

Development of Portable Aerosol Collector and Spectrometer (PACS): Part III: Chemical Analysis for Particle Size Distributions of Metal Elements

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Introduction

- People are exposed to a variety of particles with a wide range of sizes
- Current portable samplers cannot measure real-time exposures to all particle size ranges simultaneously
- Particle number, surface area, and mass concentrations need to be measured simultaneously by size from 10 nm to 10 μ m, and particles need to be collected for subsequent chemical analysis

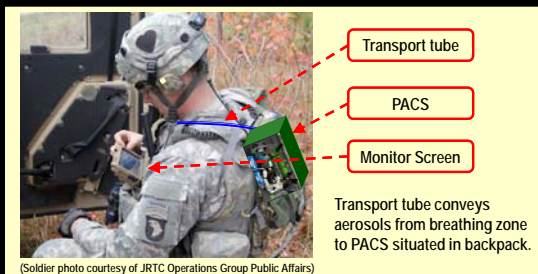
Objective

- Measure chemical composition of particles collected by size from 10 nm to 10 μ m using the PACS
- Compare concentrations measured by PACS to those measured by reference instruments

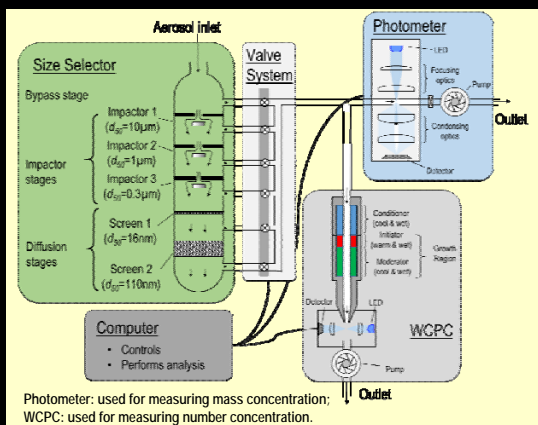
Methods

PACS hardware

- Combines three devices: selector, photometer and water condensation particle counter (WCPC)
- Uses polycarbonate membrane filters and nylon meshes to collect particles in impactor and diffusion stages, respectively

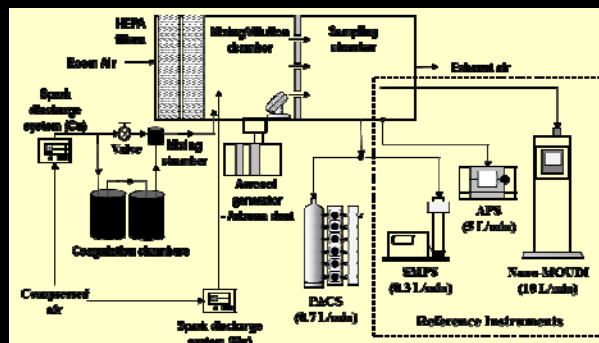


Schematic view of the design of PACS



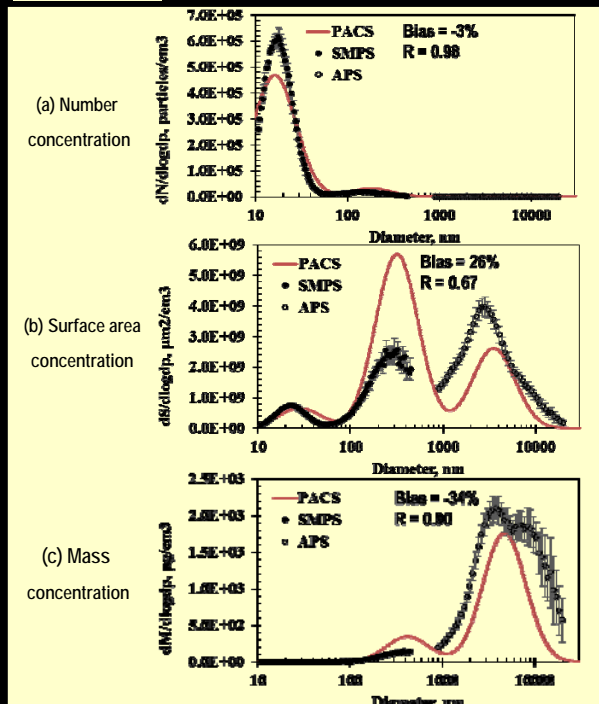
Experimental Setup

- Generated a three mode aerosol: (1) fresh Mn fume for ultrafine mode, (2) aged Cu fume for fine mode, and (3) Arizona road dust for coarse mode
- Compared size distributions measured by PACS to reference instruments (scanning mobility particle sizer, SMPS, aerodynamic particle sizer, APS, and Nano-MOUDI), using R^2 and normalized mean bias (NMB)

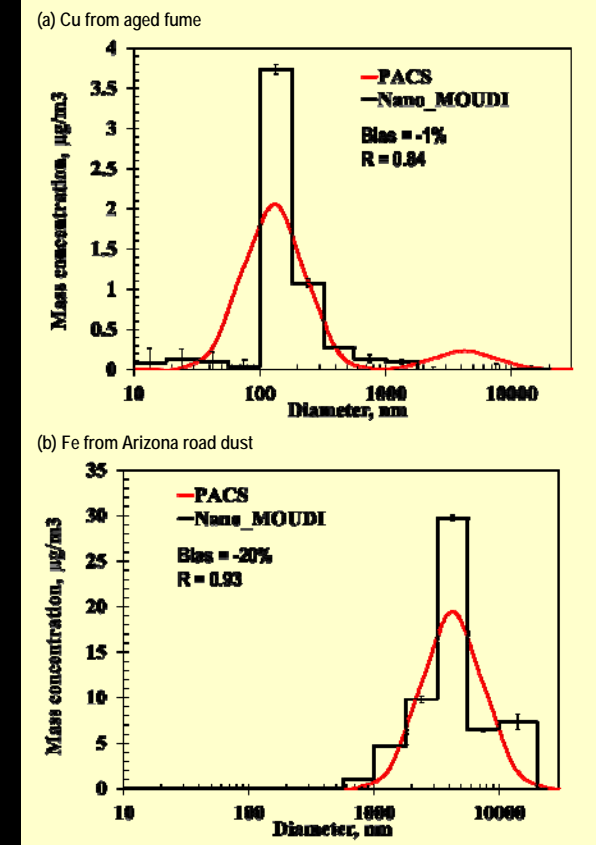


Results

PACS vs SMPS/APS



PACS vs Nano-MOUDI



Conclusions

- Size distributions measured with the PACS agree well with reference instruments
- The PACS is able to distinguish the target aerosol (Cu nanoparticles) from the background aerosol (Fe element from Arizona road dust)
- Future work will investigate the PACS performance in a real-world environment

Acknowledgements

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