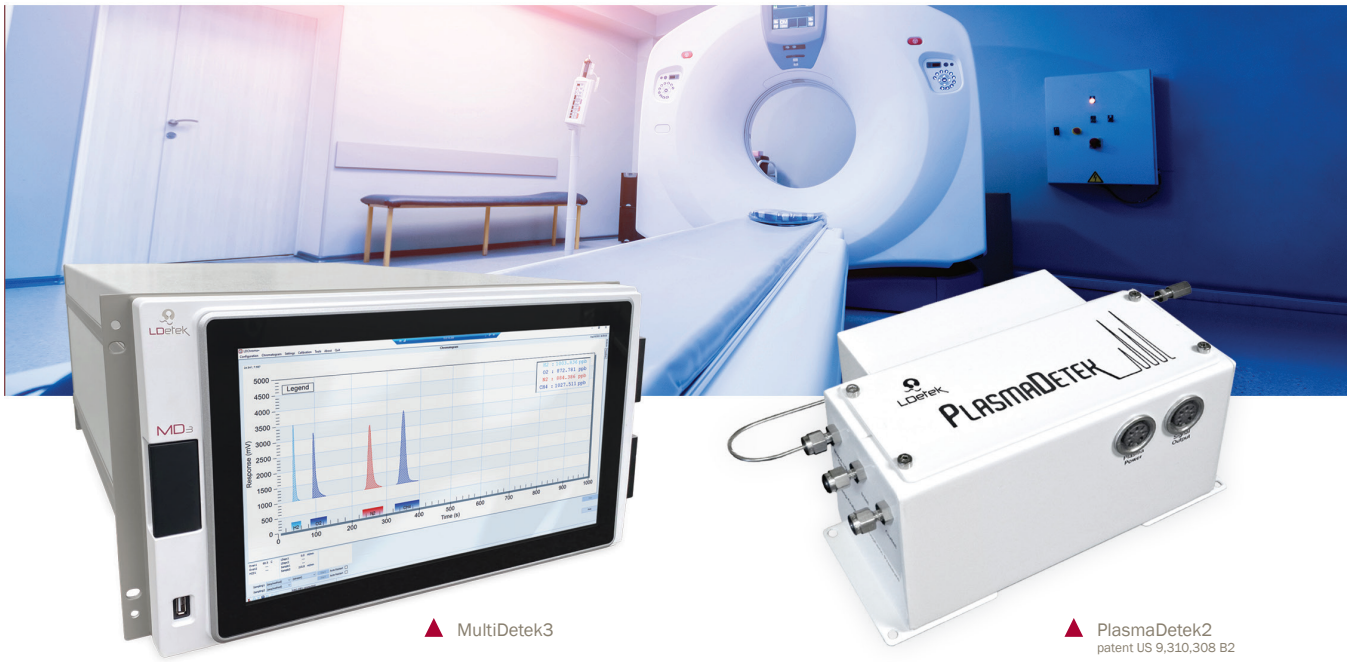
APPLICATION NOTE
LD23-01

PST PROCESS SENSING TECHNOLOGIES | LDetek A PST BRAND

Analysis of trace impurities in UHP Helium



▲ MultiDetek3

▲ PlasmaDetek2
patent US 9,310,308 B2

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.

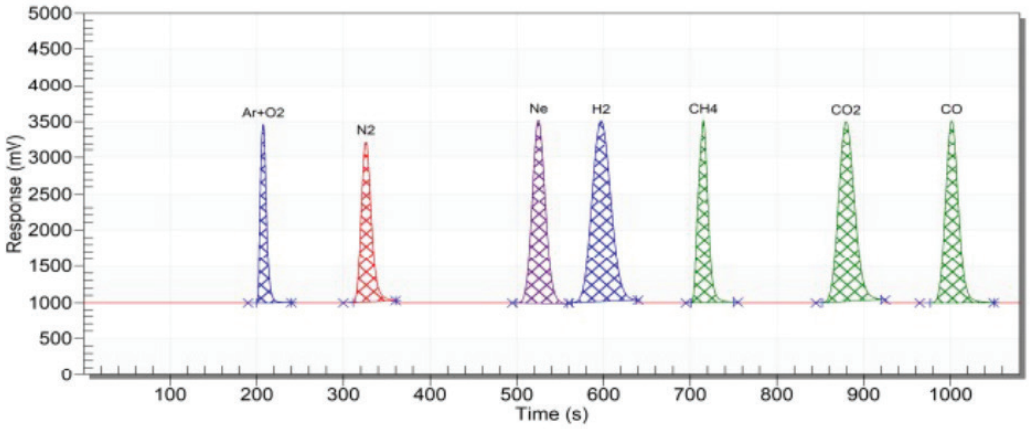
LDETEK SOLUTION

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



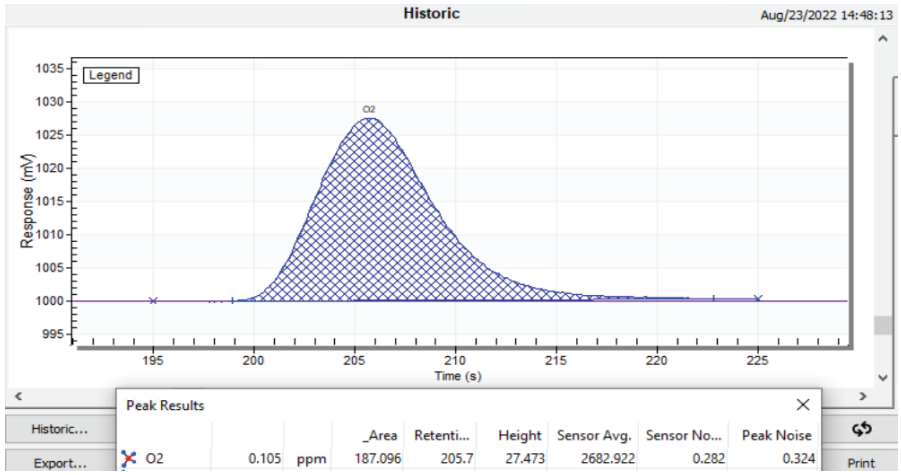
Chromatogram (Span calibration) of trace impurities Ar+O2-N2-Ne-H2-CH4-CO2-CO in balance gas Helium

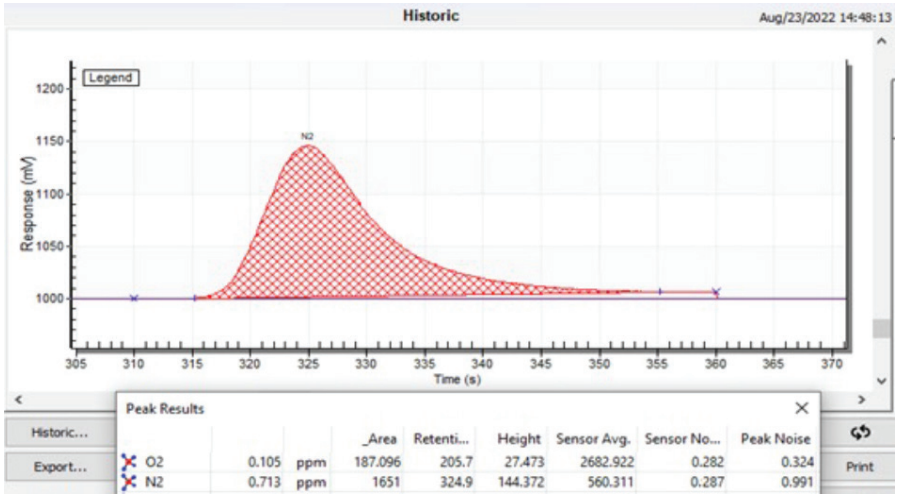
Peak	Unit	Calibration Value	_Area Counts
Ar+O2	ppm	12.000	18856
N2	ppm	12.200	26165
Ne	ppm	10.700	44546
H2	ppm	12.200	60413
CH4	ppm	12.700	30129
CO2	ppm	12.400	48965
CO	ppm	12.700	39694

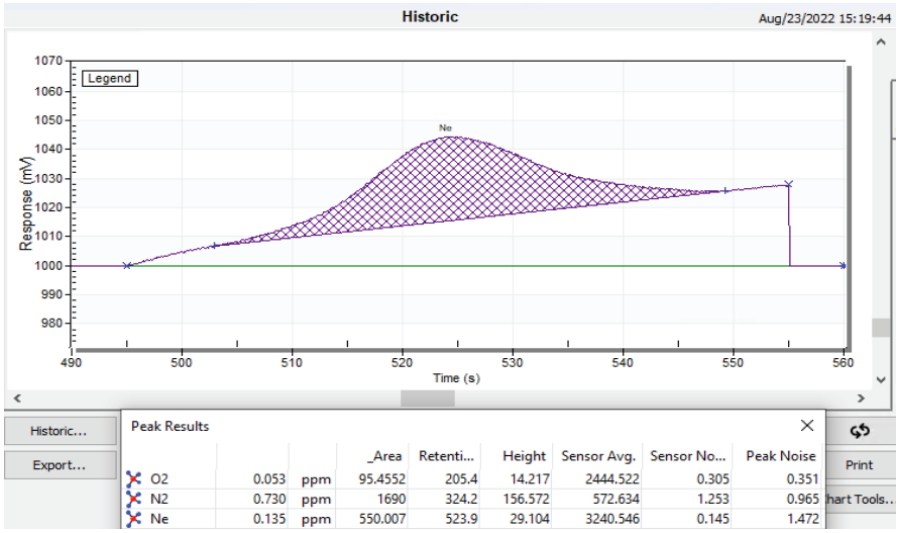
Limit of detection (based on 3 times the noise level from a blank)

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

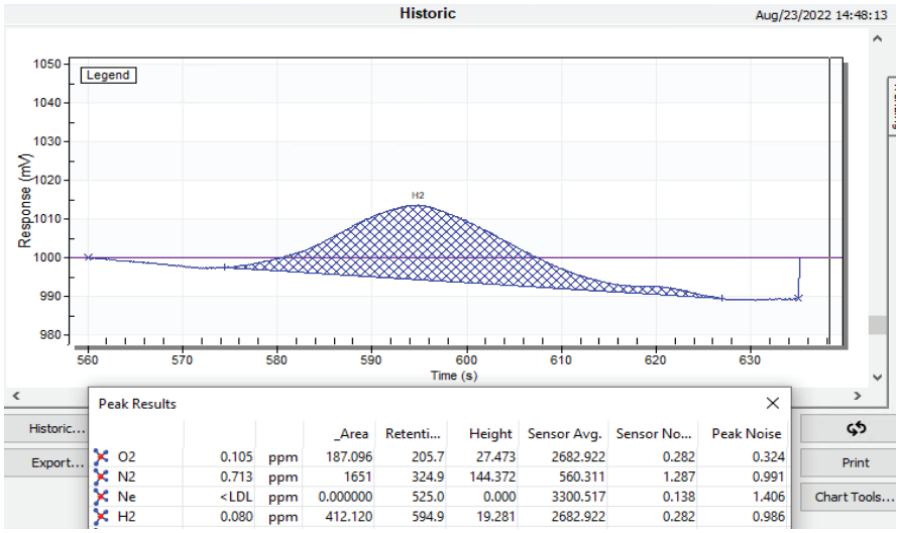
Note: other LDL could be obtained with different injection volume and chromatographic condition.



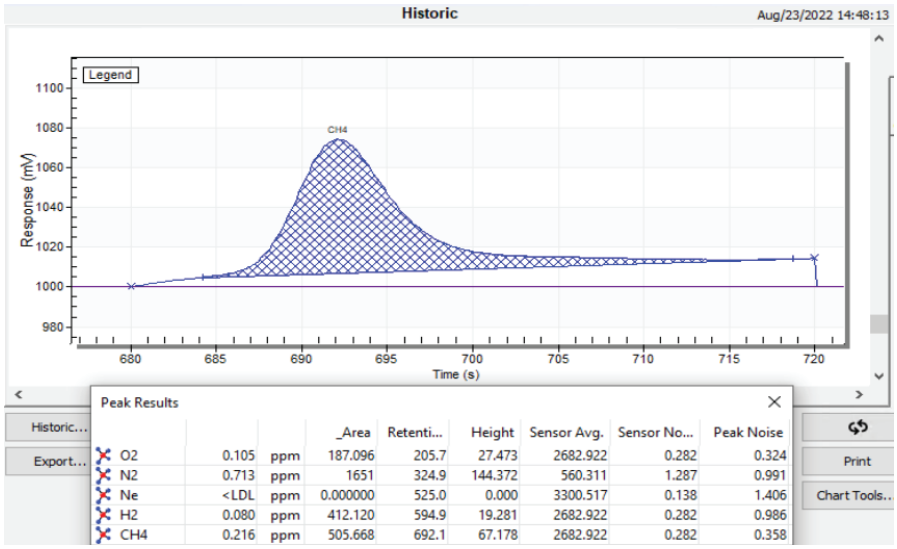




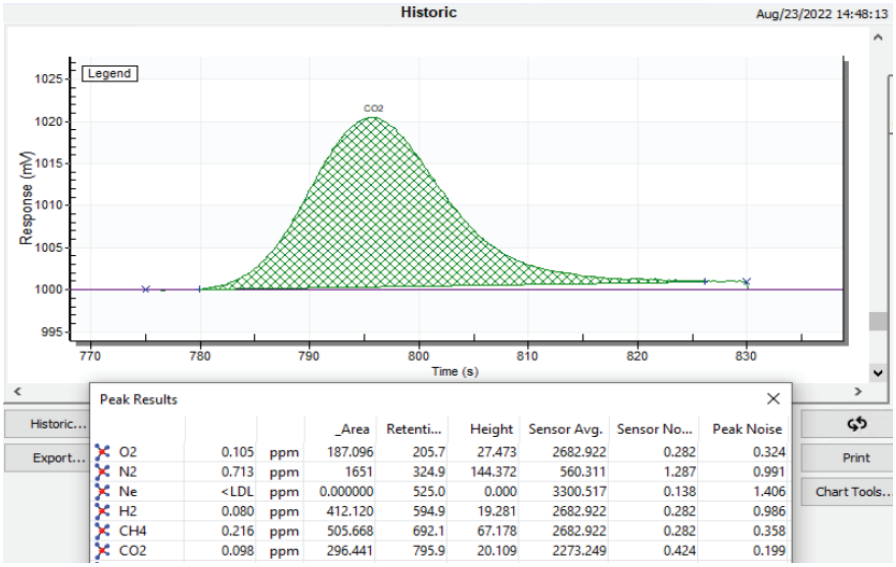
			_Area	Retenti...	Height	Sensor Avg.	Sensor No...	Peak Noise
O2	0.053	ppm	95.4552	205.4	14.217	2444.522	0.305	0.351
N2	0.730	ppm	1690	324.2	156.572	572.634	1.253	0.965
Ne	0.135	ppm	550.007	523.9	29.104	3240.546	0.145	1.472

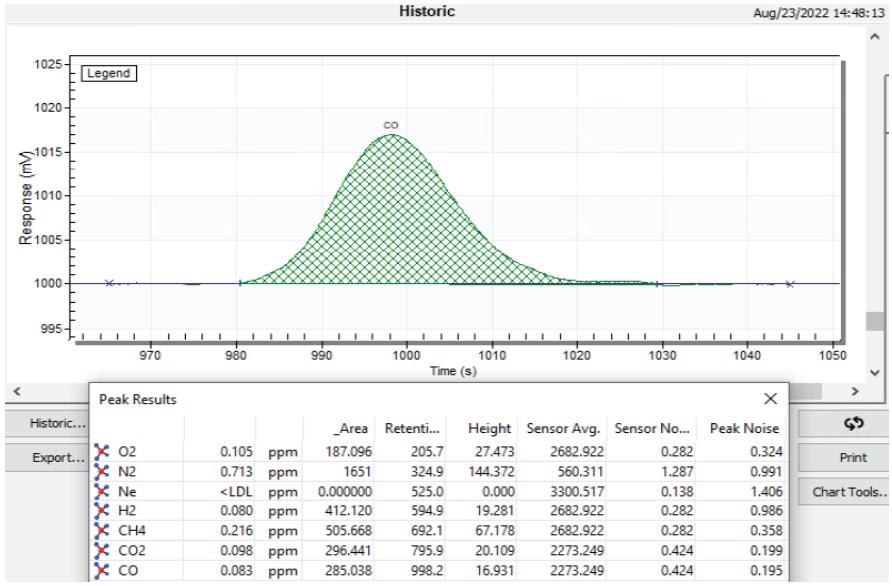


			_Area	Retenti...	Height	Sensor Avg.	Sensor No...	Peak Noise
O2	0.105	ppm	187.096	205.7	27.473	2682.922	0.282	0.324
N2	0.713	ppm	1651	324.9	144.372	560.311	1.287	0.991
Ne	<LDL	ppm	0.000000	525.0	0.000	3300.517	0.138	1.406
H2	0.080	ppm	412.120	594.9	19.281	2682.922	0.282	0.986



			_Area	Retenti...	Height	Sensor Avg.	Sensor No...	Peak Noise
O2	0.105	ppm	187.096	205.7	27.473	2682.922	0.282	0.324
N2	0.713	ppm	1651	324.9	144.372	560.311	1.287	0.991
Ne	<LDL	ppm	0.000000	525.0	0.000	3300.517	0.138	1.406
H2	0.080	ppm	412.120	594.9	19.281	2682.922	0.282	0.986
CH4	0.216	ppm	505.668	692.1	67.178	2682.922	0.282	0.358





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 measured 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.

LDetek A PST BRAND
990 Monfette Est, Thetford Mines, (Qc), Canada, G6G 7K6
Phone: 418 755-1319 • Fax: 418 755-1329 • **info@ldetek.com**
www.ldetek.com