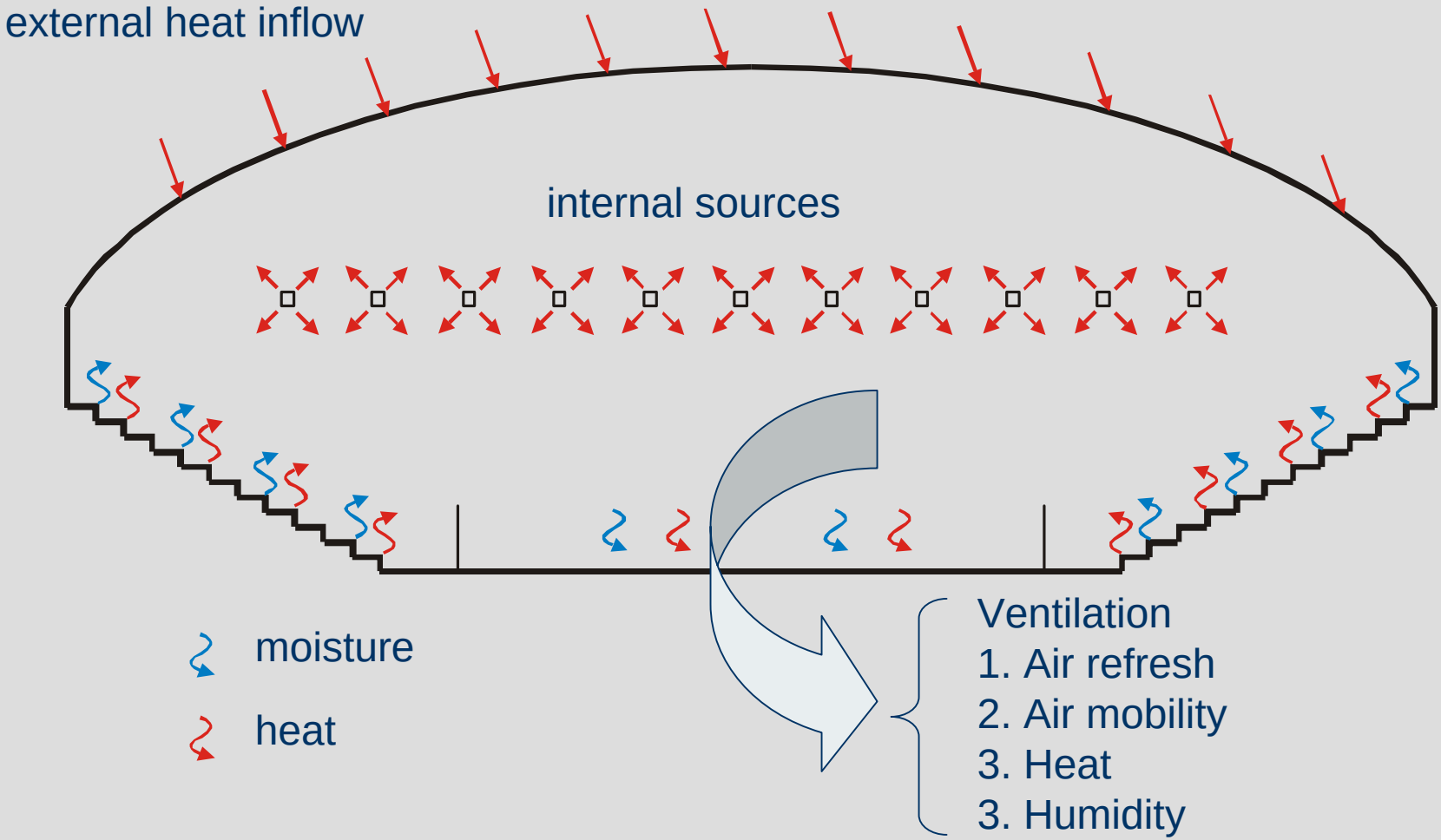
CAE services

O.G. Buzykin, K.V. Myakushev

VENTILATION OF A LARGE ROOM

Ventilation of a large room



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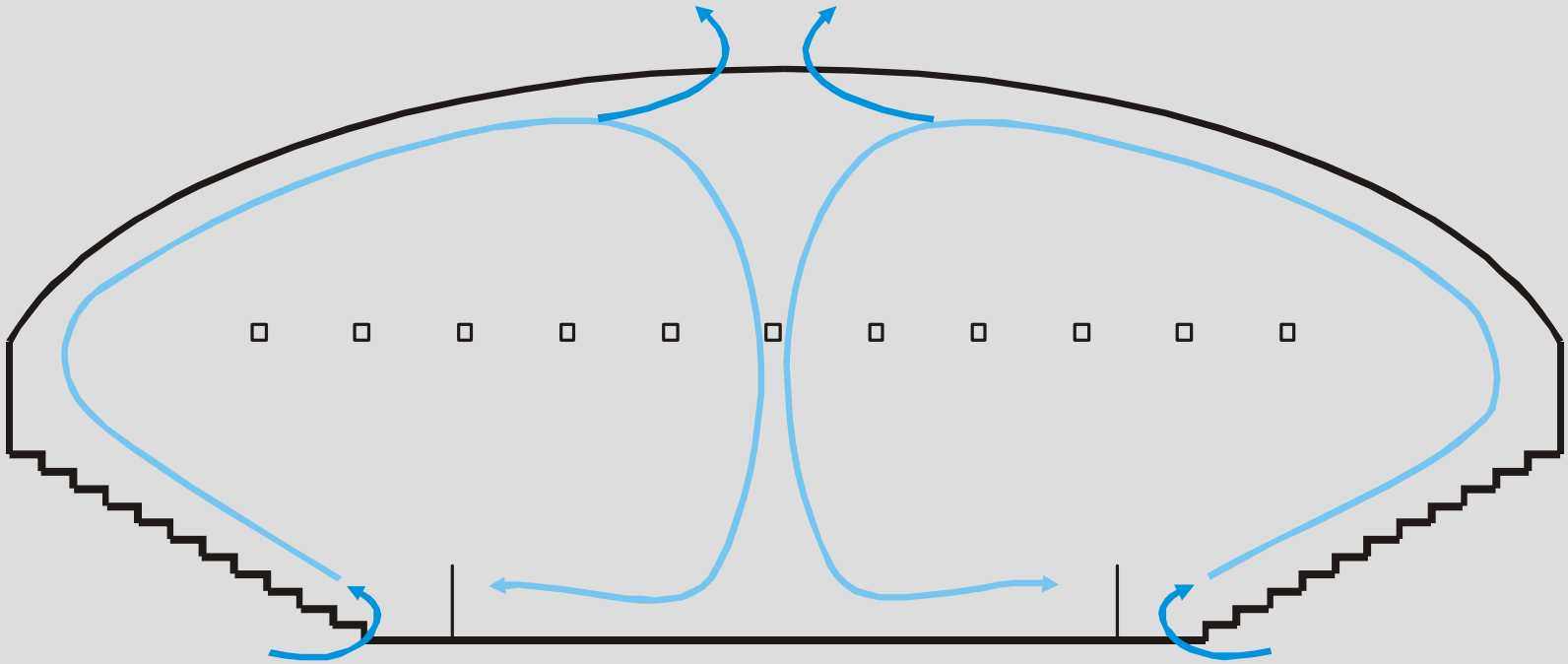
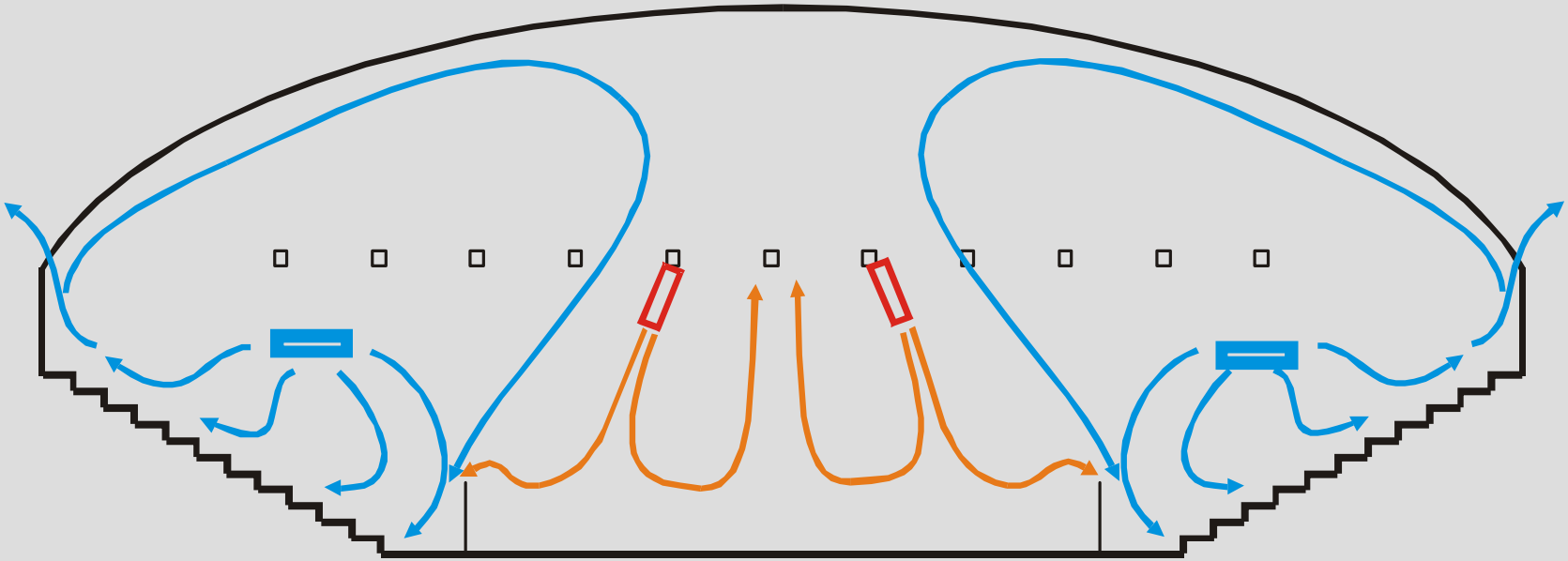


Natural convection:

1. environment responsivity
2. nonuniformity
3. coupling of air temperature, humidity and mobility

Ventilation of a large room

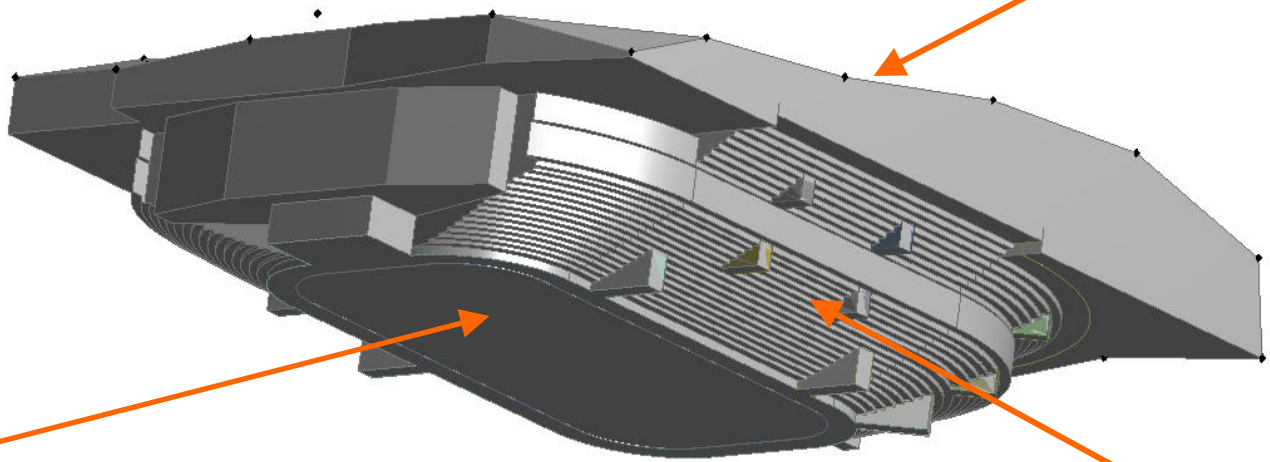


Extract and input ventilation:

1. zonal control
2. comfort enhancement
3. efficient conditioning

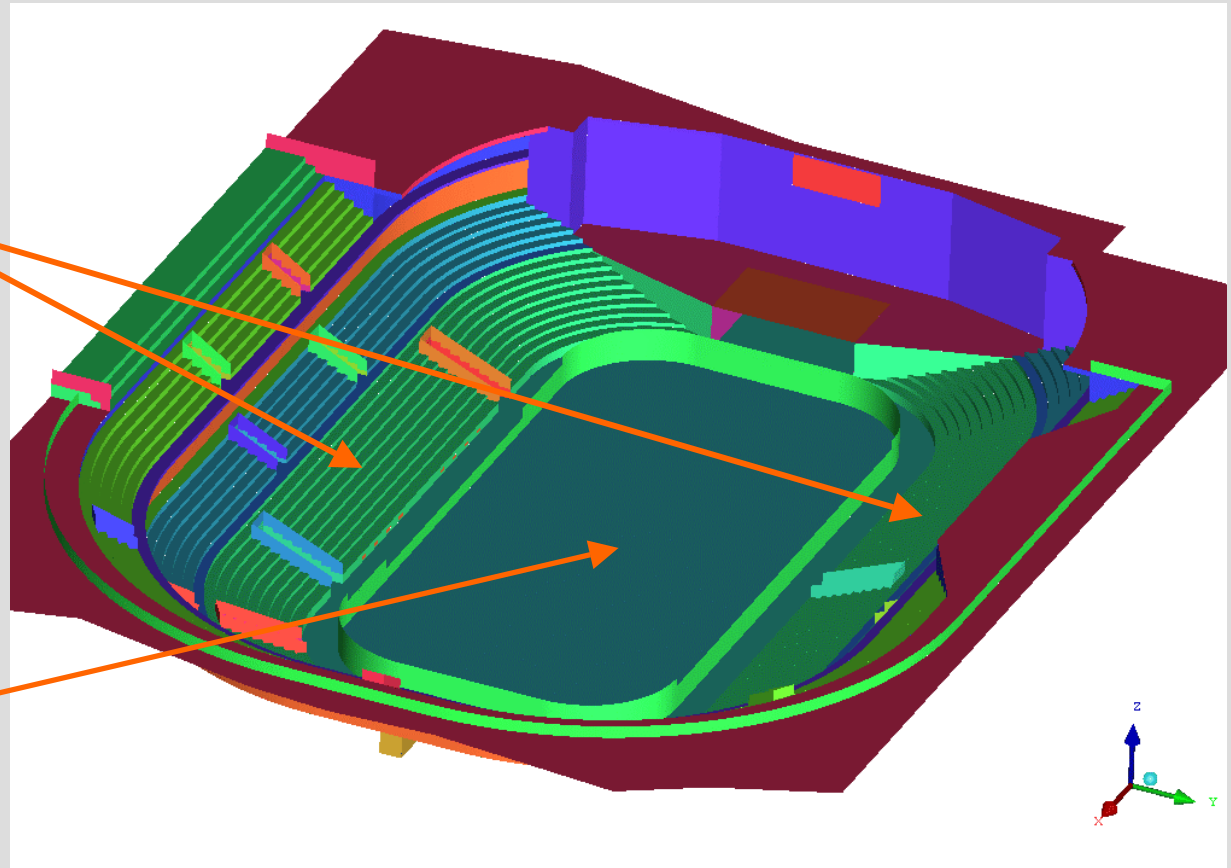
Solid model of the room

(ANSYS Design Modeller)



Shell model (roof not shown)

(ANSYS ICEM CFD)



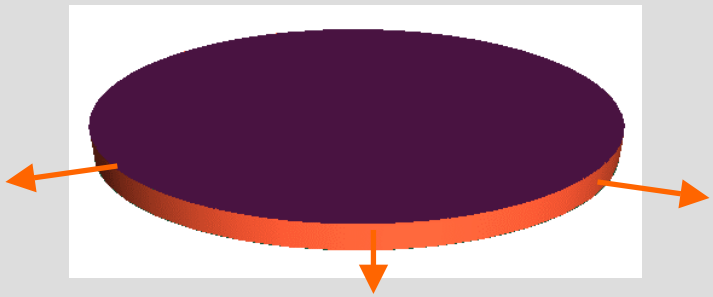
Ventilation of a large room

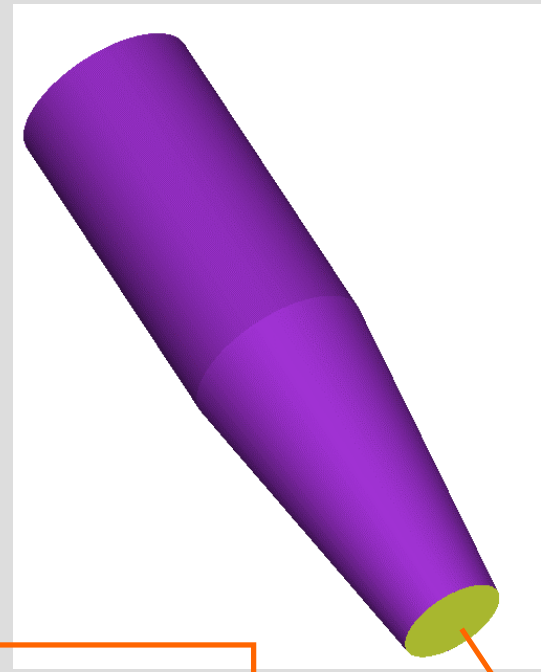
inflow terminal units

(ANSYS ICEM CFD)

diffuser (cooled air)

fan jet





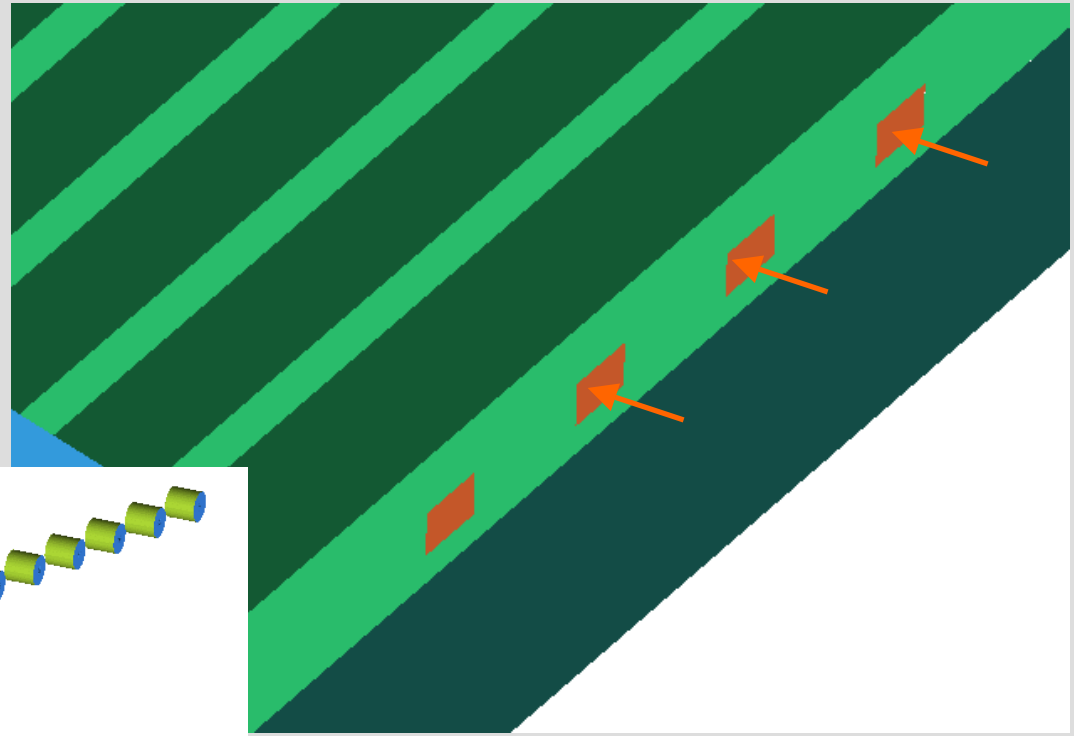
nozzle (warm dry air)

directed jet

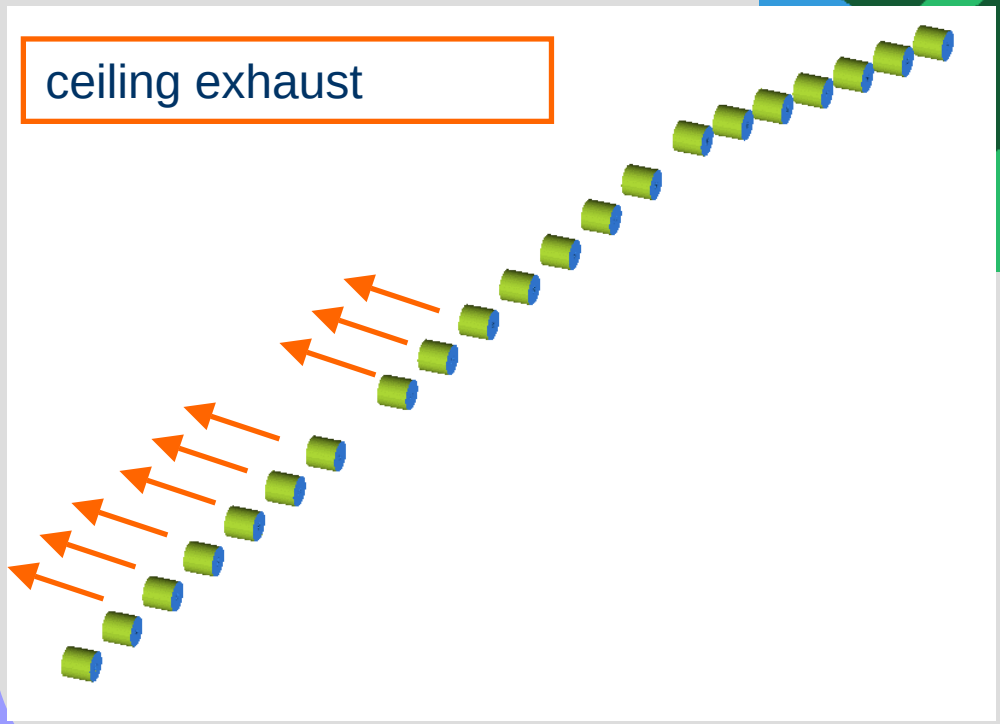
Ventilation of a large room

Exhaust units

(ANSYS ICEM CFD)



ceiling exhaust

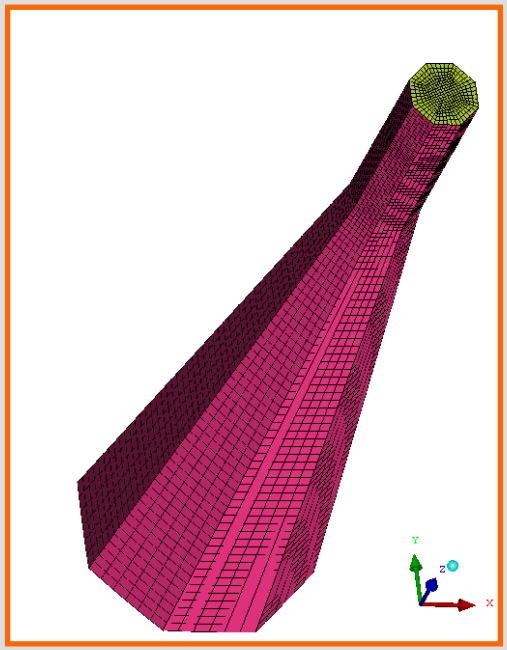


bottom exhaust grilles

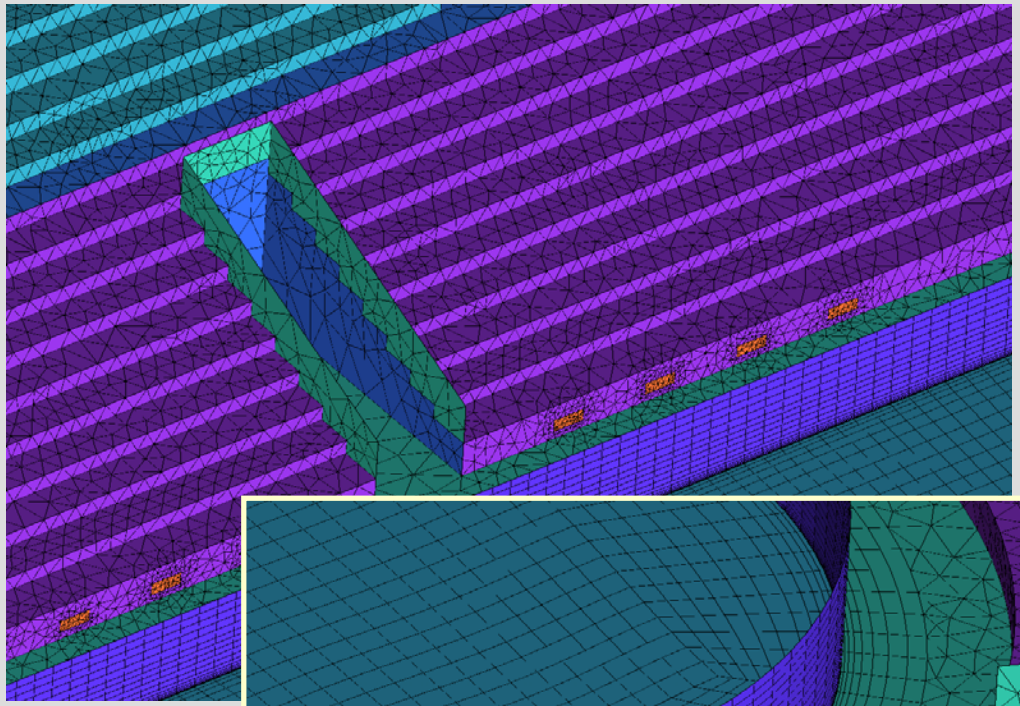
Ventilation of a large room

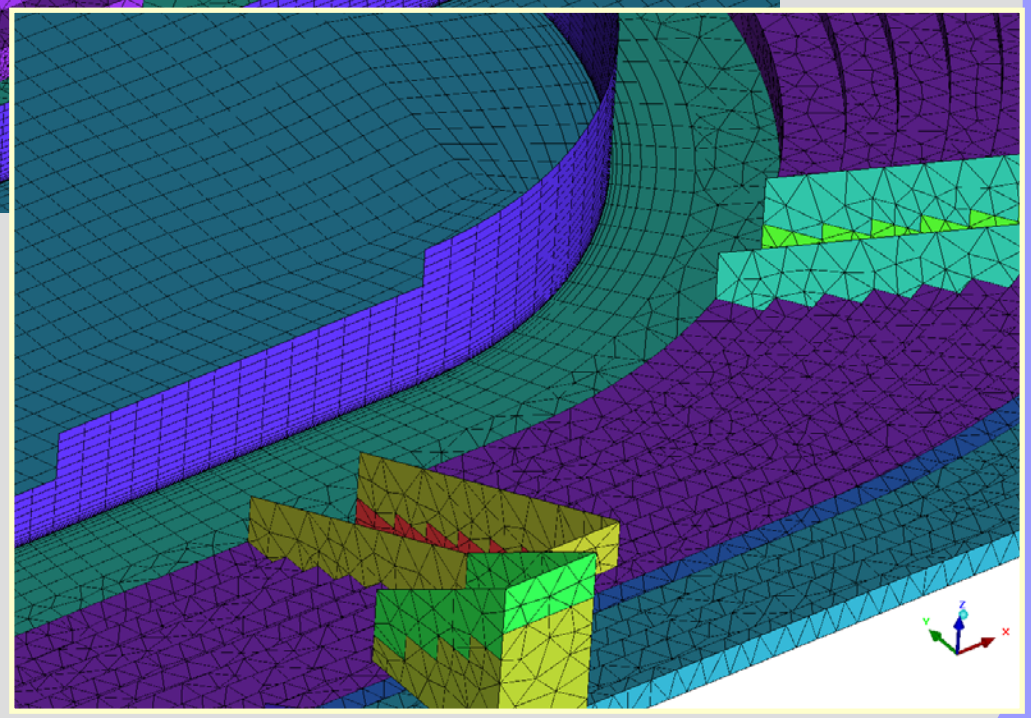
Hybrid mesh

(ANSYS ICEM CFD)
4.5 million nodes
13.5 million elements



jet region





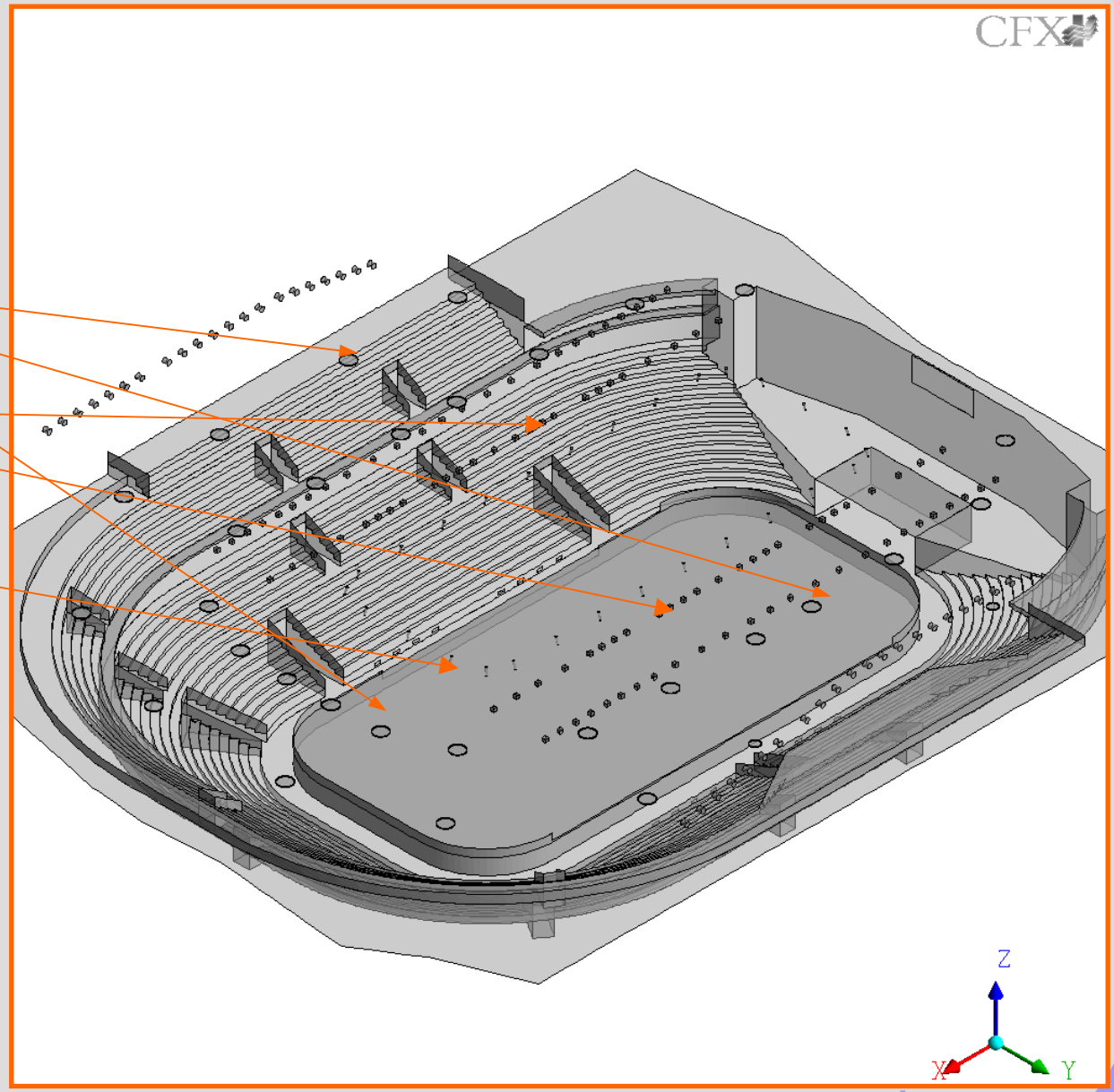
Ventilation of a large room

model assembly

(ANSYS CFX)

- diffusers
- spotlight
- jets

Ideal gas
RNG turbulence model
H_2O transfer
radiation



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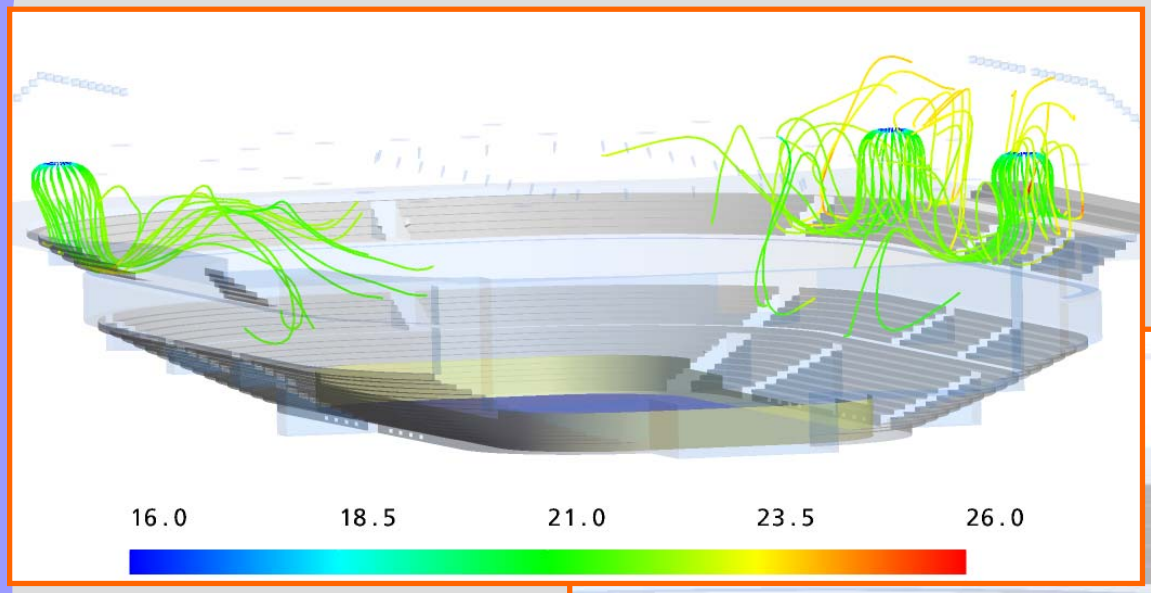
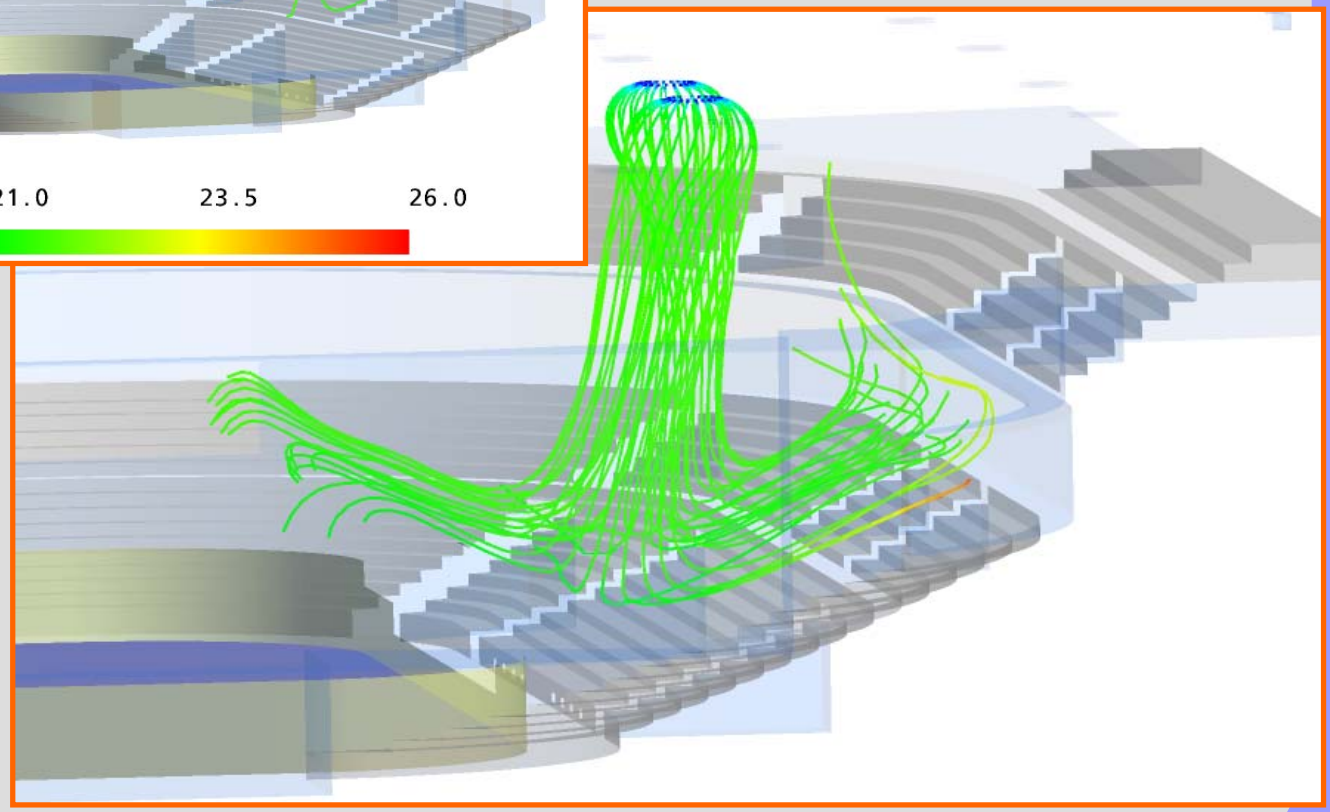
Ventilation of a large room



diffuser streamlines



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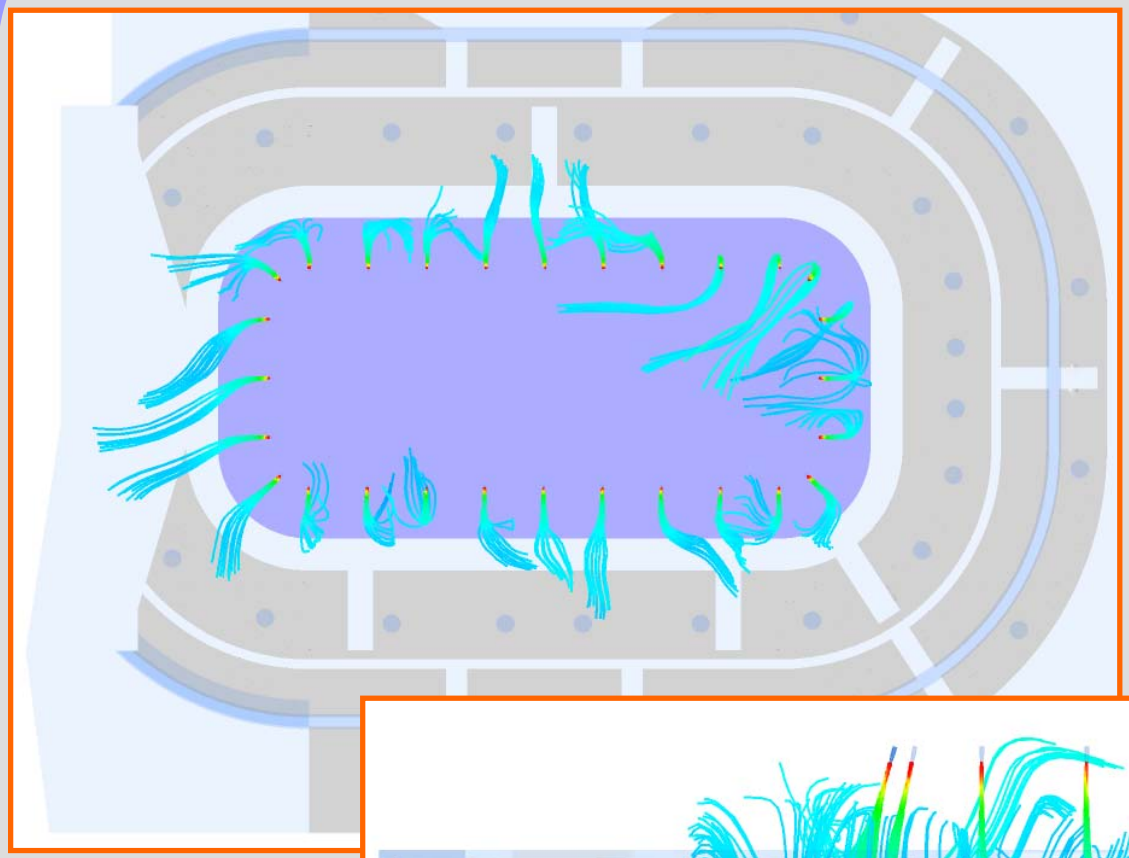
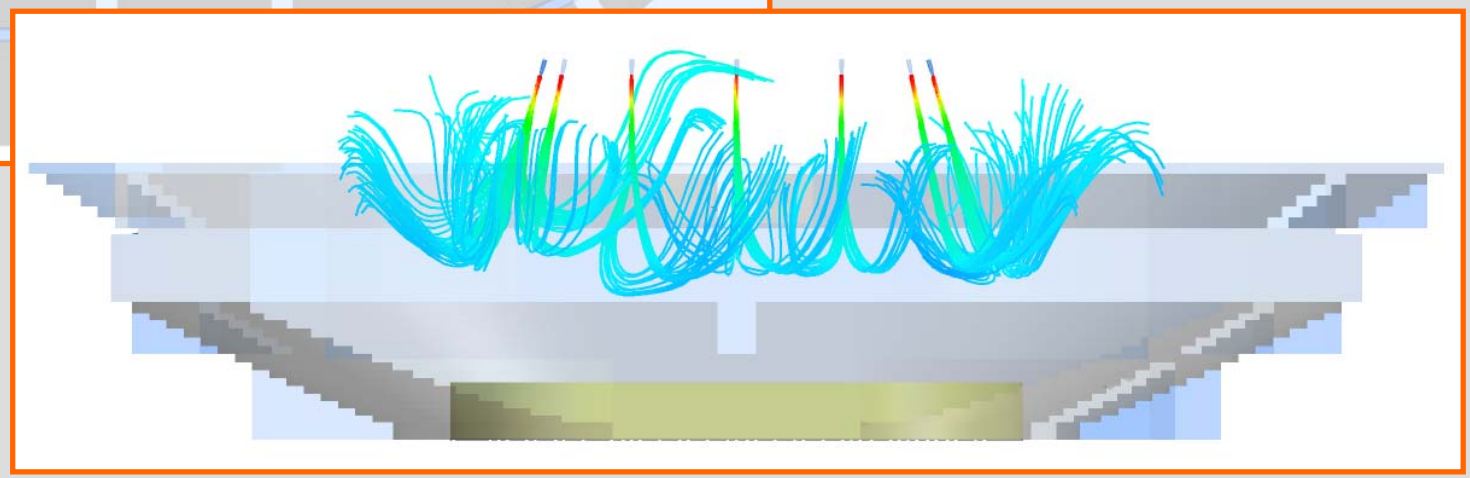
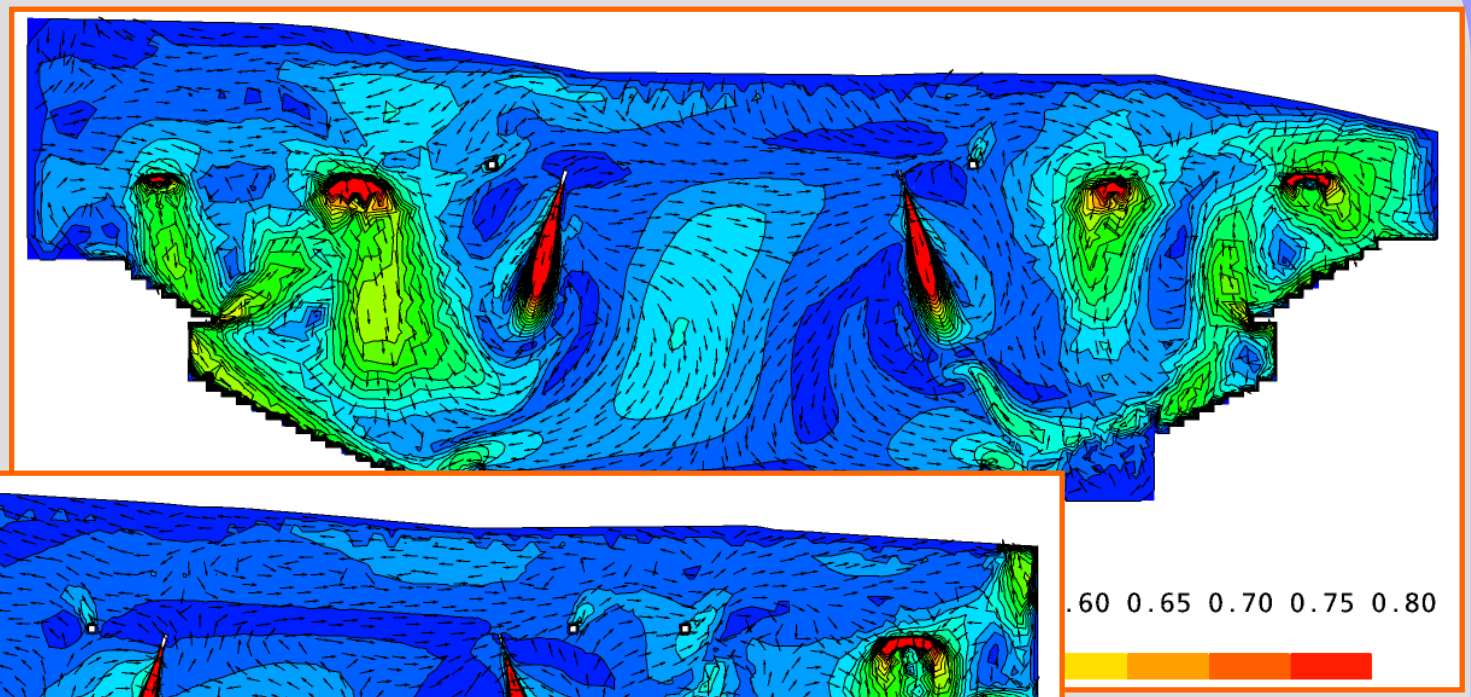


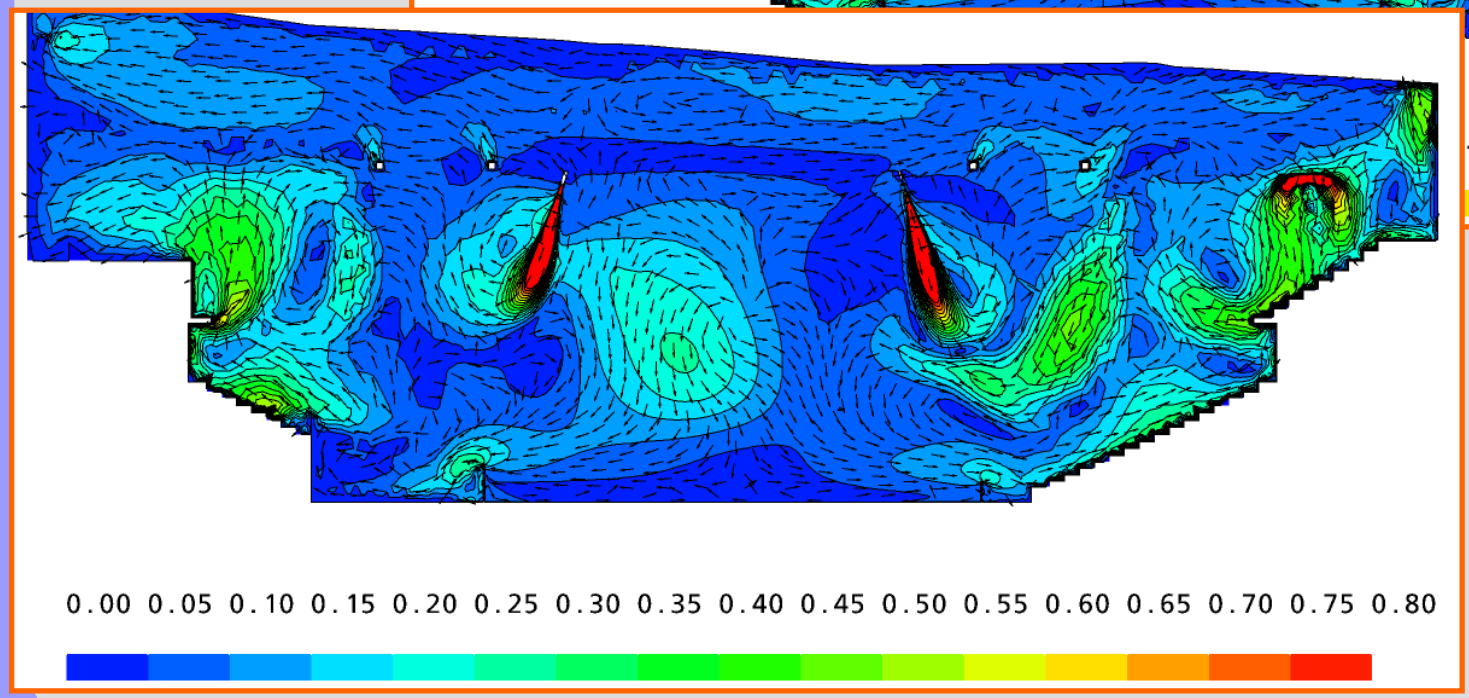
nozzle streamlines



Ventilation of a large room

flowfield





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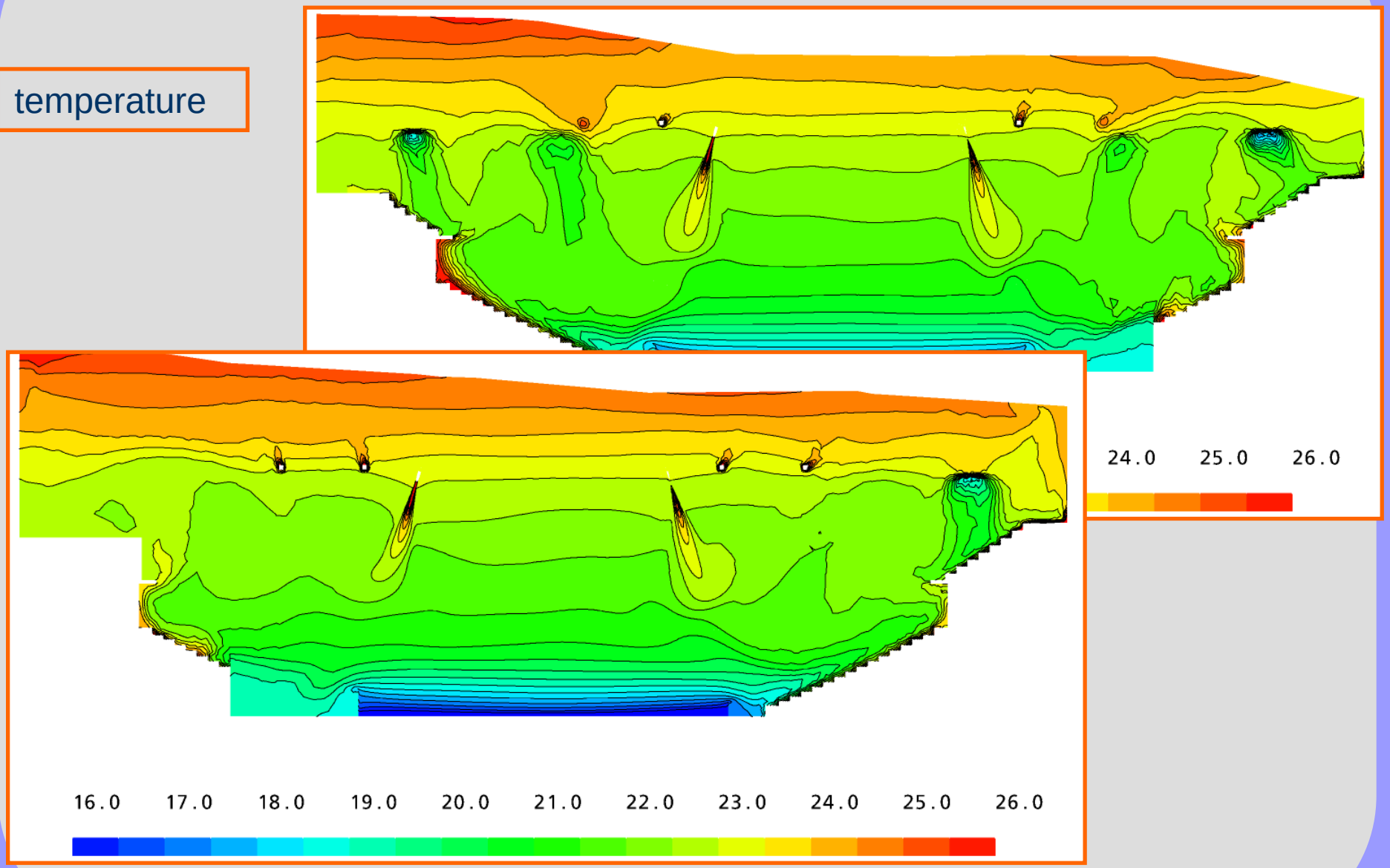
Ventilation of a large room

temperature



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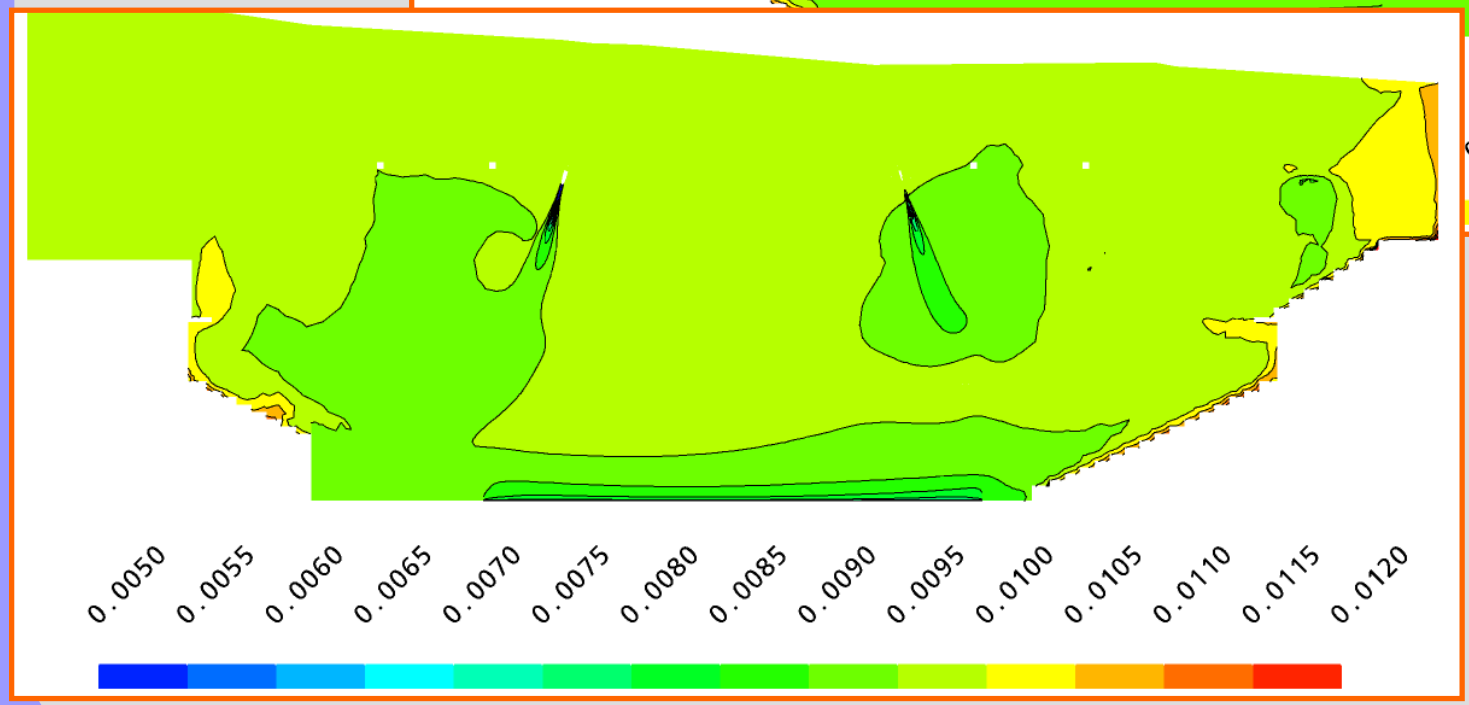
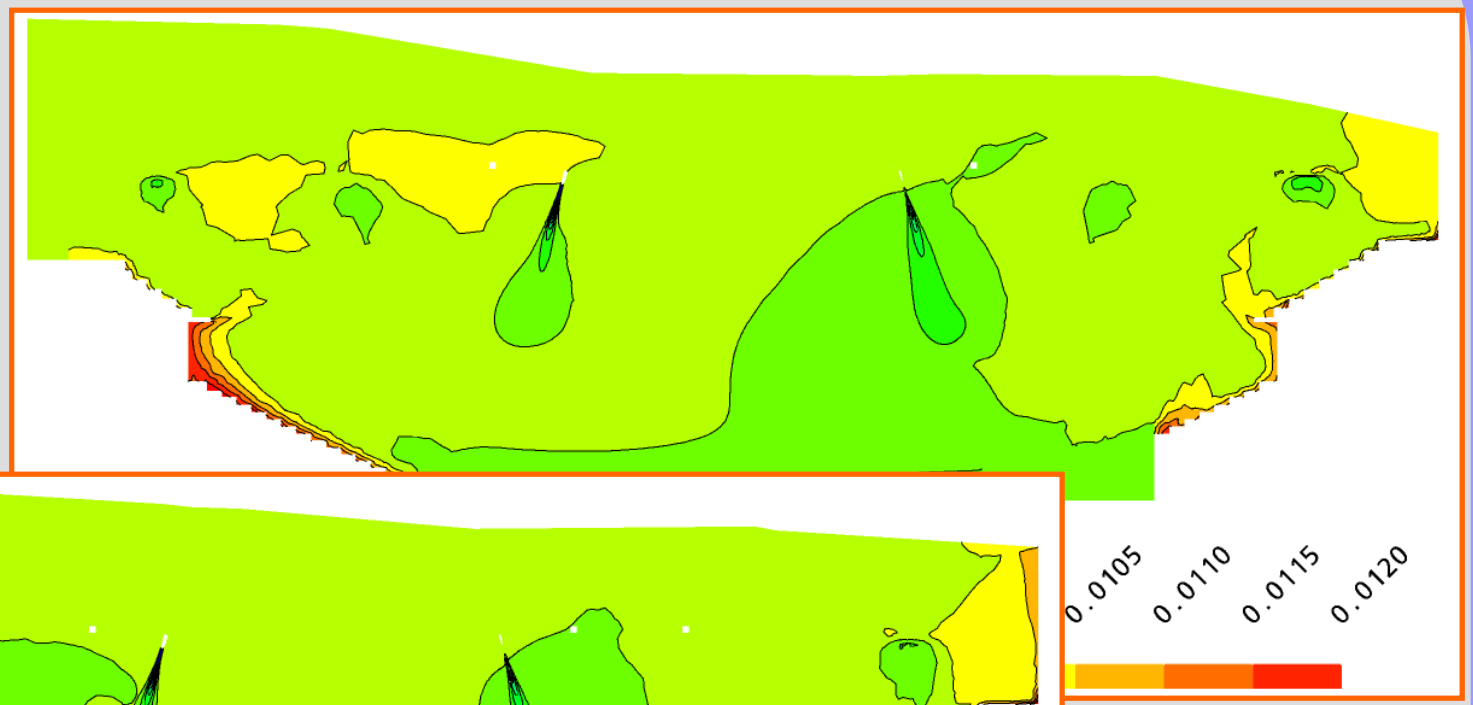
Ventilation of a large room

humidity





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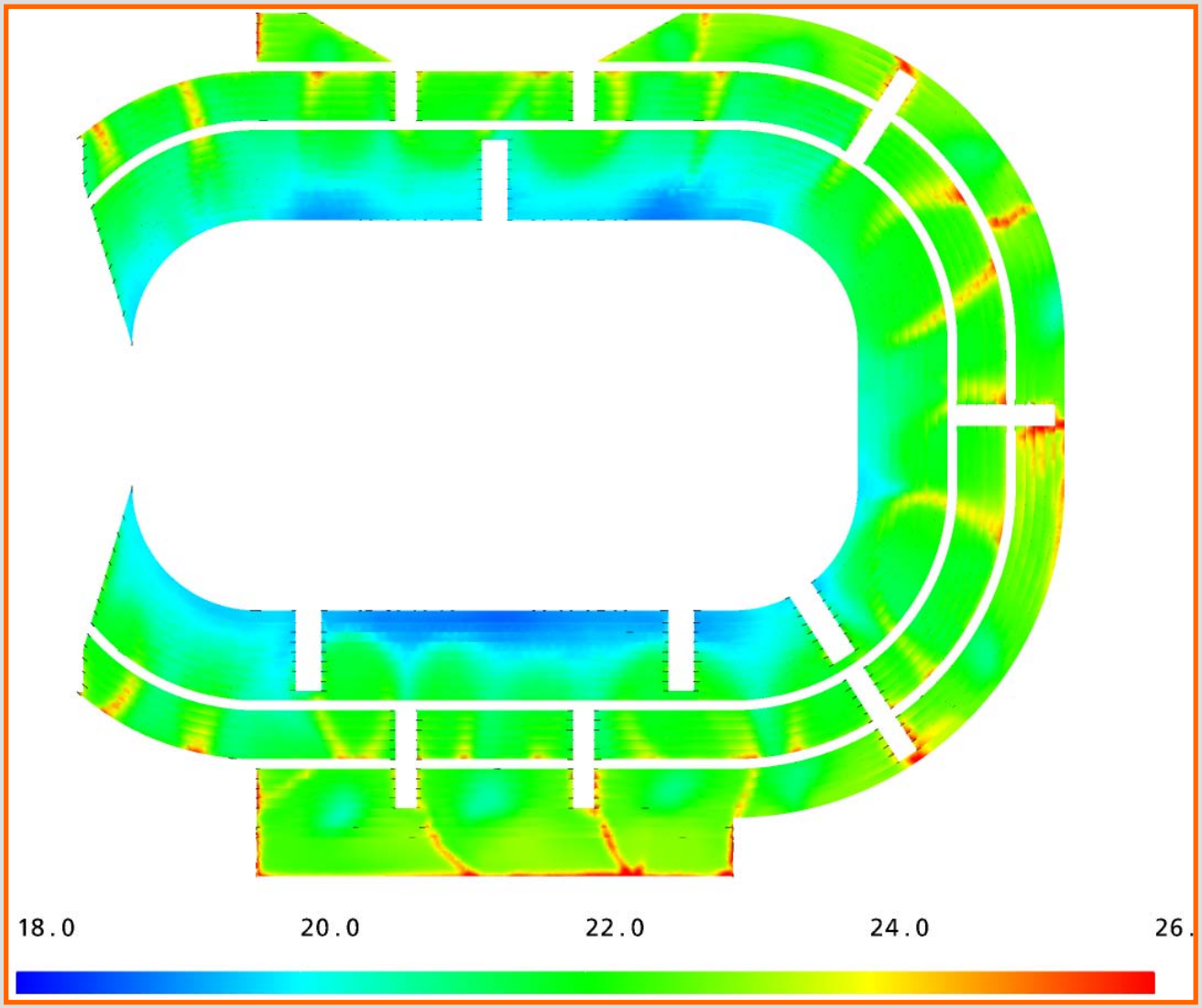
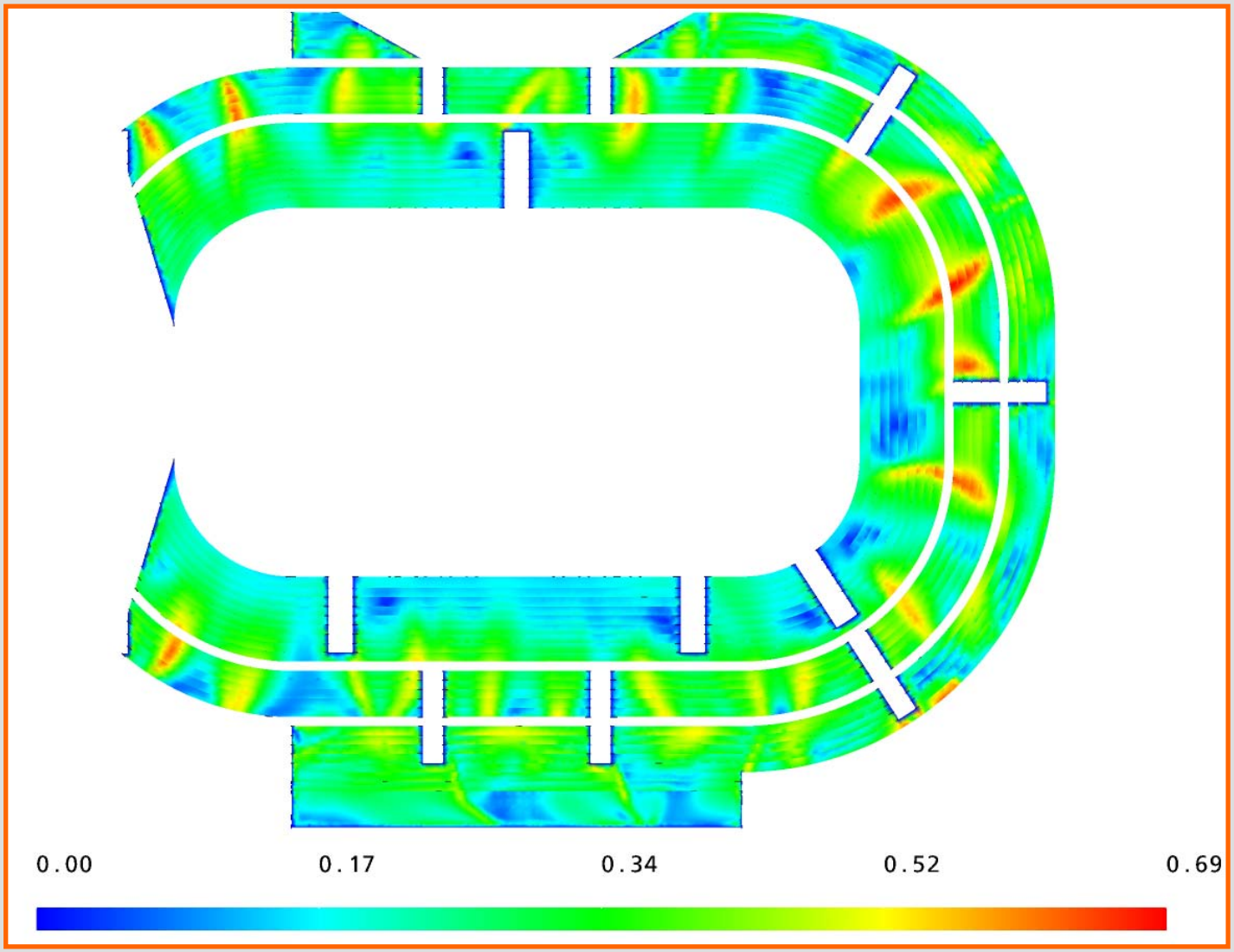


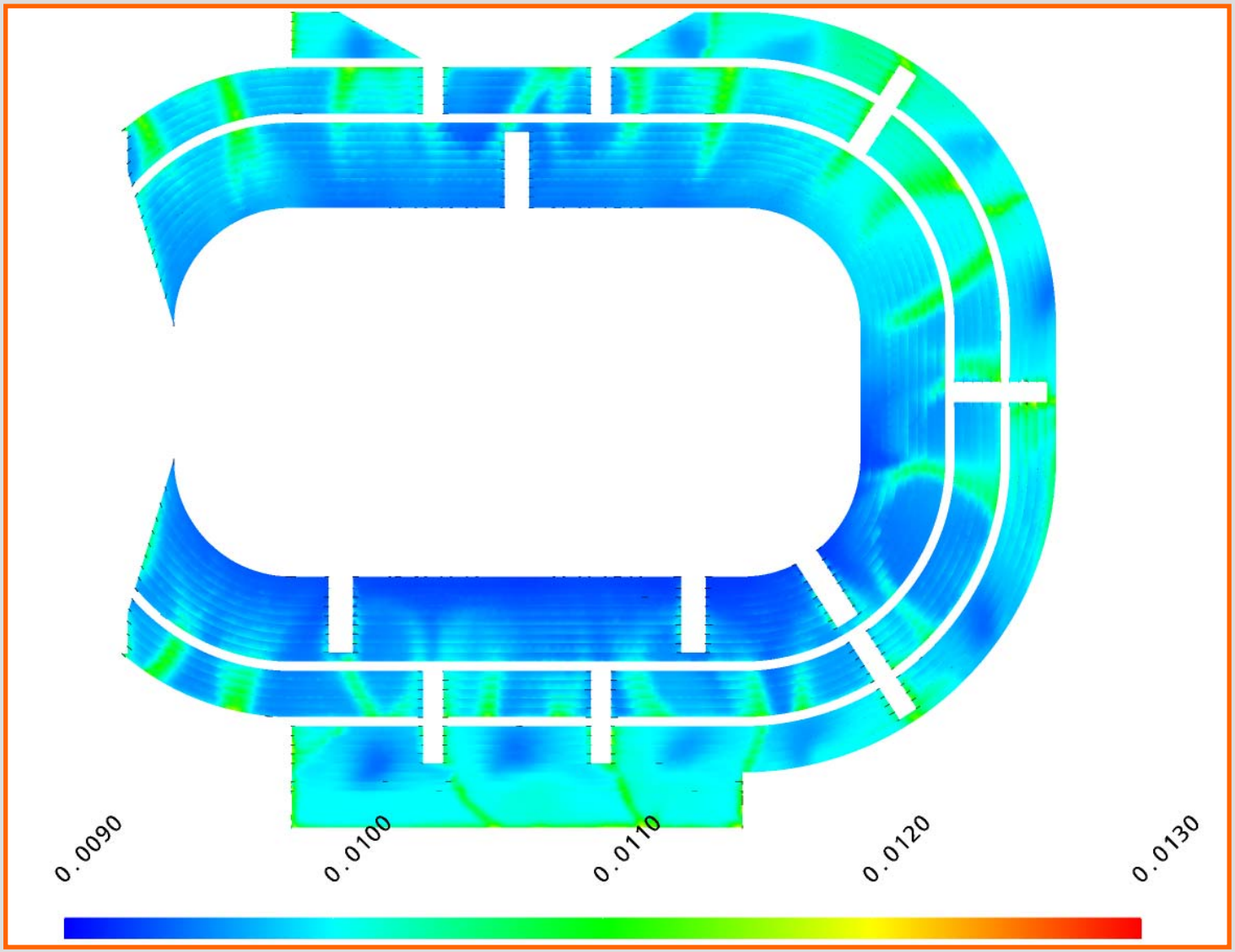
temperature at stand zone (1m above floor)

Ventilation of a large room



air mobility at stand zone (1m above floor)

Ventilation of a large room



humidity at stand zone (1m above floor)

CONCLUSIONS:

1. Complicated air circulation structure in a large room essentially distorts rated performances of inflow units

2. Local structure and intensity of air motion around hot of cold surfaces may govern the temperature and humidity levels in the room as a whole

3. Reliable prediction of large room climate is possible providing full aerophysic modeling with high detaling (10^7 nodes and more)