Modelling a Naturally Ventilated Double Skin Façade with a Building Thermal Simulation Program

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Contents

- Why Double Skin Façade?

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Main advantages of DSF

- Provide noise protection
- Provide better view to the outside + Day lightning
- Improve comfort parameters
- Reduction of energy consumption (night cooling, heat removal, preheating of the inlet air etc.)

- Application of natural ventilation strategy
- Burglary safe
- Possibility for fire escape and fire protection
- Better protection of solar shading devices
- Allow opening of windows on the top floors in a multistory building

Current status

- No single software tool can accommodate all of the following three governing elements of DSF physics
  - Flow Element
  - Optical Element
  - Heat Transfer Element

- Minimum requirement
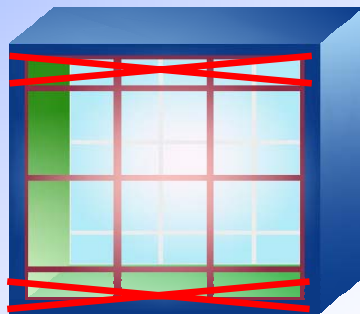 - Cooling load
  - Energy consumption

IEA ECBCS Annex43/SHC Task 34
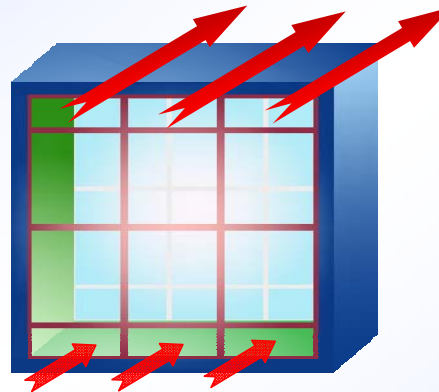# Validation of Building Energy Simulation Tools

- Empirical Validation of Building Simulation Software: Modelling of Double Facades
  - VA114
  - TRNSYS
  - IDA
  - BSim
  - ESPr

Rasmus Lund Jensen ◆ rlj@civil.aau.dk ◆ Indoor Environmental Engineering
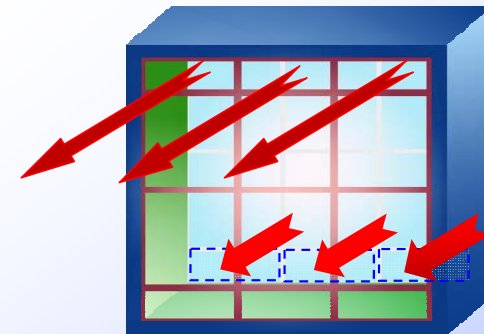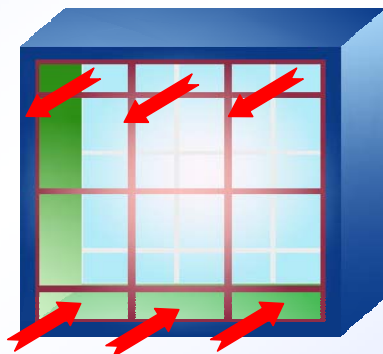
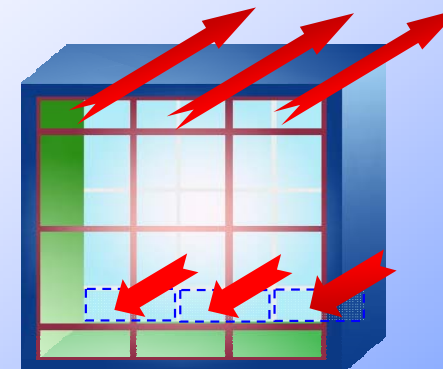# DSF Options

Transparent insulation
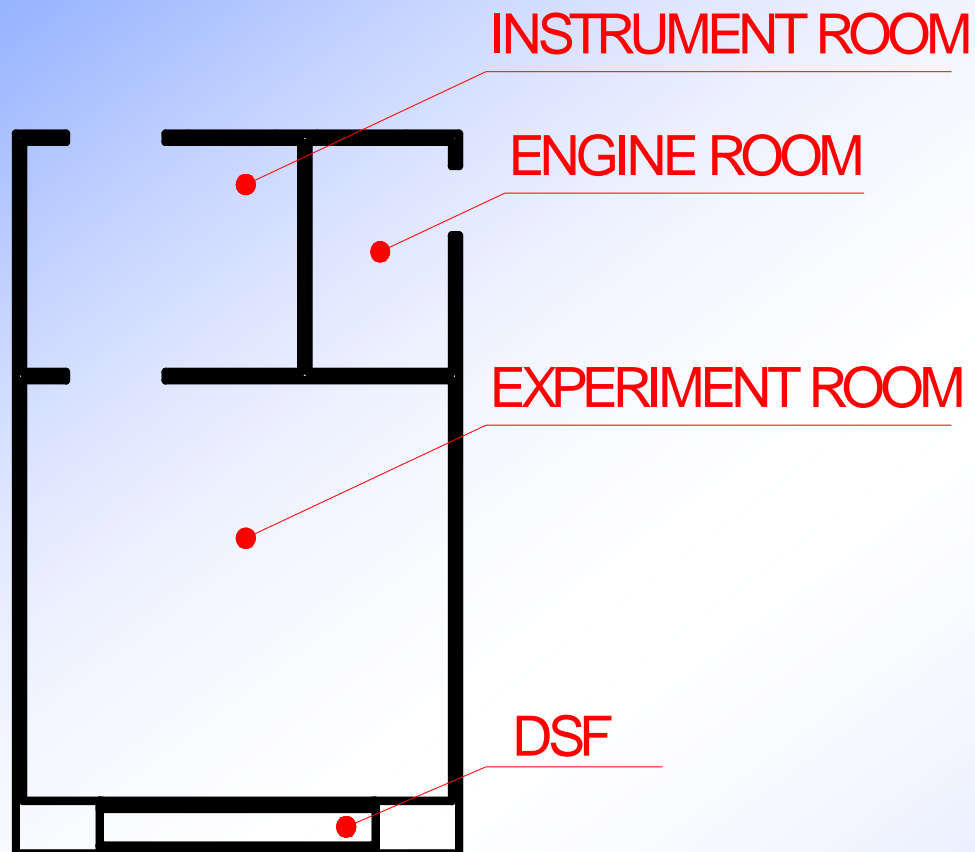
Preheating mode

Exhaust mode

External air curtain

Internal air curtain

The Cube

The Cube

INSTRUMENT ROOM

ENGINE ROOM

EXPERIMENT ROOM

DSF

The Cube

Rasmus Lund Jensen ◆ rlj@civil.aau.dk ◆ Indoor Environmental Engineering

Objective of this work

- Compare "global" results from building simulation software to measured values

  - Power loads to the experiment room

  - Air temperature in the DSF

  - Mass flow in the DSF

- Show the sensitivity of g-value

Results

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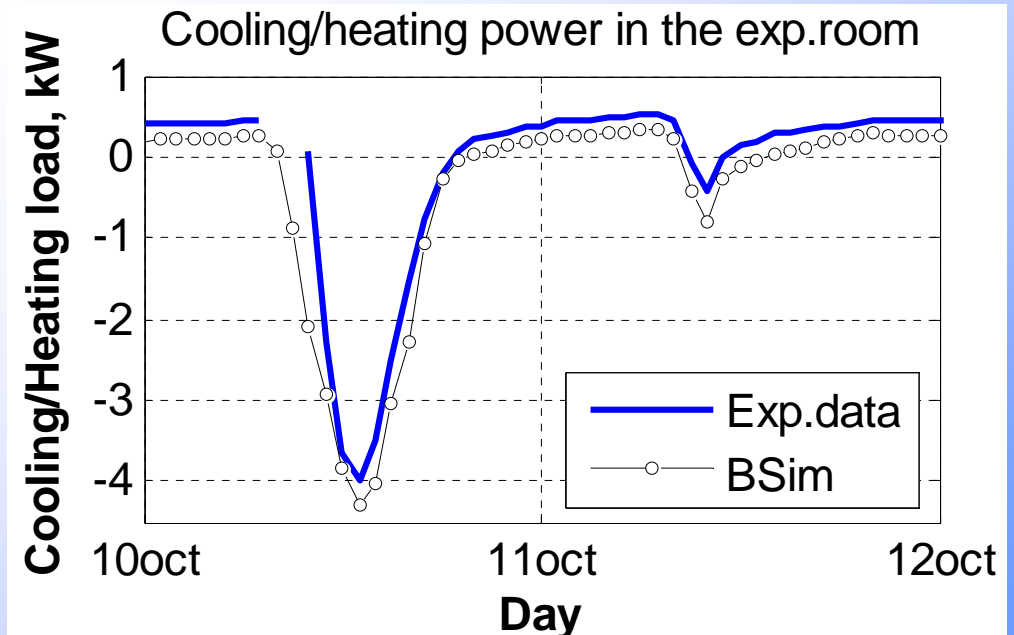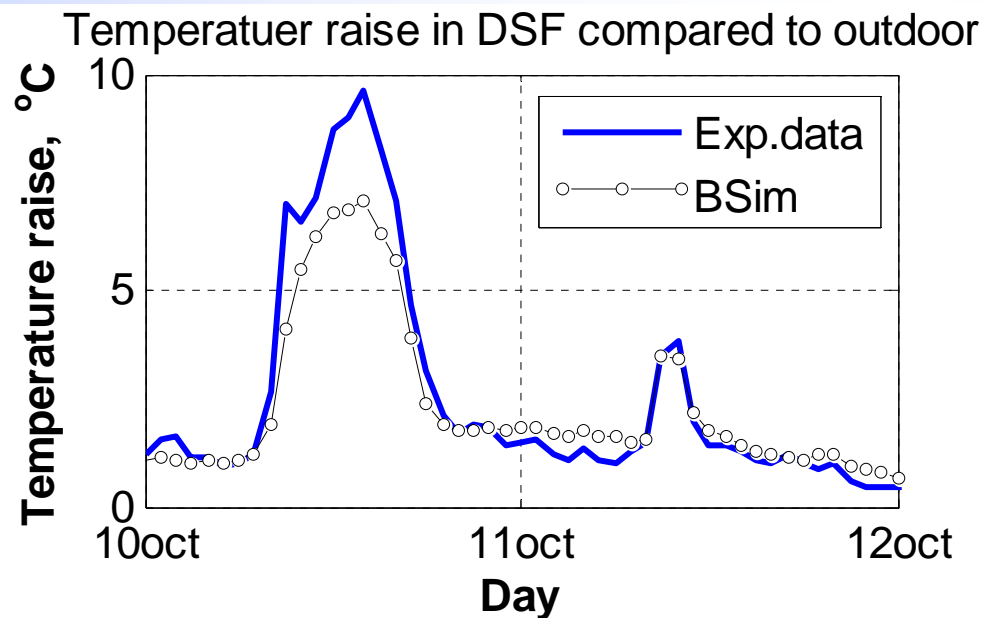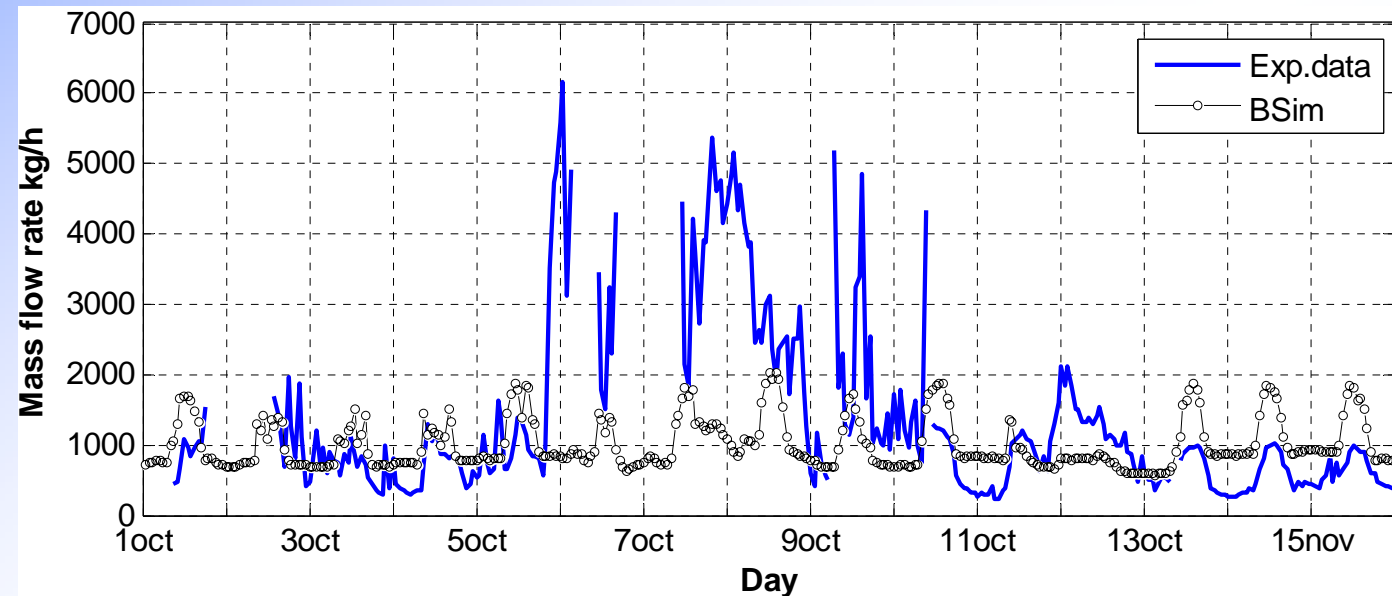
Variation of g-value

- The main difference between the DSF and a conventional window is that in case of DSF it is difficult to estimate what part of the solar heat gains that will penetrate through the DSF into the adjacent zone

- Global heat gain coefficient (g-value) cannot be directly applied to ventilated facades as these are standard coefficients, which assume steady state and one directional heat flow
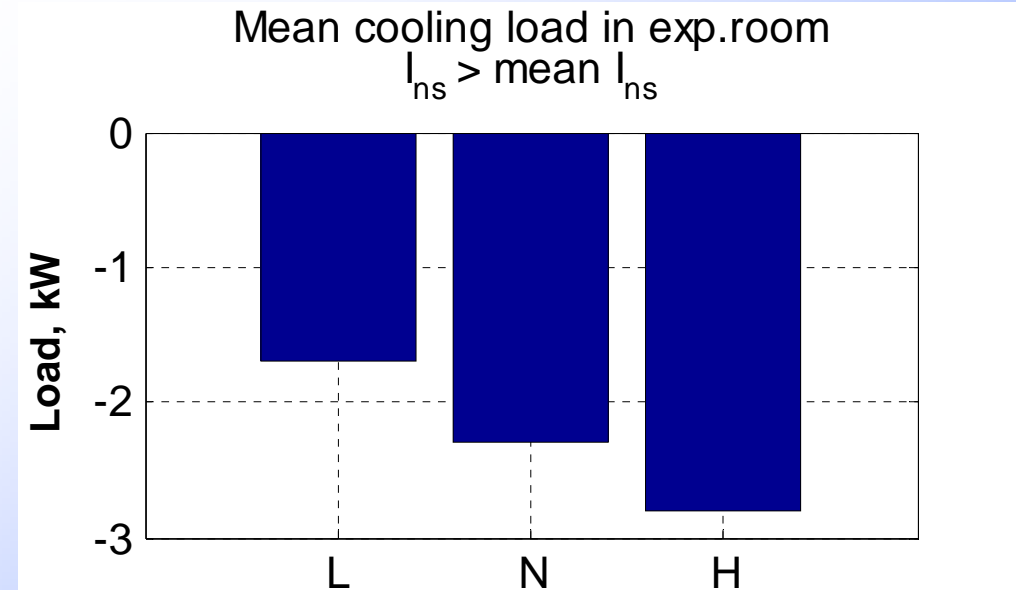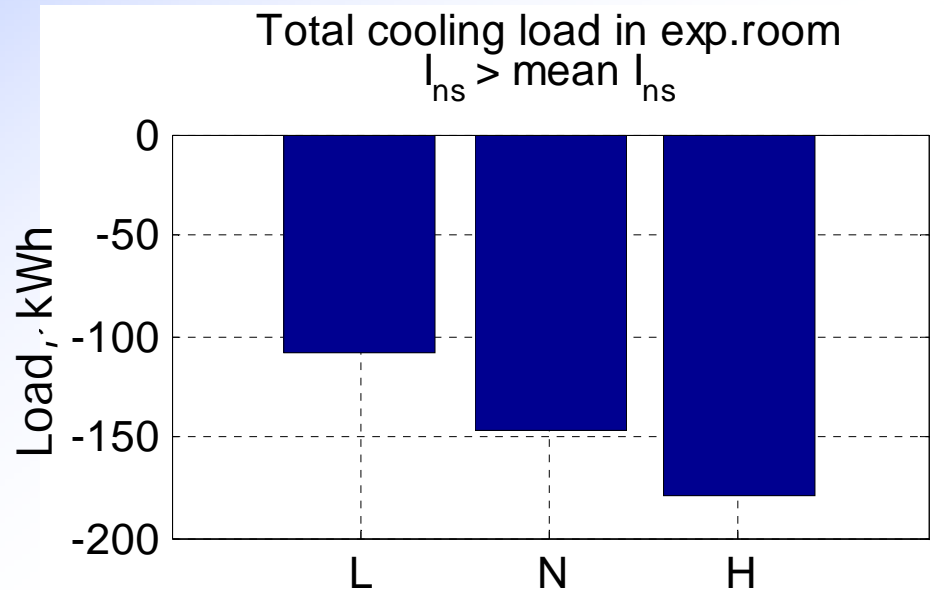
Variation of g-value

Model	g-value	
	External window	Internal window
Low (**L**)	0.75 (-6%)	0.53 (-16%)
Normal (**N**)	0.8 (100%)	0.63 (100%)
High (**H**)	0.85 (+6%)	0.73 (+16%)
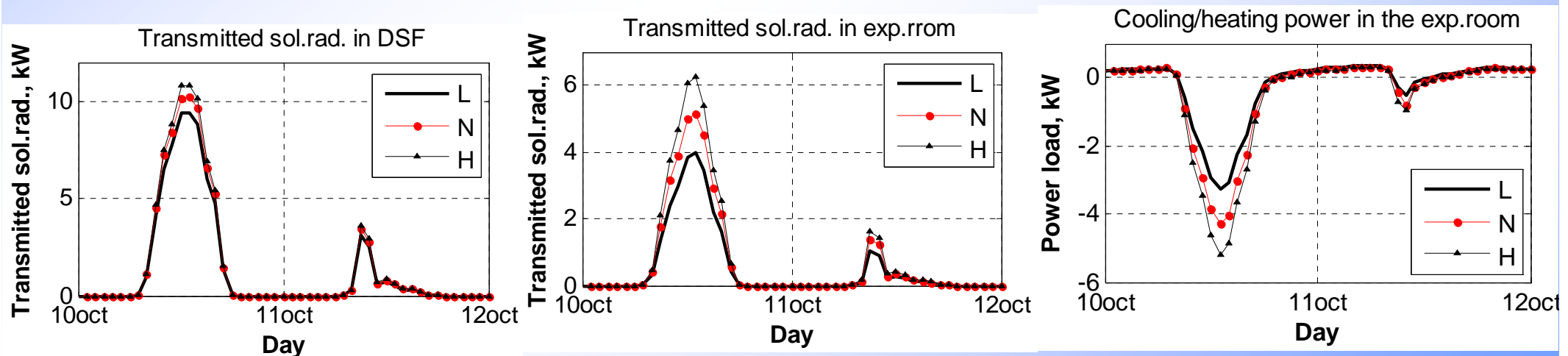
Results

- Variation in energy use and cooling load for a time period of 14 days

Conclusion and future work

- Not possible to model a DSF and predict its impact on the energy use, size of cooling system and thermal comfort
- If measurements are available it is possible to estimate e.g. the energy consumption
- New models that includes all three elements of the DSF (Flow, Optical,Heat Transfer)

- Measurements with solar shading just ended – showed large reduction in cooling load