

***“HAND HELD LASER INDUCED FLUORESCENCE
ANALYZER TO MONITOR OIL TRACES IN
PRODUCED WATERS”***

— Application Overview

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Fundamental Features

- The HD-1000 is designed for portable use within Safe Areas to measure the residual hydrocarbon content of Process and Produced Waters.
- Light weight & real time measurements
- Built in spectrometer to provide for high sensitivity and stability
- Wide concentration ranges to cover a vast field of applications
- High storage capacity of experimental results and calibration files
- LIF probe for ease of use with intuitive SW
- Can be applied to process and environment controls, and product quality needs
- Android based SW interface with touchscreen and multilingual capabilities
- Ability to combine the best calibration fit with trace oil concentration determination
- High specificity identifies the oil in most cases

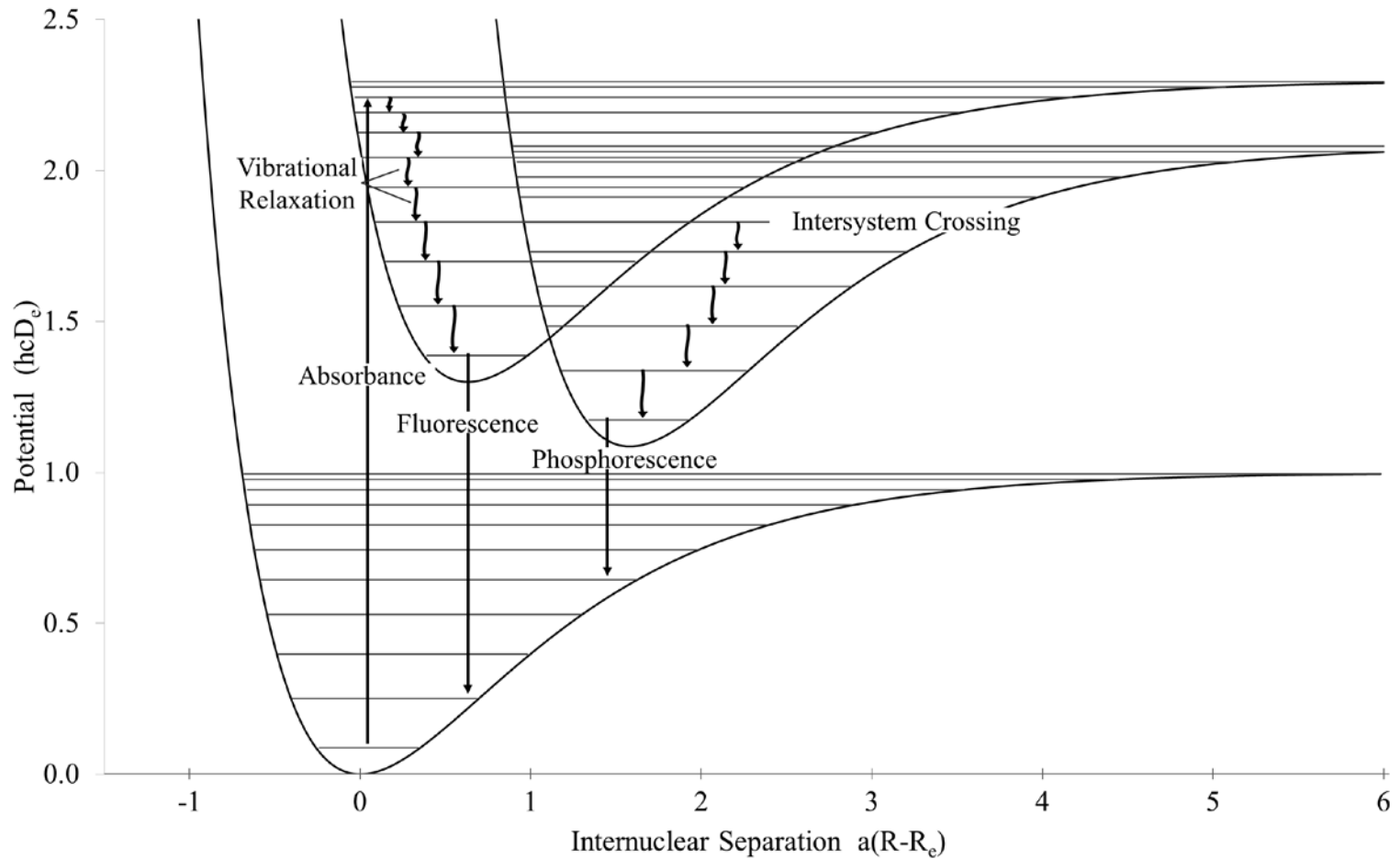
Oil in Water Analyzer



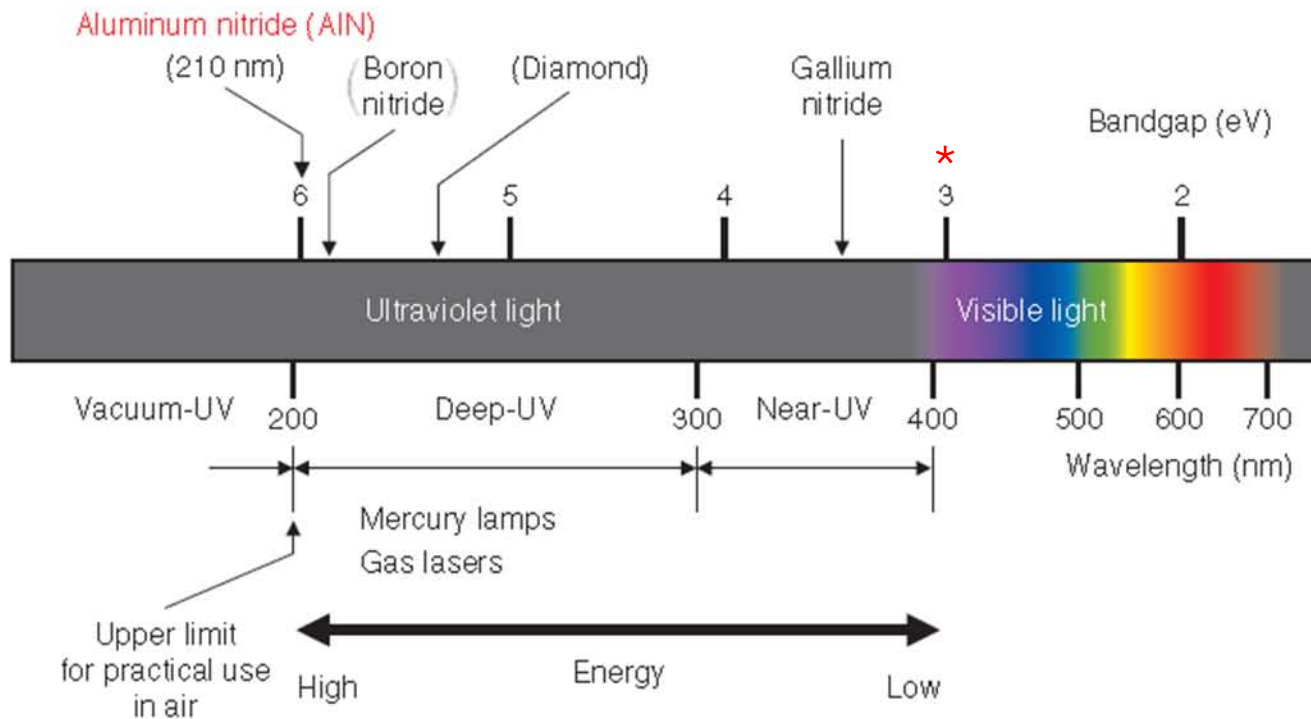
Conformity

- EN 55011: 2009 + A1: 2010: Radio-Frequency Disturbance Characteristics
- EN 61010-1: 2010 Electrical Safety Requirements
- EN 61326-1: 2006 Electrical Equipment for Measurement, Control & Laboratory use
- EN 61000-4-2: 2009 Electromagnetic (EMC)
- EN 61000-4-3: 2006+A1:2007+A2:2010 Radiated / Immunity tests
- EN 61000-4-8: 2010 Power Frequency Magnetic Immunity

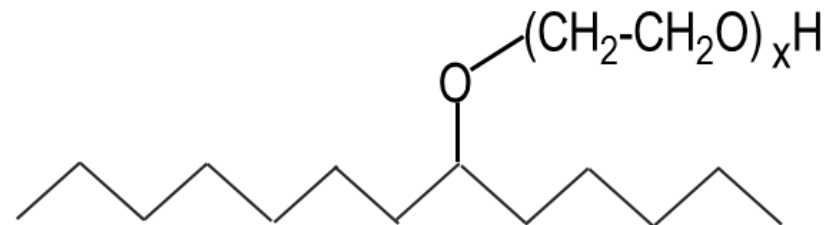
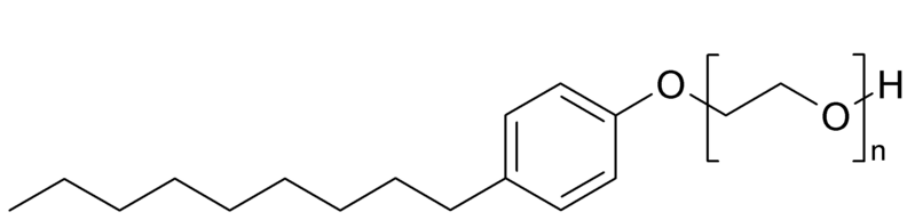
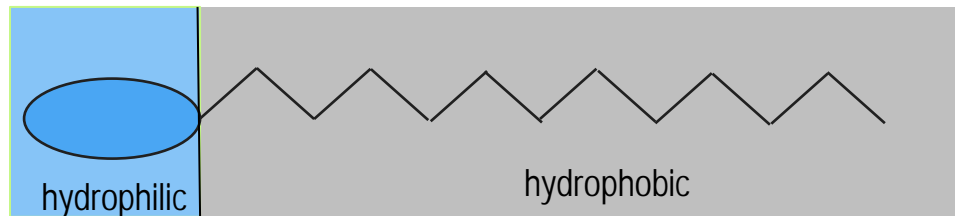
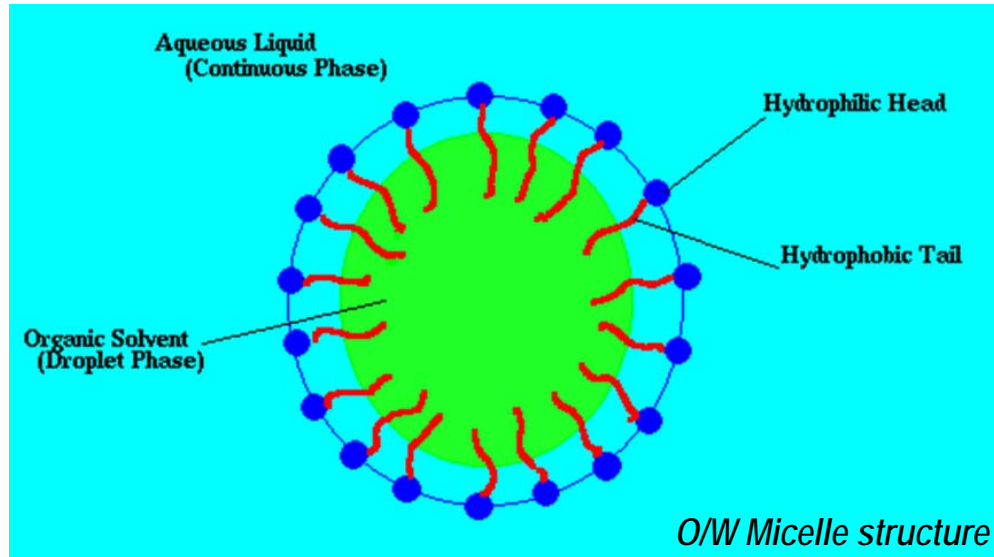
Fluorescence



Laser Induced Fluorescence



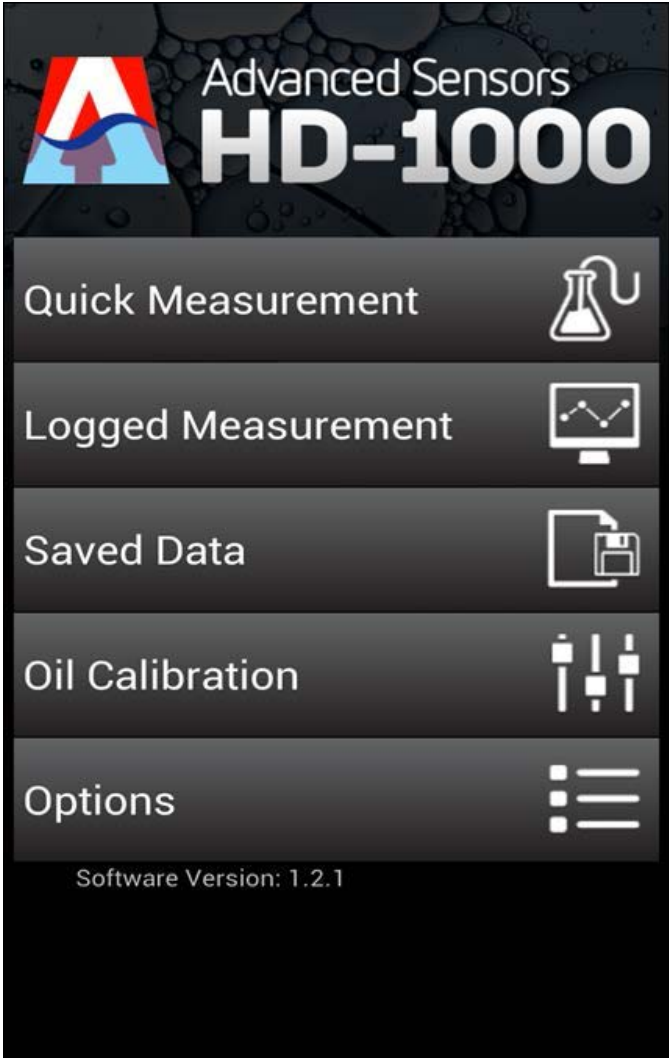
Nonionic Surfactants



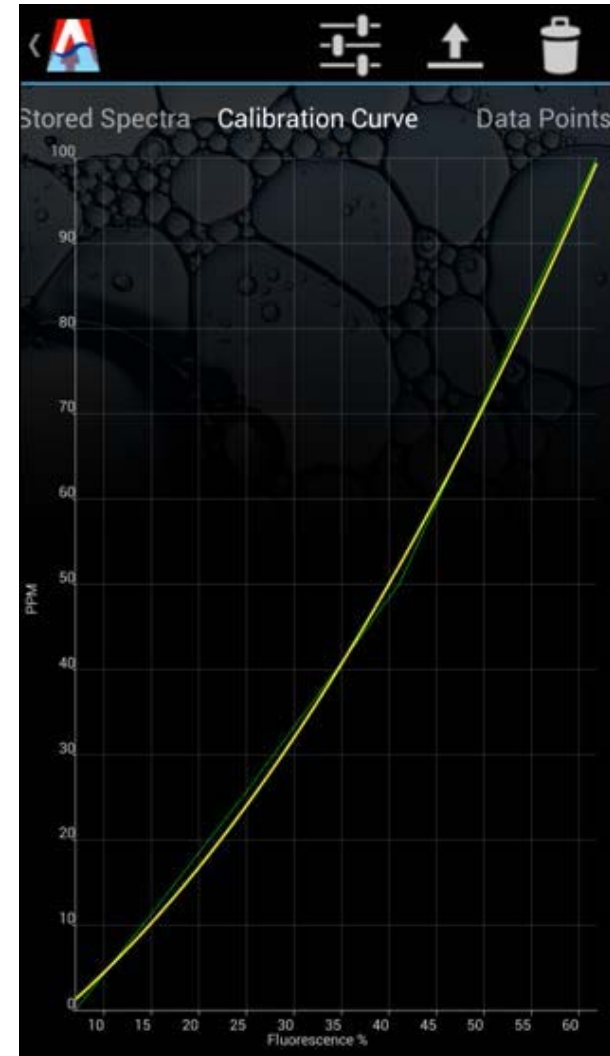
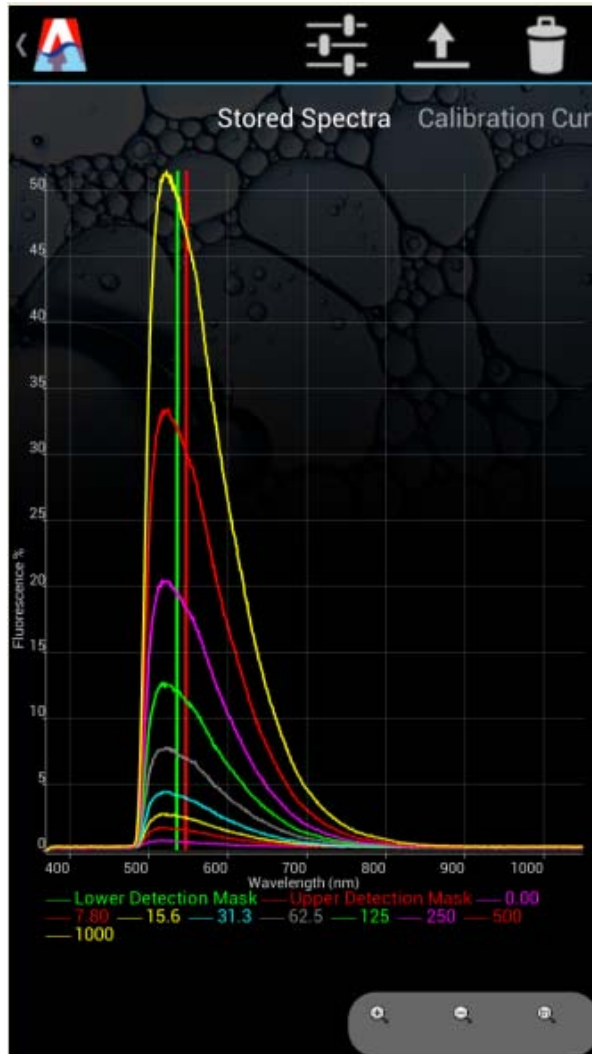
Heavy Crude Oil



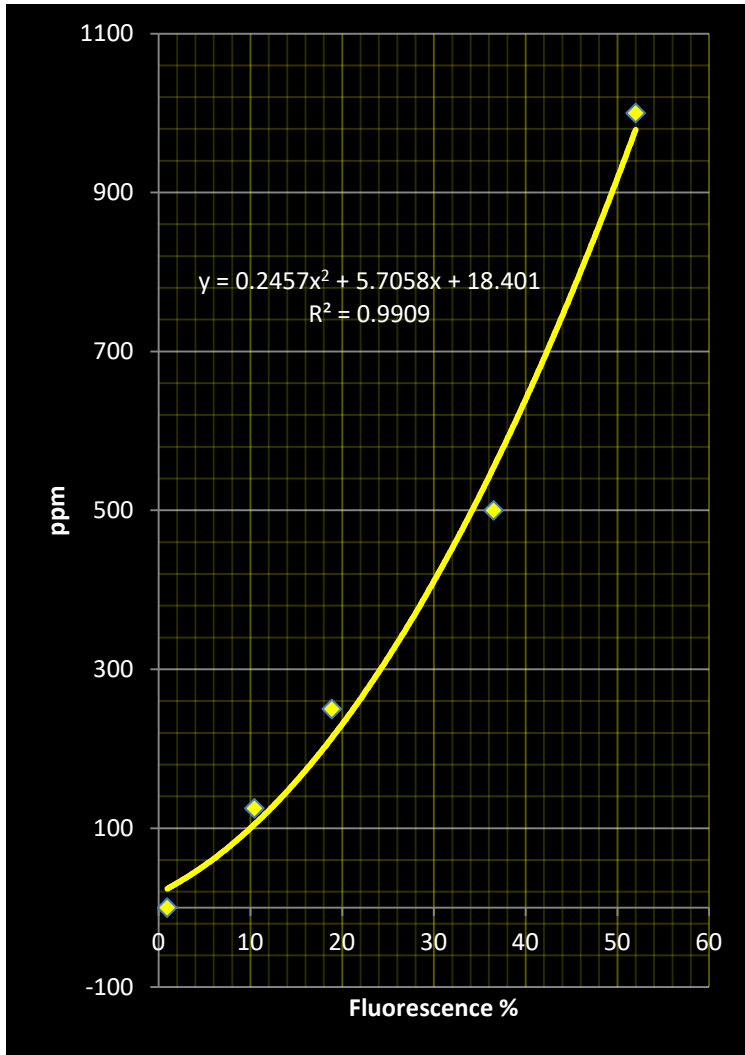
Main Menu



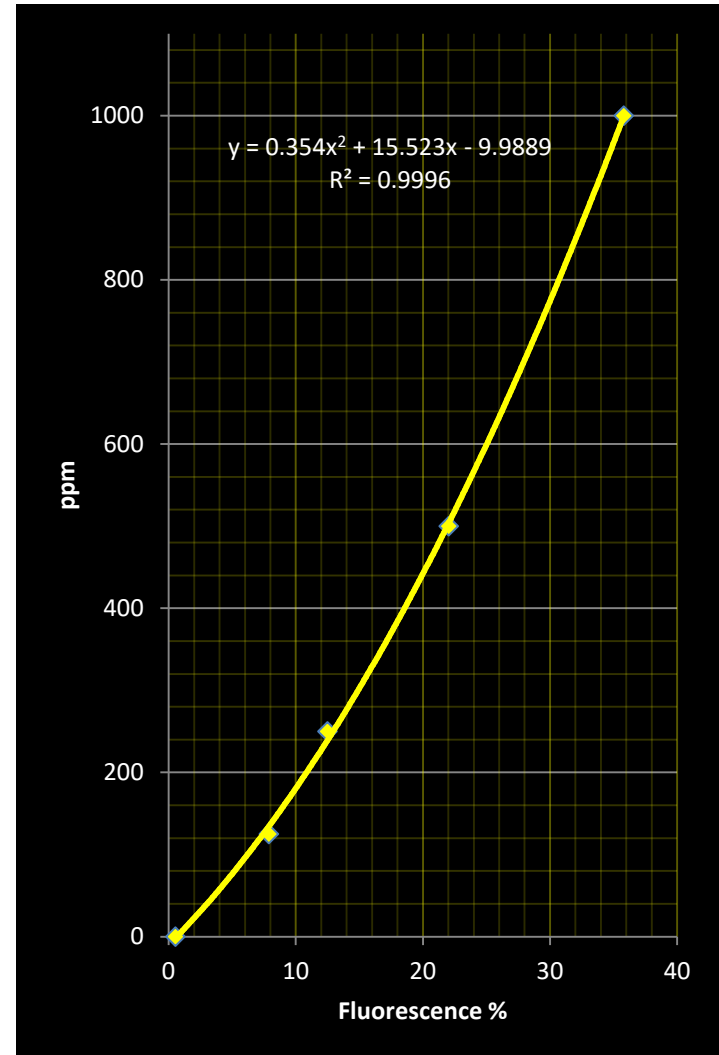
Calibration Mode



Light Crude Oil

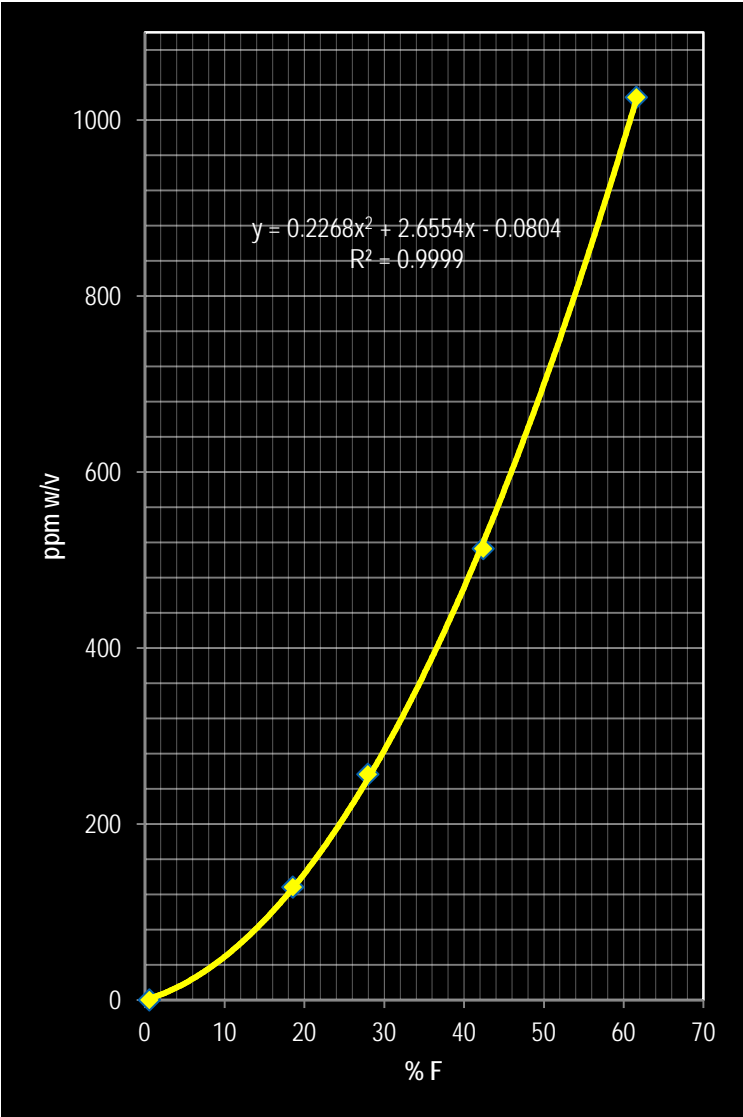


Centenario



Hidra

Light Crude Oil

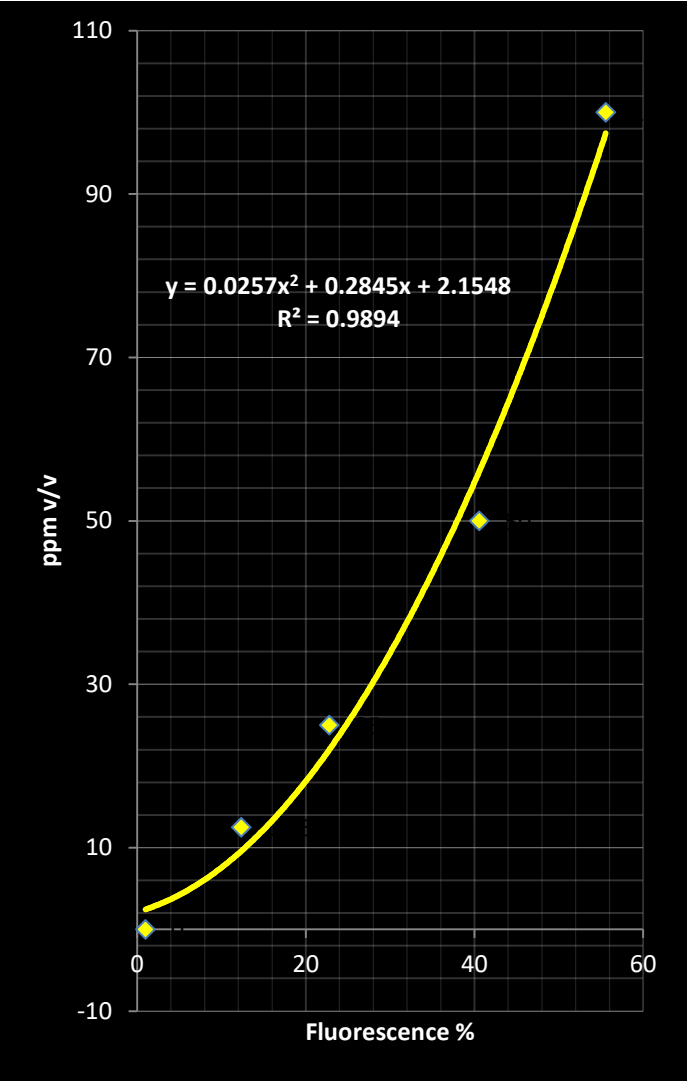


YPF Light

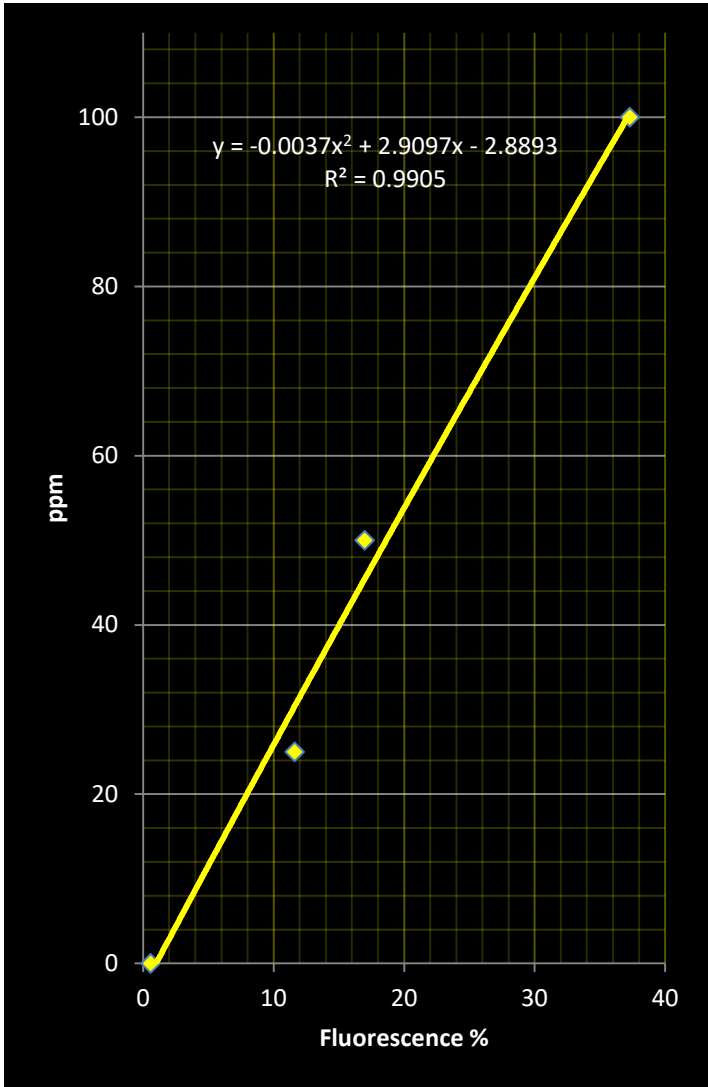
Calibration Check				
Run	QC(256.5ppm)	Average	SD	%RSD
1	266.5	264.81	1.68	0.633
2	264.3			
3	266.4			
4	267.2			
5	266			
6	265.6			
7	264.8			
8	263.4			
9	263.2			
10	261.4			
11	264.1			
12	263.9			

Highly Stable Emulsion
(10/28/2014)
Calibration performed: 1/06/2015

Medium Crude Oil

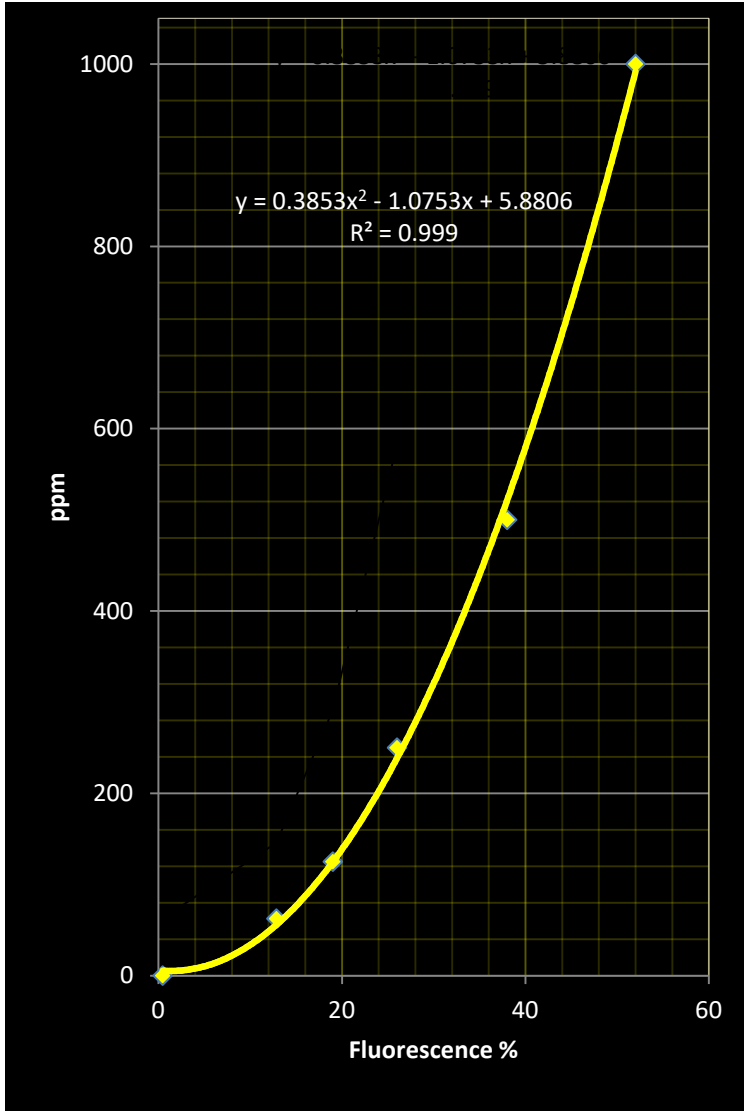


Challaco



Neuquen

Medium Crude Oil



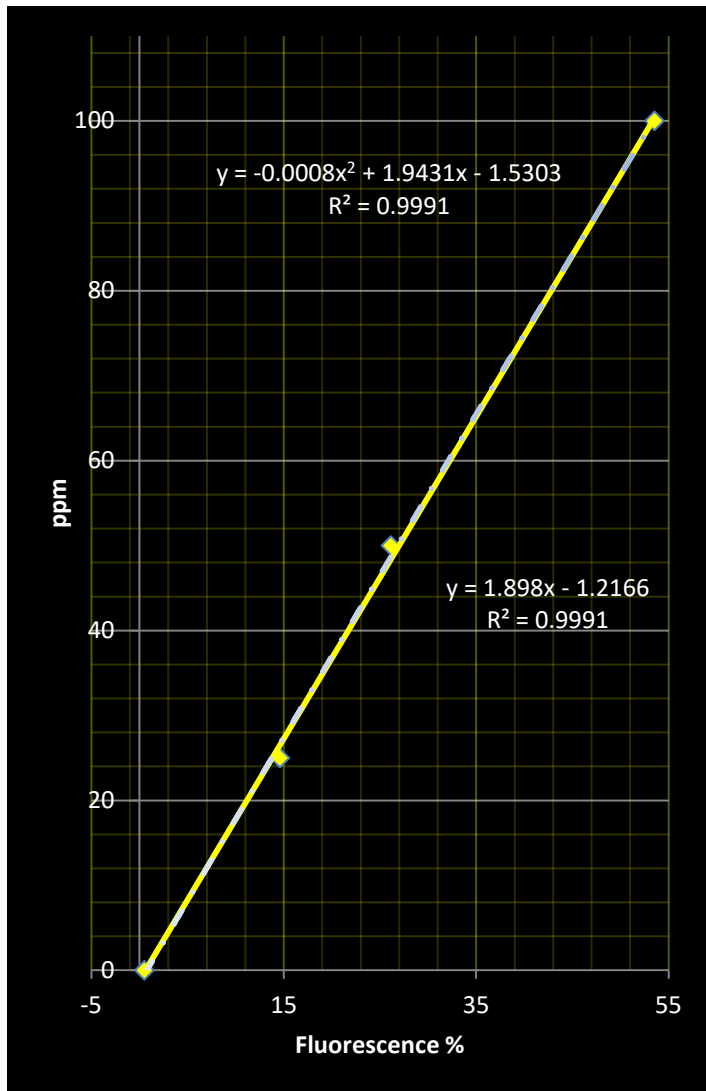
NRN-057

Calibration check

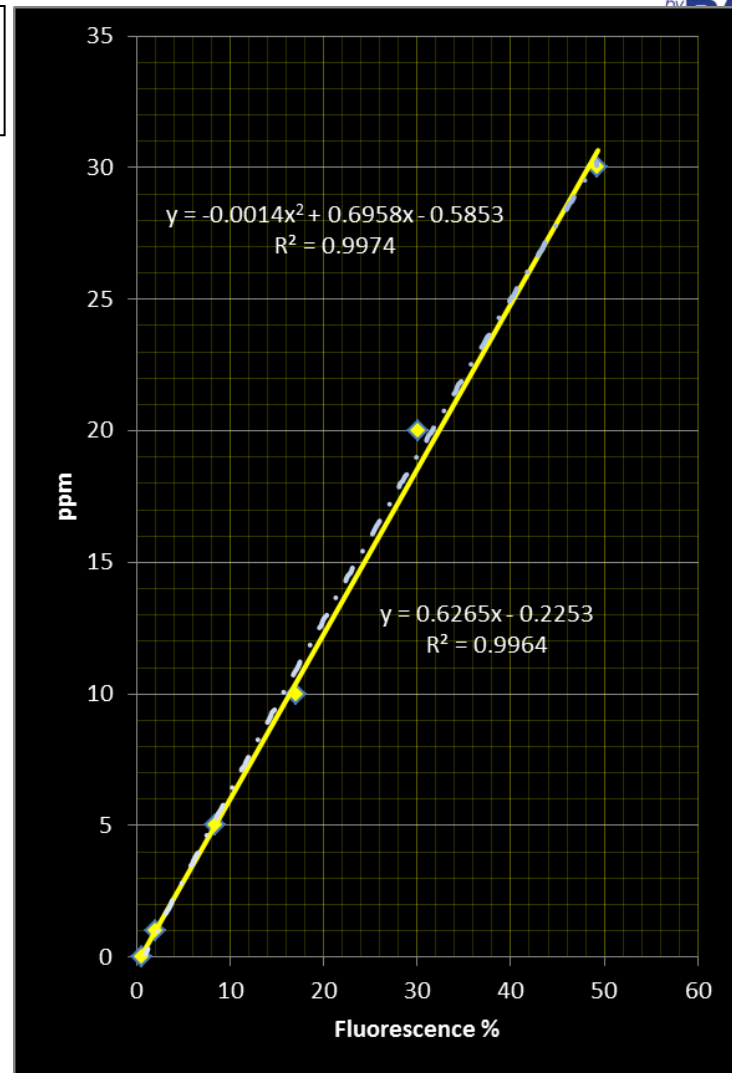
QC = 206.87ppm

Run	ppm
1	224
2	200
3	216
4	222
5	220
6	221
7	222
8	221
9	216
10	217
Mes. Average =	217.9
SD =	6.85
%RSD =	3.14

Heavy Crude Oil

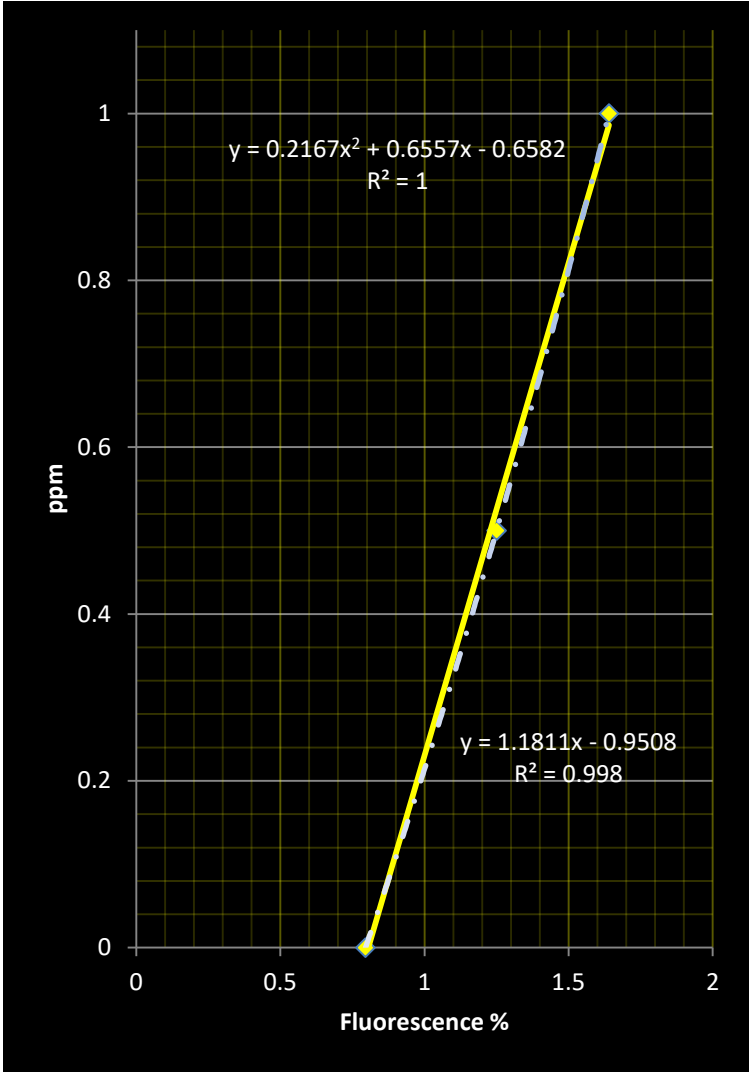


Similar R^2
30 – 100 ppm range



Barrancas(20 °API)

Heavy Crude Oil



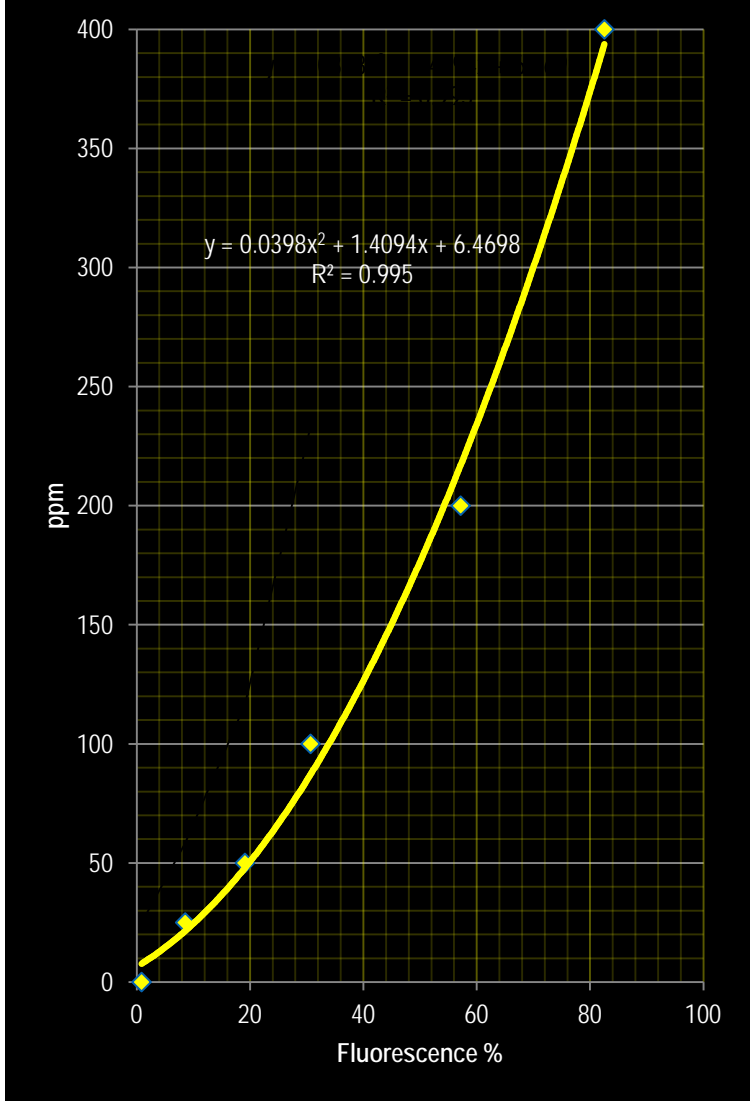
Barrancas(20 °API)

Main Use: EOR

Heavy Crude Oil

Calibration check 10/2/2014				Calibration check 10/3/2014			
1ppm	Average	STDEV	%RSD	1ppm	Average	STDEV	%RSD
0.94	0.917	0.0519	5.66	0.88	0.929	0.0682	7.34
0.89				0.86			
0.93				0.89			
0.86				0.91			
0.85				0.81			
0.95				1			
0.85				0.98			
0.98				0.96			
0.99				1			
0.93				1			

Heavy Oil Calibration

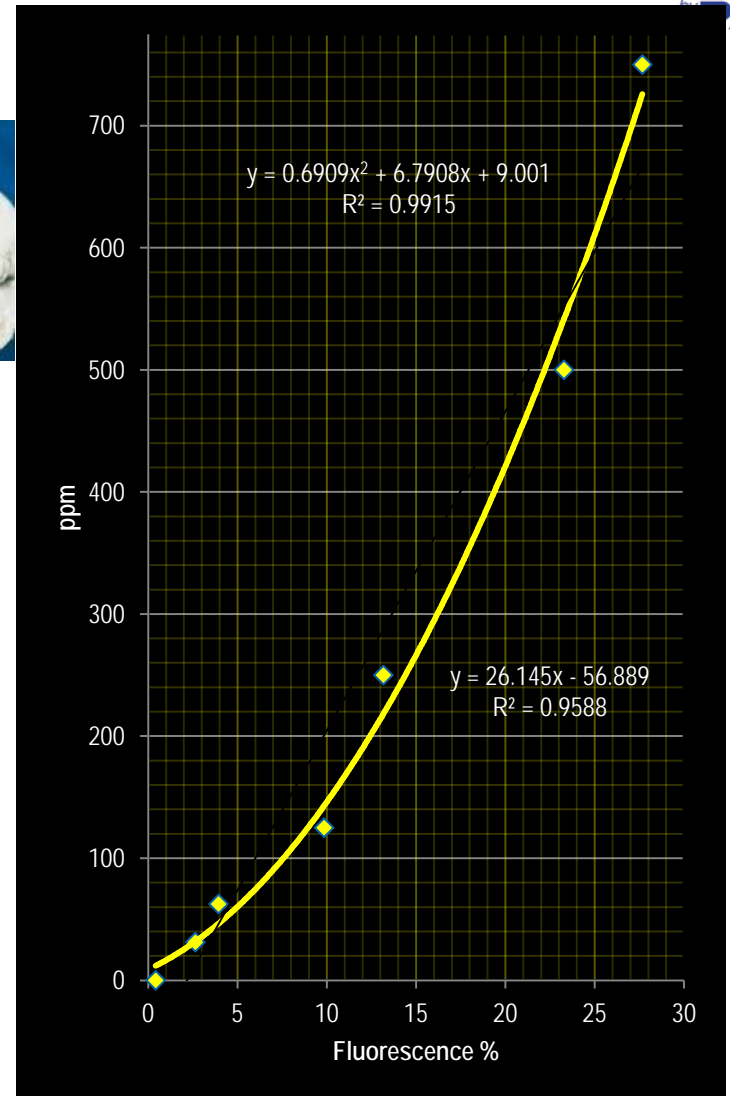
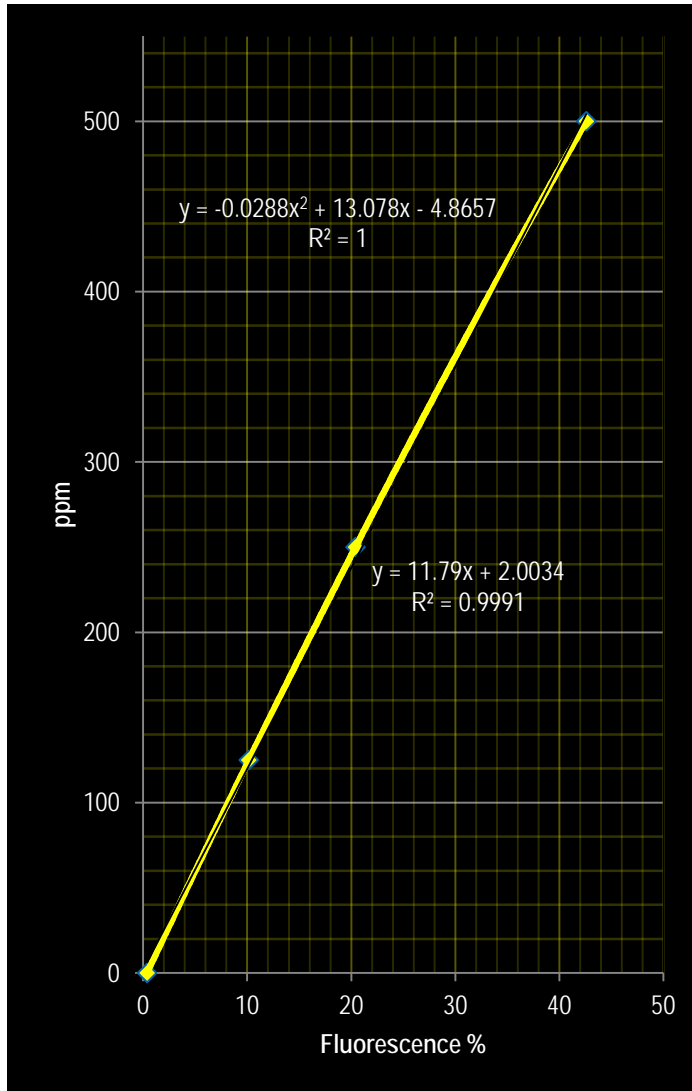


$R^2 < R^2$ (Light)

CMN-090

Heavy Oil Calibration

LDR

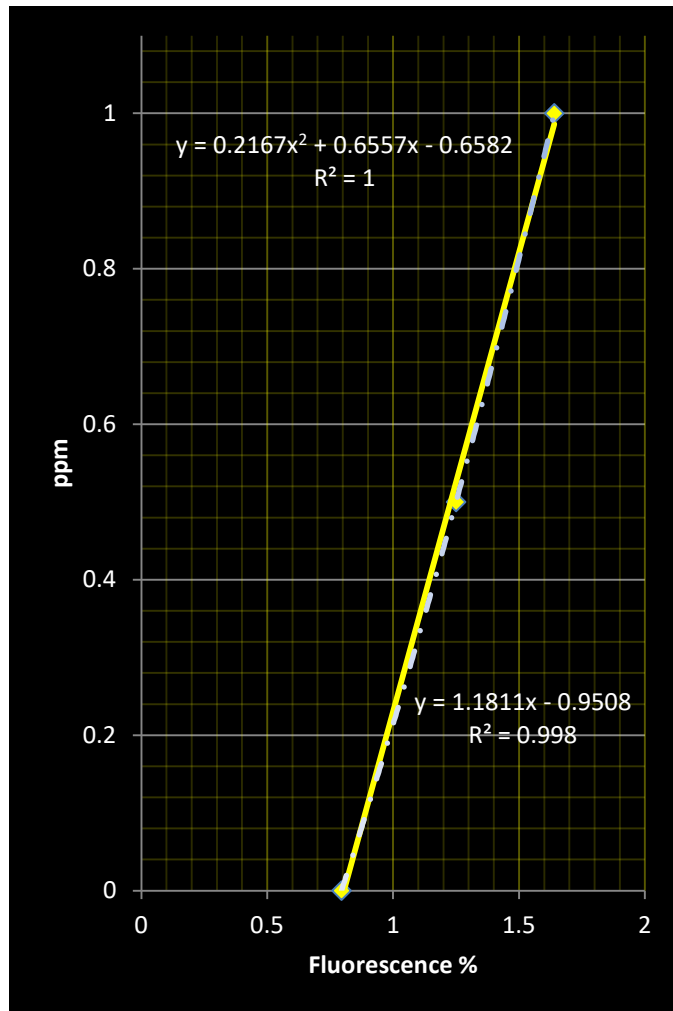


SYNTHETIC CRUDE OIL

Limit of Detection LOD

Conc. (ppm w/v)	% Fluoresc.		
30	49.27		
20	30.12		
10	17.12		
5	8.41		
1	1.99		
0	0.59		
		Blk	SDBlk
		0.5822	0.0274
		0.6210	
		0.59	
	Blank Average =		
Y =	mX + b		
m =		1.5903	
b =		0.4229	
Y =	$\mu_{blk} + 3 * SDBlk$		
Y =		0.672	
LOD = X =			0.157 ppm

Limit of Detection



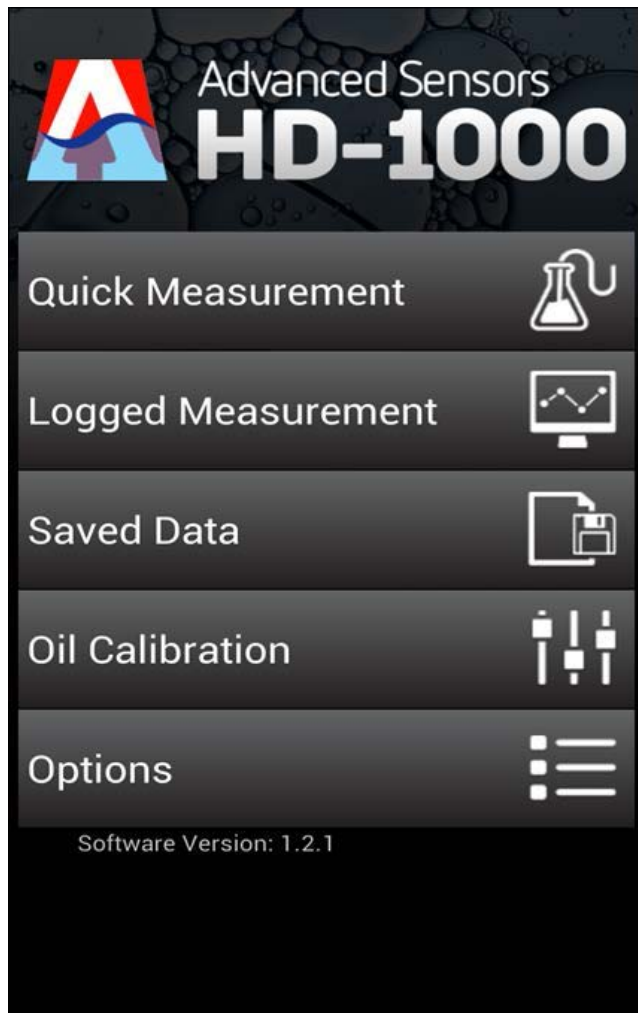
Conc.(ppm)	% Fluor.
1	1.64
0.5	1.25
0	0.795

LOD	Aver. Blk	SD
	0.795	0.0274






$m =$	0.905
$b =$	0.7958

$Y = \mu_{blk} + 3 \times \sigma$	
$Y =$	0.877
$LOD = X =$	0.0899
$LOD =$	0.09 ppm
$LOQ =$	0.30 ppm

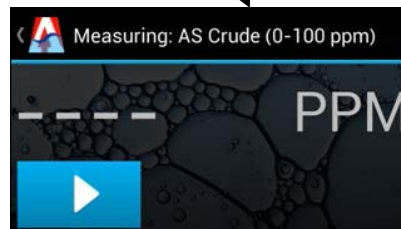
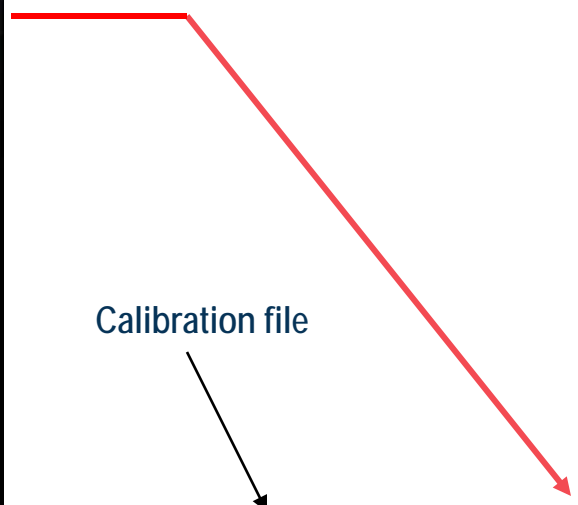
Analysis Mode



Advanced Sensors
HD-1000

- Quick Measurement 
- Logged Measurement 
- Saved Data 
- Oil Calibration 
- Options 

Software Version: 1.2.1



Measuring: AS Crude (0-100 ppm)

PPM



Measuring: AS Crude (0-100 ppm)

23.9 PPM



Measuring: AS Crude (0-100 ppm)

28.7 PPM

Calibration Check

Calculated Value (ppm w/v)	Measured Value (ppm w/v)	Diff.
30.31	31.43	+ 1.12 (3.69%)
25.13	24.82	- 0.30 (1.20%)
15.01	15.57	+ 0.561 (3.7%)
1.035	0.944	- 0.091 (0.09%)

Correlation Fit Test

<i>Measured Value(I) (ppm w/v)</i>	<i>% Fluorescence</i>	<i>Measured Value(II) (ppm w/v)</i>	<i>Diff.</i>
25.7	41.29	25.7	0
19.5	30.87	19.14	0.36
7.02	11.18	6.76	0.26
2.75	4.84	2.78	-0.03
0.23	1.18	0.48	-0.25

Conclusions

- **Laser Induced Fluorescence is amenable to simple and fast at-line determination of traces of hydrocarbons in process and produced waters.**
- **The handheld HD-1000 device provides highly repeatable results in real time with simple sample preparation steps or whenever a simple measurement needs to be taken immediately.**
- **The system has been successfully tested in light, medium and heavy crude oils suspended in water.**
- **Heavy Crude Oil – Water system can be analysed in a LIF Handheld HD-1000 with a high degree of accuracy.**
- **Calibration ranges from 0 to 30 and 0 to 100 ppm were obtained with acceptable linearity and excellent polynomial fit. Although higher concentration ranges can be covered depending on the particular application needs.**
- **The limit of detection of the technique for heavy crude-water system was found to be 0.09 ppm and the Limit of Quantitation 0.30 ppm.**

Conclusions

- **Excellent repeatability was obtained throughout the experiments.**
- **High storage capacity of calibration files and experimental results.**
- **The preparation of a stable emulsion is critical for the calibration step and it is a fundamental condition to obtain stable calibration curves to provide for consistent results. In general use the system provide immediate real time consistent results.**
- **Results confirm that for the vast majority of applications the use of a linear regression fit is adequate enough to obtain reliable results.**
- **Results also show that LIF can be applied in a “go no go” mode but can also be adequate enough to obtain accurate results.**
- **The HD-1000 can be applied to process and environment control, and product quality needs.**

Back Up Slides

Technical Specifications

Measurement Performance	
Technical Principle	Laser Induced Fluorescence (LIF)
Concentration Range	0 – 3000 ppm
Accuracy	± 1% of meas. range
Repeatability	> 99%
Response Time	< 1 s continuous results
Operating Conditions	
Process Temperature	0 °C to 100 °C
Operating Temperature	-5 °C to +50 °C
Spectral Analysis Specifications	
Emission Wavelength Range	400 – 1100 nm
Resolution	0.5 nm
Utilities	
Power	Rechargeable battery (3,000 mAh) 5 Vdc (Charging device required: 100-240 VAC Output: 2A)
Weight and Dimensions	
Weight	1.75 lbs
Dimensions	3.3W x 6D x 2H in. Aluminum
Flexible Probe Length	4 ft. Stainless Steel jacketed fiber optics
Communications	
Wireless (Wi-Fi)	Standard
Bluetooth	Standard
Internal Data Storage	9 GB (Expandable to 41 GB)
Security	Password Protection