Chevron

On Site WIO/Water in Fuel Testing

Droplet Size Distribution and PPM

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Location: Star Measurement Lafayette LA

Date: 11/17/14 – 11/19/14

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Objective

The purpose of this test is to determine if a vision based system provided by Canty can view and measure PPM and droplet size distribution of Water in Oil and Water in Diesel samples provided by Chevron. Below are the results of the testing performed at Star Measurement during the 3- day test.

Sample Description

HLS	35.5 API Oil at 64°F
ZUATA	20.6 API Oil at 60°F
Diesel Fuel	34.88 API at 60°F

Sample Preparation

Samples were mixed and then 30L of sample was added to flow loop. Flow loop was cleaned with diesel fuel prior to running next sample.

Operating Procedure

1. Sample was added to flow loop and run at approx. 6GPM and 50 – 80PSI.
2. Un-adulterer oil/fuel sample was allowed to run through loop for approx. 5 minutes to allow for adequate mixing.
3. Canty Karl Fischer and M-Flow analyzers were run multiple times over a 20 minute period to establish baseline readings.
4. After baseline reading was recorded; water was added to the loop in order to get an established level of .25% water concentration.
5. Analyzers were run for approx. 20 minutes after each addition of water. .5%, .75%, 1.0%, 2%, 5% respectively.
6. Flow loop was cleaned with diesel fuel before adding next sample and establishing baseline.

Typical Images: Setup

Figure 1-Flow Loop Setup, Star Measurement Lafayette LA

Figure 2– JM Canty OIW/WIO InFlow Analyzer

Typical Images: HLS

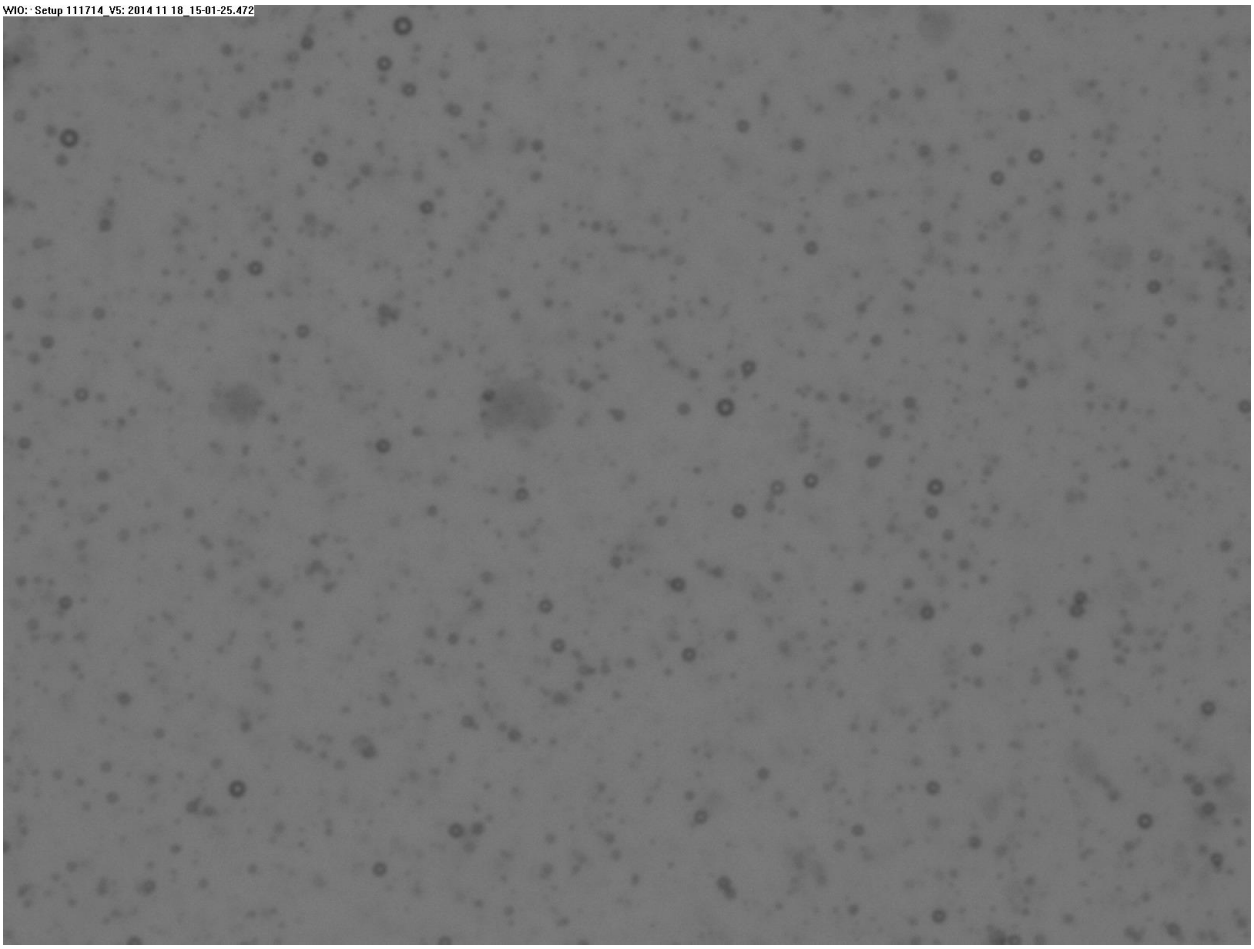


Figure 3– Sample HLS - BASELINE, Karl Fischer (1070 PPM) Canty (892 PPM)

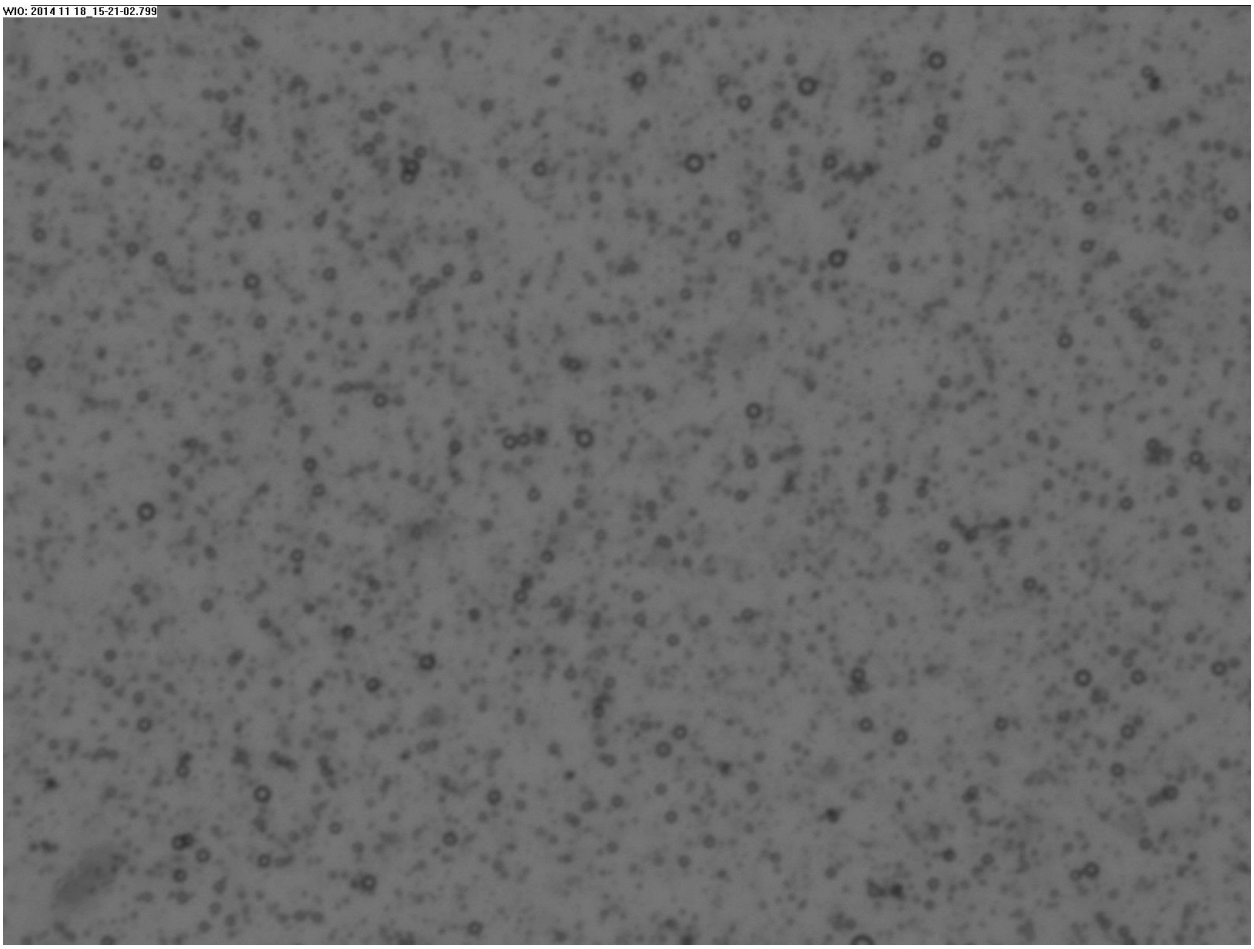


Figure 4– Sample HLS - .25%, Karl Fischer (2100 PPM) Canty (2514 PPM)

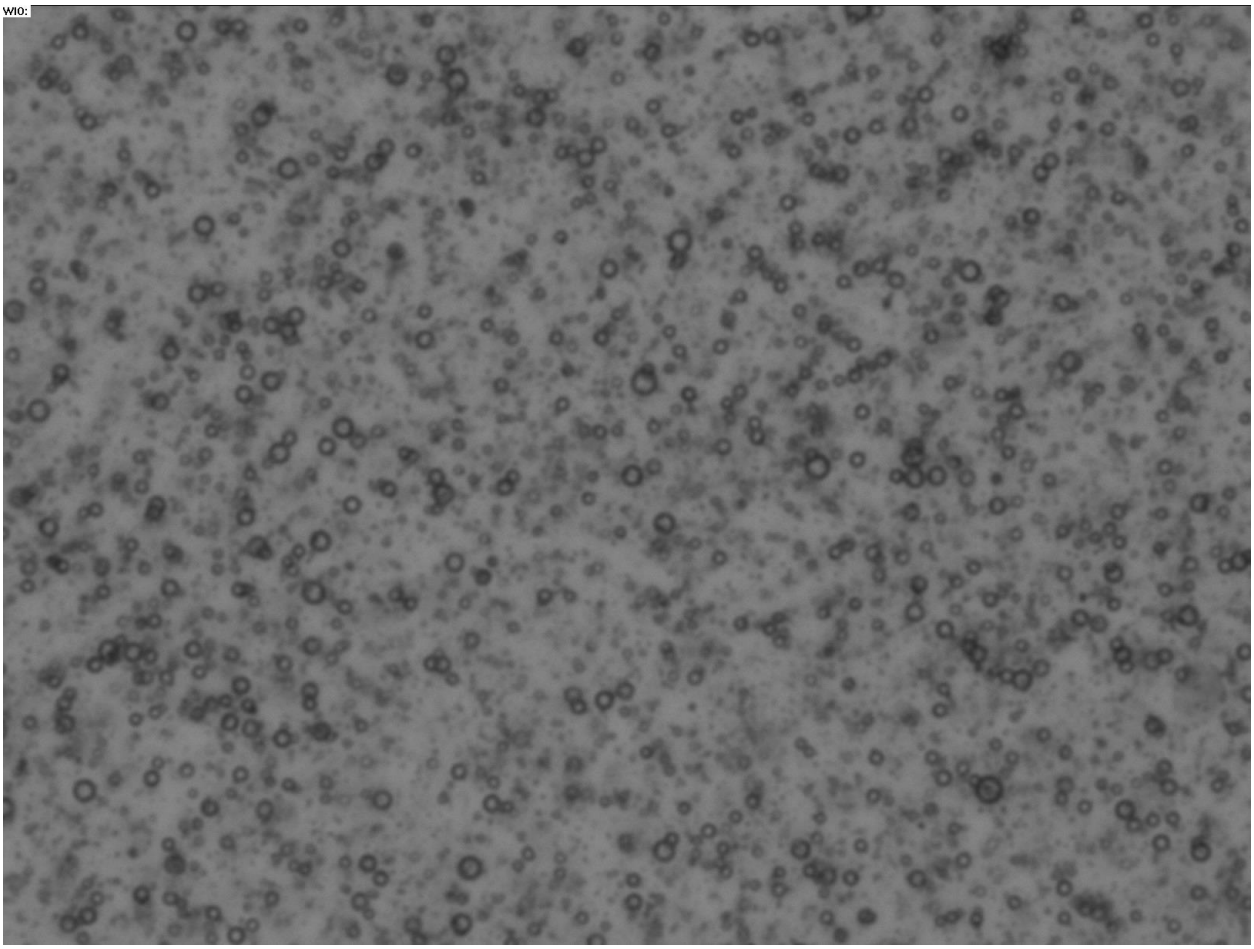


Figure 5– Sample HLS - .5%, Karl Fischer (4710 PPM) Canty (4383 PPM)

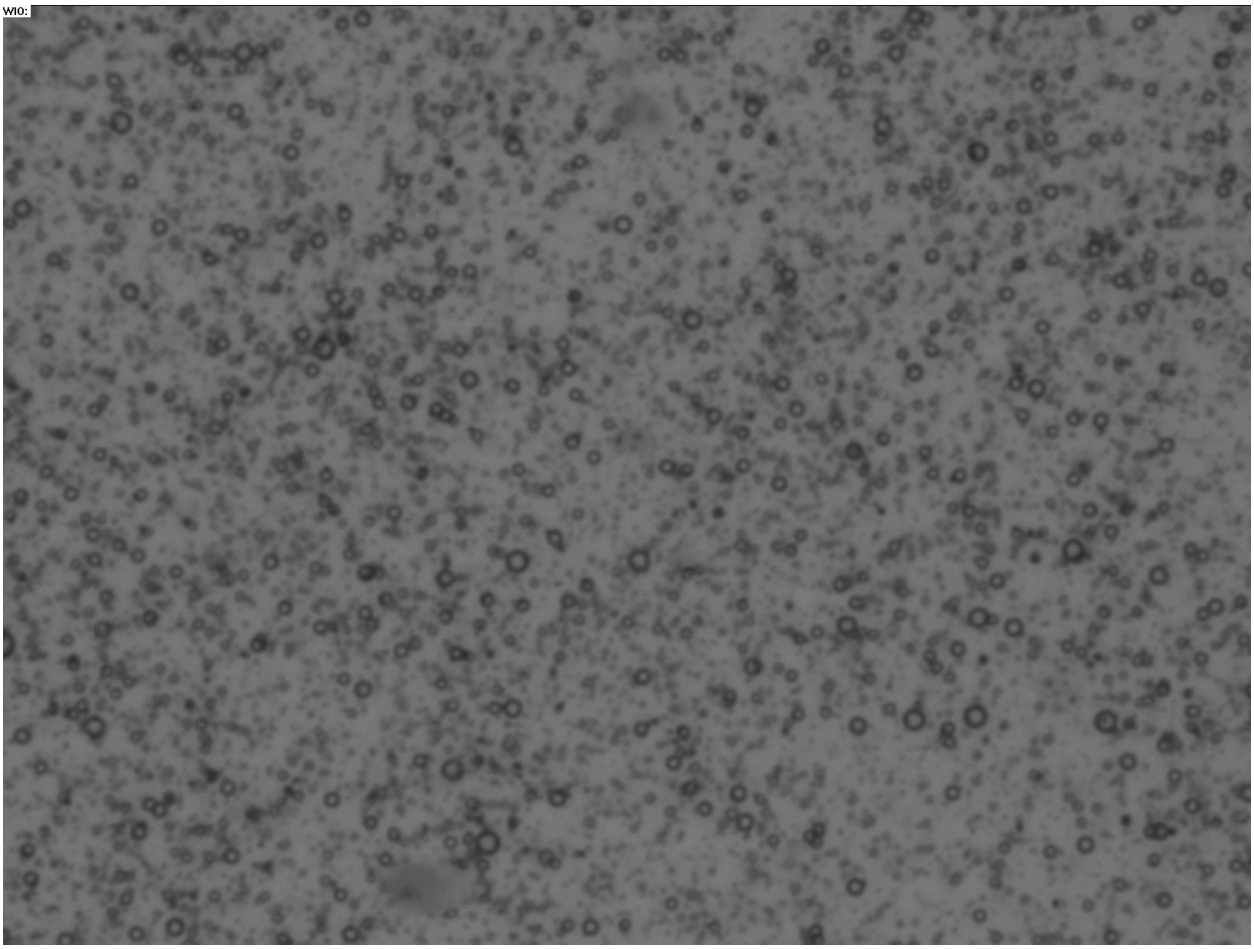


Figure 6– Sample HLS - .75%, Karl Fischer (7322 PPM) Canty (7062 PPM)

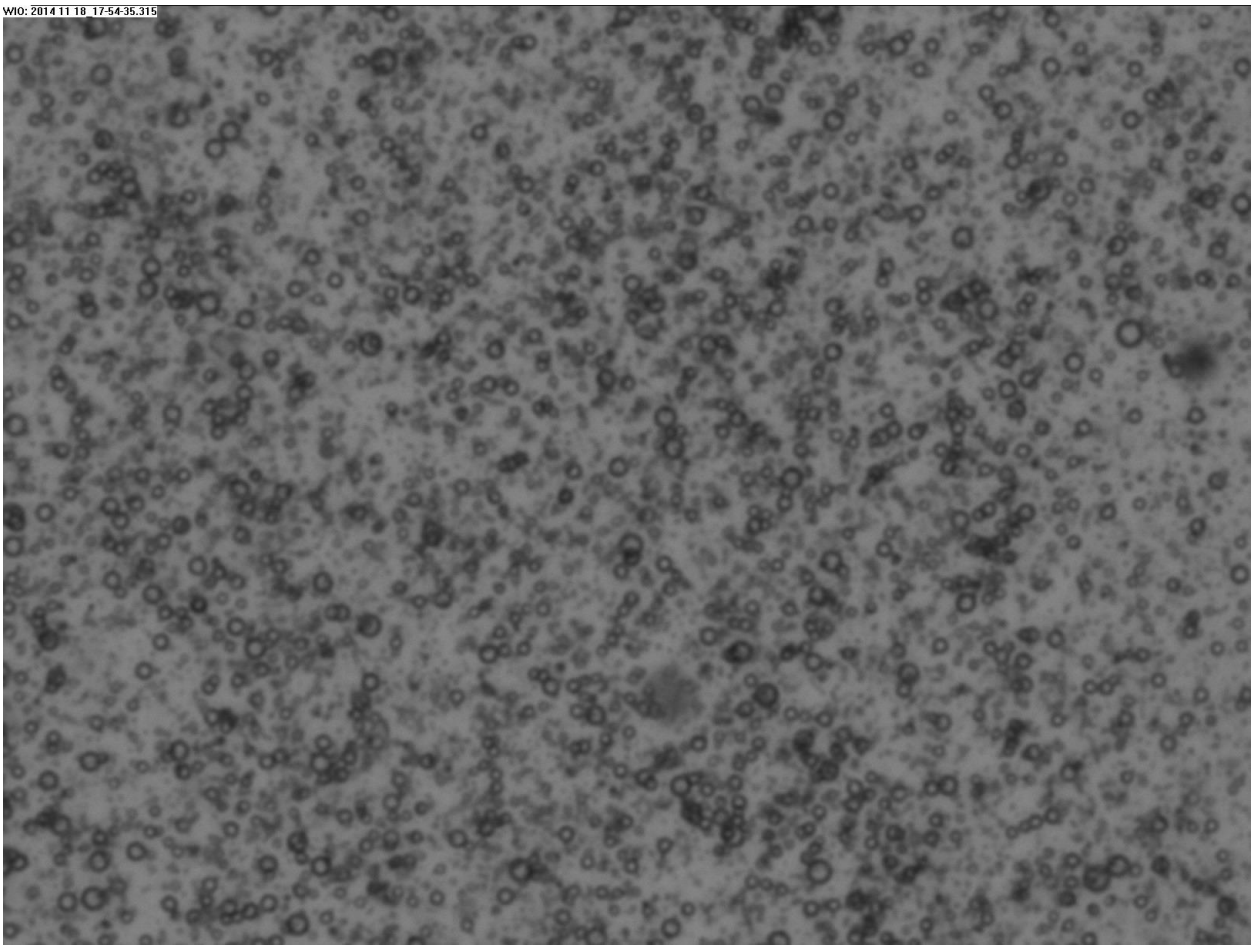
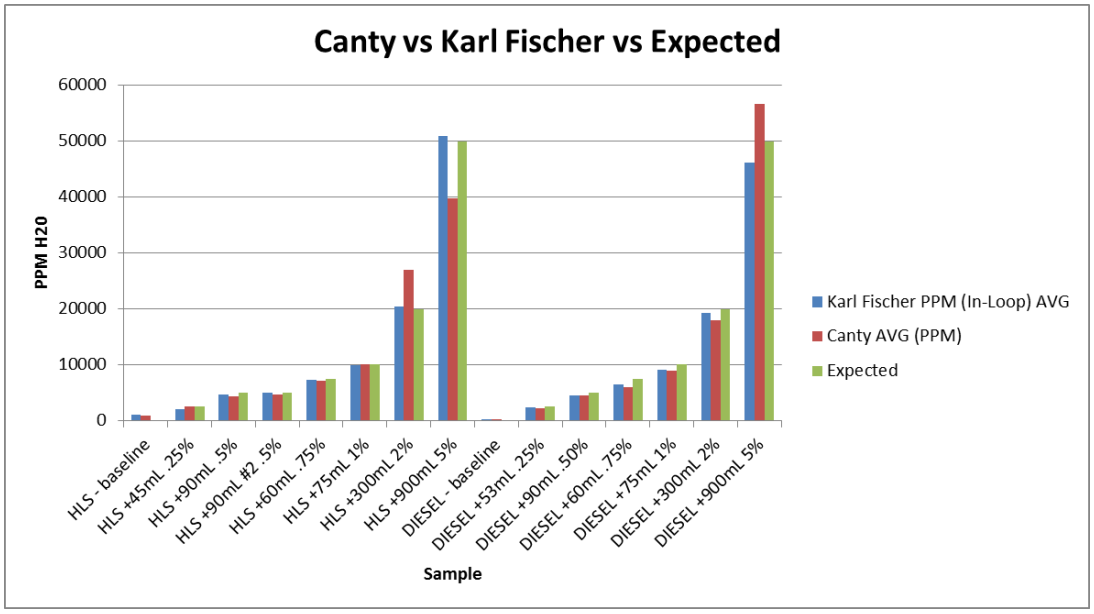


Figure 7– Sample HLS - 1%, Karl Fischer (9857 PPM) Canty (10049 PPM)

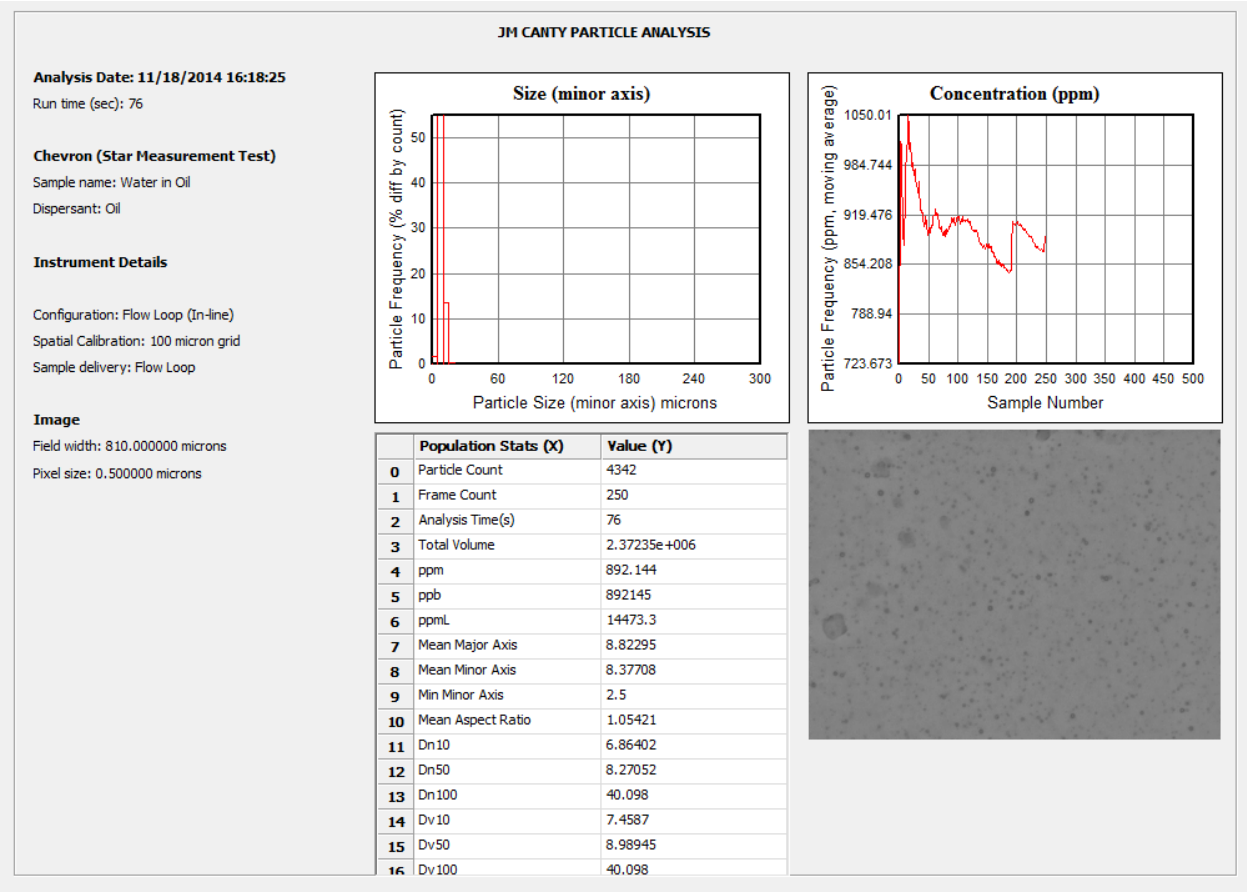
Data: HLS, ZUATA & DIESEL

Sample	Volume (L)	Karl Fischer PPM (In-Loop) AVG	API	Canty AVG (PPM)	Expected	StDev	%RSD
HLS - baseline	30	1070	35.5 @ 64F	892		126	12.8%
HLS +45mL .25%		2100		2514	2500	235	9.9%
HLS +90mL .5%		4710		4383	5000	309	6.6%
HLS +90mL #2 .5%		4984		4749	5000	141	2.9%
HLS +60mL .75%		7322		7062	7500	220	3.0%
HLS +75mL 1%		9857		10049	10000	100	1.0%
HLS +300mL 2%		20429		26924	20000	3880	17.3%
HLS +900mL 5%		51000		39708	50000	6251	13.3%
ZUATA baseline	30	1302	20.6 @ 60F	Too Dark			
ZUATA +45mL .25%		2219		Too Dark			
ZUATA +90mL .5%		4842		Too Dark			
ZUATA +60mL .75%		7205		Too Dark			
ZUATA +75mL 1%		9827		Too Dark			
ZUATA +300mL 2%		19130		Too Dark			
ZUATA +900mL 5%		45927		Too Dark			
DIESEL - baseline	30	73	34.88 @ 60F	4		49	126.7%
DIESEL +53mL .25%		2297		2245	2500	135	5.7%
DIESEL +90mL .50%		4581		4434	5000	294	6.3%
DIESEL +60mL .75%		6414		5942	7500	799	12.1%
DIESEL +75mL 1%		9074		9005	10000	556	5.9%
DIESEL +300mL 2%		19240		17932	20000	1046	5.5%
DIESEL +900mL 5%		46150		56684	50000	5330	10.5%

Table 1 – Canty Average PPM readings vs Expected & Karl Fischer



Droplet Size Data



	Population Stats (X)	Value (Y)
0	Particle Count	4342
1	Frame Count	250
2	Analysis Time(s)	76
3	Total Volume	2.37235e+006
4	ppm	892.144
5	ppb	892145
6	ppmL	14473.3
7	Mean Major Axis	8.82295
8	Mean Minor Axis	8.37708
9	Min Minor Axis	2.5
10	Mean Aspect Ratio	1.05421
11	Dn10	6.86402
12	Dn50	8.27052
13	Dn100	40.098
14	Dv10	7.4587
15	Dv50	8.98945
16	Dv100	40.098

Figure 16- Sample HLS - Baseline, Droplet Size & Concentration Data

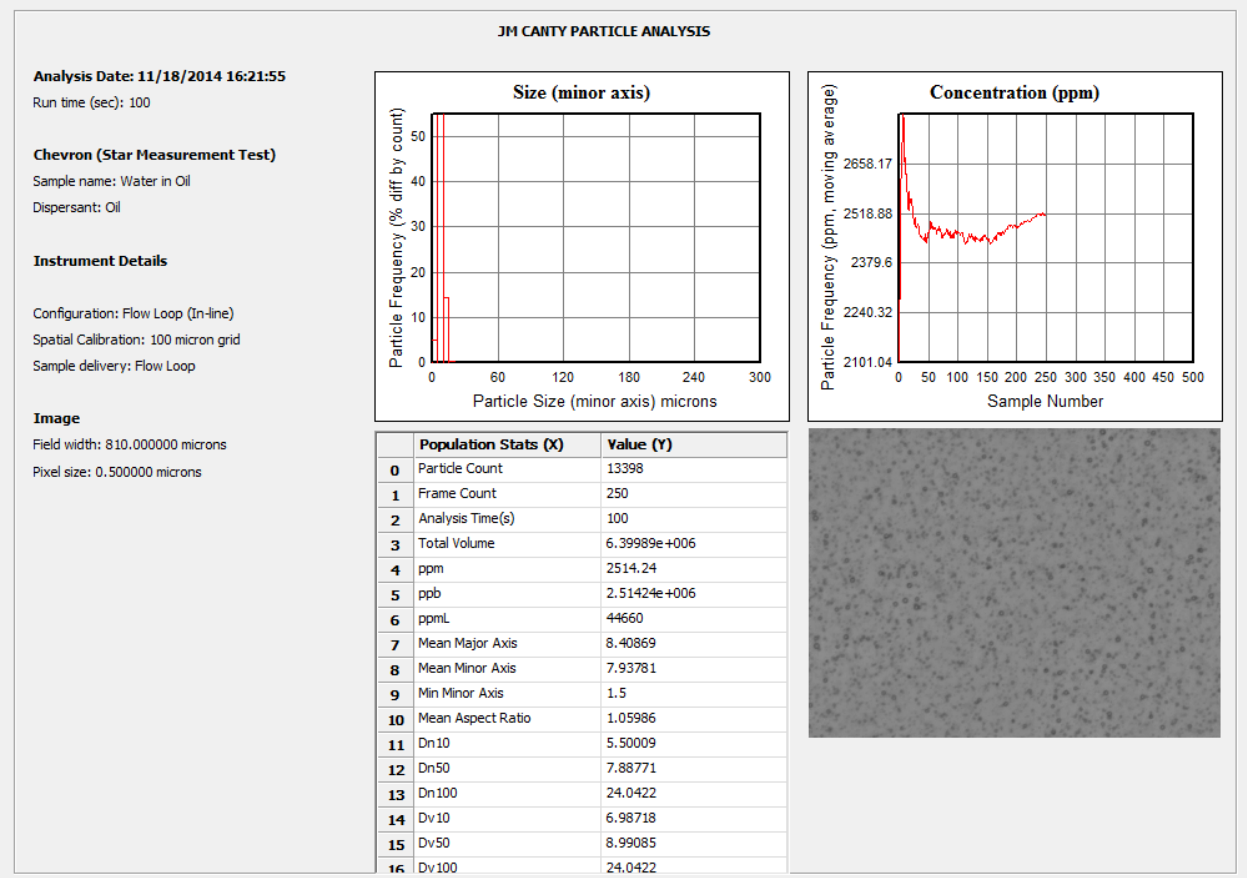


Figure 17- Sample HLS - .25%, Droplet Size & Concentration Data

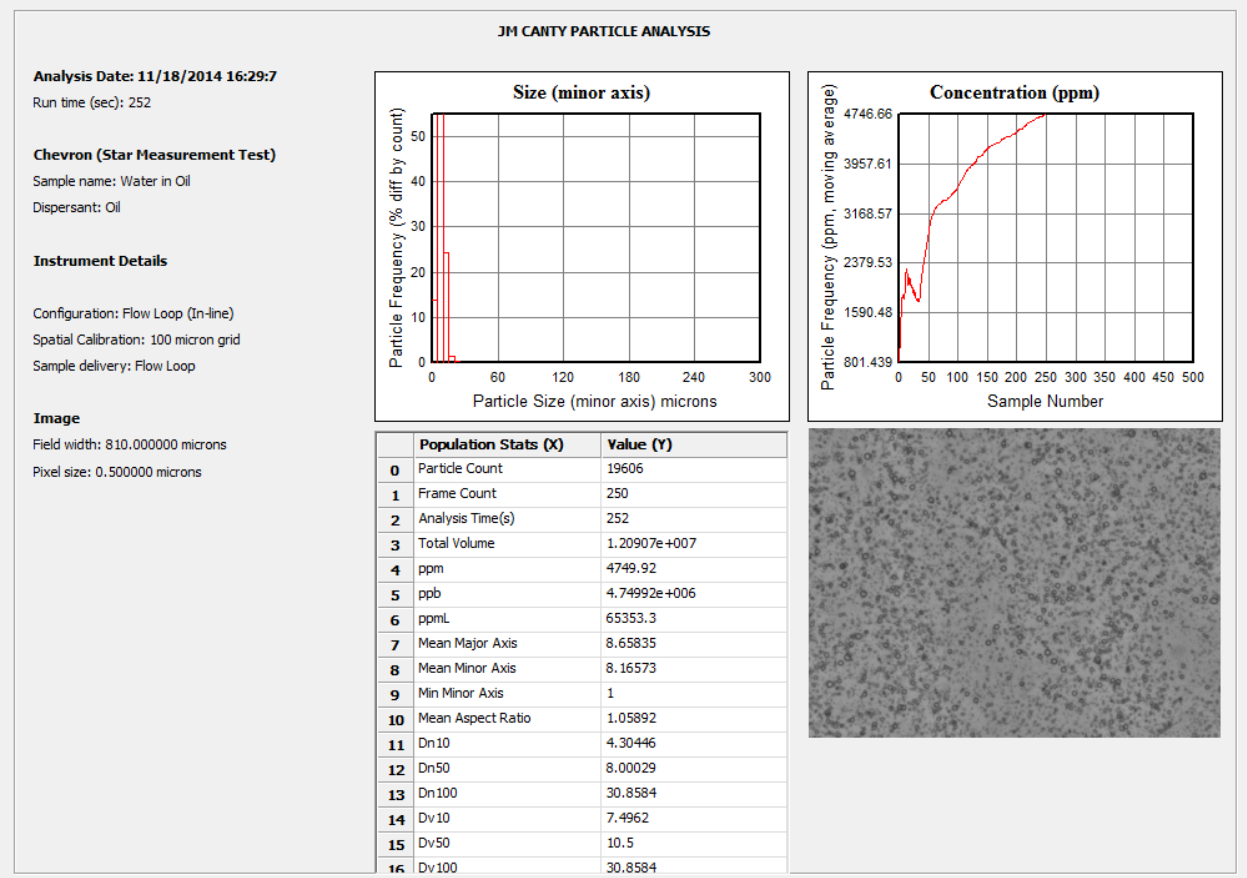
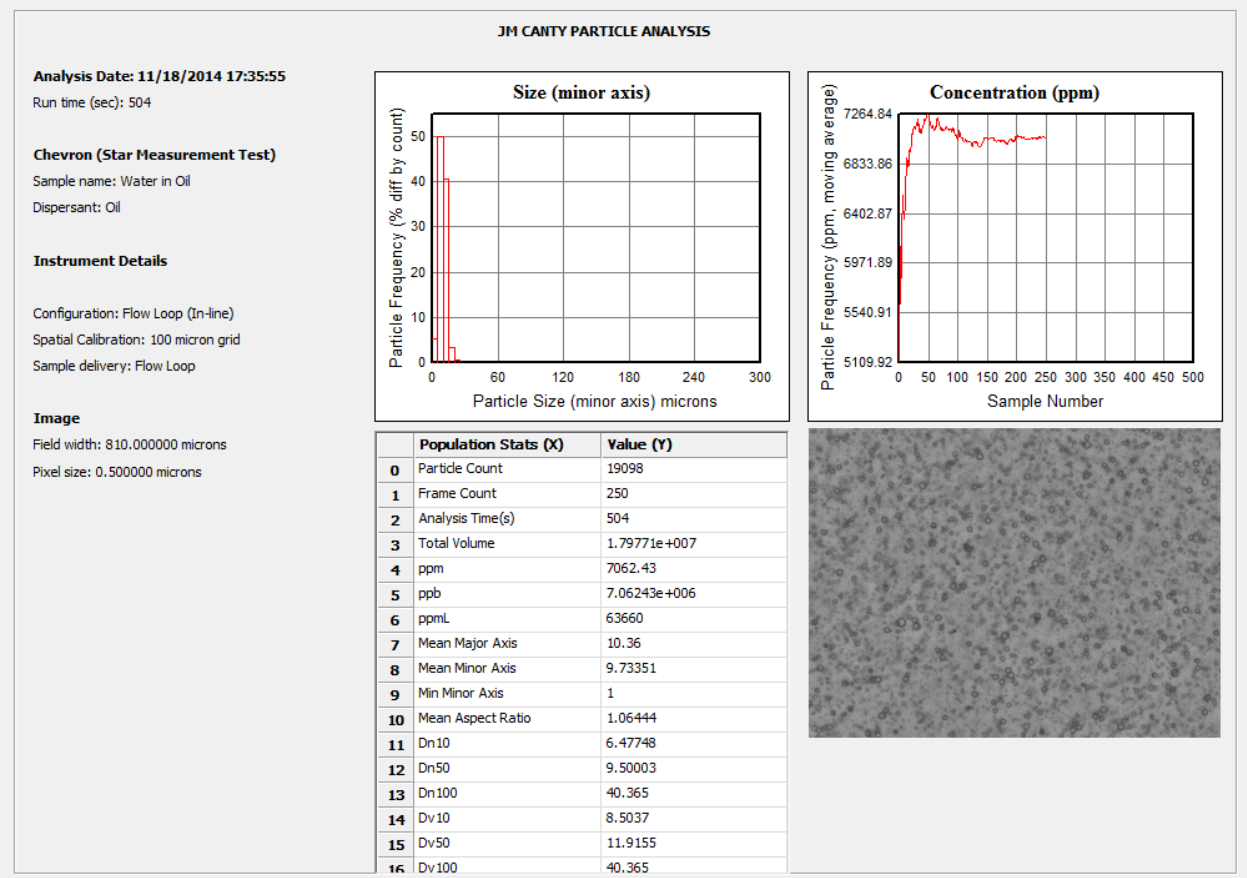


Figure 18- Sample HLS - .5%, Droplet Size & Concentration Data



	Population Stats (X)	Value (Y)
0	Particle Count	19098
1	Frame Count	250
2	Analysis Time(s)	504
3	Total Volume	1.79771e+007
4	ppm	7062.43
5	ppb	7.06243e+006
6	ppmL	63660
7	Mean Major Axis	10.36
8	Mean Minor Axis	9.73351
9	Min Minor Axis	1
10	Mean Aspect Ratio	1.06444
11	Dn10	6.47748
12	Dn50	9.50003
13	Dn100	40.365
14	Dv10	8.5037
15	Dv50	11.9155
16	Dv100	40.365

Figure 19- Sample HLS - .75%, Droplet Size & Concentration Data

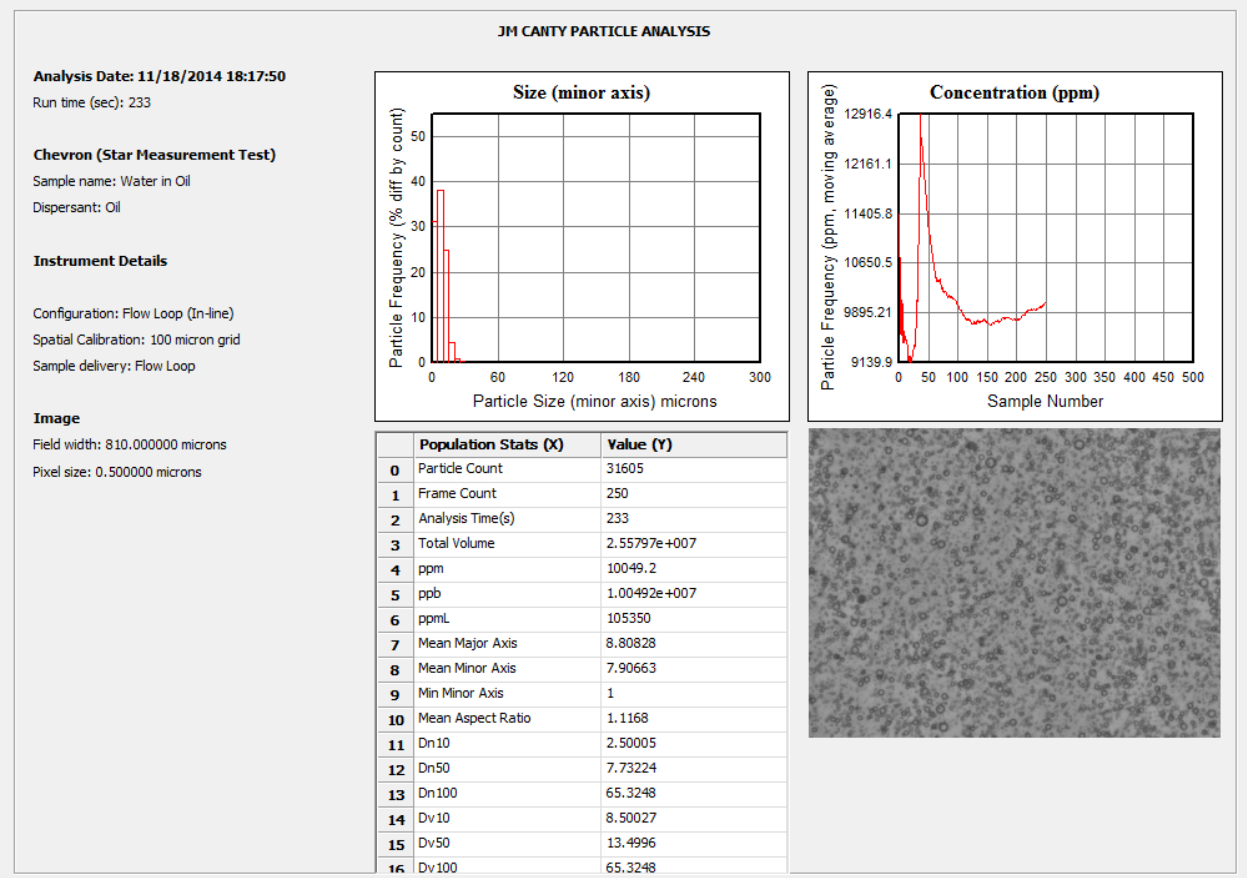
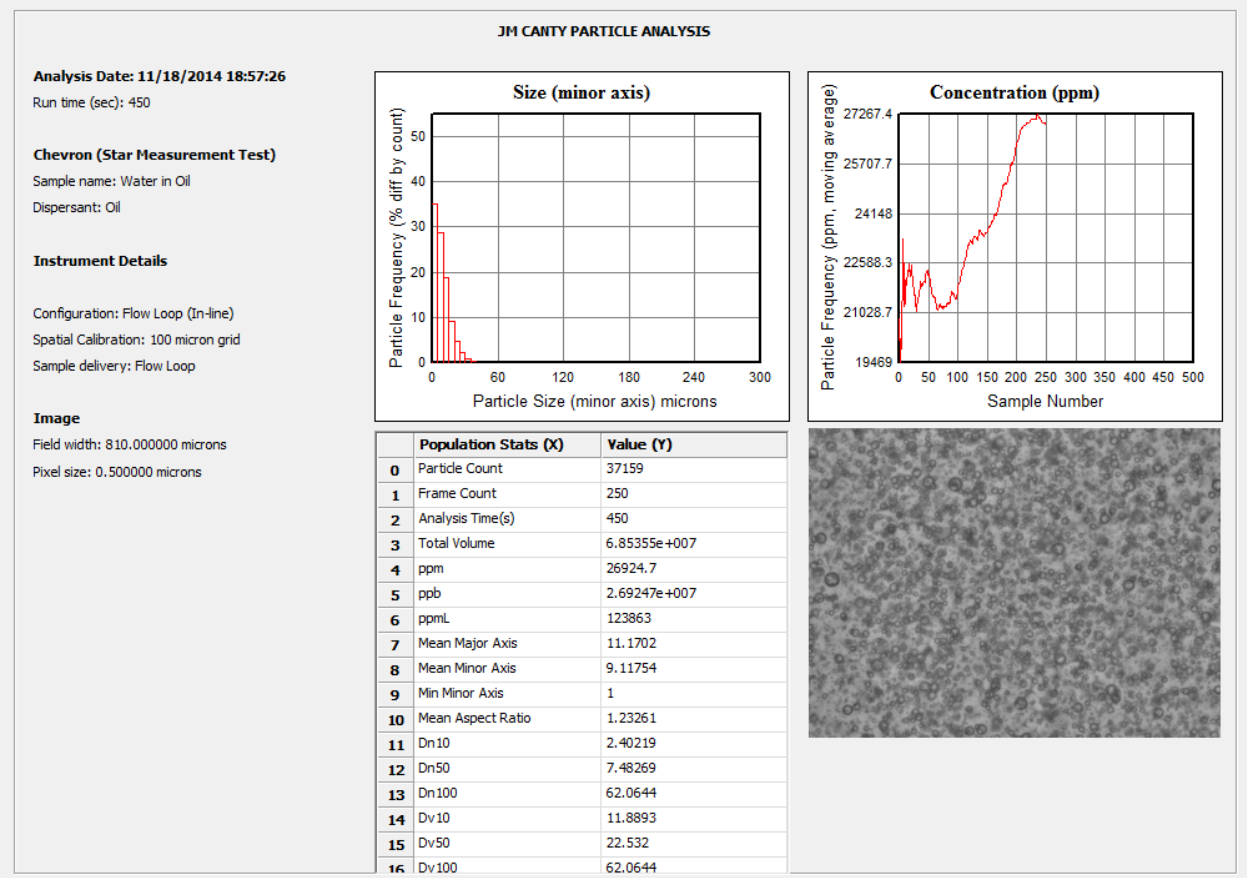


Figure 20- Sample HLS – 1%, Droplet Size & Concentration Data



	Population Stats (X)	Value (Y)
0	Particle Count	37159
1	Frame Count	250
2	Analysis Time(s)	450
3	Total Volume	6.85355e+007
4	ppm	26924.7
5	ppb	2.69247e+007
6	ppmL	123863
7	Mean Major Axis	11.1702
8	Mean Minor Axis	9.11754
9	Min Minor Axis	1
10	Mean Aspect Ratio	1.23261
11	Dn10	2.40219
12	Dn50	7.48269
13	Dn100	62.0644
14	Dv10	11.8893
15	Dv50	22.532
16	Dv100	62.0644

Figure 21- Sample HLS – 2%, Droplet Size & Concentration Data

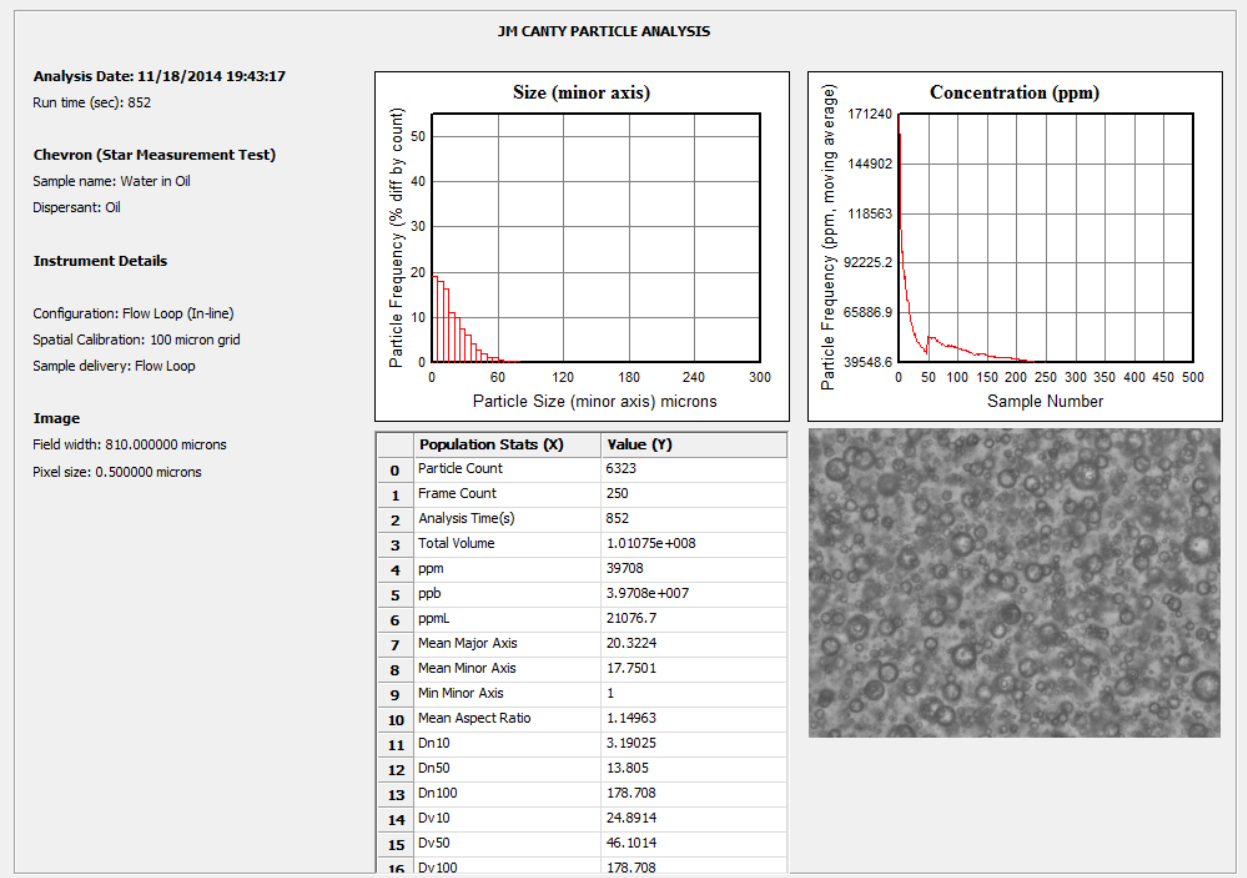


Figure 21- Sample HLS – 5%, Droplet Size & Concentration Data