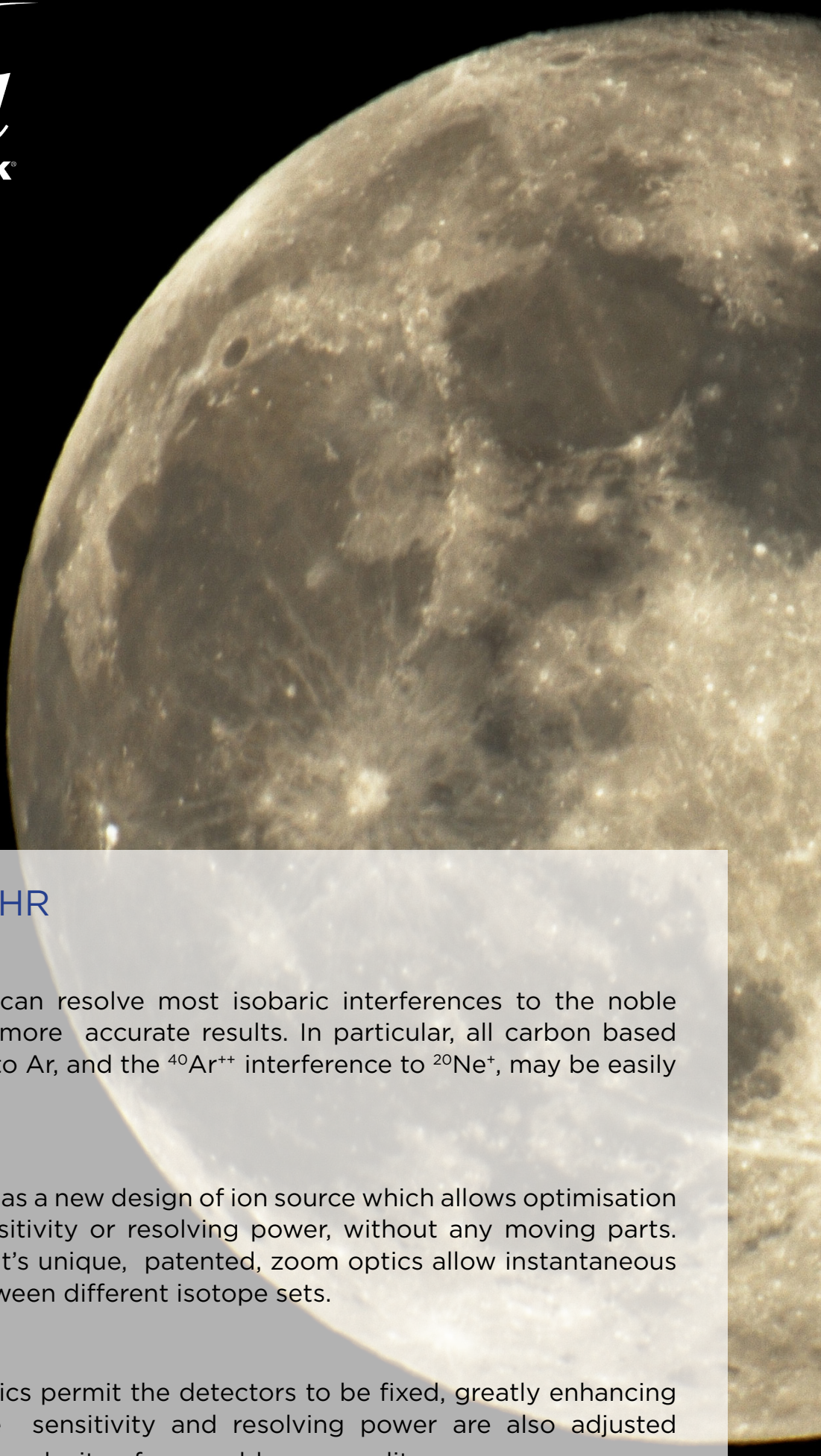
Noble

noblesse HR

Noble Gas Mass Spectrometer

nu / AMETEK

www.nu-ins.com



Noblesse HR

Accurate

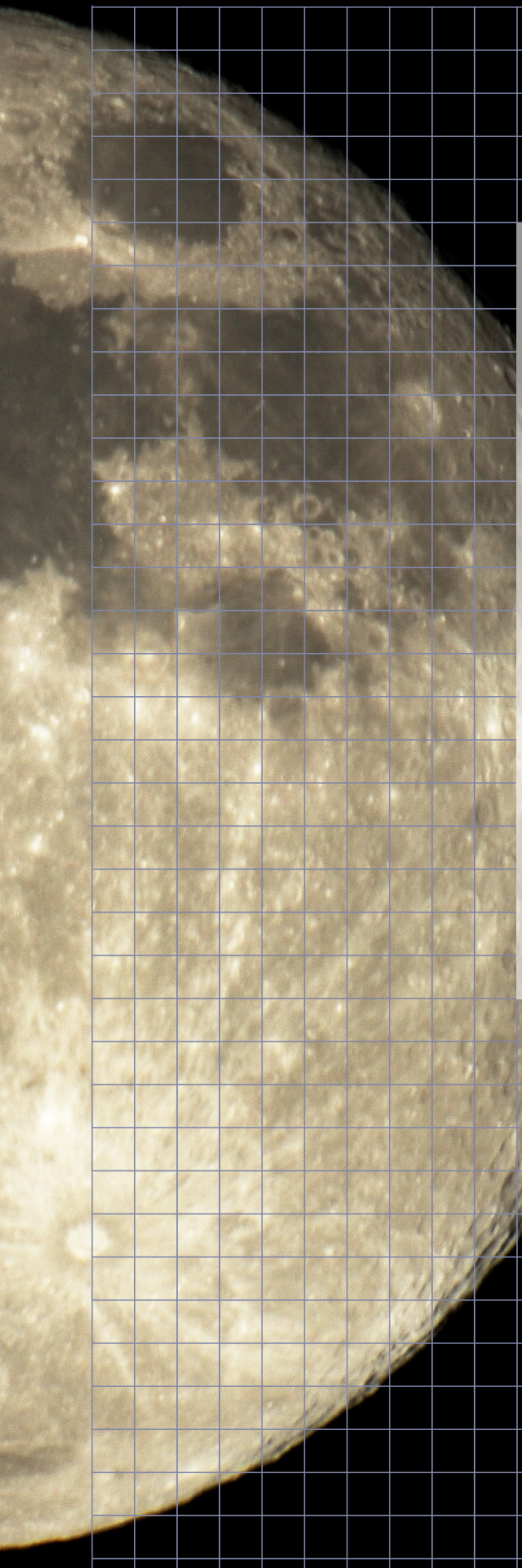
Noblesse HR can resolve most isobaric interferences to the noble gases, giving more accurate results. In particular, all carbon based interferences to Ar, and the $^{40}Ar^{++}$ interference to $^{20}Ne^{+}$, may be easily separated.

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.

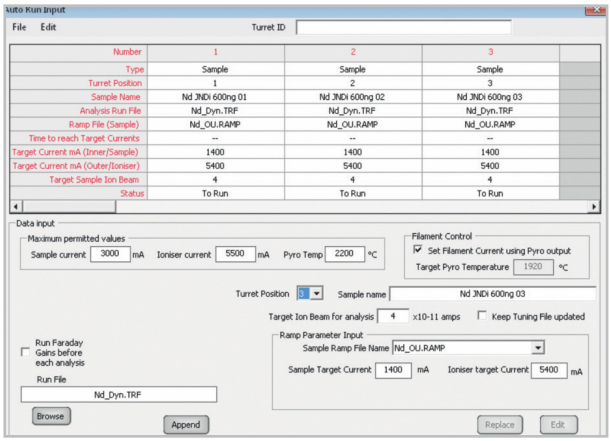


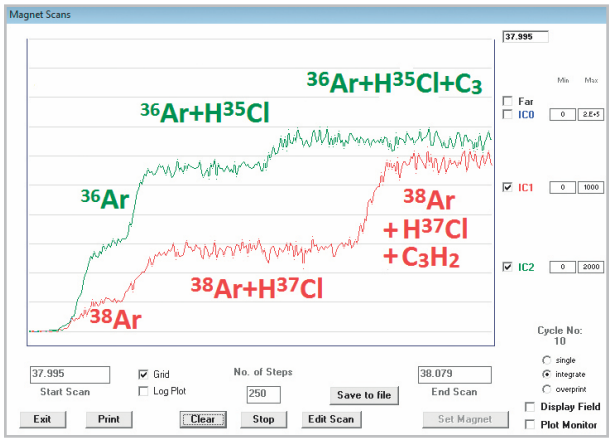
Noblesse HR - key features

- Greatly enhanced resolving power — demonstrated separation of $H^{35}Cl$ from ^{36}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 masses
- Fully bakeable to 300 deg C
- Intuitive control software

Noblesse HR

Noble Gas Mass Spectrometer





Mass scans showing resolution of ^{36}Ar and ^{38}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 ~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.

Noblesse HR

Versatile Collector Options

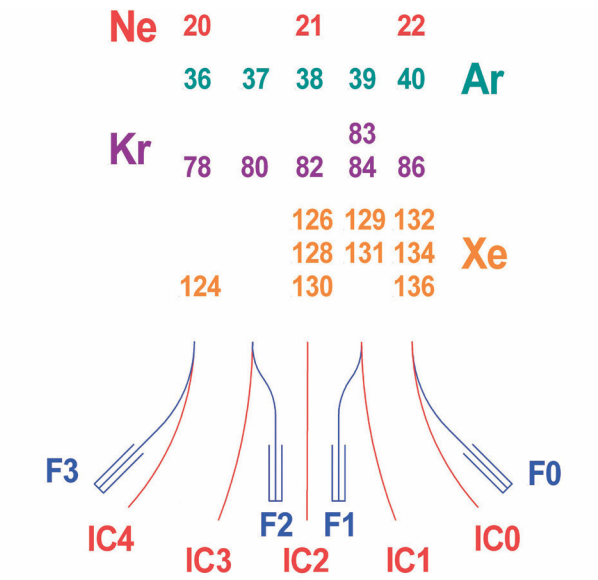
Collector Options

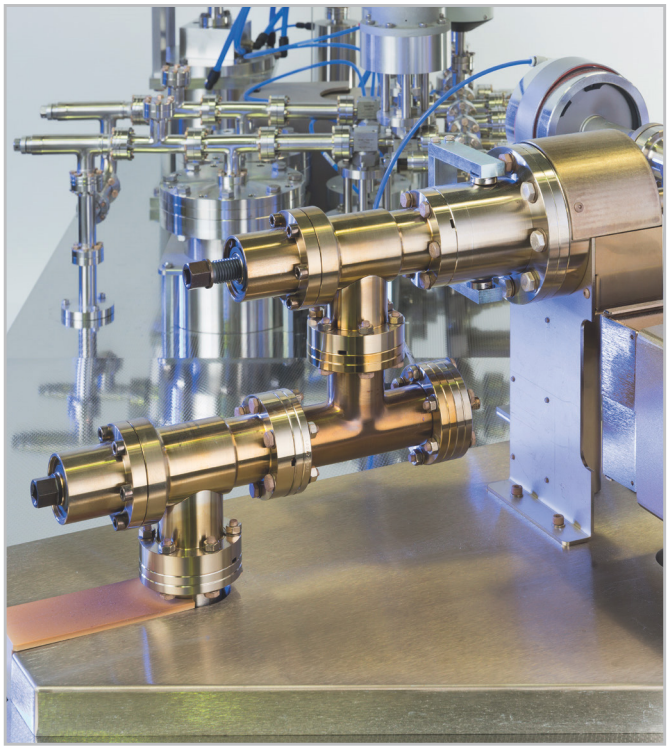
A key feature of Noblesse HR is the wide range of collector arrays which are offered. These have evolved over the last 10 years, leading to the 5 ion counter array shown below. This provides the ultimate in multicollection capability. All 5 Ar isotopes can be measured simultaneously, with the option 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}Ar. In each case, the two detectors are positioned behind the same source slit.

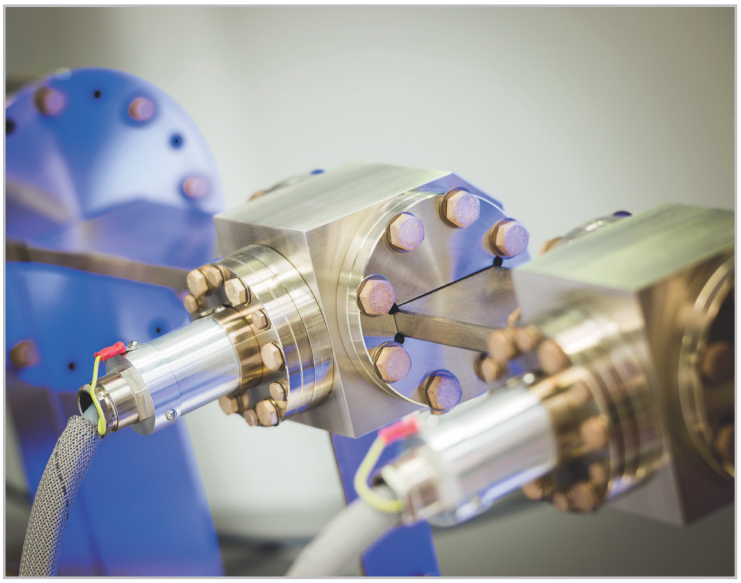
55V amplifiers are used providing enhanced dynamic range. Full size discrete dynode multipliers are employed, providing maximum stability and lifetime. Over-limit protection is provided, preventing beam entry into the multipliers should the count rate become too high.

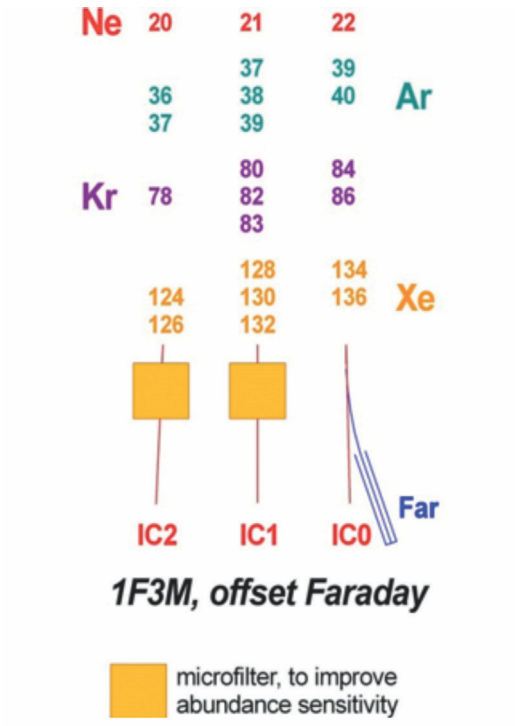




Collector Option Examples

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.





Noblesse HR

Integrated Sample Preparation System

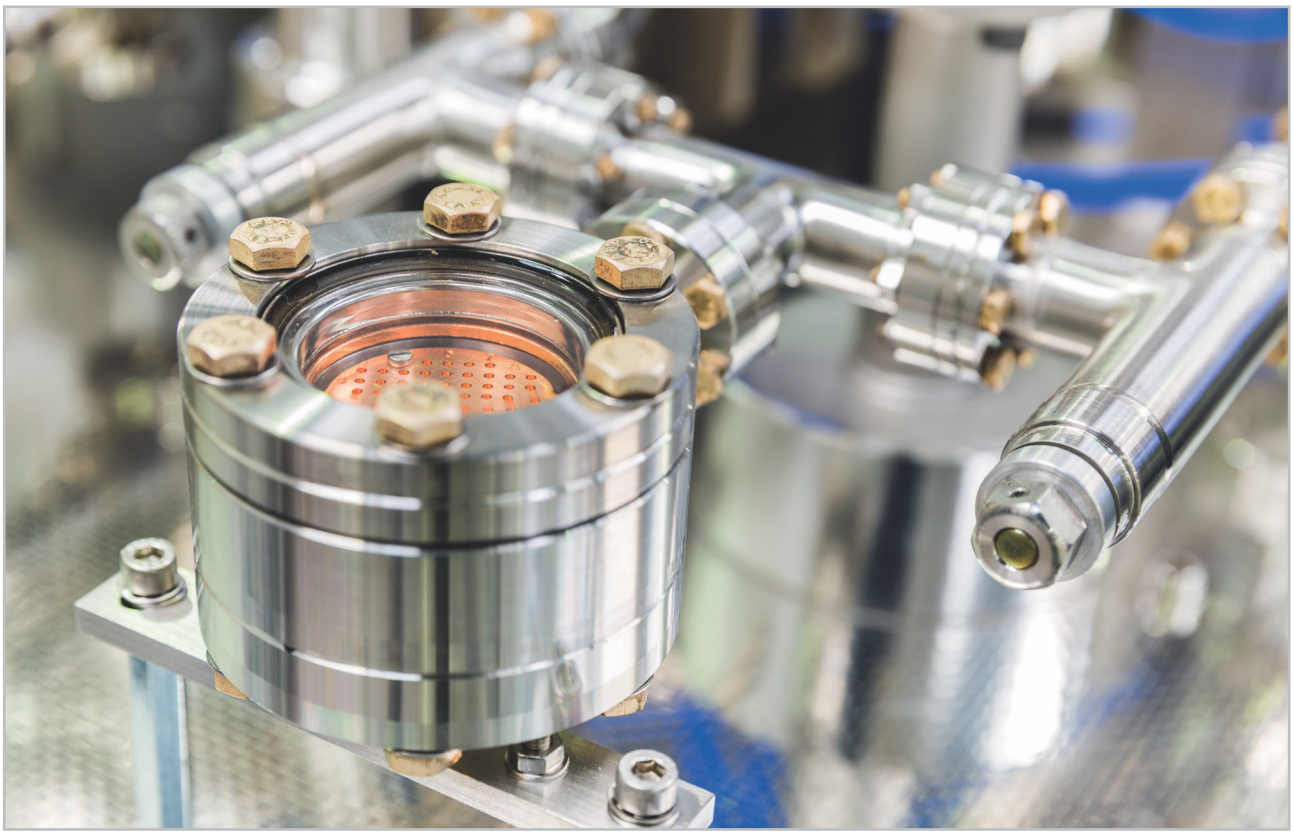
Sample Preparation System

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.

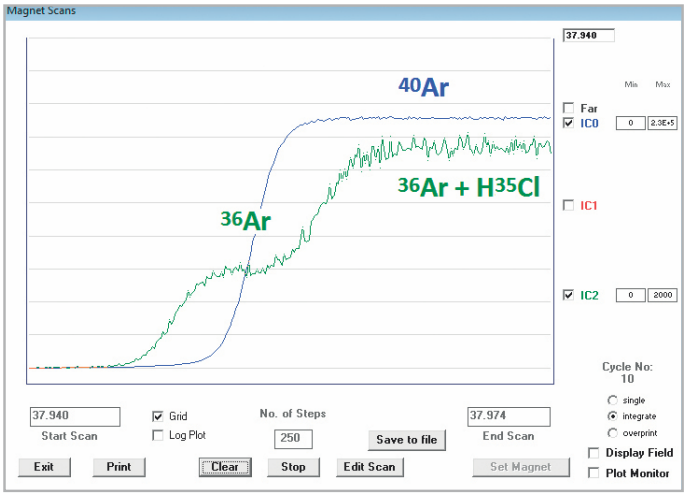
A disposable tantalum inner liner is used to contain the dropped samples in the furnace, and hence minimise chemical reactions with the tantalum crucible, thus maximising its lifetime.

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.

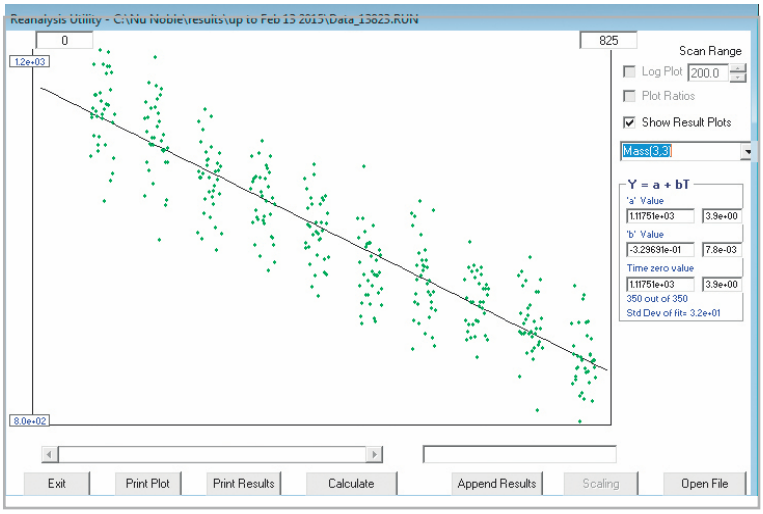
The temperature of the furnace is monitored using a W/W-Re thermocouple, and controlled using a dedicated controller, interfaced to a PC. A number of different heating profiles may be stored for use in different experiments.

Noblesse HR

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.

Selected Publications

C J Warren, S C Sherlock, S P Kelley. Interpreting high pressure phengite $^{40}Ar/^{39}Ar$ laser probe ages: an example from Saih Hatat, NE Oman. Contributions to Mineralogy and Petrology, DOI 10.1007/s00410-010-0576-1 (2010).

C J Warren, S P Kelley, S C Sherlock, C S McDonald. Metamorphic rocks seek meaningful cooling rate: Interpreting $^{40}Ar/^{39}Ar$ ages in an exhumed ultra-high pressure terrane. Lithos, DOI: 10.1016/j.lithos.2012.08.011 (2012).

C J Campisano, E C Kirk, K E B Townsend and A L Deino. Geochronological and Taxonomic revisions of the Middle Eocene Whistler Squat Quarry (Devil's Graveyard Formation, Texas) and Implications for the Early Uintan in Trans-Pecos Texas. PloS one 9 (7), e101516 (2014).

Brad Singer, Brian Jicha, Daniel Condon, Alexandra S Macho, Kenneth A Hoffman, Joseph Dierkhising, Maxwell C Brown, Joshua M Feinberg, Tesfaye Kidane. Precise ages of the Reunion event and Huckleberry Ridge excursion: Episodic Clustering of geomagnetic instabilities and the dynamics of flow within the outer core. Earth and Planetary Science Letters (405), 25-38 (2014).

D Kellett and N Joyce. Analytical details of single- and multicollection 40Ar/39Ar measurements for conventional step-heating and total-fusion age calculation using the Nu Noblesse at the Geological Survey of Canada. Geological Survey of Canada, Technical Note 8 (2014)

Bastian Baecker. Primordial and other noble gases in micrometeorites. Doctoral Thesis, Ruprecht-Karls-Universität, Heidelberg (2014).

Stephanie Flude, Alison M Halton, Simon P Kelley, Sarah P Sherlock and James Schwanetal, Observation of centimetre-scale argon diffusion in alkali feldspars: implications for $^{40}Ar/^{39}Ar$ thermochronology. Geological Society, London, Special Publications, 378 pp. 265–275 (2014).

Cameron M Mercer, Kelsey E Young, John R Weirich, Kip V Hodges, Bradley L Jolliff, Jo-Anne Wartho, Matthijs C van Soest. Refining lunar impact chronology through high spatial resolution $^{40}Ar/^{39}Ar$ dating of impact melts. Sci. Adv. 2015; 1; e1400050 (2015).

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).

E Cossette, D A Schneider, C J Warren, B Grasseman. Lithological, rheological and fluid infiltration control on $^{40}Ar/^{39}Ar$ ages in polydeformed rocks from the West Cycladic Detachment System, Greece. Lithosphere 7, 189-205 (2015)

J M Saxton, A method for measurement of ^{36}Ar without $H^{35}Cl$ interference. Chemical Geology, 409, 112-117 (2015).

noblesse HR

Innovators in Mass Spectrometry

Noble Gas Mass Spectrometer

planetary geochemistry nuclear

Nu Instruments Limited

Corporate Headquarters
Unit 74, Clywedog Road South,
Wrexham Industrial Estate,
Wrexham,
LL13 9XS - UK.

Tel: +44 (0)1978 661304
nu.info@ametek.com

Innovators in Mass Spectrometry. We deliver cutting-edge science and technology solutions, and offer our customers unparalleled support and maintenance service through the comprehensive AMECARE PERFORMANCE SERVICES program.

Corporate Headquarters
Nu Instruments UK • nu.sales@ametek.com

Regional Contacts
Nu Instruments Europe • nu.europe-sales@ametek.com
Nu Instruments Americas • nu.americas-sales@ametek.com
Nu Instruments Asia • nu.asia-sales@ametek.com

visit us online:
www.nu-ins.com

nu / AMETEK®

Noblesse HR version BRO9.7