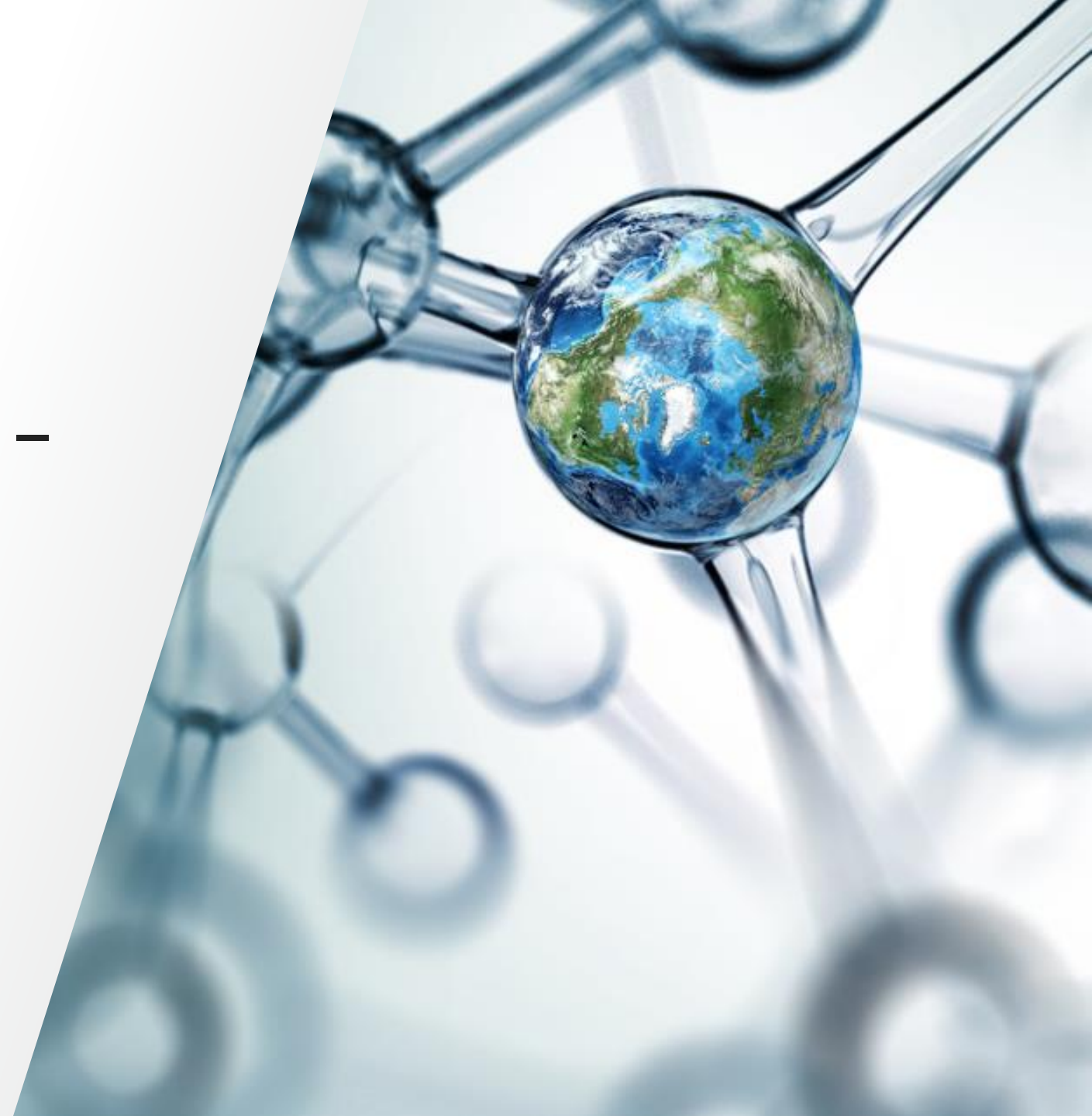# Power your elemental analysis – Get ready to transform your productivity

Weimin Yang

Sr. Application Scientist, Trace Elemental Analysis
Thermo Fisher Scientific

The world leader in serving science

Typical challenges faced by laboratories analyzing trace elements

- Highly diverse matrix samples
- Interruptions due to maintenance
- Operational complexity
- Personnel that operate several different instrument types
- Reducing environmental impact

Introducing the latest advances in ICP-MS analysis

Thermo Scientific™ iCAP™ RQplus ICP-MS

Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution (ISDS) Software

Thermo Scientific™ iSC-65 Autosampler

Building on our strengths

Ease of use

Automated Get Ready data driven, start-up process

Easy access interface door

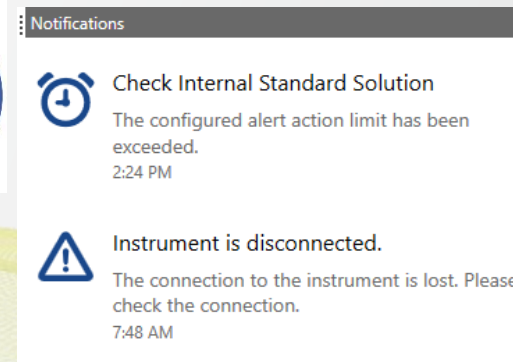Quick connect sample introduction components

High productivity

Single mode He-KED

Comprehensive interference removal

Intuitive Workflows with Qtegra ISDS Software

Reliable, robust trace elemental analysis

Removing the challenges of complex sample analysis

- Prevents decline in instrument performance due to complex samples using **Argon Gas Dilution.**

- Proactive planning of key maintenance helps optimize the instrument uptime and prevents unwanted interruptions.

- Qtegra ISDS Software workflows reduce complexity and save time.

- Features support laboratories to make decisions faster and be more agile.

Challenges associated with diverse matrix and complex samples

Instrumental drift from matrix deposition on ICP-MS interface

Impromptu cleaning that interrupts sample analysis

Need to perform offline dilution that can be prone to contamination and dilution error

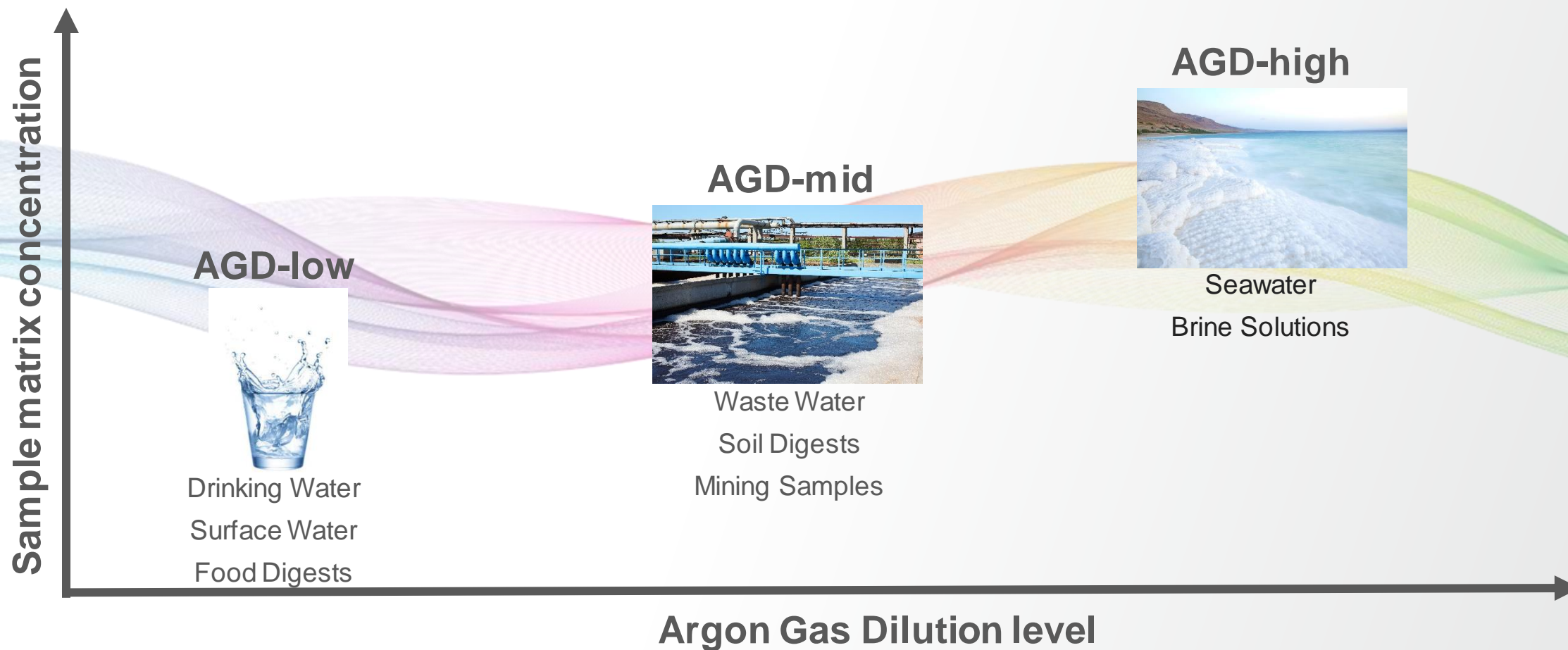# Reducing complexity for challenging sample analysis

Integrated and optimized **Argon Gas Dilution** for any sample matrix

Sample matrices	% TDS content [%]	Recommended dilution level
Drinking Water and Surface Water	< 0.5	Low
Food Digests	0.5 – 1.0	
Wastewaters	< 1.0	Mid
Soil digests, geological, and mining samples	< 1.0	
Brackish waters, fracking flowback solutions	< 1.5	
Brackish waters, sea water, brine solutions	< 3.0	High
Highly concentrated brine solutions	> 4.0	

Achieving robustness and improving productivity every day!

Reducing complexity for challenging sample analysis

Integrated and optimized **Argon Gas Dilution** for any sample matrix

Sample matrix concentration (vertical axis)

Argon Gas Dilution level (horizontal axis)

AGD-low

Drinking Water

Surface Water

Food Digests

AGD-mid

Waste Water

Soil Digests

Mining Samples

AGD-high

Seawater

Brine Solutions

Reducing complexity for challenging sample analysis

Integrated and optimized **Argon Gas Dilution** for any sample matrix

Sample introduction system component	Dilution level		
	Low	**Mid**	**High**
Glass concentric nebulizer	✓	✓	✗
Baffled cyclonic spray chamber	✓	✓	✓
2.5 mm i.d. quartz injector	✓	✓	✓
Torch (quartz, Thermo Scientific™ PLUS Torch)	✓	✓	✓
Skimmer cone insert	High matrix		
Humidifier			✓
PFA-ST microflow nebulizer			✓

Identifier	△	Dwell time (s)	Measurement mode	Resolution
7Li (KED AGD hig		0.1	KED AGD high	Normal
23Na (KED AGD		0.1	KED AGD high	High
27Al (KED AGD h		0.1	KED AGD high	Normal
45Sc (KED AGD		0.1	KED AGD high	Normal
51V (KED AGD hi		0.1	KED AGD high	Normal
52Cr (KED AGD		0.1	KED AGD low / KED AGD mid	Normal
55Mn (KED AGD		0.1	KED	Normal
56Fe (KED AGD		0.1	STD AGD high	Normal
59Co (KED AGD		0.1	STD AGD low / STD AGD mid	Normal
63Cu (KED AGD		0.1	STD	Normal
66Zn (KED AGD		0.1	KED AGD high	Normal

Reducing complexity for challenging sample analysis

Sample matrices	Typcial TDS level	Internal standard recovery [%]							
		^{45}Sc	^{73}Ge	^{89}Y	^{103}Rh	^{115}In	^{175}Lu	^{193}Ir	^{205}Tl
Food digests[1]	0.5 to 1%	98 ± 6	N/A	99 ± 5	94 ± 4	N/A	100 ± 2	N/A	97 ± 6
Drinking water[2]	0.4 %	105 ± 5	102 ± 5	N/A	N/A	102 ± 4	N/A	101 ± 4	N/A
Surface water[3] Wastewater[3]	0.4 to 1%	101 ± 5	N/A	97 ± 3	103 ± 5	N/A	103 ± 5	N/A	103 ± 5
Brackish water[3]	0.75%	107 ± 7	N/A	105 ± 6	104 ± 7	N/A	97. ± 5	N/A	91 ± 5
Saline water[3]	1.6%	94 ± 7	N/A	89 ± 8	91 ± 7	N/A	92 ± 7	N/A	85 ± 4
Brine[4]	[2.5% m/m]	101 ± 6	N/A	105 ± 6	101 ± 4	N/A	98 ± 5	N/A	N/A

Reducing complexity in instrument set-up

New **EasyClick Compact (ECC) peristaltic pump** design to support ease of use in daily operation

- Peristaltic pump is an integral part of the sample introduction system
- Tension of arms dictates the flow
- Different users adjust tension differently
- A challenge for many laboratories is adjusting the tension for the right, consistent flow

Reducing complexity in instrument set-up

New **EasyClick Compact (ECC) peristaltic pump** design to support ease of use in daily operation

- A unique design with automatic tensioning which mitigates these challenges and extends pump tubing lifetime.

- A clever pop out design provides easy access to the arm for exchanging or repositioning the tubing, regardless of the size of your hands.

Operational inefficiencies cause delays

- Unplanned downtime can cause significant disruptions in a lab
- Deviations in expected performance can be equally disruptive
- It's not always obvious when or what maintenance should be performed to keep the system running smoothly

Reducing operational inefficiencies
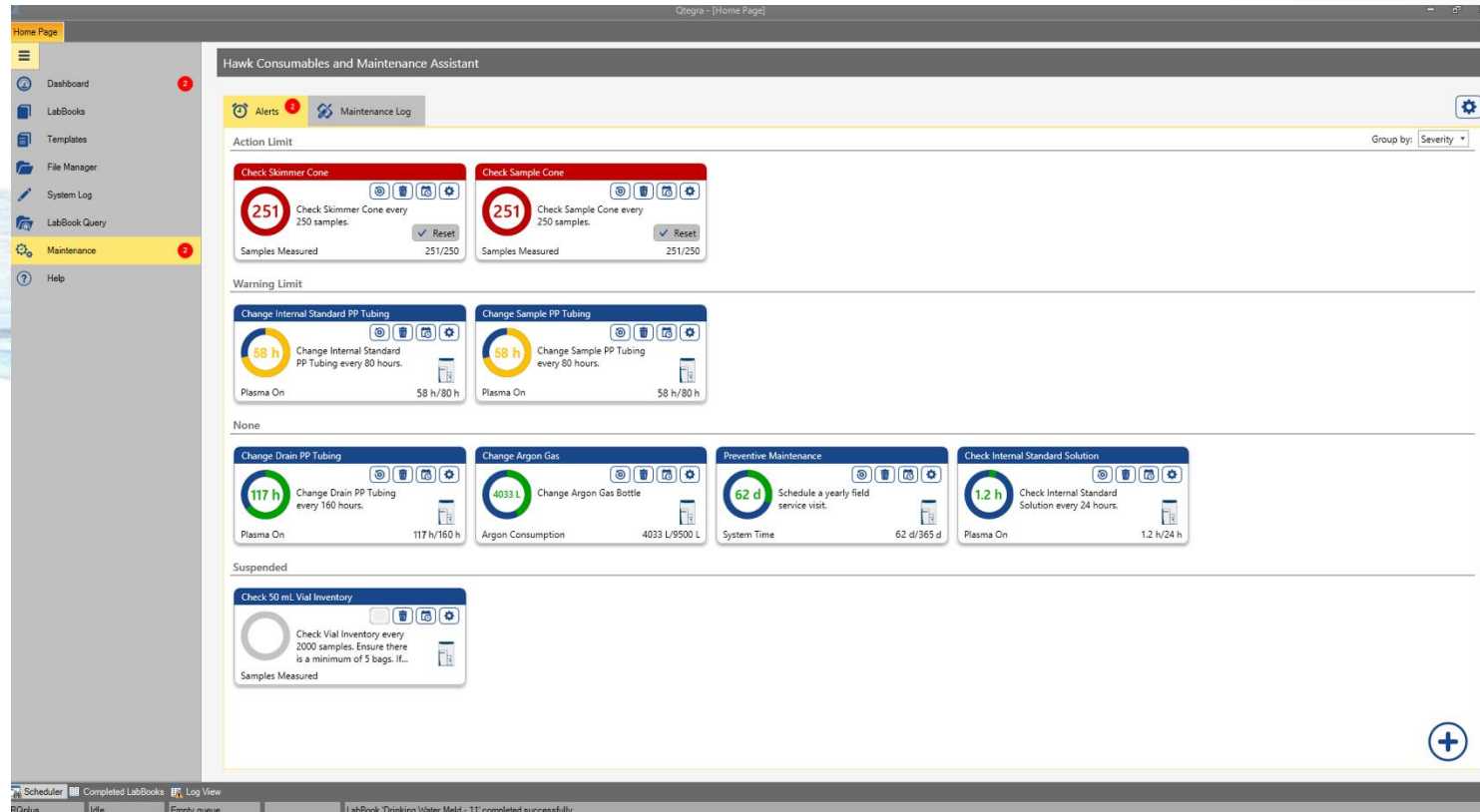
The **Thermo Scientific Hawk™ Consumables and Maintenance Assistant** supports the laboratory by keeping track and sending notifications (through Alerts) when important maintenance activities should be performed.

Check Skimmer Cone

250

Visually check skimmer cone tip for sample deposits or damage every 500 samples. Pay special attention if your daily performance is trending downwards.

Number of samples measured   250/500
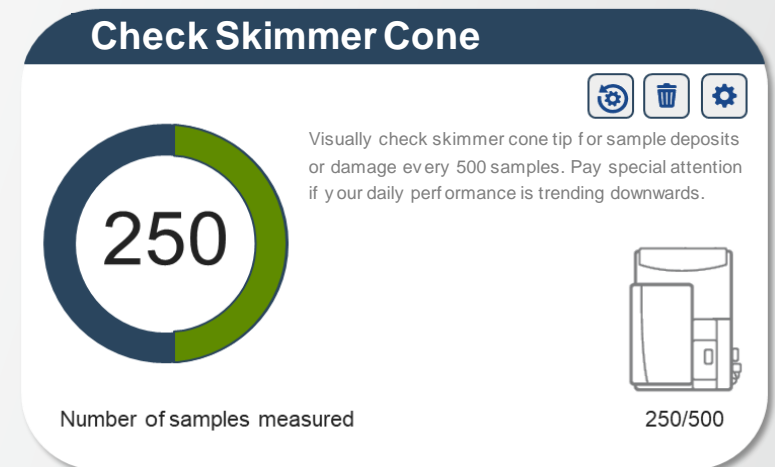
Reducing operational inefficiencies

Hawk Consumables and Maintenance Assistant

Dashboard notifications of trigger Alerts

Action limit notifications can only be cleared from this view by resetting the alert.

Warning and action notifications can be set to appear in the Notification (bottom right) section of the Dashboard.

Instrument performance monitoring

Performance reports and autotune files are collected and archived in one handy tool that makes it easier to find and plot specific performance data.

Instrument performance monitoring

Flexibility to use the alerts and performance monitoring according to the needs of the laboratory

Simply activate the default alerts provided to start leveraging the features with minimal effort.

Edit the alerts as you go according to the pace of your work and the needs of the laboratory

In a well-established testing laboratory, tailor the alerts to your specific SOPs to avoid missing or falling behind with maintenance

Leverage access control that enables lab managers to edit and create new alerts while letting operators focus on performing maintenance tasks

Use the alerts to manage general lab activities such as checking consumable inventory

Reducing complexity with iCAP RQplus ICP-MS technology

Simplified set-up and operation with accurate results

- Stability required to enable long-term analysis of varying matrices without drift, QC failures, or the need to re-run samples.

- Proactive monitoring of consumables and instrument performance prevents unplanned downtime or deviations in expected performance, making the laboratory more productive.

- Simplified workflows enable consistent and efficient analysis for all operators to ensure your laboratory meets internal or external regulatory requirements.

Power your productivity with the Thermo Scientific iSC-65 autosampler

Automation that accelerates elemental sample throughput with total confidence

# The iSC-65 autosampler: Your workflow's perfect partner

- Full support of the range of tube racks required current workflows.

- Variable sample depth on a per vial basis.

- A capped single feed rinse station to ensure minimal contamination.

- Dedicated dual channel rinse pump with cartridge mounted chemical resistant tubing.

Thermo Scientific iSC-65 autosampler – key features

Hardware and software advance in sample introduction
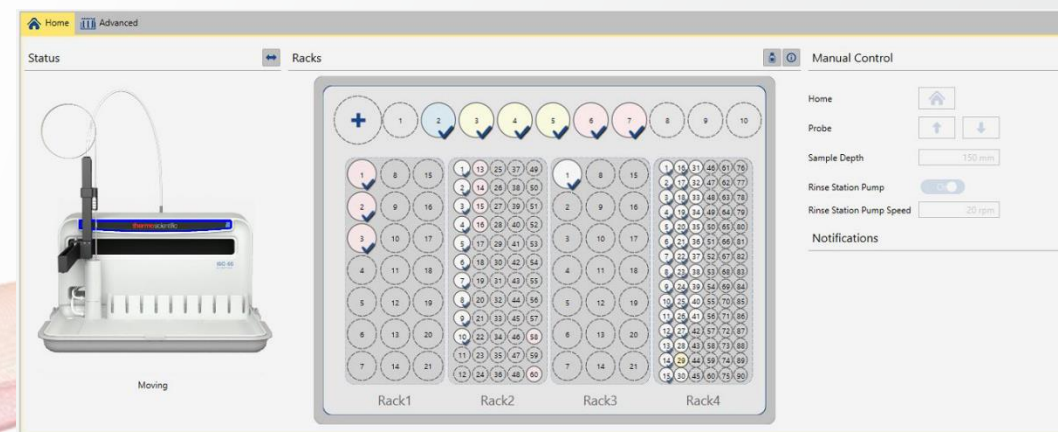
- Obstruction detection in all three axes
- Ethernet connectivity
- Easier operation through full integration and unique features within Qtegra ISDS Software
- LED status feedback on the complete workflow
  - Green (solid) – no action required, system is online and ready to run
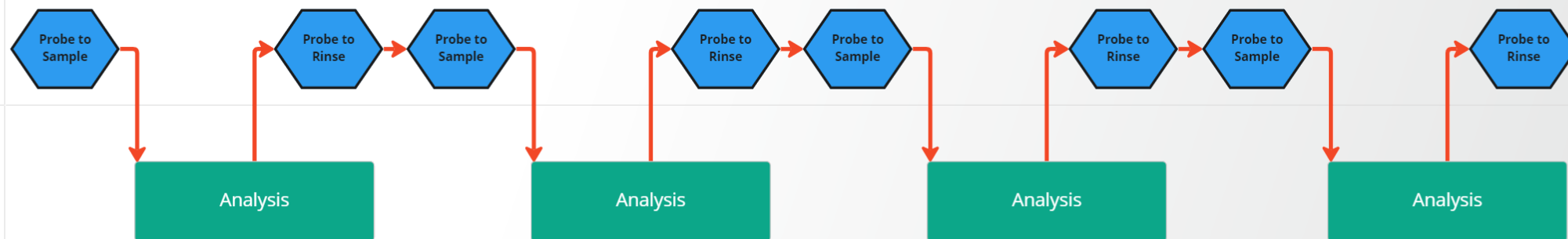 - Blue (intermittent) – analysis in progress
  - Red (solid) – action required; operation unsuccessful

Your workflow's perfect partner

Improved sample throughput with Step Ahead analysis on the iSC-65 autosampler

Gain up to 25% more productivity relative to traditional sampling

Sustainability: an increasing demand for laboratories

Accountability
Consistency
Transparency

my green lab.

ACT. The Environmental Impact Factor Label — EU

Thermo Scientific iCAP RQplus ICP-MS
Bremen, Germany
SKU BRE731344A

Environmental Impact Scale
Decreasing Environmental Impact
1 ← → 10

Manufacturing

Manufacturing Impact Reduction	1.0
Renewable Energy Use	Yes
Responsible Chemical Management	5.0
Shipping Impact	1.0
Product Content	10.0
Packaging Content	5.0

User Impact

Energy Consumption (kWh/day)	8.6
Water Consumption (liters/day)	N/A
Product Lifetime	5.0

End of Life

Packaging	4.2
Product	1.0

Innovation

Innovative Practices	-1.0

Environmental Impact Factor:	**39.8**
Label Valid Through:	February 2025

act.mygreenlab.org

ACT. The Environmental Impact Factor Label — EU

Thermo Scientific iSC-65 Autosampler
Shanghai, China
SKU BRE0030065

Environmental Impact Scale
Decreasing Environmental Impact
1 ← → 10

Manufacturing

Manufacturing Impact Reduction	1.0
Renewable Energy Use	No
Responsible Chemical Management	1.0
Shipping Impact	10.0
Product Content	10.0
Packaging Content	5.0

User Impact

Energy Consumption (kWh/day)	0.9
Water Consumption (liters/day)	N/A
Product Lifetime	1.0

End of Life

Packaging	5.0
Product	1.0

Environmental Impact Factor:	**35.0**
Label Valid Through:	February 2025

act.mygreenlab.org

iCAP RQplus ICP-MS iSC-65 Autosampler Applications

The world leader in serving science

New solutions to power through complex samples

New Hawk Consumables and Maintenance Assistant

New look, providing optical similarity to the Thermo Scientifc™ iCAP™ PRO Series ICP-OES

Improved Argon Gas Dilution available on all models

New peristaltic pump designed for easy daily operation

New iSC-65 autosampler

How to test and demonstrate robustness?

ThermoFisher
SCIENTIFIC

Simulate a typical workflow

Run everyday

Replicate over several consecutive days

Monitor Productivity

Monitor instrument performance
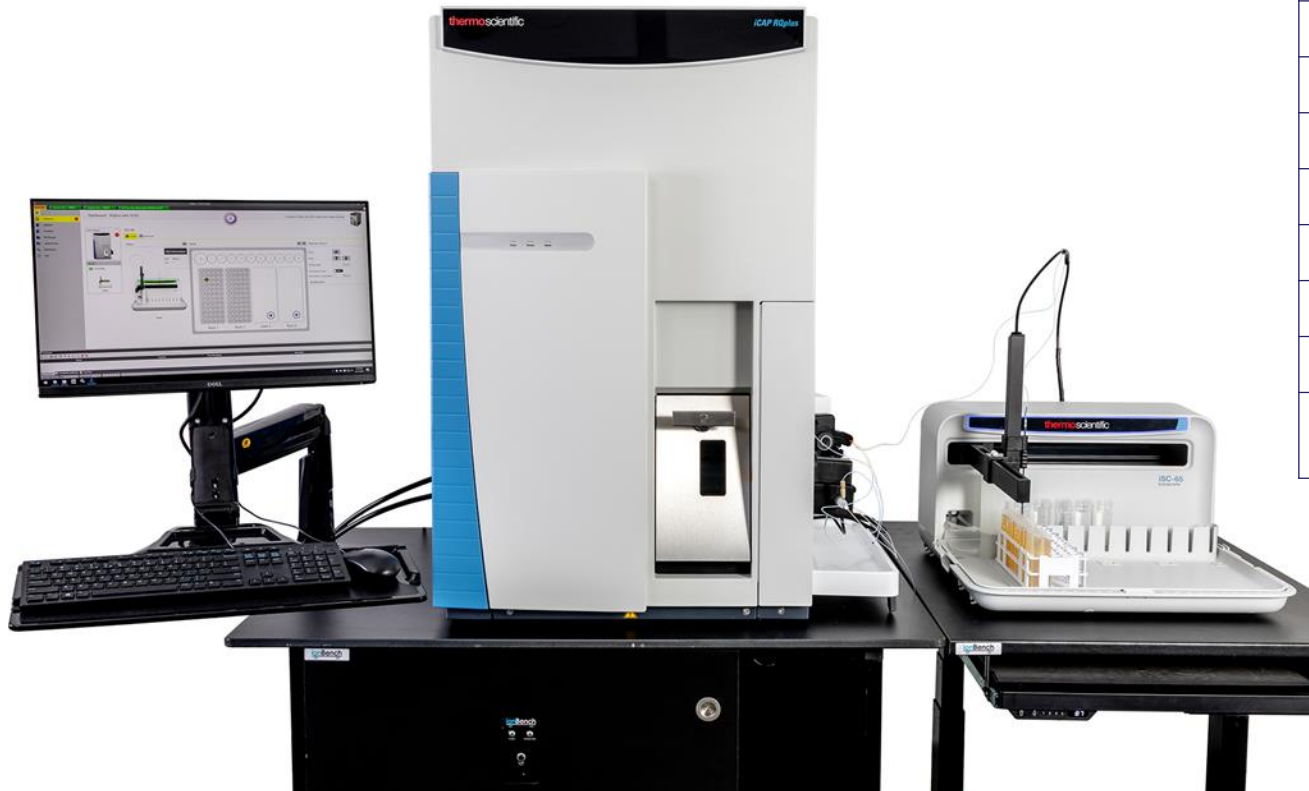
Ignite plasma and stabilize for 10-15 mins

Acquire performance report

Condition cones

Start measurement

More than 10,000 samples were analyzed for testing and application development of the iCAP RQplus ICP-MS

Experimental set-up

Parameter	Value
Nebulizer	Micromist nebulizer (400 µl.min^{-1})
Interface cones	Ni – tipped sample and Skimmer
Skimmer cone Insert	High matrix
Spray chamber	Cyclonic quartz
Injector	Quartz, 2.5 mm ID
Torch	Quartz torch
RF power (W)	1550
Number of replicates	3
Spray chamber temp (^{0}C)	2.7
KED settings (gas flow rate in mL·min^{-1})	4.8 (with a 3V kinetic energy barrier)

- AGD dilution levels were selected depending on the application
- Step-ahead function was applied in all measurements

Application overview

- Analysis of water samples

Complexity:
- ✓ Variable and potentially high matrix load
- ✓ Comprehensive QC protocols in regulated methods
- ✓ Ultra-trace detection requirements.

- Analysis of food & beverages

Complexity:
- ✓ Variety and complexity of sample matrices (e.g., fats, oils, sugars, organics)
- ✓ Industry standards
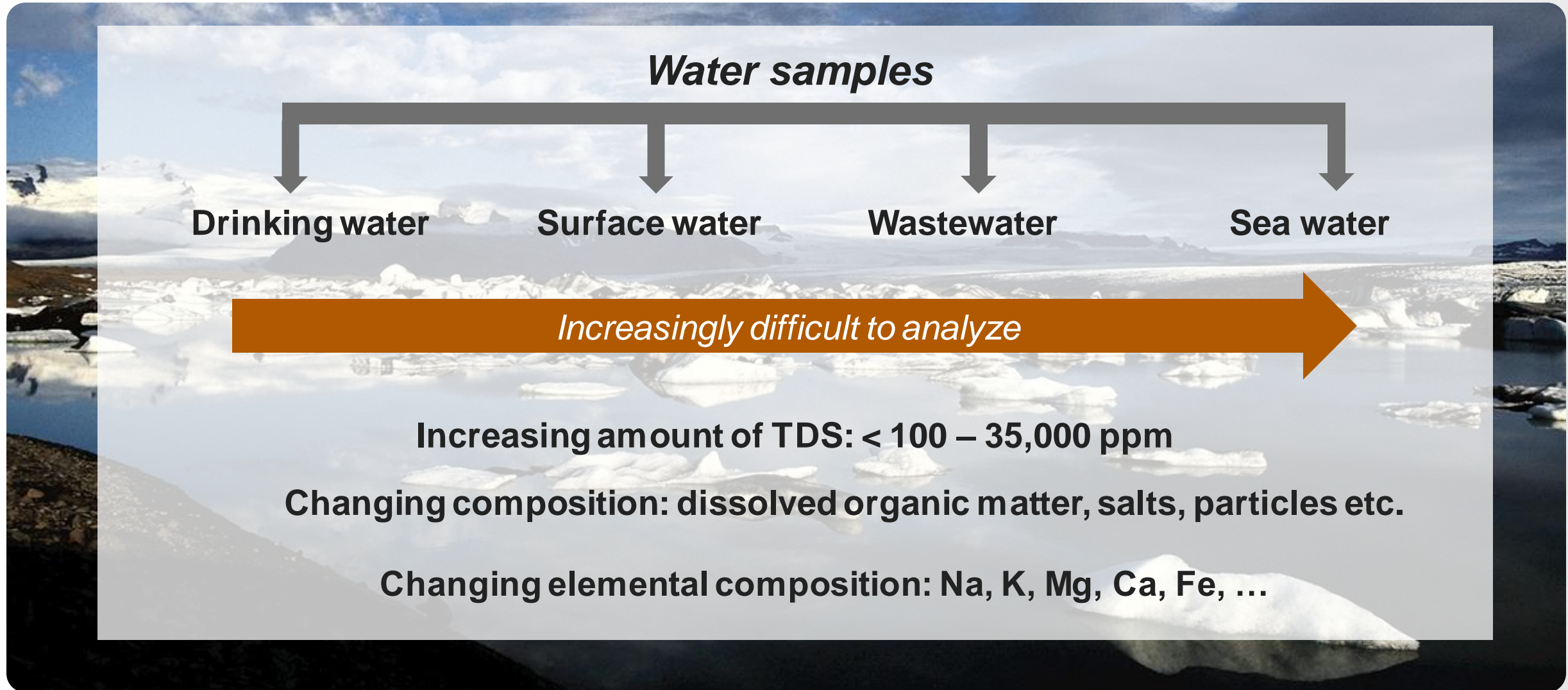- ✓ From ultra-trace to percent level QC analysis

- Analysis of brines, refinery products, high purity chemicals

Complexity:
- ✓ Highly demanding matrix type
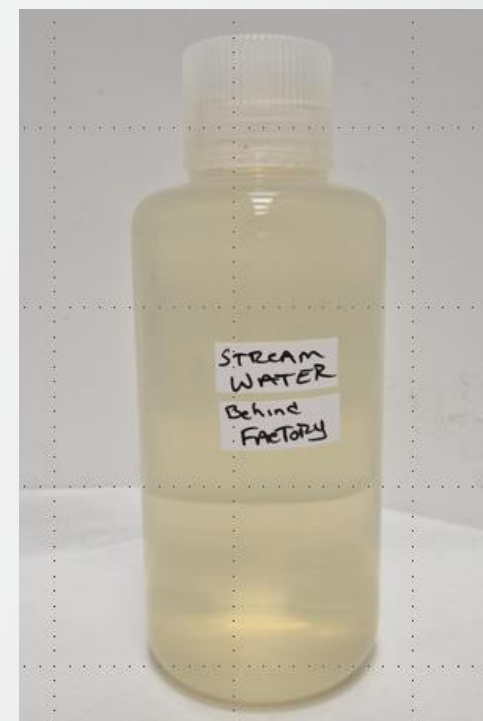- ✓ Moderate sample load, but quick and reliable turnover required

Water analysis using ICP-MS

Water samples

Drinking water → Surface water → Wastewater → Sea water

Increasingly difficult to analyze

Increasing amount of TDS: < 100 – 35,000 ppm

Changing composition: dissolved organic matter, salts, particles etc.

Changing elemental composition: Na, K, Mg, Ca, Fe, …

Argon Gas Dilution

- Tuning of the dilution level is achieved by variation of nebulizer gas flow and the additional gas flow
- As a consequence of the dilution, a lower oxide level is achieved, indicating a more robust plasma
- Tuning all dilution levels is fully automated within the Qtegra ISDS software

Sample matrices	% TDS Content [%]	Dilution level
Drinking water and surface water	**< 0.5**	**Low**
Food digests	**0.5 – 1.0**	
Wastewaters	< 1.0	Mid
Soil digests, geological & mining samples	< 1.0	
Brackish waters, fracking flowback solutions	< 1.5	
Brackish waters, sea water, brine solutions	< 3.0	High
Highly concentrated brine solutions	> 4.0	

Water samples analyzed

Total amount of major elements in mg·L⁻¹

Tap water 1	66
Tap water 2	83
Tap water 3	116
Surface water 1	96
Surface water 2	184
Wellwater	111
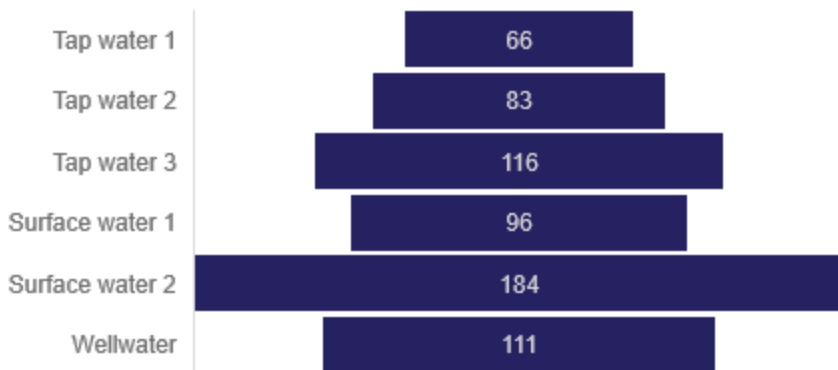
| Item	Place	Category	Note
Tap water 1	Bremen West	Tap water	-
Tap water 2	Bremen South	Tap water	-
Tap water 3	Bremen North	Tap water	-
Surface water 1	Bremen South	Lake	Sampling location is close to a major highway
Surface water 2	Bremen North	Lake	Sampling location is close to an area with heavy traffic
Well water	Bremen North	Well water	Ground water sample, no additional treatment
SLRS-5	Ottawa	River	CRM

Additional advantage of iCAP RQplus for ISO 17294

- ***Single analysis mode using He KED*** achieved the excellent interference removal and detection at low concentrations (below 1 µg·L^{-1}) with high ratio of signal/background.

Polyatomic interference of selenium

Symbol	Mass	Abundance	Interferences
74Se	73.9225	0.90	74Ge(36.500%); 16O ..
76Se	75.9192	9.00	76Ge(7.800%); 36Ar ..
77Se	76.9199	7.60	40Ar + 37Cl(24.133%) ..
78Se	77.9173	23.60	78Kr(0.350%); 14N + ..
80Se	79.9165	49.70	80Kr(2.250%); 40Ar +
82Se	81.9167	9.20	82Kr(11.600%); 1H + ..

^{78}Se $1 - 100 \, \mu g \cdot L^{-1}$
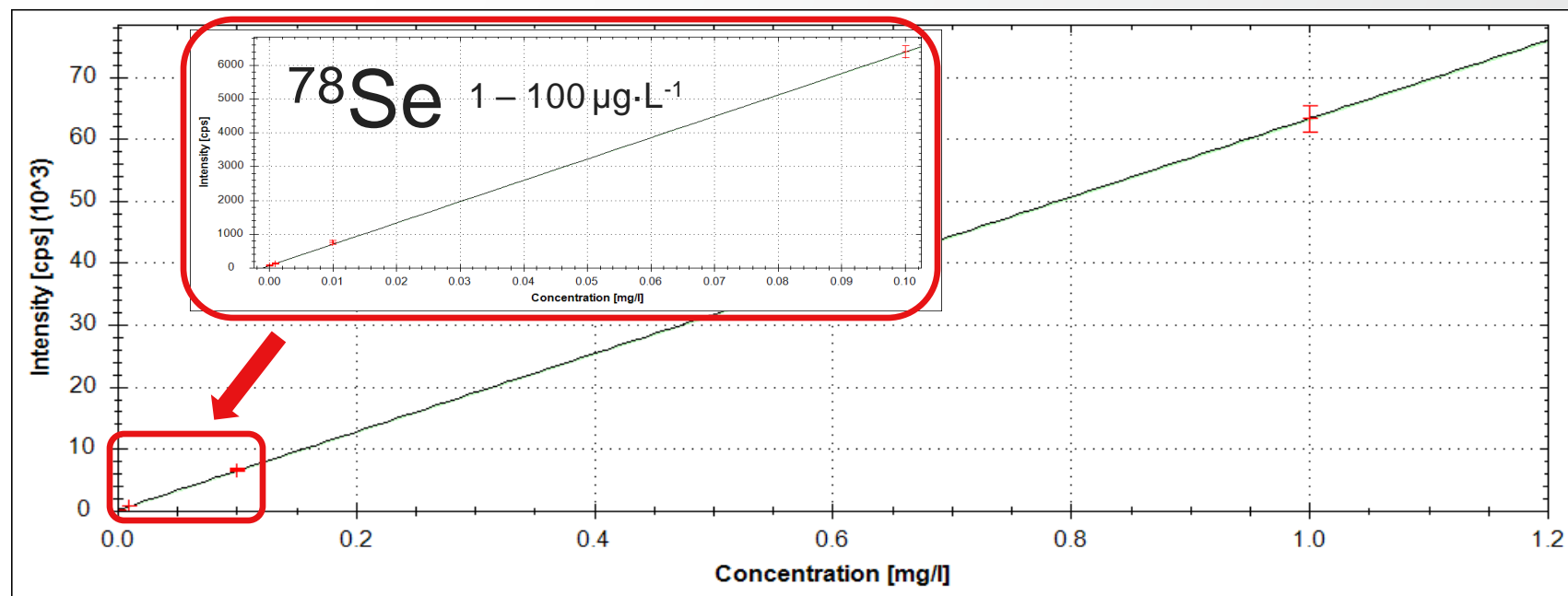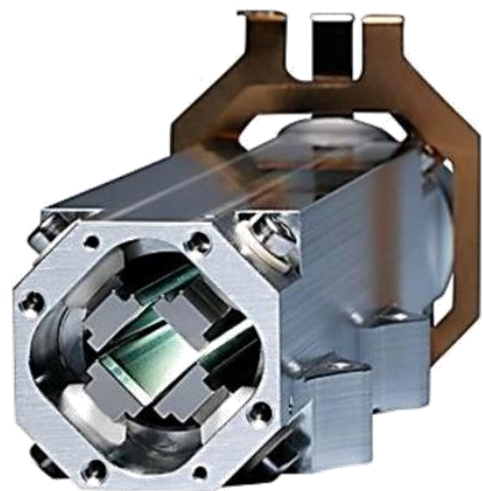
Accuracy analysis results river water CRM SLRS-5

All CRM values, measured, and result concentrations are in µg·L^{-1}

	CRM values	Measured	Recovery (%)	Result
Al	49.5	50.6	102%	✔
Sb	0.3	0.35	117%	✔
As	0.413	0.478	116%	✔
Ba	14.0	15.2	109%	✔
Cr	0.208	0.216	104%	✔
Co	0.05	0.052	104%	✔
Cu	17.4	18.7	107%	✔
Fe	91.2	91.3	100%	✔
Pb	0.081	0.077	95%	✔
Mn	4.33	4.64	107%	✔

	CRM values	Measured	Recovery (%)	Result
Mo	0.27	0.27	100%	✔
Ni	0.476	0.525	110%	✔
Sr	53.6	55.9	104%	✔
U	0.093	0.092	99%	✔
V	0.317	0.304	96%	✔
Zn	0.845	0.960	114%	✔
Na	5,380	4,890	91%	✔
Mg	2,540	2,450	96%	✔
K	839	823	98%	✔
Ca	10,500	9,900	94%	✔

Robustness: internal standard recovery

- Daily sample load was approximately 300 samples per day
- Total analysis time approximately 12 hours
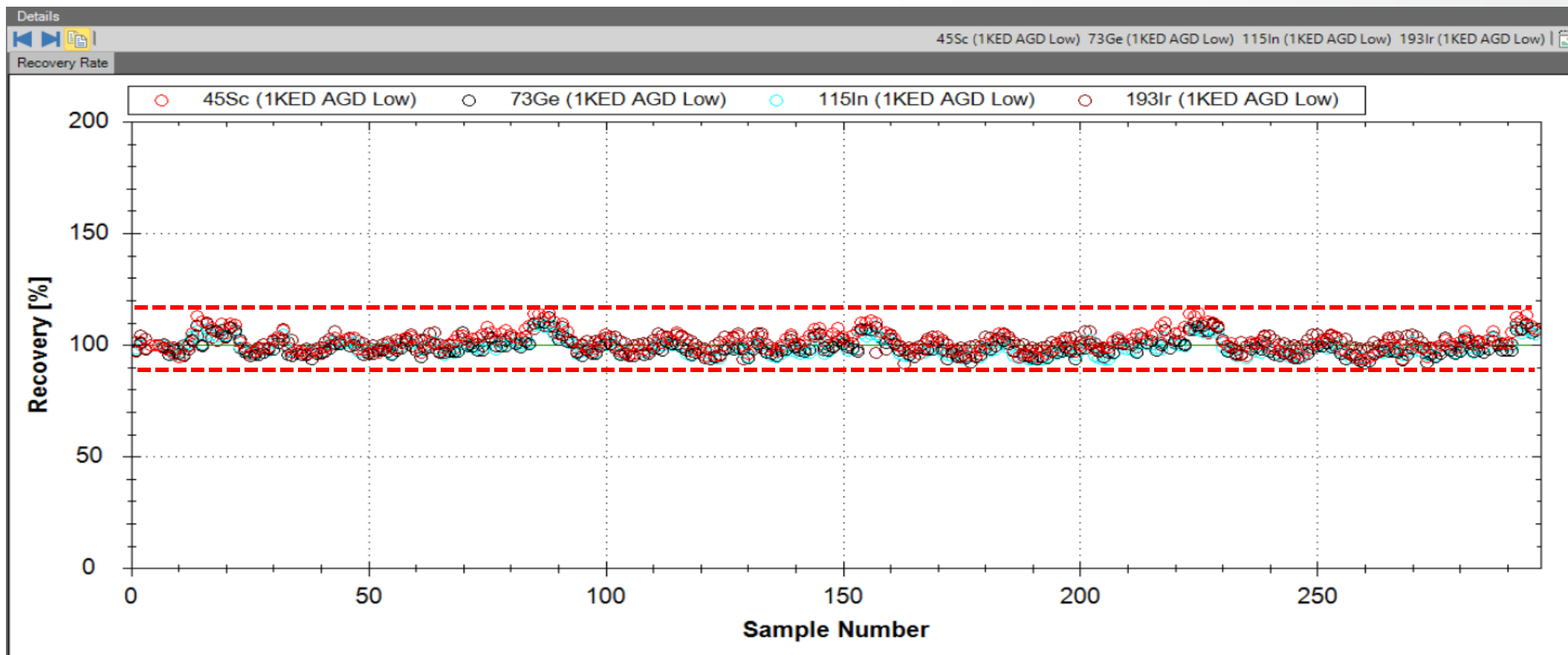
Hawk: instrument health monitoring software

Example: Check sample cone and peristaltic pump tubing

Start of analysis: Day 1

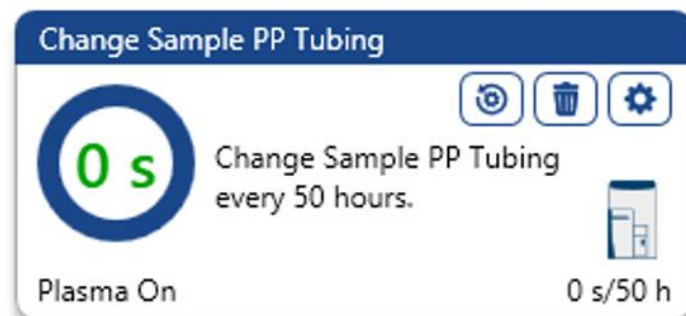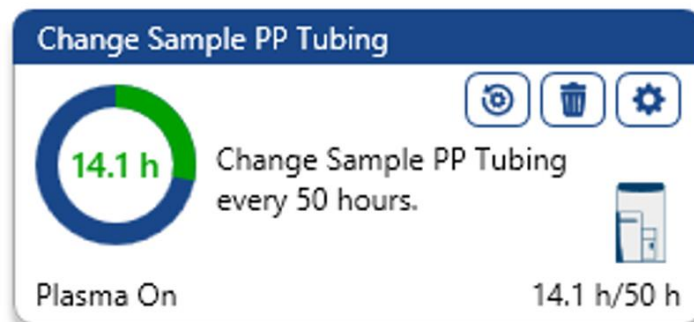# Hawk: Instrument health monitoring software
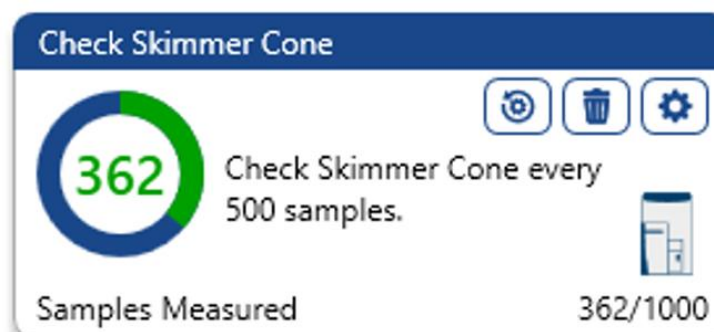
Example: Check Sample cone and peristaltic pump tubing

Hawk: Instrument health monitoring software

Example: Check Sample cone and peristaltic pump tubing

Start of analysis: Day 1

Day 2

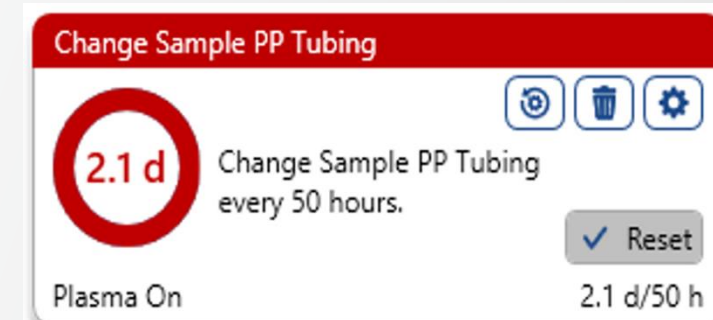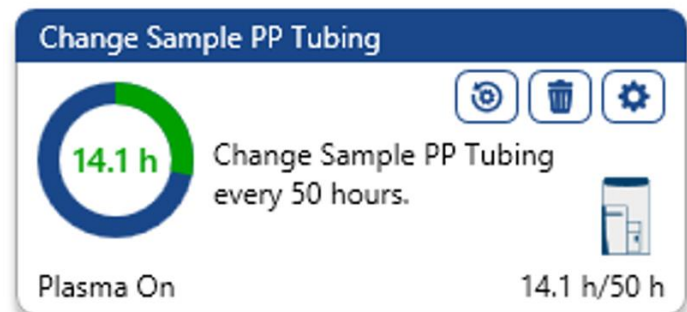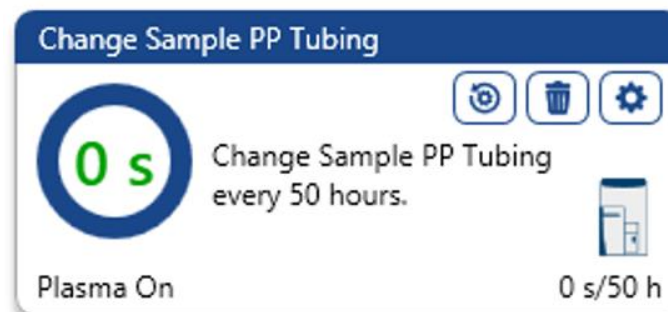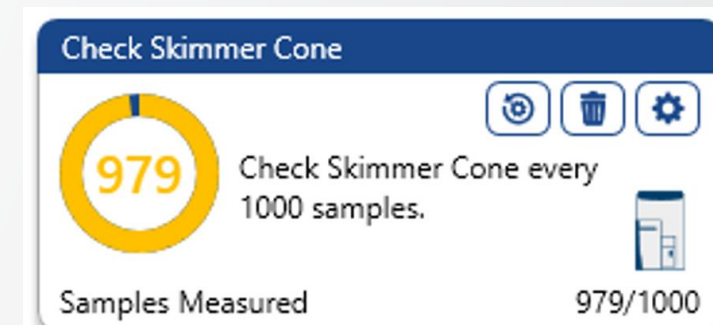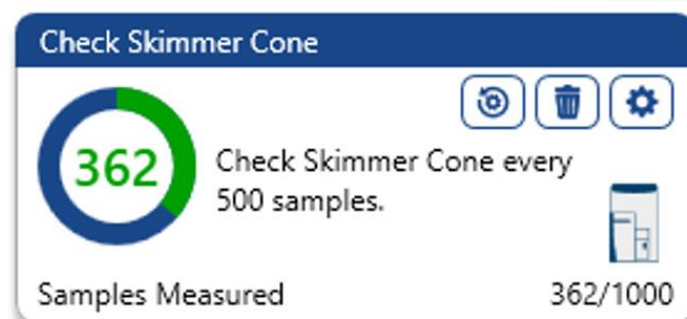**Day 4**

Reliable hardware: performance without tuning for 10 days
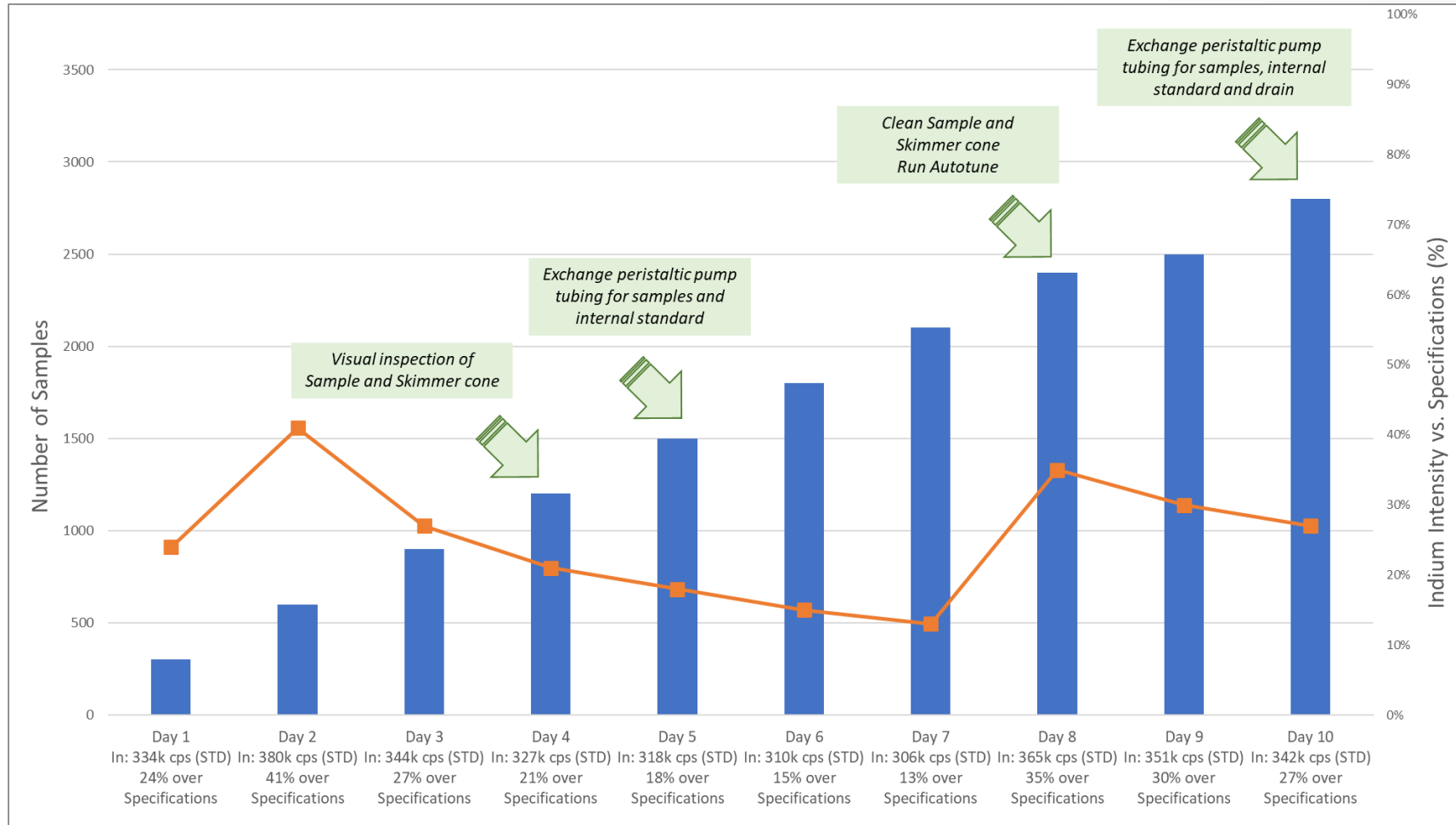
- Total 2800 sample analysis for 10 days.
- Stable and reliable hardware: autotune was running only day 1 and day 8.
- ^{115}In (Tune solution) intensity achieved 115% to 140% of specification.

Linear dynamic range vs. analytical range
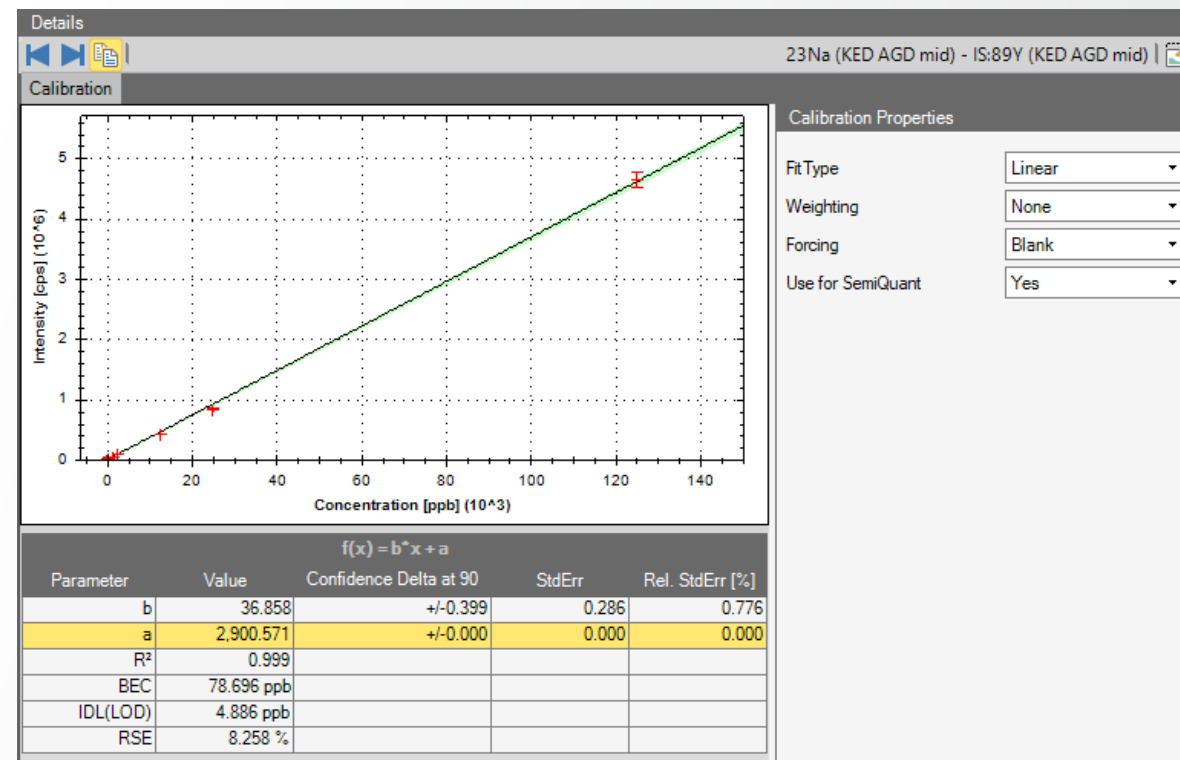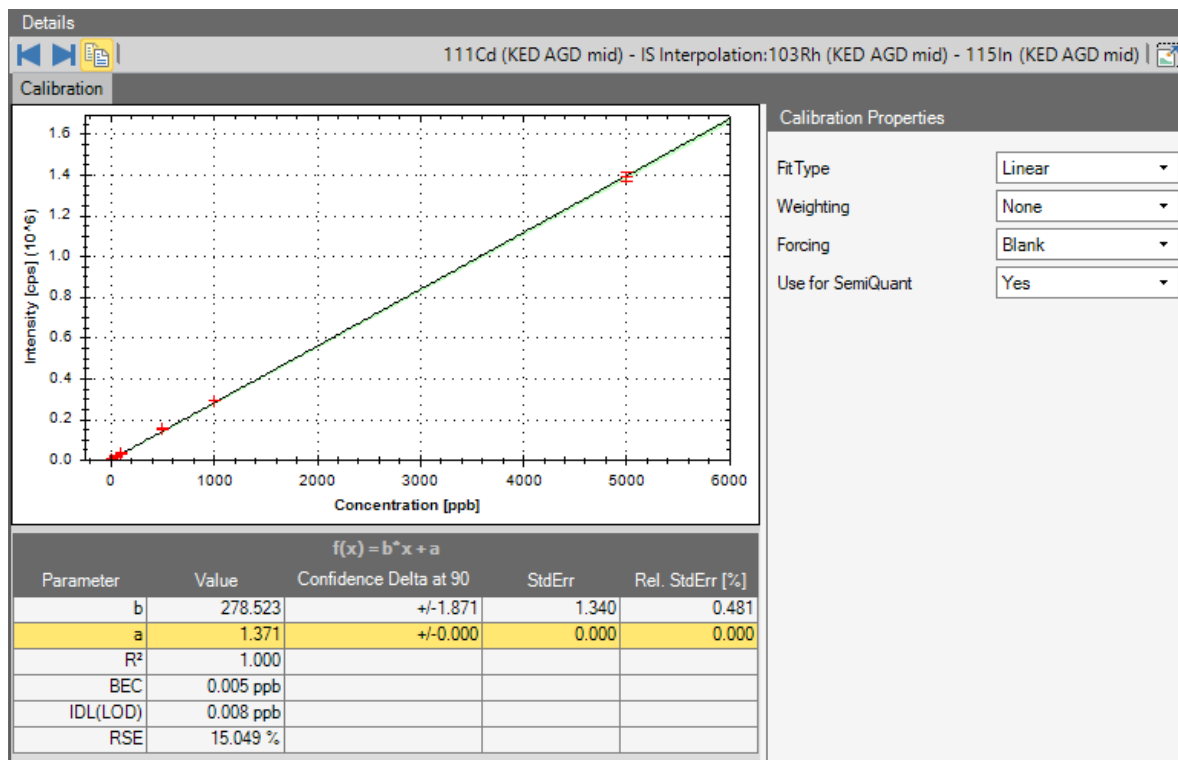
- The detector of the iCAP RQplus ICP-MS offers 10 orders of magnitude linear dynamic range
- The analytical range can be much larger, depending on the calibrated range for each analyte
  - Argon Gas Dilution is a way to extend calibration ranges to % levels
  - Adjustable resolution allows for analyte specific signal attenuation

Food samples

	Group no.	Description	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Day 1	1	Carbohydrate and protein rich	Rice	Cereal	Couscous	Flour	Fish (sardines)
Day 2	2	Vegetables and fruits	Puree-1	Puree-2	Tomato	Spinach	Carrot
Day 3	3	Spices	Mustard	Pepper	Coriander	Basil	Cinnamon
Day 4	4	Milk and high fat	Infant formula	Milk powder	Biscuits	Cocoa powder	Drinking chocolate
Day 5	5	Beverages	Apple juice	Orange drink	Cola	Flavoured water	Energy drink
			Days 6 to 9 all samples randomly mixed together.				

Samples and preparation

- Six reference materials
  - SRM 1568b Rice flour
  - DORM-3 Fish
  - NIST 2383a baby food
  - TYG082 Infant formula
  - BCR-063 Milk
  - LGC-7103 Biscuit

- 20 food and beverage samples
  - Dry (rice, cinnamon, etc.) and wet (tomato, sauce, etc.) samples
  - Beverages (juice, water, etc.)

Dry sample
0.5 g

Wet sample
2.0 g

Added 6 mL aqua regia

Microwave digestion 30 min
at 210 °C

Make up 50 mL

Excellent detection: trace of the toxic elements

| Analyte	R^2	LOD	MLOQ in beverage samples, DF = 10	MLOQ in wet food samples, DF = 25	MLOQ in beverage dry food samples, DF = 100
^{7}Li	0.9994	0.193	5.8	14.5	57.9
^{9}Be	0.9997	0.002	0.05	0.1	0.5
^{23}Na	0.9995	0.002	0.1	0.1	0.5
^{24}Mg	0.9999	0.001	0.02	0.05	0.2
^{27}Al	0.9994	0.001	0.02	0.05	0.2
^{31}P	0.9999	0.012	0.4	0.9	3.6
^{39}K	0.9995	0.006	0.2	0.4	1.7
^{44}Ca	0.9998	0.006	0.2	0.4	1.7
^{52}Cr	0.9994	0.015	0.5	1.1	4.5
^{55}Mn	0.9999	0.0004	0.01	0.03	0.1
^{57}Fe	0.9994	0.0005	0.01	0.04	0.1
^{59}Co	0.9999	0.004	0.1	0.3	1.2
^{60}Ni	0.9998	0.013	0.4	1.0	4.0
^{65}Cu	0.9994	0.032	1.0	2.4	9.6
^{66}Zn	0.9998	0.133	4.0	9.9	39.8
^{75}As*	0.9996	0.004	0.1	1.0	3.9
^{77}Se*	0.9997	0.015	0.5	1.2	4.6

- Coefficient of determination (R^2) achieved >0.9994

- All LODs are well below the maximum contamination level.
  - All result numbers are in $\mu g \cdot L^{-1}$ (blue numbers are in $mg \cdot L^{-1}$)
  - LOD is from 3x STDEV of ten repeats of the blank
  - MLOQ is calculated as dilution factor (DF) x 3x IDL

Accuracy analysis results using CRMs

Element	Biscuit CRM LGC-7103		TYG RM082 Infant Formula		NIST CRM 2383a Baby food composite	
	n = 40	Dilution factor = 100	n = 50	Dilution factor = 100	n = 16	Dilution factor = 25
	Certified value (mg·L⁻¹)	Average recovery (%)	Certified value (mg·L⁻¹)	Average recovery (%)	Certified value (mg·L⁻¹)	Average recovery (%)
^{23}Na	5010 ± 400	96 ± 7	1698 ± 29	93 ± 6	195 ± 29	94 ± 9
^{24}Mg		92 ± 6	505 ± 7	92 ± 6	212.2 ± 4.0	106 ± 7
^{31}P	900 ± 140	91 ± 5	2898 ± 60	90 ± 11	453 ± 11	90 ± 9
^{39}K	1580 ± 170	97 ± 6	5408 ± 90	91 ± 6	2910 ± 220	102 ± 6
^{44}Ca		-	5355 ± 77	95 ± 4	342.6 ± 5.0	102 ± 11
^{55}Mn	5.49 ± 0.6	100 ± 8	0.623 ± 0.022	87 ± 11	0.963 ± 0.064	93 ± 5
^{57}Fe	-	-	74.8 ± 1.4	94 ± 5	4.420 ± 0.51	104 ± 9
^{59}Co	-	-	-	-	0.048 ± 0.005	100 ± 7
^{65}Cu	-	-	3.69 ± 0.08	101 ± 5	0.758 ± 0.082	94 ± 6
^{66}Zn	6.41 ± 0.99	113 ± 5	52.1 ± 0.9	115 ± 5	2.22 ± 0.18	88 ± 2
^{78}Se	-	-	0.123 ± 0.007	104 ± 10	-	-

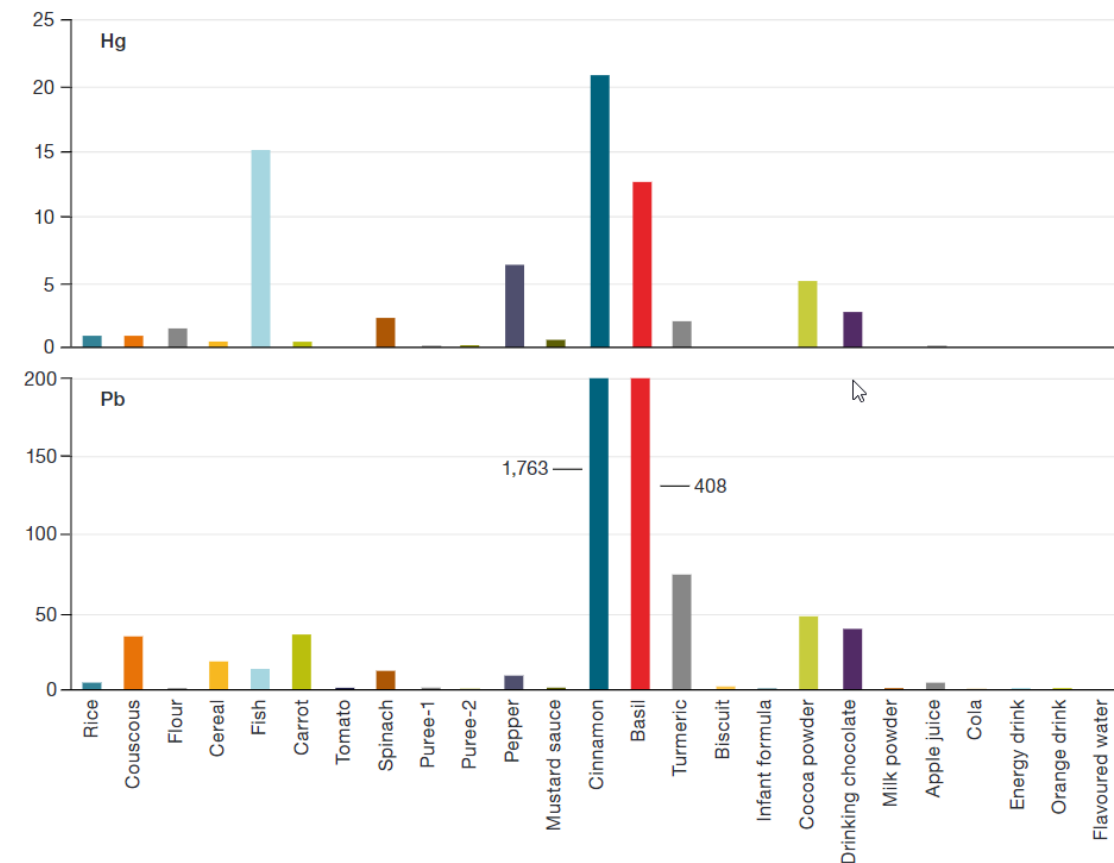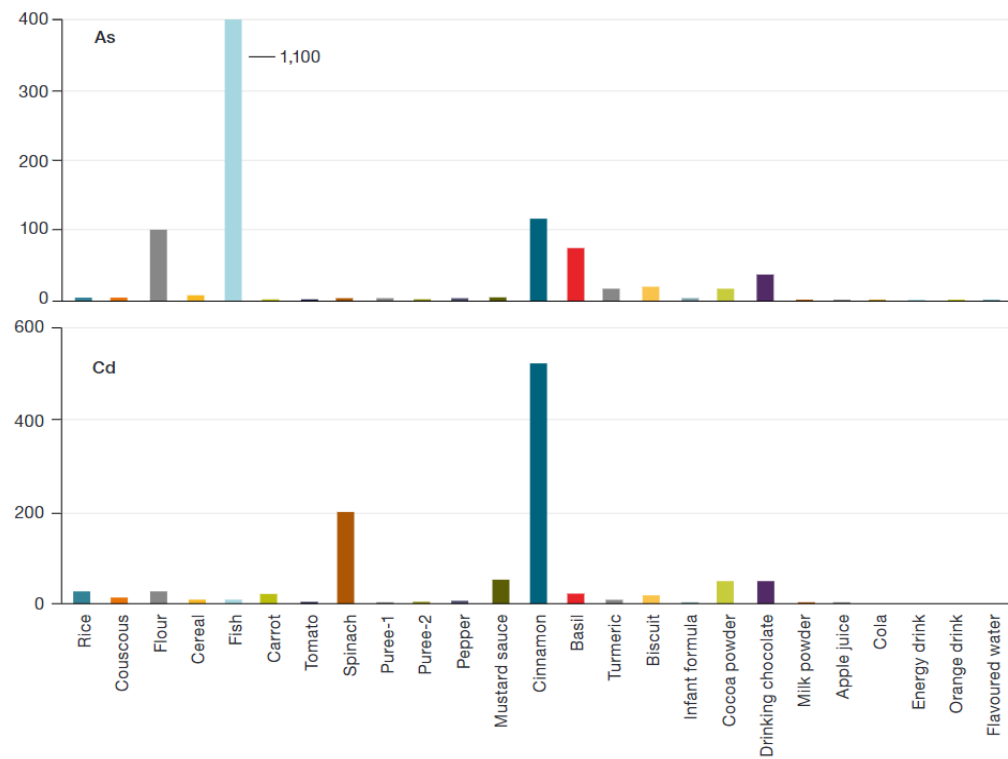| Item	Analysis result
SRM 1568b Rice flour	✔
LGC-7103 Biscuit	✔
BCR-063 Milk	✔
TYG082 Infant formula	✔
DORM-3 Fish	✔
NIST 2383a baby food	✔

Robust: containing the high amounts of alkali metal
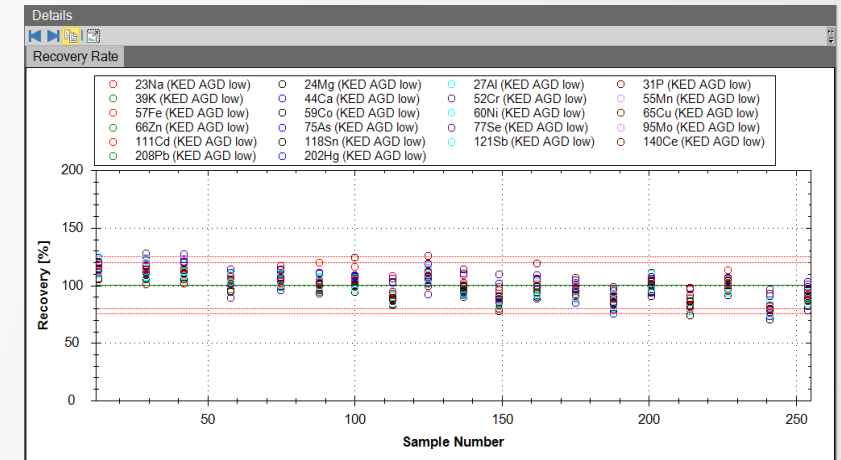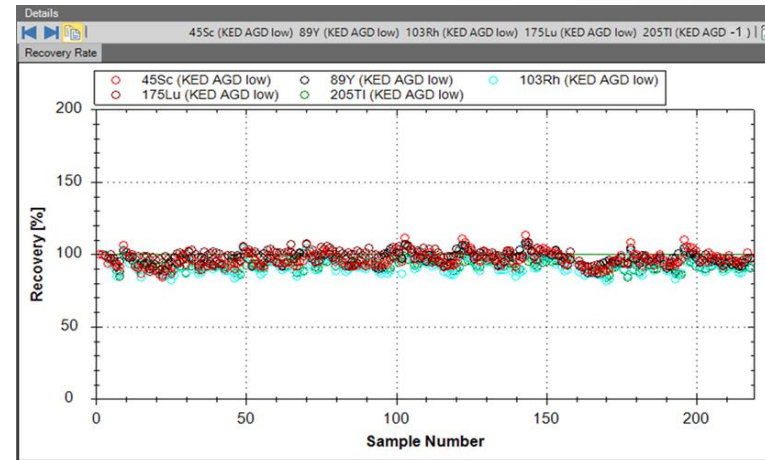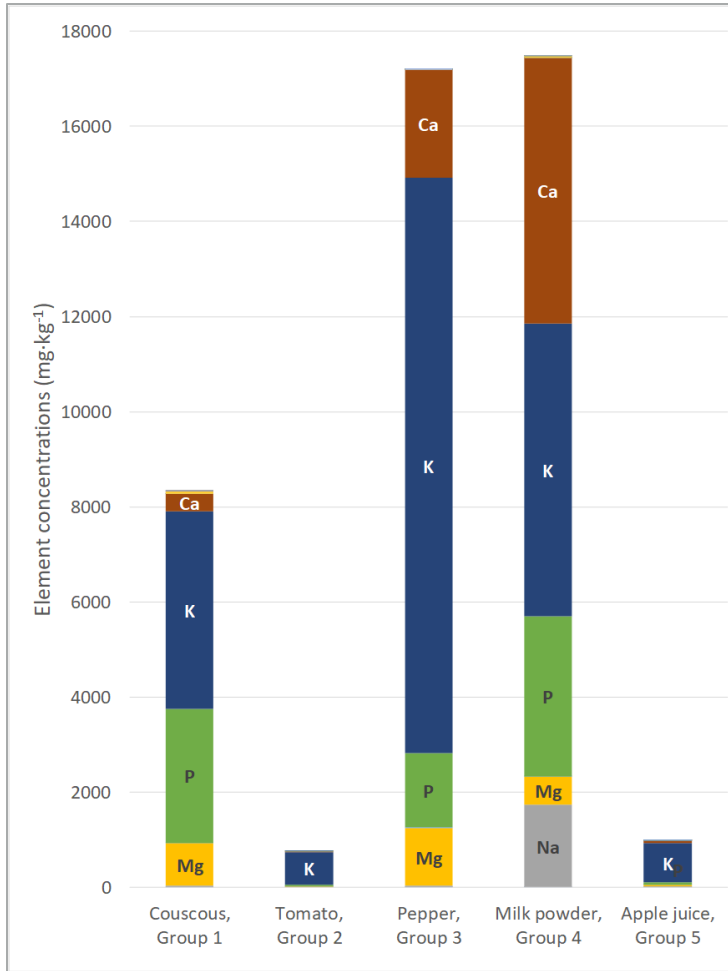
- High amount of the nutrient elements with TDS >1 %
- Around 220 samples analyzed per day, 9 days in a row
- Consistent internal standard recovery achieved
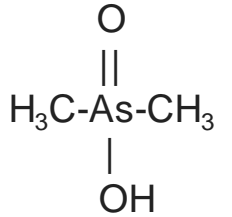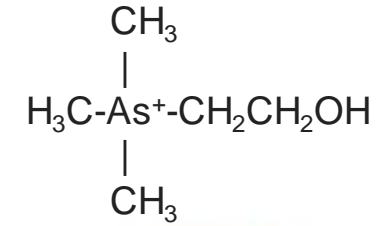- Quality control: CCV was measured every 20 unknown samples

- Highest concentrations of cadmium, mercury, and lead were found in spices
- Fish samples contained slightly elevated levels of mercury and expectedly high levels of arsenic

Unknown food and beverage sample results
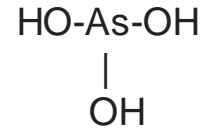
$$HO-As-OH$$
$$|$$
$$OH$$

$$CH_3$$
$$|$$
$$H_3C-As^+-CH_2CH_2OH$$
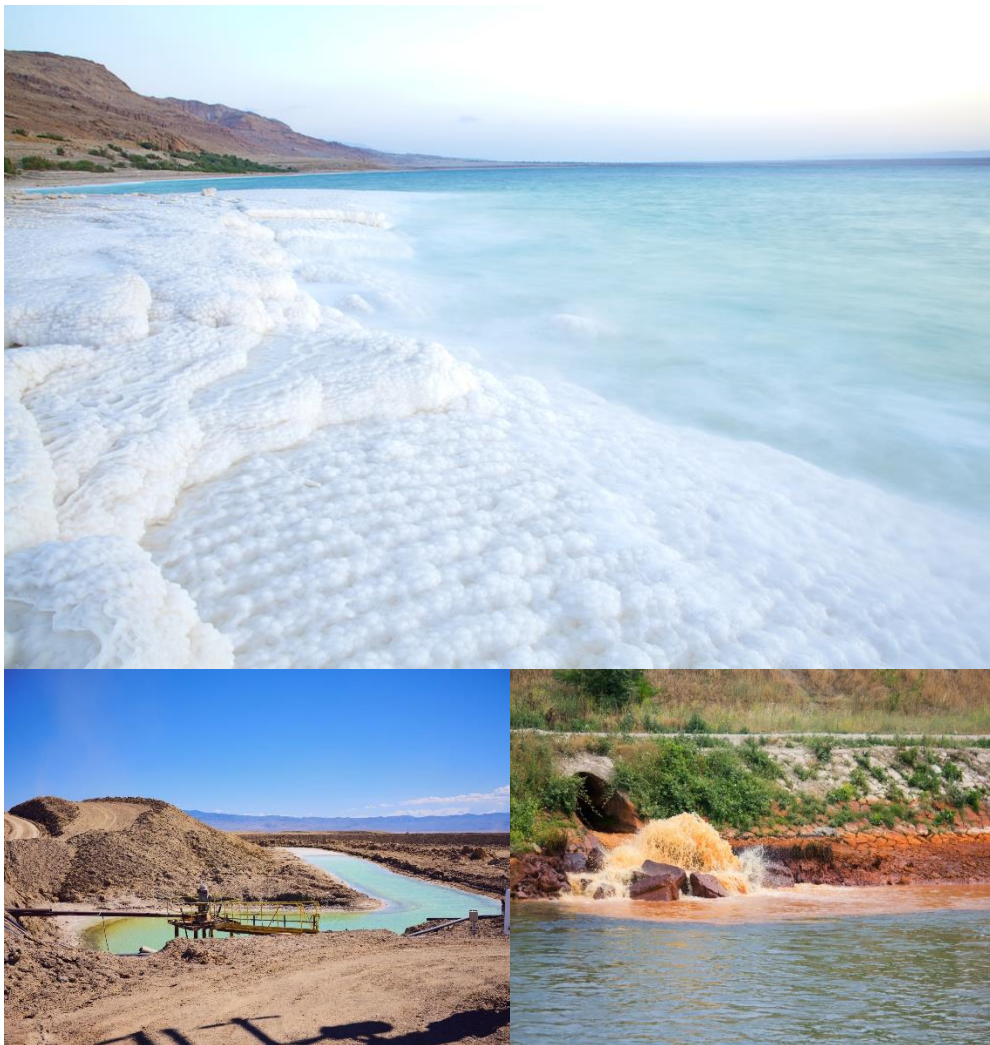$$|$$
$$CH_3$$

$$O$$
$$||$$
$$H_3C-As-CH_3$$
$$|$$
$$OH$$

- Highest concentrations of cadmium, mercury and lead were found in spices
- Fish samples contained slightly elevated levels of mercury and expectedly high levels of arsenic
- IC-ICP-MS can be used for further investigation of the toxic levels of mercury and arsenic

Analysis of high concentrated brine using ICP-MS

- Brine is a complex matrix comprising mostly NaCl at % level concentration.

- Seawater and brackish waters have high NaCl content and are often analyzed for trace elements.

Analysis of high concentrated brine using ICP-MS

| Lithium ores |
| Lithium rich underground brines |

Extraction and purification steps

| Lithium carbonate (Li_2CO_3) |
| Lithium hydroxide (LiOH) |

Lithium salts used as raw materials for different Li-ion battery (LIB) components

Anodes
Special materials replacing conventional graphite anodes e.g., lithium titanate (synthesized from Li-salt + titanium oxide)

Cathodes
Lithium cobalt oxide, lithium ion phosphate, multi-metal oxides with added lithium etc.

Electrolytes
Lithium hexafluorophosphate ($LiPF_6$) in organics, lithium perchlorate ($LiClO_4$) etc.

- Brine is an incredibly difficult matrix to analyze using ICP-MS

- It is a starting point (or important intermediate) in many industrial processes

  - Brines can be rich sources of lithium but need to be explored carefully to avoid environmental contamination.

  - Extraction of rare earth elements typically present at sub µg·L^{-1} can become viable

Argon Gas Dilution

- Tuning of the dilution level is achieved by varying the nebulizer gas flow and additional gas flow.
- As a consequence of the dilution, a lower oxide level is achieved, resulting to a more robust plasma.
- Tuning all dilution levels is fully automated in the Qtegra ISDS Software.

| Sample matrices	% TDS Content [%]	Dilution level
Drinking water and surface water	< 0.5	Low
Food digests	0.5 – 1.0	
Wastewaters	< 1.0	Mid
Soil digests, geological & mining samples	< 1.0	
Brackish waters, fracking flowback solutions	< 1.5	
Brackish waters, sea water, brine solutions	**< 3.0**	**High**
Highly concentrated brine solutions	**> 4.0**	

Argon Gas Dilution

- Compatible with the standard sample introduction system components

- PFA-ST Microflow nebulizer is more resistant against blockage when analyzing high salt loads

- Argon humidification beneficial for salt-rich matrices

Sample introduction system components	Dilution level		
	Low	*Mid*	*High*
Glass concentric nebulizer	✔	✔	✘
Baffled cyclonic spray chamber	✔	✔	✔
2.5 mm i.d. quartz injector	✔	✔	✔
Torch (quartz, PLUS torch)	✔	✔	✔
Skimmer cone insert	✔	High Matrix	✔
ESI Pergo humidifier			✔
PFA-ST Microflow nebulizer			✔

AGD: Consistent spike recovery
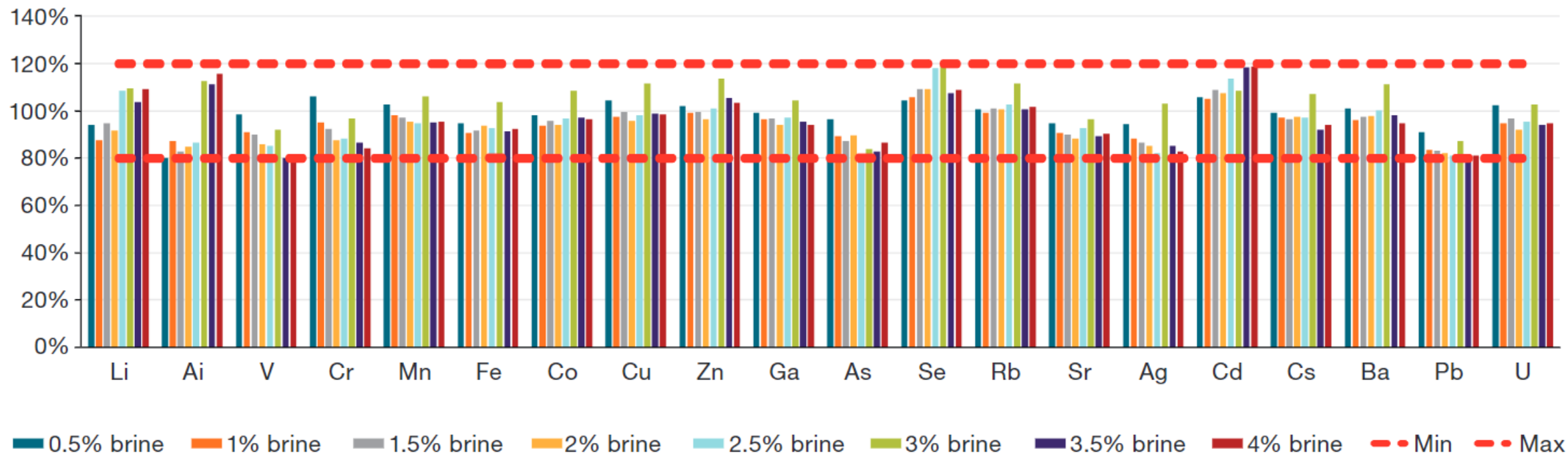
- Consistent spike recovery independent of the matrix load
- Also high IP elements read back within accepted limits
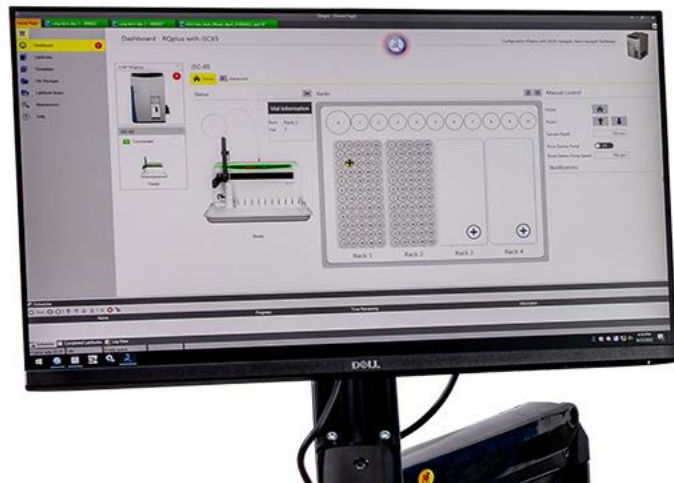
Robust consumable for sustainability
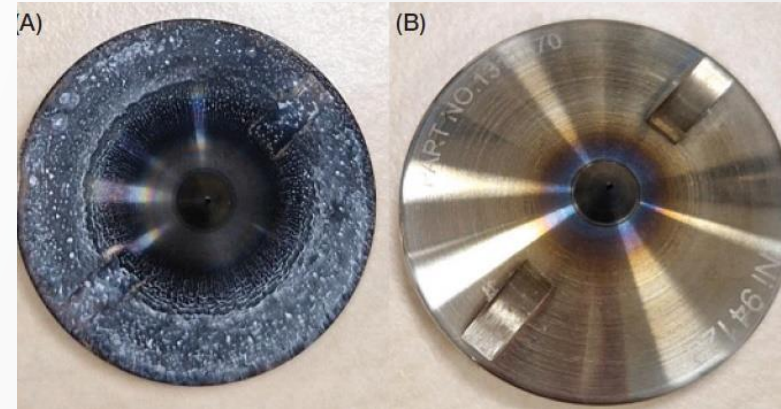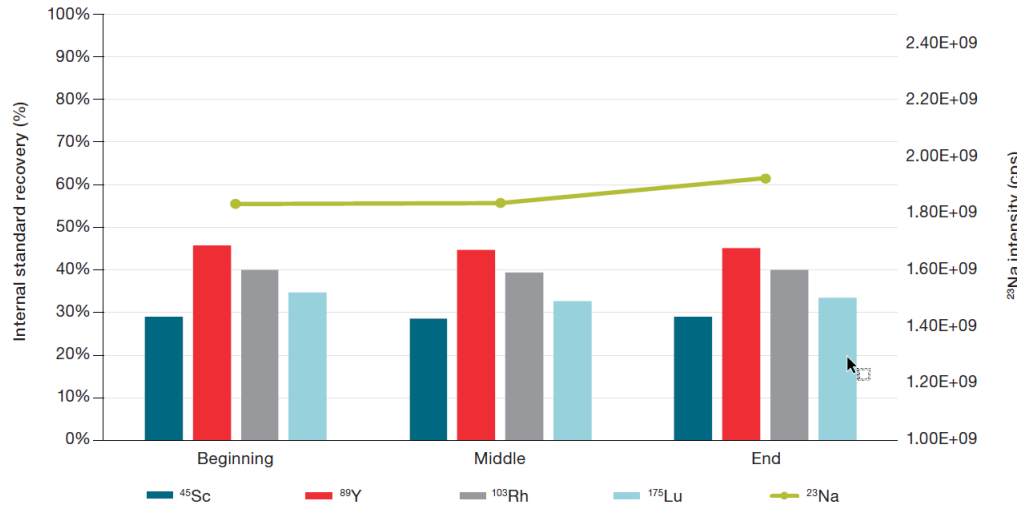
- Analysis of 25% for with minimum rinse time 30s
- Data acquisition for ^{23}Na is also possible thanks to the high sample dilution and high resolution applied to the analyzing quadrupole

- Robust spare parts: skimmer cone after the analysis and after cleaning
- High dilution using AGD reduces deposition and cross contamination

Summary

- Power through your challenging samples with next generation argon gas dilution

- Robust sample handling that meets regulatory demands with exceptional long term stability

- Efficiently managed uptime and maintain productivity with HAWK Consumable and Maintenance Assistant

- Simplify your workflow with Qtegra ISDS with structured method creation

- Automated reliable performance with the one-click Get Ready for automatic performance checks

Thank you!