Wouldn't it be Nice to Never Clean an Ion Source?
Ion Source Robustness on the StayClean® Ion Source

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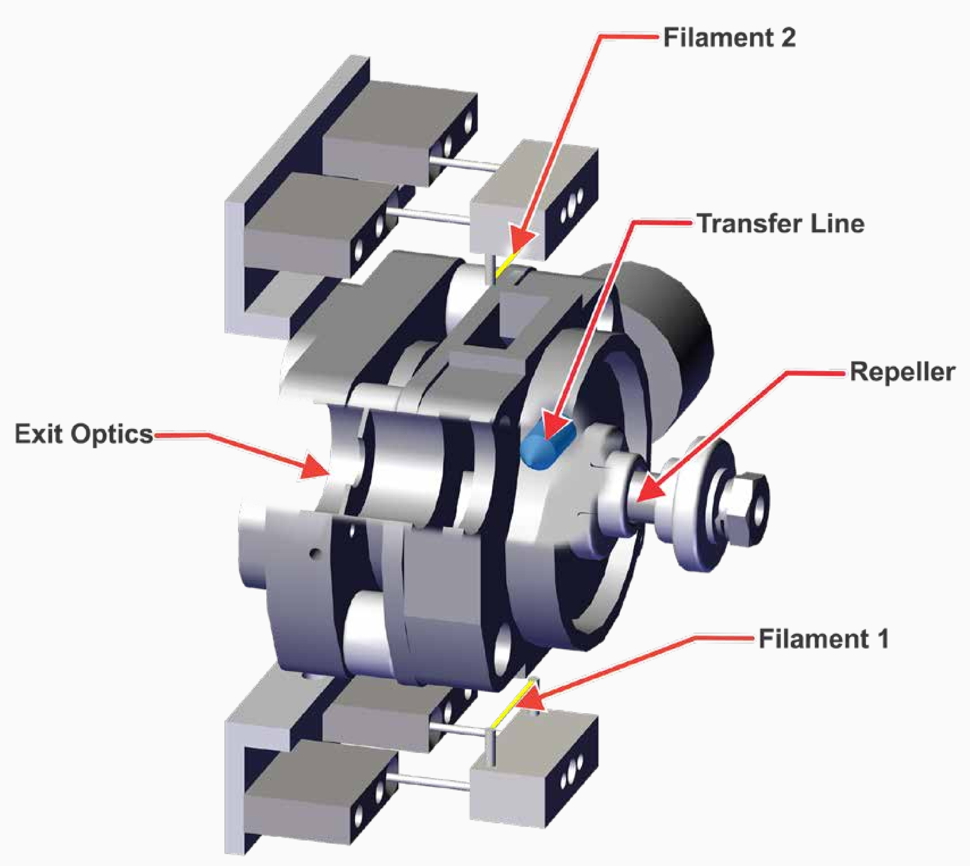
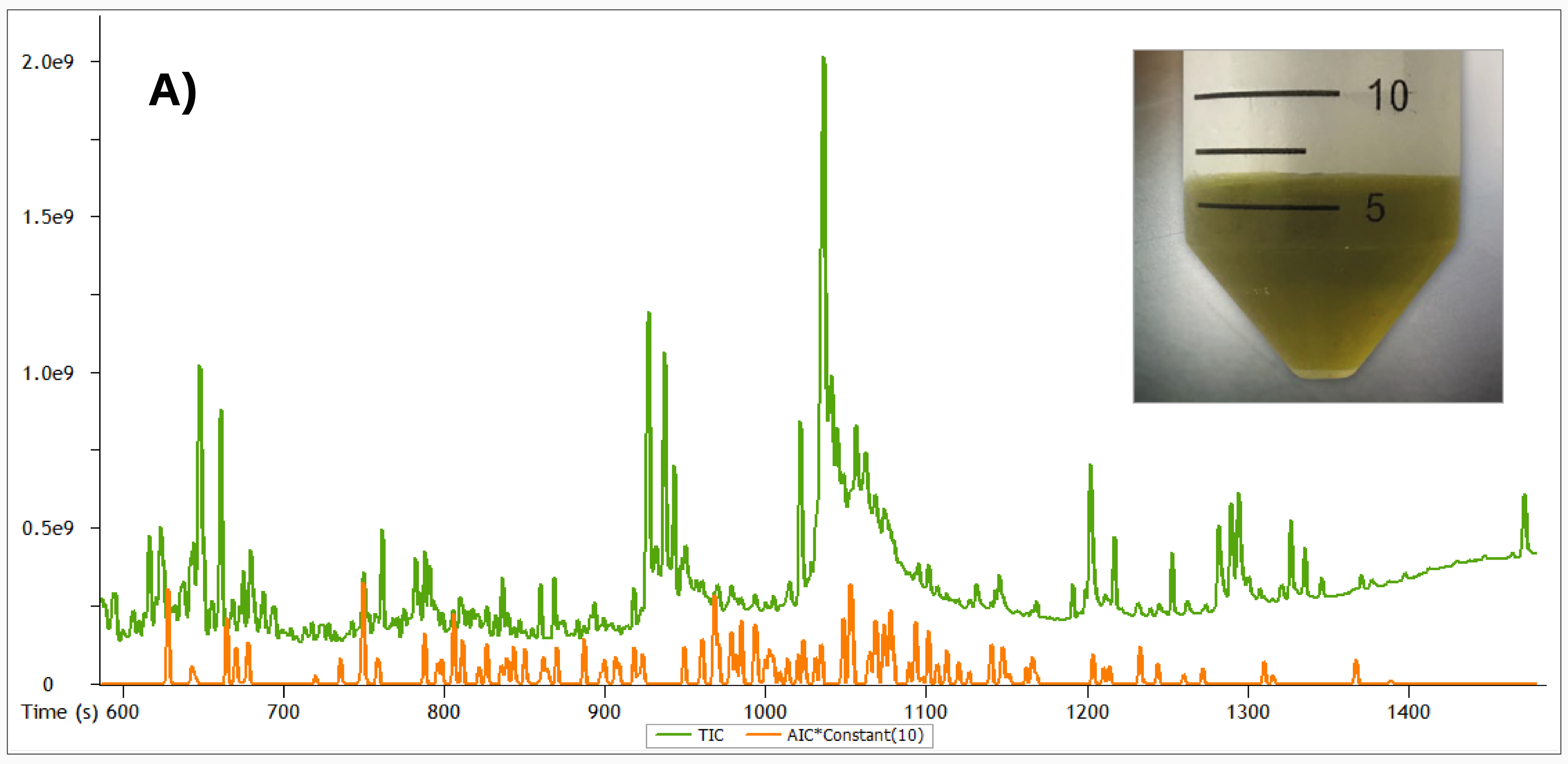
Introduction

Fouled ion sources and related issues are often time-consuming to diagnosis and resolve. A definitive diagnosis can only be achieved after other preventative maintenance steps (inlet maintenance, column trimming, etc.) have been tried and tested. Once the source has been pinpointed as the issue, users must remove, disassemble, clean, reassemble, reinstall, and test the source before proceeding. Even routine, scheduled preventative cleaning leads to system downtime and opens the door to potential mistakes in source reassembly. In less controlled environments the incremental contamination of an ion source may not be noticed until long past the point of compromised results or impacting the stability of the overall system. Worse still, tuning routines will typically compensate for the loss in signal by increasing various voltages, not the least of which is at the detector. This decreases the detector's operational life, requiring additional maintenance time to resolve. For these reasons, LECO has specifically designed the Pegasus® BT with an ion source that virtually eliminates the need for removal and cleaning. The purpose of this poster is to provide significant evidence that the LECO *StayClean* ion source actually stays clean.

StayClean



Modified CAD drawing of the *StayClean* Ion Source available on the Pegasus BT and Pegasus BT 4D system



Experimental

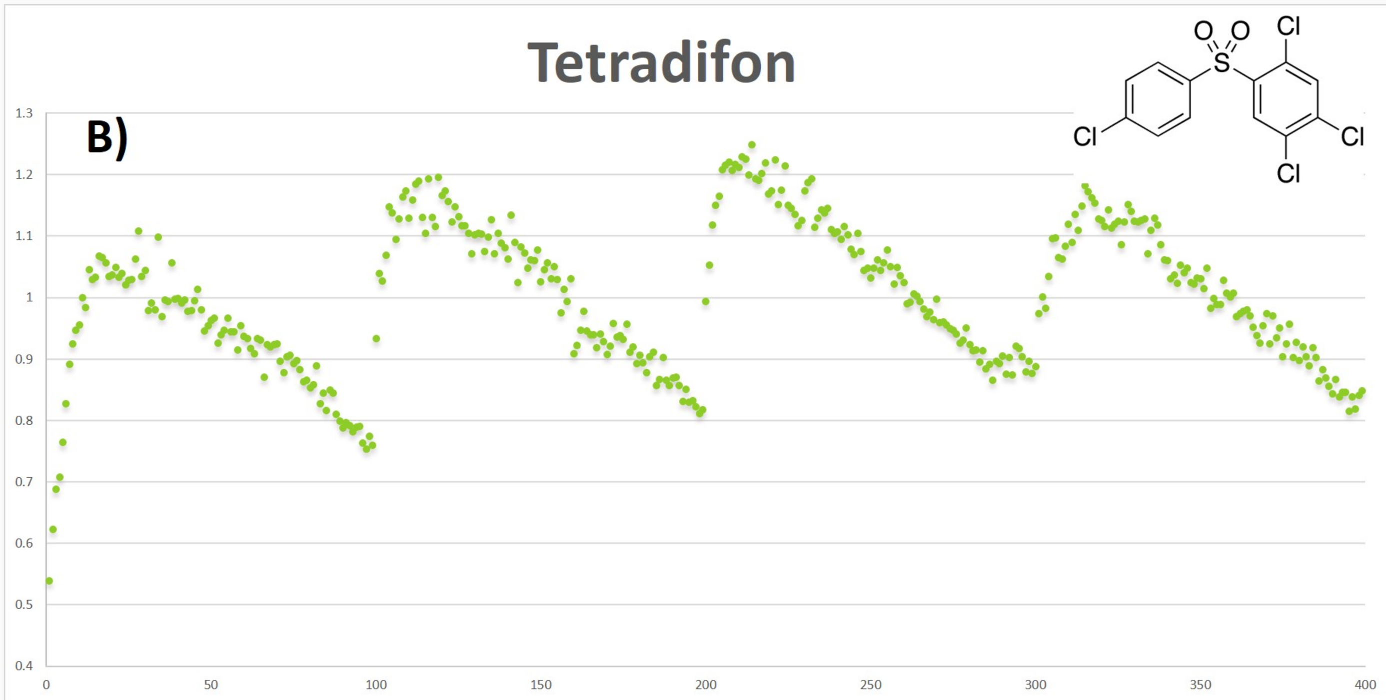
A QuEChERS spinach extract spiked with various pesticides at 50 ppb was used as the test matrix. In each test round, 100 spiked matrix injections were made. At the end of each round, the inlet liner and gold seal were replaced and 0.25 m was trimmed from the guard column. Following inlet maintenance, the system auto-tune was run and another 100 spiked test matrix injections followed. This sequence was repeated for a total of 400 matrix injections.

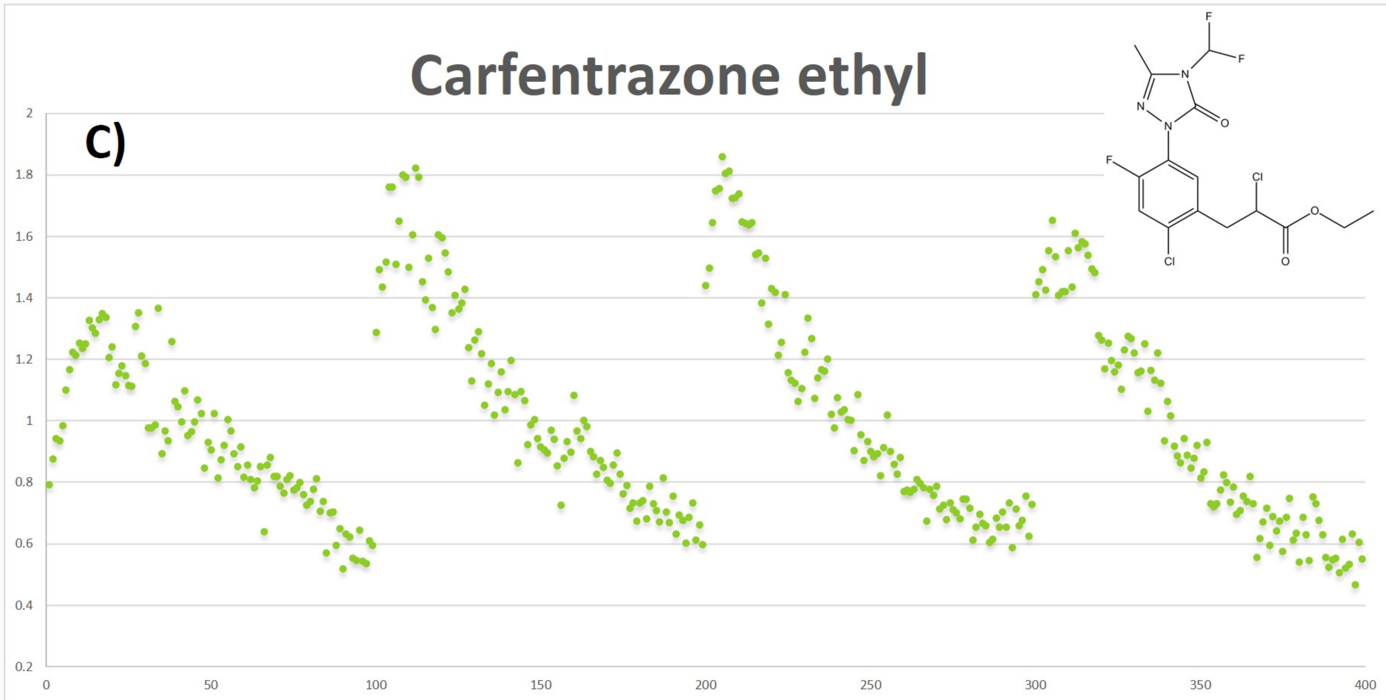
To verify that system tuning had not compensated for a fouling source, the tuning logs were reviewed. After the first round of injections the detector increased 12V (~0.6% of the overall voltage) and remained static for all subsequent tunings. Other values set during the automatic tuning were similarly consistent over the test period. Despite the heavy sample matrix load, the ion source remained unaffected.

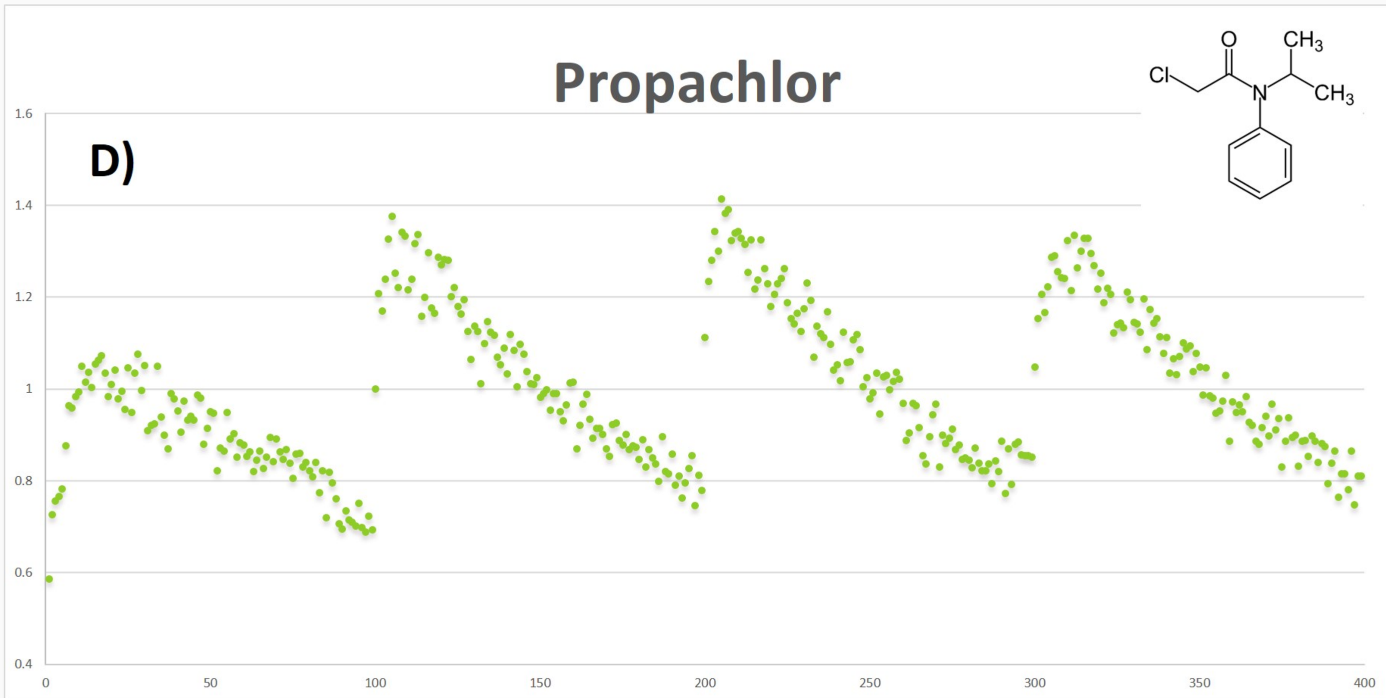
Results

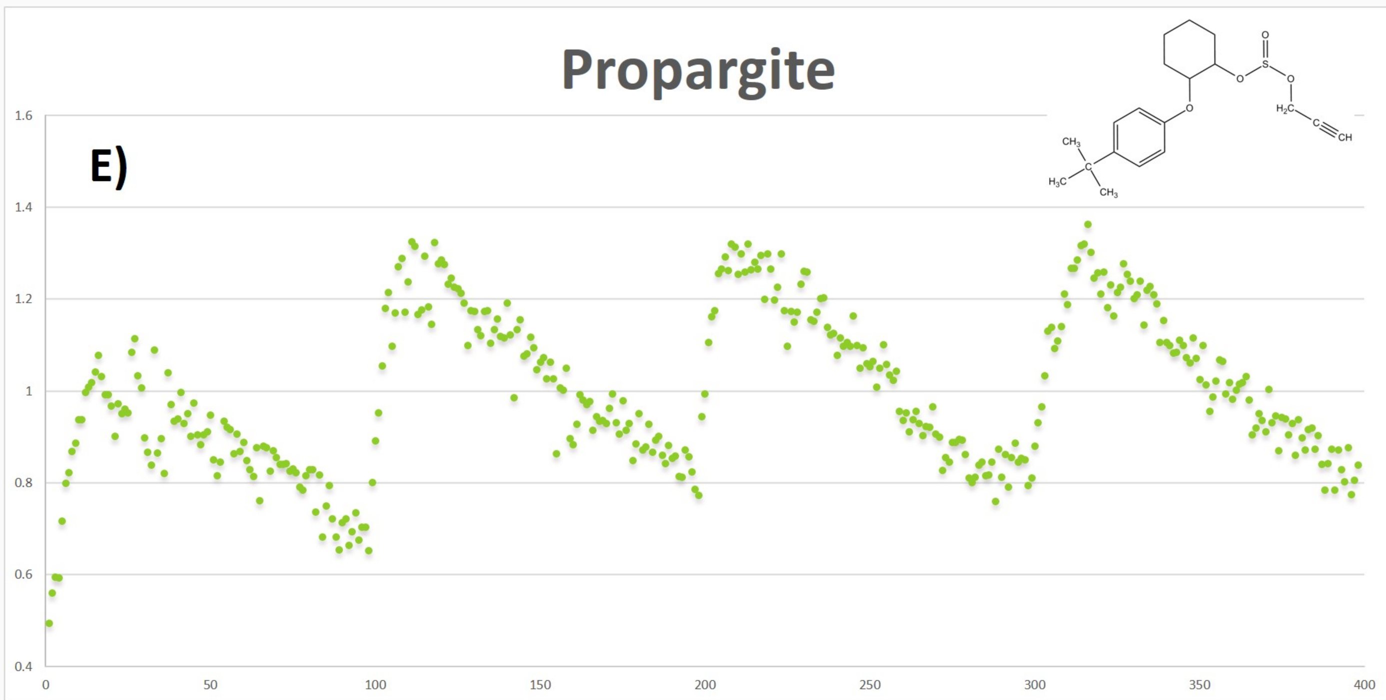
A typical injection is shown in Figure A, where significant matrix is evident—the analytes of interest (pesticides, orange) are at least a factor of ten less intense than the background. The examples in Figures B through E show a consistent response pattern for the spiked pesticides in each of the sampling rounds. The signal degrades over the course of the 100 replicate injections, but returns to the initial response after inlet maintenance and column clipping, without cleaning the ion source. This suggests the ion source is not experiencing any signs of contamination even with injections of a very dirty spinach matrix extract. All data were processed with the same method settings and no changes were made to the software-determined peak integrations.

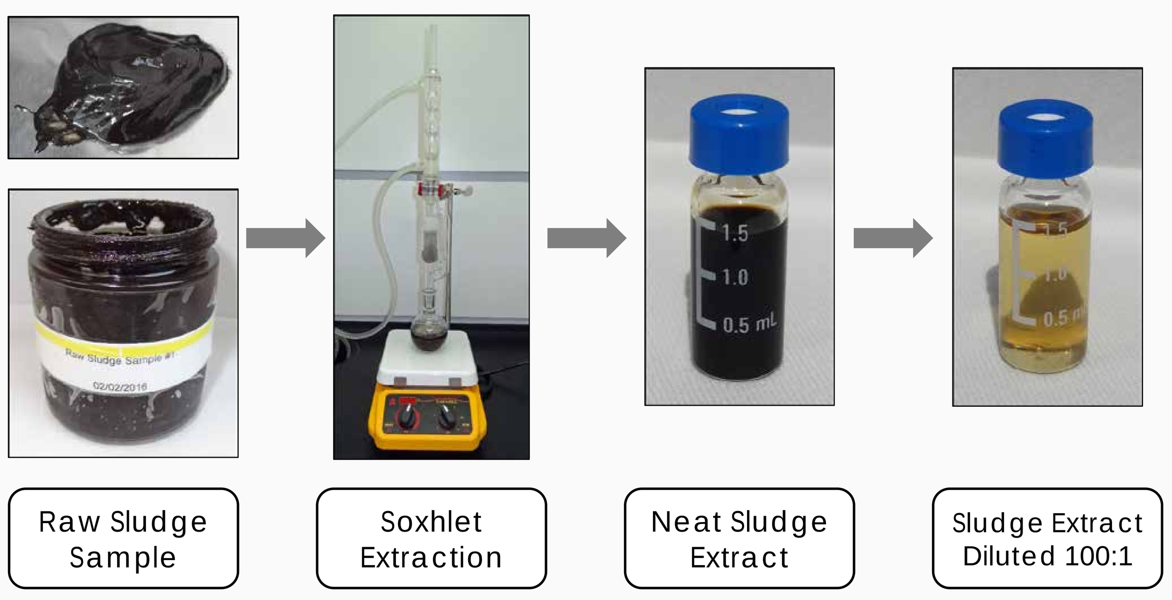
In a separate experiment, raw sludge samples were Soxhlet extracted for 4 hours, the neat extract was diluted 100 fold, and then injected into a StayClean source through an uncoated capillary column. After each set of several hundred sludge extract injections, an analytical column was installed and OFN was injected to monitor sensitivity. As shown in the bar graphs, no performance degradation was observed even after 3000 sludge extract injections.











3000 injections