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INTRODUCTION TO PRAGUE AEROSOL CALIBRATION CENTER

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INTRODUCTION

Prague Aerosol Calibration Center (PACC) is a node of Central Facility for Aerosol In-Situ measurements CAIS-ECAC (Centre for Aerosol In-Situ - European Centre for Aerosol Calibration and Characterisation) of a pan-European research infrastructure called ACTRIS ERIC (Aerosols, Clouds and Trace gases Research Infrastructure). ACTRIS ERIC is associating research performing organizations all over Europe, concentrating on high-quality observations of different atmospheric variables and processes. Main goal of ACTRIS large research infrastructure is to provide high-quality open-access data on aerosols, clouds and trace gases. ACTRIS also creates a platform for researchers to combine their efforts to tackle the most important challenges related to different fields of science (e.g. air quality, health, climate change). The ACTRIS community currently comprises over 100 research performing institutions and organisations from 22 European countries.

The ACTRIS data are measured and provided to central database by ACTRIS National Facilities (NF), which are in other words the observational (ground-based measurement stations) or exploratory platforms (mobile labs, UAVs, experimental chambers) operated by the research performing organizations. ACTRIS NFs are supported by ACTRIS Central Facilities (CF), which provide the operational support to the NFs, QA/QC measures, SOPs, calibration services, as well as services to ACTRIS and non-ACTRIS users (including instrument manufacturers and authorities on national and international levels).

The PACC is a newly built calibration laboratory within ACTRIS CAIS-ECAC CF. The PACC is equipped with state-of-the-art aerosol instrumentation and currently offers calibration/validation of Condensation Particle Counters (CPC), Mobility Particle Sizer Spectrometers (MPSS) and Aerodynamic Particle Sizer Spectrometers (APSS). The services of the PACC will be expanded in the near future to offer calibration/verification of instruments measuring optical properties of aerosol particles. Furthermore, the PACC is capable of performing characterization of size-resolved penetration of aerosol particles through various parts of aerosol sampling lines (such as membrane dryers, flow splitters, etc.). The PACC is closely linked and harmonized with the World Calibration Centre for Aerosol Physics (WCCAP, TROPOS, IfT, Leipzig). Regular intercomparisons between the two calibration centers are performed in order to assure high quality calibration/verification services. The PACC is offering also hands-on training for ACTRIS NF operators and technicians, consultancy and knowledge transfer to ACTRIS and non-ACTRIS users from academic and commercial sector.

CALIBRATION SET-UPS

The state-of-the-art calibration set-up includes three separate calibration lines for CPC, MPSS and APSS calibration/validation. On top of the calibration lines, the PACC is

also equipped with flexible set-up for characterization of size-resolved aerosol particle losses in various parts of sampling lines.

The calibration setup for CPC counting efficiency and concentration linearity response (see Fig. 1) is based on a two-furnace design using silver as a source of well-defined spherical reference aerosol particles. The polydisperse aerosol is then transported to the reference electrostatic classifier which enables the precise selection of the monodisperse fraction of the reference aerosol. The monodisperse aerosol is then diluted and distributed to the reference CPC and reference aerosol electrometer (the primary standard) and the candidate CPCs. The whole set-up complies with the ISO 27891 standard.

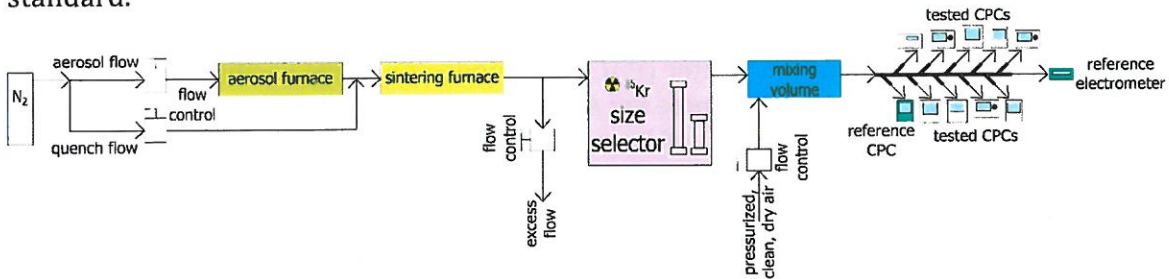


Fig. 1: CPC calibration set-up.

The MPSS validation set-up (see Fig. 2) enables the sampling of atmospheric aerosols or well-defined standard aerosol particles (such as NIST polystyrene Latex spheres), assures smooth size distribution in well-mixed homogenization volume and

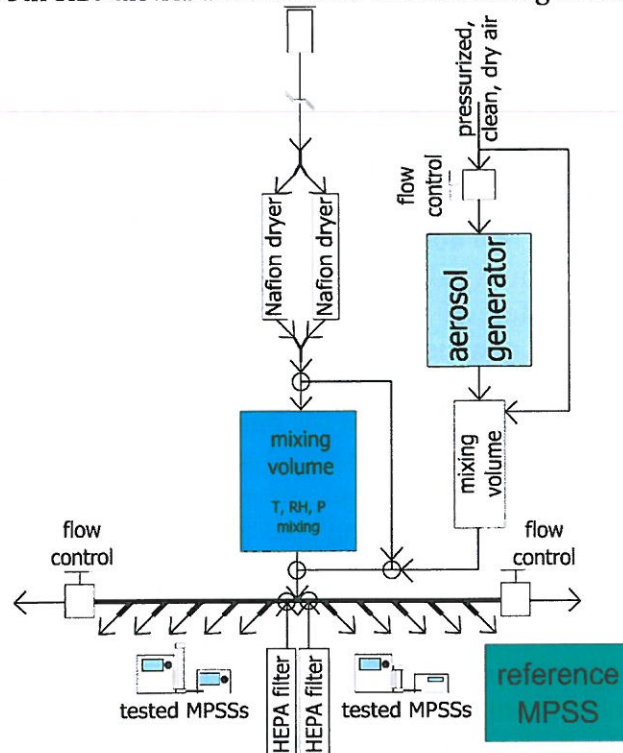


Fig. 2: MPSS calibration set-up.

distributes them correctly to MPSS validation candidates as well as to the ACTRIS reference MPSS. The validation set-up follows CEN/TS 17434 standard.

The APSS verification set-up (see Fig. 3) includes aerosol generators for the production of well-defined supermicron aerosol particles, followed by an electrostatic classifier with “large” DMA. The distribution of the representative sample to the APSS verification candidates and the reference instrument is secured by means of mixing volume and proper isokinetic subsampling.

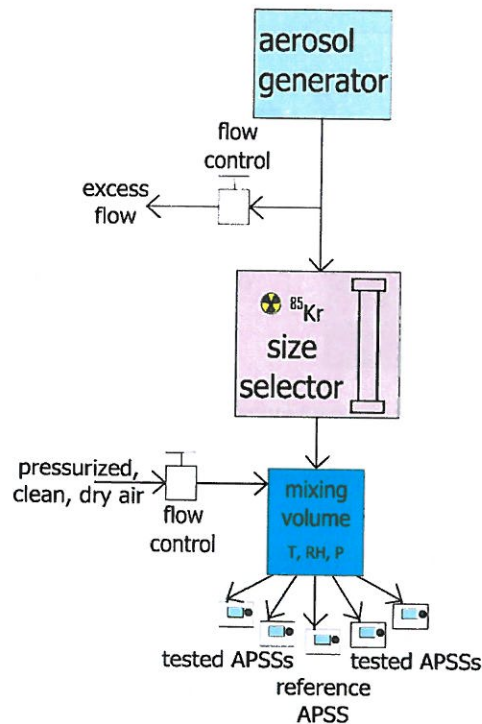


Fig. 3: APSS calibration set-up.

The set-up for characterization of size resolved aerosol particle losses (see Fig. 4) allows to select any flowrate in the range 2-100 l/min and the size of challenging aerosol particles in the size range 20-400 nm. The challenging aerosol is generated by aerosol generator, then it is dried in the diffusion drier containing silica-gel and after that the Boltzmann charge distribution on aerosol particles is achieved by passing through a neutralizer with ^{85}Kr and then the treated aerosol continues into an electrostatic classifier (Electrostatic Classifier, EC Goliath, Research Workshop of ICPF CAS). The monodisperse fraction of the generated aerosol, selected in the classifier by corresponding voltage on the inner electrode, is diluted in the mixing volume so, that the required flow rate through the tested part is reached. The number concentration of aerosol particles of given size is determined at the same time upstream and downstream the tested part of sampling line by two CPCs.

The position of the two CPCs is alternated for every selected size of the particles using the pair of electromagnetic valves. The valve switching allows avoiding any errors in measurement due to possible differences in the measurement of both counters. The pressure drop across the tested part of the aerosol sampling line is monitored during the whole measurement.

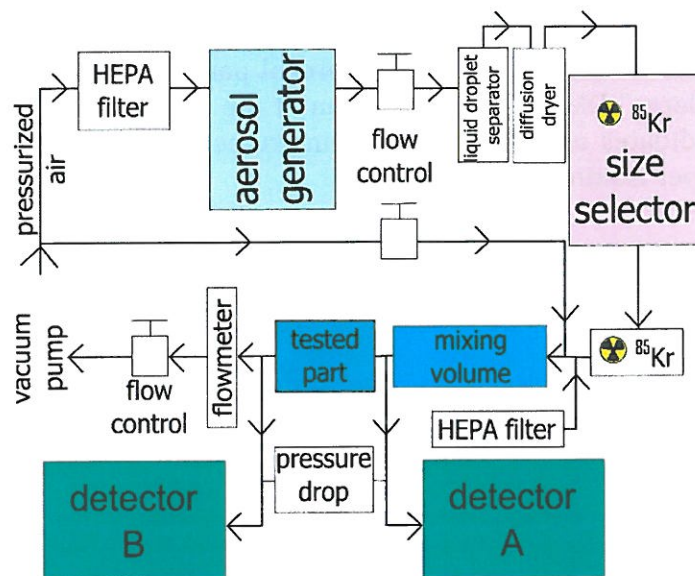


Fig. 4: Set-up for characterization of size-resolved particle losses.

RESULTS AND CONCLUSIONS

In general, the PACC offers a range of services, from calibration and consulting to methodology and technical development. Furthermore, the PACC has the capacity to organize and perform training for microphysical (including optical in the near future) aerosol in-situ instrumentation. The equipment at the PACC is fully in-line with the state-of-the-art aerosol instrumentation (starting from various aerosol generators for well-defined nanoparticles, reference instruments, and newly designed calibration lines) and the laboratory space is flexible for various types of instrument calibration/verification/intercomparison or testing of newly developed, cutting-edge equipment.

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