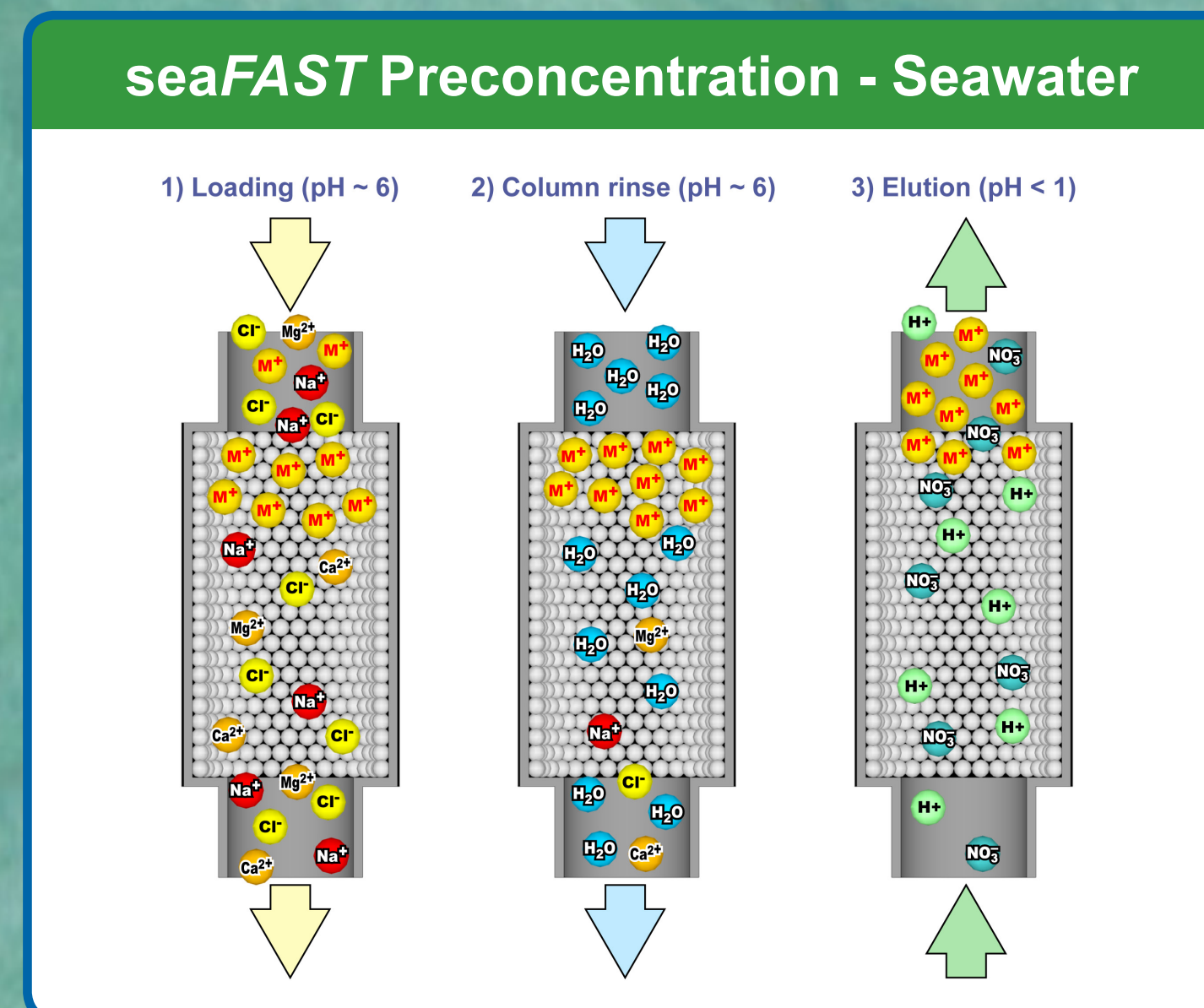


Ultratrace ICPMS Determination of Transition Metals in Seawater by Automated, Syringe-Based Preconcentration and Matrix Removal

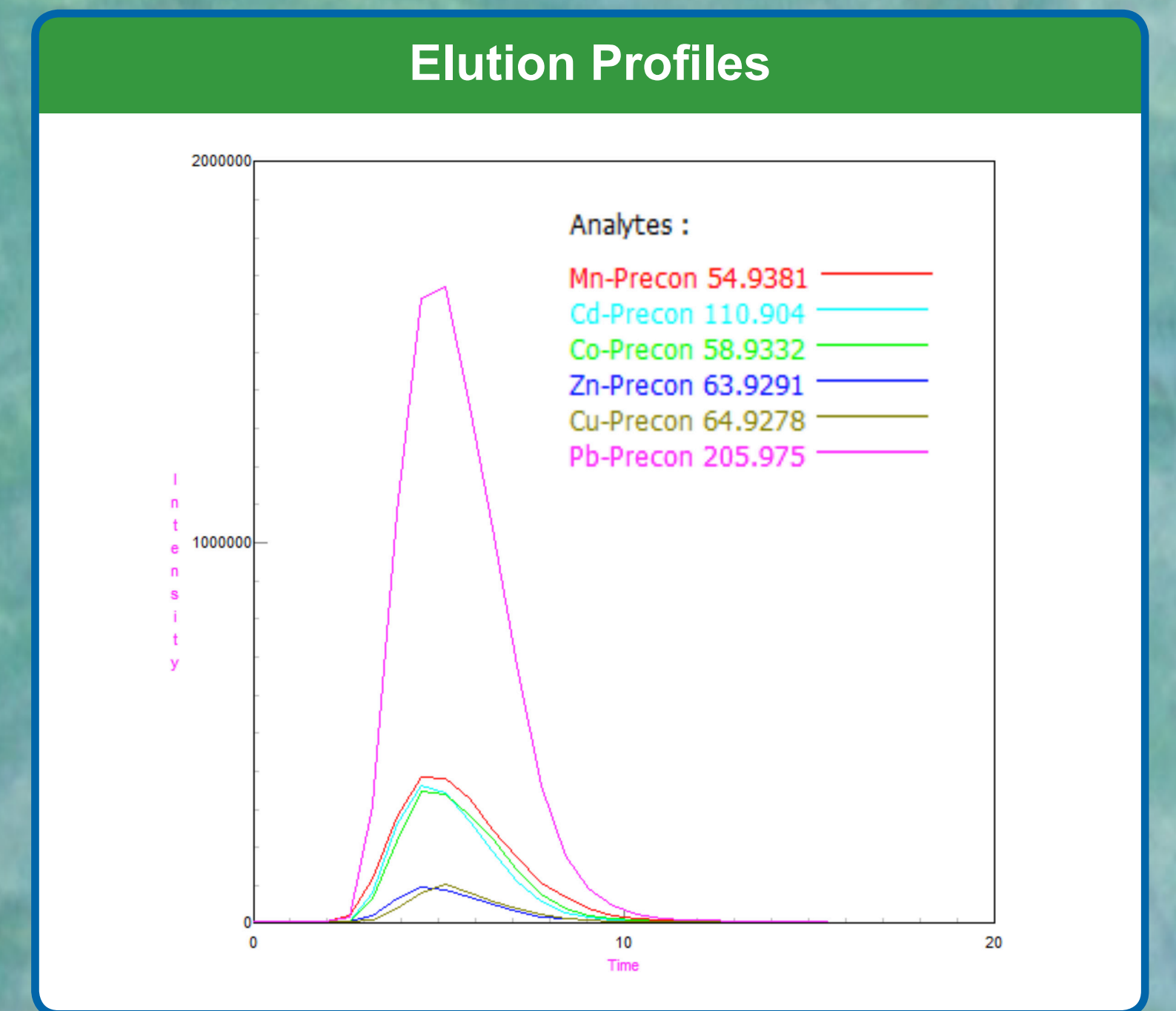
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Abstract

The seaFAST S2 is a high performance, automated sample introduction system for the determination of trace elements in seawater and other high matrix samples by ICPMS. Undiluted samples can be measured directly with a user-specified dilution while simultaneously loading an aliquot of sample onto a column for automated, online preconcentration and matrix removal. Both Direct and Preconcentration modes reduce procedural blanks associated with offline sample preparation, and Preconcentration mode dramatically improves detection limits by eliminating matrix effects and increasing sensitivity. The seaFAST S2 offers complete flexibility and can run in Direct, Preconcentration, or both modes by simply selecting the desired mode(s) in the ESI software.



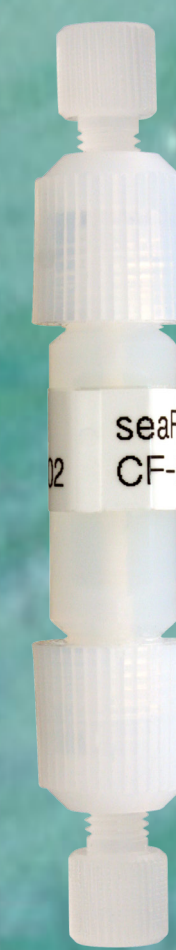
At a pH ~ 6, many metals are chelated on the preconcentration column, while matrix elements are flushed from the column. Metals are eluted directly to the ICPMS with nitric acid.



Simultaneous elution of 6 elements in Preconcentration mode at 1 ppt.

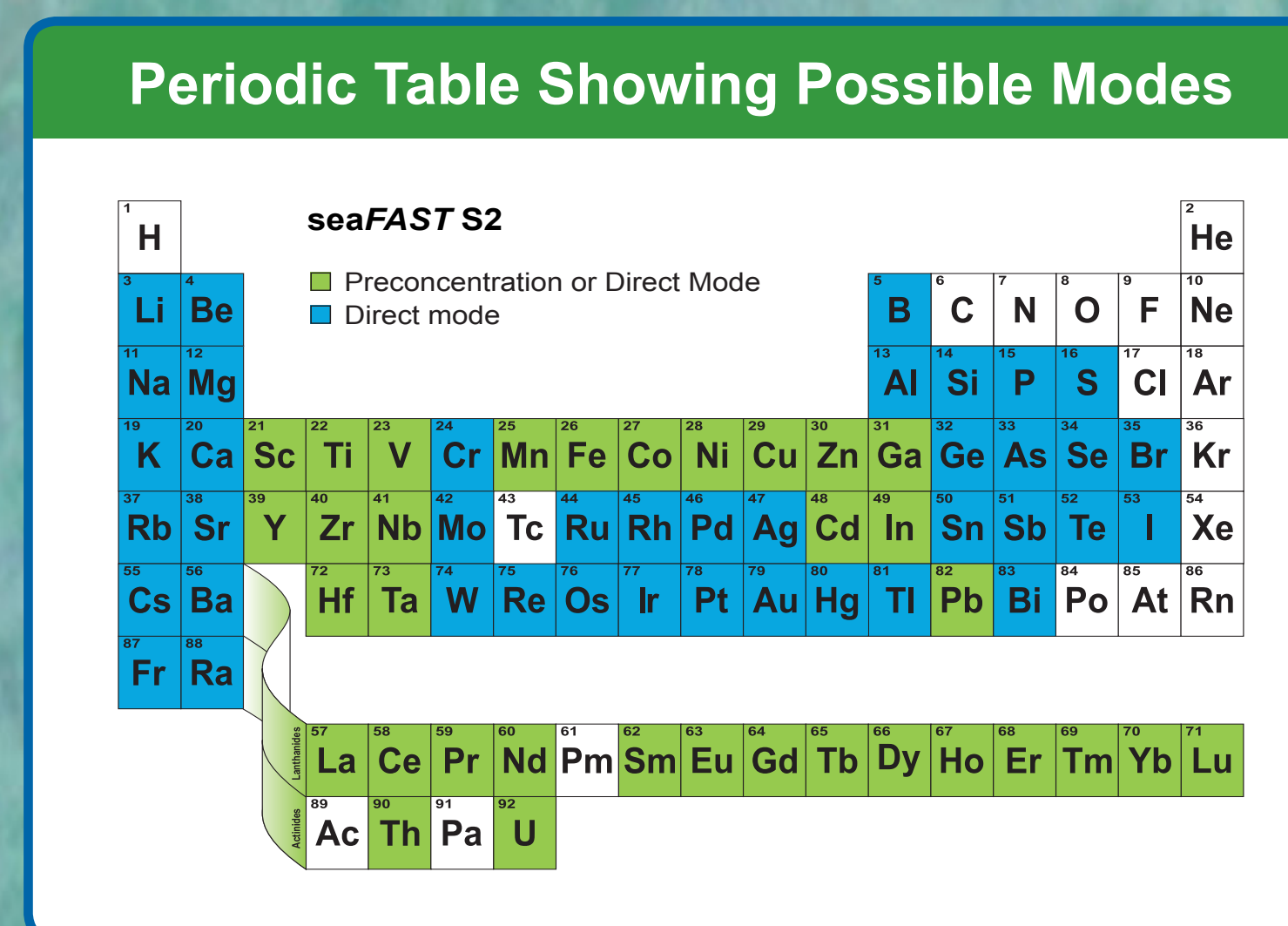
Features

- Fully automated, inline preconcentration and matrix removal
- Direct mode with up to 50x dilution
- Offline preconcentration mode (optional)
- Syringe-driven reagents for consistent chemistry and maximum throughput and cleanliness
- Higher preconcentration factors
- Flexible sample preconcentration volume
- Automatic cleaning of buffer cleanup column
- Completely enclosed liquid flow path for ultra-low blanks
- Automated ICPMS optimization



seaFAST Preconcentration Column

Modes



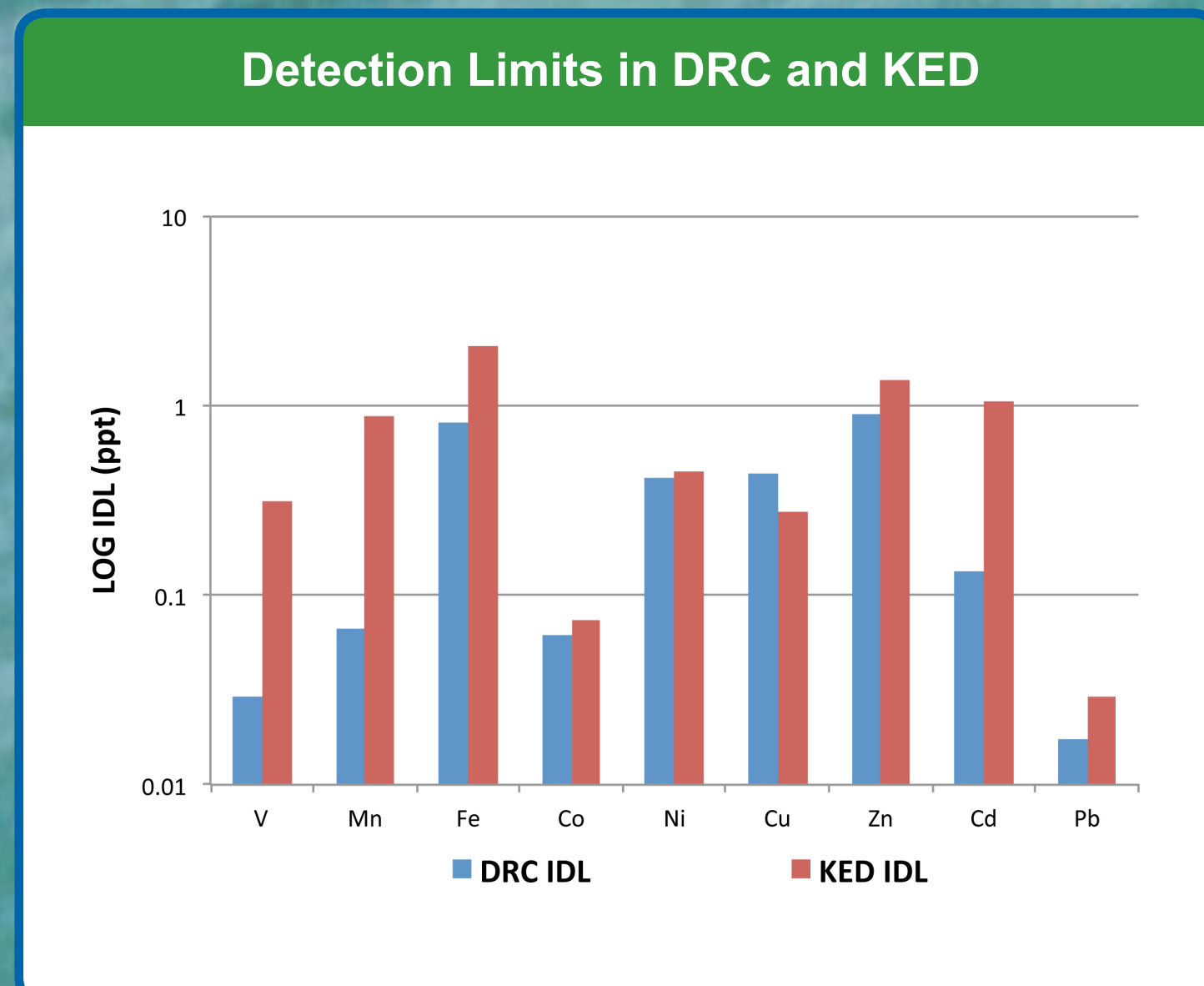
Preconcentration mode:

A chelation column binds transition metals and rare earth elements but allows matrix Na⁺, Cl⁻, Ca²⁺ and Mg²⁺ ions to be rinsed out. After the preconcentration step, analytes are eluted and detected by ICPMS.

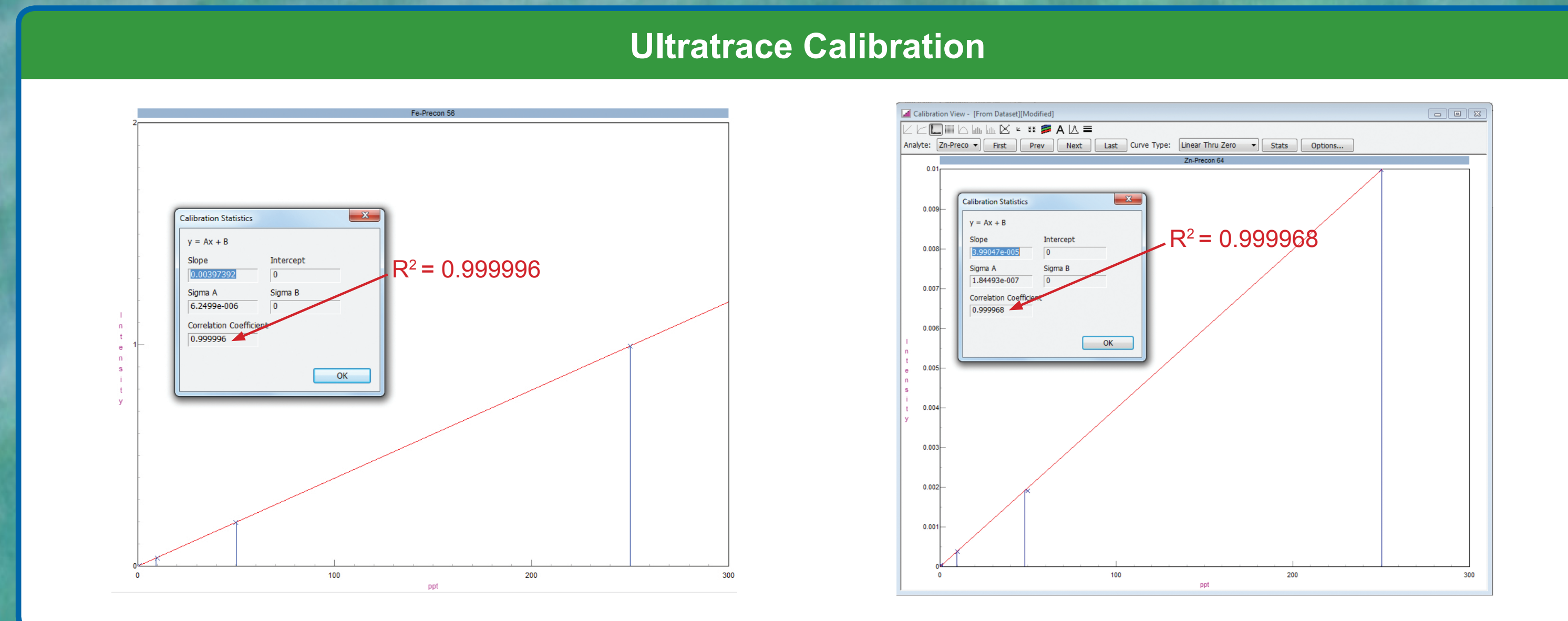
Direct mode:

Sample is automatically diluted inline by high-precision syringe pumps. Dilution reduces matrix effects and allows the determination of elements whose chemistry is not compatible with the preconcentration column.

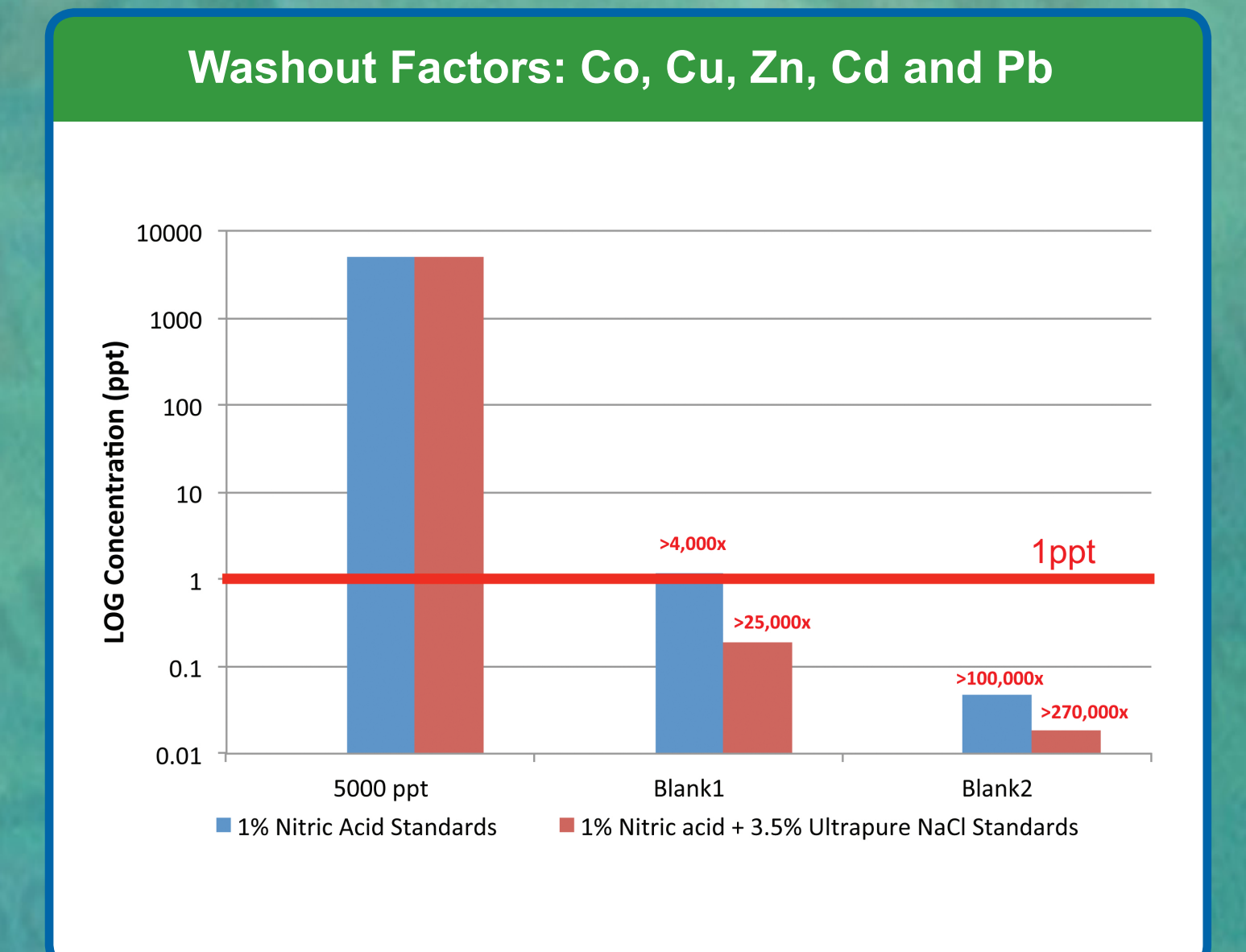
Preconcentration Mode



Detection limits are near or better than 1 ppt on a quadrupole ICPMS (n=10, 3σ).

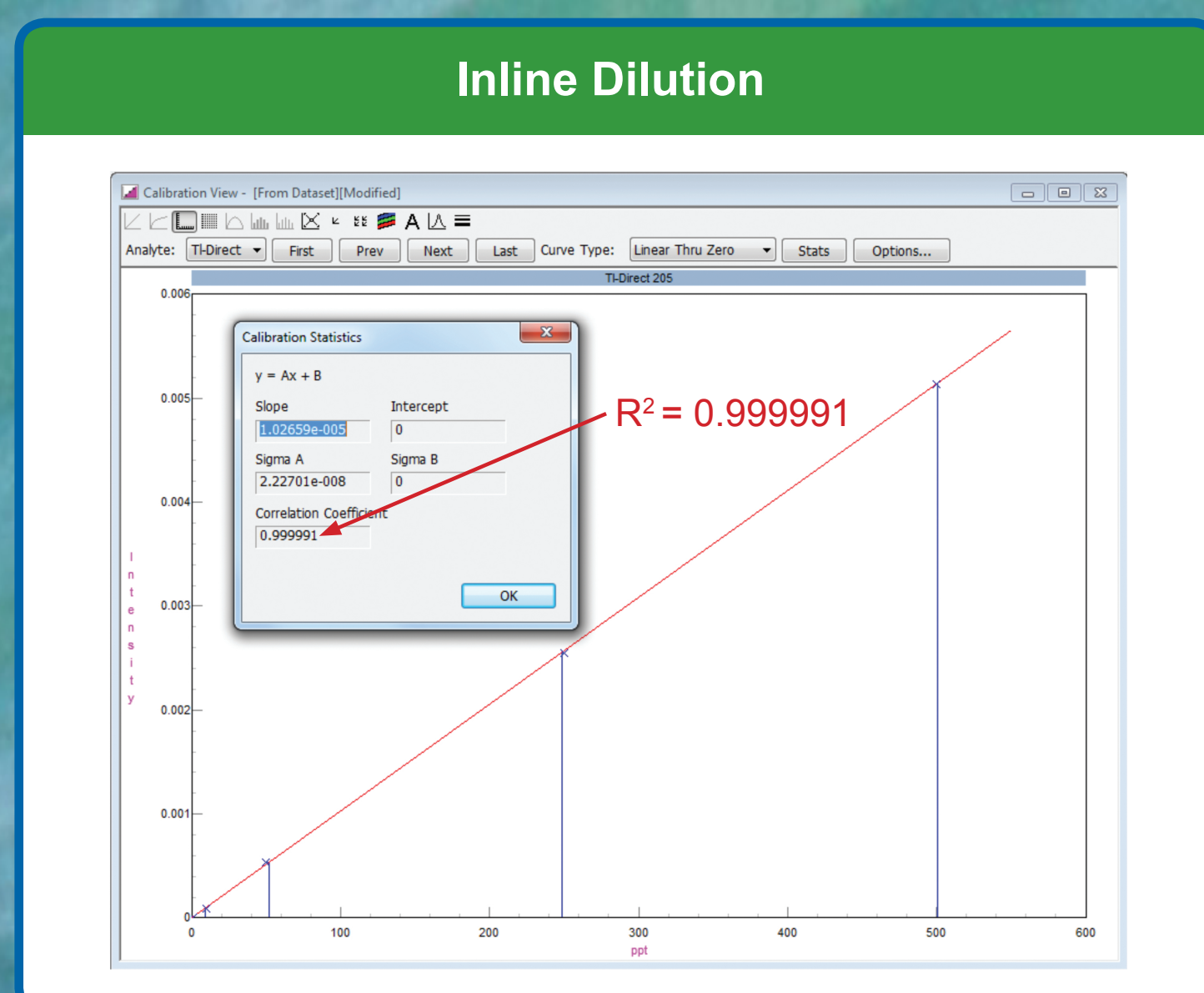


Preconcentration mode calibration of Fe and Zn in 3.5% NaCl. Calibration spikes are 1, 10, 50 and 250 ppt.



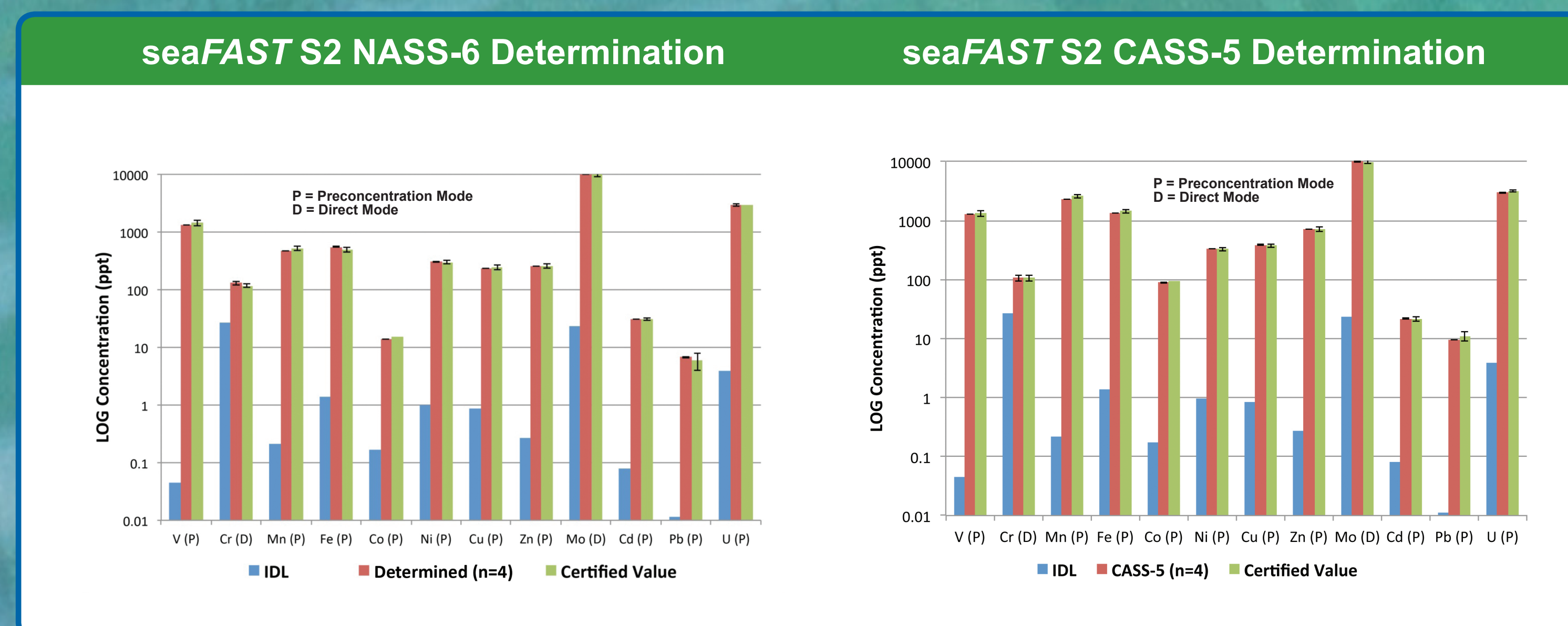
Washout in Preconcentration mode is excellent with both 1% nitric acid calibration standards and matrix-matched standards. Matrix matching the standards with seaBlank is not required for Preconcentration mode, but it enhances washout.

Direct Mode



Direct mode calibration of TI in 3.5% NaCl. Calibration spikes are 1, 10, 50, 250 and 500 ppt.

Results



Results for NASS-6 and CASS-5 Seawater Reference Materials are shown. Elements determined with the seaFAST S2 are accurate and precise for elements with certified concentrations from < 10 ppt to > 10 ppb.

Benefits

- Low blanks
- Low carryover
- Sub-ppt IDL's
- FAST: < 8 minutes inline
- Eliminate pump tubing
- No daily maintenance
- Easy ICPMS optimization

Conclusion

Determination of trace elements in high saline matrices with the seaFAST S2 is rapid, accurate, and precise. Ultrapur flow paths and optimized chemistry provide blank levels suitable for even the most demanding samples, such as open ocean seawater.