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TECHNICAL ARTICLE

ETP Electron Multipliers

for GC/MS and LC/MS Instruments

Instantaneously increase your mass spectrometer's sensitivity, improve the linear dynamic range and extend the lifetime of your electron multiplier.

The electron multiplier is the 'eyes' of your GC/MS or LC/MS system **(refer Figure 1)**. An inferior multiplier will decrease the performance of the instrument and lead to poorer precision and senstivity.

Improved Sensitivity.

For analysts involved in residue analysis, sensitivity is the major issue as this will lead to improved detection limits. As the signal-to-noise ratio increases, integration, and hence quantitation, of chromatographic peaks improves. Noise can be either chemical or electronic in nature. Chemical noise can originate from a 'dirty' liner (or even a poorly deactivated liner), a bleeding septum or column bleed. The source of the noise can often be found through examination of the mass spectrum, and the problem rectified. For example: the use of low-bleed septa; replacement of the liner; and the use of a low-bleed column such as the BPX series can all reduce chemical noise.

Noise originating from the electron multiplier is often overlooked but contributes significantly to the overall performance of the GC/MS. For a GC or LC mass spectrometer, better electron multiplier performance ultimately results in increased sensitivity. ETP electron multipliers optimize sensitivity by both reducing noise and increasing the signal (**Figure 2**). An increase in the signal occurs by collecting the maximum number of ions from the mass analyzer over a very wide range of operating conditions. This higher collection efficiency, combined with the high-gain and low-noise performance of the ETP multipliers, will significantly lower your detection limits resulting in the highest sensitivity available.

Enhanced Linearity.

The linearity of an electron multiplier is also often overlooked. This is especially true for analysts who are accustomed to the wide linear range associated with a FID. Most instruments have a specified linear range. ETP electron multipliers exceed these instrument specifications **(figure 3)**. This allows full access to an instrument's capabilities, guaranteeing accuracy and reproducibility of results, time after time.

Longer Lifetime.

In GC/MS systems, the electron multiplier is typically operated in analog mode with a gain of around 10^5. For a new electron multiplier this gain is typically achieved with an applied voltage of around 1400 volts. As the multiplier is used, the surfaces of the dynodes slowly become covered with contaminants, causing the gain of the multiplier to decrease. The level of contaminates on the multiplier depends on the frequency and intensity of use and the level of contamination from the sample and the vacuum system. To compensate for this process, the

Figure 1. The electron multiplier is the 'eyes' of the MS

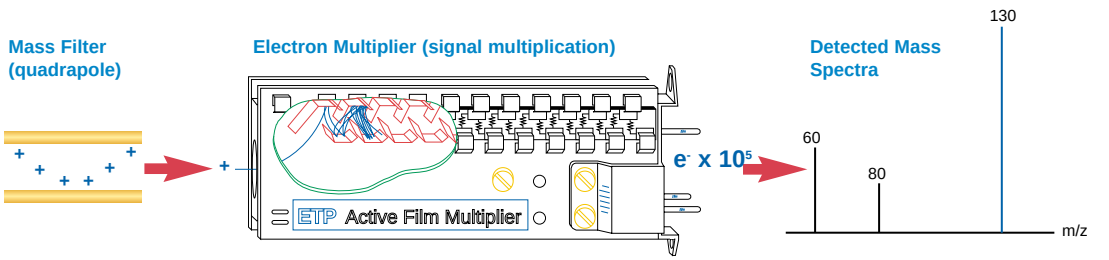
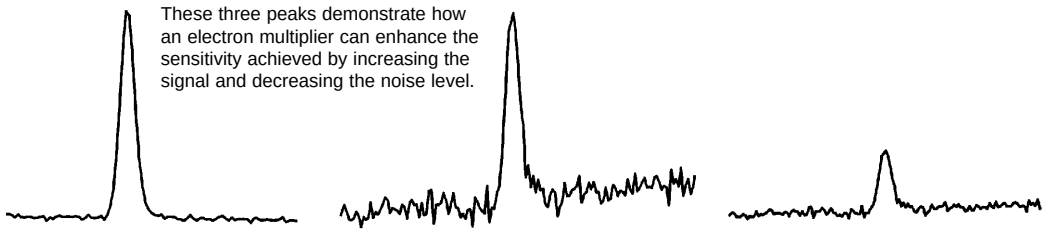


Figure 2. Chromatograms showing peaks with various signal-to-noise ratios.



"Our mass spectrometers are fitted with ETP multipliers and we are happy with their performance. ETP provides us cost effective multipliers that meet our criteria for performance and durability."

Dr. Duffield, Director, Australian Racing Forensic Laboratory.

operating high voltage applied must be increased to maintain the required gain. For most users, this is done automatically by autotuning and the electron multiplier voltage is displayed in a tune report. The electron multiplier voltage is limited to 3000 volts in most GC/MS systems. When the applied voltage begins to approach this limit, it is necessary to replace the multiplier with a new one.

The unique design of ETP's discrete-dynode system provides a much greater surface area than used in other electron multipliers. This, combined with the "Active Film" dynode material, produces a more durable and stable product, resulting in a maximized lifetime, even in the most demanding conditions.

All of the surfaces of an ETP electron multiplier are stable in air, so performance is guaranteed even after years of shelf life, allowing a spare multiplier to be held in the laboratory.

Installation Ease

Each ETP electron multiplier has been carefully designed to allow total instrument compatibility with a simple direct plug-in for ease of installation.

Compatibility

There is now an ETP electron multiplier to suit almost every GC/MS and LC/MS instrument available.

Active Film Multipliers – The Difference.

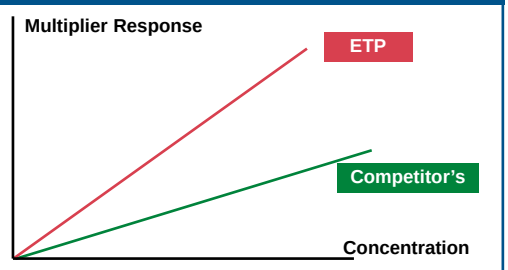
ETP electron multipliers have been designed using sophisticated computer techniques to produce a new and unique "Active Film" Multiplier.

While other manufacturers continue to produce the traditional channel electron multiplier, ETP's Active Film multipliers incorporate a revolutionary "discrete dynode" system which works like a cascade. This cascade design provides a larger internal surface area resulting in higher throughput, better ability to cope with difficult materials, wider dynamic range and overall enhanced performance.

The primary active dynode in ETP electron multipliers is based on a highly efficient aluminum oxide material. Unlike other manufacturers' silica surfaces, this material is stable, robust, chemically durable and virtually impervious to degradation caused by long or repeated exposure to the atmosphere.

Mark Ferry from ECS/MDL Systems, USA, assessed the ETP electron multiplier, finding that under US EPA 8270 tuning criteria using DFTPP (decafluorotriphenyl - phosphine), the ETP multiplier gave a 20% higher abundance of the 69m/z ion than new K&M or Galileo multipliers have achieved under the same conditions.

Figure 3. Response vs. Concentration



Concentration graph showing the wider linear range of a ETP multiplier compared with a competitor's multiplier.

For further information request publication BR-0095-A.

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