

# Clearing the Way: ICP WASHOUT & SPRAY CHAMBER TACTICS

**INORGANIC  
VENTURES'  
PARTNER WEBINAR  
SERIES:  
A SPECTRUM  
OF DIALOGUE**



**Ryan Brennan, PhD**  
Glass Expansion  
CEO, USA



**Mike Booth**  
Inorganic Ventures  
Technical Director

**TUESDAY, MARCH 19 | 9:00–9:45AM EST**

# Introduction

**For more than 40 years, Glass Expansion has been designing and manufacturing high quality ICP-OES and ICP-MS sample introduction components.**

**Three Glass Expansion offices providing global support:**

## **Asia Pacific**

6 Central Boulevard  
Port Melbourne Vic 3207  
Australia

Phone: +61 3 9320 1111  
Email: [enquiries@geicp.com](mailto:enquiries@geicp.com)

## **Americas**

31 Jonathan Bourne Dr.  
Unit 7, Pocasset MA 02559  
USA

Phone: 508 563 1800  
Email: [geusa@geicp.com](mailto:geusa@geicp.com)

## **Europe**

Friedenbachstrasse 9  
35781 Weilburg  
Germany

Phone: +49 6471 3778517  
Email: [gegmbh@geicp.com](mailto:gegmbh@geicp.com)

**[www.geicp.com](http://www.geicp.com)**

# Industry Standard Trademark Designs

You will find Glass Expansion products within every instrument manufacturers catalog.



**Tracey™ & Twister™**  
Cyclonic Spray Chambers



**SeaSpray™ & MicroMist™**  
Nebulizers



**Helix™** CT Interface



**Guardian™** Inline Particle  
Filter



**D-Torch™**



**IsoMist™ XS**



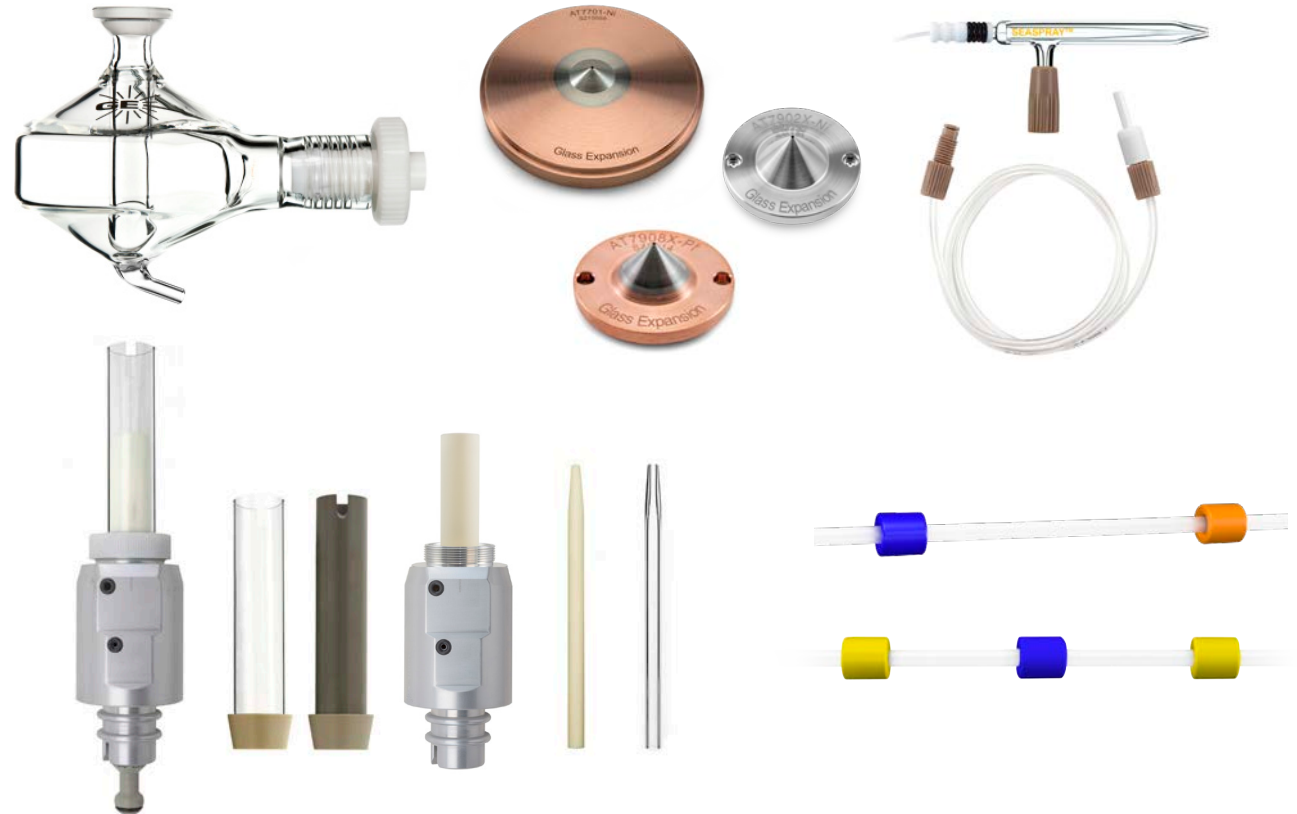
**TruFlo™**

# Manufacturers Supported

- Agilent®
- Analytik Jena
- GBC Scientific
- Hitachi
- Horiba
- Nu Instruments
- PerkinElmer®
- Shimadzu®
- SPECTRO (Ametek)
- Standard BioTools™ (Fluidigm)
- Teledyne CETAC
- Teledyne Leeman
- Thermo™

# Products Offered

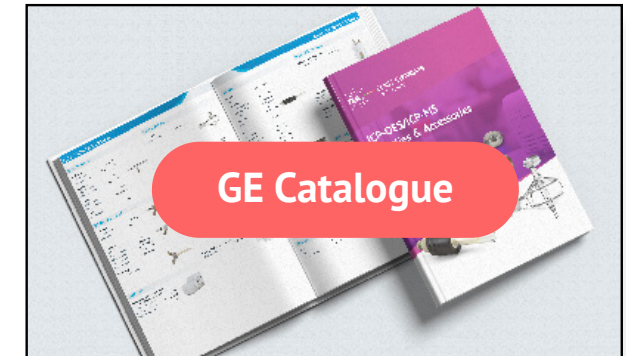
- Autosampler Probes
- Pump Tubing
- Nebulizers
- Spray Chambers
- Torches
- Cones
- RF Coils
- Fittings, Connectors, & Adaptors
- Performance Enhancing Accessories





# Helpful ICP Resources

- Webinars
- Application and Technical Notes
- Product Assembly Guides
- Full Color Catalog Organized by ICP Model



# Glass Expansion Cyclonic Spray Chambers



**Cinnabar™**



**Tracey™**



**Twister™**



**Twinnabar™**



**PTFE (Tracey™ & Twister™)**



**IsoMist™ XR**



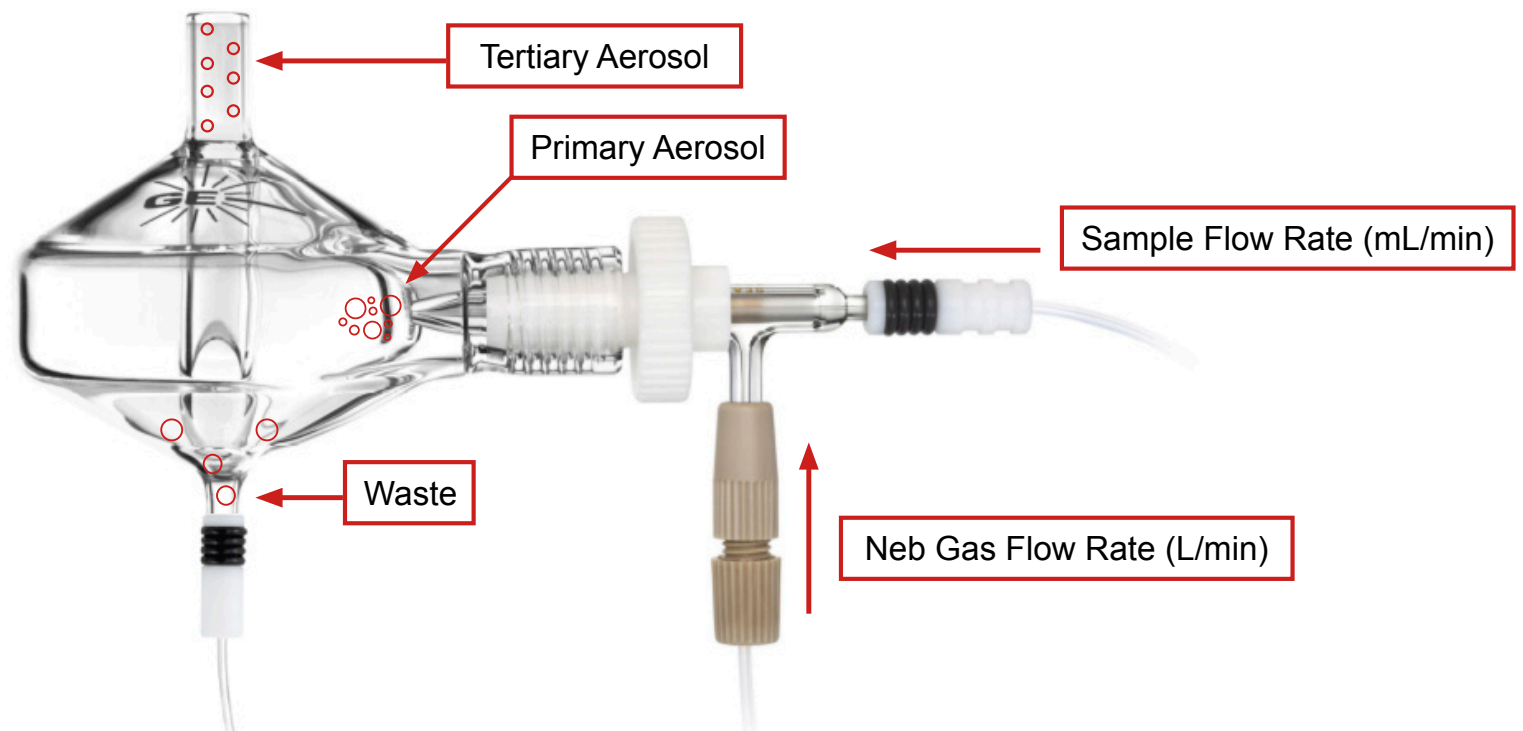
**PCC™**



**PFA Tracey™**

# Basics of Aerosol Generation

- Smaller diameter droplets are good ( $<10\text{ }\mu\text{m}$ ).
- Spray chambers remove  $>10\text{ }\mu\text{m}$  droplets
- Desolvation  $\rightarrow$  Vaporization  $\rightarrow$  Atomization  $\rightarrow$  Ionization  $\rightarrow$  Detector Signal
- Smaller Droplets require  $\downarrow$  Energy = Efficient Ionization
- Cyclonic spray chambers incorporate two means of filtering large droplets:
  1. Gravity (all spray chambers)
  2. Centrifugal Force (only cyclonic)






**Quality of Aerosol  $\propto$  Quality of Results**



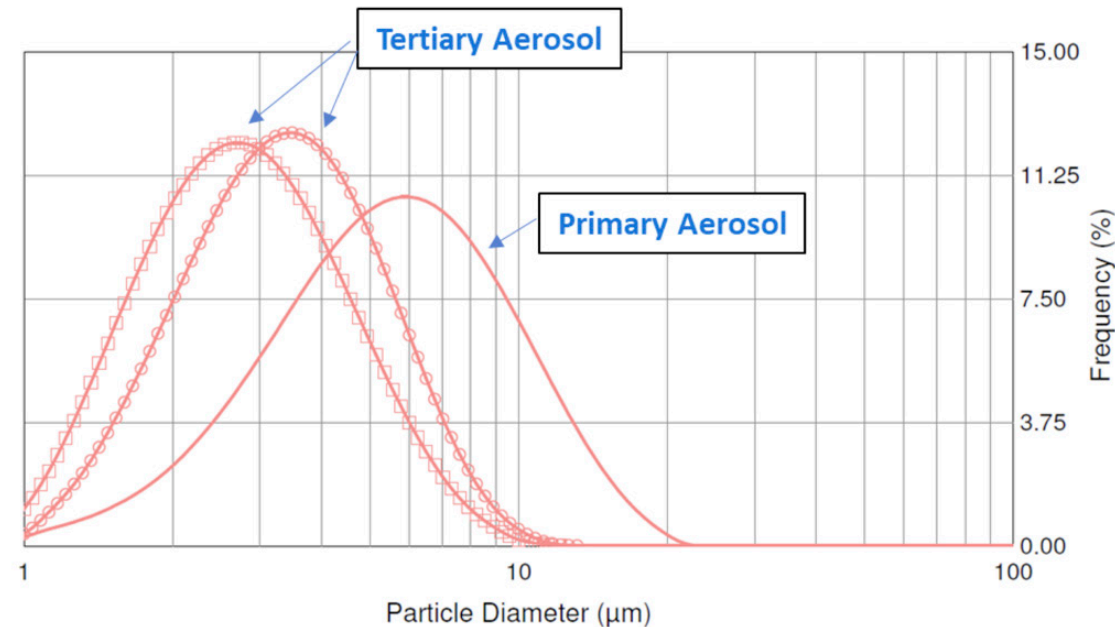
# Basics of Aerosol Generation

- Droplet size
- Primary Aerosol
- Tertiary Aerosol

| Sample Introduction System  |   |
|---|---|
|  | MicroMist™ - Primary Aerosol            |
|  | MicroMist & Tracey™ - Tertiary Aerosol  |
|  | MicroMist & Twister™ - Tertiary Aerosol |

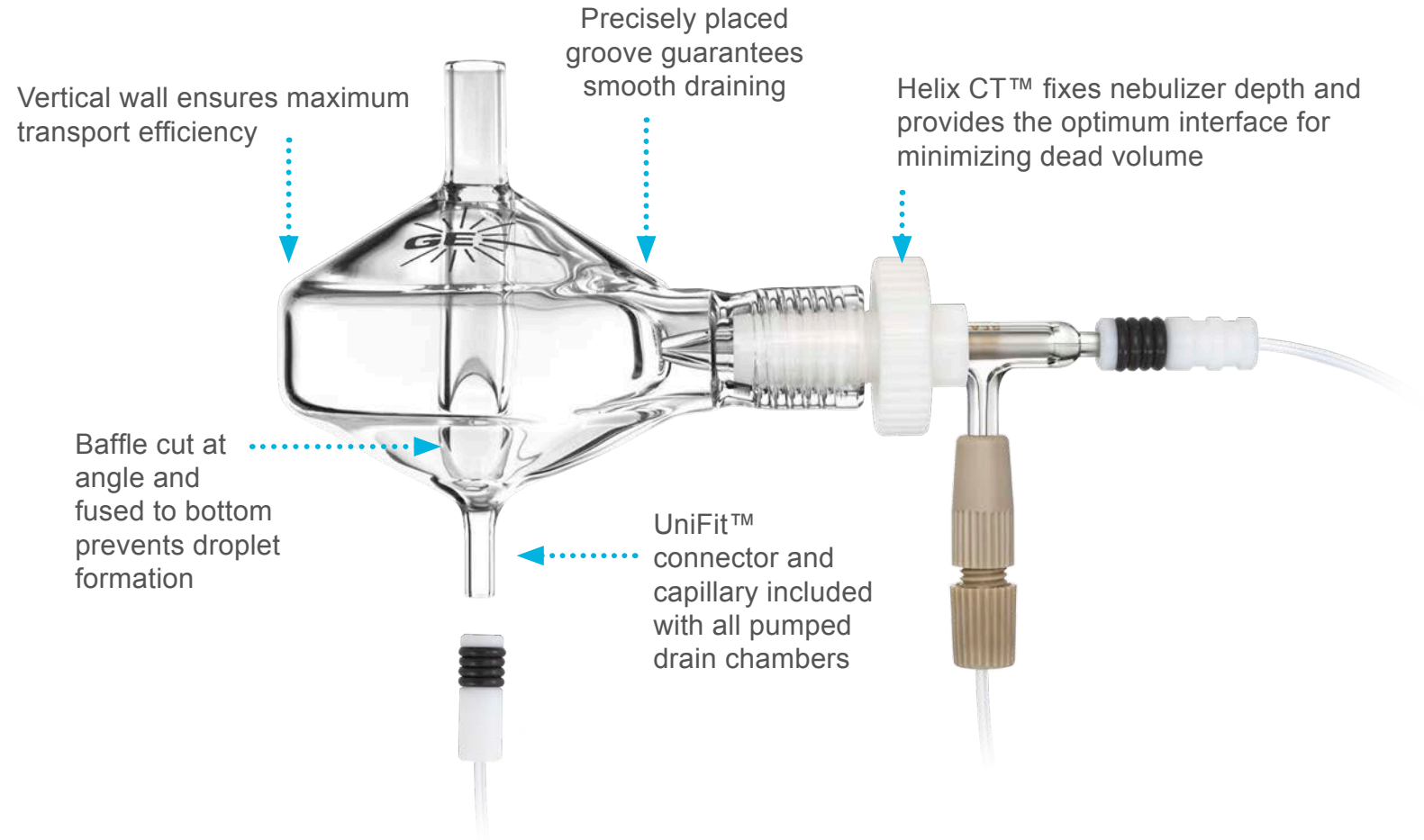


Tracey™



Twister™

# Spray Chambers



# Helix CT™ Interface

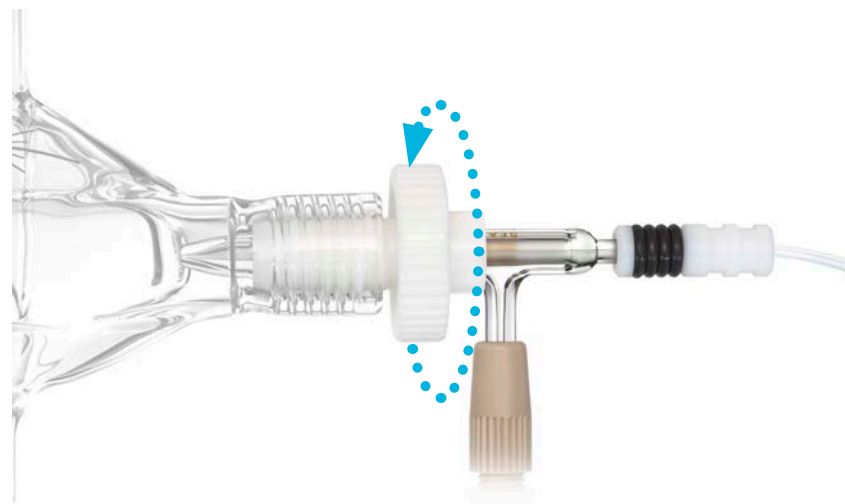
The new Helix™ locking screw with built-in torque control mechanism allows for a consistent seal of the PTFE ferrule against the nebulizer - making it impossible to overtighten or undertighten while ensuring a gas-tight seal each and every time.



Helix CT Locking Screw



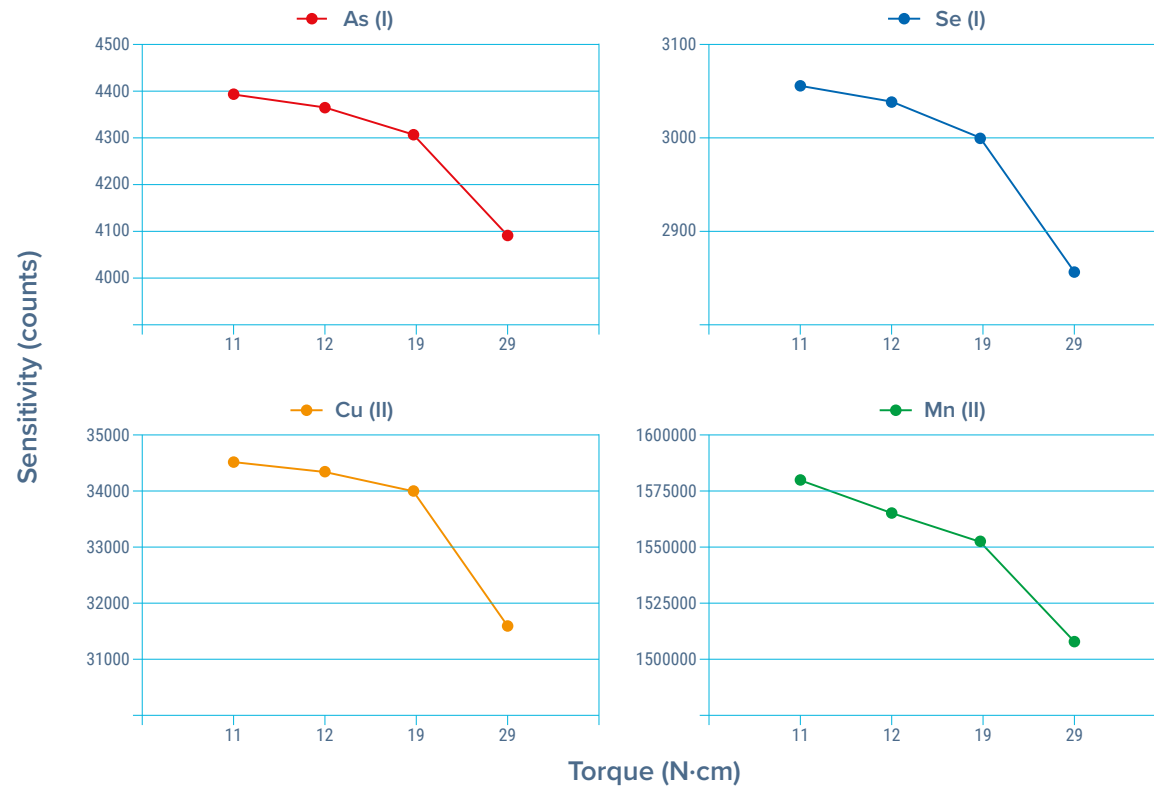
Helix CT Seal



Tighten the nebulizer in place and seal the spray chamber by turning the knurled knob of the Helix CT further clockwise by hand until the ratchet mechanism clicks.

# Helix CT™

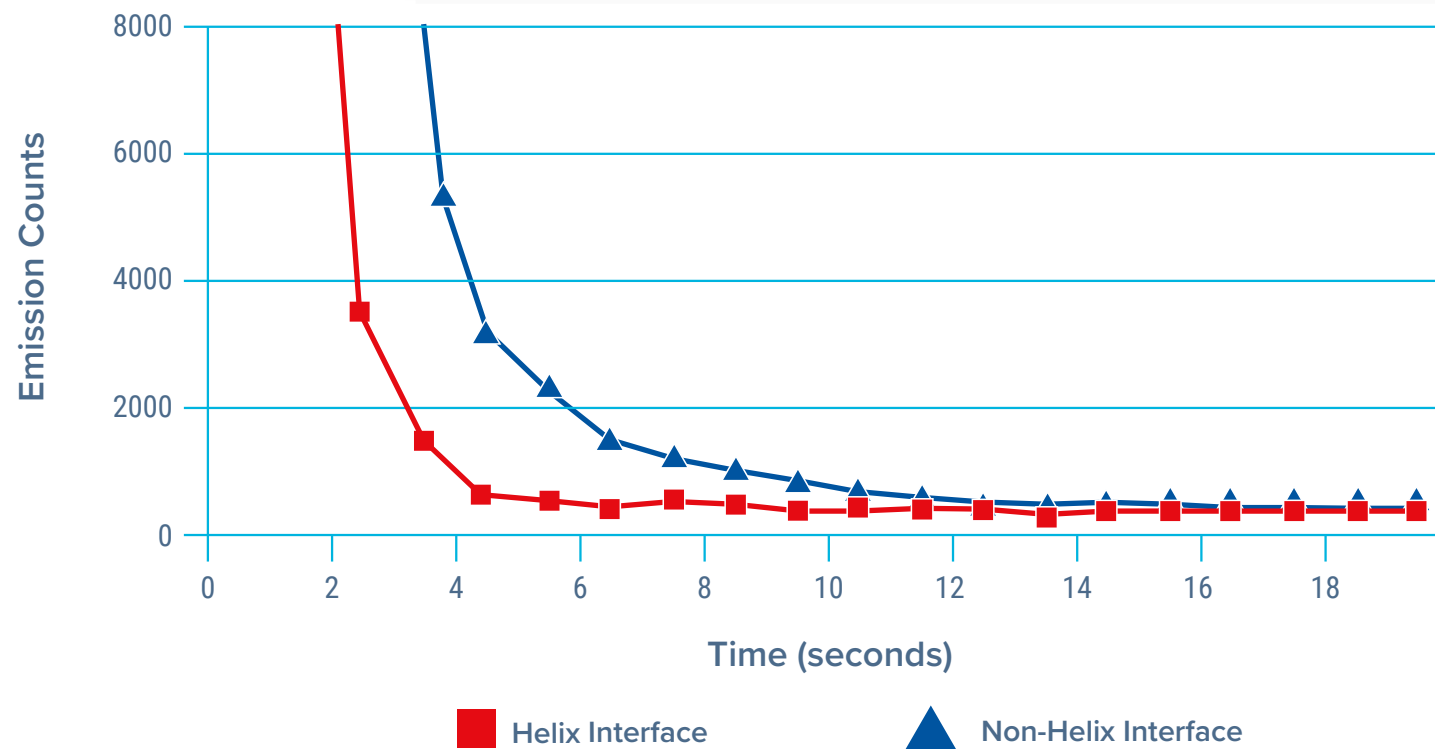
## Constant Torque



- ConstantTorque control
- Provides unparalleled, reproducible day-to-day ICP performance.

# Helix CT™

## Washout Comparison



Non-Helix Interface



# Twister™ vs Tracey™

- Tracey™ provides approximately 15% increase in counts (on average)
- Twister™ provides improved signal to noise ratio (SNR)
- Negligible difference in signal-to-root background ratio (SRBR)
- Baffle of Twister provides narrower droplet distribution and smaller particle size
- Twister more suitable for high matrix samples and improved short-term precision



**Twister™**



**Tracey™**

# Twinnabar™ vs Cinnabar™

- Low volume (20 mL) for application rate of 400 uL/min or less
- Provides fast washout for low flow applications
- Excellent sensitivity and precision
- Cinnabar™ provides approximately 15% increase in counts (on average)
- Twinnabar™ more suitable for higher matrix samples and improved short-term precision



**Twinnabar™**



**Cinnabar™**

# Inert Spray Chambers



## PFA – ICP-MS

- PFA Material
  - » Inert
  - » Ultra high purity
  - » Stediflow surface treatment
- 44mL internal volume

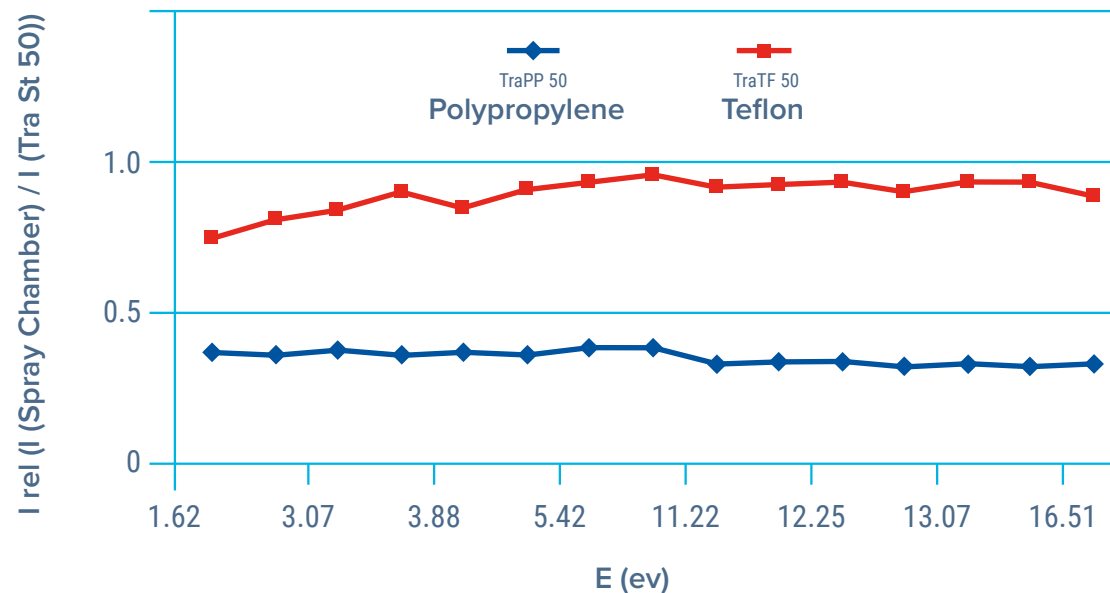


## PTFE – ICP-OES

- PTFE Material
  - » Inert
  - » High purity
  - » Stediflow surface treatment
- » 50mL internal volume
- Tracey™ and Twister™ models available

# Inert Spray Chambers - Stediflow

- Improves wettability of spray chamber surface
- Ensures efficient drainage
- Improves sensitivity and precision
- Treatment can be regenerated



## StediFlow Surface Treatment



PTFE – ICP-OES



PFA – ICP-MS

# Spray Chambers

## Limitations of Room Temperature Spray Chambers

- Sensitivity drift as temperature changes
- Excessive plasma loading (volatile solvents)
- Excessive oxide formation (ICP-MS)
- Insufficient control of analyte transport



# IsoMist™ XR and PCC™



Glass



Quartz



PFA



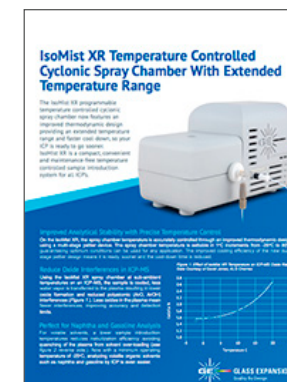
IsoMist™ XR



PCC™

# IsoMist™ XR

- Programmable from -25 to 80°C in 1°C increments.
- Time taken to pass below 0°C from 25°C <15 minutes.
- Enables the analysis of volatile organics.
- Enhances sensitivity for limited volume samples.
- Reduces isobaric oxide interferences.
- Increases the chance of passing QC checks.
- Provides a record for regulatory compliance.
- Eliminates drift ( 2°C change equals 10% shift in sensitivity).



IsoMist XR Flyer

# PCC™ Kit

- Compatible with Agilent® 7850/7900/8900.
- Compatible with Agilent® HMI and UHMI.
- Compatible with Agilent® ISIS-3.
- Interfaces directly to the existing electronics and water-cooling system of the Agilent® ICP-MS.
- A convenient mounting bracket allows for fast and simple installation.
- Minimizes washout time with highly concentrated samples and troublesome elements, such as B, Hg, Pb and Sb compared to the standard Scott-style spray chamber.



# PCC™ Kit

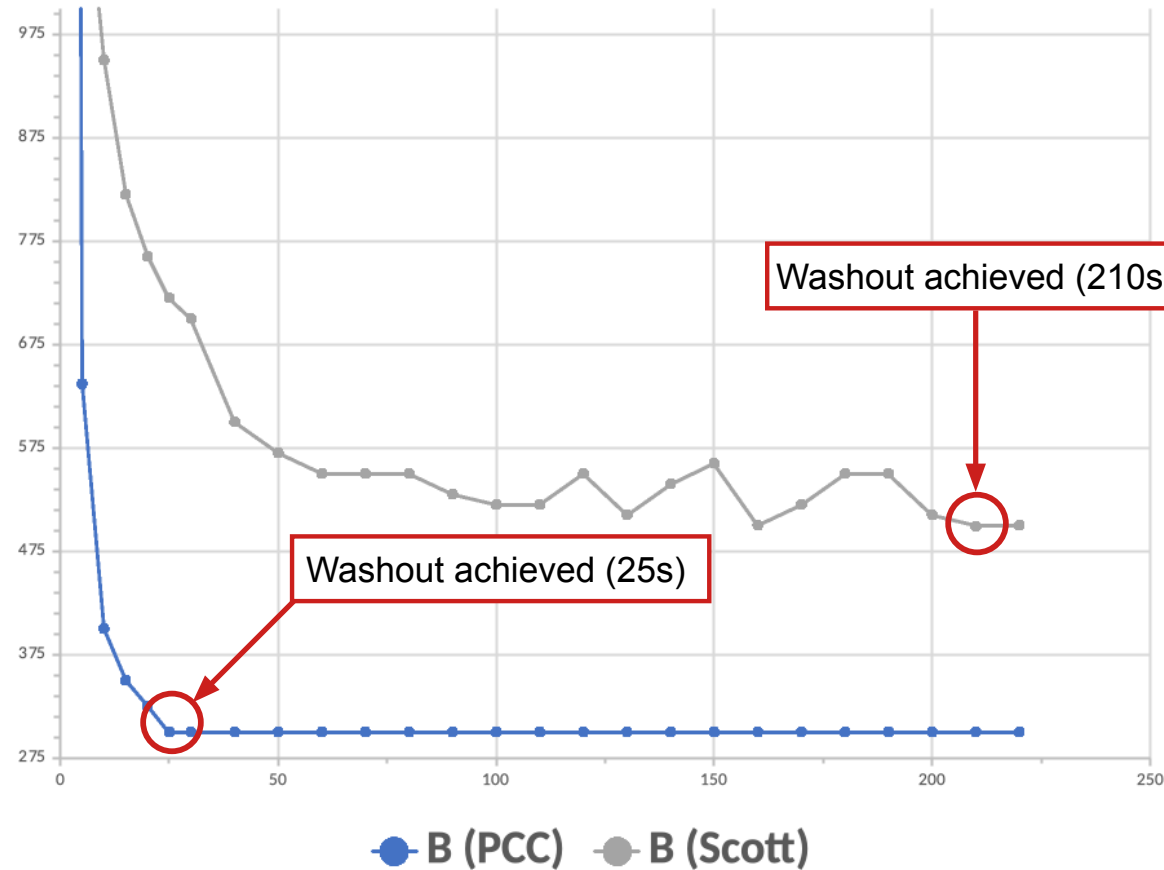


Scott style Spray Chamber



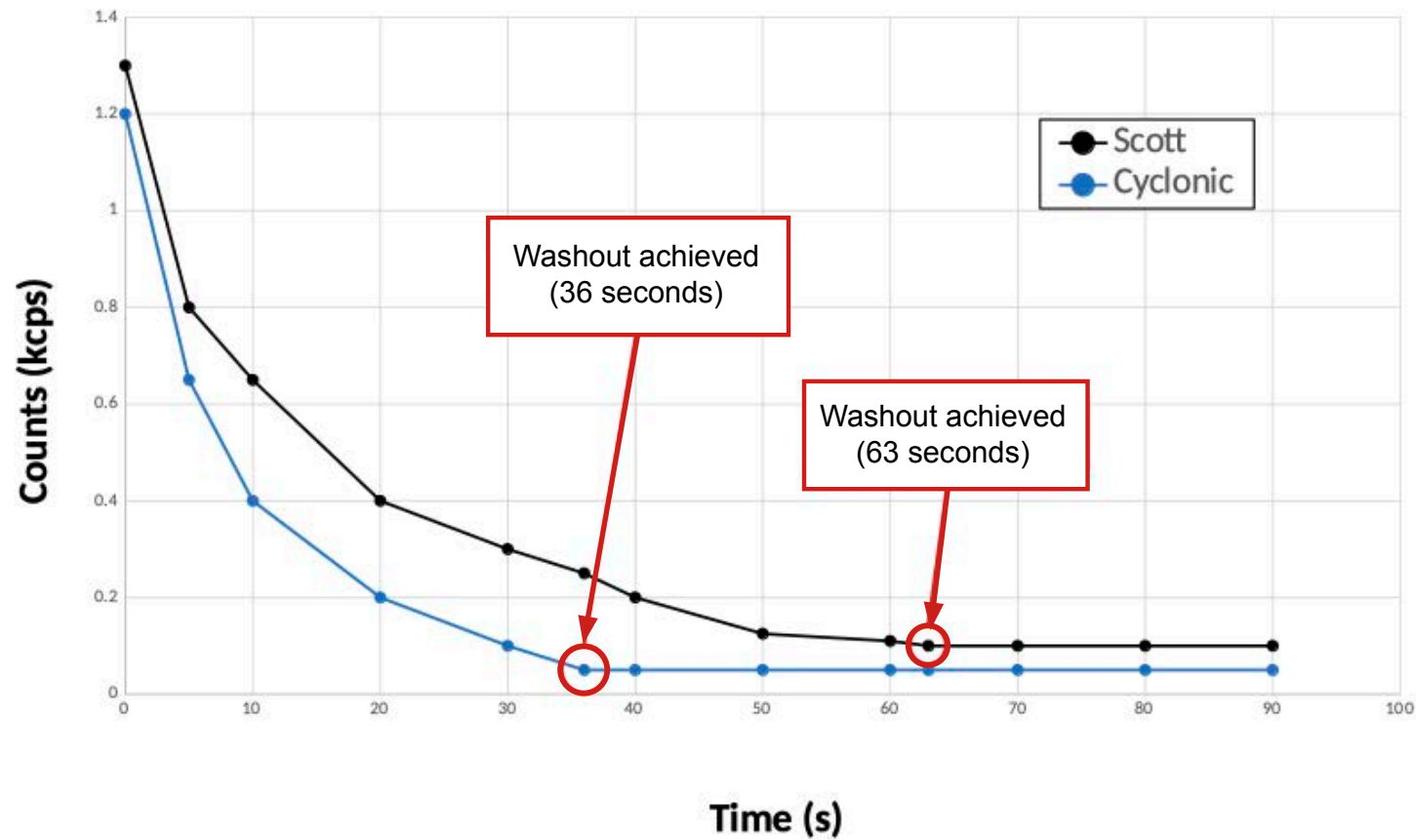
Tracey Spray Chamber

# Washout Comparison (200 ppb Boron)





# Washout Comparison (100 ppb Mercury)



# NEW – High Efficiency Tracey Direct Connect (DC) Spray Chamber

- No o-rings.
- DC connection is inert all PEEK construction.
- Eliminates ball joint clamps that rust over time.
- Guarantees perfect alignment each and every time for improved precision and better transport efficiency.
- Low volume (30mL) cyclonic spray chamber for faster washout with Helix CT technology.
- Tracey DC Spray chamber design is available in Glass and PEEK.
- Lower cost structure.



P/N 20-809-4880



P/N 20-809-4801

# Tracey<sup>™</sup>

## DC PEEK Spray Chamber

- HF resistance up to 5%
- Excellent wetting characteristics of PEEK ensure the spray chamber wetting properties are retained with general laboratory cleaning maintenance.
- Compact lightweight design avoiding the need of spray chamber brackets.
- Spray chamber doesn't require internal surface treatment compared to TFE or PFA spray chamber designs.
- Lower cost structure compared to other HF spray chamber designs.



P/N 20-809-4801  
Tracey DC PEEK Spray  
Chamber



# Tracey™ DC and DC Injector Adapter Alignment

- Guarantees perfect alignment each and every time.
- Improved precision and better transport efficiency.



# Available for most common Glass Expansion D-Torch, SDT, & FDT Designs

Requires compatible DC Injector Adaptor



P/N 31-808-4253



P/N 31-808-4293



P/N 31-808-4408



P/N 31-808-4374



P/N 31-808-4489



# Tracey™ DC Currently Compatible ICP-OES Instruments



| Instrument Model                                   | Tracey DC Compatible |
|--|----------------------|
| Agilent® 5100/5110/5800/5900 ICP-OES               | ✓                    |
| Analytik Jena® PQ9X00 Series ICP-OES               | ✓                    |
| PerkinElmer® Avio 200/220/500/550 ICP-OES          | ✓                    |
| Radom MICAP® OES 1000                              | ✓                    |
| Thermo Fisher Scientific® PRO/PRO Duo ICP-OES      | ✓                    |
| Thermo Fisher Scientific® 6000/7000 Radial ICP-OES | ✓                    |

\*Instrument not listed, contact Glass Expansion about future availability.

# Jet Vortex Interface

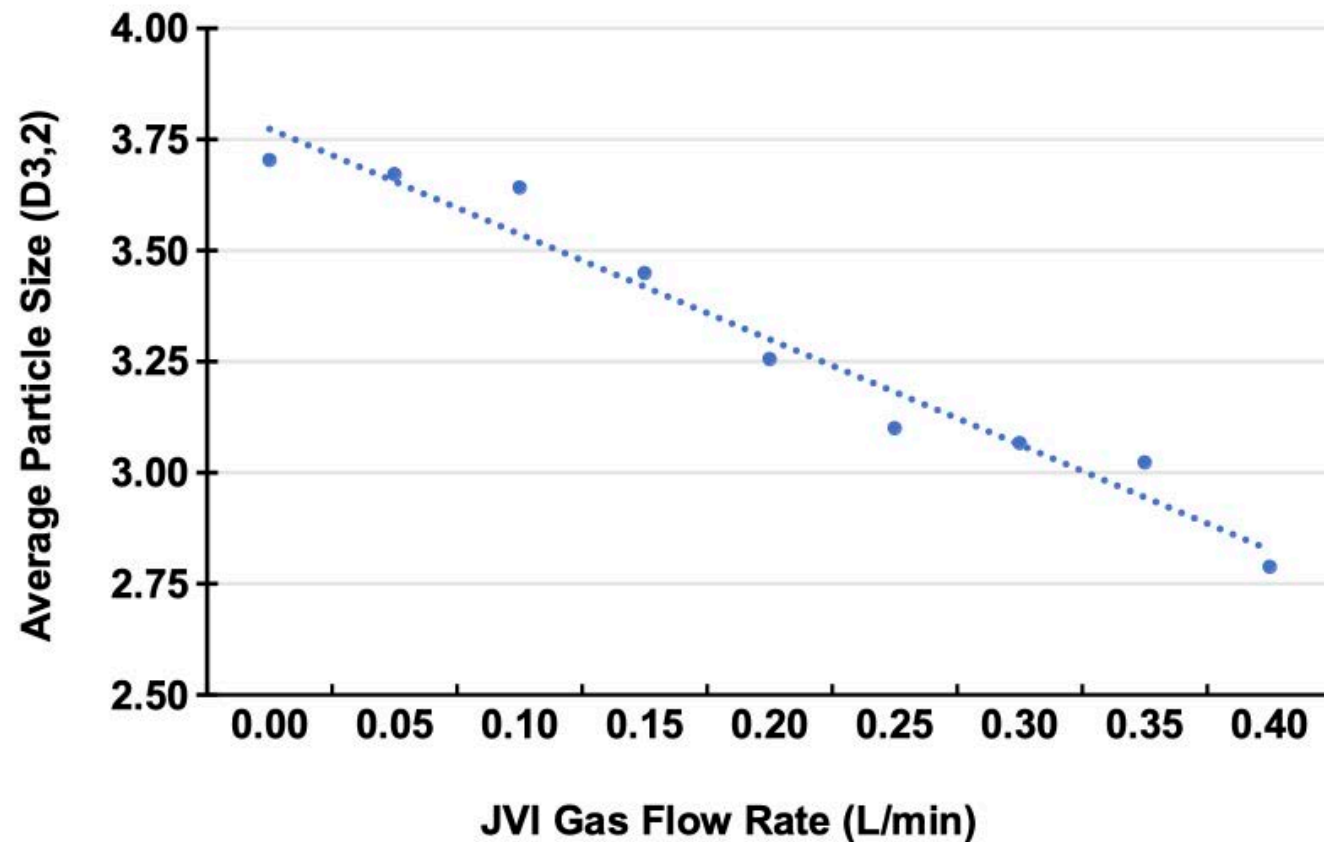
A novel design (Patent Pending), providing highly efficient Aerosol Filtration. Simple and straightforward installation, the JVI works in conjunction with the existing “Make-Up” or “Dilution/Auxiliary ” gas option of your ICP and Glass Expansion DC gas connector. Compatible with any Glass Expansion DC spray chamber. For use with ICP-OES and ICP-MS applications.

## Benefits

- Reduces average particle size by 3-4% for every 0.05 L/min flow of JVI.
- Chemically inert, made from Ceramic & PEEK.
- Secure connection to gas supply, torch & DC spray chamber.
- Improved life of torch & interface cones.
- Reduce build-up on injector & interface cones.
- More robust plasma conditions.



# JVI™ Gas Flow Rate Effect on Particle Size



# Lithium Analysis in Undiluted IPA (neat)

- Pure Lithium (Charlestown, MA)
- Instrument used – Spectro Arcos II (EOP)
- Evaluation of standard sample introduction to Tracey DC + JVI + SeaSpray DC
- Washout comparison and analytical figures of merit



Tracey DC + JVI + SeaSpray DC



Scott + CrossFlow

# Li Blank in IPA

|            | Scott + CrossFlow | Tracey DC + JVI + SeaSpray DC |
|------------|-------------------|-------------------------------|
|            | Li 323.261        | Li 323.261                    |
| Mean Blank | 74,108 CPS        | 36,567 CPS                    |
| Mean RSD   | 2.33%             | 0.632%                        |

## Benefits of Tracey DC

- Blank for Li decreased by approximately 50%
- More stable plasma
- 3x improvement in RSD
- Improved LOD for Li

|            | Tracey DC + JVI + SeaSpray DC |
|------------|-------------------------------|
| Li 323.261 | Mean RSD (%)                  |
| 0 ppm      | 0.38                          |
| 2 ppm      | 0.23                          |
| 4 ppm      | 0.28                          |
| 100 ppm    | 1.33                          |

# Thank You

## Asia Pacific

6 Central Boulevard  
Port Melbourne Vic 3207  
Australia

Phone: +61 3 9320 1111  
Email: [enquiries@geicp.com](mailto:enquiries@geicp.com)

## Americas

31 Jonathan Bourne Dr.  
Unit 7, Pocasset MA 02559  
USA

Phone: 508 563 1800  
Email: [geusa@geicp.com](mailto:geusa@geicp.com)

## Europe

Friedenbachstrasse 9  
35781 Weilburg  
Germany

Phone: +49 6471 3778517  
Email: [gegmbh@geicp.com](mailto:gegmbh@geicp.com)

**[www.geicp.com](http://www.geicp.com)**