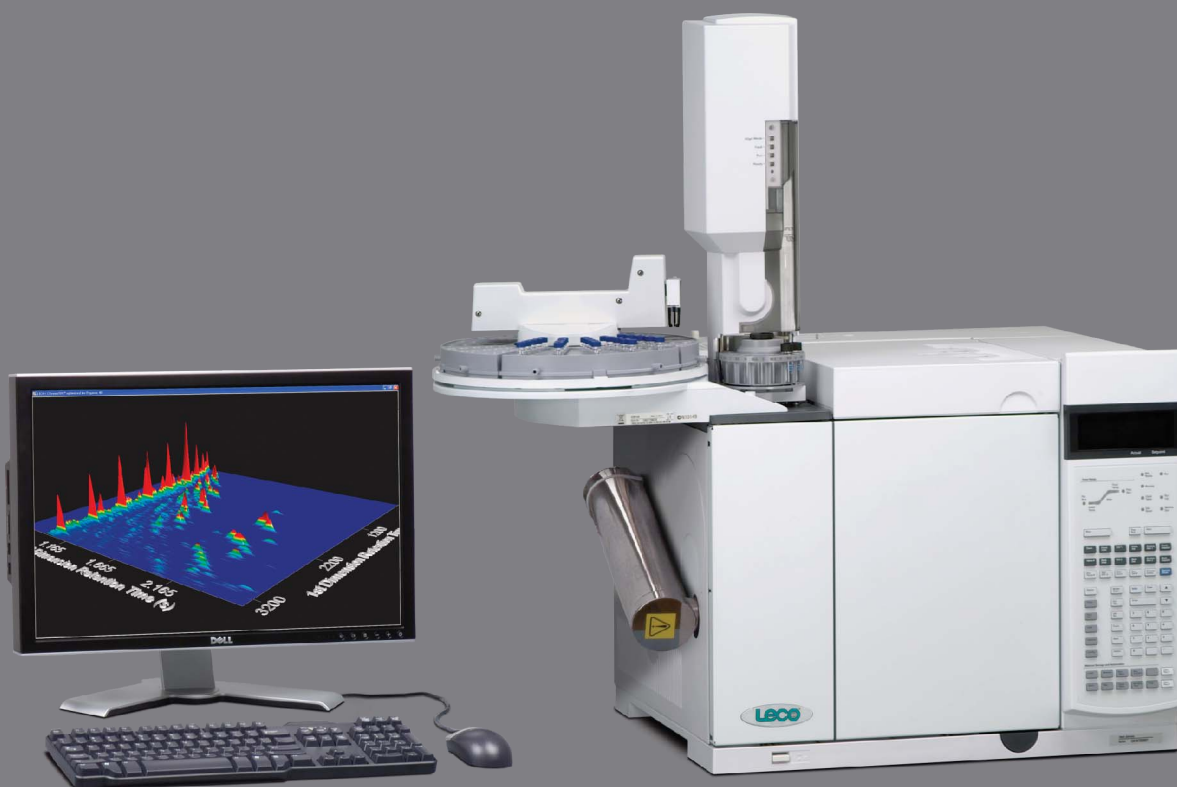


GCxGC Comprehensive Two-Dimensional Gas Chromatography

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

Patents include no. US4472631, US4490806, US5175430, US5367162, US5712480, IT1167562, WO9220435, WO8304326, WO9500236, EP540720, CA1225155. Other patents pending.

Leading the Way in GCxGC Instrumentation

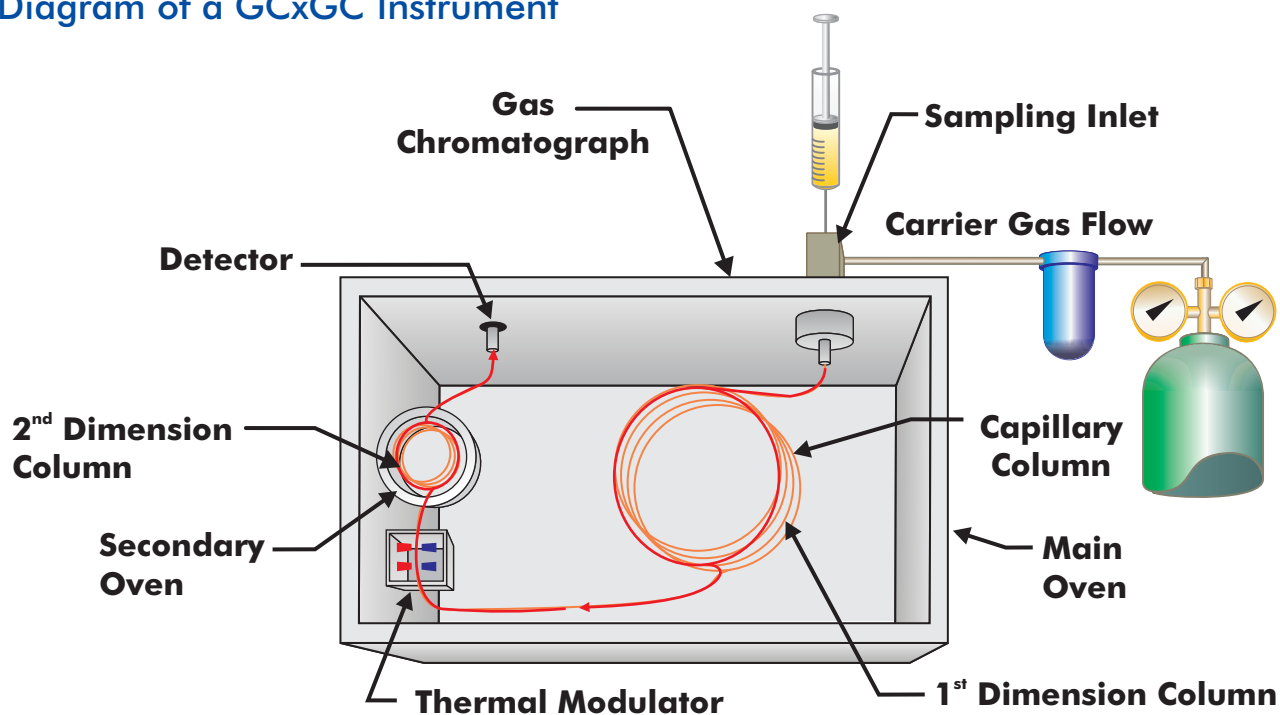
What is GCxGC?

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, **now with an available 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 separation of compounds across a plane rather than just along a line.

Diagram of a GCxGC Instrument



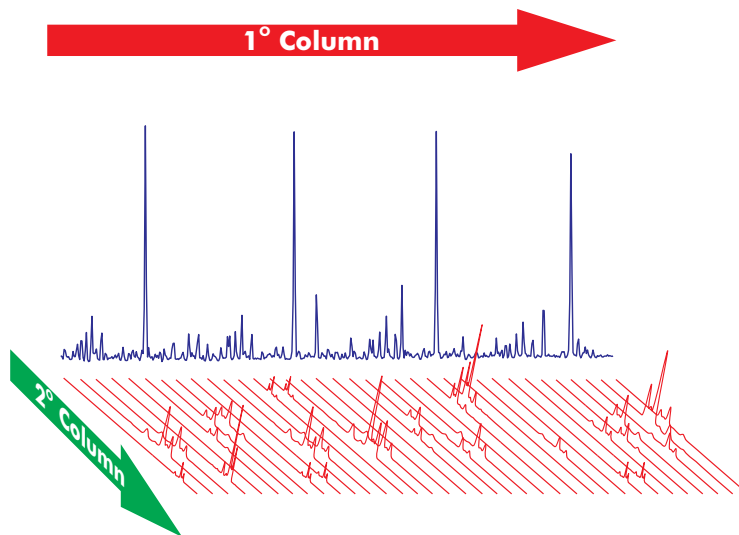
The GCxGC hardware (modulator and secondary oven) are mounted inside the primary GC oven. Control of the GC autosampler, GC, LECO's GCxGC thermal modulator, and the selected detector are fully integrated within a single computer using LECO's ChromaTOF[®] software.

The Answers to Your Chromatographic Challenges

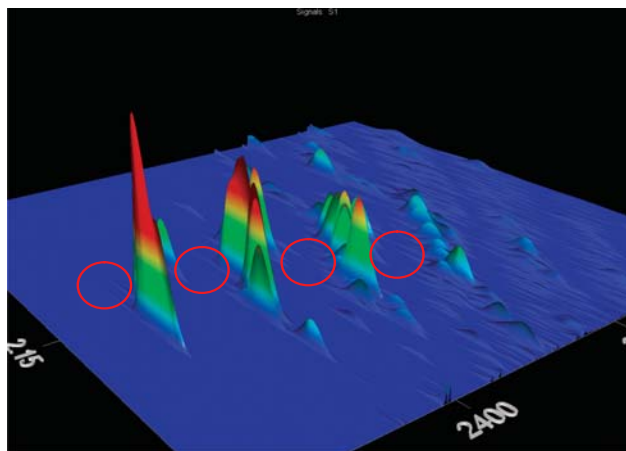
Why Do I Need GCxGC?

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.



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 the addition of 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 does not require you to modulate highly volatile compounds, the Consumable-Free Modulator will save you time and money without sacrificing performance.

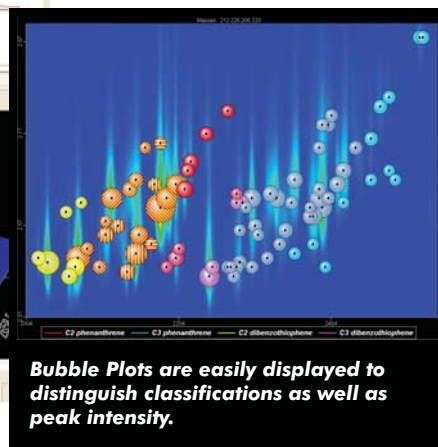
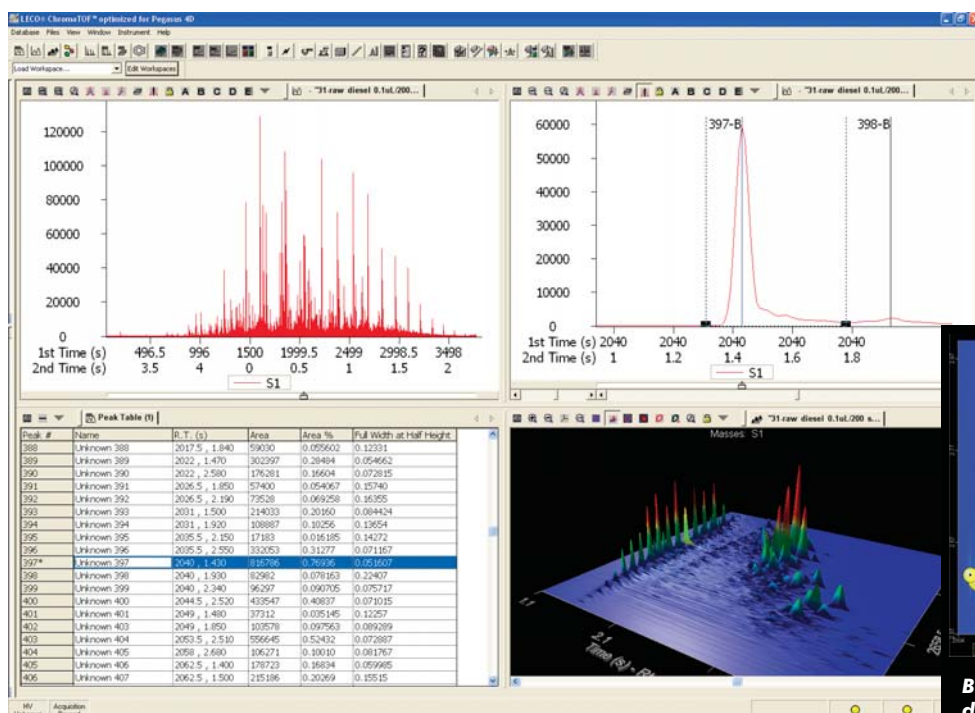
LECO's thermal modulation design gives you the upper hand in laboratory productivity. Ease-of-use and flexibility for second column choice allow for improved analytical results. Ask yourself—if you're not getting complete results from your second dimension, are you really justifying the purchase of a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

Leading the Way in Advanced GCxGC Data Processing

ChromaTOF® 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	RT. (s)	Classifications	UniqueMass	Area	Area %
376	Benzene, 2-butanyl-	5140, 1.170	C4 Benzene	117	1538995	2.3140
386	Benzene, 2-butanyl-	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, 1.690	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-Isoproperylnaphthalene	8680, 1.960	C1 Biphenyl	153	39085	0.058768
2217	Naphthalene, 1,4,5-trimethyl-	8720, 1.820	C3 Naphthalene	155	225433	0.33896

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

The 'Peak Table' configuration dialog box is shown, allowing users to customize the display of peak data. It includes tabs for 'Font', 'Columns', 'User Fields', 'Concerns', 'Filters', and 'Sort'. Key options include:

- Link filter and concern changes between views.
- 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

 Buttons for 'OK', 'Cancel', 'Apply', and 'Help' are at the bottom.

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 biotechnology (metabolomics) industries, we have an instrument configuration to meet your needs.



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



TruTOF® HT GCMS

- Continuous full-range mass acquisition rates up to 80 spectra/second (Fast GCMS)
- Electron ionization (EI) and chemical ionization (CI) source capabilities
- Environmental reporting software (standard)
- ChromaTOF software with Automated Peak Finding and True Signal Deconvolution for fast/easy data analysis and clean library searches



Unique® HT LCMS

- Accessible and affordable high-speed LC-TOFMS
- Compact benchtop TOFMS designed for complex sample analysis
- With collection rates up to 100 full-range mass spectra/second, the Unique is the best MS detector for the latest high-resolution/high-speed chromatographic applications
- Integrated control for high-speed Agilent 1200SL LC
- ChromaTOF Automated Peak Find and True Signal Deconvolution algorithms



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-9001:2000 certification. We conform to CE quality and safety specifications, fully testing our instruments at our on-site Compliance Testing Center.

3000 Lakeview Avenue • St. Joseph, MI 49085 • Phone: 800-292-6141 • Fax: 269-982-8977
info@leco.com • www.leco.com • ISO-9001:2000 • No. FM 24045 • LECO is a registered trademark of LECO Corporation.

LECO Corporation



Delivering the Right Results