SAMPLE TRAX S5

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

Elemental Scientific

ICP | ICPMS | AA

SAMPLETRAX

SAMPLETRAX S5 Analytical Station

SAMPLETRAX 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 S5.

How it Works

SAMPLETRAX S5 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

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, 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

1 mL cup and 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.

Autocalibration of ^{39}K from a Single Stock Solution

SAMPLETRAX S5 analytical station automatically:

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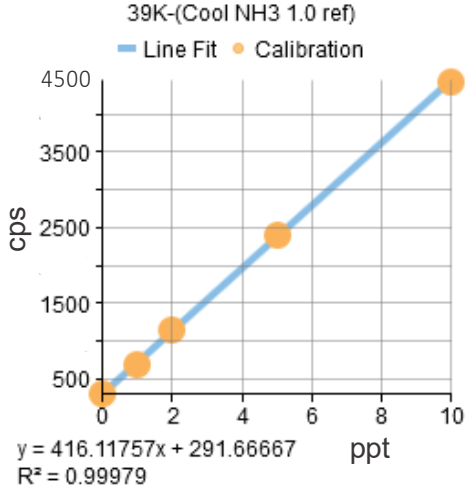
5. Generates and reports data



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

Barcoded Bottles

A variety of precleaned barcoded bottles, vials and caps are available.

1D and 2D Barcodes Permanently Marked Into Inert PFA

Benefits

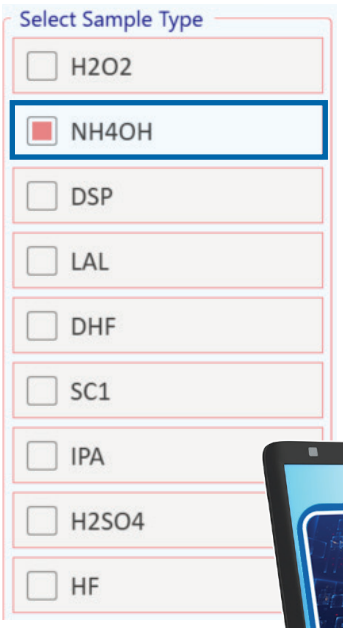
- Chemically inert barcodes
- Non-contaminating markings into acid-resistant PFA
- Reusable
- 2D barcoded bottles are compatible with SAMPLETRAX scanning automation systems
- Track bottle position and sample identity
- Precleaned

Types

- Bottles
  - 2D bottom barcoded
  - 1D side barcoded
- Caps
  - Available with 2D barcodes
- Any type of bottle can be custom labeled

TRAX Scan Stations

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



1.) Select sample type

2.) Scan bottle

3.) Add user input

- Location
- Operator
- Bottle Status
- Chemical
- Comments/notes
- Customizable inputs

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

TRAX S5 Analytical

Status Indicator Light

Alerts user to system problems
(leaks, empty reagents, etc...)

Integrated Computer Monitor with Swivel Arm

Convenient, protected location
for instrument computer

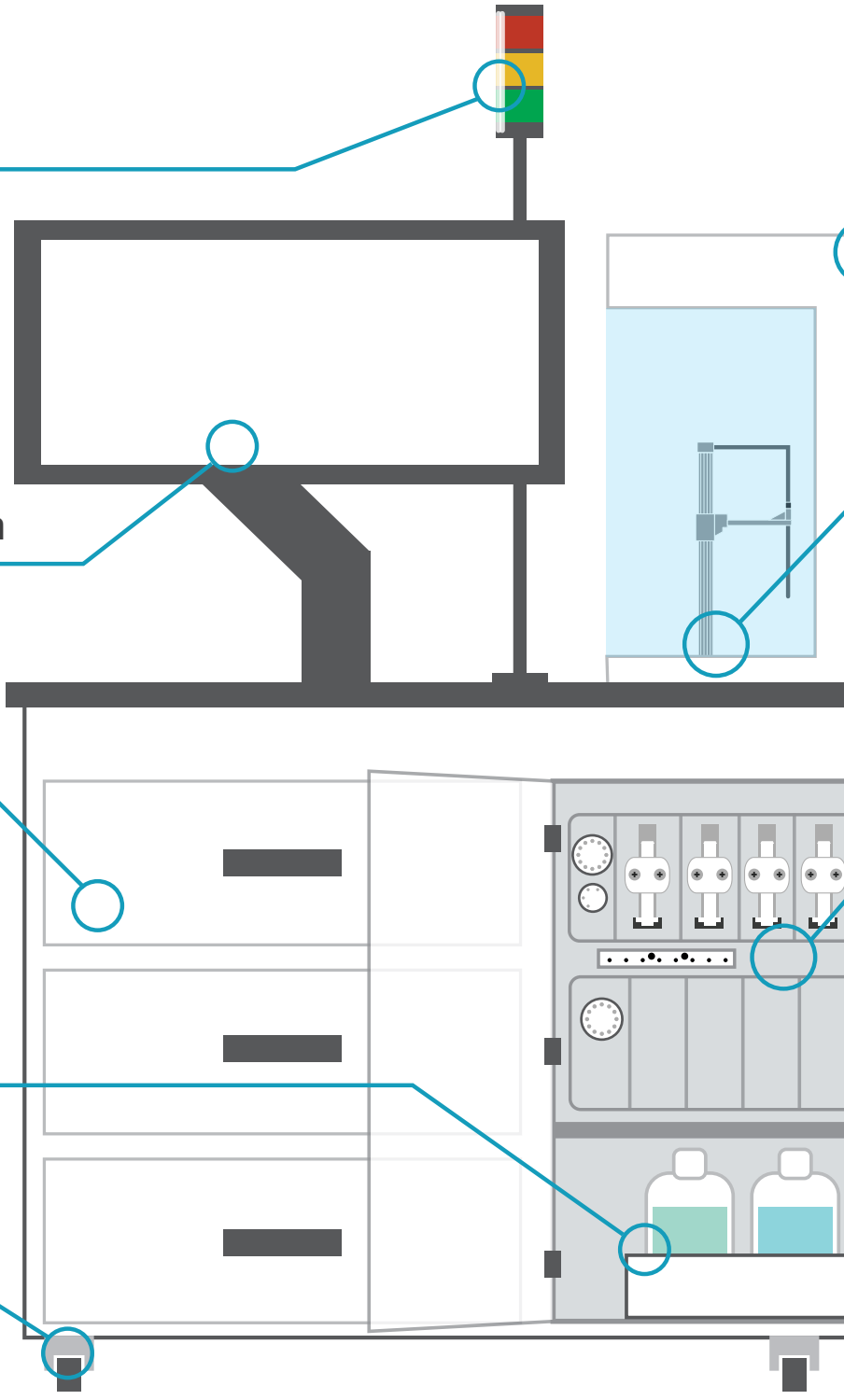
Storage Drawers

High Purity PFA Reservoirs

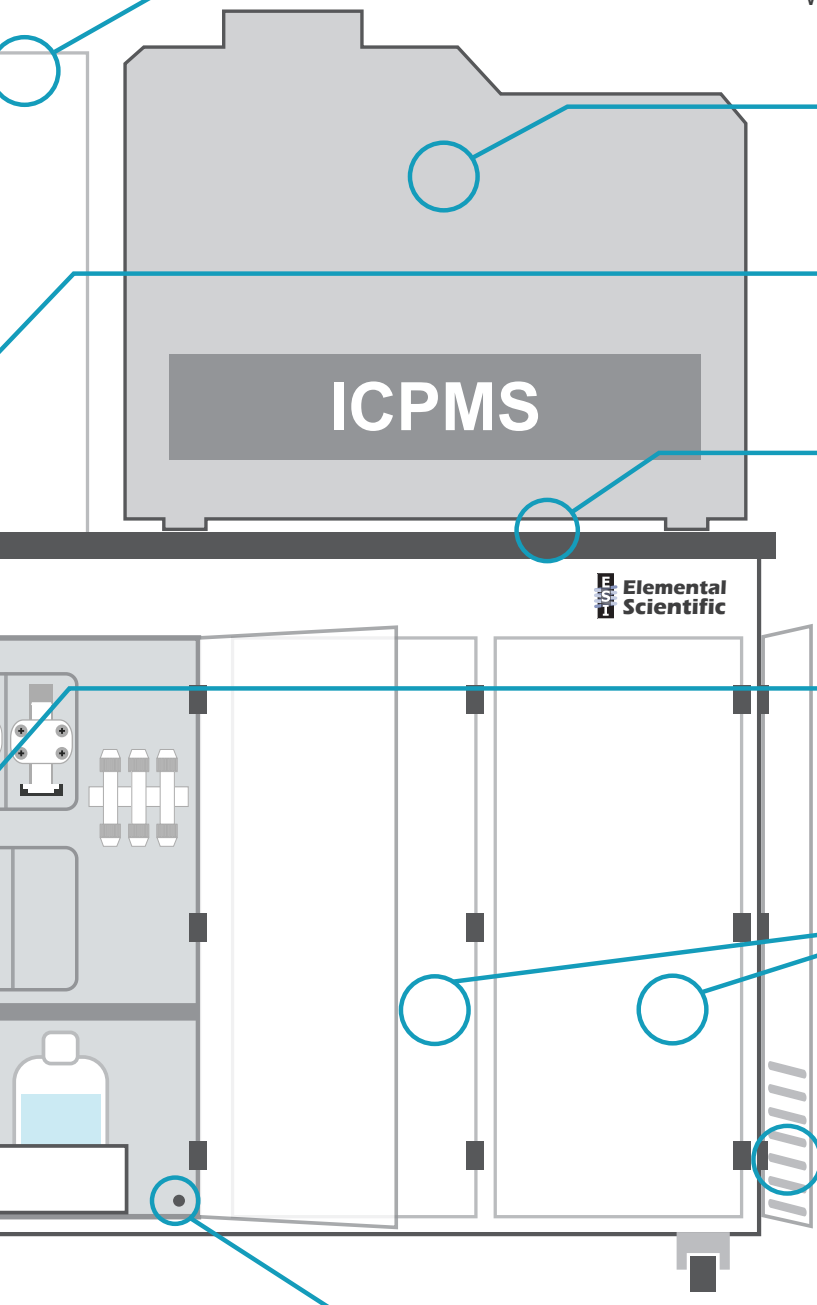
With integrated level sensors

Wheels

Allows for flexible positioning



Station



Ultra-clean Enclosure Exhausted with Air Shower

With exhaust vents and inert-gas air shower

ICPMS Instrument

Total metal and microparticle analysis

plasmaTRAX Autosampler

With barcode scanning and PFA probe

HDPE Countertop

Inert and acid resistant

Integrated prep*FAST* S5

With ultra high purity syringes and valves

Vented Storage Areas

Vacuum Pump Storage Chamber

Pull out drawer for easy maintenance

Leak Sensors

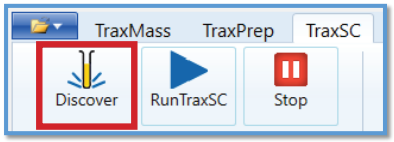
Detects leaks and alerts user

Automated Grouping and Wash

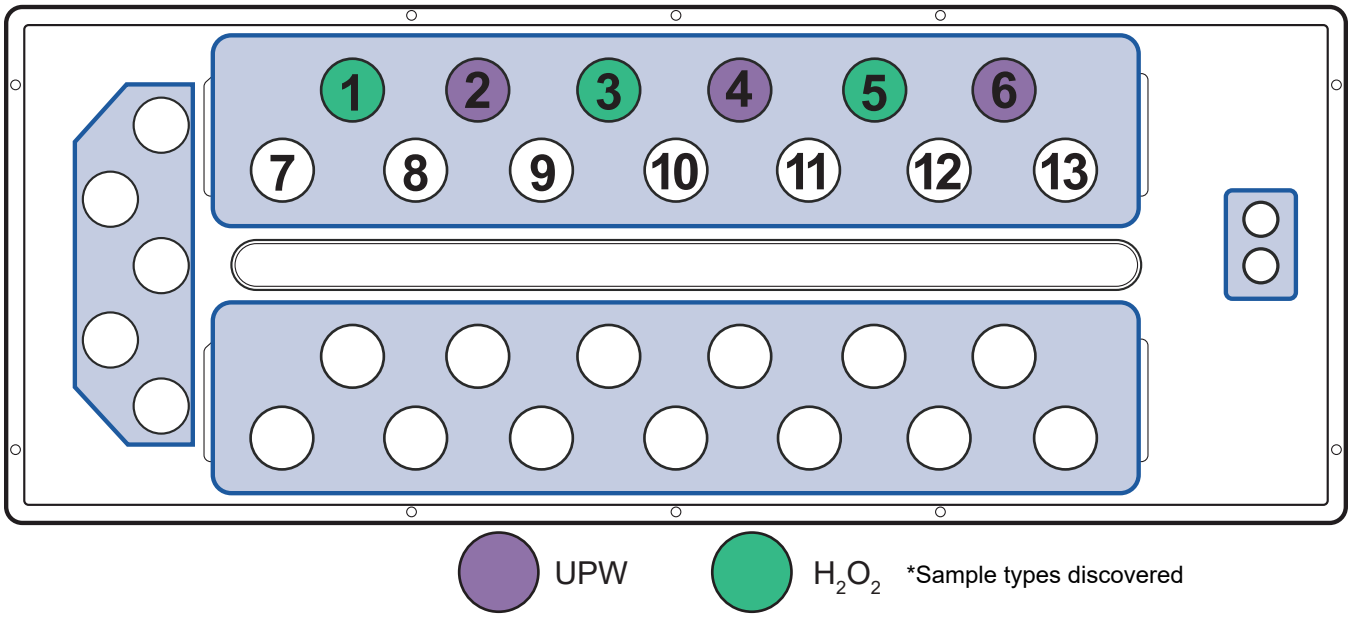
TRAX S5 Analytical Station simplifies and performs the most demanding sample analysis in 3 easy steps.

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



TRAX S5 discovers sample location and analytical information.



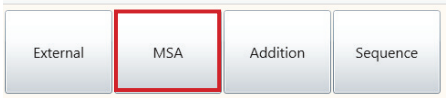
Group Samples

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_2O_2 - Group 2
2	1
4	3
6	5

MSA Sequence

2a) Select Desired Sequence

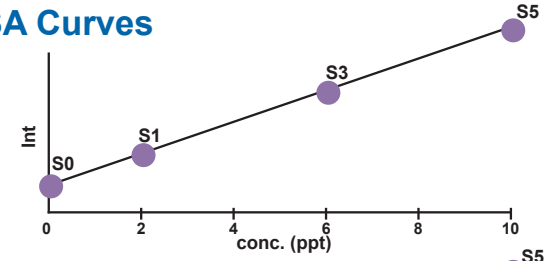


Build MSA curves according to protocol for each sample and perform chemical specific washes after each sample type.

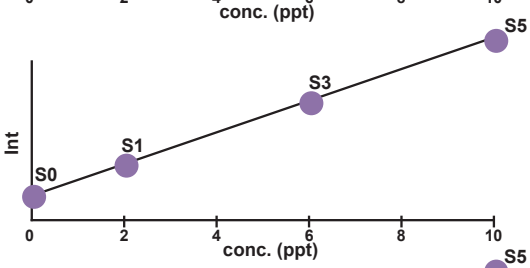
1

Build UPW MSA Curves

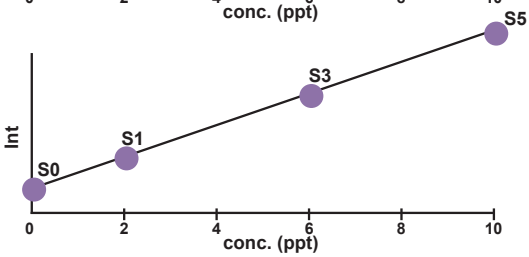
2
S0
S1
S3
S5



4
S0
S1
S3
S5



6
S0
S1
S3
S5

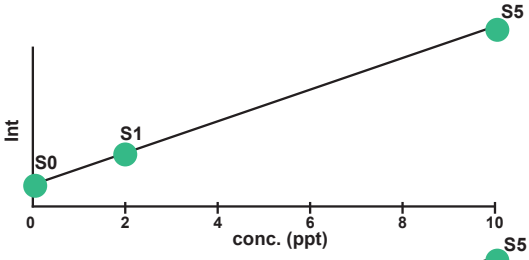


Perform UPW User Specified Wash

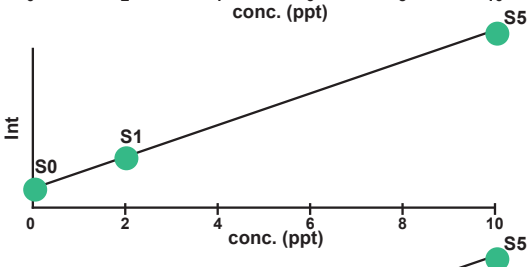
2

Build H_2O_2 MSA Curves

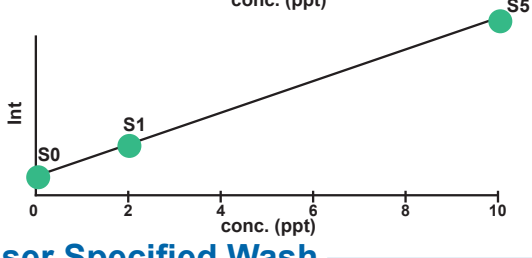
1
S0
S1
S5



3
S0
S1
S5



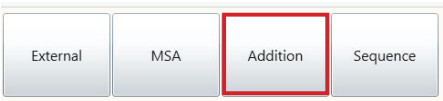
5
S0
S1
S5



Perform H_2O_2 User Specified Wash

Addition Cal Sequence

2b) Select Desired Sequence

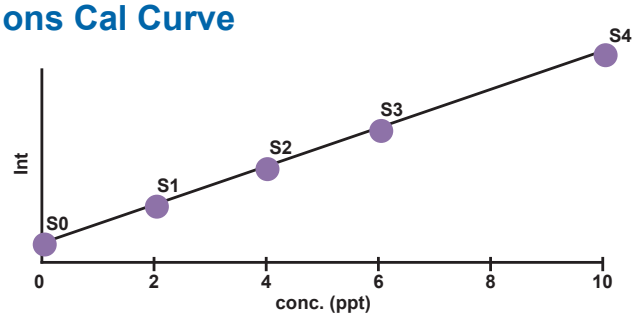


Build Addition calibration curves according to protocol for each sample and perform chemical specific washes after each sample type.

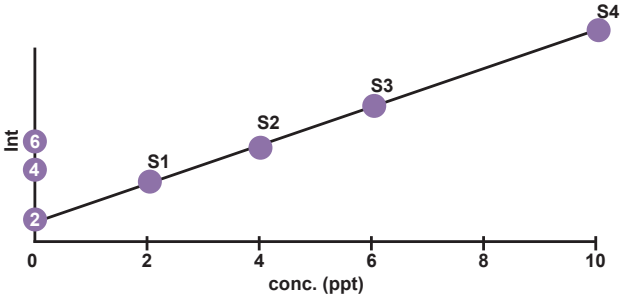
Build UPW Additions Cal Curve

1

Group 1: S0, S1, S2, S3, S4



2, 4, 6

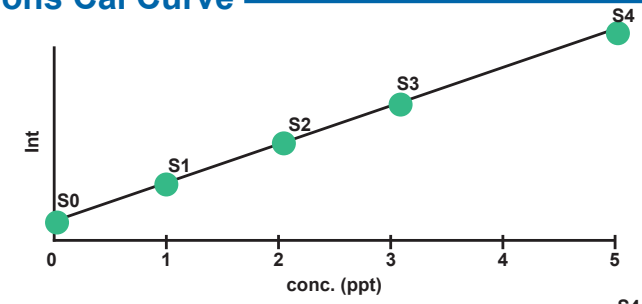


Perform UPW User Specified Wash

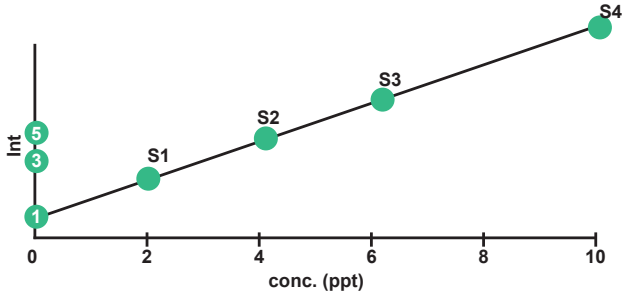
Build H_2O_2 Additions Cal Curve

2

Group 2: S0, S1, S2, S3, S4



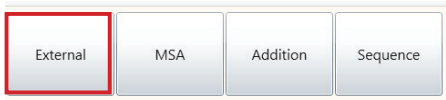
1, 3, 5



Perform H_2O_2 User Specified Wash

External Cal Sequence

2c) Select Desired Sequence Type



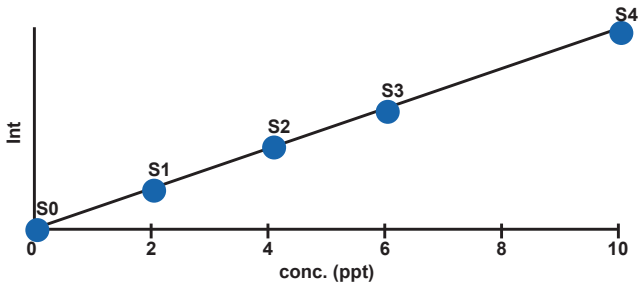
Build External calibration curves according to protocol for each sample and perform chemical specific washes after each sample type.

Build External Calibration Curve

R2

R2

S0
S1
S2
S3
S4



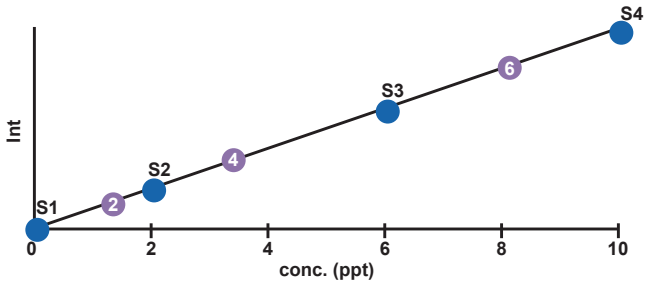
Perform User Specified Wash

Build External Calibration Curve

UPW

1

2
4
6



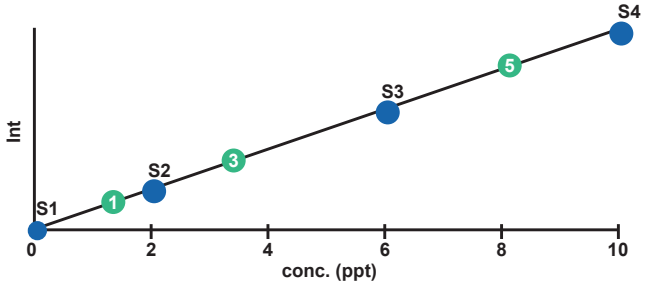
Perform User Specified Wash

Build External Calibration Curve

H_2O_2

2

1
3
5



Perform User Specified Wash

Run Samples

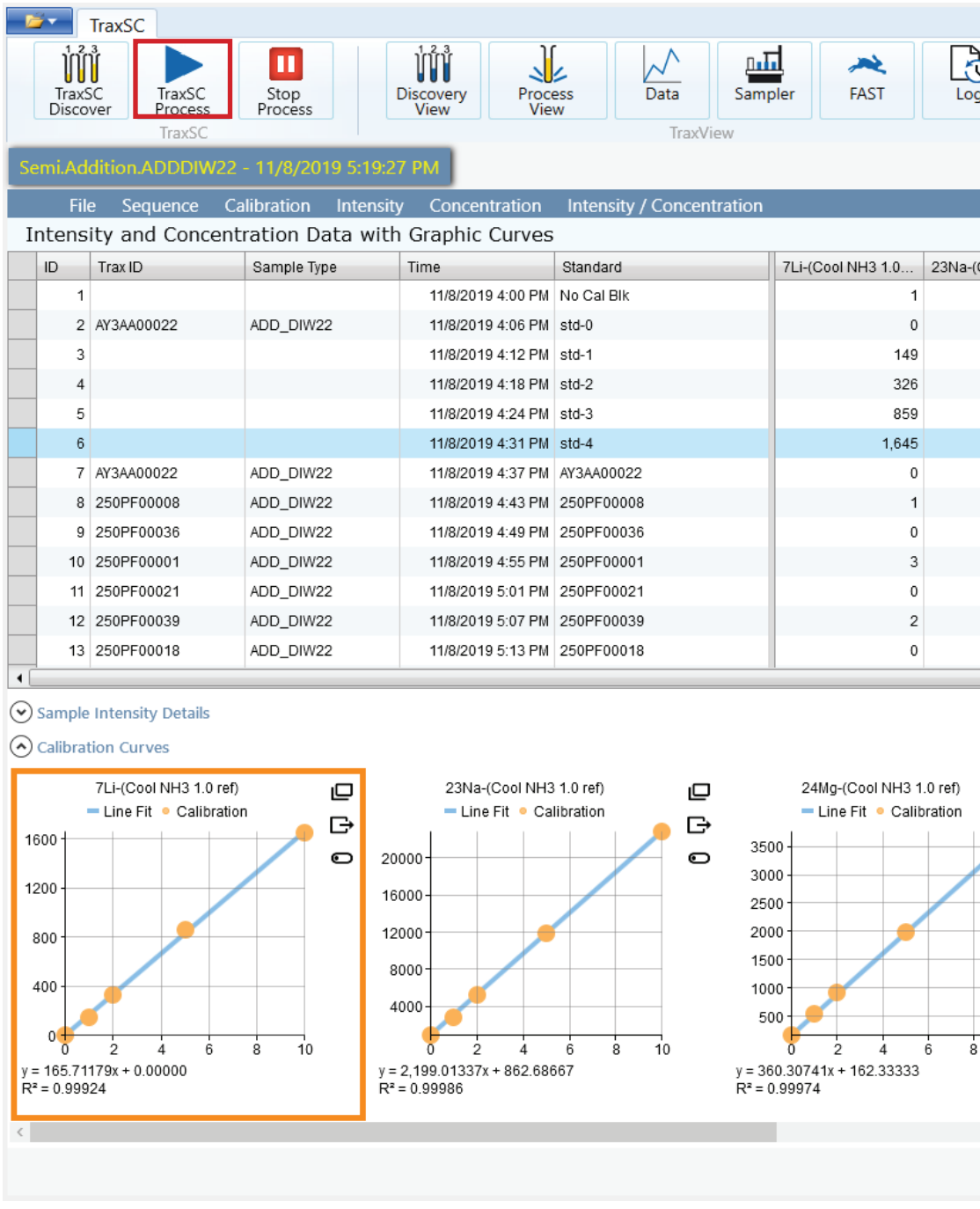
3) Run samples, acquire data and calculate results for reporting to sample

TRAX S5 automatically prepares desired calibration curve and samples for analysis.

As each chemical is prepared and injected, TRAX S5 triggers the 7900 to acquire data and imports raw intensities.

Raw intensities are:

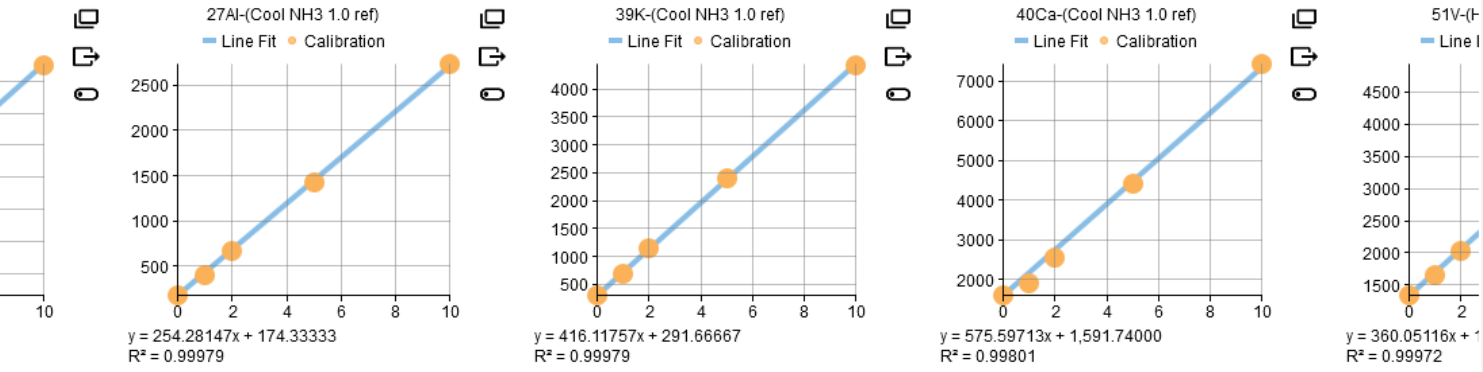
- Associated with TRAX ID
- Used to calculate concentrations
- Stored in database



eTRAX database

Intensity Concentration

Cool NH3...	24Mg-(Cool NH3...	27Al-(Cool NH3...	39K-(Cool NH3...	40Ca-(Cool NH3...	51V-(Hot NH3 1.0...	52Cr-(Cool NH3...	55Mn-(Cool NH3...	56Fe-(Cool NH3...
803	164	155	273	1,182	1,320	43	89	226
863	162	174	292	1,592	1,335	43	94	260
2,813	546	400	681	1,916	1,658	179	283	418
5,258	929	670	1,137	2,540	2,041	351	518	592
11,894	1,993	1,423	2,408	4,429	3,168	807	1,167	1,116
22,860	3,739	2,734	4,435	7,434	4,926	1,611	2,139	1,941
917	103	318	304	1,191	1,315	25	34	298
1,982	272	525	574	12,956	1,354	26	50	380
1,851	165	340	455	4,851	1,264	26	62	348
4,427	219	598	2,874	8,602	1,340	42	39	354
2,105	170	464	687	5,568	1,330	28	38	379
2,214	214	617	460	2,999	1,316	33	38	417
1,098	103	478	340	1,906	1,256	25	33	336

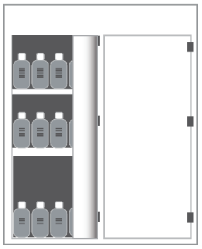


Tracking a Typical Bottle Cy

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.

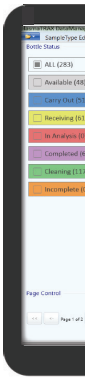


Bottle Storage

Available

Cleaned Before Sampling

Scan and Update Status



Cleaning

Bottle Clean Verification

Analysis Complete
Send Data and Update Status

Completed

sam
and

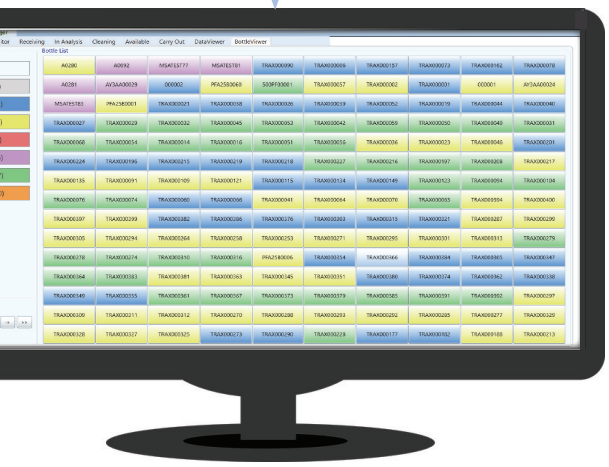
*Typical PFA cycle with a number of scanning stations is illustrated. Bottle cycle and scan stations are customizable for any lab process.

cle

Scan and
Update Status

Carry Out

Collect Sample
and Update Status

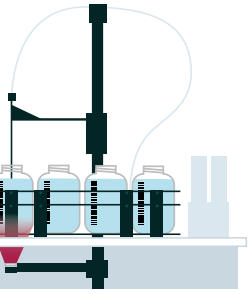


Bottle Manager

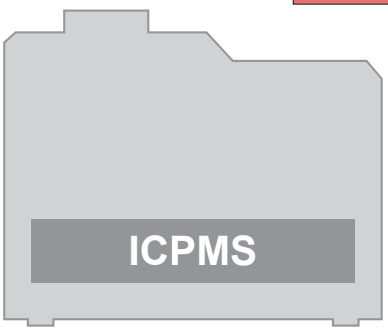
Receiving

In Analysis

Entering Lab
and Update Status



mpleTRAX Scan
d Update Status



ICPMS Instrument

*Barcoded PFA bottles are reusable, have ultra-low blanks and get cleaner after they are reused again and again. The SAMPLETRAX S5 tracks each bottle, ensures cleanliness and data integrity.

Bottle Manager: Tracki

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.

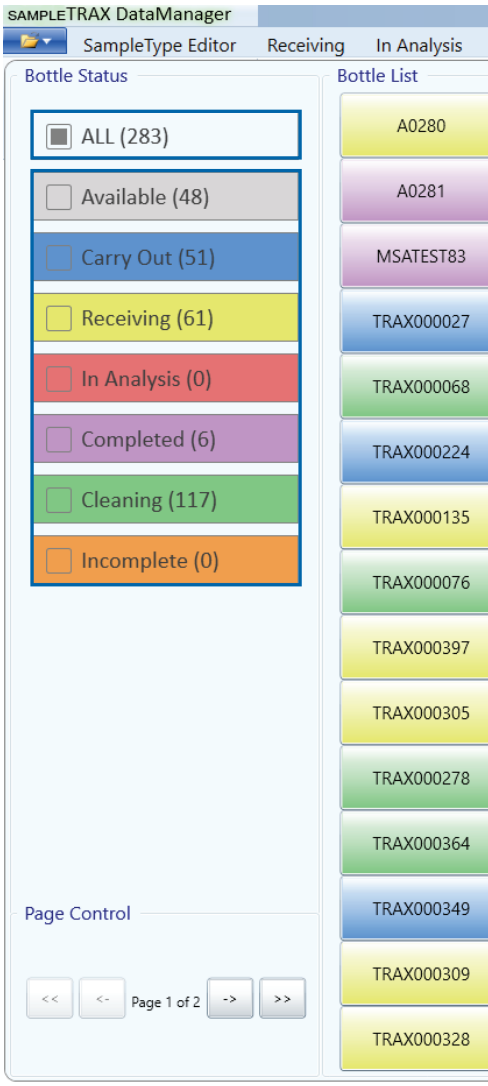
Quantity of bottles is indicated with (##) in each of the seven color-coded stages.

Bottle History

Click on the TRAXID to view its complete history.

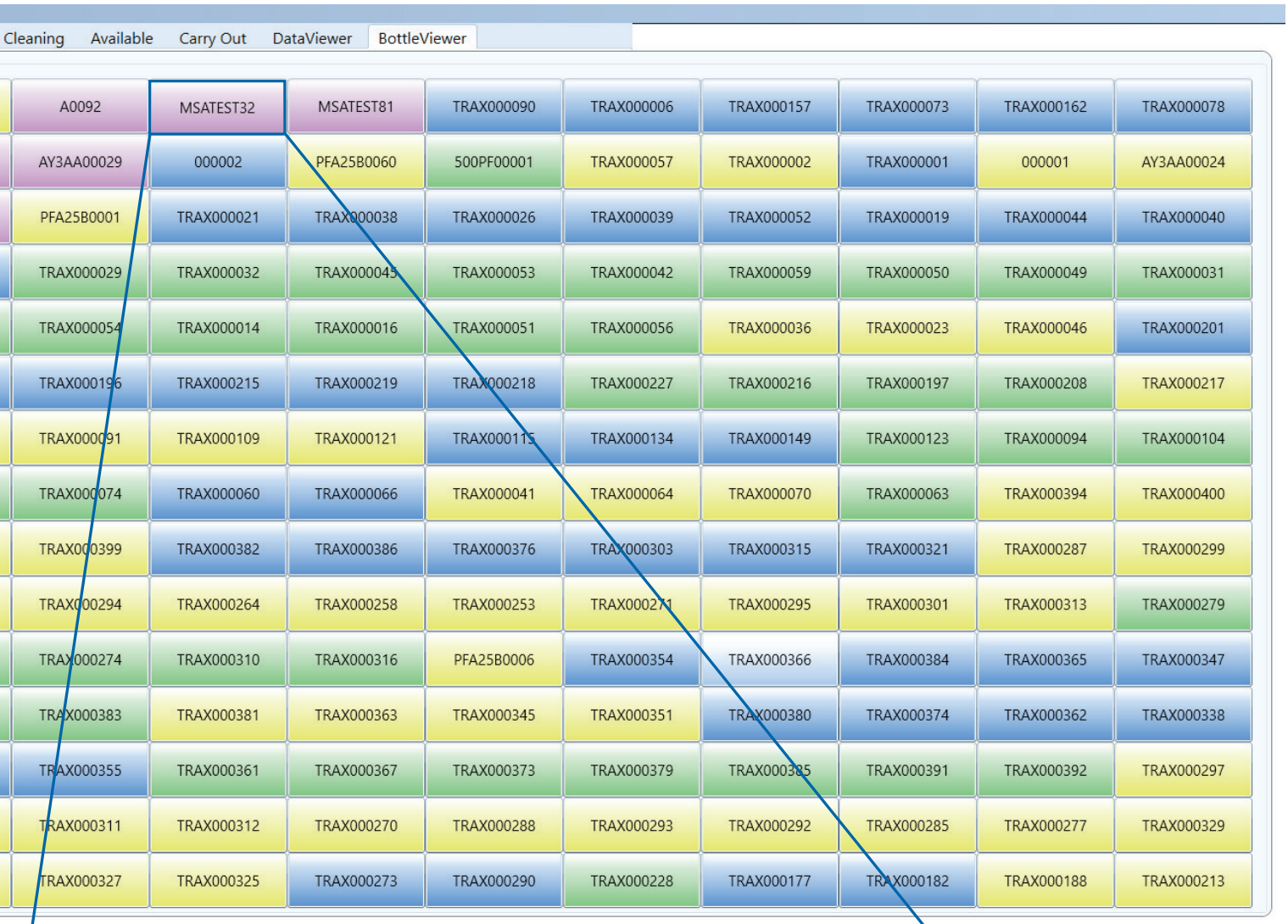
- Status
- Sample type
- Purpose
- Concentrations

12 mL vial | 250 mL bottle | 1 mL vial



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

ing and History



Bottle History for MSATEST32

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

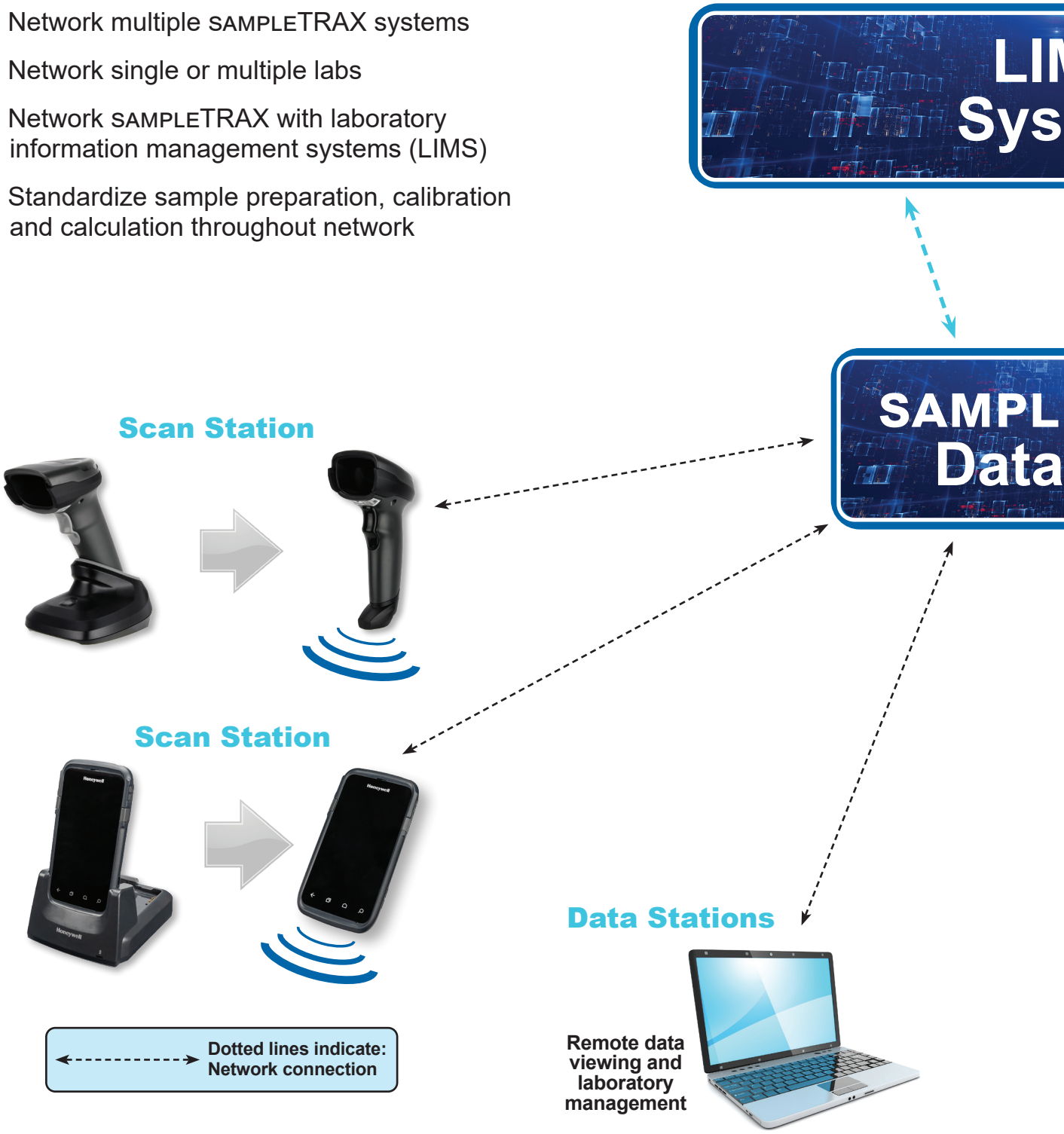
TraxId	SampleType	Device	DateTime	Standard	Na	Mg	N	K	Ti	V	Cr	Fe	Ni	Co
MSATEST32	Validation	2	1/28/2019 5:56:42 PM	std-0	0.184	0.001	0.002	0.004	0.002	0.001	0.056	0.002	0	0
MSATEST32	Validation	2	1/29/2019 9:13:03 AM	std-0	0.139	0.108	0.124	0.042	0.108	0.016	0.212	0.113	0.041	0.111

Close

Flexible, Customizable SAM

Automate the whole lab by incorporating

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



MPLETRAX Networking

multiple scanning and analytical stations

MS
tem

eTRAX
base

Multiple
Analytical Stations

Location #3

Location #1

Location #2

Full System at a Glance

Features and Benefits

Sample Identification

- Barcode scanning accesses information including:
  - Sample type
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- Automated matrix matched MSA or external calibration
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Examples of Semiconductor Chemicals Analyzed at the ppt Level with sampleTRAX S5			
Acids	**Bases**	**Organics**	**Chemical Mixes**
98% H_2SO_4	22% NH_4OH	IPA	SC-1
89% H_3PO_4	2.38% TMAH	PGMEA/PGME	SC-2
70% HNO_3	25% TMAH	Photoresist	BOE
49% HF	KOH	NMP	DSP
35% HCl		Butyl Acetate	
30% H_2O_2		Cyclohexanone	
SPM			
FPM			
DHF			
Etchant			
Others			

All semiconductor pure chemicals can be analyzed using sampleTRAX S5. This table contains only a partial list of common chemicals.

Notes

Notes

Elemental Scientific

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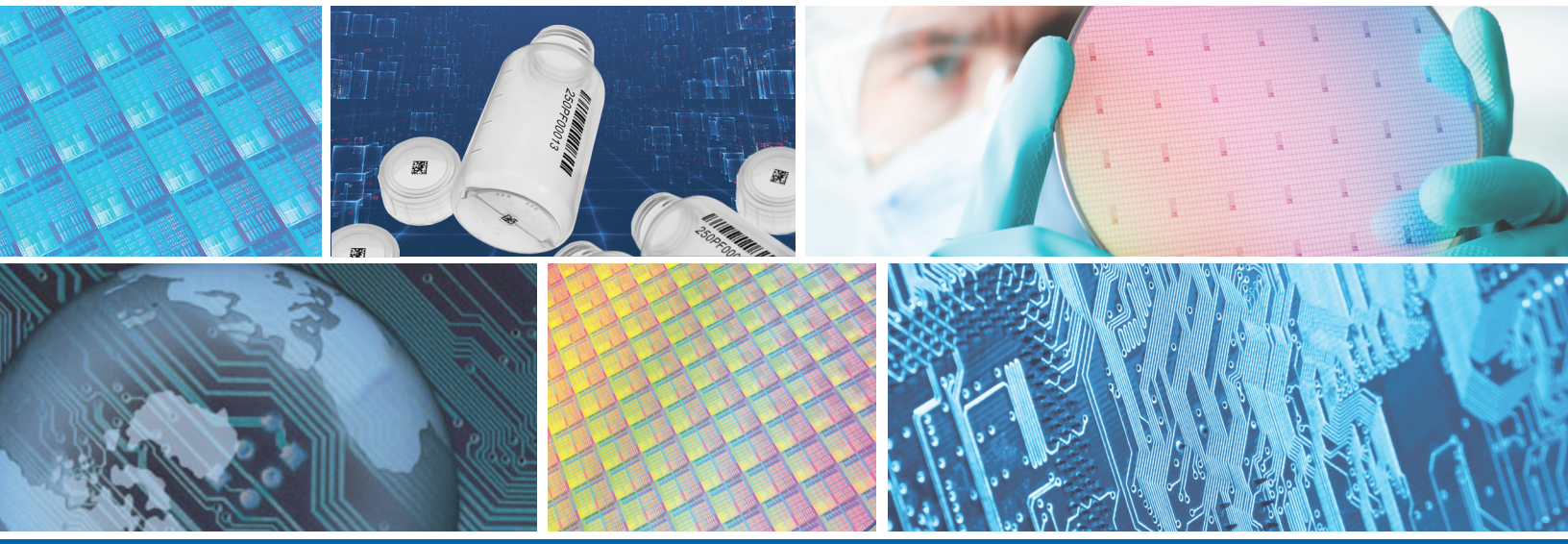
Contact us by phone at 402.991.7800 or by e-mail at sales@icpms.com. Our scientists and engineers are available to answer your questions related to elemental analysis. We are pleased to provide our customers complimentary analytical advice from our on-staff chemists.



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