Thermo Scientific HELIX MC *Plus*

Multicollector noble gas mass spectrometer

A new state-of-the-art multicollector noble gas mass spectrometer

The Thermo Scientific™ HELIX MC *Plus*™ static vacuum mass spectrometer is a state-of-the-art magnetic sector mass spectrometer for the high precision isotopic analysis of small samples of all of the noble gases. It comprises a magnetic sector analyzer with 35 cm, 120° extended geometry ion optics. The geometry combines excellent ion optic performance with two-direction focusing and high dispersion. This instrument represents the ultimate tool for the isotopic measurement of the noble gases.

Electromagnet

The electromagnet is manufactured utilizing extremely pure, homogeneous soft iron. The magnet is mounted on a platform that can be retracted from the flight tube during the system baking process. Given the unique design of the ion optical assembly, the magnet does not require any adjustment during the alignment process.

- Excellent results for peak jumping acquisitions
- Delivers extended mass range
- Electromagnet can scan over the entire analyzer operating range
- High stability achieved with a temperature controlled Field probe
- Fully controlled by Thermo Scientific Qtegra™ Intelligent Scientific Data Solution™ (ISDS) allowing rapid peak jumping between masses whilst maintaining maximum sensitivity

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Ion Source

Flange mounted 10 kV "Nier" type ion source designed for easy de-mount, filament change and cleaning. The source is self-realigning on assembly.

- Source filament self-aligning
- Maximized ion production giving high sensitivity
- Simple design, easy to clean and maintain

Vacuum System

The vacuum system of the HELIX MC *Plus* is designed for true UHV performance. The system is manufactured using stainless steel with minimum of welds present in either the source or collector housings. The flight tube is however manufactured from a new composite material that is a mix of titanium and stainless steel. This new material is almost magnetically transparent and therefore has no impact on the ion optics. The UHV pumping is achieved utilizing a 40 L/s ion pump designed specifically for pumping the noble gases and a 80 L/s turbo molecular pump backed by a two-stage diaphragm pump. The ion pump isolation valve is a CF40 all metal valve, which is pneumatically controlled. The inlet valve to the mass spectrometer is manually controlled and the connection to the sample preparation system is via a mini conflat flange. The mass spectrometer also includes two SAES NP10 nonevaporable getter pumps. Both are mounted in their own water cooled jackets. The first is mounted on the source housing and the second on the collector assembly. The getter at the collector can be isolated from the collector housing and if necessary degassed through a backing line into the turbomolecular pump.

- 40 L/s Ion pump with controller
- Vacuum typically 10^{-10} mbar
- 80 L/s turbo-molecular pump mounted beneath the bench
- Dry-pumped backing line
- Ion gauge for vacuum monitoring (optional)
- 2×NP10 SAES getter controlled via Qtegra ISDS
- Pneumatic/manual valves have helium leak rates for valve and body
  $< 1 \times 10^{-10}$ cc STP/sec
- Heaters and controls to bake mass spectrometer to 350° C are included

Electronic Control Systems

Source electronics - All tuning parameters are computer controlled, interfacing to a suite of electronics that operate the HV, Focus, Electron Volts, Ion Repeller, Trap and Steering.

- Intelligent Interface - Controls communication between the PC and the source, the magnet and all valve controls
- Output lines for implementation of full valve control by Pericon
- High stability head amplifier
- Additional data collection channels for prep system inputs

Collector Array

Up to a total of 5 detectors are fitted to the HELIX MC *Plus* noble gas MS. The detectors are Faraday/ion counting multiplier CFM detectors. These collectors contain both a voltage suppressed deep Faraday bucket and an ion counting CuBe type electron multiplier. The position of the low 1 & 2 and the high 1 & 2 collectors can be externally adjusted. The axial is fixed. As an option, either the low 1 or low 2 CFM collectors can be specified to work at a higher resolution (≥ 1,500), in order to separate $^{20}Ne^{+}$ from $^{40}Ar^{2+}$.

- Resolution for Faraday/ion counting CFM detectors ≥ 750
- Optional Hi-Res CFM to separate $^{20}Ne^{+}$ from $^{40}Ar^{2+}$
- Resolution for optional Hi-Res CFM ≥ 1,500 at 10% valley
- Electron multiplier – ion counting efficiency ~ 85% or better with inherent noise less than 10 CPM

Data System and Software

Qtegra is the dedicated data acquisition and control software utilized to create the HELIX MC *Plus* system software. Operating under Windows 7 and in conjunction with the embedded computer system this provides comprehensive system control, acquisition and reporting.

- Full computer control and storage of all source parameters including trap current and ion repeller voltage
- Full color display, including a numeric and graphical display of ion beams and pressure gauges and a graphical valve status display
- Full access to valve control when automatic sequences not in operation
- Ion beams and isotope ratio display during data acquisition to allow operator assessment of data quality during analysis
- All raw data stored
- Operating parameters for the mass spectrometer and preparation systems are stored in parameter files for recall and control of automated sample runs
- Manual control routines for scan control, source tuning, and valve operation
- True multi-tasking enabling concurrent operation of multiple programmes including access to Microsoft Excel for offline data handling whilst analysis is still taking place

Standard Specifications

The HELIX MC *Plus* system is an extended geometry 35 cm radius 120° magnetic sector analyzer.

Mass range	He, Ne, Ar: 9.9 kV acceleration voltage Kr, Xe: ≥ 6 kV
Background	≤ 1×10^{-13} cc STP @ *m/z* ^{36}Ar
Sensitivity	Helium: ≥ 2×10^{-4} Amp/Torr @ ≤ 1.2 mA source, 9.9 kV , 0.25 mm source slit Argon: ≥ 1×10^{-3} Amp/Torr @ ≤ 1.0 mA source, 9.9 kV, 0.25 mm source slit
Resolution	For Faraday/ion counting CFM ≥ 750 @ 10% peak valley For Hi-Res Faraday/ion counting CFM ≥ 1,500 @ 10% peak valley
Res. power	≥ 5000 @ 0.05 mm source slit; typically achieved > 6500
Peak side stability	*m/z* ^{40}Ar: ≤ ± 50 ppm / 30 min.
Rate of rise	@ ^{40}Ar to be ≤ 2×10^{-12} cc STP/min in 30 min
Abundance	≤ 1 ppm for adjacent masses sensitivity (^{39}Ar contribution from ^{40}Ar) at a pressure of 1×10^{-7} mbar

www.thermoscientific.com/HelixMCPlus

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