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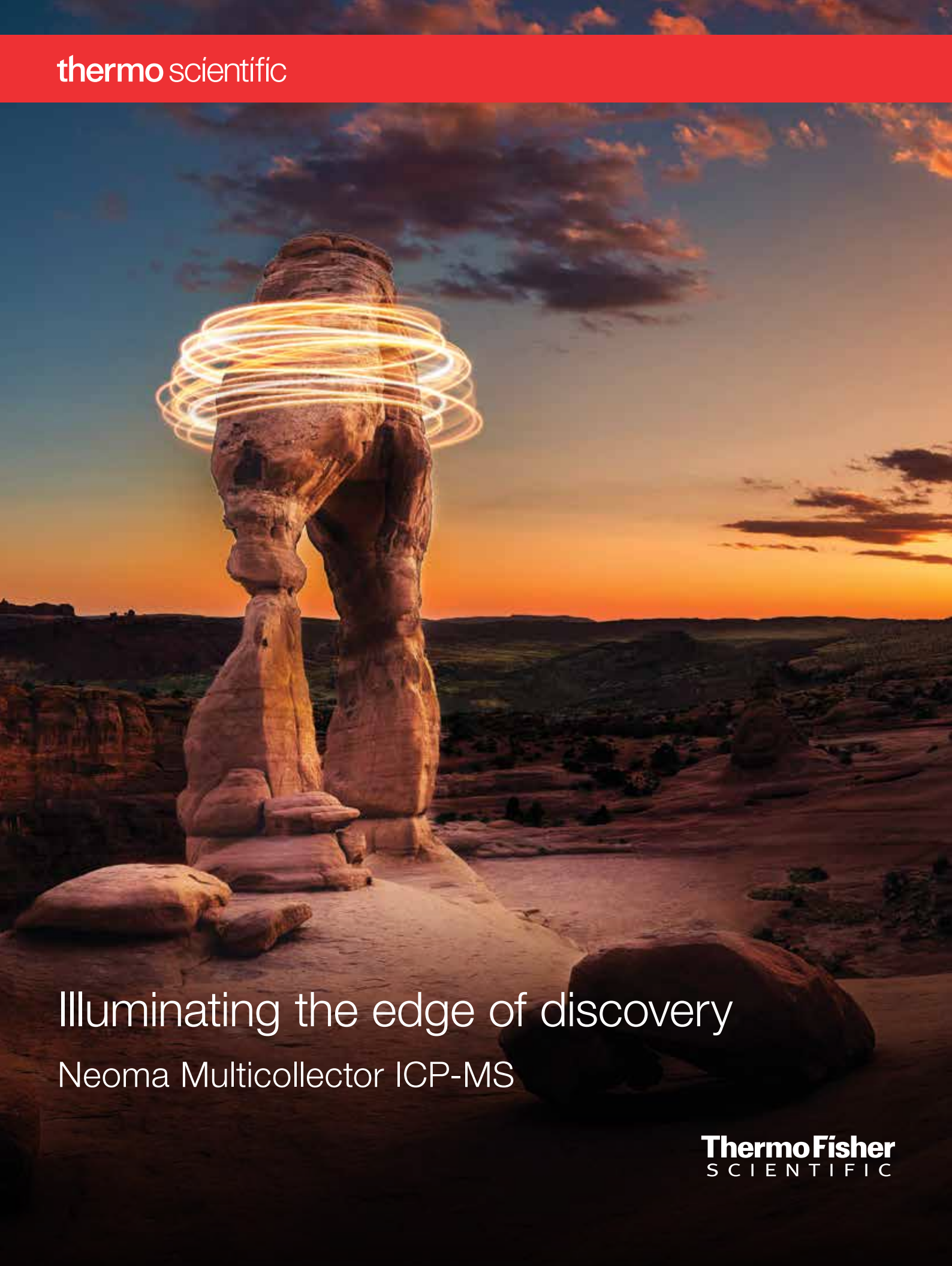


Illuminating the edge of discovery

Neoma Multicollector ICP-MS

ThermoFisher SCIENTIFIC

Illuminating the edge of discovery

Just when you thought it couldn't be done, the Thermo Scientific™ Neoma™ MC-ICP-MS raises the bar. Building on the strength of our multicollector technology, this next generation system delivers all the advantages of high-precision isotope ratio analysis, but none of the limitations.

High precision isotope ratio analysis, simplified

The Neoma MC-ICP-MS delivers on performance with market-leading sensitivity, isotope ratio precision and accuracy.

The latest hardware and software makes the Neoma MC-ICP-MS easier to use than prior generation MC-ICP-MS systems.

An operator-focused software, with integrated first- and third-party peripheral control, streamlines workflows to enhance productivity.

The Neoma MC-ICP-MS enables high throughput for routine applications while retaining the flexibility required for researching new applications.

Neoma Multicollector ICP-MS

Technology that transforms your science

Limit-breaking detector array

- 11 Faraday cup mobile detector array: no limitations
- 24 customizable amplifier slots
- Thermo Scientific™ 10^{13} Ω Amplifier Technology™ with extended dynamic range
- Dynamic measurements with extended dispersion lens optics

Thermo Scientific™ iCAP™ Qnova Series ICP

- Robust, easy assembly quartz ICP torch
- Balanced coil technology for ultimate plasma stability
- Field-proven argon ion source

Thermo Scientific™ Jet Interface™

- Highest sensitivity and stability in wet and dry plasma
- Low maintenance

A modern multicollector platform

- Enhanced resolving power
- Superior vacuum system
- Innovative electronics
- Excellent abundance sensitivity

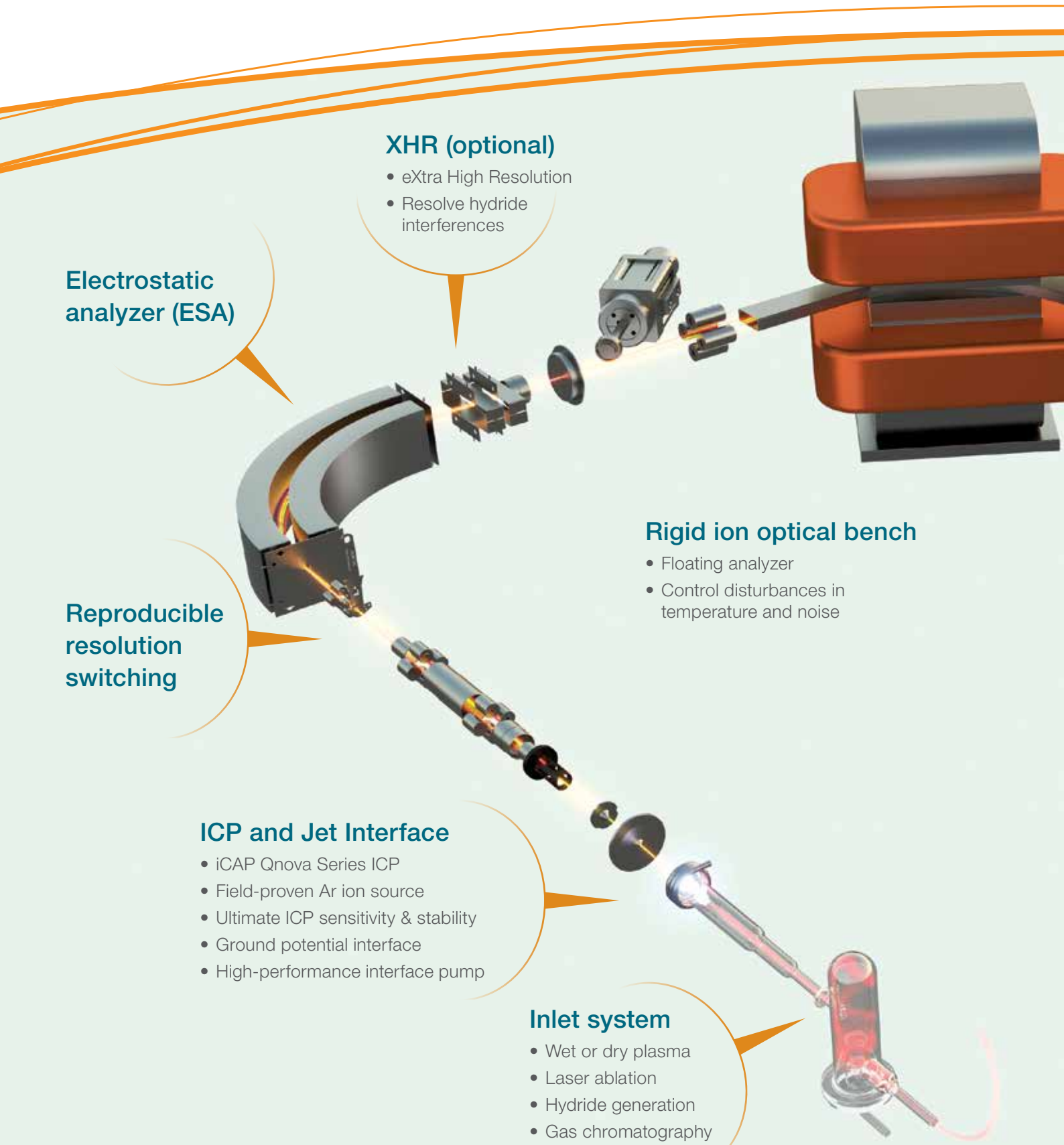
Thermo Scientific™ Qtegra™ ISDS™ Software

- Workflow support and automation for ease of use and productivity
- Comprehensive data evaluation including transient signal analysis
- Integration of peripherals such as desolvating nebulization, laser ablation and chromatography systems

Future upgrade path to a MS/MS collision/reaction cell MC-ICP-MS

Neoma Multicollector ICP-MS

Technology that transforms your science



XHR (optional)

- eXtra High Resolution
- Resolve hydride interferences

Electrostatic analyzer (ESA)

Rigid ion optical bench

- Floating analyzer
- Control disturbances in temperature and noise

Reproducible resolution switching

ICP and Jet Interface

- iCAP Qnova Series ICP
- Field-proven Ar ion source
- Ultimate ICP sensitivity & stability
- Ground potential interface
- High-performance interface pump

Inlet system

- Wet or dry plasma
- Laser ablation
- Hydride generation
- Gas chromatography

Magnetic sector

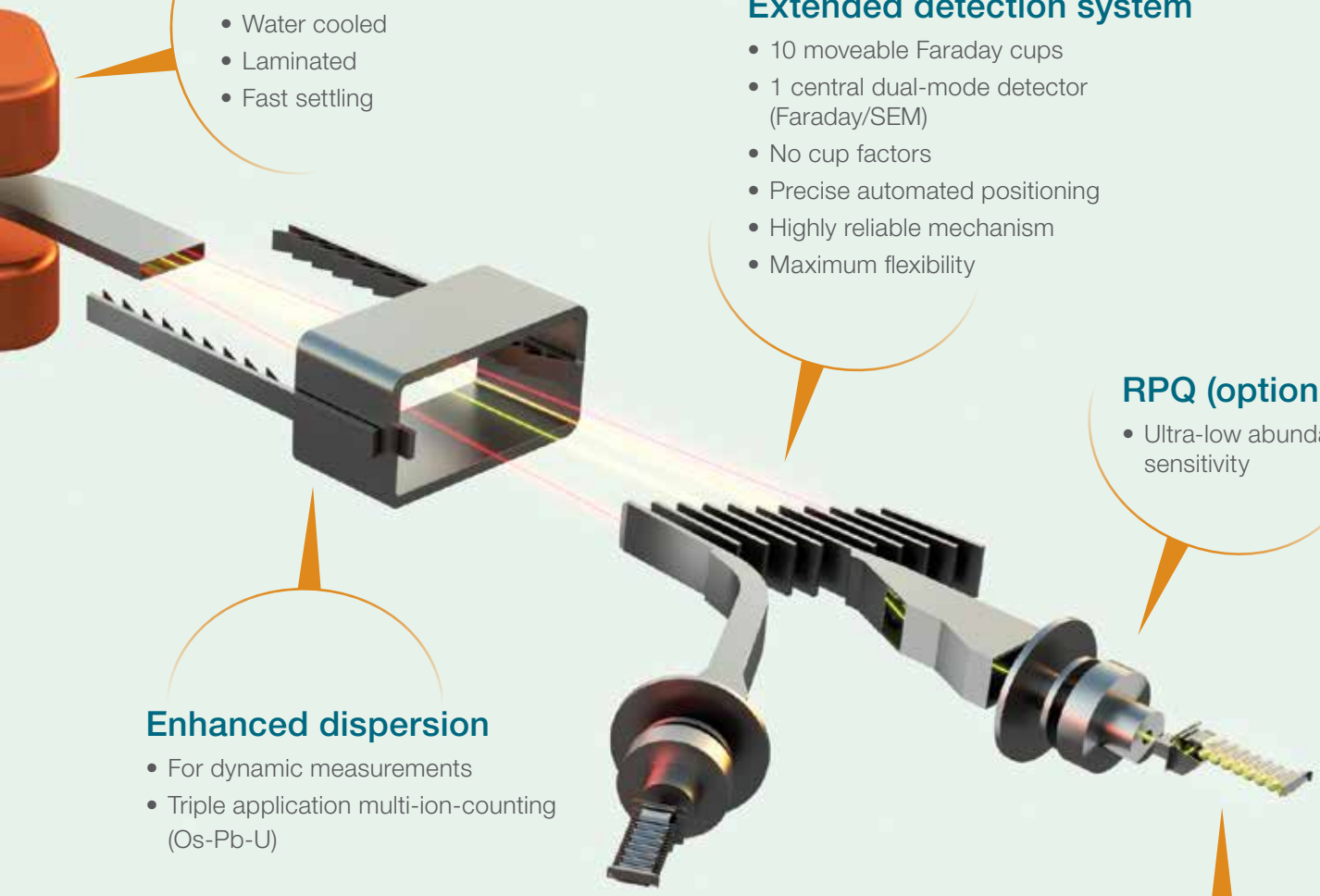
- Water cooled
- Laminated
- Fast settling

Extended detection system

- 10 moveable Faraday cups
- 1 central dual-mode detector (Faraday/SEM)
- No cup factors
- Precise automated positioning
- Highly reliable mechanism
- Maximum flexibility

RPQ (optional)

- Ultra-low abundance sensitivity



Enhanced dispersion

- For dynamic measurements
- Triple application multi-ion-counting (Os-Pb-U)

Ion current amplifiers

- Up to 24 amplifier slots
- 6 Gcps dynamic range (10^{11} Ω)
- Freedom of amplifier selection
- 10^{13} Ω Amplifier Technology
- Dual gain current calibration
- High temperature stability

SEM

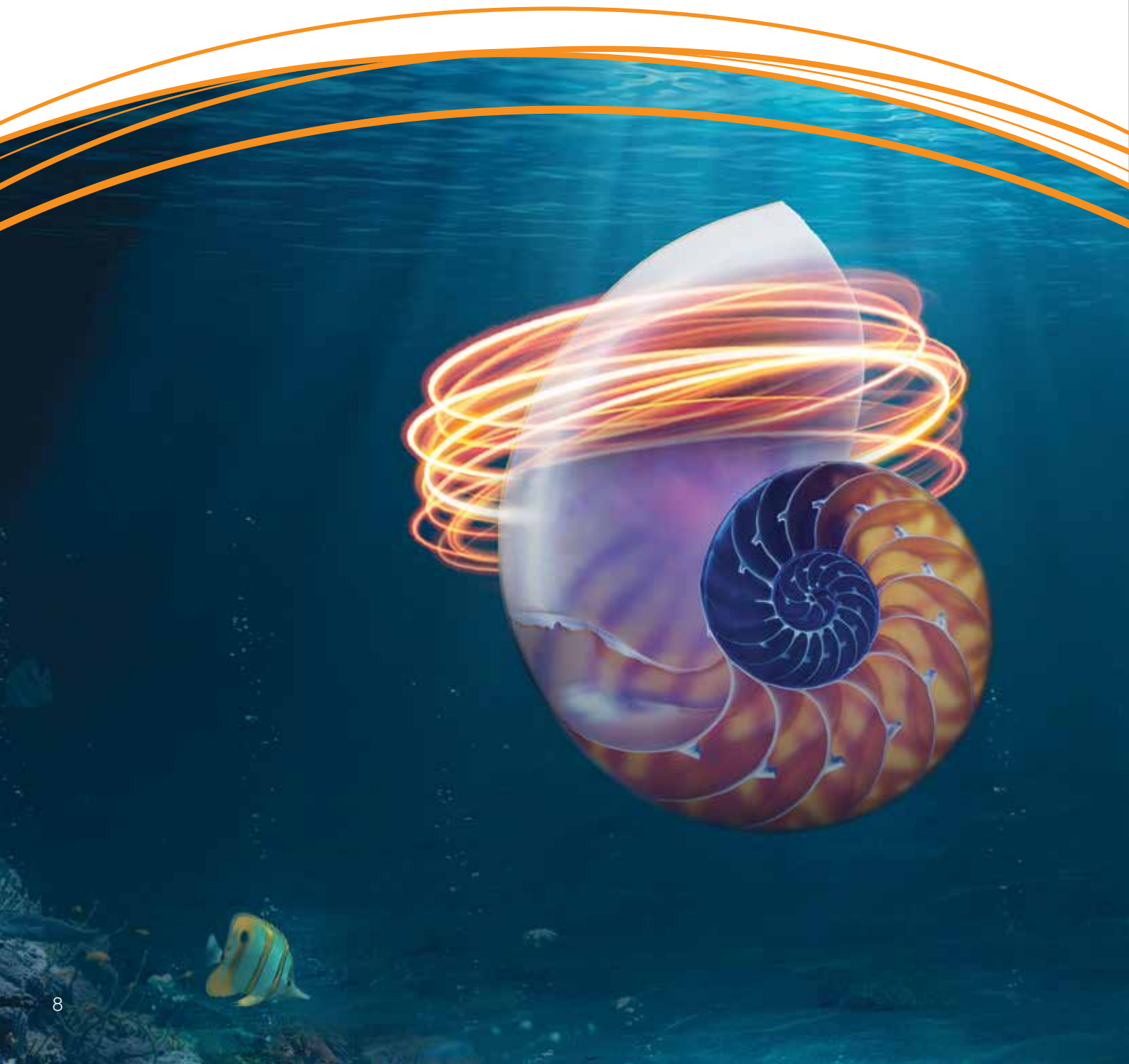
- High linearity
- High stability
- Long lifetime

Ultimate sensitivity, ultimate precision

Inductively Coupled Plasma

The iCAP Qnova ICP is designed to adapt rapidly to changing sample matrices and provide unparalleled robustness, even for challenging samples. Its field-proven Ar ion source with digital, solid state 27 MHz RF generator is unique. A low ion energy spread results in optimum ion focusing and transmission. Balanced coil technology accounts for ultimate plasma stability.

The single piece, demountable, quartz torch is a straightforward push-in design. All connections are integrated into the torch holder reducing complexity. A peristaltic pump, gas ports and Peltier water lines are all contained within the module.

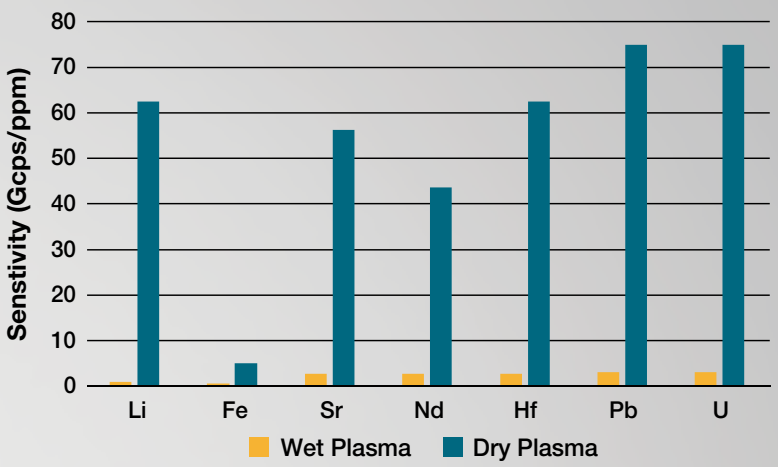


Jet Interface

The total number of ions detected provides the ultimate theoretical limit on the precision of any isotope ratio measurement. In many applications this dictates the minimum sample amount from which useful information can be extracted.

The Jet Interface, in combination with a desolvating nebulizer system, increases sensitivity by 10 to 20 times compared to standard wet plasma. With the Neoma MC-ICP-MS and the Jet Interface, sample ion yields of greater than 1.5% for uranium and lead are routinely achieved, making it the most sensitive ICP-MS available.

The outstanding performance of the Jet Interface is achieved with a high-performance interface pump, an optimized interface design, and a set of cones that can be changed to address individual application needs. For example, the Neoma MC-ICP-MS enables accurate $^{143}Nd/^{144}Nd$ ratios using a high-sensitivity low-oxide cone combination (standard skimmer cone and Jet sampler), whilst $^{176}Hf/^{177}Hf$ measurements benefit from the highest sensitivity combination.



Sensitivity specifications of the Neoma MC-ICP-MS, comparing Jet Interface with wet plasma.

Note sensitivity specifications are given for 100 µL/min uptake rate. Fe is measured in medium resolution. A desolvating nebulizer system is required for the dry plasma specifications.

Ultimate flexibility, ultimate precision

Enhanced variable detector array

At the heart of the Neoma MC-ICP-MS is our enhanced variable multicollector detector array with 11 Faraday cup detectors. The highly reliable mechanism brings all Faraday cups into precise alignment with ion beams of different dispersions. This ensures the flexibility to cover isotopic applications from Li through to U, in low or high resolution, and without compromising the native dispersion of the mass analyzer.

High-performance Faraday cups

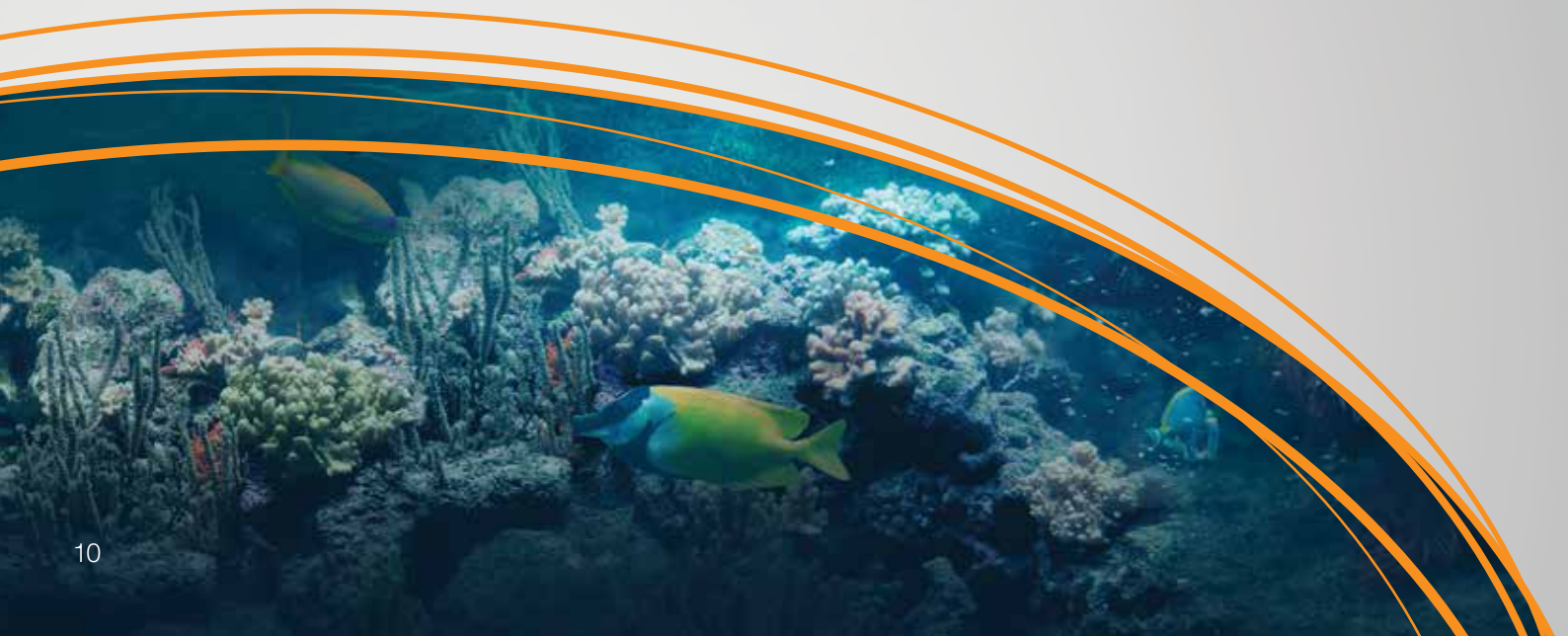
The Faraday cups used in the Neoma MC-ICP-MS have been brought forward from the pioneering Thermo Scientific™ Neptune™ Series instruments and are capable of the highest precision static isotope ratio measurements. The combination of the 2x magnification of the mass analyzer, with wide and deep Faraday cups, means that ion beams are captured in their entirety. Precision machined from solid graphite for uniform response; cup factors are eliminated.

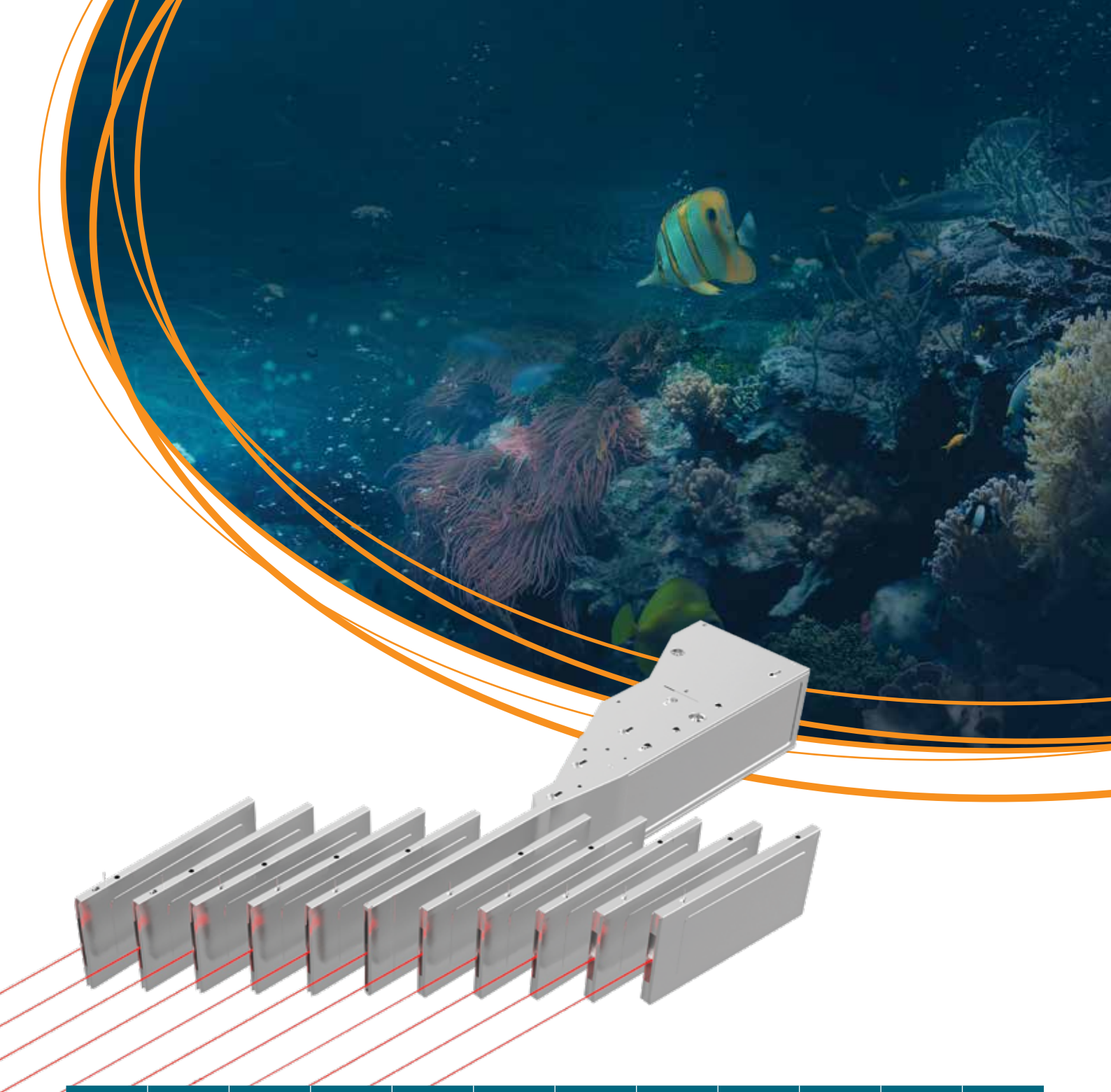
Flexibility to cover multiple applications

- Switching between applications is quick and easy
- Every isotopic system: without compromise
- Ideal for multi-user facilities

Flexibility of detector types

The Neoma MC-ICP-MS offers the most flexible detector system yet offered by Thermo Fisher Scientific™, with three different detector types spanning more than 9 orders of magnitude in signal intensity range (from 1 cps to 6 Gcps). The central channel of the Neoma MC-ICP-MS is equipped with a dual mode detector that can be switched from Faraday cup to SEM ion counter, and with the proprietary relay matrix any amplifier can be assigned to any of the Faraday cups via software.





	L5	L4	L3	L2	L1	C	H1	H2	H3	H4	H5
Mg/Si	^{24}Mg		^{25}Mg		^{26}Mg	^{27}Al	^{28}Si		^{29}Si		^{30}Si
Si/S	^{28}Si		^{29}Si		^{30}Si	^{31}P	^{32}S		^{33}S		^{34}S
Ca	(^{40}Ca)*	^{41}K	^{42}Ca	^{43}Ca	^{44}Ca	^{45}Sc	^{46}Ca	^{47}Ti	^{48}Ca		^{49}Ti
Fe/Ni	^{52}Cr		^{54}Fe	^{56}Fe	^{57}Fe	^{58}Ni	^{60}Ni	^{61}Ni	^{62}Ni	^{63}Cu	^{65}Cu
Sr	^{82}Kr	^{83}Kr	^{167}Er^{++}	^{84}Sr	^{85}Rb	^{171}Yb^{++}	^{86}Sr	^{173}Yb^{++}	^{87}Sr	^{88}Sr	^{177}Hf^{++}
Nd	^{140}Ce	^{142}Nd	^{143}Nd	^{144}Nd	^{145}Nd	^{146}Nd	^{147}Sm	^{148}Nd	^{149}Sm	^{150}Nd	^{151}Eu
Hf	^{171}Yb	^{173}Yb	^{174}Hf	^{175}Lu	^{176}Hf	^{177}Hf	^{178}Hf	^{179}Hf	^{180}Hf	^{181}Ta	^{182}W
U/Pb	^{202}Hg	^{204}Pb	^{206}Pb	^{207}Pb	^{208}Pb				^{232}Th	^{235}U	^{238}U

Selection of cup configurations from the variable detector array of the Neoma MC-ICP-MS. *With future MS/MS Option.

Ultimate detector, ultimate precision

10^{13} Ω Amplifier Technology

The Thermo Scientific™ 10^{13} Ω Amplifier Technology has revolutionized the measurement of isotope ratios from low intensity ion beams, with a long list of publications that prove the utility and performance of this technology for isotope geochemistry applications.

The Neoma MC-ICP-MS is the first MC-ICP-MS designed from inception to incorporate high-ohmic amplifier technology. It ensures fast response times with extremely low noise characteristics. The benefits of Faraday cups can be realized at low signal intensities (30 kcps – 3 Mcps), delivering external precisions that approach the ultimate limits of counting statistics.

Extended dynamic range, extended choice

Faraday cups are the detector of choice for high precision isotope ratio measurements. Ion currents can be measured to the highest degree and accuracy and precision, without the uncertainty of linearity and frequent yield corrections.

The standard amplifier for MC-ICP-MS contains a 10^{11} Ω feedback resistor. A software-controlled relay matrix connects any amplifier to any Faraday cup. On the Neoma MC-ICP-MS, 24 ion current amplifiers are mounted in a doubly shielded, evacuated and thermostated housing with a temperature stability of 0.01 ˚C/hour, guaranteeing baseline and gain stability. This is sufficient slots to tailor the amplifier-cup configuration to the requirements of any analytical measurement.

- Extended Dynamic Range up to 60 Gcps
- Automated amplifier gain calibration
- 24 amplifier slots
- 10^{13} Ω Amplifier Technology – sensitivity with effective time resolution

Optimum operating range for three different detectors incorporated into the Neoma MC-ICP-MS, and the level of precision which could be expected from counting statistics in 10-minute measurement.

Over 9 orders of magnitude in signal intensity range are spanned by the detector system. For intermediate signal intensities, ca. 30 kcps to 6 Mcps, the 10^{13} Ω Amplifier Technology is uniquely able to deliver precisions approaching the theoretical limits of counting statistics. Ion counters, such as the SEM, are recommended for the lowest signal intensities.

Ultimate detection, ultimate precision

Multi ion counting arrays

The smallest sample amounts and the lowest abundance isotopes require the use of ion counting detectors. The Neoma MC-ICP-MS can be fitted with a Multi Ion Counting (MIC) array to allow simultaneous detection of the lowest abundance ion beams. Efficiency is significantly increased when compared with single collector measurements.

Up to eleven discrete dynode secondary electron multipliers can be installed on the Neoma MC-ICP-MS, with packages tailored for different applications. The SEM and CDD ion counters available for the Neoma MC-ICP-MS offer the lowest noise with excellent stability, linearity and lifetime characteristics.

The latest extended dispersion optics available for the Neoma MC-ICP-MS allow more applications to be measured with a single MIC array than ever before. A triple-application multi-ion-counting package brings Re/Os, U/Th and U/Pb measurements together in a single MC-ICP-MS for the first time.

Excellent abundance sensitivity

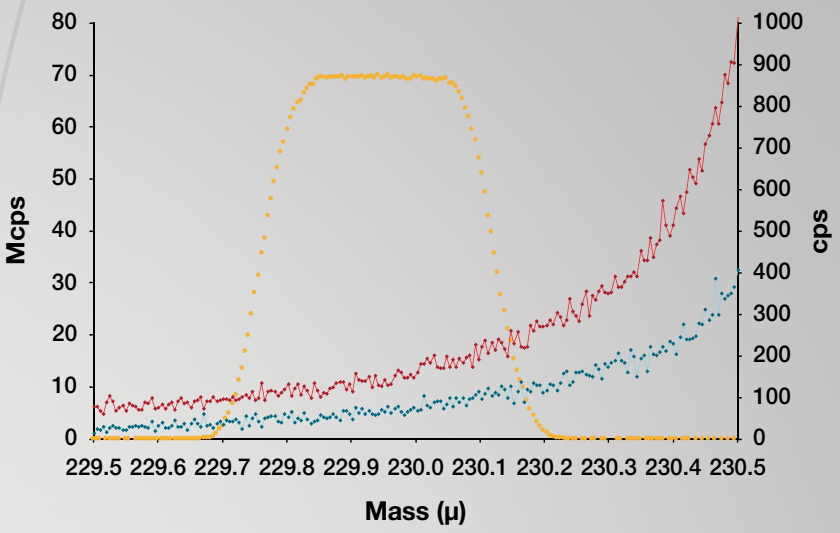
Reliable analysis of $^{234}U/^{238}U$ and $^{236}U/^{238}U$ provides key information for nuclear safeguarding, but measurement can be difficult due to the very low abundance of ^{234}U and ^{236}U. Ion counters offer the lowest quantification limits for these isotopes. Scattered ions from ^{238}U and ^{235}U, can bias the measured ratios. The Retarding Potential Quadrupole (RPQ) improves abundance sensitivity by an order of magnitude.

The Neoma MC-ICP-MS can be configured with two RPQ lenses for simultaneous ^{234}U and ^{236}U analysis. The MIC packages offer comprehensive coverage of isotopic measurements, with flexibility to use combinations of ion counters and Faraday cups for sample amounts from the fg to µg level. Combined with the Jet Interface the smallest traces of sample can be analyzed for precise information.

MIC Geoscience Package – U/Pb, U/Th and Re/Os analysis in a single MC-ICP-MS.

	L5	CDD	CDD	L fixed/ SEM*	SEM RPQ	L4	L3	L2	L1	C	H1	H2	H3	H4	H5
U/Pb		^{202}Hg	^{204}Hg	^{206}Pb	^{207}Pb	^{208}Pb							^{232}Th	^{235}U	^{238}U
U/Th				^{229}Th	^{230}Th	^{233}U	^{234}U	^{235}U	^{238}U						
Re/Os		^{185}Re	^{187}Os	^{189}Os	^{190}Os	^{192}Os									

*Dual-mode detector, switchable between Faraday and SEM. Please contact your local sales specialist to discuss the range of configurations available.



Peak tailing from ^{232}Th onto *m/z* 229.5 with (blue trace cps) and without RPQ (red trace cps). The ^{232}Th beam is shown for reference (Mcps scale).

MIC
MULTI ION COUNTING

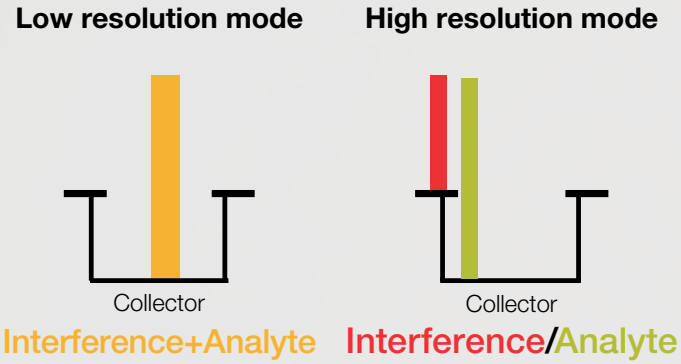
RPQ

Experience high resolution MC-ICP-MS

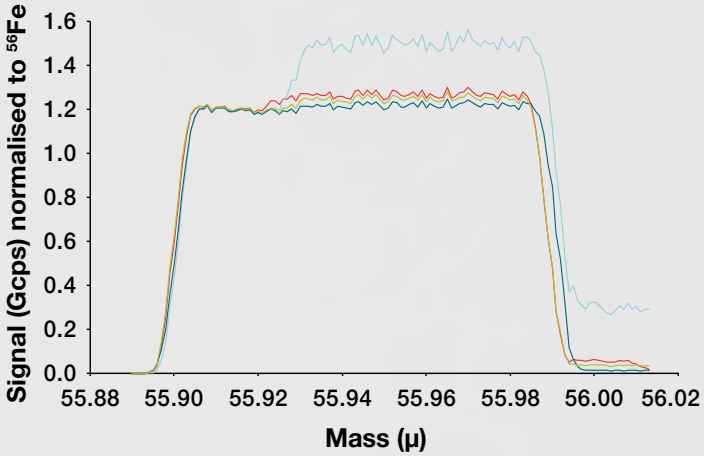
Thermo Fisher Scientific introduced high mass-resolution to MC-ICP-MS with the Neptune MC-ICP-MS series, enabling new applications with high-precision interference-free isotope ratio measurements. Flat interference-free plateaus are ideal for MC-ICP-MS isotope ratio measurements and ensure the highest precision results. Now with the Neoma MC-ICP-MS, high resolution ICP-MS is made even easier.

The Neoma MC-ICP-MS can be operated at three different resolution settings: low, medium and high. A reproducible resolution setting can be conveniently selected through software. The Neoma MC-ICP-MS is optimized for transmission, over 20% transmission can be retained for measurements of isotope systems such as Si, S and Fe.

In order to achieve the high mass resolution necessary to separate molecular interferences from elemental peaks a narrow source slit is selected. Through a combination of narrow source and wide detector slits, interferences can be separated from the analyte ions on either side of the detector slit. Many molecular interferences are in the low and middle mass range, and according to the systematics of the nuclear mass defect, these interferences are typically heavier than the elemental species. A wide detector slit in all mass resolutions is the best choice, since it guarantees the widest peak flatness, which is essential for highly precise and accurate isotope ratio analyses.



Schematic depiction of low and high resolution measurement modes showing the separation of interferences such as ArO^+ from the $^{56}Fe^+$ analyte ions.



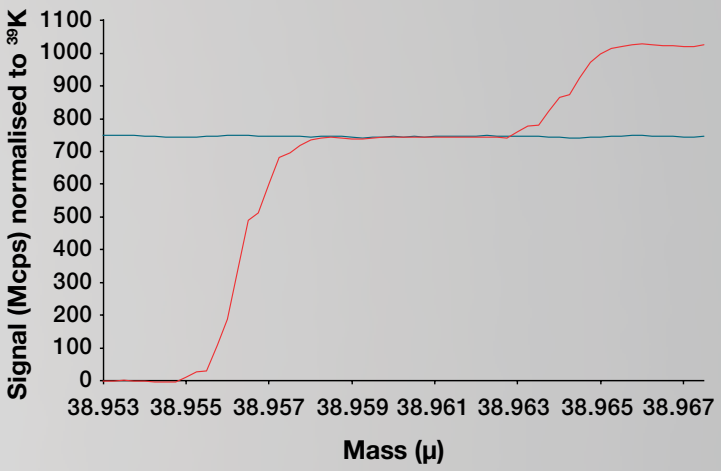
Mass scans for iron isotopes (left), showing the measurement position for high-precision interference-free measurements of $\delta^{56}Fe$, $\delta^{57}Fe$ and $\delta^{58}Fe$.

XHR – Extra High Resolution

The Thermo Scientific™ XHR™ Option for the Neoma MC-ICP-MS increases the resolving power to 15,000 by including a switchable intermediate aperture. By doing so it allows access to hydride removal from systems such as Si, Mg, Cl and K. This increase in resolution is only possible due to the excellent peak position stability of the Neoma MC-ICP-MS.

Case study – $\delta^{41}K$ analysis by using XHR mode

The potassium isotopic system has applications in terrestrial geochemistry, planetary science, and potentially for biomedical and agricultural research. The strong $^{40}Ar^{1}H$ interference on ^{41}K has until recently limited its measurement by MC-ICP-MS. By increasing the resolving power of the Neoma MC-ICP-MS, the XHR option opens the door to precise, accurate and routine measurement of the potassium isotopic system by MC-ICP-MS.



Mass Scans on the $^{41}K^{+}$ peak using the XHR Extra High Resolution Option for the Neoma MC-ICP-MS. $^{41}K^{+}$ is clearly resolved from the polyatomic interference $^{40}Ar^{1}H^{+}$.

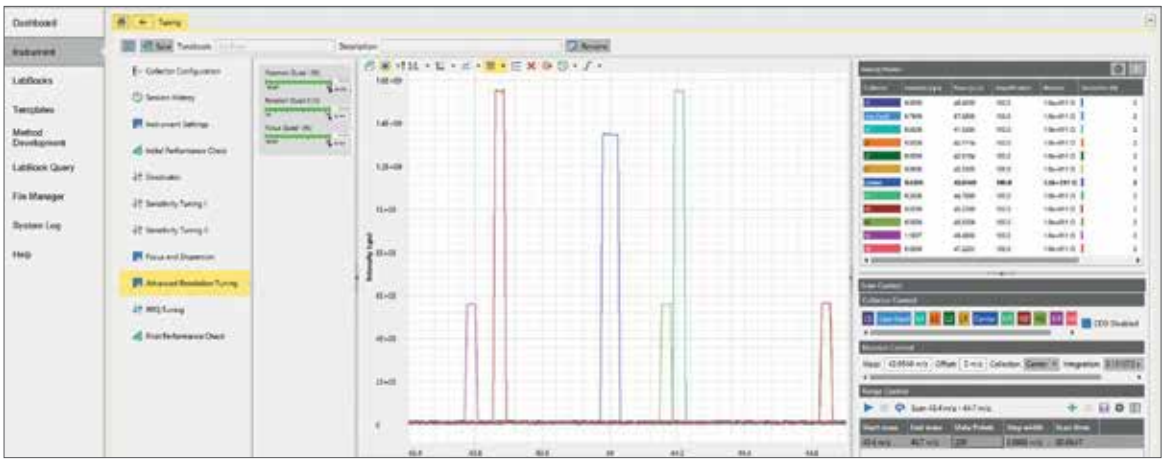
Ultimate ease of use

Minimize training, automate workflows, simplify your experience, and improve efficiency with the innovative Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution (ISDS™) Software. This shared software approach provides control and data processing for a range of elemental and isotopic analysis technologies including: ICP-OES, ICP-MS, MC-ICP-MS, Noble Gas MS and High Resolution IRMS. Qtegra Software is updated and upgraded regularly to reflect changes in analytical demands. Users can leverage software familiarity across techniques. Designed for workflow, scalability, compliance and data management, Qtegra Software provides essential tools for consistent, accurate analysis.

Minimize user steps – Get Ready
One-click "Get Ready" function with automatic performance checks reduces operator time, freeing up valuable resources and increasing accuracy. Three fail-safe steps from sample introduction to report.

Maximize ease of use
Simple, dynamic workflow and intuitive user interface places controls at the operator's disposal for reduced training and expertise requirements.

Minimize task times
Just a few quick steps create an analytical LabBook, the start of the intelligent analysis sequence, with full QA/QC protocols and powerful what-you-see-is-what-you-get reports.



Qtegra Software for the Neoma MC-ICP-MS

- Graphical Cup Collector Configurator for automated detector alignment and adjustment
- First- and third-party peripherals (laser ablation, desolvators, chromatography) are directly controllable through Qtegra plug-ins with 2-way communication
- Time-resolved data acquisition and analysis (TRA)
- Tunebooks: Tuning in Qtegra Software has been redesigned with an emphasis on clear and automatable workflows
- Enhanced data visualization, processing, search, extract and report functions for powerful sample to final report evaluation
- Customizable reference material and standards database

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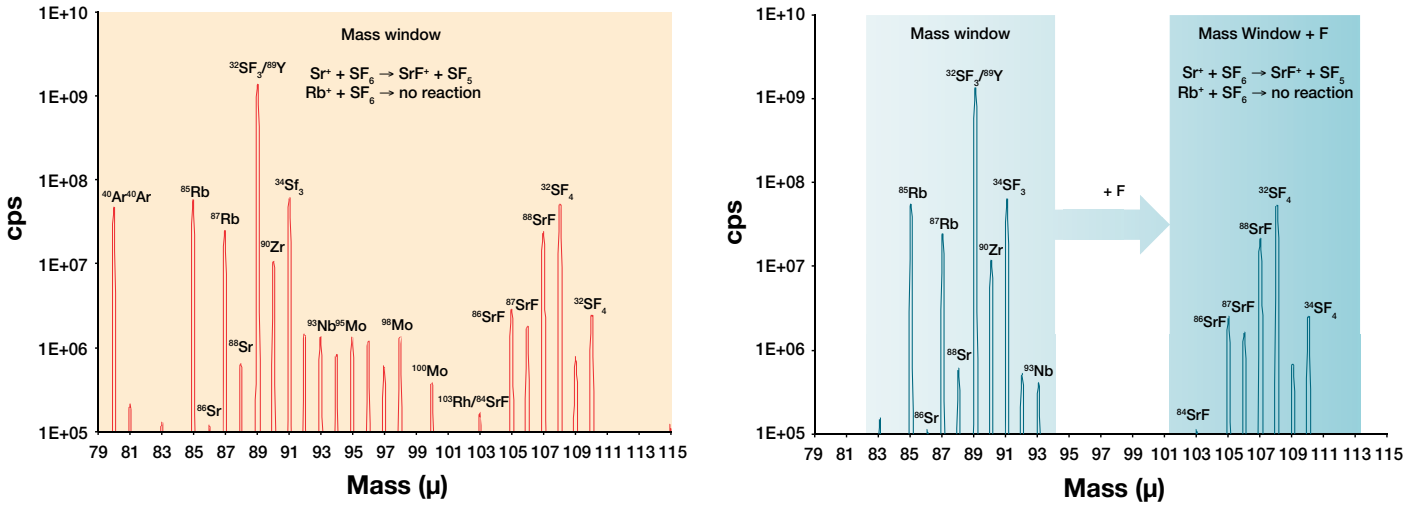
MS/MS collision/reaction cell MC-ICP-MS

The Neoma MC-ICP-MS is designed to accommodate a future upgrade path to a MS/MS with collision/reaction cell, equipped with a unique pre-cell mass filter. This Thermo Scientific™ MS/MS™ Option when combined with reactive gases such as O_2, N_2O, NH_3 and SF_6, alongside H_2 and He, gives access to an extra library of dedicated applications.



Mass window selection for *in-situ* Rb/Sr dating using the Neoma Collision Cell MS/MS Option. The pre-cell mass filter is used to select a mass window which is transmitted into the collision cell for fluorination by SF_6. Only with a pre-cell mass filter are potential sources of interferent ions (Ar, ArN, ArO, Rh, Pd, Ag, Cd) removed from the analysis.

Adding the MS/MS option to a Neoma MC-ICP-MS does not compromise performance. As isotope sensitivity and exponential mass bias are retained, neither the accuracy or precision of isotopic analyses are affected, when operated in conventional mode.

Features

- Unique pre-cell mass filter design, essential for *in-situ* Rb/Sr dating
- Choice of four collision/reaction cell gases
- Variable mass window selection
- <50 ppb abundance sensitivity at 1 amu

Find out more at **thermofisher.com/neoma**

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