# Discover the Advantage of QPS Stability

## Extrel's newest Quadrupole Power Supplies (QPS) deliver unrivalled long-term stability. Here we demonstrate two of the most critical performance factors for Quadrupole Power Supplies:

- Mass Stability
- Resolution Stability

**Mass Stability**

Mass stability is probably the most noted performance factor for quadrupole power supplies. Typical specifications for mass drift are 0.1 Da over 48 hours. In order to demonstrate exceptional mass stability performance, we used a QPS operating at 2.9MHz to drive a 19mm Tri-filter QMF configured as part of a MAX instrument having a mass range of 1 to 50 Daltons. Data was collected continuously over a 76 hour period. Figure 1 is an overlay of 19 scans from the data set taken at the end of every four hours. ***The peak position movement is measured to be just 0.0008 Daltons, which means that it is essentially unmoved over the entire 76 hour operating period.***

**Peak Position Does Not Change Over 76 Hours**

In order to determine the limits to which mass drift can be detected visually, we used the programmable mass position command in Extrel's "Merlin" software application to shift the peak position until the change was detectable. Figure 2 shows a peak that was moved just 0.01 Da using the Merlin Automation Data System. Visually, the mass drift is still barely perceptible and is in fact a factor of x10, better than most commercial specifications. Looking more closely at the exploded portions of the plot, which show the peak edge at approximately half the maximum height, it can be seen that the previous data from the 76 hours of continuous scanning fits well within the forced shift. **The mass drift of the QPS is visually undetectable.**

Figure 1: 76 Hour Mass Stability, Spectra Extracted Every 4hrs Overall STD 0.0008 Da

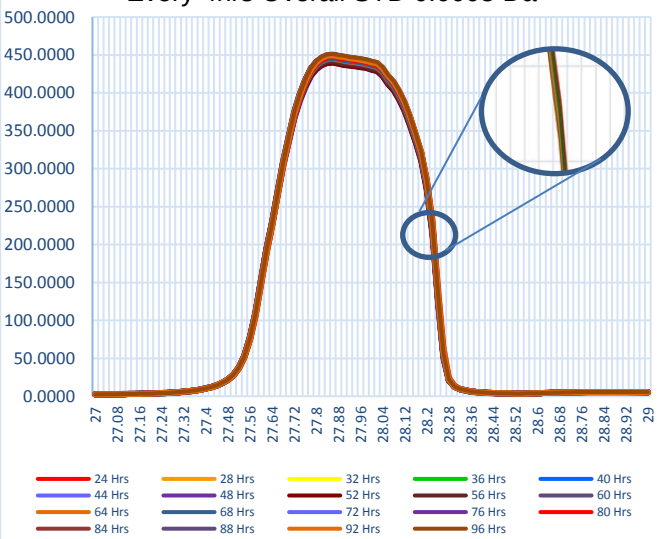
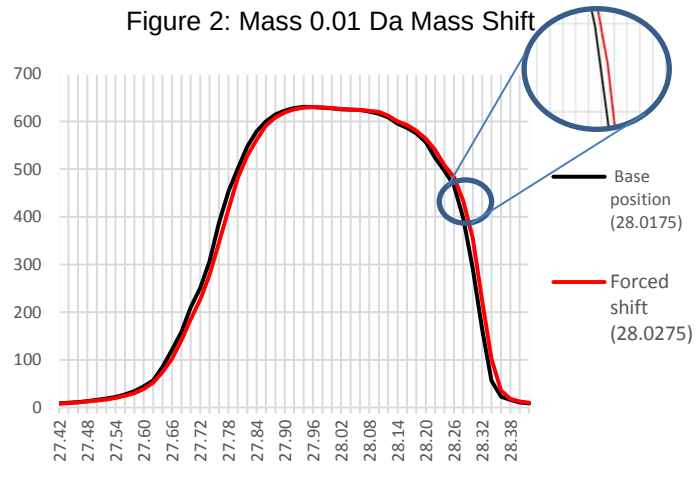



Figure 2: Mass 0.01 Da Mass Shift

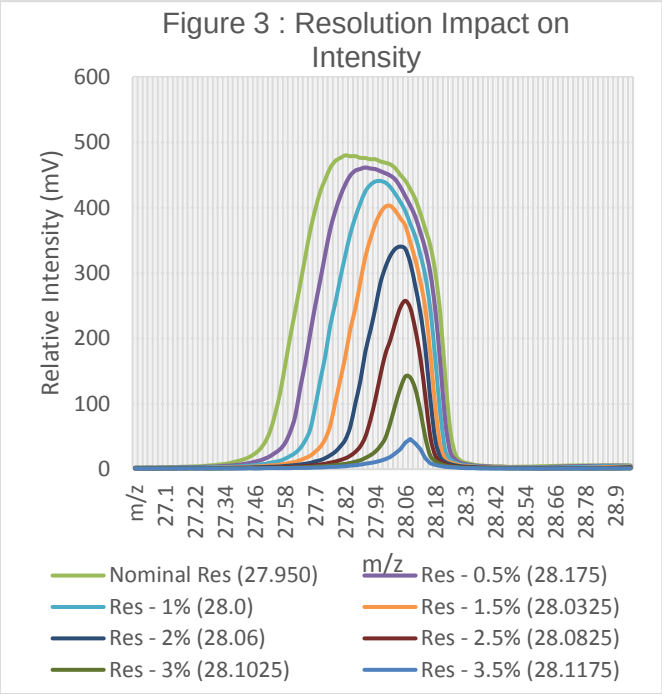


**Warm-up**

All quadrupole power supplies take some time to stabilize, often referred to as a "warm-up". The time to warm up from a cold start is a key performance factor, and is another good indicator of quality power supply design. As a test of start-up mass drift, we compared the mass position at the end of a **4 day** experiment to the mass position from a cold start, and for various times in between (see Table 1). ***The initial start-up mass position was less than 0.06 Da from the mass position 4 days later, demonstrating the exceptional mass stability, once again.***

| Elapsed Time from Cold Start (hrs) | Normalized Mass (Da) | Difference from Final Mass Position (Da) |
|---|---|---|
| 0 | 28.0536 | 0.0536 |
| 1 | 28.0421 | 0.0421 |
| 2 | 28.0386 | 0.0386 |
| 4 | 28.0286 | 0.0286 |
| 8 | 28.0185 | 0.0185 |
| 12 | 28.011 | 0.011 |
| 16 | 28.0035 | 0.0035 |
| 96 | 28 | 0 |

Table 1




**Resolution Stability Yields Excellent Repeatability**

Another key performance factor is the resolution stability. This is important as it affects the repeatability of the ion intensity measurement at any nominally the same set of experimental conditions. In order to demonstrate the impact of resolution stability, Figure 3 shows a series of peaks where the programmable resolution command in Merlin was used to transition a peak from low resolution to high resolution. As the resolution is increased, the peak height becomes more and more dependent on the resolution. The resolution change between each peak is 0.5%. For the first 0.5% resolution change, the maximum intensity for the peak changes by over 4%. ***It's clear that a repeatable peak height also requires extremely high resolution stability.***

Looking back to Figure 1, again, we can see that the width of the peak, the resolution, is also incredibly stable over the full 76 hour measurement period. In order to evaluate the resolution stability of the Extrel QPS, we consider the peak width (ΔM) defined as the Full Width at Half Maximum (FWHM), and use Extrel's Merlin software to collect the peak width over the period of the test. The average width at half the maximum height was 0.05829 Da, and the Standard Deviation was just 0.0004 Da! ***As with the mass stability, any resolution drift is virtually undetectable.***

Flexible enough to drive Extrel's "MAX" range of application specific Quadrupole Mass Spectrometers, as well as any of Extrel's standalone quadrupole mass filters (QMF), Extrel QPS products deliver performance.


Extrel
**www.extrel.com**
**412-963-7530**