

D1.460 : Evaluation of temperature-controlled laminar airflow technology to filter aeroallergen-contaminated ambient air in environmental exposure chamber

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1. Background

Temperature-controlled Laminar Airflow (TLA) has shown in clinical trials to improve symptoms control in allergic asthma and atopic eczema by reducing airborne particles in the breathing zone. This technical study aimed to assess the capacity of TLA to reduce airborne allergens in the breathing zone. The tests were done in ALYATEC Environmental Exposure Chamber (EEC) which is a validated model of controlled environment with standardized airborne allergen concentration.

2. Methods

To assess TLA's ability to purify the breathing zone, different allergen concentrations known to trigger allergic reactions were nebulized separately in the EEC: 40 ng/m³ cat dander (Fel d 1), 60 ng/m³ Timothy grass (Phl p 5) and 25 ng/m³ house dust mite (Der p 1). Three different 2-hour tests were performed for each allergen. TLA, provided by the medical device Airsonett Air4 (picture 1), was placed by a seat in laying position, to reproduce a bed in a home environment. A particle counter and a fiberglass filter were placed on the seat, in the intended breathing zone (picture 2). Two additional fiberglass filters and nine additional particle counters were placed in the EEC around the seat (Picture 3). The number of particles was monitored throughout the tests using the ten particle counters (Lighthouse, APEX R05) (Picture 4 and 5). Allergens were collected during exposure on the three fiberglass filters. Then, Enzyme-Linked Immunosorbent Assay (ELISA, per Indoor Biotechnologies, Inc.) was performed to determine the allergen concentration both in the breathing zone and the surrounding air.

3. Results

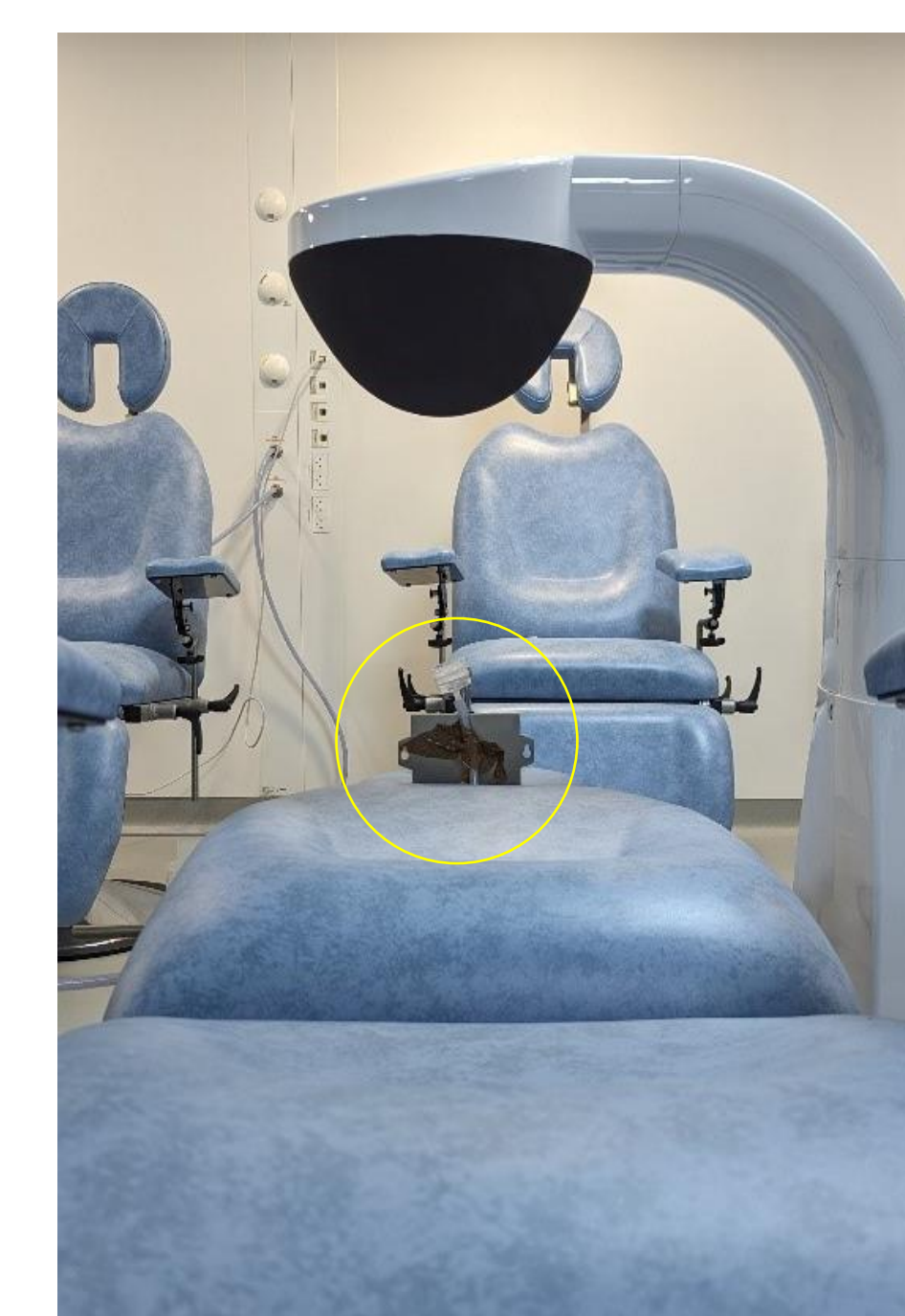
In the breathing zone, a mean particle reduction rate from 99.95% to 99.99% was observed for particles between 0.5 and 5 μm and from 99.97% to 99.99% for particles between 5 and 10 μm with cat, mite, and grass pollen allergen (Table 1). All allergen concentrations measured in the breathing zone were below the detection limit. Fel d 1 measured in the clean air breathing zone was below 0.043 ng/m³ compared to 39.96 ng/m³ in the EEC. Der p 1 was below 0.337 ng/m³ compared to 28.62 ng/m³ in the EEC. Phl p 5 was below 0.423 ng/m³ compared to 62.21 ng/m³ in the EEC. The concentration of allergen reduction correlates well with particle reduction rate.

4. Conclusion

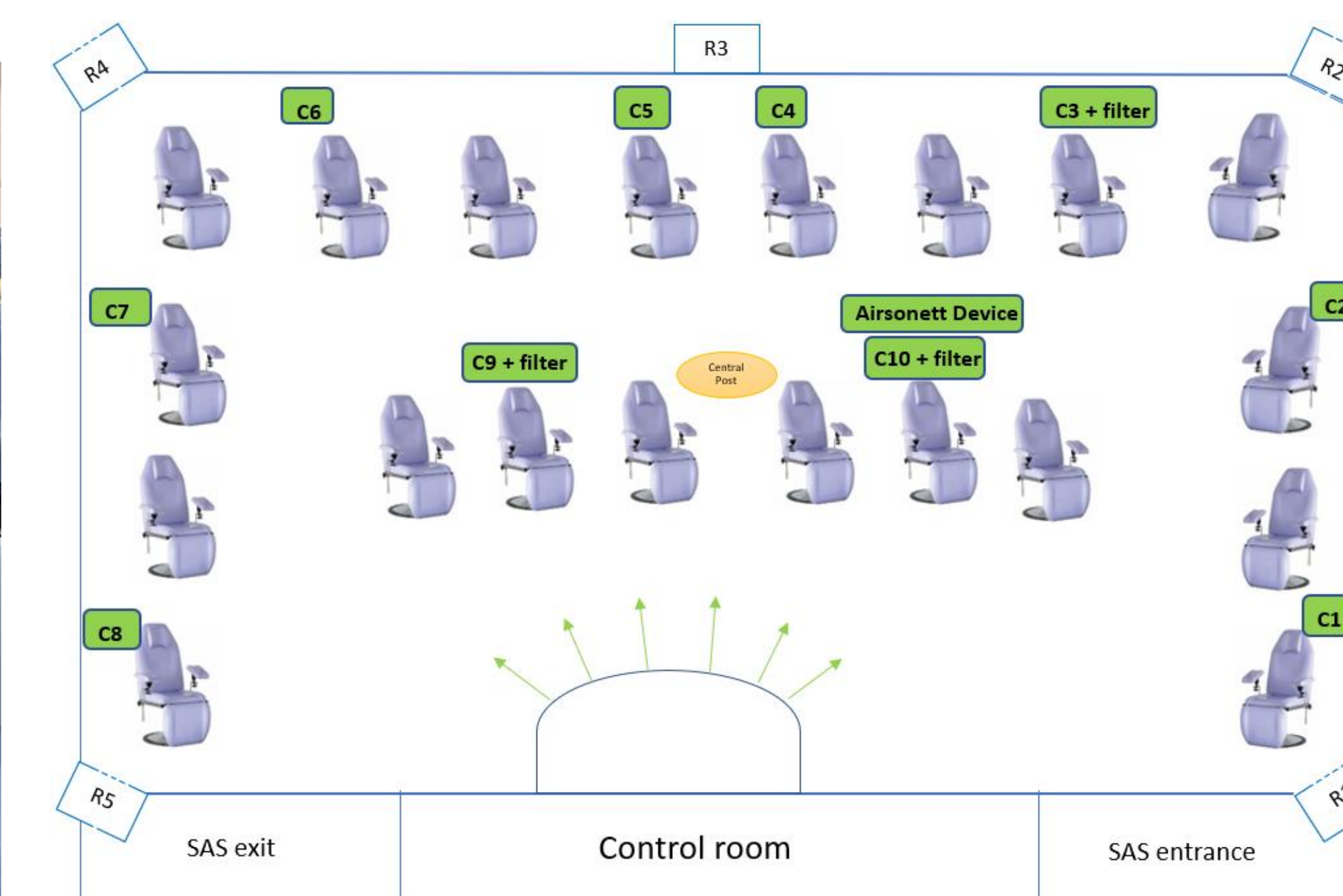
TLA significantly reduces cat, grass pollen and house dust mite allergens from the breathing zone. The creation of a clean air breathing zone without allergen detection confirms the capacity of TLA to improve allergic symptoms.



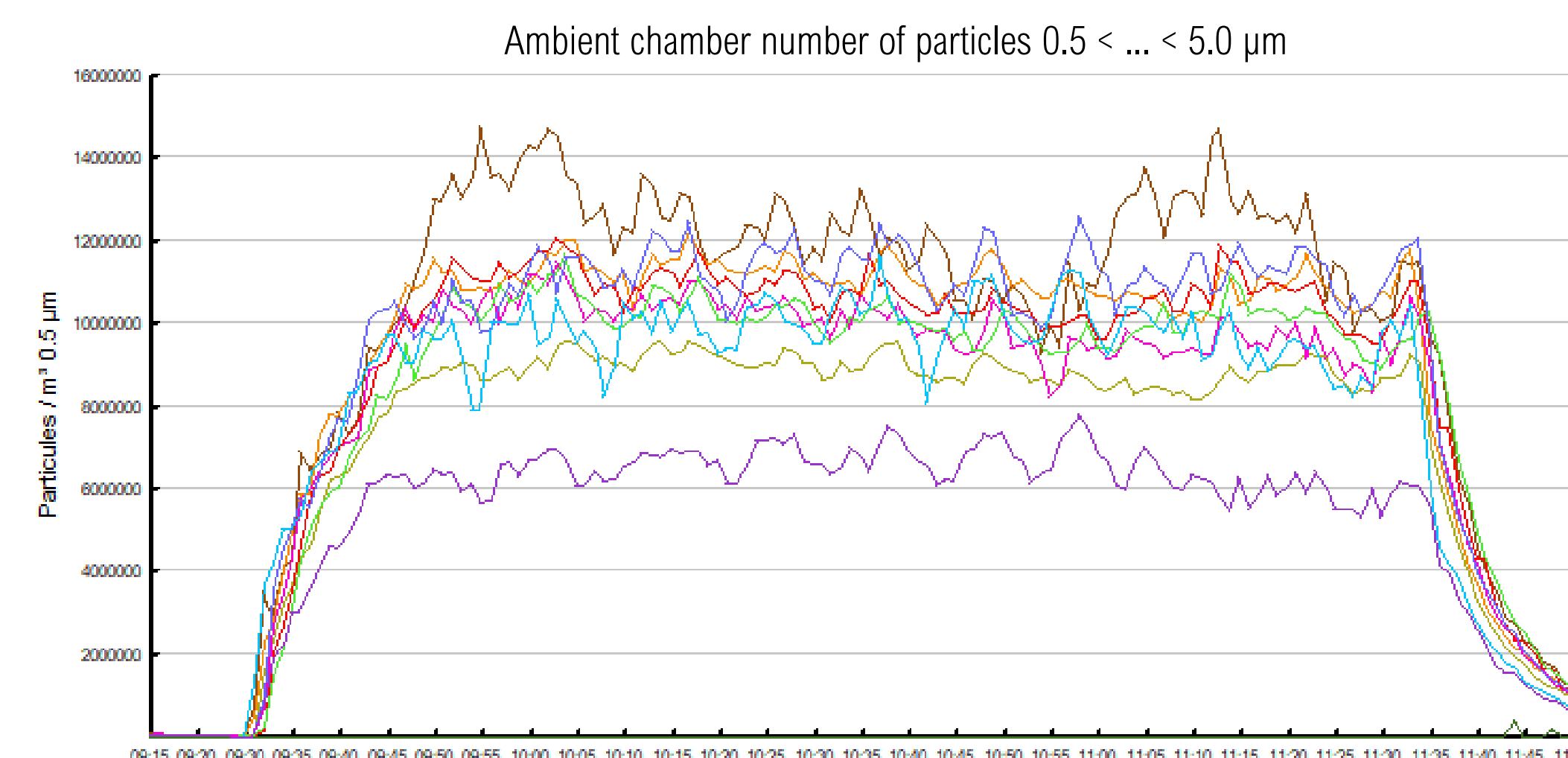
Picture 1: Medical device Airsonett Air4.



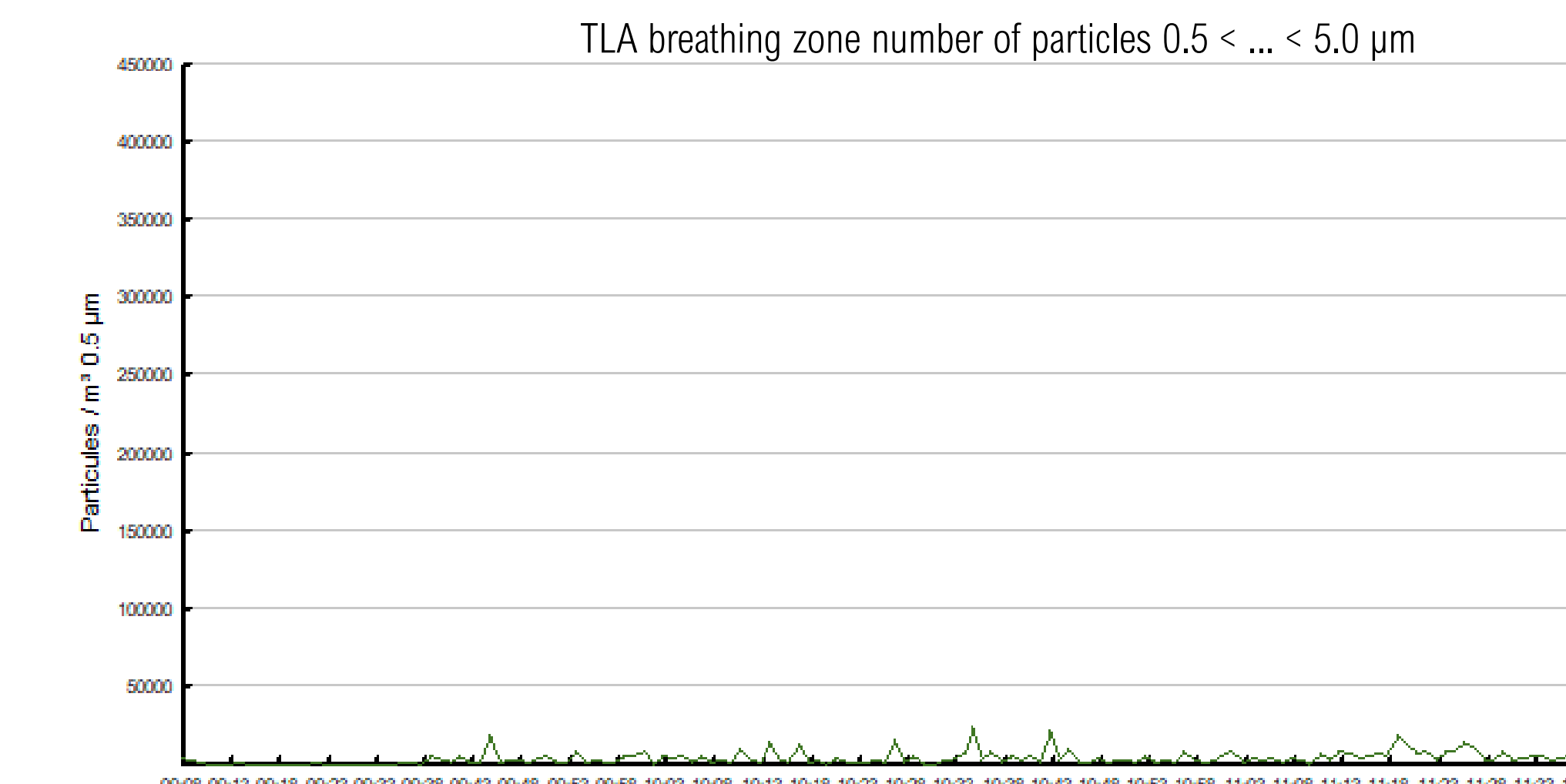
Picture 2: TLA above the seat. Particle counter and fiberglass filter in the breathing zone (yellow circle).



Picture 3: Layout of ALYATEC EEC. C1-C9: particle counters out of the breathing zone. C10: particle counter in the breathing zone.



Picture 4: Graph of particles count over 2 hours for C1 to C9 (out of the breathing zone).



Picture 5: graph of particles count over 2 hours for C10 (in the breathing zone).

Allergen		Particles/m ³		Allergen concentration (ng/m ³)
		0,5 ≤ ... < 5 μm (all runs)	5 ≤ ... < 10 μm (all runs)	
Cat	Mean out of the breathing zone	10 312 870	2 145 590	39,96
	Mean in the breathing zone	4659	516	[0;0,043]
	Mean % of diminution	99,95	99,97	99,89 to 100
House Dust Mite	Mean out of the breathing zone	10 096 790	2 029 531	28,62
	Mean in the breathing zone	3 016	244	[0;0337]
	Mean % of diminution	99,97	99,99	98,92 to 100
Grass Pollen	Mean out of the breathing zone	10 365 911	2 792 179	62,21
	Mean in the breathing zone	277	678	[0;0,423]
	Mean % of diminution	99,997	99,98	99,32 to 100

Table 1: Particles counts, allergens concentrations in and out of the breathing zone, and percentage of diminution for each allergen (cat, mite, grass pollen).