



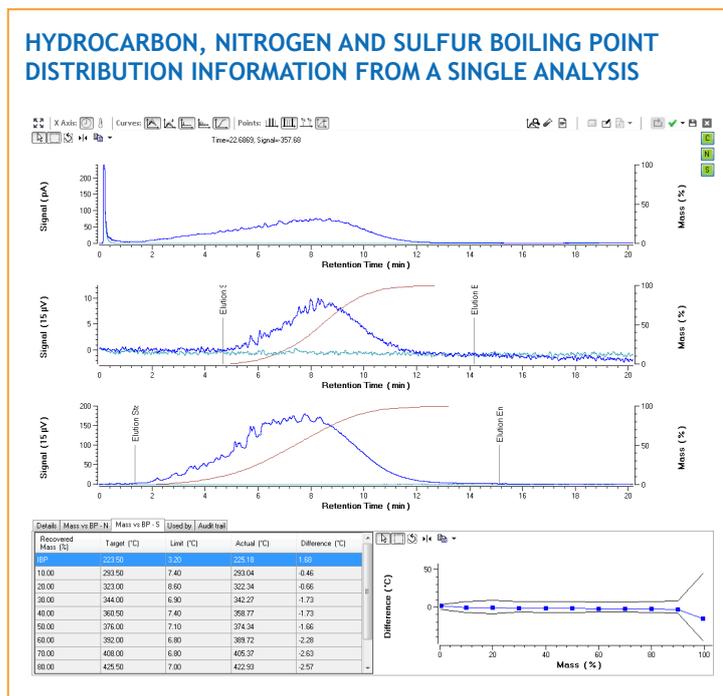
CNS SIMDIS ANALYZER FOR CRUDE OIL

Making Crude Assays Easy: Fast Crude Oil Characterization for Sulfur, Nitrogen and Carbon using Gas Chromatography

- 🌐 Crude Oil Characterization for Sulfur, Nitrogen and Carbon from a Single Analysis
- 🌐 Fast Hydrocarbon, Nitrogen, and Sulfur Boiling Point Distribution Information
- 🌐 Comparable to ASTM D2887, D6352, D7500, D7169 and D7807 SIMDIS Methods
- 🌐 Advanced Hardware Design for Wide Boiling Point Range Coverage (FBP up to 700 °C and Unique DHA Front End for Light End Fractions)

CNS SIMDIS ANALYZER FOR CRUDE OIL AND CRUDE OIL FRACTIONS

AC Analytical Controls pioneers the fast, simultaneous analysis of carbon, sulfur and nitrogen for hydrocarbon streams, including diesels and heavy crudes. Built around recognized simulated distillation (SIMDIS) methods with additional Chemiluminescence detectors, the CNS SIMDIS analyzer delivers accurate and comprehensive all-in-one quantitative boiling point data for Carbon, Sulfur and Nitrogen. CNS SIMDIS analysis data correlates with traditional measurement methods at a fraction of the time and cost. The CNS Analyzer allows faster decision making in the process, eliminates laborious steps in assay physical fractionation distillation, and perform simultaneous Quality Control analysis on refined products for Sulfur and Nitrogen.



Example of a diesel sample - A single analysis run yields three chromatograms

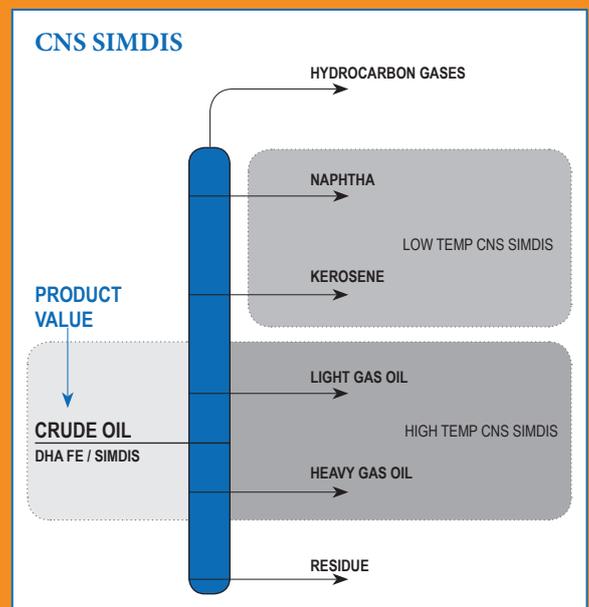
THE CNS SIMDIS FEATURES:

- Dedicated software provides complete control of the application and automates all aspects of:
 - specific calibration
 - validation
 - sample analysis
 - data reporting
- Sulfur and Nitrogen data processing are seamlessly integrated into the SIMDIS software; no extensive software knowledge is required
- Report options include:
 - total concentration
 - %mass vs boilingpoint distributions for each species
 - %vol conversions for crude oils
 - cutpoints and fractions
 - user dedicated boilingpoint cutpoints
 - recovery calculations
 - a suite of specific quality control reports
 - customizable reports for different sample types
 - merge reporting with DHA Front End data (optional)

FINAL PRODUCT CUTPOINTS OPTIMIZE PRODUCT VALUE!

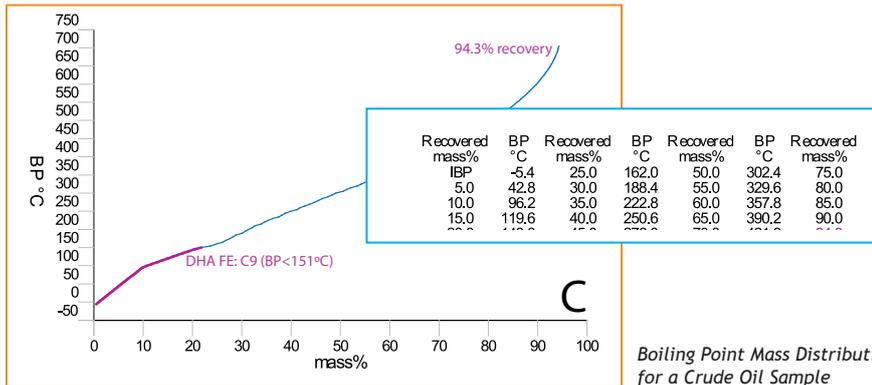
Over the last few years, refiners have faced declining quality of crude oils, as in many cases they are “heavier” and contain more impurities or unwanted species, such as sulfur and nitrogen. Making continuous decisions in adjusting the refining process to get the optimal amount of the best-performing products are elementary to optimizing profit. In the case of Sulfur and Nitrogen, specifications are getting more and more stringent every day, and delivering the product on-spec is critical. These components may even have detrimental effects in catalysts, so understanding their presence in products can make a difference in each refinery.

Lastly, they have an environmental interest that is getting increased attention. Crude-Assays are very time-consuming exercises that are used to learn how to cut the crude to optimize product value. In these exercises, the crude material is fractionated on boiling point and each fraction is tested in the lab for an extensive set of parameters. Sulfur content and distribution is one of the most critical parameters that drives final product cutpoints and thus product value.

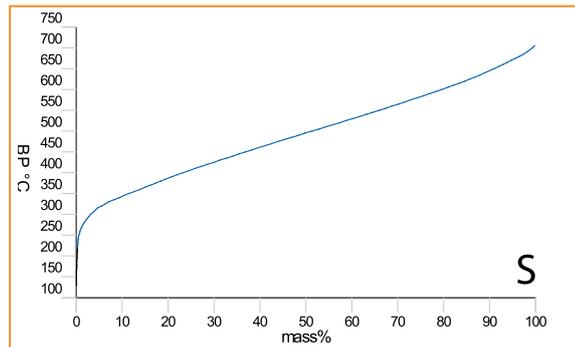
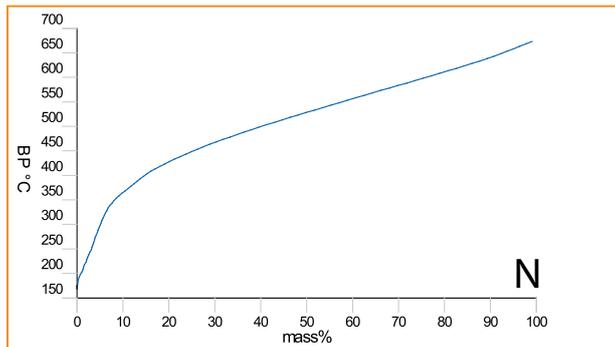


WIDE BOILING POINT RANGE WITH CNS SIMDIS AND DHA FRONT END COMBINATION

CNS SIMDIS systems can be combined with our unique AC Detailed Hydrocarbon Analysis (DHA) Front End (FE) solution. This combination completes the hydrocarbon distribution profile for the fractions under C9 (BP < 151°C). This is normally partially lost in SIMDIS as a result of dilution solvent overlap with the low boiling fractions. Specific software combines DHA and SIMDIS data into one comprehensive report with a normalized carbon distribution profile over the complete boiling point range of the sample. The figure below shows the additional DHA FE Merge



Boiling Point Mass Distribution for C, N and S for a Crude Oil Sample



BP °C	Recovered %	Fraction %	BP °C	Recovered %	Fraction %	BP °C	Recovered %	Fraction %
190	0.5	0.5	390	13.5	1.5	540	54.0	3.5
210	1.5	1.0	400	15.0	1.5	550	57.5	3.5
230	2.5	1.0	410	16.5	1.5	560	61.5	4.0
250	3.0	0.5	420	18.5	2.0	570	65.0	3.5
260	3.5	0.5	430	20.5	2.0	580	68.5	3.5
280	4.5	1.0	440	23.0	2.5	590	72.5	4.0
300	5.0	0.5	450	25.5	2.5	600	76.0	3.5
310	5.5	0.5	460	28.0	2.5	610	79.5	3.5
320	6.0	0.5	470	31.0	3.0	620	83.0	3.5
330	6.5	0.5	480	34.0	3.0	630	86.5	3.5
340	7.5	1.0	490	37.0	3.0	640	90.0	3.5
350	8.0	0.5	500	40.0	3.0	650	92.5	2.5
360	9.5	1.5	510	43.5	3.5	660	95.5	3.0
370	10.5	1.0	520	47.0	3.5	670	98.0	2.5
380	12.0	1.5	530	50.5	3.5	680	100.0	2.0

BP °C	Recovered %	Fraction %	BP °C	Recovered %	Fraction %	BP °C	Recovered %	Fraction %
240	0.5	0.5	420	28.5	2.5	570	71.5	2.5
270	1.5	1.0	430	31.5	3.0	580	74.5	3.0
290	2.5	1.0	440	34.0	2.5	590	77.0	2.5
300	3.0	0.5	450	37.0	3.0	600	79.5	2.5
310	4.0	1.0	460	39.5	2.5	610	82.0	2.5
320	5.5	1.5	470	42.5	3.0	620	84.5	2.5
330	7.0	1.5	480	45.5	3.0	630	87.0	2.5
340	9.5	2.5	490	48.5	3.0	640	89.0	2.0
350	11.5	2.0	500	51.5	3.0	650	91.0	2.0
360	14.0	2.5	510	54.5	3.0	660	93.0	2.0
370	16.0	2.0	520	57.5	3.0	670	95.0	2.0
380	18.5	2.5	530	60.5	3.0	680	96.5	1.5
390	20.5	2.0	540	63.0	2.5	690	98.0	1.5
400	23.5	3.0	550	66.0	3.0	700	99.5	1.5
410	26.0	2.5	560	69.0	3.0	710	100.0	0.5

SYSTEM CALIBRATION & QUALITY CONTROL

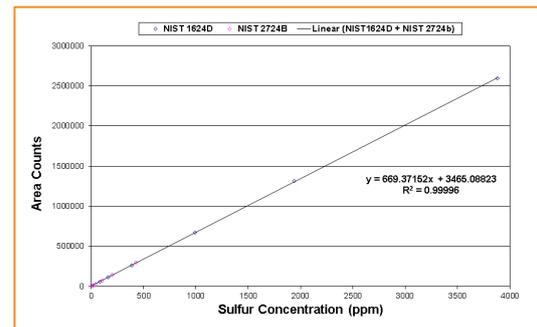
The system is calibrated in similar fashion to ASTM methods D2887, D6352, D7500 and D7169. A set of samples is included for calibration and QC.

For High Temperature CNS D6352, D7500, and D7169 methods, calibration samples are included. This calibration mix is a crude oil (bp 200-550°C) with known sulfur and nitrogen distributions, and only requires a single analysis for calibration.

Other dedicated QC samples and software features are available to monitor performance for equimolarity, sensitivity, and stability.

EXCELLENT ANALYSIS PERFORMANCE

The High Temperature CNS SIMDIS features a post column vent for heavy component fractions (>C90), to ensure the best performance. It protects nitrogen and sulfur detectors and avoids heavy residue build up in the system. The excellent sensitivity and stability of the Sulfur Chemiluminescence Detector (SCD) and Nitrogen Chemiluminescence Detector (NCD) allows for detection levels below 50 ppm depending on element and sample type. Linear Dynamic Range (LDR) is typically in excess of four orders of magnitude for sulfur and nitrogen, which is sufficient for common crudes. Additional dilution can be applied to further extend LDR.



Linearity Plot for Sulfur

SPECIFICATIONS

Ordering Information	LOW TEMP CNS SIMDIS	HIGH TEMP CNS SIMDIS				
GCG6151A	SIMDIS D2887 CNS 120V on 8890 GC	-				
GCG6151C	SIMDIS D2887 CNS 230V on 8890 GC	-				
GCG6152A	-	SIMDIS High Temp CNS 120V on 8890 GC				
GCG6152C	-	SIMDIS High Temp CNS 230V on 8890 GC				
Utility Requirements						
Carrier gas	Helium (99.999%)					
FID / SCD	Hydrogen (99.999%) Nitrogen (99.999%) Oxygen (99.999%)					
System power	110 - 230 Volts					
Accessories Included	Operating manual, Calibration samples, Reference samples, Startup kit, Carrier gas filters, Oven exhaust detector Factory plumbing for quick installation					
Analysis Scope	LOW TEMP CNS SIMDIS	HIGH TEMP CNS SIMDIS				
Comparable to	ASTM D2887, D3710, D7096, D7807, ISO3924, IP406	ASTM D6352, D7500, D6417, D7213, D7398 and D7169, EN15199-3, IP545 (DHA FE)				
Sample Type / Range	Jet Fuel, Diesel	Distillates, Base Oils, Lube base Stocks				
Carbon Number Range	C5-C44	C9-C90*				
Boiling Point Range	FBP < 538 °C (1000 °F)	IBP > 151 °C (304 °F) FBP < 700 °C (1292 °F)				
Sample Injection	Neat	1-2% dilution				
Analysis Performance	LOW TEMP CNS SIMDIS	HIGH TEMP CNS SIMDIS				
	S	N	C	S	N	C
Application Range**	50-10000 (ppmS wt)	100-10000 (ppmS wt)	n.a.	200-50000 (ppmS wt)	500-50000 (ppms wt)	n.a.
Repeatability	<10% RSD			<10% RSD		
Equimolarity	<10%	<10%	n.a.	<10%	<10%	n.a.
Selectivity	S/C: 5E7			S/C: 5E7		
	N/C: 2E7			N/C: 2E7		
* With DHA FE addition (option)						
** Depended on distribution / recovery of a sample						

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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