PV . AS . ART

Frédérique Sanders . TU Delft . AE Studio 16

P5 Presentation . 03-02-2017

PRESENTATION **CONTENT**

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INTRODUCTION

- *Problem Statement*
- *Objective*

2

RESEARCH

- *Daylight*
- *Solar Energy*

3

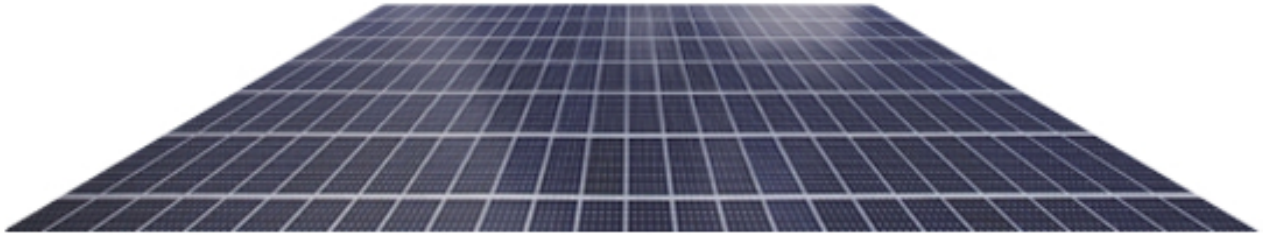
DESIGN

- *Marineterrein*
- *Heros Daylight School*

INTRODUCTION

PROBLEM STATEMENT 1

Current way of mounting solar panels on roofs
is a good development, but **not fed by an architectural approach;**



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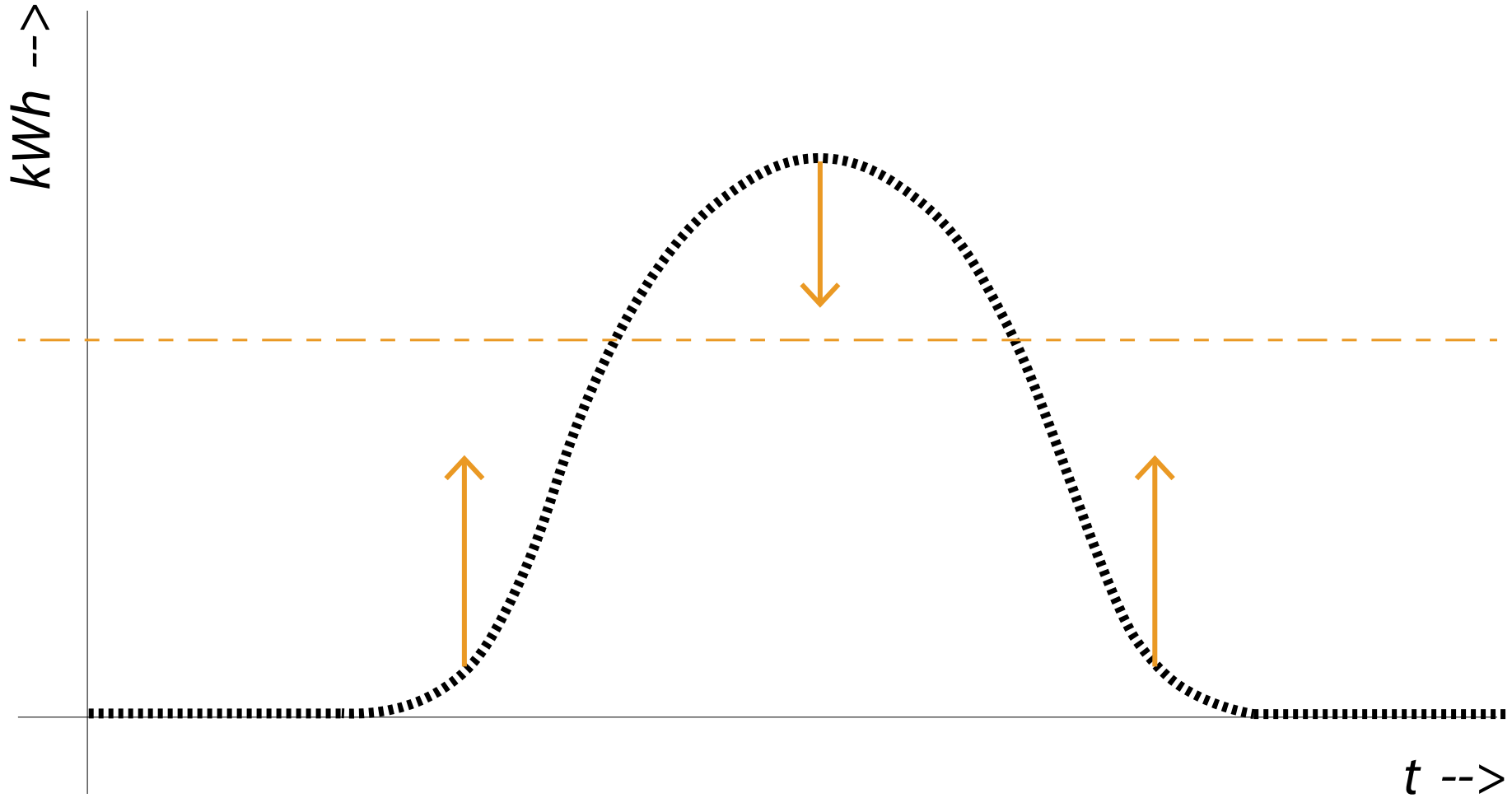
PROBLEM STATEMENT 2

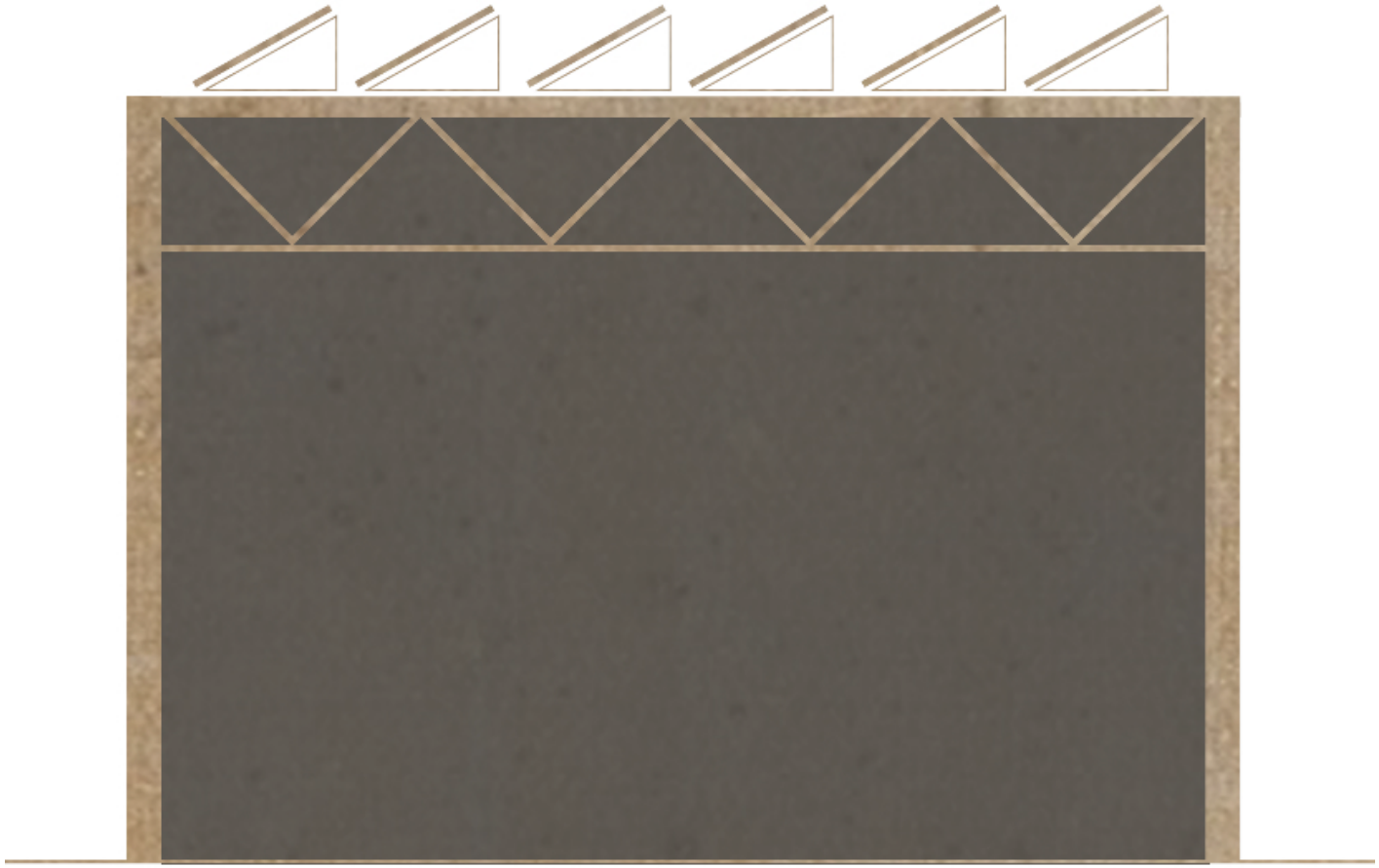
Instead of focusing on producing energy, the first steps
should be to **reduce and reuse** existing energy (i.a. artificial lighting);



noon: high peak

PROBLEM STATEMENT 3

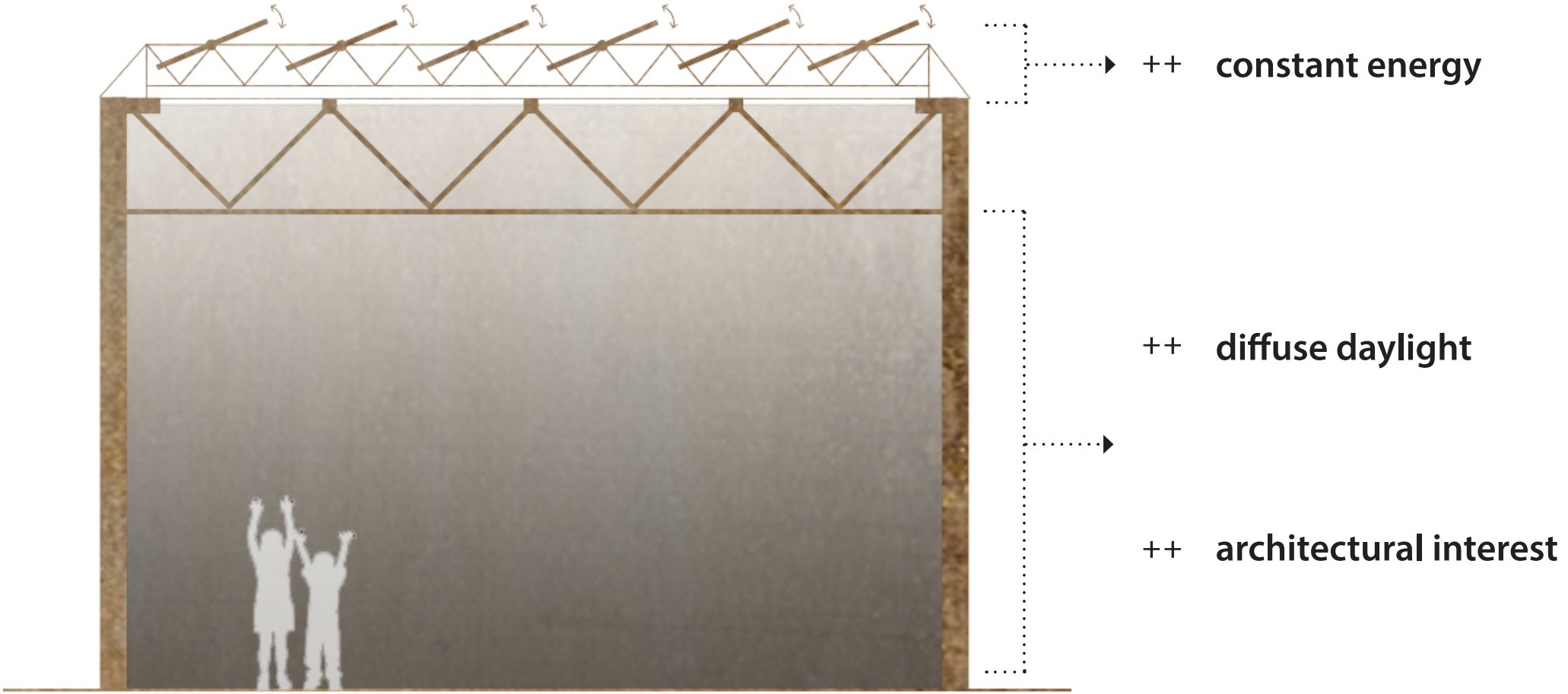
Instead of absorb the produced energy peaks
(otherwise the power grid get overloaded), **prevent** them.



current situation

=

adding solar panels


++ constant energy
++ diffuse daylight
++ architectural interest

OVERALL DESIGN QUESTION

In which **aesthetic and eco-efficient** way,
solar energy and daylight can be integrated in a **roof-mounted system**,
using an existing building on the Marineterrein in Amsterdam as a test subject?

2

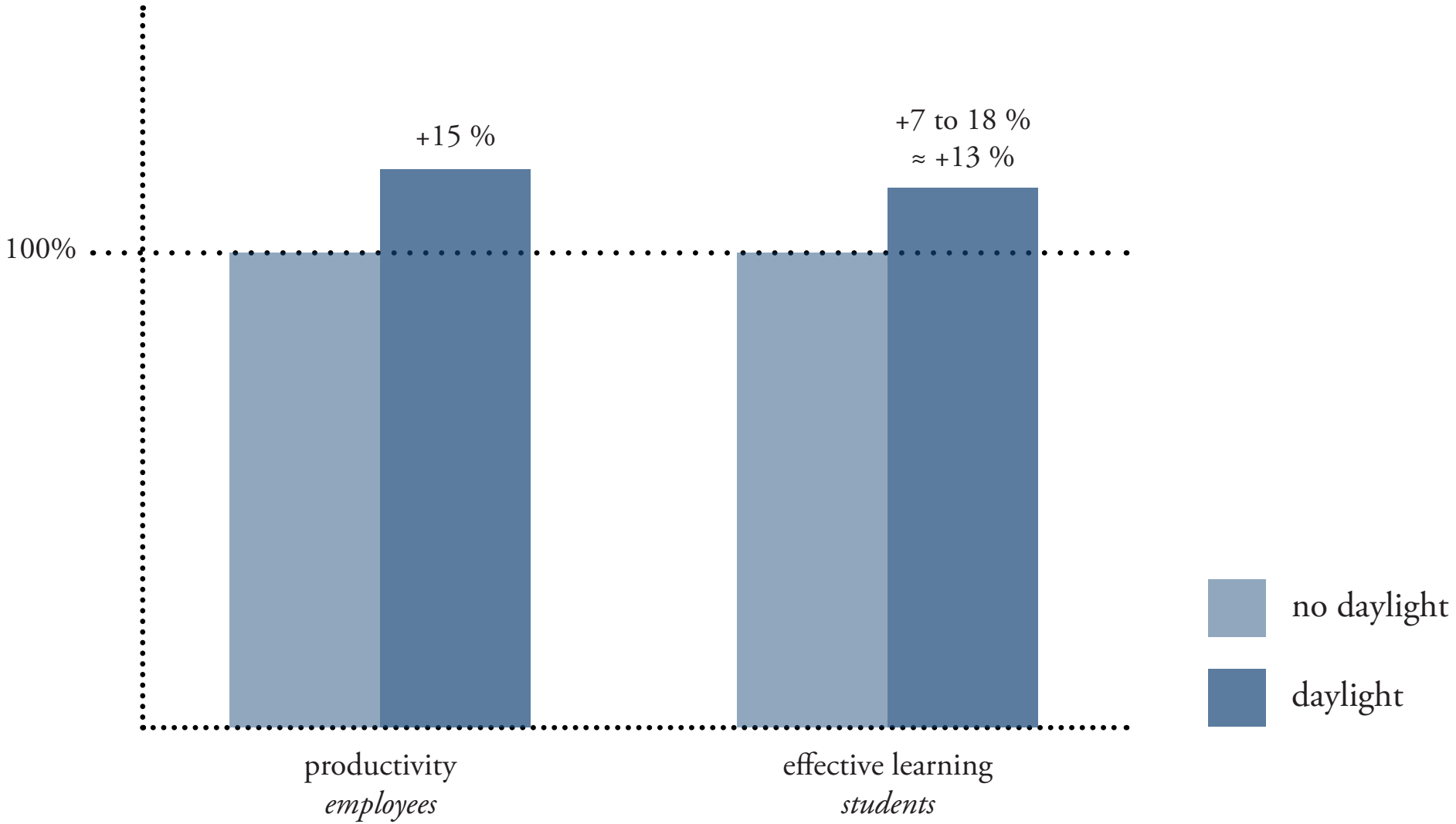
RESEARCH

DAYLIGHT

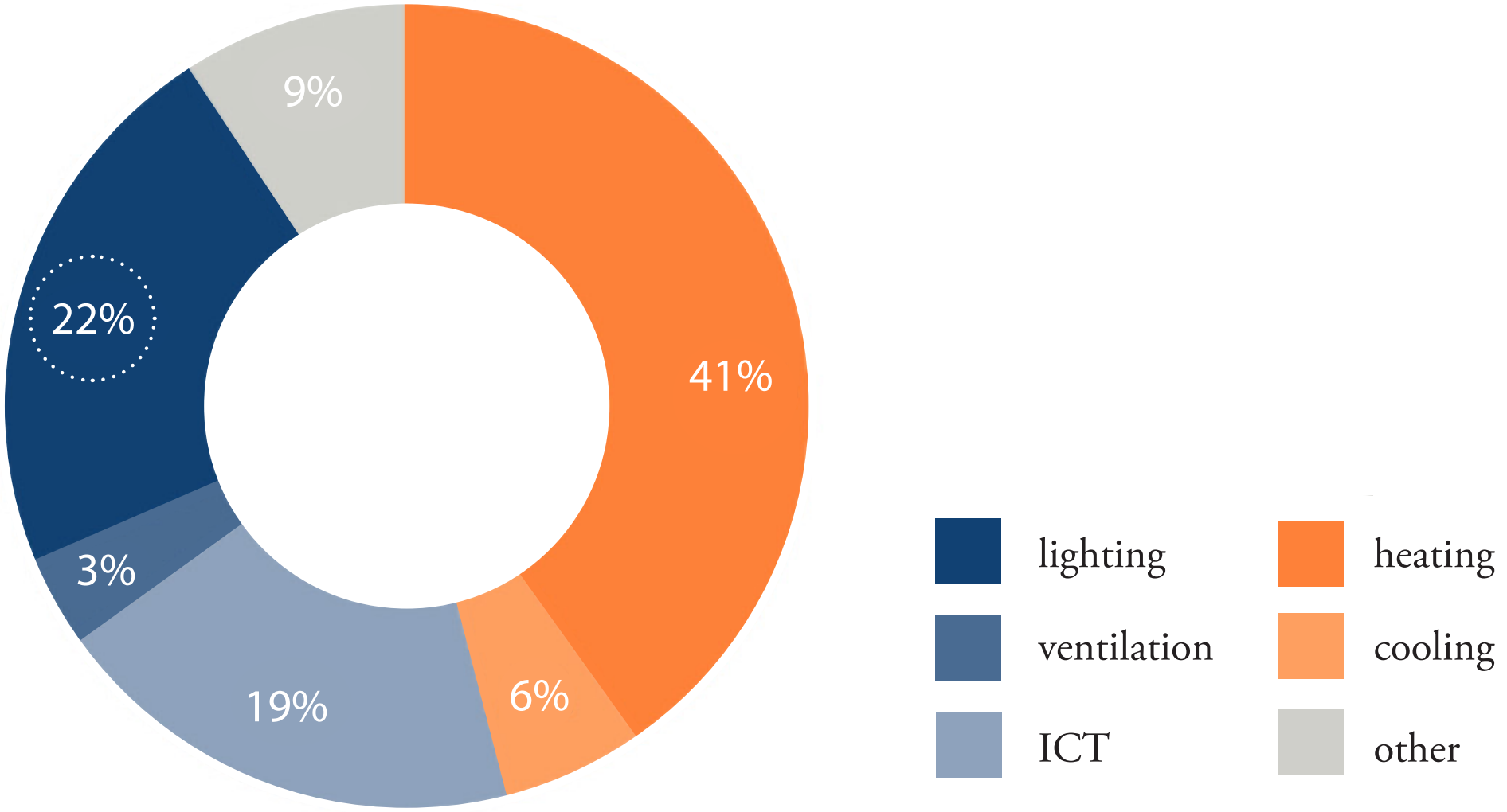
The Weather Project

Artist: Olafur Eliasson
Tate Modern, London - 2003

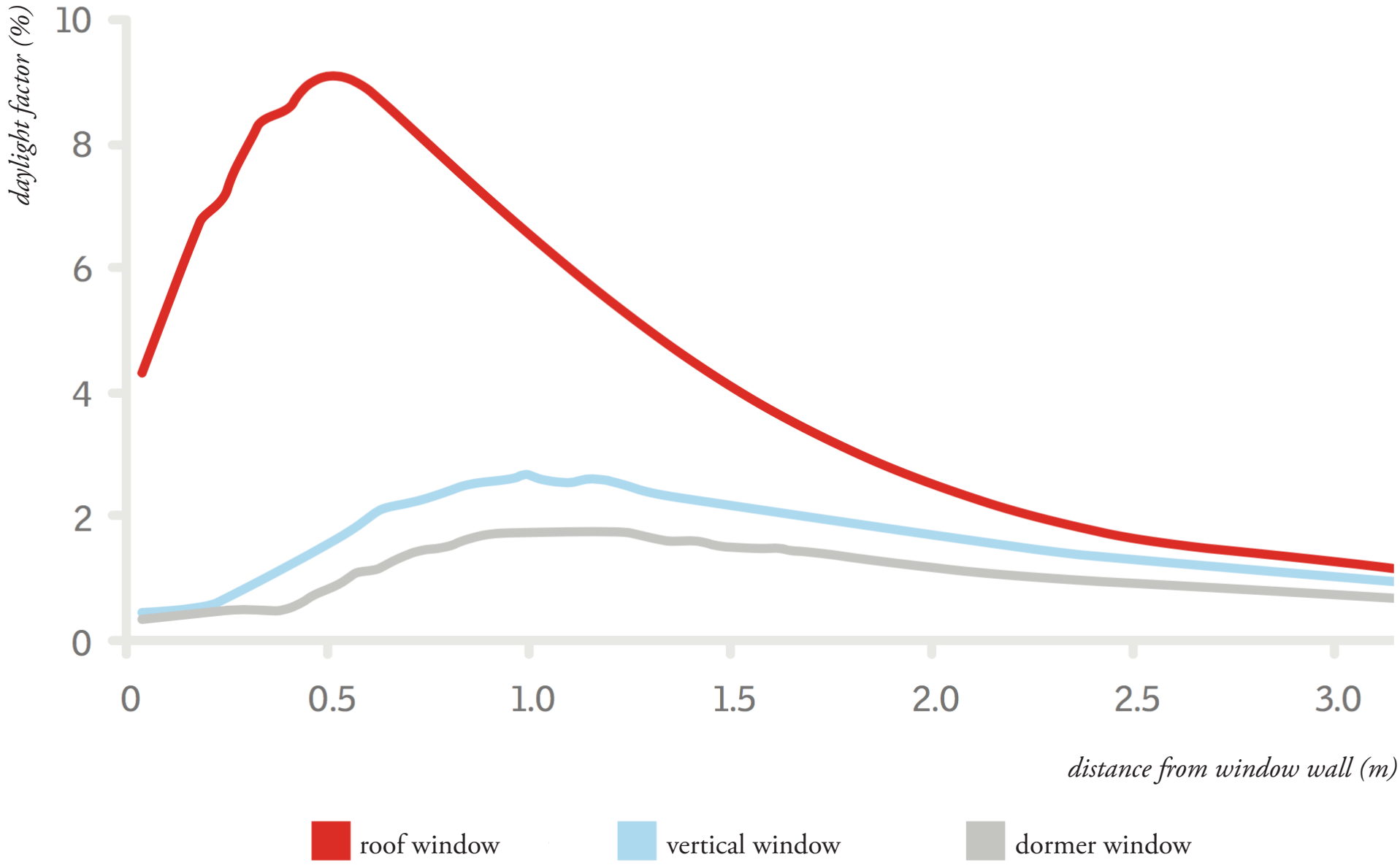
HUMAN BENEFITS



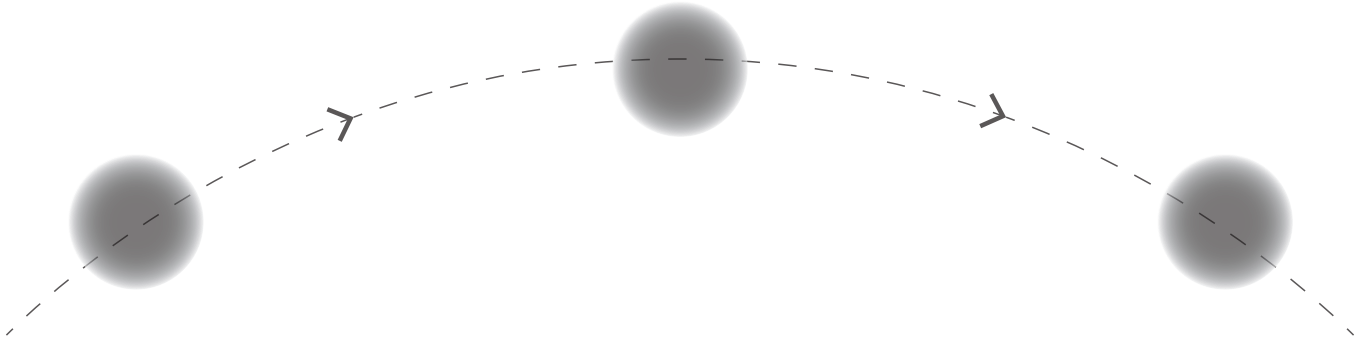
AVERAGE ENERGY USE - OFFICE BUILDING

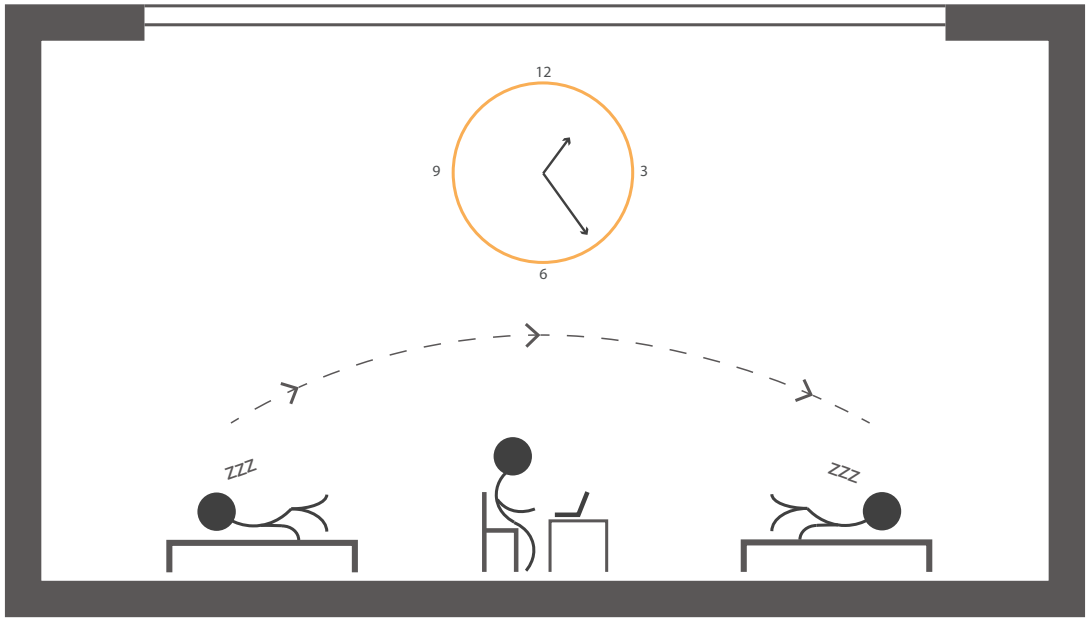


ROOF DAYLIGHT



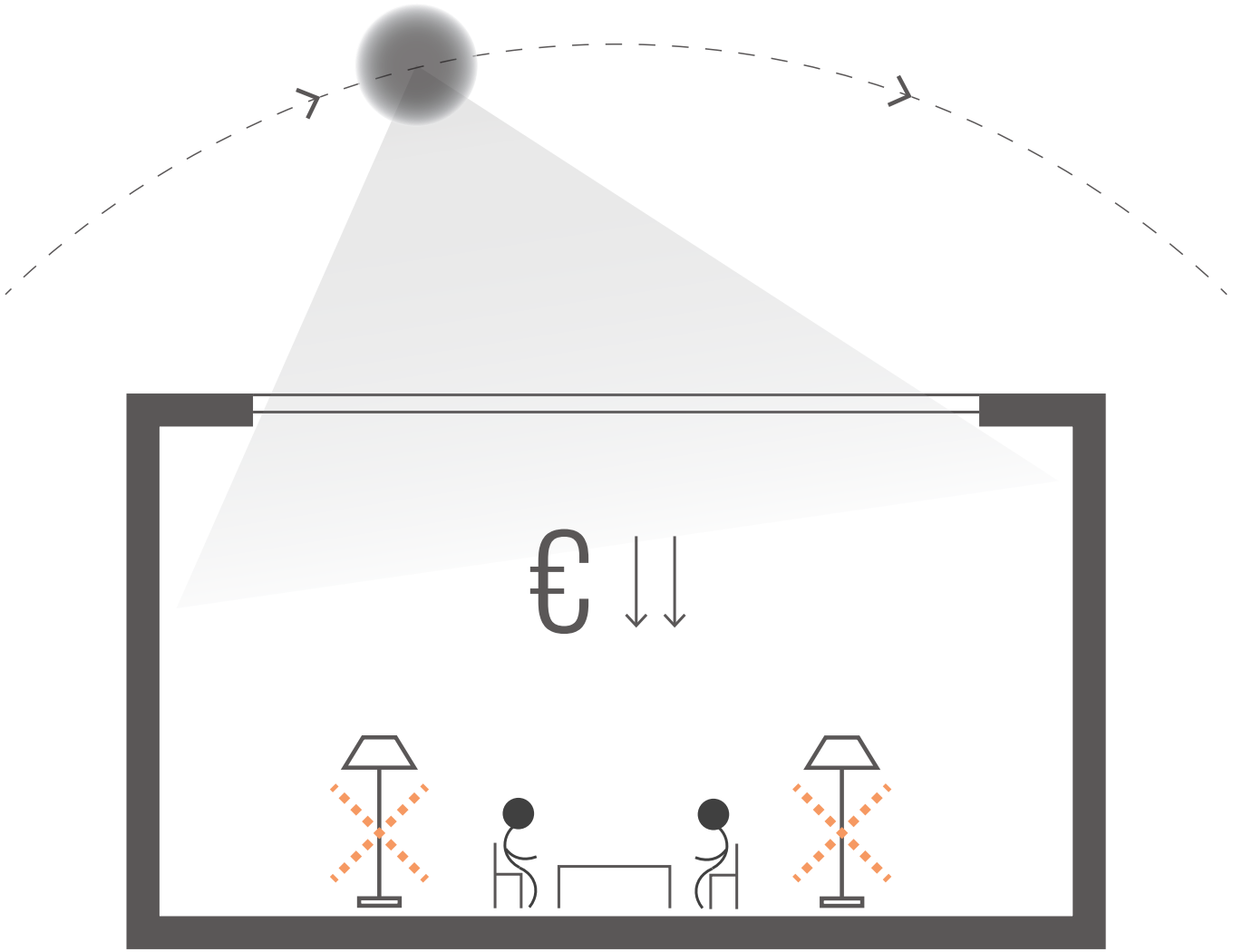
ADVANTAGES





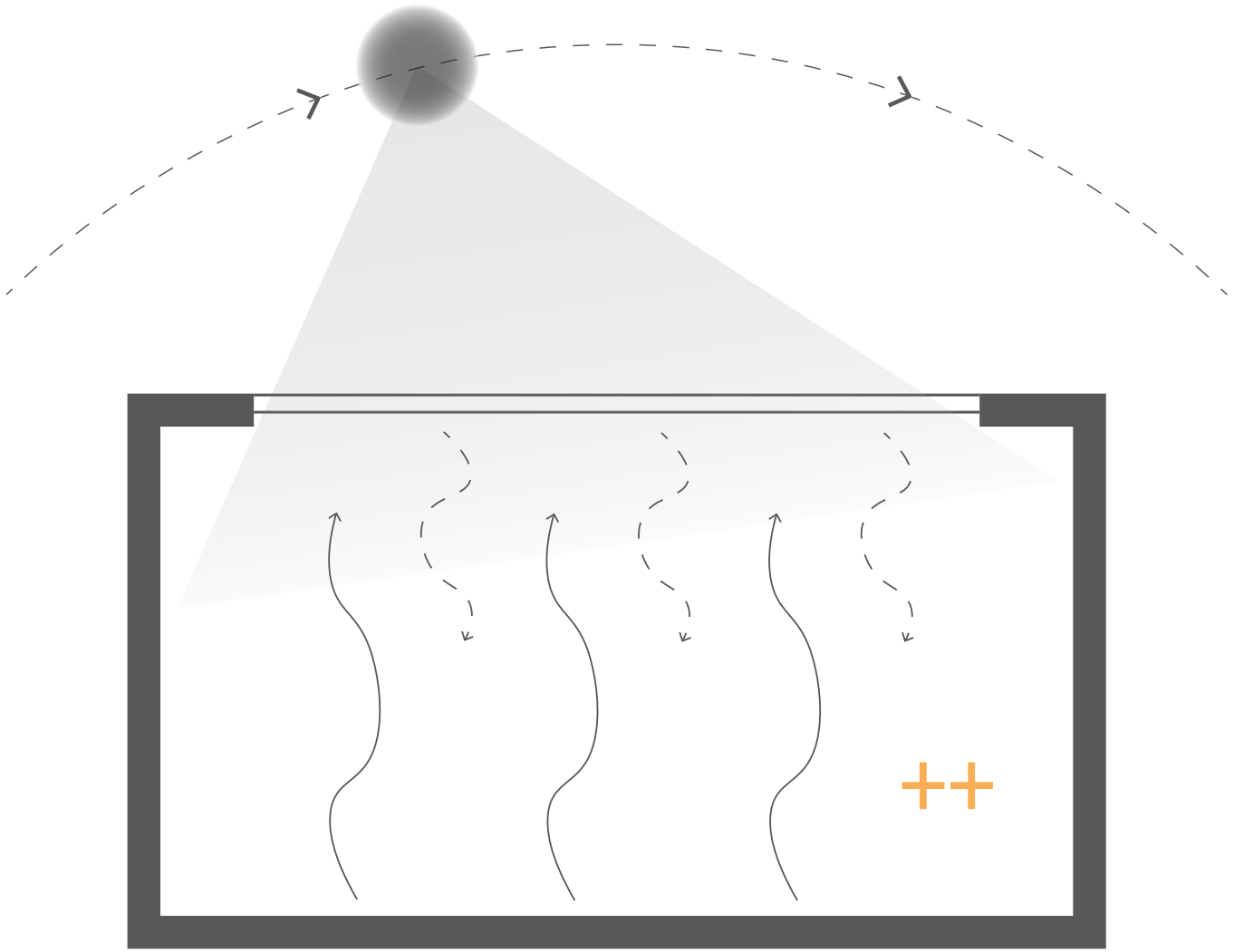
stimulate biorhythm of users

ADVANTAGES



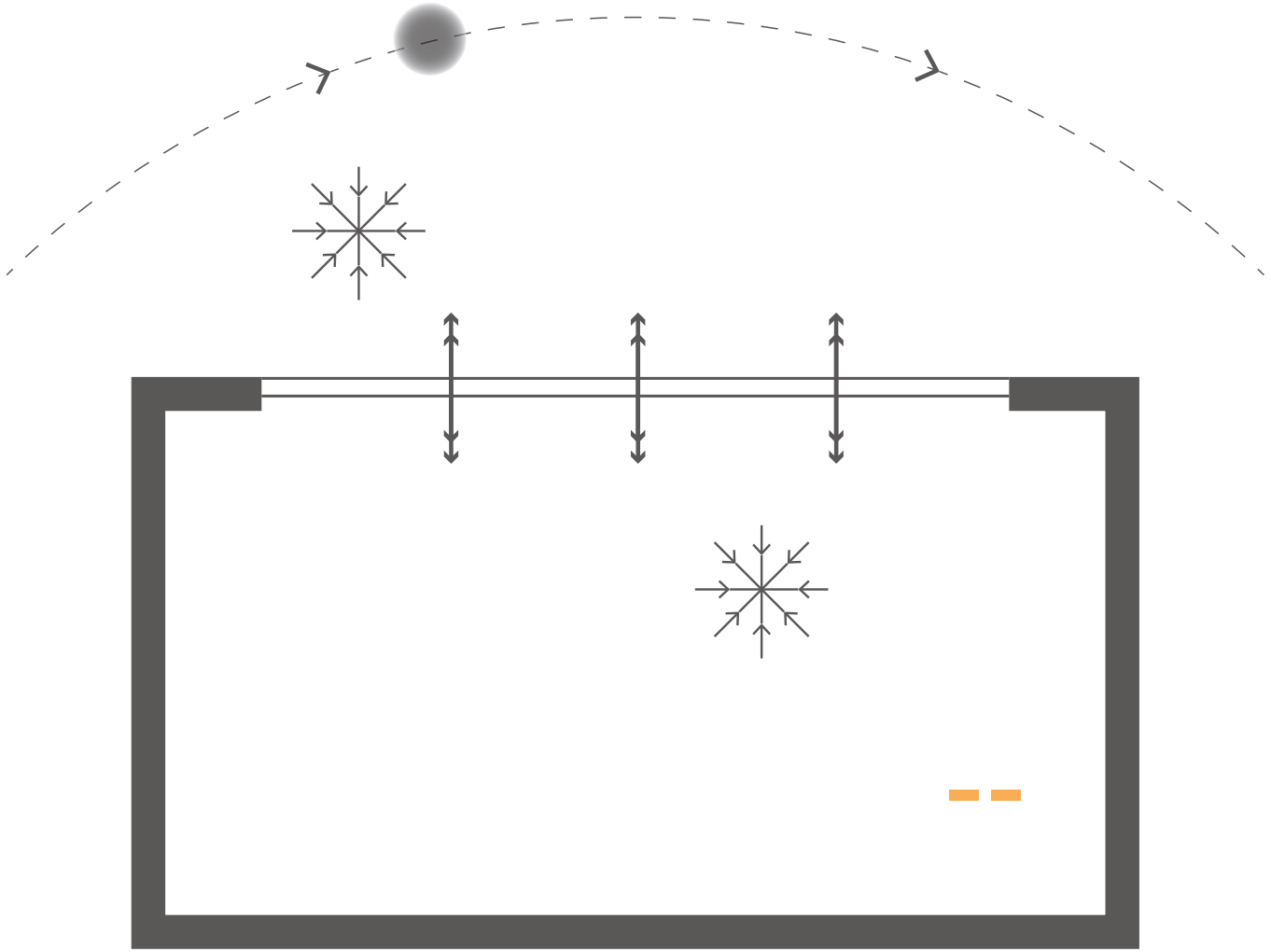
decrease in lighting / electricity costs

DISADVANTAGES



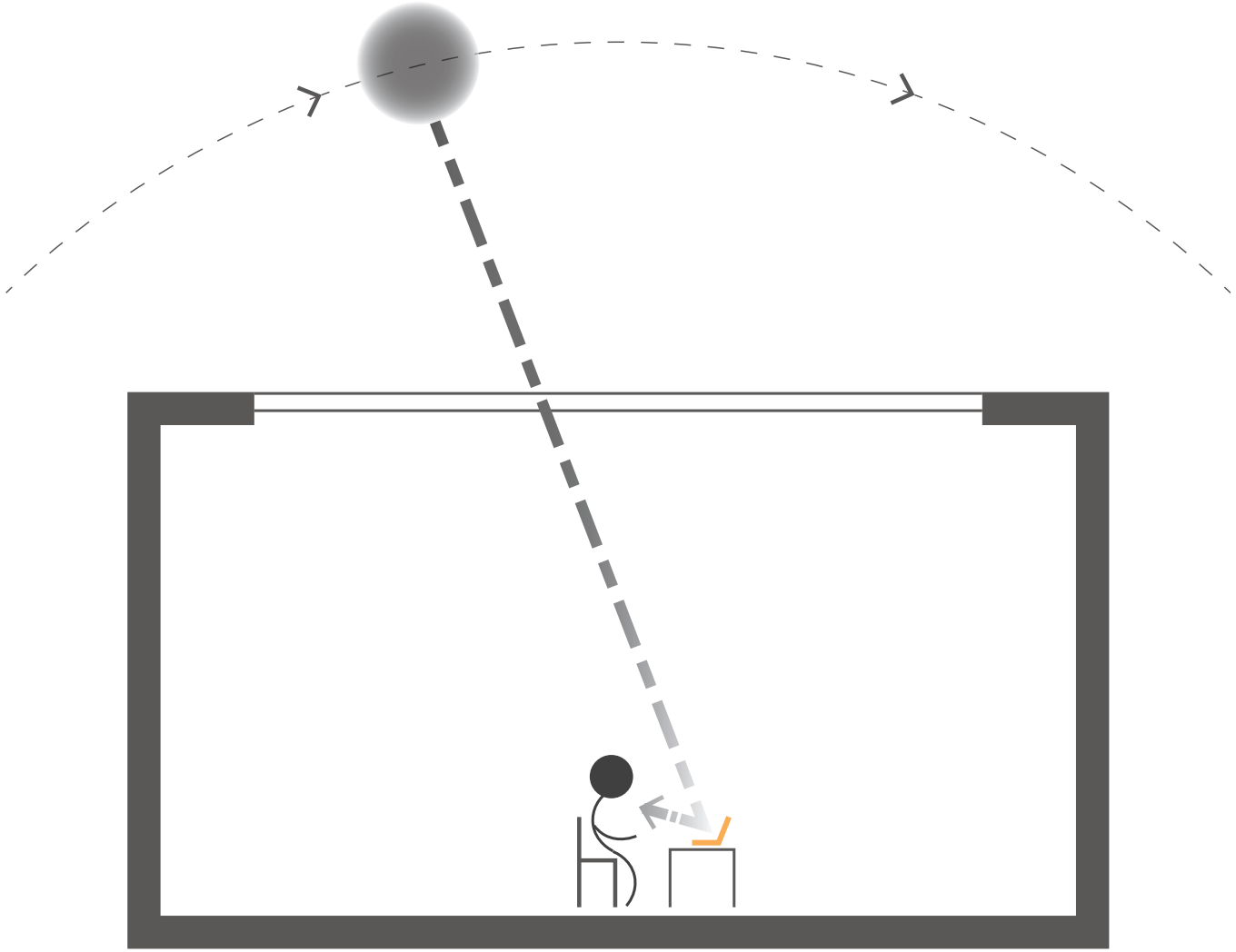
summer: overheated by greenhouse effect

DISADVANTAGES



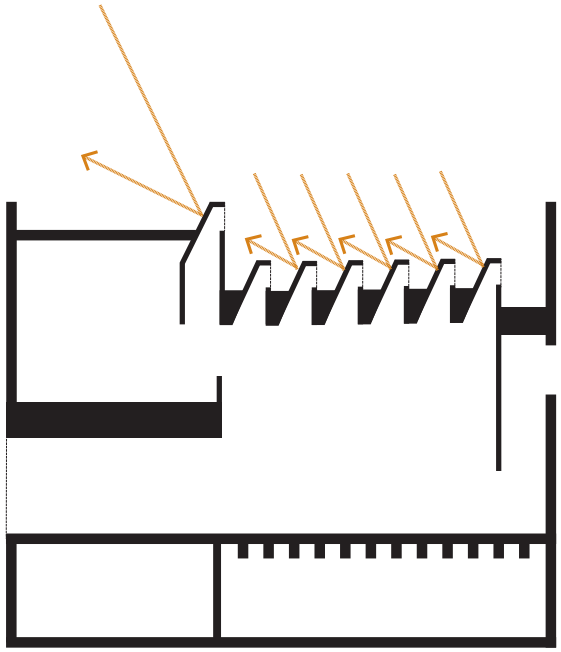
winter: high heat losses through glass

DISADVANTAGES

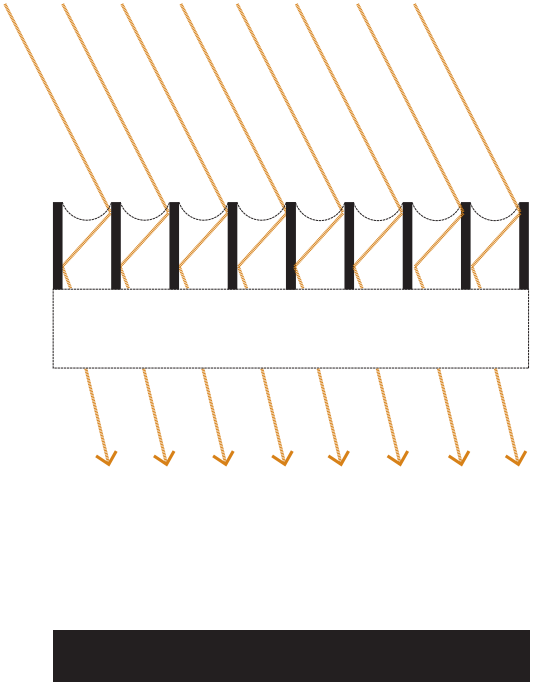


sun glare on screens

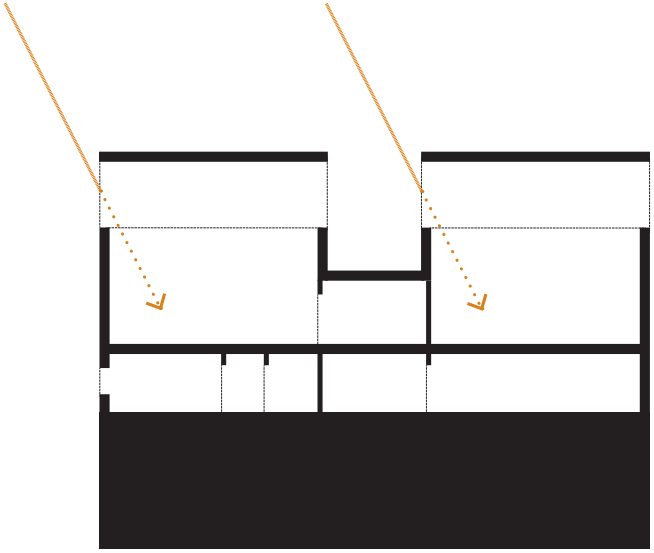
DIFFUSE RADIATION



rebound



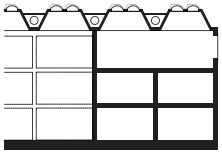
reflection



filtration

DATABASE ROOF DAYLIGHT SYSTEMS

REBOUND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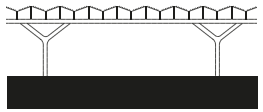
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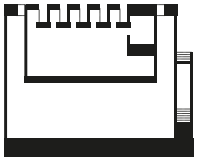
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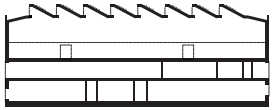
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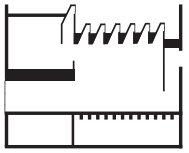
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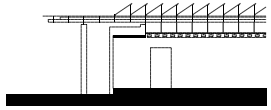
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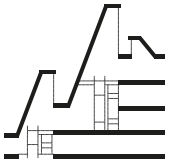
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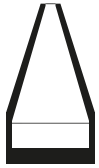
REFLECTION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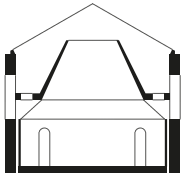
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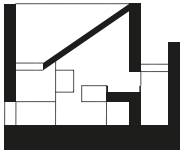
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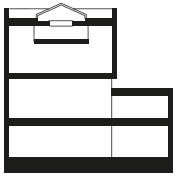
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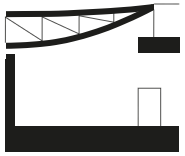
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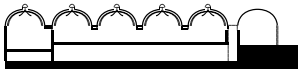
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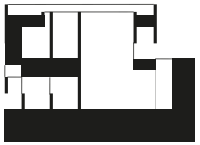
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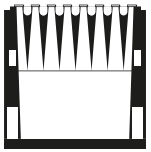
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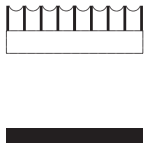
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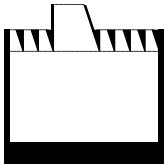
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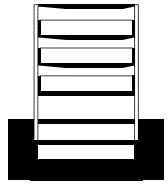
FILTRATION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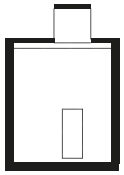
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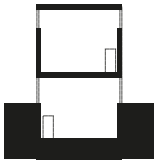
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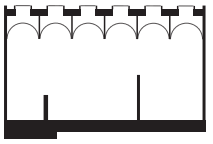
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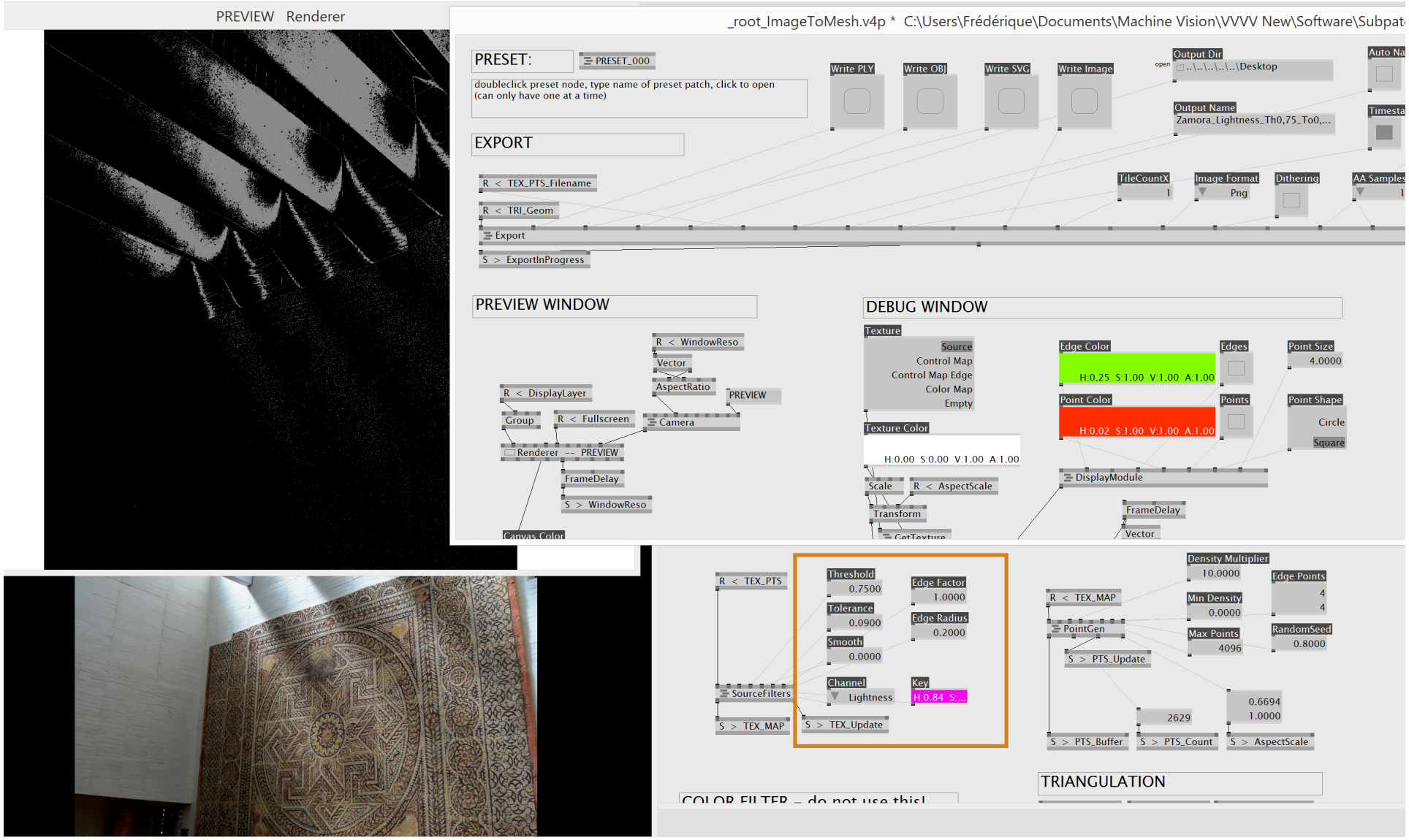
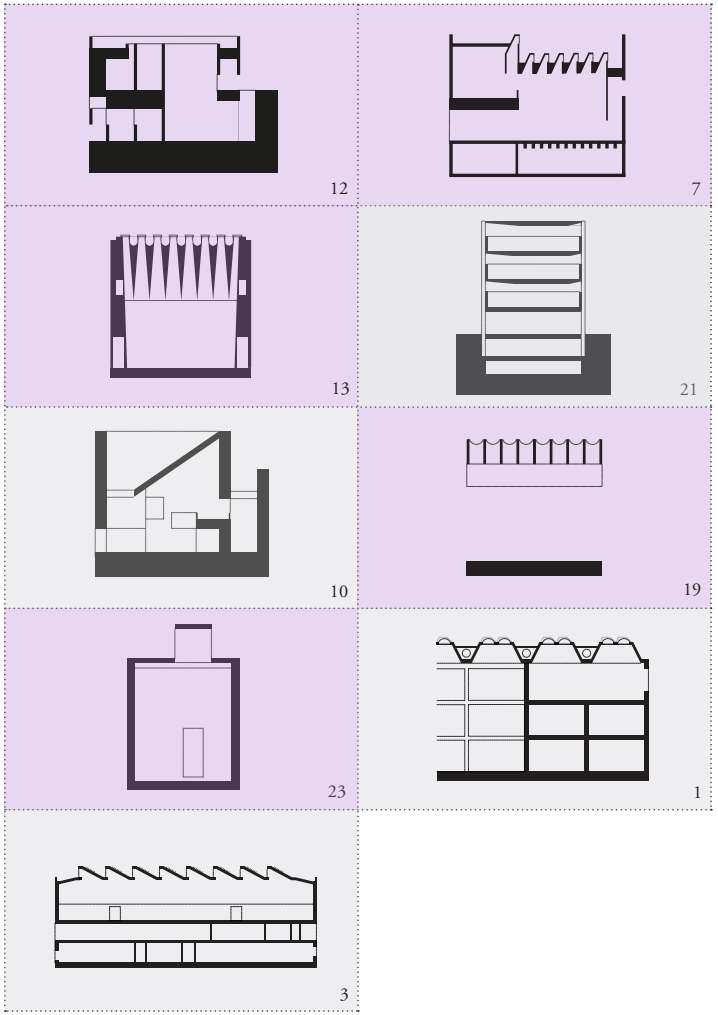
ANALYSIS METHOD



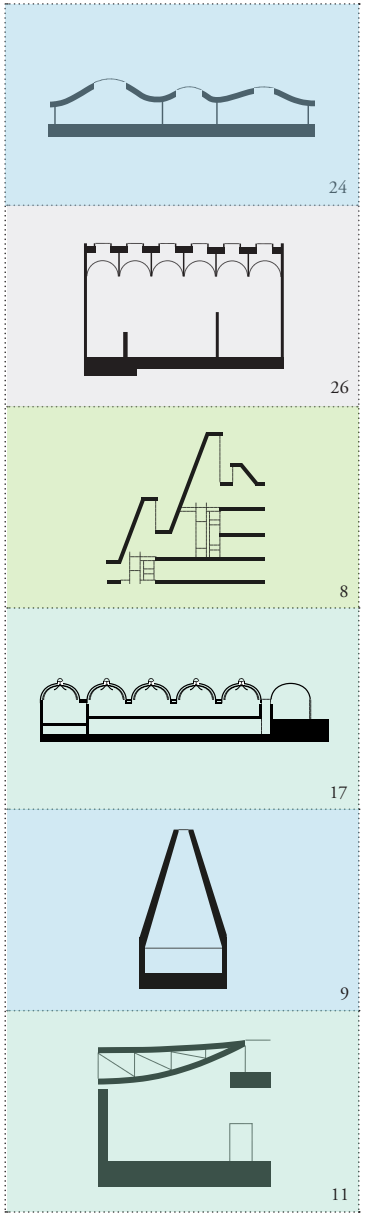
VVVV-1 software analyzes points of lightness

CONCLUSION DATABASE

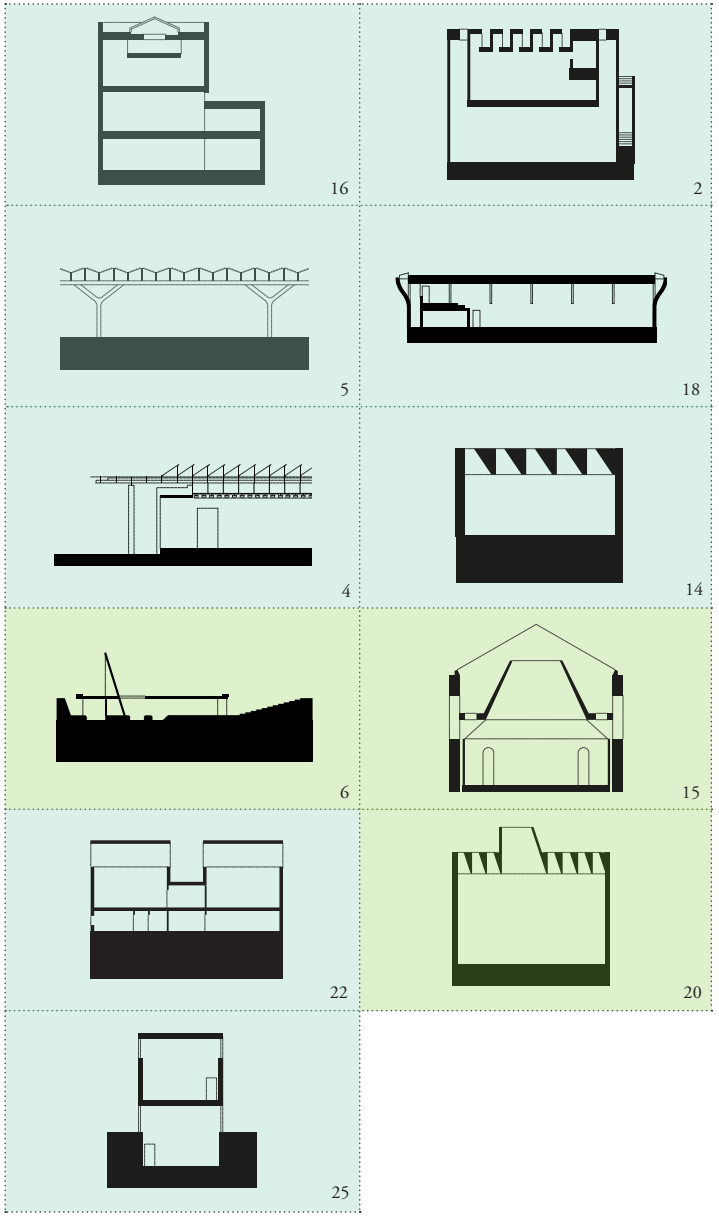
TH LOW [0.60-0.75] ; TO HIGH [HIGH-LOW]



TH MEDIUM [0.76-0.86] ; TO MEDIUM [HIGH-LOW]



TH HIGH [0.87-1.00] ; TO LOW [HIGH-LOW]



REFLECTIVE CEILING

REFLECTIVE FLOOR

REFLECTIVE WALLS

REFLECTIVE CEILING + WALLS

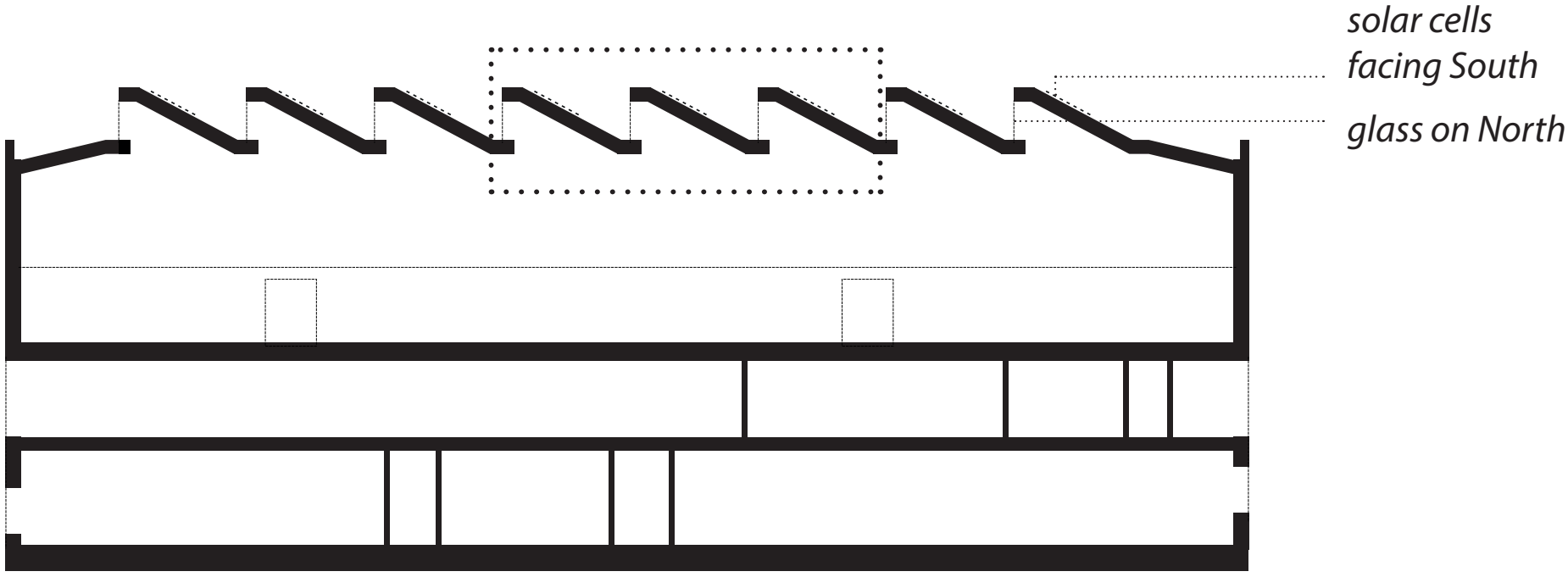
REFLECTIVE CEILING + WALLS + FLOOR

SOLAR ENERGY

Pajol Sports Centre

Architect: Brisac Gonzalez

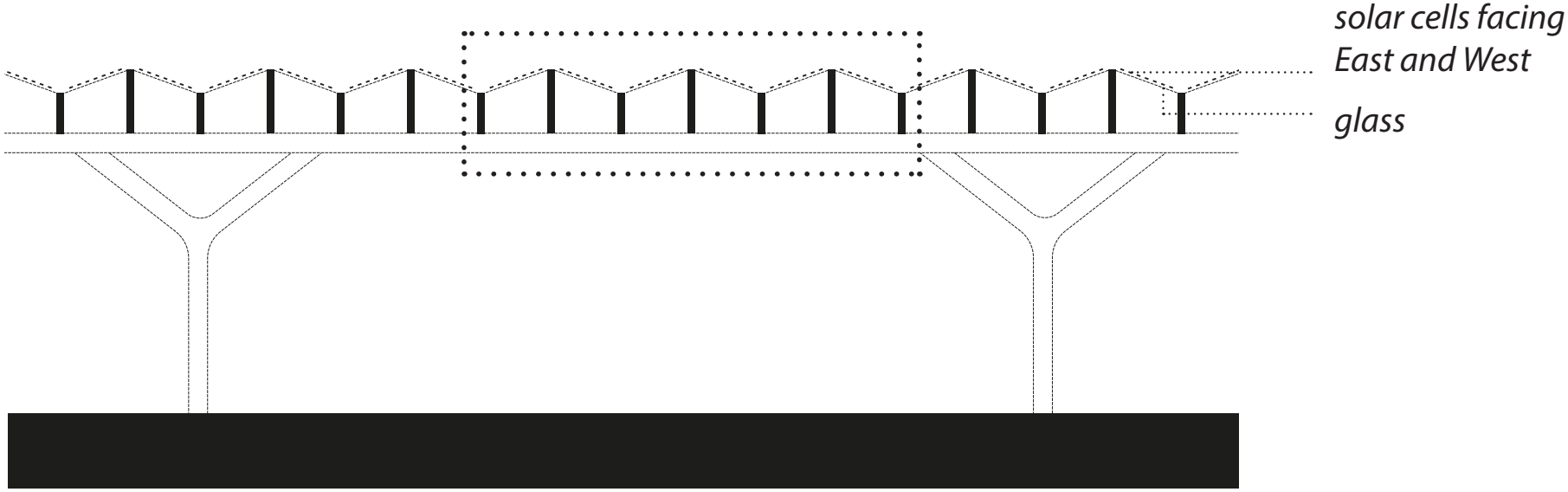
Paris, France - 2012



Rotterdam Central Station

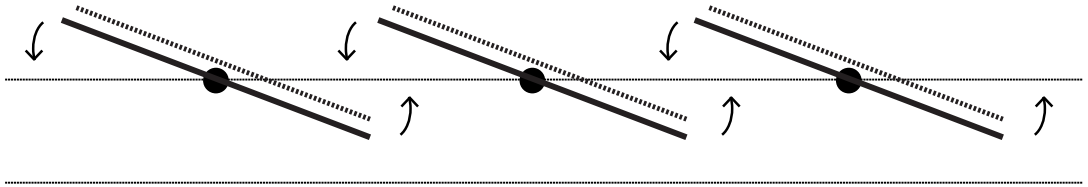
Architect: Team CS

Rotterdam, The Netherlands - 2014



SOLAR TRACKING SYSTEM

West



East

++ Constant energy production

++ Allows comfortable, diffuse light

integrate solar energy and daylight system

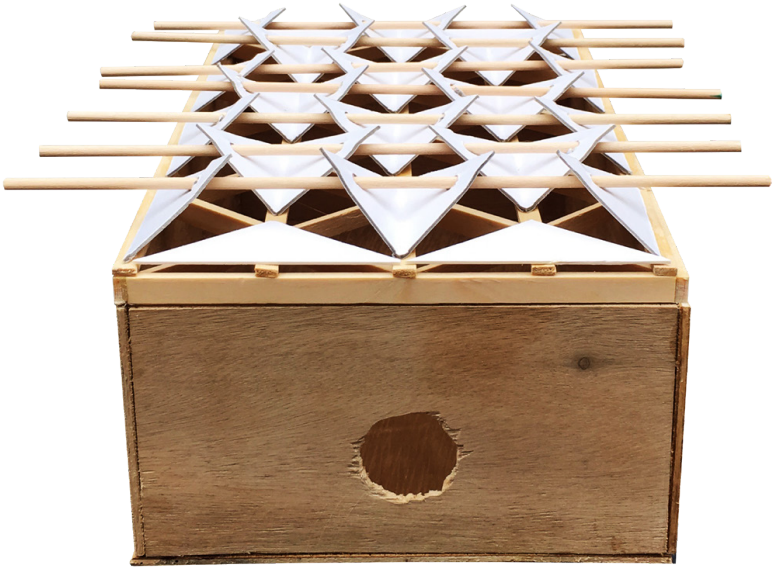
“ 1 + 1 = 3 ”

more value with less impact

MODEL RESEARCH

SUNFLOWER MOTION
horizontal grid

SUNFLOWER MOTION
diagonal grid



LOTUS MOTION
diagonal grid

3

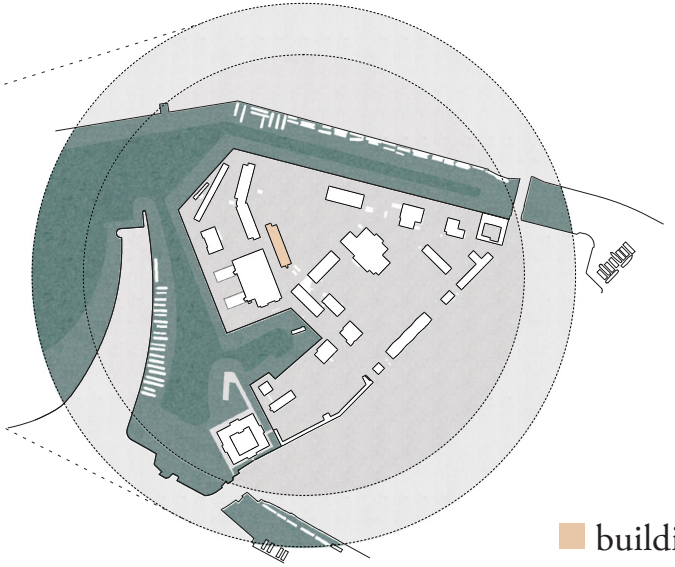
DESIGN

HEROS DAYLIGHT SCHOOL

TEST LOCATION

The Netherlands

Amsterdam



Marineterrein

BUILDING #39

office / education Marine

BUILDING #34

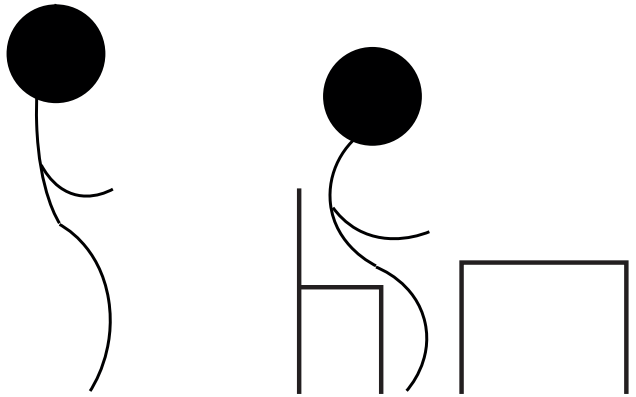
sportschool and -fields Marine

HEROS

hoofd handen hart

- *VMBO-t*
- *active education*
- *eye for 'boy talents'*

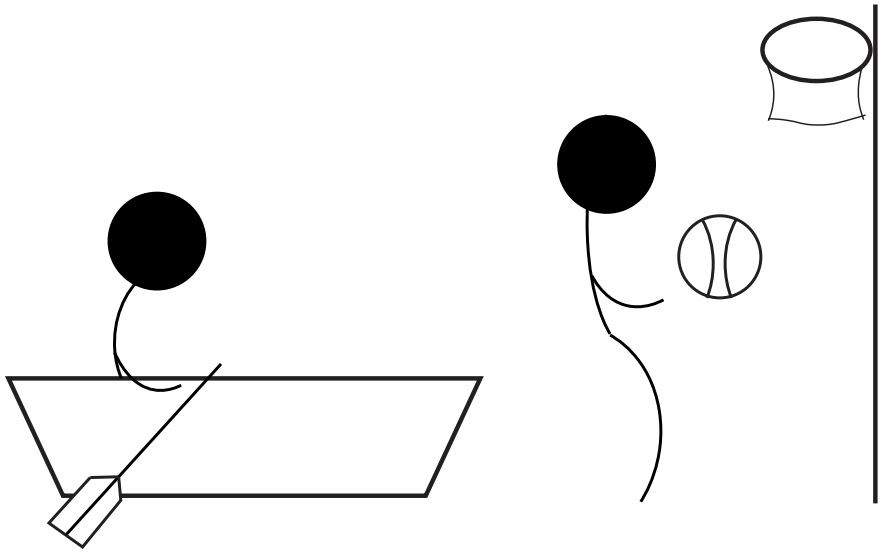
HEROS
hoofd handen hart



80% doing and 20% sitting/listening

HEROS

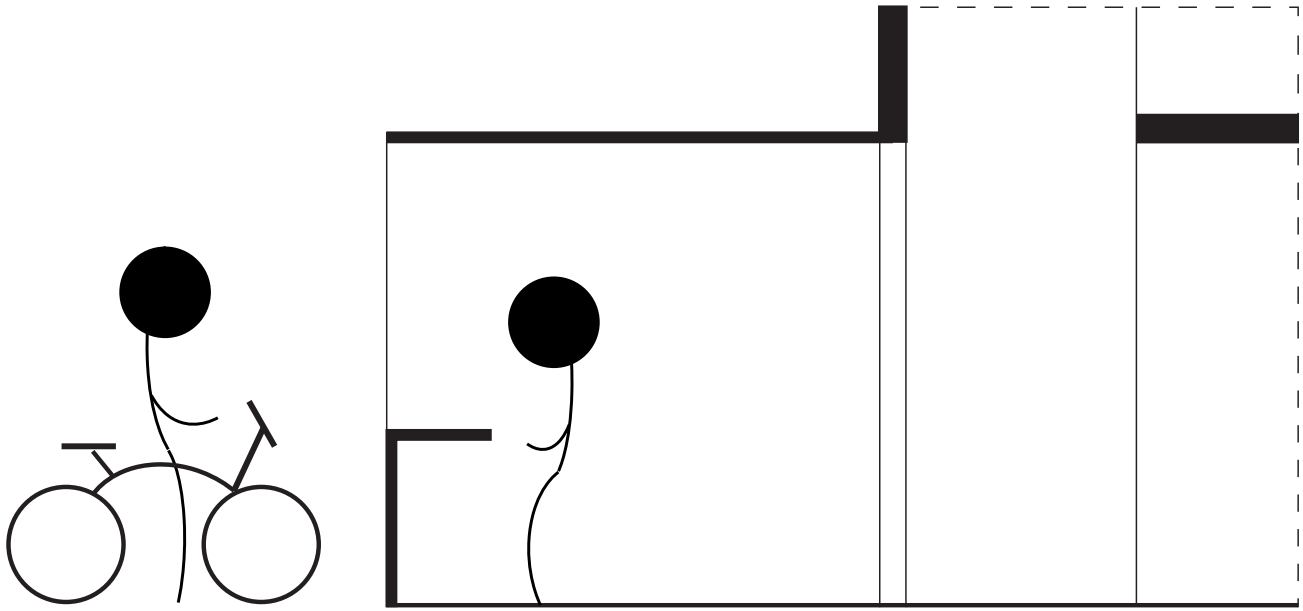
hoofd handen hart



every morning sports outside school (no gym) ;
related to mental strength and discipline

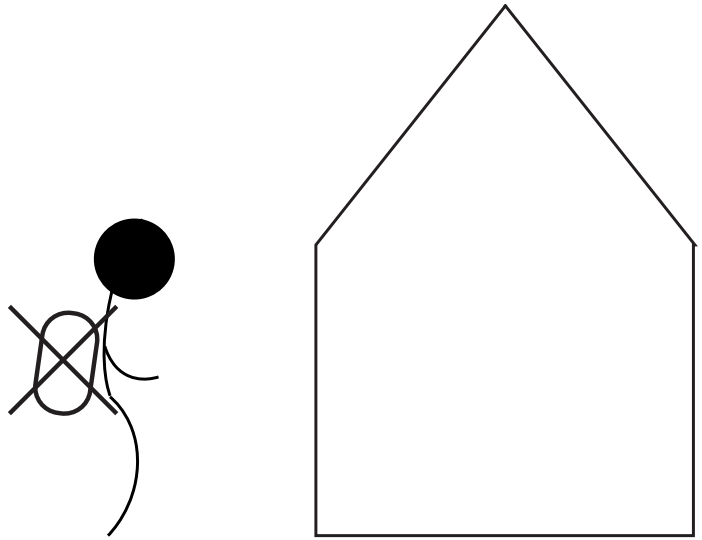
HEROS

hoofd handen hart



shops runned by the students ;
provide engagement with society
and skills in entrepreneurship

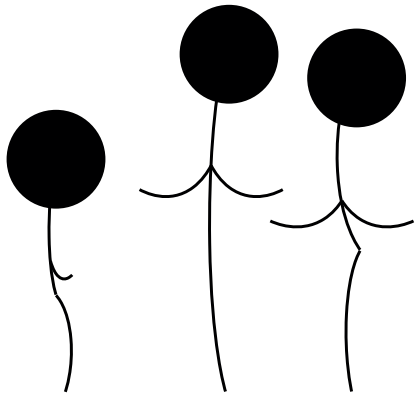
HEROS
hoofd handen hart



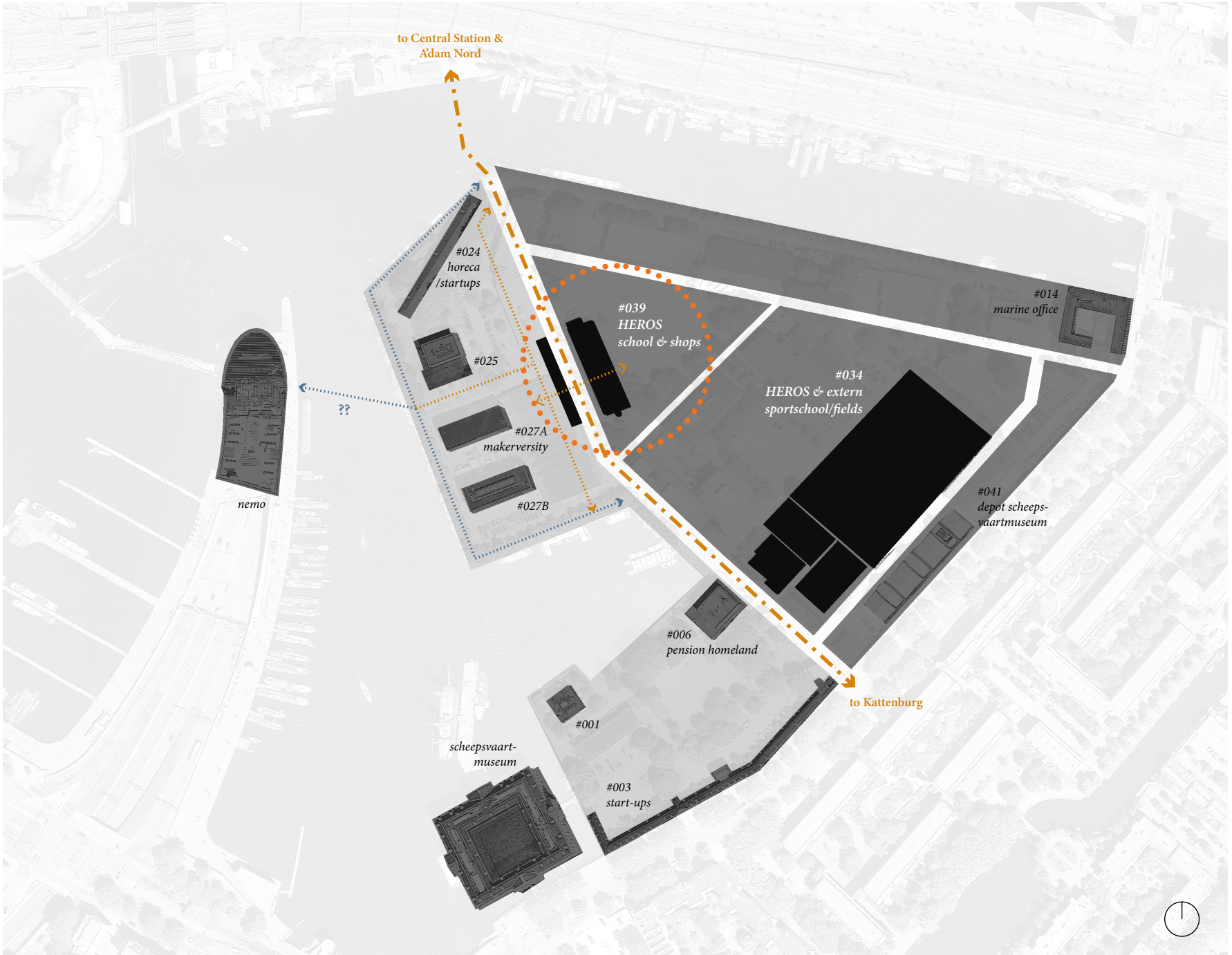
school is school and home is home ;
no homework (books stay in school)

HEROS

hoofd handen hart



parents highly involved in student progress



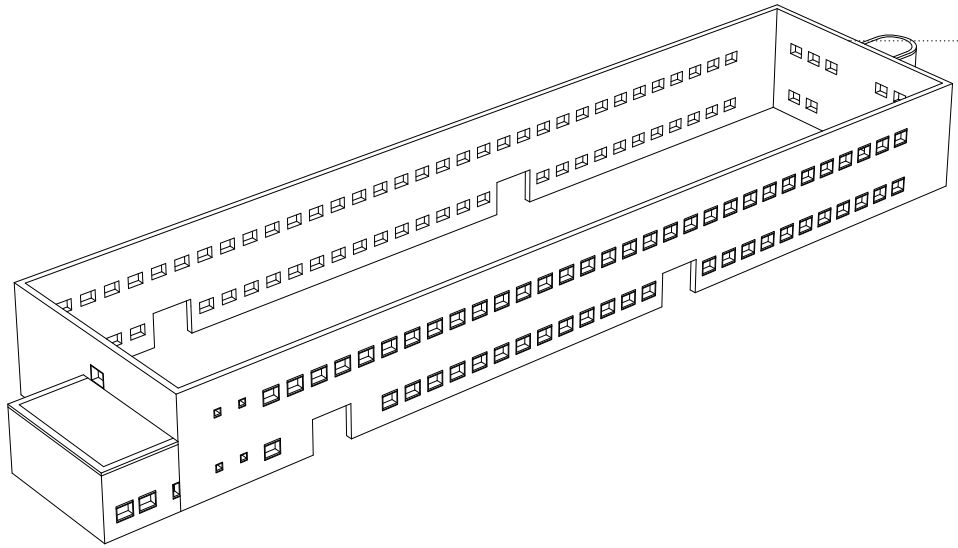
STRATEGIENOTA MARINETERREIN
50/50 PLAN

DWELLING

PARK

IMPORTANT
CYCLING ROUTE

TRANSFORMATION **BUILDING #39**



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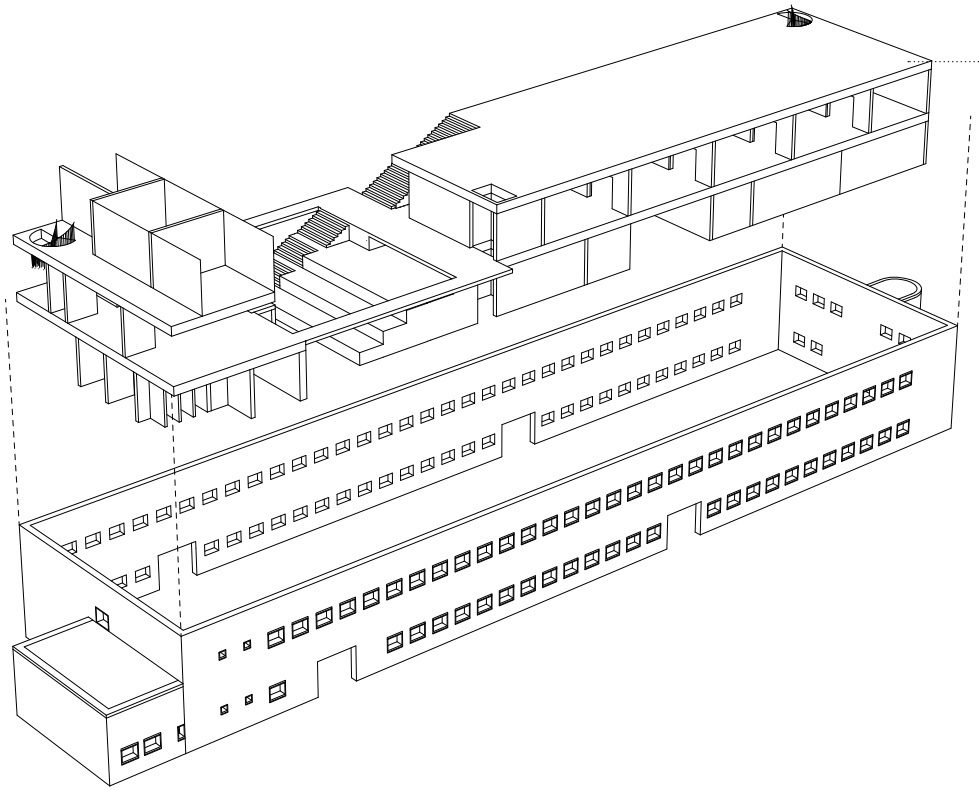
REUSE EXISTING

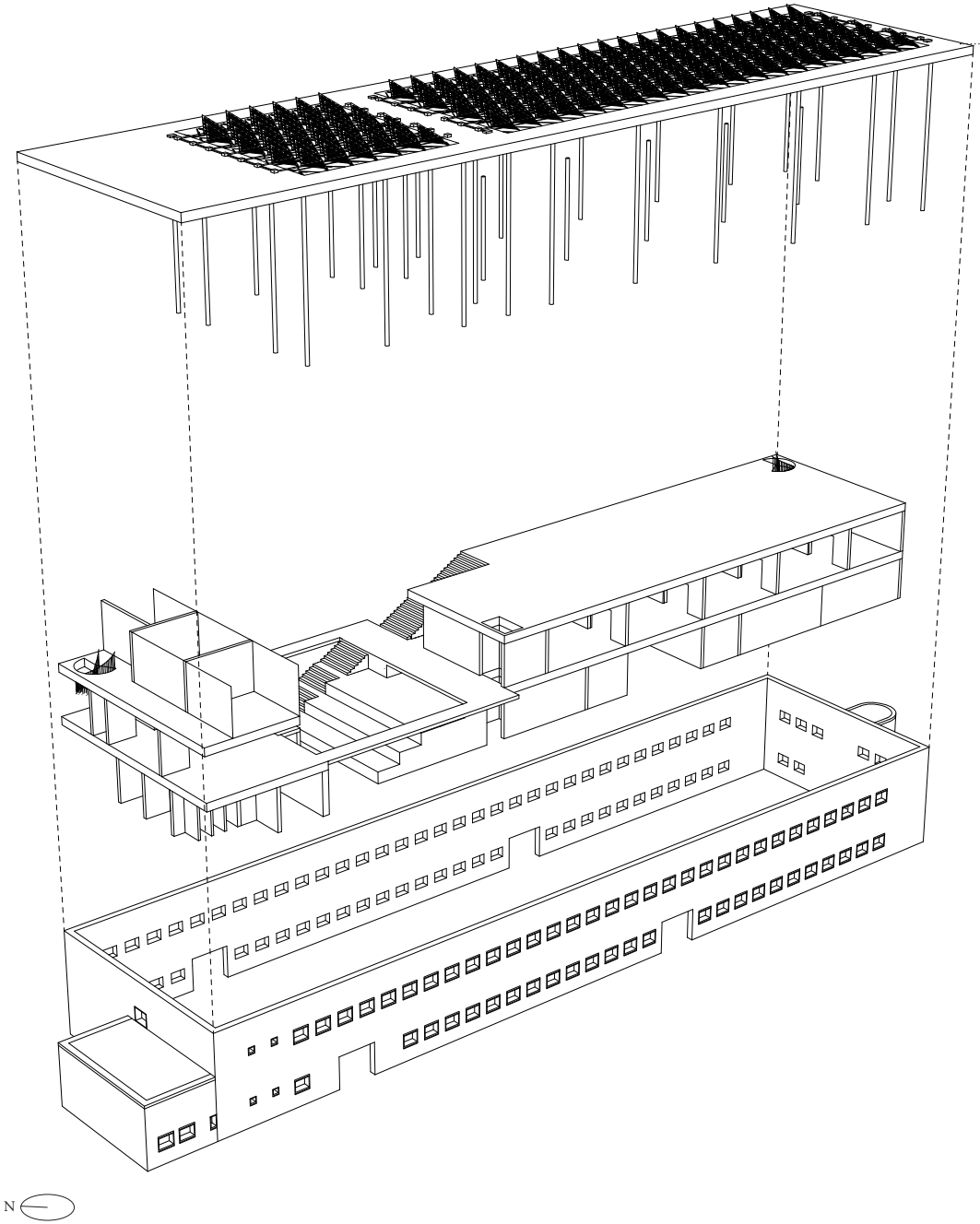
- *façades*
- *foundation*
- *ducting systems*



NEW INTERIOR

- columns & beams

- flexible system

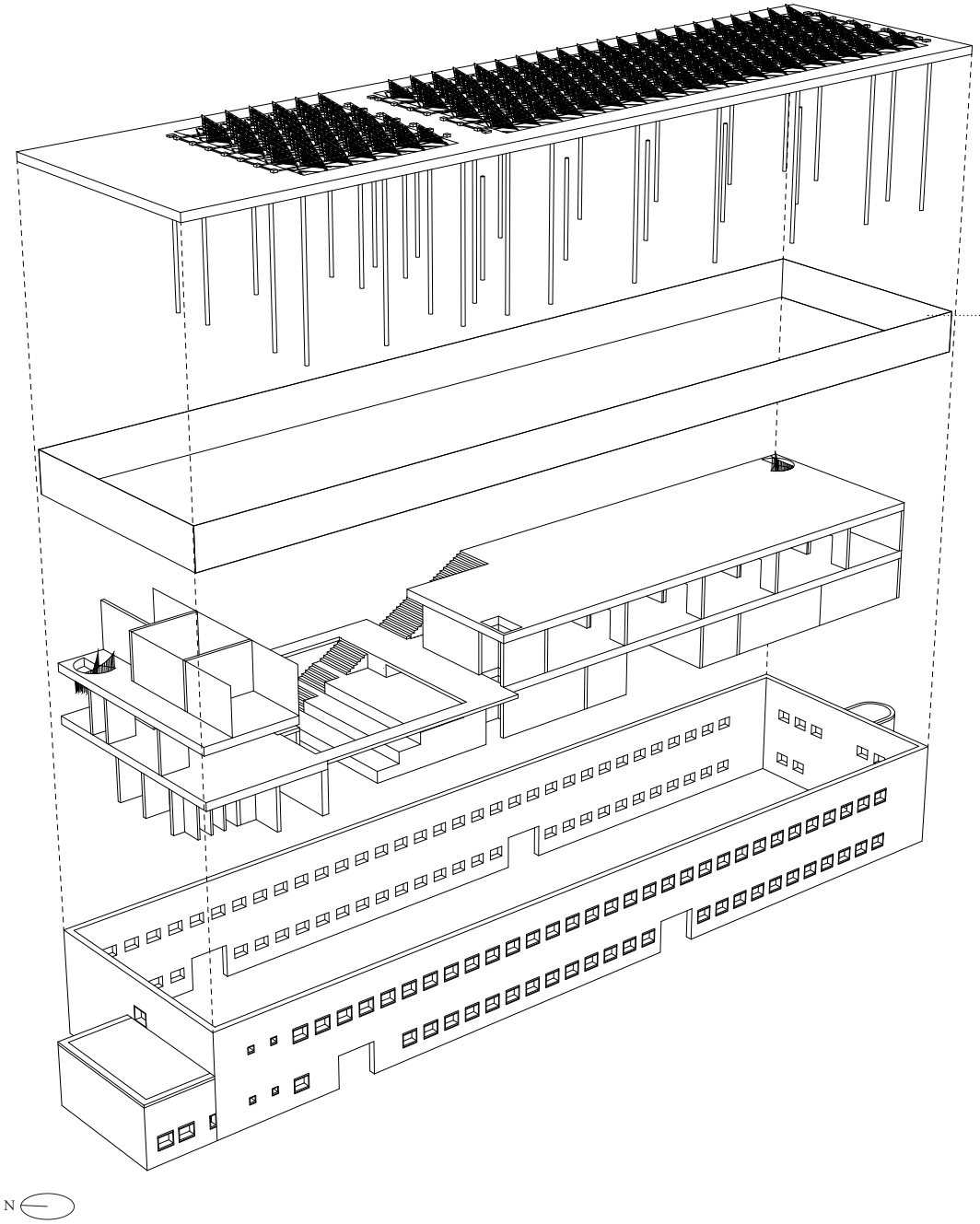


SOLAR / DAYLIGHT ROOF SYSTEM

- monocrystalline solar cells

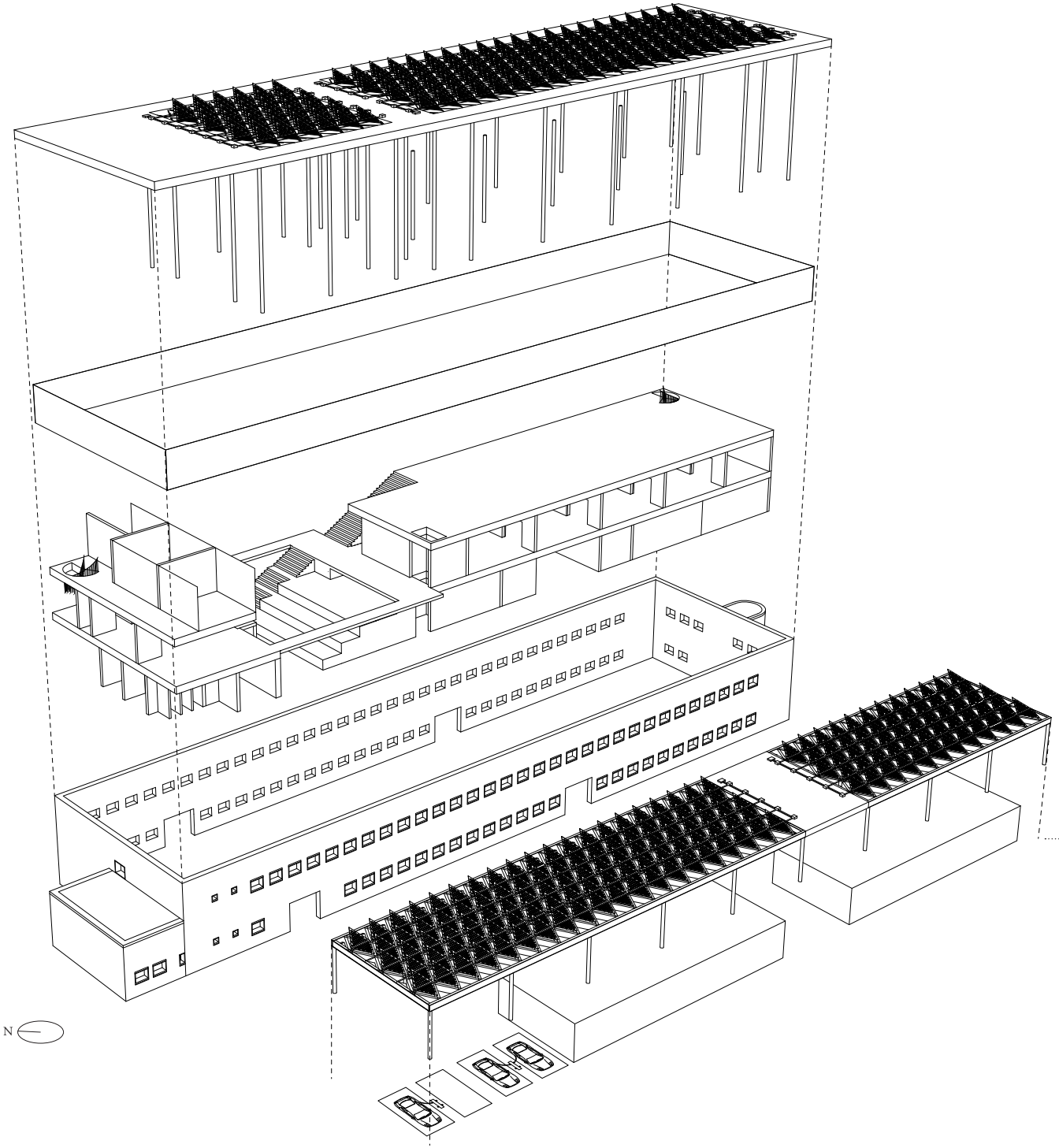
- total output: 140.000 kWh/year (including output roof pavilion)

- equal to 40 average households



MILKGLASS

- 70% transparent glass

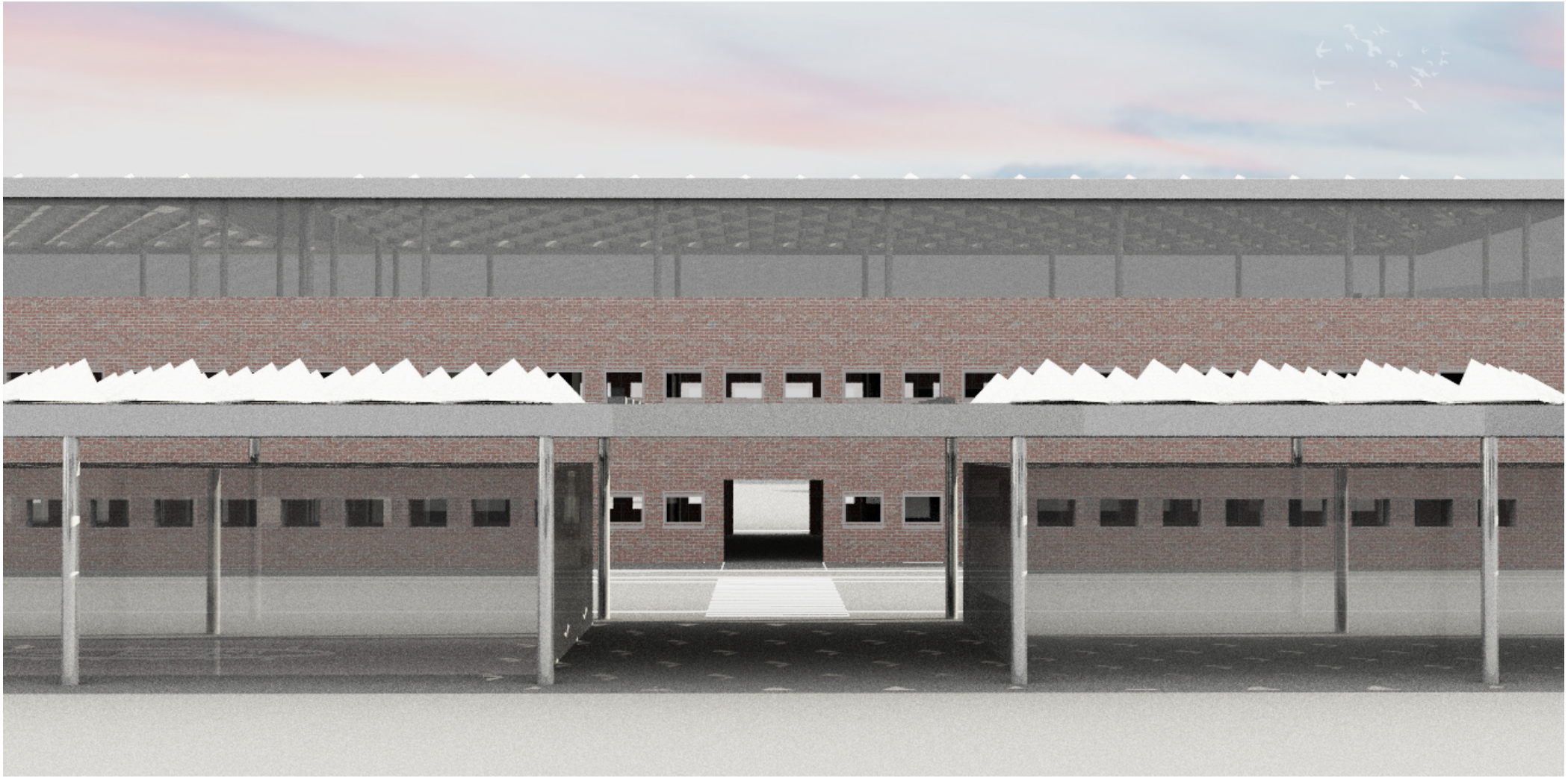


SOLAR PAVILION

- student shops

- electric car charging point

HEROS

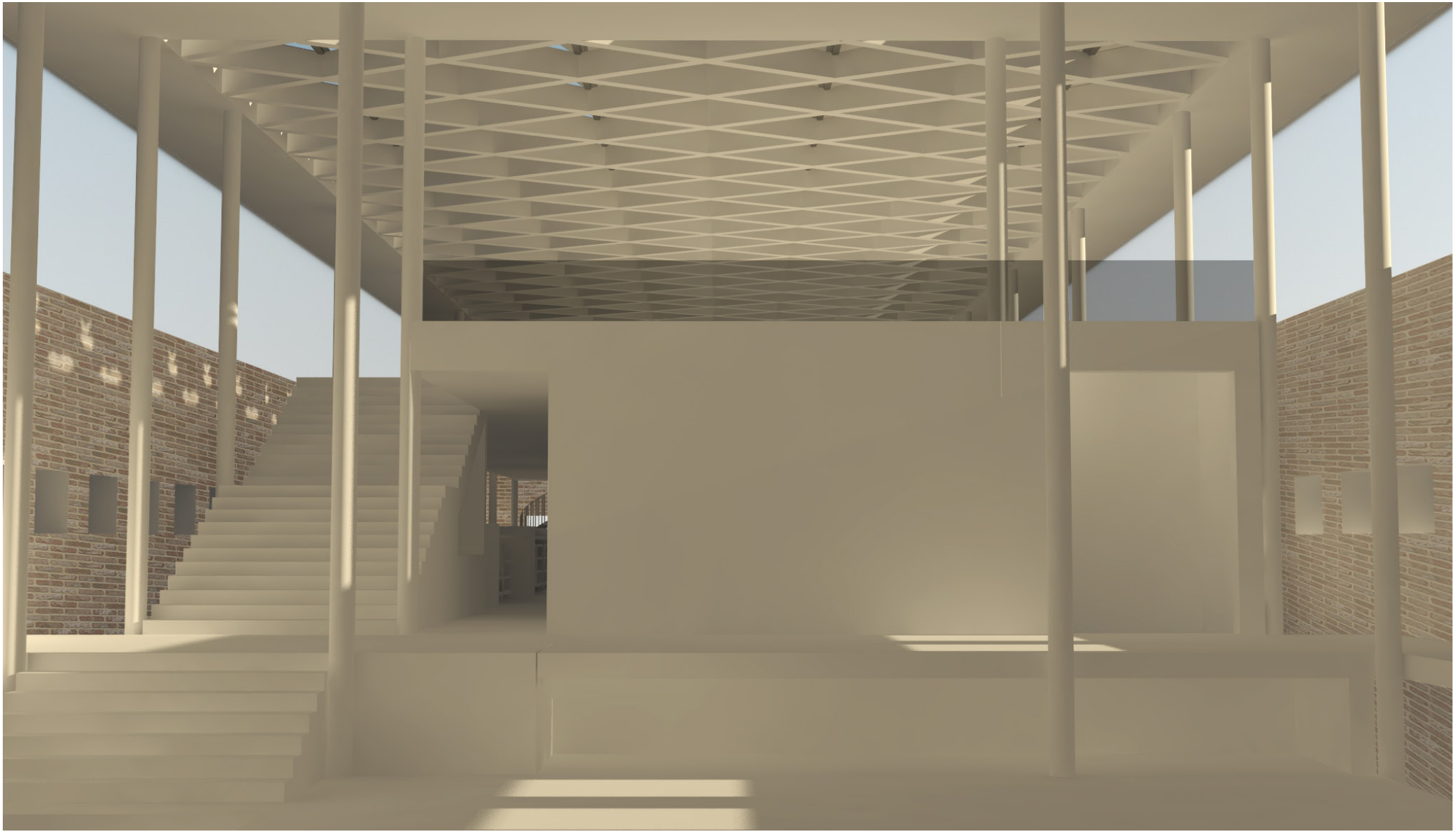


Heros Daylight School

Entrance

Heros Daylight School

Entrance

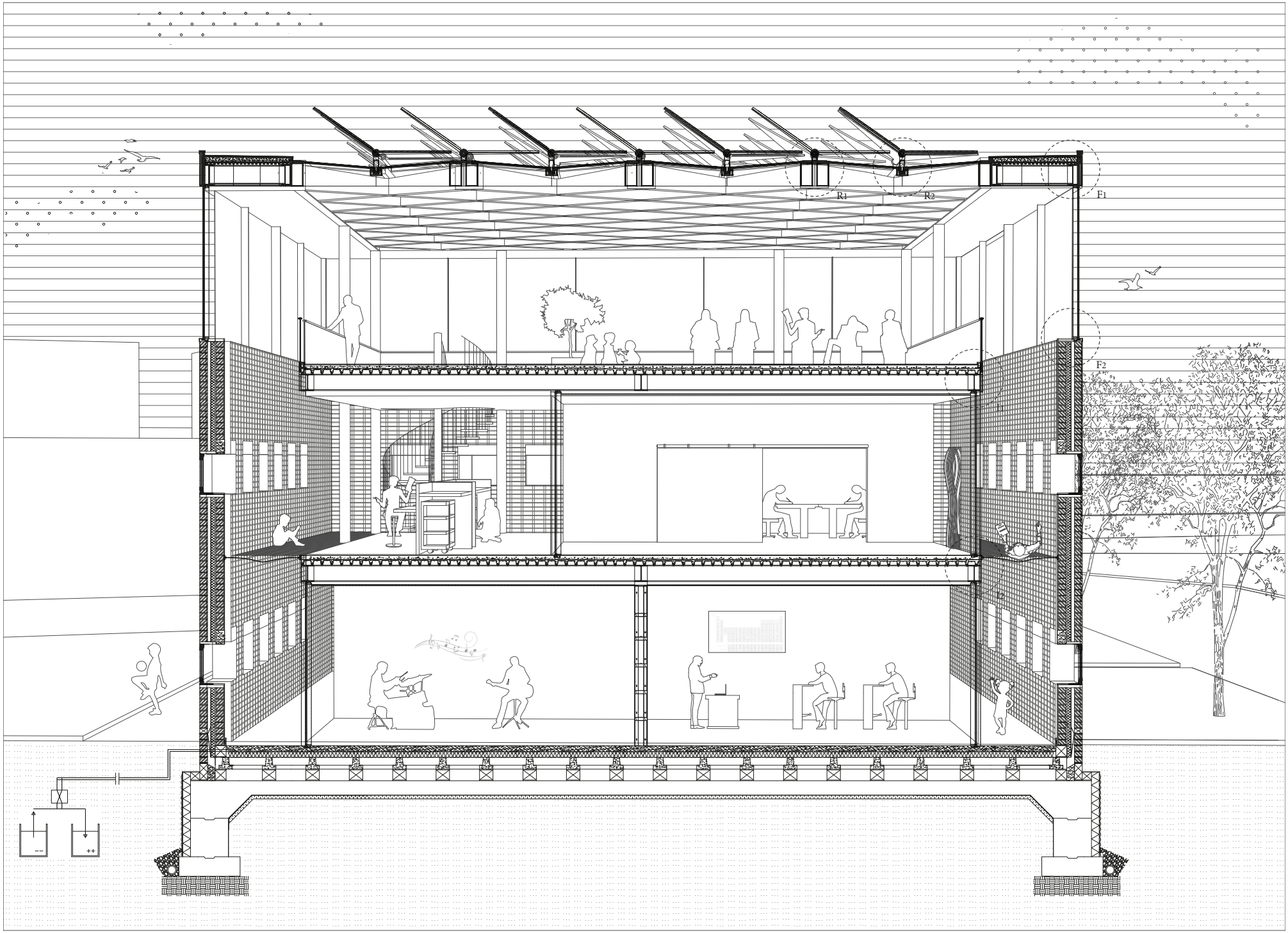


Heros Daylight School

Aula / sporttribune

Heros Daylight School

Aula / sporttribune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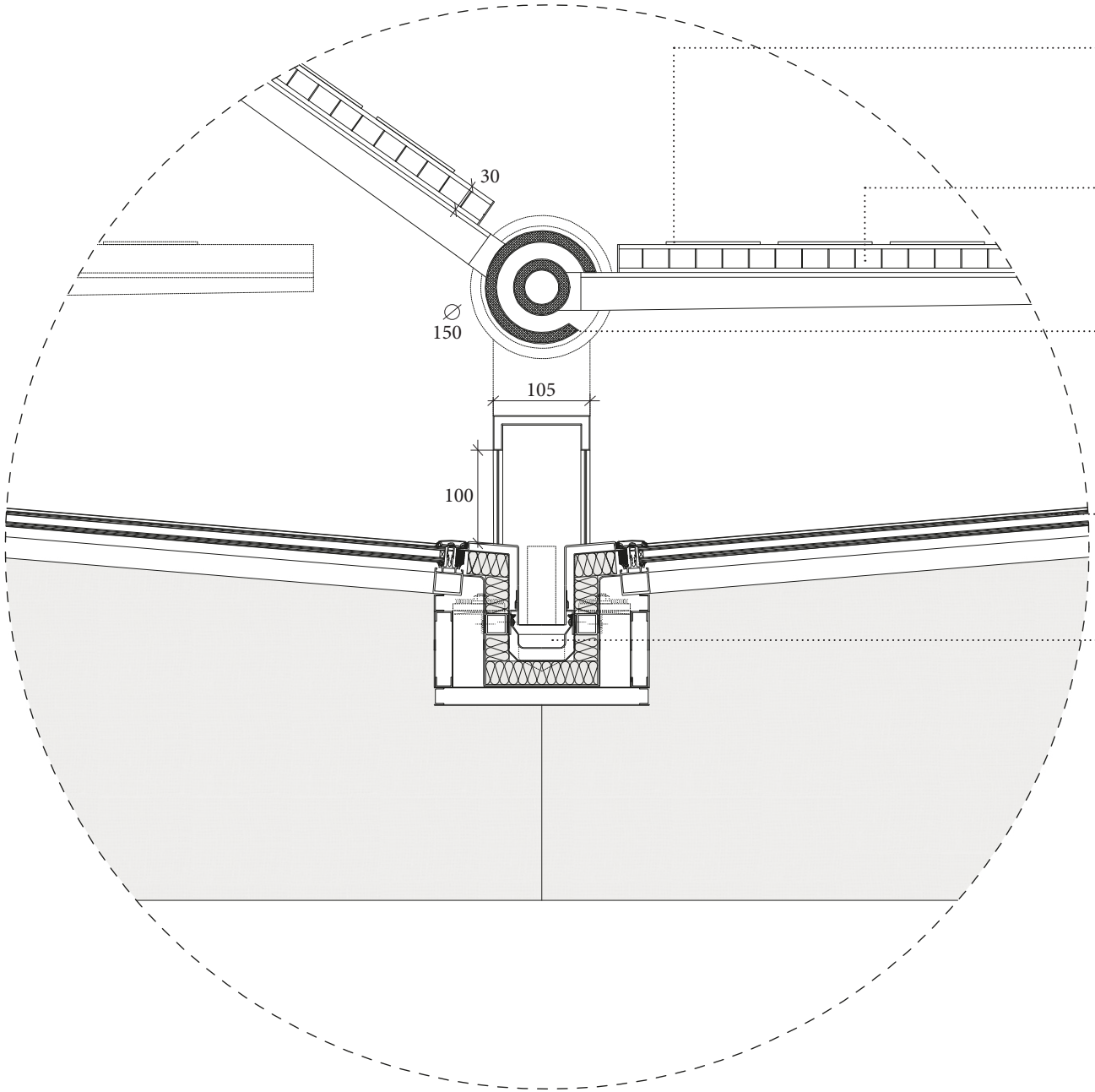


monocrystalline solar cell;
61 cells/panel;
output 210 kWh/year / panel

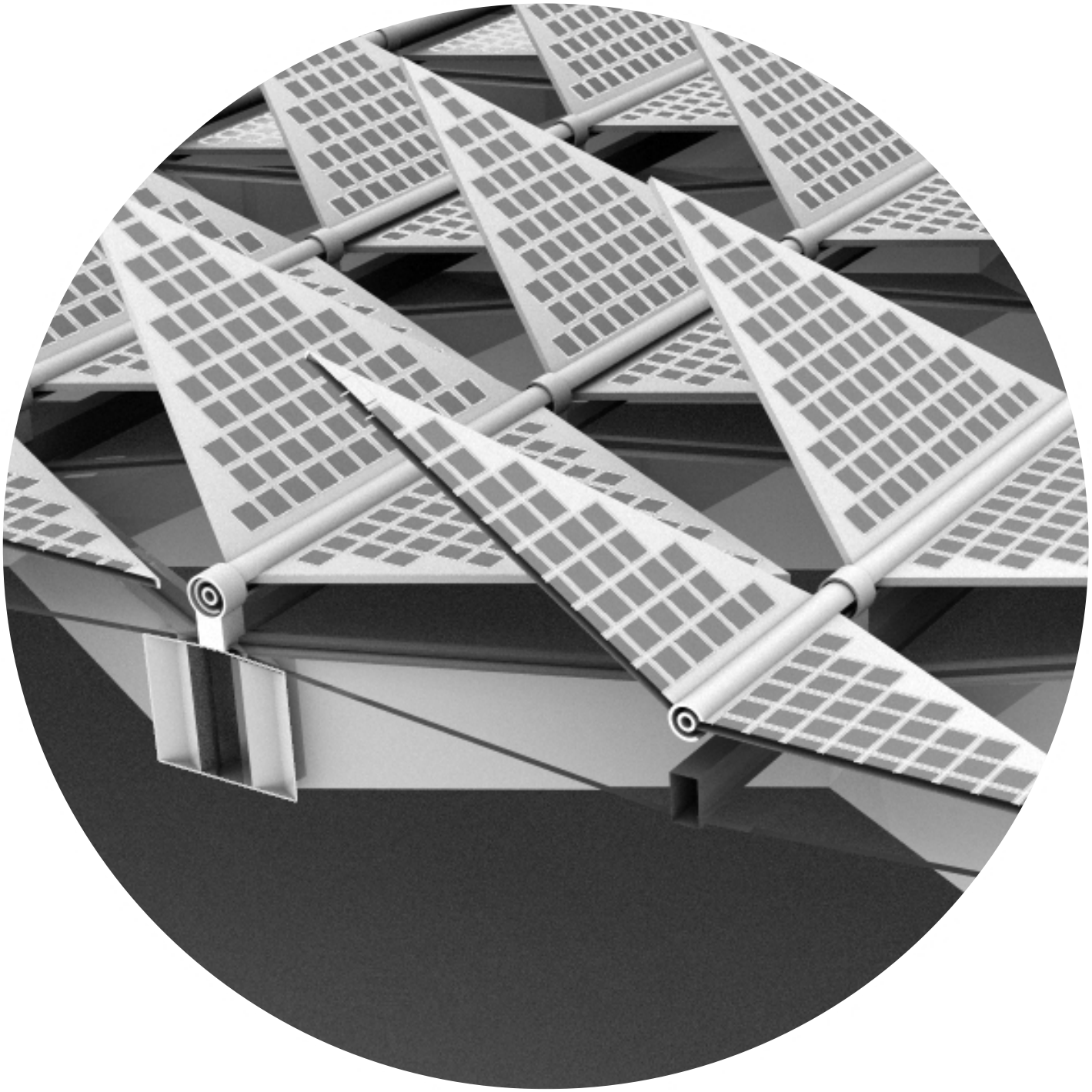
rigid, triangular panel;
aluminum honeycomb, white coated;
placed on aluminum profile

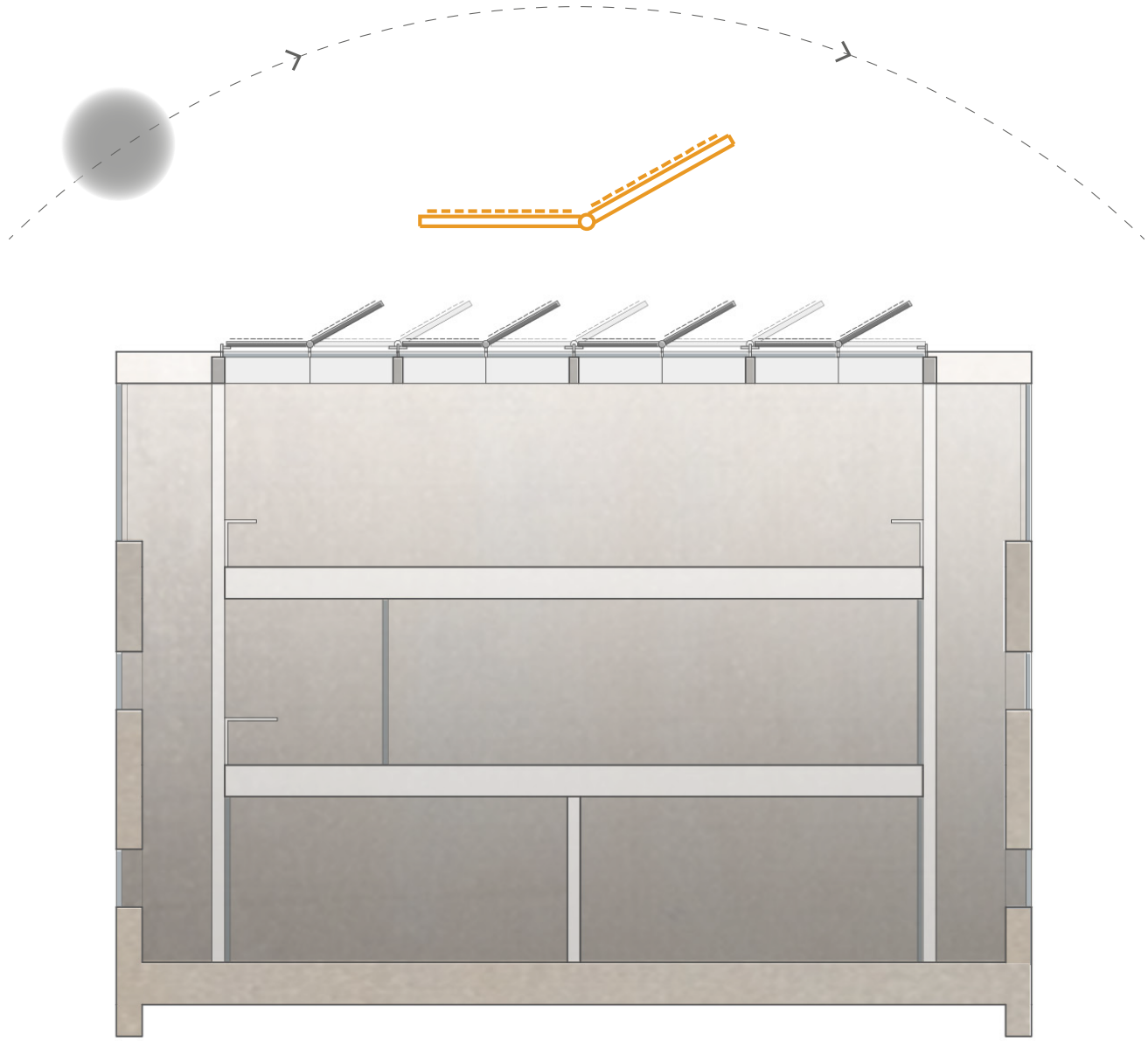
rotation axis solar panels;
double shaft

glass;
double, insulating HR++

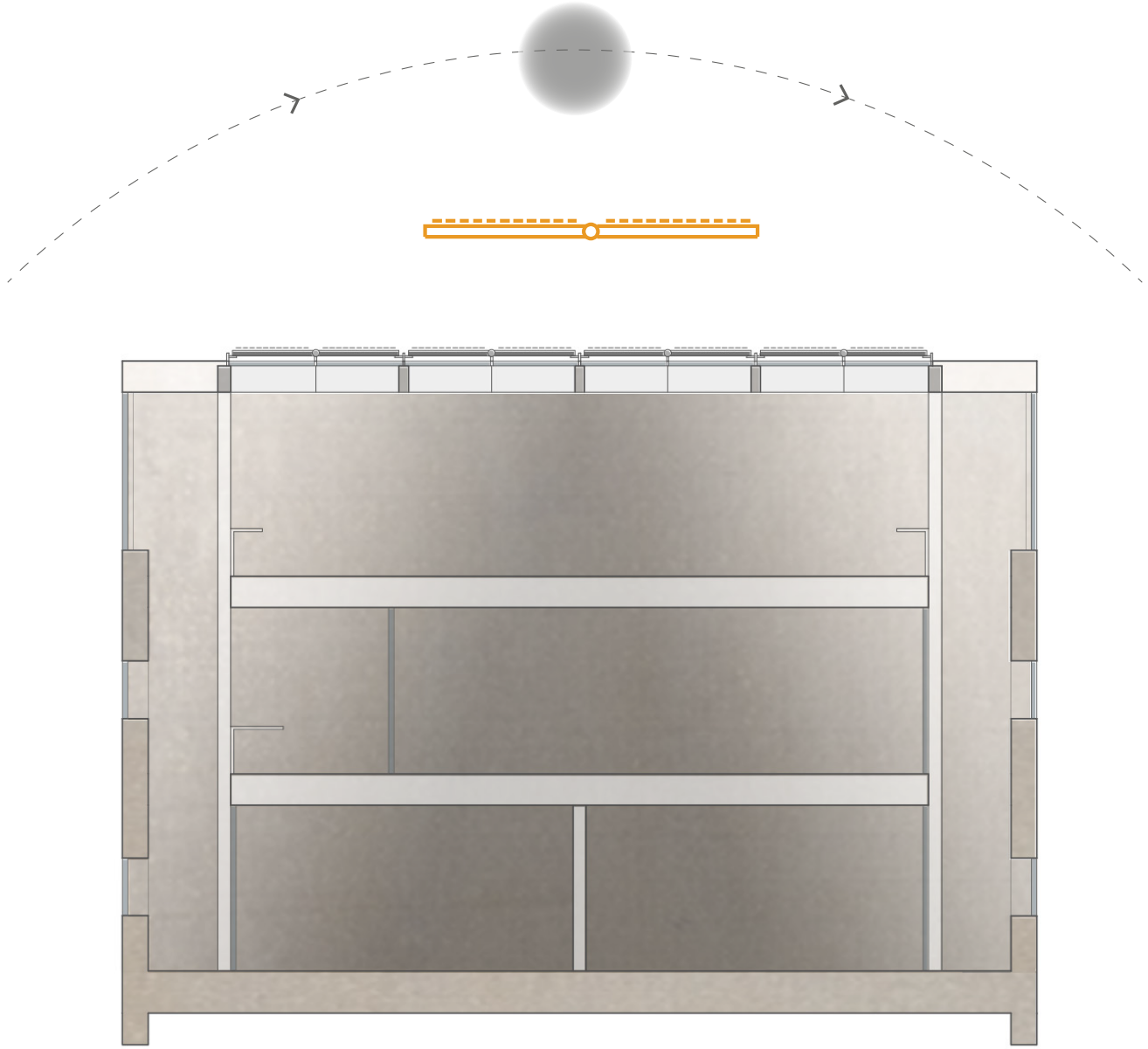
rainwater drainage;
protected with filter

Roof detail 2

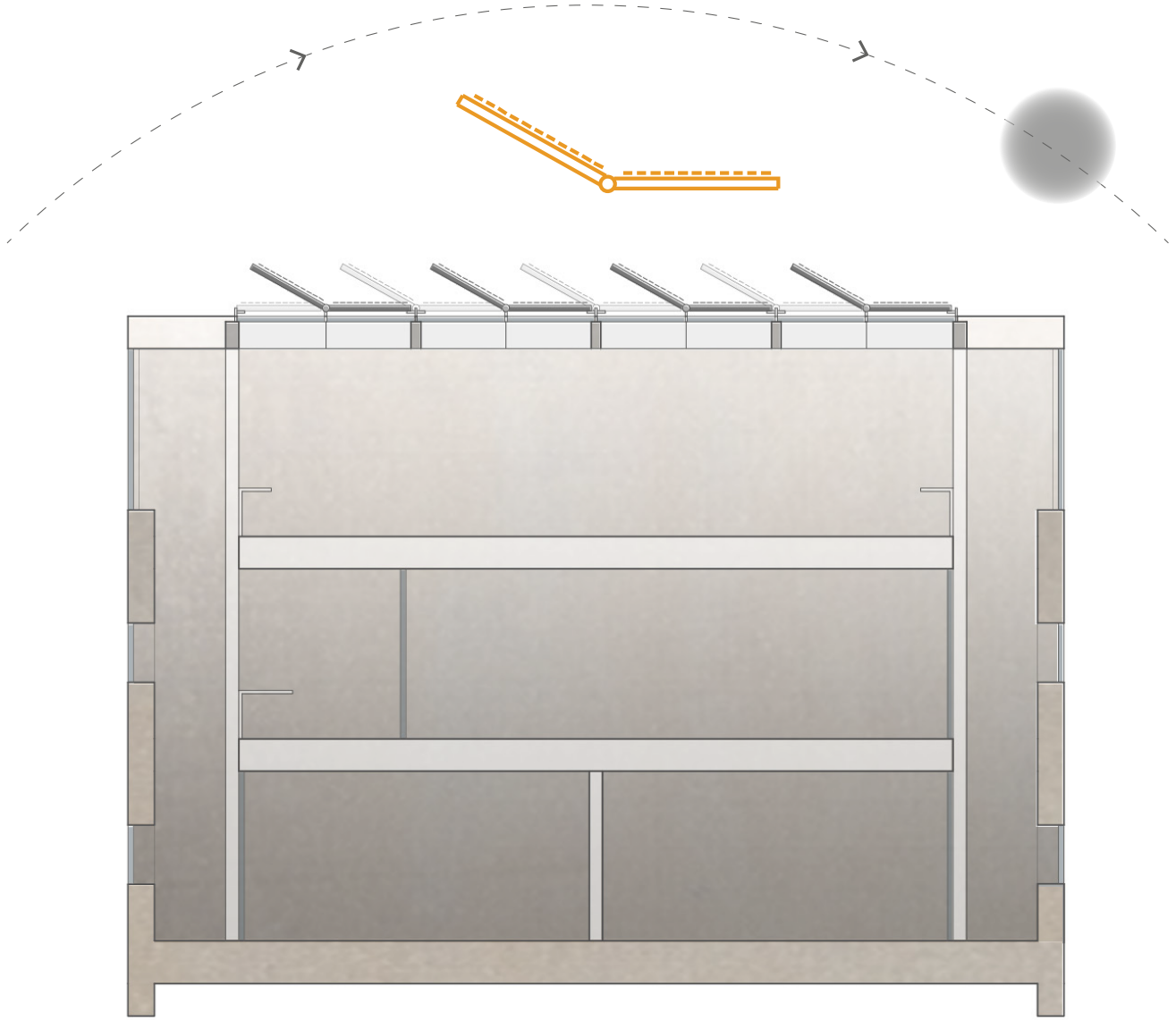




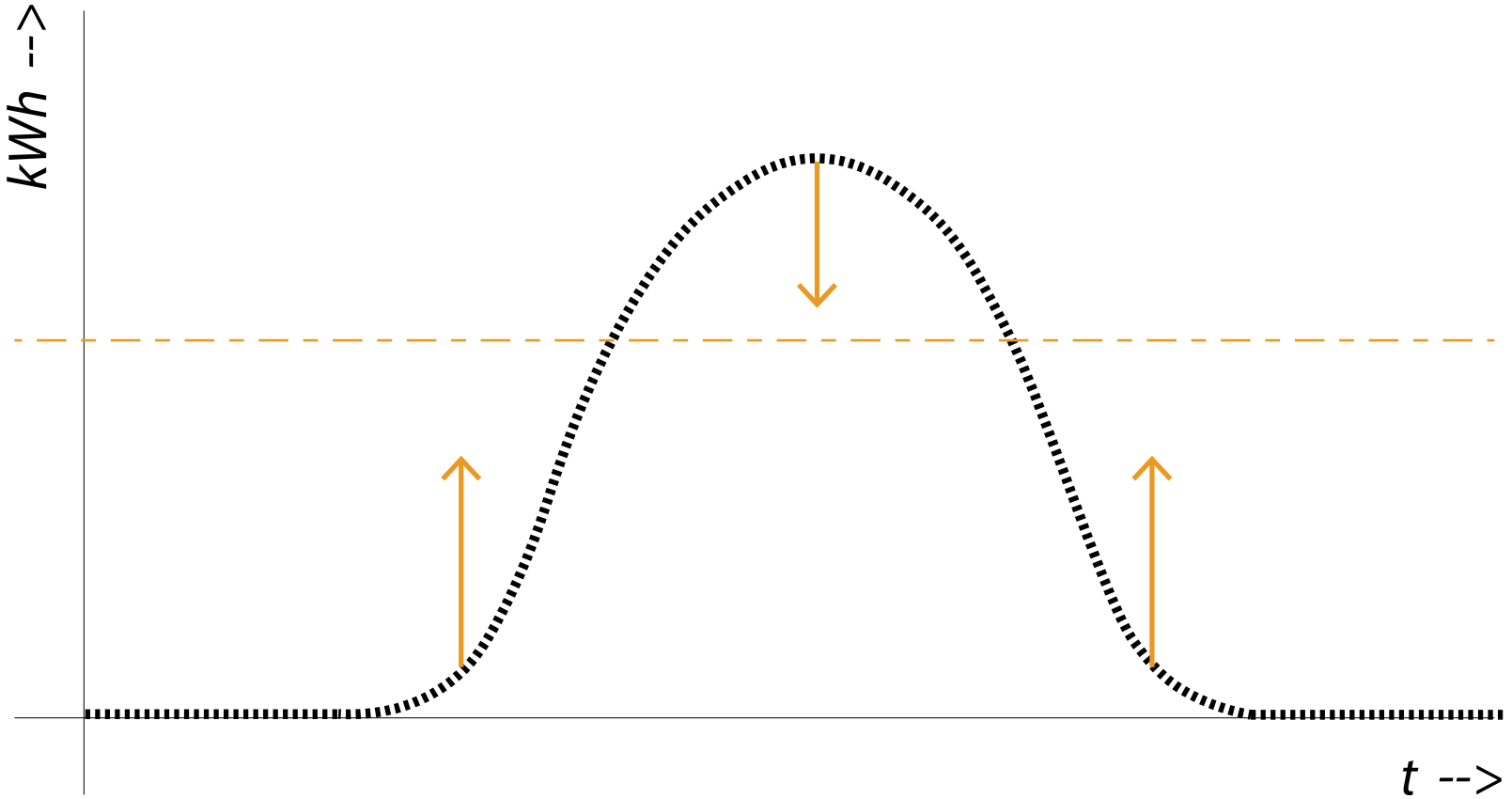
morning

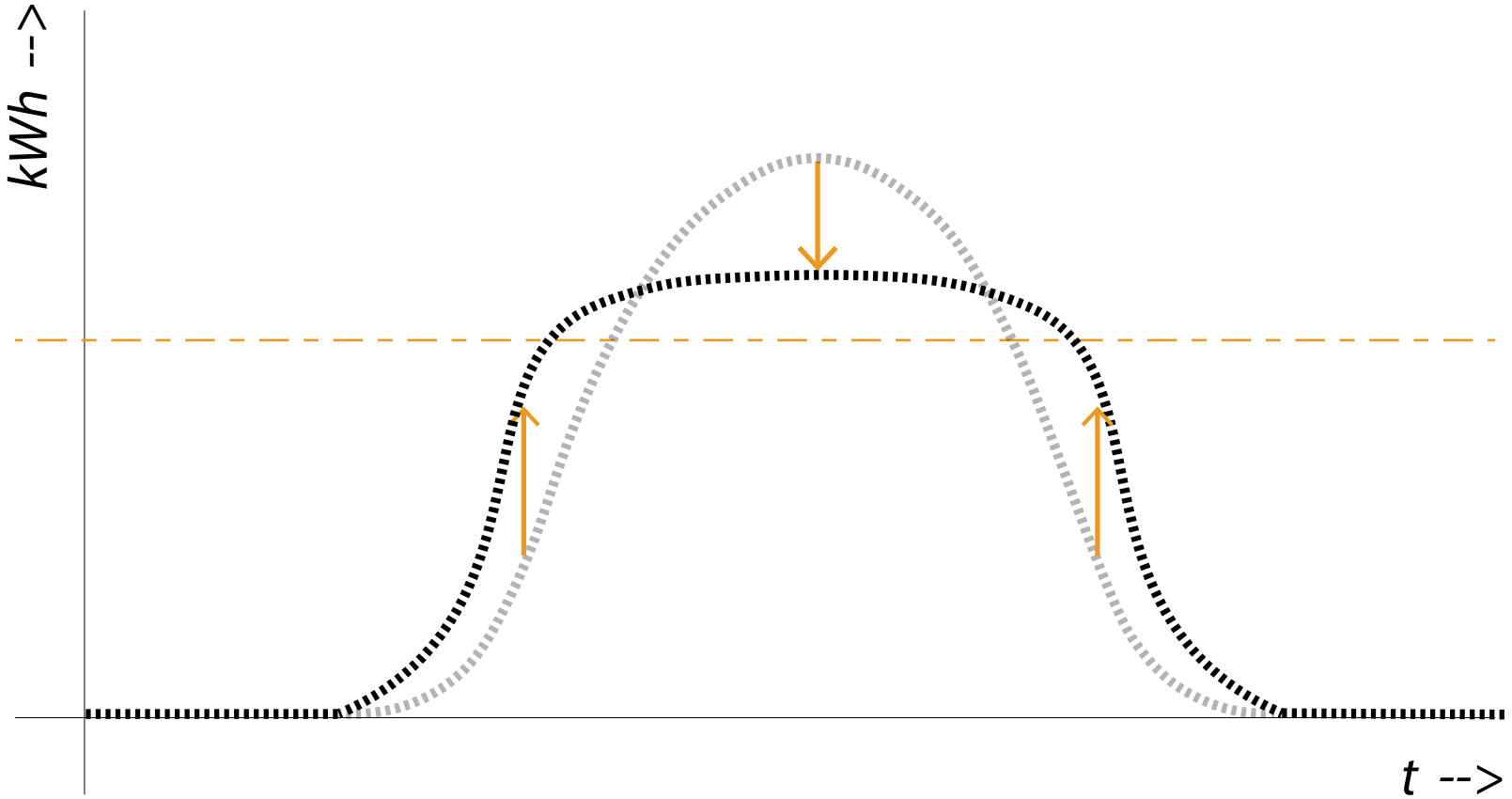


noon

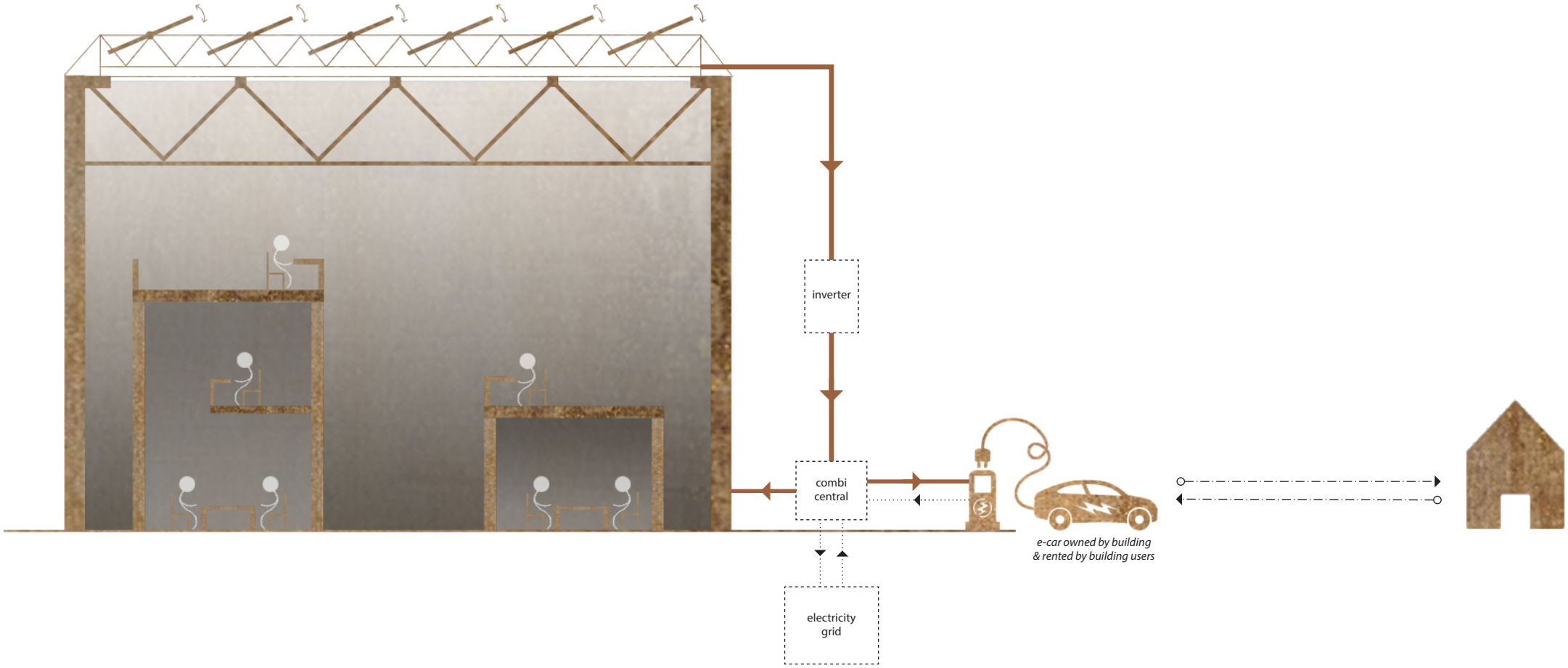


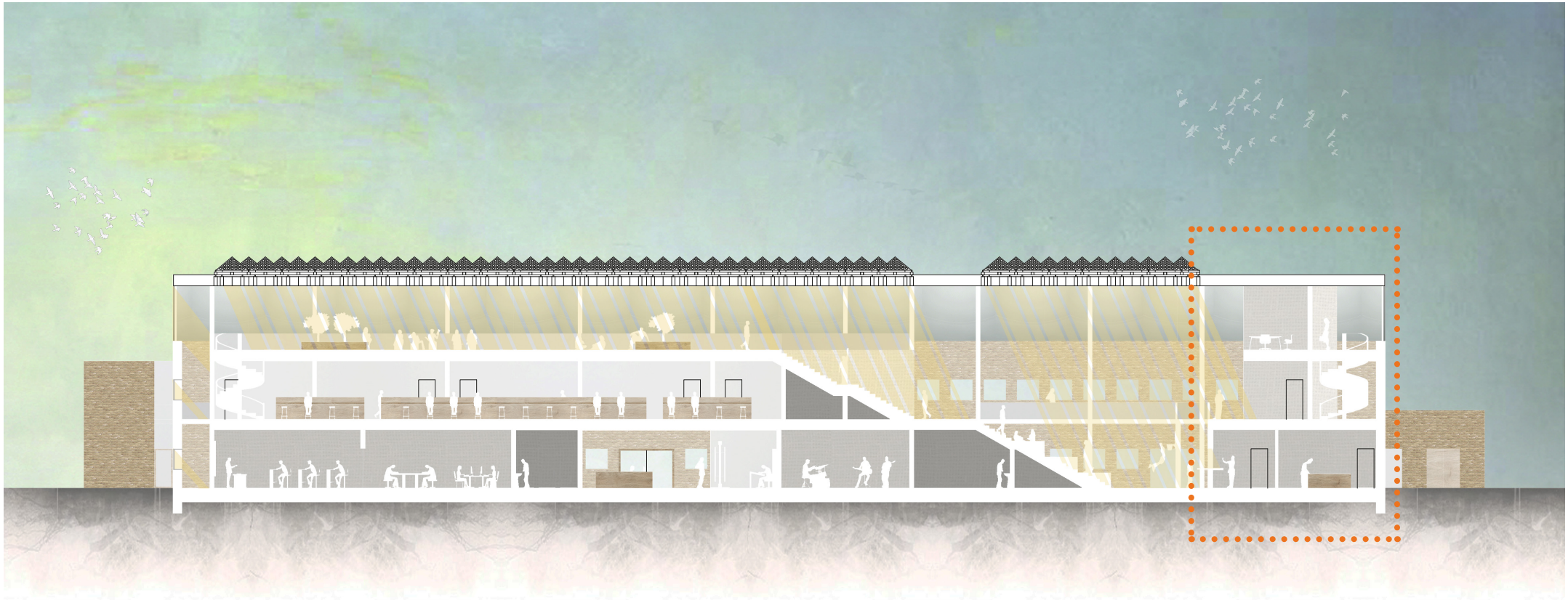
afternoon


kWh -->
t -->
noon: high peak


kWh -->
t -->
noon: less high peak
morning/afternoon: higher efficiency

DECENTRAL/AUTONOMOUS ENERGY SYSTEM

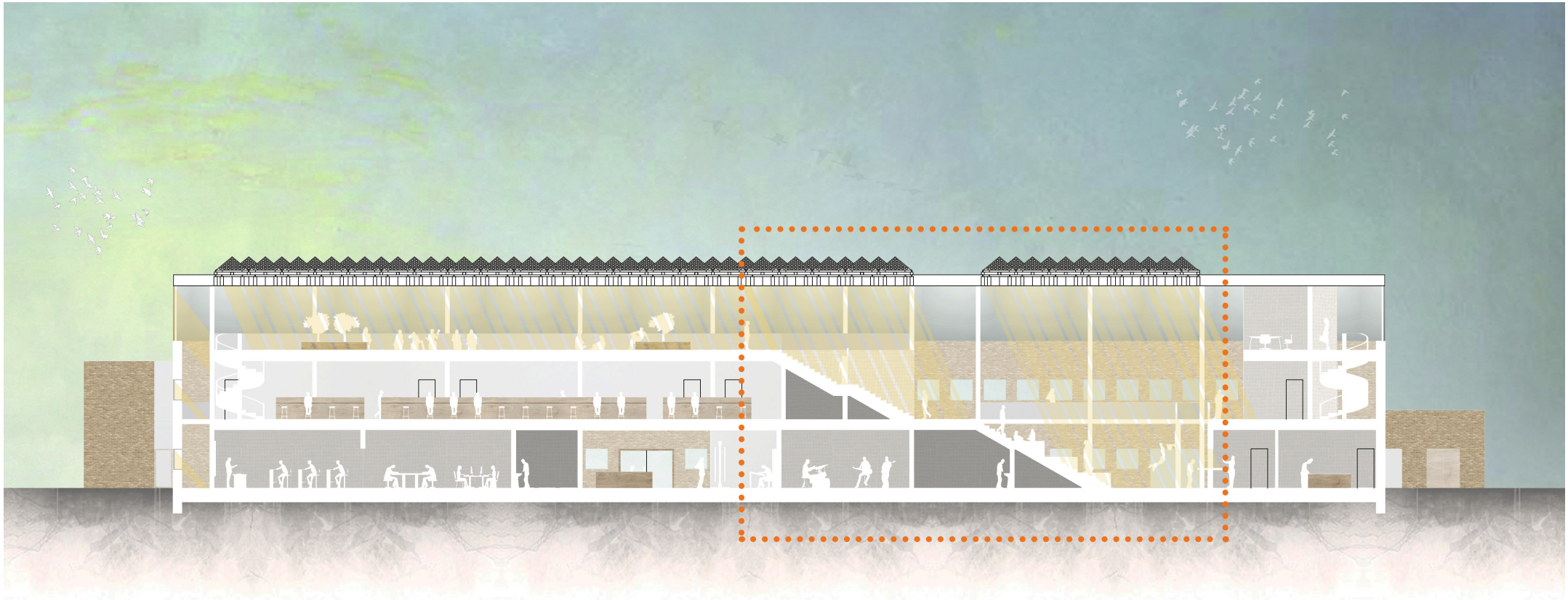




+2 STUDY GARDEN
+1 LIBRARY / LANGUAGE LABS
0 COURSE SPECIFIC CLASSROOMS

AULA / SPORTTRIBUNE

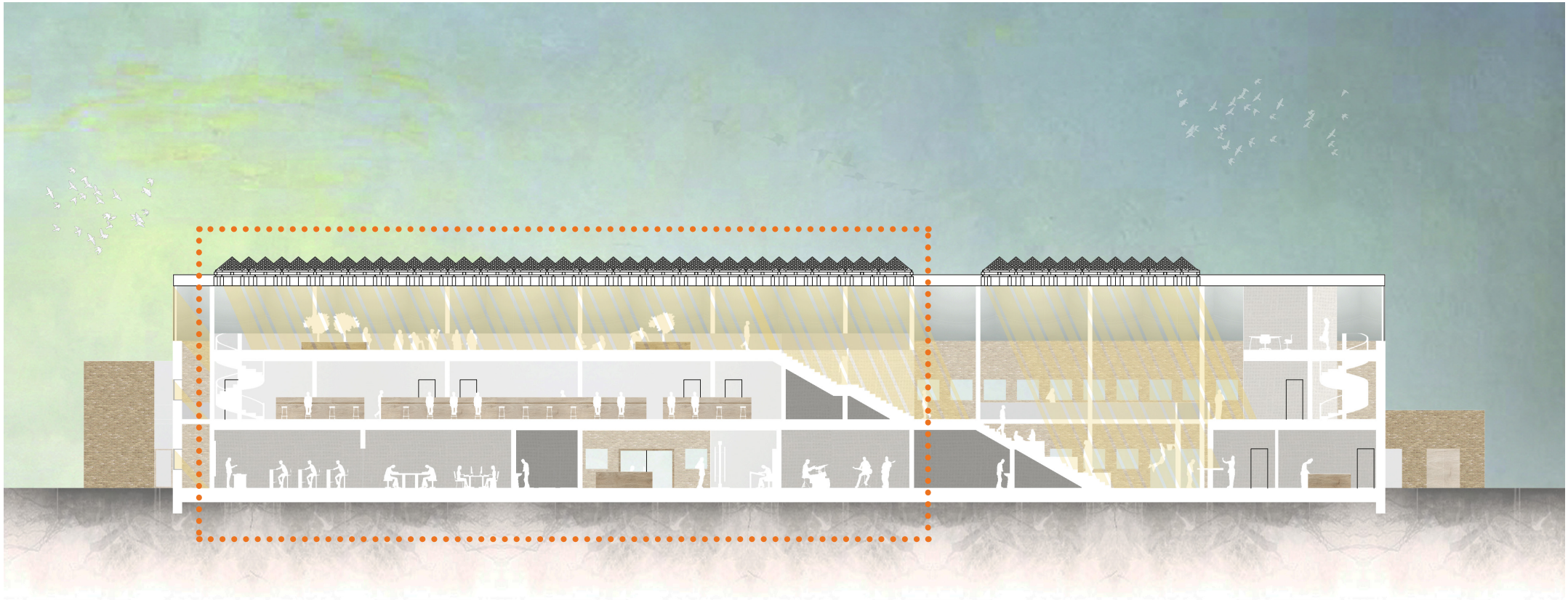
+1/2 TEACHER / STAFF AREA
0 FACILITIES



+2 STUDY GARDEN
+1 LIBRARY / LANGUAGE LABS
0 COURSE SPECIFIC CLASSROOMS

AULA / SPORTTRIBUNE

+1/2 TEACHER / STAFF AREA
0 FACILITIES



+2 STUDY GARDEN
+1 LIBRARY / LANGUAGE LABS
0 COURSE SPECIFIC CLASSROOMS

AULA / SPORTTRIBUNE

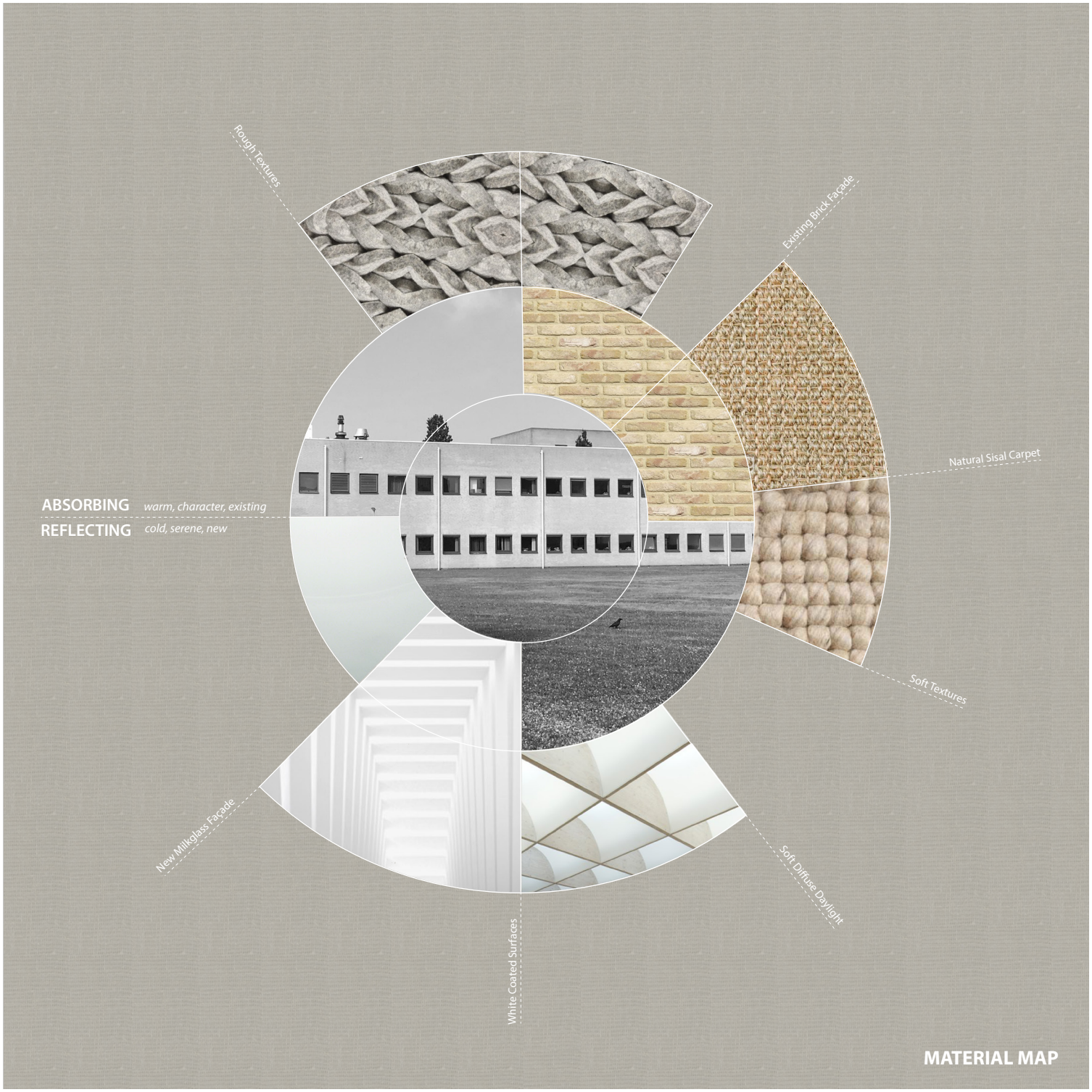
+1/2 TEACHER / STAFF AREA
0 FACILITIES

Heros Daylight School

Study garden

Heros Daylight School
Hammocks

Heros Daylight School
Library


Rough Textures
Existing Brick Facade
Natural Sisal Carpet
Soft Textures
Soft Diffuse Daylight
White Coated Surfaces
New Milkglass Façade
ABSORBING warm, character, existing
REFLECTING cold, serene, new
MATERIAL MAP

TIMELAPSE

Sun-motion during a day

TIMELAPSE

Sun-motion during a day

↓

Roof system adapts constantly

↓

TIMELAPSE

Sun-motion during a day

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Roof system adapts constantly

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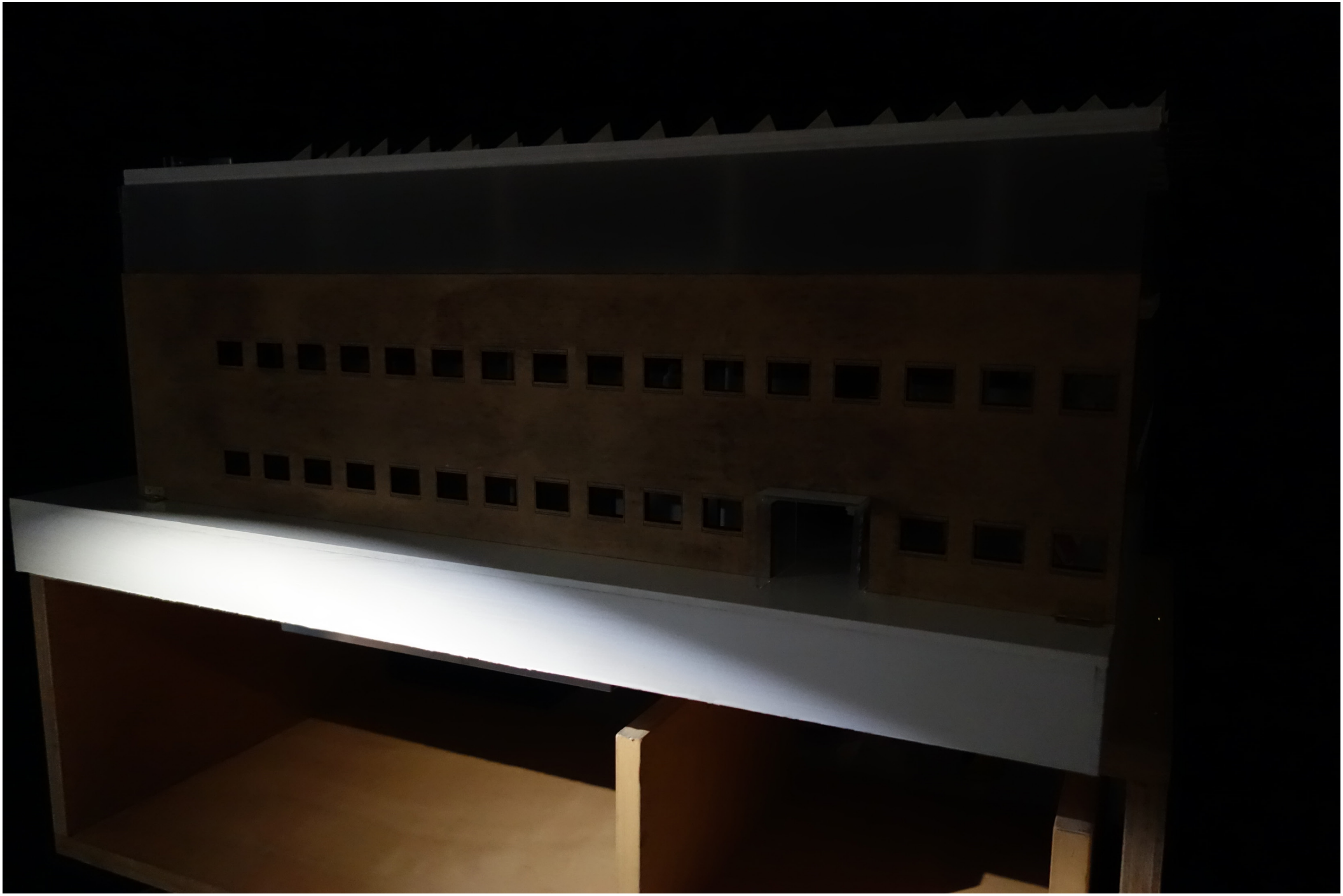
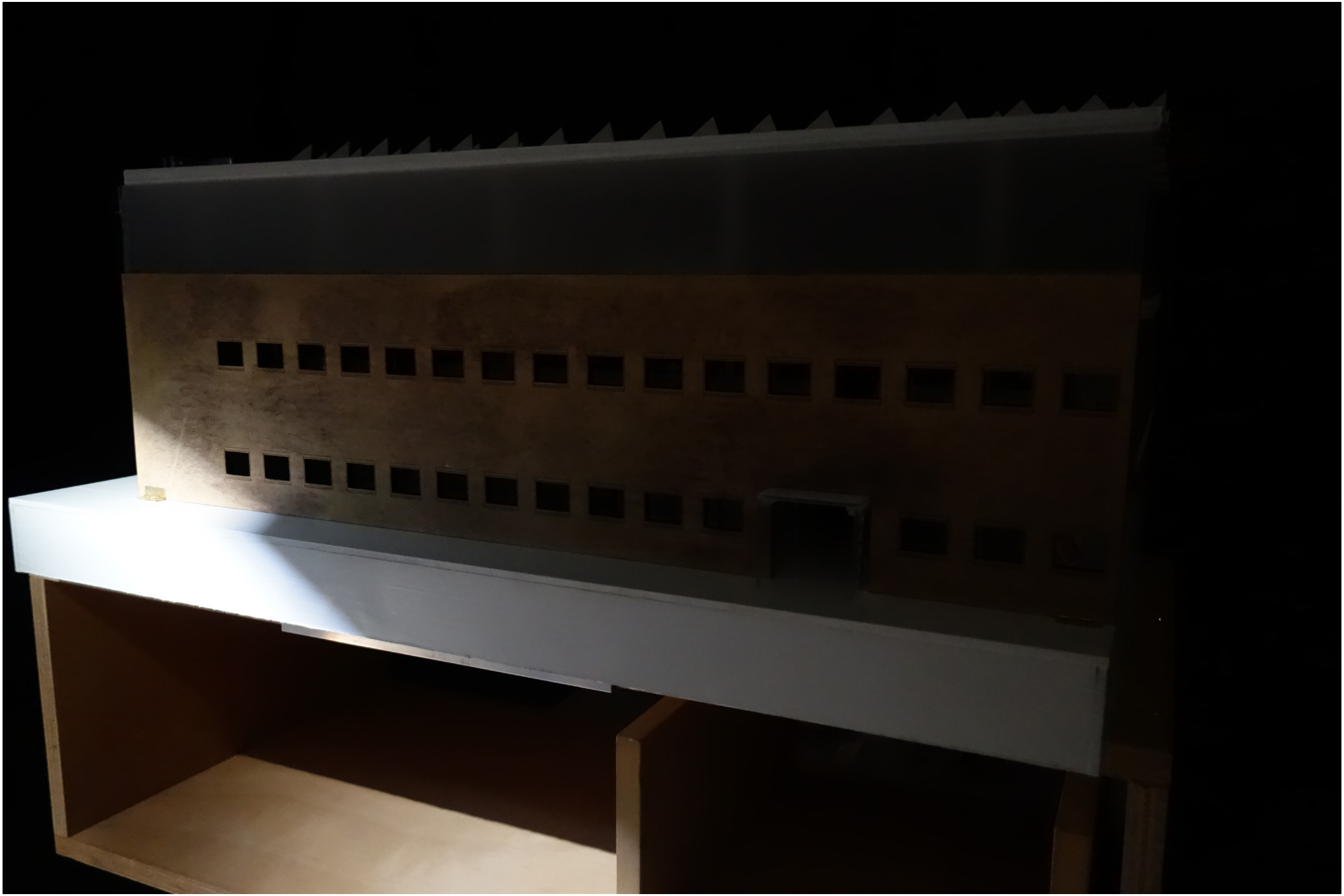
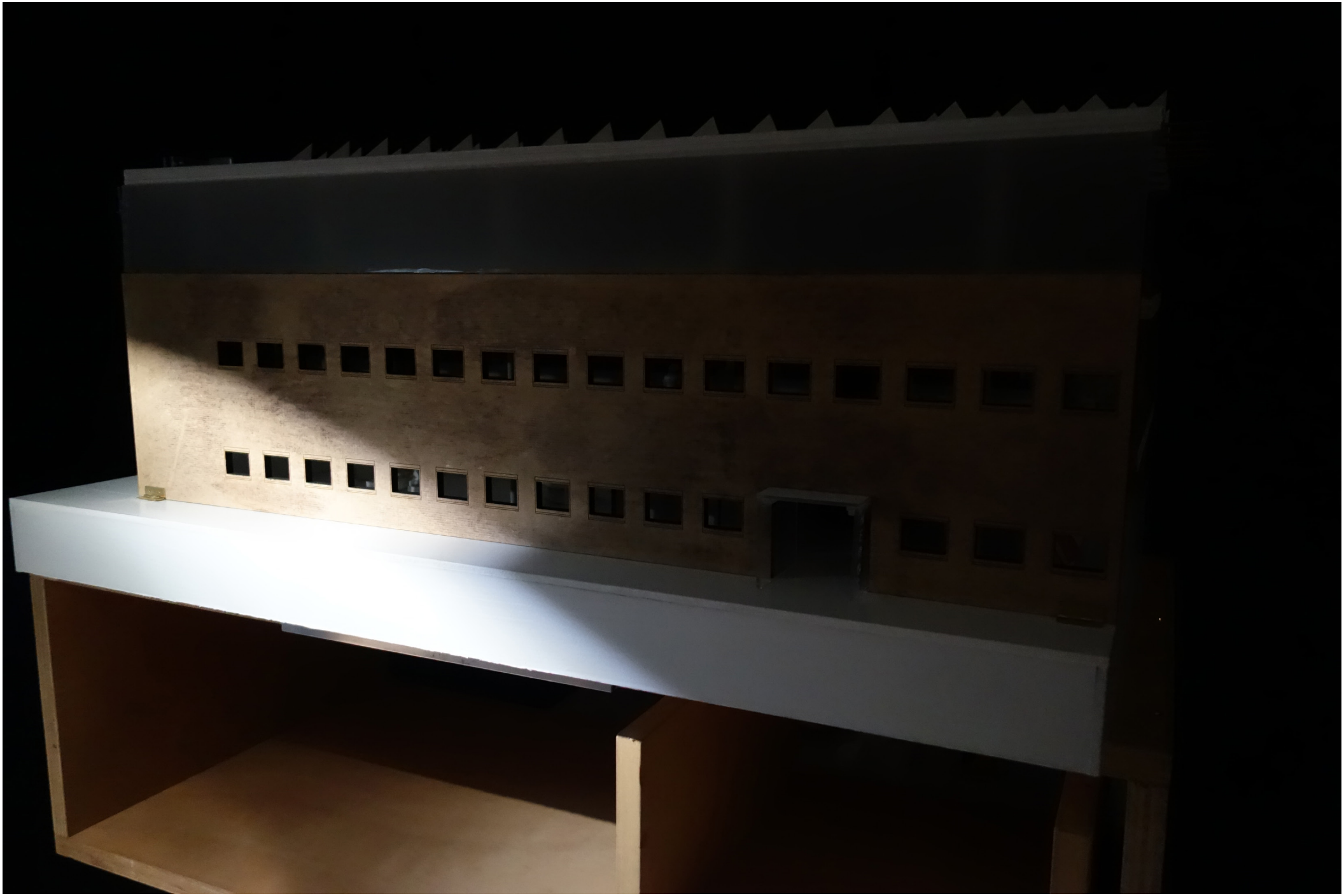
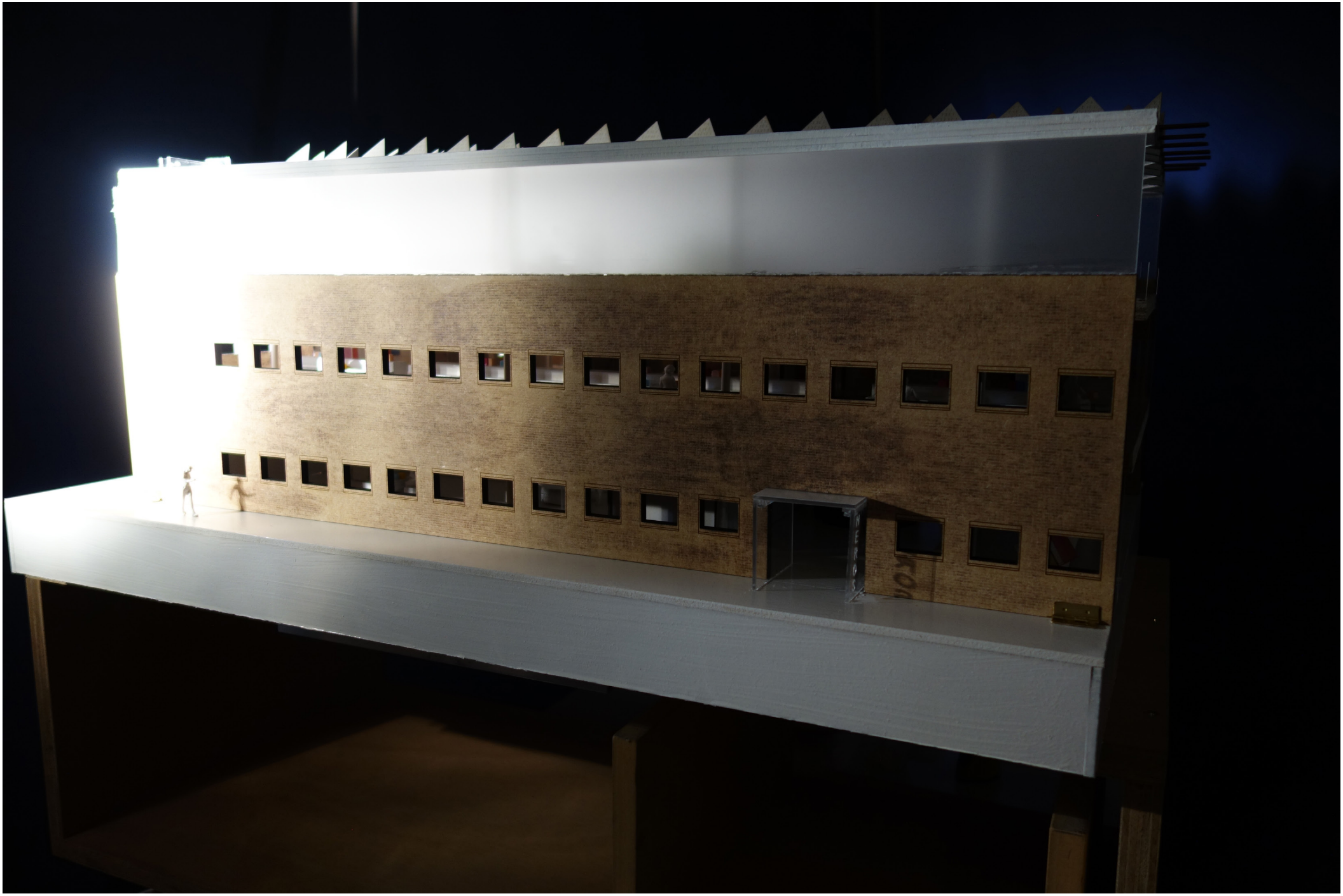
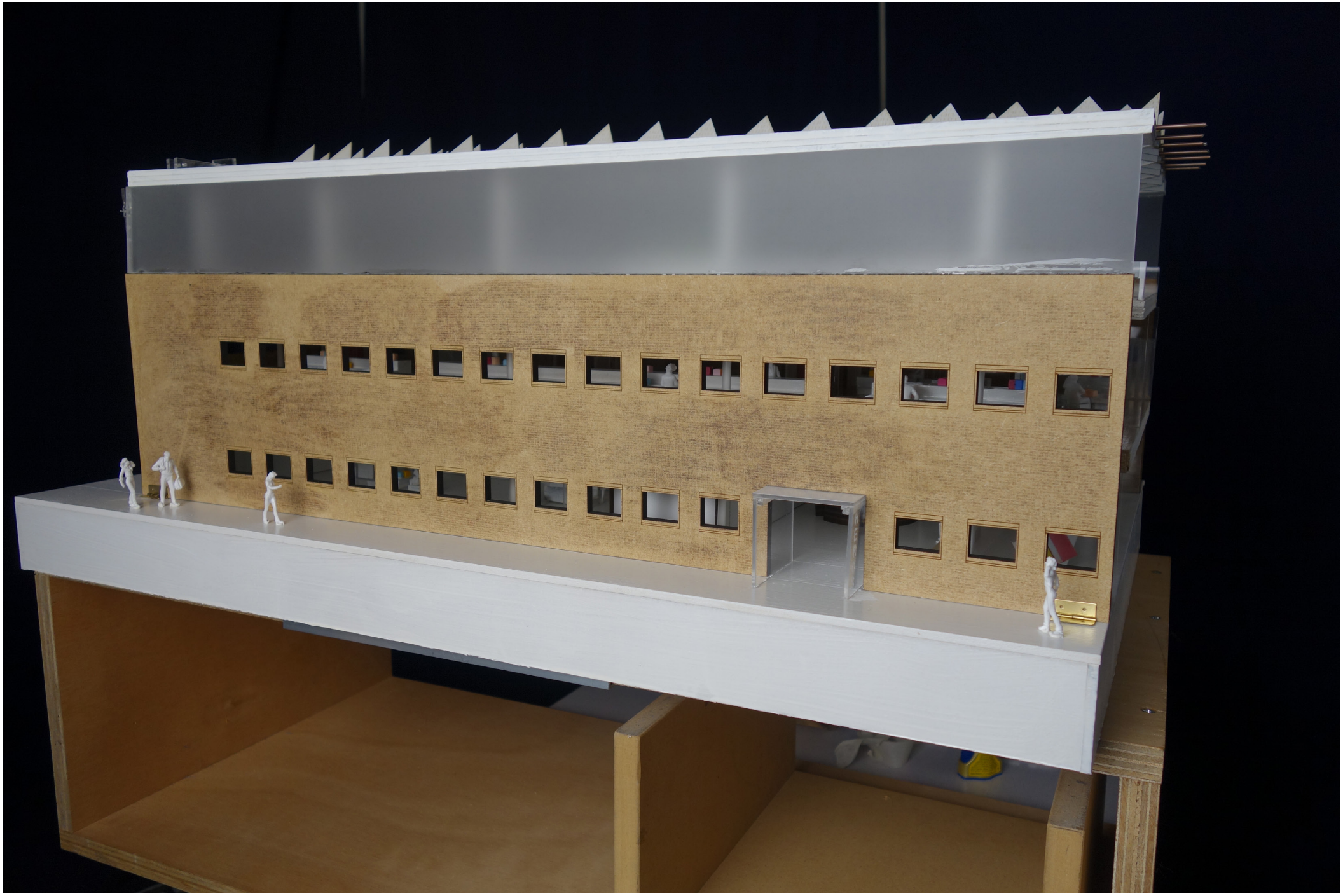
Stimulating biorhythm of the school life

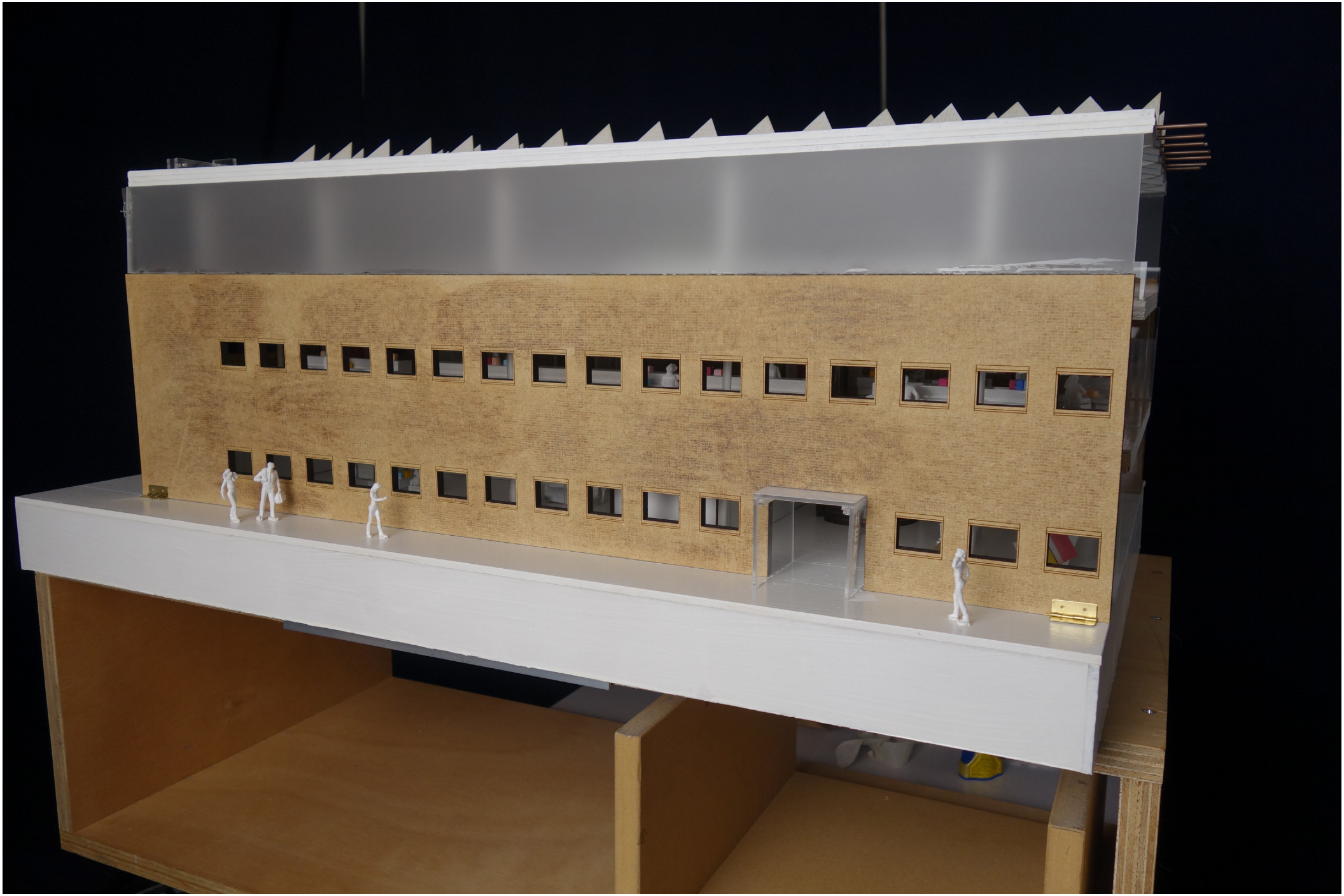


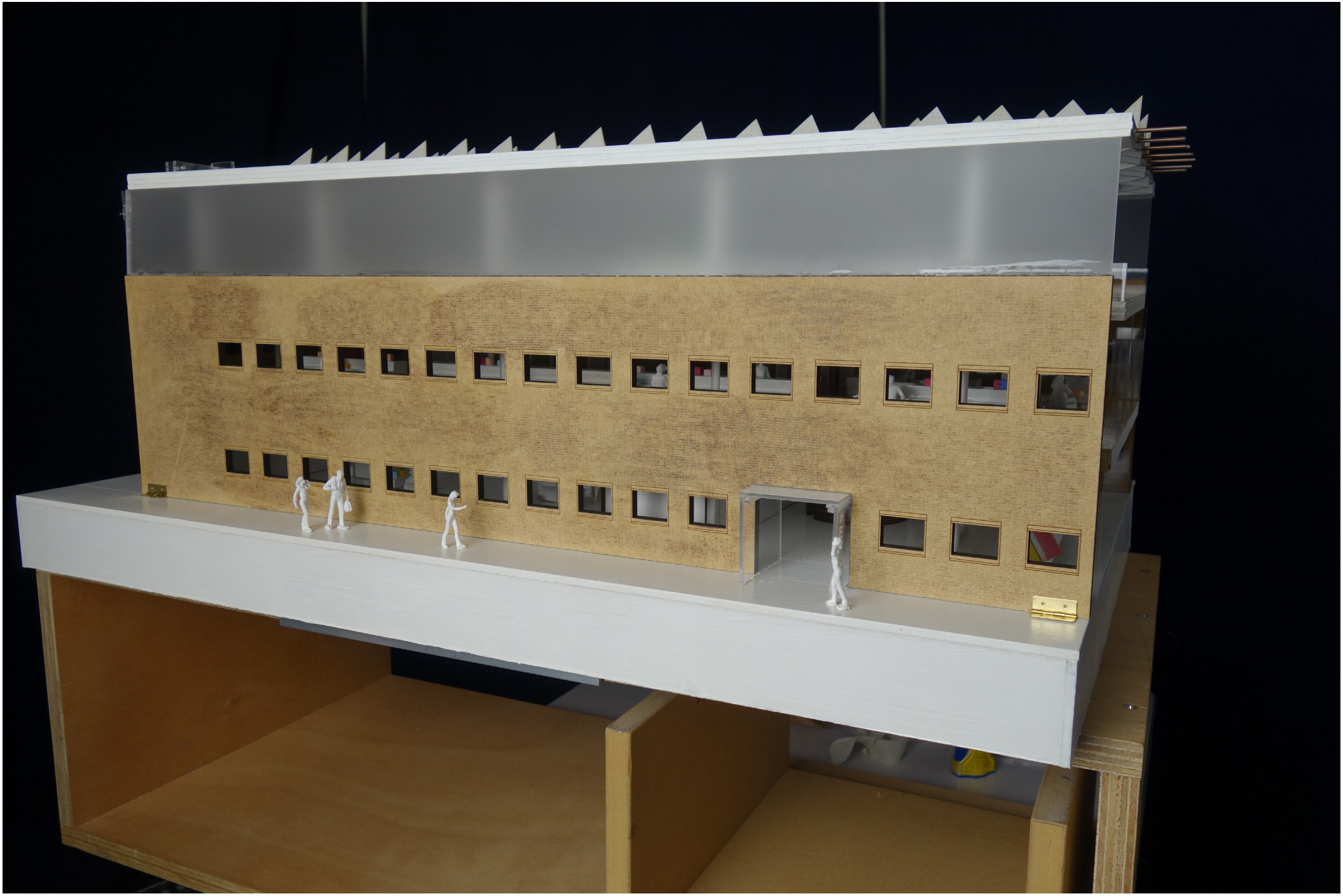


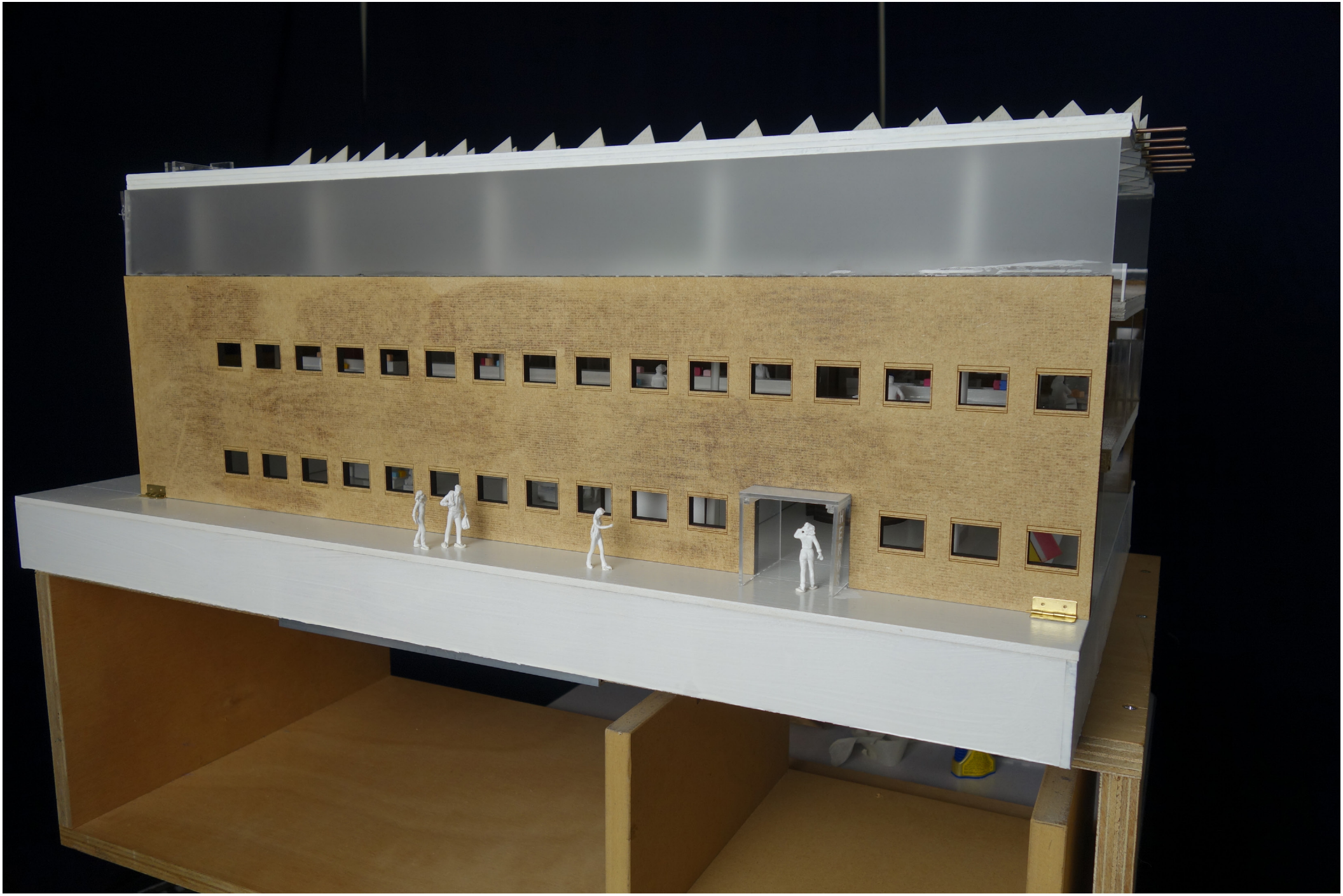


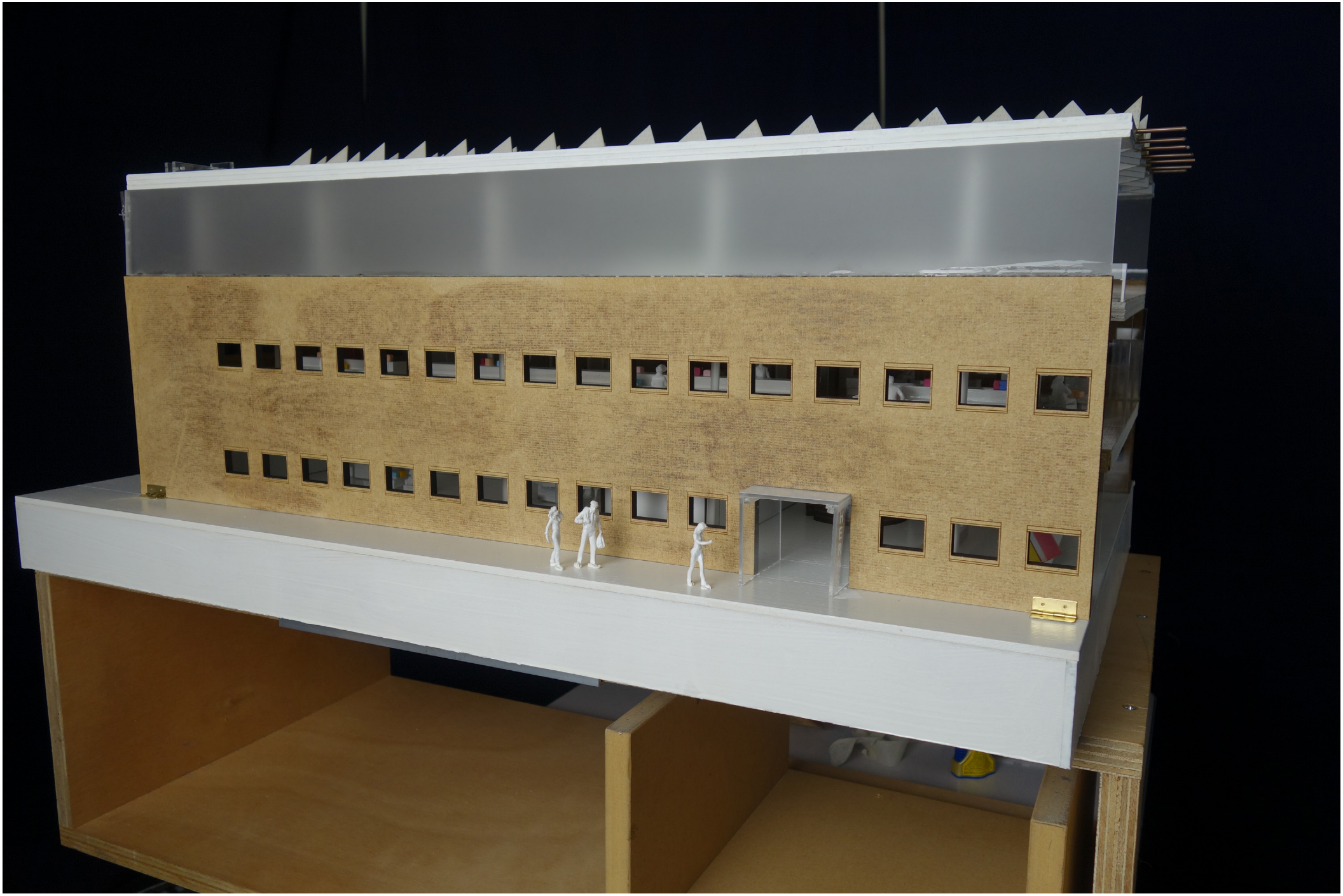


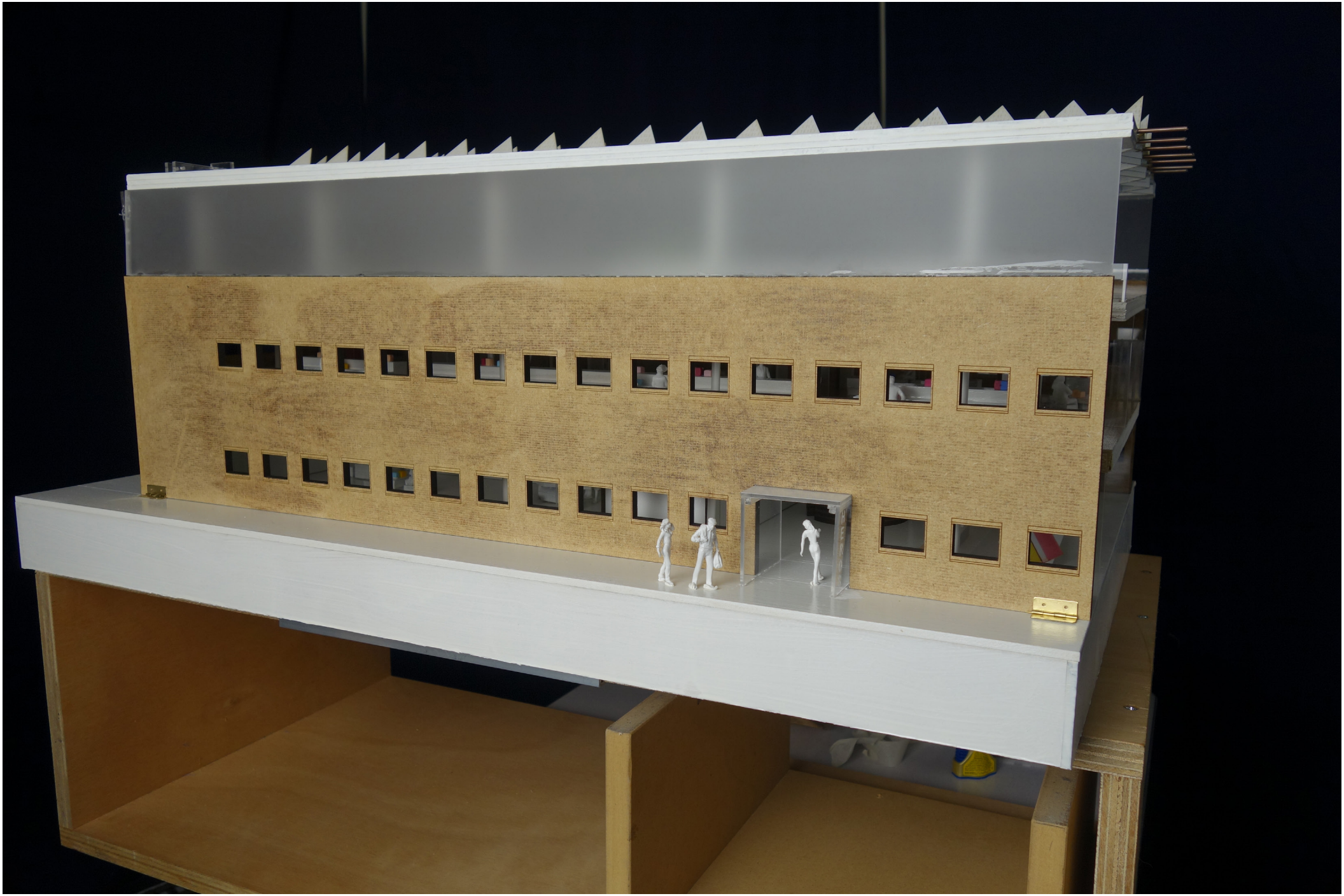


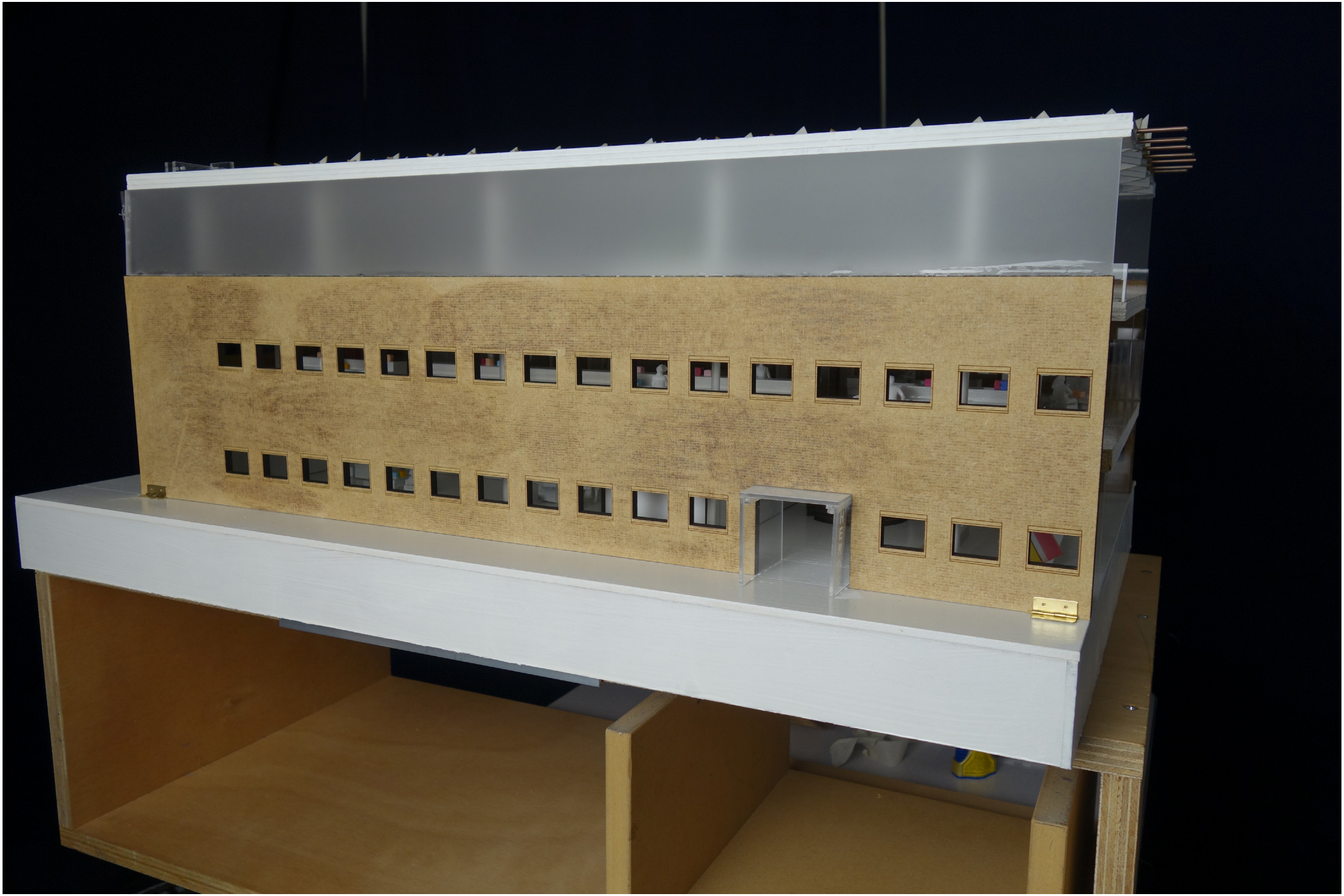


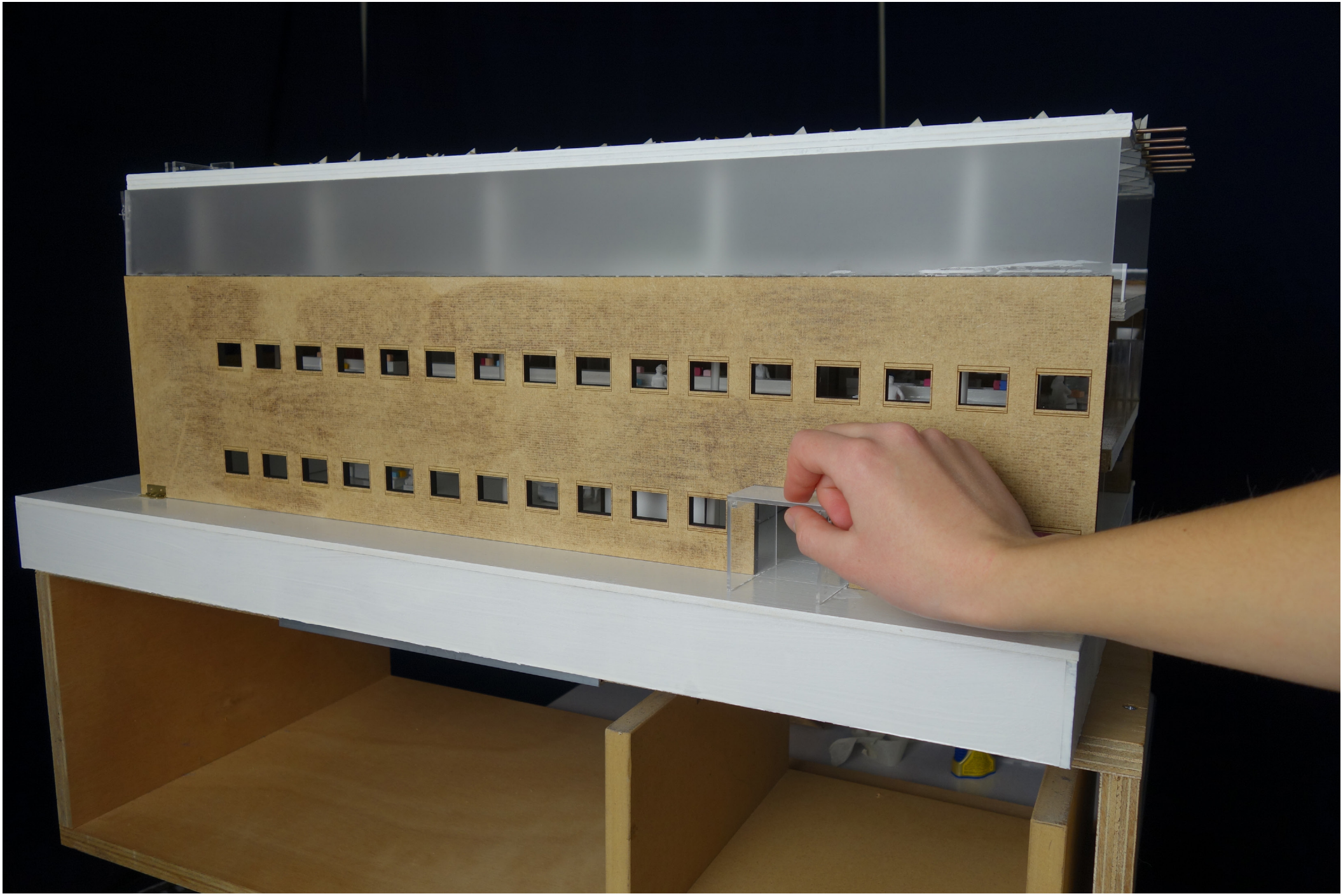


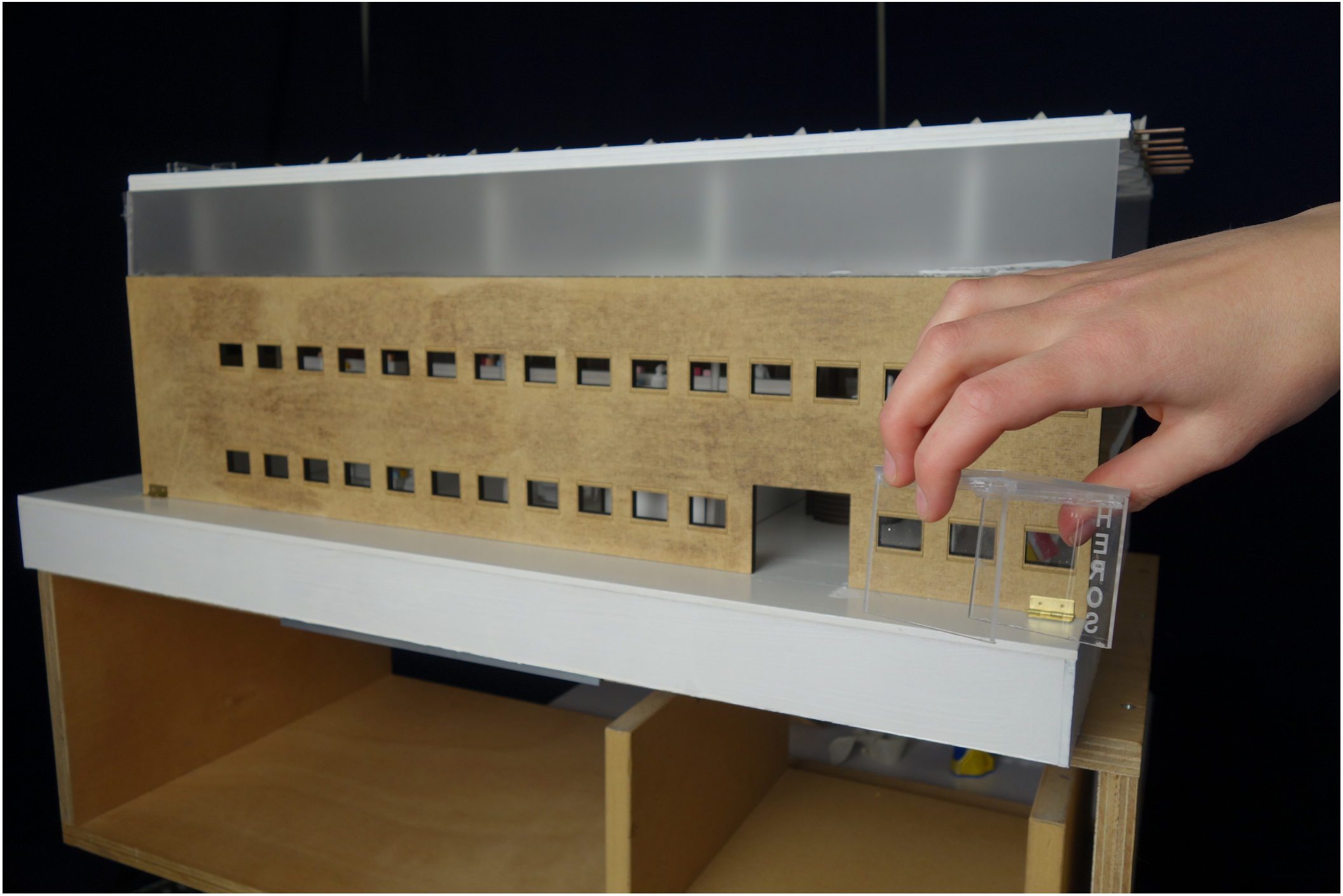


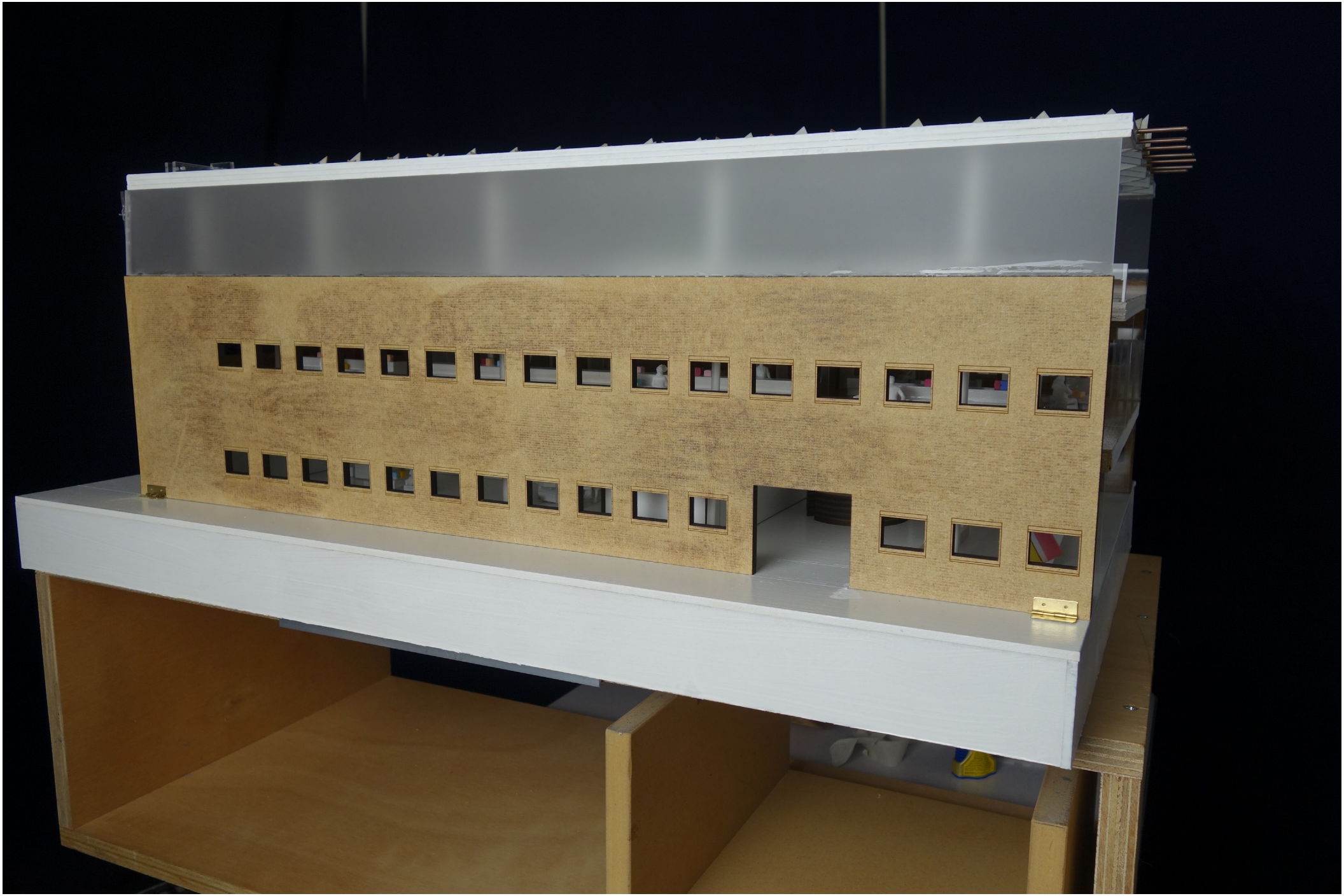


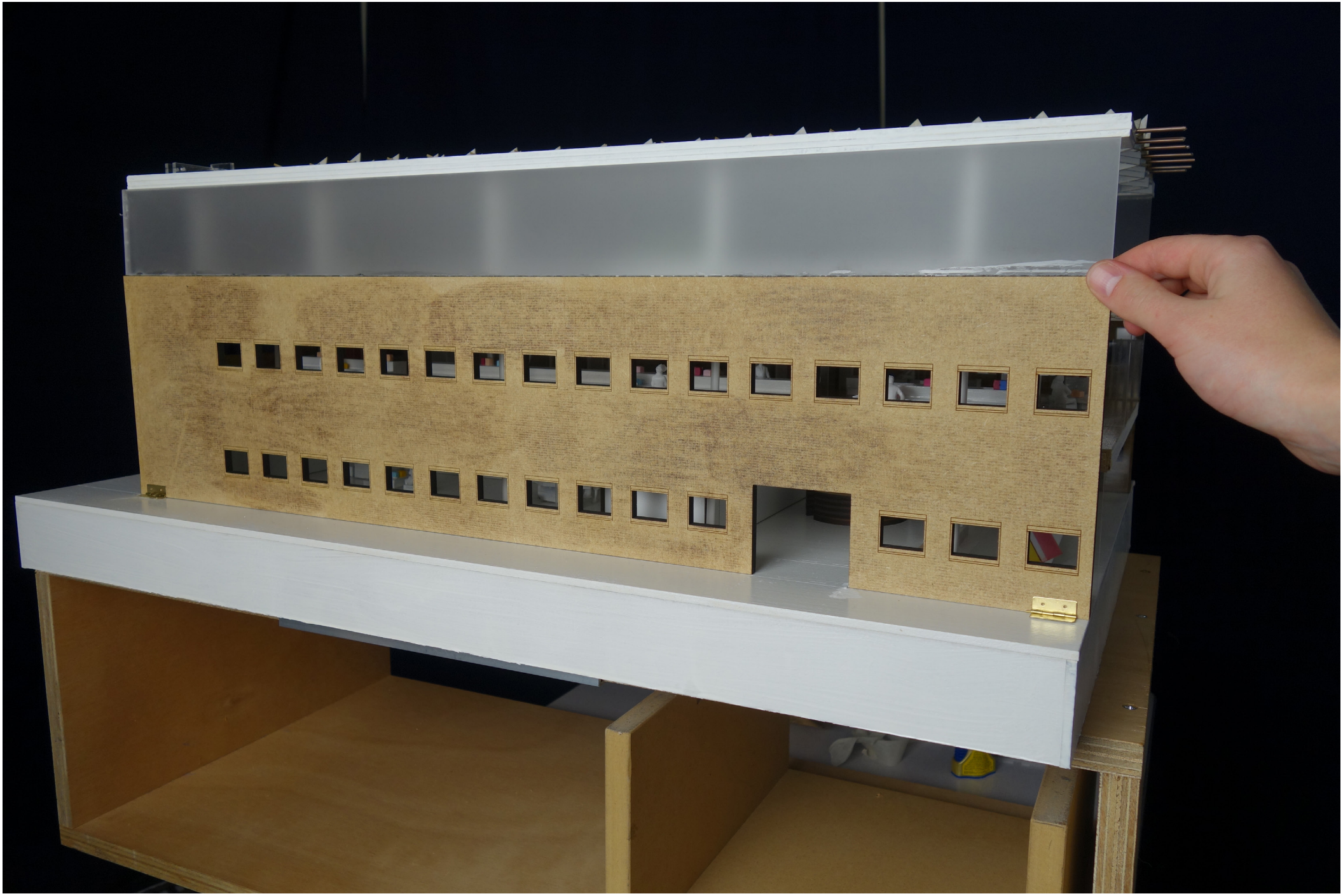


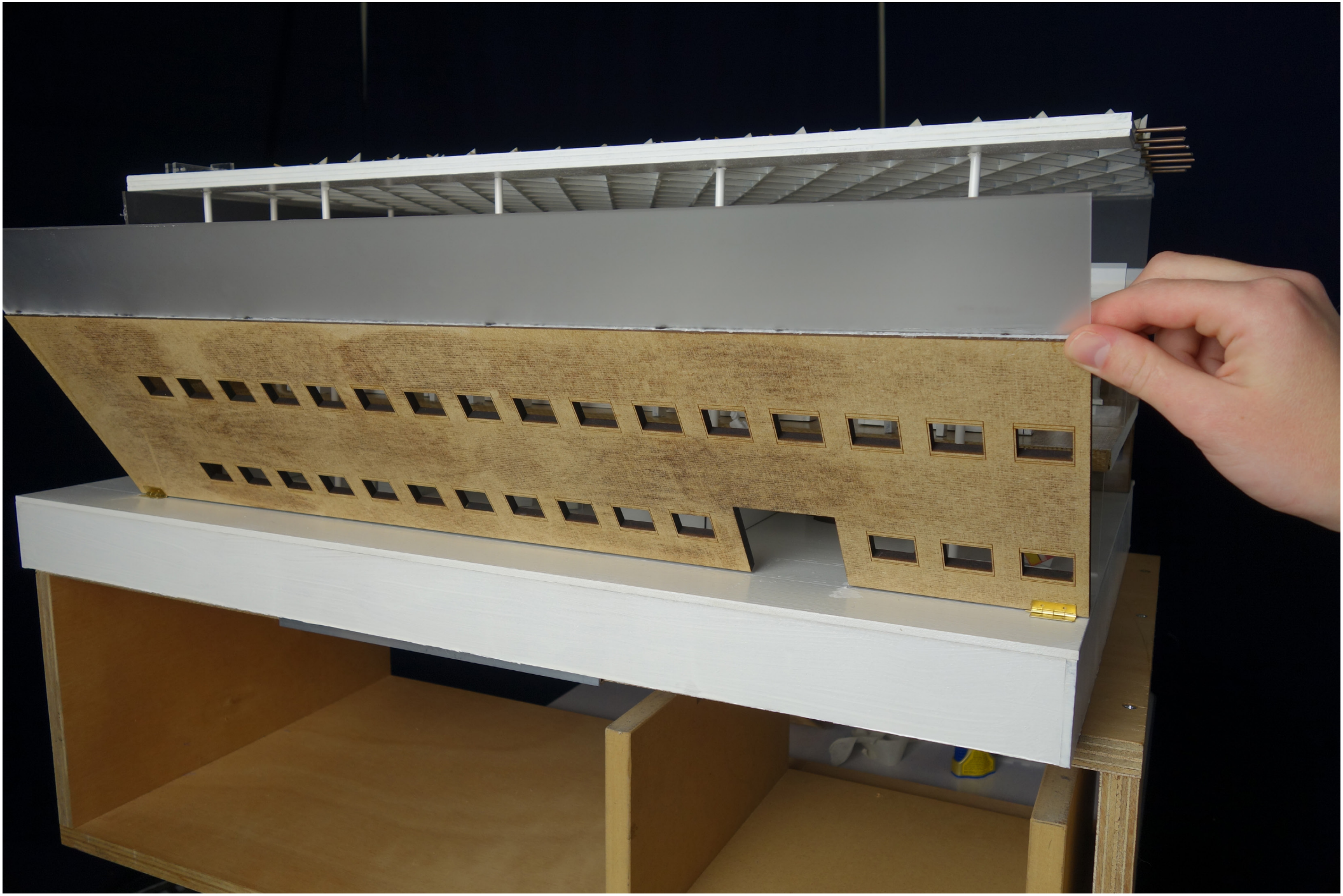


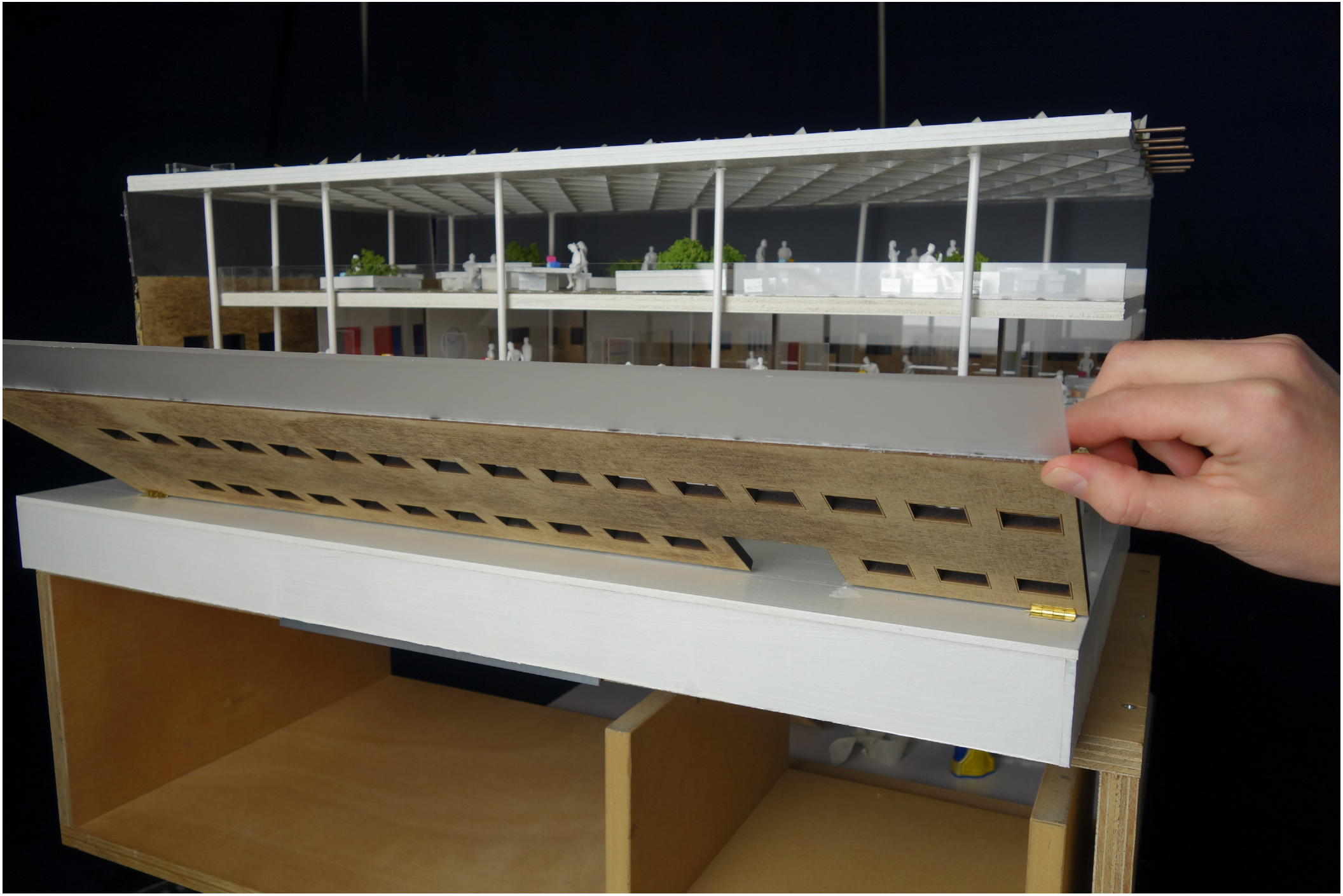


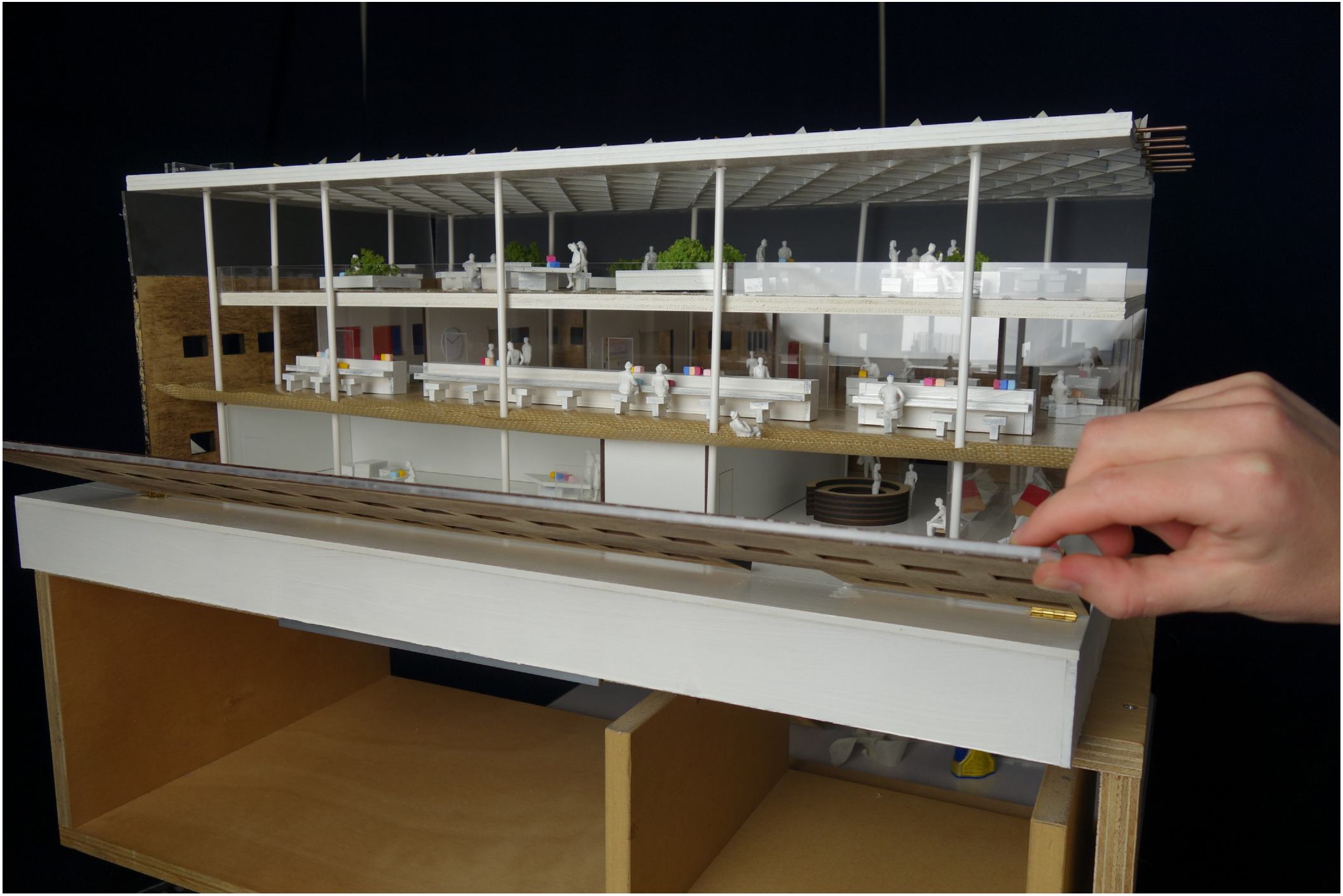


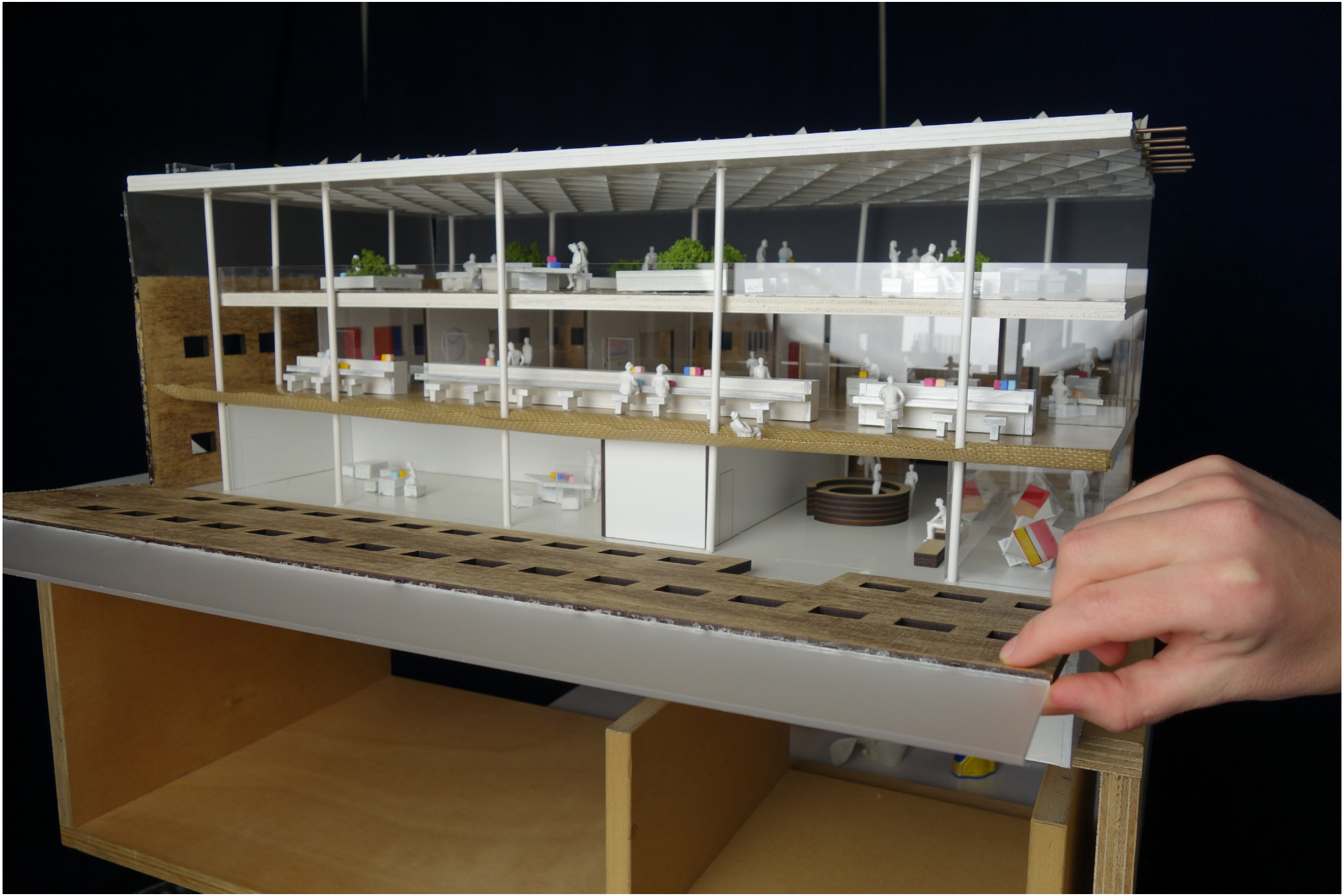


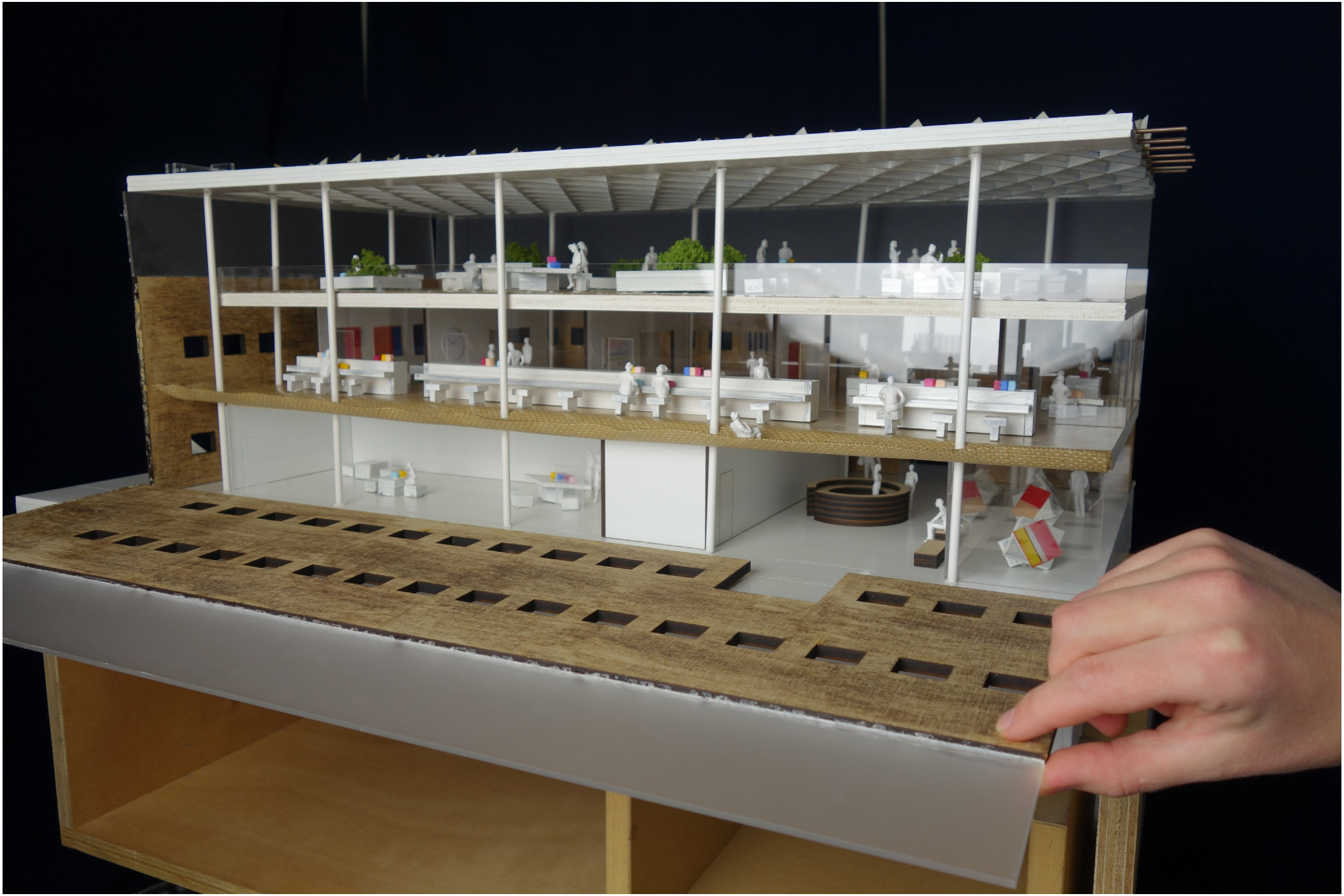










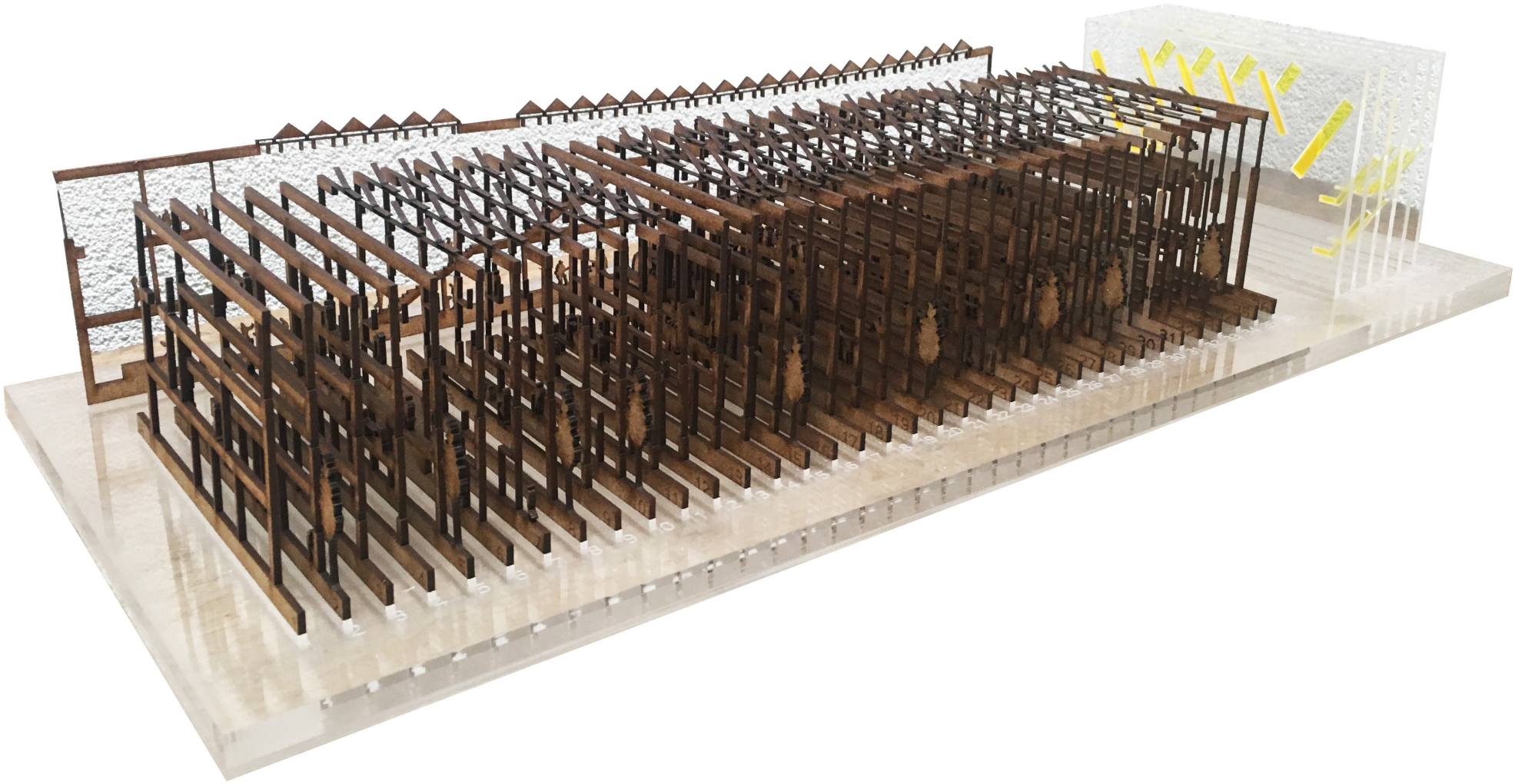


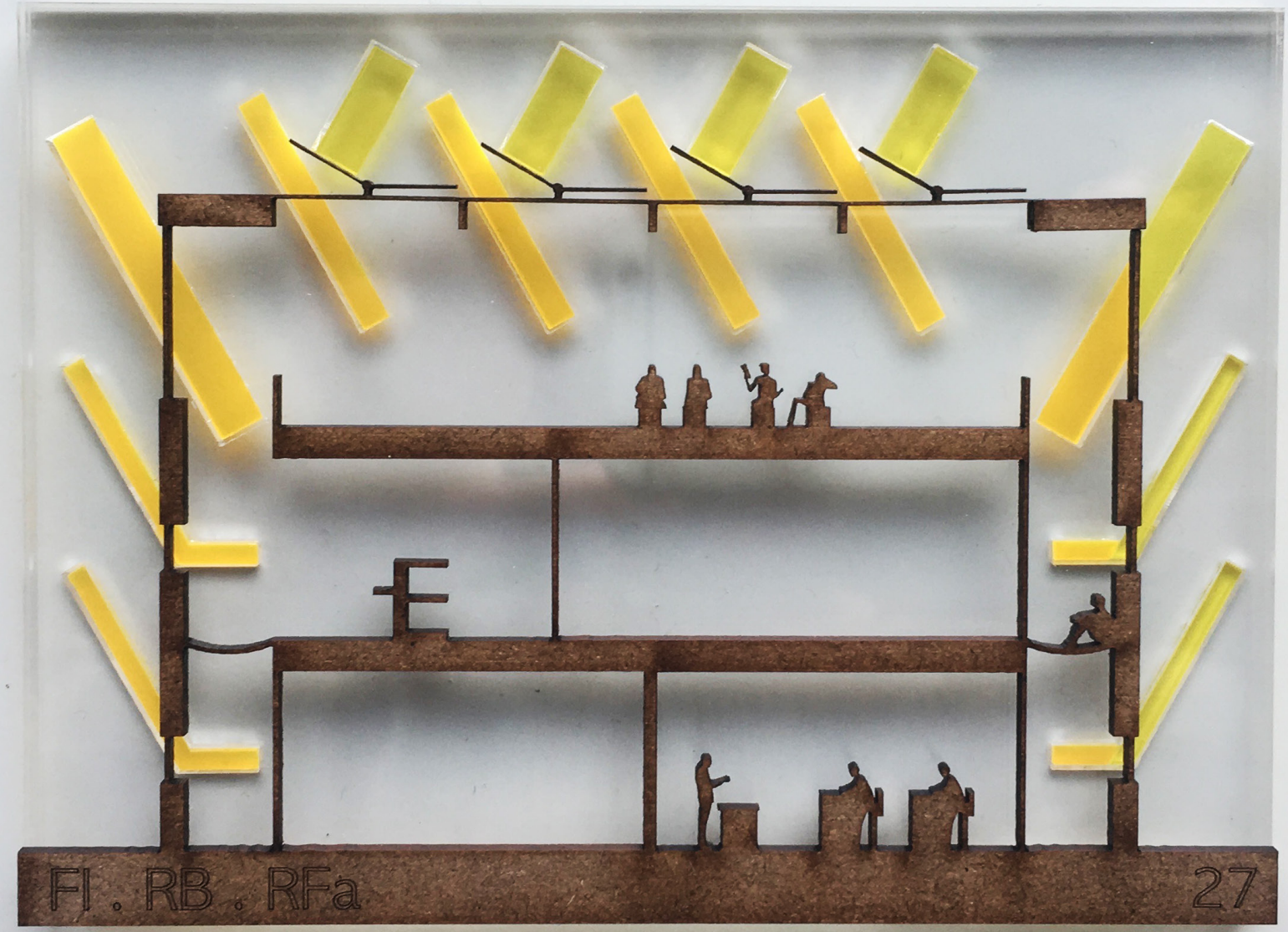
ARCHITECTURAL GOAL

The visitor experiences a constantly ***changing architecture***
that has the ability to alter our understanding of space and place,

as well as ***calling attention*** to the enduring relationship
between architecture and the environment.

SECTION MODEL

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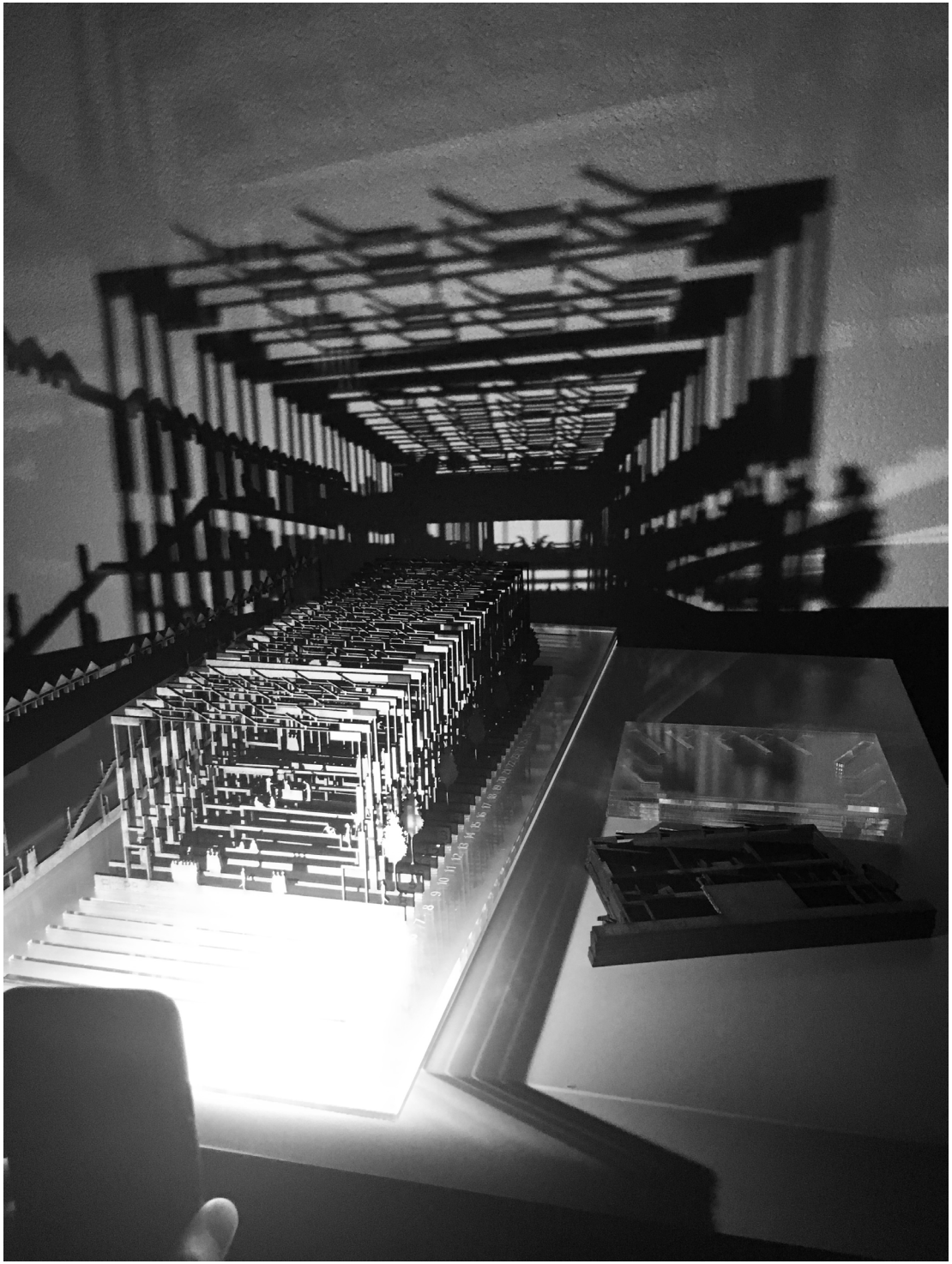
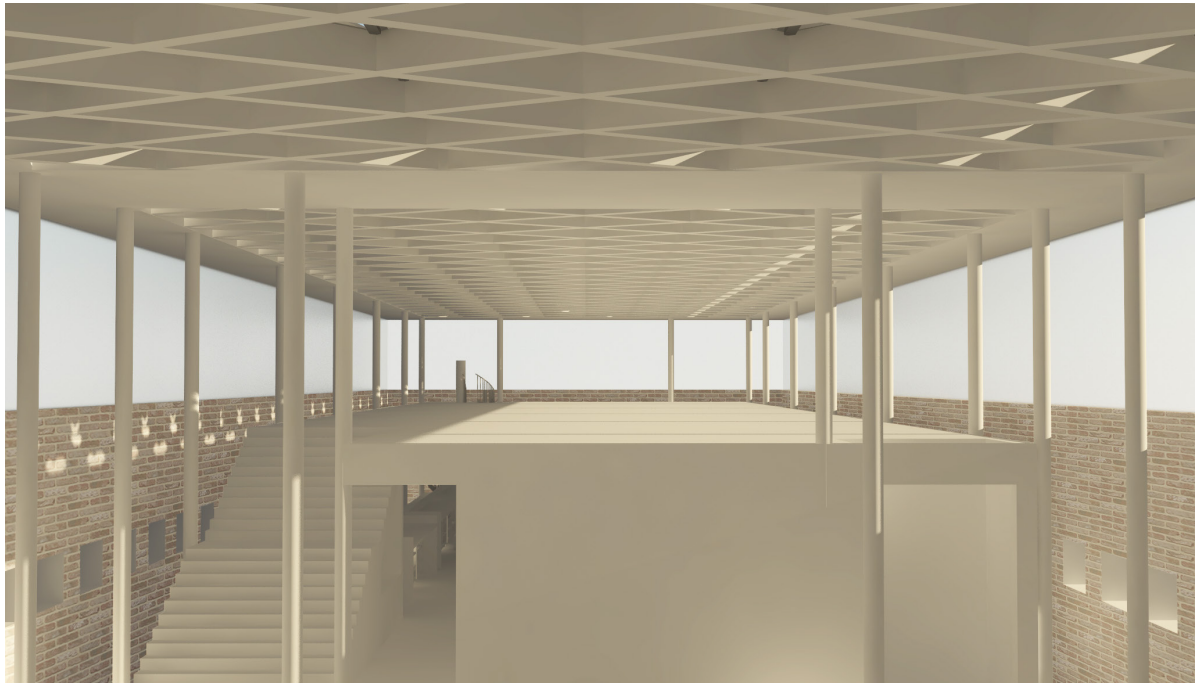
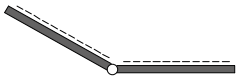


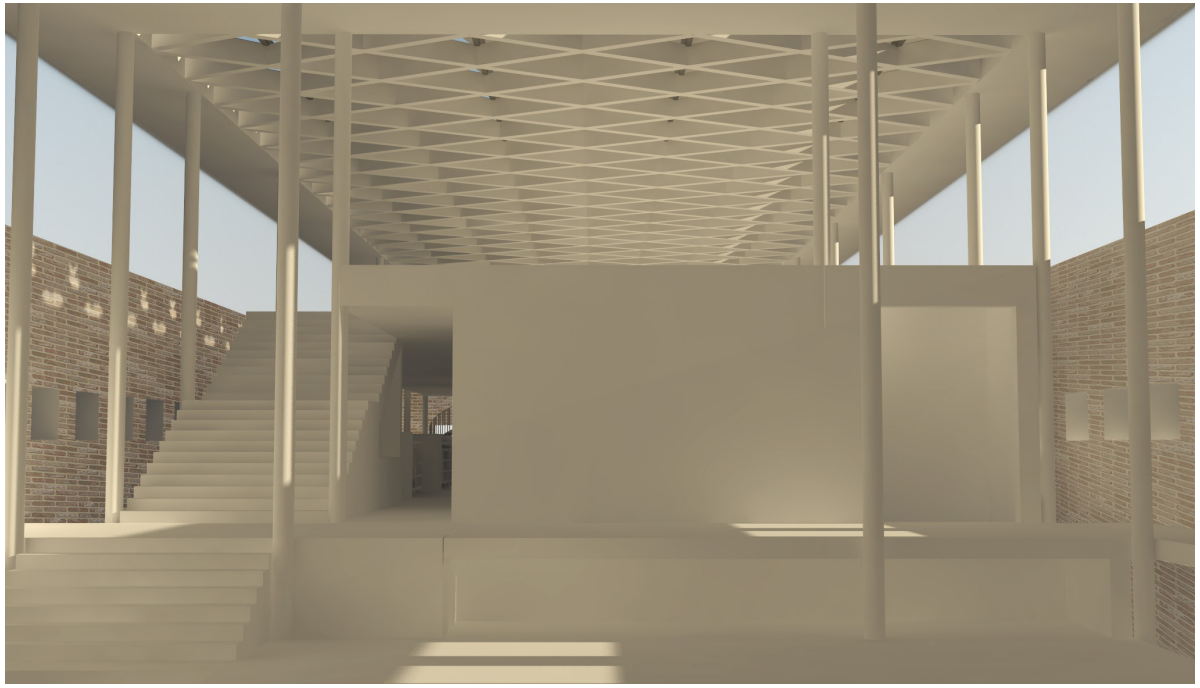
QUESTIONS

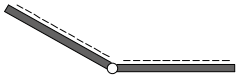
HEROS





DAYLIGHT SCENE 1
- equinox 21 march/sept.
- 17.00 h / afternoon
- second floor

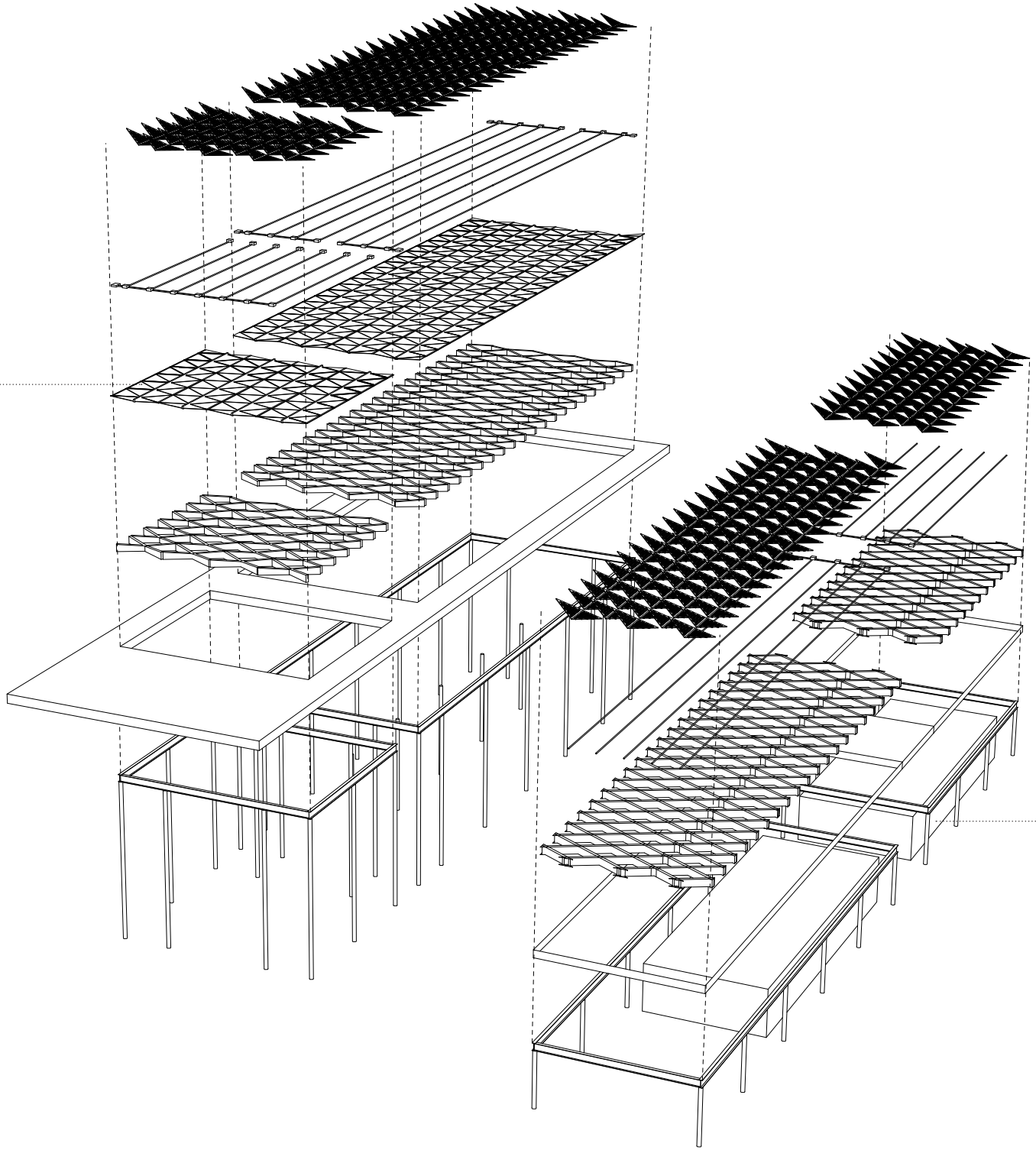




DAYLIGHT SCENE 2
- equinox 21 march/sept.
- 17.00 h / afternoon
- first floor

HEROS SCHOOL

glass triangles



HEROS PAVILION

glass structure

CONCLUSION DATABASE

1.

The difference in reflective surfaces has more influence on the light intensity in the building, than the difference in type of sunshading system (rebound, reflection or filtration);

2.

Reflective walls have more effect
on the light intensity than a reflective floor.

This indicates to the designer: keep the walls as light in color as possible and use the floor surface for deep colors or character-giving patterns;

CONCLUSION DATABASE

3.

To create an interesting interior with a pleasant light intensity, the sunhading system has to be **composed of several different layers**.