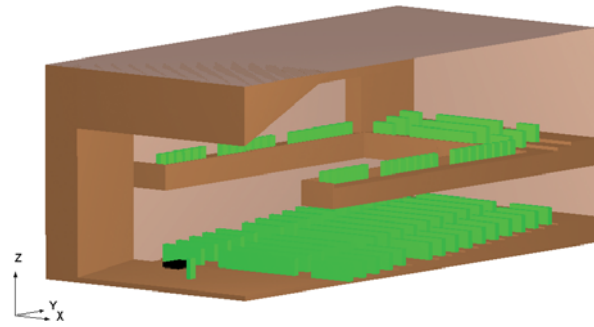


Audience Comfort in a Concert Hall

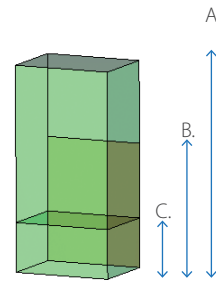
Audience comfort in a concert hall is assessed using scSTREAM for thermo-fluid analysis. Predicted Mean Vote (PMV) is calculated in a simplified manner from the simulation results. PMV (-3 < PMV < +3) predicts the mean response of a large group of people where -3 is the coldest, +3 is the hottest, and 0 is neutral.

Simulation Model and Conditions

15m X 32m X 12.5m concert hall:
450 seats (first floor: 360 seats, 2nd floor 90 seats)

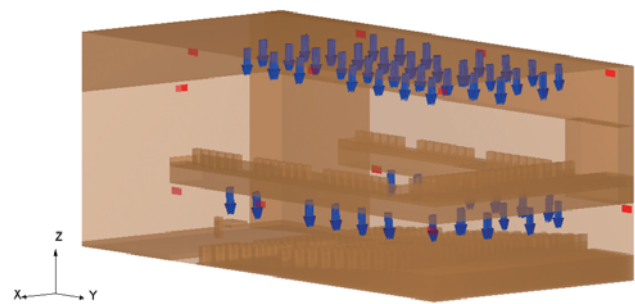
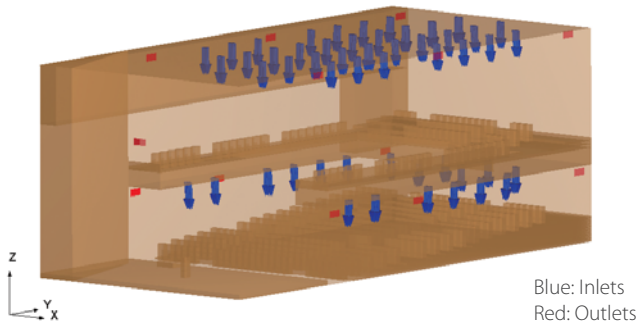


Audience model:
Generates heat at 100W/person



A. Audience 1.0m
B. Backrest 0.60m
C. Seat 0.24m

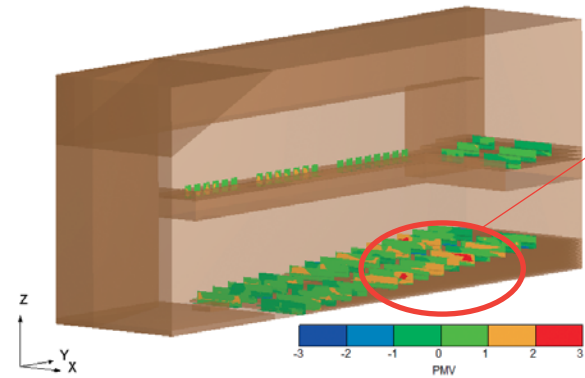
Ventilation setup: Total 1,000m³/min from 52 inlets (34 on the ceiling, 18 below the second floor, at 23 deg. C) 13 outlets (12 on side walls, 1 on stage wall)



Simulation results

Contour plot of PMV near audience (half view)

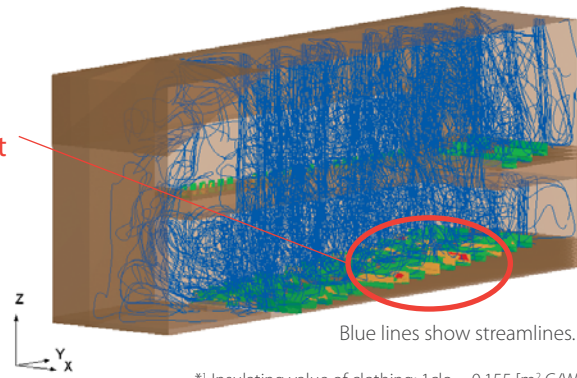
Calculated air temperature is used as mean radiant temperature (MRT).
Assumed clo*¹ = 0.75, met*² = 1.0, humidity = 70%.



High PMV
→ Discomfort

Streamline plot (half view)

Complex air flow patterns cause inadequate ventilation in certain areas. This increases local PMV values and suggests the people in these seats will feel too warm.



*1 Insulating value of clothing: 1clo = 0.155 [m² C/W]
*2 Metabolic equivalent: 1met = 58.15 [W/m²]

Notes

scSTREAM is used to assess audience comfort in a concert hall. The PMV calculation and flow field streamlines suggest the audience seated in the middle section of the first floor could feel too warm and uncomfortable with the current ventilation inlet and outlet layout.