

ICP-MS and ICP-OES

Key Benefits

- Increased sample throughput
- Ease of use
- Extended stability and reduced maintenance
- Excellent reliability and precision



High Throughput System for ICP-MS/OES

Introduction

PerkinElmer's High Throughput System (HTS) is a uniquely designed

modular sample introduction that integrates with the NexION® series of ICP-MS and the Avio® series of ICP-OES to dramatically reduce sample-to-sample time, thereby improving sample throughput while maintaining operation simplicity. The HTS maximizes productivity by significantly reducing the time required for the sample uptake, stabilization, and washout.

This valve-driven system is fully integrated with the Syngistix platform, eliminating the need for third-party software. Using a metal-free fluid path, the system quickly delivers the sample to the plasma, providing excellent results. With simple programming and workflow, the NexION ICP-MS and Avio ICP-OES with HTS simplifies method development for high-throughput analyses, allowing you to dramatically increase the number of samples you can analyze per day.

How High Throughput System (HTS) Works

The HTS system consists of a metal-free 7-port valve, 4-channel peristaltic pump and a modular high-speed vacuum pump that expedites the sample loading and washout processes.

Loading the Sample: During sample uptake, the valve is in the load position where the high-speed vacuum pump fills the sample loop. At the same time, the carrier and internal standard solutions are pumped to the nebulizer to maintain a stable plasma. As soon as the loop is filled, the valve switches to the inject position.

Injecting the Sample: The carrier solution pushes the sample out of the loop and mixes it with the internal standard prior to entering the nebulizer, where it is aspirated for analysis. While the sample is being analyzed, the autosampler probe moves to the rinse station where the uptake path is rinsed with the high-speed vacuum pump. Once sample analysis is complete, the valve switches back to the load position, and the vacuum pump pulls rinse solution through the loop to waste, cleaning the loop and eliminating any possible carryover prior to analyzing the next sample.

HTS Key Benefits

Increased Sample Throughput

Analysis with a standard sample introduction setup involves the peristaltic pump delivering samples directly to the nebulizer and rinsing the sample flow path and spray chamber between samples. In contrast, the HTS utilizes a high-speed vacuum pump, a 7-port low-volume valve, and a peristaltic pump. All three components work in unison to significantly reduce sample-to-sample time while also improving instrument stability and minimizing maintenance. This combination improves sample throughput 3-5 fold by greatly reducing the sample flush, read delay, rinse, and overhead steps in the sample analysis cycle.

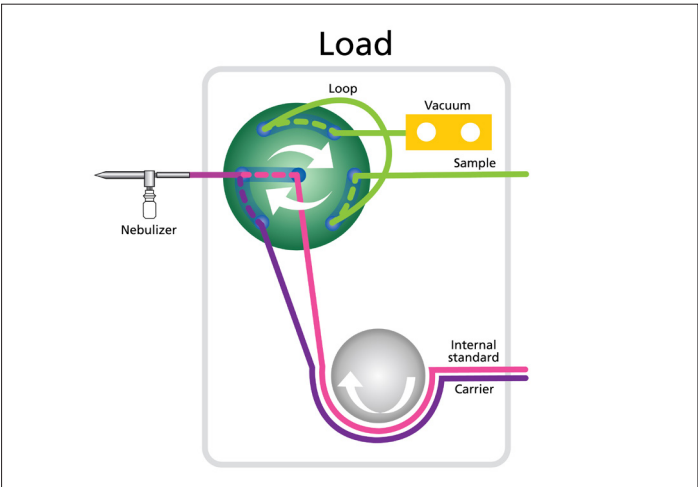


Figure 1. Diagram of the HTS during sample loading. Dashed lines represent the fluid path within the valve.

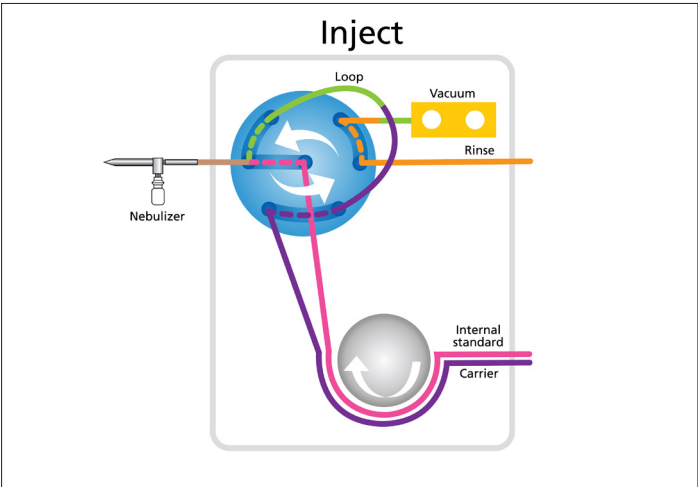
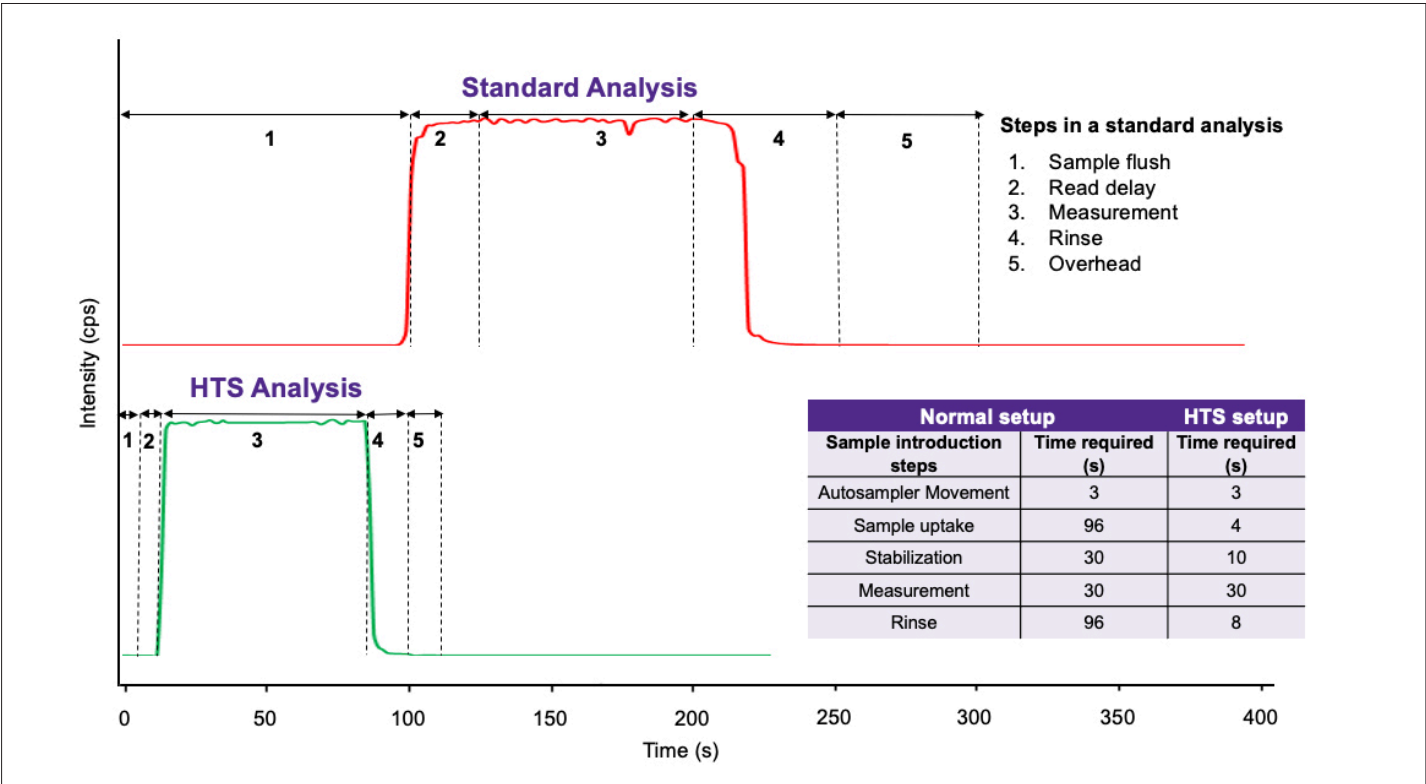


Figure 2. Diagram of the HTS during sample injection. Dashed lines represent the fluid path within the valve.



2 Figure 3. Comparison of acquisitions with standard and HTS sample introduction systems.

Ease of Use

The HTS is fully integrated with the NexION series of ICP-MS and the Avio series of ICP-OES and is controlled by Syngistix™ software. This integration eliminates additional complex software interactions and enables users to benefit from controlling all system parameters using one software platform. With such simplicity, users can now focus on what matters most – productivity.

Extended Stability and Reduced Maintenance

The HTS increases instrument stability and reduces maintenance by reducing the sample volume introduced into the instrument: only the amount required for analysis enters the instrument, with any extra sample being directed to waste. This significantly reduces the matrix load on the instrument front-end, thus minimizing possible build-up on the nebulizers tip, torch, injector and cones (ICP-MS only). As a result, instrument front-end maintenance is significantly reduced, and stability is remarkably improved.

Excellent Reliability and Precision

The metal-free path of the HTS is reliable and corrosion-resistant, as demonstrated by the analysis of several high concentration acids over 8 hours. These tests showed excellent short and long-term precisions of < 1% in the acids shown in Table 1. Thirty thousand cycles are equivalent to approximately 6 months of use in a high throughput laboratory environment. To maintain high performance, valve inspection and cleaning is recommended every six months.

The HTS delivers improved throughput without compromising data precision. Table 2 compares the precision of the data obtained with and without the HTS, showing a variance between the RSDs of the isotopes used for EPA method 200.8, ranging from 0-1.4%.

Table 1. Chemical Compatibility and Reliability.

	Test Type	W/O Valve	10K Cycles	30K Cycles
Aqua Regia 20%	Precision	✓	✓	✓
	Stability (8hrs)	✓	✓	✓
Sulfuric Acid 20%	Precision	✓	✓	✓
	Stability (8hrs)	✓	✓	✓
Nitric Acid 20%	Precision	✓	✓	✓
	Stability (8hrs)	✓	✓	✓

Table 2. Comparison of precision for the analytes in EPA Method 200.8: Standard Sample Introduction vs. HTS for a 10 µg/L Standard.

Elements	% RSD with Standard Sample Introduction	% RSD with HTS
⁹ Be	1.1	0.7
²⁷ Al	0.9	0.6
⁵¹ V	0.8	1.3
⁵² Cr	0.8	1.1
⁵⁵ Mn	1.0	0.7
⁵⁹ Co	1.0	0.6
⁶⁰ Ni	1.0	0.9
⁶³ Cu	0.5	0.8
⁶⁶ Zn	0.6	0.7
⁷⁵ As	0.8	1.1

Elements	% RSD with Standard Sample Introduction	% RSD with HTS
⁹⁸ Mo	1.9	1.3
¹⁰⁷ Ag	1.4	1.4
¹¹¹ Cd	0.9	0.8
¹²¹ Sb	0.9	1.1
¹³⁷ Ba	1.1	0.6
²⁰⁵ Tl	0.6	0.4
²⁰⁸ Pb	0.5	0.3
²³² Th	0.5	0.3
²³⁸ U	0.3	0.6

Summary

The High Throughput System is fully integrated with the NexION series of ICP-MS and the Avio series of ICP-OES instruments to maximize productivity by increasing sample throughput more than three-fold without compromising analytical performance. In addition, the HTS improves ease of use while minimizing instrument maintenance to provide a more cost-effective solution for elemental analysis.

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