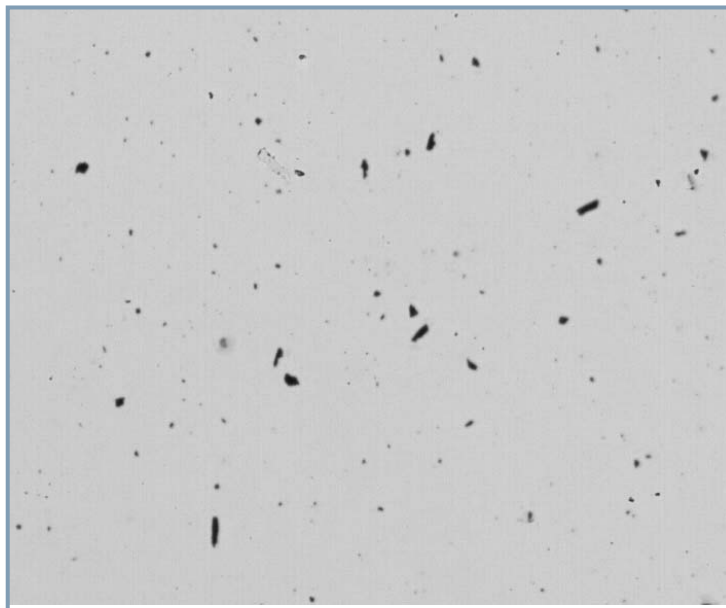


CLEMEX
intelligent microscopy

751

Particle Size Analysis



Prepared by Myriam Savard Eng.
Clemex Technologies Inc.
For National Renewable Energy Laboratory

Sample Description

One sample of washed pretreated corn stover was submitted for analysis.

Purpose of Analysis

To demonstrate the Clemex Vision image analysis system capabilities to measure a large size distribution (from 1 micron to 3 mm) and the corresponding appropriate shape characteristics.

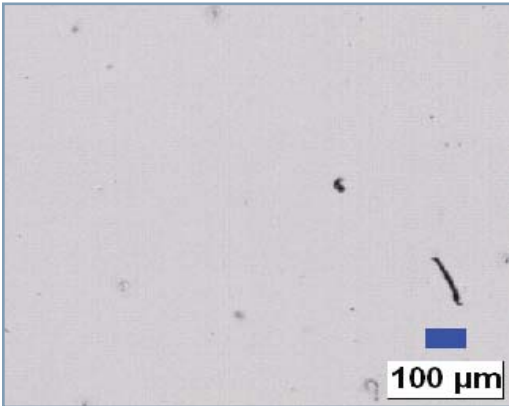


Figure 1: Part of the original image at 25 x (2.9326 microns/pixel).

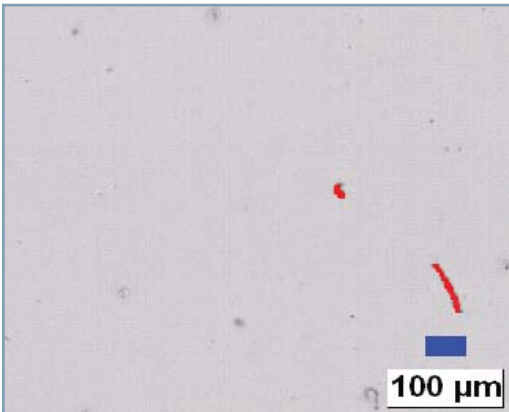


Figure 2: Particles over 20 microns as measured in red bitplane.

Procedure¹

A small part of the sample was diluted with distilled water and one drop was deposited on a slide. The camera exposure time was automatically set for a perfect and constant lightening.

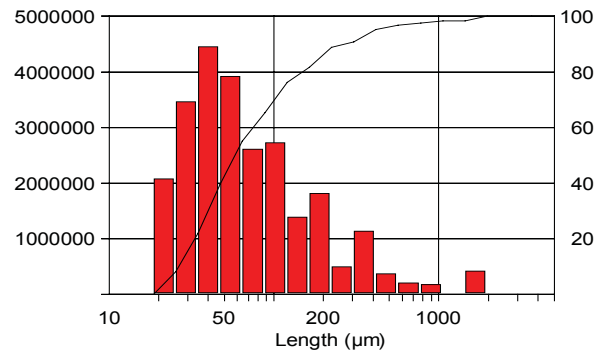
To measure a large size distribution of particle diluted in water, two runs have to be performed. The first run is executed at 25x where we have a great depth of field and large fields of view. This allows, using a multi layer grab, to obtain a clear view of all features whatever their height in the liquid. Also, working with a guard frame, large particles are not sectioned prior to measurements. The optical resolution being of 4.5 at 25x, all features that are over 20 microns can easily be measured at 25x and the remaining are

measured at higher magnification. In this case, since we wish to detect features as small as 1 micron, a magnification of 500x was selected. At 500x, the optical resolution correspond to 0.4 microns. However, we obtain a much narrower depth of field and only one layer of the particles in suspension are captured for analysis.

Particles were binarized in blue using Contrast Thresholding. Particles shorter than 20 microns were eliminated from the 25x analysis and those smaller than 1 micron or larger than 40 microns were eliminated from the 500x run.

Results²

Length, Width, String Length, String Width, Circular Diameter, Aspect Ratio, String Aspect Ratio, Area and Volume measurements were performed on each feature. Automated statistics and graphs were generated and cumulated. Final results were saved for further use. A customized report was built using the Report Generator module. A picture of the field containing the longest feature is shown along with charts and statistics. Raw data is linked to their respective objects for validation purposes.



Minimum: 21.26 microns
Maximum: 1659.09 microns
Mean: 130.79 microns
Std Dev.: 237.42 microns

Figure 3: Particles' Length to Volume distribution and corresponding statistics.

Equipment

Image Analysis System: Clemex PS3 V5.0
Microscope: Leica DM 4000 M
Objective/Magnification: 2.5x / 25x and 50x / 500x
Illumination: Transmitted Light
Calibration: 2.93255 and 0.145490 microns/pixel
Camera: Clemex L1.3 M (1280 x 1024)
Motorized Stage: Marzhauser EK32IM 75x50mm

Discussion

The main difficulty was to binarize all particles since some were dark and others were translucent. A contrast thresholding was used to overcome this problem.

¹ Images taken during the procedure are available in appendix A

² Complete results are available in appendix B.



Appendix A: Image Analysis Steps



Image Analysis Steps



Image 1: Original image at 25x magnification (2.9326 mic./pixel).

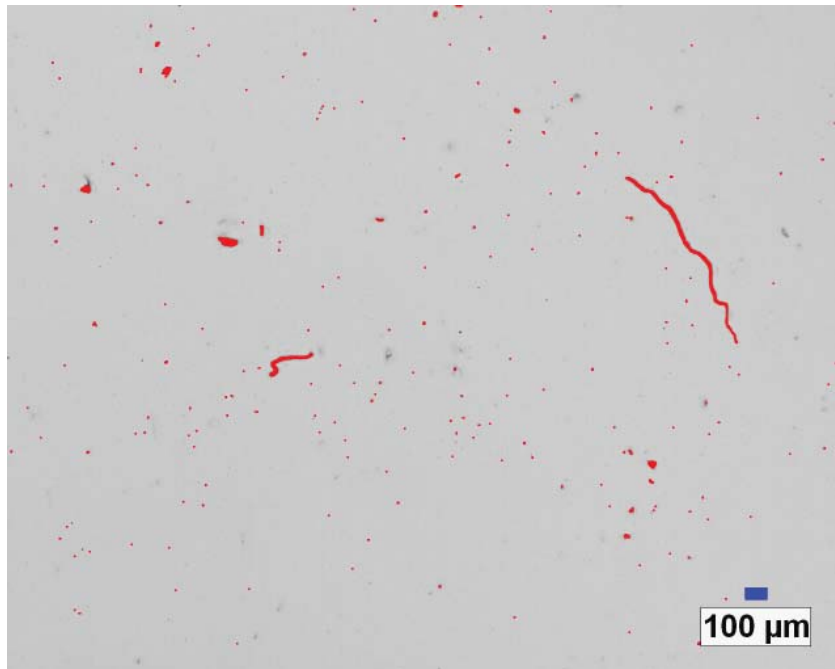


Image 2: Particles as binarized in red using contrast thresholding. Features that remained out of focus have fuzzy edges and consequently, they are not binarized by the contrast thresholding.

Image Analysis Steps

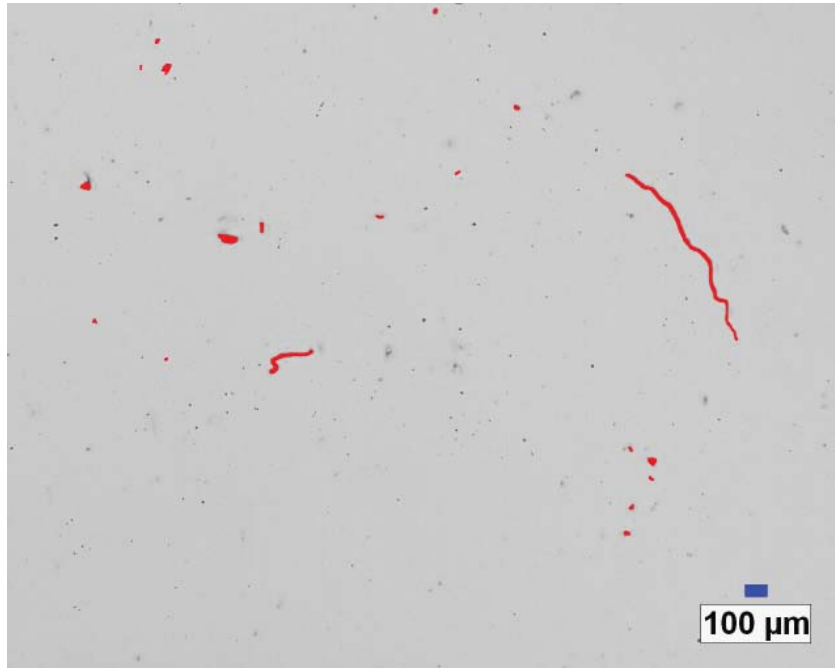


Image 3: Particles smaller than 20 microns are eliminated from the analysis. Incomplete features (sectioned by the field of view) are also rejected but only from the current field. They are going to be analyzed in a subsequent field, when they will fit completely inside the field of view.

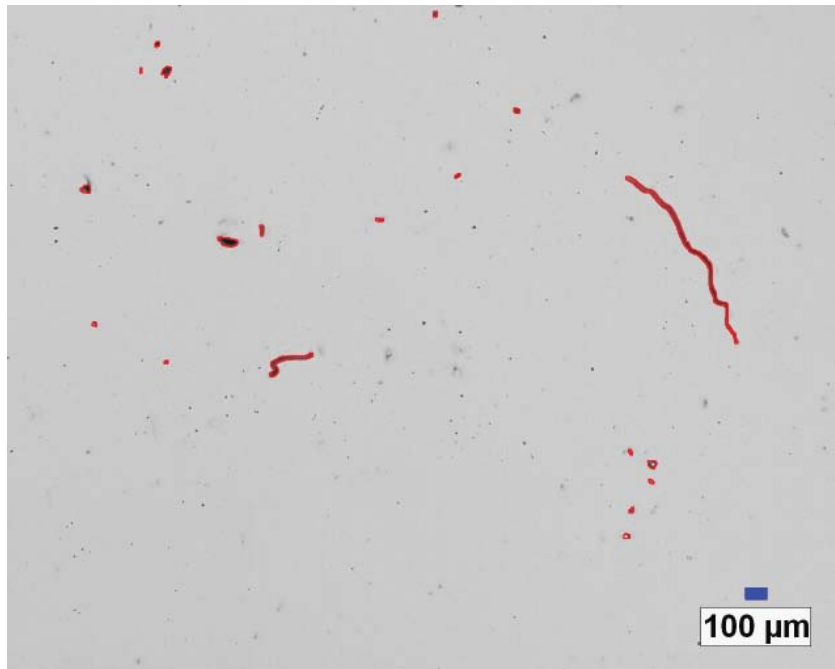
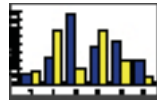


Image 4: Same as previews showing the particles outline as measured ,over-laid against the original image.



Appendix B: Results

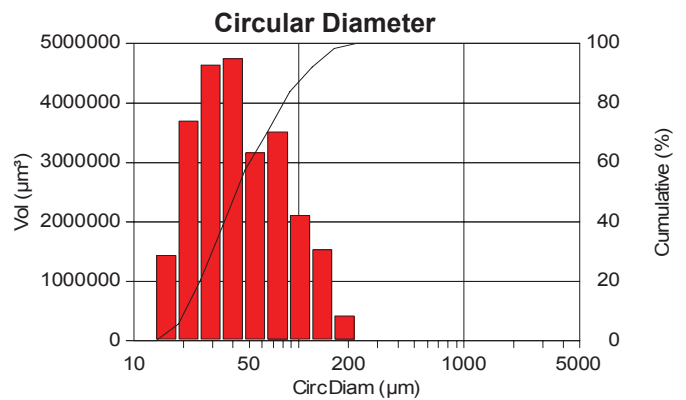
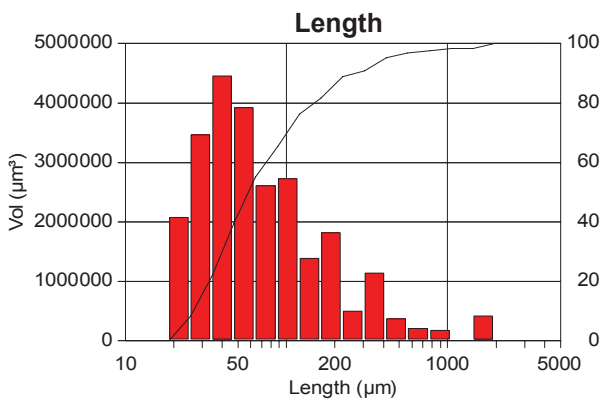


Reports

Particle Sizing

Sample ID:	2007-Nov-15, 10:38:31 AM -05'00'	Magnification:	25xT
Company:	Clemex	Calibration:	2.9326 $\mu\text{m}/\text{pixel}$
Department:	Laboratory	Units:	microns
User Name:	Myriam Savard ...)	# Fields:	63
Sample ID:	Sample 1	Total area (mic^2):	505382650.6

Figure 1: Fields showing the longest particle found



Count: 1716
Min: 21.261 microns
Max.: 1659.091 microns
Mean: 130.786 microns
Std. Dev.: 237.423 microns
P10: 26.0129 microns
P50: 57.70998 microns
P90: 236.4152 microns

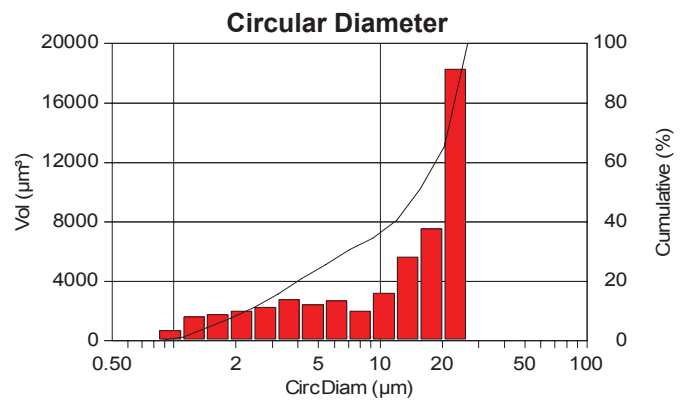
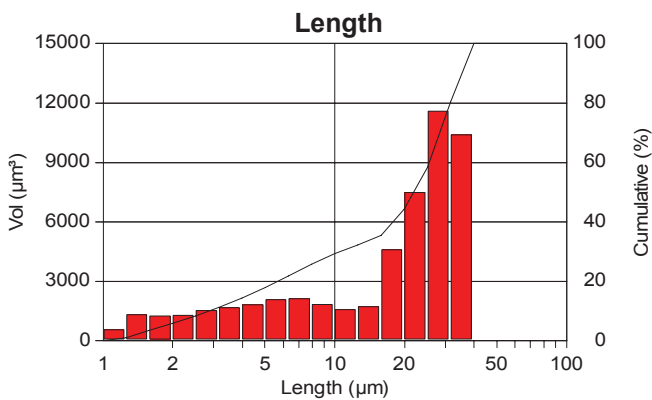
Count: 1716
Min: 14.039 microns
Max.: 199.395 microns
Mean: 55.370 microns
Std. Dev.: 38.974 microns
P10: 20.00579 microns
P50: 41.91163 microns
P90: 116.7168 microns

Particle Sizing

Date: 2007-Nov-16, 3:26:13 PM -05'00'
Company: Clemex
Department: Laboratory
User Name: Myriam Savard ...)
Sample ID: Sample 1

Magnification: 500xT
Calibration: 0.1455 $\mu\text{m}/\text{pixel}$
Units: microns
Fields: 1600
Total area (mic^2): 33775944.74

Figure 1: Fields showing the longest particle found



Count: 3818
Min: 1.05 microns
Max.: 35.37 microns
Mean: 20.25 microns
Std. Dev.: 12.02 microns
P10: 2.86 microns
P50: 24.92 microns
P90: 34.56 microns

Count: 3818
Min: 0.79 microns
Max.: 26.47 microns
Mean: 14.04 microns
Std. Dev.: 8.60 microns
P10: 2.21 microns
P50: 14.56 microns
P90: 22.15 microns

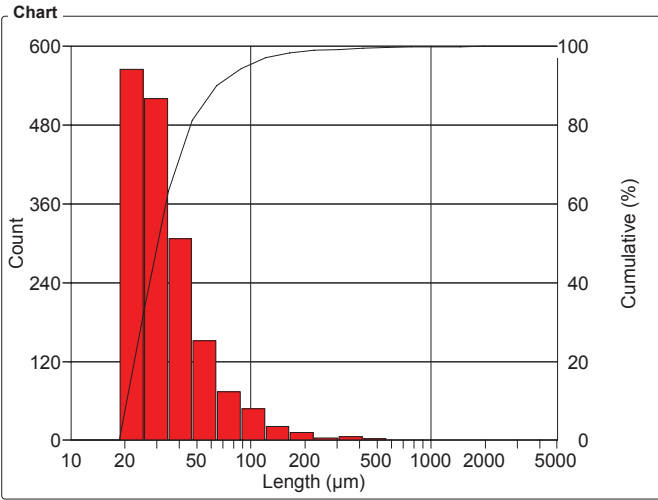
All printed results - 25x Magnification

Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:35 PM**
 Sample:

OBJM1 Count - Length

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



Values

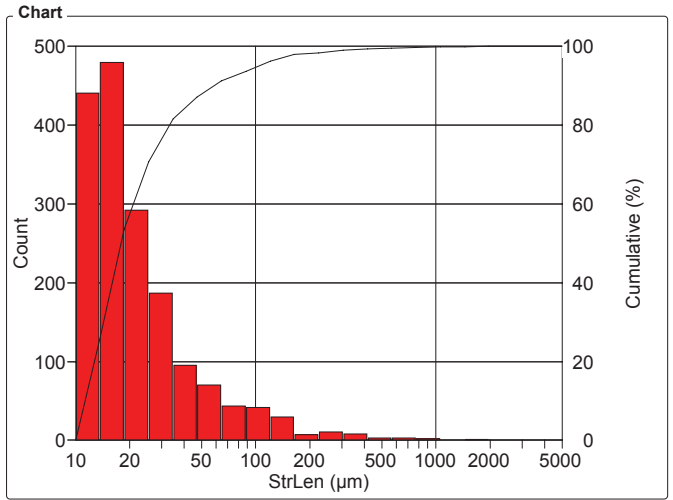
Length Intervals (µm)	Count	%	Cumul%
10 - 13.60	0	0	0
13.60 - 18.60	0	0	0
18.60 - 25.40	565	32.93	32.93
25.40 - 35	521	30.36	63.29
35 - 47	307	17.89	81.18
47 - 65	152	8.86	90.03
65 - 88	74	4.31	94.35
88 - 120	48	2.80	97.14
120 - 164	21	1.22	98.37
164 - 224	12	0.70	99.07
224 - 305	4	0.23	99.30
305 - 416	6	0.35	99.65
416 - 568	3	0.17	99.83
568 - 775	1	0.06	99.88
775 - 1057	1	0.06	99.94
1057 - 1443	0	0	99.94
1443 - 1968	1	0.06	100
1968 - 2686	0	0	100
2686 - 3665	0	0	100
3665 - 5000	0	0	100

Statistics

Minimum:	21.26	µm
Maximum:	1659.09	µm
Mean:	42.39	µm
Std Dev.:	60.70	µm
Sum:	72742.30	µm
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm ²
Total Area:	505.38e+06	µm ²
D10:	21.55	µm
D50:	29.72	µm
D90:	64.77	µm

OBJM1 Count - StrLen

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



Values

StrLen Intervals (µm)	Count	%	Cumul%
10 - 13.60	441	25.70	25.70
13.60 - 18.60	480	27.97	53.67
18.60 - 25.40	292	17.02	70.69
25.40 - 35	187	10.90	81.59
35 - 47	95	5.54	87.12
47 - 65	70	4.08	91.20
65 - 88	44	2.56	93.76
88 - 120	42	2.45	96.21
120 - 164	30	1.75	97.96
164 - 224	7	0.41	98.37
224 - 305	11	0.64	99.01
305 - 416	8	0.47	99.48
416 - 568	3	0.17	99.65
568 - 775	3	0.17	99.83
775 - 1057	2	0.12	99.94
1057 - 1443	0	0	99.94
1443 - 1968	1	0.06	100
1968 - 2686	0	0	100
2686 - 3665	0	0	100
3665 - 5000	0	0	100

Statistics

Minimum:	10.96	µm
Maximum:	1811.85	µm
Mean:	33.98	µm
Std Dev.:	72.98	µm
Sum:	58312.45	µm
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm ²
Total Area:	505.38e+06	µm ²
D10:	12.08	µm
D50:	17.73	µm
D90:	57.31	µm

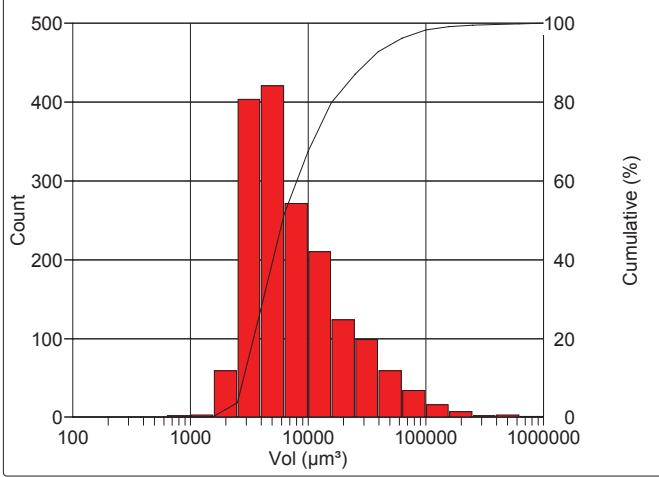
Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:35 PM**
 Sample:

OBJM1 Count - Vol

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2

Chart



Vol Intervals (µm³)	Count	%	Cumul%
100 - 158	0	0	0
158 - 251	0	0	0
251 - 398	0	0	0
398 - 631	0	0	0
631 - 1000	2	0.12	0.12
1000 - 1585	3	0.17	0.29
1585 - 2512	59	3.44	3.73
2512 - 3981	404	23.54	27.27
3981 - 6310	421	24.53	51.81
6310 - 10000	272	15.85	67.66
10000 - 15849	210	12.24	79.90
15849 - 25119	124	7.23	87.12
25119 - 39811	99	5.77	92.89
39811 - 63096	59	3.44	96.33
63096 - 100000	34	1.98	98.31
100000 - 158489	16	0.93	99.24
158489 - 251189	7	0.41	99.65
251189 - 398107	2	0.12	99.77
398107 - 630957	3	0.17	99.94
630957 - 1000000	1	0.06	100

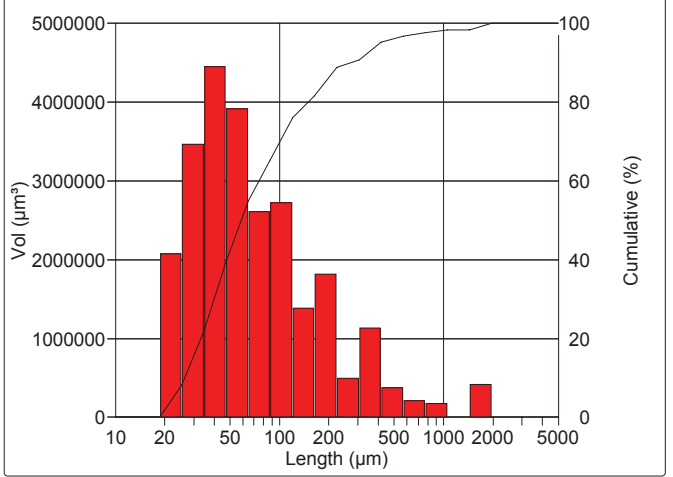
Statistics

Minimum: 996.24 µm³
 Maximum: 681268.13 µm³
 Mean: 14721.11 µm³
 Std Dev.: 33026.41 µm³
 Sum: 25.26e+06 µm³
 Count: 1716
 Under: 0
 Over: 0
 Accepted: 100 %
 Field Count: 63
 Field Area: 8021946.84 µm²
 Total Area: 505.38e+06 µm²
 D10: 3002.91 µm³
 D50: 6109.54 µm³
 D90: 29747.89 µm³

OBJM1 Vol - Length

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2

Chart



Length Intervals (µm)	Vol (µm³)	%	Cumul%
10 - 13.60	0	0	0
13.60 - 18.60	0	0	0
18.60 - 25.40	2078987.13	8.23	8.23
25.40 - 35	3464183.50	13.71	21.94
35 - 47	4447696.50	17.61	39.55
47 - 65	3914736	15.50	55.05
65 - 88	2611201.50	10.34	65.38
88 - 120	2723555.25	10.78	76.16
120 - 164	1388378.50	5.50	81.66
164 - 224	1814714	7.18	88.84
224 - 305	497623.38	1.97	90.81
305 - 416	1137518.63	4.50	95.32
416 - 568	373551.88	1.48	96.80
568 - 775	208224.45	0.82	97.62
775 - 1057	178383.41	0.71	98.33
1057 - 1443	0	0	98.33
1443 - 1968	422671.19	1.67	100
1968 - 2686	0	0	100
2686 - 3665	0	0	100
3665 - 5000	0	0	100

Statistics

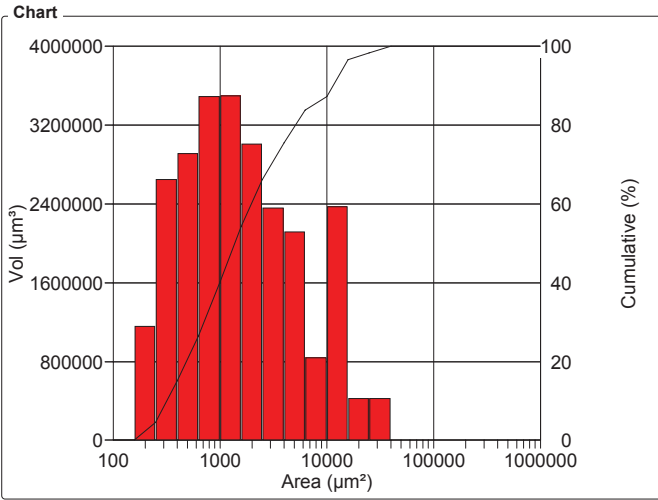
Minimum: 21.26 µm
 Maximum: 1659.09 µm
 Mean: 130.79 µm
 Std Dev.: 237.42 µm
 Sum: 3.30e+09 µm
 Count: 1716
 Under: 0
 Over: 0
 Accepted: 100 %
 Field Count: 63
 Field Area: 8021946.84 µm²
 Total Area: 505.38e+06 µm²
 D10: 26.01 µm
 D50: 57.71 µm
 D90: 236.42 µm

Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:35 PM**
 Sample:

OBJM1 Vol - Area

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



Values

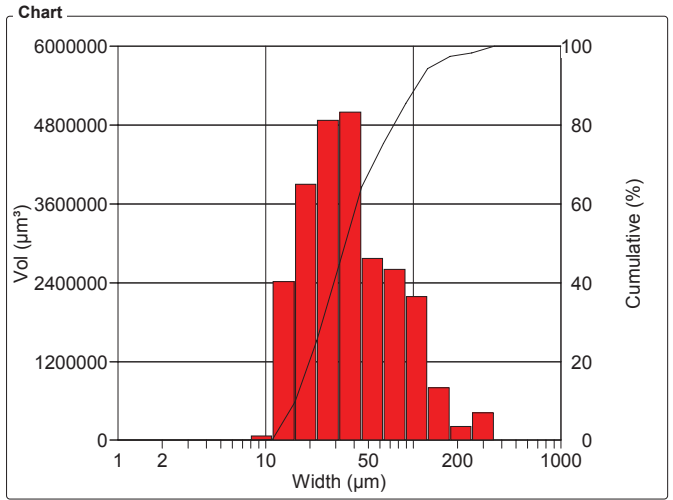
Area Intervals (µm²)	Vol (µm³)	%	Cumul%
100 - 158	1992.47	7.89e-03	7.89e-03
158 - 251	1157565.75	4.58	4.59
251 - 398	2648211	10.48	15.07
398 - 631	2910941.75	11.52	26.60
631 - 1000	3489598.75	13.81	40.41
1000 - 1585	3502077	13.86	54.27
1585 - 2512	3011803.75	11.92	66.20
2512 - 3981	2358133.25	9.33	75.53
3981 - 6310	2116146.25	8.38	83.91
6310 - 10000	840815.31	3.33	87.24
10000 - 15849	2376483.25	9.41	96.64
15849 - 25119	424985	1.68	98.33
25119 - 39811	422671.19	1.67	100
39811 - 63096	0	0	100
63096 - 100000	0	0	100
100000 - 158489	0	0	100
158489 - 251189	0	0	100
251189 - 398107	0	0	100
398107 - 630957	0	0	100
630957 - 1000000	0	0	100

Statistics

Minimum:	154.80	µm²
Maximum:	31226.08	µm²
Mean:	3596.68	µm²
Std Dev.:	5480.07	µm²
Sum:	90.86e+09	µm²
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm²
Total Area:	505.38e+06	µm²
D10:	314.36	µm²
D50:	1379.62	µm²
D90:	10700.82	µm²

OBJM1 Vol - Width

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



Values

Width Intervals (µm)	Vol (µm³)	%	Cumul%
1 - 1.41	0	0	0
1.41 - 2	0	0	0
2 - 2.80	0	0	0
2.80 - 4	0	0	0
4 - 5.60	0	0	0
5.60 - 7.90	0	0	0
7.90 - 11.20	67786.39	0.27	0.27
11.20 - 15.80	2418113.75	9.57	9.84
15.80 - 22.40	3899775.50	15.44	25.28
22.40 - 32	4876602	19.30	44.58
32 - 45	5000326.50	19.79	64.38
45 - 63	2769889	10.96	75.34
63 - 89	2605419.75	10.31	85.66
89 - 126	2192205.50	8.68	94.33
126 - 178	800414.75	3.17	97.50
178 - 251	208224.45	0.82	98.33
251 - 355	422671.19	1.67	100
355 - 501	0	0	100
501 - 708	0	0	100
708 - 1000	0	0	100

Statistics

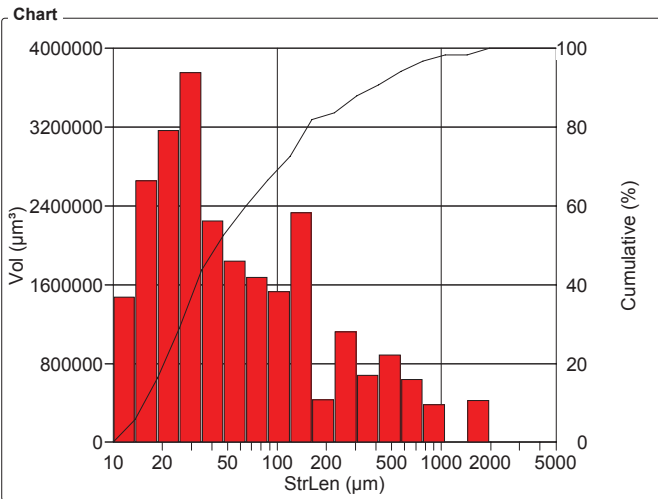
Minimum:	8.80	µm
Maximum:	325.51	µm
Mean:	51.39	µm
Std Dev.:	50.80	µm
Sum:	1.30e+09	µm
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm²
Total Area:	505.38e+06	µm²
D10:	15.98	µm
D50:	34.78	µm
D90:	105.91	µm

Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:35 PM**
 Sample:

OBJM1 Vol - StrLen

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2

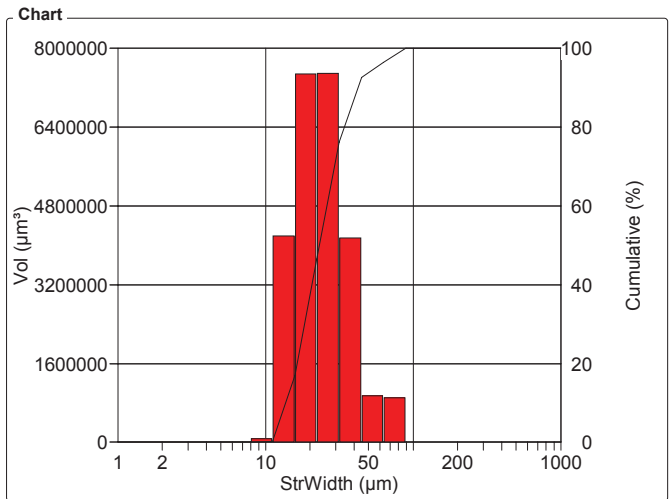


StrLen Intervals (µm)	Vol (µm³)	%	Cumul%
10 - 13.60	1473682.25	5.83	5.83
13.60 - 18.60	2654286.50	10.51	16.34
18.60 - 25.40	3170134.50	12.55	28.89
25.40 - 35	3757529.25	14.87	43.76
35 - 47	2248798.25	8.90	52.67
47 - 65	1843412.50	7.30	59.96
65 - 88	1677701.75	6.64	66.61
88 - 120	1530329.38	6.06	72.66
120 - 164	2334071.50	9.24	81.90
164 - 224	433998.44	1.72	83.62
224 - 305	1124997.13	4.45	88.07
305 - 416	679334.63	2.69	90.76
416 - 568	885897.63	3.51	94.27
568 - 775	637974.50	2.53	96.80
775 - 1057	386607.88	1.53	98.33
1057 - 1443	0	0	98.33
1443 - 1968	422671.19	1.67	100
1968 - 2686	0	0	100
2686 - 3665	0	0	100
3665 - 5000	0	0	100

Statistics	
Minimum:	10.96 µm
Maximum:	1811.85 µm
Mean:	143.01 µm
Std Dev.:	275.81 µm
Sum:	3.61e+09 µm
Count:	1716
Under:	0
Over:	0
Accepted:	100 %
Field Count:	63
Field Area:	8021946.84 µm²
Total Area:	505.38e+06 µm²
D10:	15.36 µm
D50:	42.28 µm
D90:	377.37 µm

OBJM1 Vol - StrWidth

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



StrWidth Intervals (µm)	Vol (µm³)	%	Cumul%
1 - 1.41	0	0	0
1.41 - 2	0	0	0
2 - 2.80	0	0	0
2.80 - 4	0	0	0
4 - 5.60	0	0	0
5.60 - 7.90	0	0	0
7.90 - 11.20	80588.88	0.32	0.32
11.20 - 15.80	4195594	16.61	16.93
15.80 - 22.40	7486342.50	29.64	46.56
22.40 - 32	7500626.50	29.69	76.26
32 - 45	4151528	16.43	92.69
45 - 63	945574.44	3.74	96.43
63 - 89	901177.88	3.57	100
89 - 126	0	0	100
126 - 178	0	0	100
178 - 251	0	0	100
251 - 355	0	0	100
355 - 501	0	0	100
501 - 708	0	0	100
708 - 1000	0	0	100

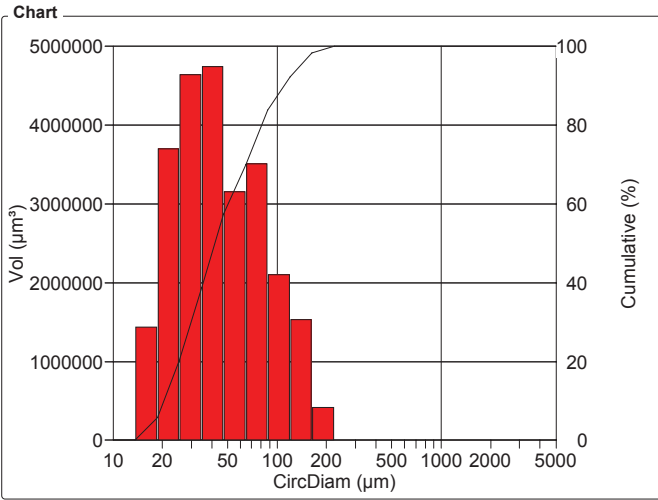
Statistics	
Minimum:	8.19 µm
Maximum:	77.00 µm
Mean:	26.52 µm
Std Dev.:	13.05 µm
Sum:	669.95e+06 µm
Count:	1716
Under:	0
Over:	0
Accepted:	100 %
Field Count:	63
Field Area:	8021946.84 µm²
Total Area:	505.38e+06 µm²
D10:	14.38 µm
D50:	23.67 µm
D90:	39.81 µm

Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:35 PM**
 Sample:

OBJM1 Vol - CircDiam

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2

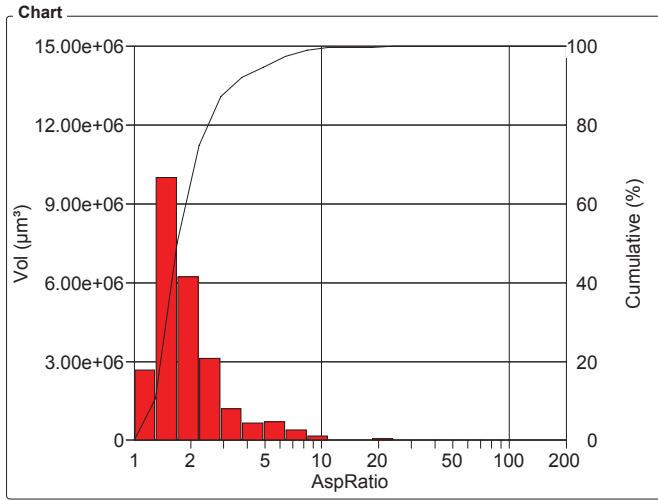


CircDiam Intervals (µm)	Vol (µm³)	%	Cumul%
10 - 13.60	0	0	0
13.60 - 18.60	1440369.75	5.70	5.70
18.60 - 25.40	3700901.25	14.65	20.35
25.40 - 35	4639207.50	18.36	38.72
35 - 47	4745455.50	18.79	57.50
47 - 65	3160004.75	12.51	70.01
65 - 88	3510531.50	13.90	83.91
88 - 120	2105355.50	8.33	92.24
120 - 164	1536928	6.08	98.33
164 - 224	422671.19	1.67	100
224 - 305	0	0	100
305 - 416	0	0	100
416 - 568	0	0	100
568 - 775	0	0	100
775 - 1057	0	0	100
1057 - 1443	0	0	100
1443 - 1968	0	0	100
1968 - 2686	0	0	100
2686 - 3665	0	0	100
3665 - 5000	0	0	100

Statistics		
Minimum:	14.04	µm
Maximum:	199.39	µm
Mean:	55.37	µm
Std Dev.:	38.97	µm
Sum:	1.40e+09	µm
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm²
Total Area:	505.38e+06	µm²
D10:	20.01	µm
D50:	41.91	µm
D90:	116.72	µm

OBJM1 Vol - AspRatio

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2



AspRatio Intervals	Vol (µm³)	%	Cumul%
1 - 1.30	2668828.50	10.56	10.56
1.30 - 1.70	10.01e+06	39.63	50.20
1.70 - 2.21	6240329.50	24.70	74.90
2.21 - 2.89	3126120.25	12.38	87.27
2.89 - 3.80	1211000.38	4.79	92.07
3.80 - 4.90	652201.81	2.58	94.65
4.90 - 6.40	718251.19	2.84	97.49
6.40 - 8.30	412706.53	1.63	99.13
8.30 - 10.90	167557.67	0.66	99.79
10.90 - 14.10	0	0	99.79
14.10 - 18.40	0	0	99.79
18.40 - 24	52829.22	0.21	100
24 - 31.30	0	0	100
31.30 - 41	0	0	100
41 - 53	0	0	100
53 - 69	0	0	100
69 - 90	0	0	100
90 - 118	0	0	100
118 - 153	0	0	100
153 - 200	0	0	100

Statistics		
Minimum:	1.09	
Maximum:	18.86	
Mean:	2.14	
Std Dev.:	1.46	
Count:	1716	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	63	
Field Area:	8021946.84	µm²
Total Area:	505.38e+06	µm²
D10:	1.29	
D50:	1.70	
D90:	3.38	

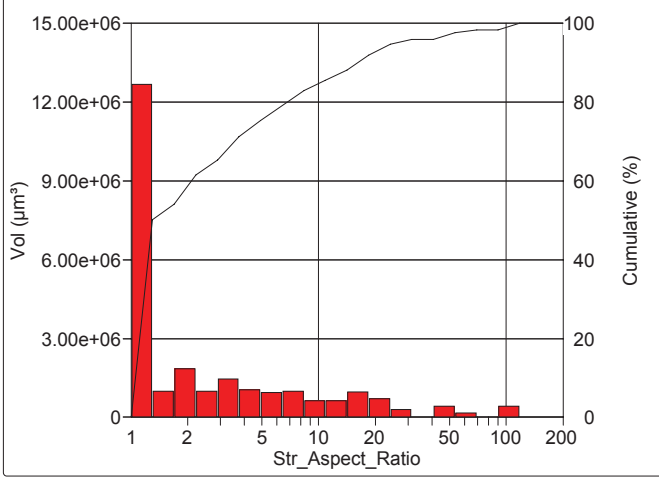
Organization: **Clemex**
 Department:
 User:

Date & Time: **16/11/2007 17:40:36 PM**
 Sample:

OBJM1 Vol - Str_Aspect_Ratio

Magn.: 25xT Calib.: 2.9326 µm/pixel Bitplane: Bitplane 2

Chart



Values

Str_Aspect_Ratio Intervals	Vol (µm³)	%	Cumul%
1 - 1.30	12.69e+06	50.24	50.24
1.30 - 1.70	993865.56	3.93	54.18
1.70 - 2.21	1850835.25	7.33	61.51
2.21 - 2.89	992504.13	3.93	65.43
2.89 - 3.80	1465959.38	5.80	71.24
3.80 - 4.90	1043543.19	4.13	75.37
4.90 - 6.40	950868.94	3.76	79.13
6.40 - 8.30	984567	3.90	83.03
8.30 - 10.90	643568.25	2.55	85.58
10.90 - 14.10	637725.88	2.52	88.10
14.10 - 18.40	968223.88	3.83	91.94
18.40 - 24	719465	2.85	94.78
24 - 31.30	295545.78	1.17	95.95
31.30 - 41	0	0	95.95
41 - 53	421213.94	1.67	97.62
53 - 69	178383.41	0.71	98.33
69 - 90	0	0	98.33
90 - 118	422671.19	1.67	100
118 - 153	0	0	100
153 - 200	0	0	100

Statistics

Minimum:	1
Maximum:	105.13
Mean:	6.77
Std Dev.:	15.82
Count:	1716
Under:	0
Over:	0
Accepted:	100 %
Field Count:	63
Field Area:	8021946.84 µm²
Total Area:	505.38e+06 µm²
D10:	1
D50:	1.27
D90:	16.12

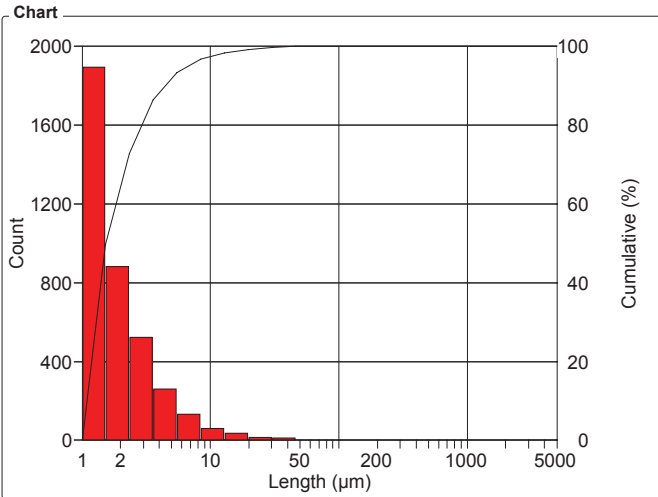
All printed results - 500x Magnification

Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:26 PM**
 Sample:

OBJM1 Count - Length

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2

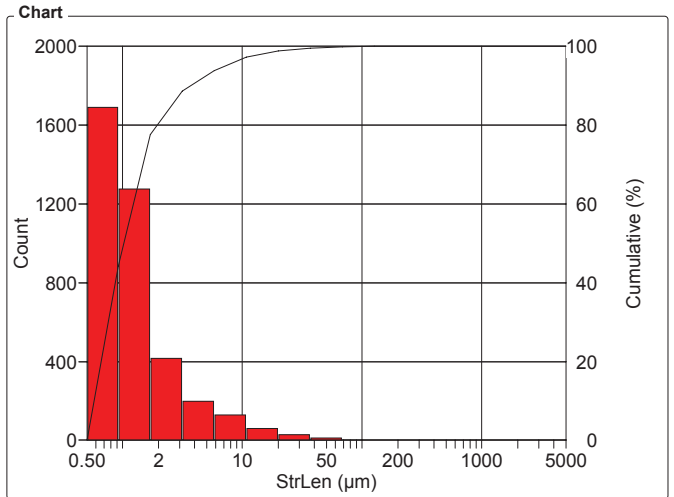


Length Intervals (µm)	Count	%	Cumul%
1 - 1.53	1896	49.66	49.66
1.53 - 2.30	884	23.15	72.81
2.30 - 3.60	523	13.70	86.51
3.60 - 5.50	260	6.81	93.32
5.50 - 8.40	132	3.46	96.78
8.40 - 12.90	59	1.55	98.32
12.90 - 20	36	0.94	99.27
20 - 30	17	0.45	99.71
30 - 46	11	0.29	100
46 - 71	0	0	100
71 - 108	0	0	100
108 - 166	0	0	100
166 - 254	0	0	100
254 - 388	0	0	100
388 - 595	0	0	100
595 - 910	0	0	100
910 - 1394	0	0	100
1394 - 2133	0	0	100
2133 - 3266	0	0	100
3266 - 5000	0	0	100

Statistics	
Minimum:	1.05 µm
Maximum:	35.37 µm
Mean:	2.49 µm
Std Dev.:	3.07 µm
Sum:	9511.52 µm
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm ²
Total Area:	33.78e+06 µm ²
D10:	1.10 µm
D50:	1.53 µm
D90:	4.32 µm

OBJM1 Count - StrLen

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



StrLen Intervals (µm)	Count	%	Cumul%
0.50 - 0.92	1691	44.29	44.29
0.92 - 1.70	1275	33.39	77.68
1.70 - 3.20	417	10.92	88.61
3.20 - 5.80	200	5.24	93.84
5.80 - 10.80	130	3.40	97.25
10.80 - 20	59	1.55	98.80
20 - 37	31	0.81	99.61
37 - 68	13	0.34	99.95
68 - 126	2	0.05	100
126 - 232	0	0	100
232 - 429	0	0	100
429 - 792	0	0	100
792 - 1464	0	0	100
1464 - 2706	0	0	100
2706 - 5000	0	0	100

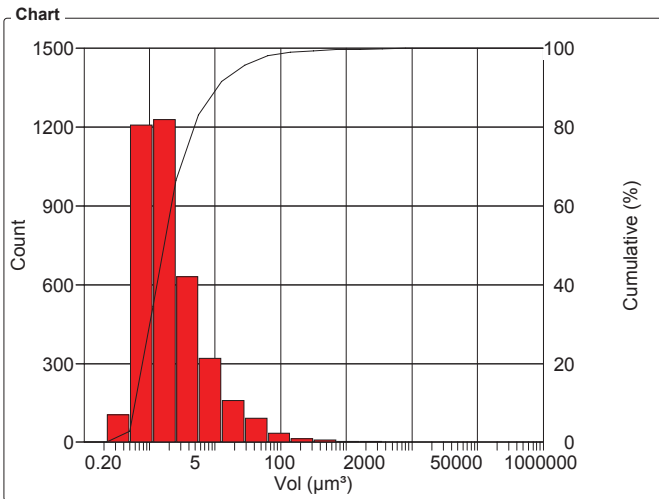
Statistics	
Minimum:	0.57 µm
Maximum:	85.81 µm
Mean:	2.11 µm
Std Dev.:	4.47 µm
Sum:	8054.48 µm
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm ²
Total Area:	33.78e+06 µm ²
D10:	0.69 µm
D50:	0.98 µm
D90:	3.69 µm

Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:26 PM**
 Sample:

OBJM1 Count - Vol

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2

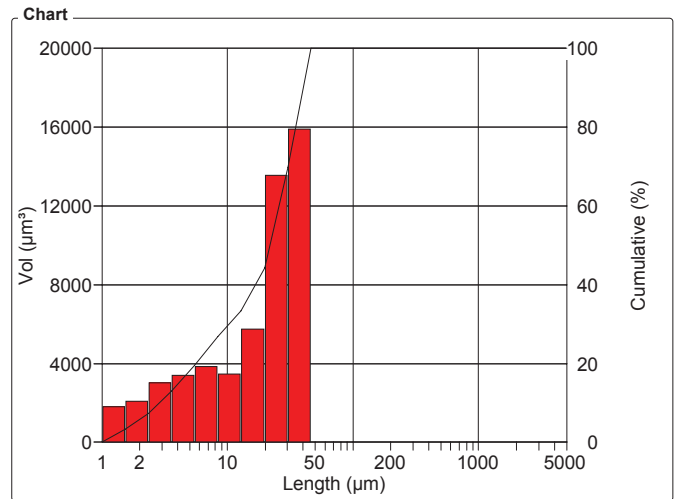


Vol Intervals (µm³)	Count	%	Cumul%
0.10 - 0.22	0	0	0
0.22 - 0.50	106	2.78	2.78
0.50 - 1.10	1209	31.67	34.44
1.10 - 2.50	1229	32.19	66.63
2.50 - 5.60	630	16.50	83.13
5.60 - 13	321	8.41	91.54
13 - 28	160	4.19	95.73
28 - 63	93	2.44	98.17
63 - 141	36	0.94	99.11
141 - 316	14	0.37	99.48
316 - 708	9	0.24	99.71
708 - 1585	4	0.10	99.82
1585 - 3548	5	0.13	99.95
3548 - 7943	2	0.05	100
7943 - 17783	0	0	100
17783 - 39811	0	0	100
39811 - 89125	0	0	100
89125 - 199526	0	0	100
199526 - 446684	0	0	100
446684 - 1000000	0	0	100

Statistics	
Minimum:	0.27 µm³
Maximum:	5893.38 µm³
Mean:	13.86 µm³
Std Dev.:	160.53 µm³
Sum:	52908.02 µm³
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm²
Total Area:	33.78e+06 µm²
D10:	0.62 µm³
D50:	1.52 µm³
D90:	10.59 µm³

OBJM1 Vol - Length

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



Length Intervals (µm)	Vol (µm³)	%	Cumul%
1 - 1.53	1814.41	3.43	3.43
1.53 - 2.30	2102.83	3.97	7.40
2.30 - 3.60	3011.40	5.69	13.10
3.60 - 5.50	3406.52	6.44	19.53
5.50 - 8.40	3859.06	7.29	26.83
8.40 - 12.90	3480.38	6.58	33.41
12.90 - 20	5754.67	10.88	44.28
20 - 30	13563.94	25.64	69.92
30 - 46	15914.80	30.08	100
46 - 71	0	0	100
71 - 108	0	0	100
108 - 166	0	0	100
166 - 254	0	0	100
254 - 388	0	0	100
388 - 595	0	0	100
595 - 910	0	0	100
910 - 1394	0	0	100
1394 - 2133	0	0	100
2133 - 3266	0	0	100
3266 - 5000	0	0	100

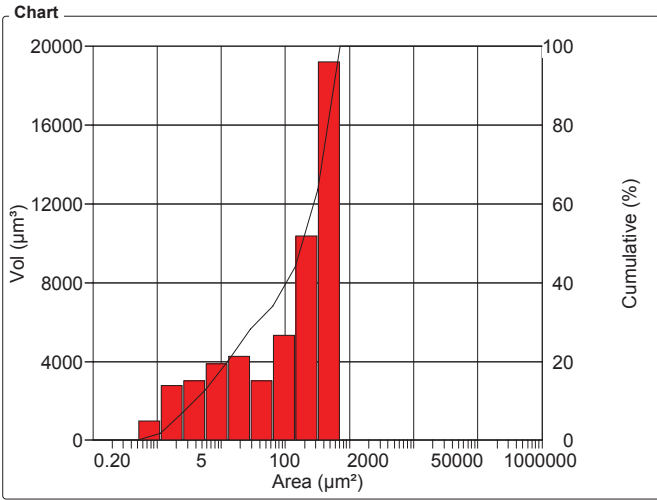
Statistics	
Minimum:	1.05 µm
Maximum:	35.37 µm
Mean:	20.25 µm
Std Dev.:	12.02 µm
Sum:	1071632.96 µm
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm²
Total Area:	33.78e+06 µm²
D10:	2.86 µm
D50:	24.92 µm
D90:	34.56 µm

Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:27 PM**
 Sample:

OBJM1 Vol - Area

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2

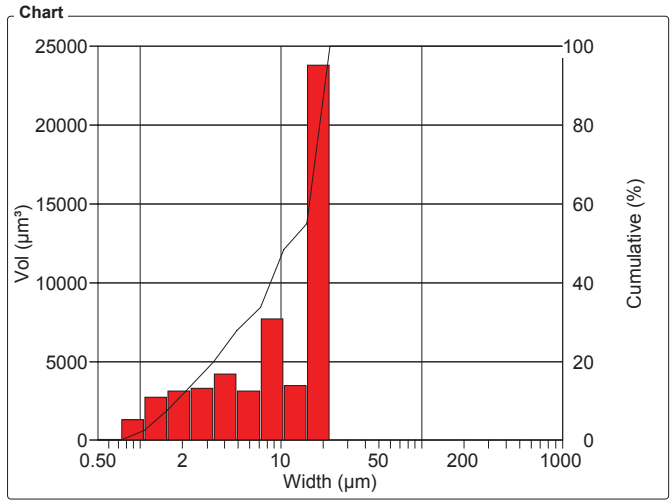


Area Intervals (µm²)	Vol (µm³)	%	Cumul%
0.10 - 0.22	0	0	0
0.22 - 0.50	0.55	1.03e-03	1.03e-03
0.50 - 1.10	987.90	1.87	1.87
1.10 - 2.50	2787.22	5.27	7.14
2.50 - 5.60	3021.76	5.71	12.85
5.60 - 13	3891.94	7.36	20.20
13 - 28	4278.20	8.09	28.29
28 - 63	3038.72	5.74	34.03
63 - 141	5330.40	10.07	44.11
141 - 316	10364.24	19.59	63.70
316 - 708	19207.08	36.30	100
708 - 1585	0	0	100
1585 - 3548	0	0	100
3548 - 7943	0	0	100
7943 - 17783	0	0	100
17783 - 39811	0	0	100
39811 - 89125	0	0	100
89125 - 199526	0	0	100
199526 - 446684	0	0	100
446684 - 1000000	0	0	100

Statistics	
Minimum:	0.49 µm²
Maximum:	550.48 µm²
Mean:	210.90 µm²
Std Dev.:	185.71 µm²
Sum:	11.16e+06 µm²
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm²
Total Area:	33.78e+06 µm²
D10:	3.83 µm²
D50:	166.56 µm²
D90:	386.90 µm²

OBJM1 Vol - Width

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



Width Intervals (µm)	Vol (µm³)	%	Cumul%
0.50 - 0.73	73.46	0.14	0.14
0.73 - 1.07	1295.45	2.45	2.59
1.07 - 1.56	2735.65	5.17	7.76
1.56 - 2.30	3140.88	5.94	13.69
2.30 - 3.30	3324.45	6.28	19.98
3.30 - 4.90	4191.55	7.92	27.90
4.90 - 7.20	3135.35	5.93	33.83
7.20 - 10.50	7715.73	14.58	48.41
10.50 - 15.30	3496.74	6.61	55.02
15.30 - 22	23798.74	44.98	100
22 - 33	0	0	100
33 - 48	0	0	100
48 - 70	0	0	100
70 - 102	0	0	100
102 - 150	0	0	100
150 - 219	0	0	100
219 - 320	0	0	100
320 - 468	0	0	100
468 - 684	0	0	100
684 - 1000	0	0	100

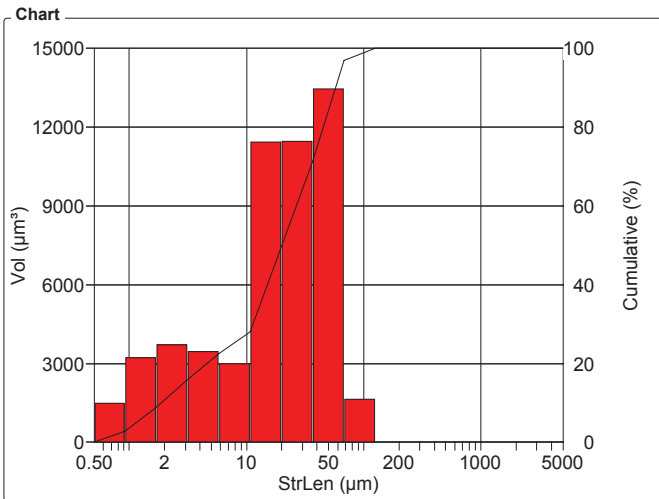
Statistics	
Minimum:	0.58 µm
Maximum:	21.64 µm
Mean:	11.91 µm
Std Dev.:	7.50 µm
Sum:	630017.16 µm
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm²
Total Area:	33.78e+06 µm²
D10:	1.76 µm
D50:	11.47 µm
D90:	20.50 µm

Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:27 PM**
 Sample:

OBJM1 Vol - StrLen

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



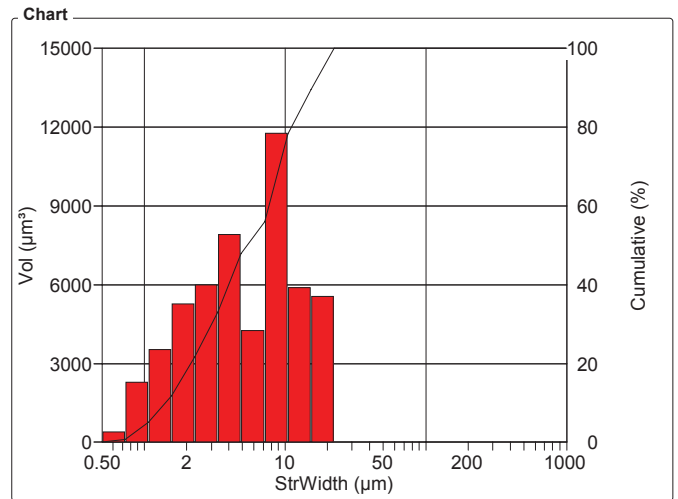
StrLen Intervals (µm)	Vol (µm³)	%	Cumul%
0.50 - 0.92	1490.36	2.82	2.82
0.92 - 1.70	3213.67	6.07	8.89
1.70 - 3.20	3727.15	7.04	15.94
3.20 - 5.80	3465.67	6.55	22.49
5.80 - 10.80	2992.54	5.66	28.14
10.80 - 20	11442.76	21.63	49.77
20 - 37	11464.04	21.67	71.44
37 - 68	13468.28	25.46	96.89
68 - 126	1643.53	3.11	100
126 - 232	0	0	100
232 - 429	0	0	100
429 - 792	0	0	100
792 - 1464	0	0	100
1464 - 2706	0	0	100
2706 - 5000	0	0	100

Statistics

Minimum:	0.57	µm
Maximum:	85.81	µm
Mean:	25.26	µm
Std Dev.:	19.41	µm
Sum:	1336610.21	µm
Count:	3818	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	1600	
Field Area:	21109.97	µm²
Total Area:	33.78e+06	µm²
D10:	1.87	µm
D50:	20.73	µm
D90:	46.41	µm

OBJM1 Vol - StrWidth

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



StrWidth Intervals (µm)	Vol (µm³)	%	Cumul%
0.50 - 0.73	389.04	0.74	0.74
0.73 - 1.07	2291.43	4.33	5.07
1.07 - 1.56	3539.62	6.69	11.76
1.56 - 2.30	5269.28	9.96	21.72
2.30 - 3.30	6005.30	11.35	33.07
3.30 - 4.90	7908.46	14.95	48.01
4.90 - 7.20	4265.66	8.06	56.08
7.20 - 10.50	11777.60	22.26	78.34
10.50 - 15.30	5893.38	11.14	89.48
15.30 - 22	5568.24	10.52	100
22 - 33	0	0	100
33 - 48	0	0	100
48 - 70	0	0	100
70 - 102	0	0	100
102 - 150	0	0	100
150 - 219	0	0	100
219 - 320	0	0	100
320 - 468	0	0	100
468 - 684	0	0	100
684 - 1000	0	0	100

Statistics

Minimum:	0.57	µm
Maximum:	17.86	µm
Mean:	7.14	µm
Std Dev.:	5.43	µm
Sum:	377547.40	µm
Count:	3818	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	1600	
Field Area:	21109.97	µm²
Total Area:	33.78e+06	µm²
D10:	1.42	µm
D50:	5.39	µm
D90:	13.84	µm

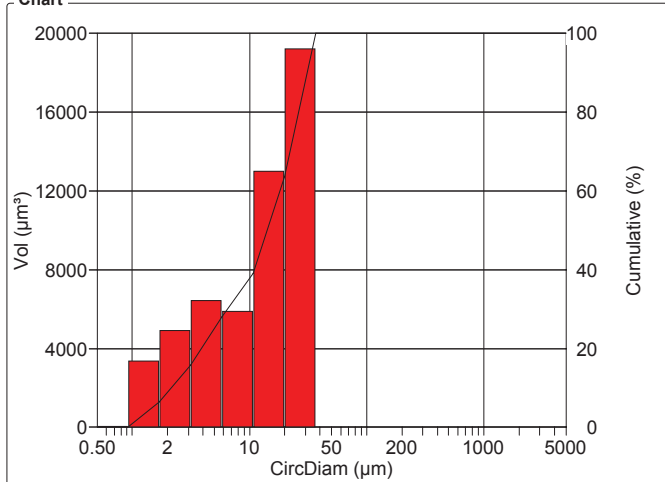
Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:27 PM**
 Sample:

OBJM1 Vol - CircDiam

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2

Chart



Values

CircDiam Intervals (µm)	Vol (µm³)	%	Cumul%
0.50 - 0.92	55.92	0.11	0.11
0.92 - 1.70	3378.37	6.39	6.49
1.70 - 3.20	4930.85	9.32	15.81
3.20 - 5.80	6439.23	12.17	27.98
5.80 - 10.80	5885.90	11.12	39.11
10.80 - 20	13010.67	24.59	63.70
20 - 37	19207.08	36.30	100
37 - 68	0	0	100
68 - 126	0	0	100
126 - 232	0	0	100
232 - 429	0	0	100
429 - 792	0	0	100
792 - 1464	0	0	100
1464 - 2706	0	0	100
2706 - 5000	0	0	100

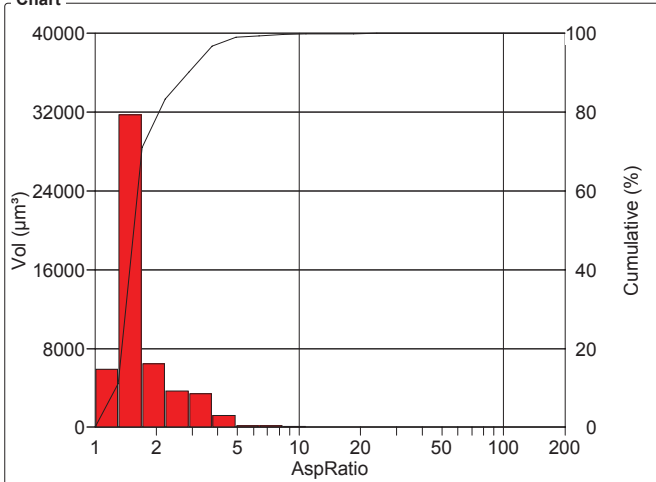
Statistics

Minimum:	0.79	µm
Maximum:	26.47	µm
Mean:	14.04	µm
Std Dev.:	8.60	µm
Sum:	743083.21	µm
Count:	3818	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	1600	
Field Area:	21109.97	µm²
Total Area:	33.78e+06	µm²
D10:	2.21	µm
D50:	14.56	µm
D90:	22.15	µm

OBJM1 Vol - AspRatio

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2

Chart



Values

AspRatio Intervals	Vol (µm³)	%	Cumul%
1 - 1.30	5880.70	11.11	11.11
1.30 - 1.70	31759.54	60.03	71.14
1.70 - 2.21	6430.02	12.15	83.30
2.21 - 2.89	3717.05	7.03	90.32
2.89 - 3.80	3399.95	6.43	96.75
3.80 - 4.90	1226.17	2.32	99.07
4.90 - 6.40	185.73	0.35	99.42
6.40 - 8.30	141.26	0.27	99.68
8.30 - 10.90	111.87	0.21	99.89
10.90 - 14.10	32.65	0.06	99.96
14.10 - 18.40	9.61	0.02	99.97
18.40 - 24	13.48	0.03	100
24 - 31.30	0	0	100
31.30 - 41	0	0	100
41 - 53	0	0	100
53 - 69	0	0	100
69 - 90	0	0	100
90 - 118	0	0	100
118 - 153	0	0	100
153 - 200	0	0	100

Statistics

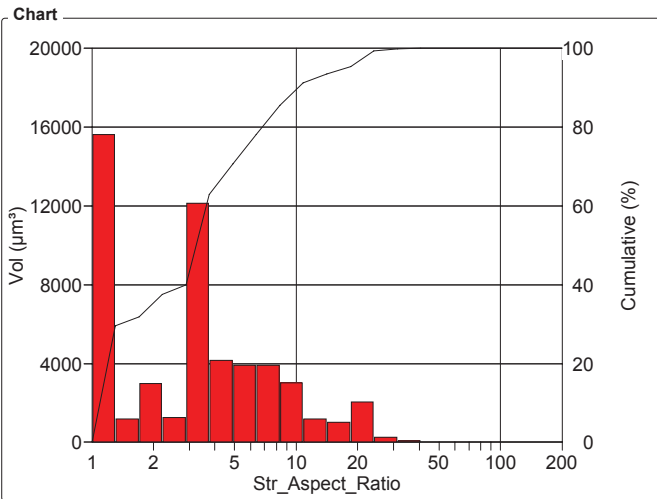
Minimum:	1.04	
Maximum:	20.84	
Mean:	1.84	
Std Dev.:	0.975	
Count:	3818	
Under:	0	
Over:	0	
Accepted:	100	%
Field Count:	1600	
Field Area:	21109.97	µm²
Total Area:	33.78e+06	µm²
D10:	1.27	
D50:	1.65	
D90:	2.81	

Organization: **Clemex**
 Department:
 User: **Myriam Savard**

Date & Time: **16/11/2007 17:48:27 PM**
 Sample:

OBJM1 Vol - Str_Aspect_Ratio

Magn.: 500xT Calib.: 0.1455 µm/pixel Bitplane: Bitplane 2



Values

Str_Aspect_Ratio Intervals	Vol (µm³)	%	Cumul%
1 - 1.30	15635.26	29.55	29.55
1.30 - 1.70	1204.99	2.28	31.83
1.70 - 2.21	3004.16	5.68	37.51
2.21 - 2.89	1265.30	2.39	39.90
2.89 - 3.80	12155.01	22.97	62.87
3.80 - 4.90	4168.05	7.88	70.75
4.90 - 6.40	3912.31	7.39	78.15
6.40 - 8.30	3933.66	7.43	85.58
8.30 - 10.90	3033.29	5.73	91.31
10.90 - 14.10	1178.11	2.23	93.54
14.10 - 18.40	1017.57	1.92	95.46
18.40 - 24	2054.82	3.88	99.35
24 - 31.30	262.01	0.50	99.84
31.30 - 41	83.45	0.16	100
41 - 53	0	0	100
53 - 69	0	0	100
69 - 90	0	0	100
90 - 118	0	0	100
118 - 153	0	0	100
153 - 200	0	0	100

Statistics

Minimum:	1
Maximum:	39.45
Mean:	4.70
Std Dev.:	5.27
Count:	3818
Under:	0
Over:	0
Accepted:	100 %
Field Count:	1600
Field Area:	21109.97 µm²
Total Area:	33.78e+06 µm²
D10:	1
D50:	2.96
D90:	9.53

CLEMEX

intelligent microscopy