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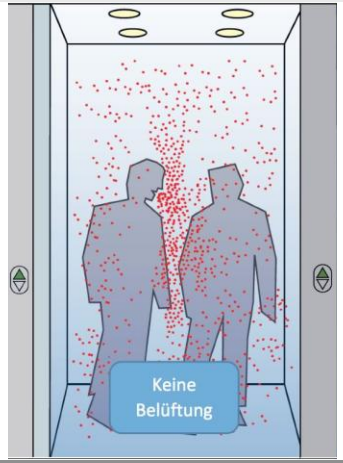
# Virtual Ventilation – Applying CFD to Reduce Indoor Aerosol Exposure

VERT Forum 2026

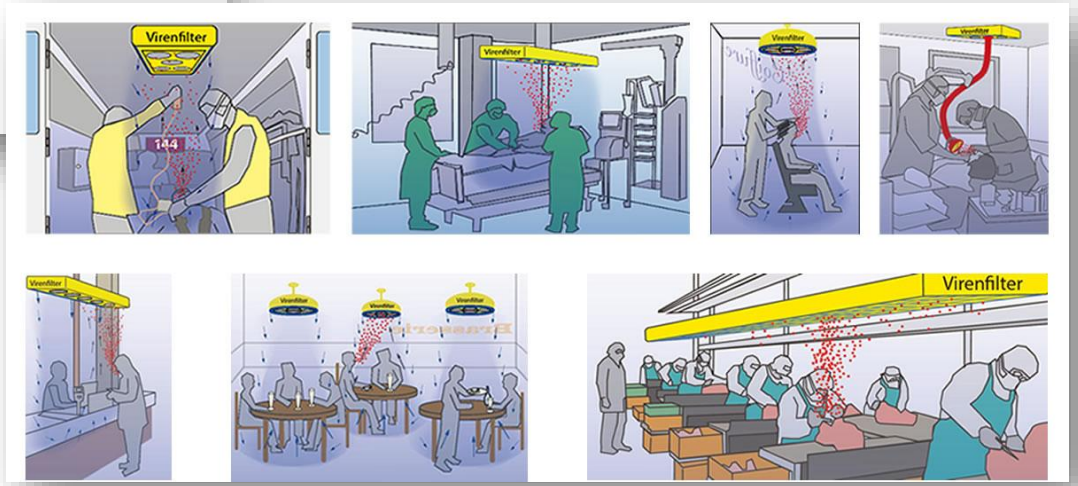
March 19, 2026, Dr. sc. techn. Christian Lämmle

# The basic idea and its areas of application




- Ventilation from bottom to top
- Filtration of aerosols
- Inflow of filtered air at the bottom

→ Natural convection caused by body heat supports airflow




*Source: NanoCleanAir AG*

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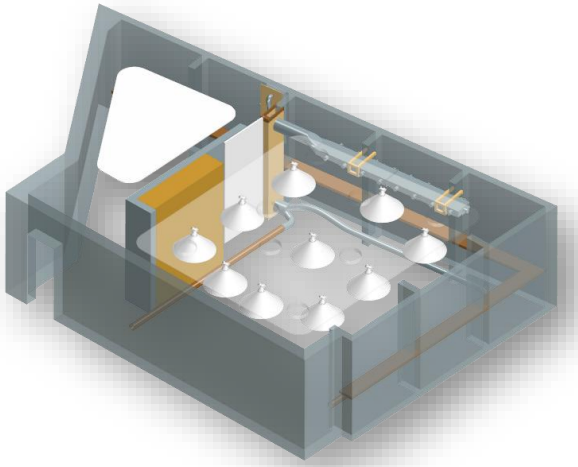
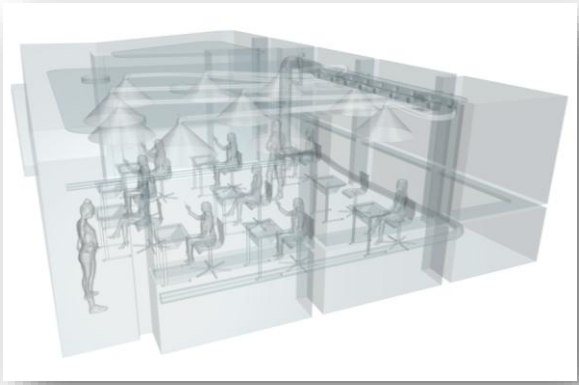
Aerosol Reduction in a Classroom

# Aerosol Reduction in a Classroom: Initial Design

*Source: NanoCleanAir AG*



*Source: Patrick Specht, FHNW*



*Source: combustion and flow solutions GmbH*

→ Initial CFD simulations showed that the shields were not effective. Therefore, fabric ducts were used.

# Aerosol Reduction in a Classroom: Final Design

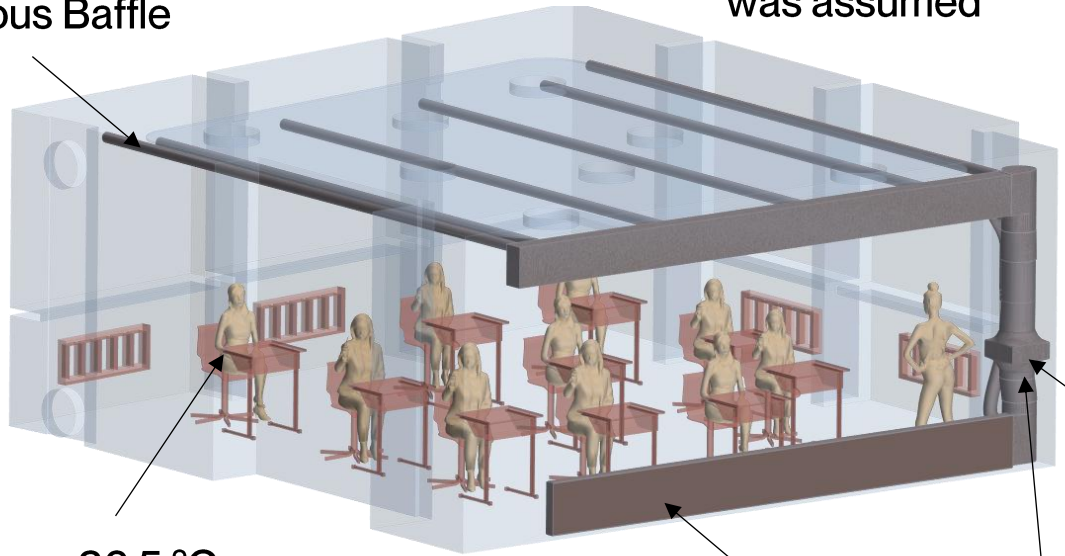
*Source: NanoCleanAir AG, Patrick Specht, FHNW*

→ Based on the CAD data of variant 1, the shields and supply lines were removed. The piping was rebuilt in the CAD module of the CFD software using splines.

# Geometry / Boundary Conditions of the Final Design

Pulsating breathing was assumed

Porous Baffle



Numerical Setup Siemens Simcenter STAR-CCM+

- Realizable k-ε model
- Lagrange Approach for the Aerosols («Injection of particles»), without break-up / evaporation
- Implicit Unsteady Solver

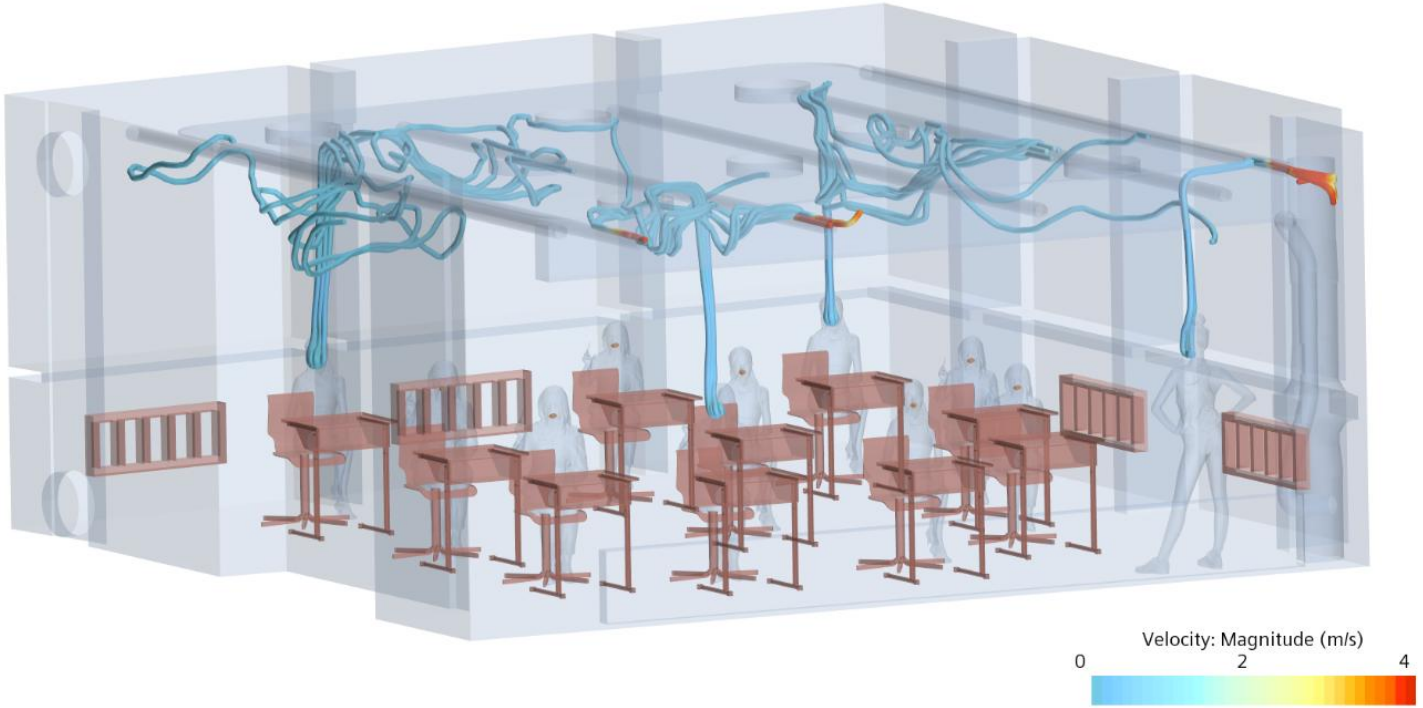
$T_{Body}$=36.5 °C for all bodies

Porous Baffle with porosity parameters of a test (front)

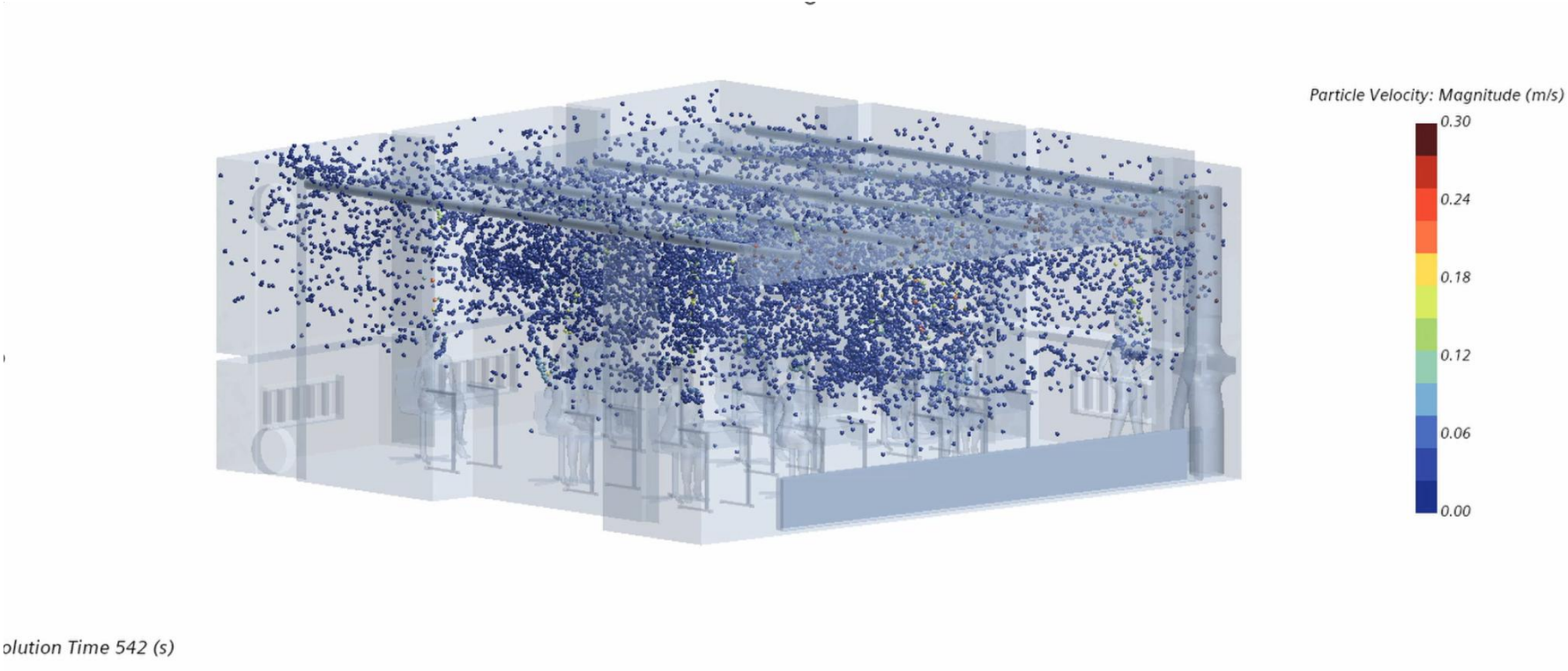
$\dot{m}_{\mathrm{Out}} = \dot{m}_{\mathrm{In}}$

Volumetric flow rate of air

# Flow Field visualised by means of Streamlines



# Animation of aerosol motion in the room



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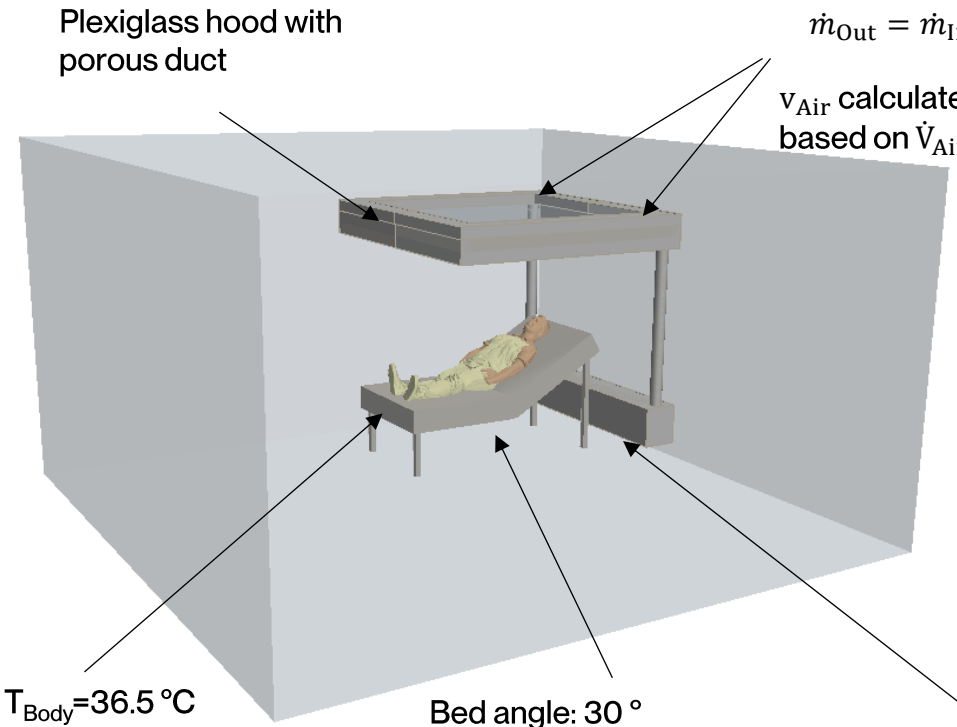
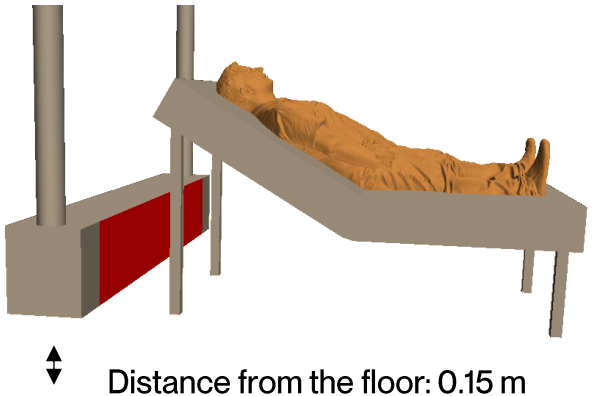
Aerosol Reduction in a Hospital Room

# Initial and boundary conditions – final arrangement

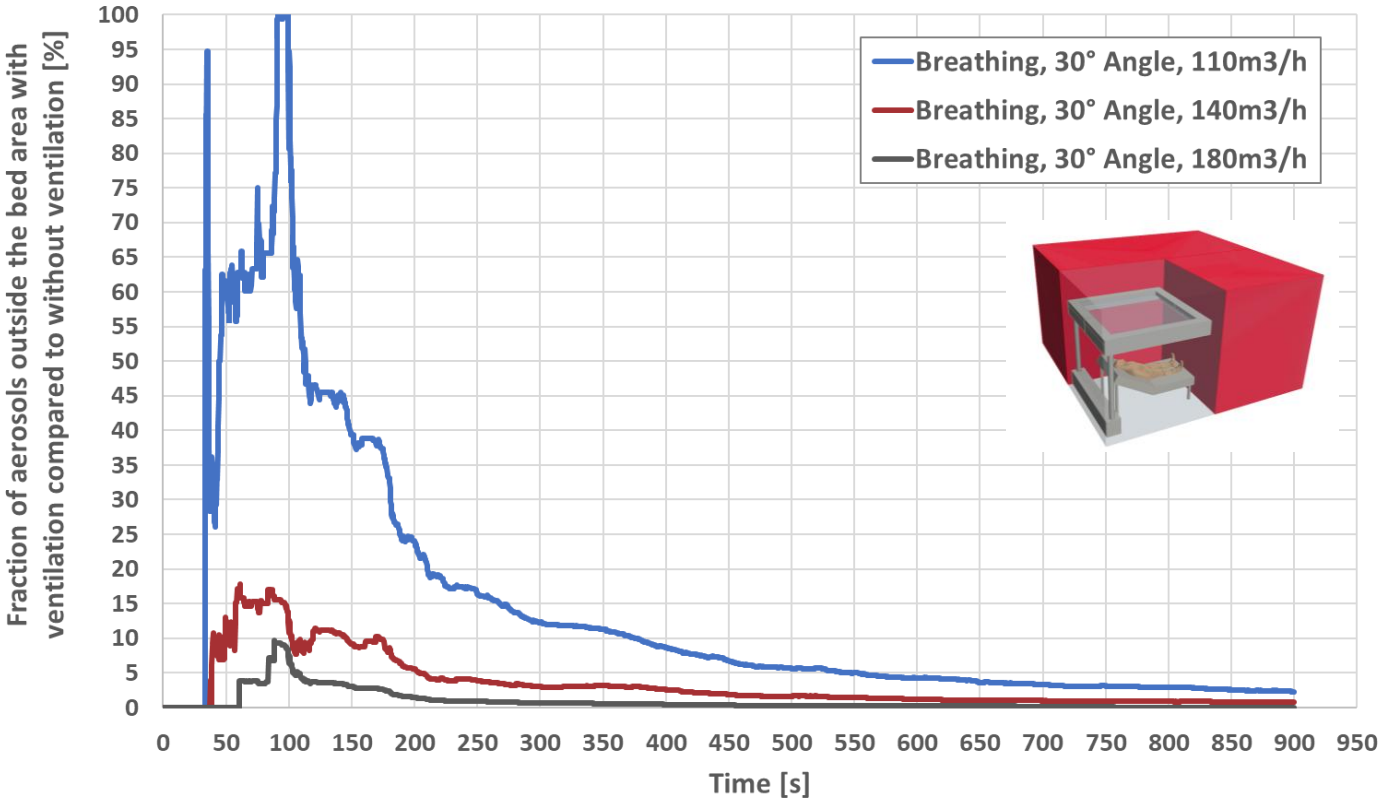



Fresh air flows through an area of 0.35 m × 1.8 m

The fresh air inlet manifold is 2.2m wide in total



# Quantification of Cross-Contamination



# Thanks for your attention.

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