

Shortwave Studies with RADIANCE in the Historic Center of Bayonne

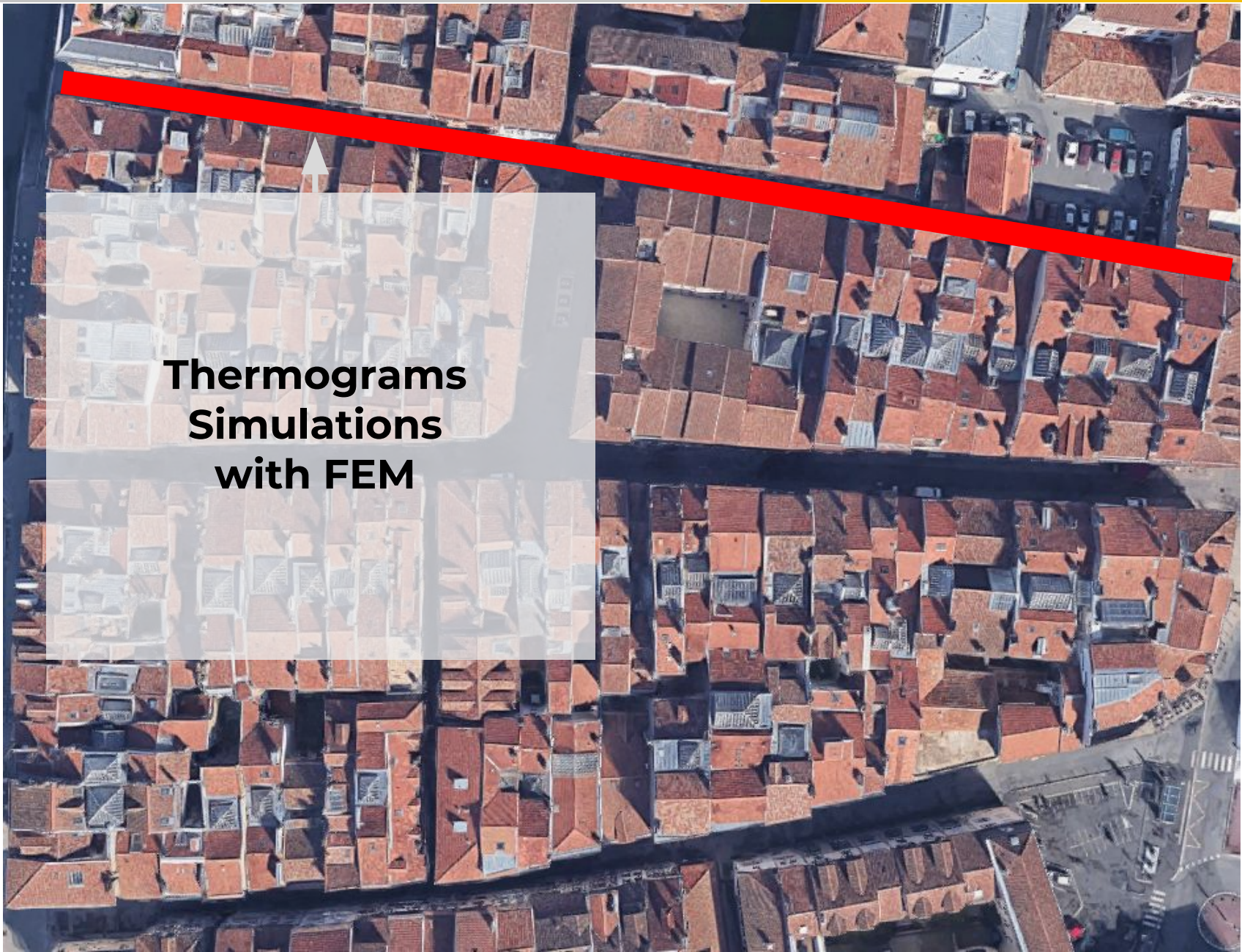
Antoine Bugeat^a, Benoit Beckers^a, Eduardo Fernández^b

Radiance International Workshop, Loughborough 2018

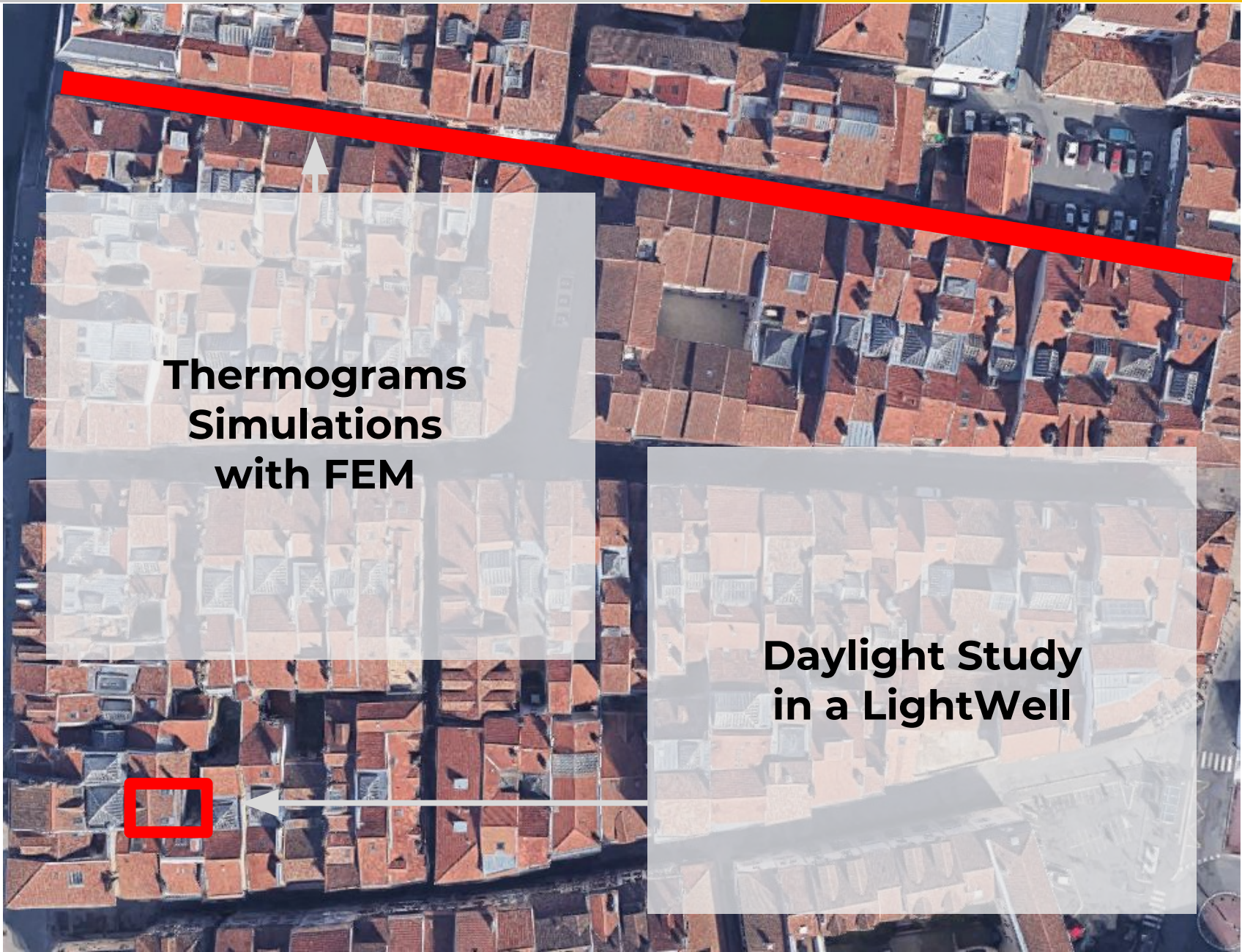
^a Urban Physics Joint Laboratory, Université de Pau et des Pays de l'Adour, E2S UPPA. Anglet, France

^b Instituto de Computación, Universidad de la República, Montevideo, Uruguay



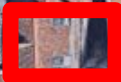


**Thermograms
Simulations
with FEM**



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Simulations
with FEM**

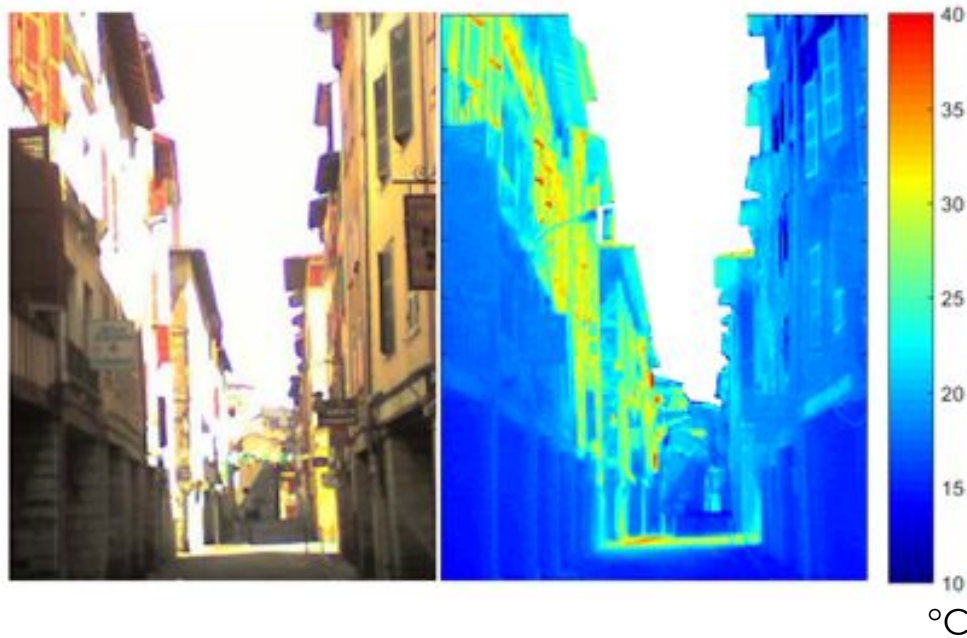
**Daylight Study
in a LightWell**



Thermograms Simulations with FEM

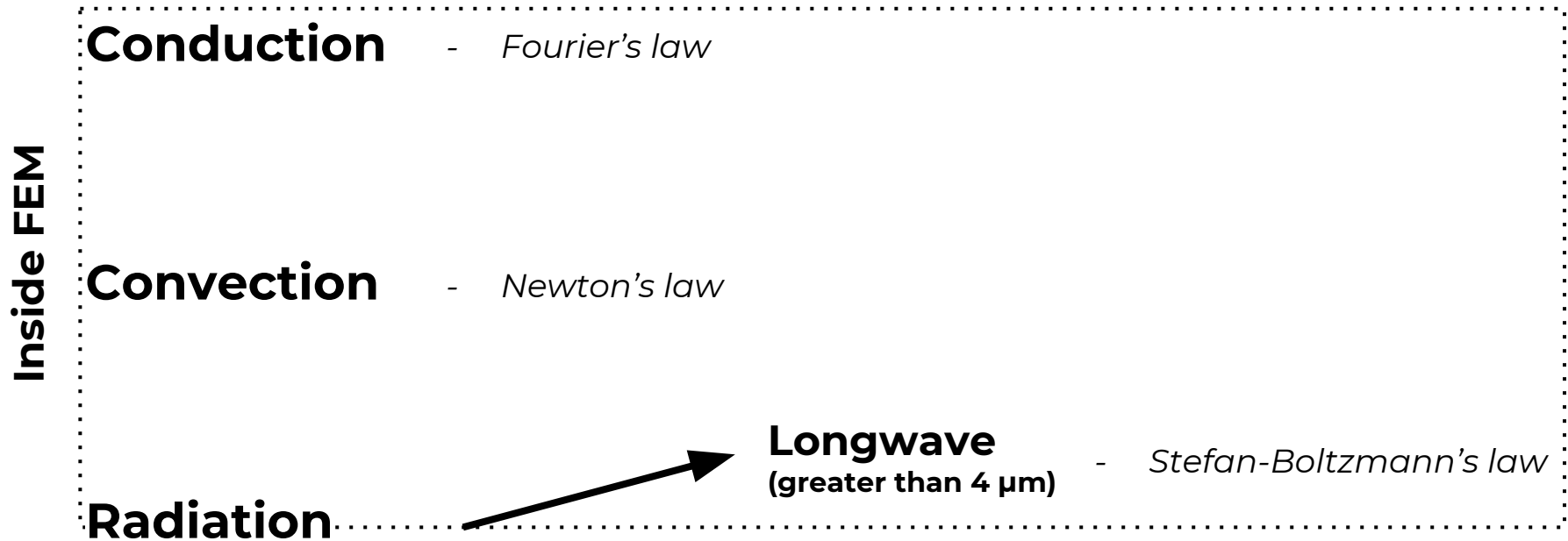
Photograph

Thermogram

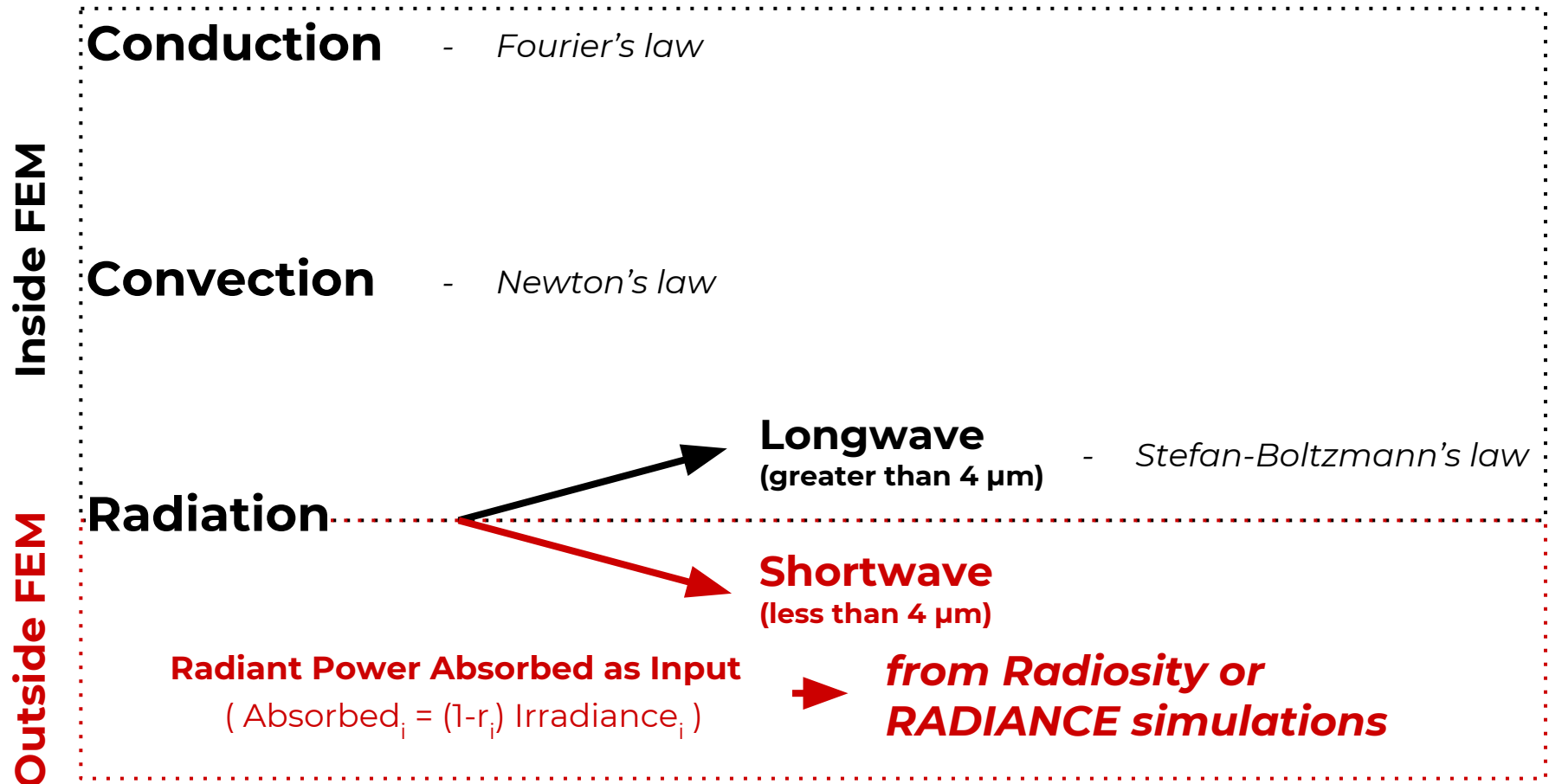


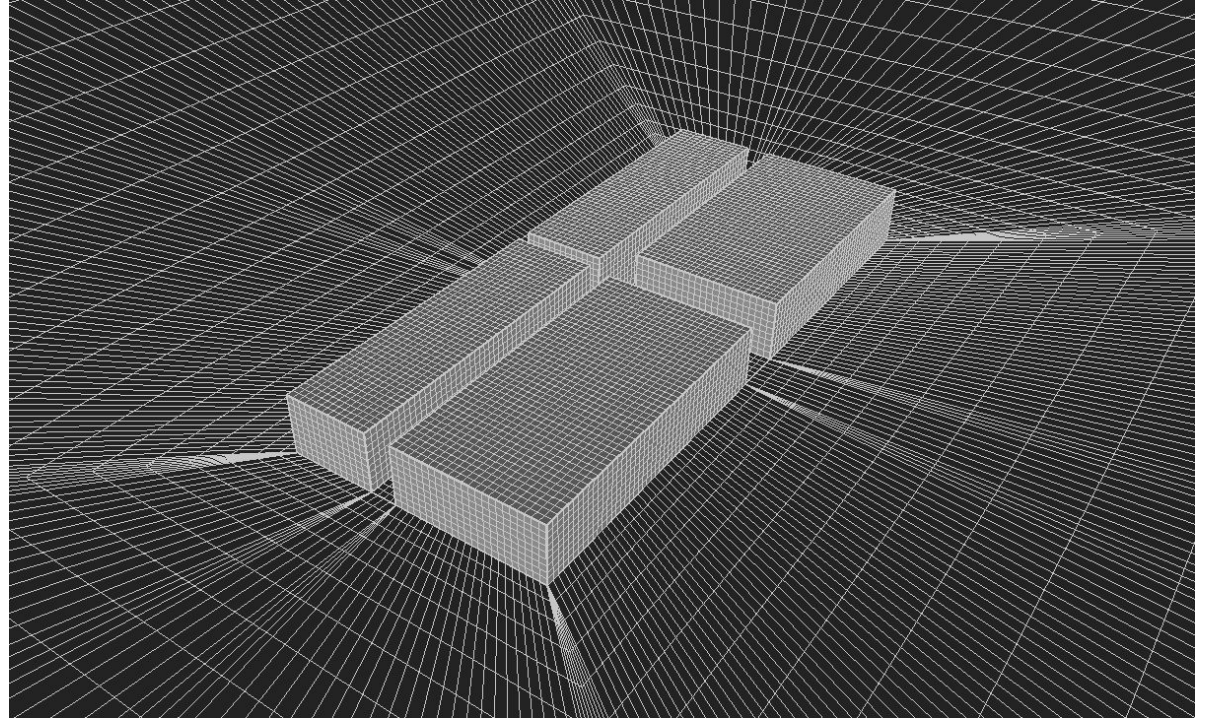
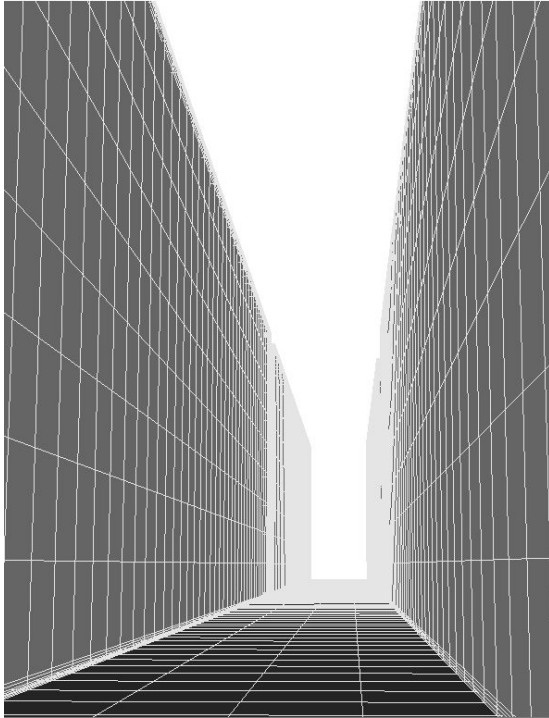
Photograph (left) and Thermogram (right) of Bayonne street at 13h

Thermograms Simulations with FEM



Thermograms Simulations with FEM





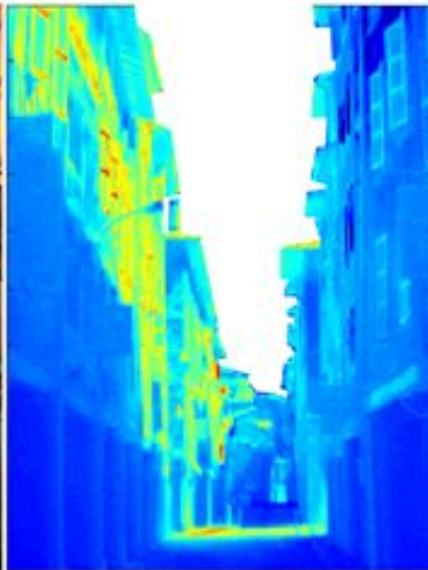
Views of the simplified model of the street

Thermograms Simulations with FEM

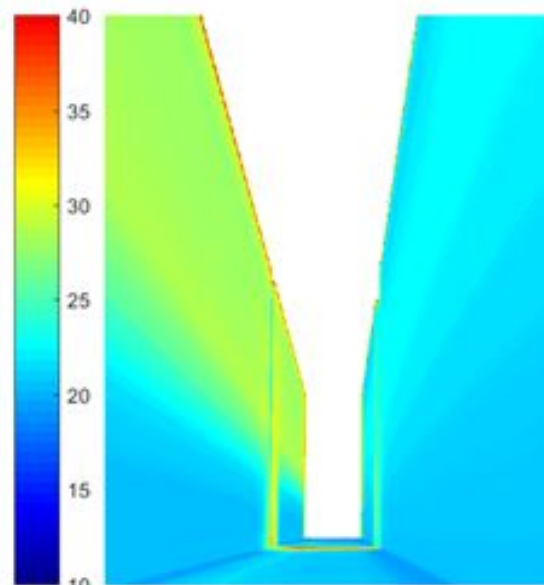
Photograph



Thermogram

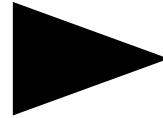
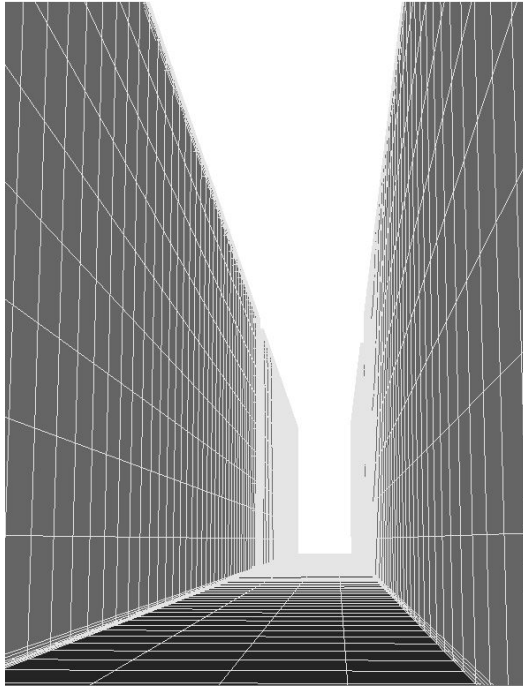


Simulated Thermogram



°C

Photograph (left), thermogram (center), and simulated thermogram (right) of Bayonne street at 13h



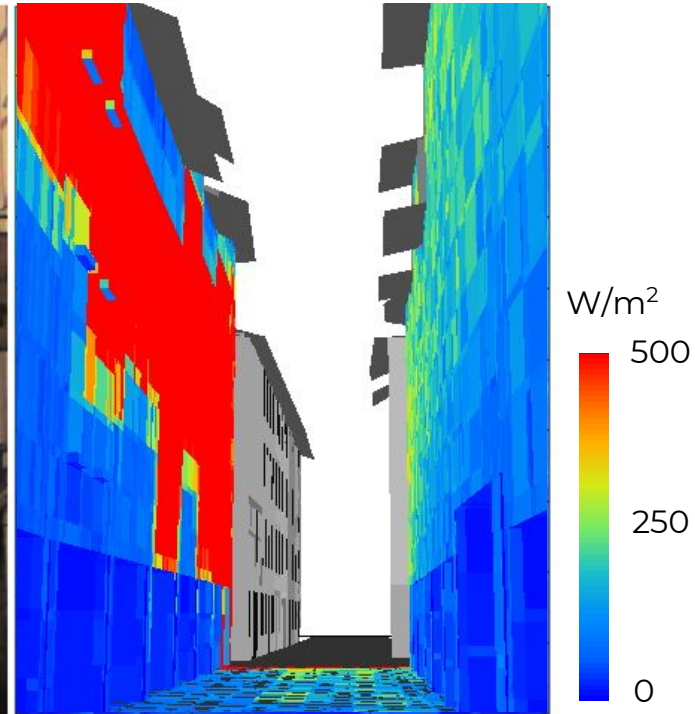
Improve the level of detail in:

- **Geometry**

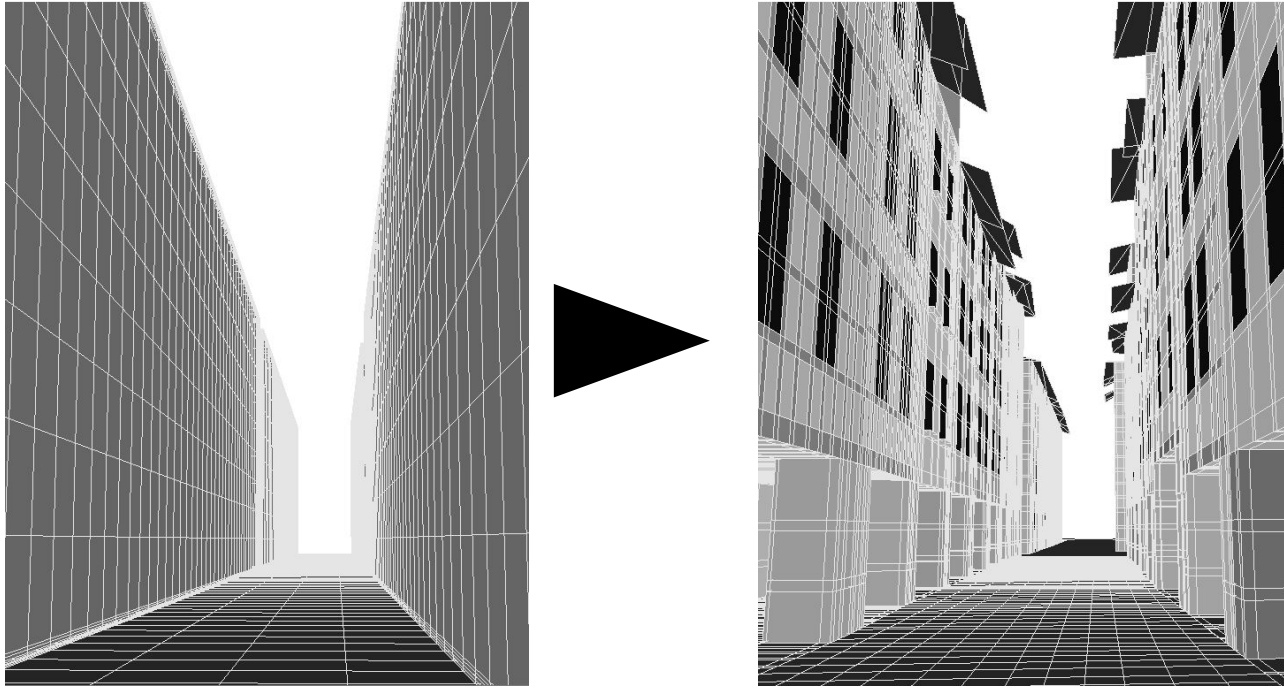
Photograph



Irradiance Map



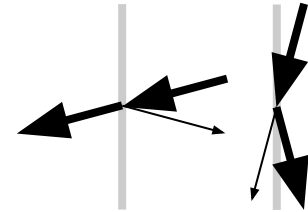
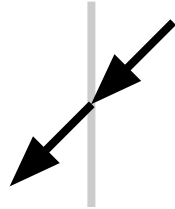
Photograph of Tonnelier street (left) and Irradiance map from rfluxmtx simulation (right) of Bayonne street at 13h

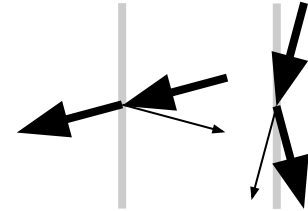
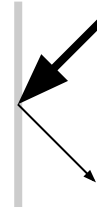
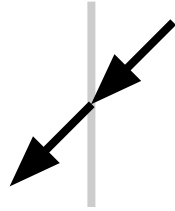


Improve the level of detail in:

- **Geometry**
- **Materials characteristics**

Reflectance heterogeneity
Transmittance and
Specular Reflection of windows





Materials	Specular Transmission	Specular Reflection	Fresnel's Law (angular dependence)
glass	X		X
trans			
mirror		X	
BRTDfunc	X	X	
BSDF	X	X	X
glass + mirror + brightfunc	X	X	X

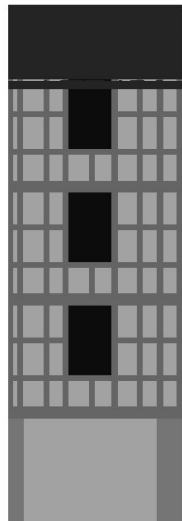


Irradiance maps of a North building facade during a April clear day at 13h

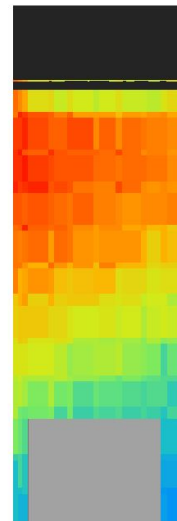
- Diffuse Reflections
- Specular Reflections

+ Diffuse Reflections
- Specular Reflections

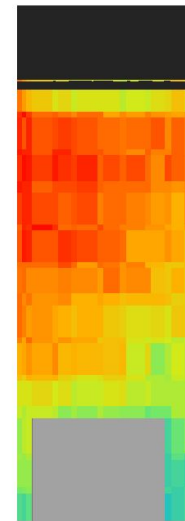
+ Diffuse Reflections
+ Specular Reflections



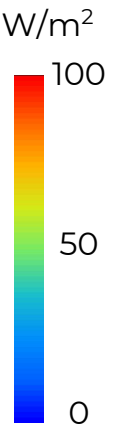
Mean: **7** W/m²



Mean: **67** W/m²



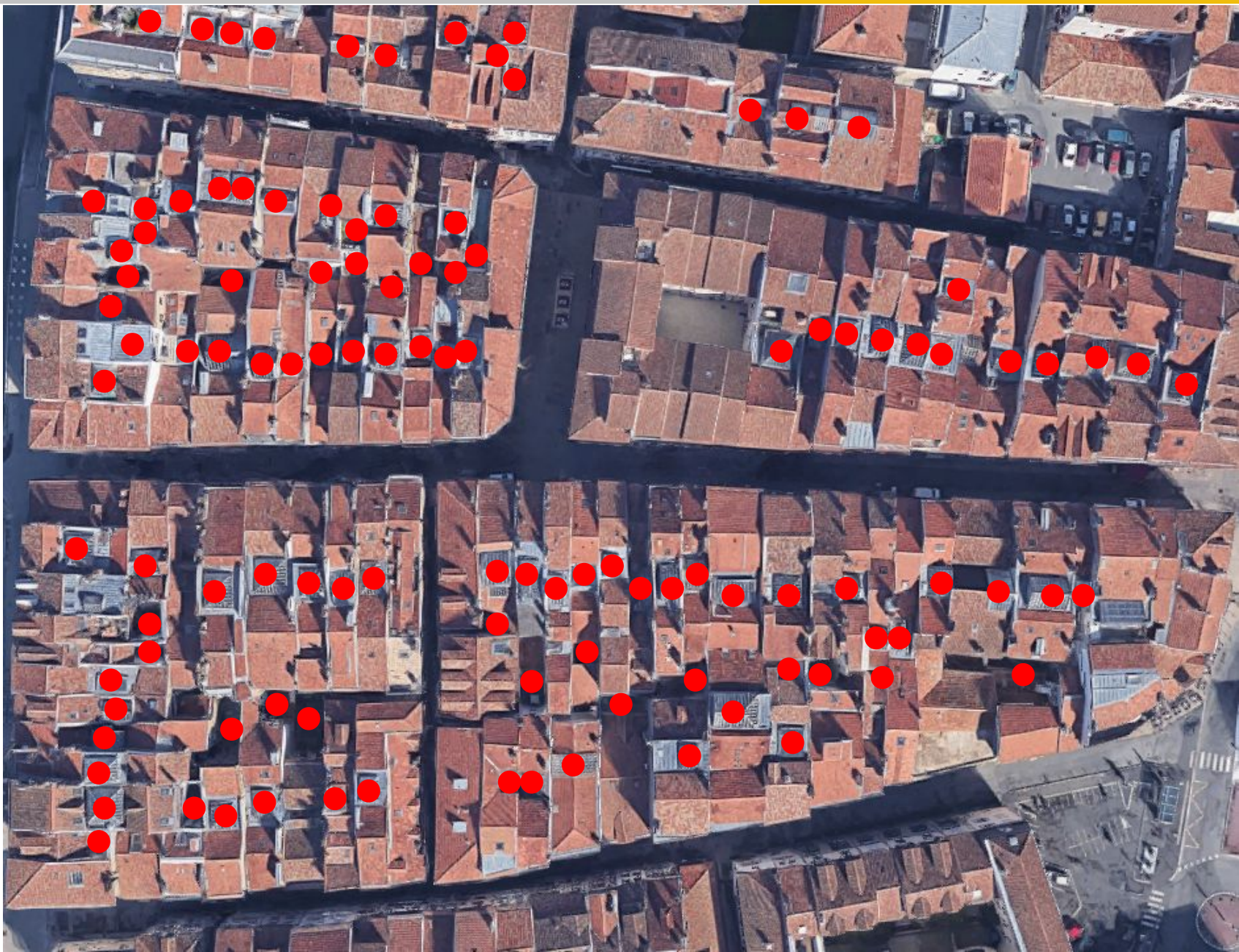
Mean: **74** W/m²

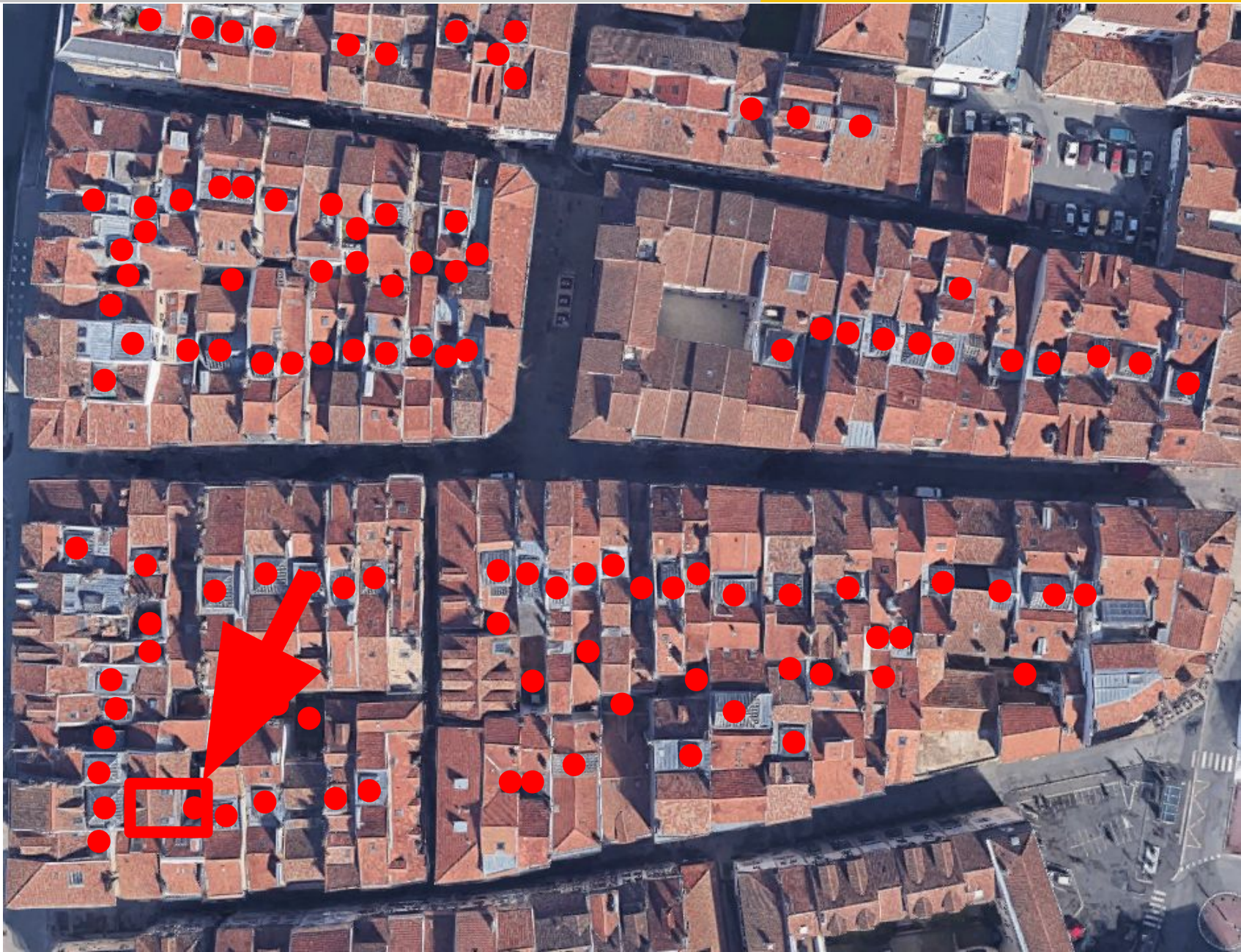


$\Delta \approx 10\%$

```
rfluxmtx -I -y ≈100000 -ab 7 -ad 100000
```



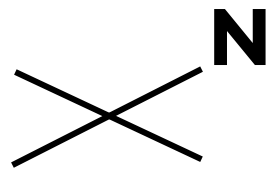
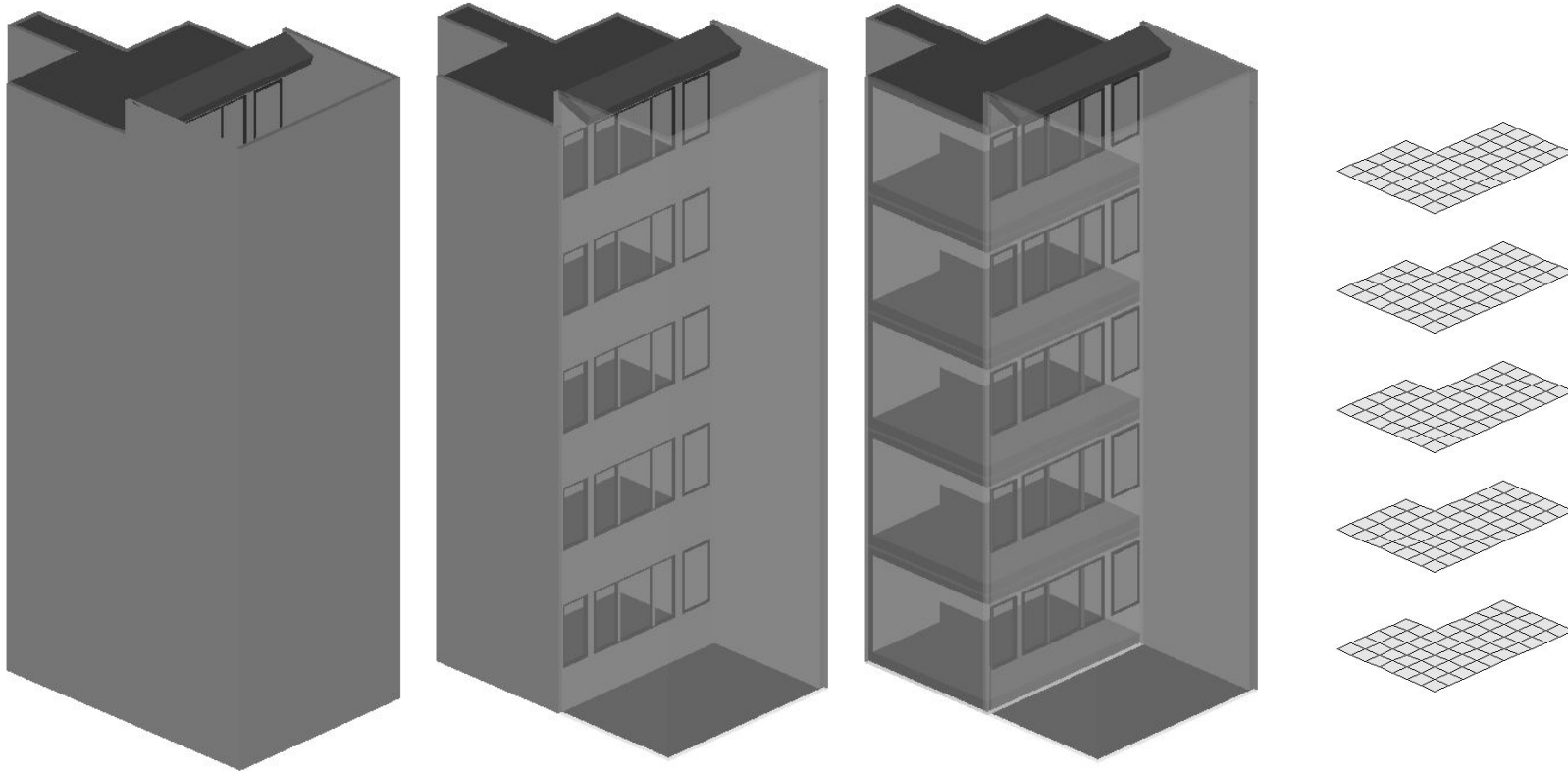




Model

Calcul

- UDI 100-2000 Lux
- Daylight Coefficients (2PM)
rfluxmtx





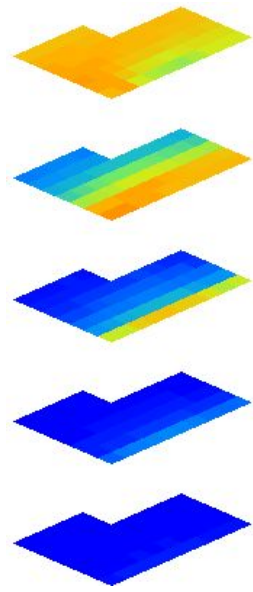




Base Model



UDI
100-2000



%Surf.
UDI > 50

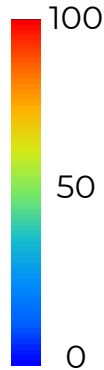
99%

50%

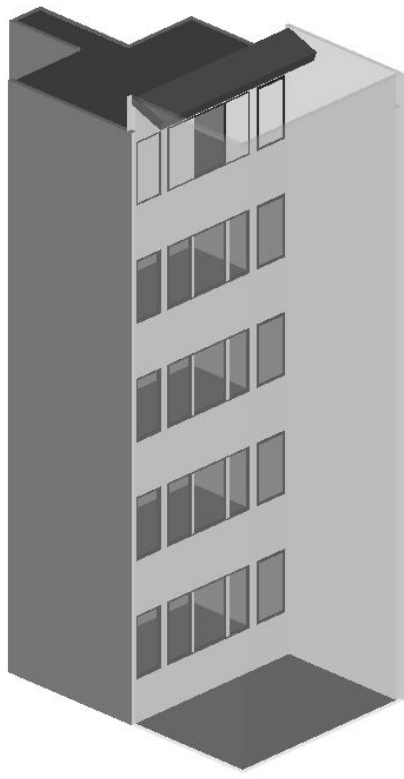
17%

0%

0%

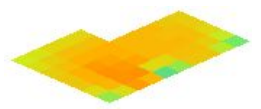


White Walls

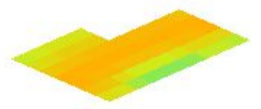


UDI
100-2000

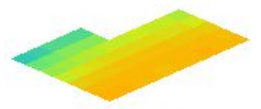
%Surf.
UDI > 50



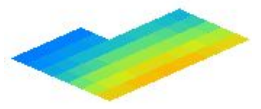
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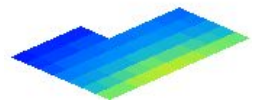
100%



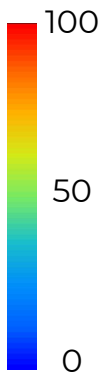
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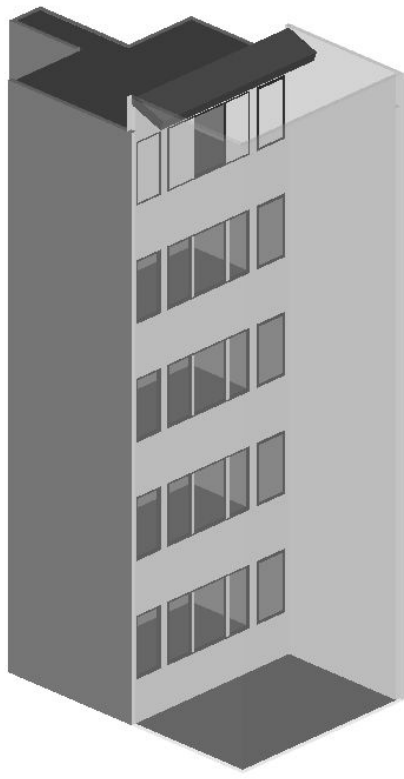
47%



10%

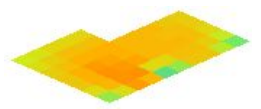


White Walls

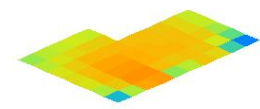


UDI
100-2000

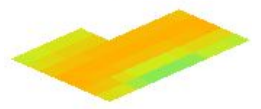
%Surf.
UDI > 50



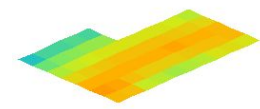
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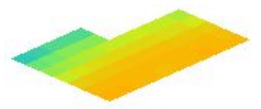
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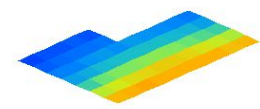
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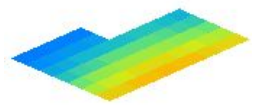
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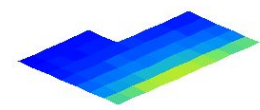
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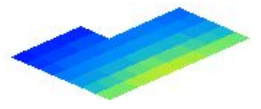
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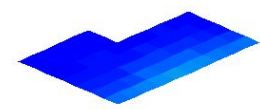
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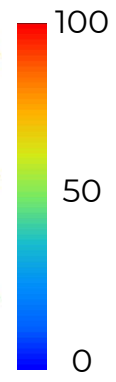
8%



10%



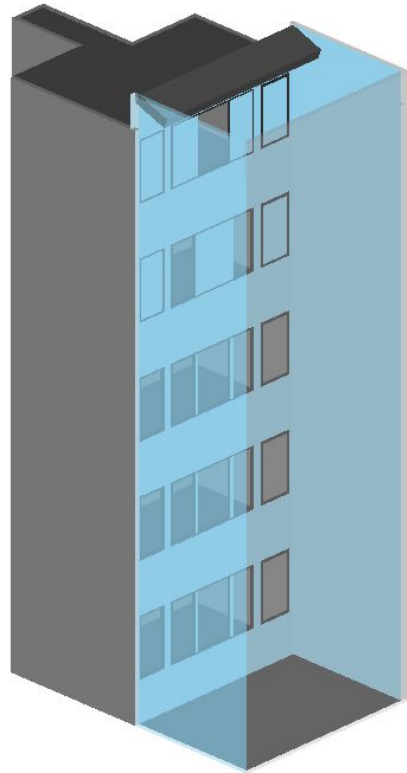
0%



-ab 13

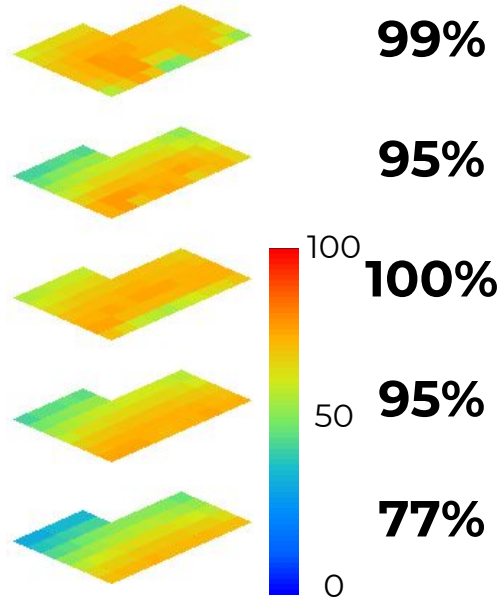
-ab 5

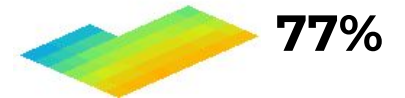
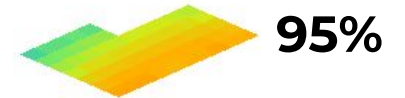
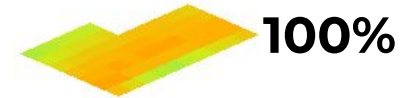
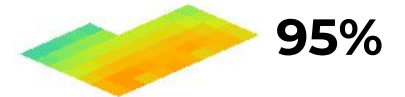
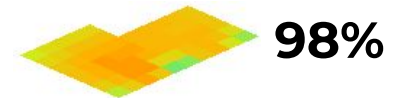
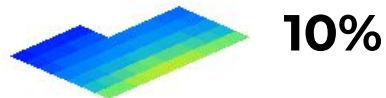
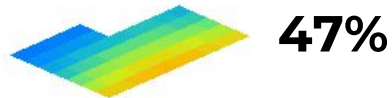
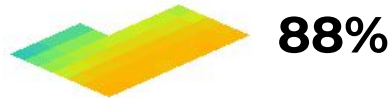
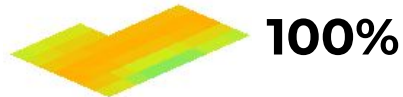
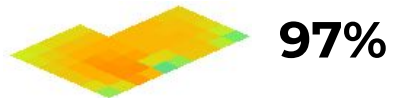
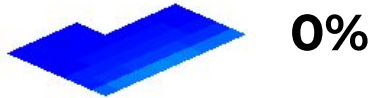
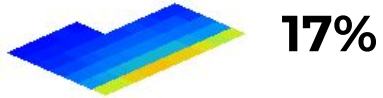
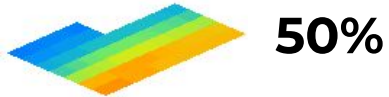
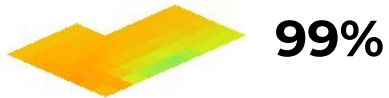
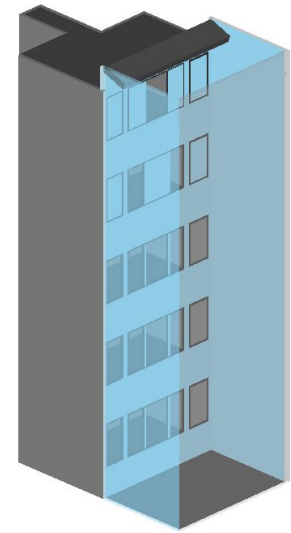
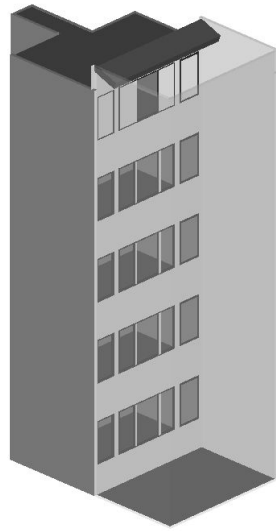
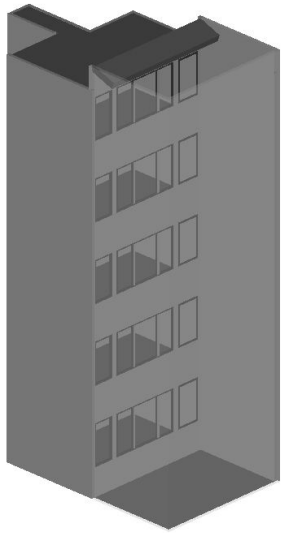
3 Mirror-Walls



UDI
100-2000

%Surf.
UDI > 50







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**Thank you for your
attention**