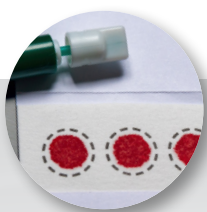


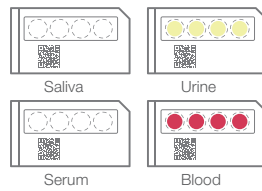
Clinical research

Transcend DSX-1 System Automated dried spot analysis



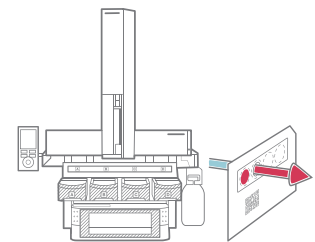


Single
Integrated
Workflow



Collection and spotting

Laboratory user obtains samples and spots onto card which enables sampling ease, handling convenience, and specimen authentication



Flow-through desorption

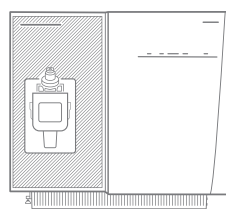
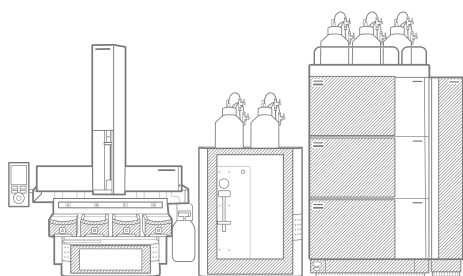
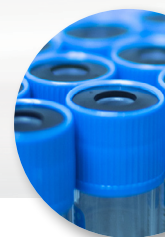
Innovative flow-through desorption (FTD™) technology for direct elution from dried spot cards



Automated dried spot analysis

Fully automate dried spot sampling and analysis with the Thermo Scientific™ Transcend™ DSX-1 UHPLC system. The system redefines the traditional, labor-intensive dried spot analysis workflow by enabling easy to use automation providing simple and efficient online extraction and enrichment, while delivering sample compliance and minimal ambiguity, for high throughput LC-MS/MS analysis in a single integrated system.

- Automates labor-intensive handling and analysis of dried spots
- Online sample clean-up and enrichment of the most difficult matrices, including whole blood, serum, urine, and saliva
- Sample traceability and chain of custody through accurate image capture, before and after analysis
- Thermo Scientific™ TurboFlow™ technology enhances sample throughput, analyte sensitivity and system robustness
- Instrument software controls the entire dried spot analysis workflow
- Compatible with Thermo Scientific™ mass spectrometers



Automated dried spot analysis

The combined FTD with high pressure dispenser (HPD™) wash step prevents carryover, and delivers a liquid sample to the UHPLC for online SPE and liquid chromatography

Mass spectrometry

LC-MS platforms solve everyday screening and quantitation challenges to detect drugs and other analytes

Data analysis

Thermo Scientific™ Aria™ MX software, combined with Thermo Scientific™ TraceFinder™ software, enable seamless instrument control, data acquisition and processing

Efficiency, automation, and traceability

Clinical research laboratory professionals demand compliant, trouble-free sample handling and unambiguous specimen authentication in their dried spot analysis workflow.

The Transcend DSX-1 system addresses these requirements and is an efficient system that minimizes user intervention, maintains sample integrity, and enhances sample throughput with TurboFlow technology—delivering substantial savings on time, labor, and reagent costs compared to manual workflows.

Transcend DSX-1 system
Automated

DSX card

Dried spot module (DSM) High pressure dispenser (HPD)

Analysis by LC-MS

Completion time:
~9 min

Traditional dried spot analysis
Manual

- Punch disc
- Add internal standard
- Mix
- Extract
- Remove supernatant
- Repeat extraction
- Combine extracts
- Evaporate
- Reconstitute
- Transfer
- Analysis by LC-MS

Hours to complete

Completion time:
~2.5–3.0 hrs

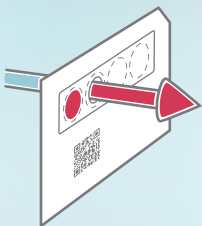
Minutes to complete

96 card capacity

Dried spot module (DSM) automates sequential dried spot analysis and simplifies the entire analytical process while maximizing throughput.

Flow-through Desorption

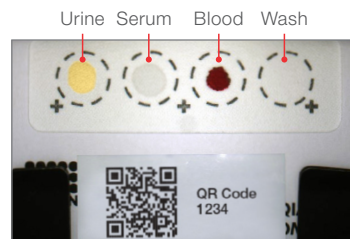
Proprietary FTD technology facilitates direct elution from dried spot cards, enabling samples to be sent directly for online cleanup and enrichment. The dried spot module positions cards into the Transcend DSX clamp, forming a leak-tight seal around the spot. Solvent from the UHPLC is delivered to the card and now carries a liquid sample for additional cleanup and analysis. A high pressure dispenser (HPD) is used to wash the Transcend DSX clamp.



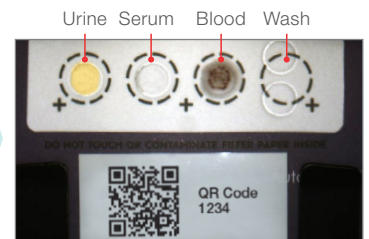
Intelligent Vision Camera

Sample traceability, chain of custody, and accurate spot recognition (sample card position, spot size, shape and location, and barcode ID) via the Intelligent Vision Camera™ (IVC™) is captured and ensures sample information can be tracked and stored should retrospective monitoring become necessary.

A. Before



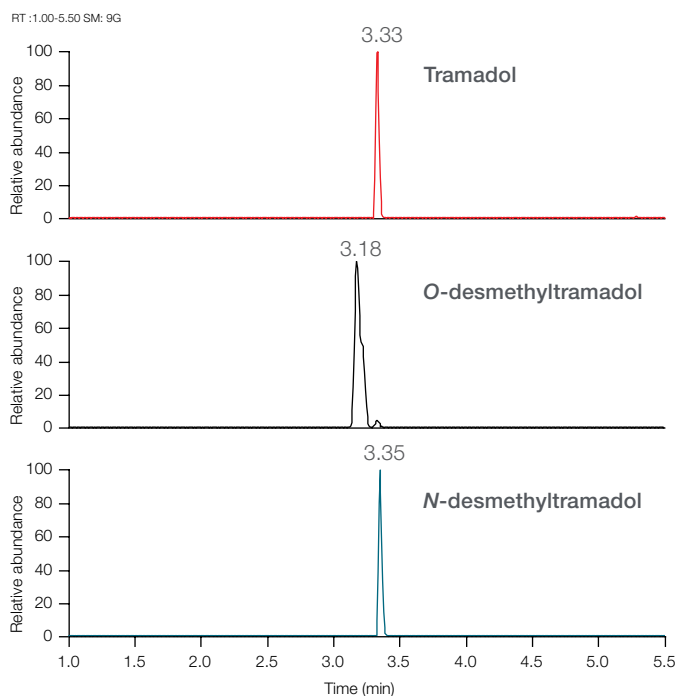
B. After



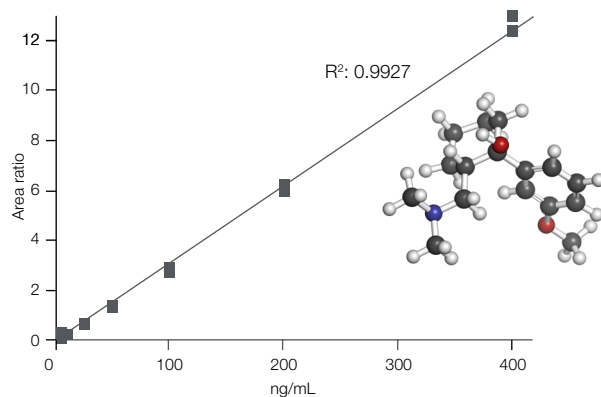
(A) First three card spots intended for sample; last spot intended for wash step. (B) White circles on spots indicate clamp imprints; first three card spots after desorption show single imprints; last spot washed twice to prevent carryover shows two imprints.

Quantification of tramadol in various matrices

Tramadol, a synthetic opioid, has been widely prescribed for management of chronic and acute pain in sports settings. Recently, agencies such as the World Anti-Doping Agency (WADA) and the International Testing Agency (ITA) have announced implementation of dried blood spot (DBS) testing in competitive sports and international sporting events. Here we demonstrate the fully automated dried spot analysis of tramadol using the Transcend DSX-1 system coupled to a Thermo Scientific™ TSQ Altis™ triple quadrupole mass spectrometer.



Extracted ion chromatograms of tramadol and its metabolites at 5 ng/mL.



Calibration curve for spiked tramadol in whole blood, ranging from 5 to 400 ng/mL.



Accuracy and precision in different matrices

A method to rapidly determine tramadol, and its two metabolites, *O*-desmethyltramadol and *N*-desmethyltramadol, was developed for dried matrix cards spotted with whole blood, saliva, serum, and urine.

Quantitation was evaluated using an integrated internal standard delivery module, resulting in linearity ($R^2 > 0.99$) across 5 ng/mL to 400 ng/mL and RSDs < 20% to satisfy different cut-off needs in clinical research use.

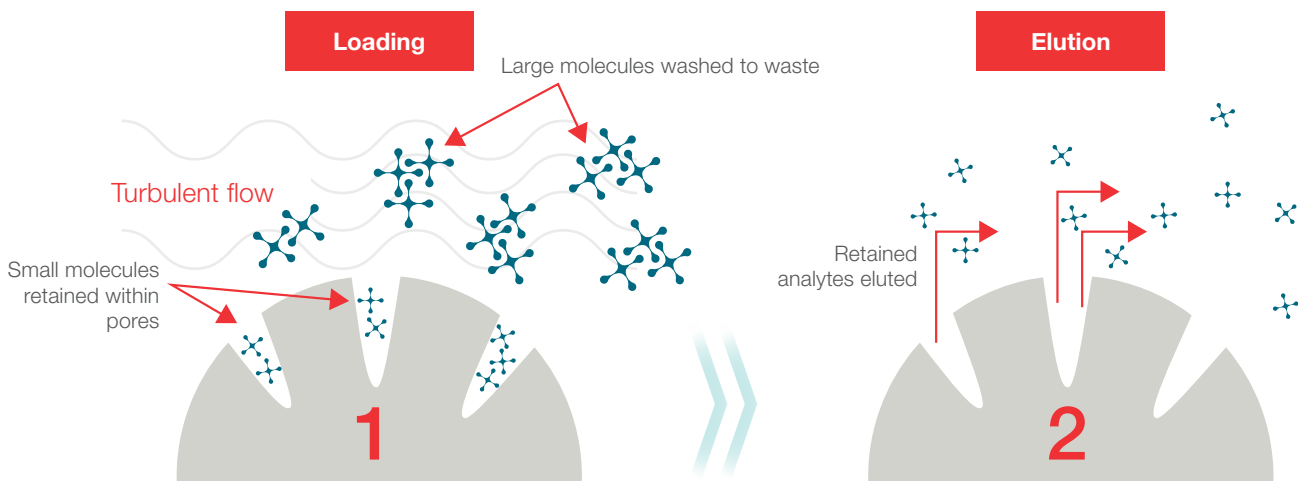
Fast and robust analyses were achieved with minimal sample preparation by on-line extraction and separation followed by MS/MS identification.

Dried spot matrix Concentration (ng/mL)	Whole Blood			Saliva			Serum			Urine		
	% Diff	% RSD	% CV	% Diff	% RSD	% CV	% Diff	% RSD	% CV	% Diff	% RSD	% CV
5	18.5	5.6	7.8	3.1	8.8	6.9	4.3	5.0	5.4	-9.1	4.7	3.5
10	-3.1	15.4	18.6	3.0	10.3	9.1	0.9	5.4	5.6	9.6	13.8	12.1
25	-3.0	5.2	5.6	-1.6	6.8	6.5	0.1	5.8	5.9	8.9	12.3	11.7
50	-6.2	8.5	8.8	1.3	8.3	8.1	-3.2	7.7	7.7	8.7	9.1	8.8
100	-4.2	6.5	6.6	-0.3	7.4	7.3	0.2	9.6	9.7	10.9	4.8	4.7
200	-3.5	7.9	7.9	-1.4	8.1	8.0	-1.3	5.5	5.5	0.9	8.0	7.9
400	3.6	7.9	7.9	2.3	7.6	7.6	1.0	8.7	8.7	-4.8	5.8	5.8

Whole blood, saliva, serum and urine samples were spiked with tramadol to determine accuracy and precision. The % Diff, % CV, and % RSD all are below 20%.

The power of on-line sample clean-up with TurboFlow technology

The Transcend DSX-1 system incorporates advanced TurboFlow technology for online sample cleanup and enrichment, which helps improve method robustness and sensitivity for clinical research applications. This technology uses 2-dimensional (2D) chromatography that incorporates a high velocity turbulent flow to wash large molecules to waste. TurboFlow methods are ideal for dried spot analyses, having been developed to handle direct injection of blood, serum, plasma, urine, as well as other complex matrices into the mass spectrometry system.

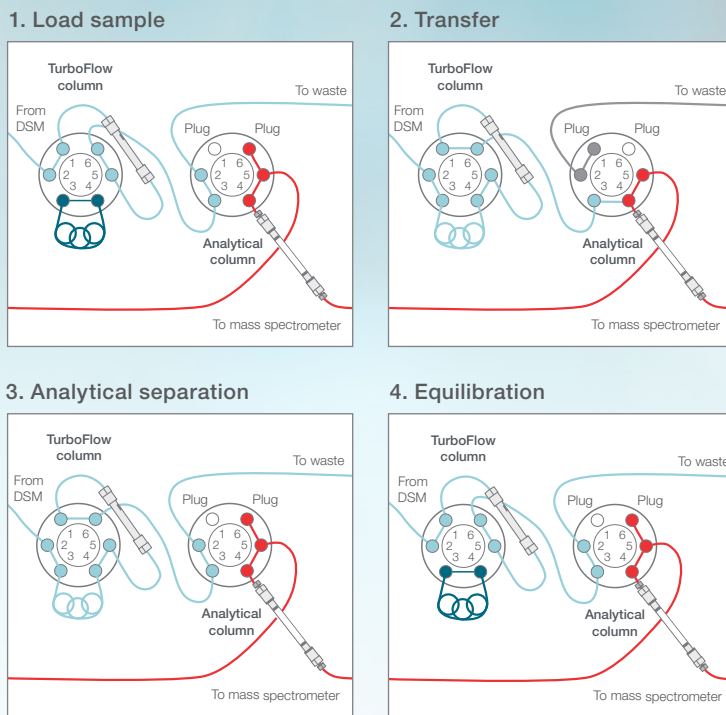


Samples in complex matrices are loaded onto the TurboFlow column at high velocity, leading to biased diffusion of small molecules into column pores. Within pores, analytes are retained on the stationary phase—RP, IEX, and mixed mode available.

Analytes are then eluted off the TurboFlow column at lower flow rates and loaded onto the head of the analytical column.

TurboFlow method with valve switching

Samples in complex matrices can be loaded onto the TurboFlow column at high flow rates, generating turbulent flow and resulting in biased diffusion of small molecules into column pores. Within the pores, analytes are retained on the stationary phase. Aria MX software controls valve switching, which allows analytes to be eluted from the TurboFlow column at lower flow rates and loaded onto the analytical column. Equilibration prepares the analytical column for the next sample to be loaded.



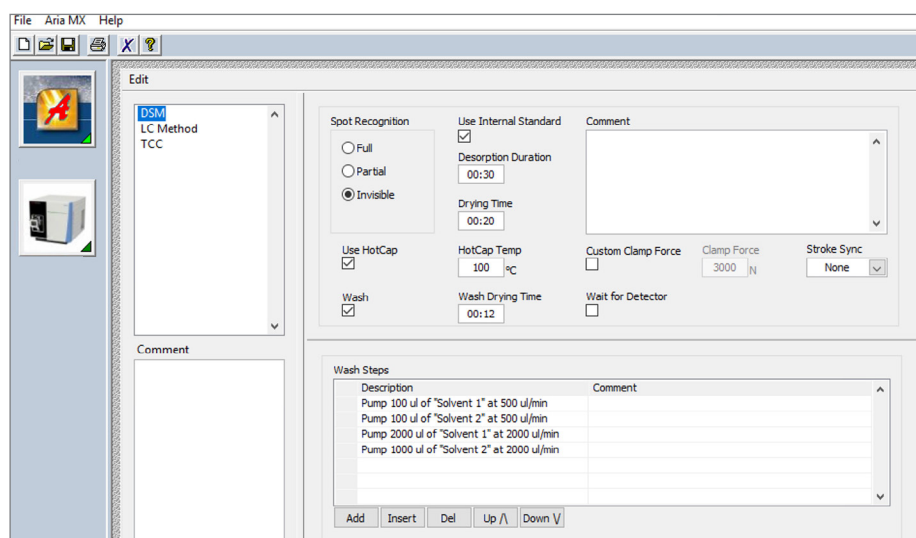
Aria MX software controls pump operation, valve switching, cleaning, and gradient procedures.

Smart software control with Aria MX software

The Transcend DSX-1 solution is controlled by Aria MX software that fully integrates all aspects of the dried spot analysis workflow, including card handling, pump operation, valve switching, on-line sample clean-up, and LC-MS/MS methods. It features an intuitive graphical user interface that enables users to see both dried spot module and UHPLC interfaces for user-friendly operation.

Seamless instrument control

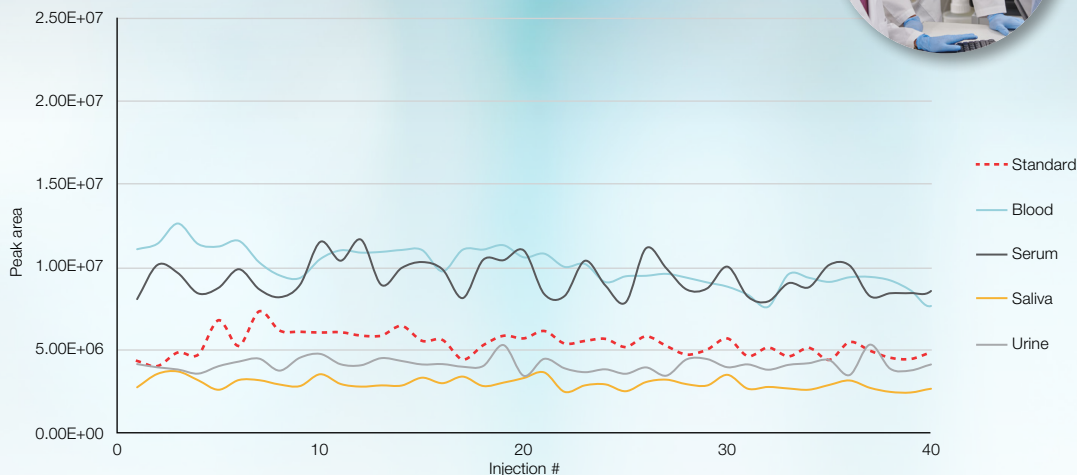
Aria MX software simplifies method set-up and controls several parameters of the instrument method. Shown is a view of Aria MX software that enables control of key method parameters associated with desorption and recovery efficiency for the dried spot module.



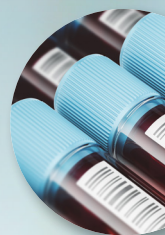
Aria MX software control optimizes performance and productivity.

Peak area reproducibility

Reproducibility is critical for any assay performed day after day. The graph demonstrates the isotopically labeled standard peak area for tramadol for over forty injections in five different matrices.



Internal standard peak area reproducibility in different matrices.



General specifications

Application	Clinical research	<ul style="list-style-type: none"> • Toxicology • Anti-doping • Wellness • Therapeutic drug monitoring research • Inborn errors of metabolism
Dried Spot Analysis Components	Flow-through desorption (FTD) technology	<ul style="list-style-type: none"> • Leak-tight clamp head eliminates manual disc punching • Enables direct elution of analyte from card without intervention
	Intelligent Vision Camera (IVC)	<ul style="list-style-type: none"> • Image capture of 1D and 2D barcodes • Determines shape, size and location of spot for full or partial spots
	HotCap heated capillary	<ul style="list-style-type: none"> • Rapid heating of solvents enables better desorption and recovery
	Automated Internal Standard Addition (AISA™) and High Pressure Dispenser (HPD)	<ul style="list-style-type: none"> • Automated internal standard addition from the loading pump of the LC • Syringe dispenser used to wash dried matrix spot flow path
	Card capacity	<ul style="list-style-type: none"> • 96 total cards: 4 separate racks (A–D), capable of holding 24 sample cards/rack for a total of 96
UHPLC System	Includes	<ul style="list-style-type: none"> • Thermo Scientific™ Vanquish™ Flex Quaternary pumps (loading) • Thermo Scientific™ Vanquish™ Flex Binary pumps (eluting) • 3-Valve Interface Model – VIM • Vanquish base • Solvent tray
MS System	Compatibility	<ul style="list-style-type: none"> • Compatible with Thermo Scientific mass spectrometers running under Thermo Scientific™ Xcalibur™ 4.5 software or TraceFinder 5.1 software and later versions • Mass spectrometer sold separately
Software	System control	<ul style="list-style-type: none"> • Integrated Aria MX software
	Data processing	<ul style="list-style-type: none"> • TraceFinder software



Find out more at thermofisher.com/TranscendDSX

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