

Nu Plasma II  
Multi-Collector ICP-MS



Nu Plasma 1700  
Multi-Collector ICP-MS



Nu TIMS  
Thermal Ionisation MS



Attom ES  
High Resolution ICP-MS



Astrum  
Glow Discharge MS



Evolution  
HR Gas Analysis MS



Noblesse HR  
Noble Gas MS



Aspect  
HR Stable Isotope Ratio MS



Panorama  
HR Stable Isotope Ratio MS



Horizon  
Stable Isotope Ratio MS



Perspective  
Stable Isotope Ratio MS



# *Noblesse* HR

## NOBLE GAS MASS SPECTROMETER



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FM 51915



## Noblesse HR

### Accurate

Noblesse HR can resolve most isobaric interferences to the noble gases, giving more accurate results. In particular, all carbon based interferences to Ar, and the  $^{40}\text{Ar}^{++}$  interference to  $^{20}\text{Ne}^{+}$ , may be easily separated.

### Flexible

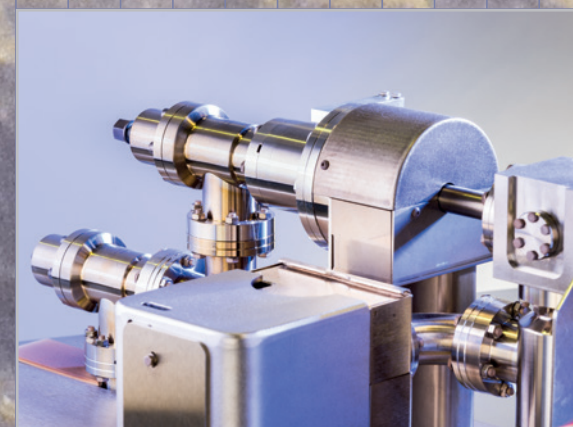
Noblesse HR has a new design of ion source which allows optimisation of either sensitivity or resolving power, without any moving parts. The instrument's unique, patented, zoom optics allow instantaneous switching between different isotope sets.

### Reliable

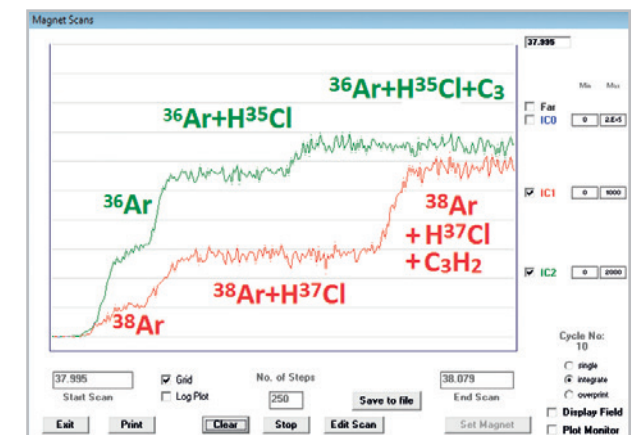
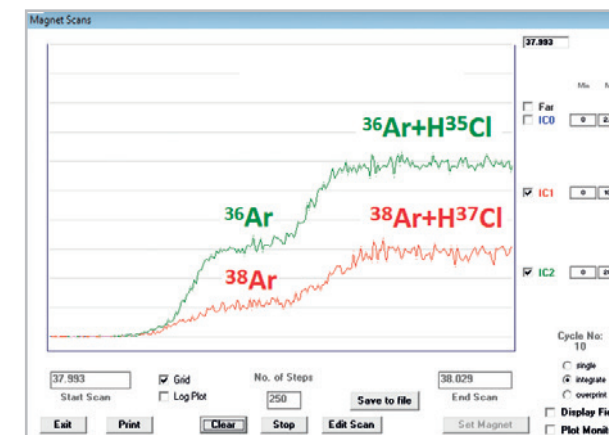
The zoom optics permit the detectors to be fixed, greatly enhancing reliability. The sensitivity and resolving power are also adjusted without the complexity of a movable source slit.

### Noblesse HR - key features

- Greatly enhanced resolving power – demonstrated separation of  $\text{H}^{35}\text{Cl}$  from  $^{36}\text{Ar}$
- Up to 5 large discrete dynode electron multipliers for simultaneous measurements of Argon Isotopes
- Enhanced collector options
- Zoom Optics for maximum flexibility and reliability
- Large 55 Volt dynamic range on the Faraday collectors
- State of the art purpose built electronics
- Straightforward source filament change
- Removal of carbon based interferences at all Ar masses
- Fully bakeable to 300 deg C
- Intuitive control software
- Lifetime technical support







mass scans showing resolution of  $^{36}\text{Ar}$  and  $^{38}\text{Ar}$  from interferences

### Mass Spectrometer

The Noblesse HR is a single focussing mass spectrometer using a 24 cm radius, 75 degree magnet. The instrument provides good mass dispersion without excessive volume – the volume of the popular 1 Faraday – 3 Multiplier array is  $\sim 1550$  cc (without getters).

### Source

The Noblesse HR employs a unique Nier type ion source, which permits adjustment between higher sensitivity and higher resolving power, without using a moveable source slit. The filament can be replaced easily without removing the source and is self-aligning on installation.

### Variable Dispersion Ion Optics

The Noblesse HR uses Nu Instruments' unique and patented Zoom Optics system, which enables multi-collection of different sets of isotopes using a fixed collector array. The Zoom Optics allows the dispersion to be changed instantaneously – even during an analysis – whilst use of a fixed array reduces volumes and greatly increases reliability. The Zoom lenses also perform fine focussing of the ion beam, making adjustable magnet pole pieces a thing of the past.

### Vacuum System

The Noblesse HR is fitted with a 20 l/s ion pump for pump out during normal operation, whilst a 75 l/s Turbomolecular pump and dry backing pump are used to pump the instrument down from atmospheric pressure. The pneumatic valve to the source end ion pump is software controlled. A pneumatic inlet valve is available as an option, for use with an automatic gas preparation system. The instrument is fitted with a getter adjacent to the source; a getter or ion pump can be fitted at the collector. Both getters can be isolated and pumped independently, allowing activation without polluting the mass spectrometer.

## VERSATILE COLLECTOR OPTIONS

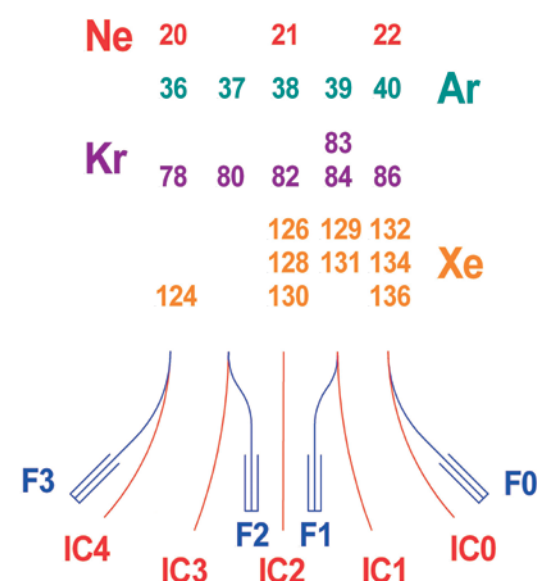
### Collector Options

A key feature of Noblesse HR is the wide range of collector arrays which are offered. These have evolved over the last 10 years, leading to the 5 ion counter array shown below. This provides the ultimate in multicollection capability. All 5 Ar isotopes can be measured simultaneously, with the option to measure 37, 39 and/or 40 on Faradays. All Xe isotopes can be measured in just 3 steps.

The detectors are fixed – giving greater reliability – and the dispersion changed with the unique zoom optics.

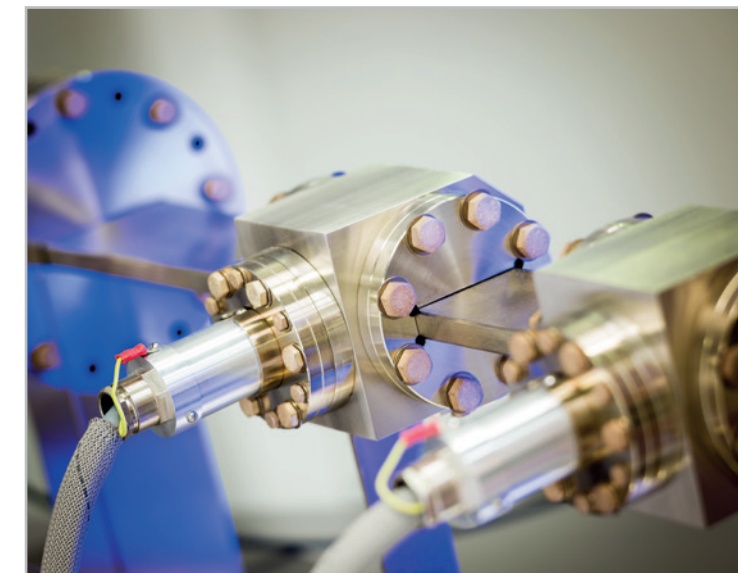
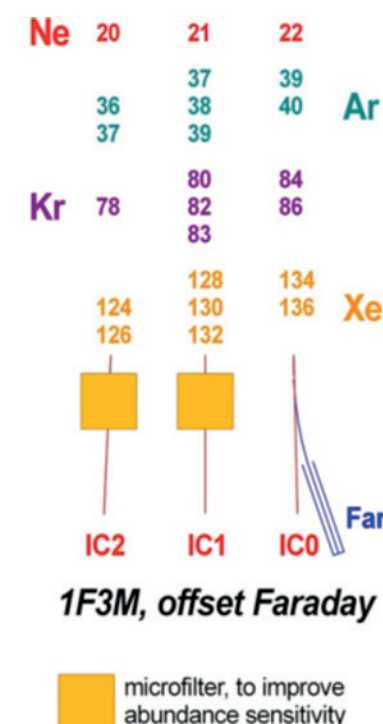
It is possible to switch the beam between Faraday and multiplier, increasing the dynamic range for isotopes such as  $^{40}\text{Ar}$ . In each case, the two detectors are positioned behind the same source slit.

55V amplifiers are used providing enhanced dynamic range. Full size discrete dynode multipliers are employed, providing maximum stability and lifetime. Over-limit protection is provided, preventing beam entry into the multipliers should the count rate become too high.



## COLLECTOR OPTIONS - EXAMPLES

The most popular collector array has been the 1 Faraday, 3 Multiplier (1F3M, offset Faraday) system illustrated below. Other collector arrays have been developed, many in collaboration with our users for specific applications, and these are still available. We welcome enquiries from researchers requiring a special array for a specific application.





## INTEGRATED SAMPLE PREPARATION SYSTEM

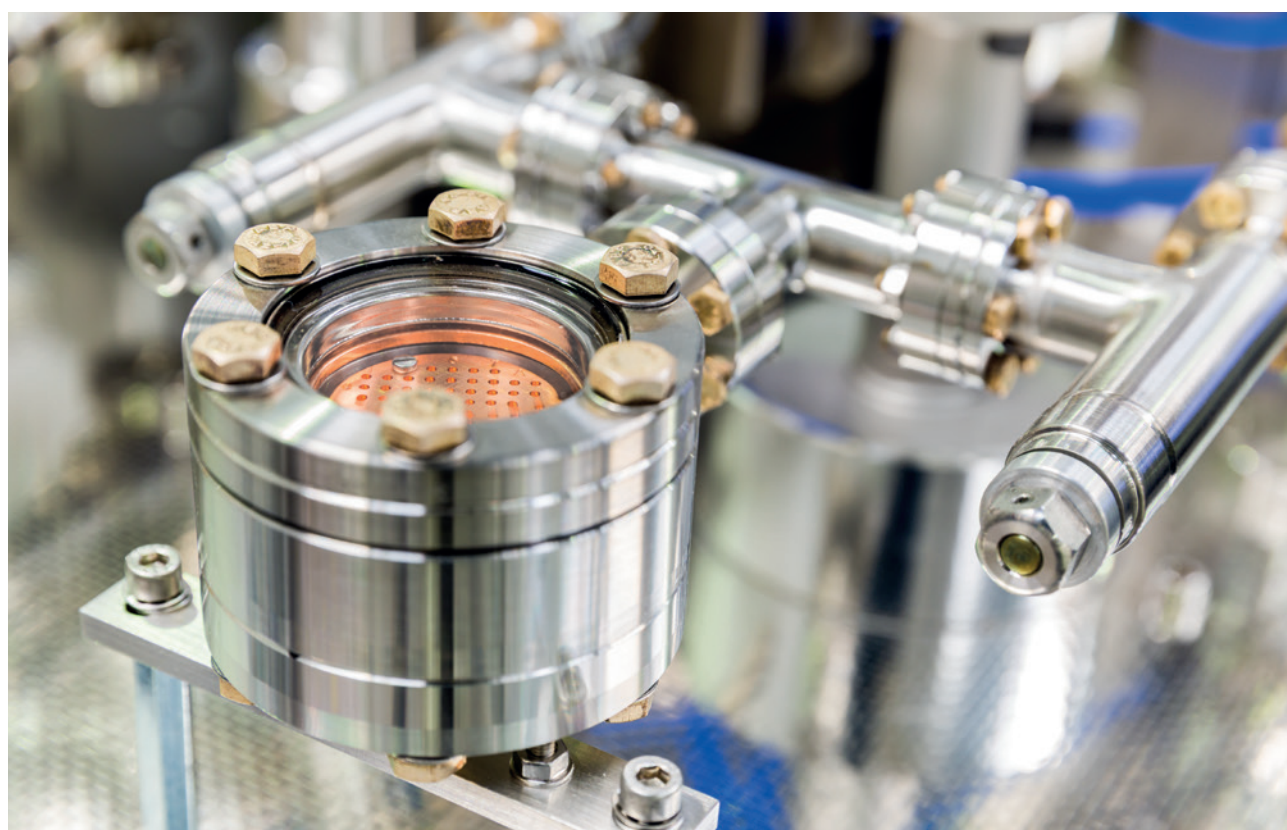
### Sample Preparation System

Nu Instruments offer an all metal sample preparation system for connection to the Noble gas mass spectrometer, either for use by itself, or as an interface between the user's systems and the mass spectrometer inlet. The complete manifold system is manufactured to rigorous UHV standards, and has been designed to have the smallest possible volume, whilst maintaining reasonable gas conductance, so as to ensure the lowest possible blank levels for the analyses.

The system includes two calibration gas reservoirs, each fitted with a pipette with auto valves, to enable known quantities of reference gas to be admitted into the mass spectrometer.

Automatic valves are provided to the ion pump, and to the furnace section. A dedicated getter is provided adjacent to the furnace, to enable "dirty" samples to be processed prior to opening the valve to the main manifold section. An additional getter is provided on the manifold near the ion pump.

A sample cell is provided, for the user to integrate with their own laser system.



### Resistance Furnace

The furnace consists of a central tantalum crucible, heated by a split tantalum resistive element. This is then surrounded by a series of heat shields and the whole assembly is placed inside a water-cooled chamber, which is pumped independently from the main sample introduction line, with a dedicated high vacuum and backing pump. A water chiller unit is included in the package.

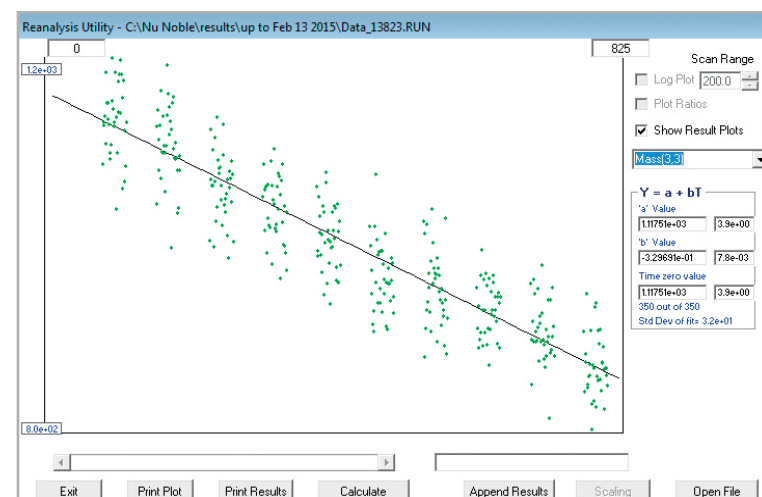
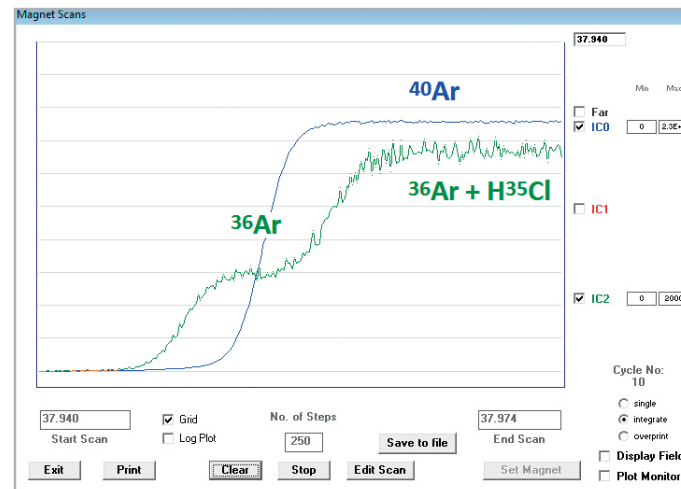
A disposable tantalum inner liner is used to contain the dropped samples in the furnace, and hence minimise chemical reactions with the tantalum crucible, thus maximising its lifetime.

Samples are introduced using a low volume carousel, which permits sequential dispensing of samples. A window enables the samples to be viewed during heating, as well as enabling the temperature to be monitored independently via the use of a (user supplied) optical pyrometer, if required.

The temperature of the furnace is monitored using a W/W-Re thermocouple, and controlled using a dedicated controller, interfaced to a PC. A number of different heating profiles may be stored for use in different experiments.

## USER FRIENDLY AND INTUITIVE SOFTWARE

The Noblesse HR comes with powerful, yet easy to use software that provides the user with all the tools required for analysis of the noble gases. All instrument parameters are controlled from the software. The data analysis package includes curve fitting and extrapolation to time zero, for either amounts versus time or ratios versus time – and including rigorous error propagation. Data acquisition runs are simple to set up and it is also possible to construct batch runs for a series of samples. The software may also be used to control the Nu Instruments sample preparation system and furnace. Additional digital outputs are available for the control of user-supplied valves.



The standard Nu Instruments Calculation Editor (NICE) software provides user-definable data reduction functions. Both raw and calculated data are available for each sample run along with full logging of instrument settings. Data can be analysed on or off-line and can be easily exported for further analysis to third party software packages. Upgrades are available free of charge for the lifetime of instrument.

## NOBLESSE – SELECTED PUBLICATIONS

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E N DiMaggio, C J Campisano, J Rowan, G Dupont-Nivet, A L Deino, F Bibi, M E Lewis, A Souron, L Werdelin, K E Reed and J R Arrowsmith. *A Rare late Pliocene Fossiliferous Sedimentary Record and the Environmental Context of the early Homo from Afar, Ethiopia*. Science Express, 5 March 2015 / 10.1126/science.aaa1415 (2015).

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