

# isoprime precisI0N

*The most flexible IRMS ever created*



Great flexibility



High sensitivity



Small footprint



High data quality





## Complete workflow solutions for any IRMS application

Stable isotope analysis provides greater understanding of the micro- and macro-cycling mechanisms of organic elements in the world around us. Our systems have been delivering innovation to the stable isotope community since the 1970s, and continue to be at the forefront of IRMS technology. With a global install base of over 1,000 instruments and thousands of citations in peer-reviewed publications, you can be confident that we understand your applications and have the knowledge to support your research. And because we design and build all our instruments and software in house, our experienced team can work with you to develop bespoke solutions, creating novel interfaces and customizing systems to your individual needs.

## Excellence in IRMS analysis

Elementar is a global technology leader in elemental analysis and isotope ratio mass spectrometry (IRMS). We have over 40 years' experience in the IRMS market, and we pride ourselves on designing, manufacturing and supporting high quality solutions that push the boundaries of stable isotope analysis.

We aim to make stable isotope analysis as simple and straightforward as possible, by providing hardware and software systems that work in harmony to deliver high quality, reliable results.

We work closely with our customers to ensure that they have both the high quality instrumentation and knowledgeable technical support necessary to achieve the highest possible performance. Our international footprint, with a global sales and service network and nine offices across major markets, allows us to effectively serve the academic and commercial sectors around the world – our instruments are used in over 80 countries – providing specialist consultancy, technical support, maintenance and training to match our customers' growing needs.



## isoprime precisiON – take your research in any direction

**isoprime precisiON** is our flagship stable isotope ratio mass spectrometer, offering market-leading gas ionization and mass resolution performance in the most compact footprint possible. This benchtop instrument combines exceptional analytical power and unrivalled flexibility to meet the needs of virtually any application, providing the perfect starting point for your research to go in any direction.

**isoprime precisiON** maximizes the possible experimental options by allowing any combination of inlet systems, automatically switching between them using the integrated **centrION** continuous flow interface system. It can also be interfaced with custom experimental set-ups – using the revolutionary **Novel Inlet Control Module (NICM)** – and combined with specialized collector arrays to meet your growing research needs.

Crucially, our market-leading IRMS instruments have been developed side by side with our **lyticOS®** Software Suite – the most powerful software solution on the market that has been designed exclusively for stable isotope analysis – to provide an unmatched level of workflow automation and intelligent control. This intuitive user interface offers unparalleled sophistication and instrument control, giving users the ability to quickly and easily generate exceptional and insightful data.



### isoprime precisiON KEY FEATURES

- 100 V amplification for large dynamic range samples, with auto-resistor switching for enriched isotope analysis
- Simultaneous measurement of up to 10 ion beams across a  $\pm 25$  % mass range for novel multi-collector experiments
- Improved gas ionization performance of 1,100 molecules  $\text{CO}_2/\text{ion}$  (CF mode) and 800 molecules  $\text{CO}_2/\text{ion}$  (DI mode)
- Improved mass resolution of 110 m/Dm (@10 % valley separation)
- **lyticOS** Method Workflow Designer graphical user interface for advanced instrument control
- Handle up to six monitoring gases and five inlets with **centrION** continuous flow interface system
- Vacuum-grade stainless steel analyzer construction for the highest vacuum performance, using a single turbomolecular pump and optional bakeout
- Automatic control of every aspect of the hardware with **lyticOS**
- Bespoke DAC dual resistor configurations for non-standard isotopomer distributions
- Instant instrument status recognition with color LED warnings

# isoprime precisIOn

*The most flexible and powerful  
IRMS ever created*



## Great flexibility

The system can be combined with a variety of continuous flow peripheral inlet systems – as well as dual inlet technologies for the measurement of water and carbonate materials – ensuring the broadest possible range of applications. Its **centrION** continuous flow interface system enables it to switch seamlessly between inlet systems, offering fully automated handling and dilution of sample gases. This simplicity and flexibility makes your workflows more efficient, whatever your application.



## Small footprint

**isoprime precisIOn** is the most compact fully functional IRMS on the market, with a unique electrostatic filter for the isobaric separation of  $^2\text{H}$ -H and  $^3\text{He}$  isotopes. This allows the system to be almost 50 % smaller than any other IRMS, making it ideal for space-limited laboratories. Its benchtop design and integrated **centrION** continuous flow interface ensure easy operation without compromising on flexibility or performance.



## High sensitivity

**isoprime precisIOn** is one of the most powerful stable isotope ratio mass spectrometers ever created, with exceptional ionization efficiency in both continuous flow and dual inlet modes. Combined with our dedicated range of inlet systems, this offers unrivalled limits of detection for the smallest sample sizes across any application.



## High data quality

Data quality is dependent on many factors, including sample preparation, analytical methodology and data interpretation. **lyticOS** offers complete control of the entire IRMS workflow to ensure the very best quality results at every step. The software offers automatic, multi-point, multi-isotope calibration using standard reference materials, and provides instant access to statistical analyses – such as averages and standard deviations – for sample replicates.

## Applications

powered by **lyticOS**  
SOFTWARE SUITE BY ELEMENTAR

The use of IRMS is growing across a broad range of research areas, each with its own unique set of hardware requirements. As our flagship IRMS platform, **isoprime precisIOn** is designed to offer complete application flexibility, allowing you to take your research in any direction. Combined with our dedicated **lyticOS** Software Suite and backed by our expert technical support, this powerful technology can bring new understanding and insights to research areas, including:



### Environmental

- Ecology
- Oceanography
- Pollution
- Climate change
- Geochemistry
- Hydrology



### Forensics

- Sports doping
- Criminal investigations
- Archeology
- Food and flavorings



### Chemicals

- Medical
- Pharmaceutical



### Agriculture

- Soil and plant science



### Energy

- Oil and gas exploration

# Compact, high performance ion optics

*Designed for flexibility, built for reliability*



## Faraday detectors

The standard instrument is supplied with a Universal Collector Array for analysis of CO<sub>2</sub>, N<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>2</sub>, N<sub>2</sub>O and H<sub>2</sub> gases. This array combines four fixed-position Faraday detectors with a unique electrostatic filter for the isobaric separation of <sup>2</sup>H-H and <sup>3</sup>He isotopes, allowing H<sub>2</sub> analysis in continuous flow without additional H<sub>2</sub> geometry. **isoprime precisION** is also able to monitor up to 10 ion beams simultaneously, allowing a broad range of Faraday detector configurations for the analysis of chlorine and bromine isotopes, atmospheric gas ratios, CO<sub>2</sub> 'clumped isotopes' and N<sub>2</sub>O/NO and SO<sub>2</sub>/SO fragments. All Faraday detectors are supplied with a 10 year guarantee against failure.



## Amplifier

The system's 100 V amplifier provides a larger dynamic range compared to 10 or 50 V amplifiers. This maximizes productivity by allowing the system to analyze a broader range of elemental ratios and/or isotopic compositions before needing to switch gain, for example, when measuring samples with a high C:S ratio using an elemental analyzer, or ethane/propane isotopes in the presence of very high concentrations of methane. The system can also support the measurement of both natural abundance samples and artificially enriched isotope abundance samples used in tracer analysis, thanks to the seamless automated gain switching.



## System control electronics

The system's modular electronics design ensures a highly stable 5 kV power supply to the ionization source for long term peak-center stability. **lyticOS** Software Suite provides full automated system control – with a choice of automatic or manual ion source tuning – using in-depth readbacks to provide a detailed on-board diagnostics and a comprehensive understanding of instrument behavior, helping to detect and correct potential faults before they happen. The system also offers optional automatic firmware updates, ensuring that all systems are working with the latest firmware version from our development team.



## Electromagnet

Ion beam separation is achieved using a highly stable, computer-controlled, stigmatically-focussed electromagnet, without the need for a Hall probe or water cooling. This ensures consistently reliable peak jumps with excellent peak centering and stability, allowing sequential analysis of NCHS isotopes from a single sample using our patented technique. For greater robustness, the electromagnet of each **isoprime precisION** instrument is fixed at the factory, making the instrument more reliable.



## Ionization source

The self-tensioning design of our latest generation electron impact (EI) source has 27 % fewer components than the previous version, simplifying maintenance and repair. Located directly over the turbomolecular pump for fast removal of non-ionized gases, this set-up ensures very low residence times through the source, resulting in minimal doubly ionized gas molecules. As a result, it offers excellent ionization efficiency and dependable performance over a broad range of gas loads, with an extremely stable H<sub>3</sub><sup>+</sup> correction factor of ≤8.0 ppm/nA and no memory effect when transitioning between isotopically distinct gases. The system also features a self-aligning filament with a unique thorium coating, extending filament lifetime and increasing maintenance intervals.



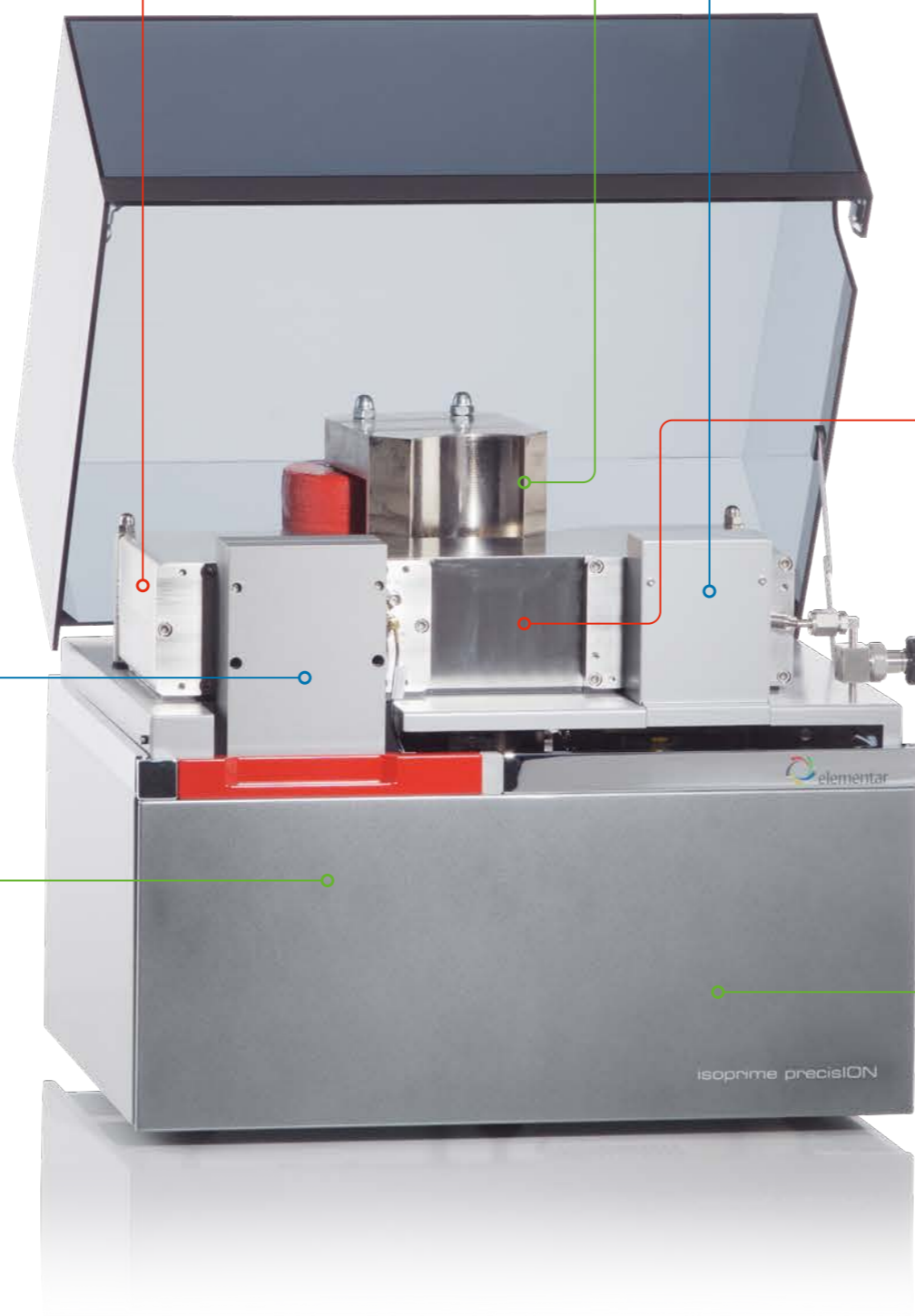
## Vacuum performance

Unlike other instruments, the analyzer is constructed entirely from stainless steel using non-metallic gaskets. This unique design ensures a high vacuum conductance for efficient removal of gas – requiring only a single Edwards nEXT24-0D turbomolecular pump to achieve fast pump down within 12 hours (without bakeout) – helping to reduce both system and maintenance costs, as well as instrument downtime. The resulting low intrinsic water background is especially important for good isotope analysis, since it reduces the risk of carbonic/sulfuric acid formation due to protonation, protecting the ion source and minimizing the risk of isotope fractionation. The system also features an automatic vacuum isolation valve to protect the ion optics in the event of a power failure.



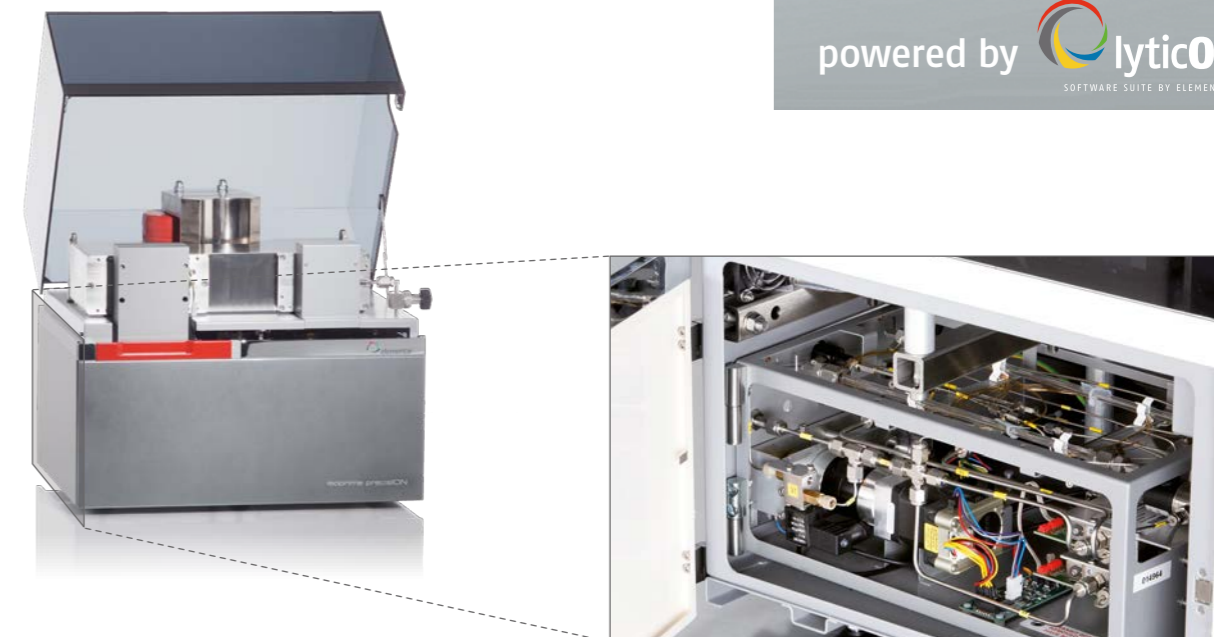
## Compact geometry

The **isoprime precisION**'s compact, horizontal analyzer configuration combines benchtop convenience and high performance, using a 90° stigmatic focusing magnetic sector and 108 mm of mass dispersion. This provides a unit mass resolution of 110 (10 % valley definition), allowing isotope measurements of masses up to 96 amu. The horizontal arrangement also simplifies access to the ion source and Faraday detectors, for easier maintenance and less downtime.



## Fully integrated CF gas handling system

**centrION** is the interface between **isoprime precisION** and the rest of the world. This continuous flow (CF) interface system offers completely automated, intelligent control of sample, carrier and monitoring gases to maximize measurement flexibility. It streamlines experimental workflows by providing fully automated system testing and optimization using pure monitoring gases, and offering seamless, software-controlled switching between all connected CF inlet systems.



It is fully integrated into the **isoprime precisION** system, reducing space requirements and protecting delicate components while still allowing easy access for maintenance.



### Automated dilutions

Natural variations in elemental abundance make it necessary to dilute samples to allow analysis of high and low abundance isotopes in a run. **centrION** can automatically and variably dilute sample gases with helium, offering a large dynamic range without causing isotopic fractionation.



### Rapid inlet switching

**centrION** enables users to rapidly and seamlessly switch between peripheral inlet systems, allowing up to five devices – including any combination of elemental analysis (EA), total organic carbon analysis (TOC), liquid chromatography (LC), gas chromatography (GC), and gas and headspace analysis systems – to be connected at one time. Inlet switching is performed automatically and controlled by **lyticOS**, without the need for reconfiguration of the hardware or software.

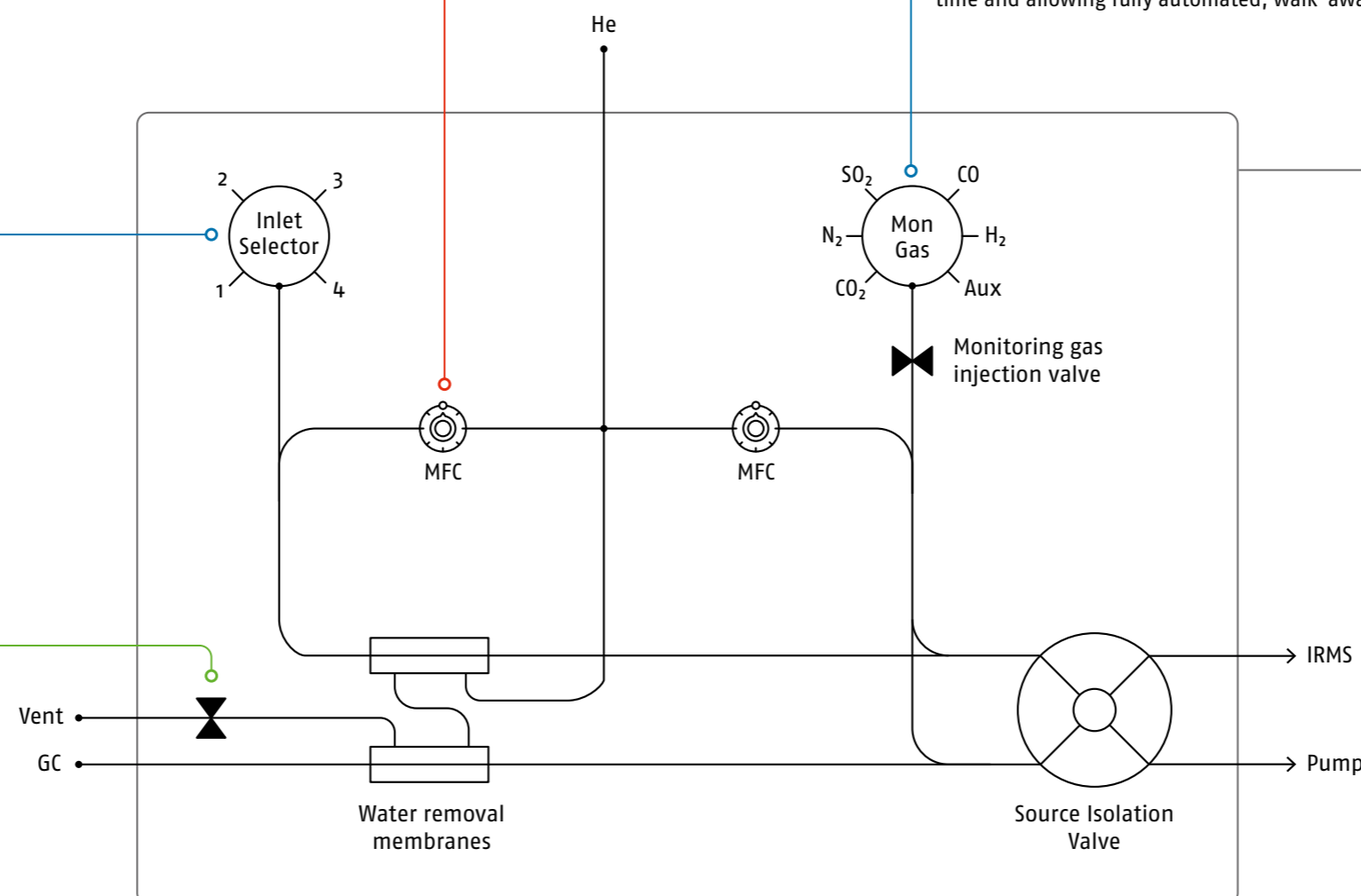


### Sleep mode

**lyticOS**'s Sleep/Wake-up function significantly reduces the consumption of precious laboratory resources, such as helium gas and electricity. The instrument can be programmed to wake up and perform Good For Go routines at a pre-defined time, ensuring that it is ready to run as soon as the operator arrives in the laboratory.

### Choice of monitoring gases

Up to six monitoring gases can also be connected to the system at any time. For most experiments, this eliminates the need to replumb the system to support different isotope modes, saving time and allowing fully automated, walk-away analysis.



### centrION KEY FEATURES

- Automatic switching for up to five CF inlet systems
- Automatic selection of up to six monitoring gases
- Sleep/Wake-up function reduces carrier helium usage by up to 85%
- Complete digital control and readbacks for all flow rates and pressures
- High precision digital mass flow controllers
- Safety vent for toxic gases, such as CO and SO<sub>2</sub>
- No requirement for additional heated lines for SO<sub>2</sub> analysis
- No requirement for compressed air
- Fully enclosed within the **isoprime precisION** chassis
- Internalized connections – no exposed fused silica capillaries
- Selective water removal membranes
- Automatic dilution of sample gases

# Advanced quality control

## Standardize analytical protocols and data processing

**isoprime precis10N** and **lyticOS** Software Suite have been developed to work in harmony to simplify day-to-day stable isotope analysis activities. The software includes a number of workflow-oriented features that accelerate routine tasks and help you get the most out of your system.

### User access and permissions

**lyticOS** offers built-in, fully customizable user access and permissions functions to provide comprehensive process security. Password protected instrument access and auto-lock time out features ensure only authorized users can operate the system, and administrators can freely define exactly which settings or features can be accessed or adjusted by each user, either individually or by user group. This prevents methods and standards being edited between users, and ensures that SOPs are adhered to, helping to provide consistent, reliable data.

### Quick Tasks

Quick Tasks allows pre-defined templates containing one or more tasks that can be run at the push of a button, accelerating instrument programming for frequently performed operations. **lyticOS** offers a number of pre-configured Quick Tasks – such as running peak centers for N<sub>2</sub>, CO<sub>2</sub> and SO<sub>2</sub> gases as a single operation – or users can set up custom Quick Tasks for their SOPs. Users can also choose to schedule a Quick Task to run at a defined date/time.

### Logs

The software records the information associated with every action, providing a comprehensive audit trail and simplifying troubleshooting. The System monitor log includes data of all system parameters before analysis, helping to track baseline instrument performance over time. This makes it easy to check when a test was last

performed, and its success, as well as allowing the system to pause analysis if a critical parameter goes out of tolerance. These logs can be easily archived or exported for internal review in a custom-definable format, and can also be sent to Elementar engineers to aid diagnosis and resolution of technical issues. The audit log provides a comprehensive record of all analytical activities, assigning each task a unique ID. This ensures full traceability of the parameters and methods used, which operator performed each task, and any post-analytical changes to the records, for complete peace of mind.

### Notifications

A colored LED status light on the front of the instrument provides at-a-glance warnings if user attention is required, and the system can be programmed to provide email notifications for status alerts – such as completed runs or faults requiring user attention – allowing walk-away operation with complete confidence.

### Sample loss prevention

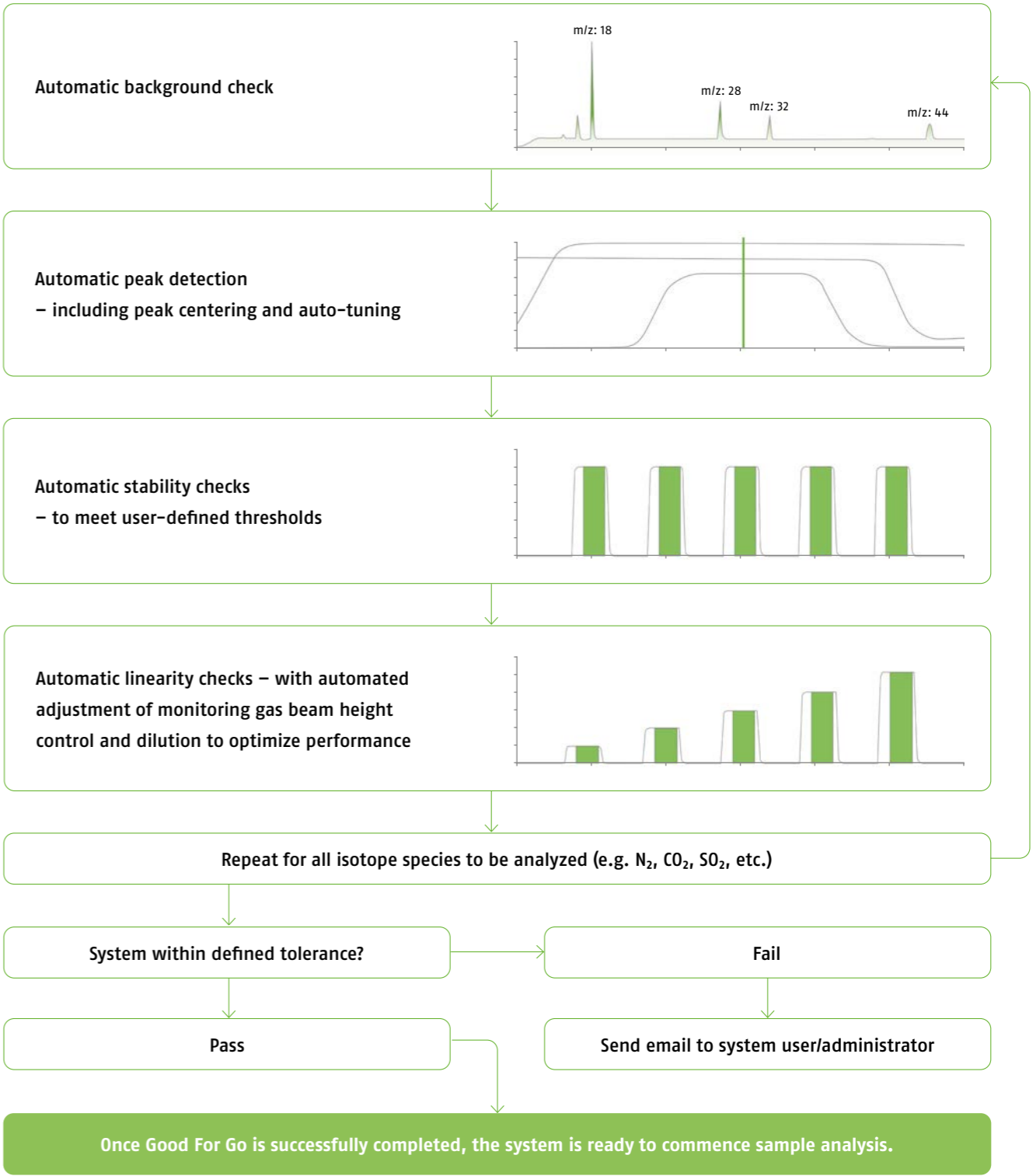
A number of intelligent checks have been built into **lyticOS** to minimize the risk of precious samples being lost. The system continuously analyzes the data in real-time to ensure that monitoring gas peaks exist, that the expected number of sample peaks are detected and that a particular ion beam does not exceed a pre-defined threshold. The user can also define the number of failures before the task list is paused, or prevent a task from starting if a system status error is detected.



Good For Go

**isoprime precis10N**'s unique Good For Go functionality enables complete automation of peak tuning, stability and linearity checks for multiple gases, saving user time and ensuring optimal instrument performance. Automation of these activities simplifies user training and ensures compliance with SOPs.

### GOOD FOR GO PROCESS



# Stable isotope portfolio

## Ultimate flexibility for stable isotope analysis

**isoprime precisION** can be combined with a broad portfolio of peripheral inlet systems. Designed specifically for stable isotope analysis, these devices offer exceptional sample handling while eliminating isotope fractionation. Complete control and automation of both the inlet system and IRMS by lyticOS allows walk-away sample processing, ensuring dynamic and flexible stable isotope analysis to match your workflow.

## Elemental analysis



### vario ISOTOPE select

- Entry-level elemental analyzer for  $^{15}\text{N}$ ,  $^{13}\text{C}$  and  $^{34}\text{S}$  analysis of organic material
- Uses a single temperature-programmable desorption (TPD) separation column
- Reliable results for sample sizes up to 7 mg (abs) carbon
- Patented ball valve for blank-free sample transfer
- Integrated autosampler with options for up to 240 sample positions
- 10-year guarantee on the high-temperature combustion furnace and the thermal conductivity detector cell of the thermal conductivity detector (TCD)
- Sleep/Wake-up function to reduce gas consumption
- Example sample types: *plant/tree material, fruits and vegetables, meat, honey, keratin, muscle, collagen, microorganisms, crude oils*

### vario ISOTOPE cube

- Industry-leading accuracy and precision thanks to Advanced Purge and Trap technology
- Capable of analyzing materials with a C:S ratio of >5,000:1
- Excellent analysis of large sample sizes up to 20 mg (abs) carbon
- Reliable results, even for low-microgram samples
- Patented ball valve for blank-free sample transfer
- Patented ability to measure  $^{15}\text{N}$ ,  $^{13}\text{C}$ ,  $^{34}\text{S}$  and  $^2\text{H}$  from a single sample
- Low temperature pyrolysis options with unique backflush technology for  $^{18}\text{O}$  analysis
- 10-year guarantee on the high-temperature combustion furnace and the thermal conductivity detector cell of the thermal conductivity detector (TCD)
- Sleep/Wake-up function to reduce gas consumption
- Example sample types: *plant/tree material, soils and sediments, clays, fruits and vegetables, meat, honey, keratin, muscle, collagen, microorganisms, crude oils, glass fiber filters*



## Elemental analysis continued...



### vario PYRO cube®

- Industry-leading accuracy and precision thanks to Advanced Purge and Trap technology
- Furnace temperatures up to 1,450 °C, allowing both OH and CNS isotope ratio analysis
- Matrix-independent, reliable results thanks to patented backflush technology, with exceptional separation of  $\text{N}_2$  and  $\text{CO}$
- Capable of analyzing materials with a C:S ratio of >5,000:1
- Patented ball valve for blank-free sample transfer
- Sleep/Wake-up function to reduce gas consumption
- Isolated sheath helium flow in pyrolysis mode for blank-free  $^{18}\text{O}$  analysis
- Example sample types: *plant/tree material, fruits and vegetables, meat, honey, keratin, muscle, collagen, sulfate minerals, biogenic silicates, phosphates, apatite, nitrate salts*



### iso TOC® cube

- Only truly integrated TOC-IRMS system for analysis of dissolved organics
- Eliminates the need for sample extraction and purification
- High temperature combustion of recalcitrant compounds yields 100 % C and N recovery
- Exceptional dissolved organic carbon and bound nitrogen isotope analysis
- Up to 3 ml liquid injection volumes with 32 position autosampler
- Example sample types: *ground water, plant water, waste water, body fluids, beverages*

## Chromatography



### GC5

- Online measurement of  $^{13}\text{C}$ ,  $^{15}\text{N}$ ,  $^2\text{H}$  and  $^{18}\text{O}$  in compounds separated by GC
- Agilent 8890 GC with split/splitless, PTV or on-column injectors
- High temperature  $^2\text{H}$  pyrolysis of compounds at 1,450 °C
- Optimized to maintain chromatography integrity
- $\text{O}_2$  furnace recharge gives long term analytical robustness in  $^{13}\text{C}$  mode
- Compatible with Gerstel® and CTC autosamplers for SPME/HS analysis
- Hyphenation with GC-QMS, GC-QQQMS and GC-TOFMS systems possible
- Example sample types: *urinary steroids, fatty acids, oil fractions, natural gases, alkanes, biomarkers, lipids, amino acids, aromas and fragrances, VOCs, PAHs, POPs*

## Chromatography continued...



### LiquiFace

- Liquid chromatography interface for  $^{13}\text{C}$  measurements
- Fractionation-free wet chemical oxidation at 90 °C
- Direct injection mode for bulk isotope measurements
- Excellent chromatography performance
- Automatic chemical reagent delivery using on-board peristaltic pump
- Highly robust analysis thanks to thorium-coated IRMS ionization filament
- Example sample types: *honey, wines and spirits, fruit juices, amino acids, carbohydrates*

## Gas and headspace



### iso FLOW

- Headspace analyzer for a broad range of sample matrices
- UltiTrap technology provides dynamic separation of sample gases
- Carrier He flow controlled by a digital high precision MFC
- 180-position heated sample tray with  $\pm 0.1$  °C stability up to 90 °C
- Direct drive pump for precise delivery of acid (optional)
- Analyze  $^2\text{H}$  isotopes in fluids using platinum catalyst
- Example sample types: *ground water, sea water, body fluids, fruit juices, wines and spirits, carbonates and DICs*



### iso FLOW GHG

- Cryogenic pre-concentration system for analysis of atmospheric concentrations of  $\text{CO}_2$ ,  $\text{N}_2\text{O}$  and  $\text{CH}_4$  greenhouse gases
- Perform high-sensitivity analysis of nitrate via 'bacterial denitrification' technique
- Optional 1,500 °C furnace for  $^{13}\text{C}$  analysis of  $\text{CH}_4$
- Optional autosampler for analyzing up to 220 x 12 ml or 70 x 20 ml sample vials
- Optional manual injection port
- Example sample types: *greenhouse gases, dissolved nitrates*

## Dual Inlet

### iso DUAL INLET

- High precision pure gas analyzer
- The only dual inlet instrument capable of extremely high precision measurements of carbonate and water samples
- Micro-volume cryogenic cold-finger makes analysis of very small (5  $\mu\text{g}$ ) carbonate samples possible
- The world's highest precision  $^{18}\text{O}$  analysis of water samples
- Switch between water and carbonate analysis with only a change of sample needle
- Extremely compact benchtop system
- Example sample types: *pure gases, biological and geological carbonate materials, body fluids, ice cores, ground waters*



## Software



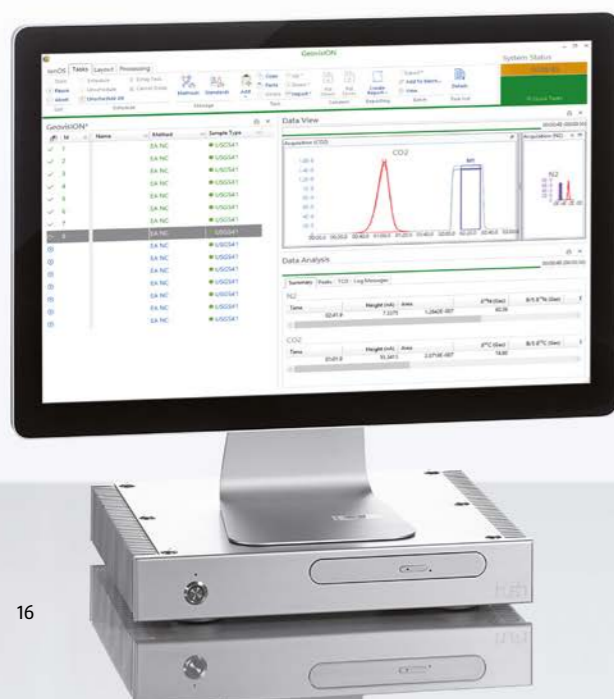
*The most advanced stable isotope software ever created*

## *Unrivalled intelligent control of your IRMS*

**lyticOS** Software Suite has been developed extensively for stable isotope analysis, offering a range of advanced features to support the IRMS community. Designed to work in concert with our range of IRMS instruments and inlets, it offers complete control, method development and data processing, simplifying day-to-day activities and streamlining laboratory workflows.

**lyticOS** is designed to be simple to use, with an intuitive user interface. Its clear iconography and structure offers a wide range of powerful features to match the everyday needs of IRMS users. Intelligent automation – from pre-run instrument checks to data processing – ensures optimal results while minimizing the need for user intervention. This helps to standardize analytical protocols and data processing, providing greater insights from every experiment.

## *Unlock the power of your IRMS with **lyticOS** Software Suite*



## *Fast and robust data processing for even the most complex samples*

**lyticOS** Software Suite offers an array of powerful features designed to save time when processing large IRMS data sets. It offers complete automation of laborious manual tasks using functions such as peak mapping, standard compound identification and multi-point, multi-isotope calibration, performing all the necessary calculations transparently and robustly to simplify analyses and eliminate errors.

Crucially, **lyticOS**'s advanced analytical capabilities are not limited to real-time data generated on Elementar IRMS systems. It can also be used to simplify processing of data generated on third party IRMS platforms, providing a consistent and flexible approach to data handling. Combined with the software's advanced instant search functionality, this gives you the ability to quickly and easily find and manage all your stable isotope analysis data directly within **lyticOS**.

### KEY FEATURES

- Built especially for stable isotope analysis
- Modern, clean design with simple user interface using a ribbon tool bar
- Clear and simple iconography and structure, with at-a-glance instrument status
- Method Workflow Designer graphical user interface
- Quick Tasks for routine and regular workflows
- Multi-point, multi-isotope calibration of raw data to international reference scales
- Peak maps for quick compound identification and peak refinements across multiple sample injections
- Instant search function makes finding data quick and easy
- Real-time and fast data processing using multi-core parallel processing
- Calculated Columns enabling custom calculations to be applied to the entire batch
- Flexible and powerful peak detection and integration algorithms
- Third party IRMS data processing
- No external spreadsheet software required, ensuring a robust audit trail
- Sample Loss Prevention protects valuable samples from being lost due to error
- System Data Log keeps a record of instrument performance
- Windows® 10, 64-bit compatible
- Automatic software updates
- Integration with **ArDB** software
- Administrator and user access levels with password protection
- Multiple languages supported

Simplifying stable isotope analysis workflows

lyticOS Software Suite has been designed to provide an intuitive interface for IRMS workflows. It allows users to quickly and easily set-up stable isotope analysis experiments, import and export data, and interpret results.

"I'm very impressed by **lyticOS** Software Suite, especially the calibrations part. It's basically doing what I always wanted other software to do, but it never seemed to work or wasn't clear enough. This applies to a lot of chromatography quantifying packages I've used."

Dave Hughes, Lancaster Environment Centre, Lancaster University, United Kingdom

Task-based workflow

Every action that the **isoprime precision** performs is programmed and scheduled via **lyticOS**'s Task List. Tasks can be either individually created, copied from existing workflows or selected from a list of pre-defined 'Quick Tasks', then instantly added to the Task List, providing a clear, at-a-glance status for each action.

Intuitive workflow design

The Method Workflow Designer makes it easy to create and maintain methods visually, without the need for specialist programming skills. It avoids the use of complex programming languages, using a straightforward drag

and drop approach with sample-by-sample method customization and easily defined process logic to build and edit methods.

Logical methods

**lyticOS** offers logic-based decision making within your methods. When developing new workflows, users can choose any combination of time-based and event-driven methods to provide more flexible sample handling. This allows the system to automatically change its acquisition behavior based on either input parameters or the real-time status of a device.

Importing and exporting data

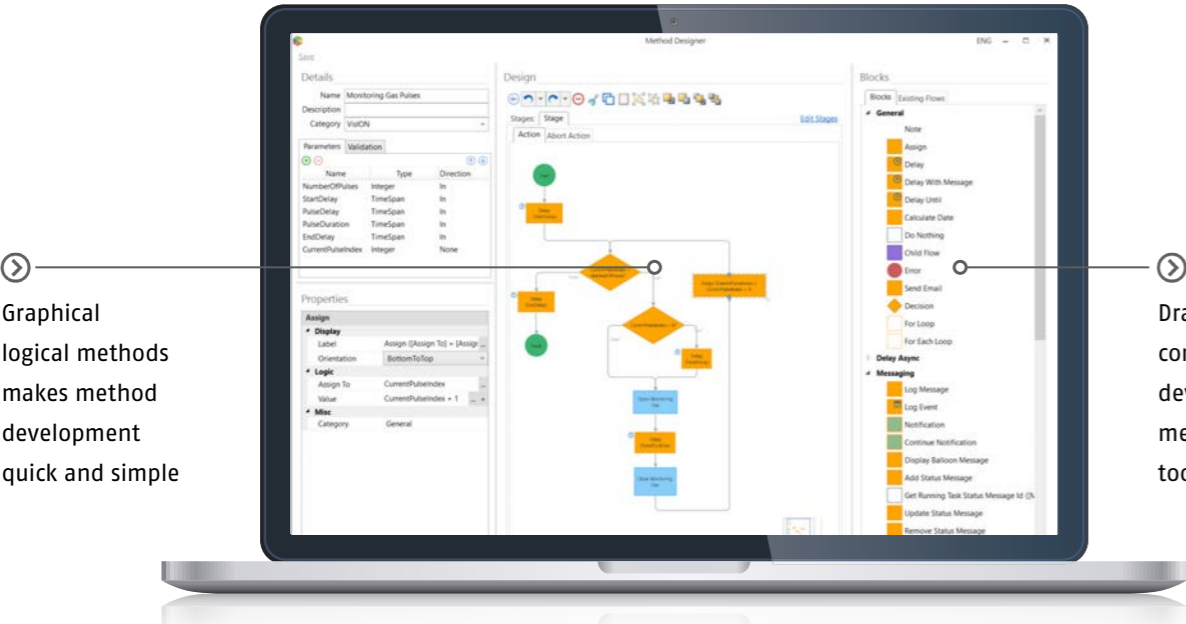
**lyticOS** employs a user-friendly .IArc file format to simplify archiving, transfer and sharing of data. .IArc files can be shared with clients, collaborators or students using the **lyticOS** Data Viewer enabling them to view processed sample data alongside interactive peak displays but without editing the results. You can also easily import IonVantage or ionOS data from older instruments, or data from other manufacturer's stable isotope instrumentation. **lyticOS** can also be integrated into your LIMS system to create a seamless laboratory workflow.

Development and support

**lyticOS** is continually updated with new and improved features, with automatic updates to ensure you have access to the latest innovations. If your instrument is not connected to the internet, software updates are available from our website: <https://secure.elementar.com>.

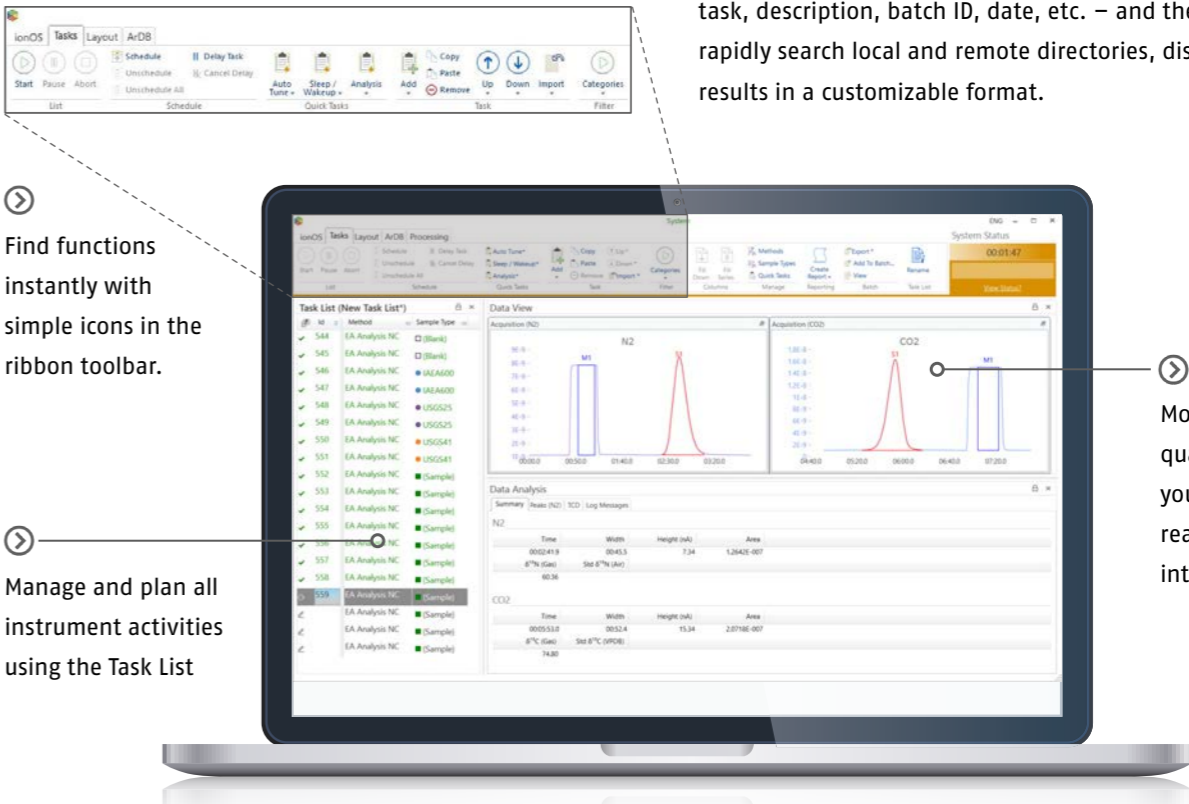
Search

You can quickly and easily find samples, batches and tasks directly from the home screen. Simply start typing search terms – such as the sample name, sample type, method, task, description, batch ID, date, etc. – and the system will rapidly search local and remote directories, displaying the results in a customizable format.



Graphical logical methods makes method development quick and simple

Drag and drop common controls, devices and sub-methods from the toolbox



Find functions instantly with simple icons in the ribbon toolbar.

Manage and plan all instrument activities using the Task List

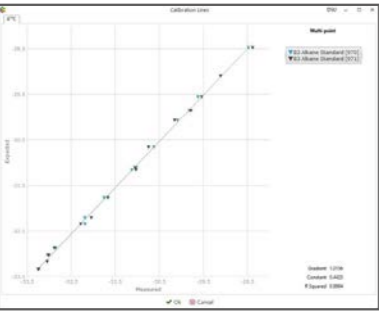
Monitor data quality throughout your analysis with real-time data integration

Fast and robust data processing for the most complex samples

lyticOS Software Suite has been developed extensively for stable isotope analysis workflows, providing a range of advanced features to streamline and automate IRMS data processing – regardless of the IRMS system used for acquisition. It is capable of handling large data sets, offering faster, more robust processing to save time and effort. The software uses customizable wizards and sophisticated algorithms to provide fully automated, comprehensive and transparent processing of complex data sets, ensuring consistent analysis and providing greater insight into your experimental data.

“Our lab runs whole crude oils with hundreds of peaks, of which only a select number are of interest. Peak mapping makes selecting only those peaks across large data sets a quick and easy process, saving us a huge amount of time and effort. Even when there is a change in retention time **lyticOS** can determine where the peaks of interest have shifted to.”

Craig Barrie, Oil Isotope Lab, GeoMark Research, USA



Isotope calibration

lyticOS goes further than any other stable isotope software, providing automated multi-elemental, multi-point isotope calibration of raw data for immediate interpretation of results, without needing to export your data to a separate spreadsheet. Calibrations are based on a custom-defined library of isotopic standards, using transparent calculation procedures and visualizations to show each data point relative to a multi-point calibration curve.

Calculated columns

lyticOS's Calculated Columns feature supports any number of complex scenarios – including inter-sample calculations and aggregation. It allows standard and custom calculations, such as calculating the  $\delta$ -difference between two compounds, to be performed and applied to entire batches automatically.

Sample grouping

For batch processing, lyticOS can automatically organize results by sample type, name or ID, or according to user-defined groupings, allowing easy calculation of summary information, such as averages and standard deviations. Toggling the view between grouped data and acquisition order lets you quickly assess the performance of all standards throughout a sequence.

Reporting

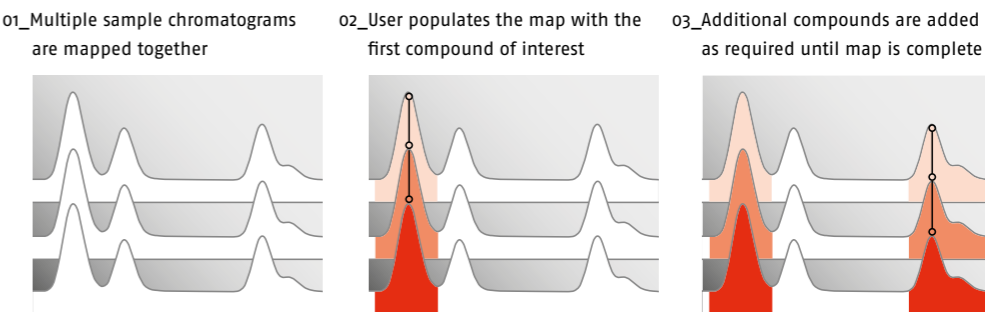
The software offers straightforward generation of customized reports – in XLSX or PDF formats – according to your specific requirements. All of lyticOS's advanced data processing features display the relevant results in a batch results grid, which also functions as a report designer.

Peak Maps

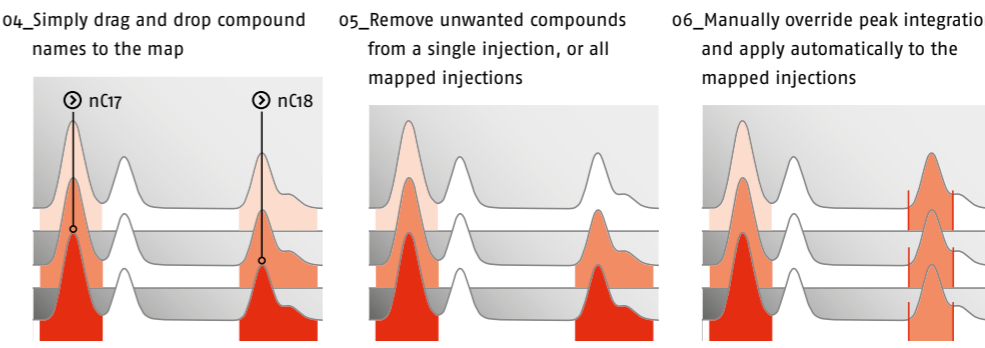
The unique Peak Maps feature can instantly rationalize individual compounds across multiple injections for GC-IRMS data processing. This ensures that each compound is reported consistently across all injections, accounting for potential minor variations in retention time and potentially saving users hours of manual post-analysis processing time.



Map



Refine



Interpret

Now that you have mapped your chromatograms you can get on with interpreting your results quicker and faster to discover the hidden information in your samples. Set up bespoke calculations with Compound-To-Compound reporting for even simpler interpretation of intra-compound variability.

Report

When you are happy with your data, you can then report your data to your favourite software package, or utilize the lyticOS .IARC functionality to send your final results to customers and colleagues using the free lyticOS Data Viewer.

*Make your database work for you*

**ArDB** is a combined database management tool and analytics platform that can be optionally used alongside **isoprime precision** and **lyticOS** Software Suite to construct, maintain and manage a centralized database of analytical results – regardless of the analytical technique. Designed to handle the large quantities of data generated by modern high throughput technologies, **ArDB** simplifies data processing workflows, making it easier to discover the story behind your results.

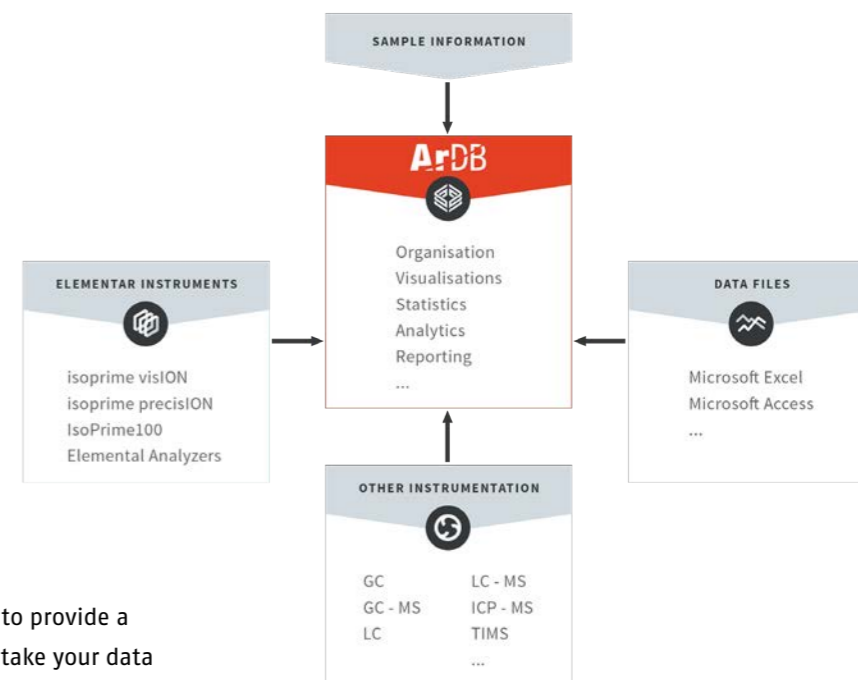
Results are recorded and organized together with all associated meta data, allowing simple, fast interrogation of the database. Powerful data visualization capabilities make discovering trends and relationships within datasets straightforward, while integrated multi-variate analysis tools enable analytical results to be statistically reduced for easier interpretation.

➤ Instantly perform multivariate analysis to find similarities between unknown samples and your known populated database



## Effortless database management

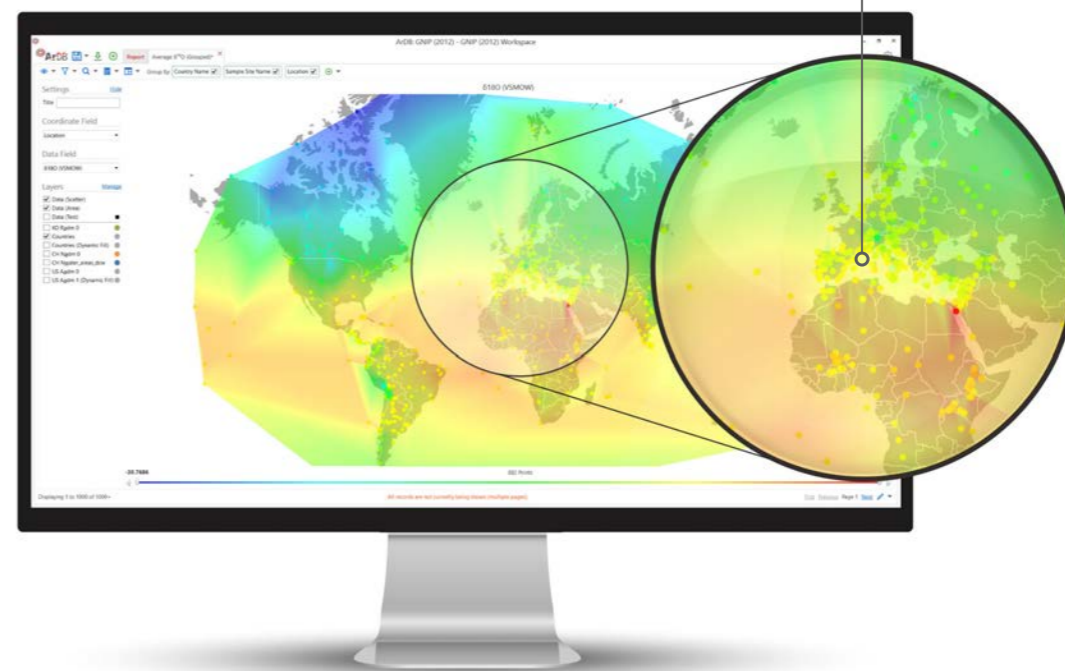
**ArDB** has been designed for flexible integration into your laboratory workflow, allowing seamless transfer of sample information and results between the database and your instruments. Bringing together sample results for numerous analytical techniques – IRMS, ICP-MS, TIMS, etc. – it eliminates transcription errors, duplication and inconsistent data handling.



## Advanced data analytics

**ArDB** goes beyond database management to provide a comprehensive suite of analytical tools to take your data further. These tools provide a straightforward, standardized approach to data analysis, ensuring reproducible analytics across your experiments and organization.

➤ Plot your data on a map to look for spatial variation and use the time step to find temporal variation



# Novel Inlet Control Module

Allowing you to take your research further



*"We needed to build something that was not available commercially, so we decided to use NICM. It was a very welcome surprise how simple and flexible **lyticOS**, **isoprime precisIION** and the NICM are to use. It was very simple to implement the control of several multiport valves within a method, and to develop a nice interface dashboard. With this system, we will be able to truly push the boundaries of our novel research, and look forward to opening up new opportunities."*

Peter Nyfeler, Climate and Environmental Physics, University of Bern, Switzerland

The Novel Inlet Control Module (NICM) is an optional hardware device offering a revolutionary approach to interfacing custom experimental set-ups with **isoprime precisIION**. It provides customizable input/output ports allowing you to control multiple novel inlet devices through **lyticOS**.

### A world of potential

Your research goals should not be limited by hardware, so **NICM** is designed to support a broad range of different input and output types. This makes it possible to integrate a variety of components required for custom experimental set-ups. **lyticOS** can even control multiple NICM boxes simultaneously, allowing you to run experiments that require more devices than it is possible to operate with a single **NICM box**, so there are no limits to the amount of control available.

### Straightforward user control

**lyticOS** provides all the development tools needed to create a full control solution for your custom inlet, without the need for specialist knowledge or programming skills. The intuitive software allows you to bring together all the different inputs and outputs for your devices into customizable dashboards.

### Developing methods

**lyticOS** method workflows offer intelligent, parameter-based control of your novel inlet, making it easy to manage interactions between the various inputs and outputs in real time. Each interactive method workflow can be easily configured to exactly match your process requirements, and provides live system data, such as numerical readbacks, gauges or charts. This allows you to switch devices on or off as required, or create logic-based processes – for example, setting the state of a custom valve based on a thermocouple input – editing system operation in real time.

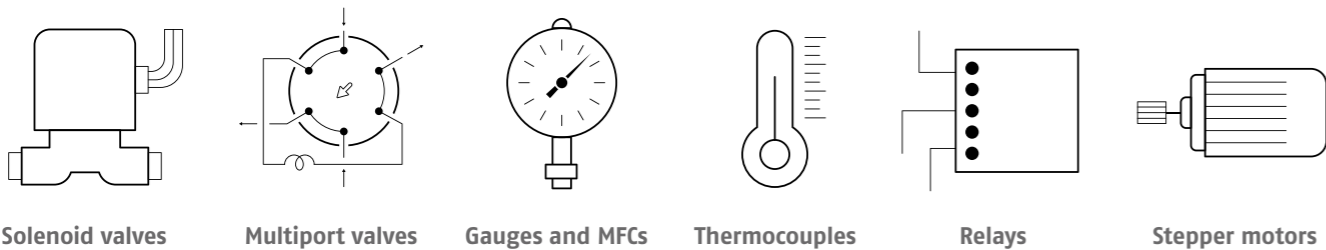
### Method Recorder

A recorded method provides a great starting point for creating a fully functional and optimized method workflow. Creating a recorded method is quick and easy; simply record your interactions with a schematic or dashboard. Once you have established a basic recorded method, you can focus on the more complicated requirements of your custom inlet and experimental workflow, developing further customizations.

### Application Programming Interface (API)

**lyticOS** provides an API that enables the task list to be controlled remotely. This allows, for example, tasklists generated in your LIMS to be imported directly into **lyticOS**, or integration of your Elementar devices into a larger laboratory ecosystem.

- Add additional sample loops and gas flows to an existing inlet system
- Develop a laser ablation system for tree rings or mineral cross-sections
- Build your own carbonate digestion system for "clumped isotopes"
- Automate control of an offline preparation system



24x 24 V digital outputs

3x relays

4x analog inputs

Power and USB (powered by lyticOS)



4x 5 V digital outputs  
(CMOS/TTL compatible)

16x digital inputs

6x thermocouple inputs  
(K-, R- and S-type)

Critical specifications

Design	<div><ul style="list-style-type: none"><li>Fully enclosed, highly compact benchtop instrument with horizontally aligned stainless steel vacuum chamber</li><li>Integrated Continuous Flow Interface System (<b>centrION</b>)</li><li>Complete automated control of every parameter from <b>lyticOS</b> Software Suite</li></ul></div>
Dimensions	Width: 595 mm Depth: 460 mm Height: 650 mm
Weight	102 kg
Ion beam acceleration	0 – 5 kV
Ion source efficiency	Dual inlet (DI) mode: 800 molecules CO <sub>2</sub> /ion Continuous flow (CF) mode: 1,100 molecules CO <sub>2</sub> /ion
H <sub>3</sub> <sup>+</sup> correction factor	≤ 8.0 ppm/nA
Radius	108 mm
Resolution	Greater than 110 m/Δm @ 10 % valley separation
Max. measurable single mass	96 amu
Mass range @ 3kV	1 – 76 amu
Dynamic amplifier range	0 – 100 V
Simultaneous acquisition	Up to 10 ion beams across a mass range of ±25 % at any one time

Standard detector configuration

Gas species	Masses	Isotopes	Ratio
CO <sub>2</sub>	44, 45, 46	<sup>13</sup> C	45/44
		<sup>18</sup> O	46/44
CO	28, 29, 30	<sup>18</sup> O	30/28
N <sub>2</sub>	28, 29	<sup>15</sup> N	29/28
N <sub>2</sub> O	44, 45, 46	<sup>15</sup> N	45/44
		<sup>18</sup> O	46/44
O <sub>2</sub>	32, 33, 34	<sup>17</sup> O	33/32
		<sup>18</sup> O	34/32
SO	48, 49, 50	<sup>33</sup> S	49/48
		<sup>34</sup> S	50/48
SO <sub>2</sub>	64, 66	<sup>34</sup> S	64/66
H <sub>2</sub>	2, 3	<sup>2</sup> H	3/2

Optional detector configurations

Gas species	Masses	Isotopes	Ratio
ClCH <sub>3</sub>	50, 52	<sup>37</sup> Cl	52/50
BrCH <sub>3</sub>	94, 96	<sup>81</sup> Br	96/94
CO <sub>2</sub>	44, 45, 46, 47, 48, 49	D <sup>47</sup>	29/28
N <sub>2</sub> O	30, 31, 44, 45, 46	<sup>15</sup> N <sub>α</sub> , <sup>15</sup> N <sub>β</sub>	31/30
		<sup>15</sup> N <sub>bulk</sub>	45/44
		<sup>18</sup> O	46/44
SO <sub>2</sub>	48, 49, 50, 64, 66	<sup>33</sup> S	49/48
		<sup>34</sup> S	50/48
		<sup>34</sup> S	64/66
Air	28, 29, 30, 32, 34, 36, 40, 44, 45, 46*	–	40/28
			32/28
			44/28

\*Other configurations possible. Consult your Elementar representative for more details.

Continuous Flow monitoring gas performance

Gas species	Isotope	Internal Precision	Isotope ratio linearity
		1σ (‰)	‰/nA
CO <sub>2</sub>	<sup>13</sup> C	≤ 0.06	≤ 0.02
	<sup>18</sup> O	≤ 0.06	≤ 0.04
N <sub>2</sub>	<sup>15</sup> N	≤ 0.06	≤ 0.02
CO	<sup>18</sup> O	≤ 0.10	≤ 0.04
SO <sub>2</sub>	<sup>34</sup> S	≤ 0.10	≤ 0.04
H <sub>2</sub>	<sup>2</sup> H	≤ 0.20	n/a

Dual Inlet internal precision performance

Gas	Isotope	Sample Size	Internal Precision
		bar μL	2σ (‰)
CO <sub>2</sub>	δ <sup>13</sup> C	100	≤ 0.010
	δ <sup>18</sup> O		≤ 0.016
CO <sub>2</sub>	δ <sup>13</sup> C	> 1	≤ 0.020
	δ <sup>18</sup> O	using cold finger	≤ 0.030
N <sub>2</sub>	δ <sup>15</sup> N	100	≤ 0.010
O <sub>2</sub>	δ <sup>18</sup> O	100	≤ 0.010
H <sub>2</sub>	δH	100	≤ 0.10
SO <sub>2</sub>	δ <sup>34</sup> S	100	≤ 0.010

## LEADERS IN AFTER-SALES SUPPORT AND SERVICE

Elementar combines innovative technologies and user-friendly instruments to benefit a wide range of workflows. Following installation, the company offers extensive instrument validation and qualification services, and provides ongoing support to its customers through technical services, training programs, and cost-effective consumables kits and parts.

Elementar has daughter offices in nine major territories and a comprehensive network of trusted distributors providing sales and service support in other markets. With this support infrastructure, you can depend on Elementar to provide outstanding, rapid technical support and application advice no matter where in the world your instrument is installed.

## QUALITY YOU CAN TRUST

Our consumables and spare parts are designed to meet the highest standards of quality and reliability – certified and validated in accordance with international norms and standards – to guarantee the long lifetime of our instruments.



### Great flexibility

Complete integration of all inlet systems, including novel inlets



### High sensitivity

Analyze the most challenging samples with exceptionally high ion source sensitivity



### Small footprint

Almost 50 % smaller than any other commercial stable isotope ratio mass spectrometer



### High data quality

Achieve the highest analytical performance with the most precise instrument available

### Elementar – your partner for excellent elemental analysis

Elementar is the world leader in high performance analysis of organic and inorganic elements. Continuous innovation, creative solutions and comprehensive support form the foundation of the Elementar brand, ensuring our products continue to advance science across agriculture, chemical, environmental, energy, materials and forensics markets in more than 80 countries.

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