



Setting the Standard for Automation™

VOC & LEL monitoring, a novel approach to meeting the requirements of very different parameters with a combined analytical system

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Presentation agenda



- The toxicity of Volatile Organic Compounds (VOCs)
- Process Mass Spectrometer analysis of BTEX
- Secondary Electron Multiplier detector technology
- High performance Micro Channel Plate
- Incorporating Lower Explosion Limit analysis
- Sample data
- Conclusions

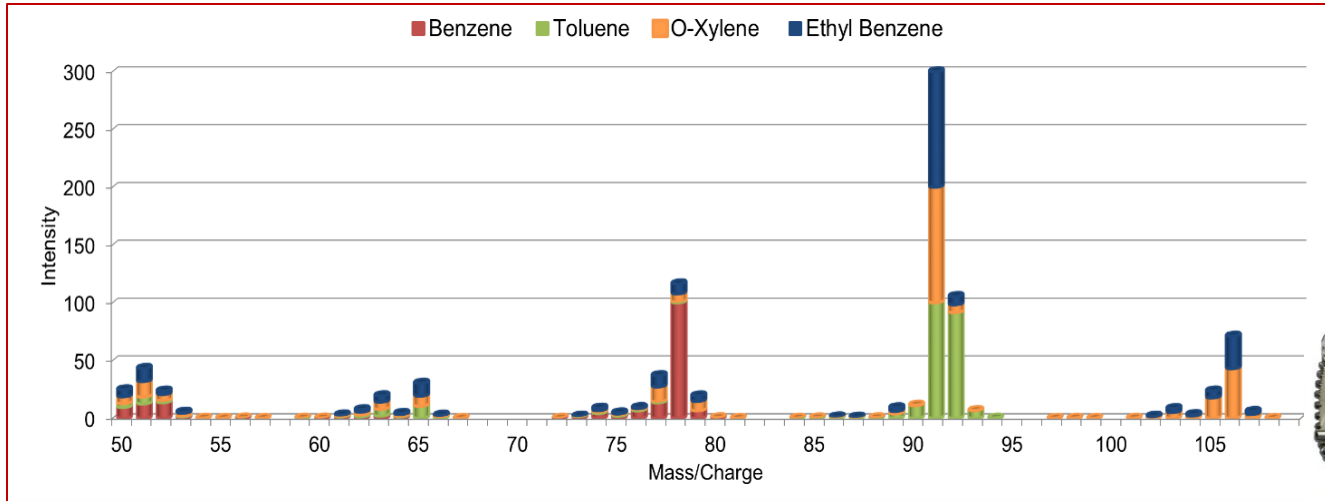
Toxicity of VOCs - BTEX



Compound	MW	OSHA PEL STEL ppm	OSHA PEL 8-hour TWA ppm	NIOSH REL STEL ppm	NIOSH REL 8-hour TWA ppm	MS Detection Limit
Benzene	78	5	1	1	0.1	<5 ppb
Toluene	92	300	200	150	100	<5 ppb
Ethyl Benzene	106		100	125	100	<5 ppb
Xylene	106		100	150	100	<5 ppb

- Occupation Safety & Health Organisation (OSHA)
- Short Term Exposure Limit (STEL)
- Permissible Exposure Limit
- Time Waited Average (TWA)
- National Institute for Occupational Safety & Health (NIOSH)
- Recommended Exposure Limits (REL)

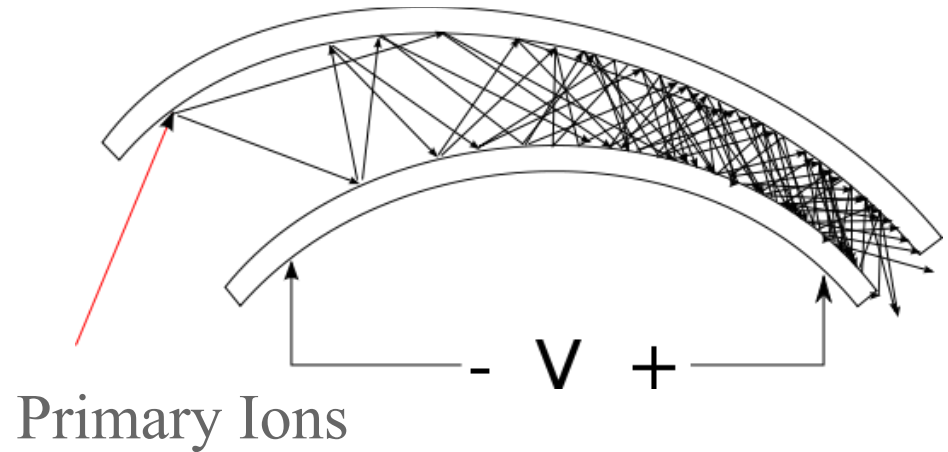
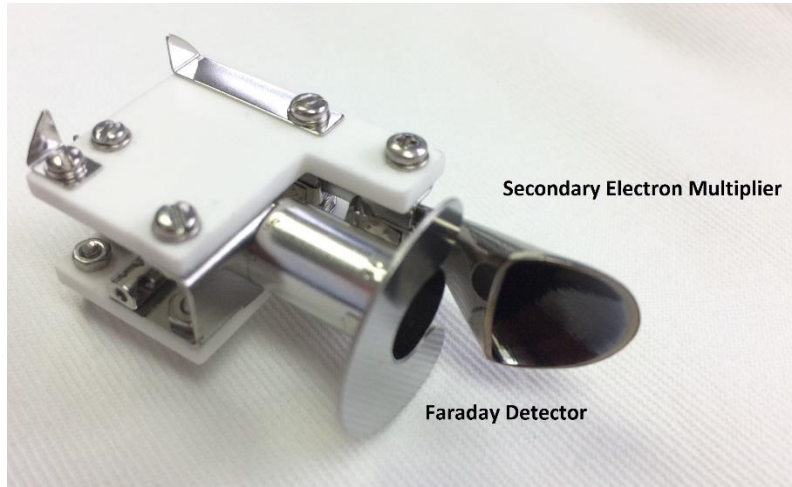
Process MS solution for BTEX



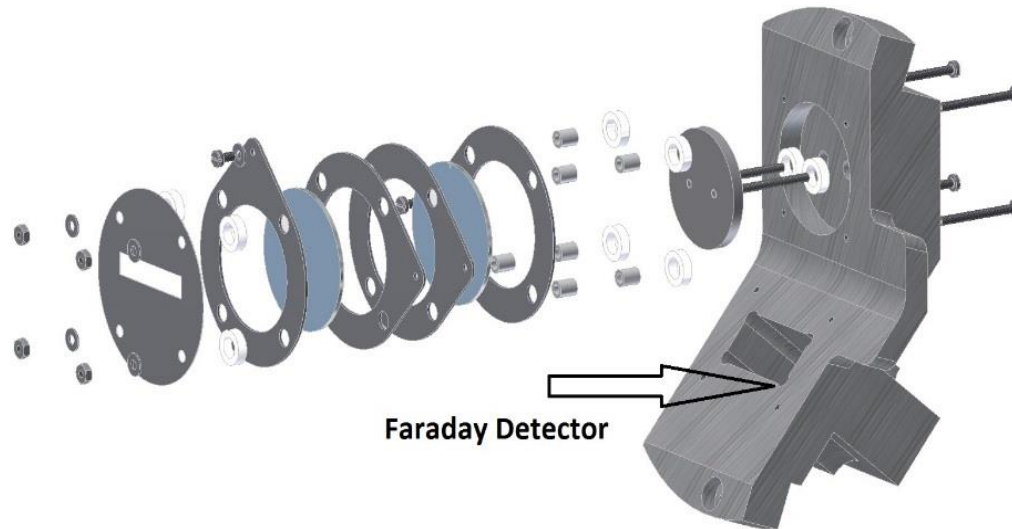
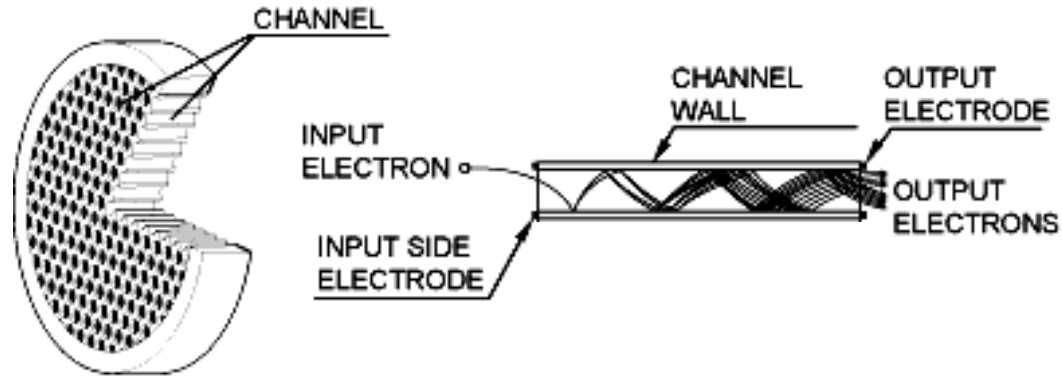
- Each VOC calibrated individually
- Minimal interference between species
- ppb detection limits for each VOC
- Cycle time typically 12 seconds
- 60 or more sample points is common



Secondary Electron Multiplier



Twin Microchannel Plate SEM

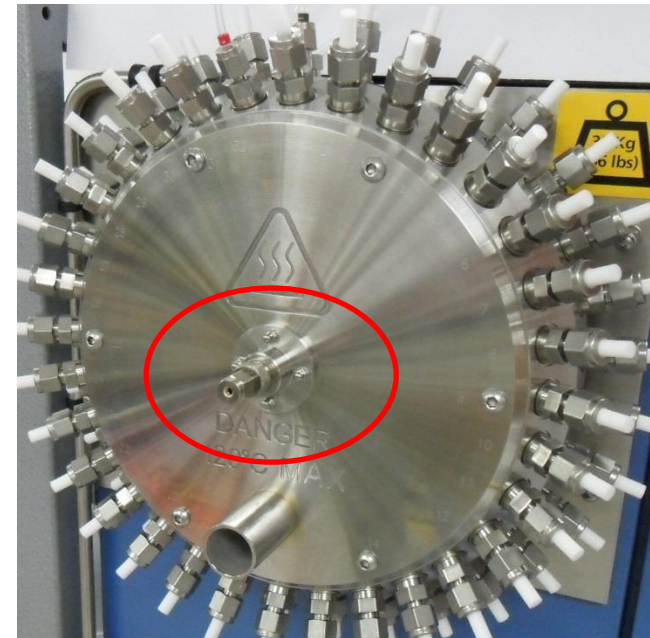
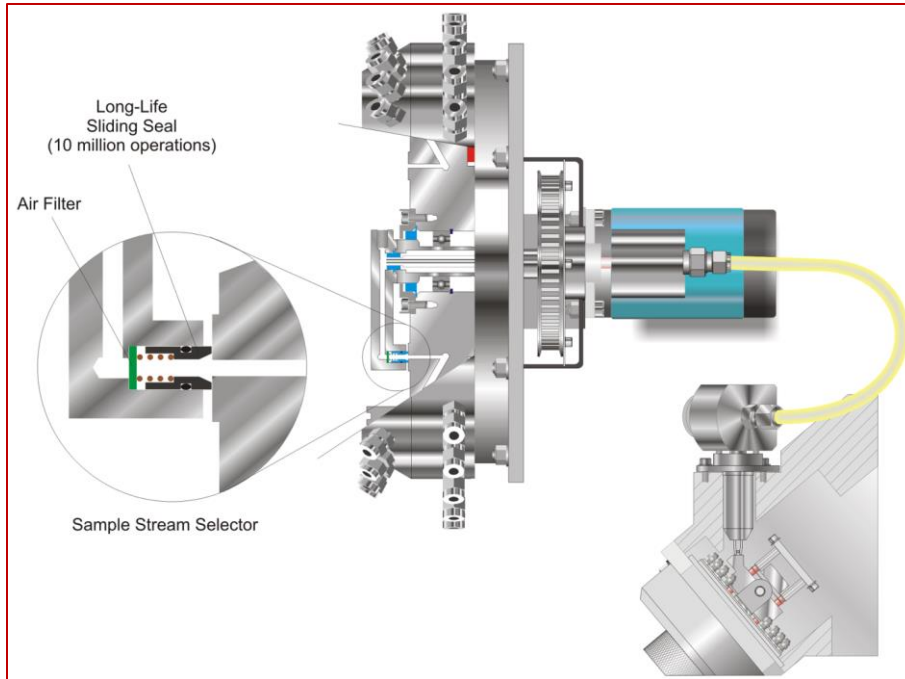


Higher performance Twin MCP

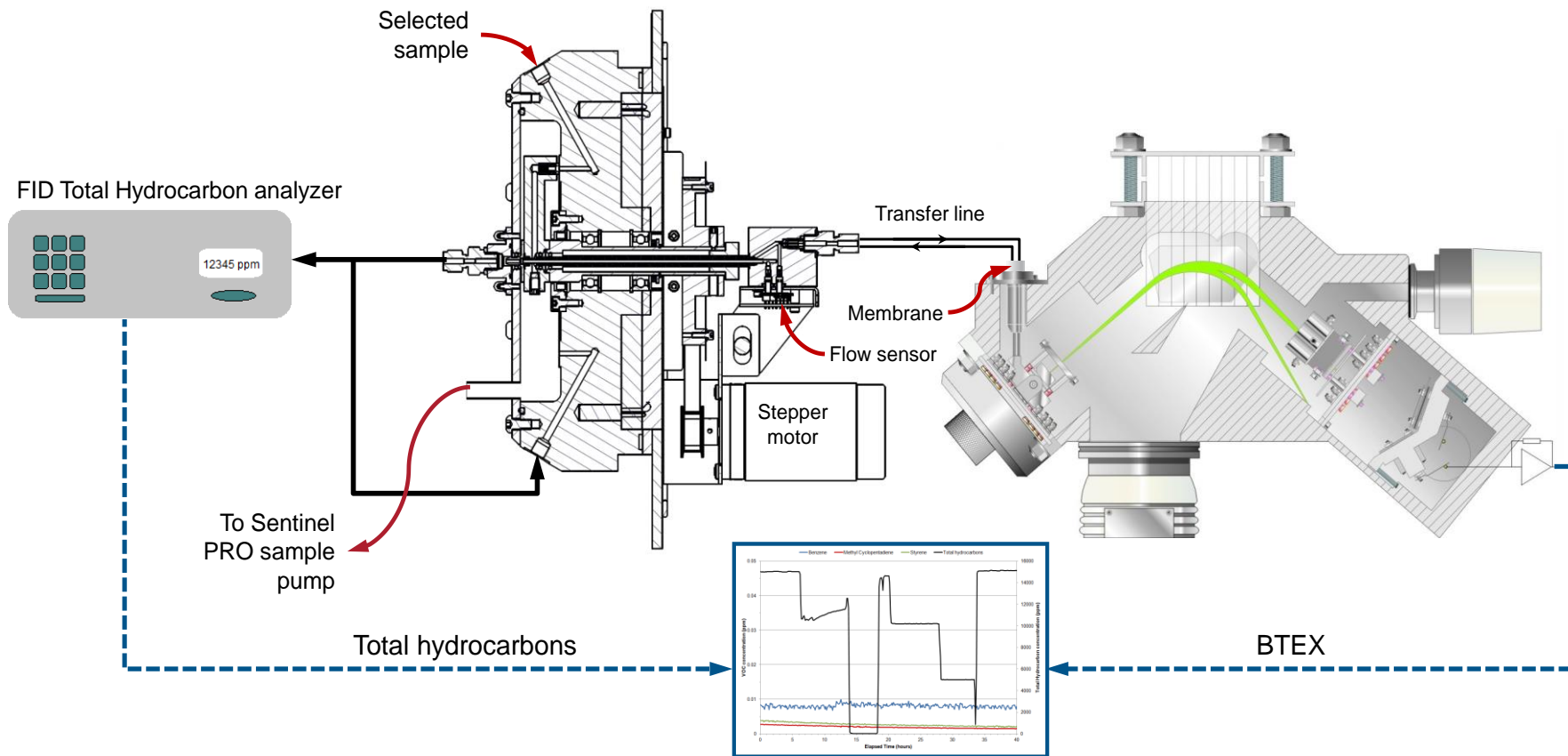


	Ion current (amps)	Single MCP current at 10³ gain (amps)	Ion Optical Noise (amps)	Electrometer Noise (amps)	Ion Statistical Noise (amps)	Total Noise (amps)	Signal/Noise
100 ppm	1.00E-13	1.00E-10	1.00E-13	1.00E-14	1.26E-13	2.36E-13	422.8
10 ppm	1.00E-14	1.00E-11	1.00E-14	1.00E-14	4.00E-14	6.00E-14	166.7
1 ppm	1.00E-15	1.00E-12	1.00E-15	1.00E-14	1.26E-14	2.36E-14	42.3
0.01 ppm	1.00E-17	1.00E-14	1.00E-17	1.00E-14	1.26E-15	1.13E-14	0.9
	Ion current (amps)	Two MCPs current at 10⁴ gain (amps)	Ion Optical Noise (amps)	Electrometer Noise (amps)	Ion Statistical Noise (amps)	Total Noise (amps)	Signal/Noise
100 ppm	1.00E-13	1.00E-09	1.00E-12	1.00E-14	1.26E-12	2.27E-12	439.6
10 ppm	1.00E-14	1.00E-10	1.00E-13	1.00E-14	4.00E-13	5.10E-13	196.1
1 ppm	1.00E-15	1.00E-11	1.00E-14	1.00E-14	1.26E-13	1.46E-13	68.3
0.01 ppm	1.00E-17	1.00E-13	1.00E-16	1.00E-14	1.26E-14	2.27E-14	4.4

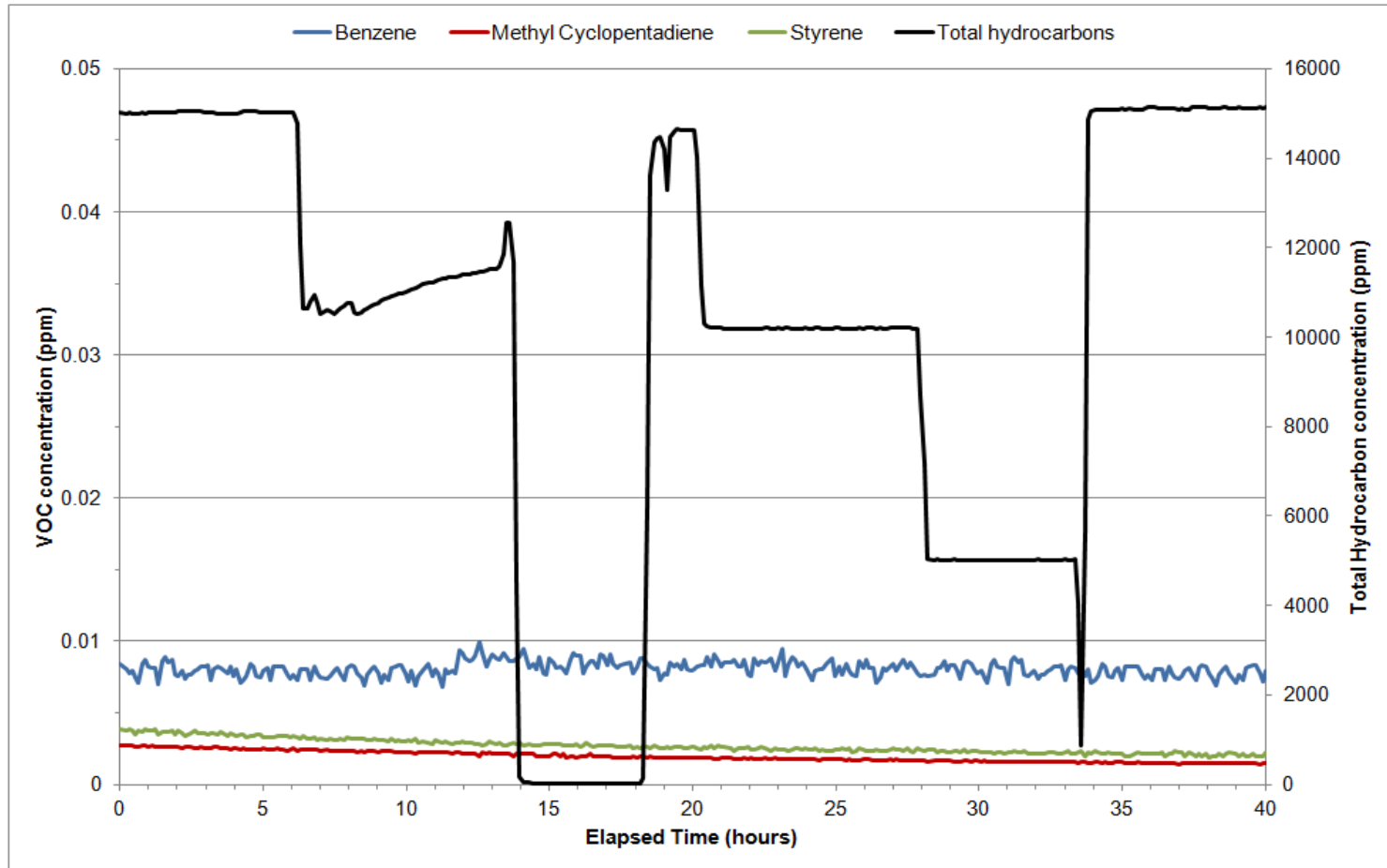
Incorporation of LEL monitoring



Incorporation of LEL monitoring



LEL & VOC data incorporated



Conclusions

- Combined solutions provide employee, environment and plant safety capability
- Both techniques should have fast response time to avoid compromising performance
- MS detection limits are significantly lower than exposure limits
- Micro Channel Plate improves performance of MS and extends the detector lifetime
- The hybrid solution may reduce or eliminate the need for point LEL detectors and the associated infrastructure