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
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 confit 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 x 10⁻⁹ 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 ²⁰Ne from ⁴⁰Ar²⁺.
- Resolution for Faraday/ion counting CFM detectors ≥ 750
- Optional Hi-Res CFM to separate ²³Ne from ⁴⁰Ar²⁺
- 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.
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- Optional Hi-Res CFM to separate ²³Ne from ⁴⁰Ar²⁺
- 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

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Mass range</td>
<td>He, Ne: 9.9 kV acceleration voltage</td>
</tr>
<tr>
<td></td>
<td>K, Xe: ≥ 6 kV</td>
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<tr>
<td>Background</td>
<td>≤ 1 x 10⁻¹³ cc STP @ m/z ⁴⁰Ar</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Helium: ≥ 2 x 10⁻⁴ Amp/Torr @ 1.2 mA source, 9.9 kV, 0.25 mm source slit</td>
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<tr>
<td></td>
<td>Argon: ≥ 1 x 10⁻³ Amp/Torr @ 1.0 mA source, 9.9 kV, 0.25 mm source slit</td>
</tr>
<tr>
<td>Res. power</td>
<td>≥ 5000 @ 0.05 mm source slit; typically achieved ≥ 6500</td>
</tr>
<tr>
<td>Peak side</td>
<td>≤ 50 ppm</td>
</tr>
<tr>
<td>stability</td>
<td>@ ³⁶Ar to be ≤ 2 x 10⁻¹² cc STP/min in 30 min</td>
</tr>
<tr>
<td>Abundance</td>
<td>≤ 1 ppm for adjacent masses</td>
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