

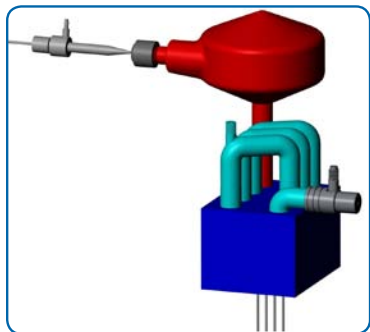
### Sensitivity Increase Apex E & ICP-OES

#### Introduction

A number of applications require the analysis of a limited volume of sample while maintaining detection limits. Reducing sample flow rate on an optical ICP typically results in a loss of sensitivity and associated detection limits. Here we demonstrate that sensitivity at low flow (100  $\mu\text{L}/\text{min}$ ) rate is not only maintained, but improved resulting in a potential 13 fold improvement in absolute detection limits.

#### Instrumentation and Sample Introduction

- Varian MPX radial view
- Meinhard concentric nebulizer
- Glass cyclonic spray chamber
- Apex E
- 100  $\mu\text{L}$  min PFA-ST nebulizer



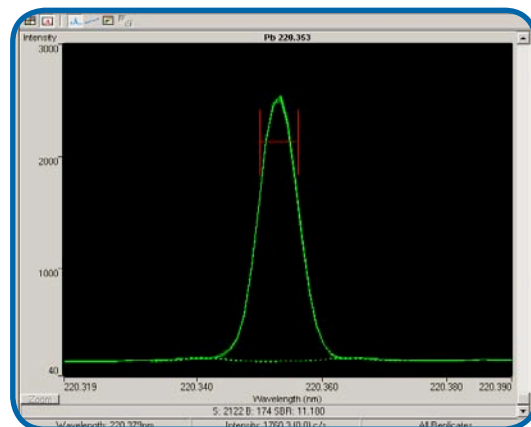
#### APEX E

The Apex is a fully-integrated inlet system that connects directly to the torch injector and incorporates ESI's MicroFlow PFA or PP nebulizer technology. Liquid samples are nebulized into a heated cyclonic spray chamber and Peltier-cooled desolvation system where the sample aerosol is conditioned to produce

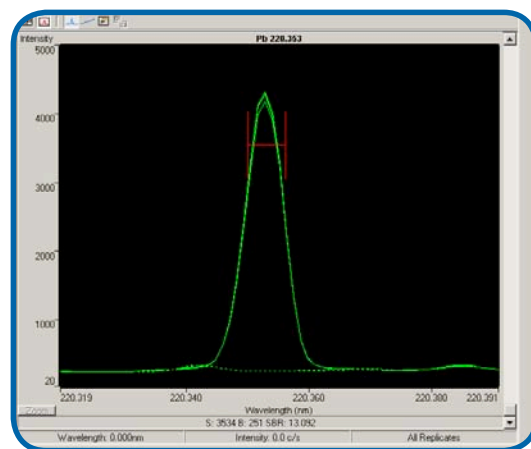
uniform aerosol that is transported to the ICP.

#### Sensitivity

Relative to ICP-MS, ICP-OES instruments have much better tolerance to total dissolved solids and therefore can easily tolerate samples at significantly lower dilutions. When sample mass is limited, analysis using high flow rate nebulizers requires 5 to 10 mL volumes resulting in a reduction in analyte concentration. The analysis of 500  $\mu\text{L}$  volumes results in a 10 to 20 fold increase in analyte concentration (**Fig 1**), however, the analysis of a 500  $\mu\text{L}$  volume requires a sample uptake rates around 100  $\mu\text{L}/\text{min}$ . This reduction in flow rate in a cyclonic spray chamber would result in lower sensitivity due to a drop in sample transport. Using the Apex E to condition the aerosol results in very efficient sample transport and no loss in sensitivity at approximately 10 fold lower sample uptake rates. Not only is sensitivity maintained it is increased by 70% (**Fig 2**). The increase in sensitivity combined with the reduction in uptake rate (and therefore reduced dilution) equates to a 14 fold improvement in absolute detection limit.



Analysis of a 500  $\mu\text{L}$  sample without Apex.



Analysis of a 500  $\mu\text{L}$  sample with Apex. Apex increases sensitivity maintenance by 70%.

Data Courtesy of: M. Paul Field, Institute of Marine and Coastal Sciences, Rutgers The State University of New Jersey