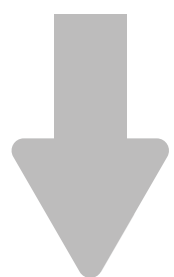


Intelligence



Please, use the arrows to access
the rest of the presentation

Who we are

Arcora

1



Arcora

Subsidiary of the Ingérop Group, Arcora is a engineering firm with 45 years of experience.

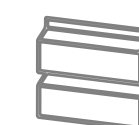
Areas of expertise



Structures



Building envelope



Facades

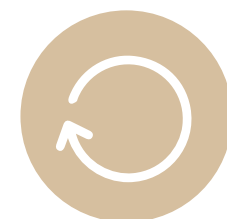
Arcora

The Lab

2

With its R&D department, Arcora aims to promote positive transformations.

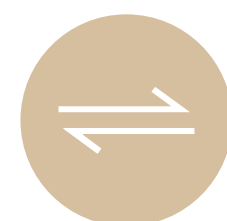
Research fields:



Life cycle analysis



Urban revegetation



Reversibility
of uses



Bio-sourced
materials

3

A PhD Thesis

A collaboration between Arcora and Navier Laboratory has been initiated with a PhD Thesis focusing on the thermomechanical behavior of shape memory alloys for architectural applications.

Thesis defence

Various prototypes of morphing structures have been developed.

The studies led to the patenting of an actuation system for kinetic facades based on shape memory alloy wires and elastic springs.

Design and development

2015

Material modelling, numerical implementation and experimental validation of the material behavior have been conducted.

2018

Development of Héméra during various workshops with Arcora's teams and laboratory experiments

2020

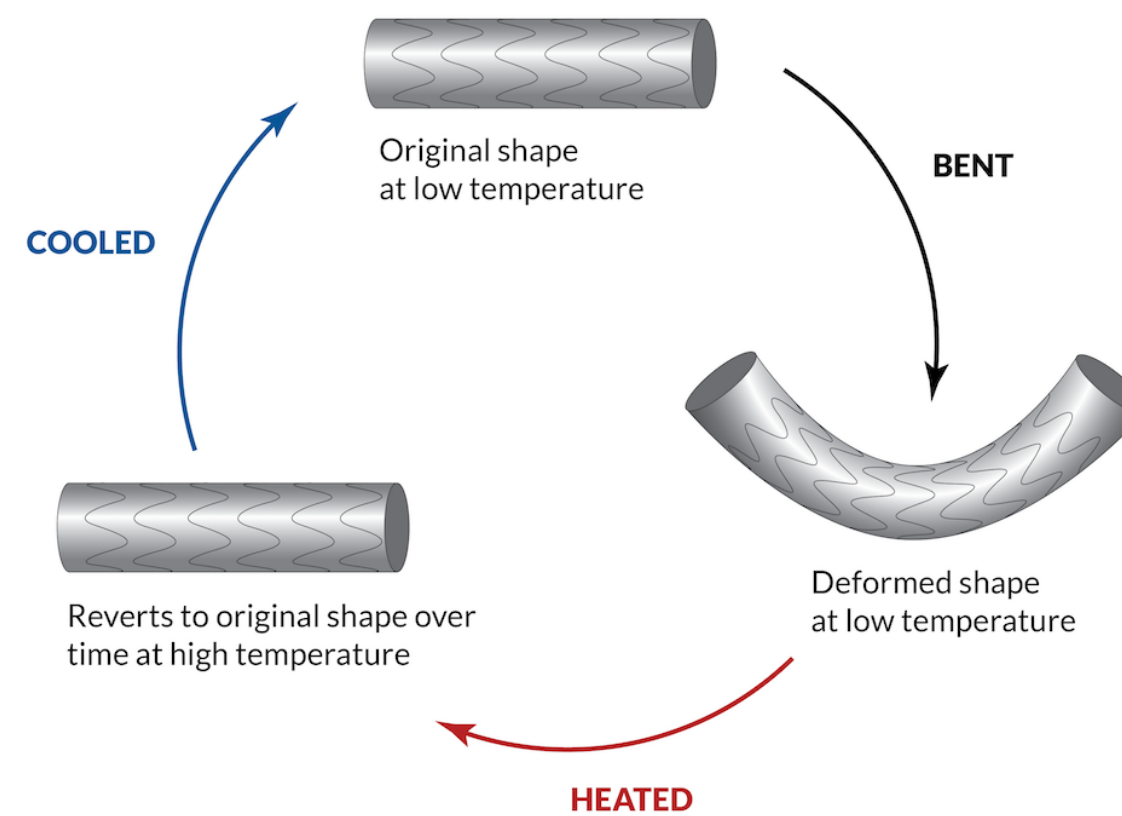
2021

SMA

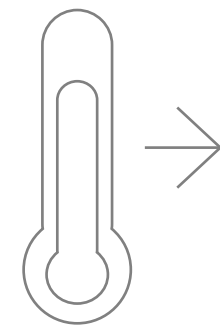
FOCUS

4

The Phase Transformation Process for SMAs



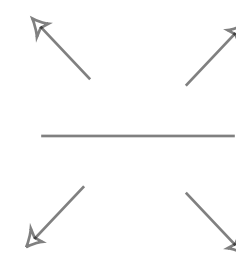
Made from Nickel and Titanium, Shape memory alloys (SMA) present some remarkable properties:



Thermomechanical properties: This so-called “smart material” can undergo large deformations (up to 8%) and return to its original shape with a high recovery force when heated, which is known as the “shape-memory effect.” This feature relies on a solid-solid phase change at the crystal lattice level resulting in a coupling between temperature and mechanical loads.



Resilience: This alloy is especially interesting because of its satisfying fatigue properties: it can undergo a huge number of deformations without losing its elasticity.



Exceptional actuation qualities: SMA can be used as actuators or shape-changing devices in various systems.

The final system

Héméra

5



The SMA is more easily exploited in its wire form and is therefore used like that in this project.



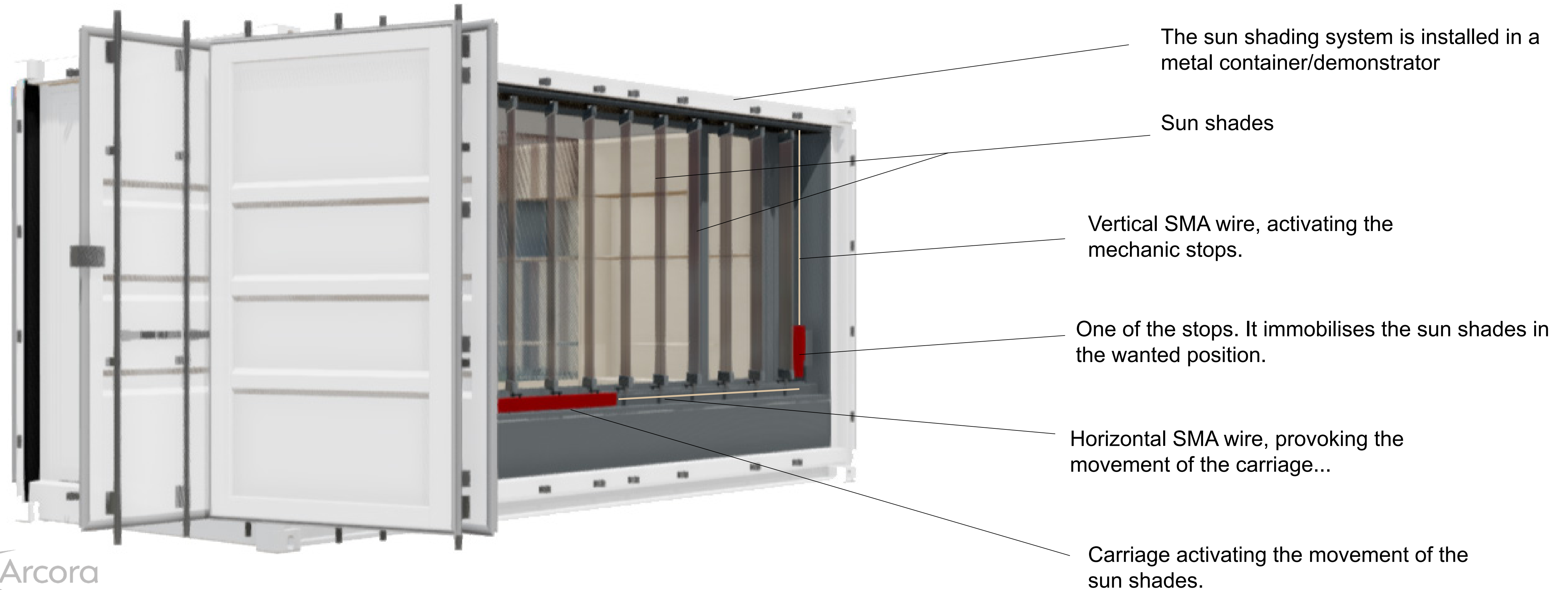
During the thesis, different types of actuators have been developed and tested.



Various prototypes have been created, with one integrating the alloy directly in its vents.
The SMA reacts directly to ambient temperature changes and move the vents accordingly.



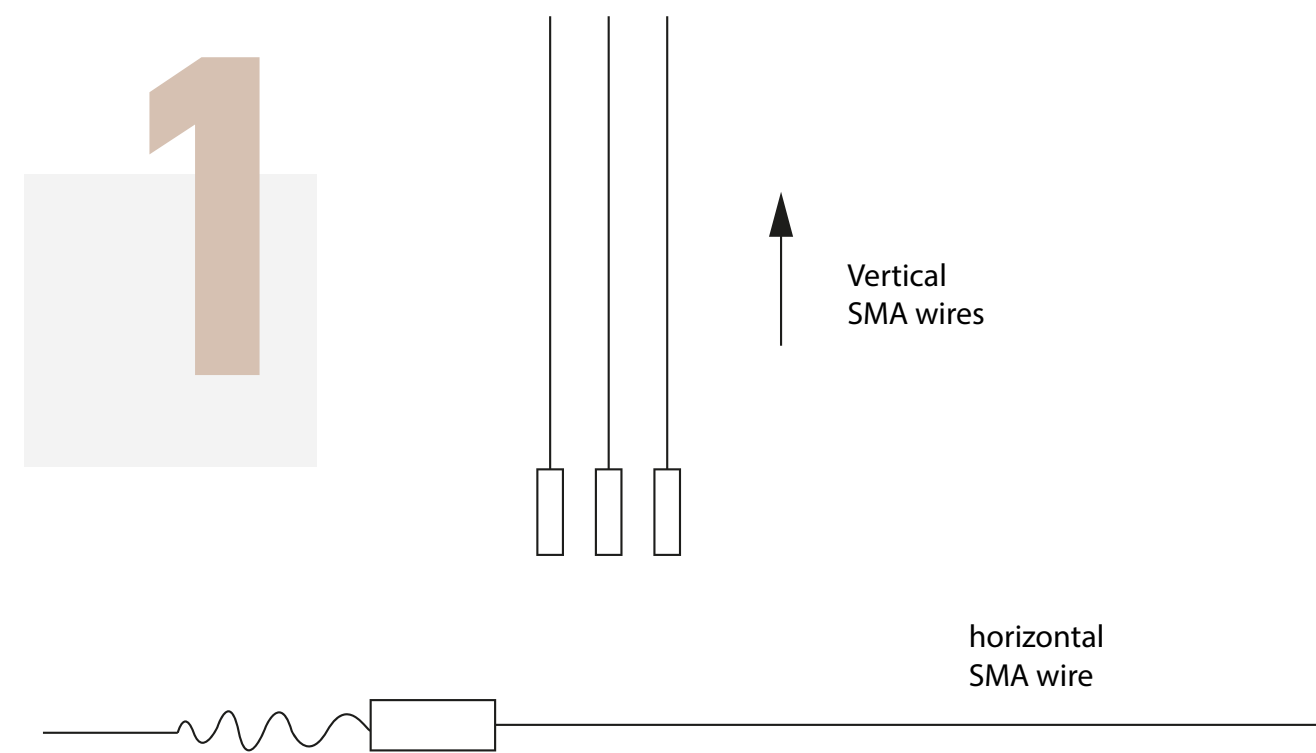
Héméra is finally created: his movement is activated by an SMA actuator.



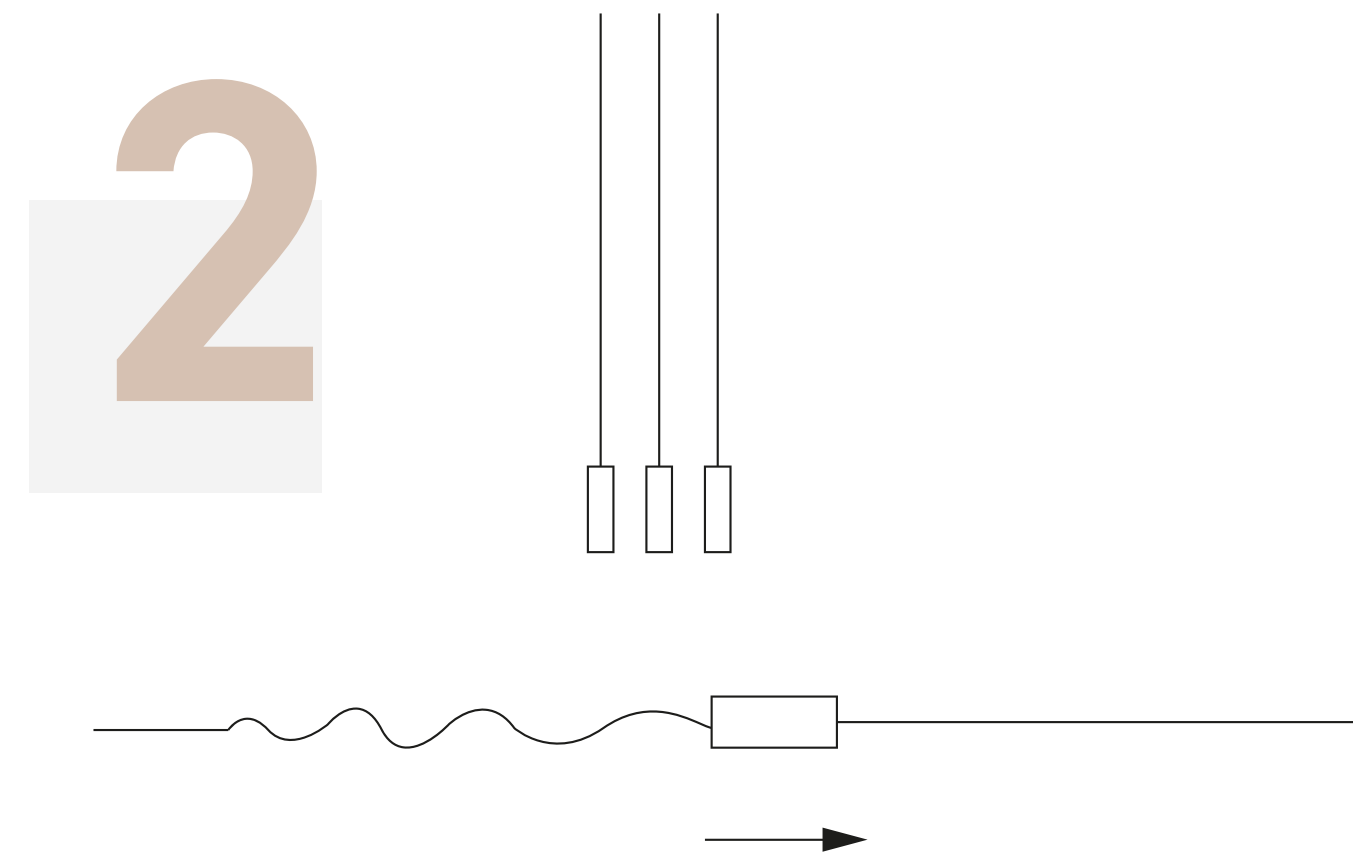
7

Héméra

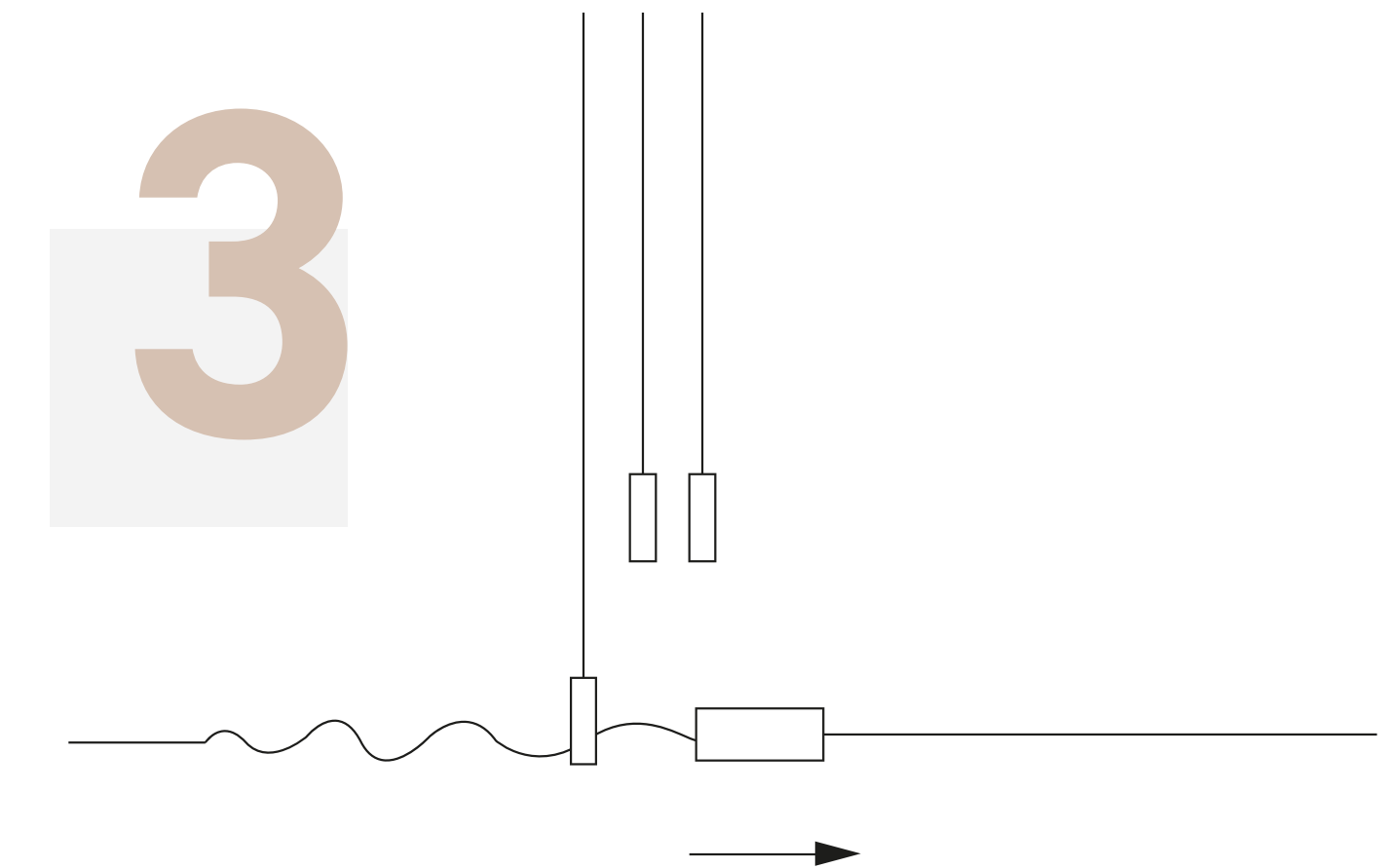
The mechanism



The vertical SMA wires are heated: the stops go up and the horizontal carriage is free to move.



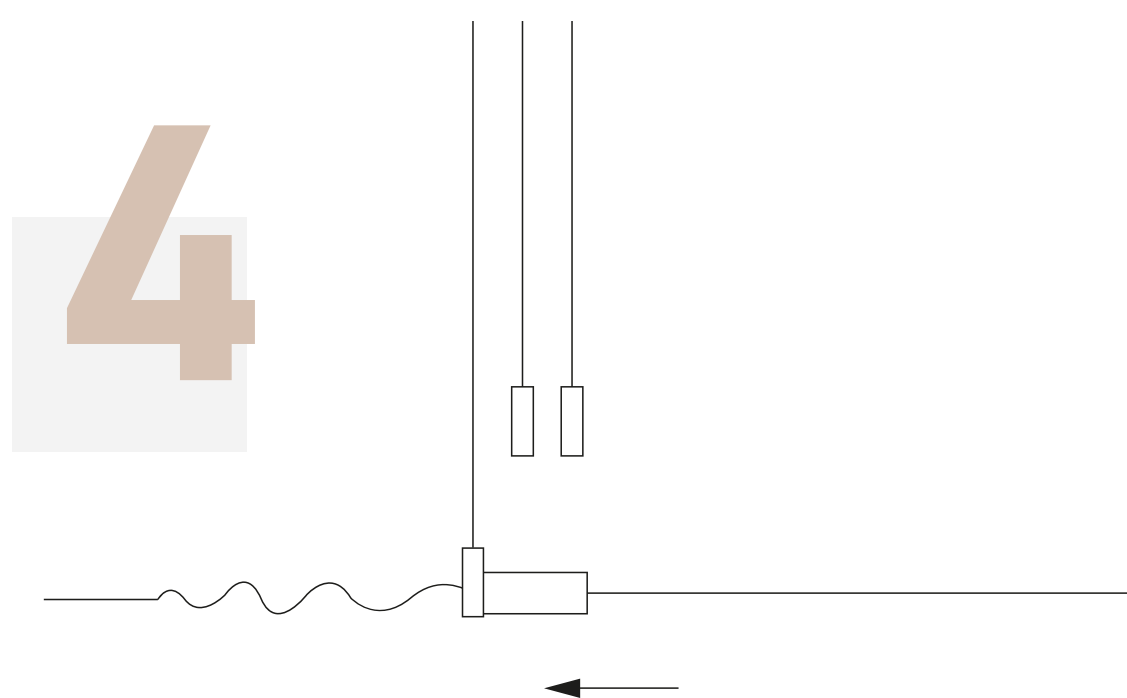
The horizontal SMA wire is heated: the carriage moves and activate the movement of the sun shades.



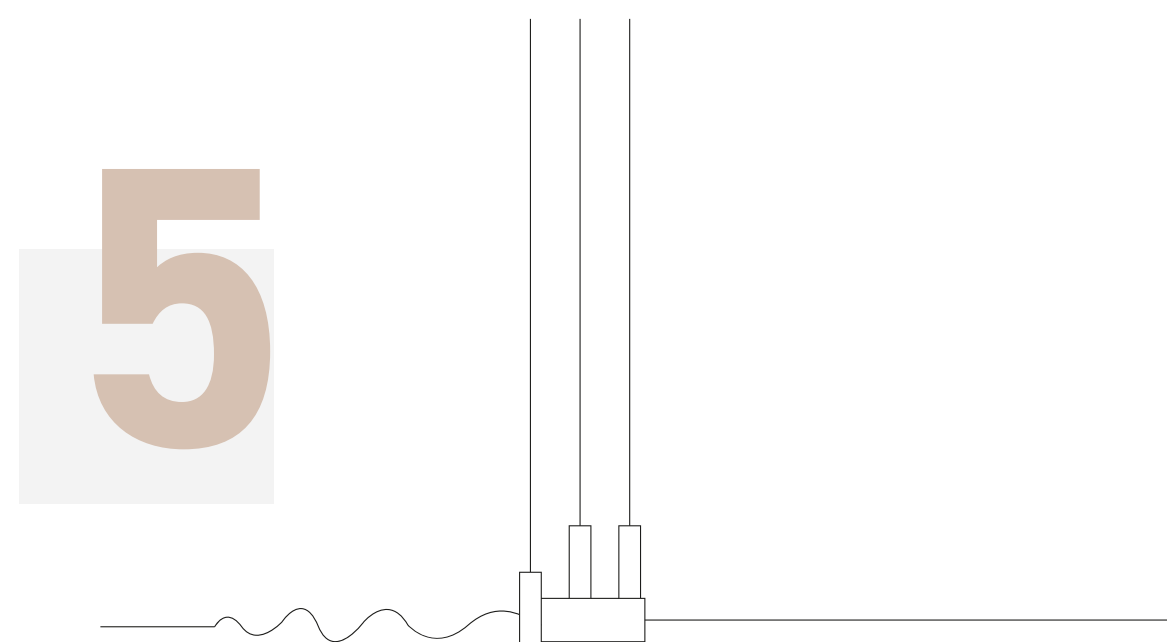
The heating of one of the vertical wires is stopped: the stop system goes down.

Héméra

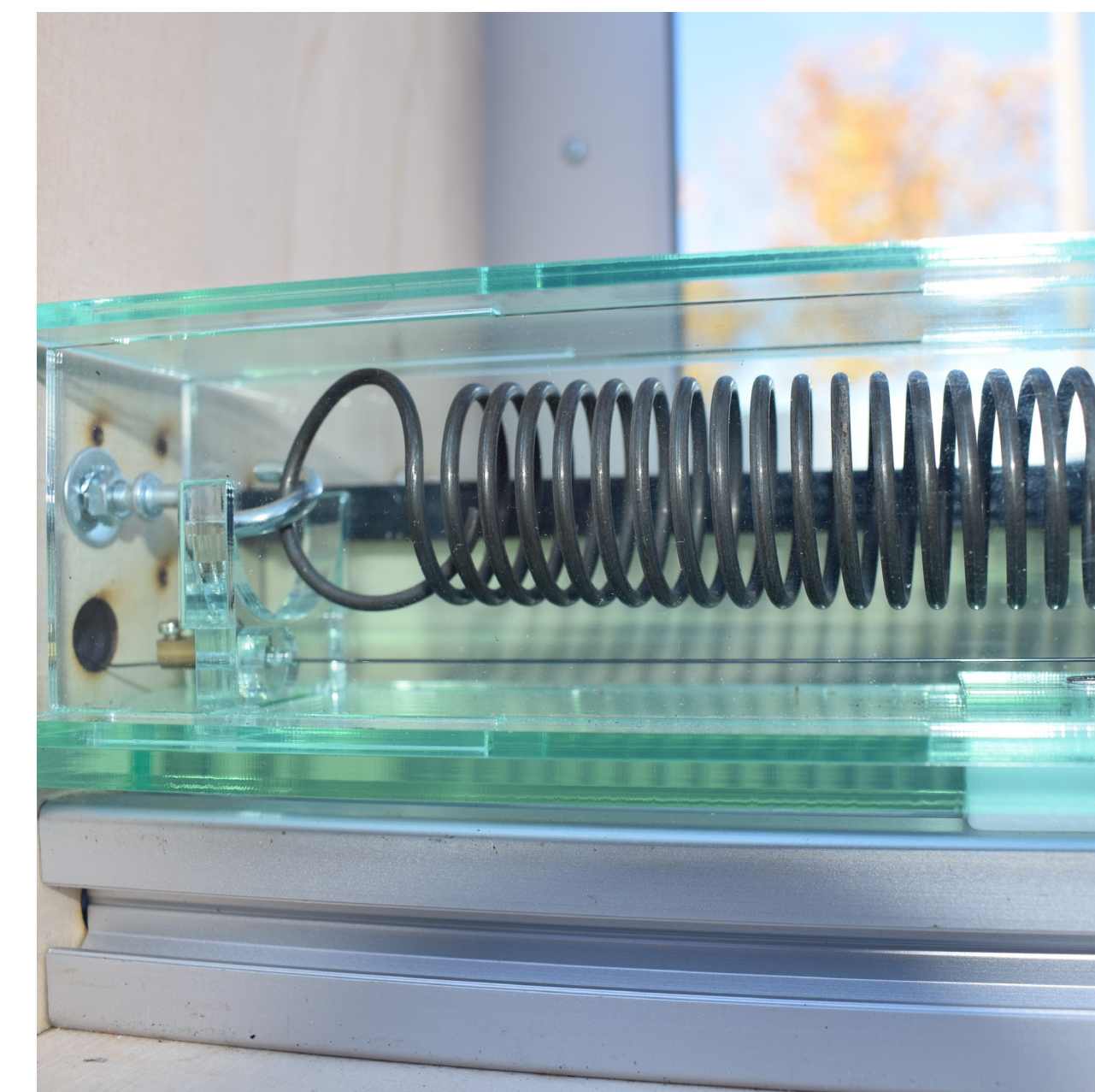
The mechanism



The heating of the horizontal wire stops: the carriage tries to find his position back and is immobilized by the stop. The sun shades are stuck in the wanted position.



All heating sources are turned off: the stops go down, the sun shades stay in position and the system does not consume any resource.





Aluminium from Wicona for the mechanism parts

For the parts of the mechanism (carriage, bases of the vents, facade supporting the solar shading system, etc.)

Photovoltaic vents

The glass vents include some photovoltaic films supplied by the french company Asca Armor. The energy produced by the films allows the thermal stimulation of the AMF wires and therefore the operation of the solar shading.

A demonstrator

The R&D team at Arcora started designing a showcase for this new sun shading system: a shipping container with one of its faces receiving the façade prototype, allowing the visitor to experience it from the inside and from the outside. This container can easily be carried from one exhibition site to another, and the interior will be arranged to make it a cosy place. It is insulated, thermally regulated and ventilated, and the interior finishes are made with bio-based or reused materials.

To be continued...

 **Arcora** is a subsidiary of the  **INGÉROP** Inventons demain **Group**