PICARRO

The World's Leading Instruments for Carbon and Water Cycle Measurements

PICARRO A0213 IM-CRDS Analyzer

Quick and Easy Analysis of Water Isotopes from Solid Samples

- Prepare and analyze water extracted from solid samples and liquids with high total dissolved solids in as little as 5 minutes
- Fully integrated with Picarro L2120-*i* & L2130-*i* analyzers
- Capable of in situ analysis in remote locations

Advantage Note: Picarro's Induction Module – Cavity Ring-Down Spectroscopy (IM-CRDS) system is a breakthrough technology that allows scientists to perform high-precision isotope analysis of matrix-bound water extracted from solid materials and liquids with high total dissolved solids, such as plant leaves and stems, juices and tissues, in as little as five minutes. The IM-CRDS merges the sample extraction and analysis steps and requires only 30 seconds of sample preparation. Due to it's portability, quick set-up and low power consumption, the IM-CRDS can function virtually anywhere.

Picarro's patent-pending Induction Module (IM), coupled with Picarro's L2120-*i* & L2130-*i* isotopic analyzers, can replace the traditional combination of cryogenic distillation systems and Isotope Ratio Mass Spectrometry (IRMS). The traditional combination requires an entire room, a highly-skilled dedicated operator, and over 90 minutes to process the samples. The additional time, expense and complexity of cryogenic distillation systems limits research in this area. Picarro's unique IM-CRDS opens new application horizons to researchers in diverse disciplines including ecohydrology, ecophysiology, entomology, life science, soil science, and crop studies, among others.

A sample is placed in the metal sample holder, which is then sealed in a purged glass vial. The vial is loaded into the IM-CRDS and pierced by a septa. The IM-CRDS software then activates an induction coil to precisely and controllably heat the metal sample holder in the vial. The heated sample quantitatively releases matrix-bound water as water vapor. This water vapor is fed directly into the CRDS for oxygen and hydrogen isotope analysis ($\delta^{18}O$ and δD). Picarro's onboard software integrates the resulting vapor pulse, and determines the integrated isotopic composition of water extracted from the sample. The dried out sample can then be further analyzed for carbon isotopes using Picarro's Combustion Module – CRDS system.

This new technology is exclusively available to interface with the Picarro L2120-*i* & L2130-*i*. To optimize system performance, several sample holders and associated methods are available for common sample types. Leaves can be sampled with a simple hole-punch. The resulting punched disk is then crimped inside a folded metal foil. Stems can be sampled by slicing thin cross-sectional pieces and loading them into the folded metal foil. Liquid samples (such as water standards and juices) can also be analyzed using the IM-CRDS system by dispensing approximately 3µL of liquid onto glass filter paper. This filter paper can then be processed in the same fashion as leaf samples. Researchers can develop methods for different types of samples and levels of moisture content by controlling the level of heating and dry gas flow. Given the appropriate methods development, the IM-CRDS can accommodate many types of samples such as small organisms, minerals, and soils.

The IM-CRDS employs Picarro's Micro-Combustion Module™ technology, a proprietary cartridge that eliminates organic interferences through an oxidation process. It has optimal efficacy for samples containing total organics in

concentrations typical for plant extracts (< 0.5%). Higher concentrations of alcohols, such as those found in certain beverages, will not be completely broken down. However, the process is highly reproducible and can create high-precision fingerprint data.

Picarro's Patented CRDS Technology: The heart of the Picarro analyzer is a sophisticated time-based measurement that uses a laser to quantify spectral features of gas phase molecules in an optical cavity. Picarro's patented CRDS technology enables an effective measurement path length of up to 20 kilometers in a compact cavity, which results in exceptional precision and sensitivity with a small footprint. Because lasers drift in all instruments, Picarro uses a patented, high precision wavelength monitor to maintain absolute spectral position and the most accurate peak quantification of any instrument. In addition, CRDS measurements are made with the laser off, thus minimizing spurious noise.

Target System Performance		
Parameter	**Precision Between Identical Water Samples**	**Instrument Drift (peak to peak, 24 hours, defined by liquids analysis)**
$\delta^{18}O$	< 0.35 ‰	< 0.6 ‰ / < 0.2 ‰ for L2120-*i* and L2130-*i*
δD	< 1.5 ‰	< 1.8 ‰ / < 0.8 ‰ for L2120-*i* and L2130-*i*

Sample Range		
Parameter	**Standard Method(s)**	**Accessible Range**
Sample Size	6 mm OD punch (leaves and stems) ~ 3 µL of liquid (water and juices)	Combined sample + sample holder Min. dimension < 7.5 mm Max. dimension < 25 mm
Moisture Content	60 to 90 %	> 2 µL water
Sample Preparation and Analysis Time Combined	ca. 5 minutes	3 to 20 minutes

System Requirements		
Parameter	**Notes**	**Quantity**
Operations Gas Pressure	Stable 2 stage regulator required	Standard 1.5 psi Accessible 0.5 to 5 psi
Operational Gas Flow (*use of a gas flow meter is recommended for optimization of IM methodology*)	Air (< 500 ppm moisture)	Standard 150 sccm Accessible 50-400 sccm
Maximum Power Draw	100-240 VAC, 50/60 Hz	75 Watts
Operations Power Draw	100-240 VAC, 50/60 Hz	< 25 Watts
Dimensions	Fits above analyzer	5.0 x 4.5 x 10.5" (13 x 12 x 27 cm)
Weight	Sits atop analyzer	1.4 kg