

# VSF as a proxy for Particle Size Distribution

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# Particle Size Distribution

- Particles in natural waters
- Sizes 0.1 nm ~ 250  $\mu\text{m}$
- $N(D)dD = N_0(D/D_0)^{-\xi}$

$N(D)dD$  = # of particles in a given diameter range  $dD$

$N_0$  = Number of particles at reference diameter  $D_0$

$\xi$  = Slope of the Junge distribution

- Instruments to measure PSD
  - Coulter Counter
  - LISST



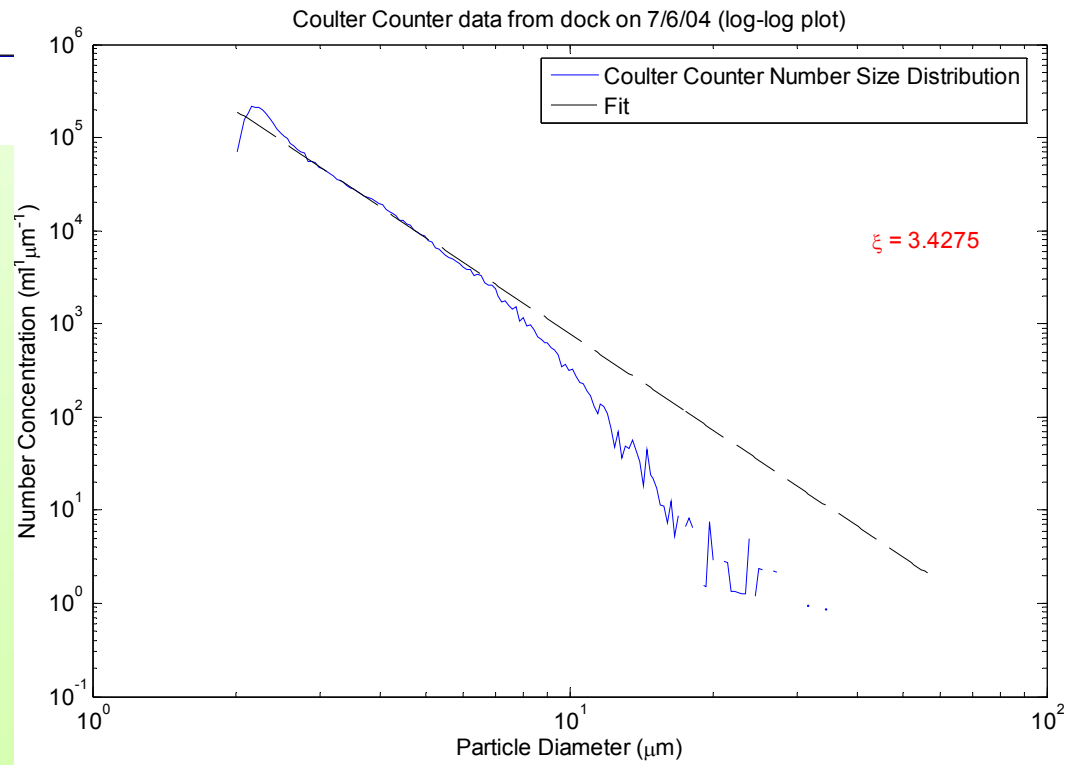
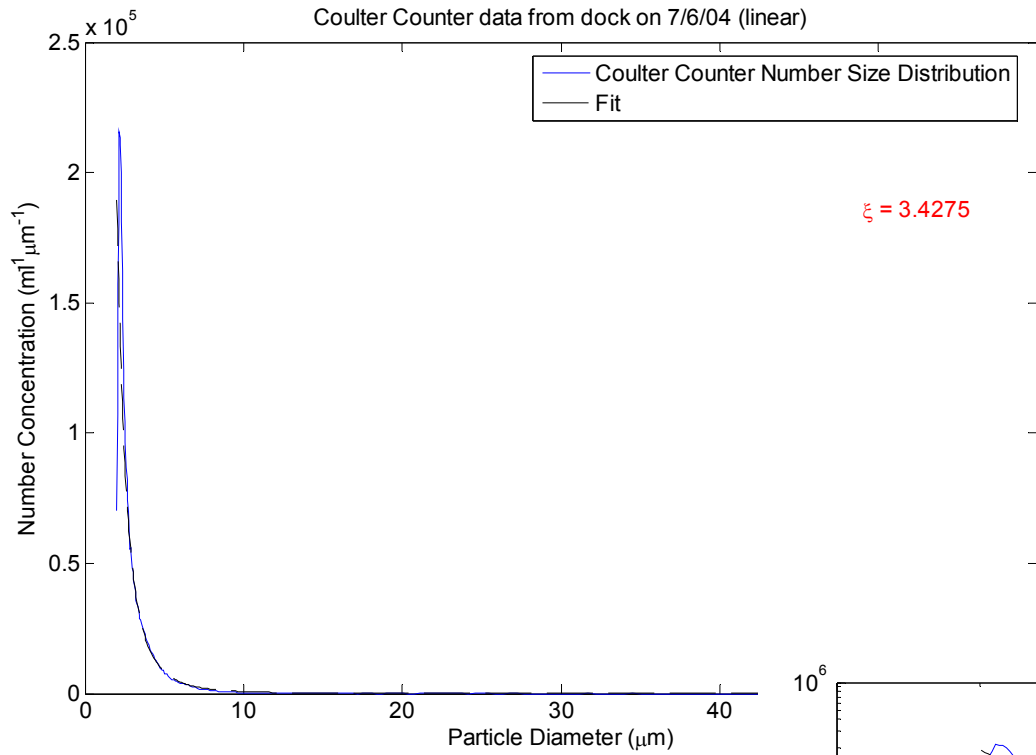
# Coulter Counter

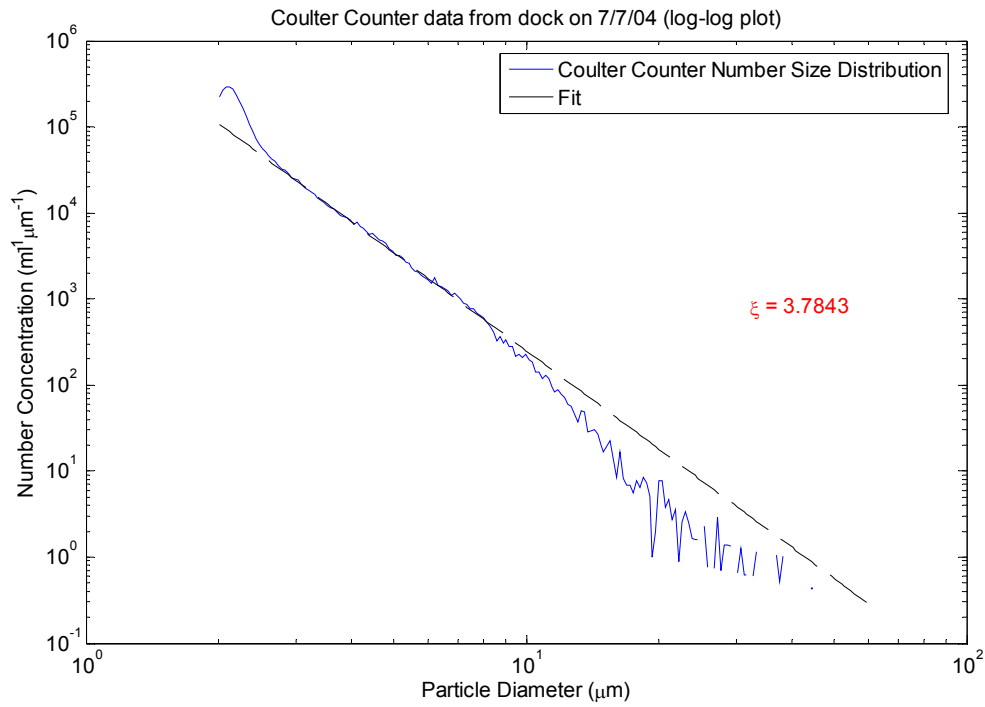
- Electrical Sensing Zone between electrodes
- Particles displaces volume proportional to its size
- Voltage change induced at constant current is measured
- Conc. of particles per unit volume

# Dock Sampling

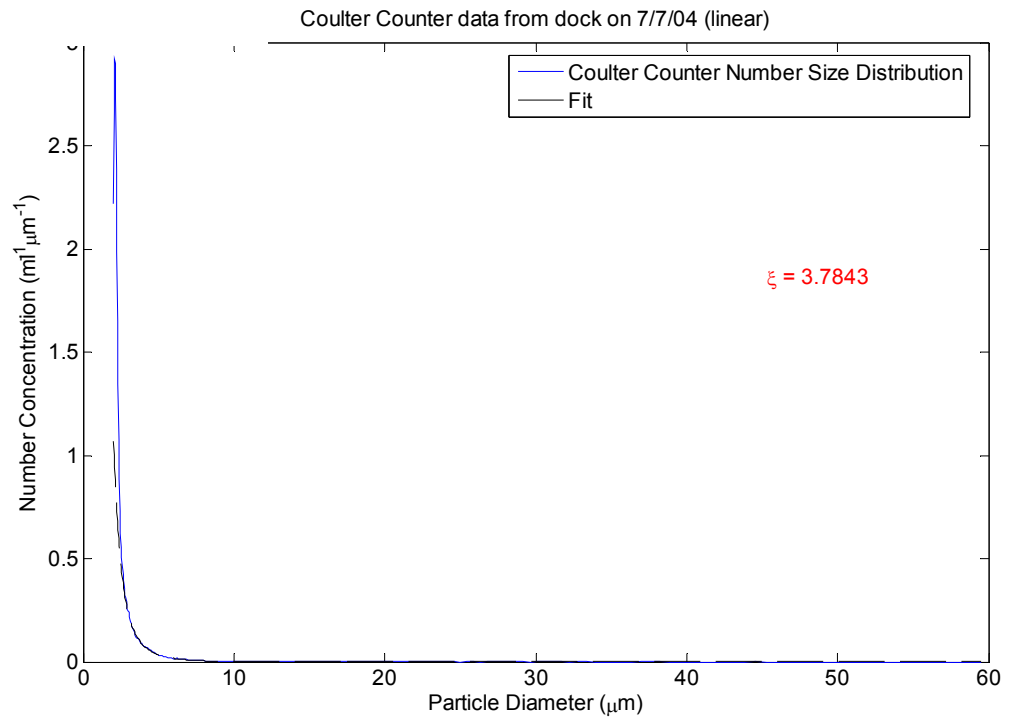
1. July 6<sup>th</sup> 10:00 a.m.
2. July 7<sup>th</sup> 10:00 a.m.
3. July 13<sup>th</sup> 1:05 p.m.
4. July 15<sup>th</sup> 1:00 p.m.
5. July 15<sup>th</sup> 4:20 p.m.

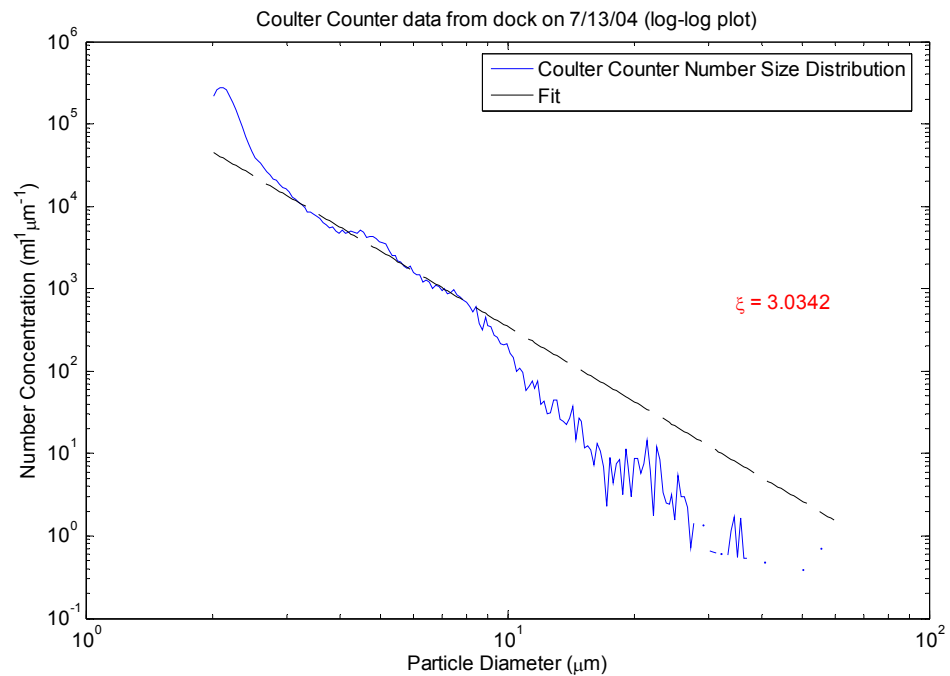
# July 6<sup>th</sup>



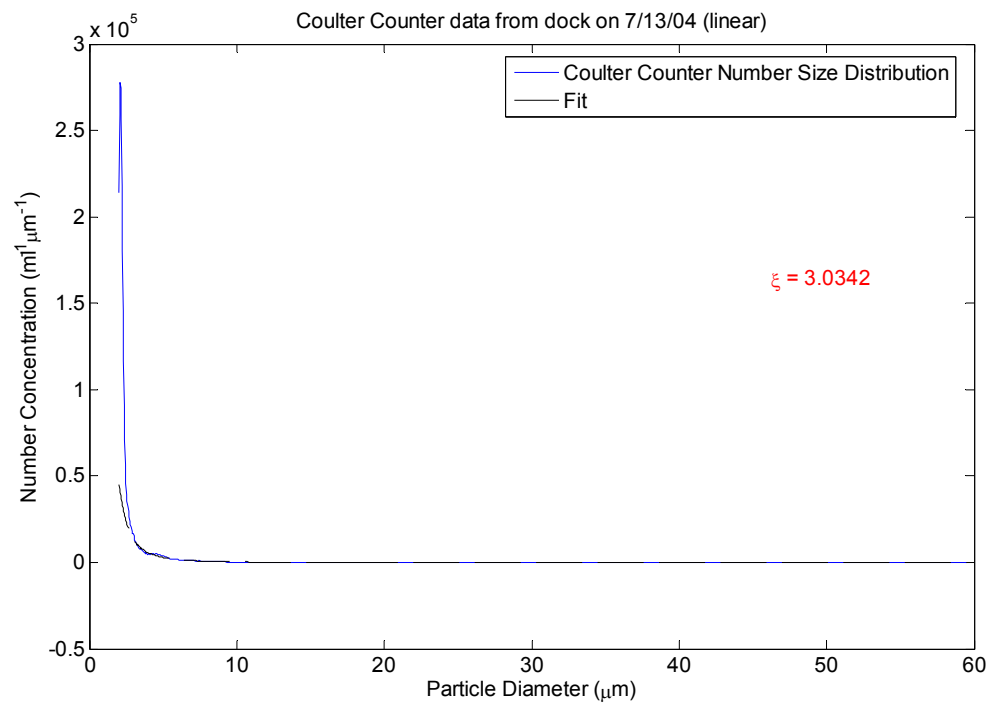


July 7<sup>th</sup>

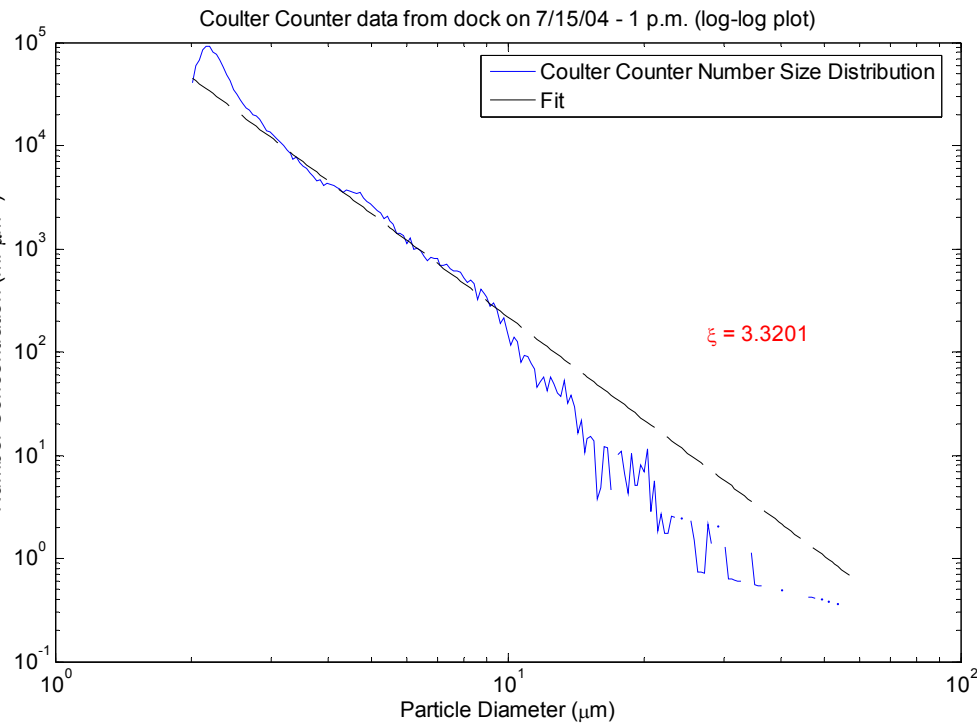




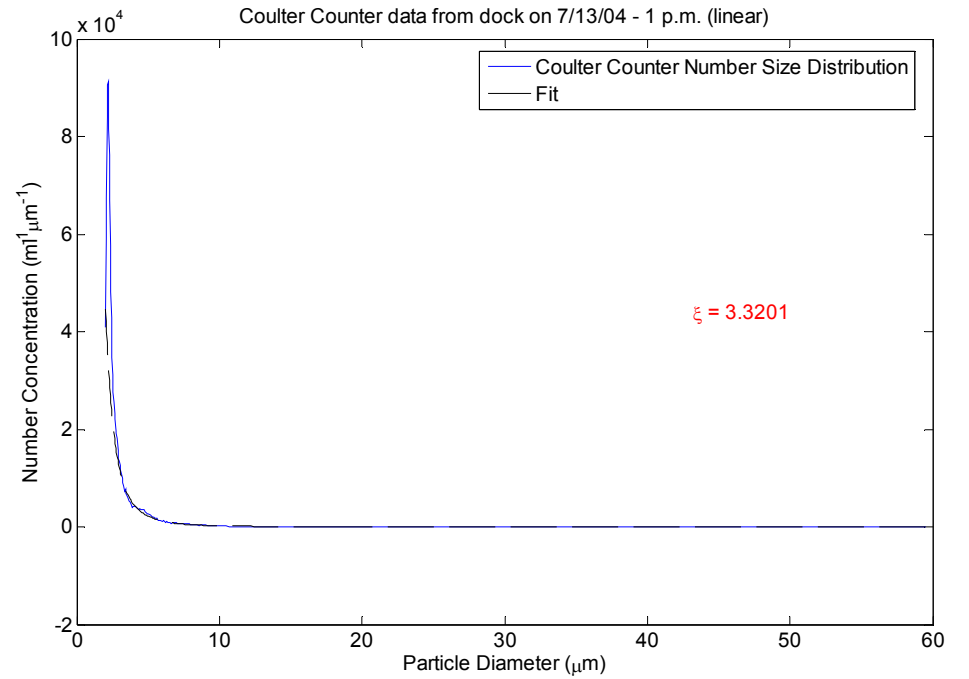
July 13<sup>th</sup>

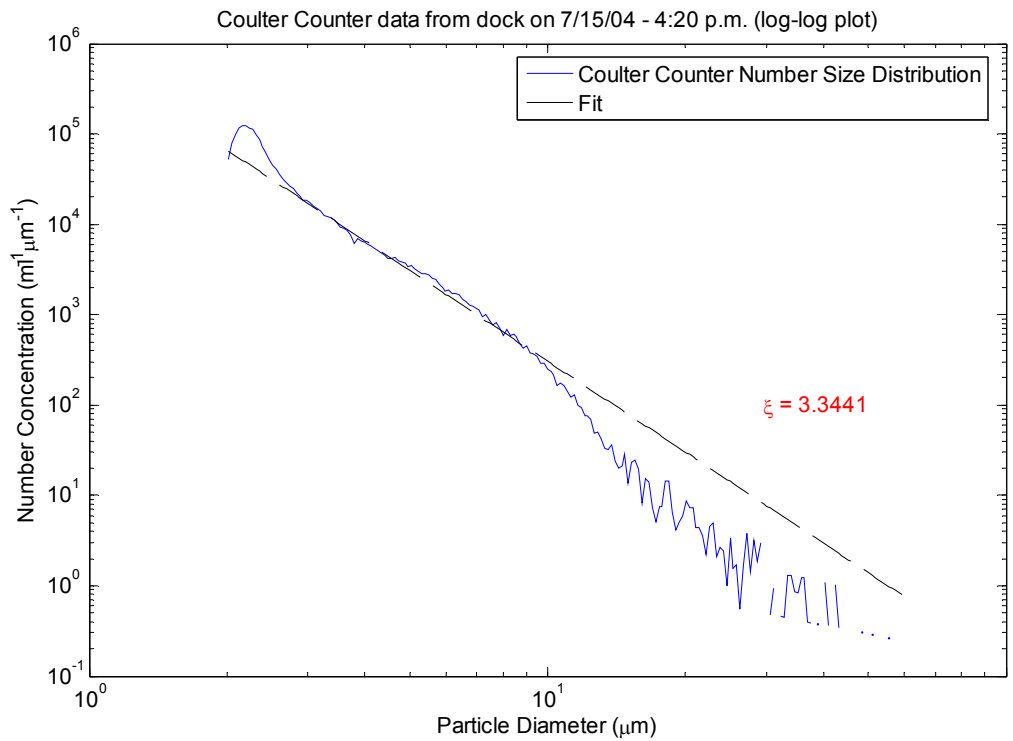




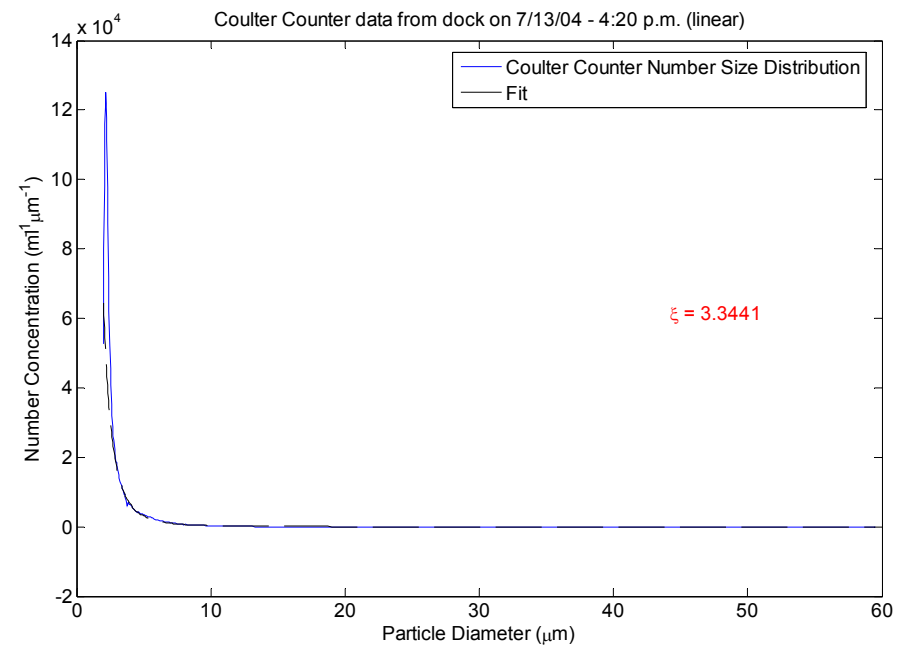


July 15<sup>th</sup>  
1:00 p.m.





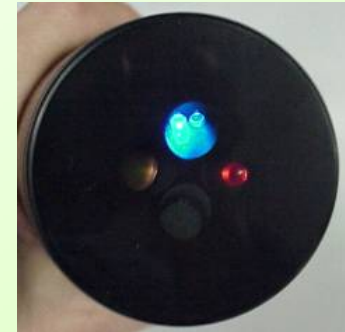
July 15<sup>th</sup>  
4:20 p.m.



# Back-scattering

- Scattering of light in the backward direction
- VSF – Proportion of the incident light scattered from a unit volume
- Backscattering sensors measure the VSF

# Combination spectral backscattering meter and Chlorophyll Fluorometer



$$\lambda = 470, 700$$

$$\theta = 117$$

Output from sensor is counts

Counts are scaled to obtain VSF at 2 wavelengths

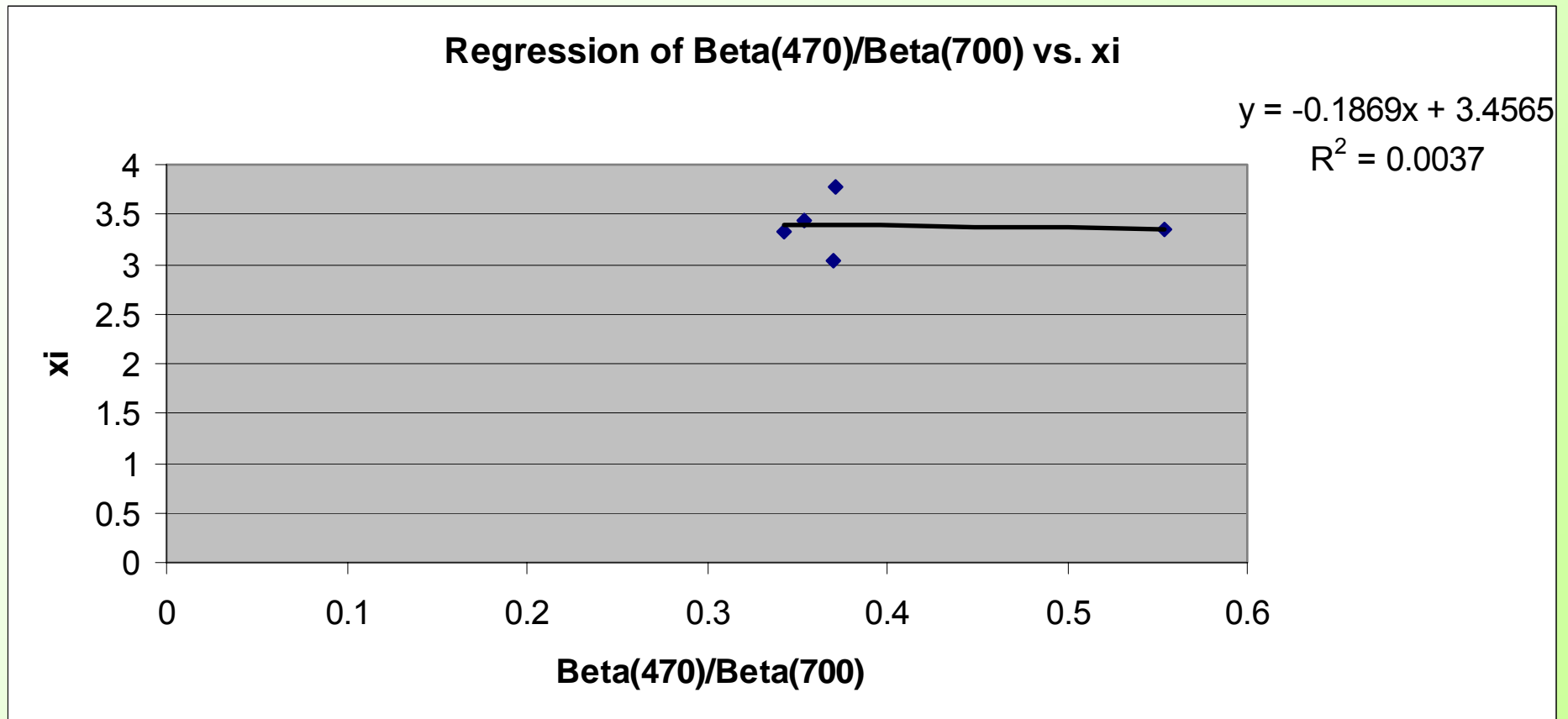
VSF corrected for scattering due to water

$$\text{Particulate Backscattering } b_{bp} = 2 * \pi * X * \text{VSF}$$

# VSF and $b_{bp}$

Date	beta470_p	beta700_p	bb470_p	bb700_p	beta470/beta700	xi
July 6 10:00 a.m.	0.0091734	0.025925	0.063402	0.17918	0.35384378	3.428
July 7 10:00 a.m.	0.0078113	0.021046	0.053988	0.14546	0.371153663	3.784
July 13 1:00 p.m.	0.0067652	0.018262	0.046757	0.12622	0.370452305	3.034
July 15 1:00 p.m.	0.0036443	0.010622	0.025188	0.073411	0.343089814	3.32
July 15 4:20 p.m.	0.0077081	0.013928	0.053274	0.096265	0.553424756	3.344

# Regression



# Discussion

- The regression between VSF ratio and slope of PSD gave a poor fit ☹️
- High backscattering ratio indicates presence of small particles
- Correction for attenuation using ac9 and calibration
- Accuracy of Coulter counter measurements
- Accuracy of sampling time considerations.