



Next Generation Lab Environments

Flexible, Adaptable, Energy-Efficient

I2SL Annual Conference 2025

Tim Walsh

Learning objectives

Attendees will: **Learn** the forces driving need for advanced adaptability, flexibility and modularity in research labs; **review** examples of the innovative lab systems, operating strategies, emerging technologies and modular infrastructure developed for this challenge; and **evaluate** results of a fully operational pilot test comparing conventional lab configurations to a next generation lab, including levels of versatility and performance of energy cost, comfort and contaminant clearing parameters.

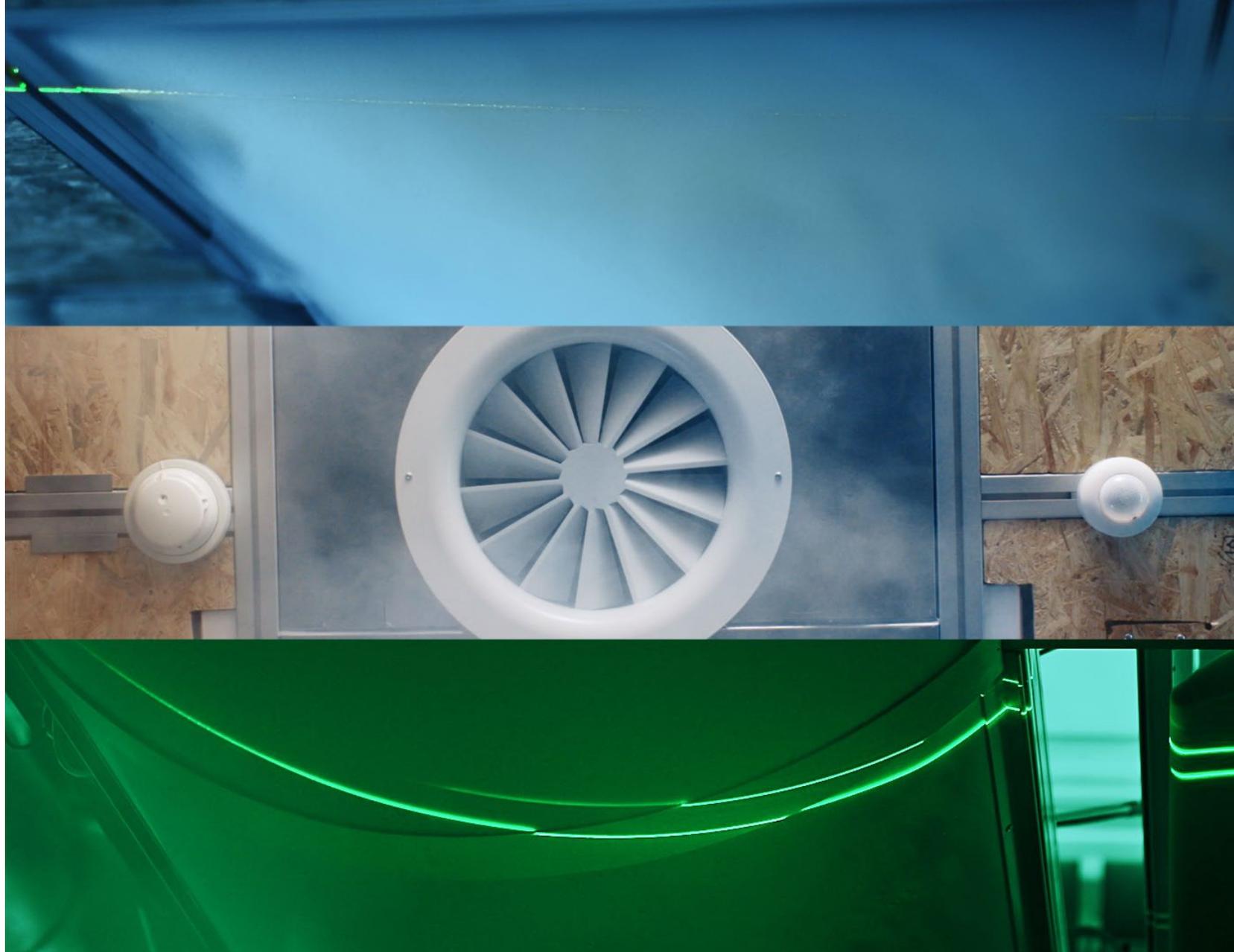


Take a deep breath



What

**makes this project
so extraordinary?**



Myth 1

**More air is
always better**



The right amount and control of air is better

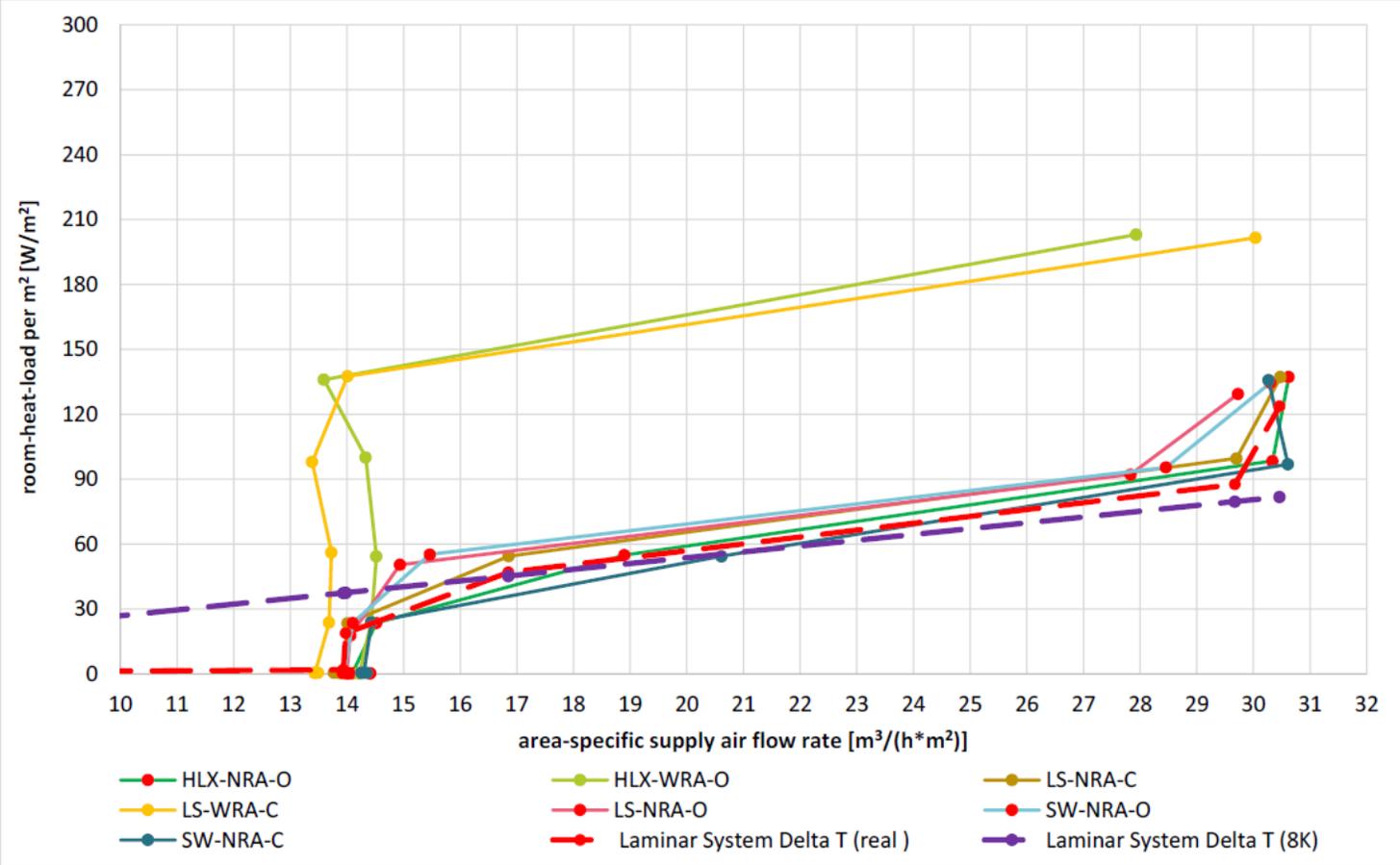


Figure 20: Room heating load per m² (W/m²) and area-specific supply air volume flow [m³/(h*m²)] converted for the entire system and corresponding heat load point until LP3400



Myth 2

“Good enough”
is good enough



Next generation labs perform better and are safer

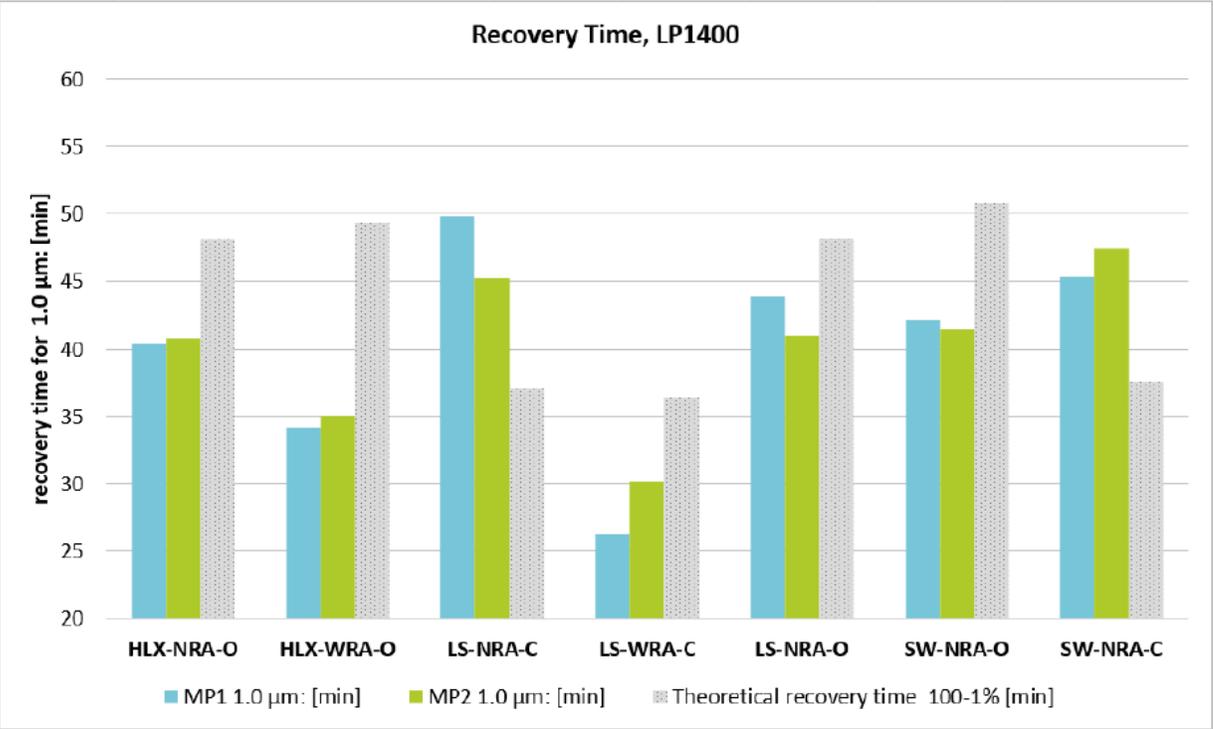


Figure 30: Recovery times for 1 µm for MP1 and MP1 and for all ventilation systems examined and theoretical recovery time



Myth 3

Modularity is expensive



Flexibility to scale comfortably from zero up to 300 W/m2 heat load dissipation

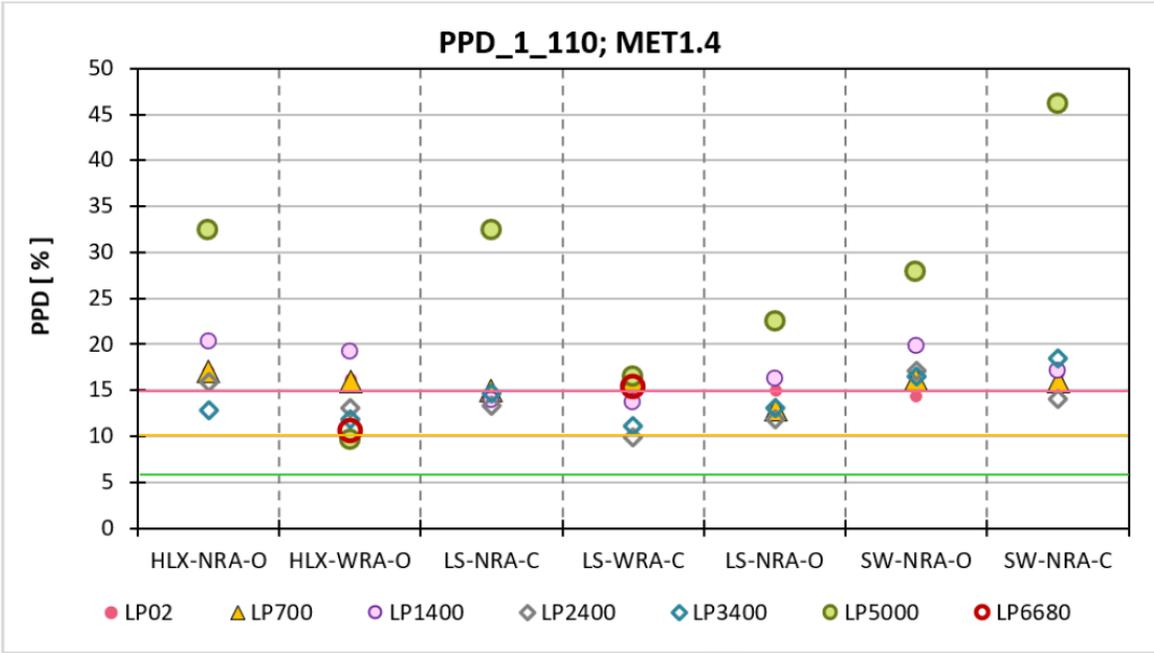


Figure 8: PPD in percentage across all systems for 1.10 meters and with MET1.4; PPD <6 % Category A, green line / PPD <10 % Category B, yellow line / PPD <15 % Category C, red line.

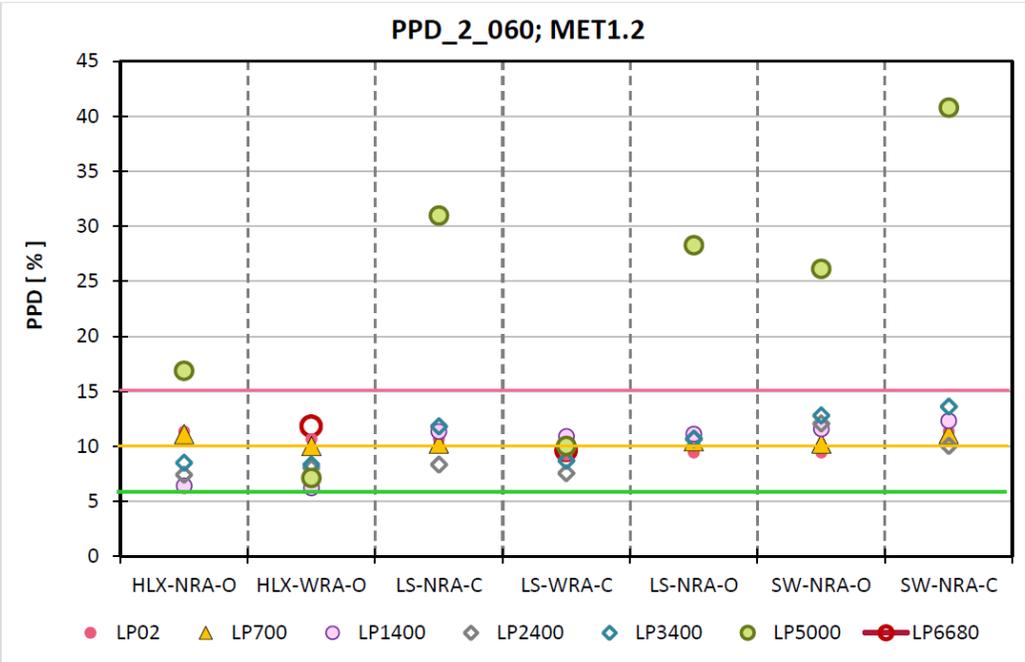
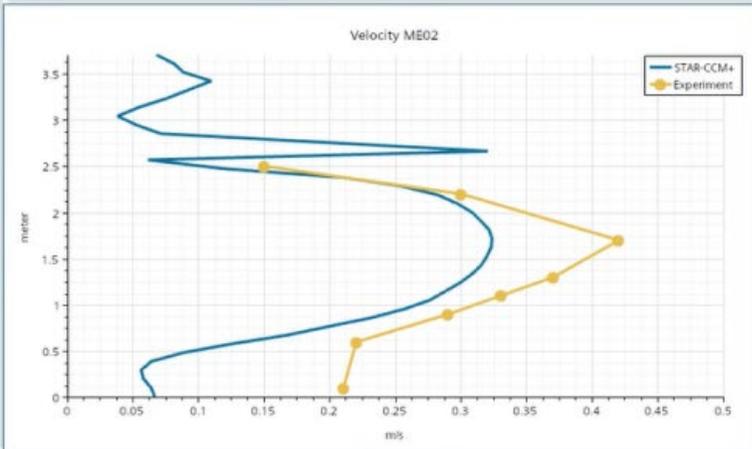
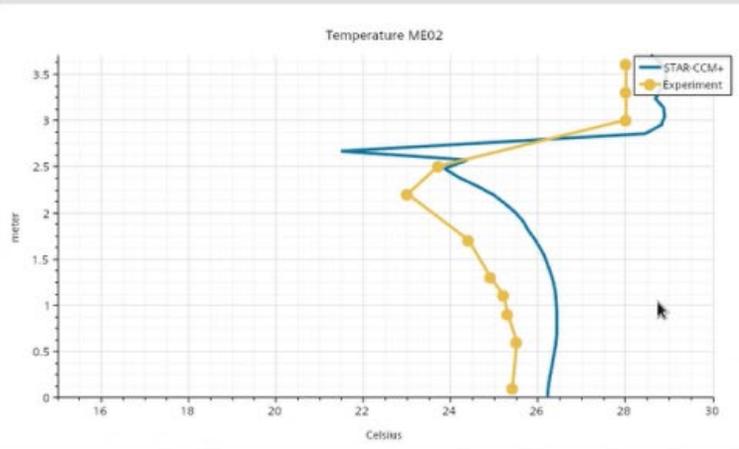
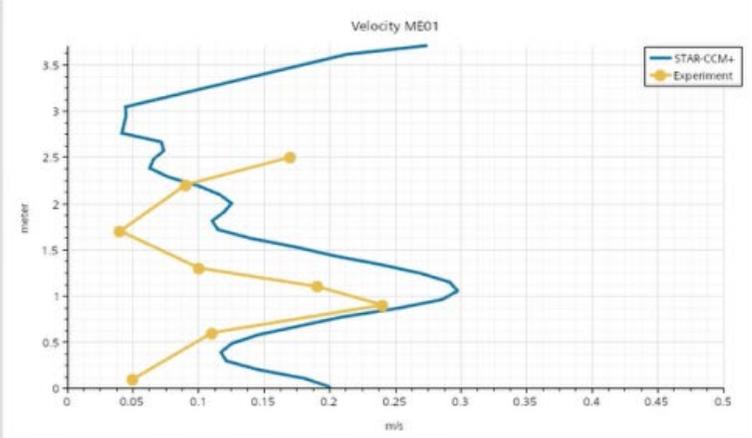
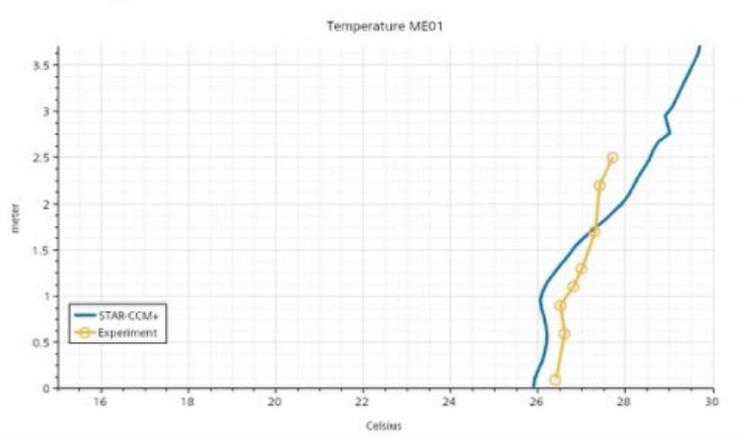


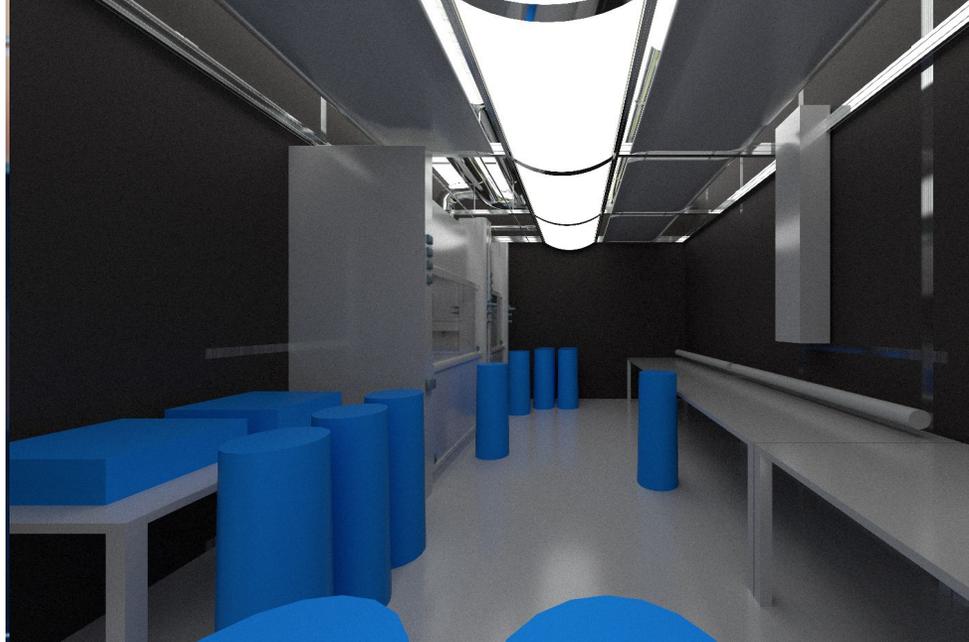
Figure 12: PPD in percentage across all systems examined for 0.60 meters and with MET1.2; PPD <6 % Category A, green line / PPD <10 % Category B, yellow line / PPD <15 % Category C, red line

Thermal Comfort standards ISO 7730 and ASHRAE 55

Preparing with a digital twin!



— STAR-CCM+
— Experiment





Questions

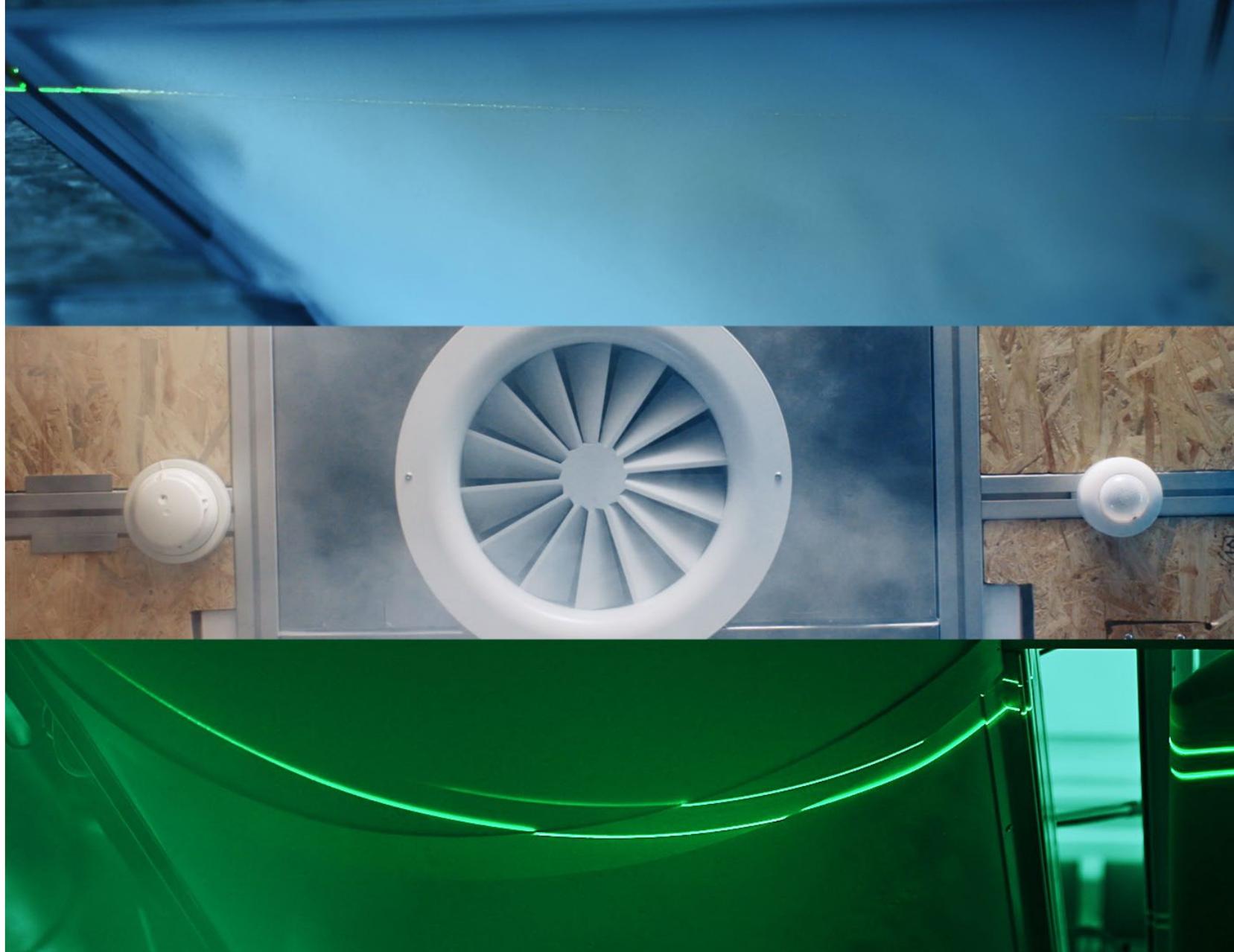
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Answers

What

**makes this project
so extraordinary?**

Closing remarks



Thank you.



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