HOLISTIC DESIGN SOLUTIONS TO RESIDENTIAL BUILDINGS

MACH
Group

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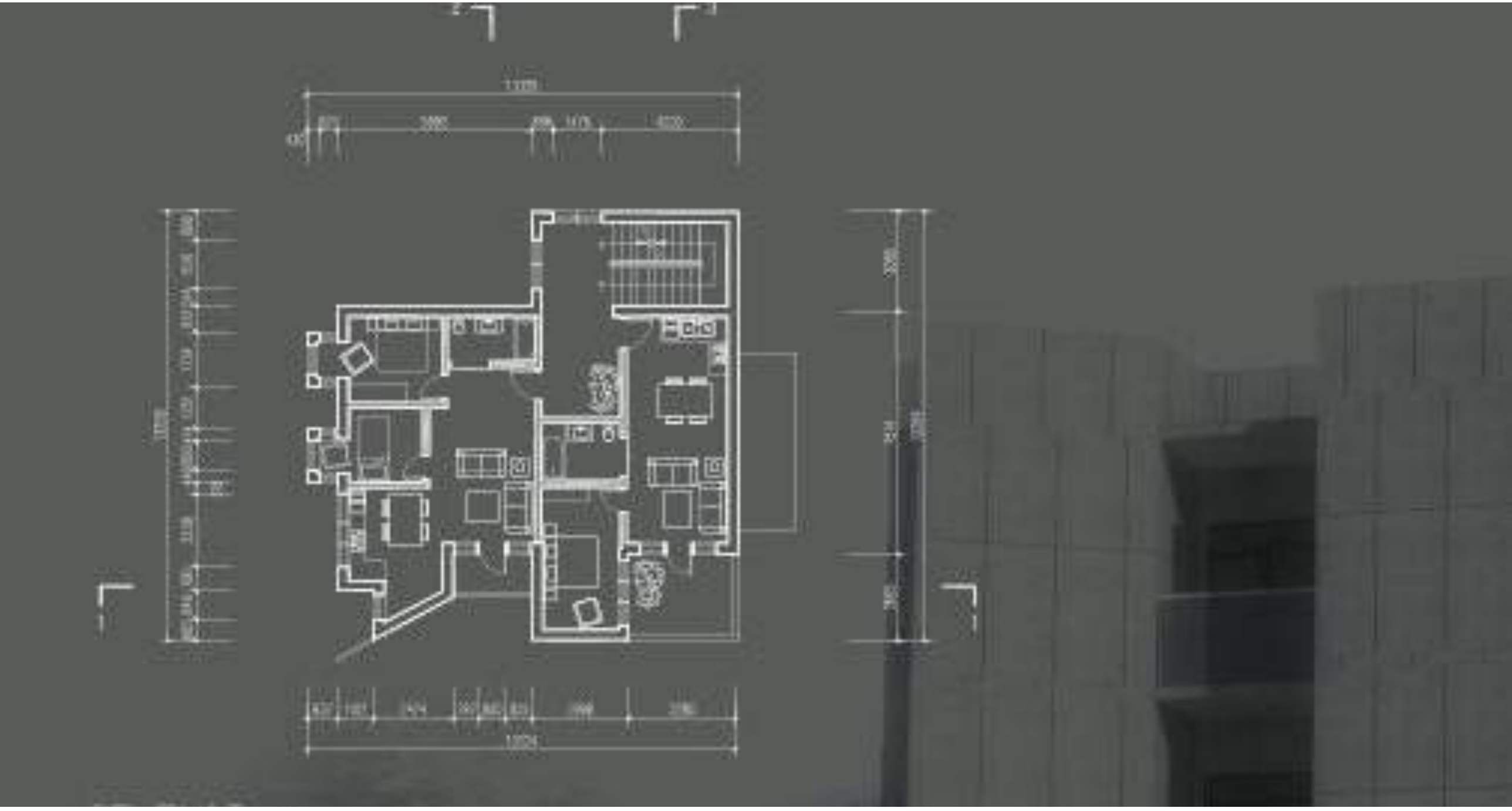

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Summary - Ventilation & Acoustics

Ventilation

Window opening

- **Open (free) areas should include any restrictors, and take into account any security, noise or air quality issues which reduce opening area**
  - **Windows should only be modelled as open when rooms are scheduled to be occupied, unless secure openings are provided**
- **Internal doors can be included and open as modelled as open during waking hours to improve cross-ventilation**

Summary - Ventilation & Acoustics

Key overheating risk factors in homes

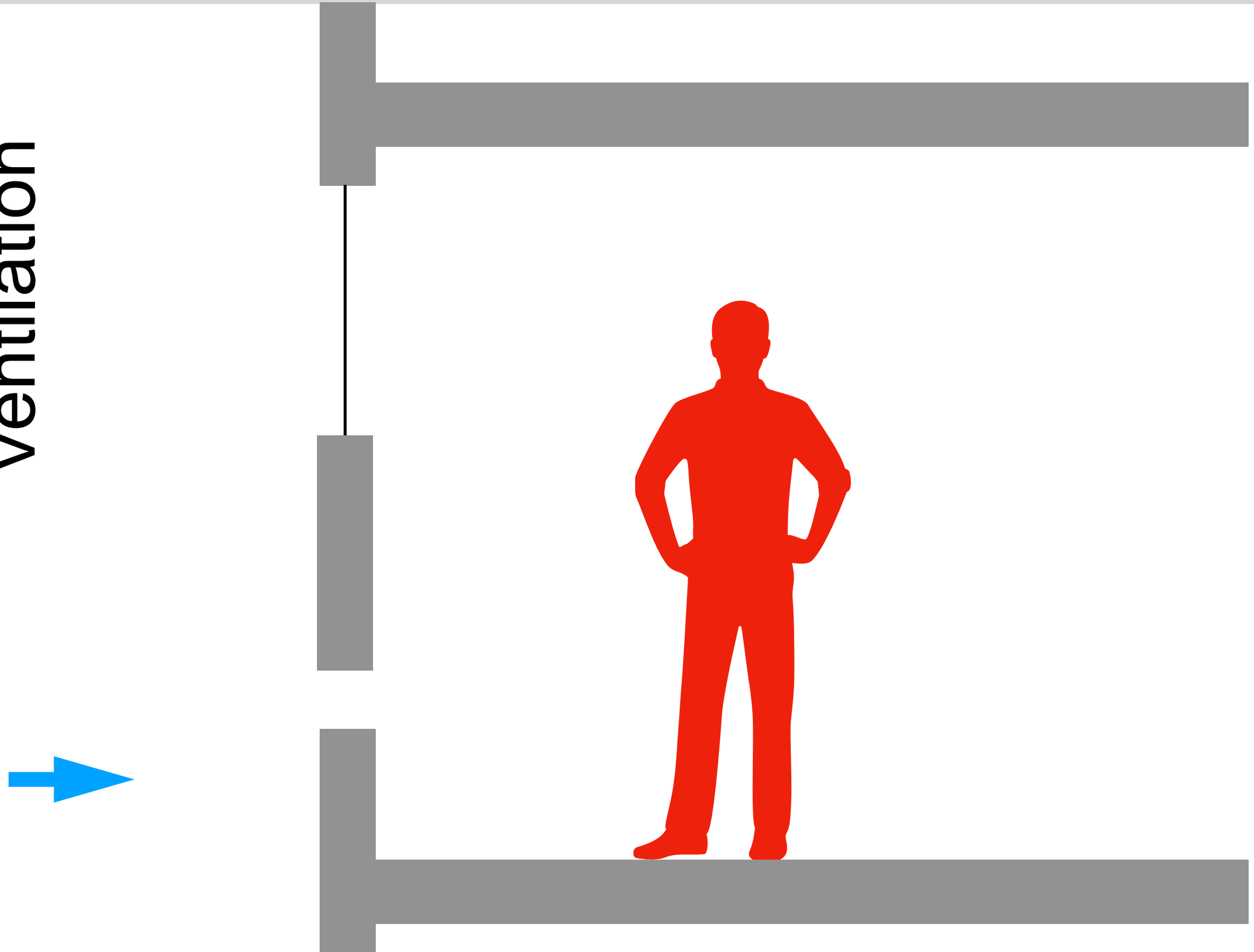
- **Single aspect**
  - **No cross-ventilation – so openings need to be larger**
- **Large areas of glazing**
  - **Greenhouse effects**
  - **Solar gain has large radiative component which is not removed with ventilation**
- **Limited ventilation**
  - **Restricted openings due to:**
    - **Health and safety concerns (tall buildings)**
    - **Noise**
    - **Poor air quality**

Open (free) areas

Air flow

Open (free) area

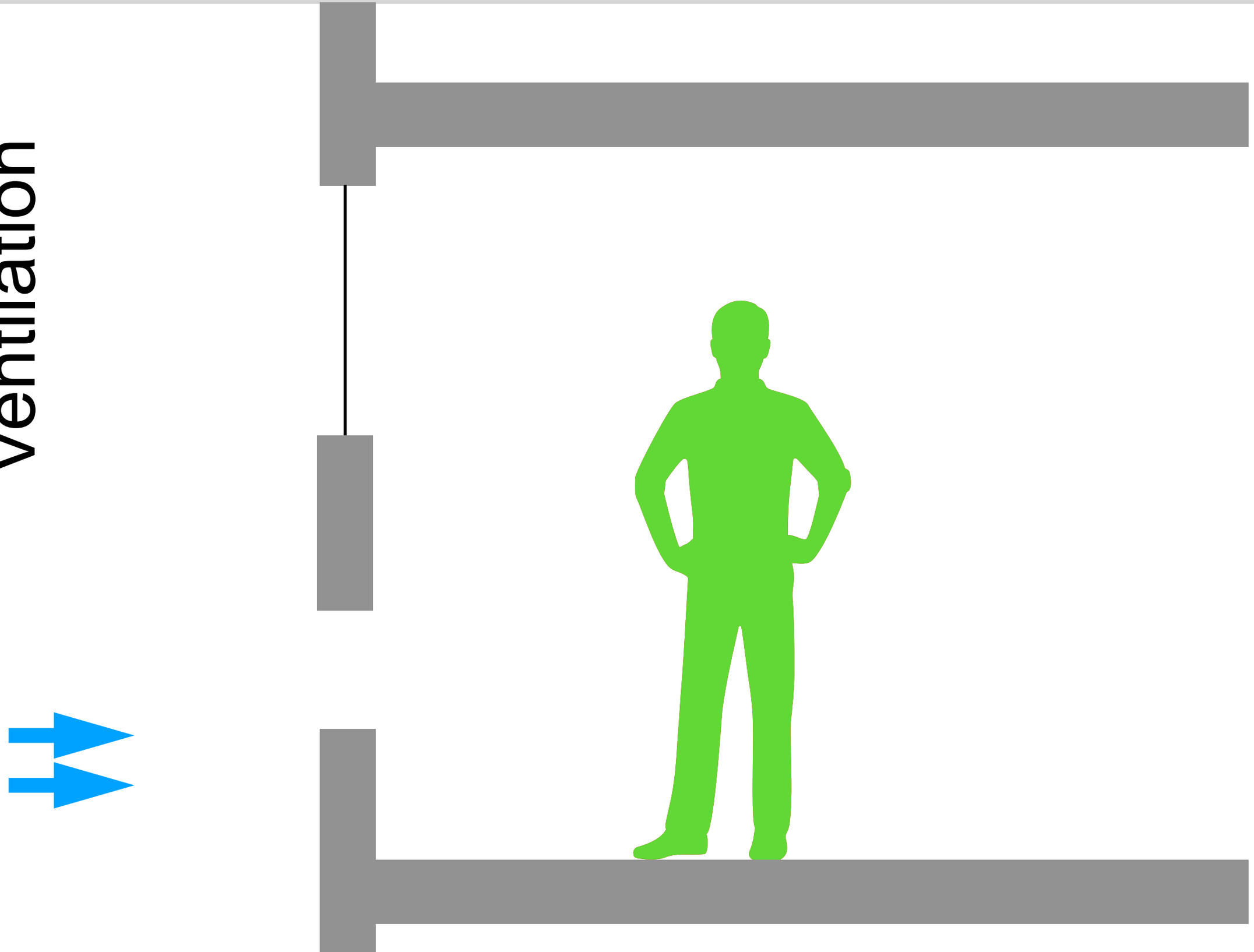
Ventilation



Air flow

Open (free) area

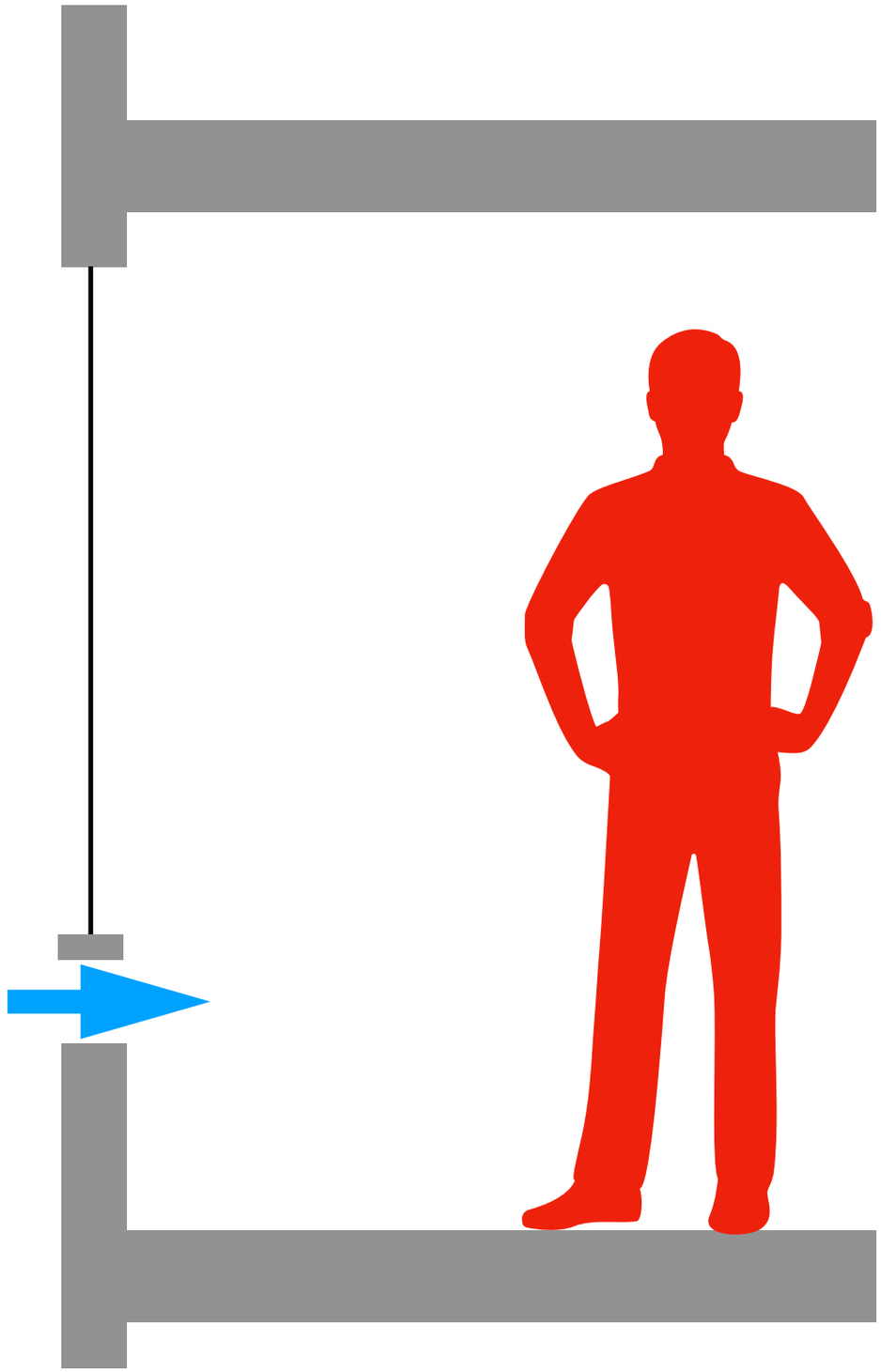
Ventilation

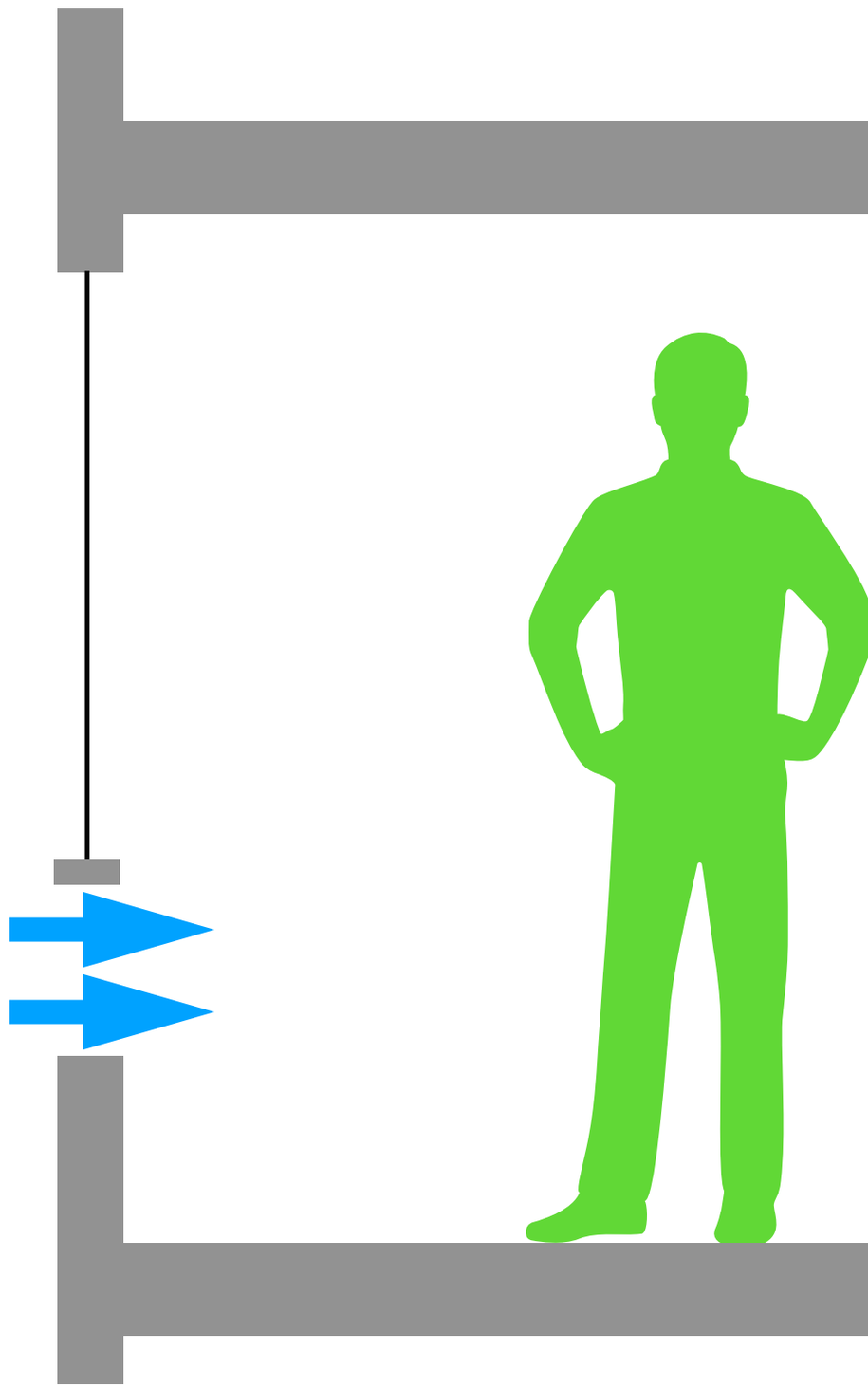


Summary

Open (free) area

Ventilation

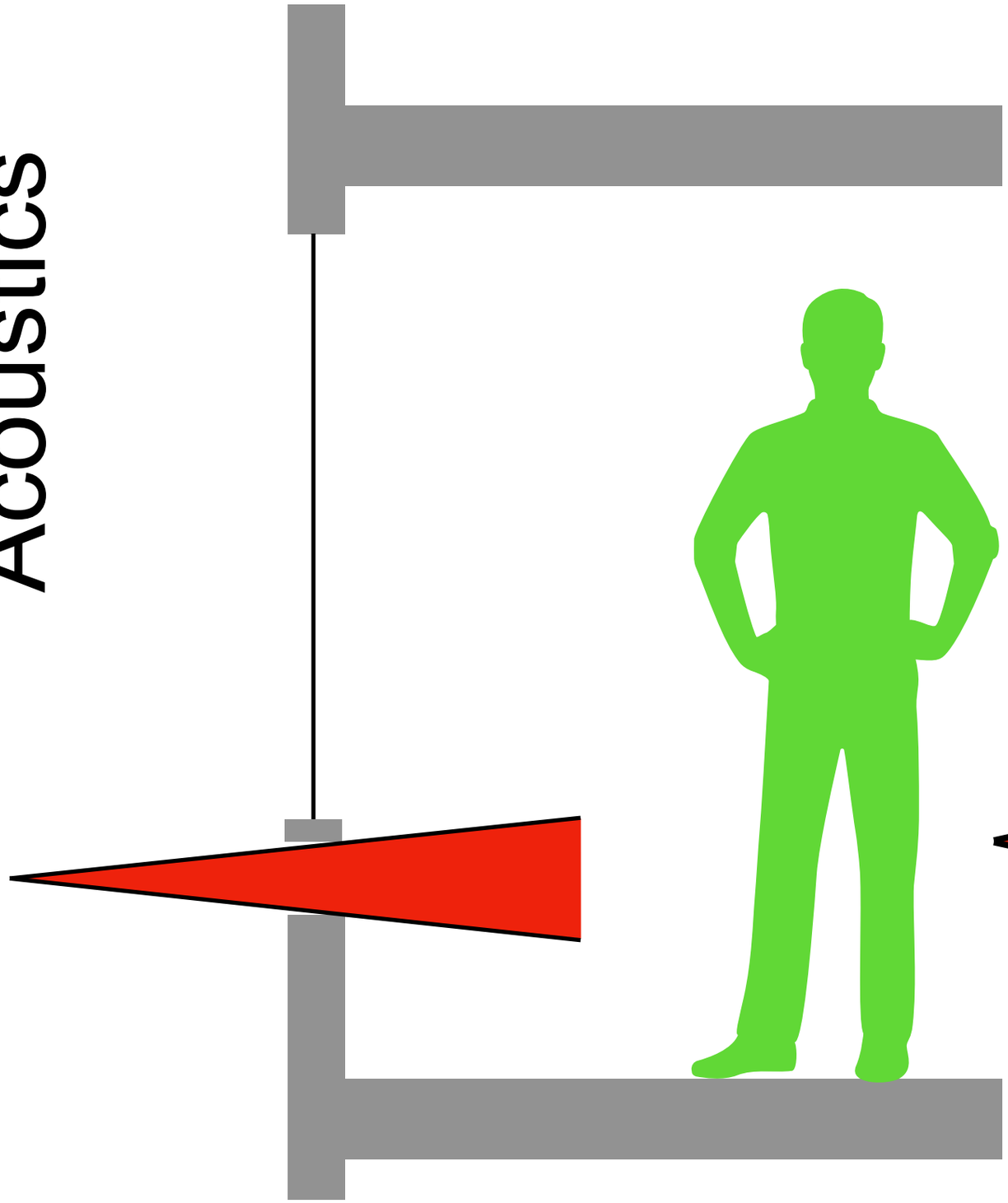


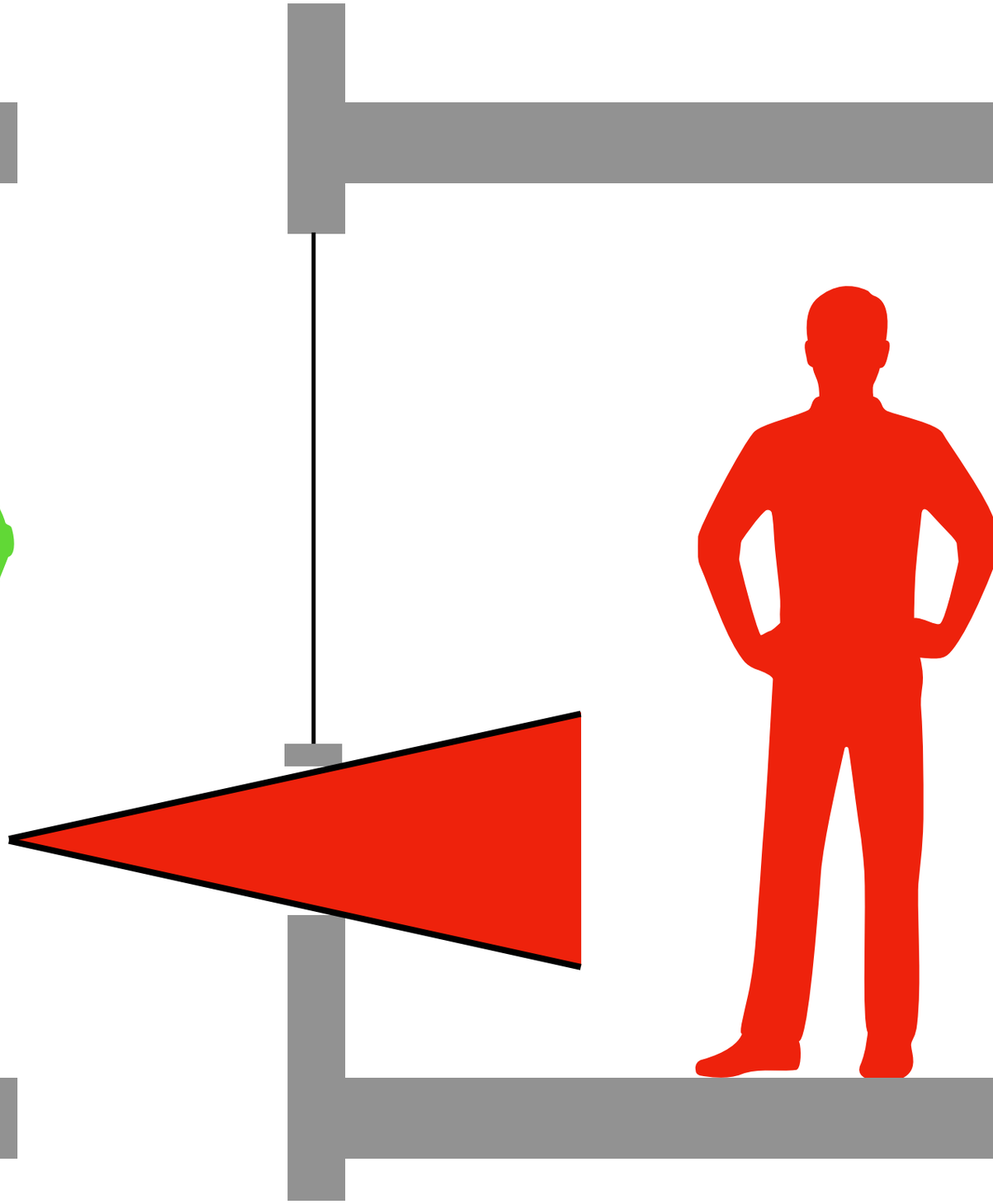


Summary

Open (free) area

Acoustics

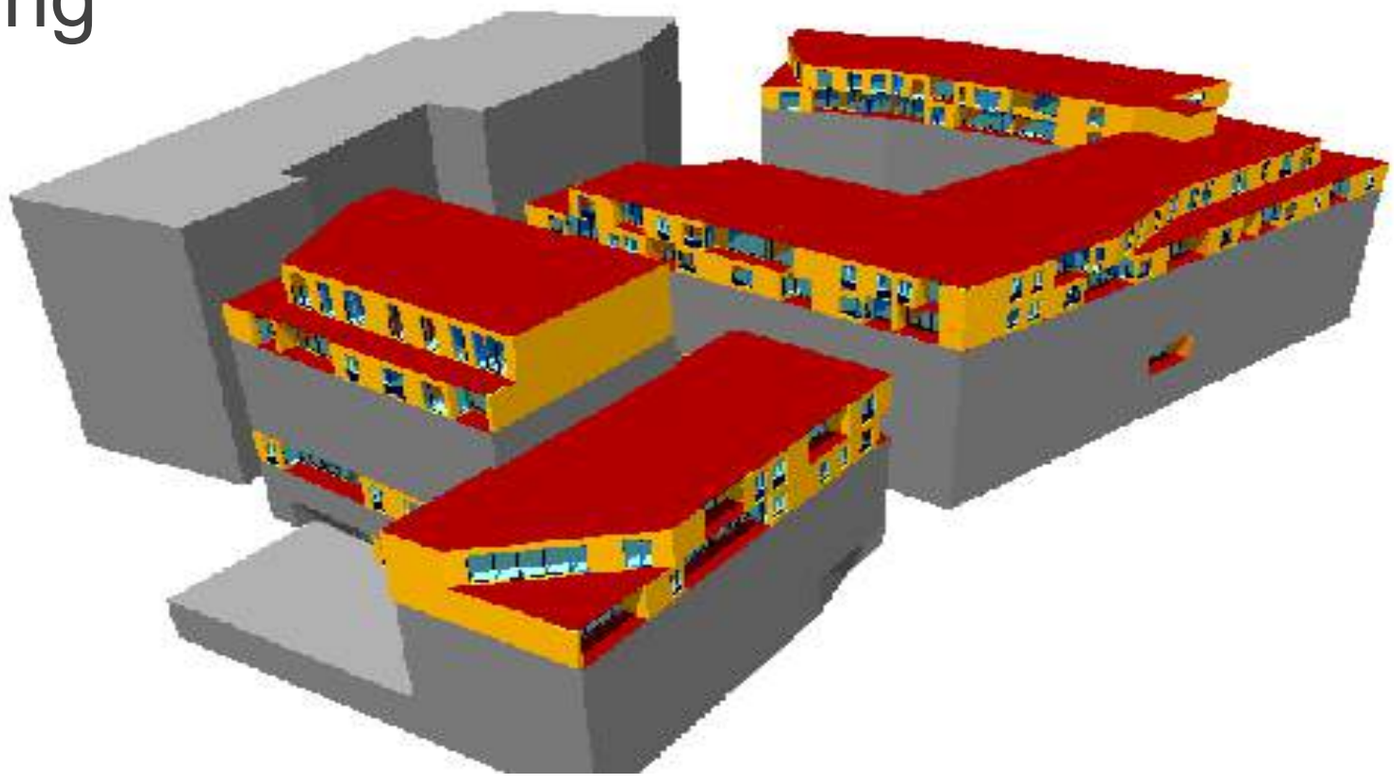




Dynamic Thermal Modelling

Inputs include:

- Building location & orientation
- Facade thermal properties
- Internal / external shading
- Mechanical systems
- Open windows/vents
- Internal gains
- Room types
- Occupancy profiles
- Weather files for site



Design & Fixed Parameters

Design Parameters

Building location & orientation
Facade thermal properties
Internal / external shading
Mechanical systems
Open windows/vents

Fixed Parameters

Internal gains
Room types
Occupancy profiles
Weather files for site

MACH Agenda for today

Building location & orientation

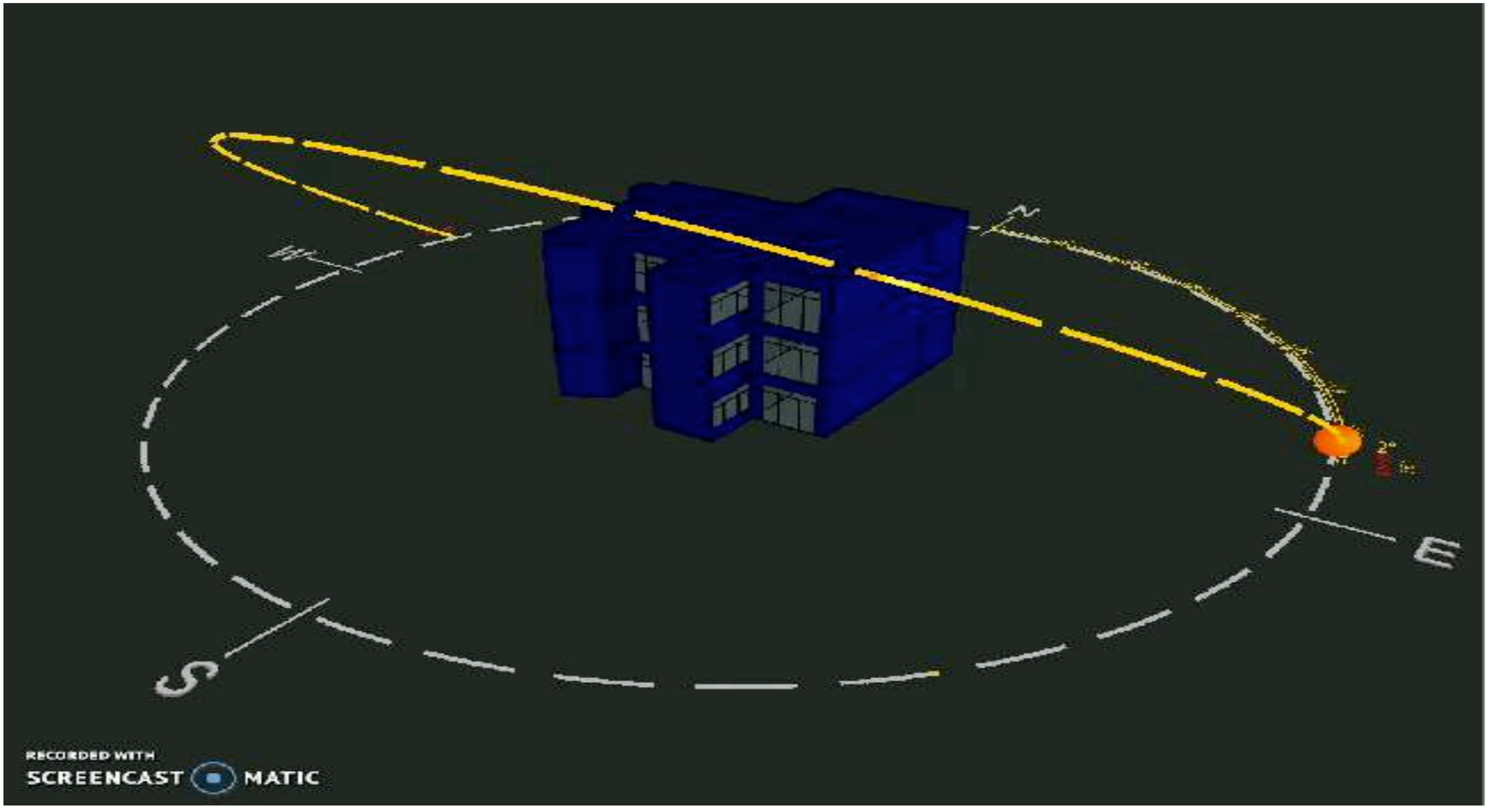
Facade thermal properties

Internal / external shading

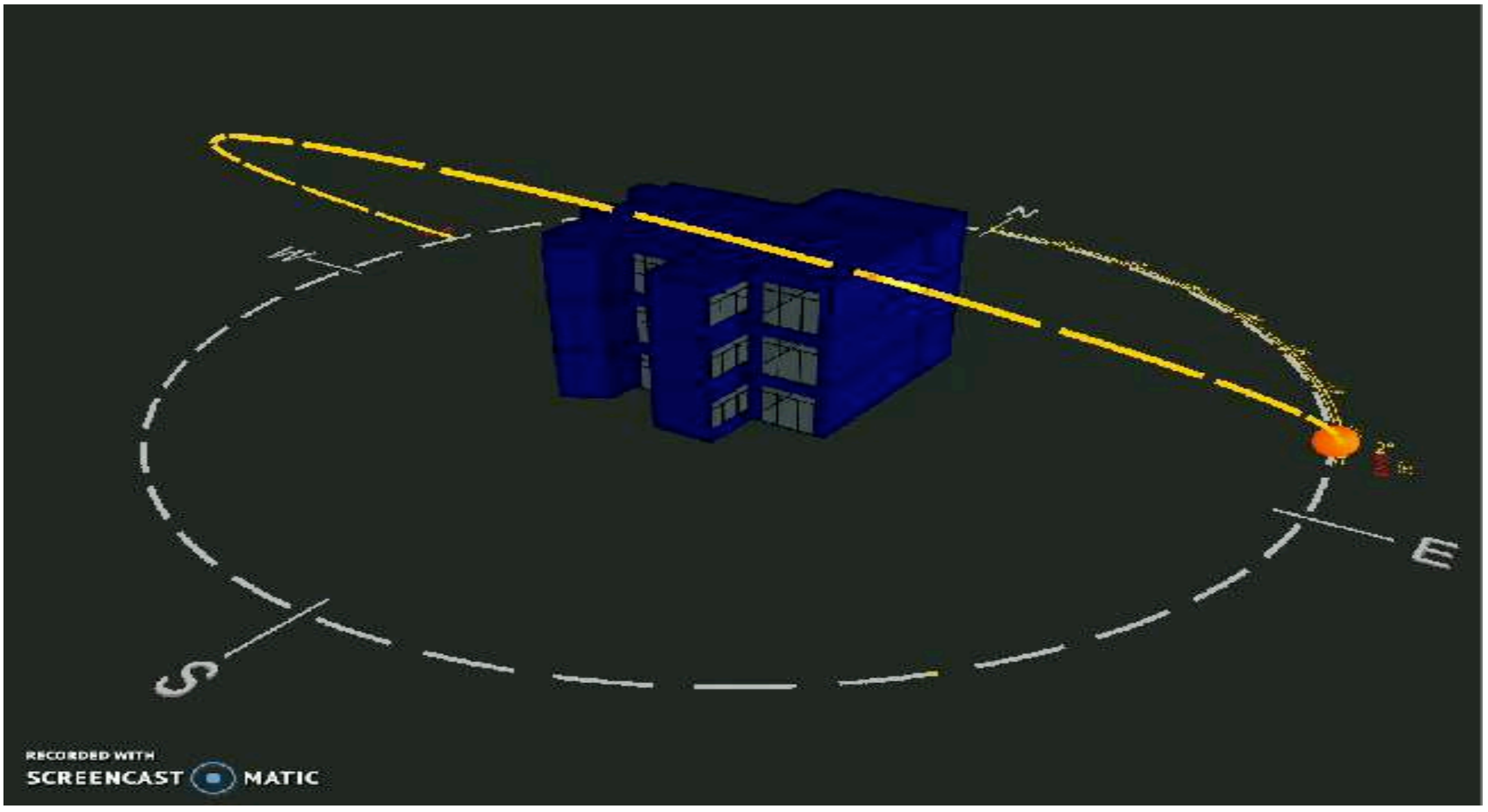
Mechanical systems

Open windows/vents

Building location & orientation - Thermal Performance



Building location & orientation - Thermal Performance



Building location & orientation - Thermal Performance

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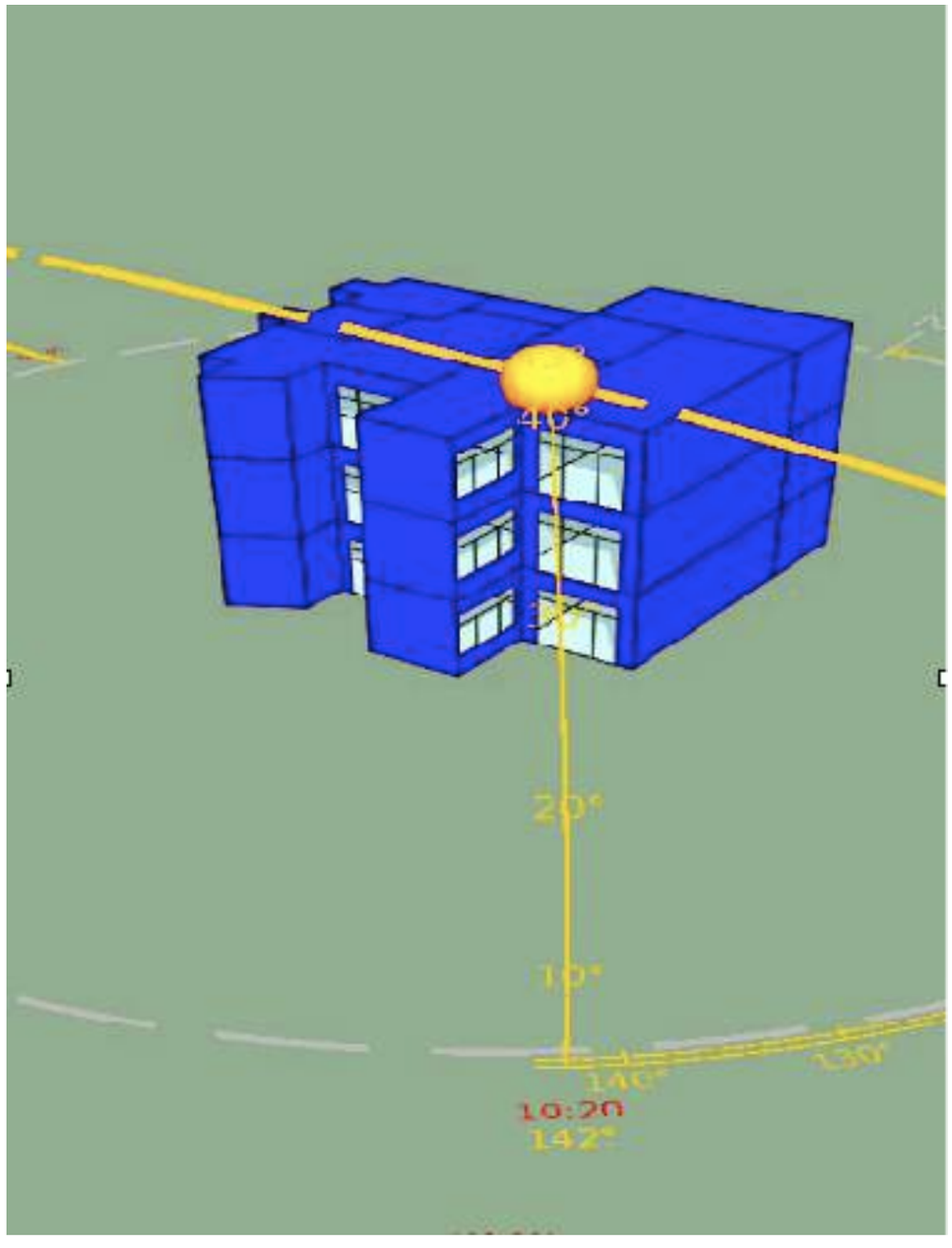
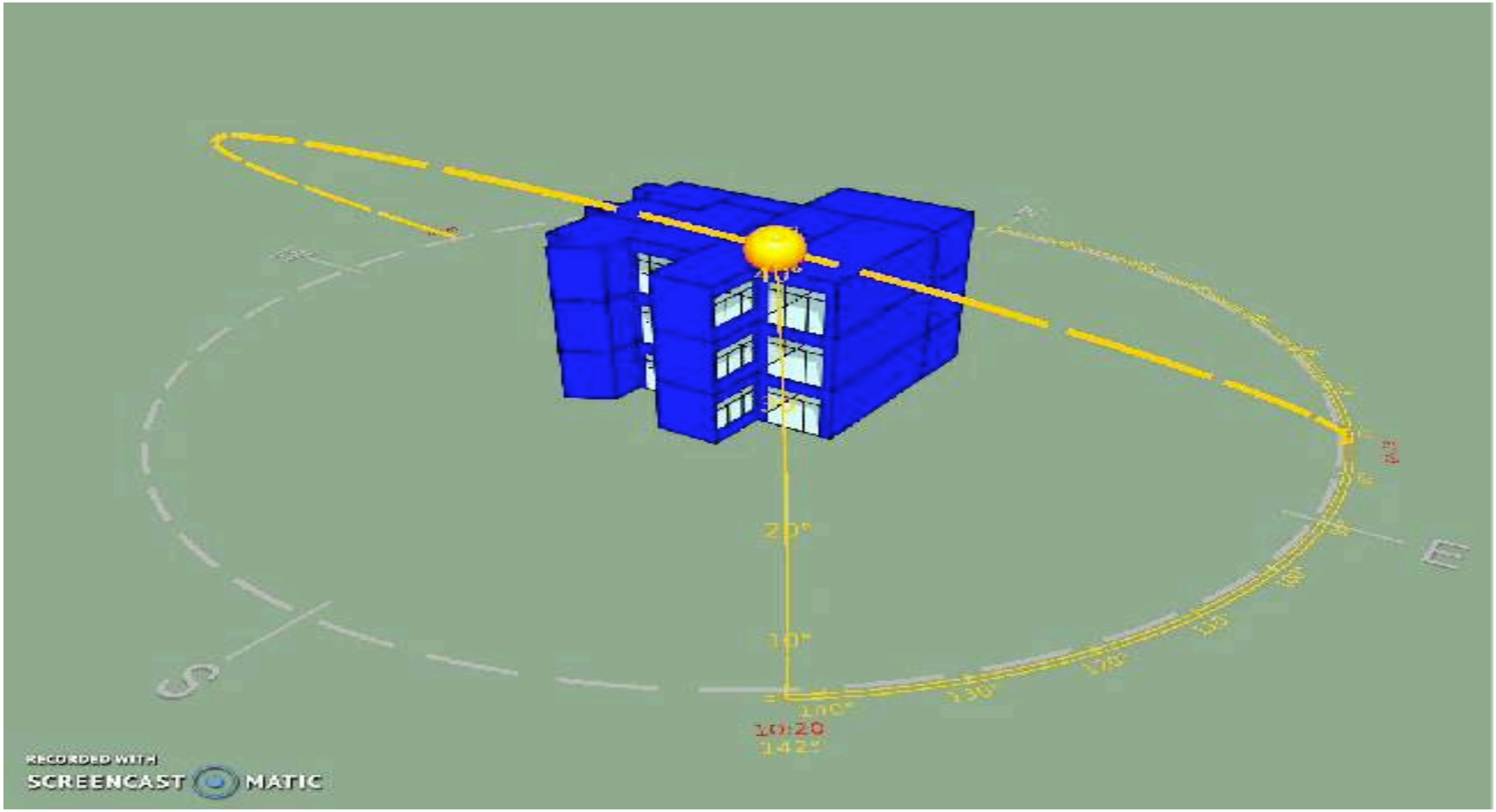
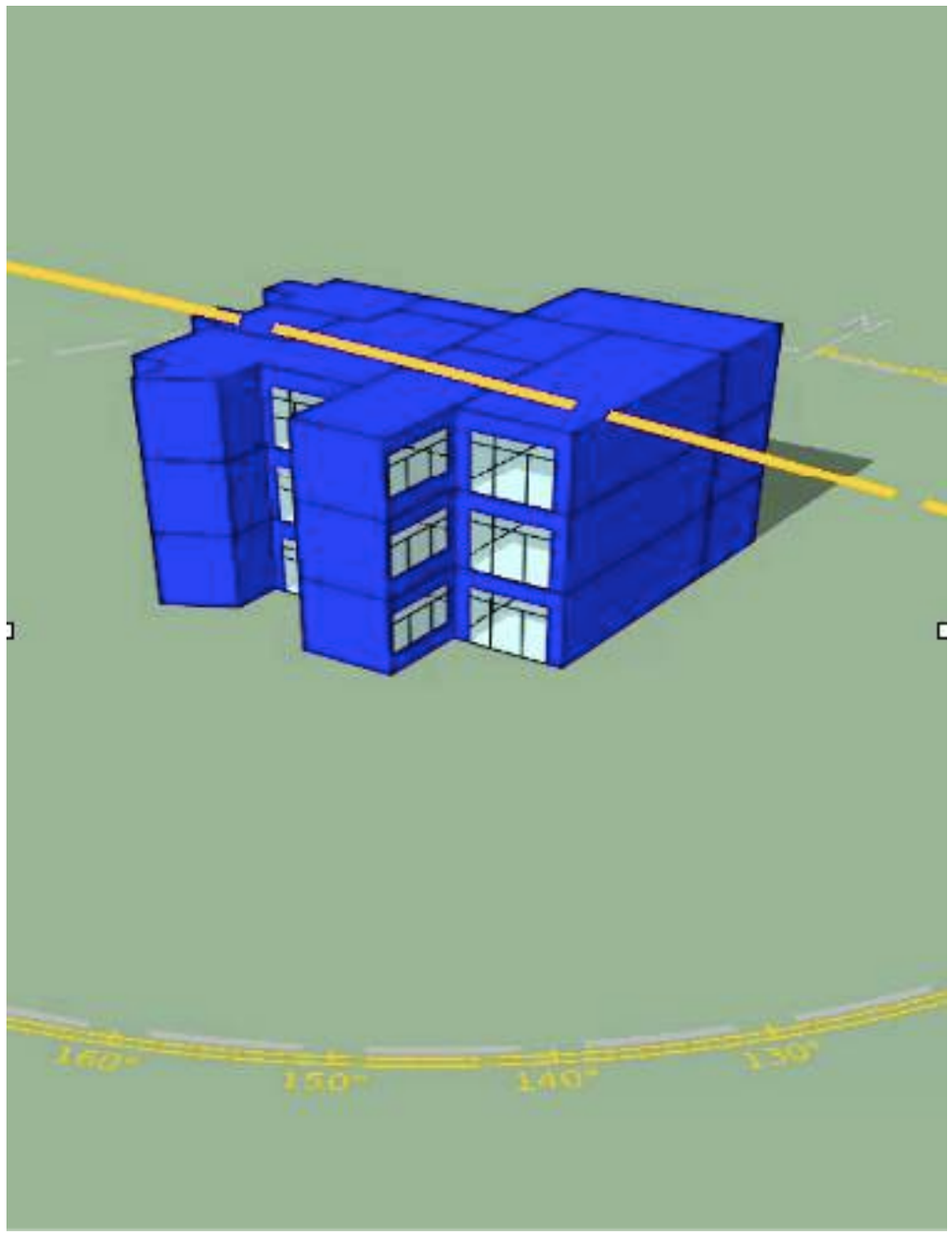


Building location & orientation - Thermal Performance



Building location & orientation - Thermal Performance



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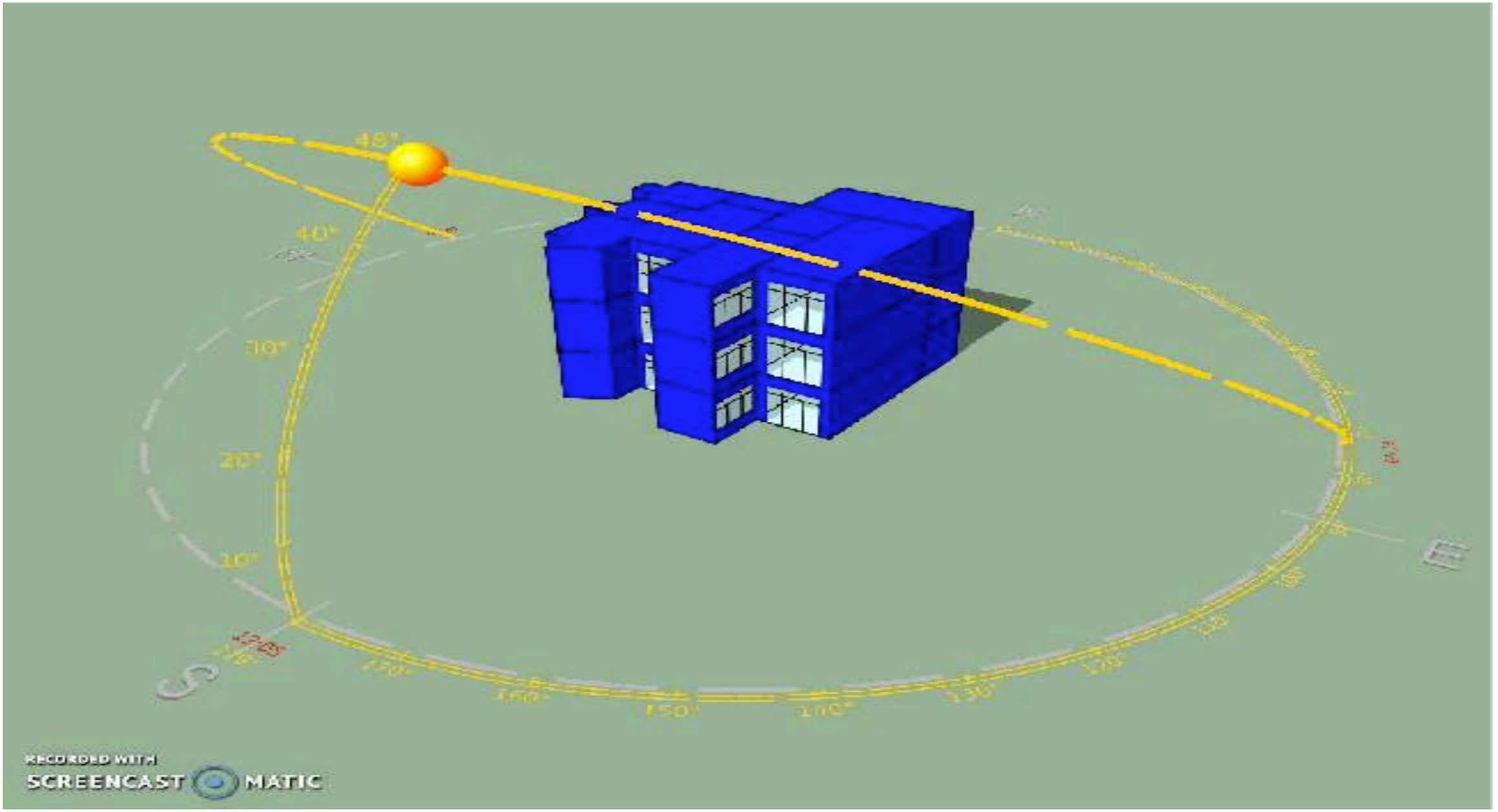

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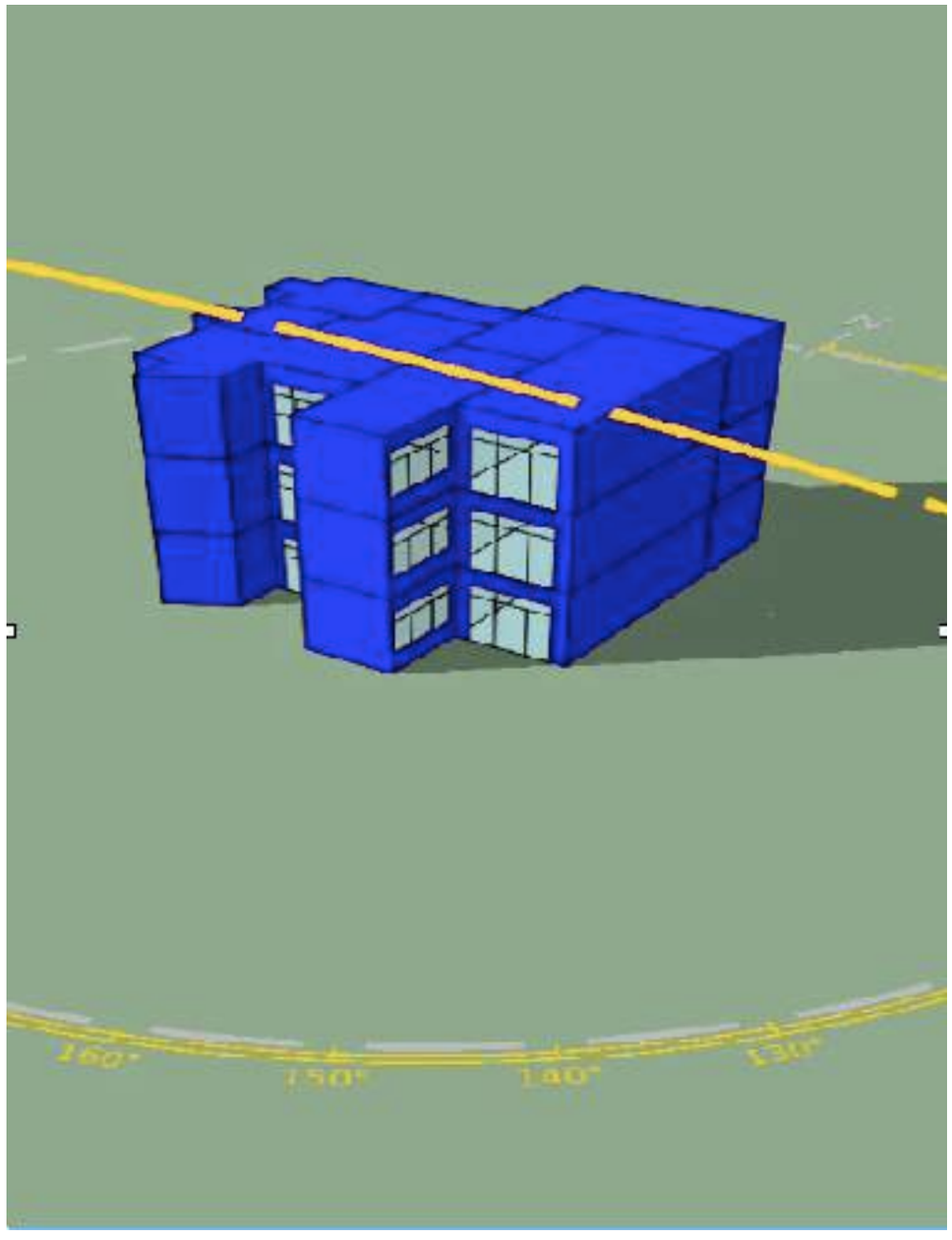

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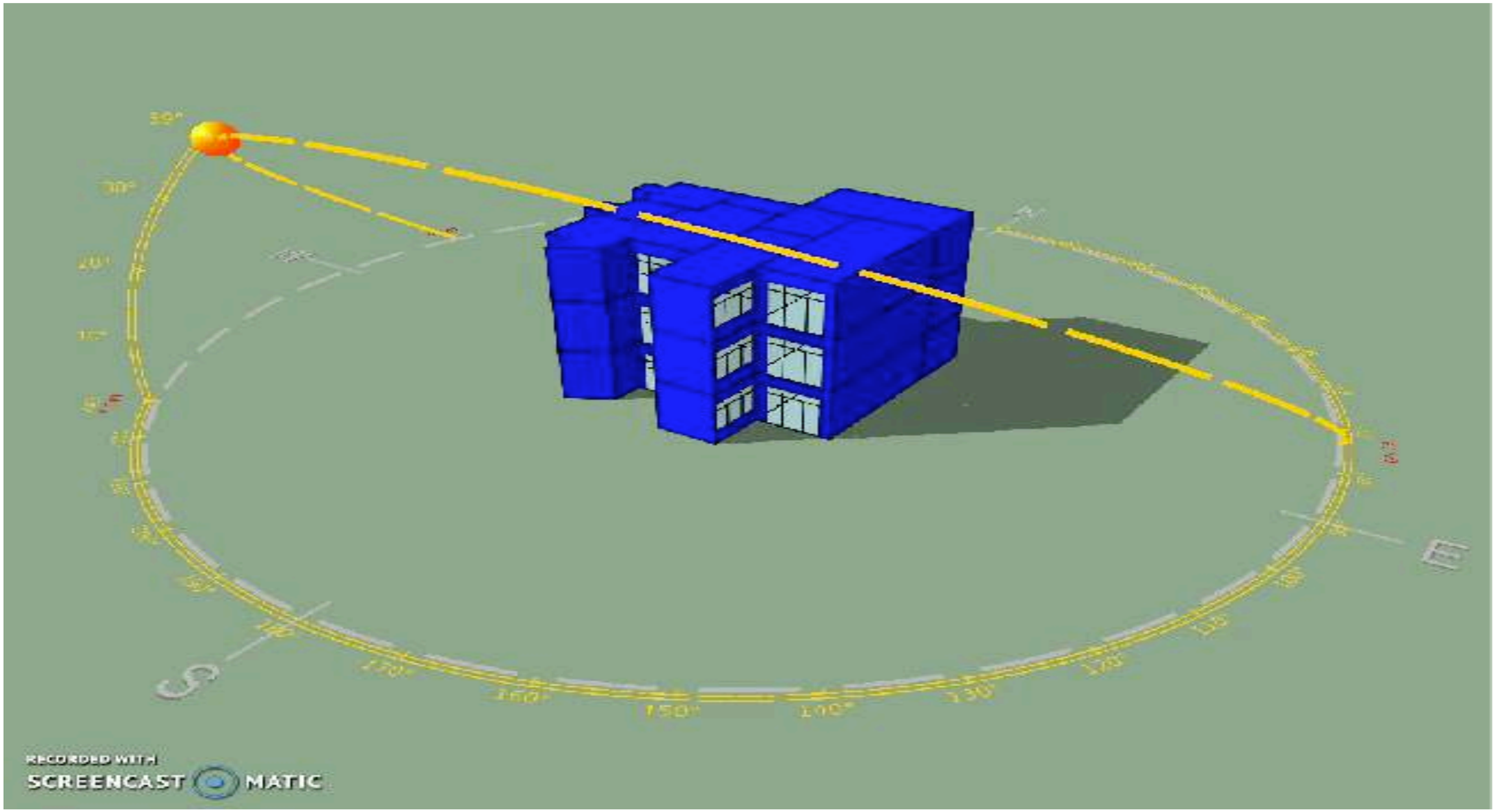

Building location & orientation - Acoustic Performance

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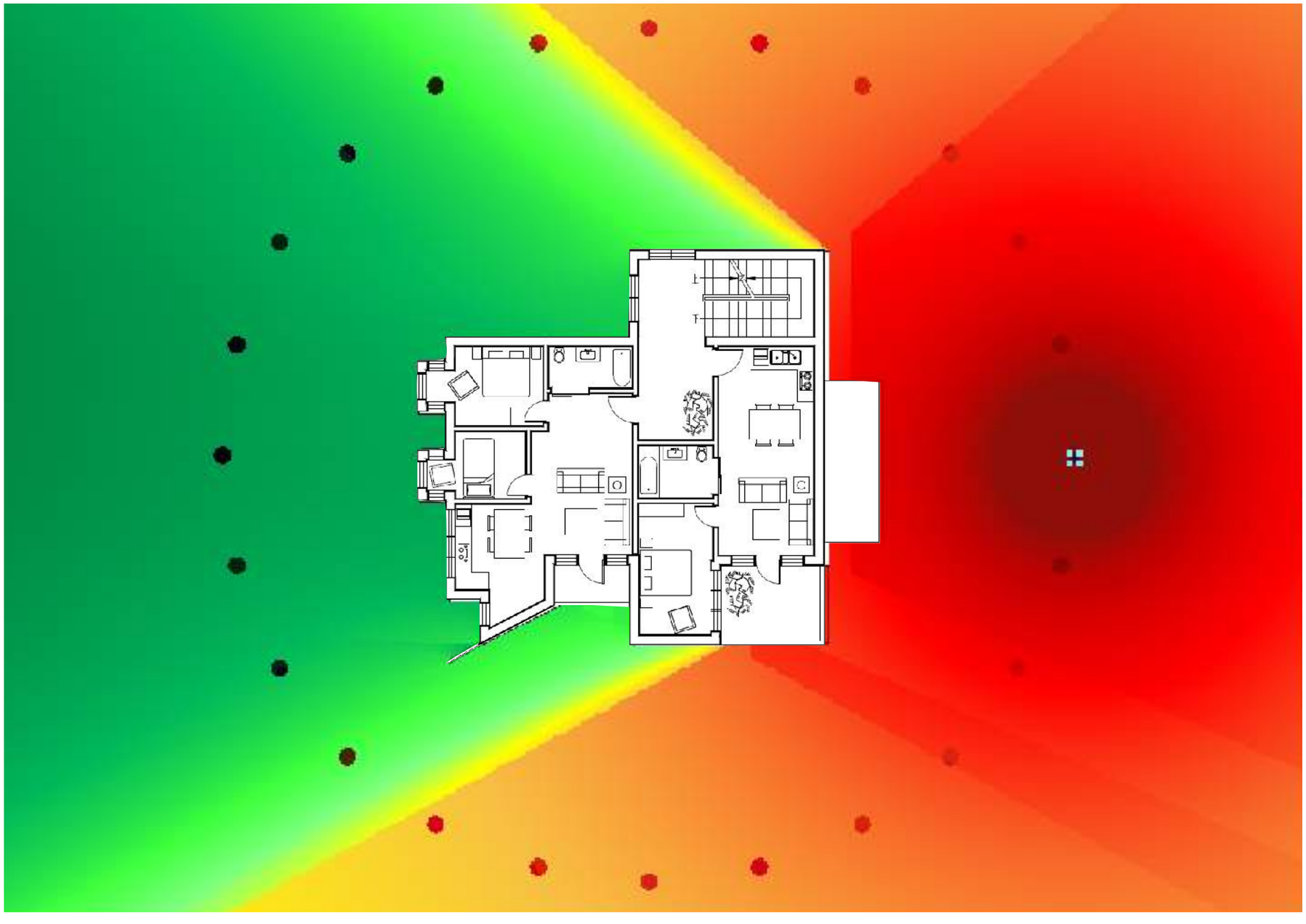

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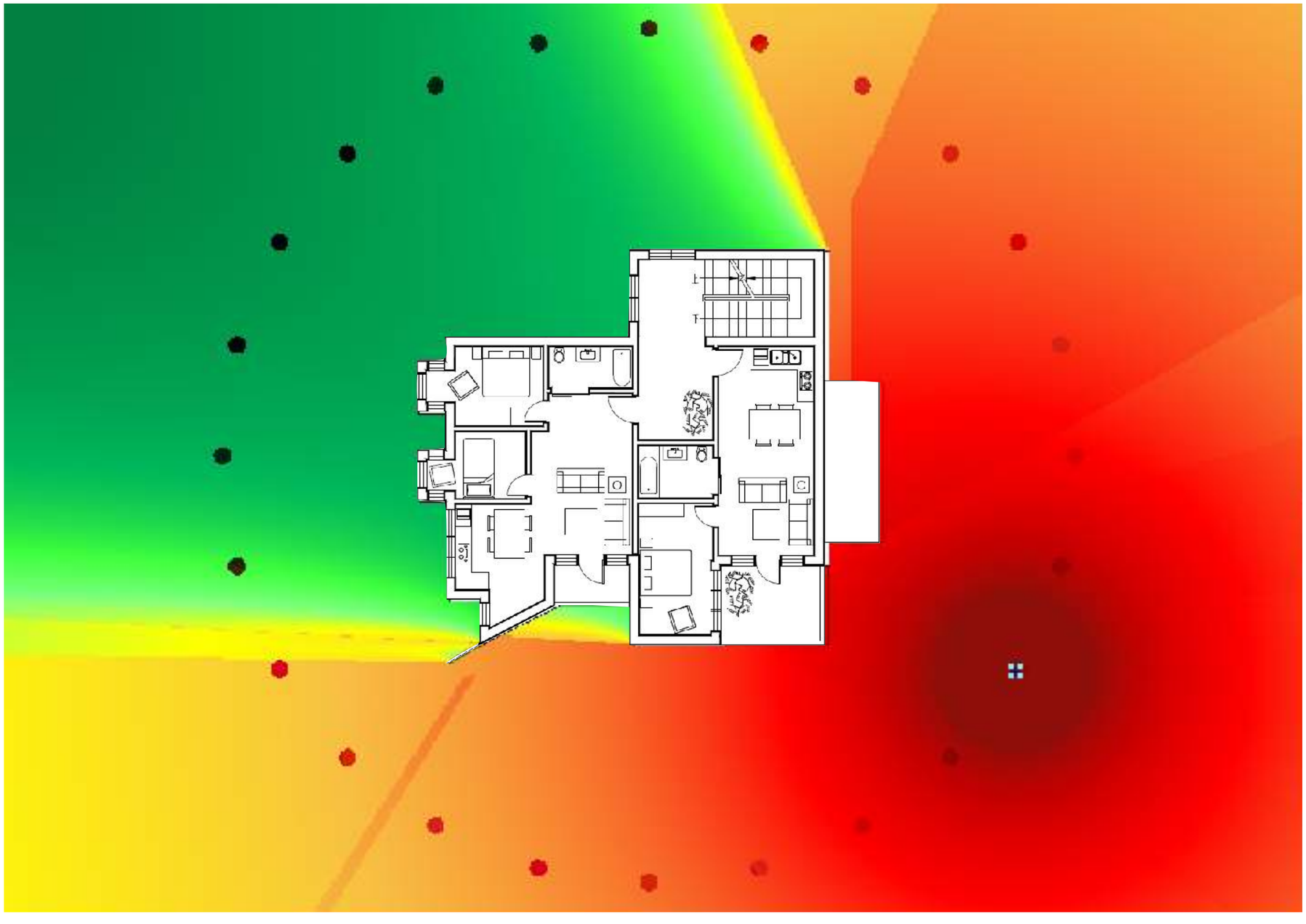

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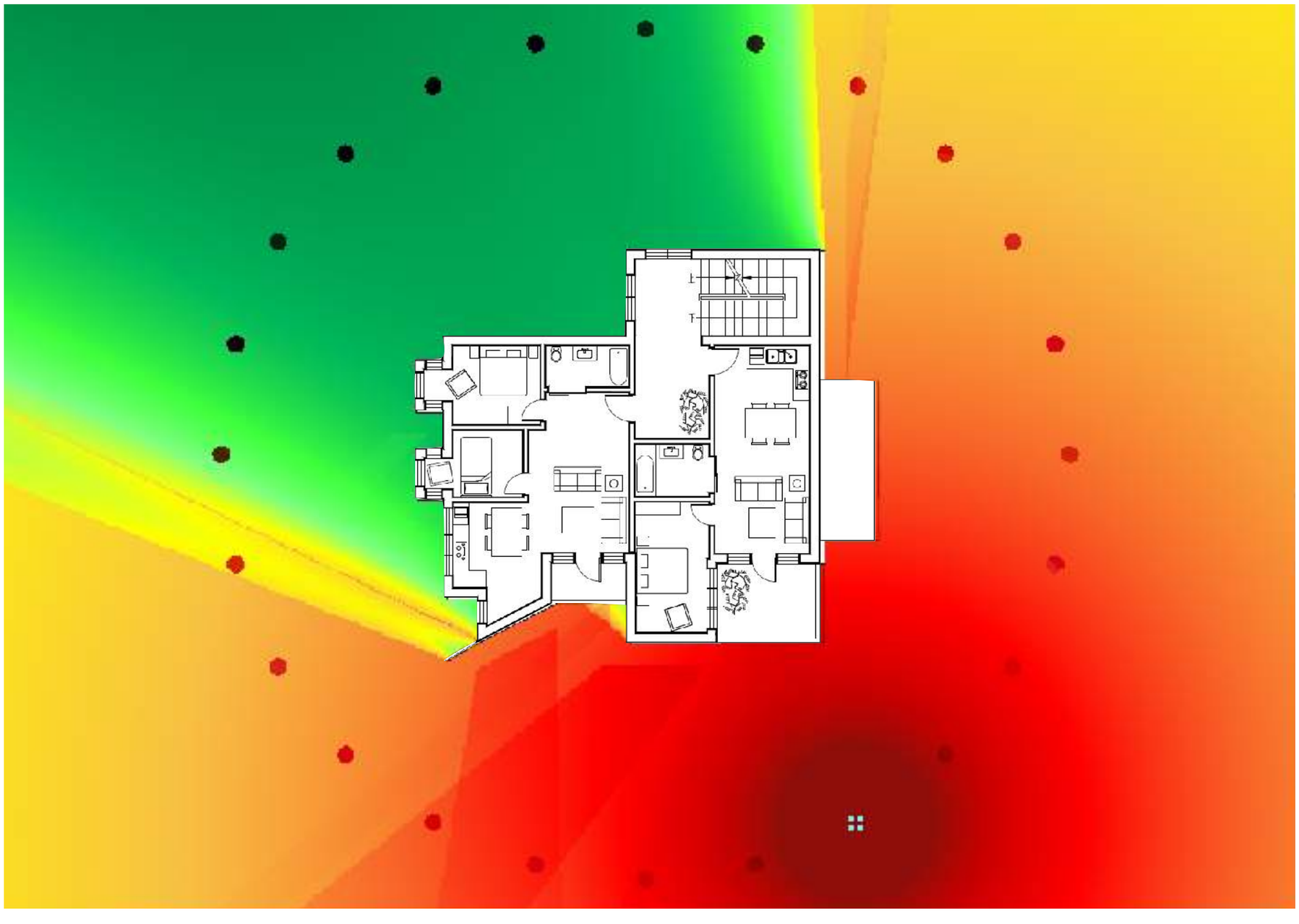

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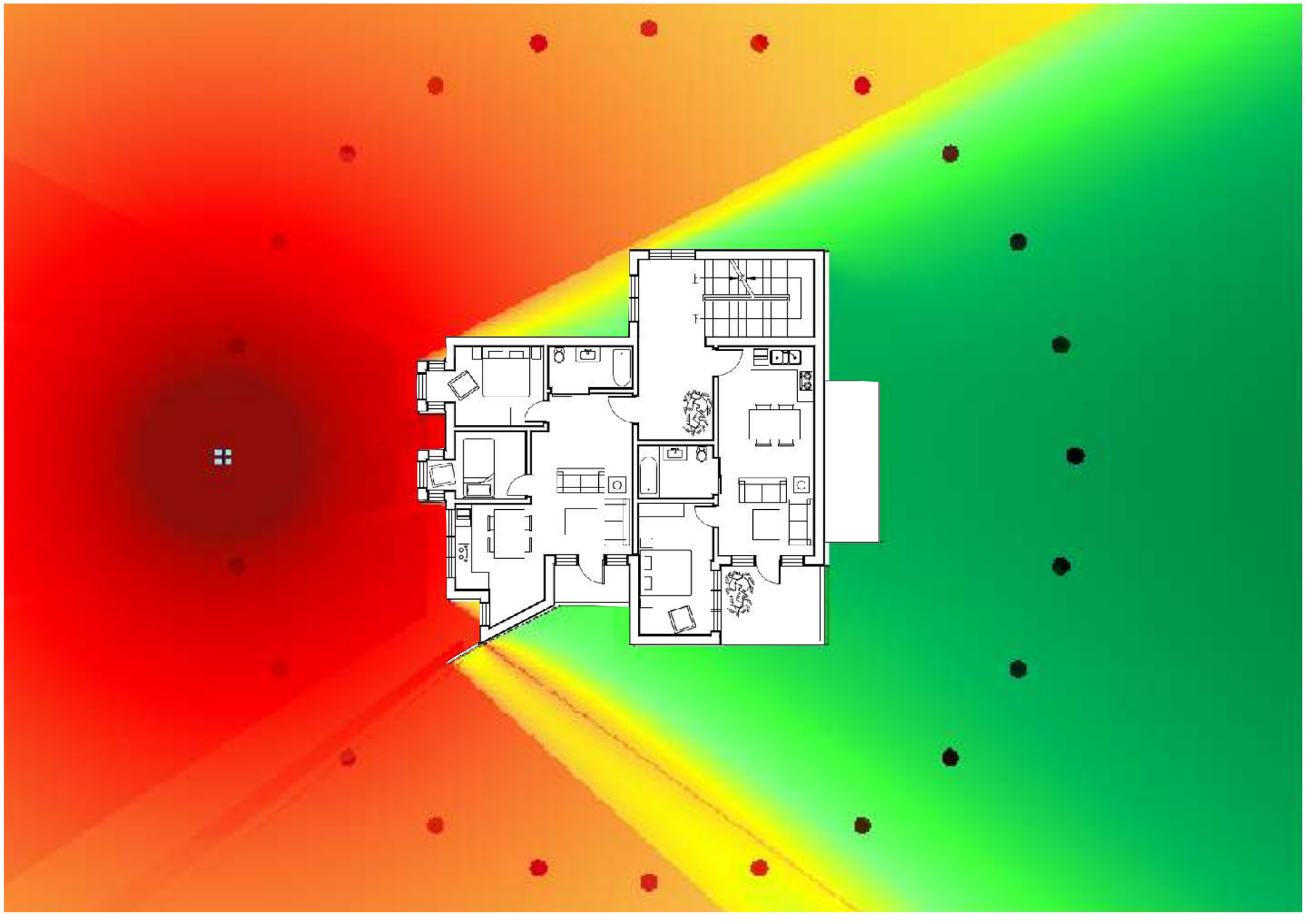

Building location & orientation - Acoustic Performance

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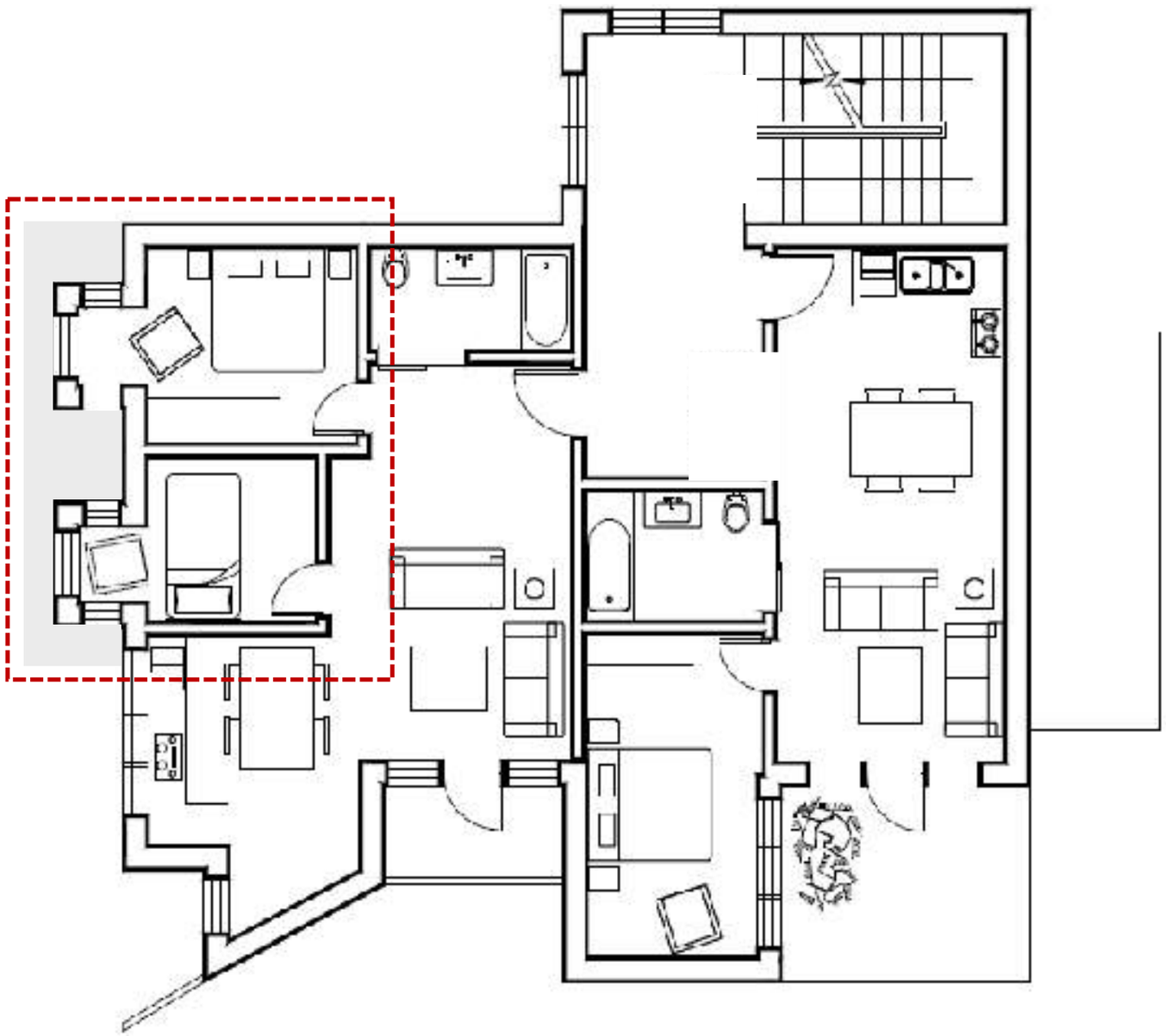
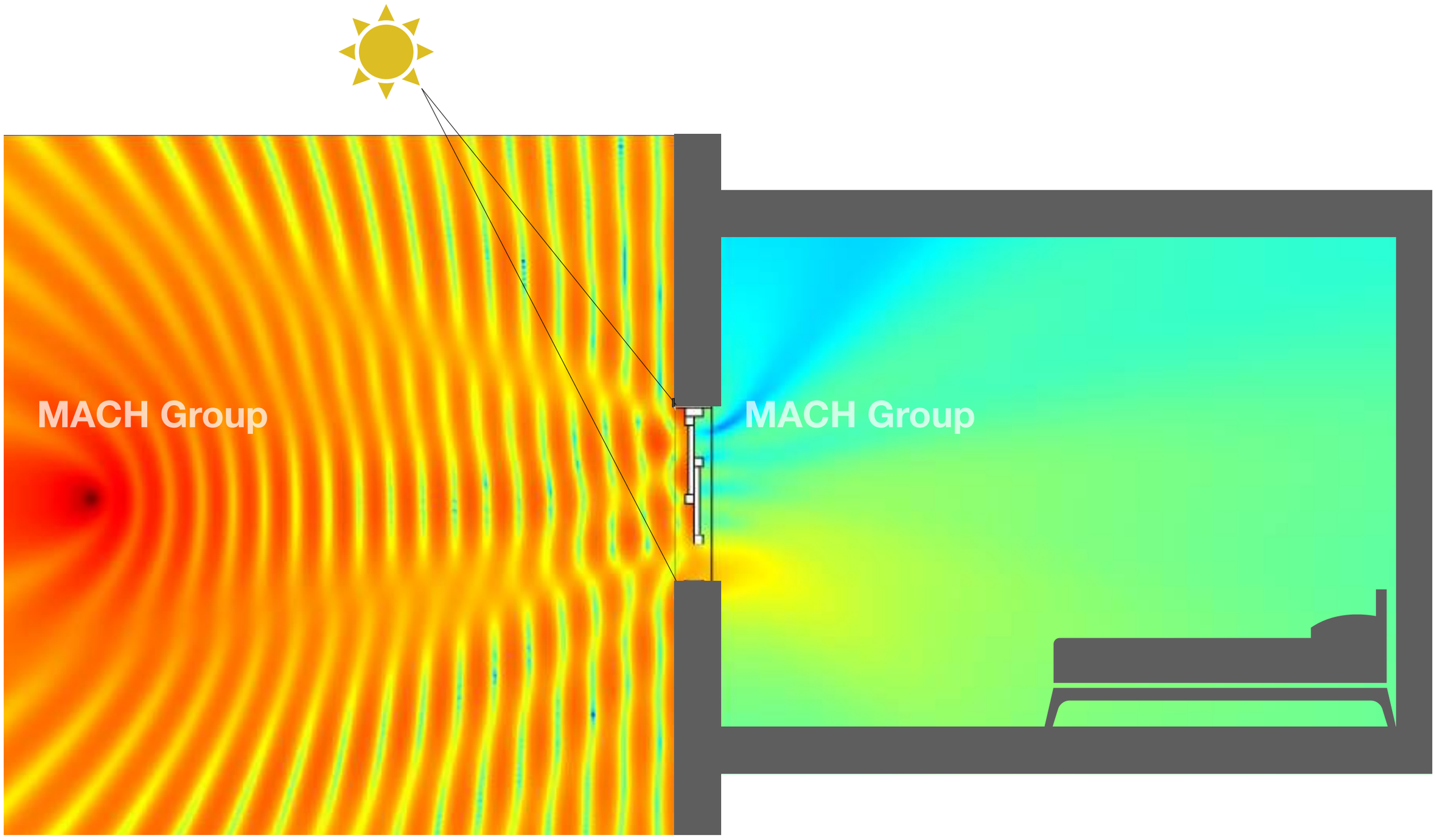
Agenda

Building location & orientation
Facade thermal properties
Internal / external shading
Mechanical systems
Open windows/vents

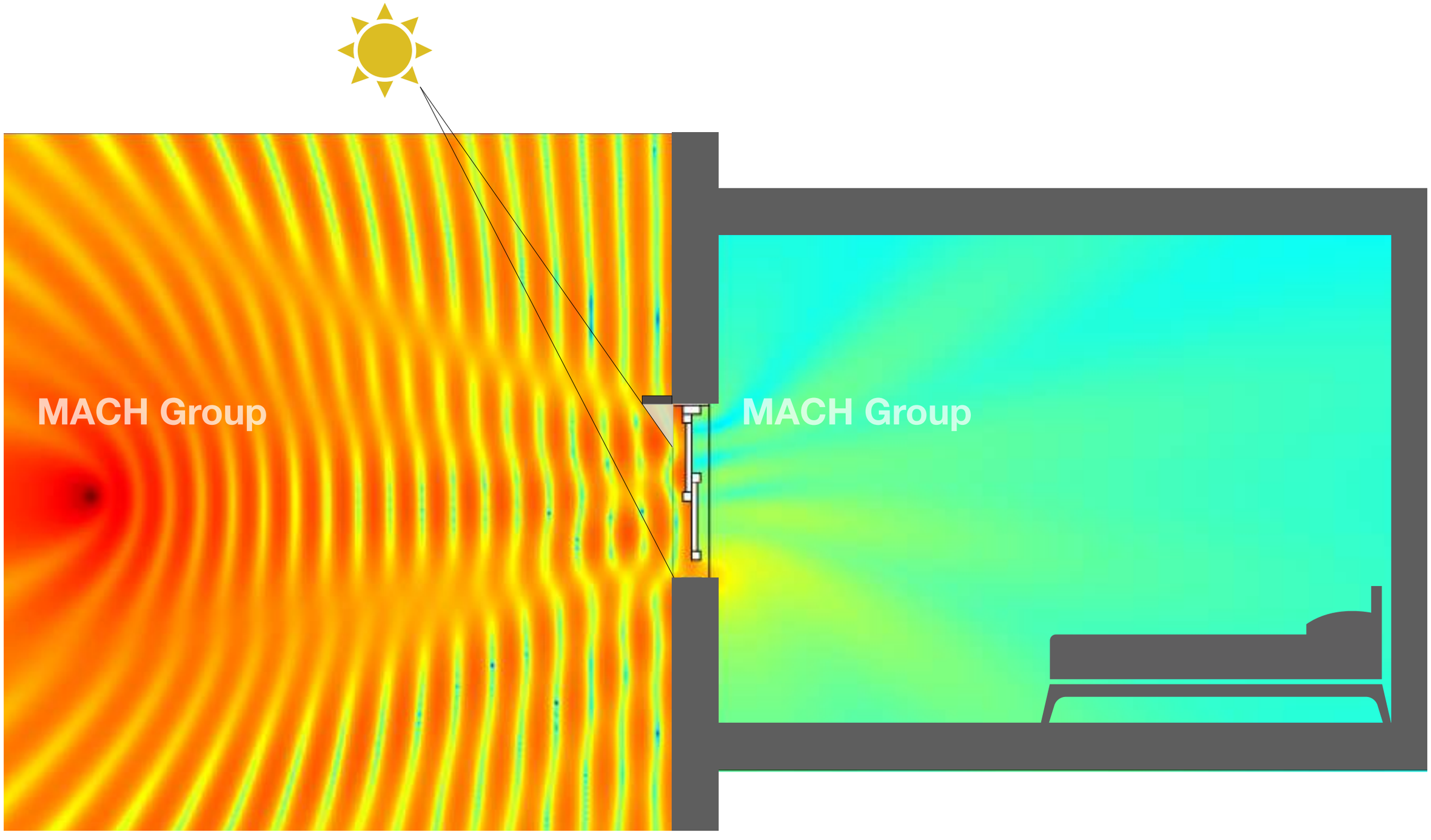
Facade thermal properties Internal / external shading



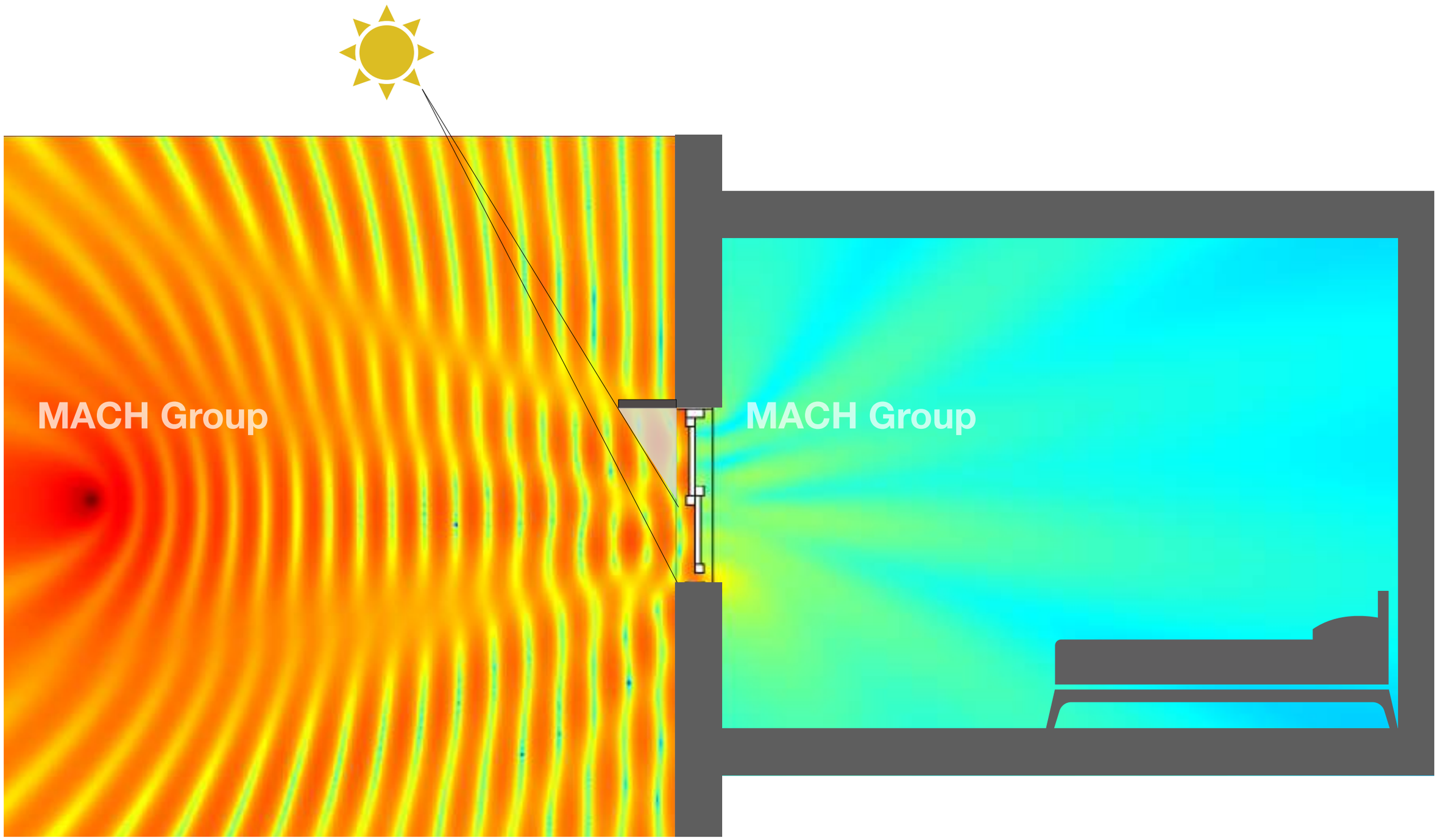
Facade thermal properties Internal / external shading 1



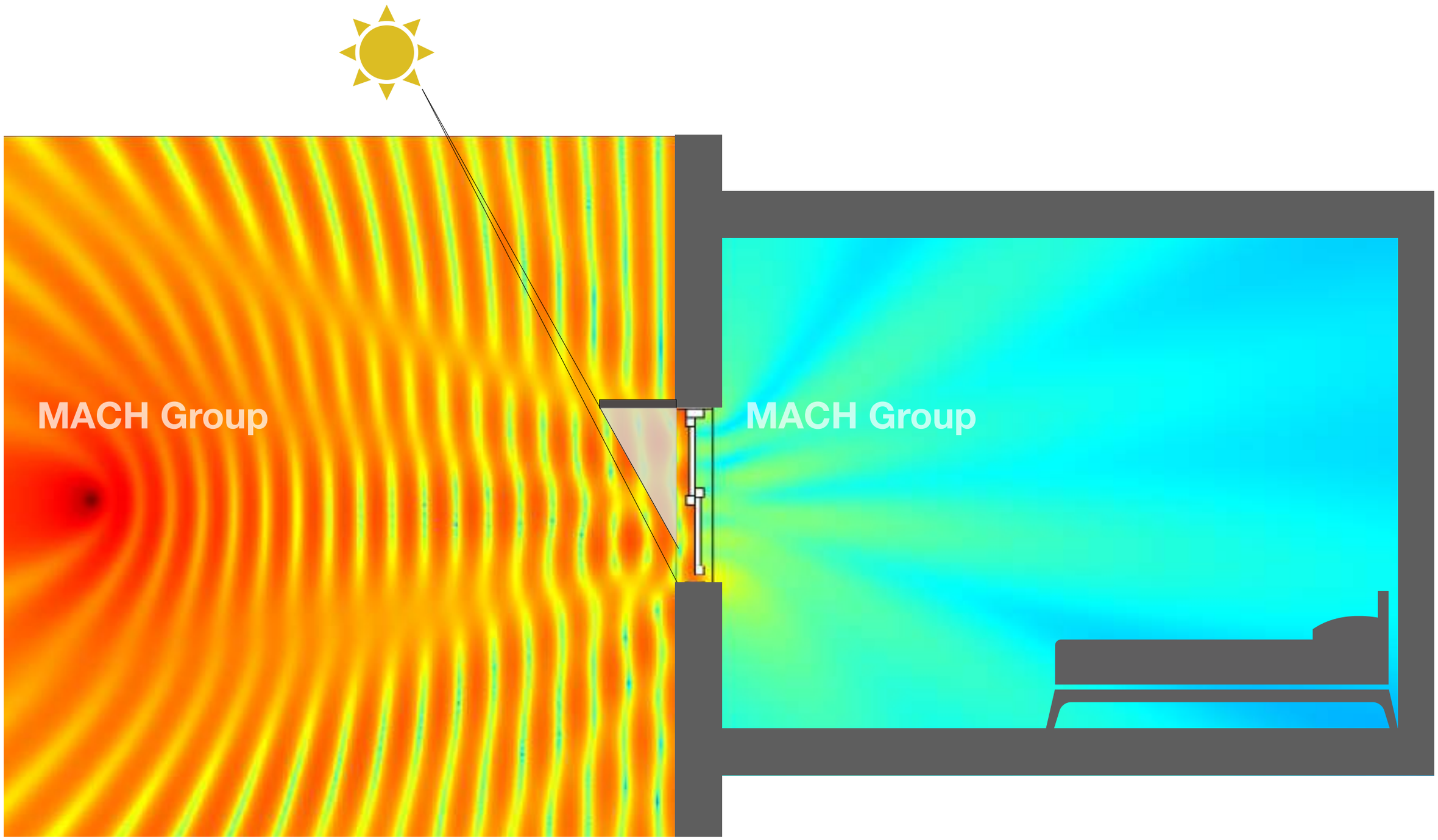
Facade thermal properties Internal / external shading 2



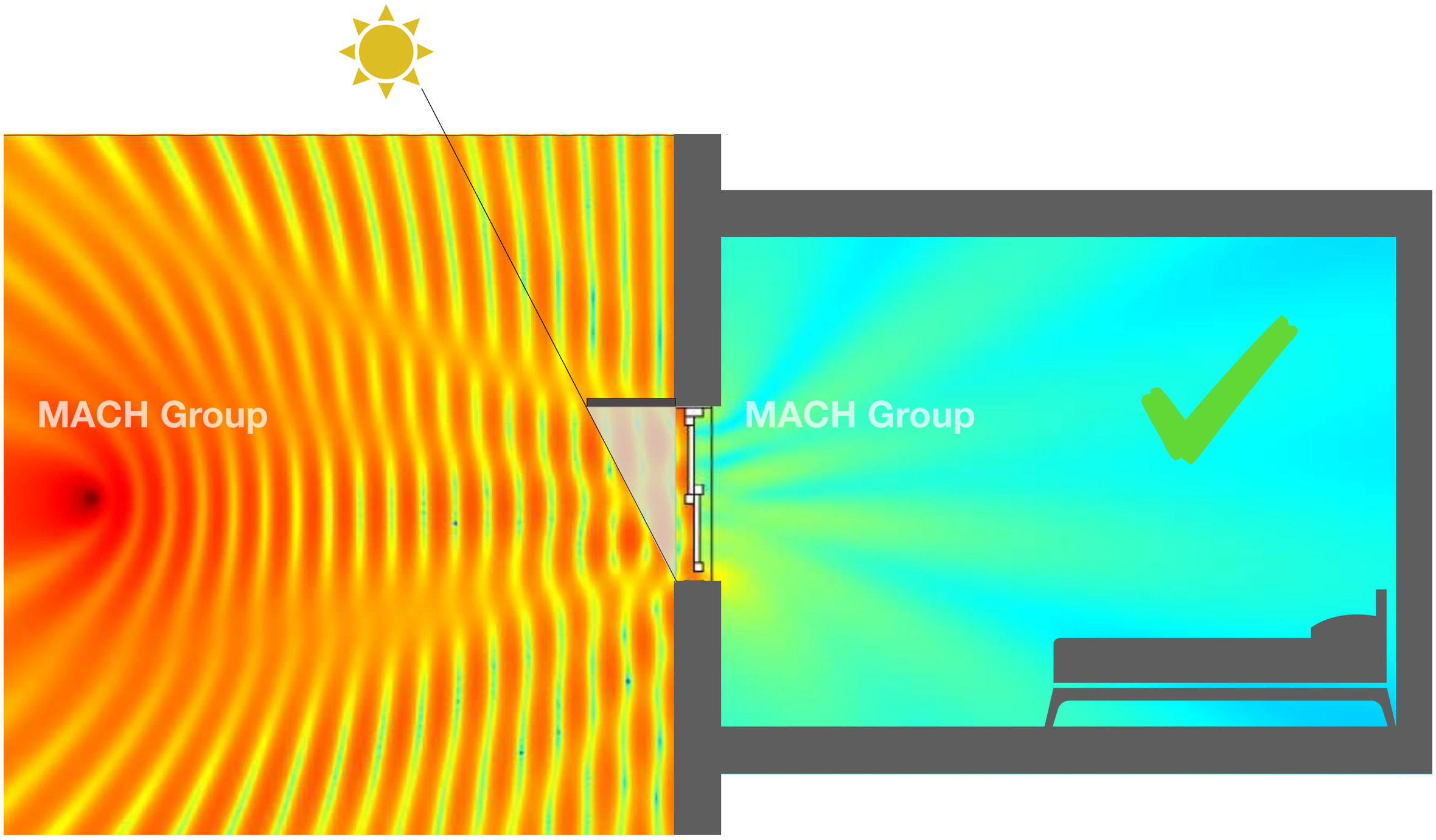
Facade thermal properties Internal / external shading 3



Facade thermal properties Internal / external shading 4

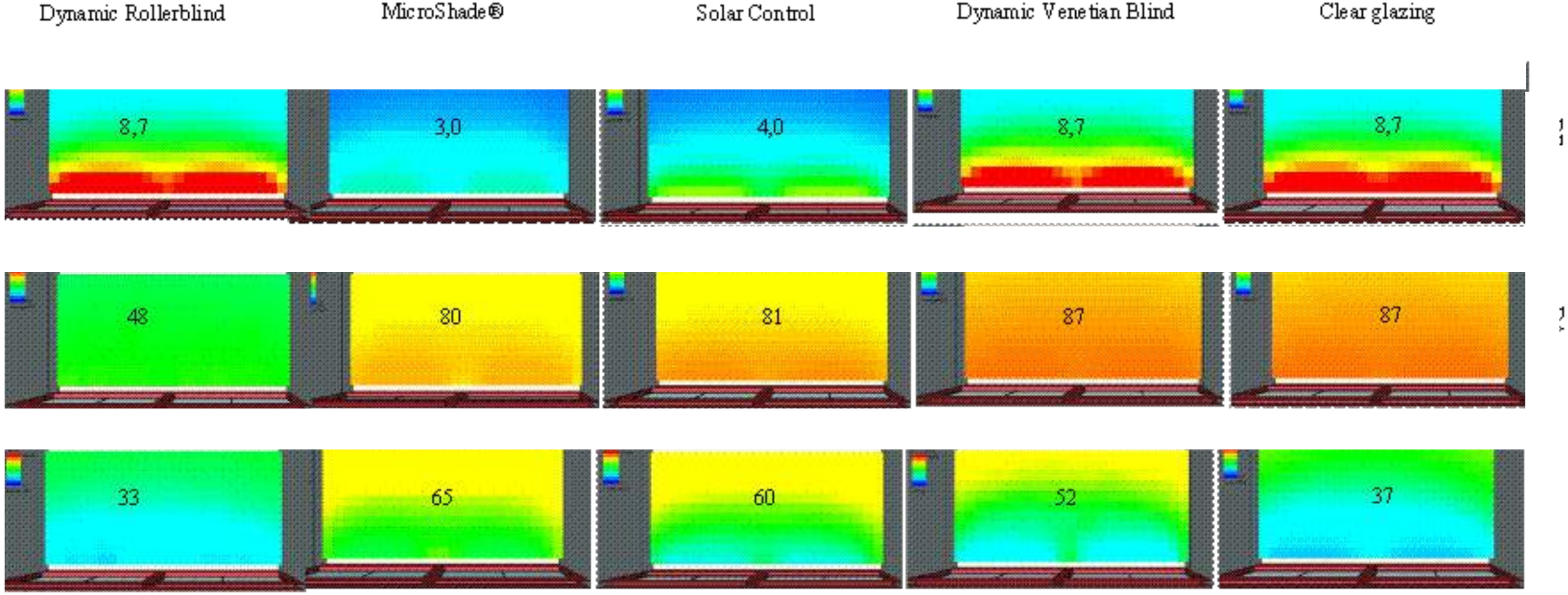


Facade thermal properties Internal / external shading 5



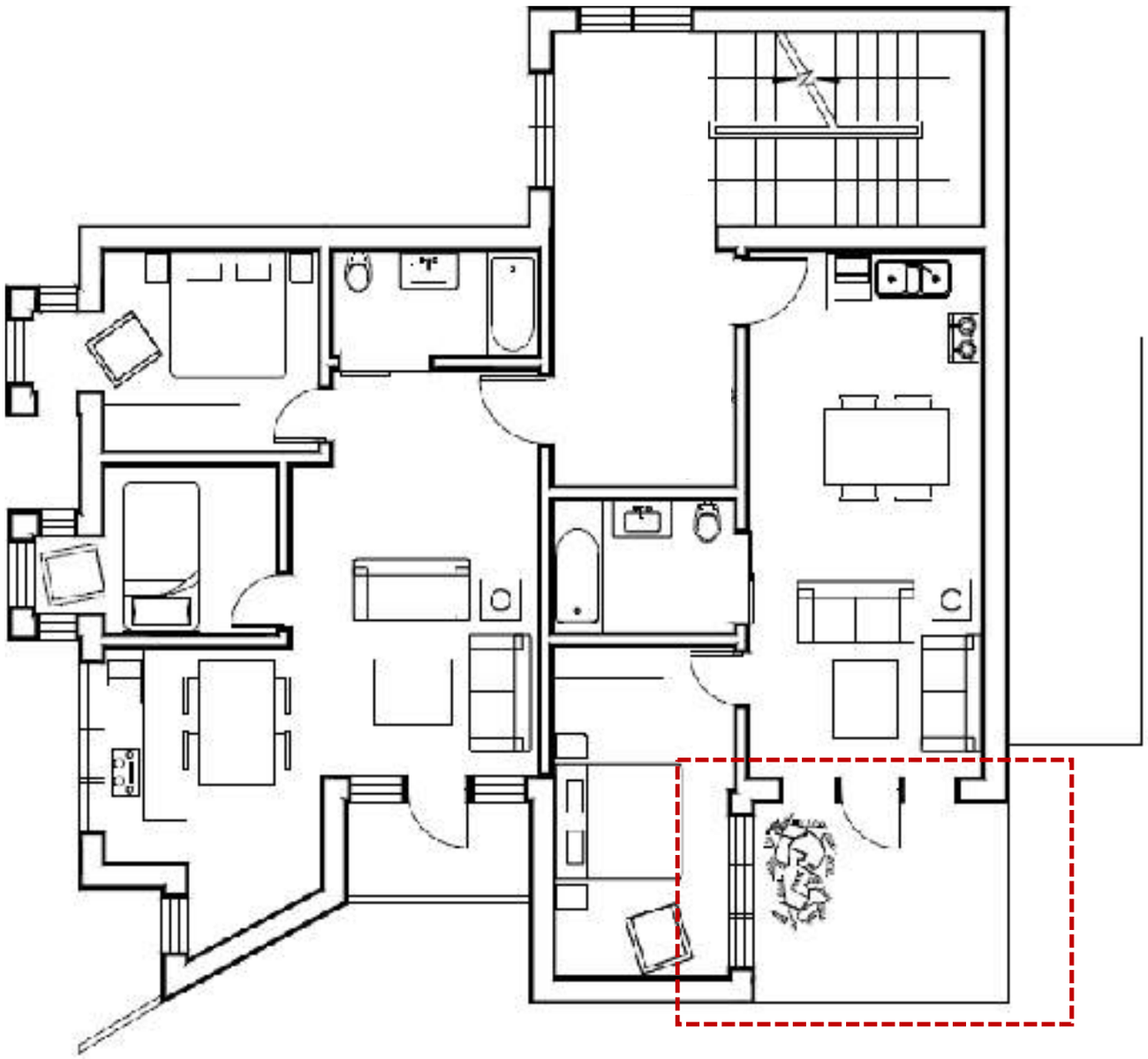
Facade thermal properties Internal / external shading

Solar Shading & Daylighting



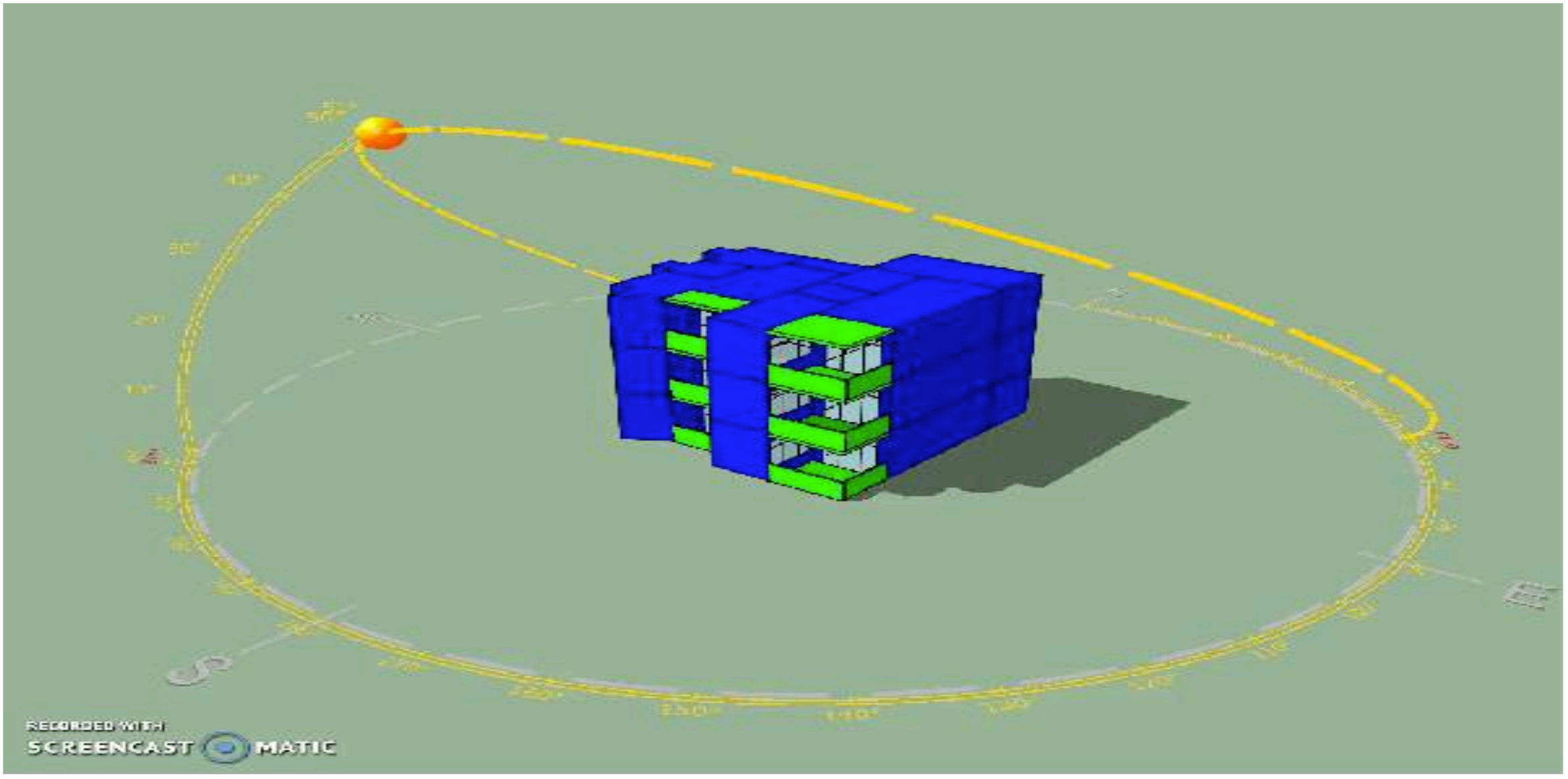
Facade thermal properties Internal / external shading

External shading - The effect of balconies on thermal gains



Facade thermal properties Internal / external shading

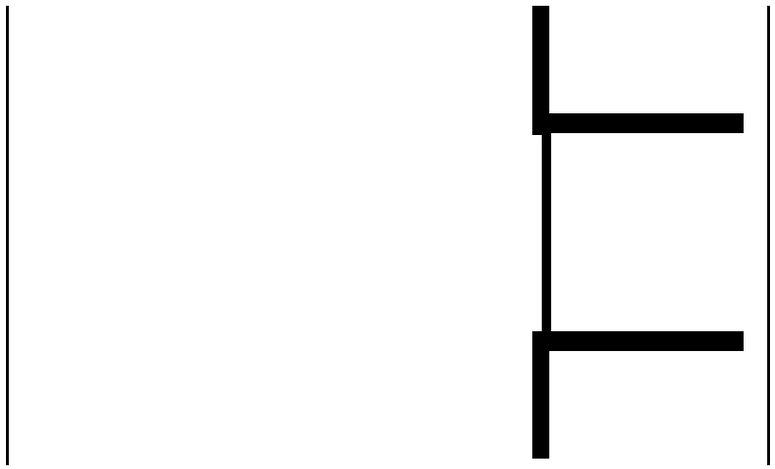
External shading - The effect of balconies on thermal gains



Facade thermal properties Internal / external shading

BS12354 - Airborne sound insulation against outdoor sound

1 Plane Facade



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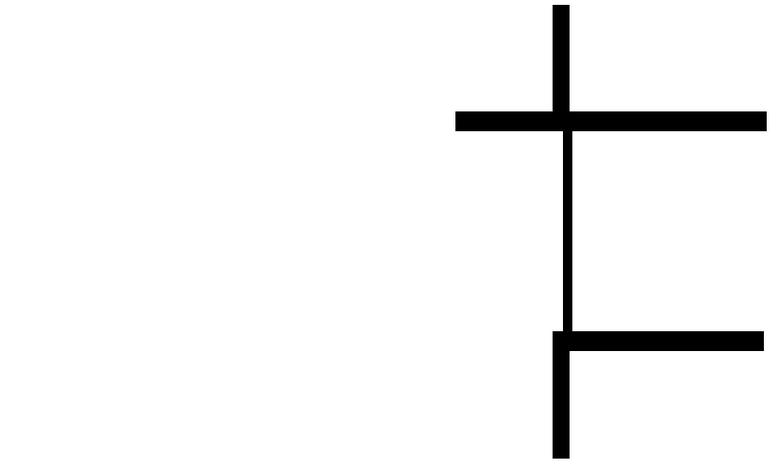

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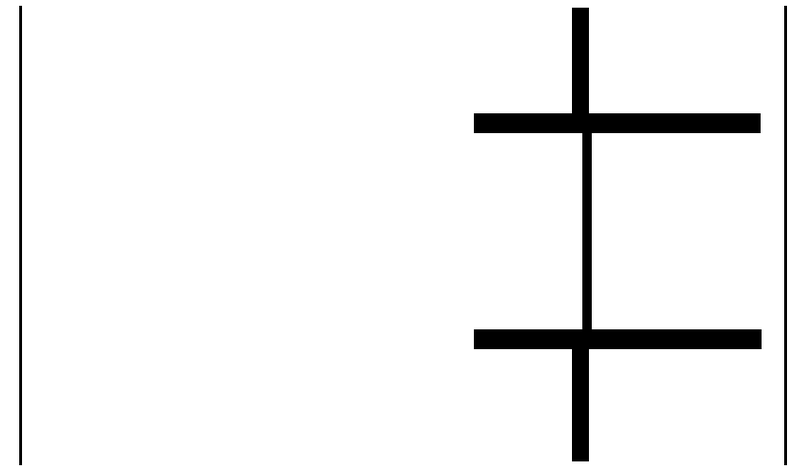

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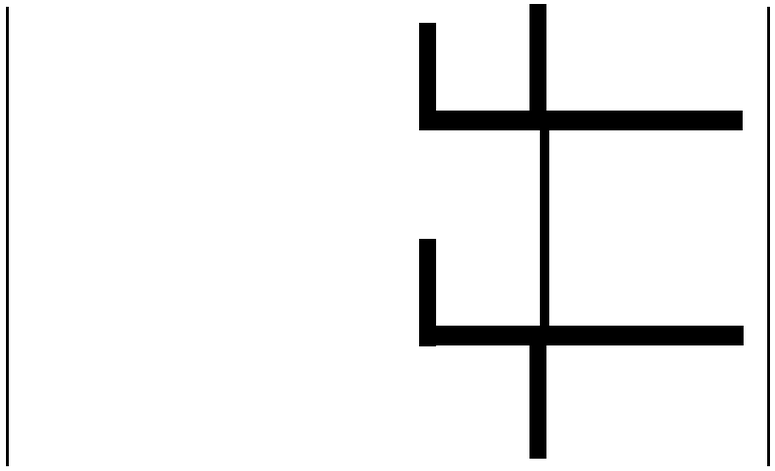
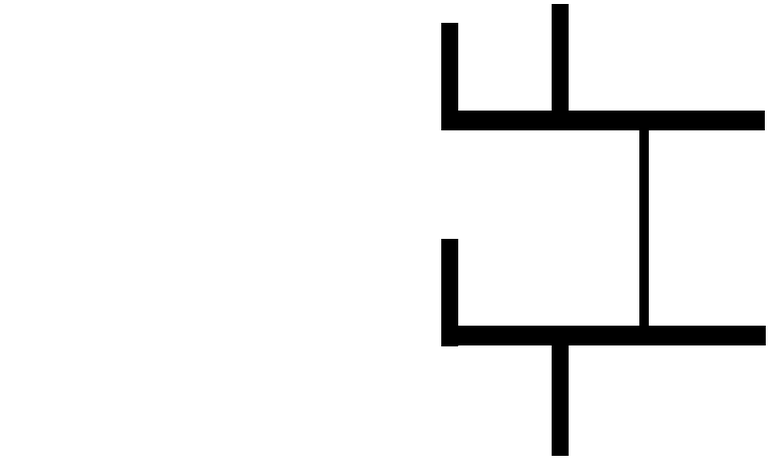


7 Balcony



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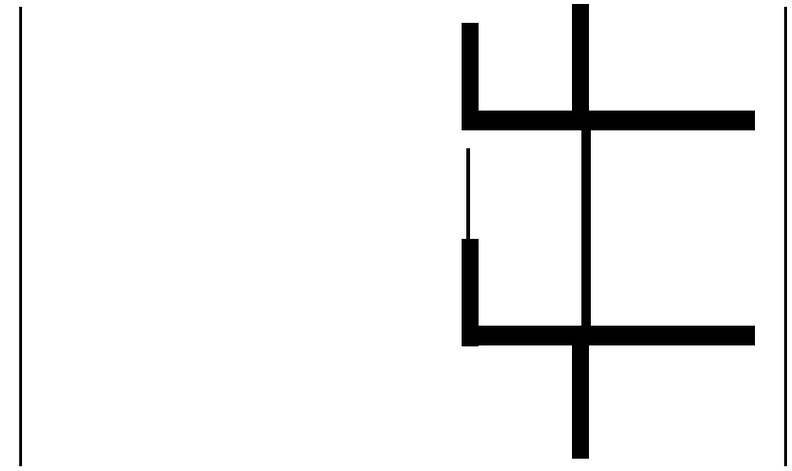
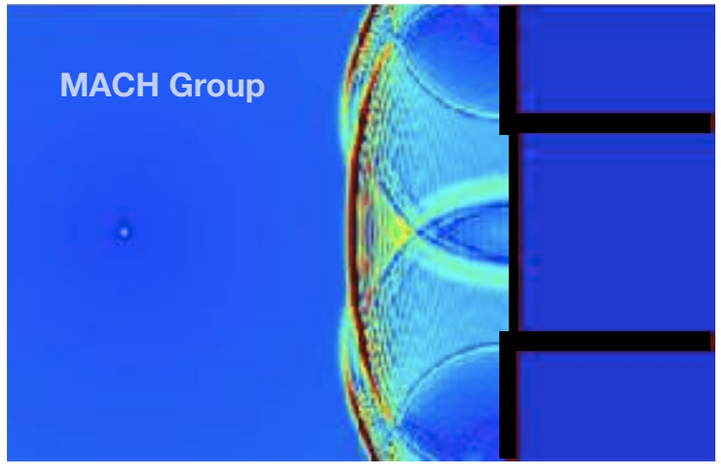


Facade thermal properties Internal / external shading

BS12354 - Airborne sound insulation against outdoor sound

1 Plane Facade



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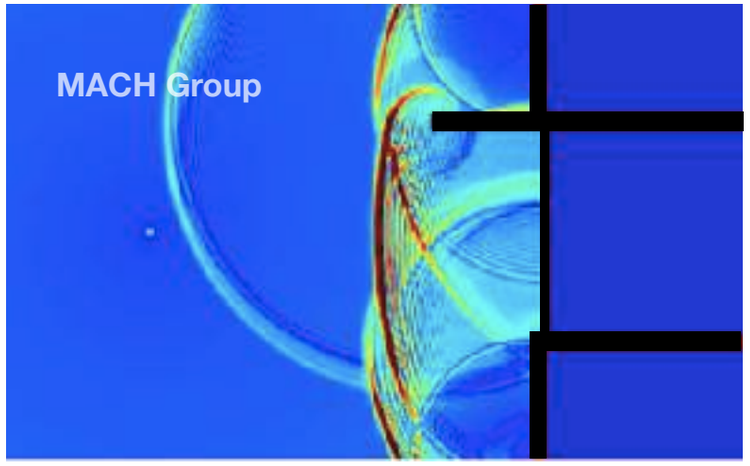
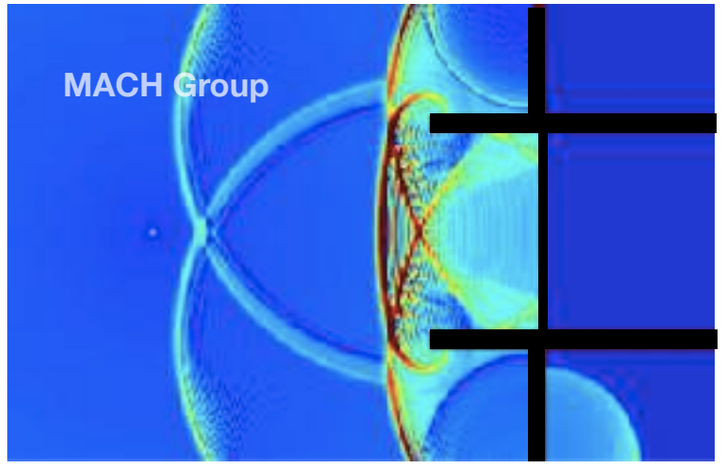


3 Gallery



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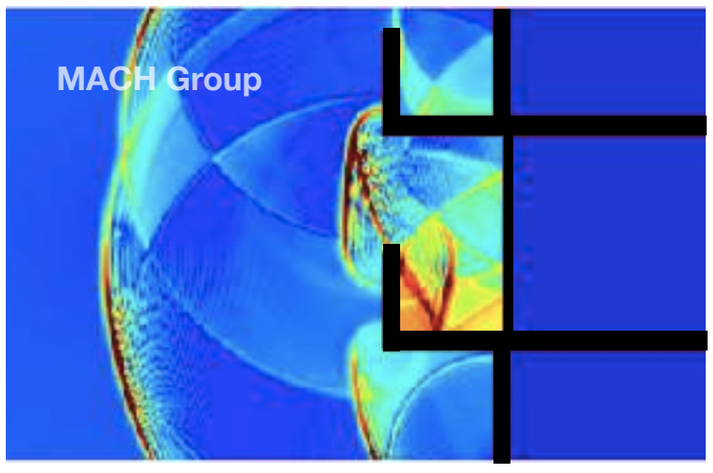

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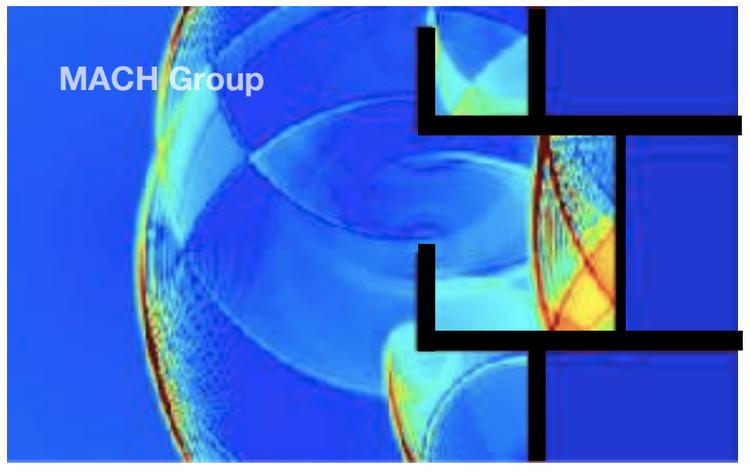

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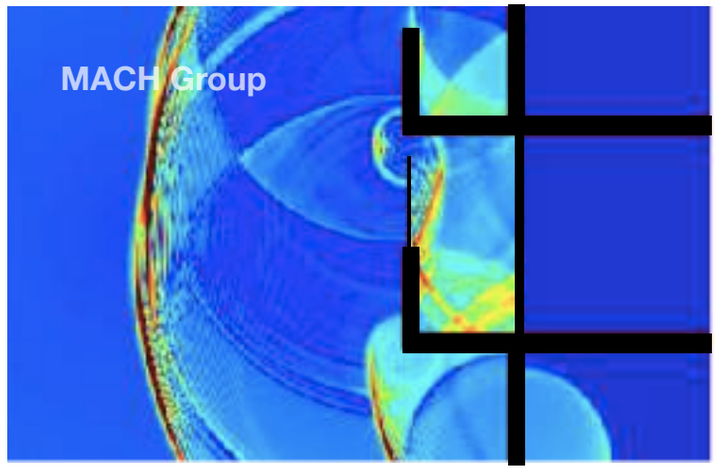

Facade thermal properties Internal / external shading

BS12354 - Airborne sound insulation against outdoor sound

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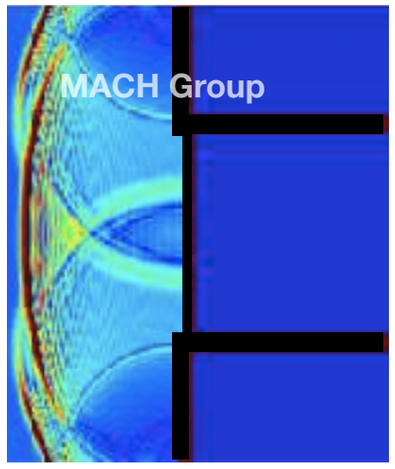
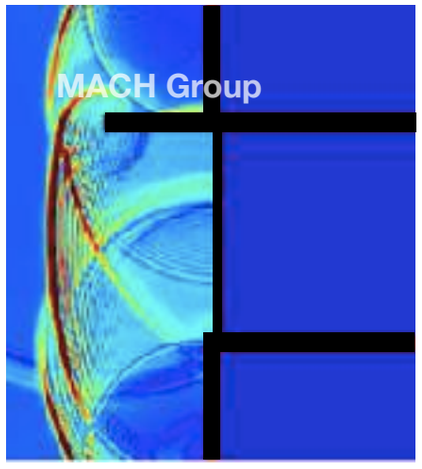


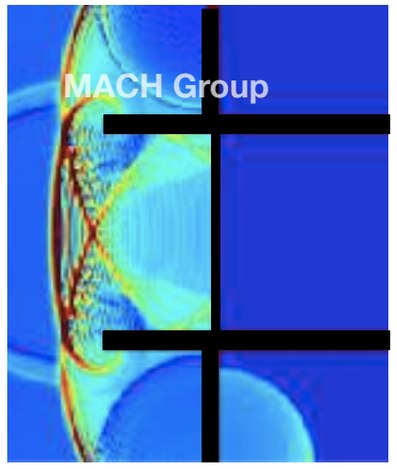
0 dB

2 Gallery



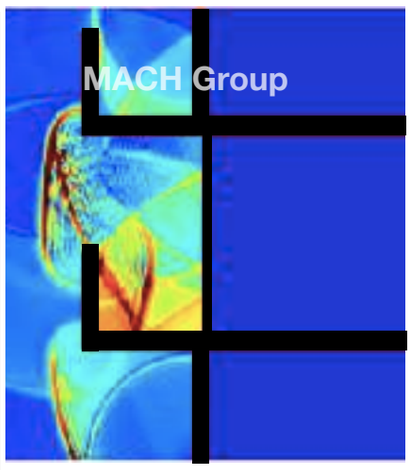
-1 dB

3 Gallery



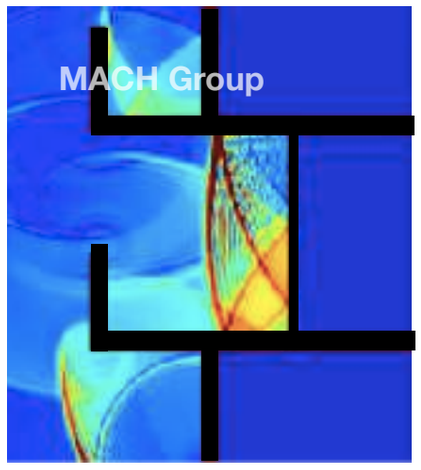
-1 dB

4 Gallery



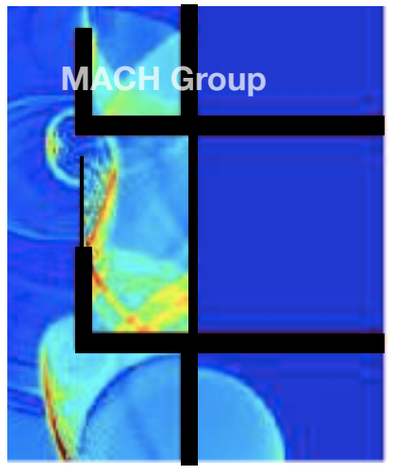
3 dB

7 Balcony



4 dB

5 Gallery



6 dB

Agenda

Building location & orientation

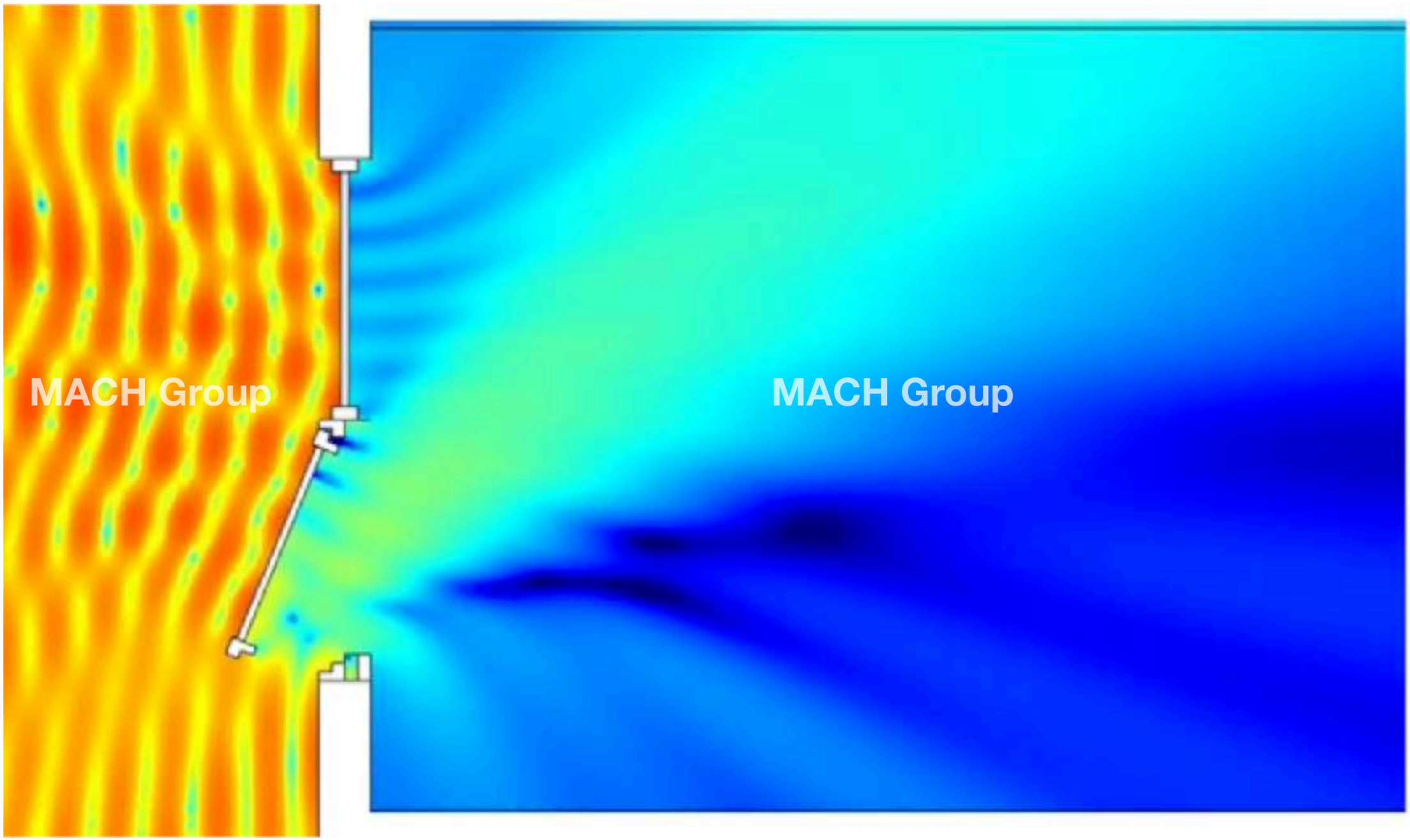
Facade thermal properties

Internal / external shading

Mechanical systems

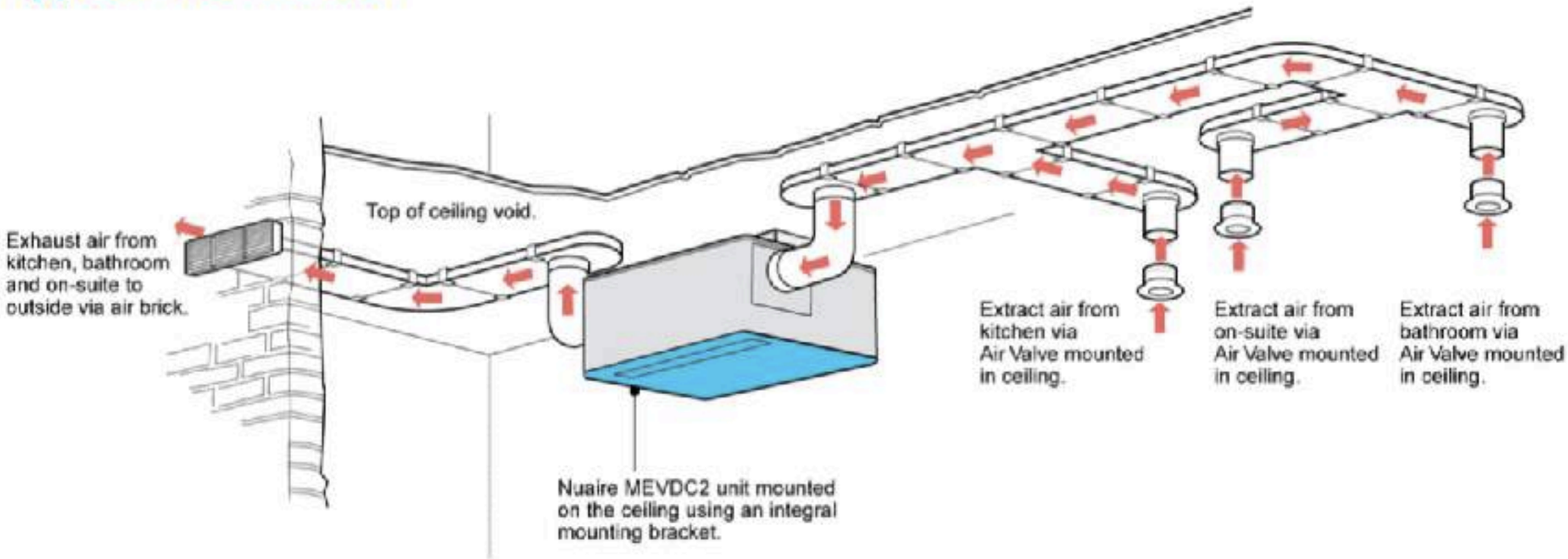
Open windows/vents

Mechanical systems - Baffled Window - Air Flow

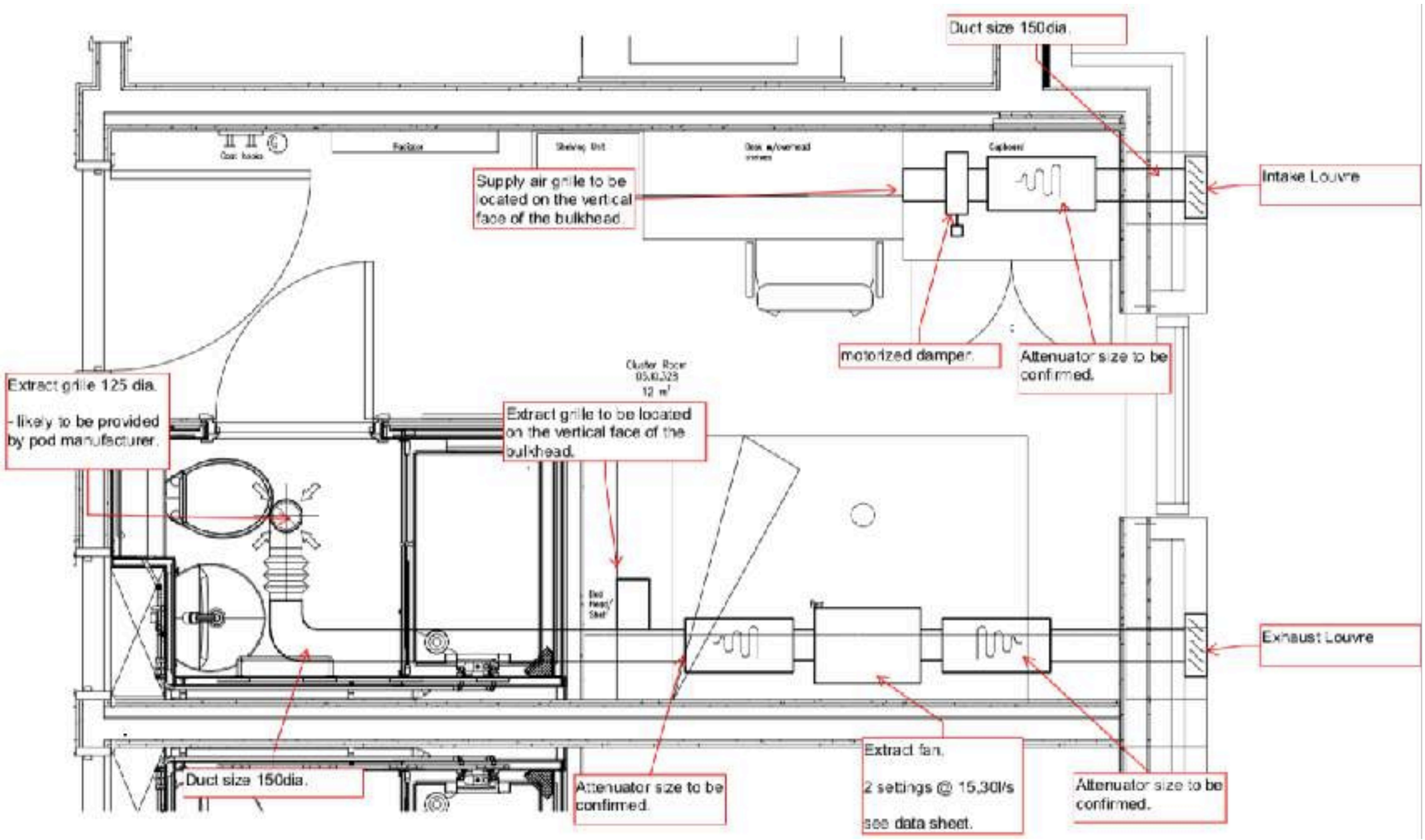


Mechanical systems - Increased Pressure Smaller Openings

Typical Installation

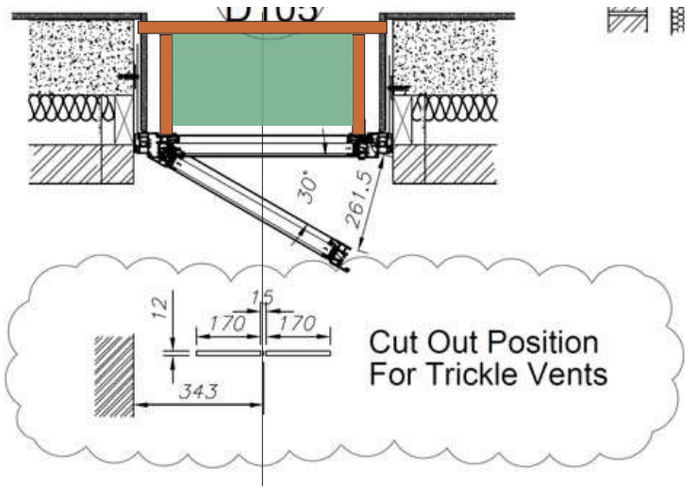


Mechanical systems - Facade Vent

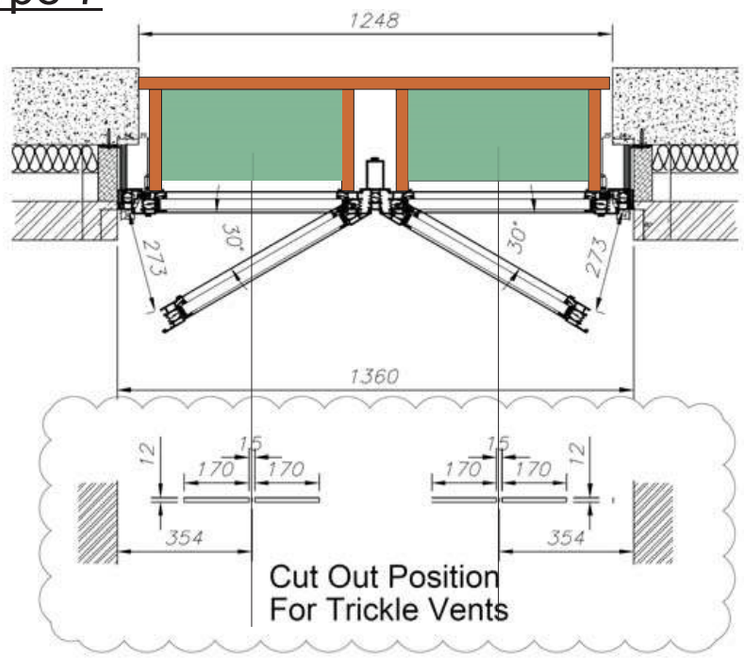


Mechanical systems - Facade Vent

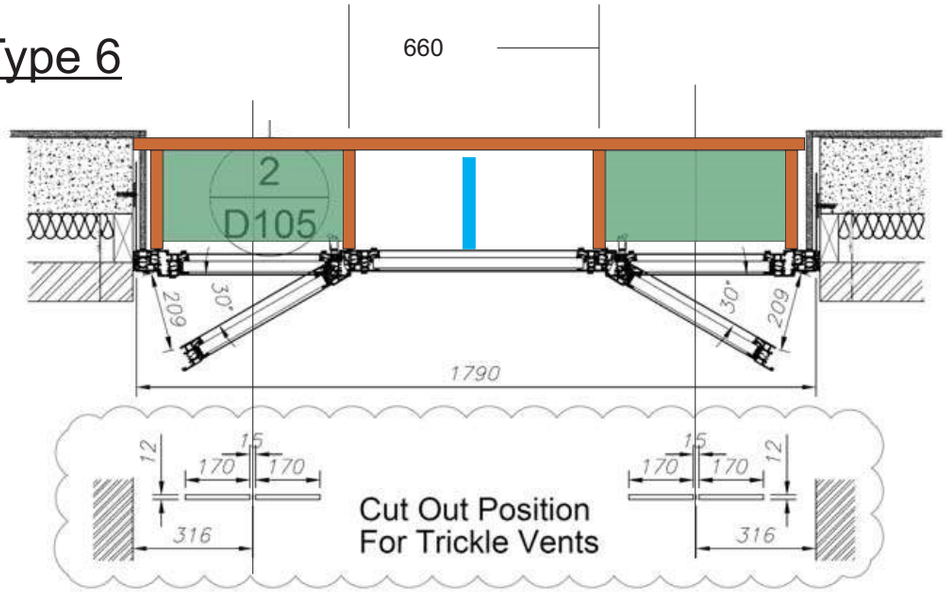
Type 5



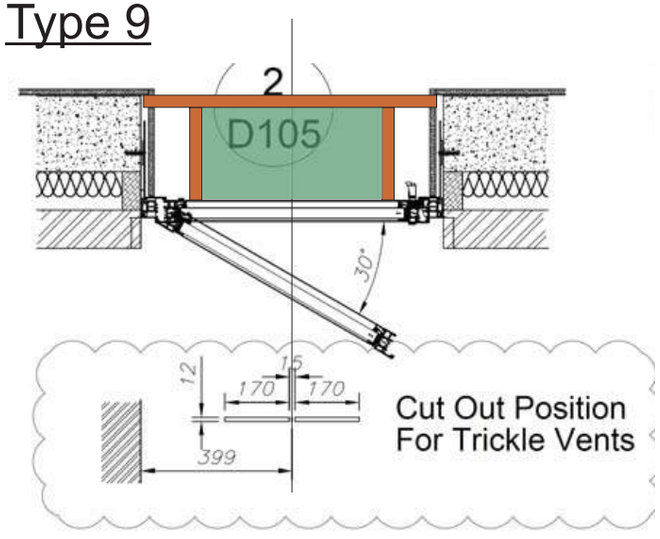
Type 7



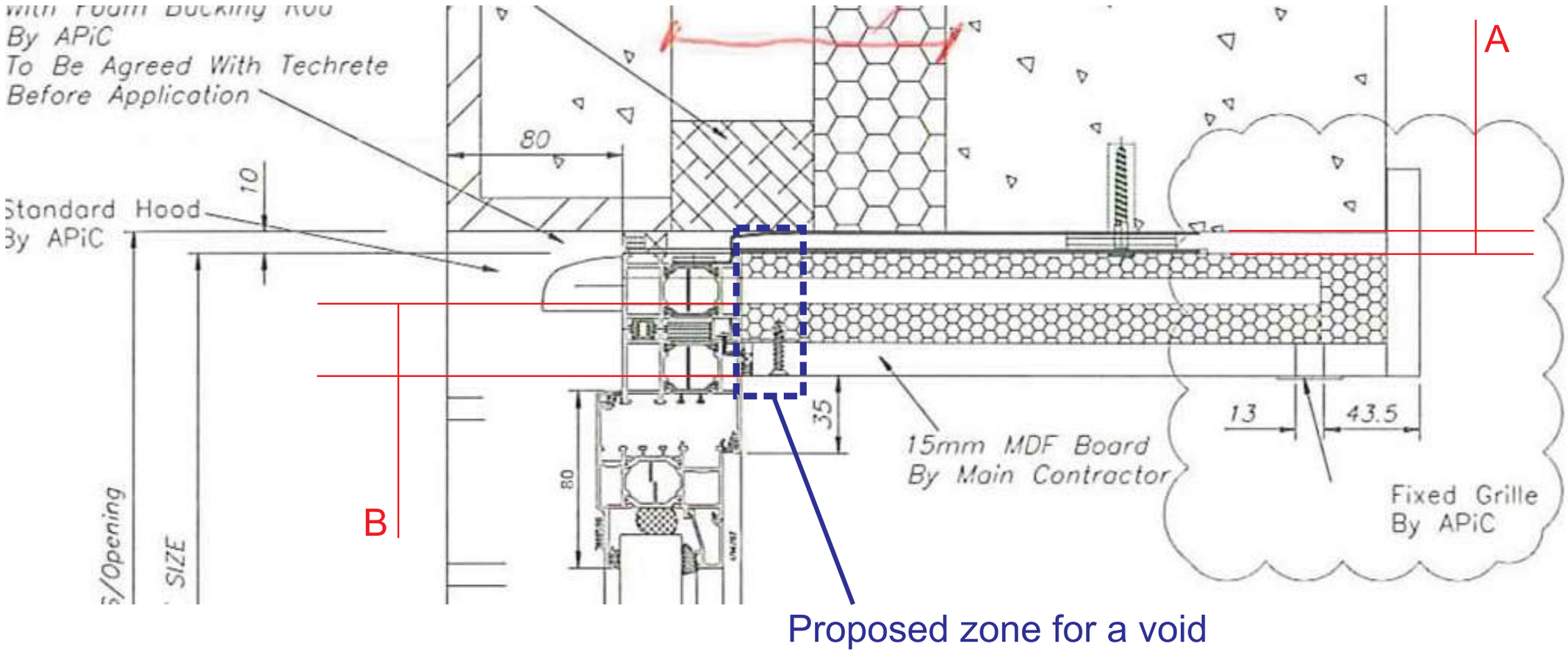
Type 6



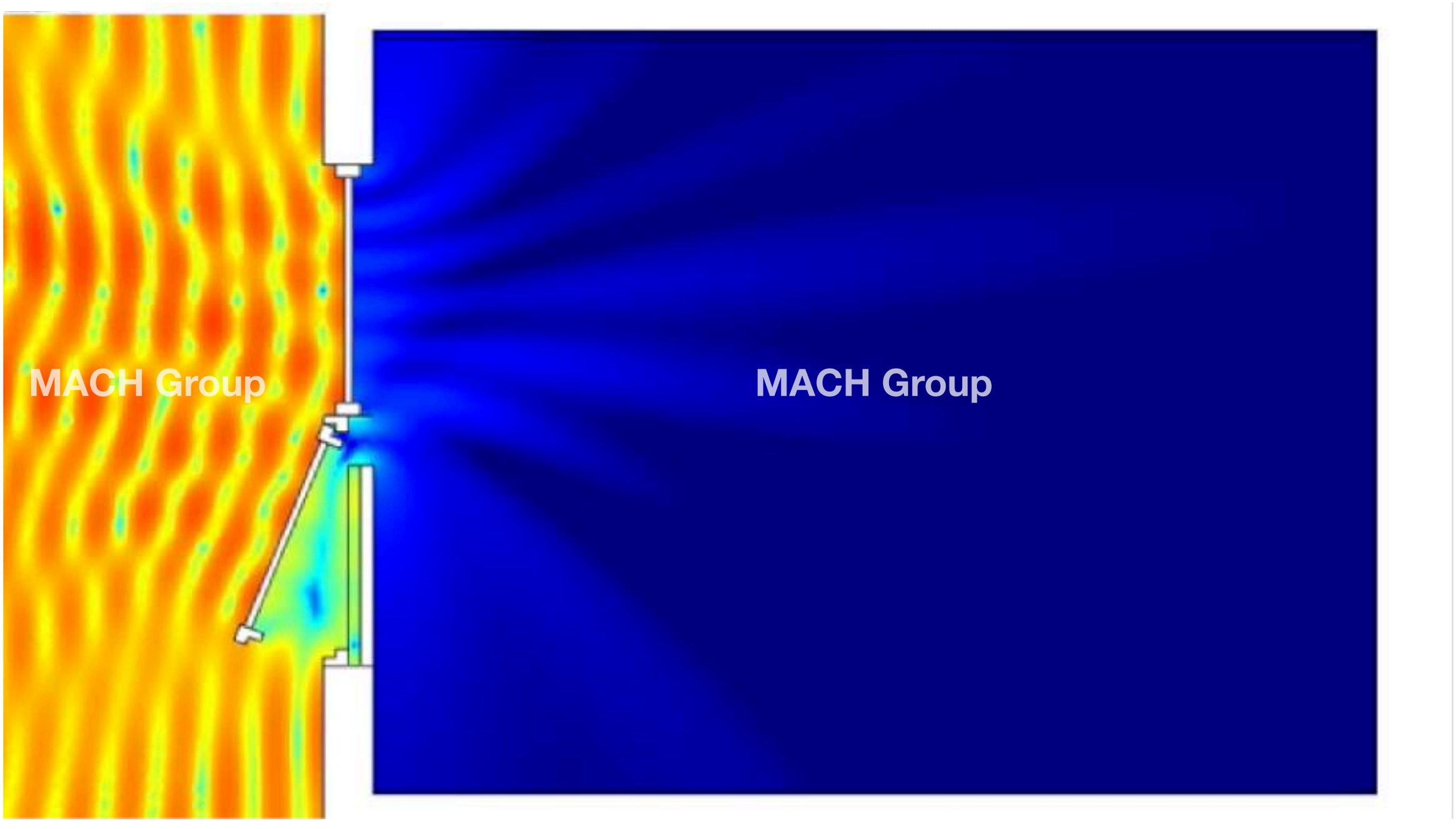
Type 9



Mechanical systems - Facade Vent



Mechanical systems - Facade Vent



Agenda

Building location & orientation

Facade thermal properties

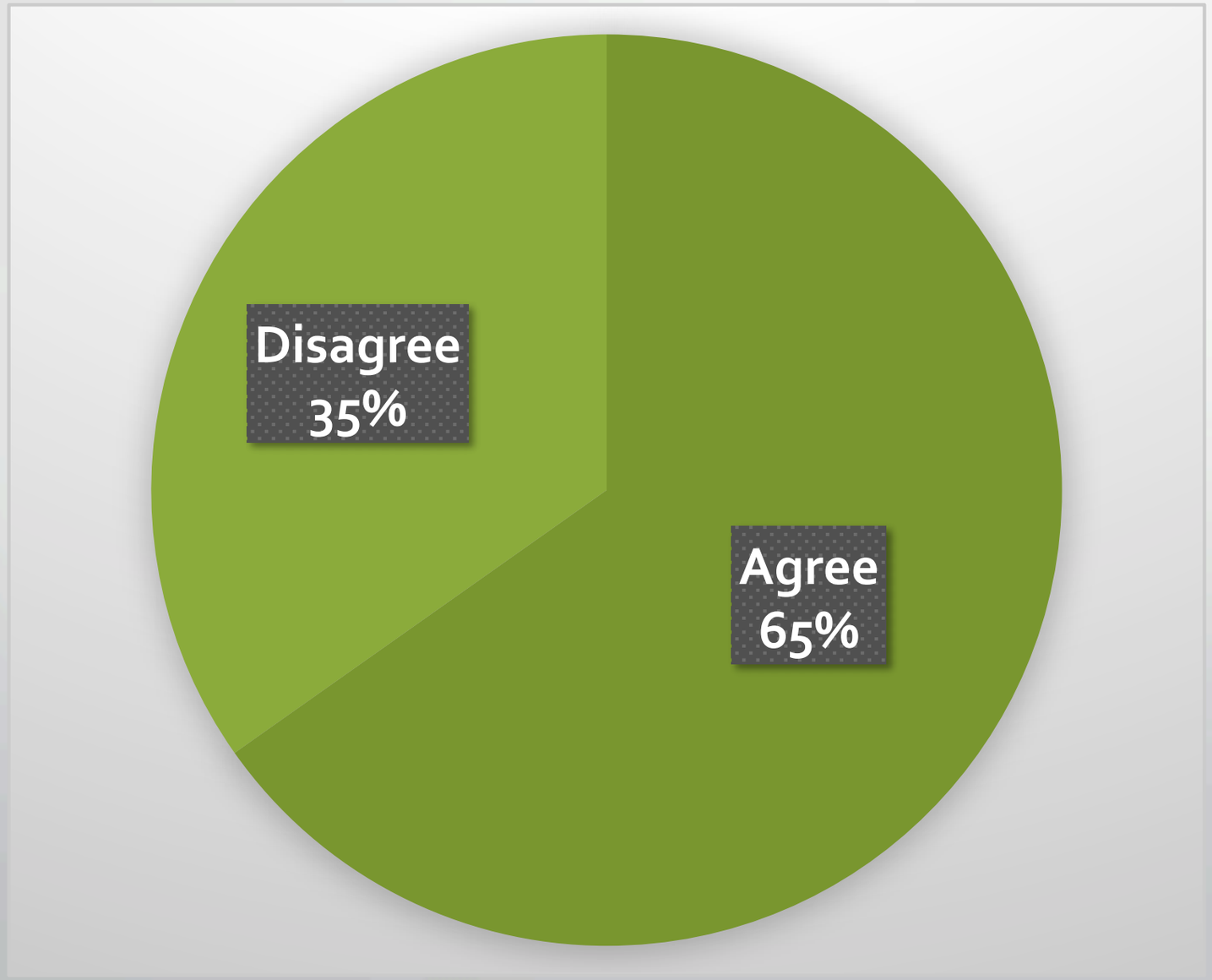
Internal / external shading

Mechanical systems

Open windows/vents

Open windows/vents

Open Window – 12dB Sound Insulation



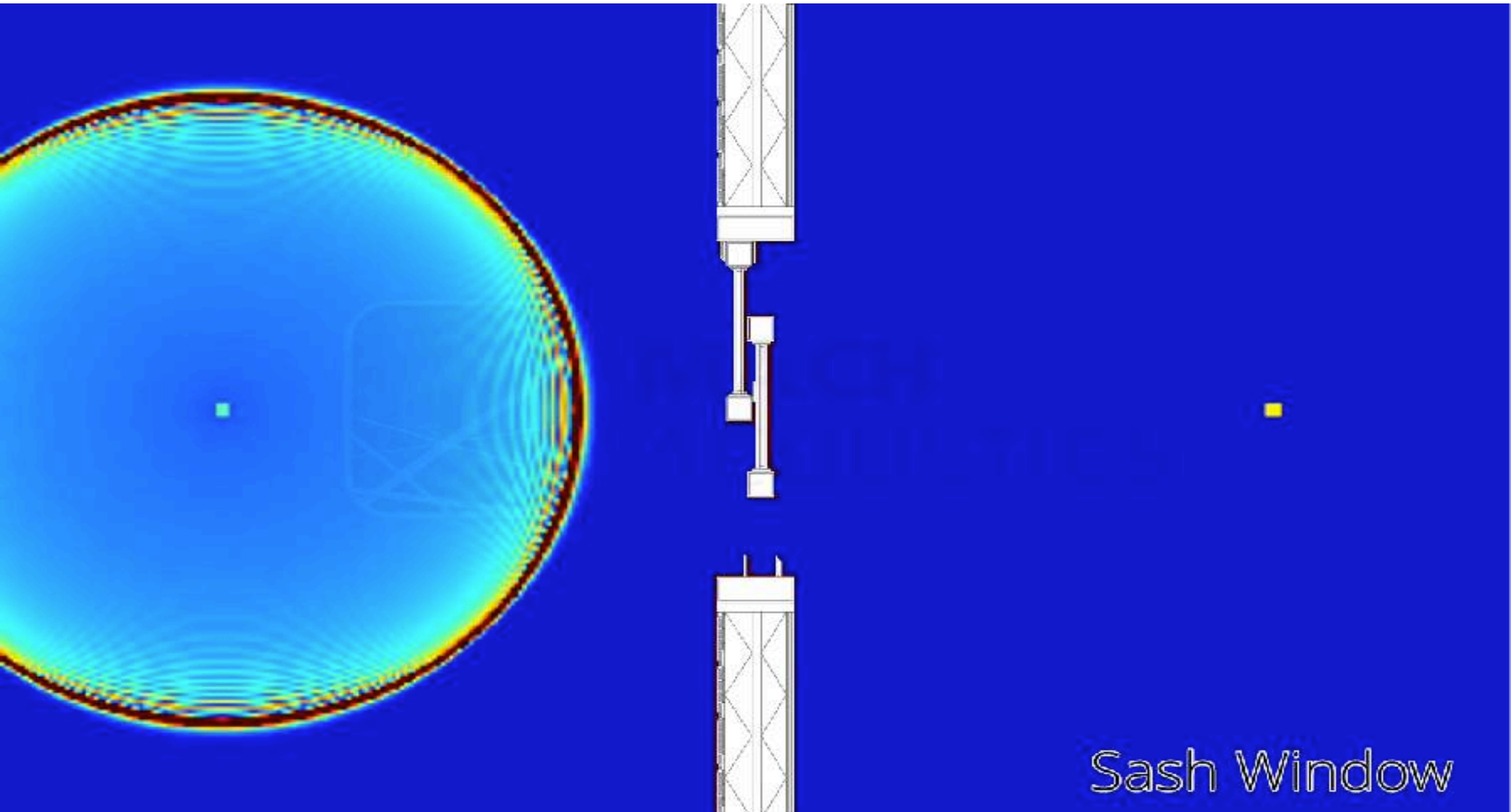
Open windows/vents - Three Open Windows

Open windows/vents - Huge Windows

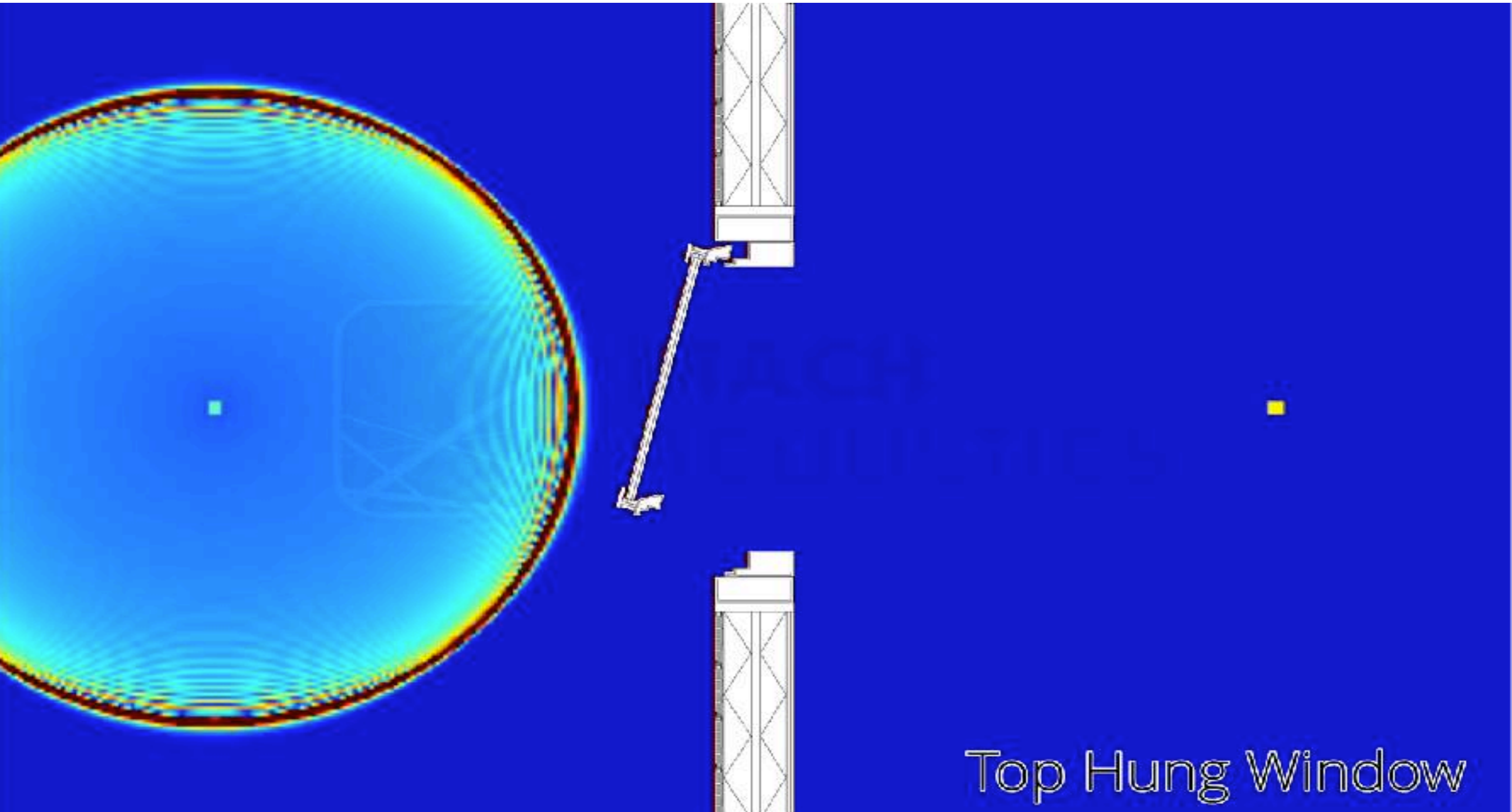
Open windows/vents - Single Pivot Open Windows

Open windows/vents - Single Partially Open Windows

Open windows/vents - Sash



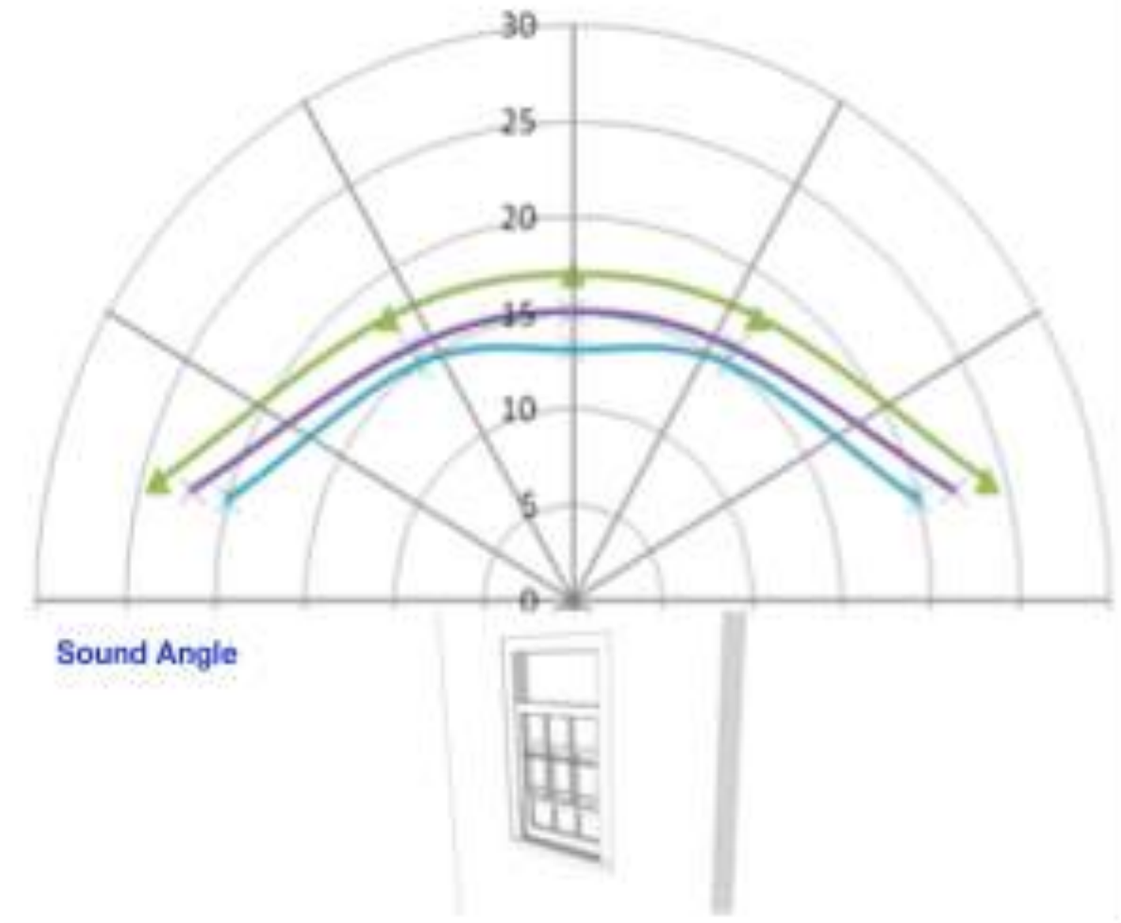
Open windows/vents - Top Hung

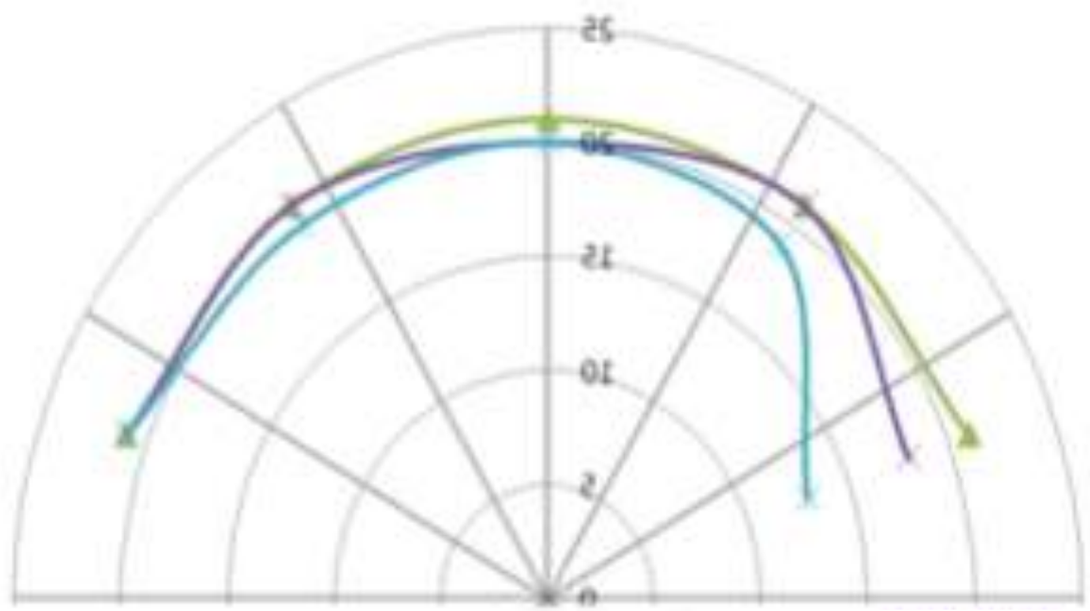


Open windows/vents - Real Data

Napier University carrying out the biggest study into the acoustics performance of open windows over 425 separate tests.

Open windows/vents - Measured Levels

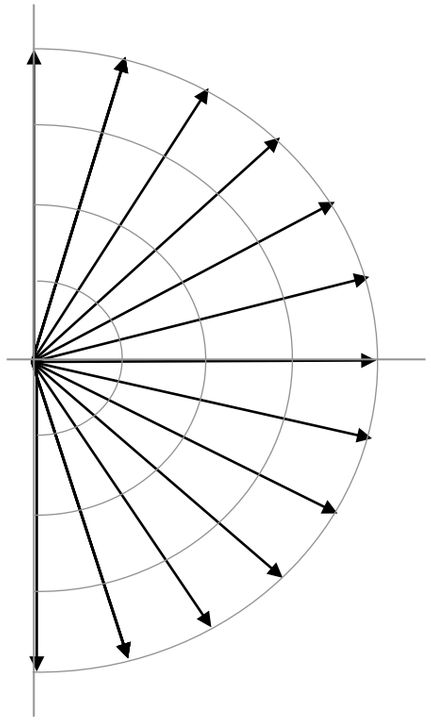




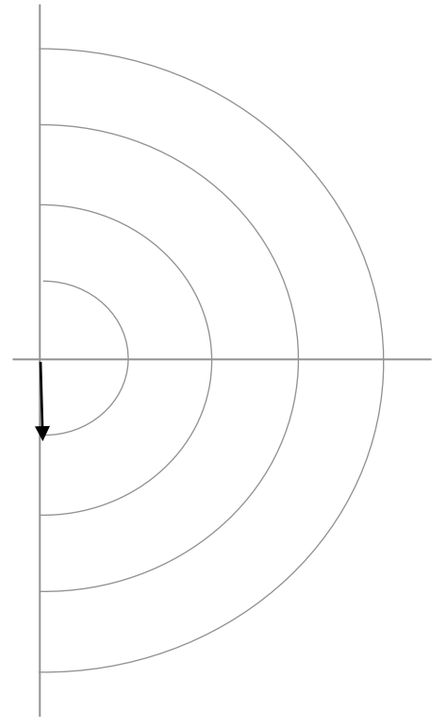
Open Area — 0.05 m — 0.1 m — 0.2 m

Open windows/vents - Sound Angle

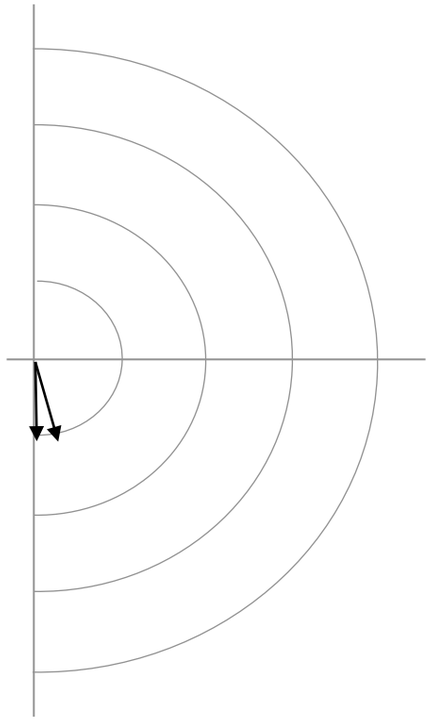
Open windows/vents - Sound Angle



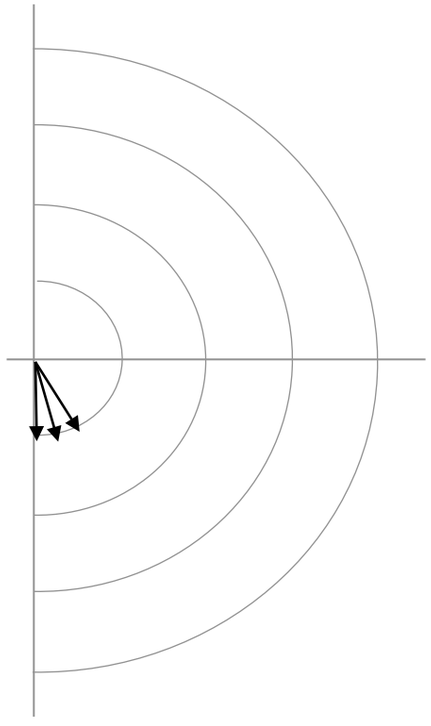
Open windows/vents - Sound Angle



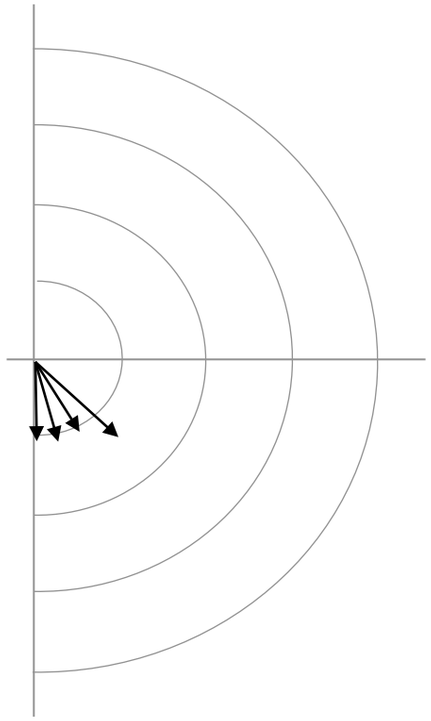
Open windows/vents - Sound Angle



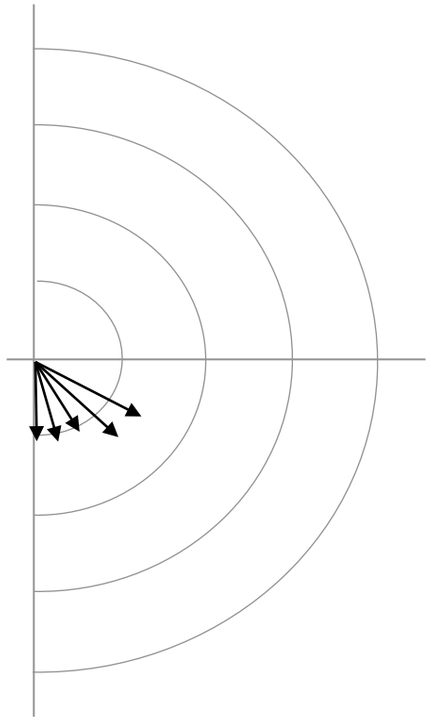
Open windows/vents - Sound Angle



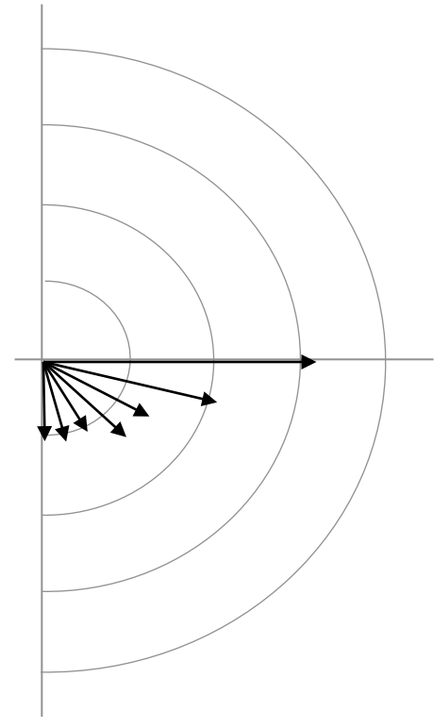
Open windows/vents - Sound Angle



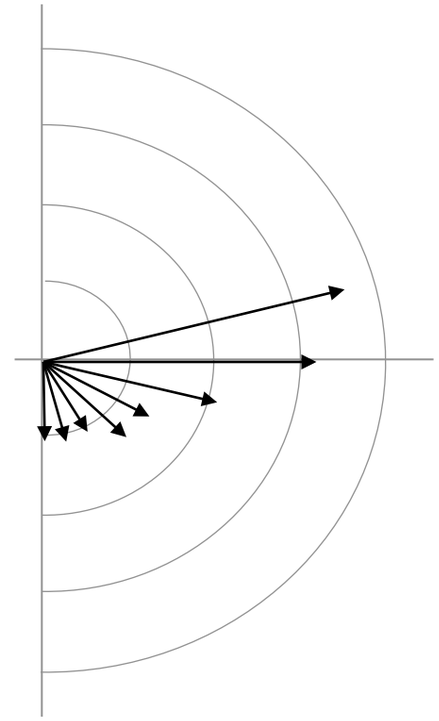
Open windows/vents - Sound Angle



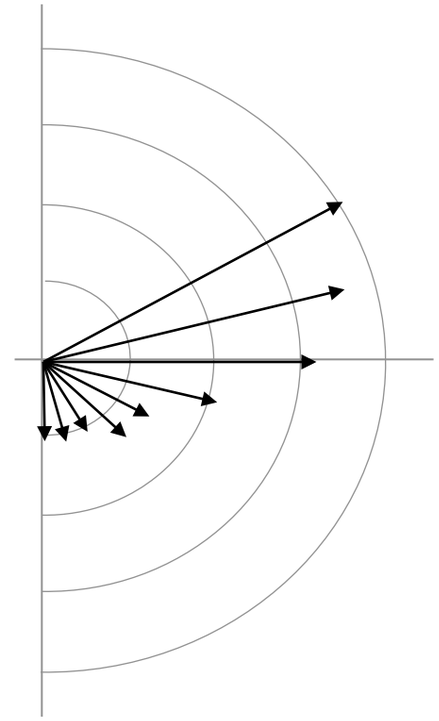
Open windows/vents - Sound Angle



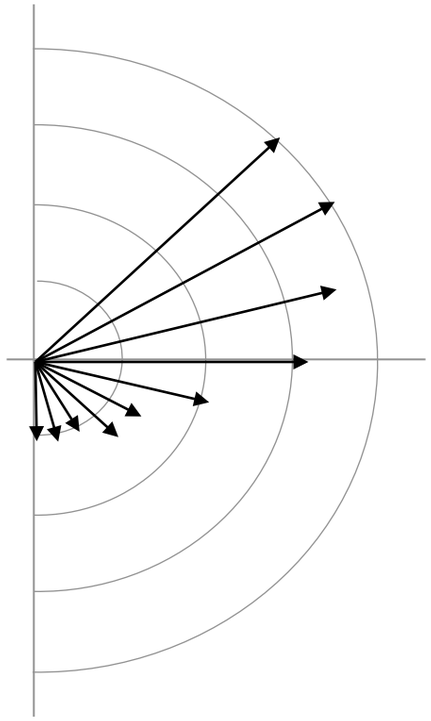
Open windows/vents - Sound Angle



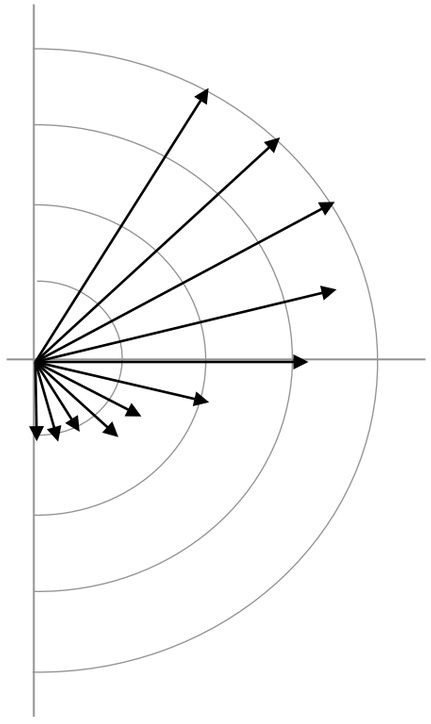
Open windows/vents - Sound Angle



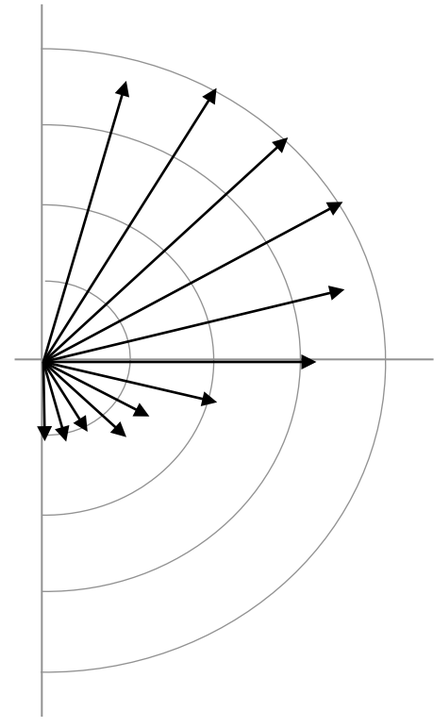
Open windows/vents - Sound Angle



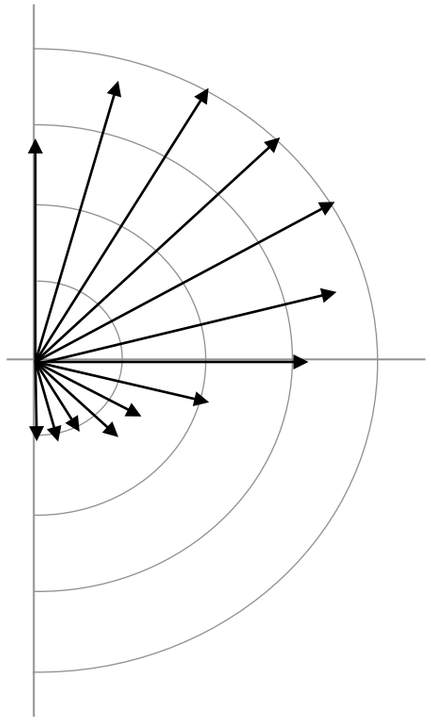
Open windows/vents - Sound Angle



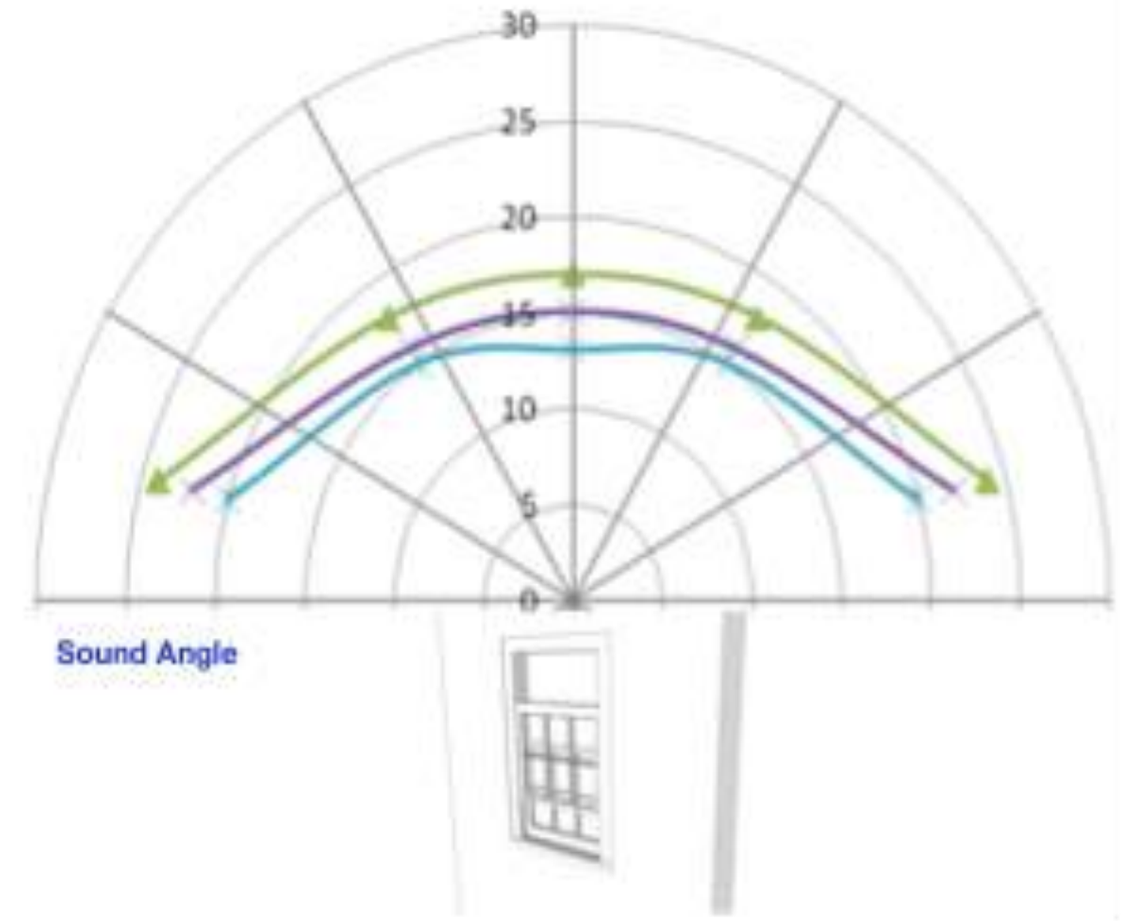
Open windows/vents - Sound Angle

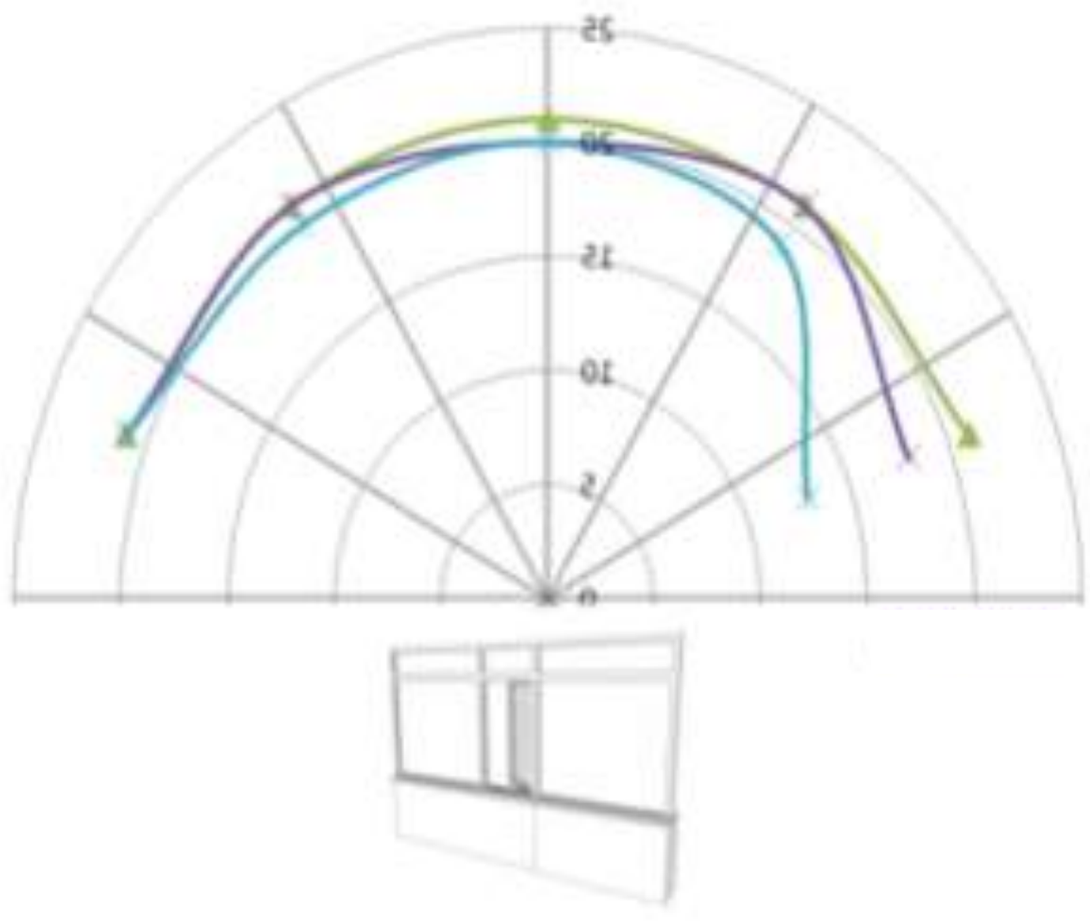


Open windows/vents - Sound Angle



Open windows/vents - Measured Levels

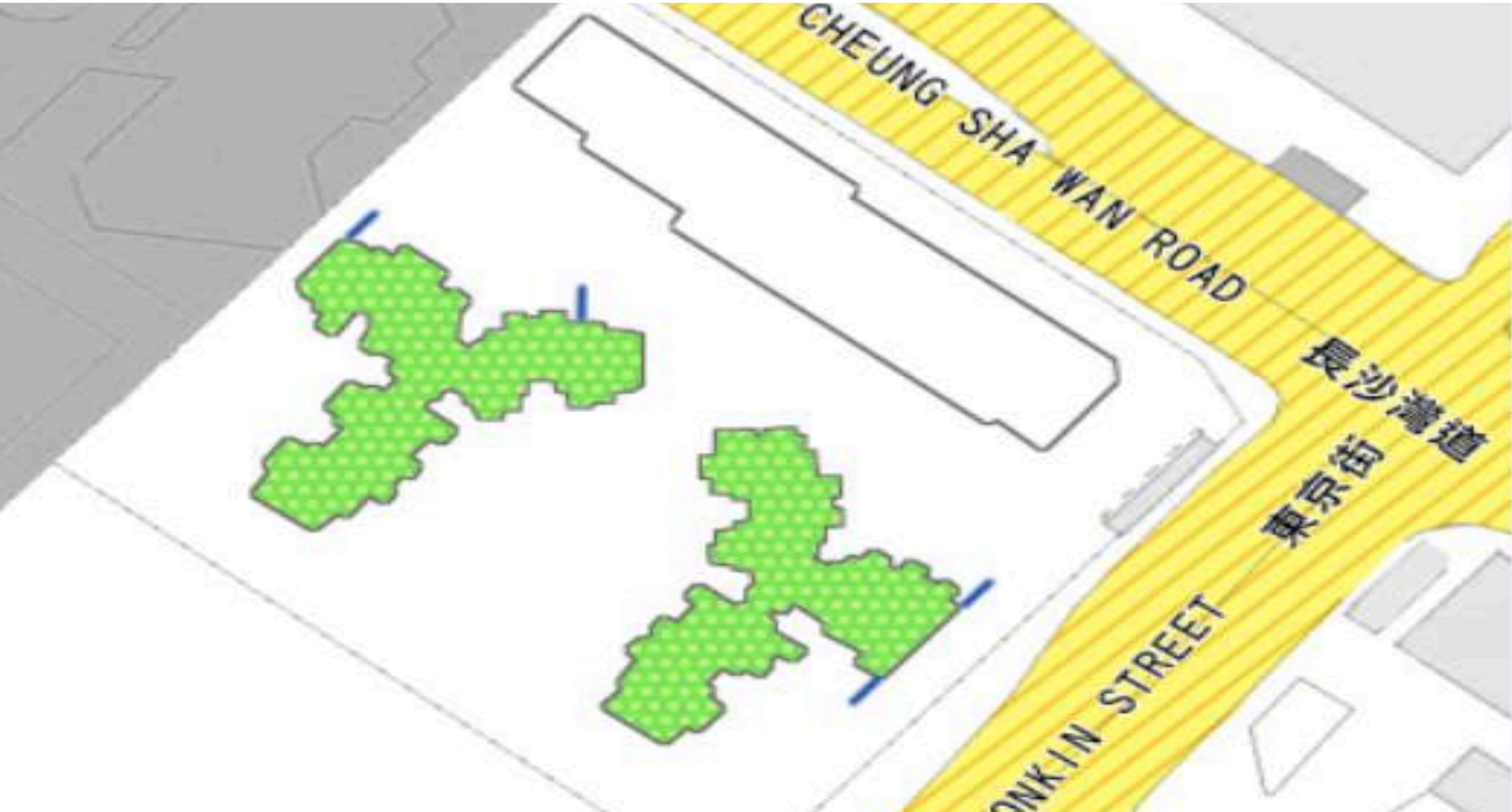




Open Area — 0.05 m — 0.1 m — 0.2 m

Jump

Open windows/vents - Acoustics Fins Used In China

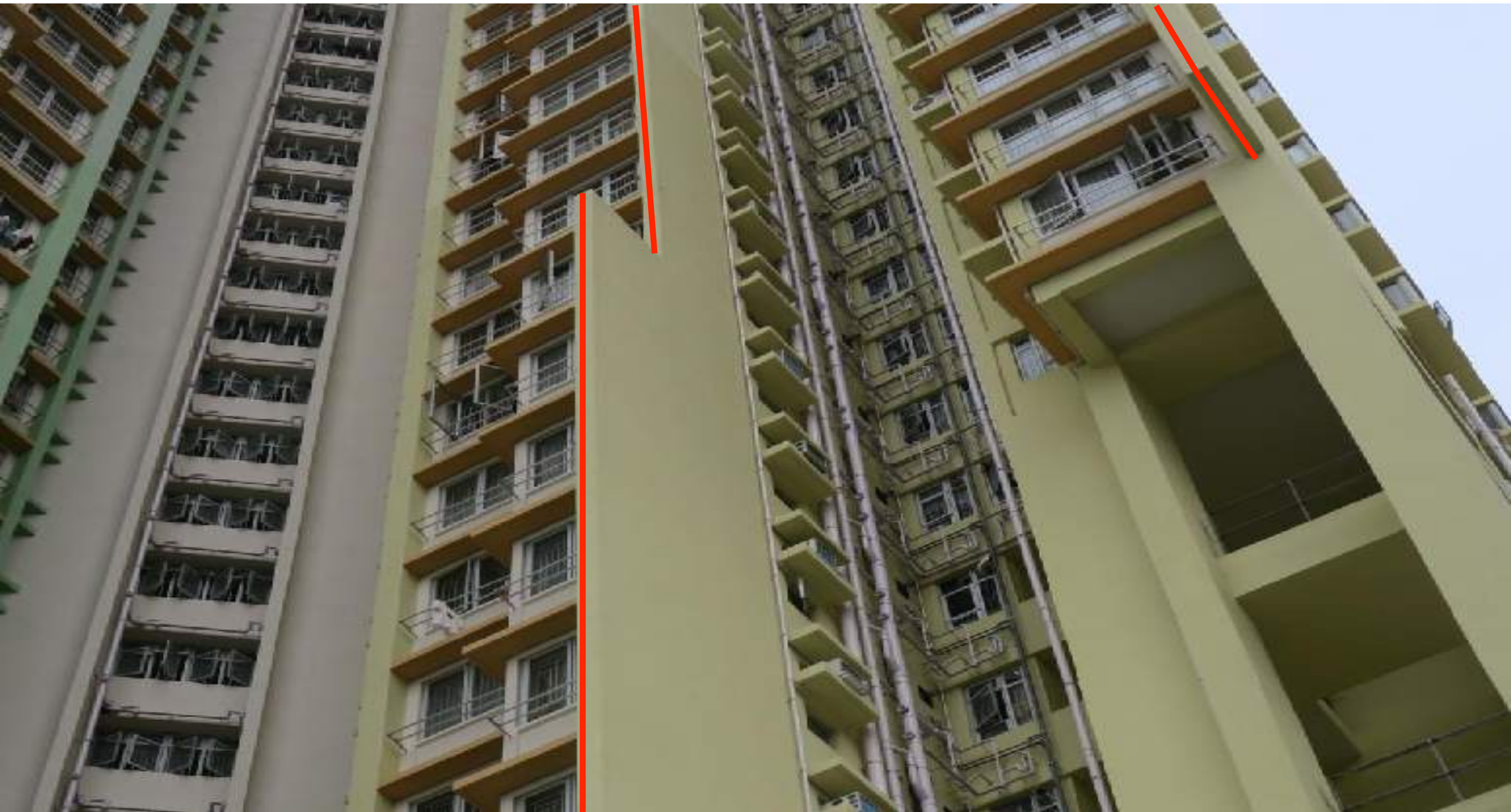


MACH Group

Holistic Design

Open windows/vents - Acoustics Fins Used In China

Open windows/vents - Acoustics Fins Used In China



MACH Group

Holistic Design

Open windows/vents - Acoustics Fins Used In China

MACH Group

Holistic Design

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MACH Group

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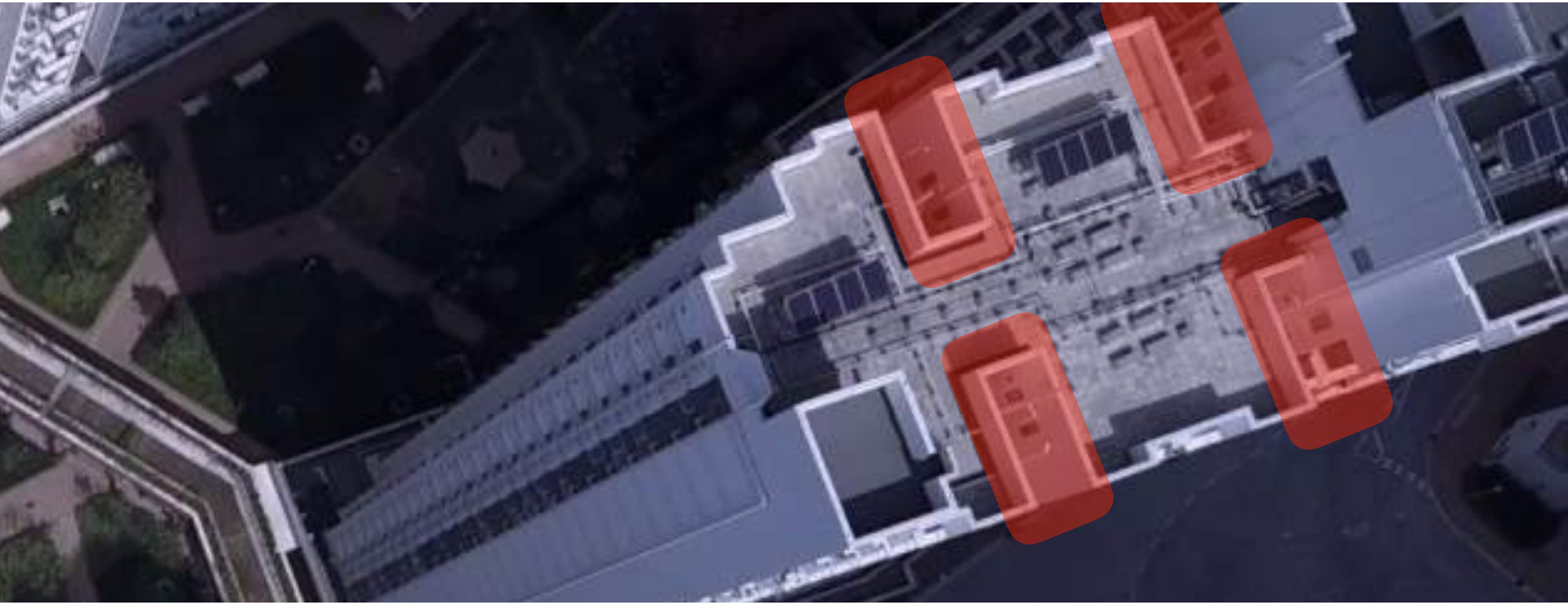
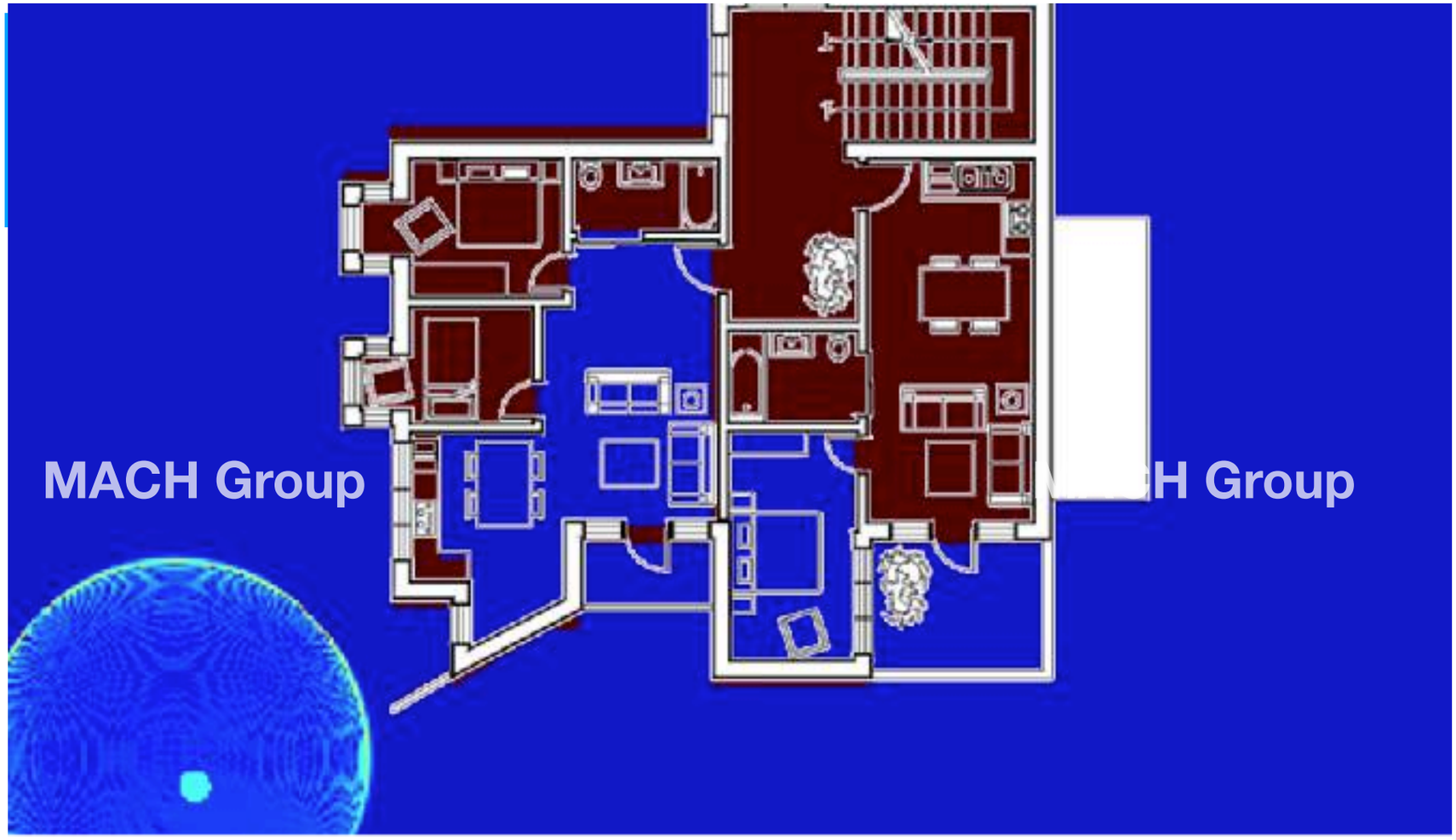


MACH Group

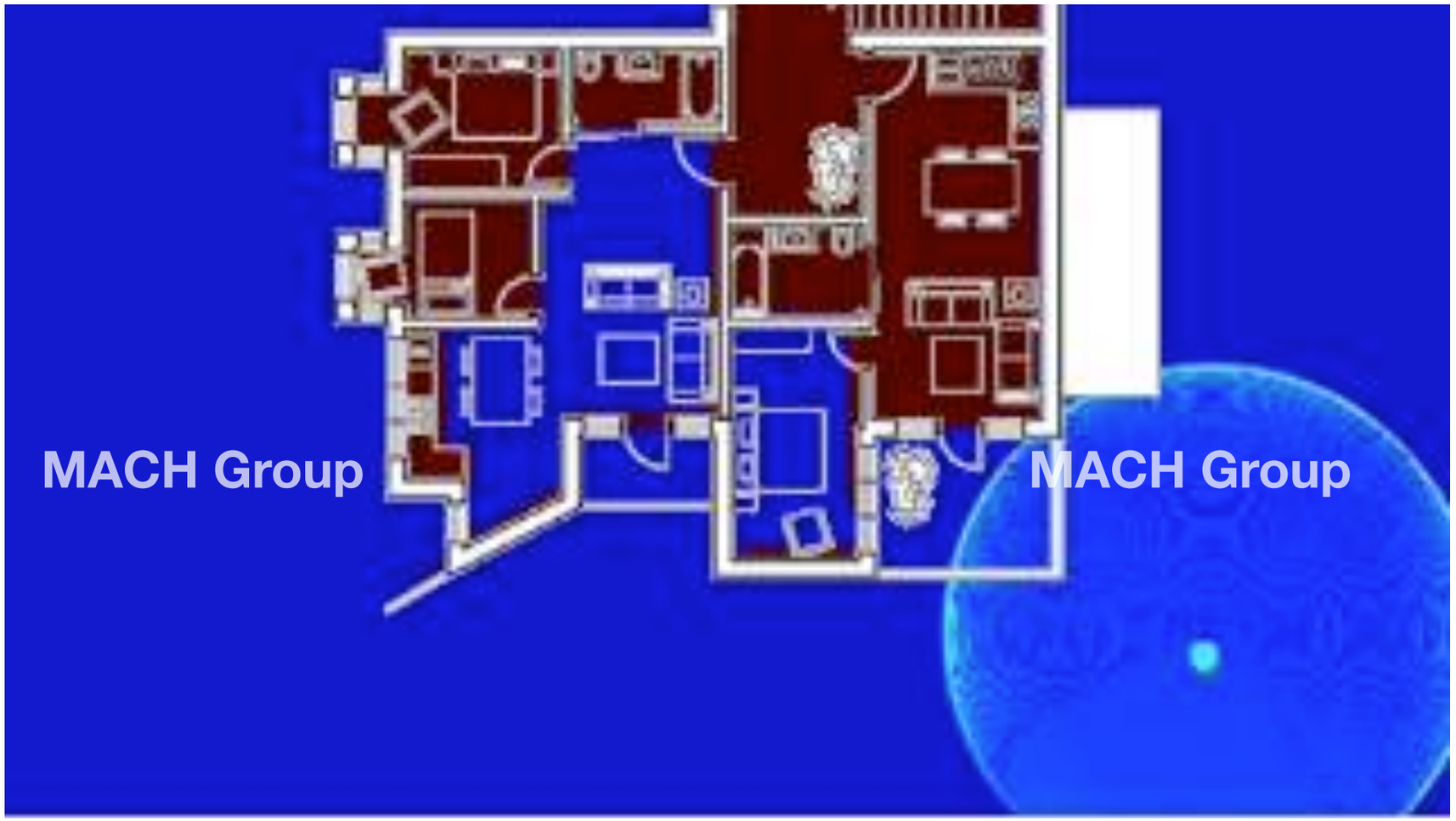
Holistic Design

Open windows/vents - Acoustics Fins Used In China

Open windows/vents - Acoustics Fins



Open windows/vents - Acoustics Fins



Agenda

Building location & orientation

Facade thermal properties

Internal / external shading

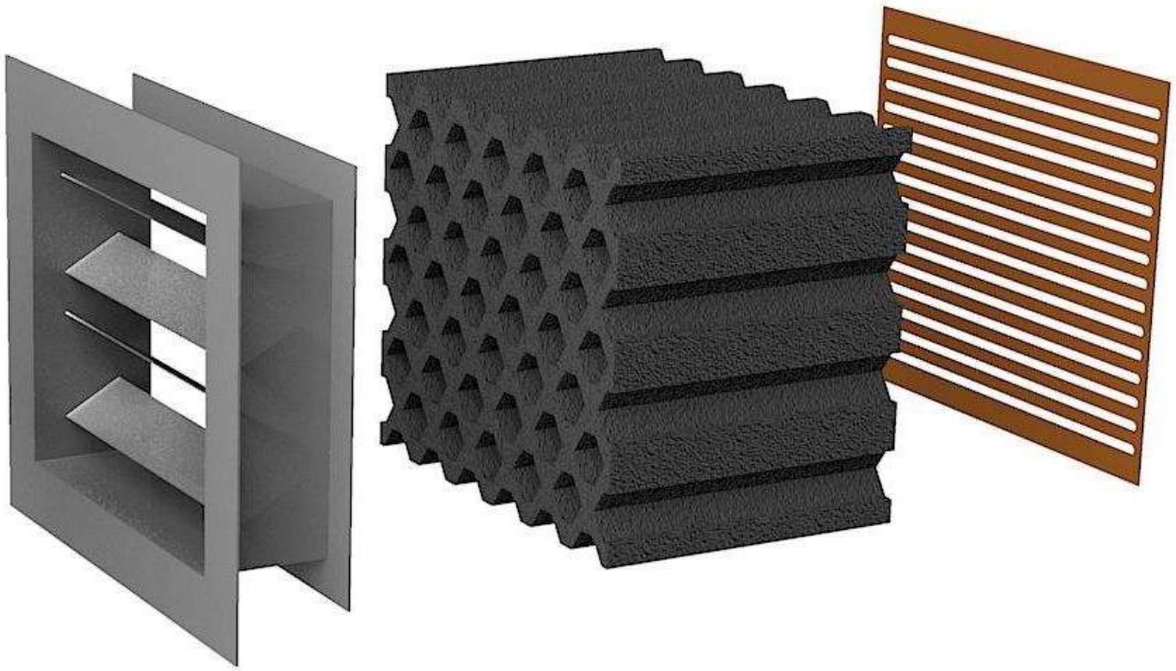
Mechanical systems

Open windows/vents

MACH Group

Holistic Design

Open windows/vents - Attenuated Opening
MACH Products

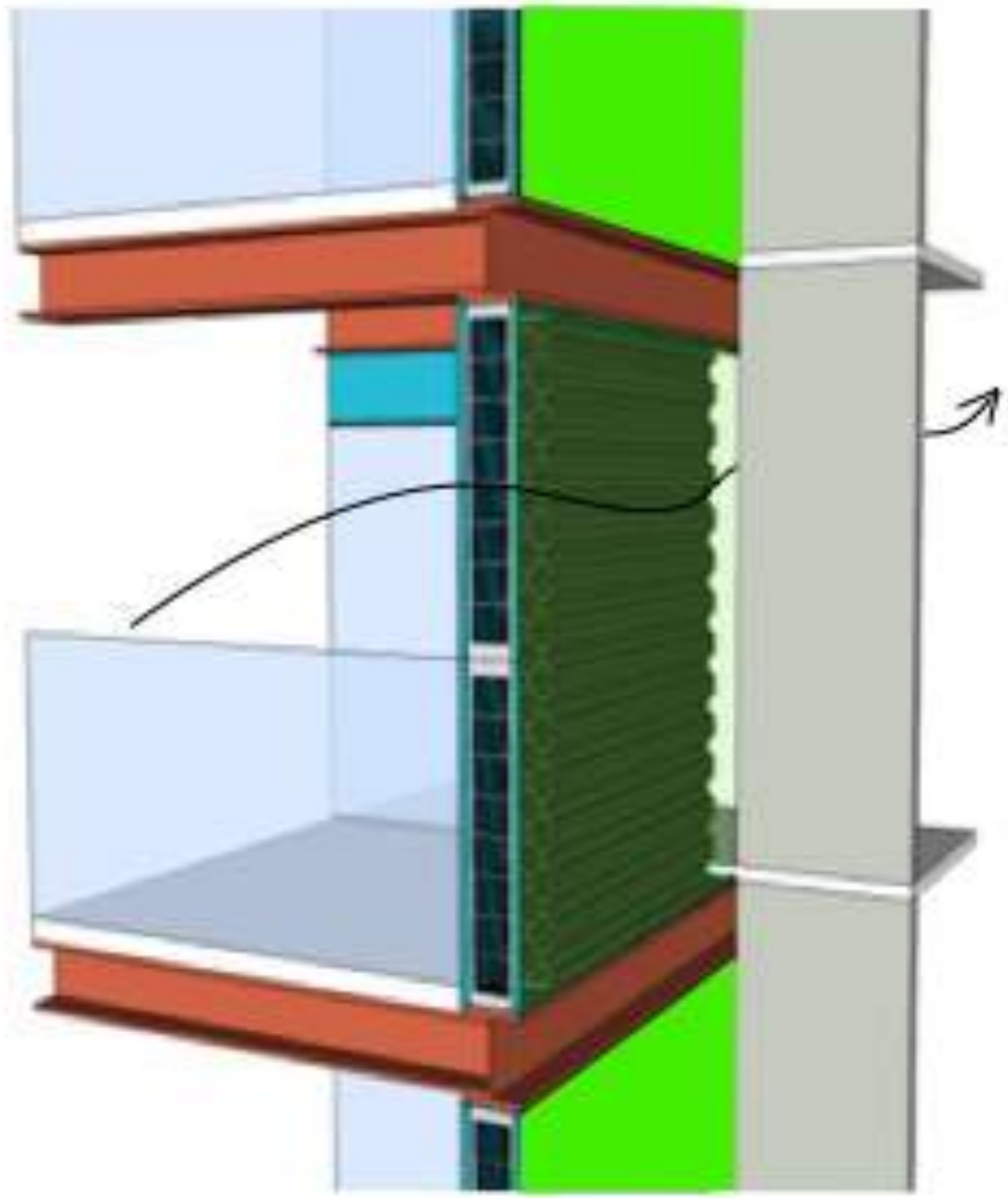


MACH Group

Holistic Design

Open windows/vents - Attenuated Opening
MACH Products

Open windows/vents - Attenuated Opening
MACH Products



Design & Fixed Parameters

Design Parameters

Building location & orientation

Facade thermal properties

Internal / external shading

Mechanical systems

Open windows/vents

Design & Fixed Parameters

Design Parameters

Building location & orientation
Facade thermal properties
Internal / external shading
Mechanical systems
Open windows/vents

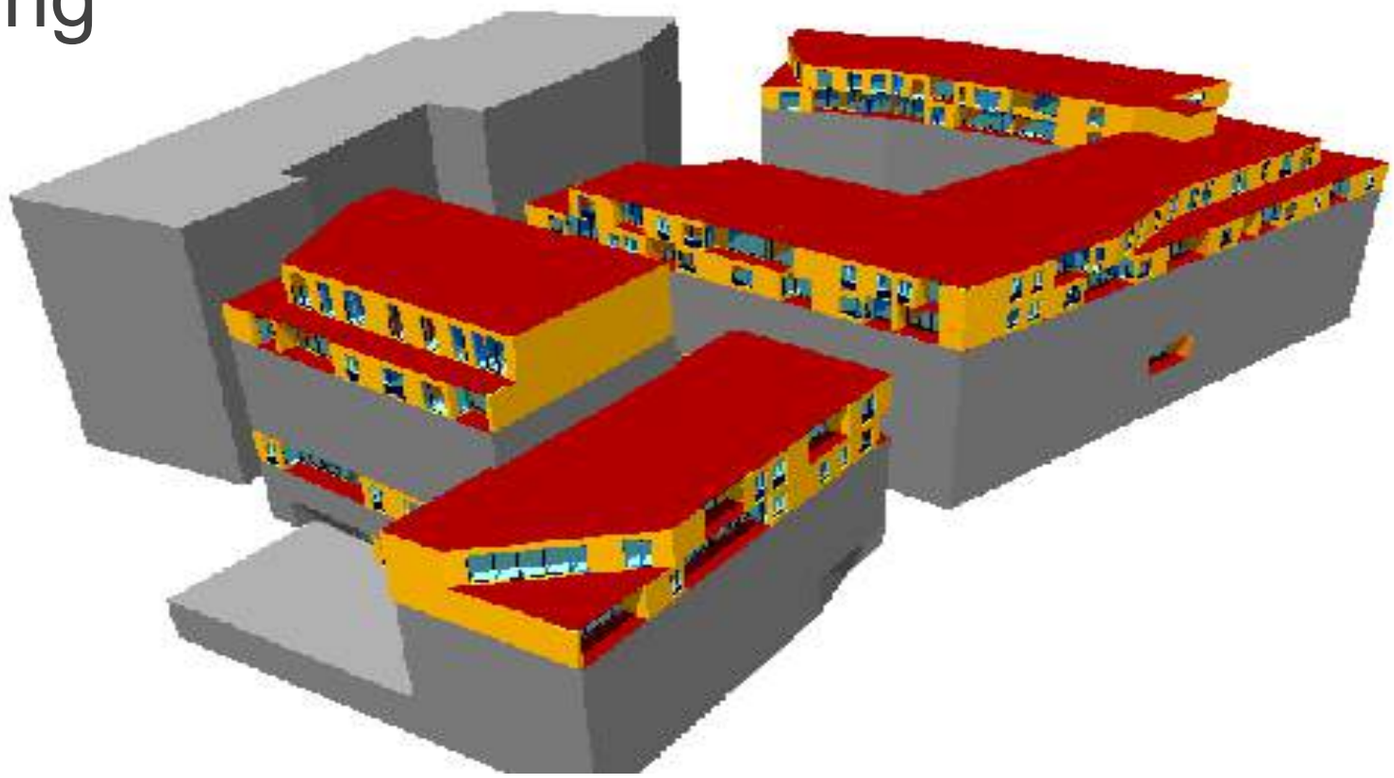
Fixed Parameters

Internal gains
Room types
Occupancy profiles
Weather files for site

Dynamic Thermal Modelling

Inputs include:

- Building location & orientation
- Facade thermal properties
- Internal / external shading
- Mechanical systems
- Open windows/vents
- Internal gains
- Room types
- Occupancy profiles
- Weather files for site



Dynamic Thermal & Acoustic Modelling

Thank you