• Clean and comfortable micro-environment for occupants in offices

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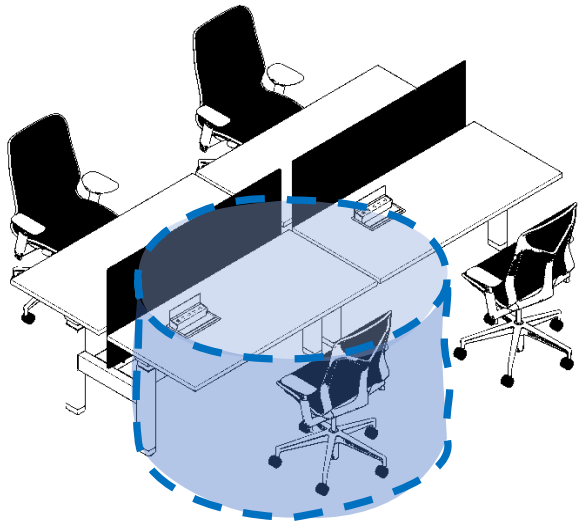
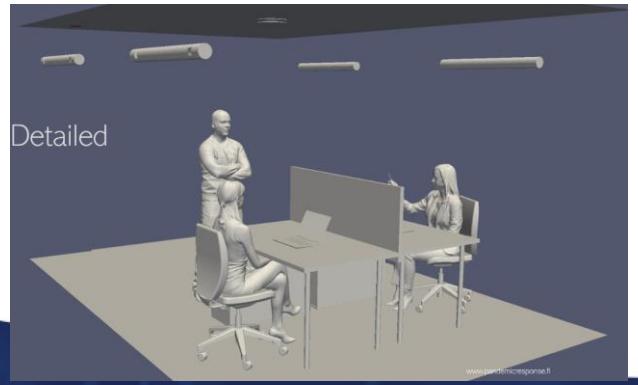
Micro-environment use case targets

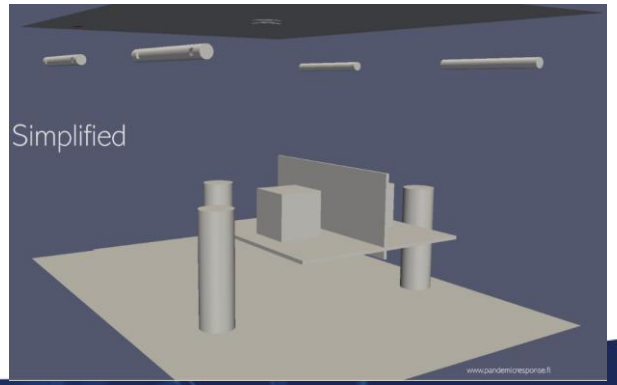


- Potential of Controlled micro-environment solution in offices
  - High indoor air quality or Clean air zone for occupant (healthy/cross-infection risk reduced) energy efficiently
  - Individually adjustable indoor climate zone for occupant (high comfort/productivity)
- Studied earlier extensively with several published results
  - Still limited practical applications in real offices
  - Post-Covid time with demand for enhanced IAQ and for high energy efficiency increase the need for micro-environment solutions significantly
- E3 use case focuses on studying promising micro-environment solutions in realistic conditions starting from a typical mixing ventilation solution

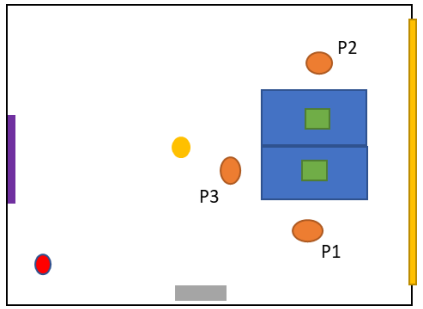
Research Method

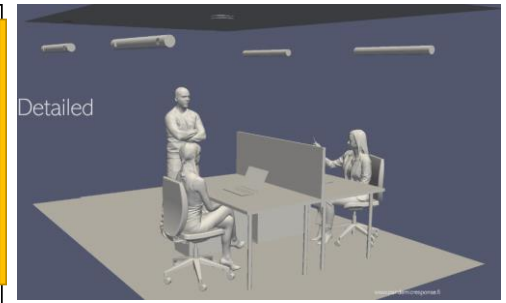
- Current focus on CFD-simulations of typical office room setup in multiple setups for ventilation and air-cleaning
  - Cases with ventilation air or air-cleaner recirculation air distribution
- E3 use case study going on - first results from CFD simulations presented here
- Most interesting situations will be measured in full-scale tests including furhter analysis of the performance in real conditions and studied further with CFD simulations



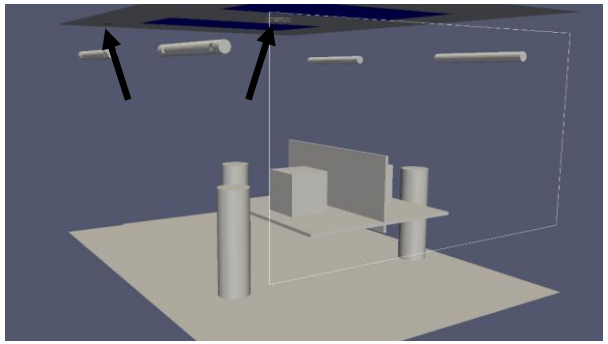


Research Method: CFD Cases

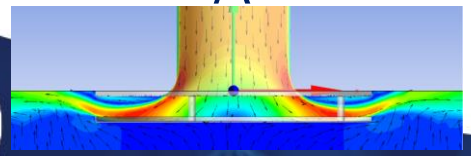


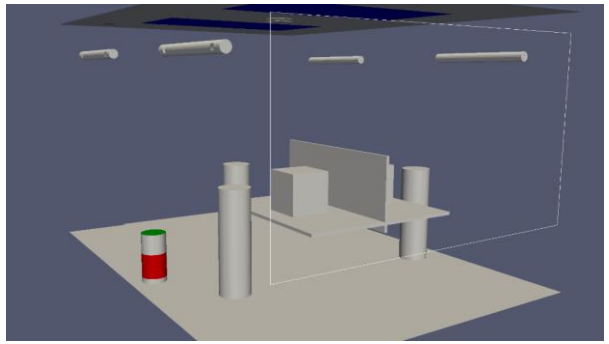


- Typical office room setup ~25 °C with two workstations, 3 occupants and lighting with optional window heated by solar radiation (total 36 W/m^2_{floor} or 50 W/ m^2_{floor})
- Ventilation flow rate 30 l/s (EN16798 cat.2) or optionally 45 l/s (cat.1) at 16 °C and radiant panels to compensate heat loads
- Ventilation/Clean air distribution: A) ceiling diffuser (with ceiling exhaust), B) air cleaner, C) typical personal ventilation device and D) low velocity air supply (or as local exhaust)



A





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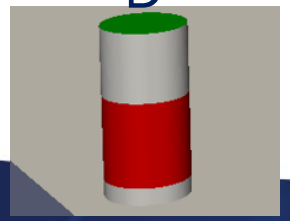

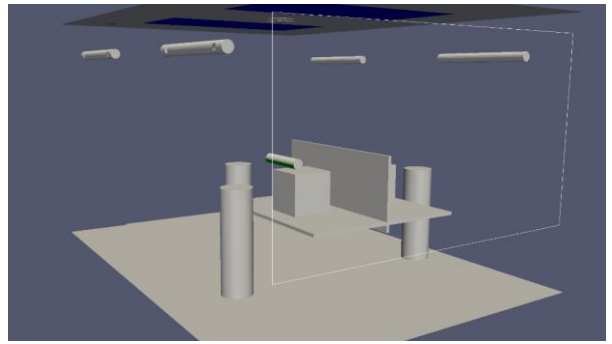

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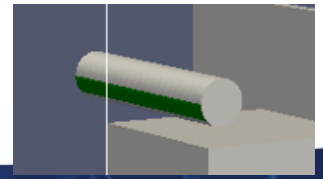
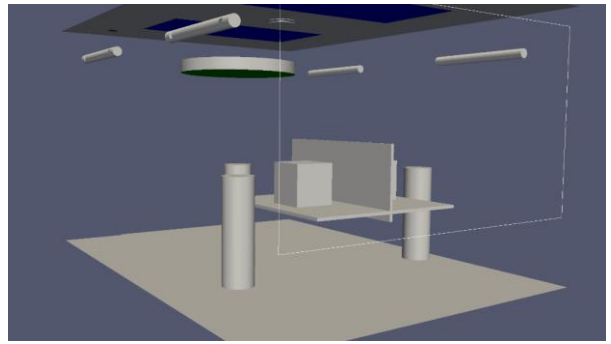
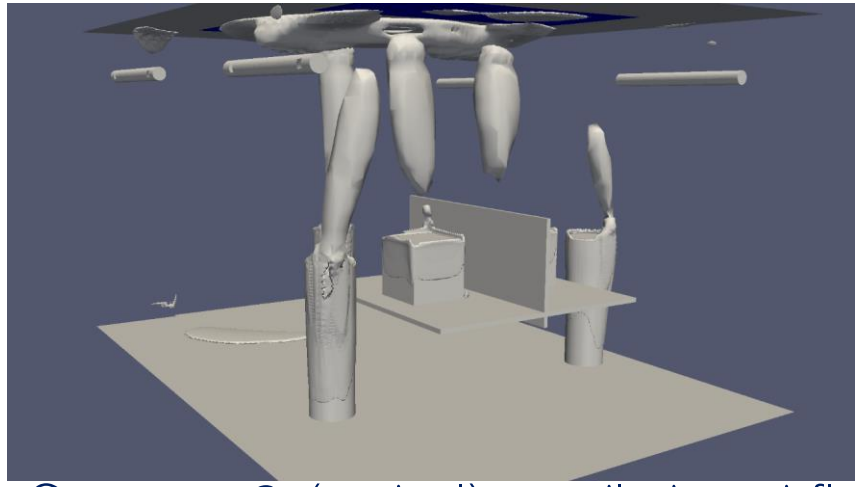


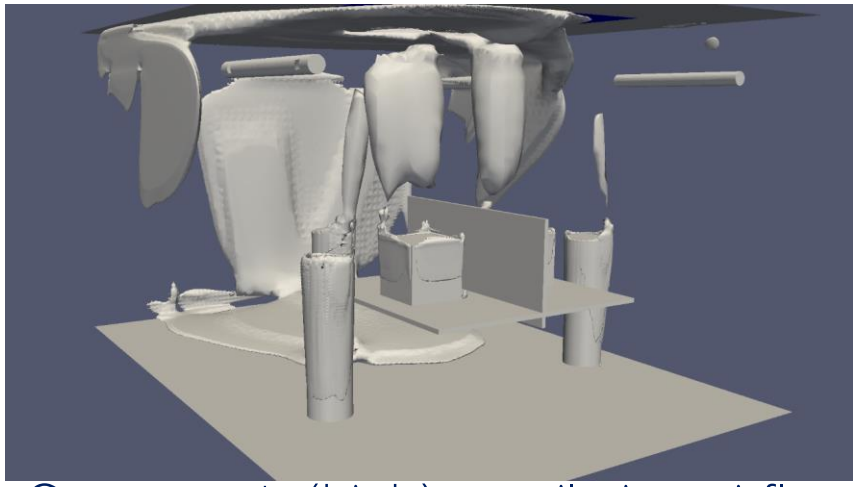


D

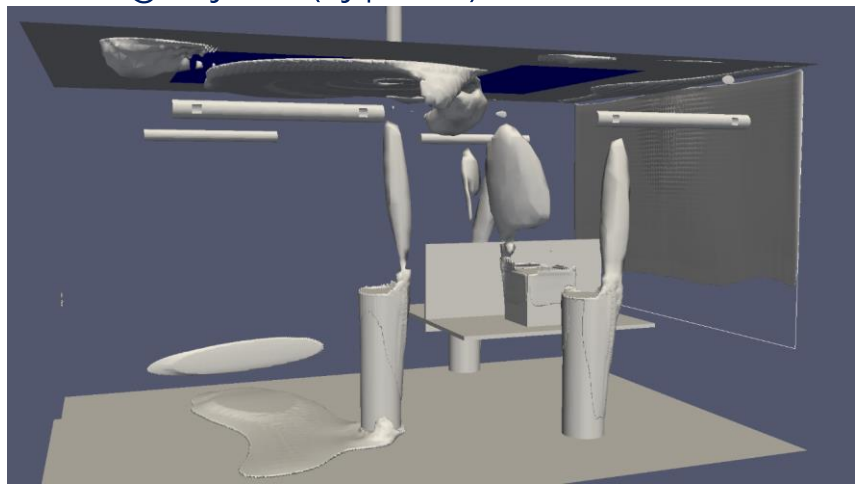
Results: Room air velocity field over 0.25 m/s



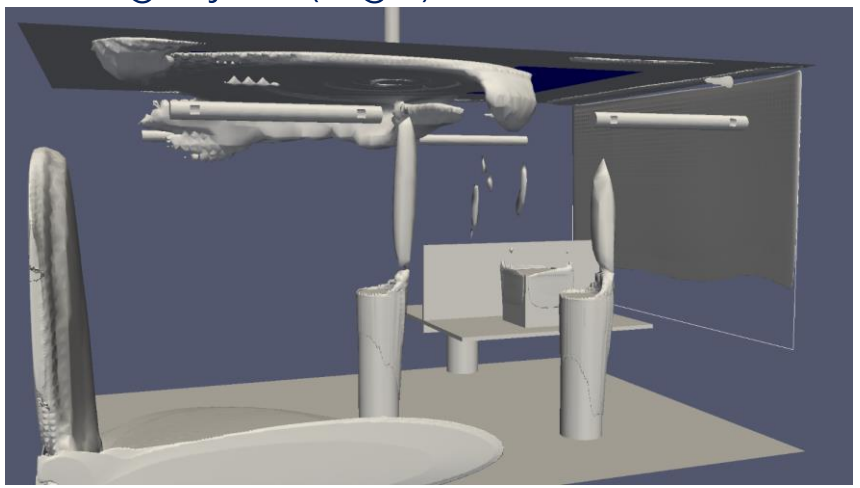
Category 2 (typical) ventilation airflow



Category 1 (high) ventilation airflow



Category 2 ventilation + warm window



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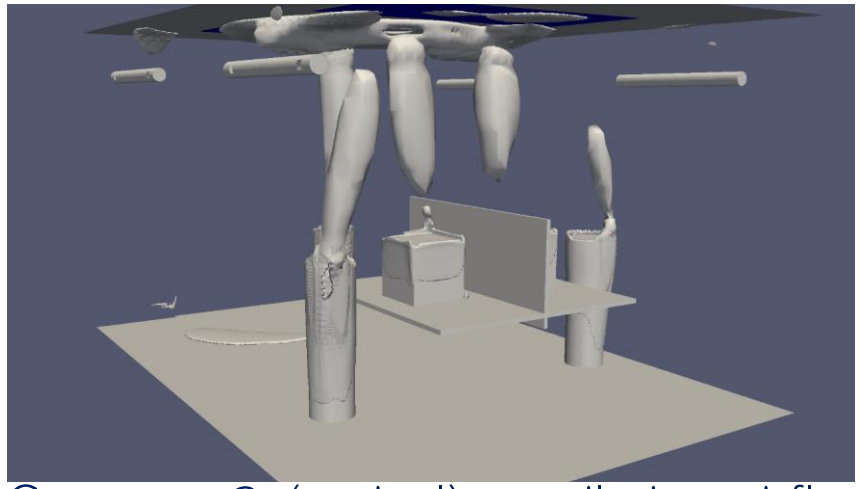

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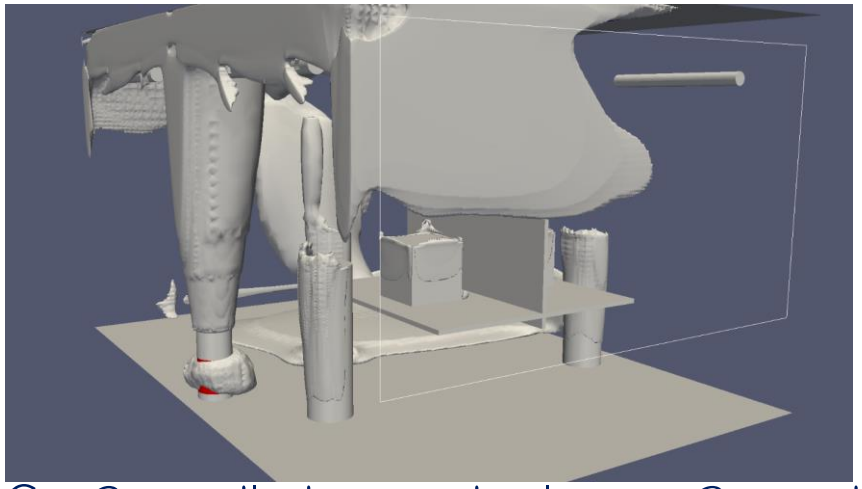
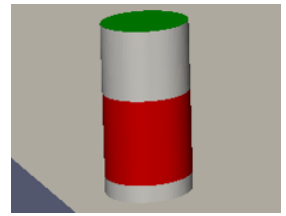
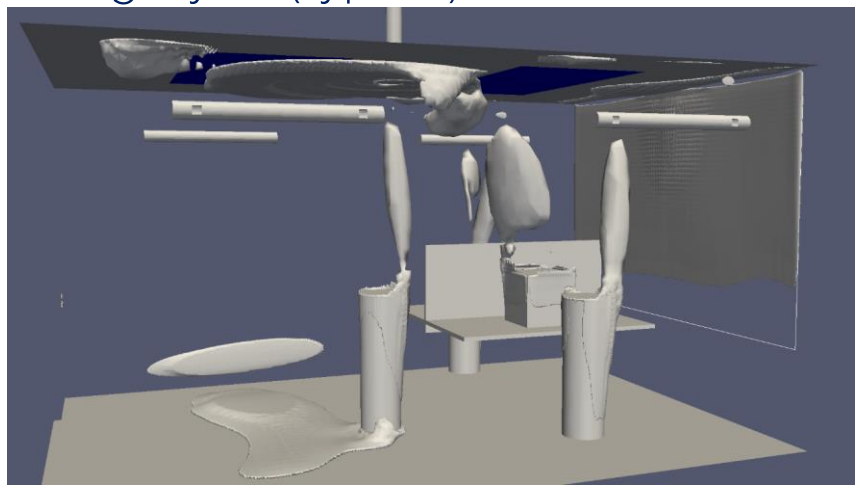




Cat.2 ventilation + air cleaner 3xventilation



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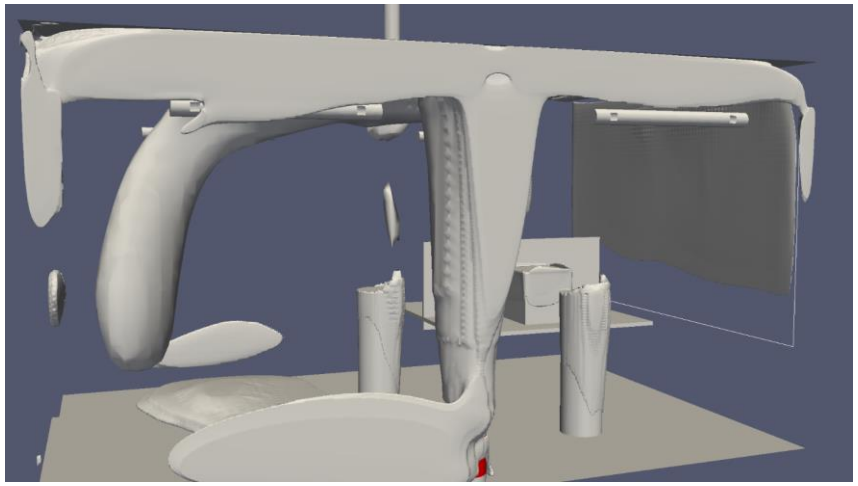

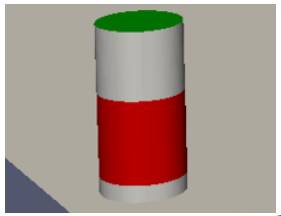

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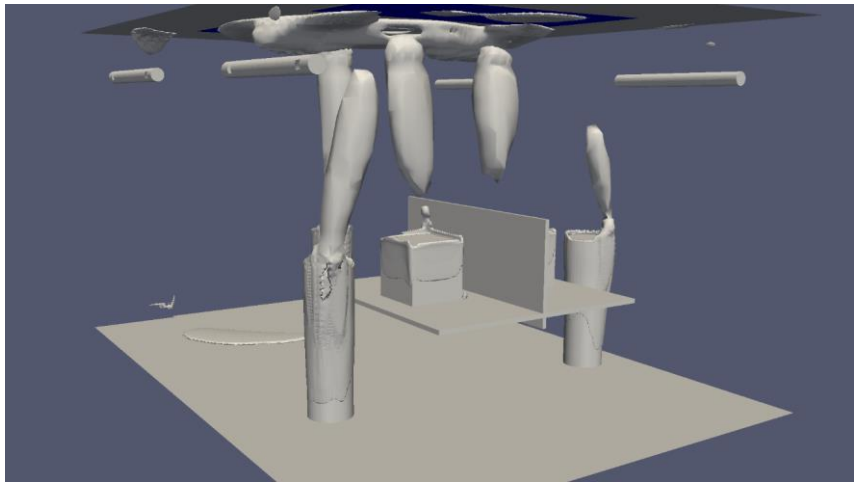

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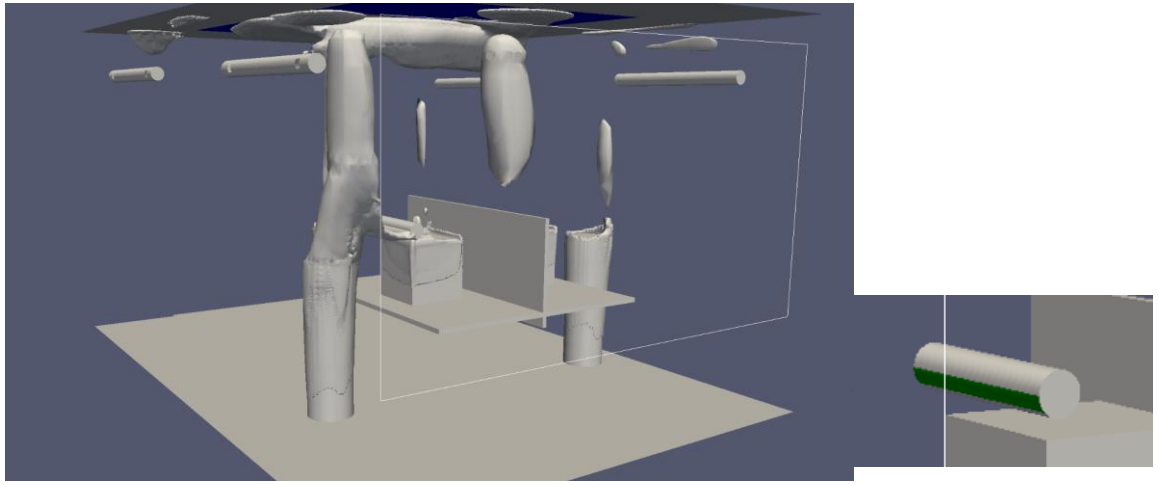

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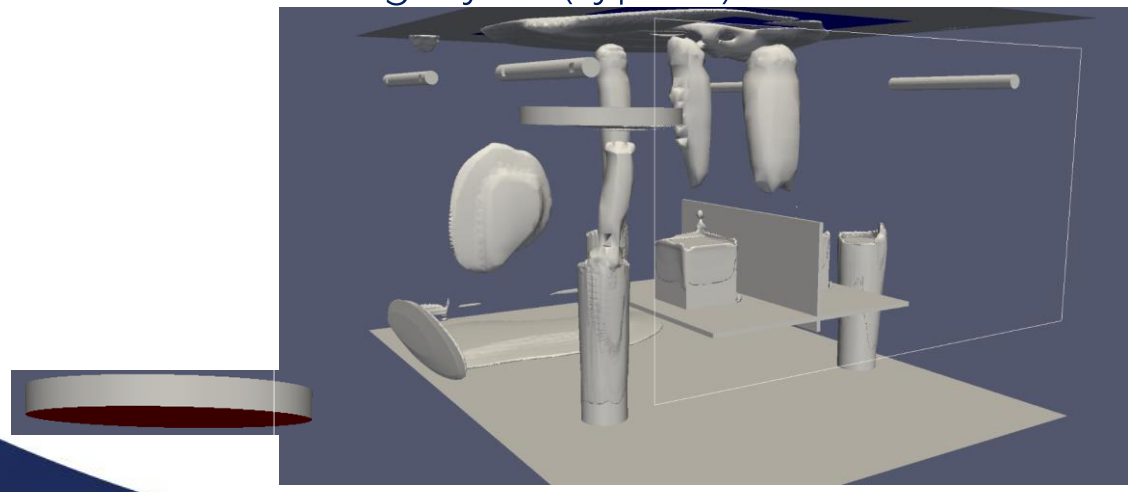
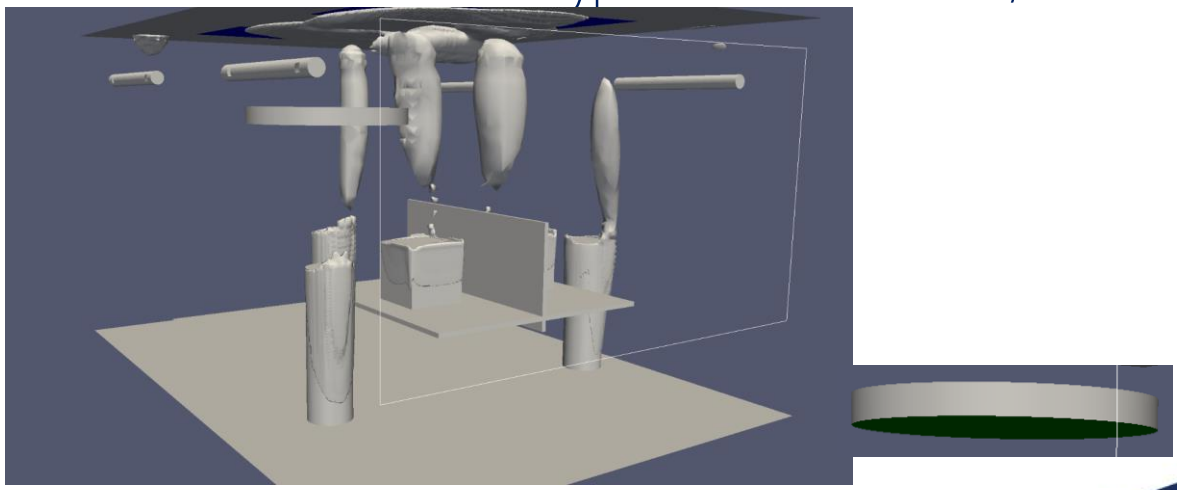


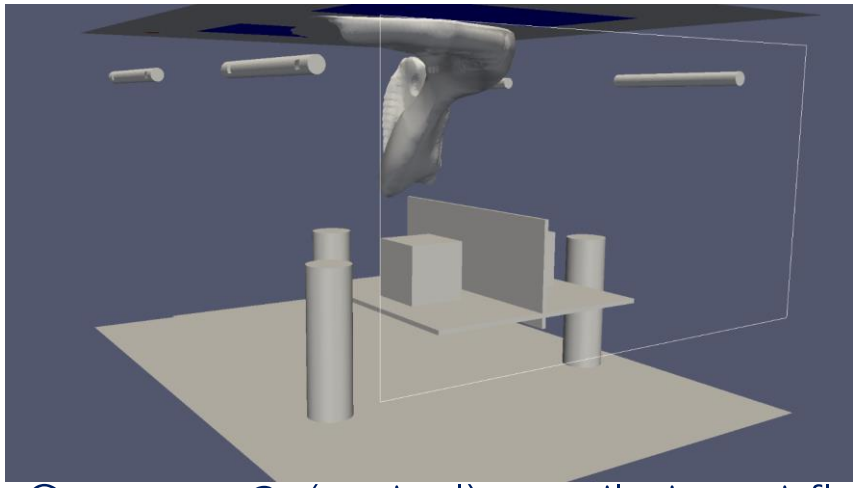
Cat.2 ventilation + incl.local top exhaust 10 l/s



Cat.2 ventilation+incl.local top air supply 10 l/s

Results: Locations of cleaner than 0.75 * fully mixed air in room

Contaminant source from male, Note: absolute source differs in cases, visualises only micro-environment potential



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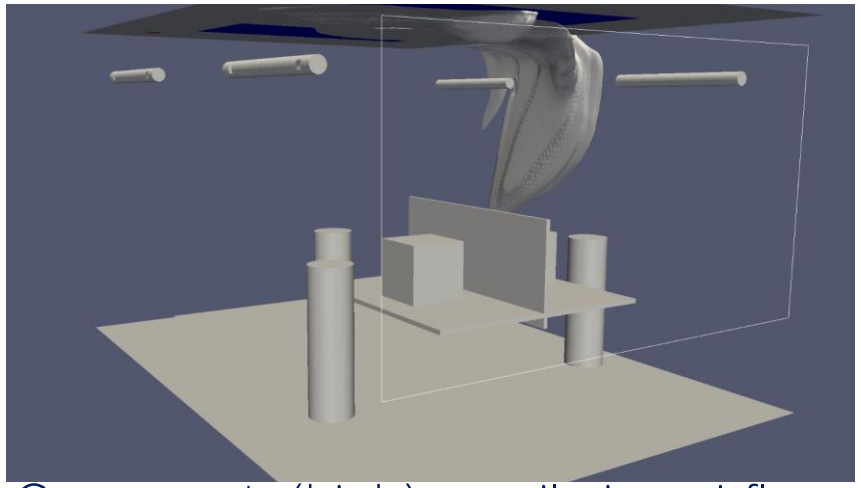

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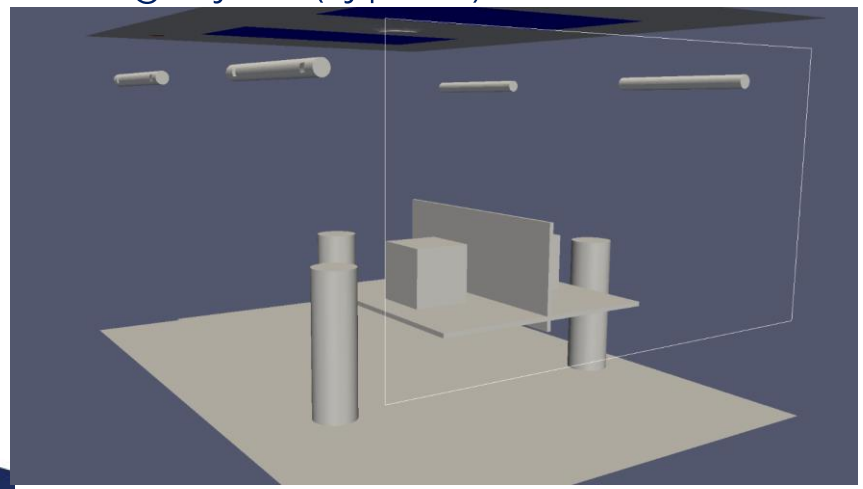

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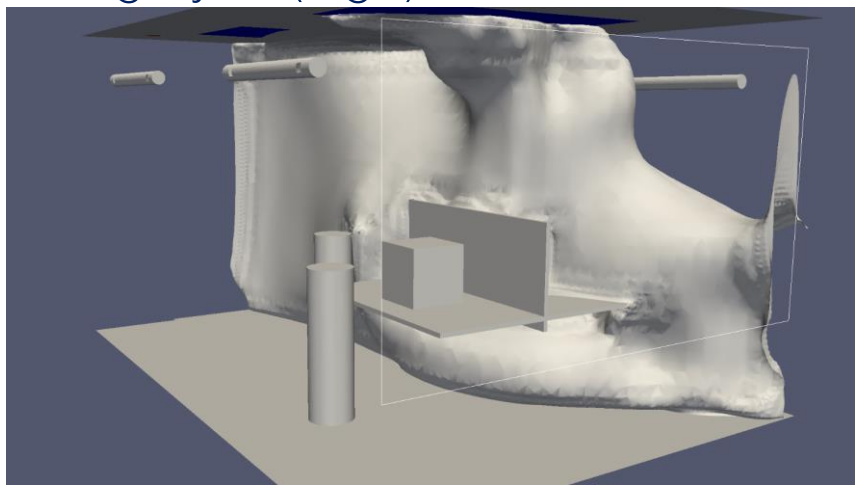

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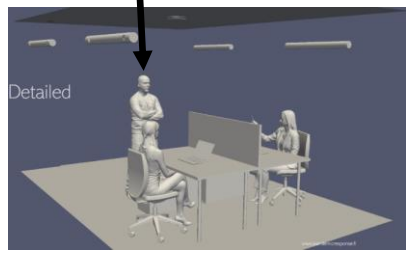

Preliminary results, will be continued:

- Comparable contaminant sources will be used between cases
- New cases will be simulated for generating useful micro-environments

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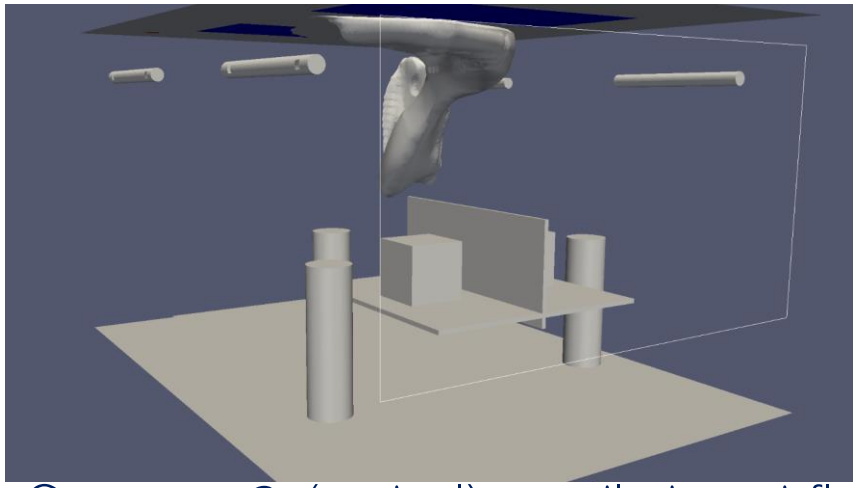

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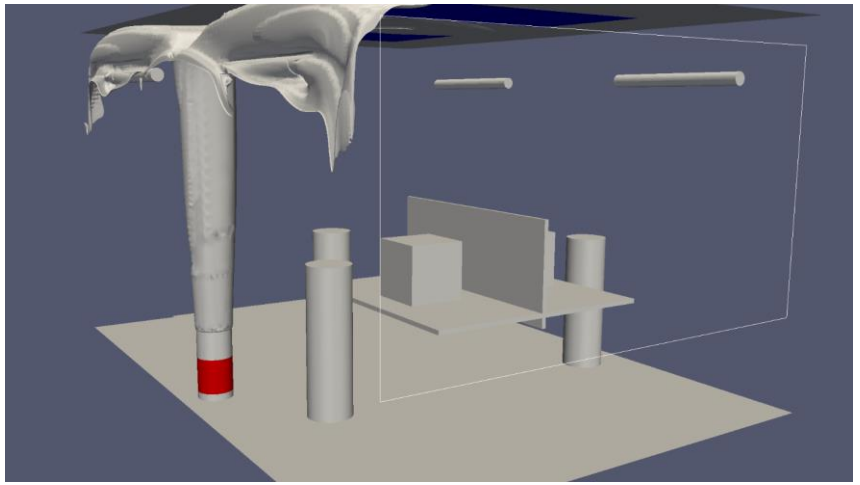

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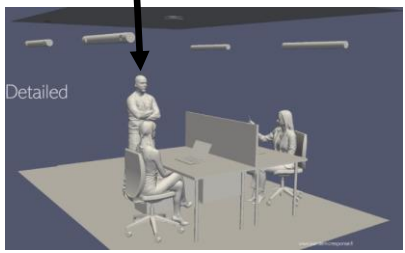

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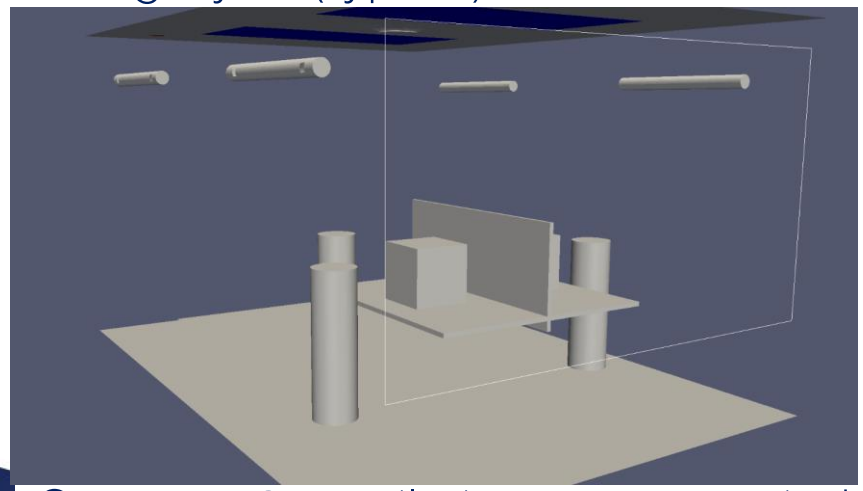

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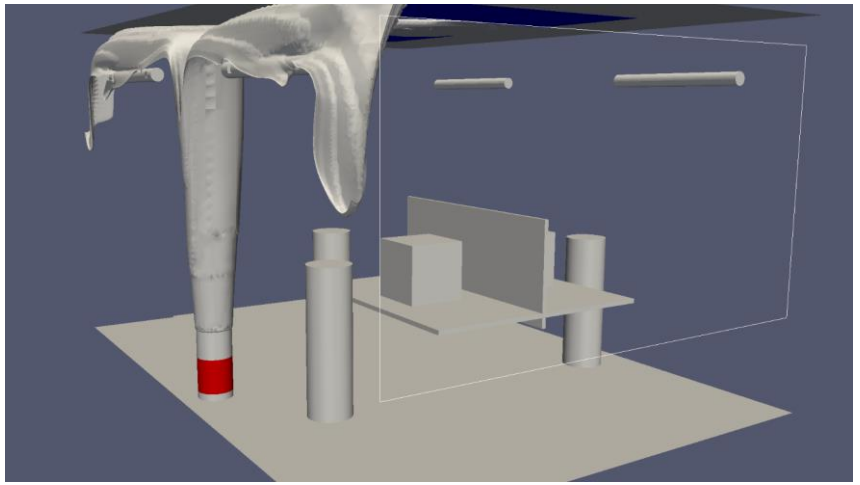

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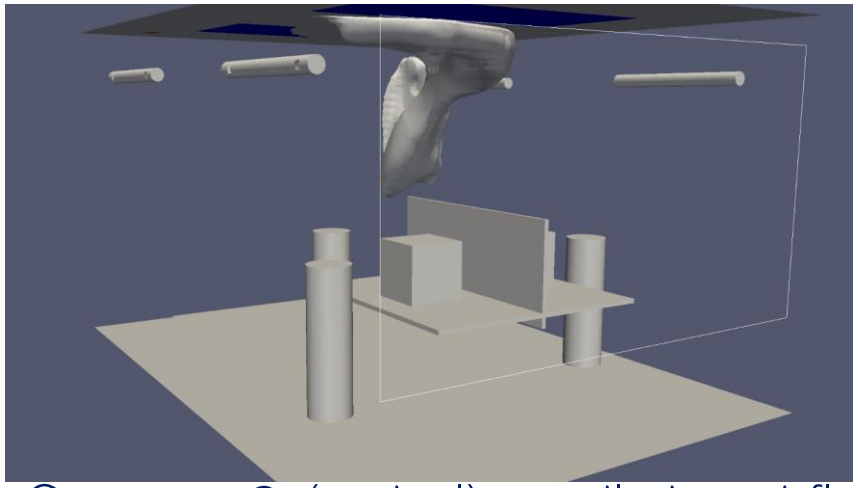

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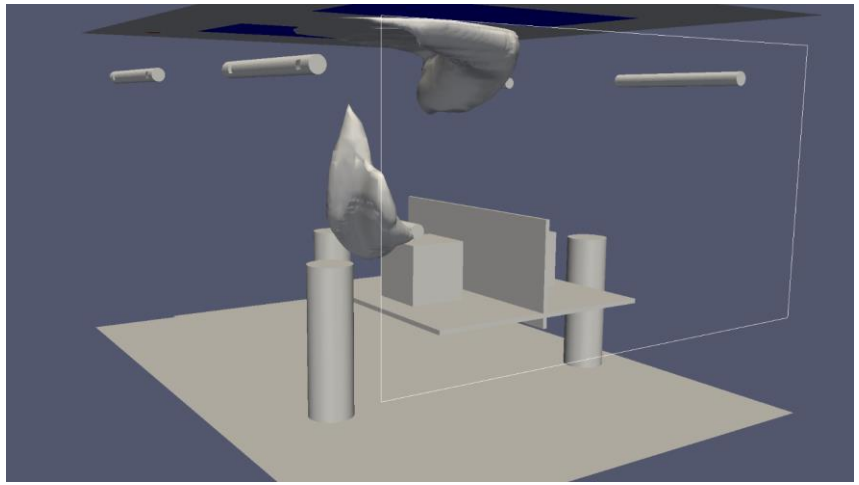

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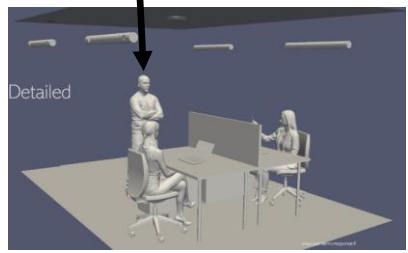

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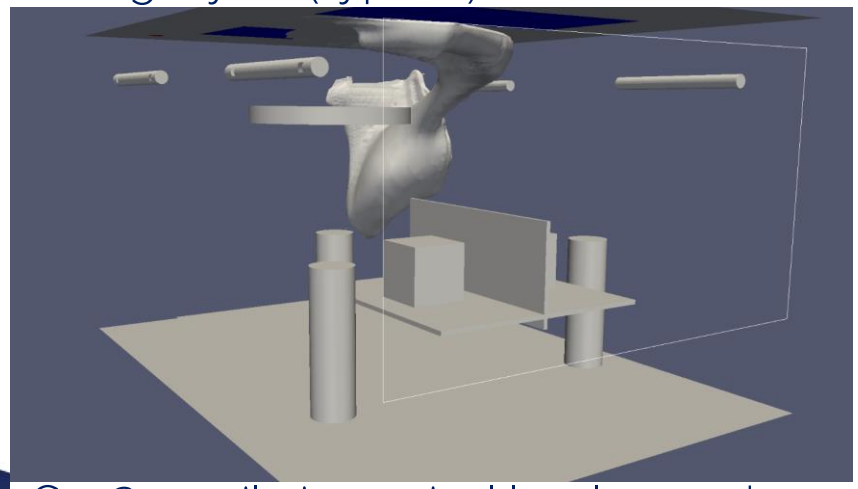

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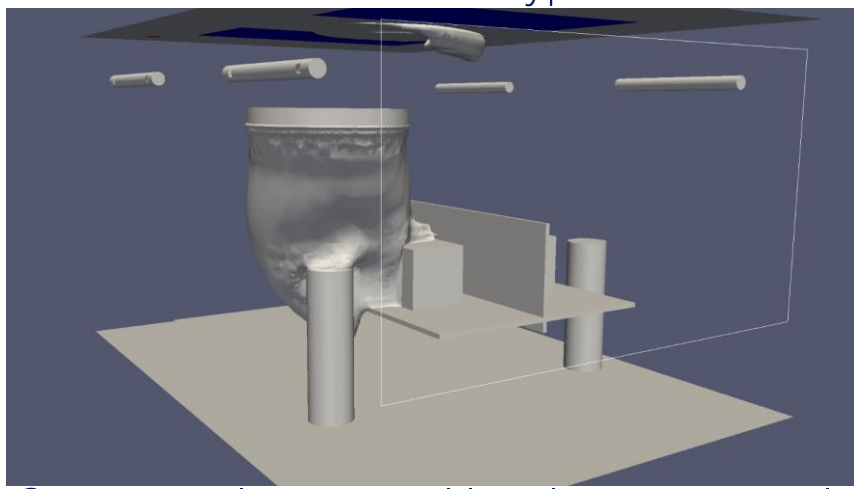

Cat.2 ventilation+incl.local top air supply 10 l/s

Conclusions

Findings of the first set of results of micro-environment use case study with typical office room

- Heat sources and higher ventilation flow rate changes room flow patterns and increases velocities
- Location and effective air distribution from air-cleaner with high flow rate is important (location near room exhaust carefully designed)
- Micro-environment was generated with typical personal ventilation (PV) device or with top low velocity air supply
  - PV device was able to generate very compact area with cleaner room air
  - Top low velocity air supply generated wide area with cleaner room air around occupant
- Further simulations and measurements will be performed
  - Refined cases and more potential micro-environment setups

Thank You!