

# Wire Shaper

The fabrication of shape-changeable object  
utilizing LMPA and the applications

低融点合金による造形後に形状変更可能なオブジェクトの  
ファブリケーションとその応用

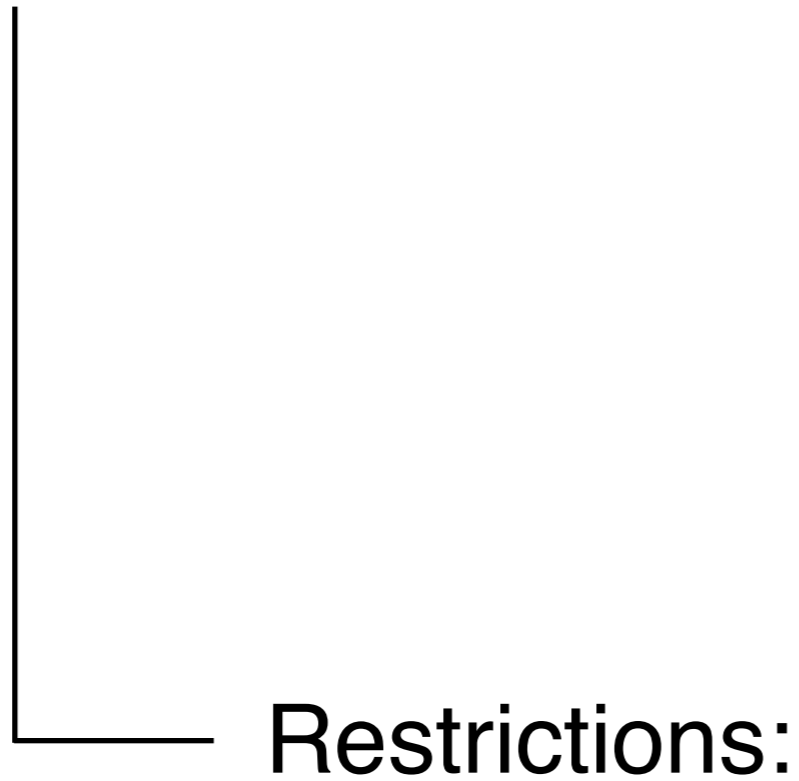
Kakehi Lab. M2 Yasunori Fujikawa

# Agenda

- | Background
- | Goal
- | Proposal
- | Design Implementation
- | Evaluation
- | Future prospects

# Background

For **Room-scale** fabrication



**Material** ×

**Cost** ×

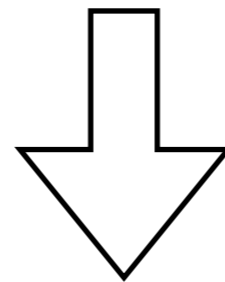
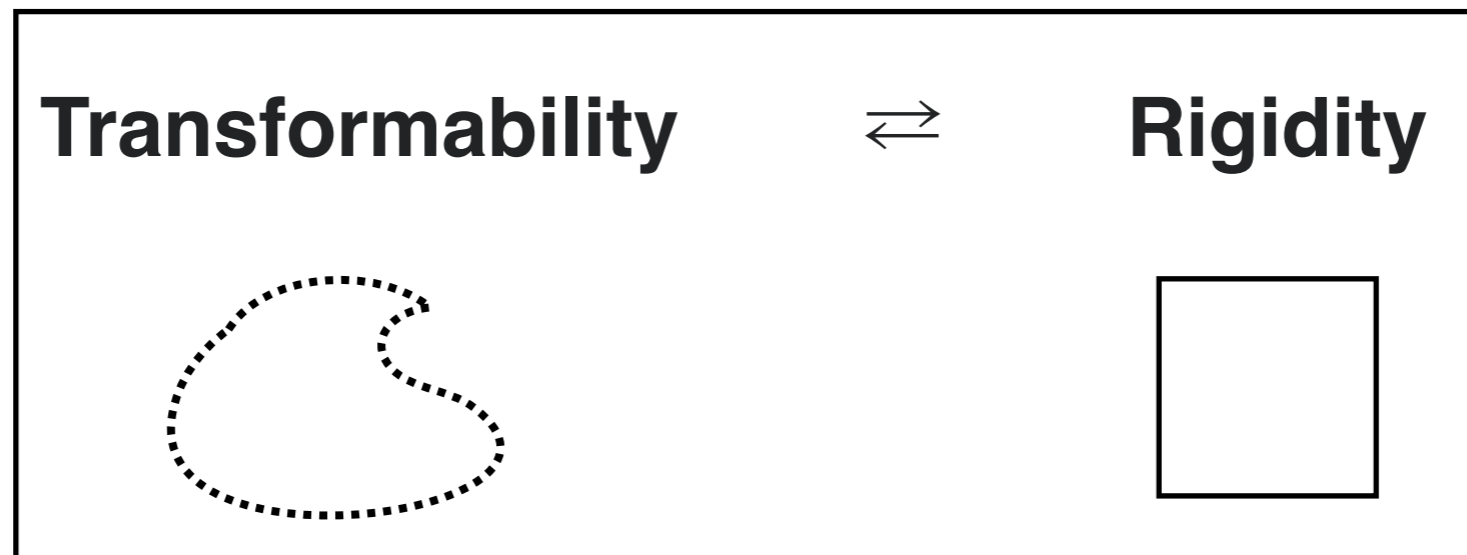
**Time** ×

**Durability** ×

# Goal

## LMPA

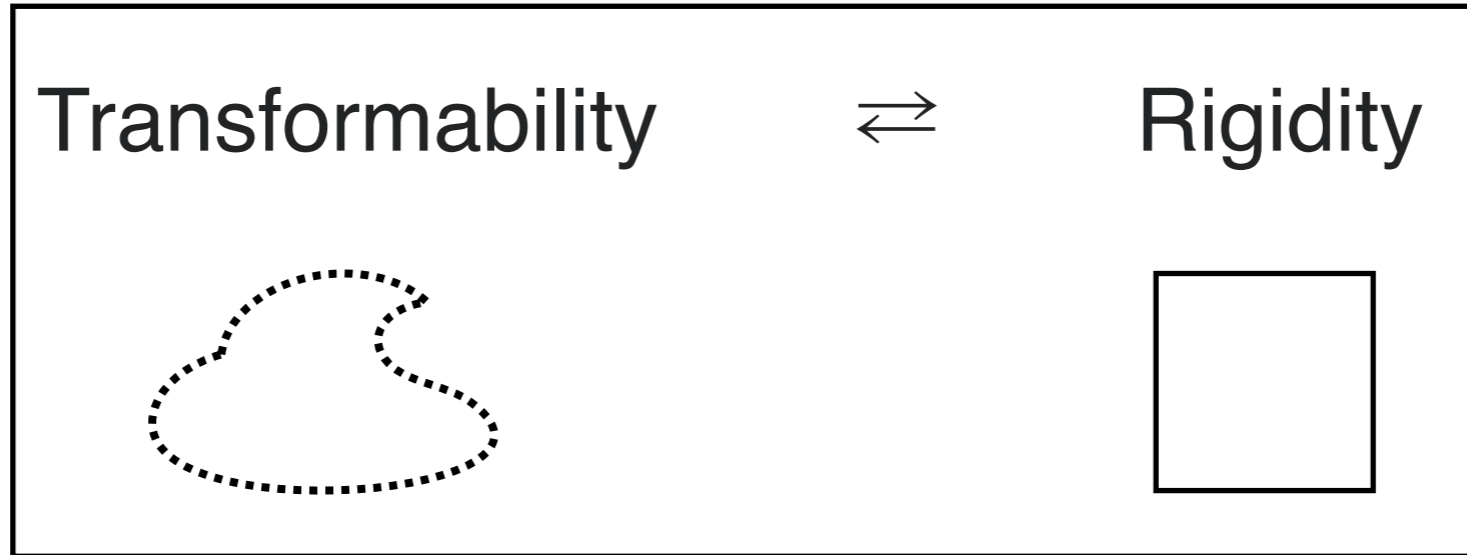
低融点合金（融点29.7度）を用いて変形可能性と剛性を温度によって制御することで  
リライタブルな空間スケールファブリケーションを可能にしようとする



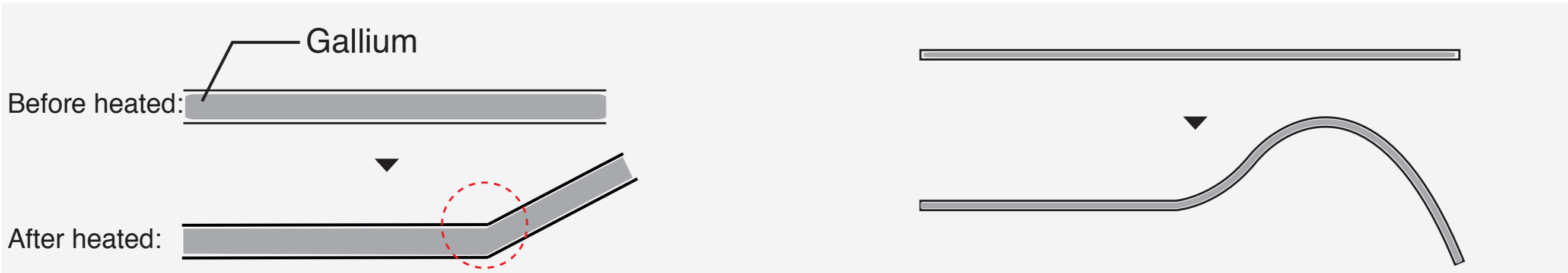
**Rewritability**



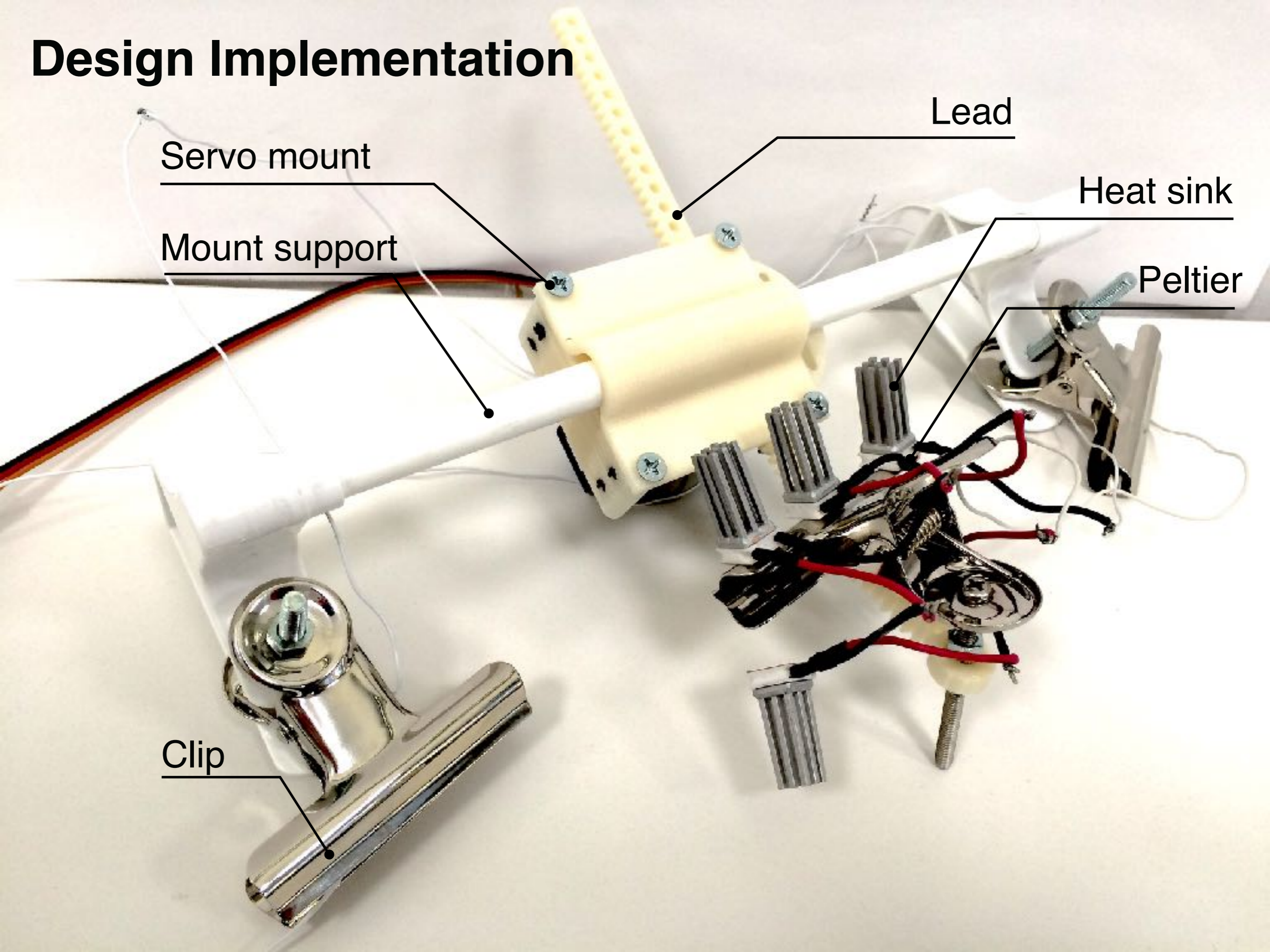
# Proposal



熱制御のみでこの二つの要素を行き来することによりリライタブルになる



# Design Implementation



Lead

Servo mount

Heat sink

Mount support

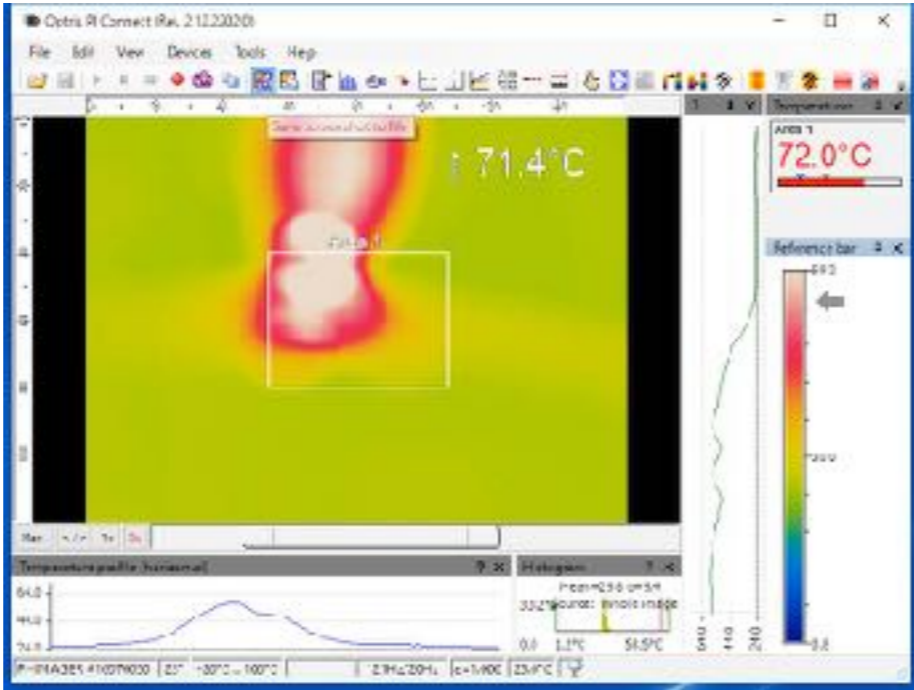
Peltier

Clip

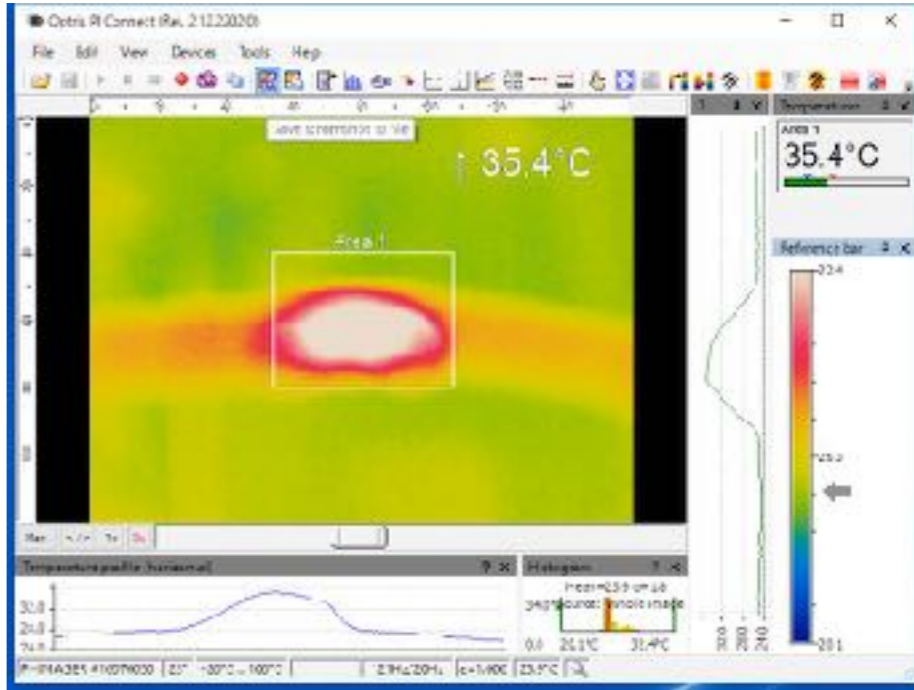
# Evaluation -Heating efficiency-

## Thermal camera analytics

**Heat gun:**

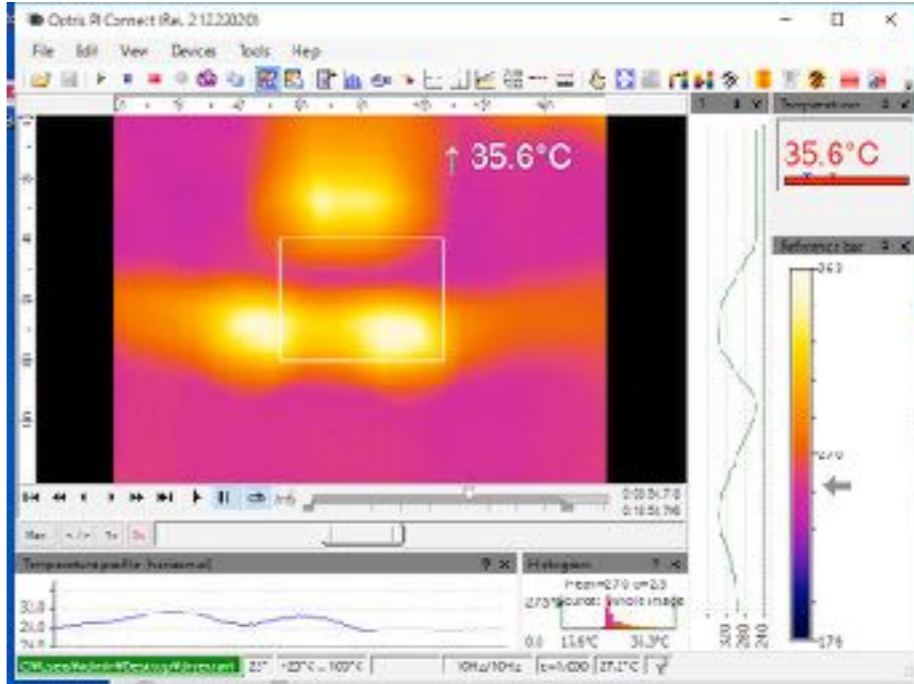
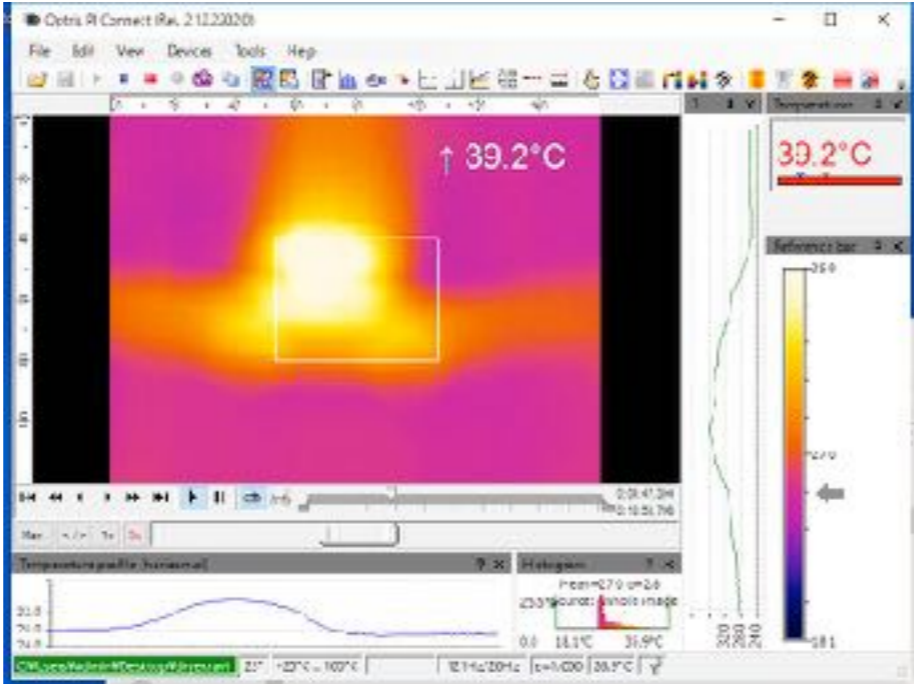


(When heated)



(Heat conduction on Ga tube)

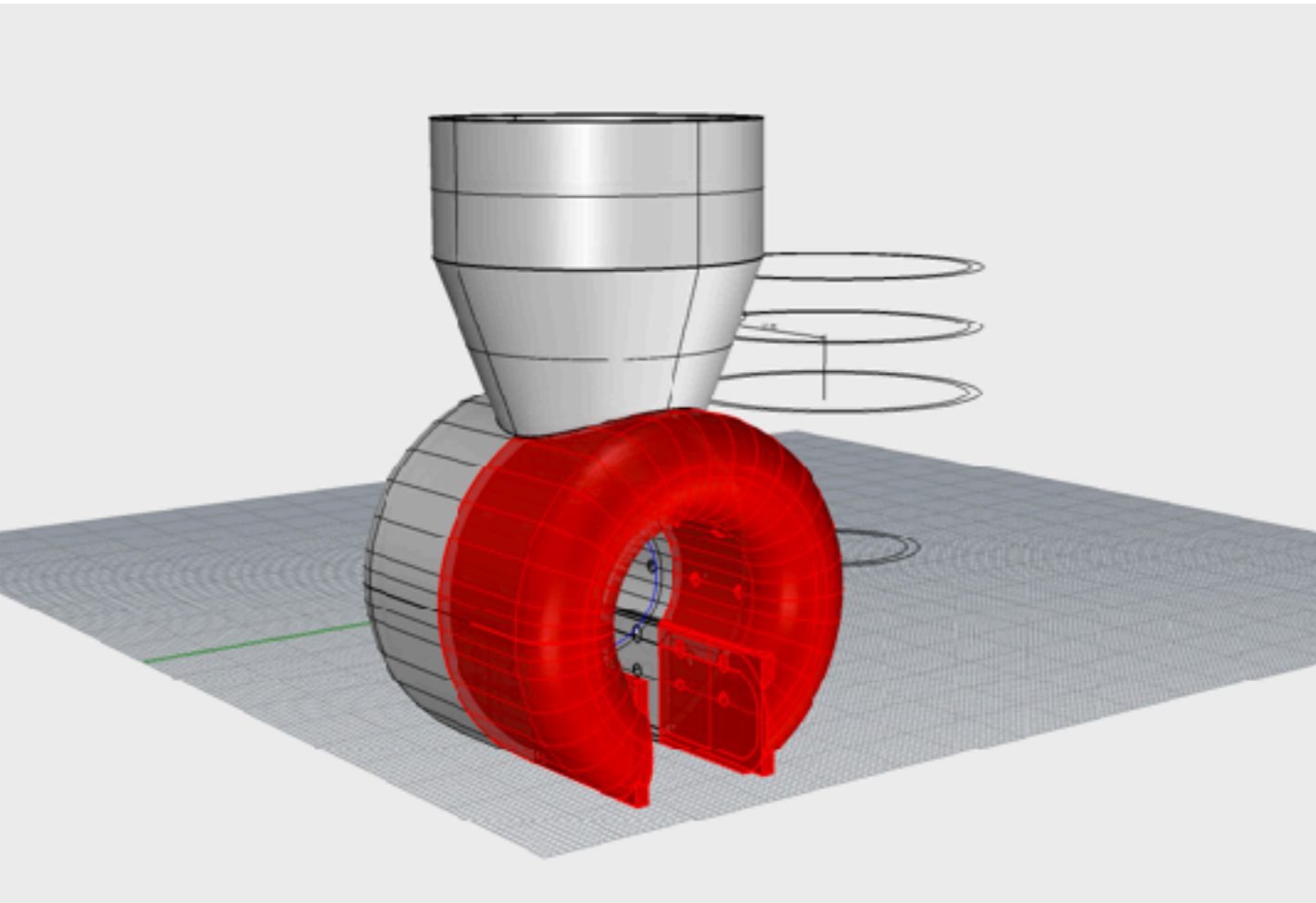
**Hair dryer:**





# Heating

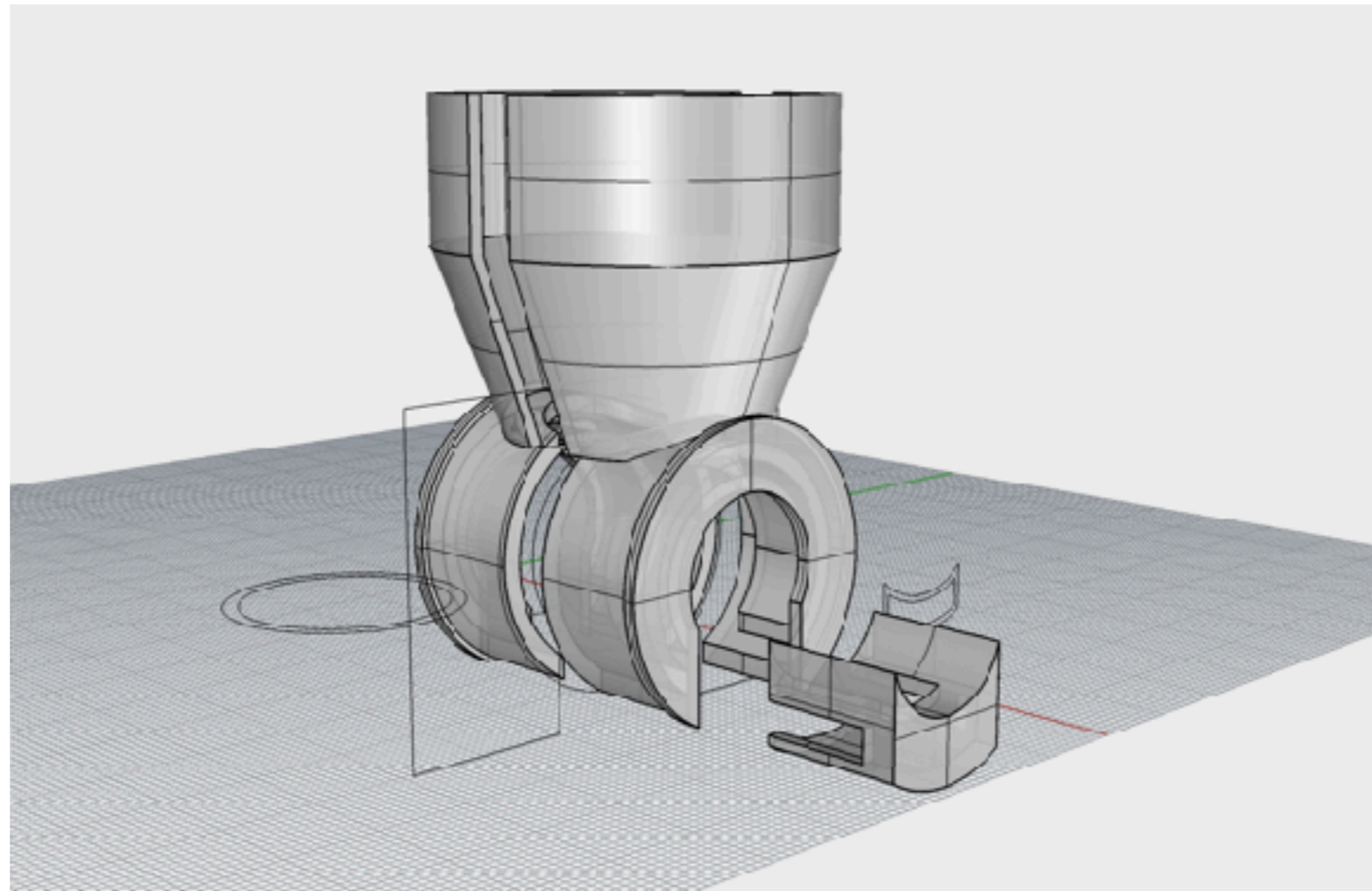
21φGa チューブ  
ヒーター + 吹き出し口



→ 高温になり、吹き出し口が溶けてしまう。

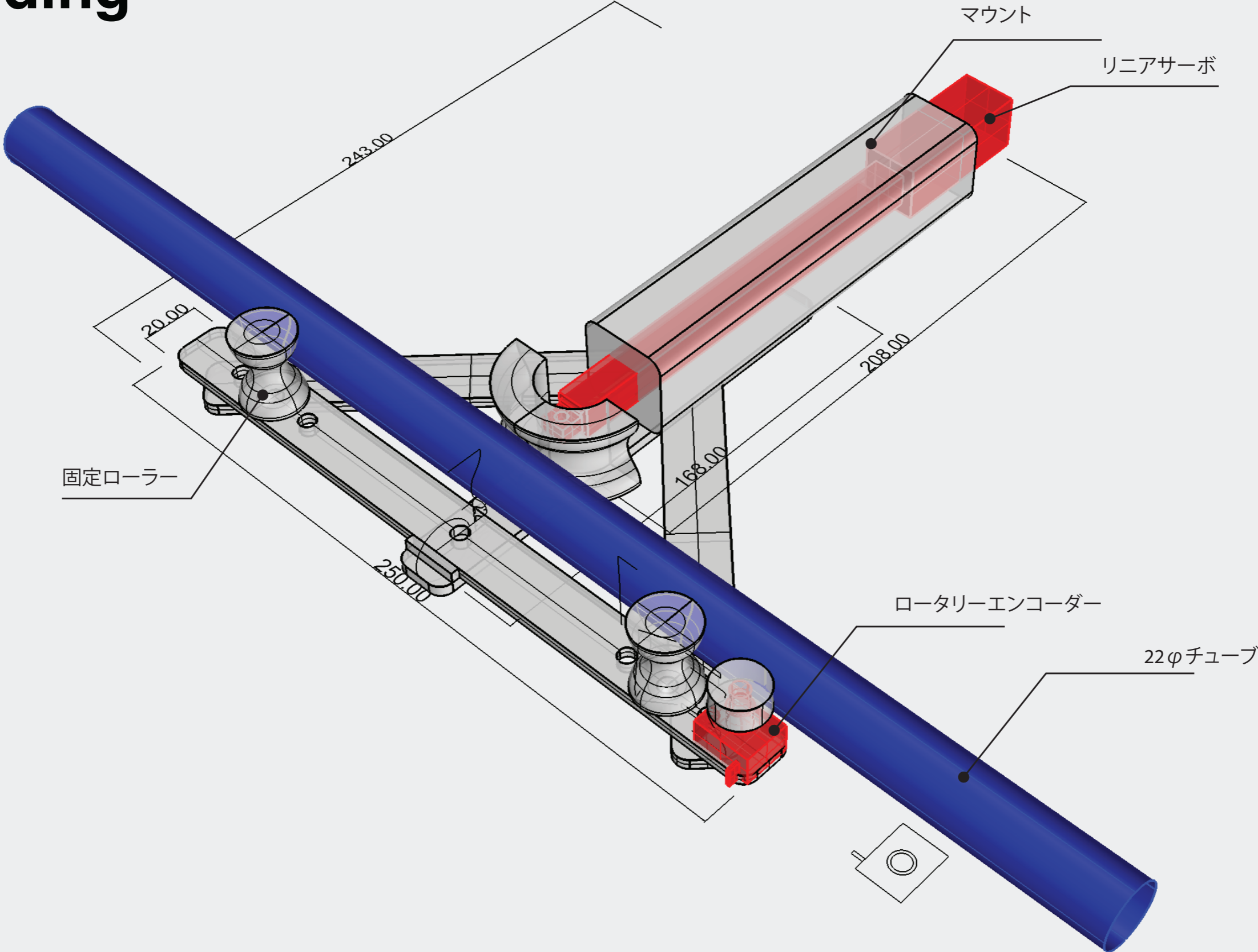
# Heating

21φGa チューブ  
ドライヤー + 吹き出し口 (密閉型)



→ 融解に 4 分間

# Bending



# Bending



# Bending



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## L16-P Miniature Linear Actuator with Feedback



L16-P Miniature Linear Actuator with Feedback

[Larger Photo](#) [Email A Friend](#)

Alternative Views:



Price: \$80.00

Availability: Usually Ships in 24 Hours

Product Code: L16 P

### Choose your options:

#### Stroke

[Click to view another Actuator Series](#)

Actuator Stroke\*:

#### Ratio

Gear Ratio\*:

#### Voltage

Max. Operating Voltage\*:

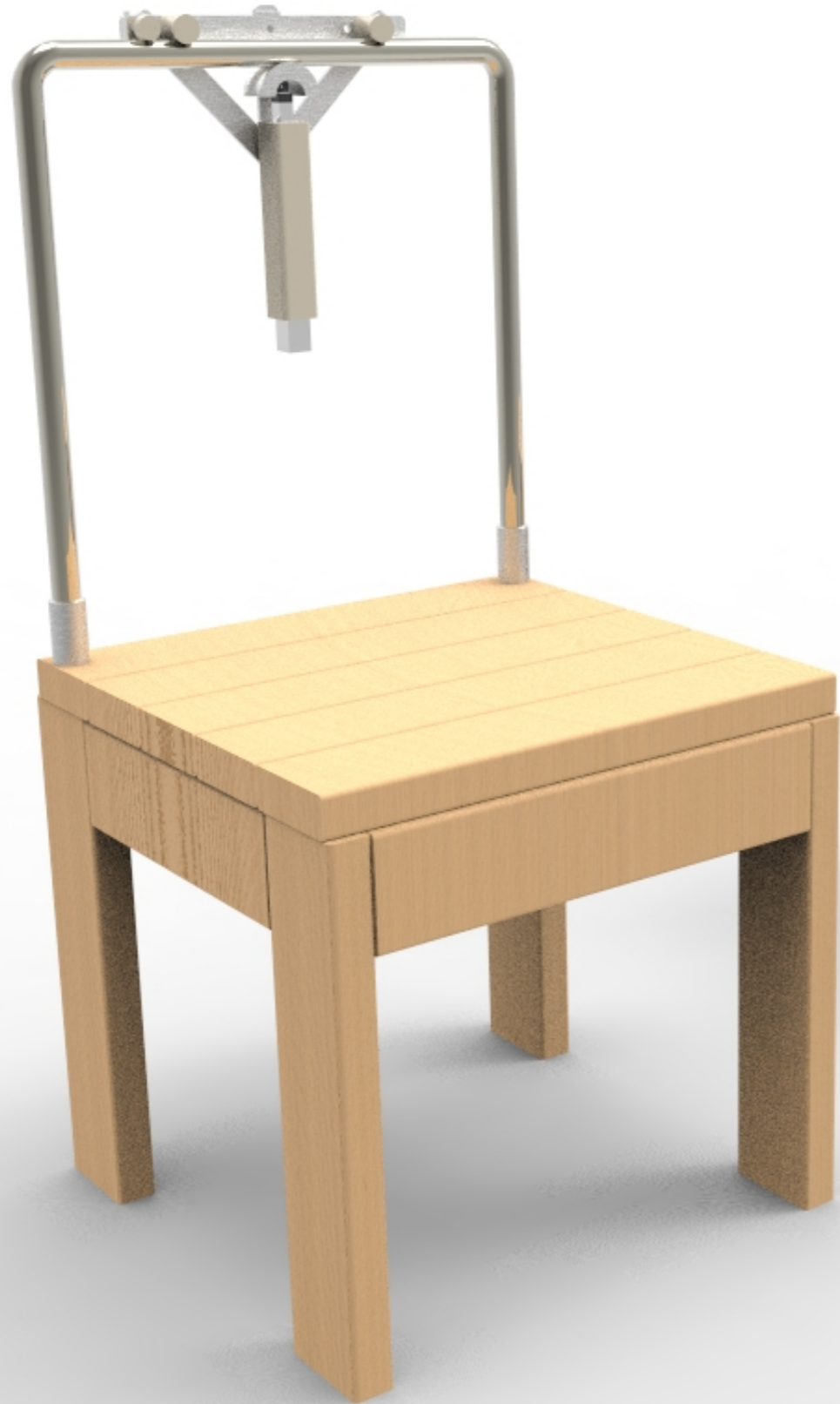
Acc LAG\*:

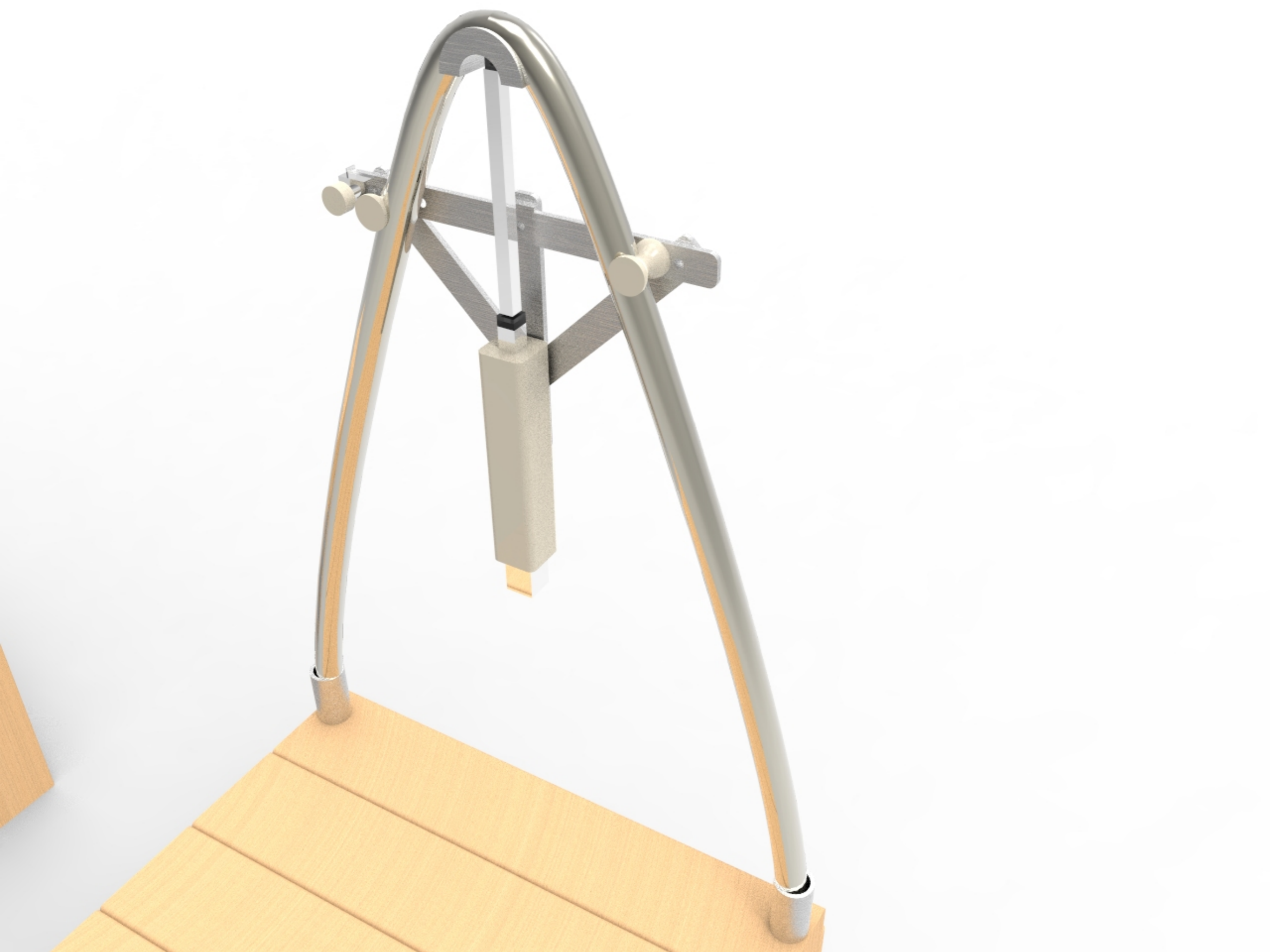
Qty:

[Add To Cart](#)

### L16 Specifications

	35:1	63:1	150:1
Peak Power Point	50N @16mm/s	75N @10mm/s	175N @4mm/s
Peak Efficiency Point	24N @24mm/s	38N @15mm/s	75N @7mm/s
Max Speed (no load)	32mm/s	20mm/s	8mm/s
Max Force (lifted)	50N	100N	200N
Back Drive Force	31N	46N	102N
Stroke Option	50mm	100mm	140mm
Mass	56g	74g	84g
Repeatability (-P & LAC)	0.3mm	0.4mm	0.5mm
Max Side Load (extended)	40N	30N	20N
Closed Length (hole to hole)	118mm	168mm	208mm
Feedback Potentiometer	6kΩ±15%	11kΩ±15%	16kΩ±15%
Feedback Linearity	Less than 2.00%		
Input Voltage	0-15 VDC. Rated at 12VDC.		
Stall Current	650mA @ 12V		
Operating Temperature	-10°C to +50°C		
Audible Noise	60dB @ 45cm		
Ingress Protection	IP-54		
Mechanical Backlash	0.25mm		
Limit Switches	Max. Current Leakage: 8uA		
Maximum Static Force	250N		
Maximum Duty Cycle	20%		









# Evaluation -Tube structure-

## 分断構造

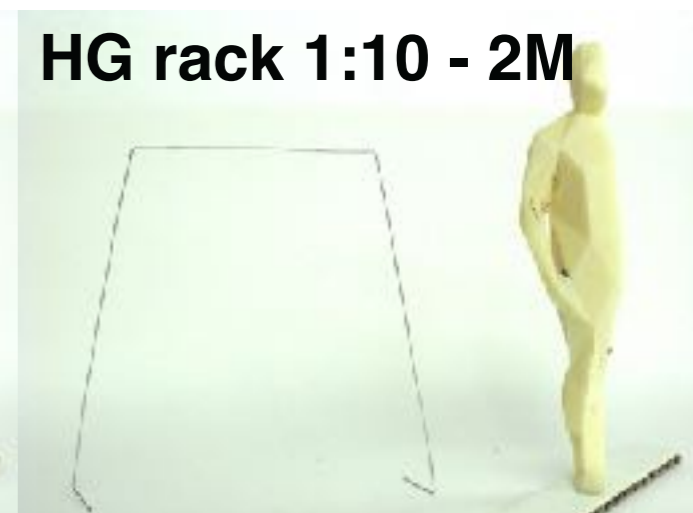
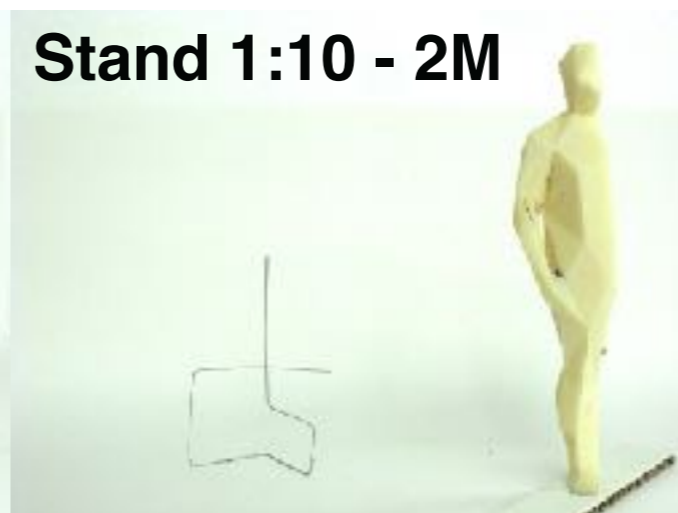
チューブ内に一定間隔でスペーサー（中空構造）を置くことで  
局所的に熱制御をする。

→スペーサーの間に加熱機構を置いて、どの程度、  
熱制御効率が上がるかを検証する

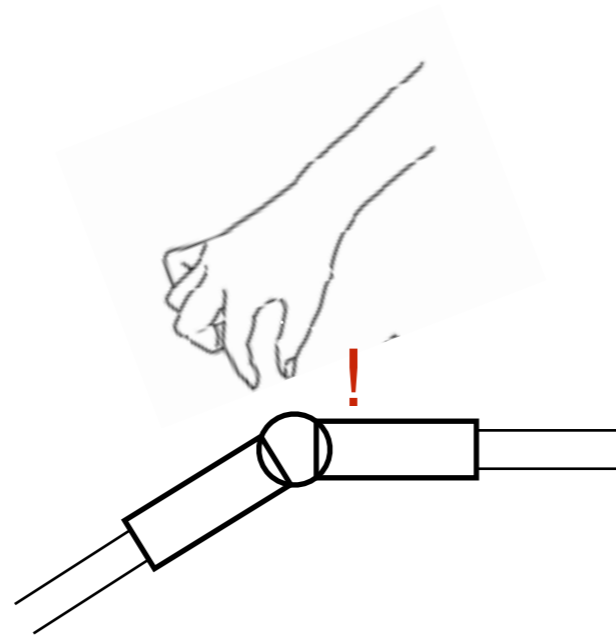


→

# Evaluation -Expected shape changing-



# Future prospects



## Software

+User design input

## Wire Shaper

+Placing device by hand  
+Heating with heat gun  
+Bending by device

## Model

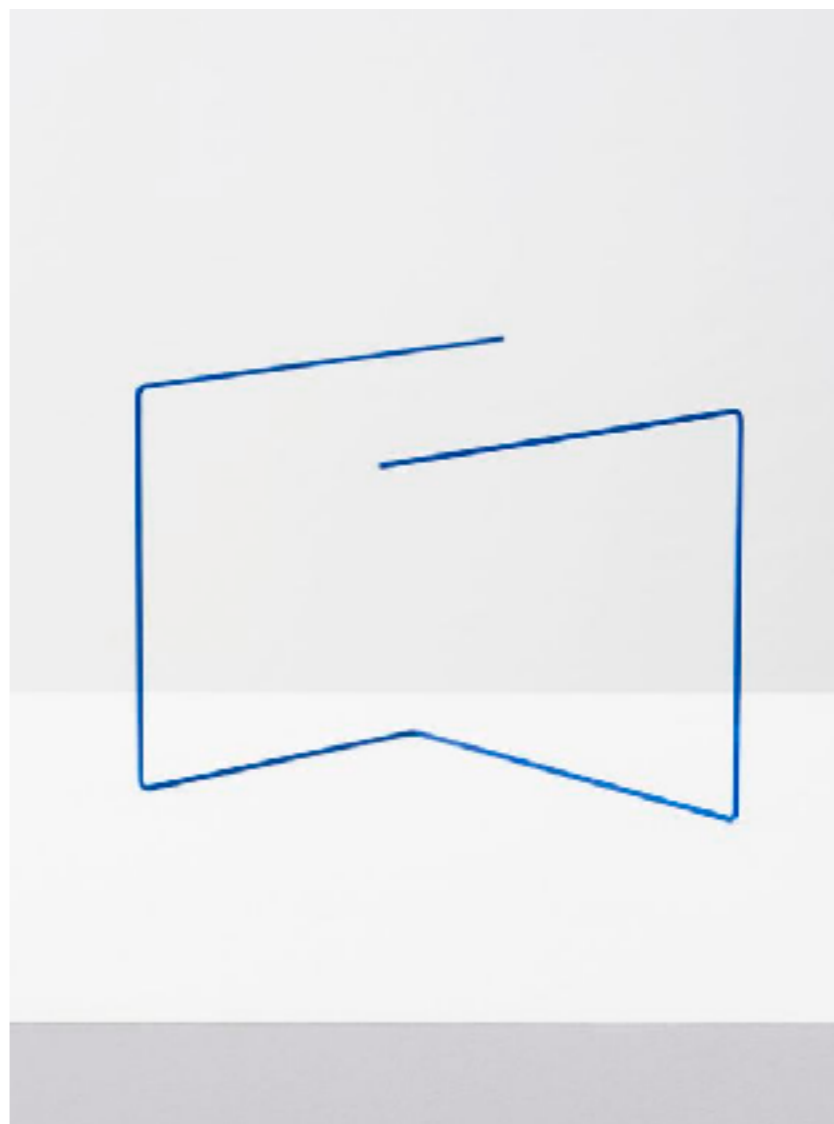
+Prototyping model  
+Practical use  
+Repeat remodeling

## APPLICATION



デザイナーがクライアントにデザインを説明するとき

## APPLICATION



限られたスペース内で多様なディスプレイ方法が必要な店舗