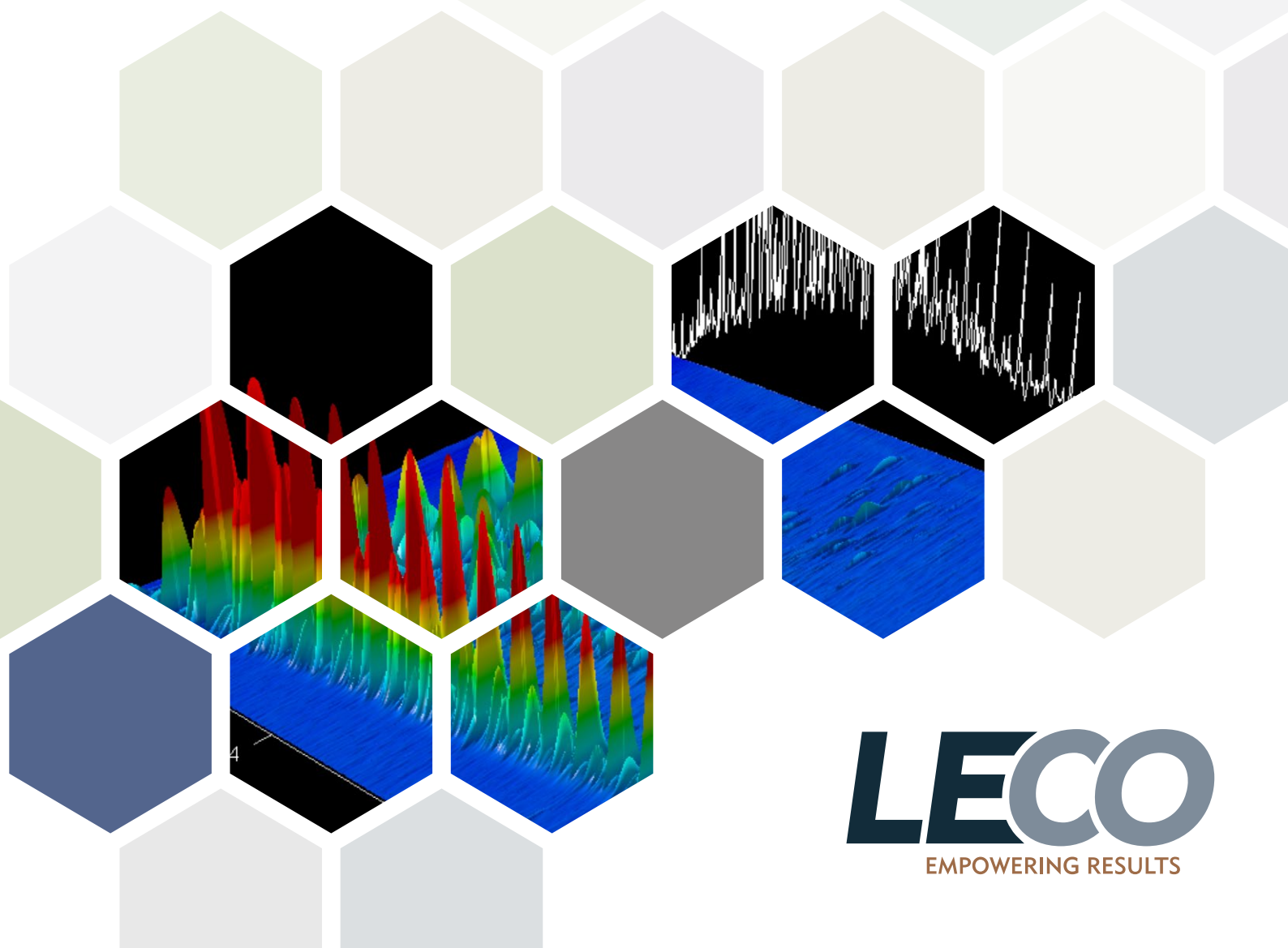


PEGASUS[®] HRT+ 4D



LECO
EMPOWERING RESULTS

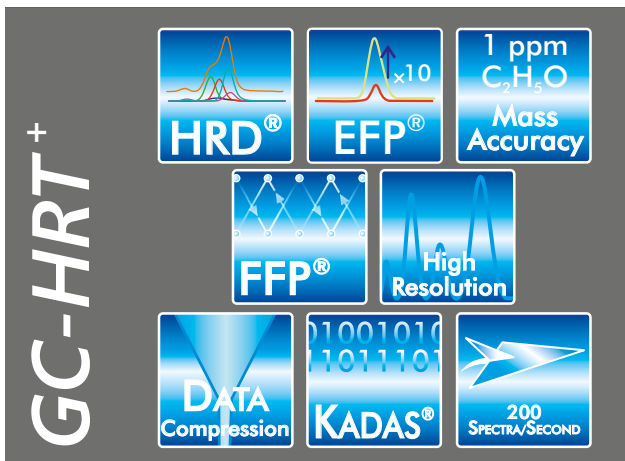
The Ultimate GC×GC Game Changing Technology

The solution for complex sample analysis has arrived. LECO's PEGASUS® GC-HRT⁺ 4D combines the highest performance Time-of-Flight Mass Spectrometer with industry leading GC×GC, giving analytical scientists the ability to identify components with more confidence, convert unknowns to real knowns, and find out what else is in their sample. The *Pegasus* GC-HRT⁺ 4D takes advantage of four dimensions of separation and resolution.

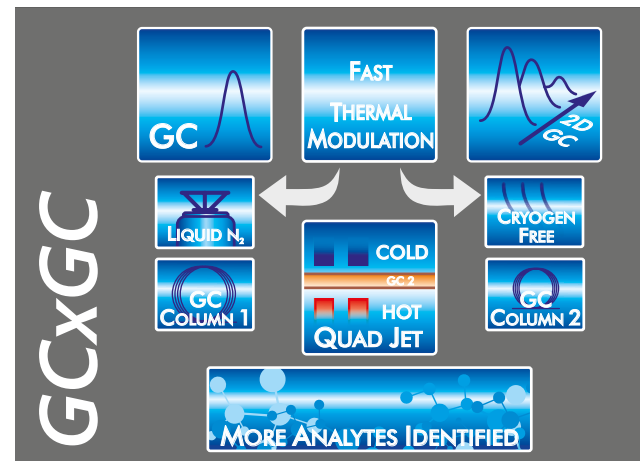
- (1) 1st dimension chromatographic resolution
- (2) 2nd dimension chromatographic resolution
- (3) High mass resolution and exceptional mass accuracy
- (4) High Resolution Deconvolution® (HRD®) from the leaders in deconvolution



An Integration of Two High Performance Technologies



+

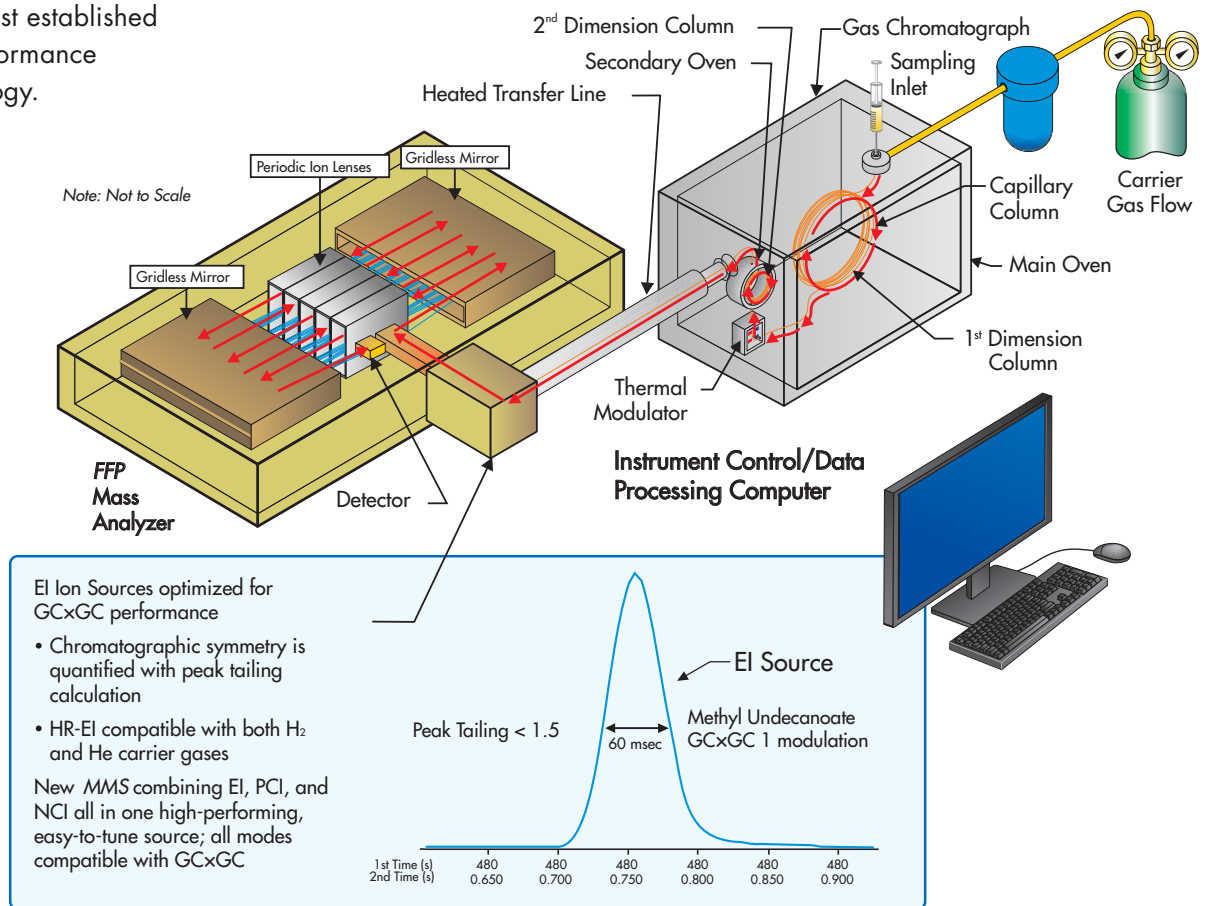


- A combination of the highest performance GCxGC and TOF on the market gives users an unprecedented ability to interrogate complex samples
- Find more analytes than ever before and identify components with the ultimate confidence
- Mass accuracies of 1 ppm and peak capacities at least two times greater than any other product in the marketplace
- The industry's most established GCxGC system; thermal modulation with liquid nitrogen or cryogen-free versions
- Novel Encoded Frequent Pushing® (EFP®) allows increased sensitivity
- Multi-Mode Source™ (MMS™) has great mass accuracy and high resolution on pseudo-molecular ions, which complements the traditional Electron Ionization Source (HR-EI), to provide the comprehensive characterization of unknowns
- Integrated software platform acquires data, controls all hardware, and analyses and reports results with a high level of automation; tailored to get the most out of High Resolution TOF data
- Designed to maintain 1st dimension chromatographic separation and harness the power of a 2nd dimension of chromatography

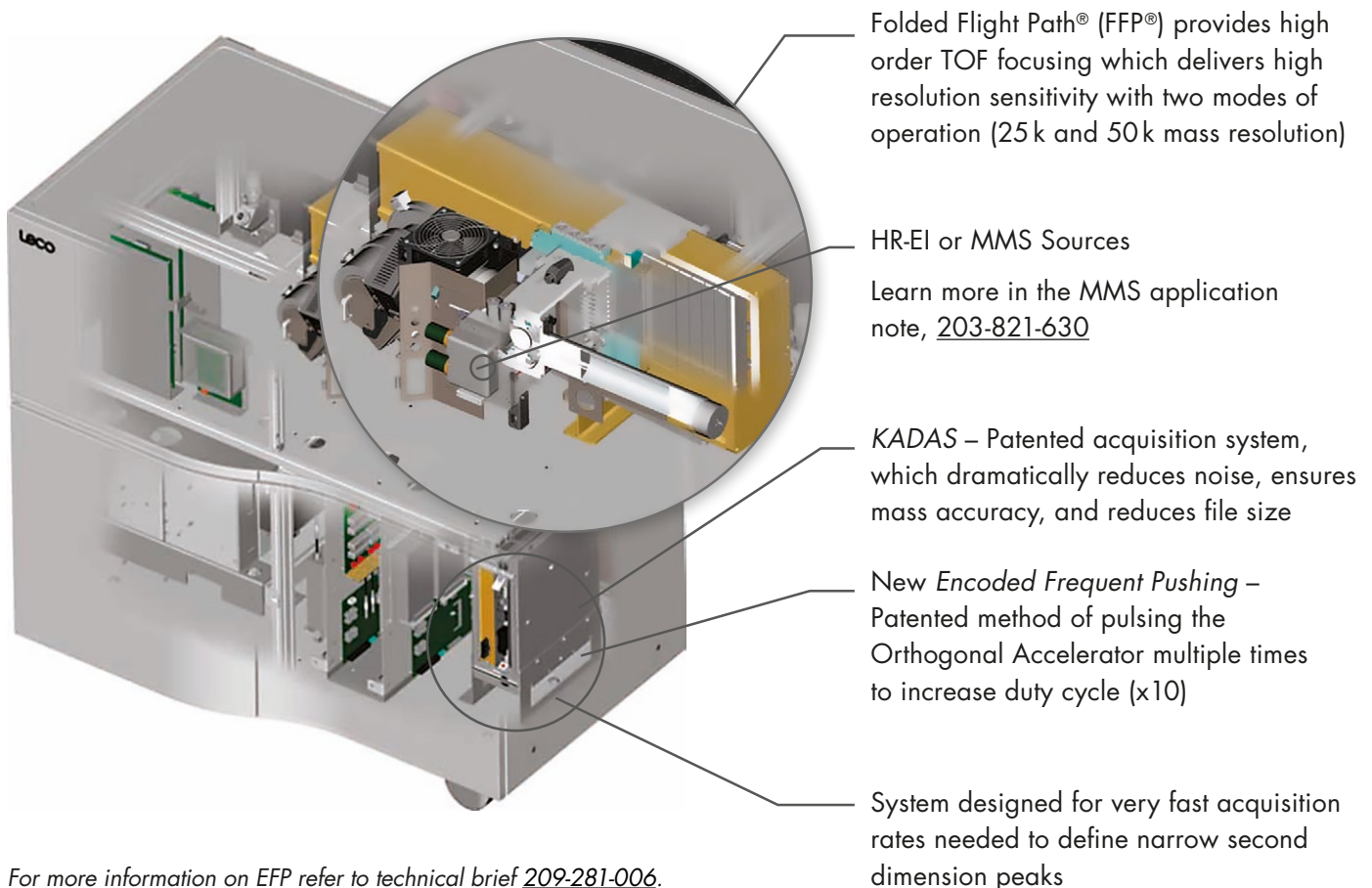


PEGASUS® GC-HRT+ 4D Hardware

The industry's most established and reliable performance GCxGC technology.



Capable of up to 50,000 mass resolution and acquisition rates up to 200 spectra/second.



For more information on EFP refer to technical brief [209-281-006](#).

PEGASUS® GC-HRT+ 4D Software

Identification Grading System™ (IGS™)

Increase confidence in your identification challenges with intuitive ChromaTOF® brand software. LECO's *Identification Grading System (IGS)* feature eases data review by allowing users to quickly see, justify, have

confidence in, and report on which chemicals are in a particular sample. This in turn allows a user to make confident decisions on what to do next.

Stop Guessing What is in Your Sample: KNOW

The IGS uses all the available chemical information generated from the *Pegasus GC-HRT+ 4D* to add confidence to your unknown unknown identification process.

The IGS™ gives a grade to a particular identification based on 4 criteria:

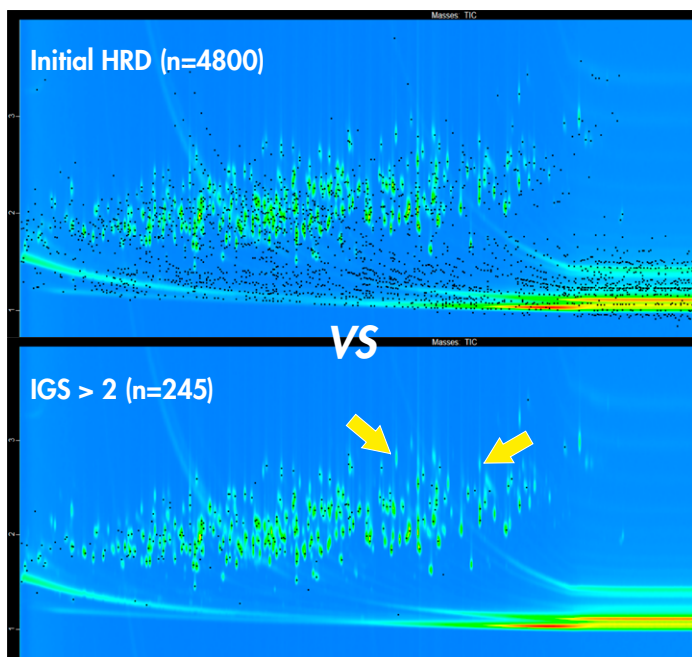
- (1) Presence and accurate mass of a molecular ion
- (2) Presence and good correlation of a spectral similarity score from a curated library
- (3) Accurate masses of sensible potential formulae of fragmented ions corresponding to a spectral library hit
- (4) Matching retention index from the library hit

The higher the value of the grade the more confident you can be in your identification.

The true power of identification can only be realised with the combined power of GCxGC and high resolution time-of-flight mass spectrometry (TOFMS)

- GCxGC separates coeluting species and gives cleaner mass spectra than other techniques
- TOFMS enables unskewed mass spectra across a chromatographic peak even across very narrow second dimensional peak; which, when combined with deconvolution, yields the highest quality spectra that you can generate

Born out of the EPA's Non-Targeted Analysis Collaborative Trial (ENTACT), the IGS is LECO's solution to the time-intensive process of data review.



Here is an example of the unfiltered deconvolution results from a GCxGC-TOFMS analysis of a sample from the EPA's ENTACT project:

www.doi.org/10.1007/s00216-018-1435-6

By applying the IGS filter, we can quickly view only the most confident identifications. This simplification is dramatic and enables you to immediately begin investigating the "unknown unknowns," indicated by arrows in the diagram.

Of the known compounds entered into the sample from this particular example (which was provided to LECO as a blind sample), IGS identified approximately 80% of the known peaks. The combination of GCxGC and high resolution TOF was proven to be necessary for this confidence. See website:

pubs.acs.org/doi/10.1021/es5002105

ChromaTOF® Tile

ChromaTOF Tile revolutionizes how GCxGC data is analysed. This software compares GCxGC data files quickly and easily. Statistically significant differences

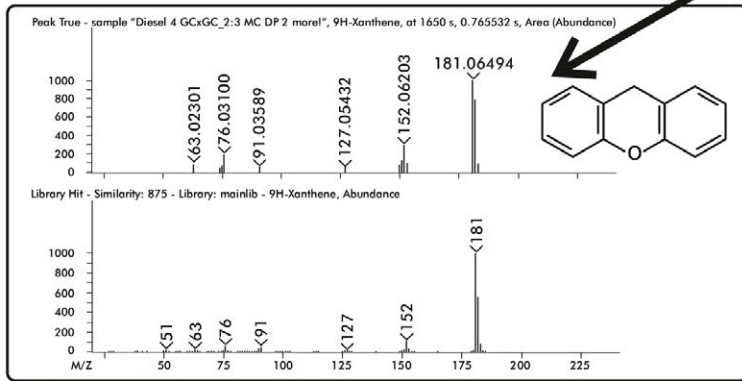
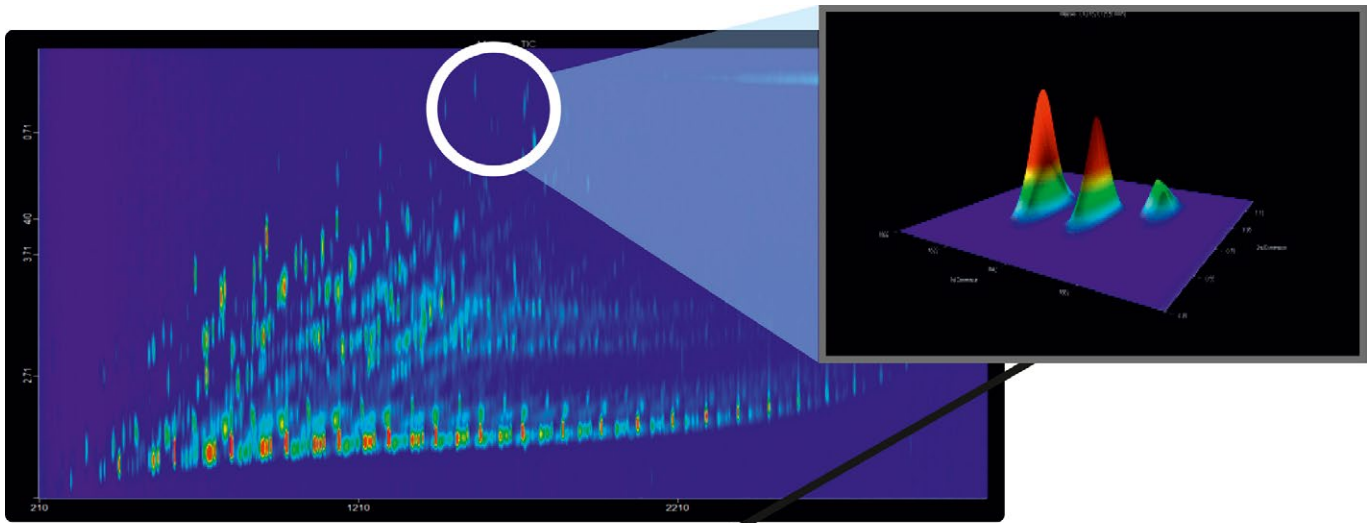
rise to the top so you can spend less time finding the differences and more time finding out what they mean.

Identify Components with Confidence



High Resolution Deconvolution® (HRD®) Example: Diesel GCxGC

The combination of HRD and mass accuracy gives users exceptional confidence in identification.

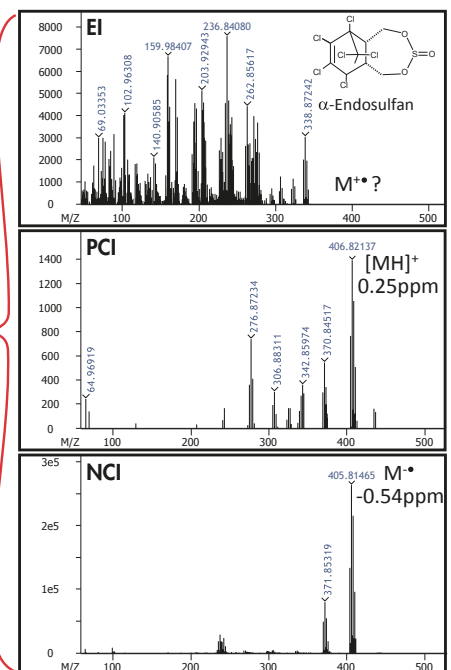
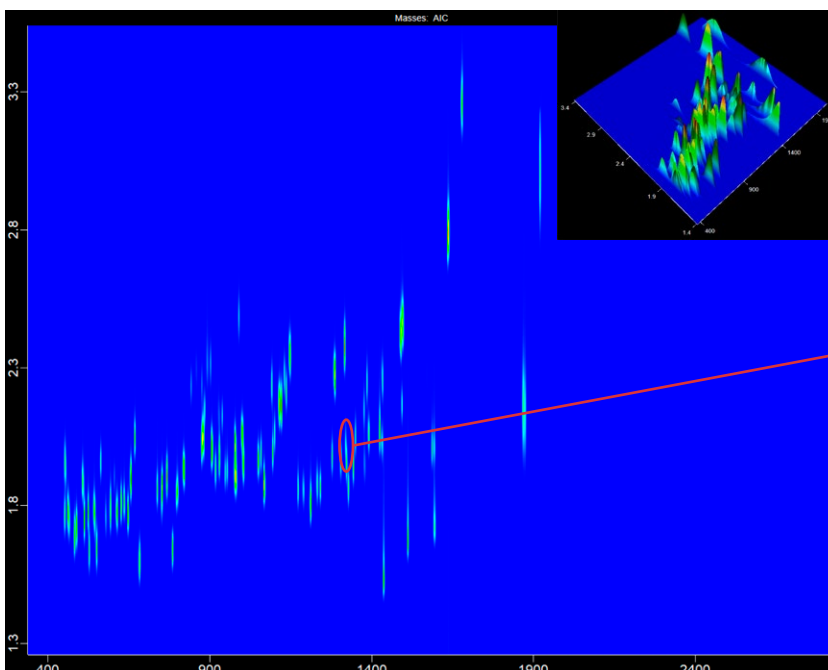


| Mass | Formula | Accuracy (ppm) |
|-----------|-----------------------------------|----------------|
| 182.07233 | C ₁₃ H ₁₀ O | -0.68 |
| 181.06494 | C ₁₃ H ₉ O | 0.80 |
| 152.06207 | C ₁₂ H ₈ | 0.13 |

Identify more with confidence

The highly robust Multi-Mode Source™ allows for the acquisition of regular Electron Ionization as well as complementary Positive and Negative Chemical

ionization spectra in GCxGC mode, easily switching between modes for each acquisition. This uncovers extra molecular ion evidence for your identification challenges.



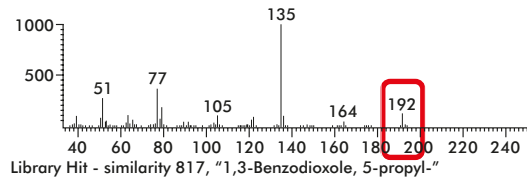
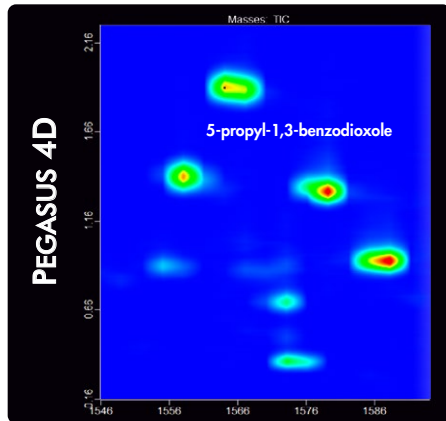
Make Your Unknowns Known

Unknown identification is made easy with the PEGASUS® GC-HRT+ 4D.

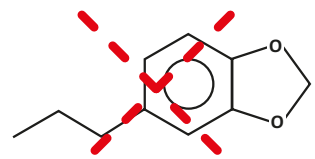
Example: Perfume Investigation

The process of improving identifications is simplified by the GC-HRT+ 4D. In the following, there is a moderate identification from our Pegasus 4D (top) of an analyte with very different odour properties.

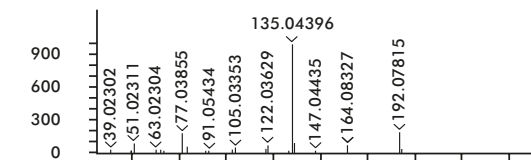
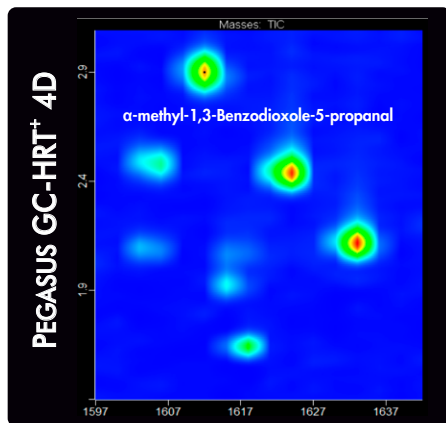
The Pegasus GC-HRT+ 4D (bottom) has improved the identification of this component to a more odour appropriate hit, as well as being more consistent with the data.



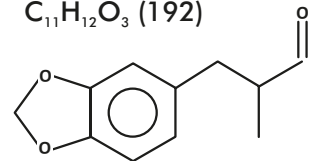
Identification close, but not precise



Odor Type: Spicy



$C_{11}H_{12}O_3$ (192)



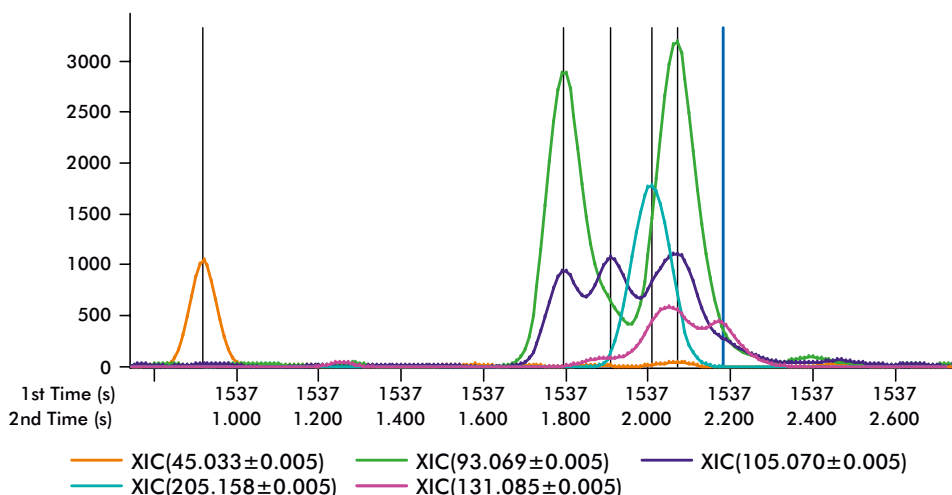
Odor Type: Floral

| Formula | Observed Mass | Calculated Mass | Mass Accuracy (ppm) |
|-------------------|---------------|-----------------|---------------------|
| $C_{11}H_{12}O_3$ | 192.0782 | 192.0781 | 0.29 |
| $C_{10}H_{12}O_2$ | 164.0833 | 164.0832 | 0.53 |
| $C_9H_{10}O_2$ | 135.044 | 135.0441 | -0.75 |
| $C_8H_8O_2$ | 122.0363 | 122.0362 | 0.47 |
| C_7H_8O | 105.0335 | 105.0335 | 0.38 |
| C_6H_6 | 77.03855 | 77.03858 | -0.4 |

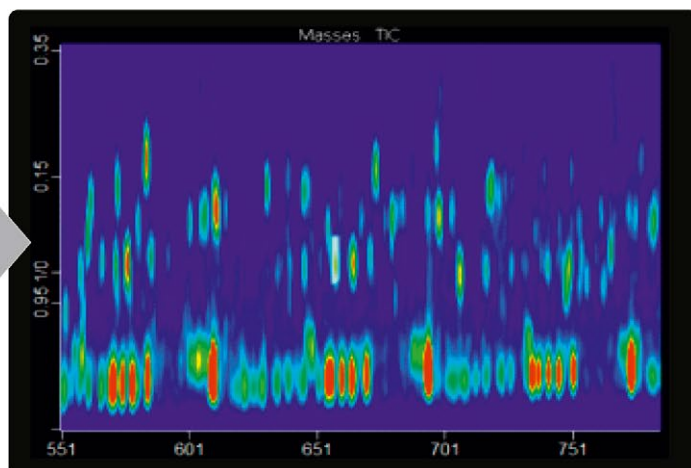
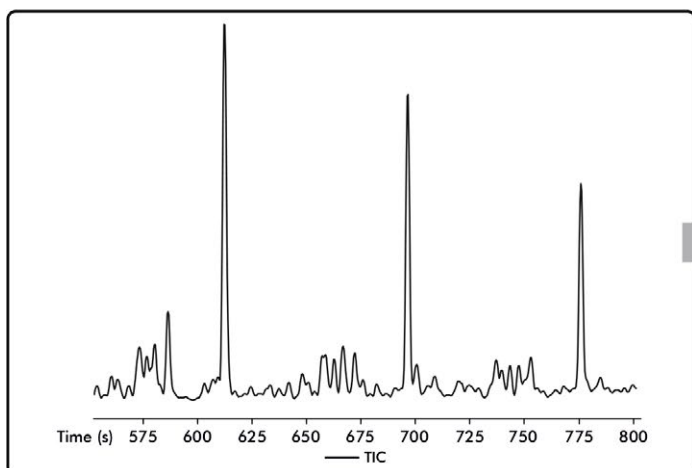
Find more peaks

One modulation period is depicted below, fast spectra acquisition rates are vital to deconvolute complex regions of the chromatogram. Fast modulation is needed to maintain the first dimension of chromatography.

If a peak in the second dimension chromatogram is 60 msec wide, it requires 200Hz to sample appropriately for effective deconvolution.



Find More Peaks Using GCxGC and Discover: What Else Is In Your Sample



Find more peaks than ever before using high resolution GCxGC. These insets of a diesel sample show the

difference in data collected using one-dimensional (left) and two-dimensional chromatography (right).

Be More Confident In Your Assignments

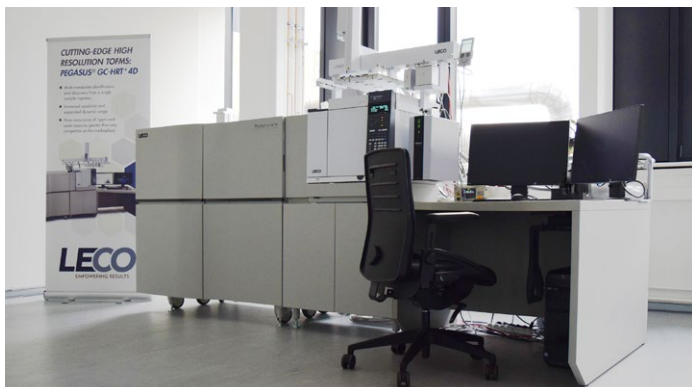
Better understand the chemistry of your sample by finding out what else is in your sample.

PEGASUS® GC-HRT+ 4D

Deconvolution | GCxGC

Productivity | Reproducibility

Accurate Mass | Identification



Our Commitment to Quality and Service

LECO instruments are noted for superior precision, speed, and ease-of-use. We are an international company with over 25 subsidiaries worldwide. Our global network of sales/support is dedicated to customer service and satisfaction, and our commitment to quality is further underscored with ISO-9001:2015 certification. We conform to CE quality and safety specifications, fully testing our instruments at our on-site Compliance Testing Centre.

ISO-9001:2015 Q-994 | LECO, Pegasus, ChromaTOF, Folded Flight Path, FFP, High Resolution Deconvolution, HRD, KADAS, Encoded Frequent Pushing, EFP, Multi-Mode Source, and MMS are trademarks of LECO Corporation. Microsoft, Windows are registered trademarks of Microsoft Corporation.

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