

Infrared measurements on a ventilated cladding

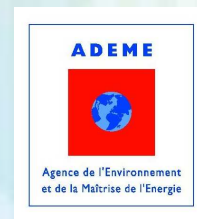
Surface temperature measurements
Heat transfer calculation through the insulated part of the envelope

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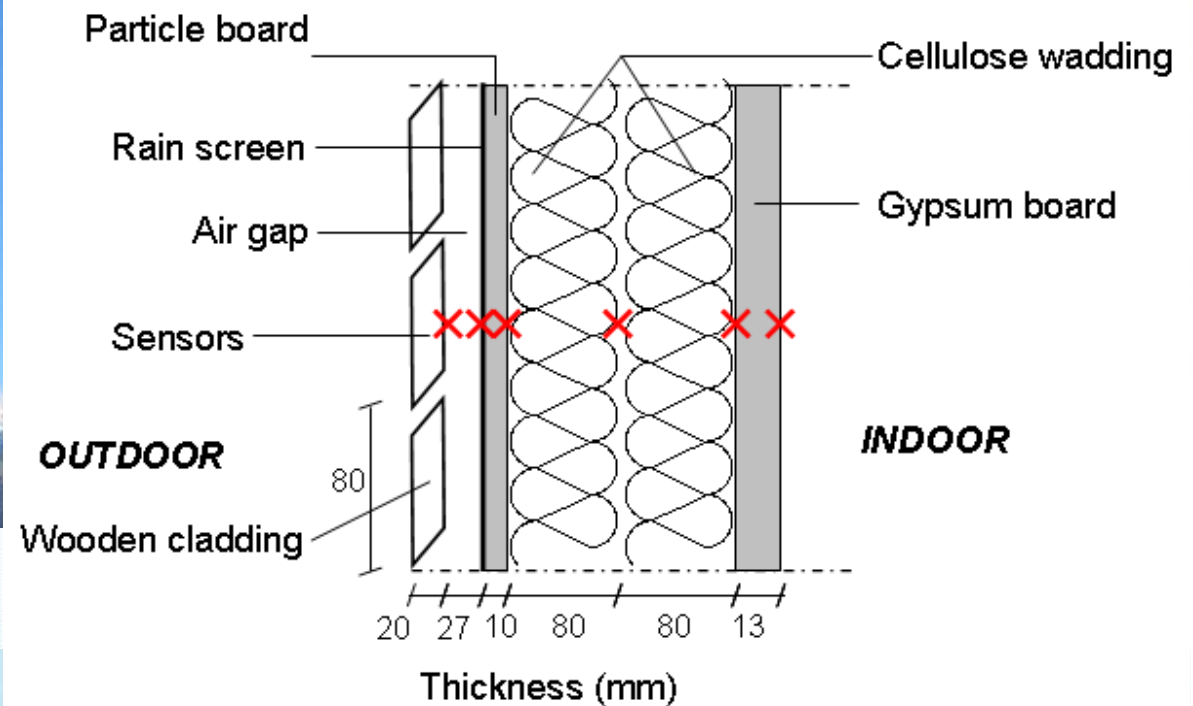
Experimental set up

20m²
50m³

142
Sensors

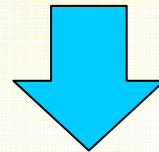
+ wheater station

Vapour and heat
production

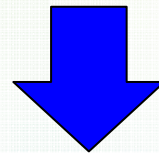


Aim of this study

Test house → Compare different envelope types
1D- HAM model Validation



Errors on heat transfers around the cladding



Measurements on a wall in summer
Evaluate bi-dimensional effects

IR technique

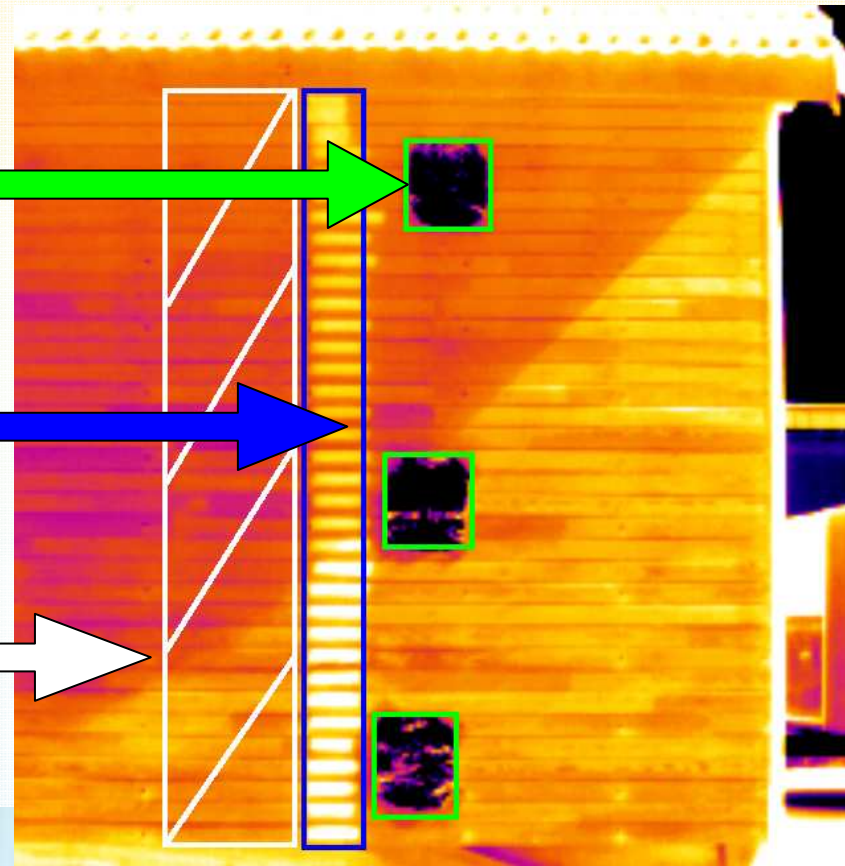
Infrared radiation measurements:

$$J = \varepsilon \cdot \sigma \cdot T_{Tar}^4 + (1 - \varepsilon) \cdot \sigma \cdot T_{Surr}^4$$

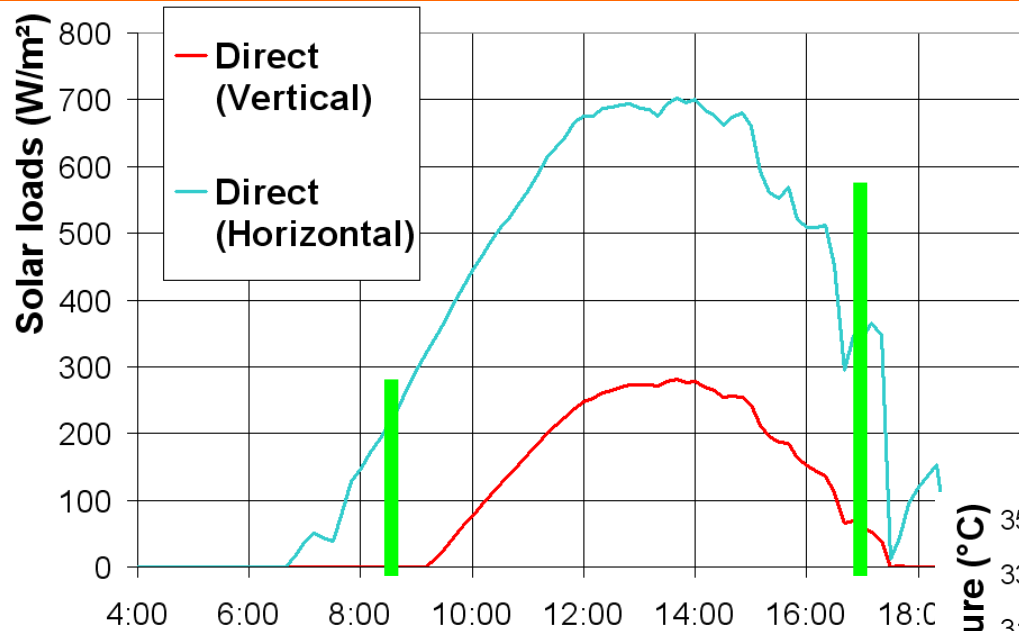
T_{Surr} : aluminium foil

ε : black tape

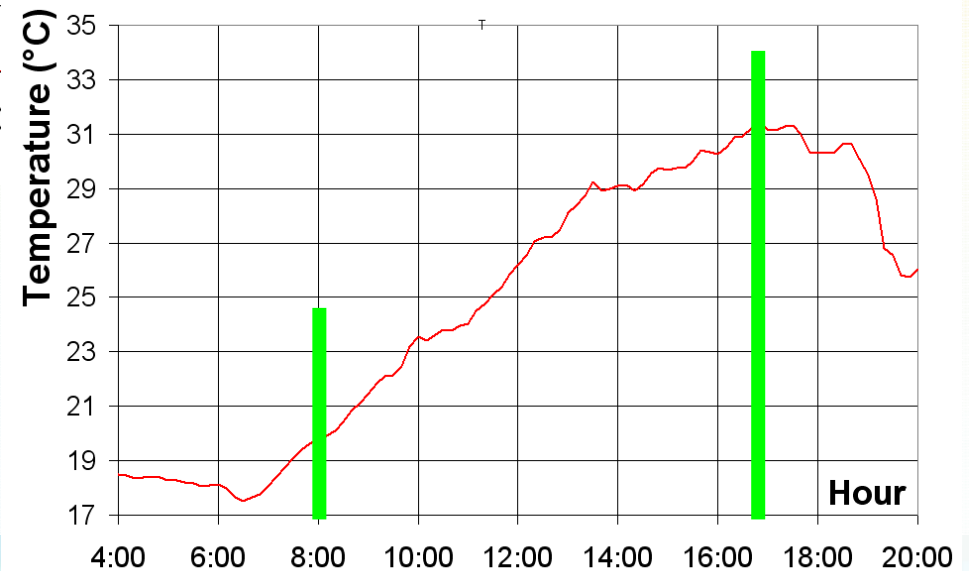
T_{Tar}



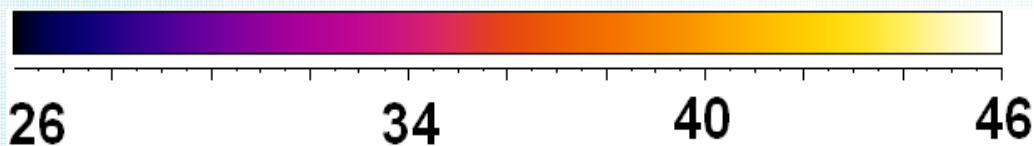
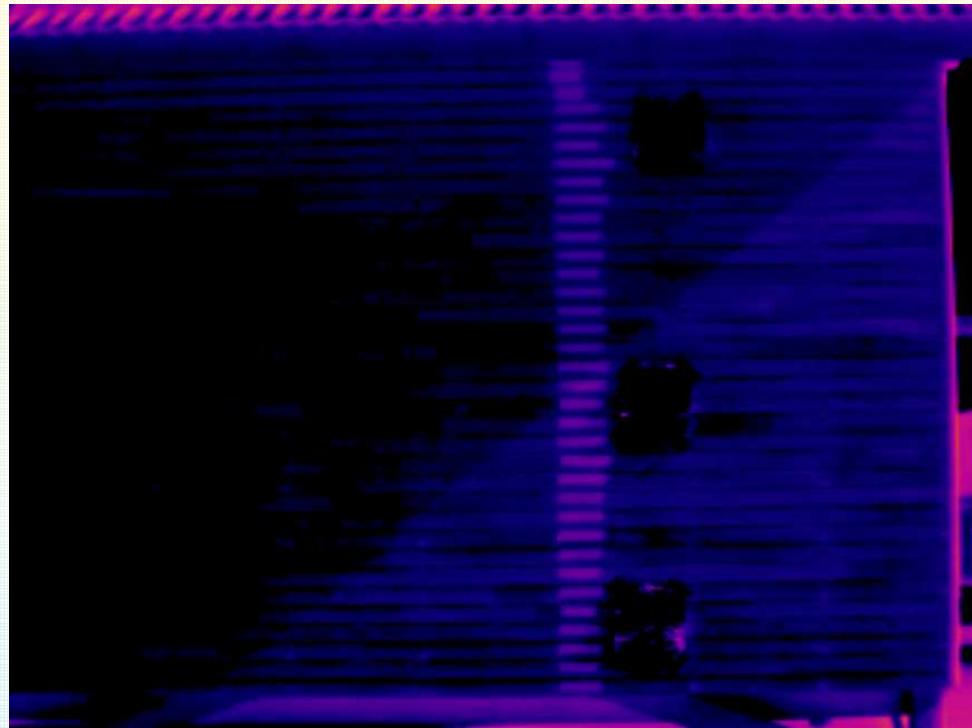
Weather conditions – 30/06



IR Measurements



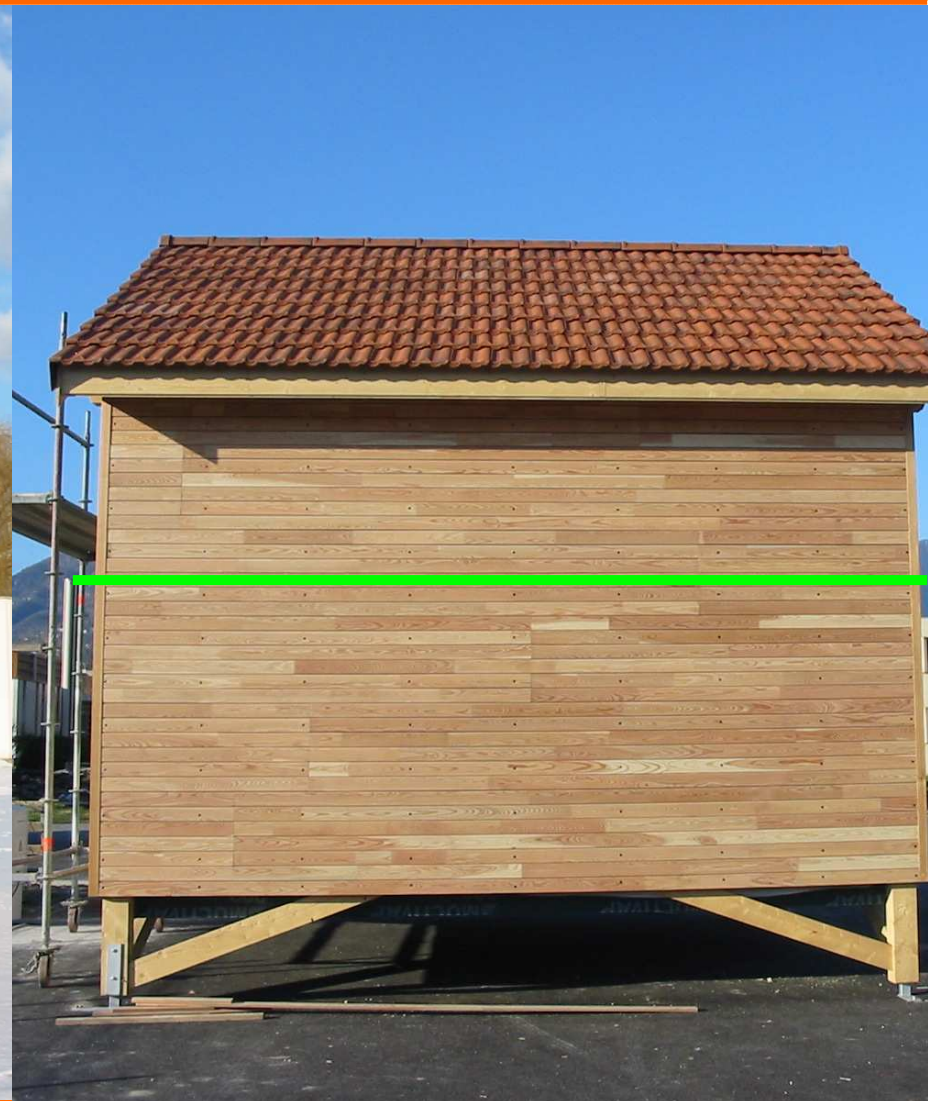
Southern side – 9h40



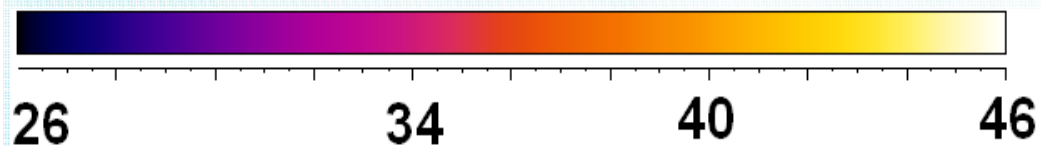
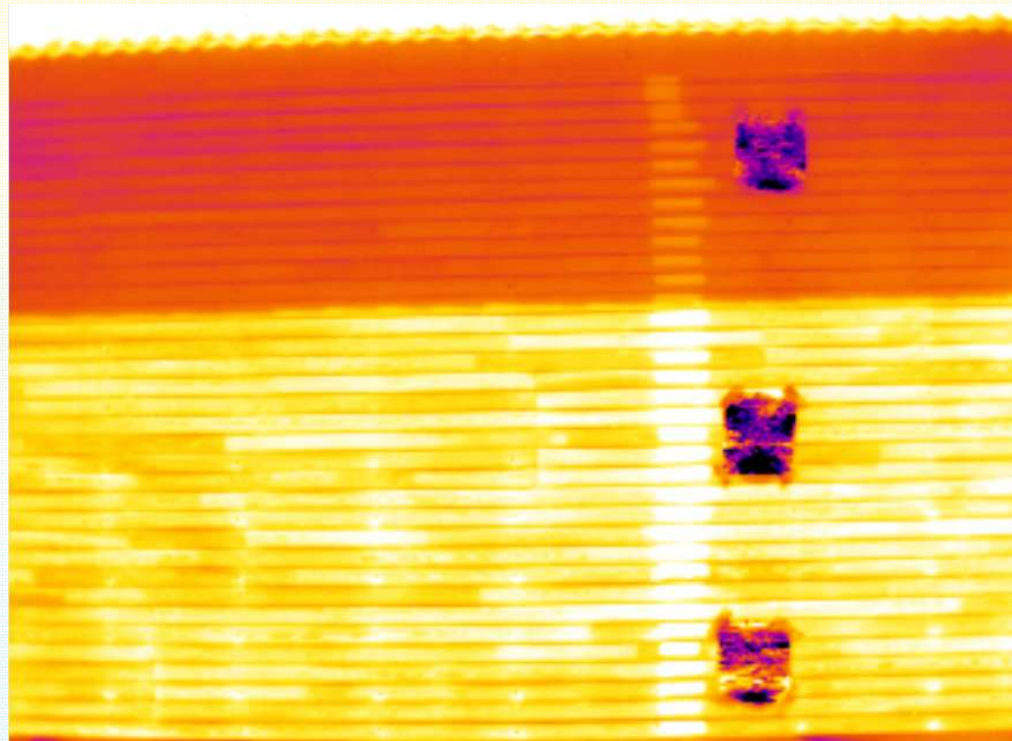
Air Temp (°C)	22.8	
Cladding	Exposed	Shaded
Mean Temp (°C)	27.6	27.5
Max Temp (°C)	28.5	27.9

Wall temperature
is
1°C homogenous

Southern side – 11h40

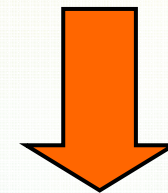


South wall – 13h40



Air Temp (°C)	29,7	
Cladding	Exposed	Shaded
Mean Temp (°C)	46.2	39.1
Max Temp (°C)	47.6	43.4

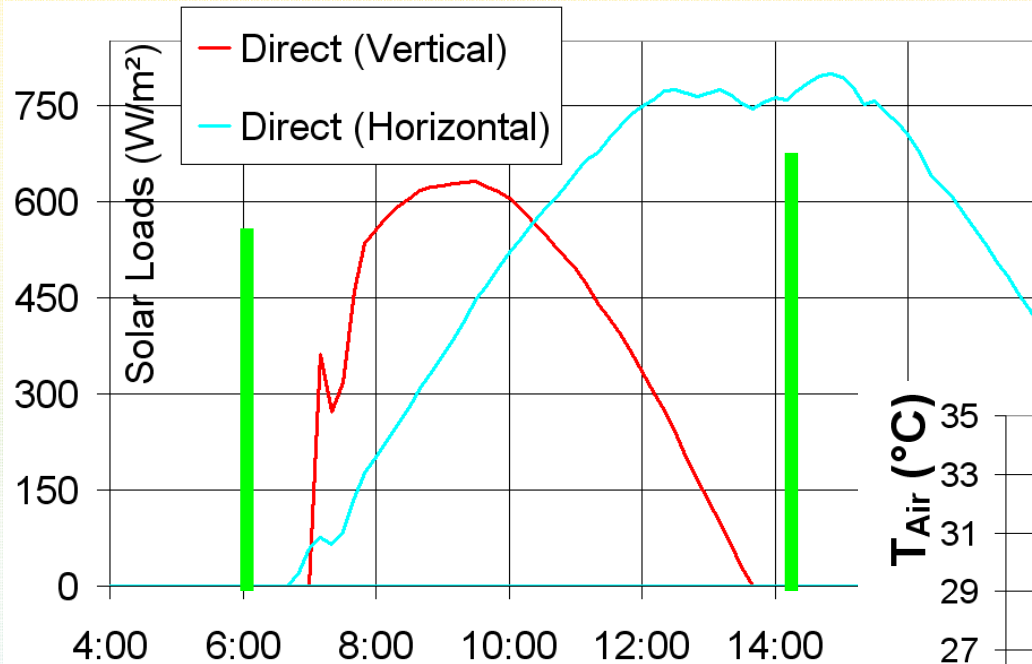
Solar loads 280 W/m²



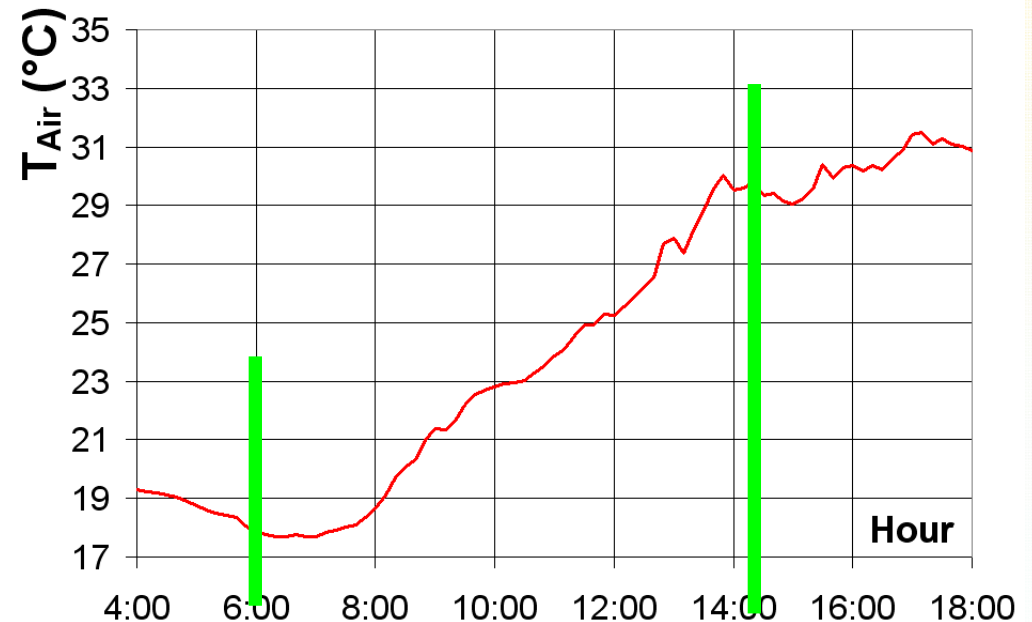
ΔT with air

[9.4 ; 16.5]°C

Weather conditions – 07/07

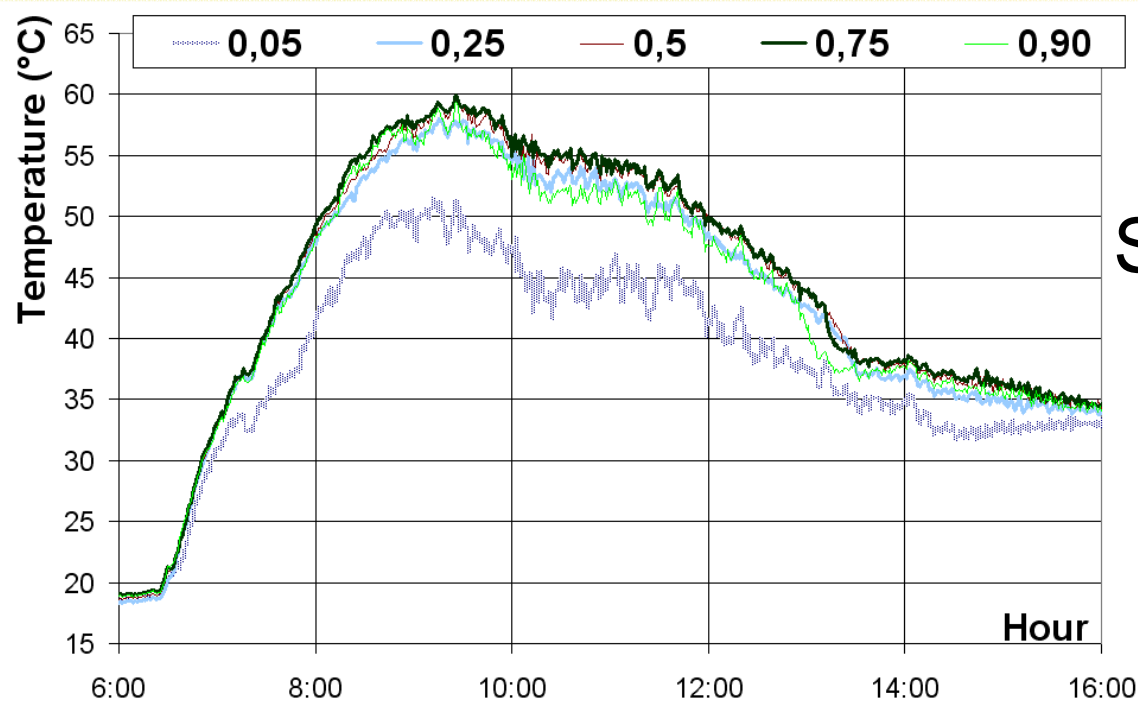


← IR Measurements →



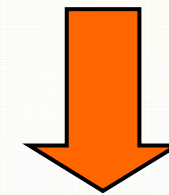
Eastern wall – 6h to 16h

Results plotted for few relative heights (H=3.81 m)



No shaded part

Solar loads > 600 W/m²

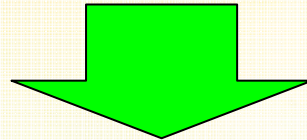


ΔT with air

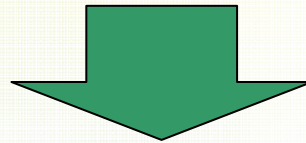
[28 ; 36]°C

Toward simulations

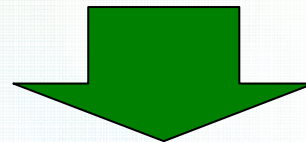
IR measurements



75% of the cladding is 3°C homogeneous



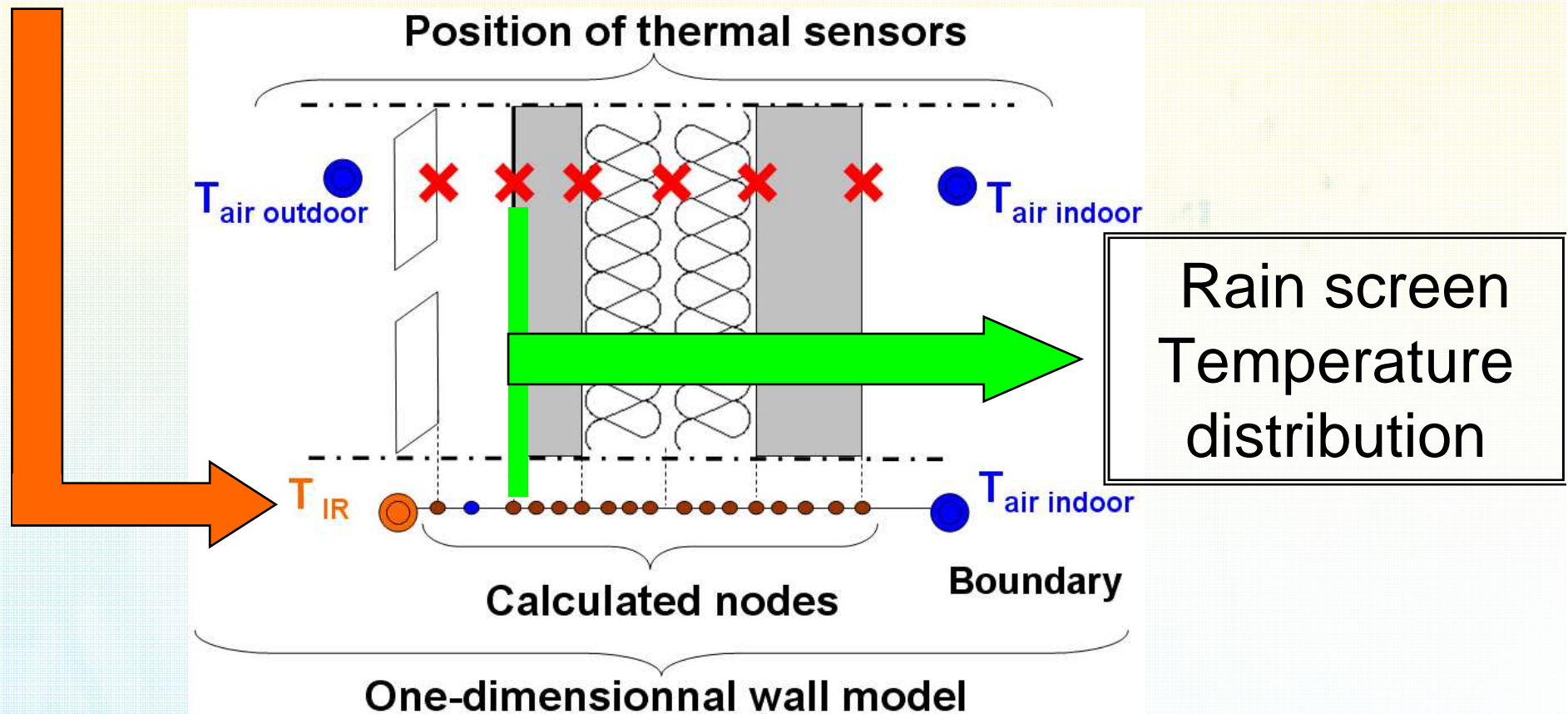
Temperature distribution on the rain screen ?



Computational work

Toward simulations

IR Measurements

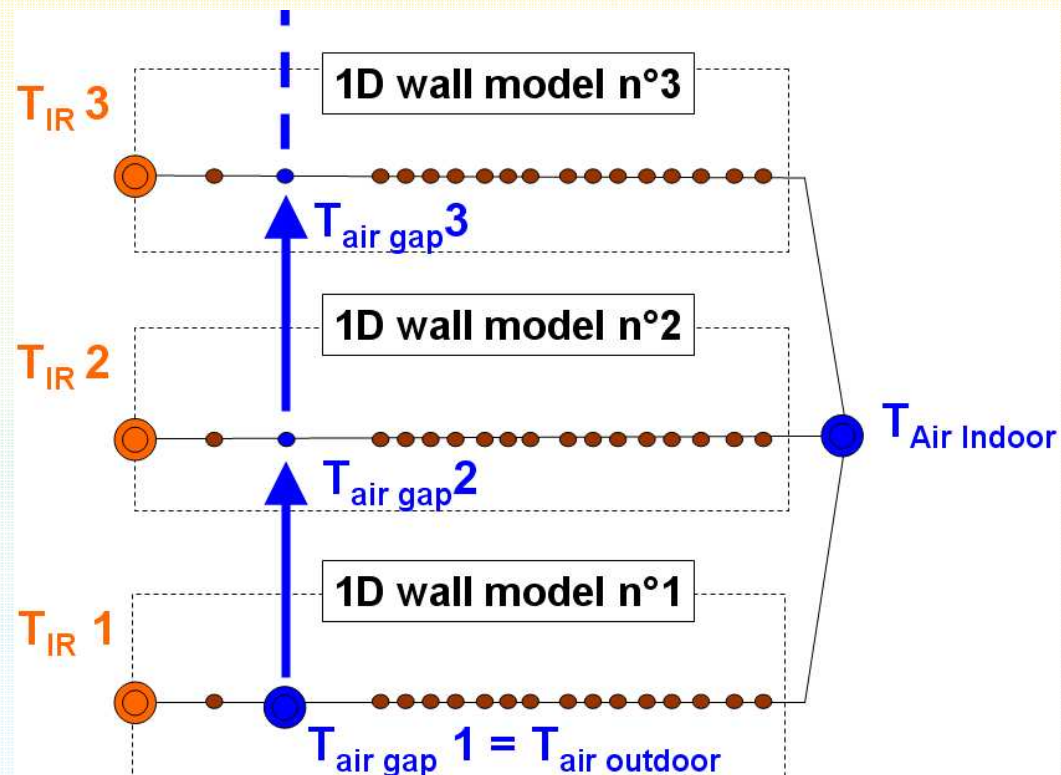


Rain screen
Temperature
distribution

Enhanced model

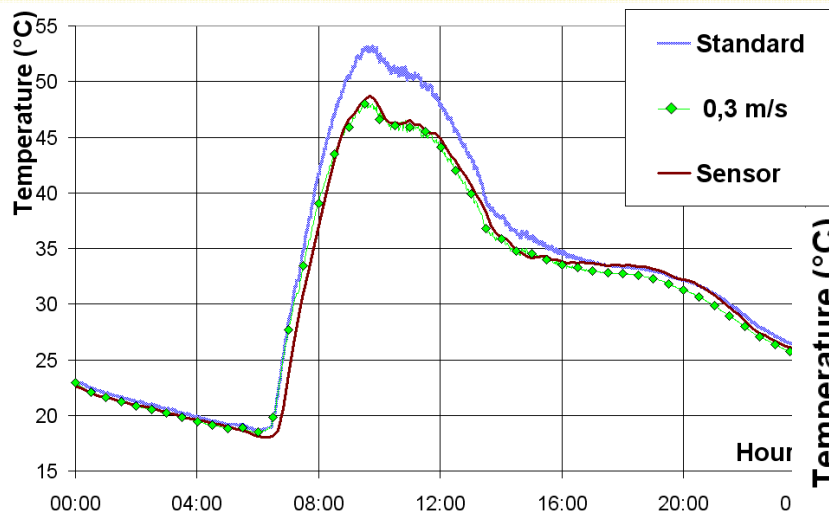
44 IR measurements

=> 44 superimposed one-dimensional models

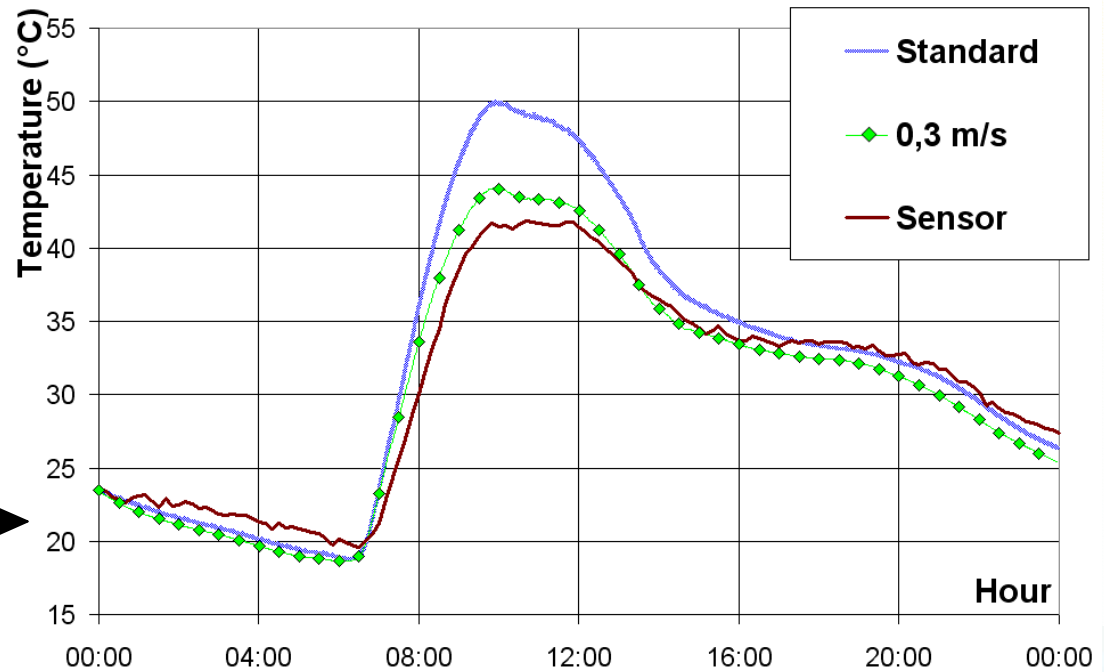


Fitting air gap coefficients

Increasing air speed in the air gap from 0.1 to 0.3 m/s

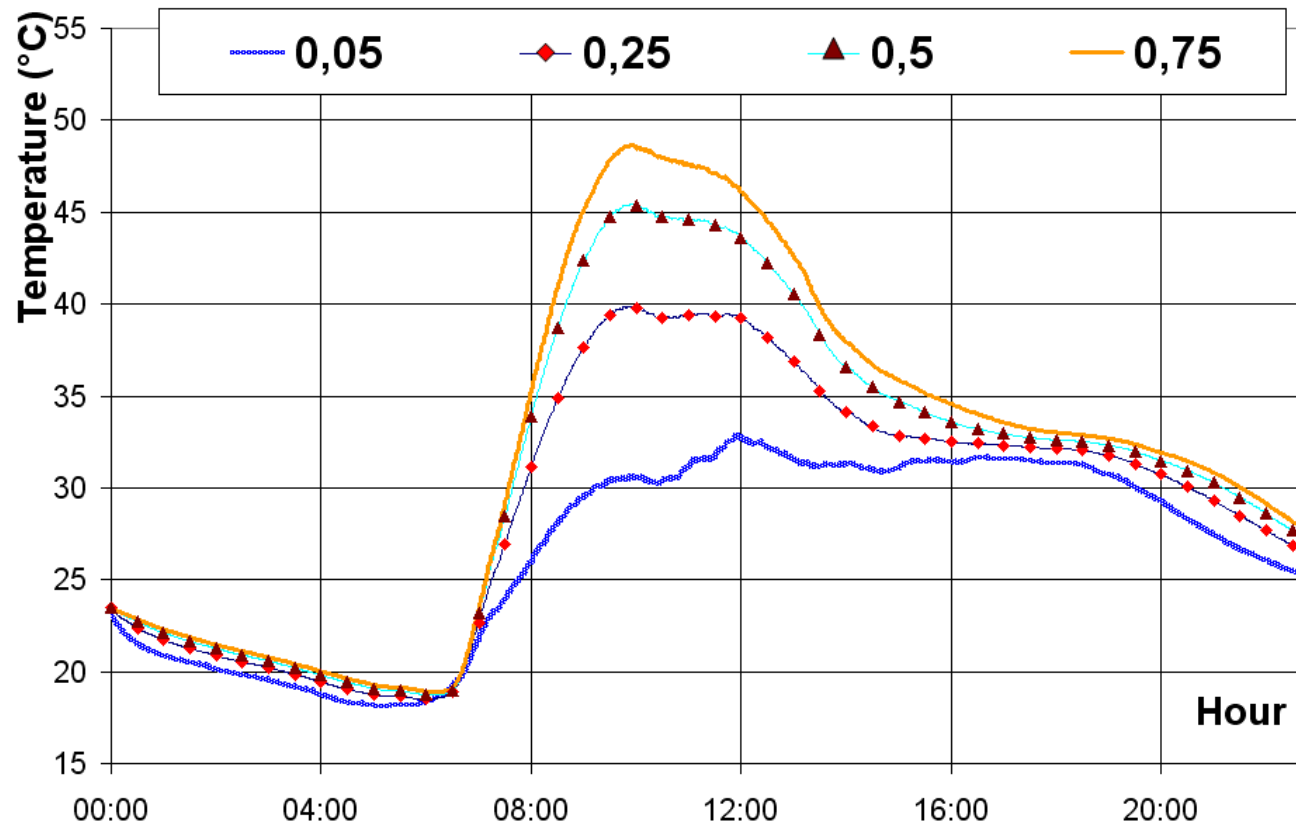


On the cladding



On the rain screen

Temperature distribution



Widely spread
from 0 to 2.5m

$\sigma > 3^{\circ}\text{C}$
(8h00 to 13h20)

Rain screen temperature is not homogeneous

Conclusion

IR measurements

ΔT with air : [9.4 ; 16.5]°C on southern side
[28 ; 36]°C on eastern side

Heat transfer calculation

Bi-dimensional effect through the air gap
Rain screen temperature is not homogenous

Outlook

Comparison with CFD simulations
Enhancing modelling

**Thank you
for your attention**



CETHIL
UMR 5008



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9th Nordic Symposium
on Building Physics

