# *FAST*Fluidic FilterProbe: Ultra-high Throughput for Determination of Gold in Ore-grade Samples by ICPOES

## Synopsis

*FAST*Fluidic is a fourth generation ICP valve injection system with syringe backflushed CTFE FilterProbe that delivers 1000-fold Au rinseout in seconds. The automated system includes a RidingRinse autosampler with rinse station access in <0.5 s, eliminating translation time between samples. Sample throughput for 1000-fold Au rinseout is >270 samples per hour. At 500-fold Au rinseout, throughput is 360 samples per hour. *FAST*Fluidic FilterProbe reduces maintenance, prevents valve clogs, improves rinseout, increases instrument up-time, and delivers clean baselines between samples to provide productivity gains needed for ore-grade gold analyses.

## *FAST*Fluidic FilterProbe Key Features and Benefits

- 13 s sample-to-sample for 1000x Au rinseout (0.1%)
- Syringe-driven 5% HCl Rinse
  - 1.5 mL of rinse in <1 second
- Backflushing CTFE FilterProbe prevents clogs
- RidingRinse Accessed in <0.5 seconds

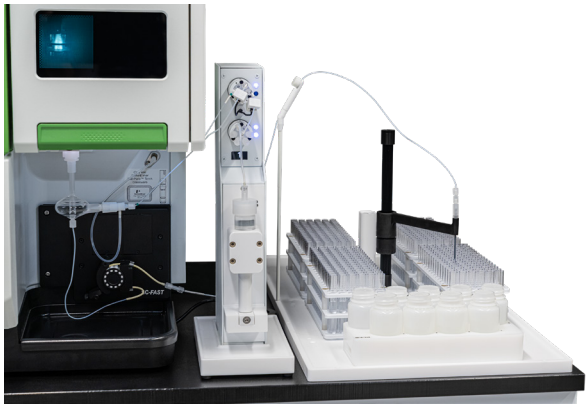

**Figure 1.** *FAST*Fluidic FilterProbe configured for analysis with an Avio 550 Max.

## 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.

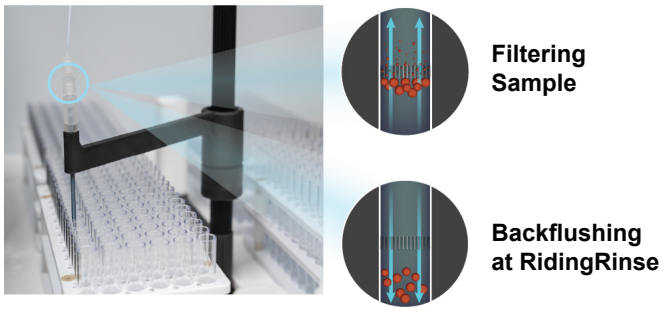


**Figure 2.** FilterProbe catches particulates and backflushes them to waste.

### 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, *FAST*Fluidic FilterProbe Soil 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

*FAST*Fluidic FilterProbe Soil 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.

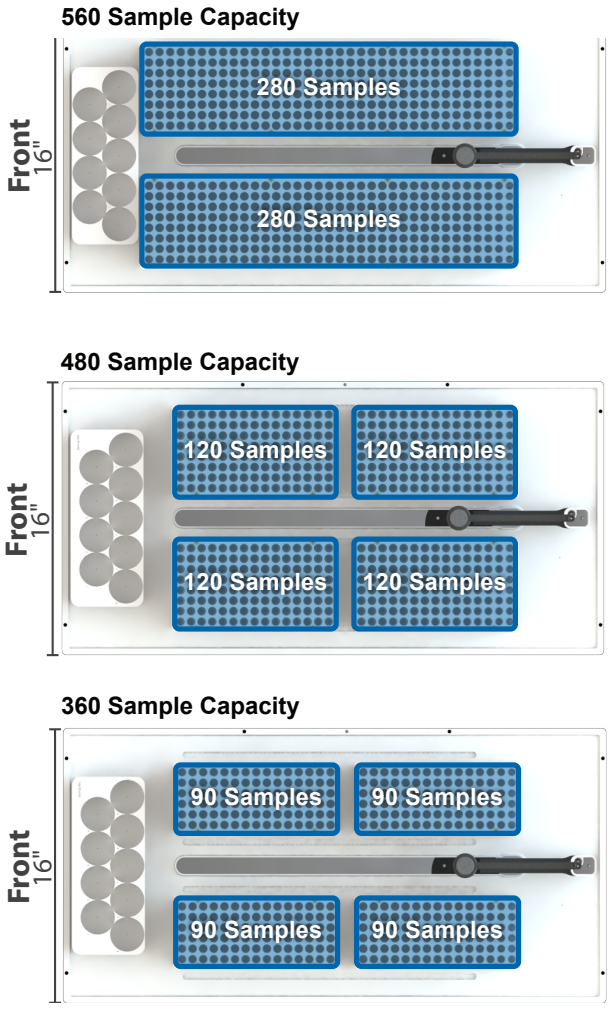


**Figure 4.** 4DXW autosampler example rack layouts. Capacities up to 560 samples taking up only 16" of linear lab bench space.

## Experimental

**Table 1.** Instrument Conditions 1000x Washout Method.

| Instrument Parameter | Value |
|---|---|
| Instrument | Avio 550 Max |
| Peri-Pump Rate | 1.5 mL/min |
| Matrix | 5% HCl |
| Axial Acquisition View | 15 mm |
| Plasma Gas Flow | 12 L/min |
| Auxiliary Gas Flow | 0.5 L/min |
| Nebulizer Gas Flow | 0.55 L/min |
| RF Power | 1500 Watts |
| Integration Time | 3 Seconds |
| Replicates | 2 |
| Total Measurement Time | 6 Seconds |
| Total Time Sample-to-Sample | 13 Seconds |

**Table 2.** Sample Introduction Parameters.

| Sample Introduction Parameter | Value |
|---|---|
| FAST System | *FAST*Fluidic FilterProbe |
| Filter | FilterProbe CTFE Filter |
| Autosampler | ESI 4DXW with RidingRinse |
| Nebulizer | PFA ST3 Nebulizer |
| Spray Chamber | G3 Cyclonic |
| Injector/Torch | 2 mm Quartz ZipTorch |
| Sample Tubing | Black-Black |
| ISTD Tubing | Orange-Green |
| Backflush Syringe | HPQ-24 mL |

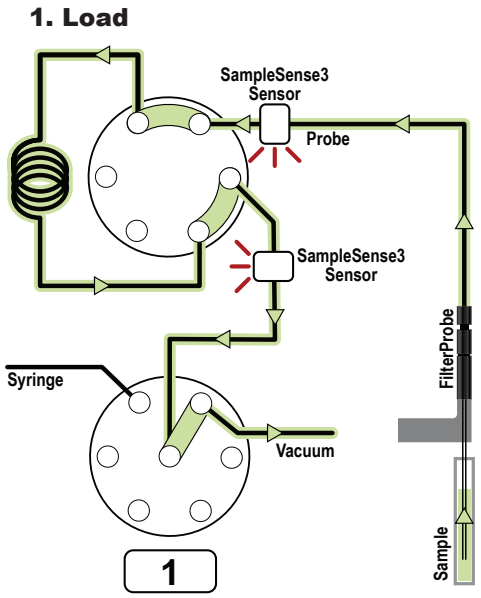


**Figure 5.** Free-flowing filtered sample loaded to valve loop with SampleSense3 detection.

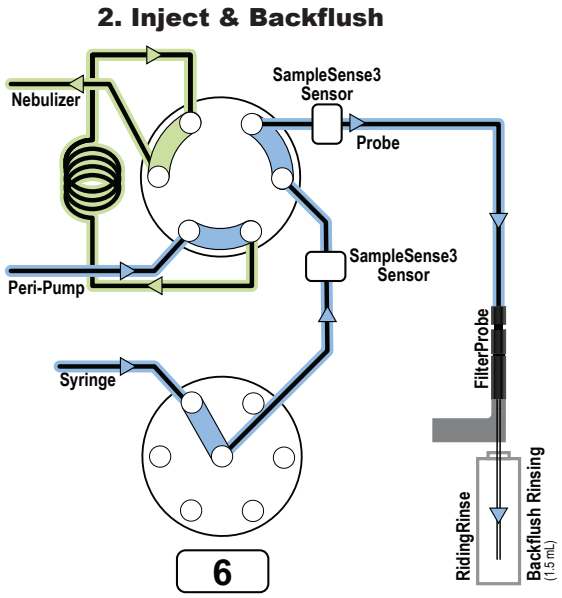


**Figure 6.** Sample injected and analyzed while FilterProbe is backflushed and rinsed.

## Sample Throughput and Rinseout

### Sample-to-Sample Time

Show RSDs  Show Replicates

| | Sample Id | Acquisition Time | Au 242.795 (cps) | Au 267.595 (cps) | Tm 313.1... (cps) |
|---|---|---|---|---|---|
| 1 | 1ppm | 2/23/2026 11:22:31 AM | 11398.6 | 7896.8 | 176117.9 |
| 2 | 1ppm | 2/23/2026 11:22:43 AM | 11393.8 | 7926.9 | 176926.6 |
| 3 | 1ppm | 2/23/2026 11:22:55 AM | 11268.3 | 7871.7 | 174896.6 |
| 4 | 1ppm | 2/23/2026 11:23:08 AM | 11389.3 | 7805.0 | 178916.1 |
| 5 | 1ppm | 2/23/2026 11:23:20 AM | 11492.6 | 7936.6 | 177382.8 |
| 6 | 1ppm | 2/23/2026 11:23:32 AM | 11640.8 | 8001.6 | 179724.9 |
| 7 | 1ppm | 2/23/2026 11:23:45 AM | 11465.4 | 7870.2 | 178867.0 |
| 8 | 1ppm | 2/23/2026 11:23:57 AM | 11556.9 | 7899.3 | 179073.8 |
| 9 | 1ppm | 2/23/2026 11:24:09 AM | 11625.2 | 7934.6 | 180765.2 |
| 10 | 1ppm | 2/23/2026 11:25:11 AM | 11638.4 | 7906.2 | 180188.6 |

**Figure 7.** Sample-to-sample analysis of 1 ppm Au in 13 seconds or less.

### Rinseout

**Table 3.** Au rinseout factors for several analytical conditions. Methods are easily adjusted to effect maximum throughput for the desired rinseout factor. The backflushing syringe delivers 1.5 ml of 5% HCl rinse in less than 1 second, effecting superior rinseout performance for Au compared with much slower peristaltic pump rinseout for each analytical condition.

| Condition | Sample-to-Sample Time (s) | Samples per Hour | Total ICP Integration Time (s) | Au Rinseout Factor |
|---|---|---|---|---|
| 1 s Syringe Backflush | 10 | 360 | 3 | 500x |
| 1 s Syringe Backflush with Loop Rinse | 13 | 275 | 6 | 1000x |
| 1 s Syringe Backflush + Additional Loop Rinse | 18 | 200 | 6 | 5000x |

Show RSDs  Show Replicates

| | Sample Id | Acquisition Time | Au 242.795 (cps) | Au 267.595 (cps) | Tm 313.1... (cps) |
|---|---|---|---|---|---|
| 1 | Blank | 2/23/2026 12:19:47 PM | 2.3 | 70.7 | 195525.8 |
| 2 | Blank | 2/23/2026 12:20:01 PM | 6.9 | 63.6 | 196131.7 |
| 3 | Blank | 2/23/2026 12:20:19 PM | -3.0 | 69.5 | 194188.0 |
| 4 | Blank | 2/23/2026 12:20:37 PM | -17.0 | 81.2 | 195748.0 |
| 5 | Blank | 2/23/2026 12:20:56 PM | 18.6 | 71.6 | 197339.2 |
| 6 | Blank | 2/23/2026 12:21:15 PM | 22.4 | 80.0 | 198550.5 |
| 7 | Blank | 2/23/2026 12:21:33 PM | 19.4 | 79.5 | 198370.9 |
| 8 | Blank | 2/23/2026 12:21:51 PM | 31.2 | 100.2 | 197462.6 |
| 9 | Blank | 2/23/2026 12:22:09 PM | 6.7 | 90.3 | 196605.5 |
| 10 | Blank | 2/23/2026 12:22:28 PM | -4.0 | 63.9 | 195795.2 |
| 11 | 100ppm | 2/23/2026 12:22:46 PM | 1075989.8 | 739447.7 | 199666.3 |
| 12 | 100ppm | 2/23/2026 12:23:04 PM | 1068599.5 | 738558.8 | 197630.2 |
| 13 | 100ppm | 2/23/2026 12:23:22 PM | 1075418.8 | 737374.6 | 199414.7 |
| 14 | Blank | 2/23/2026 12:23:40 PM | 195.7 | 212.1 | 195026.3 |

**Figure 8.** Rinseout of 100 ppm Au using an 18-second syringe-backflush method. The net signal for 100 ppm Au is 1 million cps. The first 5% HCl blank analyzed after 100 ppm Au is 200 cps above the initial blank demonstrating a rinseout factor of 5000x.

## Calibration Linearity for Two Au Lines

### Linearity

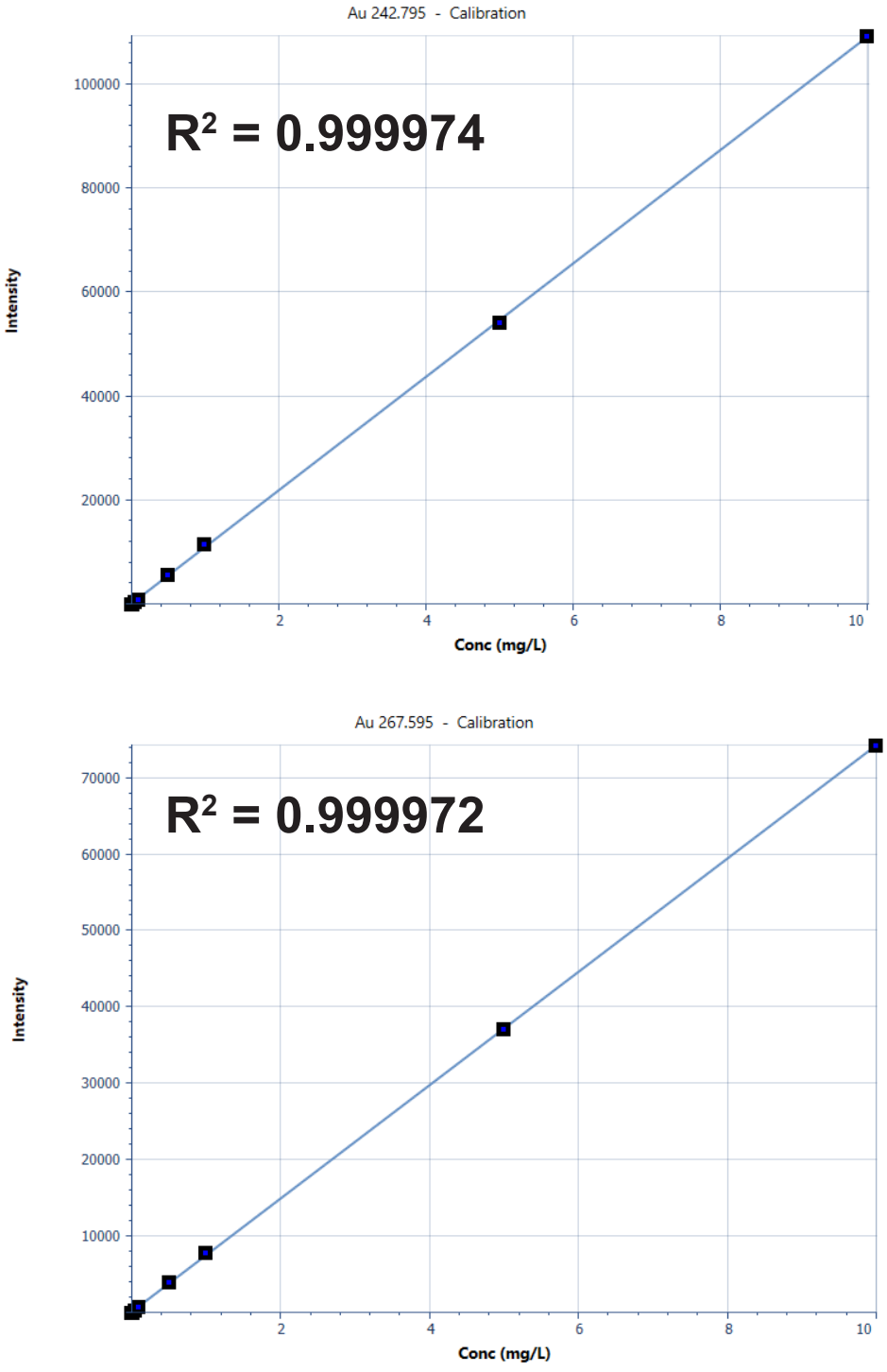


**Figure 9.** Au calibration curves in ~1 minute with $R^2$ of >0.9999.

## Conclusion

*FAST*Fluidic FilterProbe effectively resolves the main throughput and reliability challenges in ore-grade gold analysis. By preventing particle-driven clogs, enabling rapid sample-to-sample time, and maintaining low carryover even in difficult matrices, the system delivers cleaner baselines, faster washout, and significantly higher operational uptime.

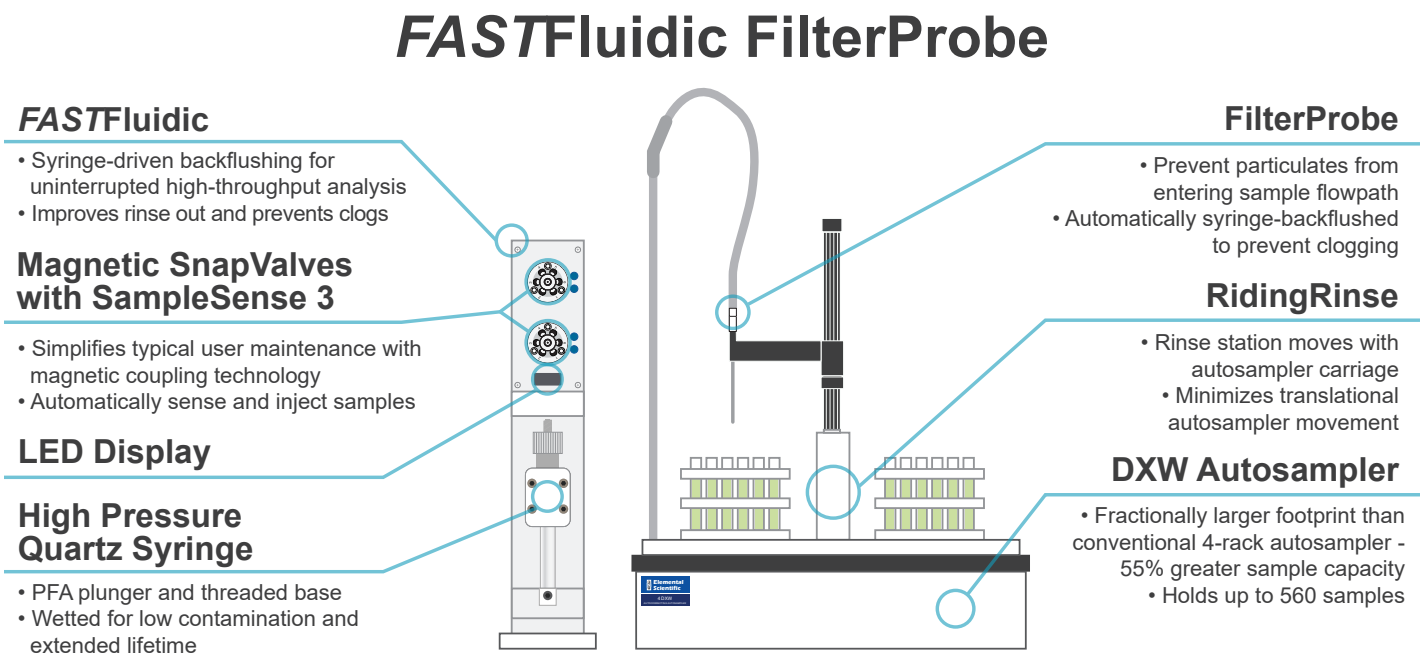


**Figure 10.** *FAST*Fluidic FilterProbe features diagram.

## Notes