

Principle of the optical Counter HIAC (Pacific Scientific) measurements

The size of each particle is estimated from its geometrical cross section s , estimated by the attenuation of a laser beam unpinning a receptor. Each particle crossing the beam generates a signal (mV) with an amplitude proportional to the shadow area projected on the receptor. The diameter d of a non spherical particle is equivalent to the diameter of a disk having the same geometrical cross section s .

During the PROSOPE cruise, the granulometer was calibrated in order to sort the particles between 1.55 and 100 μm among 100 log-normally distributed size classes. The particles counted in the size class i have a diameter ranging between d_i et d_{i+1} , respectively the lower and upper limits of the size class. The upper limit of the size class i is equal to the lower limit of the size class $i+1$. The mean diameter and the mean volume of particles in the size class i are respectively:

$$\bar{d}_i = \frac{d_i + d_{i+1}}{2} \quad \bar{v}_i = \mathbf{p} \frac{(\bar{d}_i)^3}{6}$$

PDAS (Particle Distribution Analysis Software) software gives the number of particles (n_i) counted in each size class i in a sample of volume L (0.1 to 0.15 liter following the rosettes). The Excel files *Rosette.xls* and *Continu.xls* contain these rough data.

Some indications to manage the rough data:

The number and concentration of particles counted in the range i_{inf} to i_{sup} are respectively:

$$N_{i_{\text{inf}}}^{i_{\text{sup}}} = \sum_{i=i_{\text{inf}}}^{i_{\text{sup}}} n_i \quad \text{and} \quad C_{i_{\text{inf}}}^{i_{\text{sup}}} = \frac{1}{L} N_{i_{\text{inf}}}^{i_{\text{sup}}}$$

The mean diameter and the mean volume of particles counted between i_{inf} to i_{sup} are respectively:

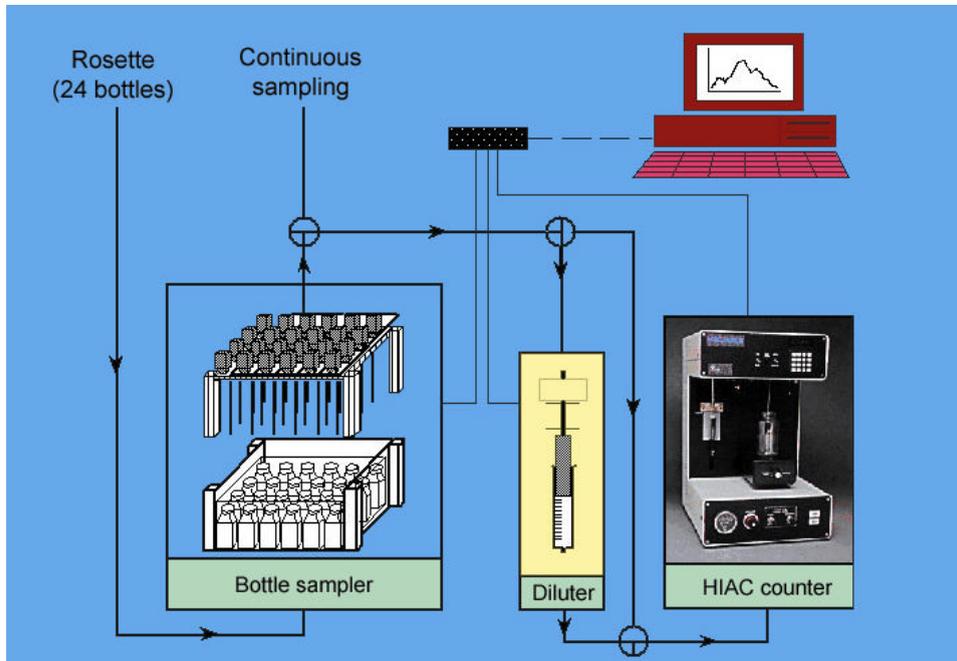
$$D_{i_{\text{inf}}}^{i_{\text{sup}}} = \frac{1}{N_{i_{\text{inf}}}^{i_{\text{sup}}}} \sum_{i=i_{\text{inf}}}^{i_{\text{sup}}} n_i \bar{d}_i \quad \text{and} \quad V_{i_{\text{inf}}}^{i_{\text{sup}}} = \frac{1}{N_{i_{\text{inf}}}^{i_{\text{sup}}}} \sum_{i=i_{\text{inf}}}^{i_{\text{sup}}} n_i \bar{v}_i$$

The biovolume ($\mu\text{m}^3 \cdot \Gamma^1$) of particles counted in the same range is defined as:

$$B_{i_{\text{inf}}}^{i_{\text{sup}}} = \frac{1}{L} \sum_{i=i_{\text{inf}}}^{i_{\text{sup}}} n_i \bar{v}_i$$

Utilization of the data files

The HIAC Counter was used either for depth profile acquisitions from rosette bottle samples, or for continuous acquisitions made on seawater pumped at the surface during the transects.



1. Depth profiles.

In the *Rosette.xls* data file, columns give:

A: Identification Rosette_Bottle

B: Rosette number

C: Bottle number

D: Sample volume counted by the HIAC (ml)

E: Depth (m)

F : Time of HIAC measurement (Universal Time)

G to DB: - **1th row:** lower limit d_i (μm) of the size class i . The upper limit of the last size class $i=100$ is $350 \mu\text{m}$.

- **Next rows:** number of particles counted within the range d_i et d_{i+1} , for the size classes $i=1$ to 100 , in the sample referenced in the column A, whose volume is indicated in column D. Example: Cell G2 indicates that 28260 particles ranging from $1,55$ to $1.617 \mu\text{m}$ was counted in 100ml sea water sampled in bottle N°2 of the rosette N°1.

Remarks: - The 108 profiles performed during the PROSOPE are available in the data file *Rosette.xls*, except for the profile N° 24 for which the HIAC Counter was used with another calibration curve.

- The profile named "pump" refers to samples obtained with a pump placed on board, and for which the corresponding depths are approximate.
- As 1.55 μm corresponds to the physical detection threshold of the sensor HRLD 400 HC employed during the cruise, the counts of the first size are probably underestimated and should not be considered.

2. Surface monitoring.

Measurements were performed every 2 minutes on seawater pumped continuously on board.

In the data file *Continu.xls*, columns are:

A: Time of HIAC measurement (Universal Time)

B to CW: - **1th row:** lower limit d_i (μm) of the size class i . The upper limit of the last size class $i=100$ is 350 μm .

- **Next rows:** number of particles counted within the range d_i et d_{i+1} , for the size classes $i=1$ to 100, in a sample of 40 ml. (During the surface monitoring, the volume of seawater sampled by the HIAC was always 40 ml.)

Remarks: -Acquisitions failed from: 24 Sept 20h00 to 25 Sept 16h40
26 Sept 10h25 to 27 Sept 5h00

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