



High-throughput Analysis of Pb in Blood at 15 Seconds per Sample Using *FASTfluidic FilterProbe*

High Rinseout Factor with High-Throughput Clinical Analysis

FASTfluidic is a fourth generation ICPMS valve injection system with syringe backflushed CTFE FilterProbe that delivers 1000x blood Pb rinseout in less than a second. The automated system includes a RidingRinse autosampler with rinse station accessible in less than 0.5 seconds, eliminating translation time between samples.

Sample throughput for 1000x blood Pb rinseout is more than 240 samples per hour. *FASTfluidic FilterProbe* reduces maintenance, prevents valve clogs, improves rinseout, increases instrument up-time, and delivers the reliably clean baselines between samples needed to provide productivity gains for blood lead analyses.

FASTfluidic FilterProbe Benefits Labs in Several Ways

- 15 second sample-to-sample time for 1000x blood Pb rinseout
- 1.5 mL syringe-driven rinse containing 1% nitric acid and 2% methanol in less than 1 second
- Backflushing CTFE FilterProbe prevents clogs
- RidingRinse accessed in less than 0.5 seconds



Figure 1. *FASTfluidic FilterProbe* configured for blood analysis.

Instrumentation

FilterProbe with Syringe-driven Backflush

The FilterProbe's inline CTFE filter prevents particulates, fibers and debris from entering the sample flowpath, significantly reducing valve and nebulizer maintenance. The free-flowing filter enables unrestricted sample transport without slowing analytical runs, while syringe-driven backflushing automatically clears the sample flowpath before the next sample is analyzed.

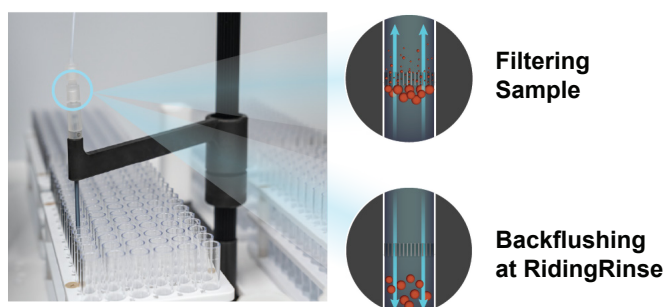


Figure 2. FilterProbe catches particulates and backflushes them to waste.

RidingRinse: Mobile Rinse Station

RidingRinse moves with the autosampler carriage, providing the fastest access to a rinse station and further expediting sample-to-sample time. With a simple rotary movement, FASTFluidic FilterProbe can perform backflushing and rinsing in place, preventing wasted autosampler movements required for a conventional fixed rinse location.



Figure 3. RidingRinse integrated to 4DXW autosampler.

Multiposition Magnetic SnapValves

FASTFluidic FilterProbe features patented Magnetic SnapValves with magnetic coupling technology, enabling valves to snap on and off by hand for tool-free installation and maintenance. Clearly labeled ports simplify line attachment, and cleaning takes just seconds, enhancing both usability and efficiency.

SampleSense 3

SampleSense 3 Optical Sensors are integrated into the sample flowpath, providing intelligent, real-time sample detection that automatically triggers analysis. This eliminates fixed timing parameters, improving throughput and reducing sample consumption. It adapts dynamically to variable sample viscosities and detects missed or incomplete samples, delivering real-time error notifications.

4DXW Autosampler

The innovative 4DXW autosampler increases sample capacity by 55% in a footprint narrower than a conventional 4-rack autosampler.

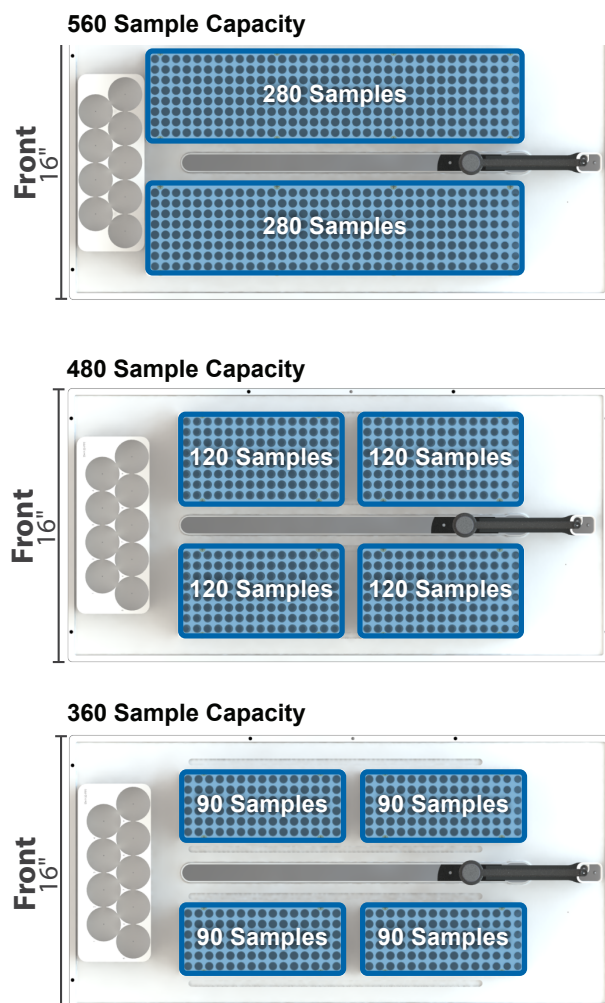


Figure 4. 4DXW autosampler example rack layouts. Capacities up to 560 8 mL samples taking up only 16" of linear lab bench space. The 4DXW is also compatible with microplates.

Experimental

Table 1. Instrument conditions

Instrument Parameters	Value
Instrument	NexION 5000
Peri-Pump Rate	0.9 mL/min
Analysis Mode	Standard
Scan Mode	Q3 Only
Nebulizer Gas Flow	0.97 L/min
AMS Gas Flow	0.1 L/min
Auxiliary	1.2 L/min
Plasma Gas Flow	16 L/min
RF Power	1600 Watts
Analyte Isotopes	$^{206}\text{Pb}+^{207}\text{Pb}+^{208}\text{Pb}$
Internal Standard	^{209}Bi
Integration Time Per Replicate	300 ms
Replicates Per Sample	3
Sweep/Reading	10
Reading/Replicate	1
Dwell Time Per AMU	30 Milliseconds
Total Measurement Time	3.6 Seconds
Sample-to-Sample Time	15 Seconds

Table 5. Sample preparation

Reagent	Matrix
Sample/Blank	100x Diluted Bovine Whole Blood, 1 ppb Bi, 1% Nitric Acid, 2% Methanol
Carrier/Rinse	1% Nitric Acid, 2% Methanol

Table 2. Sample introduction parameters.

Sample Introduction Parameters	Value
FAST System	FASTfluidic FilterProbe
Filter	FilterProbe CTFE Filter
Autosampler	ESI 4DXW with RidingRinse
Nebulizer	PFA ST3-64
Spray Chamber	Quartz Cyclonic
Injector/Torch	2.5 mm One Piece Quartz
Sample Tubing	Black-Black
Pergo	Pergo2000 AMS
Backflush Syringe	HPQ-24 mL

Table 3. Analytes

Analyte	Mass
Pb	206 + 207 + 208

Table 4. Pb calibration levels

Calibration Level	Concentration
Blank	0 µg/dL
1	1 µg/dL
2	5 µg/dL
3	10 µg/dL
4	25 µg/dL
5	50 µg/dL
6	100 µg/dL

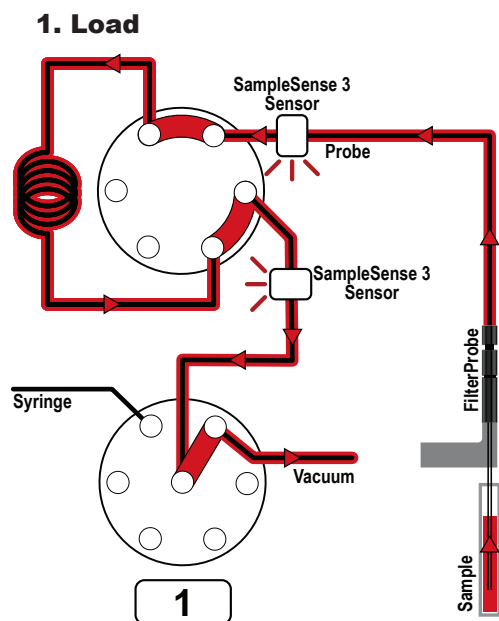


Figure 5. Free-flowing filtered sample loaded to valve loop with SampleSense 3 detection.

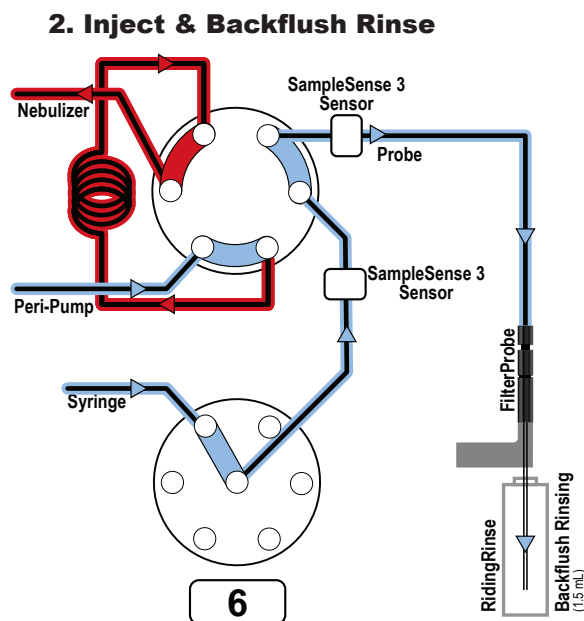


Figure 6. Sample injected and analyzed while FilterProbe is backflushed and rinsed.

Extended Blood Analysis Stability

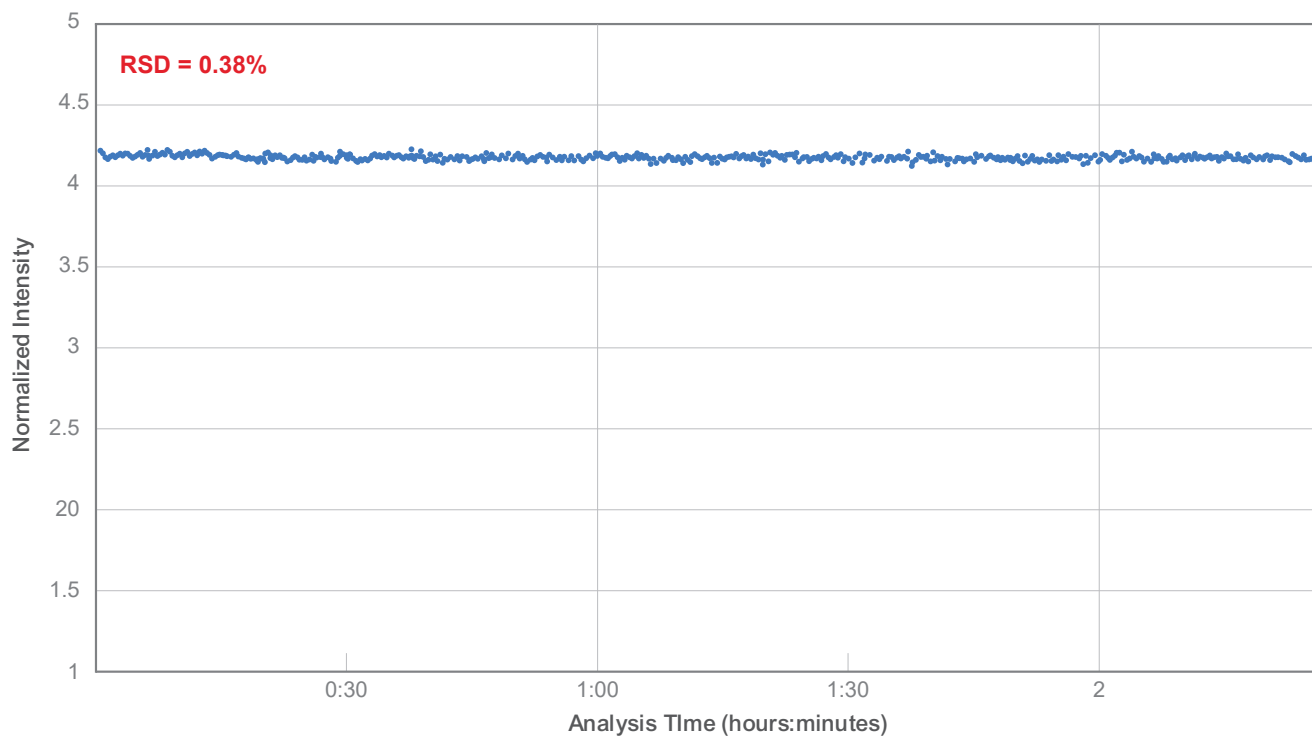


Figure 7. Normalized intensity ratio ($^{206}\text{Pb}+^{207}\text{Pb}+^{208}\text{Pb}$) during extended analysis of 576 samples. Excellent long-term reproducibility within 1% RSD was observed over the 2 hour and 24 minute analysis for the 100x diluted bovine blood samples.

Calibration Linearity

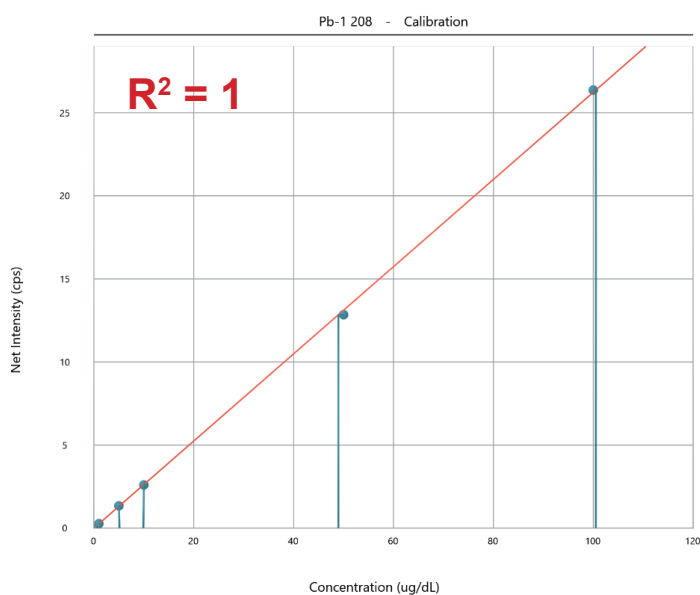


Figure 8. Highly linear calibration of 3 Pb isotopes ($^{206}\text{Pb}+^{207}\text{Pb}+^{208}\text{Pb}$)

Sample Throughput

Table 6. Sample-to-sample analysis of 100x diluted bovine blood in 15 seconds.

Acquisition Time	²⁰⁹ Bi (IS) (cps)	²⁰⁸ Pb (cps)
12:07:00	1102699	4463817
12:07:15	1115539	4493856
12:07:30	1101161	4472136
12:07:46	1110413	4471577
12:08:01	1117677	4483894
12:08:16	1106551	4432586
12:08:31	1108665	4456042
12:08:46	1098867	4451662
12:09:01	1099146	4437343
12:09:16	1098187	4439280
12:09:31	1105753	4459808
12:09:46	1101902	4455358
12:10:02	1098634	4440282
12:10:18	1107796	4458430

Table 7. Sample throughput at 1000x washout as a function of ICPMS measurement times.

Number of Isotopes Monitored (²⁰⁶ Pb+ ²⁰⁷ Pb+ ²⁰⁸ Pb)+ ²⁰⁹ Bi	Total ICPMS Measurement Time	Time Per Sample
4	3.6 seconds	15 seconds
4	6 seconds	18 seconds
4	8 seconds	20 seconds

Sample Rinseout

The backflushing syringe delivers 1.5 mL of 1% nitric acid, 2% methanol rinse in less than 1 second, allowing superior rinseout performance for Pb compared with much slower peristaltic pump rinseout.

1000x Pb Rinseout After High Calibration Standard

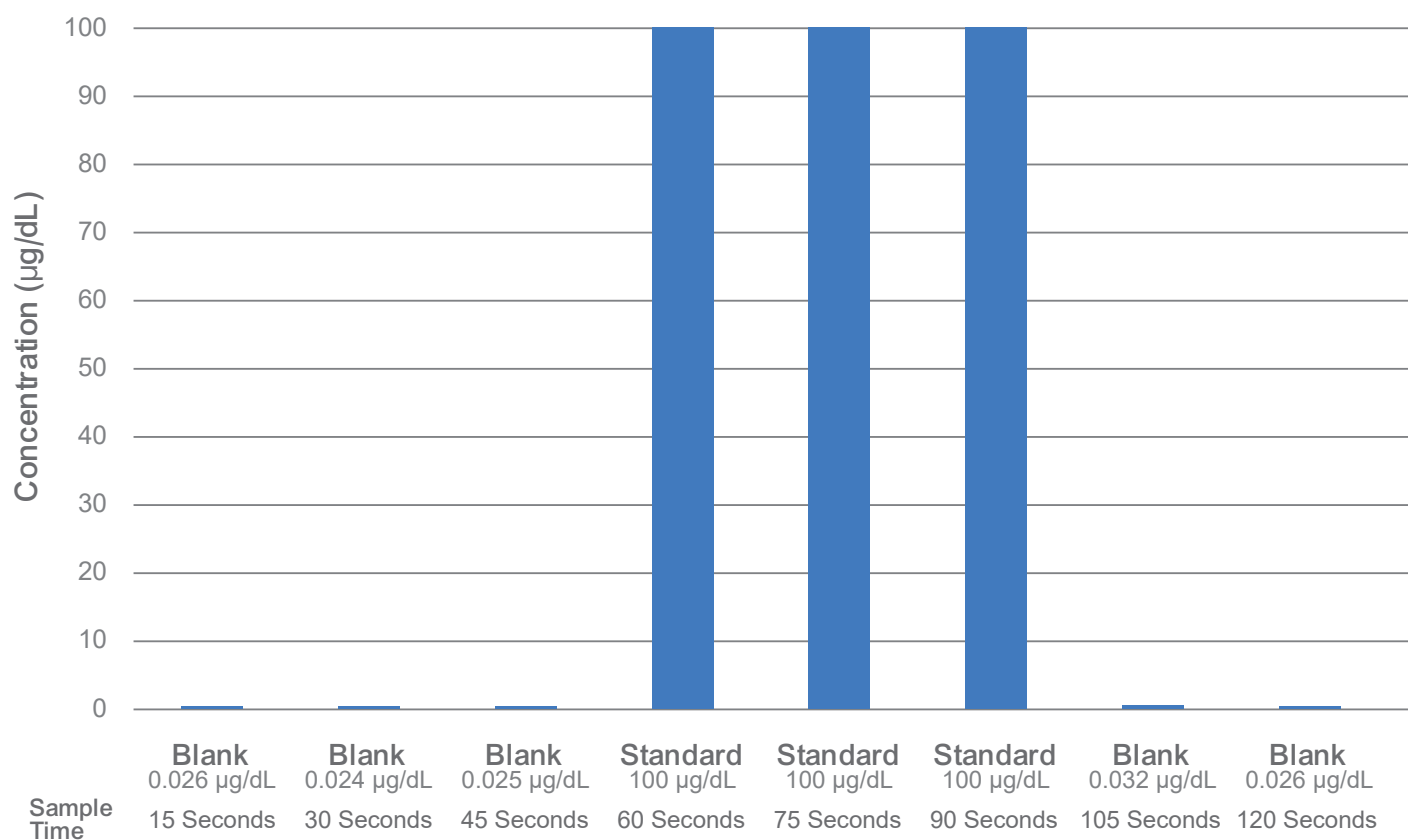


Figure 9. Pb rinseout after high calibration standard runs 3 times in a row. With *FAST*Fluidic FilterProbe, rinseout on the first blank is less than 1000x. 8 blanks and standards were analyzed in two minutes.

Conclusion

FASTfluidic FilterProbe automates high-throughput blood analysis while delivering rinseout performance previously unattainable at these operating speeds. By maintaining rapid sample-to-sample operation with

minimal carryover, it ensures accurate determination of trace Pb in blood with both reliability and efficiency for laboratory testing workflows.

FASTfluidic FilterProbe

FASTfluidic

- Syringe-driven backflushing for uninterrupted high-throughput analysis
- Improves rinse out and prevents clogs

Magnetic SnapValves with SampleSense 3

- Simplifies typical user maintenance with magnetic coupling technology
- Automatically sense and inject samples

LED Display

High Pressure Quartz Syringe

- PFA plunger and threaded base
- Wetted for low contamination and extended lifetime

FilterProbe

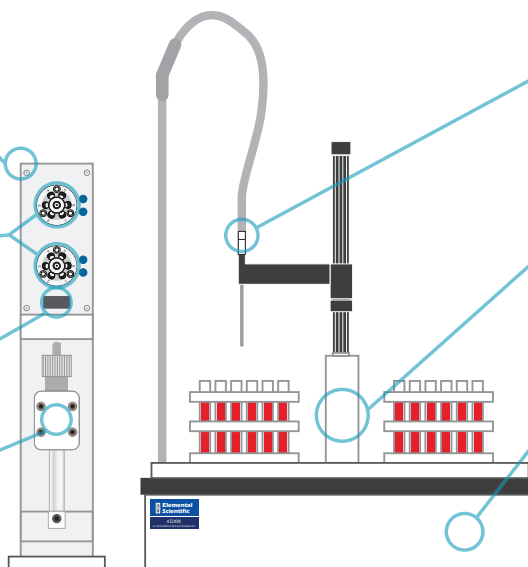
- Prevent particulates from entering sample flowpath
- Automatically syringe-backflushed to prevent clogging

RidingRinse

- Rinse station moves with autosampler carriage
- Minimizes translational autosampler movement

DXW Autosampler

- Narrower footprint than a conventional 4-rack autosampler with 55% greater sample capacity
- Holds up to 560 samples



Enhance Your High-Throughput Blood Analysis Today!

Scan the QR code to contact ESI Experts.



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A-26076