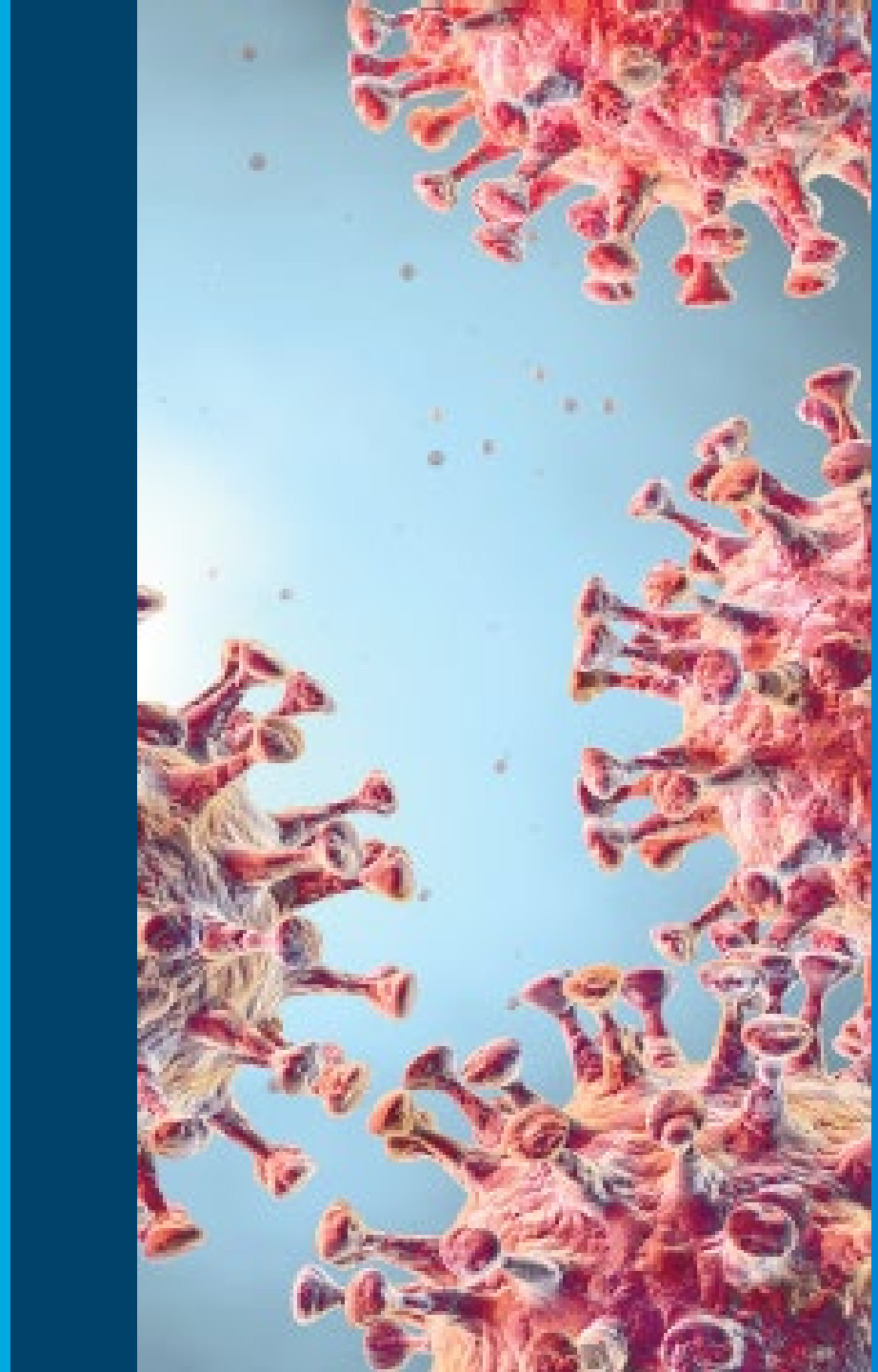
Maintaining lab operations in extraordinary times

Dealing with operating impacts from the COVID-19 Coronavirus

DE.43375

GC/MS	Thursday, April 16th
HPLC and LC/MSD	Friday, April 17th
ICP-OES & ICP-MS	Wednesday, April 22nd
LC/QQQ & LC/QToF	Thursday, April 23rd
GC	Thursday, April 30th



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Important general information for managing lab operations

Follow your SOP's – but here are some additional things to consider

- How has operational changes affected your SOP's? Are there impacts to instrument maintenance, qualifications, etc? Has instrument usage changed as this may affect service/consumable replacement intervals? Document these and prepare a plan to bring them online once you resume normal operations.

- Develop a new schedule/routine for working in the lab. This is a challenging time for everyone and routine helps everyone acclimate to these impacts.

- Prioritize time in the lab - Can any tasks be shifted remote or online (training, remote monitoring, data analysis)? Is your IT department aware of these and is bandwidth/VPN/remote access capable of handling this.

- Are service providers allowed on-site? Or is there remote work they can do? Discuss this before any scheduled visit. Our service teams are currently offering free live video conferences to support labs around the world – more info at the end of the presentation.

- Proactively replace lab consumables before you see performance issues. If ordering supplies, check if shipping/receiving/logistics for your company has been affected.

- When you return to normal operations, have a detailed restart plan that outlines priorities and timelines. Agilent will provide additional information on returning/restarting your lab in a few weeks.

ICP System Readiness

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5800 ICP-OES

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In This Section, We Will Discuss:

- Basic maintenance of the Agilent 5100 ICP-OES instruments.
- Daily, weekly and monthly regimes for good laboratory maintenance practices.
- How to troubleshoot sample introduction problems.
- How to get support for anything associated with your Agilent ICP.

Quality ICP Data Begins with Maintenance

- Most instrument failures occur in the sample introduction area.
  - Torch.
  - Spray Chamber.
  - Nebulizer.
  - All tubing.
  - Drain Assembly.
- Improper maintenance of this area can result in poor data quality.
- Establishing routine maintenance procedures can prevent problems.
- Refer to ICP Expert Help for videos on all maintenance procedures.

ICP Maintenance: Daily/Weekly

•Daily
- Inspect torch.
- Check nebulizer for blockage/pulsation.
- Rinse spray chamber after every use.
- Inspect peristaltic pump tubing.
- Empty waste vessel.
- Check water level in Argon Humidifier Accessory (if used).
- Wipe down exterior surfaces of your ICP.
- Inspect all other tubing and connections..

•Weekly
- Clean torch.
- Inspect cone (axial) or snout (radial).

Weekly Torch Maintenance

- Inspect Torch for Cracks or Deformations.
- Replace if necessary.
  - Cracked.
  - Broken.
  - Partially Melted.
  - Severely Eroded.

- Inspect injector tube for sample buildup.
- Inspect outer tube for deposits.
- The transport tubing between the spray chamber and the torch should be cleaned weekly.

Weekly Maintenance

- Inspect and clean Snout.
- Remove and clean CCI.
- Consult the videos in the ICPExpert Software help for:
  - Torch removal and installation.
  - Snout removal and installation.
  - CCI removal and installation.

Cleaning the Torch (1)

•Rinse torch with de-ionized water to remove salt deposits, and allow to dry before use.

•To remove other deposits or stains:

- Soak the torch in aqua-regia (3:1 HCl/HNO_3) overnight.
- Rinse well with water and allow to dry before use

•Slotted outer tube for use with Axial Plasma will show signs of de-vitrification after first use

- DO NOT spend time cleaning
- Monitor for cracks

Tip: Use pipe cleaner dipped in aqua-regia to remove persistent compounds from injector tube.

Cleaning the Torch (2)

- Organic deposits:
  - Remove deposits gently with spatula.
  - Soak in H_2SO_4 & H_2O_2 (9:1).

    Rinse with water, then methanol and dry.
  - Rinse with CS_2 to dissolve carbon.
  - Injector tubes can be “flammed” with a propane torch or placed in a muffle furnace.
- Torch lifetime is dependent on:
  - Total dissolved solids level in samples.
  - Plasma conditions.
    - RF Power.
    - Nebulizer flow.
    - Plasma gas flow.

ICP Maintenance：Monthly/Yearly

- Monthly
  - Clean spray chamber.
  - Clean nebulizer.
  - Inspect the state of induction coil.
  - Verify that the water level in water recirculator is sufficient.
  - Clean/check air filter on top of ICP.
- 6 months
  - Replace the water in the re-circulator/chiller and add Chloramine-T.
  - Change argon filters (compressed gas cylinder).
- 12 months
  - Change argon filters (liquid dewar).

Spray Chamber Cleaning

- Glass Cyclonic
- Cleaning required when the sample aerosol begins to BEAD UP on the spray chamber walls.
  - Soak in aqua-regia, rinse and replace.
  - Soak in Fluka 'RBS-25‘ or TritonX-100 (0.5%) overnight, rinse and replace.
- Consult the videos in the ICP Expert software help library for cleaning details.

Spray Chamber Cleaning – After Running Organics

Must clean out organics before running aqueous samples:

- Flush Spray chamber with solvent miscible in water and the organic solvent used.
  - i.e., ethanol, iso-propyl alcohol
- Then rinse thoroughly with water

  OR
- Use separate spray chamber for non-miscible solvents
  - Reduces down-time due to cleaning

Nebulizer Cleaning

Glass Concentric：

- Soak in Aqua-Regia.
- Back Flush with Water Bottle or Vacuum.
  - Syringe
  - Nebulizer gas outlet
- Never sonicate as the inner capillary may shatter or crack leaving the nebulizer useless.

Water Cooling System

- Set Thermostat at 25°C.
- Check for Correct Water Levels.

  Fill with DI water only (Not 18.2 MΩ.cm Ultra Pure Water).
- Prevent growth of aerobic bacteria by adding Chloramine T Trihydrate.
  - Only required when changing water.
  - Add 1g for each liter of water (~0.1%) is adequate.
- Maintenance instructions detailed in Water Cooling Service Manual.

Cleaning the Water Particulate Filter

•Turn the water cooler off and disconnect it from the main power supply.

•Unscrew and remove the lower filter nut.

- Pull out the micron mesh filter.
- Using a mild detergent, clean the filter then rinse thoroughly with de-ioinized water.

•Re-assemble the water filter and tighten nut. Check t iller operational.

Air Filter

- Air filter located on top of ICP.
  - Housed in an opening, lift out using the tab on the filter.
- Check monthly.
- Clean as often as required.
  - Depends on cleanliness of laboratory.
  - Wash with tap water or detergent solution.

Troubleshooting: General (1)

•90% of all ICP-OES related problems are in the sample introduction area.

•There are common procedures available to indicate if there is a sample introduction problem.

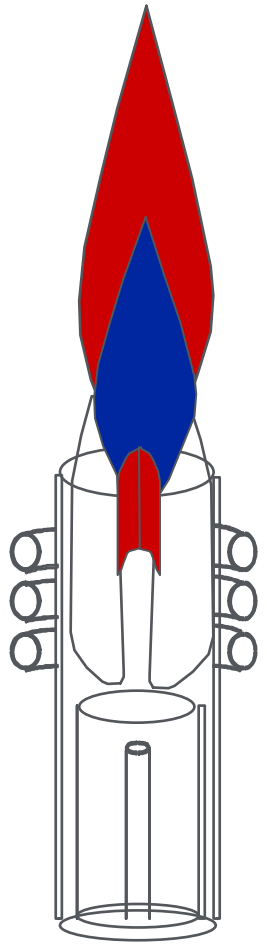
•Diagnose sample introduction problems using Yttrium (e.g., 1000 ppm), or any element that gives a coloured plasma

- Bullet should not pulsate.
- Yttrium should penetrate plasma and not travel around the outside.

Troubleshooting: General (2)

If using Y, remember that the blue portion of the plasma represents the NORMAL analytical zone.

- Radial normal analytical zone should be 5-16 mm above the coil.
  - The red plasma tail should be fanned around the cone orifice.



Wavelength Calibration

•Perform a wavelength calibration, ensure all lines are measured successfully

•If your wavelength calibration fails:
- Check that polyboost is on – repeat if necessary
- Remake the Agilent tuning solution
- Inspect sample introduction area

•Wavelength calibration does not need to be performed daily
- Suggest weekly or monthly recalibrations

Drift During Analysis - Temperature Change

•Agilent optics are thermostatted at a stable 35 °C.

Unlikely that this type of drift will occur.

•If wavelength calibration is performed at a different temperature, then the focus of the emission will be at a different spot on the detector surface.

•A symptom of this can be change in emission intensity for the same concentration.

•Correction Choices:

- Only perform wavelength calibration once optics are at 40 °C.
- To avoid warm-up delays at start-up, leave the main switch turned on.

The optics are then already stable at 40 °C.

Troubleshooting: Low Signal

Low analytical signal:

- Standards prepared incorrectly.
- Blocked nebulizer or low nebulizer gas flow.
- Blocked injector.
- Worn pump tubing.
- Conditions not optimized.

Troubleshooting: Poor Precision

Poor precision:

- Determine if it is drift or noise related.
- Run the Cu/Mn Ratio Method to monitor the drift.
- Check the nebulizer for blockage.
- Check the torch and injector tube.
- Check the pump and pump tubing.

Drift Test Using Cu/Mn Ratio

•Cu/Mn ratio method to monitor drift:

- Select a soft atomic line [Cu(I) 327.4 nm] and a hard ionic line [Mn (II) 257.6 nm].
- Measure the intensity at each line with a single solution when the instrument is at optimum.
- Define the optimum ratio of Cu to Mn (on a clean working instrument before hand).
- The value measured subsequently should not deviate more that 5% from the optimum value.

•If deviation of the ratio is > 5%, clean nebulizer, spray chamber, torch and replace pump tubes.

Troubleshooting: Noisy Signal

Noisy signal/Plasma pulsations.

- Contamination of the spray chamber.
- Air leak.
- Damaged pump tubing.
- Low pump speed.
- Partially blocked injector tube.
- Partially blocked nebulizer.
- High salt content.

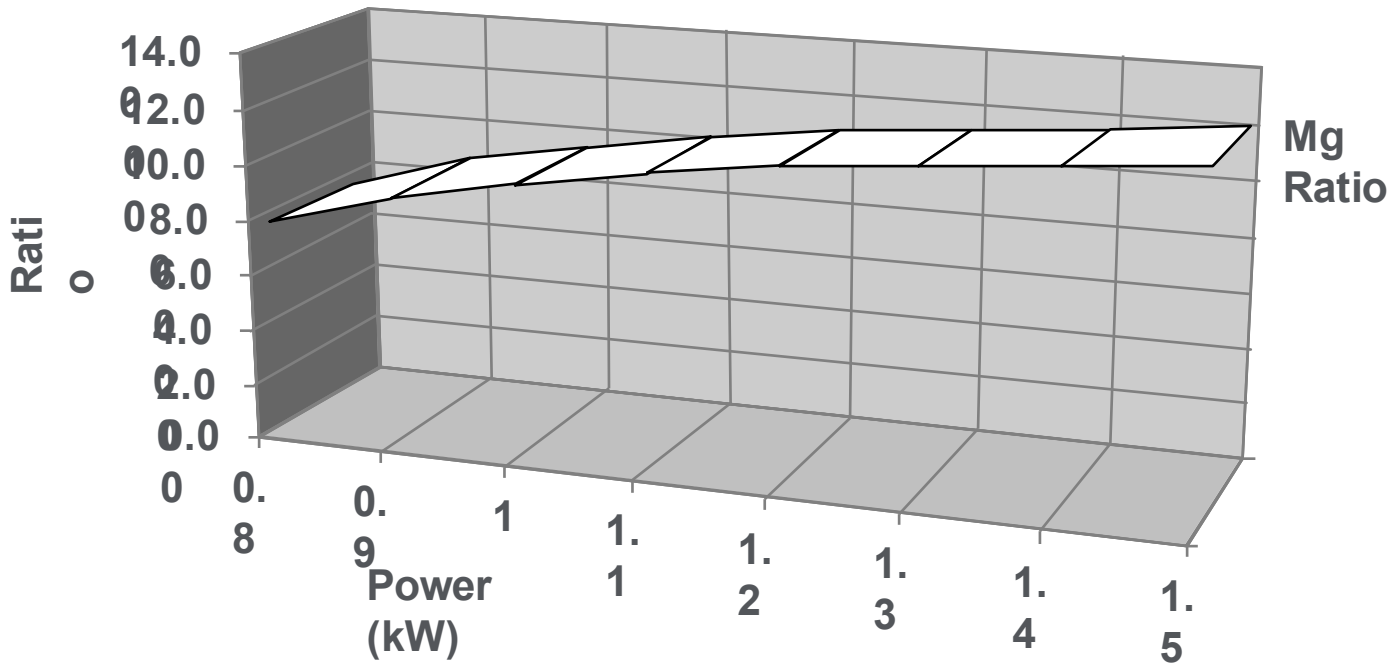
Troubleshooting: Memory Effects

Elements typically exhibiting memory effects:

- Ag, Au, B, Hg, Mo, Si, Sn, W, Zr.
- Avoid using high concentrations of these as analytes.

  Maybe pre-dilute samples (if known to be high in concentration)
- Ensure that the rinse time is adequate.
- May require 2% HNO_3 blank solution to be run between samples

Plasma Robustness Test – Mg II/Mg I Ratio



Ratio of Mg (II) at 280.270 nm to Mg (I) at 285.213 nm

$$\frac{\text{Intensity at 280}}{\text{Intensity at 285}} * 1.8$$ (Echelle factor)

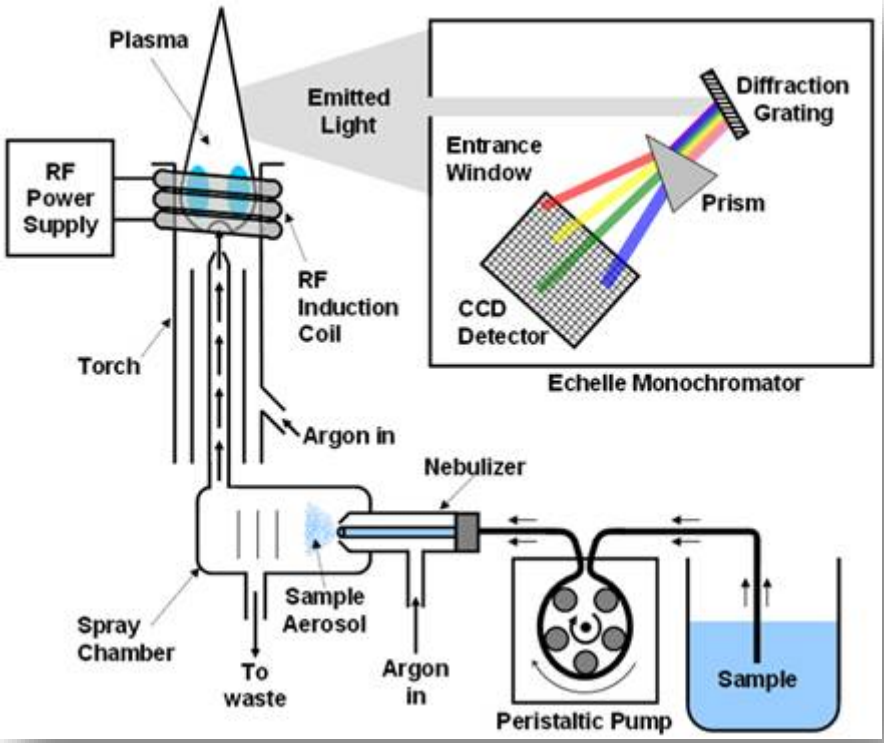
Plot intensity ratio vs RF Power , Ratio > 10 corresponds to “robust” plasma conditions

ICP Performance Tests

- Allow plasma to warm up for < 20 minutes (when poly is at temp).
- Go to Analysis page and recall a suitable worksheet.
- Stabilize the instrument on the method conditions.
- Run the worksheet using suitable solutions (QC solutions, blank).
- Evaluate the figure of merit involved (SBR, %RSD, detection limit, resolution, etc.).
- A record (for example, stored worksheets) of system performance for these parameters, since installation can help with checking the current spectrometer performance.

Agilent 5100 ICP-OES Sample Introduction System

Sample Introduction System Introduction



The sample introduction system provides the means for taking a sample and introducing it to the plasma for analysis

Sample Introduction System Overview

What will be covered in this training . . .

Sample area

Nebuliser and spray chamber

Torch Loader

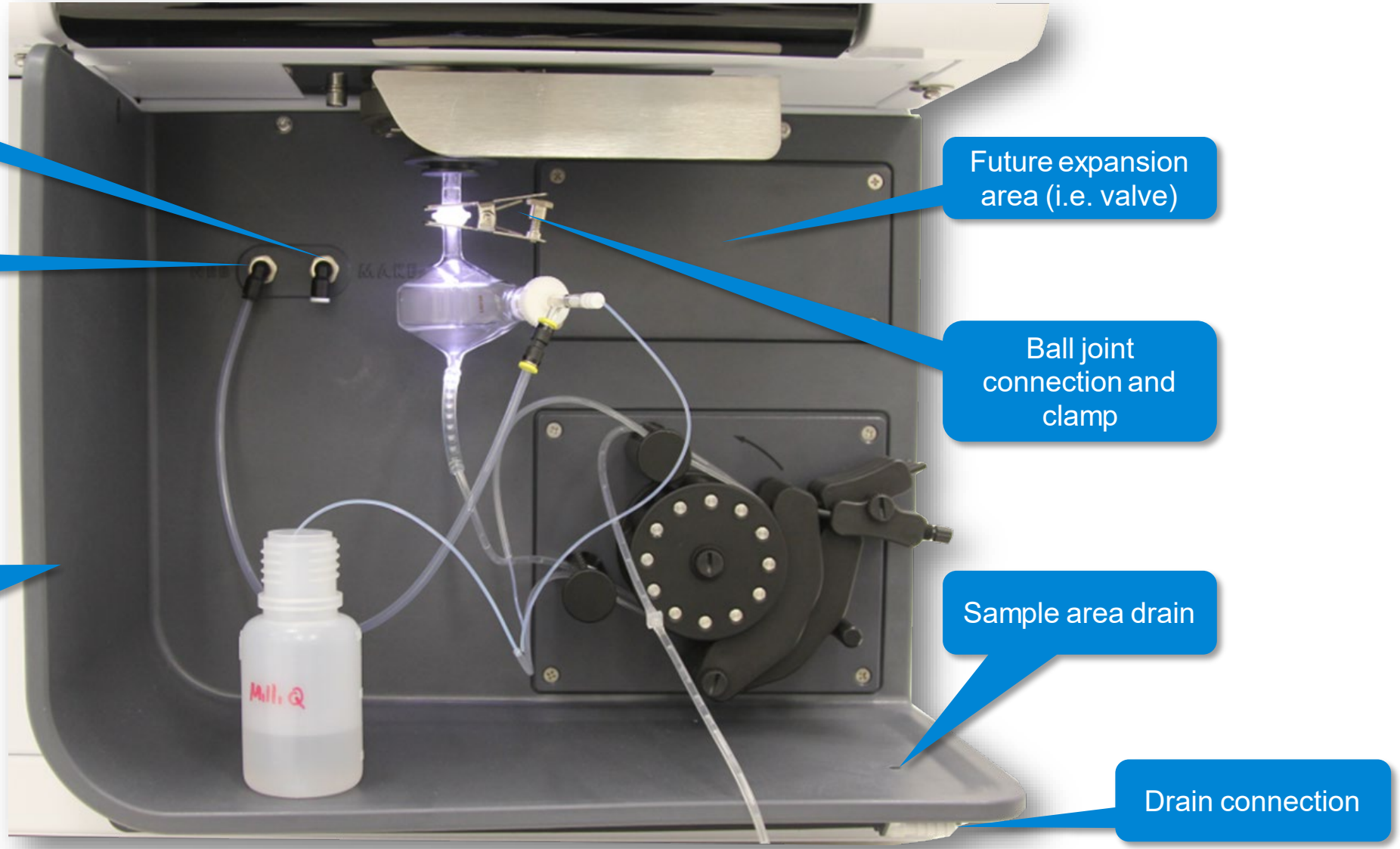
Torch

Peristaltic Pump

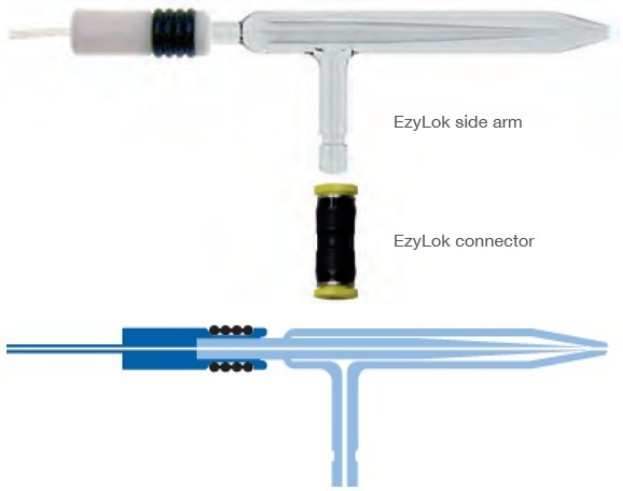
SVS +

Humidifier

Sample Area

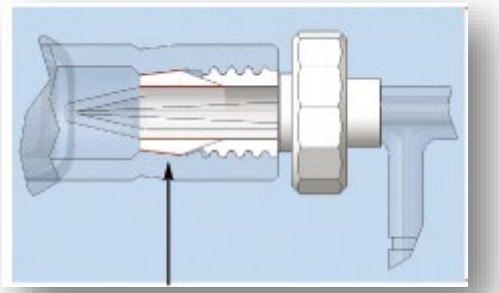

Make-up (sheath gas) Connection
Nebuliser Connection
One piece molded drip tray for corrosion resistance
Future expansion area (i.e. valve)
Ball joint connection and clamp
Sample area drain
Drain connection
Milli Q

Nebuliser - Spray Chamber



SeaSpray nebuliser

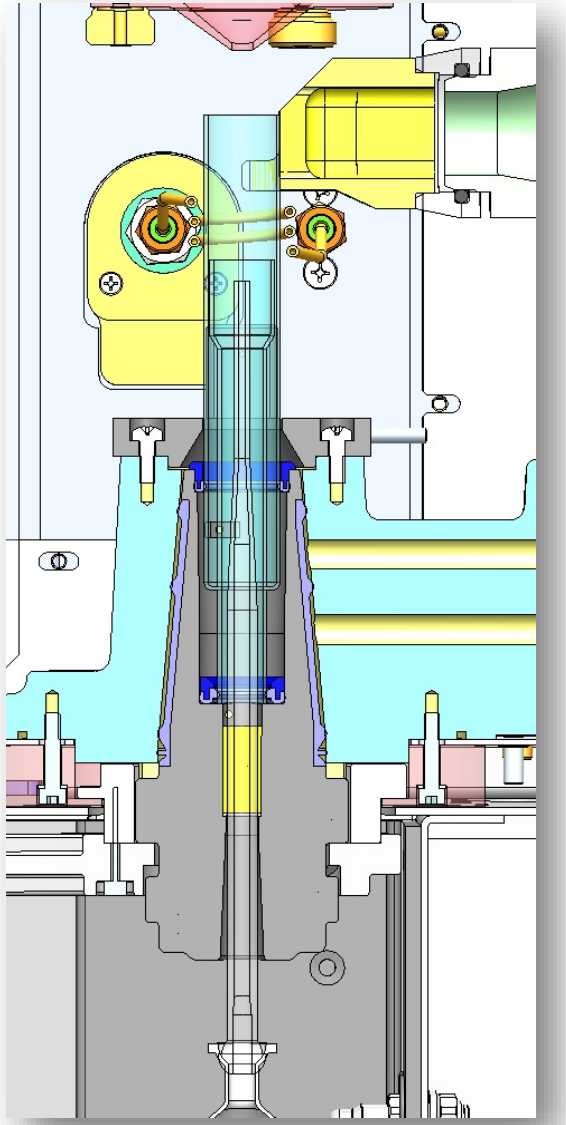
- New UniFit sample line connector
- EzyLok argon connects directly to nebuliser gas line.



Cyclonic double pass spray chamber

- Helix nebulizer fitting, o-ring free. Solvent and acid resistant.
- Ball joint and clamp to connect directly with torch
- New UniFit drain line connector

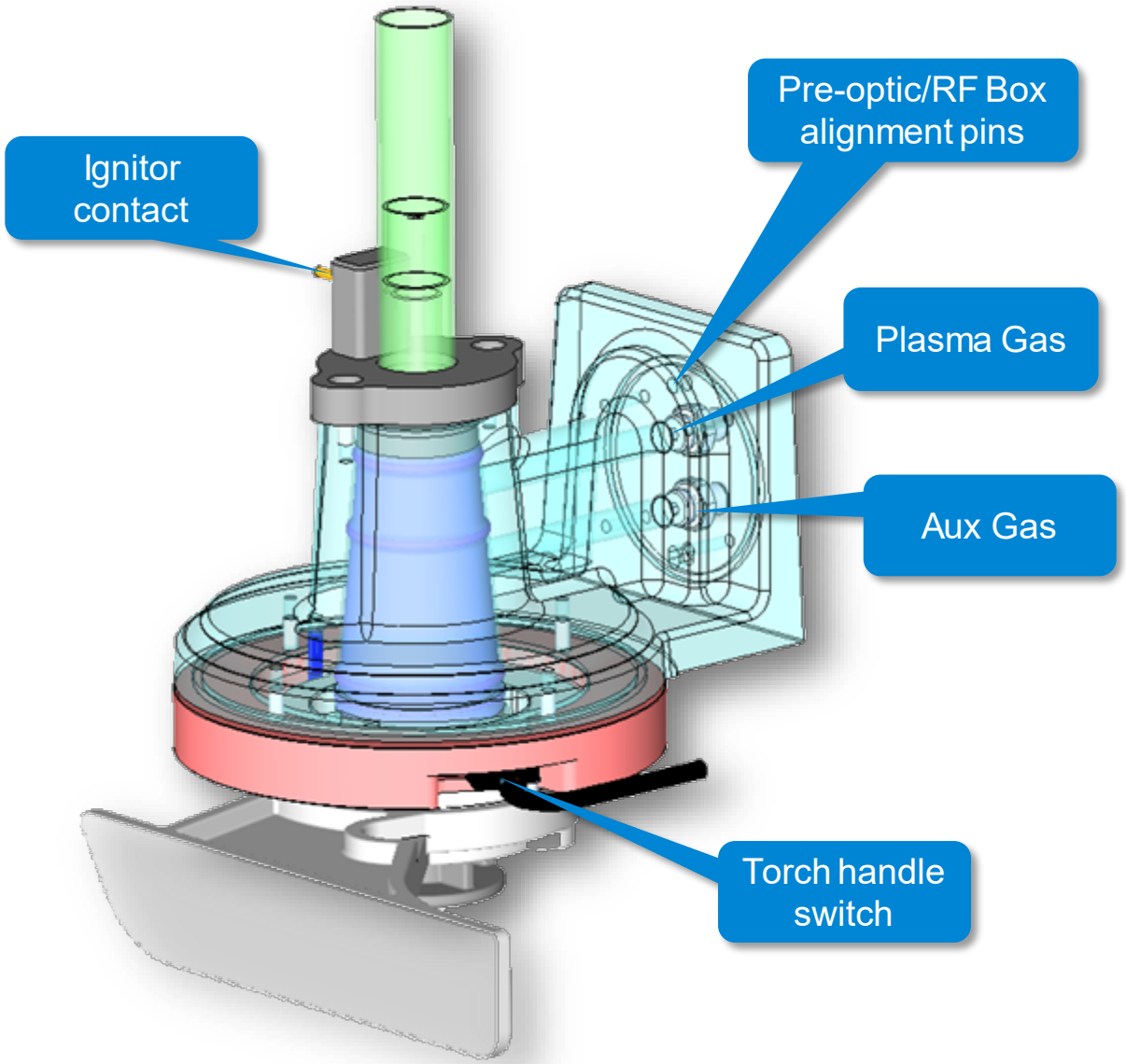
Torch Loader



The torch loader allows:

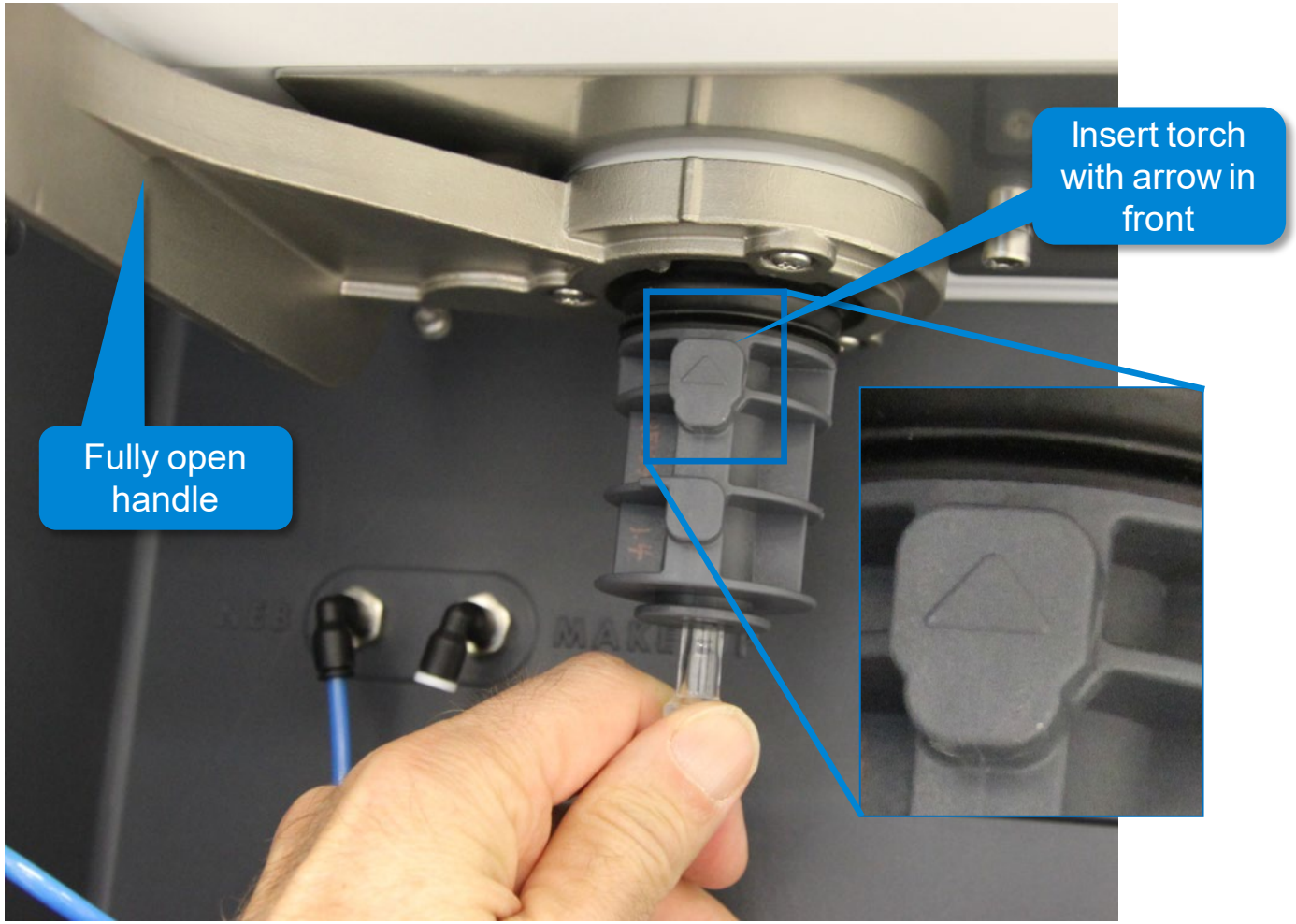
- Ease of operation for the customer.
- Automatic connection of torch gases.
- Precise positioning of torch:
  - Scanning for maximum signal no longer required.
  - Automatically aligned within the work coil for reproducible results.
  - Avoids torch melts.

Torch Loader



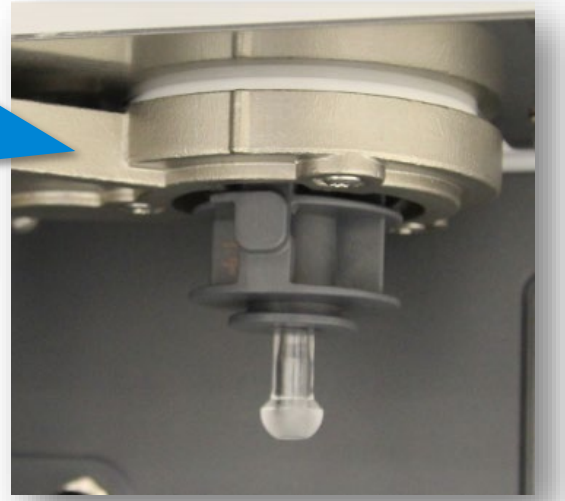
The torch loader aligns the torch with the pre-optics and RF box to ensure the injector position is correct.

Loading The Torch

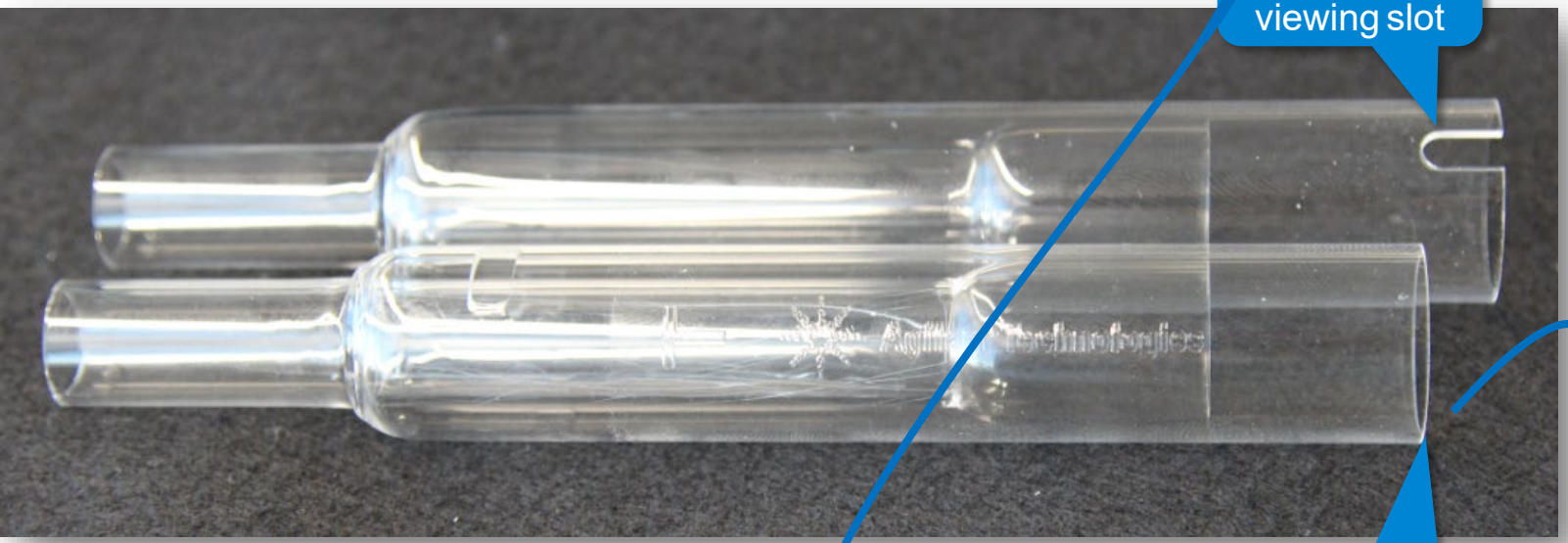


Rubber ring retains torch until handle closed

Torch remains in place even with handle open



Torch Outers



The torch outer and intermediate tube are one part.

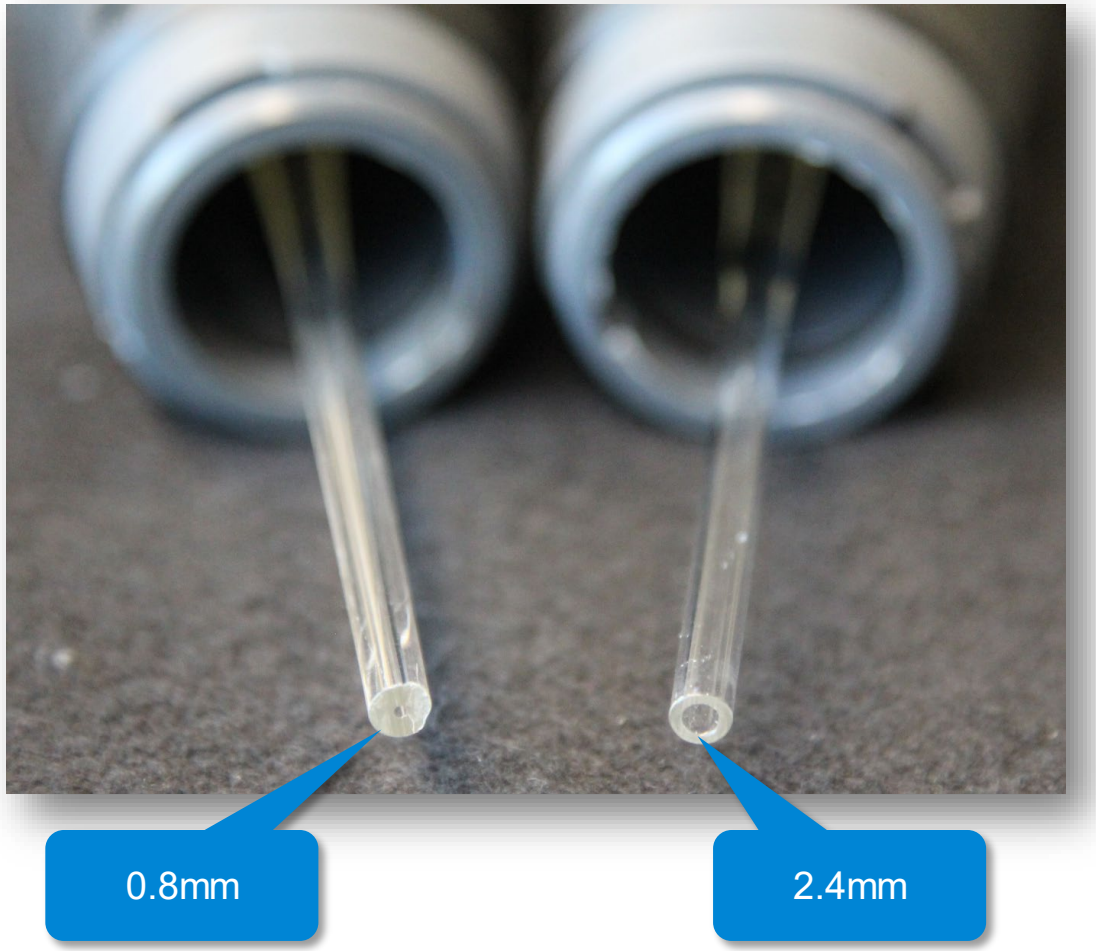
Standard torch is fully bonded and not removable.

Semi demountable torch is available.

There is to types:

- Dual view with radial slot.
- Radial

Torch injectors



Injector Dia.	Setback*	Use/Application
2.4mm	0.5mm	Dual View
1.8mm	0.5mm	Dual View
1.4mm	0.5mm	Radial
1.4mm	2.0mm	Organics
0.8mm	2.0mm	Volatile organics

*Setback is distance from the intermediate tube (injector tube to intermediate tube)

All injectors can be used with either radial or dual view outer tubes.

Injector is bonded to torch base and not removable. This is required for injector position

One Piece Torch

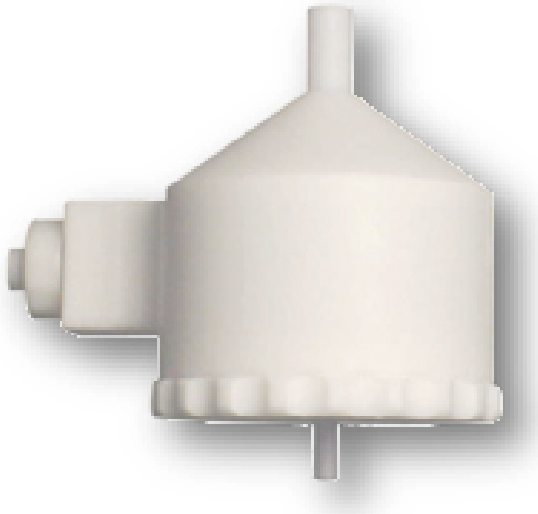
The standard torch will be a one piece torch where the outer tubes are not removable.

One Piece torches have black ring at the top of the torch base.

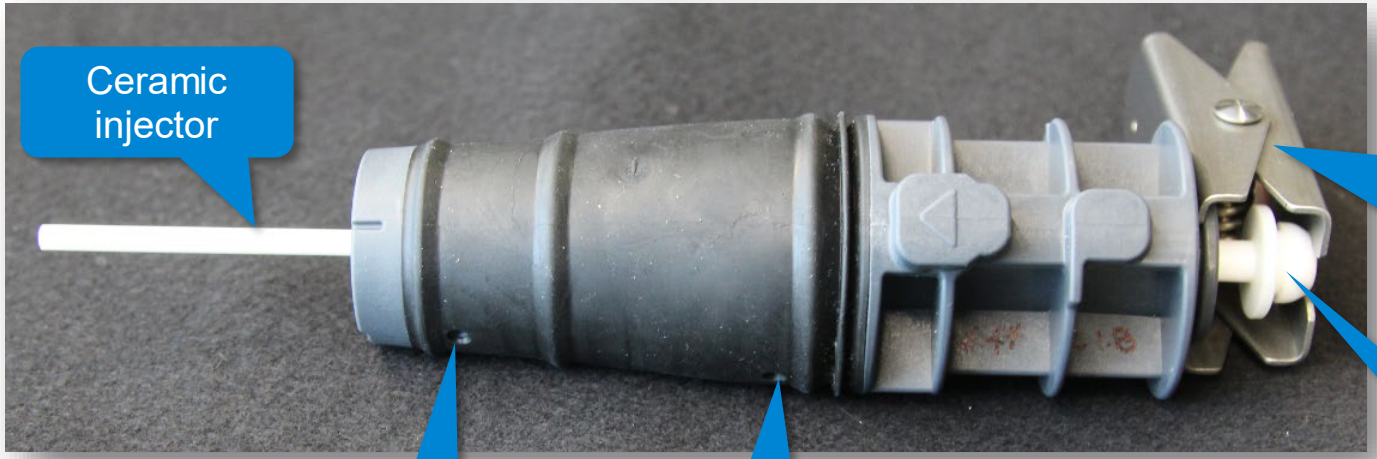
SVDV-VDV 1.8mm Injector

Radial 1.4mm Injector

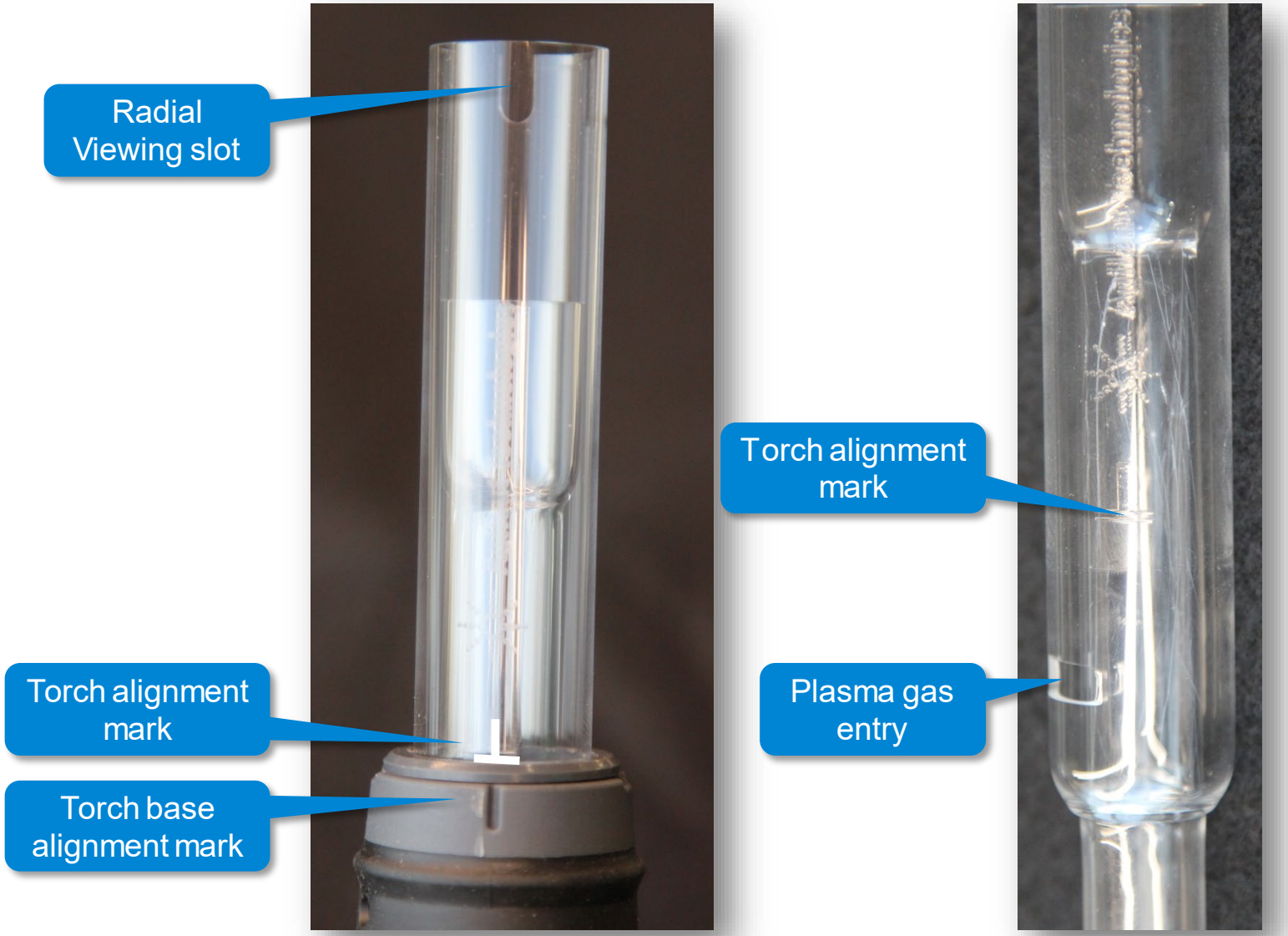
Inert System (for HF)



Inert cyclonic spray chamber with OneNeb



Assembling The Torch

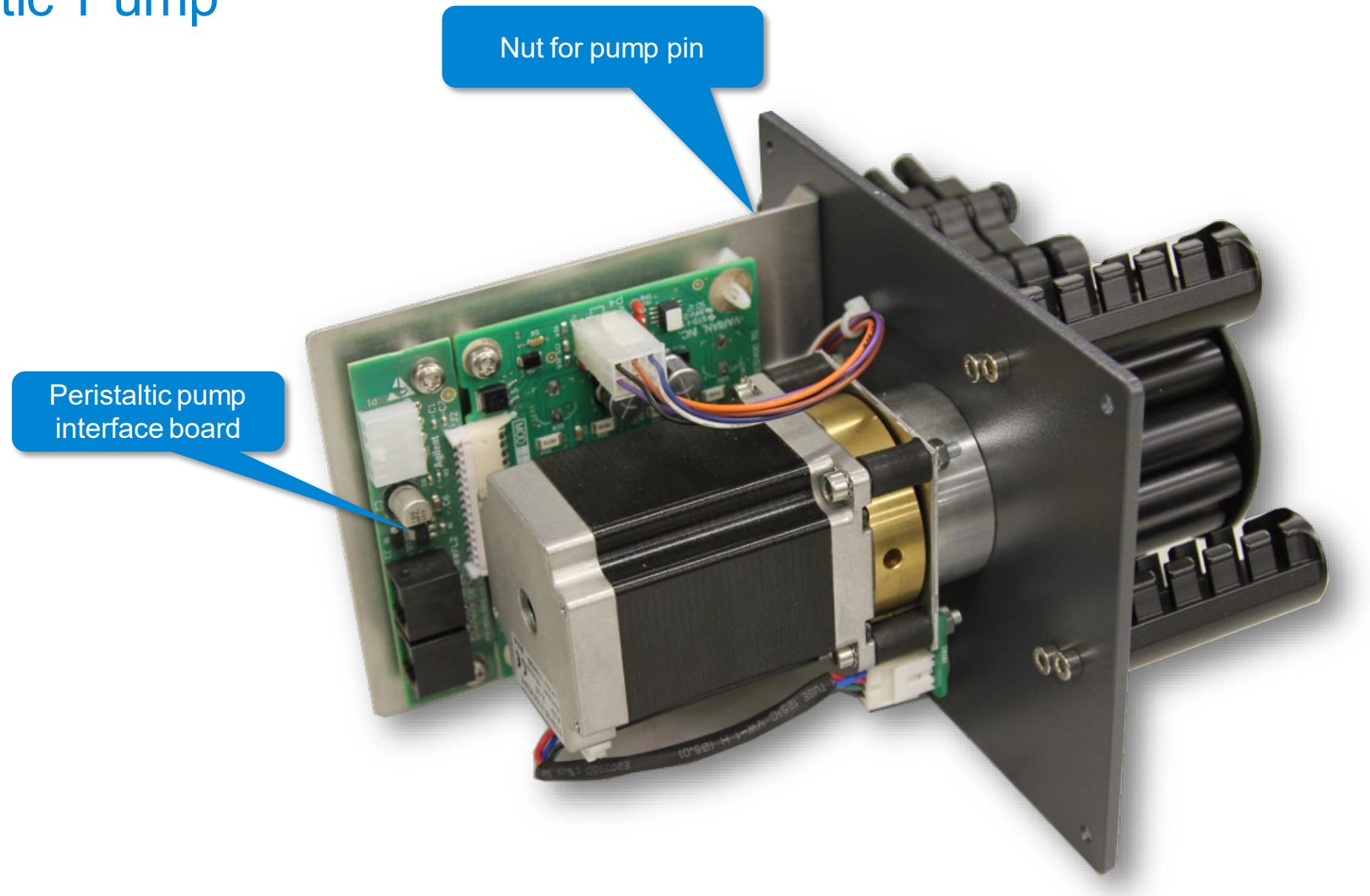


When reassembling the torch it is important to align so that:

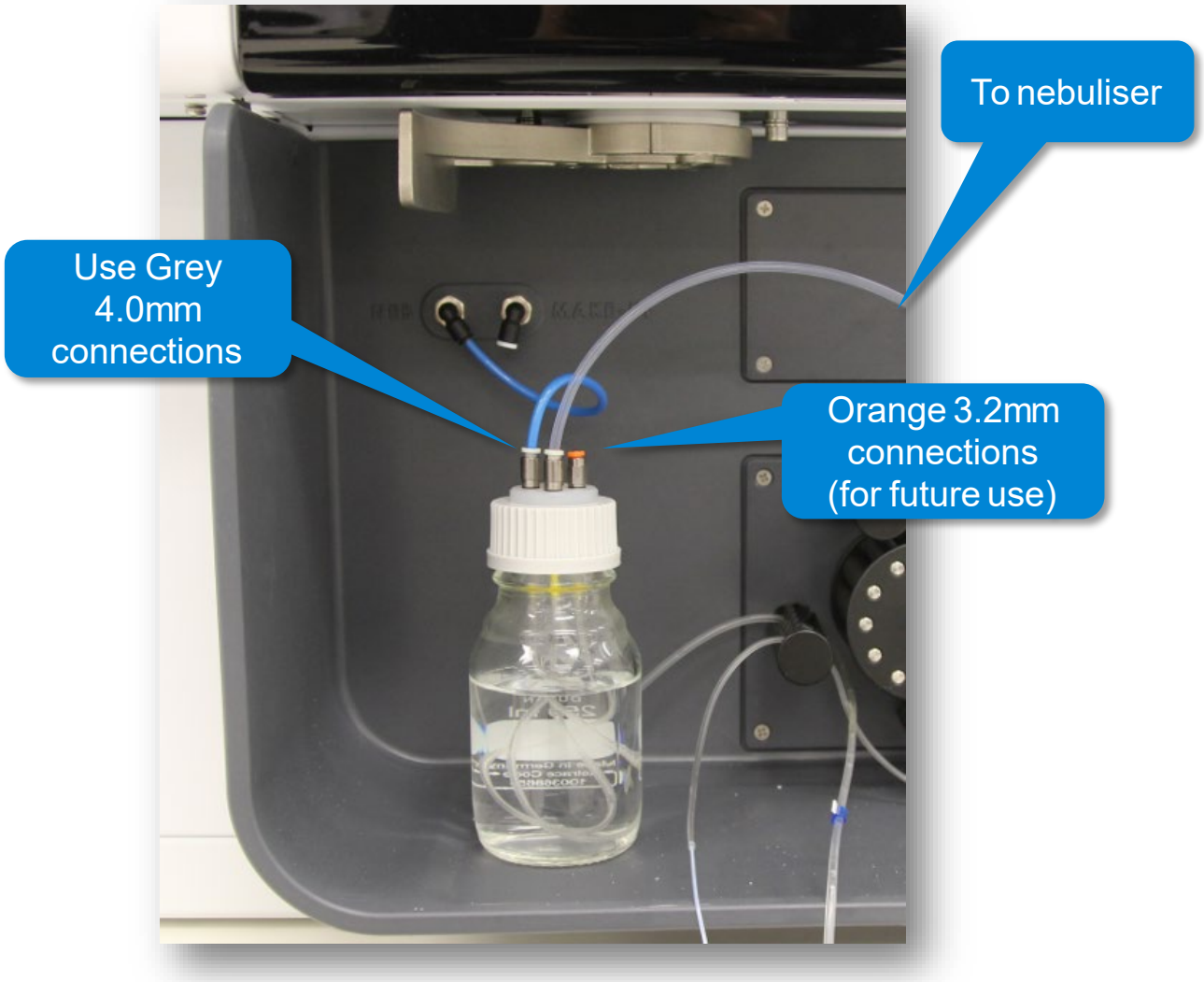
a) The radial viewing slot on the axial torch aligns with the snout.

b) The plasma gas entry is aligned with the base to ensure correct tangential flow.

Peristaltic Pump



New Argon Humidifier Assembly (AHA)



Uses semi permeable membrane rather than bubbler.

Used with high salt samples to avoid blockages.

Partially fill bottle with DI water.

Note: droplets of water may be present inside the tubing, this is normal and does not indicate a problem

ICP System Readiness

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5800 ICP-OES

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ICP-MS

Top 5 tips to ensure ICP-MS performance

The main time robber in an ICP-MS lab is **unplanned maintenance**.

1. Change your **pump tubing**
2. Prevent **nebulizer blockage**
3. Keep it clean: **Torch** and **Spraychamber**

4. Pay attention to the **interface cones** and **lenses**
5. Take advantage of **Mass Hunter Maintenance** tools

Proactively replace lab consumables before you see performance issues.

ICP-MS

1

Change your pump tubing

Drain tubing 1.52 mm ID
Agilent P/N G1833-65570

Sample tubing 1.02 mm ID
Agilent P/N G1833-65569

Tubing diameters

- Waste to be larger ID than sample ID

Chemical compatibility

- Ensure tubing is resistant to the solvent being used

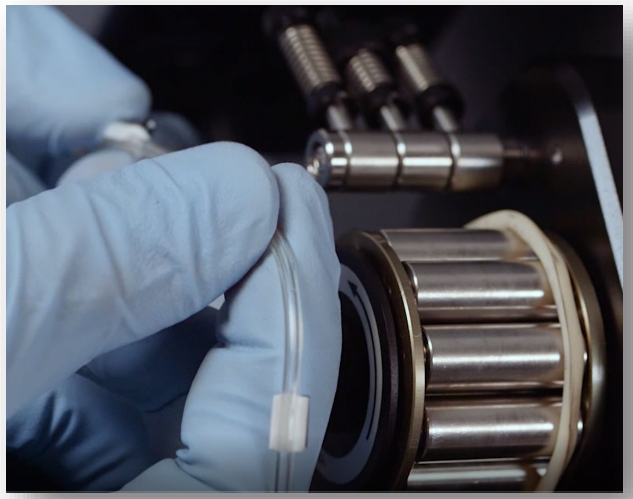
Replace frequently

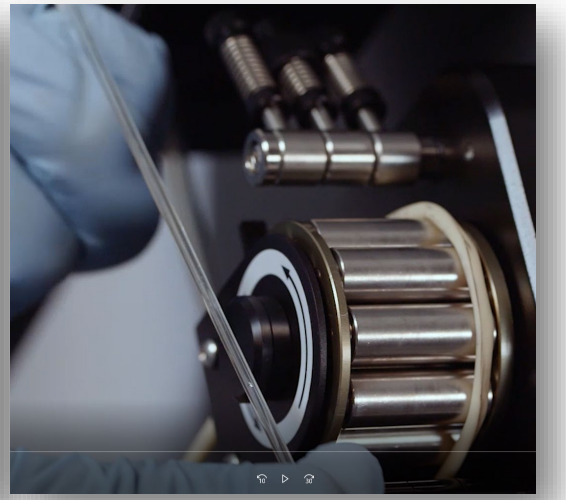
- Pre-clean new tubing to remove potential contamination
- Using “old” tubing can lead to problems with precision and stability
  - Can also contribute to nebulizer blockage (if inside lining breaks down)
- Typical lifetime is ~5 days based on normal 8 hour working day
  - Detach from tube holder after use – allows tube to “relax”

Maintaining tubes – What to check?

- Check 2 key things on pump tubing
  - Roundness of tube – should not be any “flat” spots
  - Tubing should still be elastic – replace if obviously stretched
- Don’t over tighten – just need smooth and even sample flow

Remember to check other tubing for wear, leaks and crimps





Cleaning the Nebulizer

Symptoms
Low sensitivity
Poor stability

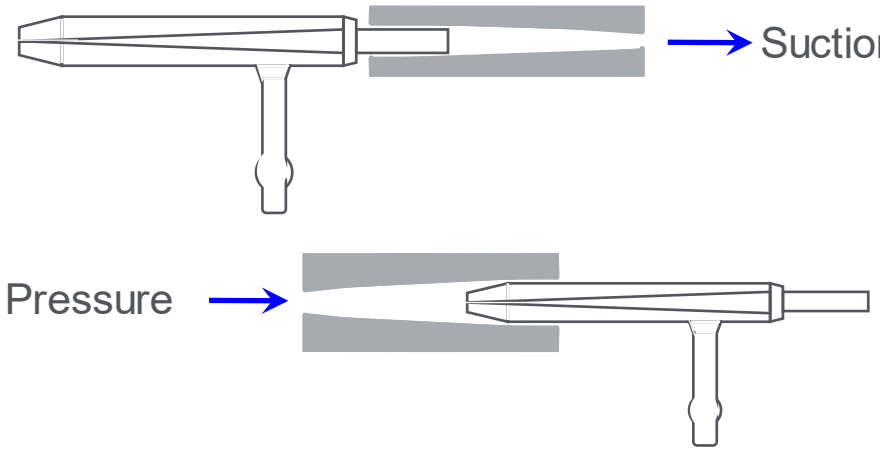
Never sonicate or attempt to clean with wire

For normal cleaning:

- Soak in 5% nitric acid for ~10 mins.

To remove a nebulizer blockage:

- Use a dedicated nebulizer cleaning tool to force methanol solution through the tip; OR
- Reverse pump the nebulizer with the tip in solvent; OR
- Apply suction from the wide end of the capillary using a vacuum aspirator; OR
- Apply high pressure clean air via a tubing snugly fitted over the nebulizer tip (use with caution)

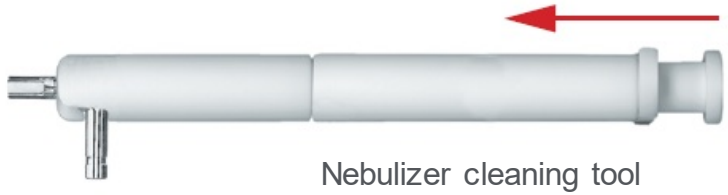


For salt deposits:

- Soak the nebulizer overnight in a beaker of 25% alkaline lab detergent. Rinse with pure water.

For “stubborn” deposits:

- Soak the nebulizer overnight in conc. nitric acid. Use a pipette to ensure there are no air bubbles in capillary. Rinse with pure water.



Nebulizer cleaning tool
Agilent pn G3266-80020

https://www.agilent.com/en/products/lab-supplies/nebulizertips

http://www.agilent.com/en-us/promotions/icp-ms-resource

3

Keep it clean
Spray Chamber

Routine cleaning:

- Soak the end cap and spray chamber in **5% nitric acid** or Citranox for >30 mins
- Rinse, dry and refit

If you see precision problems or droplet formation on the walls of the spray chamber (beading):

- Soak overnight in a 25% detergent solution
  - Best to leave it soaking for 24 hours
  - Use any laboratory detergent
    e.g. **Fluka RBS25**, **Triton X-100**, **Decon 90** etc.

Cleaning the Torch

Visually check the torch, bonnet and shield when removing the torch

- Replace if deformed or chipped

⚠ **Do not sonicate!**

For routine cleaning:

- Soak in >5% nitric acid for ~30 mins

For more stubborn stains:

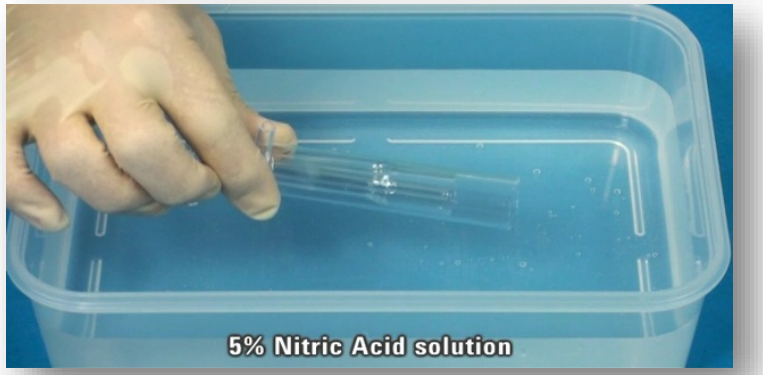
- Soak in bleach (e.g. Chlorox ©) overnight
- Soak in aqua regia (1:3 HNO_3:HCl)

For salt deposits:

- Rinse with water to remove deposits
- Soak the torch overnight in a beaker of 25% Fluka RBS-25 detergent

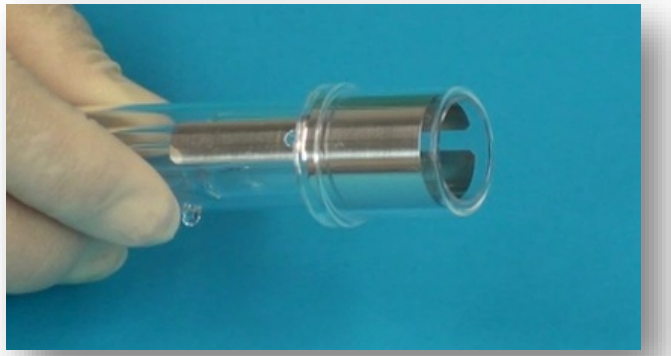
Rinse and allow to dry

⚠ **Caution! Reinstall only when dry**



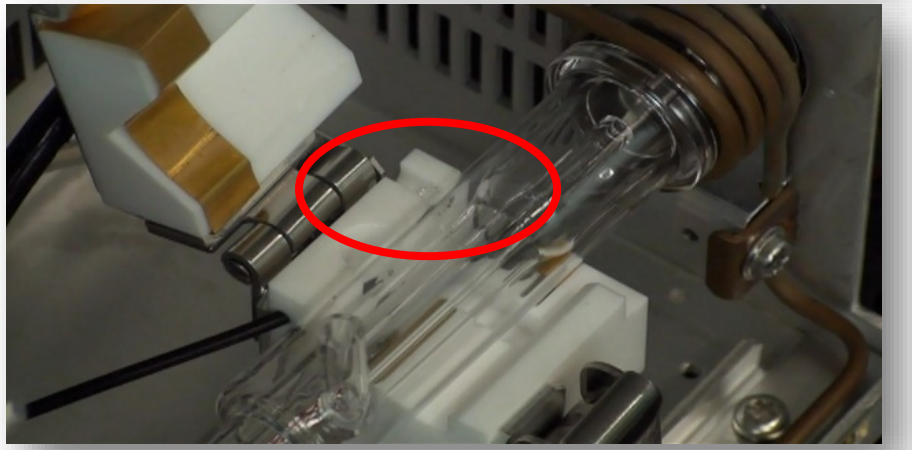
Torch damage due to incomplete drying

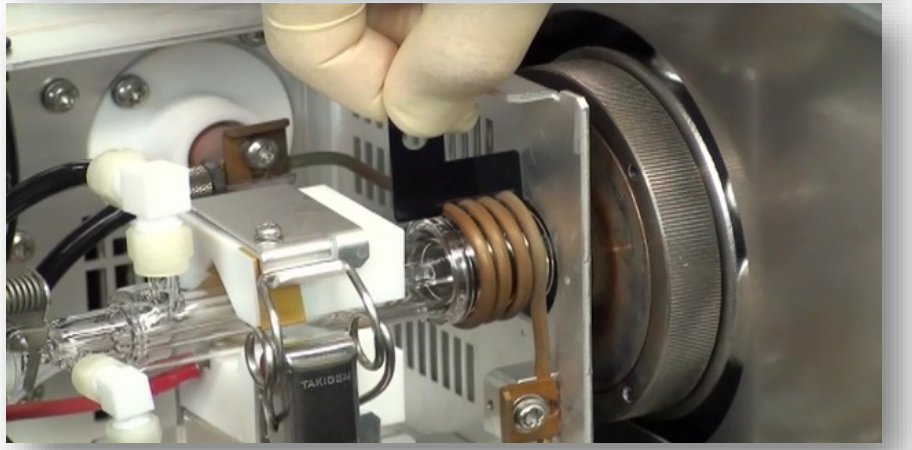
Re-installing the Torch



1. Refit the torch shield and torch bonnet.
2. Replace the torch into the torch holder.
3. Ensure the torch projection fits into the slot on the torch holder.
4. Can check the alignment of the RF coil when re-installing the torch.
5. Reconnect gas fittings and transfer tube from spray chamber.
6. Check torch alignment – esp. sampling depth (z position).
7. Test plasma ignites and instrument switches to “analysis” mode.

   If plasma fails to ignite, check all connections for possible air leaks





ICP-MS

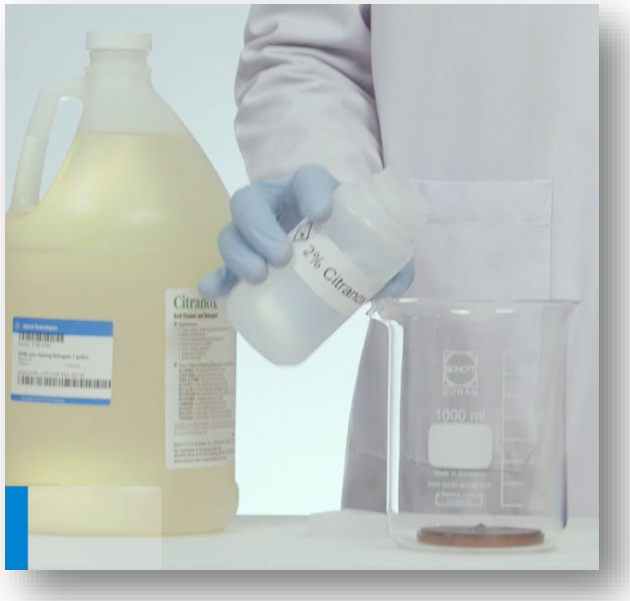
4

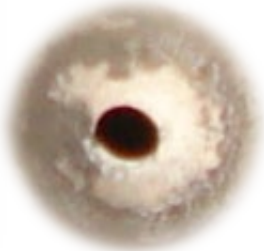
What's the Right Way to Clean Interface Cones?

Routine Cleaning:

Simple clean with **pure water**

- Dip a cotton swab (**pn 9300-2574**) in pure water and clean both sides of the cone
- Rinse with pure water
- Ultrasonicate the cones in pure water for >5 mins (typ. 20 mins)
- Repeat as required (aim for water to stay clean)





Only if performance is still not satisfactory, clean with a **2% Citranox** solution (**pn 5188-5359**)
(NOT MORE THAN 2%)

- Ultrasonicate in a 2% Citranox solution for max. 2-3 mins
- Rinse with pure water
- Ultrasonicate in pure water for >5 mins

http://www.agilent.com/en-us/promotions/icp-ms-resource

4

What's the Right Way to Clean Interface Cones?

ONLY for more severe contamination:

Clean with a 2% nitric acid solution

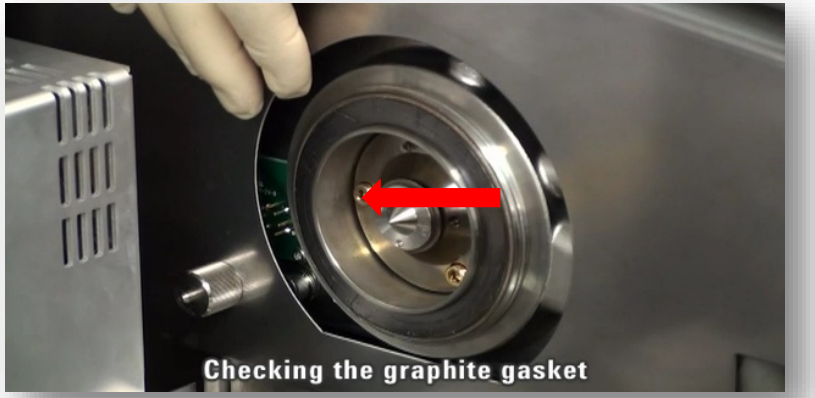
- Dip a cotton swab in 2% HNO_3 and clean both sides of the cone **(DO NOT SOAK IN ACID)**
- Rinse with pure water
- Ultrasonicate in pure water for 2 - 3 mins
- Rinse with pure water
- Ultrasonicate again in pure water for an additional 2 - 3 mins

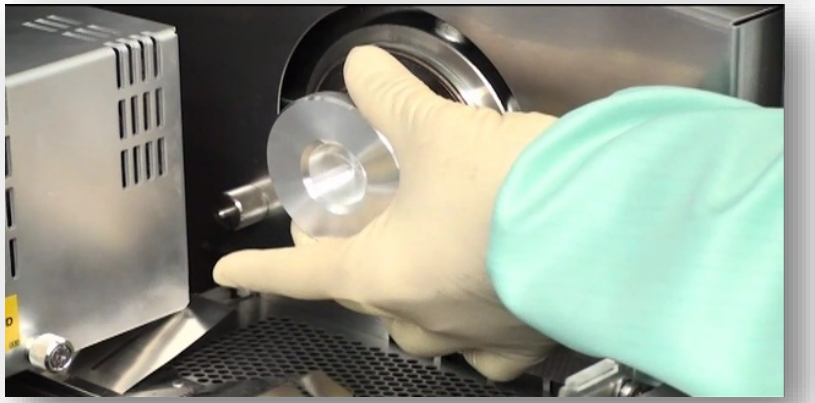
⚠ The cones must not be stored in pure water for more than 30 minutes or they will become damaged by corrosion.

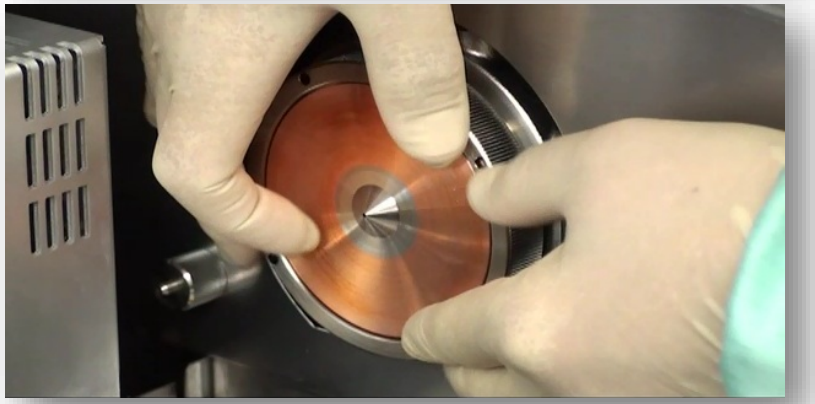
.

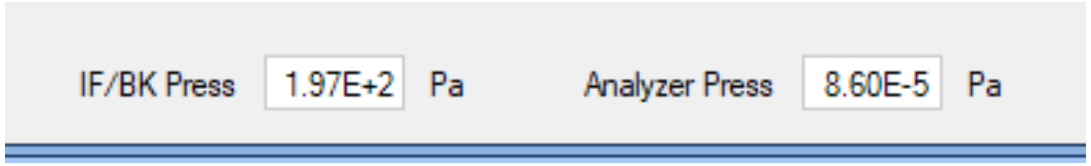
Re-installing the Cleaned Cones

- Check the condition of the graphite gasket and replace if necessary
- Refit the skimmer cone using the removal tool
- Refit the sample cone and tighten by hand
- Check the vacuum levels to confirm correct installation
  - Interface pressure: ~500 Pa (~4 torr, 0.005 atm)
  - Analyzer pressure: ~0.002 Pa (~1.5 x10^{-5} torr, 2 x10^{-8} atm)

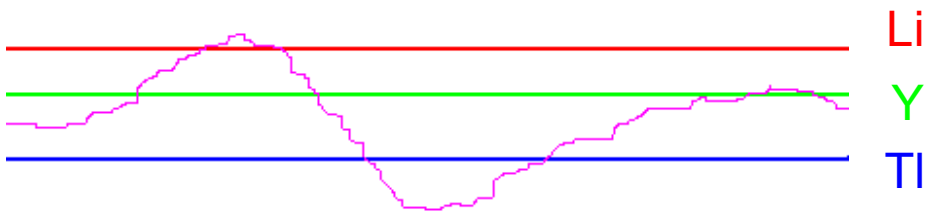








Condition Cones to reduce “Drift” (Instability) with Higher Matrix Samples



“Condition” cones prior to analysing samples with TDS > 0.5 %!

Condition new cones and cones after cleaning. Reduces drift due to initial deposition of sample matrix on the clean cone surface

Condition cones at full sensitivity with either:

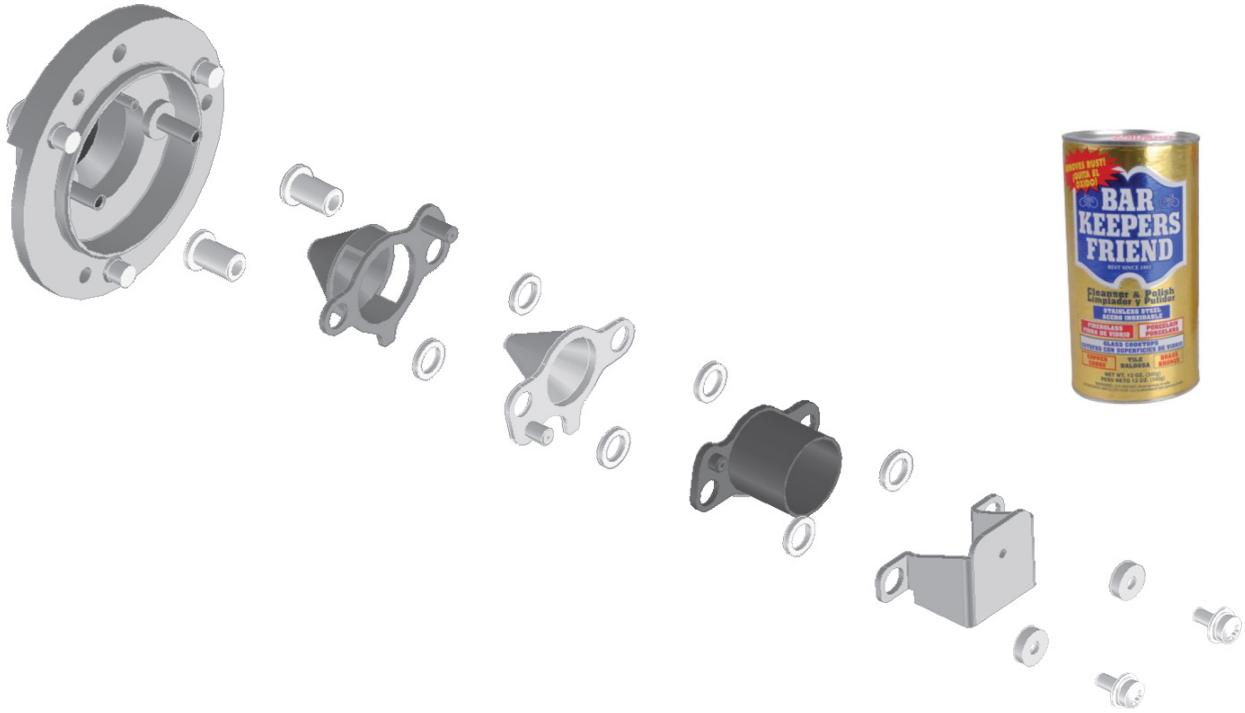
1. Tap water for ½ hour.
2. 0.3 % NaCL for 20 minutes.
3. ICSA solution diluted 10x for 20 minutes.
4. Samples.

Lens Maintenance

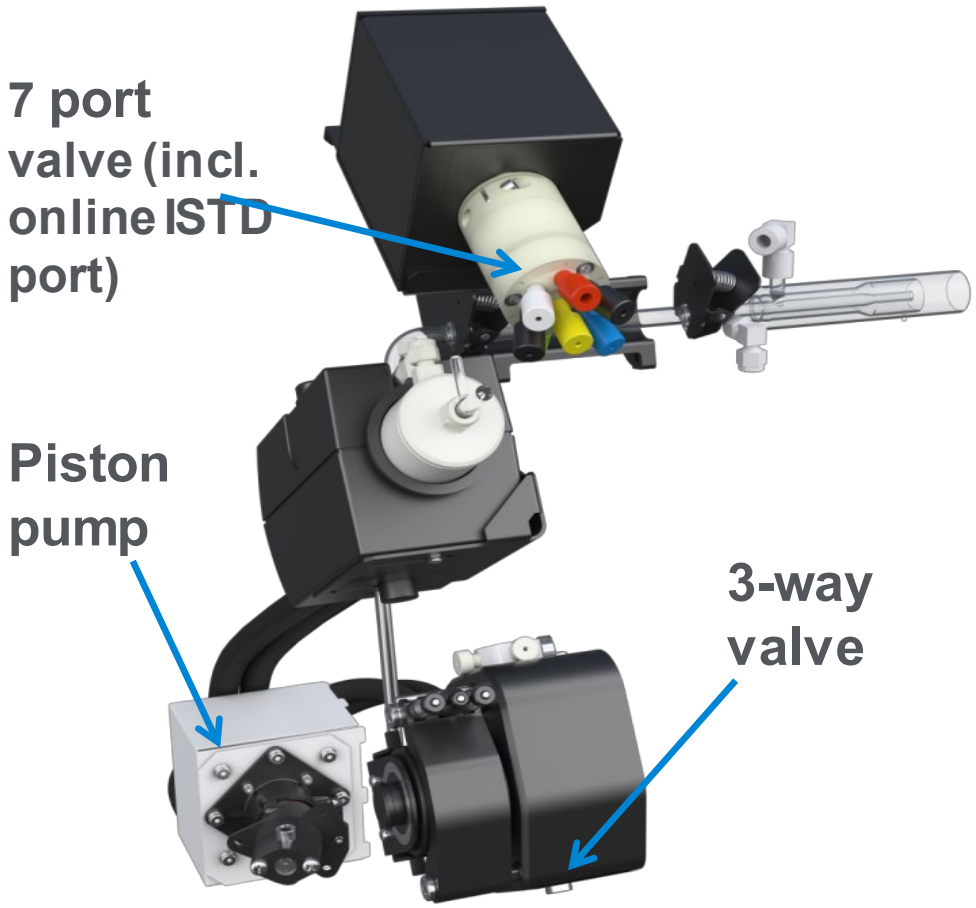
Symptoms
Low sensitivity
Poor stability

Cleaning the lens

1. Disassemble lens
2. Scrub all surfaces and orifices with Bar Keepers Friend/polishing paper
3. Rinse with tap water – **Very Important**
4. Sonicate in pure water for 5 minutes
5. Repeat sonicating in pure water 2 more times
6. Dry using clean gas – nitrogen or argon
7. Reassemble
8. Reinstall and run Lens Shortage Test



Integrated Discrete Sampling ISIS 3



For routine maintenance:

Fittings and ferrules

Check that they are not too tight and replace ferrules.

Tubing should be replace periodically.

Cell Gas Maintenance

If you have good sensitivity in nogas but little in gas mode

– Check the color indicator on the He gas filter

1. Purge cell gas
2. Check filter indicator
3. Replace filter if needed (~ 6 months for smaller ones)

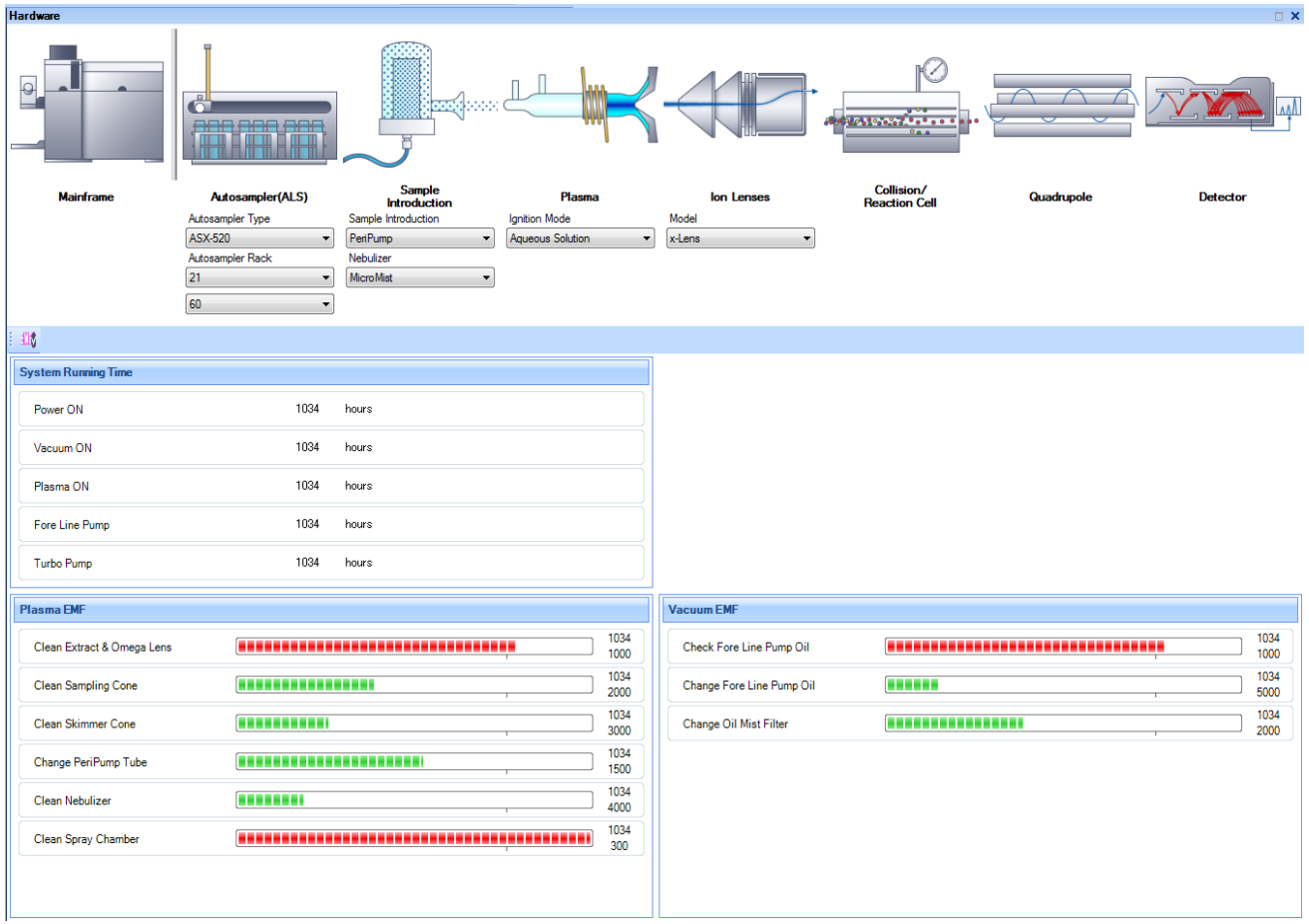
Part No. **CP17973**

5

How the ICP Mass Hunter Software can help?

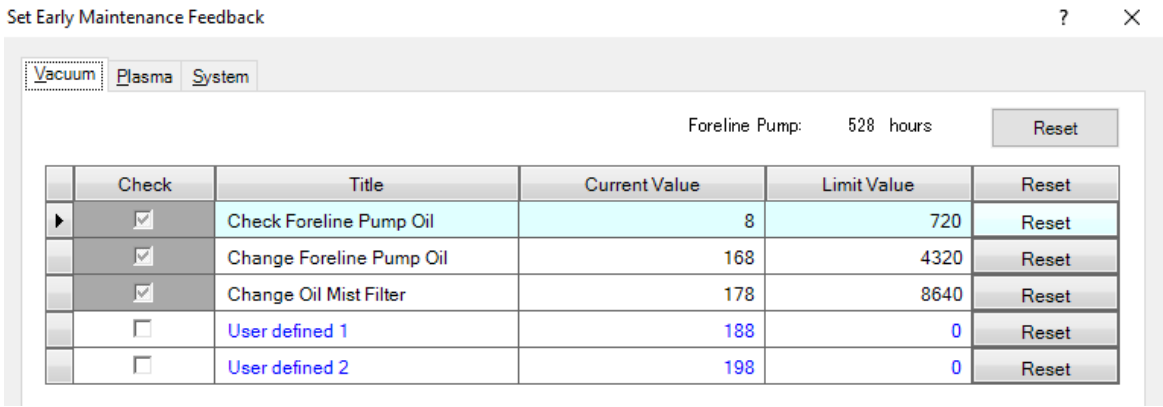
EMF (Early Maintenance Feedback)

Instrument ▶ Mainframe ▶ Early Maintenance feedback



EMF window shows usage of various components and predicts when to perform maintenance

All gauges and limit values are user definable



Check	Title	Current Value	Limit Value	Reset
☑	Check Foreline Pump Oil	8	720	Reset
☑	Change Foreline Pump Oil	168	4320	Reset
☑	Change Oil Mist Filter	178	8640	Reset
☐	User defined 1	188	0	Reset
☐	User defined 2	198	0	Reset

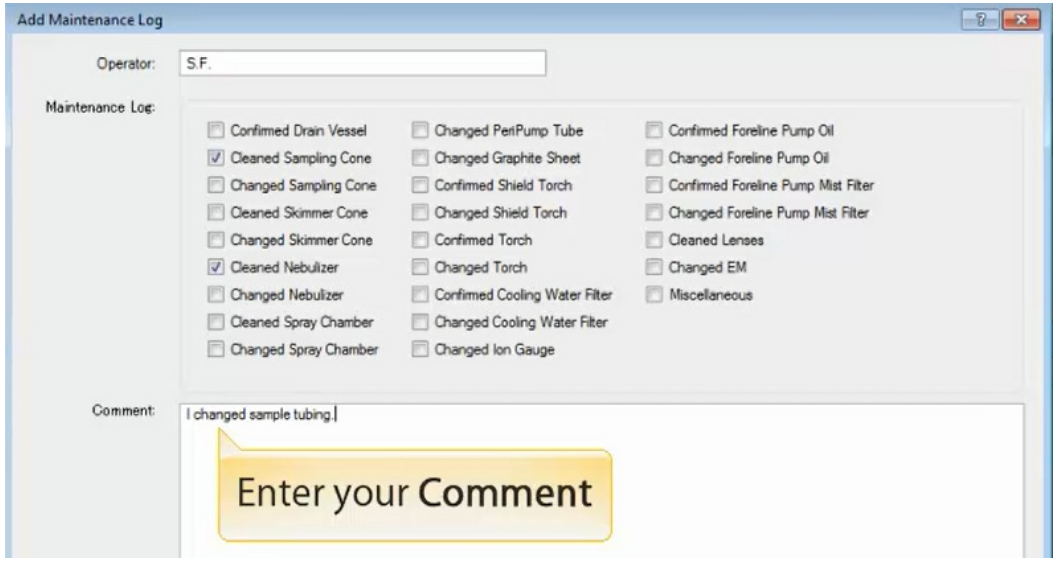
How the Agilent ICP Mass Hunter Software can help?

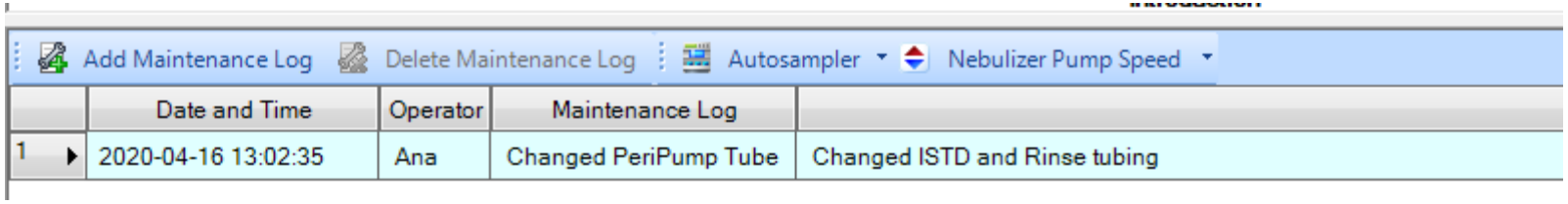
ICP-MS System Tips – User Log

Instrument ▶ Mainframe ▶ Maintenance Log

- Use the "Maintenance Log" to record routine and non routine maintenance activities

- Maintenance log can track:
  - When the maintenance activity was completed
  - Operator who completed the maintenance
  - Type of maintenance activity
  - Any operator comments





ICP-MS

ICP-MS System Optimization

Startup provides a simple, user-configured schedule of system optimization and performance checks

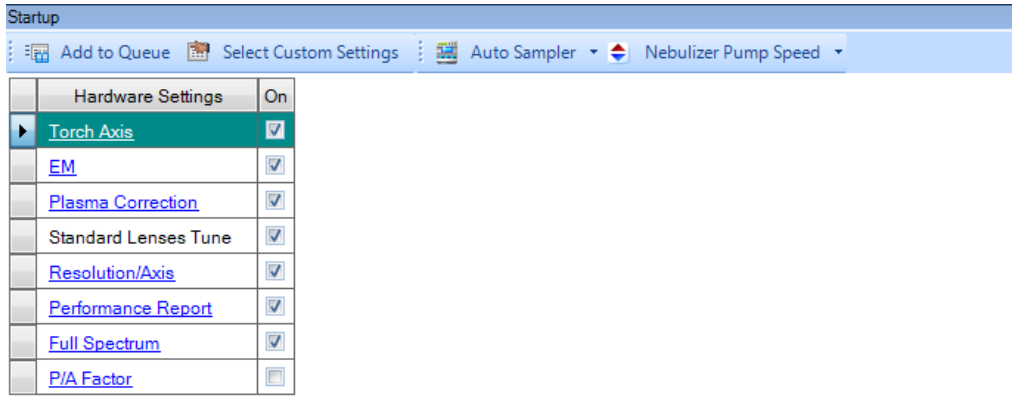
– Automatically generate a Performance Report

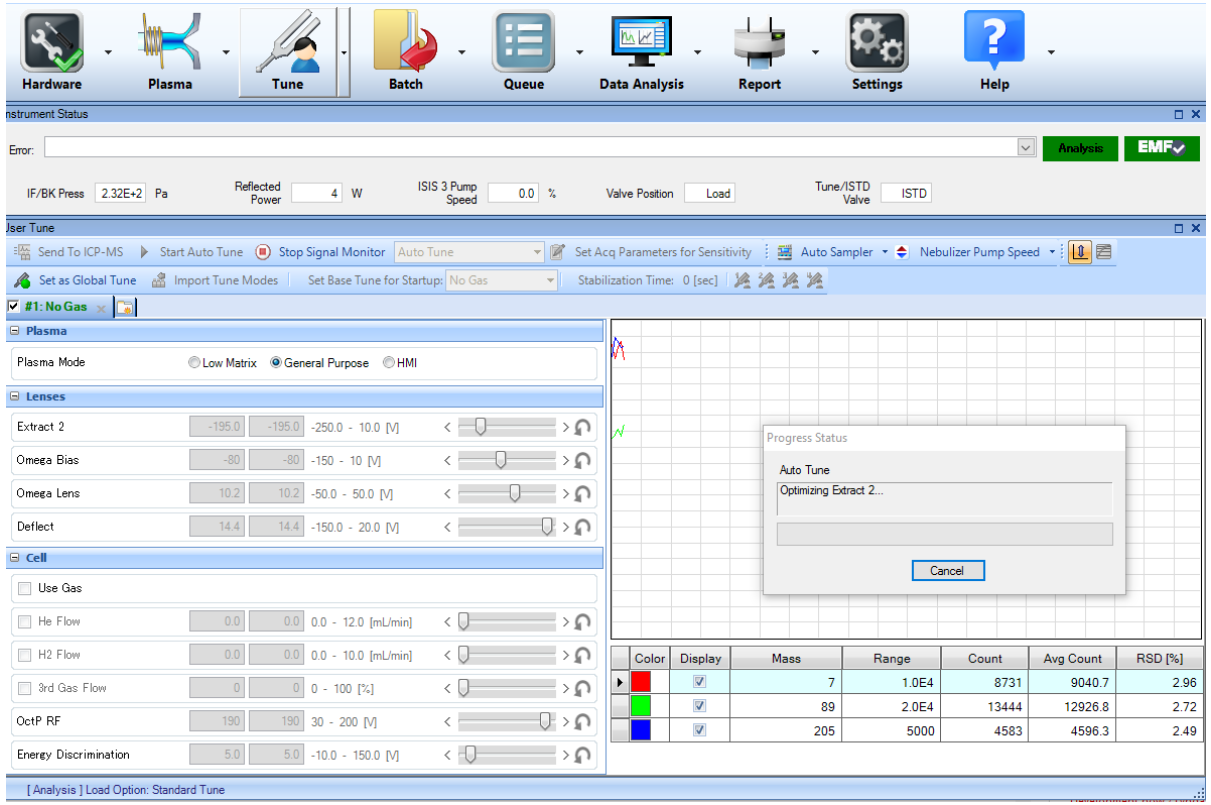
– Provides a continuing record of system performance

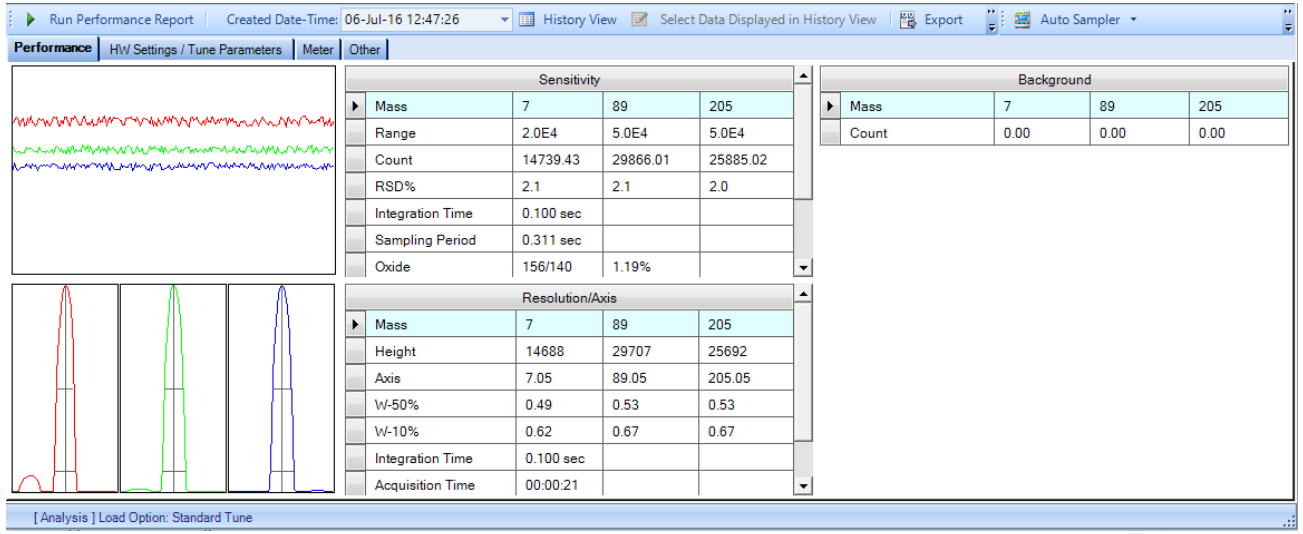
One-click expert AutoTune for simple optimization

– Ensures consistent performance from day to day

– Independent of operator experience

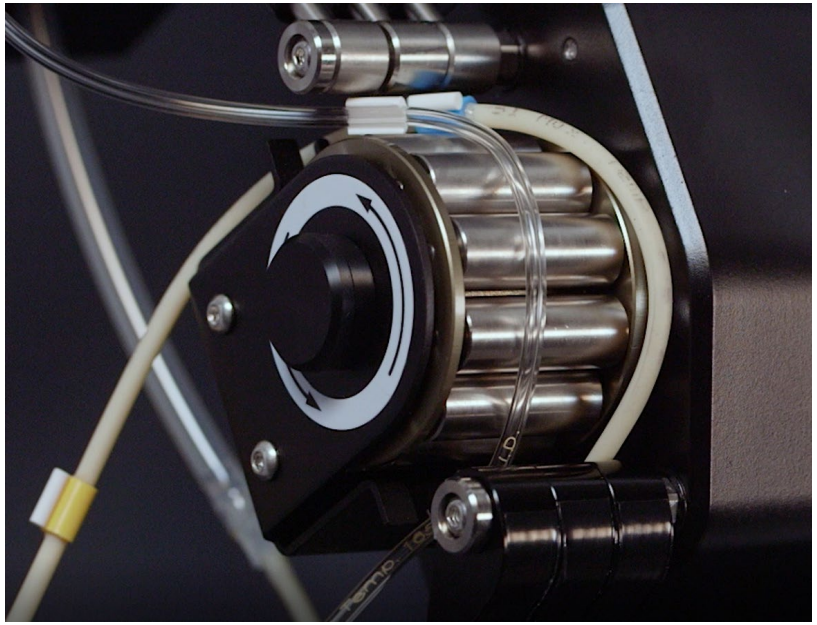






Recommended Procedures at End of the Day

1. Aspirate acid rinse solution for a few minutes before shutting off the plasma
   - Helps to prevent sample deposition inside the nebulizer after the run
2. Extinguish the plasma and switch off the chiller
3. Remove the sample capillary from the rinse, start the pump again and pump any remaining rinse solution from the spray chamber
4. Release the pressure bars on the pump tubing and remove the bridges from the securing slot
   - Ensure the tubes are no longer stretched over the pump rollers
5. Empty waste vessel
6. Close the current worksheet – leave Mass Hunter S/W running
7. Leave mains power and argon on
   - Keeps instrument in stand-by mode (ensures fastest start-up)



ICP-MS – Recommended Maintenance Schedule

Daily:

- Argon and cell gas (He, H_2, …) pressures
- Check peristaltic pump tubing for damage/deterioration
- Visual check of glassware
  (connections OK, no filling of spray chamber or connector)
- Visual inspection of sample cone exterior (orifice shape & deposition)

Frequently, as needed - perform these operations:

- Empty the drain reservoirs
- Thorough visual inspection of interface cones
- Check nebulization
- Replace peristaltic pump tubing
- Clean/replace torch
- Check recirculation water level

Frequency and extent of maintenance depends on the usage of the instrument:
this overview assumes daily use, 8 hours/day.
For systems run 24/7, more frequent maintenance is required.

ICP-MS – Recommended Maintenance Schedule on your Hardware Maintenance Manual

Table 4 Maintenance Schedule

Frequency	Component	Task/Action	Remarks
Daily (As a matter of routine, check daily before starting work and over the course of daily analysis)	Argon gas	Check argon gas pressure and volume	
	Drain vessel	Check, empty if required	Refer to note in Chapter 2, "Precautions"
	Peristaltic pump tubing	Check for damage/deterioration	
Weekly	Sampling cone, Skimmer cone	Check orifice for foreign matter, deformation and enlargement	Clean when necessary
Monthly	Foreline Pump	Check oil level and color. Check the exhaust hose from foreline pump is not damaged, not clogged, and surely connected.	
	Nebulizer	Run Nebulizer test, take appropriate action as indicated	
	Shield contact, Torch box contact plate	Clean Replace shield plate as needed	
	Cooling fluid	Check level and condition	
6 Months	Foreline Pump	Change oil (refer to page 101)	
Annually	Foreline Pump oil mist filter	Check / replace mist filter	
	Water strainer	Check and clean	
	Cooling Fluid	Replace	

Table 4 Maintenance Schedule (continued)

Frequency	Component	Task/Action	Remarks
Periodically (Maintenance frequency of these components is highly dependent on lab conditions, sample throughput, and sample type. They should be checked periodically, at least on an annual basis, and appropriate action taken)	Sample Introduction area parts: such as Spray chamber, End cap	Clean	
	Torch	Clean	Replace as needed
	Electron Multiplier	Check	Replace as needed*
	Plasma gas, auxiliary gas tubing	Check	Replace as needed
	Argon gas filter	Replace	Replace as needed
	Graphite gasket	Replace	Replace when surface or shape is damaged.
	Extraction/Omega Lenses	Check	Clean as needed (refer to page 93)
	Octopole	Replace	Replace as needed
	Cell entrance lens, Cell exit lens, Plate bias lens, Deflect lens	Clean	Clean as needed

Summary – Maintaining lab operations

Most “instrument” failures occur in the sample introduction area:

- Interface cones
- Peristaltic pump tubing
- Drain Assembly
- Torch
- Spray chamber
- Nebulizer

Improper maintenance of this area can result in poor data quality.

Establishing maintenance procedures can prevent problems.

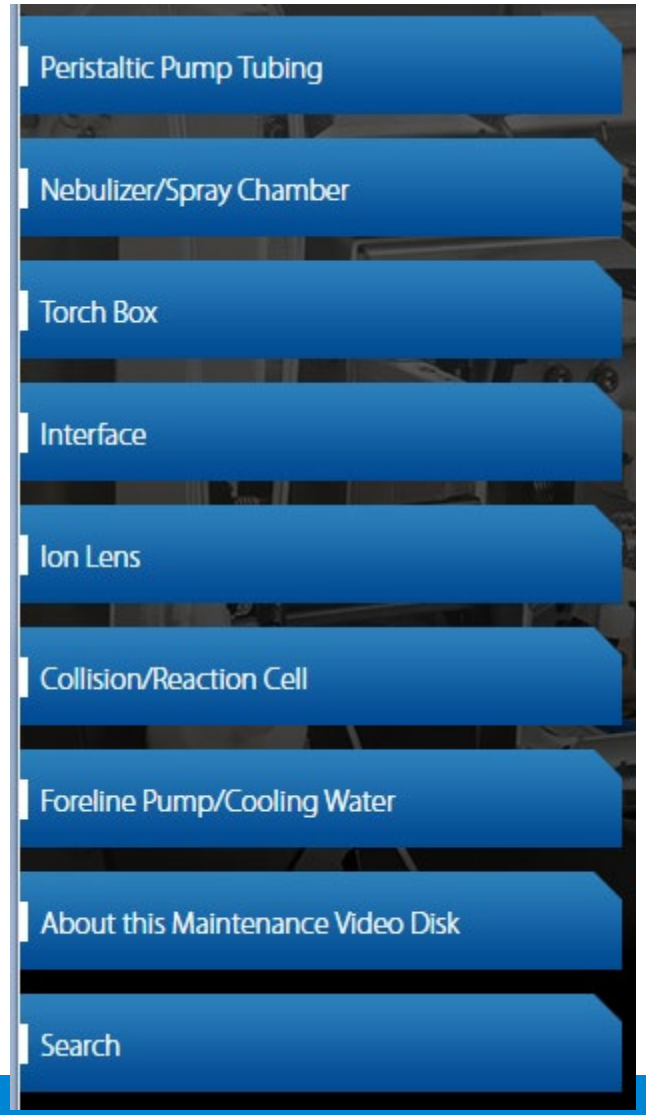
Use the smart tools in the software Mass Hunter that can help you to overcome unplanned maintenance problems:

- Early Maintenance Feedback
- Maintenance Log

ICP-MS

Other Support Resources for Agilent ICP-MS Users

Maintenance Video Disk (40 video clips for maintenance)

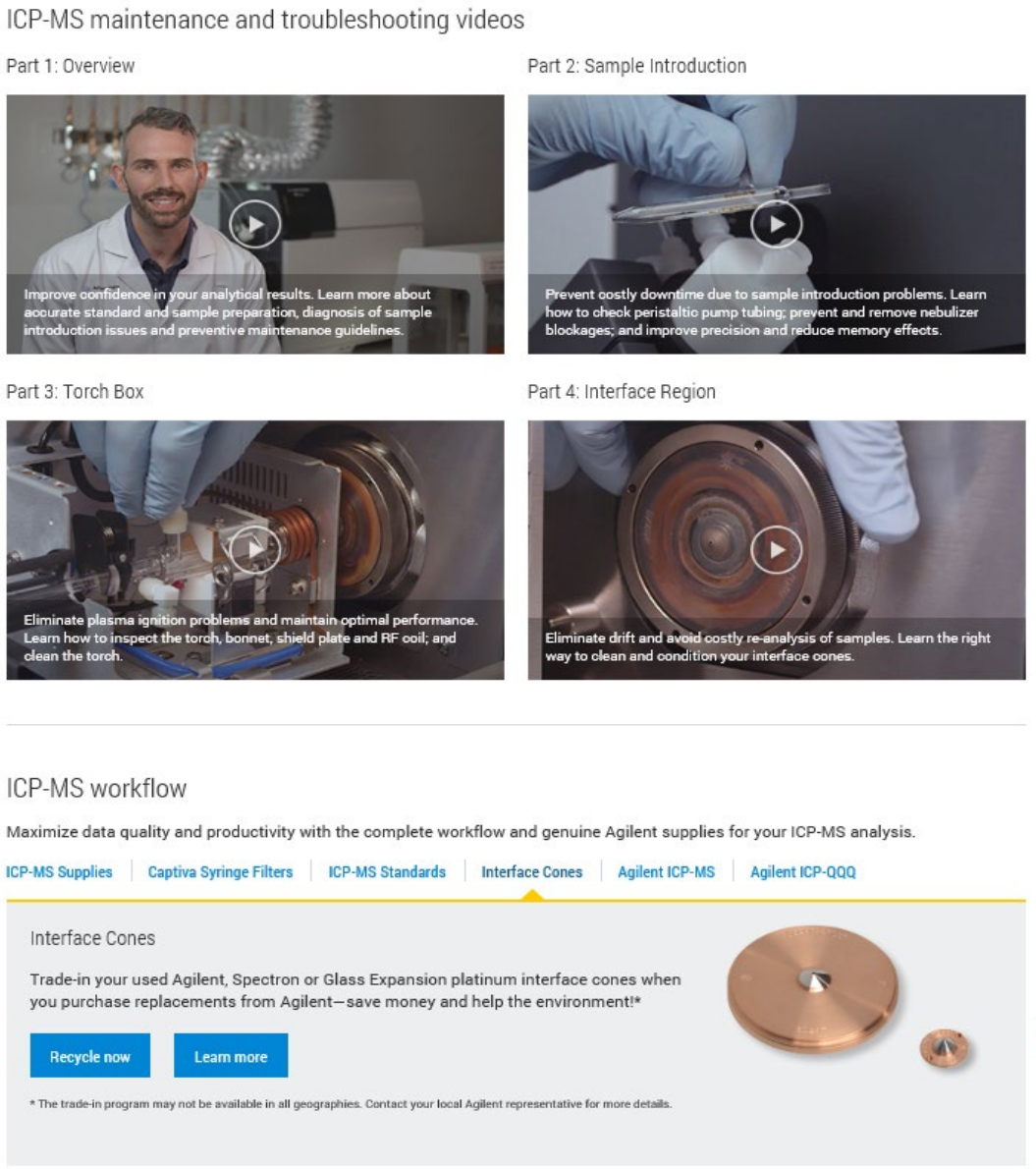


Hardware maintenance manual

Interactive troubleshooting tool for high background

Interactive troubleshooting tool for low sensitivity

Interactive troubleshooting tool for plasma ignition problem

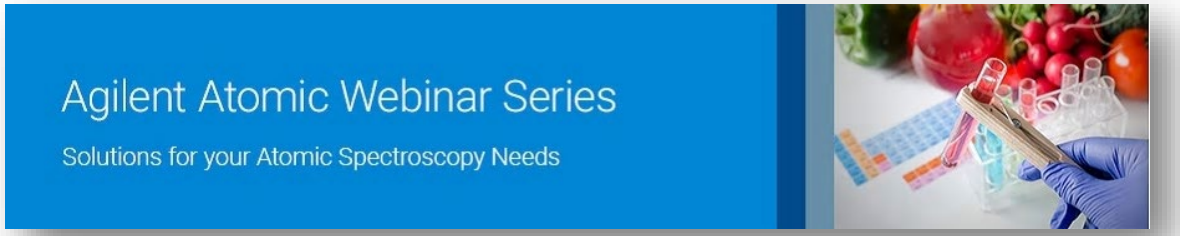


lent.com/en-us/promotions/i

Agilent

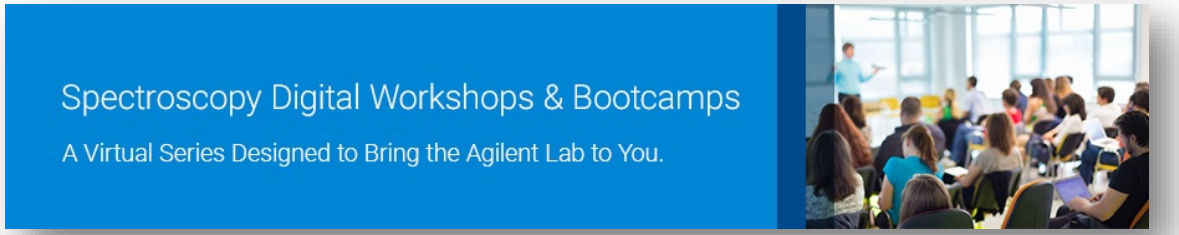
Additional online e-seminars and educational material

https://www.agilent.com/en/training-events/eseminars



https://www.agilent.com/en/training-events/eseminars/atomic-spectroscopy

https://www.agilent.com/en/training-events/eseminars/openlab2



Register here

https://www.agilent.com/en/training-events/eseminars/lc-lc-ms-column-e-seminars
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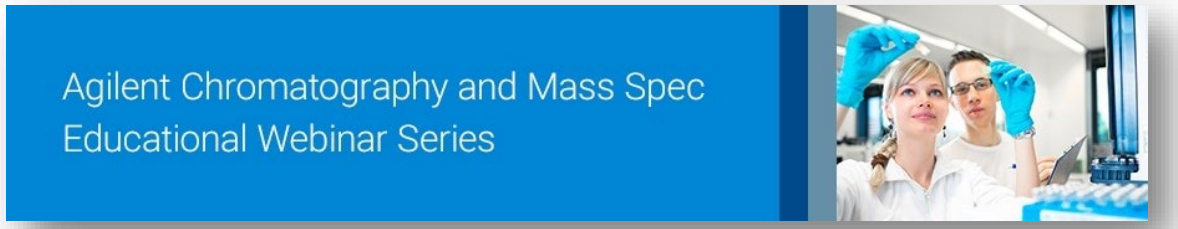

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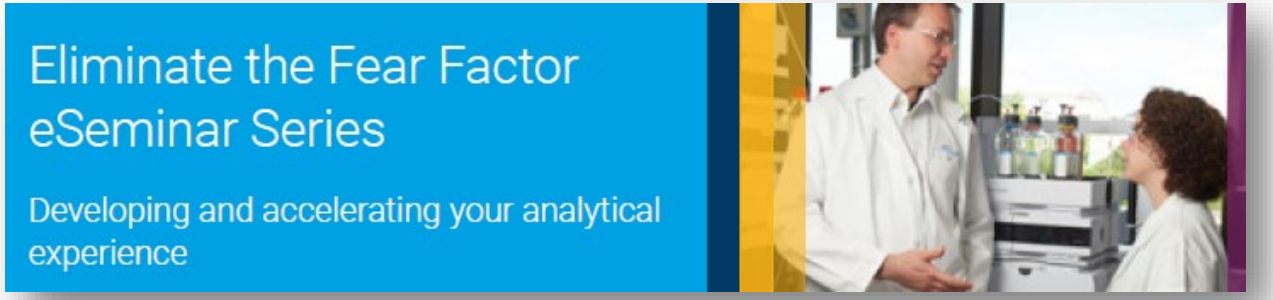

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Whether you are away from your lab or are limiting access to your lab, Agilent can support you with remote, digital solutions.

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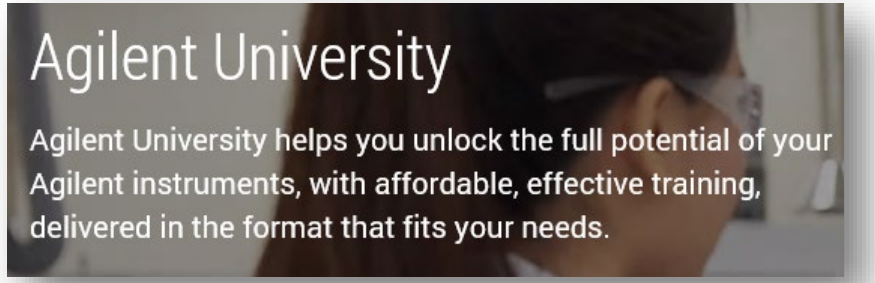

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Training without the Travel: *Virtual Instructor-led Training*

Remote Custom Training

Agilent offers customized live Instructor-led Training delivered remotely to a single customer site at a time of your choosing. For additional information, please reach out to your Regional Customer Education Coordinator team.

Virtual Instructor Led Training

Agilent has now introduced Live Instructor-led Training; delivered remotely to a group of customers covering standardized contents (https://inter.viewcentral.com/events/cust/catalog2.aspx?cid=agilent&pid=1&lid=1&app_id=3). This live e-Learning offers many of the benefits of classroom training without the need to travel.

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1-800-227-9770 Option 3, Option 3:

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Option 2 for LC/LCMS Columns and Supplies

Option 3 for Sample Preparation, Filtration and QuEChERS

Option 4 for Spectroscopy Supplies

Option 5 for Chemical Standards

800 Phone lines available 8-5 in all US time zones

Phone Tree Navigation Assistance

gc-column-support@Agilent.com

lc-column-support@agilent.com

spp-support@agilent.com

spectro-supplies-support@agilent.com

chem-standards-support@agilent.com

Additional support – Live one-on-one video conference with our service team

- Agilent Service Engineers are currently running live video conferences to remotely support labs around the world.
- To request a one-on-one video conference with one of our service engineers, please send your request through the polling survey and indicate the following:

  Name, Company, and instrumentation requiring support or questions

- We will get back to you shortly to schedule a video conference

In Summary

We at Agilent understand the restrictions and hardship many of you are going through because we're experiencing them as well

Given all that we are going through, Agilent remains a stable and continuing resource to meet and exceed your analytical measurement needs

We are open for business and here to help

Any questions?

All unanswered chat questions will be followed up post-event.

Slides will be distributed to the email address you registered with.

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Trusted Answers

Any doubts?

Paul Krampitz: paul.kramptiz@agilent.com

Ana Garcia: ana.garcia-gonzalez@agilent.com