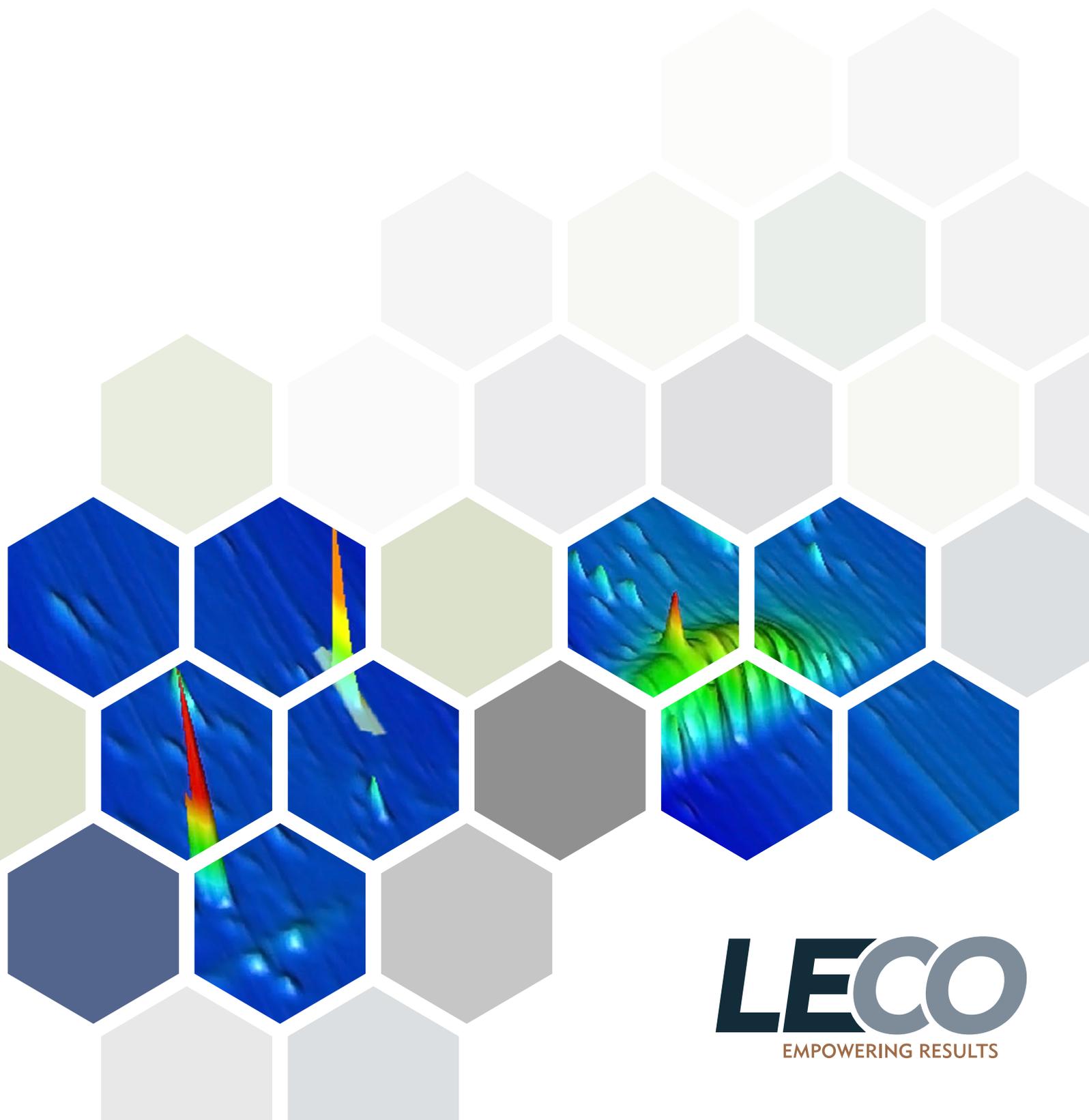


GCxGC
*Comprehensive Two-Dimensional
Gas Chromatography*

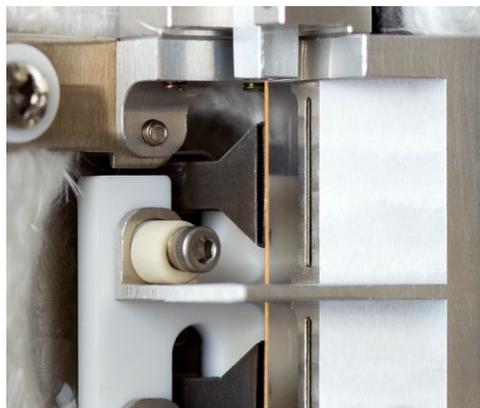


LECO
EMPOWERING RESULTS

LECO's GCxGC – Comprehensive Two-Dimensional Gas Chromatography

Take Your Chromatography to the Next Level

LECO comprehensive two-dimensional gas chromatography (GCxGC) with FID and/or ECD detectors is the ideal solution for your analytical methods which require superior resolving power over that which you have been able to achieve with traditional GC. Whether you need to speciate sulfurcontaining compounds in petroleum, separate halogenated pesticides, or quantify chiral compounds in flavours or fragrances, LECO's GCxGC options deliver unparalleled separating power and up to an order-of-magnitude increase in peak detectability. No other system available on the market can deliver these advantages to you in a seamless, easy-to-use package.



Introducing the first-ever low-maintenance, consumable-free thermal modulator



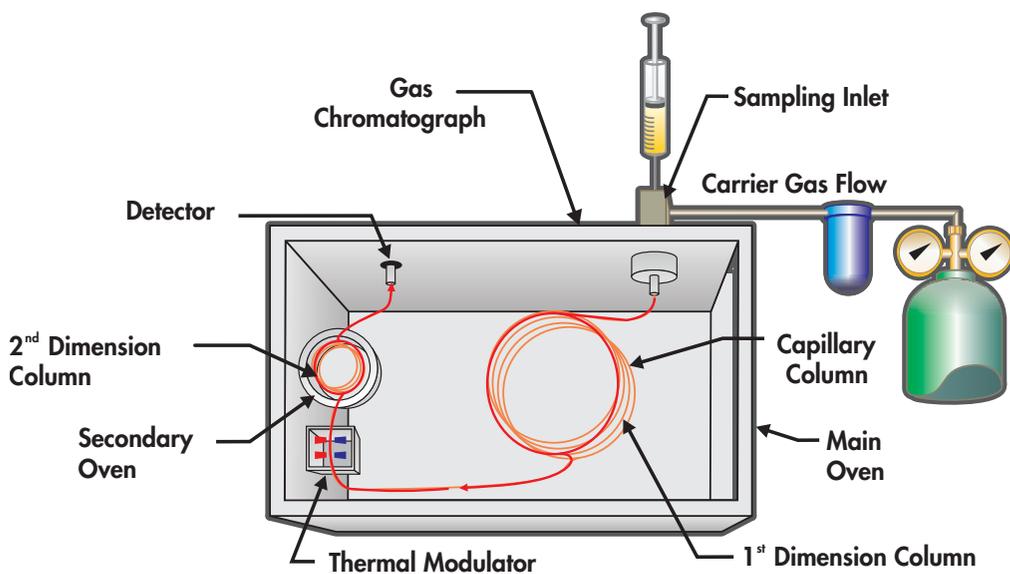
Leading the Way in GCxGC Instrumentation

What is GCxGC?

GCxGC, or comprehensive two-dimensional gas chromatography, is a technique that utilises two columns of differing selectivities connected in series by a modulation device. The end result of the technique is dramatically increased peak capacity, improved peak resolution, and up to an order-of-magnitude increase in compound detectability. As opposed to heart-cutting (2DGC), GCxGC passes all effluent from the primary column through the secondary column, maximising sample resolution throughout the entire analysis. Heart-cutting can only accomplish this in a narrow, pre-determined time window. Hundreds-to-thousands of individual heart-cutting analyses would be required to accomplish what LECO's GCxGC delivers to you in one analysis.

LECO's GCxGC Thermal Modulator, **also available as a consumable-free option**, is the key to the enhancement of peak detectability. The modulator, located between the two columns, consists of a robust dual-stage, quad-jet system that creates two distinct cooled trapping zones which ensures all of the effluent from the first column is properly focused prior to thermal release into the second column. A secondary oven is used for optimisation of the second dimension separation. GCxGC occurs by the subsequent re-injection of effluent from one chromatographic column into a second orthogonal column. The cycle of refocusing and reinjection is matched to the time required for compounds to elute from the second GC column, resulting in the separation of compounds across a plane rather than just along a line.

Diagram of a GCxGC Instrument



The GCxGC hardware (modulator and secondary oven) are mounted inside the primary GC oven. Control of the GC autosampler, GC, LECO's GCxGC thermal modulator, and the selected detector are fully integrated within a single computer using LECO's ChromaTOF software.

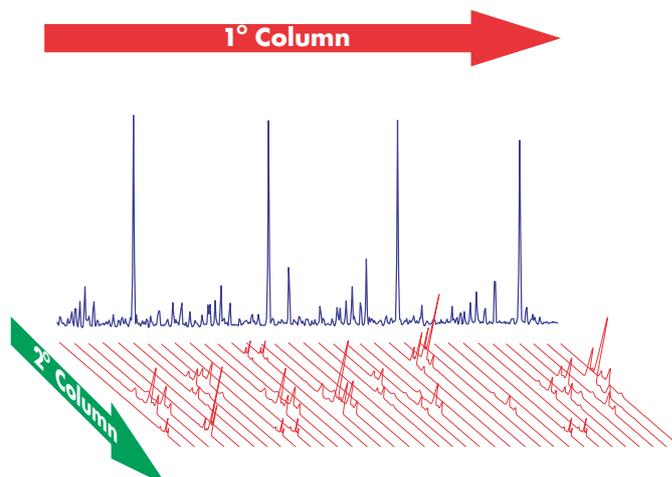


The Answers to Your Chromatographic Challenges

Why Do I Need GCxGC?

Simple answer—resolving power! Ever struggle to separate a compound of interest from matrix background or nearby coeluting peaks? Due to the orthogonal nature of the separation mechanism in GCxGC, compounds are easily separated from matrix interferences. Baseline separation for each peak of interest can be clearly seen on a visually elegant retention plane.

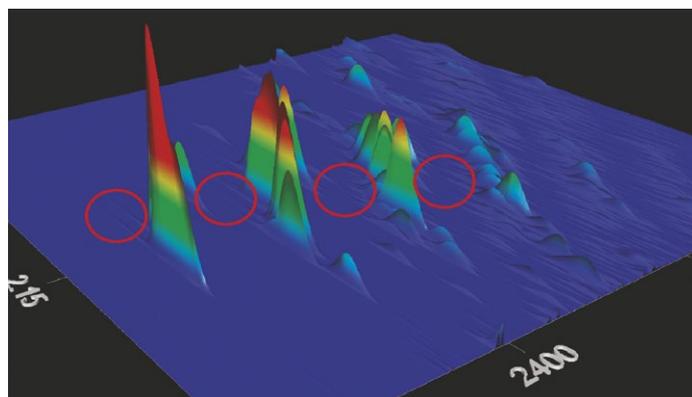
The use of GCxGC will also provide your laboratory with increased peak detectability. Because true GCxGC incorporates a modulation device, peaks eluting from the primary column are quantitatively segmented into smaller sections prior to release onto the second column. This “segmenting”, combined with the cryo-focusing of the modulator, delivers peak widths as narrow as 50 ms to the second column. These segmented cryo-focused peaks provide up to an order-of-magnitude increase in signal-to-noise. With this focusing you will gain the ability to separate your peaks of interest AND you will lower the limit of detection of your chromatographic system to levels unachievable in traditional GC methods.



Schematic demonstrating the creation of a GCxGC surface plot. The linear signal received by the detector is mathematically realigned to form the three dimensional chromatogram.

Thermal Modulation

Thermal modulation delivers the highest performance of any available modulator for GCxGC. Other types of thermal or valve-based modulators do not match up to the ruggedness, reliability, and performance of LECO's patented GCxGC modulator. With LECO's GCxGC system, modulation is accomplished via a dual-stage, quad-jet thermal modulator positioned between the two columns. LECO's thermal modulator allows for on-column cryo-focusing within the GCxGC system, providing increased peak detectability and increased separation of coeluting compounds.



GCxGC chromatogram of a diesel sample showing the loss of sulfur (red circles) after refining.

Thermal Modulation Without the Hassle of Liquid Nitrogen

With LECO's Consumable-Free Modulator you can now choose the compound volatility range you need to modulate. If your application requires you to modulate at extreme low volatility, the traditional LN2 cooled modulator is recommended. However, if your method requires you to modulate highly volatile compounds, the consumable-free modulator will save you time and money without sacrificing performance.

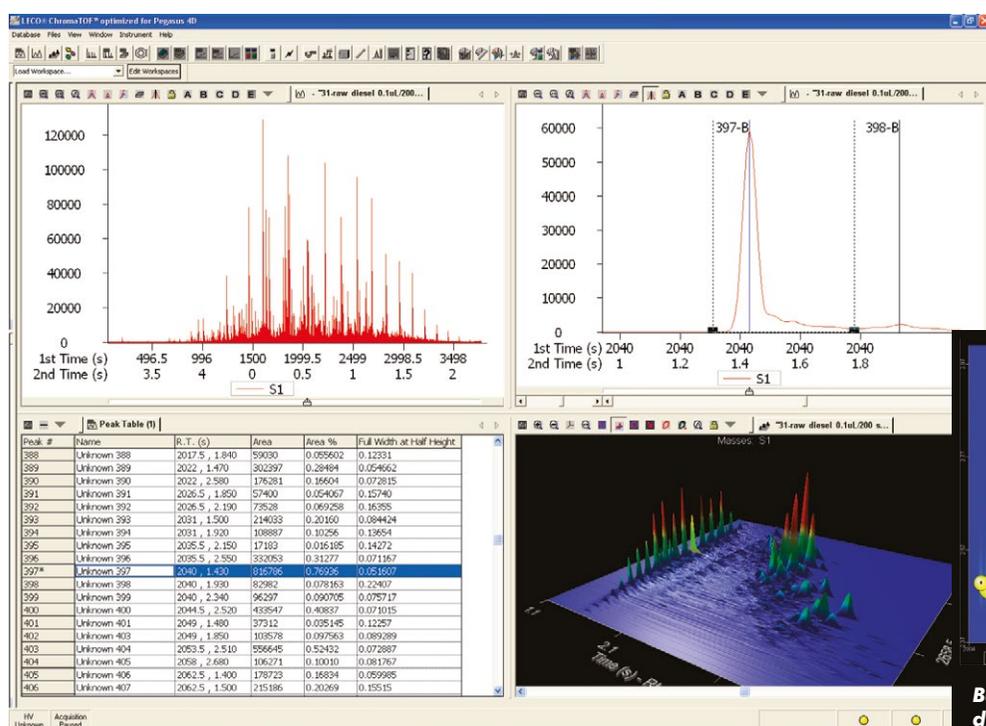
LECO's thermal modulation design gives you the upper hand in laboratory productivity. Ease-of-use and flexibility for second column choice allow for improved analytical results. Ask yourself – if you're not getting complete results from your second dimension, are you really justifying the purchase of a GCxGC instrument?

Leading the Way in Advanced GCxGC Data Processing

ChromaTOF® Brand Software

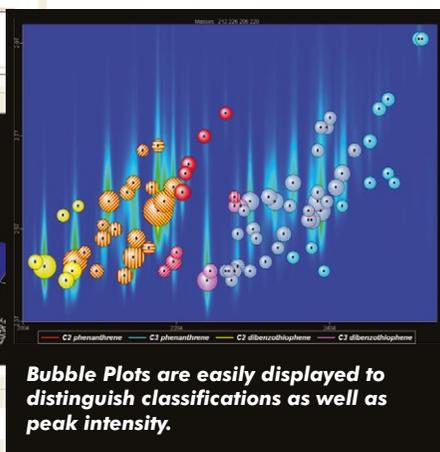
LECO's pioneering efforts in GCxGC data processing have resulted in the most comprehensive software package available. Offering the industry's most advanced data-mining algorithms, *ChromaTOF* combines ease-of-use with advanced chromatographic techniques and three-dimensional chromatogram visualisation to deliver a seamless data analysis package well-suited for both routine and research-level use. Even the most demanding analytical samples will be easily characterised, resulting in increased component identification and laboratory productivity.

- User-defined classifications – peak grouping based on proximity in chromatographic plane
- Bubble plots – peak intensity represented by circle radius
- Custom generated reports
- Built-in spreadsheets for advanced data-mining
- Data exporting for secondary software analysis
- Advanced Automated Peak Find algorithm
- Contour and surface plot 3D chromatogram visualisation



Compound classifications can be displayed in peak tables to provide quick identification and ease of filtering.

Peak #	Name	R.T. (s)	Classifications	UniqueMass	Area	Area %
376	Benzene, 2-butenyl-	5140, 1.170	C4 Benzene	117	1538995	2.3140
386	Benzene, 2-butenyl-	5190, 1.200	C4 Benzene	89	322884	0.48549
400	Benzene, 1-methyl-3-(1-methylethyl)-	5240, 1.140	C4 Benzene	119	1008683	1.5167
441	Benzene, 2-ethyl-1,4-dimethyl-	5370, 1.170	C4 Benzene	119	2227039	3.3486
635	Naphthalene	6040, 2.060	Naphthalene	128	3039449	4.5701
1036	Naphthalene, 1-methyl-	7010, 1.930	C1 Naphthalene	115	2319808	3.4880
1108	Naphthalene, 1-methyl-	7140, 2.010	C1 Naphthalene	142	2113343	3.1776
1417	Biphenyl	7650, 2.070	Biphenyl	154	1253861	1.8853
1519	Naphthalene, 1-ethyl-	7800, 1.820	C2 Naphthalene	141	1376714	2.0700
1536	1,1'-Biphenyl, 4-methyl-	7820, 1.890	C1 Biphenyl	168	314007	0.47214
1585	Naphthalene, 2,6-dimethyl-	7890, 1.840	C2 Naphthalene	156	1109035	1.6675
1795	Naphthalene, 1,3-dimethyl-	8160, 1.970	C2 Naphthalene	141	735212	1.1055
1872	Naphthalene, 1-ethyl-	8270, 2.020	C2 Naphthalene	156	250039	0.37596
1892	Naphthalene, 2-(1-methylethyl)-	8290, 1.700	C3 Naphthalene	155	94854	0.14262
2008	1,1'-Biphenyl, 4-methyl-	8450, 1.980	C1 Biphenyl	168	1312337	1.9732
2031	Benzene, 1,1'-ethyldienebis-	8480, 1.780	C3 Naphthalene	167	12686	0.019074
2041	Naphthalene, 1-propyl-	8490, 1.740	C3 Naphthalene	141	194757	0.29284
2066	1,1'-Biphenyl, 4-methyl-	8520, 1.990	C1 Biphenyl	168	509795	0.76653
2092	1(2H)-Naphthalenone, 3,4-dihydro-	8550, 1.990	C1 Biphenyl	90	36484	0.054858
2120	Naphthalene, 1,4,5-trimethyl-	8580, 1.750	C3 Naphthalene	155	142313	0.21398
2130	Naphthalene, 1,4,5-trimethyl-	8600, 1.780	C3 Naphthalene	155	129745	0.19508
2164	Naphthalene, 1,4,5-trimethyl-	8650, 1.750	C3 Naphthalene	155	986836	1.4838
2183	Naphthalene, 1,4,5-trimethyl-	8680, 1.790	C3 Naphthalene	170	140984	0.21198
2184	1-Isopropenylnaphthalene	8680, 1.960	C1 Biphenyl	153	39085	0.058768
2217	Naphthalene, 1,4,5-trimethyl-	8720, 1.820	C3 Naphthalene	155	225433	0.33896



Bubble Plots are easily displayed to distinguish classifications as well as peak intensity.

Peak Table

Font | Columns | User Fields | Concerns | Filters | Sort

Link filter and concern changes between views.

Display the following Types in the Peak Table

Quantified

Match

Out Of Tolerance

Unknown / Contaminant

Not Found

Group:

Classification: Naphthalene,C1 Naphthalene,C2 Naphthalene,C3

Display Summary Quantifications

Expand Semi Quantifications

Display Second Dimension Peaks

Display Problem Peaks

Display Total Row

OK Cancel Apply Help

Life Science and Chemical Analysis Solutions

Every day around the world, LECO instruments continuously perform analyses for today's most complex applications. Whether you are analysing samples in the



PEGASUS® HRT+ 4D GCxGC-MS

- Find more analytes than ever before and identify components with the ultimate confidence
- With mass accuracies of 1 ppm and peak capacities at least two times greater than anywhere else in the marketplace
- The industry's most established GCxGC systems; thermal modulation with liquid nitrogen or cryogen-free versions
- Chemical Ionization source (HR-CI) provides the same mass accuracy and high resolution on pseudo-molecular ions which complements the traditional Electron Ionization source (HR-EI) to provide comprehensive characterisation 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 HR data

food, flavour/fragrance, petroleum, environmental, or life science (metabolomics) industries, we have an instrument configuration to meet your needs.



PEGASUS® BT 4D GCxGC-MS

- Enhanced sensitivity by coupling our benchtop Pegasus BT with our high performance GCxGC thermal modulation system for analysing the most complex samples
- Cost-effective FLUX™ flow modulation system is an excellent option for those looking for added capability over one dimensional GC
- Unique and powerful ChromaTOF brand software simplifies quantitation and analyte identification with features such as NonTarget Deconvolution® (NTD®), Target Analyte Find, library searches, and more
- StayClean® ion source eliminates the need for source cleaning

A Commitment to Quality and Service



European Application and Technology Centre, Berlin – Germany

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 and support includes over 25 subsidiaries worldwide, and is dedicated to customer service and satisfaction. Our commitment to quality is further underscored with ISO-9001:2015 certification. We conform to CE quality and safety specifications, fully testing instruments at our on-site Compliance Testing Centre.

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