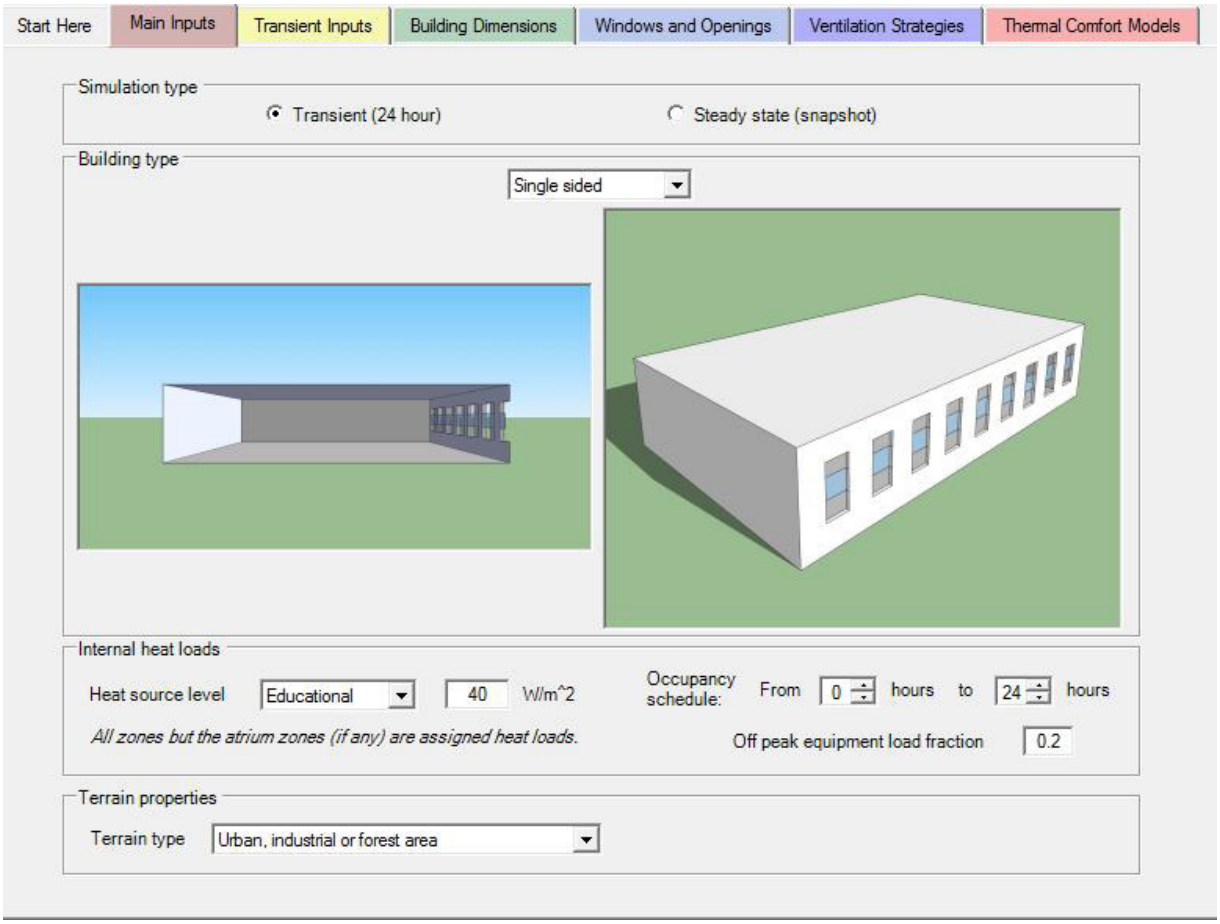
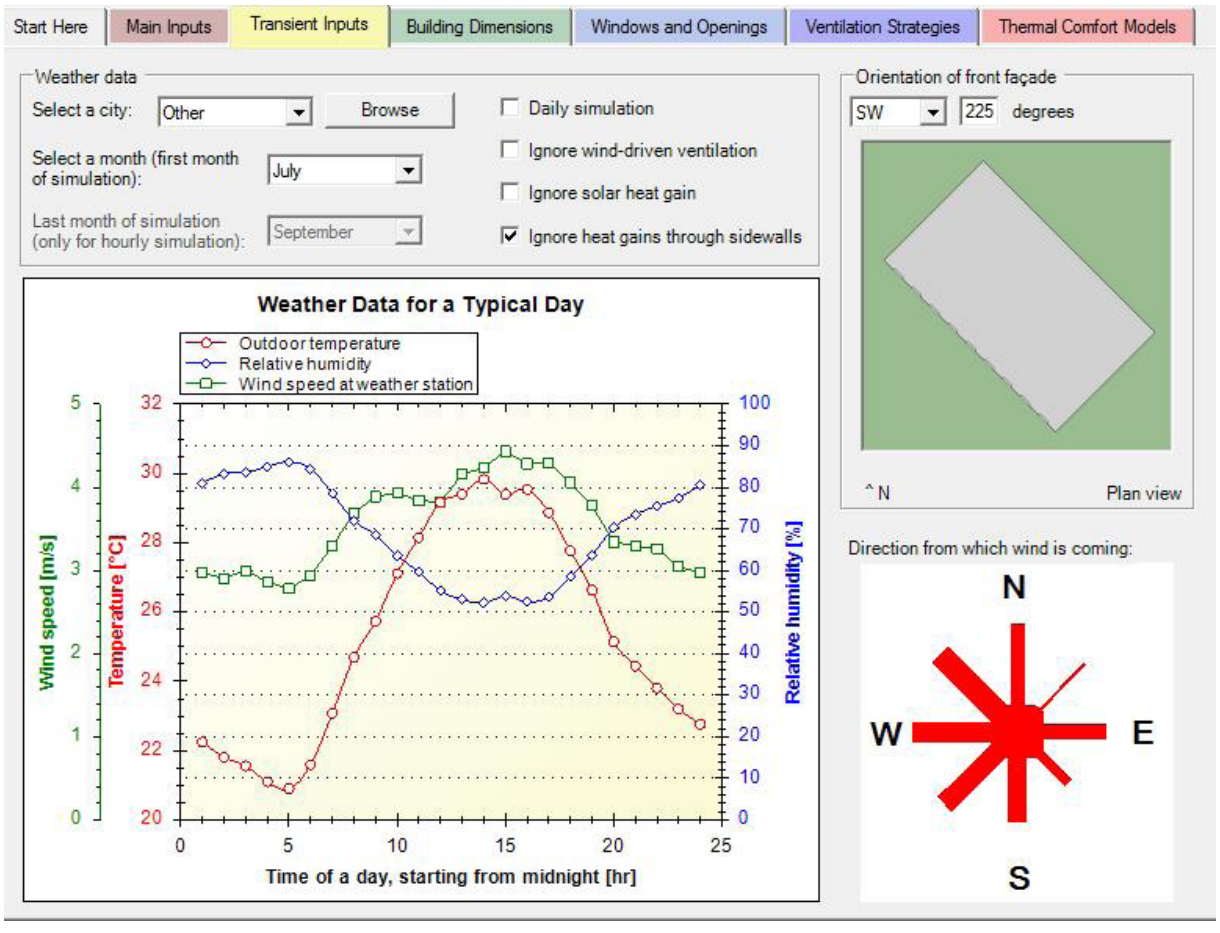
ARCH633 Environmental Systems I

Assignment 7:
Meyerson Hall Natural Ventilation

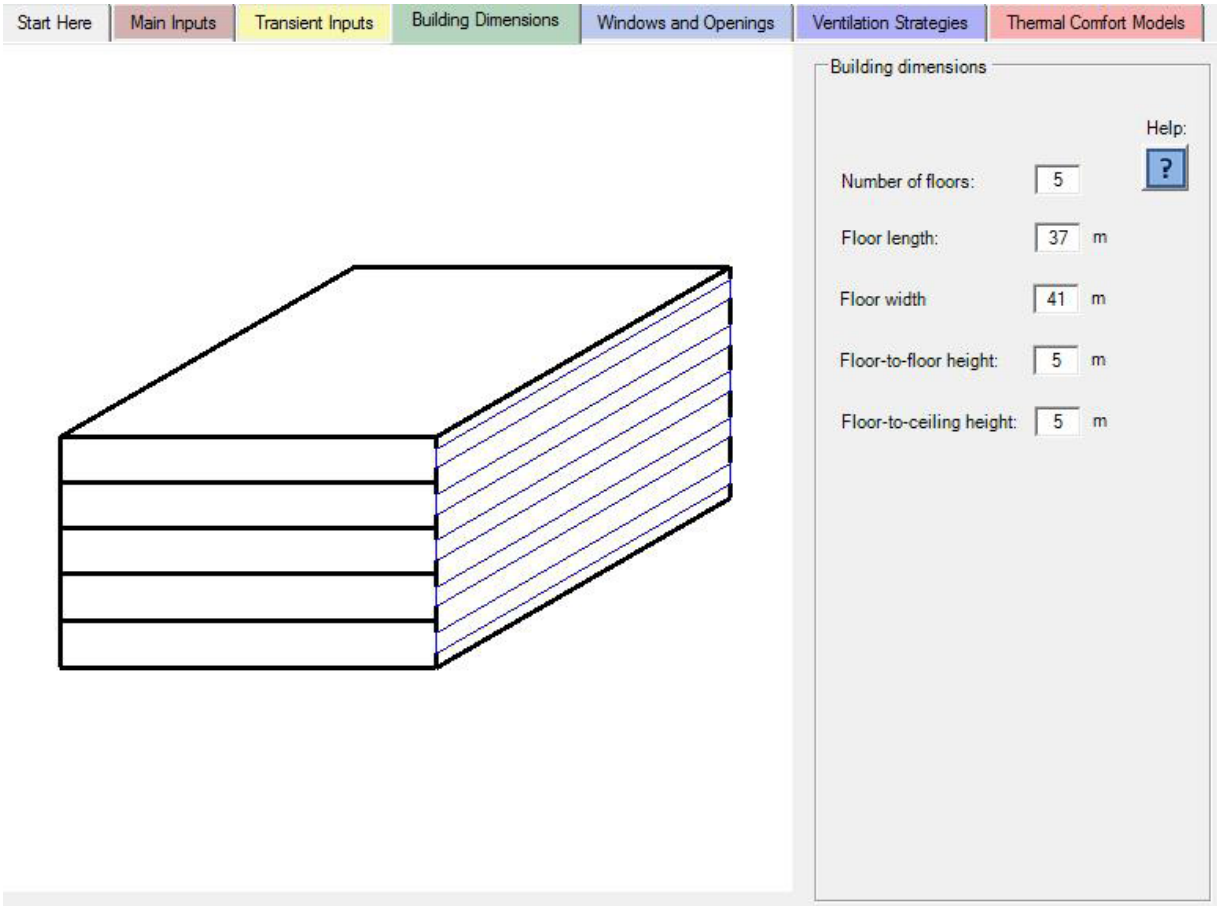
Yefan Zhang



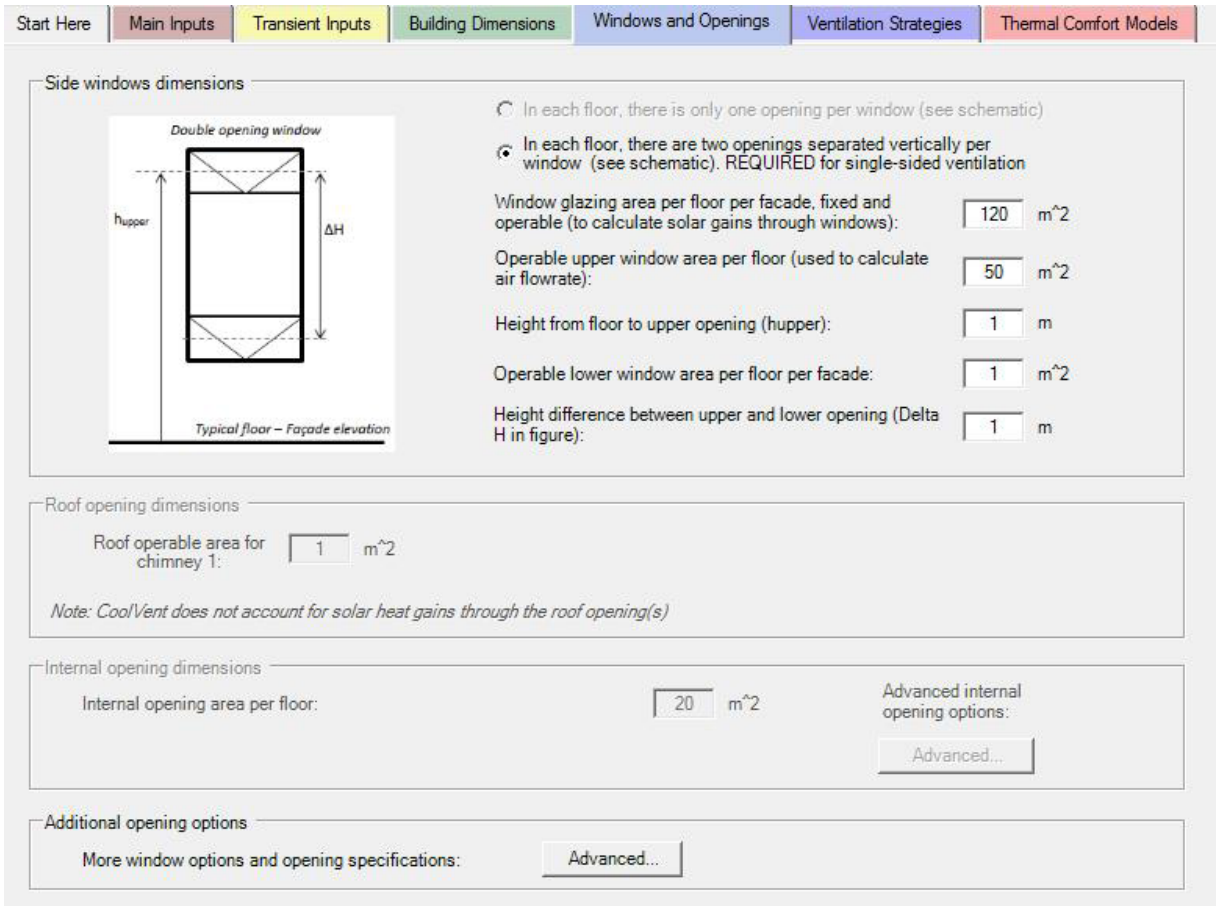
Basic Geometry Simulation of Meyerson Hall



Weather Data of Philadelphia in July

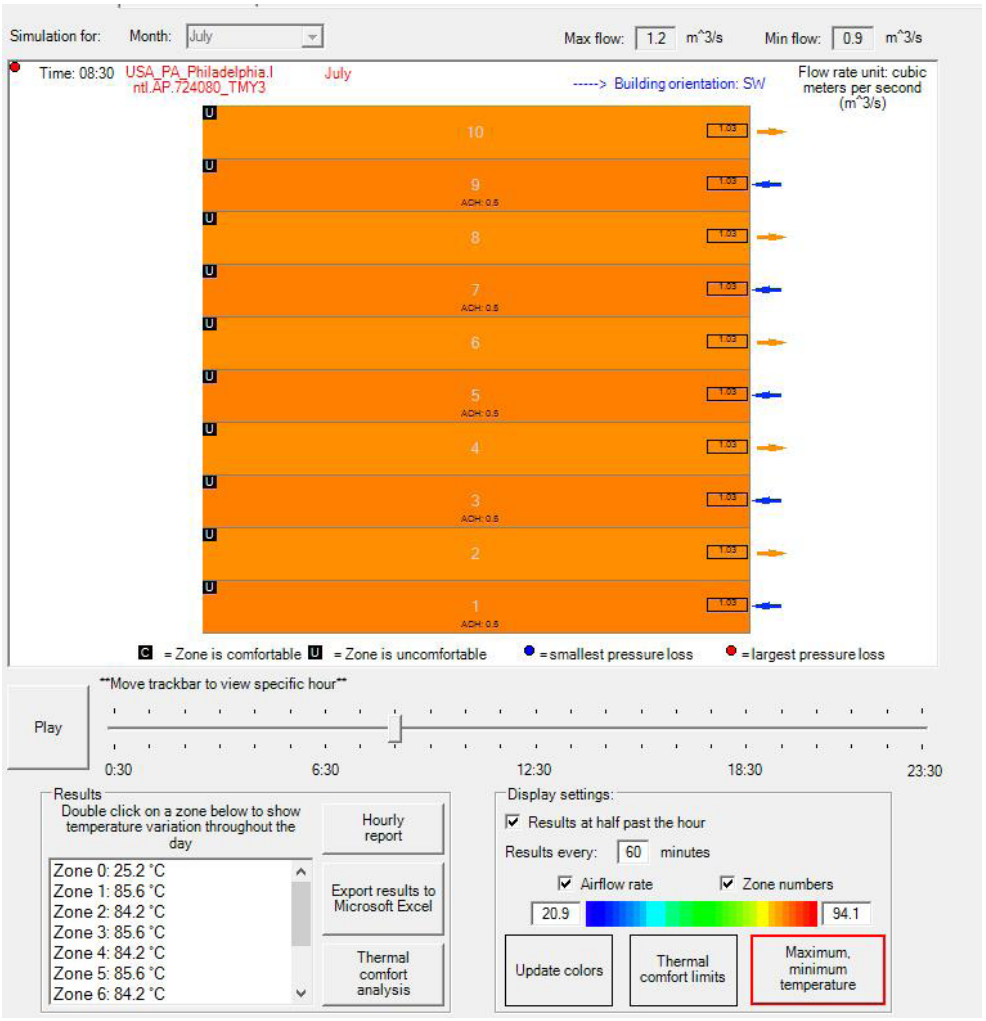


Floor Numbers & Dimension Simulation

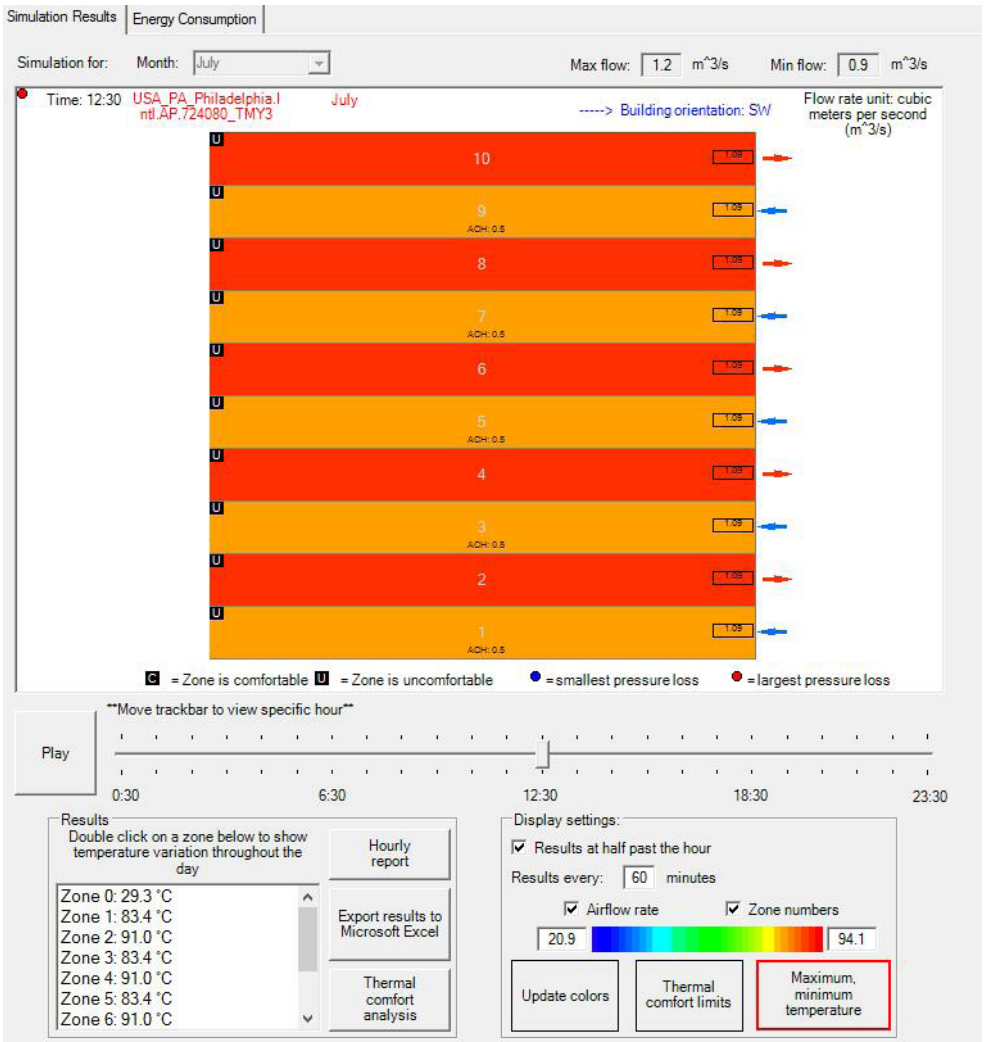


Window Size & Area Simulation

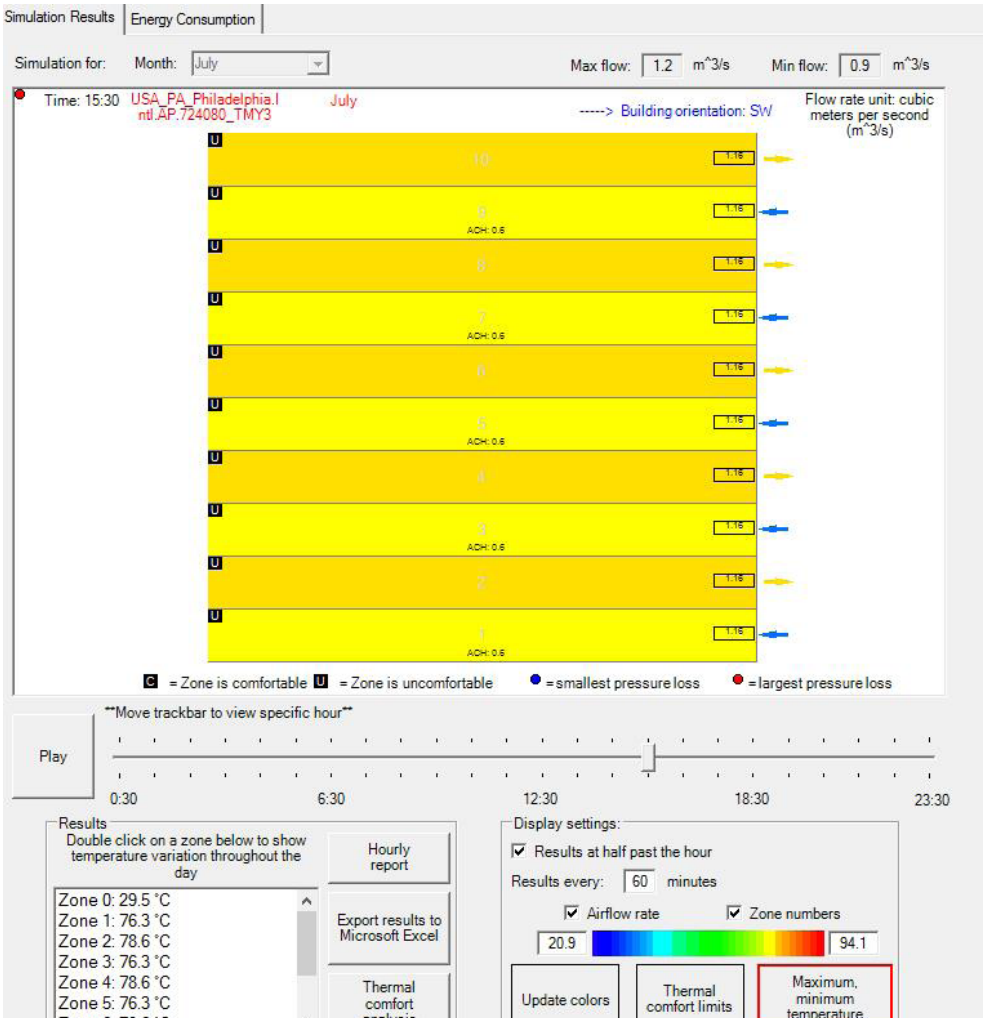
Original Simulation



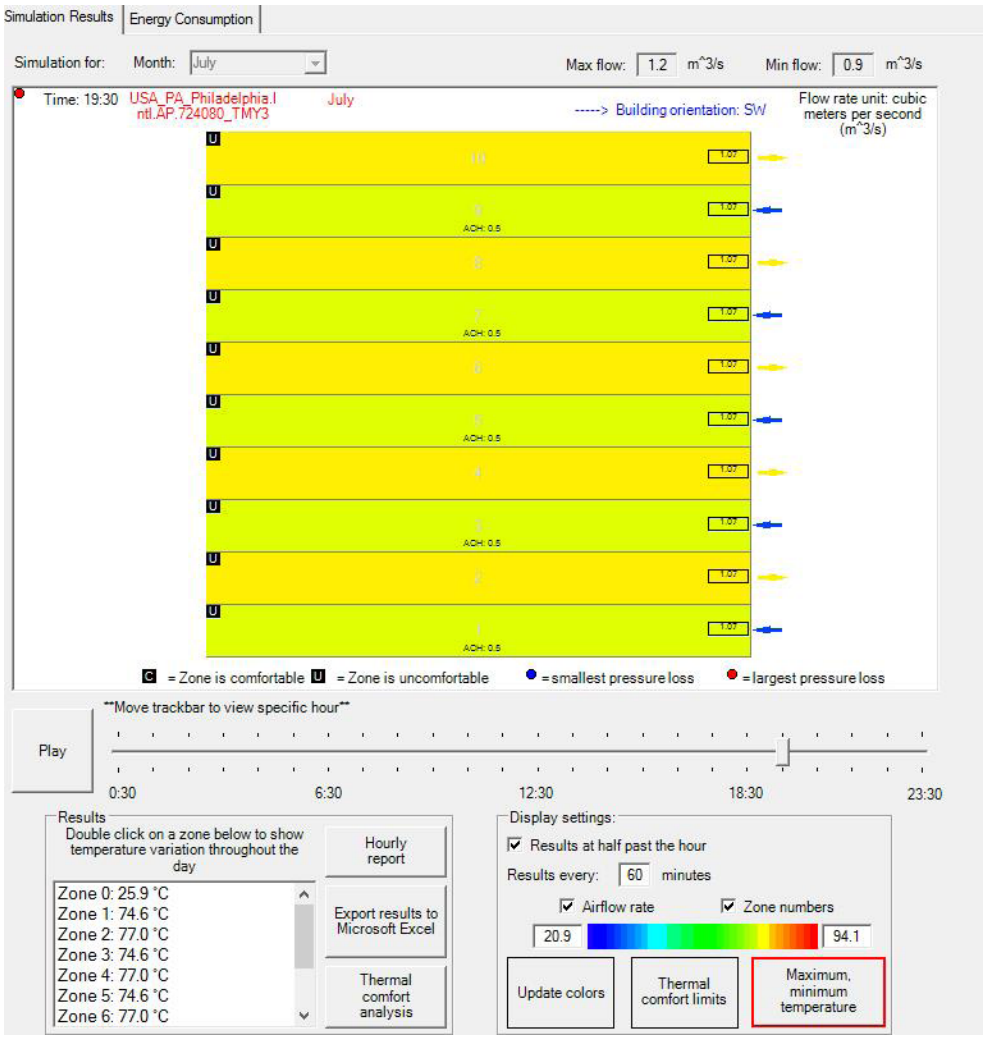
Time1 8:30



Time2 12:30

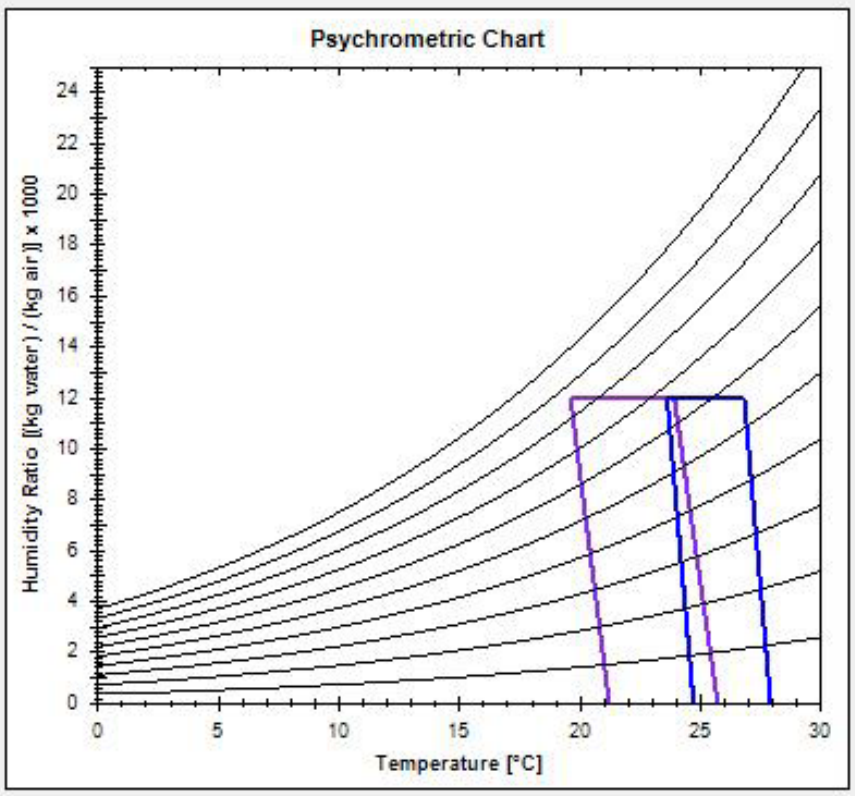


Time3 15:30



Time4 19:30

Psychometric Chart & Window Ratio



Scenario name

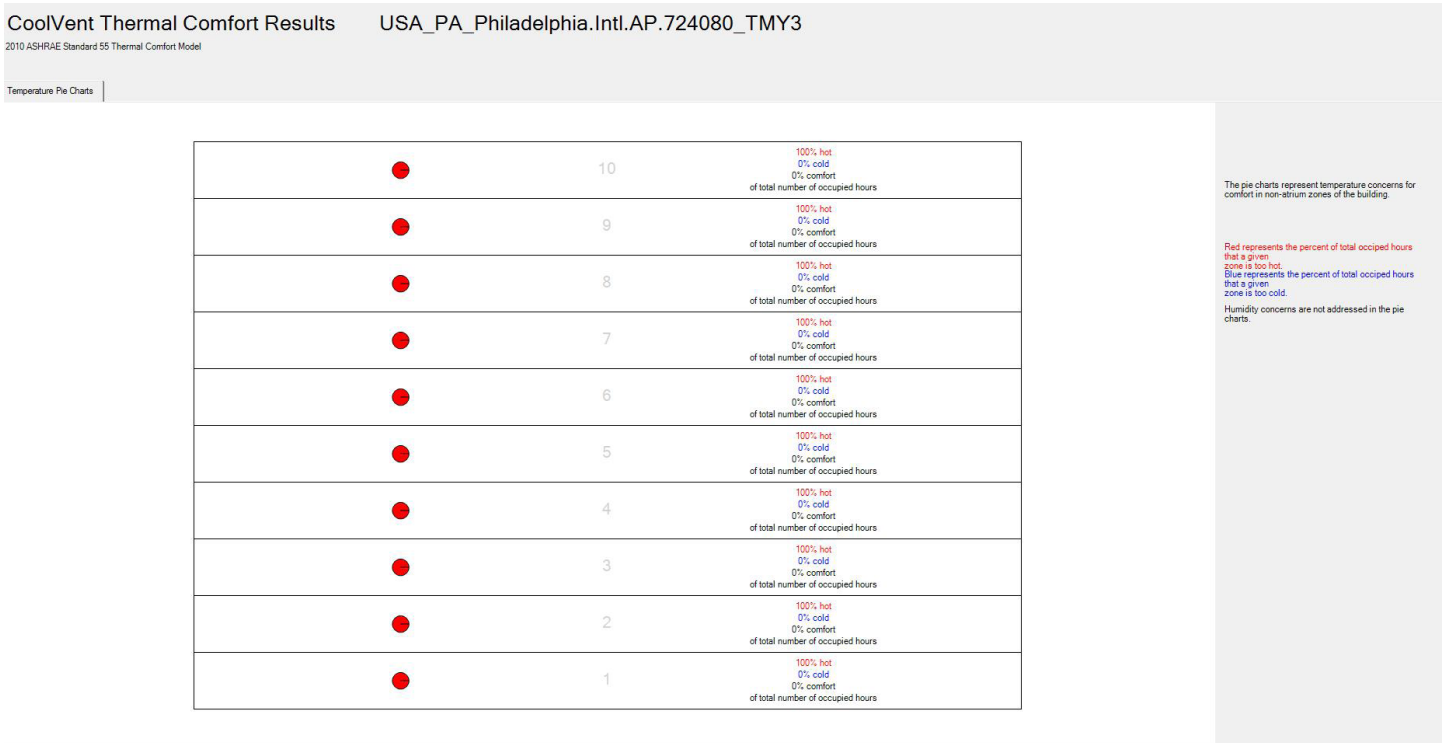
Scenario summary

Simulation type: transient

Building type: single sided

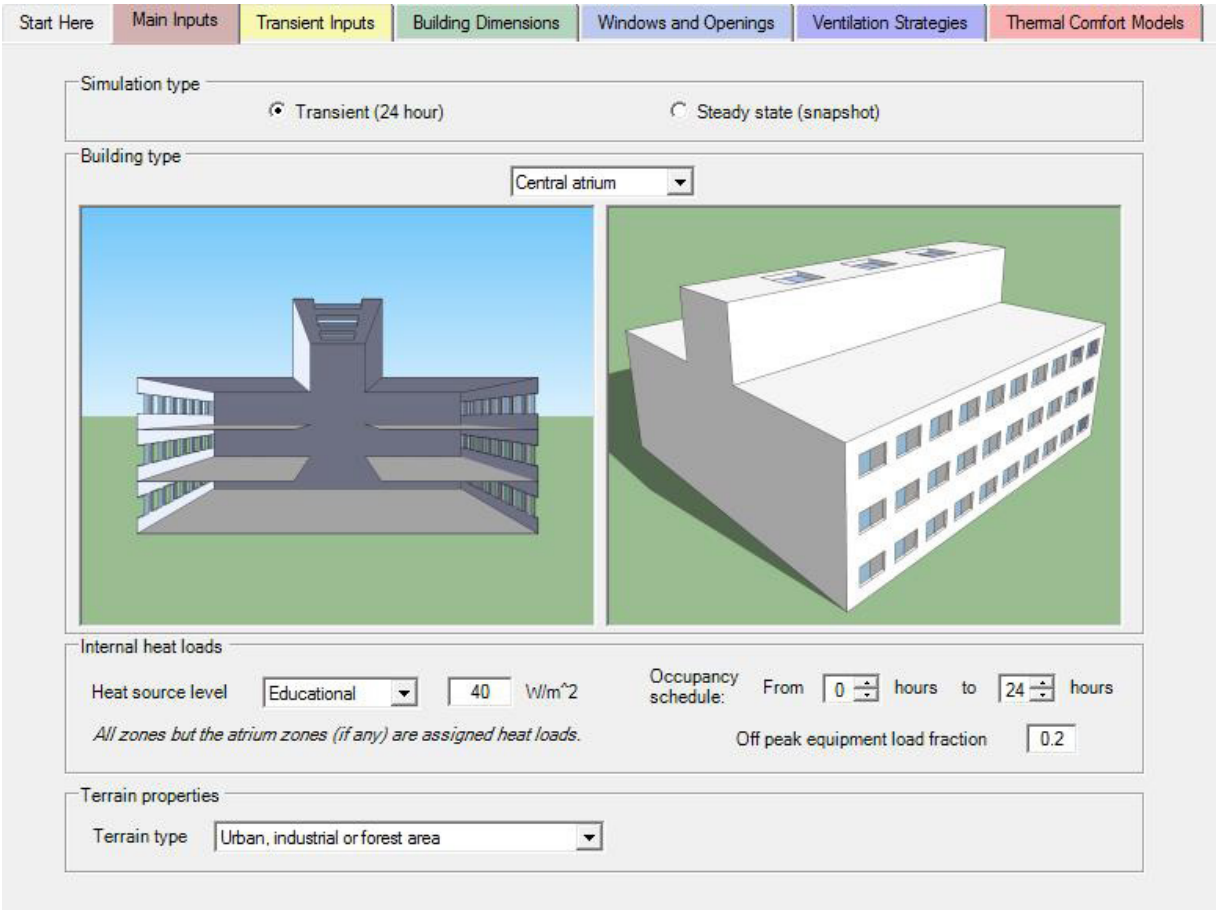
Building footprint:	**1517.0**	m^2
Occupied area per floor:	**1517.0**	m^2
Glazing-to-wall ratio per floor:	**64.9**	%
Opening-to-wall ratio per floor:	**27.6**	%
Ratio of roof opening to roof area:	**0.0**	%

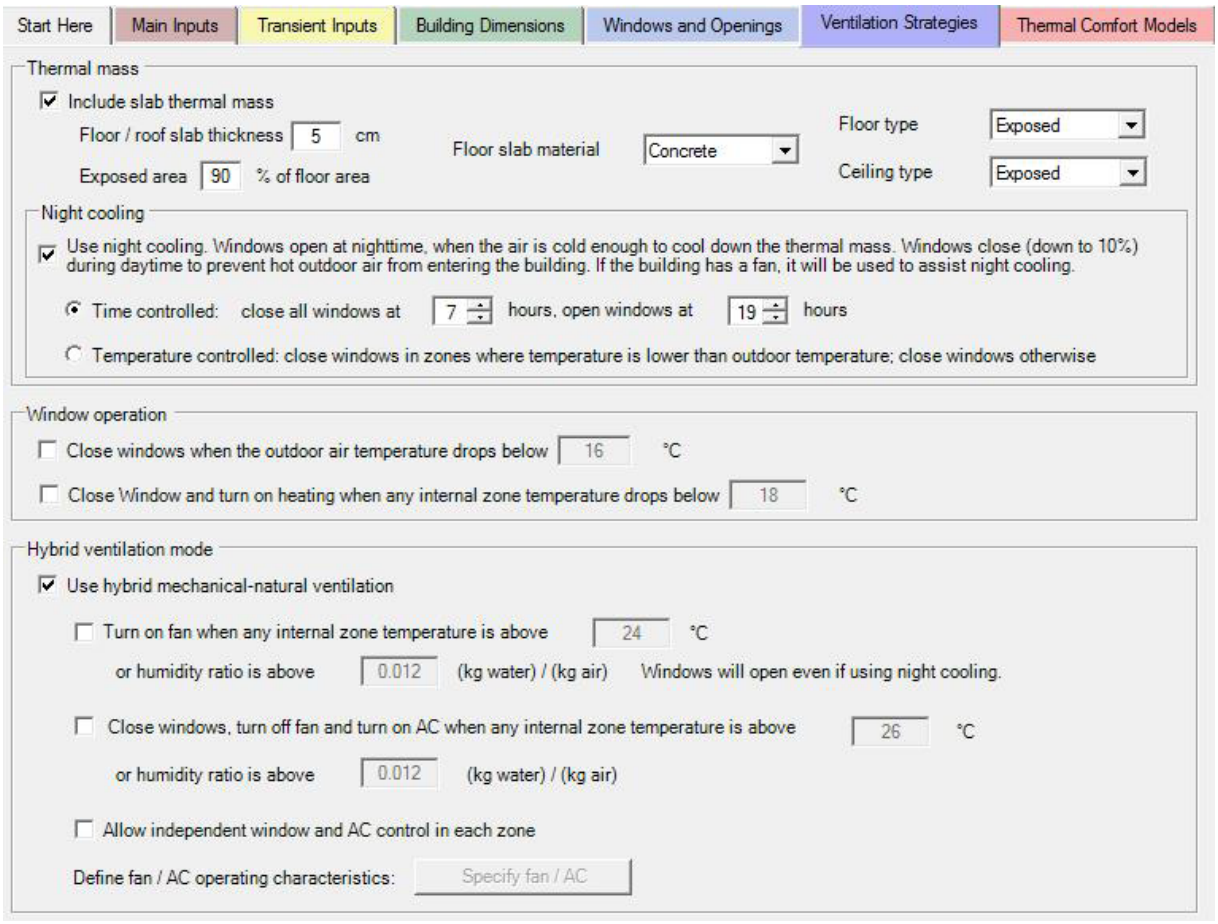
Thermal Comfort Chart



Summary:

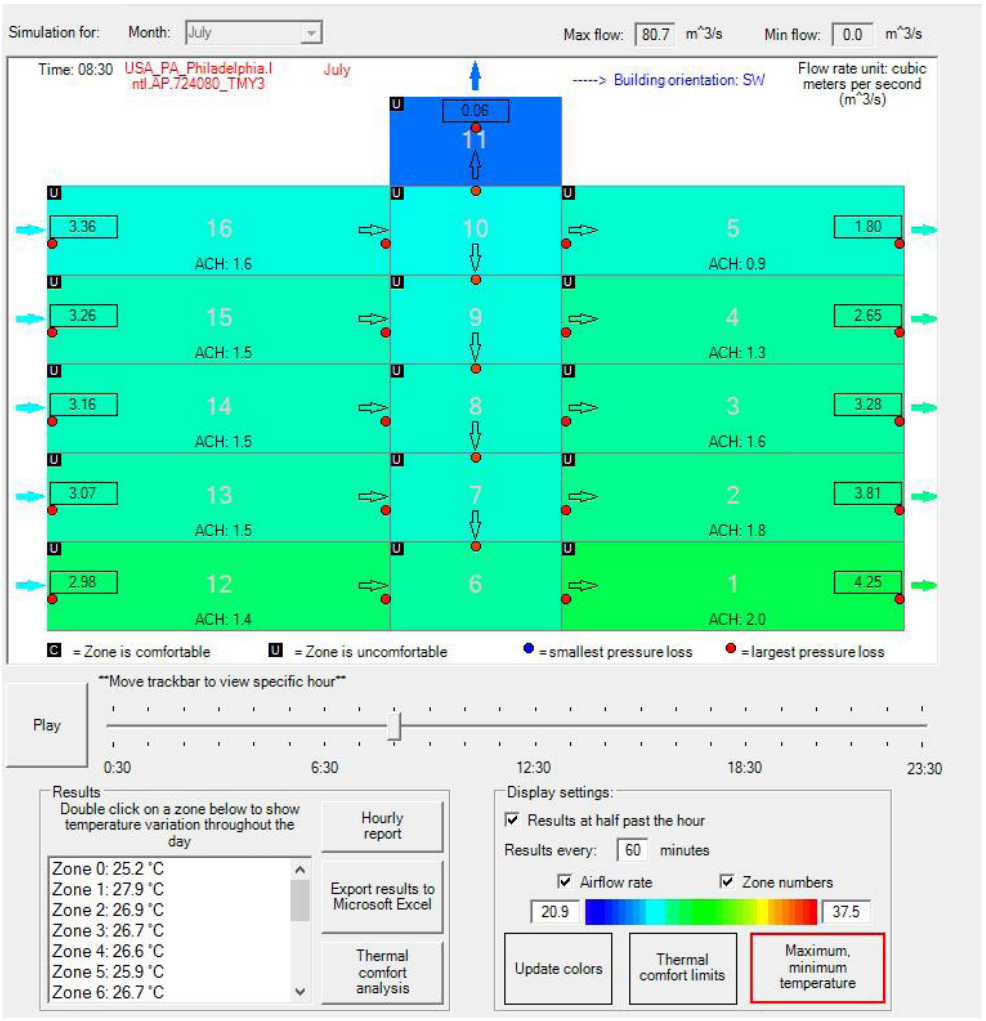
The Meyerson Hall is centered with Lower Galley, Computer Lab and Fabrication Lab throughout the building, therefore the cross ventilation is almost completely blocked by these enclosed rooms in-between main east and west studio. In addition, There is not any North and South natural ventilation at all according to the rooms arrangements. The windows on main East and West sides are not operable. Therefore, the building is simulated as single sided building perhaps more accurately and people feel totally unconformable and very hot if only depending on natural ventilation in summer.



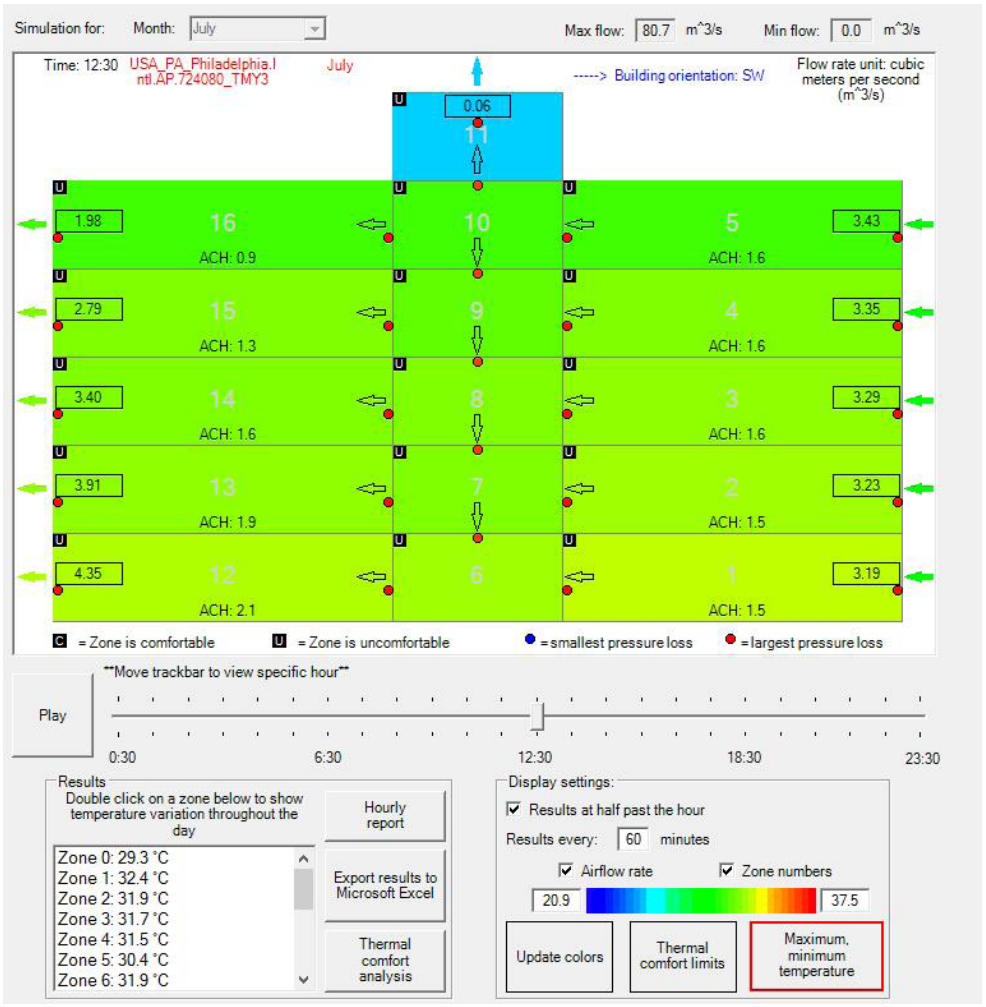


Strategy I: Add Atrium, Thermal Mass, Night Cooling & Mechanical Ventilation

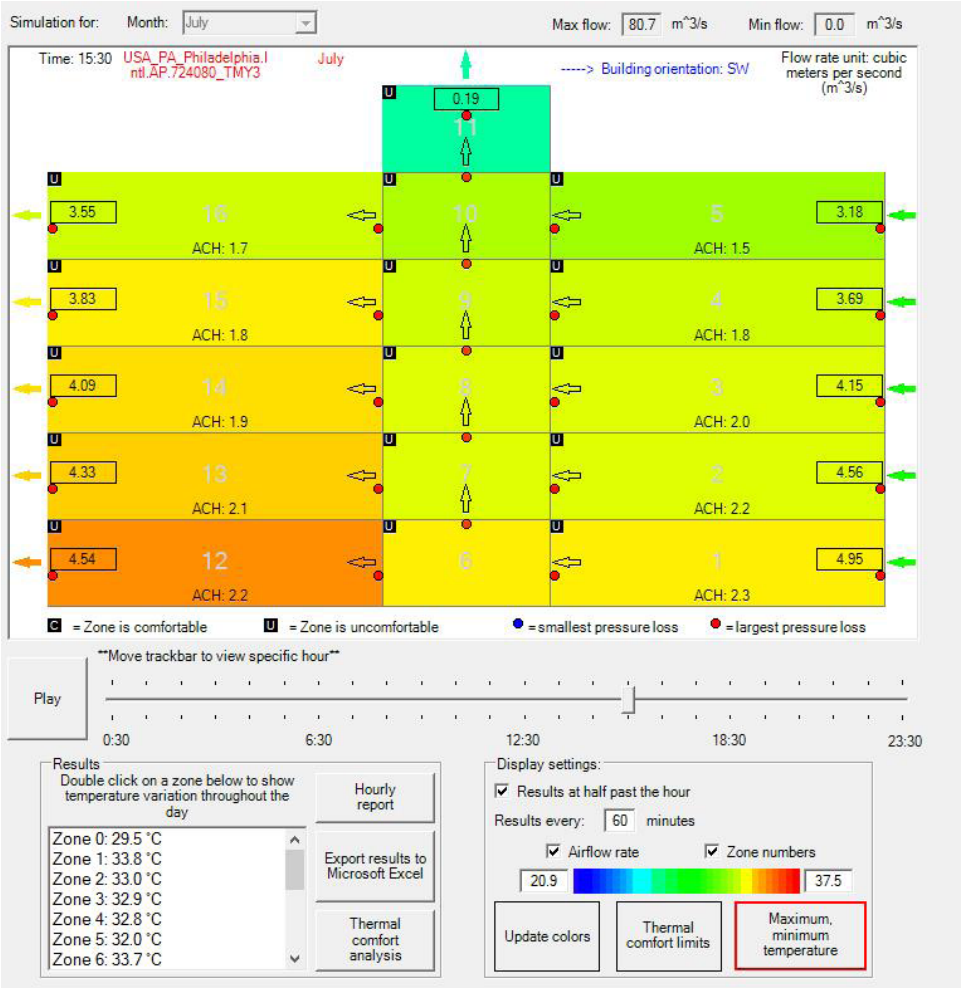
Simulation Strategy I



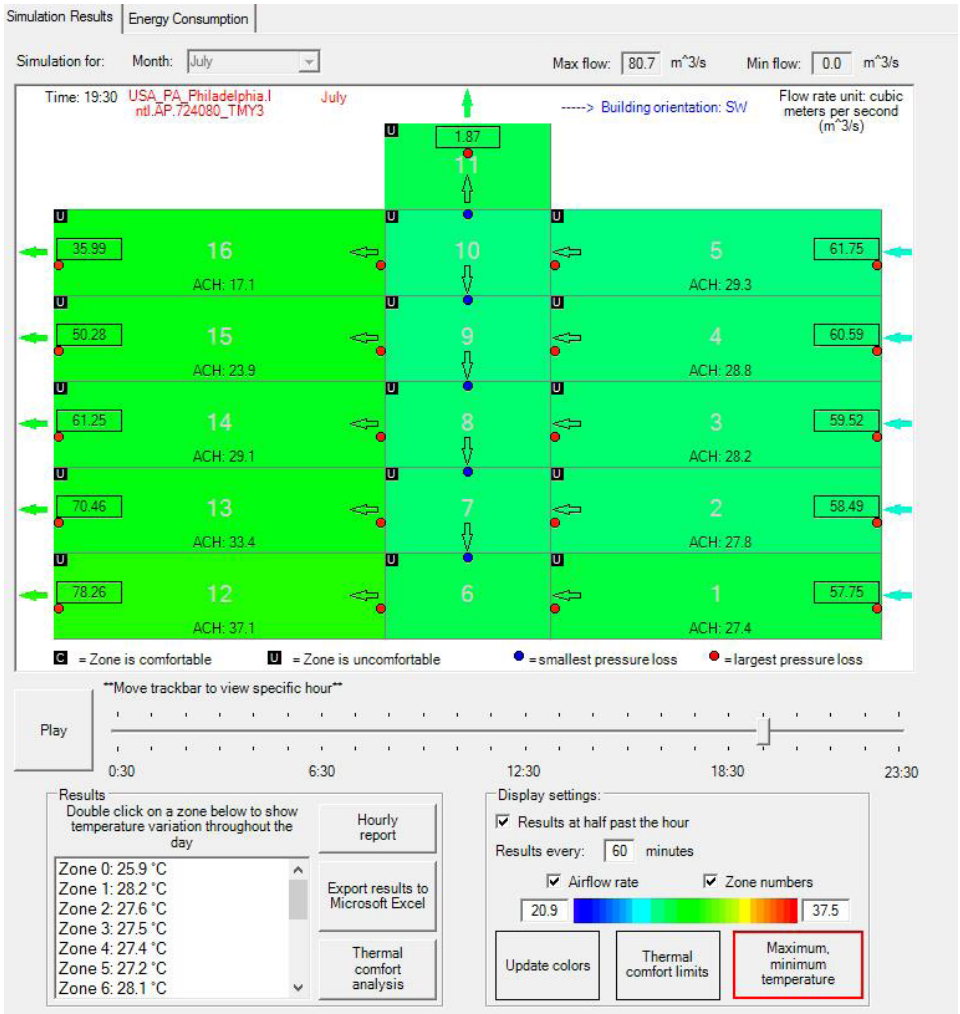
Time1 8:30



Time2 12:30

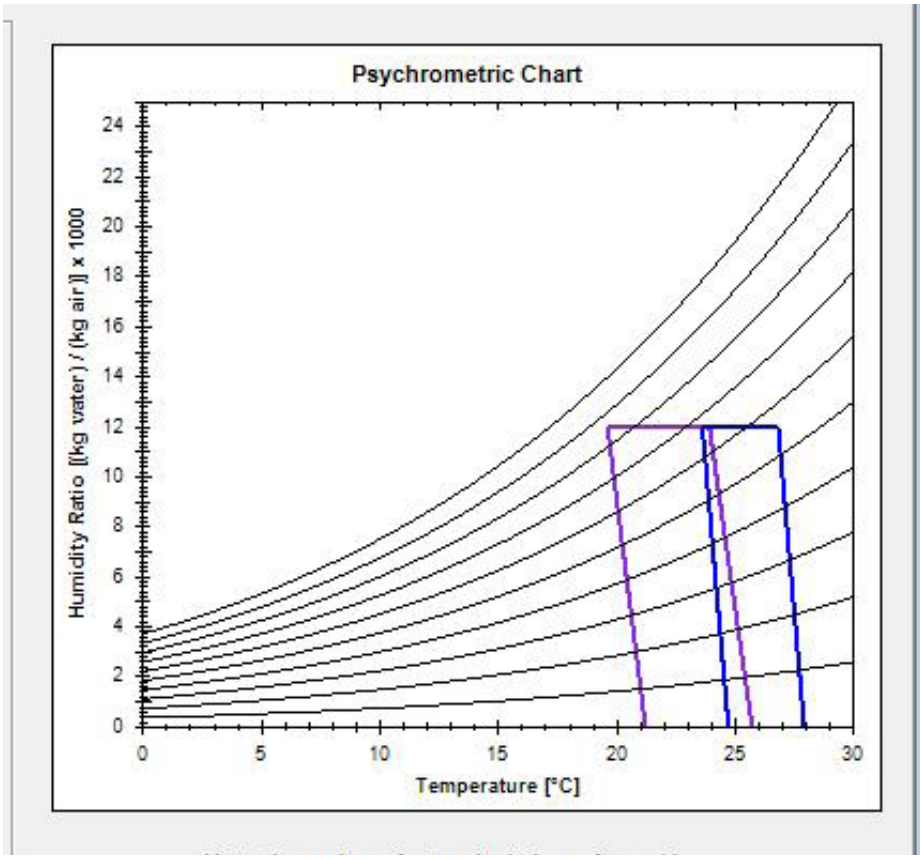


Time3 15:30



Time4 19:30

Psychometric Chart & Window Ratio



Scenario name

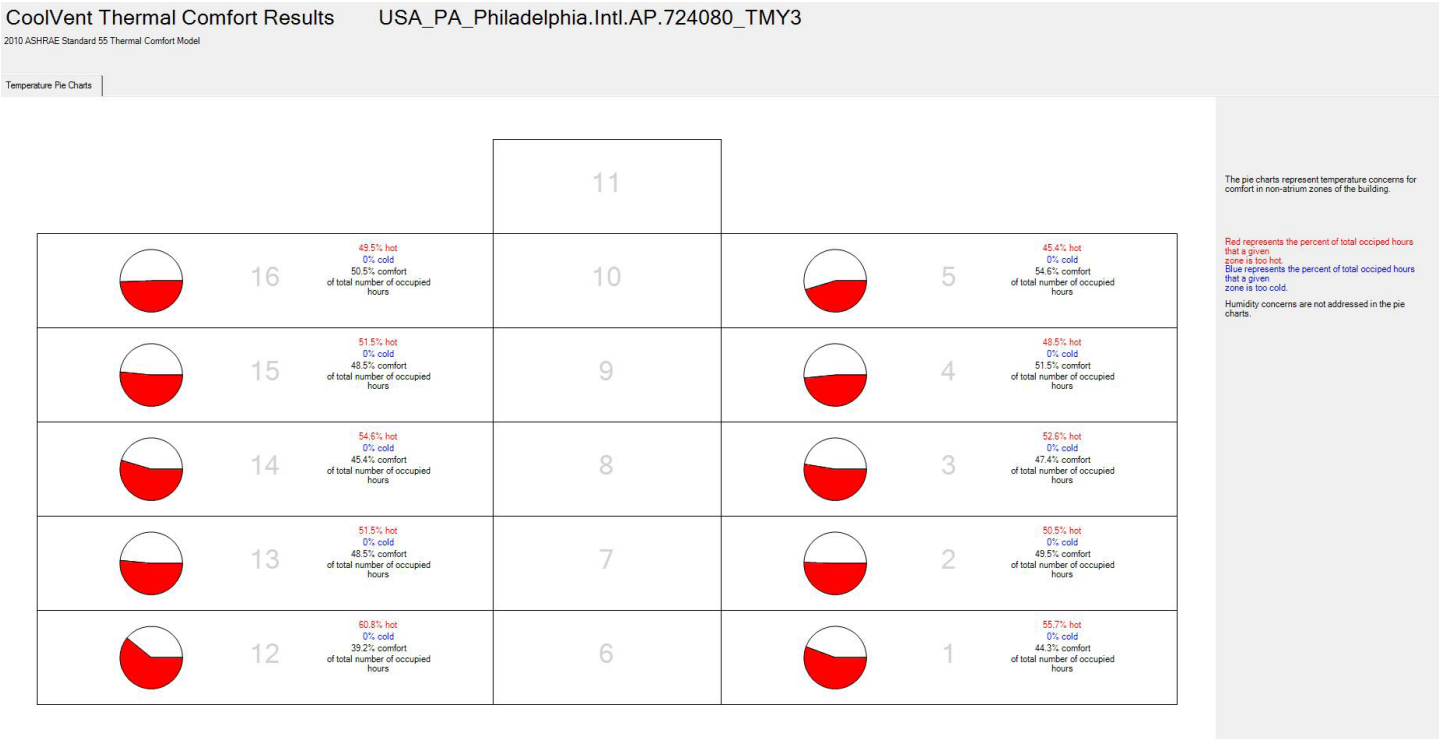
Scenario summary

Simulation type: transient

Building type: central atrium

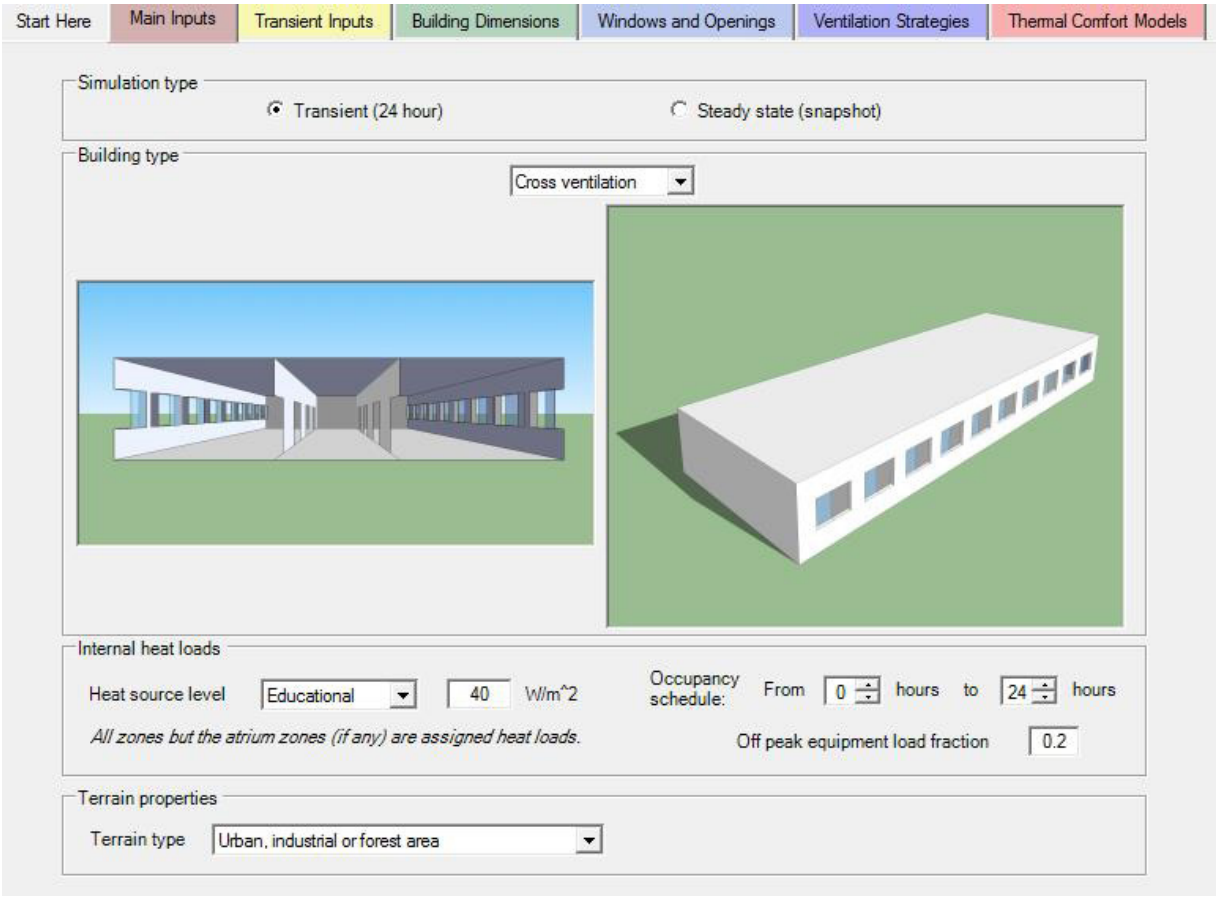
Building footprint:	3774.0	m^2
Occupied area per floor:	3034.0	m^2
Glazing-to-wall ratio per floor:	64.9	%
Opening-to-wall ratio per floor:	27.0	%
Ratio of roof opening to roof area:	0.1	%

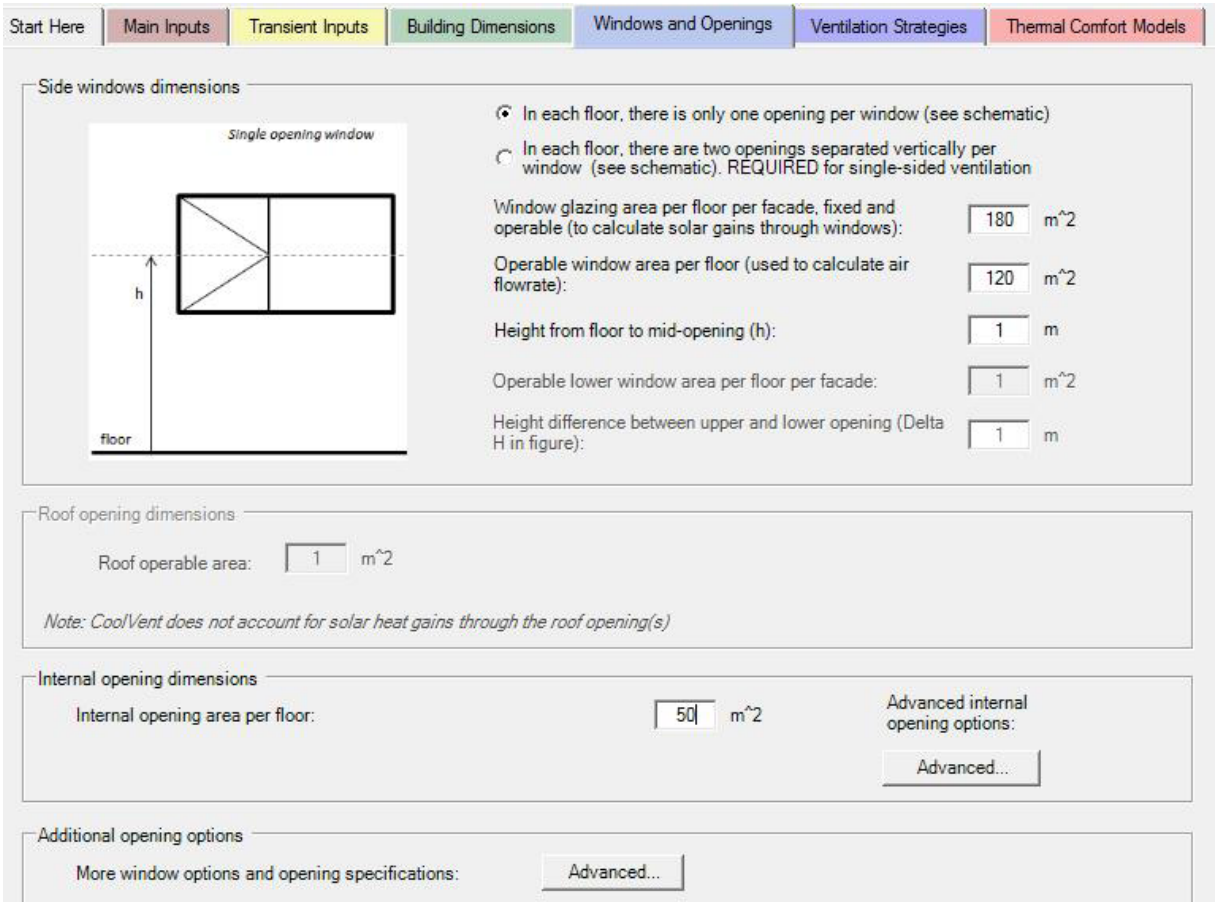
Thermal Comfort Chart



Summary:

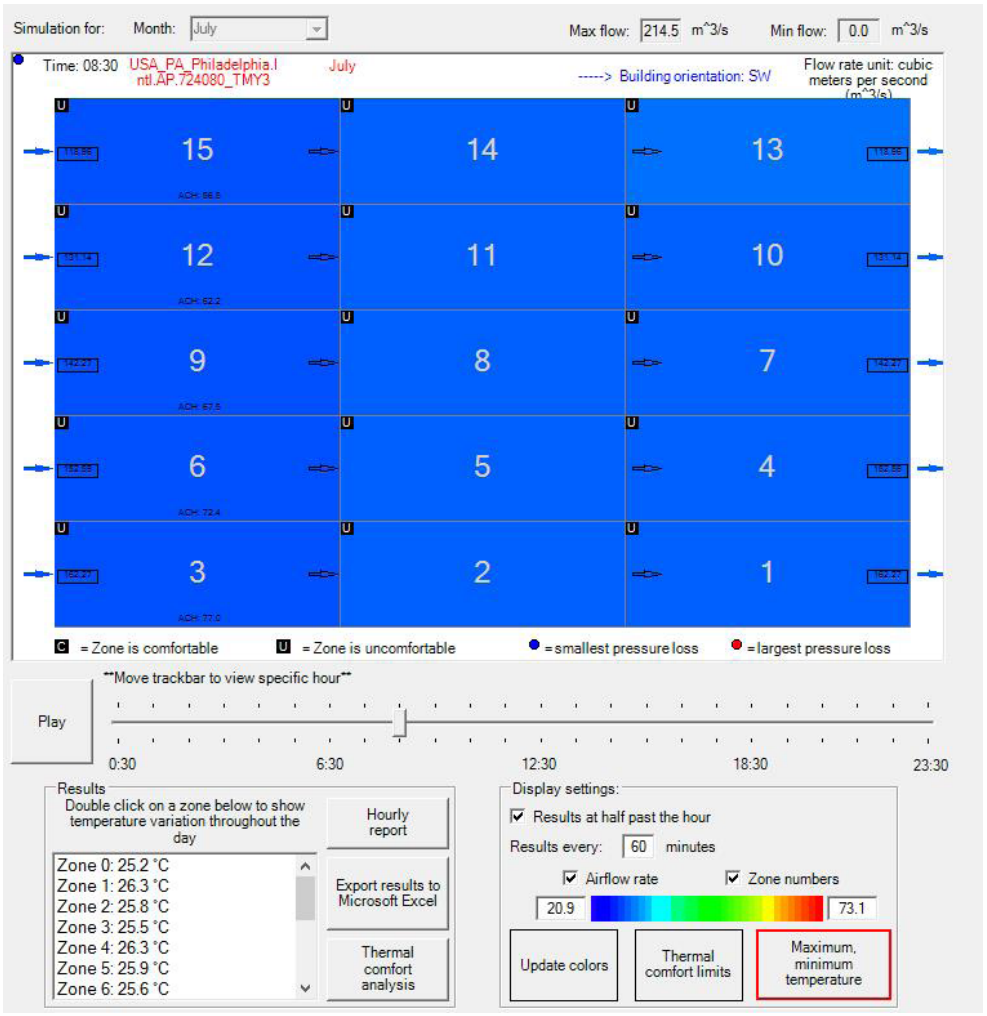
The first strategy includes the thermal mass values into the simulation, open some windows at night and add hybrid Mechanical and Natural Ventilation system. In addition, adding a big atrium to change the central rooms from lower gallery to lab till roof is another important approach. Based on this strategy, the performance of building improves a lot, most area could keep around 50% comfort during the day, people will feel hot only in some lower parts of the building. Generally, it can keep in an neutral-comfort condition according to simulation analysis.



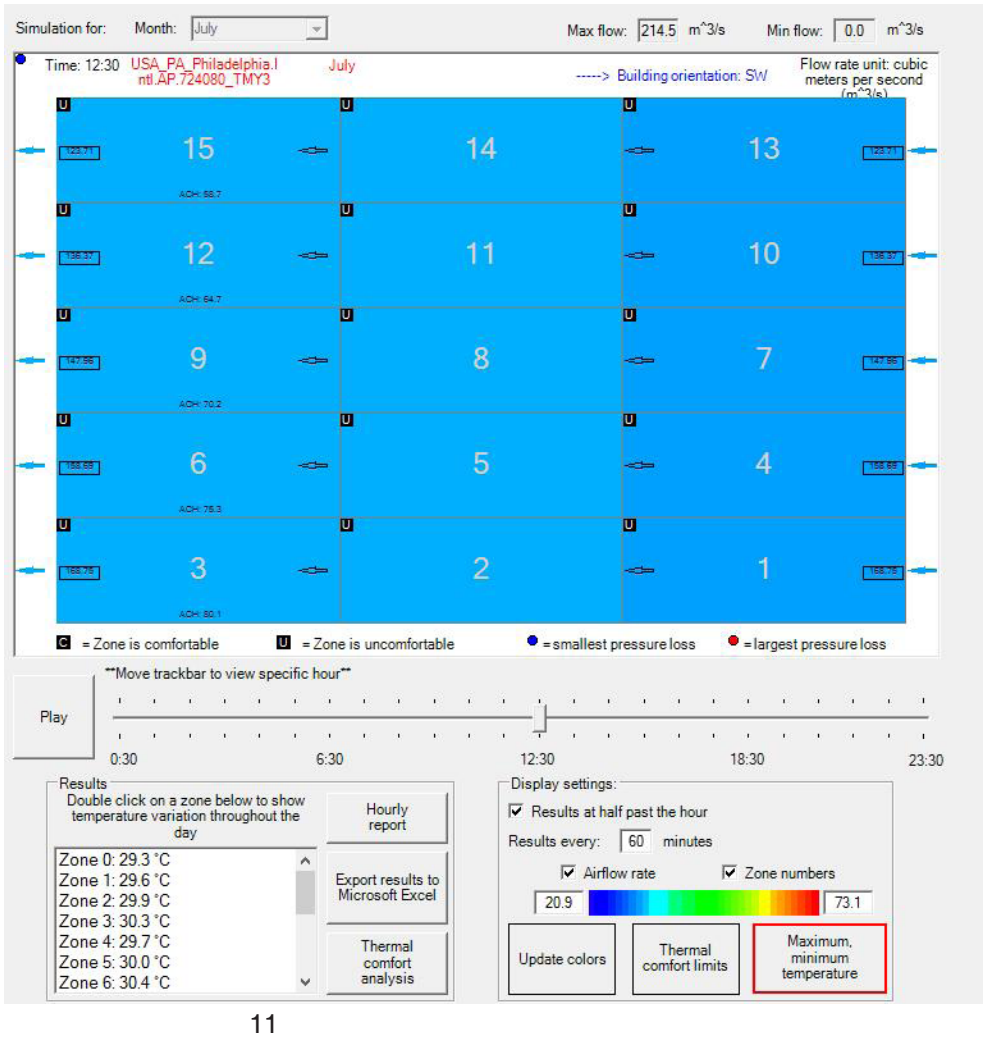


Strategy II: Add Cross Ventilation & Increase the Area of Windows

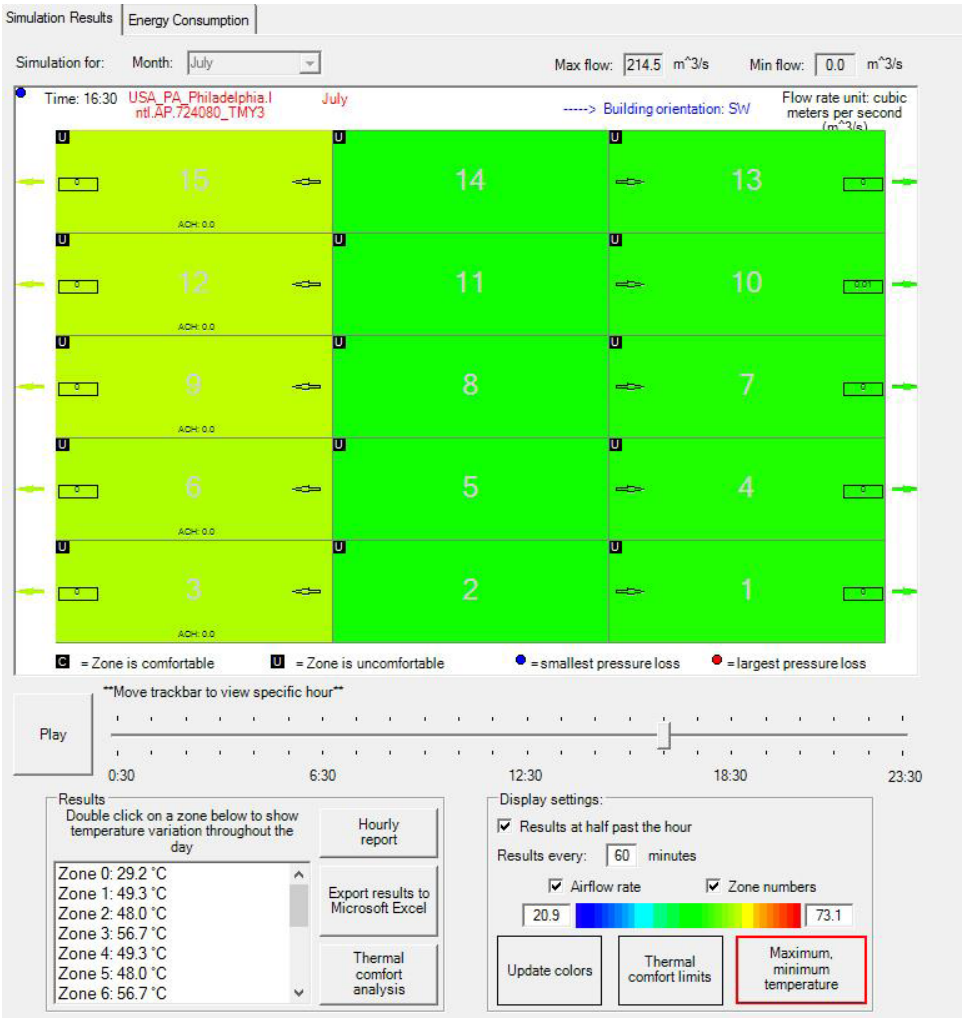
Simulation Strategy I



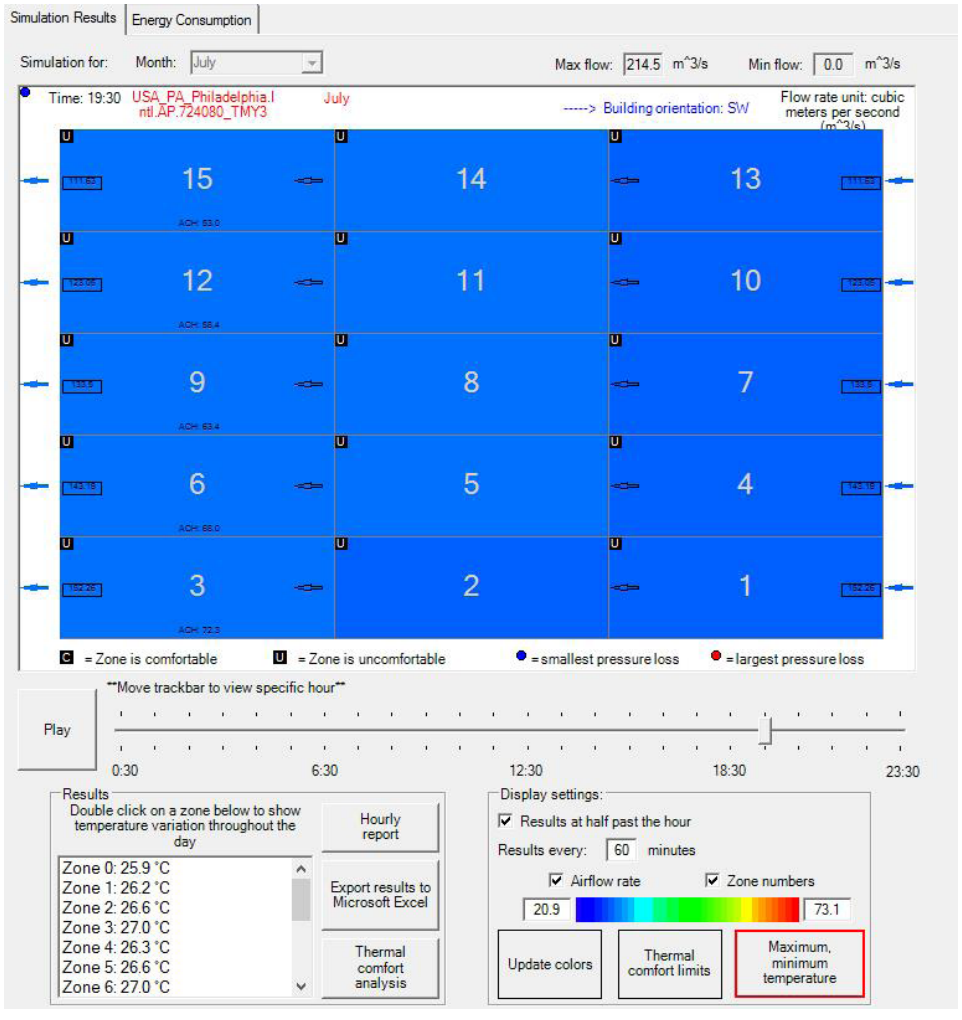
Time1 8:30



Time2 12:30

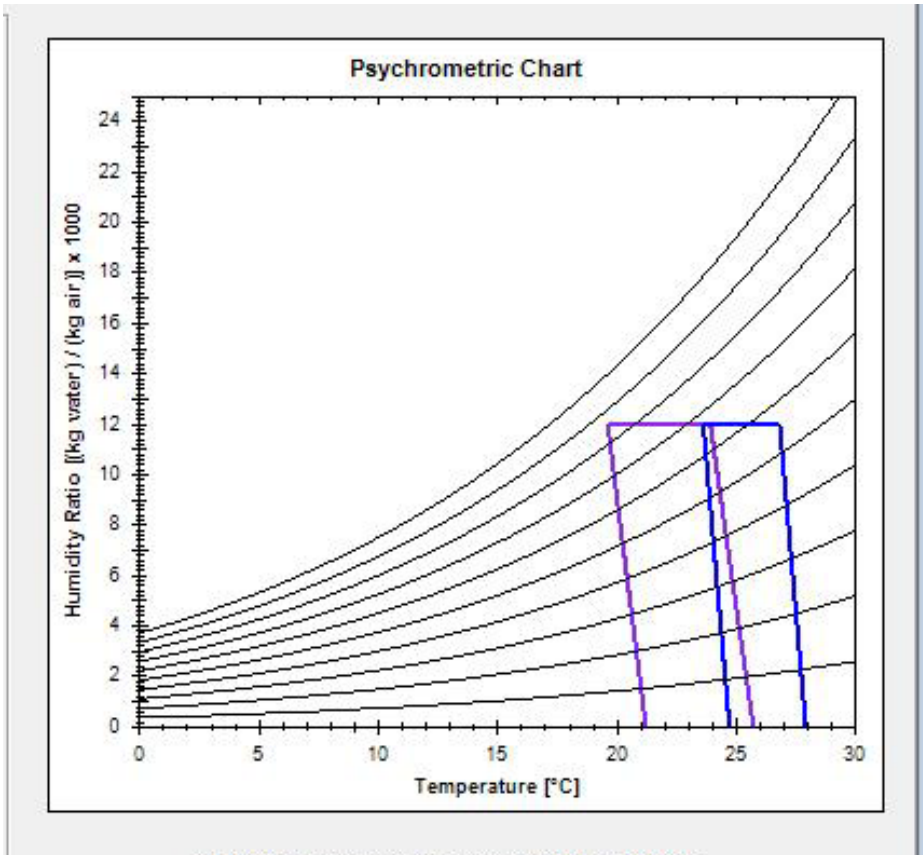


Time3 15:30



Time4 19:30

Psychometric Chart & Window Ratio



Scenario name

Scenario summary

Simulation type: transient

Building type: cross ventilation

Building footprint:	**4551.0**	m^2
Occupied area per floor:	**4551.0**	m^2
Glazing-to-wall ratio per floor:	**97.3**	%
Opening-to-wall ratio per floor:	**64.9**	%
Ratio of roof opening to roof area:	**0.0**	%

Thermal Comfort Chart

Summary:

The strategy II is mainly focused on the cross ventilation on each floor, like connecting East and West wings studio, and try to increase the area of windows and operable parts as large as possible. The simulation result shows that it is better strategy that all area of the building could keep morn than 50% comfort condition. In different time during the day, the building performance is still better than the Strategy I which combines with several different ventilation approaches. Therefore, probably, to introduce air go across the building if only want to improve natural ventilation effect.