A METHOD TO TEST FLOCCULATION

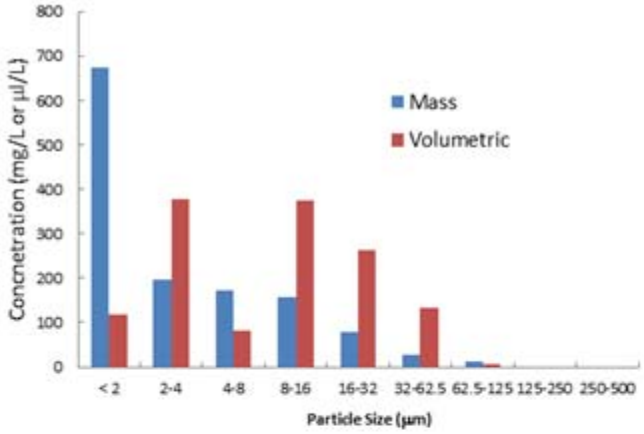
–TEAM SEQUOIA

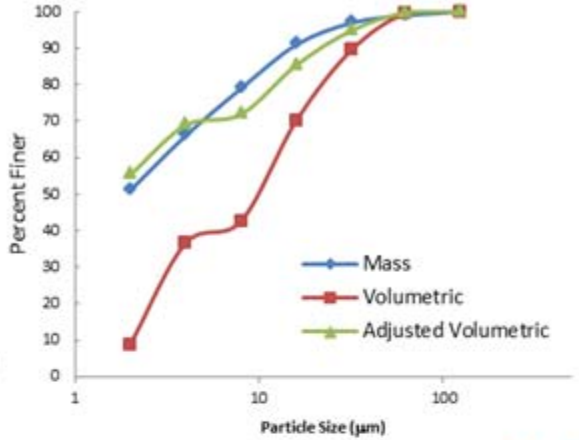
The Paradox

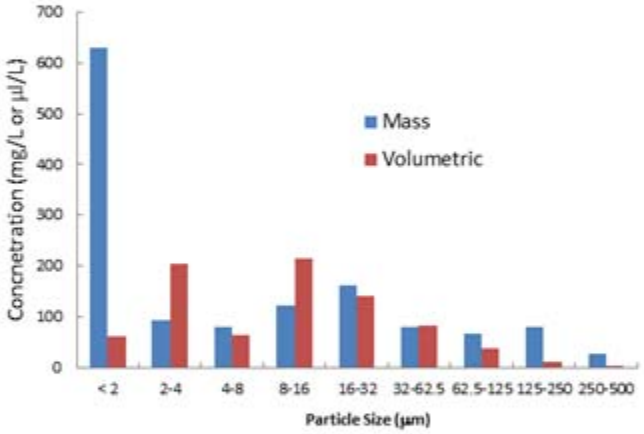
Tim’s Data show:

Large sub-2mm particles in PSD from lab.

But, LISST-SL data does not show this.


Concnetration (mg/L or µl/L)
800
700
600
500
400
300
200
100
0
Mass
Volumetric
< 2
2-4
4-8
8-16
16-32
32-62.5
62.5-125
125-250
250-500
Particle Size (µm)


Percent Finer
100
90
80
70
60
50
40
30
20
10
0
Mass
Volumetric
Adjusted Volumetric
1
10
100
Particle Size (µm)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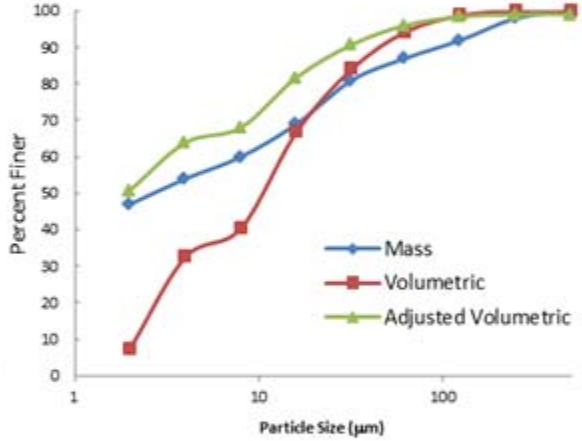
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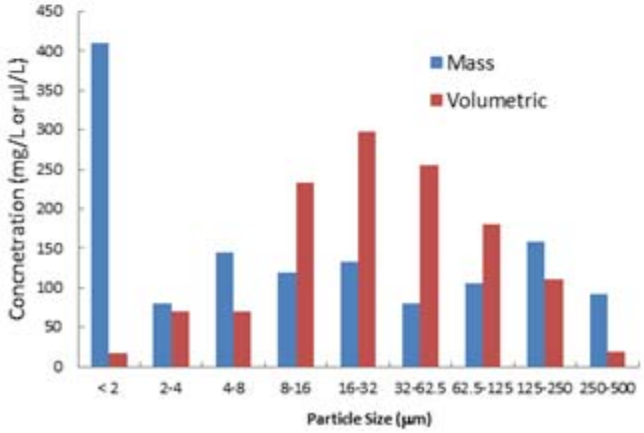
Particle Size (µm)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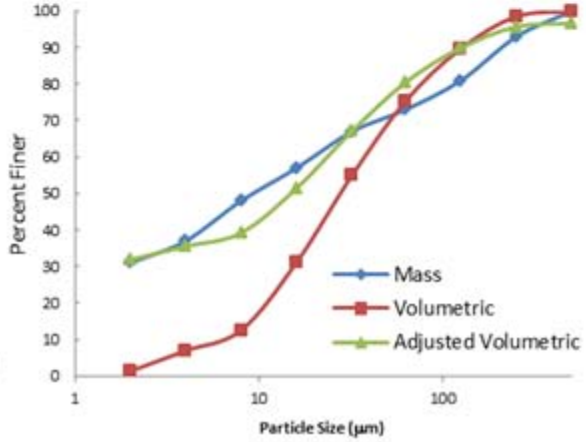
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Question: Can we find a third indicator?

Answer: Indeed yes. This method leads to Establishing if flocculation is the explanation.

That is, is disaggregation in the lab before analysis is the explanation.

The Method

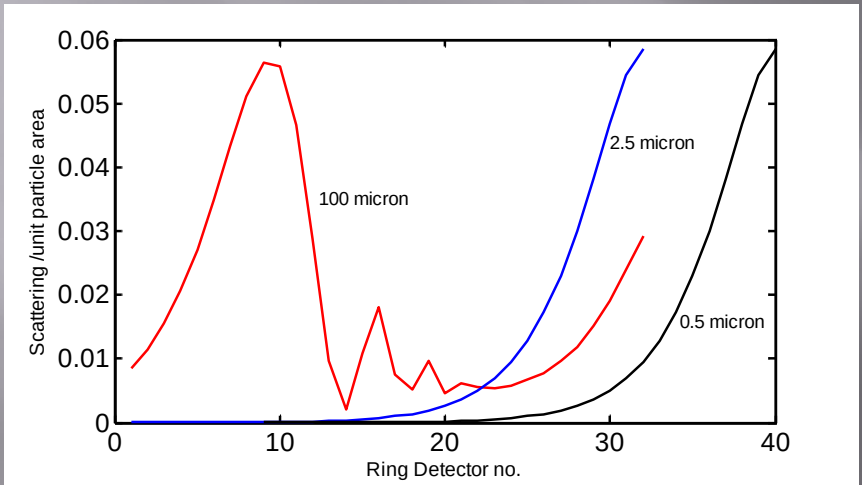
1. LISST measures the optical attenuation coefficient, c, = – log(τ)/l *; this is total light removed from the laser by scattering by particles.*

2. The total light falling on ring detectors is part of this; over angles 0.05 to 10^o*; say* b_f

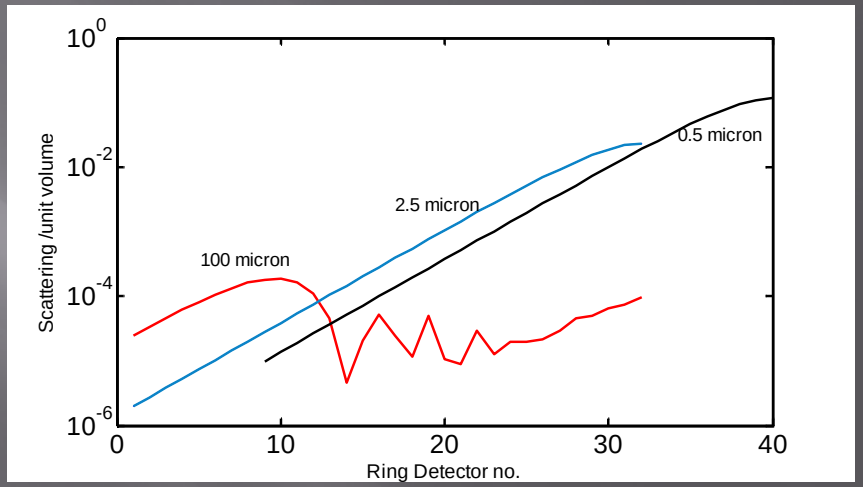
3. For particles in the measurement range, the ring detectors capture most of the total scattering, i.e. $b_f/c \sim 1$

4. Thus if significant particle concentration exists below 2 mm, $b_f/c << 1$. This is the test.

A graphical explanation



Equal area of particles



Equal volume of particles

Sub-size particles put most light outside our rings;
Consequently, total of light on rings << light removed

Computing b_f/c for SL

$b_f = 5.2 \times 10^{-3}$ sum(cscat)/P_o; if R_f =1 MΩ; 5V A/D

$b_f = 2.6 \times 10^{-3}$ sum(cscat)/P_o; if R_f =1 MΩ; 2.5V A/D

$c = -\log(\tau)$

Matlab function getscat_SL delivers cscat needed above.

So what if…

It is confirmed that there was not much volume in below-size particles?

1. It would indicate that the lab data shows them because they were product of disaggregation before sizing.
2. In this case, one will need to estimate mass density from total volume concentration and gravimetric mass.
3. However, the size distribution would be valid *in-situ.*

Typical values b_f/c

AC Coarse: 0.74