

# Processing Backscattering at the DAC level

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ACTION 9

# Plan

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- ECO sensor
  - Measurements and Data processing
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  - Particle Backscattering related parameters

# Introduction

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The measurements :

-Scattering coefficient of a medium is the scattered fraction of incident light flux, divided by the infinitesimal thin layer of the medium. (Forward and backward  $b_b$ )

-The backward part is directly related to the density and size of particles, but also to their composition (i.e. organic vs inorganic)

-Measurements of the volume scattering function, VSF,  $\beta(\theta, \lambda)$  at a single plane (i.e. assuming azimuthal symmetry) and at a single angle (around  $117^\circ$ ) have been found to provide  $b_b$  with an uncertainty smaller than about 10% (Boss and Pegau, 2001)

-In order to obtain the particle backscattering scattering coefficient, the contribution of pure water  $b_{bw}$  is subtracted :

$$b_{bp}(\lambda) = 2\pi\chi\beta(\lambda) - b_{bw}(\lambda)$$

# Recommendations for addressing the Particle Backscattering processing

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Here are the recommendations to address the Particle Backscattering processing:

- The official Bio-Argo unit for Particle Backscattering is  $m^{-1}$

- Store any data transmitted by the backscatterometer with meaningful names.

The proposed name for the counts transmitted by the backscatterometer is "BETA\_BACKSCATTERING".

- Store in « PARTICLE\_BACKSCATTERING » the Particle Backscattering in  $m^{-1}$ , estimated from the « BETA\_BACKSCATTERING » counts.

- Fill properly the metadata to document the calibration, the conversions equations and the fields to identify a sensor.

## ECO sensor : Measurements and Data processing

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Raw data from the ECO backscatterometer BETA\_BACKSCATTERING are transmitted as counts, ranging from 0 to 4120 +/- 5.

$$\text{PARTICLE\_BACKSCATTERING} = 2 * \pi * \chi [(\text{BETA\_BACKSCATTERING} - \text{DARK\_BACKSCATTERING}) * \text{SCALE\_BACKSCATTERING}] - b_{bw}$$

PARTICLE\_BACKSCATTERING = particle backscattering of a sample of interest ( $\text{m}^{-1}$ )

BETA\_BACKSCATTERING = raw counts output when measuring a sample of interest

DARK\_BACKSCATTERING = dark counts, the measured signal output of the backscatterometer in clean water with black tape over the detector

SCALE\_BACKSCATTERING = multiplier in  $\text{m}^{-1}/\text{counts}$

The scale factor SCALE\_BACKSCATTERING, dark counts DARK\_BACKSCATTERING supplied by WETLabs for every wavelengths and will be stored in the "PREDEPLOYMENT\_CALIB\_EQUATION" and in the "PREDEPLOYMENT\_CALIB\_COEFFICIENT", as well as  $\chi$  and  $b_{bw}(i)$ .

## ECO sensor : Sensor metadata

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On the ECO sensor, there might be different backscattering sensors at different wavelengths

=>In the netcdf file, a new dimension should have been set : "N\_SUBLEVELS".

=>In order to be compliant with previous version, N\_SUBLEVELS will appear in the Netcdf File, only if it > 1.

For example, N\_SUBLEVELS=2, for an ECO3 sensor with two particle backscattering measurements at 532nm and 700nm)

Name	Value	Definition
N_SUBLEVELS	N_SUBLEVELS=<int value>;	TBD (Number of optical wavelengths" for backscattering parameters)

## ECO sensor : Sensor metadata

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Sensors	
SENSOR	backscattering
SENSOR MAKER	WET labs
SENSOR_MODEL	ECO
SENSOR_SERIAL_NUMBER	To be filled
SENSOR_UNITS	Counts
SENSOR_ACCURACY	
SENSOR_RESOLUTION	0.003m <sup>-1</sup>
OPTICAL_WAVELENGTH_BACKSCATTERING(N_SUBLEVELS)=<real value>;	Wavelengths of the optical measurements (nm)

## ECO sensor : Chlorophyll-a related parameters

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**PARAMETER**="BETA\_BACKSCATTERING"

**PREDEPLOYMENT\_CALIB\_EQUATION**="none"

**PREDEPLOYMENT\_CALIB\_COEFFICIENT**="none"

**PREDEPLOYMENT\_CALIB\_COMMENT**="Uncalibrated backscattering measurement"

This BETA\_BACKSCATTERING is converted in particle backscattering  
PARTICLE\_BACKSCATTERING

**PARAMETER**="PARTICLE\_BACKSCATTERING"

**PREDEPLOYMENT\_CALIB\_EQUATION**="PARTICLE\_BACKSCATTERING=2\* $\pi$ \* $\chi$   
\*((BETA\_BACKSCATTERING-DARK\_BACKSCATTERING)\*SCALE\_BACKSCATTERING- $b_{bw}$ )"

**PREDEPLOYMENT\_CALIB\_COEFFICIENT**="DARK\_BACKSCATTERING=71  
SCALE\_BACKSCATTERING=0.008,  $\chi$ =1.097,  $b_{bw}$ =0.00034978 (at 700nm)"

**PREDEPLOYMENT\_CALIB\_COMMENT**="Sullivan et al. 2009, IOCCG 2006 "