Project Update: STANBC @ EAC 2025

Moderator:
Krzysztof Ciupek (NPL)

Panelists:
Marjan Savadkoohi (IDAEA/CSIC)
Hilkka Timonen (FMI)
Joel Corbin (NRC-CNRC)
David Green (ICL)
Jorge Saturno (Coordinator of STANBC project, PTB)

The BC Symposium organized by 22NRM02 STANBC project during European Aerosol Conference EAC2025 (3 September 2025, Lecce, Italy) convened a panel of experts and an engaged audience to explore the challenges and opportunities surrounding Black Carbon (BC) in environmental science.

The inclusion of BC in the new EU Air Quality Directive marks a significant policy shift, and any ambiguity remains regarding standardization, harmonization, and reporting this metrics have been and are being addressed in STANBC.

BC Symposium @ EAC 2025

Key themes included:

- **Measurement & Harmonization:** Panelists stressed the need to standardize BC measurement techniques, particularly light absorption metrics together with mass determination via mass absorption cross-section values (MAC). The distinction between instrument-based (eBC, EC, rBC) and traceable material-based definitions was a recurring topic.

- **Health & Climate Impacts:** BC's dual role as a climate forcer and health hazard was emphasized. The need for consistent data to support meta-analyses in health studies was highlighted, along with the importance of metrics like particle size distribution (PSD) and surface area.

- **Policy & Communication:** Reporting BC in mass concentration units (µg m-3) was deemed essential for clarity and comparability with PM2.5. The panel called for clearer guidelines and better communication with the public and policymakers.

- **Collaboration:** A strong consensus emerged on the need for continuing and extending the cooperation between researchers, instrument manufacturers, and regulators to advance BC standardization and implementation.

Technical Updates

The STANBC project is approaching its final phase. The following deliverables are now publicly available.

Deliverable 1: Guide on the traceable calibration of in situ EMS and PTI methods to determine aerosol light absorption coefficients as a function of the light source wavelength and aerosol SSA using reference gases and aerosols with an uncertainty budget (target ≤10 %)

This deliverable describes calibration procedures for aerosol light absorption measurement techniques that are considered as primary standards given their traceability to SI-units. The described techniques include photothermal interferometry and extinction-minus-scattering.

Deliverable 2: Report on the generation of a traceability chain for transferring light absorption calibrations between EMS and PTI reference methods and field instrumentation used for environmental measurements of BC using photoacoustic spectrometers as the transfer instrument

This deliverable outlines the development and implementation of a traceability chain for the calibration of light absorption measurement system for of black carbon (BC) aerosols. The approach enables reliable transfer of calibration from laboratory-based primary standards (e.g., Extinction Minus Scattering and Photo-Thermal Interferometry) to field-deployable instruments.

Deliverable 3: Report on the establishment of the relationship between eBC mass, rBC mass and EC mass (EN 16909:2017) based on the range of MAC values established in an intercomparison of aerosol absorption and EC mass using different monodisperse soot and aged soot aerosols (mobility diameter range 70 – 400 nm) with an uncertainty based on traceable measurements of light absorption coefficient and EC mass

The definition of BC is qualitative, and therefore more narrow descriptions: equivalent black carbon (eBC),refractory black carbon (rBC) and elemental carbon (EC), have been defined, corresponding to the main principles of practical BC mass measurement techniques. In this deliverable, fresh and coated BC particles generated under controlled laboratory conditions were used to compare mass-based measurement techniques, like EC/OC analysis and SP2 vs. light absorption coefficient measurements, including PTI and EMS.

Publications

Mass absorption cross-section of ambient black carbon aerosols - a review.

Eija Asmi, Timothy A. Sipkens, Jorge Saturno, John Backman, Konstantina Vasilatou, Ernest Weingartner, Alejandro Keller, Krzysztof Ciupek, Thomas Müller, Arun Babu Suja, Griša Močnik, Luka Drinovec, Konstantinos Eleftheriadis, Maria I. Gini, Andreas Nowak & Joel C. Corbin. https://doi.org/10.1038/s41612-025-01288-2, 2025

An accurate assessment of black carbon (BC) climate and health impacts requires knowledge of its mass absorption cross-section (MAC_{BC}), which links optical and mass measurements. In this review, we highlight the wide variability in atmospheric MAC_{BC} observed at ambient monitoring stations worldwide, based on different measurement approaches. We analyze MAC_{BC} values from 80 studies covering diverse environments, including urban areas, remote regions (such as rural, Arctic, and high-altitude sites), and mixed settings like suburban locations and urban outflow regions.

Characterization of filter photometer artifacts in soot and dust measurements – laboratory and ambient experiments using a traceably calibrated aerosol absorption reference.

Yus-Díez, J., Drinovec, L., Alados-Arboledas, L., Titos, G., Bazo, E., Casans, A., Patrón, D., Querol, X., Gonzalez-Romero, A., Perez García-Pando, C., and Močnik, G. https://doi.org/10.5194/amt-18-3073-2025 , 2025.

This study presents a comprehensive analysis of the multiple-scattering compensation parameter (C) and cross-sensitivity to scattering for the widely used AE33 and CLAP filter photometers, as well as a detailed characterization of the pseudo-reference MAAP. The results enable more accurate correction of filter-photometer-derived aerosol absorption coefficients, highlight the importance of accounting for scattering artifacts and particle size, and underscore the need for reference-quality absorption measurements. The findings also motivate a re-evaluation of previously reported absorption coefficients and mass absorption cross-sections derived from MAAP data.

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Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EURAMET. Neither the European Union nor the granting authority can be held responsible for them.

The project has received funding from the European Partnership on Metrology, co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States.

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