Application Note – Computing bb with ECOVSF beta data

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%Calculates profiles of backscattering coeff from profiles of beta measured
%        at 100, 125, and 150 degrees
%Method of Twardowski, Zaneveld, and Moore (2000)

function[bb]=bback(data);

%data has corrected beta100, beta125, and beta150 in columns 1:3

%IMPORTANT: raw scattering counts should already be 1) converted to beta values (m-
1 sr-1)
%   with the calibration protocol (see cal sheet) and 2) corrected for absorption of the
%   incident beam (recommended).  A description of the absorption correction is
provided below.

%////////////CORRECTION FOR ABSORPTION OF INCIDENT BEAM

%   For the population of photons scattered within the sample volume, there is
%   attenuation along the path from the light source to the sample volume to
%   the detector.  This results in the scattering measurements being
%   underestimates of the true volume scattering in the hydrosol.  Corrected
%   volume scattering coefficients can be obtained by accounting for the
%   effect of attenuation along an average pathlength for the measurement
%   at each angle.  This average pathlength is numerically solved in the
%   weighting function determinations developed by Ron Zaneveld that are
%   used in the calibration procedures.

%   Since the calibration of the ECOVSF uses microspherical scatterers, the
%   component of attenuation that can be attributed to scattering is incorporated
%   into the scaling factor, i.e., the calibration itself.  Thus, only absorption
%   of the incident beam needs to be included in the correction.

%   The dependence on a is determined as follows, where the measured scattering
%   function at a given value of a, beta_meas(angle,a), is corrected to the value for
%   a = 0 m-1, beta_corr(angle,a=0):

%   beta_corr(100°,a=0) = beta_meas(100°,a) exp(0.0314a);
%   beta_corr(125°,a=0) = beta_meas(125°,a) exp(0.0441a);
%   beta_corr(150°,a=0) = beta_meas(150°,a) exp(0.0804a);

%////////////CALCULATION OF BACKSCATTERING COEFFICIENTS

%first, convert beta values to a scattering flux, dw
%beta(180) serves as a 4th dw, always =0
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dw(:,1)=2.*pi.*sin(pi*100/180).*data(:,1);
dw(:,2)=2.*pi.*sin(pi*125/180).*data(:,2);
dw(:,3)=2.*pi.*sin(pi*150/180).*data(:,3);
dw(:,4)=0;

%fit each line of dw data with a 3rd order polynomial and integrate from 90-180 deg
%to obtain bb (the backscattering coefficient)

[r c]=size(dw);
rad=[pi*100/180 pi*125/180 pi*150/180 pi];

for i=1:r
   [polycoeff(i,1:4) s]=polyfit(rad,dw(i,:),3);
   coeff=polycoeff(i,1:4);
   bb(i)=coeff(1)*(pi^4)/4+coeff(2)*(pi^3)/3+coeff(3)*(pi^2)/2+coeff(4)...
       *pi-
(coeff(1)*((pi/2)^4)/4+coeff(2)*((pi/2)^3)/3+coeff(3)*((pi/2)^2)/2+coeff(4)*pi/2);
end

bb=bb';

%correction to produce best match with Petzold(1972)
%bb=1.013bb;
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