

Detailed Hydrocarbon Analyser

- Solutions comply with all ASTM, CEN, DIN, IP and ISO methods
- DHA calculations fully integrated in Chromeleon datasystem
- High uptime due to modular injector/detector technology
- Data merge of DHA Front End and High Temp SIMDIST

Get ready for tomorrow's analytics

Global Analyser Solutions

GAS offers custom configured GC analysers for many application fields for over 50 years. GAS analysers are designed to meet many standardised methods from GPA, ASTM, UOP, ISO, EN and others. The efficient configurations are based on proven GC technology, resulting in robust, highly productive instruments with an optimal return on investment.

Detailed analysis of light petroleum streams is essential for hydrocarbon processing. GAS DHA analysers offer full characterisation of hydrocarbon streams like spark ignition engine fuels and gasoline blending feedstocks. The dedicated, fully automated software provides detailed reporting of sample composition and physical properties, and a straightforward workflow.

GC instruments

DHA methods are based on obtaining as much separation as possible of individual components, using a single high resolution capillary column (figure 4). Undiluted samples are injected using Split-Splitless or PTV injector with high split ratio, and FID is used for detection. The Thermo Trace GC1600 (figure 1) is the optimal choice for this type of analysis, because the low thermal mass oven design offers superb retention time stability. This is of great importance for DHA, since component identification relies on retention time indices from a database.

InstantConnect module concept

The Trace 1600 GC offers unique InstantConnect injector and detector modules, which can be exchanged by the user in minutes, guaranteeing high uptime and low maintenance costs. See figure 2.

Columns and options

DHA columns are described by ASTM and other standardised methods. Restek Rtx-1, 50m*0.21mm is applied for ASTM D5134, while Rtx-DHA 100, 100m*0.25mm, is used for ASTM D6729. An optional tuning column is available for enhanced separation of oxygenated components (ASTM D6730/PIONAX). Depending on the complexity of the sample, GC oven programming starts at 30 °C or at sub-ambient temperatures (cryogenic cooling option). The latter is especially needed in case of high olefin content and/or C1-C3 light petroleum compounds. The typical analysis time for fast DHA is 80 minutes, and 140

minutes for the classical DHA method.





Figure 1 DHA based on Thermo Trace GC1600 and AS 1610 autosampler

12.04

19.27

19.92

13.37

10.70

9.92

2.45

2.62

3.12

0.05

0.66

0.18

0.01

Instrument Instrument Me			Detailed Hy	drocarbon	Analysis			
Processing Met Data File Injection Date Injection Time Calculation Typ Physical proper	thod te ty report	GC1 DHA DHA - D6730 Cal DEHA-X 15/Aug/2014 14:58 Total	ibration PIONA	Sequence nan Data Vault	ne	# Data G.A.S. F ChromeleonLo DHA Report D6 8 116 0.2 159	cal	(ASTM D673(
Density @ 60/60 °F RVP @ 100 °F (psi) Research ON (RON) Motor ON (MON) MW (g/mol) Bromine number		0.7342 4.75 65.8 62.2 104.82 16.99	Notes:	Gross Heat combustion @ 77 °F (25 °C) Nett Heat combustion @ 77 °F (25 °C)			Btu/lb 19592 18281	KJ/Kg 45570 42522
Composition re	port (mass %)		Filter:	PIONAX				
Carbon	n-Paraffins	iso-Paraffins	Olefins	Naphthenes	Aromatics	Oxygenates	Unknowns	Total
						0.23		0.23
C1								
C1 C2						4.76		4.76
	0.03					4.76	0.02	4.76 0.05
C2	0.03 1.14	0.34				4.76	0.02	
C2 C3		0.34 2.75	1.37			4.76		0.05
C2 C3 C4	1.14		1.37 1.88	2.66	1.63		0.04	0.05
C2 C3 C4 C5	1.14 3.49	2.75		2.66 5.15	1.63 3.02	1.84	0.04	0.05 1.52 10.65
C2 C3 C4 C5 C6	1.14 3.49 3.78	2.75 6.89	1.88			1.84	0.04	0.05 1.52 10.65 18.40
C2 C3 C4 C5 C6 C7	1.14 3.49 3.78 2.58	2.75 6.89 7.72	1.88 1.36 0.55 1.13	5.15	3.02	1.84	0.04 1.21 0.05	0.05 1.52 10.65 18.40 19.88
C2 C3 C4 C5 C6 C7 C8	1.14 3.49 3.78 2.58 1.55	2.75 6.89 7.72 5.02	1.88 1.36 0.55	5.15 2.74	3.02 3.33	1.84	0.04 1.21 0.05 0.63	0.05 1.52 10.65 18.40 19.88 13.83
C2 C3 C4 C5 C6 C7 C8 C9	1.14 3.49 3.78 2.58 1.55 1.18	2.75 6.89 7.72 5.02 5.91	1.88 1.36 0.55 1.13	5.15 2.74 0.59	3.02 3.33 1.87	1.84	0.04 1.21 0.05 0.63	0.05 1.52 10.65 18.40 19.88 13.83 10.86
C2 C3 C4 C5 C6 C7 C7 C8 C9 C10	1.14 3.49 3.78 2.58 1.55 1.18 1.11	2.75 6.89 7.72 5.02 5.91	1.88 1.36 0.55 1.13	5.15 2.74 0.59	3.02 3.33 1.87 5.34	1.84	0.04 1.21 0.05 0.63	0.05 1.52 10.65 18.40 19.88 13.83 10.86 10.84
C2 C3 C4 C5 C6 C7 C7 C8 C9 C10 C11	1.14 3.49 3.78 2.58 1.55 1.18 1.11 1.18	2.75 6.89 7.72 5.02 5.91	1.88 1.36 0.55 1.13	5.15 2.74 0.59	3.02 3.33 1.87 5.34 1.52	1.84	0.04 1.21 0.05 0.63	0.05 1.52 10.65 18.40 19.88 13.83 10.86 10.84 2.69

4.06

4.19

2.75

1.61

1.20

1.11

1.16

1.05

3.11

21.71

C6

C7

C8

C9

C10

C11

C12

C12+

3 23

7.63

8.23

5.18

6.04

3.40

34.16

1 54

2.03

1.41

0.56

1.13

0.48

2.54

4.93

2.57

0.57

0.41

1.35

2.54

2.80

1.58

4.50

1.29

1.57

15.63

GAS DHA Calculator software

DHA calculations are fully integrated in Chromeleon datasystem, therefore data export to external software is not needed. The result is a highly reliable, user friendly and easy workflow based system. Identification, calculation and reporting start automatically after each run, see the result report shown in figure 3. DHA Calculator software provides the solution for all mentioned standardised methods.

Database tuning and easy identification

Calibration mixtures containing PIONA components are used to tune the internal database, see figure 5. Retention time indices (RI) of the sample are compared with the database for identification of the unknown components. A n-paraffin standard is injected regularly to check system stability; update of retention times is an intuitive graphical operation. The database with retention indices of 500 components is part of the software package. The internal database can be secured by user levels: different privileges are allocated to fit to any chromatography workflow.

Results

The analysis results for each individual component are reported in mass% and volume% to the nearest 0.01% for accurate results.

Calculation of group type and physical parameters

Besides reporting of individual components, hydrocarbon group type data is presented. These groups include normal, iso- and cyclic saturates, unsaturates, aromatic component and oxygenates (PIONAX). Physical parameters like Specific Gravity, MON, RON, Vapour Pressure and Molar Weight are reported as well (figure 2).

Custom calculations, database filters

Custom calculations like n-C4/i-C4 ratio are added on request. Database filters are available to exclude component groups in specific sample streams (PNA, PIONA, PIONAX) for reliable identification.

ASTM D7900: DHA front-end + SIMDIST Merge

DHA front-end analysis according to ASTM D7900 is available using the optional iConnect PTV backflush module (figure 6), for C_1-C_9 detailed analysis in crude oil. C_{10} and higher boiling components are backflushed, see figure 7. The SIMDIST data can be merged with ASTM D7169 data for full characterisation of crude oil. For more details, see application note 'Crude Oil Analyser'.

Improved DHA by GC-VUV

Standard DHA relies on detection by FID, which has limitations due to possible incomplete component separation and lack of selectivity. Alternatively, UV detection provides enhanced identification and highly reliable results. For more detailed information, refer to application note AN19-3WA0523A.

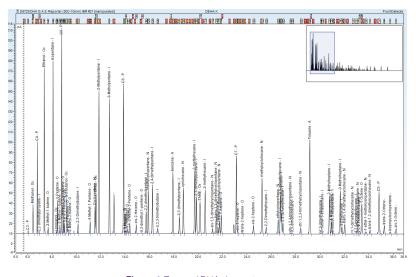
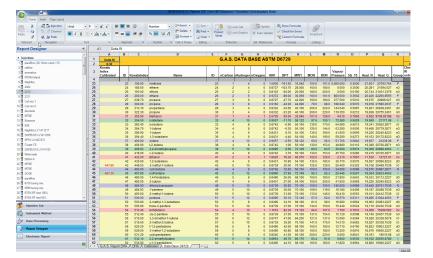


Figure 4 Zoomed DHA chromatogram





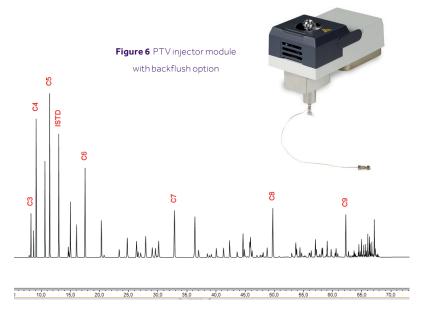


Figure 7 DHA front-end chromatogram of crude oil sample. C $_{10}$ and higher boiling components are backflushed using PTV module with backflush option

Standardised methods:	ASTM D5134, D6729, D6730, D6733, D7900, IP601, IP PM DL, Fast DHA
Standardised methods.	ASTTED1134, D0723, D0730, D0733, D7300, II 001, II TTEDE, T030 DTA

GC Instrument:	
Configuration:	1-channel instrument based on Thermo Trace 1600 GC with InstantConnect SSL and FID,
	Triplus RSH or AS/AI-1610 liquid autosamplers
Optional:	InstantConnect PTV module with backflush option for DHA-front end analysis
	Cryogenic oven cooling (CO ₂ or LN_2)
	Hydrogen safety system in case of hydrogen carrier gas
Application:	Detailed analysis of petroleum products in the range of gasoline blending feedstocks. Separation of as
	many as possible components using a long high resolution capillary column with optional pre-column
	for polarity tuning. Dedicated DHA software for analysis of the individual component concentrations; grouping
	on carbon number; grouping on component type (PIONAX); and calculation of the various physical properties
	of the sample.
	Software merge of DHA and Simdist data in case of DHA of crudes
Sample requirements:	Undiluted sample injection
Analysis Time:	Typical 80 minutes for Fast DHA using H_2 carrier gas; 140 minutes in case of the classical method
Calibration standards:	GAS supplies all needed calibration standards and reference samples
DHA Calculator	GAS DHA Calculator: integrated calculation module in Chromeleon.
	No need for data export to external software
	Reporting of:
	 Individual components (mass% and volume%)
	 O-PIONA group type data (mass% and volume%)
	Physical properties: Specific Gravity, True Boiling Point, MON, RON,
	Reid Vapour Pressure (RVP), Bromine number, Gross heat combustion (Btu/lb;kJ/kg)
	• Nett heat combustion (Btu/Ib), Molecular Weight
	• Custom calculations on request
	Database filters for selective identification (PNA, PIONA, PIONAX)
	• DHA/Simdist merge according to ASTM D7900/D7169

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