C146-E286C

SHIMADZU
Excellence in Science

Liquid Chromatograph Mass Spectrometer

LCMS-8060

UFMS
ULTRA FAST MASS SPECTROMETRY

CHANGES EVERYTHING

Sensitivity

Speed

Solutions

LCMS-8060

The LCMS-8060 pushes the limits of what we can see. Creating the future of LC/MS/MS analysis can mean making something work with higher sensitivity, go faster or cost less. Sometimes it means trusting answers from one day to another.

2015 **LCMS-8060**

A new vision in sensitivity.
It simply changes everything.

2013 LCMS-8050

First mass spectrometry company to achieve a scan speed of 30,000 u/sec and 5msec polarity switching time. Increased sensitivity by 30 times.

2012 LCMS-8040

Increased sensitivity by a factor of 5 compared to the LCMS-8030.

2010 GLOBAL LAUNCH

LCMS-8030

First mass spectrometry company to achieve a scan speed of 15,000 u/sec and polarity switching time of 15 msec.


SHIMADZU

LCMS-8060
Triple Quadrupole Mass Spectrometer

Pushes the limits of what we can see

Sensitivity

Speed

Solutions

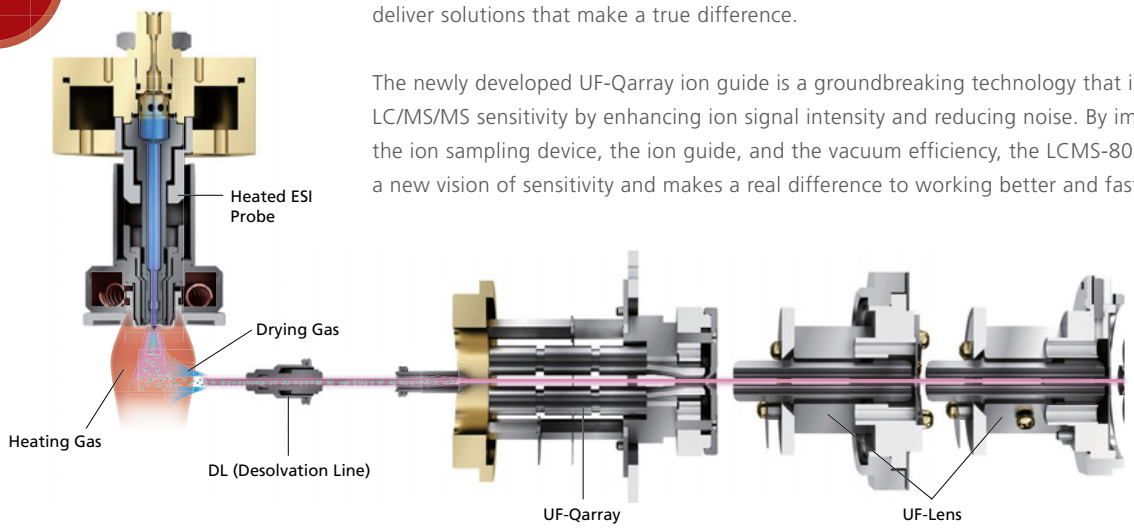
The LCMS-8060 is a ground breaking innovation in mass spectrometry helping to transform LC/MS/MS data quality by developing a new vision of sensitivity and speed.

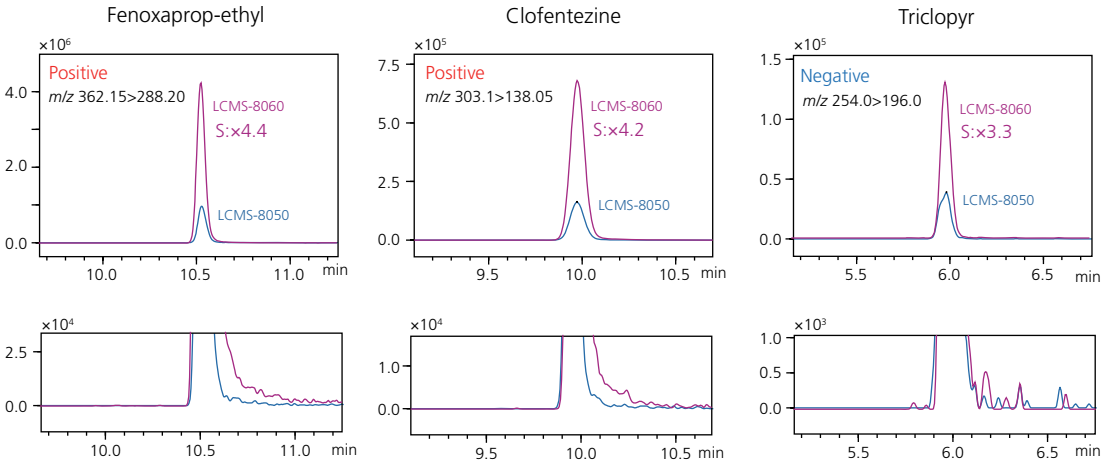
Shimadzu is the first mass spectrometry company in the world to deliver a triple quadrupole mass spectrometer with the highest sensitivity and ultra-fast technologies to create an innovation that really matters.

Sensitivity

By redefining the ion focusing capability on the UF-Qarray, the LCMS-8060 brings a meaningful impact to quantitative detection and opens new opportunities for scientists to deliver solutions that make a true difference.

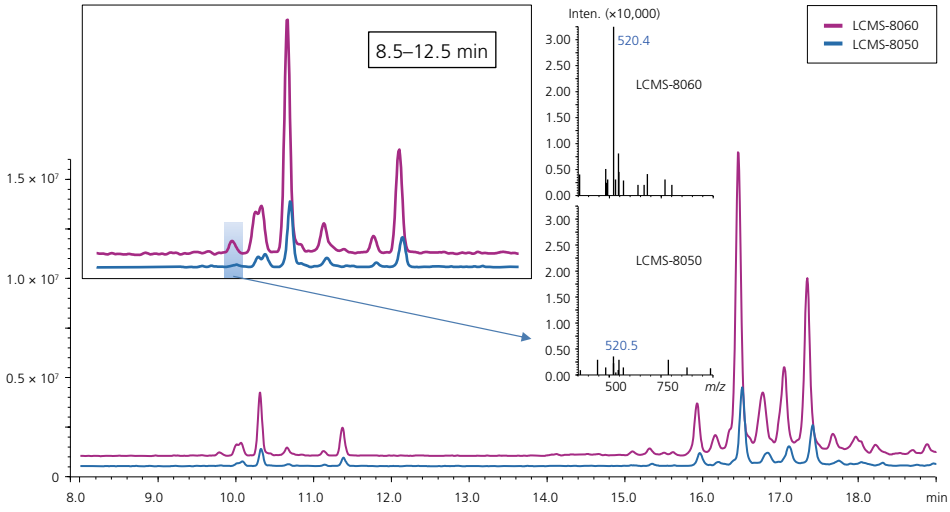
The newly developed UF-Qarray ion guide is a groundbreaking technology that increases LC/MS/MS sensitivity by enhancing ion signal intensity and reducing noise. By improving the ion sampling device, the ion guide, and the vacuum efficiency, the LCMS-8060 delivers a new vision of sensitivity and makes a real difference to working better and faster.





MRM chromatograms: 100 ng/mL neat standard, upper: signal comparison, lower: baseline noise comparison

Built on the proven platform of the LCMS-8050, the new patented ion guides developed for the LCMS-8060 greatly improves ion production and collisional focusing without affecting noise. The ion production, transmission and detection of three pesticides (fenoxaprop-ethyl, clofentezine and triclopyr) results in increased sensitivity compared to previous technologies. The chromatogram for each pesticide has been magnified to show the noise has not increased with a higher ion production. Innovations in ion guide technologies not only delivers new limits of MRM sensitivity but has an impact on full-scan sensitivity.



Comparison between the LCMS-8060 (purple) and LCMS-8050 (blue) for the analysis of lipids (precursor ion scanning at *m/z* 184-choline-containing phospholipids in positive ion mode)

Lipid profiling on the LCMS-8060 can detect more ion signals with greater precision and with higher confidence. After protein precipitation, the human serum sample was diluted 1000 times by methanol and 1µL was injected onto the LCMS-8050 and LCMS-8060 systems using a scan speed of 3,000 u/sec. With the LCMS-8060 lower levels of phosphatidylcholine could be detected in a human serum sample following a protein crash sample preparation compared to the LCMS-8050.

Speed

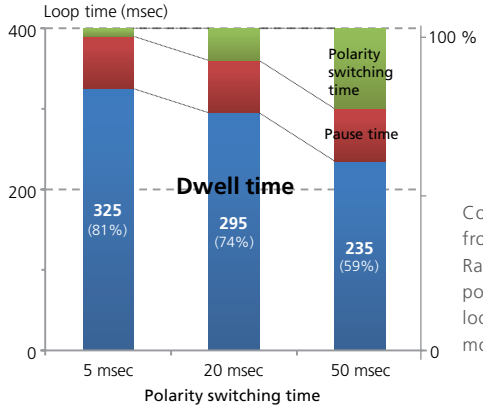
Inspired by the need to balance advanced high speed MS/MS detection technologies with unrivalled LC performance, we were the first mass spectrometry company in the world to deliver a scan speed of 15,000 u/sec and a polarity switching speed of 15 msec. In the LCMS-8060 the scan speed is now increased to 30,000 u/sec and a polarity switching speed of 5 msec making a real difference to working better and faster.

Fast polarity switching

The LCMS-8060 uses UF Technologies to switch polarity in 5 msec.

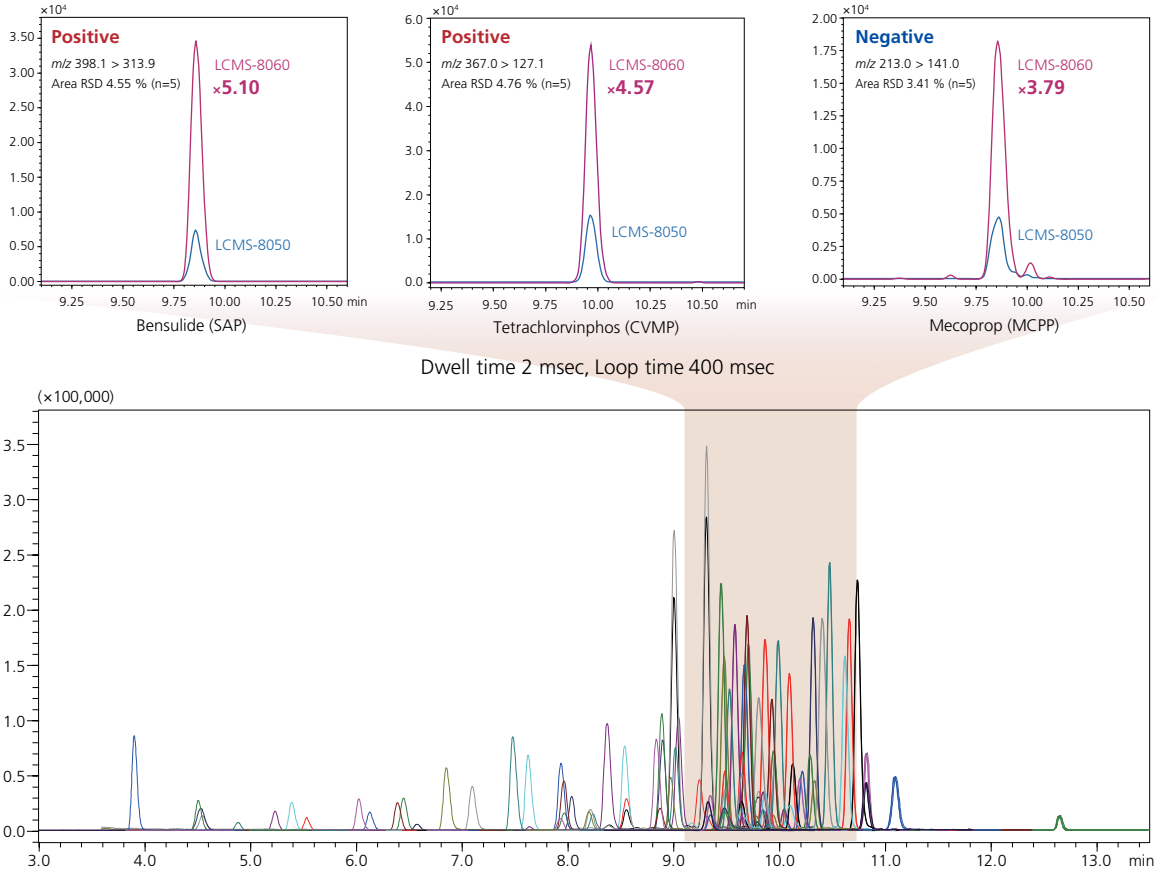
Detect more

Fast cycle time helps to detect more compounds with greater confidence and precision.

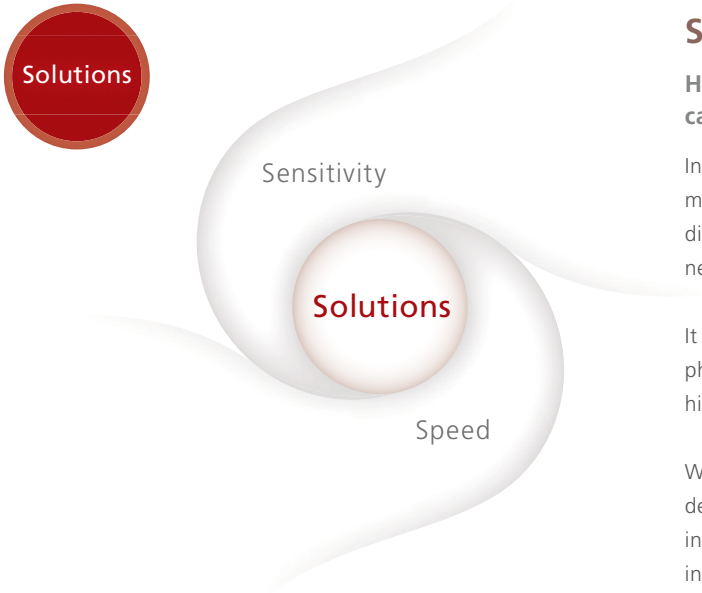


Faster polarity switching time maximizes dwell times and helps to optimize the cycle time of LC/MS/MS methods.

Comparing the differed polarity switching times from 5, 20 to 50 msec.
Ratio of dwell time (blue), pause time (red) and polarity switching time (green) in 400 msec of loop time when 65 of MRMs are simultaneously monitored.



MRM chromatograms of 105 pesticides (300 pg/mL each) using a polarity switching speed of 5 msec and a sampling window of 65 compounds in 400 msec loop time



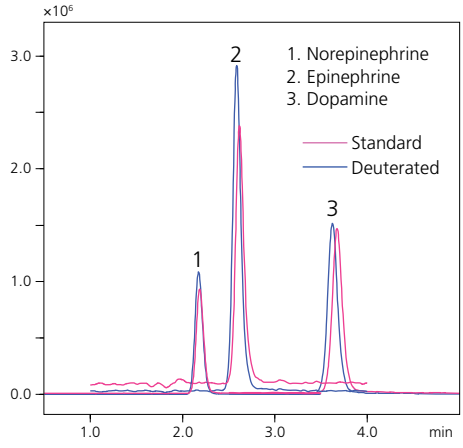
Solving Complex Problems

High-sensitivity quantitation of intact catecholamines (CAs) in human plasma.

In clinical research, plasma catecholamines and their O-methylated metabolites (metanephrines) are measured as biomarkers for diseases such as hypertension, pheochromocytoma or neuroblastoma.

It is a challenging assay as the low physiological levels of CAs, physicochemical properties, and potential interferences require high sensitivity and specificity.

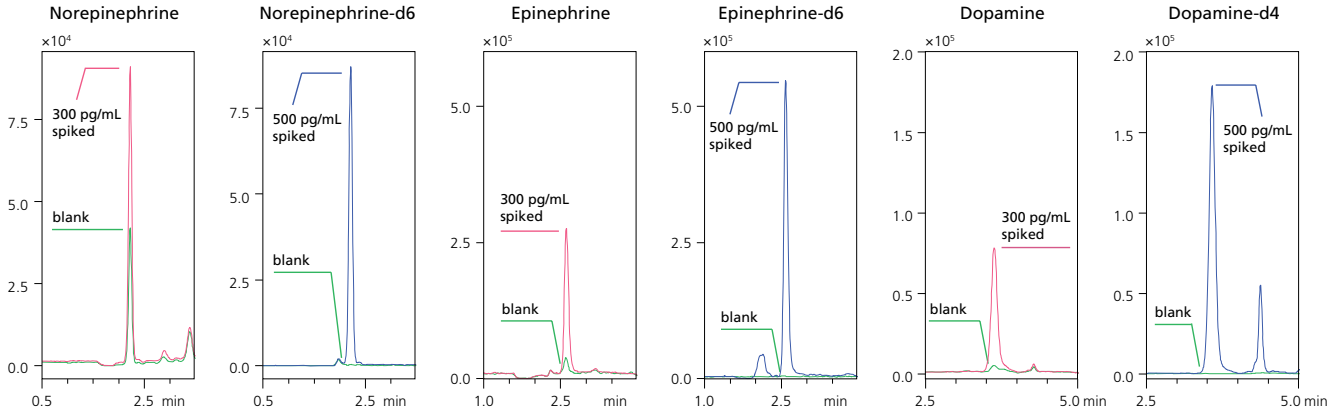
We developed a SPE-LC/MS/MS assay by using LCMS-8060 to detect catecholamines at ultra-high sensitivity without matrix interferences. As the measurement cycle time was 12 mins including the column re-equilibration the LCMS-8060 assay opens new possibilities for multiplexed sample analysis and higher sample throughput.



Representative MRM chromatograms of 3 catecholamines

Quantitative range of neat and matrix-matched calibration curves

Compound name	Neat standard curve		Matrix-matched	
	Range (pg/mL)	Linearity (r^2)	Range (pg/mL)	Linearity (r^2)
Norepinephrine-d6 (158.1 > 111.1)	2.5 – 2000	0.9999	2.5 – 2000	0.9997
Epinephrine-d6 (190.1 > 172.1)	10 – 2000	0.9999	10 – 2000	0.9994
Dopamine-d4 (158.1 > 95.1)	5 – 2000	0.9999	10 – 2000	0.9995



Detection of Norepinephrine, Epinephrine and Dopamine and their deuterated internal standards in plasma

Expand your capabilities in quantitation

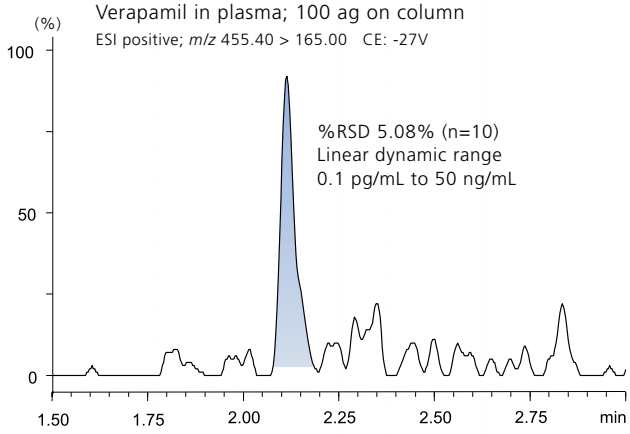
Ultra sensitive detection in bioanalysis

Bringing together ultra fast scanning technologies with high sensitivity pushes the limits of what we can see.

The LCMS-8060 is built for high data quality and drives confidence and consistency 24/7.

The triple quadrupole LCMS-8060 has an advanced ion guide design to increase ion production and detection and makes a meaningful impact on high sensitivity detection.

High-Sensitivity Quantitation of Verapamil in Plasma

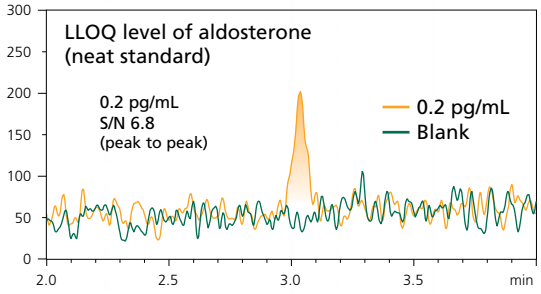


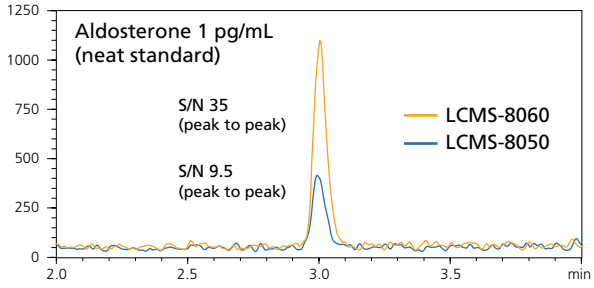
Precision and accuracy of verapamil

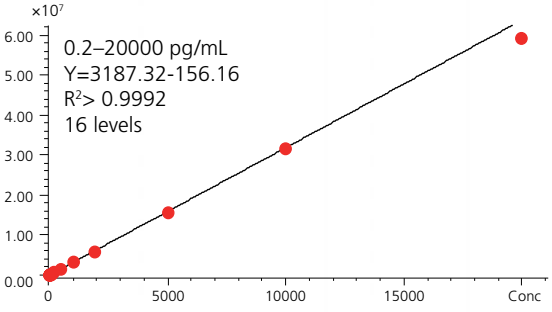
Actual Conc. (ng/mL)	Calculated Conc. (ng/mL)	Area RSD (%, n=3)	Accuracy (%)
0.0001	0.000100	2.97	100.3
0.0005	0.000508	6.15	101.7
0.001	0.000942	5.32	94.3
0.005	0.00491	3.54	98.9
0.01	0.00949	2.94	95.0
0.05	0.0511	2.14	102.4
0.1	0.0996	1.18	99.8
0.5	0.522	0.63	104.5
1	1.01	0.26	100.8
5	5.28	0.43	105.6
10	10.0	0.60	100.0
50	48.8	0.33	97.8

- Verapamil spiked into a plasma crash sample can be quantified at 100 ag on column with a precision of 5.08% for multiple injections (n=10).
- The LCMS-8060 also delivers a linear dynamic range from 0.1 pg/mL to 50 ng/mL.

High-Sensitivity Quantitation of Steroid Hormones







- Aldosterone was detected at a lower concentration of 0.2 pg/mL using neat standards and the calibration curve was linear from 0.2 to 20,000 pg/mL.

Lv	Actual conc. (pg/mL)	Mean area (n=5)	RSD (n=5, %)	Calc. conc. (pg/mL)	Accuracy (%)
1	0.2	448	13.2	0.190	94.8
2	0.5	1597	3.8	0.550	110.0
3	1	3225	2.5	1.06	106.1
4	2	6085	1.4	1.96	97.9
5	5	16398	2.0	5.19	103.9
6	10	31448	1.1	9.92	99.2
7	20	63339	1.2	19.9	99.6
8	50	158487	1.1	49.8	99.5
9	100	322774	0.9	101	101.3
10	200	602459	0.3	189	94.5
11	500	1556542	0.5	488	97.7
12	1000	3284586	2.1	1031	103.1
13	2000	5883876	0.5	1846	92.3
14	5000	15641489	0.3	4907	98.1
15	10000	31567190	1.0	9904	99.0
16	20000	59328173	2.6	18613	93.1

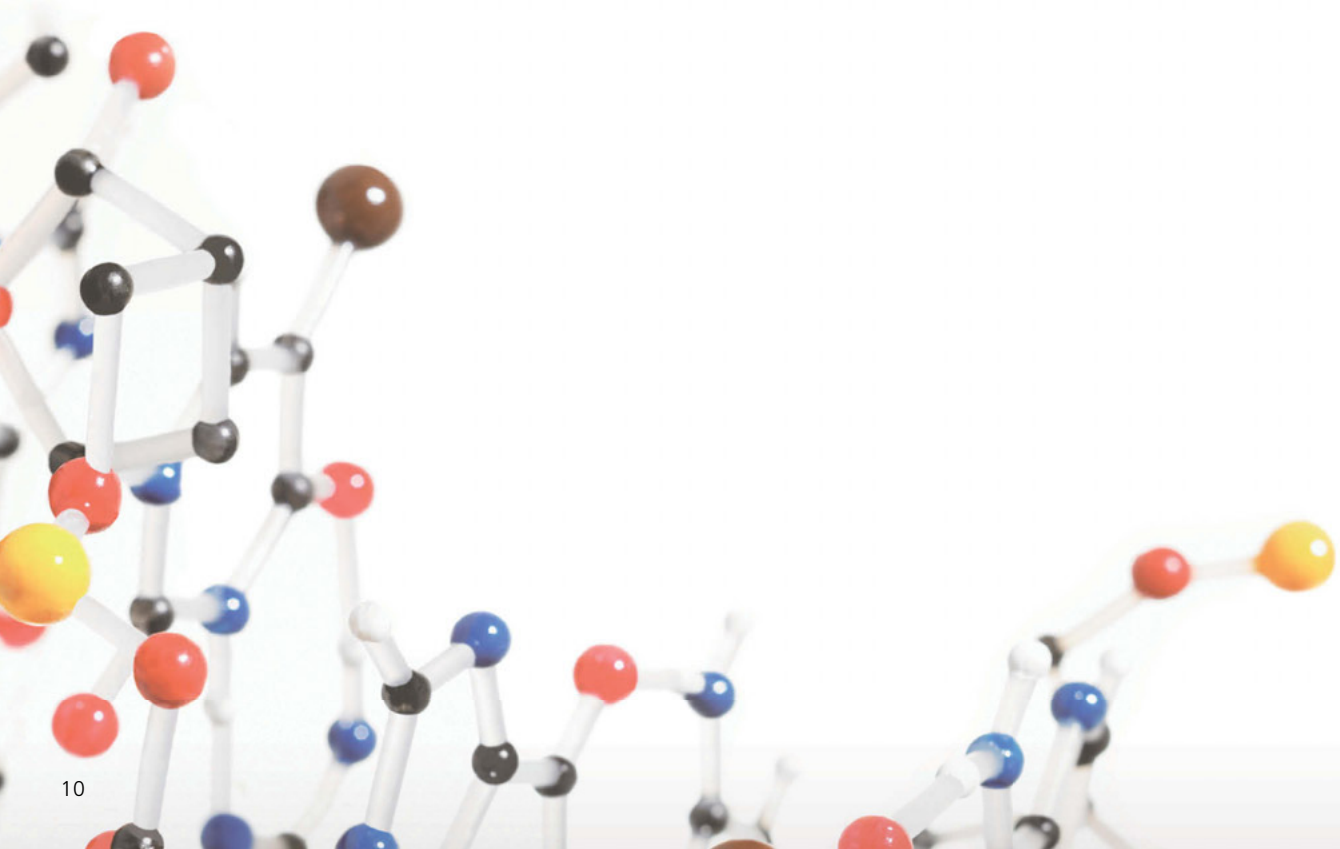
Expand your capabilities in quantitation

Ultra sensitive peptide analysis and lipid profiling

Advanced design, fast workflows and added business value help the LCMS-8060 deliver on a broad range of applications.

The challenge in peptide analysis and lipid profiling is to generate high data quality in complex samples.

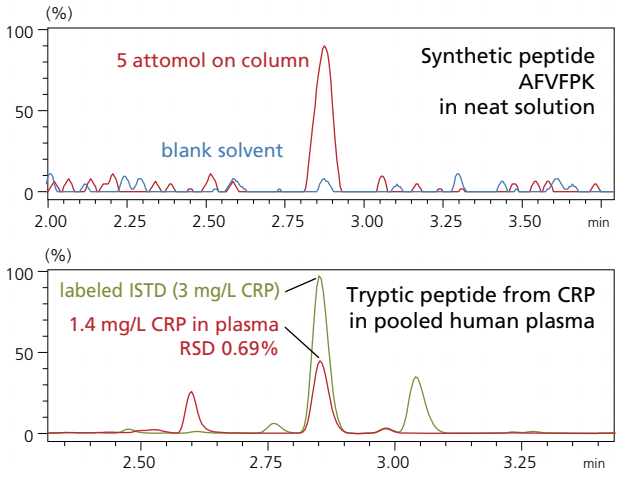
For research use only. Not for use in diagnostic procedures.



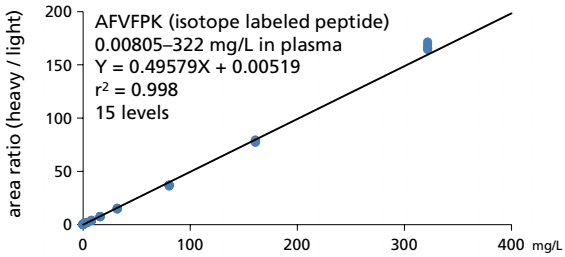
High-Sensitivity Peptide Detection

High sensitivity and fast scanning capabilities has opened up new workflows for quantitative proteomics.

In the detection of the tryptic peptide AFVFPK (from C-reactive protein, CRP) as a biomarker for inflammation 3 mg/L is reported as an average level of CRP in plasma. The LCMS-8060 delivers a highly sensitive detection of AFVFPK with the lowest calibration curve point at 0.008 mg/L.



Chromatogram of trypic digested peptide derived from CRP using conventional flow rate



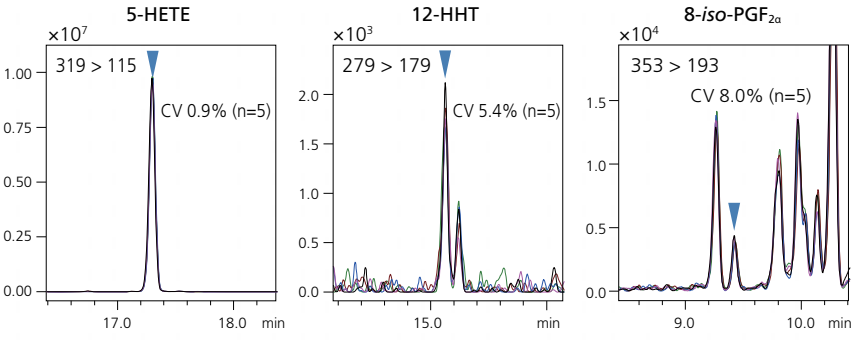
Spiked conc. (mg/L, in plasma)	Calculated conc. (mg/L, in plasma)	Accuracy (%)	RSD (%, n=5)
0.00805	0.00929	115	7.1
0.0161	0.0181	112	8.2
0.0322	0.0356	111	5.2
0.322	0.320	99	1.2
3.22	3.01	93	0.7
32.2	29.8	93	1.0
322	337	105	0.9

Quantitative results of AFVFPR (isotope labeled peptide) spiked into trypic digested plasma

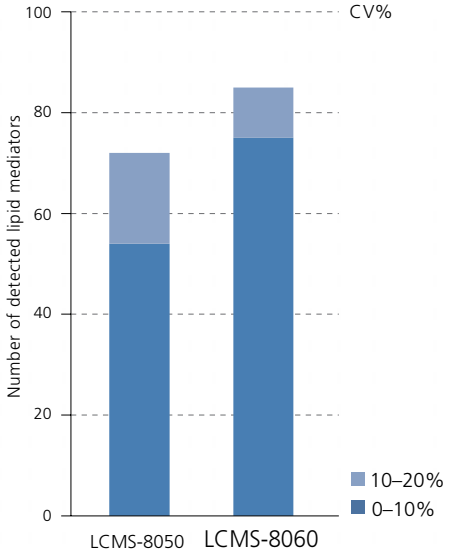
Lipid Mediator Profiling

Lipid mediators represent a class of bioactive lipids that are produced locally through specific biosynthetic pathways in response to extracellular stimuli. Lipid mediators are involved in many physiological processes, and their dysregulations have been often linked to various diseases such as inflammation, infertility, atherosclerosis, ischemia, metabolic syndrome, and cancer. To help further our understanding of lipid mediators in the disease process we have created a method package designed to detect lipid mediators derived from arachidonic acid cascade.

Using the lipid mediator method package the LCMS-8060 detected arachidonic acids metabolites in human serum over a wide dynamic range from sub nM to µM concentrations. 5-HETE has shown the highest concentration which was 1 µM and the lowest was 12-HHT (0.5 nM). In case of 8-*iso*-$PGF_{2\alpha}$, its concentration was 0.1 nM.



MRM chromatograms of 5-HETE, 12-HHT and 8-*iso*-$PGF_{2\alpha}$



Comparison of No. of detected lipid mediators in human serum

Expand your capabilities on Quan/Qual

Quan/Qual approaches using ultra fast capabilities

Shimadzu is a global leader in ultra fast capabilities in mass spectrometry creating methods that are designed to overcome real-world obstacles and deliver better data.

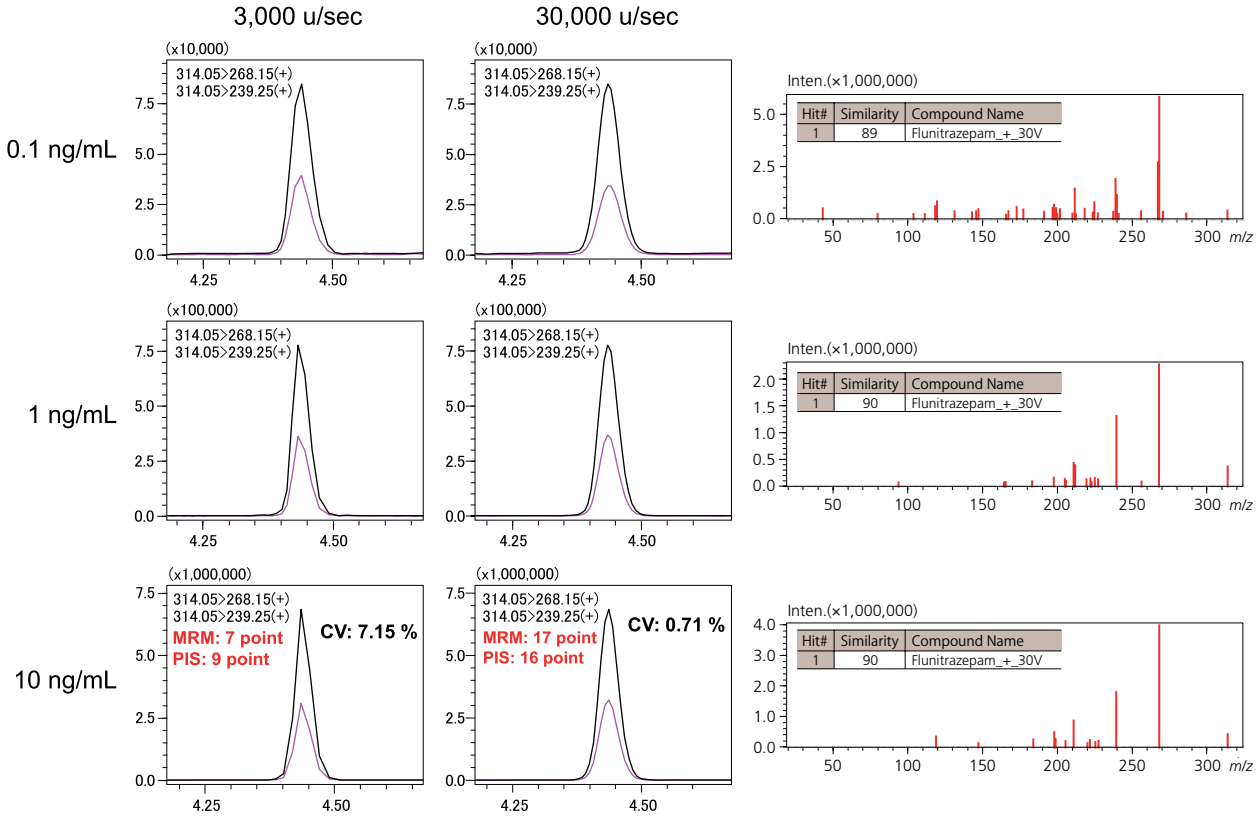
High Sensitive and High Speed Forensic Screening

Ultra fast capabilities help to reshape workflows and help productivity by bringing together definitive quantitation and information rich MS/MS spectra in a single analysis.
The LCMS-8060 can quickly switch between a full scan analysis and precise quantitation using the Synchronized Survey Scan (SSS) mode. This mode automatically performs product ion scanning once a pre-defined threshold has been exceeded. Qual/Quan methods can support a maximum of 1000 events in a single SSS methods.

Type	Event#	+/–	Compound Name *m/z*	Time (1.099 min - 6.690 min)
MRM	11	+	Flunitrazepam 314.05>268.15	
├ Product Ion Scan	12	+	> 20.00 : 324.00	
MRM	13	+	Nimetazepam 296.05>250.20,	
├ Product Ion Scan	14	+	> 20.00 : 306.00	
MRM	15	+	Estazolam 295.05>267.15, 29	
├ Product Ion Scan	16	+	> 20.00 : 305.00	
MRM	17	+	Triazolam 343.05>308.20, 34	
├ Product Ion Scan	18	+	> 20.00 : 353.00	
MRM	19	+	Alprazolam 309.10>281.10, 3	
├ Product Ion Scan	20	+	> 20.00 : 319.00	

Data acquisition method setting of synchronized survey scan using MRM as survey and product ion scan as dependent event

Quan/Qual method set up for the analysis of benzodiazepines in blood. The SSS method in rapid toxicology screening method package combines MRM and MRM triggered product ion scanning for 161 compounds.

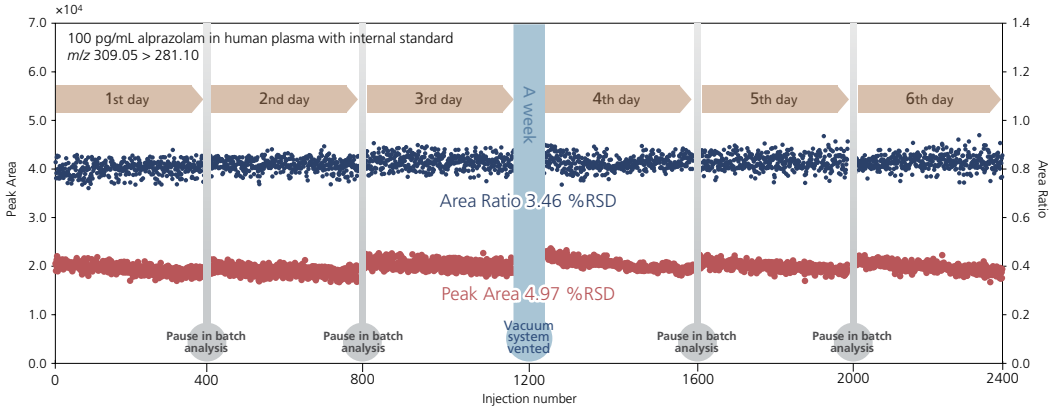


Data acquisition method setting of synchronized survey scan using MRM as survey and product ion scan as dependent event

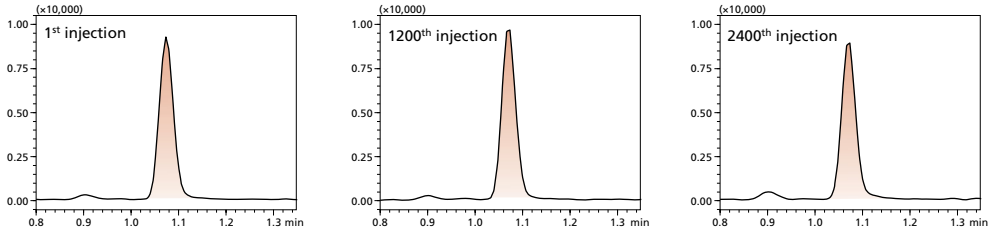
Blood samples were spiked with flunitrazepam at three concentration levels (0.1, 1.0 and 10 ng/mL) and pretreated by a simplified QuEChERS method. Flunitrazepam was precisely detected at two different scan speeds 3,000 u/sec and 30,000 u/sec. At a scan speed of 30,000 u/sec the LCMS-8060 acquires more data points over a peak without loss of mass accuracy or quantitative precision. In the case of the lower calibration standard at a concentration of 0.1 ng/mL the data quality of the product ion spectrum was still maintained at 30,000 u/sec.

Engineered for Robustness and Easy Operation/Maintenance

The robustness of the LCMS-8060 and modified ion optics was also assessed by injecting 2400 samples of femto-gram levels of alprazolam spiked into protein-precipitated human plasma extracts over a 6 day period (over 400 samples were injected each day). The RSD of peak area response was 5% over this test period, using a deuterated internal standard (alprazolam-d5) the RSD was 3.5%. As part of the robustness test the vacuum system was vented to model a transient power failure with no effect on signal response or baseline noise level.



Long term stability study on LCMS-8060



MRM chromatograms for the 1st, 1200th and 2400th measurements of alprazolam

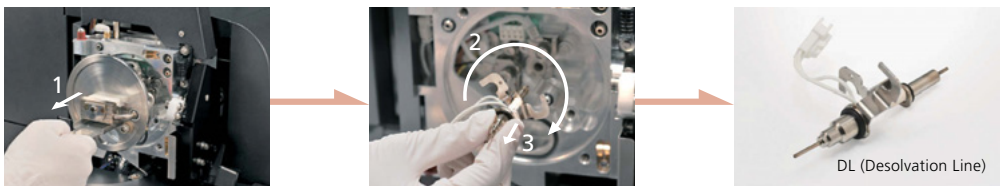
Intraday and Interday variations on LCMS-8060

Compound	Intraday Variation (%RSD)						Interday Variation (%RSD)		
	1st day	2nd day	3rd day	4th day	5th day	6th day	Days 1–3	Days 4–6	6 Day Total
Alprazolam	5.04	4.94	5.06	5.38	4.55	4.83	3.19	1.63	2.74
Alprazolam-d5 (ISTD)	5.04	4.68	5.48	5.31	4.26	4.91	2.62	1.89	2.18
Area ratio (Alprazolam / Alprazolam-d5)	3.48	3.11	3.48	3.44	3.71	3.54	1.79	0.26	1.40

Easy System Maintenance Reduces Downtime

As with Shimadzu's other triple quad systems, maintaining the LCMS-8060 is simple. Replacing the desolvation line (DL) and ESI capillary is quick and easy. Additionally, the design allows users to replace the DL without breaking vacuum, providing greater uptime and usability.

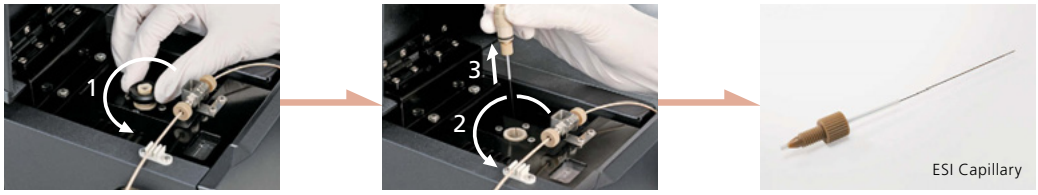
● Steps for DL Replacement



Newly Designed Ionization Unit

Designed without cables or tubes, removing the new ionization unit is simple: release a one-touch lever to open the unit and lift it out. In addition, no tools are needed to detach the needles fitted in APCI and DUIS units, allowing for easy maintenance.

Steps for ESI Capillary Replacement



ESI (standard)

APCI (optional)

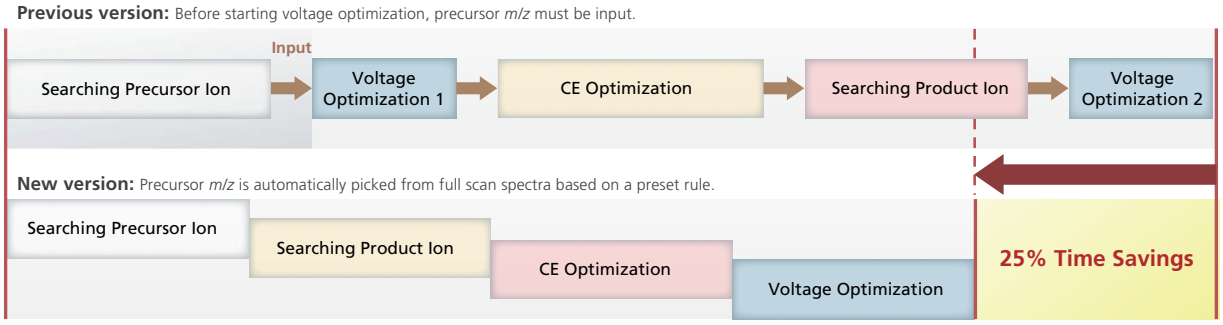
DUIS (optional)

LabSolutions LCMS

Shimadzu's data acquisition software provides a single point of control for LC and MS parameters. In addition, by incorporating critical input from customers, Shimadzu provides laboratories with software tools to address specific laboratory workflows and improve productivity.

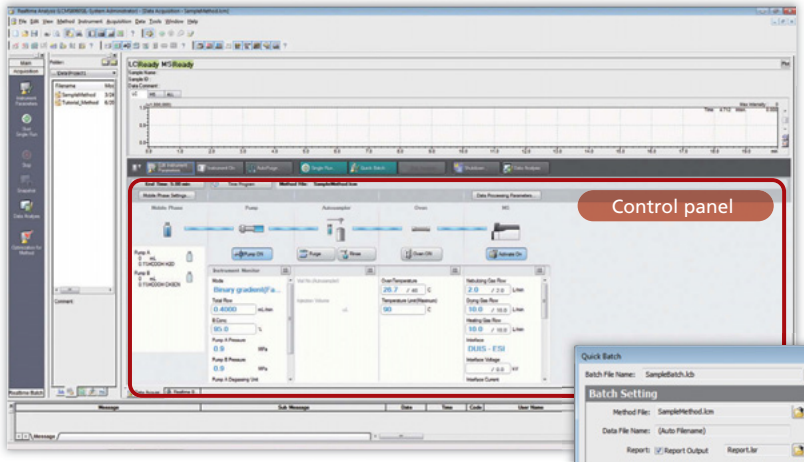
Fully Automated MRM Optimization

It's faster and easier to optimize quantitative parameters with updated software that reduces MRM optimization time by 25%.



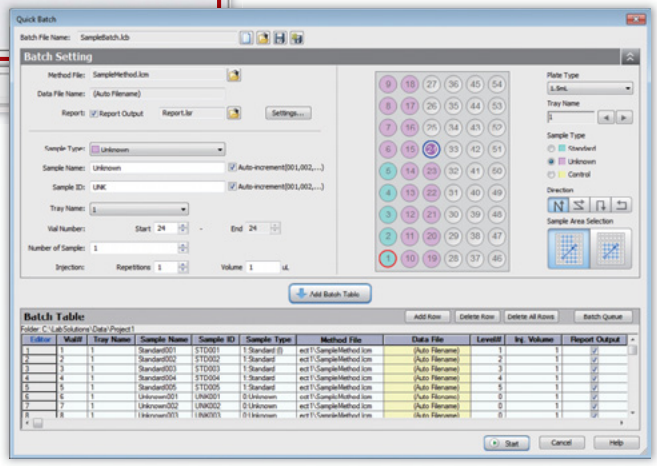
Intuitive User Interface

A new approach helps simplify the user experience for high-throughput laboratories. Quick batch makes it easier to perform routine LC/MS/MS analyses and changes to the Control Panel help method development.



Method development

An updated Control Panel makes it easier to change LC/MS/MS methods.



Quick Batch

Streamlines sample submission. A simple color-coded autosampler graphic offers quick visualization of the sample queue. Three color codes have been designed for standards (sky blue), unknowns (purple) and controls (yellow).

Automatic Calculation of Dwell Time

The optimum dwell time is calculated automatically from the number of overlapping MRM channels and maximum loop time, thereby obtaining the necessary data points for the entire analysis.

Optional Software Programs

Shimadzu offers numerous options to address specific customer requirements.
Combining LabSolutions LCMS with these programs improves workflow efficiency.

LC/MS/MS Method Packages and MRM Libraries

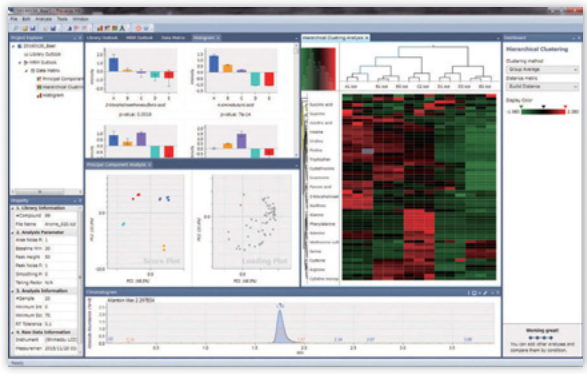
A variety of method packages and MRM libraries, which include analysis conditions such as MRM parameters, enable efficient implementation of simultaneous multi-component analyses. The method parameter list included in these packages can be used to create methods that analyze targeted components only. These packages can save laboratories a great deal of method development time.

	Description	Flyer code
Method Packages	Residual Pesticides	C146-E306
	Veterinary Drugs	C146-E161
	Water Quality Analysis	C146-E180
	Drugs of Abuse	C146-E181
	Rapid Toxicology Screening	C146-E224
	Primary Metabolites	C146-E227
	Lipid Mediators	C146-E225
	Cell Culture Profiling	C146-E279
	D/L Amino Acids	C146-E336
MRM Libraries	Metabolic Enzymes in Yeast	C146-E275
	Phospholipid Profiling	C146-E314

Note: Optimization of analysis parameters will be necessary in some cases when using the LCMS-8060.

Traverse MS

Multivariate Analysis Software Supports MRM Data
Traverse MS data analysis software is intended for high-speed processing of MRM data acquired with Shimadzu triple quadrupole LCMS systems in the field of targeted metabolomics.
Using multiple samples and multiple components, the software is able to create graphical and statistical analysis for metabolic pathway analysis.



Brochure: C146-E308

Multi-analyte Quantitation Software

LabSolutions Insight

Laboratory efficiency is driven by highly automated mass spectrometry platforms delivering large volumes of high quality data and yet manual data review can limit sample turnaround times and reduce productivity. LabSolutions Insight has been designed to drastically simplify the review process and transforms data processing.

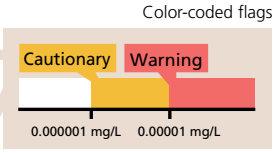
Multi-Analyte Data Review

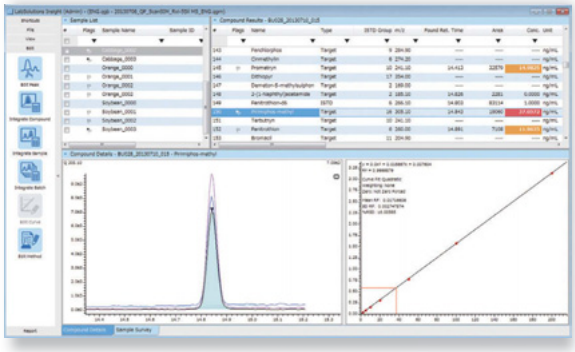
Results can be re-integrated and re-quantified directly from LabSolutions Insight.

Color-coded QA/QC Flags

In LabSolutions Insight, quantitative results can be compared to established criteria, and any outliers are color-coded for easy identification and further review. Color-coded criteria levels can be defined, making it easy to determine which data points are outliers, and which specific QC criteria were not met. Any changes made to calibration curves or manual peak integration are immediately reflected in the color-coded flags.

Sample Survey

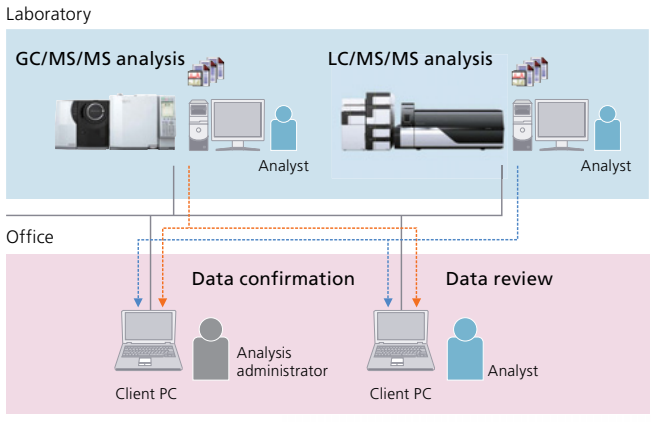




Compound Information

Multiple Workspaces

Insight supports data review over a network creating new opportunities in remote data review and enables multiple pane display for 2 monitors.



Nexera UHPLC

Our unique approach to delivering high-quality, high-speed LC/MS/MS analysis is combining the Nexera UHPLC and LCMS-8060 as a seamlessly integrated system.

Key elements of Nexera and LCMS-8060 performance to maximize your productivity

Nexera

- The fastest gradient cycle and sample injection time
- Eliminates carryover even with high sensitive LC/MS/MS
- Solvent blending, and sample preparation are possible

LCMS-8060

- 0.8 msec dwell time and 1 msec pause time
- 5 msec polarity switching speed
- No signal loss even at lower dwell time by UFsweeper technology

Nexera X2

Brochure: C196-E079

Nexera XR

Brochure: C196-E082

Nexera MP

Brochure: C193-E030

Nexera-i

Brochure: C196-E084

Nexera UC
On-line SFE-SFC-MS System

It is a revolutionary system that combines on-line SFE and SFC in a single flow path. Target compounds are extracted from solid samples and then automatically transferred to SFC/MS so that no human intervention is required. The Nexera UC on-line SFE-SFC system reduces the time for pretreatment of samples and acquires highly accurate data.

Brochure: C190-E185

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