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Development of a Method to Determine the Fractional Deposition Efficiency of Full-Scale HVAC and HEPA Filter Cassettes for Nanoparticles ≥3.5 nm

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The spatial homogeneity of the particle concentration across the cross section of the test rig in the filter plane has been measured, using a frame with an open area of 610 mm × 610 mm. The frame includes three sampling tubes, sticking in from the side at a level of 102 mm, 305 mm and 508 mm from the top, respectively. These tubes include a 90° bend at the inner end to sample in flow direction and can be freely moved in horizontal direction. To determine the spatial homogeneity of the particle concentration, it has been measured in a matrix of up to nine position as specified in Figure S1a. The concentrations were measured in all nine positions for a flow rate of 1700 m³/h (Figure S1b) and exemplarily for four positions (Pos. 1, 3, 5 and 8) for flow rates of 3400 m³/h and 4250 m³/h (Figure S1c and Figure S1d). During all filter tests presented here, particle size distributions and/or concentrations were determined in the center point (Pos. 5). Therefore, Pos. 5 is used as the reference point in Figure S1. Percentages given in Figure S1 hence refer to the deviation of the concentrations measured in comparison with the one in Pos. 5.

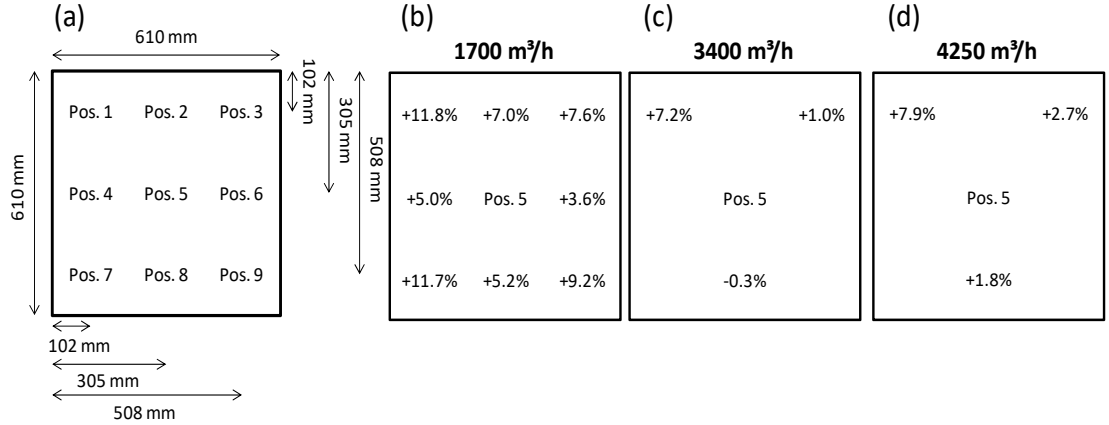

Figure S1. Determination of the spatial homogeneity of the particle concentration in the test rig; (**a**) matrix of nine spatially distributed measurement positions, view in flow direction; (**b**) deviations of the number concentrations measured in comparison to Pos. 5 at a flow rate of 1700 m³/h; (**c**) deviations of the number concentrations measured in comparison to Pos. 5 at a flow rate of 3400 m³/h; (**d**) deviations of the number concentrations measured in comparison to Pos. 5 at a flow rate of 4250 m³/h**.**

The data in Figure S1 show that the homogeneity is higher for the higher flow rates with max. deviations of +7.2% and +7.9% for 3400 m³/h and 4250 m³/h, respectively, whereas in case of 1700 m³/h the deviation was up to +11.8% in the top left position (Pos. 1).

Table S1. Parameters of the lognormal size distributions of the generated test aerosols for different settings**.**

Flow rate test rig [m³/h]	NaCl Solution [g/l]	Solution feed rate [ml/h]	Punched plate	Mode [nm]	GSD	Number Conc. [1/cm³]
3400	0.5	30	none	4.4	1.29	$1.7x10^7$
	0.5	40	none	4.6	1.29	$2.3x10^7$
	0.5	50	none	4.8	1.30	$2.6x10^7$
	0.5	90	none	5.3	1.28	$3.2x10^7$
	1	90	none	6.2	1.35	$4.1x10^7$
	10	90	none	13.3	1.46	$5.5x10^7$
	50	90	none	21.3	1.50	$5.2x10^7$
	10	50	25 holes	38.5	1.44	$1.5x10^6$
	20	90	25 holes	53.3	1.39	$1.4x10^6$
	80	90	25 holes	79.1	1.40	$1.3x10^6$
	5	90	48 holes	20.2	1.45	$7.0x10^6$
4250	0.5	30	none	3.5	1.24	$2.3x10^7$
	0.5	40	none	3.8	1.25	$3.4x10^7$
	0.5	50	none	4.1	1.27	$3.9x10^7$
	0.5	90	none	4.6	1.30	$5.3x10^7$
	1	90	none	5.1	1.31	$6.7x10^7$
	10	90	none	9.6	1.46	$8.1x10^7$
	50	90	none	15.7	1.58	$6.7x10^7$
	10	50	25 holes	33.4	1.45	$1.9x10^6$
	20	90	25 holes	47.8	1.40	$1.8x10^6$
	80	90	25 holes	68.5	1.39	$1.7x10^6$
	5	90	48 holes	20.2	1.47	$6.6x10^6$