C146-E121E

SHIMADZU
Excellence in Science

Liquid Chromatograph Mass Spectrometer

LCMS-2020

UFMS
ULTRA FAST MASS SPECTROMETRY

LCMS-2020

—Seeing is Believing.

Ultra Fast

UFswitching

Rapid 15 msec Polarity Switching

Ultra Fast

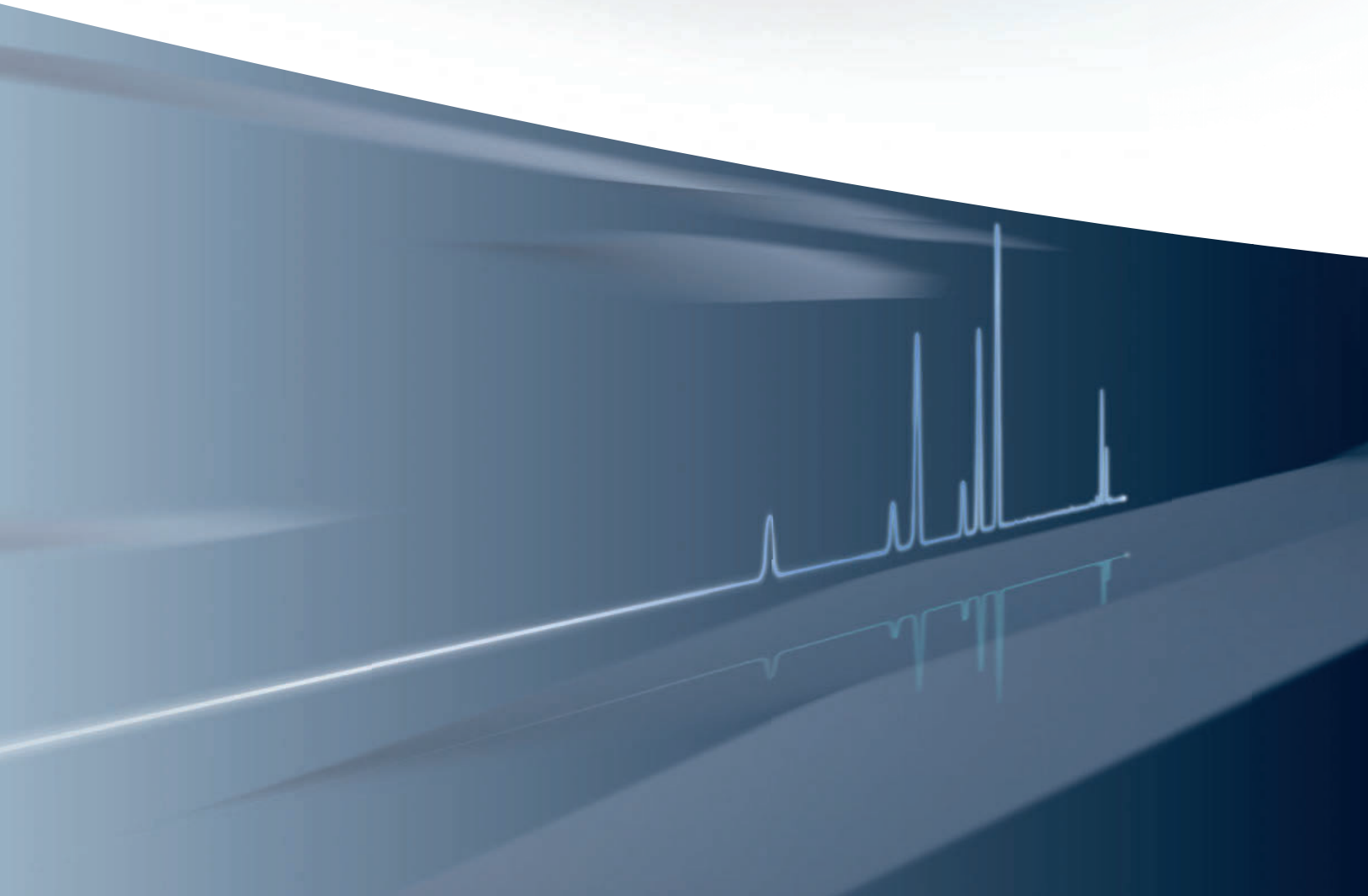
UFsensitivity

Superior Sensitivity from UFLC

Ultra Fast

UFscanning

15,000 u/sec Fast Scanning Speed



UFMS

ULTRA FAST MASS SPECTROMETRY

Speed Beyond Comparison

GCMS-QP2010 Ultra
GCMS-QP2010 SE

GCMS-TQ8030

LCMS-8030

LCMS-8040

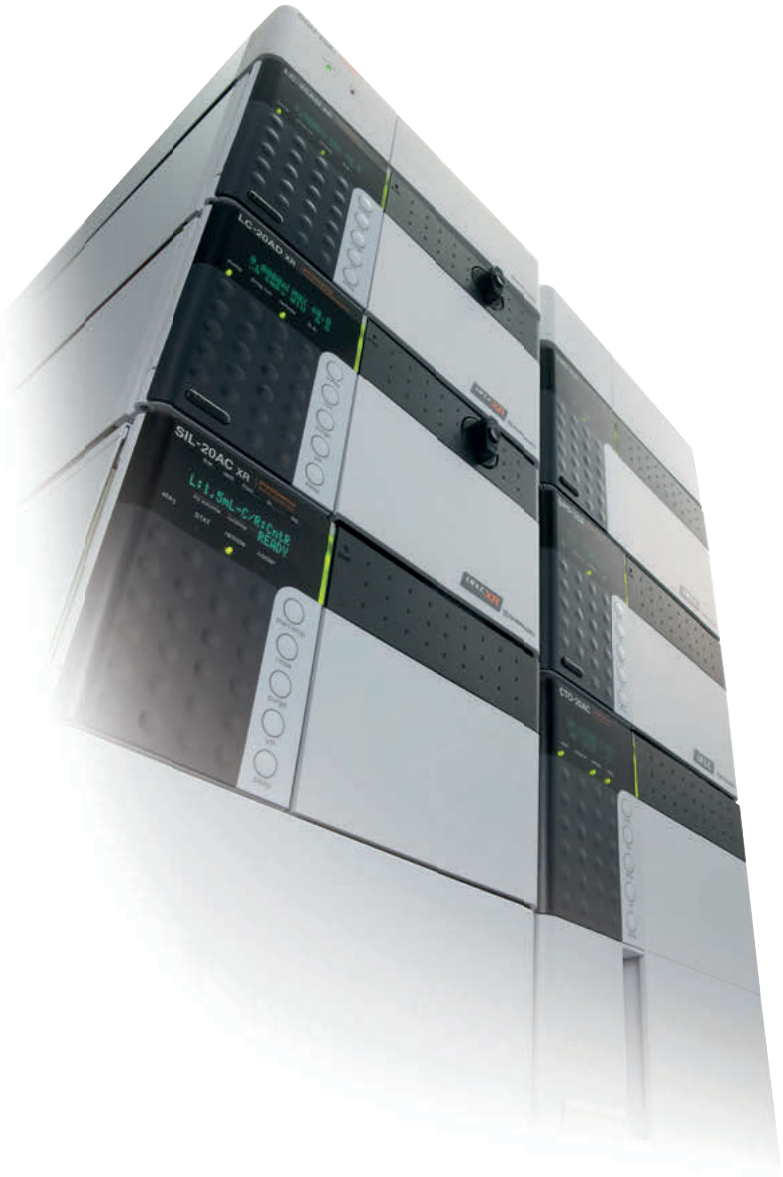
LCMS-8080

LCMS-2020

LCMS-IT-TOF

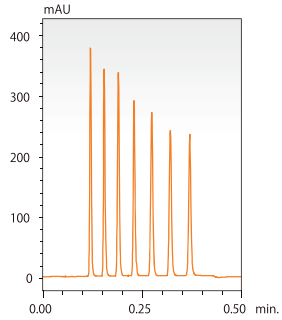
UFLC Quality.

From HPLC to UFLC. Then to UFLC/MS.



From HPLC to UFLC

UFLC achieves excellent speed and resolution, while offering the high precision not available with conventional HPLC and expandability options.



Ultra Fast

Not only high-speed analysis, but increased overall speed through rapid sample injection and fully automatic analysis functions.

Unquestionable Fidelity

UFLC offers exceptional injection reproducibility as well as ultra high-speed operation.
In terms of minimizing sample carryover, essential in LC/MS analysis, the LCMS-2020 stays ahead of the competition.

Ultra Flexible

Covers an extensive range from ultra-fast analysis to conventional HPLC and semi-preparative analysis.

Ultra Fast

UFsensitivity
UFswitching
UFscanning

Speed is Power.

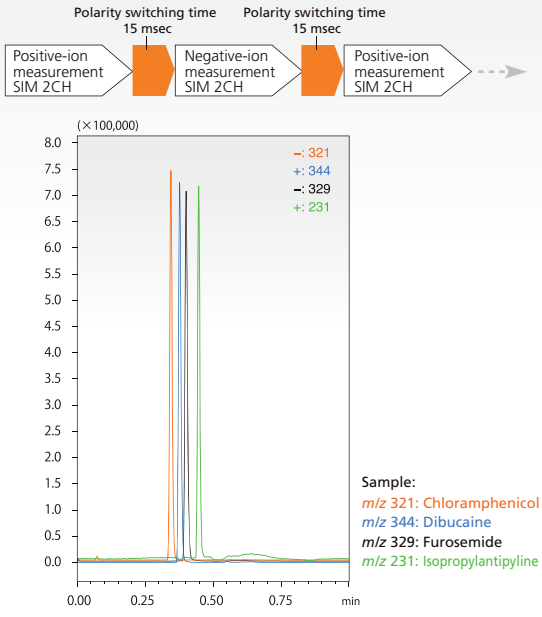
Greater speed. Greater sensitivity.

Ultra-fast

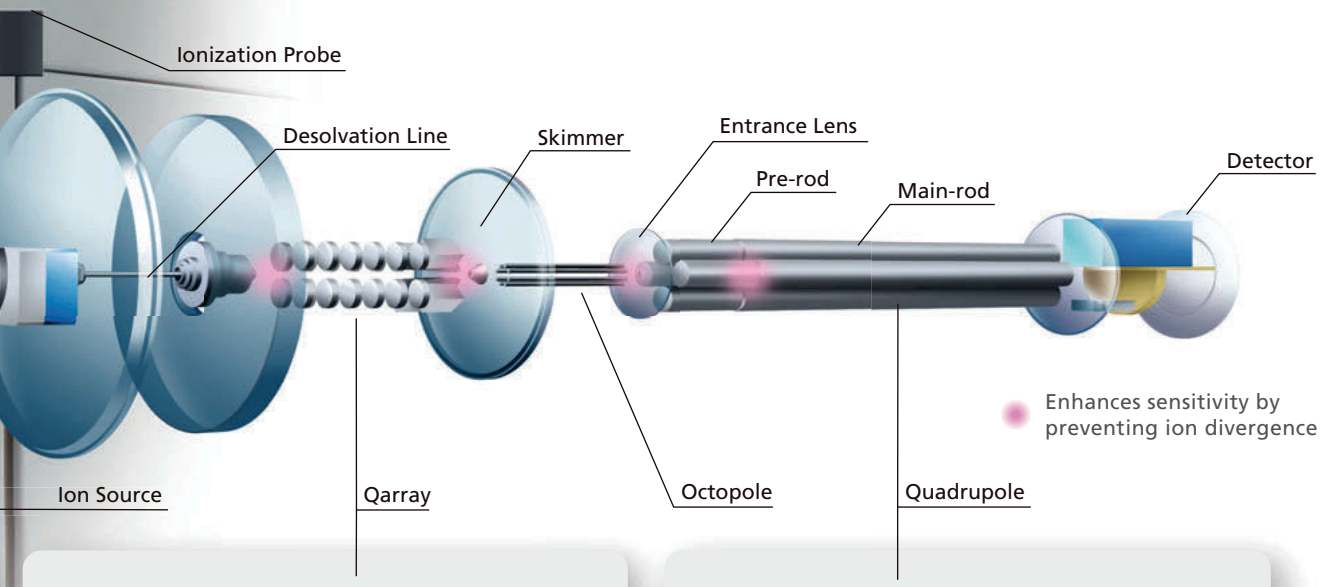
*UF*switching

Rapid 15-millisecond positive/negative ionization switching

To detect both positive and negative ions, analysis is performed while switching between the positive and negative ionization modes.
The LCMS-2020 adopts patented high-voltage power supply technology (Patent: US7855355) to achieve an ultra-fast polarity switching time of just 15 ms.



Accurate mass analysis of sharp chromatographic peaks obtained by UFLC requires ultra-fast MS detection capabilities.
The LCMS-2020 offers UFswitching for rapid switching between the positive and negative ionization modes and UFscanning for ultra-fast scan measurements to capture the sharpest UFLC peaks.

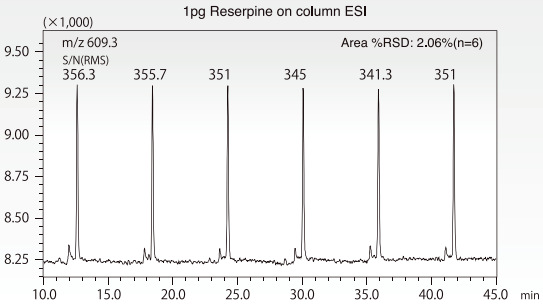


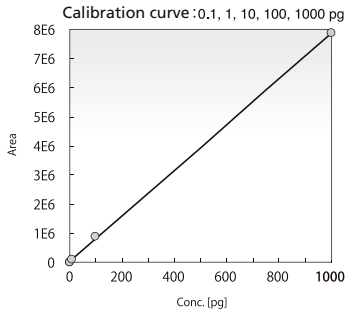
Ultra-fast

*UF*sensitivity

Superior sensitivity from UFLC

The newly developed Qarray® Optics achieves superior sensitivity, reproducibility, and linearity.





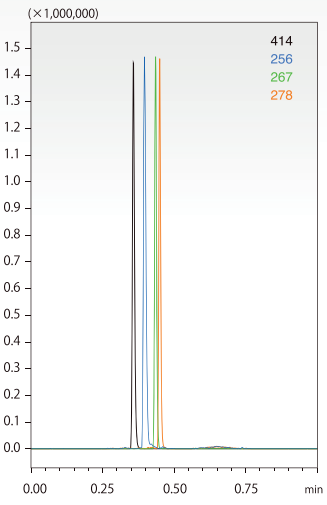
pg	Area
0.1	802.5
1	7743.5
10	84799.7
100	891423.7
1000	7864342.1

Ultra-fast

*UF*scanning

15,000 u/sec fast scanning speed

Controls the voltage applied to the Quadrupole according to the scan speed and *m/z*.
Shimadzu's proprietary scanning technology (Patent: US8188426) maintains resolution and achieves high ion transmittance even at high scanning speeds.

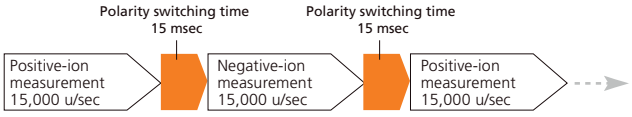


m/z 414: L-α-Narcotine
m/z 256: Diphenhydramine
m/z 267: Desipramine
m/z 278: Amitriptyline

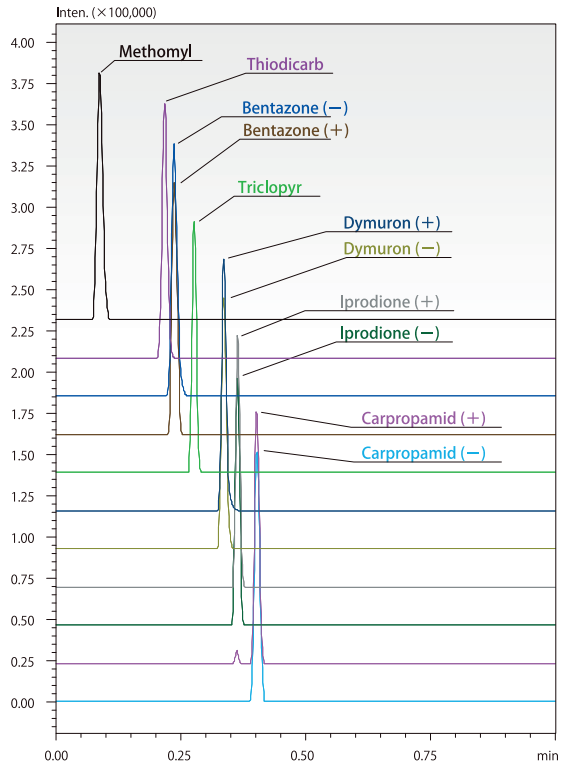
UFscanning & UFswitching

Necessity of UFswitching and UFscanning for ultra-fast analysis

Ultra-fast detection (MS measurement) is required for ultra-fast analysis with elution of six components per minute, for example. The UFswitching and UFscanning functions permit the required ultra-fast mass spectrometry.

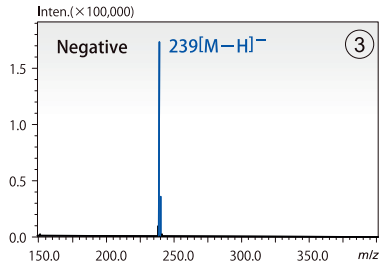


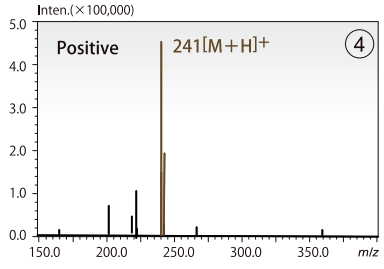
Sample : Polarity	
① Methomyl	: *m/z* 163 (+)
② Thiodicarb	: *m/z* 355 (+)
③ Bentazone	: *m/z* 239 (−)
④ Bentazone	: *m/z* 241 (+)
⑤ Triclopyr	: *m/z* 256 (−)
⑥ Dymuron	: *m/z* 269 (+)
⑦ Dymuron	: *m/z* 313 (−)
⑧ Iprodione	: *m/z* 330 (+)
⑨ Iprodione	: *m/z* 243 (−)
⑩ Carpropamid	: *m/z* 334 (+)
⑪ Carpropamid	: *m/z* 378 (−)



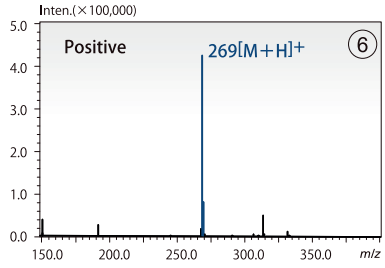
Examples of ionization in positive and negative modes

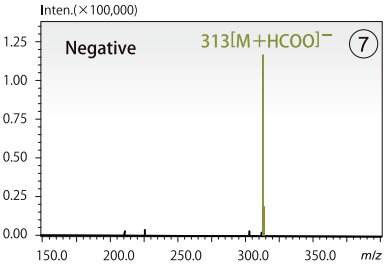
● MS Spectra of Bentazone



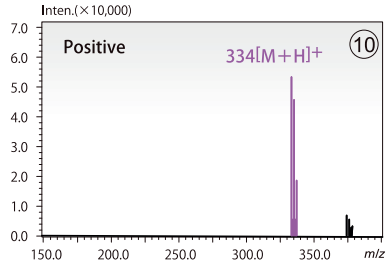


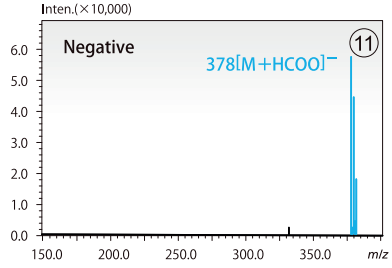
● MS Spectra of Dymuron





● MS Spectra of Carpropamid

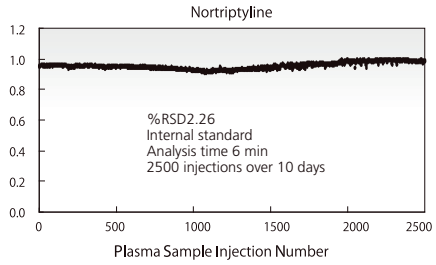




Hardware Features that to Powerfully Support Three UFs

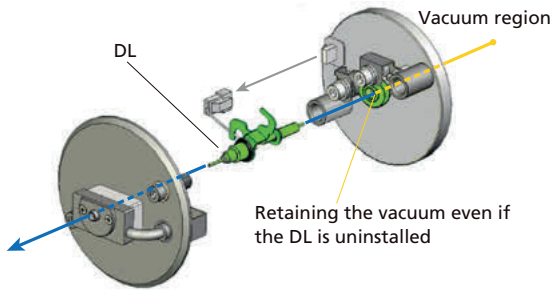
Toughness against dirty samples

In order to check the toughness of the LCMS-2020 against dirty samples, plasma samples simply precipitated with only acetonitrile were injected 2,500 times over 10 days (1 µL volume per injection). Excellent reproducibility of peak area was demonstrated and its RSD was 2.26%.



Easy Maintenance

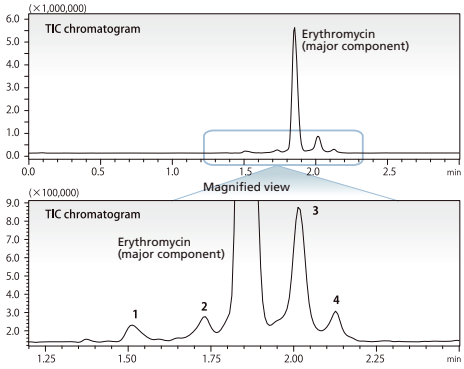
The desolvation line (DL) that introduces the sample from the ion source into the vacuum can be installed and uninstalled without breaking the vacuum, which dramatically enhances ease-of-maintenance.



Creating Fragment Ions by In-source CID

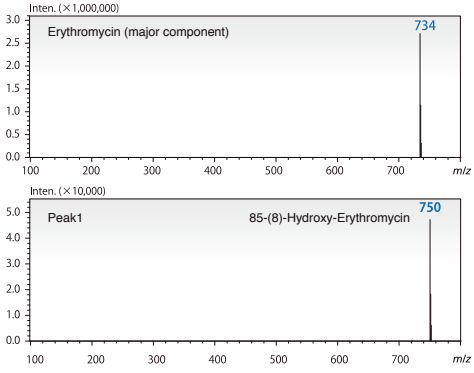
In-source CID (collision-induced dissociation) is effective for confirming the molecular weight of synthetic compounds and for the quantification of impurities.

● MS Chromatogram for Erythromycin Measurements DL=0V, Qarray DC=0V

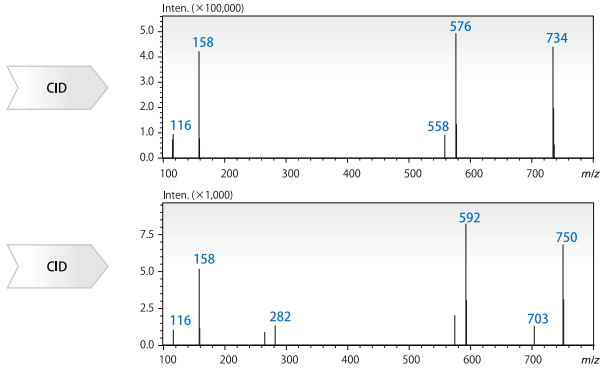


Using in-source CID allows the generation of fragment ions. This example shows the structure of impurities in erythromycin estimated from fragment ions generated by in-source CID.
The multi-sequence mode permits several other methods within a single analysis, such as CID, positive/negative ion switching modes, and SCAN/SIM modes.
Precisely setting the parameters reduces the risk of erroneous evaluations and enhances the reliability of analysis results.

● MS Spectra (Normal mode) DL=0V, Qarray DC=0V



● MS Spectra (In-source CID mode) DL=0V, Qarray DC=60V



Diverse Ionization Methods Expand the Range of Applications

Selecting the ionization method appropriate for the target compound achieves superior analysis results.

LCMS-2020 offers APCI and DUIS in addition to ESI. Diverse ionization methods support a wide range of applications.

Selecting the most appropriate Ionization Method

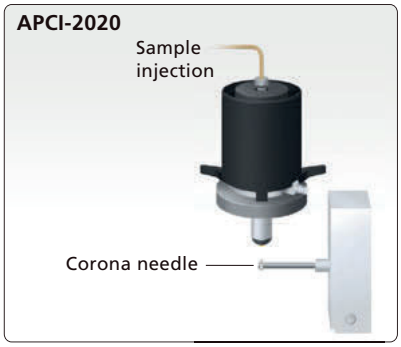
		ESI	APCI	DUIS
Compounds	DNA	B	—	B
	Proteins	A	—	B
	Peptides	A	—	B
	Amino acids	B	—	B
	Macromolecules	B	C	B
	Carbohydrates	B	A	A
	Triglycerides	B	A	A
	Aromatic hydrocarbons	C	C	C
	Aliphatic hydrocarbons	—	C	C
Properties	Polar	A	B	A
	Non-polar	—	B	B
	Volatile	A	A	A
	Non-volatile	A	—	A
	Thermostable	A	A	A
	Thermolabile	A	—	C

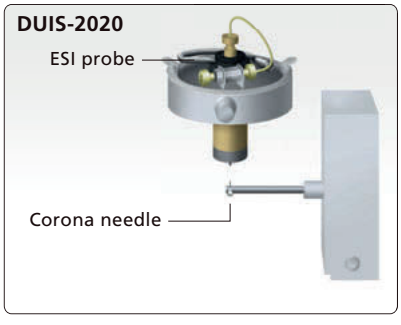
		ESI	APCI	DUIS
Functional groups	Acid	A	B	A
	Alcohol	C	B	B
	Aldehyde	C	B	B
	Alkane	—	C	C
	Alkyne	—	B	B
	Amino	A	A	A
	Carbonyl	C	B	B
	Ester	B	A	A
	Ether	C	B	B
	Phenol	B	A	A

A	Extremely suitable
B	Suitable
C	Analysis possible with appropriate parameters
—	Inherently unsuitable

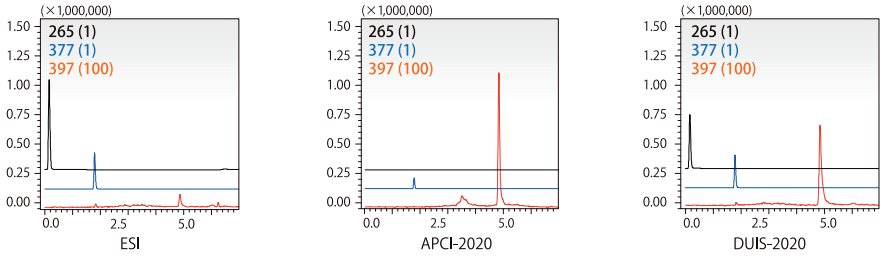
Ionization Options

While the water-soluble vitamins thiamine and riboflavin can be detected by ESI, they are virtually undetectable by APCI. Conversely, the fat-soluble vitamin calciferol can be detected by APCI but ESI does not offer adequate detection sensitivity. DUIS-2020 allows detection of a mixture of compounds suited to ESI or APCI, without missing any compounds.

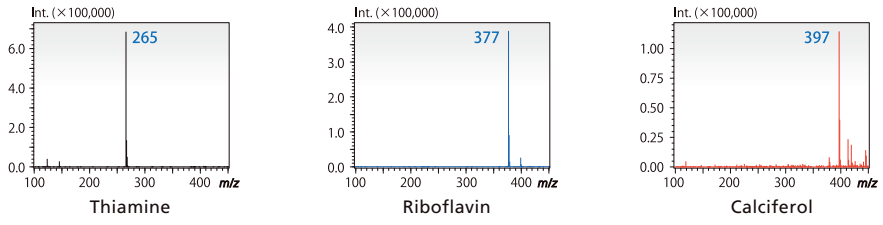




MS Chromatograms



MS Spectra from DUIS Measurements

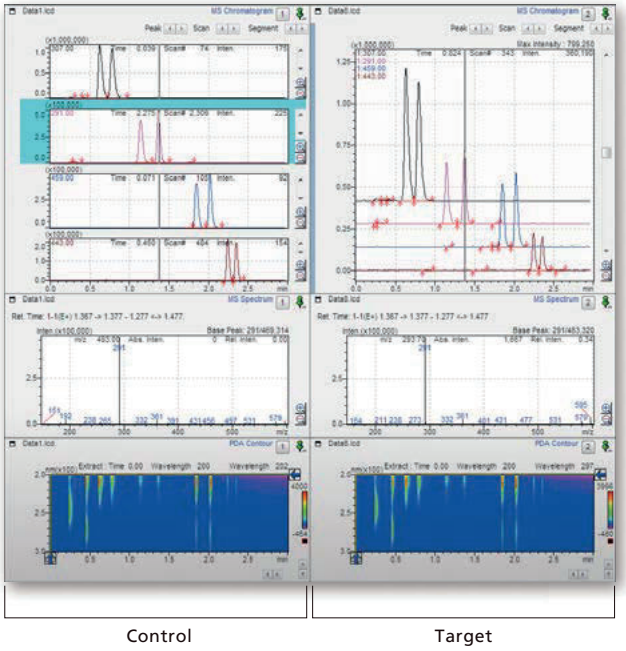


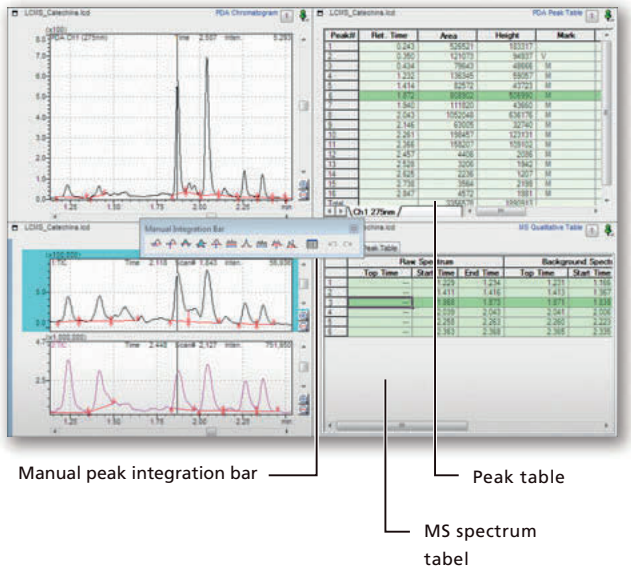
Mixed Sample of Three Water-soluble/Fat-soluble Vitamins
1. Thiamine: *m/z* 265; cation, generated by ionization, water-soluble vitamin
2. Riboflavin: *m/z* 377; protonated molecule, water-soluble vitamin
3. Calciferol: *m/z* 397; protonated molecule, fat-soluble vitamin

LabSolutions LCMS

Powerful support for UFLC/LCMS-2020 high-speed performance. This software maximizes analysis performance.

Rapidly analyzes huge volumes of data in browser windows. The comprehensive, clear display provides a stress-free working environment.





Comparison of Control and Target

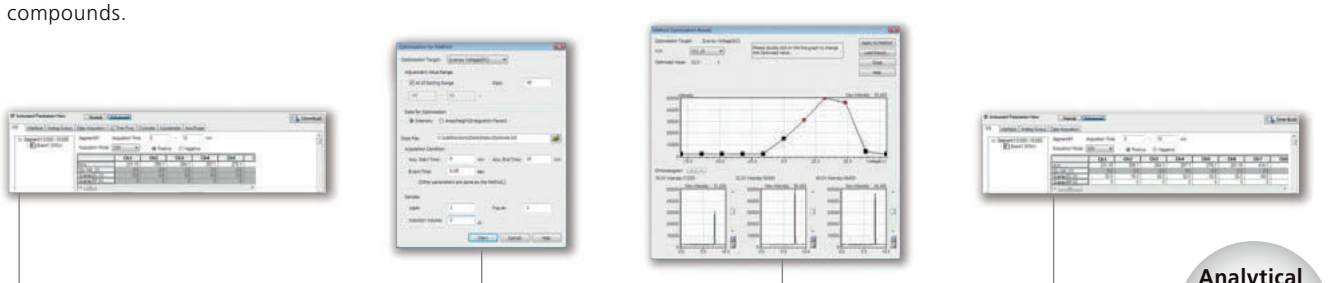
Multiple data items are displayed sequentially on the same screen. To view the diverse information in a data file in the optimal layout for comparison, the data can be browsed like flipping through the pages of a book to discover differences between the data.

Peak Integration

Manual peak integration can be conducted on both LC and MS chromatograms simultaneously. Both the peak table and MS spectrum table are displayed. The peak table and chromatograms/spectra are interlinked for easier operation.

Optimization of Analysis Parameters

Automatically searches and sets the voltages that affect the ion transmittance (DL/Qarray voltage) to the optimal values for the target compounds.



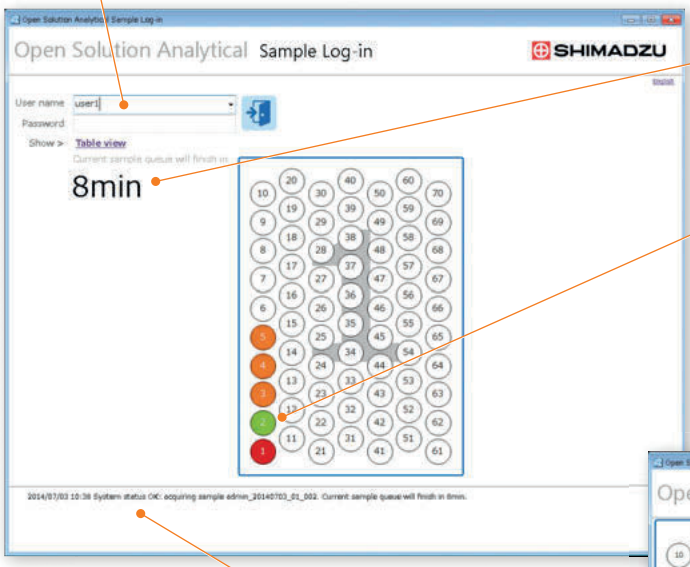
- **SIM Table**
  Enter the target *m/z*
- **Method Optimization Window**
  Specify the conditions to search for the optimal voltage
  ↓
  Automatic analysis execution
- **Method Optimization Result Window**
  The Search results of the optimal voltage value are displayed
- **SIM Table**
  The optimal voltage value is set into the SIM table automatically

Open Solution Analytical

‘Adaptive’ open access software

- Multiple options for sample log-in (Wizard, Table or Simple sample log-in mode)
- Advanced column management support (pH switching, column washing and parking)
- File management (including copy locations)
- Instrument use (including night time operation, sleep mode)
- Method management (advanced options for pre- and post-run options
- Global sample and instrument status and message board feedback

Log-in options
Can be configured for user name, password (or none)

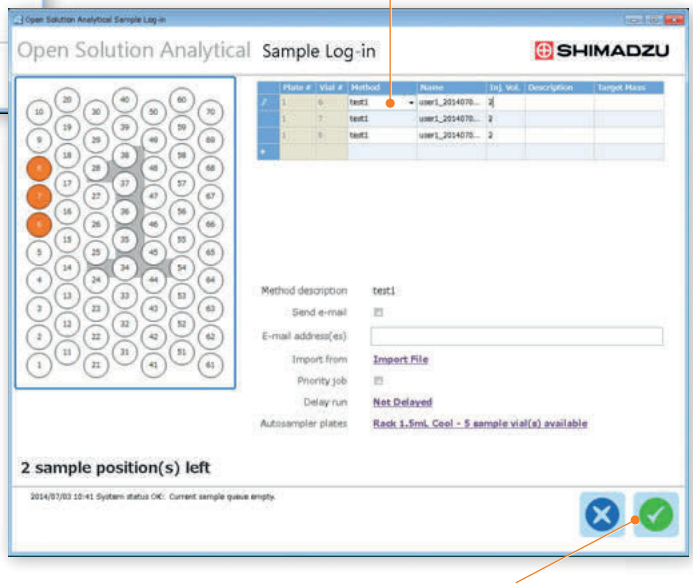


Time remaining
Large display for clarity

Status
Color coded updates

Message board
Updates system messages

Select Method | Add description
Name can be automatically generated



2 Steps only!

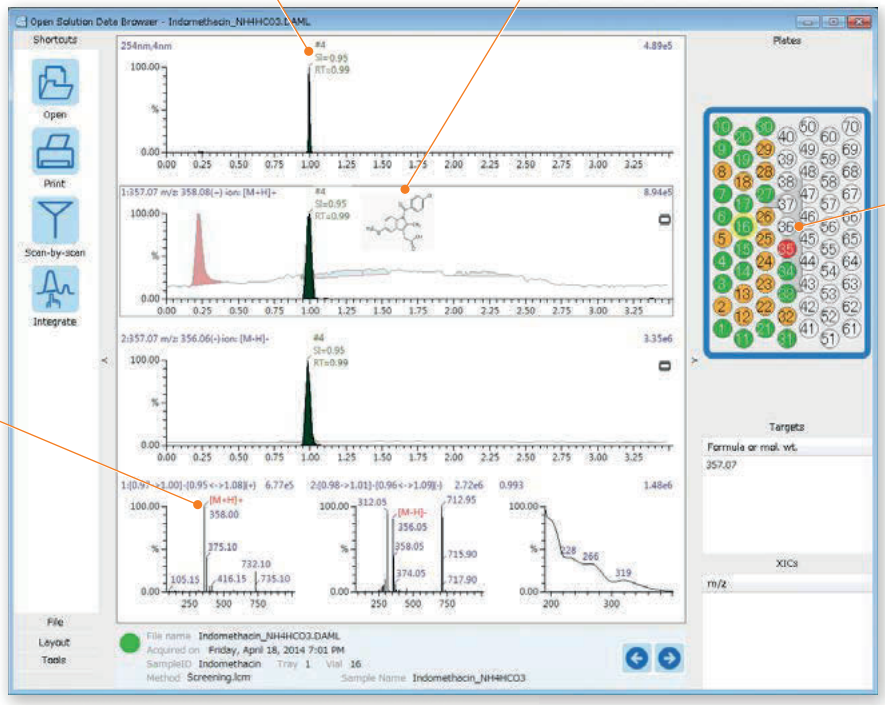
Click to submit and finish
Sample queue analysis

‘Dynamic’ data review experience

- Data review can be launched on any remote PC without software installation.
- Click on the link in an e-mail and the data will be shown.
- Supports multiple data presentations (including 2 panels for data comparison) for simple, clear data review.
- Advanced users can reprocess raw data or quickly review processed XML results.
- Spectral integrity; unique mode for checking for co-elution. Automatically checks mass spectral data across a detected peak.

Spectral integrity score
Highlights possible co-elution

Copy/Paste | Text | Structure display
Pasted structure

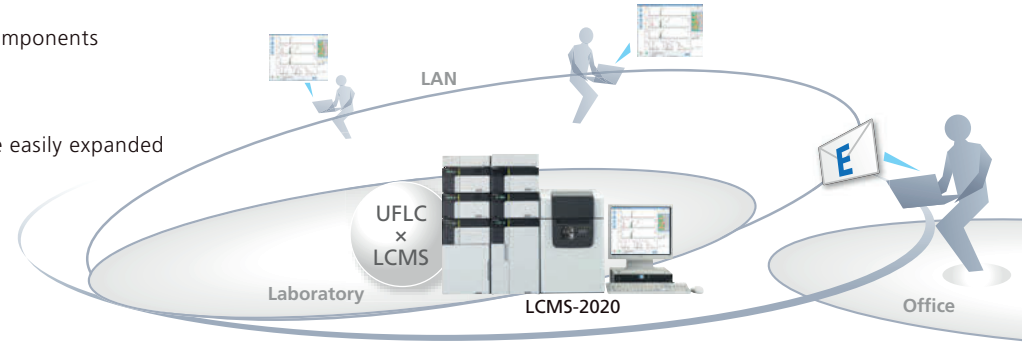


Target views
Each *m/z* target colored green, yellow or red

Intelligent mass spectrum labelling
Target ions labelled in the mass spectrum

No installation
Only requires free Microsoft components

Scalability
Number of user licenses can be easily expanded



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www.shimadzu.com/an/

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