Low-concentration Nutrient Determination Needs and Challenges—Which Ones? How Low? What Applications?

Charles J. Patton[1] **and William Lipps**[2]

[1] U.S. Geological Survey
National Water Quality Laboratory
P.O. Box 25585, Denver, Colorado 80225-0585

[2] ITT | OI Analytical
College Station, TX 77842-9010

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Speakers for Challenges of low-concentration nutrient analysis morning and afternoon sessions

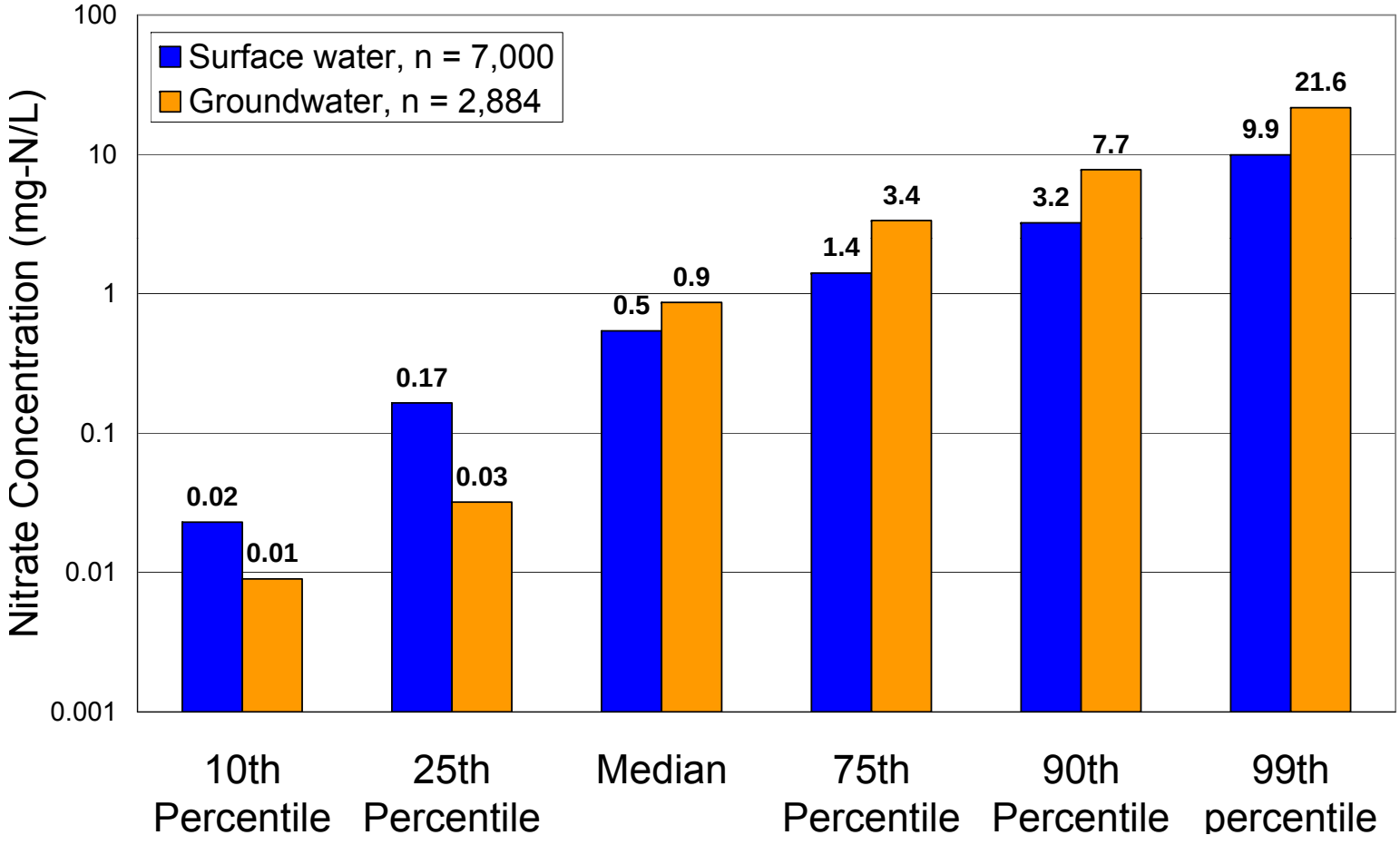
Speaker Name	Time	Title
Charles Patton	9:00	Low-concentration Nutrient Determination Needs and Challenges—Which Ones? How Low? What Applications?
JB Neethling	9:30	Variability in Wastewater Effluent Phosphorus Measurements
		Morning Break
Gertrud Nurnberg	10:30	Importance of low-level analysis in comparison to sample timing, handling and other methods to obtain representative phosphorus measurements in lake water
Carl Zimmermann	11:00	Accurate Measurement of Particulate Nitrogen and Phosphorus in Environmental Water Samples
Wei Ning Yap	11:30	Monitoring and Fractionation of Low-Level Phosphorus in Water and Environment
		Lunch Break
Nancy Simon	1:30	The importance of analytical methods in the interpretation of data from natural systems- Accounting for all forms of P in the water and sediment of Upper Klamath Lake, OR
Scott Smith	2:00	Evaluation of Colorimetric Phosphate Speciation Analysis Using Long Path Lengths and Model Compounds
Edward Askew	2:30	Low Level Determination of Ammonia by Membrane Extraction-Conductivity
		Afternoon Break
William Lipps	3:30	Low-concentration Nutrient Determinations in Water—An Overview of Approved- and Candidate-method Capabilities
William Lipps and Charles Patton	4:00	Speaker/SessionAttendee Round Table Discussion

- Analytical service laboratory
- Production sample processing ~ 30,000 samples/year, ~ 1.5 x 10^6 determinations
- Quality Assurance/Quality Control
- New methods development including laboratory automation

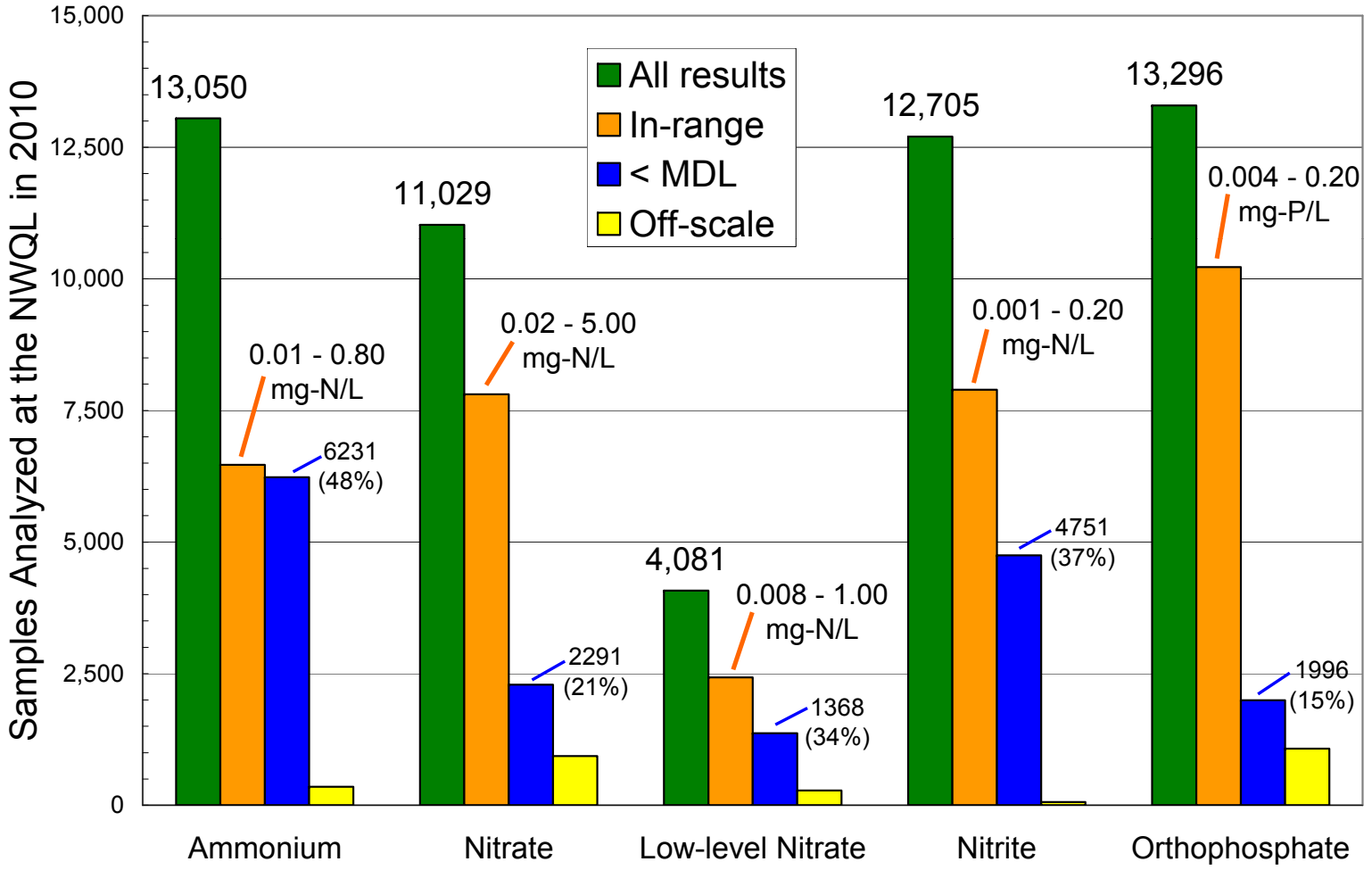
Overview of Yearly of Nutrient Concentrations in Surface Water and Groundwater in the United States

- Nitrogen- and Phosphorus-containing Nutrients
  - Filtered, Undigested
  - Filtered, Digested
  - Whole-water, Digested
    - Detection limits
    - Laboratory blanks
    - Blind blanks
    - Field blanks

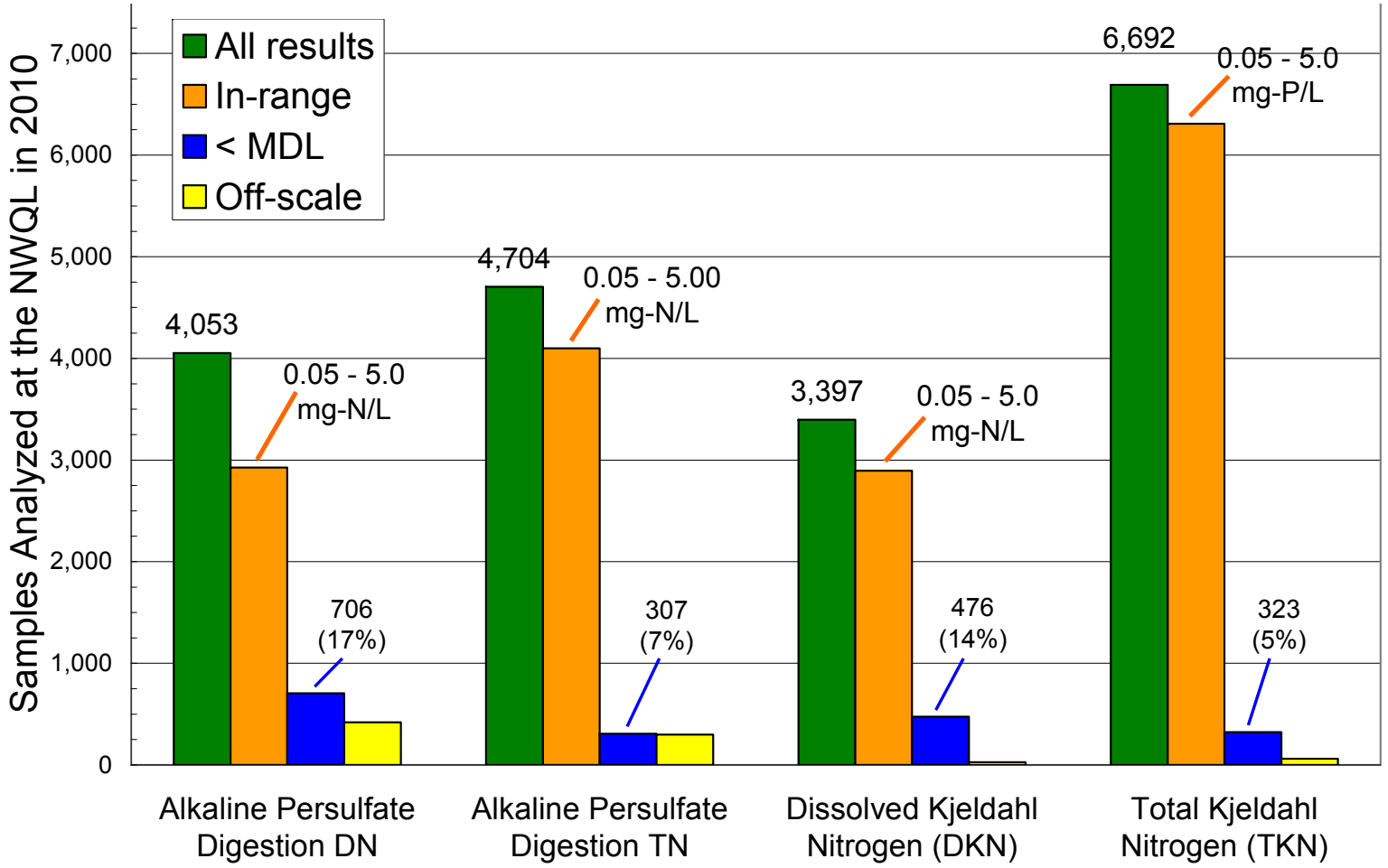
Differences in concentration distributions for different water types



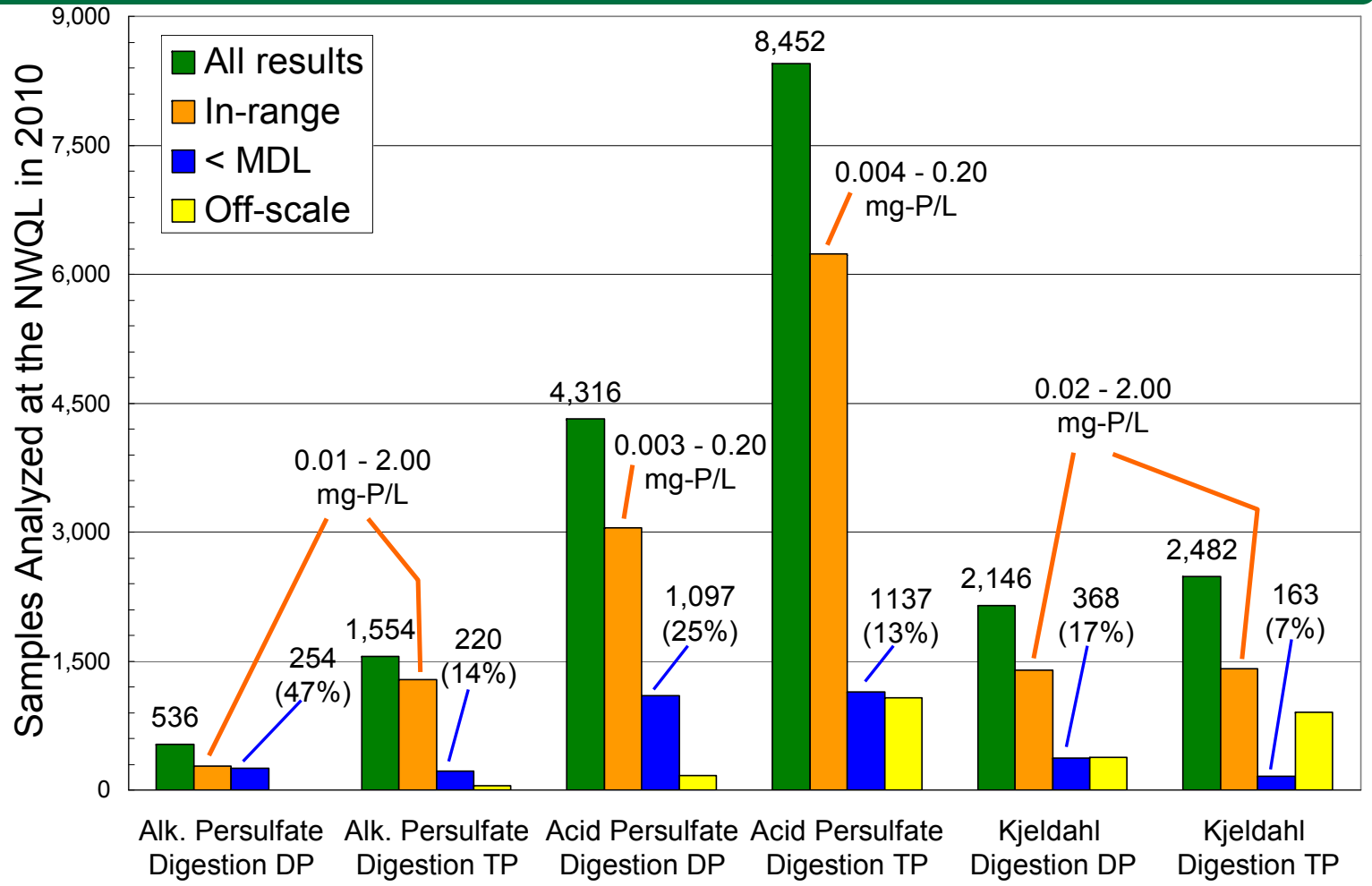
NWQL Dissolved Nutrient Analyses in 2010



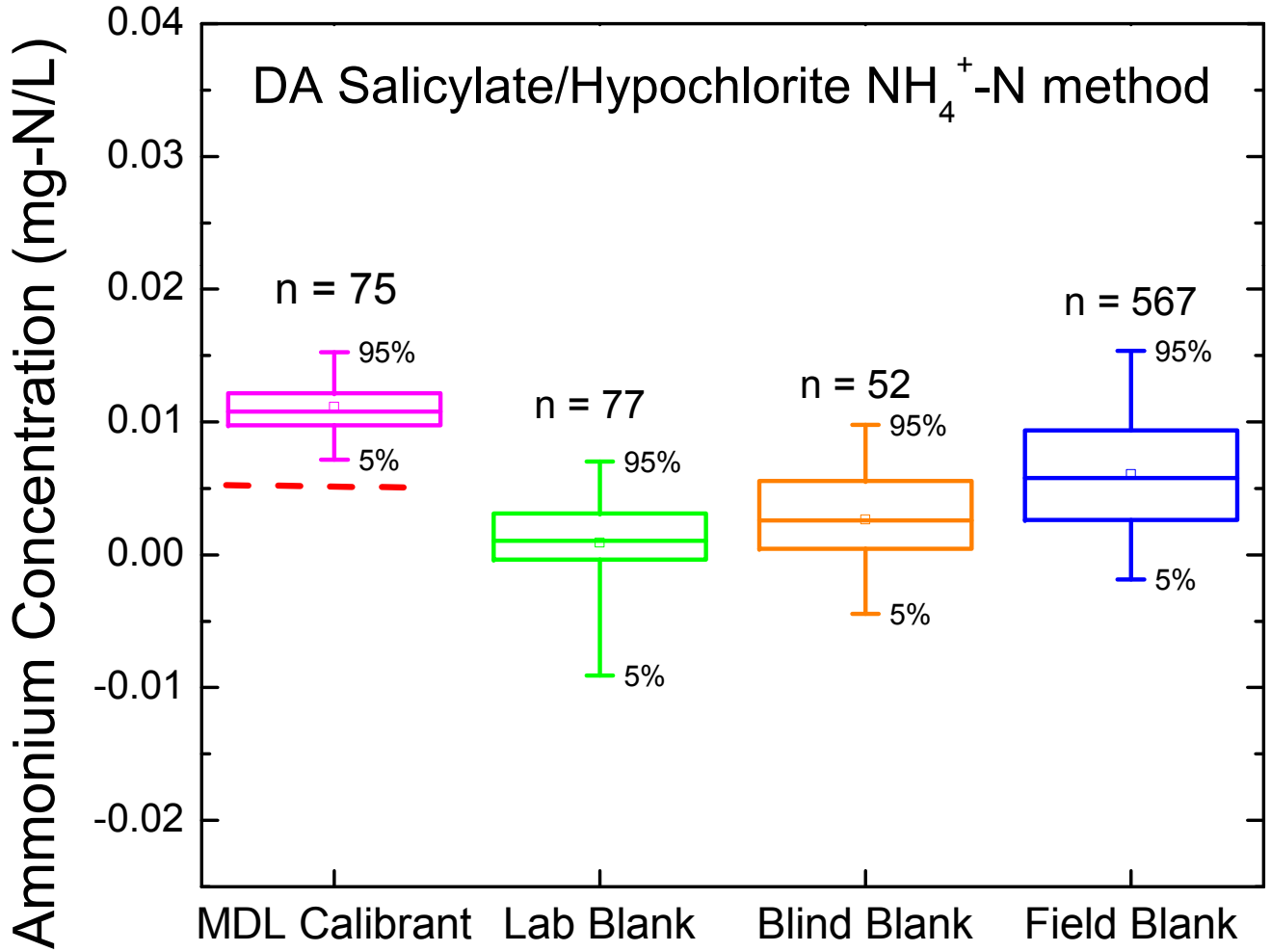
NWQL Dissolved and Total Nitrogen Analyses in 2010



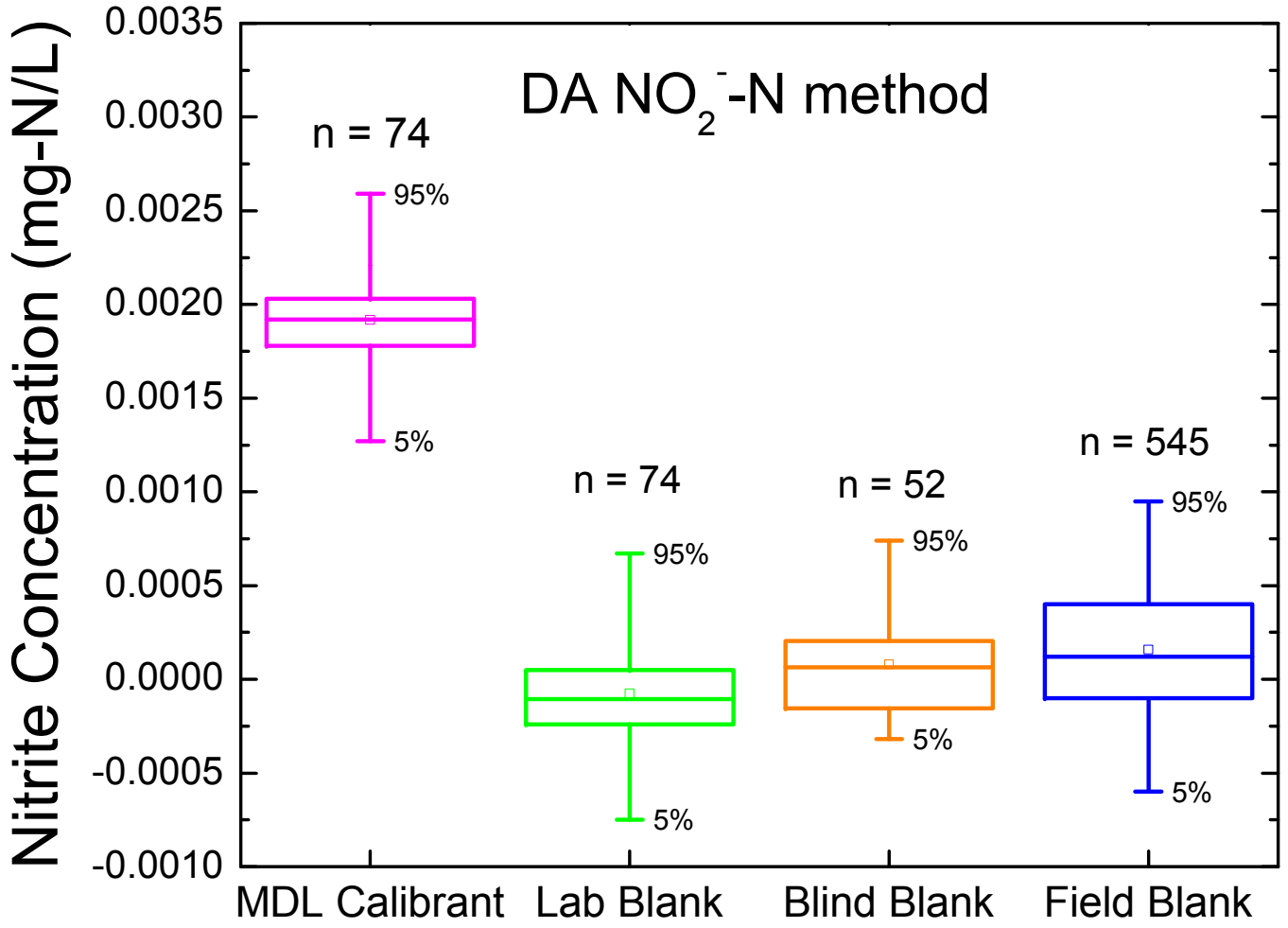
NWQL Dissolved and Total Phosphorus Analyses in 2010



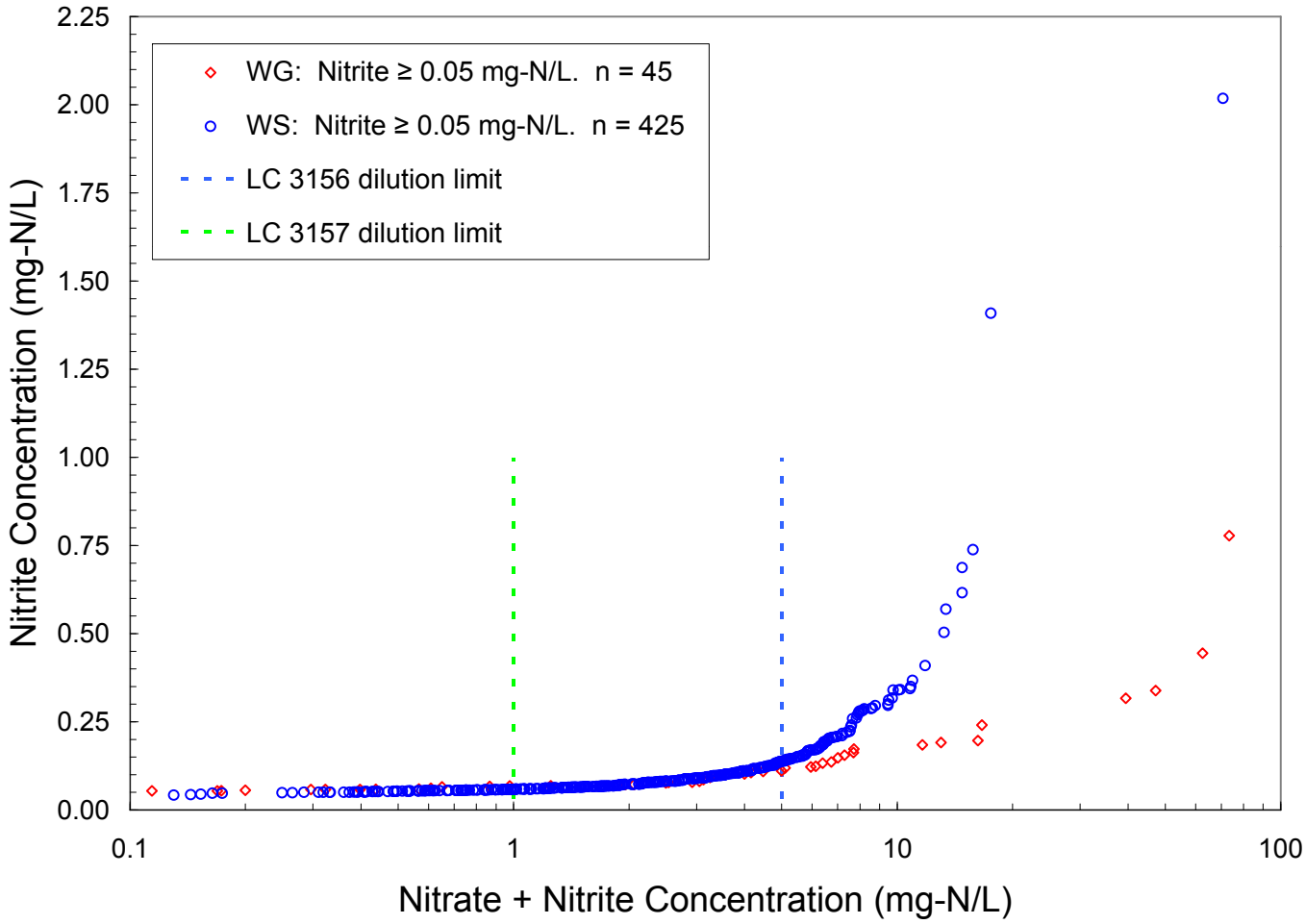
NWQL Ammonium Analyses 2010(Discrete Analyzer)



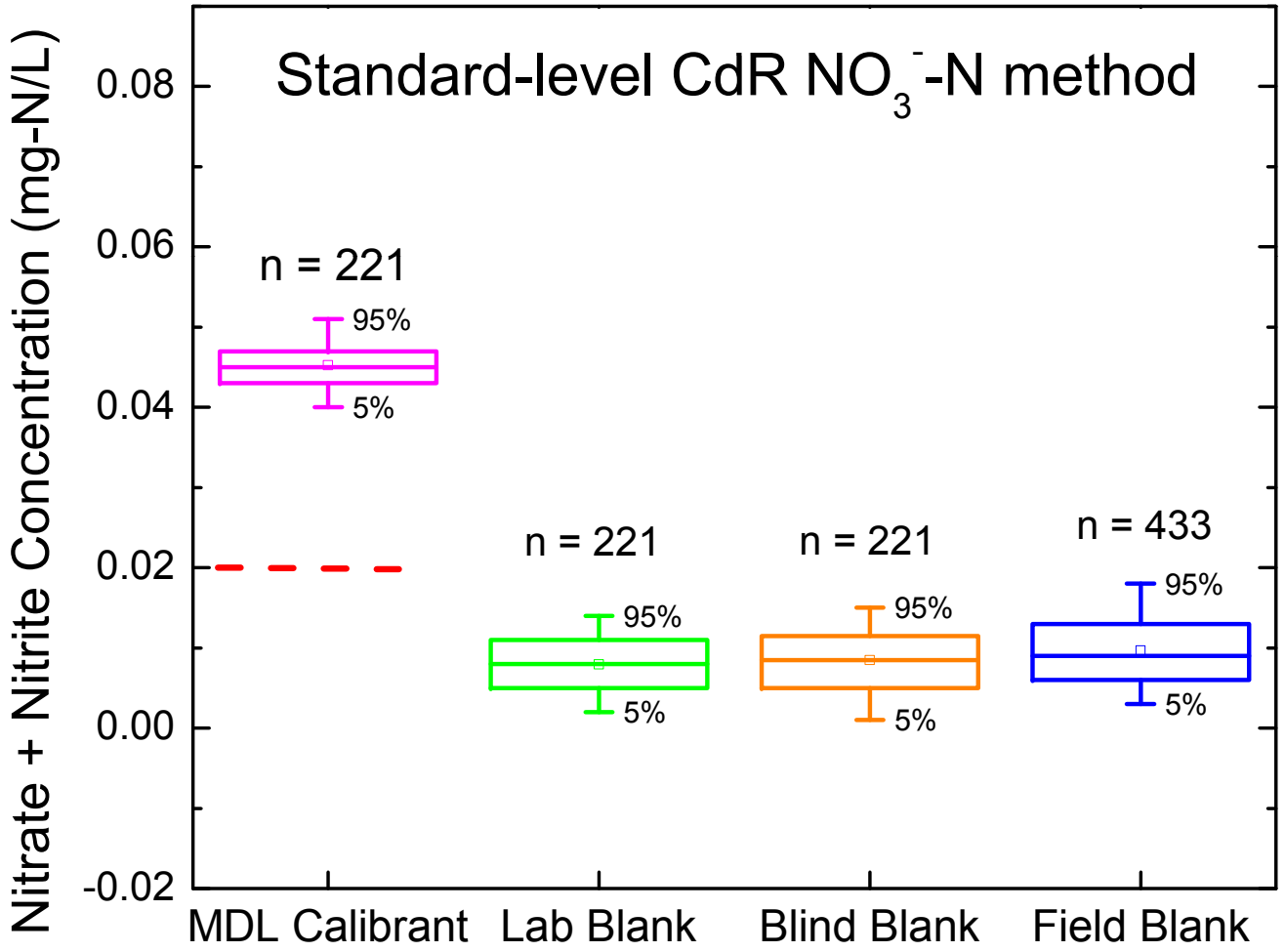
NWQL Nitrite Analyses 2010 (Discrete Analyzer)



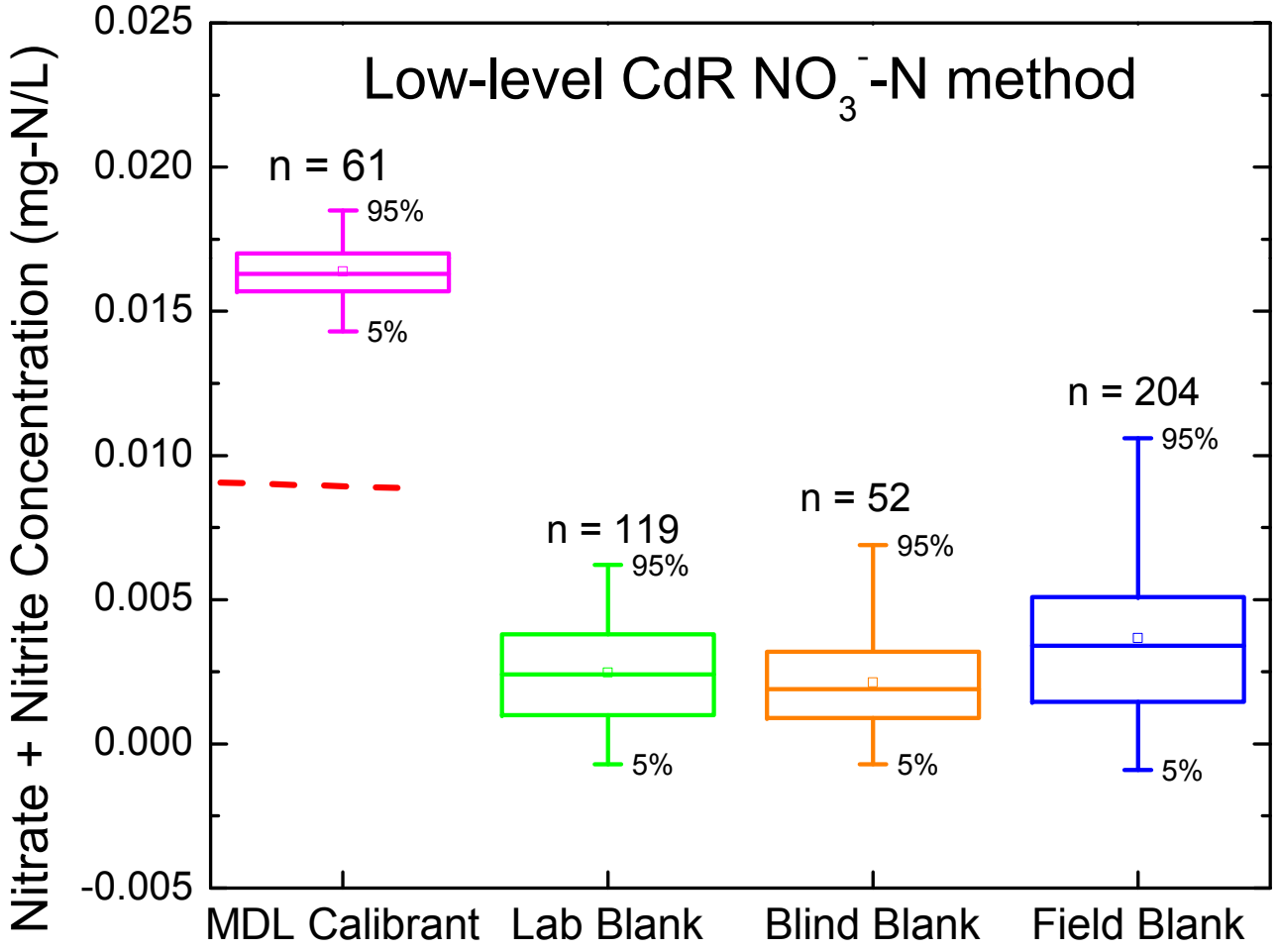
Relationship between nitrate + nitrite and nitrite concentrations analyzed at the NWQL in 2010



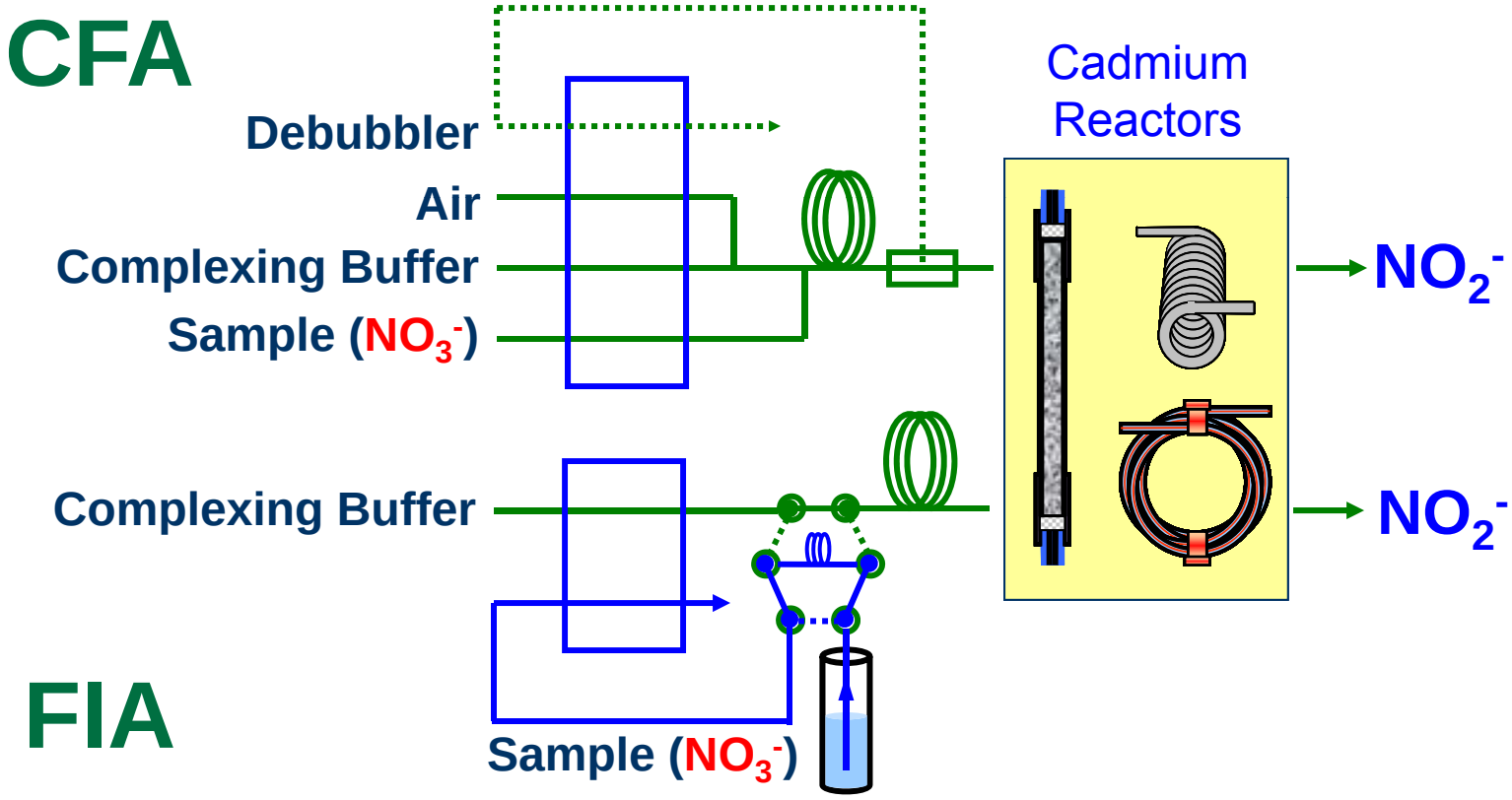
NWQL Standard-level Nitrate Analyses 2010 (Continuous-flow Analyzer)



NWQL Low-level Nitrate Analyses 2010 Analyses 2010 (Continuous-flow Analyzer)

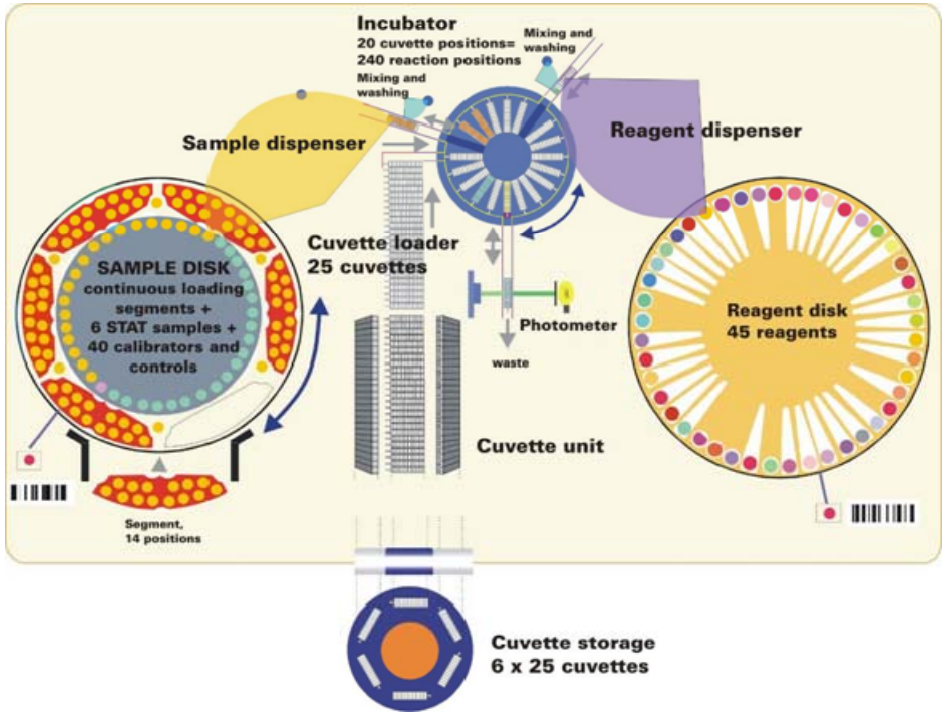


Cadmium reactors are easily incorporated into continuous flow analyzers

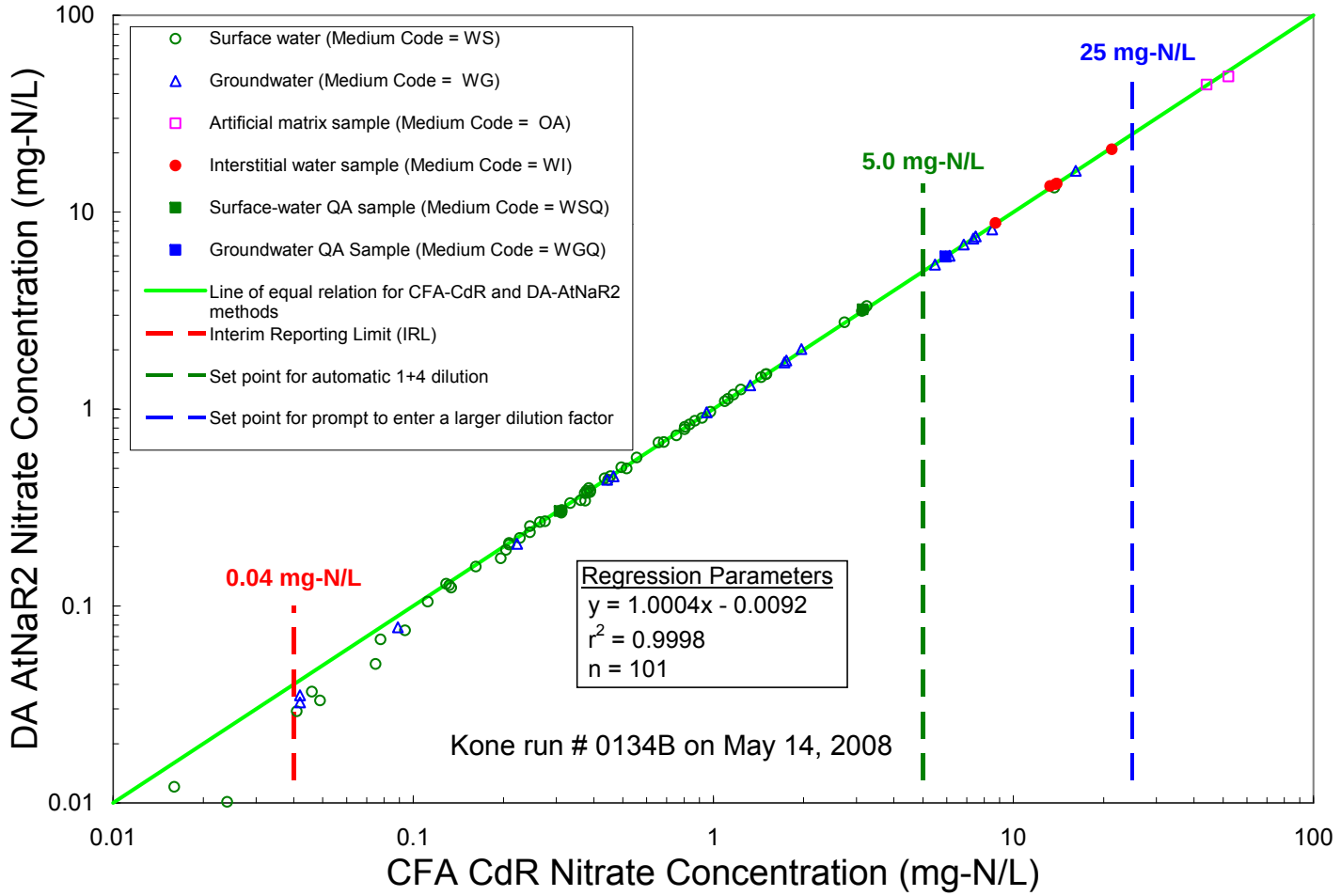


Discrete analyzer nitrate reductase (AtNaR2) nitrate assay (37°C)—now USGS approved

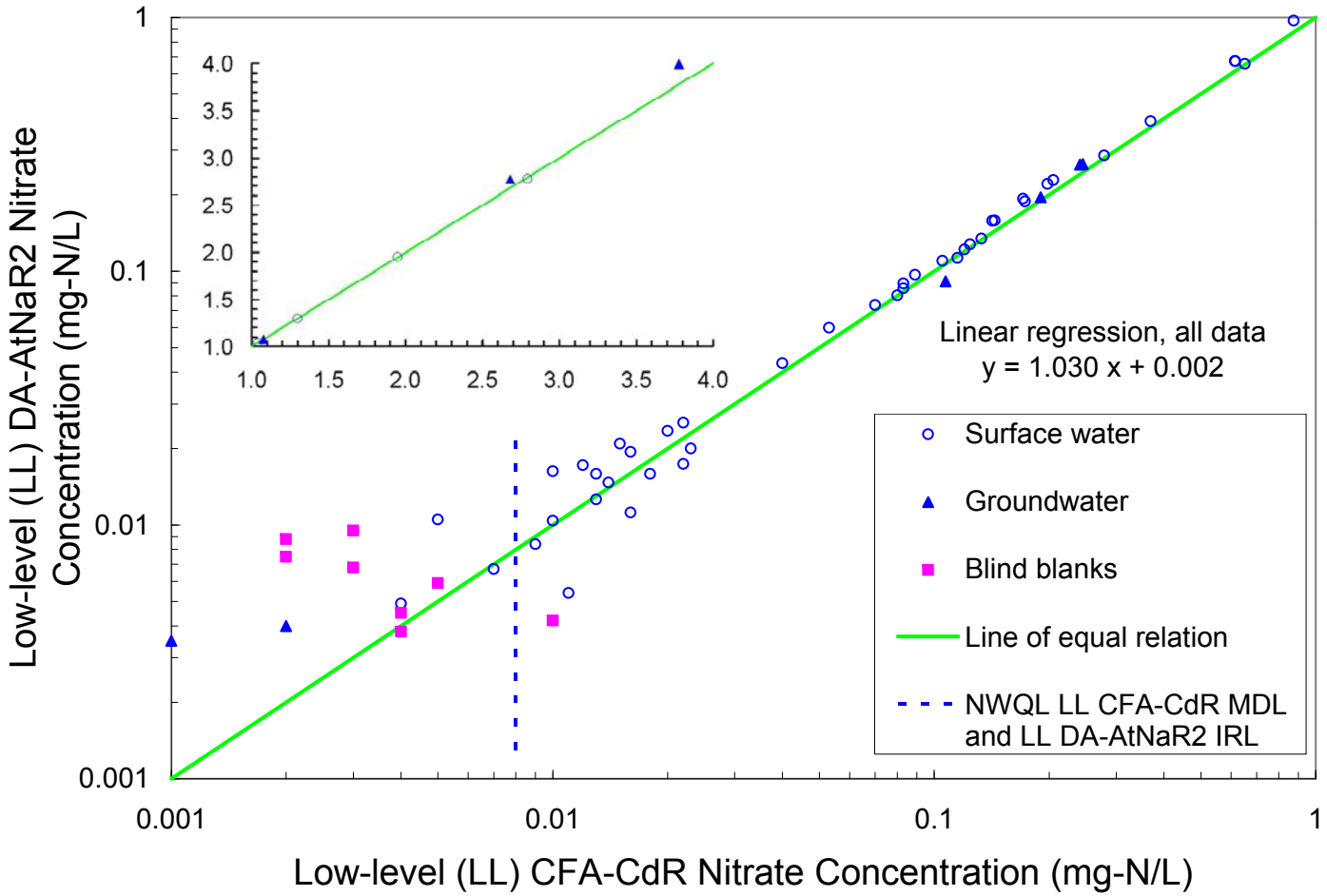
$$NO_3^- + NADH + H^+ \xrightarrow[(pH=7;30^\circ C)]{NaR} NO_2^- + NAD^+ + H_2O$$



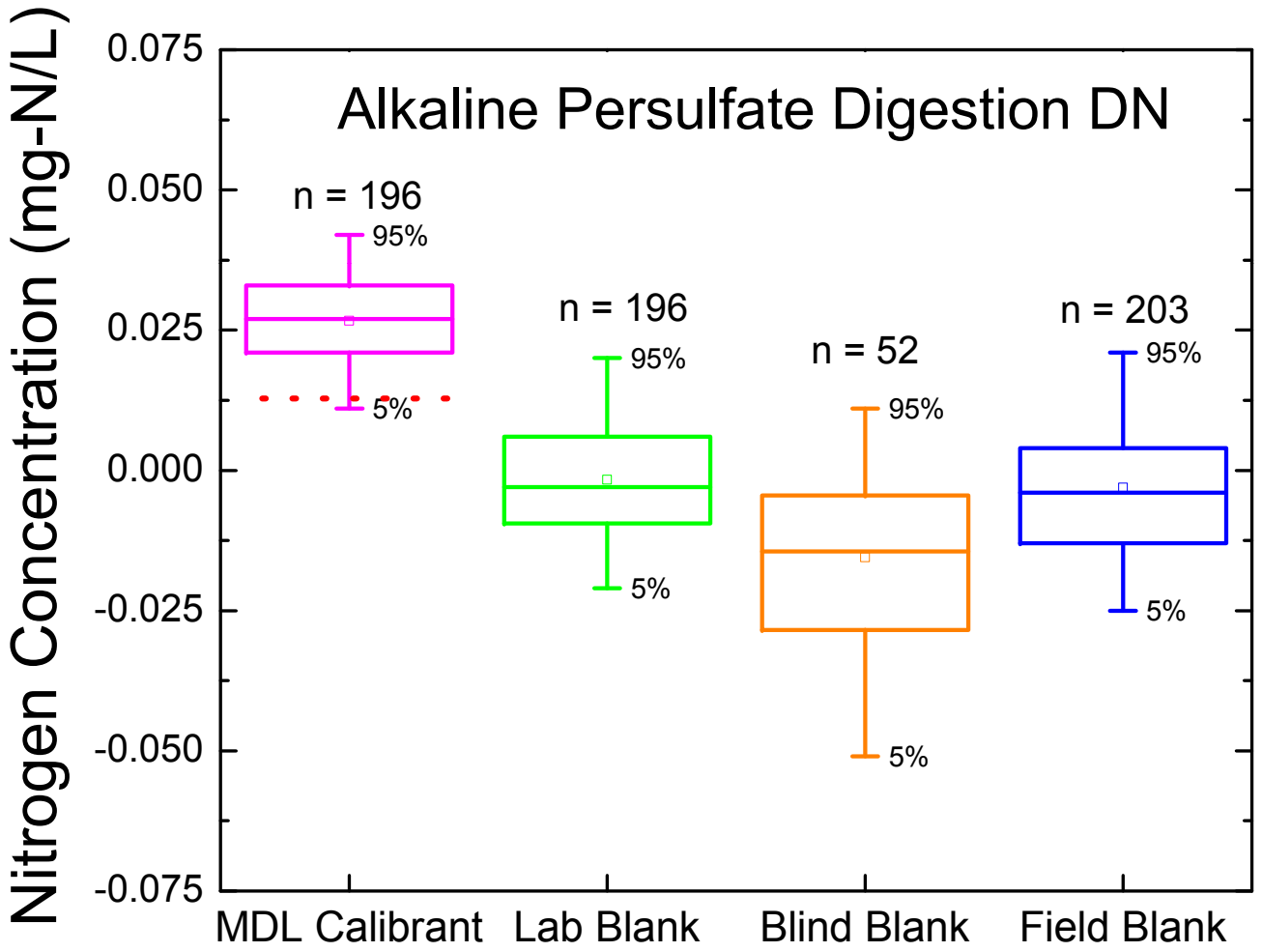
CFA cadmium-reduction and DA enzyme-reduction nitrate concentration data pairs plotted about the line of equal relation



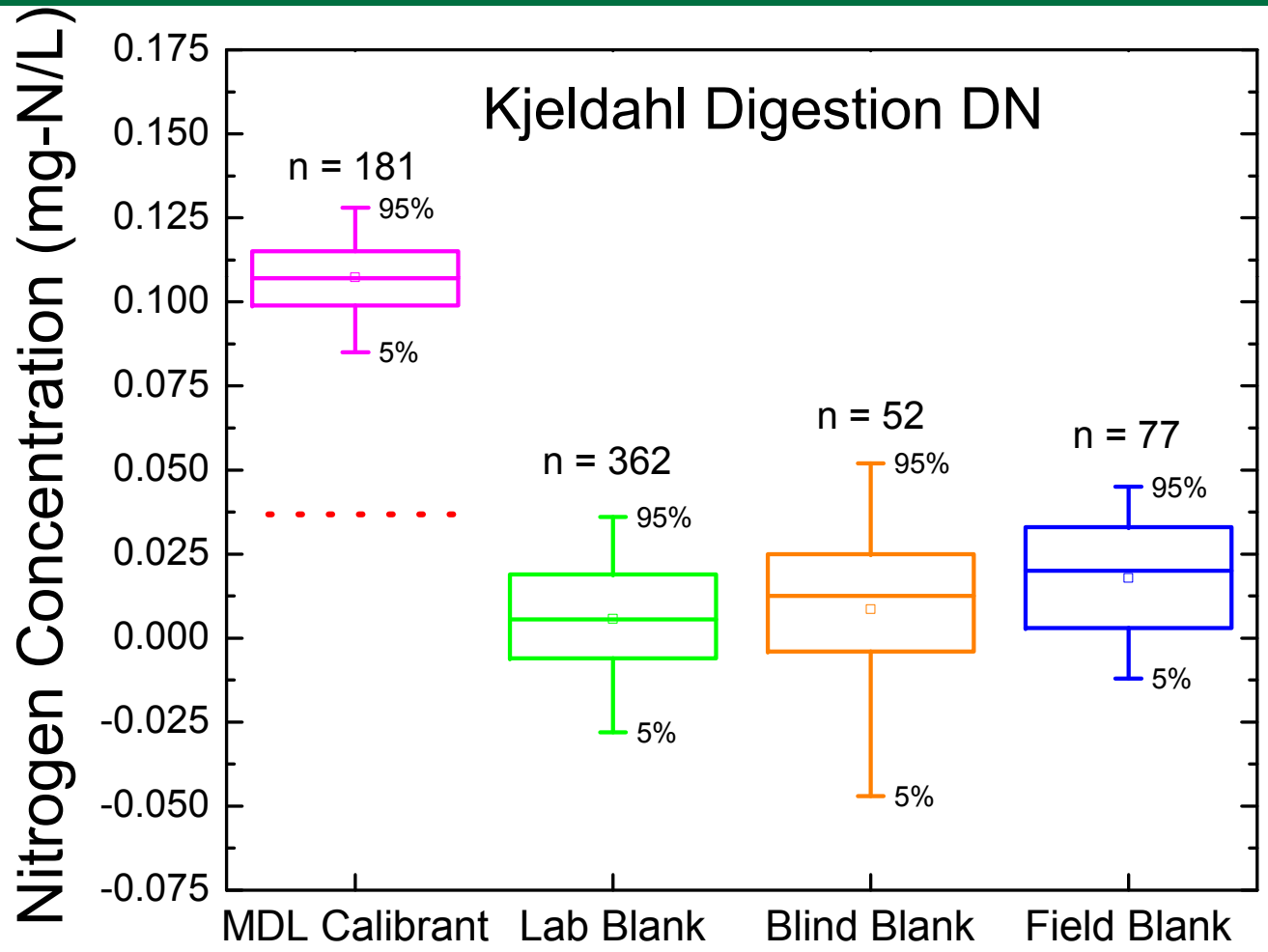
CFA cadmium-reduction and DA enzyme-reduction low-level nitrate concentration data pairs plotted about the line of equal relation



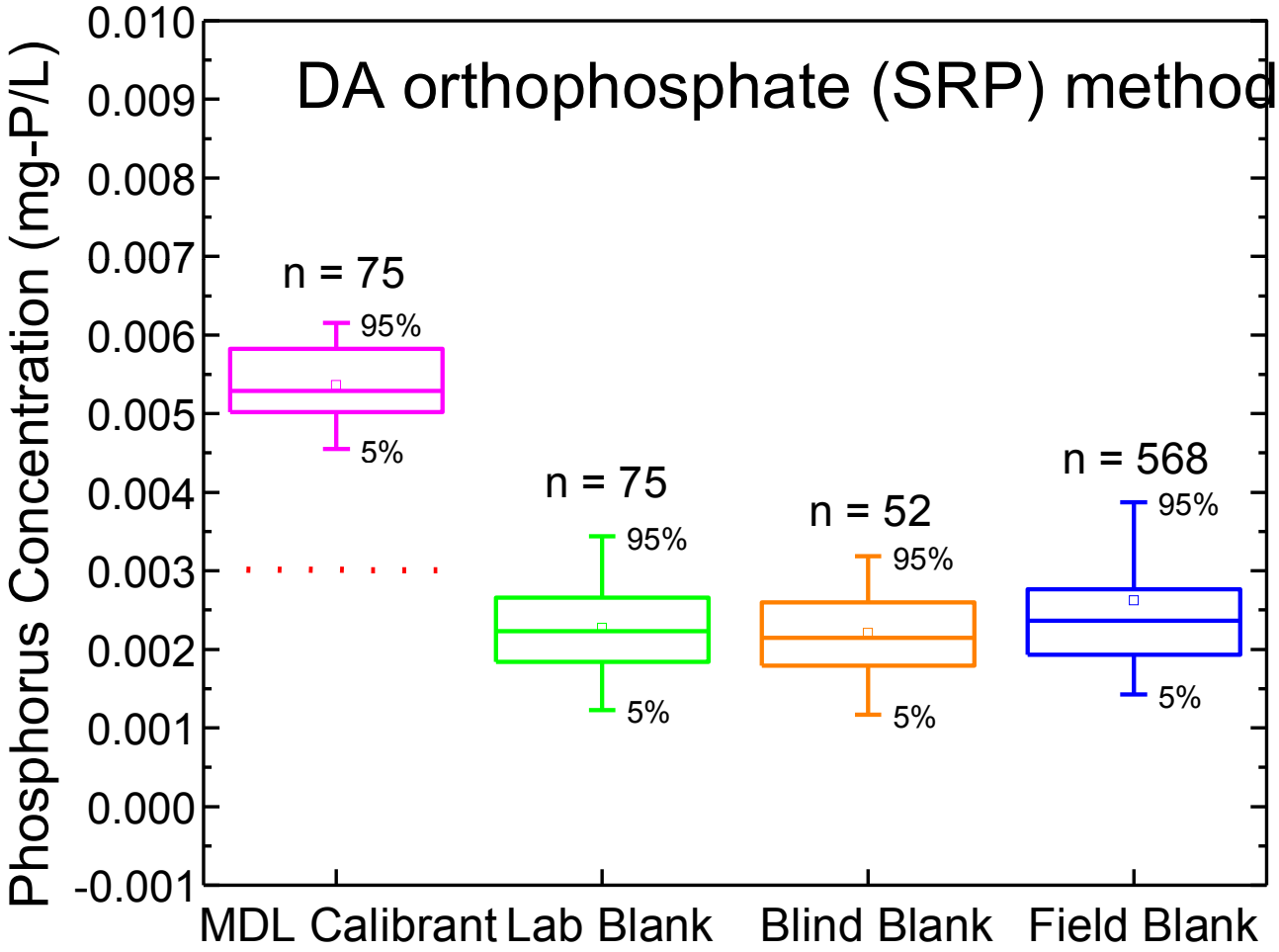
NWQL 2010 Alkaline-persulfate-digestion Dissolved Nitrogen (Continuous-flow Analyzer; determined as nitrate)



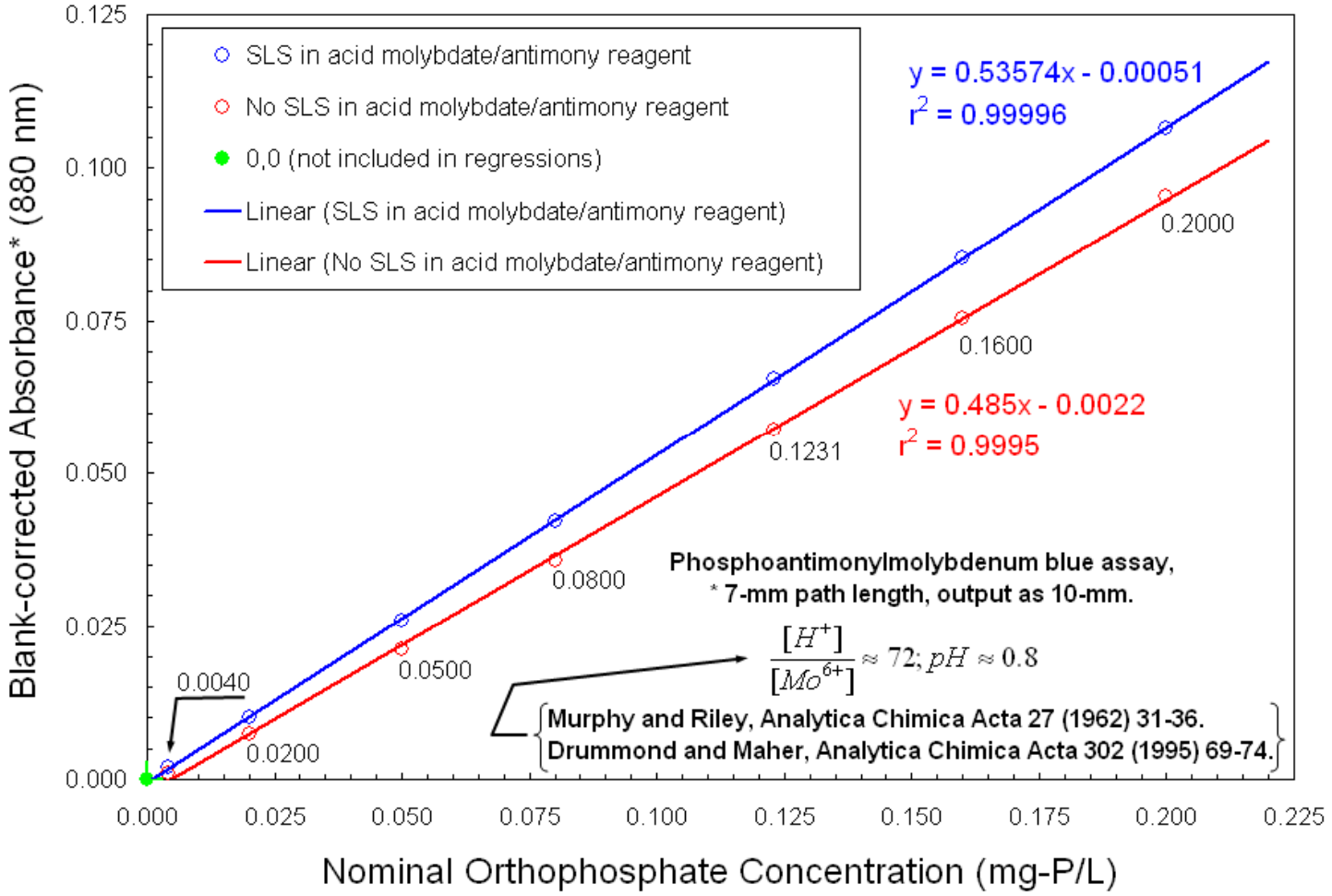
NWQL Kjeldahl Nitrogen 2010 (ammonium + organic nitrogen; continuous-flow analyzer; determined as ammonium)



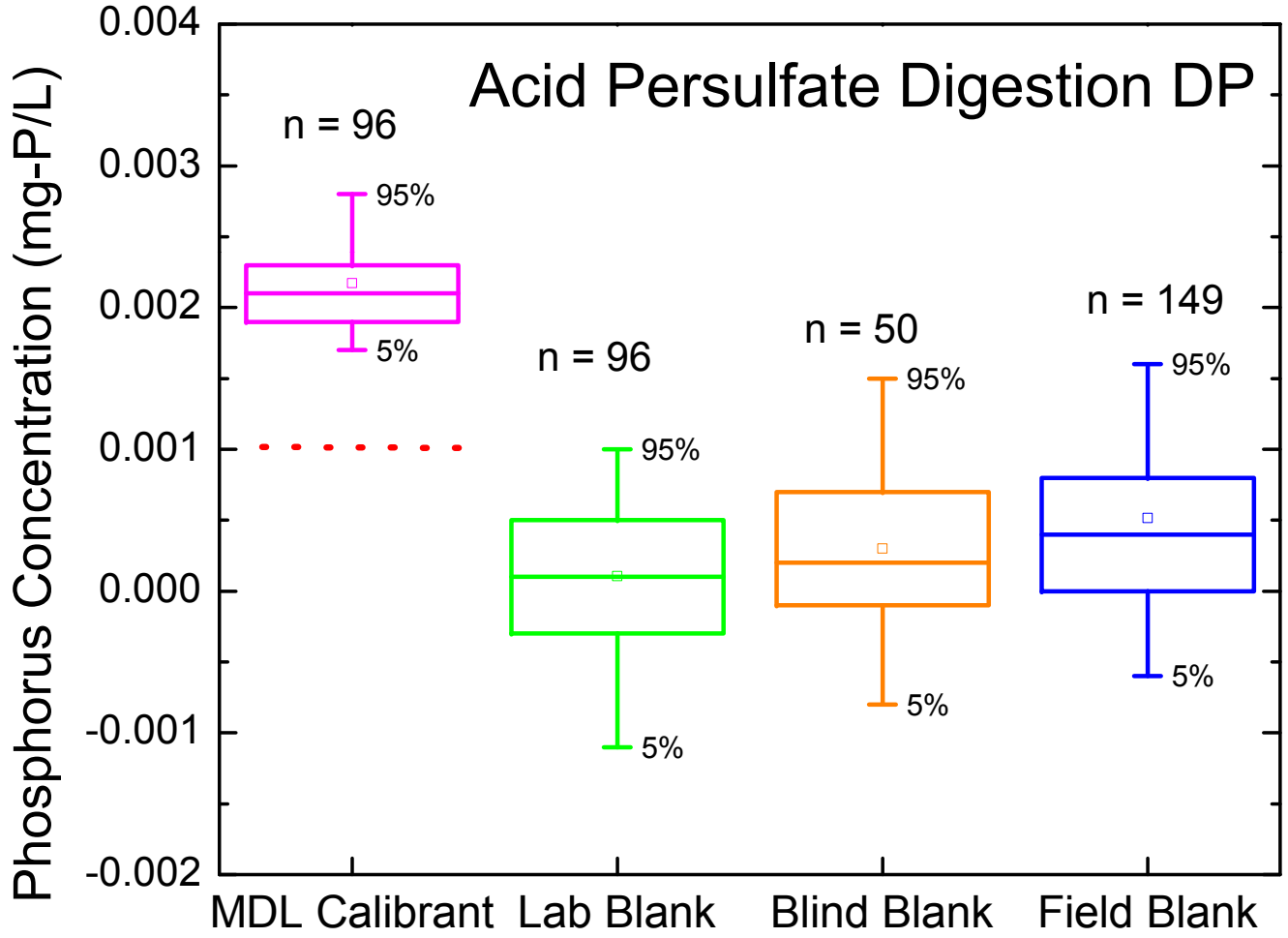
NWQL Orthophosphate Analyses 2010 (Discrete Analyzer)



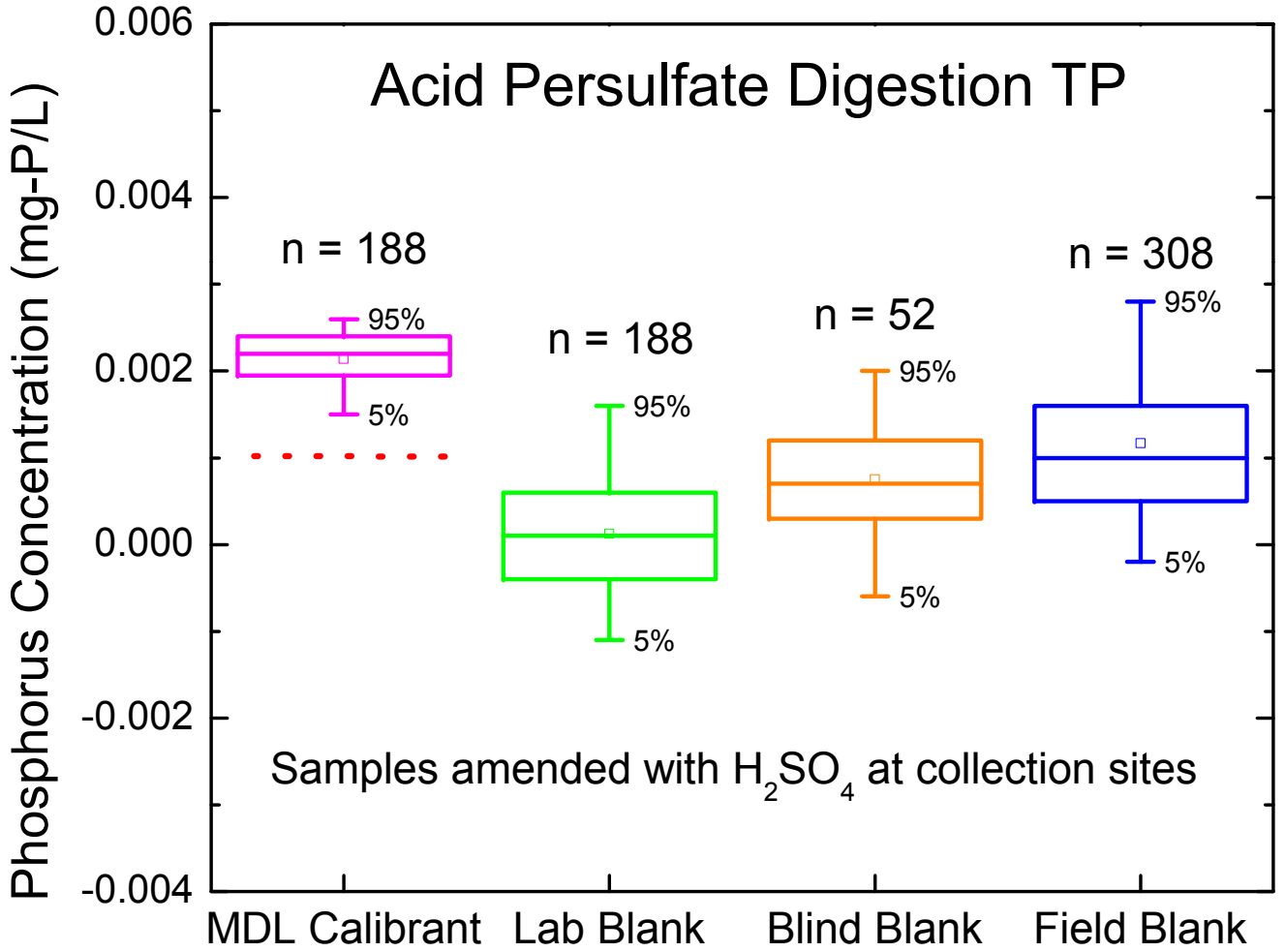
Murphy & Riley phosphate assays need sodium lauryl sulfate (SLS) even on discrete analyzer platforms



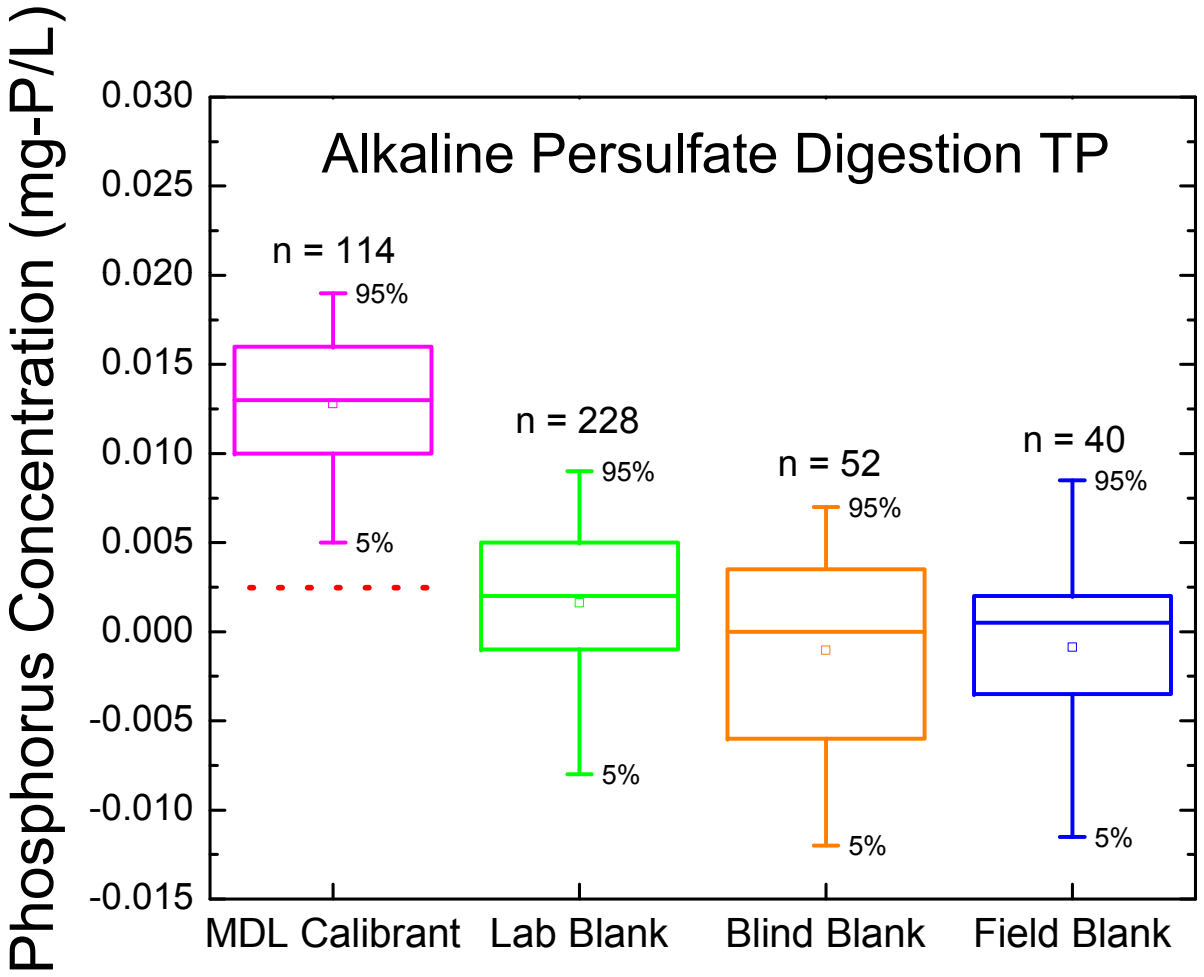
NWQL Low-level DP 2010 (Continuous-flow Analyzer)



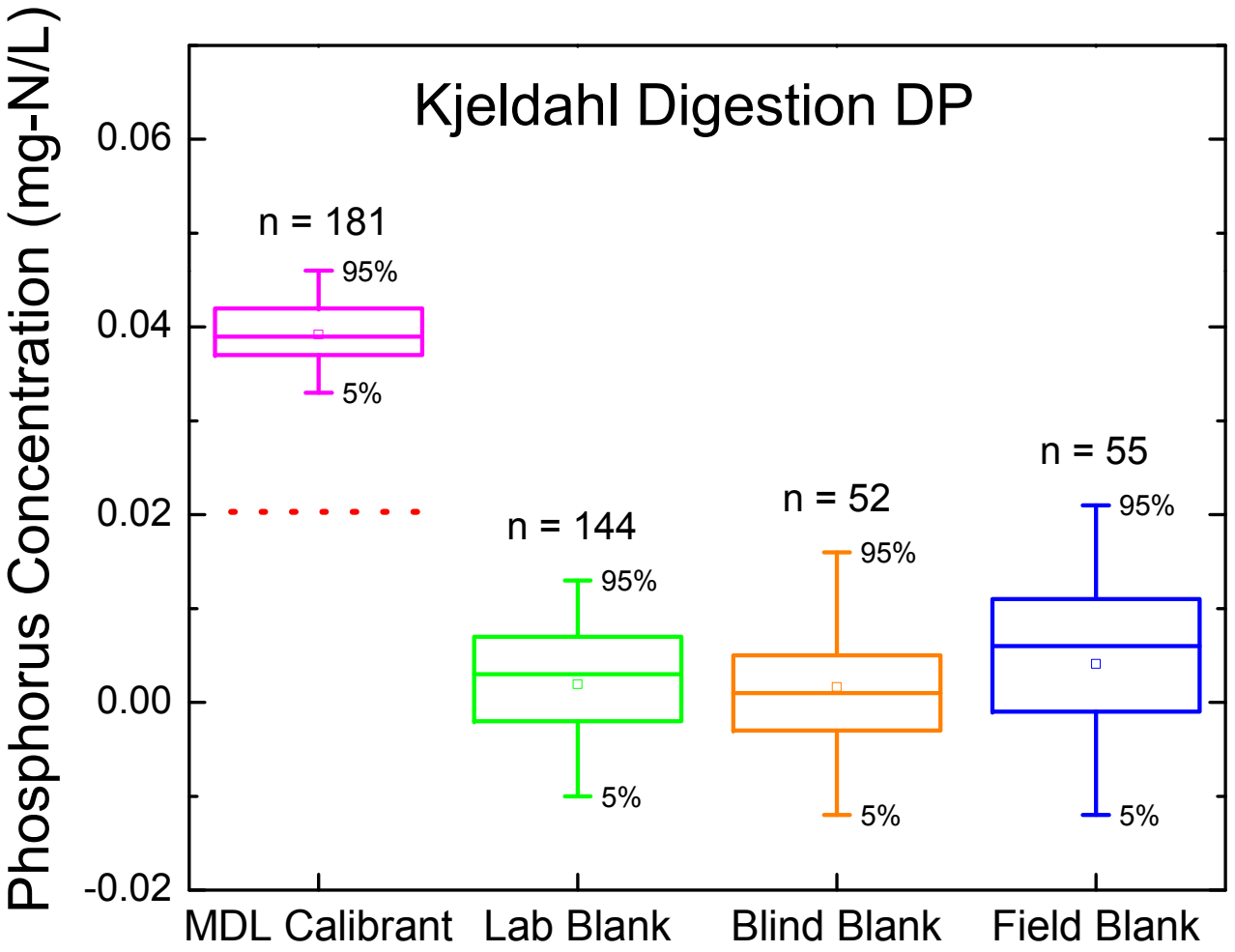
NWQL Low-level TP 2010 (Continuous-flow Analyzer)



NWQL Alkaline-persulfate-digestion DP 2010 (Continuous-flow Analyzer; determined as orthophosphate)



NWQL Kjeldahl Phosphorus 2010 (Continuous-flow analyzer; determined as orthophosphate)



NWQL Detection limit summary

- Nitrite: 2 µg NO_2^--N/L
  - With lower calibration range, reagent and field blank limited at about 0.5 ppb
- Orthophosphate (SRP): 4 µg PO_4^{3-}-P/L
  - 2 µg PO_4^{3-}-P/L w/ SLS in acidic molybdate/antimony reagent; reagent and field blank limited at about 1 ppb)
- Acid-persulfate-digestion DP and TP: 2 µg-P/L
  - With lower-P persulfate reagent, perhaps 1 ppb before field blank limited
- Alkaline-persulfate-digestion DP and TP: 10 µg-P/L
  - Lower-P persulfate reagent needed
- Kjeldahl-digestion DP and TP: 20 µg-P/L
  - Reagent blank limited
- Ammonium: 10 µg NH_4^+-N/L
  - Field and reagent blank limited
- Standard- (low-) range Nitrate: 20 (10) µg NO_3^--N/L
  - Field and reagent blank limited at about 5 ppb
- Alkaline-persulfate-digestion DN and TN: 20 µg-N/L
  - If nitrate could be removed prior to digestion to permit lower calibration range and lower-N persulfate reagent used, field and reagent blank limit at about 5 ppb
- Kjeldahl-digestion nitrogen: 50 µg-N/L
  - Reagent blank limited

Acknowledgements

- TNI and NEMC
  - Earl Hansen
  - Jerry Parr
- USGS Office of Water and National Water Quality Laboratory (NWQL) for financial support and encouragement of numerous ongoing method development and laboratory automation projects
  - NWQL Nutrients Unit
- Speakers to follow for their time and effort to attend and contribute to this session