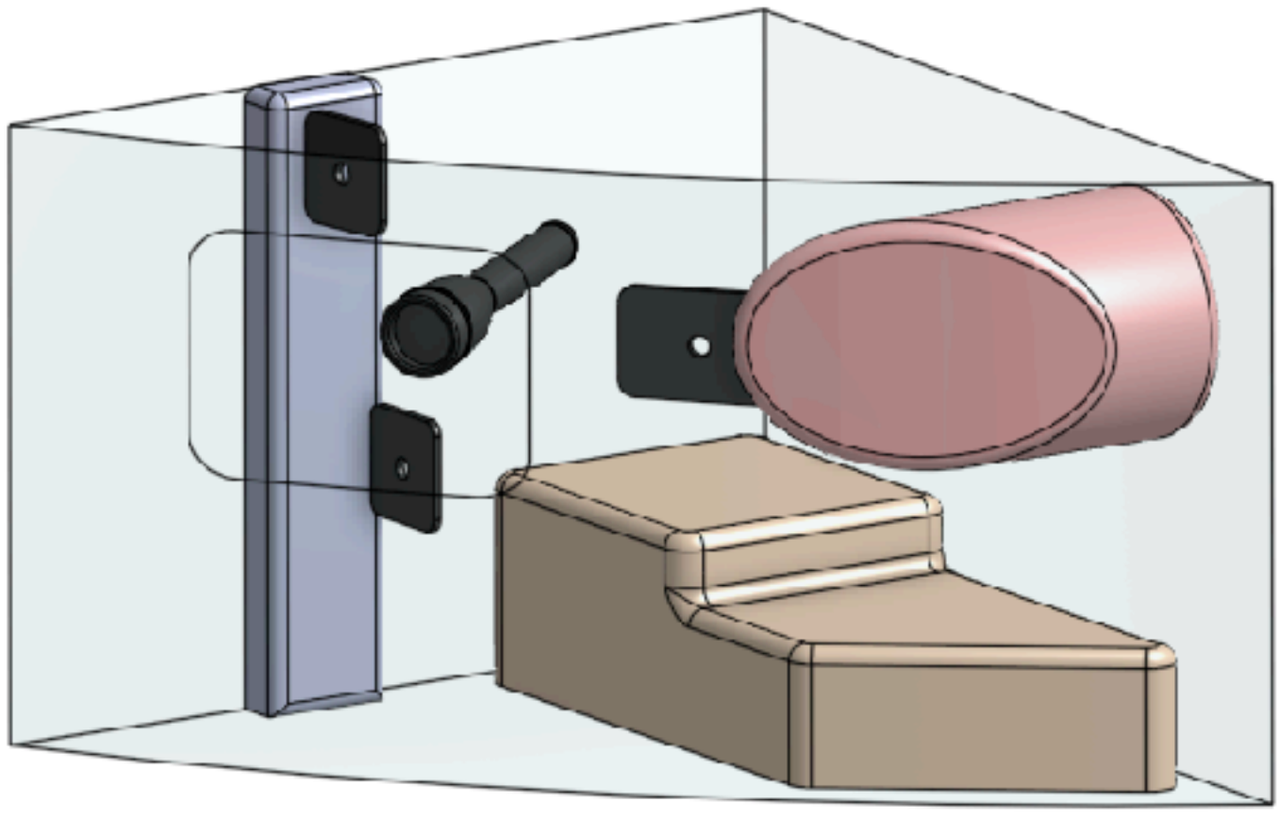
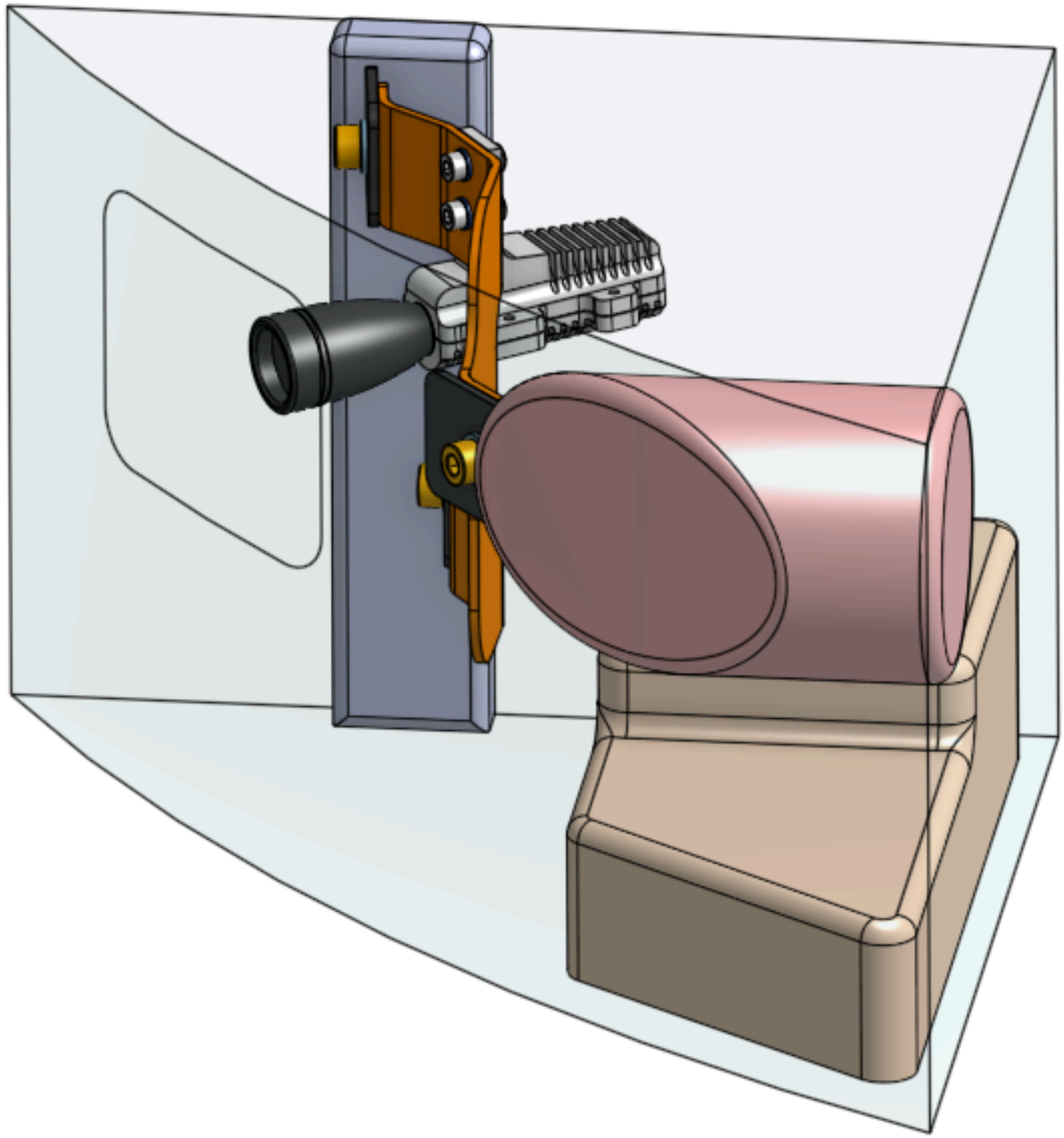
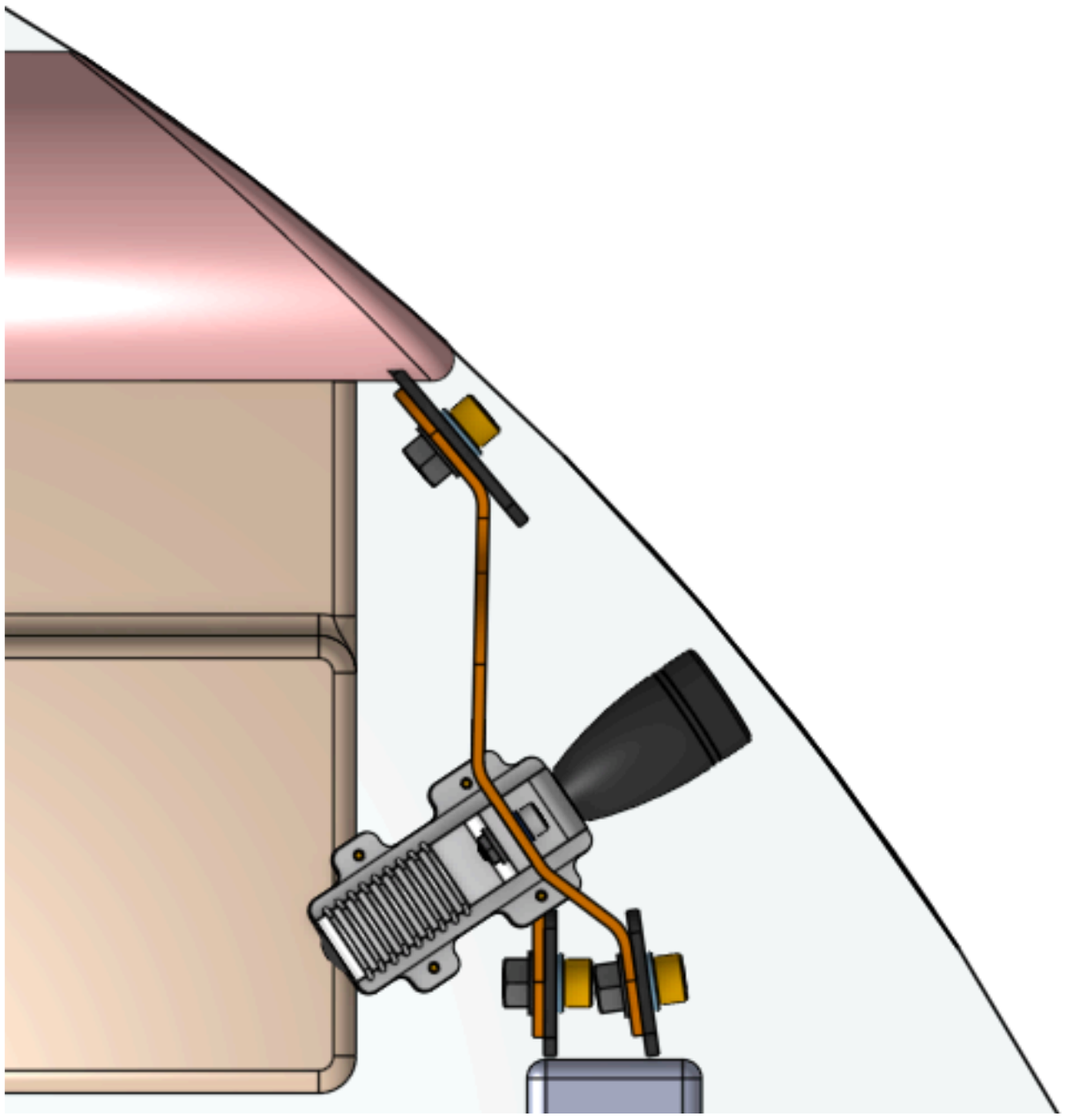
# Flashlight Mount Problem



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

# Solution





# Materials

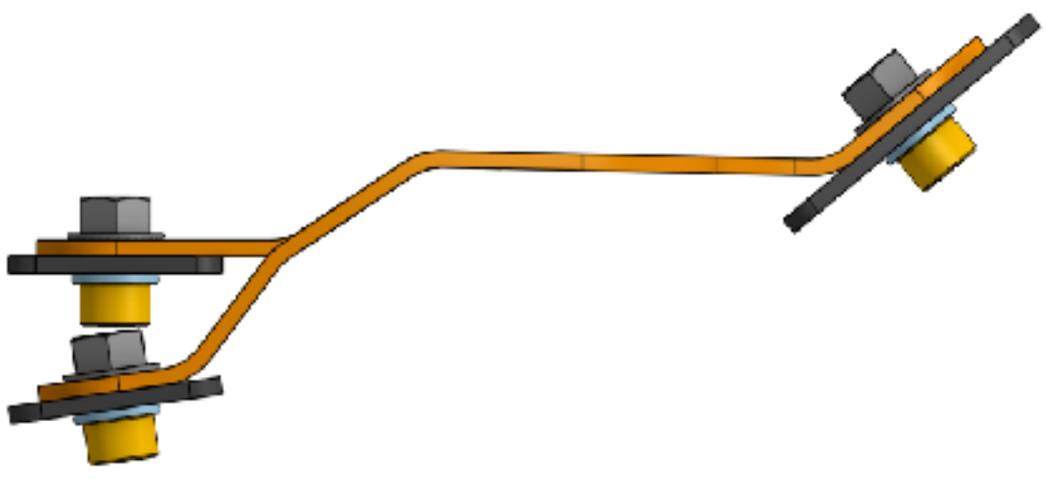
| | |
|---|---|
| Mount Panel | Aluminum 6061-T6 |
| Top Half Cover | Aluminum 6061-T6 |
| Bottom Half Cover | Aluminum 6061-T6 |
| Flashlight (approximate as solid) | Aluminum 6061-T6 |

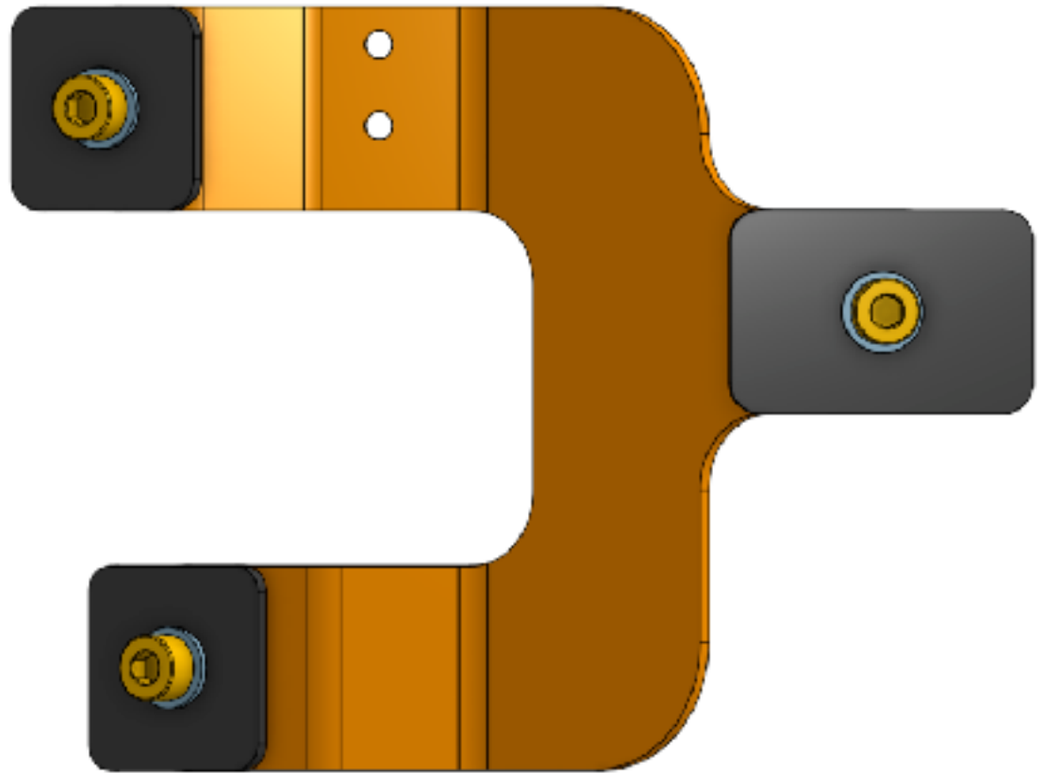
6061 T6 offers good strength, thermal conductivity and machinability

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

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

# Design Decisions- Mount



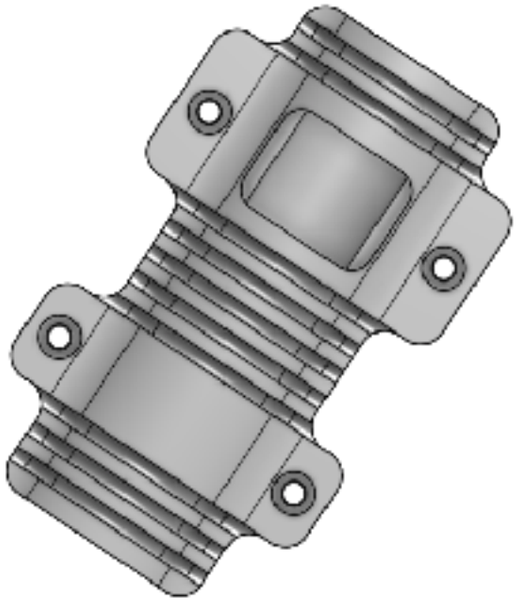


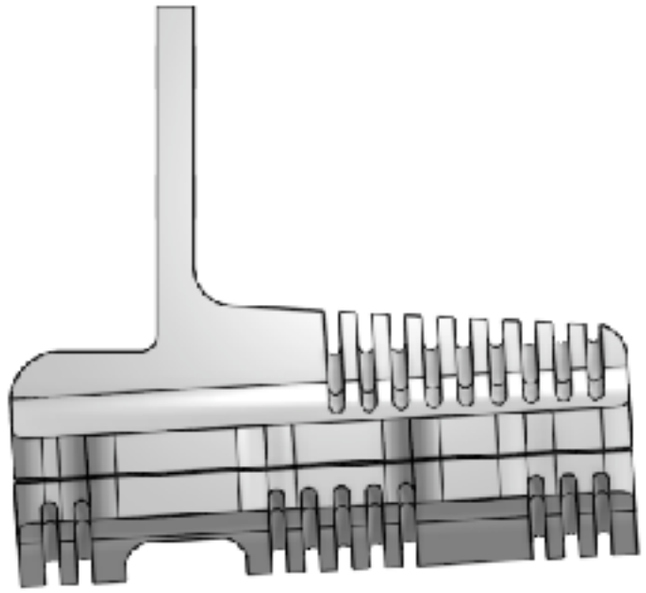
**1) Minimize number of parts**
**- One piece of 3mm sheet metal**

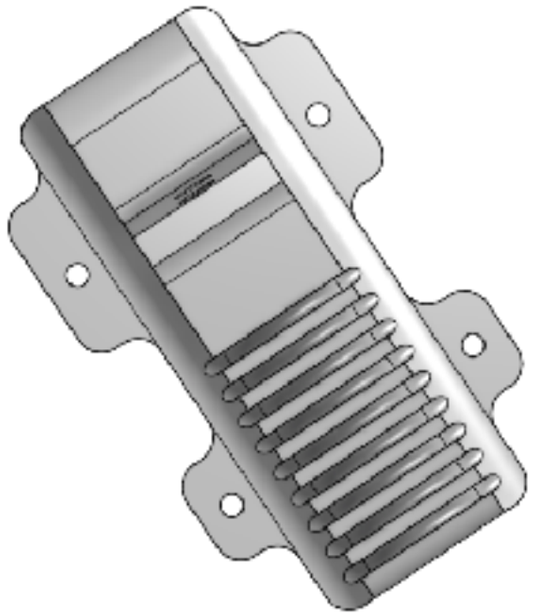
**2) Rigid Structure**
**- Utilize all 3 mounting points for support**

**3) Ease of Assembly**
**- Screws to mounting nodes are mounted in 1 direction (from outside facing in)**

# Design Decisions - Flashlight Covers







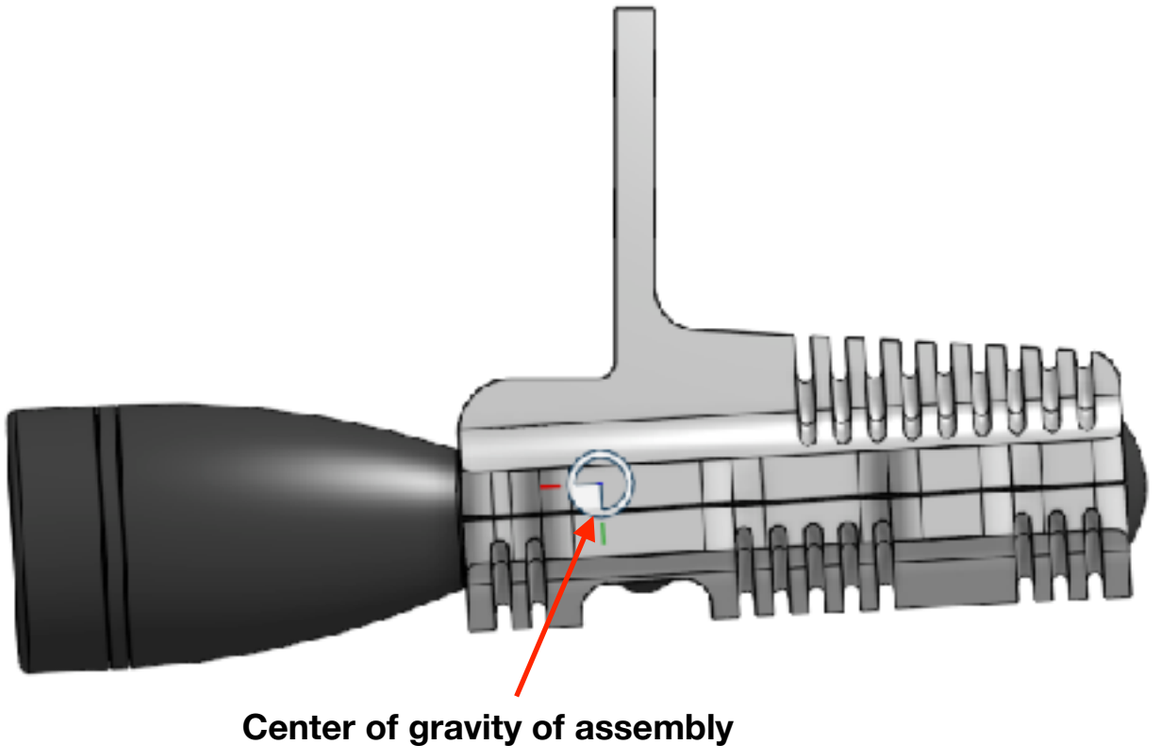
bottom half

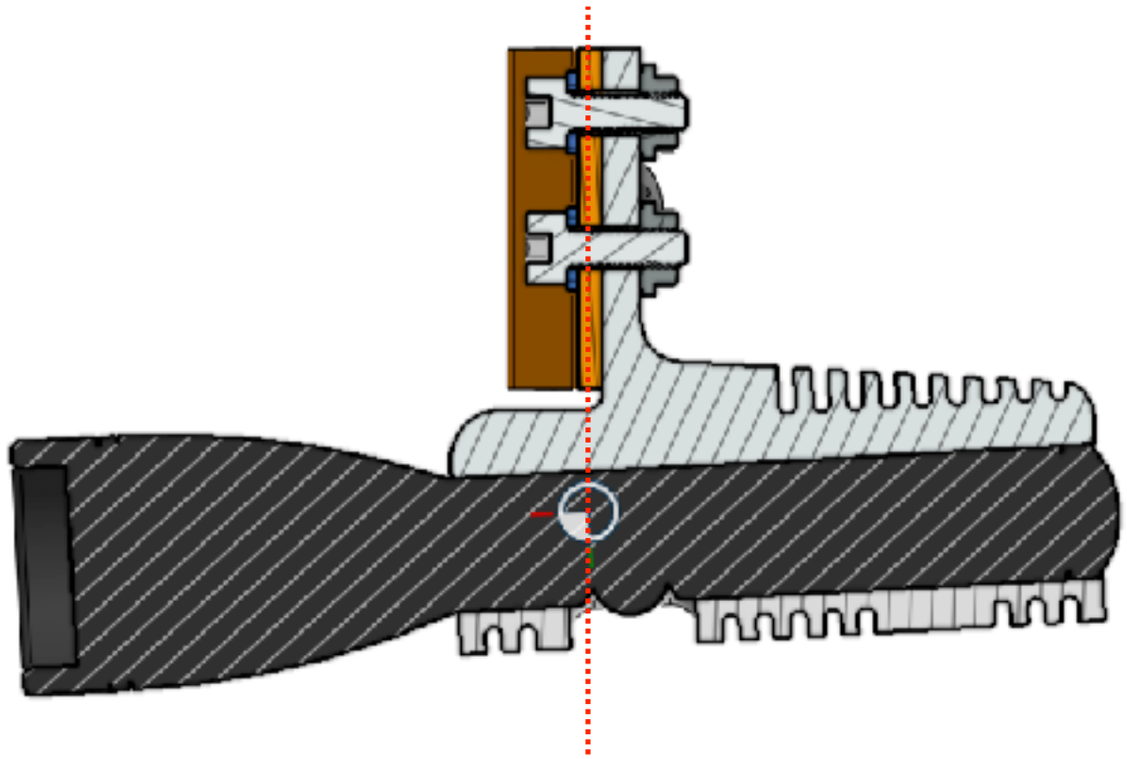
top half

**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**

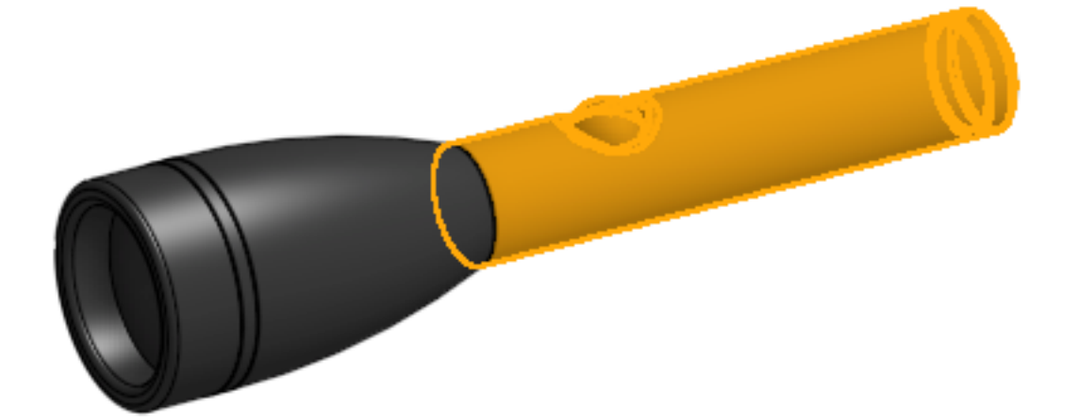
# Thermal Analysis Setup

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

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

4145.644 mm² = 0.0041456 m²

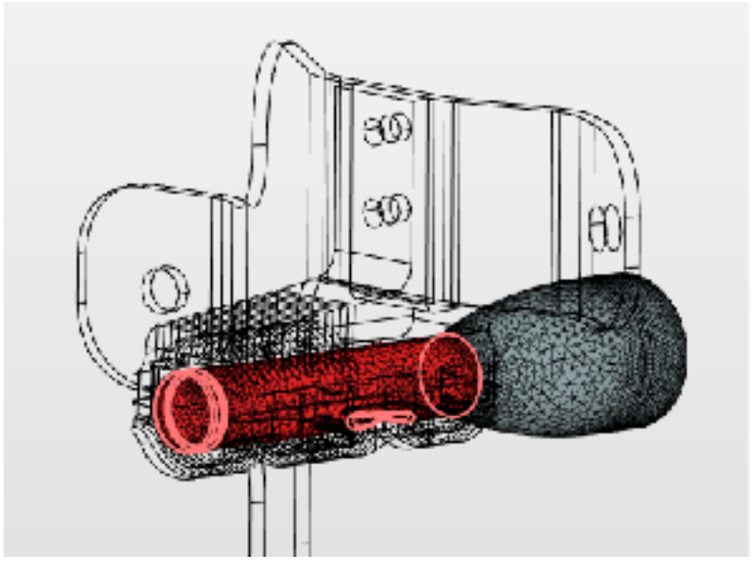
30W/(0.0041456m²) = 7236.5 W/m²




Reference Temperature: **293.15 K**

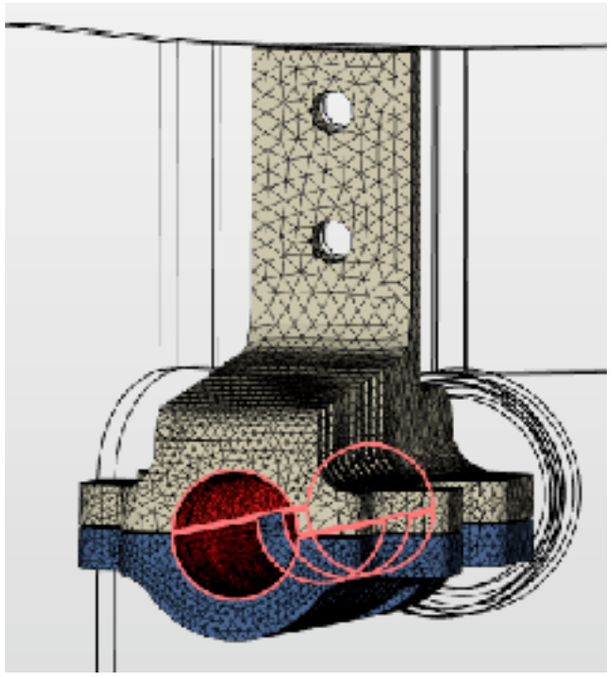
Convective Coefficient (natural convection of air) used: **15 W/(m²*K)**

# Thermal Analysis Setup Cont.

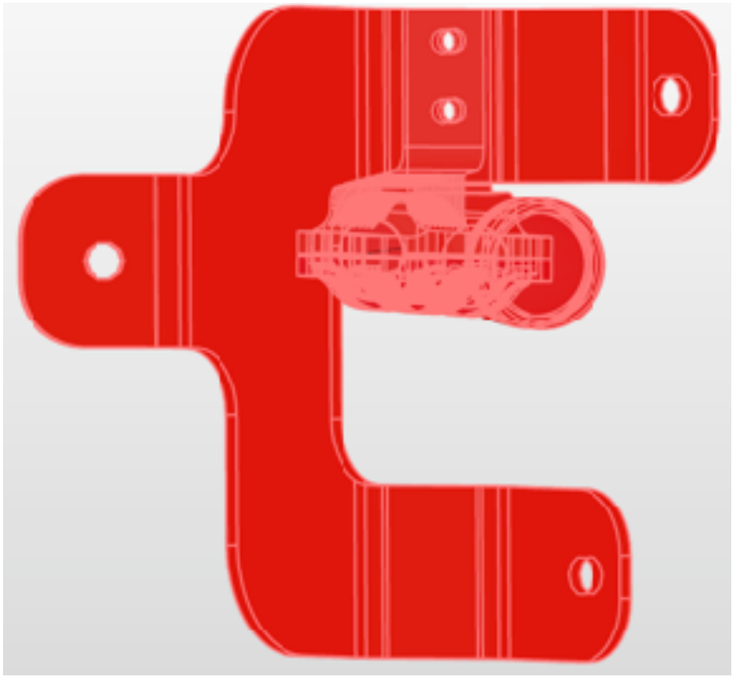


## Heated Handle

- Includes flashlight button



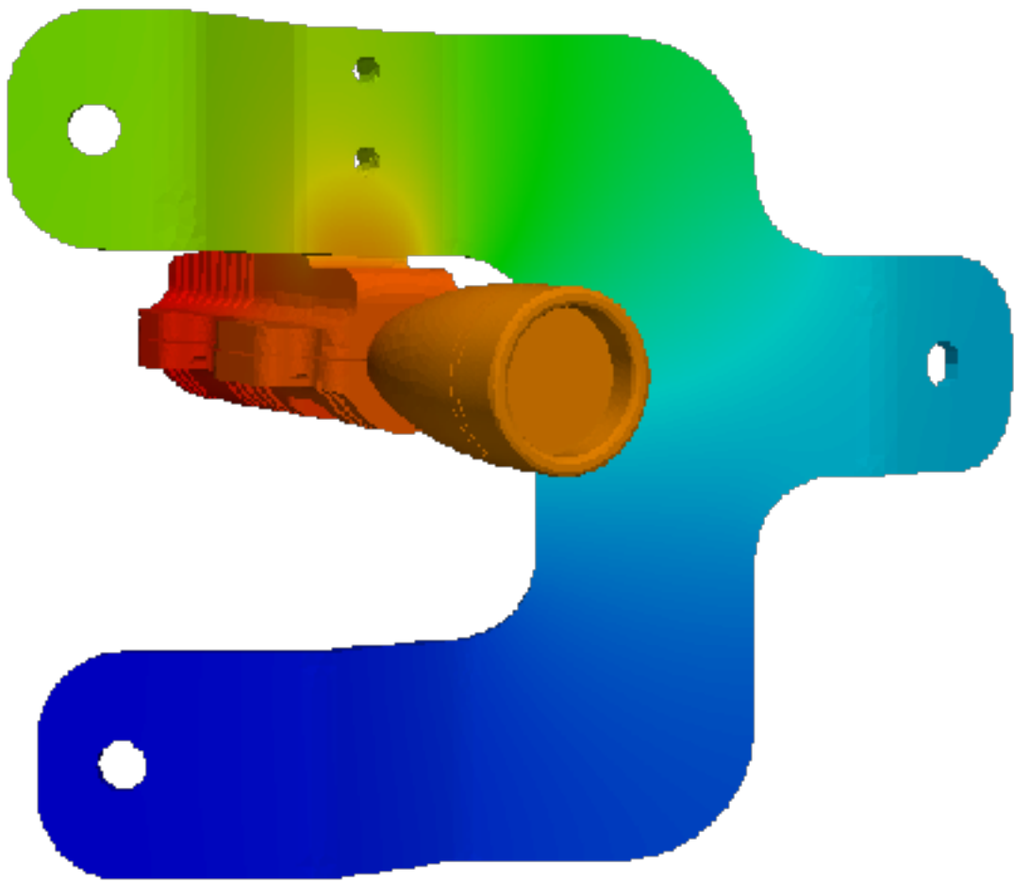
## Internal contact surfaces

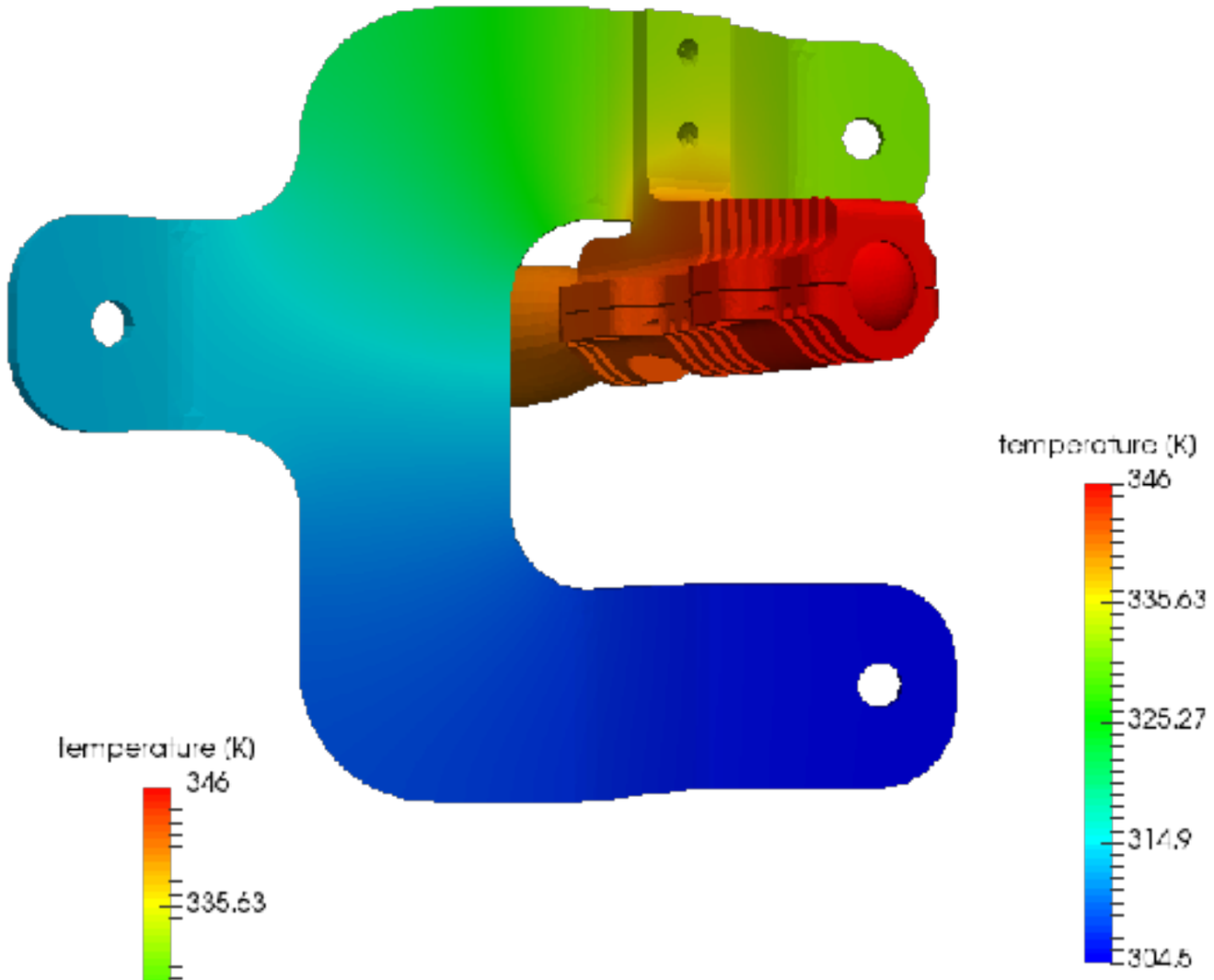


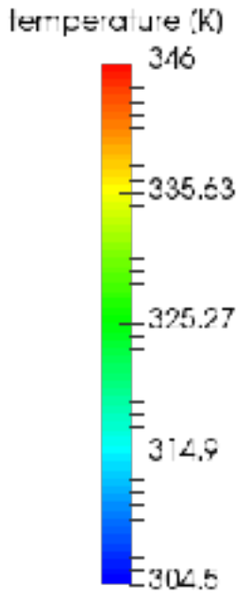
## Convective surfaces

- 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)



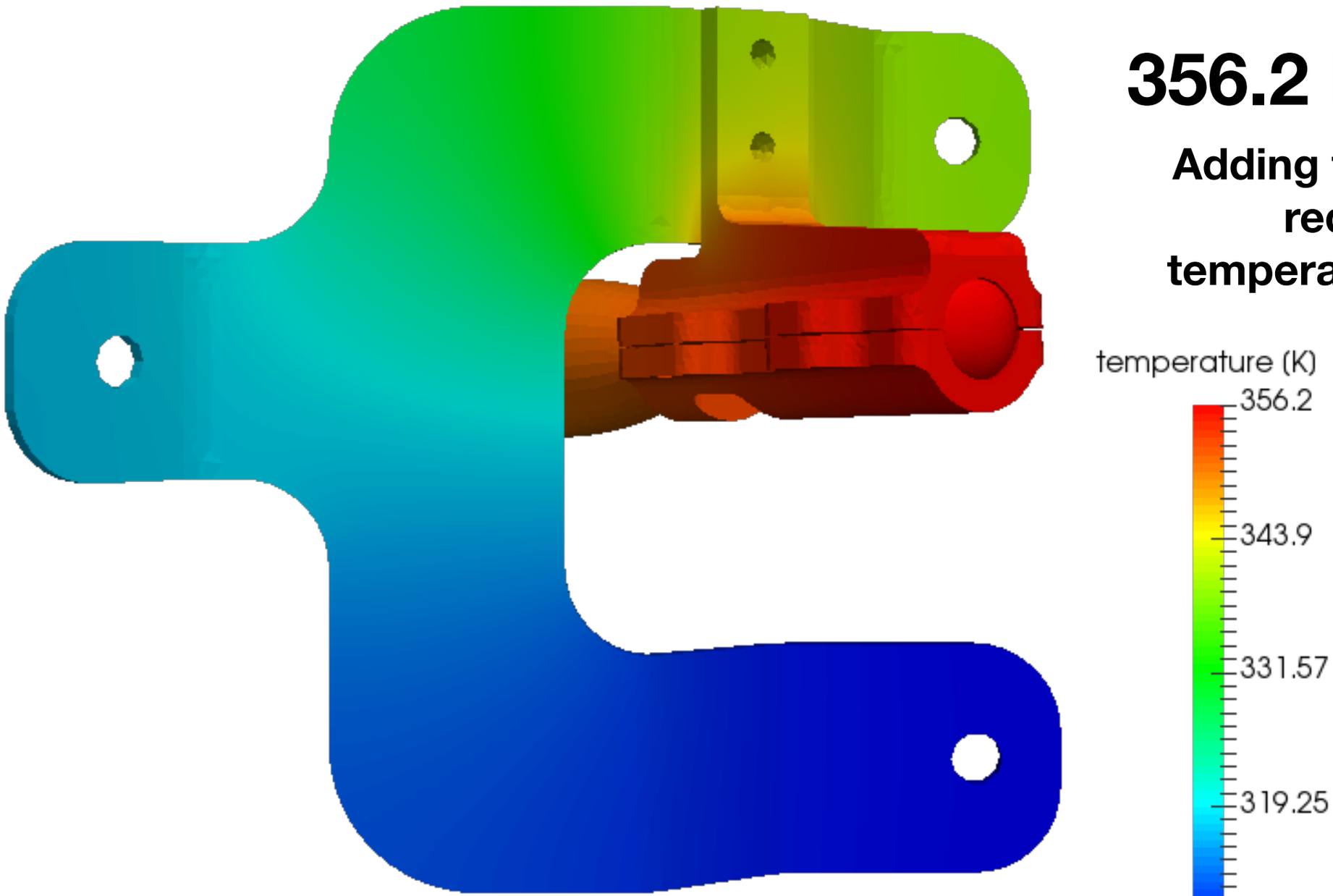



**346 K = 72.85 °C**

*** Under 85 °C max housing temperature**

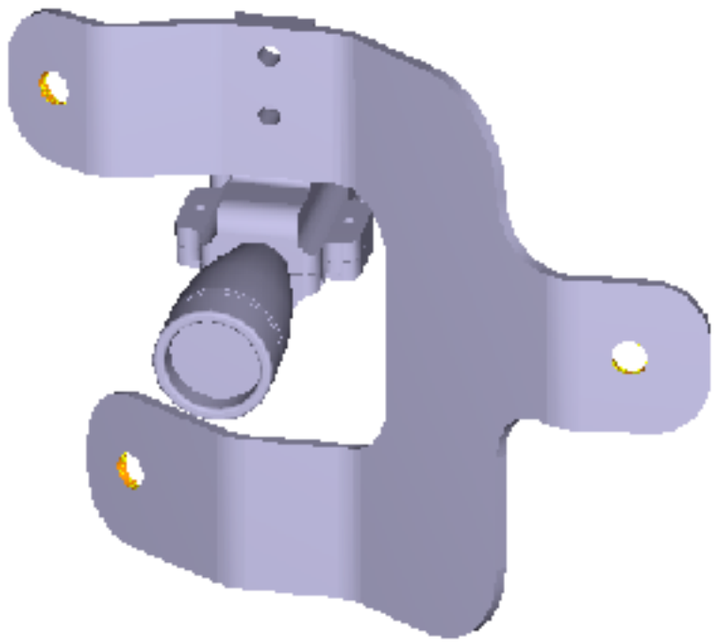
# Thermal Analysis for Comparison (No Fins)

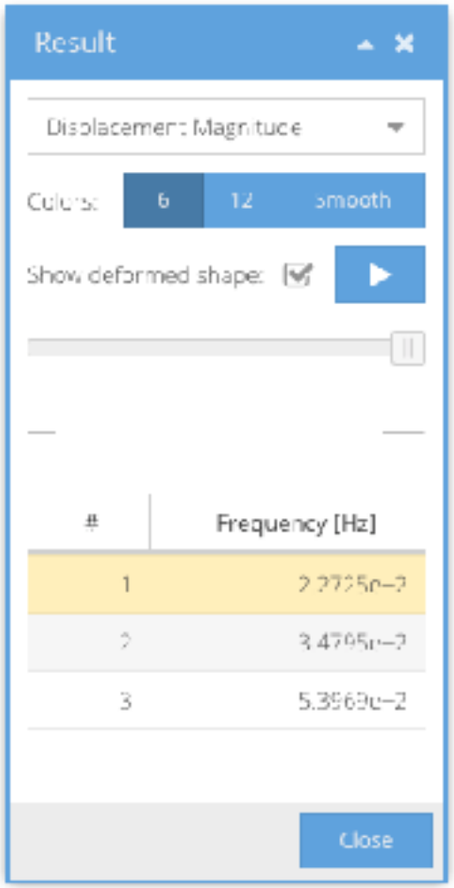


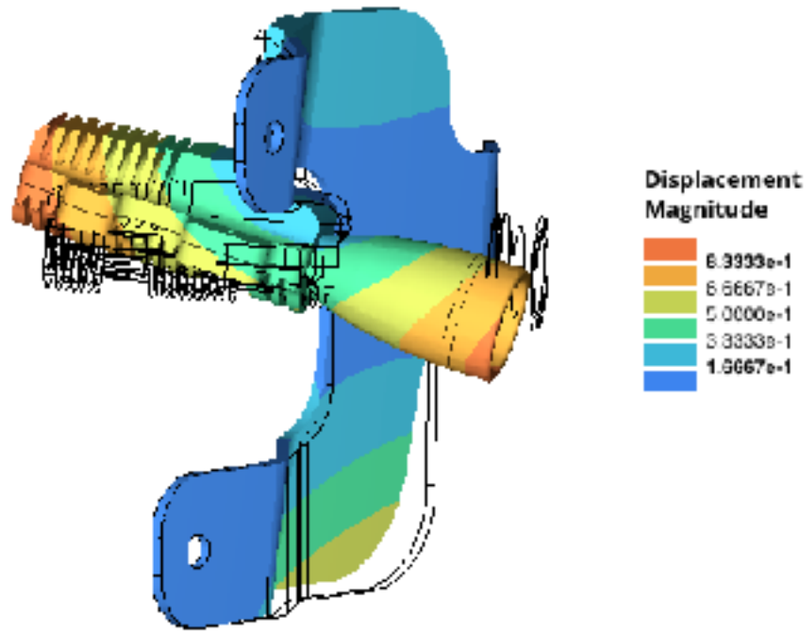

**356.2 K = 83.5 °C**

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

# Modal Analysis (Simsolid)






**3 constraints at mounting points**

**First Mode: ~227.2 Hz**