

ThermoFisher
S C I E N T I F I C

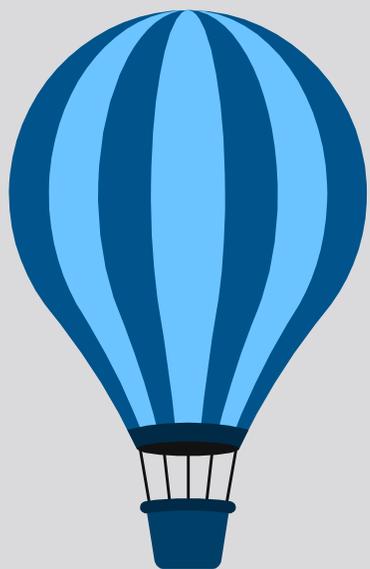
Revolutionising Chromatography with the Vanquish UHPLC Systems

Dr. Carsten Paul
HPLC Product Marketing Manager
Thermo Fisher Scientific, Germering, Germany



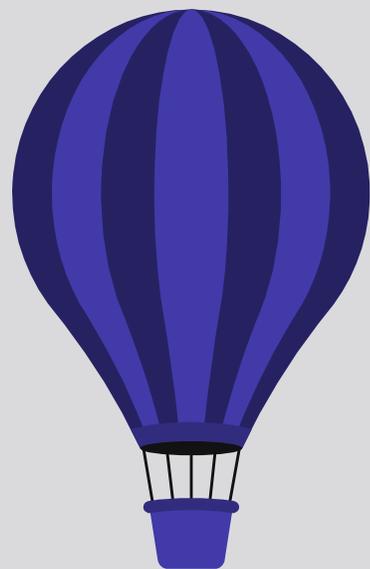
The world leader in serving science

Thermo Scientific™ Vanquish™ UHPLC Systems – 5 Years Anniversary



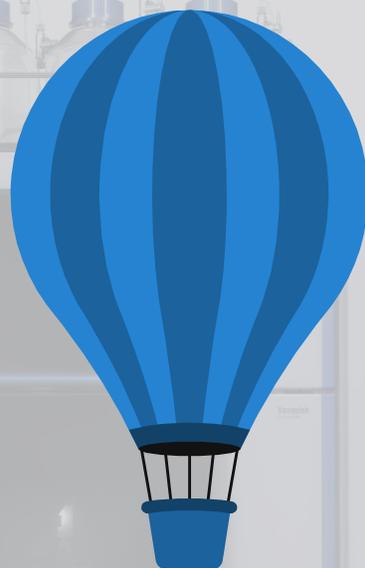
2014

Vanquish
Horizon
System



2015

Vanquish
Flex
Quaternary
System



2015

Vanquish
Charged
Aerosol
Detector



2016

Vanquish
Flex
Binary
System



2018

Vanquish
Duo
System

Vanquish Systems Brings You

Performance



To improve separations

- Binary and quaternary systems
- Widest flow-pressure footprint

Sensitivity



To find the complete picture

- Diverse detector portfolio to provide highly sensitive and selective detection
- Unique near universal charged aerosol detection

Productivity



To get more done

- Charger Module extends capacity
- Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS) Software



Accuracy

To control experiments

- Unsurpassed sample dosage
- Active and passive pre-heating
- Multiple thermostating options



Confidence

To ensure highest data quality

- Unmatched retention time precision with SmartInject
- Automation of workflows with barcode reading



Flexibility

To grow with your research

- Biocompatible and tool-free set up by default with optimized fluidics
- Integrated modularity – swap modules

Vanquish Systems Brings You

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To get more done

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Prof. Christian Huber, University of Salzburg:

“They really made efforts to move the technology significantly forward.”



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To control experiments

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- Active and passive pre-heating
- Multiple thermostating options



Confidence

To ensure highest data quality

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- Automation of workflows with barcode reading

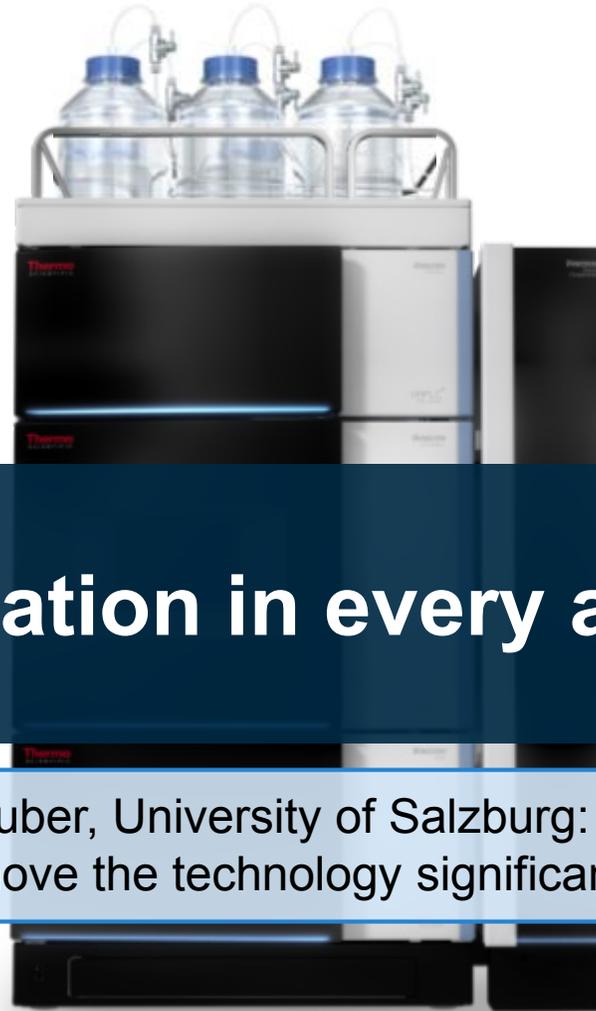


Flexibility

To grow with your research

- Biocompatible and tool-free set up by default with optimized fluidics
- Integrated modularity – swap modules

Innovation in every aspect



Vanquish Systems – Comparison

Vanquish Platform

- Improved retention time precision
- Biocompatible by default
- Increased sample capacity
- SmartInject Technology
- Improved sample cooling
- Multiple heating modes

- Active and passive pre-heating
- 4 detection options
- Platform-inherent robustness & maintenance features

Vanquish Horizon System

- 1500 bar binary system
- Ultra low gradient delay volume

Vanquish Flex Binary System

- 1000 bar binary system
- Low gradient delay volume

Vanquish Flex Quaternary System

- 1000 bar quaternary system
- Medium gradient delay volume



Highest performance for best separation or throughput

Throughput for targeted UHPLC separations

UHPLC for resolution or method development

Vanquish Platform

- Improved retention time precision
- Biocompatible by default
- Increased sample capacity
- SmartInject Technology
- Improved sample cooling
- Multiple heating modes

- Active and passive pre-heating
- 4 detection options
- Platform-inherent robustness & maintenance features

Cutting-edge fit-for-purpose UHPLC

Vanquish Horizon System

- 1500 bar binary system
- Ultra low gradient delay volume

Vanquish Flex Binary System

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Vanquish Flex Quaternary System

- 1000 bar quaternary system
- Medium gradient delay volume

Dr. Jonathan Bones, NIBRT:

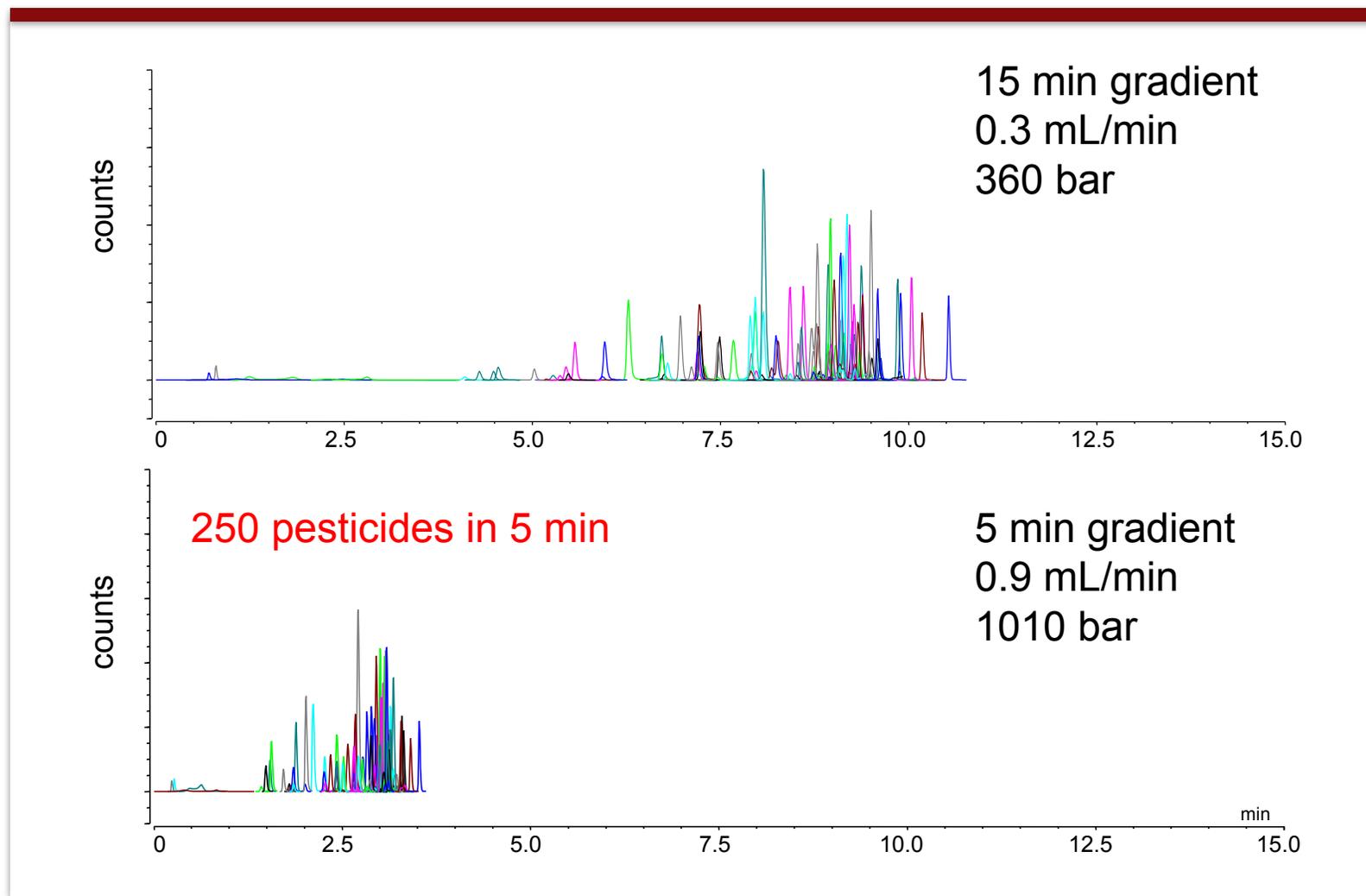
“One of the key features for us is really the simplicity of use.”

Highest performance for best separation or throughput

Throughput for targeted UHPLC separations

UHPLC for resolution or method development

Vanquish Horizon Delivers – Boosted MS Performance

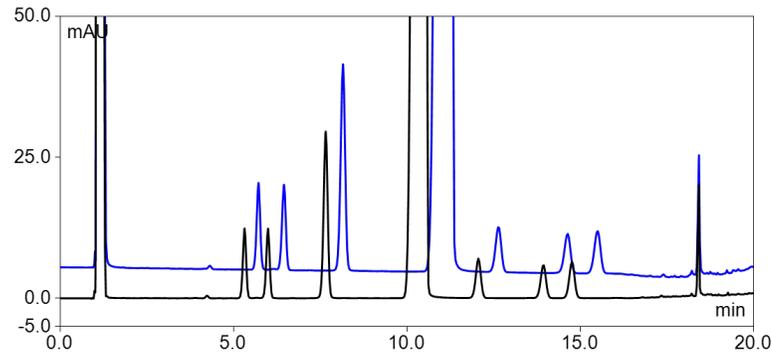


- Ultra efficient pesticides screening and quantification
- Average peak width 1.8 s while still yielding 10-15 data points per peak
- Outstanding retention time precision allows for very fast timed SRM MS
- Same number of pesticides detected for both run times

Method Transfer Example from Waters Acquity to Vanquish Horizon

Separation of Mebendazol and it's impurities

— Waters Acquity
— Vanquish Horizon



Waters Acquity:

TCC 40°C

Vanquish Horizon:

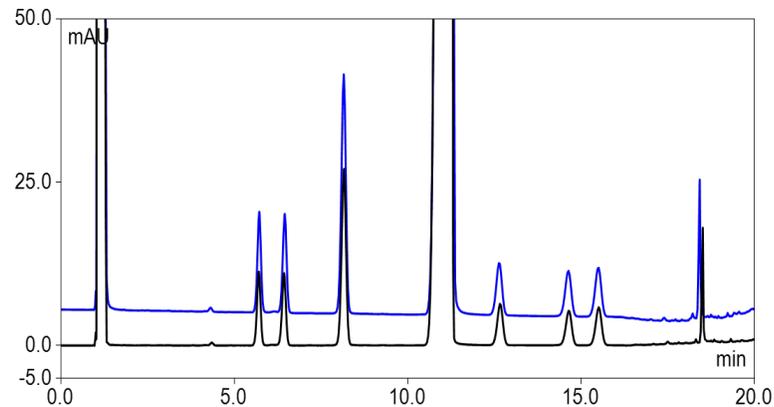
TCC 40°C, Preheater: 40°C

Waters Acquity:

TCC 40°C

Vanquish Horizon:

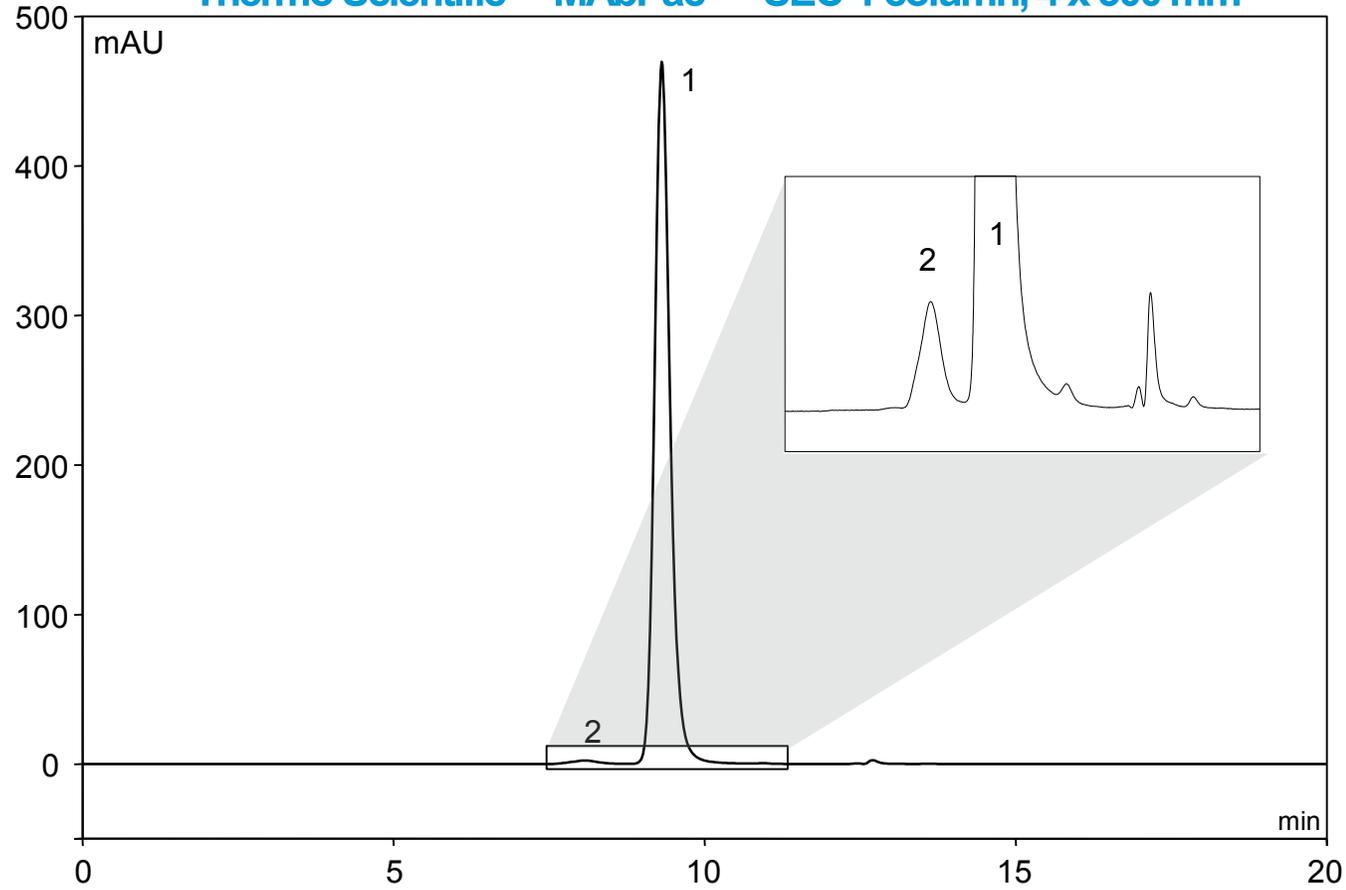
TCC 40°C, Preheater: 33°C



- Methods can be transferred between Waters Acquity and Thermo Scientific Vanquish Horizon
- While having similar delay volumes, the heating efficiency differs
- For Vanquish preheater temperature can be freely adjusted

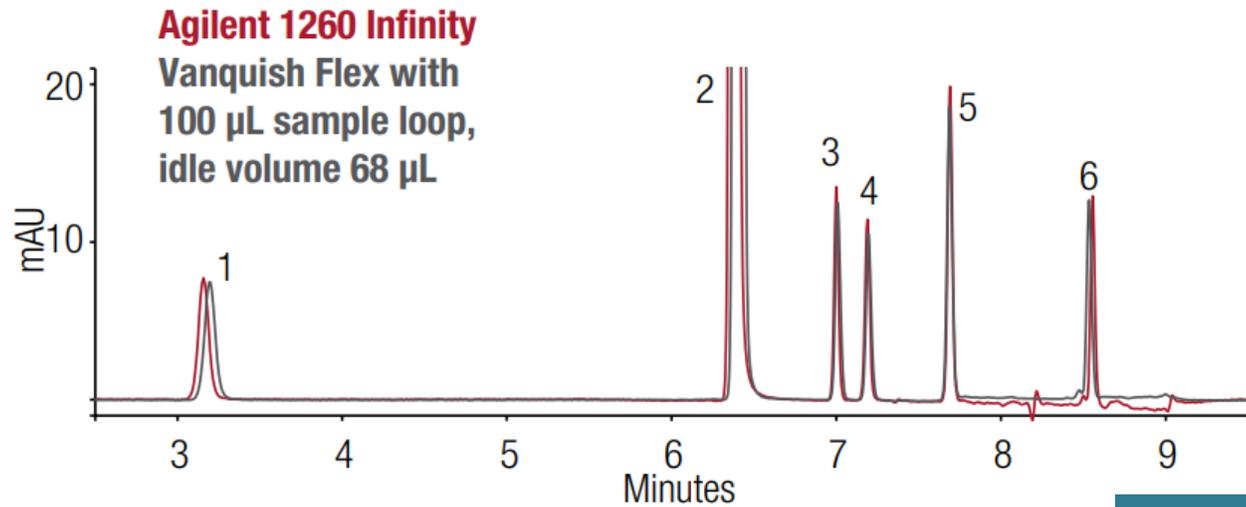
Vanquish Flex Quaternary – Aggregate Analysis

mAb size exclusion separation using Thermo Scientific™ MAbPac™ SEC-1 column, 4 x 300 mm



- Size exclusion is the standard test for aggregate analysis with therapeutic proteins
- Baseline separation achieved of dimer (2) and monomer (1)
- Thermo Scientific™ LightPipe™ DAD linearity allows detection of aggregates even in very low amounts

Transfer of a USP derived acetaminophen assay (AN 72717)



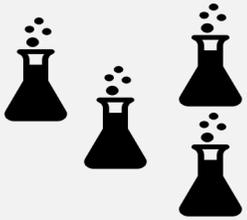
Tunable gradient delay volume by sampler metering device

Peak No.	Compound
1	4-Aminophenol
2	Acetaminophen (API)
3	Impurity B
4	Impurity C
5	Impurity D
6	Impurity J

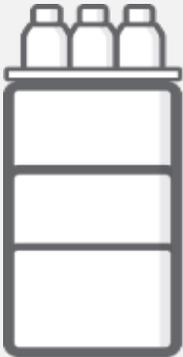
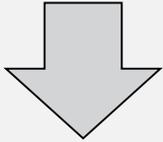
- Method could be transferred easily with all SST fulfilled
- Tunable metering device facilitated method transfer
- Improved signal-to-noise performance achieved

Analytical Challenges – Increased Expectations

Accelerate time to results



Increased number of samples



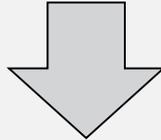
Process more samples with decreasing number of resources

Asked to do more with less

Need for efficient characterization



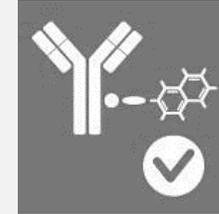
Increased complexity of samples



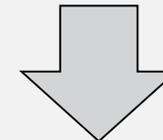
Need for complementary characterization methods

Asked to know more with less

Need for increasing precision of results



Increased depth of characterization



Need for high precision results, both qualitative and quantitative

Asked to see more with less

Vanquish Duo LC: Four Workflows. Two Flow Paths. One Integrated UHPLC Solution.



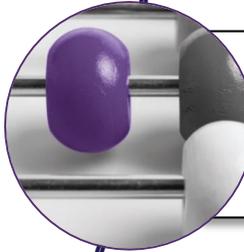
Dual LC

- A two channel LC system with standard footprint



Tandem LC-MS

- Increase MS utilization



Inverse Gradient

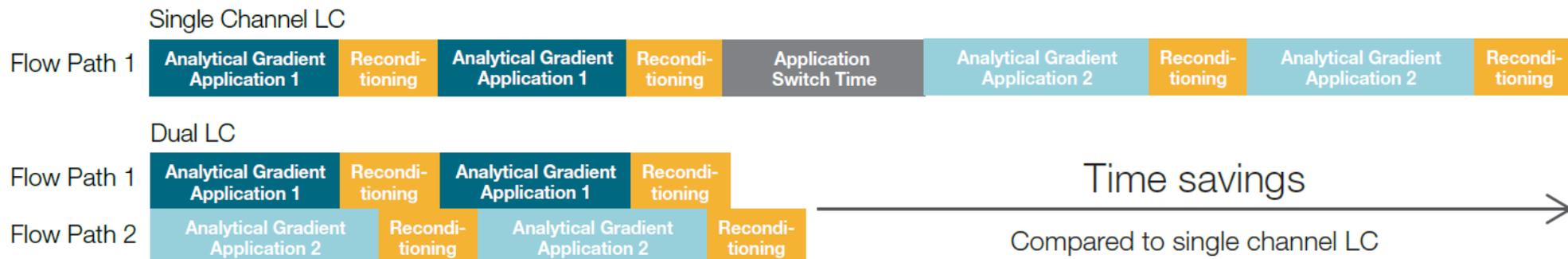
- System for advanced quantification capabilities



Transcend Duo LX-2

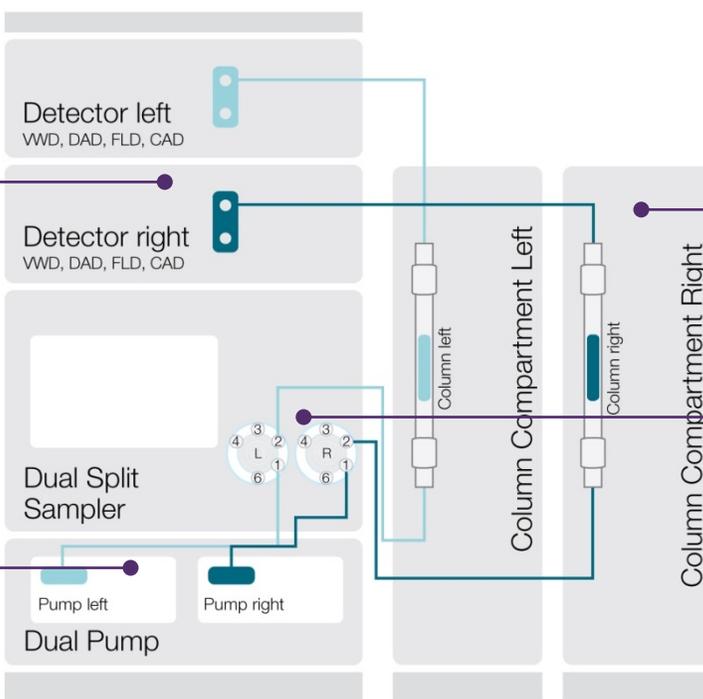
- Maximize MS utilization

Vanquish Duo System for Dual LC



Detectors

Any combination of two detectors ensuring sensitive and universal detections



Column compartment

Two columns in one or two column compartments for full application flexibility

Pump

Two independent pumps in one housing

Autosampler

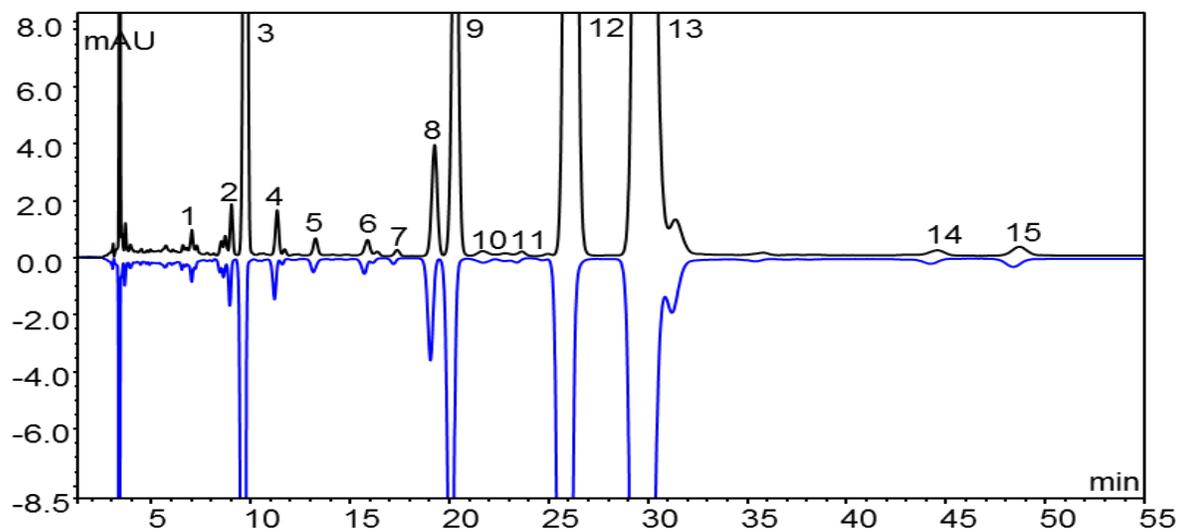
Two injection valves allowing the simultaneous analysis of completely different applications

What Can Be Accomplished with Vanquish Duo System for Dual LC?

Dual LC

Flow Path 1	Analytical Gradient Application 1	Reconditioning	Analytical Gradient Application 1	Reconditioning
Flow Path 2	Analytical Gradient Application 1	Reconditioning	Analytical Gradient Application 1	Reconditioning

Run two identical columns



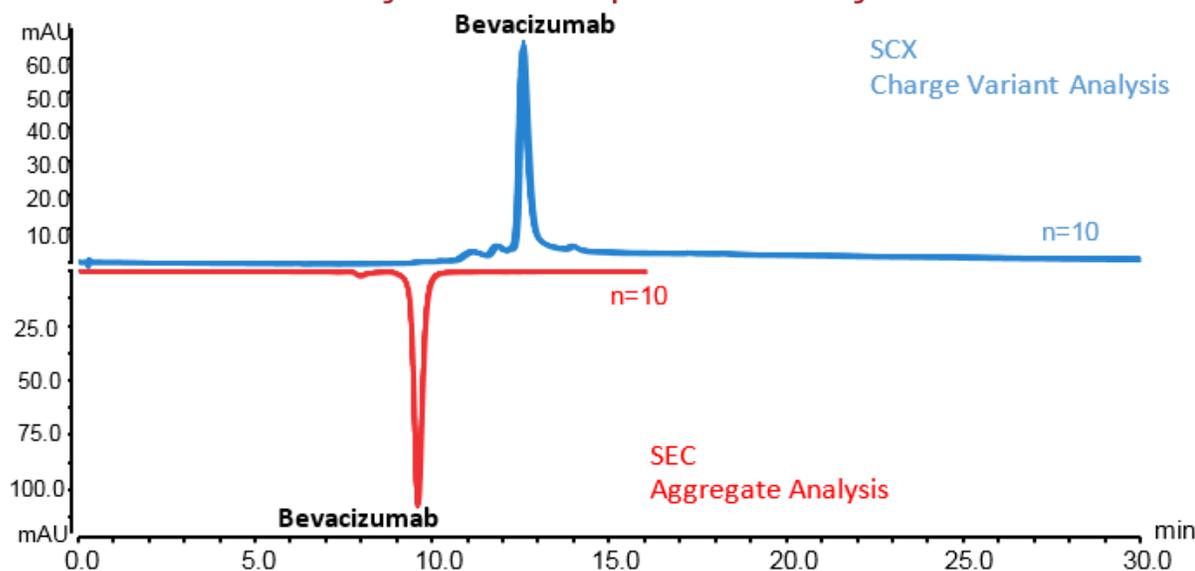
Be finished in half the time

Finished in half the time

Dual LC

Flow Path 1	Analytical Gradient Application 1	Reconditioning	Analytical Gradient Application 1	Reconditioning
Flow Path 2	Analytical Gradient Application 2	Reconditioning	Analytical Gradient Application 2	Reconditioning

Run your complementary



Get more information out of every sample

Efficient characterization

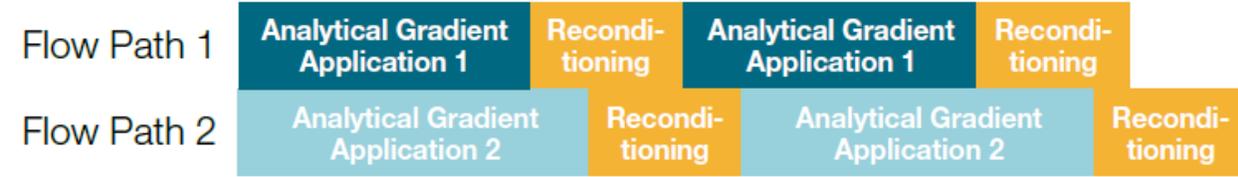
What Can Be Accomplished with Vanquish Duo System for Dual LC?

Dual LC



Run two identical columns

Dual LC



Run your complementary

“The instrument offers a fantastic increase in throughput when running two different separation chemistries, enabling us to generate large amounts of characterization data”

Dr. Jonathan Bones, NIBRT

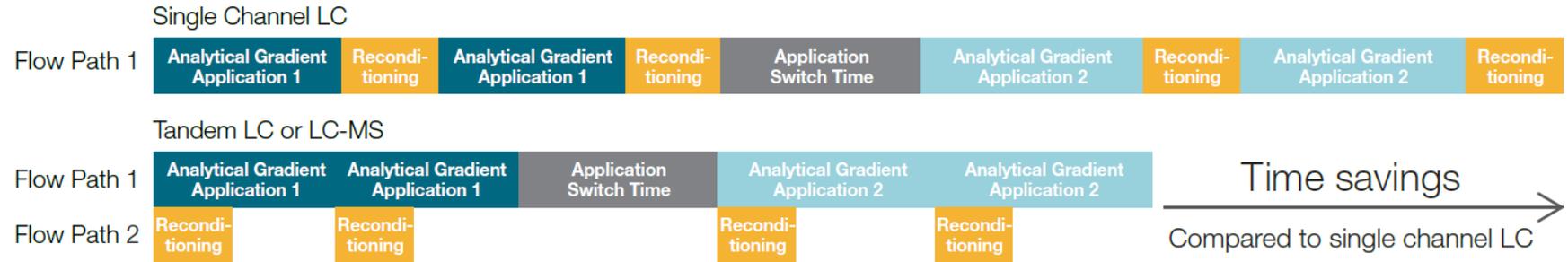
Be finished in half the time

Finished in half the time

Get more information out of every sample

Efficient characterization

Vanquish Duo System for Tandem LC or LC-MS

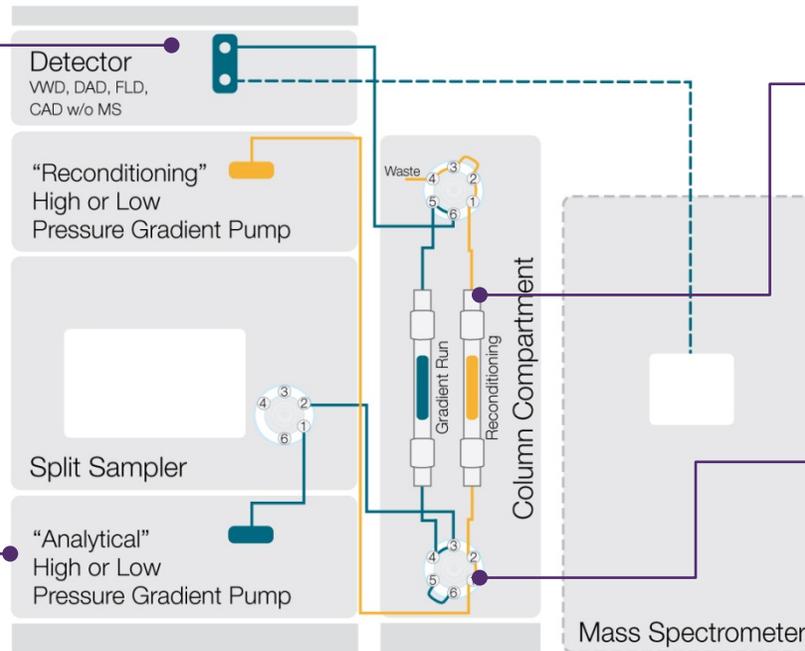


Detectors

Optional UV detector with pressure resistant, low dispersive flow cells

Pump

Flexible pump selection. Here High Pressure Gradient Pump for analytical gradient



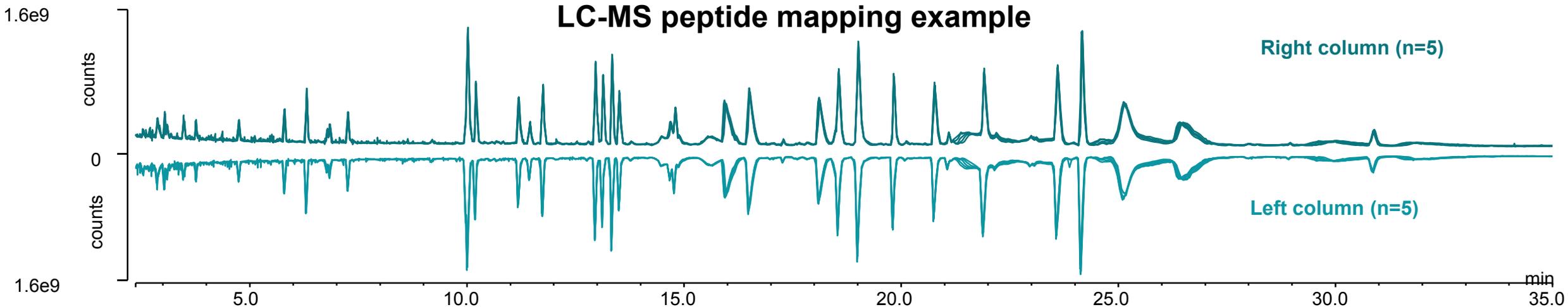
Column compartment
Two columns for parallel separation and column reconditioning

Column switching Valve
Valve to switch between two columns to allow for offline column reconditioning

Key Benefits –Vanquish Duo System for Tandem LC or LC-MS

Increased throughput

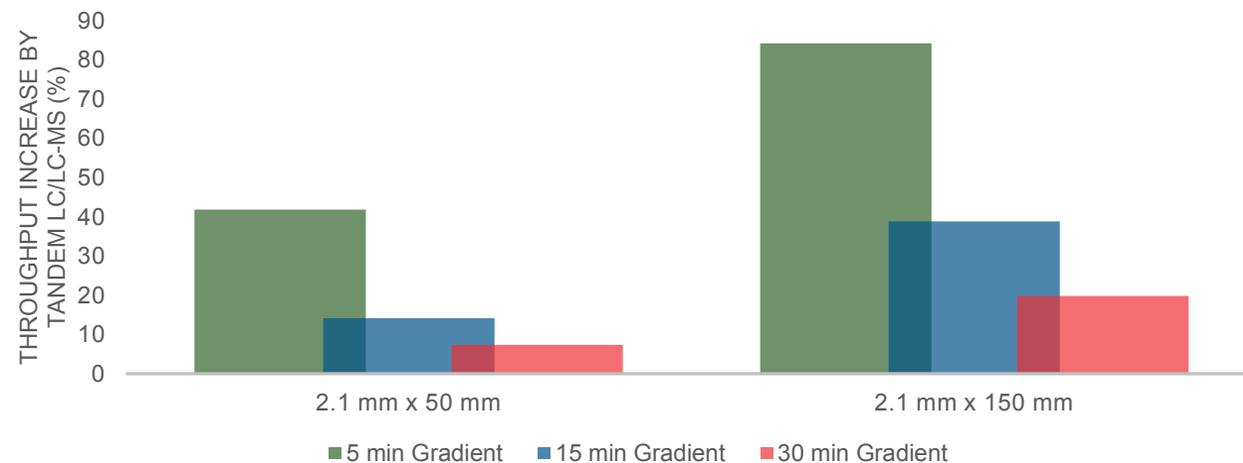
LC-MS peptide mapping example



Vanquish Duo for Tandem

Abs. RT Shift Column left to right [min]	Rel. RT Shift Column left to right [%]	RT RSD [%] n=10	Area RSD [%] n=10
0.023	0.18	0.11	2.47

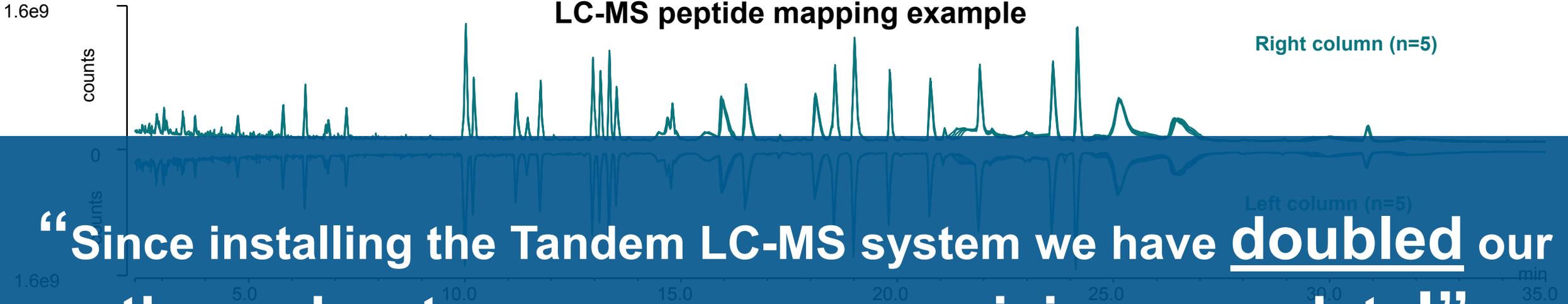
Throughput increase by Tandem LC or LC-MS



Key Benefits –Vanquish Duo System for Tandem LC or LC-MS

Increased throughput

LC-MS peptide mapping example

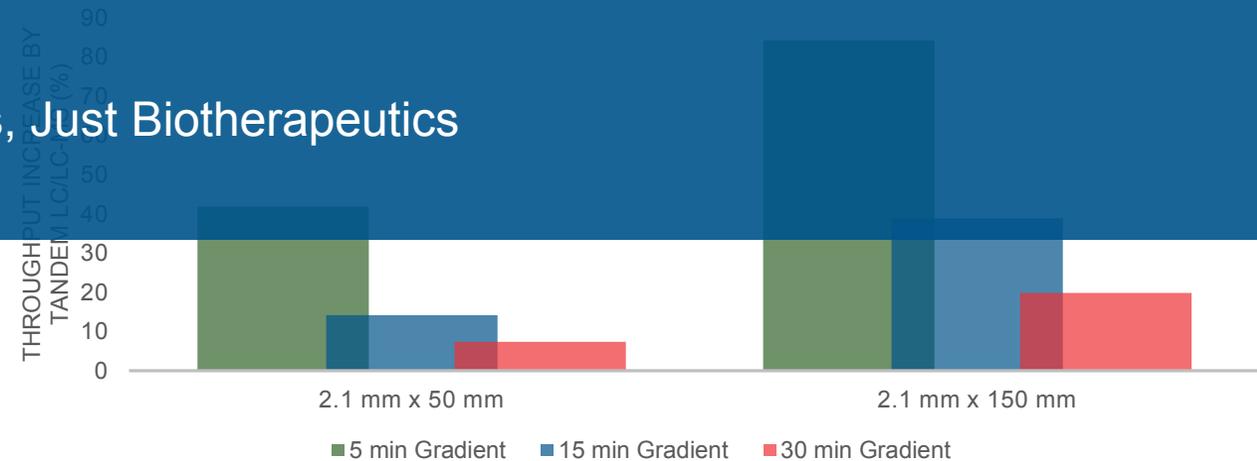


“Since installing the Tandem LC-MS system we have doubled our throughput and increased the precision of our data!”

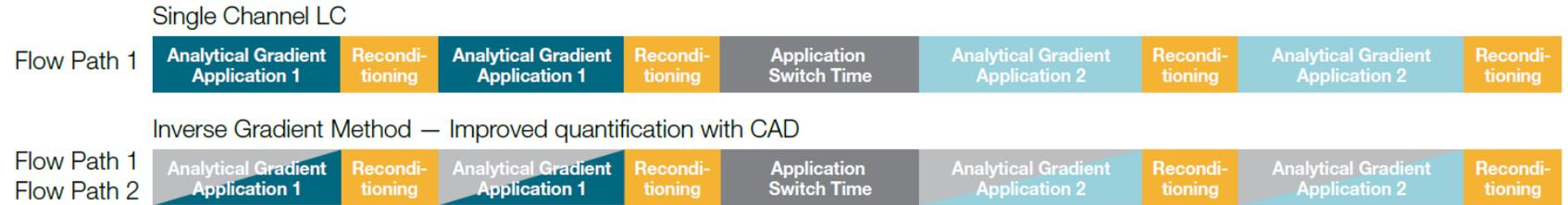
Vanquish Duo for Tandem

Dr. Richard Rogers, Just Biotherapeutics

Abs. RT Shift Column left to right [min]	Rel. RT Shift Column left to right [%]	RT RSD [%] n=10	Area RSD [%] n=10
0.023	0.18	0.11	2.47



Thermo Scientific Vanquish Duo System for Inverse Gradient

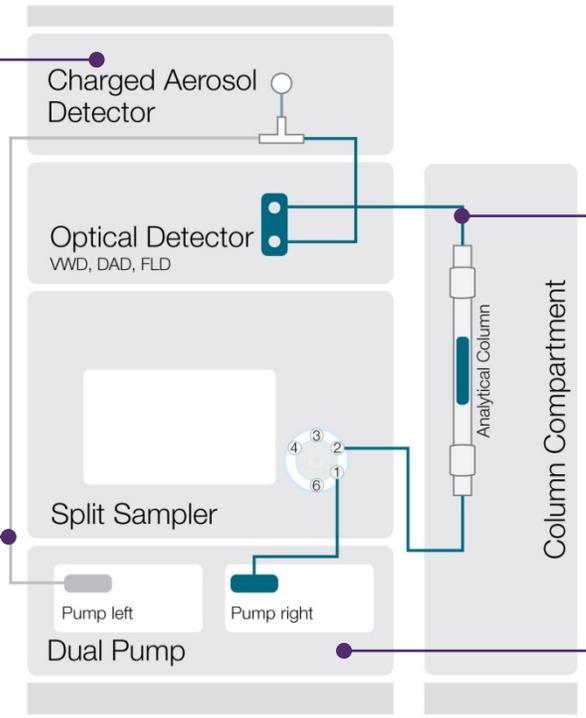


Detector

Universal Charged Aerosol Detector to detect any non-volatile analyte

Compensation flow

Keeps eluent at detector constant



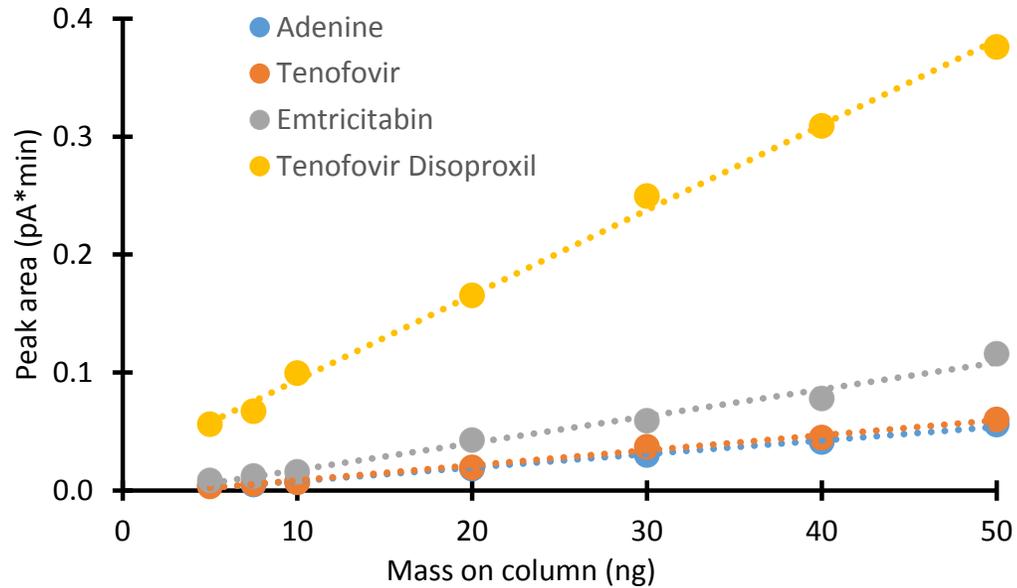
Analytical flow path With separation column

Vanquish dual pump Delivers analytical and compensation gradient

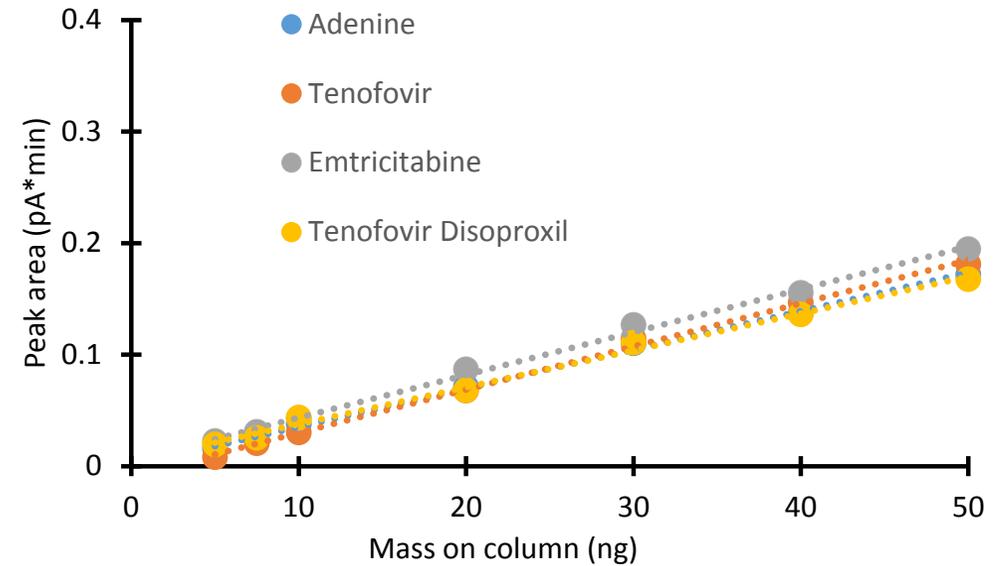
Key Benefits –Vanquish Duo System for Inverse Gradient

Standard free quantification

Without gradient compensation



With inverse gradient compensation

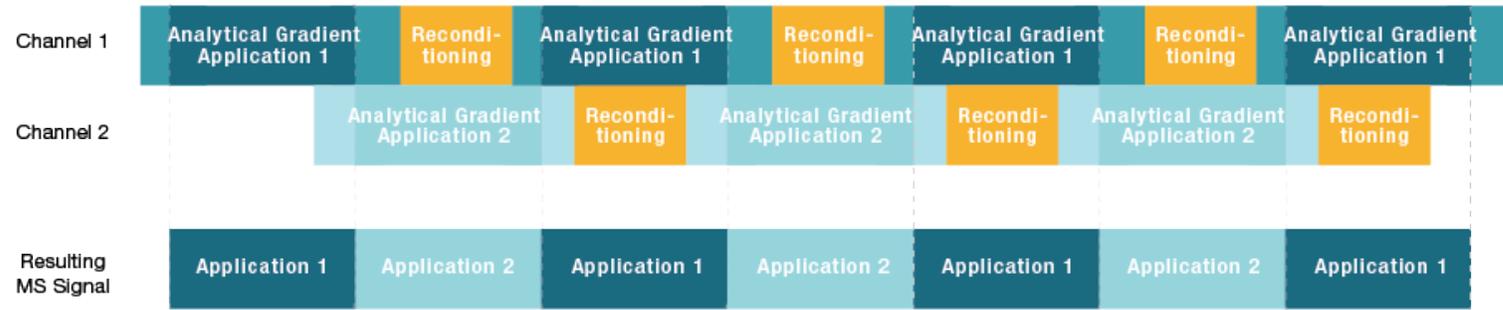


Similar response curves for all analytes after gradient compensation

Vanquish Transcend Duo LX



Multichannel LC-MS Method

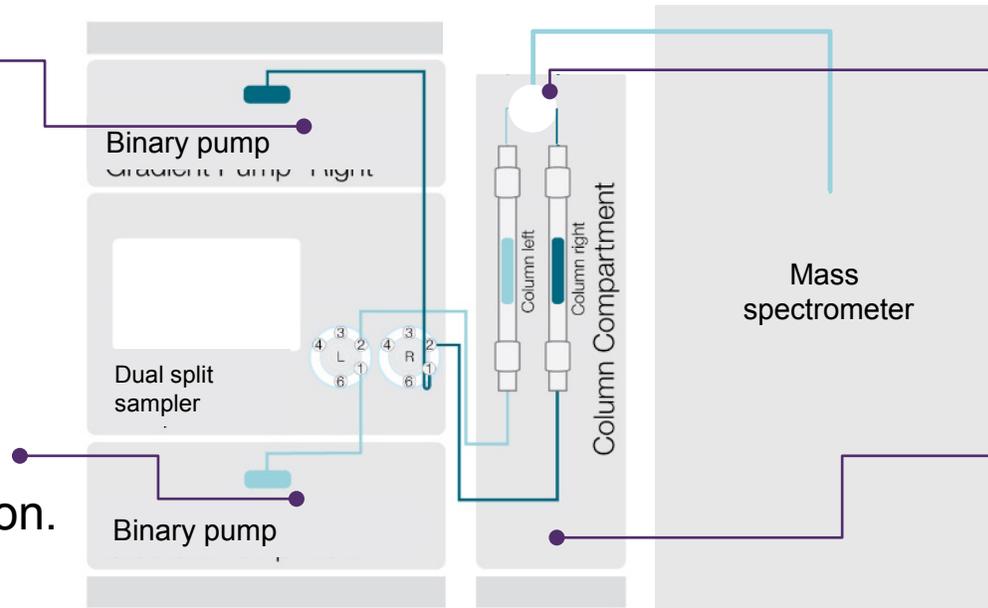


Aria

Smart interlacing of runs

Binary pump

Flexible pump selection. Binary pump H and F possible



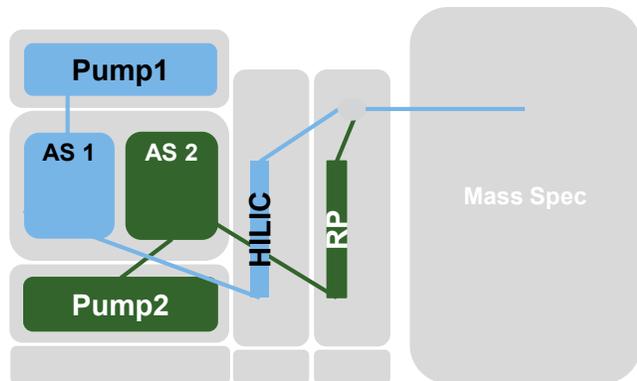
Column switching valve

Decides which flow path goes to MS

Column compartment

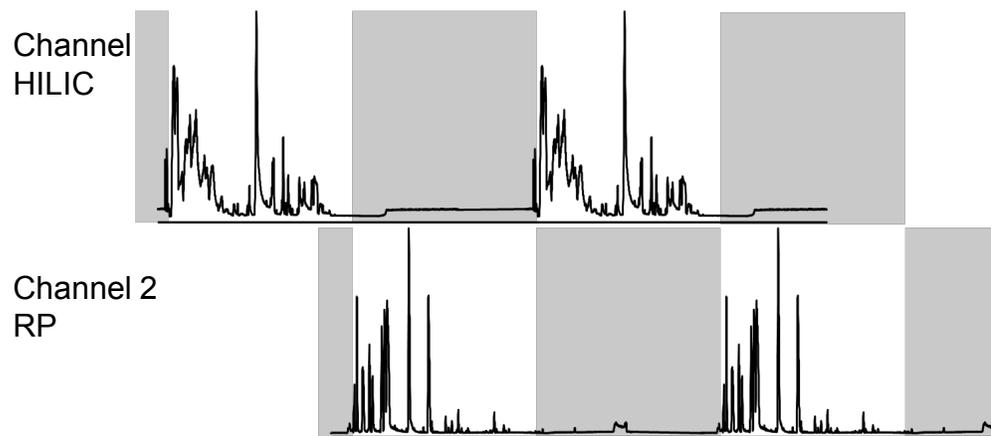
Column thermostating for excellent retention precision

Metabolomics of cell media over time

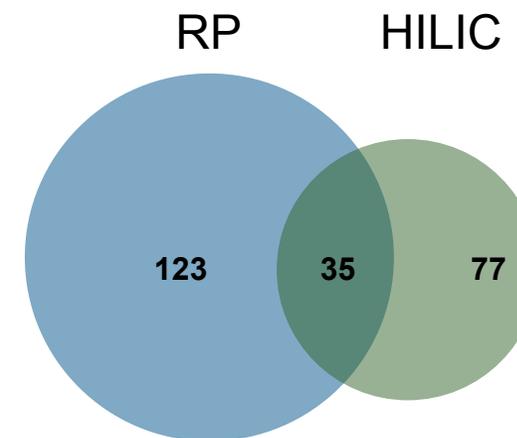


Two separate flow paths for simultaneous RP and HILIC analysis

Interlaced chromatograms of RP and HILIC



- 5,000 compounds putatively annotated
- Increased throughput for 30% time savings
- Wider metabolome coverage by RP and HILIC analysis



Let's move to the real metabolomics expert

Prof. Dr. Gunda Köllensberger
University of Vienna
Department of Chemistry
Austria

Please access the following publication to view the results presented at the Thermo Fisher Scientific HPLC 2019 vendor seminar:

Merging metabolomics and lipidomics into one analytical run

<https://pubs.rsc.org/en/content/articlelanding/2019/an/c8an01219a#!divAbstract>