

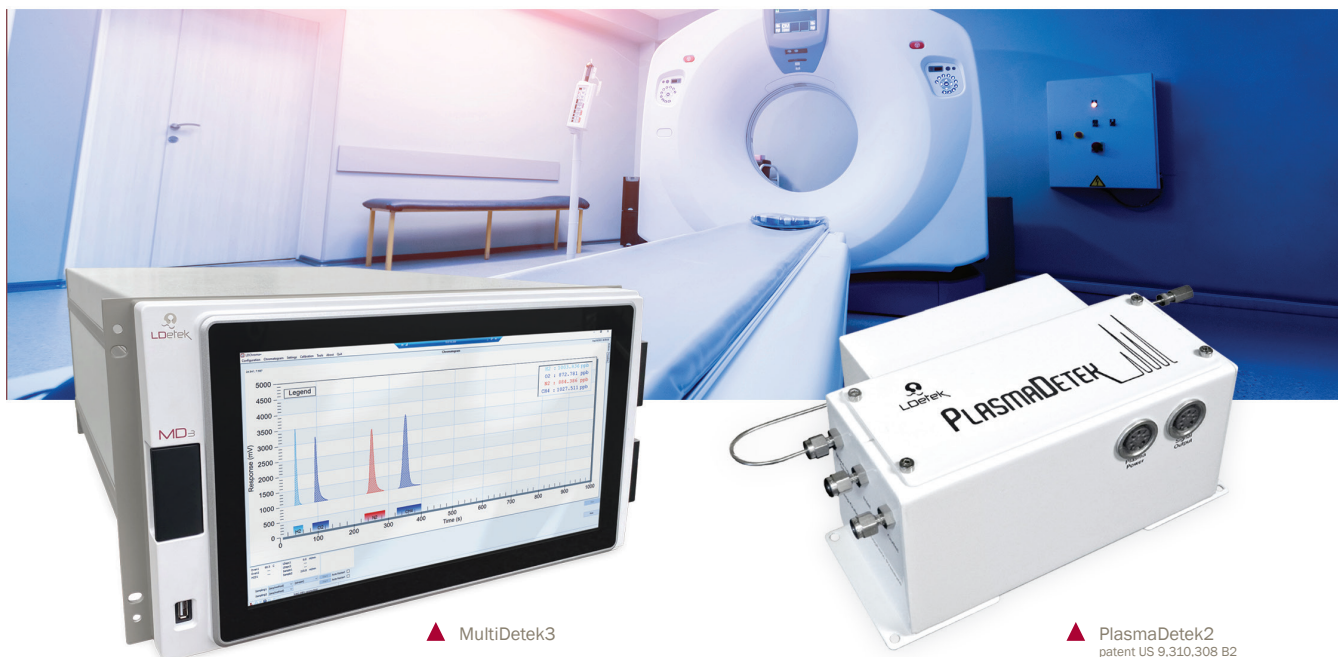
APPLICATION NOTE

LD23-01

PST
PROCESS SENSING
TECHNOLOGIES



Analysis of trace impurities in UHP Helium



Helium is one of the basic chemical elements. In its natural state, helium is a colorless gas known for its low density and low chemical reactivity. It is probably best known as a non-flammable substitute for hydrogen to provide the lift in blimps and balloons. Because it is chemically inert, it is also used as a gas shield in robotic arc welding and as a non-reactive atmosphere for growing silicon and germanium crystals used to make electronic semiconductor devices. Liquid helium is often used to provide the extremely low temperatures required in certain medical and scientific applications, including super conduction research.

Helium is usually produced as a by-product of natural gas processing. Natural gas contains methane and other hydrocarbons, which are the principal sources of heat energy when natural gas is burned. Most natural gas deposits also contain smaller quantities of nitrogen, water vapor, carbon dioxide, helium, and other non-combustible materials, which lower the potential heat energy of the gas. To produce natural gas with an acceptable level of heat energy, these impurities must be removed. This process is called upgrading. There are several methods used to upgrade natural gas. When the gas contains more than about 0.4% helium by volume, a cryogenic distillation method is often used in order to recover the helium content. Once the helium has been separated from the natural gas, it undergoes further refining to bring it to 99.99+% purity for commercial use. During the helium purification process, a gas analyser system for the trace impurities analysis is required to control the process and to qualify the helium purity before using it.

LDETEK SOLUTION

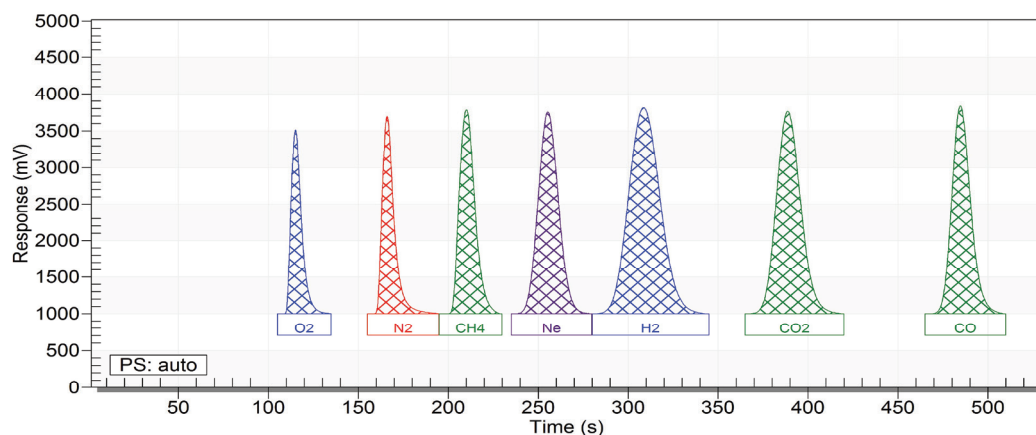
The Multidetek3 industrial gas chromatograph has been configured here with the plasma emission detector using Helium as carrier gas. The unit is constructed here using multiple channels to allow the simultaneous analysis of trace impurities Ar+O₂-N₂-Ne-H₂-CH₄-CO₂-CO in balance pure Helium. The analysis is performed in a time frame of +/- 15 minutes for all impurities. The analysis time can be reduced if required by adding an extra channel to isolate CO₂ and CO impurities with independent columns to accelerate their retention times.

Additional optional modules possible to install in the same instrument:

- The analysis of impurity NMHC can be added using the same PED with an extra backflush to detector valve/column module.
- The separation of Ar-O₂ can be done by adding an ArgoTek column module within the same instrument.
- A quartz crystal sensor/module can be mounted in the same instrument to allow the analysis of trace moisture down to 10ppb ldl.

The MultiDetek3 helium purity analysis system here has been configured with a range of 0-10ppm and a ldl at 5-10ppb. Other configurations are possible on request.

RESULTS



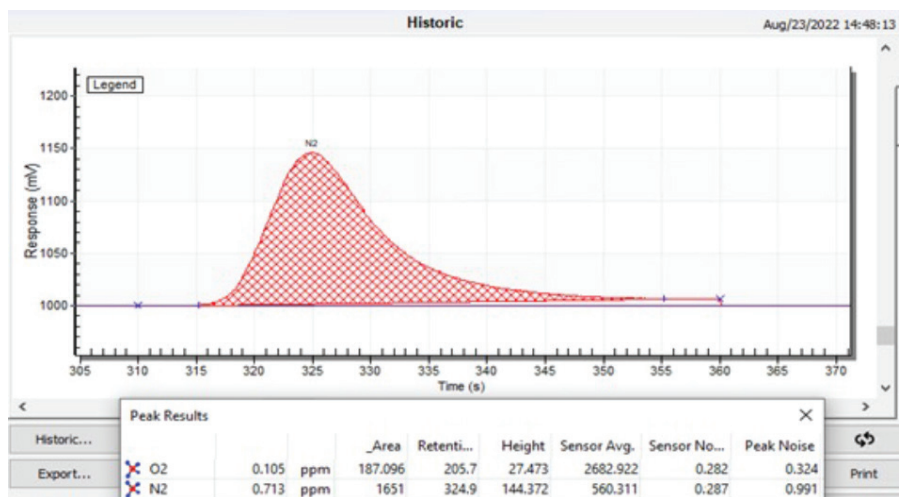
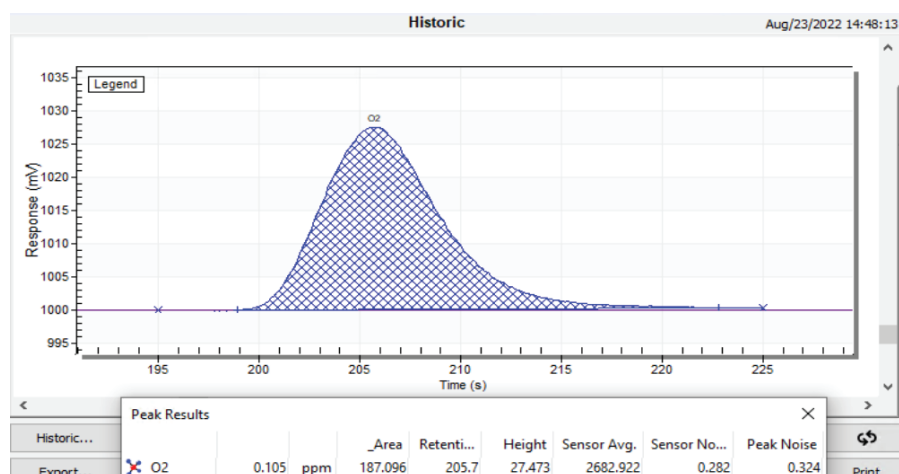
Chromatogram (Span calibration) of trace impurities Ar+O₂-N₂-Ne-H₂-CH₄-CO₂-CO in balance gas Helium

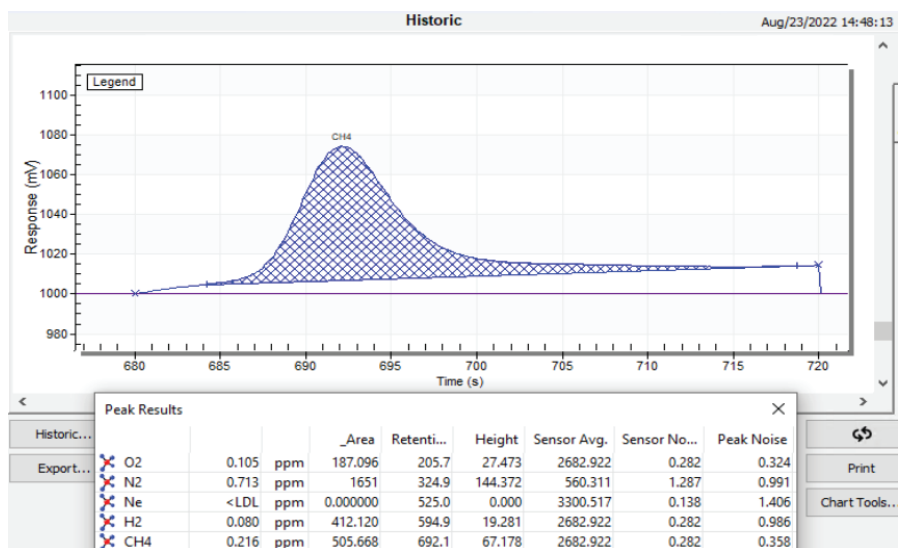
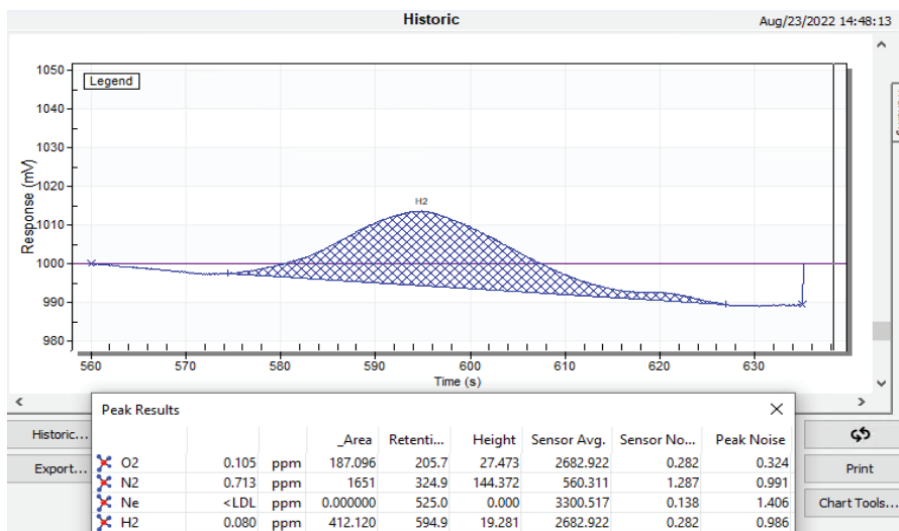
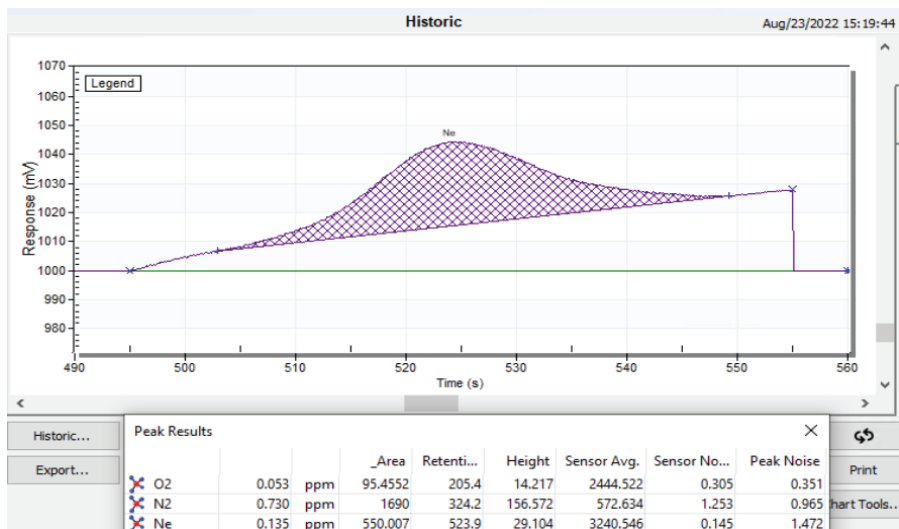
Peak	Unit	Calibration Value	_Area Counts
O ₂	ppm	10.25	10827
N ₂	ppm	10.40	35271
CH ₄	ppm	11.32	44014
Ne	ppm	10.90	5890
H ₂	ppm	11.38	14841
CO ₂	ppm	11.10	49535
CO	ppm	11.28	51841

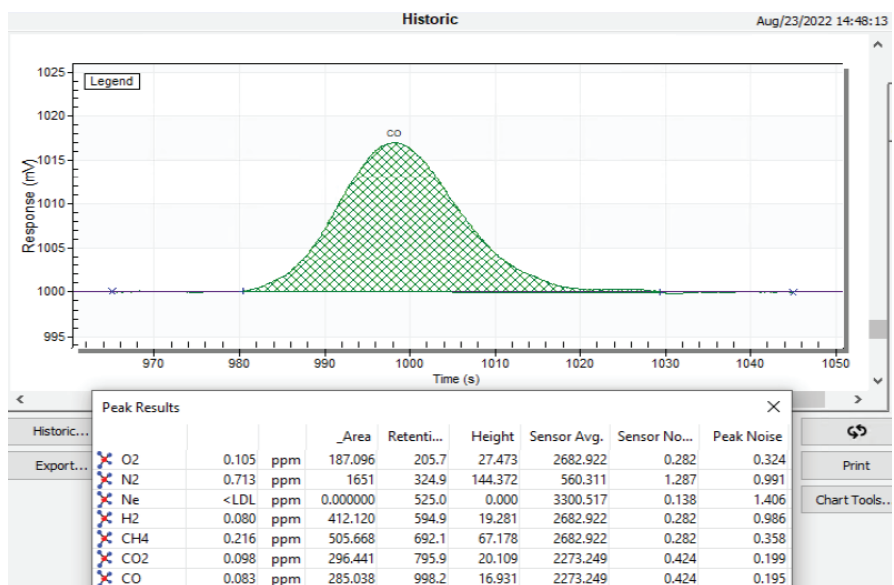
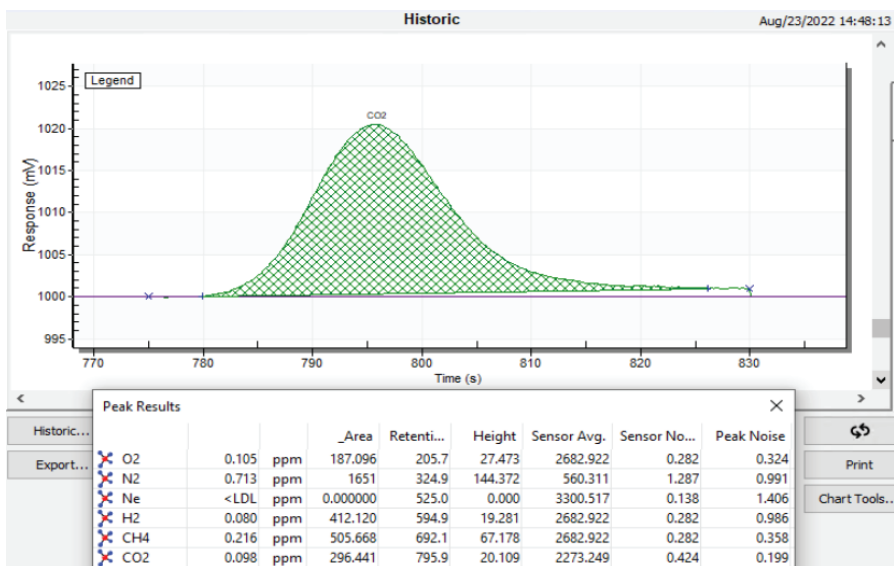
Limit of detection (based on 3 times the noise level from a blank)

COMPONENTS	CONCENTRATION (ppb)	PEAK HEIGHT	NOISE	LDL (3X NOISE)
Ar+O2	105	27mV	0.28mV	3ppb
N2	713	144mV	0.28mV	4ppb
Ne	135	29mV	0.14mV	2ppb
H2	80	19mV	0.28mV	3ppb
CH4	216	67mV	0.28mV	3ppb
CO2	98	20mV	0.42mV	6ppb
CO	83	17mV	0.42mV	6ppb

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







Repeatability: Based on the GC standards. Using 6 of 10 consecutive runs, being lower than 5% of 3*CV%

CONCLUSION

The MultiDetek3 configured with PED and Helium carrier gas can measure all trace impurities in one instrument. The system offers the performances required by the industries for stability/repeatability/limit of detection and linearity. Its modular construction allows to build the unit upon your analytical requirements. The MD3 gas analyzer offers a complete analytical solution for the certification of UHP helium production within a robust system. Ask our experts for more details about all our accessories that come with such analytical device.



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