



# Crude Oil Analyser

## Simdist-DHA Merge

- Combining DHA and simulated distillation
- More accurate simulated distillation results for crude oil
- Efficient 'all in one' analyser system
- ASTM D7900, D7500, D7169

AN5WA0225B merge

GAS offers custom configured GC analysers for many application fields since 40 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 instruments with an optimal return on investment.

The GAS Crude Oil analyser according to ASTM D7900 offers accurate boiling point distribution data for crude oil samples. The analyser provides improved results compared to ASTM D7500 and D7169. Results of DHA front end and high temperature Simdist are combined in one TBP (True Boiling Point) report for highly accurate results.

### Improved HT-Simdist results

Simdist methods ASTM D7169 and D7500 are widely used for characterising crude oils. These methods provide reliable boiling point distribution information, although common issues are (1) interference (quenching) of C<sub>5</sub>-C<sub>9</sub> components by carbon disulfide, which is used as a solvent and (2) lack of resolution in the C<sub>5</sub>-C<sub>9</sub> range, since a thin film separation column is used. Both issues can be overcome by using Simdist data from DHA (Detailed Hydrocarbon Analyser). DHA provides component details for light hydrocarbons up to C<sub>9</sub> (151 °C), using a high resolution separation column, and offers therefore more precise TBP data. Prevention of accumulation by heavy oil crude components of this column is necessary, and is achieved by injection using PTV (programmable temperature vaporiser) with backflush option (figure 3). Figure 2 shows that the high boiling components are effectively vented, while figure 1 shows the schematic diagram.

### Efficient analyser system

Simdist and DHA are efficiently combined in one analyser system, consisting of 2 separate GC's for DHA and Simdist, sharing one Triplus autosampler, saving costs and laboratory space.

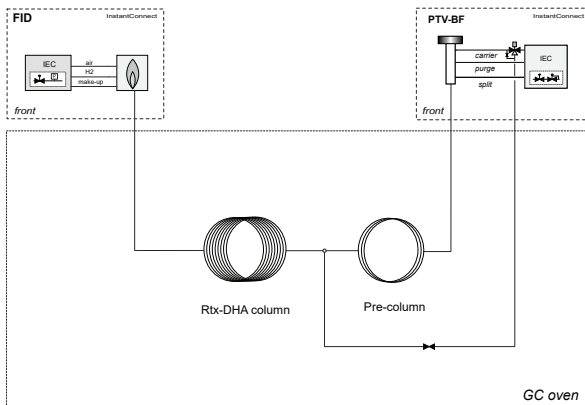


Figure 1. Diagram DHA with PTV-BF



Figure 3. InterConnect PTV injection module with back flush option.

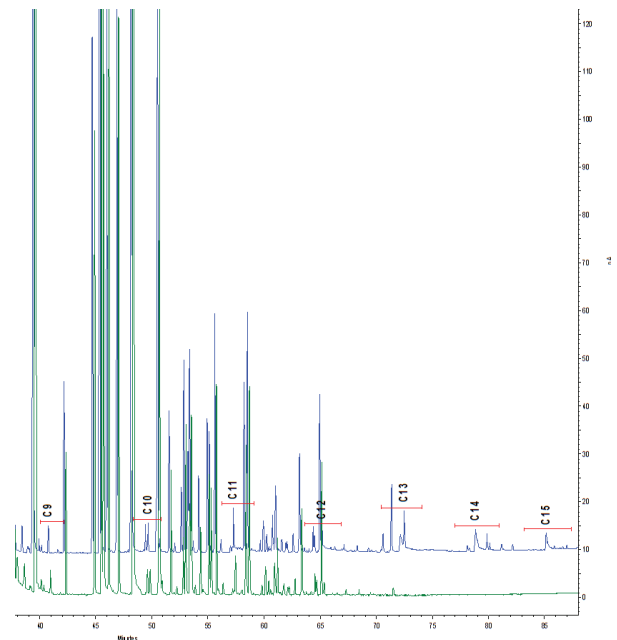


Figure 2. Chromatogram DHA.

Green: back flush used; blue: without back flush).

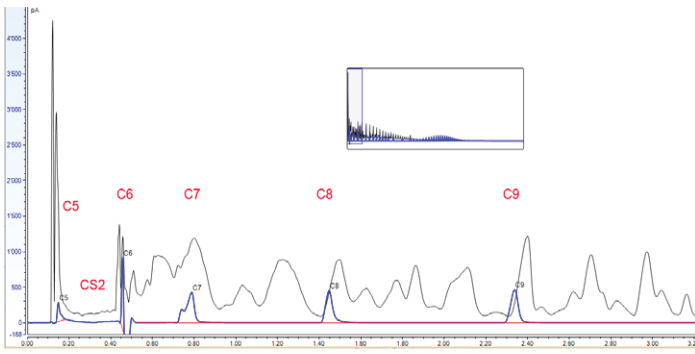


Figure 5. D7169 chromatogram, C<sub>5</sub>-C<sub>9</sub> ; quenching by CS<sub>2</sub>

%OFF	BP (°C)
0.5	-13.3
5.0	17.8
10.0	44.9
15.0	67.7
20.0	92.7
25.0	104.2
30.0	126.8

Figure 6. D7169

Simdist results

% OFF	BP (C)
0.5	-37
1.0	-31.5
2.0	-19.5
3.0	-7.5
4.0	14.5
5.0	28
6.0	57
7.0	60
8.0	63
9.0	64.5
10.0	66
11.0	68.5
12.0	80.5
13.0	90
14.0	91.5
15.0	92
16.0	93
17.0	94.5
18.0	97.5
19.0	99.5
20.0	109.5
21.0	115.5
22.0	118
23.0	119.5
24.0	124.5
25.0	125
26.0	131.5
27.0	137
28.0	139
29.0	145

Figure 8. DHA

Simdist results

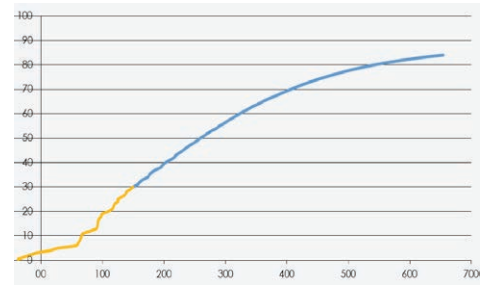


Figure 9. Simdist back end (blue curve) with corrected DHA front end (orange).

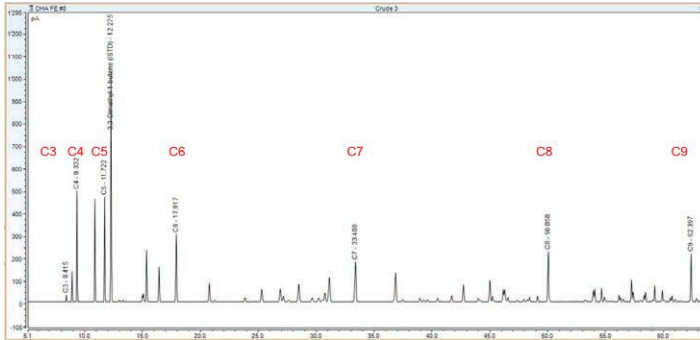


Figure 7. DHA chromatogram C<sub>3</sub>-C<sub>9</sub>

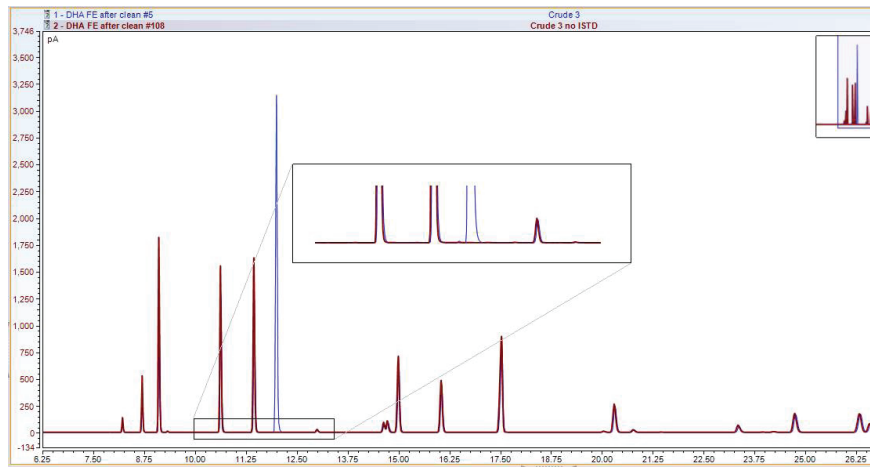


Figure 10. Added internal standard (blue graph) for DHA crude oil recovery calculation

## Results

In figure 5-8 the chromatograms and boiling point tables are shown of ASTM D7169 and DHA. The DHA chromatogram is not disturbed by solvent CS<sub>2</sub> and the used column offers strongly increased resolution for the light hydrocarbons, with more precise Simdist data as a result. Figure 9 shows D7169 boiling point curve, with DHA front end correction according to ASTM D7900.

## Recovery

The whole crude oil sample does not elute on both analysers, therefore the recovery has to be determined for both methods separately based on internal standards to obtain accurate results. See figures 10 and 11.

## Calculation and reporting

Figure 12 (page 4) shows the Simdist merge report. All results are provided by Chromeleon data system using integrated calculation modules for calculation of Simdist, DHA and merging. In this way export of data to external software programs is not needed, which offers very easy user operation, and errors are avoided.

See also the separate GAS application notes on DHA and Simdist for further explanation and examples.

#	FrontDetector	Name	Type	Position	Volume [μL]	Instrument Method	*Solvent Weight [gram]	*Sample Weight [gra]
1		Blank	Blank	10	0.50	SIMDIST D7169	1.6000	0.2000
2		HT BP cal	Calibration Standard	11	0.50	SIMDIST D7169	1.6000	0.2000
3		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
4		HT Ref	Unknown	12	0.50	SIMDIST D7169	3.3362	0.0364
5		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
6		5010	Check Standard	13	0.50	SIMDIST D7169	4.0354	0.0422
7		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
8		Crude 3	Unknown	14	0.50	SIMDIST D7169	4.7840	0.1366
9		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000

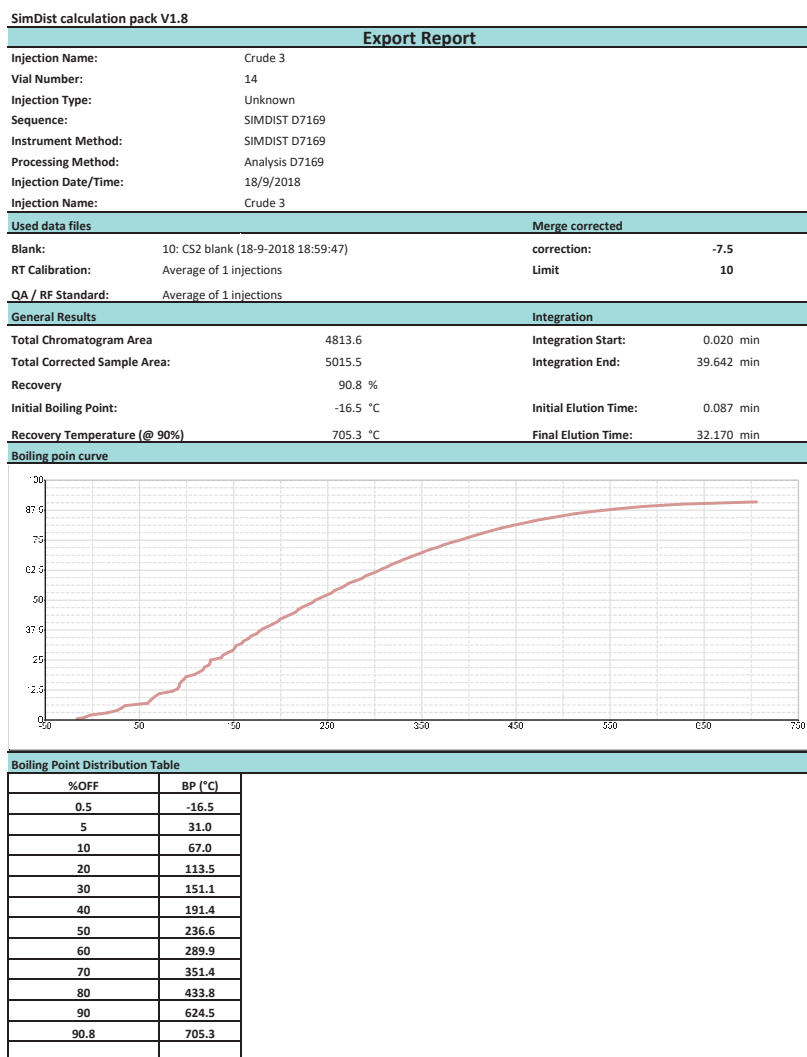
Figure 11. Simdist sample sequencing for recovery calculation based on reference standard (5010)

## Specifications

Standard methods:	ASTM D7900, D7500, D7169, IP 545, IP 601, EN 115199-3
Configuration:	2 GC systems and 1 Triplus auto sampler: <ul style="list-style-type: none"> <li>- Thermo Trace GC1600 with PTV and FID for Simdist analysis,</li> <li>- Thermo Trace GC1600 with PTV - Backflush and FID for DHA</li> <li>- Triplus auto sampler (one sampler covers both GCs)</li> </ul>
Application range:	DHA: nafta, reformate, alkylate, crude oil Simdist: crude oil
Data system:	Chromeleon
Calculations:	Customised calculation modules for DHA, Simdist and merging. Calculations are integrated in Chromeleon CDS

See the separate GAS application notes on DHA and Simdist analysers for more information

Figure 12.  
Simdist/DHA Merge report



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