

# Indoor and Outdoor Air Profiling and Toxicity Level Determination at Extremely Low Concentrations

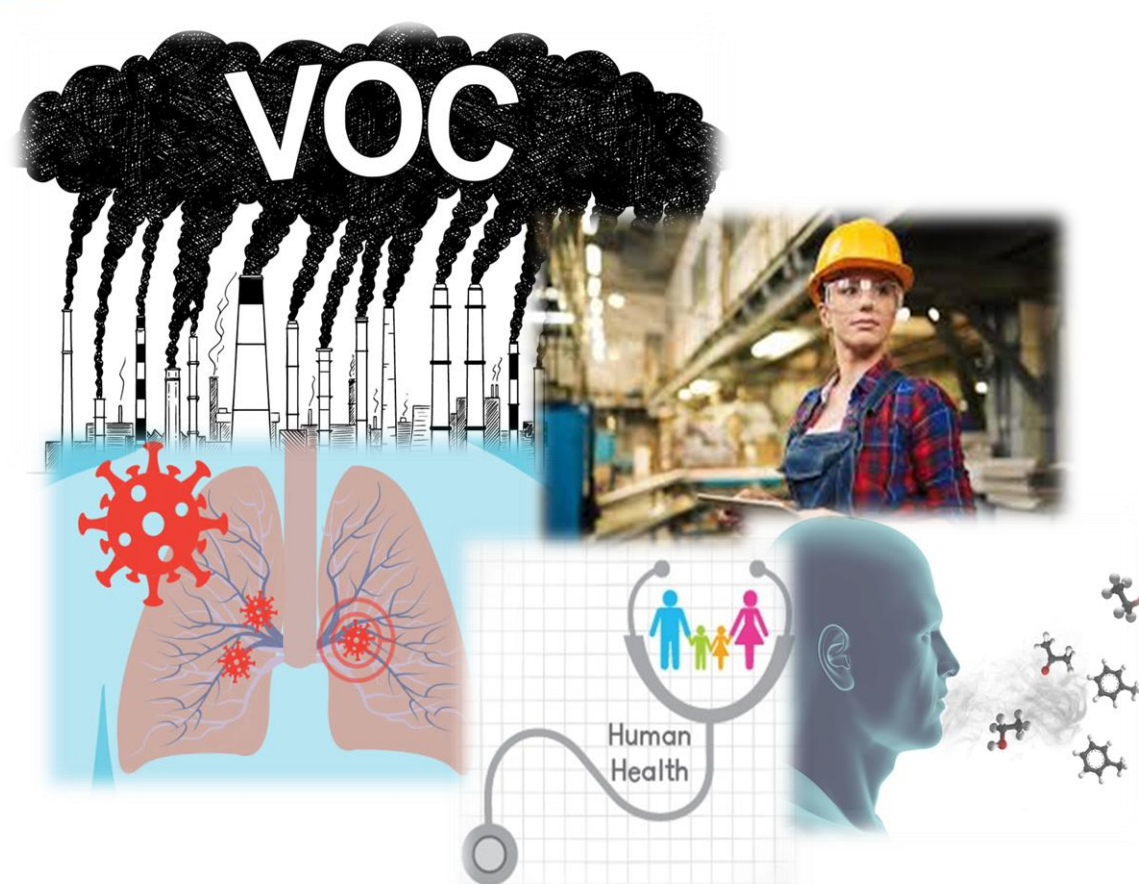
Pedro Catalão Moura<sup>1</sup>, Carlos Fajão<sup>2</sup>, and Valentina Vassilenko<sup>1,3</sup>

<sup>1</sup> LIBPhys – Laboratory of Instrumentation, Biomedical Engineering and Radiation Physics, NOVA University Lisbon - NOVA School of Science and Technology (LIBPhys|FCT-UNL), 2896-516, Caparica, Portugal

<sup>2</sup> Volkswagen Autoeuropa, Quinta da Marquesa, 2954-024, Quinta do Anjo, Portugal

<sup>3</sup> NMT, S. A., Edifício Madan Parque, Rua dos Inventores, 2825-182, Caparica, Portugal

pr.moura@campus.fct.unl.pt



## Volatile Organic Compounds and Air Quality: why are they so important?

Volatile Organic Compounds (VOCs) are chemical compounds with two main properties, the capacity of being in gaseous form at room temperature, and the aptitude to pass through biological tissues. Ranging from almost inert to very reactive, VOCs can represent a serious risk to human health due to a continued exposure or if exposed to dangerous levels of concentration. Volatile compounds are emitted to the air from different sources, such as building materials, furniture, cleaning and preservation products, and activities-related materials so, their study is crucial for both air quality assessment and pathologies prevention.

## Gas Chromatography – Ion Mobility Spectrometry: a third millennium analytical technique

Gas Chromatography – Ion Mobility Spectrometry (GC-IMS) is an innovative analytical technique for volatile organic compounds (VOC) identification. The GC-IMS applications are wide: air quality assessment, health, security purposes, food quality and spoilage, products identification, fraud assessment and much more!

### ADVANTAGES:

- Outstanding sensitivity (low ppb concentration range - 1000 more sensitive than electronic noses)
- High selectivity
- Analytical flexibility / no need of sample preparation
- In-situ and almost-real time results
- Portable and Chemical-free

### Interesting Results [1]

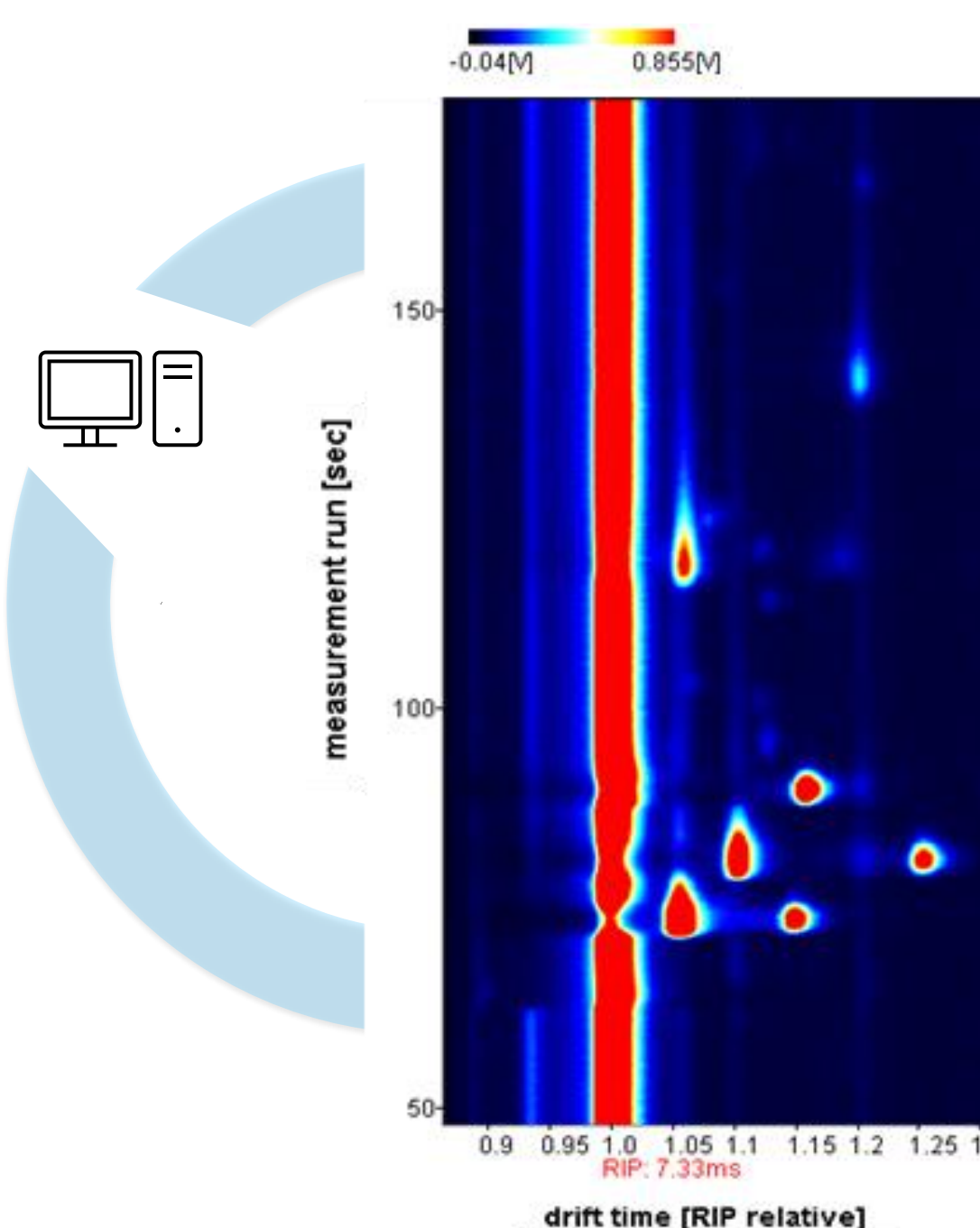
#### Identification of Volatile Organic Compounds

Peak Number	Drift Time (sec.)	Relative Retention Time	Identified Compound	CAS Number	Note
1	1,055	72,823	Ethanol	64-17-5	Monomer
2	1,127	93,108	1-propanol	71-23-8	Monomer
4	1,121	117,077	Ethyl Acetate	141-78-6	Monomer
7	1,284	246,377	Hexanal	66-25-1	Monomer
8	1,253	78,893	2-propanol	67-63-0	Trimer
9	1,103	79,330	2-propanol	67-63-0	Monomer
10	1,205	78,985	2-propanol	67-63-0	Dimer
14	1,158	87,569	Acetone	67-64-1	Dimer
16	1,077	120,420	2-Butanone	78-93-3	Monomer
18	1,149	71,803	Ethanol	64-17-5	Dimer
33	1,396	117,182	Ethyl Acetate	141-78-6	Dimer

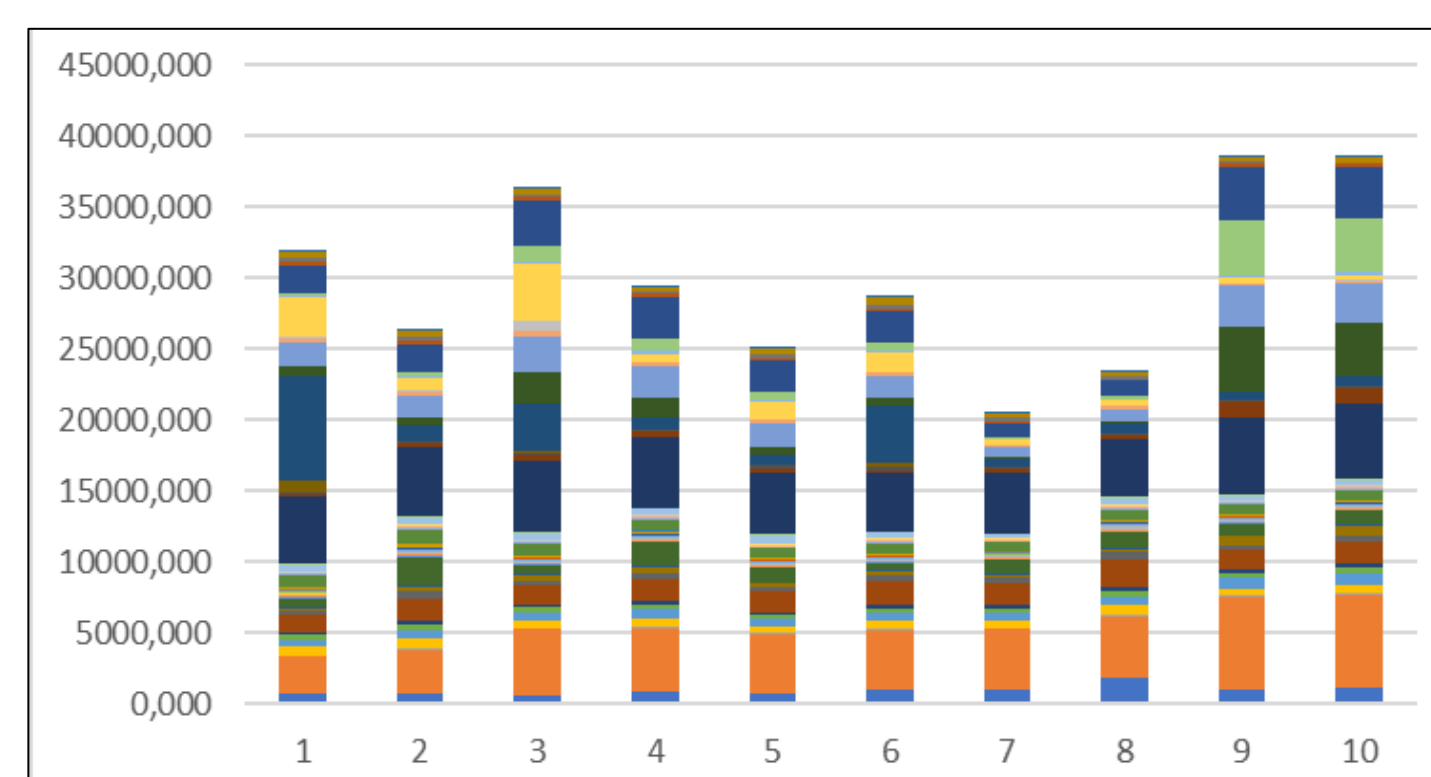
Radar - charts for profiling of location - specific in-situ samples



After collection, all kind of volatile organic samples are analysed by GC-IMS

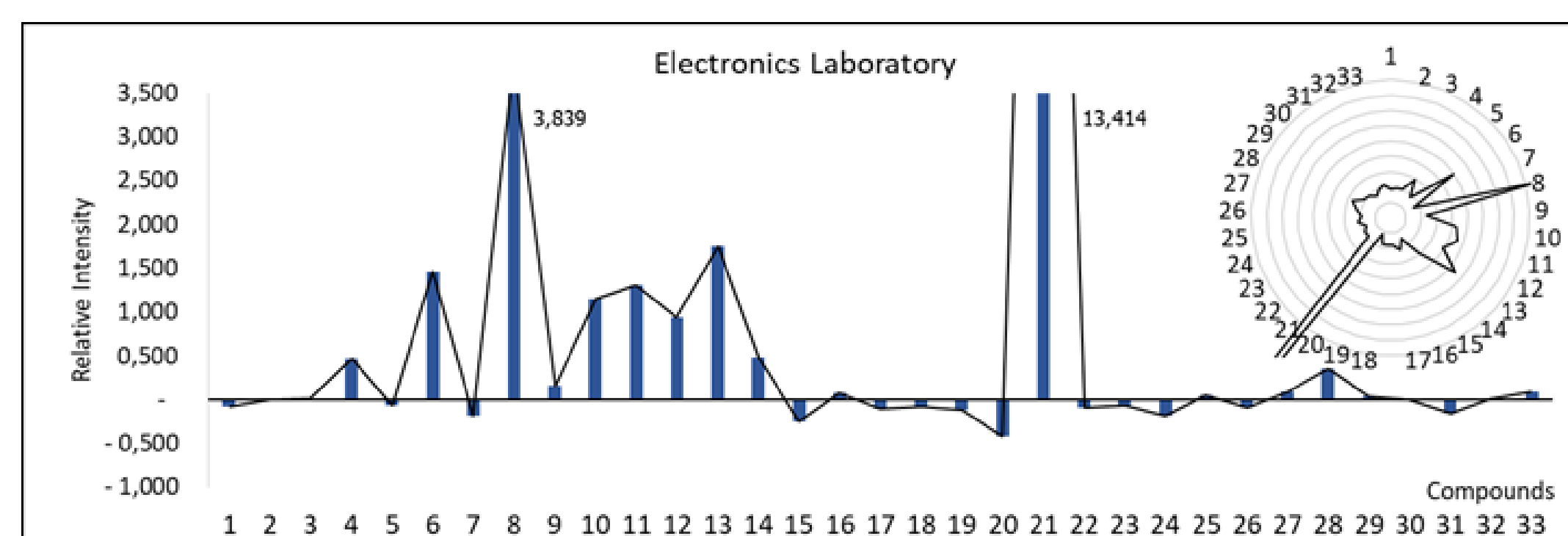


A 3D - spectrum representing all VOCs present in the sample is created.



Intensity levels for all VOCs identified for 10 different-origin samples

Intensity profile of all VOCs identified in a single sample



**Conclusions:** Significant concentration variations of specific compounds between different samples were quantified, proving the crucial importance of volatile organic compounds identification and quantification, and of air quality assessment. Due to its wide range of applications, high selectivity and outstanding sensitivity, analytical flexibility, portability and almost real time monitoring, GC-IMS proves itself as the analytical technique of modern science and as one of the most suitable, appropriate and extremely accurate tool for such studies.

## References

- [1] P. C. Moura, V. Vassilenko, J. M. Fernandes and P. H. Santos, "Indoor and Outdoor Air Profiling with GC-IMS.", in Technological Innovation for Life Improvement, DoCEIS 2020. IFIP Advances in Information and Communication Technology, 2020, Caparica, Portugal, 2020. [https://doi.org/10.1007/978-3-030-45124-0\\_43](https://doi.org/10.1007/978-3-030-45124-0_43)

