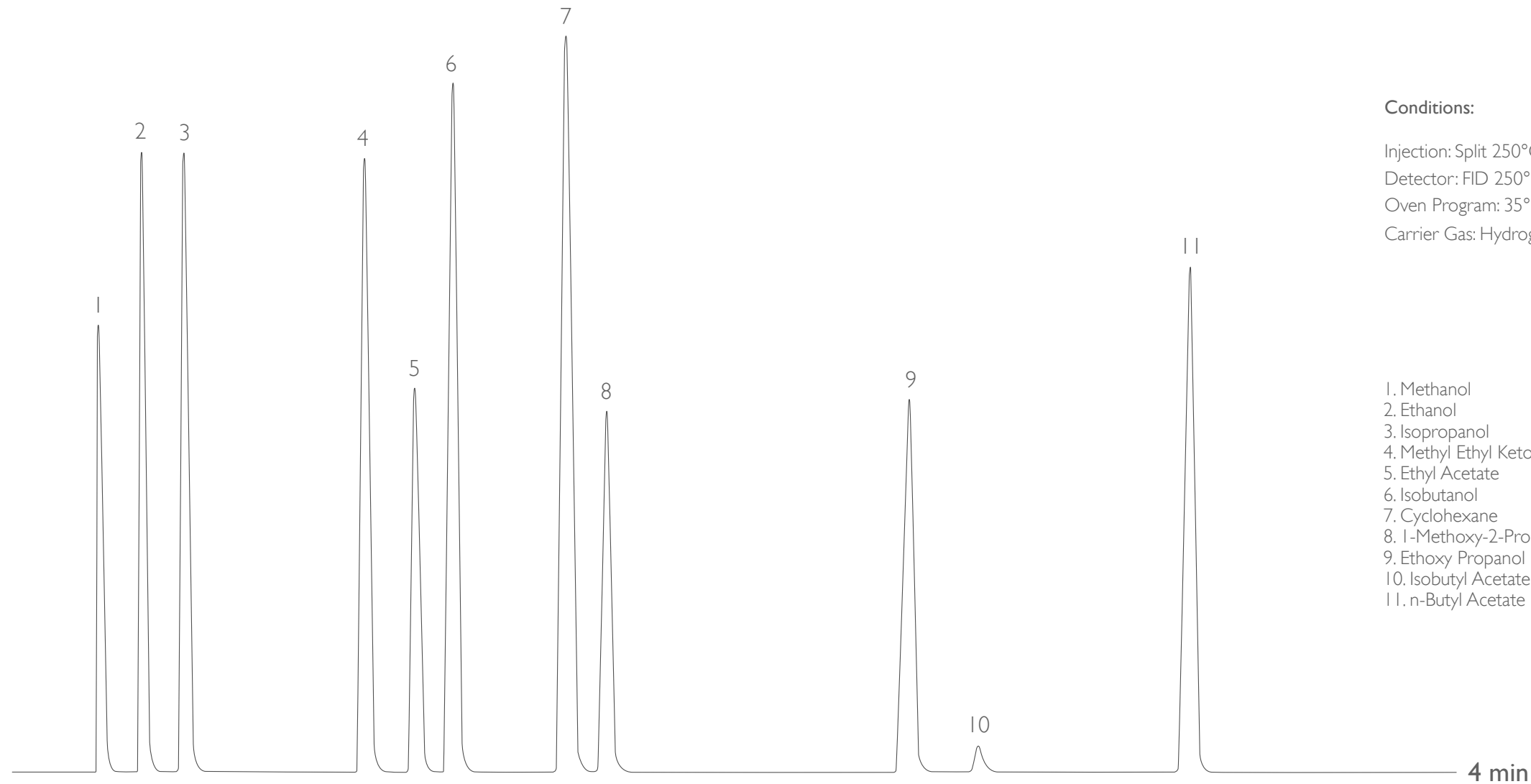
Column: **MEGA-SE54 FAST** - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-SE54-010-010-5



Acknowledgement: Prof. C. Bicchi, C. Brunelli et al., Università di Torino, Dipartimento di Scienza e Tecnologia del Farmaco, Via Pietro Giuria, 9 - Torino - Italy.



Column: **MEGA-VOC 2 FAST** - 0.20mm, 1.00µm, 10m
Catalog Code: F-VOC2-020-100-10

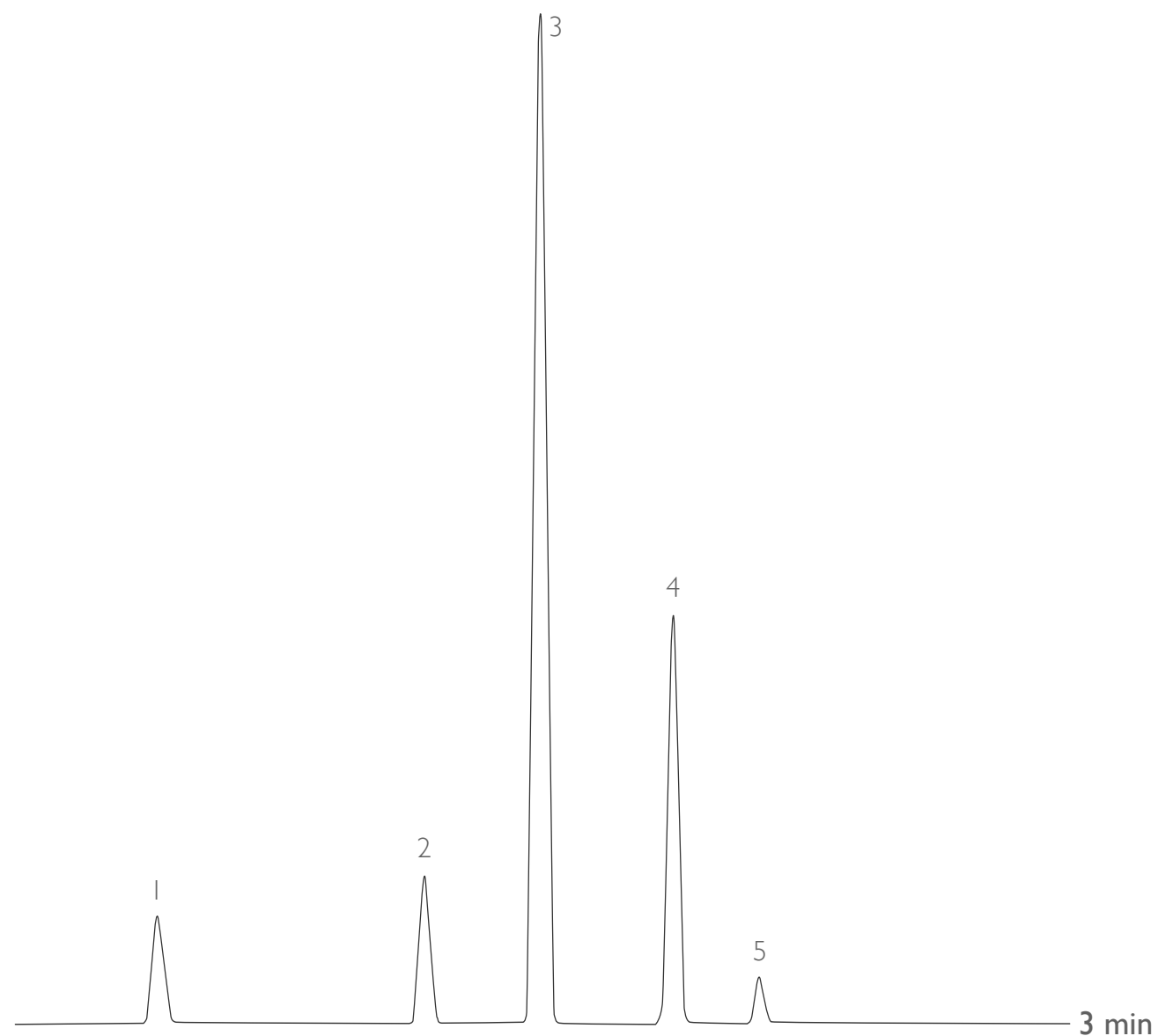


Conditions:

Injection: Split 250°C.
Detector: FID 250°C.
Oven Program: 35°C (0.5min), 15°C/min, 100°C.
Carrier Gas: Hydrogen, 50kPa.

- 1. Methanol
- 2. Ethanol
- 3. Isopropanol
- 4. Methyl Ethyl Ketone (MEK)
- 5. Ethyl Acetate
- 6. Isobutanol
- 7. Cyclohexane
- 8. 1-Methoxy-2-Propanol
- 9. Ethoxy Propanol
- 10. Isobutyl Acetate
- 11. n-Butyl Acetate

Analysis carried out with DANI Master GC.



Analysis carried out with DANI Master GC.

Column: **MEGA-624 FAST** - 0.10mm, 0.45 μ m, 10m

Catalog Code: F-624-010-045-10

(USP G43 phase)

Conditions:

Injection: Split 250°C, 0.5mL with Gas Syringe, 1:100 Split Ratio.

Sample: Headspace of Residual Solvents Mix, hold 45min @ 80°C.

Detector: FID 250°C.

Oven Program: 35°C, 15°C/min, 100°C.

Carrier Gas: Hydrogen, 0.4mL/min.

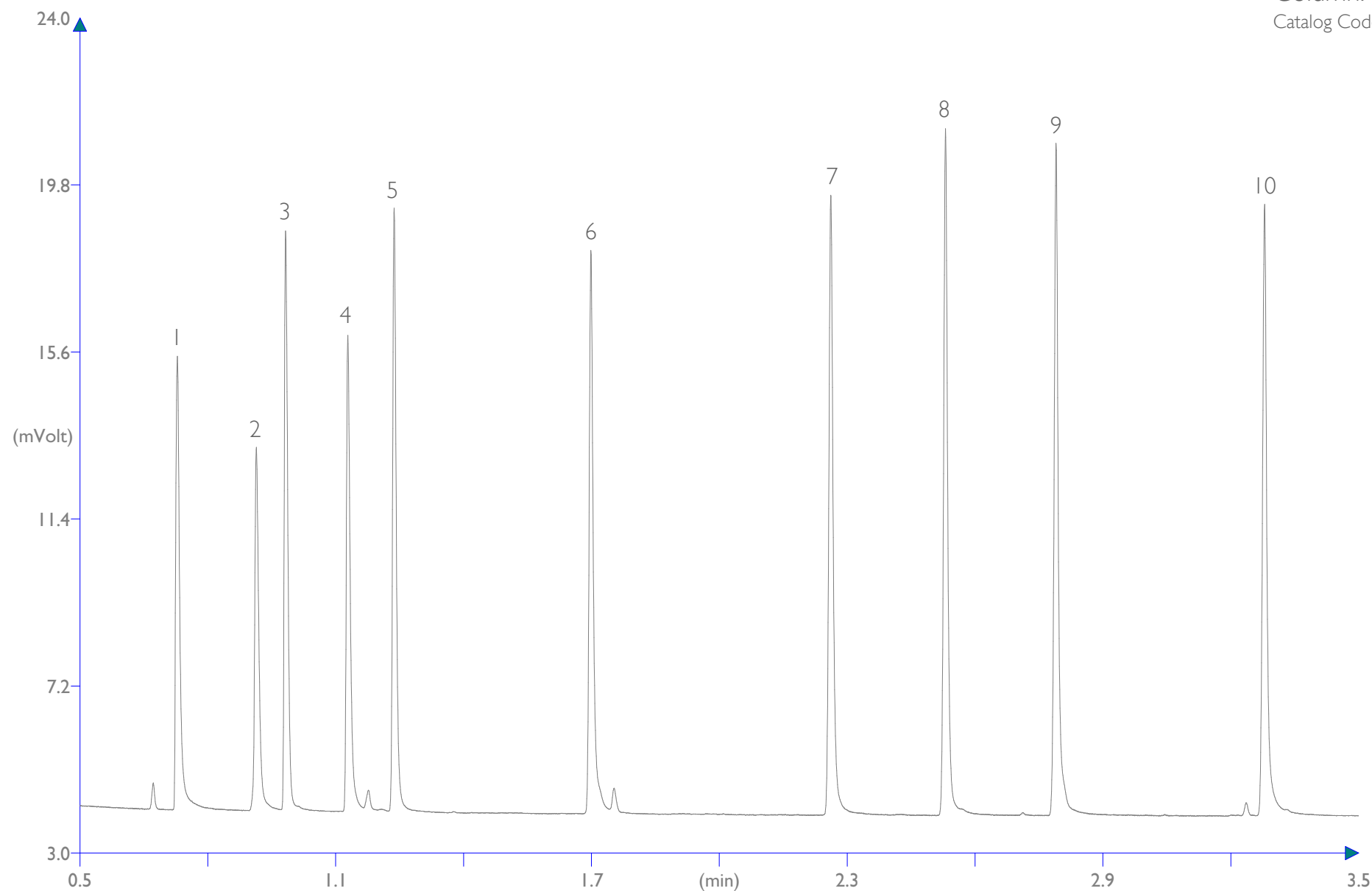
- 1. Methylene Chloride
- 2. Chloroform
- 3. Benzene
- 4. 1,1,1 - trichloroethylene
- 5. 1,4 - dioxane

Free Fatty Acids

FAST-GC
solutions



Column: **MEGA-ACID (FFAP) FAST** - 0.10mm, 0.10 μ m, 5m
Catalog Code: F-ACID-010-010-5



Conditions:

Injection: Split 250°C, 0.2 μ L, 80mL/min Split Flow.
Sample Dilution: from 28 to 46mg/100mL each component, sol. 50% Ethanol.
Detector: FID 250°C.
Oven Program: 80°C (0.1min), 40°C/min, 250°C.
Carrier Gas: Hydrogen, 130kPa.

1. Acetic Acid
2. Propionic Acid
3. Iso-Butyric Acid
4. Butyric Acid
5. Iso-Valeric Acid
6. Caproic Acid
7. Caprylic Acid
8. Nonanoic Acid
9. Decanoic Acid
10. Dodecanoic Acid

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Bibliography and acknowledgments

[1]. Chiara Cordero, Patrizia Rubiolo, Barbara Sgorbini, Mario Galli, Carlo Bicchi

Comprehensive two-dimensional gas chromatography in the analysis of volatile samples of natural origin: A multidisciplinary approach to evaluate the influence of second dimension column coated with mixed stationary phases on system orthogonality.

Journal of Chromatography A, Volume 1132, Issues 1-2, 3 November 2006, Pages 268-279.

[2]. A. Antonelli, Mario Galli

Determination of volatiles in spirits using combined stationary phases in capillary GC.

Chromatographia, Volume 41, Numbers 11-12 / December, 1995.

We would like to thank all the partners and friends, mentioned in the previous pages, that have helped us to prepare a lot of application notes reported in this work, in particular Prof. C. Bicchi and all his group at the University of Turin for their continuous support.

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