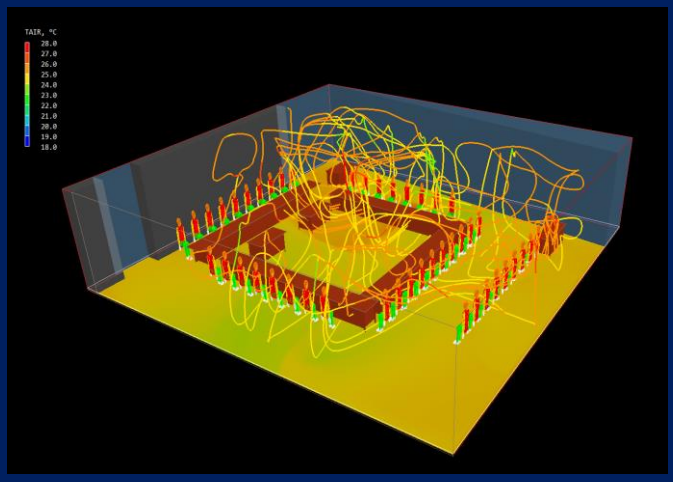
CHAM Case Study - PHOENICS Use in Germany
Five Case Studies supplied by Coolplug GmbH
Winter 2019

1. Comfort in a meeting room

A new ventilation system needed to be developed for a meeting room in a town hall where fresh air was supplied through diffusors in the ceiling and exhaust air flowed through shadow gaps at the ceiling along the room.

The room had a cooled ceiling (summer) and floor heating (winter).

PHOENICS/FLAIR was used to evaluate various diffusor types and positions, air flows and air temperatures to ensure a good comfort in the winter and summer. The advantage of being able to visualise PMV and PPD according to the ISO 7730 standard was very useful.



Temperature distribution just above the floor and streamlines in the bedroom during the summer

2. High-performance data centre

Cooling high-performance data centres is power-hungry; it is therefore crucial that it is done efficiently.

In this particular data centre the underfloor conditioned air entered the cold aisle through perforated floor tiles; the cold air was pulled into the front of the rack mount equipment using fans. At the same time, exhaust left the rear of the rack mount equipment and exited the enclosure into the hot aisle. Servers were set up in the racks back to back and the warm isles were isolated from the rest of the room. By that energy-critical "air short circuit" gets prevented.

PHOENICS/FLAIR was used to calculate temperature and velocity distribution for normal operation and during an “accident” where only half of the air flow is available.

Based on these simulations a number of design changes could be suggested to improve cooling effectiveness and robustness in case of a failure.

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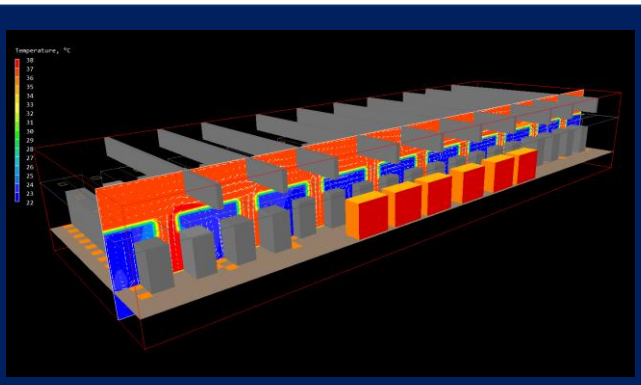
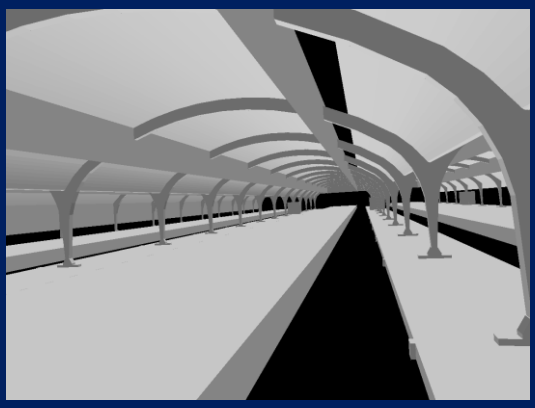


Data Centre temperature distribution

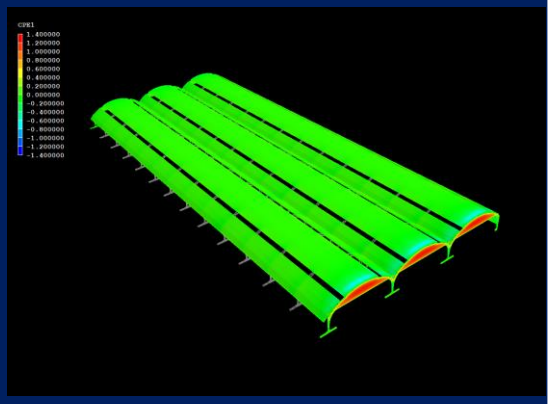
3. Old track hall

As part of renovation planning for an old track hall, existing wind loads needed to be determined. PHOENICS wind - load simulations were carried out for 3 flow directions: transverse, longitudinal and under 45°.

Wind loads were expressed as net pressure coefficients defined as the difference at the out- and inside of local pressure on the construction divided by the dynamic head at the wind reference velocity. The pressure coefficients were used by a design engineer to construct a renovated track hall capable of withstanding all future



Old Track Hall



Pressure coefficients on the track hall

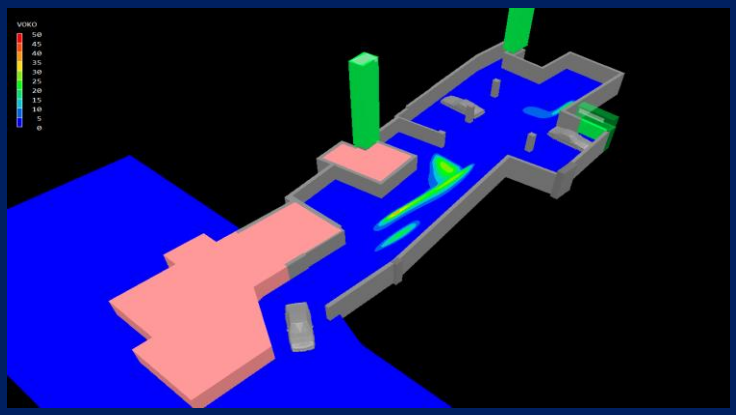
4. CO concentrations in an underground park

A small private underground car park needed checks to determine if it needed an expensive ventilation system installed.

Local authorities would approve the non-installation of said system only if the owner could prove that natural ventilation of the underground car park ensured a 0.5-fold air change and that the half-hour average CO concentration of 50 ppm was not exceeded for a scenario with three car trips within 30 minutes.

It was agreed to perform PHOENICS transient calculations for two atmospheric conditions: one with a wind speed of 3.6 m/s from west-northwest and one when there was no wind. Outside temperature was set to 20ºC.

It was proved that, for both cases, the requirements of the local authorities were met.



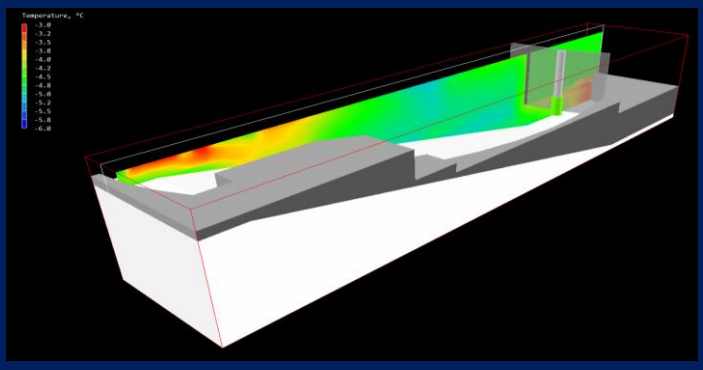
CO (ppm) distribution in an underground car park

5. Keeping snow fresh in a ski hall

Snow was melting too quickly in a ski hall because of overly high air temperatures just above the snow deck. It was decided to remove the old ventilation system and use PHOENICS to design a new system.

Several designs were evaluated using PHOENICS. The high outside temperatures (over 35ºC) and the high number of people inside the hall made it extremely difficult to fulfil the inside air temperature demands and still keep the climate comfortable (no draughts) for visitors.

With the use of PHOENICS it has been possible to find the optimal system.



Temperature distribution in a ski hall