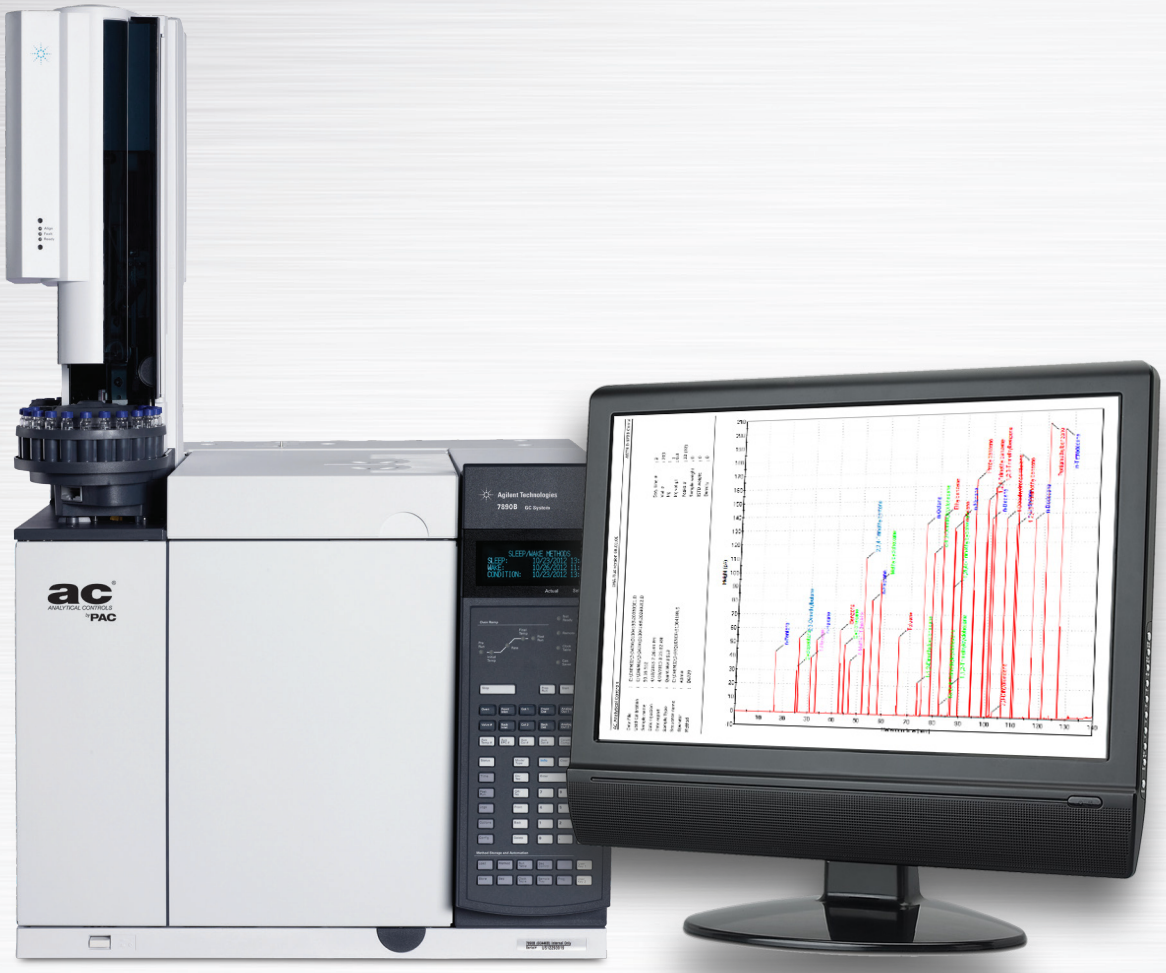
PAC | solid partners proven solutions



Full Range of DHA Solutions

Detailed Hydrocarbon Analysis of Light Petroleum Streams and Light End in Crude Oils

- Reliable and Repeatable Performance with the User-friendly DHA Plus Software
- Unique DHA Combi allows the Analysis of both Light Petroleum Streams and Light End in Crude
- Easy Instrument Validation through Dedicated Quality Control Samples
- In Compliance with ASTM D5134, D6729, D6730, D6733, D7900, Fast DHA, DHA Front End, IP601, prEN 15199-4

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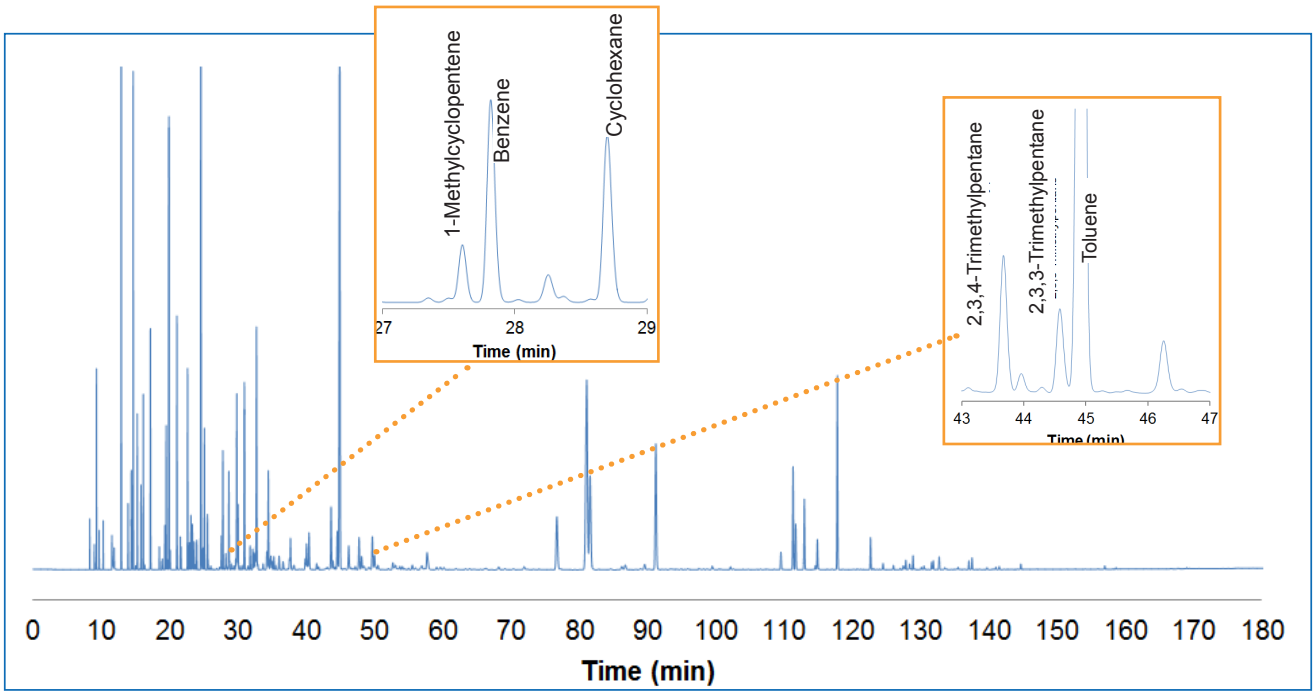
DHA Solutions

COMPLETE RANGE OF DETAILED HYDROCARBON ANALYSIS SOLUTIONS

Refinery gas streams vary considerably in composition. Determining individual components of each gas Detailed hydrocarbon analysis uses single column technology to determine the individual components in petroleum streams. PAC offers a full range of AC Analytical Controls® Detailed Hydrocarbon Analyzers (DHA) for flexible and reliable component identification, which contribute to highly accurate analysis calculations for precise product value determination.

The AC DHA analyzers comply with ASTM standard methods D5134, D6729, D6730 and D6733, and PAC offers a fast DHA application to determine the individual components in gasoline blending feedstocks within 28 minutes, keeping critical components chromatographically separated. The productrange also includes a DHA Front End (FE), and a DHA Combi, where FE can be combined with a standard method in one solution.



AC DHA Analyisis of Gasoline N

DEDICATED QUALITY CONTROL SAMPLES FOR ENSURED VERIFICATION

To verify the DHA application, PAC offers a calibration sample and various quality control (QC) samples, including an n-alkane mixture. The QC sample range consists of:

- Reformer feed
- Reformate
- Alkylate
- Isomerate
- FCC naphtha
- Gasoline with ETBE & ethanol sample
- Gasoline with ethanol
- Gasoline with MTBE

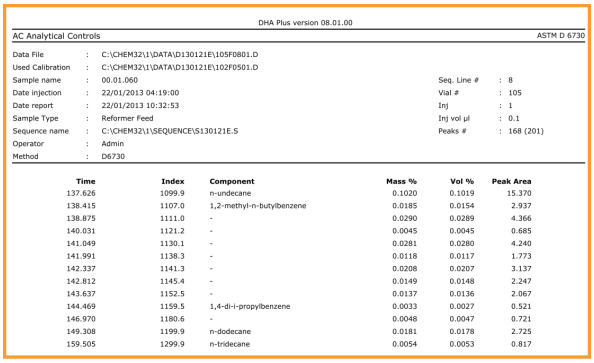
USER-FRIENDLY DHA PLUS SOFTWARE FOR RELIABLE AND REPEATABLE PERFORMANCE

Pre-defined Settings for Excellent Peak Identification

The AC DHA Plus software predefines the properties of the DHA application to each sample type specifically, which contributes to a more accurate peak identification and analysis reliability. The software includes definition for retention time, index and molecular weight. Component database and dedicated sample types can easily be created or modified to match specific needs.

Report Options fully Configurable per Sample Type and User Requirements:

- Chromatogram with colored peak identification
- Component concentrations table
- True boiling point distribution report
- Carbon number versus group type tables (O-PIONA) in mass%,mol%, and vol%
- RON specification
- Specific gravity and molecular weight report
- Export or output of reports to several formats, such as CSV and PDF
- Direct export to MS Excel or upload to a LIMS, for reviewing results outside the DHA software



DHA Plus version 08.01.00

AC Analytical Controls — ASTM D 6730

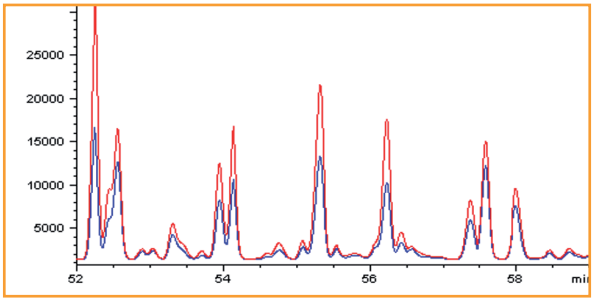
Data File	:	C:\CHEM32\1\DATA\D130121E\105F0801.D			
Used Calibration	:	C:\CHEM32\1\DATA\D130121E\102F0501.D			
Sample name	:	00.01.060	Seq. Line #	:	8
Date injection	:	22/01/2013 04:19:00	Vial #	:	105
Date report	:	22/01/2013 10:32:53	Inj	:	1
Sample Type	:	Reformer Feed	Inj vol µl	:	0.1
Sequence name	:	C:\CHEM32\1\SEQUENCE\S130121E.S	Peaks #	:	168 (201)
Operator	:	Admin			
Method	:	D6730			

Time	Index	Component	Mass %	Vol %	Peak Area
137.626	1099.9	n-undecane	0.1020	0.1019	15.370
138.415	1107.0	1,2-methyl-n-butylbenzene	0.0185	0.0154	2.937
138.875	1111.0	-	0.0290	0.0289	4.366
140.031	1121.2	-	0.0045	0.0045	0.685
141.049	1130.1	-	0.0281	0.0280	4.240
141.991	1138.3	-	0.0118	0.0117	1.773
142.337	1141.3	-	0.0208	0.0207	3.137
142.812	1145.4	-	0.0149	0.0148	2.247
143.637	1152.5	-	0.0137	0.0136	2.067
144.469	1159.5	1,4-di-i-propylbenzene	0.0033	0.0027	0.521
146.970	1180.6	-	0.0048	0.0047	0.721
149.308	1199.9	n-dodecane	0.0181	0.0178	2.725
159.505	1299.9	n-tridecane	0.0054	0.0053	0.817

Report Example of a D6730 Reformer Feed Analysis

Unique and Fully Automated LineUp Tool™:

- Elimates run-to-run variability, stabilizes retention times, ensures accurate peak identification
- Automatically corrects for any variation in column aging and/or flow by aligning the retention axis
- Contributes to a high accuracy by processing each sample automatically

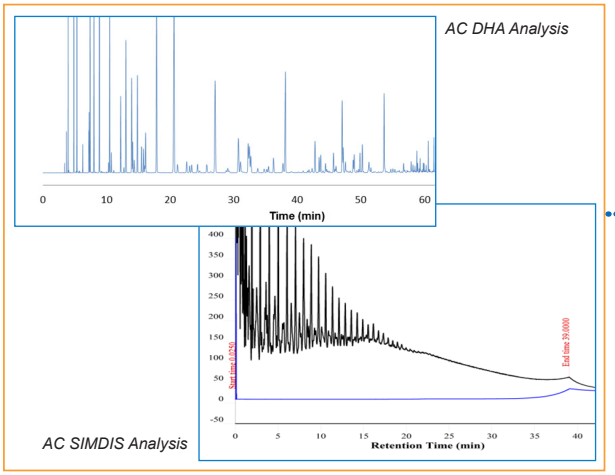


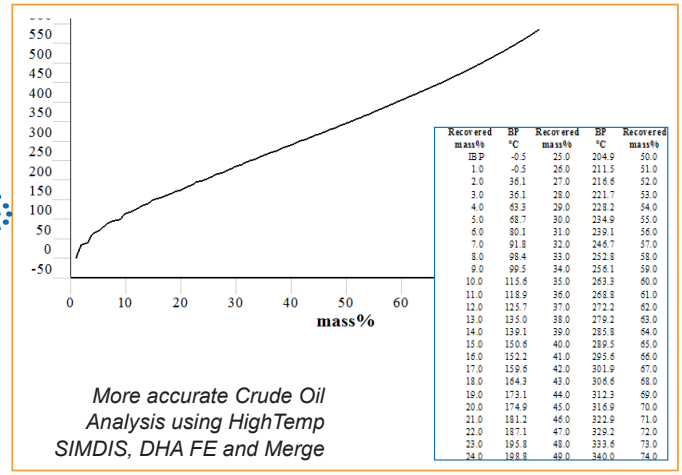
DHA Analysis after alignment without affecting the original analysis files

UNIQUE DHA COMBI ALLOWS THE ANALYSIS OF BOTH LIGHT PETROLEUM STREAMS AND LIGHT END IN CRUDE

The AC DHA Combi allows analysts to combine two DHA applications into one gas chromatograph (GC). Using the unique AC DHA Combi inlet, the instrument includes both the DHA Front End (FE) application for light end analysis in crude oil and one of the following standard ASTM test methods: D6729, D6730, D6733 or the AC Fast DHA application.

DHA FE complies with IP 601/344 to characterize the C1 - nC9 fraction in crude oil. PAC pioneered and developed the innovative software to merge the DHA FE analysis data with High Temperature SIMDIS results for improving the crude oil analysis accuracy according to IP 545, EN 15199-3 and ASTM D7169.





Recovered mass%	BP °C	Recovered mass%	BP °C	Recovered mass%
IBP	-0.5	25.0	204.9	50.0
1.0	-0.5	26.0	211.5	51.0
2.0	36.1	27.0	216.6	52.0
3.0	36.1	28.0	221.7	53.0
4.0	61.3	29.0	228.2	54.0
5.0	68.7	30.0	234.9	55.0
6.0	80.1	31.0	239.1	56.0
7.0	91.8	32.0	246.7	57.0
8.0	98.4	33.0	252.8	58.0
9.0	99.5	34.0	256.1	59.0
10.0	115.6	35.0	263.3	60.0
11.0	118.9	36.0	268.8	61.0
12.0	125.7	37.0	272.2	62.0
13.0	135.0	38.0	279.2	63.0
14.0	139.1	39.0	285.8	64.0
15.0	150.6	40.0	289.5	65.0
16.0	152.2	41.0	295.6	66.0
17.0	159.6	42.0	301.9	67.0
18.0	164.3	43.0	306.6	68.0
19.0	173.1	44.0	312.3	69.0
20.0	174.9	45.0	316.9	70.0
21.0	181.2	46.0	322.9	71.0
22.0	187.1	47.0	329.2	72.0
23.0	195.8	48.0	333.6	73.0
24.0	198.8	49.0	340.0	74.0

SPECIFICATIONS

Ordering Information	
CCG6510.002A/C	DHA FAST SYSTEM ON 120V 7890 GC
CCG6510.003A/C	DHA D 6730 SYSTEM ON 120V 7890 GC
CCG6510.006A/C	DHA D 6729 SYSTEM ON 120V 7890 GC
CCG6510.008A/C	DHA D 6730 COMBI SYSTEM ON 120V 7890 GC
CCG6510.010A/C	DHA FAST COMBI SYSTEM ON 120V 7890 GC
CCG6510.013A/C	DHA D 6729 COMBI SYSTEM ON 120V 7890 GC
CCG6510.014A/C	DHA D 6733 SYSTEM ON 120V 7890 GC
CCG6510.015A/C	DHA D 6733 COMBI SYSTEM ON 120V 7890 GC
CCG6512.002A/C	DHA FE SYSTEM ON 120V 7890 GC
ACG6515.002A/C	DHA FAST SYSTEM ON 120V 6850 GC
ACG6515.003A/C	DHA D 6730 SYSTEM ON 120V 6850 GC
ACG6515.006A/C	DHA D 6729 SYSTEM ON 120V 6850 GC
ACG6515.014A/C	DHA D 6733 SYSTEM ON 120V 6850 GC
Standard Methods	
Carrier gas	Helium (99.999%), hydrogen (99.999%) for Fast DHA
Detector gas	Hydrogen (99.999%) and air
System power	110 - 230 Volts
Cryogenic oven cooling	Liquid nitrogen or liquid CO2 - (6850 based systems only LCO2)

Standard Methods

Standard Test Methods	Scope	Max FBP (°C)	Conc. Range (%mass)	Max Olefin Content	Column Length	Run time (min)	Separation Comments
ASTM D6729 Formally CGSB 14.3-199	Spark ignition engine fuels oxygenate blends	225°	0.01-30	25	100	140	No separation of vital oxygenates and toluene
ASTM D6730 Formally known as DHAX	Spark ignition engine fuels oxygenate blends	225°	0.01-30	25	100 + 3	170	Separation is tuned for major components. No 1-methyl-naphthalene/tridecane separation
ASTM D6733	Spark ignition engine fuels oxygenate blends	225°	0.01.15	20	50		No separation of benzene, toluene and vital oxygenates for ambient method. Uses ASTM D3606 or D5580 for Benzene/Toluene, ASTM D5599 or D4815 for oxygenates
Fast DHA	AC in-house standard, hydrogen carrier	225°	0.01-30	20	40	28	No separation of vital oxygenates and toluene. The resolution between peaks depends on the individual concentration of the components
DHA FE	Stabilized crude oils, straight naphta, reformates, alkylates.	n.a.	0.01-30	20	50	118	Separates up to C9, after C9 SIMDIS is used for data merge

Continuing research and development may result in specifications or appearance changes at any time

ABOUT PAC

PAC develops advanced instrumentation for lab and process applications based on strong **Analytical Expertise** that ensures **Optimal Performance** for our clients. Our analyzers help our clients meet complex industry challenges by providing a low cost of ownership, safe operation, high performance with fast, accurate, and actionable results, high uptime through reliable instrumentation, and compliance with standard methods.

Our solutions are from industry-leading brands: AC Analytical Controls, Advanced Sensors, Alcor, Antek, Herzog, ISL, Cambridge Viscosity, PSPI, and PetroSpec. We are committed to delivering superior and local customer service worldwide with 16 office locations and a network of over 50 distributors. PAC operates as a unit of Roper Technologies, Inc., a diversified technology company and a constituent of S&P 500, Fortune 1000, and Russell 1000 indices.

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