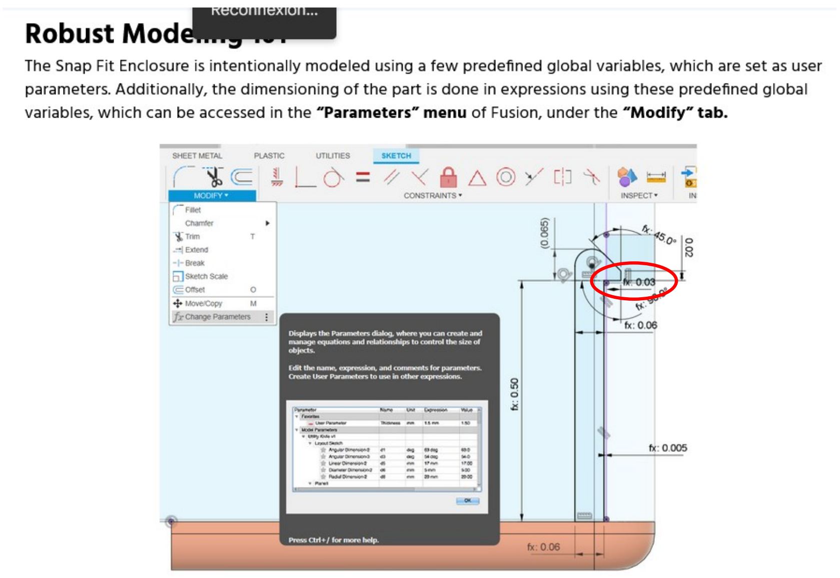
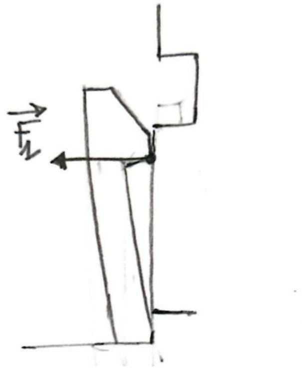
1) Analysis



Where to find the Parameters box in Fusion

Maximum deflection for each snap is equal to the « snapEngagement » parameter, and is equal here to 0.03 in

<u>FBD when the box is opening</u>



Calculation of the applied force F1 :

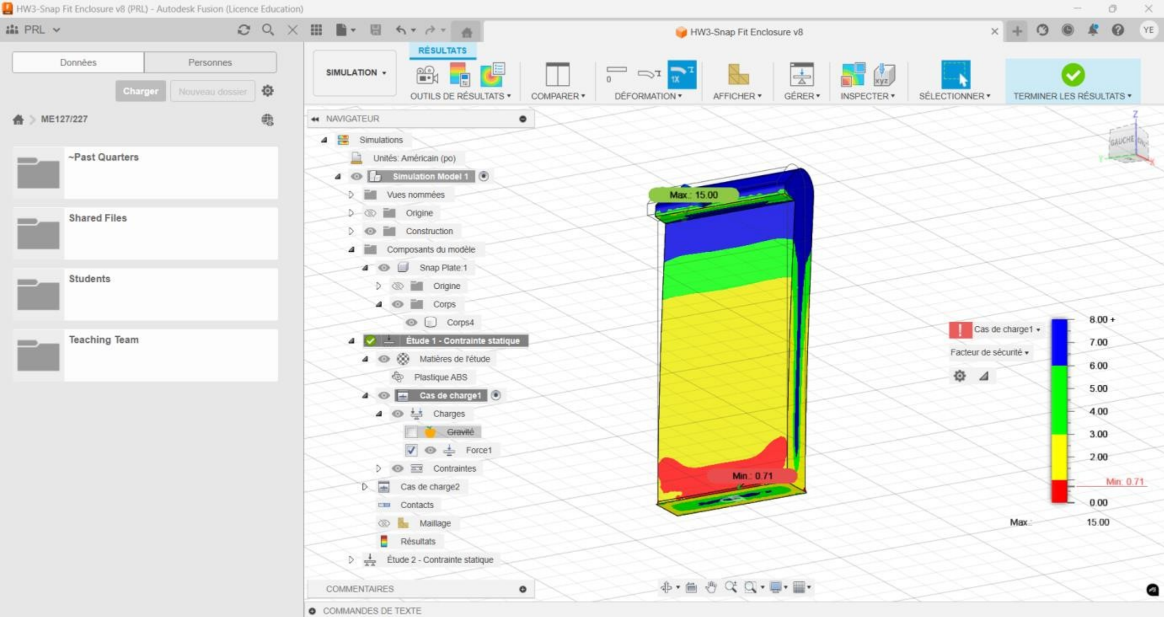
$$F = \frac{3EI}{L^3} \times \delta = \frac{3 \times E}{12}\left(\frac{bh^3}{L^3}\right) \times \delta$$

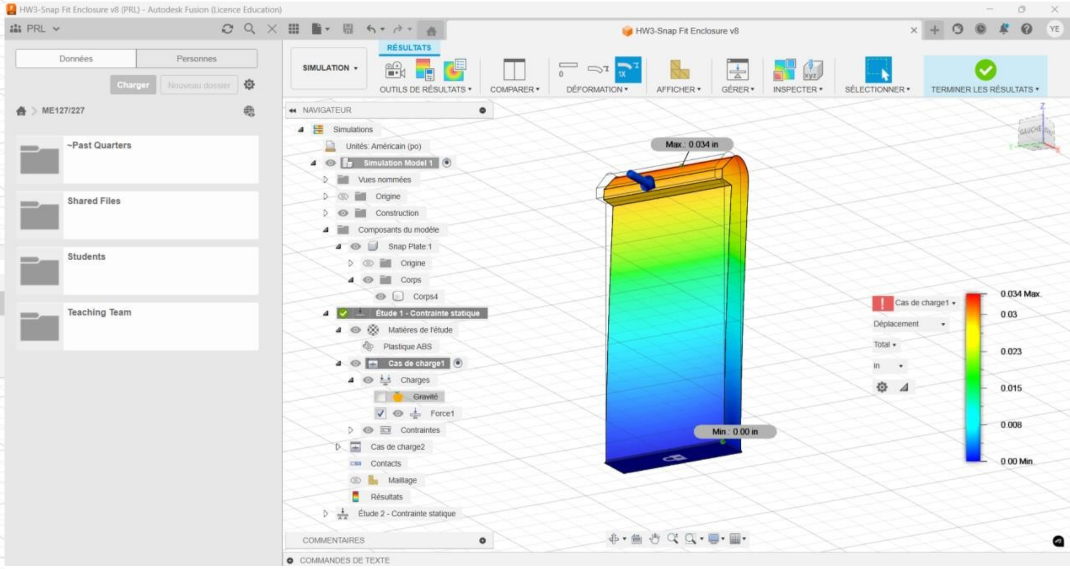
$$\simeq \frac{3}{12} \times (3.25 \times 10^5) \times \frac{0.25 \times 0.06^3}{0.5^3} \times 0.03$$

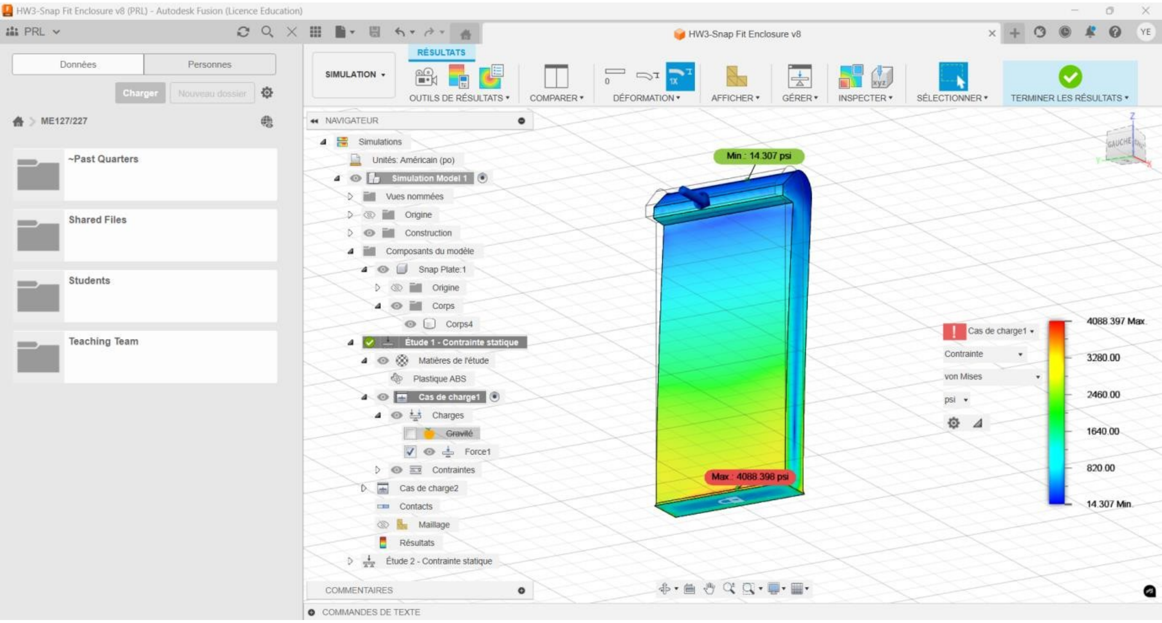
$$\simeq 1.053 \text{ lbs}$$

2) Simulations

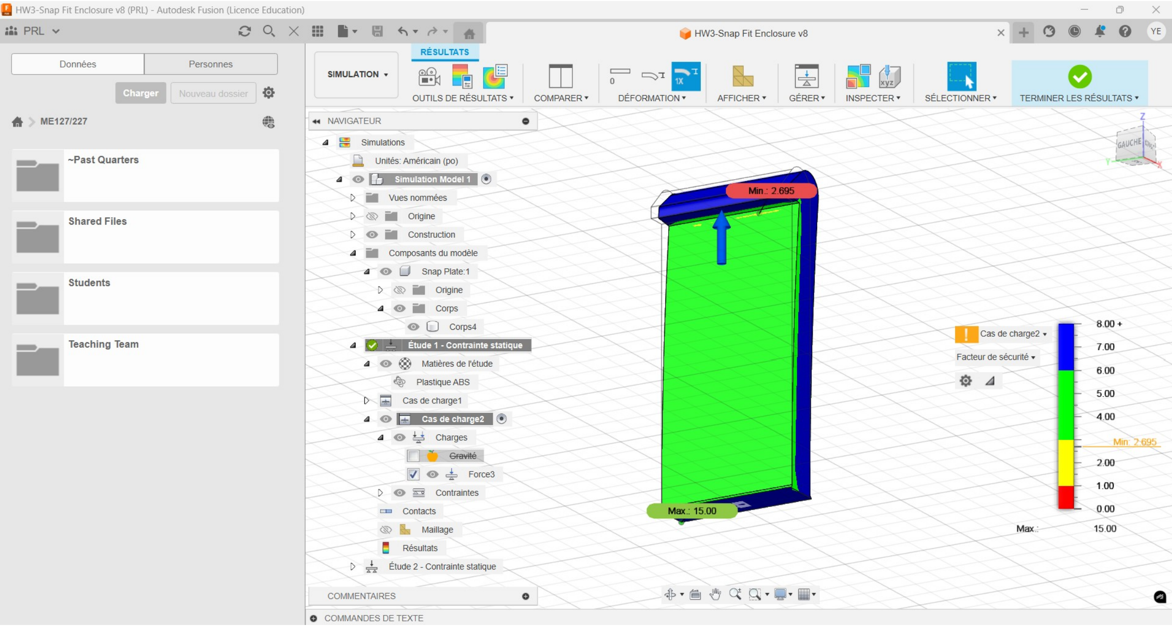
Load case 1

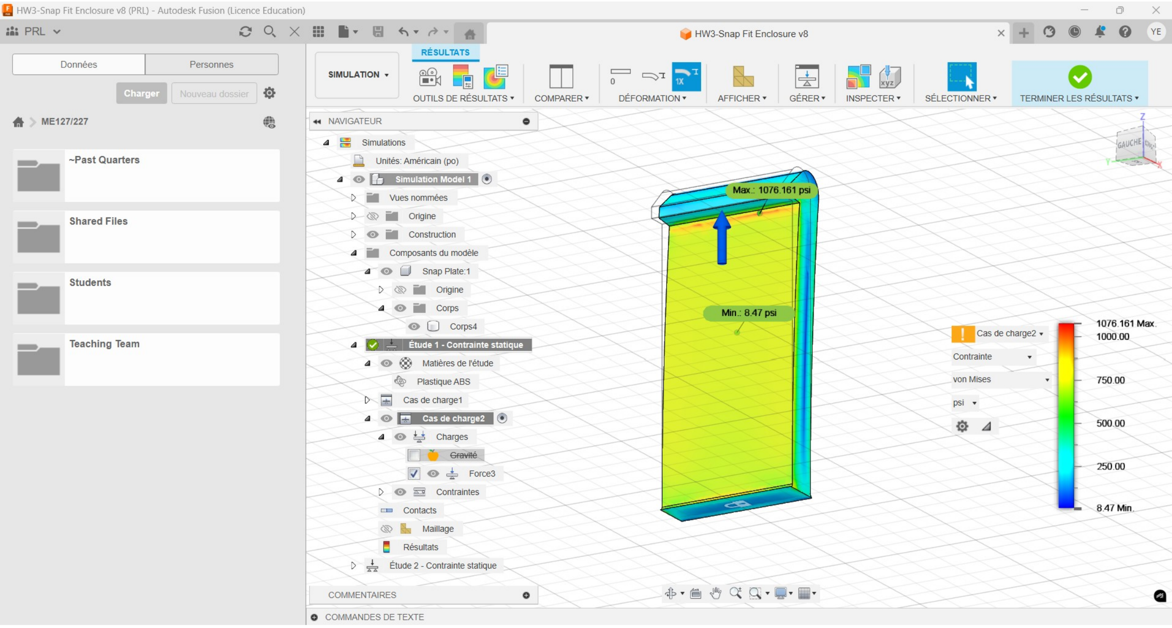


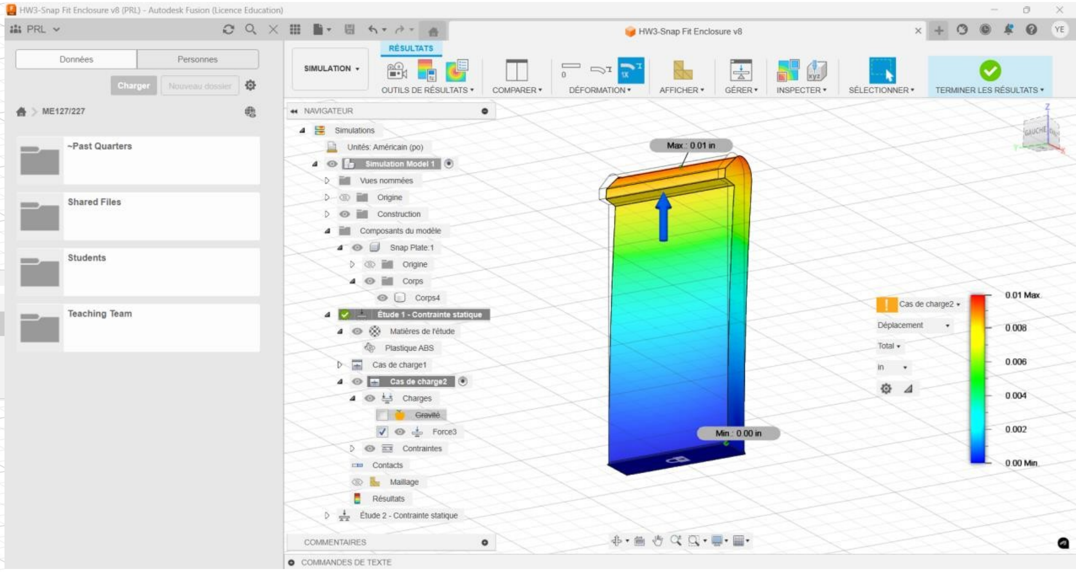




Load case 2


HW3-Snap Fit Enclosure v8 (PRL) - Autodesk Fusion (Licence Education)
Min : 2.695
Max : 15.00
Cas de charge2
Facteur de sécurité
8.00 +
7.00
6.00
5.00
4.00
Min: 2.695
2.00
1.00
0.00
Max 15.00


HW3-Snap Fit Enclosure v8 (PRL) - Autodesk Fusion (Licence Education)
Max : 1076.161 psi
Min : 8.47 psi
Cas de charge2
Contrainte
von Mises
psi
1076.161 Max
1000.00
750.00
500.00
250.00
8.47 Min


HW3-Snap Fit Enclosure v8 (PRL) - Autodesk Fusion (Licence Education)
Max : 0.01 in
Min : 0.00 in
Cas de charge2
Déplacement
Total
in
0.01 Max
0.008
0.006
0.004
0.002
0.00 Min

INTERPRETATION :

3. Interpretation

a. Using images and concise annotations, what do the simulation results tell you about the snap design? How do these results align with or differ from your calculations?

b. What design modification(s) do you expect will most improve the performance of the snap arms?

   i. Note that the applied load in the insertion load case (representing Condition 1) will likely need to change to maintain proper snap deflection.

   ii. Also consider the impact of your design modification(s) on snap retention (Condition 2).

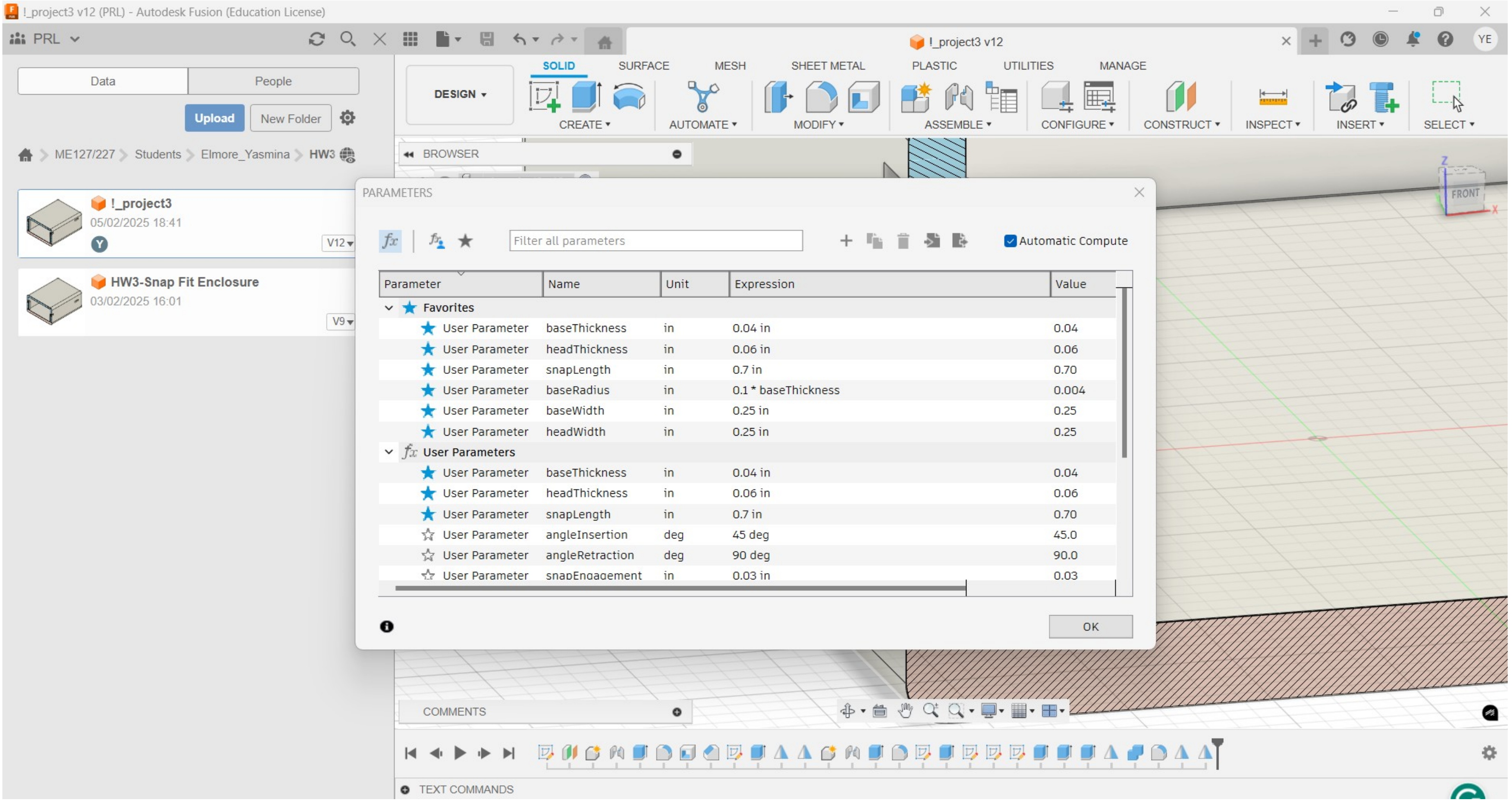
a) We have a saftey factor of 0.71 when applying load case 1, and this safety factor is close to the base of the snap. So the snap will be breaking. But, we can see that if we apply a force of 1.053 lbs, as calculated, we have a deflection of 0.03 in.

b) In order to improve the performance of the snap, we have to design the snap such as the force F linked to the deflection applied to the snap decreases. Since, we have a fixed deflection (we want a deflection of 0.03 in), then we have to decrease the ratio (h/L). Which means either we have to increase L or decrease h. But at the same time, we need to make sure that the safety factor for loads 1 and 2 isn’t below 1.5.

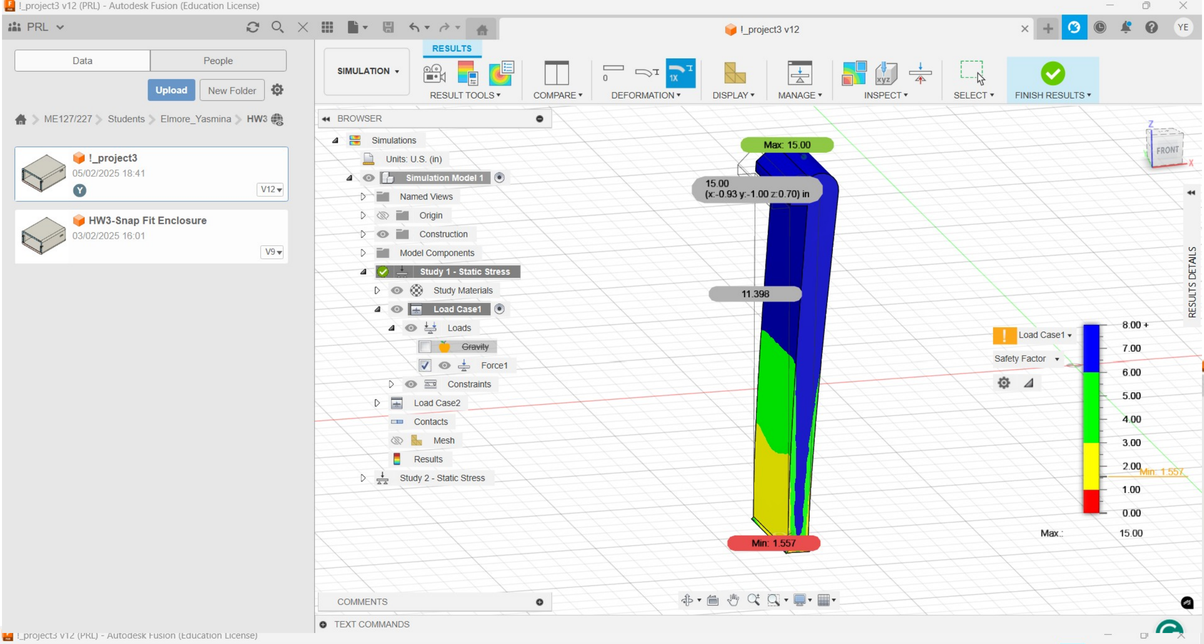
$$F = \underbrace{\frac{3E}{12}}_{\text{fixed}} \times b \left(\frac{h}{L}\right)^3 \times \underset{\text{fixed}}{\delta}$$

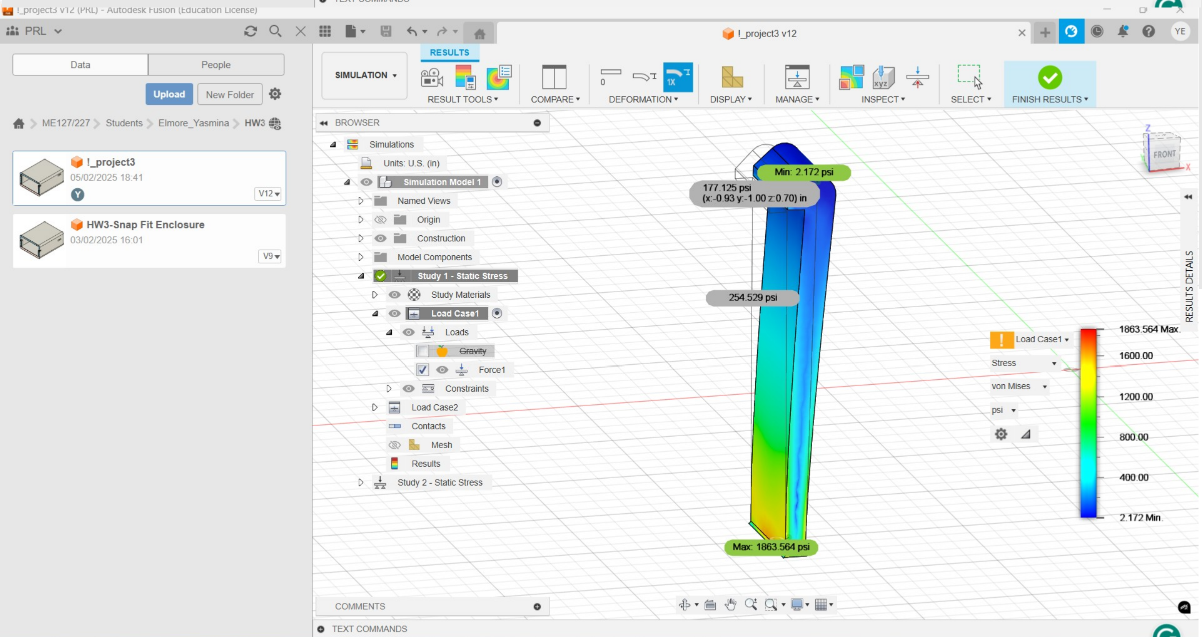
4) Iteration

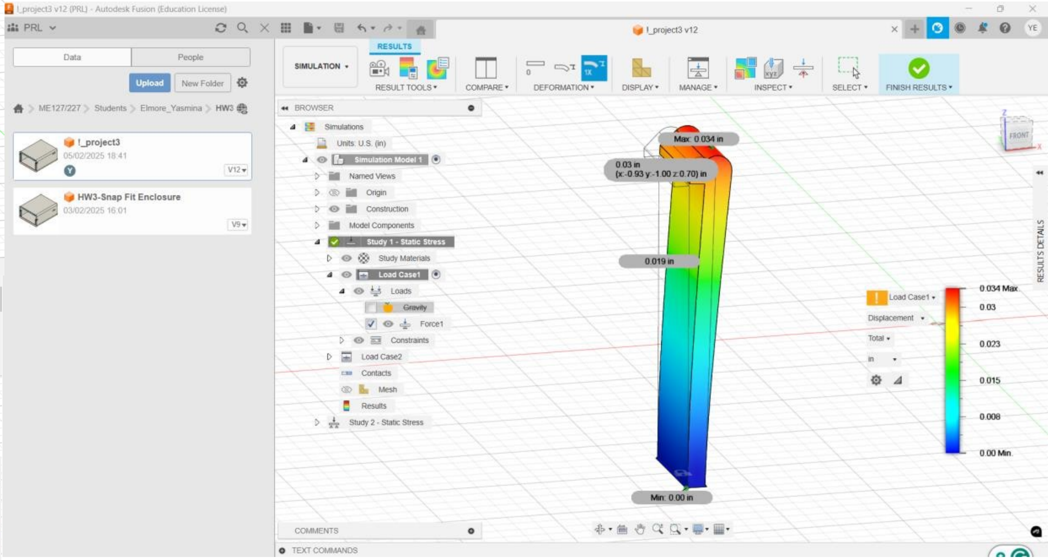
After iterating, we find the following parameters for a correctly functioning snap: snaplength (l) = 0.7 in (instead of 0.5 in) and basethickness (h) = 0.04 in (instead of 0.06 in)



Load case 1

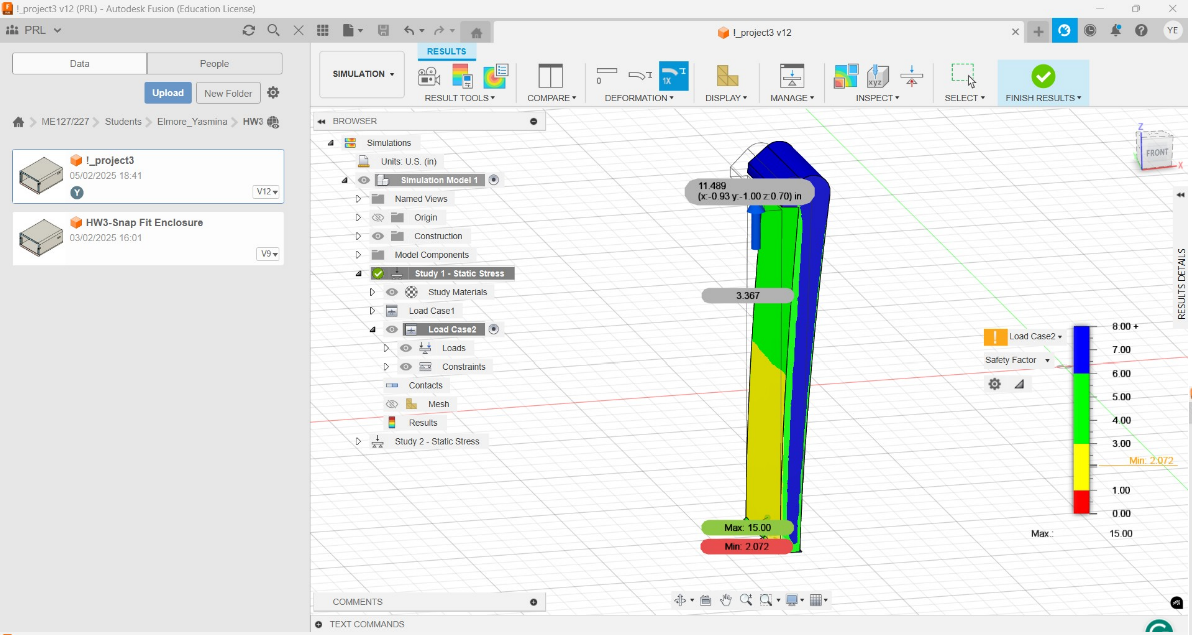




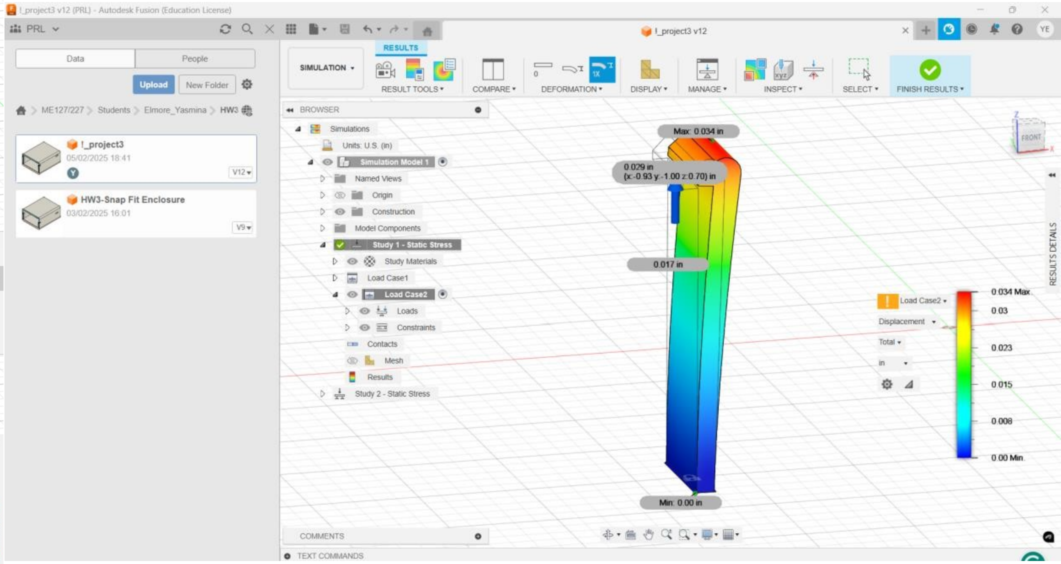


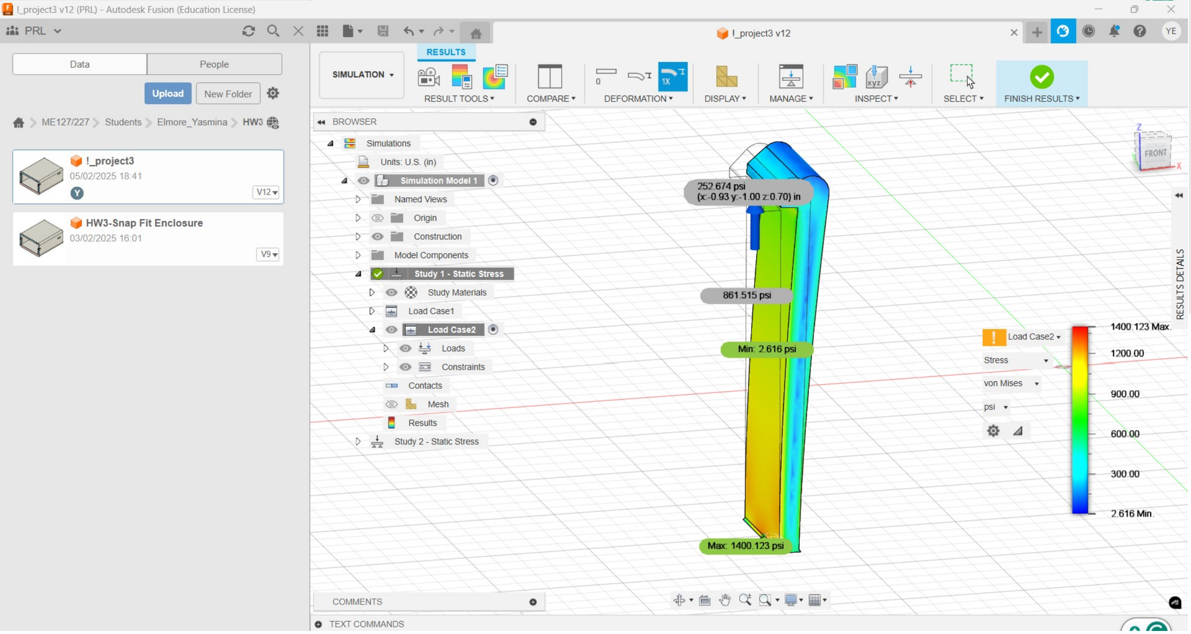
Minimum safety factor : 1.557

Deflection : 0.03 in



Load case 2





Minimum safety factor : 2.072