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Selection of quasi-monodisperse super-micron aerosol particles

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Size-segregated quasi monodisperse particles are essential for e.g. fundamental research concerning cloud microphysical processes. Commonly a DMA (Differential Mobility Analyzer) is used to produce quasi-monodisperse submicron particles. Thereto first, polydisperse aerosol particles are bipolarly charged by a neutralizer, and then selected according to their electrical mobility with the DMA [Knutson et al. 1975]. Selecting a certain electrical mobility with a DMA results in a particle size distribution, which contains singly charged particles as well as undesired multiply charged larger particles. Often these larger particles need to either be removed from the generated aerosol or their signals have to be corrected for in the data inversion and interpretation process. This problem becomes even more serious when considering super-micron particles.
Here we will present two different techniques for generating quasi-monodisperse super-micron aerosol particles with no or only an insignificant number of larger sized particles being present.
First, we use a combination of a cyclone with adjustable aerodynamic cut-off diameter and our custom-built Maxi-DMA [Raddatz et al. 2013]. The cyclone removes particles larger than the desired ones prior to mobility selection with the DMA. This results in a reduction of the number of multiply charged particles of up to 99.8%.
Second, we utilize a new combination of cyclone and PCVI (Pumped Counterflow Virtual Impactor), which is based on purely inertial separation and avoids particle charging. The PCVI instrument was previously described by Boulter et al. (2006) and Kulkarni et al. (2011). With our two setups we are able to produce quasi-monodisperse aerosol particles in the diameter range from 0.5 to 4.4 μm without a significant number of larger undesired particles being present.

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