Image analysis for time-resolved analysis of microparticle resuspension kinetics on a ventilated duct surface

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Context and objectives

Analyse the temporal evolution of particle number and deposit properties

- **Monolayer deposit** of isolated bronze micro-particle
- **Glass surface** with nanometric roughness
- **Accelerated airflow** followed by a steady-state

Methods

Channel flow acquisition

- Open-loop ventilated duct
- **Optical method**: 2320 x 1728 pxl² window, 30 Hz acquisition frequency, 0.86 mm/pxl resolution
- **Airflow properties** acquisition: hot wire and glue-on hot film probes

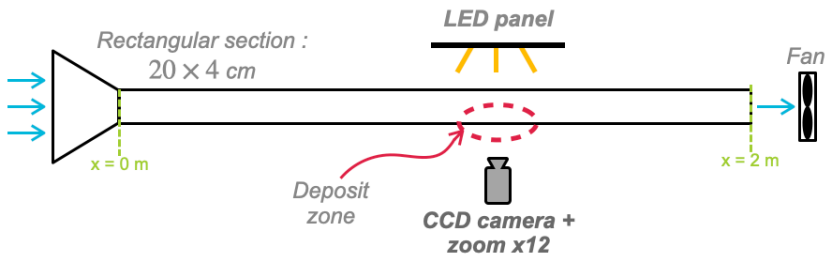
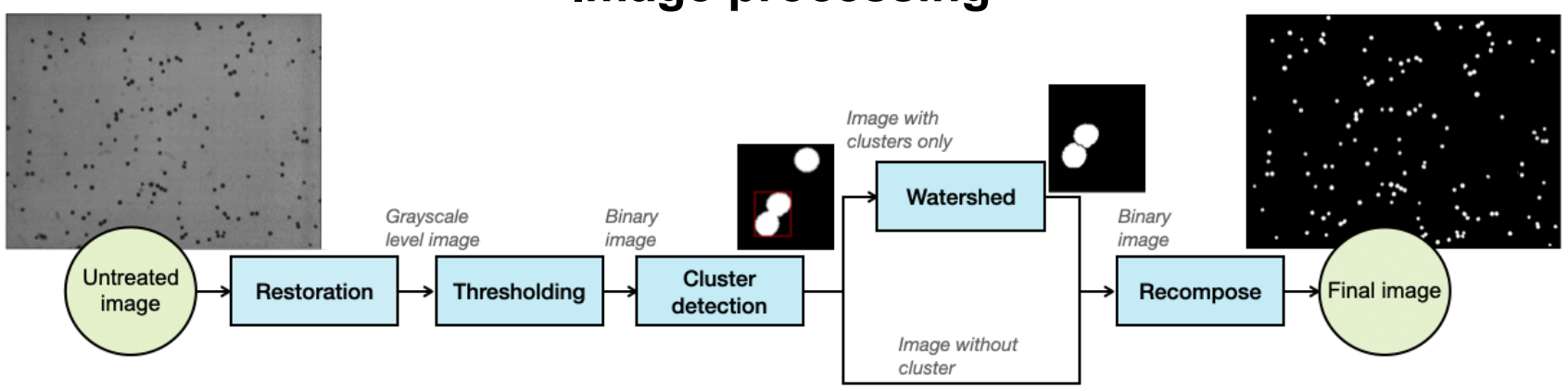


Image processing



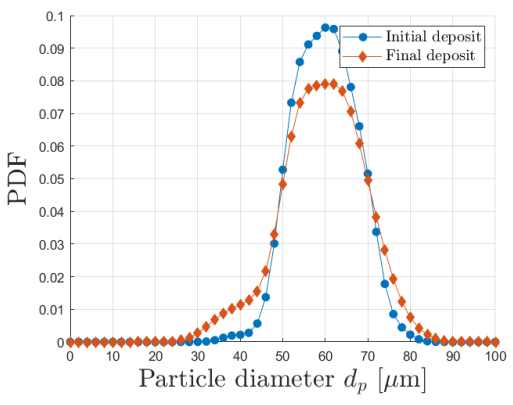
Algorithm validation and results

- Creation of synthetic images and numerical comparison between particle number and size distribution

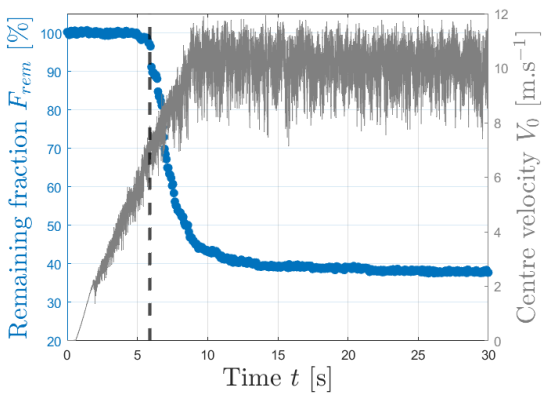
Sample n°	Particle number	Size distribution
	Relative difference [%]	Bhattacharyya distance [%]
1	2.6	0.36
2	2.9	0.39
3	3.1	0.27
4	4.0	0.33

- Comparison between manual counting and algorithm result on real images: **relative difference < 4%**

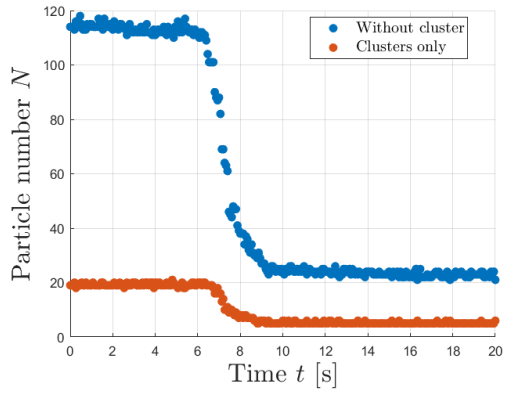
- Identification of particle sizes preferentially resuspended



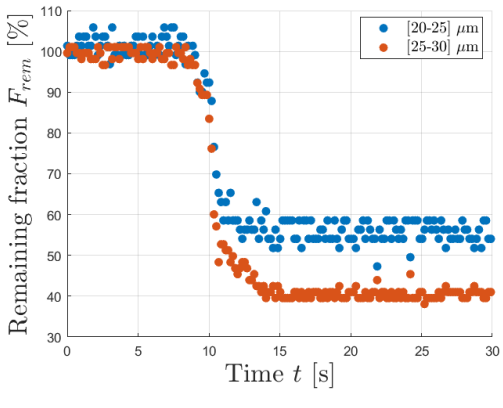
- Remaining particle fraction evolution with airflow properties



- Study of cluster behaviour



- Influence of the particle size



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References

- Crocker, J. C. and Grier, D. G. (1996) *Journal of Colloid and Interface Science*, 179(1):298–310
- Giering, S. L. C., Hosking, B., Briggs, N. and Iversen, M. H. (2020) *Front. Mar. Sci.* 7:564
- Theron, F., Debba, D. and Le Coq, L. (2020) *J Aerosol Sci* 140, 105477

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