

# APPLICATION NOTE

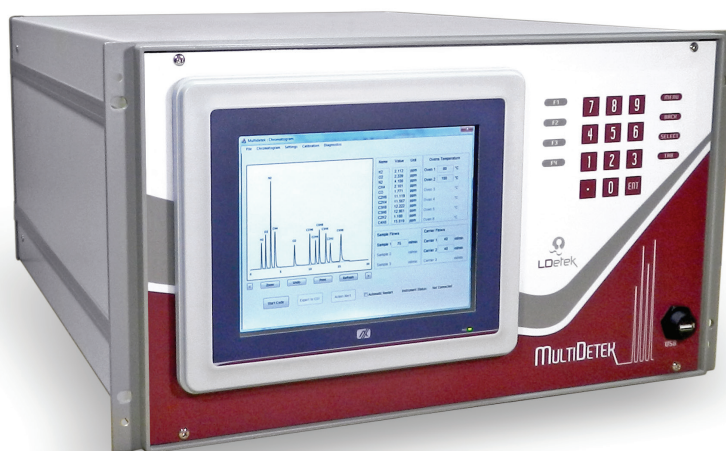
# LD14-01



## Light hydrocarbons measurement with the \*PlasmaDetek-E system with nitrogen carrier gas and the MultiDetek-2.



◀ PlasmaDetek-E



▲ Multidetek-2

Hydrocarbons are ones of the most important impurities measured in the industry. Whether it is for safety, quality control, special gases or any other needs, those compounds are everywhere.

The techniques used to measure those compounds have been the same for quite some years. The FID (Flame Ionization Detector) is surely the most widely used in the industry. The selectivity for hydrocarbon (HC) gives the simplicity desired for all gas chromatograph (GC) users. However the need of air, but mostly hydrogen as fuel is the drawback of this technology. Many plants and laboratories would like to get rid of the hydrogen as potential explosive gas. All the safety feature (valves, extra lines, procedures, etc) are required and brings extra cost and manpower.

Other technologies to measure the light hydrocarbon have arisen over the years. The Discharge Ionization Detector (DID) brought a solution without the need of air and fuel. Working on helium carrier gas, the safety problem was resolved. However the selectivity is not present and the need of helium is required. With the worldwide shortage of helium and its increasing price constantly, it becomes a more costly solution not attractive enough for gas chromatograph developer.

Another solution was brought to the market: the Plasma Emission Detector (PED). With its advantage to work in helium and argon carrier gas, this solution becomes more attractive because of argon pricing. It is also produced and available anywhere in the world. Furthermore, the PED has some selectivity against some other gases, not completely, but enough to make the GC user life easier. However, there is no selectivity for HC against many compounds, including air and oxygen. Measuring HC in a stream of Oxygen or Air is very important in Air Separation Unit (ASU). There is also a lack of sensitivity in some case by using argon as carrier. Measuring  $C_2H_2$  for a ASU plant is critical and it needs to be measured in low concentration.

### LDETEK SOLUTION:

With the patent pending PED system (PlasmaDetek-E) provided by LDETEK, it is now possible to improve and overcome the drawbacks of other available technologies.

\* Patent pending

## NITROGEN CARRIER GAS:

First of all, such system can work with argon and helium, but with nitrogen carrier as well. Nitrogen is a low cost and inert gas that makes it very attractive to use in a GC. Air contamination and leak are not much problematic as it is with other PED systems. Typical PED detector can be sensitive, but it needs to be in a very pure environment. A little leak or contamination can compromise the whole measurement. The recovery time from column changes and GC start-up is then extremely fast with the PlasmaDetek-E using nitrogen as carrier gas.

A simple injection configuration has been used to inject different matrices to evaluate the response and selectivity over CnHm components. Figure 1 shows such configuration with the PlasmaDetek-E system.

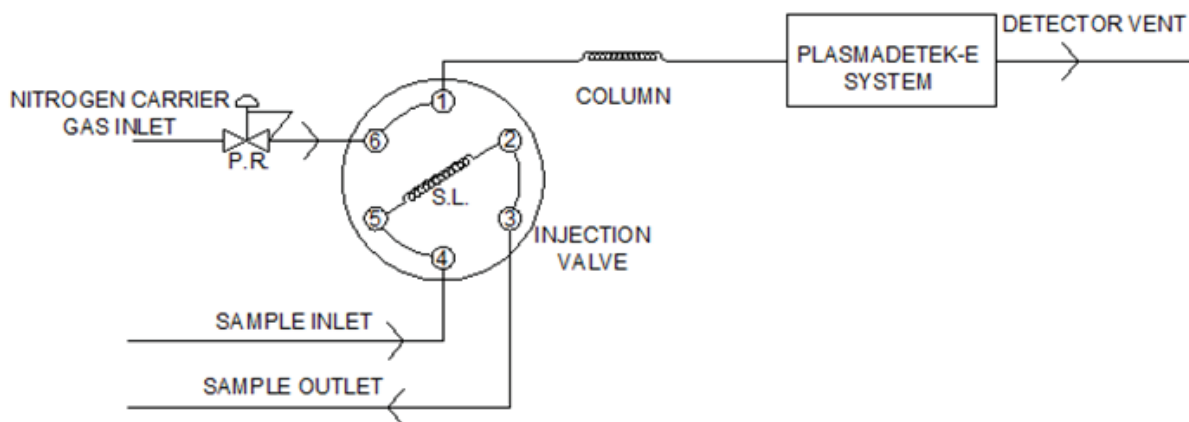


Figure 1

## SENSITIVITY:

To evaluate the response and sensitivity, injection of CnHm impurities in Argon balance has been used. Figure 2 shows the chromatogram with indication of each compounds detected by the PlasmaDetek-E.

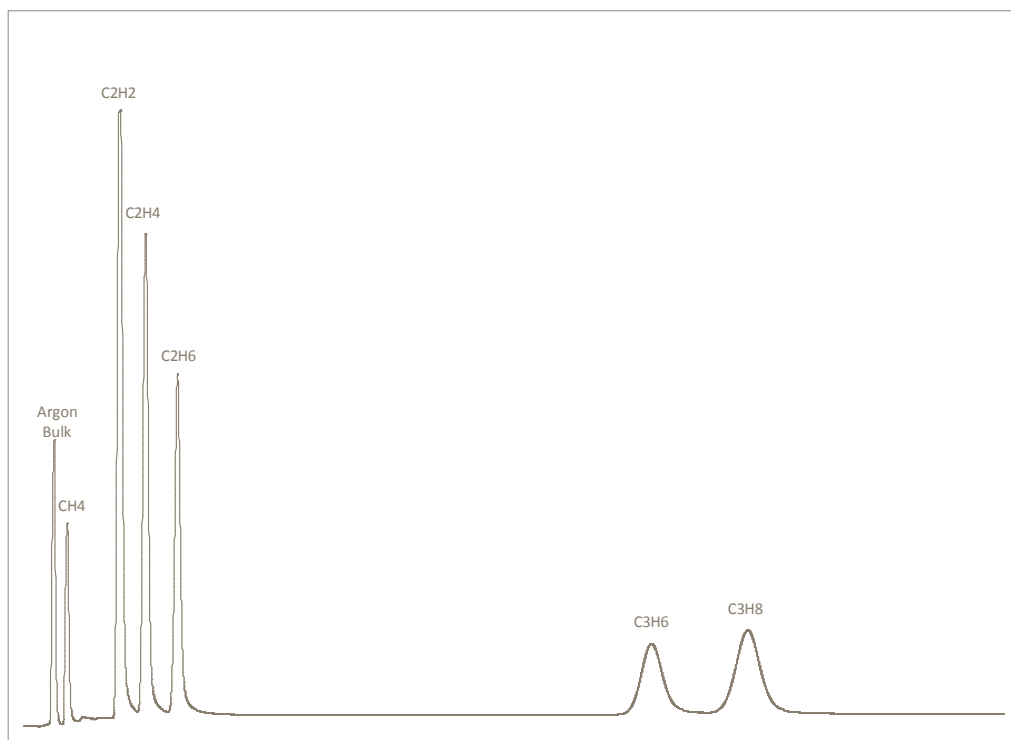


Figure 2

By evaluating the noise level and peak height, LDL for each compounds can be evaluated by considering the limit as 3 times the noise level. Figure 3 is showing the results of this analysis.

COMPONENT	CONCENTRATION	PEAK HEIGHT	NOISE (3x)	LDL (3x NOISE)
CH4	9.56 ppm	1300 mV	1.5 mV	11 ppb
C2H2	10.50 ppm	4800 mV	1.5 mV	3 ppb
C2H4	9.96 ppm	3100 mV	1.5 mV	4 ppb
C2H6	10.80 ppm	2300 mV	1.5 mV	7 ppb
C3H6	10.40 ppm	460 mV	1.5 mV	33 ppb
C3H8	9.20 ppm	560 mV	1.5 mV	24 ppb

Note: other LDL could be obtained with different injection volume and chromatographic condition

Figure 3

By using different injection volume and/or chromatographic configuration, even lower LDL could be obtained. However, by comparing with same the chromatographic condition than a traditional argon PED, LDL is improved by a factor of about 10 times with the PlasmaDetek-E. It is even more the case for C<sub>2</sub>H<sub>2</sub>, where it is about 100 times more sensitive.

## SELECTIVITY:

By using the same configuration as figure 1, air has been injected to evaluate the interference that can occur with the first hydrocarbon content out of the column, which is CH<sub>4</sub>. Figure 4 shows an injection with the PlasmaDetek-E using argon as carrier gas optimized for the best response to Hydrocarbon in air. It is obvious that the CH<sub>4</sub> is influenced by the residual air. In such cases, extra valves or hardware would be required to achieve possible measurement.

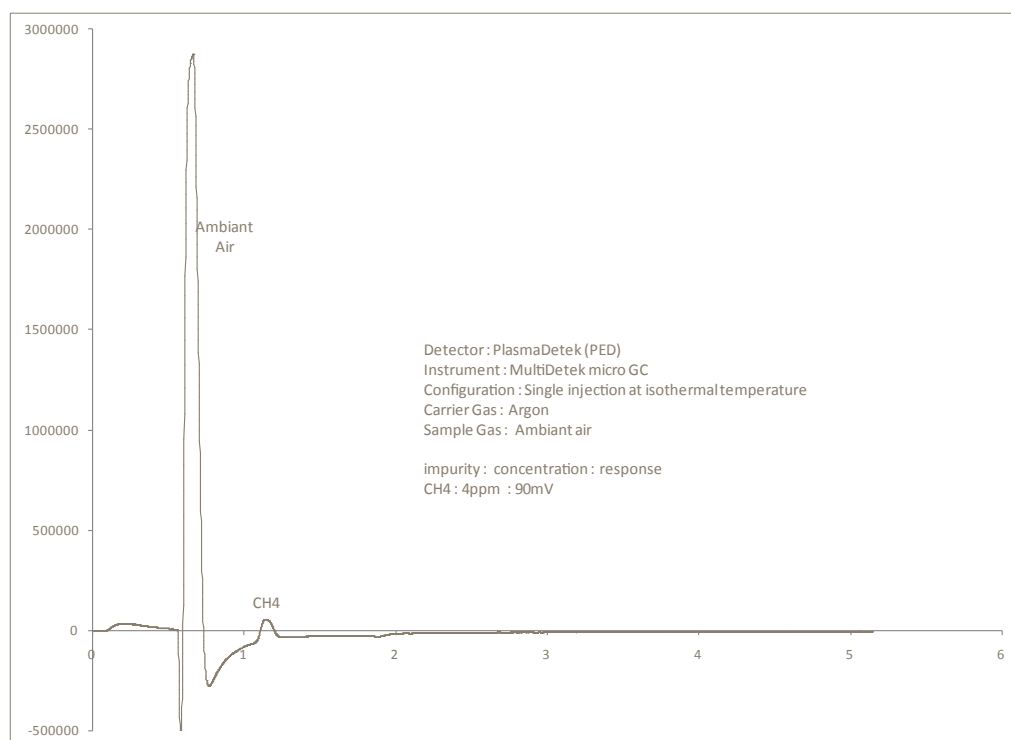


Figure 4

Figure 5 is using the same system with nitrogen carrier gas. Air response has been reduced considerably compared to argon carrier gas. Only with a simple injection configuration will make the CH<sub>4</sub> detectable.

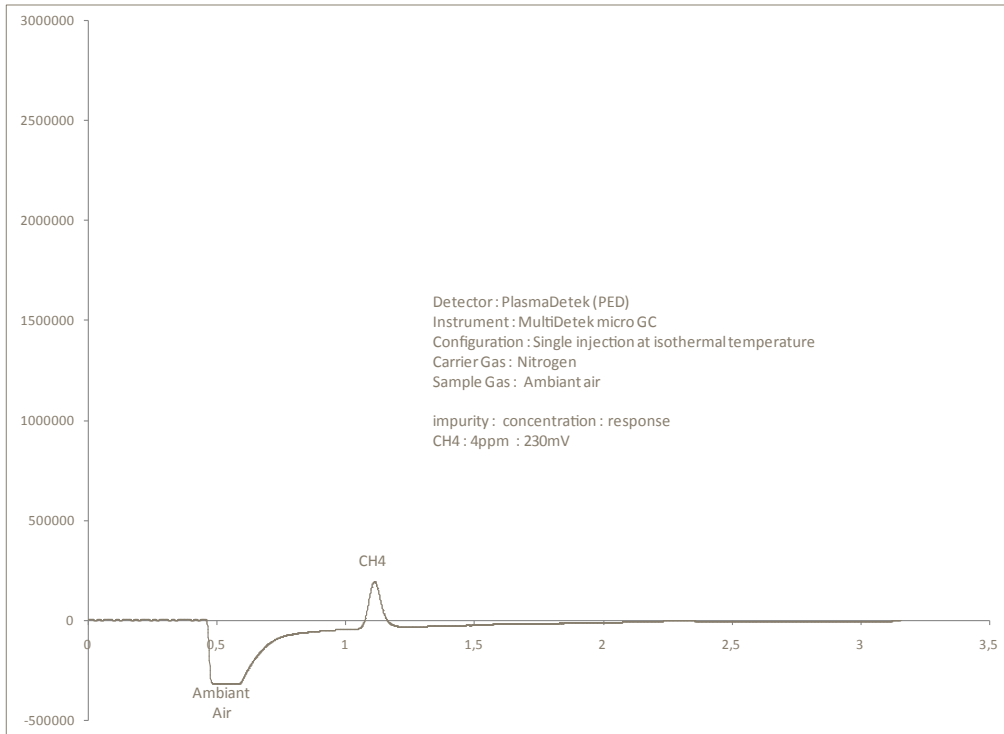


Figure 5

## CONCLUSION:

With the PlasmaDetek-E system, lights hydrocarbon measurement is now safe and easy. No fuel, no air and no safety features needed, only nitrogen carrier gas.

It is also the lowest operation cost solution, but the sensitivity is not compromised where low ppb can be achieved.



Where **innovation** leads to **success**

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