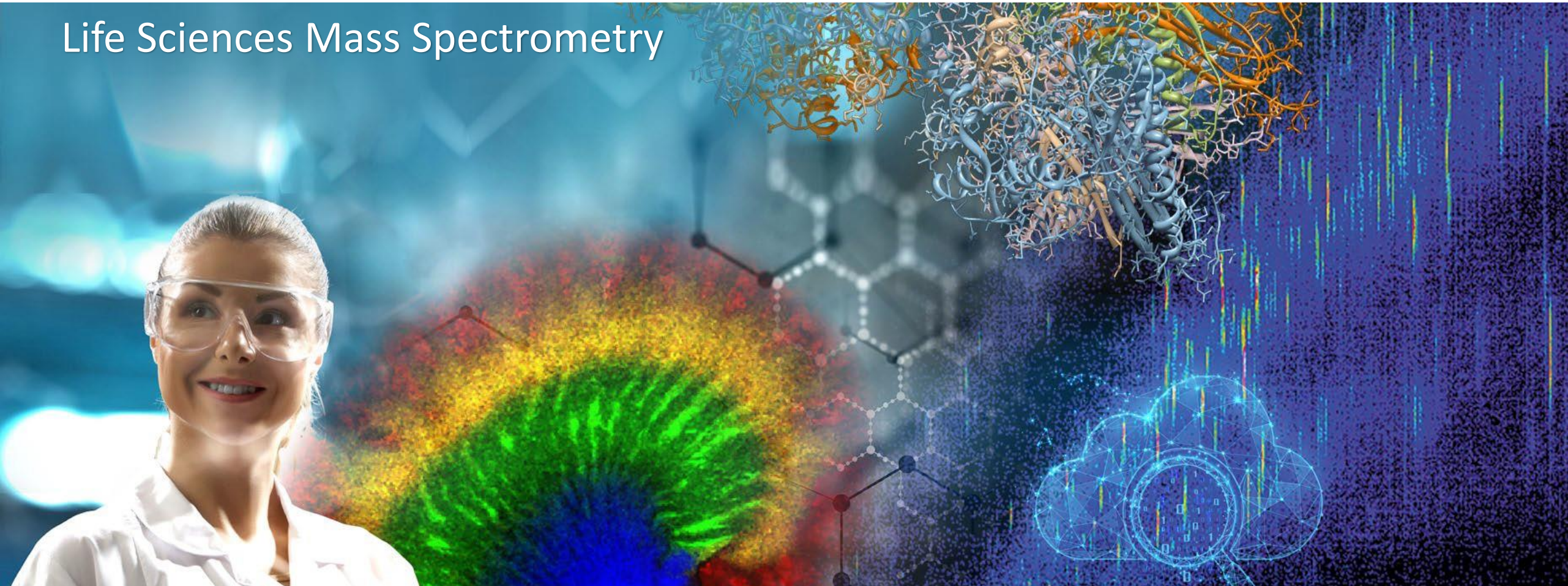
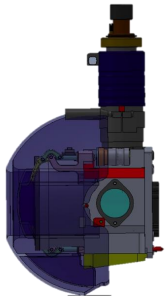


Overview on API Ion Sources

Life Sciences Mass Spectrometry



Choice of ionization techniques



ESI



APCI



DIP Option for
APCI II



APPI



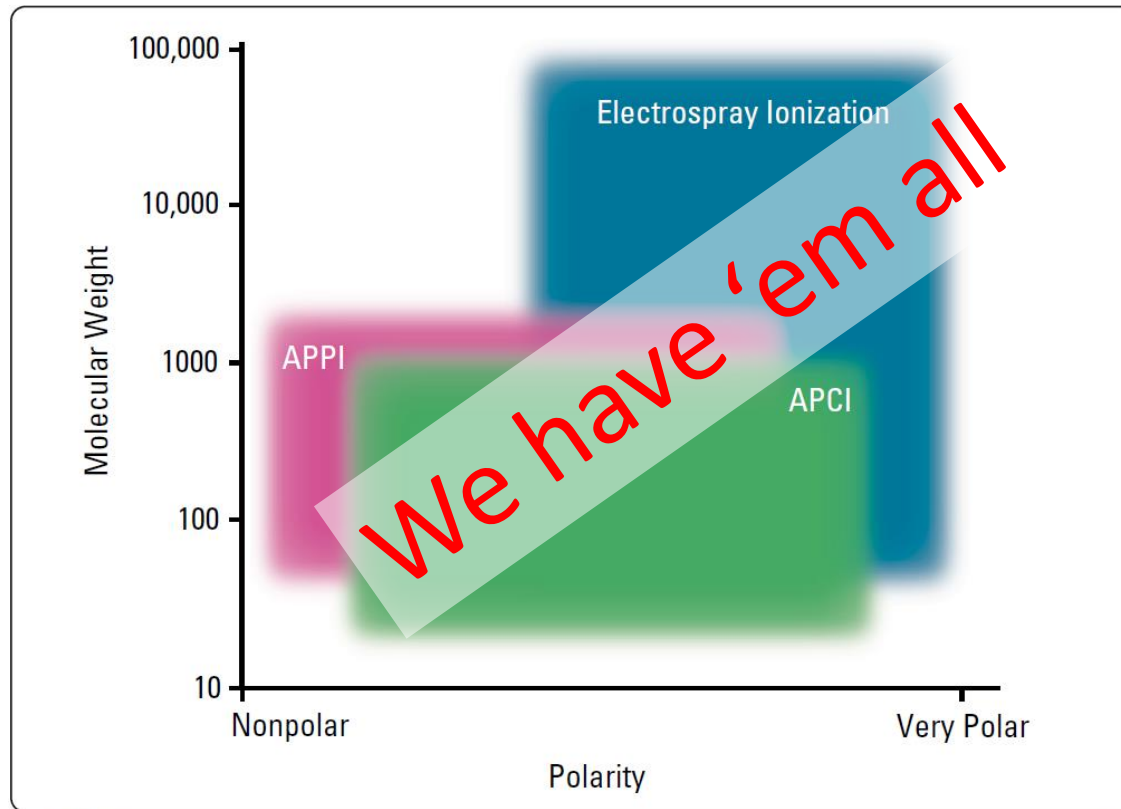
GC-APCI II



CaptiveSpray nanoBooster

TOC

- [ESI Apollo II](#)
- [CaptiveSpray™ Ion Source](#)
 - [CaptiveSpray™ Emitter adjustment](#)
 - [IonOpticks columns](#)
 - [CaptiveSpray™ nanoBooster™](#)
- [GC-APCI II](#)
 - [CaptiveSpray™ nanoBooster™](#)
- [APCI II](#)
 - [Direct Insertion Probe](#)
- [APPI II](#)
 - [CaptiveSpray™ nanoBooster™](#)
 - [Direct Insertion Probe](#)
- [IonBooster™](#)
- [CryoSpray](#)
- [HESI-VIP](#)



Different ionization principles are required for different compounds

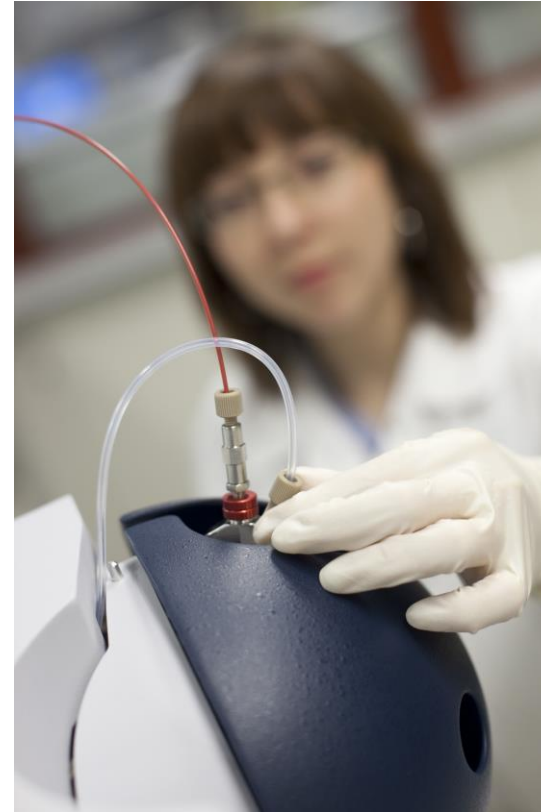
Some guidance is attached to this presentation

ESI Source Apollo II

for timsTOF, maXis, impact II, compact, amaZon, MRMS



- Standard ion source for all electrospray instruments
- All installations are done with ESI source
- All specifications are based on ESI source
- Analytical Flow range 1 – 1000 $\mu\text{L}/\text{min}$

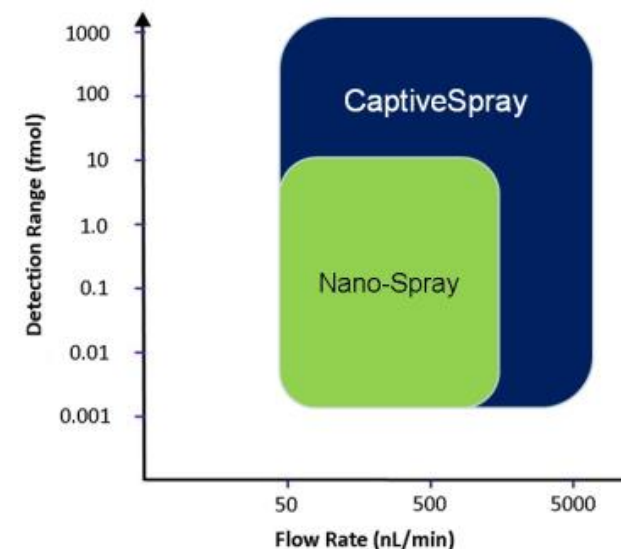
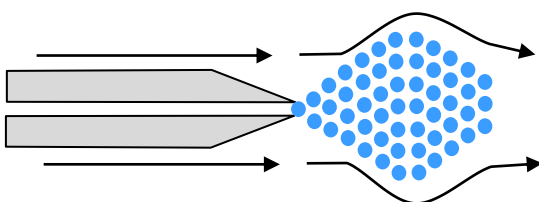
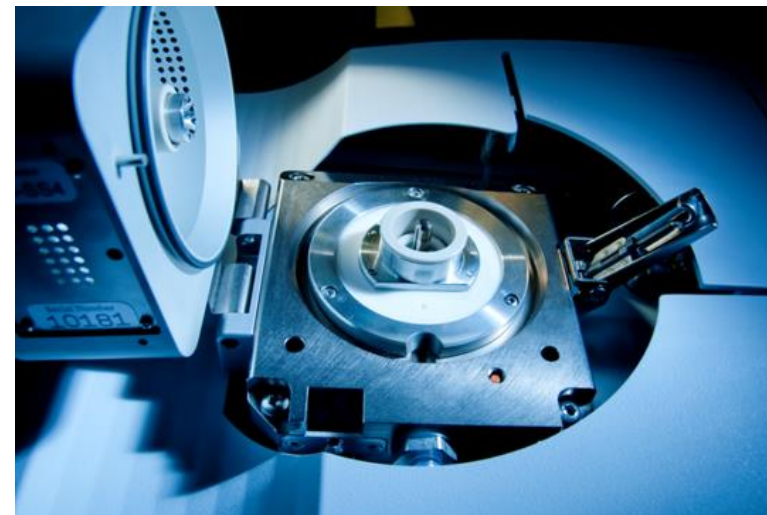


CaptiveSpray™ Ion Source

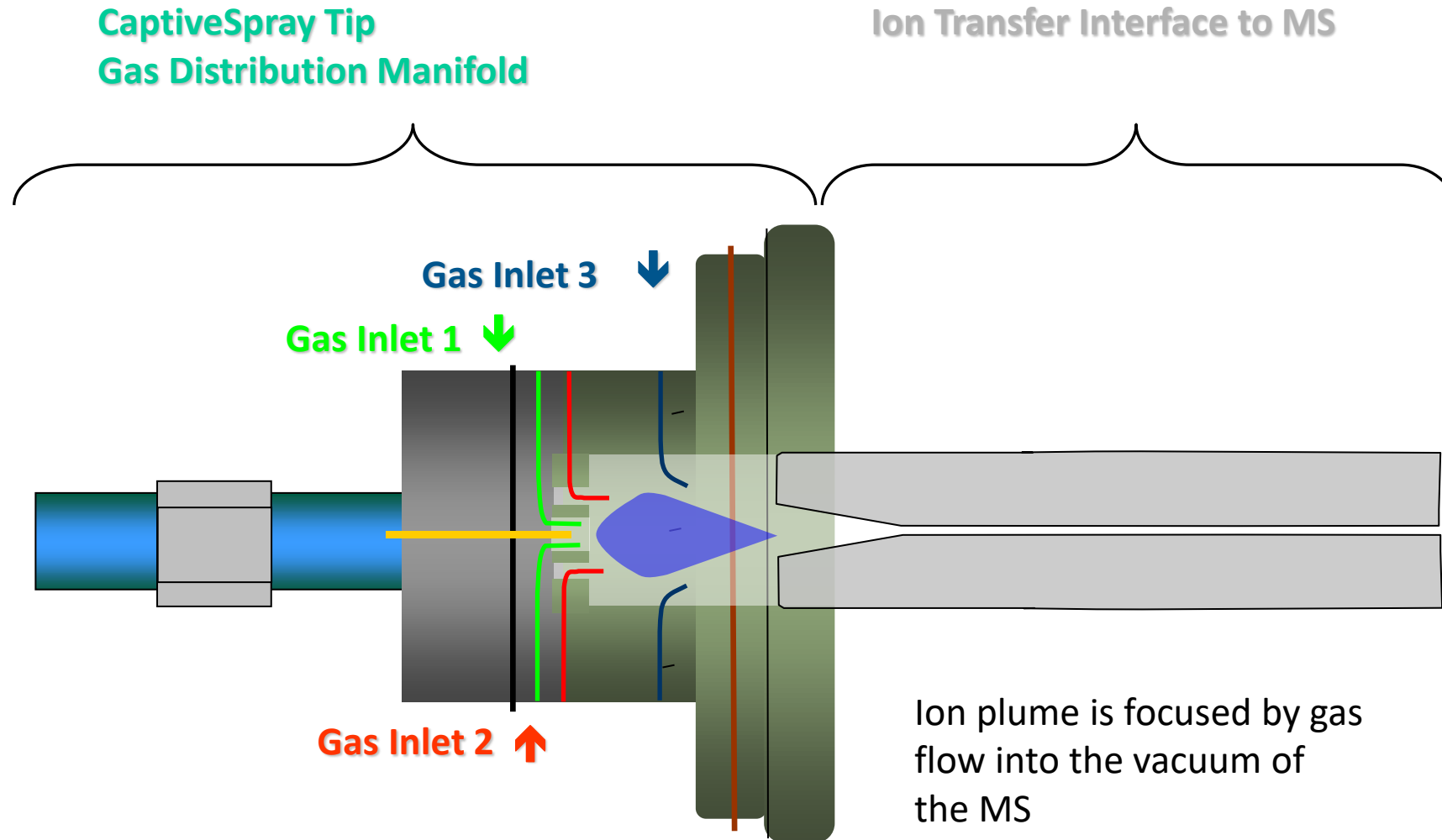
for timsTOF, maXis, impact II, compact, amaZon, MRMS



- PN 1820410
- Nano-spray **sensitivity** at UHPLC flow rates up to 5 mL/min
- Improved **dynamic range**
- Easy to use **plug and play** design for simple operation
- Robust design **minimizes fouling** and clogging of spray tip
- Superb **reproducibility** for protein quantitation



CaptiveSpray Gas Distribution Manifold



CaptiveSpray™ Emitter Adjustment Kit

for CaptiveSpray™ Ion Source

Research

✕ Author's Choice

© 2015 by The American Society for Biochemistry and Molecular Biology, Inc.
This paper is available on line at <http://www.mcponline.org>

The Impact II, a Very High-Resolution Quadrupole Time-of-Flight Instrument (QTOF) for Deep Shotgun Proteomics*

Scarlet Beck‡, Annette Michalski§, Oliver Raether§, Markus Lubeck§, Stephanie Kaspar§, Niels Goedecke§, Carsten Baessmann§, Daniel Hornburg‡, Florian Meier‡, Igor Paron‡, Nils A. Kulak‡, Juergen Cox¶, and Matthias Mann‡||

ASBMB

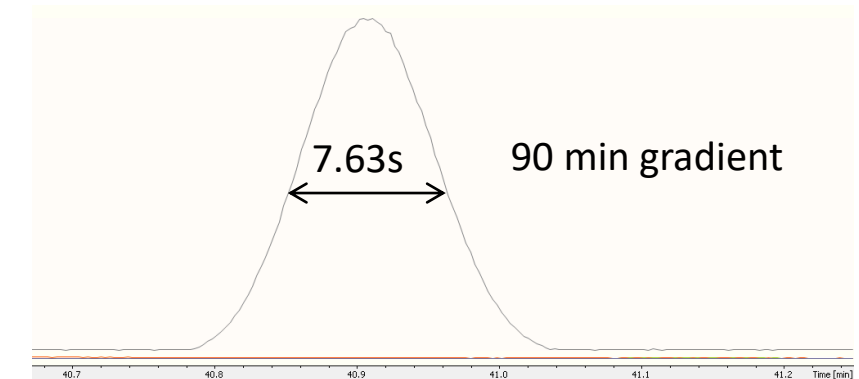
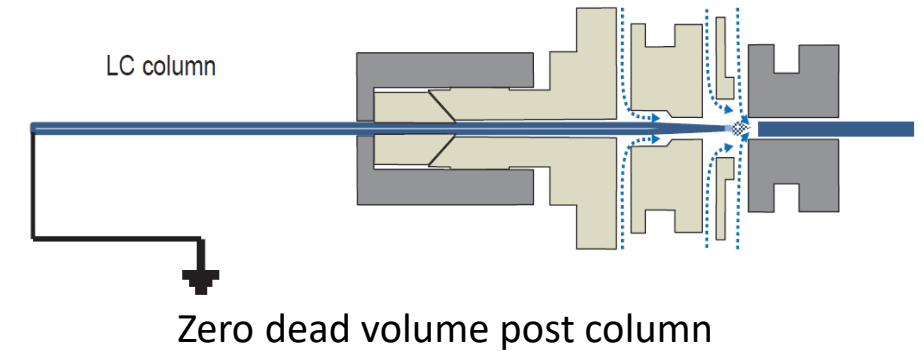
Minimizing Postcolumn Dead Volume—Using the described design, the CaptiveSpray source provides very stable ionization; however, when we initially coupled it to the LC set-up used in the Munich laboratory (17, 24), we observed broader LC peak elution distributions than we normally do (supplemental Fig. S1B). Furthermore, we wished to incorporate a column oven and pulled tip columns. We therefore constructed a modified source, which keeps the back end of the CaptiveSpray but replaces the front end by the standard set-up used in our department. The modified set-up incorporating the tip

- PN 1837982
- Publication in 2015 introduced a “modified CaptiveSpray™ source”
- This used **pulled emitter** columns for high chromatographic resolution
- Columns using this design have been **exclusively sourced** to Bruker from IonOpticks (Australia)



1837982 CaptiveSpray Emitter Adjustment Kit

- Pulled emitter columns for high chromatographic resolution
- Zero dead volume post column
- Optimized emitter tip shape to achieve high ionization efficiency
- Directly compatible with the captivespray source
- Only **25 cm long**, flow rates of 400 nL/min at ~700 bar backpressure
- Optimized for proteomic applications with more than 5000 protein group IDs on HeLa digest with PASEF on a 90 min gradient



25 cm x 75 μ m 1.6 μ m C18 column

	90min	45min
Peak width [s]	17.13	12.30
Peak width (FWHM) [s]	7.63	5.41

Average peak widths on HeLa

CaptiveSpray™ nanoBooster™ Patented*

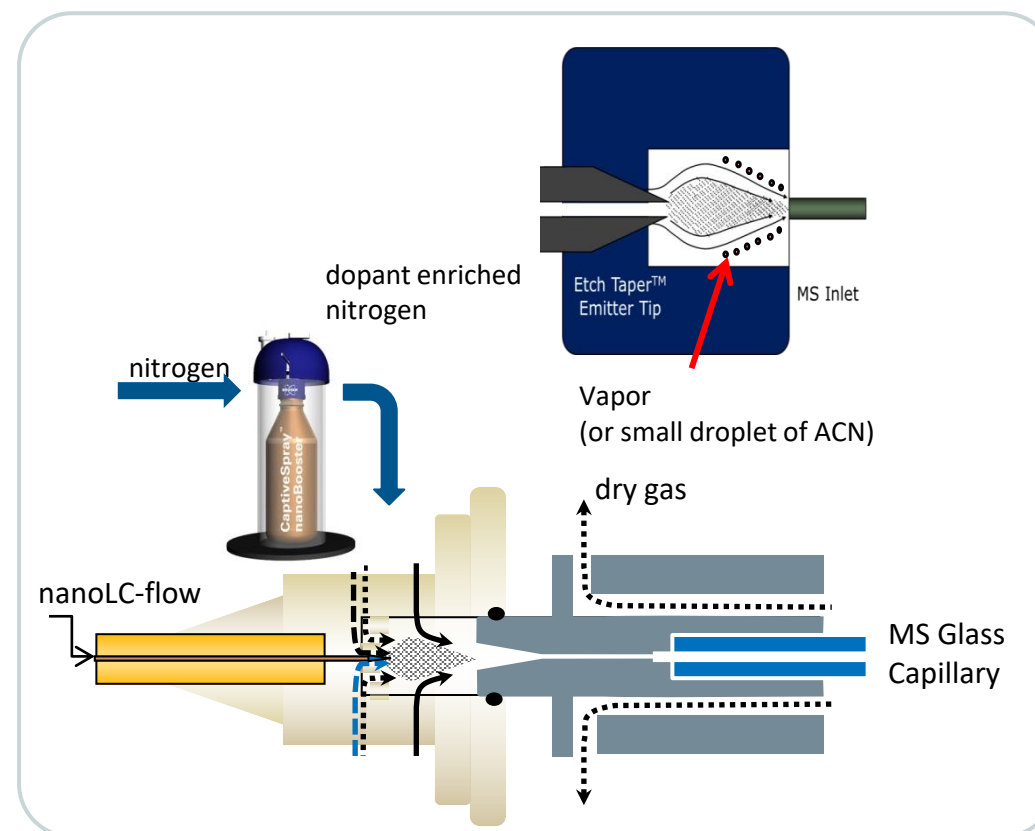
for ultimate Proteomics performance



nanoBooster™

Enhance signal intensity and charge state for Protein ID

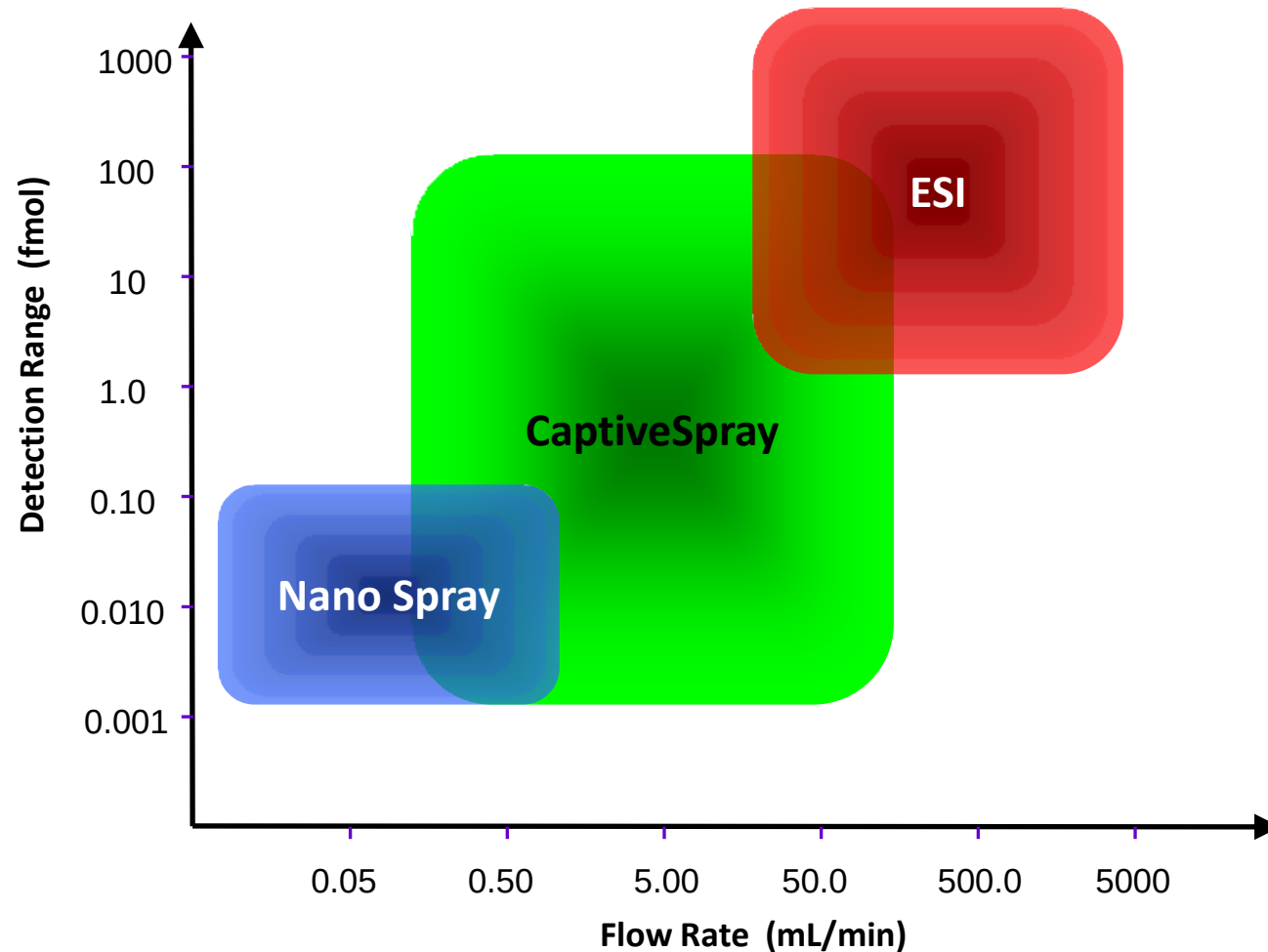
- PN 1820410 incl. ion source
PN 1819454 nanoBooster only
- Boost nanoflow sensitivity
- Push up ID rates
- Enabling Glycoanalysis
- Supercharging capability



Smart dopant enrichment of nitrogen for optimized ionization conditions. * US8,227,750 B1



CSI Bridges the Gap Between ESI and NSI MS



Electrospray

Pro:

- Robust
- Established
- Wide dynamic range
- Wide flow range

Con:

- Limited sensitivity

Nano spray

Pro:

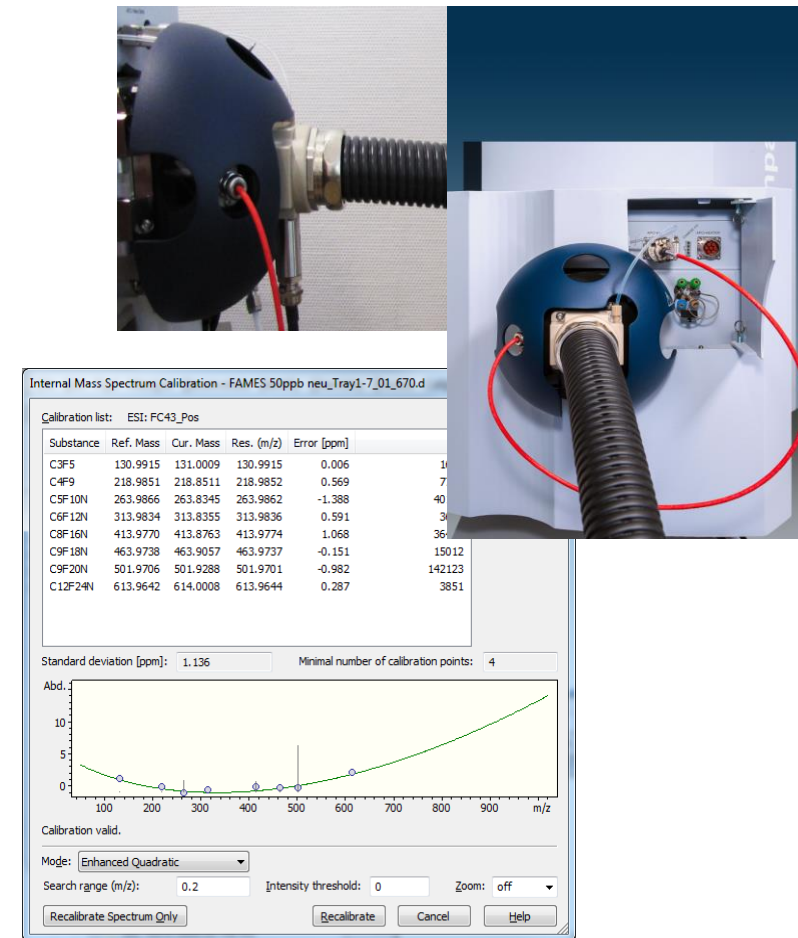
- Sensitive
- Established

Con:

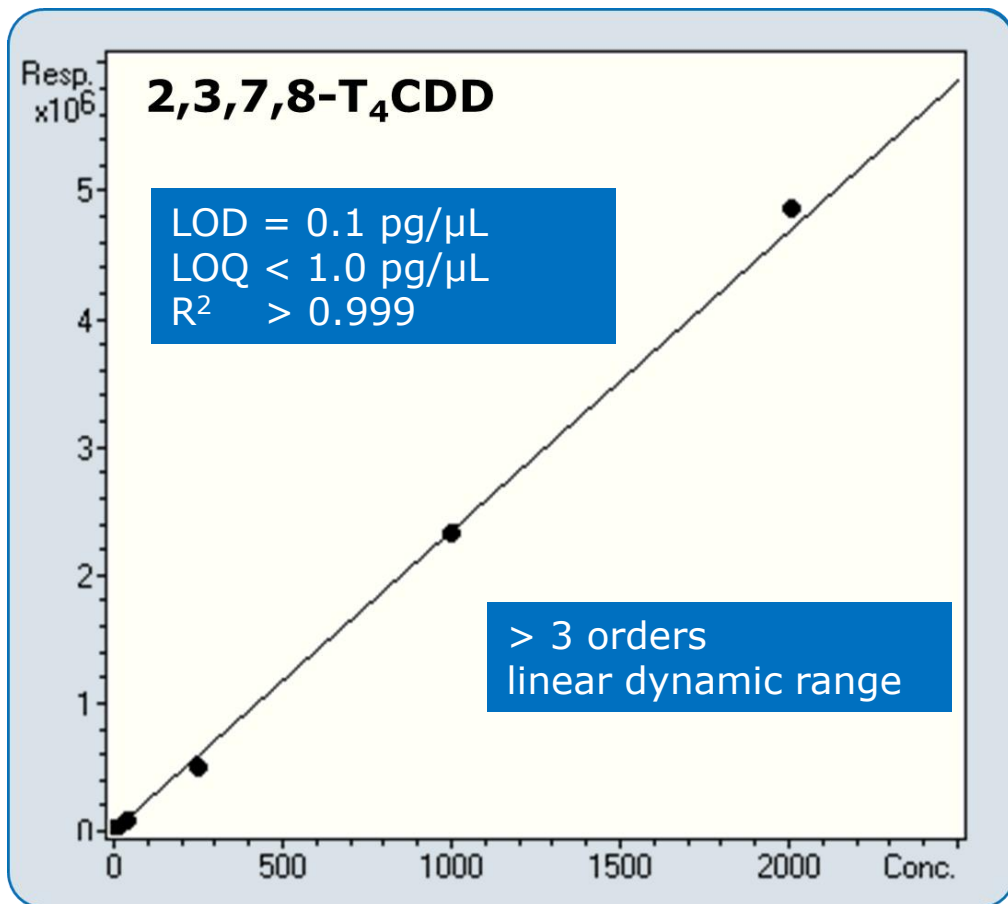
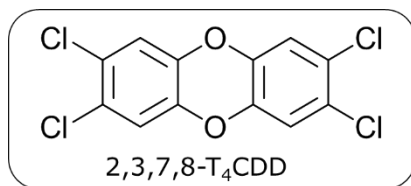
- Limited flow range
- Limited dynamic range
- Not robust

GC-APCI II for ultimate performance for timsTOF, maXis, impact II, compact, amaZon, MRMS

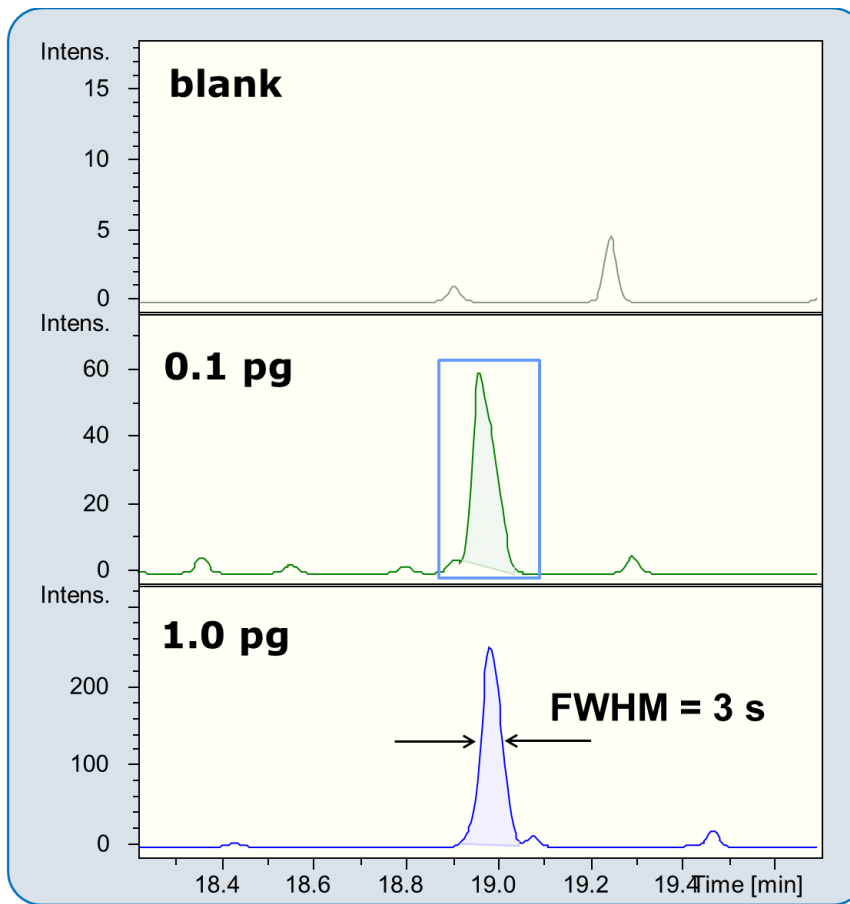
- PN 8700493
- Flexible heated GC-transfer line
 - Higher flexibility in GC-positioning
 - Tool-less coupling
 - Constant temperature from GC to emitter for best GC-resolution
- Automatic MS-calibration
 - Best mass accuracy



GC-APCI II can be a USP for TargetScreener HR



XICs of TCDD @ 321.8931 $\pm$ 0.005 Da



nanoBooster™ Patented*

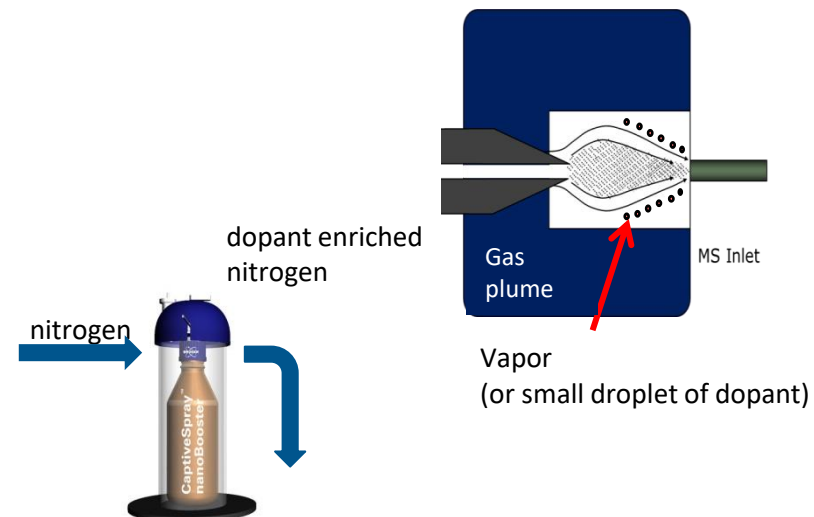
for more polar analytes in GC-APCI



nanoBooster™

Enhance signal intensity by proton addition in GC-APCI

- PN 1819454 nanoBooster only
- Boost GC-APCI sensitivity
- Increasing protonation of polar analytes



Smart dopant enrichment of nitrogen for optimized ionization conditions. * US8,227,750 B1



APCI II Source

for timsTOF, maXis, impact II, compact, amaZon, MRMS



- PN 8262721 APCI II
- Analytical Flow range 2 – 1500 $\mu\text{L}/\text{min}$
- Support of DIP



APPI II Source

for timsTOF, maXis, impact II, compact, amaZon, MRMS

- **PN 8272968 APPI II**
- **Standardized Krypton lamp from PhotoMate™ allows for comparability of MS spectra amongst different vendors almost like Electron Impact ionization on GC-EI**
- **Analytical Flow range 2 – 1500 $\mu\text{L}/\text{min}$**
- **Support of DIP – this is a USP!!!**
- **Kr lamp with 10.0 or 10.6 eV ionization energy, the latter being equivalent to 117 nm**





nanoBooster™ Patented*

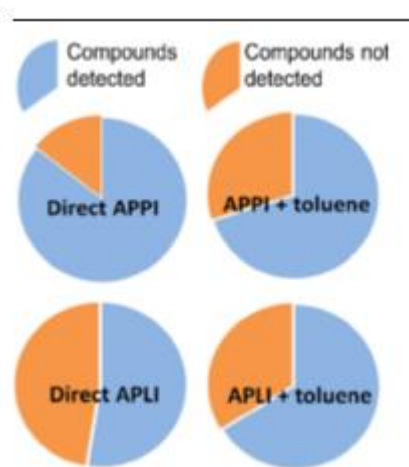
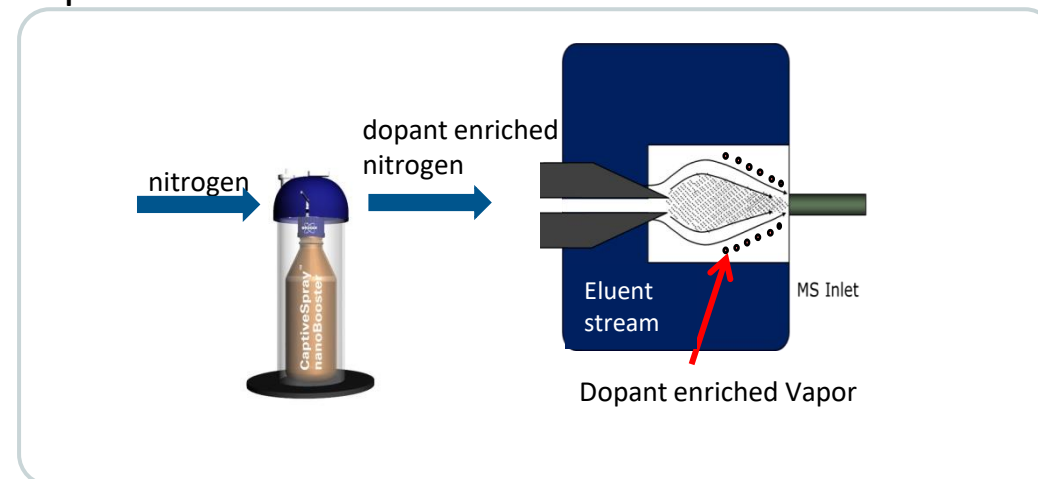
for dopant addition to help APPI ionization

nanoBooster™

helping to achieve ionization by lowering the ionization potential

- PN 1819454 nanoBooster only

Smart dopant enrichment of nitrogen for optimized ionization conditions. * US8,227,750 B1



PhotoMate™ lamp

Krypton 10.0 eV, 10.6 eV

Ionization Potentials (IP)

Anthracene	7.4 eV
Fluoranthene	7.8 eV
Caffeine	8.0 eV
4-Nitrotoluene	9.5 eV
2,4,6-Trinitrotoluene	10.59 eV

Dopant Ionization Potentials

Toluene	8.82 eV
Acetone	9.70 eV

Solvent Ionization Potentials

Methanol	10.85 eV
Acetonitrile	12.19 eV
Water	12.61 eV



Direct Insertion Probe (DIP) for APCI II and APPI II

DIP = Heated Direct Insertion Probe

- Add-on for the Bruker APCI/APPI II source for fast methods



- PN 8602357
- Minimum sample preparation
- Direct analysis of liquid & solid samples
- Short analysis time
- No memory due to single-use glass tubes

- PN 1856935
- Analytical Flow range:
100 – 1500 $\mu\text{L}/\text{min}$
- Temperature range:
250 – 450 °C
- Selective ion source: The „boost“ effect reaches a factor of >100 for some compounds



Bruker Cryospray

for timsTOF, maXis, impact II, compact, amaZon, MRMS

JOURNAL OF MASS SPECTROMETRY
J. Mass Spectrom. 2003; **38**: 473–490
 Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/jms.488

JMS

SPECIAL FEATURE: TUTORIAL

Cold-spray ionization mass spectrometry: principle and applications

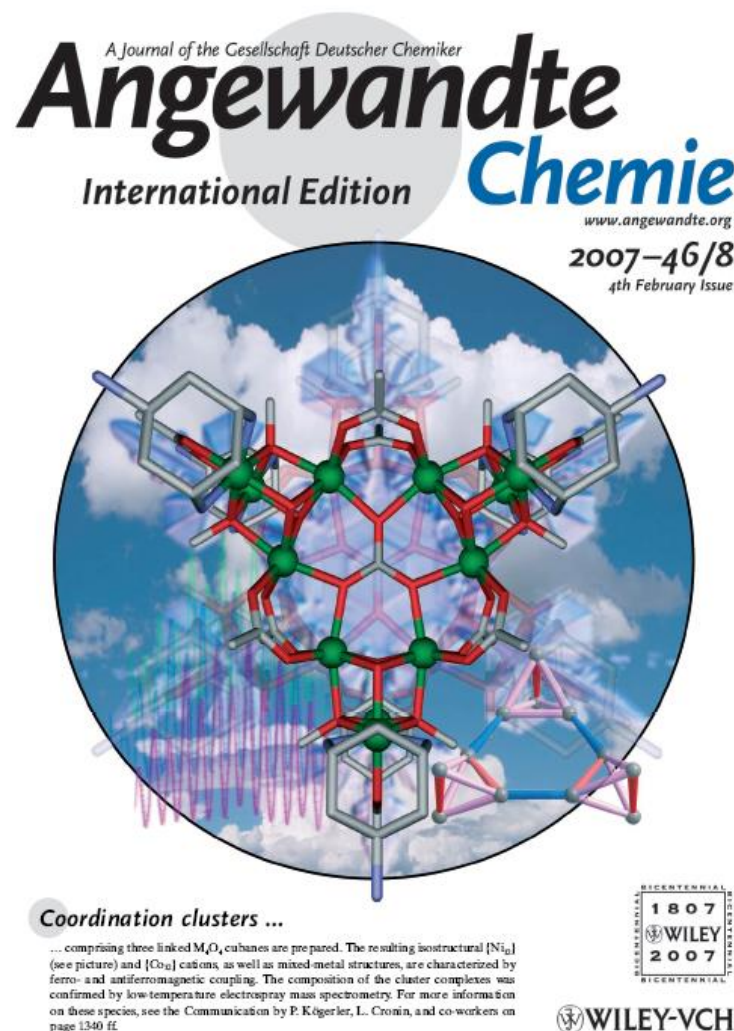
Kentaro Yamaguchi*

- PN 8261587
- Only ESI sprayer is replaced.
- -100 to +100 °C gas temperature (separately) for drying gas and nebulizing gas
- Gas temperature important for relationship between temperature and structure of supermolecules.
- Liquid Nitrogen used for cooling of gas from existing N2 generator by heat exchange
- Lead time of 10 weeks, no demo capabilities



Bruker Cryospray

Which specialties is it good for? Other than being a USP

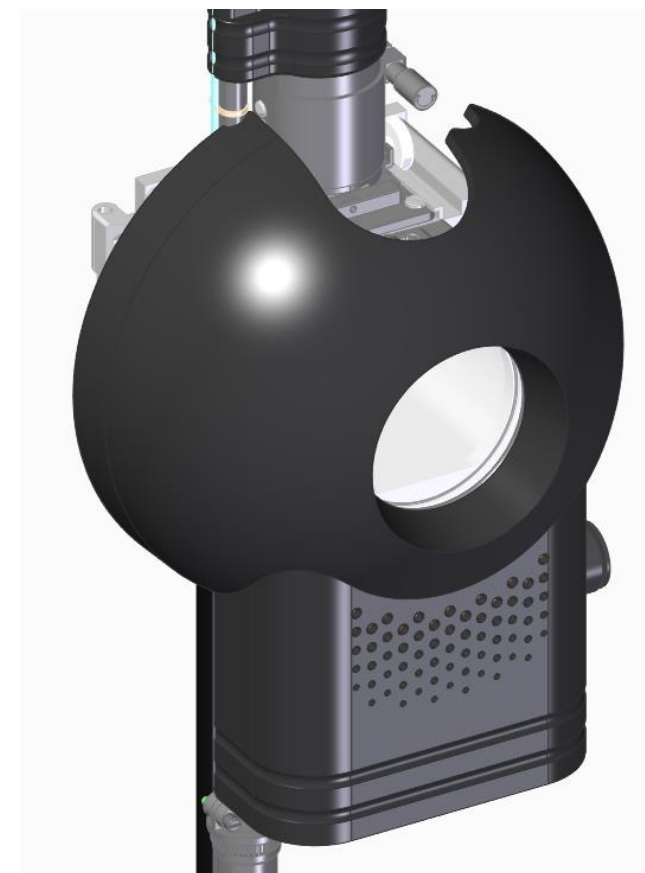
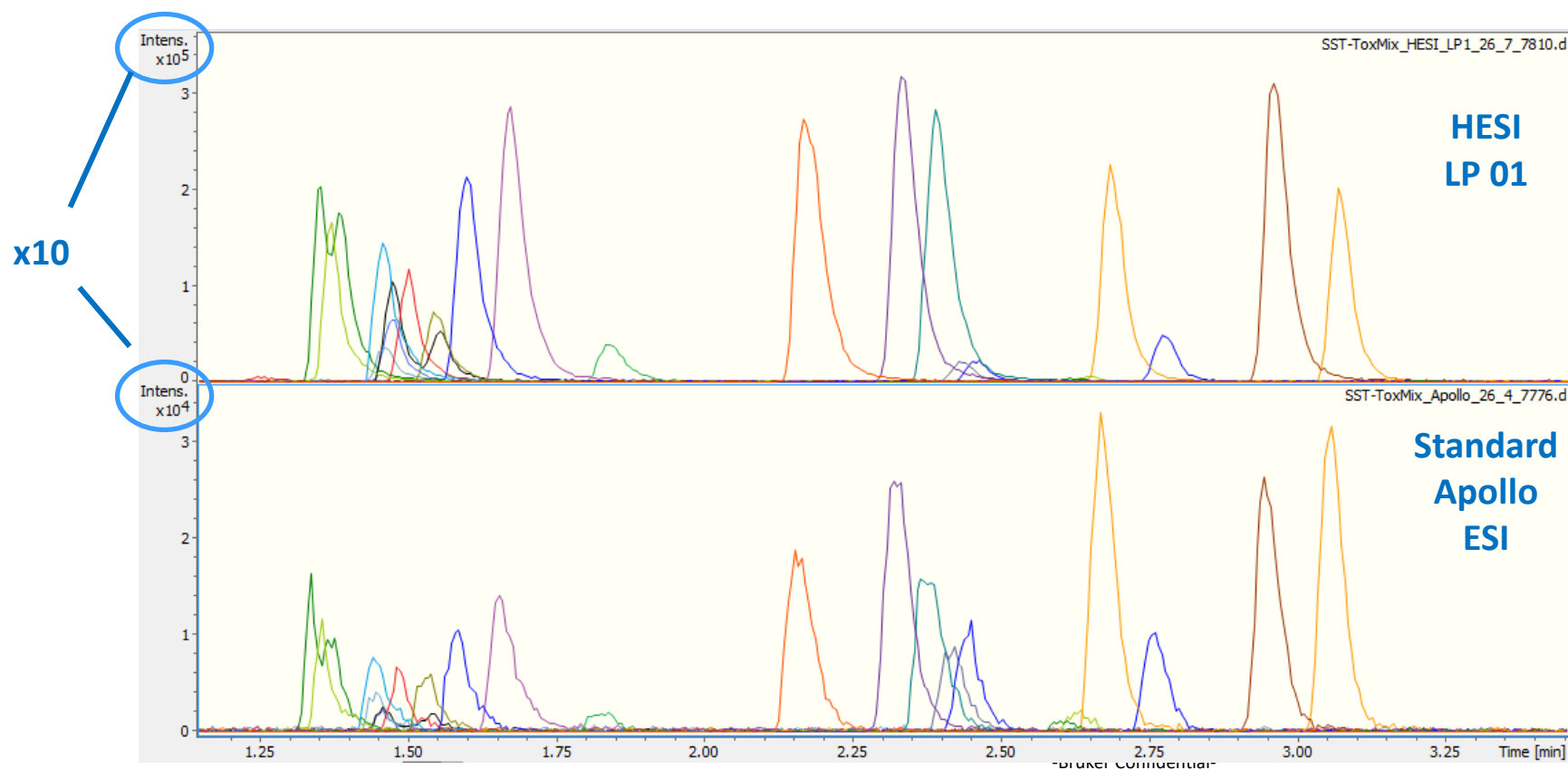


- Applications:
 - novel weak interactions
 - catalysts and non-covalent complexes
 - in academic research.
- A source which is exclusively available from Bruker → a nice USP
- Fits to all Apollo source ESI-MS
- No additional S/W needed
- First 2 publications on metal cluster analysis from Lee Cronin, University Glasgow with micrOTOF-Q

VIP-HESI as option for ESI-TOF



- PN for timsTOF #1884274
- PN for impact II incl. upgrade #1885692



standard delivery EVOQ LC-TQ series – add on for ESI-TOF

Active Exhaust

The Problem

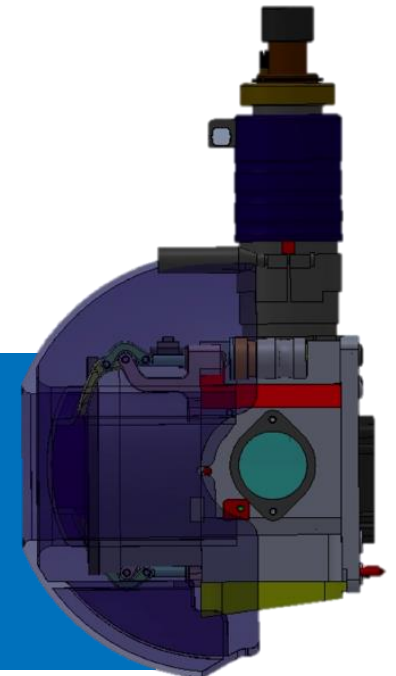
- Higher chemical noise, low sensitivity, and frequent cleaning of the ion source housing or clean and replace expensive capillaries.

Technical Feature: Active Exhaust

- Eliminates recirculation of nebulized gases due to pressure differential between the chamber and the exhaust.
- Large exhaust opening captures and helps entrain nebulized gases, which significantly improves robustness.

User benefit provided by Bruker

- Higher sensitivity due to reduction in chemical noise.
- Higher utilization of instrument time.
- Less time spent cleaning, more time spent running samples.



How Does Active Exhaust Work?

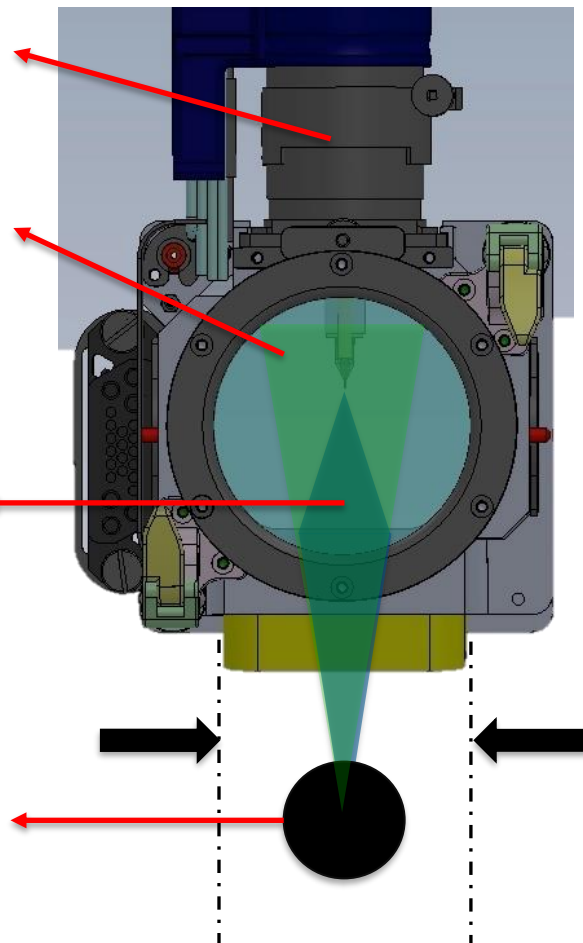


High wattage
(1.5 Kw) ceramic heater
ensures complete
desolvation

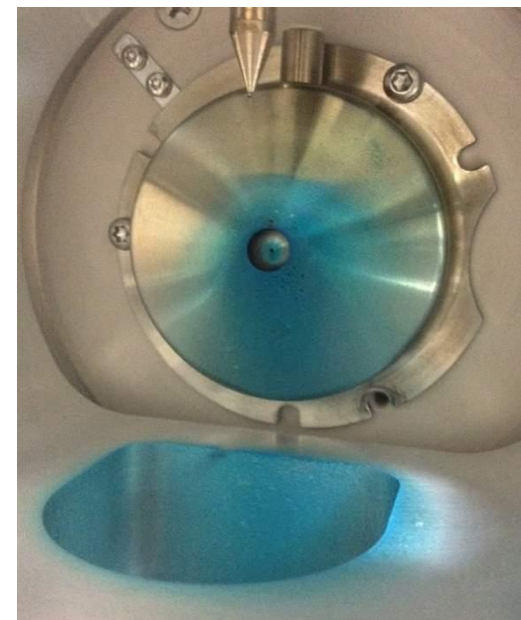
Source housing gases are
streamlined and evacuated

Nebulized gas accelerates
towards the low pressure
region of the Active
Exhaust & exits the system

Low pressure region pulls all
exhaust gases through the
large exhaust opening and
out of the mass spec.



Exhaust opening sets new
industry standard, allowing for
unrestricted evacuation of
nebulized gases.



Blue dye infused to visually
study gas entrainment of the
Active Exhaust technology:
Note NO accumulation
anywhere inside the ion source
chamber after spraying 30mL of
food dye, indicating elimination
of recirculation of nebulized
gases

The Problem

- Low sensitivity due to thermal breakdown of thermally fragile compounds due to LC eluent 'over-heating' before the nebulization process.

Technical Solution: Vacuum Insulated Probe Heated-ESI

- A layer of vacuum between the ESI probe heater and the LC-eluent dramatically reduces heat transfer from the hot ceramic heater to the sample.

User benefit provided by Bruker:

- Less thermal degradation, more sensitivity.

