

POLLUTION
ANALYTICAL EQUIPMENT



**THE ANSWER
TO YOUR ON-SITE
DETECTION
CHALLENGES**

Carrier-Gas-Free GC BTEX Analyser

The New Frontier for Real-Time Monitoring of Aromatics

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BTEX monitoring needs

As VOCs, BTEX chemicals are released into the air, soil, and water as Fugitive Emission:

- ✓ Leakage in underground storage tanks
- ✓ Pipeline leaks
- ✓ Surface spills
- ✓ Refinery facility leaks
- ✓ Vehicle and aircraft emissions
- ✓ Paints and adhesives
- ✓ Other seemingly unlikely trades....



VOCs are known to have toxic effects and cause pollution, giving rise to state and federal regulations.

BTEX monitoring needs

Volatile organic compounds (VOCs) are hazardous compounds that may cause damage to humans with chronic exposure

OSHA recommendation:

- ✓ TWA (time-weighted average limit): The employer shall assure that no employee is exposed to an airborne concentration of benzene in excess of 1 ppm as an 8-hour time-weighted average.
- ✓ STEL (Short-term exposure limit): The employer shall assure that no employee is exposed to an airborne concentration of benzene in excess of 5 ppm as averaged over any 15 minute period.

European Air Quality Directive (AQD) gives the limit value (LV) of 1,5 ppb for the annual mean

U.S. EPA recently promulgated **Methods 325A** and **325B** for ambient monitoring of VOCs using passive sorbent samplers.

Methods 325A and 325B are incorporated in the recent refinery sector rule update requiring continuous measurement of benzene concentrations at the refinery fence line over 14-day periods

In Europe, the monitoring of benzene in ambient air is mandatory according the European Directive 2008/50EC

Reference method consists of on-line sampling followed by desorption and gas chromatography (**EN 14662:2005 part 1, 2 and 3**)

Available Technologies

□ Photo-Ionisation Detectors (PID)

- high sensitivity to benzene up to sub-ppb
- Not selective to a particular VOC: benzene, toluene and xylene cannot be distinguished

□ Metal Oxide Sensors (MOx)

- respond to a large variety of gases: measure low concentrations of VOCs is very difficult where gases such as NO, NO₂ or CO are also present in higher concentrations.
- like PID not specific to individual organic compounds.
- temperature and humidity are also important interferents of the signal

□ Amperometric or potentiometric electrochemical cells

- Broadband sensor with high deviation from linearity
- Temperature and humidity may change the response

□ Gas Chromatographic (GC) instrumentation

Traditional GC System

- ✓ can perform multi-VOC field measurement

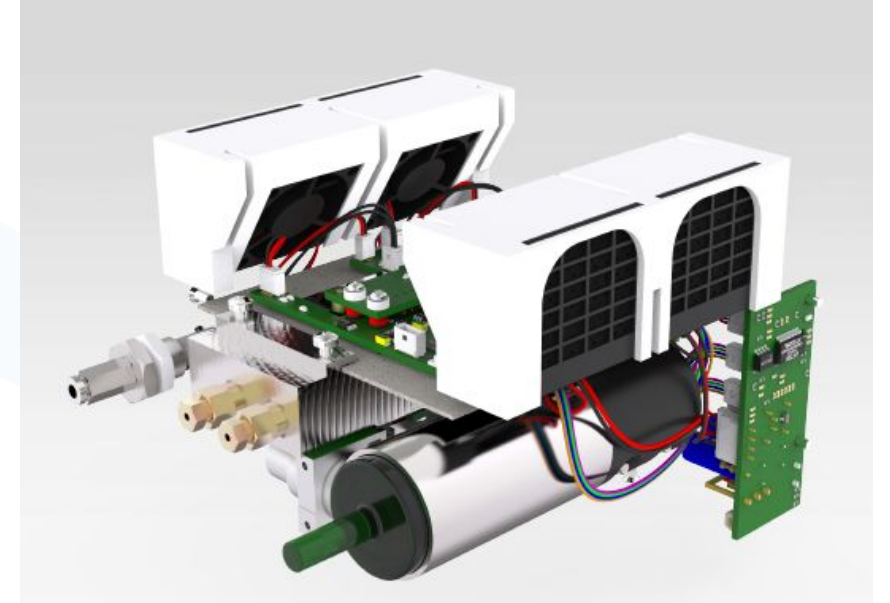
However

- ✓ GC is too large and expensive and it needs skilled personnel to perform complex operations
- ✓ It needs carrier gas cylinder
- ✓ it is not for dense networks of BTEX automatic monitoring sites covering large areas or for the estimation of real-time human exposure.



Revolutionary GC System

- ✓ Without carrier gas cylinder
- ✓ Smaller foot print
- ✓ Lower power consumptions
- ✓ lower costs
- ✓ greatly increased portability for in-field use



Is it possible to integrate all of this advantages in a real instrument?

Miniaturized GC system for BTEX WITHOUT CARRIER GAS BOTTLE



- ✓ Gas-chromatographic (GC) separation unit
- ✓ Sampling pump and pre-concentration unit
- ✓ PID detector unit
- ✓ Manifolds for flow distribution and filter
- ✓ Housing, including cooling fans and electrical connectors
- ✓ Embedded mini-PC for control, acquisition and data processing

PyxisGC

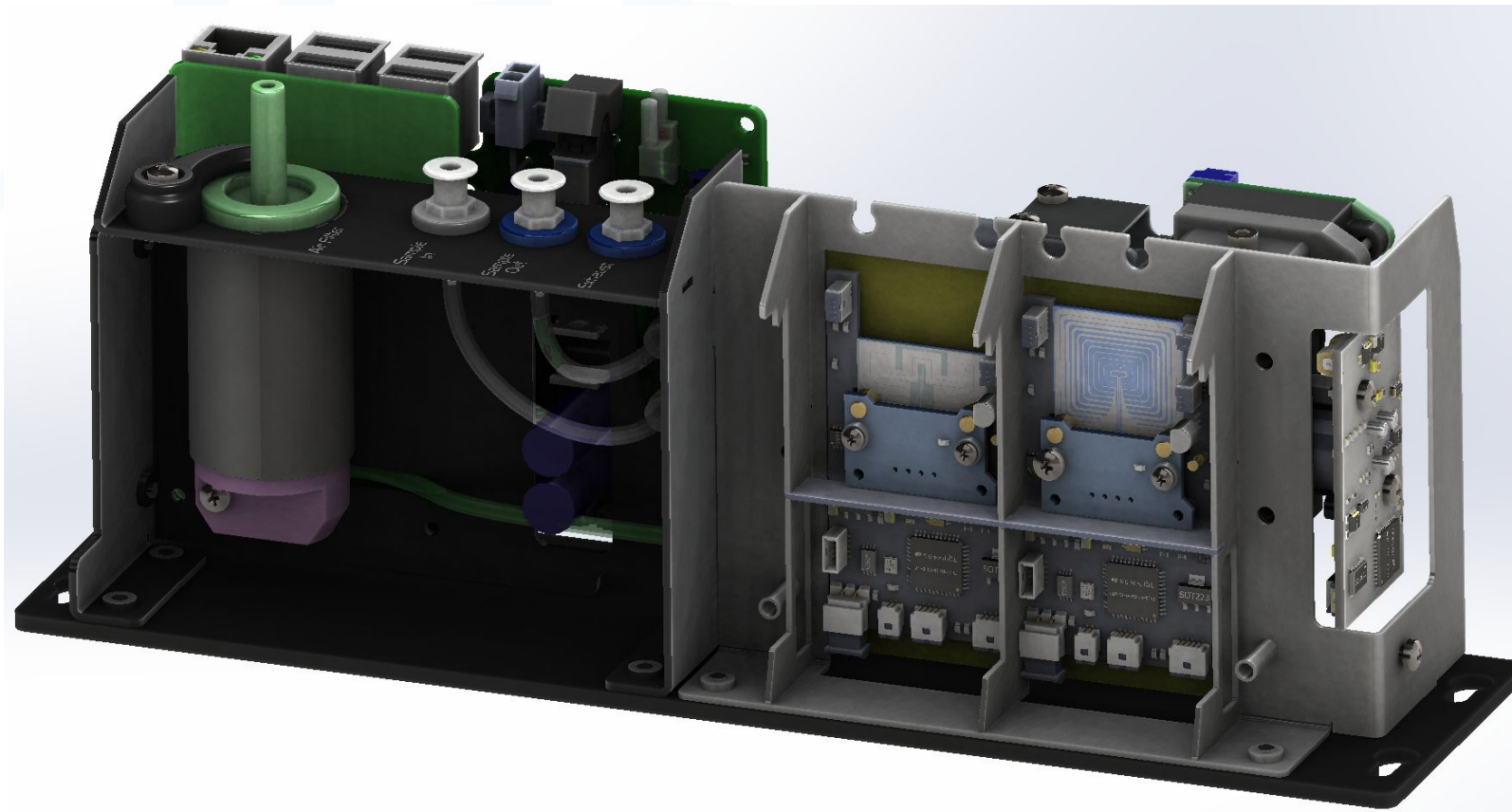
CARRIER FREE ANALYSER

BTEX

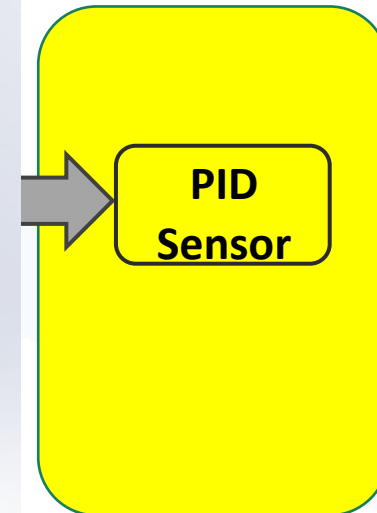
- Without carrier gas cylinder
- Miniaturized
- Low power consumptions
- Highly selective
- Real-time monitoring
- Connectivity



Inside PyxisGC System

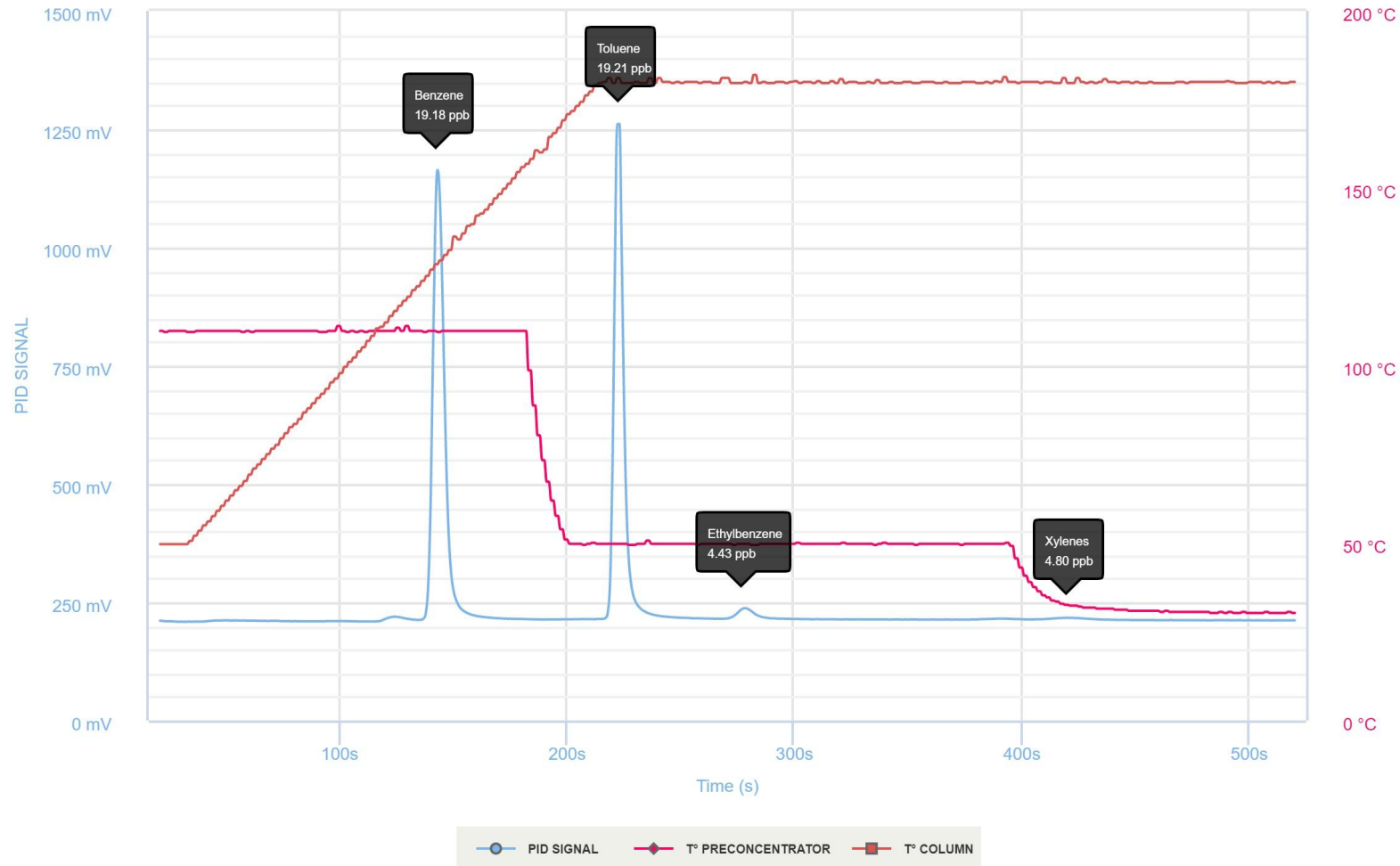


Detection Unit



Inside PyxisGC System

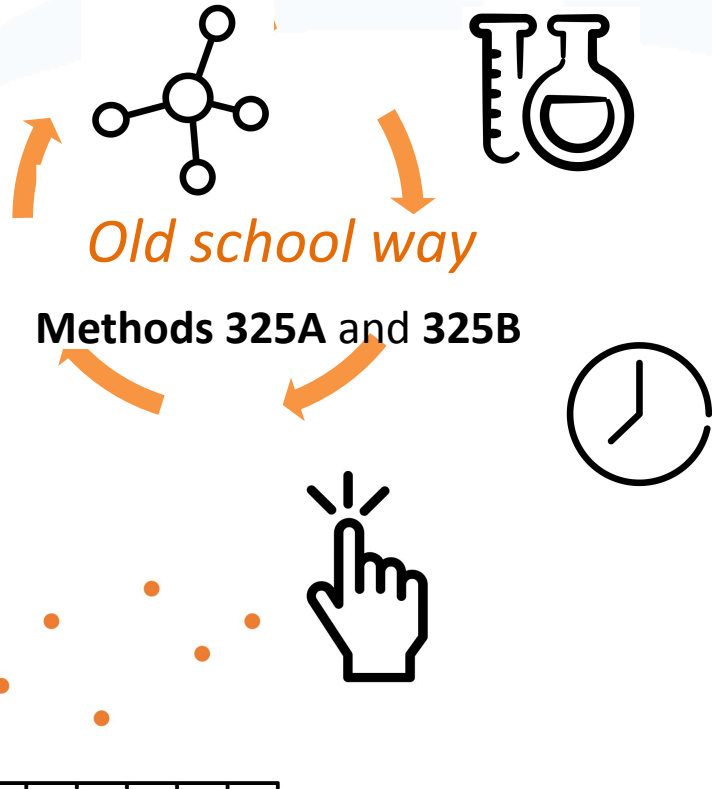
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Detection Unit



SAMPLEIFICATION



PyxisGC BTEX

Auto-Calibration

Auto-calibration system with span-gas bottle. Maintains analytical stability for one year without replacing the cylinder

Battery

UPS system with lithium batteries. It keeps the monitoring system active up to 6 hours, in the event of a power failure

Analytical module

Includes Concentrator and MEMS Column, PID Detector and chromatographic processing architecture



Connectivity

- LAN, Wi-Fi, 4G for local access and "Pollution Guardian" Cloud integration
- MODBUS Ethernet for automated control

FENCE LINE MONITORING

SMART FACTORY



REAL-TIME BTEX MONITOR FOR A SAFER ENVIRONMENT



- **FENCE LINE**

CONTINUOUS CONTROL

AND FAST RESPONSE FOR EVERYDAY SAFETY

- ✓ Oil & gas plants
- ✓ Iron and steel industries, foundries
- ✓ Harbours and airports
- ✓ Solvents, chemicals, or fuel depot
- ✓ Waste management areas, landfills



- **SMART CITY**

THE AIR QUALITY MONITOR AROUND YOU

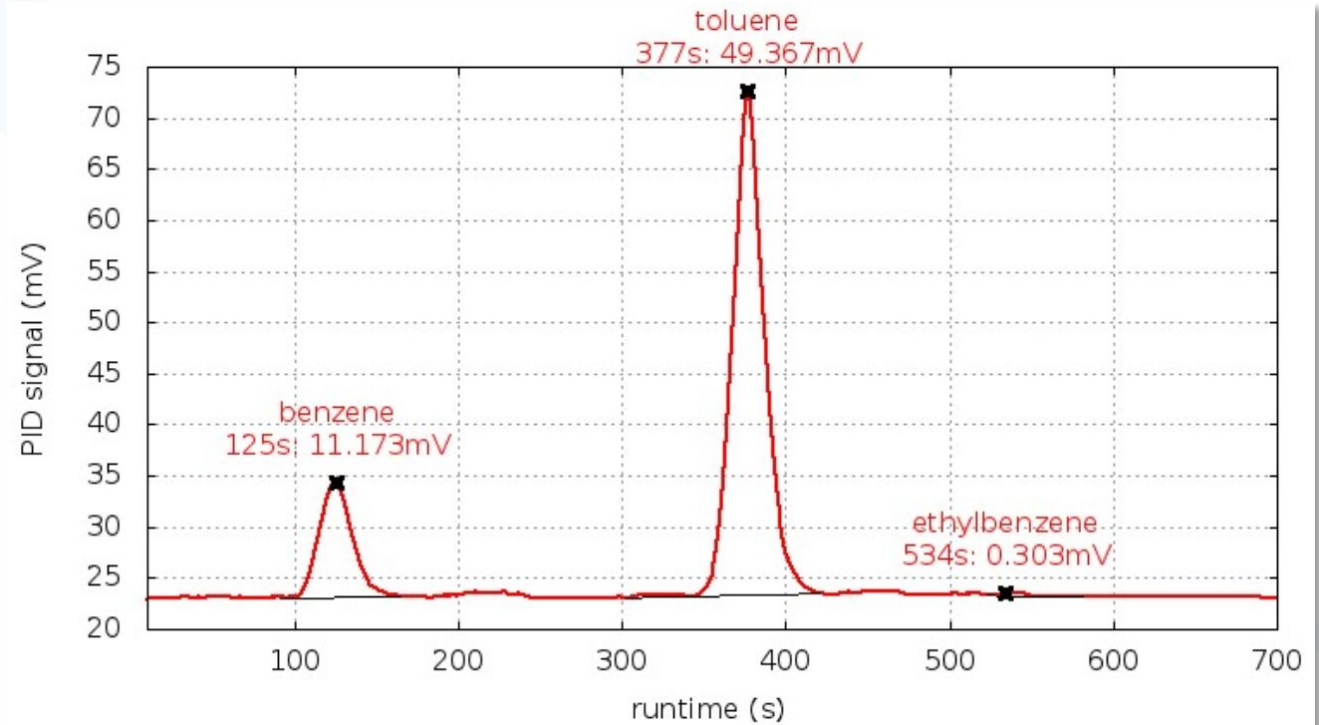
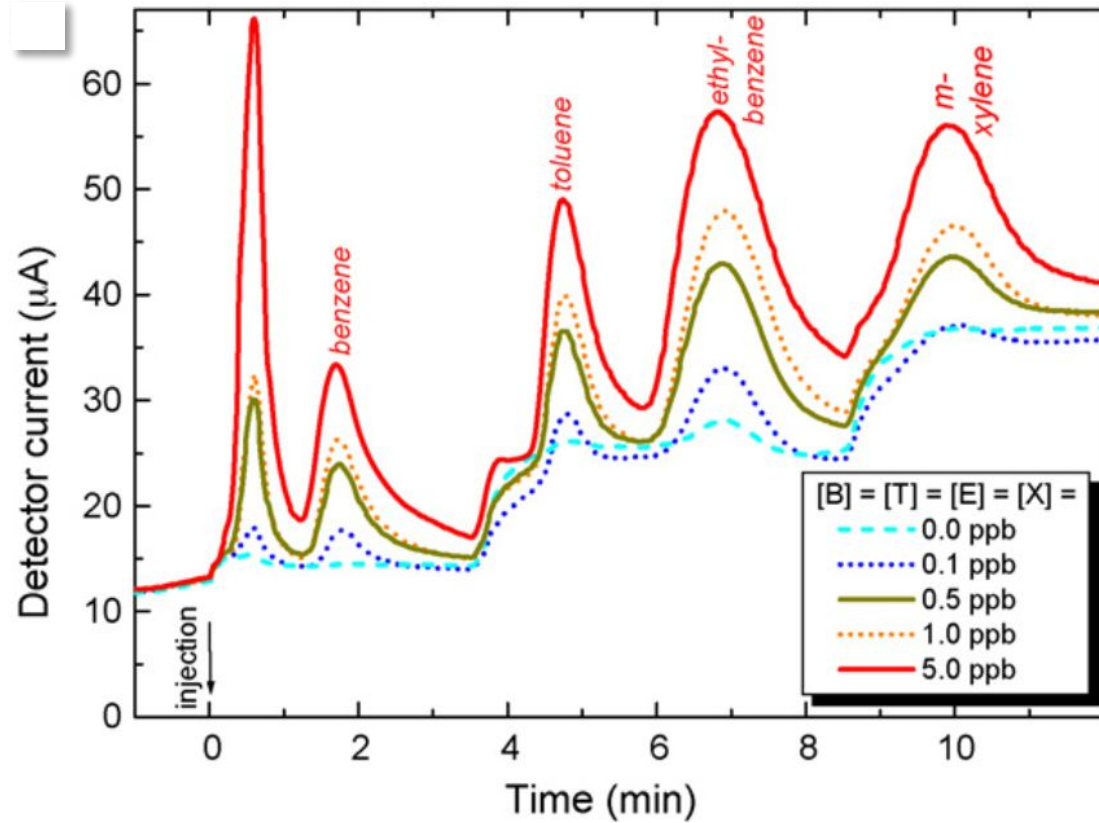
- ✓ Schools, hospitals, museums, parks
- ✓ Street canyons, garages, tunnels, high-traffic areas
- ✓ Airports, stations, harbours



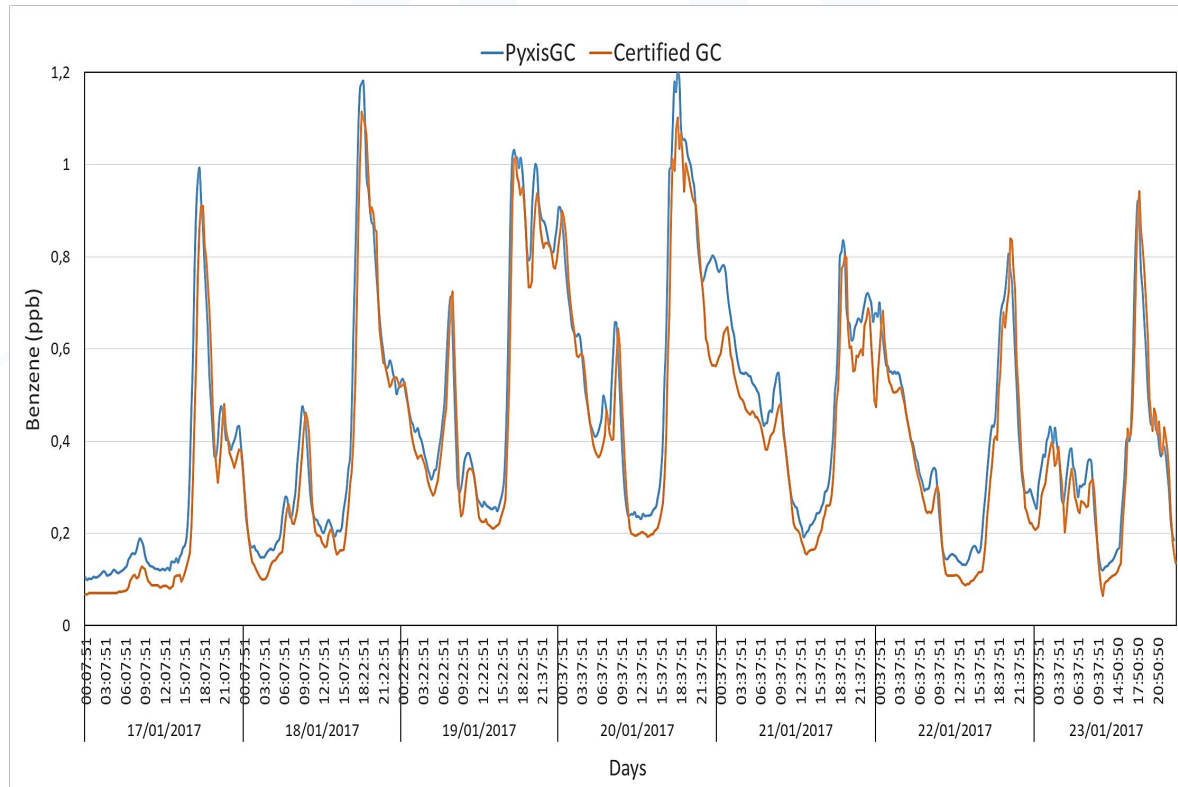


ANALYTICAL PERFORMANCE

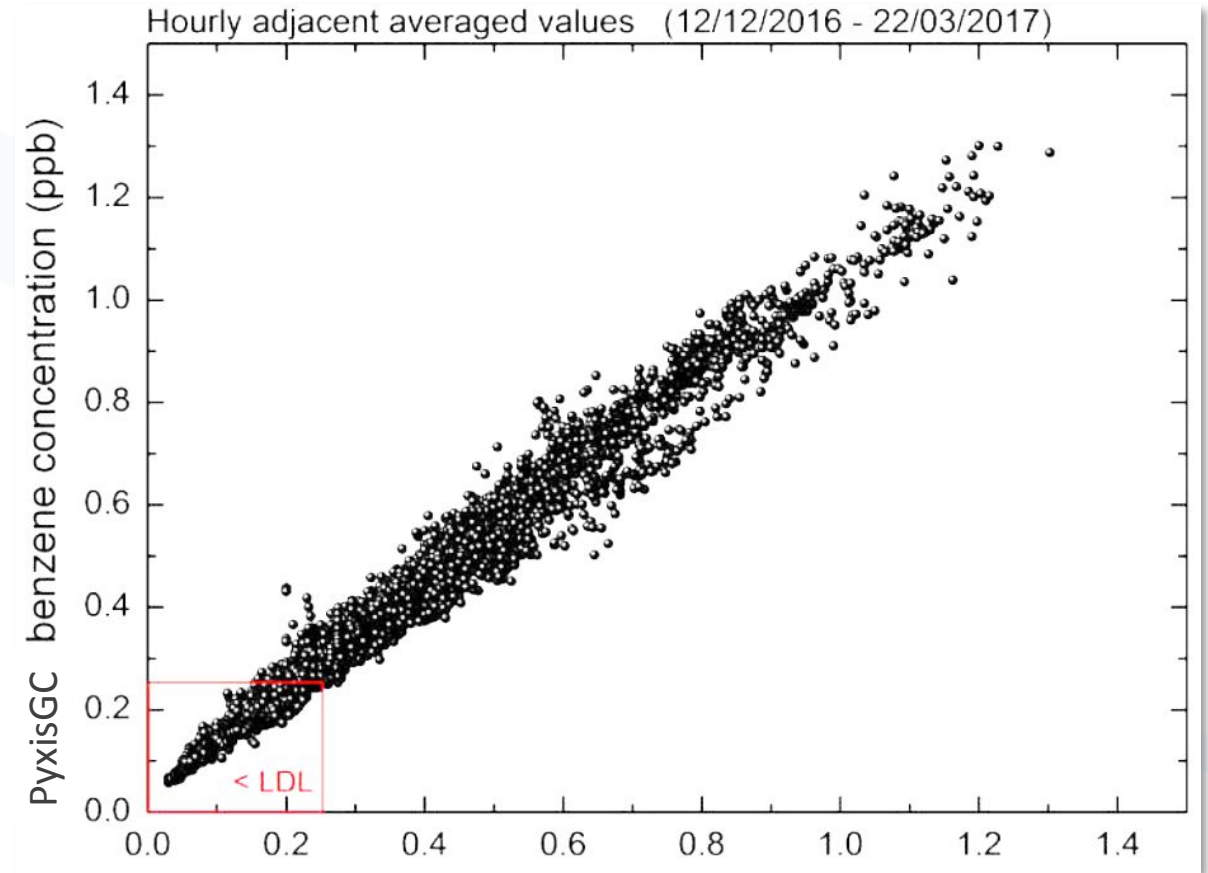
Calibration and Lab test



Field test campaign

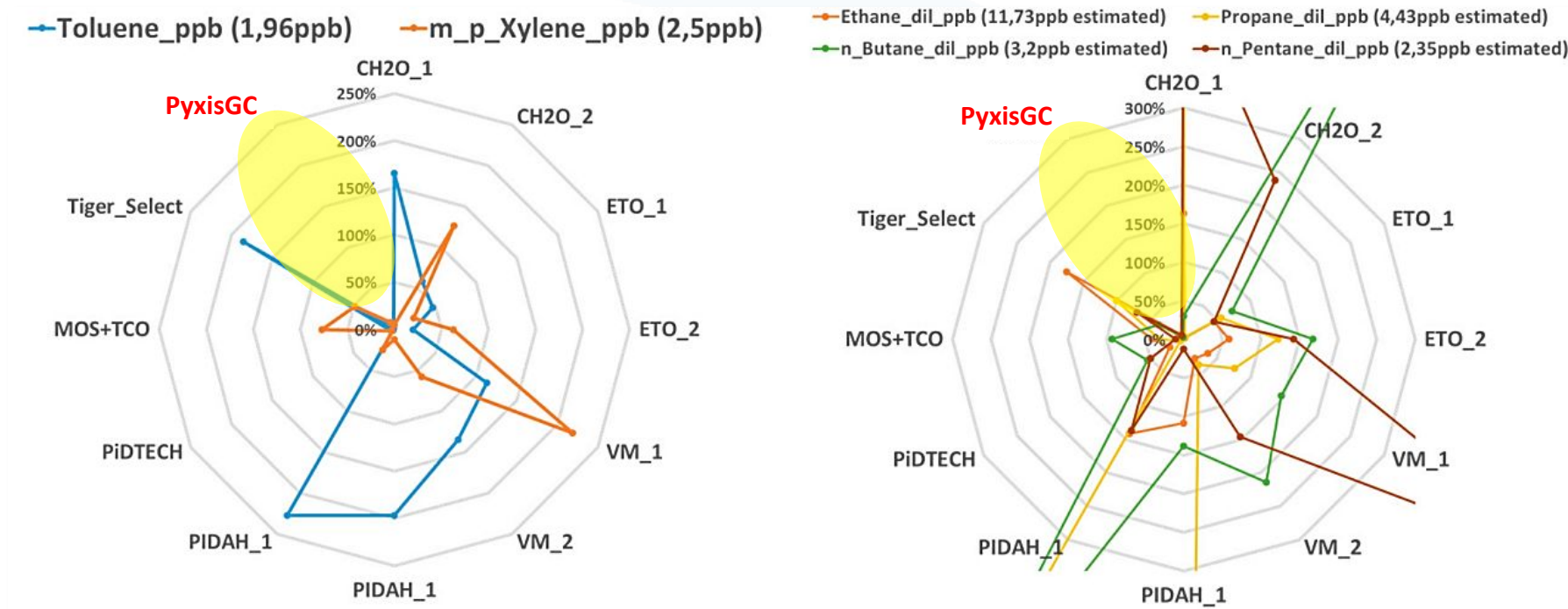


Example of several days field measurement of Benzene versus certified GC system



Correlation plot for the whole testing period of 3 months

Performance Evaluation of Low-Cost BTEX Sensors and Devices within the EURAMET KeyVOCs Project



Estimation of the sensor sensitivity to organics interfering compounds

Ref.: *Proceedings 2017, 1, 425 - Eurosensors 2017 Conference, Paris, France*

Conclusion

- ✓ Use only ambient air as carrier gas
- ✓ Suitable for sub-ppb BTEX (LOD 0.2 ppb of Benzene) monitoring applications associated with very low cross sensitivity towards interfering compounds
- ✓ Handheld, stand-alone GC shows excellent results in cross-comparison with a reference GC unit
- ✓ Compliant with EN14662-3:2015
- ✓ Low power consumption
- ✓ Low maintenance interval
- ✓ The analytical core of the PyxisGC BTEX, is also available to be integrated as OEM module in other monitoring station



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