

Automatic analysers actually used PM10-PM2,5 for assessment differ from the reference (gravimetric) method.
 The European "Equivalence Document" of 2004-2005 is intended to reconcile PM analyser data with gravimetric reference.

Outline of the question for the Walloon network (Belgium)

analyser MP101M.C, beta attenuation	Source: ¹⁴ C 3,7MBeq (100 µCi)
Equivalence: only with a 24h cycle	Cycle length used : 2h or 6h
Correction factors used :	
1,08 (for one industrial site, factor from an actual gravimetric trial)	
1,37 (for eleven sites, actually factor taken from another beta analyser)	

Gravimetric standard troubles, filter material issue

Flaws in PM10 (EN12341) and PM2,5 (EN14907 standards) have been proven in 2004-2006, hence their on going revision.

Filter conditioning/blank issue	Standard's provision not sufficient
Filter material issue	Significant influence of quartz filter brand
example: equally legal quartz Macherey-Nagel filter instead of more widespread Whatman lead to 15% inferior results PM10 (VMM-Flanders summer data, 2006)	



Experience at Liège-Coditel telemetric site with the Swam-5a

Oct 2006-August 2007
 mean PM10~30 µg/m³

Network MP101M.C-2h

2 Swams (PM10+PM2,5)

trailer with PM2,5 equipment

Swam-5a : performances obtained

Flow stability: quadratic mean of deviations from nominal flow		
Mechanical reliability: 2 blockings in one year of use (user's mistakes)		
Equivalence beta versus own gravimetric result		Y=1,03x -0,66
Factor from ratio of means: 1,00		from orth. regr. through origin : 1,01
Beta analyser u_{bs} (µg/m³)	fibreglass Whatman	0,67 - 070
PM10-PM2,5 precision	quartz Whatman	0,67-0,76
Standard(s): ≤ 2 µg/m³	quartz Macherey	0,99

Trouble-shooting / initial problems

quartz adhesions with initial FAI cartridge	ISSEP solution to get around, then new cartridges delivered by FAI Dec. 2006
Shape of filter dust spots (evenness of dust layer)	Adjustment by firm (Feb.2007) after switching to new cartridges
Temp. of filter compartment	Rule of max Δ with ambient 5°C not fully respected. New Temp + RH regulation on exchange devices (April 2007)

Quartz brand issue and Swam beta attenuation analysis

Performing a beta attenuation mass analysis on a sampling filter isolates *sampling from field blank* aspect of filter material effect
 Effect observed: deviation of quartz Macherey from quartz Whatman (summer) PM10: minus 13% PM2,5: minus 11%

Swam analyser as transfer standard, correction factors got

Swam filter material	factor
fibreglass Whatman	1,15
quartz Macherey-Nagel winter	1,20
quartz Whatman summer	1,17
quartz Whatman winter	1,25
from ratios of means, very similar with orthogonal regression through origin	

Interim conclusions, benefits of transfer standard approach

The MP101M.C (with a cycle shorter than 24h) is flunked et equivalence trials and has ultimately to be replaced.
 Although data of several other sites is necessary, use of the Swam as a transfer standard showed that the appropriate correction factor is in the range 1,15-1,25 and that current practice (1,37 factor) corresponds to an overestimation for PM10 concentrations of 12 to 22%.
 That transfer standard approach can speed up removal of inconsistencies.

The Swam-5a, dual channel analyser and sampler



Dual channel Reference **SAMPLER**

Dual channel **beta attenuation ANALYSER** on same Reference filters

here with the option integrated **OPC** Optical counting device

Features of SWAM-5a of FAI-Instruments, Fonte-Nuova, Italy

Most obvious use PM10+PM2,5 analyser and sampler,
Source: ¹⁴ C 3,7MBeq (100 µCi)
Autonomy: 34 filters (17 days) in configuration used by ISSEP
Beta cycle duration the same as filter sampling duration, which almost always means (as for our experience) 24 hours
Two resident aluminium calibration foils re-analysed each cycle, and three resident "spy filters" (same material as sampling filters), to check/correct influence not due to the layer of sampled dust on the filter.



LEFT
4-modular Swam s/n 129
 OPC included
 TSP inlet of OPC, far right
 Service/flow unit for OPC requires a fourth module
 door hinge height: 2,03 m

OPC channels "Fine" + "Coarse"
 Resolution: from 5 minutes

RIGHT
3-modular Swam s/n 126
 door hinge height: 1,67 m
 90 kg in all, truly transportable

UPPER MODULE, BACK
 more or less idiot proof labelled connections for sampling lines, compressor etc. to be reconnected after putting apart for transport and reassembling the device

SECOND UPPER MODULE, BACK
 with Temp.RH Conditioner in favour of upper Swam and filters module

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