Measurement of black carbon absorption using photo-thermal interferometry

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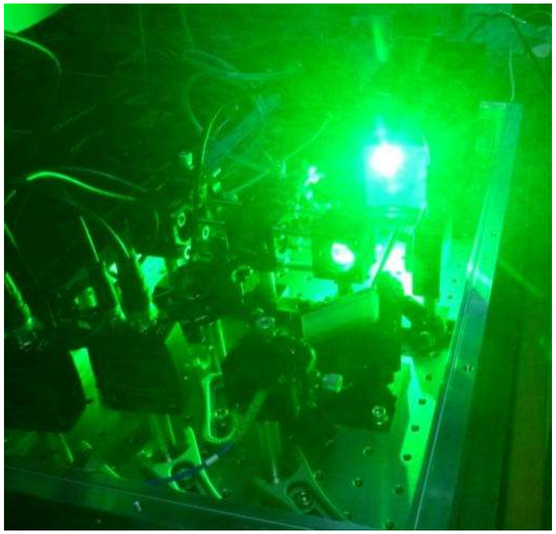
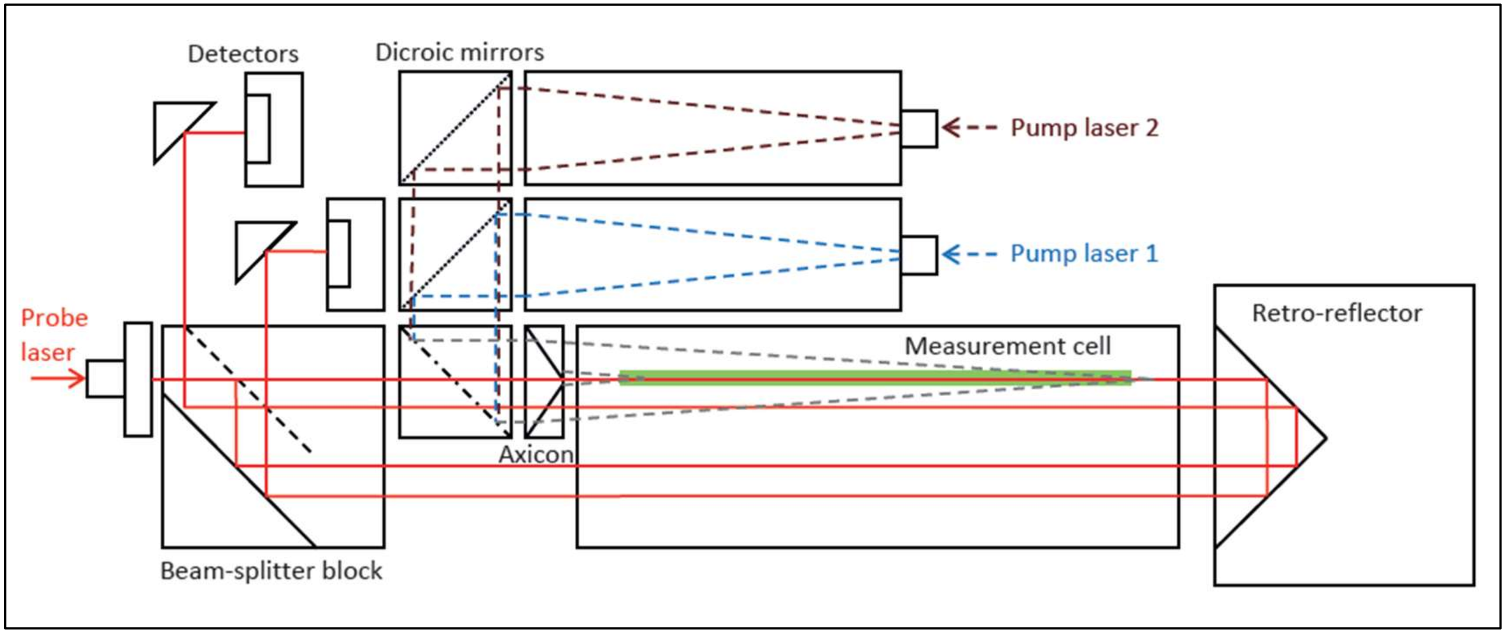


Modini, Bell, Zhang, Jiang, Saathoff, Linke, Ferrero, Jagodič, Kattner, Zanatta, Petit, Holanda, Fombelle, Kalbermatter, Visser, Röhrbein, Oscity, Weingartner, Hyvärinen, Gysel-Beer, Vasilatou, Favez, Močnik

BC Footprint seminar – Tampere, 7. Oct 2024

Photo-thermal aerosol absorption monitor (PTAAM)

- Photo-thermal interferometer
- Pump beam focused by **axicon** (patent EP 3492905)
- Article: Drinovec et al., 2022
- Simultaneous measurements at **532 & 1064** nm (or 450 & 808 nm)
- Absorption coefficient determined with ultra-low uncertainty



Determination of MAC & absorption enhancement *E*

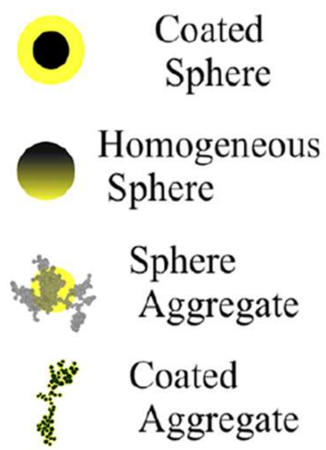
$$MAC = \frac{b_{abs}}{BC}$$

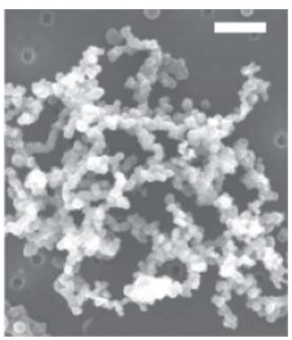
$$MAC = E * MAC_0$$

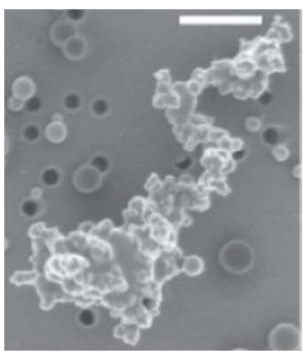
- Laboratory campaign at METAS 2021
  - miniCAST soot
  - Flow-tube reactor
- Laboratory campaign at PSI 2021
  - laboratory combustion sources
  - Photo-oxidation chamber
- Ambient campaigns – winter 2021-2022
  - Ljubljana – urban site
  - Deskle (Slovenia) – rural site
  - Paris – SIRTA – regional background site

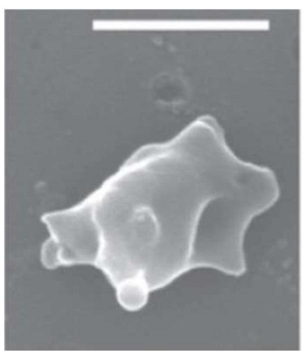
Conclusions

- Absorption of BC was measured in laboratory and ambient campaigns
- MAC depends on coating thickness and particle geometry
  - Oxidation flow-reactor: higher enhancement at shorter wavelengths
  - Photo-oxidation chamber: strong enhancement for all wavelengths
  - Ambient studies: absorption enhancement between 1.1 and 2.1
- We need to measure coating thickness and particle-coating geometry









Project stanBC

Standardisation of Black Carbon Aerosol metrics for air quality and climate modelling

stanBC

European Partnership | Co-funded by the European Union

METROLOGY PARTNERSHIP | EURAMET

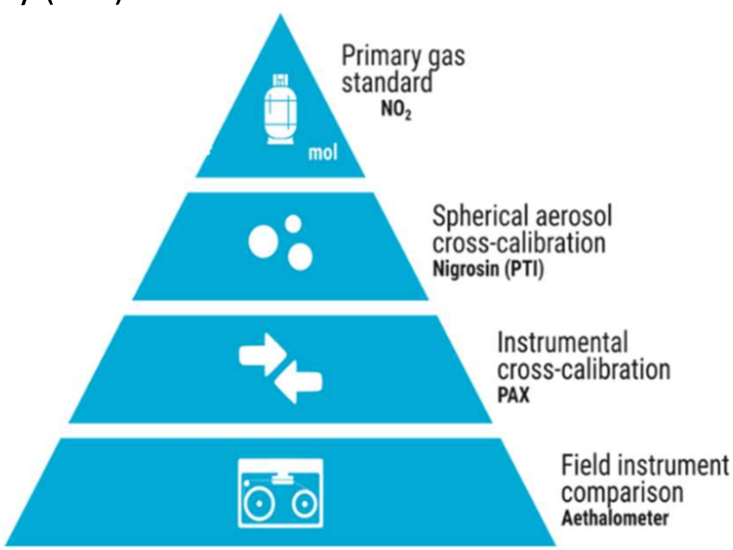
Uncertainty (k=1)

2%

5%

10%

25%



Aerosol absorption traceable to **primary definitions** of SI units

Primary standard methods

- **Photo-thermal interferometry (PTI)**
- Extinction-minus-scattering (EMS)

Secondary standard: PAX 870 nm

Field instruments: Filter photometers

Thank you for your attention

Additional questions -> luka.drinovec@ung.com

Acknowledgements

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