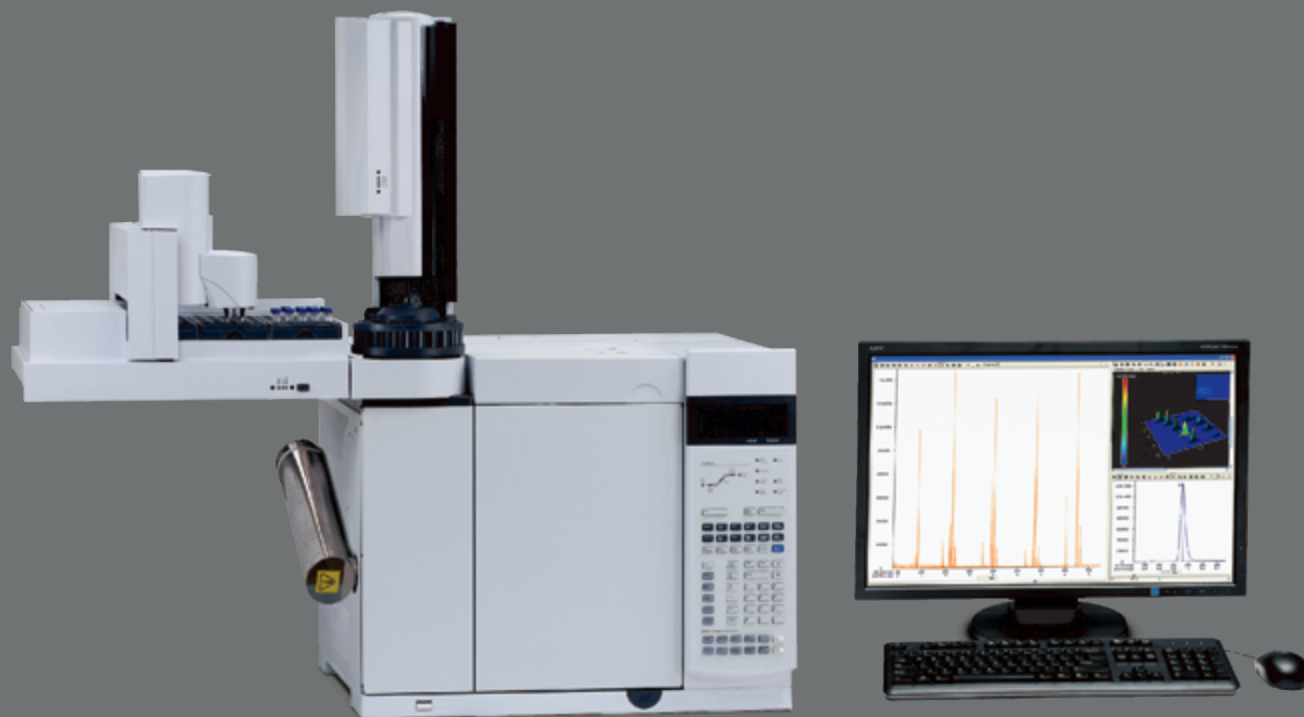


## GCxGC Comprehensive Two-Dimensional Gas Chromatography

# 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 sulfur-containing compounds in petroleum, separate halogenated pesticides, or quantify chiral compounds in flavors 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.



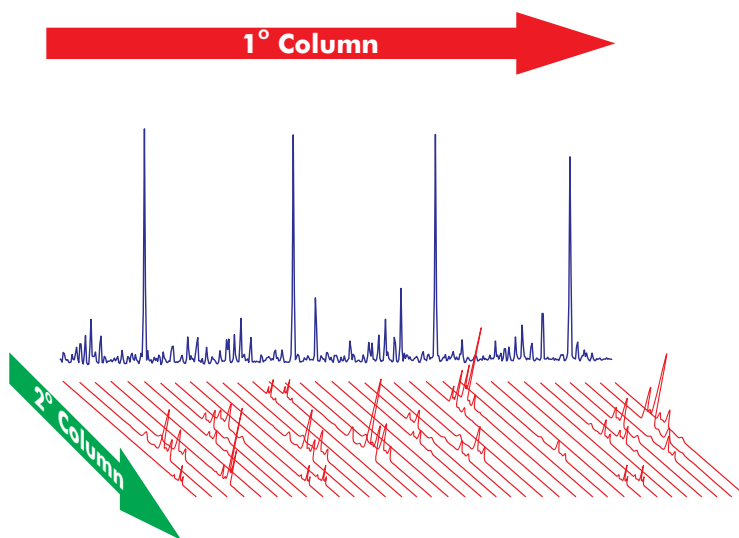
Introducing the first-ever low-maintenance, consumable-free thermal modulator

# The Answers to Your Chromatographic Challenges

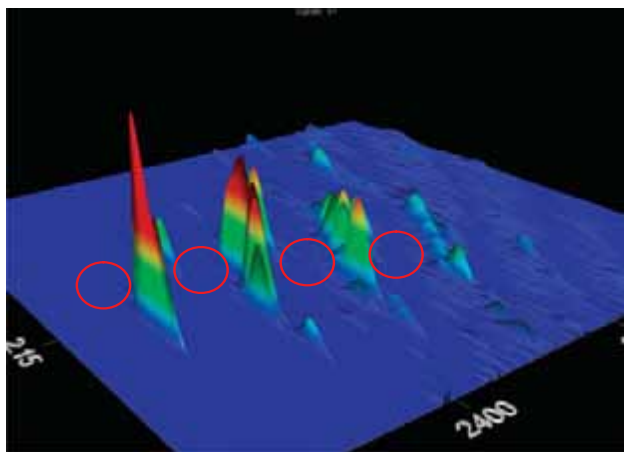
## Why Do I Need GCxGC?

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.*



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

## 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.

## 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 LN<sub>2</sub> 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.

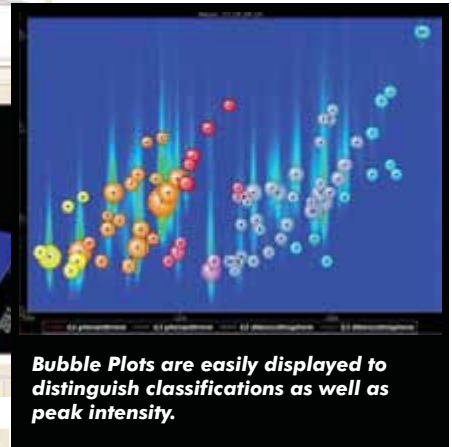
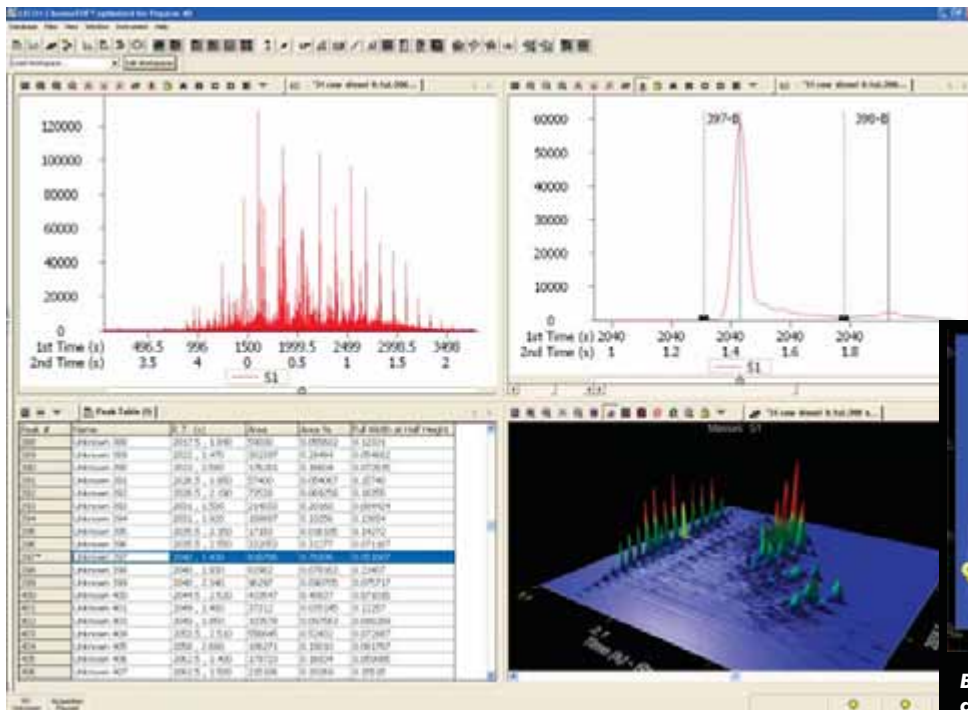
LECO's thermal modulation design gives you the upper hand in laboratory productivity. Ease-of-use and flexibility for second column choice allow for improved analytical results. Ask yourself—if you're not getting complete results from your second dimension, are you really justifying the purchase of a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



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

Peak #	Name	R.T. (s)	Classifications	Uniqueness	Area	Area %
376	Benzene, 2-butanyl	5140, 1.170	C4 Benzene	117	1538995	2.3140
386	Benzene, 2-butanyl	5190, 1.200	C4 Benzene	99	322694	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	Napthalene	6040, 2.060	Napthalene	129	3039449	4.5701
1036	Napthalene, 1-methyl-	7010, 1.930	C1 Napthalene	115	2319800	3.4980
1108	Napthalene, 1-methyl-	7140, 2.010	C1 Napthalene	142	2113343	3.1776
1417	Biphenyl	7650, 2.070	Biphenyl	154	1253881	1.8853
1519	Napthalene, 1-ethyl-	7800, 1.820	C2 Napthalene	141	1376714	2.0700
1536	1,1'-Biphenyl, 4-methyl-	7820, 1.690	C1 Biphenyl	168	314007	0.47214
1585	Napthalene, 2,6-dimethyl-	7890, 1.840	C2 Napthalene	156	1109035	1.6675
1795	Napthalene, 1,3-dimethyl-	8160, 1.970	C2 Napthalene	141	735212	1.1055
1872	Napthalene, 1-ethyl-	8270, 2.020	C2 Napthalene	156	250039	0.37596
1892	Napthalene, 2-(1-methyl-ethyl)-	8290, 1.700	C3 Napthalene	155	94854	0.14252
2008	1,1'-Biphenyl, 4-methyl-	8450, 1.980	C1 Biphenyl	168	1312337	1.9732
2031	Benzene, 1,1-ethyl-dimethyl-	8480, 1.780	C3 Napthalene	167	12686	0.019074
2041	Napthalene, 1-propyl-	8490, 1.740	C3 Napthalene	141	194757	0.29294
2066	1,1'-Biphenyl, 4-methyl-	8520, 1.990	C1 Biphenyl	168	509795	0.76653
2092	1(2H)-Napthalenone, 3,4-dihydro-	8550, 1.990	C1 Biphenyl	90	36404	0.054050
2120	Napthalene, 1,4,5-trimethyl-	8580, 1.750	C3 Napthalene	155	142313	0.21398
2130	Napthalene, 1,4,5-trimethyl-	8600, 1.780	C3 Napthalene	155	129745	0.19508
2164	Napthalene, 1,4,5-trimethyl-	8650, 1.750	C3 Napthalene	155	588836	1.4833
2183	Napthalene, 1,4,5-trimethyl-	8680, 1.790	C3 Napthalene	170	140994	0.21190
2184	1-isopropenyl-napthalene	8680, 1.960	C1 Biphenyl	153	30095	0.050768
2217	Napthalene, 1,4,5-trimethyl-	8720, 1.820	C3 Napthalene	155	225433	0.33896

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

The 'Peak Table' settings dialog box allows users to customize the display of peak data. It includes options for displaying various types of peaks (e.g., Quantified, Match, Out Of Tolerance) and a 'Classification' dropdown menu. The 'Classification' menu is currently set to 'Napthalene C1 Napthalene C2 Napthalene C3'.

# Leading the Way in GCxGC Instrumentation

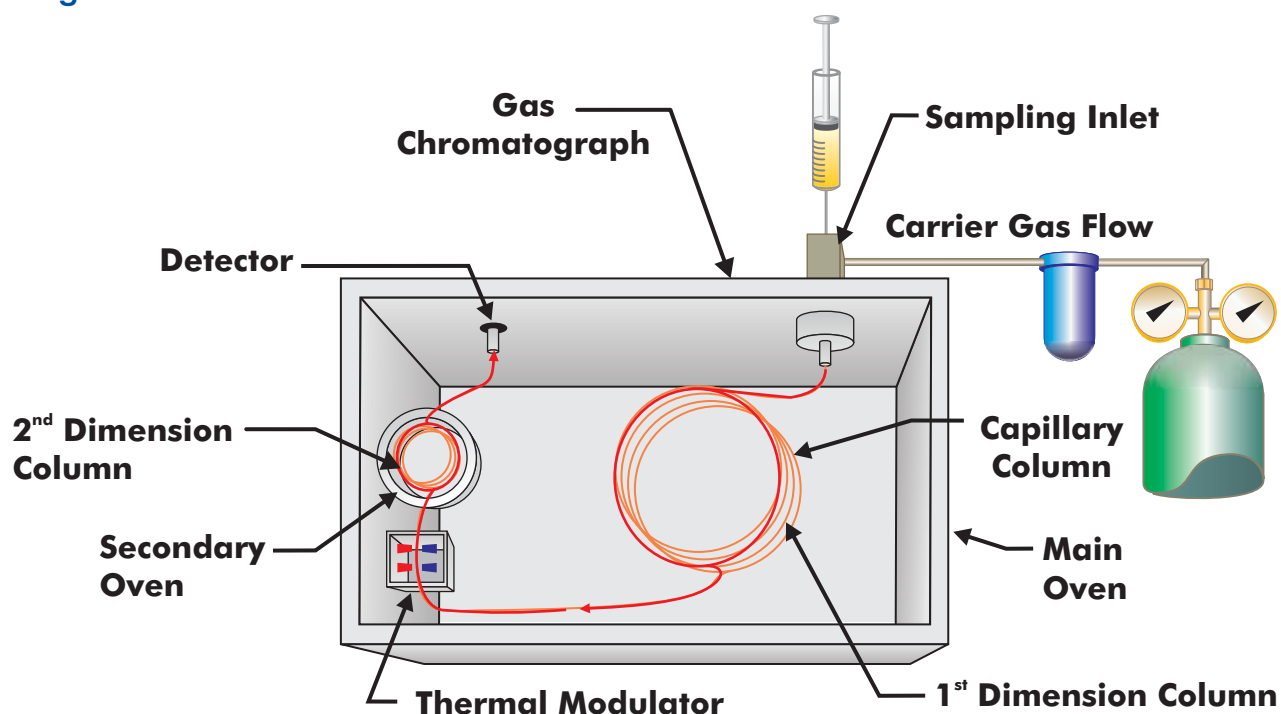
## What is GCxGC?

GCxGC, or comprehensive two-dimensional gas chromatography, is a technique that utilizes 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, maximizing 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 optimization 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 re-injection 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.*

# 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 analyzing samples in the food, flavor/fragrance, petroleum, environmental, or life science (metabolomics) industries, we have an instrument configuration to meet your needs.



## Pegasus® GC-HRT

- Next generation of high performance mass spectrometers for the GCMS market
- Folded Flight Path® (FFP) technology to allow users to achieve resolutions of up to 50,000
- Employs ChromaTOF-HRT® software with Automated Peak Find and True Signal Deconvolution® for seamless data handling and compatibility with the NIST Library



## Pegasus 4D GCxGC-MS

- Pegasus, with 500 spectra/second, offers you the only MS detector capable of comprehensive two-dimensional GC (GCxGC)
- ChromaTOF software gives you the ability to take your sample characterization to the next level
- The ultimate in chromatographic resolution from the pioneer of GCxGC technology



## Pegasus HT GCMS

- Acquisition speed up to 500 spectra/second offers you the ideal MS detector for unparalleled throughput
- Powerful Windows®-based ChromaTOF software simplifies component identification—providing a significant increase in efficiency and productivity
- Key features include automated data mining, chromatogram locking, reverse-library search mode, and data-dependent user-defined QC method development
- Ability to upgrade to Pegasus 4D GCxGC



Technical Research Center



Global Support Center



Life Science and Chemical Analysis Centre

## A 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-9001:2008 certification. We conform to CE quality and safety specifications, fully testing our instruments at our on-site Compliance Testing Center.

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