

Gas Chromatography–Trapped Ion Mobility Mass Spectrometry: A Highly Specific and Ultra-Sensitive Platform for Quantifying Sub-ppt Levels of Dioxins and PCBs in Food

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Introduction

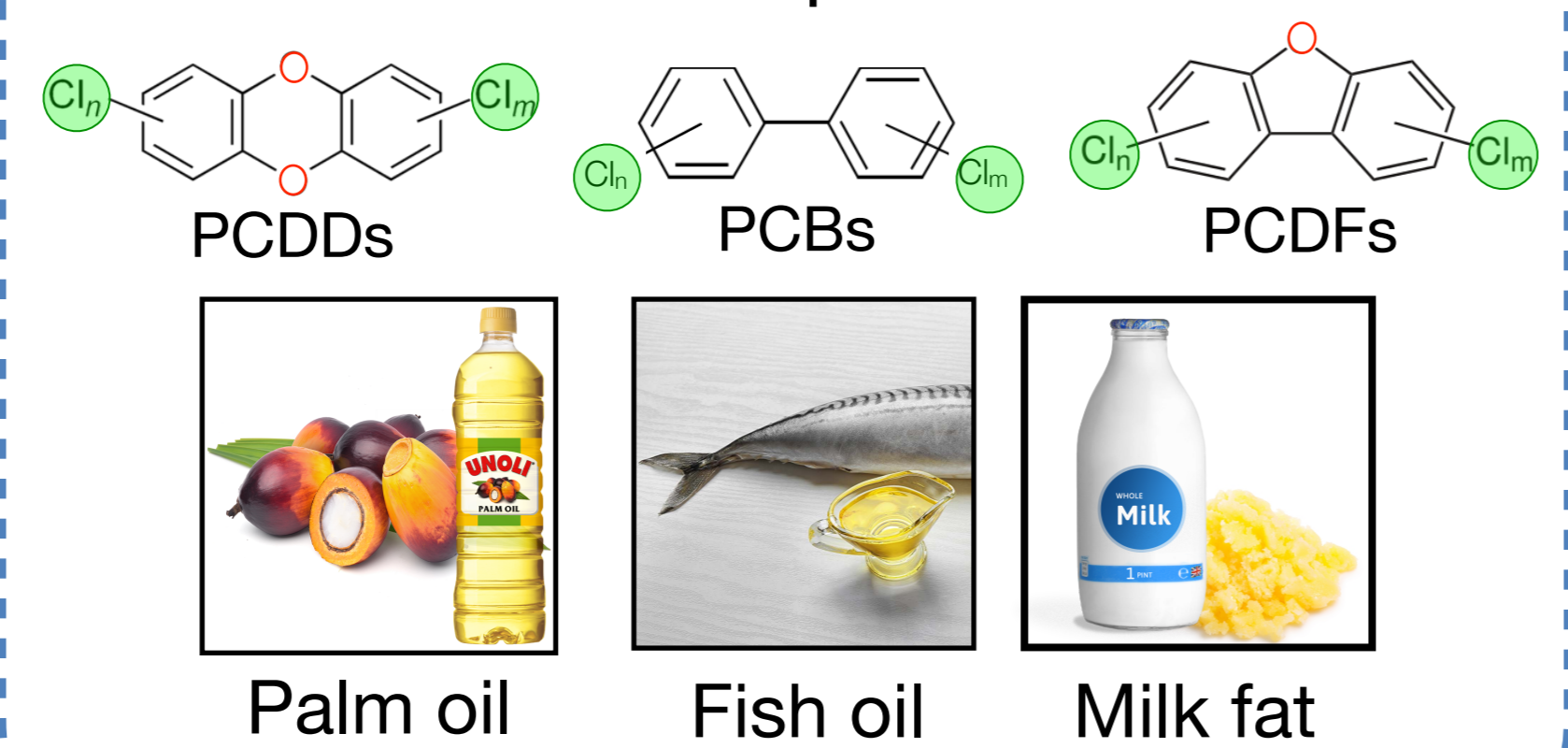
Ion mobility spectrometry (IMS) separates ions by their transport properties and, when coupled to mass spectrometry (IM-MS), has recently gained attention for **environmental contaminant analysis**. IM-MS offers higher peak capacity, cleaner spectra, and more confident annotations through collision cross section (CCS) values, but most applications have been **qualitative**, with few targeted **quantitative studies** on pollutants such as PFAS, pesticides, and hydroxylated PCBs.

Objectives

While promising, these studies remain **preliminary** and lack systematic **validation**, especially for trace contaminants analysis.

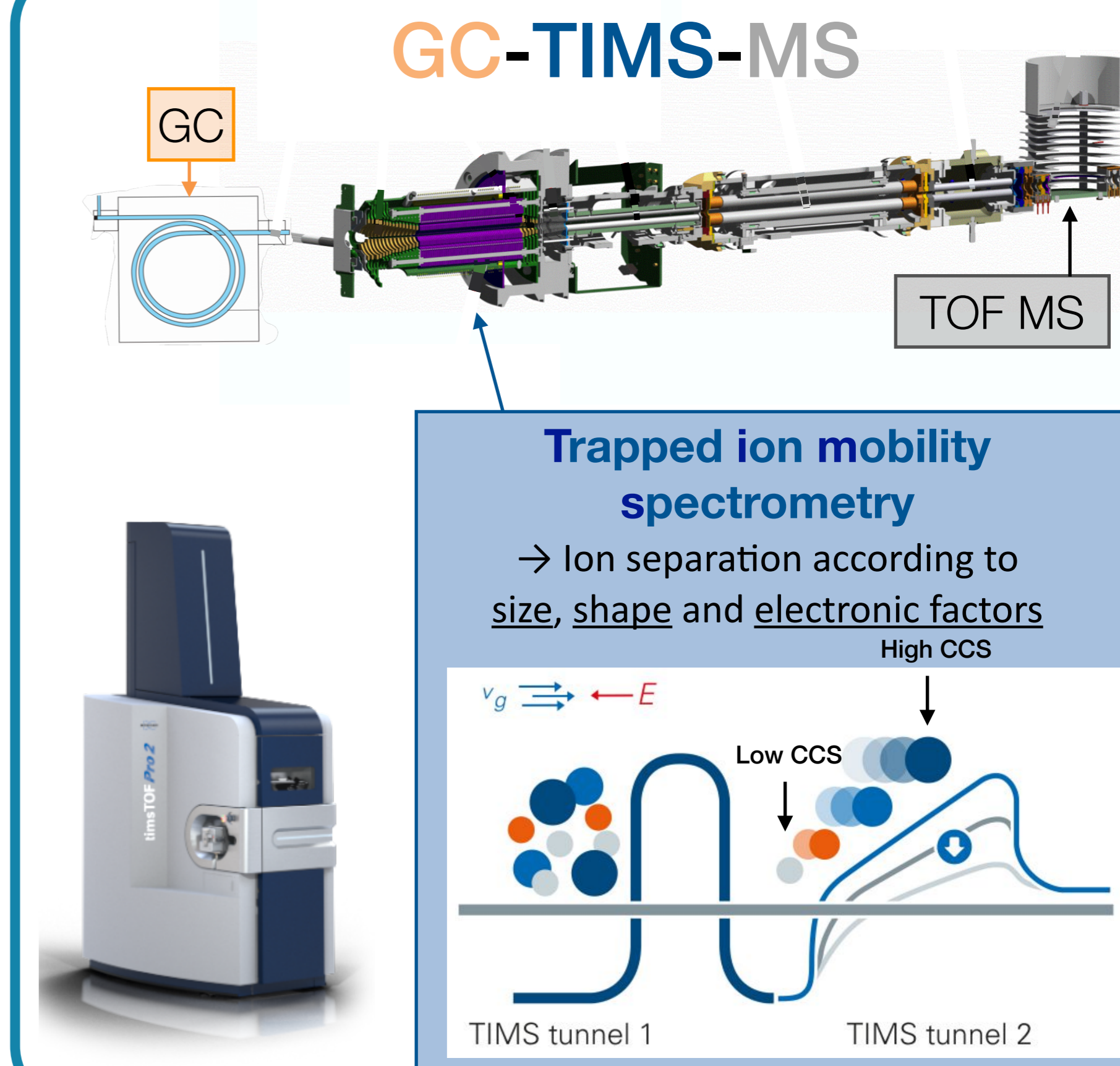
Performance assessment
(EU 2017/644)
+
Comparison reference method
(GC-EI-sector HRMS)

Evaluate the potential of the Bruker timsTOF Pro 2 for **quantifying** trace levels of **dioxins** and **PCBs** in food samples



Benefits of ion mobility?

Instrumentation



Results & discussions

Performance assessment

Instrumental LOQ

PCDD/Fs + NO PCBs	100 to 500 fg/μl	MO PCBs + NDL PCBs	4 pg/μl
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Intermediate reproducibility

[Mean RSD_R (%compliance with EU regulation)]

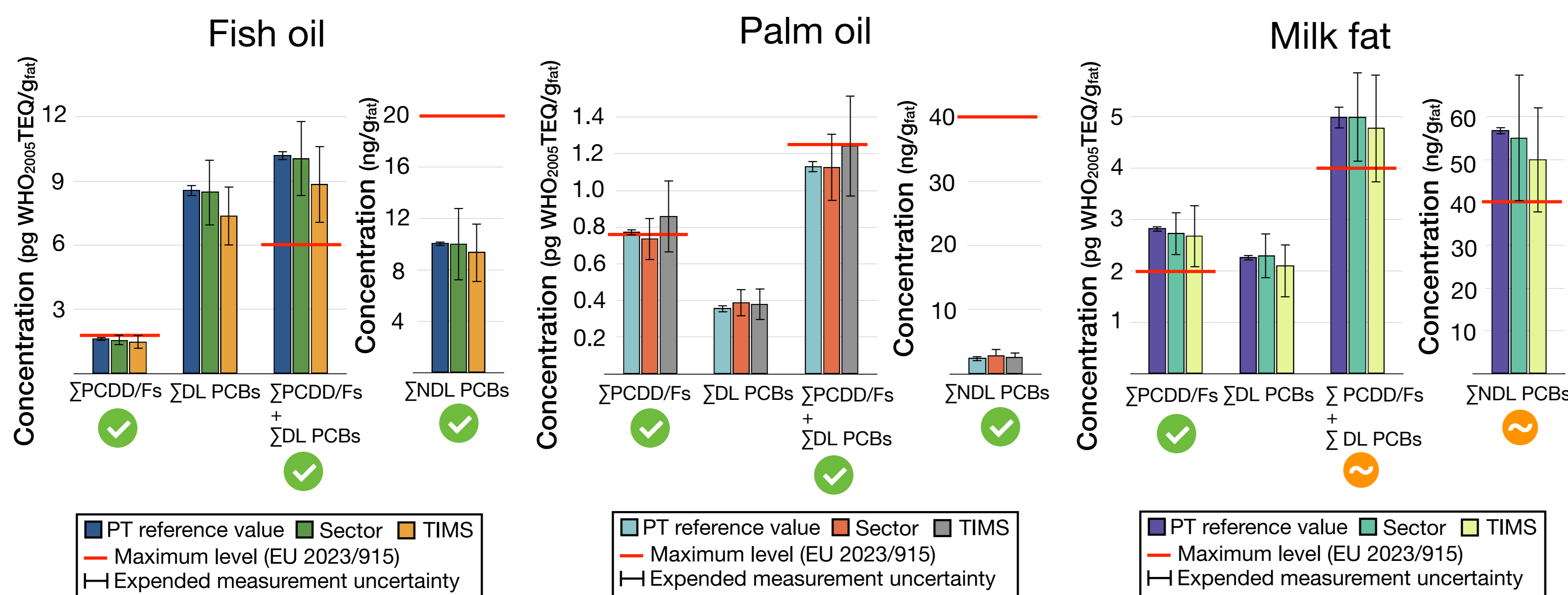
	PCDD/Fs + NO PCBs	MO PCBs	NDL PCBs
TIMS	8.9% (96%)	4.8% (96%)	5.0% (100%)
Sector	6.1% (100%)	5.4% (100%)	8.1% (100%)

Trueness

[Mean absolute bias (%compliance with EU regulation)]

	PCDD/Fs + NO PCBs	MO PCBs	NDL PCBs
TIMS	13.1% (80%)	8.9% (87%)	9.8% (93%)
Sector	7.3% (99%)	7.1% (95%)	10.3% (95%)

Compliance

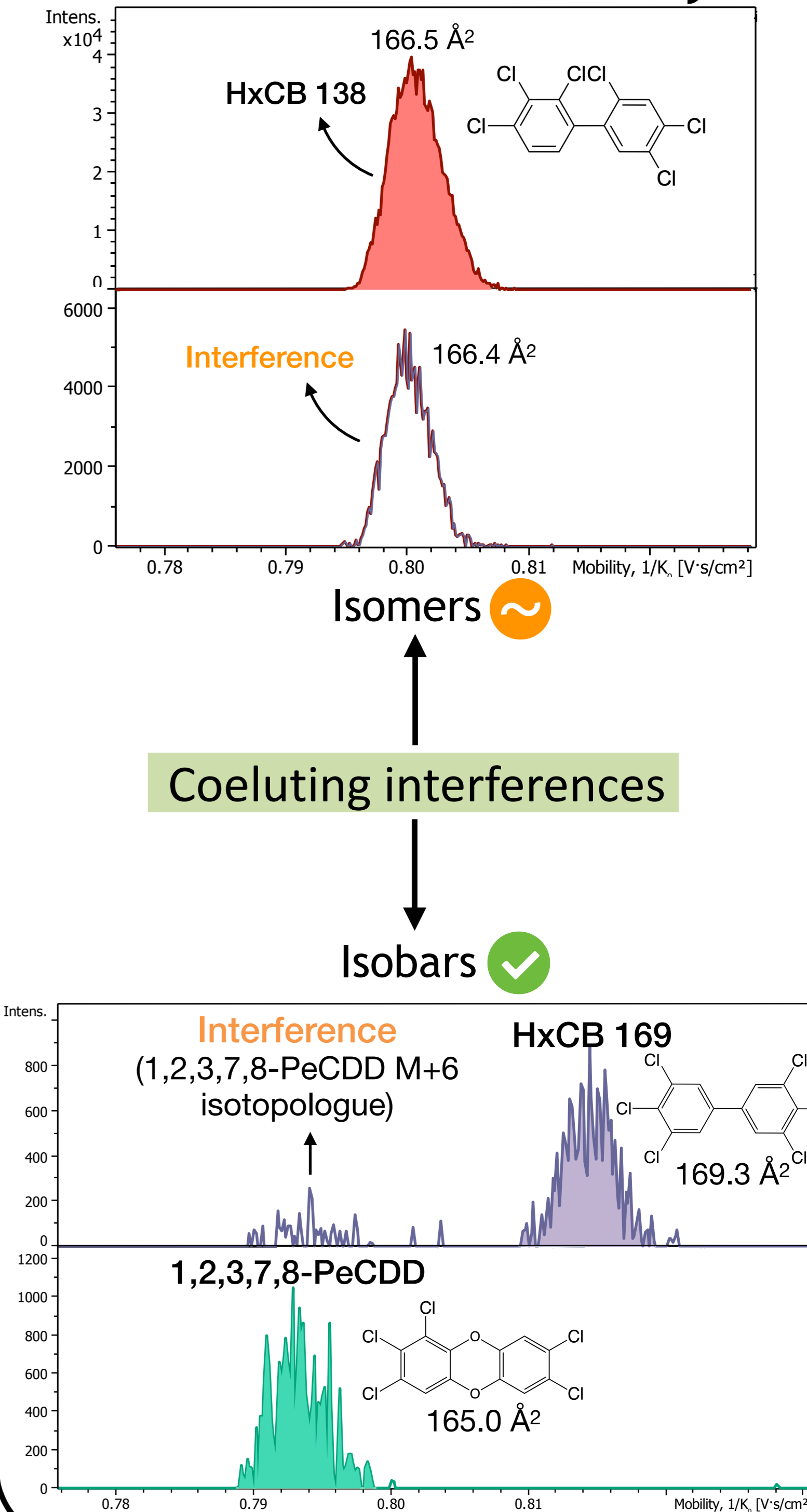


IM benefits

Analyte confirmation

ΔCCS between analyte and corresponding isotopically labelled internal standard <0.5%

Increased selectivity



Conclusions

Performances evaluation

- The GC-APCI-TIMS-TOF method broadly meets the performance requirements of EU Regulation 2017/644
- Compared to the reference GC-sector HRMS method, performances are similar or slightly lower for PCBs, and slightly to significantly lower for most PCDD/Fs

IM benefits

- Analyte confirmation:** CCS values can also serve as an additional identification point in targeted analysis
- Selectivity:** separation of some partially coeluting isomers & isobars