IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Development and testing of an inhalable dust sampling system for 20 l/min

PEROSH 2025 – 6th Research Conference Manchester

PEROSH, Manchester
10.09.2025
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Table of content

1. Aim

- Validation of 4 inhalable dust prototypes for personal aerosol sampler for 20 l/min.
- Generate reproduceable results

  ➢ dust chamber and wind tunnel needs to be adjusted

UFO1

UFO2

Beetle

Cone

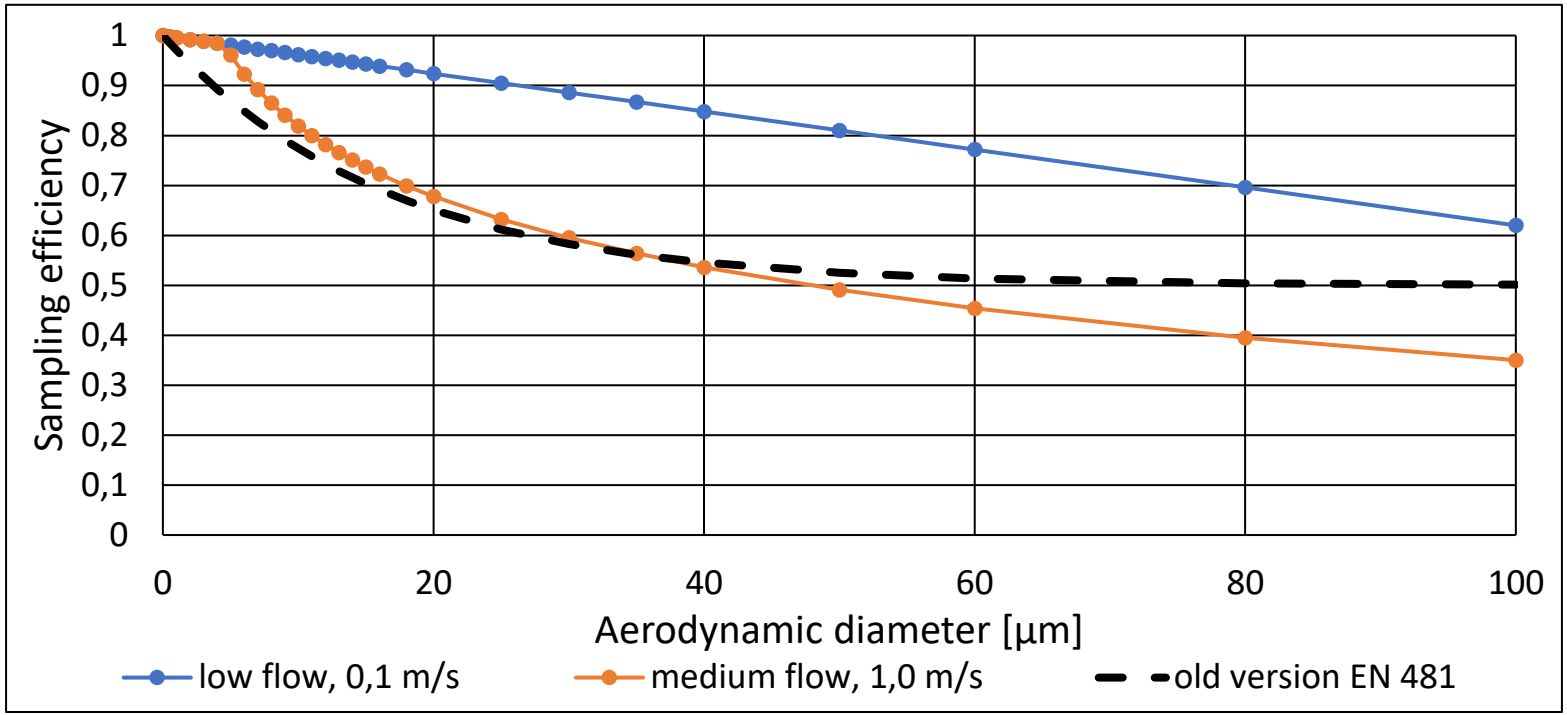
2. Specifications of standards: EN 13205

Variable	Terms of use	Measurement conditions
Aerodynamic particle diameter	Inhalable dust: 10 µm – 100 µm	≥ 9 different particle diameter, 1 needs to be ≥ 90µm
Wind velocity	Indoor and outdoor workplaces	≤ 0,1 m/s and 1m/s
Wind direction	Personal sampling	Continuous rotation or stepwise ≥ 4 directions
Variability of sampler test samples	Test group as large as possible	≥ 6 Sampler
Relative standard deviation of dust conc.	At the measurement plane	σ ≤ 10 %

Additionally (EN482)

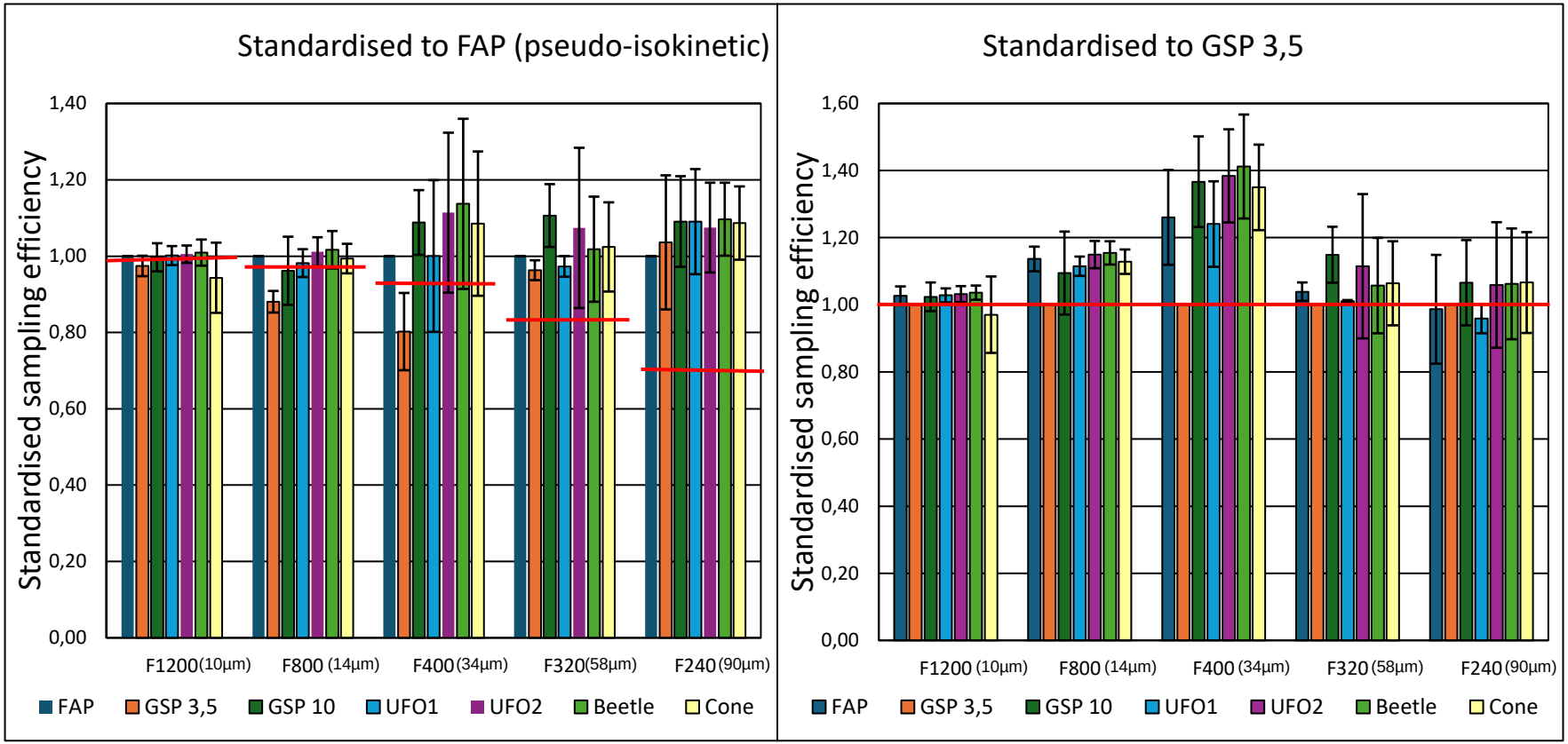
- Target concentration should be 0.1x to 2.0x the OELV, 10 mg/m^3 inhalable dust

2. Specifications of standards: EN 481

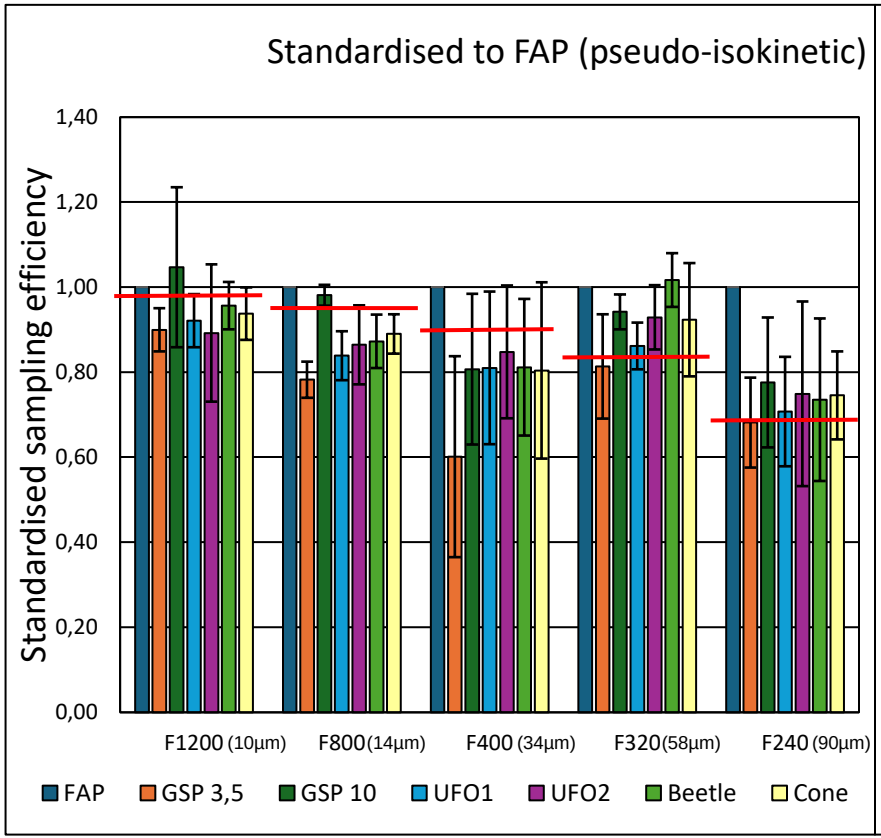


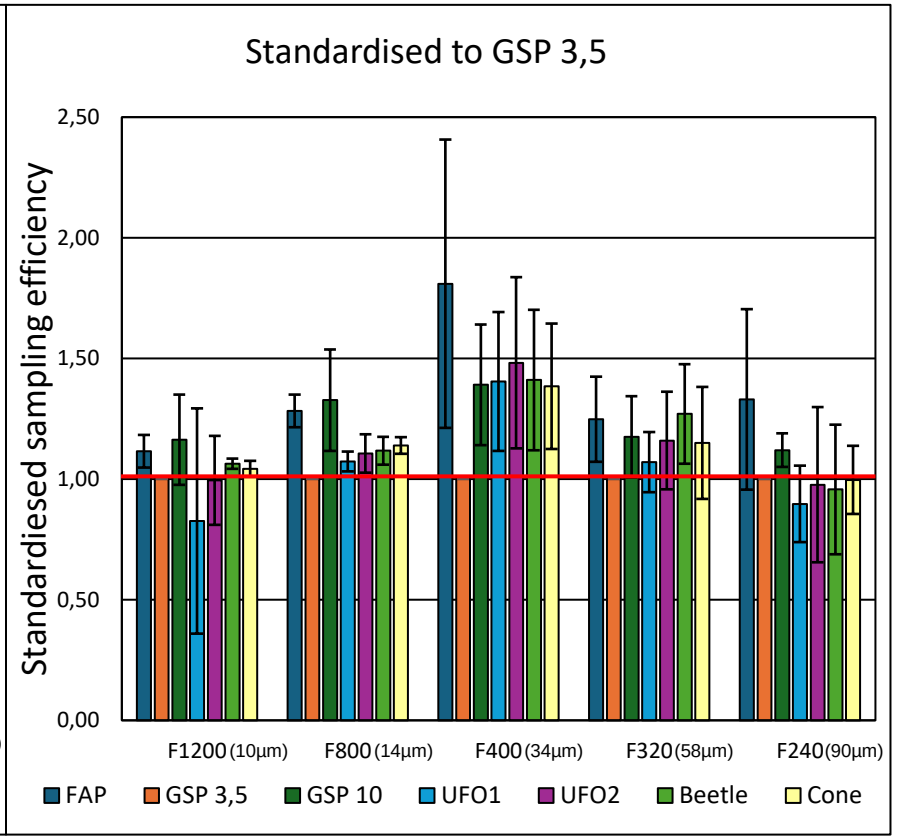
3. Aerosol chamber

3. Aerosol chamber – Sampling efficiency at 0,1 m/s, 20 mg/m³



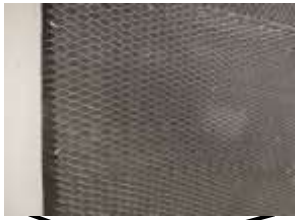
3. Aerosol chamber – Sampling efficiency at 0,1 m/s, 1 mg/m³

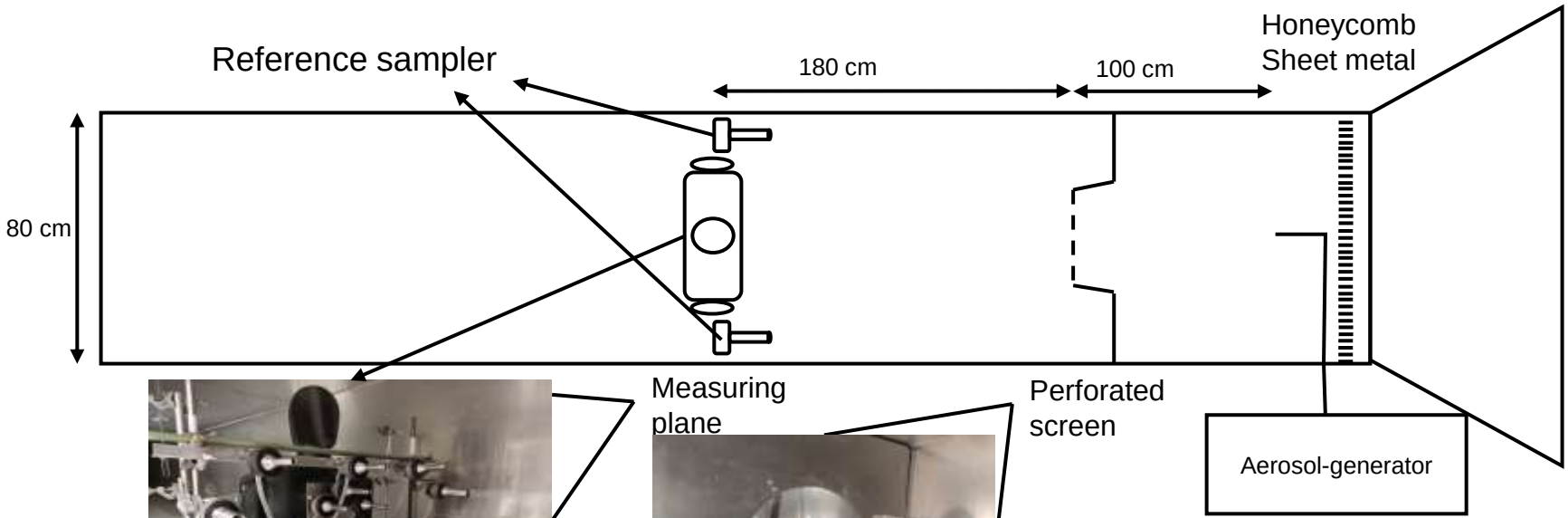




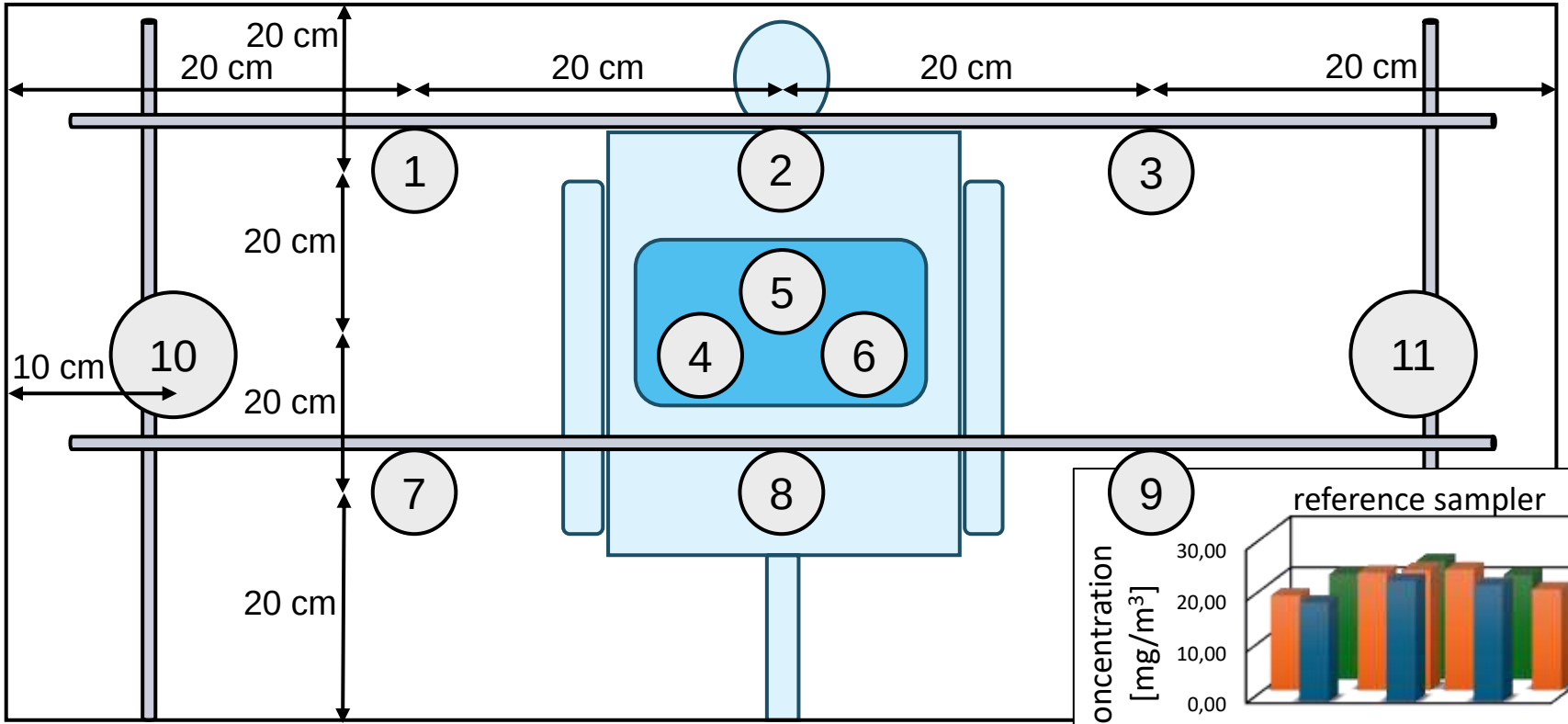
4. Wind tunnel

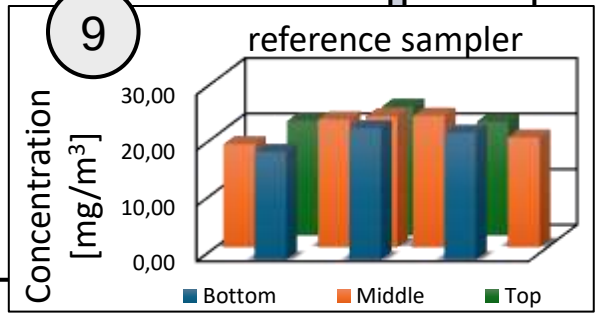
4. Wind tunnel – Measurement setup, 1 m/s





4. Wind tunnel – Sampler positioning setup





5. Measurement uncertainty - Overview

Source	Measurement uncertainty	
Dust mass losses due to filtration	F1200 (10 µm)	2,5%
	F240 (90 µm)	15,5%
Inaccuracy of the scales	absolute	0,01 mg
Sample adhesion in the sampler	GSP 3,5: ~1%	GSP 10: ~2%
	UFO1: 1,9%	UFO2: t.b.d.
	Beetle: 2,04%	Cone: 2,69%
Relative standard deviation of dust conc.	Aerosol chamber	3,97%
	Wind tunnel	9,01%
Whole measurement uncertainty	t.b.d.	

6. Summary / Outlook

- Aerosol chamber
  - ➢5 to 9 dusts measured
  - ➢High conc.: sampling efficiency did not lower with the particle size
  - ➢Low conc.: sampling efficiency follows EN481
  - ➢For choosing 1 prototype more information necessary
- Wind tunnel
  - ➢Determination of the dust for which the selected setup complies with the standard ($\sigma < 10\%$)
    - ➢Due to higher sedimentation of coarser dusts
    - ➢Modify the nozzle device, install a traverse or move it manually

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Thank you for your attention

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