

## Fwd: Freezing and coating

Please see email from Dr Smith which proves to him that our Nanobubble count is real and does not include other particles.

Begin forwarded message:

From: Steve Ward-Smith  
Subject: Freezing and coating  
Date: 16 March 2018 at 14:42:00 GMT

Dear Tony,

We froze then defrosted some of the water we generated. Counts then back to similar levels as the blank, so killed all the bubbles. This proves to any doubters that it is indeed bubbles not any other particulate contamination.

Have you any ideas on easy ways to generate coated bubbles? We have another technology for bubble measurement but have a suspicion it works best when bubbles are coated.

Was thinking generation in soapy water, but would that form a foam? Or a protein solution?

All ideas welcome..

Regards,  
Steve

Stephen Ward-Smith  
Key Account Manager



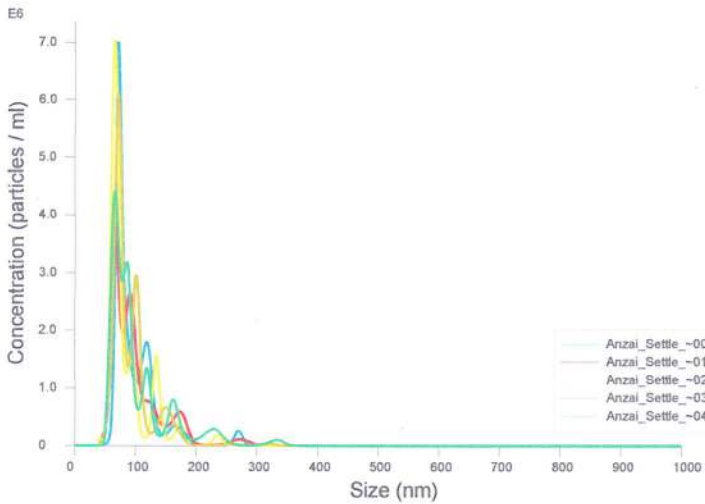
Tel +44(1684)892456  
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Malvern Panalytical Ltd  
Groewood Rd  
Malvern Worcestershire WR14 1XZ  
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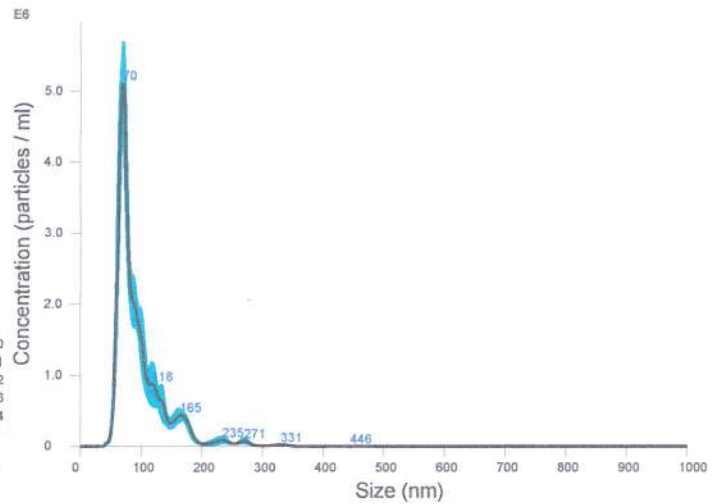
[www.malvernPanalytical.com](http://www.malvernPanalytical.com)

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FTLA Concentration / Size graph for Experiment:  
Anzai\_Settle\_time\_



Averaged FTLA Concentration / Size for Experiment:  
Anzai\_Settle\_time\_  
Error bars indicate + / -1 standard error of the mean

### Included Files

Anzai\_Settle\_time\_00  
Anzai\_Settle\_time\_01  
Anzai\_Settle\_time\_02  
Anzai\_Settle\_time\_03  
Anzai\_Settle\_time\_04

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
Script Used: SOP Standard Measurement 12-36-44PM 09~  
Time Captured: 13:03:23 09/03/2018  
Operator:  
Pre-treatment:  
Sample Name:  
Diluent:  
Remarks:

### Capture Settings

Camera Type: sCMOS  
Laser Type: Blue405  
Camera Level: Manual settings used  
Slider Shutter: 1300  
Slider Gain: 512  
FPS: 25.0  
Number of Frames: 2248  
Temperature: 23.5 - 23.7 °C  
Viscosity: (Water) 0.915 - 0.919 cP  
Dilution factor: Dilution not recorded  
Syringe Pump Speed: 80

### Analysis Settings

Detect Threshold: 6  
Blur Size: Auto  
Max Jump Distance: Auto: 14.3 - 16.0 pix

### Results

Stats: Merged Data

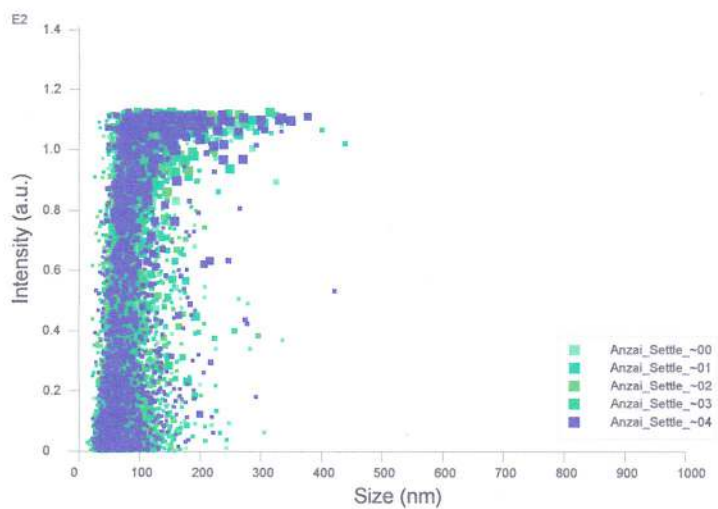
Mean: 96.3 nm  
Mode: 69.5 nm  
SD: 42.3 nm  
D10: 61.9 nm  
D50: 80.4 nm  
D90: 151.4 nm

Stats: Mean +/- Standard Error

Mean: 96.2 +/- 2.8 nm  
Mode: 68.4 +/- 1.4 nm  
SD: 41.1 +/- 3.5 nm  
D10: 62.5 +/- 1.4 nm  
D50: 80.4 +/- 2.6 nm  
D90: 149.4 +/- 7.2 nm

Concentration (Upgrade): 1.87e+008 +/- 3.76e+006 particles/ml  
22.6 +/- 0.6 particles/frame  
28.2 +/- 1.1 centres/frame

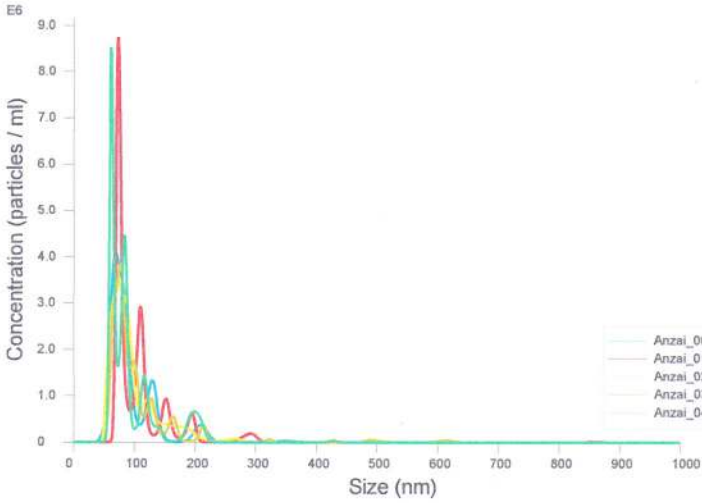
Concentration measurements may require some caution due to noise  
See summary file for more info



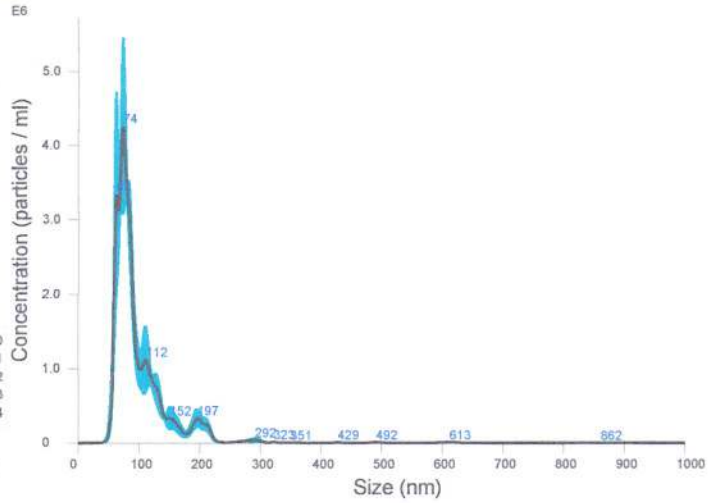
Intensity / Size graph for Experiment:  
Anzai\_Settle\_time\_

**Script Used: (Full Text):**

SOP Standard Measurement 12-36-44PM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Anzai\_



Averaged FTLA Concentration / Size for Experiment:  
Anzai\_  
Error bars indicate +/- 1 standard error of the mean

### Included Files

Anzai\_00  
Anzai\_01  
Anzai\_02  
Anzai\_03  
Anzai\_04

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
Script Used: SOP Standard Measurement 12-36-44PM 09~  
Time Captured: 12:36:54 09/03/2018  
Operator:  
Pre-treatment:  
Sample Name:  
Diluent:  
Remarks:

### Capture Settings

Camera Type: sCMOS  
Laser Type: Blue405  
Camera Level: Manual settings used  
Slider Shutter: 1300  
Slider Gain: 512  
FPS: 25.0  
Number of Frames: 2248  
Temperature: 22.7 - 23.2 °C  
Viscosity: (Water) 0.926 - 0.938 cP  
Dilution factor: Dilution not recorded  
Syringe Pump Speed: 80

### Analysis Settings

Detect Threshold: 6  
Blur Size: Auto  
Max Jump Distance: Auto: 12.8 - 16.0 pix

### Results

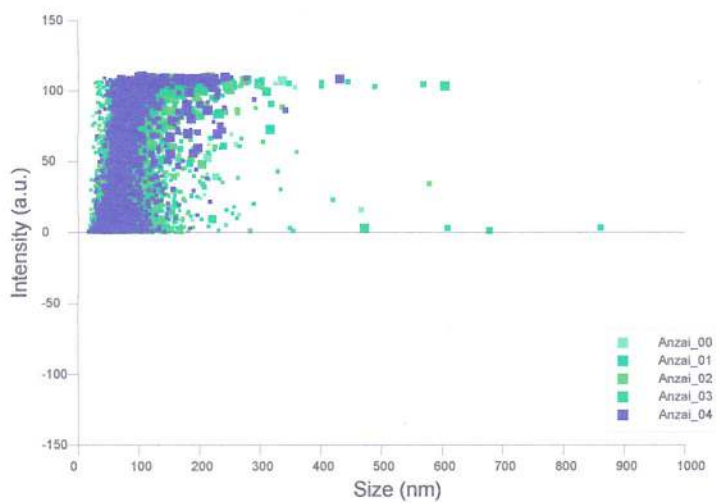
Stats: Merged Data

Mean: 99.1 nm  
Mode: 73.4 nm  
SD: 51.8 nm  
D10: 61.6 nm  
D50: 81.4 nm  
D90: 154.1 nm

Stats: Mean +/- Standard Error

Mean: 99.2 +/- 2.6 nm  
Mode: 70.7 +/- 2.6 nm  
SD: 51.0 +/- 4.8 nm  
D10: 62.8 +/- 1.9 nm  
D50: 81.8 +/- 0.9 nm  
D90: 157.6 +/- 7.6 nm  
Concentration (Upgrade): 1.80e+008 +/- 4.51e+006 particles/ml  
21.9 +/- 0.5 particles/frame  
27.8 +/- 0.4 centres/frame

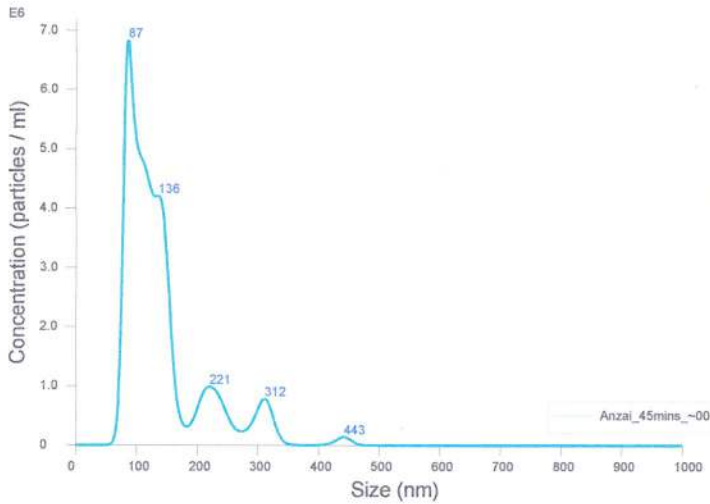
Concentration measurements may require some caution due to noise  
See summary file for more info



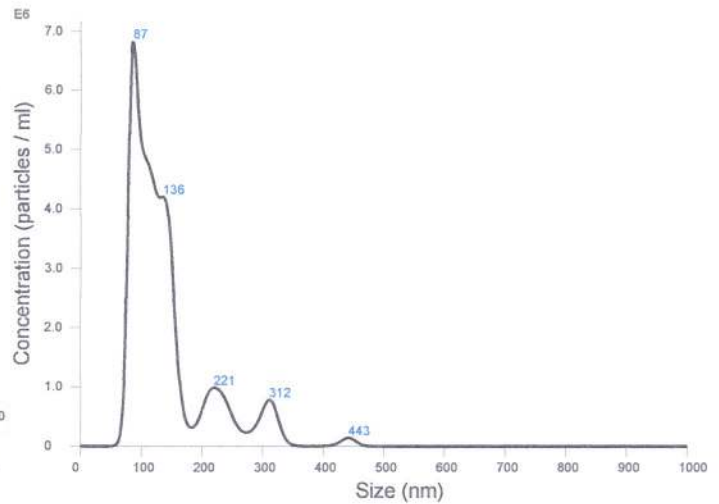
Intensity / Size graph for Experiment:  
Anzai\_

**Script Used: (Full Text):**

SOP Standard Measurement 12-36-44PM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Anzai\_45mins\_00



Averaged FTLA Concentration / Size for Experiment:  
Anzai\_45mins\_00  
Error bars indicate + / -1 standard error of the mean

### Included Files

Anzai\_45mins\_00

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
 Script Used: SOP Standard Measurement 02-14-44PM 09~  
 Time Captured: 14:15:31 09/03/2018  
 Operator:  
 Pre-treatment:  
 Sample Name:  
 Diluent:  
 Remarks:

### Capture Settings

Camera Type: sCMOS  
 Laser Type: Blue405  
 Camera Level: 14  
 Slider Shutter: 1259  
 Slider Gain: 366  
 FPS: 25.0  
 Number of Frames: 1498  
 Temperature: 23.1 °C  
 Viscosity: (Water) 0.9 cP  
 Dilution factor: Dilution not recorded  
 Syringe Pump Speed: 80

### Analysis Settings

Detect Threshold: 6  
 Blur Size: Auto  
 Max Jump Distance: Auto: 12.7 pix

### Results

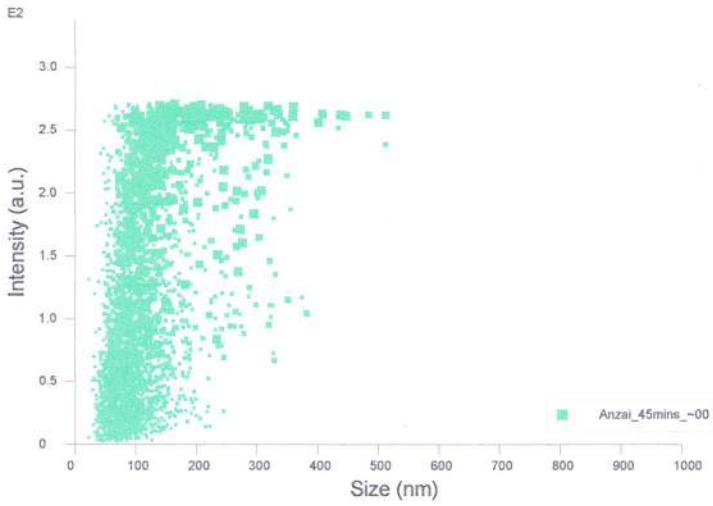
Stats: Merged Data

Mean: 141.3 nm  
 Mode: 86.2 nm  
 SD: 68.0 nm  
 D10: 82.4 nm  
 D50: 119.6 nm  
 D90: 239.3 nm

Stats: Mean +/- Standard Error

Mean: 141.3 +/- 0.0 nm  
 Mode: 86.2 +/- 0.0 nm  
 SD: 68.0 +/- 0.0 nm  
 D10: 82.4 +/- 0.0 nm  
 D50: 119.6 +/- 0.0 nm  
 D90: 239.3 +/- 0.0 nm

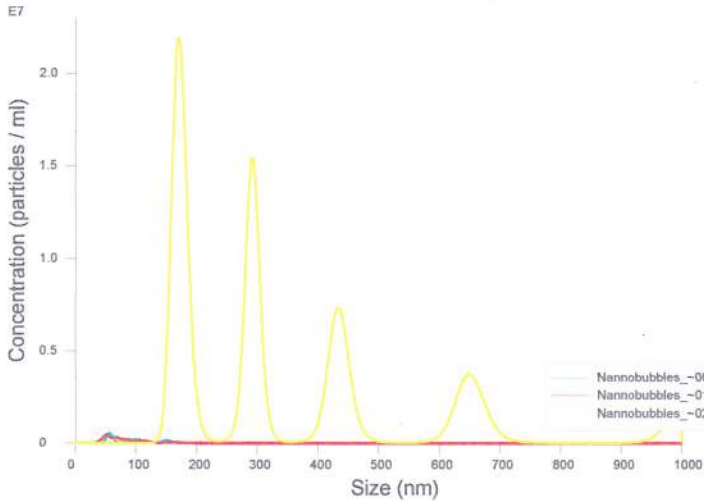
Concentration (Upgrade): 4.99e+008 +/- 0.00e+000 particles/ml  
 60.7 +/- 0.0 particles/frame  
 63.7 +/- 0.0 centres/frame



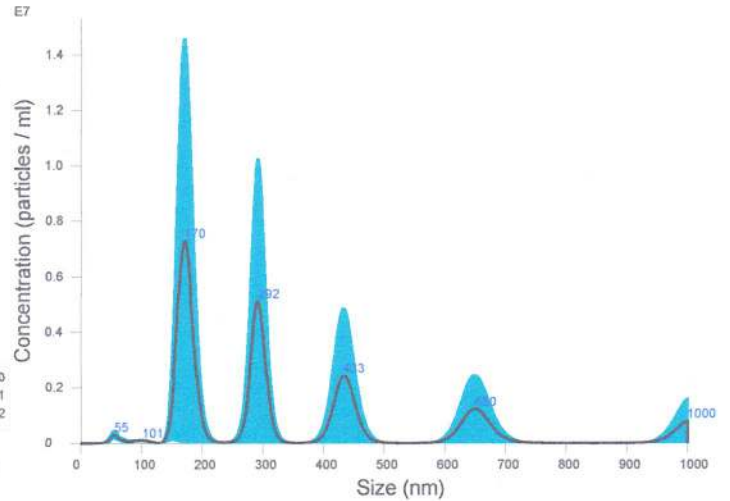
Intensity / Size graph for Experiment:  
Anzai\_45mins\_

**Script Used: (Full Text):**

SOP Standard Measurement 02-14-44PM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Nannobubbles\_



Averaged FTLA Concentration / Size for Experiment:  
Nannobubbles\_  
Error bars indicate +/- 1 standard error of the mean

### Included Files

Nannobubbles\_00  
Nannobubbles\_01  
Nannobubbles\_02

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
Script Used: SOP Standard Measurement 12-09-11PM 09~  
Time Captured: 12:09:17 09/03/2018  
Operator:  
Pre-treatment:  
Sample Name:  
Diluent:  
Remarks:

### Capture Settings

Camera Type: sCMOS  
Laser Type: Blue405  
Camera Level: 16  
Slider Shutter: 1300  
Slider Gain: 512  
FPS: 25.0  
Number of Frames: 2248  
Temperature: 23.0 - 23.1 °C  
Viscosity: (Water) 0.928 - 0.930 cP  
Dilution factor: Dilution not recorded  
Syringe Pump Speed: 100

### Analysis Settings

Detect Threshold: 5  
Blur Size: Auto  
Max Jump Distance: Auto: 7.1 - 31.6 pix

### Results

Stats: Merged Data

Mean: 337.6 nm  
Mode: 169.9 nm  
SD: 204.4 nm  
D10: 160.4 nm  
D50: 286.9 nm  
D90: 649.4 nm

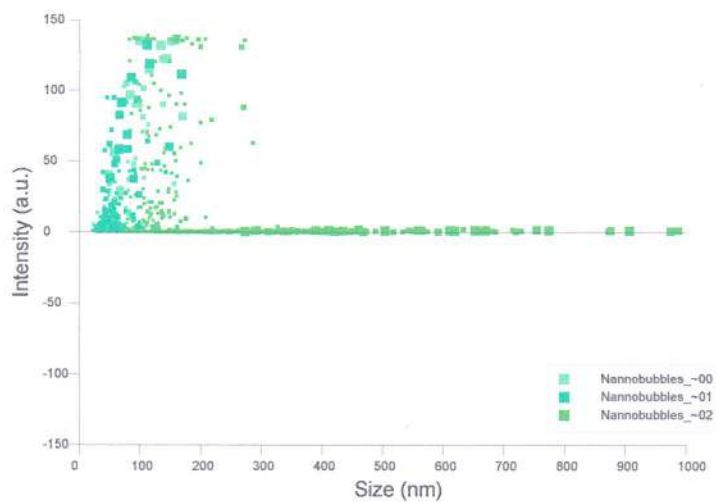
Stats: Mean +/- Standard Error

Mean: 169.7 +/- 86.5 nm  
Mode: 92.3 +/- 38.9 nm  
SD: 90.2 +/- 56.5 nm  
D10: 86.3 +/- 38.0 nm  
D50: 147.0 +/- 70.7 nm  
D90: 305.3 +/- 172.8 nm

Concentration (Upgrade): 6.12e+008 +/- 5.94e+008 particles/ml  
17.6 +/- 15.7 particles/frame  
28.9 +/- 26.7 centres/frame

Concentration measurements may be unreliable  
See summary file for more info

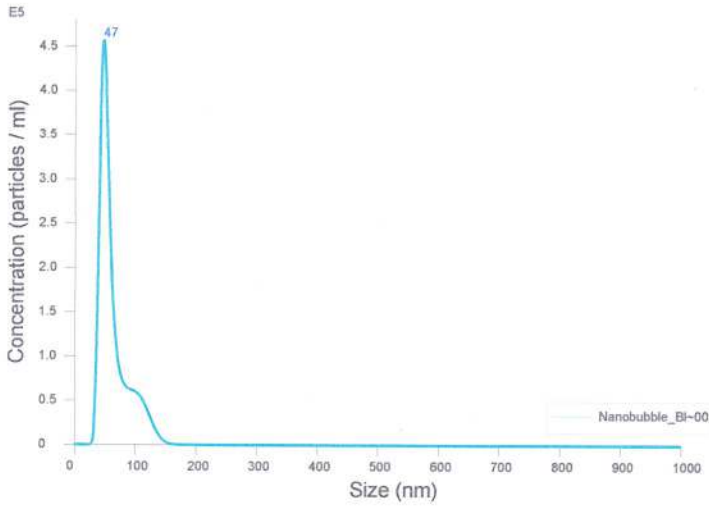




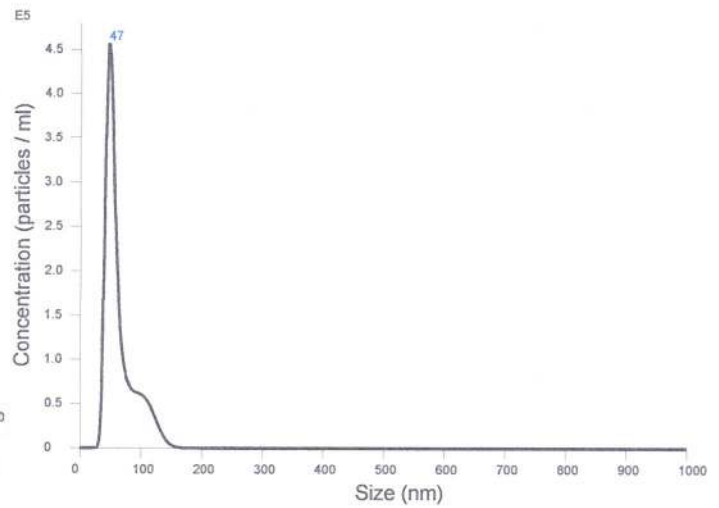
Intensity / Size graph for Experiment:  
Nannobubbles\_

**Script Used: (Full Text):**

SOP Standard Measurement 12-09-11PM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Nanobubble\_Blank\_



Averaged FTLA Concentration / Size for Experiment:  
Nanobubble\_Blank\_  
Error bars indicate + / - 1 standard error of the mean

### Included Files

Nanobubble\_Blank\_00

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
 Script Used: SOP Standard Measurement 11-40-23AM 09~  
 Time Captured: 11:40:29 09/03/2018  
 Operator:  
 Pre-treatment:  
 Sample Name:  
 Diluent:  
 Remarks:

### Capture Settings

Camera Type: sCMOS  
 Laser Type: Blue405  
 Camera Level: 16  
 Slider Shutter: 1300  
 Slider Gain: 512  
 FPS: 25.0  
 Number of Frames: 1498  
 Temperature: 21.2 °C  
 Viscosity: (Water) 1.0 cP  
 Dilution factor: Dilution not recorded  
 Syringe Pump Speed: 100

### Analysis Settings

Detect Threshold: 5  
 Blur Size: Auto  
 Max Jump Distance: Auto: 14.4 pix

### Results

Stats: Merged Data

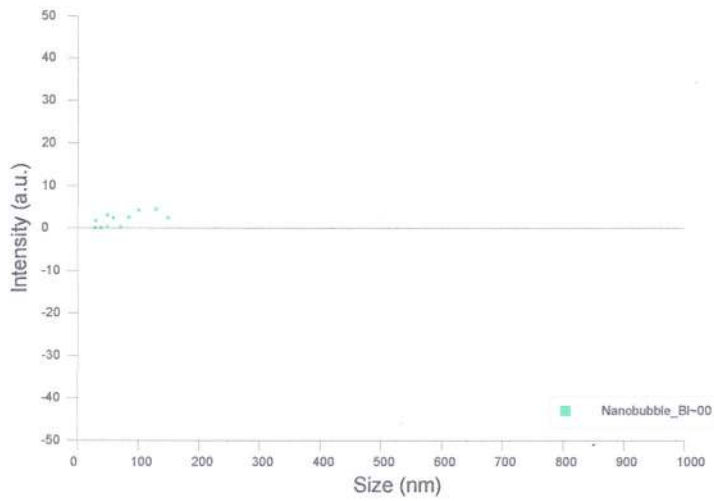
Mean: 63.5 nm  
 Mode: 46.7 nm  
 SD: 24.8 nm  
 D10: 40.1 nm  
 D50: 53.2 nm  
 D90: 103.4 nm

Stats: Mean +/- Standard Error

Mean: 63.5 +/- 0.0 nm  
 Mode: 46.7 +/- 0.0 nm  
 SD: 24.8 +/- 0.0 nm  
 D10: 40.1 +/- 0.0 nm  
 D50: 53.2 +/- 0.0 nm  
 D90: 103.4 +/- 0.0 nm

Concentration (Upgrade): 1.35e+007 +/- 0.00e+000 particles/ml  
 0.6 +/- 0.0 particles/frame  
 1.4 +/- 0.0 centres/frame

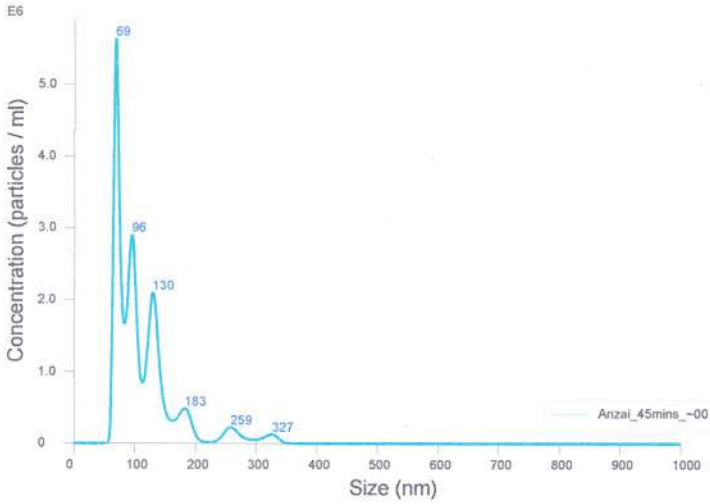
Concentration measurements may be unreliable  
 See summary file for more info



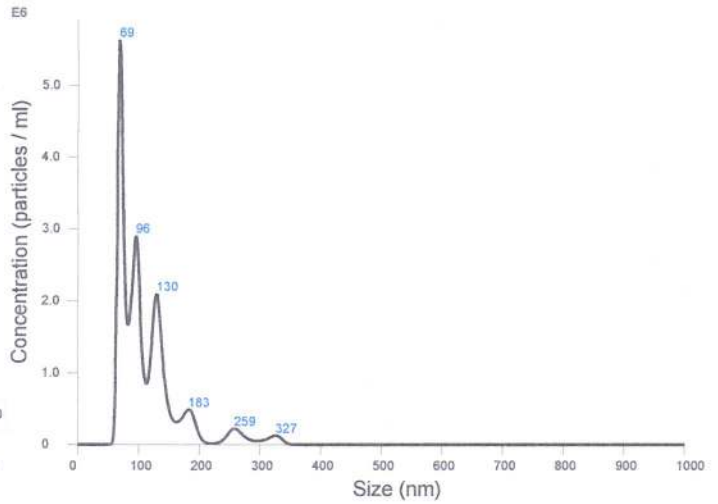
Intensity / Size graph for Experiment:  
Nanobubble\_Blank\_

**Script Used: (Full Text):**

SOP Standard Measurement 11-40-23AM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Anzai\_45mins\_10x\_



Averaged FTLA Concentration / Size for Experiment:  
Anzai\_45mins\_10x\_  
Error bars indicate + / - 1 standard error of the mean

### Included Files

Anzai\_45mins\_10x\_00

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
 Script Used: SOP Standard Measurement 02-14-44PM 09~  
 Time Captured: 14:27:36 09/03/2018  
 Operator:  
 Pre-treatment:  
 Sample Name:  
 Diluent:  
 Remarks:

### Capture Settings

Camera Type: sCMOS  
 Laser Type: Blue405  
 Camera Level: 16  
 Slider Shutter: 1300  
 Slider Gain: 512  
 FPS: 25.0  
 Number of Frames: 1498  
 Temperature: 23.2 °C  
 Viscosity: (Water) 0.9 cP  
 Dilution factor: Dilution not recorded  
 Syringe Pump Speed: 80

### Analysis Settings

Detect Threshold: 6  
 Blur Size: Auto  
 Max Jump Distance: Auto: 14.3 pix

### Results

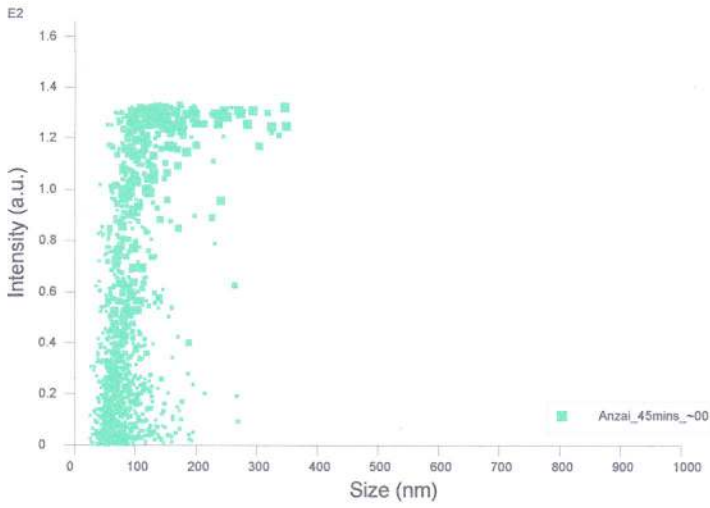
Stats: Merged Data

Mean: 113.3 nm  
 Mode: 68.7 nm  
 SD: 53.4 nm  
 D10: 66.6 nm  
 D50: 96.2 nm  
 D90: 176.7 nm

Stats: Mean +/- Standard Error

Mean: 113.3 +/- 0.0 nm  
 Mode: 68.7 +/- 0.0 nm  
 SD: 53.4 +/- 0.0 nm  
 D10: 66.6 +/- 0.0 nm  
 D50: 96.2 +/- 0.0 nm  
 D90: 176.7 +/- 0.0 nm

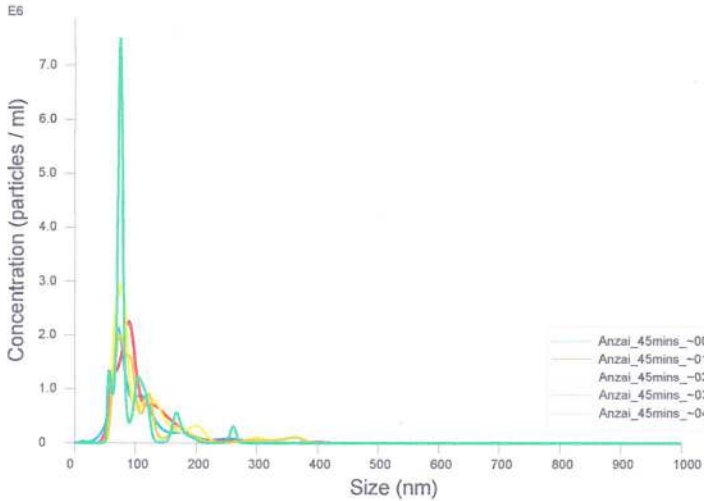
Concentration (Upgrade): 2.11e+008 +/- 0.00e+000 particles/ml  
 26.0 +/- 0.0 particles/frame  
 30.9 +/- 0.0 centres/frame



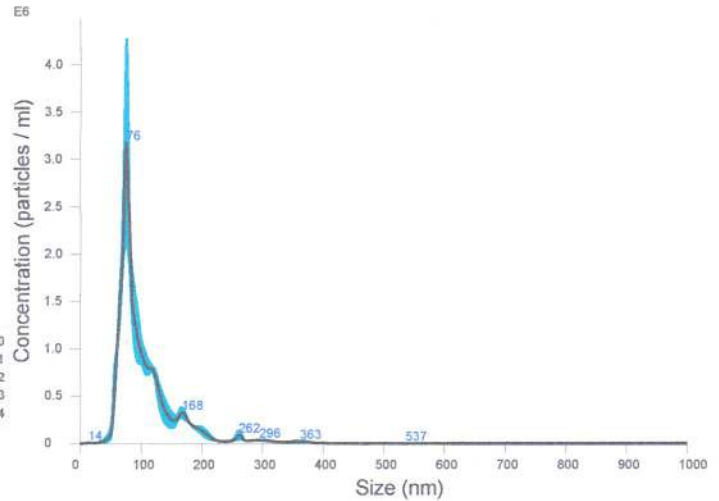
Intensity / Size graph for Experiment:  
Anzai\_45mins\_10x\_

**Script Used: (Full Text):**

SOP Standard Measurement 02-14-44PM 09Mar2018.txt



FTLA Concentration / Size graph for Experiment:  
Anzai\_45mins\_10x\_5\_repeats\_



Averaged FTLA Concentration / Size for Experiment:  
Anzai\_45mins\_10x\_5\_repeats\_  
Error bars indicate + / - 1 standard error of the mean

### Included Files

Anzai\_45mins\_10x\_5\_repeats\_00  
Anzai\_45mins\_10x\_5\_repeats\_01  
Anzai\_45mins\_10x\_5\_repeats\_02  
Anzai\_45mins\_10x\_5\_repeats\_03  
Anzai\_45mins\_10x\_5\_repeats\_04

### Details

NTA Version: NTA 3.2 Dev Build 3.2.16  
Script Used: SOP Standard Measurement 02-32-49PM 09~  
Time Captured: 14:32:59 09/03/2018  
Operator:  
Pre-treatment:  
Sample Name:  
Diluent:  
Remarks:

### Capture Settings

Camera Type: sCMOS  
Laser Type: Blue405  
Camera Level: 16  
Slider Shutter: 1300  
Slider Gain: 512  
FPS: 25.0  
Number of Frames: 2248  
Temperature: 23.5 - 23.7 °C  
Viscosity: (Water) 0.916 - 0.920 cP  
Dilution factor: Dilution not recorded  
Syringe Pump Speed: 80

### Analysis Settings

Detect Threshold: 6  
Blur Size: Auto  
Max Jump Distance: Auto: 14.3 - 27.6 pix

### Results

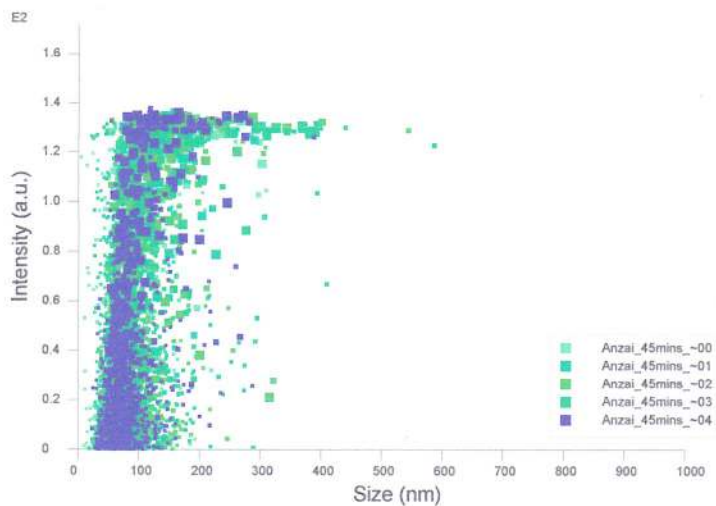
Stats: Merged Data

Mean: 106.0 nm  
Mode: 75.4 nm  
SD: 51.8 nm  
D10: 64.5 nm  
D50: 86.9 nm  
D90: 169.4 nm

Stats: Mean +/- Standard Error

Mean: 106.3 +/- 3.4 nm  
Mode: 77.5 +/- 3.1 nm  
SD: 51.2 +/- 4.4 nm  
D10: 64.4 +/- 1.1 nm  
D50: 87.0 +/- 2.9 nm  
D90: 172.0 +/- 4.8 nm  
Concentration (Upgrade): 1.25e+008 +/- 6.44e+006 particles/ml  
15.0 +/- 0.6 particles/frame  
18.4 +/- 0.2 centres/frame

Concentration measurements may require some caution due to noise  
See summary file for more info



Intensity / Size graph for Experiment:  
Anzai\_45mins\_10x\_5\_repeats\_

**Script Used: (Full Text):**

SOP Standard Measurement 02-32-49PM 09Mar2018.txt