noblesse

Noblesse Note **NG05**

Principles of Zoom Optics

Introduction

Many Nu Instruments products incorporate zoom optics. One set of zoom optics consists of a pair of miniature quad lenses, placed between the magnet and collector. Each lens can independently focus the ion beam at the collector slits. Two lenses together act as a zoom lens: by making one lens more positive and the other more negative, we can vary the mass dispersion, whilst maintaining ion beam focus.

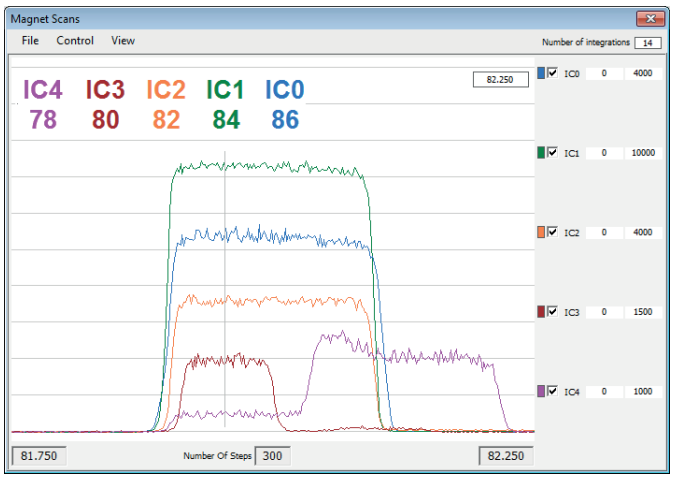
Key Advantages:

- Flexible: Can change the dispersion – allows multicollection of different isotope sets on an instrument with fixed collectors.
- Fast: Dispersion changed instantaneously (<1 second, shorter than magnet jump time) – that can change dispersion during an analysis on different measurement steps.
- Fixed collectors: No risk of outgassing when moving collectors (important as analyses made in static mode), lower collector volume, no moving parts, greater reliability.

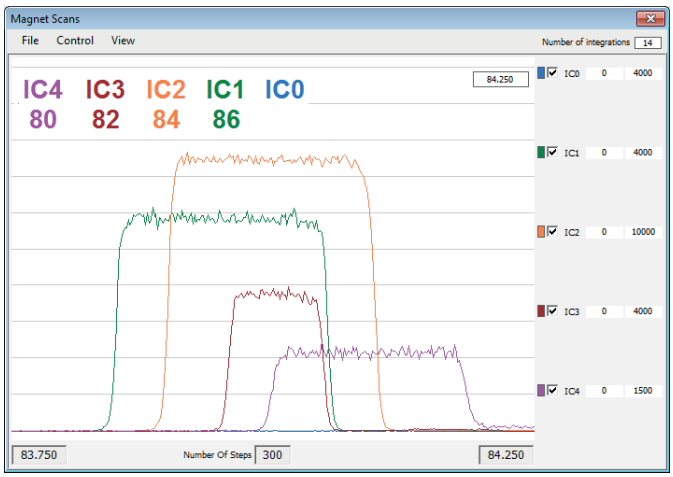
Demonstration of peak alignment using zoom optics (Kr isotopes, measured with Noblesse)

The following example demonstrates zoom optics using Kr. Kr is chosen simply because it provides an ion beam in all five collectors, but the principles are applicable to other noble gases.

In the following mass scan, the even Kr isotopes have been aligned for multicollection measurement - the vertical grey line is the suggested measurement position.

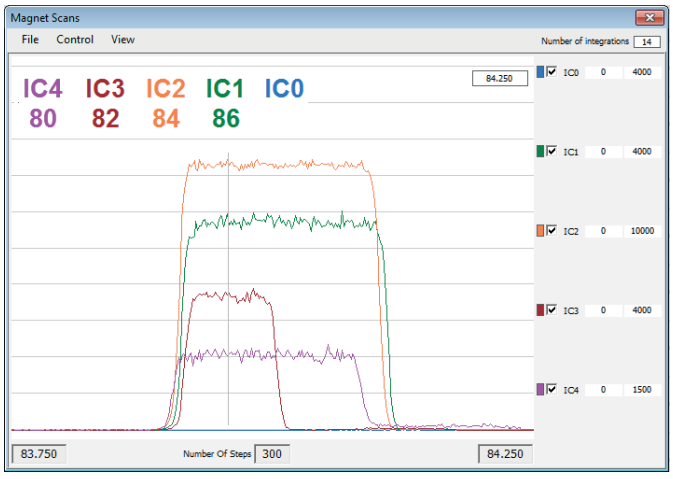


Suppose we now jump 2 amu, to shift the ion beams into adjacent collectors, whilst keeping the zoom setting fixed (there may be various reasons for this, e.g. detector calibration, or dynamic range issues if using a mixture of EMs and Faradays). If we keep the zoom (dispersion) fixed, the peaks no longer align. This would also be the situation with an instrument with fixed collectors and no zoom.



Notice how much the peaks move out of alignment, simply by shifting the mass by 2 parts in 84. This would prevent multicollection at low resolution, and even more so if mass alignment was critical (for example, if we were trying to edge resolve interferences).

We can bring the peaks back into coincidence (instantly!) by adjusting the zoom setting:



Additional notes:

- *With Noblesse, we often edge resolve the interferences, which is why most collectors are fitted with wide slits.*
- *A narrow slit is fitted to IC3 to permit true resolution of ^{3}He-HD.*
- *The prominent – but well resolved – interference to the high mass side of ^{78}Kr is C_6H_6 for which m/Δm = 616. Hydrocarbon interferences are also present for other Kr isotopes, but the relative mass differences are all greater than 616.*