Improving Sample Throughput for Metals Analysis with Intelligent Automated Standard & Sample Introduction

Agilent Auto-Diluter System

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Application Scientist, ICP-MS

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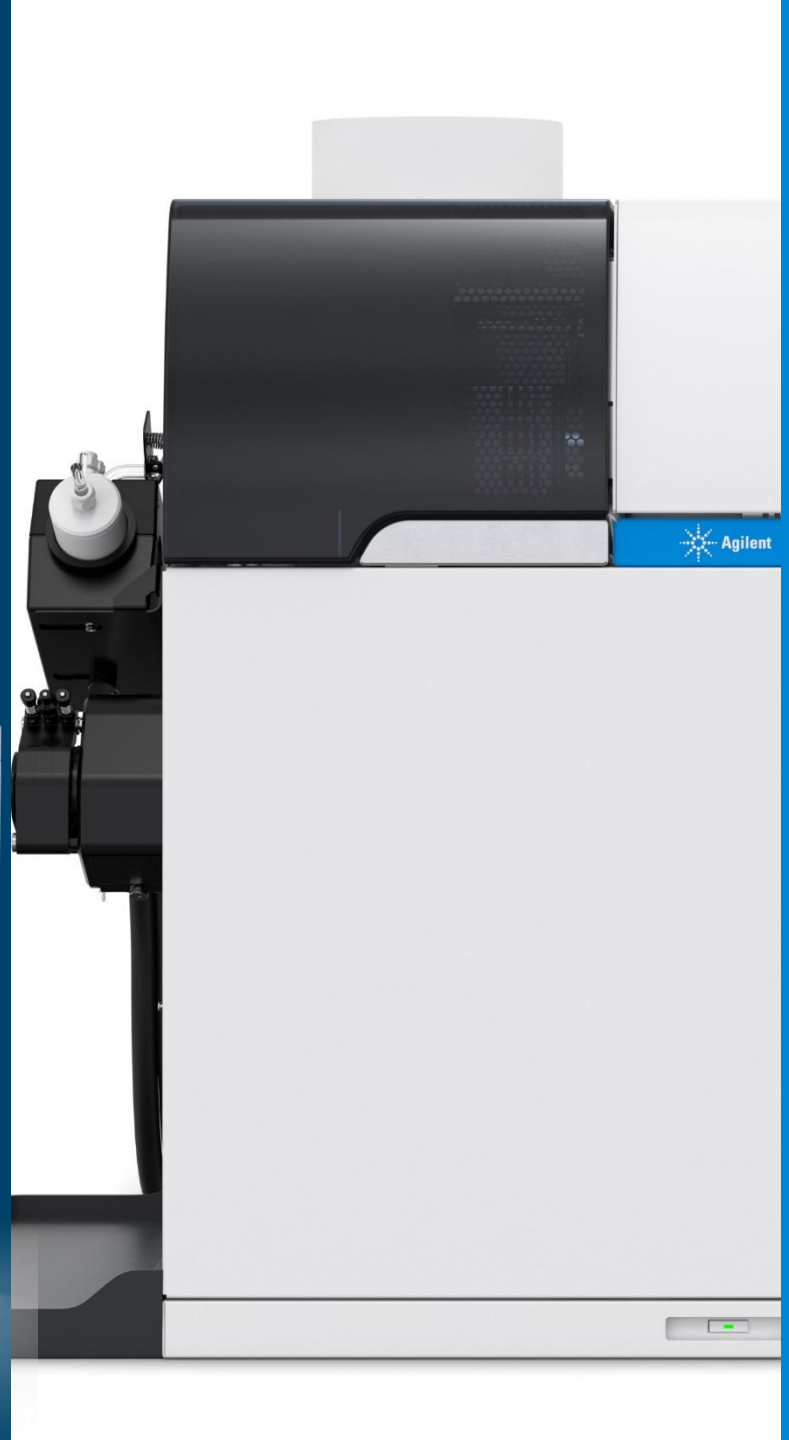

Agilent
Trusted Answers

Agilent ICP-MS Workflow

- Clamp tubing and make sure ventilation duct is turned on.
- Start Plasma.
  - This will turn on the chiller, start the plasma and run startup autotune.
- Create batch from template (or from existing batch).
- Edit sample list.
- Add the batch to the queue (start run)
  - This will optimize lenses, generate EPA tune report, analyze calibration standards, linearize the detector and analyze samples.
- Review data and print/export results.

Agilent ICP-MS Workflow

Preparation of Calibration Standards !!!

- lation duct is turned on.
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- m existing batch).
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Preparation of Calibration Sta

Dilution of Samples Prior to Analysis!!!

Agilent ICP-MS Workflow

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    calibration standards, l
    s.
- Review data and print/

Preparation of Calibration Sta

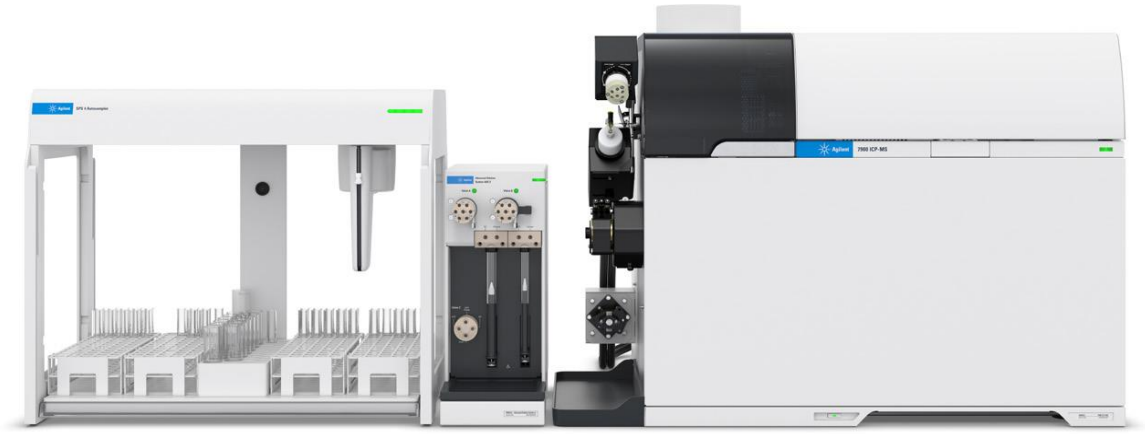
Dilution of Samples Prior to An

Re-Analysis of Samples that Over-range!!!

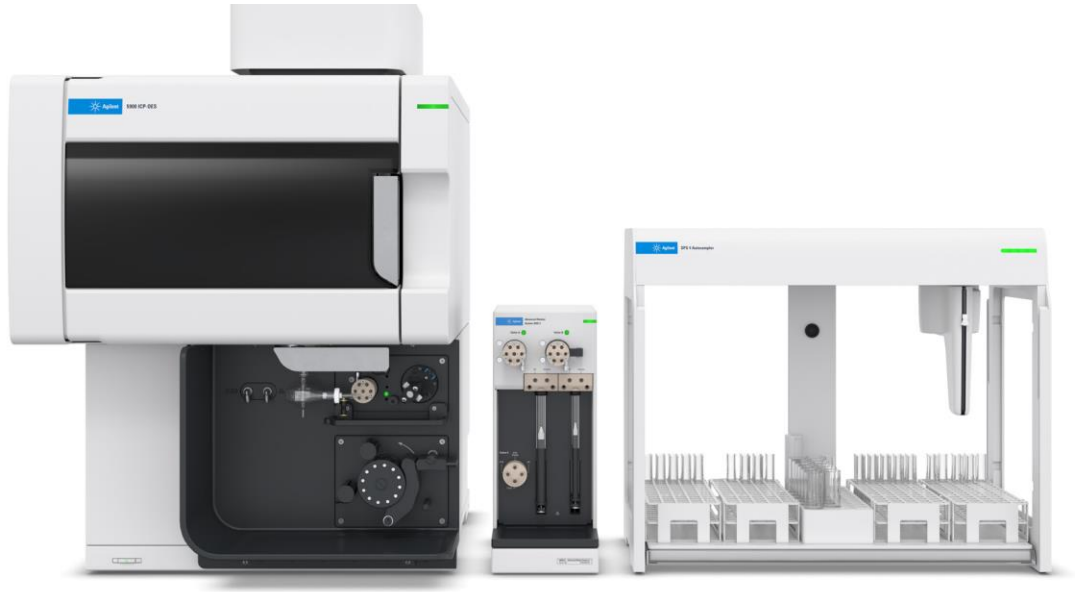
Introducing the ADS2 Automatic Dilution System
For Agilent ICP-OES and ICP-MS

- **Preparation of cal standards from cal stocks**
- **Pre-dilution of samples**
- **Auto-dilution of samples over cal range**

- **Free from human errors**
- **Kept from contaminations**
- **Traceability**
- **Single Vendor Solution/Support**



Agilent ICP-MS Automation System



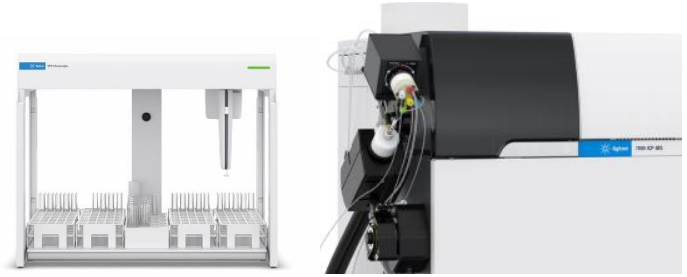
Agilent ICP-OES Automation System

Less work. More flow.
The Agilent ICP Workflow Automation Solution

- Addition of ADS 2 adds a new industry standard
  - Boosts throughput & free's up the Operator's time
  - Automates analysis dilution tasks
  - Further reduces TAT, cost/sample & human error

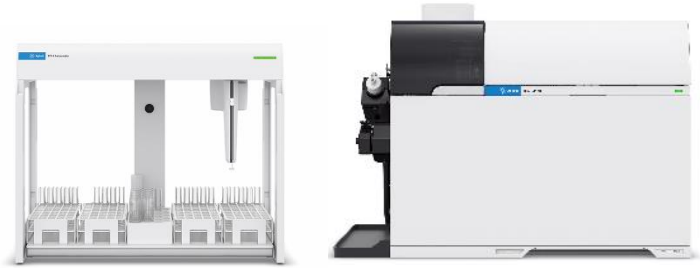
Agilent ICP-OES/-MS + SPS 4 + ADS 2

- High throughput labs have standardized on switching value technology
  - AVS increase sample throughput – improves key metrics of Turn-Around Time (TAT) and cost/sample



Agilent ICP-OES/-MS + SPS 4 + AVS/AVS-MS

- Most routine labs are using autosamplers to introduce sample to the ICP

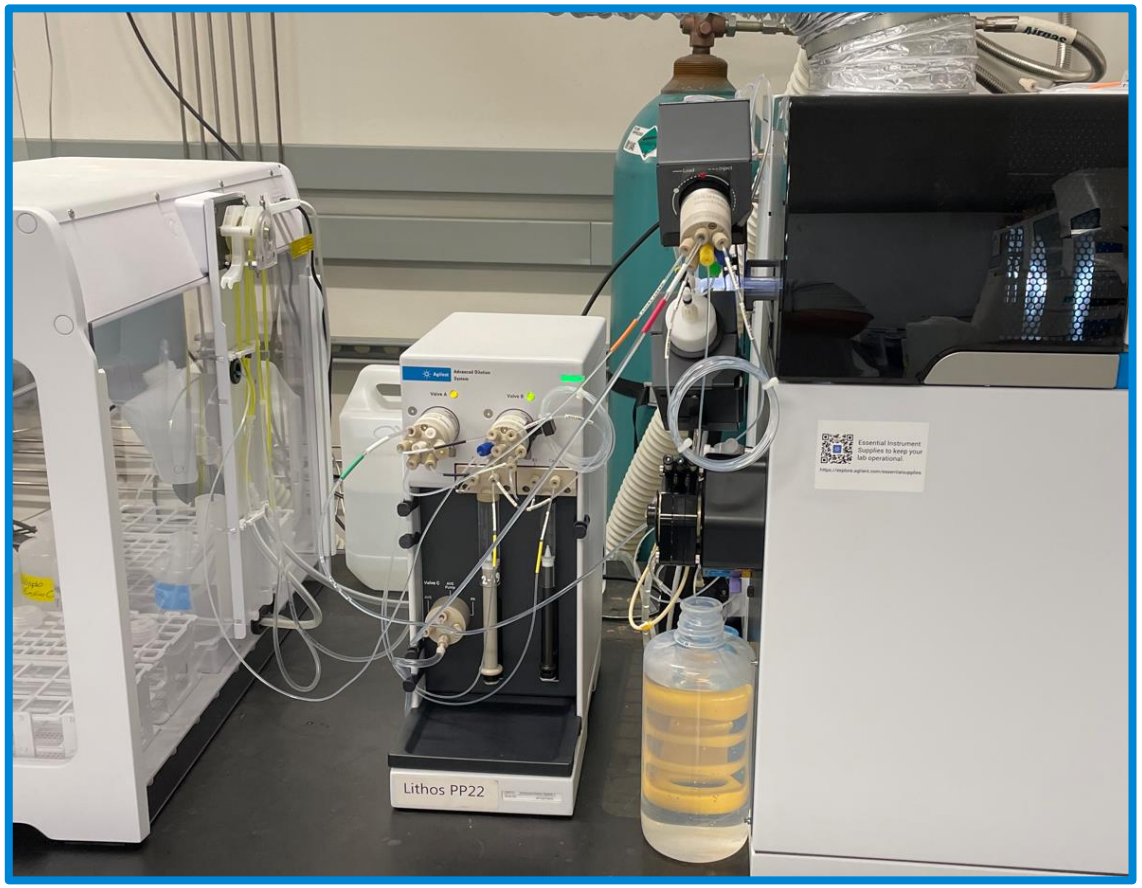


Agilent ICP-OES/-MS + SPS 4

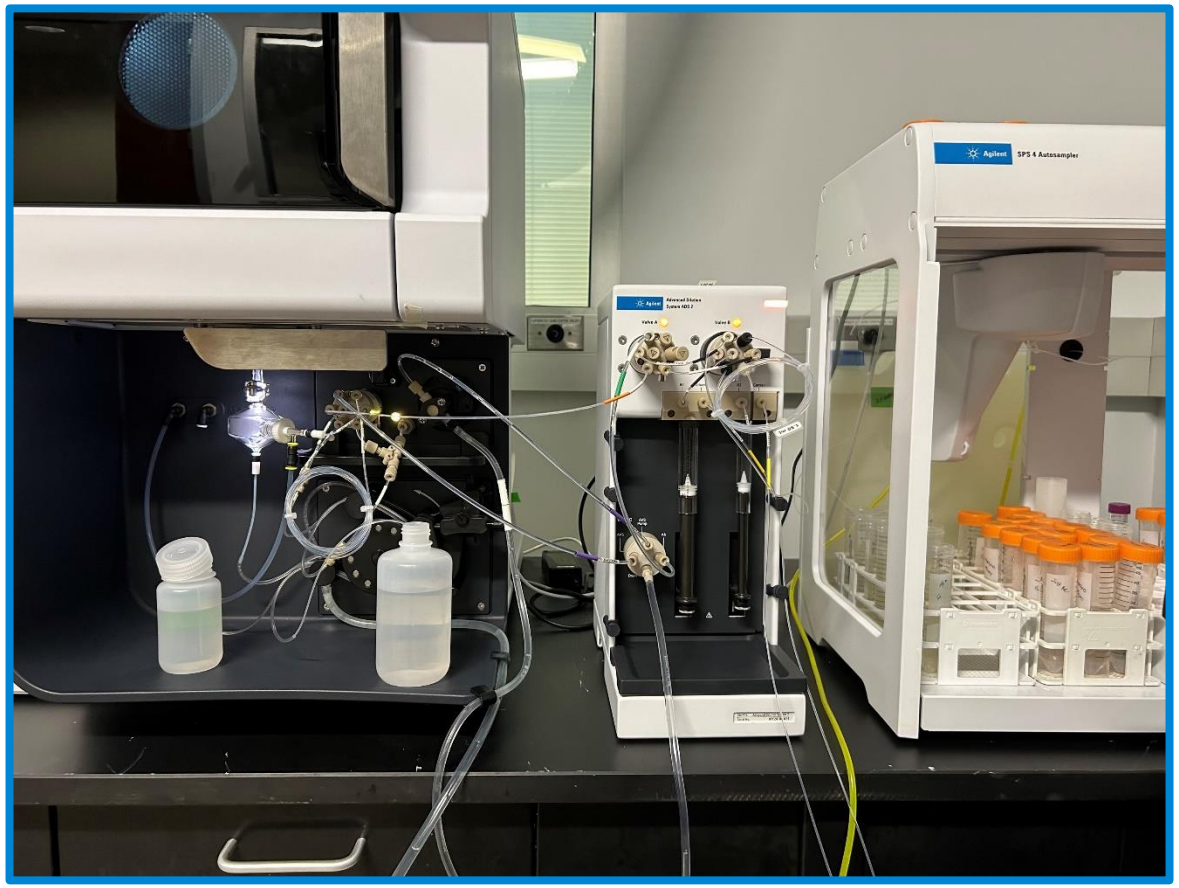
Increasing Level of Automation

ADS2 in Agilent Labs

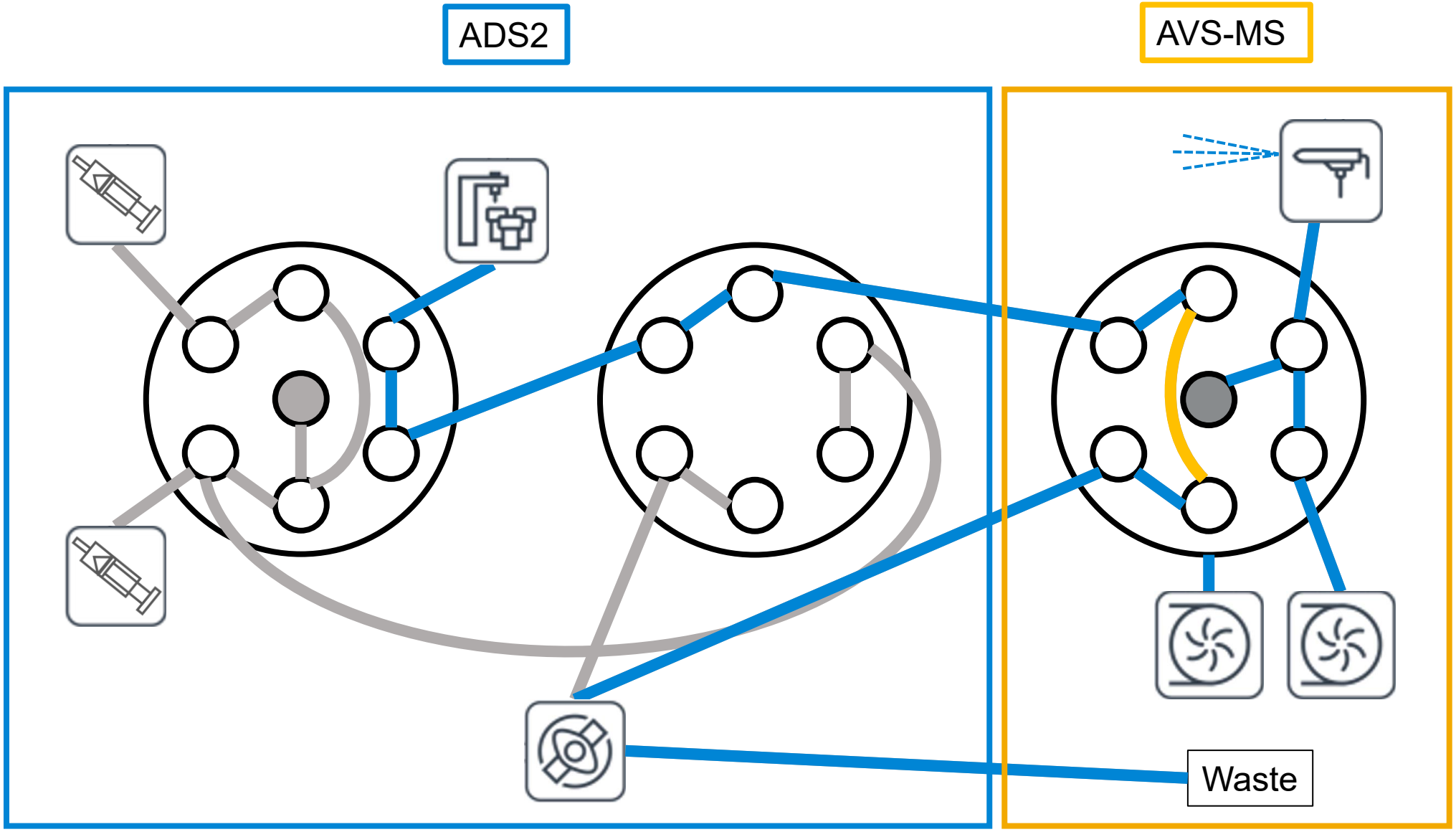
Agilent 7850 ICP-MS + SPS4 + ADS2



Agilent 5900 ICP-OES + SPS4 + ADS2

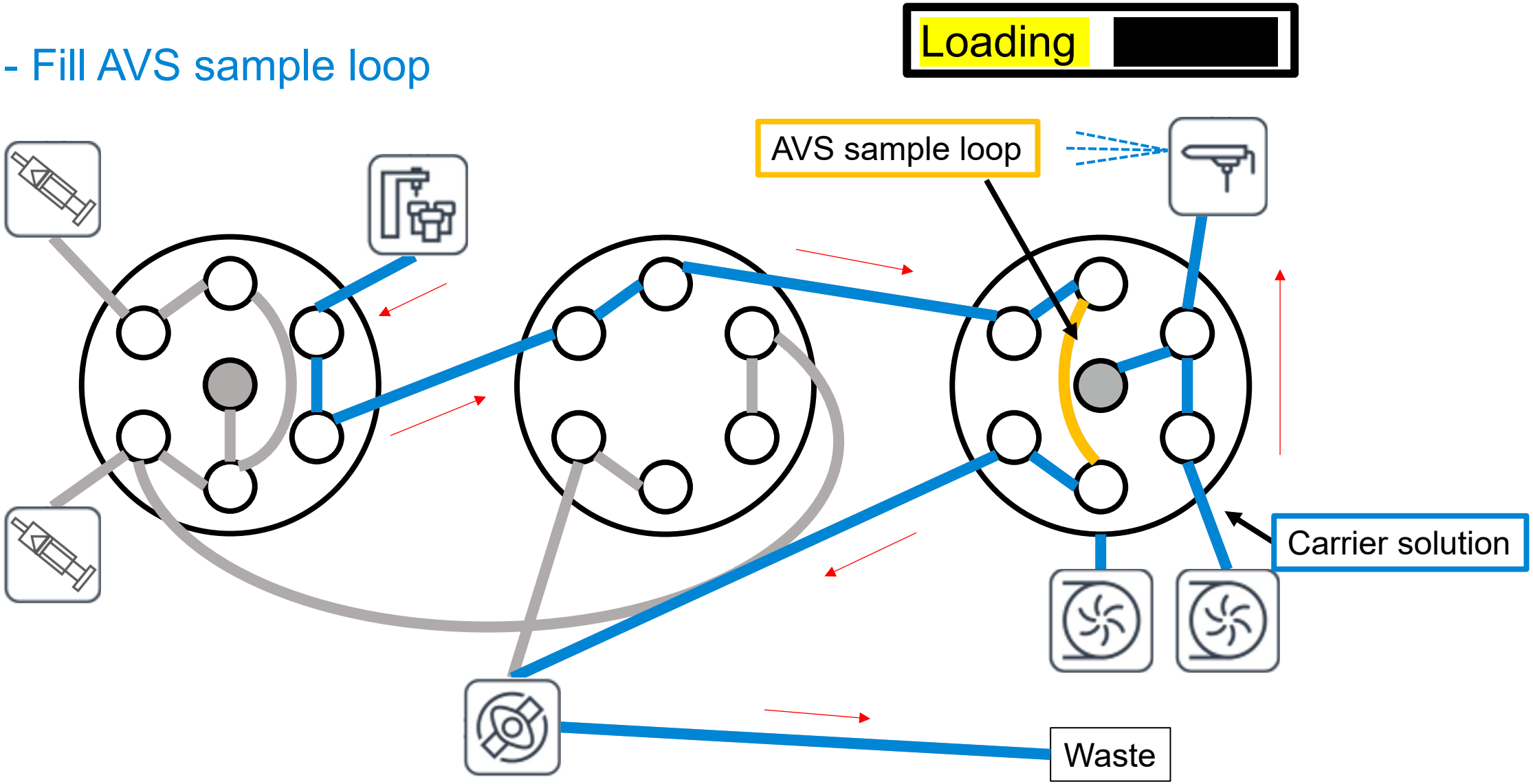


Simple Flow Diagram

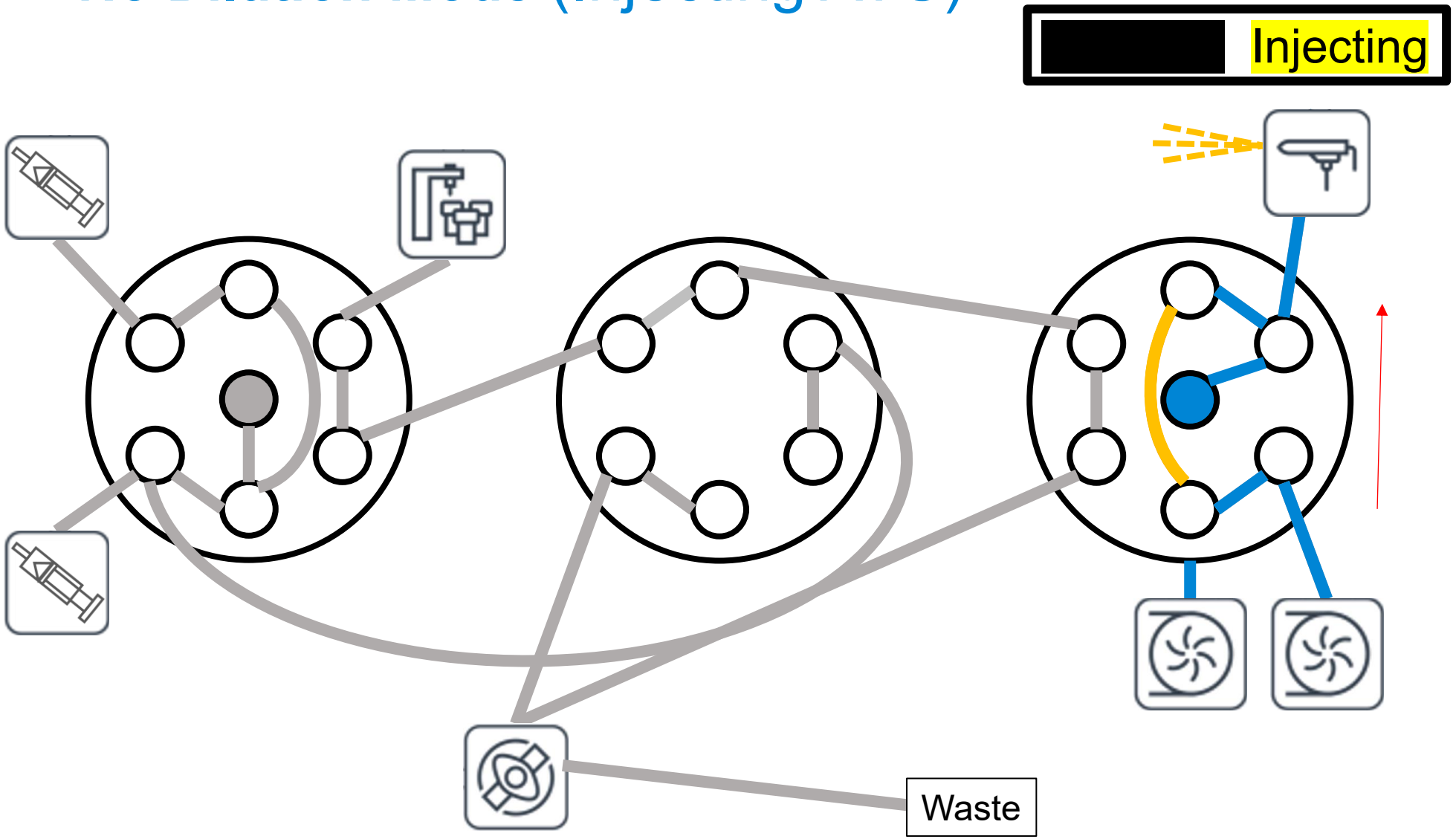


No Dilution Mode (Loading AVS)

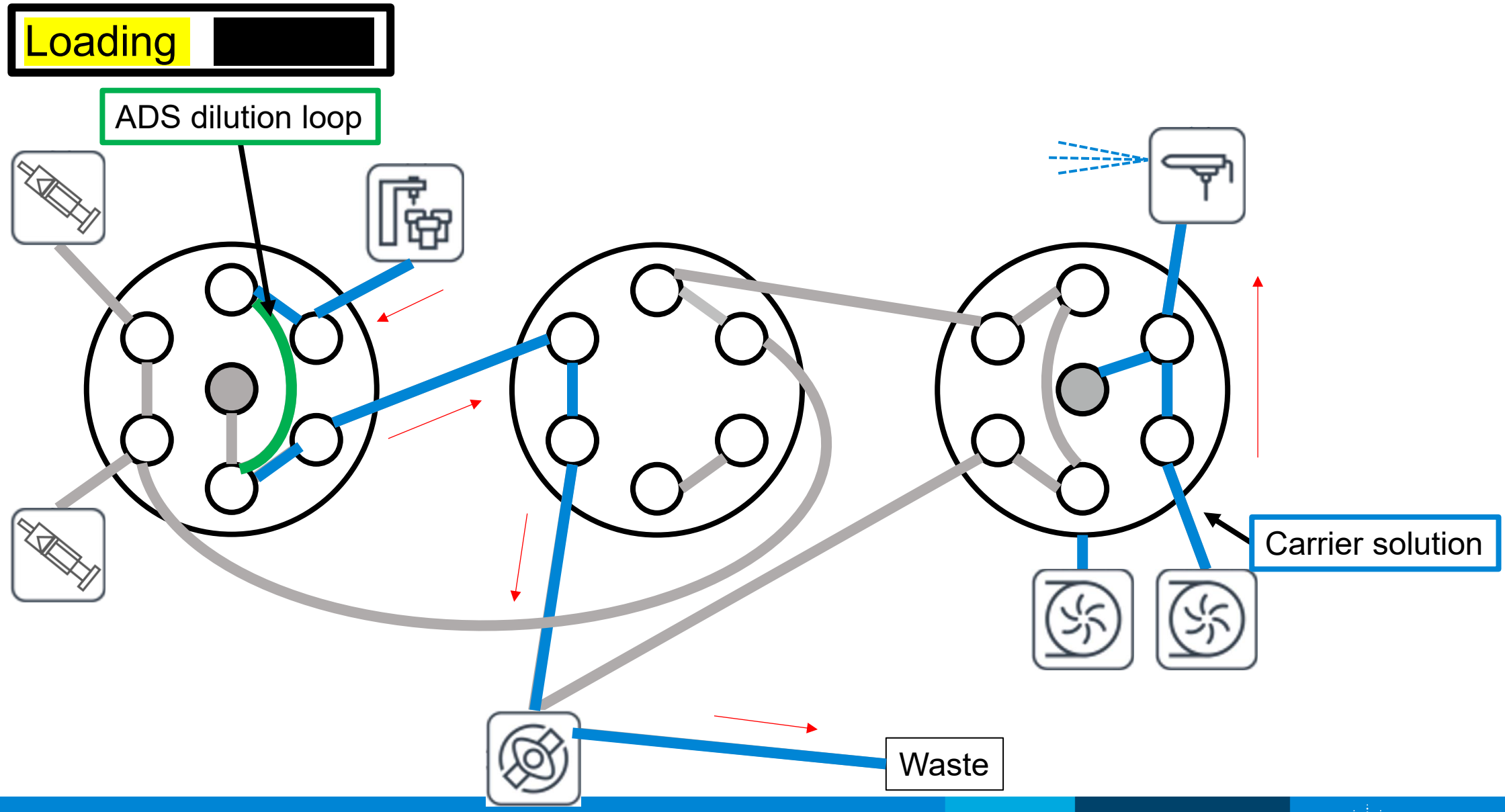
- Fill AVS sample loop



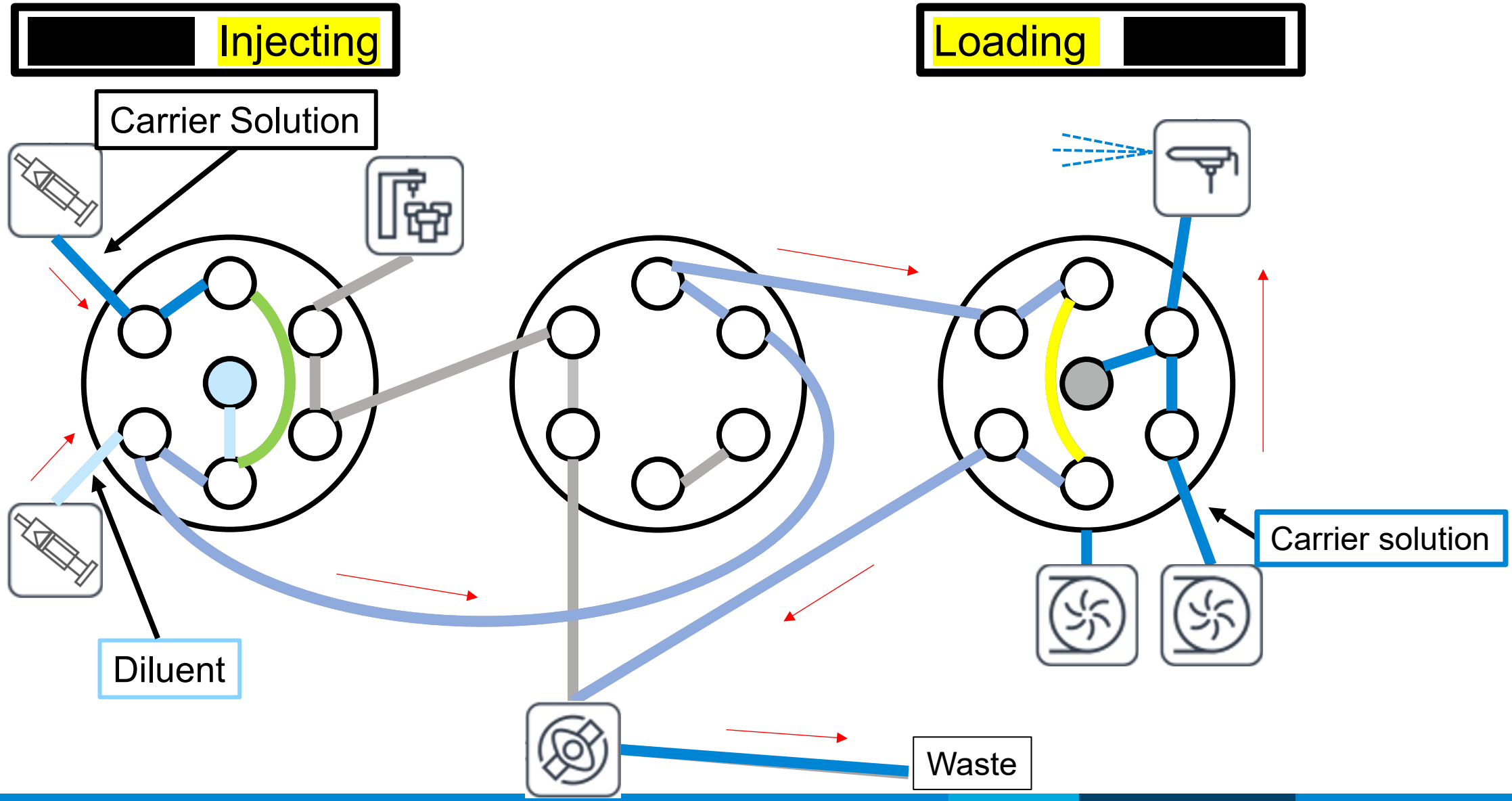
No Dilution Mode (Injecting AVS)



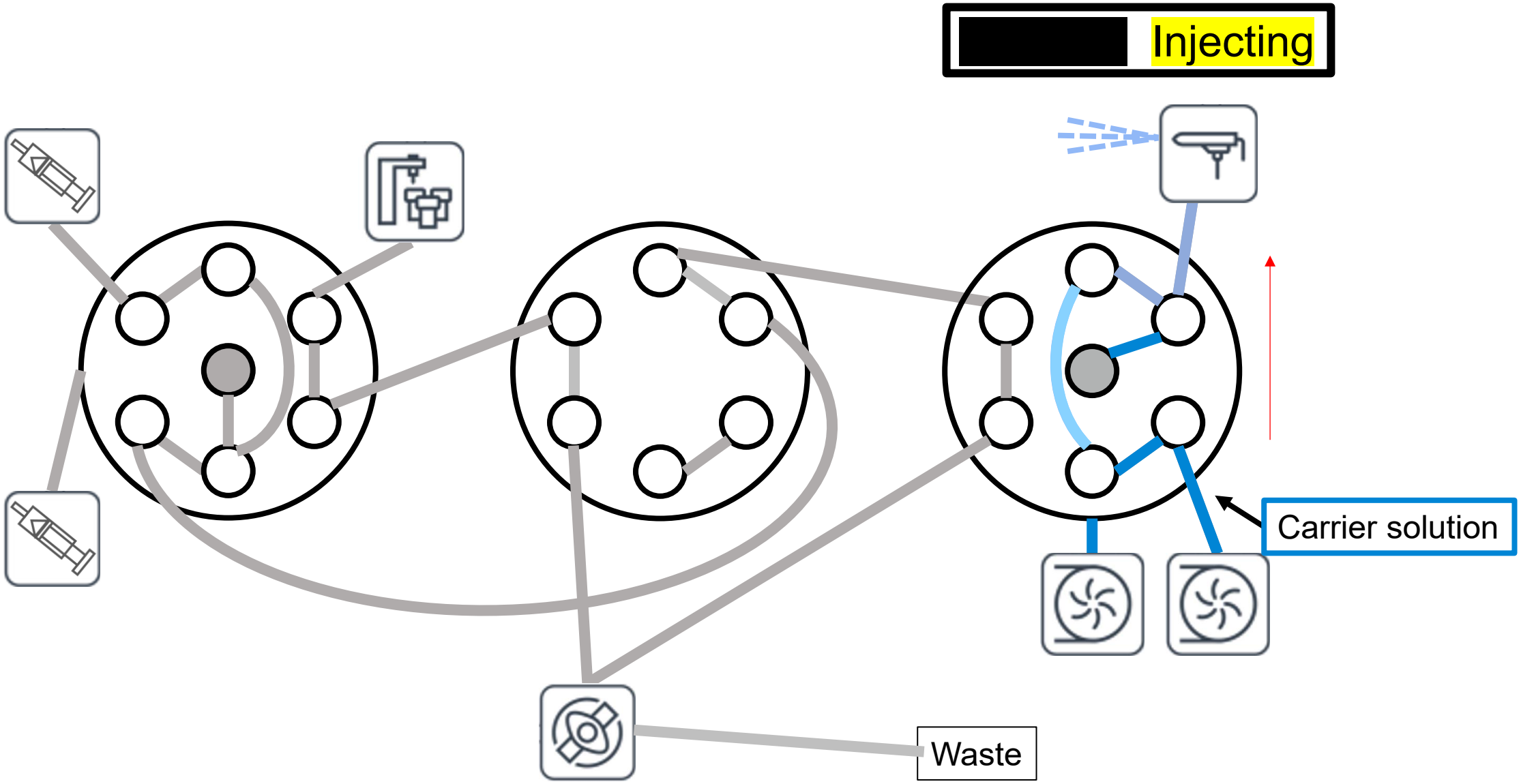
Dilution Mode (Loading the ADS dilution loop)



Dilution Mode (Diluting the sample and loading AVS loop)

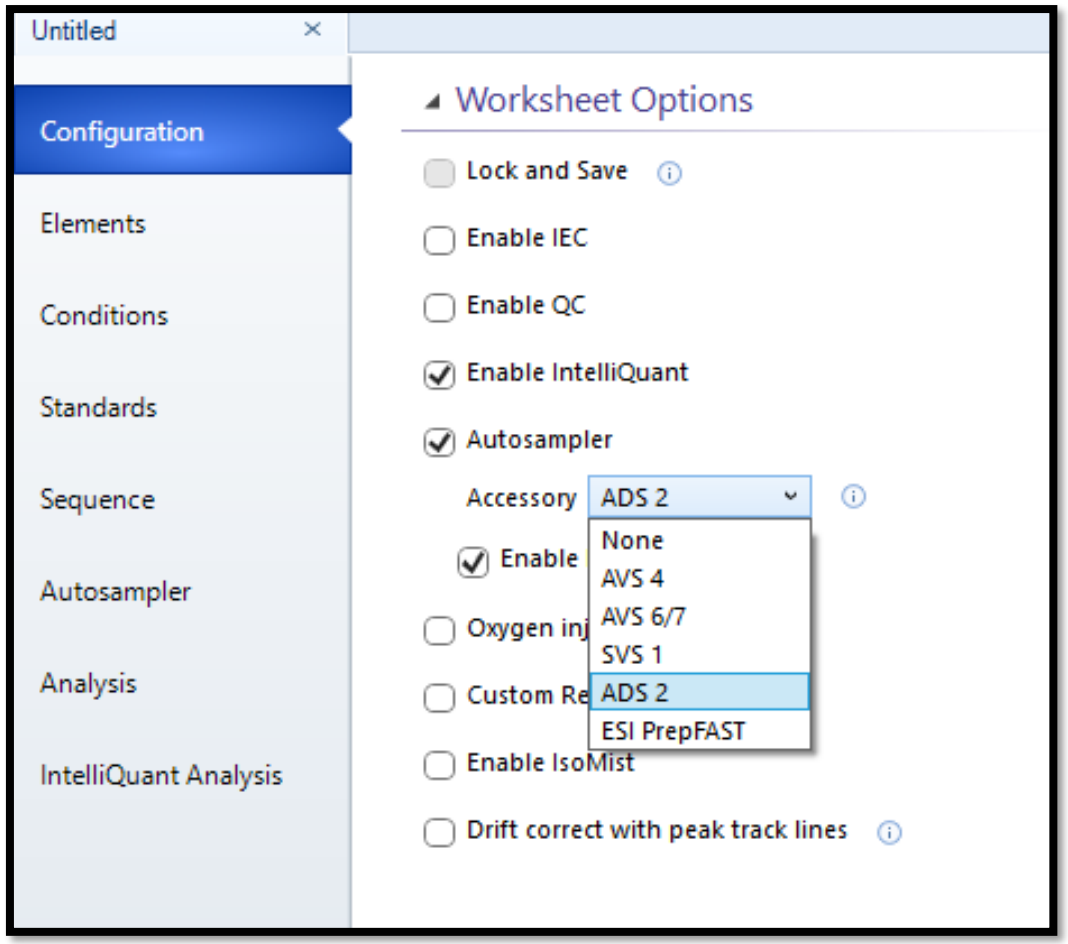


Dilution Mode (Injecting the diluted sample)

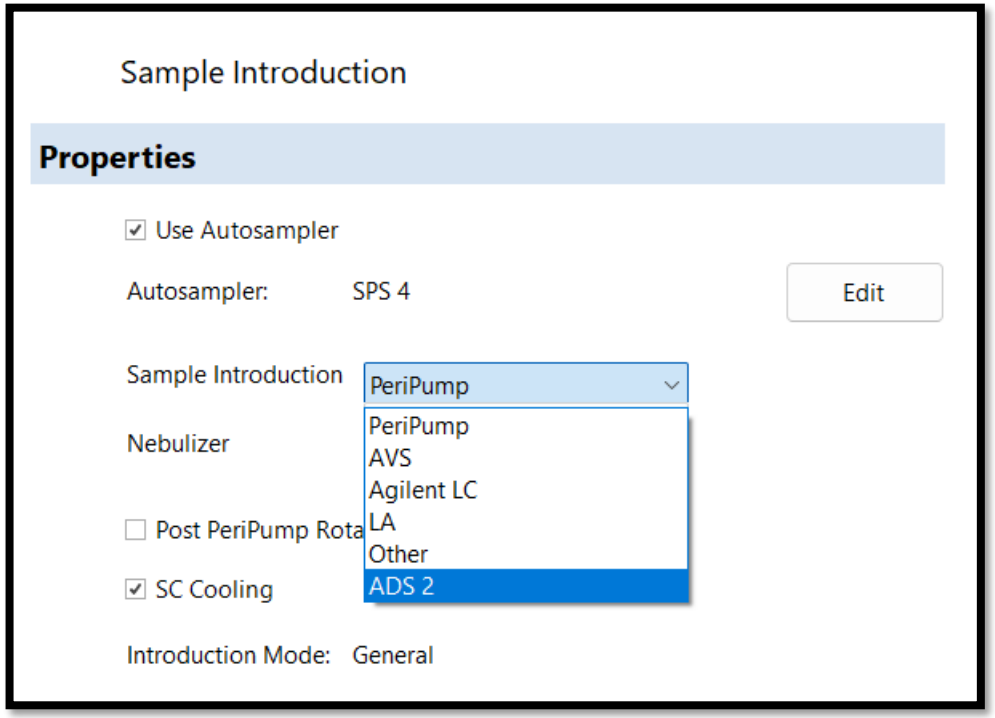


ADS2 Software Fully Integrated with Agilent Atomic Instruments

ICP Expert 7.7

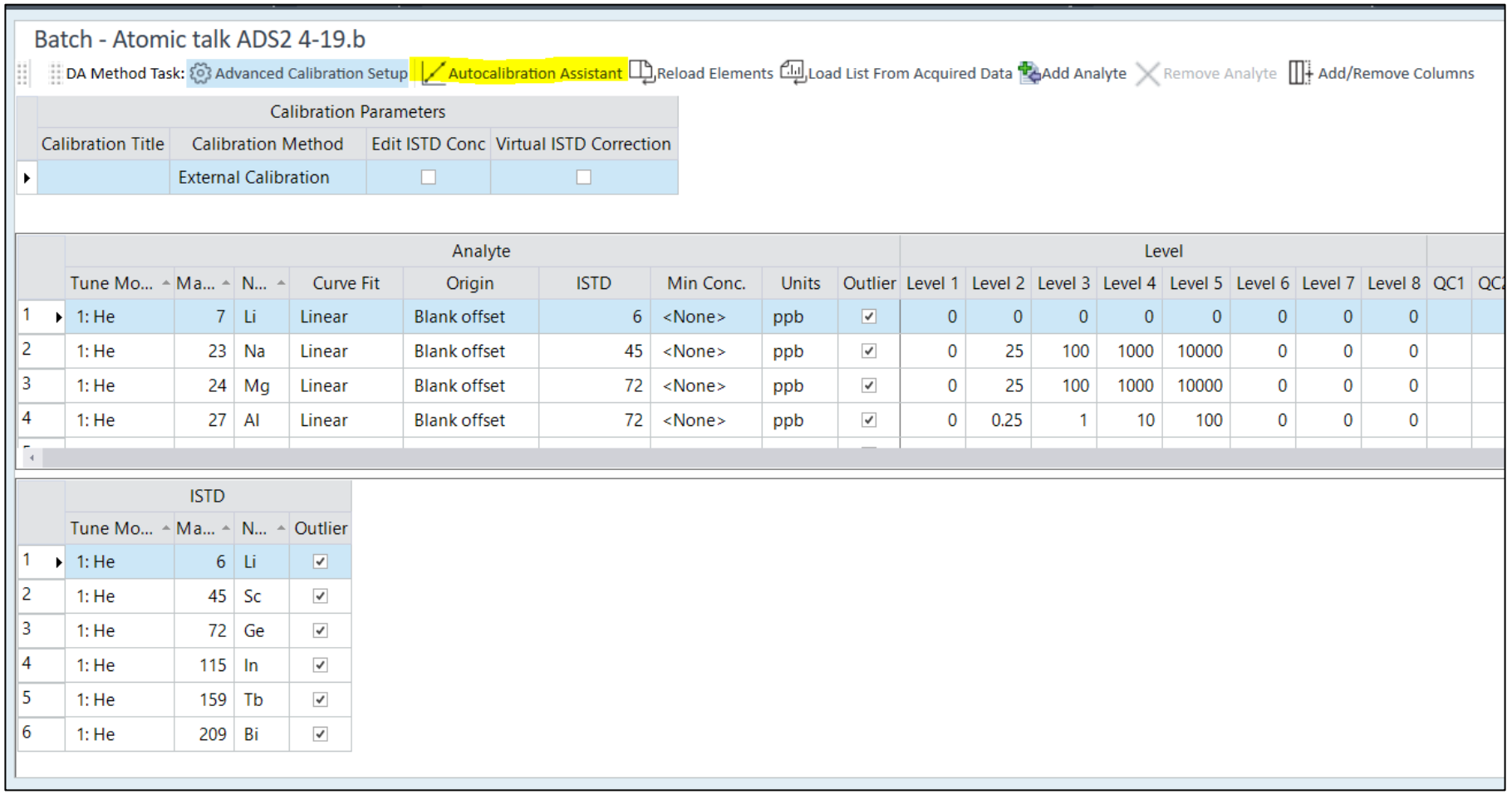


MassHunter 5.3



Automatic Preparation of Calibration Standards

MassHunter 5.3



Autocalibration Assistant

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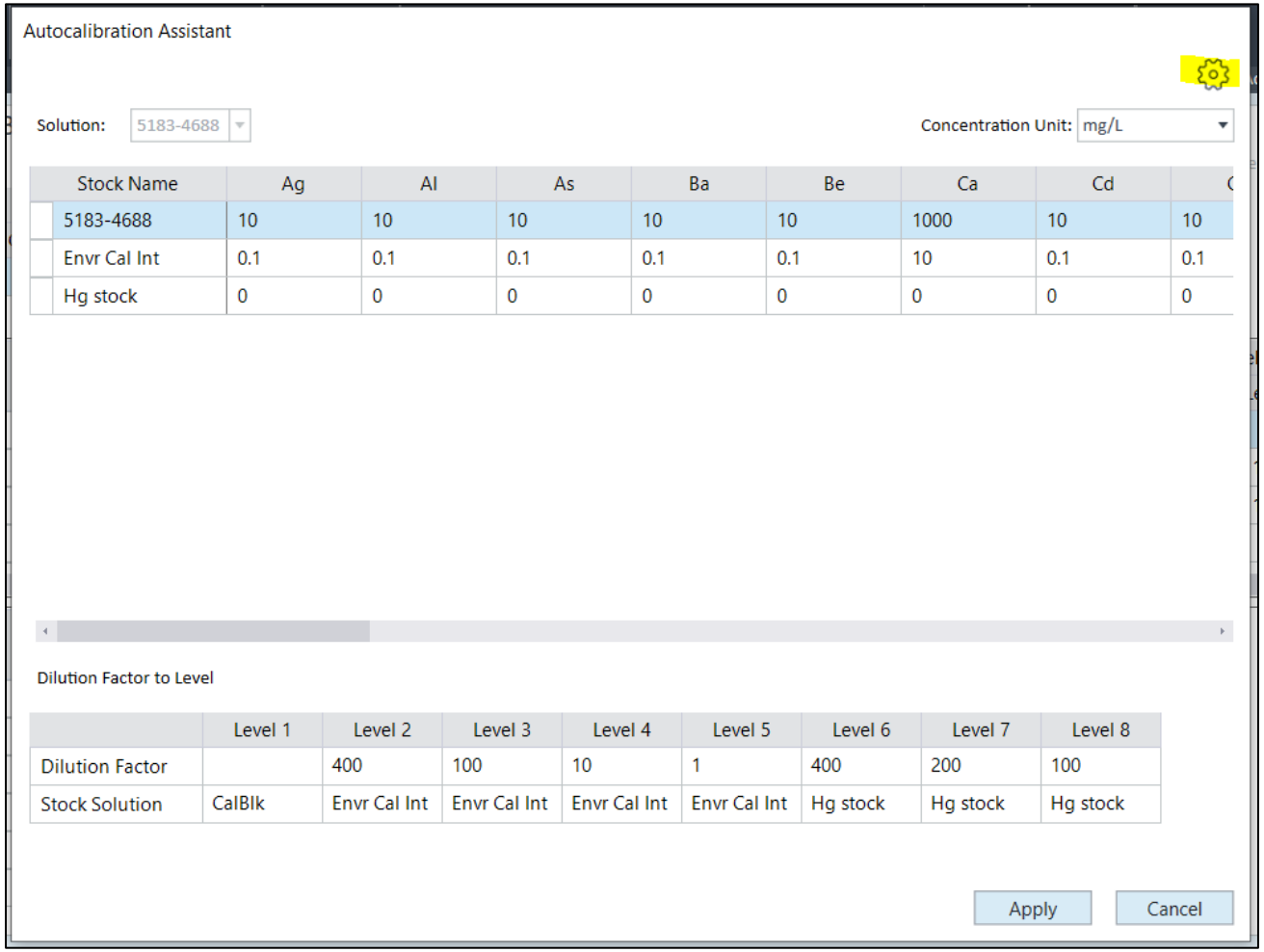
Automatic Preparation of Calibration Standards

MassHunter 5.3

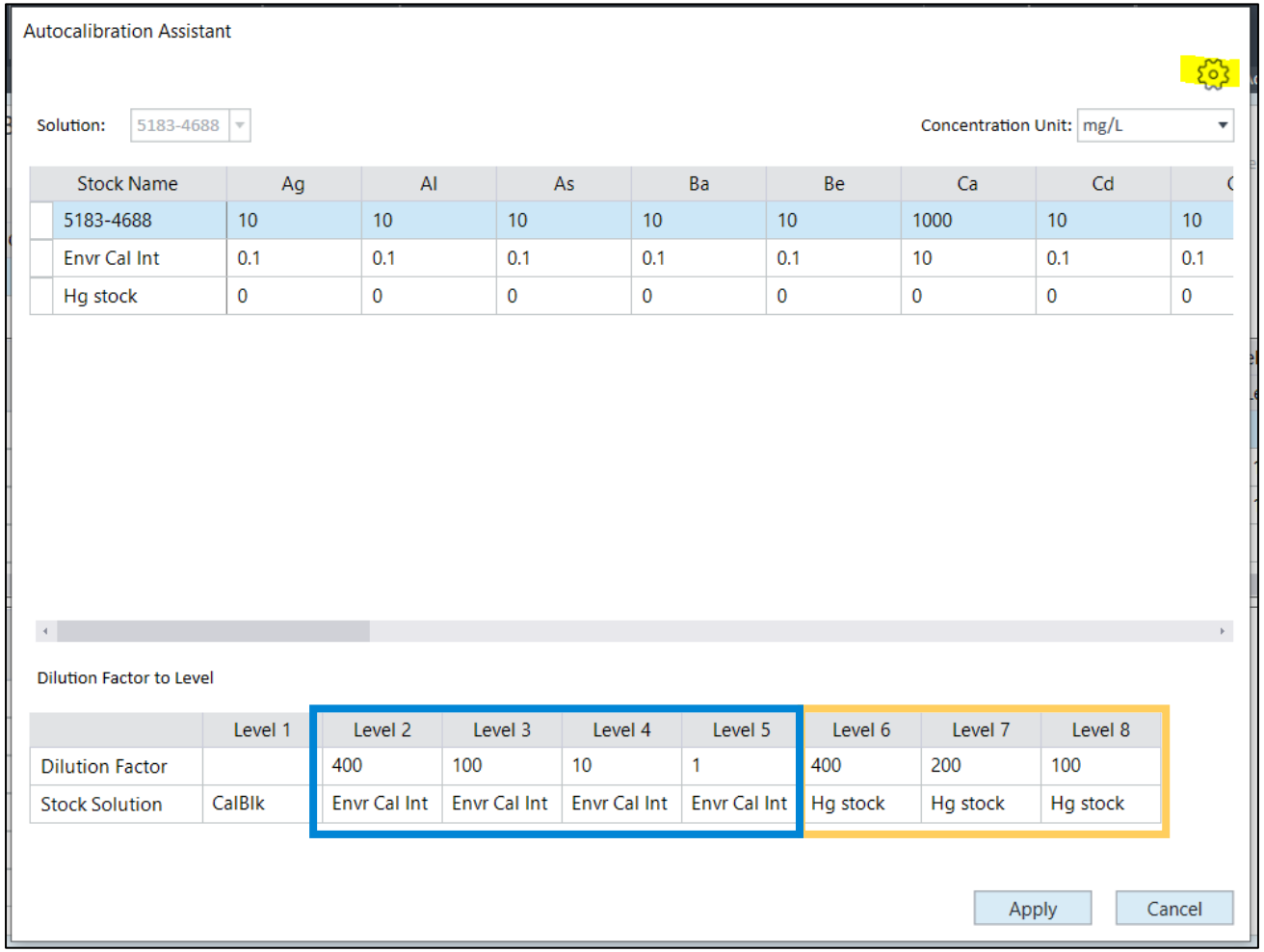


Set up calibration stocks

(only need to perform once)

Automatic Preparation of Calibration Standards

MassHunter 5.3

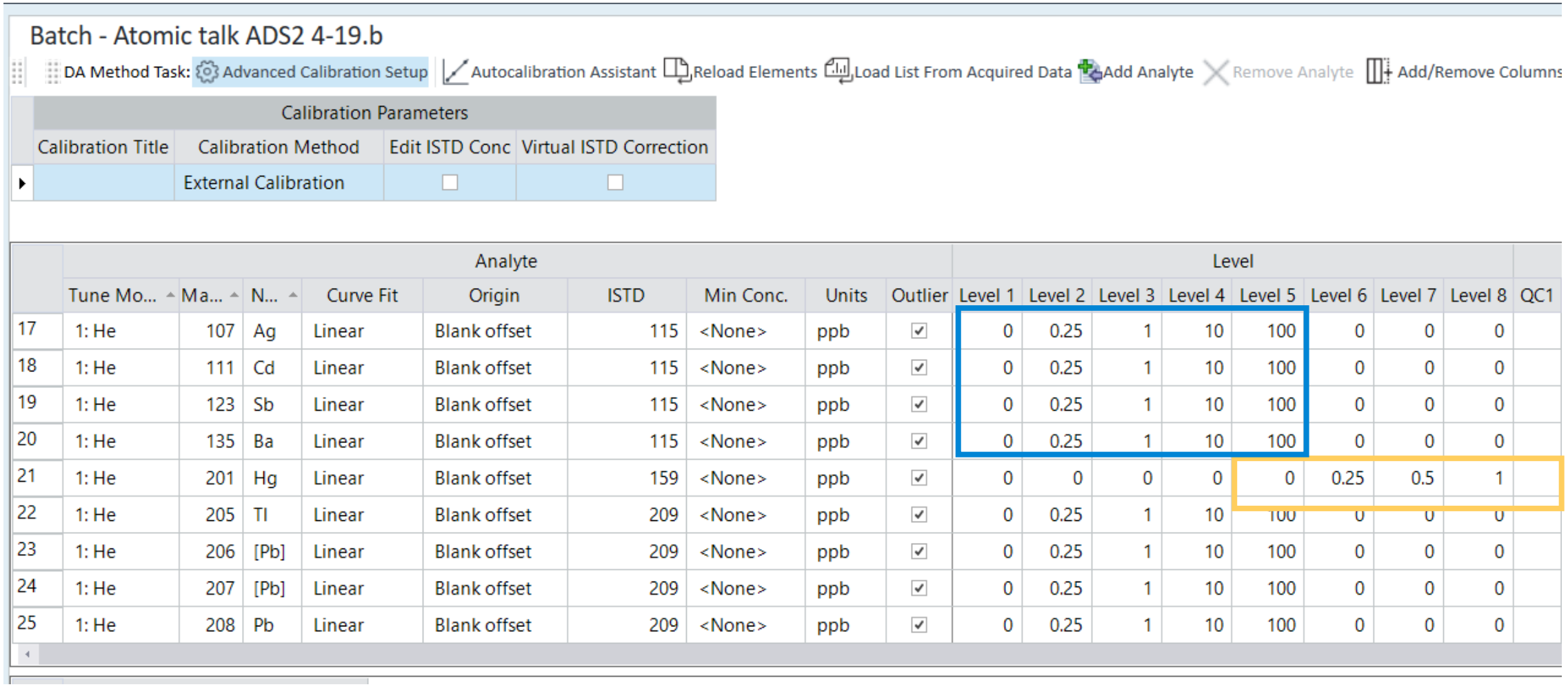


Set up calibration Levels

(only need to perform once for each batch)

Automatic Preparation of Calibration Standards

MassHunter 5.3



Batch - Atomic talk ADS2 4-19.b

DA Method Task: Advanced Calibration Setup | Autocalibration Assistant | Reload Elements | Load List From Acquired Data | Add Analyte | Remove Analyte | Add/Remove Columns

Calibration Parameters			
Calibration Title	Calibration Method	Edit ISTD Conc	Virtual ISTD Correction
	External Calibration	☐	☐

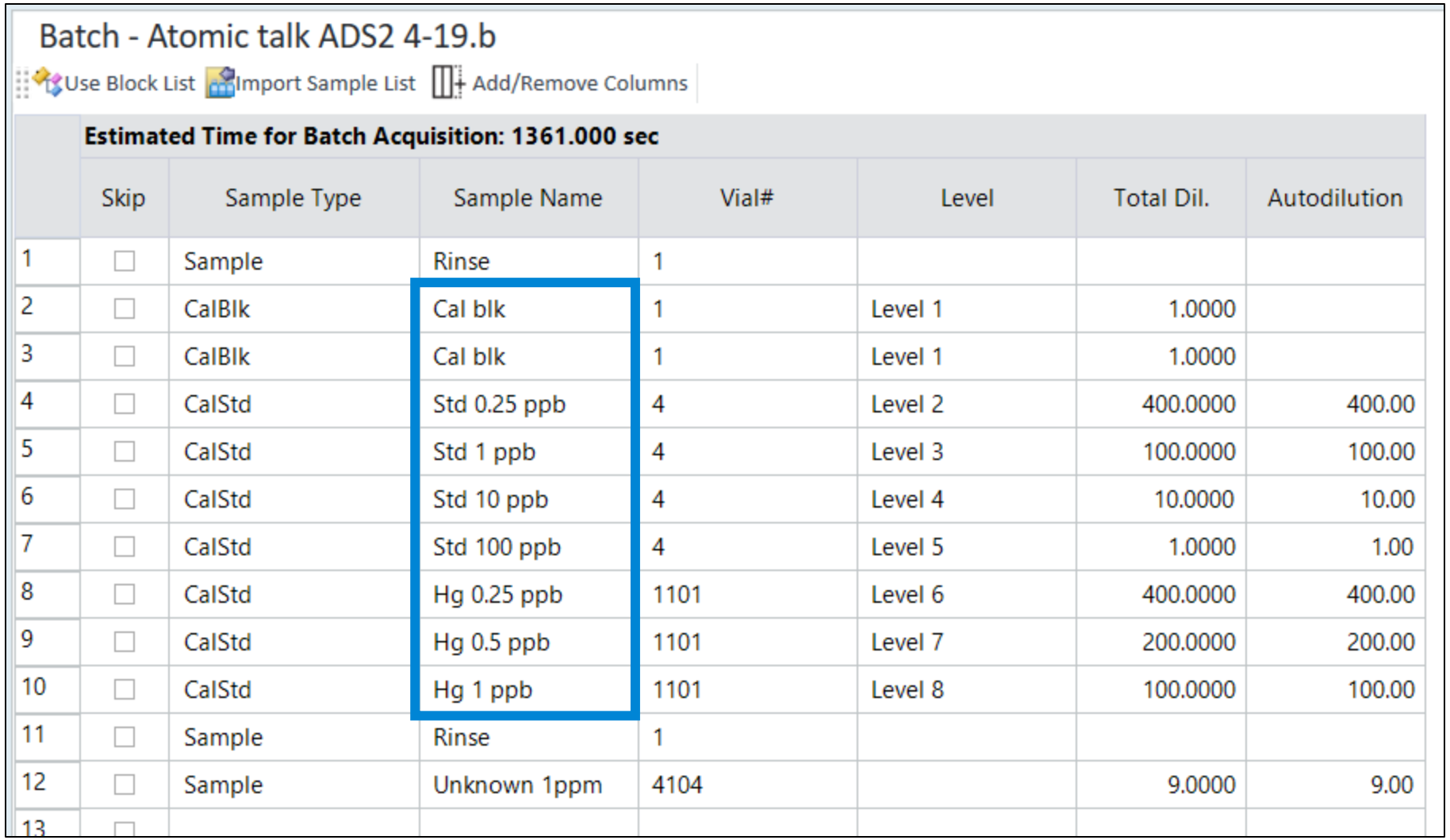
	Analyte									Level								
	Tune Mo...	Ma...	N...	Curve Fit	Origin	ISTD	Min Conc.	Units	Outlier	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	QC1
17	1: He	107	Ag	Linear	Blank offset	115	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
18	1: He	111	Cd	Linear	Blank offset	115	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
19	1: He	123	Sb	Linear	Blank offset	115	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
20	1: He	135	Ba	Linear	Blank offset	115	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
21	1: He	201	Hg	Linear	Blank offset	159	<None>	ppb	☑	0	0	0	0	0	0.25	0.5	1	
22	1: He	205	Tl	Linear	Blank offset	209	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
23	1: He	206	[Pb]	Linear	Blank offset	209	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
24	1: He	207	[Pb]	Linear	Blank offset	209	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	
25	1: He	208	Pb	Linear	Blank offset	209	<None>	ppb	☑	0	0.25	1	10	100	0	0	0	

Calibration table is auto-populated

(only need to perform once for each batch)

Sample List

MassHunter 5.3



Batch - Atomic talk ADS2 4-19.b

Use Block List | Import Sample List | Add/Remove Columns

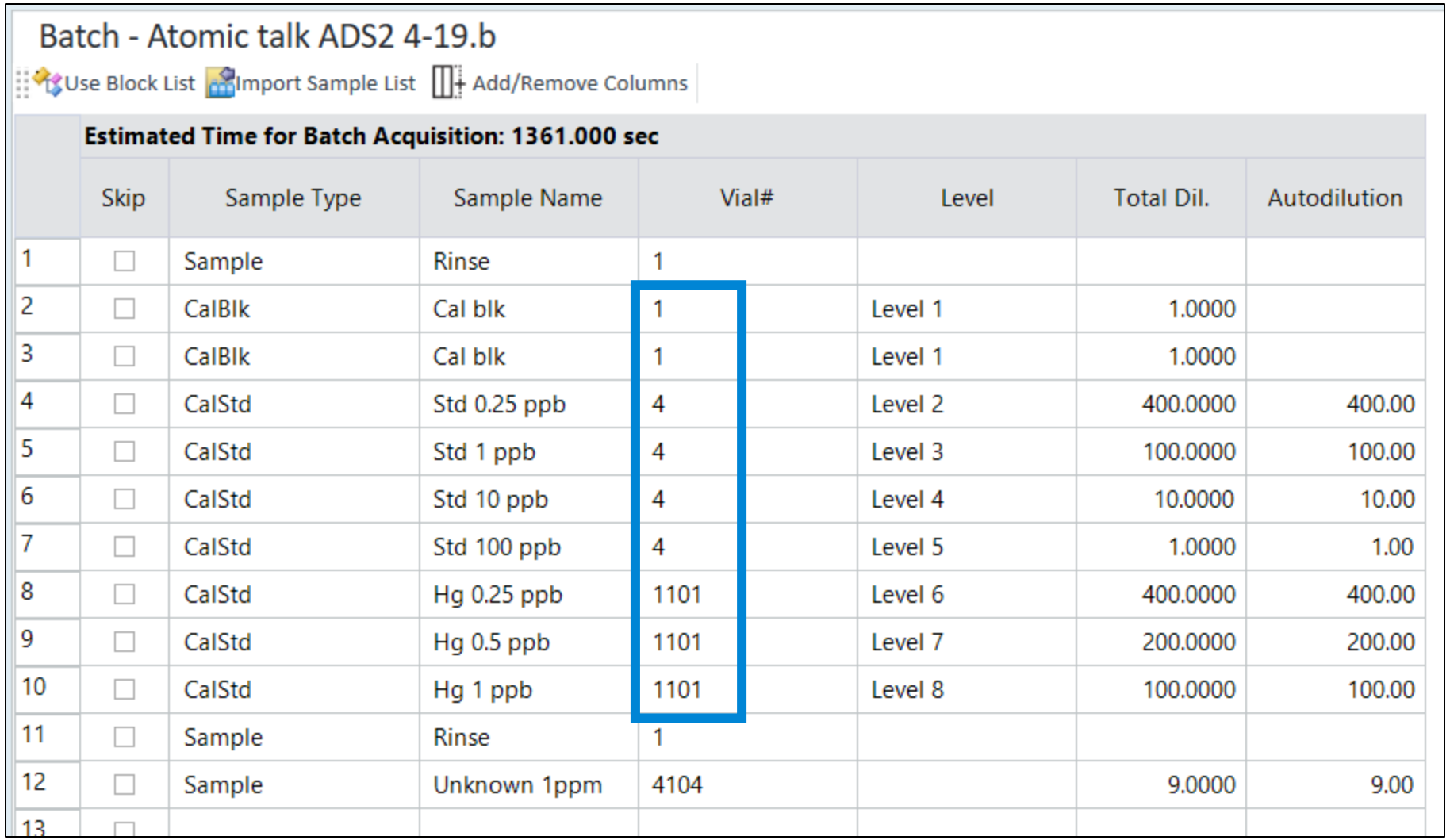
Estimated Time for Batch Acquisition: 1361.000 sec

	Skip	Sample Type	Sample Name	Vial#	Level	Total Dil.	Autodilution
1	☐	Sample	Rinse	1			
2	☐	CalBlk	Cal blk	1	Level 1	1.0000	
3	☐	CalBlk	Cal blk	1	Level 1	1.0000	
4	☐	CalStd	Std 0.25 ppb	4	Level 2	400.0000	400.00
5	☐	CalStd	Std 1 ppb	4	Level 3	100.0000	100.00
6	☐	CalStd	Std 10 ppb	4	Level 4	10.0000	10.00
7	☐	CalStd	Std 100 ppb	4	Level 5	1.0000	1.00
8	☐	CalStd	Hg 0.25 ppb	1101	Level 6	400.0000	400.00
9	☐	CalStd	Hg 0.5 ppb	1101	Level 7	200.0000	200.00
10	☐	CalStd	Hg 1 ppb	1101	Level 8	100.0000	100.00
11	☐	Sample	Rinse	1			
12	☐	Sample	Unknown 1ppm	4104		9.0000	9.00
13	☐						

Add cal blanks and calibration levels

Sample List

MassHunter 5.3



Batch - Atomic talk ADS2 4-19.b

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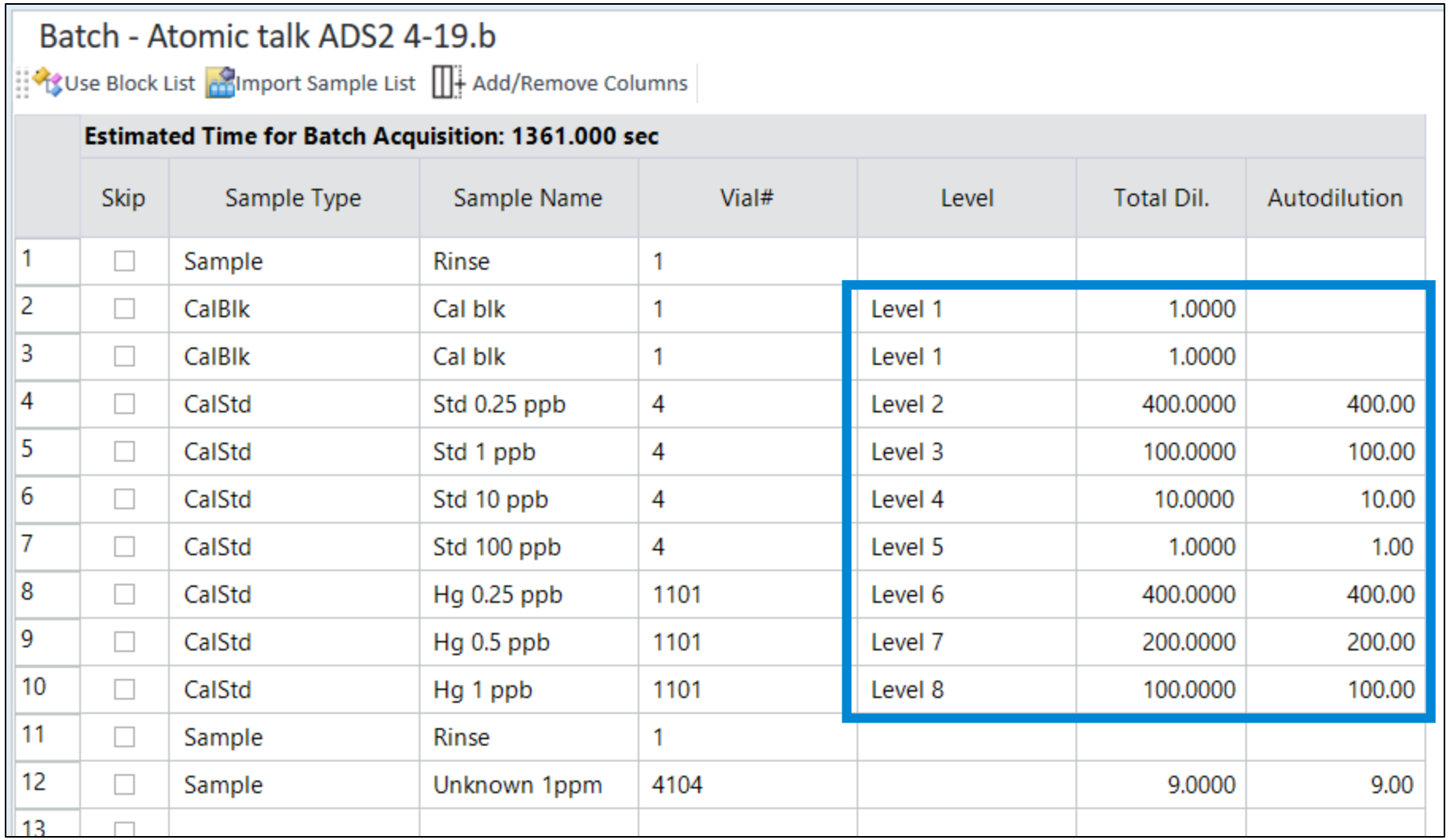
1	☐	Sample	Rinse	1			
2	☐	CalBlk	Cal blk	1	Level 1	1.0000	
3	☐	CalBlk	Cal blk	1	Level 1	1.0000	
4	☐	CalStd	Std 0.25 ppb	4	Level 2	400.0000	400.00
5	☐	CalStd	Std 1 ppb	4	Level 3	100.0000	100.00
6	☐	CalStd	Std 10 ppb	4	Level 4	10.0000	10.00
7	☐	CalStd	Std 100 ppb	4	Level 5	1.0000	1.00
8	☐	CalStd	Hg 0.25 ppb	1101	Level 6	400.0000	400.00
9	☐	CalStd	Hg 0.5 ppb	1101	Level 7	200.0000	200.00
10	☐	CalStd	Hg 1 ppb	1101	Level 8	100.0000	100.00
11	☐	Sample	Rinse	1			
12	☐	Sample	Unknown 1ppm	4104		9.0000	9.00
13	☐						

Only three vials needed!

Sample List

MassHunter 5.3



Batch - Atomic talk ADS2 4-19.b

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2	☐	CalBlk	Cal blk	1	Level 1	1.0000	
3	☐	CalBlk	Cal blk	1	Level 1	1.0000	
4	☐	CalStd	Std 0.25 ppb	4	Level 2	400.0000	400.00
5	☐	CalStd	Std 1 ppb	4	Level 3	100.0000	100.00
6	☐	CalStd	Std 10 ppb	4	Level 4	10.0000	10.00
7	☐	CalStd	Std 100 ppb	4	Level 5	1.0000	1.00
8	☐	CalStd	Hg 0.25 ppb	1101	Level 6	400.0000	400.00
9	☐	CalStd	Hg 0.5 ppb	1101	Level 7	200.0000	200.00
10	☐	CalStd	Hg 1 ppb	1101	Level 8	100.0000	100.00
11	☐	Sample	Rinse	1			
12	☐	Sample	Unknown 1ppm	4104		9.0000	9.00
13	☐						

Autodilution factors are auto-populated once levels are entered

Sample List

MassHunter 5.3

Batch - Atomic talk ADS2 4-19.b

Use Block List | Import Sample List | Add/Remove Columns

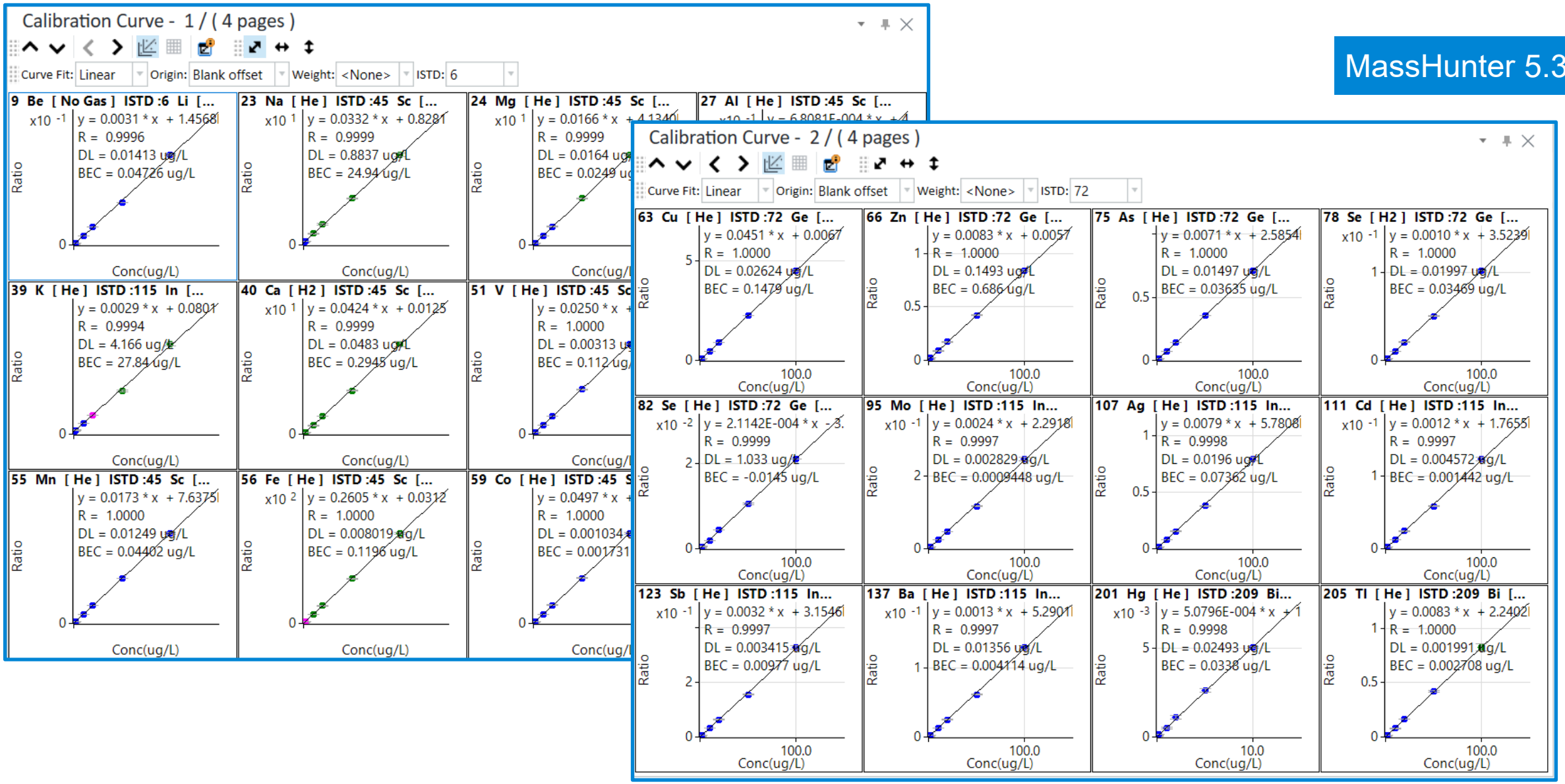
Estimated Time for Batch Acquisition: 1361.000 sec

	Skip	Sample Type	Sample Name	Vial#	Level	Total Dil.	Autodilution
1	☐	Sample	Rinse	1			
2	☐	CalBlk	Cal blk	1	Level 1	1.0000	
3	☐	CalBlk	Cal blk	1	Level 1	1.0000	
4	☐	CalStd	Std 0.25 ppb	4	Level 2	400.0000	400.00
5	☐	CalStd	Std 1 ppb	4	Level 3	100.0000	100.00
6	☐	CalStd	Std 10 ppb	4	Level 4	10.0000	10.00
7	☐	CalStd	Std 100 ppb	4	Level 5	1.0000	1.00
8	☐	CalStd	Hg 0.25 ppb	1101	Level 6	400.0000	400.00
9	☐	CalStd	Hg 0.5 ppb	1101	Level 7	200.0000	200.00
10	☐	CalStd	Hg 1 ppb	1101	Level 8	100.0000	100.00
11	☐	Sample	Rinse	1			
12	☐	Sample	Unknown 1ppm	4104		9.0000	9.00
13	☐						

Unknown sample auto-predilution

Calibration Curves from Blank Solution & Calibration Stock(s)

MassHunter 5.3



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Data Analysis Table (post analysis)

MassHunter 5.3

	Count RSD %		5	>= 10000 cps	Ignore and Continue
	Blank Conc Level % [use 'BlkVrfy' Sample]		100	BlkVrfy	Ignore and Continue
	Out of Calibration Curve Concentration Range %		100		Dilute and Re-Run

Setup preferred actions under QC setup

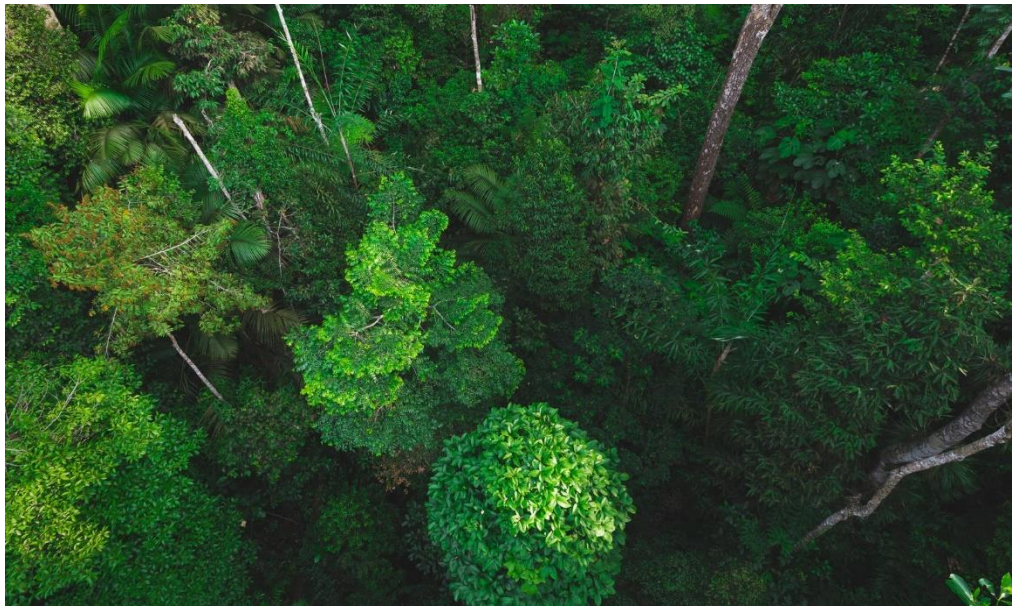
					39 K [He]		44 Ca [He]	
Sample Name	Total Dil.	Vial Number	Autodilution	]	Conc. [ppb]	Meas. Conc. [ppb]	Conc. [ppb]	Meas. Conc. [ppb]
Std 1	100.0000	4	100.00	33	102.404	102.404	98.190	98.190
Std 10	10.0000	4	10.00	77	1022.460	1022.460	990.832	990.832
Std 100	1.0000	4	1.00	01	9997.738	9997.738	10000.939	10000.939
Rinse	1.0000	1		21	-2.622	-2.622	0.871	0.871
Unknown 1ppm	9.0000	4104	9.00	10	100283.458	11142.606	97942.385	10882.487
Unknown 1ppm	20.0000	4104	20.00	28	100392.589	5019.629	96810.712	4840.536

Active smart re-dilution of overrange samples

Sustainability

The automation of manual tasks with the ICP workflow automation systems

- Increases Productivity
- Reduces Energy Consumption
- Reduces Waste of single-use plastic including:
  - Pipette Tips
  - Sample Vials
  - Gloves



Agilents' ICP Workflow Automation Systems will lower the cost-of-analysis and reduce the environmental impact of analysis, helping labs to become more sustainable.

The Integrated, All-Agilent ICP Automation System

Increasing productivity

Agilent

Trusted Answers

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Craig_jones@agilent.com

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