Analysis of backscattering using the ADV:

The sonar equation can be written for the case of the ADV as:

$$EL = C_2 \cdot counts = C_1 - 2R\alpha_p^*[conc] + 10\log_{10}\left(C_3 b_p^*[conc] + b_{background}\right)$$

Where we read *counts* of the machine, C_j are constants, star quantities denote mass specific attenuation and backscattering and $b_{background}$ is the backscattering in the blank reference material, *[conc]* is the concentration of beads.

We can obtain C_1 by running the instrument without obtaining any backscattering, e.g. into a large room far from boundaries. In this case we measure ~61counts (*[conc]=0*).

→ $C_1 = C_2 \cdot 61$.

Before we put our sample in water we measure the background which is nonzero due to bubble or dirt in the water:

→ $b_{background} = 10^{\{(C_2 \cdot counts - C_1)/10\}}$.

We can rewrite the sonar equation in terms of 3 unknowns (x_j):

$$counts = 61 - 2Rx_1[conc] + \frac{1}{x_2}10\log_{10}\left(x_3[conc] + b_{background}\right).$$

It is apparent that we cannot obtain the specific backscattering coefficient but within a constant, C_3, unless we perform prior to our measurements a calibration using beads on known acoustical properties.

When performing a least squares fit of the last equation it is readily apparent that $b_{background}$ has negligible influence on the x_j.