

## WET LABS APPLICATION NOTE

### BULK PARTICLE INDEX OF REFRACTION FROM THE SLOPE OF THE BEAM ATTENUATION SPECTRUM AND THE BACKSCATTERING RATIO.

The slope of the PSD,  $\xi$ , can be derived from the slope of the beam attenuation spectrum as obtained from an ac-9. This was examined in detail by Twardowski et al. (2001) and Boss et al. (2001). The approximate relationship between the slope of the beam attenuation spectrum,  $\gamma$ , and  $\xi$ , is used below to get  $\mu$  from gamma.

This relationship is:  $\xi = \gamma + 3 + 0.5 \cdot \exp(-6\gamma)$ .

In addition Twardowski et al. (2001) have given an approximate equation to derive the bulk index of refraction of the particles, when the ratio of the particulate backscattering to total scattering,  $B_p$ , is known in addition to  $\gamma$  or  $\xi$ .

What follows is a MATLAB program to invert this relationship to get the slope of the PSD,  $\xi$ , when the slope of the beam attenuation spectrum, gamma ( $\gamma$ ), has been measured.

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%Program Partindex
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%The slope of the PSD, xi, can be derived from the slope of the beam attenuation spectrum as obtained from an ac-9.  
%This was examined in detail by Twardowski et al. (2001) and Boss et al. (2001). The approximate relationship between the slope of the  
%beam attenuation spectrum, gamma, and xi, is used below to get xi from gamma.  
%This relationship is: xi=gamma+3-0.5*exp(-6*gamma).  
%In addition Twardowski et al. (2001) have given an approximate equation to derive the bulk index of refraction  
%of the particles, when the ratio of the particulate backscattering to total scattering, Bp, is known in addition to gamma or xi.
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    Bp=0.04 % Specify backscattering ratio.  
    gamma=1.0 % Specify slope of the beam attenuation spectrum.  
    xi=gamma+3- 0.5*exp(-6*gamma) % This from Boss et al. (2001)  
    np=1+Bp^(0.5377+0.4867*(xi-3)^2)*(1.4676+2.295*(xi-3)^2+2.3113*(xi-3)^4)%  
This is given in Twardowski et al.(2001)
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References:

Boss E., M. S. Twardowski and S. Herring, 2001. [The shape of the particulate beam attenuation spectrum and its relation to the size distribution of oceanic particles](#). Applied Optics,40, 4885-4893.

Boss, E., W. S. Pegau, W. D. Gardner, J. R. V. Zaneveld, A. H. Barnard., M. S. Twardowski, G. C. Chang and T. D. Dickey, 2001. [The spectral particulate attenuation and particle size distribution in the bottom boundary layer of a continental shelf](#). Journal of Geophysical Research, 9509-9516.

Twardowski M., E. Boss, J. B. Macdonald, W. S. Pegau, A. H. Barnard, and J. R. V. Zaneveld, 2001. [A model for estimating bulk refractive index from the optical backscattering ratio and the implications for understanding particle composition in case I and case II waters](#). Journal of Geophysical Research, 106, 14,129-14,142.