



# SAMPLE TRAX<sup>SF</sup>

Barcoded Sample Tracking and  
ICPMS Analysis of High Purity  
Semiconductor Grade Chemicals



**Elemental Scientific**

ICP | ICPMS | AA

# sampleTRAX SF



sampleTRAX SF Analytical Station

sampleTRAX SF is an advanced, automated sample identification system that uses barcodes to track samples from time of collection through reception to final analysis and data reporting. Direct analysis of semiconductor grade chemicals by ICPMS at less than 1 ppt are achieved with sampleTRAX SF.

## Sample Identification

- Barcode scanning accesses information including:
  - Sample type
  - Sample Information (Line / Sampling point / Name / etc.)
  - Method of standardization and analysis
  - QC Protocol

## Ultra Pure

- Automated capping and recapping of bottles and vials
- Ultra-clean
- <1 ppt semiconductor metals
- Automated matrix matched MSA, addition or external calibration
- Analytical stations for ICPMS instruments

## Laboratory Automation

- Bottle tracking
- Bottle history (cleaning, sample, chemical, analysis, concentration)
- Chemical grouping
- Chemical specific rinse function per chemical
- Customized network, bottle cycle
- Data management



250 mL bottle with 2D bottom, 2D cap and 1D side barcode

## Fully Automated Sample Identification and Tracking for Ultra-Pure Chemicals



An integrated barcode reader scans the bottom of a PFA bottle to identify sample information before analysis.

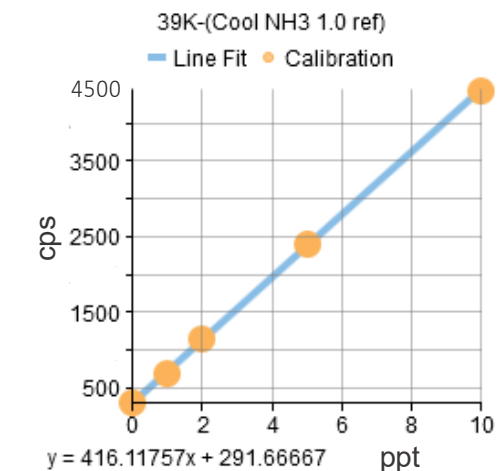
Synchronizing the patented barcode reading arm with the sample probe ensures each sample is positively identified at the time of analysis. The enclosed ultra-pure autosampler guarantees sample integrity is not compromised.

## How it Works

### sampleTRAX SF analytical station automatically:

1. Scans bottles
2. Groups samples by chemical type
3. Analyzes grouped chemicals in a user-defined order
4. Performs wash method specific to each chemical type after each group is analyzed
5. Generates and reports data

## Autocalibration of <sup>39</sup>K from a Single Stock Solution



\* All calibration strategies automated (MSA, Addition, External)

# Barcoded Bottles

# TRAX Scan Stations

## Compatible precleaned and barcoded bottles, vials and caps

See the back page for more details.



## 1D and 2D Barcodes Permanently Marked Into Inert PFA

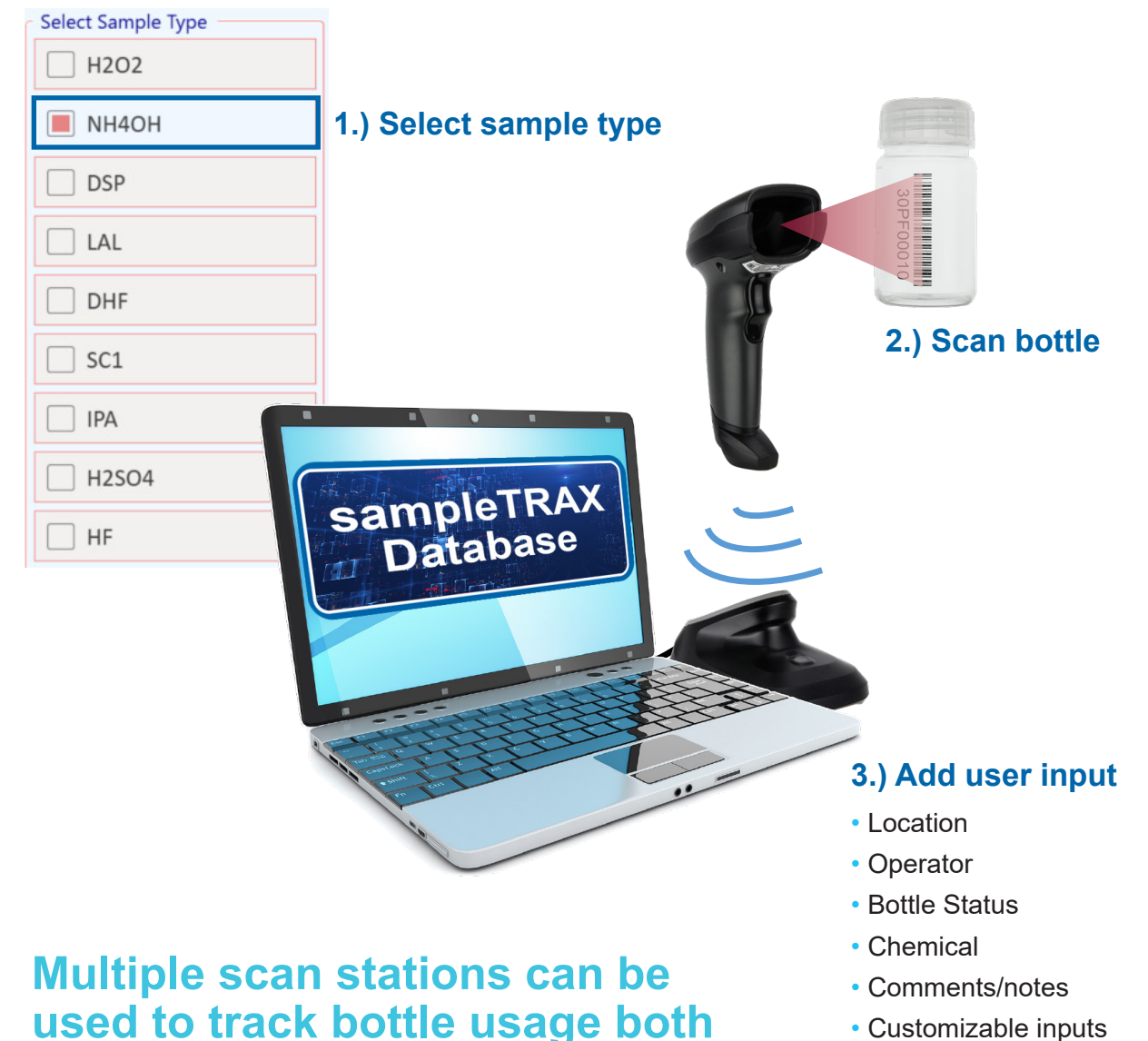
### Benefits

- Chemically inert barcodes
- Non-contaminating markings into acid-resistant PFA
- Reusable
- 2D barcoded bottles are compatible with sampleTRAX SF scanning automation systems
- Track bottle position and sample identity
- Precleaned

### Types

- Bottles and vials
  - 2D bottom barcoded
  - 1D side barcoded
- Caps
  - Available with 2D barcodes

Scan stations are used to associate sample and analytical information with the bottle's barcode.



Multiple scan stations can be used to track bottle usage both in the fab and the laboratory.

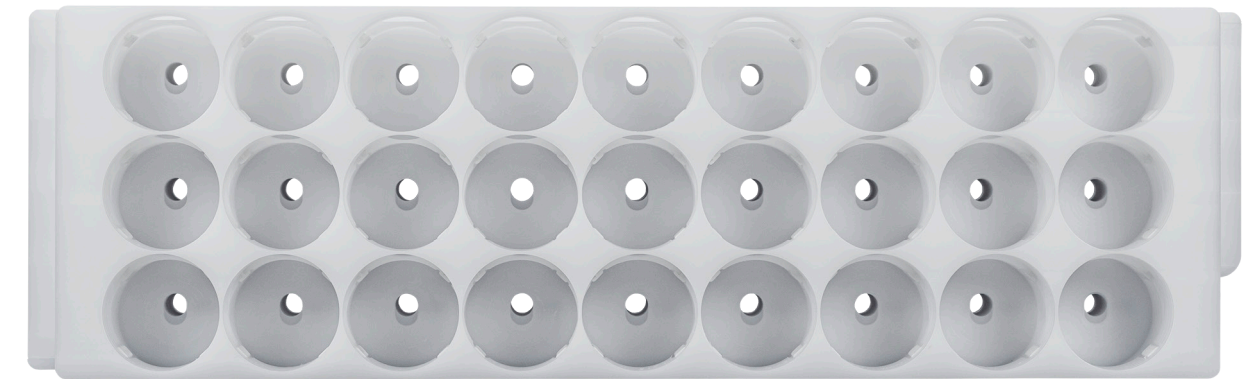
# Fluorocapper

# Fluorocapper Racks

## Automated capping and recapping of bottles and vials

### Fluorocapper for sample cap removal

- More stringent control over contamination
- Reduced exposure of operators to dangerous chemicals
- Elimination of sample evaporation
- Elimination of gas-phase reactions of adjacent sample bottles



## Automatic Locking Racks

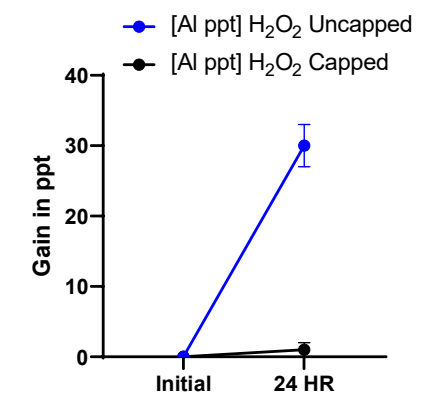
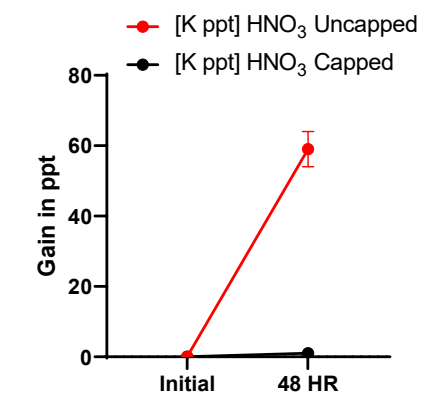
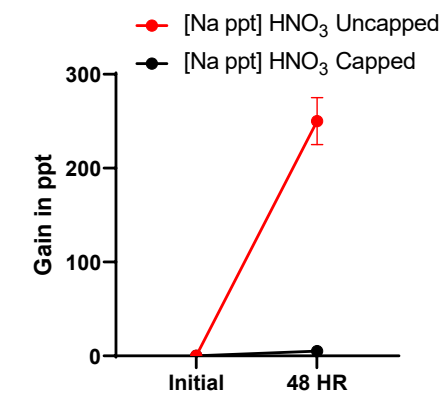
### Fluorocapper racks for 100 mL and 250 mL bottles or 60 mL vials

- Automated capping and recapping of bottles and vials
- Automated locking and unlocking of bottles and vials
- Scanning hole for each bottle or vial
- Reduced exposure of operator to samples



## Fluorocapper reduction of environmental contamination

Accumulation of environmental contamination in uncapped bottles



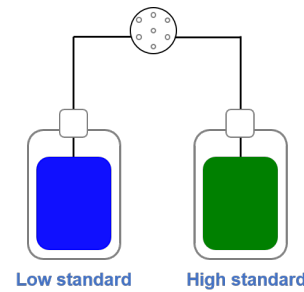
# Multi-standard Selector

## Multi-standard Features

- Up to four different calibration standards for matrix-matched calibrations without the need for switching or priming standards
- Generate “extended-range” calibrations of 1 curve from multiple bottles
- Multi-elemental calibration from stocks with
  - Different matrixes
  - Different elements
  - Different concentration

## Stand-alone or Extended-range Calibrations

- Low HNO<sub>3</sub> standard
- High HNO<sub>3</sub> standard

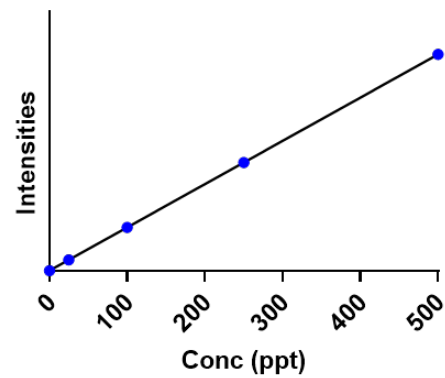


● Cal group 1

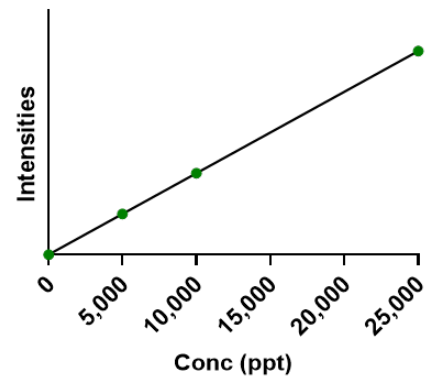
● Cal group 2

● Cal group 3

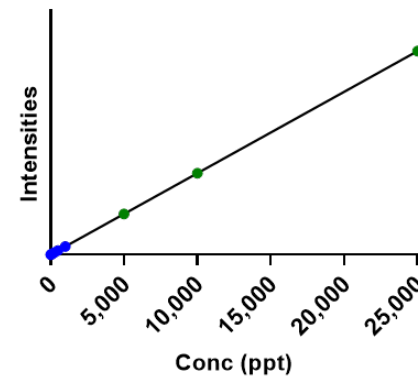
(combines groups 1 and 2)



Low HNO<sub>3</sub> standard



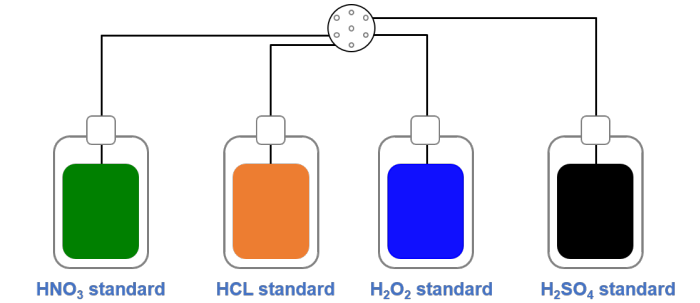
High HNO<sub>3</sub> standard



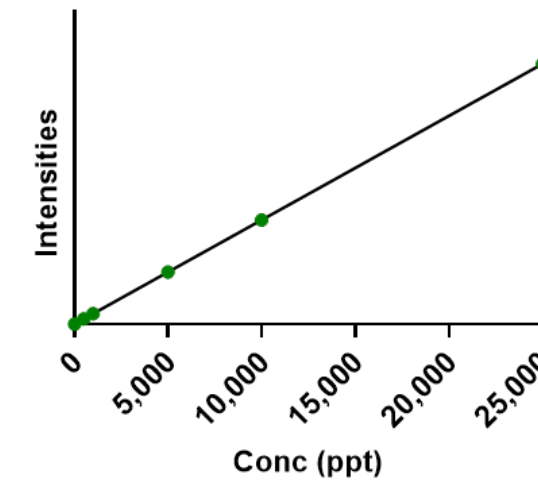
Low and High HNO<sub>3</sub> standard

## Up to 4 Different Calibration Standards Consecutively

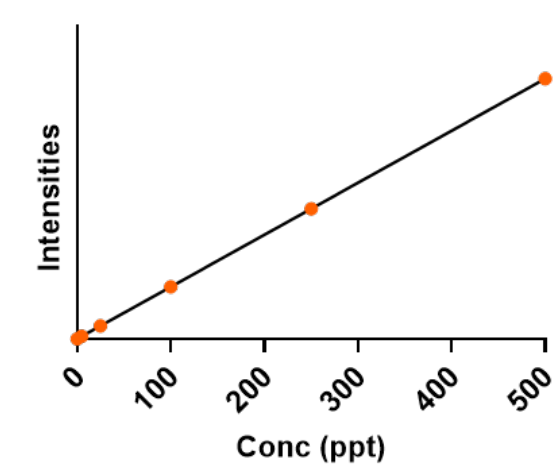
- HNO<sub>3</sub> matrix standard
- HCL matrix standard
- H<sub>2</sub>O<sub>2</sub> matrix standard
- H<sub>2</sub>SO<sub>4</sub> matrix standard



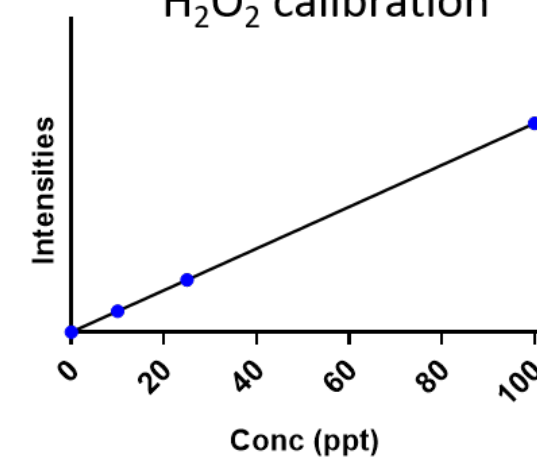
HNO<sub>3</sub> calibration



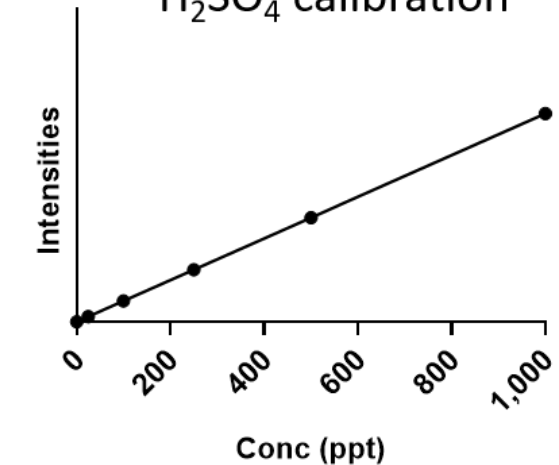
HCL calibration



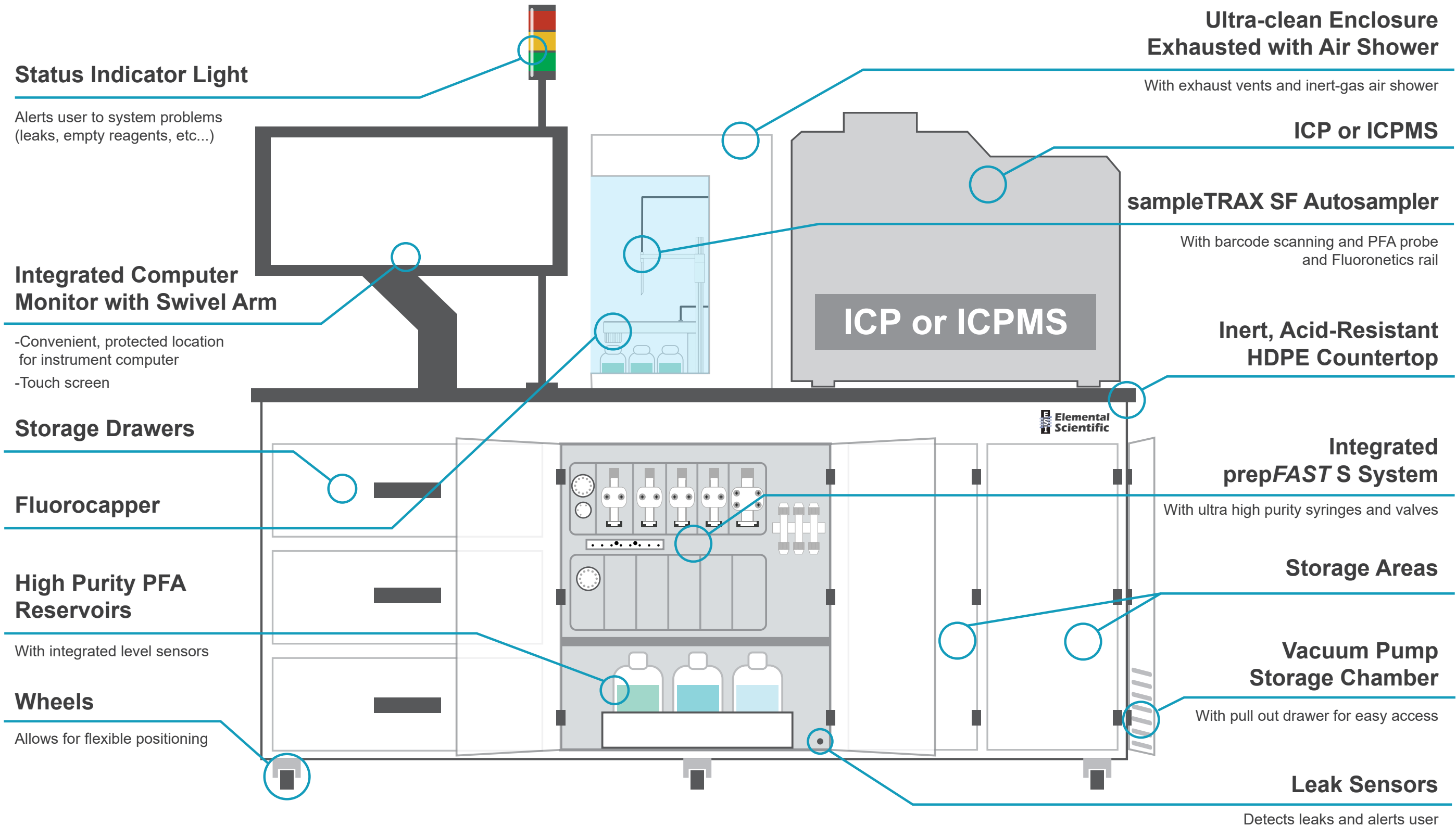
H<sub>2</sub>O<sub>2</sub> calibration



H<sub>2</sub>SO<sub>4</sub> calibration



# sampleTRAX SF Analytical Station



# Automated Grouping and Wash

# External Cal Sequence

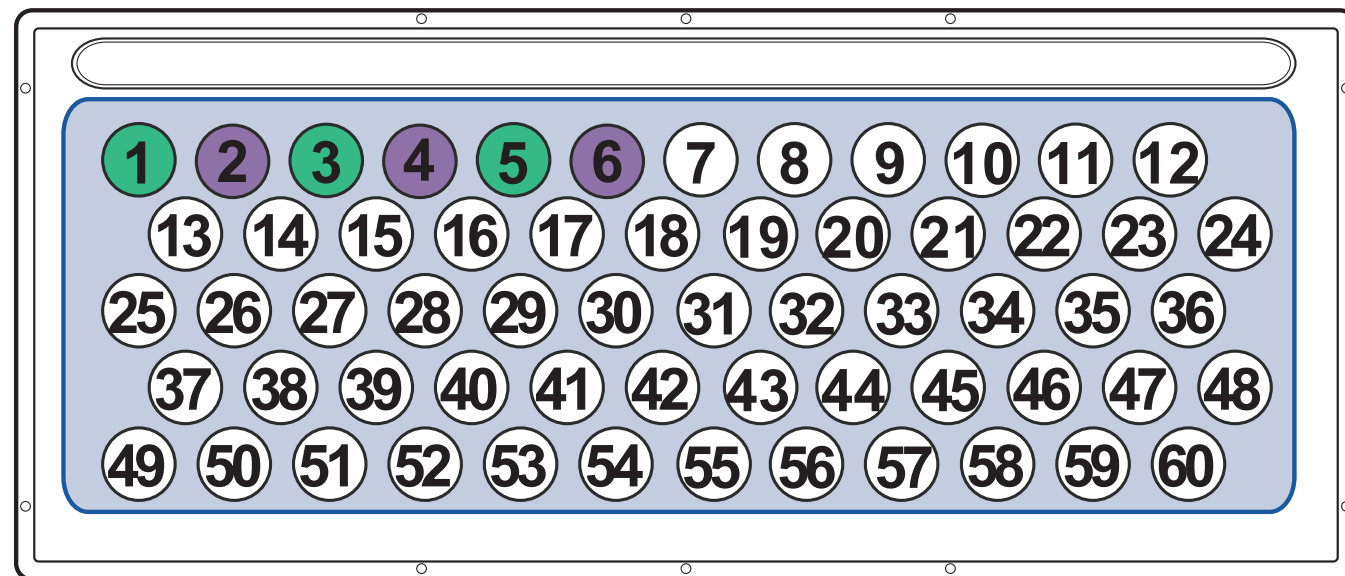
sampleTRAX SF Analytical Station simplifies and performs the most demanding sample analysis in 3 easy steps.

1. Discover and group samples
2. Create a sequence, a) MSA, b) Addition Cal, c) External Cal.
3. Run samples, acquire data and calculate results

## 1) Discover Samples



sampleTRAX SF discovers sample location and analytical information.



● UPW     ● H<sub>2</sub>O<sub>2</sub> \*Sample types discovered

## Group Samples

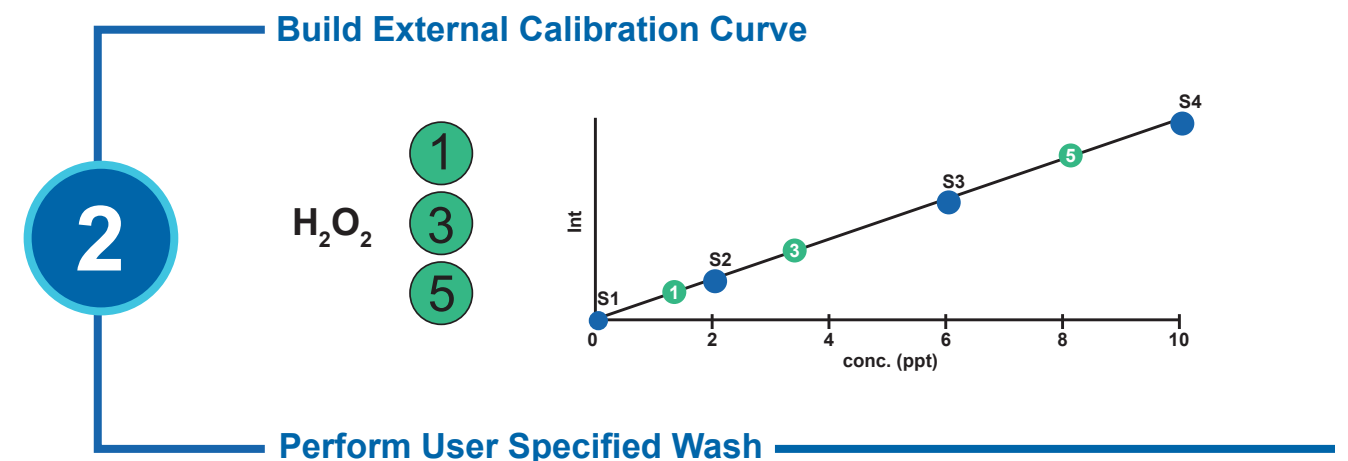
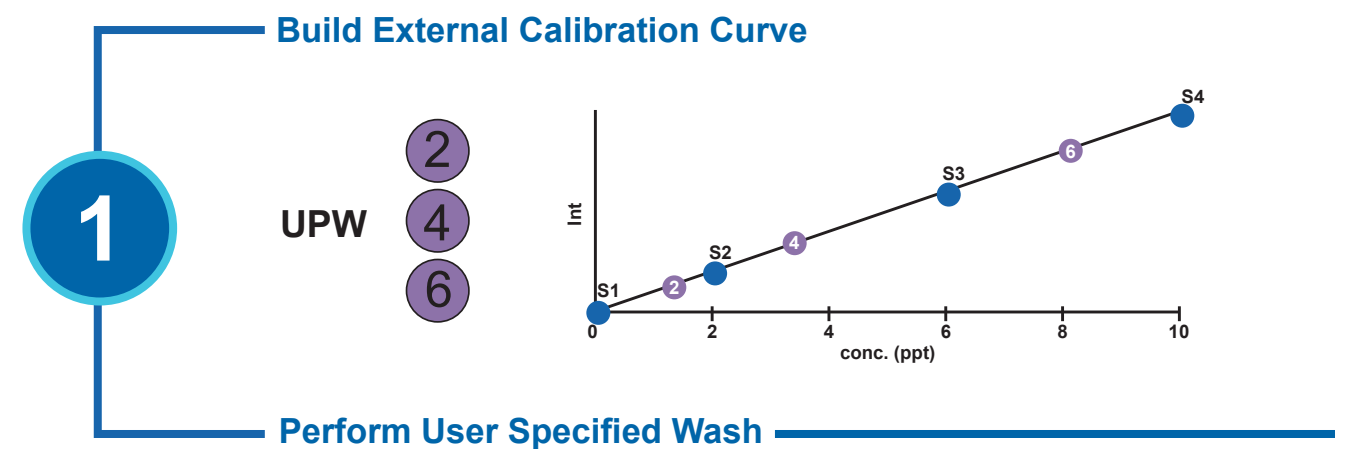
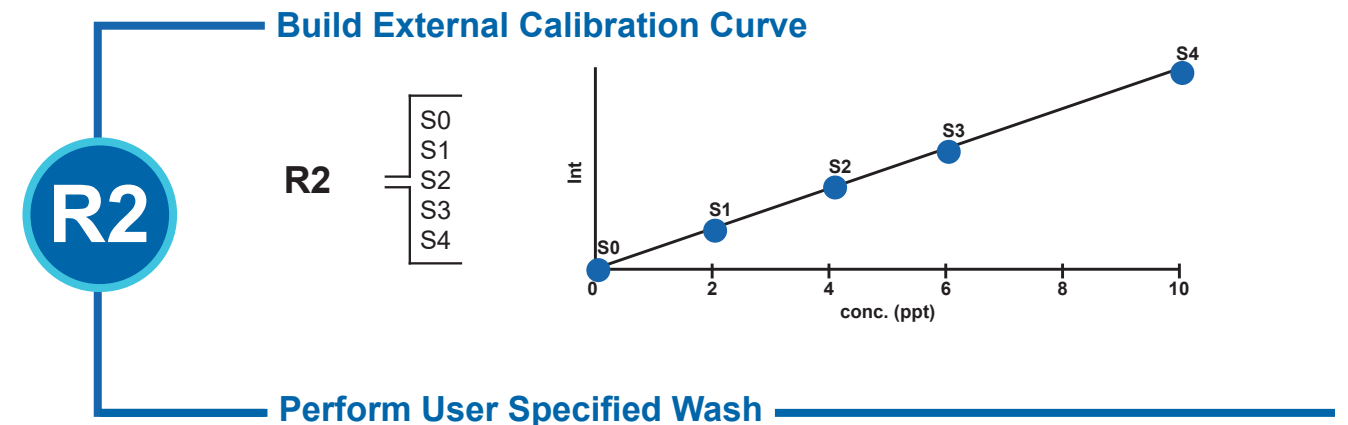
Based on discovered sample information, the sequence groups samples by type and sorts by analytical order. Chemical specific washes are performed after each group.

Sample Group Analysis Order	
UPW - Group 1	H <sub>2</sub> O <sub>2</sub> - Group 2
2	1
4	3
6	5

## 2a) Select Desired Sequence Type



Build External calibration curves according to protocol for each sample and perform chemical specific washes after each sample type.



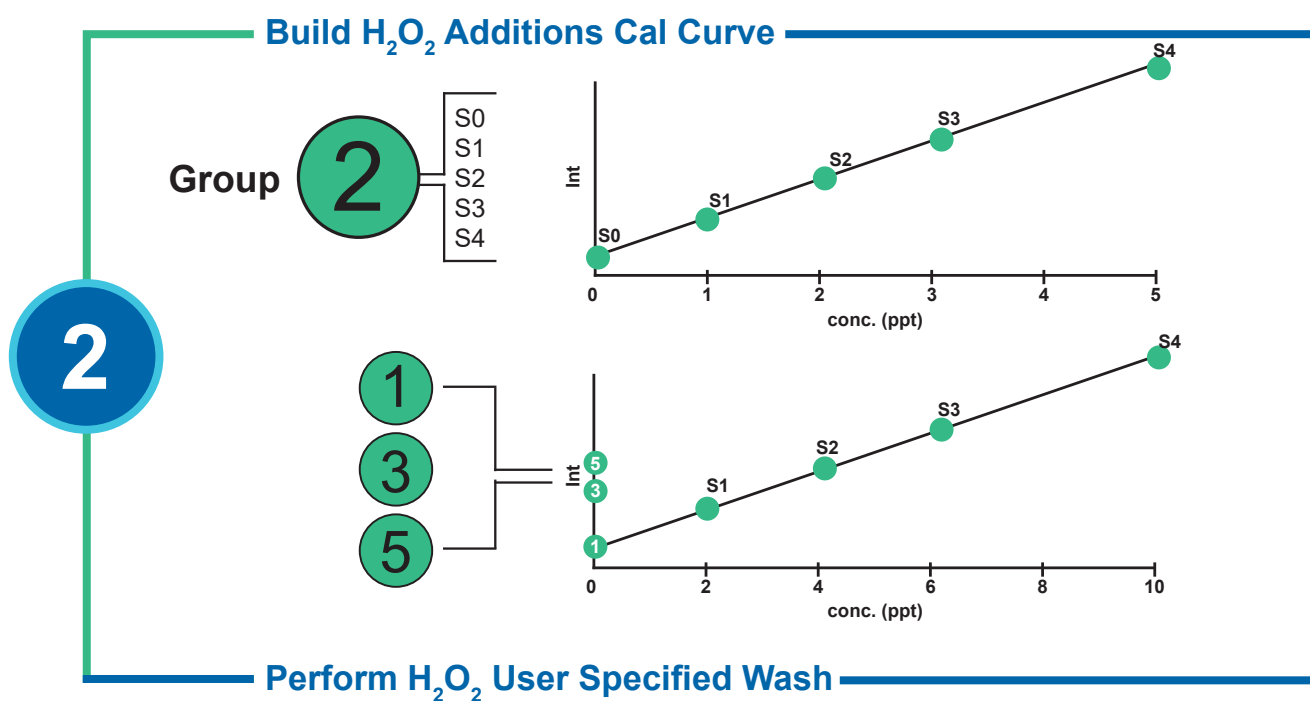
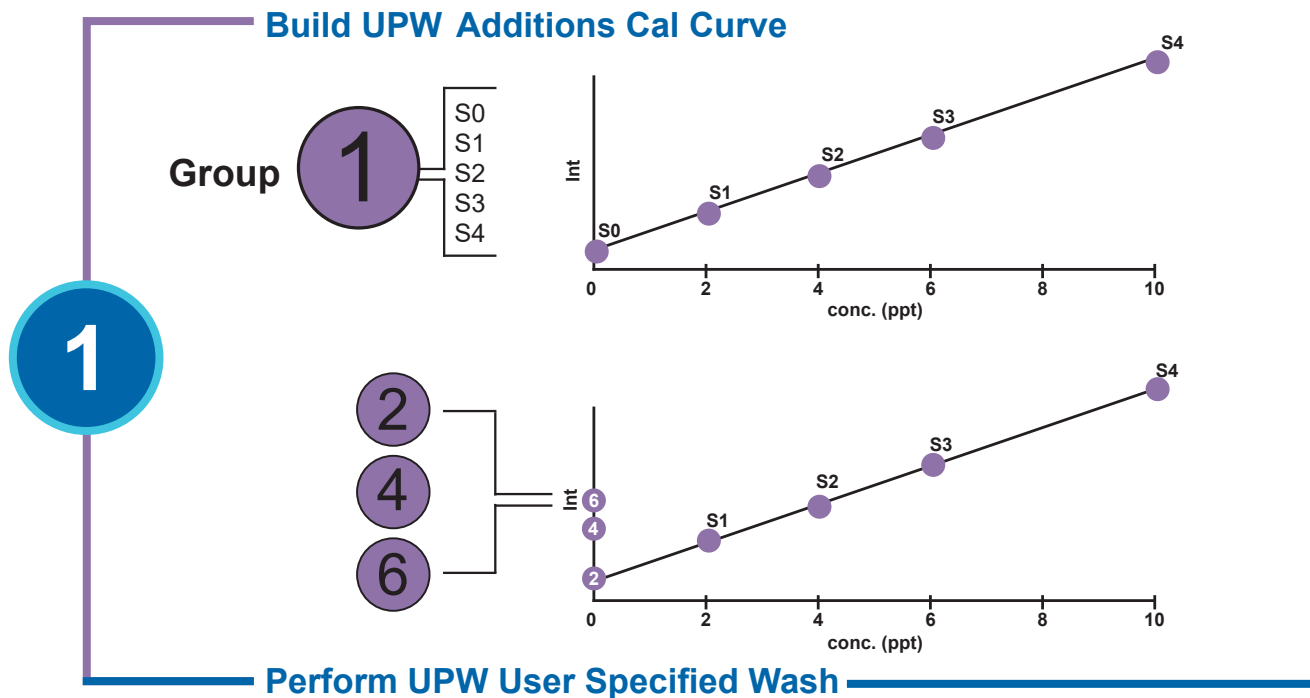
# Addition Cal Sequence

# MSA Sequence

## 2b) Select Desired Sequence



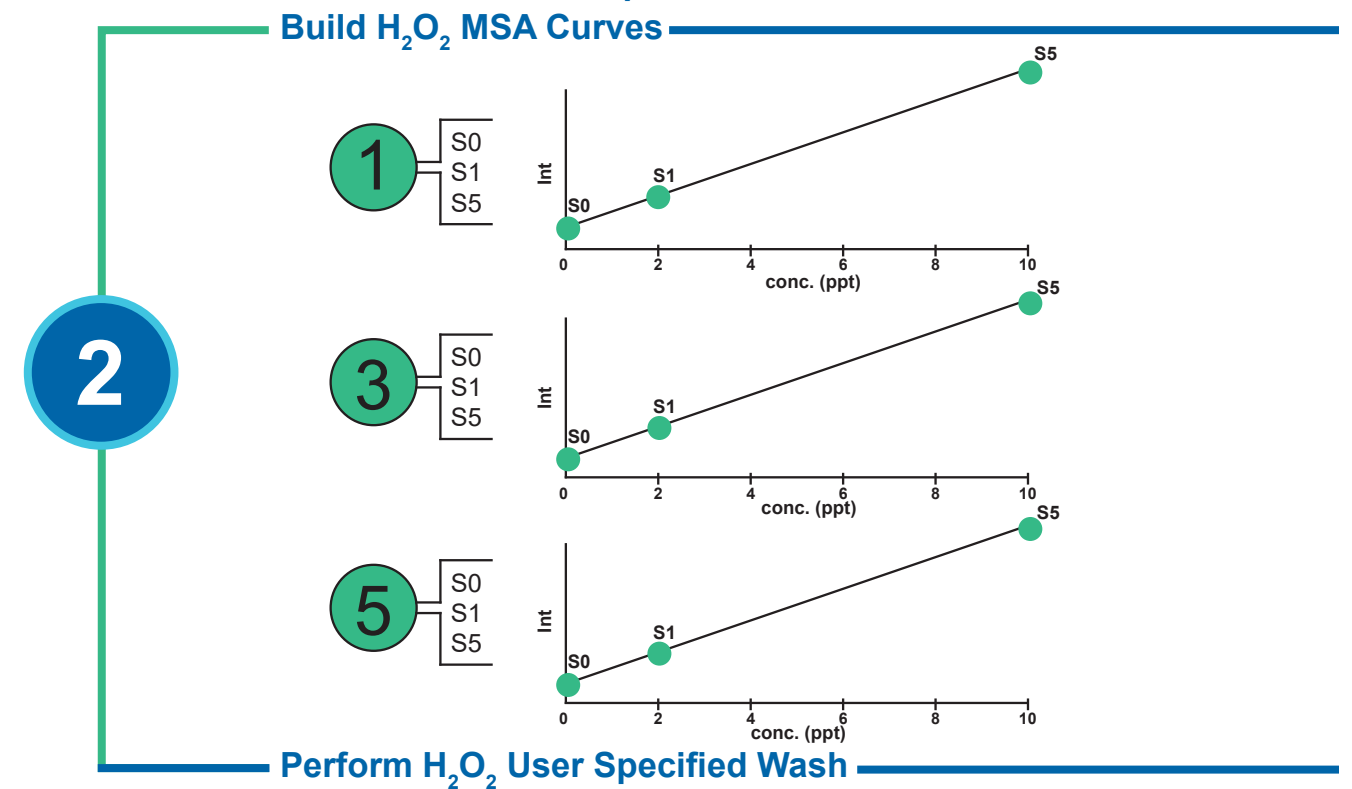
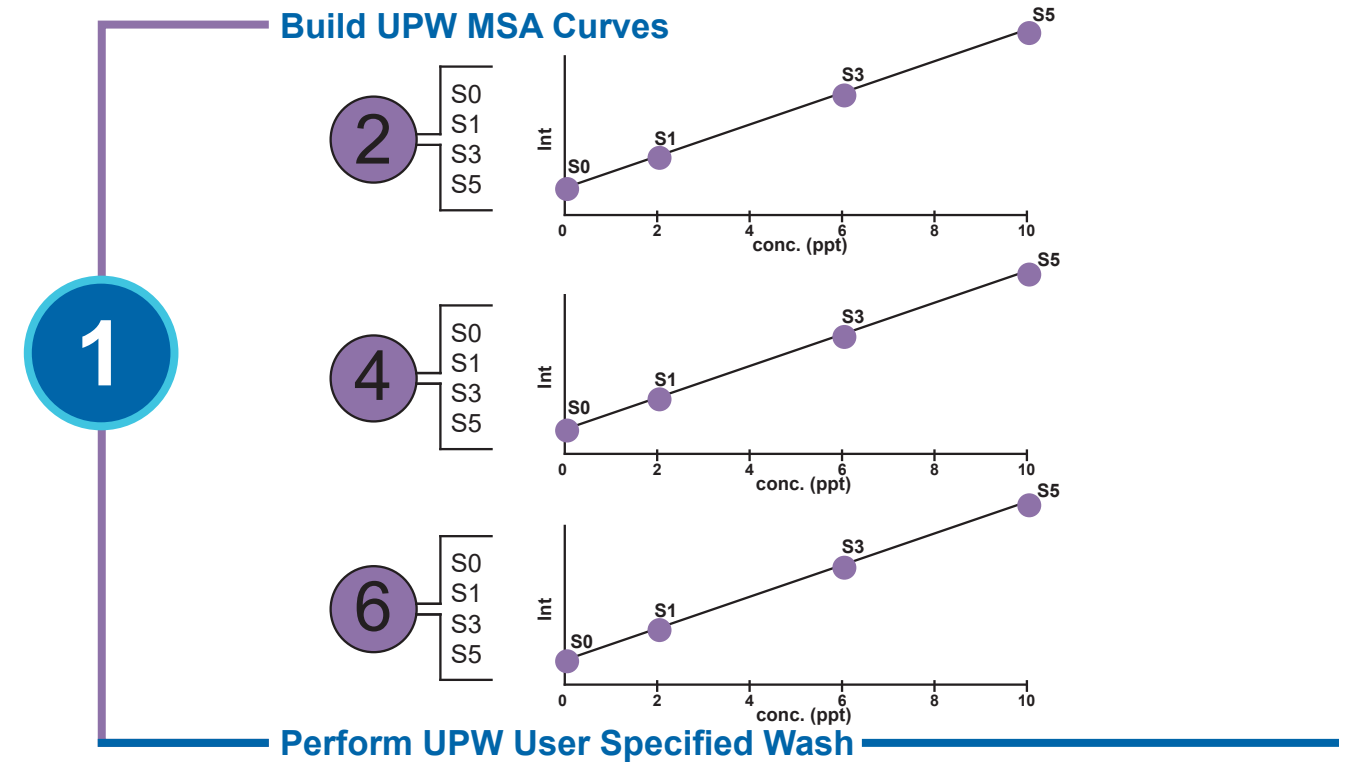
Build Addition calibration curves according to protocol for each sample and perform chemical specific washes after each sample type.



## 2c) Select Desired Sequence



Build MSA curves according to protocol for each sample and perform chemical specific washes after each sample type.





# Run Samples

## 3) Run samples, acquire data and calculate results for reporting to sampleTRAX SF database

sampleTRAX SF automatically prepares desired calibration curve and samples for analysis.

As each chemical is prepared and injected, sampleTRAX SF triggers the ICPMS to acquire data and imports raw intensities.

Raw intensities are:

- Associated with TRAX ID
- Used to calculate concentrations
- Stored in database

The screenshot displays the sampleTRAX SF software interface. At the top, it shows the time (09:55:17 06/23/2022), the analysis name (TRAX Analysis), and the user (User: Paul Field). Below this, a message indicates that a data analysis file was opened by Paul Field: Semiconductor - EXTERNAL - 6/16/2022 4:32:33 PM.

The main data table shows analysis results for three samples (ID 13, 14, 15) with various parameters including Intensity, Concentration, and Final Concentration for different elements like Ni, Cu, Zn, Ge, As, and Sr.

Below the data table, there are sections for "Sample Concentration Details" and "Calibration Curves". The calibration curves section shows five graphs for different elements: 60Ni (Cool), 63Cu (Cool), 64Zn (Cool), 74Ge (HeHe), and 88Sr (No Gas). Each graph displays a linear fit (blue line) and calibration points (orange dots). The equations for the lines are:

- 60Ni (Cool):  $y = 24.845x + 367.343$ ,  $R^2 = 0.99614$ , Units = ppt
- 63Cu (Cool):  $y = 68.062x + 1,176.720$ ,  $R^2 = 0.99595$ , Units = ppt
- 64Zn (Cool):  $y = 7.667x + 212.333$ ,  $R^2 = 0.99681$ , Units = ppt
- 74Ge (HeHe):  $y = 12.813x + 136.333$ ,  $R^2 = 0.99964$ , Units = ppt
- 88Sr (No Gas):  $y = 6.086x + 61.667$ ,  $R^2 = 0.99665$ , Units = ppt

The interface also includes a sidebar with various controls like "TRAX Stop", "EMERG STOP", "STOP", "TRAX Actions", "Discover", "Sequence", "Use Prev Cal", "Run", and "Auto-Run". On the right side, there are "TRAX Views" and buttons for "Analysis", "Details", "Process", "Devices", "FAST", and "Logs".

# sampleTRAX SF (Touch Screen)

## TRAX Actions

ES I

TRAX Stop

EMERG STOP

STOP

TRAX Actions

Discover

Sequence

Use Last Cal

Run

Resume Run

Multiple stop options to cease sampleTRAX SF operation

Barcode scan bottles on the deck to observe in Discover View & sequence for analysis

Manually sequence samples to be analyzed in a singular run (see types below)

Use previously generated Calibrations for a Sample Type

ES I

14:49:25 06/15/2023

Devices

User: Paul Field

14:48:41.510 'Devices' selected by user

00:09:36.274 Sequence Stopped: Emergency stop

FluoroCapper Valves & Pumps prepFAST DeviceStatus Alerts

Initialize Calibrate Rack Menu Motors Rinse

Cap Vacuum Enable Disable

Connected not Initialized Stow

Rack Control Lock Unlock

Connected and Initialized Stow

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60

1 2

TRAX Views

ALERT Count: 6

Analysis

Details

Process

Devices

FAST

Logs

## TRAX Views

ES I

TRAX Views

ALERT Count: 6

Analysis

Details

Process

Devices

FAST

Logs

Data report, sample sequence, re-evaluate

Displays samples discovered on-deck

Run unbarcoded samples

Fluorocapper & device status, valves/syringes

FAST method status, method running

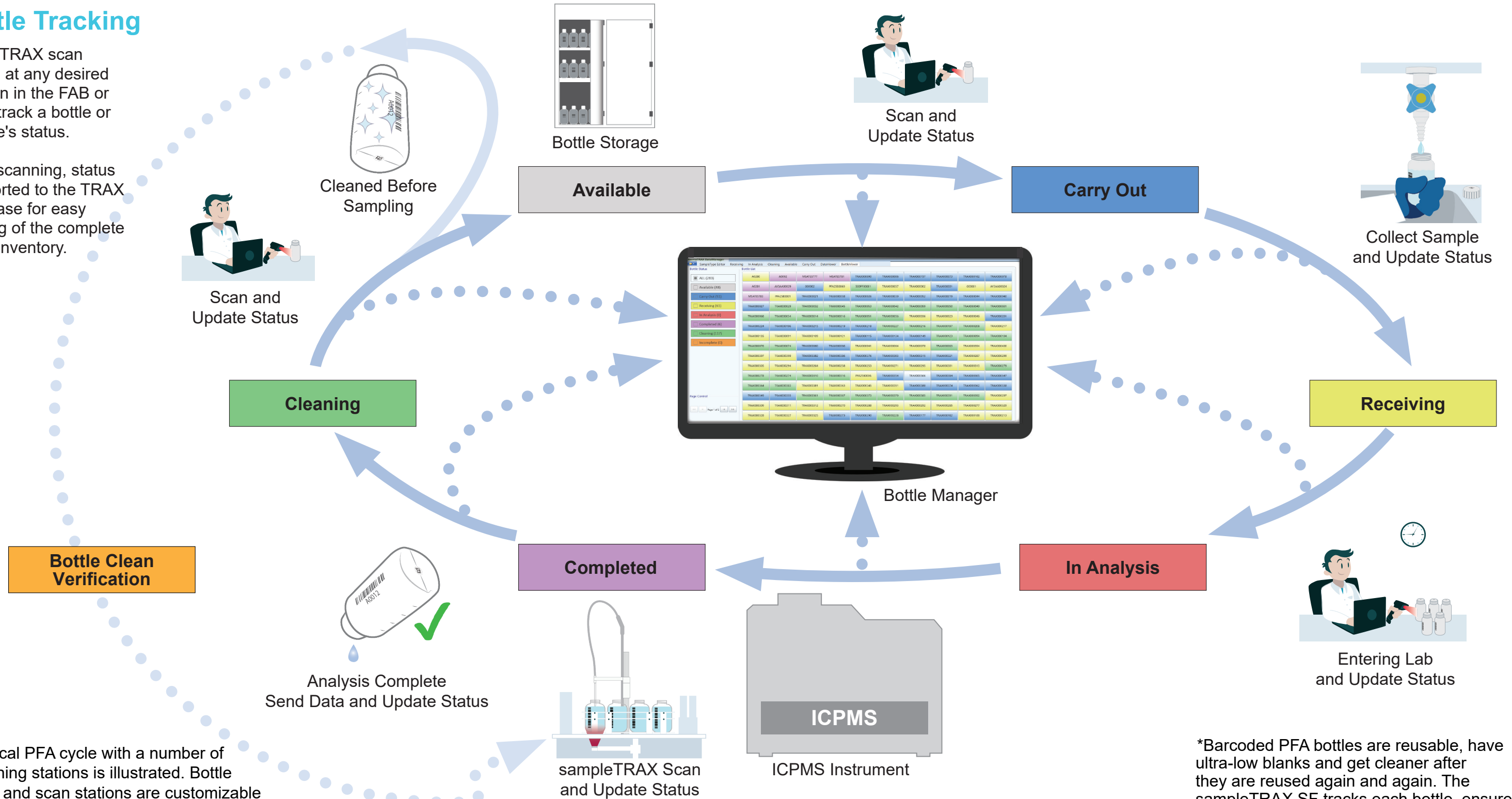
Autosampler communication and alerts logs

# Tracking a Typical Bottle Cycle

## Bottle Tracking

Add a TRAX scan station at any desired location in the FAB or lab to track a bottle or sample's status.

Upon scanning, status is reported to the TRAX Database for easy viewing of the complete bottle inventory.



\*Typical PFA cycle with a number of scanning stations is illustrated. Bottle cycle and scan stations are customizable for any lab process.

\*Barcoded PFA bottles are reusable, have ultra-low blanks and get cleaner after they are reused again and again. The sampleTRAX SF tracks each bottle, ensures cleanliness and data integrity.

# Bottle Manager: Tracking and History

Scan stations update the database in real time allowing the bottle manager to instantaneously provide a snapshot of every bottle's status.

## Bottle Tracking

Select "ALL" to view the status of the entire bottle inventory as a color-coded grid.

Quantity of bottles is indicated with (##) in each of the seven color-coded stages.

## Bottle History

Click on the TRAXID to view its complete history.

- Status
- Sample type
- Purpose
- Concentrations



250 mL bottle



100 mL vial



60 mL vial

SAMPLETRAX DataManager

SampleType Editor Receiving In Analysis Cleaning Available Carry Out DataViewer BottleViewer

Bottle Status

- ALL (283)
- Available (48)
- Carry Out (51)
- Receiving (61)
- In Analysis (0)
- Completed (6)
- Cleaning (117)
- Incomplete (0)

Bottle List

A0280	A0092	MSATEST32	MSATEST81	TRAX000090	TRAX000006	TRAX000157	TRAX000073	TRAX000162	TRAX000078
A0281	AY3AA00029	000002	PFA25B0060	500PF00001	TRAX000057	TRAX000002	TRAX000001	000001	AY3AA00024
MSATEST83	PFA25B0001	TRAX000021	TRAX000038	TRAX000026	TRAX000039	TRAX000052	TRAX000019	TRAX000044	TRAX000040
TRAX000027	TRAX000029	TRAX000032	TRAX000045	TRAX000053	TRAX000042	TRAX000059	TRAX000050	TRAX000049	TRAX000031
TRAX000068	TRAX000054	TRAX000014	TRAX000016	TRAX000051	TRAX000056	TRAX000036	TRAX000023	TRAX000046	TRAX000201
TRAX000224	TRAX000196	TRAX000215	TRAX000219	TRAX000218	TRAX000227	TRAX000216	TRAX000197	TRAX000208	TRAX000217
TRAX000135	TRAX000091	TRAX000109	TRAX000121	TRAX000115	TRAX000134	TRAX000149	TRAX000123	TRAX000094	TRAX000104
TRAX000076	TRAX000074	TRAX000060	TRAX000066	TRAX000041	TRAX000064	TRAX000070	TRAX000063	TRAX000394	TRAX000400
TRAX000397	TRAX000399	TRAX000382	TRAX000386	TRAX000376	TRAX000303	TRAX000315	TRAX000321	TRAX000287	TRAX000299
TRAX000305	TRAX000294	TRAX000264	TRAX000258	TRAX000253	TRAX000271	TRAX000295	TRAX000301	TRAX000313	TRAX000279
TRAX000278	TRAX000274	TRAX000310	TRAX000316	PFA25B0006	TRAX000354	TRAX000366	TRAX000384	TRAX000365	TRAX000347
TRAX000364	TRAX000383	TRAX000381	TRAX000363	TRAX000345	TRAX000351	TRAX000380	TRAX000374	TRAX000362	TRAX000338
TRAX000349	TRAX000355	TRAX000361	TRAX000367	TRAX000373	TRAX000379	TRAX000385	TRAX000391	TRAX000392	TRAX000297
TRAX000309	TRAX000311	TRAX000312	TRAX000270	TRAX000288	TRAX000293	TRAX000292	TRAX000285	TRAX000277	TRAX000329
TRAX000328	TRAX000327	TRAX000325	TRAX000273	TRAX000290	TRAX000228	TRAX000177	TRAX000182	TRAX000188	TRAX000213

Page Control

<< < Page 1 of 2 > >>

Clicking a TRAXID opens the bottle history window which shows the complete history of a bottle in the TRAX system including analytical data.

Bottle History for MSATEST32

TRAX ID	Status	Sample Type	User	Datetime	Protocol	Purpose	Line	Sampling Point	Comments
MSATEST32	Completed	Validation	ESI\Agilent\CPMS	2019-01-29 11:37:44	Semiconductor				
MSATEST32	In Analysis	Validation	ESI\Agilent\CPMS	2019-01-29 11:03:01	Semiconductor				
MSATEST32	Receiving	Validation	ESI\Agilent\CPMS	2019-01-29 10:59:35	Semiconductor				
MSATEST32	Carry Out		ESI\Agilent\CPMS	2019-01-29 10:56:43					
MSATEST32	Available		ESI\Agilent\CPMS	2019-01-29 10:53:07					
MSATEST32	Cleaning		ESI\Agilent\CPMS	2019-01-29 10:46:37					
MSATEST32	Completed	Validation	ESI\Agilent\CPMS	2019-01-29 09:42:04	Semiconductor				
MSATEST32	In Analysis	Validation	ESI\Agilent\CPMS	2019-01-29 09:07:18	Semiconductor				
MSATEST32	Completed	Validation	ESI\Agilent\CPMS	2019-01-28 18:25:44	Semiconductor				
MSATEST32	In Analysis	Validation	ESI\Agilent\CPMS	2019-01-28 17:50:13	Semiconductor				
MSATEST32	In Analysis	Validation	ESI\Agilent\CPMS	2019-01-28 17:47:11	Semiconductor				
MSATEST32	Receiving	Validation	ESI\Agilent\CPMS	2019-01-28 17:37:20	Semiconductor				

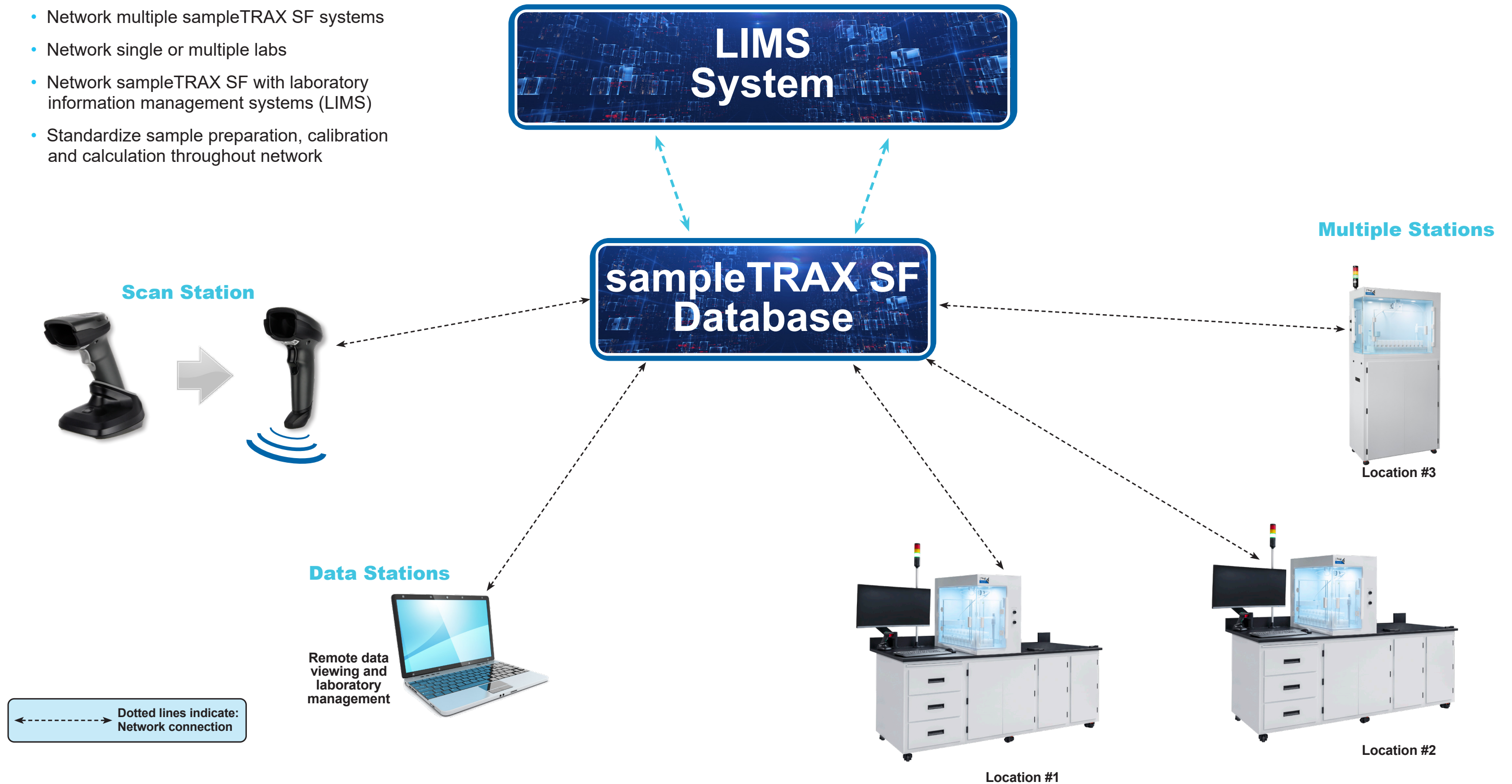
TraxId	SampleType	Device	DateTime	Standard	Na	Mg	N	K	Ti	V	Cr	Fe	Ni	Co
MSATEST32	Validation	2	1/28/2019 5:56:42 PM	std-0	0.184	0.001	0.002	0.004	0.002	0.001	0.056	0.002	0	0
MSATEST32	Validation	2	1/29/2019 9:13:03 AM	std-0	0.139	0.108	0.124	0.042	0.108	0.016	0.212	0.113	0.041	0.111

Close

# Flexible, Customizable sampleTRAX SF Networking

Automate the whole lab by incorporating multiple scanning and analytical stations

- Network multiple sampleTRAX SF systems
- Network single or multiple labs
- Network sampleTRAX SF with laboratory information management systems (LIMS)
- Standardize sample preparation, calibration and calculation throughout network



# Full System at a Glance

# Racks and Vials

## Features and Benefits

### Sample Identification

- Barcode scanning accesses information including:
  - Sample type
  - Sample Information (Line, sampling point, name, etc.)
  - Method of standardization and analysis

### Ultra Pure

- Ultra-clean
- <1 ppt semiconductor metals
- Automated matrix matched MSA or external calibration
- Analytical stations for ICPMS instruments

### Laboratory Automation

- Bottle tracking
- Bottle history (cleaning, sample, chemical, analysis, concentration)
- Chemical grouping
- Chemical specific rinse function per chemical
- Customized network, bottle cycle

## How it Works

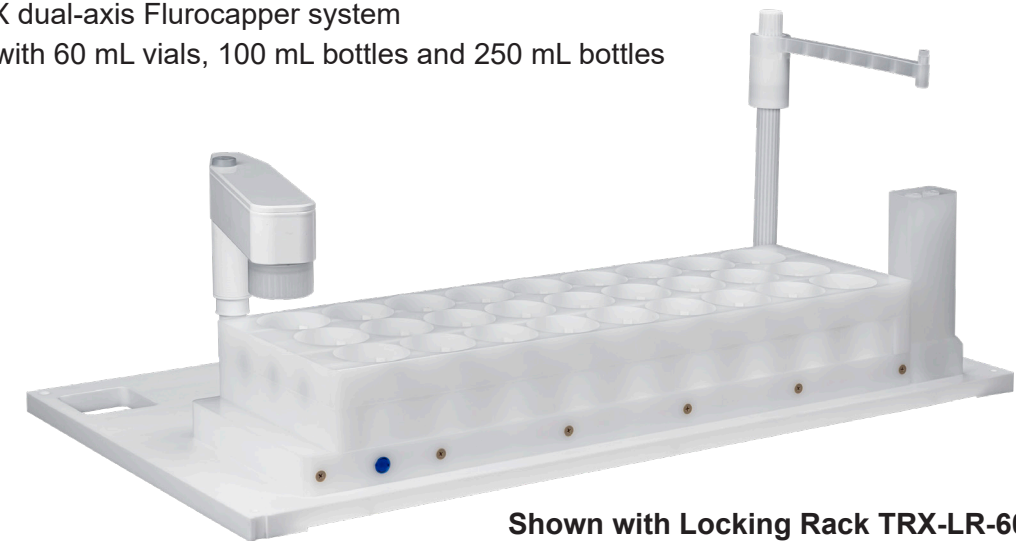
### sampleTRAX SF Analytical station automatically:

1. Scans bottles
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5. Generates and reports data

## Barcoded Bottles and Vials for Fluorocapper

### sampleTRAX SF Automatic Bottle Opening System with Fluoronic Sampling

sampleTRAX dual-axis Fluorocapper system  
Compatible with 60 mL vials, 100 mL bottles and 250 mL bottles



Shown with Locking Rack TRX-LR-60-60



TXV3-250  
250 mL bottle



TXV3-100  
100 mL vial



TXV3-60  
60 mL vial

Examples of Semiconductor Chemicals Analyzed at the ppt Level with sampleTRAX SF			
Acids	Bases	Organics	Chemical Mixes
98% H <sub>2</sub> SO <sub>4</sub>	22% NH <sub>4</sub> OH	IPA	SC-1
89% H <sub>3</sub> PO <sub>4</sub>	2.38% TMAH	PGMEA/PGME	SC-2
70% HNO <sub>3</sub>	25% TMAH	Photoresist	BOE
49% HF	KOH	NMP	DSP
35% HCl		Butyl Acetate	
30% H <sub>2</sub> O <sub>2</sub>		Cyclohexanone	
SPM			
FPM			
DHF			
Etchant			
Others			

All semiconductor pure chemicals can be analyzed using sampleTRAX SF. This table contains only a partial list of common chemicals.

### Locking Racks

Vial/Bottle P/N	Volume	OD	Position	Locking Rack PN
TXV3-60	60 mL	30 mm	60	TRX-LR-60-60
TXV3-100	100 mL	48 mm	27	TRX-LR-27-100
TXV3-250	250 mL	62 mm	27	TRX-LR-27-250



# Elemental Scientific

ICP | ICPMS | AA

Contact us by phone at 402.991.7800 or by e-mail at [sales@icpms.com](mailto:sales@icpms.com). Our scientists and engineers are available to answer your questions related to elemental analysis. We are pleased to provide our customers complimentary analytical advice from our on-staff chemists.



B-20240-3

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