

New product AAS introduction

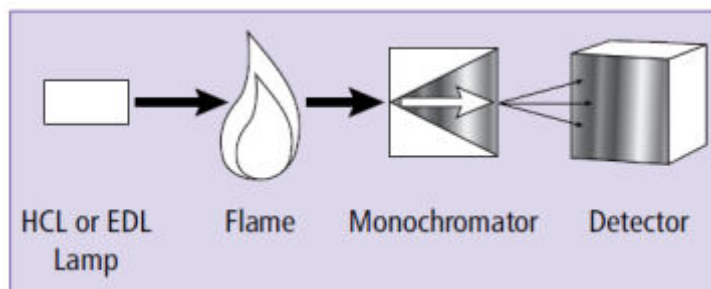
Fadi Abou-Shakra, Inorganic Product Line Leader - EMEA



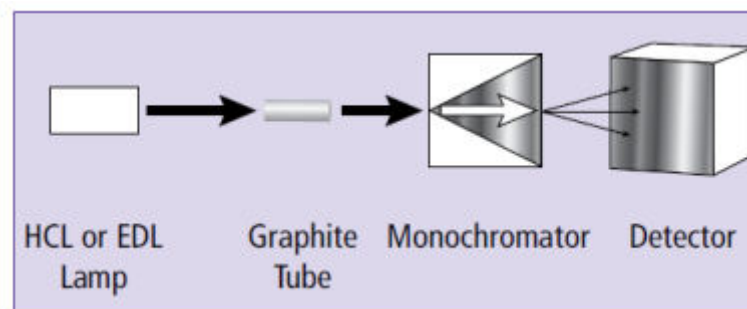
ARE YOU
IN?

JOIN THE
CONVERSATION
PERKINELMER
INTOURS 2015

Atomic Spectroscopy from PerkinElmer



Flame AA



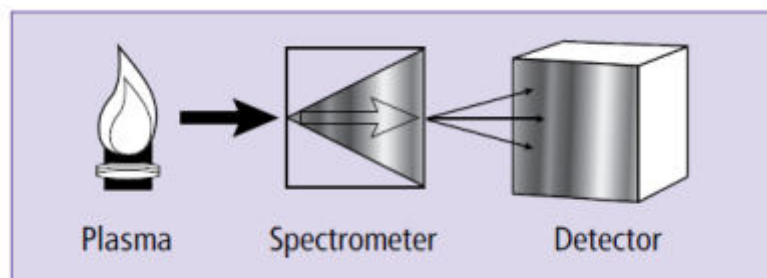
GF AAS



ICP - OES



ICP - MS



PerkinElmer long history in ICP-MS

1983 - ELAN 250

First commercially available
ICP-MS

Dual Cone Interface

Cryogenic pumping system



1990 - ELAN 5000

Turbo pump

Free-running RF generator

Total Quant



1994 - ELAN 6000

Dual detector

9 orders of magnitude

AutoLens



2002 - ELAN DRC II

DRC for interference removal

Improved low mass sensitivity

Sub ppt detection limits for Ca,
Fe



2010 - NexION 300

Universal cell ICP-MS

Nano-particles detection

No maintenance



PerkinElmer long history in ICP-OES

1979 – PerkinElmer Introduces the ICP 5000

1984 – PerkinElmer Plasma II Introduced

1987 – PerkinElmer introduces the Plasma40

1993 – PerkinElmer introduces Optima 3000

1995 – Optima 3000DV Introduced

2001 – Optima 4300 and Optima 2000

2005 – Optima 5300 and Optima 2100

2007 – Optima 7300 and Optima 7000

2011 – The New Optima 8x00 Family



PerkinElmer long history in AA

1961 – PerkinElmer introduces the Model 214 AA

1963 – PerkinElmer Model 303

1970 – PerkinElmer enters graphite furnace market

1974 – Model 370 launched

1981 – Model 5000Z launched

1986 – PerkinElmer BSW Model 1100 launched

1991 – Model 5100ZL and 4100ZL introduced

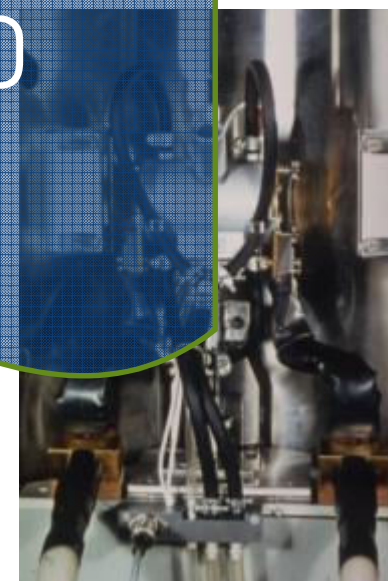
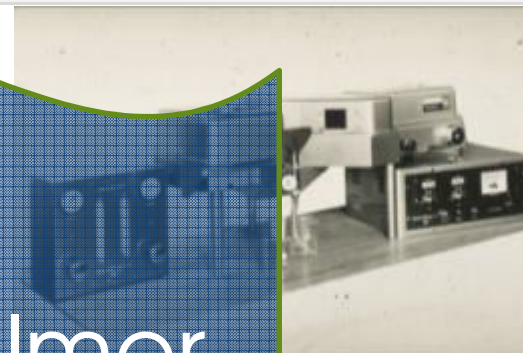
1997 – AAnalyst 700/800 introduced

1998 – AAnalyst 600 launched

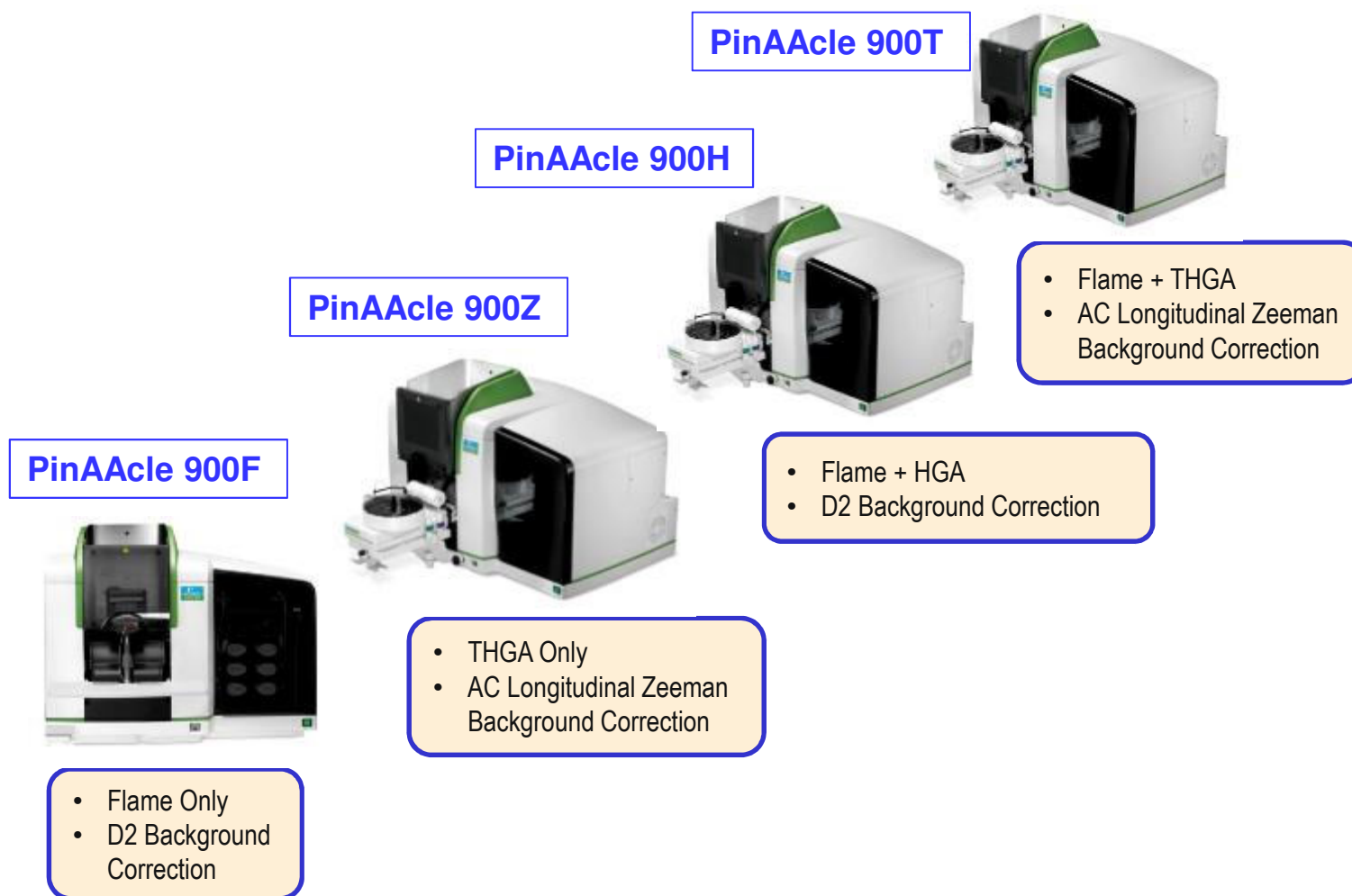
2001 – AAnalyst 200/400 launched

2011 – The Revolutionary New PinAAcle

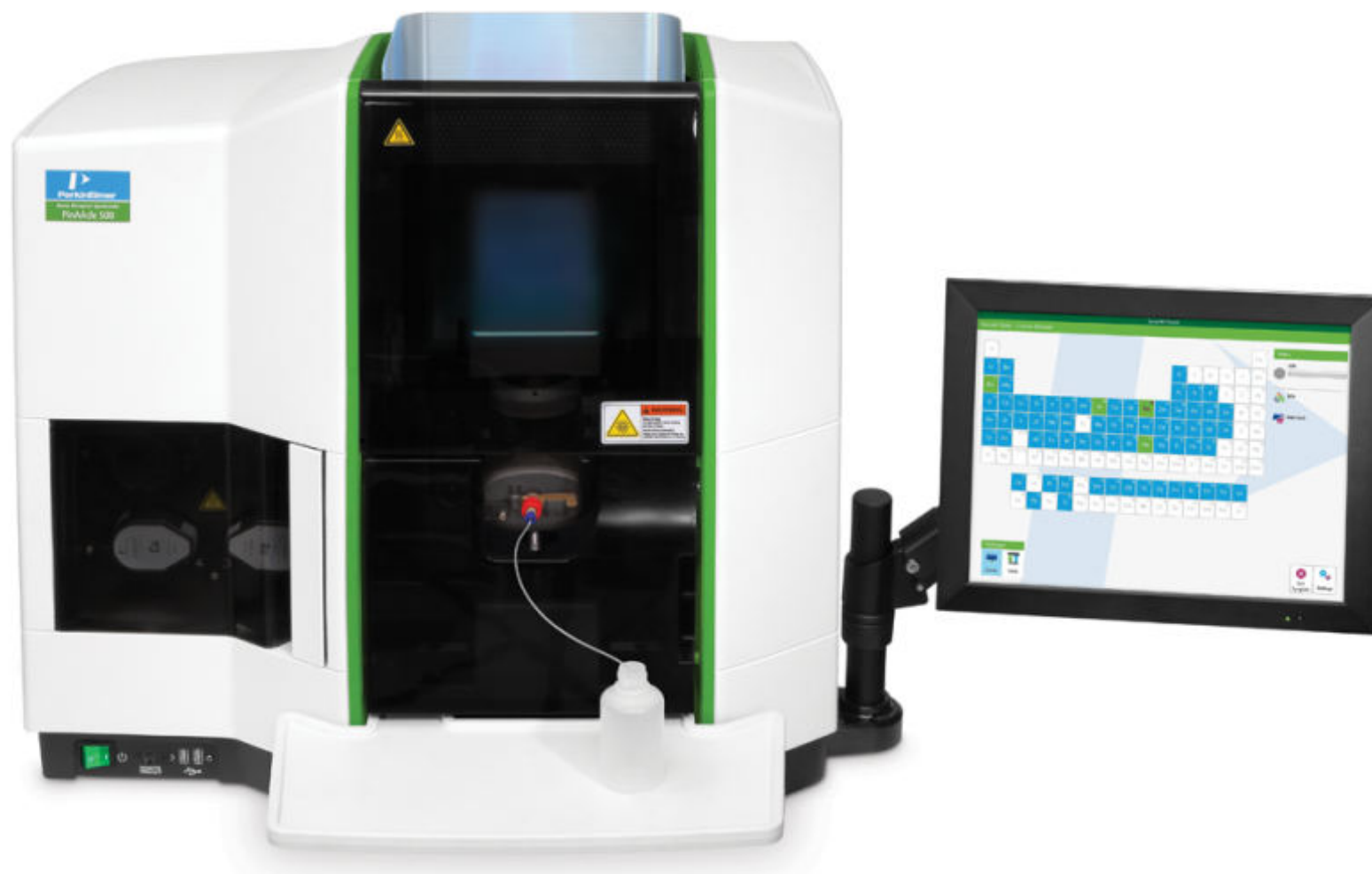
Over 50,000 PerkinElmer
AA Sold since 1960



PinAAcle™ AA Family



PinAAcle™ 500 Flame AA Spectrometer



PinAAcle 500 ... Features and benefits

Fully corrosion resistant

- Robust and reliable even in harsh environments
- Requiring minimal maintenance
- Reduced operating costs
- Faster return on investment

High-performance

- Higher sensitivity
- Better detection limits
- Better-quality data

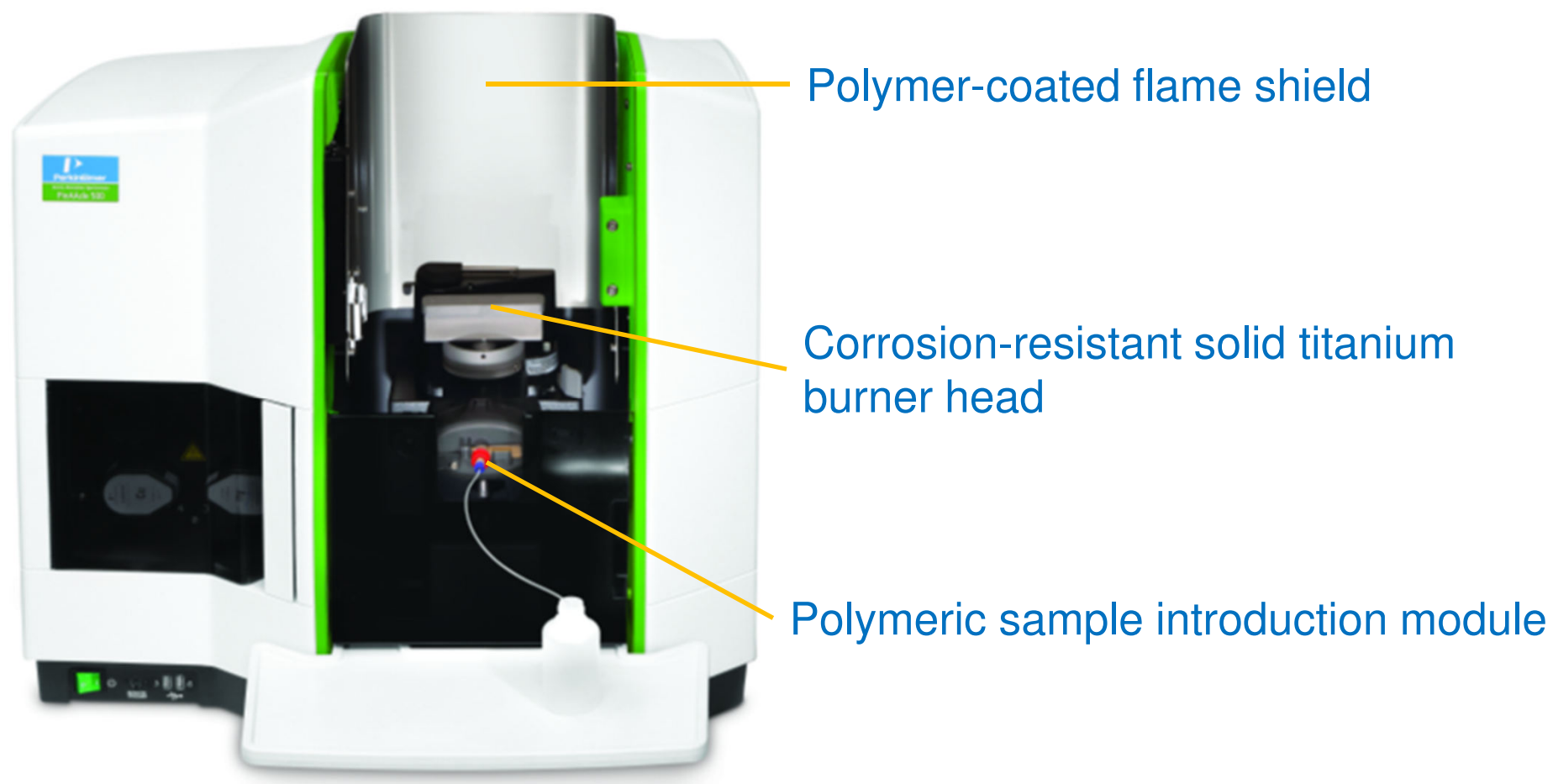
Easy to use and maintain

- Syngistix Touch software/user interface
- Quick-change modular sample introduction system

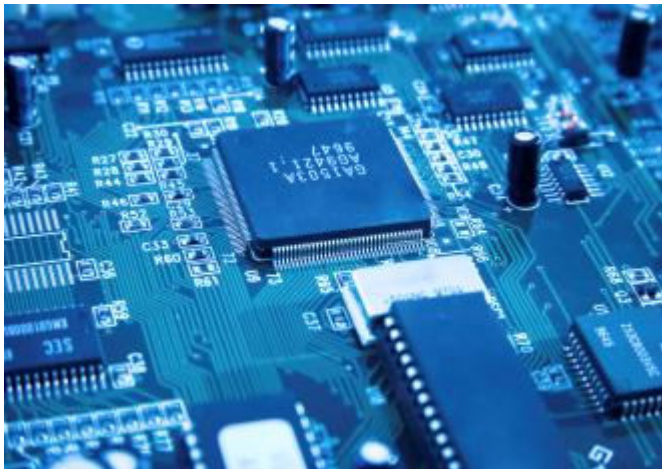


Corrosion Resistance

PinAAcle 500 ... Corrosion-resistant AA



PinAAcle 500 – Conformally Coated PCBAs



A **Conformal coating** is a,

protective chemical **coating** or polymer film 25-75 μm thick (50 μm typical)

that

'conforms' to the circuit board topology.

Its purpose is

to **protect electronic circuits from harsh environments** that may contain moisture and or strong acids.



High Performance

PinAAcle 500 ... Fiber optics for better performance

**High light
transmission
due to fiber
optics**

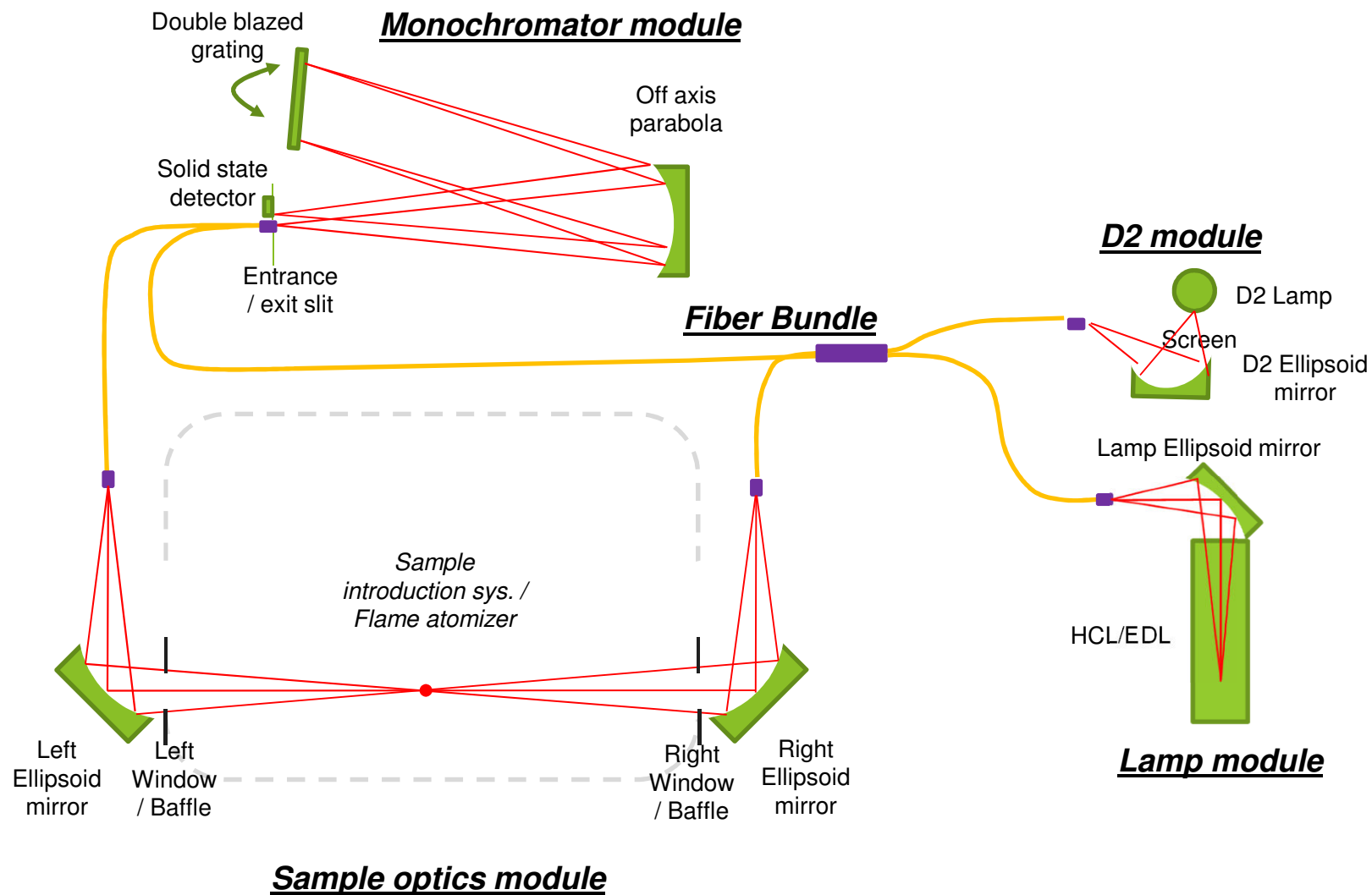


**Less cleaning
and
maintenance
of mirrors
(Fiber optic
does not get
“dirty” over
time)**



**Best light
transmission
with
minimum
maintenance**

PinAAcle 500 ... Fiber optics for better performance



PinAAcle 500 ... Unique solid state detector

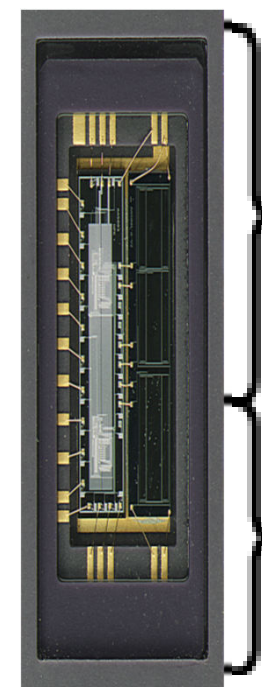
Two detectors integrated on
one chip for real-time double
beam detection



Highest quantum efficiency
over the full spectral range



The best signal to noise
ratio on the market

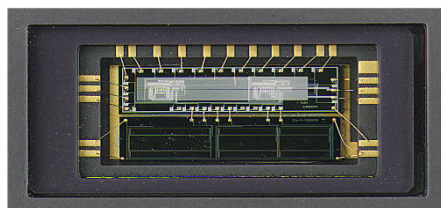


Sample
signal

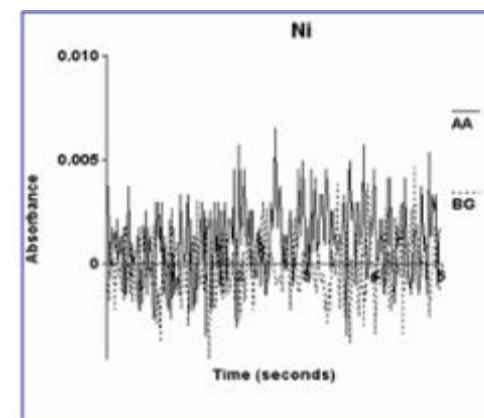
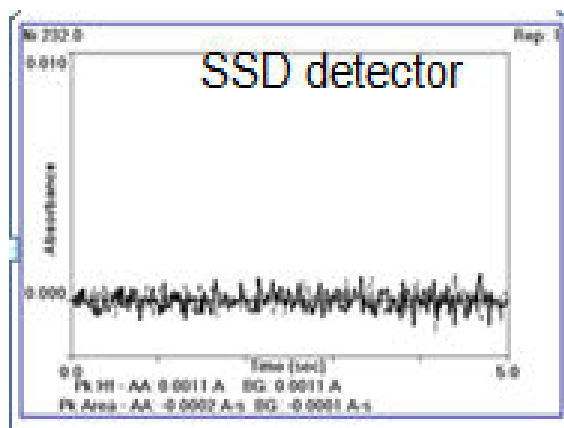
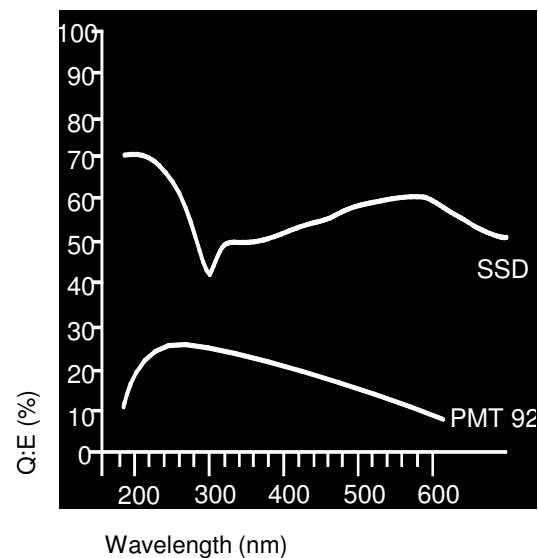
Reference
signal

PinAAcle 500 ... Unique solid state detector

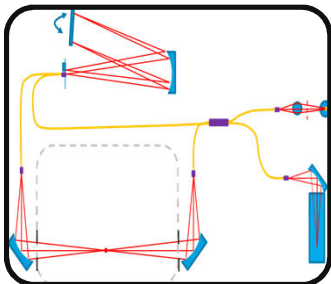
SD



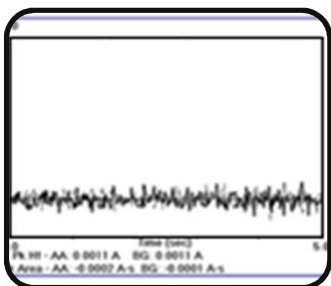
PMT



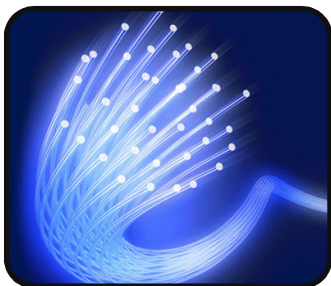
PinAAcle 500 ... Real-time, true double-beam optics



Fast start-up and exceptional long-term stability without recalibration



Stable baselines



Best detection limits

PinAAcle 500 ... Typical detection limits (µg/L)

Element	PinAAcle 500	Competitor A*	Competitor B*	Competitor C*
Geochemical:				
Cu	0.9	4	1.2	3
Ag	0.8	2	1.7	1.5
Au	5	8	5	7
Pd	7	10	15	20
Pt	35	75	76	120
Environmental:				
Fe	4	4	7	4
Mg	0.2	0.3	0.3	0.3
Zn	0.7	0.7	1.6	1.4
Ca	2.2	0.9	0.4	2
Ni	0.35	8	5.8	4
K	0.5	2	4	15
As (EDL) AABG	172	260	42	150
Se (EDL) AABG	49	260		60

* Available on public domain

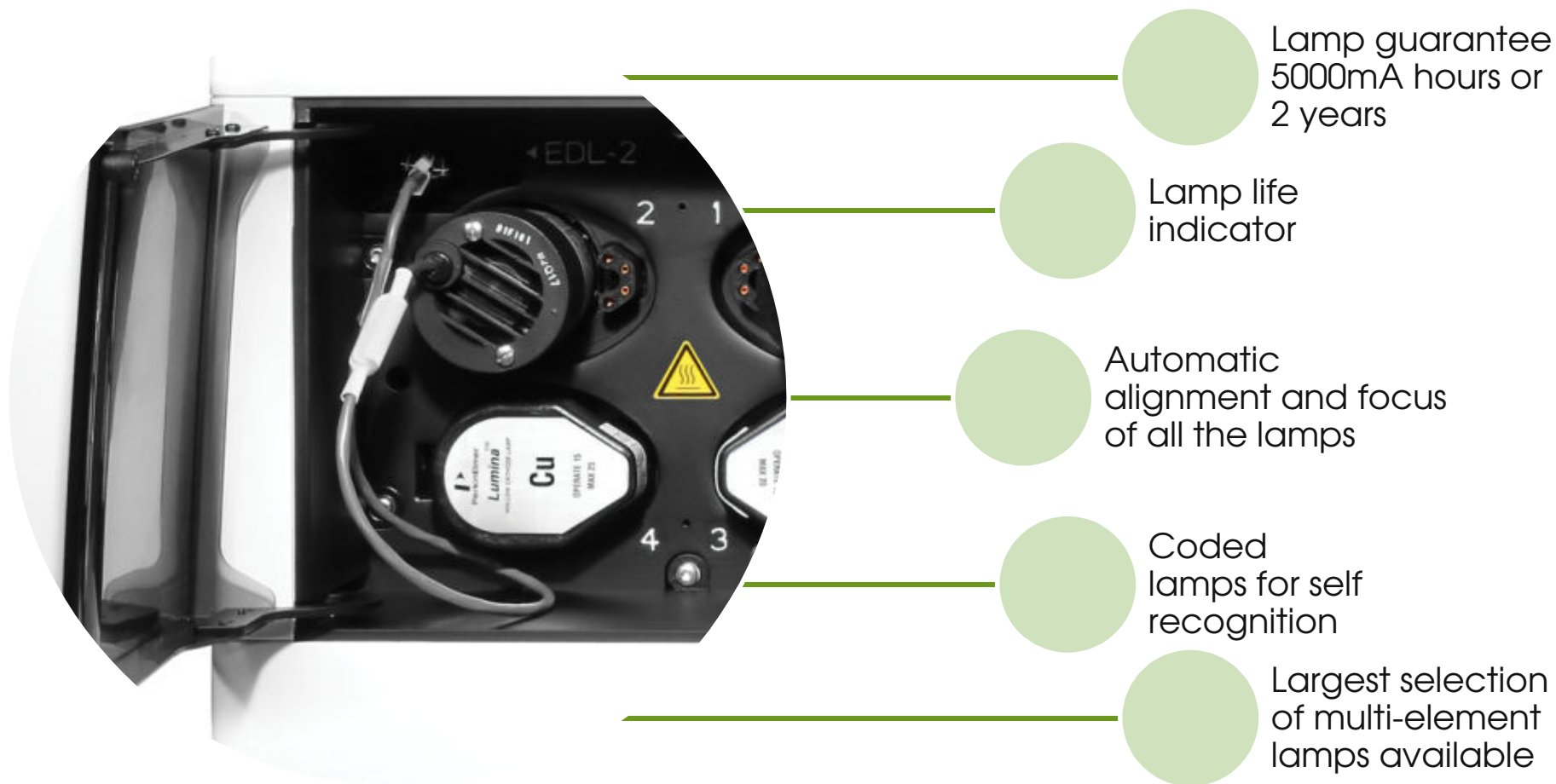


Easy To Use and Maintain

PinAAcle 500 ... Easy access lamp compartment & modular sample introduction system



PinAAcle 500 ... Lamps



PinAAcle 500 ... Unique modular quick-change burner assembly



PinAAcle 500 – Easy-to-maintain burner head



Machined from a single piece of solid titanium

Easily cleaned

Inert

Used with the widest range of sample matrices

Lifetime guarantee under normal use

PinAAcle 500 ... Syngistix Touch™ software



Syngistix Touch™ for AA

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PinAAcle 500 ... Syngistix Touch software – *choose element*

Syngistix Touch

Periodic Table - Choose Element

The periodic table displays elements with their atomic numbers and symbols. The element Copper (Cu) is highlighted in red. The lanthanide and actinide series are shown below the main table.

Technique

Flame MHS

Status

Idle

Not Connected

Not Connected

Exit Syngistix Settings

PinAAcle 500 ... Syngistix Touch software – *choose method*

Syngistix Touch

Choose Method

Cu
29
Element
Copper

	Name	Date / Time
1	Cu-300115	30/1/2015 1:30:44 PM
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Analyze

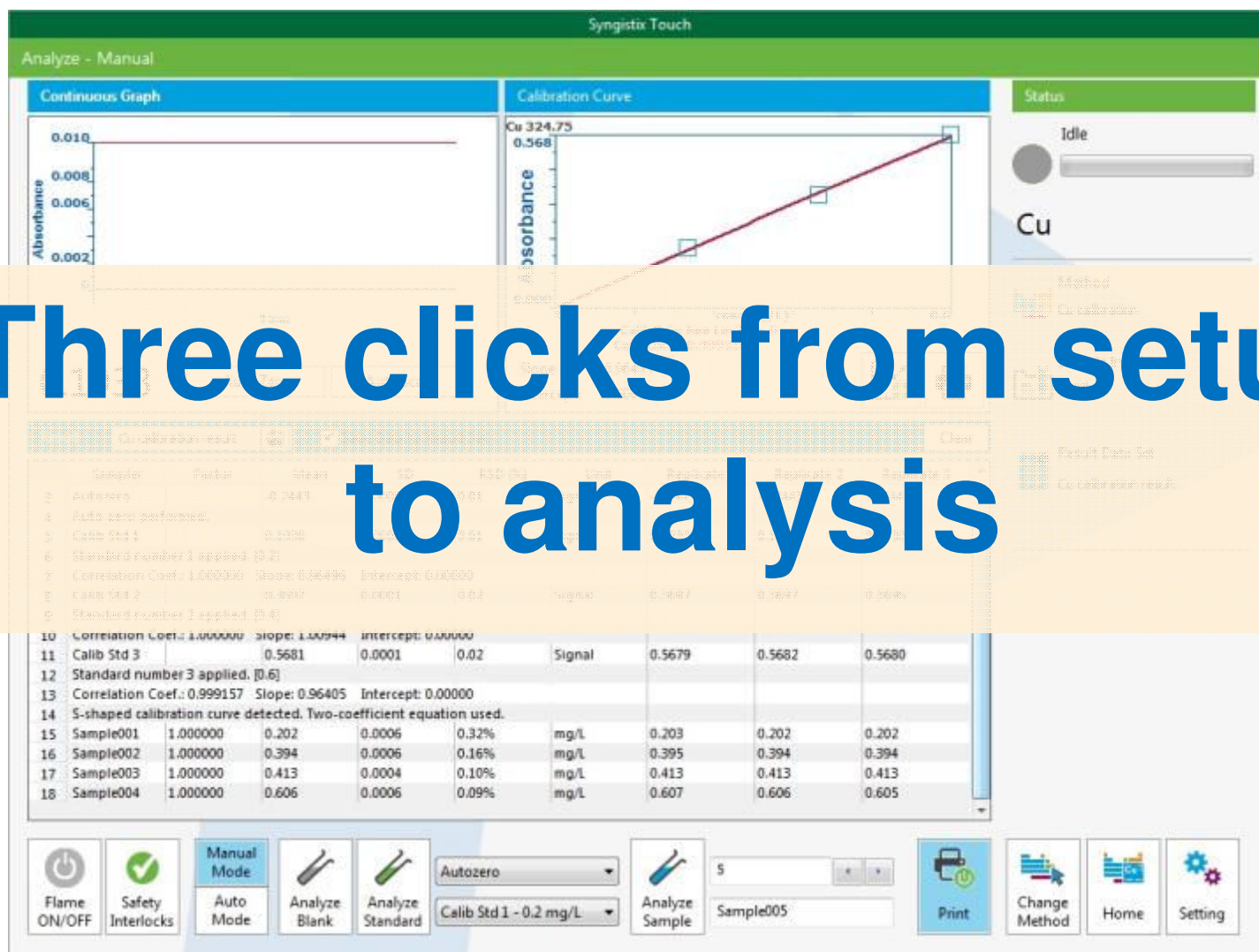
New Method

Home

Settings

PinAAcle 500 ... Syngistix Touch software – *analyse*

Three clicks from setup
to analysis



PinAAcle 500 ... Syngistix Touch software – *printing*

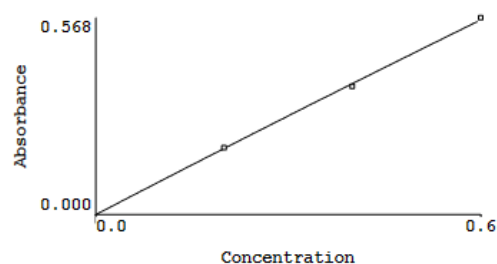
Syngistix Touch Report

11:39 2015-02-10

Page 2

#	mg/L	mg/L	Signal		Stored
1	[0.6]		0.5679	11:37:34 AM	Yes
2	[0.6]		0.5682	11:38:03 AM	Yes
3	[0.6]		0.5680	11:38:06 AM	Yes
Mean:	[0.6]		0.5681		
SD:	0.000		0.0001		
%RSD:	0.00%		0.02		

Standard number 3 applied. [0.6]
 Correlation Coef.: 0.999157 Slope: 0.96405 Intercept: 0.00000
 S-shaped calibration curve detected. Two-coefficient equation used.



Characteristic Concentration = 0.025 mg/L
 Abs = 0.96405 x C + 0.00000

Calibration data for Cu 324.75

Equation: Nonlinear Through Zero

ID	Mean Signal (Abs)	Entered Conc. mg/L	Calculated Conc. mg/L	Variation	Standard Deviation	%RSD
Autozero	0.0000	0	0.000	0.00	0.00	0.01
Calib Std 1	0.1930	0.2	0.202	-0.00	0.00	0.01
Calib Std 2	0.3697	0.4	0.391	0.01	0.00	0.02
Calib Std 3	0.5681	0.6	0.607	-0.01	0.00	0.02

Correlation Coef.: 0.999157 Slope: 0.96405 Intercept: 0.00000

Sequence No.: 5

Autosampler Location:

Sample ID: Sample001

Date Collected: 2/10/2015 11:38:24 AM

Analyst:

Data Type: Original

Replicate Data: Sample001

Analyte: Cu 324.75

Repl	Sample Conc mg/L	Std Conc mg/L	Blank Corr	Time	Signal	Stored
#	mg/L	mg/L			Signal	Stored
1	0.203	0.203	0.1936	11:38:25 AM	Yes	
2	0.202	0.202	0.1930	11:38:28 AM	Yes	
3	0.202	0.202	0.1924	11:38:32 AM	Yes	
Mean:	0.202	0.202	0.1930			
SD:	0.0006	0.0006	0.0006			
%RSD:	0.32%	0.32%	0.31			

PinAAcle 500 ... Syngistix™ for AA software



PinAAcle 500 ... Syngistix for AA software

The screenshot displays the Syngistix for AA software interface. At the top, a tabbed ribbon style toolbar contains various icons for instrument control, analysis, results, and utilities. The main workspace is divided into several panels. On the left, the 'Analysis' panel is active, showing options for 'Manual' and 'Automated' analysis. The 'Automated' section includes buttons for 'Analyze Blank', 'Analyze Standard', 'Analyze Sample', and 'Analyze QC', each with associated dropdown menus and 'Continue' buttons. Below these are fields for 'Sample Information file' and a checkbox for 'Print log during analysis'. On the right, the 'Run List' panel displays a table of analysis runs. The 'Status' panel on the far right shows 'Ag' and 'Sample Information file'.

Analysis window combines manual and automated analysis!

Tabbed ribbon style toolbar

New status panel with quick links

Run	Lot	Type	Sample ID	Status
1	---	---	---	Applied
2	---	---	Std 1	Applied
3	---	---	Std 2	Applied
4	---	---	Std 3	Applied
5	---	---	Alpha 1	Analyzed
6	---	---	QC Sample 1	QC Passed
7	---	---	Alpha 2	Analyzed
8	---	---	---	---
9	---	---	---	---
10	---	---	---	---
11	---	---	---	---
12	---	---	---	---
13	---	---	---	---
14	---	---	---	---
15	---	---	---	---
16	---	---	---	---
17	---	---	---	---
18	---	---	---	---
19	---	---	---	---
20	---	---	---	---
21	---	---	---	---
22	---	---	---	---
23	---	---	---	---

Syngistix for AA ... Ribbon-style toolbar/workflow-oriented tabs

Instrument

- Basic settings for the instrument
- Devices
- Performance tests

Analysis

- Method
- Sample information
- Analysis window

Results

- Current and previously analysed data
- Calibration curve
- Peak profiles

Utilities

- Links to external applications and other resources

Syngistix for AA ... Analysis window

Separate tabs for manual and automated analysis

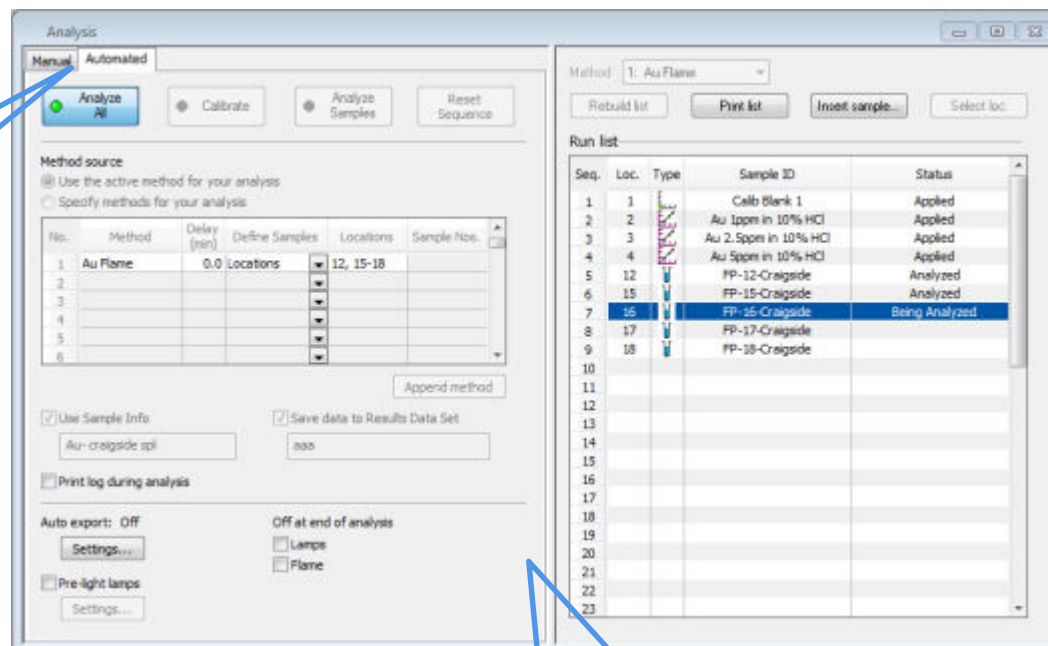
The screenshot shows the 'Analysis' window with the 'Manual' tab selected. The 'Run list' table on the right displays the following data:

Seq.	Loc.	Type	Sample ID	Status
1	--		Calib Blank 1	Applied
2	--		Au 1ppm in 10% HCl	Applied
3	--		Au 2.5ppm in 10% HCl	Applied
4	--		Au 5ppm in 10% HCl	Applied
5	--		FP-10-Craigside	Analyzed
6	--		FP-11-Craigside	Analyzed
7	--		FP-12-Craigside	Analyzed
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

Run log in manual mode showing what has been analyzed

Syngistix for AA ... Analysis window

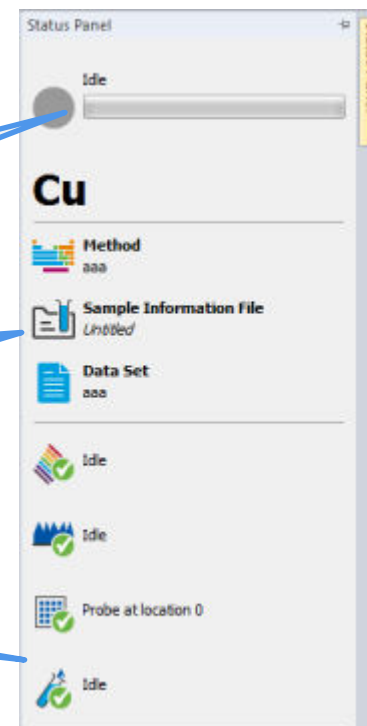
Separate tabs for manual and automated analysis



Automated analysis controls fit in one window

Syngistix for AA ... Status panel

Status of the spectrometer,
atomizer and accessories





FAST Flame Sample Automation

Introducing ... FAST Flame sample automation



AAPrep2



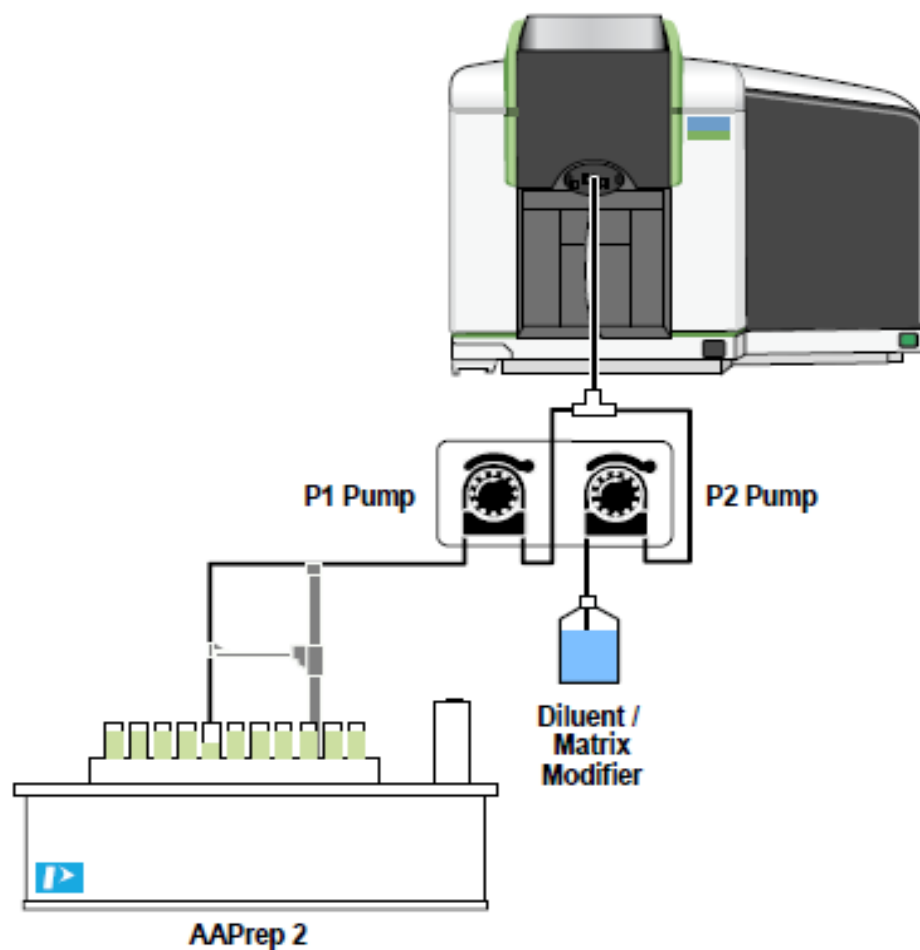
FAST Flame 1



FAST Flame 2



AAPrep 2 ... more than just an autodiluter



- Pump 1 carries sample / standards
- Pump 2 delivers diluent
- Constant total flow (Pump1 + Pump 2)
- $DF = (Pump\ 1 + Pump\ 2) / Pump\ 1$

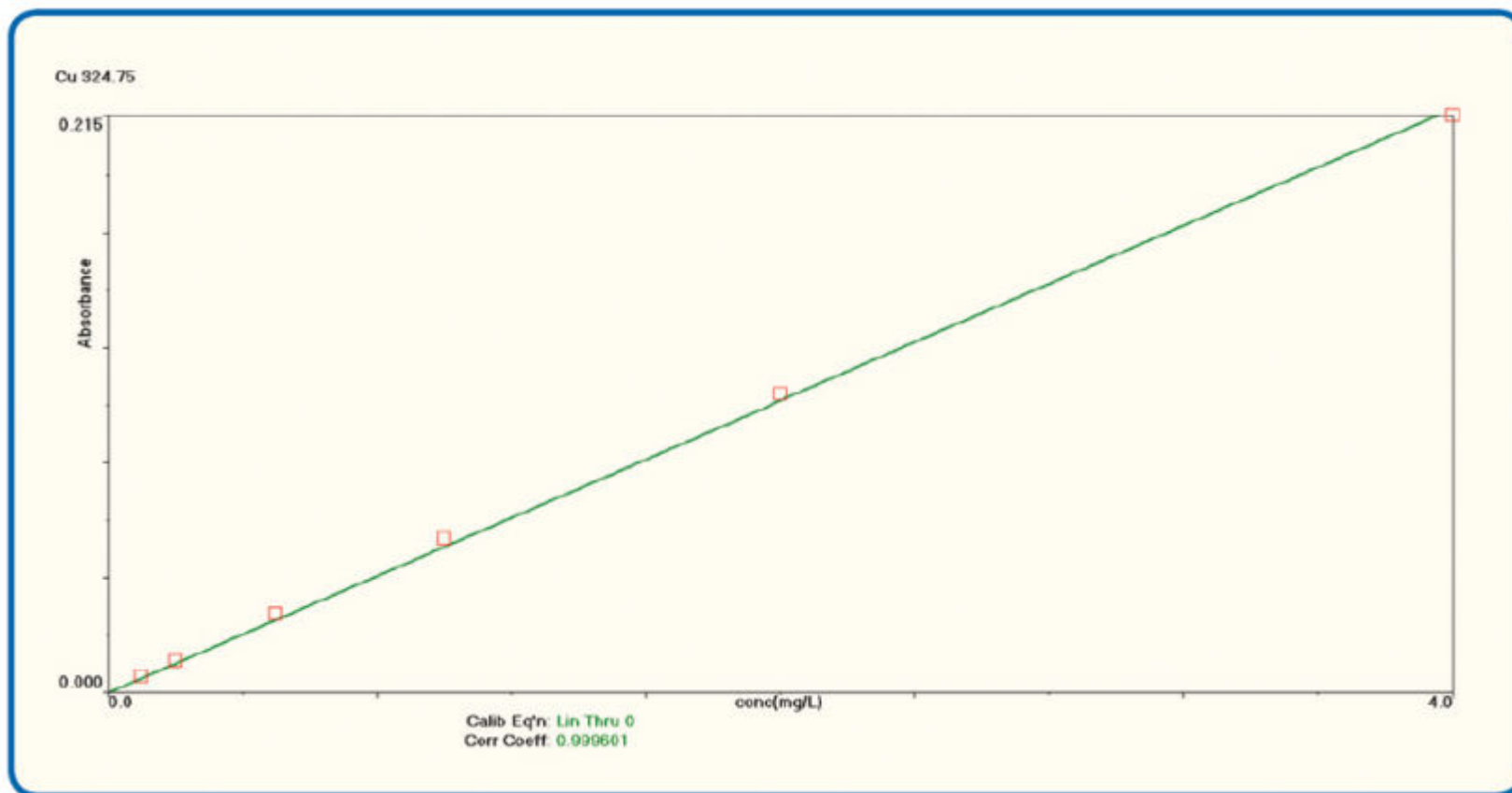
AAPrep 2 ... Features and benefits

Auto calibration

Automatically prepare standards from a single stock solution

- Better accuracy (standards are freshly prepared on the day and less potential operator error)
- Save on manpower (no need for expert chemists preparing all these standards)

AAPrep2 – Calibration curve



Inline autocalibration from 4 mg/L standard

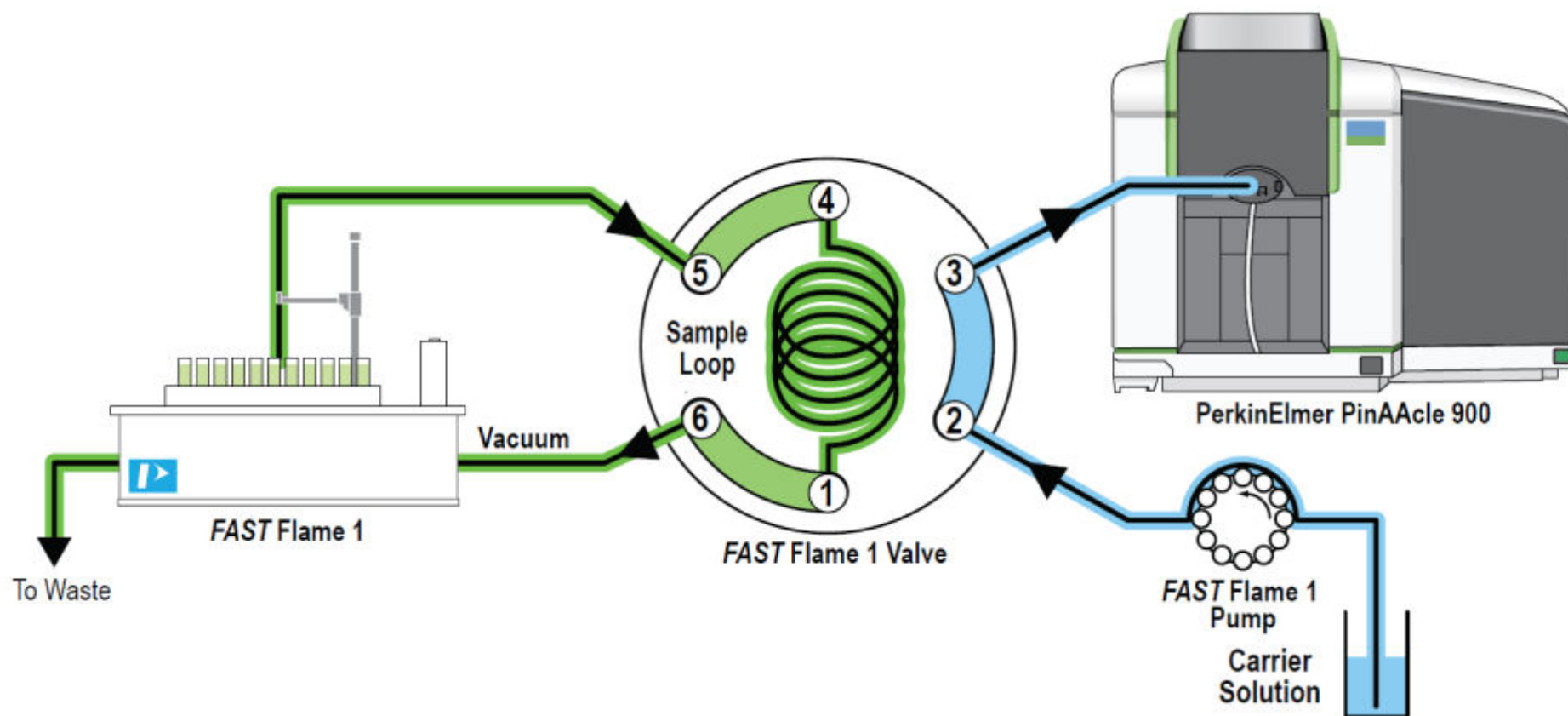
AAPrep 2 ... Features and benefits

Auto dilution

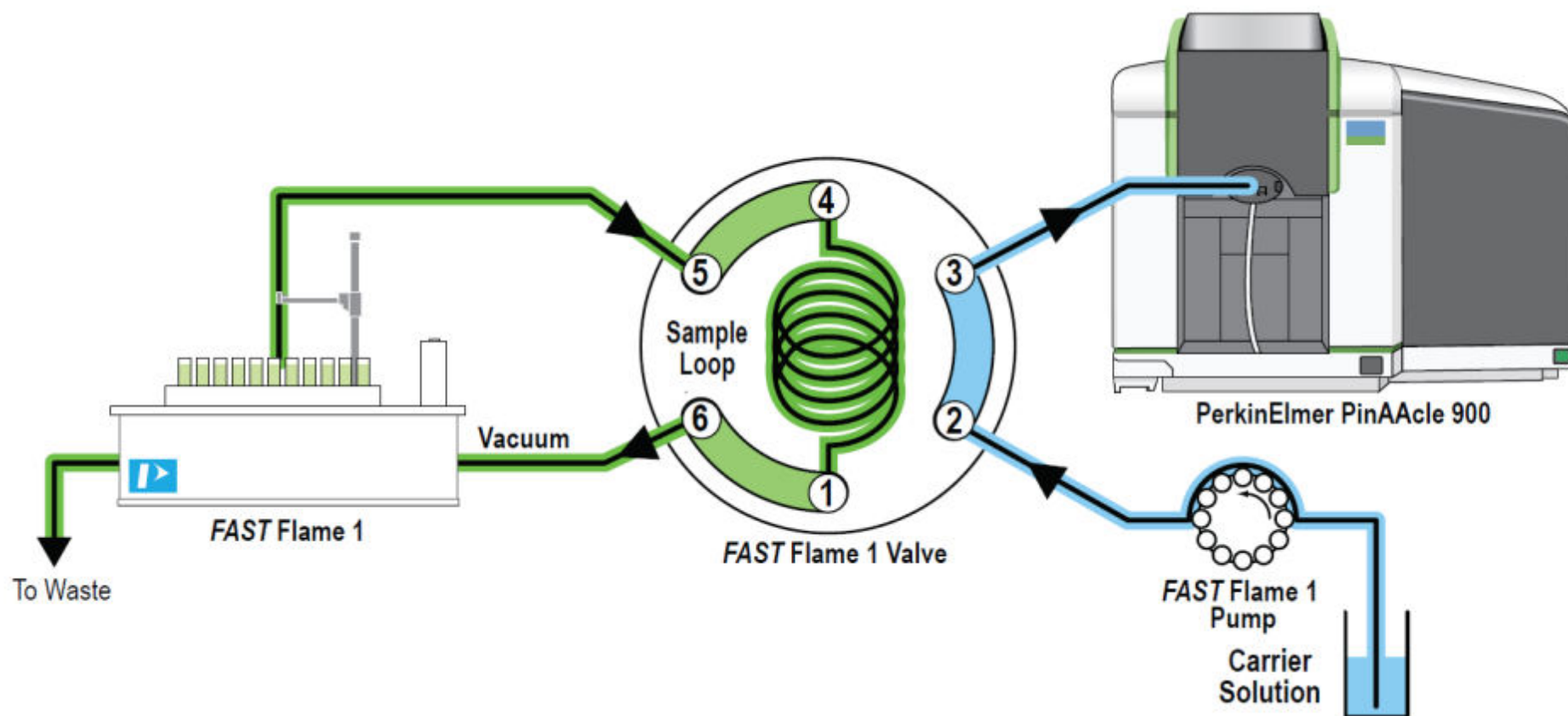
Automatically dilute samples
and over-range samples

- Better accuracy (less potential operator error)
- Save on manpower (no need for expert chemists to dilute these samples)
- Save on re-run (no need to re-analyse over-range samples)

FAST Flame 1 ... The high-throughput companion

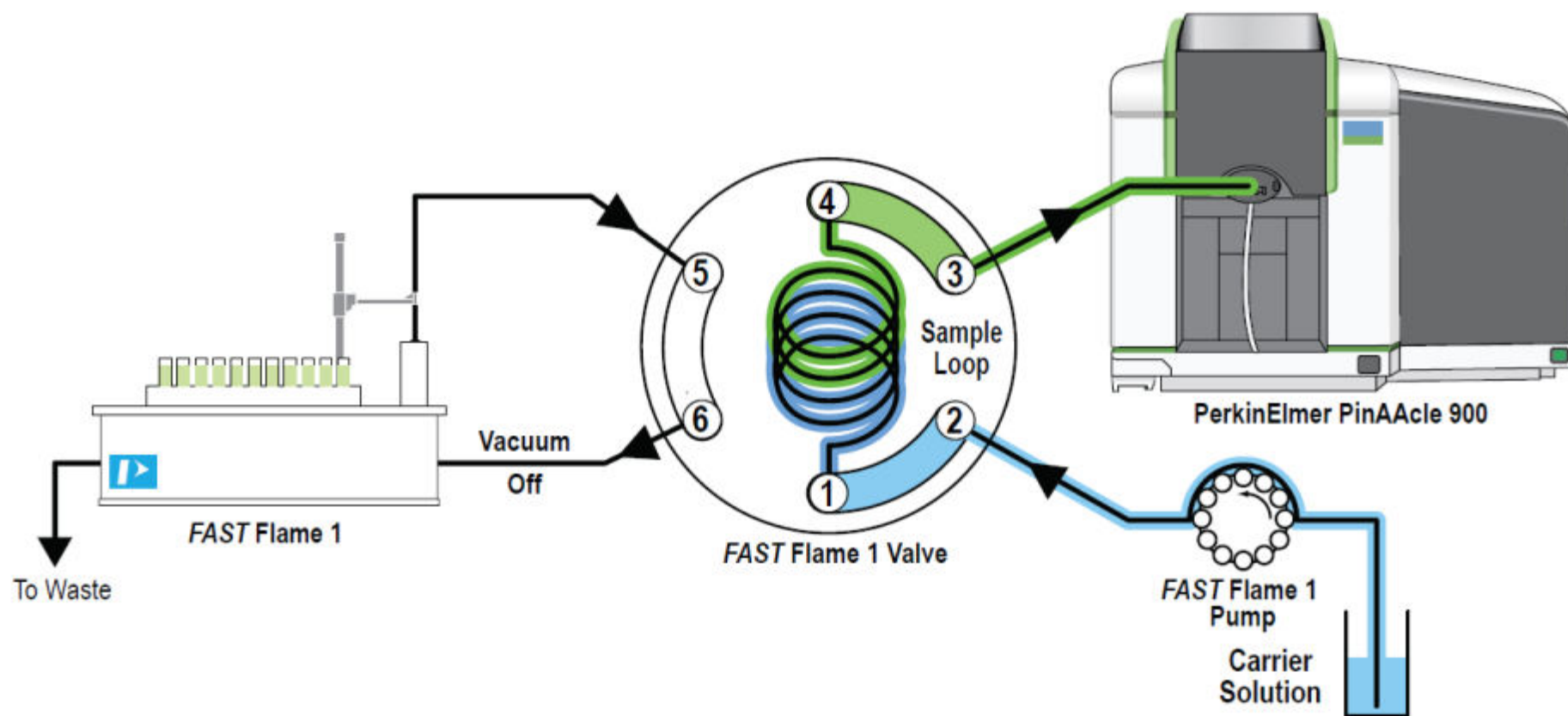


FAST Flame 1 – Load sample loop while nebulizer washes



Step 1. 2-8* seconds *=Loop size/sample viscosity dependent

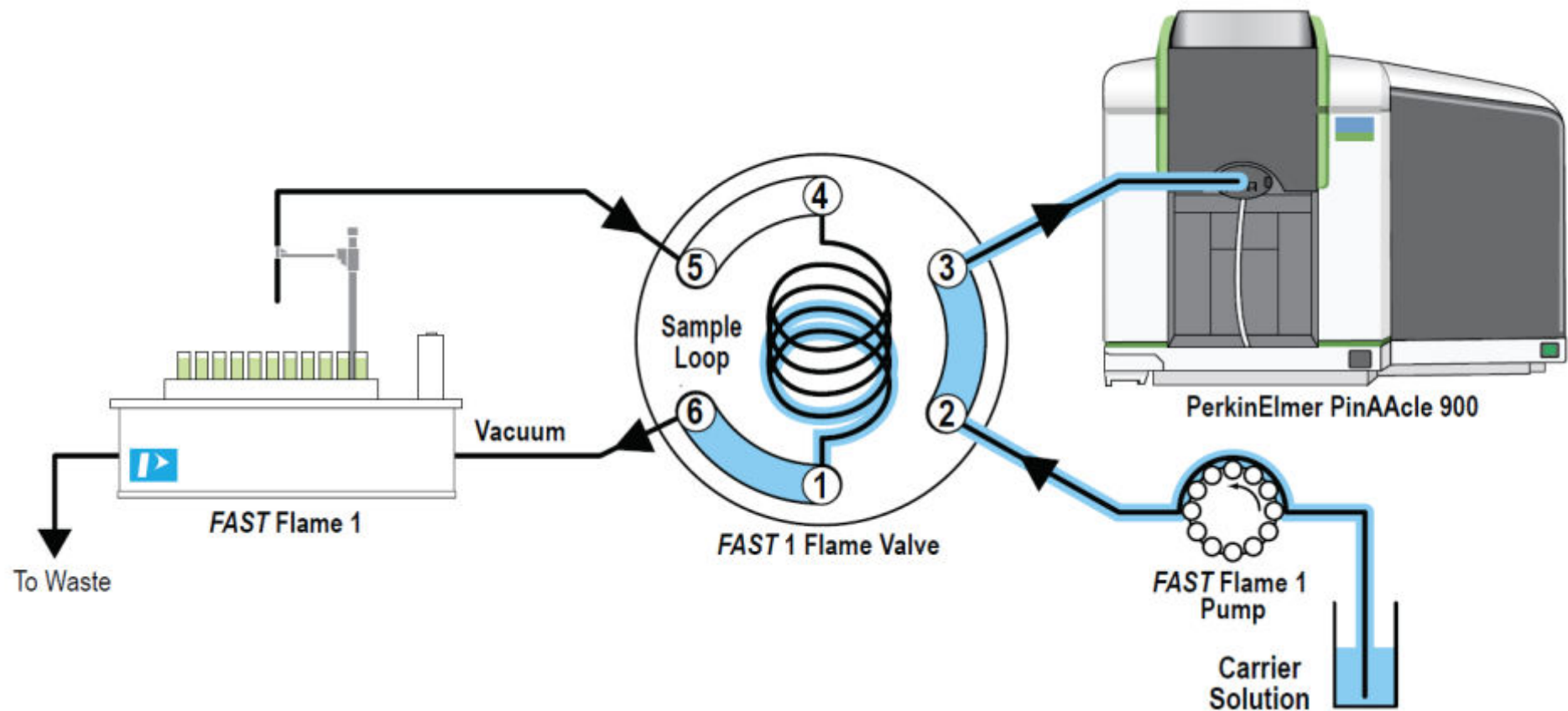
FAST Flame 1 – Inject sample and move probe toward rinse



Step 2. 1-15* seconds

*=analysis dependent

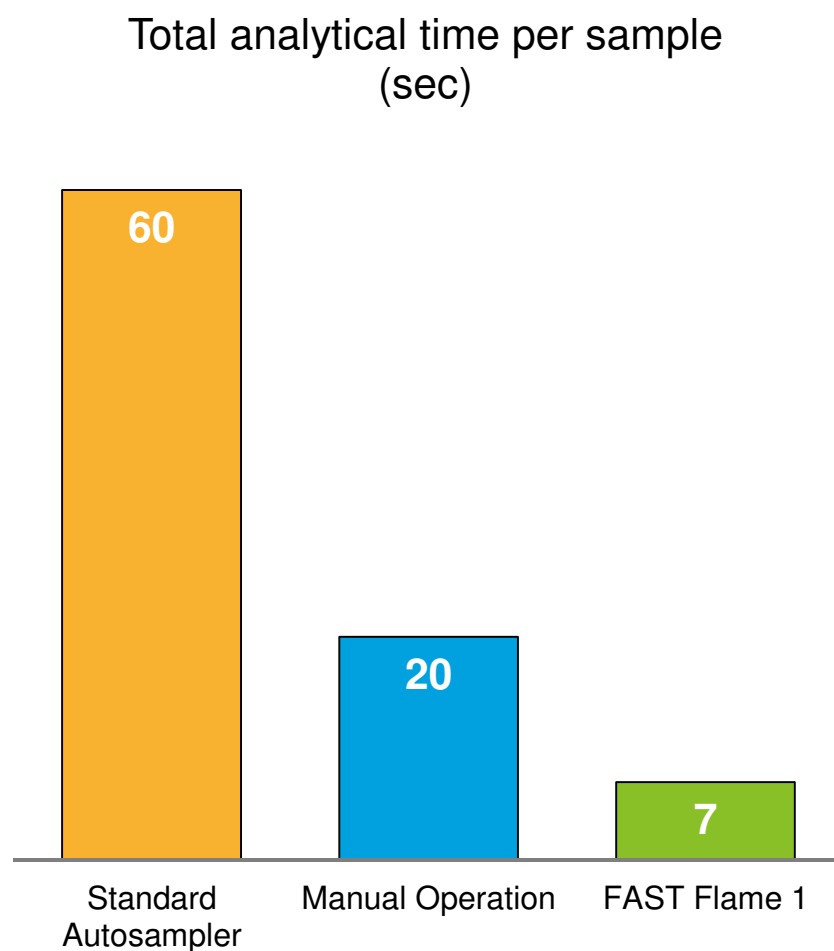
FAST Flame 1 – Empty sample loop, rinse nebulizer, next sample



Step 3. 2-8* seconds

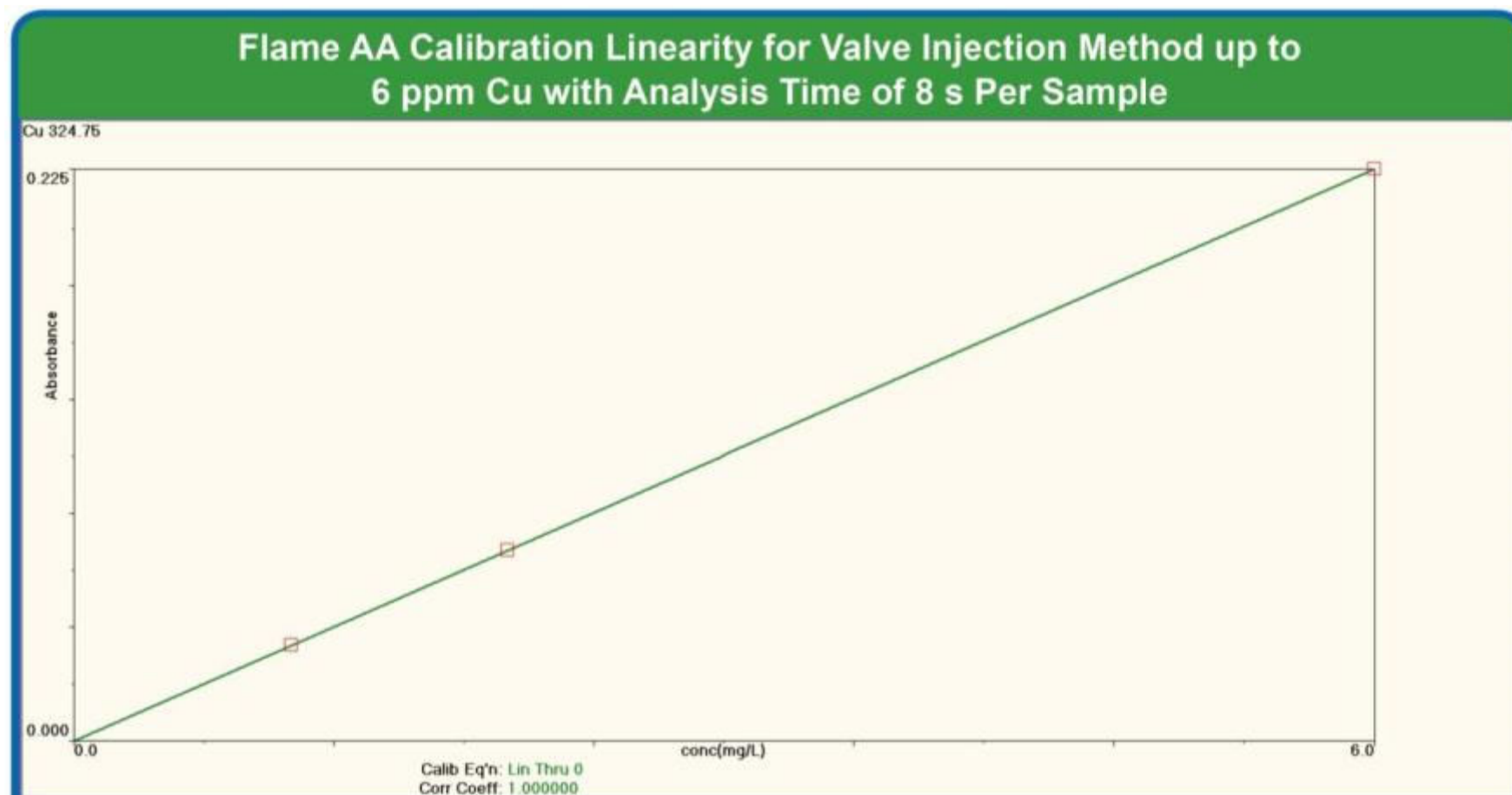
*=Instrument Wash Time

The benefits of FAST Flame 1



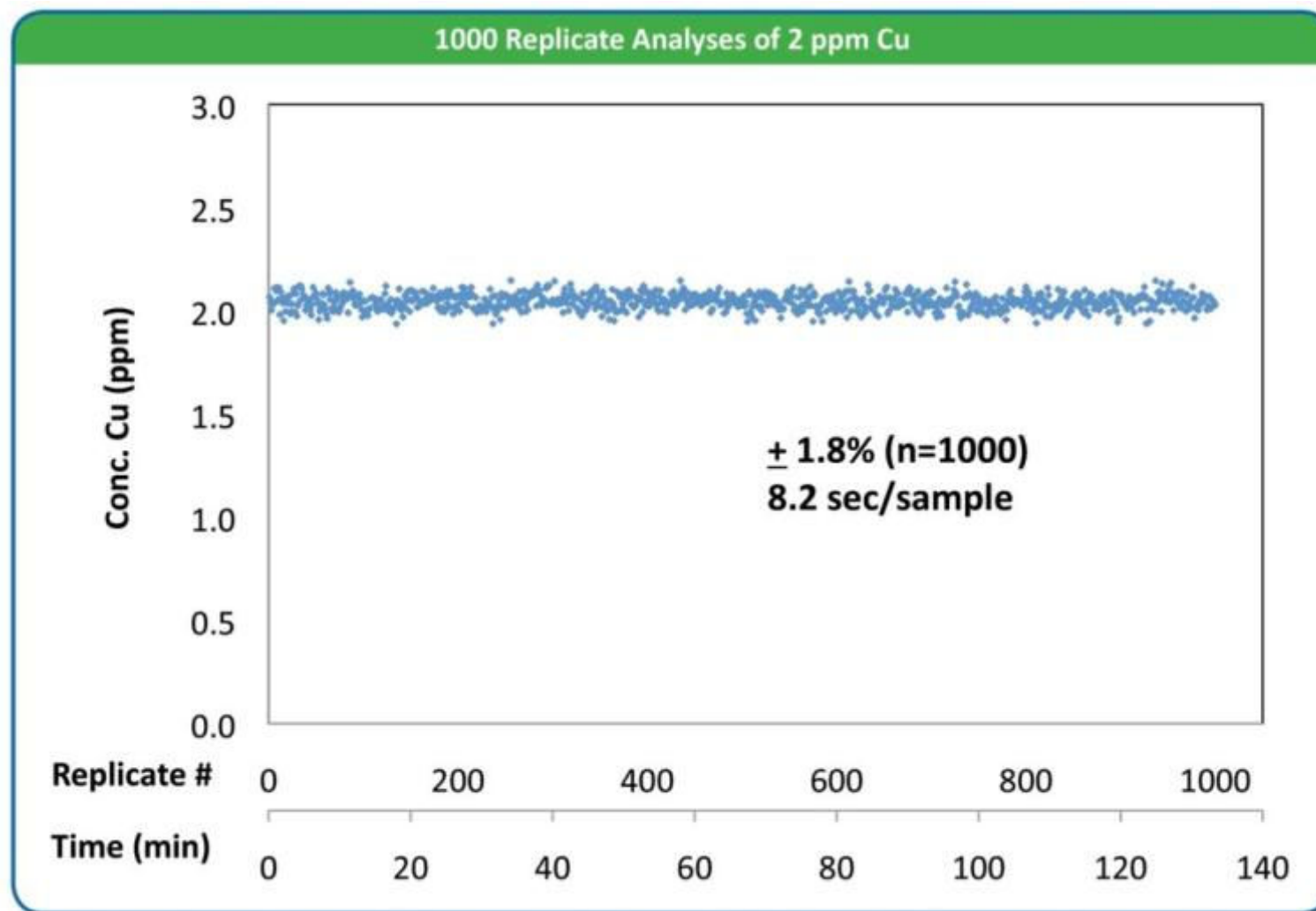
- Increases throughput while maintaining benefits of an autosampler
 - Reduced analysis time
 - Automated sample analysis
 - Automated QC with retest and recalibration capability

FAST Flame 1 – FAST Flame Cu Calibration Curve

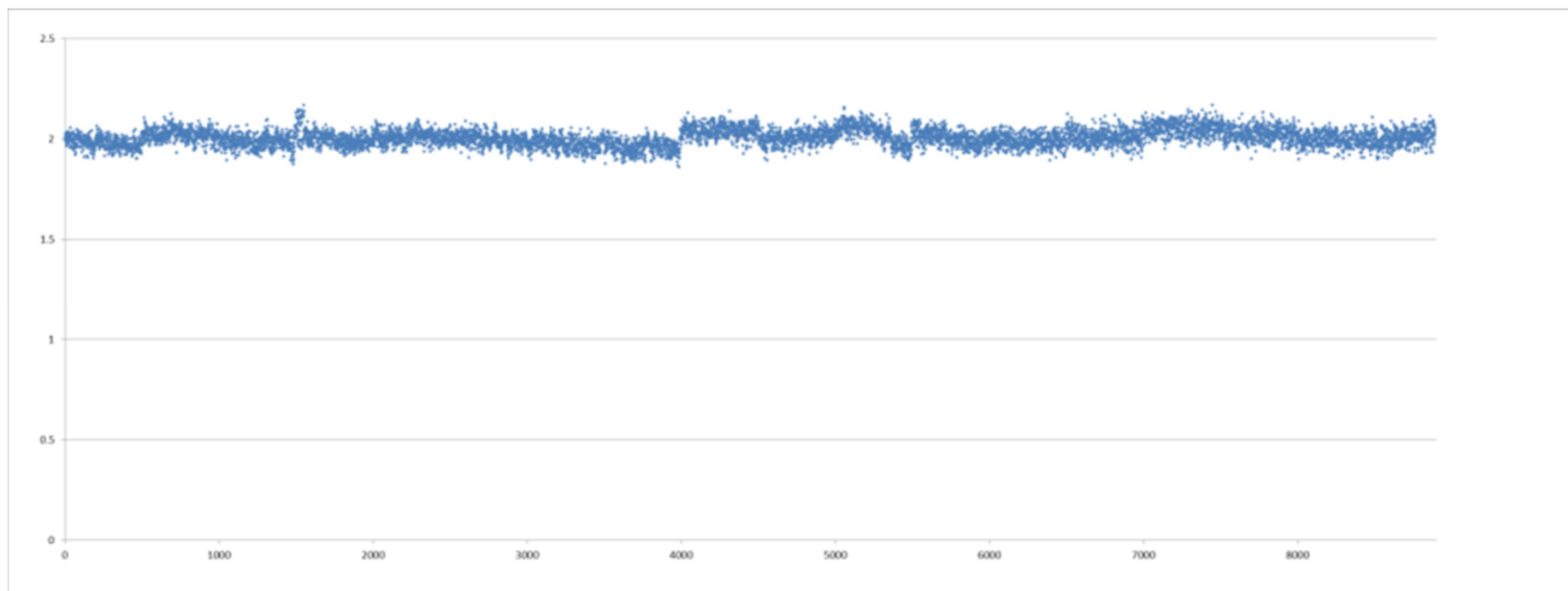


High-speed linear calibration curve using FAST Flame AA system

FAST Flame 1 – Short-term stability (2 hour) for valve injection method



FAST Flame 1 – Long-term stability (20 hour) > 8000 replicate determinations of Cu at 2 mg/L



n = 8931

Average = 2.006 mg/L

RSD = 2.1% over 20 hours

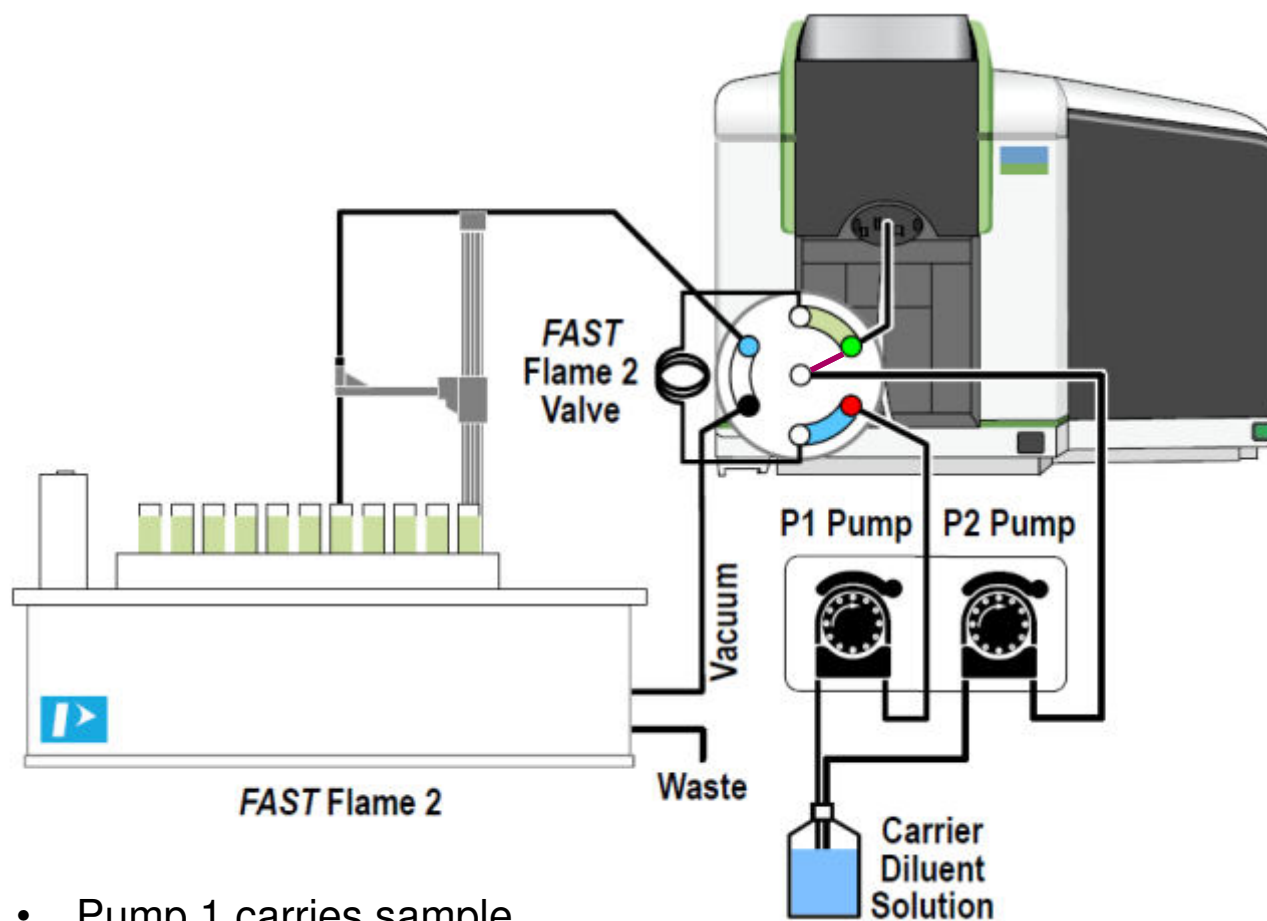
FAST Flame 1... Features and benefits

Fast sample
analysis

Can run up to 560 samples
per hour (acquisition time of
6.4 sec/sample)

- Run more samples ... Make more money
- The bottleneck is now sample dilution and preparation of standards

FAST Flame 2 ... Where speed meets quality



- Pump 1 carries sample
- Pump 2 delivers diluent
- Constant Pump 1 + Pump 2
- $DF = (Pump\ 1 + Pump\ 2)/Pump\ 1$

FAST Flame 2 ... Features and benefits

Fast sample
analysis

Auto calibration

Auto dilution

- Run more samples ... make more money
- Better accuracy
- Save on manpower
- Save on re-runs

Configurations of FAST Flame sample automation platform

Feature	AAPrep2	FAST Flame 1	FAST Flame 2
Ability to handle viscous samples/pumped sample introduction	X	X	X
High throughput		X	X
Inline matrix modification	X		X
Low memory effects		X	X
Automated dilution of over-range samples	X		X
Automated calibration standards preparation	X		X
Integrated software operation	X	X	X



Applications

Mineral analysis in drinking water

- Elements of interest
 - Minerals: Ca, K, Mg, Na
 - Others: Cu, Fe, Zn
- Important to know content of water
 - Health and industrial processes
 - Vary by geology
 - Water hardness
 - Na, Mg, K, Ca
 - Leaching of pipes
 - Cu, Fe, Zn



Results: independent calibration verification

Element	Concentration (mg/L)	Experimental (mg/L)	% Recovery
Cu	0.25	0.26	104
Fe	1.00	1.00	100
Zn	0.20	0.21	105
Ca	5.00	4.86	97
K	5.00	4.78	96
Mg	5.00	4.88	98
Na	5.00	5.12	105

Accurate Recoveries

Results: samples

Element	Municipal Water (mg/L)	Well Water-1 (mg/L)	Well Water-2 (mg/L)	Well Water-3 (mg/L)	Spring Water-1 (mg/L)	Spring Water-2 (mg/L)
Cu	0.048	< DL	0.052	0.017	< DL	< DL
Fe	< DL	< DL	0.019	< DL	< DL	< DL
Zn	0.008	0.043	0.010	0.023	< DL	< DL
Ca	17.7	0.148	35.3	32.4	3.43	19.2
K	< DL	233	4.89	4.10	6.60	7.25
Mg	6.43	0.026	4.90	5.12	0.799	6.09
Na	38.4	3.63	10.9	42.9	6.60	7.25

Analysis of wine

- Regulations on elemental content of imported wine
- Elemental content dependent on
 - Soil where the grapes are grown
 - Uptake of soil nutrients by the plant
 - Processing to produce the wine
- Elemental content can vary greatly by geography and production process



Chinese Limits on Imported Wines

Element	Limit (mg/L)
Cu	1
Fe	8
Mn	2



Analysis of wine: results

Wine Type	Country of Origin	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)
Cabernet	Australia	0.603	2.18	1.93
Chardonnay	Australia	0.478	2.928	2.09
Red Zinfandel	USA	0.256	2.80	1.67
Cabernet	USA	0.088	2.32	1.51
Chardonnay	USA	0.120	1.68	1.07
Cabernet	USA	0.088	2.31	1.50
Chardonnay	USA	0.099	1.16	0.97
Cabernet	Argentina	0.046	1.80	1.36
Chardonnay	Argentina	0.013	1.65	1.01

Limit for imported wine (China)

1

8

2

All samples meet Chinese limits, except Australian Chardonnay

Precious metals analysis in mining

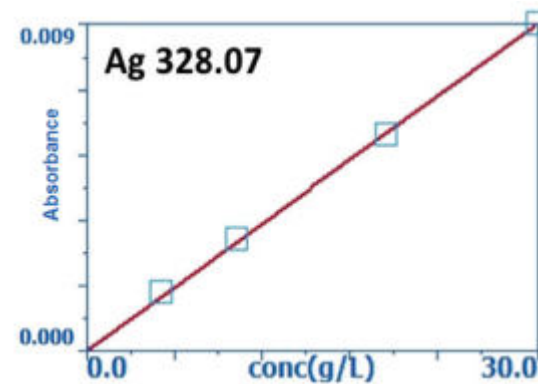
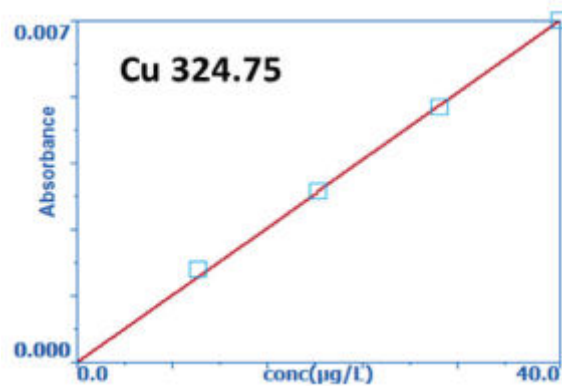
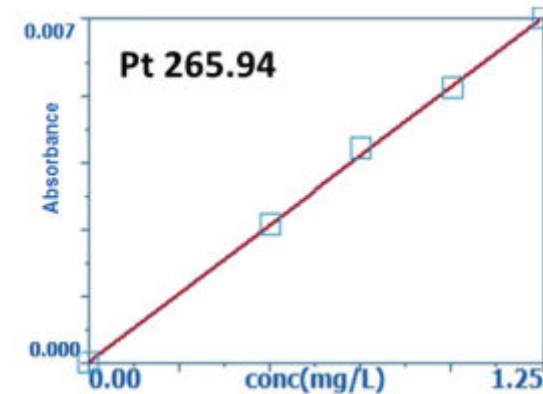
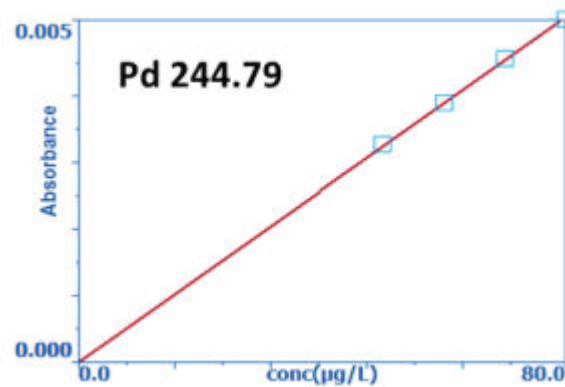
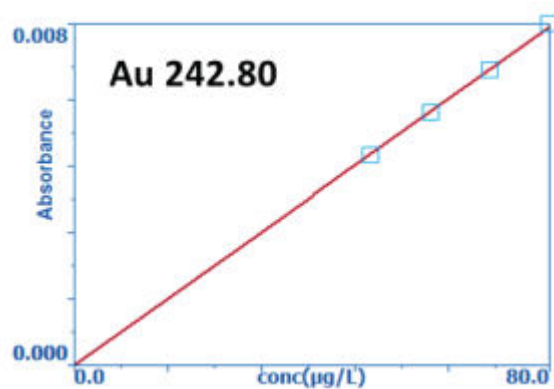
- Elements of interest
 - Minerals: Au, Pd, Pt
 - Others: Cu, Ag
- Important to know concentration of precious metals in the ground
 - fire-assay to isolate metals from the ore
 - Production of a matrix-free “button” of the metal
 - Dissolution of the buttons in appropriate acids
 - Determination of the metal concentration



Results: Operating conditions

Parameter	Gold (Au)	Palladium (Pd)	Platinum (Pt)	Copper (Cu)	Silver (Ag)
Wavelength (nm)	242.80	244.79	265.94	324.75	328.07
Slit (nm)	0.7	0.2	0.7	0.7	0.7
Lamp	HCL	HCL	HCL	HCL	HCL
Air Flow (L/min)	4.40	4.40	4.40	4.40	7.80
Acetylene Flow (L/min)	1.58	2.02	2.02	1.86	2.02

Results: Example calibrations



Results: Recoveries

Element	Standard (µg/L)	Read-back (µg/L)	% Recovery
Au	65	67.7	104
Pd	65	69.2	106
Pt	850	836	98
Cu	25	24.1	96
Ag	15	14.5	97



Thank you