

Measurement Guidelines

for the determination of particulate organics

*2nd OGTAC-CC community meeting within the framework of the
CAIS-ECAC CF 04/2026*



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 - 6.1.1. Documentation
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 - 6.1.3. Analytical procedure

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Sample pre-treatment, storage and transport

5.4. Sample pretreatment, storage and transport

In general, it is highly recommended to minimize all filter handling steps, transport of samples and keep the storage duration as short as possible, at the measurement site and at the laboratory. If any filter manipulation at the measurement is needed use always new gloves (anti-static and powder free) and cleaned tweezers in a suitable clean workplace.

Sample pretreatment:

- Conditions for filter or impactor substrate pretreatment, like preheating temperature (°C) and time (h) should be documented

Filter/ Impactor substrate weighing:

Weighing of filter/ impactor substrate samples is not required for the determination of particulate organics. However, the CC highly encourage the observatories to include the particulate mass determination within their measurement procedure.

Sample storage:

- Should be done protected from external contamination and in the dark, e.g. in light protected boxes or wrapped in aluminum foils, in zip-lock bags, clean glass petri dishes or similar containers
- Unsampld filters or impactor substrates can be stored at the measurement site as transported without a maximum storage time if an adequate field blank measurement is available
- After sampling, samples should be stored in a fridge or freezer at the measurement site, maximum sample storage time and conditions until further sample preparation in the laboratory is individually given in [Table 3](#)
- Sample storage can be done either as single filter or by folding the filter
- Impactor substrates are not permitted to be stored folded

Table 3: Recommended sample storage conditions and maximum storage times after sampling.

Module	Name of the module	Recommended storage conditions for filter/ substrate material	Recommended maximum storage time
1	Biomass Burning	Freezer	84 days
2	Primary Biogenic		
3	Organic Ions		
4	Biogenic SOA – Acids		
5	SOA – Aldehydes		
6	SOA – Nitroaromatics		
7	16 EPA PAHs		

Sample transport:

- Should be done protected from external contamination and in the dark, e.g. in light protected boxes or wrapped in aluminum foils, in zip-lock bags, clean glass petri dishes or similar containers
- Use sample transport boxes with the option of cooling to avoid excessive heating, e.g. by using cooling packs to prevent loss of volatile and semi-volatile materials during transport. Temperature should not exceed 23°C. Effects of condensation within the cooled transport box can be avoided by packing the samples in plastic bags or by sealing them.
- It is recommended to ship for daily sampling a one-week supply from the laboratory to the site, and vice versa, once every week. Exceptions because of particular site conditions are possible but need to be discussed with the CC.
- It is the decision of the NF to transport the filter placed in the filter holder to the measurement site and back to the lab or remove the filter on-site and transfer only the filter as described before.
- Sample transfer can be done either as single filter or by folding the filter
- Impactor substrates are not permitted to be transported folded

For ACTRIS observatories with special circumstances, e.g. very remote sites which cannot or only partly fulfill these requirements, all operational tasks must be organized in such a way that the sample quality does not suffer (e.g. cooling packages/dry ice for sample storage) and the full procedure is documented in detail to the calibration centre.



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Example of a particle sampling protocol

5.7. Example of a particle sampling protocol

Application of the measurement guideline for aerosol particle sampling on a 150 mm quartzfilter using a High-volume Digital sampler with PM10 inlet:

Pretreatment at the laboratory:

- Quartzfilter order in batches, 1% of the filter from each batch is restored for blank experiments
- Preheating according to VDI 2463¹⁰ at 110°C for 24 h, hot filters are transferred to a compartment drier to cool down to laboratory ambient temperature
- Equilibration for 72 h in a climate-controlled weighing room (if weighing is part of the sampling protocol), temperature and relative humidity are documented (typically within a range of 20.5-23.5°C and 25-60% relative humidity)
- Each step is documented with date and time

Weighing (optional part of the sampling protocol):

- Temperature and relative humidity (typically within a range of 20.5-23.5°C and 25-60% relative humidity) documented during weighing in an automated balance (METTLER AT261 DeltaRange)
- Filter sample transferred in light protected aluminum container, aluminum containers are precleaned using a laboratory dishwasher working with ultrapure water, if containers are new precleaning is done with neutracon, ethanol and ultrapure water (three times)
- Pretreated filters are stored within the aluminum containers in the weighing room until transport to the measurement site, maximum number of filter samples prepared in advance of the sampling is about 30 (one month)

Sample transport:

- Filter sample is placed within the respective filter holder for transport, each filter holder is wrapped in aluminum foil (marked to each sample)
- The wrapped filter holders are stacked in a small Zarges box to be transported via car to the measurement site (about one-hour drive)
- Transport 7 new filter samples once a week

Action at measurement site:

- Filter holder with filter sample unwrapped in a clean workplace and stored within a plastic container with dedicated holder options assisting the safe transfer to the Digital high-volume filter sampler at the point of measurement (sampler is placed outside)
- Used aluminum foil to wrap the filter sample in the filter holder is stored and used for the transport back after sampling exactly for the identical sample

Action at the point of measurement:

- All 7 filter samples with filter holders inserted in the high-volume sampler at ambient conditions, samples have to be protected from rain

- Every week exchange of 7 sampled filters with 7 fresh pretreated filter samples, however, the sampler contains for safety reasons always 15 samples in total
- → Maximum time of filter samples within the sampler is 14 days
- → Maximum time of filter samples within the sampler after sampling is 7 days
- Sampled filter with filter holder are transferred back to the clean workplace at the measurement site again using the plastic container

Action at measurement site:

- Sampled filter and filter holder are wrapped in aluminum (same as the way there) that was stored folded at the clean workplace
- 7 wrapped filter holders are stacked in the small Zarges box for transport to the laboratory

Sample transport:

- The Zarges box including the sampled filters is handled and transported with care and attention of keeping the temperature within the box below 23°C (about one-hour drive in an air-conditioned car).

Action at the laboratory:

- Samples are typically stored as they arrive at the laboratory in a fridge at 5°C over night
- The next day, sampled filter are removed from the filter holder and transferred back in the previously used aluminum containers and stored in a freezer at -20°C until further action

Weighing (optional part of the sampling protocol):

- Aluminum containers out of the freezer and stored within the climate-controlled weighing room for about 2 h
- Sampled filters removed and placed in dedicated holders for 72 h of equilibration
- Weighing by using an automated balance (METTLER AT261 DeltaRange)
- Temperature and relative humidity documented, two times a (weighing-) day a reference filter is weighed 10 times to derive the standard deviation
- Note: accidentally collected small insects are removed before weighing, other obvious issues are documented via pictures in the protocol
- Filters are again stored within the aluminum containers in a freezer at -20°C until further processing, in the case the next sample preparation steps won't be shortly after the weighing the filters are not transferred to the aluminum containers but wrapped only in aluminum foil without folding and then stored in a freezer (storage space)



Template available for NF individual SOP

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- Recommended and supported analytical techniques and figures of merit to be met for the determination of particulate organics:

Table 3: Recommended and supported analytical techniques and analytical figures of merit to be met for the determination of particulate organic tracers.

Target compound	CAS number	Recommended and supported analytical technique	Maximum laboratory bias	Analytical limit of detection [mg L ⁻¹]
Levoglucozan	498-07-7	HPAEC-PAD	20%	0.05
Mannosan	14168-65-1		20%	0.05
Galactosan	644-76-8		20%	0.1

- Other analytical methods applicable, participation in ILC will demonstrate capabilities (quality control)
- Intensive exchange between the NF and the CC for 1st time documentation

Instrument information:

- General type
- Autosampler type
- Injector (amount of injected volume)
- Detection unit
- Separation column (stationary phase)
- Mobile phase

Analytical conditions:

- Flow rate
- Temperature program
- Gradients
- Oven temperature
- Concentrations/mixtures

➤ **All linked to the instrument database!**



OGTAC-CC provides a detailed example for each recommended analytical protocol!

TROPOS

Planned activities within implementation phase

2) Calibration Centre Activities – task chain

- Definition of **target compounds**, e.g., biomass burning or on secondary organic aerosol constituents of biogenic and anthropogenic origin
- Set up **technical requirements**, for all steps from sampling to the quantitative result, set Data Quality Objectives (DQO)
- Development of **measurement guidelines** based on the technical requirements and **Interlaboratory Comparisons** (ILCs)

Future activities:

- SOP templates needs to be finalized by each NF individually together with the calibration centre containing step by step instructions for a specific sampler/analytical method combination at the respective NF (max. level of detail)
- **NF individual SOP** will finally need approval by the calibration centre
- Define **QA/QC** procedures, e.g., performance test by ILCs
- Develop workflow for offline **data submission**



We will publish the draft versions on the cais-ecac website

<https://www.actris-ecac.eu/>

TROPOS

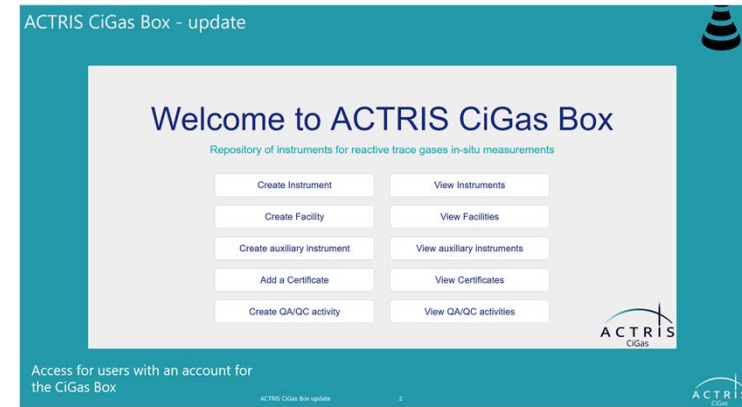
2nd OGTAC-CC community meeting 2026 (online) – Agenda Tuesday April 28	
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15:15 - 15:45	Information about the next ILCs
	a) Biennial ILC on <i>modules 1+2</i> autumn 2026
	b) 1 st ILC on PAHs (<i>module 7</i>) spring 2027
15:45 – 16:00	Open discussion

(Offline) in-situ instrument data base

Main goal → Setup a common instrument data base for all (offline) in-situ measurements throughout ACTRIS CFs (CiGas, CAIS-ECAC, CIS)

Current status:

- Working group exists, lead: KIT
- CiGas established the “CiGas Box”, an instrument data base for trace gas in-situ instrumentation
- Agreement exists between CiGas and the other CFs to use this as a common instrument data base
- Templates need to be adapted → unfortunately CiGas lost their developer, current discussion on how to implement the other CFs (strategy, resources, hosting...)
- Next meeting June 2026



<https://cigas-box.fz-juelich.de/>



Data acquisition and processing (offline data workflow)

General:

- Sequence table shall include a defined set of samples, blanks and control standards, e.g. one control standard every 10 samples
 - Sample results need to be in the calibrated concentration range of the target compound, if not samples need to be diluted
-
- Data acquisition and storage always as 1) raw data plus the corresponding calibration curves, 2) processed to the level of mass per volume extraction solvent and 3) processed to the level of atmospheric concentration in mass per volume air
 - Traceability is still an open issue, to be solved within ACTRIS Next
 - *Current agreement regarding offline data workflow documentation is to follow the EBAS templates including preparation, exposure, extraction and analysis protocol (machine readable protocol database) → under development...*

OGTAC-CC draft for the offline data workflow

10.1. Draft offline data workflow OGTAC-CC for metadata provision

Content:

Institute/NF/Laboratory

Station latitude

Station longitude

Station altitude

Time zone

PI

File name

Protocol	Property	Obligation	Description	Comment
Medium pretreatment	medium type	M	substrate material, could be a drop-down list	Do we need a drop-down list?
	medium description	M	free text e.g. manufacturer or name or size...	EBAS: Make/manufacturer and filter size. Free text.
	medium identifier	M	internal handling name of the batch of medium	or substrate material
	treatment SOP	M	URL or version number of SOP	Individual NF SOP
	date	M	date of handling ISO8601 YYYY-MM-DD (HH:mm:ss)	
	medium prefiltering	M	Temperature in Kelvin and duration of medium prefiltering treatment, or 'Not prefiltered' if this is the case.	
	medium conditioning	M	Temperature (in K), relative humidity and duration of filter conditioning. Set to 'None' if filter is not conditioned.	
	medium storage condition	M	Temperature (in K)	could be also > < XYK
	medium transport	M	transport start/end date/time, duration, temperature, container, type of transfer	

Medium exposure	Property	Obligation	Description	Comment
	medium Identifier	M	internal handling name of the batch of medium	
	station code/name/ID	M	NF specific	this should only link to the NF general description
	exposure SOP	M	URL or version number of SOP	Individual NF SOP
	instrument type	M	Type of sampling device (high volume, low volume, impactor...)	
	exposure device identifier	M	PID of the exposure device	PID includes name, manufacturer, model, serial number and the connected inlet, therefore no further inlet information needed but should we add the size fraction here?
	Size fraction	M	PM10, PM2.5 or PM1 or TSP	
	exposure start	M	start date of exposure ISO8601 YYYY-MM-DD HH:mm:ss	
	exposure stop	M	stop date of exposure ISO8601 YYYY-MM-DD HH:mm:ss	if identical to exposure start then "blank filter"
	exposure latitude	M	latitude of measurement location in degN	measurement location NOT station location
	exposure longitude	M	longitude of measurement location in degE	
	exposure altitude	M	altitude of measurement location in m a.s.l.	
	measurement height	M	height of the inlet above the ground in m a.s.l.	
	sampled air volume	M	unit???	shall we allow different units to follow what is measured within the particular instrument?
	exposure temperature	M	Temperature (in K)	as average?

	exposed substrate area	M	Size of the area of the substrate material that has been exposed, unit cm ²	not relevant for impactor sampling
	filter face velocity	M	Filter face velocity (cm s ⁻¹) = Flow rate (cm ³ min ⁻¹)/60 (s min ⁻¹)/ Exposed filter area (cm ²)	not relevant for impactor sampling
Medium storage and transport	loaded substrate identifier	M	internal handling name of the loaded substrate material (sample)	
	on site storage conditions	M	Temperature (in K)	could be also > < XYK
	loaded substrate transport	M	transport start/end date/time, duration, temperature, container, type of transfer	
	laboratory storage type	M	as loaded substrate material or as extract	
	laboratory storage conditions	M	Temperature (in K)	could be also > < XYK
Sample preparation	loaded substrate identifier	M	internal handling name of the loaded substrate material (sample)	
	date	M	date of handling ISO8601 YYYY-MM-DD HH:mm:ss	
	weighing-out prior sample preparation	M	Temperature (in K), relative humidity and duration of loaded substrate weighing-out. Set to 'None' if loaded substrate is not weighed-out.	
	sample preparation SOP	M	URL or version number of the SOP	Individual NF SOP
	laboratory code	M	if analysis is not performed at station, information on laboratory	EBAS Code?
	sample identifier	M	internal handling name of the sample (extract from loaded substrate material)	

	extracted filter area	M	Size of the area of the filter that has been extracted, unit cm ²	
	extraction type	M	device type used for extraction	shaker, ultrasonication
	extraction solvent	M	free text	to handle also mixtures
	extraction volume	M	(mL)	
	extraction conditions	M	time (min), temperature (K), speed (rpm)	
	filtration type	M	manufacturer name	
	sample storage	M	Temperature (in K), "No" means direct analysis after extraction	
Sample analysis	sample identifier	M	internal handling name of the sample (extract from loaded substrate material)	
	analytical measurement technique	M	drop down menu	see right the example from EBAS
	analytical instrument type	M	PID	PID includes name, manufacturer, model, serial number of both the separation and the detection unit
	analysis SOP	M	URL or version number of the SOP	Individual NF SOP
	date	M	date of handling ISO8601 YYYY-MM-DD HH:mm:ss	
	sample analysis procedure identifier	M	internal sequence reference	file name
	internal standard	M	name + manufacturer; if more than one please separate by semicolon	free text
	external lab code	O	unique laboratory identifier if an external lab is doing the analysis	

- Current activity besides the working group action
- We will use these type of templates and adapt to our needs
- Agreement of the ACTRIS data centre needed
- If yes, NF will be allowed to upload level 2 data to the ACTRIS data centre earliest from 01/2026

Requirements for the labelling:

- Min. requirement: 2 target compounds from one or more modules and successful participation in the corresponding biennial ILC, data upload within the respective time and coverage

Assessment of the ILC results, what does successful participation mean?

- General assessment via z-score, like OC/EC as variable questionable, because of the relatively small number of NFs (obligatory ILC participants) <10
- Statistics not robust enough
- Evaluation following the GAW guidelines for precipitation chemistry

$$\text{Acceptable Range (in percent)} = \pm [0.5 \cdot \frac{\text{IQR}}{\text{Median}} \cdot 100]$$

Eq. A-3

1) For each measurement, calculate your laboratory bias as:

$$\text{Bias} = 100 \cdot \frac{(C_{lab} - \text{Median } C)}{\text{Median } C}$$

Eq. A-4

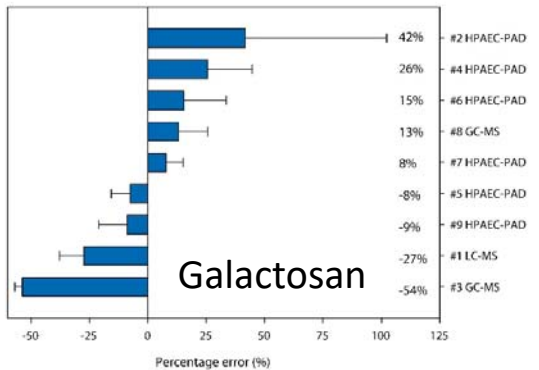
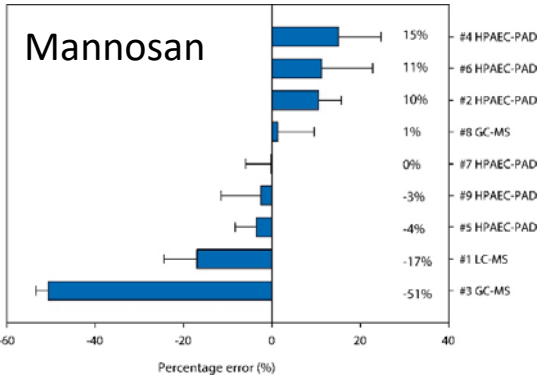
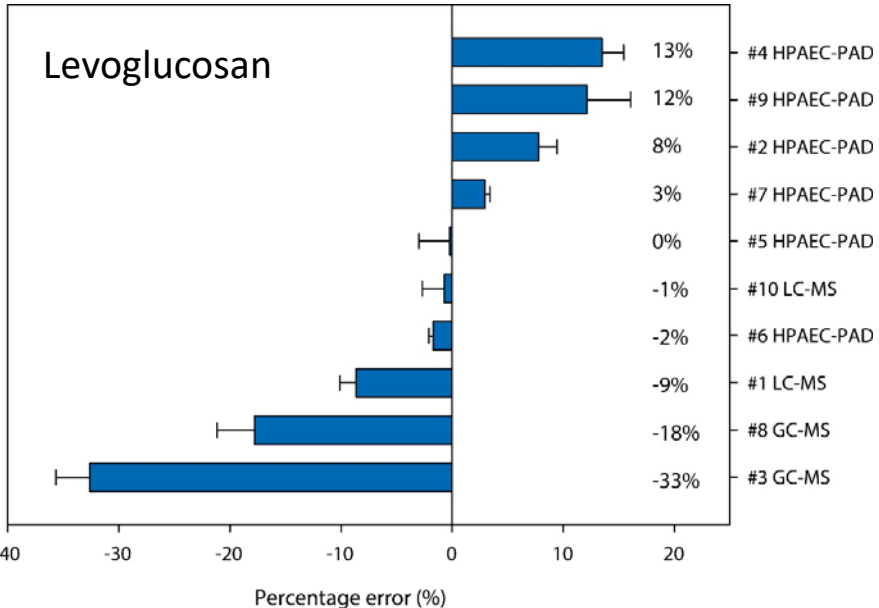
C_{lab} = laboratory's reported measurement
 $\text{Median } C$ = median measurement of all laboratories

- Use of the real filter sample results, the results of the standard solutions are evaluation criteria in the second instance
- DQOs are compound (class) dependent

TROPOS

Example BB module 1

Results from the last ILC – filter samples:



Bias: 1) Levoglucosan: -33-13%
 2) Mannosan: -51-15%
 3) Galactosan: -54-42%

Acceptable range – filter samples:

- | | | |
|----------------------|--------------------------|-------|
| 1) Levoglucosan: 10% | $\approx \times 1.5$
 | = 15% |
| 2) Mannosan: 11% | | = 15% |
| 3) Galactosan: 22% | | = 30% |

Average: 20% maximum laboratory bias set as DQO!

Acceptable range – standard solutions:

- 1) Levoglucosan: 12%
- 2) Mannosan: 15%
- 3) Galactosan: 14%



Table 2: General Data Quality Objectives (DQOs) for organic tracers and aerosol constituents.

DQO	Description
Sampler	High- or Low-volume sampler and cascade impactors according to DIN EN 12341:2023-10. ²
Field blank sampling	Minimum number shall correspond to 5% of the number of real measurement samples or minimum once a month.
Measurement time	It is recommended to measure on a continuous basis, minimum requirement is a weekly sample or one sample per week, exceptions, like intensive measurement campaigns need to be individually discussed with the calibration centre (CC).
Analytical instrument calibration	5 concentration levels, measured as triplicate
Maximum laboratory bias	Module dependent – see the measurement guidelines documentation
Limit of detection	Module dependent – see the measurement guidelines documentation
Data coverage	≥ 80% of the planned yearly activity. Technical issues and maintenance to be done by the manufacturer are excluded.
Data provision	Beginning of the next year for the full year before: 1) submission to the CC - Deadline 31 st of March 2) submission to the DC - Deadline 31 st of May
Interlaboratory comparisons	Participation in biennial module specific ILCs and stay within the maximum laboratory bias, the ILC data is discussed with the participants in a workshop after the data is assessed.

Table 5: Key facts of the laboratory analysis protocol and individual DQOs for the Biomass Burning module 1.

Target compound	CAS number	Recommended and supported analytical technique	Maximum laboratory bias	Analytical limit of detection [mg L ⁻¹]
Levogluconan	498-07-7	HPAEC-PAD	20%	0.05
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An ILC participating laboratory fails the QA if:

- a) Average of all submissions is outside of the DQO
(depending on the number of samples)
- b) >50% of individual submissions is outside of the DQO
(depending on the number of samples)

What would happens next?

- Lab is contacted by OGTAC-CC to identify potential problems
- Data can be reprocessed if software or data treatment issues are identified
- Additional standard control checks can be performed
- Otherwise data need to be flagged (offline data flagging is not yet decided, needs a common agreement between CFs and the DC)

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