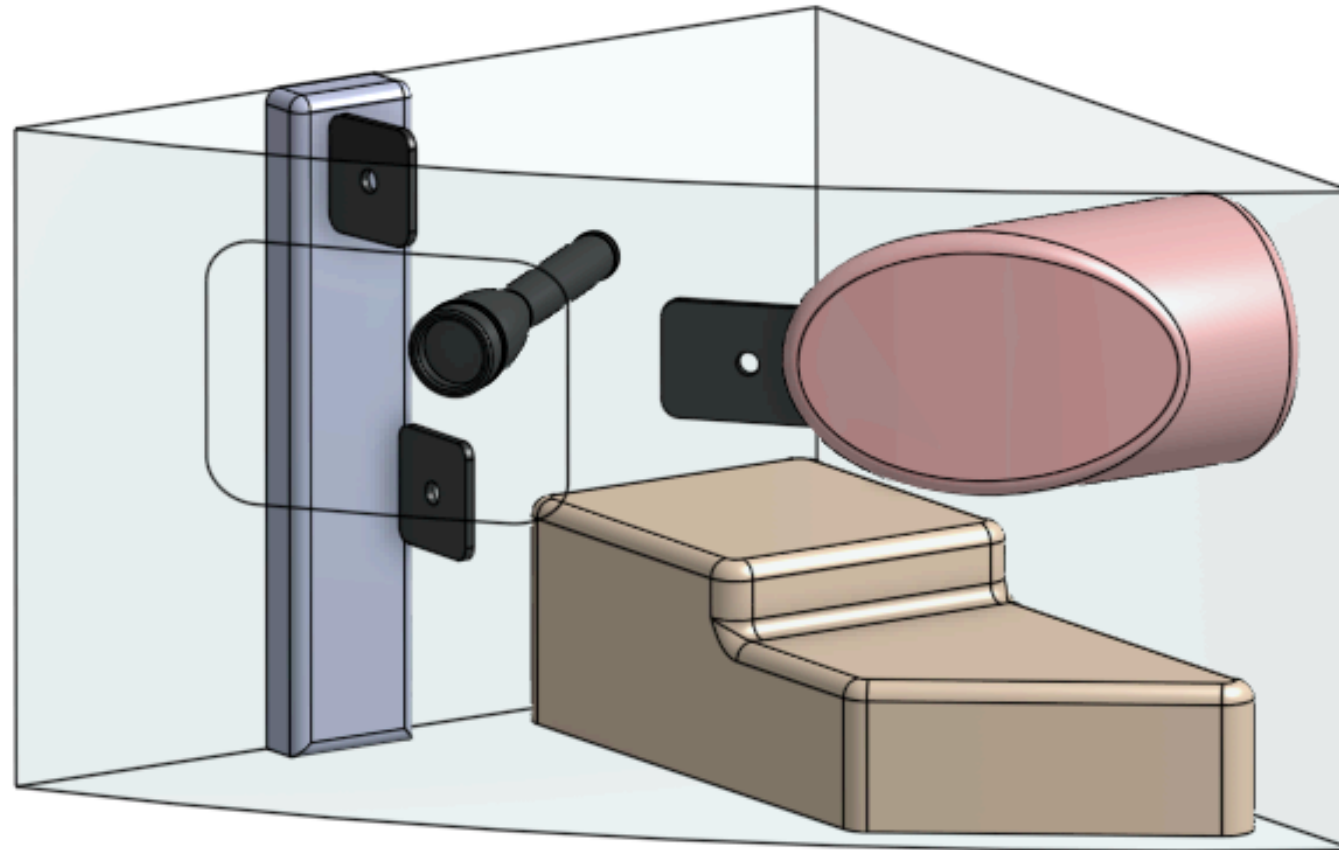
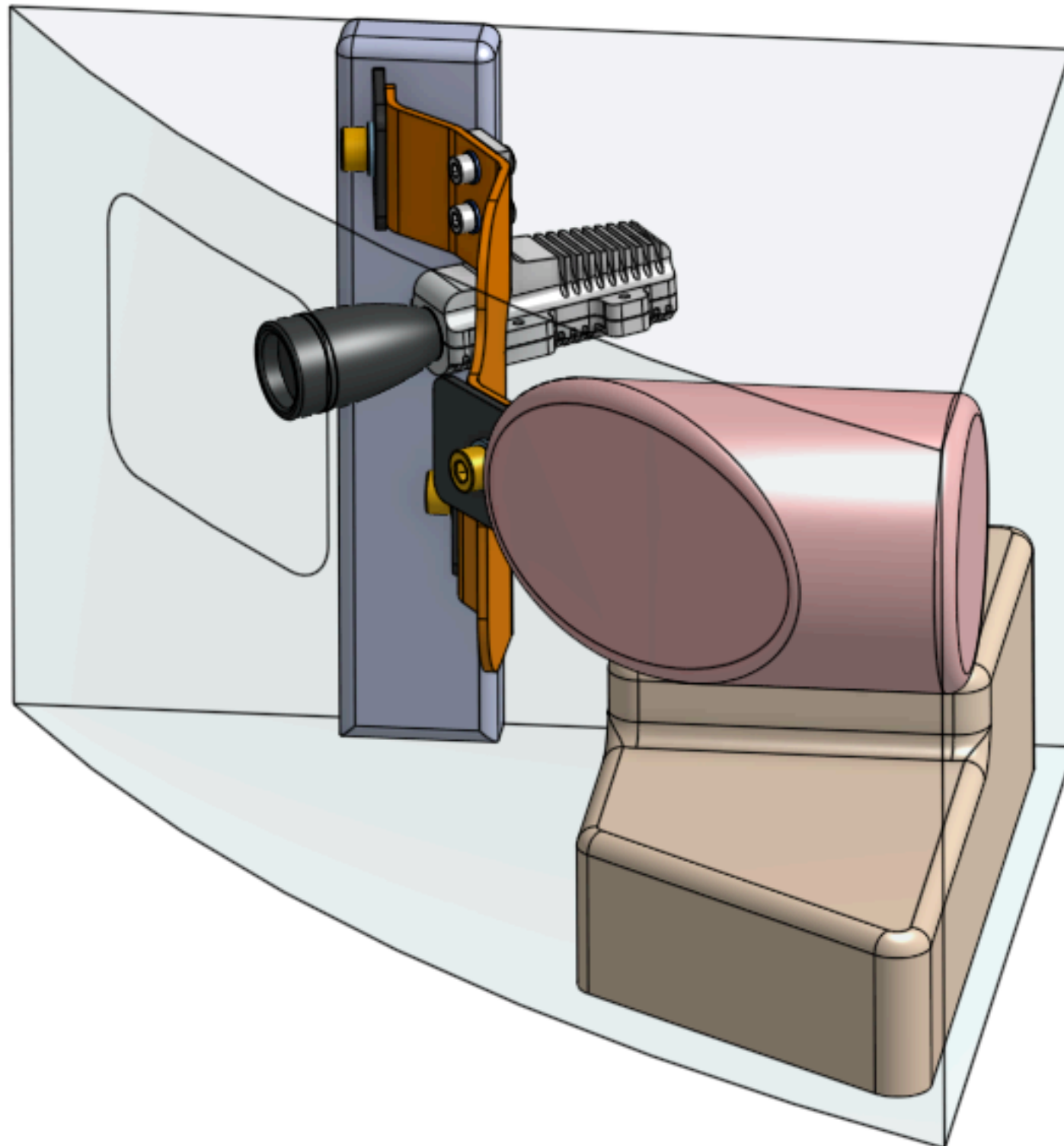


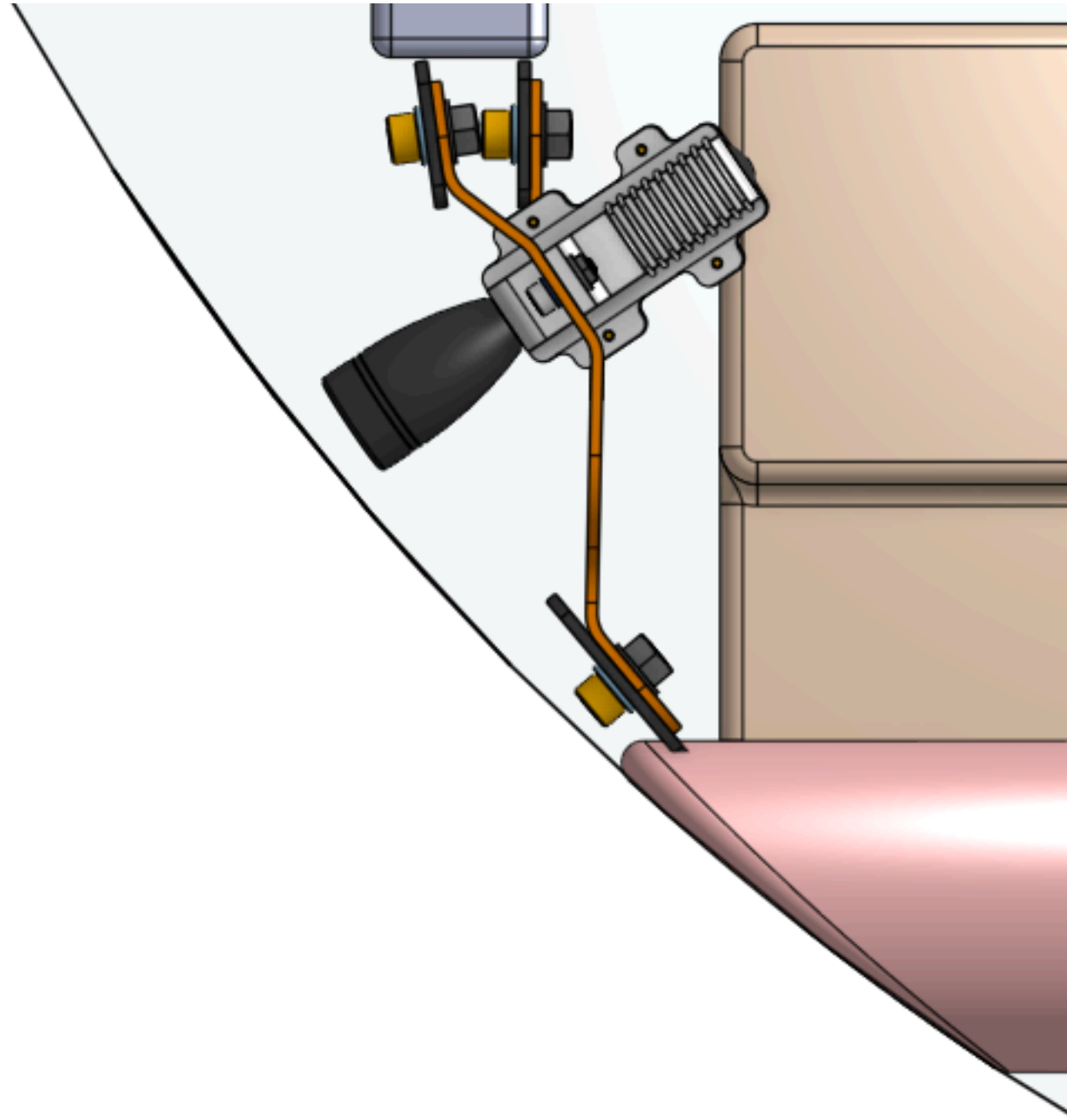
Flashlight Mount Problem



- **Mount flashlight in exact position rigidly**
- **Dissipate 30W uniformly along flashlight handle**
- **Max housing temperature of 85 °C**
- **Avoid mounting obstacles**

Solution





Materials

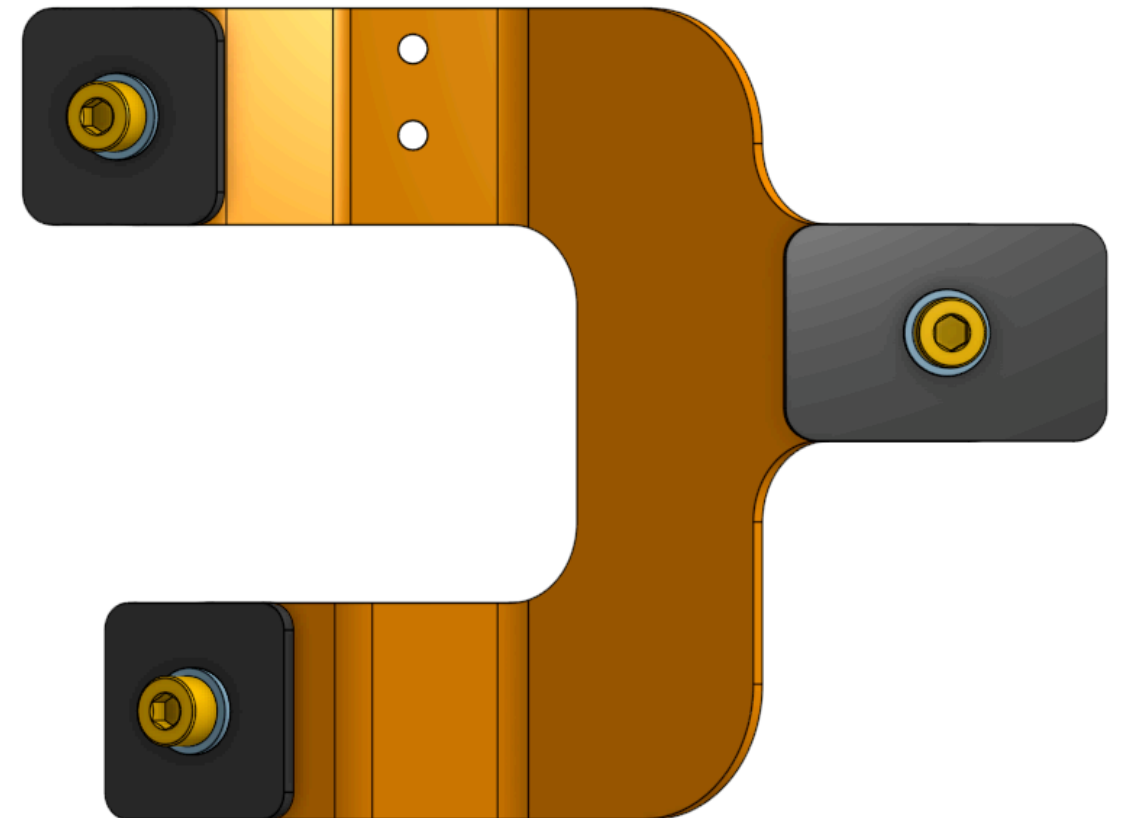
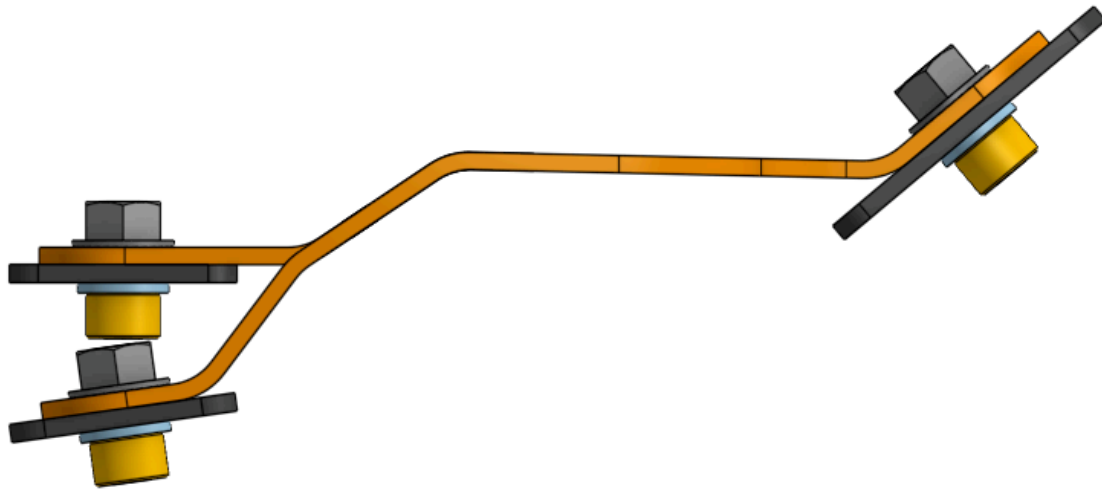
Mount Panel	Aluminum 6061-T6
Top Half Cover	Aluminum 6061-T6
Bottom Half Cover	Aluminum 6061-T6
Flashlight (approximate as solid)	Aluminum 6061-T6

6061 T6 offers good strength, thermal conductivity and machinability

Thermal Conductivity of 6061-T6: **167 W/(m*K)**

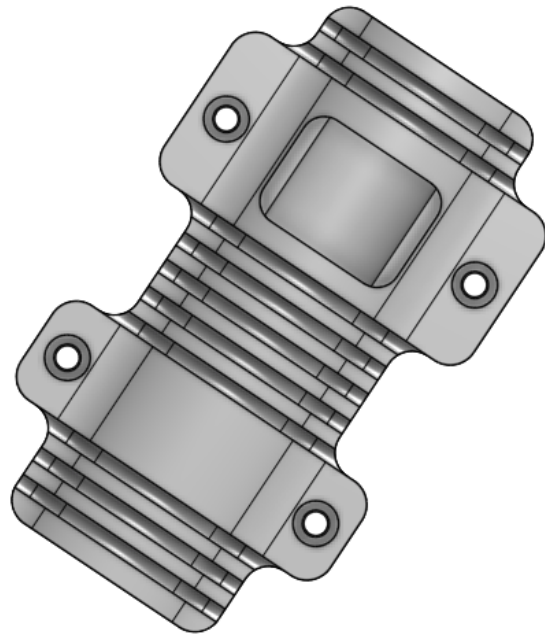
Specific Heat of 6061-T6: **900 J/(Kg*K)**

Design Decisions- Mount

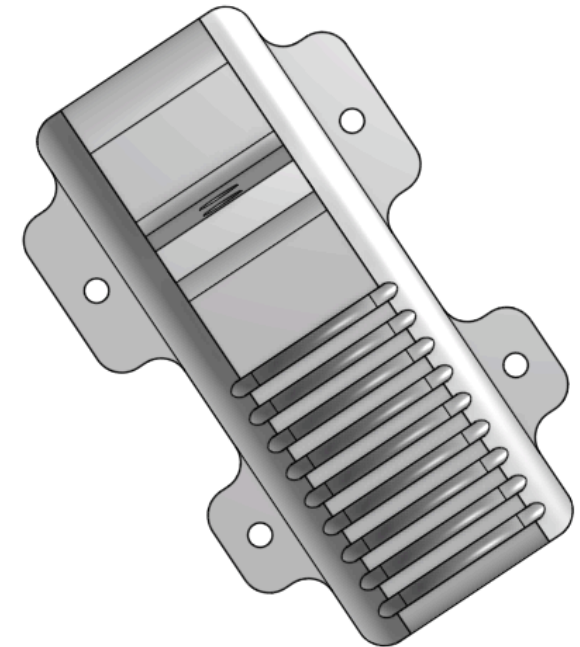
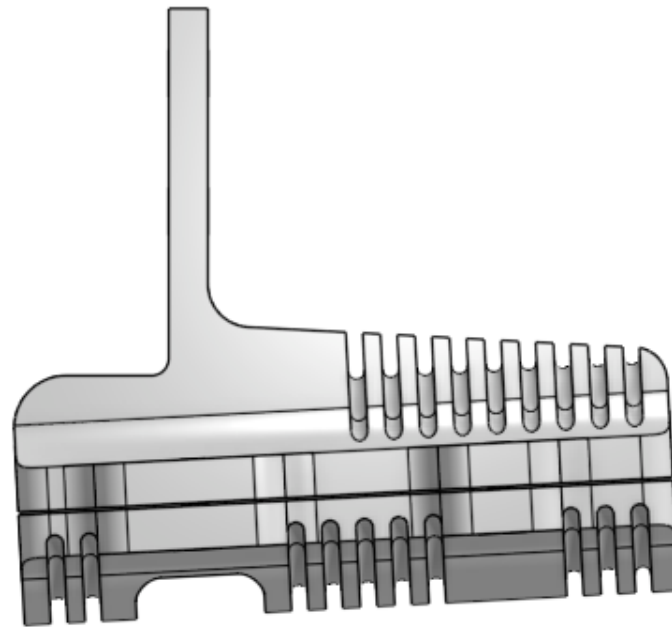


- 1) Minimize number of parts
 - One piece of 3mm sheet metal
- 2) Rigid Structure
 - Utilize all 3 mounting points for support
- 3) Ease of Assembly
 - Screws to mounting nodes are mounted in 1 direction (from outside facing in)

Design Decisions - Flashlight Covers



bottom half



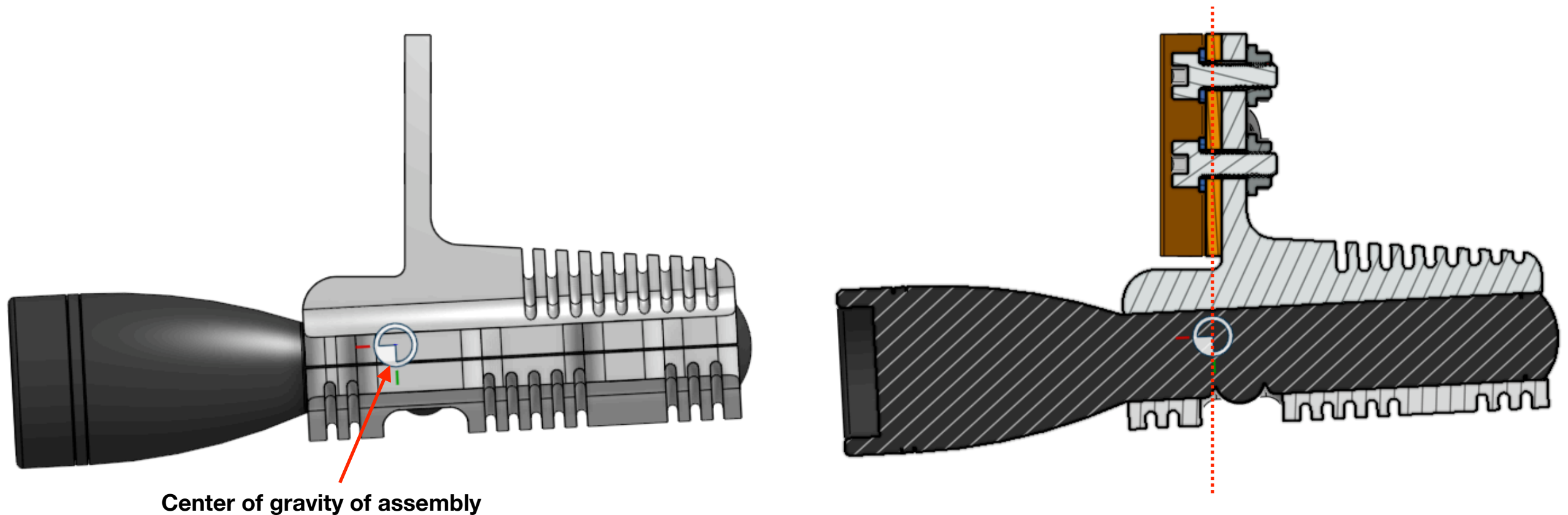
top half

1) Minimize parts
- 2 halves, made using CNC machining

2) Good cooling ability
- added fin structure (inspired by some flashlight designs)



Design Decisions - Flashlight Covers



**Mount flashlight + cover
assembly with its center of
gravity directly under center axis
of sheet metal mount panel**

**-reduces torque on mount panel
from flashlight assembly**

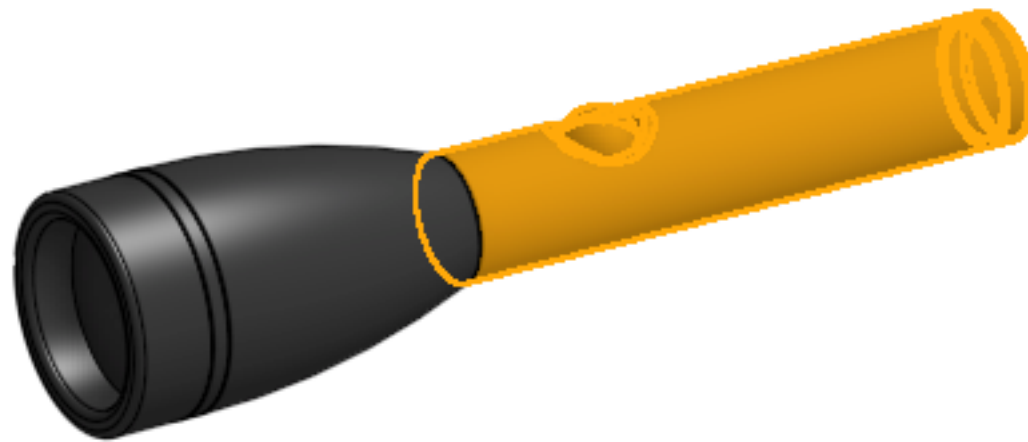
Thermal Analysis Setup

Uniform heat distribution along flashlight handle: **30 W**

Surface heat flux on handle: **7236 W/m²**

$$4145.644 \text{ mm}^2 = 0.0041456 \text{ m}^2$$

$$30\text{W}/(0.0041456\text{m}^2) = 7236.5 \text{ W/m}^2$$

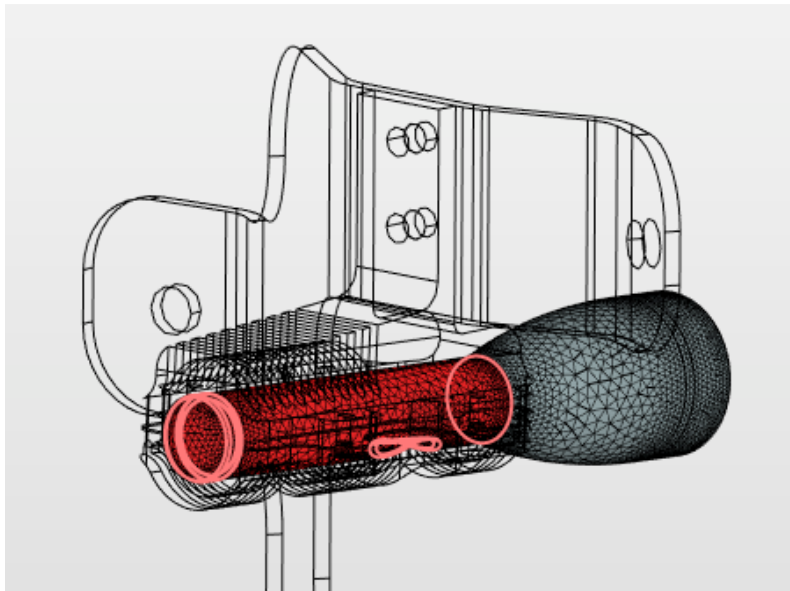


Area: **4145.644 mm²**

Reference Temperature: **293.15 K**

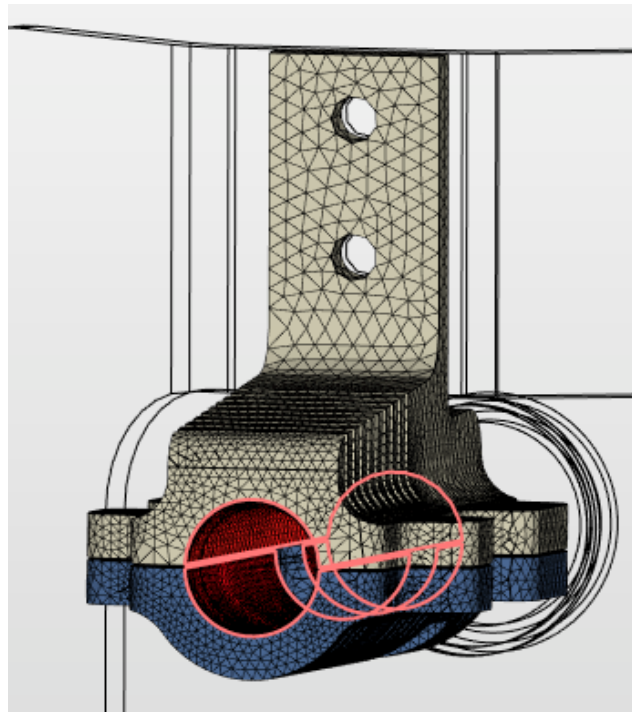
Convective Coefficient (natural convection of air) used: **15 W/(m²*K)**

Thermal Analysis Setup Cont.

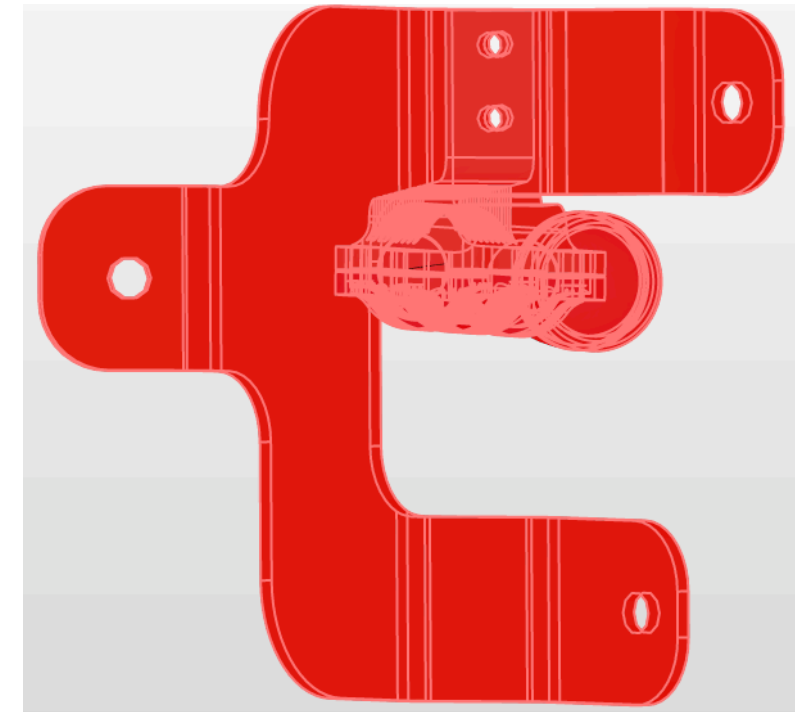


Heated Handle

- Includes flashlight button



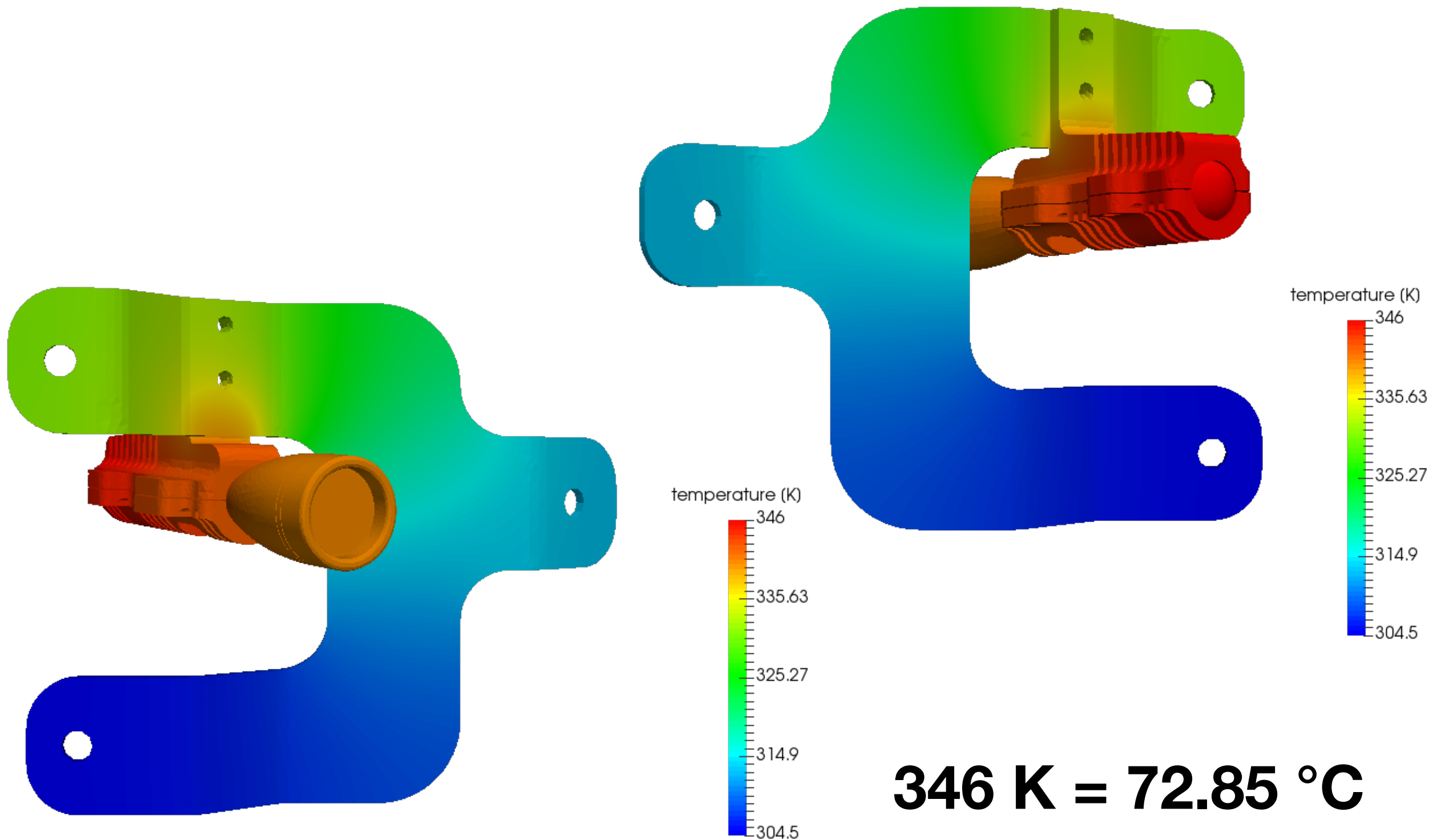
Internal contact surfaces



Convective surfaces

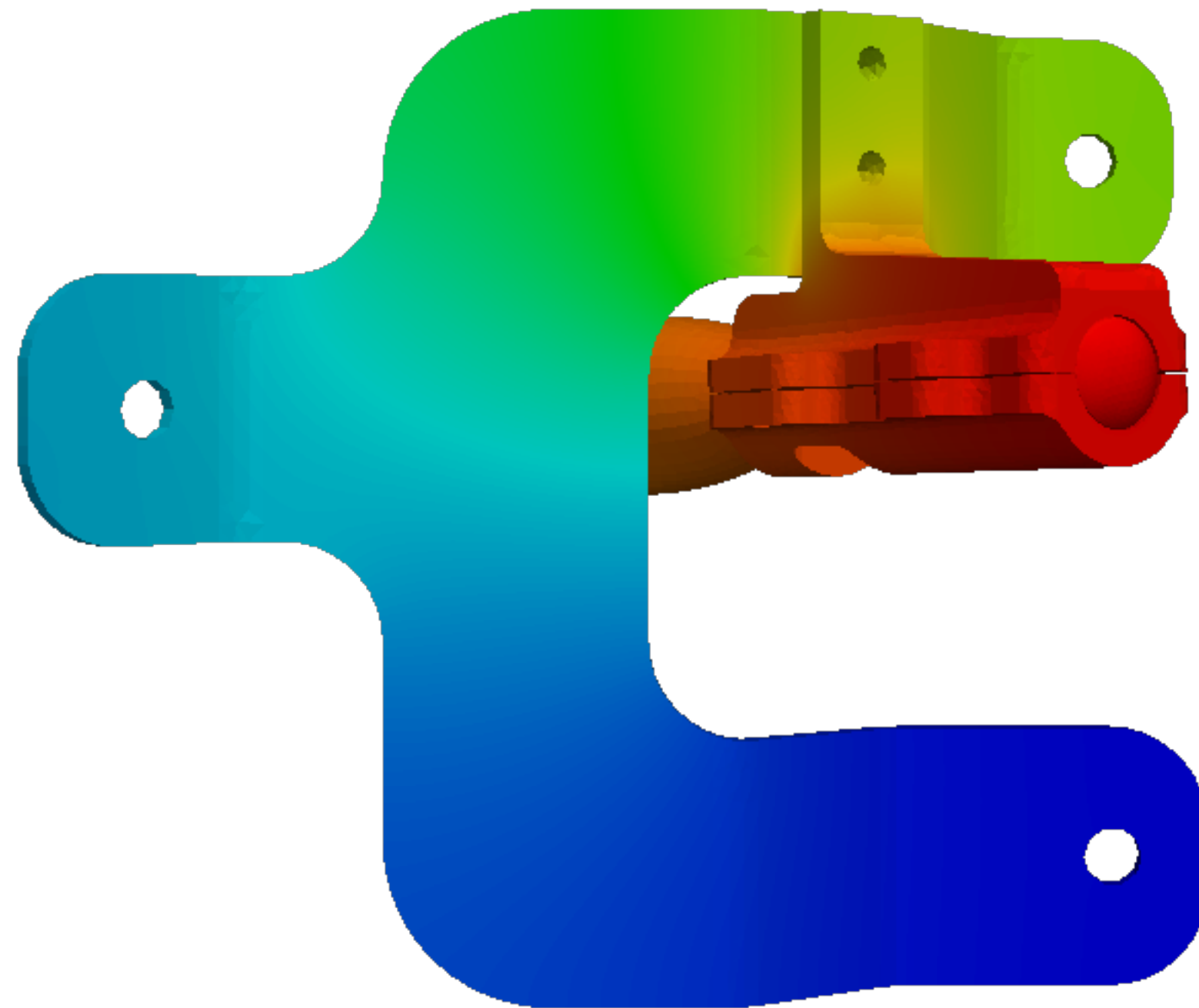
- Includes all surfaces except internal contact surfaces, covered parts of flashlight handle, flashlight lens, and contact areas between top and bottom cover halves

Thermal Analysis Results (Simscale)



* Under 85 °C max housing temperature

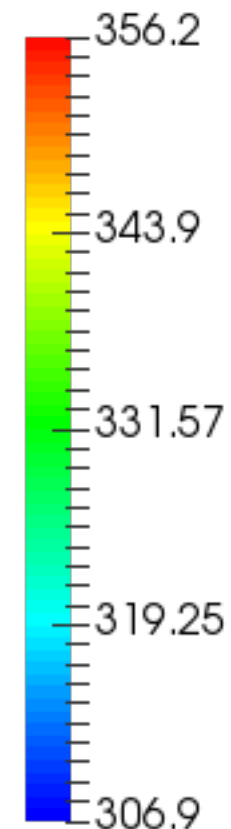
Thermal Analysis for Comparison (No Fins)



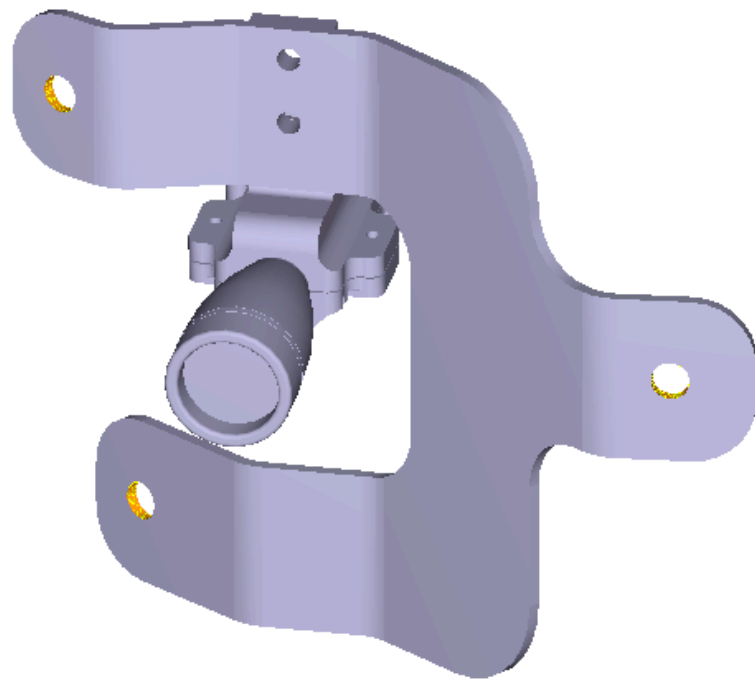
356.2 K = 83.5 °C

**Adding fins to structure
reduces max
temperature by 10.65 °C**

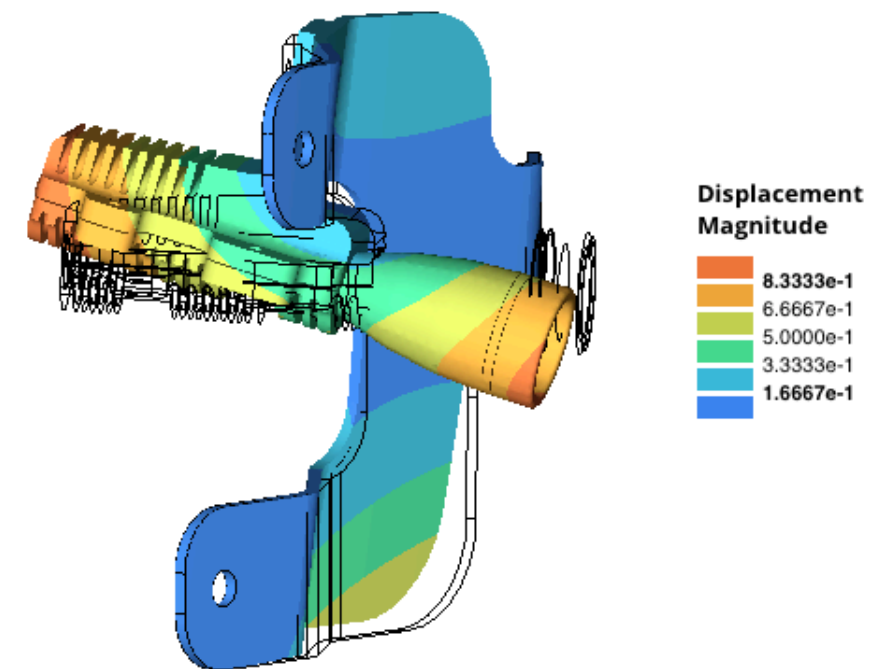
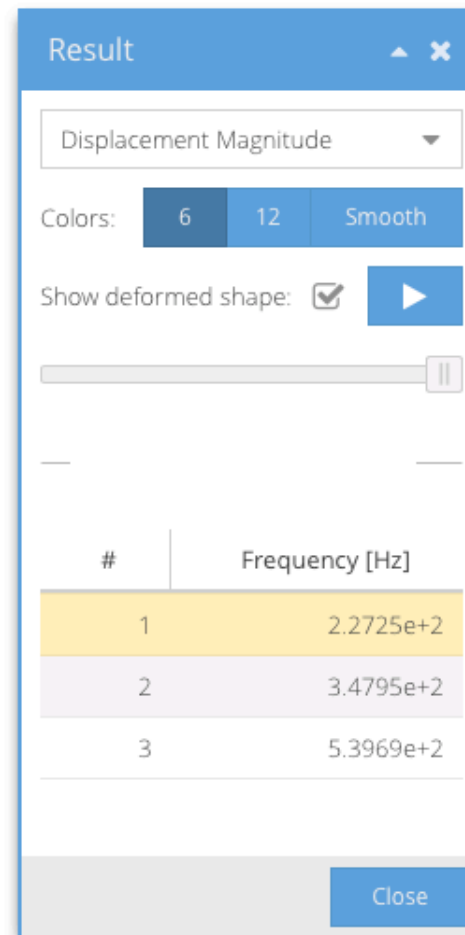
temperature (K)



Modal Analysis (Simsolid)



3 constraints at mounting points



First Mode: ~227.2 Hz