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HIDEN ANALYTICAL

High Mass QMS to 5,000 m/z

Cluster Analysis

Residual Gas Analysis

5,000 m/z Clusters needs a 9mm Quadrupole

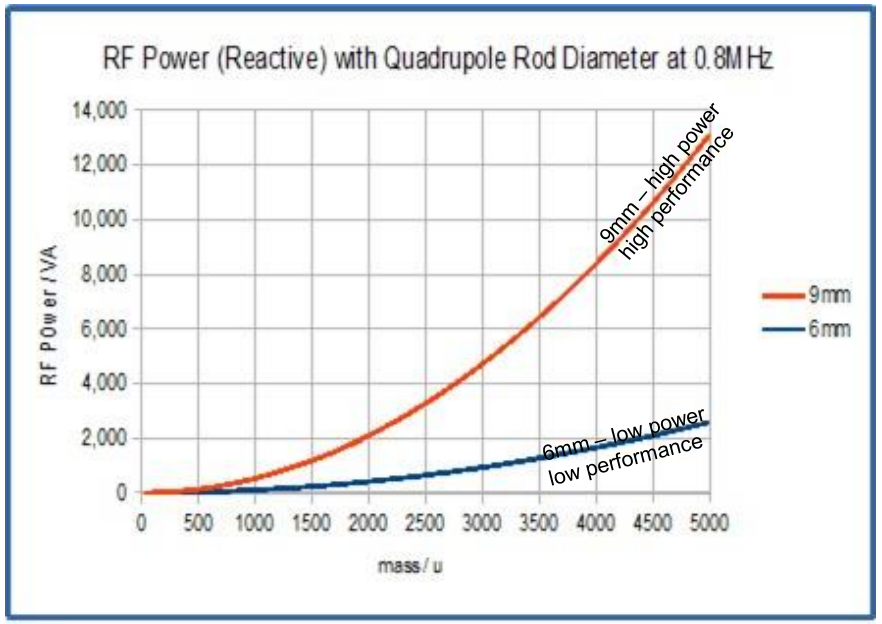
The upper mass limit of a Quadrupole filter is severely constrained by the demand for RF Power that accompanies increasing m/z.

Downsizing the Rod Diameter appears to offer a way around this problem, but comes with a significant reduction in Quad performance, limiting its effectiveness for clusters at high m/z.

Hiden's High Power RF Generator provides the solution - it is capable of delivering 5,000 m/z mass range even on a 9mm Triple Filter Quad and with a frequency of 0.8MHz, a combination that generates outstanding performance.

This brings transmission of 45% at 5,000 m/z, yielding the lowest detection limit even for the largest of clusters.

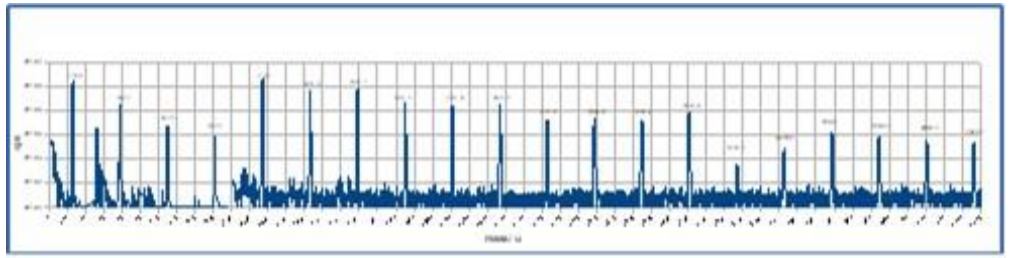
RF Power increases exponentially with m/z



5,000 m/z Quadrupole

9mm Triple Filter Quadrupole and High Power RF Generator deliver unmatchable 5,000 m/z performance

For both RGA and Cluster



Cluster Scans using a Sputtered Source

Evaluating Performance at 5,000 m/z

Positive ion Clusters with m/z in excess of 5,000 were generated as secondary ions from a Caesium Iodide target, using Hiden's SIMS Workstation*.

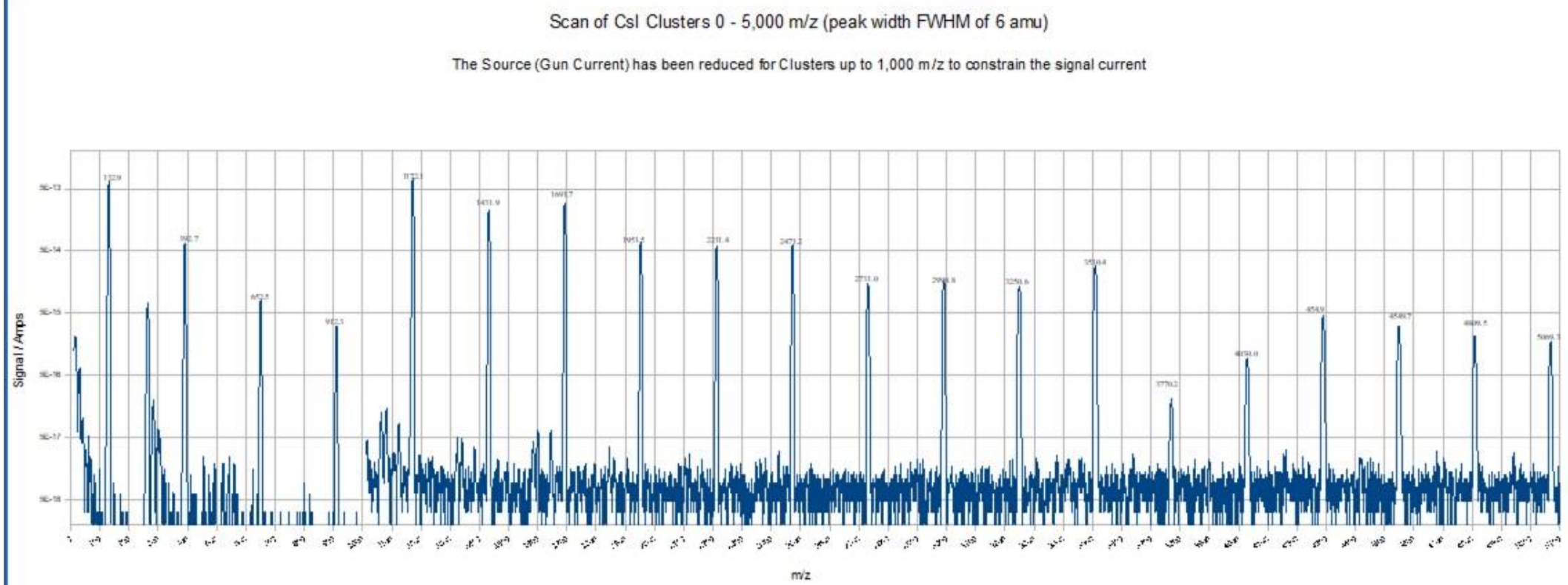
Clusters are generated with masses right across the scale at intervals of approximately 260amu, ideal for assessing the performance of the Quad

These Clusters were then focussed into the Quadrupole Mass Filter.

*Caesium Iodide Clusters were generated on Hiden's SIMS Workstation.

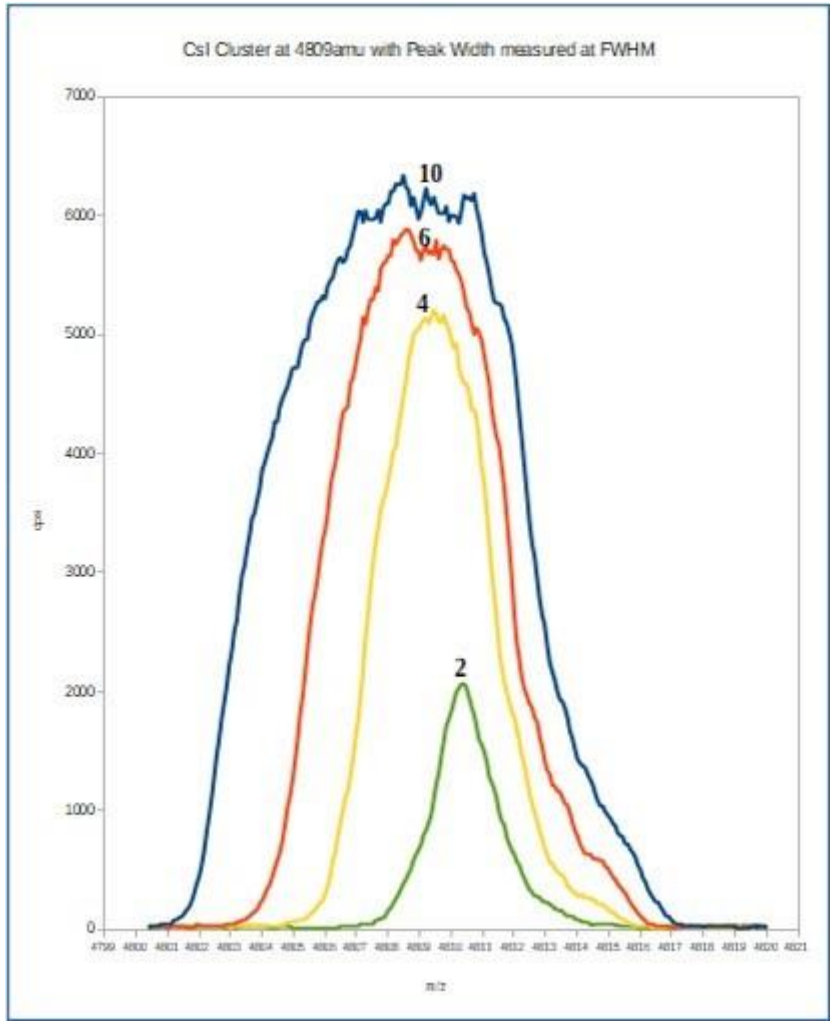
Sputtering condition: 5keV, Cs^{+}, 45˚, @50nA

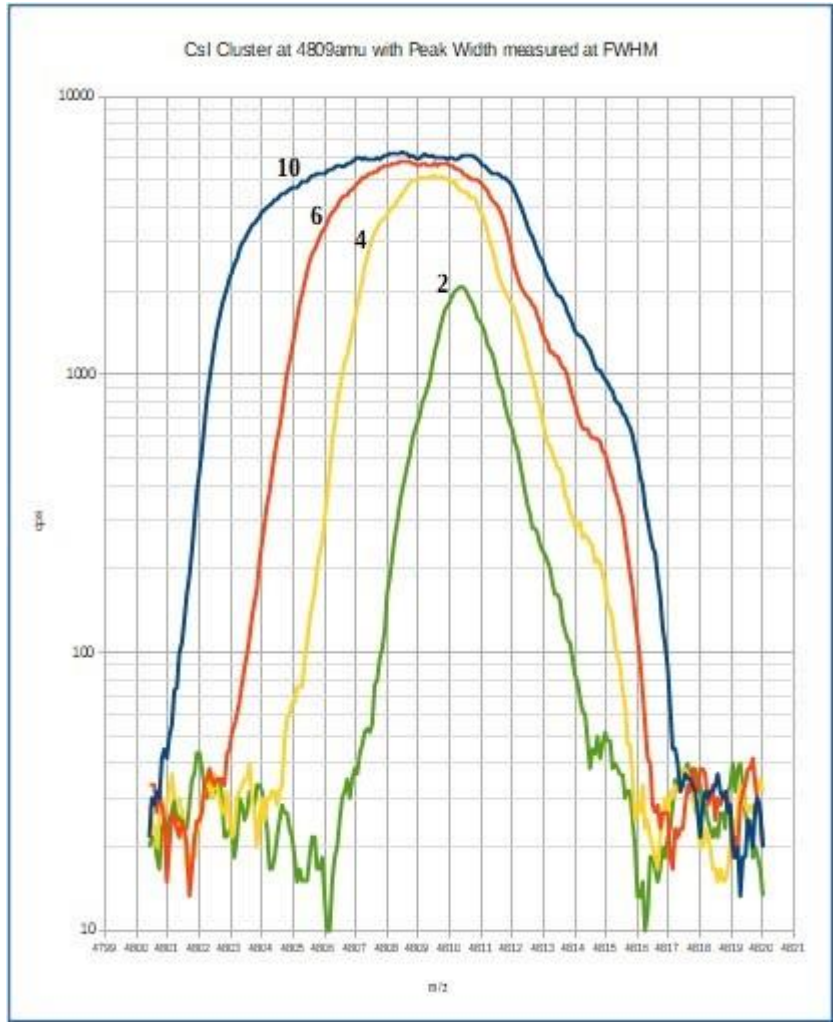
Cluster Scan of Caesium Iodide, up to 5,000 m/z



Mass alignment and stability are ensured by Hiden's High Power RF Generator

Cluster 4809 m/z, Quad Sensitivity with Peak Width

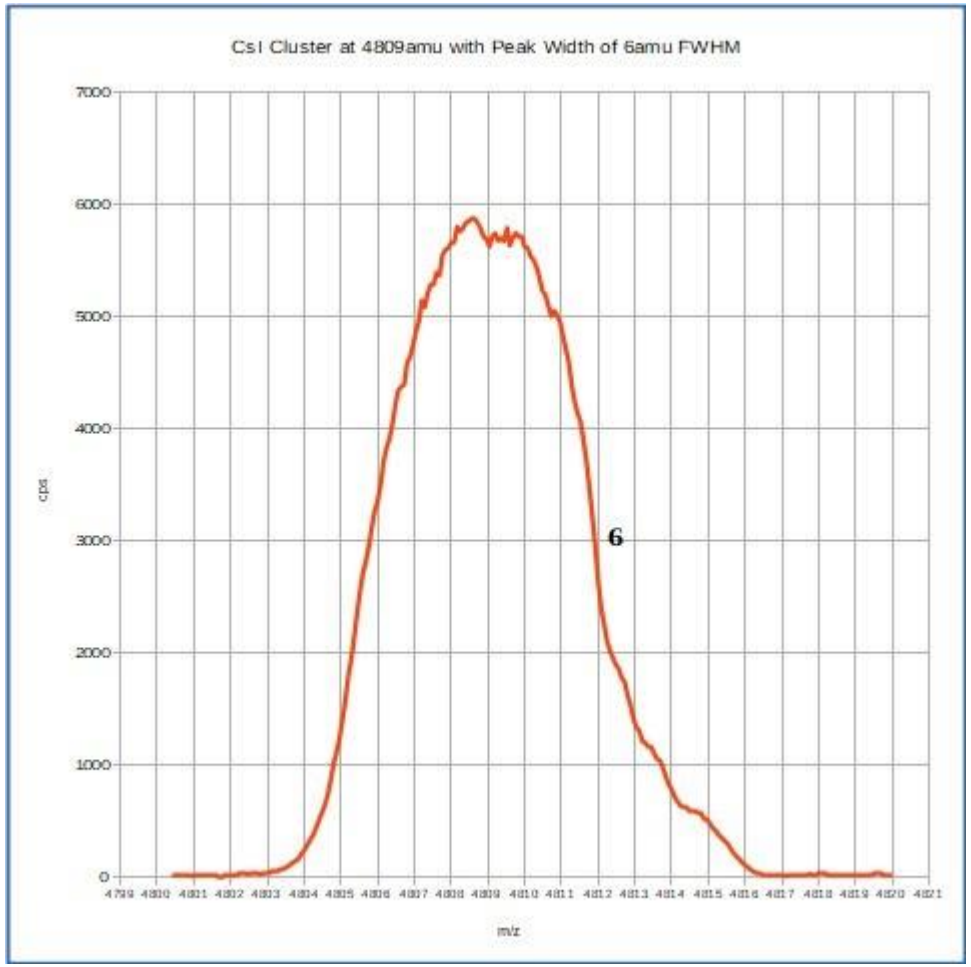


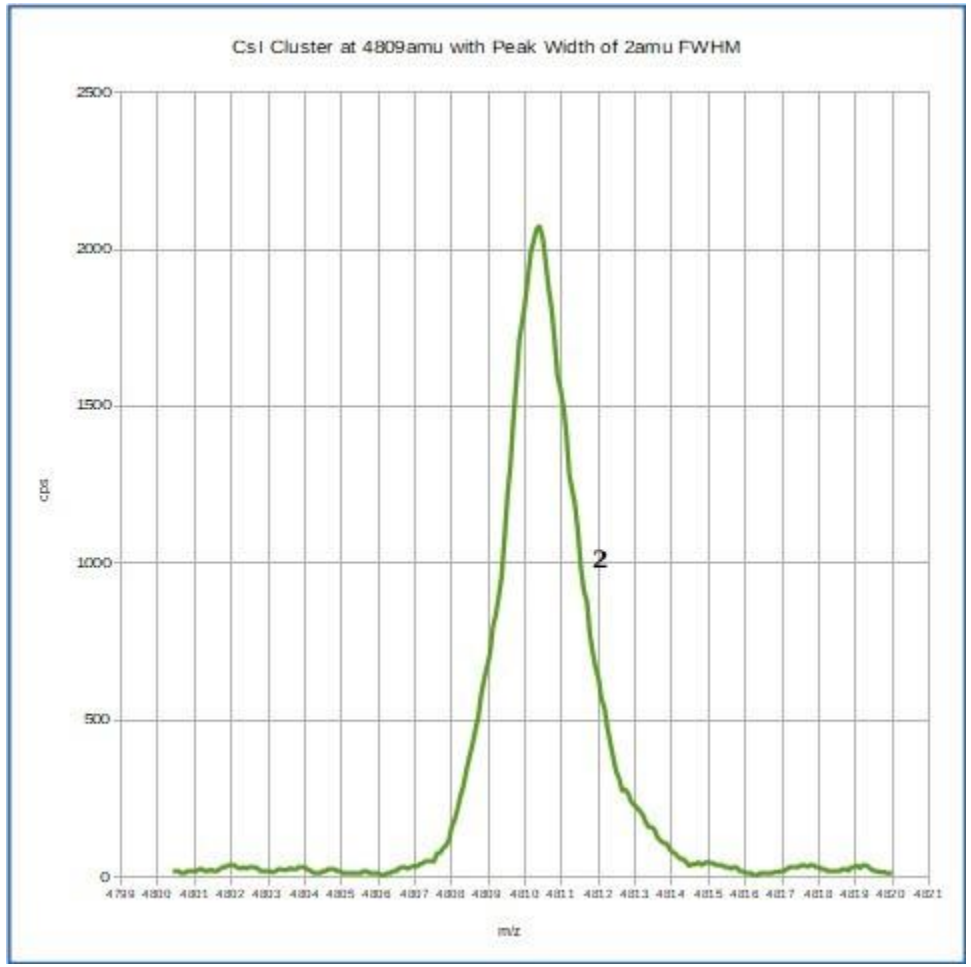


Hiden's unique combination of Triple Filter, 9mm Rods and High Frequency RF Generator, creates exceptional resolving power, even at the highest m/z

The peak width is fully user adjustable in software*

Cluster at 4809 m/z measured with 6amu and 2amu Peak Width

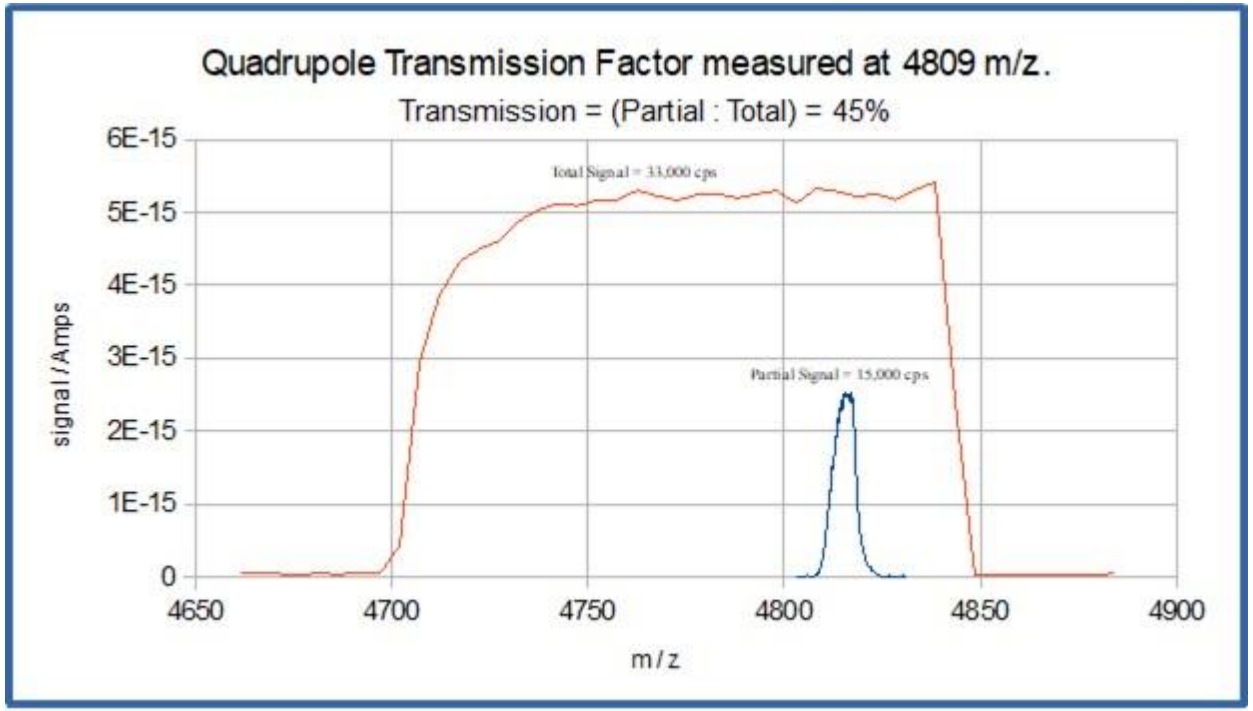




The resolving power of the 9mm Quad ensures both good transmission and peak shape even at 4809 m/z

Resolving power, measured as M/DeltaM, is up to 2,500

Quad Transmission Factor for Clusters with m/z of 4809



Transmission*, even at 4809 m/z, is as high as 45%.

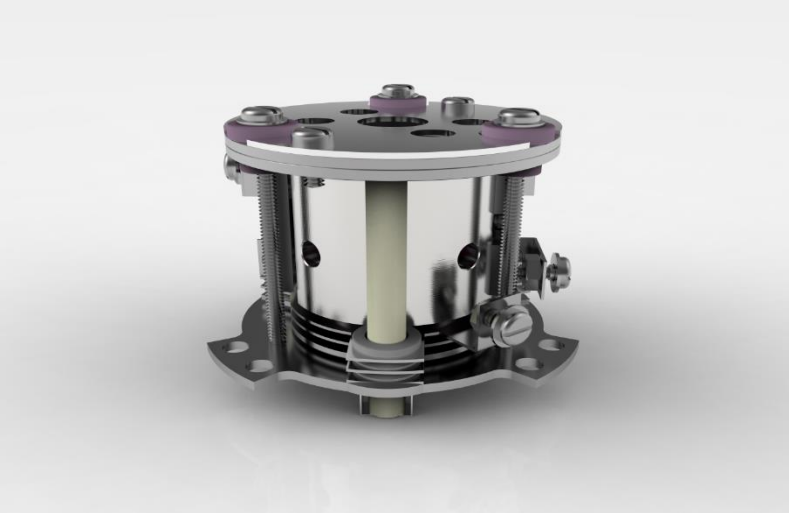
This ensures the lowest Detection Limits for even the heaviest of Clusters.

**measured as the ratio of the Partial Signal (peak width 6amu) to the Total Signal (peak width 140amu), at 4809 m/z*

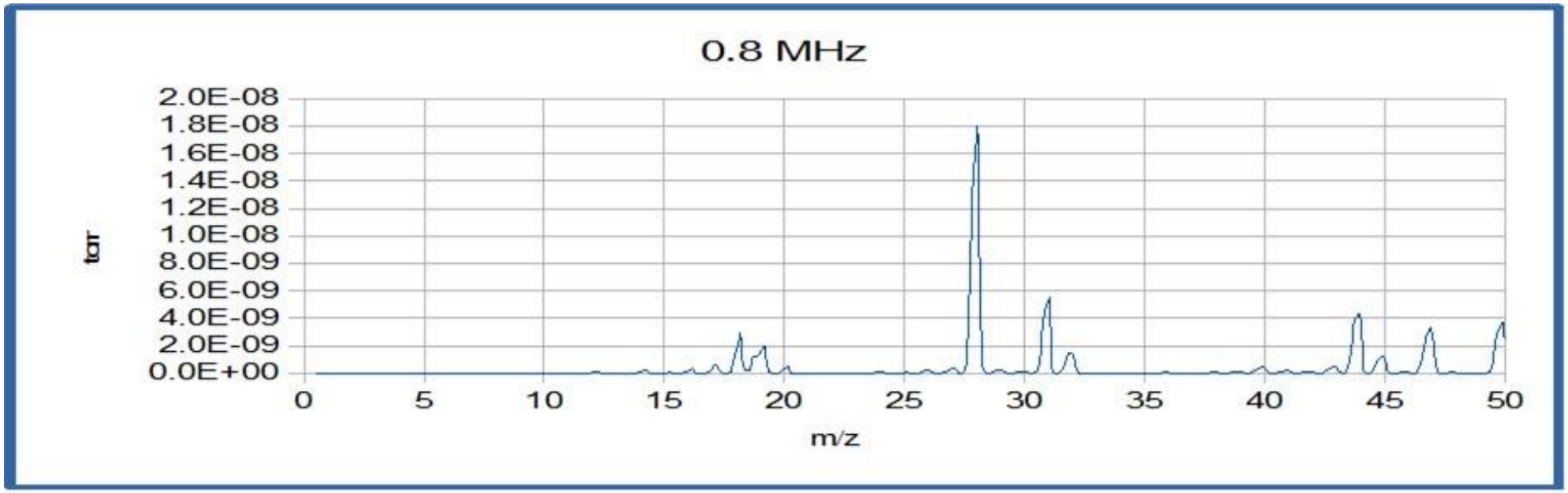
RGA using an Electron Impact Source

RGA analysis is also possible by mounting an Electron Impact source on the Quad.

This extends the versatility.

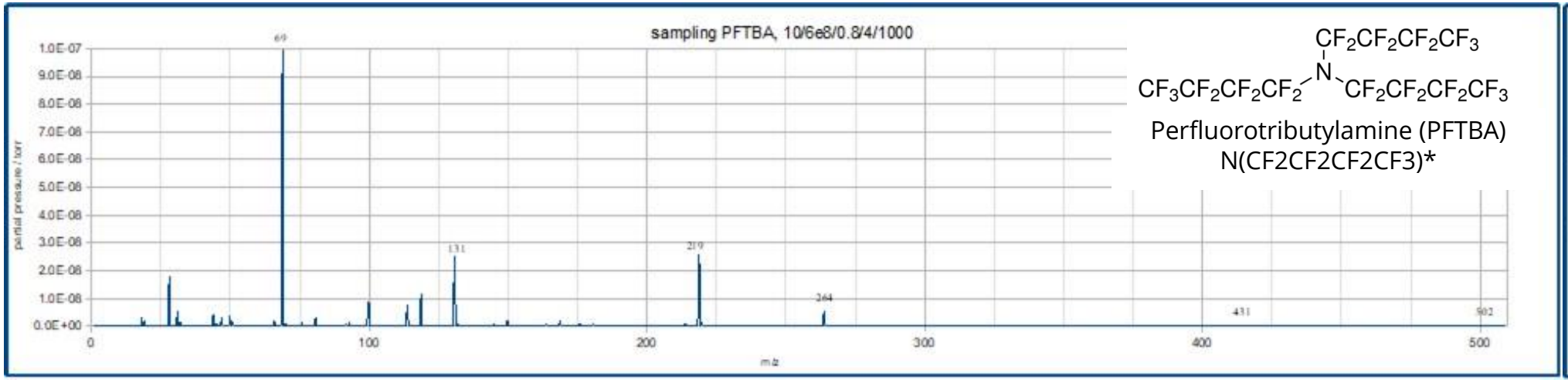


Measuring Gases using an Electron Impact Source

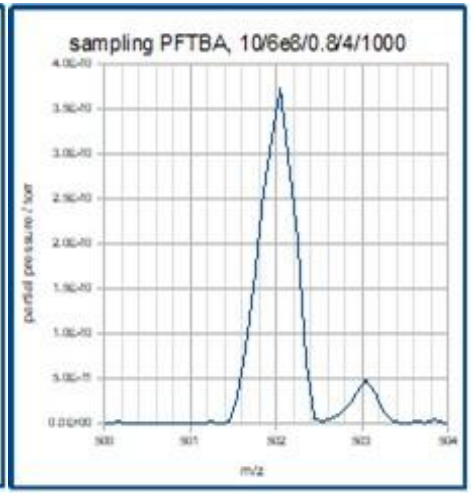


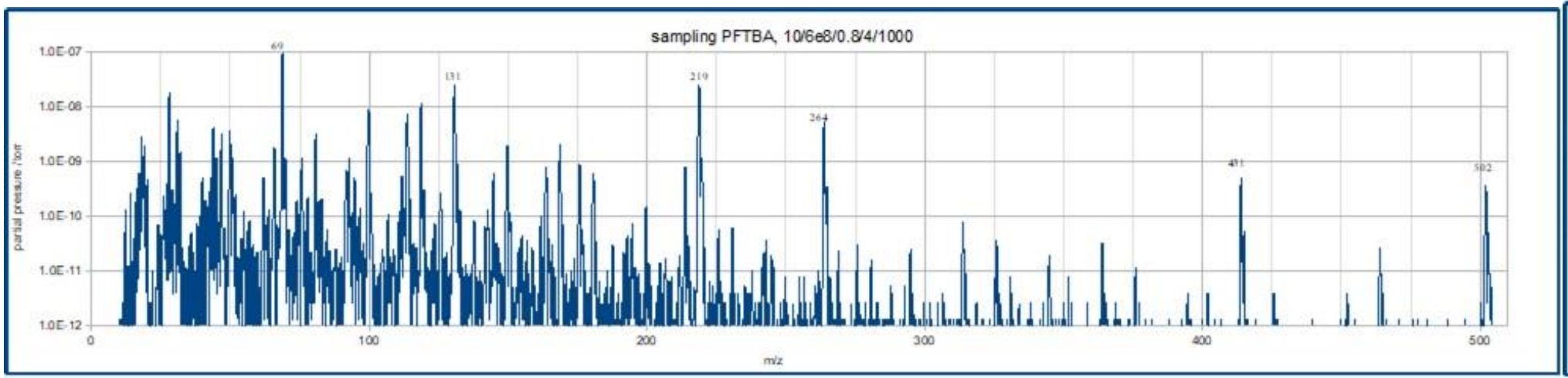
RGA performance with an Electron Impact source

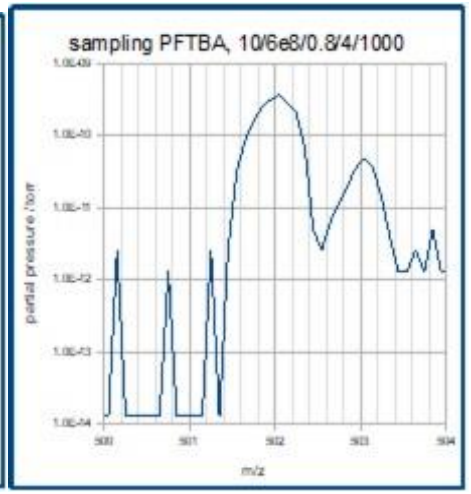
Measuring Volatile Sample using an Electron Impact Source



Perfluorotributylamine (PFTBA)
N(CF2CF2CF2CF3)*

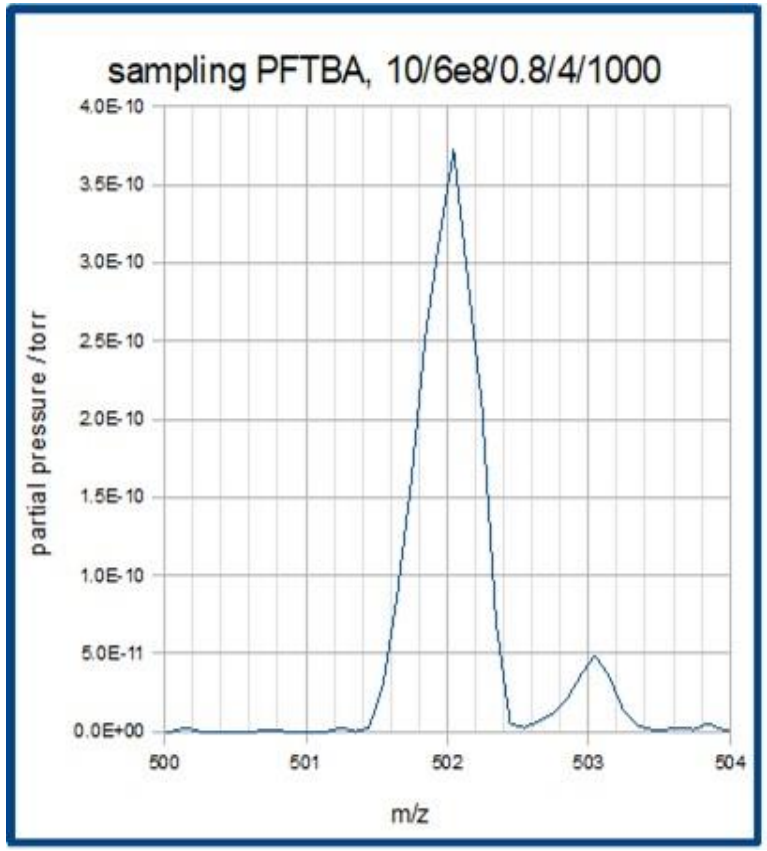


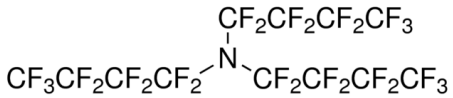




* see appendix for PFTBA

Limit of Detection with an Electron Impact Source





Limit of Detection at 502 m/z

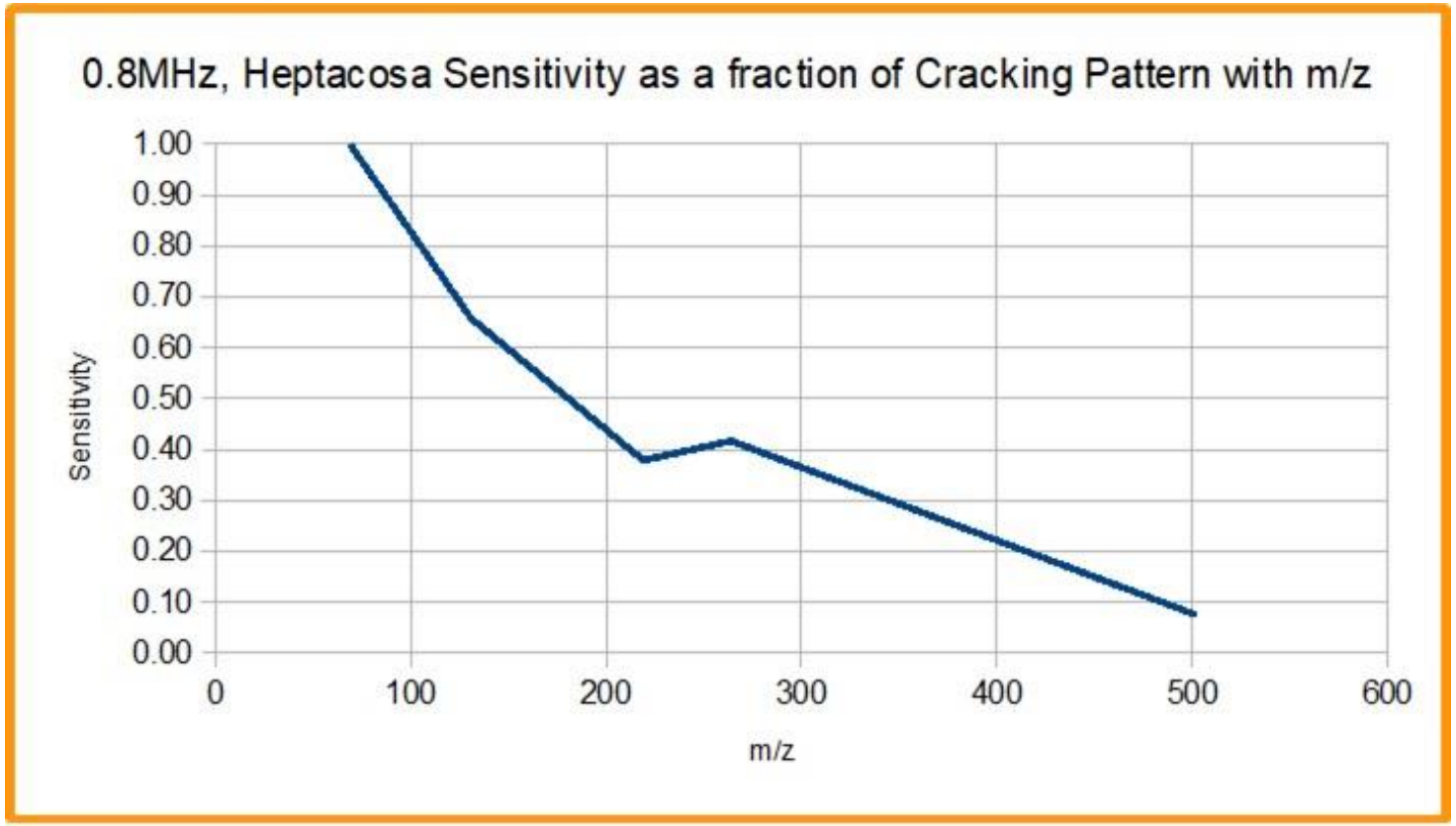
The LOD is determined by the combination of two parameters: the variance of the background and the sensitivity. Measurements which are three times greater than the background variance give 99.7% confidence of them originating from genuine signal. Generally 3 times the *standard deviation* defines then the *Limit of Detection.*

The LOD can be improved by extending the dwell time. This effectively reduces the variance of the background signal.

Dwell Time / s	LOD / torr	Bkg Variance / torr
10	1.7e-14	5.7e-15
600	2.7e-15	9e-16

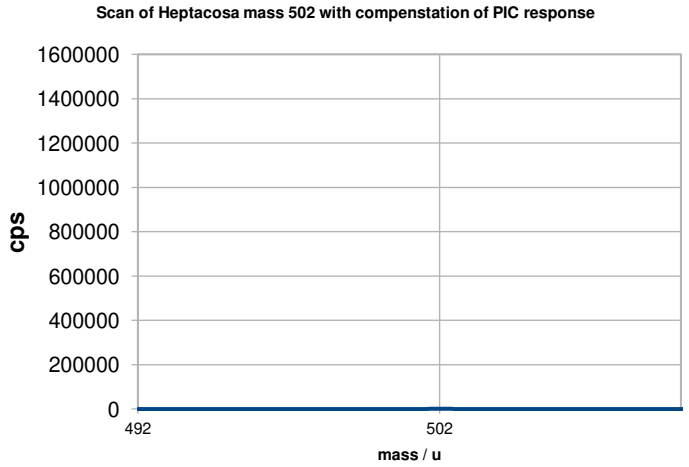
(Note: the background's average intensity does not influence the LOD, since it can be simply subtracted from measurements).

Sensitivity with Mass at up to 500 m/z



Quadrupole filters exhibit a reduction in sensitivity as mass increases

Hiden's 0.8MHz 9mm quad has sufficient resolving power to transmit a full 8% of signal at 502* m/z



5,000 m/z Quadrupole

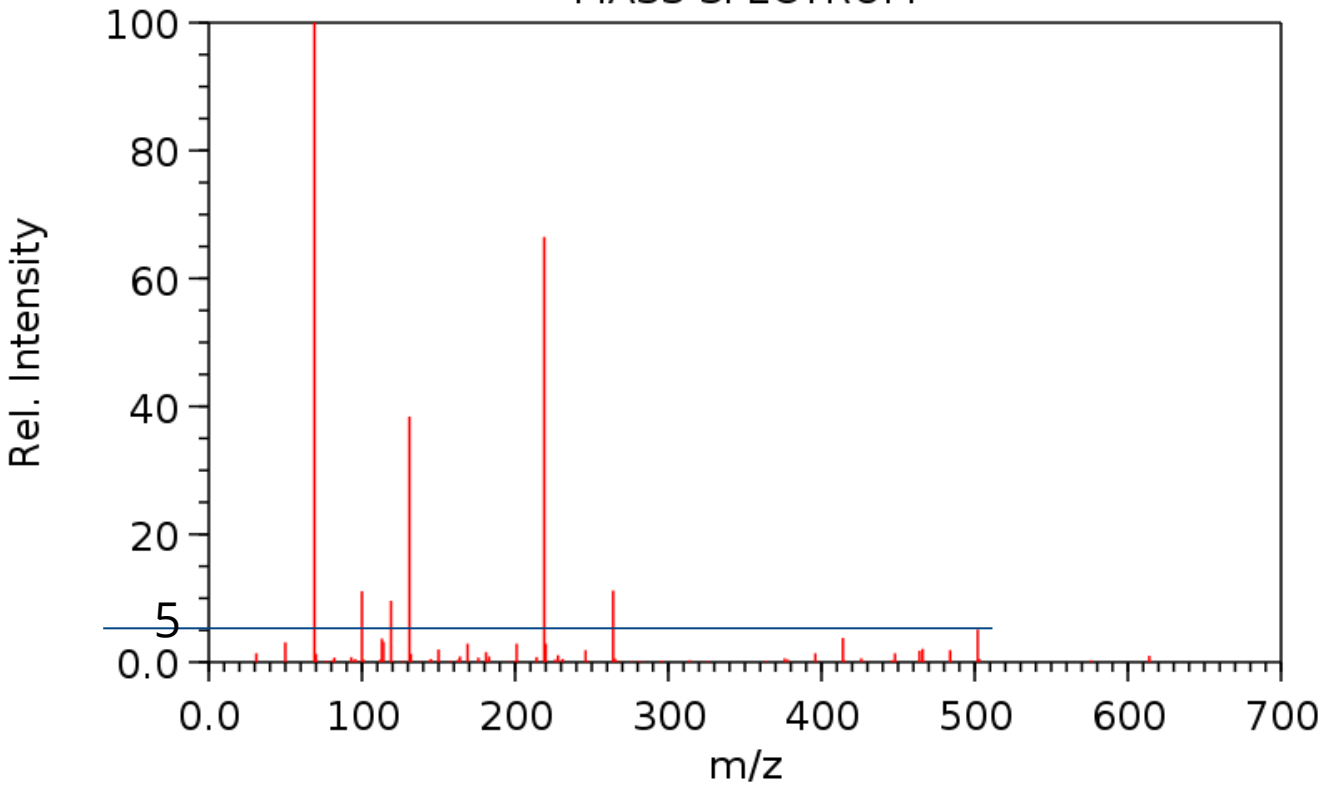
Summary

- Triple Filter, 9mm Rod Diameter Quadrupole
- High Power RF Generator
- 0.8MHz Operating Frequency
- 0 – 5,000 m/z for Cluster Analysis
- 45% Transmission at 4,809 m/z (6amu Peak Width @ FWHM)
- Capable of RGA and Cluster Analysis in one single package

Appendix

Perfluorotributylamine $C_{12}F_{27}N$, 671 m/z

MASS SPECTRUM

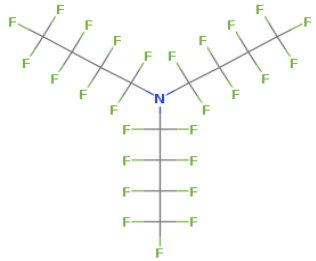


Perfluorotributylamine

- **Formula:** $C_{12}F_{27}N$
- **Molecular weight:** 671.0920
- **IUPAC Standard InChI:**
  - InChI=1S/C12F27N /c13-1(14,7(25,26)27)4(19,20)10(34,35)40(11(36,37)5(21,22)2(15,16)8(28,29)30)12(38,39)6(23,24)3(17,18)9(31,32)33

InChI TRUST CERTIFIED 2011

- **IUPAC Standard InChIKey:** RVZRBWKZFJCCIB-UHFFFAOYSA-N
- **CAS Registry Number:** 311-89-7
- **Chemical structure:**



- www.HidenAnalytical.com
- The Hiden website is an excellent resource with product pages, brochures, catalogues, product pages with some application notes, presentation and other information.
- Contact +44 1925 445225 for direct support.