



*sapphire*

*Collision Cell Multi-Collector  
ICP-MS*

# Sapphire: Technologies Collide for Unparalleled Performance

## Sapphire: Collision Cell Multi Collector Inductively Coupled Plasma Mass Spectrometer



### Introduction

The application of non-traditional stable isotope systems such as Mg, Si, S, K, Ca, Ti, V, Cr, Fe, Ni and Se in geochemistry, cosmochemistry and life sciences has been spurred by the advancement of the multi-collector ICP-MS (MC-ICP-MS) over the last two decades. This versatile technique, although widely considered as the standard method for the high precision isotopic analysis of such systems, is limited by the molecular species generated by the argon ICP ion source which cause significant interferences on the mass spectrum of these elements. These molecular species can interfere directly with the atomic ions of the same nominal mass, leading to inaccurate isotope ratio determination. A typical solution is to use the high-resolution capabilities of MC-ICP-MS to resolve or partially resolve the isotopes of interest from their respective interferences, but at the cost of significantly reduced ion transmission. Furthermore, analysis of certain isotopes such as  $^{40}\text{Ca}$  is not possible on the traditional MC-ICP-MS instruments, as the  $^{40}\text{Ar}$  interference cannot be resolved.

**Sapphire** is a collision/reaction cell MC-ICP-MS incorporating both a “high energy” ion path (traditional MC-ICP-MS) and a separate “low energy” ion path (collision/reaction cell). The instrument offers an ideal solution for the precise and accurate isotopic analysis of both the traditional isotope systems, and the non-traditional isotope systems mentioned above.

**Sapphire** has combined the Plasma 3 mass analyser with the patented (GB 2535826) dual path transfer optics offering the benefits of collision/reaction cell without compromising performance for classical geological applications.

The ‘dual path’ design allows the cell to be used to remove isobaric interferences for specific applications and can be fully bypassed when analyzing classical isotope systems that do not require removal of interferences or for systems where the high resolution features are preferred.

For more information go online: [www.nu-ins.com](http://www.nu-ins.com)

### Application Areas



planetary



life science



geochemistry

**find out more** [www.nu-ins.com](http://www.nu-ins.com)

### Key features:

Double focussing high precision isotopic measurement mass spectrometer

Enhanced Sensitivity Interface as standard

Dual Path transfer optics, incorporating:

- Low energy path with collision / reaction cell for interference removal
- High energy path for classical multi-collector performance

Up to 4 independently controlled reaction gas inlets

Fully dry pumped configuration available for lower hydrocarbon backgrounds

Sixteen Faraday detectors, with optional software switchable resistor amplifiers and up to six ion-counting detectors (with SEM / Daly options) giving maximum user flexibility and dynamic range

High abundance deceleration filters available for improved abundance sensitivity

High resolution and pseudo high resolution capabilities

Variable Zoom Optics allow for instantaneous switching between isotopic systems during analysis

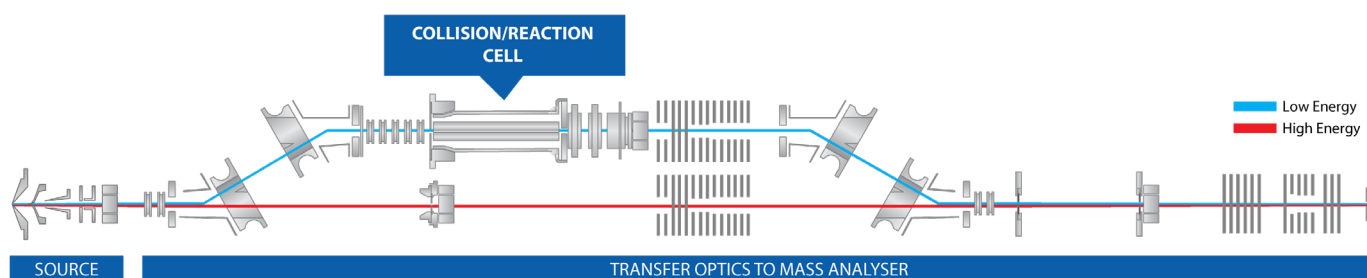
## Dual Path Transfer Optics

The dual path transfer optics retain the high sensitivity of MC-ICP-MS by extracting the ions at a high energy (~6keV). The ion beam can then be directed along two distinct paths.

The 'High Energy Path' maintains the high ion energy throughout the transfer optics before focusing into the defining slit of the double focusing mass spectrometer, retaining all the key performance of traditional MC-ICP-MS.

The 'Low Energy Path' diverts the ion beam along a second route before the ions are decelerated into the collision / reaction cell. Gas is introduced into the RF cell to produce reactions with the low energy ions. On exiting the cell, the ions are accelerated back to the high energy and focused into the defining slit of the double focusing mass spectrometer.

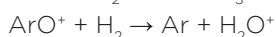
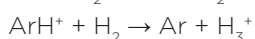
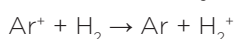
The 'dual path' design provides an effective solution to mass discrimination problems potentially caused by RF multipole devices associated with other reaction cell instruments.



## Interference Removal

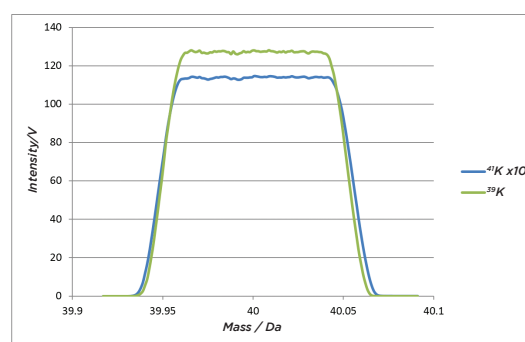
The collision / reaction cell enables removal of isobaric interferences such as Ar<sup>+</sup> or polyatomic interferences such as ArH<sup>+</sup>, ArN<sup>+</sup> or ArO<sup>+</sup> which can interfere directly with the atomic ions of the same nominal mass for example K, Ca, Fe.

Such interferences can be removed via charge exchange reactions with Hydrogen such as:

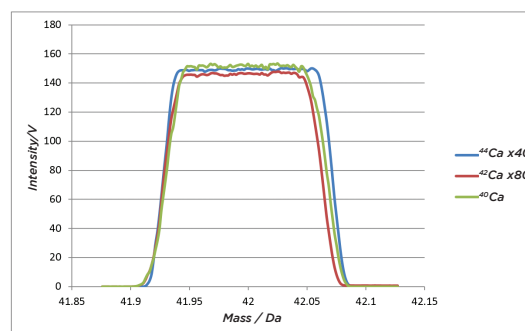


These reactions reduce the Argon ion signal by more than 9 orders of magnitude while other analytes are unaffected.

The removal of these interferences allows the measurement of non-traditional stable isotopes such as potassium and calcium at low resolution, without reducing transmission.



Mass scan of 500ppb of potassium



Mass scan of 500ppb of calcium

# sapphire

*Innovators in  
Mass Spectrometry*



## **Collision Cell Multi-Collector ICP-MS**



environmental



planetary



life science



geochemistry



material science



nuclear

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