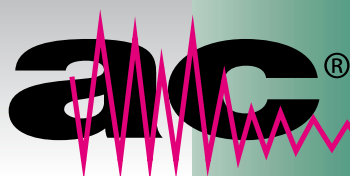


# AC SIMDIS Solutions

## True Boiling Point Distribution up to C120

- Compliance with Global Standard Test Methods
- Unique Solutions include AC 8634™ & Crude Oil Analyzer
- Dedicated Correlations & Calculations



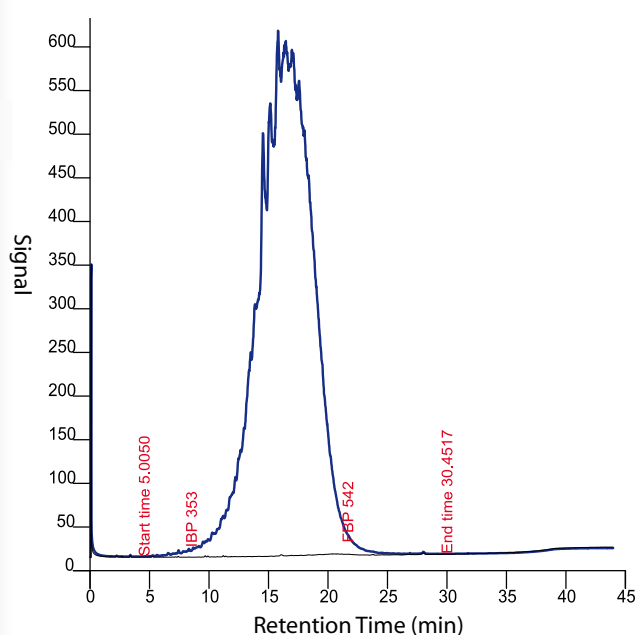
ANALYTICAL CONTROLS

A  PAC Company

# Full Range of Applications

**As the worldwide SIMDIS market leader AC Analytical Controls (AC) offers solutions that determine accurate true boiling point data in naphtha up to crude oil samples.**

- Full range of SIMDIS applications determine boiling points up to C120
- Product range includes several unique solutions:
  - **AC 8634™** analyzer for accelerated D 86 data of jet fuel and diesel
  - **Crude Oil** analyzer Merges DHA Front End with High Temp SIMDIS Technique
  - **Sulfur SIMDIS** solution to determine sulfur BP distribution in diesel fuels
  - **Wax ASTM D 5442** application
- Solutions comply with ASTM, CEN, DIN, IP and ISO SIMDIS methods
- A set of calibration, reference and quality control samples completes each SIMDIS application
- User group meetings allows users to improve analyzer performance
- SIMDIS software is compatible with major chromatographic data systems
- Dedicated correlations and calculations are available for:
  - Correlation to Physical Distillation **D 86 & D 1160** (ASTM D 2887; IP 406; ISO 3924)
  - NOACK - **DIN 51.581-2**
  - MOV - **ASTM D 6417**
  - Conversion to **volume %** for crude oil
  - **Cutpoints & fractions**
  - **Flash point**
- Special toolbar button automatically starts the LIMS interface
- Several features contribute to the analysis precision:
  - Use of **pre-programmed** sample types
  - **Automatic** blank subtraction, calibration and system validation
  - **Customer selective** start and end algorithm



AC High Temp SIMDIS Analysis of a reference sample

## General Variables

Used Blank HT750A\101F0201.D  
 Used BP calibrant HT750A\102F0301.D  
 Used Reference  
 Used Start elution (min) 5.005  
 Used End elution (min) 30.452  
 Total area 173938  
 New Response factor 5.7492e-006

## Reference Check

Recovered mass %	Target Values BP °C	dBP °C	Determined Values BP °C	dBP °C
10.0	421.0	3.5	420.8	0.0
20.0	437.0	3.5	436.6	0.5
30.0	448.0	3.5	447.0	1.0
40.0	457.0	3.5	456.0	1.0
50.0	464.0	3.5	464.5	-0.5
60.0	473.0	3.5	472.5	0.5
70.0	481.0	3.5	480.7	0.5
80.0	489.0	3.5	489.6	-0.5
90.0	501.0	3.5	501.4	-0.5

Maximum Squared Deviation = 43  
 Found Squared Deviation = 4  
 Squared test passed

# Compliance with Global Standard Test Methods

**Boiling point data is a major specification in characterizing petroleum streams. SIMDIS uses a gas chromatographic technique to determine the true boiling point (TBP) distribution. By automating the analysis the AC SIMDIS applications provide fast and accurate boiling point results.**

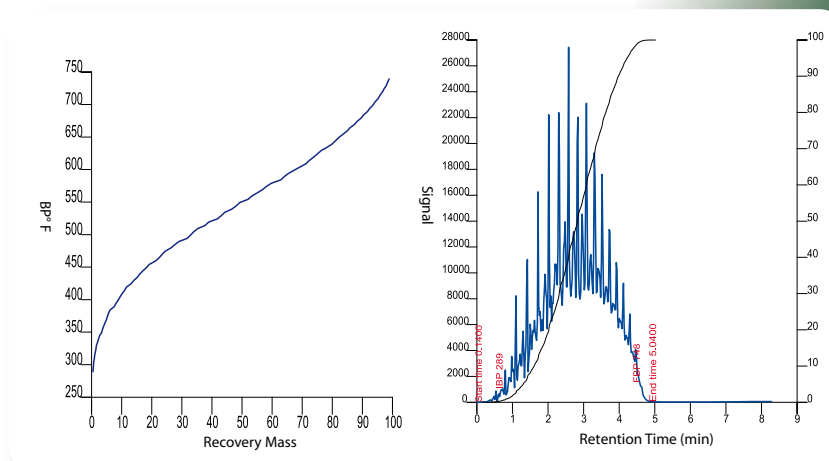
Our active involvement in worldwide standardization committees resulted in a compliance with all ASTM, CEN, DIN, IP and ISO methods and a listing of these methods in current jet fuel and diesel specifications. The AC SIMDIS application meets and exceeds the reproducibility of the worldwide standard test methods.

Method Number	ASTM D 3710	ASTM D 7096	ASTM D 2887	Accelerated SIMDIS/8634™	ASTM D 5307	ASTM D 7213	ASTM D 6352	ASTM D 7169
Maximum Carbon Number reported	C <sub>15</sub>	C <sub>16</sub>	C <sub>44</sub>	C <sub>44</sub>	C <sub>44</sub>	C <sub>60</sub>	C <sub>90</sub>	C <sub>100</sub>
Sample Range	• Gasoline • Naphtha	• Gasoline • Naphtha	• Jet Fuel • Diesel	• Jet Fuel • Diesel	• Crude Oil	• Lube Oil Base Stocks	• Lube Oil Base Stocks	• Residue • Crude Oil
Boiling Range Sample	FBP < 260°C (500°F)	FBP < 280°C (536°F)	FBP < 538°C (1000°F)	FBP < 538°C (1000°F)		IBP > 100°C (212°F) FBP < 615°C (1138°F)	IBP > 174°C (345°F) FBP < 700°C (1292°F)	FBP > 720°C (1328°F)

Overview of SIMDIS ASTM Methods

Method Number	ISO 3924 IP 406	IP 480 EN 15199-1 DIN 51.435	IP 507 EN 15199-2	prEN 15199-3 IP 545
Maximum Carbon Number reported	C <sub>44</sub>	C <sub>120</sub>	C <sub>120</sub>	C <sub>120</sub>
Sample Range	• Jet Fuel • Diesel	• Lube Oil Base Stocks (totally eluting)	• Residue	• Crude Oil
Boiling Range Sample	FBP < 538°C (1000°F)	IBP > 100°C (212°F) FBP < 750°C (1382°F)	IBP > 100°C (212°F) FBP > 750°C (1382°F)	FBP > 750°C (1382°F)

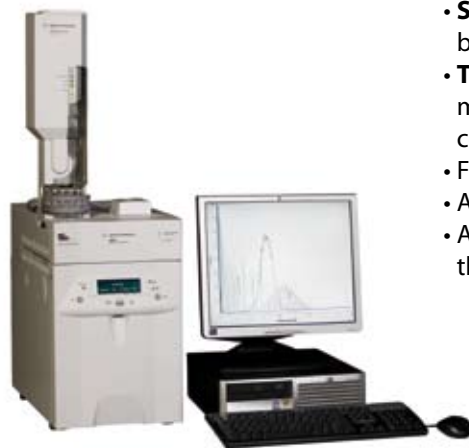
Overview of SIMDIS CEN, DIN, IP, ISO Methods



Accelerated SIMDIS analysis of a reference sample

# Flexible Configuration

The AC SIMDIS solutions are based on the new Agilent Technologies 7890 Series or the 6850 gas chromatograph equipped with:

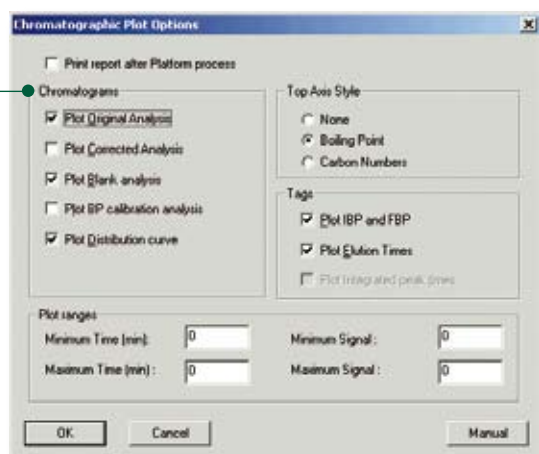


- **Single** or **dual** channel, packed or capillary column(s) for boiling point separation
- **Temperature programmable** inlet to simplify system maintenance, improve peak identification and prevent column contamination
- Flame ionization detector
- An **automatic** liquid sampler
- A set of **calibration** and **reference** samples dedicated to the method

## Data System Compatibility

The AC SIMDIS application offers you a choice in selecting a chromatographic data system. The AC software operates on the following chromatographic data systems:

- ChemStation - Agilent Technologies
- EZChrom Elite - Agilent Technologies
- Atlas - Thermo Electron



*SIMDIS report menu offers several plot options for the chromatogram*

## Extensive Report Options

The AC SIMDIS applications offer several options to report the true boiling point distribution & analysis parameters and include dedicated correlations & calculations.

## Report Options

- Chromatogram and boiling point distribution plot
- List of calculation parameters
- Report of peak skew and column resolution parameters
- Tables and graphs of boiling point versus retention time or versus mass%
- Special toolbar button automatically starts the LIMS interface

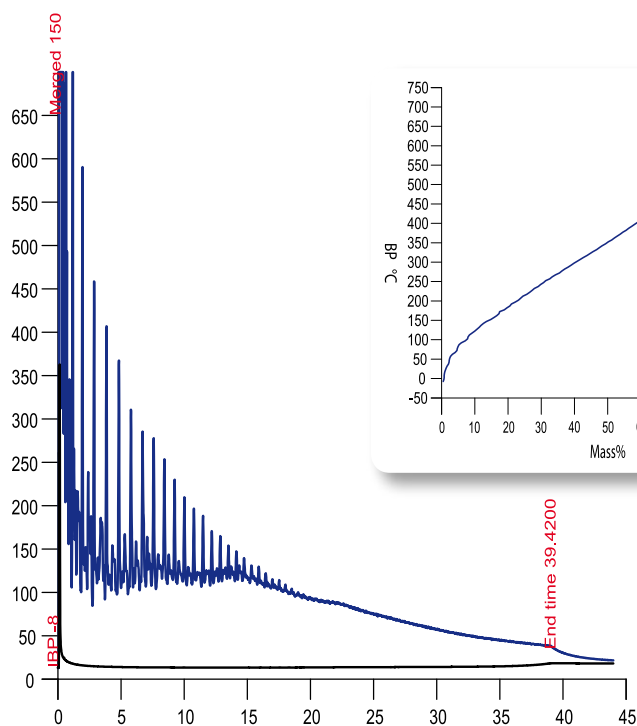
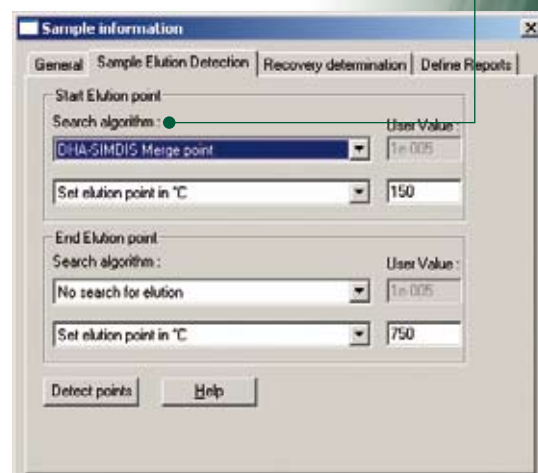
# Accurate Crude Oil Analysis

Merging Principle for DHA & SIMDIS

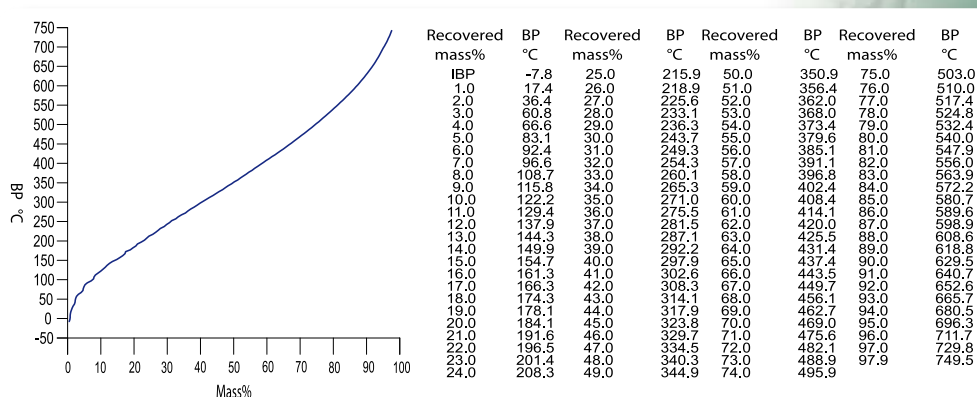
One of the unique AC solutions is the Crude Oil Analyzer that combines detailed hydrocarbon analysis (DHA) front end technique with high temperature simulation distillation. Merging the DHA & SIMDIS data of the crude oil analysis improves the accuracy. The merging principle is innovated by AC and standardized as IP 545, ASTM D 7169 and prEN 15199-3.

The dedicated system design of the Crude Oil Analyzer consists of:

- The AC High Temp SIMDIS application that incorporates all ASTM, DIN, IP and CEN methods for high temperature simulated distillation
- The AC DHA Front End application which uses a single capillary column conform IP PM-DL to characterize the C1-nC9 fraction in crude oil



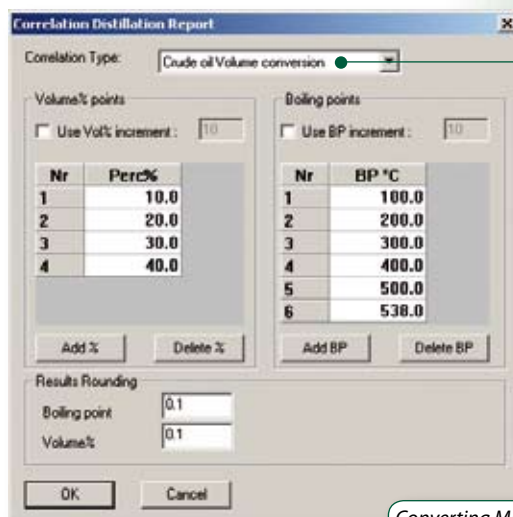
High Temp SIMDIS analysis of a crude oil



## Conversion to Volume%

The AC High Temp SIMDIS Analyzer includes a special report option to convert data from mass% to volume % for crude oils that comply with:

- FBP > 538 °C (1000°F)
- $T_{(50wt\%)} < 538$  °C (1000°F)



Converting Mass % to Volume %



# Jet Fuel and Diesel Analysis

## ASTM D 2887, IP 406 & ISO 3924

To determine the true boiling point (TBP) distribution for jet fuel and diesel AC Analytical Controls offers the SIMDIS ASTM D 2887, IP 406 & ISO 3924 application. Jet fuel specifications ASTM D 1655 and DEF STAN 91-91 list ASTM D 2887 as an alternative to physical distillation ASTM D 86 in determining distillation properties for Jet A & A-1. The AC application reports both the TBP and correlated ASTM D 86 data.

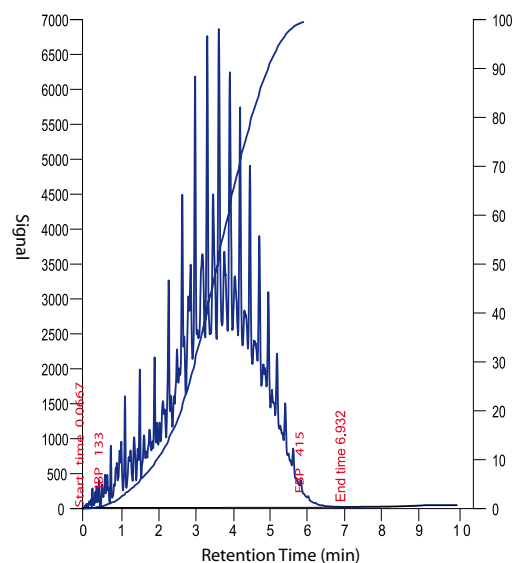
## D 86 Boiling Point

To assist refiners in determining D 86 boiling range data AC invented the AC 8634™ application, which uses an accelerated SIMDIS method to report volume % data conform D 86 and true boiling point distribution for jet fuel and diesel samples in 6 – 8 minutes.

D 86 correlation for JetFuel and Gasoil (D2887-04a) - distribution

Recovered Vol%	BP °C	Recovered Vol%	BP °C	Recovered Vol%	BP °C	Recovered Vol%	BP °C
IBP	195.2	26.0	270.1	52.0	296.9	78.0	326.9
1.0	199.4	27.0	271.4	53.0	297.9	79.0	328.2
2.0	207.7	28.0	272.6	54.0	298.9	80.0	329.5
3.0	215.5	29.0	273.8	55.0	299.9	81.0	330.7
4.0	222.6	30.0	274.9	56.0	301.0	82.0	331.9
5.0	228.4	31.0	276.1	57.0	302.0	83.0	333.2
6.0	233.0	32.0	277.2	58.0	303.1	84.0	334.6
7.0	236.4	33.0	278.3	59.0	304.1	85.0	336.0
8.0	239.0	34.0	279.3	60.0	305.2	86.0	337.6
9.0	241.0	35.0	280.4	61.0	306.3	87.0	339.4
10.0	242.8	36.0	281.4	62.0	307.4	88.0	341.3
11.0	244.6	37.0	282.4	63.0	308.5	89.0	343.5
12.0	246.4	38.0	283.4	64.0	309.7	90.0	345.9
13.0	248.3	39.0	284.4	65.0	310.8	91.0	348.5
14.0	250.3	40.0	285.3	66.0	312.0	92.0	351.3
15.0	252.2	41.0	286.3	67.0	313.2	93.0	354.1
16.0	254.1	42.0	287.3	68.0	314.4	94.0	356.7
17.0	256.0	43.0	288.2	69.0	315.6	95.0	359.1
18.0	257.8	44.0	289.2	70.0	316.8	96.0	361.0
19.0	259.6	45.0	290.1	71.0	318.0	97.0	362.7
20.0	261.3	46.0	291.1	72.0	319.3	98.0	364.0
21.0	263.0	47.0	292.0	73.0	320.6	99.0	365.3
22.0	264.6	48.0	293.0	74.0	321.8	FBP	366.5
23.0	266.0	49.0	294.0	75.0	323.1		
24.0	267.5	50.0	294.9	76.0	324.4		
25.0	268.8	51.0	295.9	77.0	325.7		

AC 8634 analysis of a gasoil



## Sulfur Boiling Point

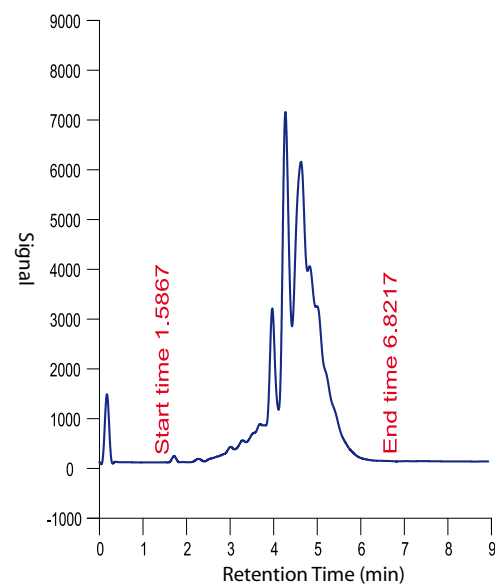
AC enhanced the Accelerated SIMDIS ASTM D 2887 application with a dedicated Sulfur Chemiluminescence Detector to check the sulfur specifications in diesel fuel. In only 8 minutes the AC Sulfur SIMDIS application reports the sulfur boiling point distribution of diesel fuels.

Sulfur Report  
Total = 377.5 ppm S

Sulfur Report - cut points

BP °C	Recovered ppm S	Fraction	BP °C	Recovered ppm S	Fraction	BP °C	Recovered ppm S	Fraction
200	0.0	0.0	290	15.8	5.4	380	347.5	28.3
210	0.9	0.9	300	23.2	7.5	390	363.5	15.9
220	0.9	0.0	310	33.1	9.9	400	371.3	7.8
230	1.0	0.2	320	60.4	27.2	410	374.7	3.4
240	1.5	0.5	330	88.4	28.0	420	376.0	1.3
250	2.3	0.7	340	152.1	63.7	430	376.7	0.6
260	3.7	1.5	350	213.2	61.2	440	377.0	0.4
270	6.6	2.8	360	274.9	61.7	450	377.4	0.3
280	10.4	3.8	370	319.3	44.4			

AC Sulfur SIMDIS analysis of a NIST standard



# User Group & PMP

**SIMDIS users can join the AC User Group. Being a member of this group we invite you to attend the periodically meetings and participate in the Performance Monitoring Program.**

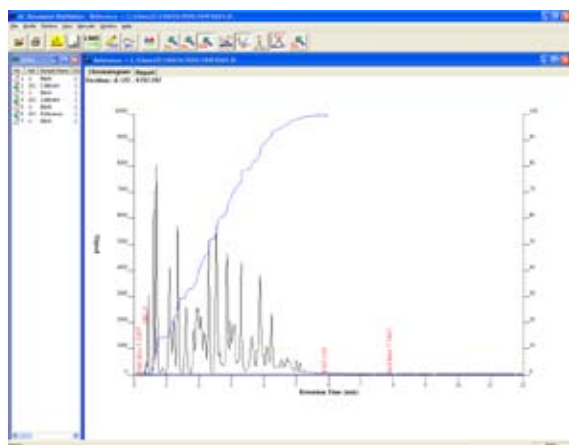
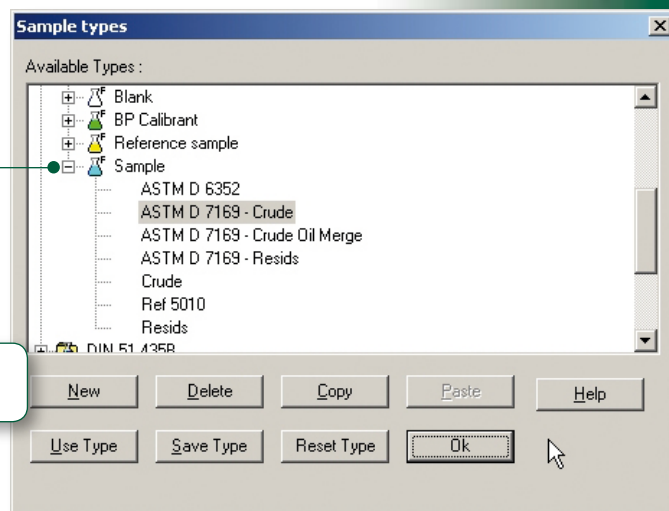
Regularly AC schedules a worldwide SIMDIS Performance Monitoring Program (PMP), which is an anonymous round robin test. AC reports the statistical values and advices on improving analysis precision. A great number of labs worldwide participate in this PMP.

## Optimize Analyzer Precision

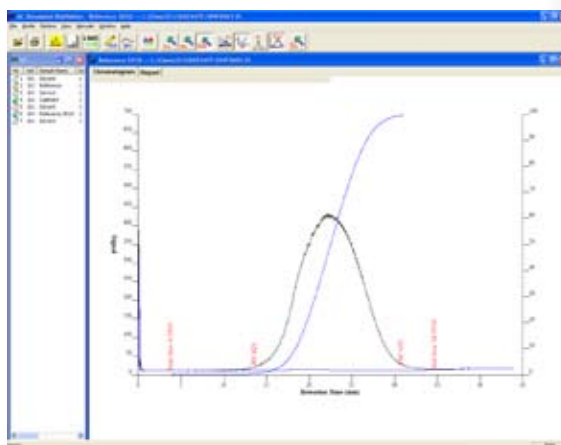
**Several features contribute to the analysis precision:**

- Use of pre-programmed sample types
- Automatic blank subtraction, calibration and system validation
- Customer selective start and end elution algorithm
- A set of calibration, reference and quality control samples completes each SIMDIS application

Sample Type Menu displays the pre-programmed sample types



Analysis of the AC SIMDIS ASTM D 7096 reference sample



Analysis of the AC High Temp SIMDIS reference sample

# Features & Benefits of SIMDIS Analyzers

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## **For more information:**

**[www.analytical-controls.com](http://www.analytical-controls.com)**  
**[www.simdis.com](http://www.simdis.com)**

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