

Laboratório de Manufatura - peça finalizada

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universidade
de aveiro



Tópicos abordados



01 Introdução



02 Peça original



03 Peça finalizada

04 Fusion

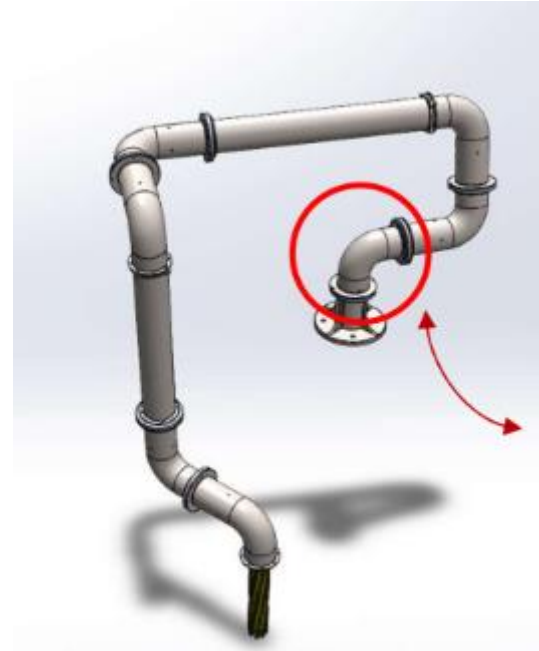


Peça



Braço robótico

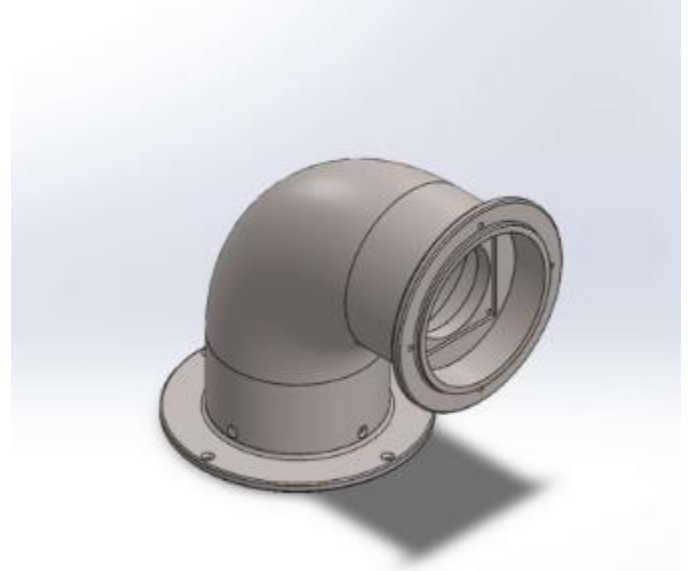
- Cotovelo com zona para ligar motor e duas superfícies de ligação



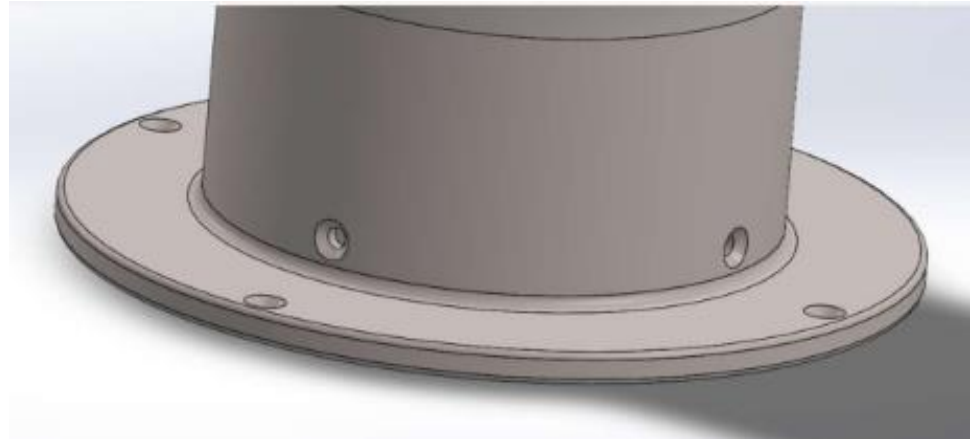
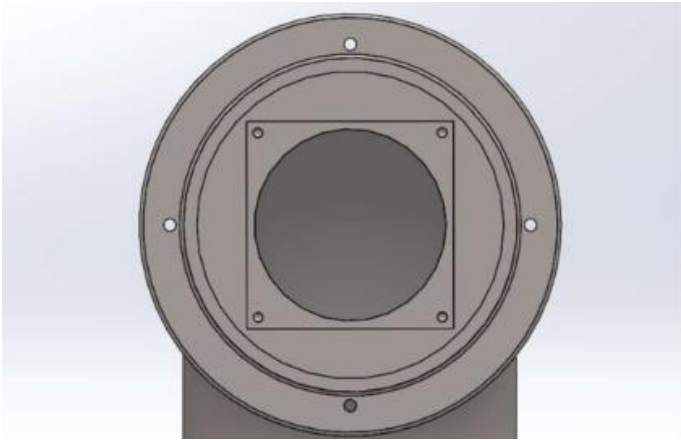
Peça original

Braço robótico

- Peça escolhida em mais detalhe

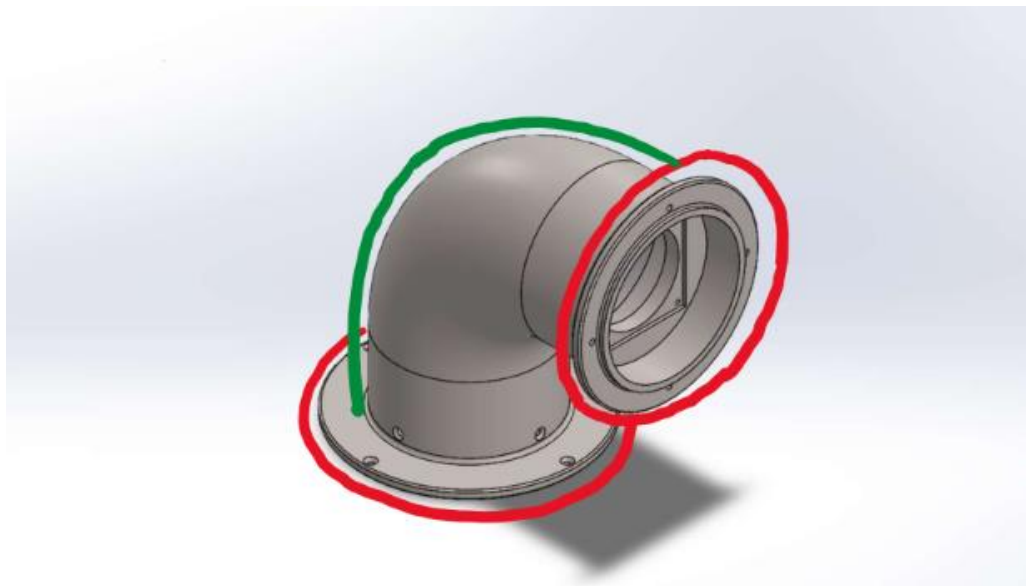


Zonas de ligação originais



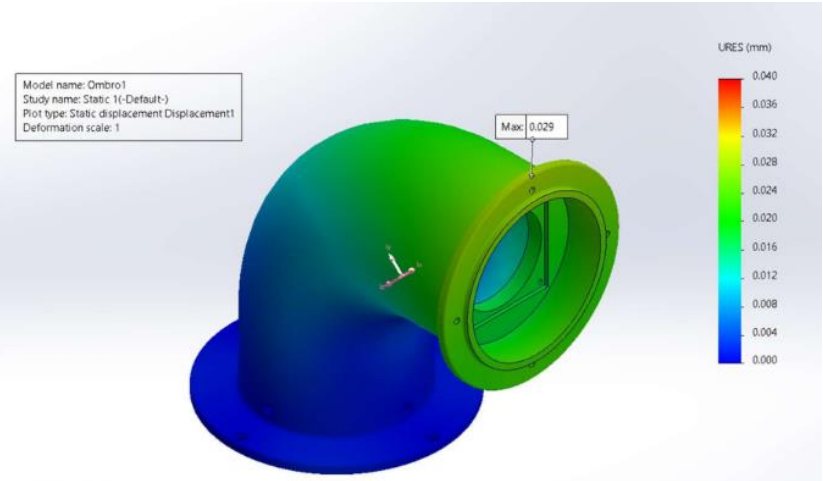
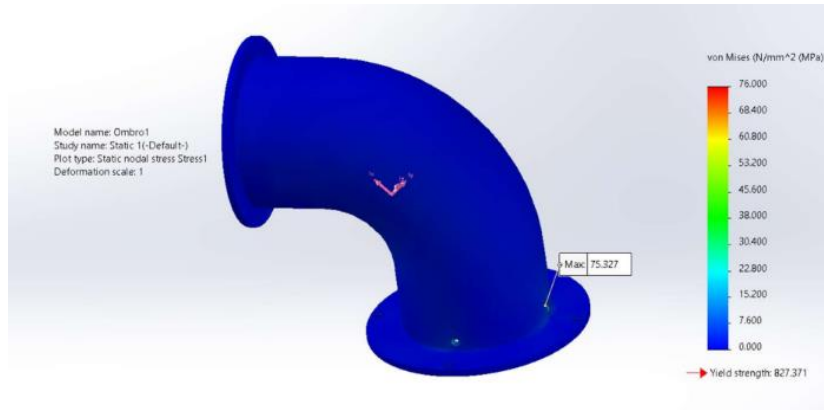
- Superfícies de ligação

Onde alterar



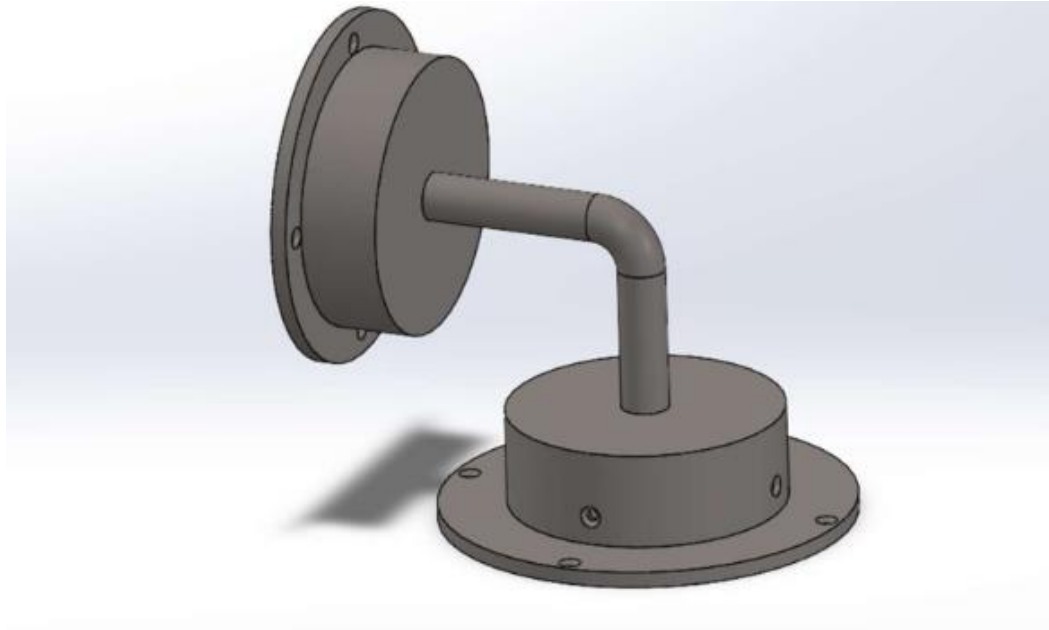
- **Alterar:** corpo do cotovelo
- **Não alterar:** zonas de ligação

Simulações realizadas



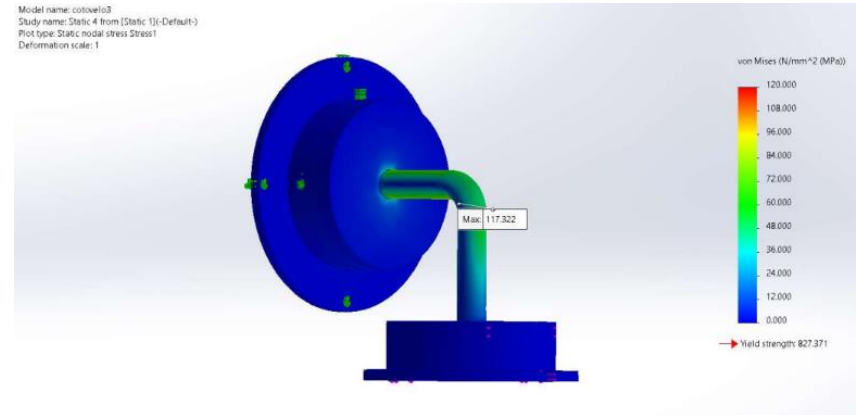
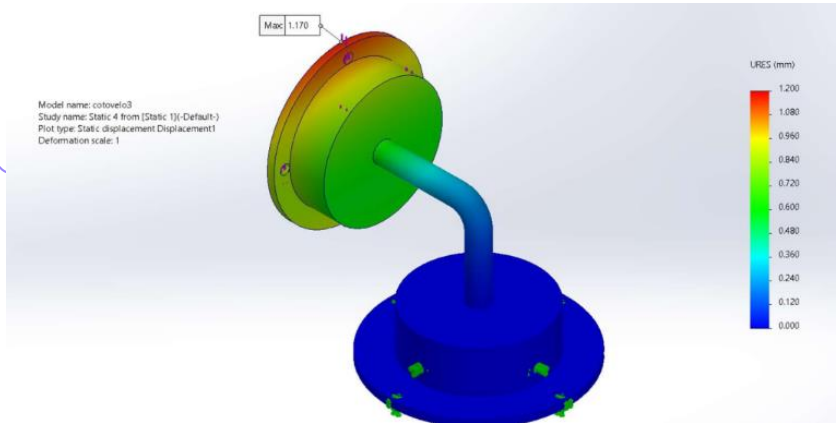
- Simulações iniciais

Primeiras alterações



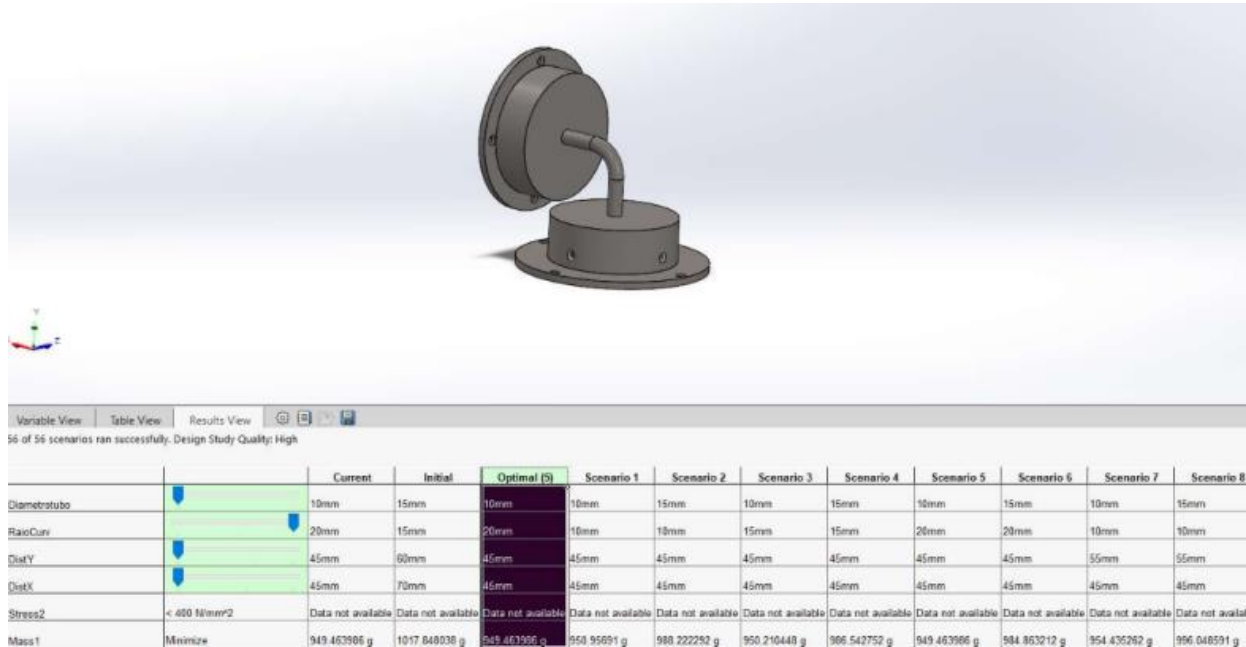
- Primeira alteração de geometria

Simulações realizadas



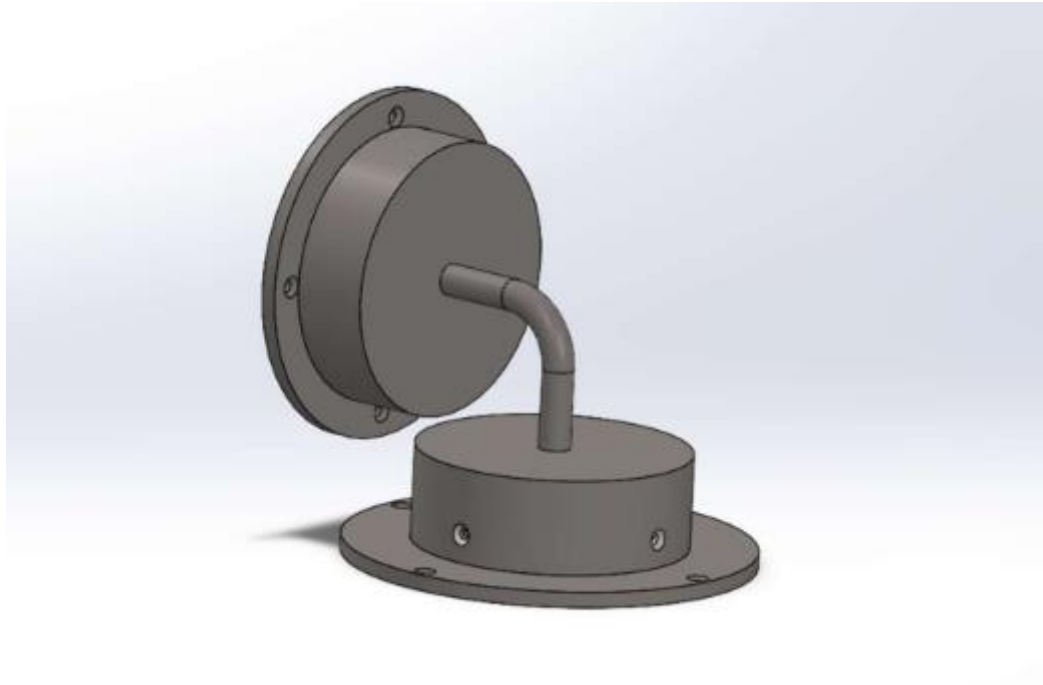
- Simulações realizadas
- Direita: tensão máxima (117 MPa) <<< Yield Strengt (827 MPa)

Estudos realizados



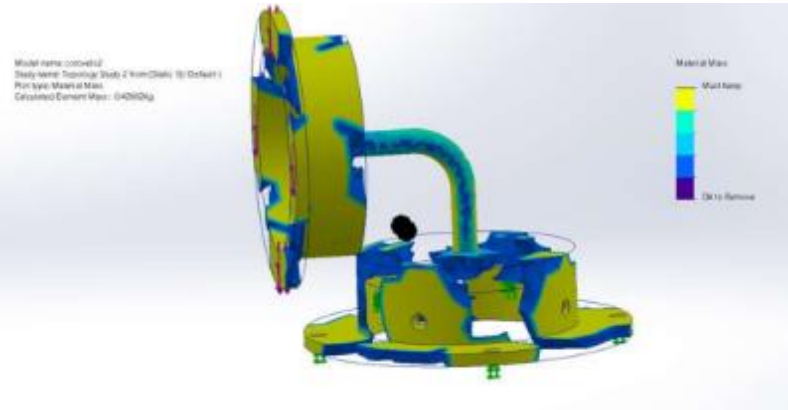
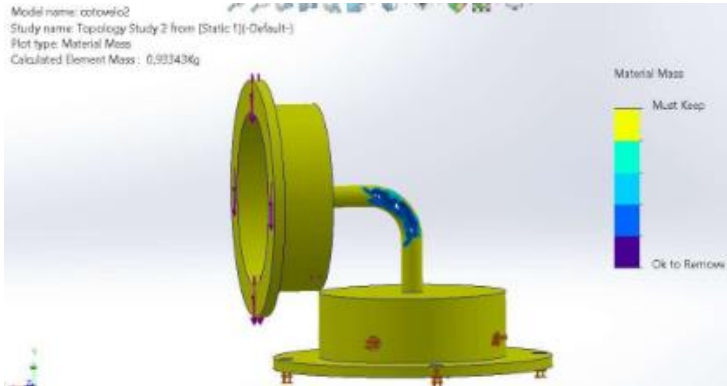
- Estudo paramétrico: descobrir medida otimizada para diâmetro do tubo e raio de curvatura, por exemplo

Alterações realizadas



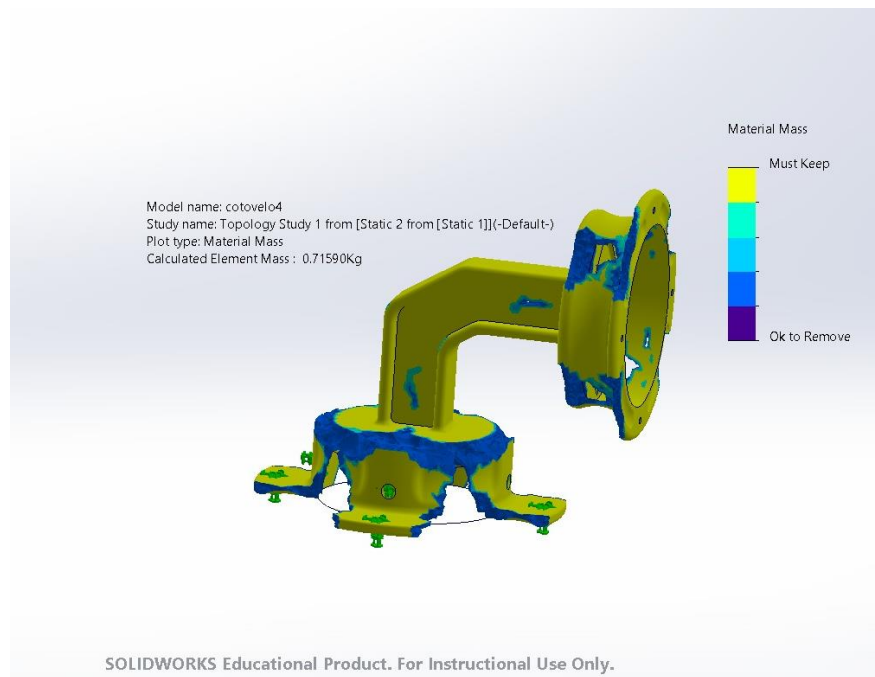
- Peça atualizada

Estudos topológicos



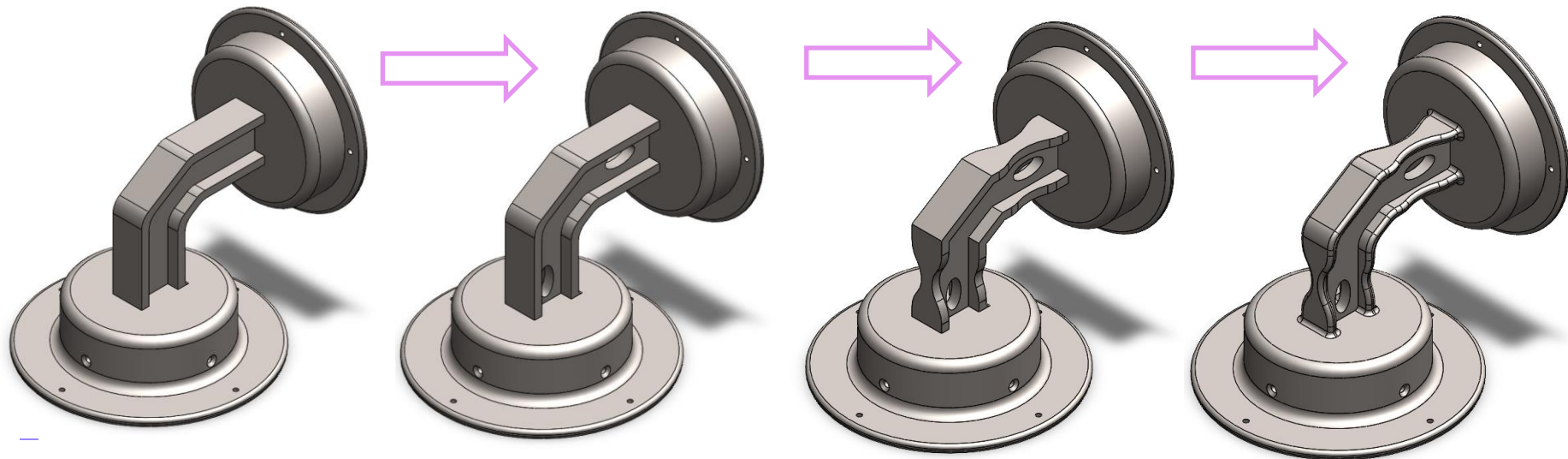
- Estudo topológico
- Possibilidade de retirar massa na zona interior do tubo: realização dessa zona em I

Análise topológica

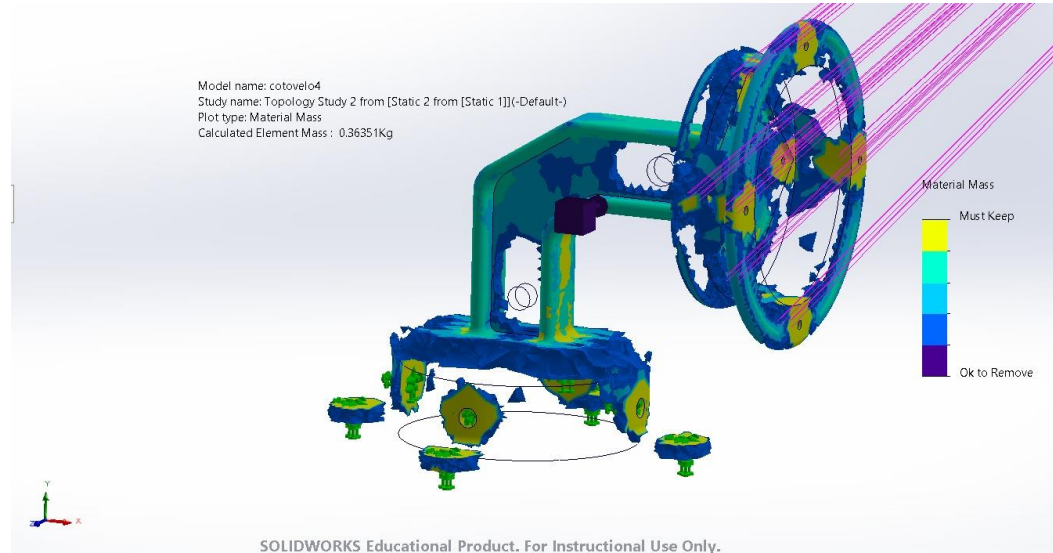


- Conclusão: há massa a retirar

Processo de otimização

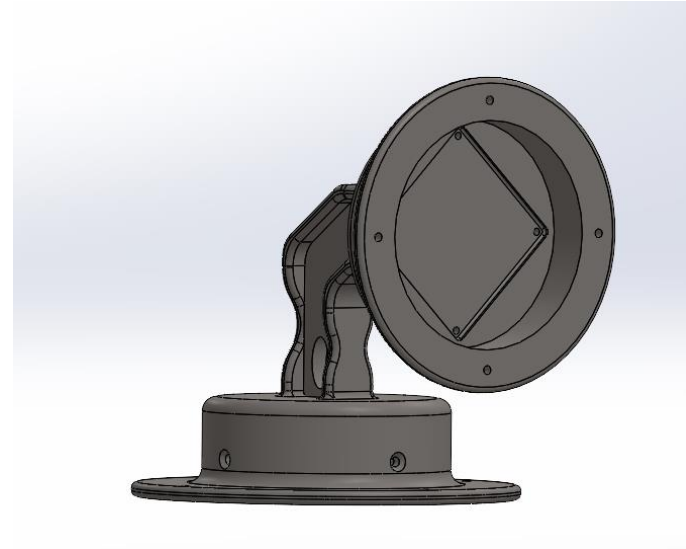
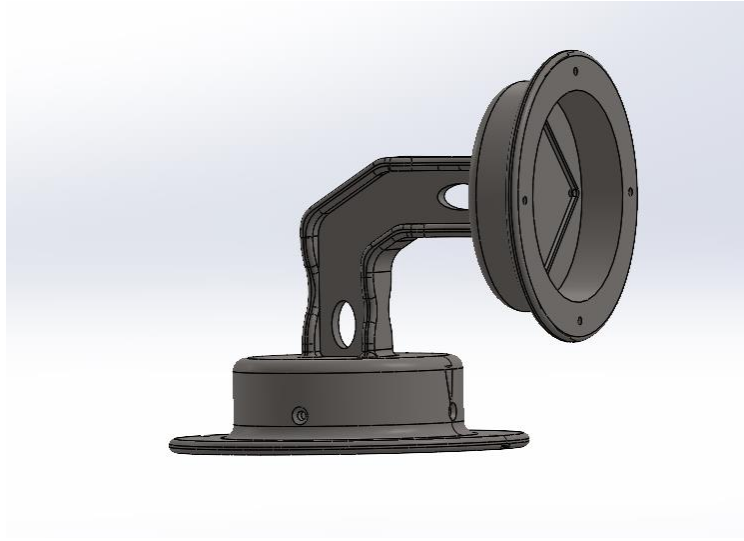


Análise topológica final



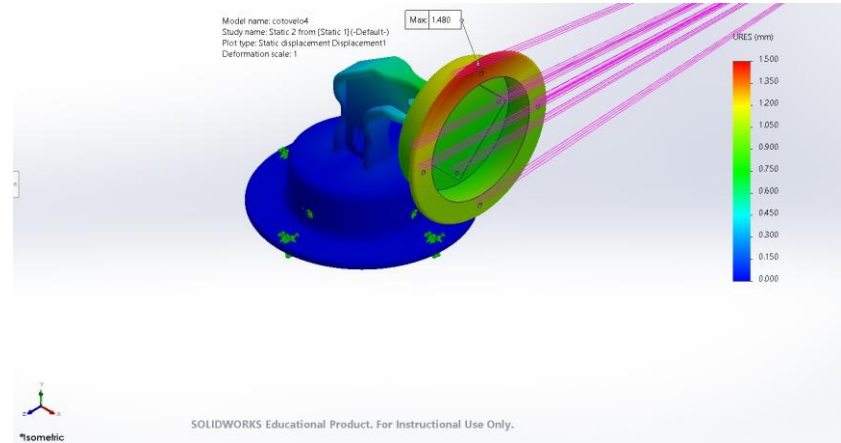
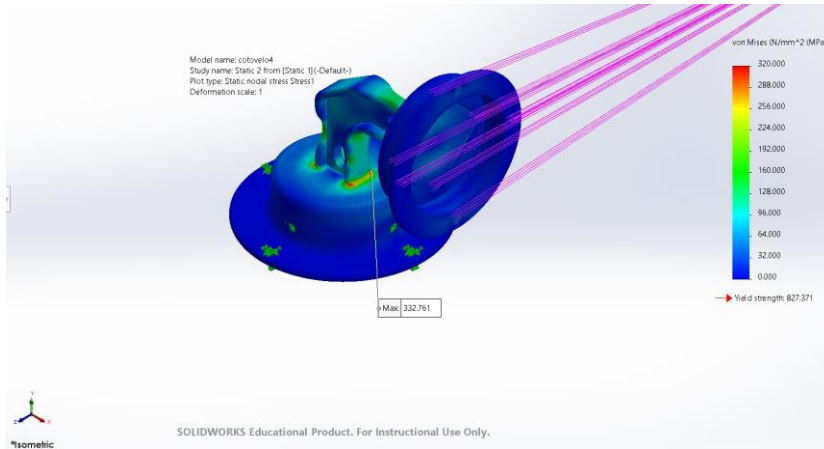
- Conclusão: não há mais massa a retirar

Nova peça



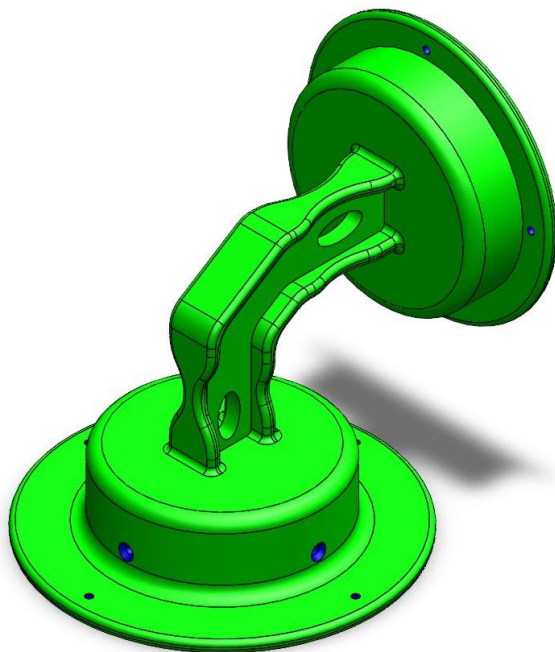
- Peça atualizada: final









Simulações realizadas

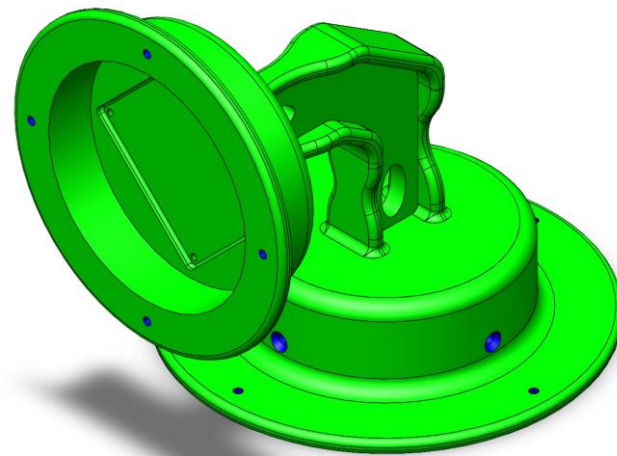


- Simulações feitas com a força colocada na zona do braço robótico que iria recolher o gelo da superfície de Titã

Código de cores

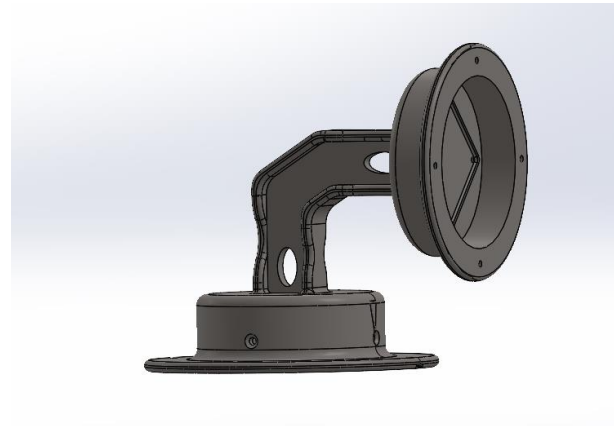
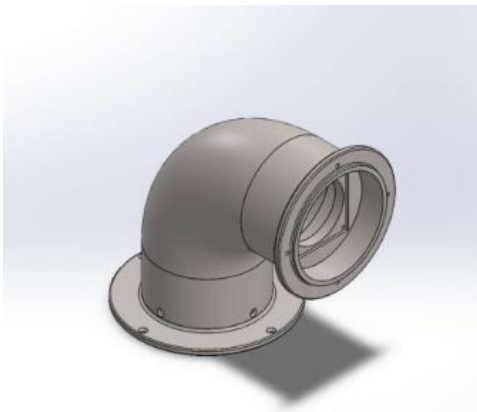


COR	CÓDIGO RGB	ONDE SE APLICA
	0, 255, 0	Peça
	255, 255, 0	Junta do molde
	0, 255, 255	Folga na junta do molde
	255, 0, 255	Caixas de precisão
	153, 0, 0	Furos mandrilados
	0, 153, 0	Furos roscados
	0, 0, 255	Furos de passagem / Caixas com folga
	255, 255, 255	Circuitos de água



Transformação

- Alteração na largura e geometria da zona de conexão entre as duas superfícies de ligação ao resto do braço
- Peça otimizada
- Menor massa = menos material = menos custo
- Otimizada para transporte até Titã; menos peso = menos combustível





Maquinagem

Software Utilizado



AUTODESK[®]
FUSION 360[™]

Ferramentas utilizadas

cotovelo4 v34					
2 - Ø25mm R2mm (D25R2)	2 mm	25 mm	8 mm	130 mm	
9 - Ø16mm (Fresa Integral Topo)	0 mm	16 mm	65 mm	130 mm	
7 - Ø16mm R2mm (D16R2)	2 mm	16 mm	8 mm	173 mm	
38 - Ø14mm 90° (14mm Spot Drill)	0 mm	14 mm	32 mm	89 mm	
11 - Ø10mm R0.5mm (D10R0.5)	0.5 mm	10 mm	3 mm	160 mm	
15 - Ø6mm R0.5mm (D6R0.5)	0.5 mm	6 mm	10 mm	90 mm	
13 - Ø6mm R0.2mm (D6R0.2v2)	0.2 mm	6 mm	6 mm	70 mm	
13 - Ø6mm R0.2mm (D6R0.2)	0.2 mm	6 mm	6 mm	70 mm	
36 - Ø3.4mm 118° (Drill)	0 mm	3.4 mm	34 mm	39.08 mm	
35 - Ø3mm 118° (Drill)	0 mm	3 mm	30 mm	35.08 mm	
25 - Ø3mm R0.2mm (D3R0.2)	0.2 mm	3 mm	3 mm	60 mm	
34 - Ø2.5mm 118° (Drill)	0 mm	2.5 mm	25 mm	30.08 mm	
33 - Ø2.5mm (M2.5)	0 mm	2.5 mm	9.5 mm	44.5 mm	
30 - Ø2mm R1mm (D2R1)	1 mm	2 mm	3 mm	55 mm	

Desbaste

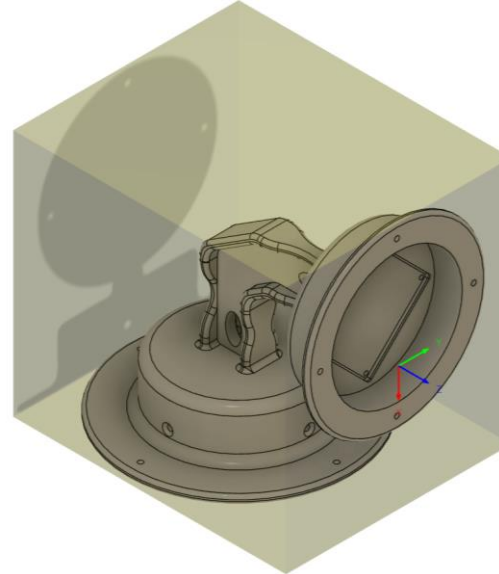
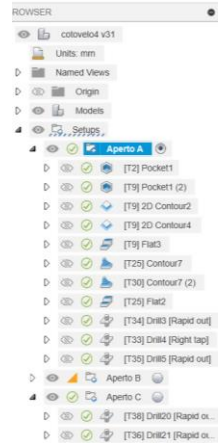
Acabamento

Furações

Etapas

Aperto A

Desbaste e
acabamento do

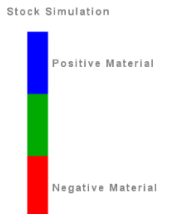
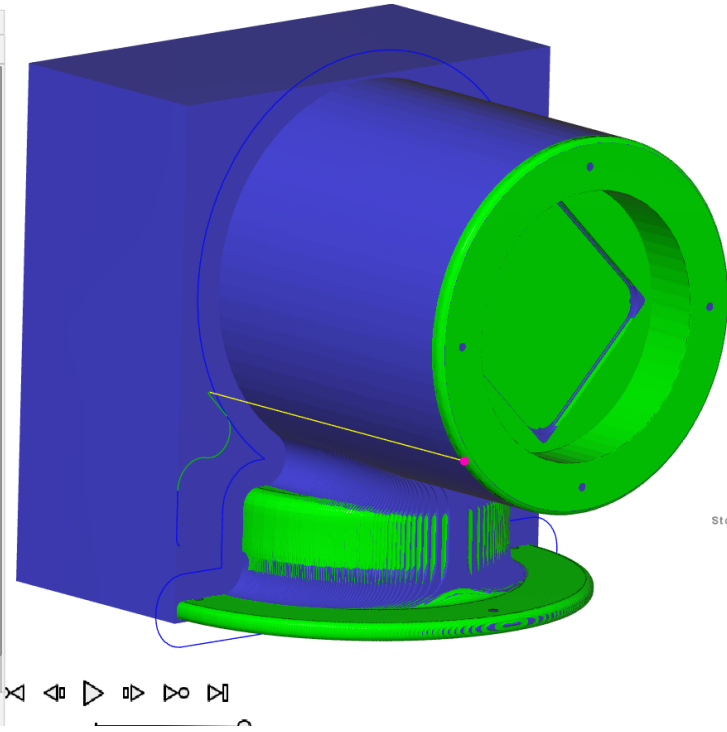
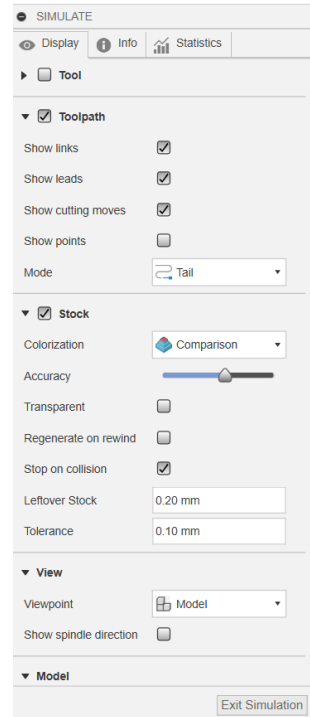
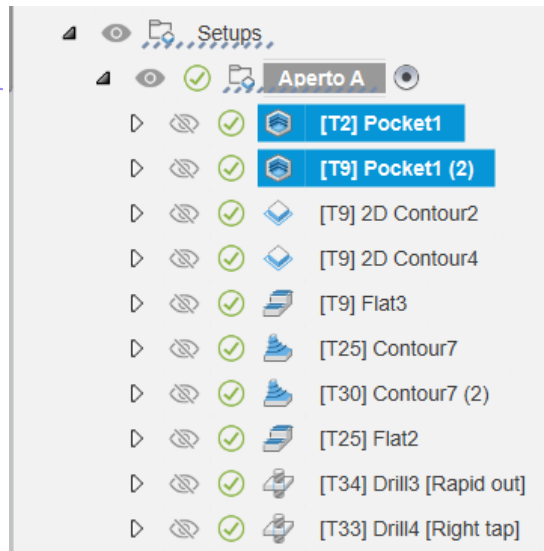


Aperto A | Total machining time: 1:28:35

Etapas

Aperto A

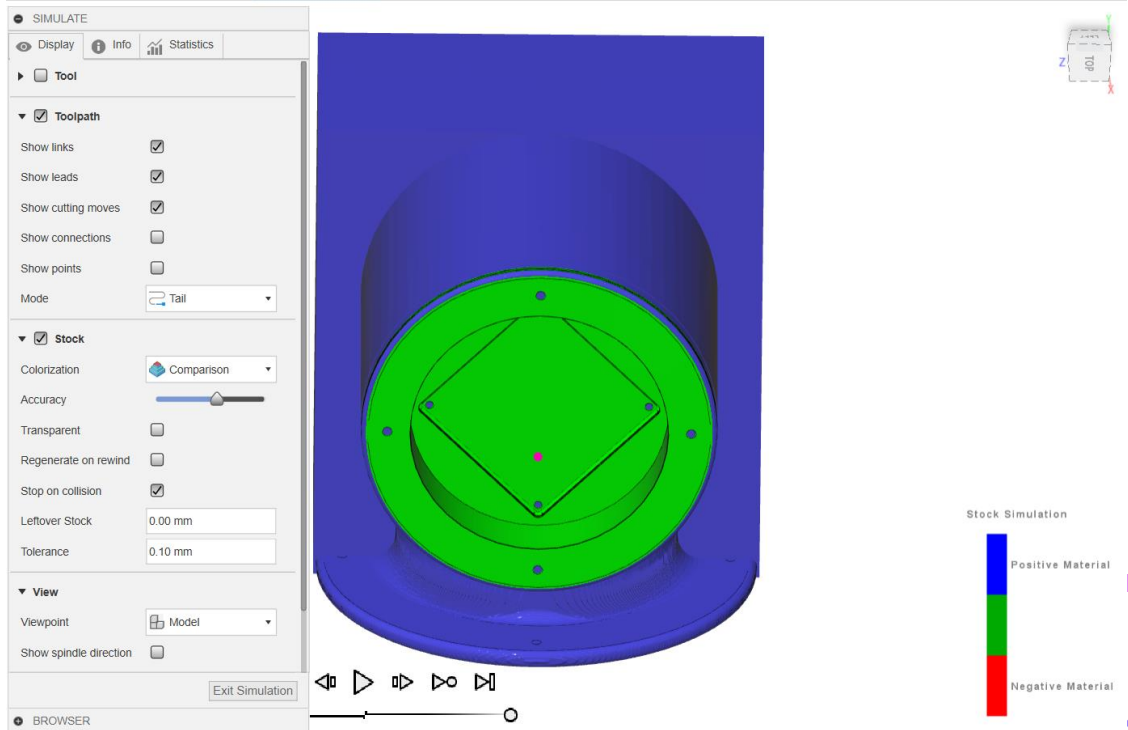
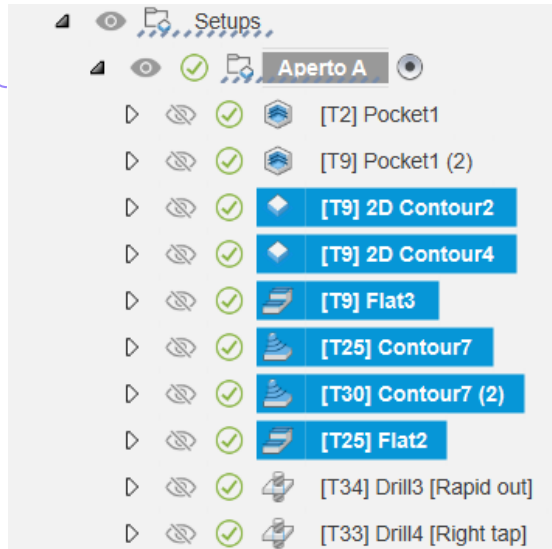
Desbaste inicial com resto de 0.2mm



Etapas

Aperto A

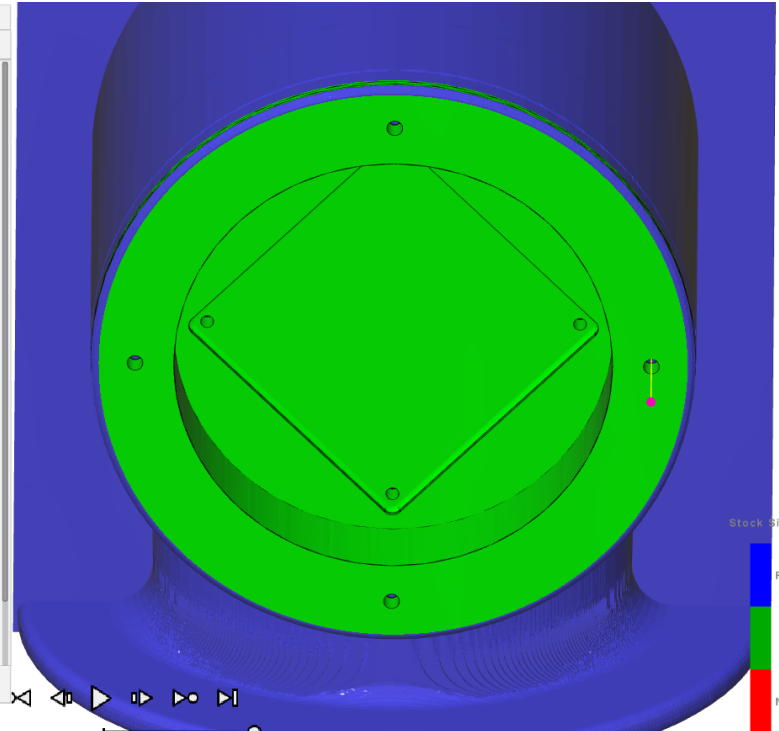
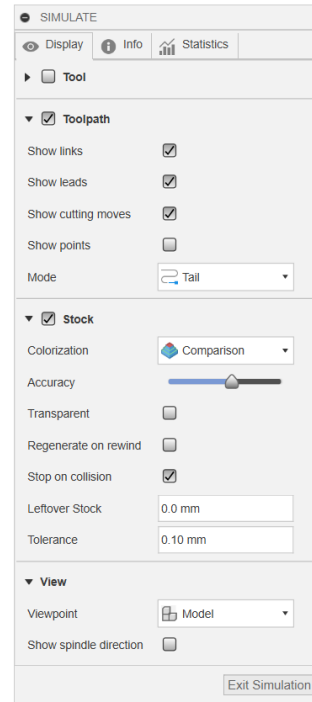
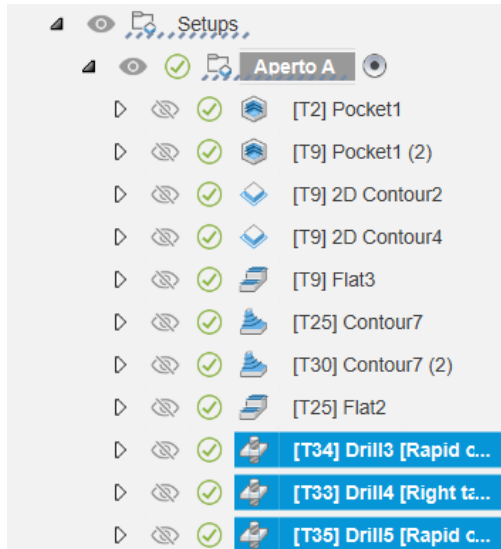
Acabamento das superfícies



Etapas

Aperto A

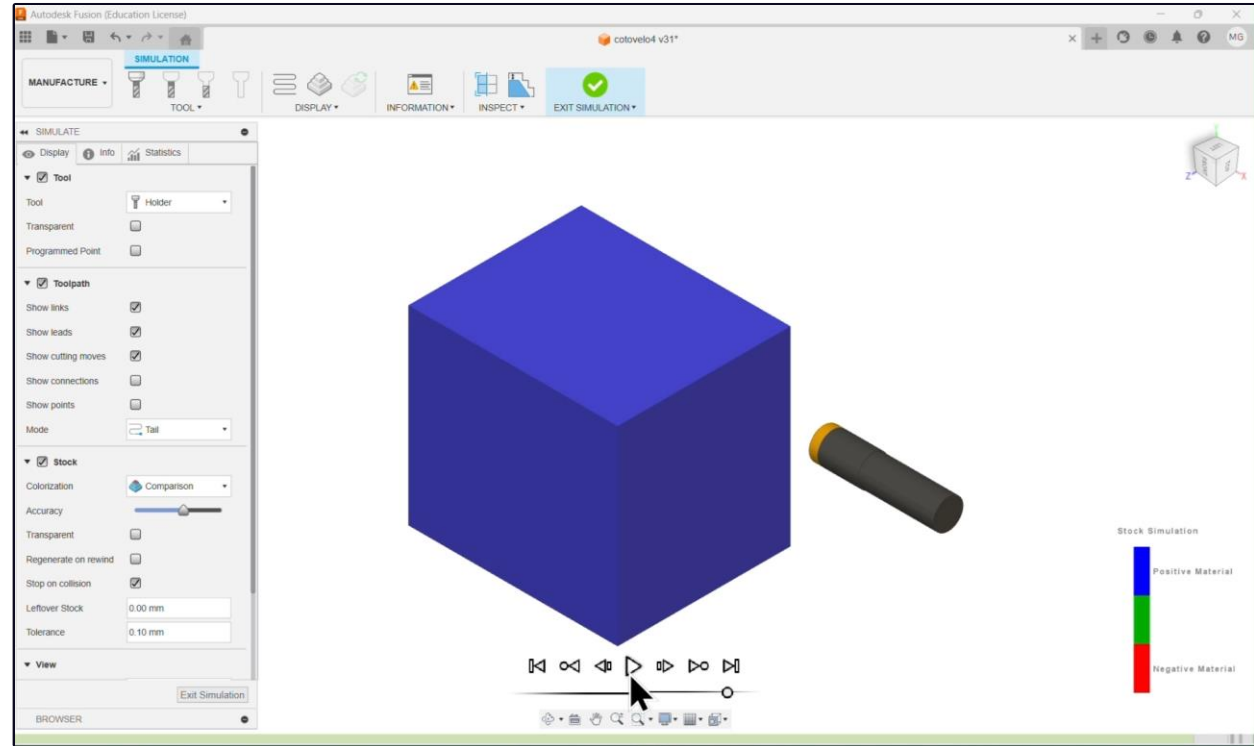
Furos de passagem e furos roscados



Etapas

Aperto A

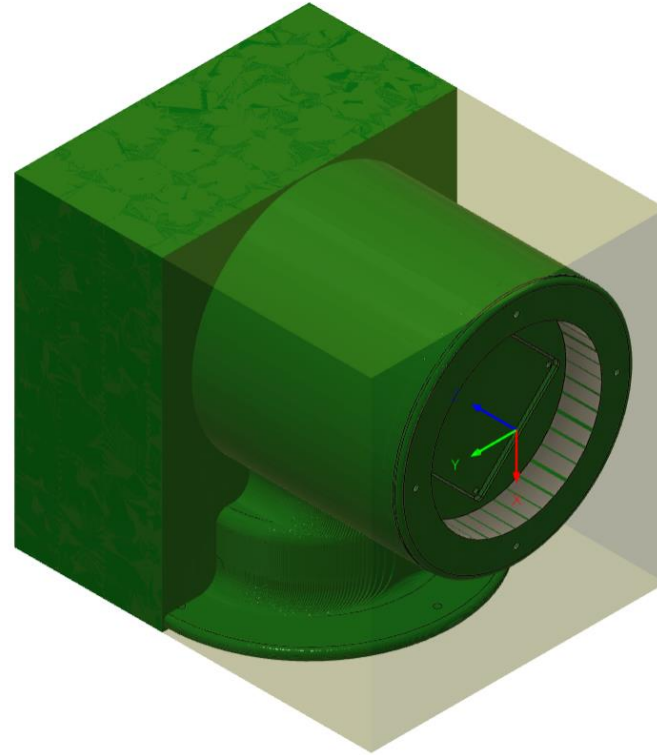
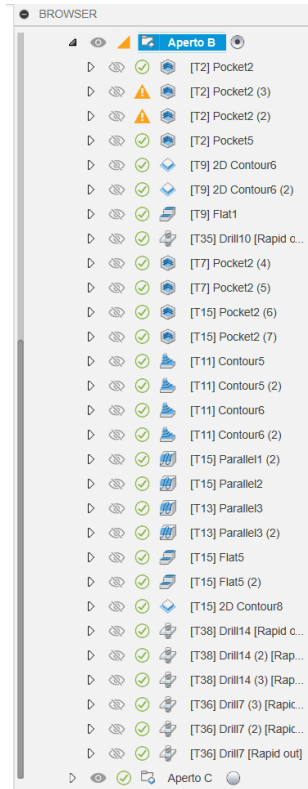
Simulação completa
dos desbastes,
acabamentos e
furações



Etapas

Aperto B

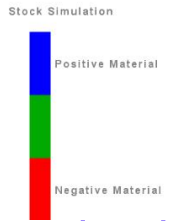
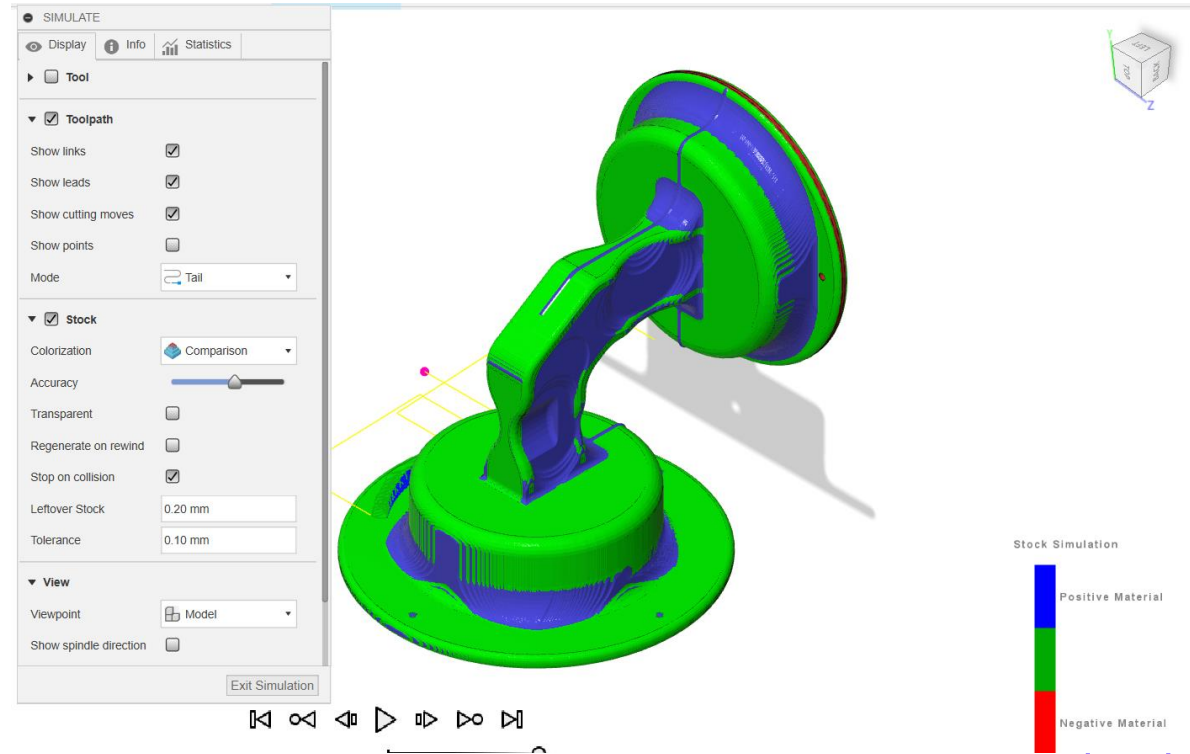
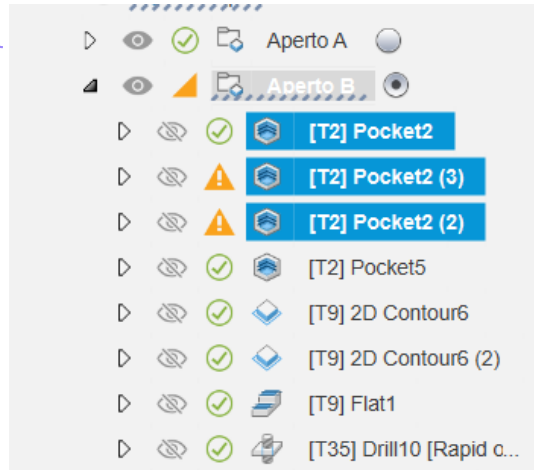
Desbaste e
acabamentos



Etapas

Aperto B

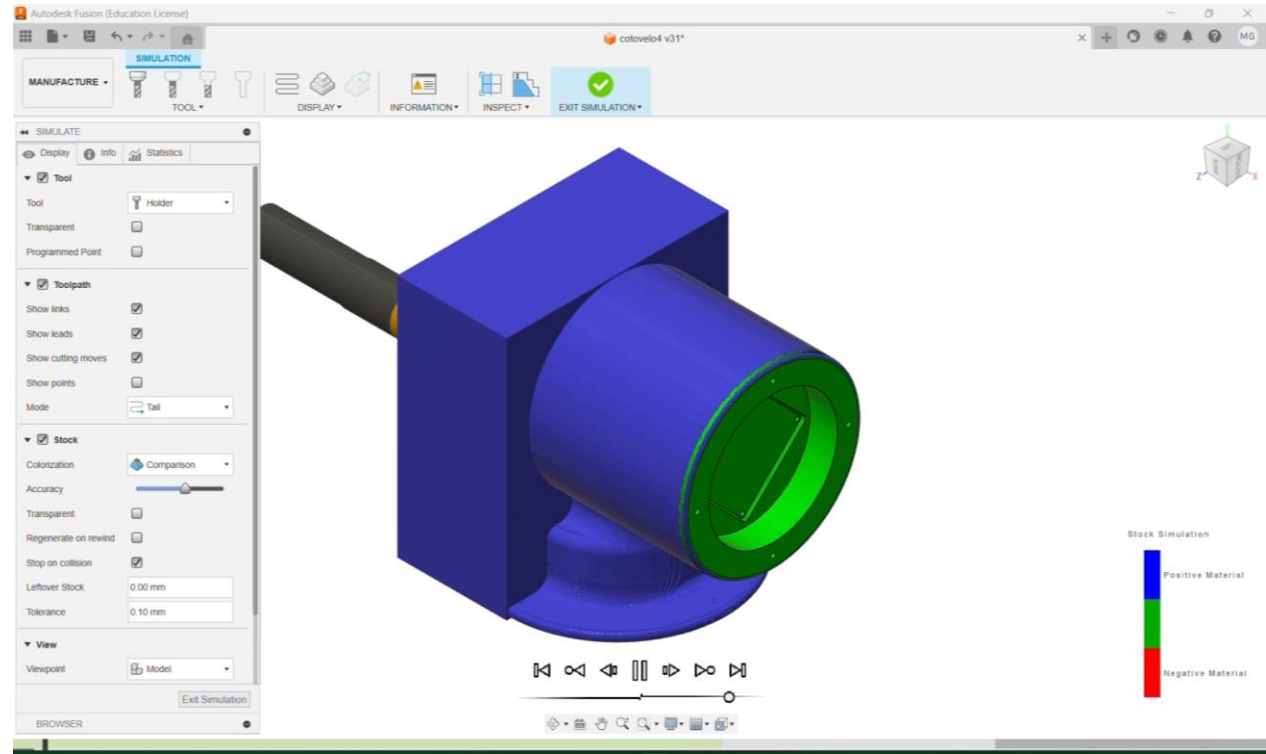
Desbaste lateral e traseiro com resto de 0.2mm



Etapas

Aperto B

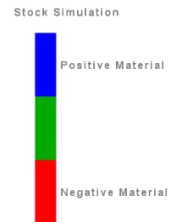
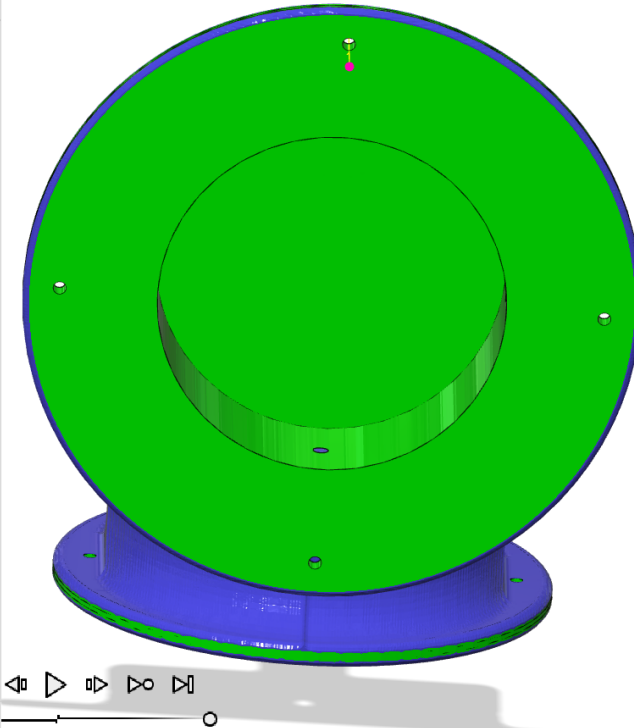
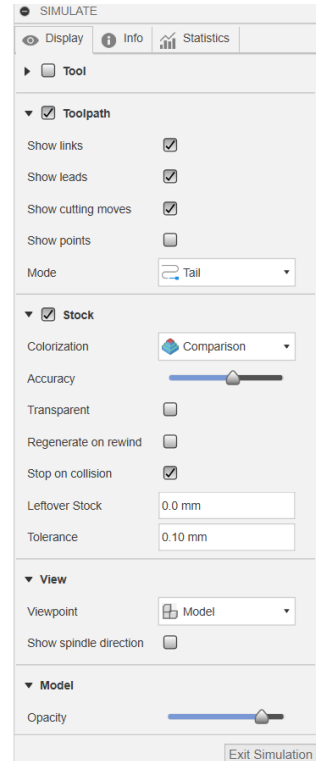
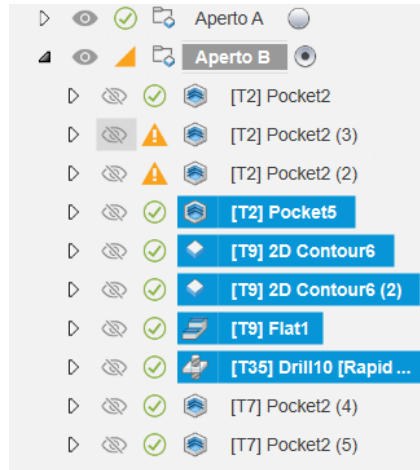
Simulação completa dos desbastes laterais e traseiros



Etapas

Aperto B

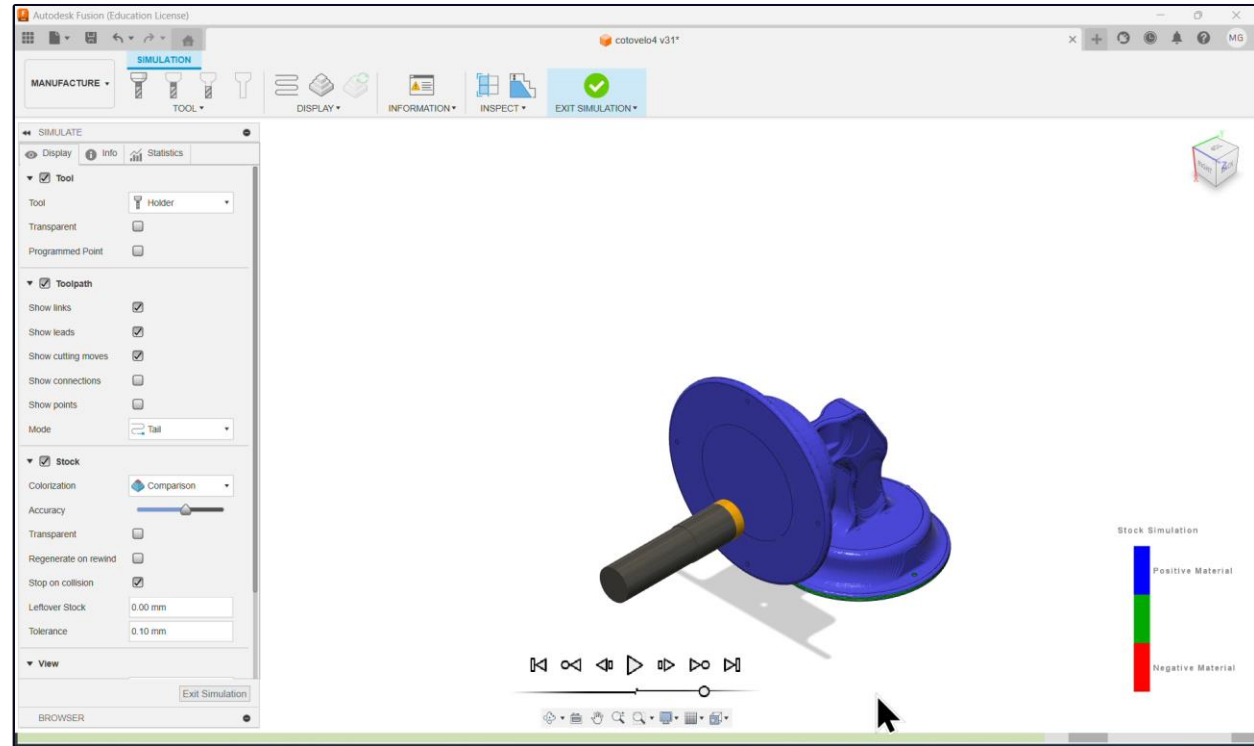
Desbaste de baixo,
acabamento e furação



Etapas

Aperto B

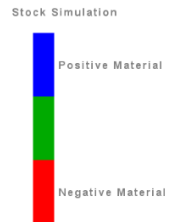
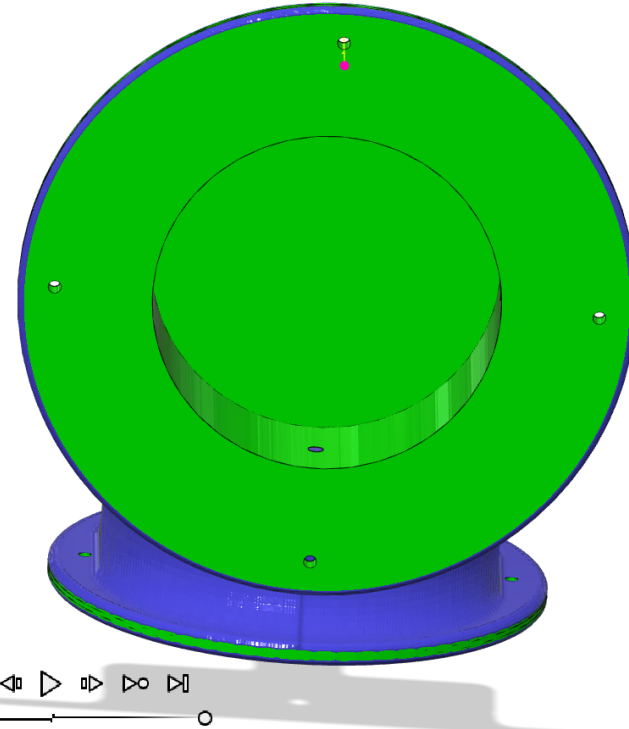
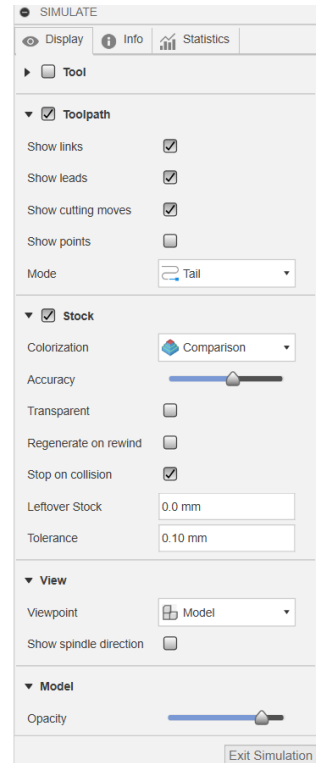
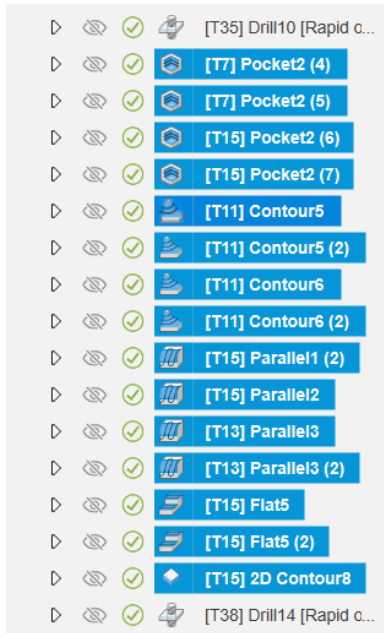
Simulação completa do desbaste, acabamento e furações de baixo



Etapas

Aperto B

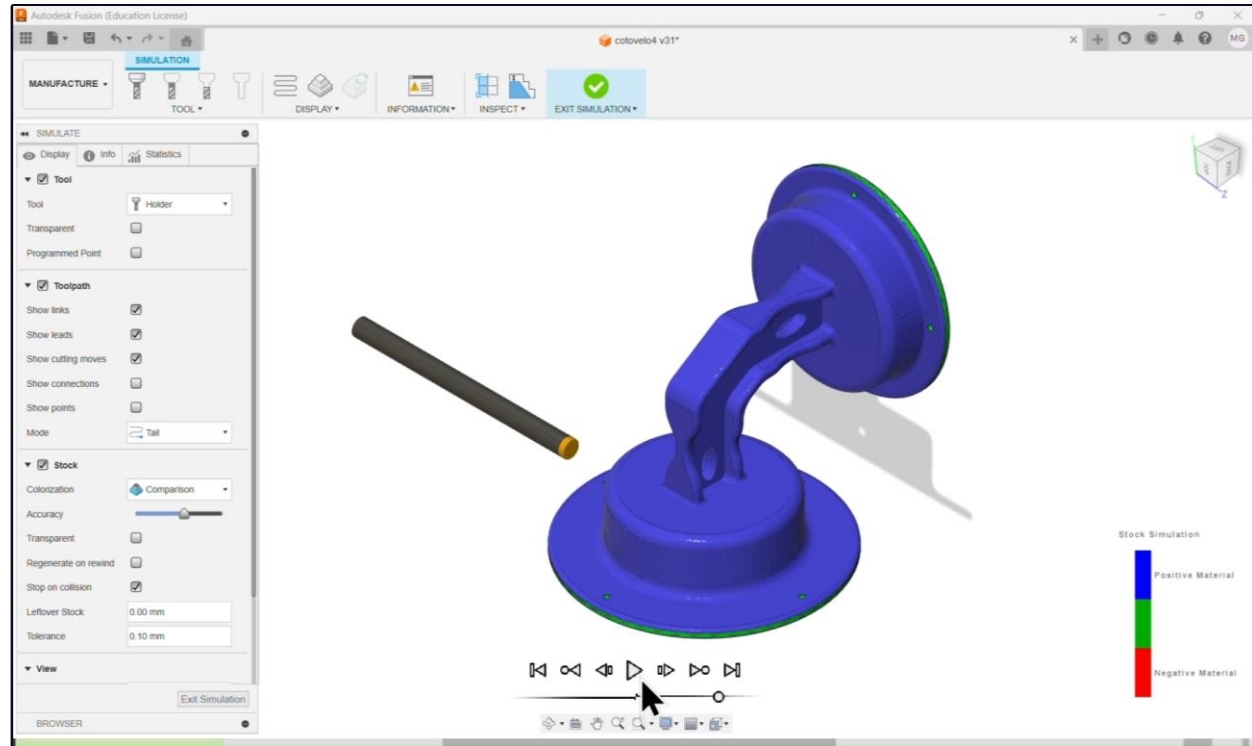
Acabamentos laterais



Etapas

Aperto B

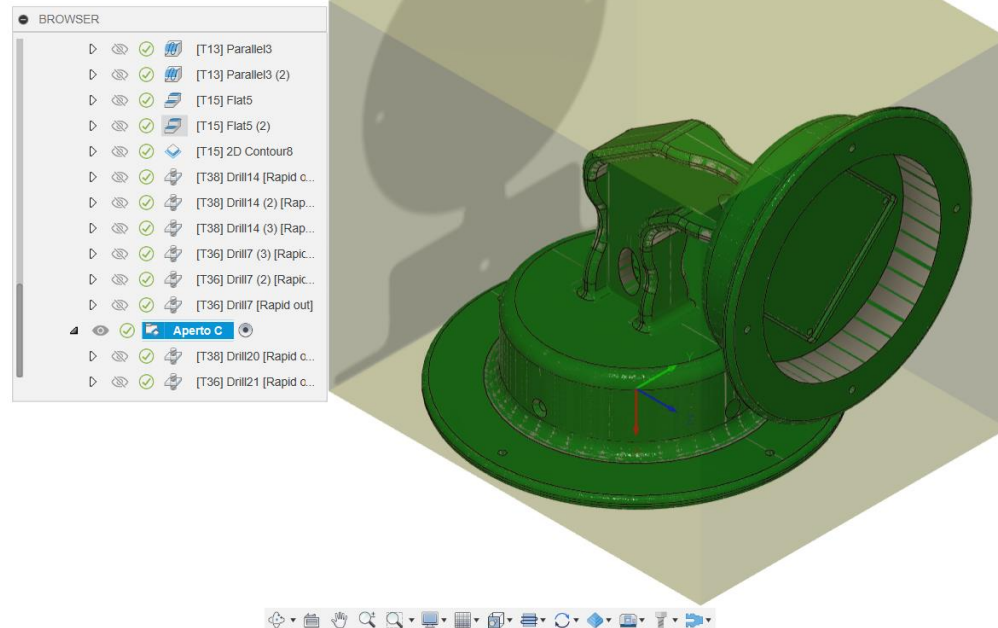
Simulação completa dos acabamentos laterais



Etapas

Aperto C

Furações

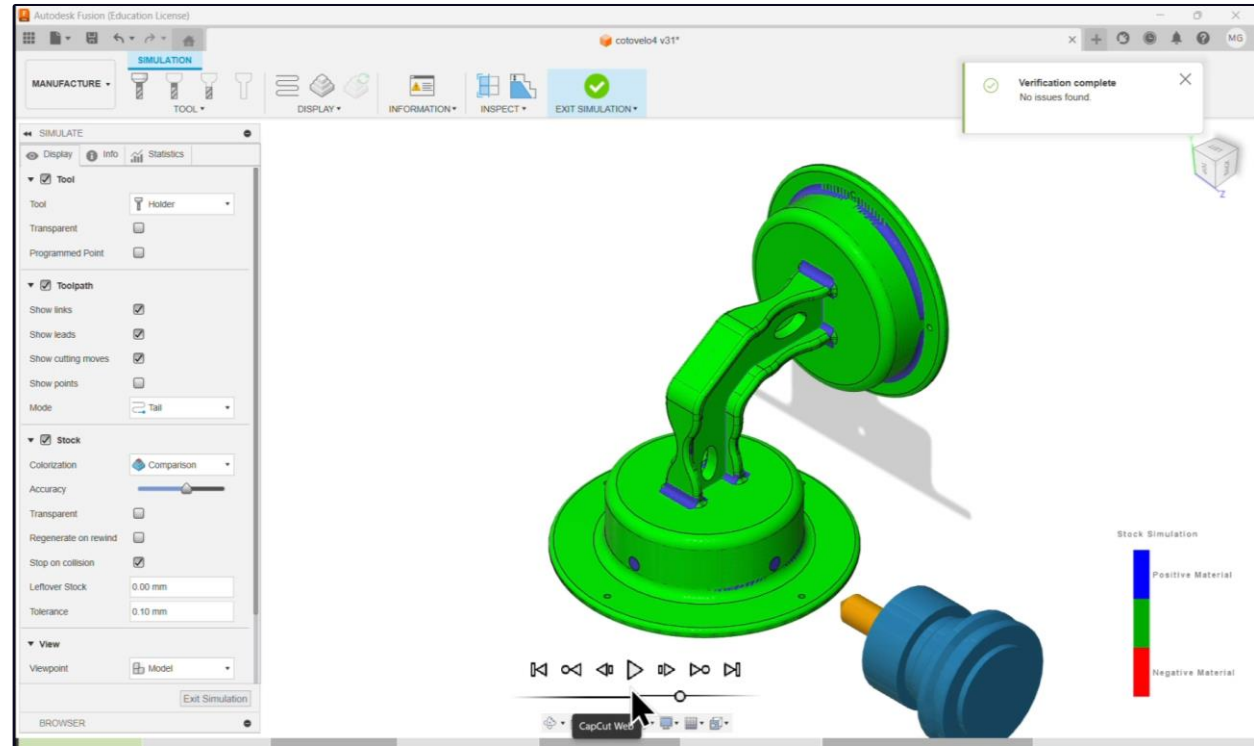


Aperto C | Total machining time: 0:00:17

Etapas

Aperto B e C

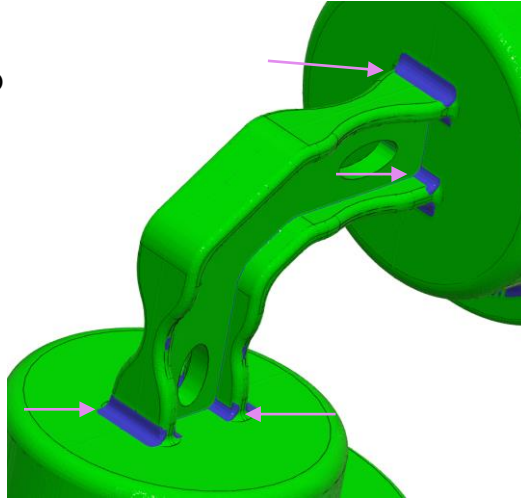
Simulação
completa das
furações radiais



Melhorias possíveis

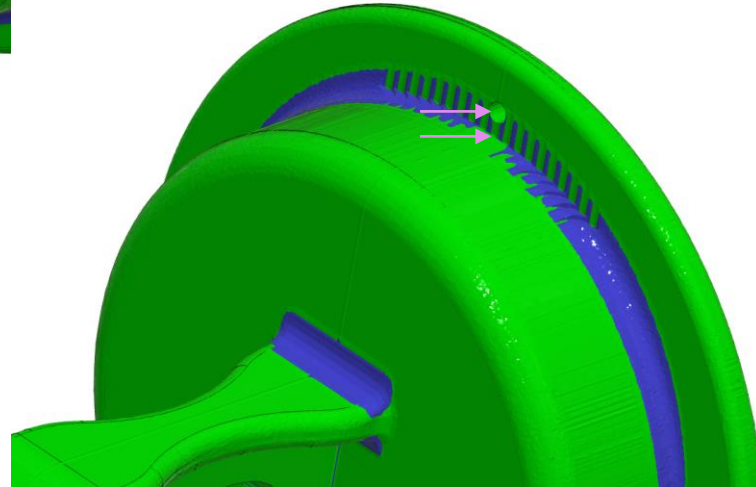
Raio interno

Aumento do raio interno para facilitar a maquinação



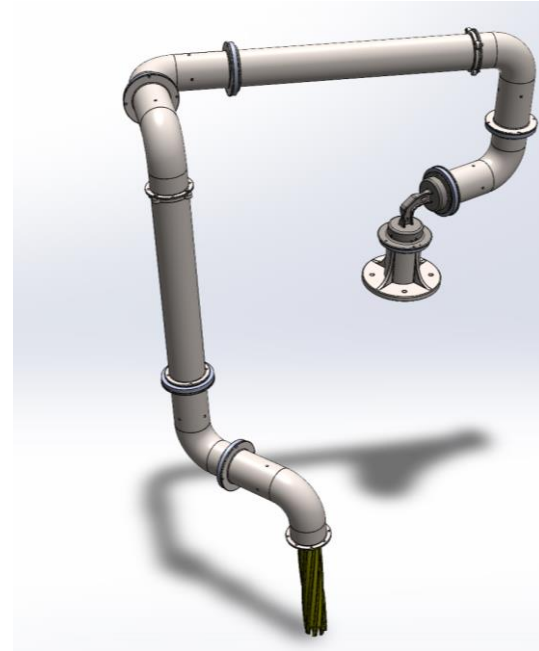
Distância do furo a aresta

Aumento da distância para facilitar a maquinação e remoção de quina



Braço robótico

- Com a peça finalizada e em funcionamento



Peça original



Obrigado!

