PEGASUS® BT SERIES

LECO

EMPOWERING RESULTS

GC-TOFMS

Mass spectrometers are perhaps the greatest tool available for the analytical chemist. With the ability to ionize, sort, and measure complex chemical mixtures by their mass-to-charge ratio (m/z) with incredible sensitivity, it is no wonder that mass spectrometers are widely used across many industries.

With the ability to acquire the full mass range of your sample with exceptional spectral continuity and fast data acquisition rates, Time-of-Flight mass spectrometers (TOFMS) are ideal for discovering new compounds, quantifying targeted compounds in complex samples, and increasing throughput with fast chromatography.

Non-targeted data mining is available with the results from TOFMS, while they also yield high quality library matches through mass spectral deconvolution and accurate quantitation using fast gas chromatography (GC). There is no compromise in data acquisition speed or sensitivity when collecting the full mass range, and it creates a historical catalog of information about a sample that can be referenced in the future if new questions arise. In addition, the spectral profile is always consistent across a peak, regardless of intensity, allowing ChromaTOF® software's industry leading deconvolution algorithms to perform optimally.

Table of Contents

PEGASUS® BT

Today's laboratories are being asked to do more everyday – run more samples, acquire more data, process more chemical information, and achieve more results – all in less time, and for less money. A smart investment for any laboratory looking to perform qualitative or quantitative analysis of targeted and non-targeted compounds, the *Pegasus* BT GC-TOFMS is the first benchtop GC time-of-Flight mass spectrometer to develop higher sample throughput, better chemical information, and very low maintenance costs, resulting in improved overall productivity in your laboratory and results that are of the highest quality.

Advantages of the PEGASUS® BT

- Find and quantify an unlimited number of analytes, in every run, every time

- Market-leading deconvolution algorithms yield clean, high-quality mass spectra

- TOF eliminates spectral skewing associated with scanning mass analyzers

- Deconvolution ensures clean spectra are obtained from coeluting peaks and matrix interferences are drastically reduced, providing the most reliable chemical information for your samples

- Complete historical record of mass spectra for each sample for future data mining

- Lab tried and tested reliability and durability

- Low-maintenance StayClean® ion source virtually eliminates downtime with no need for cleaning even after dirty samples*

- Improved productivity is directly related to higher quality results, with higher sample throughput, better chemical information, and lower maintenance costs due to its reliability and minimal downtime

After 3.000 sludge injections, all performance specifications were still achieved.
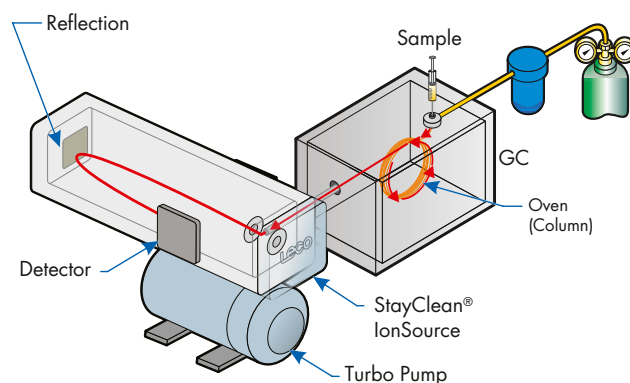
GC×GC

Real-world samples are rarely clean, and heavy matrix interference is commonplace. A single injection might have thousands of different compounds. The more compounds in a sample, the higher the chance of coelution, and even LECO's proprietary deconvolution algorithms might not be enough. This is where a second dimension of chromatographic separation shows its strength. Comprehensive two-dimensional gas chromatography (GC×GC) increases analyte detection and identification. On average, a thermally modulated GC×GC analysis has five times the sensitivity and offers three times the number of compounds identified compared to typical GC-MS runs. By running a sample through a second, orthogonal column phase, analytes can be easily separated from matrix interferences or other coeluting compounds. The increased chromatographic resolution allows better automatic library matches, leading to faster, more confident peak identification.

Polar 2nd GC column

Non-polar 1st GC column
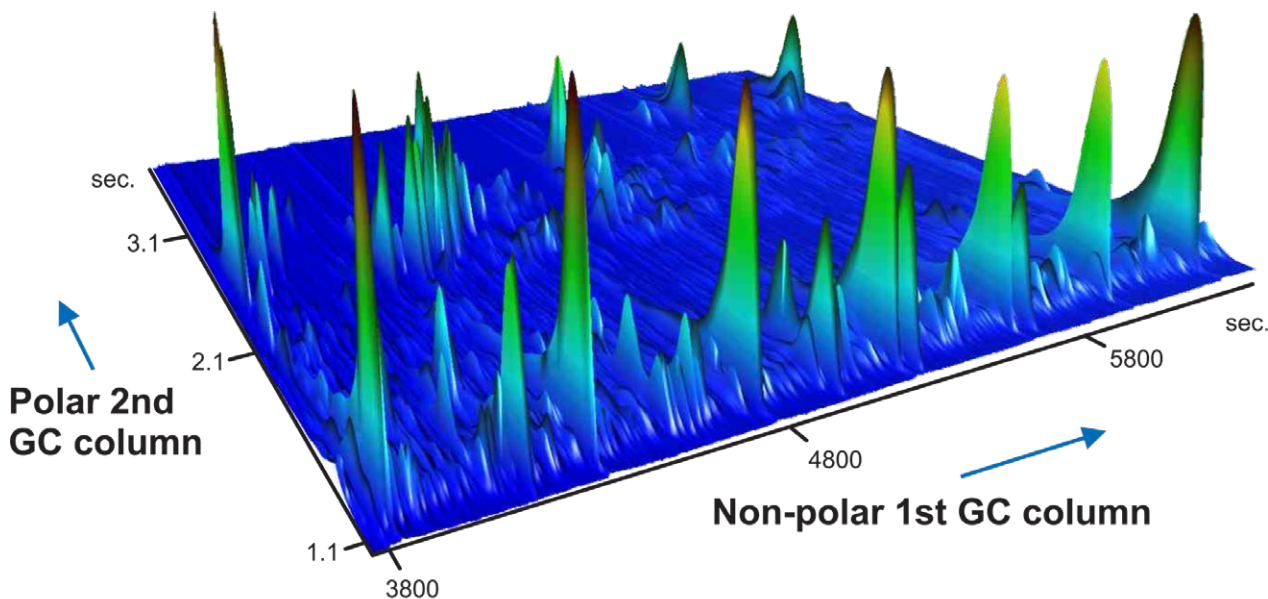
The power of GC×GC-TOFMS for your samples!
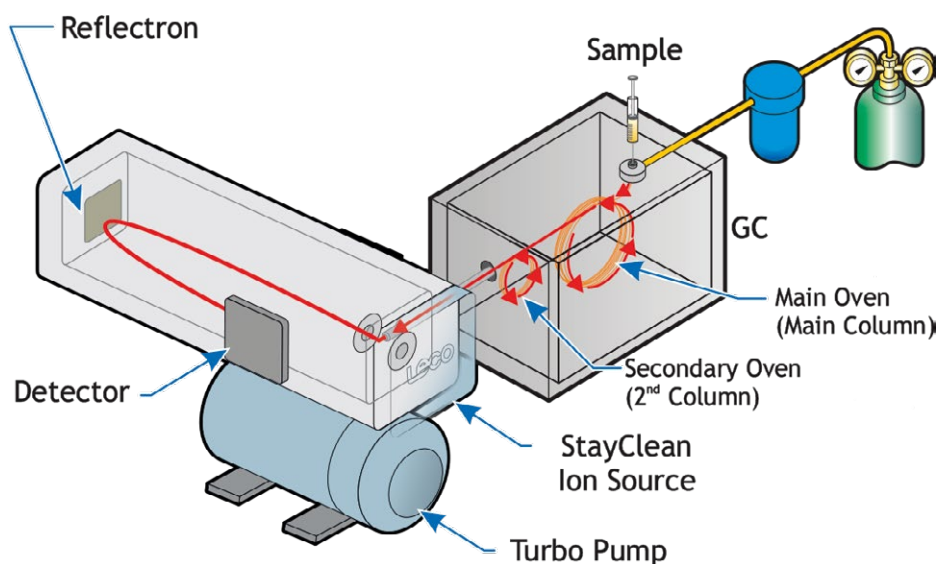
PEGASUS® BT 4D

Not all GCxGC systems are the same, and not all analyses have the same focus. LECO offers the *Pegasus BT 4D* with a variety of GCxGC modulators with various performance and operational focuses so you can choose the best setup for your laboratory's specific needs.

	QuadJet™ LN2	QuadJet™ CF	Flux™ DF
Modulator Type	Thermal	Thermal	Diverting Flow
Performance Attributes			
Sensitivity	Excellent	Excellent	Good
Chromatographic Resolution	Excellent	Excellent	Very Good
Quantitative	Excellent	Excellent	Very Good
Volatility Range	Very Good	Good	Excellent
Operation Attributes			
Robustness	Very Good	Very Good	Excellent
Consumables	$$$	$$	$
Instrument Cost	$$$	$$$	$
Method Optimization	Excellent	Excellent	Very Good

PEGASUS® BT 4D Modulators

QuadJet™ LN₂ Thermal Modulator

Industry-leading sensitivity is made possible with cryogenic focusing at the modulator using liquid nitrogen cooled jets to sharpen the peaks prior to detection, increasing the S/N ratio and improving deconvolution. Analytes that are typically too low in concentration to detect are brought into sharp focus and clearly identifiable.

QuadJet™ CF Thermal Modulator

A lack of cryogens means cost-per-analysis for the Consumable-Free *QuadJet* is lower than its Liquid Nitrogen counterpart, but it also means the *QuadJet* CF doesn't get as cold, leading to a small loss in performance for highly volatile compounds. Otherwise, the *QuadJet* CF is similar in design, performance, and initial cost to the *QuadJet* LN₂.

Flux™ Flow Modulator

The simplest of LECO's modulators, the *Flux* is a diverting-flow-based modulator for robust GC×GC analyses that do not need the full sensitivity of a thermal modulator. With no cryogens required, consumable costs are low, and the integrated ChromaTOF® brand software handles all of the timing and flow requirements so your lab can save time and boost efficiency with the introduction of comprehensive GC×GC.

Sample Introductory Tools

L-PAL3 Autosampler

LECO's L-PAL3 offers increased vial capacity, discrimination-free, ultrafast GC injections, an automatic tool exchange option to switch between injector types (liquid, headspace, or SPME), minimized carryover, and the sensing of vial bottoms to avoid mis-injections.

All of these advantages come on a highly robust and integrated platform. The LECO L-PAL3 GC autosampler allows you to safely focus on characterizing your samples without experiencing downtime and uncertainty in your lab.

All L-PAL3 models are CTC-based robots that combine an autosampler and an injector that operates in three dimensions of space.

Standard Features

- 5-position solvent wash station

- Mounting kit for GC

- Tray holder with three trays (54 positions each, 162 samples total) for 2 mL vials

- Complete injection cycle times down to 100 milliseconds

- Bottom-sensing technology to sample even very small volumes

Models

	Liquid	Headspace	SPME	ATX	DRV
Liquid Syringe	Yes	Yes	Yes	Yes	Yes
Heated Headspace Tool	No	Yes	No	Yes	Optional
SPME Fibers tool	No	No	Yes	Yes	Optional
Tool Exchange	None	Manual	Manual	Automatic	Automatic
SPME Fiber conditioning station	No	No	Yes	Yes	Optional
Heated Agitator	No	Yes	Yes	Yes	Yes
Derivatization	Manual	Manual	Manual	Manual	Automatic
Additional tray holder with three trays for 10/20 mL vials (15 positions each, 45 samples total)	No	Yes	Yes	Yes	Yes
Additional Options Available	No	Yes	Yes	Yes	Yes

L-PAL3 Options

Dilutor

- Allows automated preparation of analytical standards
- Fast wash module
- Additional syringe sizes
- Vortex mixer

ITEX Dynamic Headspace

- Rapid and sensitive enrichment of volatile and semi-volatile compounds from solid, liquid, and gaseous samples
- A choice of different adsorbents for best sensitivities
- No sample loops, transfer lines, or valves; no contamination issues
- L-PAL3 Automatic Tool Exchange (ATX) enables head space, SPME, and ITEX-sampling within one sequence

SPME Arrow

- Larger sorptive properties for immersion or headspace applications
- Various sizes and coating materials available

Peltier

- Storage of up to 3 racks or plates under user-defined temperature conditions
- Temperature range between 4 °C and 40 °C
- Capacity: Multi Titer Plates; or VT54 (54 x 2 mL); or VT70 (70 x 1 mL); or VT15 (15 x 10/20 mL); or combinations

Other Accessories

Thermal Desorption (TD)*

An automated Thermal Desorption (TD) unit made possible by combining an OPTIC-4 inlet, LINEX head for automatic transport and insertion of TD tubes, and cryotrap for collecting desorbed sample prior to analysis.

Pyrolyzer*

An automated TD and pyrolyzer made possible by combining an OPTIC-4 Pyro inlet (increases upper temp to 700 °C for pyrolysis), LINEX head for automatic transport and insertion of TD/pyrolysis tubes, and cryotrap for collecting desorbed or pyrolyzed samples prior to analysis.

Cryotrap*

The cryotrap can be used as a standalone device for effective cryofocusing of headspace or headspace SPME injections, as well as in conjunction with thermal desorption or pyrolysis accessories.

*GL Sciences

OPTIC-4*

A multi-mode inlet which can be used as a standalone inlet for hot, cold, large volume, and on-column injections, or as the base for automated TD (up to 600 °C), or liner exchange applications when coupled with a LINEX head which allows automated transport and insertion of inlet liners and TD tubes. A cryotrap is utilized for collecting thermally desorbed sample prior to releasing for analysis

OPTIC-4 Pyro*

A multi-mode inlet which can be used as a standalone inlet for hot, cold, large volume, and on-column injections, or as the base for automated TD, pyrolysis (up to 700 °C), or liner exchange applications when coupled with a LINEX head which allows automated transport and insertion of inlet liners, TD/pyrolysis tubes. A cryotrap is utilized for collecting thermally desorbed or pyrolyzed sample prior to releasing for analysis.
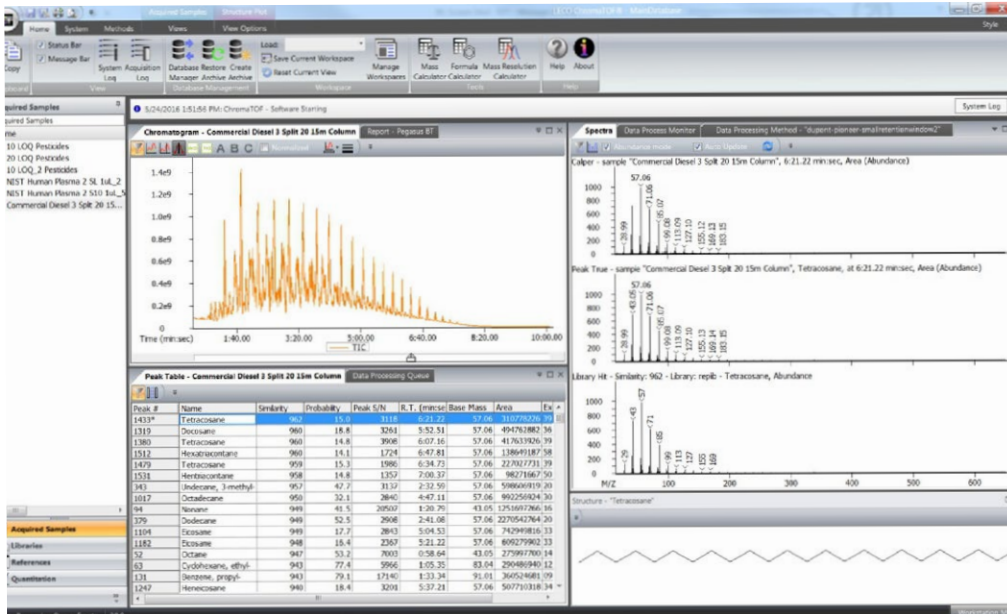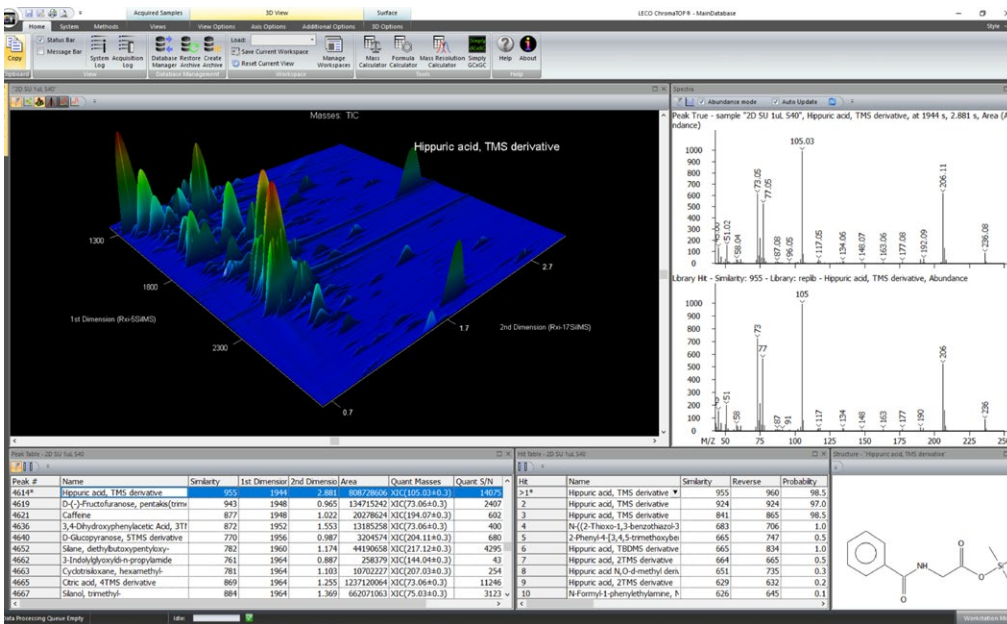
ChromaTOF ®Software

Developed exclusively by LECO, *ChromaTOF* is uniquely designed to meet the needs of today's laboratory professionals by processing and analyzing the large amounts of data that are acquired with our time-of-flight instruments. *ChromaTOF* offers seamless control of both the instrument and its accessories, as well as an intuitive interface with highly integrated data processing. *ChromaTOF* is the first mass spectrometry data system to fully accommodate multidimensional chromatographic data (GC×GC).

What Makes ChromaTOF® Unique?

- Data processing is automatically saved within the file system — no extra steps are needed and you can always come back to where you left off

- File management system stores and manages meta data (AS, GC, MS, and Processing Methods) with each data file

- Industry-leading deconvolution algorithms yield clean, high-quality spectra with higher quality spectral hits for more reliable results and more confident reports

- Integrates with commercially available mass spectral data bases, i.e. NIST, Wiley, and also allows custom library creation

- Frequently updated for improved maintenance and additional feature developmentt

Optional Software Tools

ChromaTOF® Tile revolutionizes how GC×GC data is analyzed by comparing GC×GC data files quickly and easily. Statistically significant differences rise to the top so you can spend less time finding the differences between your data and more time finding out what they mean.

Designed for Sample Group Differentiation

ChromaTOF Tile finds differences between two or more classes of samples.
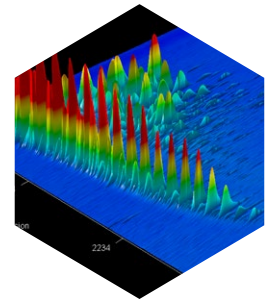
Biomarkers distinguishing healthy from not …

Off-odor detection in food samples that passed or ailed quality control …

Water samples up- and down-stream from an outflow source …

Petroleum samples from various geographical origins …

And anything else you can imagine

Fisher Ratio Hits Pane

Immediate feedback on class distinctions

Automated curation of tiles to chemical features

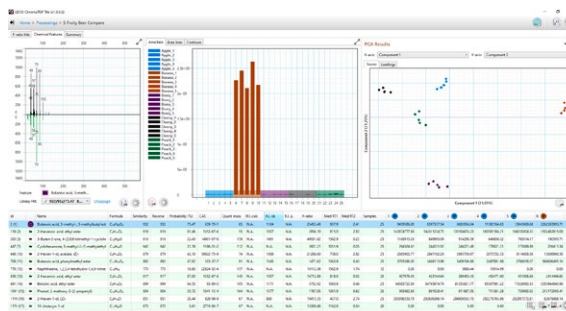*List of all significanttile hits and masses for each hit*

Quickly compare tiles for visual evaluation of significant differences as detailed level 1 images

Chemical Features Pane

View the trends across classes

*Confirm identifications with spectral matching*

Review assigned tentative identifications by chemical feature

Use Principle Component Analysis (PCA) loadings and scores plots

- *PCA loadings plots show how strongly each component influences the principle component*

- *PCA scores plots show clusters of samples based on their similarities*

Optional heatmap tables are incorporated throughout the interface to give instant feedback on relative intensities
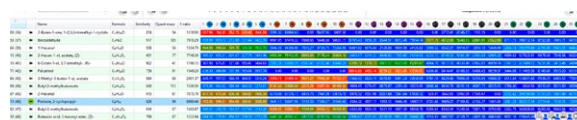
21 CFR Part 11

ChromaTOF software is now fully compliant to the United States FDA Code of Federal Regulations Title 21 Part 11 and its European equivalent (Eudralex Chapter 4, Annex 11). These regulations document the requirements for ensuring the integrity of electronic records and electronic signatures for regulated environments.

A dedicated user login, electronic signature capabilities, and audit trail are core capabilities now implemented within the software to enhance ease-of-use when meeting federal regulations. All aspects of data are secured within the GC-MS data system. *ChromaTOF* manages the meta-data for users and ensures its security, eliminating the management of complex file structures within the data system. All data structures are under the secure umbrella of *ChromaTOF* with CFR enabled. Electronic signatures can be required for acquisition, all methods, data processing, and reporting. A new Network Administrator tool securely handles the setup and management of users and roles for easy integration into your laboratory's IT environment.

Incorporating these features into our powerful *ChromaTOF* ensures that submissions to the FDA or other regulatory bodies are properly validated, secure, and correct, simplifying what can often be a complex process.

Achieve Compliance at All Levels

- Instrument Users – Prove product quality and provide electronic signatures for changing methods,results, tuning, and more; Additional options include Audit Trail Viewer and Client Configuration

- Lab Administrators and Managers-Monitor instrument usage and assign roles using the Administrator tool

- Network Administrators – Get everyone up and running quickly with an easy-to-use, clearly defined set-up process

LECO's Simply GC×GC online tool walks you through the steps of developing and optimizing a GC×GC method, whether you're creating a method from scratch or converting an existing GC method to GC×GC. Unnecessary testing is eliminated with this free tool from LECO.

Service and Support

Instrument Training

At time of installation, your LECO Service and Installation Engineer will provide you with a basic overview of how to operate your instrument and get started. However, LECO knows that the key to success in the lab with any new instrument is understanding how it works for you. Our Separation Science instrument training classes will show you how to use your new instrument to its full potential. We now offer a variety of training options to meet your schedule and comfort level.

Topics include:

- Databases and File Management
- Deconvolution and Quantitation
- Tuning and QC
- Introduction to GCxGC
- Methods and Acquisition
- Service Videos

LECOLearn allows for 24/7 access to organized training videos for our QuadJet™ and PEGASUS® series instruments so you can learn on your time, at your own pace. Videos are presented in course format by topic and designed to walk you through the natural progression of a typical training class. Access and re-watch any video, or any part of the video, at any time when you need clarity or review on a topic.

Installation Qualification and Operational Qualification

Installation Qualification (IQ) and Operational Quali-fication (OQ) ensures your instrumentation and software are installed correctly as well as functions according to LECO's specidications. This procedure also confirms that all functionality operates as intended by LECO. The OQ service uses chemical standards supplied by LECO for system validation to ensure accuracy and precision of the installed system. The results of the IQ/OQ are fully documented.

IQ/OQ is performed on-site by a certified LECO service engineer, specially trained to validate LECO instrumentation. At the end of the IQ and OQ, documentation, including testing data, forms, and copies of the protocols used during the qualification procedures, are left at the customer site. Annual OQs can be performed by a LECO service engineer.

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