

Building a Peltier-Cooled Cloud Chamber for Physics Outreach

CASST, August 12, 2026
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Project Goals

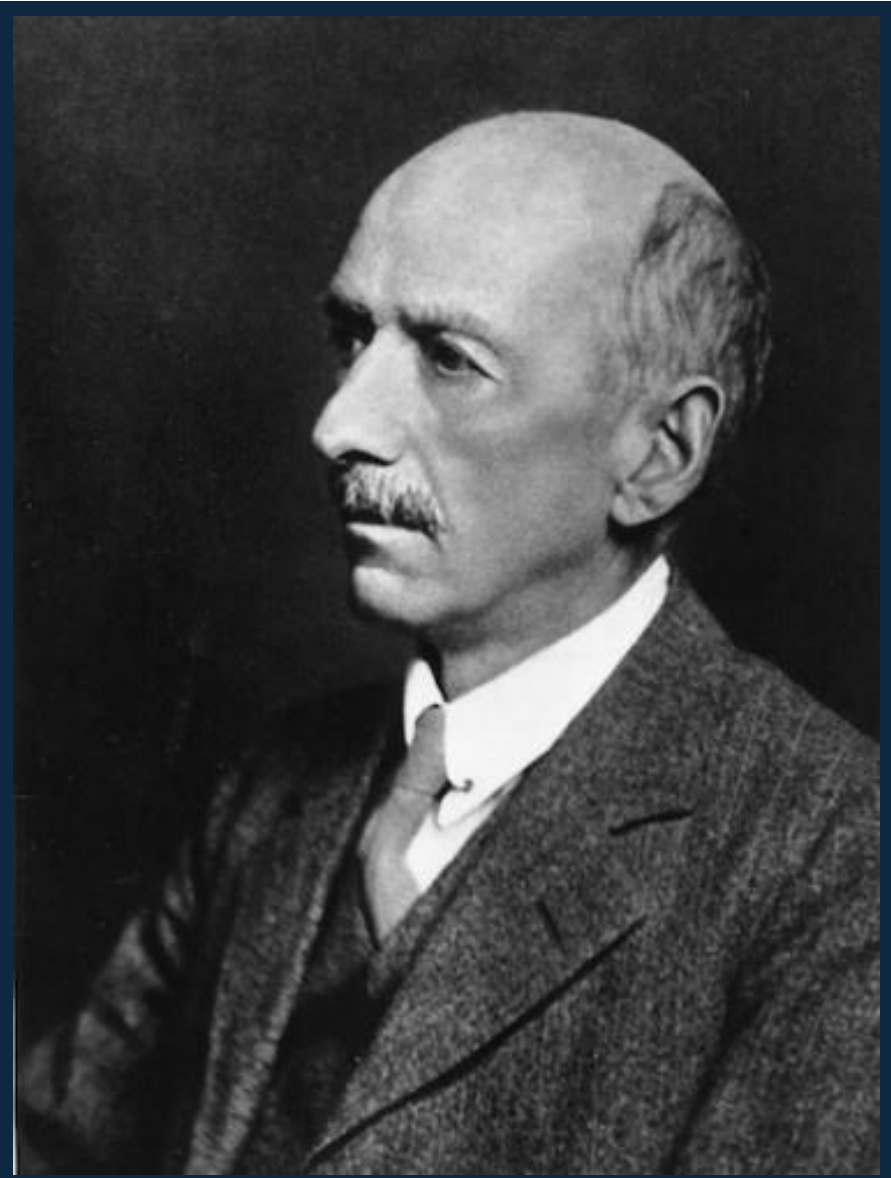
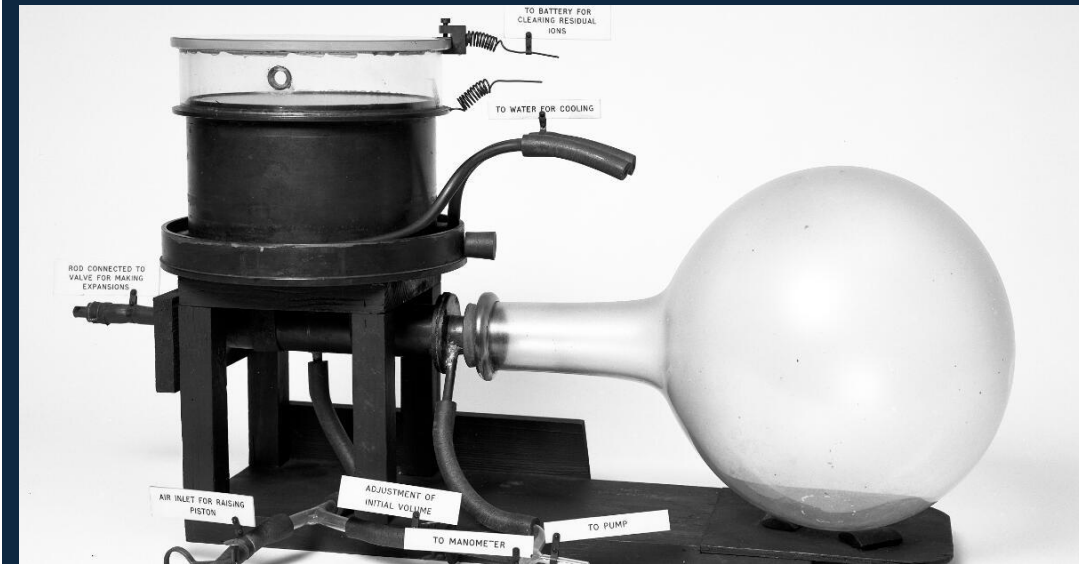
Design Philosophy

1. Accessible
2. Plug-and-Play
3. Portable
4. Effective



Cloud Chamber at FZU. Credit: [Wikipedia](#).

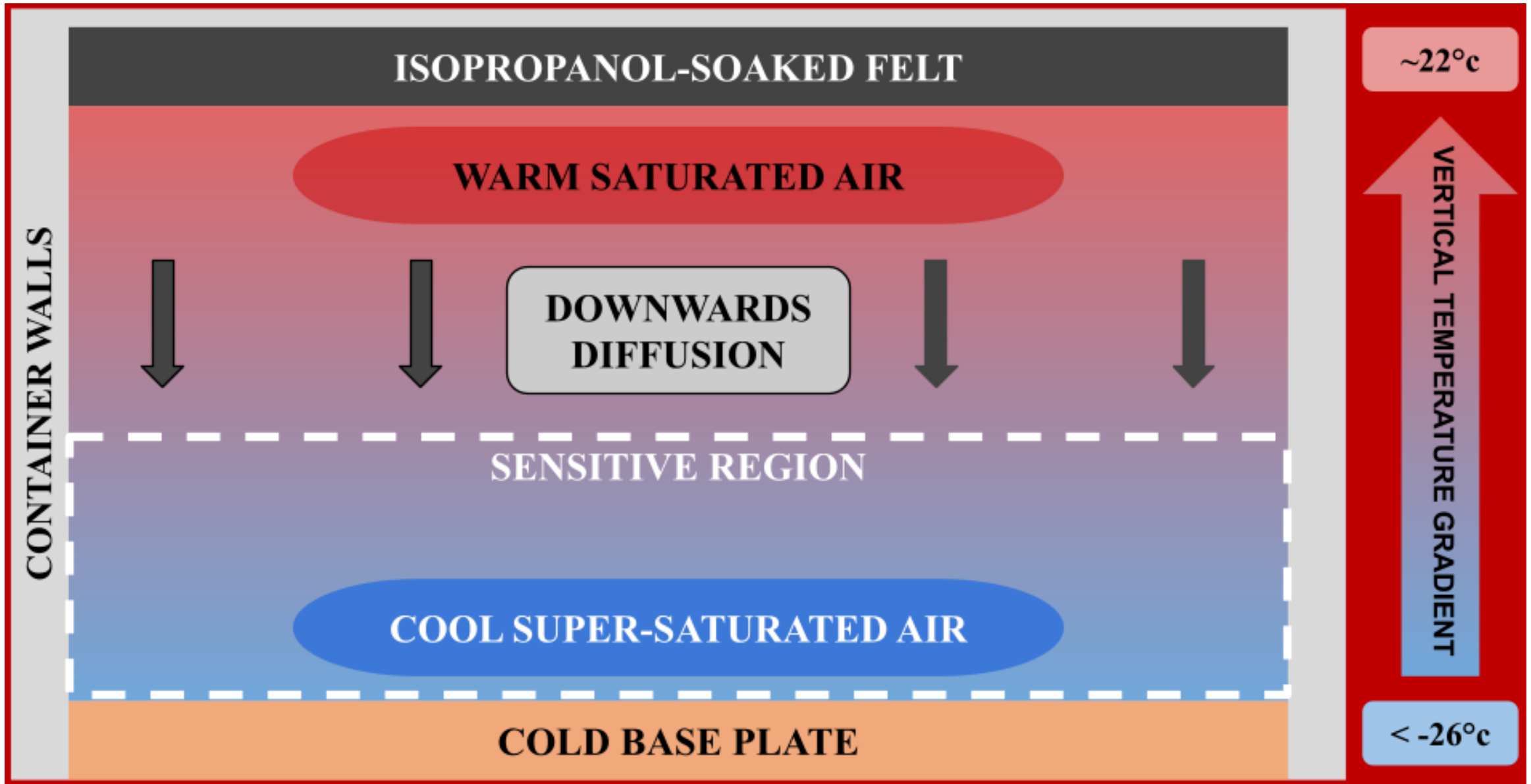
The Cloud Chamber



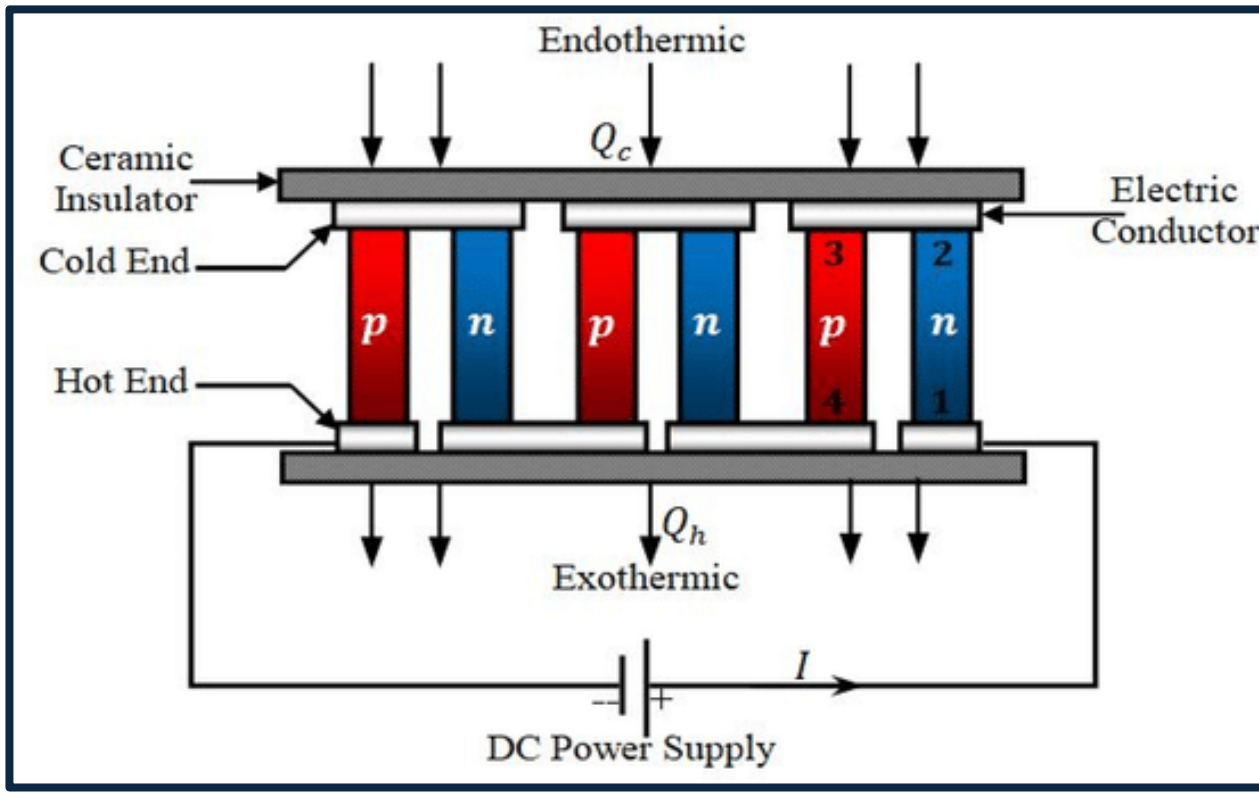
Wilson's 1911 Chamber (bottom). Credit: [Cambridge Digital Library](#). Wilson's 1911 Photo (bottom). Credit: [CERN Timeline](#). C.T.R Wilson Portrait. Credit: [Physics Today](#).



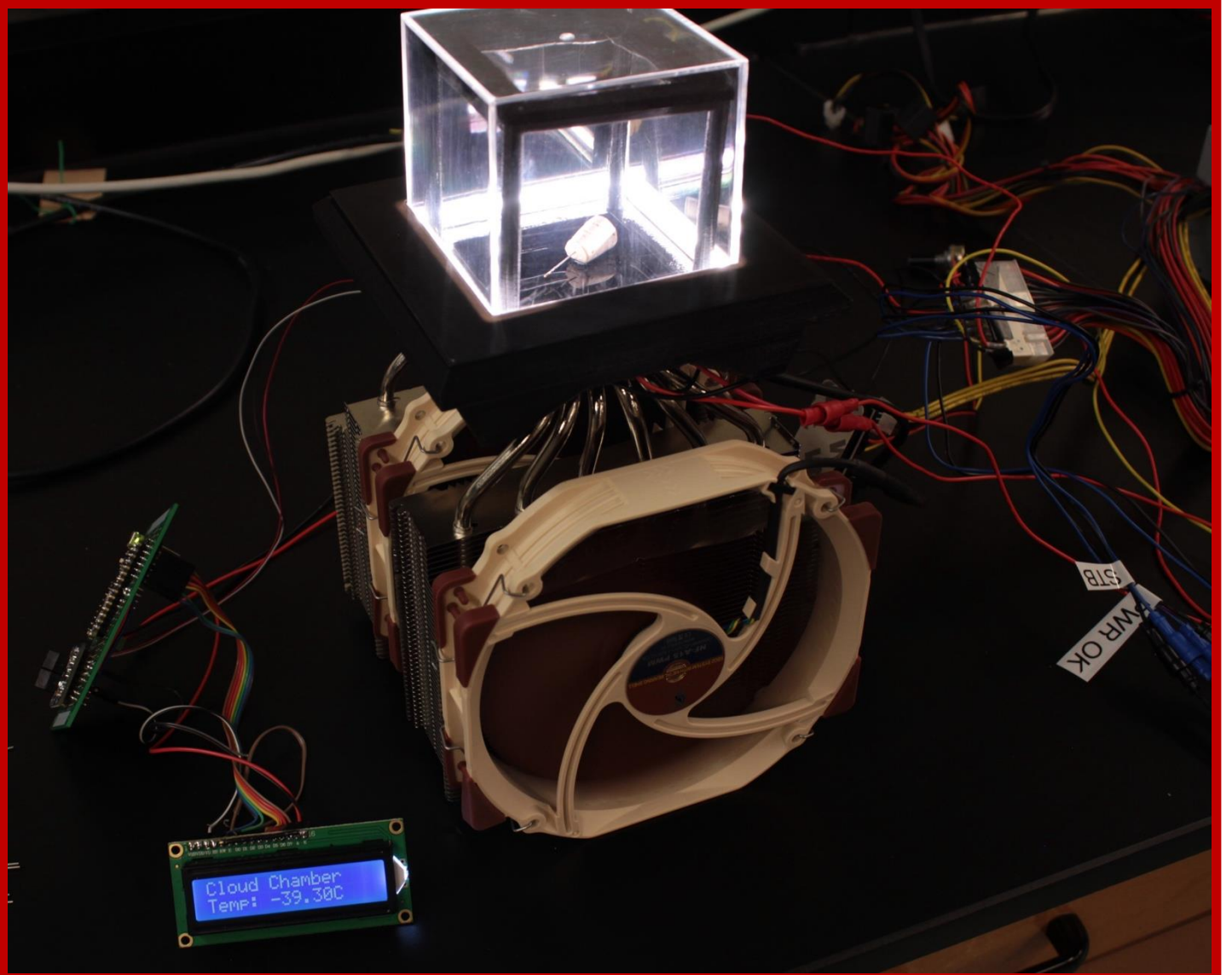
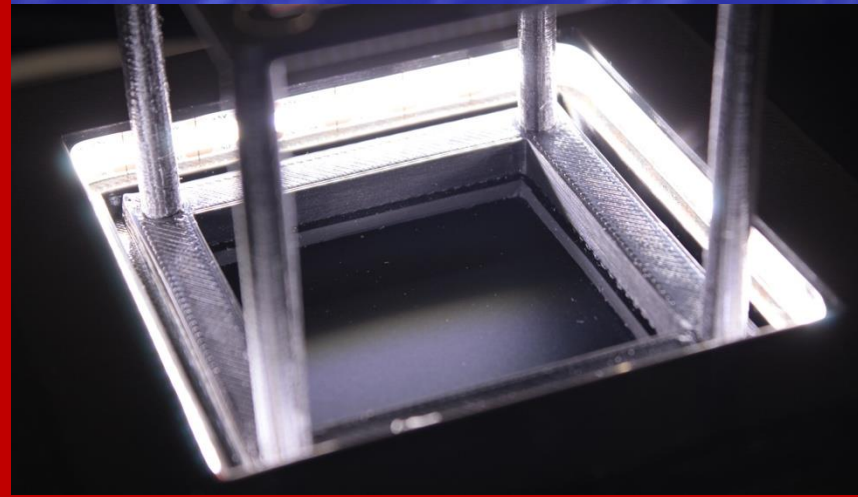
Supersaturated Environment



Peltier cooling

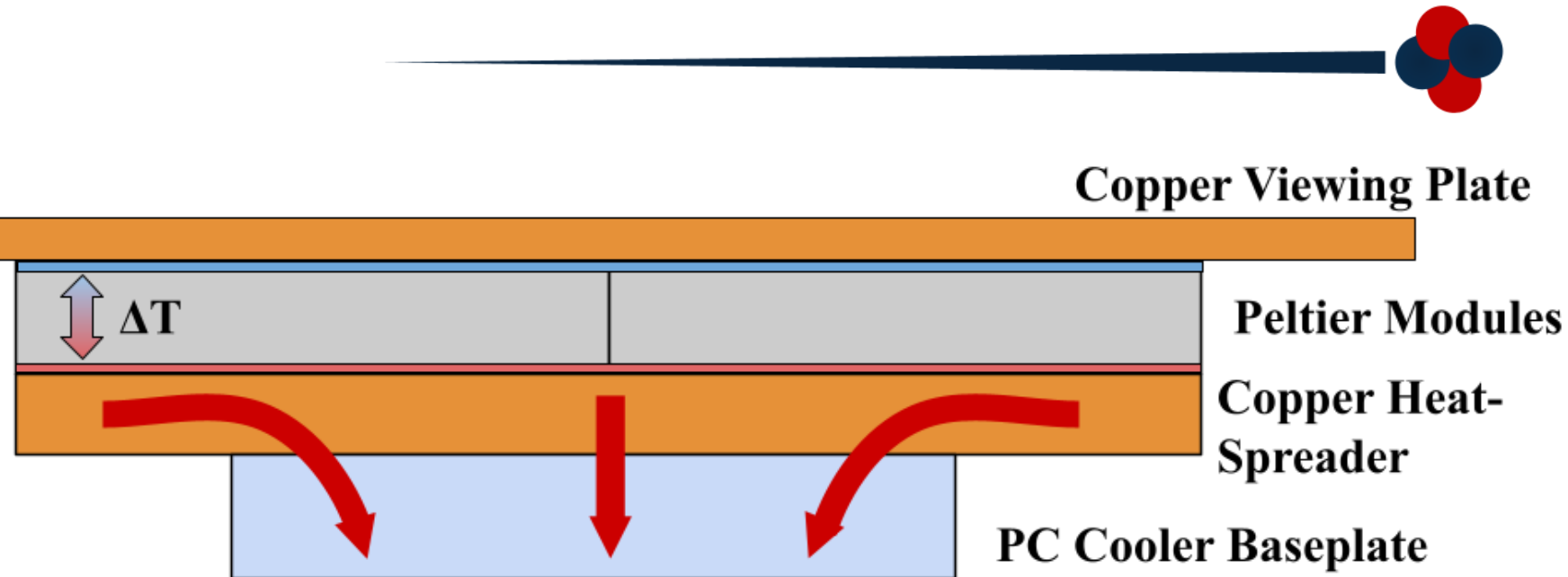


Previous Student's Build



The Cooler Challenge

- Tower coolers specifically designed for CPU's
- Solutions:
 1. Copper heat-spreader plate
 2. Oversized CPU baseplate



Cooler Baseplate (top), and Noctua cooler (bottom). Credit: [TechPowerUp](#) and [Nocuta](#).

The Four-Peltier Build

One
Peltier
module

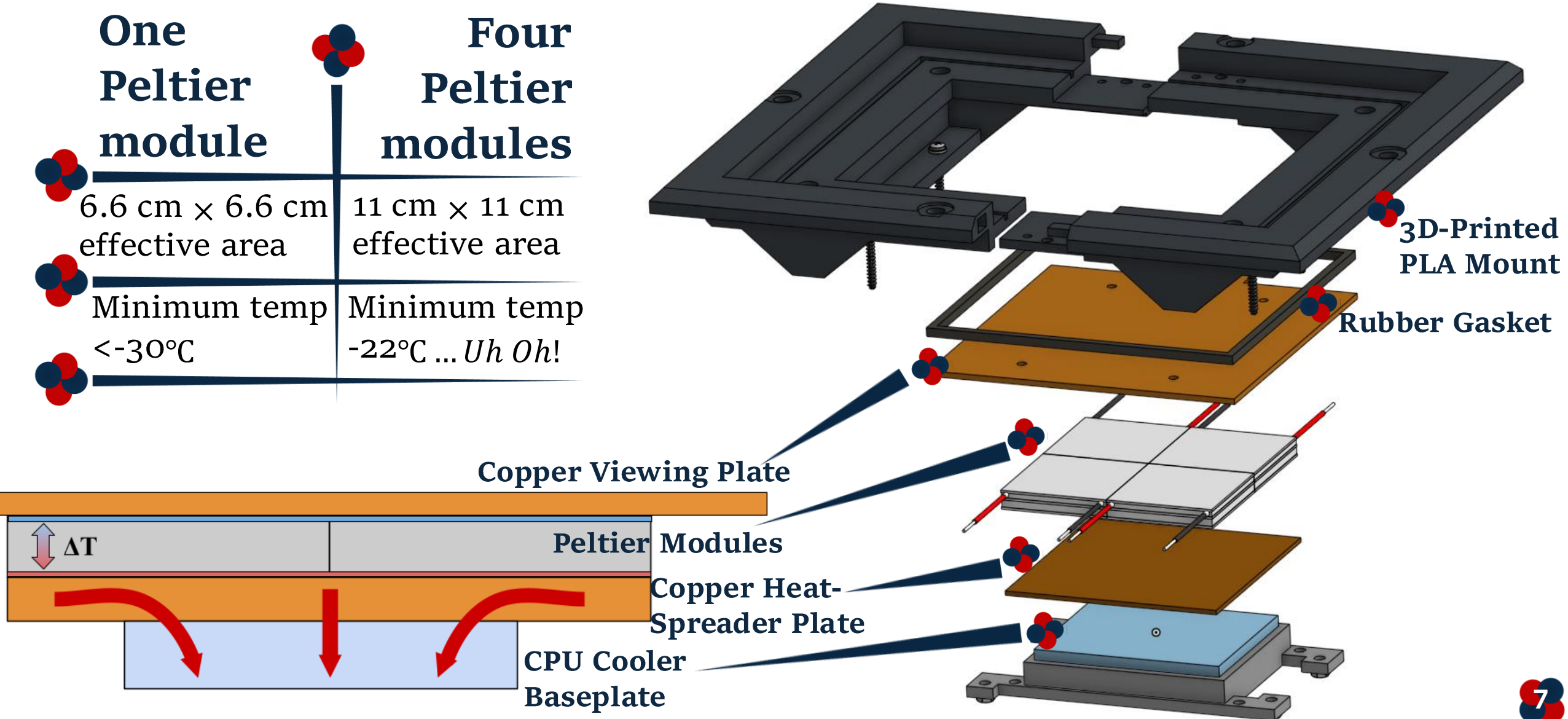
6.6 cm × 6.6 cm
effective area

Minimum temp
<-30°C

Four
Peltier
modules

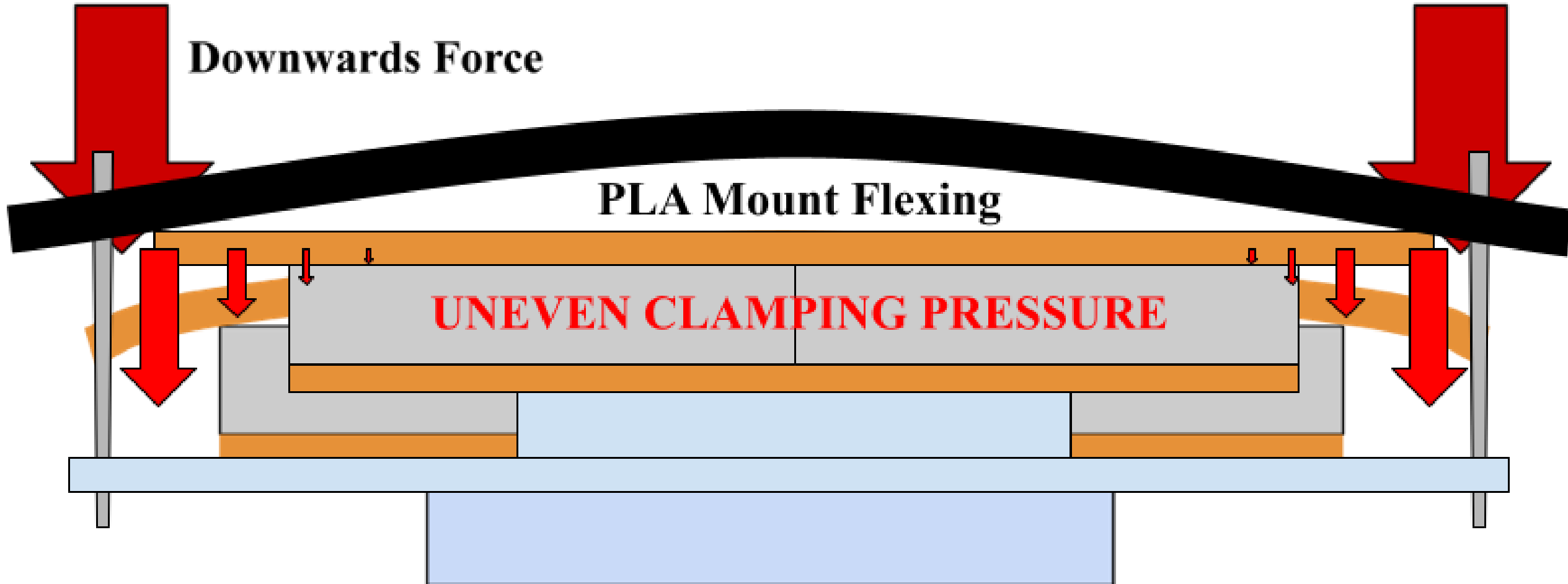
11 cm × 11 cm
effective area

Minimum temp
-22°C ... *Uh Oh!*

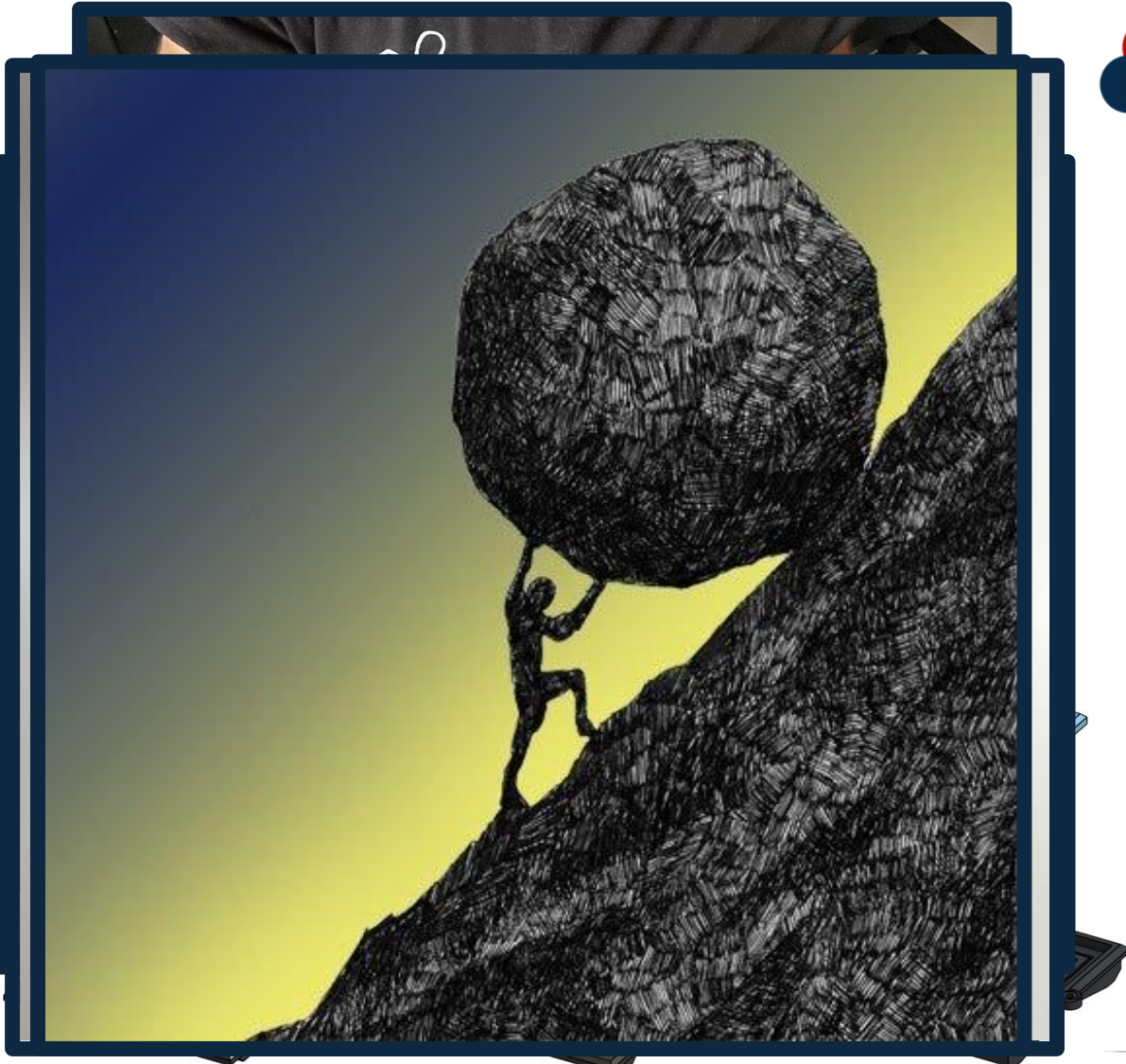


The Bowing Problem(s)

Material Bowing:



Problem Solving



Sisyphus and his boulder. Credit: [Medium](#). Imagine Him Happy.



Attempted Solutions

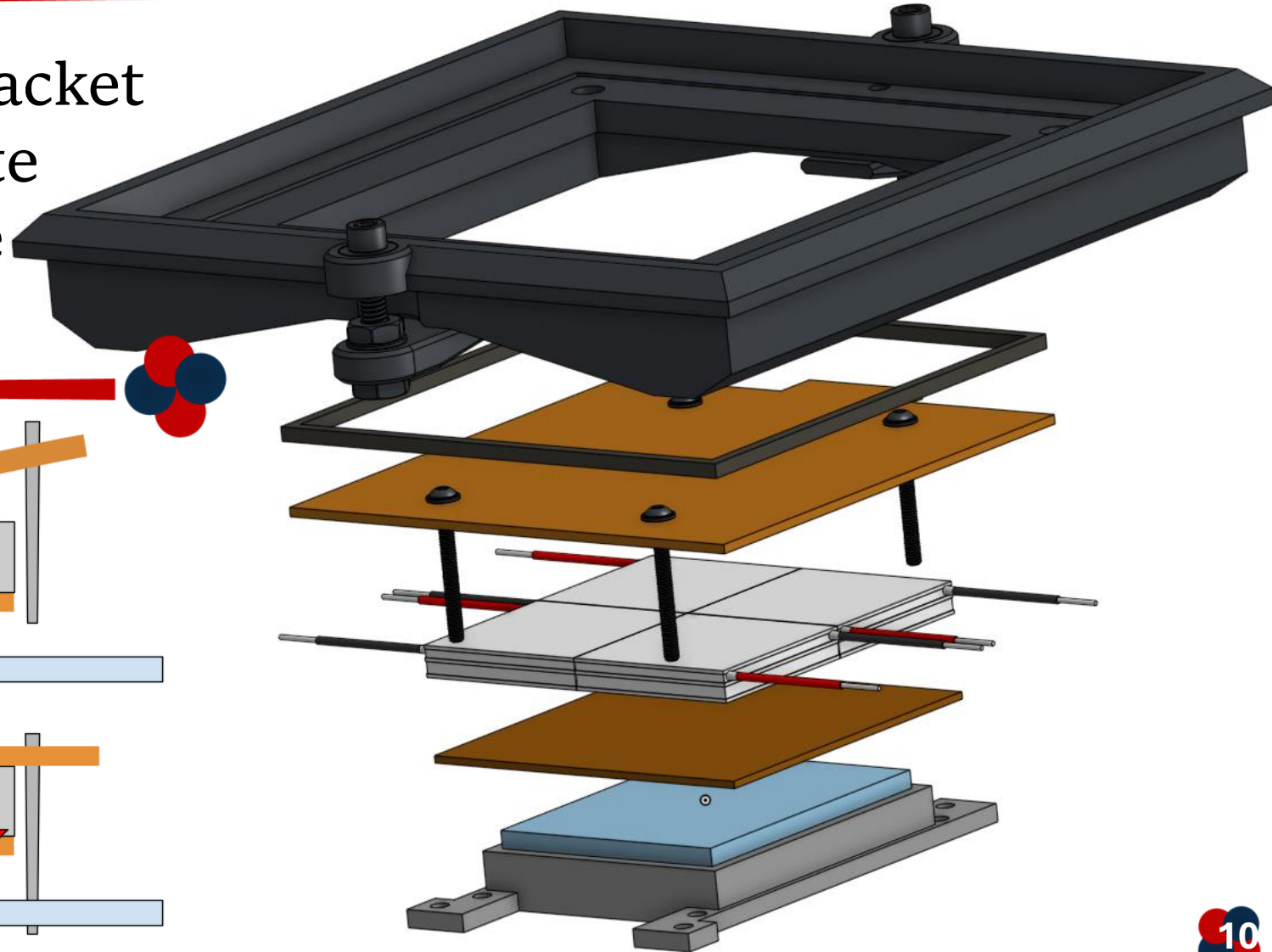
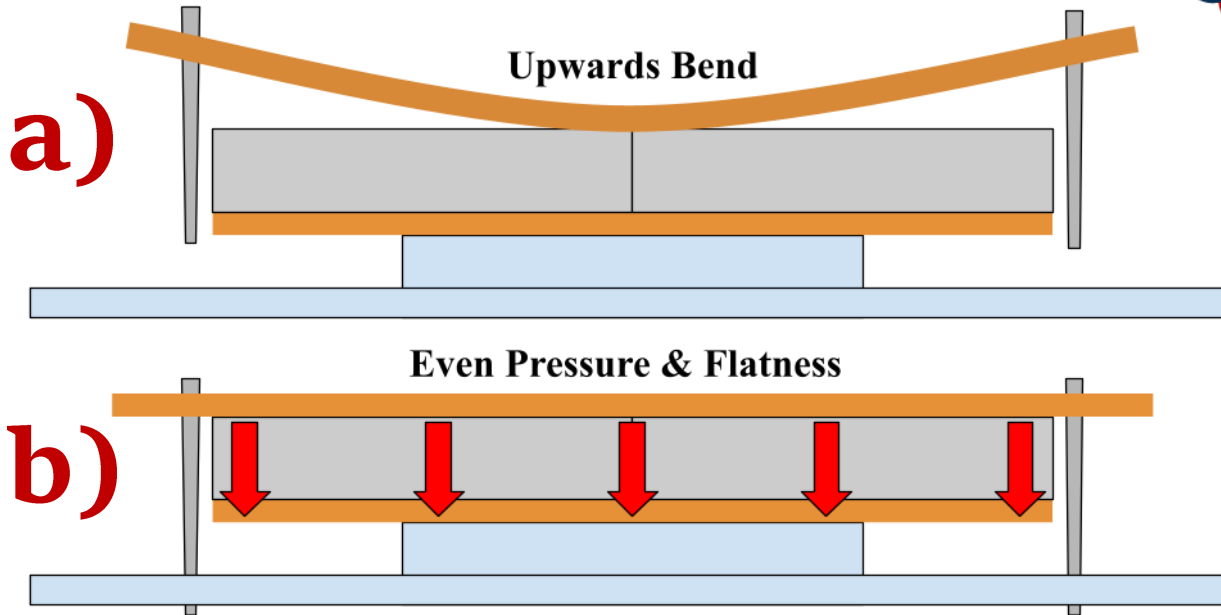
Success?

- Over-designed mounts
- Thicker top-plate
- Lapping and flattening
- Meticulous installations



The Solution(s)

1. Holes in top-plate and bracket
2. Upwards bend in top-plate
 - Minimum Temperature of -32.8°C



Particle Tracks Video



High-Voltage Clearing Field



>1600V !

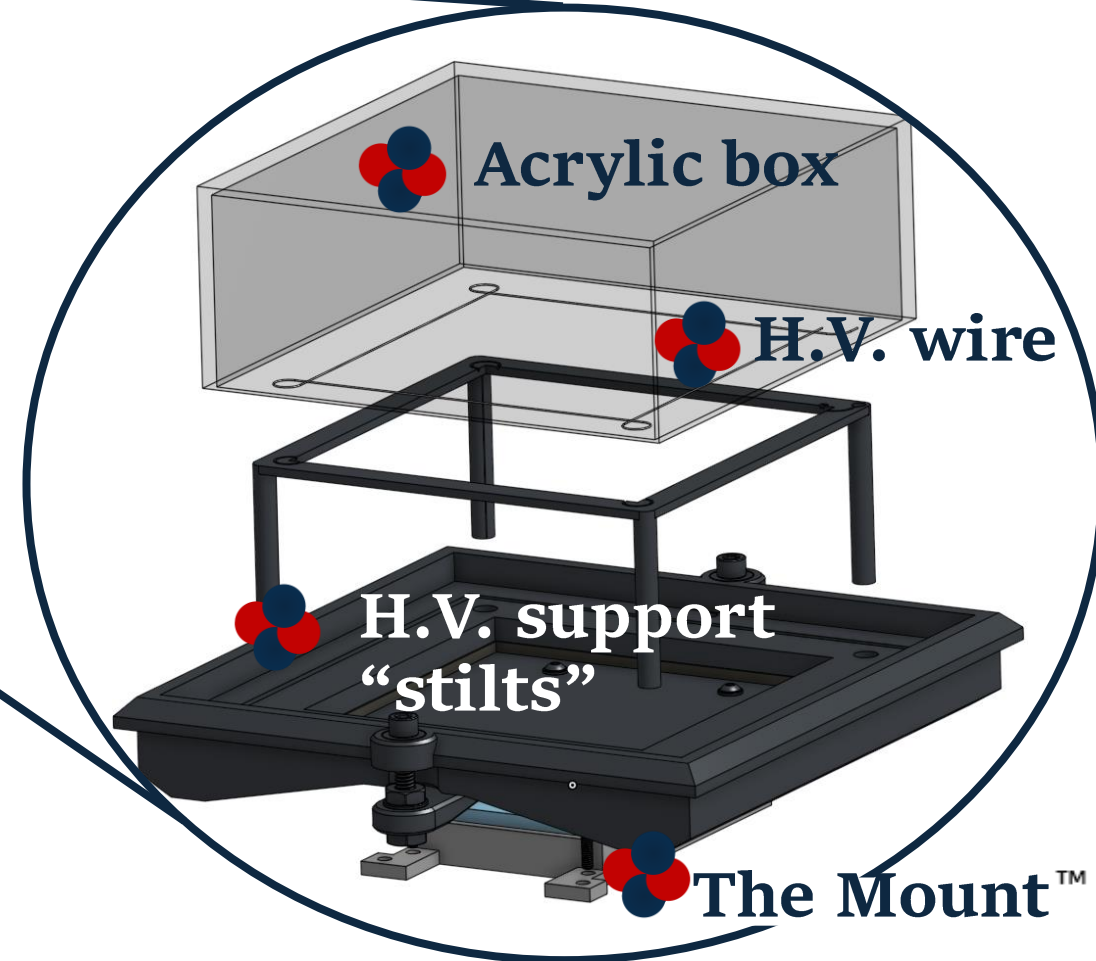
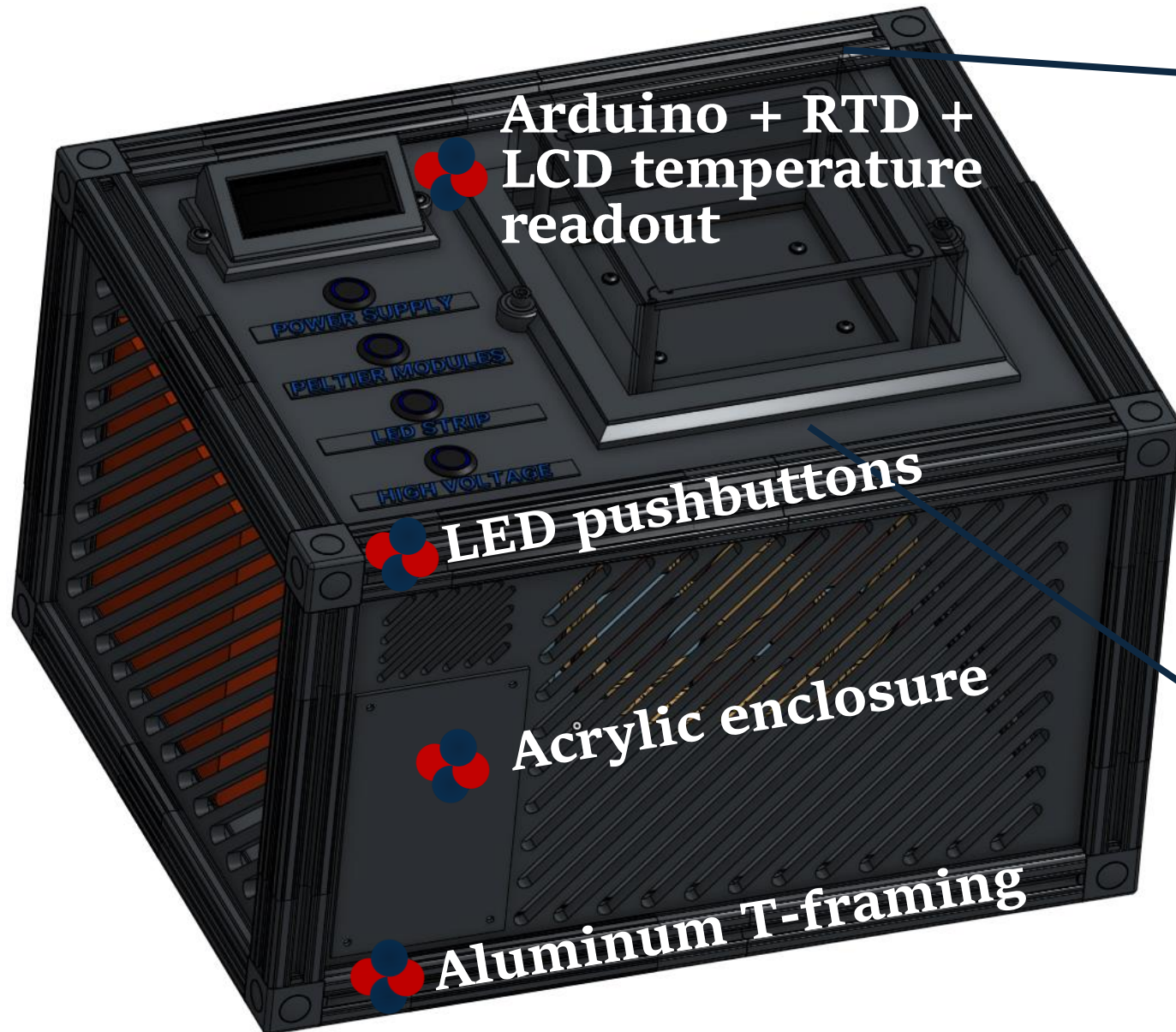


Without High Voltage

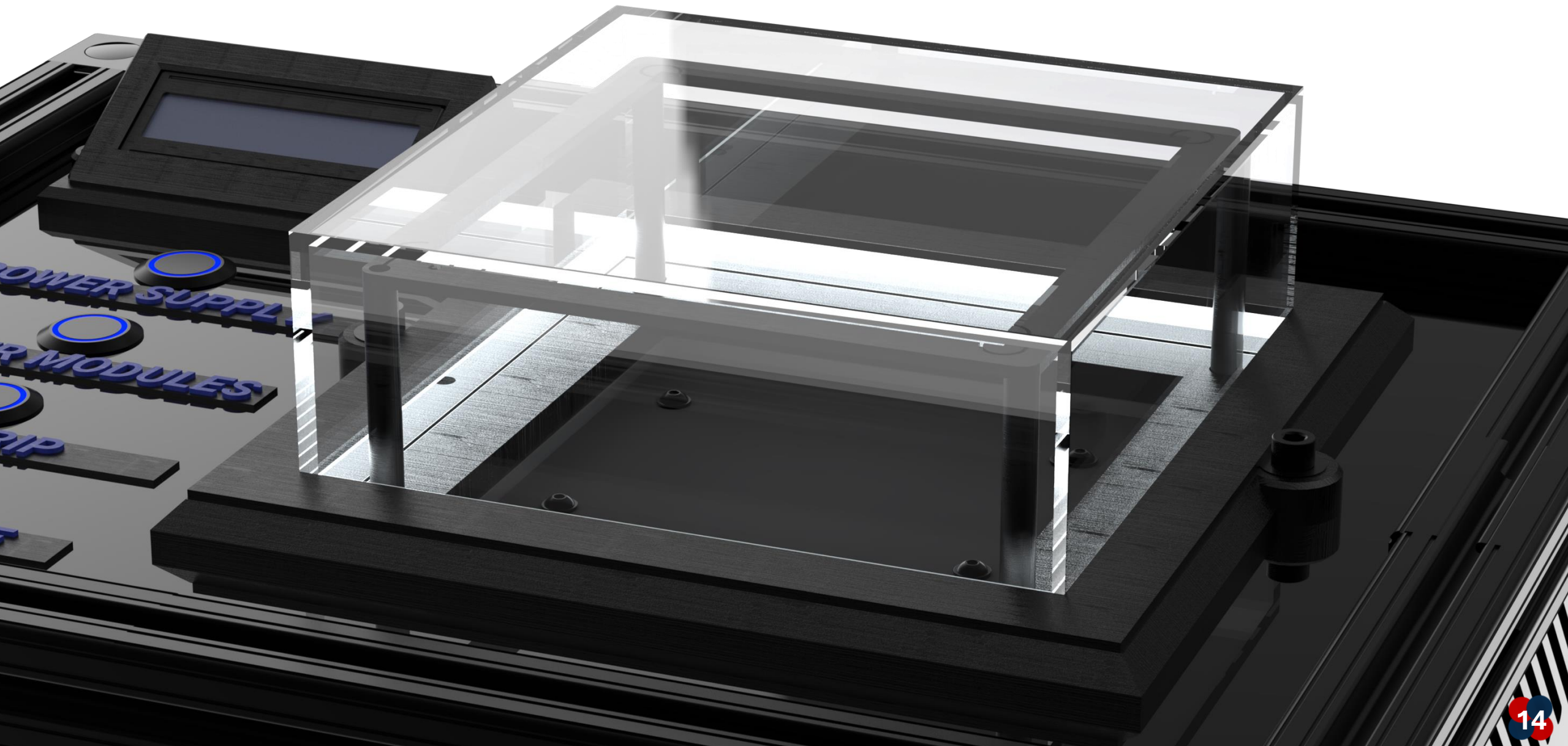


With High Voltage

A Tour of the Chamber



WHAT'S NEXT?



Conclusion

- Motivation
- Context
- Theory
- Testing
- Finalized design
- Next steps



Thanks to

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