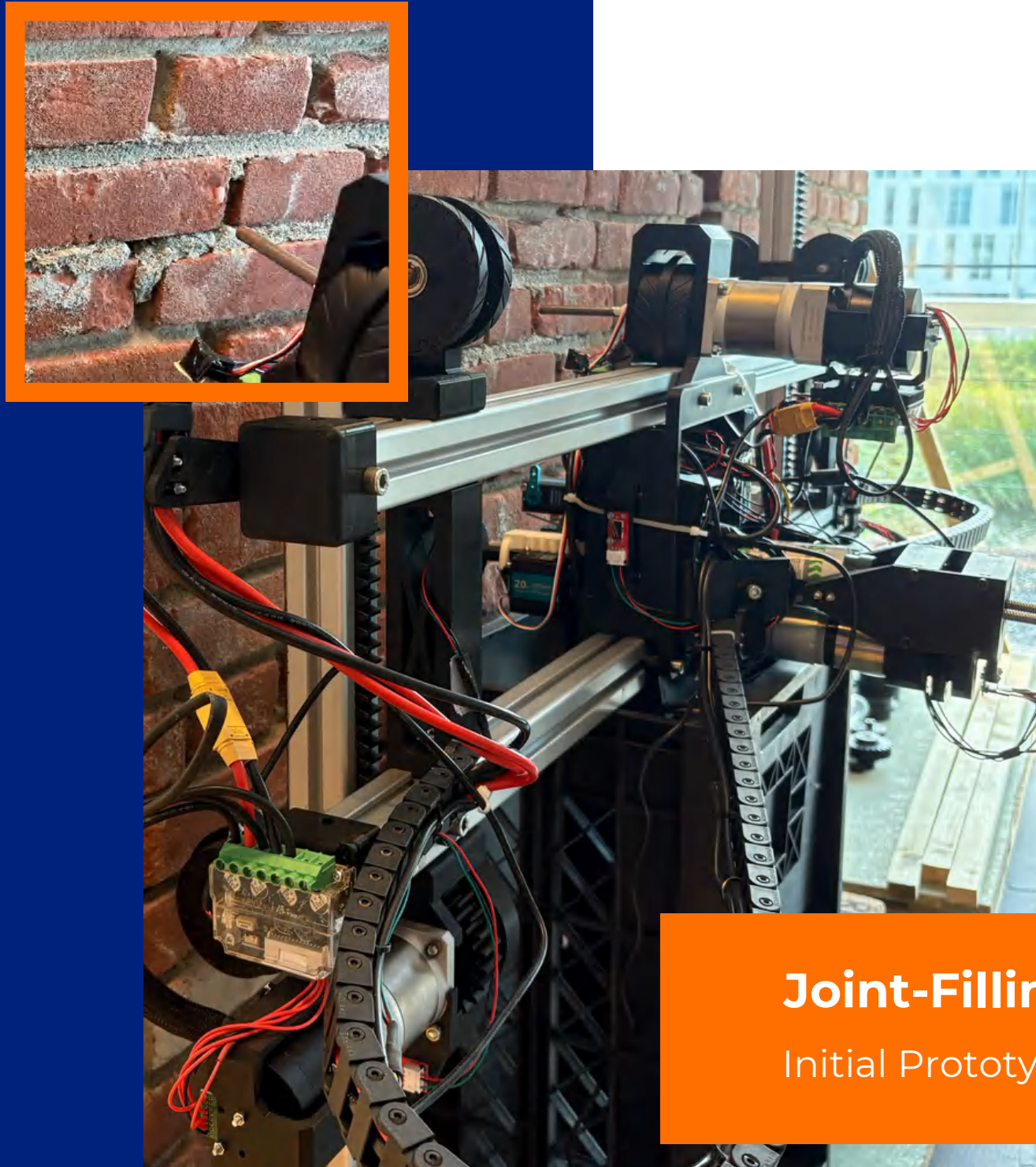


FINAL PRESENTATION

GROUP 13.1 - JACKY BOURGEOIS

Joint-Filling Robot



Joint-Filling

Initial Prototype

PROJECT BACKGROUND

Advancing Automated Joint-Filling Robot

The construction industry is currently facing significant pressure due to severe labour shortages and an aging workforce.

For the past 4 months, we took on the challenge of further developing the design of a joint-filling robot.





JOINT-FILLING ROBOT

Main Goals for Our Design



Mortar Dispensing

Redesigning the mortar delivery mechanism to ensure a consistent, uninterrupted operation with the specific 'dry' mortar mix used for joint-filling and eliminate clogging issues.



Modularity & Scalability

Developing a system that supports fast and easy set-up for multiple sizes and shapes of facades.



Structural Rigidity

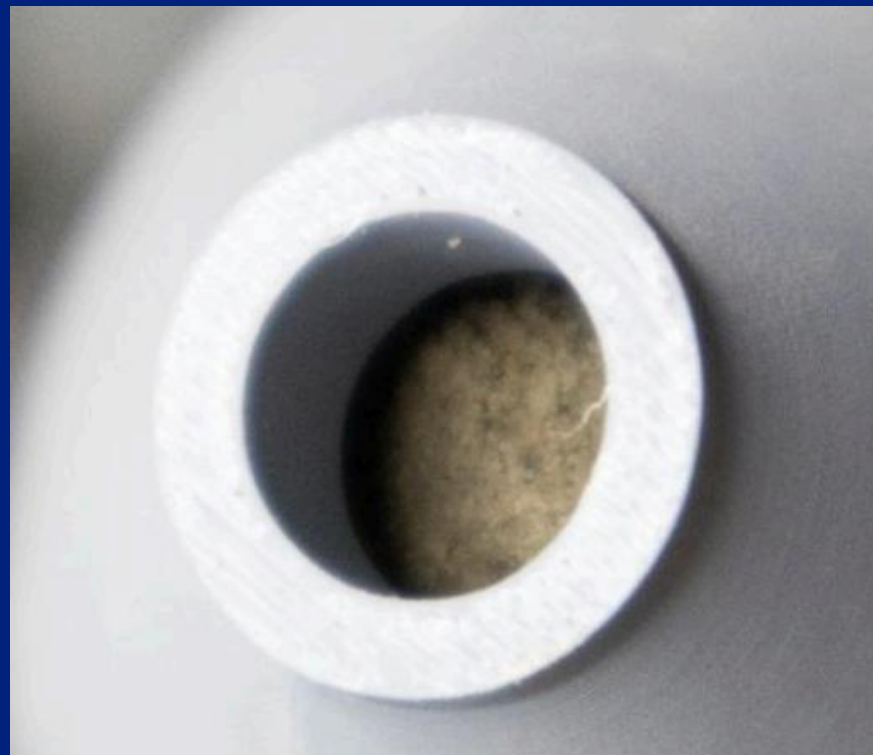
Ensuring the robot can withstand construction site conditions, including dust, impact, moisture and vibration.



Mortar Recipe Challenge

Dry Recipe

The mortar extrusion fails (clogging) because the client's specific "dry" mortar recipe (0.08L/kg)



Clogging Dry-mix

Push-pull Filling Method

Adhering strictly to the client's requirement for a dry mix, we determined to use push-pull structure.



Push-pull Structure

How to fill the joint manually?



1 Take the mortar on the plate



2 Fill the horizontal



3 Fill the vertical



4 Chiselling

Project Focus

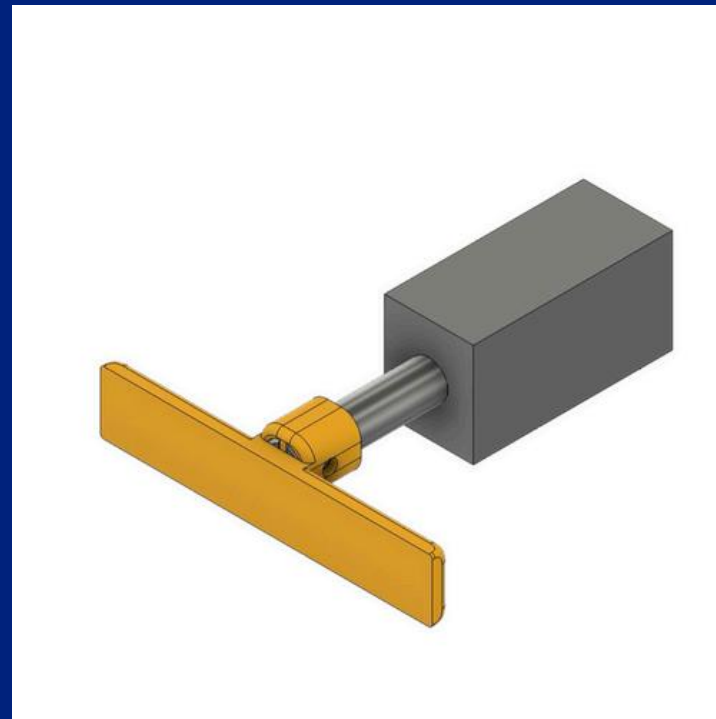
Specialized Dry-Mix
Dispenser



"I-Frame" Gantry

Design Vision

- ✓ Cope with Dry-mix
- ✓ Easy to Change Components
- ✓ Better Filling Performance



Design Vision

- ✓ Improved Structural Rigidity
- ✓ Dust-proof
- ✓ Scalability



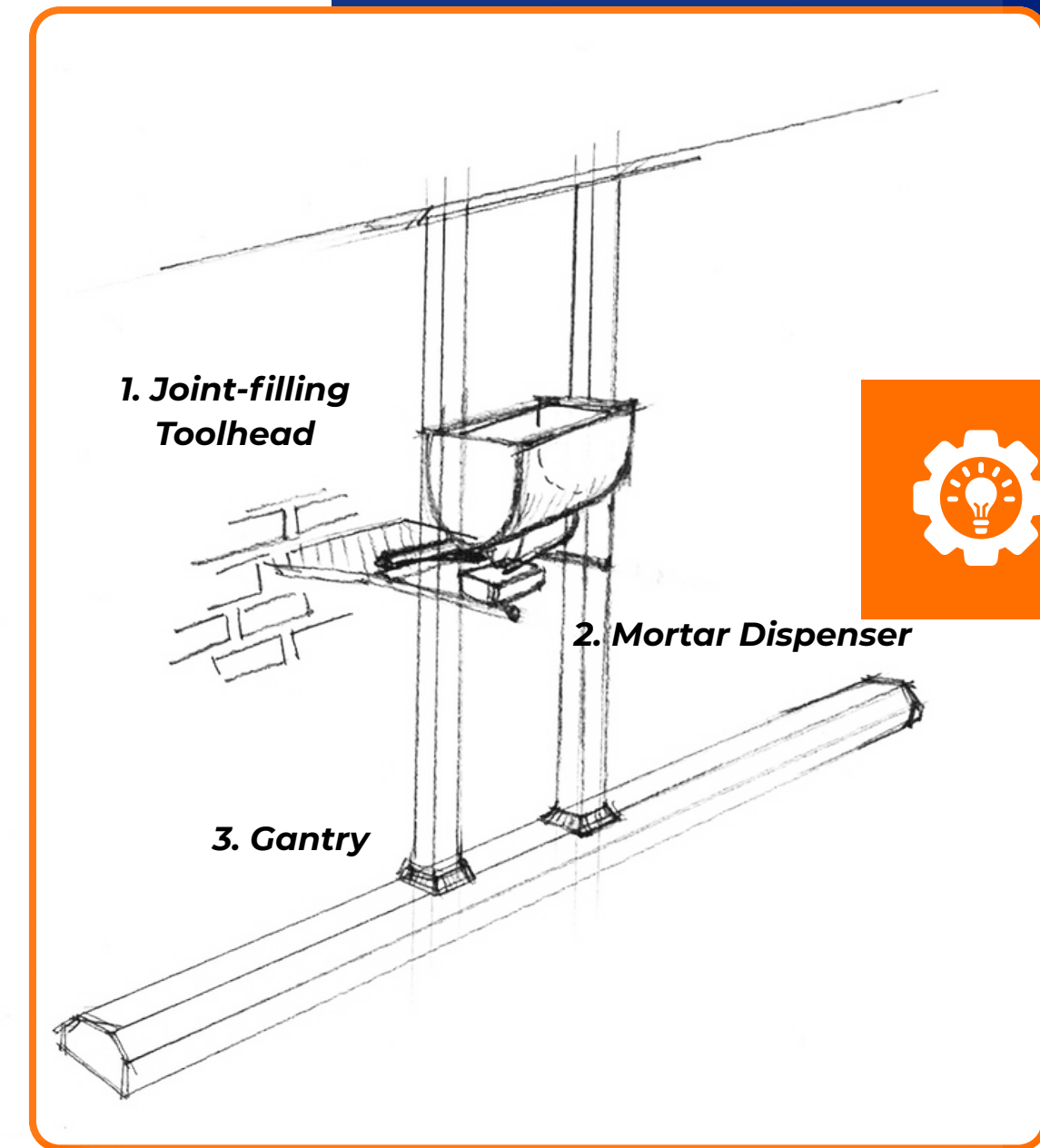
JOINT-FILLING ROBOT

Design Overview

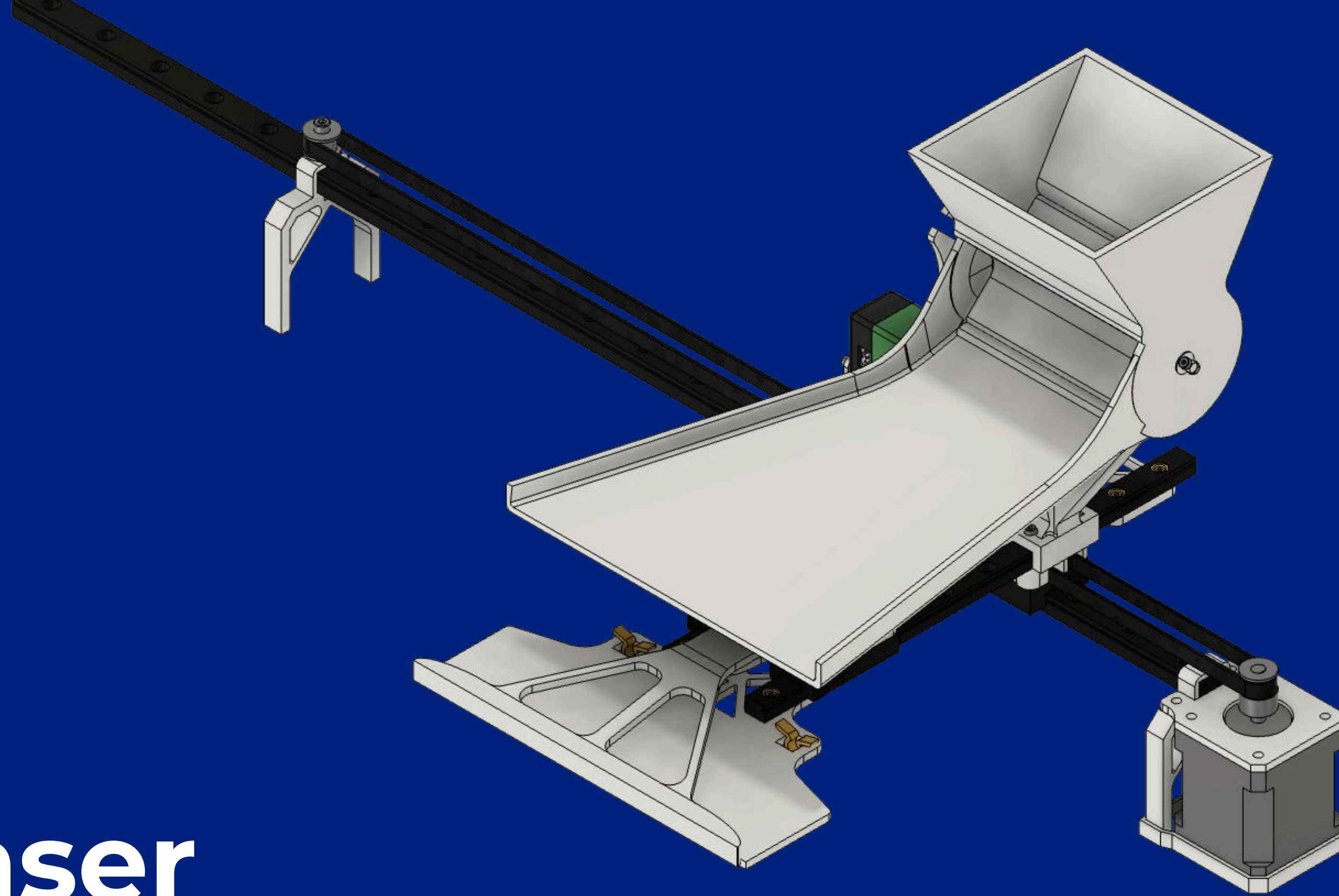
The finalized design of the joint-filling robot comprises two primary subsystems:

- **Gantry System:** An I-framed, dust-proof gantry system featuring modular rails for easy scalability;
- **Hopper Functional Unit:** An integrated hopper assembly that combines mortar storage, dispensing, and the push-pull toolhead into a single, linkage-driven mechanism. The hopper features a push-pull structure specifically engineered for dry-mix mortar.

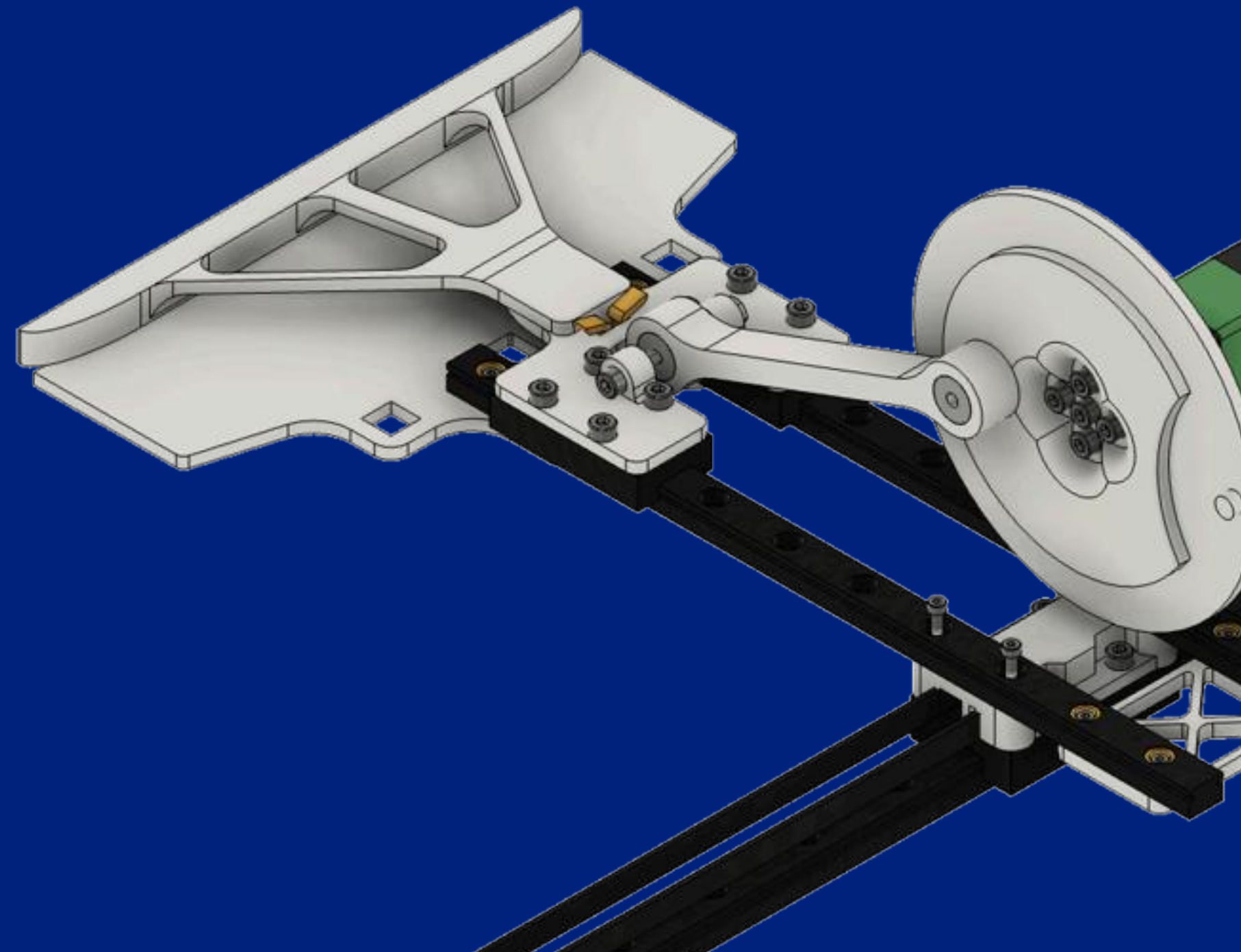
The two components are assembled as illustrated below, designed for rapid on-site assembly and disassembly.



Dispenser



Dispenser Crankshaft



Dispenser

Crankshaft

Solenoid

- ✓ Mechanically simple
- ✗ Overheats
- ✗ Limited distance



Dispenser

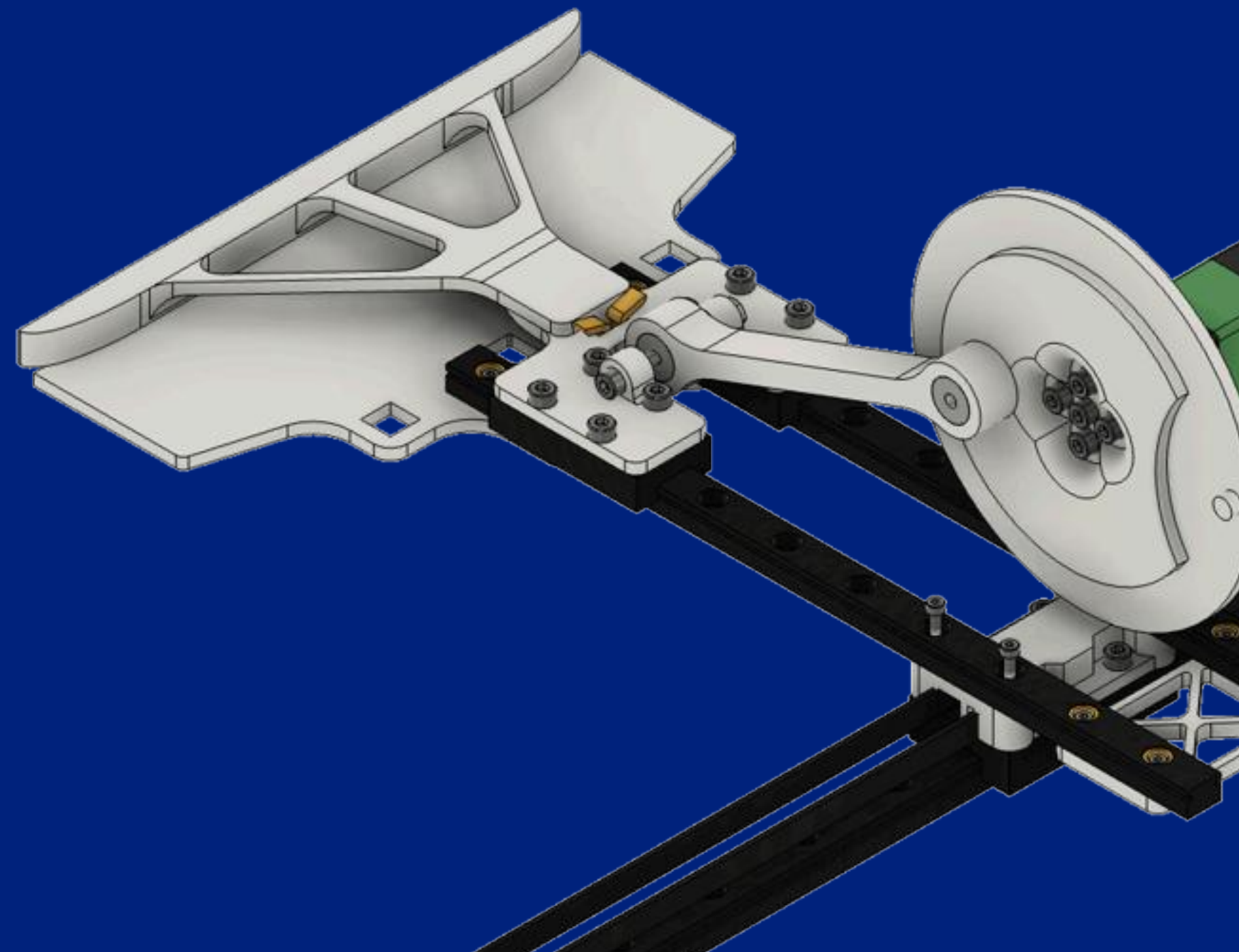
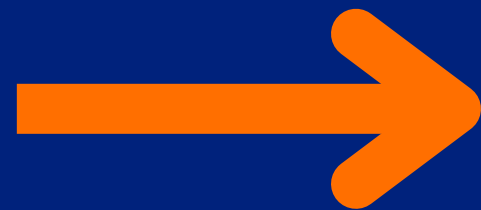
Crankshaft

Motor

- ✗ Mechanically complex
- ✓ Position control
- ✓ Adjustable distance



Dispenser Crankshaft



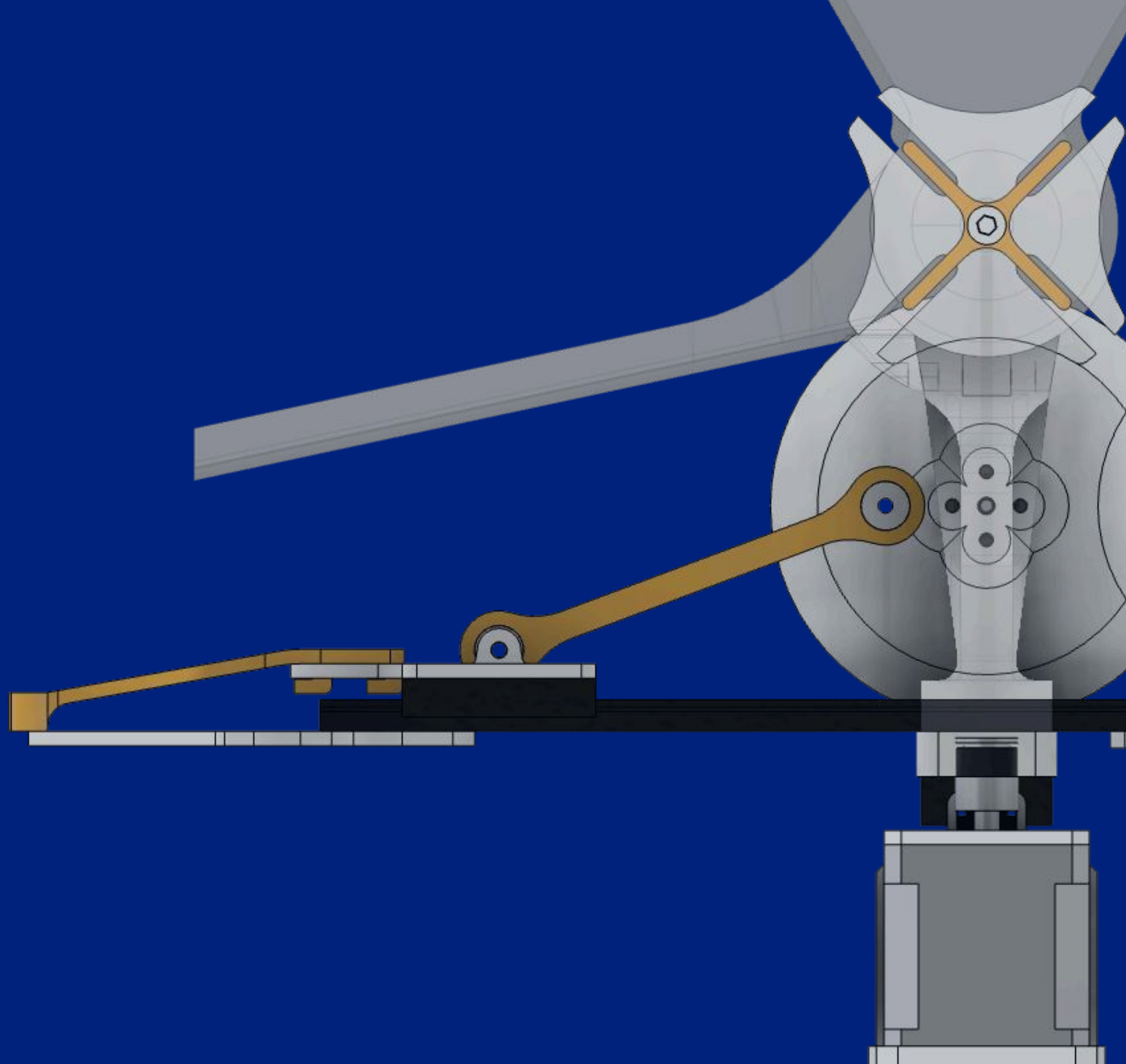
Dispenser

Crankshaft

28 N
of pushing force



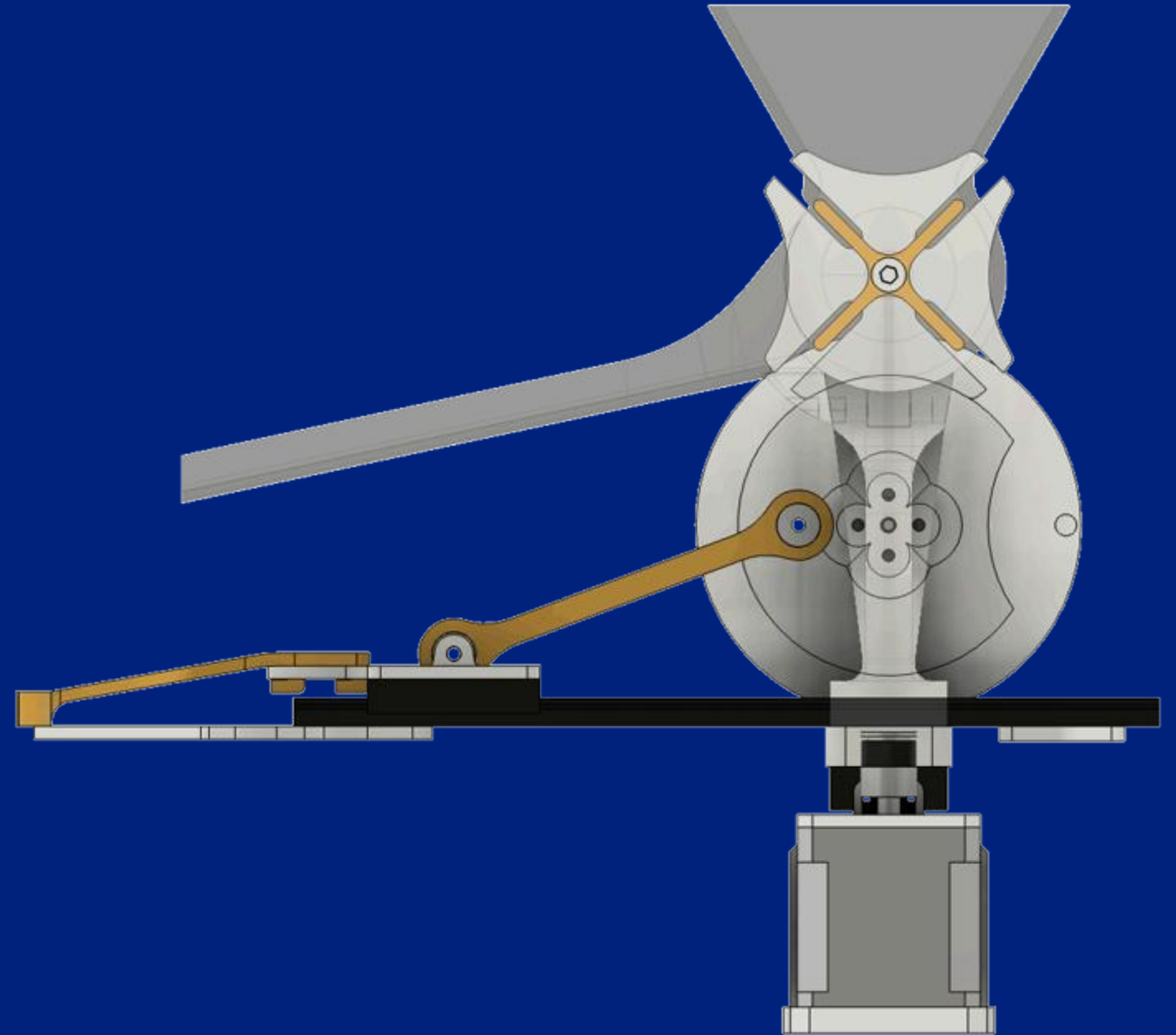
human equivalent = 13 N



Dispenser

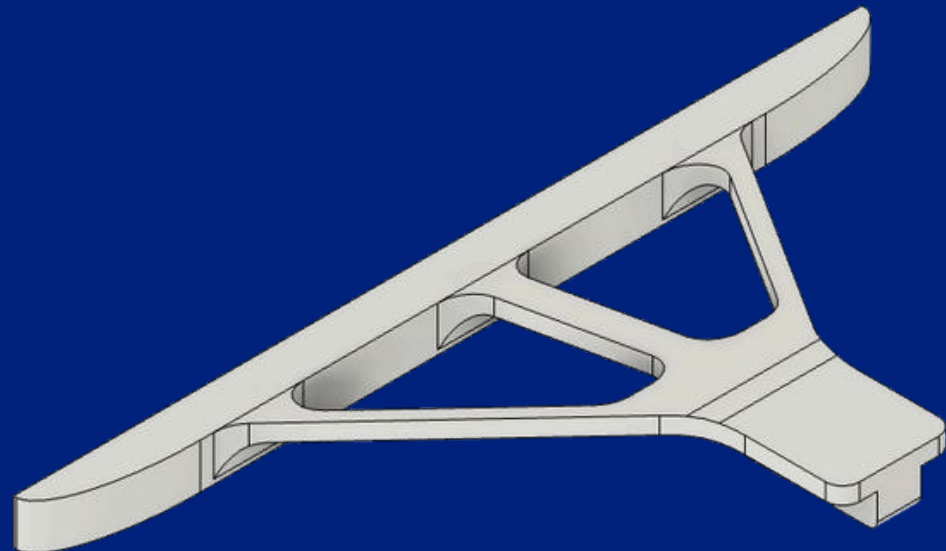
Crankshaft

1 mortar dose
per push

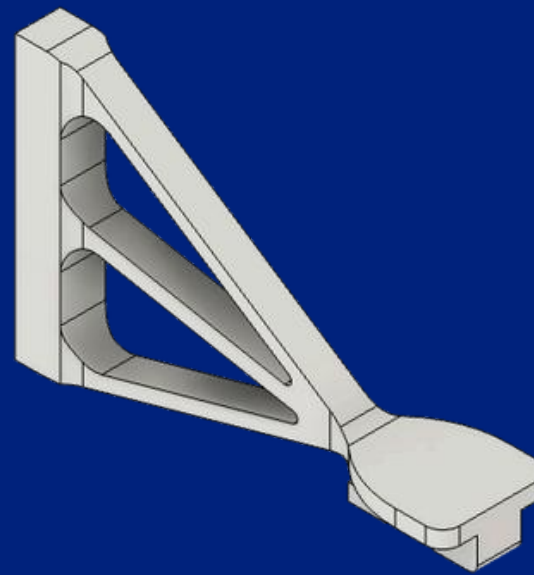


Dispenser

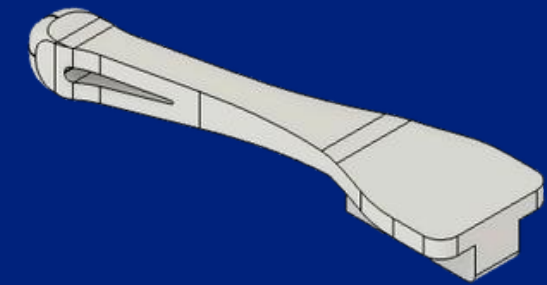
Toolheads



Horizontal
jointing



Vertical
jointing



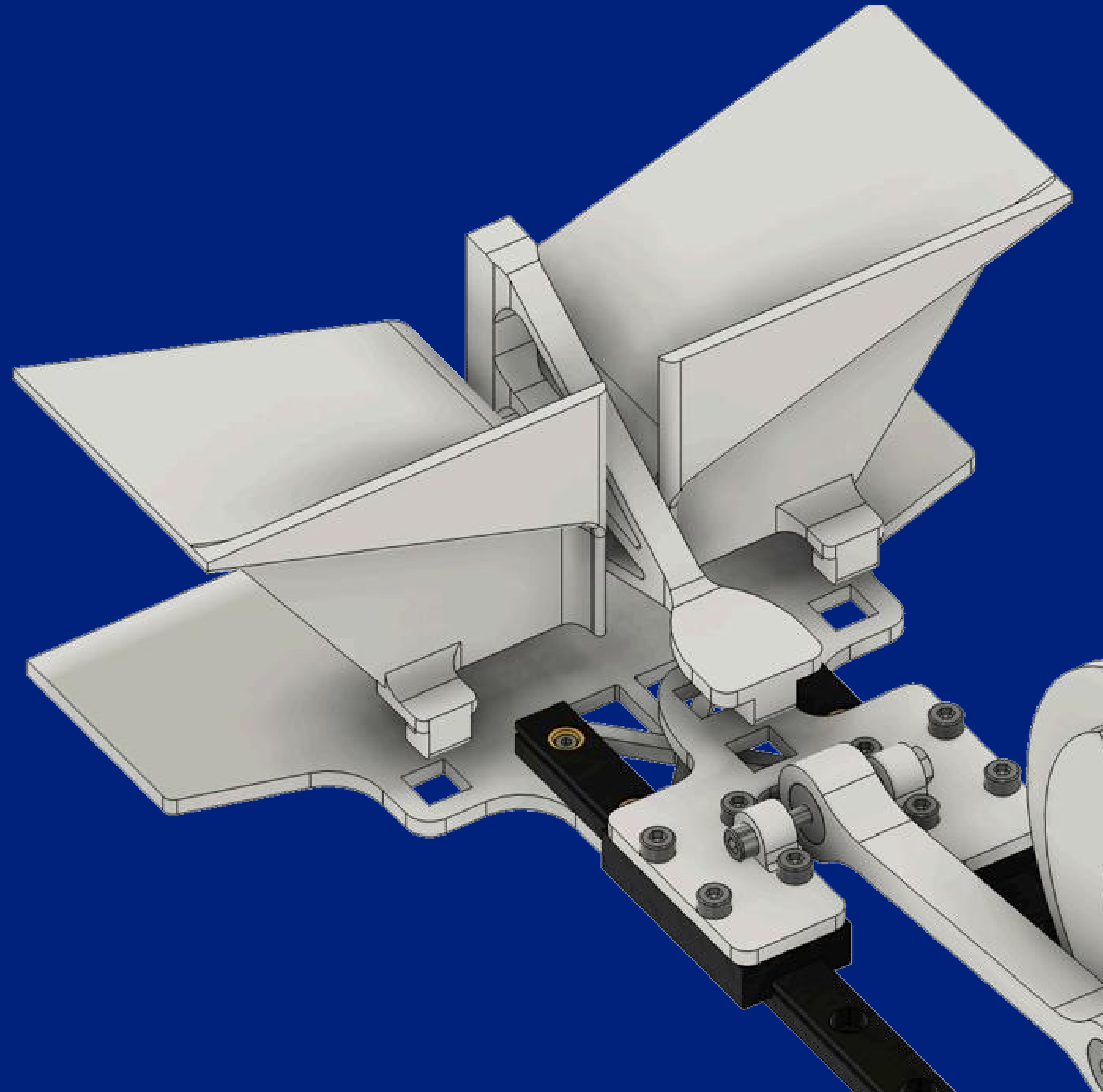
Shaping

Dispenser

Toolheads

Clip-in system

No tools required



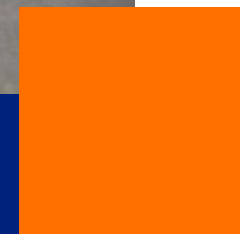
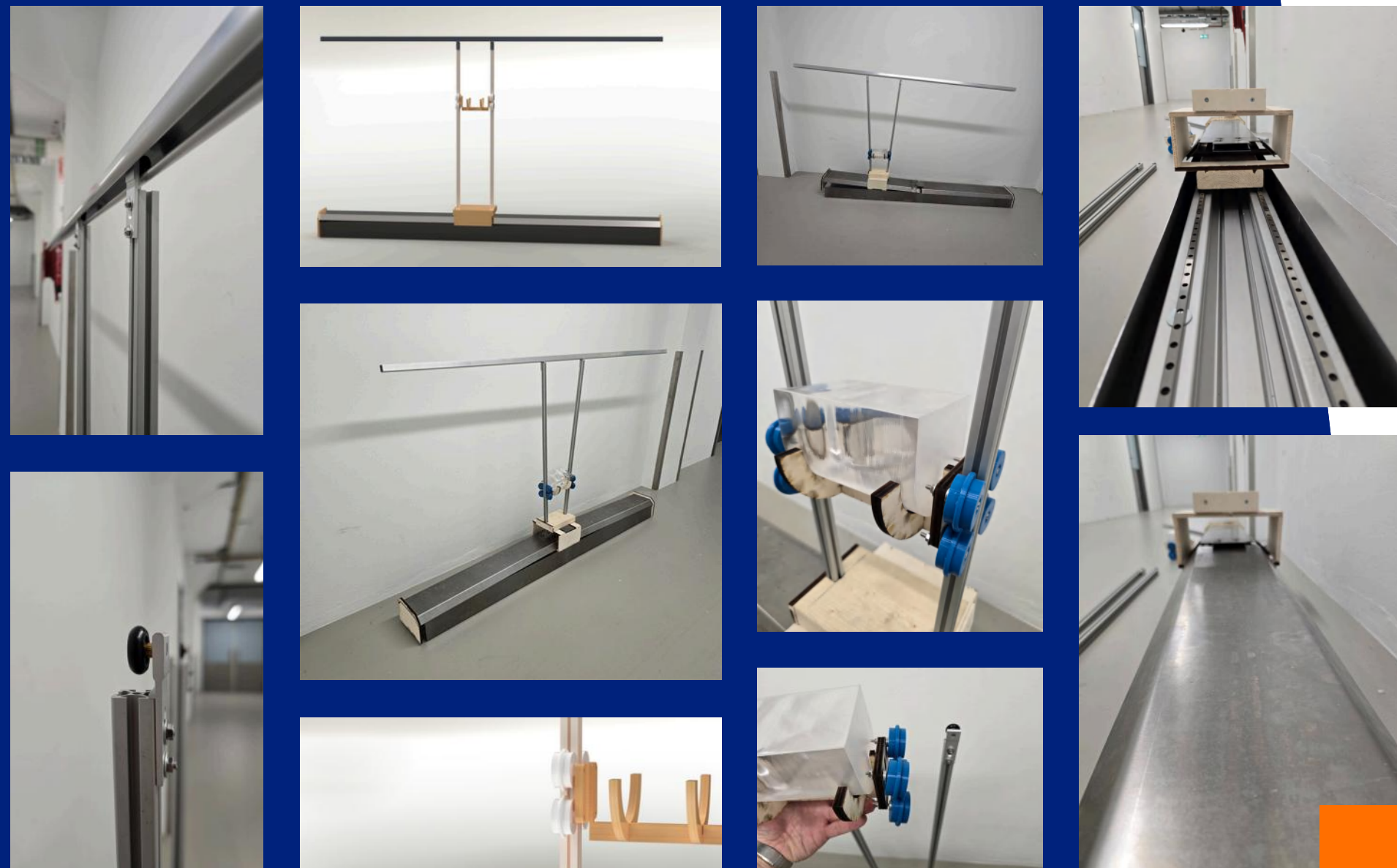


Dispenser Testing

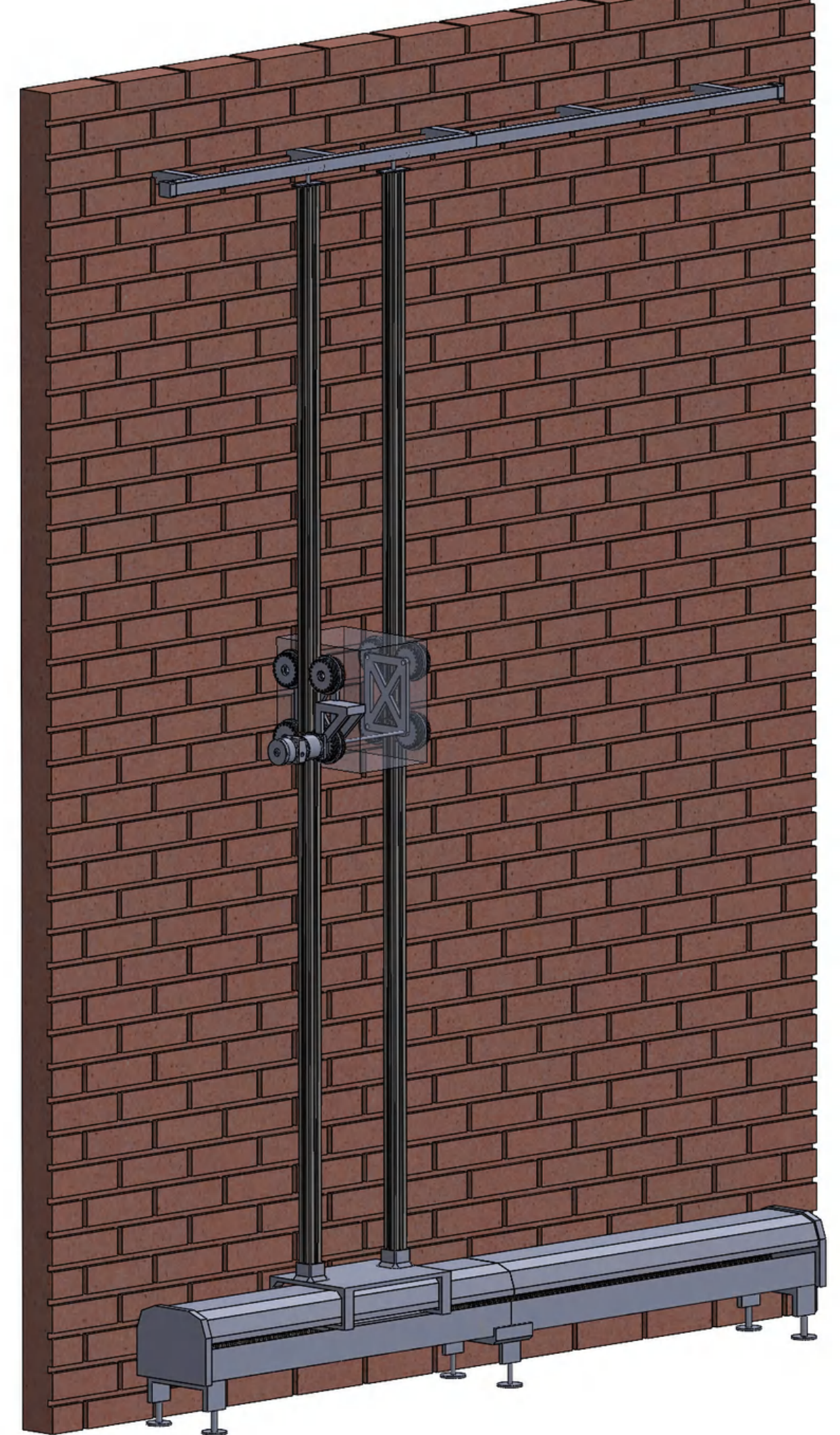
Pushing successful!

Troubles with hopper
(Geneva mechanism)





Gantry System

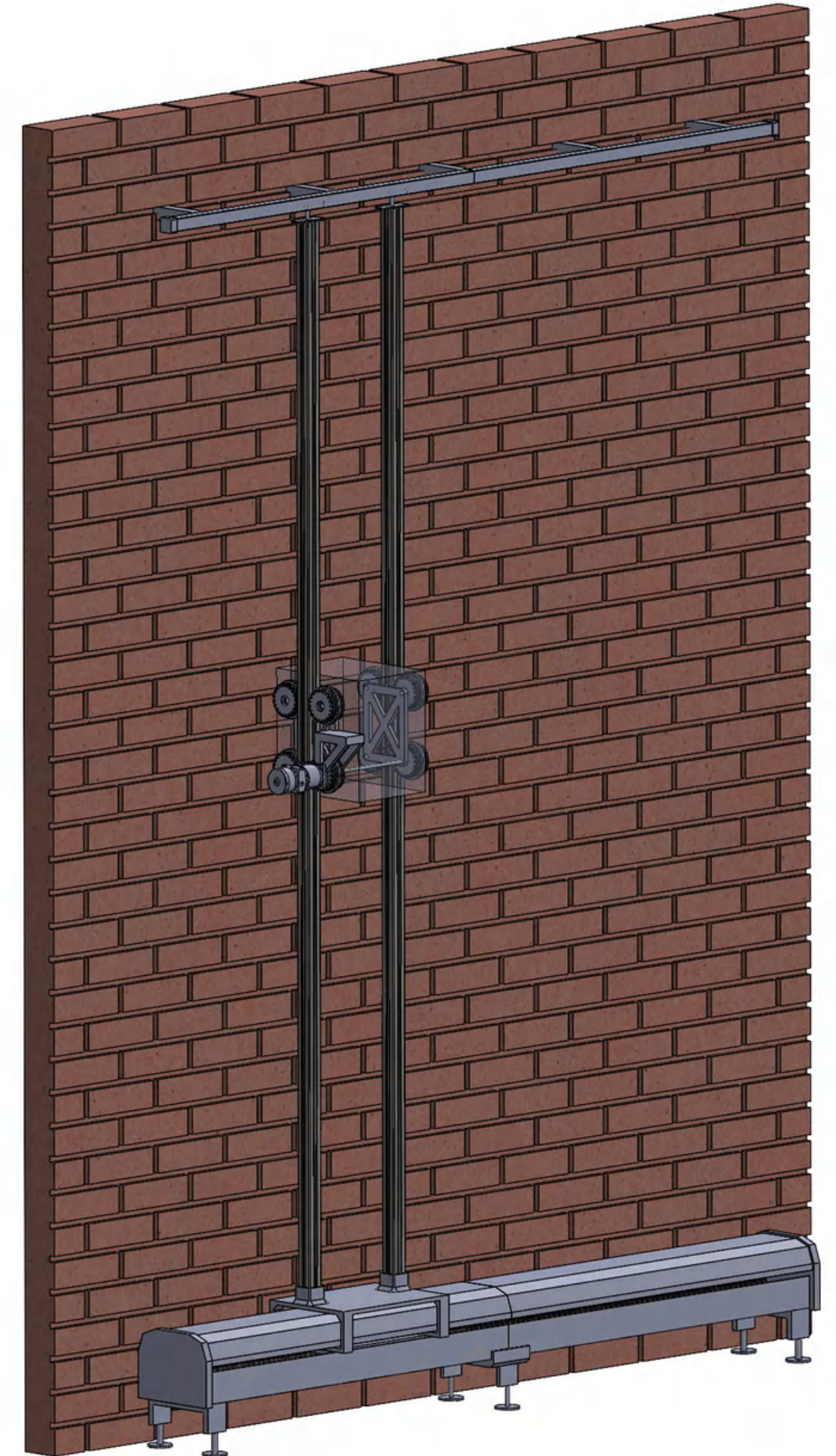


Gantry system

A gantry frame for the joint-filling robot should be a dust-proof and strong system featuring modular rails for easy scalability.

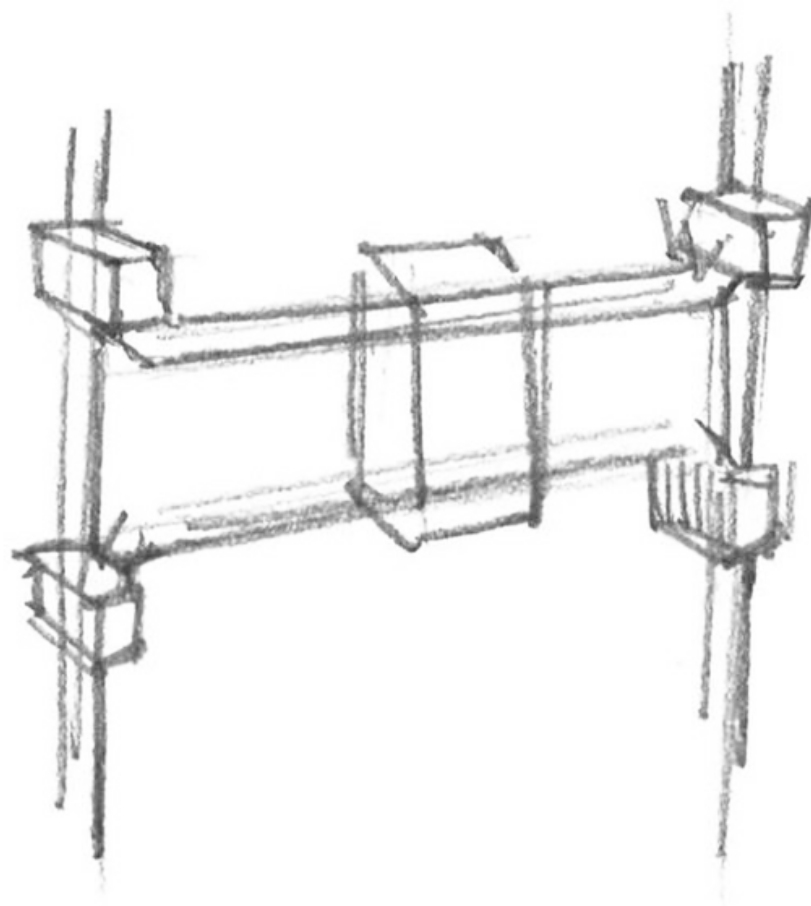
Biggest Focus on:

- Orientation
- **Dust/mortar ingress**
- Modularity

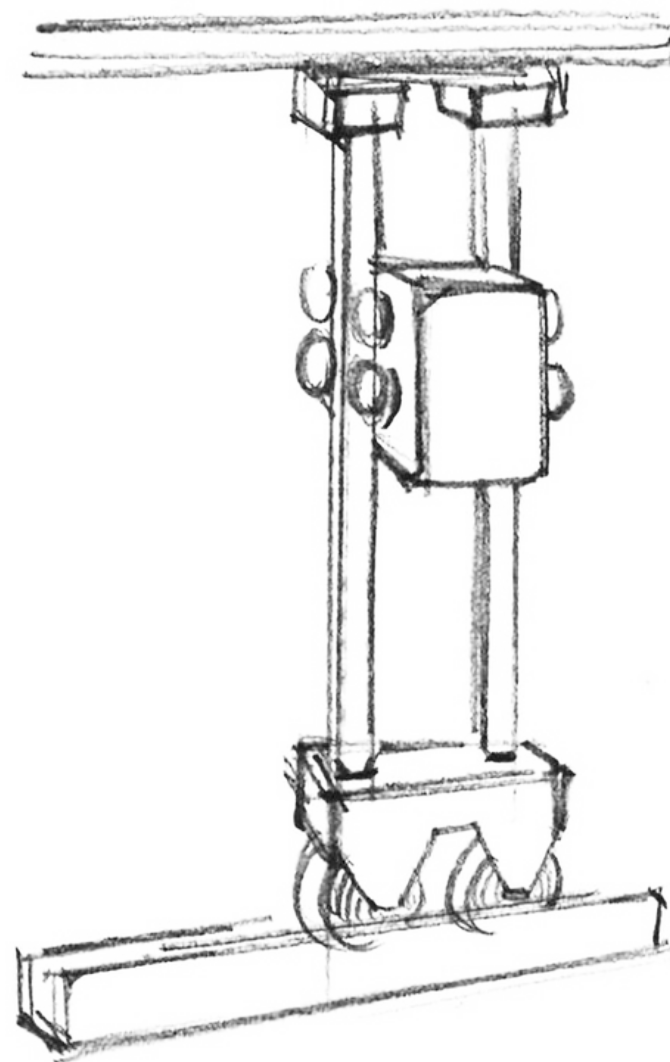


GANTRY SYSTEM

Gantry Orientation



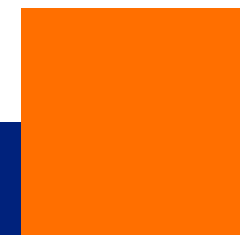
vs.



Structural Integrity during Scaling

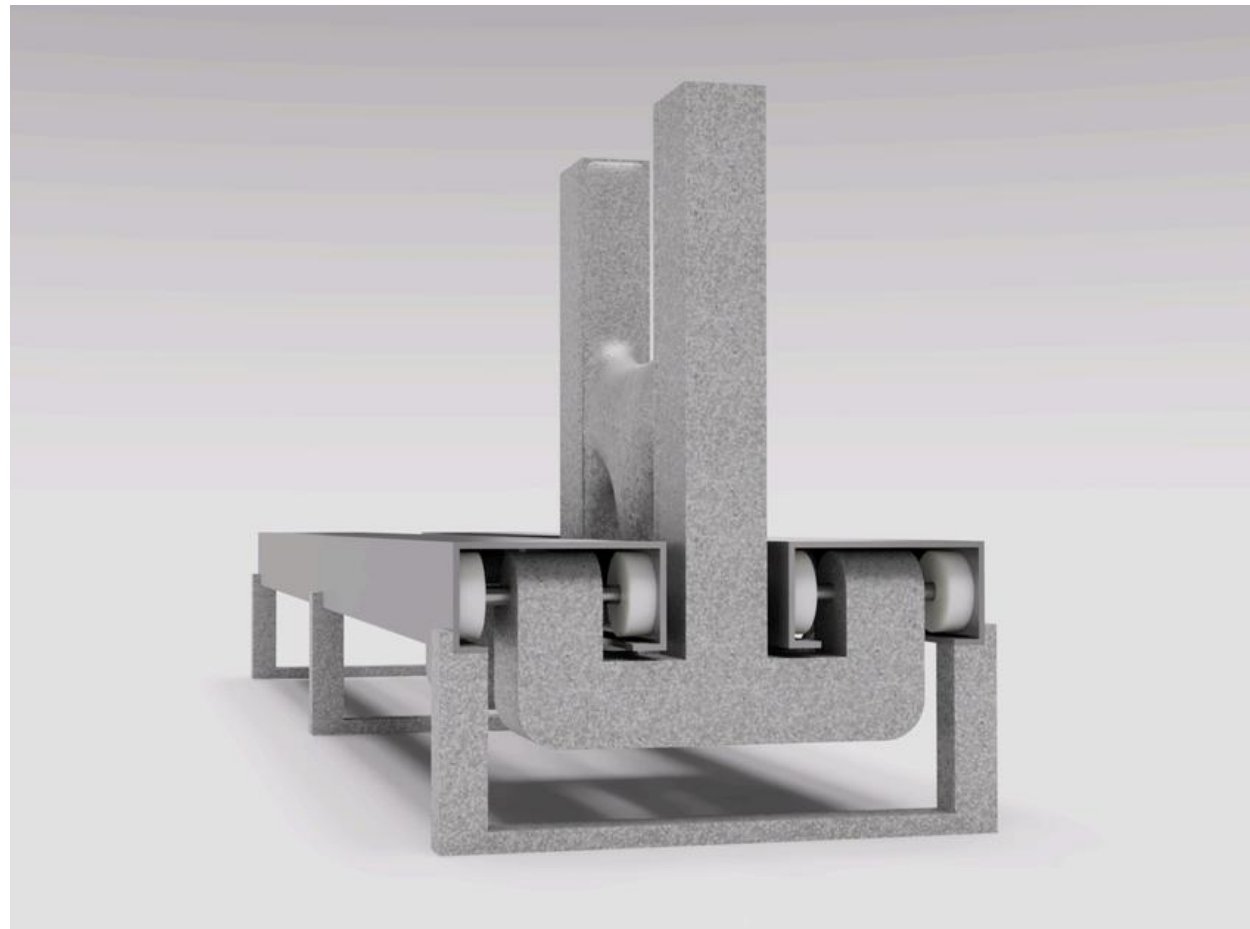
The last group's 'H-frame' showed to be less suitable for scaling for bigger walls.

The 'I-frame' can be stronger when used on bigger facades.



GANTRY SYSTEM

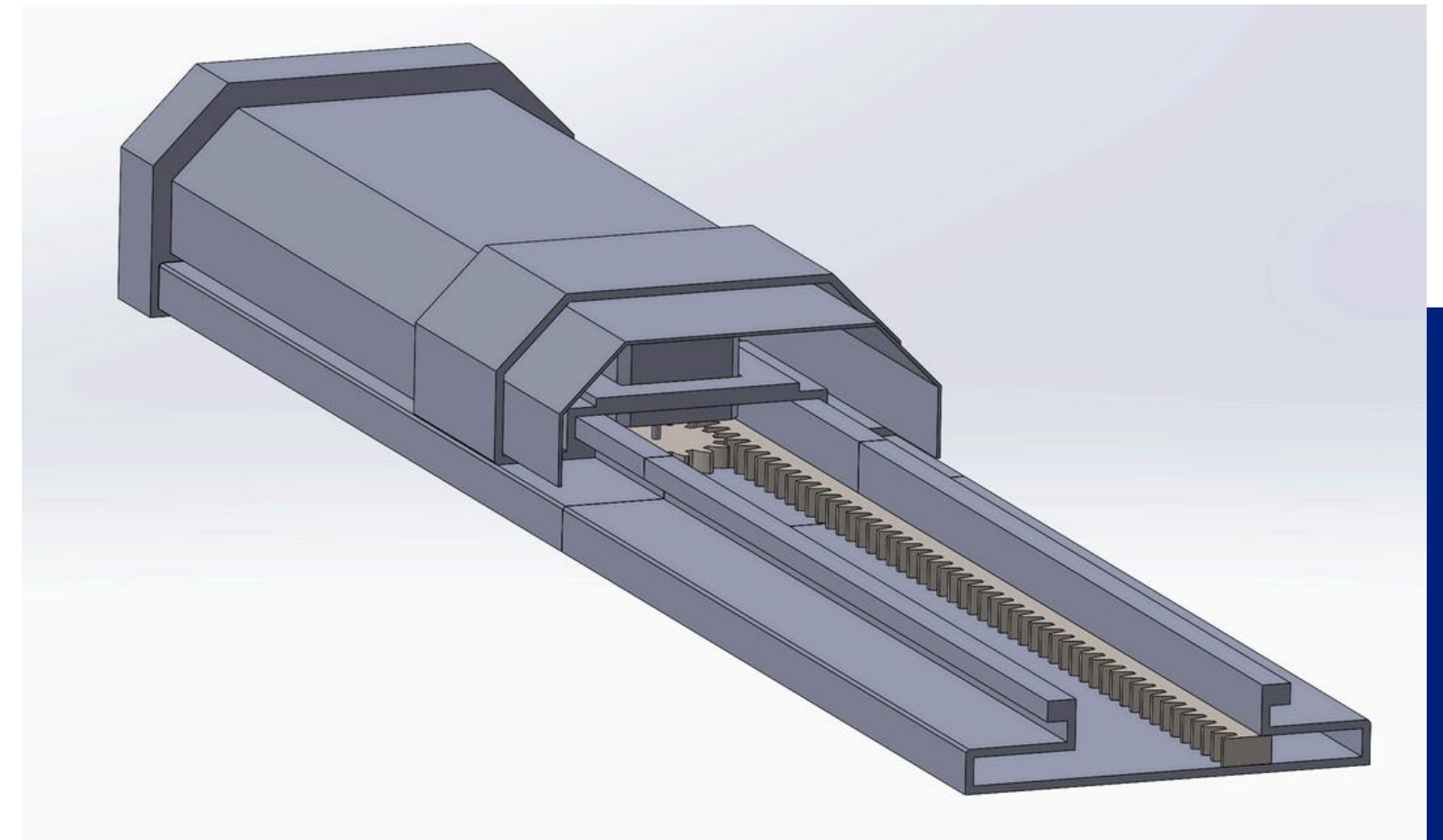
Dust & Mortar Ingress



VS.

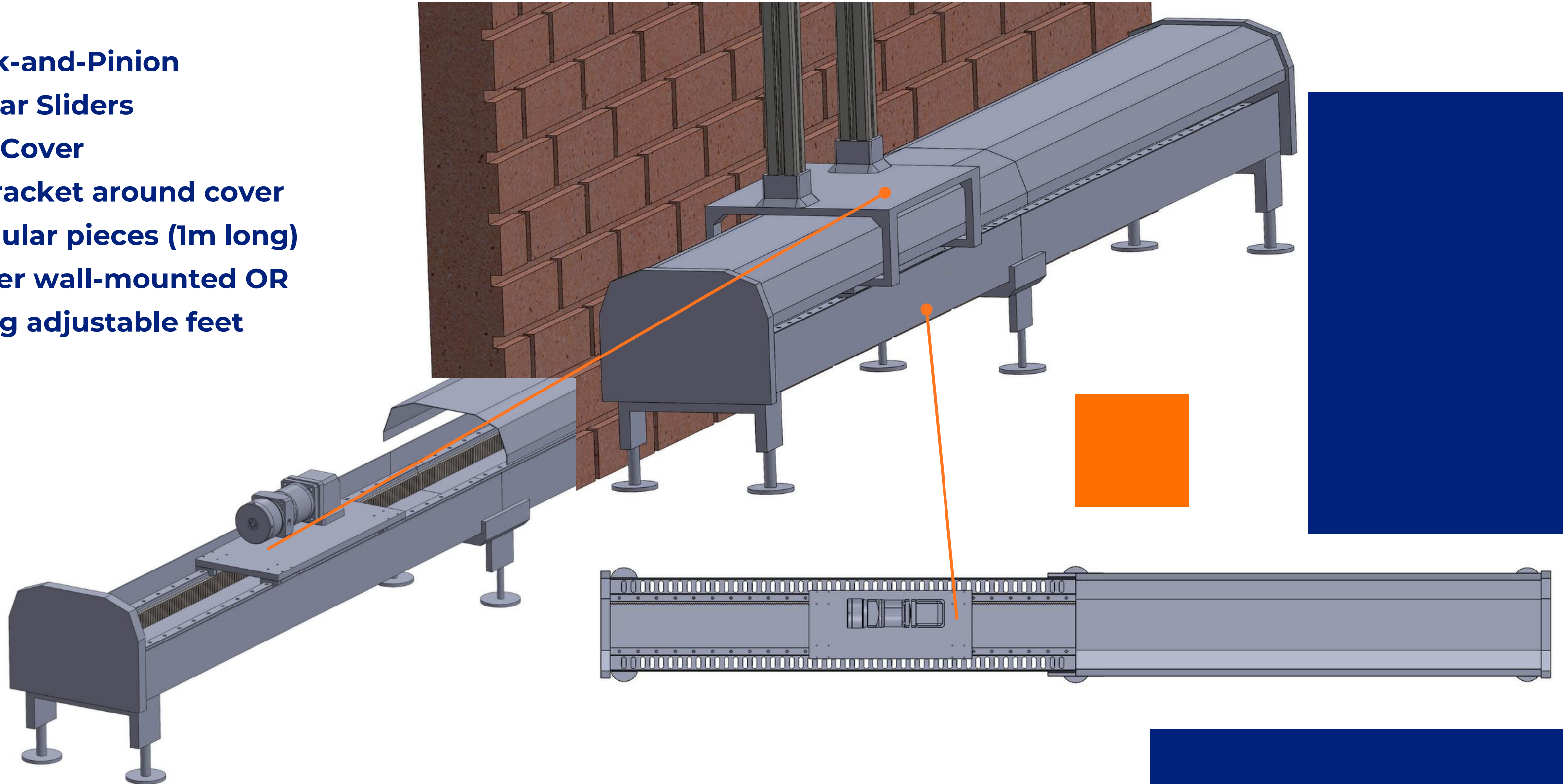
Two designs to tackle debris

Using dual upside down rails
OR using a cover over sliders...

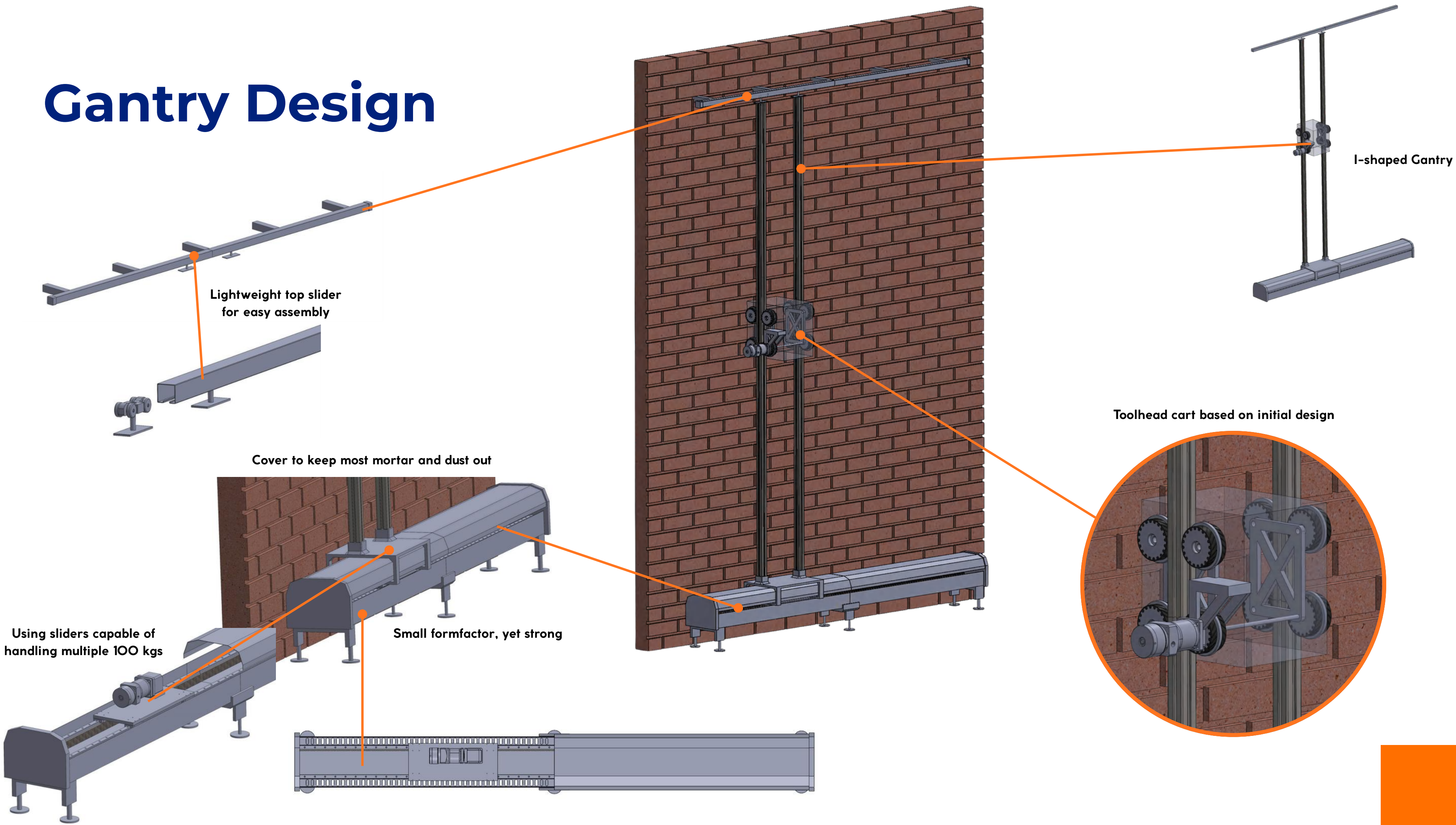


Lower-Slider

- Rack-and-Pinion
- Linear Sliders
- Top Cover
- O-bracket around cover
- Modular pieces (1m long)
- Either wall-mounted OR using adjustable feet



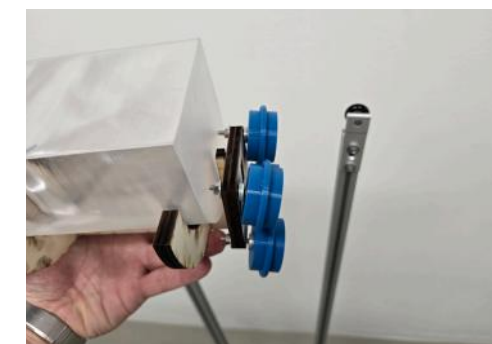
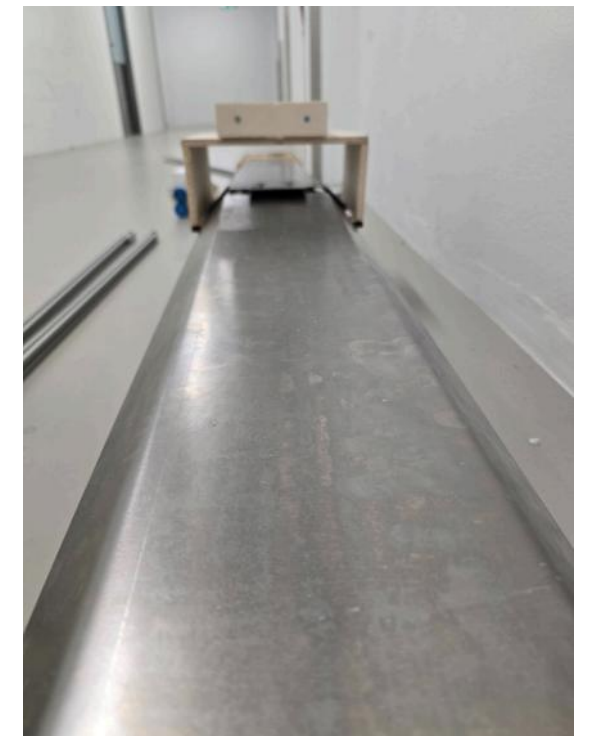
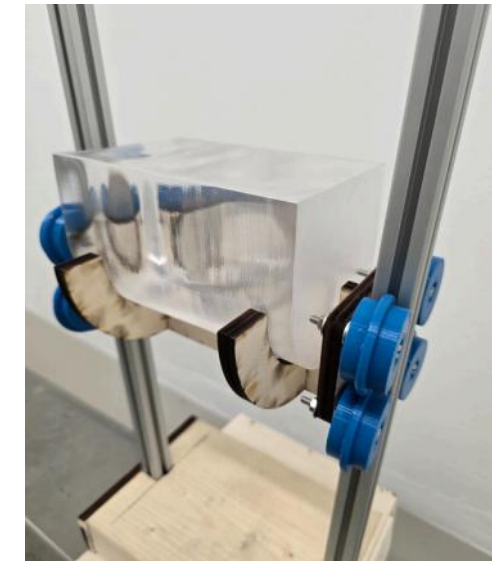
Gantry Design



GANTRY

'Half'-Sized Prototype

Demo





Final Design

Integration of the two subsystems

Areas of Improvement:

- Materials
- Electronics
- Manufacturing



JOINT FILLING ROBOT

THANK YOU
For Your Attention

QUESTIONS?