# Data Merging of Size Distributions from Electrical Mobility and Optical Measurements

T. Tritscher[1], A.F. Zerrath[2], S. Elzey[2] and H. S. Han[2]

[1]TSI GmbH, Particle Instruments, Aachen, 52068, Germany
[2]TSI Inc., Shoreview, MN, 55116, USA
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Presenting author email: torsten.tritscher@tsi.com

The measurement of size, concentration, and potential exposure to nanomaterials has received increasing attention during the last years. Nanoparticles are present in ambient air as well as in indoor or laboratory environments. A key parameter for the characterization of particles is their size distribution and number concentration.

The TSI Scanning Mobility Particle Sizer (SMPS) is well established, also used as a reference and is able to cover the range from 2.5 nm to 1 µm. Recently, a small, portable and easy to handle version of the SMPS was introduced to the market: the NanoScan SMPS, TSI model 3910 (Elzey *et al*. 2012). A Radial Differential Mobility Analyzer classifies the particles, which are then individually counted by an integrated, isopropanol-based Condensation Particle Counter (CPC). Number size distributions in the range from 10 to 420 nm can be obtained in 13 channels.

The size range of both SMPS systems can be extended to coarse particles with an additional compact instrument: the Optical Particle Sizer (OPS), TSI model 3330. The OPS is able to provide number size distributions in the range from 300 nm to 10 µm with 16 freely adjustable channels. This optical sizing method reports an optical particle diameter, which is often different from the electrical mobility diameter measured by the SMPS technique.

TSI DataMerge software is able to merge SMPS data with size distributions from aerodynamic diameter measurements from an Aerodynamic Particle Sizer (APS). DeCarlo *et al*. (2004) also reported on combining mobility and aerodynamic diameter.

We present here a next-generation data merging tool for optical diameter and electrical mobility diameter. This software module is the first approach to merge the data from the two different sizers to compile a single data set describing the particle size distribution from 10 nm to 10 µm. This software tool is user friendly and easy to use. It also allows reviewing and averaging data from SMPS, NanoScan SMPS and/or OPS. More importantly, when merging the OPS and SMPS/NanoScan distributions, the software can take the aerosol optical properties into account by automatically determining the aerosol effective refractive index.

Figure 1 shows an example for ambient measurements from NanoScan SMPS and OPS on the top panel and the resulting composite fit on the bottom panel. The merging procedure is more or less challenging depending on the particle type, concentration and distribution. The software allows several pre-settings, data averaging and adjustments. The curve fitting algorithm uses up to 3 modes of lognormal distribution function to curve fit the data.

The presentation will show different merged data sets and merged options to demonstrate their impact on the composite fit accuracy.

DeCarlo, P.F., Slowik, J.G., Worsnop, D.R., Davidovits, P. and Jimenez, J.L. (2004), *Aerosol Science and Technology* 38, 12, 1185-1205

Elzey, S., Caldow, R., Johnson, J.P., Grose, M., Morell, S. and Jensen, D. (2012), *EAC 2012 proceedings*, WG08S2O06

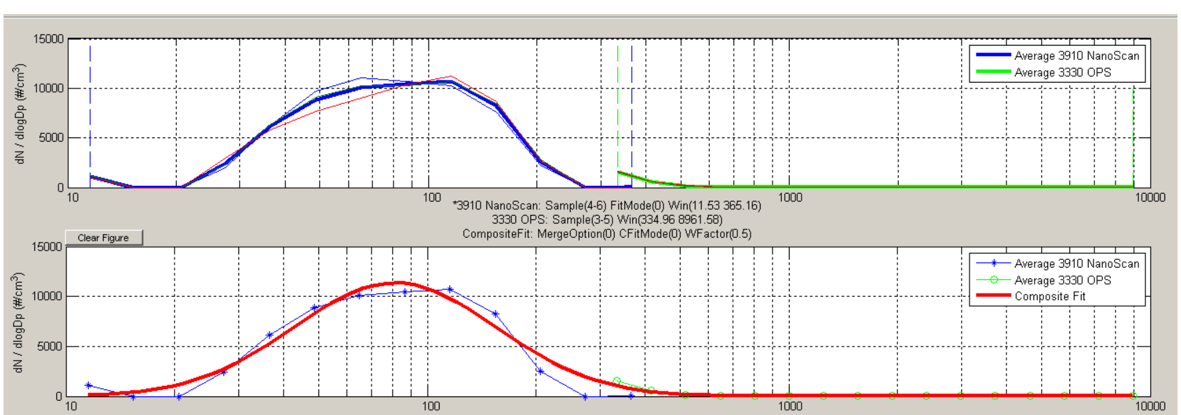


Figure 1. Top panel: Ambient data from NanoScan SMPS 3910 (blue bold line) und OPS 3330 (green bold line), thin lines represent the individual scans. Bottom panel: Fitted size distribution (red bold line) from 10 nm to 10 µm.