(24-240329-A) **Calibration Methods for In-situ Aerosol Absorption Instruments**

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Few direct methods for in-situ aerosol absorption measurement include photothermal interferometry and photo-acoustic spectroscopy. In-situ absorption instruments use different calibration schemes. NO2 is used for calibration in the visible range and can be traceable to SI units. Particles, on the other hand, allow calibration without wavelength limitations. Water soluble nigrosin is a candidate calibration material, forming spherical particles when nebulized. Mie calculations can be used to determine absorption coefficients. Calibration with monodisperse aerosols provides lower uncertainties compared to polydisperse ones.

We compare different calibration schemes in light of their measurement uncertainty and ease of implementation. Aerosol absorption was measured with a photothermal interferometer PTAAM-2λ (Haze Instruments). NO2 calibration was performed using a SI-traceable mobile reference gas permeation generator based (METAS), pre-prepared NO2 mixtures in cylinders or ambient NO2. Monodisperse nigrosin was selected from the nebulized sample using a centrifugal particle mass analyser (CPMA, Cambustion) and an electrostatic classifier (EC 3082, TSI) in series (Fig. 1), removing multiply charged particles and neutral particles from the sample stream. Particle number concentration was quantified using a condensation particle counter (CPC 3750, TSI). The refractive index of nigrosin was determined by using an ellipsometer (Acurion).

The experimental results and a comparison with the Mie model monodisperse nigrosin aerosols are shown in Fig. 2. The Mie calculation is based on measured particle number, measured nigrosin refractive index and either on particle mobility diameter (SMPS) or mass derived diameter (CPMA). Error bars represent method uncertainty. The Mie model using the mass derived diameter shows better agreement with the measurements.

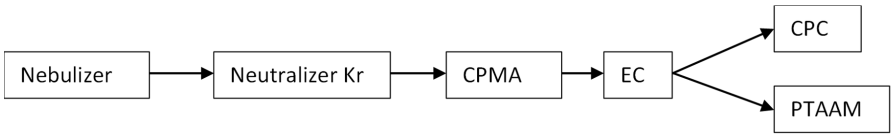


**Figure 1.** Experimental setup.

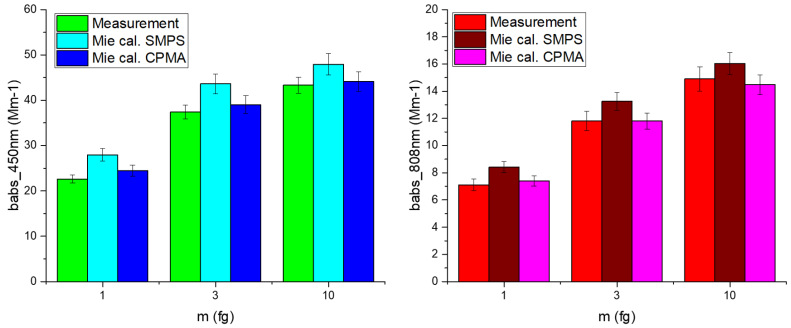


**Figure 2.** Monodisperse nigrosin – measured and modelled absorption coefficient. Errors are method uncertainty.