



# Trouble-Free ICP: Maximize Performance and Minimize Downtime



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Glass Expansion, Inc.



# Who is Glass Expansion?

**GE has been specializing in sample introduction components—from the probe to the cones—for ICP and ICP-MS instruments since 1983:**

- Many ICP and ICP-MS vendors package GE parts as part of the standard configuration
- Support all major ICP and ICP-MS instruments
- Provide sample introduction components for over 50 different ICP and ICP-MS models
- Offices located in Australia, Germany and USA (Massachusetts)

# Industry Standard Trademark Designs



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



**SeaSpray™ & MicroMist™**  
Nebulizers



**Helix™** CT Interface



**Guardian™** Inline  
Particle Filter



**D-Torch™**



**IsoMist™ XR**



**TruFlo™**

# Products Offered

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



# Helpful ICP Resources

## Glass Expansion ICP Resources

As a world leader in research, design and manufacturing of high quality ICP sample introduction components, Glass Expansion places the same value on customer support, with [www.geicp.com](http://www.geicp.com) offering you a wealth of resources.



Webinars, covering tips & tricks, product selection & product highlights.



Library of Application Notes & Newsletter Application Spotlights.



Instructional videos to aid in product assembly.

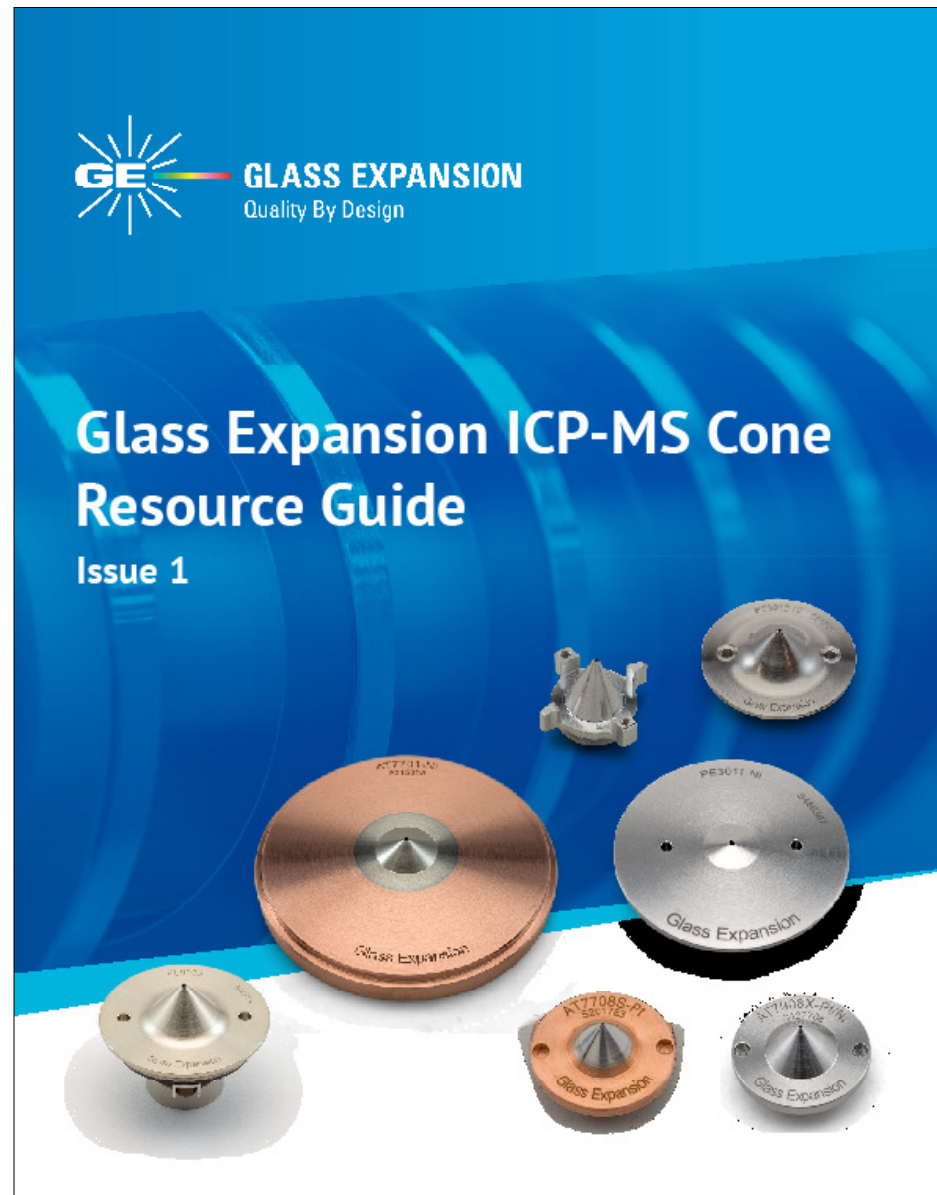


Full-color Catalogue organized by ICP-OES and ICP-MS models.

**Click on the buttons above to take you to our ICP resources.**

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

# Cone Resource Guide



- **Guidance on cone selection**
  - Advantages of different cone raw materials
  - Selection based on matrix and performance
- **Tips on Care and Maintenance**
- **Organized by ICP-MS Model**
  - Cross-reference OEM product numbers



# High Performance Sample Introduction System (HP-SIS) Series

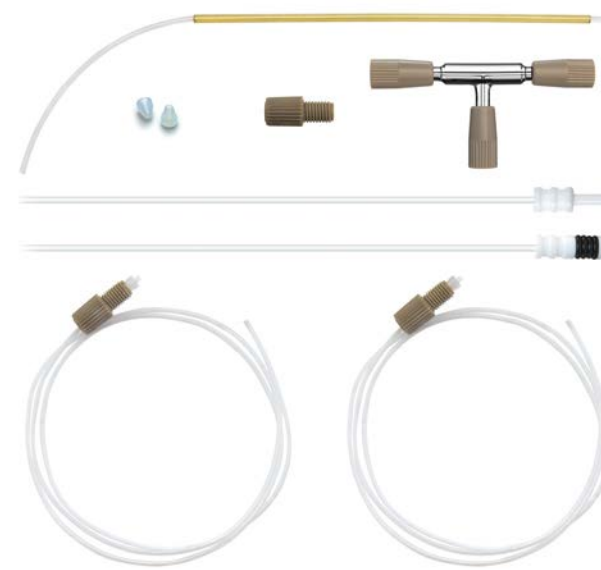
- HF-Resistant HP-SIS – Webinar & Technical Note Available Now
- Aqueous HP-SIS – Webinar & Technical Note Available Now
- High TDS HP-SIS – Coming soon... stay tuned
- Organic HP-SIS – Coming soon... stay tuned

**Visit: [www.geicp.com/HP-SIS](http://www.geicp.com/HP-SIS)**

# Aqueous HP-SIS



SeaSpray™ DC



Trident™ CT



Tracey™



D-Torch™

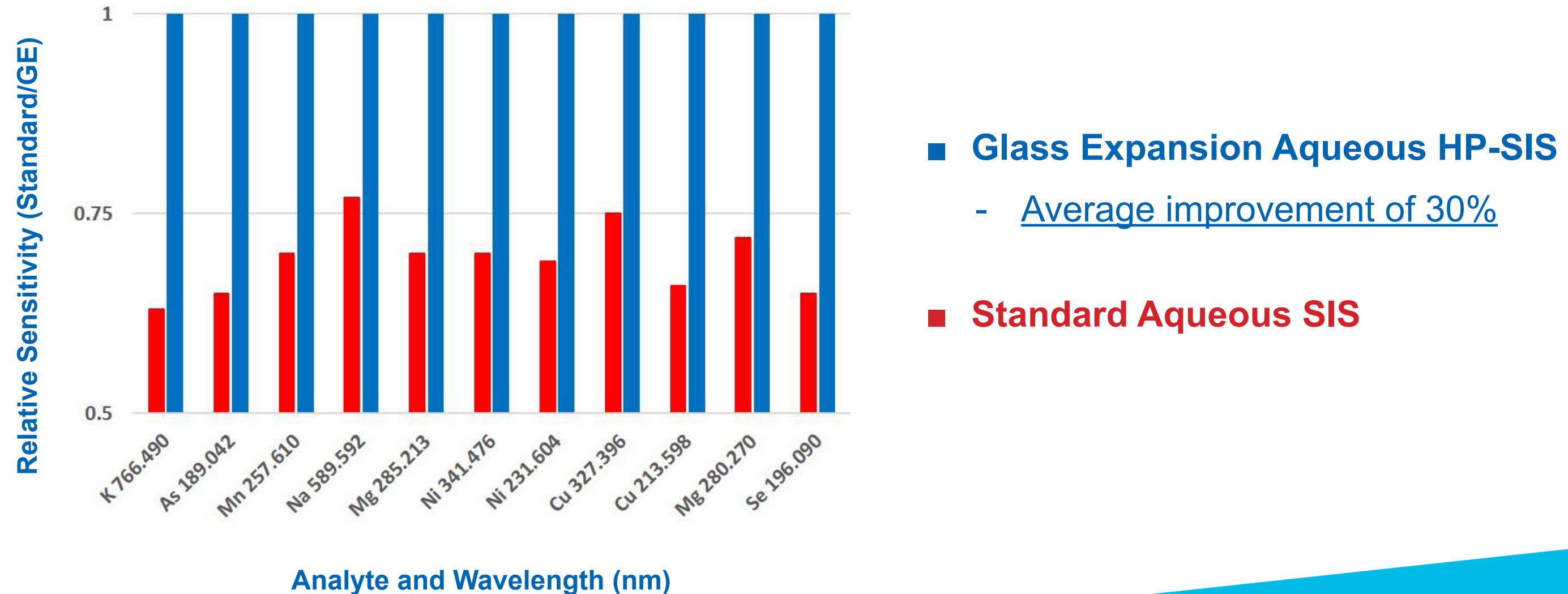


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# Aqueous HP-SIS - Sensitivity Comparison

Sensitivity of Standard Aqueous SIS relative to Glass Expansion Aqueous HP-SIS (relative sensitivity = 1)



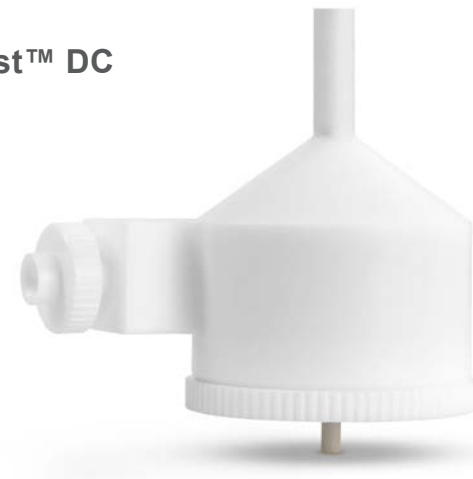
# HF-Resistant HP-SIS



DuraMist™ DC



Trident™



PTFE Tracey™



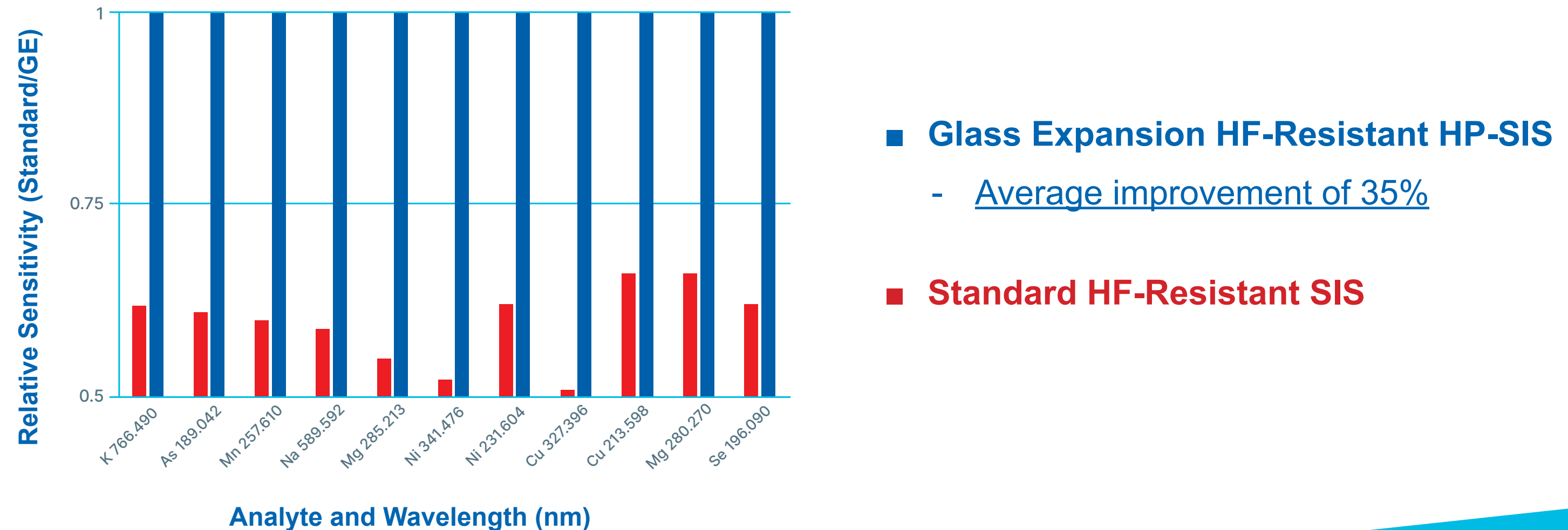
D-Torch™



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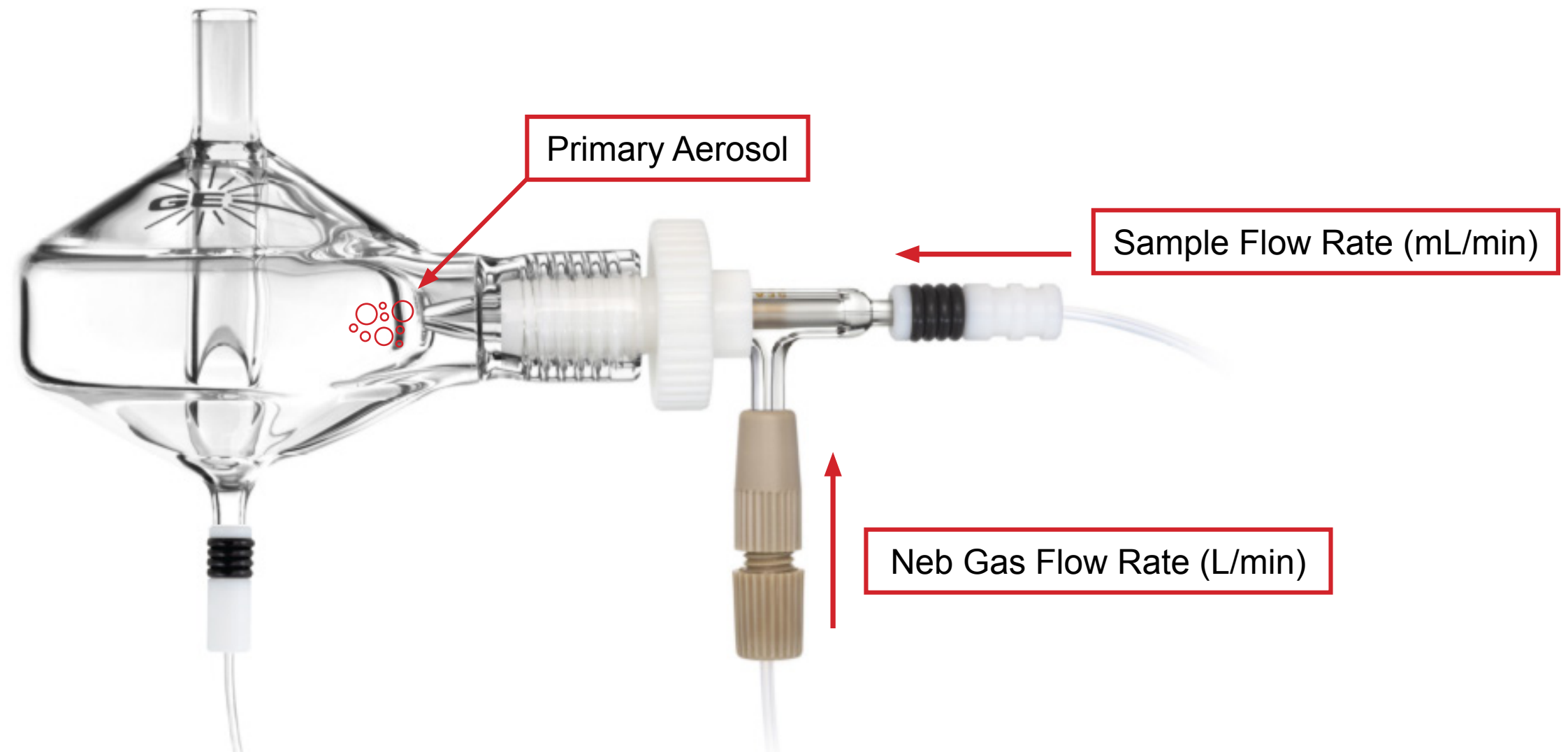
# HF-Resistant HP-SIS - Sensitivity Comparison

Sensitivity of Standard HF-Resistant SIS relative to Glass Expansion HF-Resistant HP-SIS (relative sensitivity = 1)



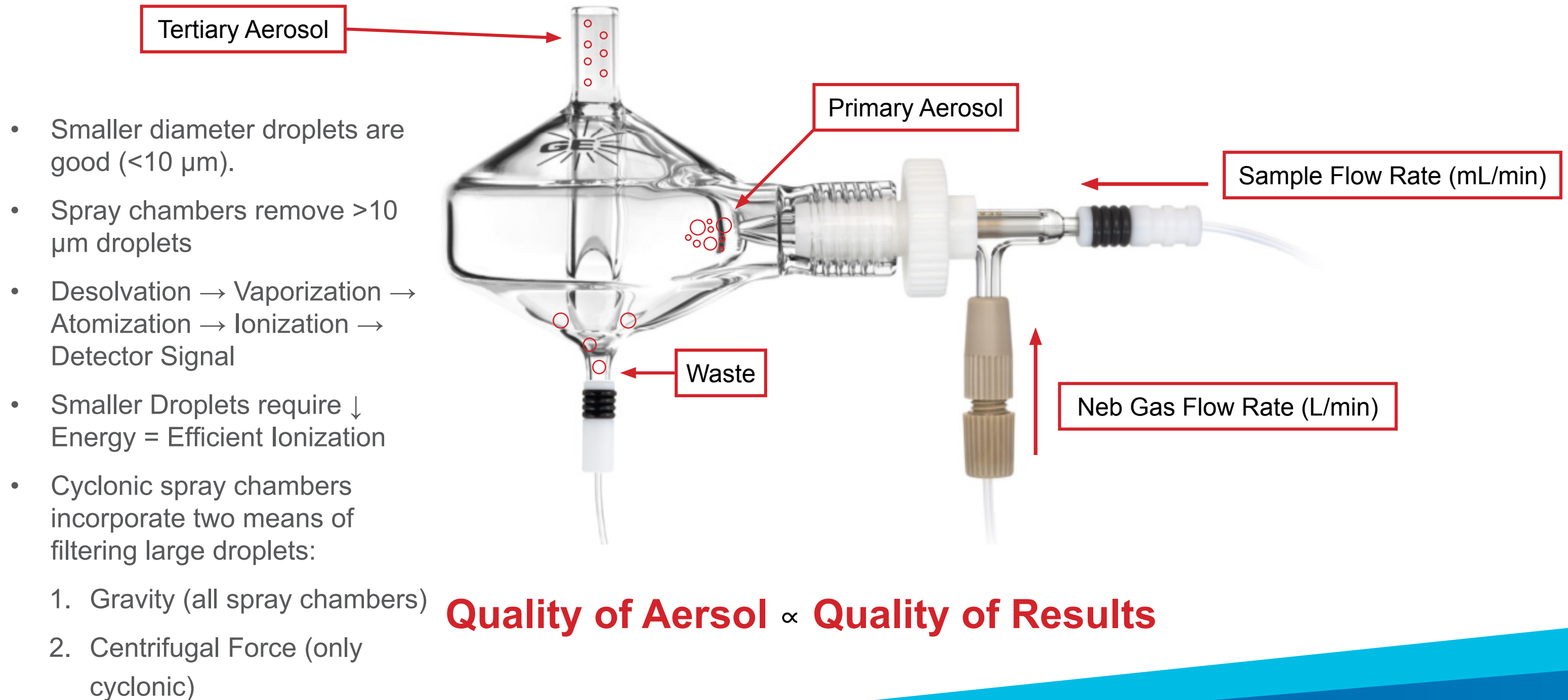
# Basics of Aerosol Generation

- Primary aerosol generated by nebulizer.
- Droplet size decreases as the argon gas velocity increases and sample liquid velocity decreases.
- Therefore, high argon flow and pressure combined with low sample flow and pressure yields the smallest droplet size.



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




# Basics of Aerosol Generation





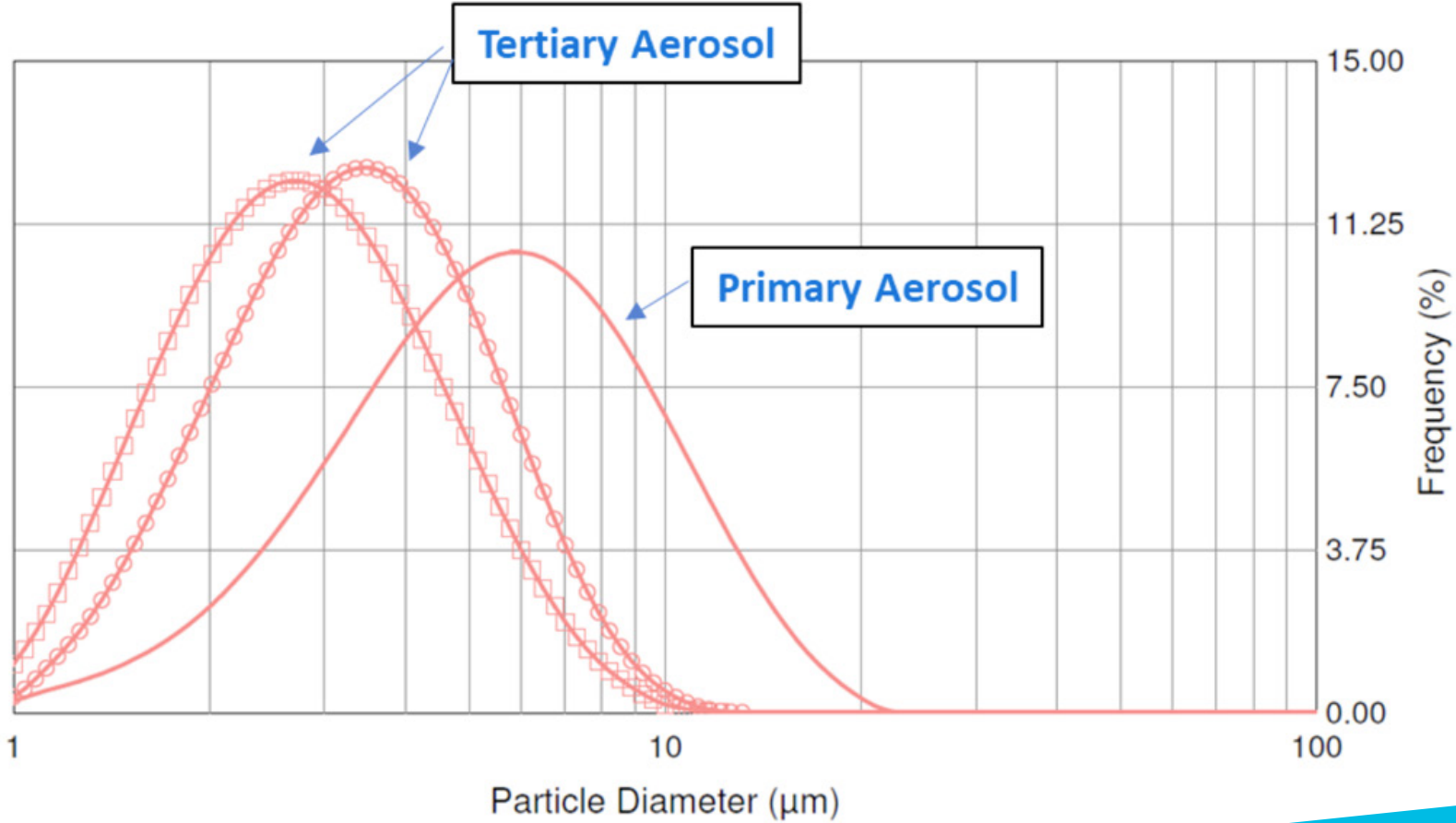
# Basics of Aerosol Generation

- Droplet size
- Primary Aerosol
- Tertiary Aerosol

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



Tracey™



Twister™



# Glass Expansion Nebulizer Product Line

Nebulizer	TDS (%)	Particulates (µm)	HF	Precision	Purity	Robustness	Material
Conikal	5	75	No	High	Good	Good	Glass
SeaSpray	20	75	No	High	Good	Good	Glass
MicroMist	15	40*	No	High	Good	Good	Glass
Slurry	1	150	No	High	Good	Good	Glass
OpalMist	15	75*	Yes	High	Excellent	Good	PFA
DuraMist	30	75*	Yes	High	Good	Good	PEEK
VeeSpray	30	300	Yes	Moderate	Good	Excellent	Ceramic

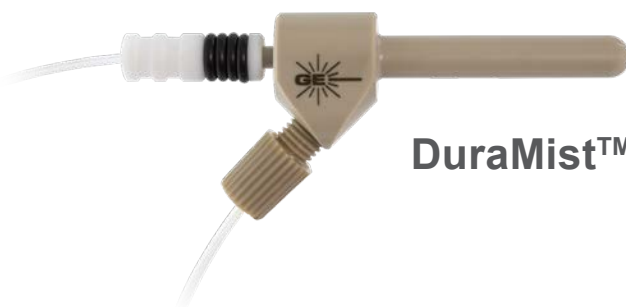
\*Varies with nebulizer uptake



Conikal™  
SeaSpray™  
MicroMist™  
Slurry™



OpalMist™



DuraMist™



VeeSpray™

# Common Problems: “Real World” Samples

**Perfect samples are nice—but they do not exist in the “real world”:**

- Clogged nebulizers and injectors
- Torch devitrification
- Destabilization of plasma
- Increased oxide formation
- Long washout times / carryover
- Long stabilization times
- Signal suppression
- Signal drift
- Poor precision (RSDs)
- Carbon build-up
  - » Orifice occlusion
  - » Signal drift
  - » Carbon-based polyatomic interferences

# Quartz Torches



# D-Torch – Ceramic

**D-Torch with ceramic outer tube is ideal for:**

- Analyses at the detection limit as the hotter plasma increases sensitivity.
- Monitoring of wear metals in engine oils, as quartz outer tubes often suffer cracking and shortened lifetimes due to thermal shock.
- Analysis of fusion samples where the lithium salts rapidly attack quartz.
- Measuring high TDS samples that will quickly devitrify the quartz outer tube.

“The D-Torch is performing very well. The ceramic outer has been in almost constant service 22 hours a day, 6 days a week since we purchased it and we have had no issues...We are due to purchase a replacement ICP and will certainly be purchasing another D-Torch to go along with it.”

*- Lubricating Oils Laboratory*



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# Ceramic Outer Tube: ICP-MS



While the nitrogen-based interferences can be addressed using a collision/reaction cell (CRC) or the use of triple quadrupole ICP-MS, the backgrounds introduced by the glassware are almost impossible to avoid.

“We are extremely pleased with the performance of the ceramic torches. With our instrument use and high matrix (salinity) samples, we were going through 3 or 4 torches a month at times for \$200+ each...so the increased upfront cost equals a definite savings...”

- *Environmental Laboratory*

**thermo scientific**

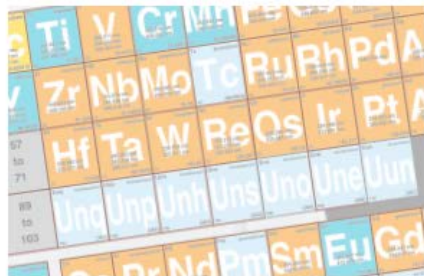
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### Thermo Scientific iCAP Qnova Series ICP-MS PLUS Torch for improved ICP-MS analysis of challenging samples

The Thermo Scientific™ iCAP™ Qnova Series ICP-MS instruments allow for robust and reliable analysis of almost all elements in the periodic table in a wide variety of sample matrices. In addition to the conventional quartz torch, the new optional PLUS Torch, made of high purity and high-performance ceramic materials, is now available to further improve the performance of both single and triple quadrupole ICP-MS.

The torch of an ICP-MS system is one of the most important components to assure consistent and reliable operation. Being in direct contact with the plasma and the sample aerosol generated by the nebulizer, it is exposed to heat, intense UV emission, and corrosive vapors. As part of the routine maintenance of the ICP-MS system, the torch needs to be inspected, cleaned, and potentially exchanged on a regular basis. Whereas different materials can be used for the injector tube (e.g. platinum or sapphire), torches are commonly made from high purity quartz. Over time, and especially when exposed to challenging sample types, conventional torches can devitrify, leading to the material becoming brittle and unstable, ultimately requiring an exchange.

For laboratories running samples such as brackish waters (e.g., fracking flowback solutions, produced waters, or sea water), highly acidic samples, or organic solvents



(e.g., crude oil or refined products), the torch may need to be exchanged more frequently as compared to other sample types, such as digested food materials. Issues with the torch may therefore become a significant part of the running cost and potentially be a reason for unplanned downtime.

At the same time, although made of high purity quartz, the torch may contribute to the backgrounds observed during analysis for a variety of elements, but most importantly for silicon. Silicon is a key element in a range of applications, for example monitoring of impurities in metals and metallurgical products, chemicals, crude oil and refinery products, pharmaceutical analysis, and environmental analysis.

**ThermoFisher**  
SCIENTIFIC

# Helpful Accessories



**HydraMist™** Spray Chamber



**Elegra™** Argon Humidifier



**Guardian™** Inline Particle Filter



**Eluo™** Nebulizer Cleaning Tool



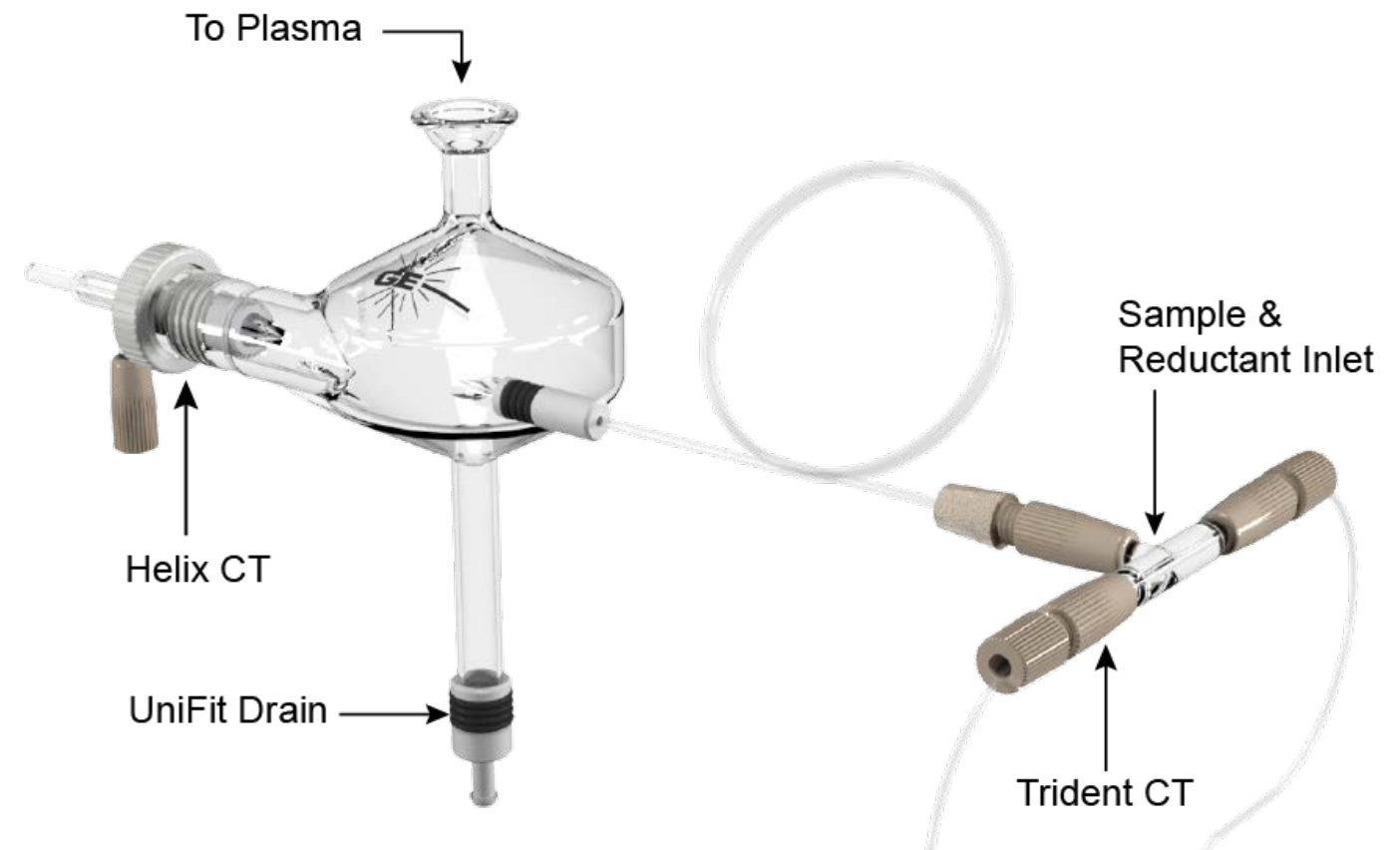
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# HydraMist Spray Chamber

**SIMULTANEOUS** analysis of hydride AND non-hydride forming elements

- 8 to 80-fold improvement in detection limits for the hydride forming elements in sensitive mode
- 2 to 80-fold improvement in detection limits using the simple mode
- No loss of performance for non-hydride forming elements
- Can function as standard spray chamber



# HydraMist – Detection Limits

**SIMULTANEOUS** analysis of hydride AND non-hydride forming elements

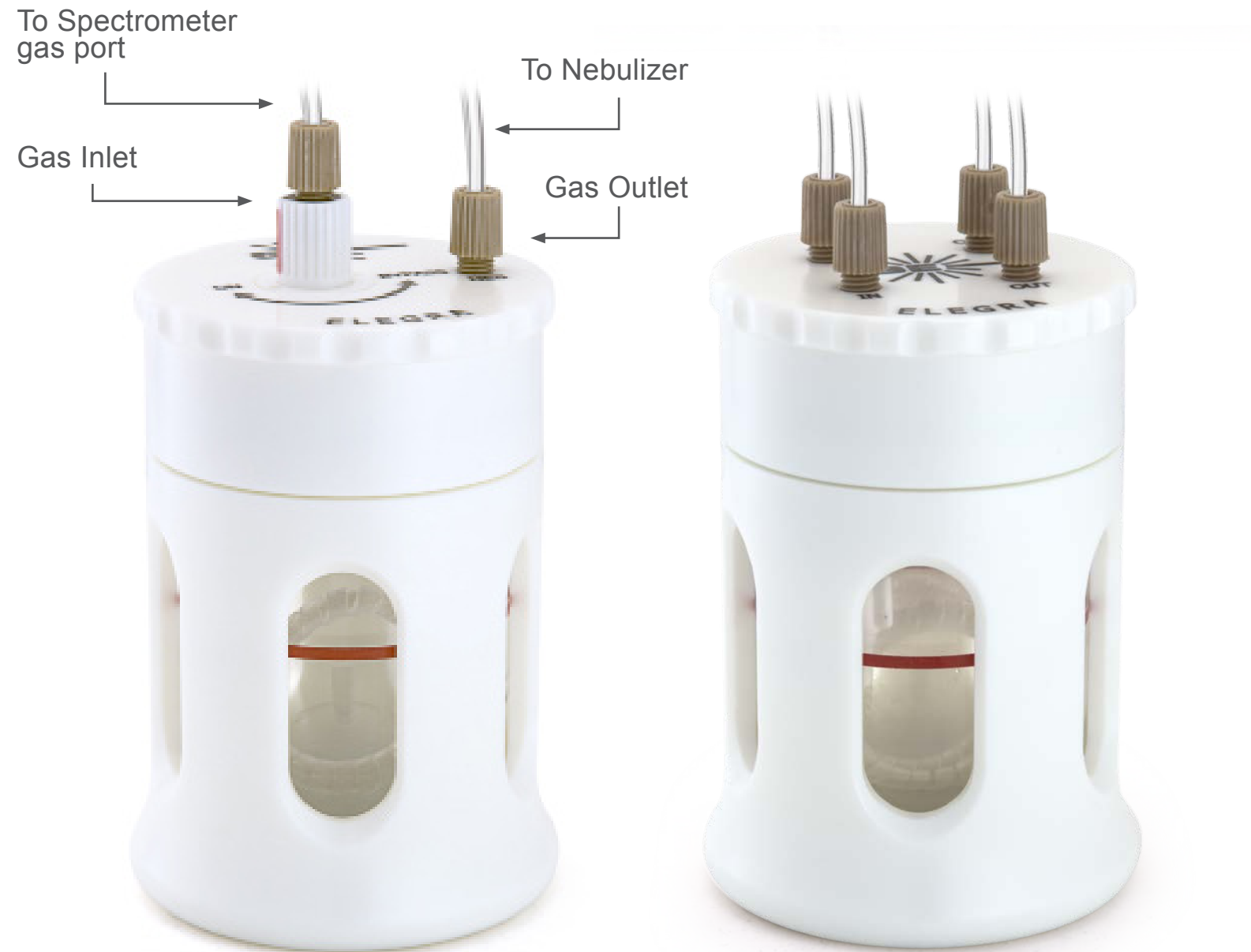
Analyte	Standard SIS DL	HydraMist DL (Simple mode)	HydraMist DL (Sensitive Mode)	Improvement
As	2.6	0.4	0.1	26x
Hg	0.8	0.01	0.01	80x
Se	3.2	0.2	0.08	40x
Sb	2.3	1.0	0.3	8x

\* Detection limits in µg/L

\*\* Data acquired using Thermo iCAP PRO

# Elegra Argon Humidifier

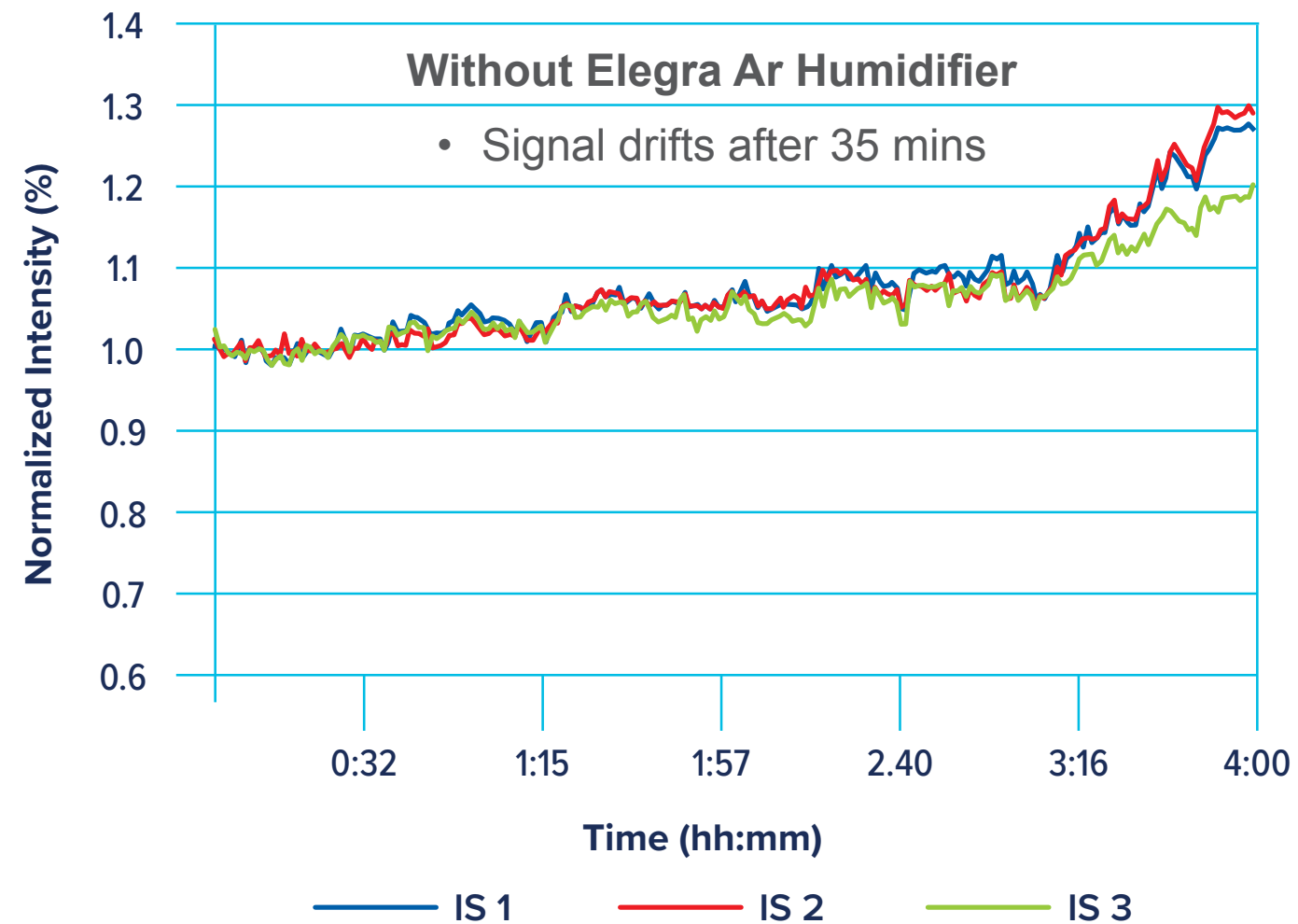
- Compact & cost effective design
- No heating or electric power required
- Non-pressurized water reservoir
- Membrane humidification technology
- Improved signal stability for samples with high TDS
- Inert metal free construction
- Dual-Channel version allows simultaneous humidification of nebulizer & aux. gas



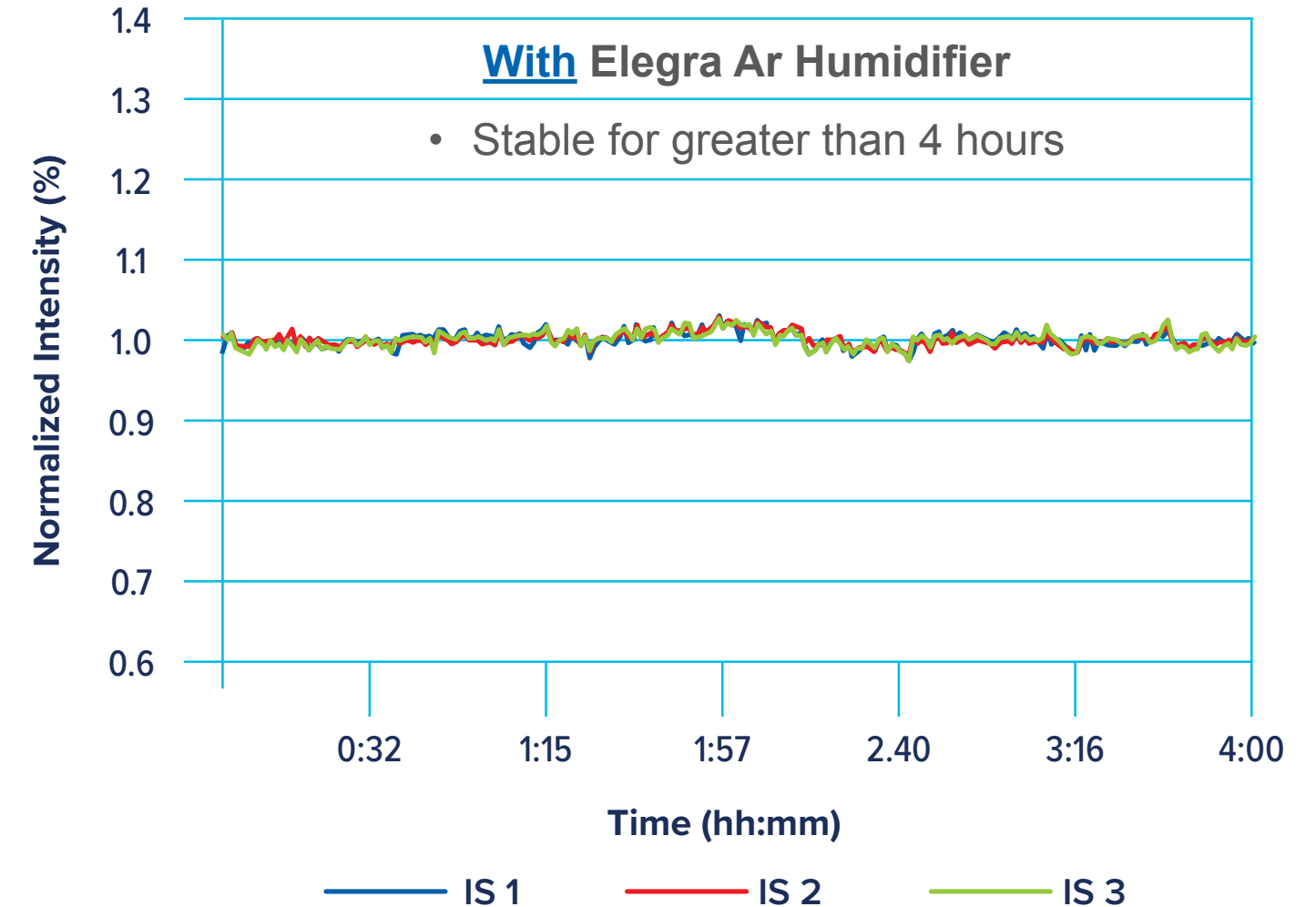
# Stability in High Solids/Salts

## Internal Standard Signal for Three Lines

### Analysis Failed



### Analysis Completed



# Eluo™

## Nebulizer Maintenance Made Easy



Conikal™  
SeaSpray™  
MicroMist™  
Slurry™



P/N 70-ELUO



DuraMist™



P/N 70-ELUO-OPD



OpalMist™

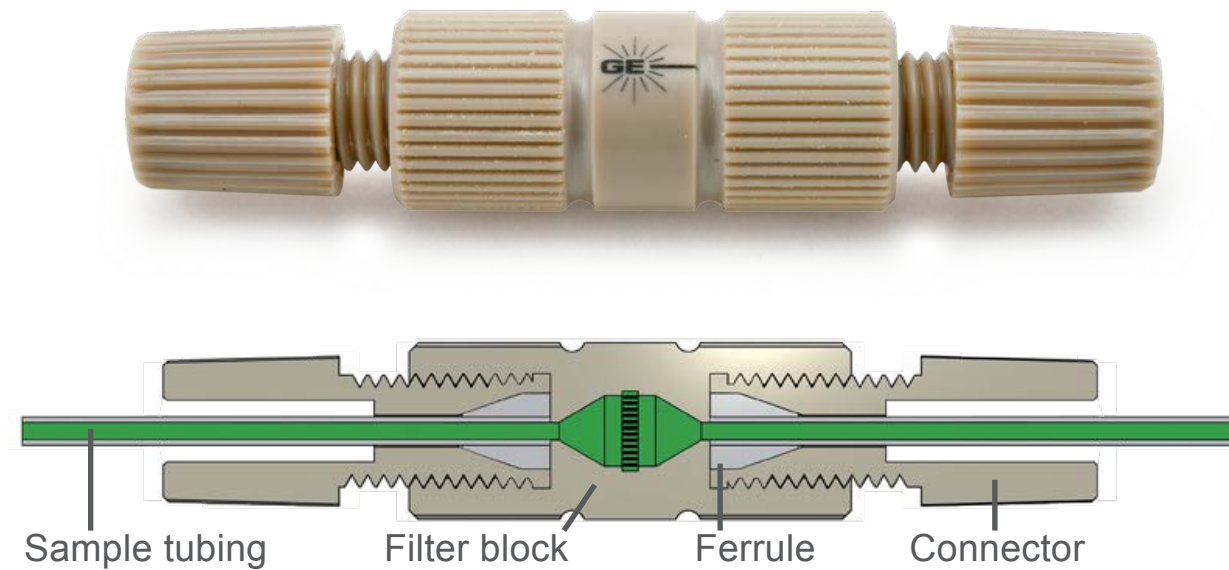


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# Guardian™

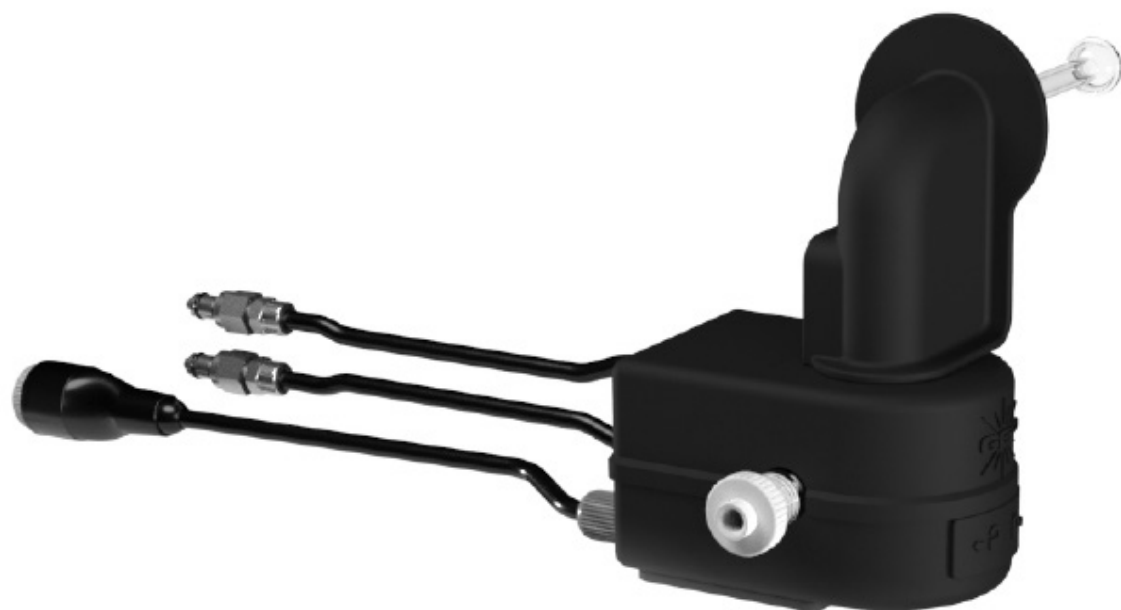
## In-Line Particle Filter

- Prevent large particles from clogging your nebulizer
- Insert between probe and nebulizer
- Re-usable PEEK filter (120 µm)
- Easily backflush to remove build up





# New Products



**IsoMist-MS**



**Jet Vortex Interface  
(JVI™)**

# IsoMist-MS

- For use with GE “Direct Connect” spray chambers (Glass, PEEK, PFA, Quartz)
- Low volume (30 mL) spray chamber results in **faster washout and stabilization times**
- Compatible with “Argon Gas Dilution” feature when using GE’s Jet Vortex Interface (JVI)
- Suitable for Thermo® Q/RQ/TQ & RQplus



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# JVI™ – 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.

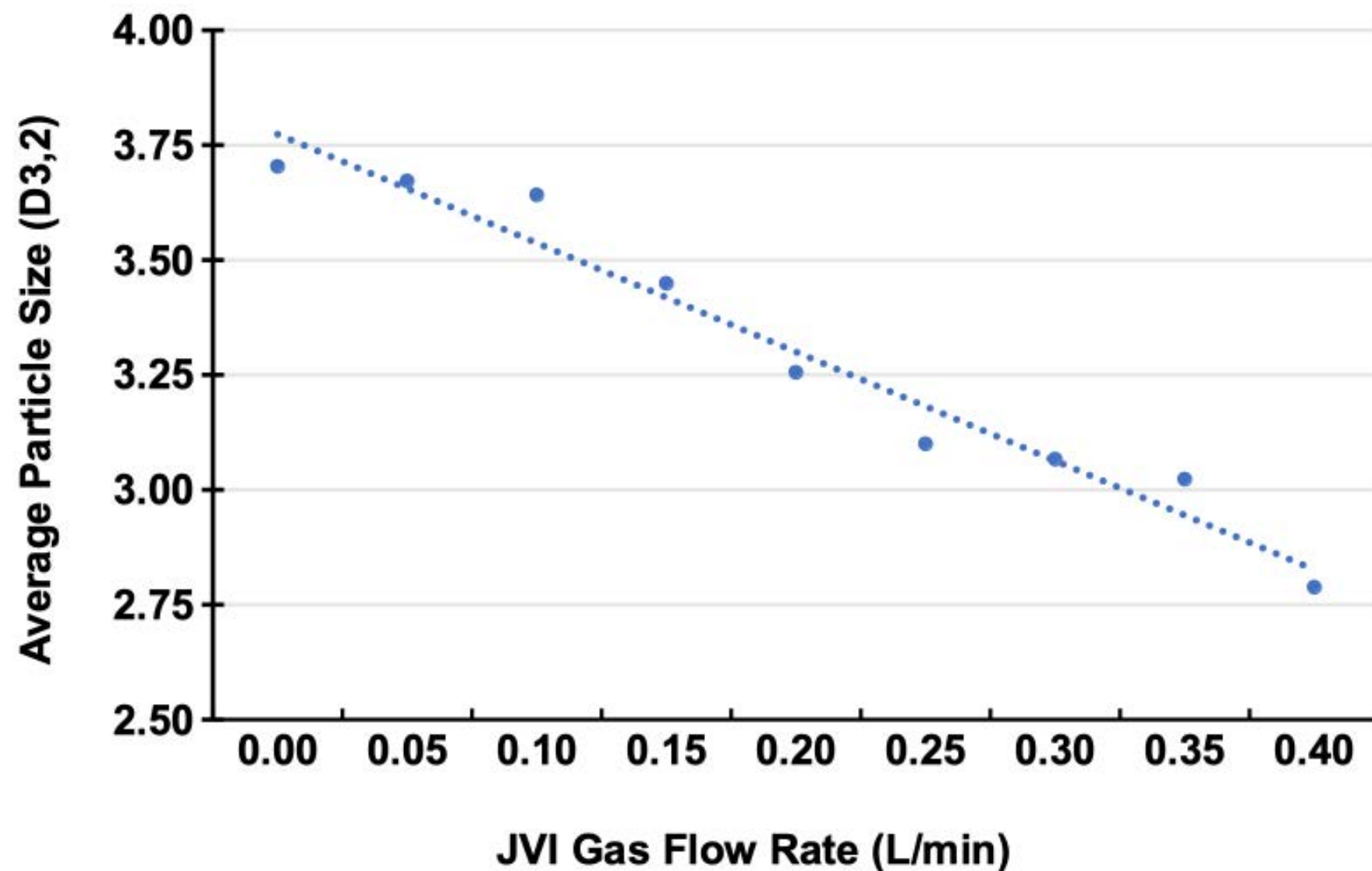
## Benefits

- Reduces average particle size by 3-4% for every 0.05 L/min flow of JVI.
- Chemically inert, made from Ceramic.
- 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.



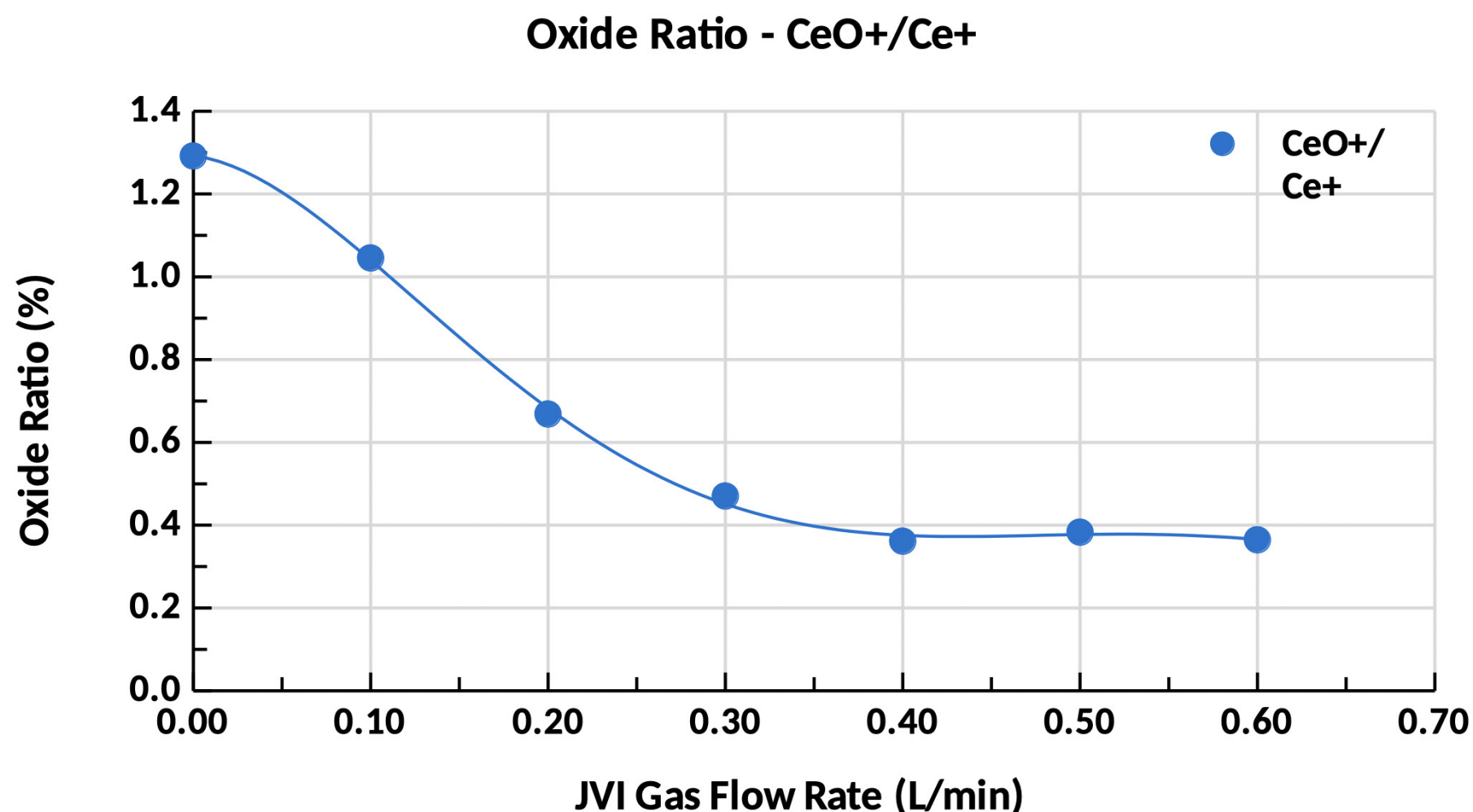
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# JVI Gas Flow Rate Effect on Particle Size



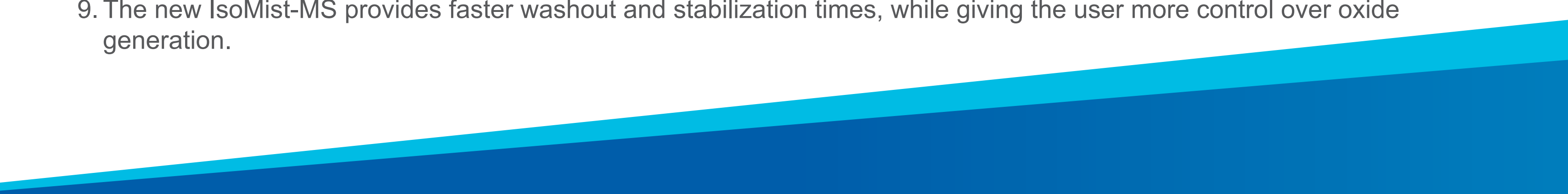
- The addition of a JVI flow reduces the average particle size reaching the plasma extending the life of torch, injector and cones.
- Less deposition of sample on the ICP-MS cones reduces drift and contamination.

# JVI: Aerosol Filtration



- The JVI can be utilized to fine tune the plasma conditions for higher matrix samples.
- Increasing the JVI gas flow reduces the Oxide ratio to well below 1%, creating a more robust plasma, ideal for higher matrix samples.
- With a more robust plasma you can achieve higher sensitivity, reduced matrix deposition on the interface, leading to improved stability and less frequent maintenance.

# Summary

1. Glass Expansion provides quality sample introduction components for all major ICP and ICP-MS instruments.
  2. Our website has a wealth of easily accessible online resources to help optimize your ICP sample introduction system for enhanced performance.
  3. Choosing the right cones for your ICP-MS can improve your analysis and decrease cone maintenance frequency.
  4. Outfitting your ICP with a properly configured HP-SIS for each analysis matrix will improve sensitivity, lower detection limits, and provide long-term stability for optimum performance.
  5. The components of your ICP's sample introduction system are critical, determining many factors, including detection limits, precision, different matrix tolerances, cost, and effective run time.
  6. The D-Torch is a versatile and cost-effective alternative for any laboratory with a moderate workload, and also provides the ceramic outer tube option for improved detection limits with less maintenance.
  7. The unique HydraMist can simultaneously analyze hydride and non-hydride forming elements, while lowering hydride DLs and maintaining non-hydride DLs.
  8. Utilizing available tools (i.e., Eluo) and accessories (e.g., Guardian Filter, Elegra) to combat challenges of real world samples can save you time and money.
  9. The new IsoMist-MS provides faster washout and stabilization times, while giving the user more control over oxide generation.
- 



Glass Expansion thanks Thermo Fisher Scientific for providing us the opportunity to participate in the Power your productivity, SMART Lab Series 2023.

**Thank You!**

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