SBE19
Graz

Building Physics as a Tool for Development of New Components: **Roof Window**

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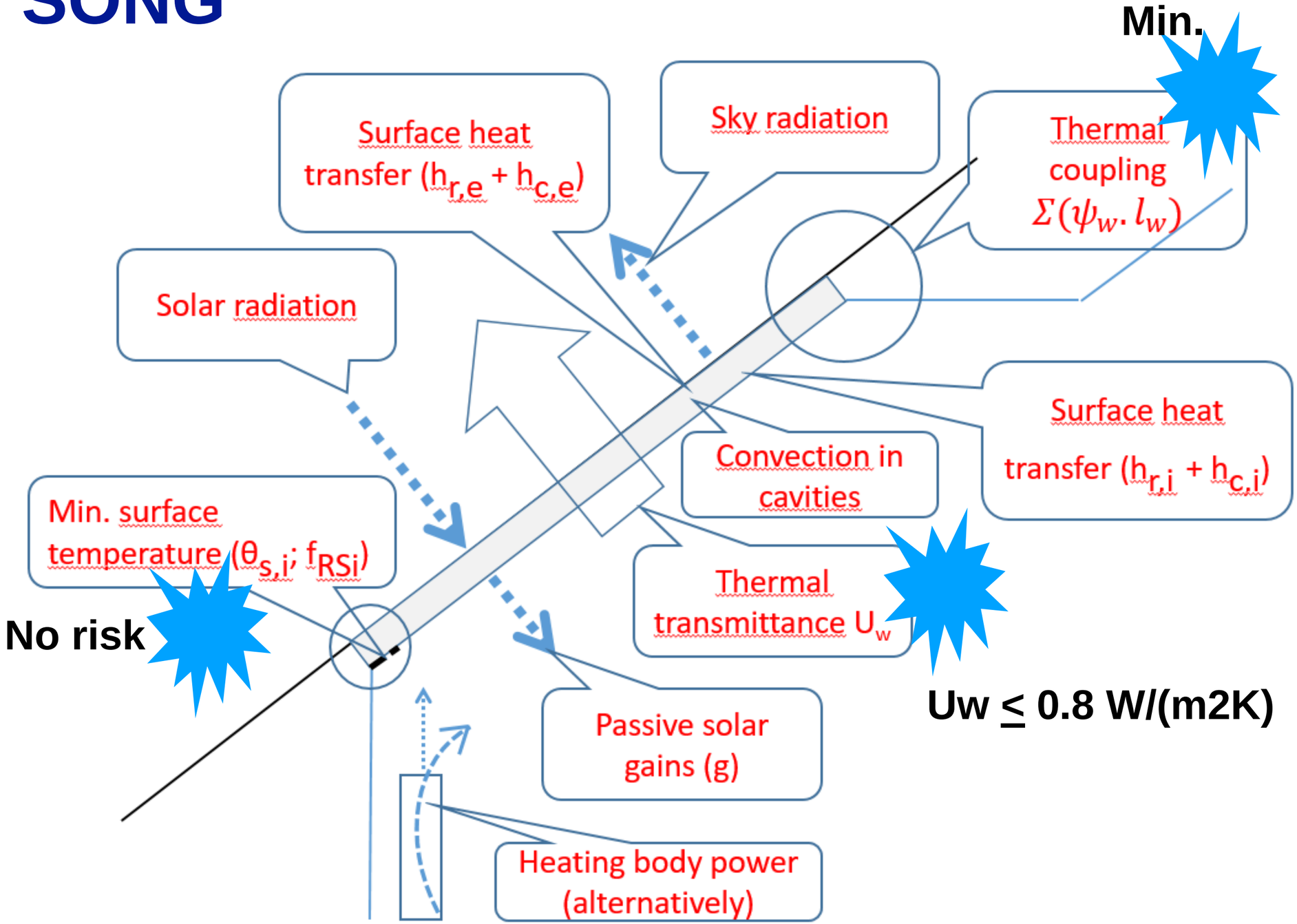
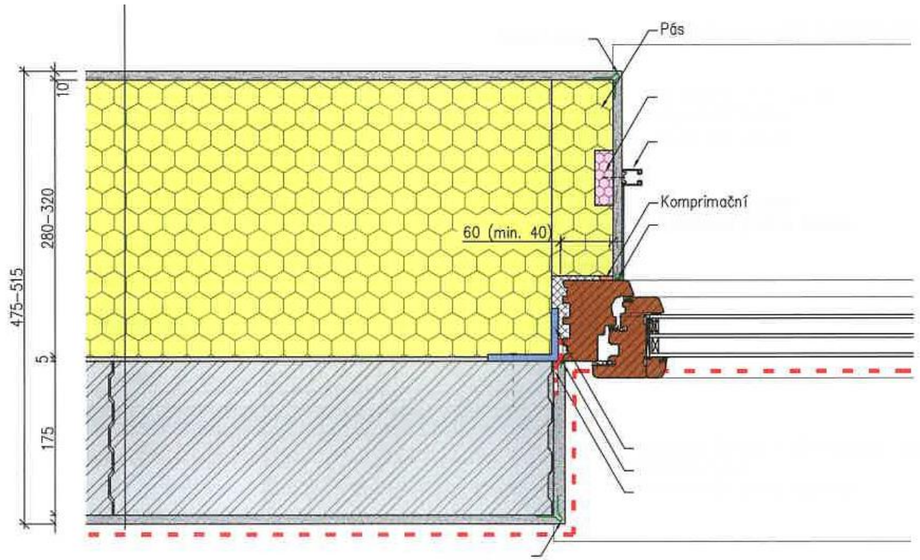
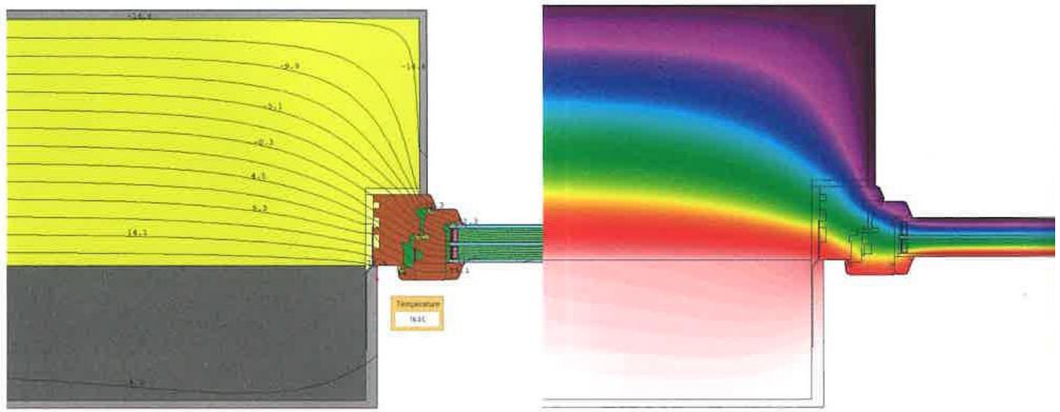
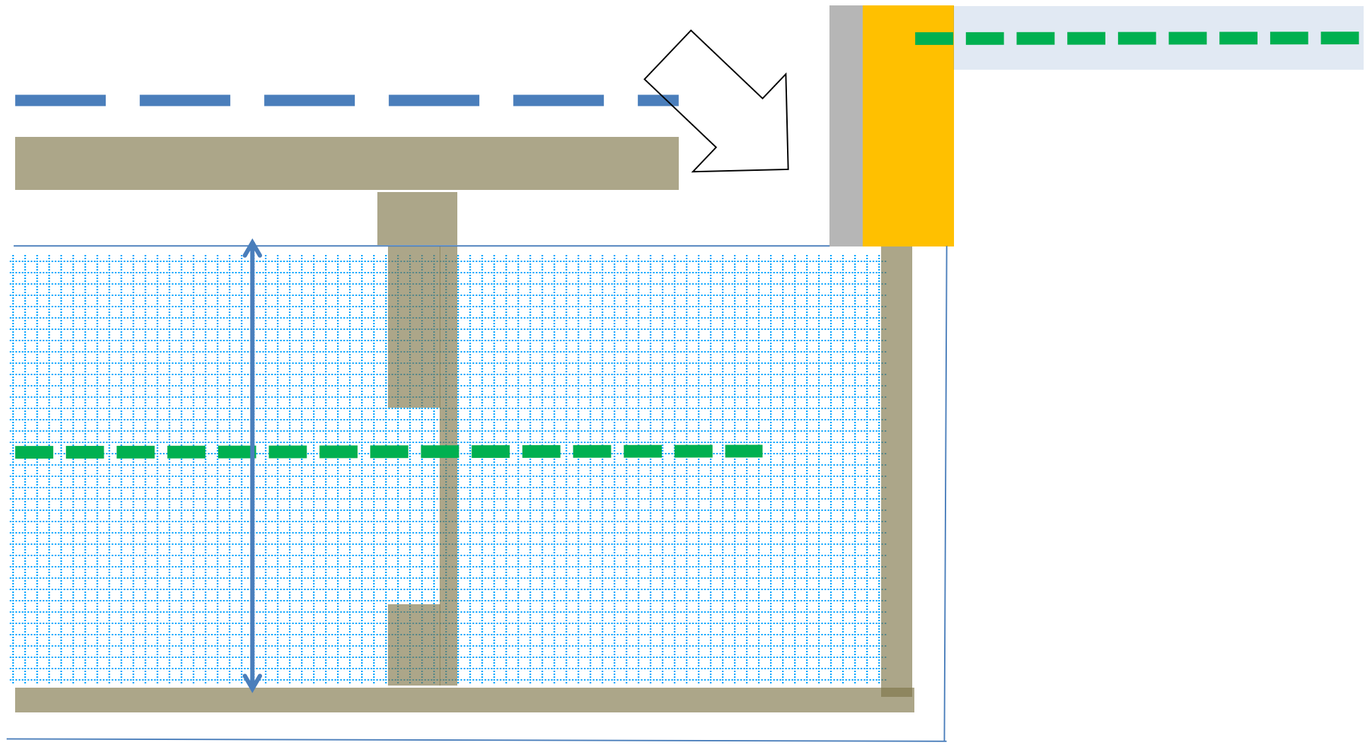
Czech Technical University in Prague

PROJECT **SONG**

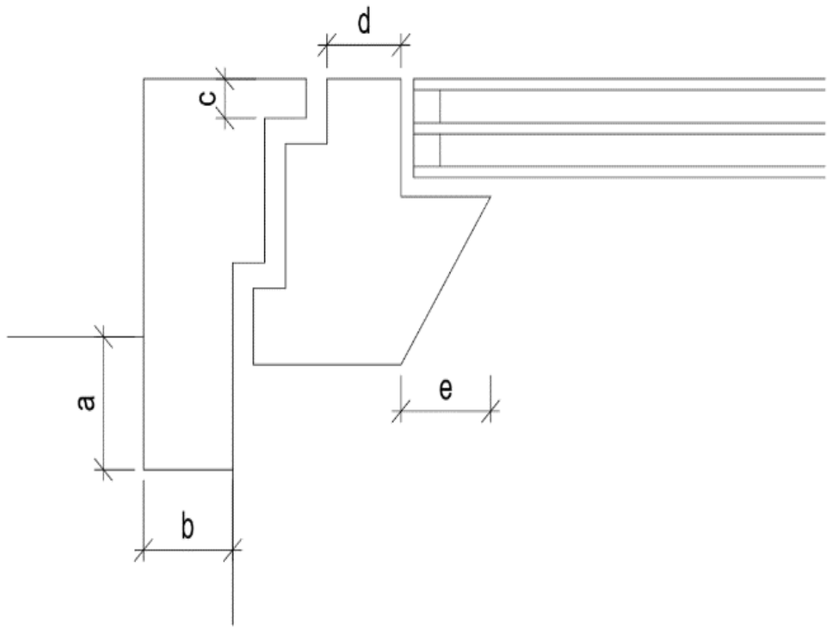


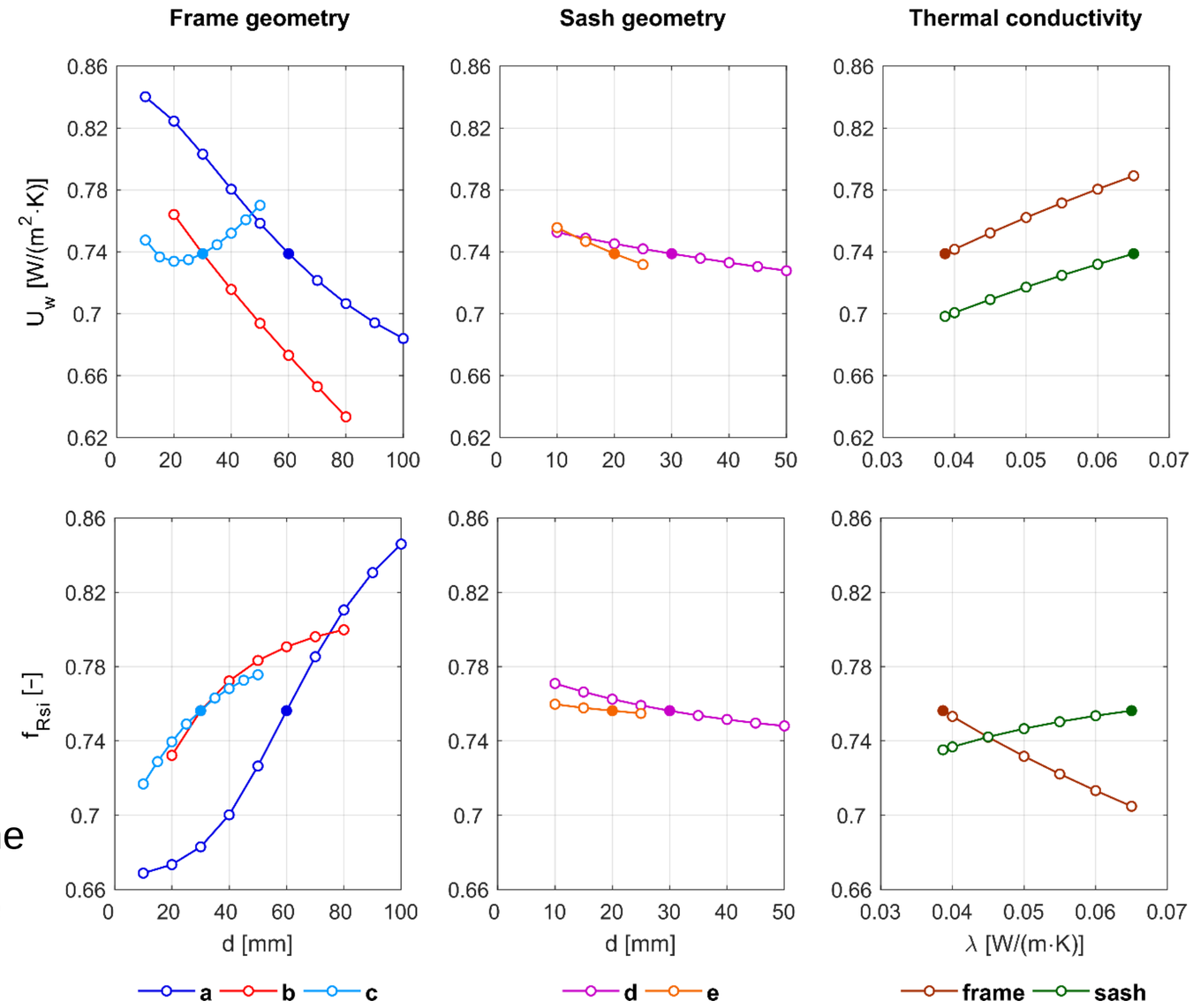

Pás
Komprimační
60 (min. 40)
475–515
280–320
10
5
175




ext.
int.

Introductory parametric studies





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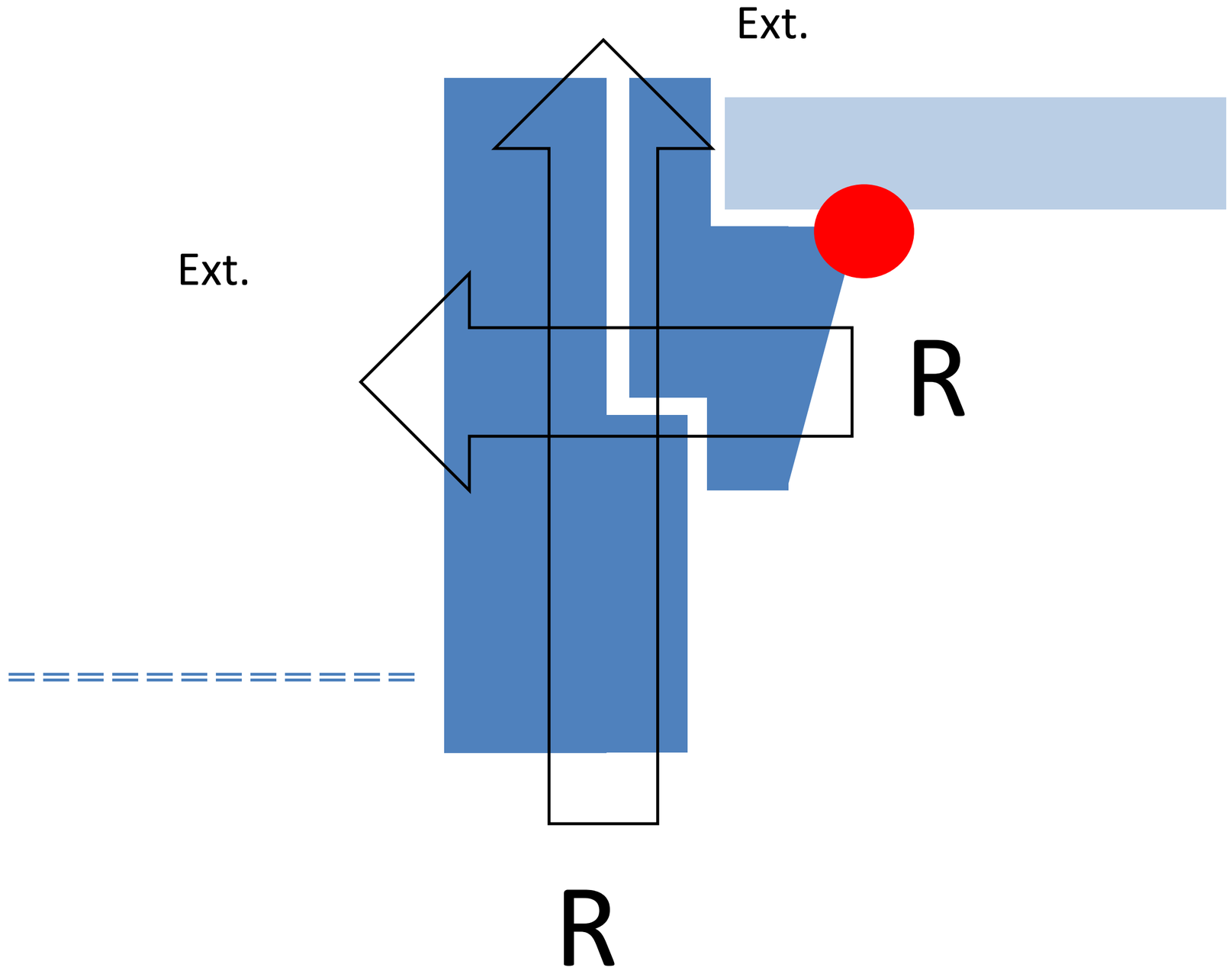
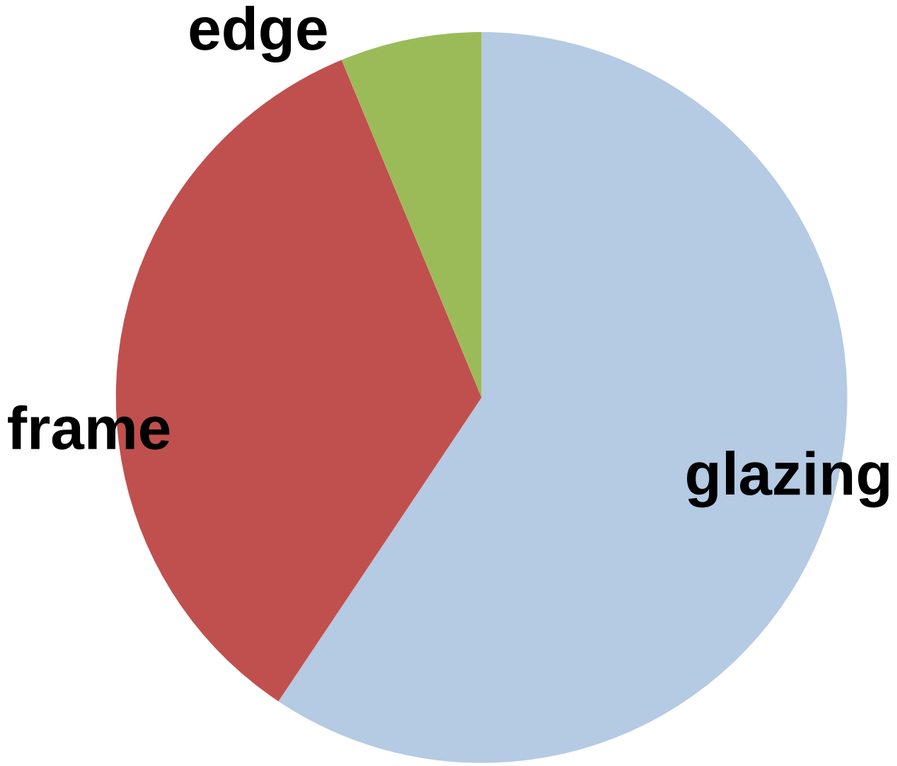
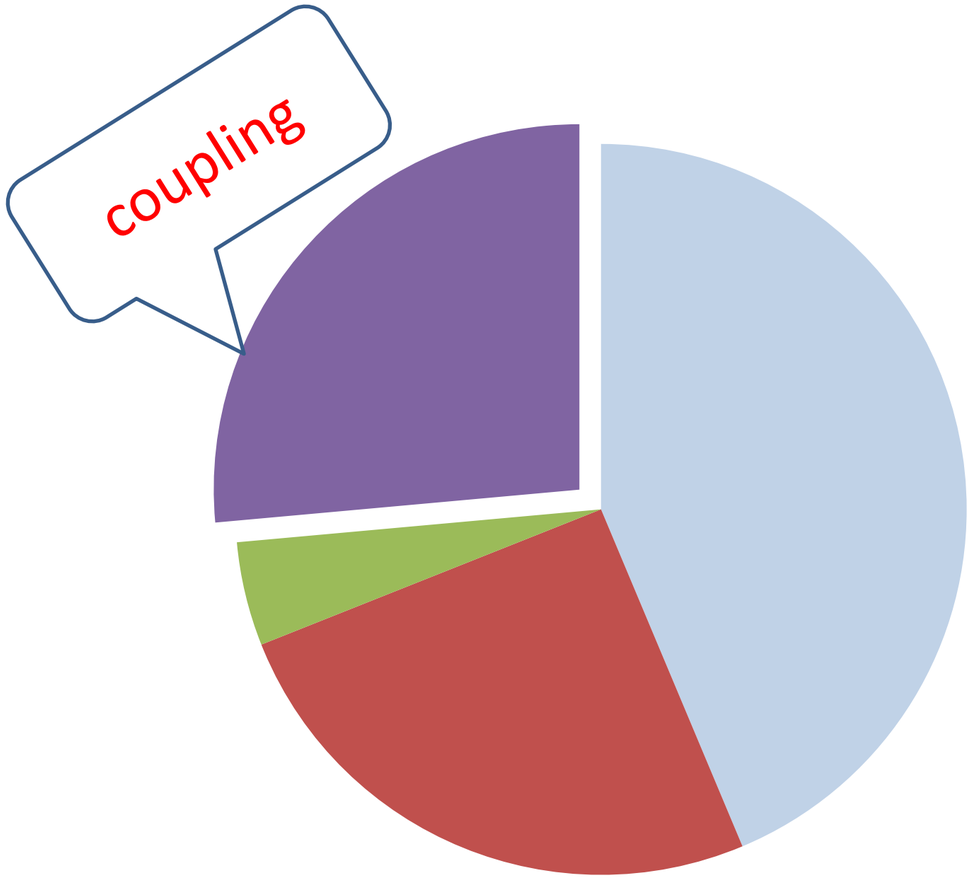

Ext.
Ext.
R
R

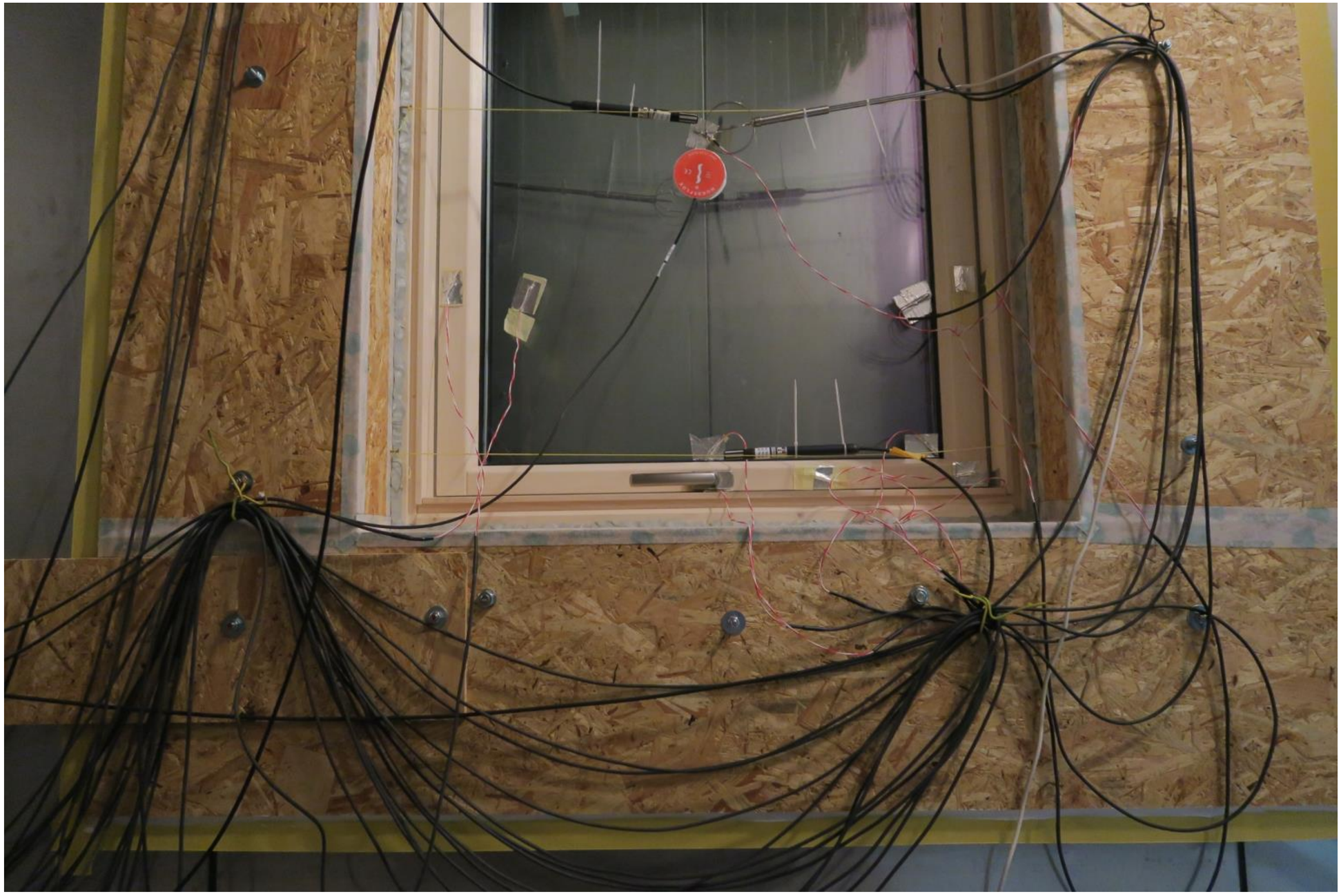


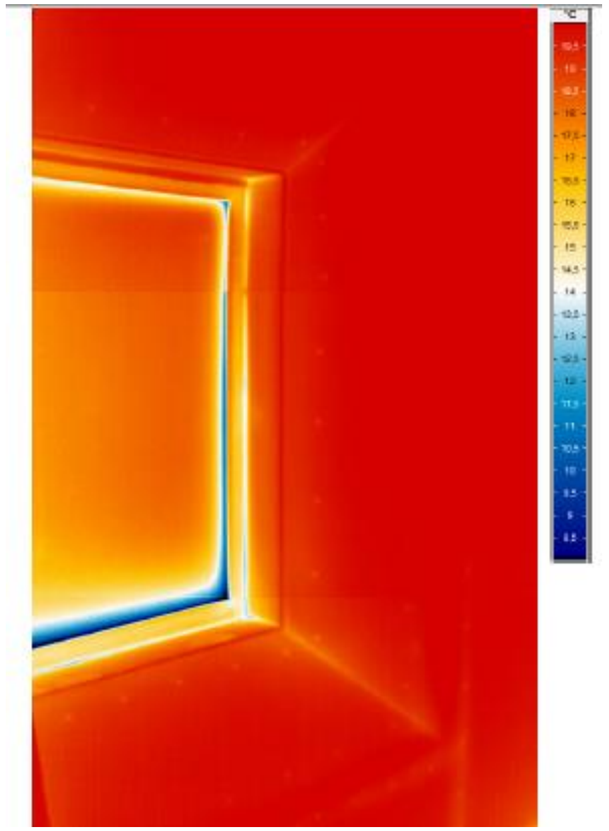


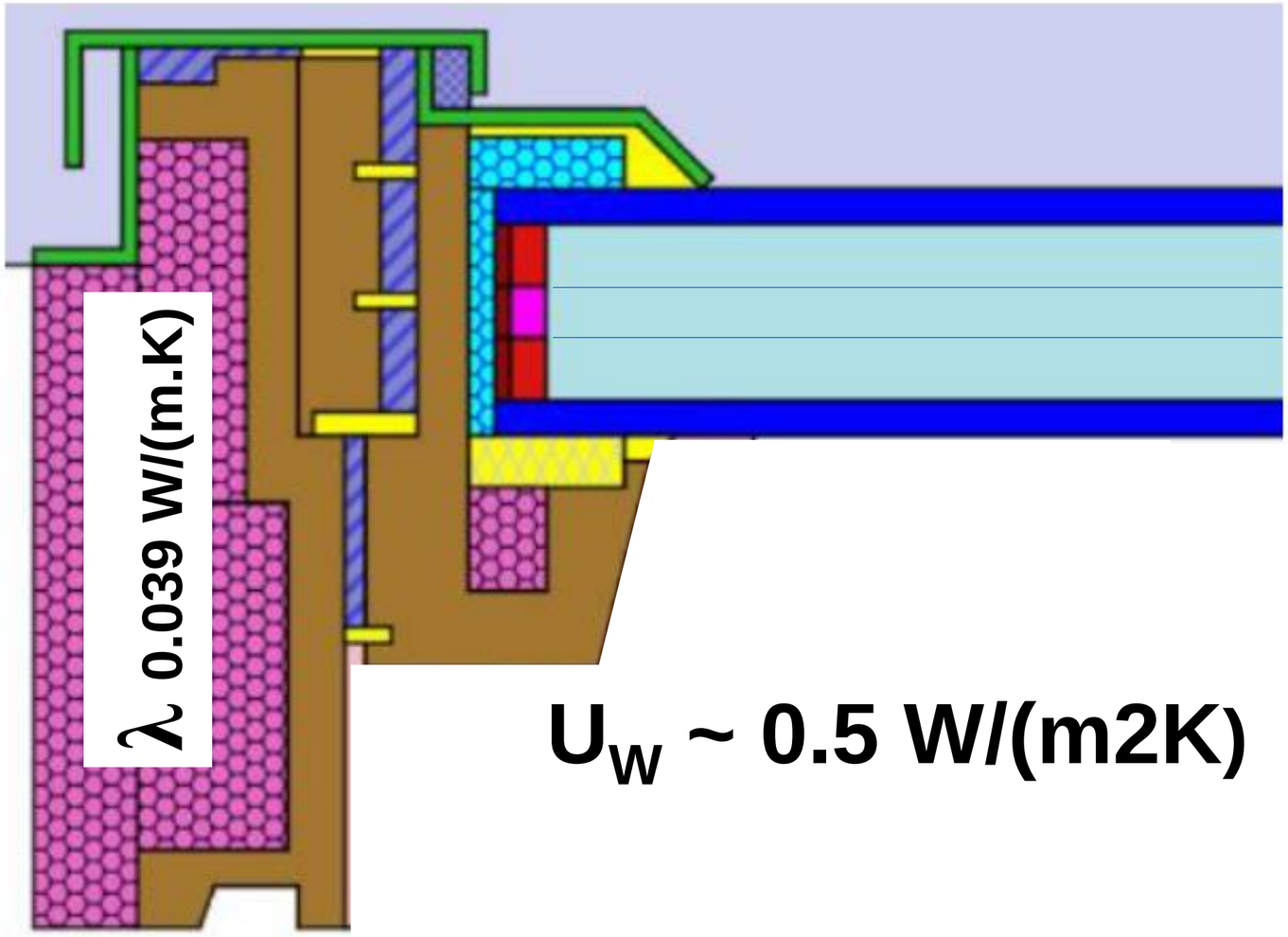
Uw 0.50 W/(m²K)

$U_{w,inst}$ 0.72 W/(m²K)

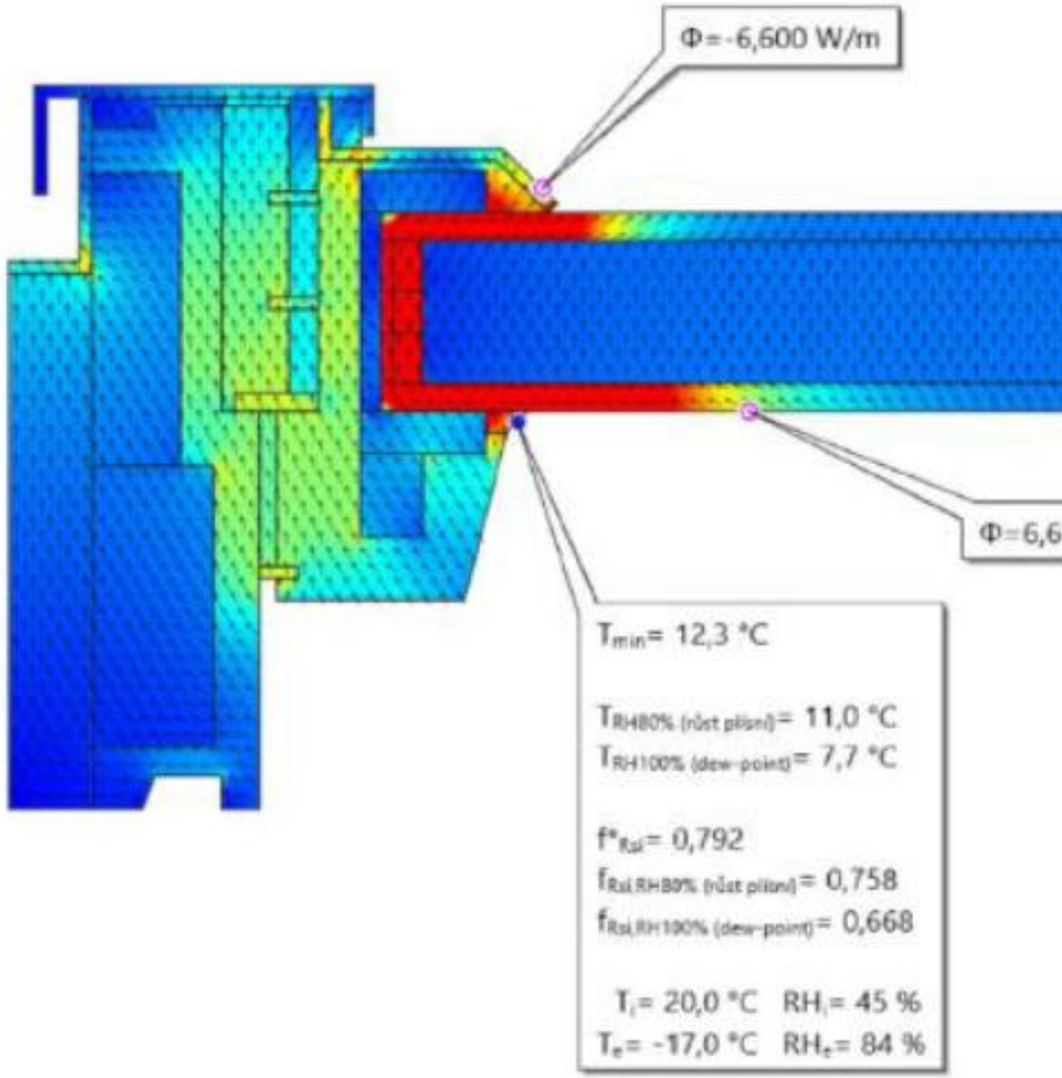
$$U_w = \frac{A_g.U_g + A_f.U_f + \Sigma(\psi_g.l_g)}{A_g + A_f}$$







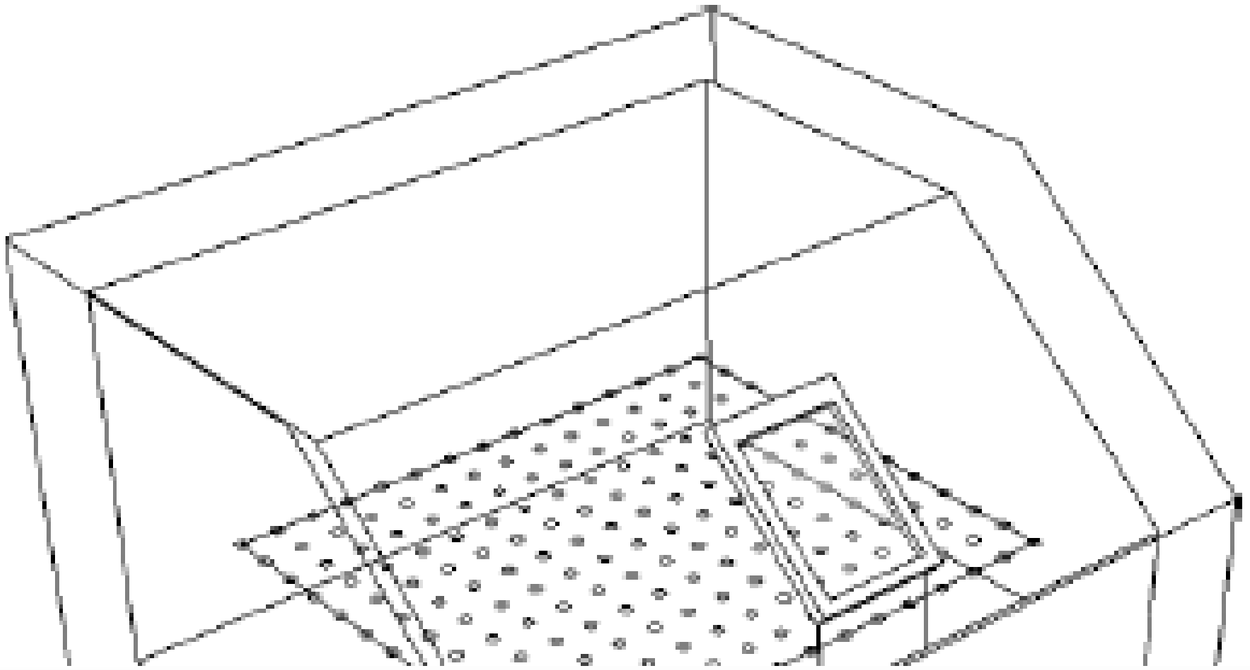
U_W ~ 0.5 W/(m2K)

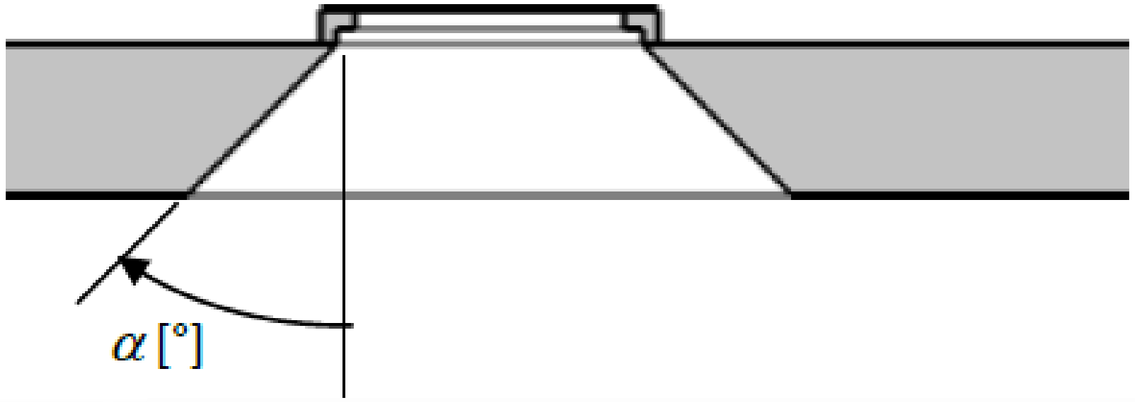


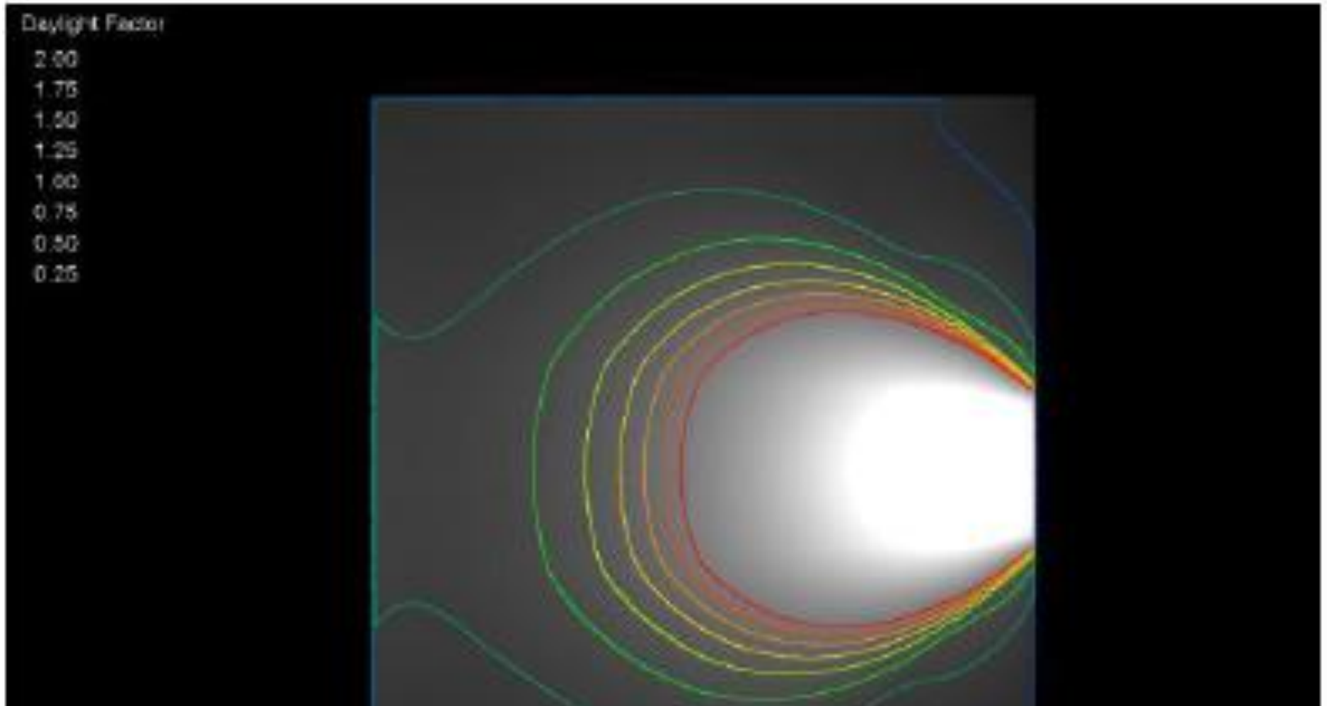
U_F ~ 0.6 W/(m2K)

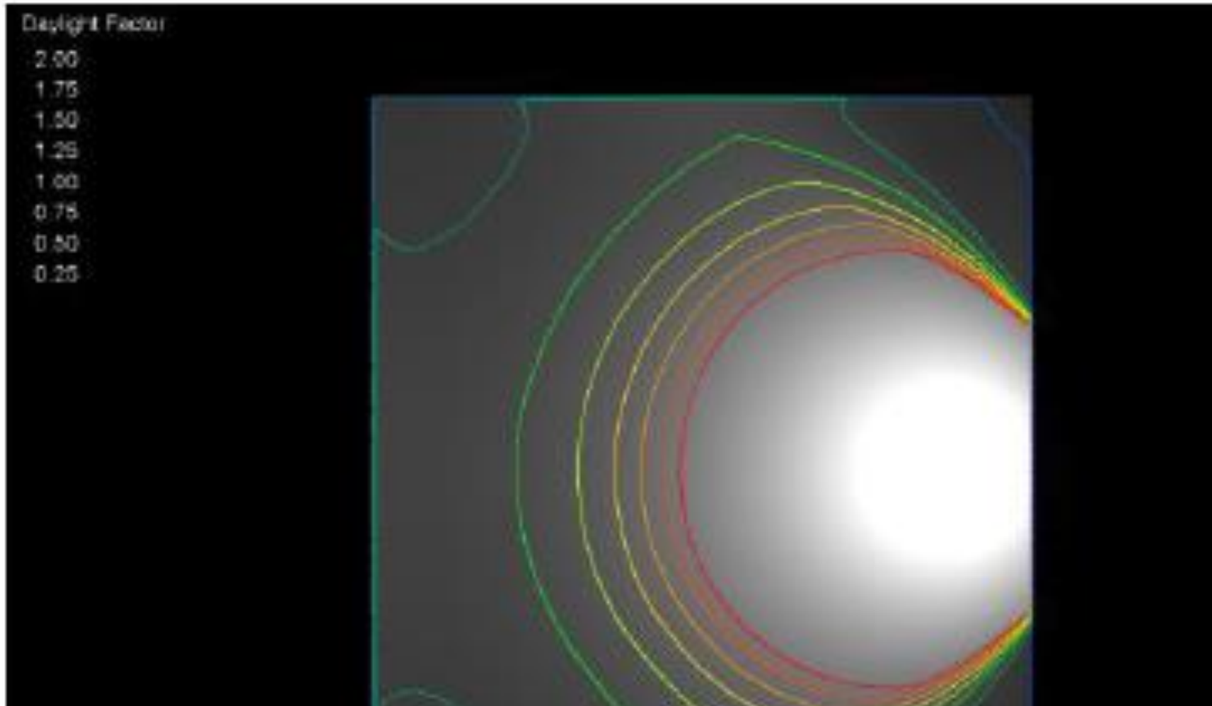
U_g 0.3 W/(m2K)

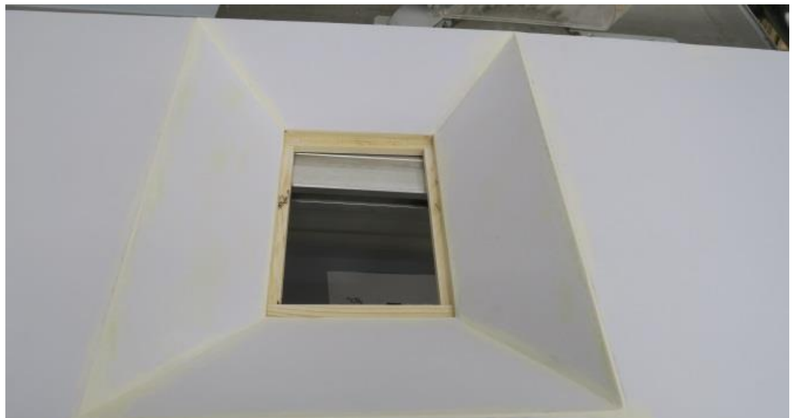

SONIC

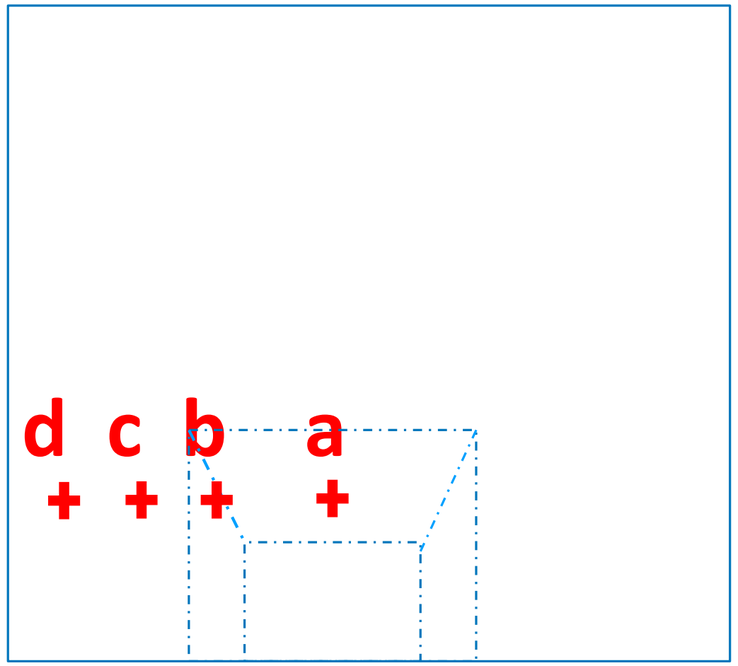


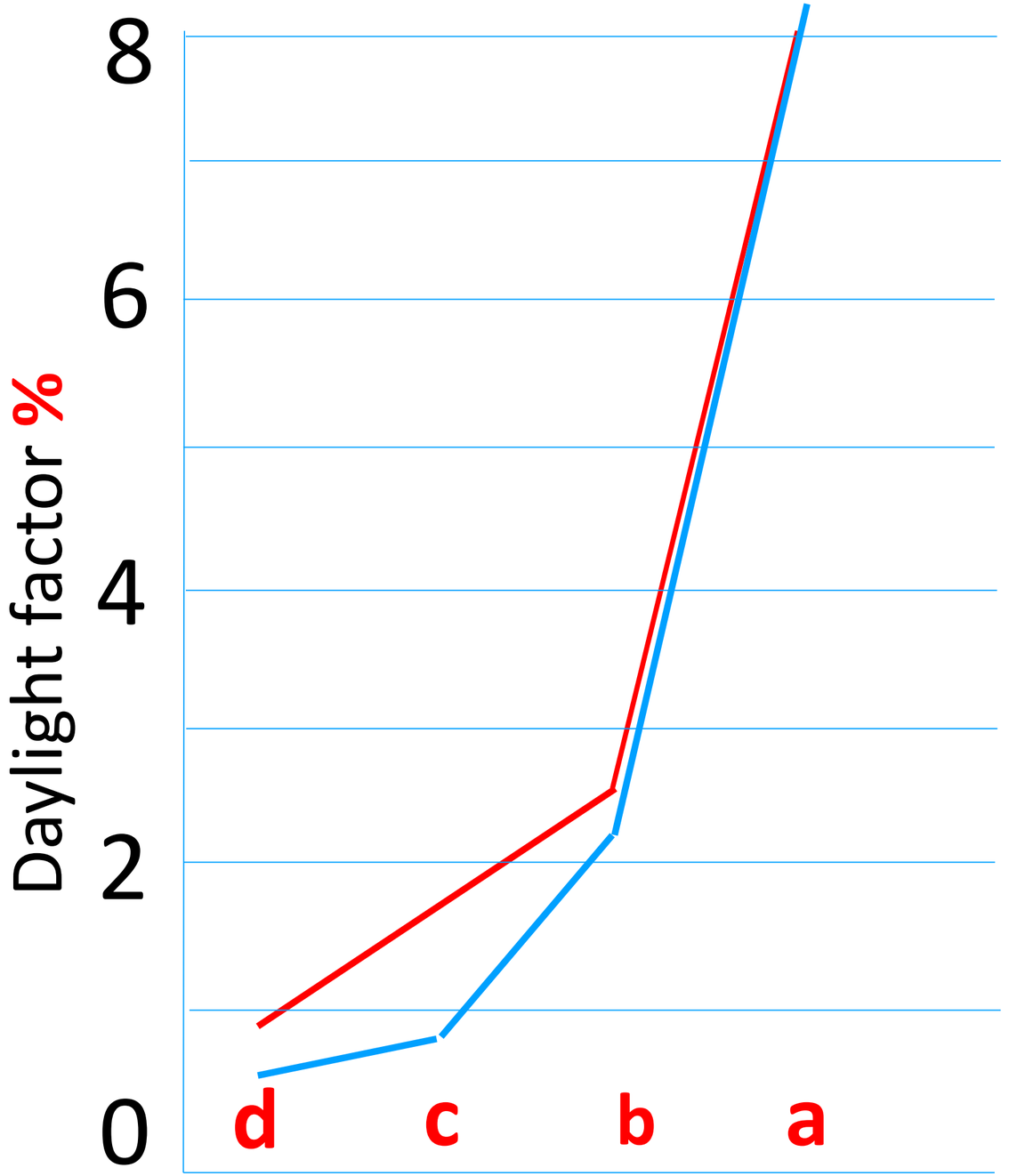

α [°]


Daylight Factor
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25

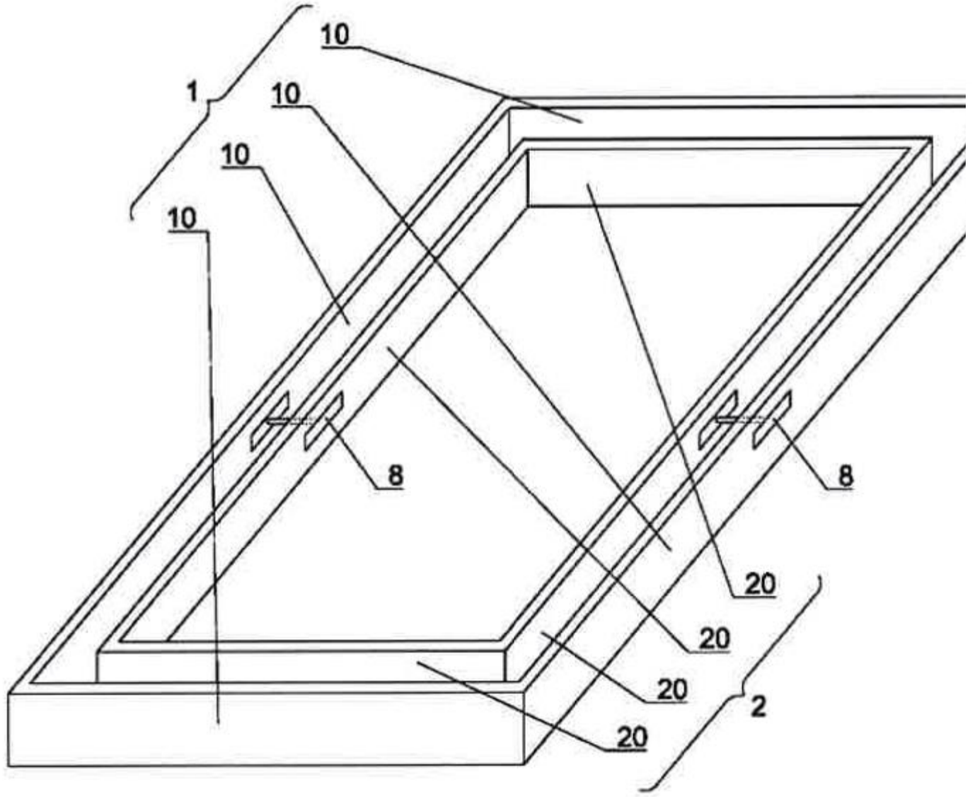

Daylight Factor
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25

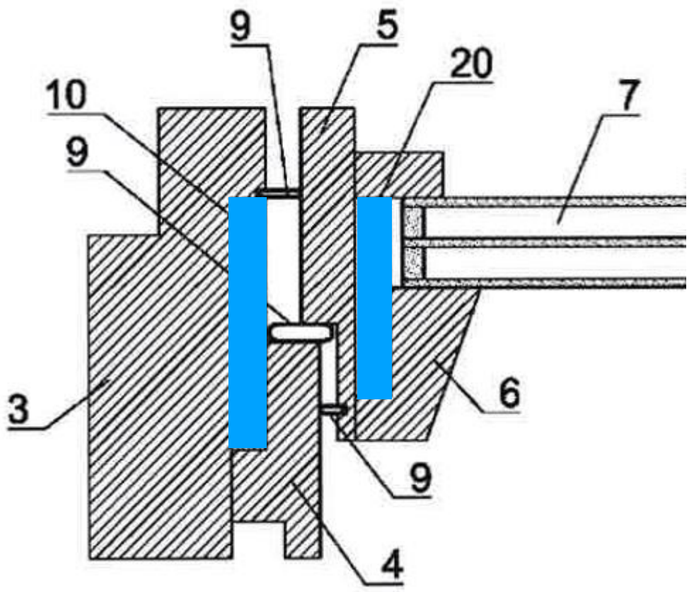



d
c
b
a


Daylight factor %
8
6
4
2
0
d
c
b
a

ROOF WINDOW – following steps





Obr. 1

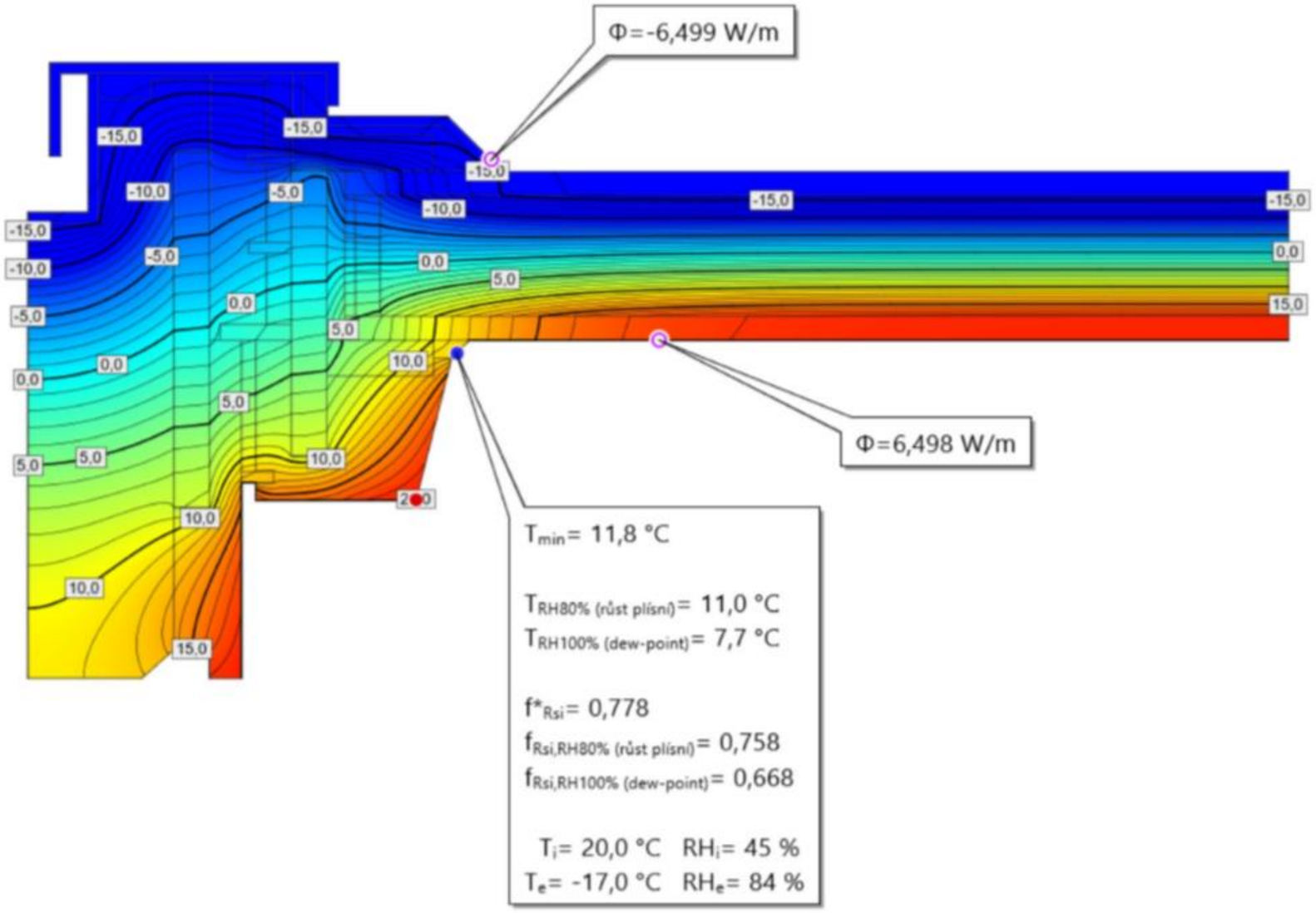
„two box solution“ for structural elements

Laminated veneer lumber (LVL) or plastic composite (glass fibers)

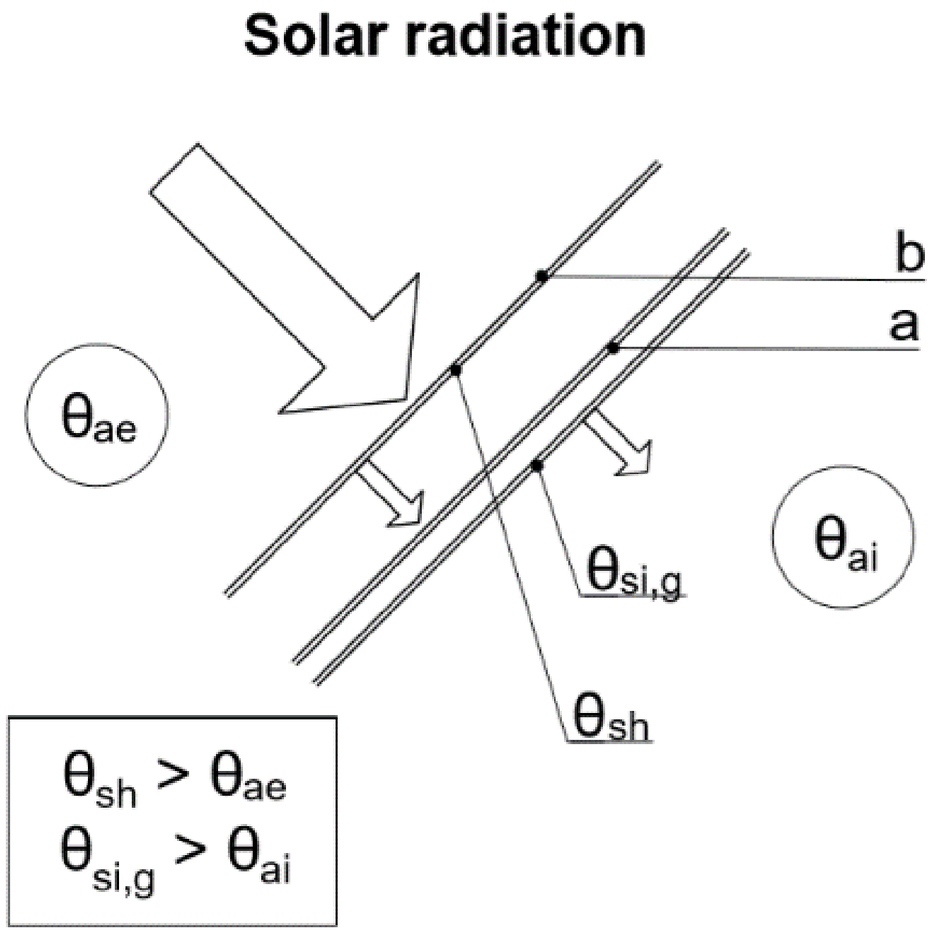
+ hardened polystyrene, both sides

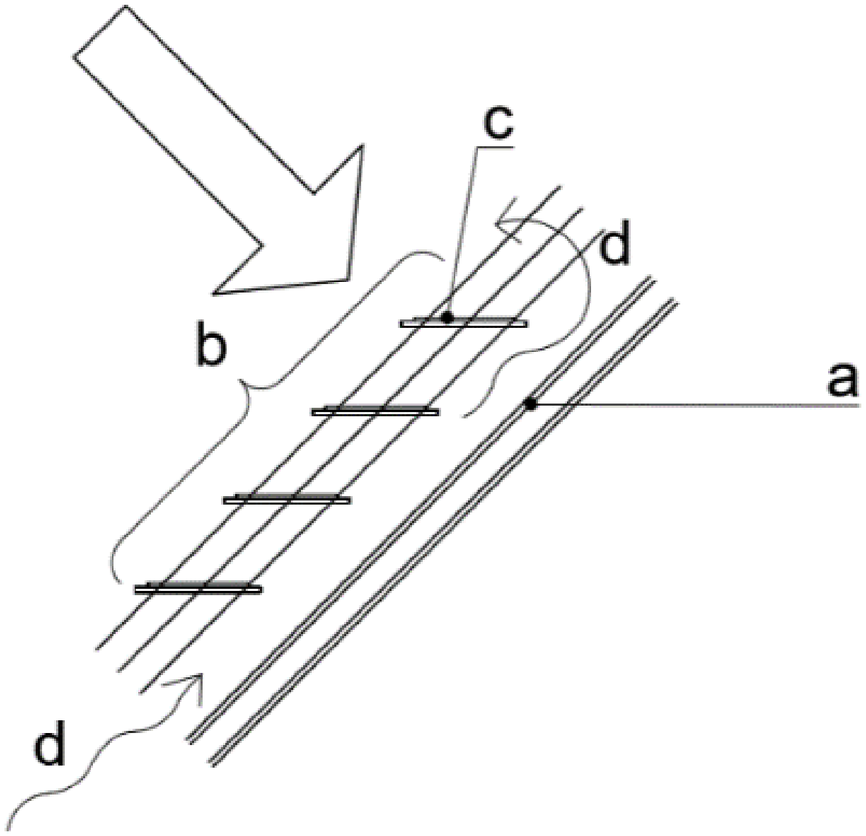
U approx. 0.45 W/(m2.K) ???

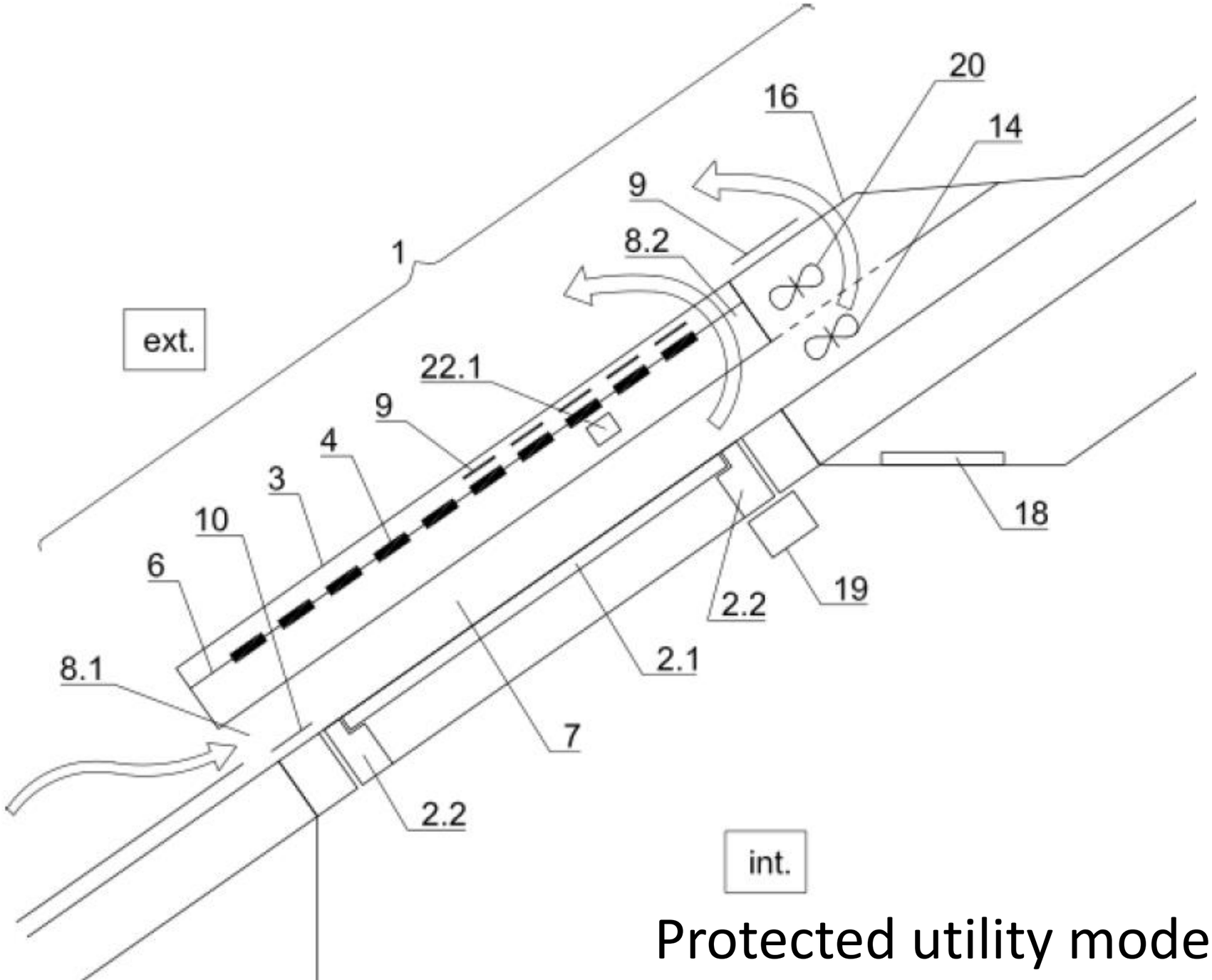
Protected utility model


Φ=-6,499 W/m
-15,0
-10,0
-5,0
0,0
5,0
10,0
15,0
Φ=6,498 W/m
T_{min}= 11,8 °C
$T_{RH80\%\ (růst\ plísní)}$= 11,0 °C
$T_{RH100\%\ (dew\text{-}point)}$= 7,7 °C
f^*_{Rsi}= 0,778
$f_{Rsi,RH80\%\ (růst\ plísní)}$= 0,758
$f_{Rsi,RH100\%\ (dew\text{-}point)}$= 0,668
T_i= 20,0 °C RH_i= 45 %
T_e= -17,0 °C RH_e= 84 %

ROOF WINDOW: shading







Protected utility model /Patent

Concluding remarks

Roof window (U 0.7 W/(m2.K)) ready for production

U 0.5 W/(m2K) reachable

Effects of thermal coupling relatively larger

Slanted lining OK

R&D continue

Focus on advanced construction and controlled shading

Open questions: how realistic are the surface heat transfer phenomena?

For building design: Compensation principles in *U mean* needed!

LCA (different scale) needed

More about: Tywoniak, J. at al. The Application of Building Physics in the Design of Roof Windows. *Energies.* Vol.12 Issue 12 Article Nr.2300

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Thank you for your attention!