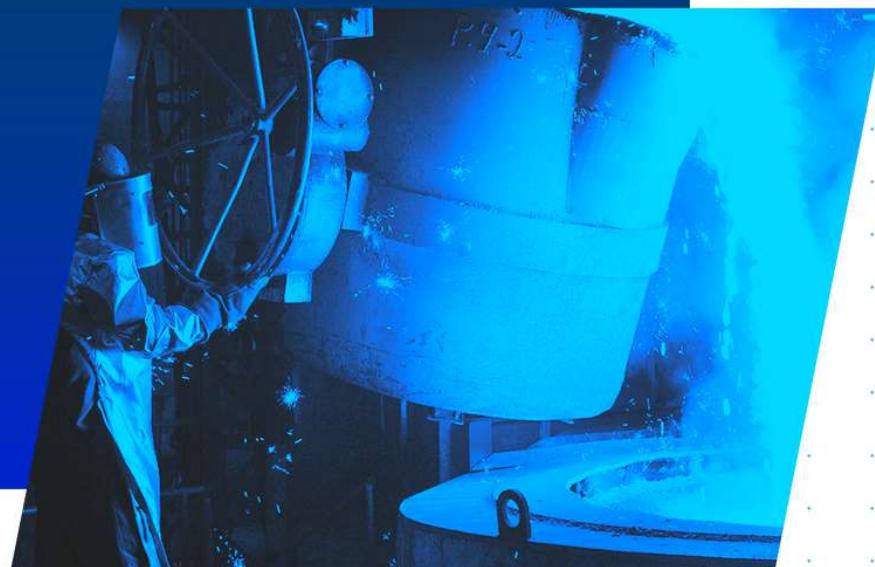


SCHULZ
AUTOMOTIVA



SCHULZ
AUTOMOTIVA



SCHULZ
COMPRESSORES



SPS

SISTEMA DE PRODUÇÃO
SCHULZ

CLIENTES SATISFEITOS

PESSOAS VALORIZADAS

NEGÓCIO RENTÁVEL

PREMISSAS BÁSICAS

Segurança
Qualidade
Disciplina

DESENVOLVIMENTO
DE PROCESSOS
ROBUSTOS

PRODUZIR CERTO,
NA HORA CERTA,
NA QUANTIDADE CERTA

MELHORIA
CONTÍNUA E
SUSTENTABILIDADE

FOCO

Zero acidente
Zero defeito
Zero reclamação
Eficiência
Organização e limpeza

PADRONIZAÇÃO E ESTABILIDADE

CULTURA PARA QUALIDADE E MEIO AMBIENTE

PESSOAS COMPETENTES E COMPROMETIDAS

SCHULZ
AUTOMOTIVA

MERCADOS E CLIENTES

52%
CAMINHÕES



29%
AGRÍCOLA,
CONSTRUÇÃO E
WINDPOWER



19%
EXPORTAÇÃO



CAMINHÕES

Cubos de roda

Carcaças de transmissão

Sapatos de freio

Quinta roda

Travessas de sustentação

Suportes de Cabine

Carcaças de diferencial

Capas de mancal

Cubos de redução



CONSTRUÇÃO

Suporte da torre

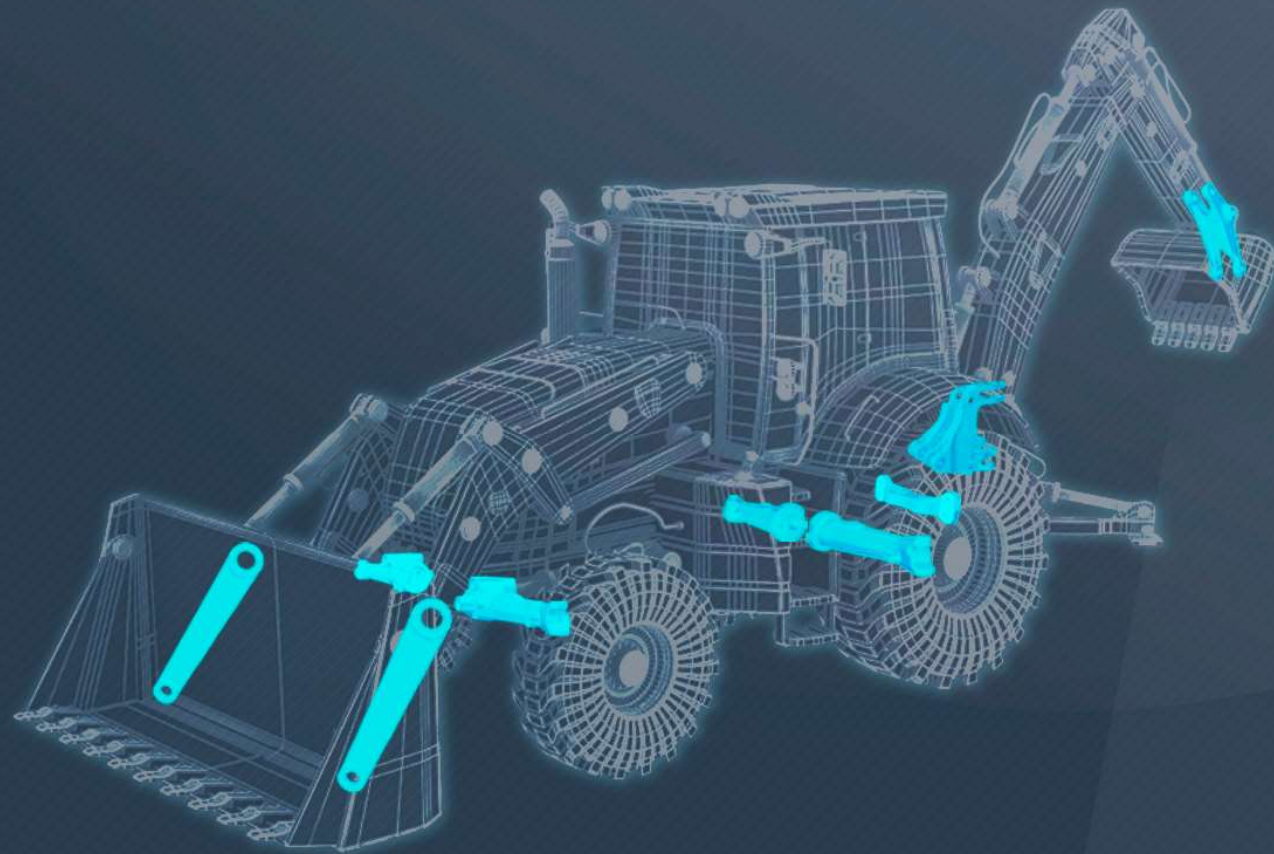
Torre de giro

Articulação

Carcaça de eixo

Contrapeso

Carcaça de Transmissão





AGRÍCOLA

Suporte traseiro

Carcaça de eixo

Suporte da suspensão

Junção de eixo

Carcaças laterais

Carcaças centrais

Suporte de bateria

NOSSOS PROCESSOS



SCHULZ
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FUNDIÇÃO

150.000 ton/ano

Ferro Cinzento (20%)
Nodular (80%)

HWS 1
900 x 760 x 300/300mm

HWS 2
1.200 x 910 x 300/330mm

Euromac
900 x 760 x 300/300mm

Hunter
600 x 500 x 165/165mm

9 Fornos
Inductotherm, Inductotherm Holding, Otto Junker e ABB

Macharia
25 estações, dentre Cold box e Shell

Rebarbação
5 células robotizadas

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UNIDADE 3

15.000 ton/ano
138.000 m²

Ferro Cinzento (20%)
Nodular (80%)

FBO II
550 x 450 x 260/400mm

FBO IIIS
610 x 508 x 260/400mm

5 Fornos
Inductotherm e Pillar

Macharia
13 estações, dentre Cold box e Shell

Acabamento
9 jatos, tambor e dirigível manual

Laboratórios completos
Metalográfico, Químico, Ensaio mecânicos
e Análise de areias.

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AUTOMOTIVA



Antes



DAF

Depois



ENGENHARIA SIMULTÂNEA

Peça original em chapas metálicas

Integração de duas peças em uma

Eliminação de soldas

Melhora das propriedades da peça





ENGENHARIA SIMULTÂNEA

Peça original em chapas metálicas

Eliminação de soldas

Redução de peso

Melhorando propriedades da peça



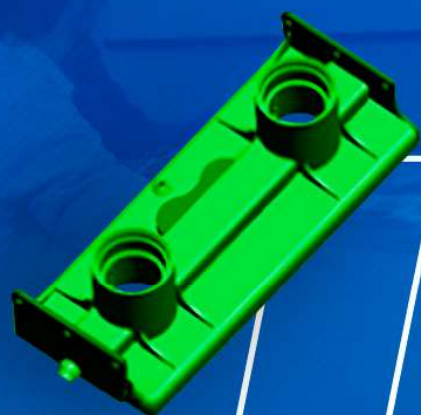
ENGENHARIA SIMULTÂNEA

Redução de peso

Melhora das propriedades mecânicas

Eliminação de machaia complexa

Otimização do processo de usinagem



Antes

JOHN DEERE



Depois

ENGENHARIA SIMULTÂNEA

Peça original em chapas metálicas

Eliminação de montagem com 13 peças

Eliminação de soldas

Peça única em ferro fundido

Antes



SCANIA

Depois

ENGENHARIA SIMULTÂNEA

Eliminação de macharia complexa

*Melhoria em propriedades mecânicas
sem tratamento térmico*

Redução de 16% no peso

CERTIFICADOS E RECONHECIMENTOS

ISO 9001
IATF 16949
ISO 14001

93 pontos NPS em nossa Pesquisa de Satisfação de clientes

Mais de **70** reconhecimentos de parceiros

VOLVO JOHN DEERE CATERPILLAR

JOIST



**CNH
INDUSTRIAL**



Mercedes-Benz

DAF



BOSCH

MAXION

MWM

MERITOR



SCHULZ
AUTOMOTIVA

Otimização de Processos de Fundição com MAGMASOFT[®]:

Simulação de Stress e Redesign de Peças para Moldagem em Areia



Introdução



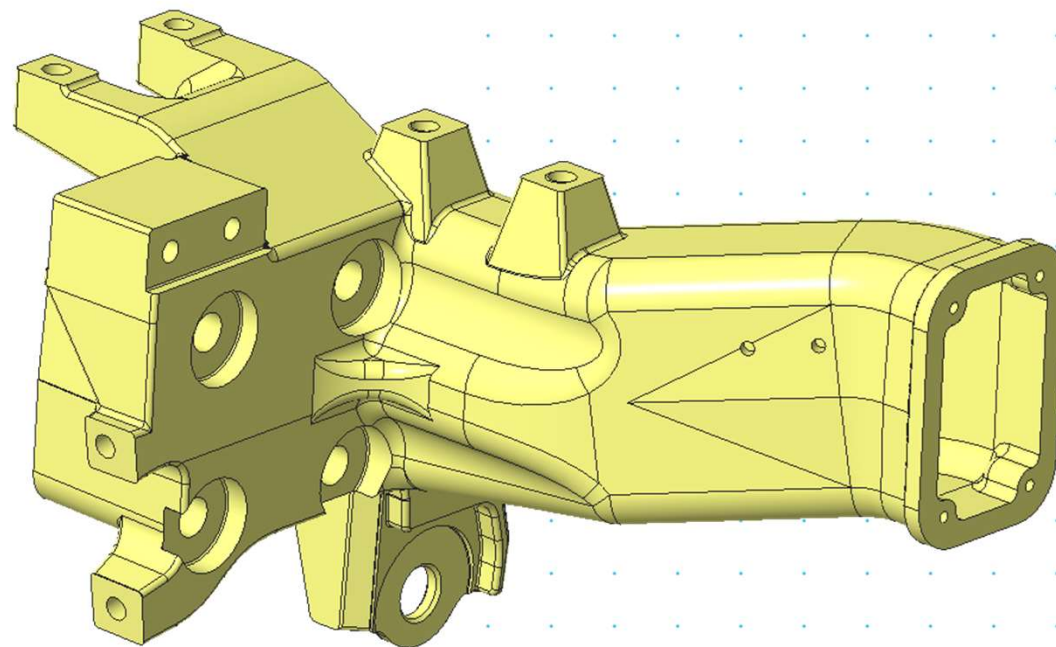
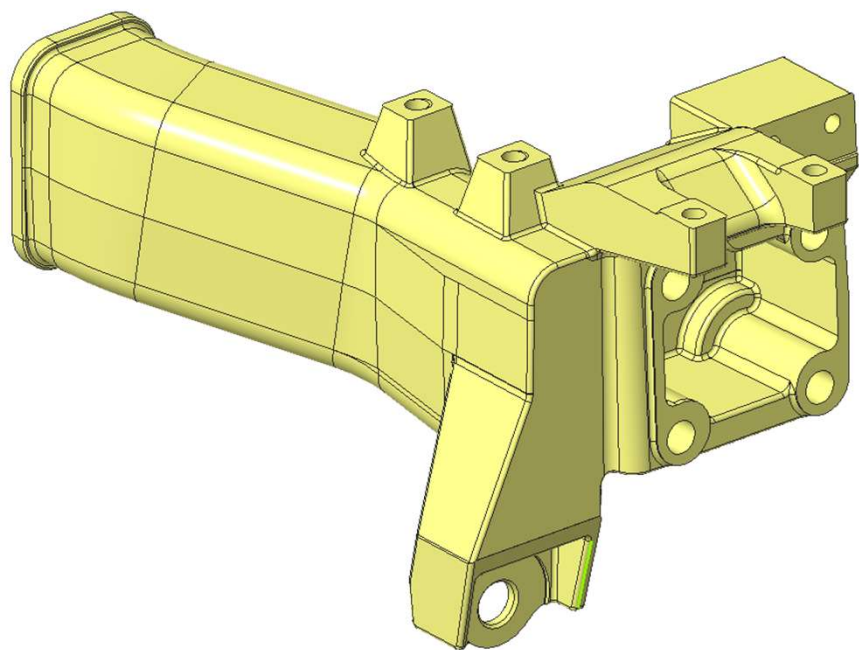
Os processos metalúrgicos estão se tornando mais dependentes a cada dia da simulação computacional como exemplo:

- Entender os fenômenos de empenamentos e deformações geométricas resultantes do vazamento de metal líquido em moldes de areia desempenha um papel crucial na busca por soluções técnicas, permitindo compreender defeitos associados a esse processo.*
- A aplicação de simulação em Redesign de peças para a fundição resulta na obtenção de geometrias mais simplificadas para o processo de fabricação, eliminando e simplificando machos, alimentadores dentre outros recursos de moldagem, resultando em redução de custo final do fundido.*
- Essas necessidades aumentam a dependência das simulações, pois a mesma auxilia na busca por soluções mais eficientes para a fundição.*

Objetivo



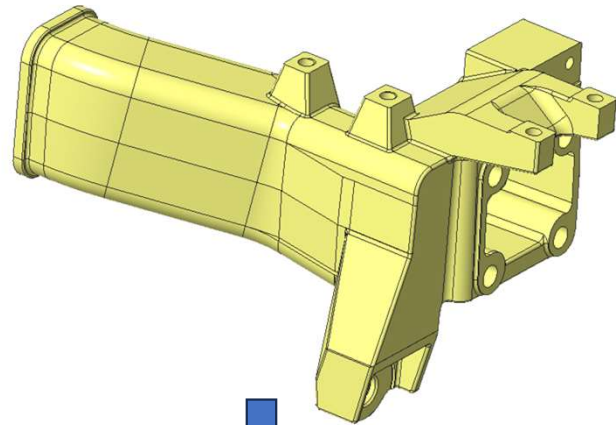
- *Entender por meio de simulação o mecanismo que gera empenamentos e deformações geométricas em peças de ferro fundido nodular;*
- *Sugerir/validar/simplificar geometrias 3D de peças fundidas com auxilio de simulação em MAGMASOFT®;*



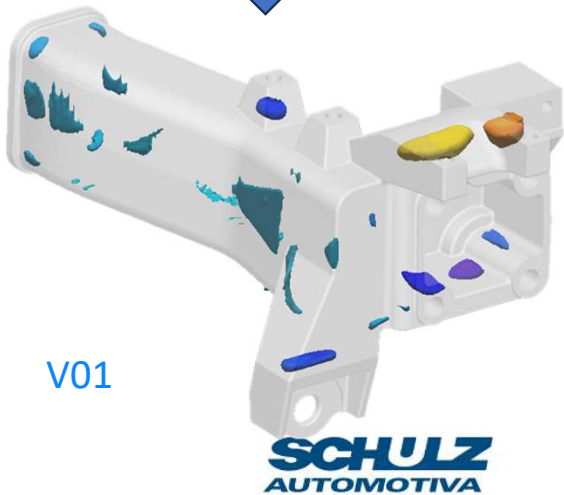
SCHULZ
AUTOMOTIVA

Redesign de Peças

Peça usinada

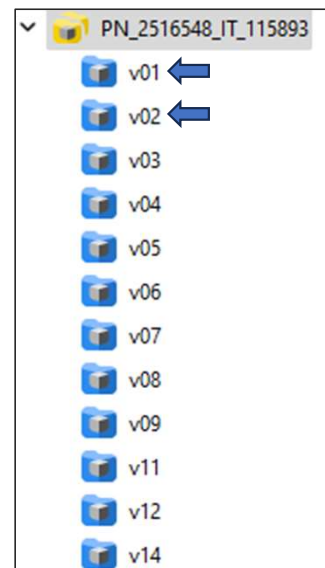
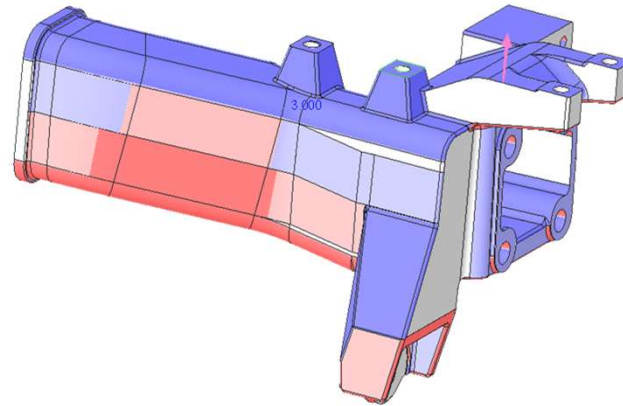


V01

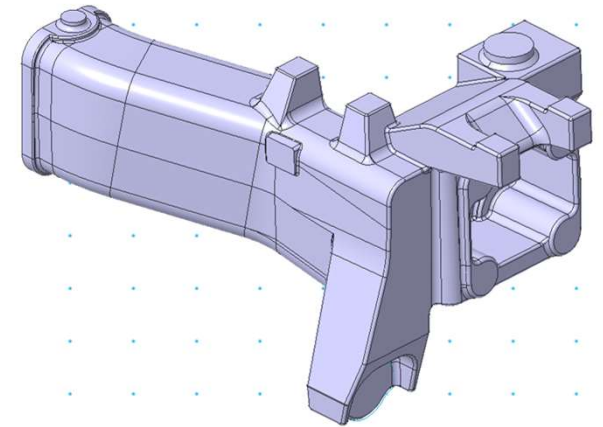


SCHULZ
AUTOMOTIVA

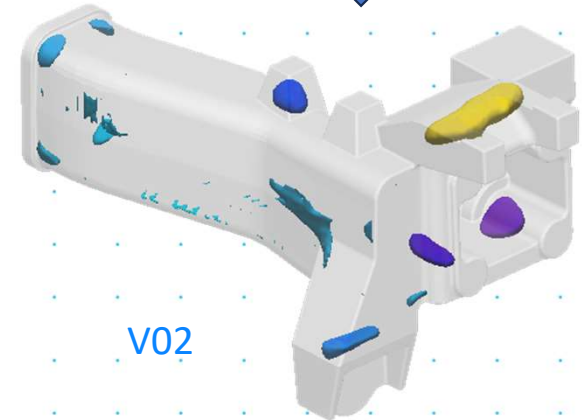
Análise extração



Peça Bruta

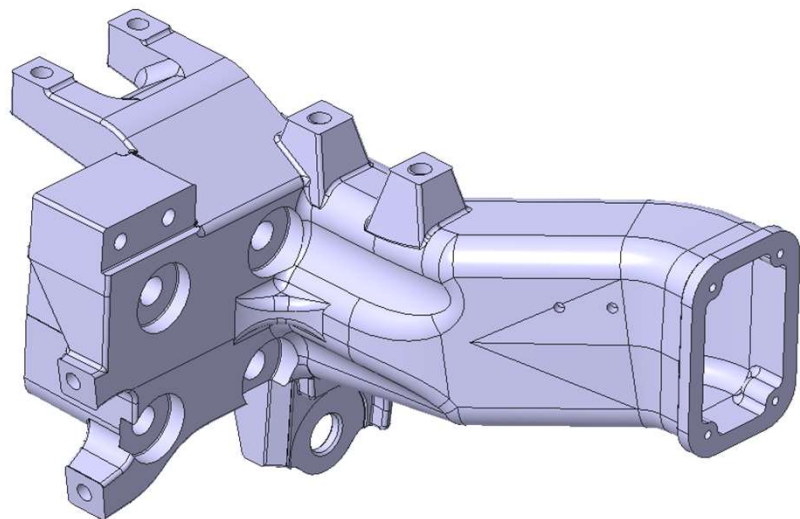


V02

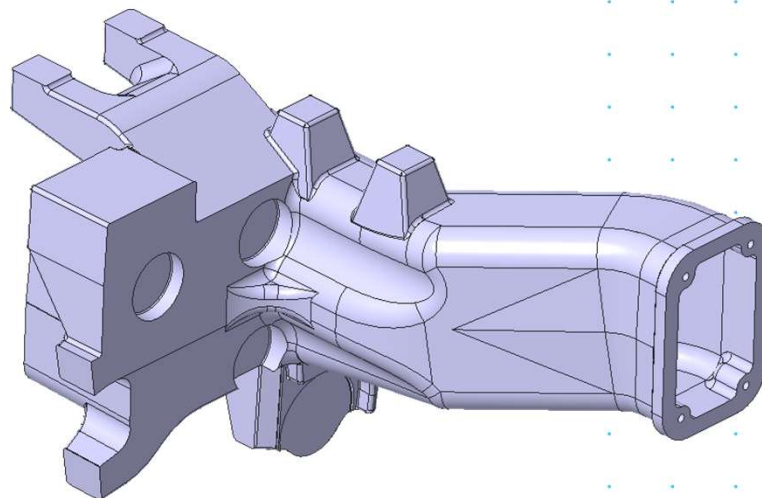


Redesign de Peças – Fases

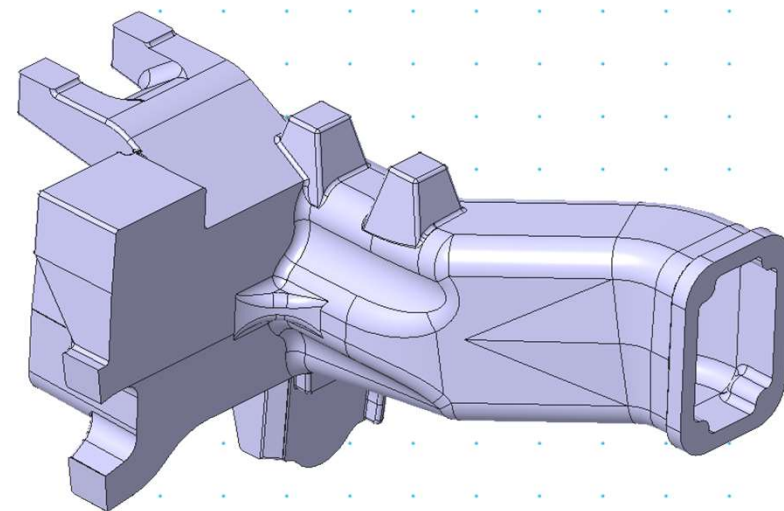
Peça usinada



Eliminando Furos



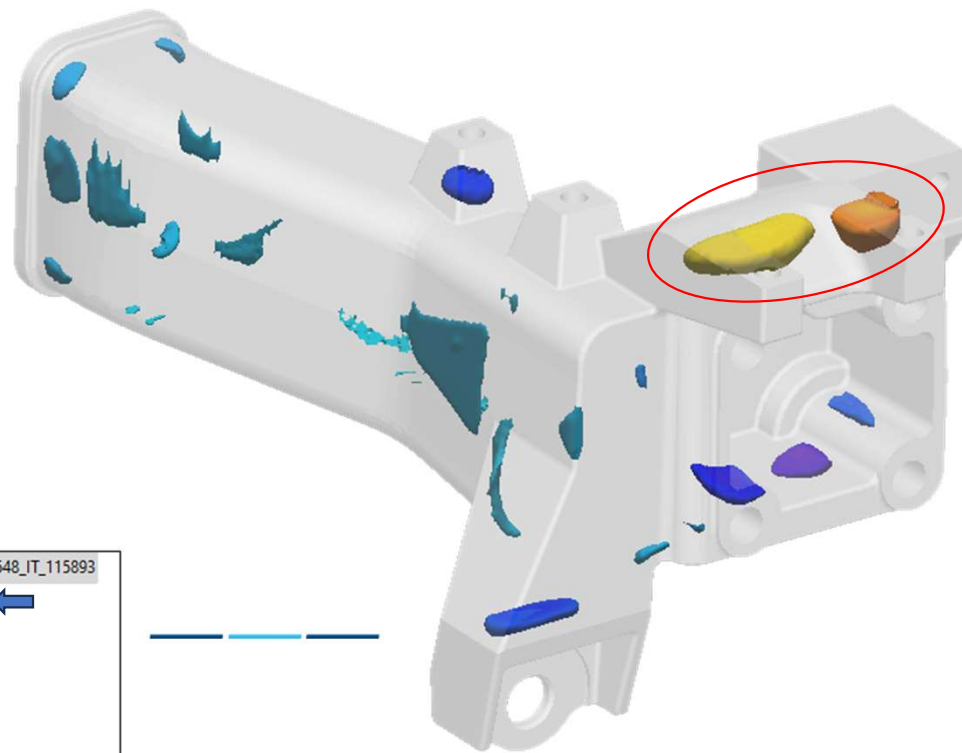
Peça Bruta



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*Redesign de Peças – Ajustes
extração 3D*

HOT SPOT - Usinado



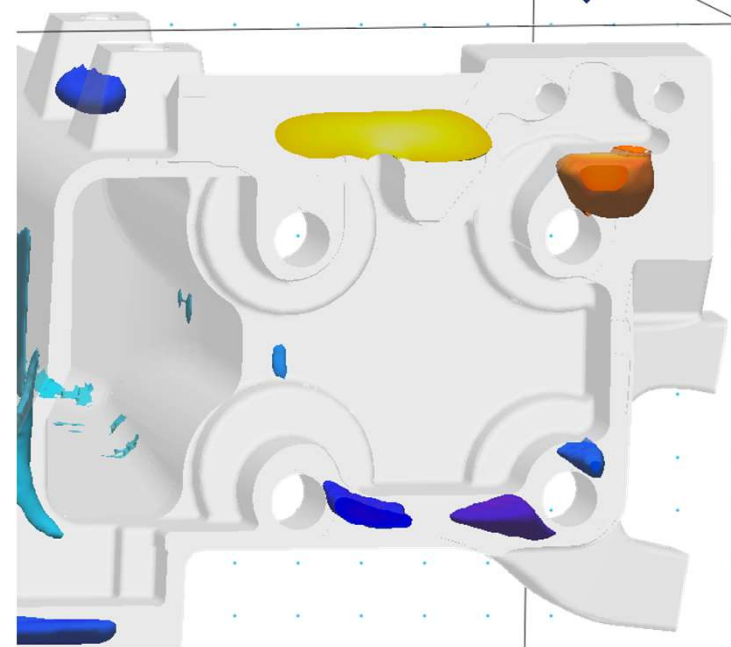
- PN_2516548_IT_115893
- v01
 - v02
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SCHULZ
AUTOMOTIVA

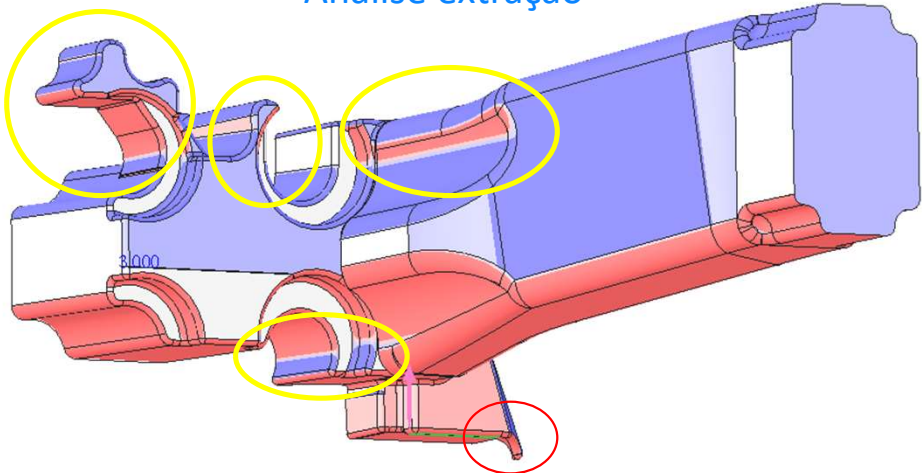
**Redesign de Peças -
Solidificação 3D usinado**

LUVA

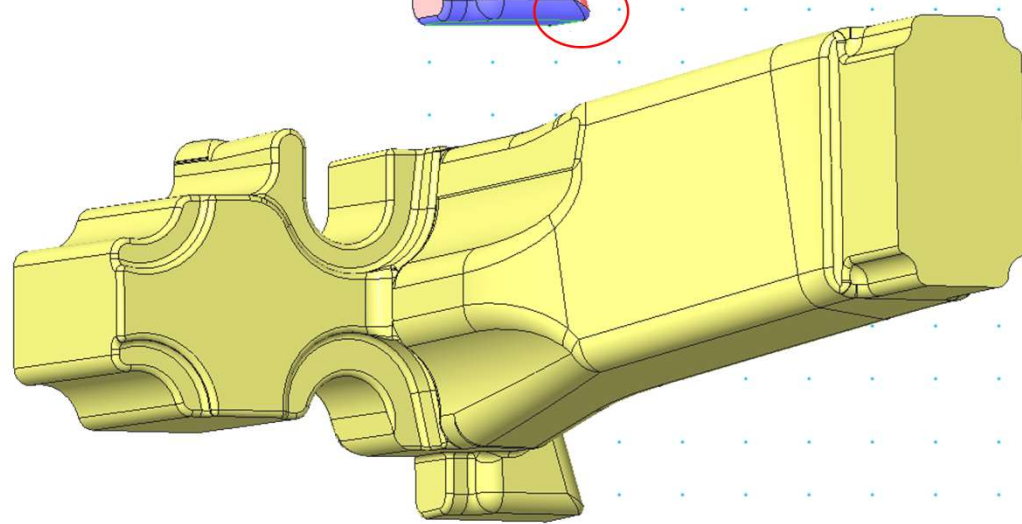
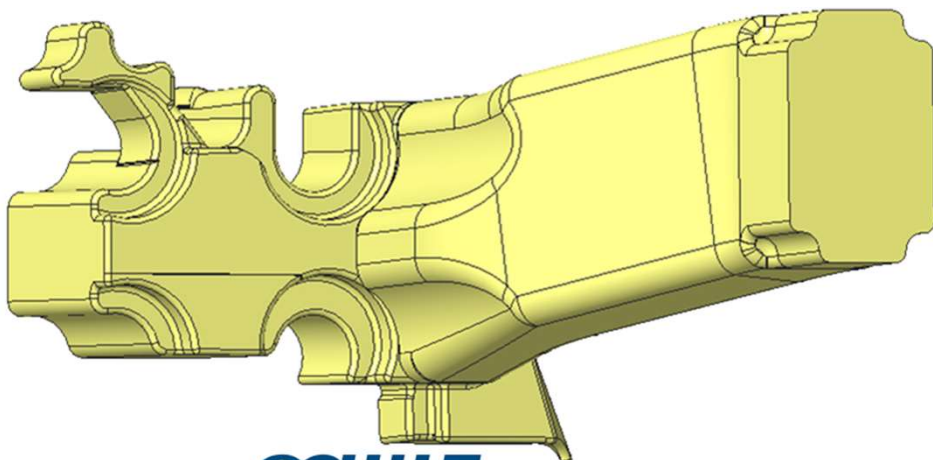
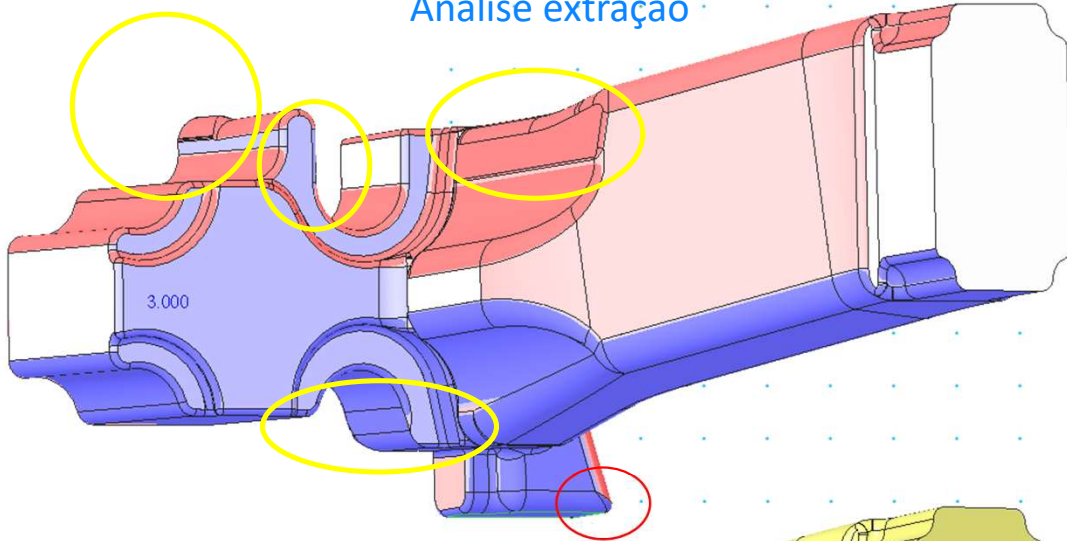
Ponto isolado



Análise extração



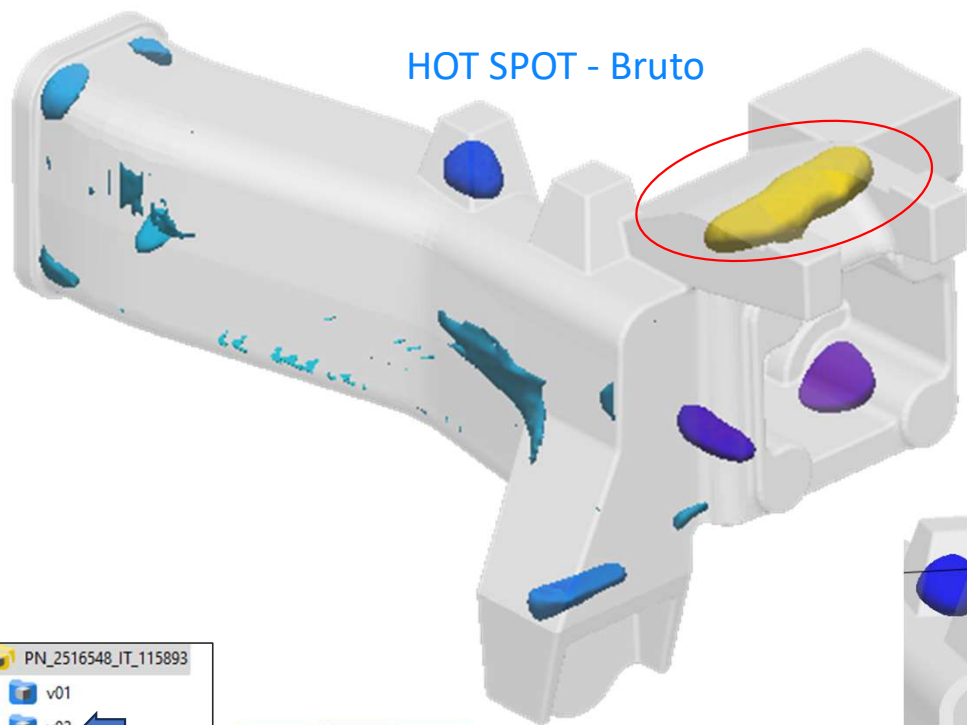
Análise extração



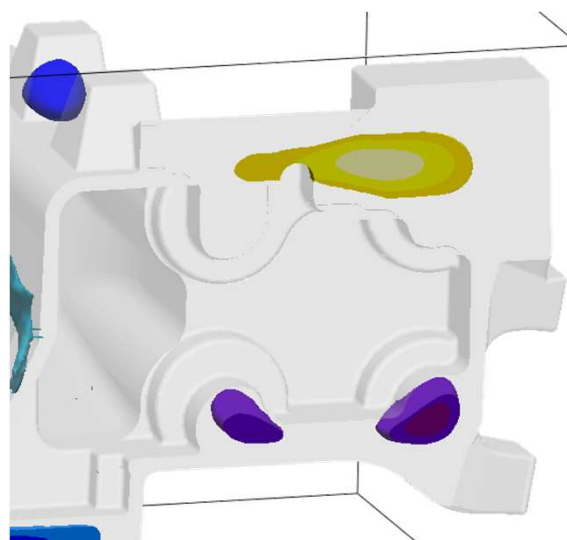
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Ajuste extração macho**

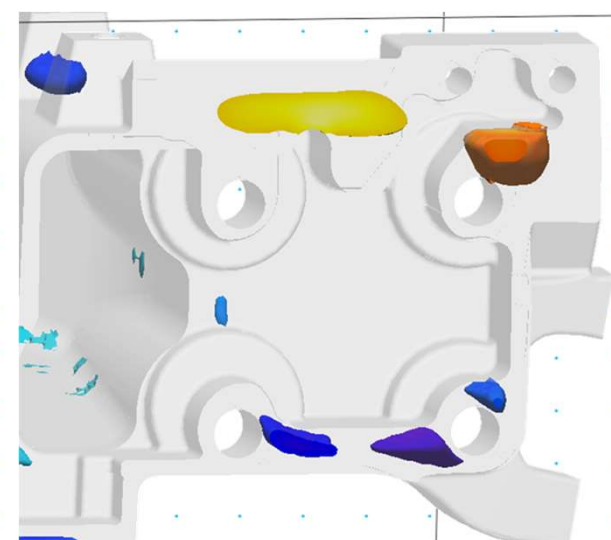
HOT SPOT - Bruto



alterado



Original

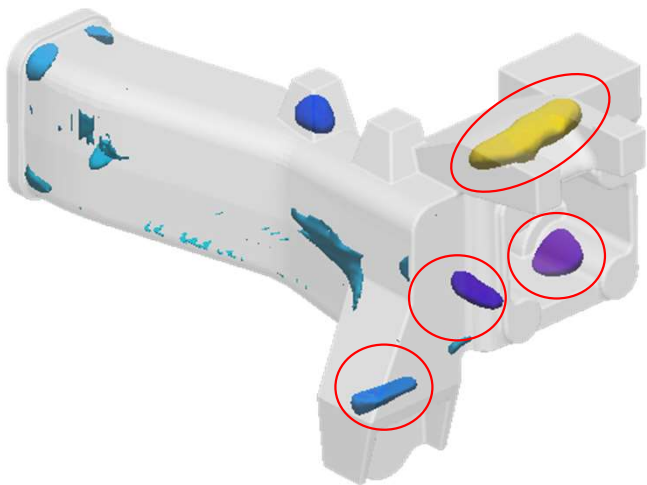


- PN_2516548_IT_115893
- v01
 - v02 ←
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 - v14

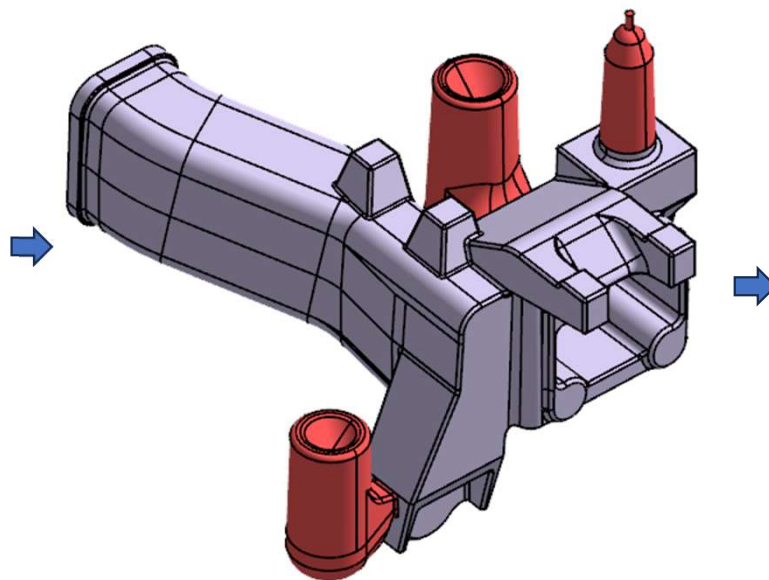
SCHULZ
AUTOMOTIVA

**Redesign de Peças -
Solidificação 3D alterado**

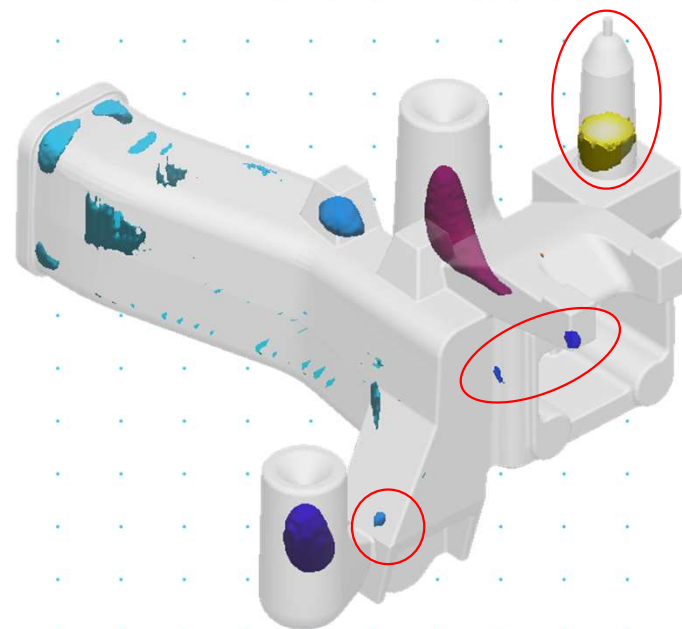
HOT SPOT - Bruto



Geometria Simulada



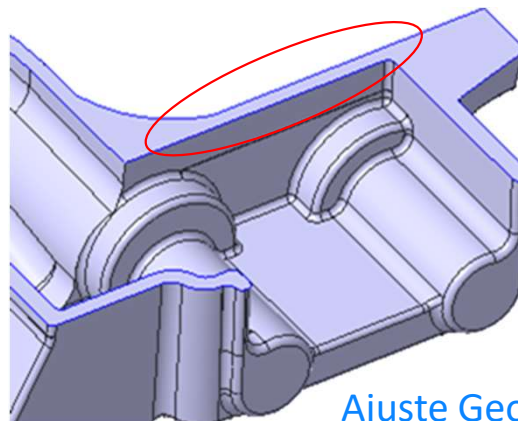
HOT SPOT - Resultado



- PN_2516548_IT_115893
- v01
 - v02
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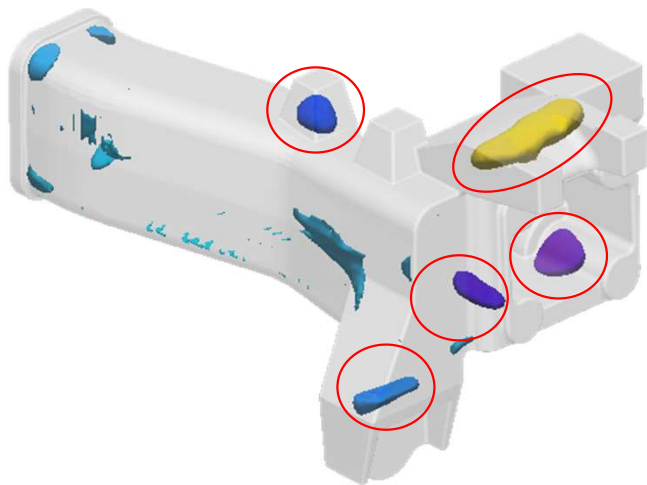
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
alteração 3D**

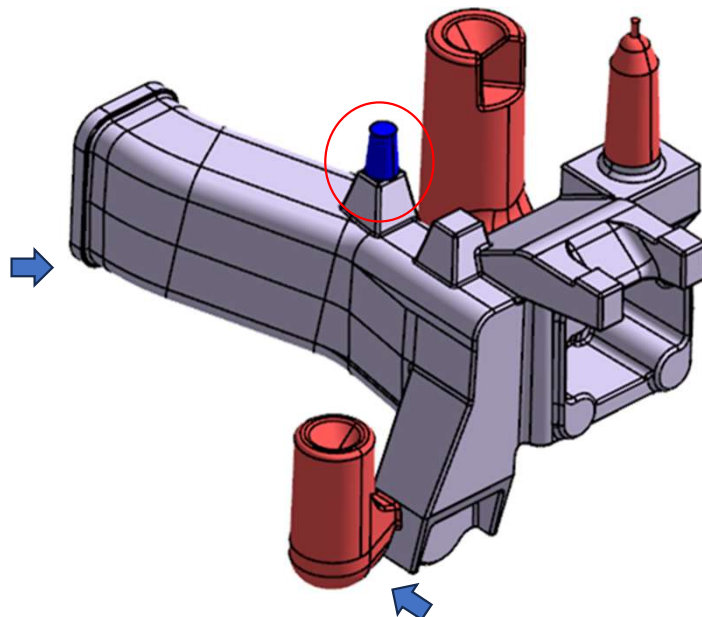


Ajuste Geometria

HOT SPOT - Bruto



Geometria Simulada



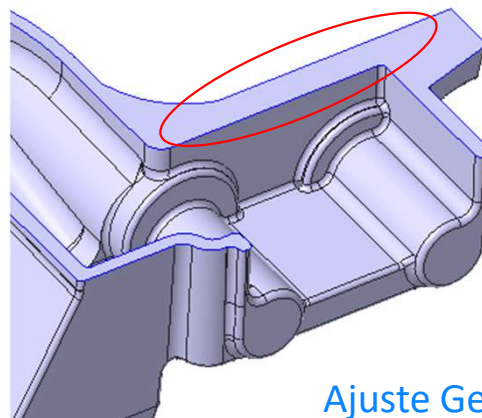
HOT SPOT - Resultado



- PN_2516548_IT_115893
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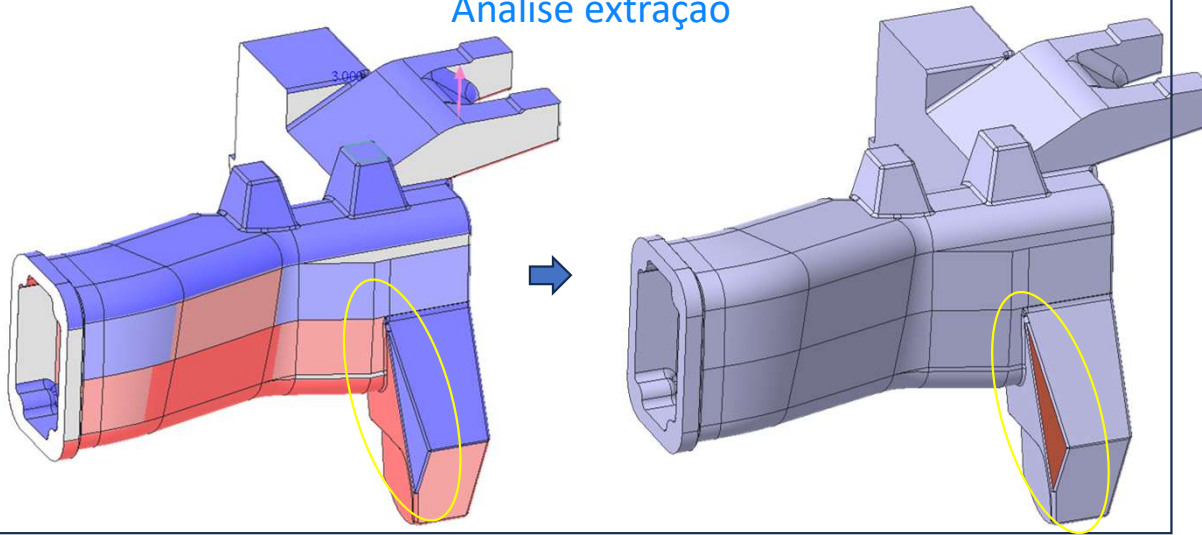
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
alteração 3D*

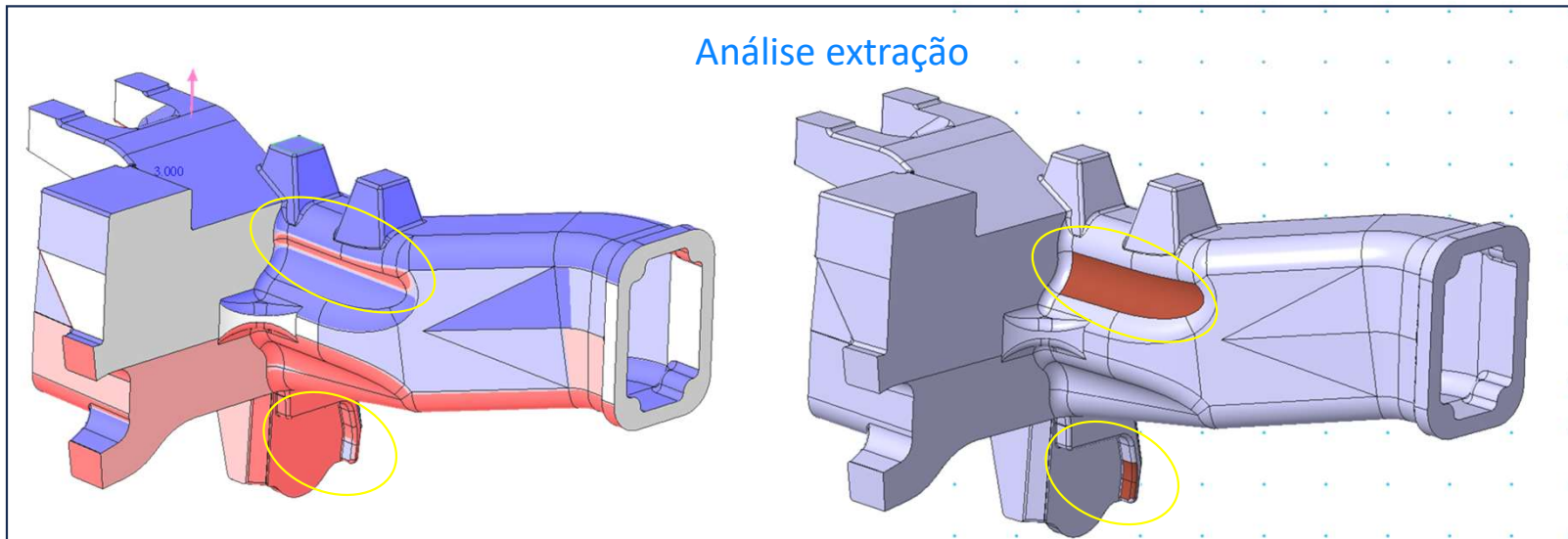


Ajuste Geometria

Análise extração

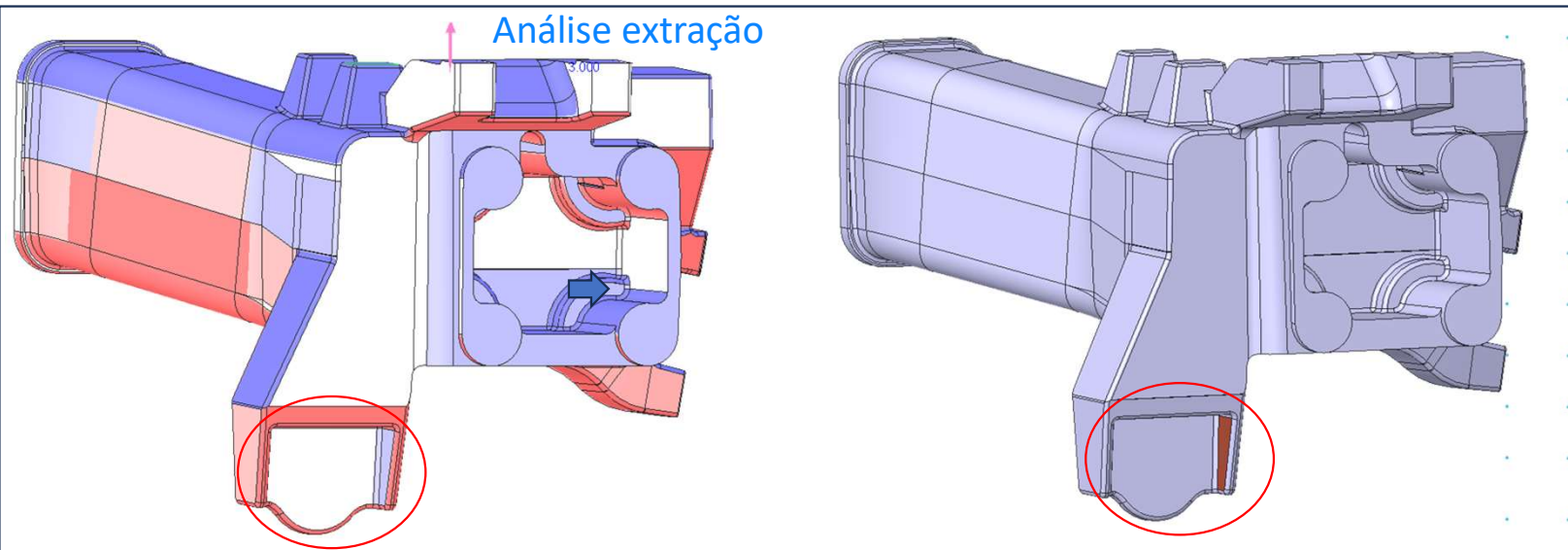


Análise extração



SCHULZ
AUTOMOTIVA

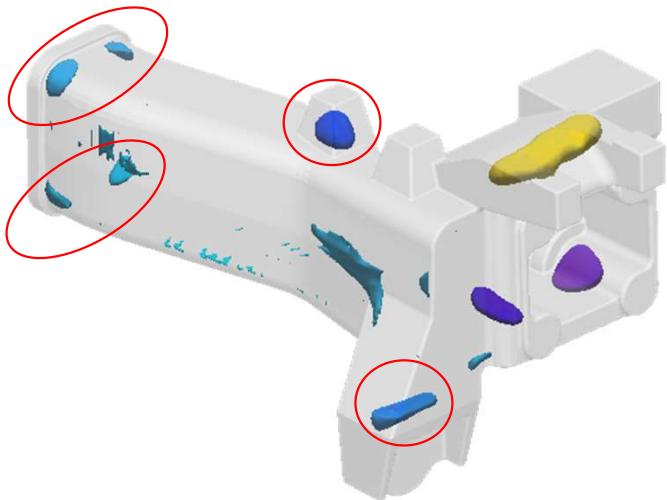
**Redesign de Peças –
Ajuste extração geometria**



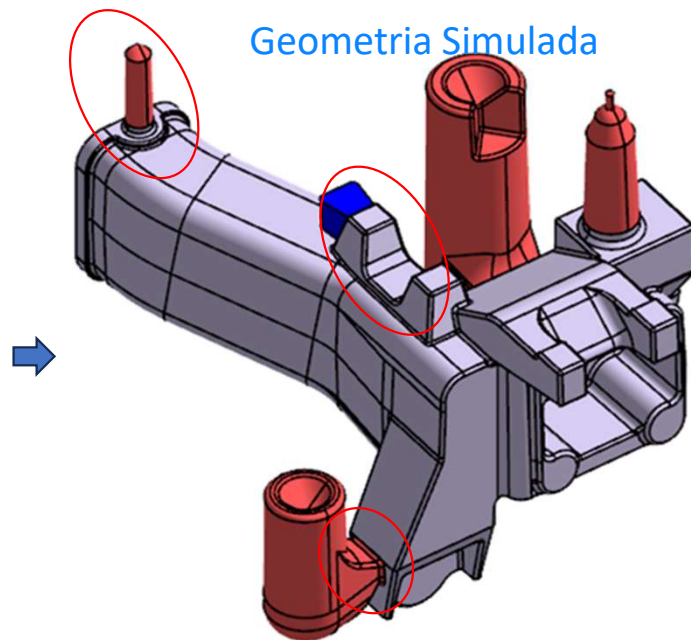
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
Ajuste extração geometria*

HOT SPOT - Bruto



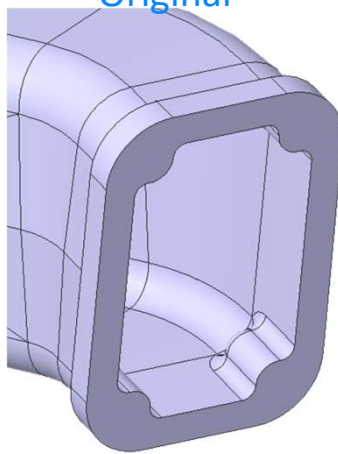
Geometria Simulada



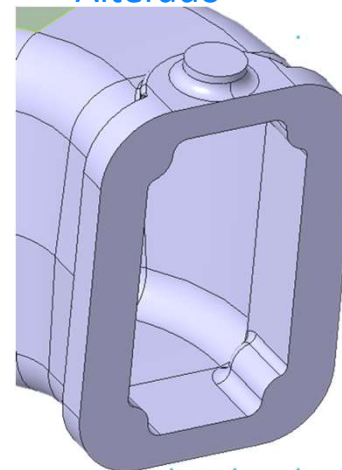
HOT SPOT - Resultado



Original



Alterado

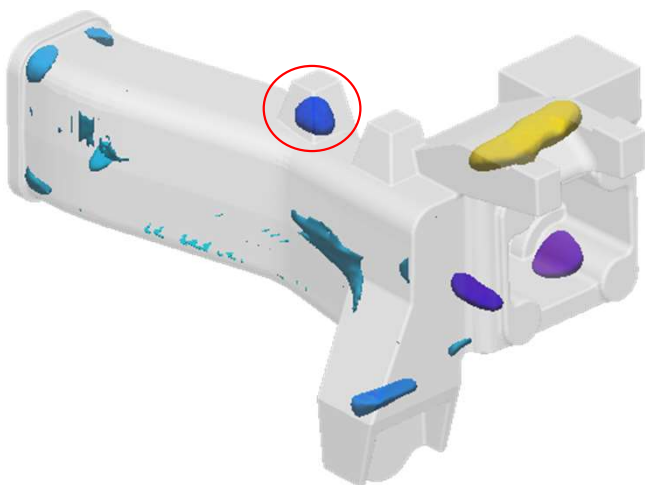


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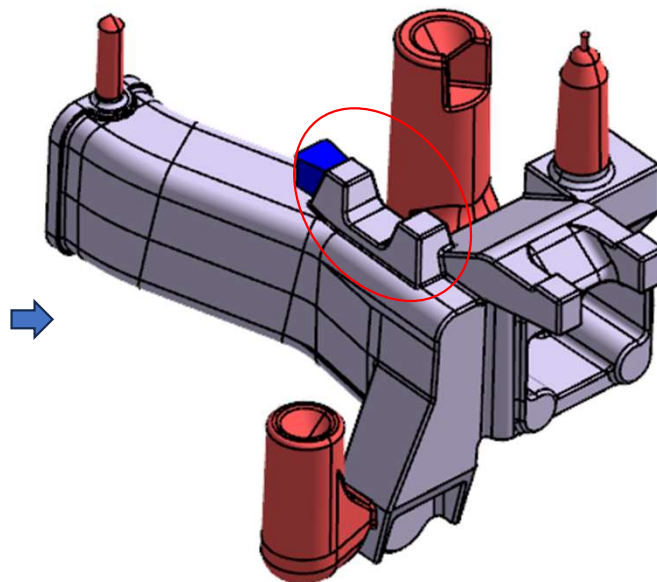
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
alteração 3D**

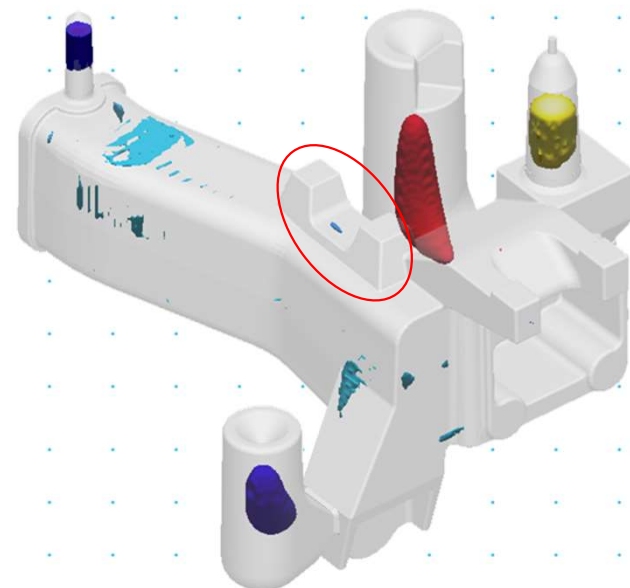
HOT SPOT - Bruto



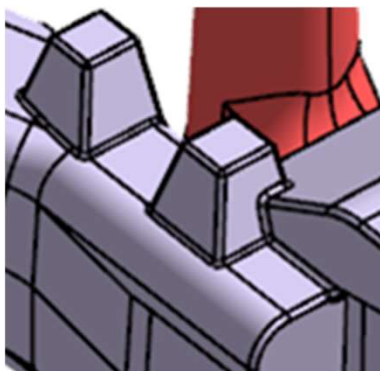
Geometria Simulada



HOT SPOT - Resultado



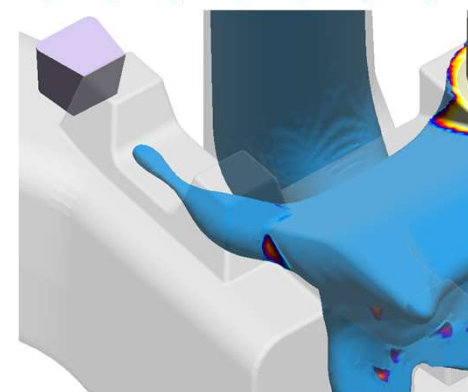
Original



Alterado



Fração líquida

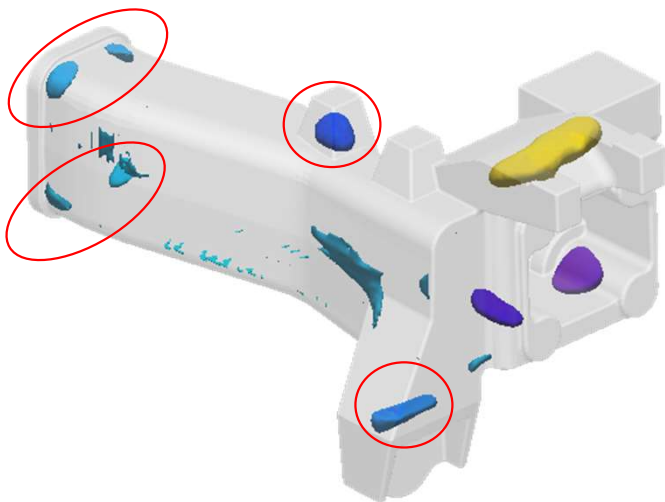


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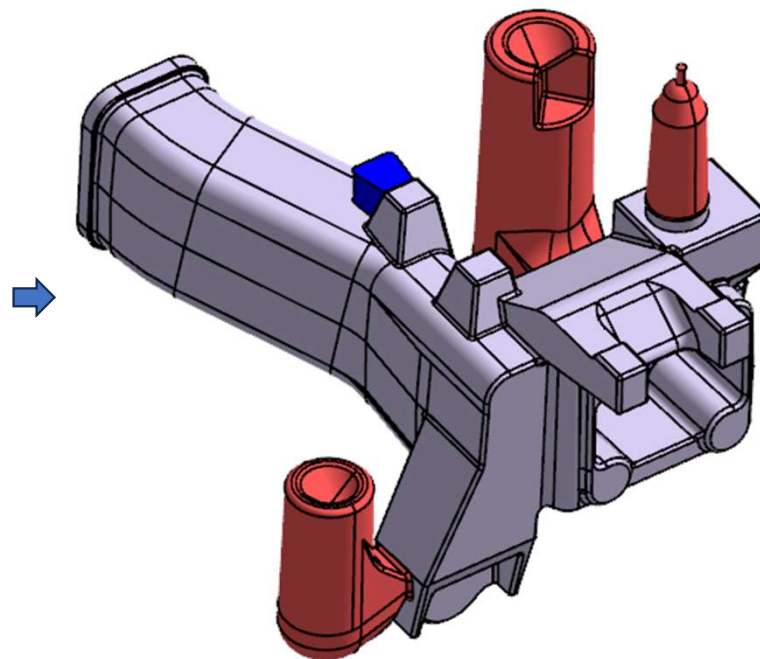
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
alteração 3D mancal**

HOT SPOT - Bruto



Geometria Simulada



HOT SPOT - Resultado

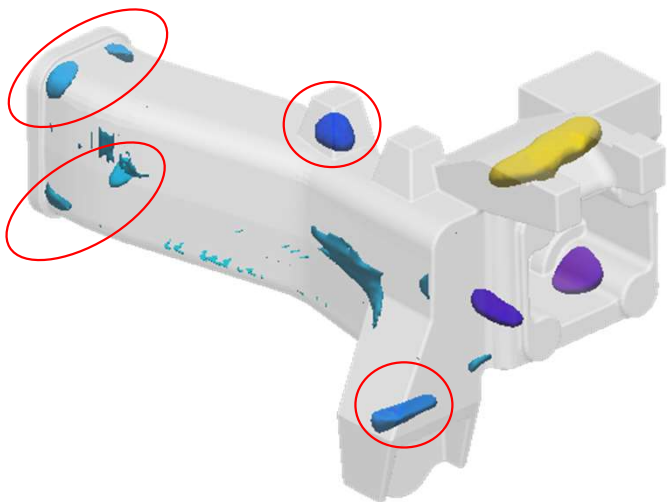


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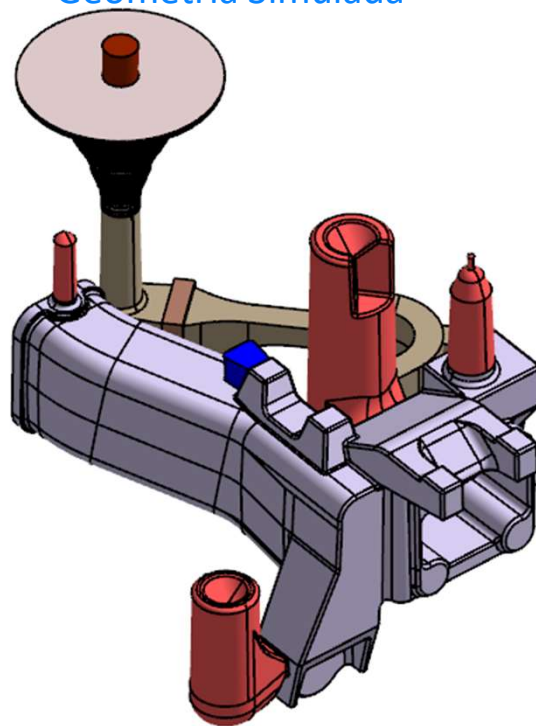
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
3D condição original*

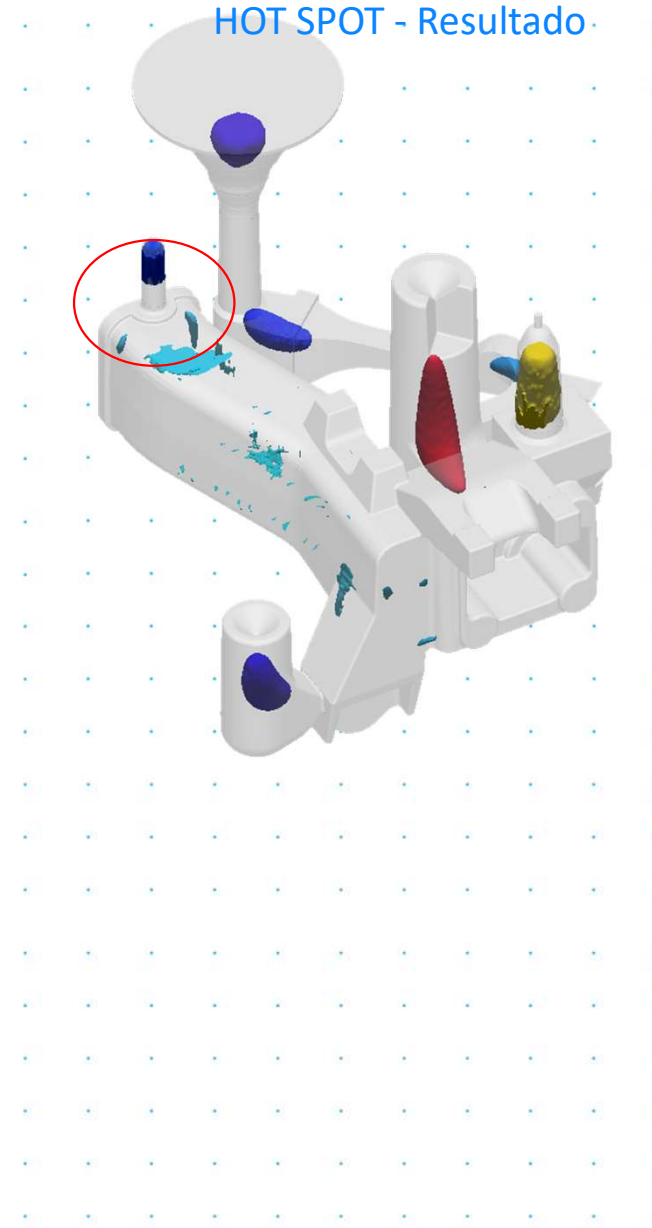
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Geometria Simulada



HOT SPOT - Resultado

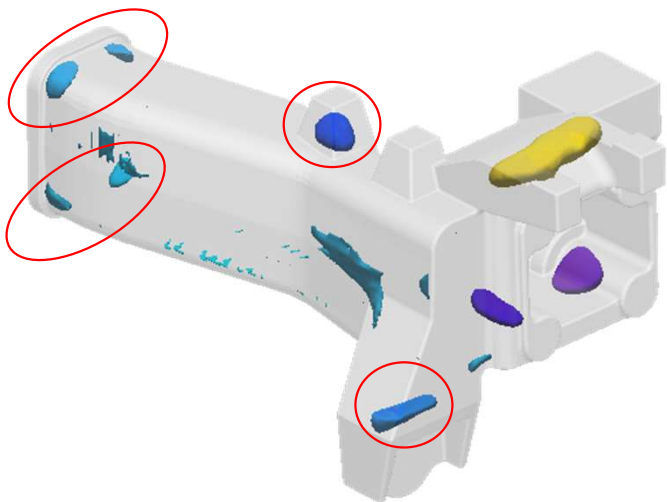


- PN_2516548_IT_115893
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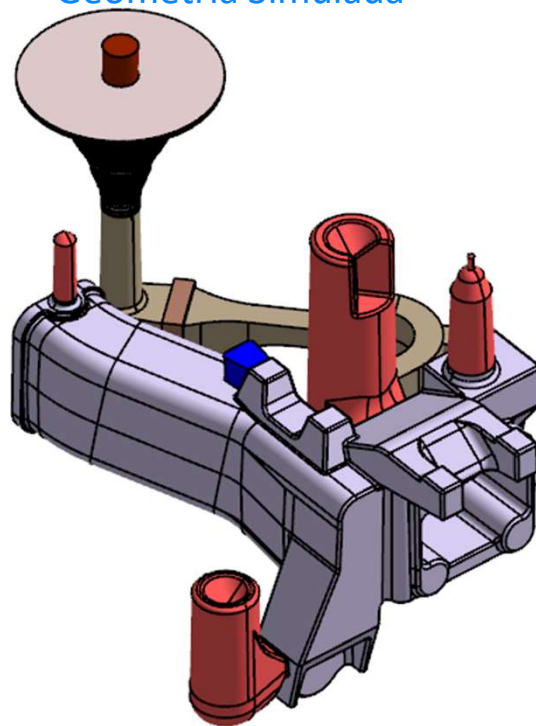
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Vazamento 3D alterado**

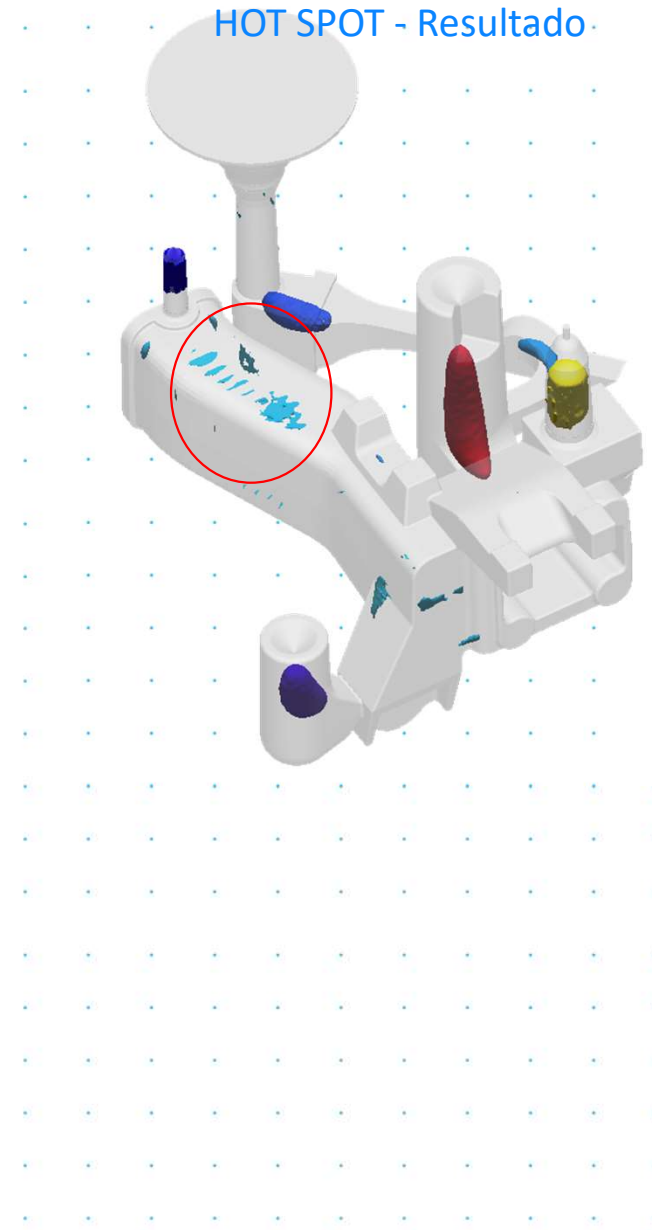
HOT SPOT - Bruto



Geometria Simulada



HOT SPOT - Resultado

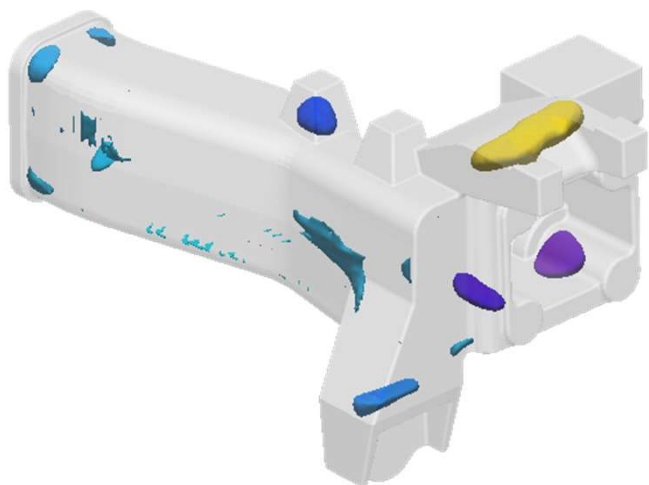


- PN_2516548_IT_115893
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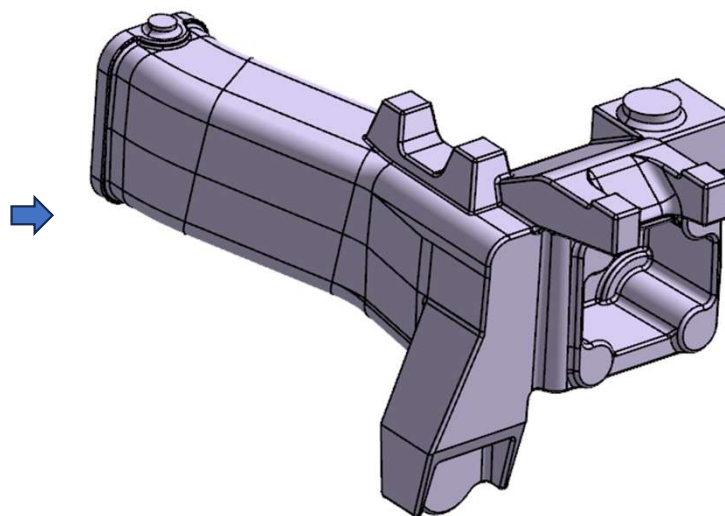
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
3D alterado tubo*

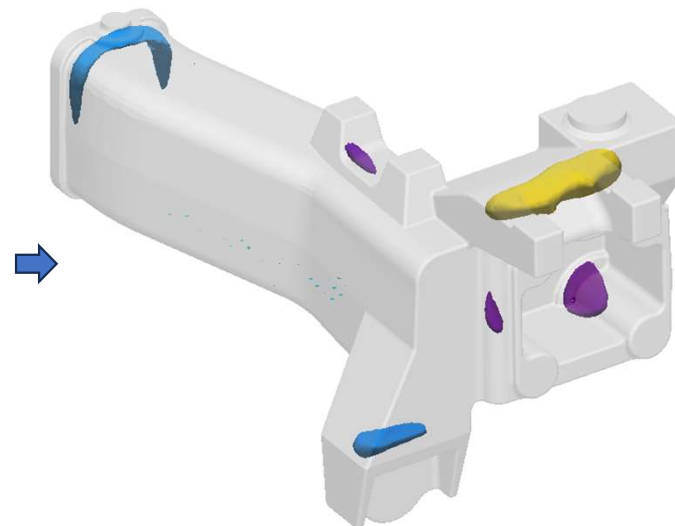
HOT SPOT - Bruto



Geometria Simulada



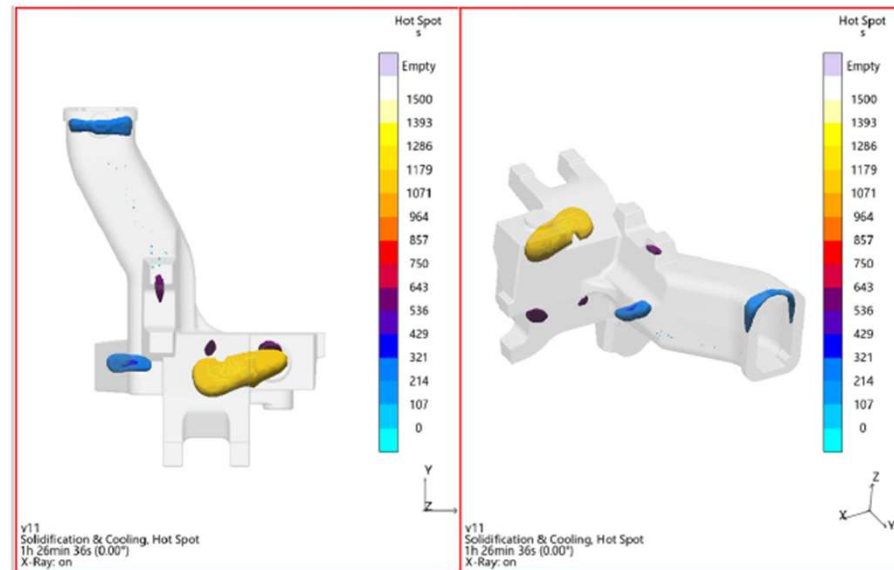
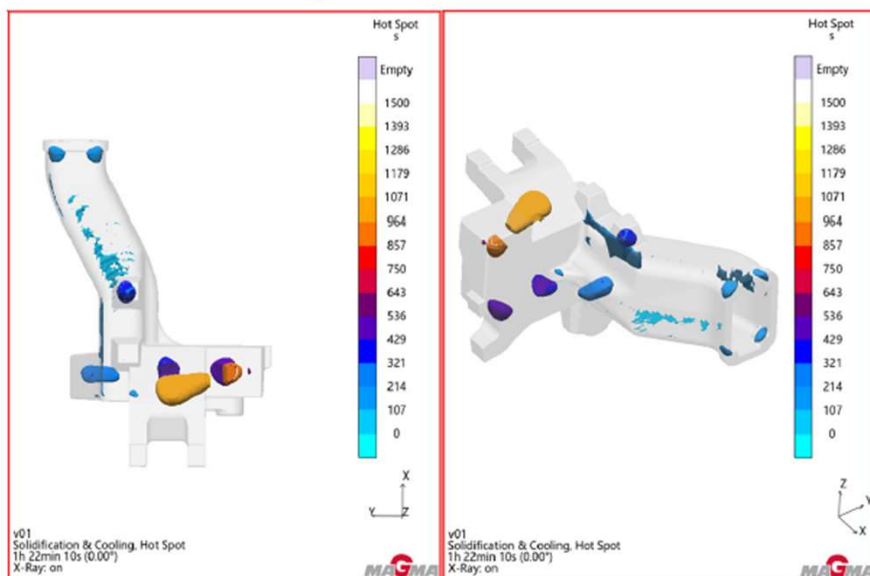
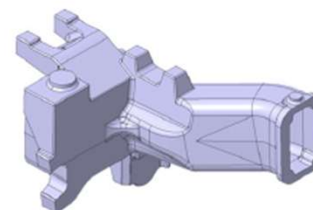
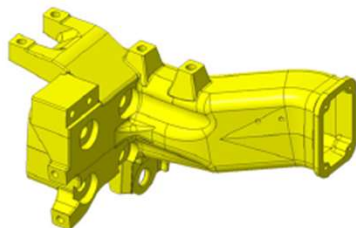
HOT SPOT - Resultado



- PN_2516548_IT_115893
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 - v12
 - v14

SCHULZ
AUTOMOTIVA

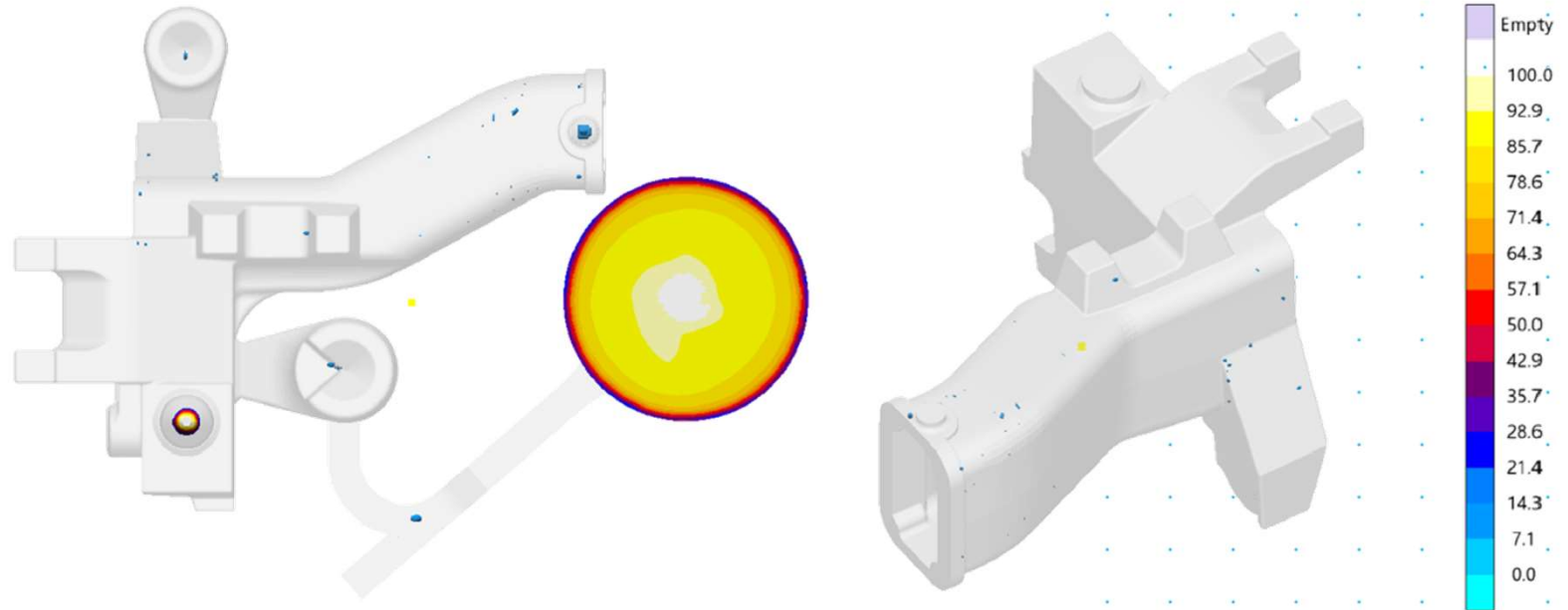
*Redesign de Peças –
nova Solidificação livre*



SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Envio Proposta ao cliente**

Porosity level:



*In general, the probability of incidence of shrinkage is less than 50%, which in the Schulz process is considered low risk.

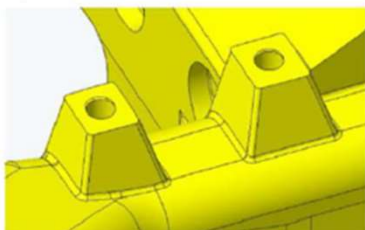
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Envio Proposta ao cliente**

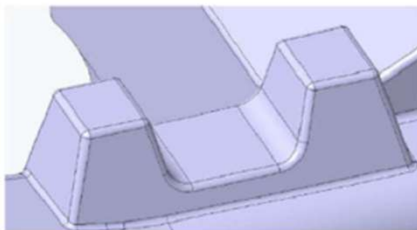
FOUNDRY PROCESS SIMULATION

11

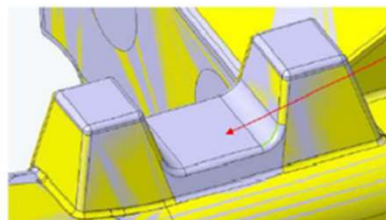
Schulz profile proposal in detail:



Original profile

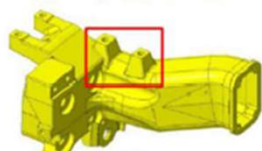


Proposal

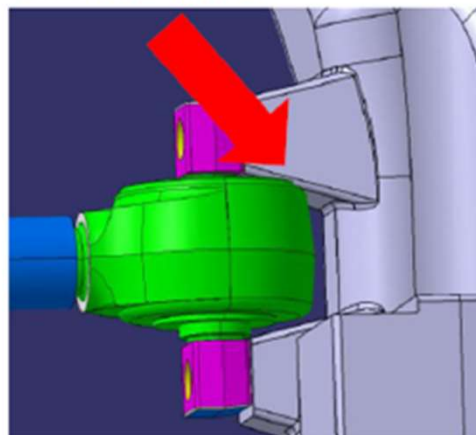


Overlay

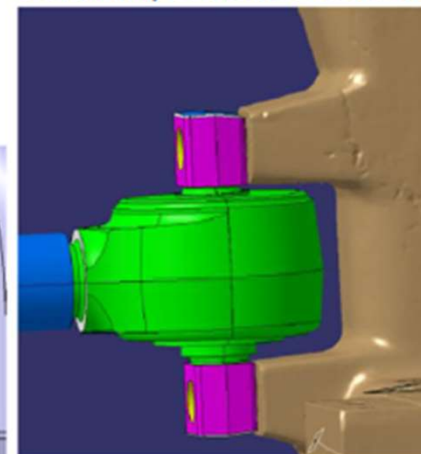
Addition of 12 mm of material between the two projections to improve the flow of the metal during solidification and avoid shrinkage where the M16 threads (2x) are located.



Clash (3D model)



Scanned part (without clash)

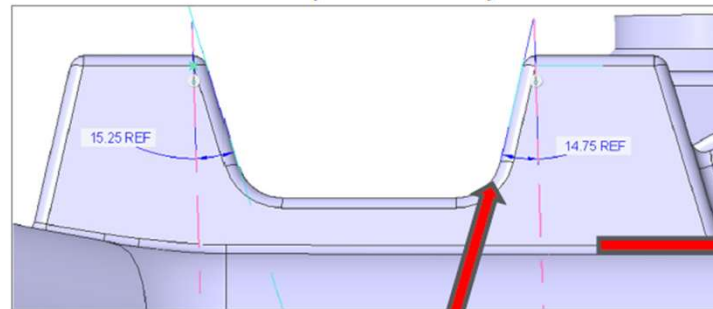


4

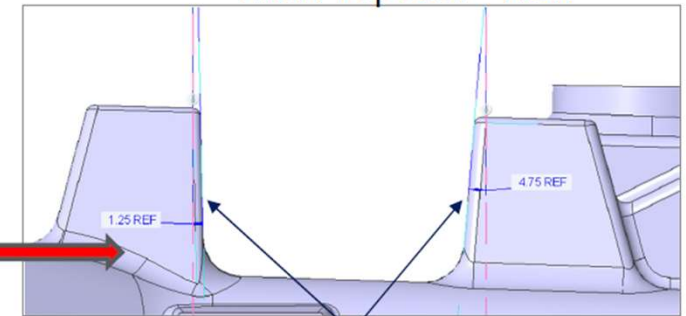
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
Resposta ao cliente*

1st Proposal - Rejected

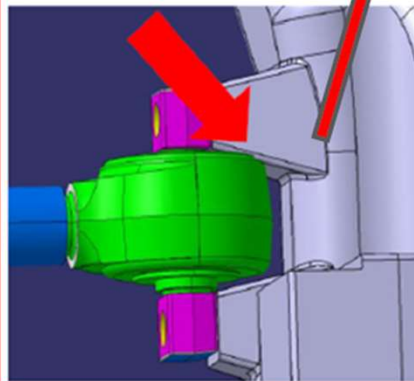


2nd Proposal - New

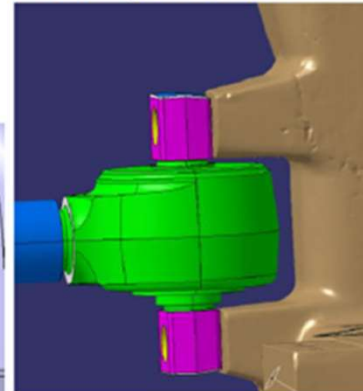


Changed angle

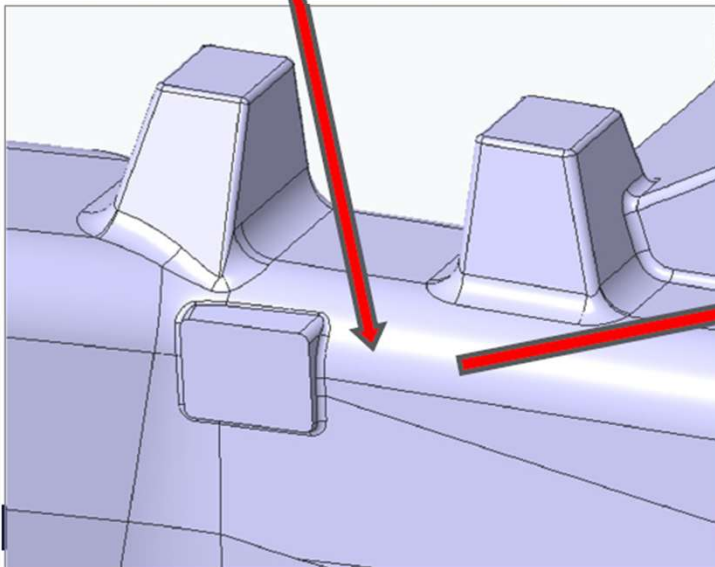
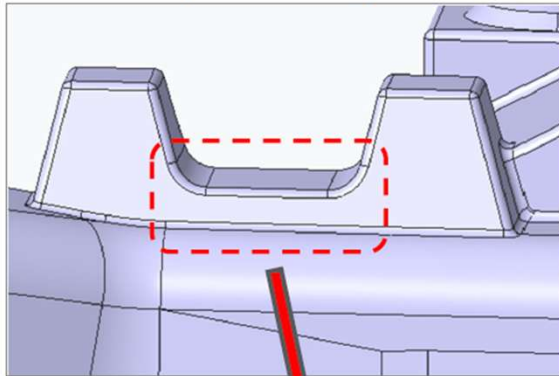
Clash (3D model)



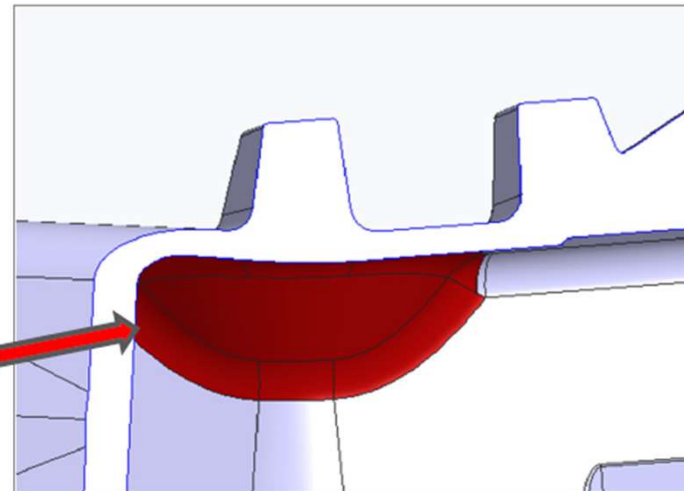
Scanned part (without clash)



1st Proposal - Rejected

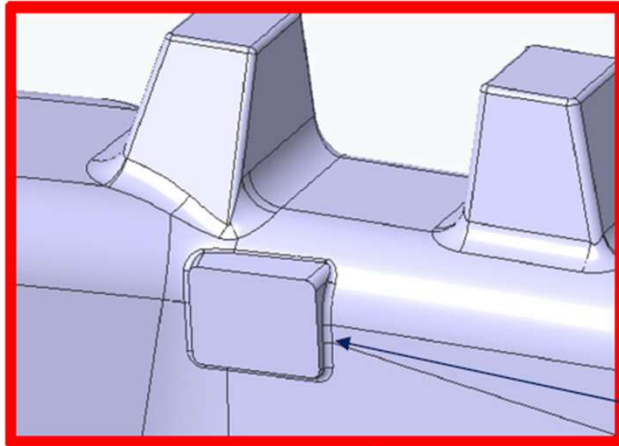


2nd Proposal – New
Adding mass inside the part

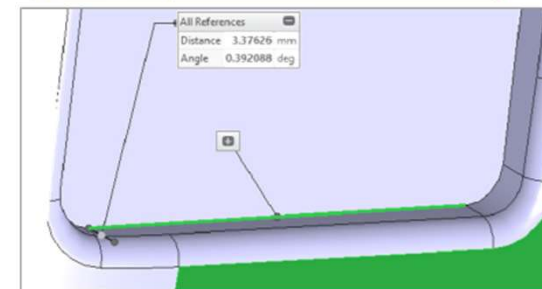
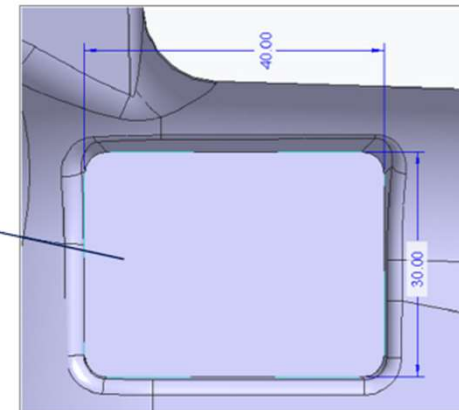


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*Redesign de Peças –
Envio nova Proposta ao cliente*



A feeder will be needed on the area where the mass is been added.

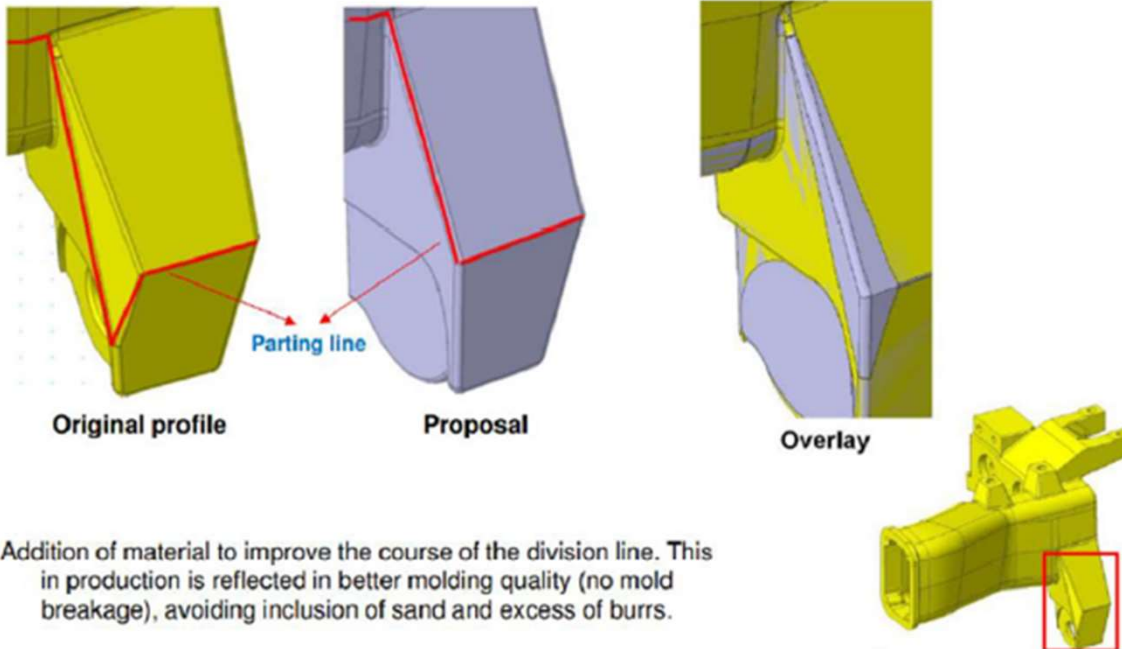


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*Redesign de Peças –
Envio nova Proposta ao cliente*

FOUNDRI PROCESS SIMULATION

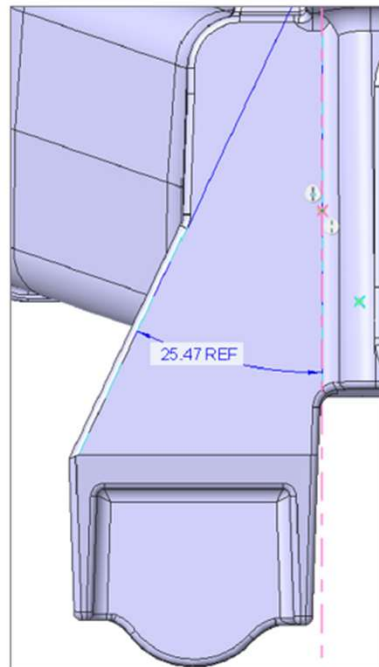
Schulz profile proposal in detail:



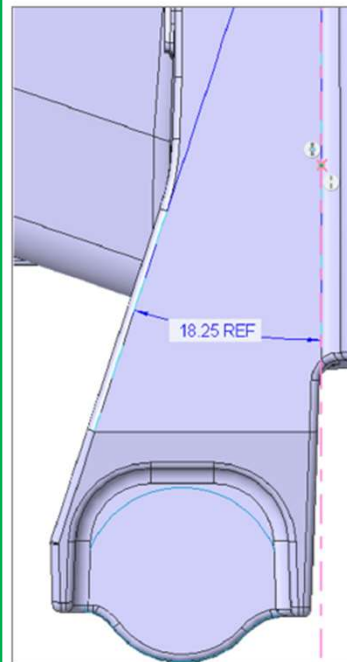
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
Resposta ao cliente*

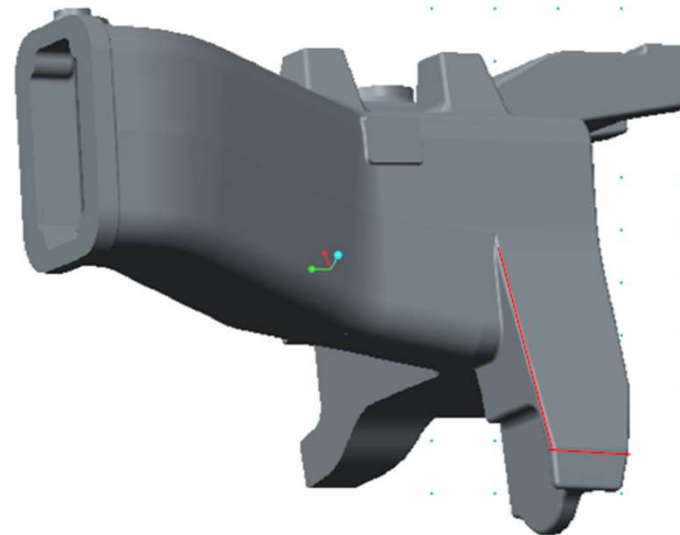
1st Proposal -
Rejected



2nd Proposal -
New



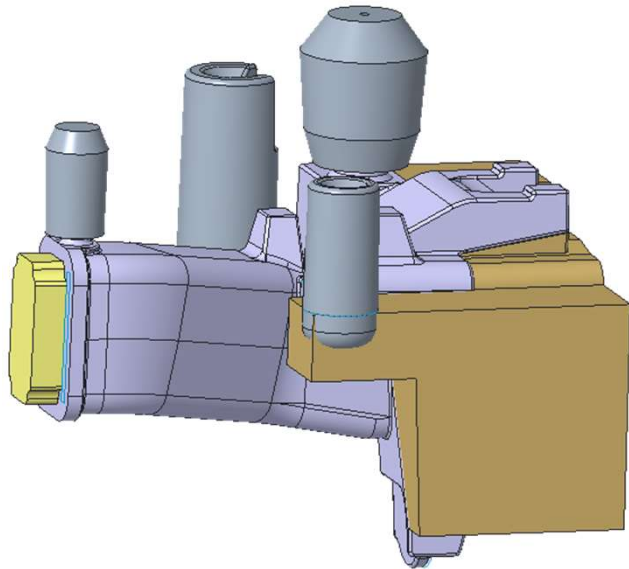
Proposal of shape change that
reduces mass and ensures good
molding in the casting process.



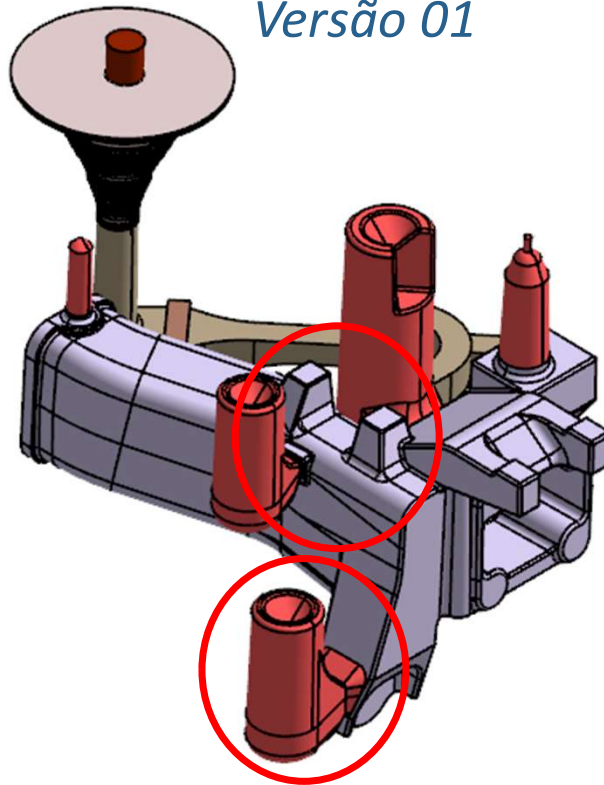
SCHULZ
AUTOMOTIVA

*Redesign de Peças –
Nova Proposta ao cliente*

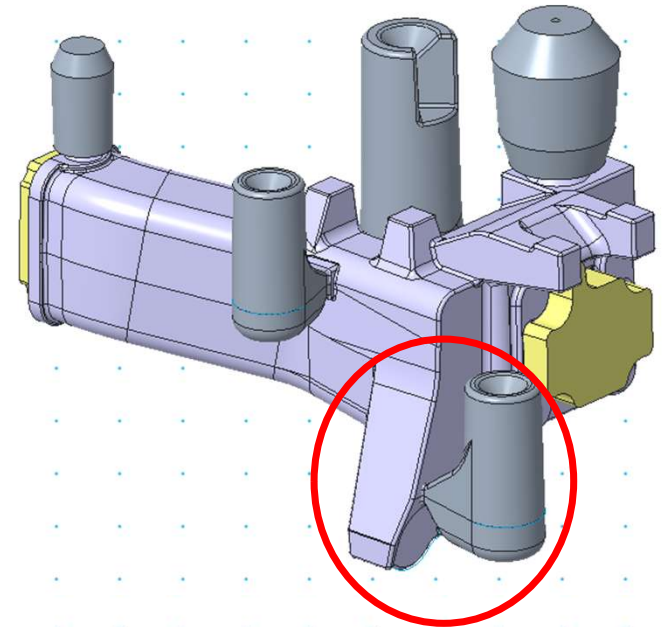
Conceito



Versão 01

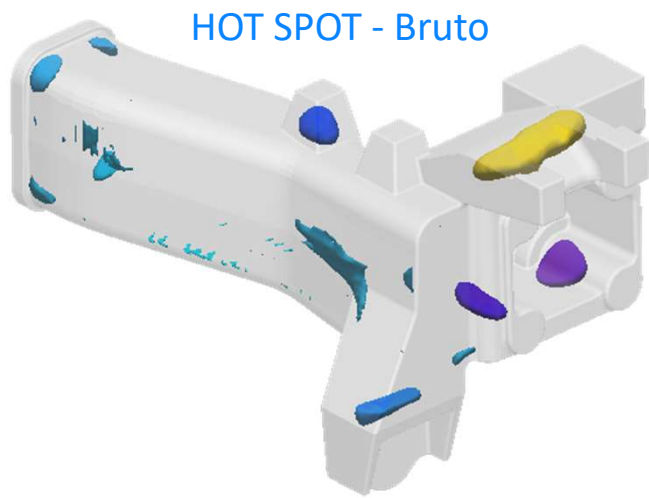


Versão 02

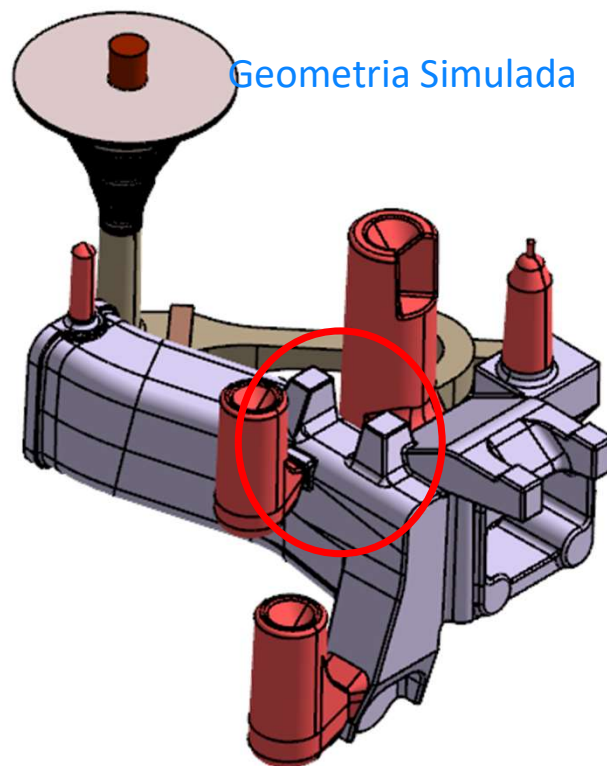


SCHULZ
AUTOMOTIVA

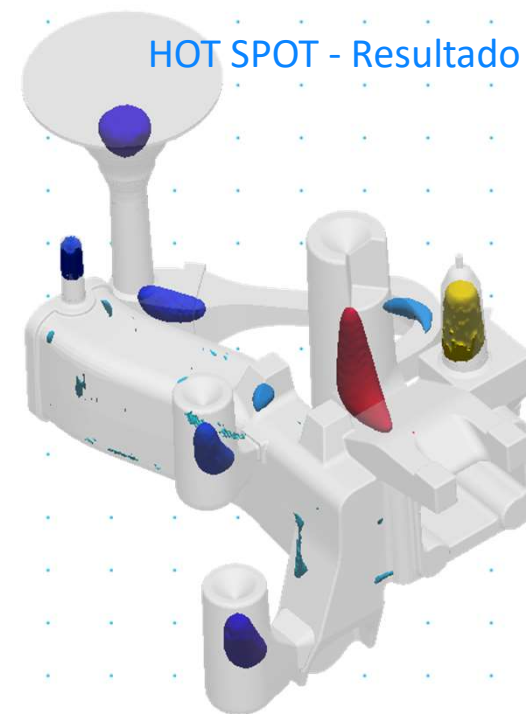
*Redesign de Peças –
Nova Proposta ao cliente*



HOT SPOT - Bruto



Geometria Simulada

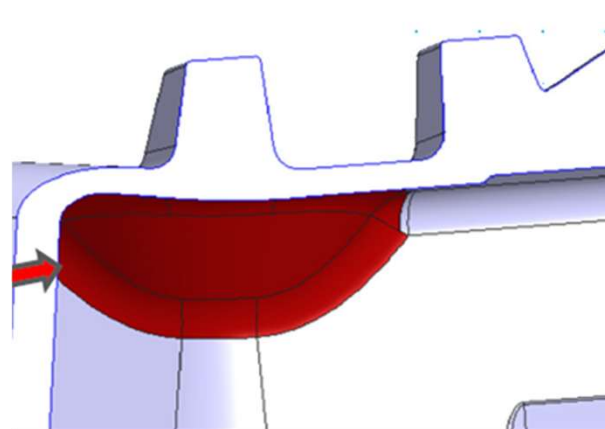


HOT SPOT - Resultado

- PN_2516548_IT_115893
- v01
 - v02
 - v03
 - v04
 - v05
 - v06
 - v07
 - v08
 - v09
 - v11
 - v12
 - v14

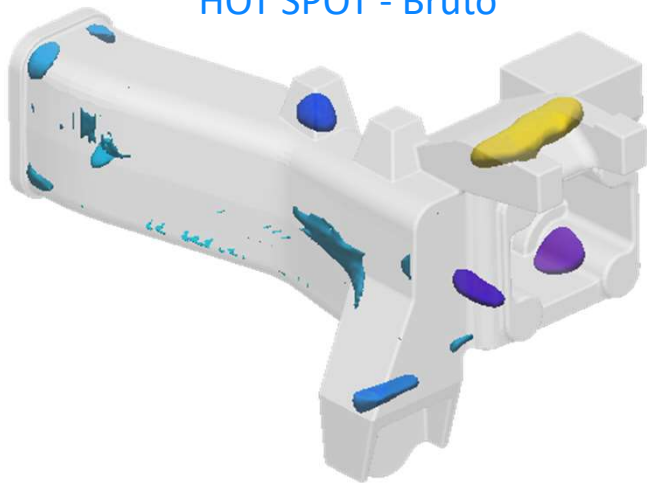
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Nova Proposta ao cliente**

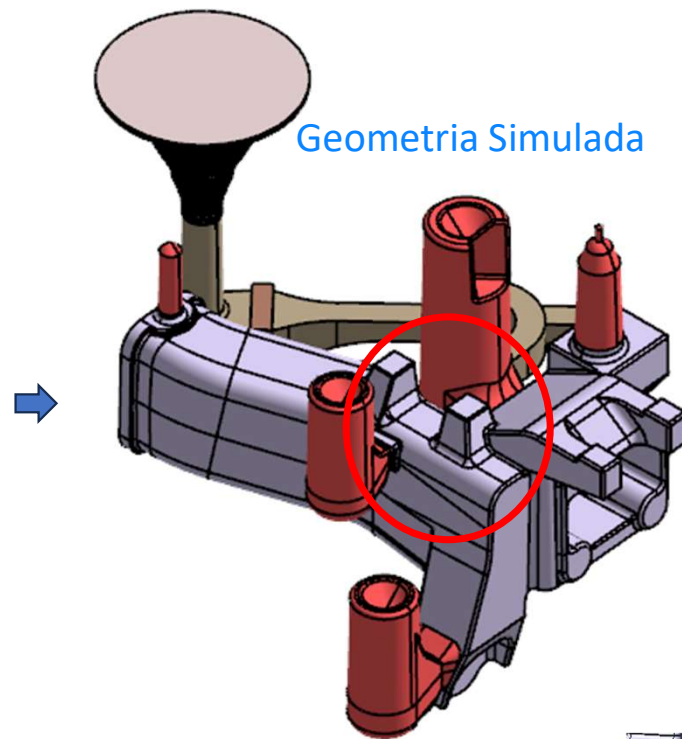


Ajuste Geometria

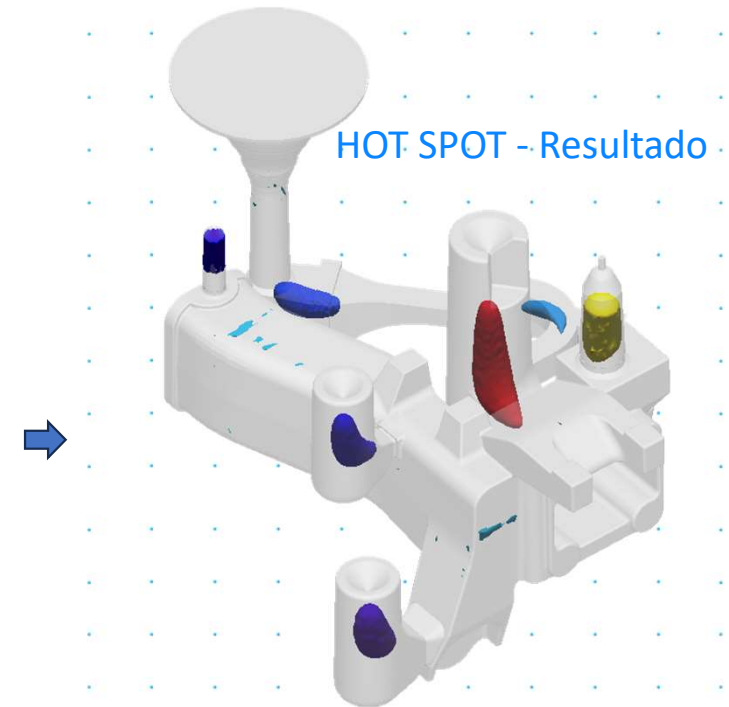
HOT SPOT - Bruto



Geometria Simulada



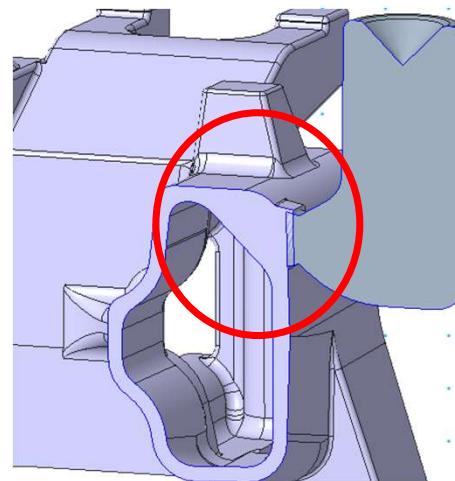
HOT SPOT - Resultado



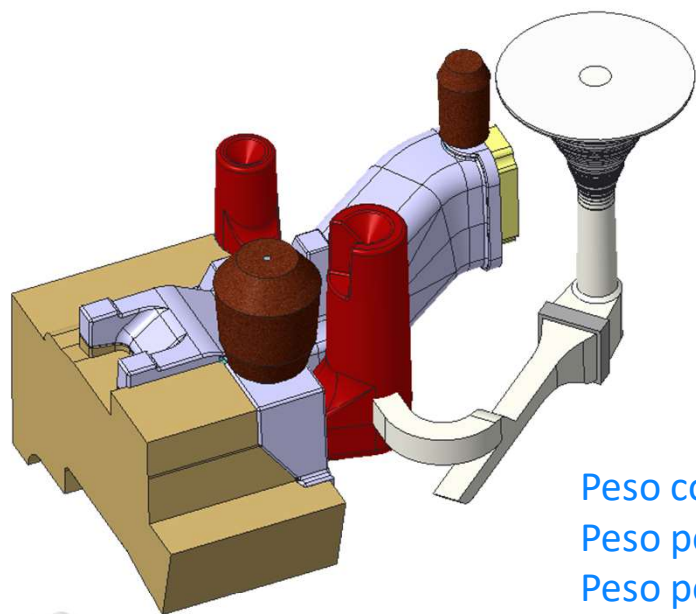
- PN_2516548_IT_115893
- v01
 - v02
 - v03
 - v04
 - v05
 - v06
 - v07
 - v08
 - v09
 - v11
 - v12
 - v14

SCHULZ
AUTOMOTIVA

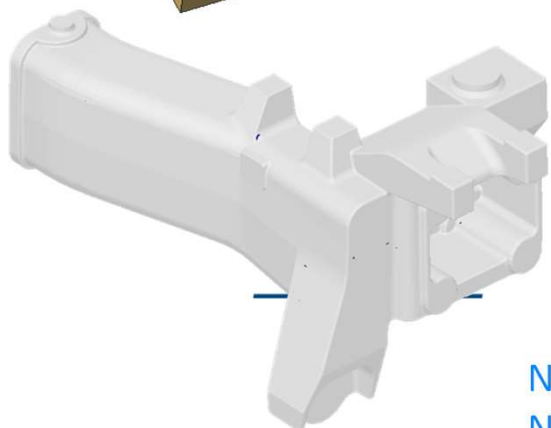
*Redesign de Peças –
Nova Proposta ao cliente*



Ajuste Geometria



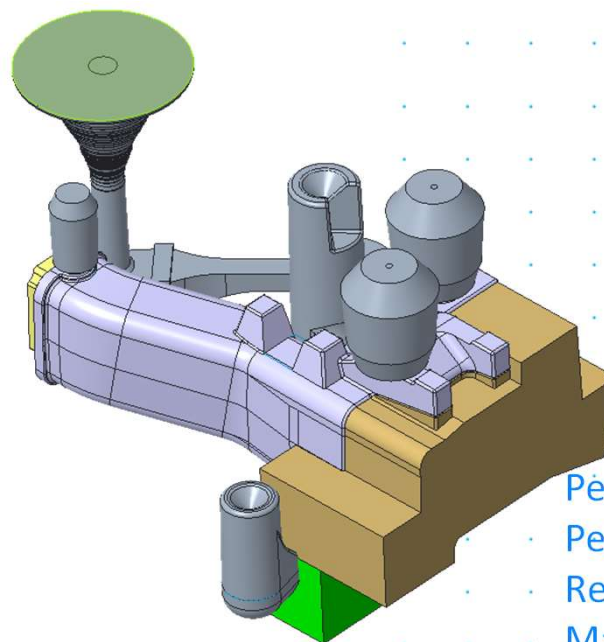
Peso conjunto: 82kg
 Peso peça Bruta: 38kg
 Peso peça Usinada: 32kg
 Rendimento: 47%
 Macho 01: 16,8kg
 Macho 02: 8,1kg
 Luva exotérmica 01: HP 190
 Luva exotérmica 01: HP 36
 Filtro: 01 - 75x75x22mm



Nível porosidade: Nível 1
 Norma: ASTM E-446

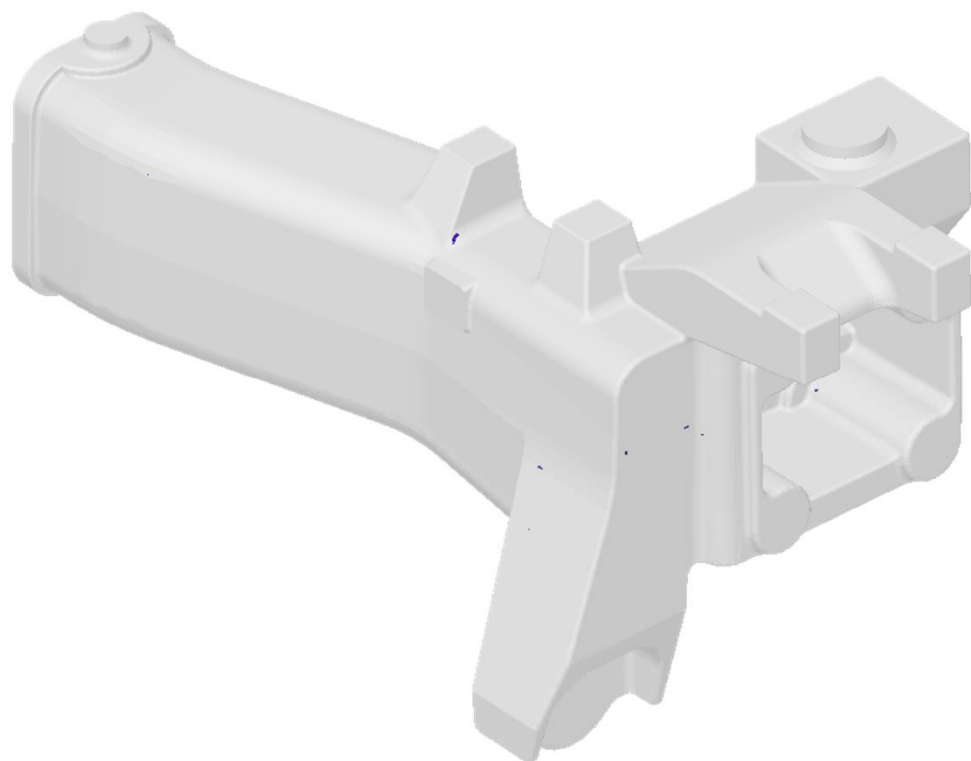
SCHULZ
AUTOMOTIVA

**Redesign de Peças –
Nova Proposta ao cliente**



Peso conjunto: 85kg
 Peso peça: 38kg
 Rendimento: 47%
 Macho 01: 12kg
 Macho 02: 8,1kg
 Macho 03: 5kg
 Luva exotérmica 01: HP 190
 Luva exotérmica 01: HP 36
 Luva exotérmica 01: HP 190
 Filtro: 01 - 75x75x22mm

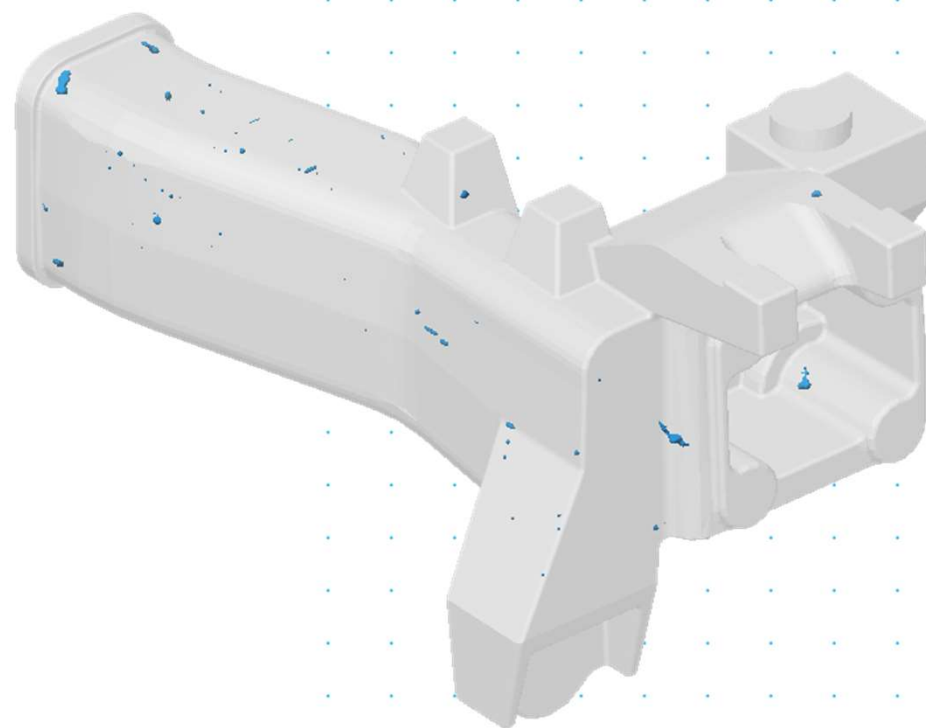
Nível porosidade: Nível 4
 Norma: ASTM E-446



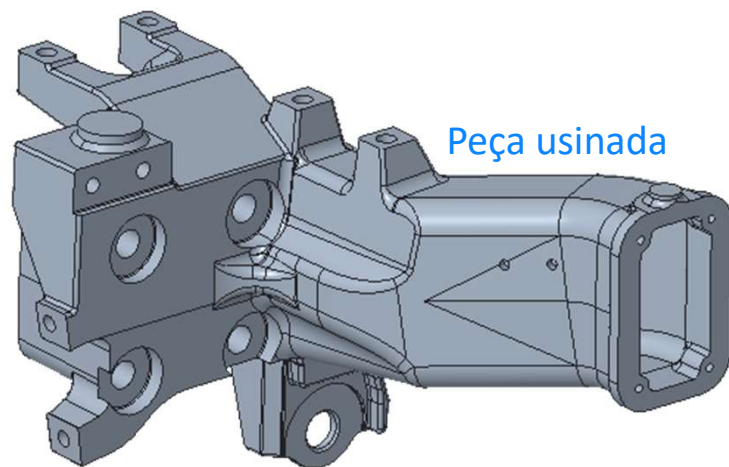
Nível porosidade: Nível 1
Norma: ASTM E-446

SCHULZ
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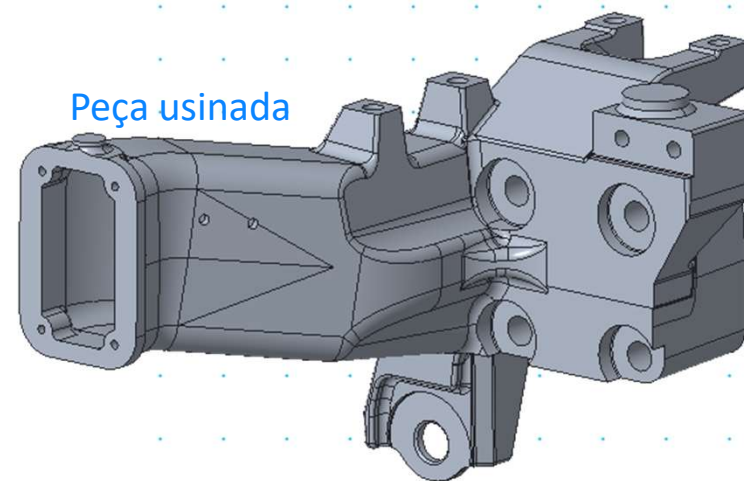
***Redesign de Peças –
Nova Proposta ao cliente***



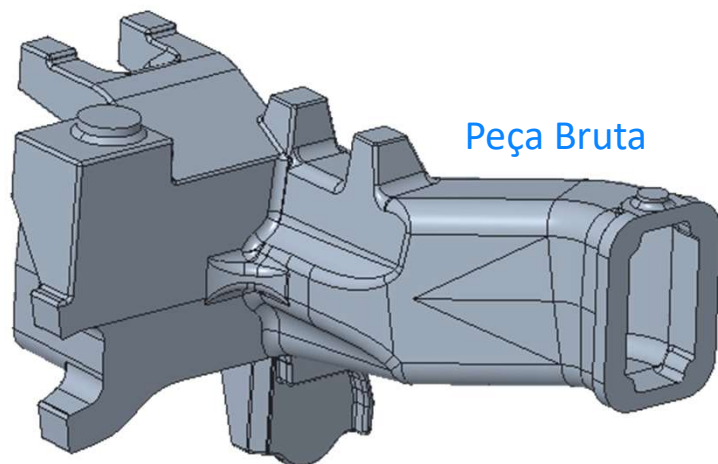
Nível porosidade: Nível 4
Norma: ASTM E-446



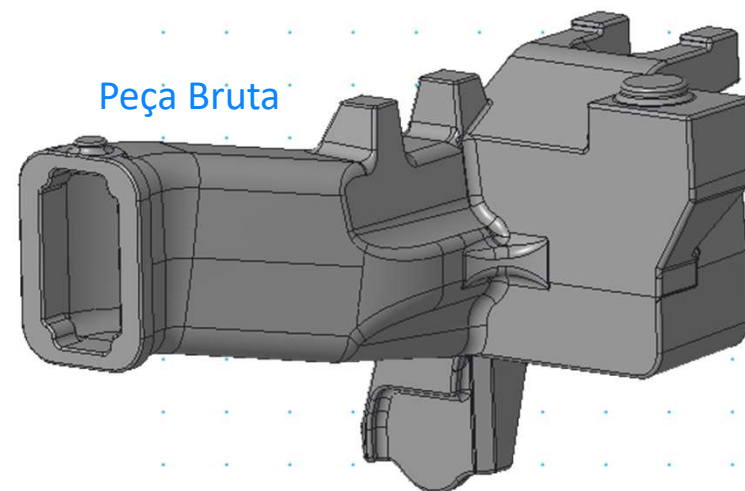
Peça usinada



Peça usinada



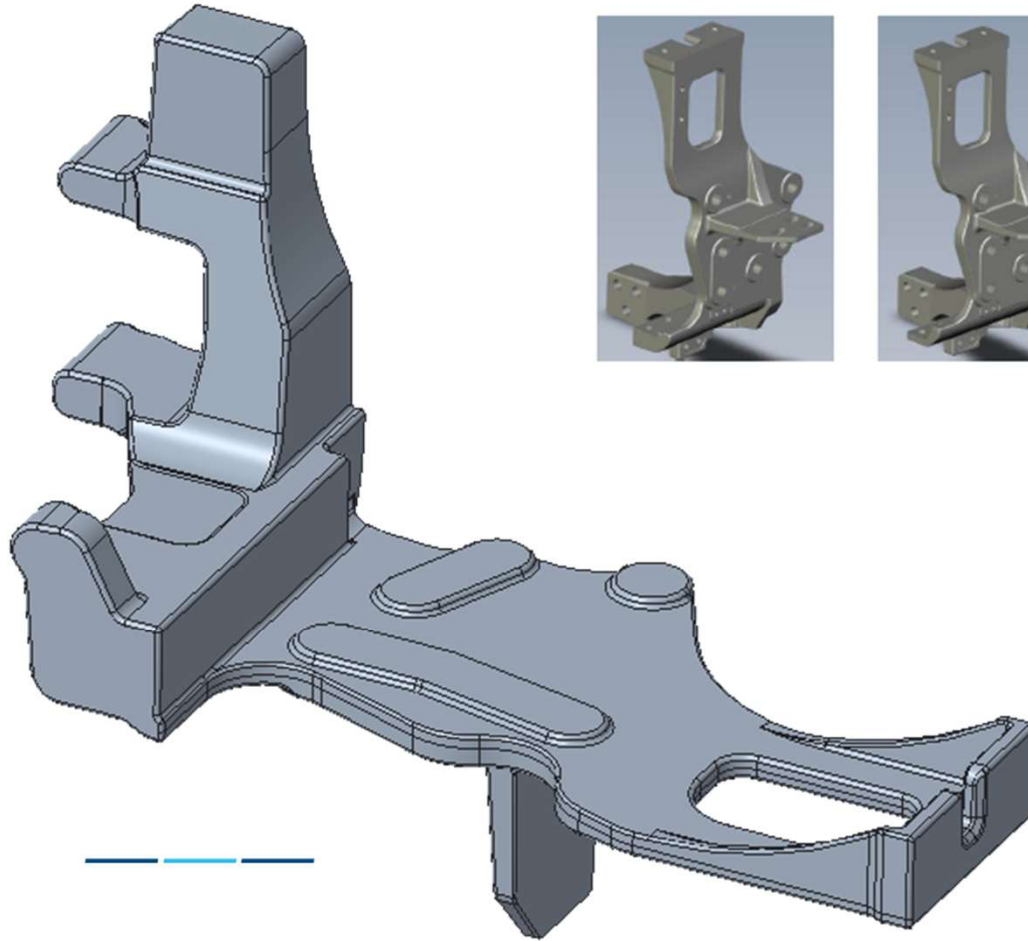
Peça Bruta



Peça Bruta

SCHULZ
AUTOMOTIVA

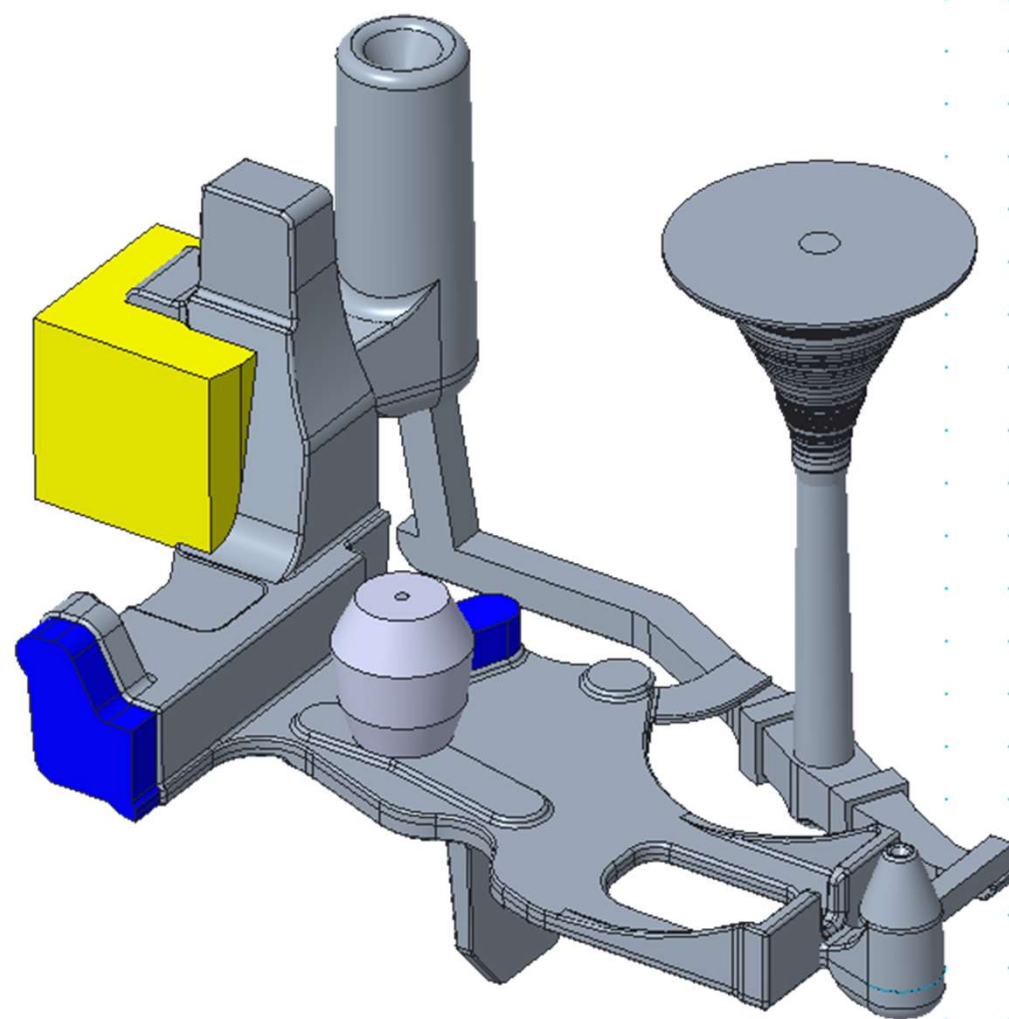
**Redesign de Peças –
Resultado final**



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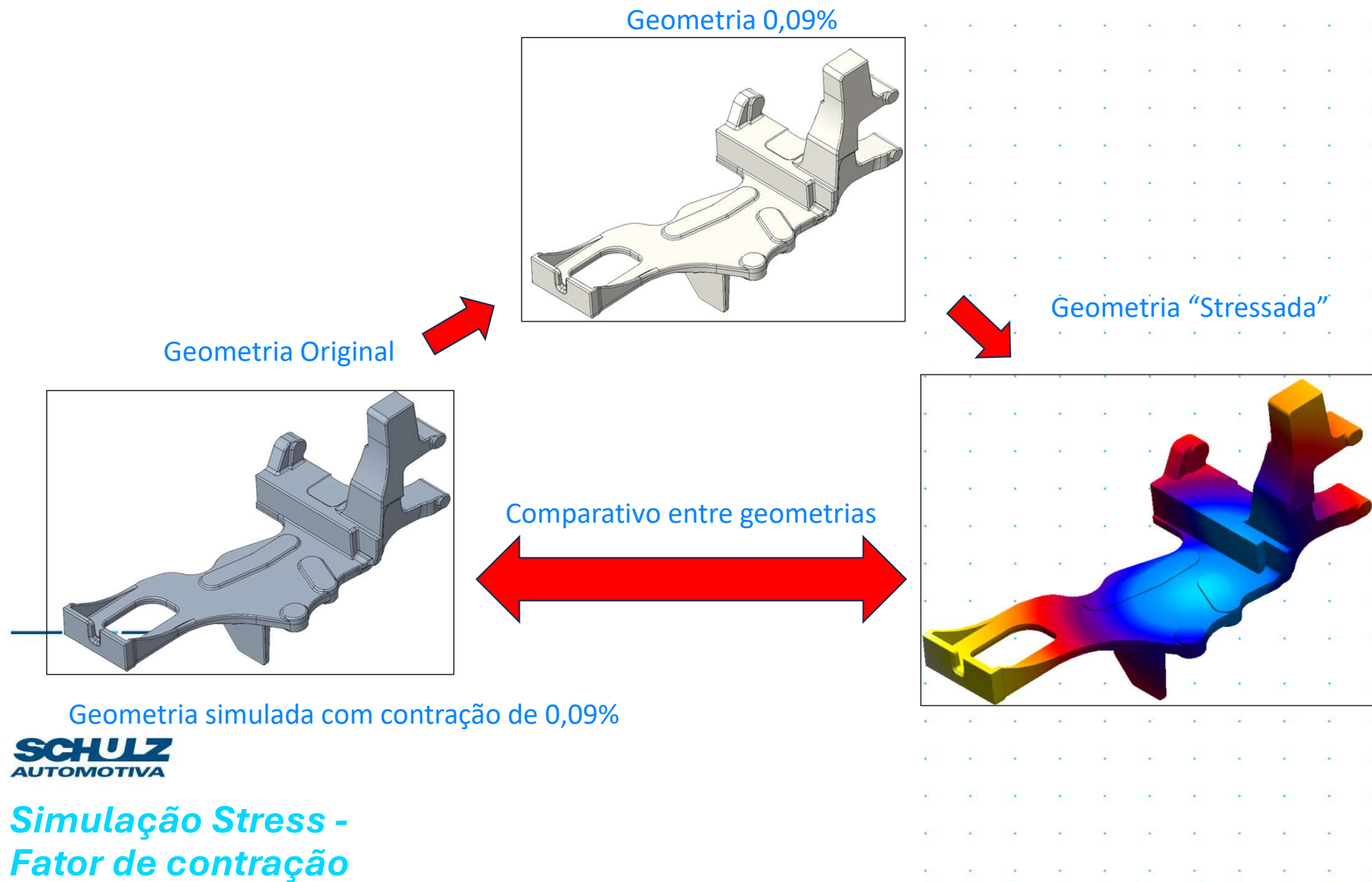
Simulação Stress





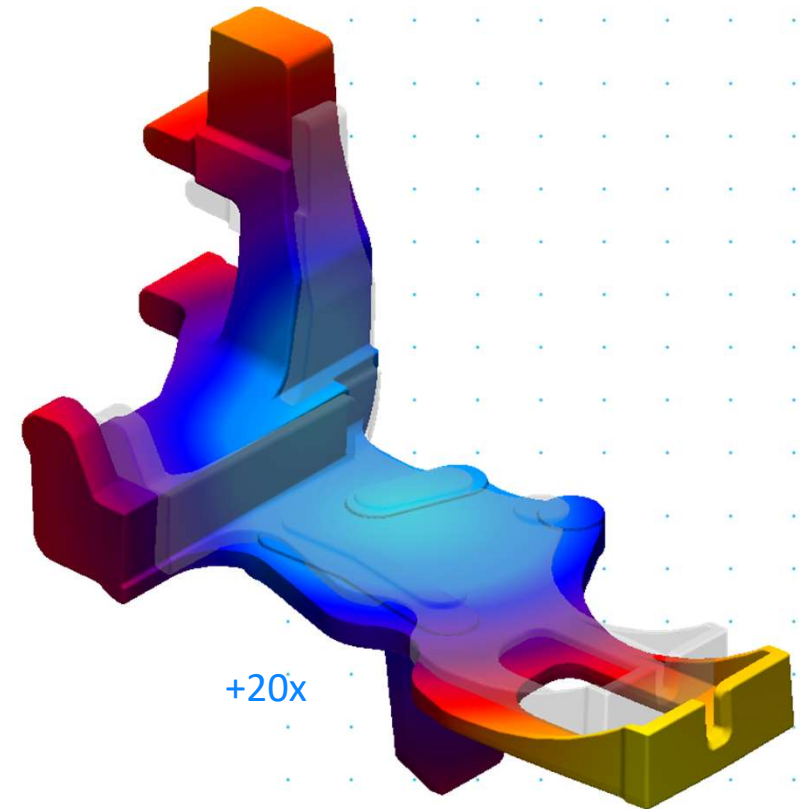
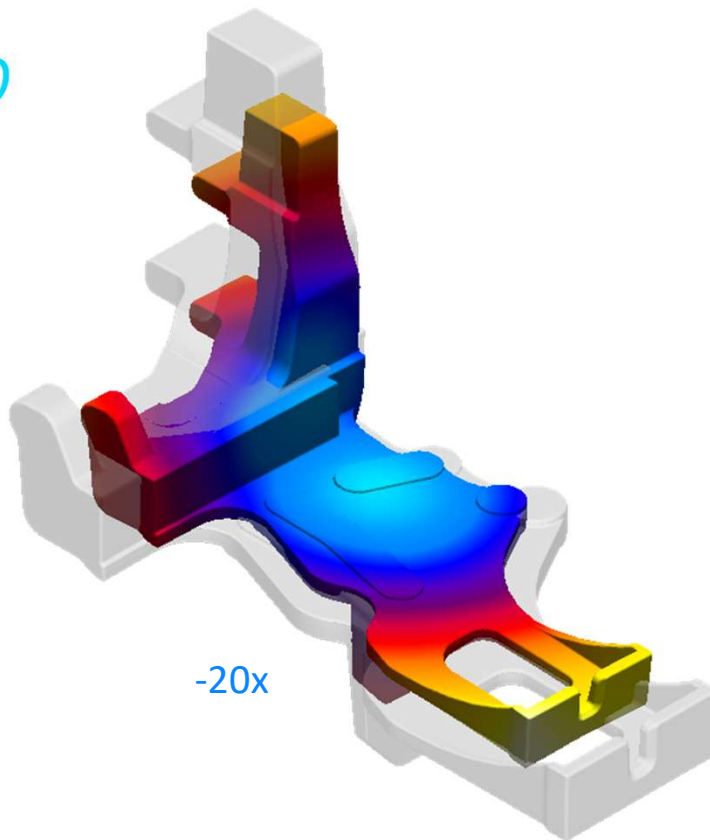
SCHULZ
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*Simulação Stress – Sistema de
canais e alimentação definidos*



Distorção

Comportamento item



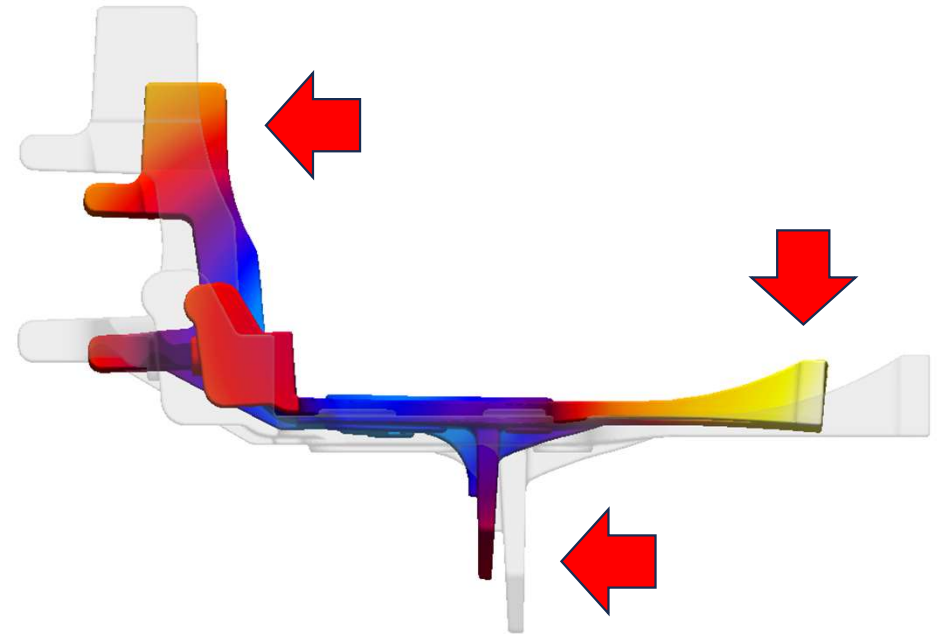
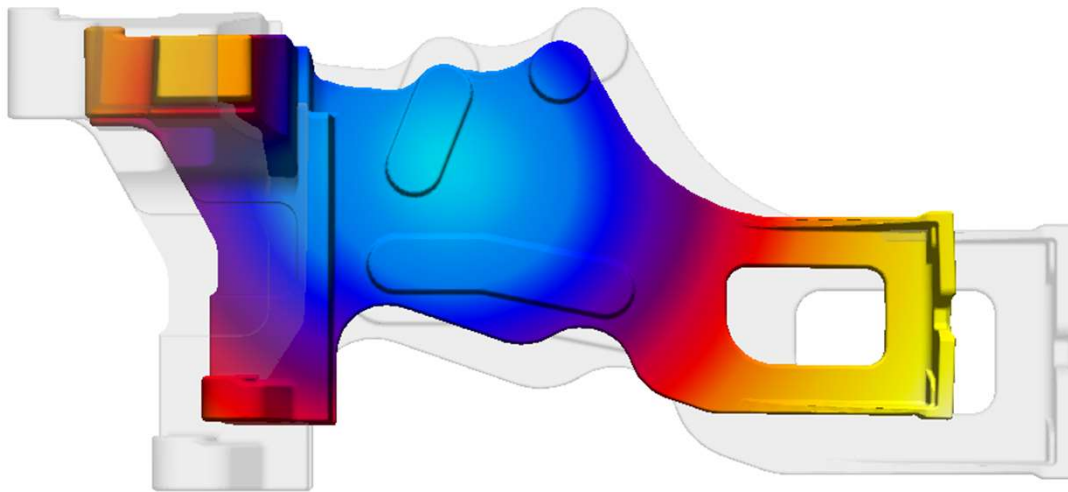
Após simulação de stress foi utilizado o recurso de distorção (20x) para potencializar o comportamento do item dentro do molde e entender melhor as possíveis regiões mais críticas para o empenamento.

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**Simulação Stress –
Distorção**

Distorção

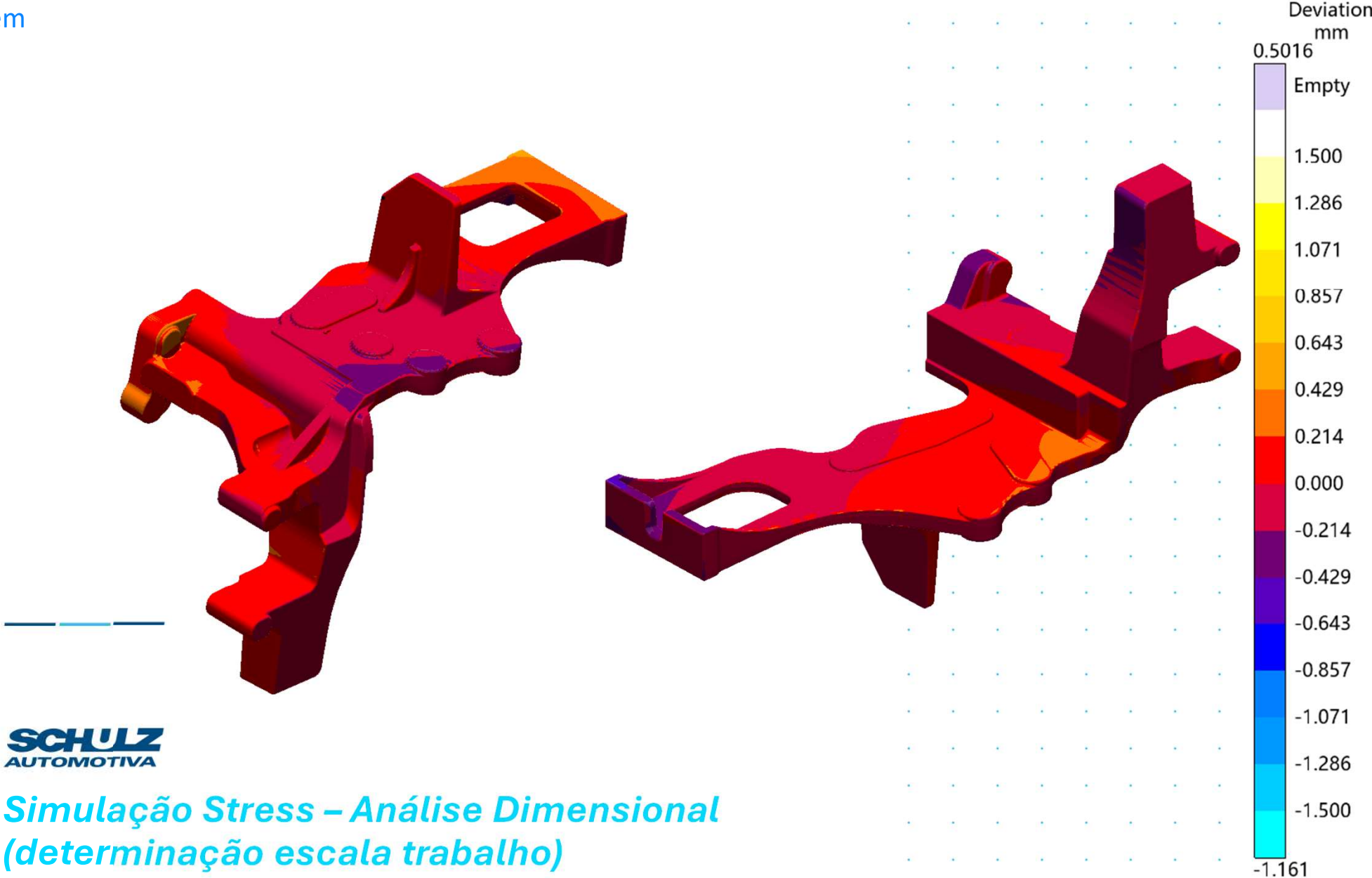
Comportamento item

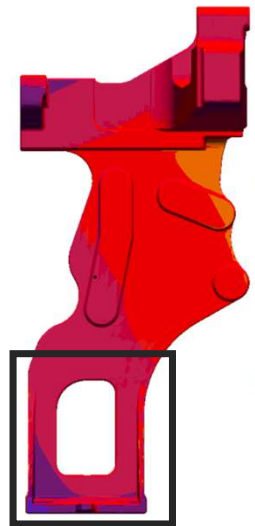


Após simulação de stress foi utilizado o recurso de distorção (20x) para potencializar o comportamento do item dentro do molde e entender melhor as possíveis regiões mais críticas para o empenamento.

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***Simulação Stress –
Distorção***

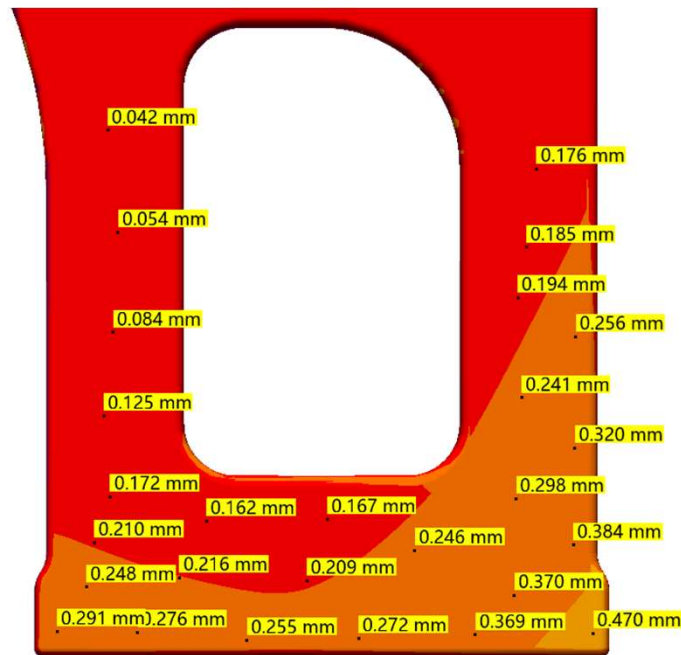




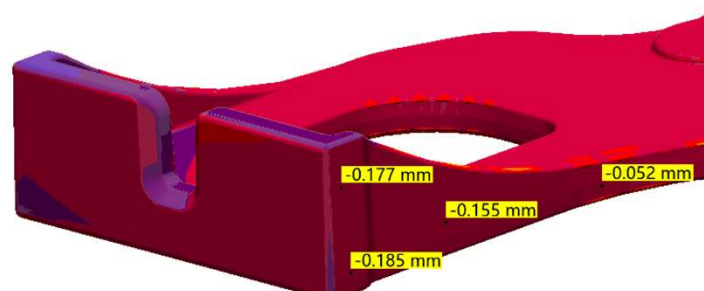
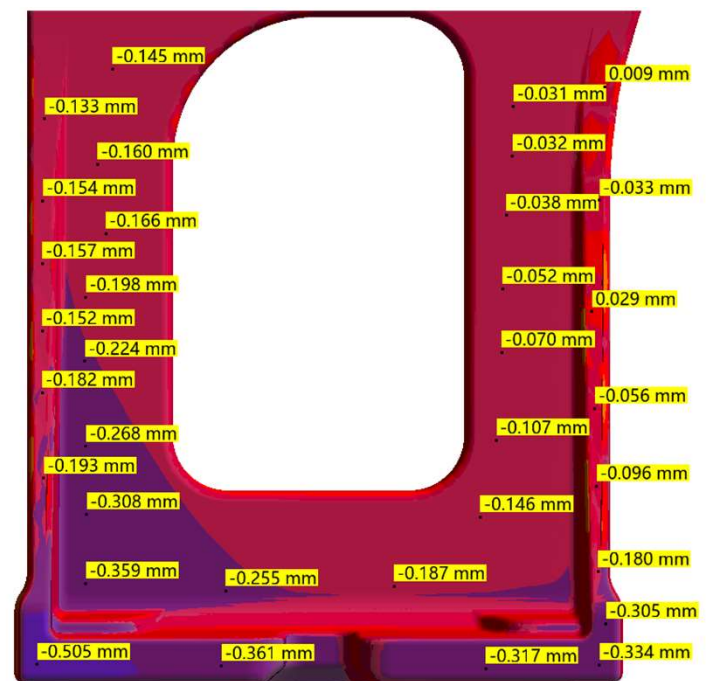
SCHULZ
AUTOMOTIVA

**Simulação Stress –
Análise Dimensional**

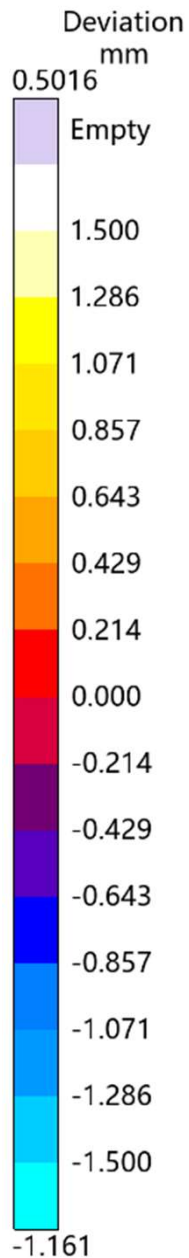
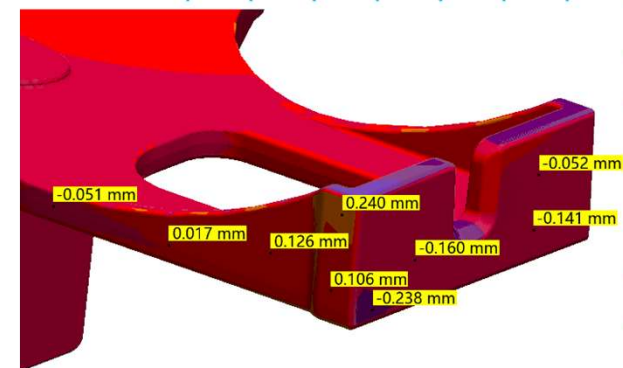
Vista inferior



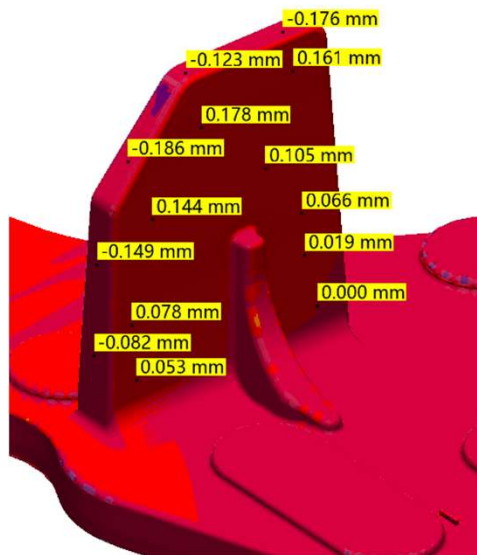
Vista superior



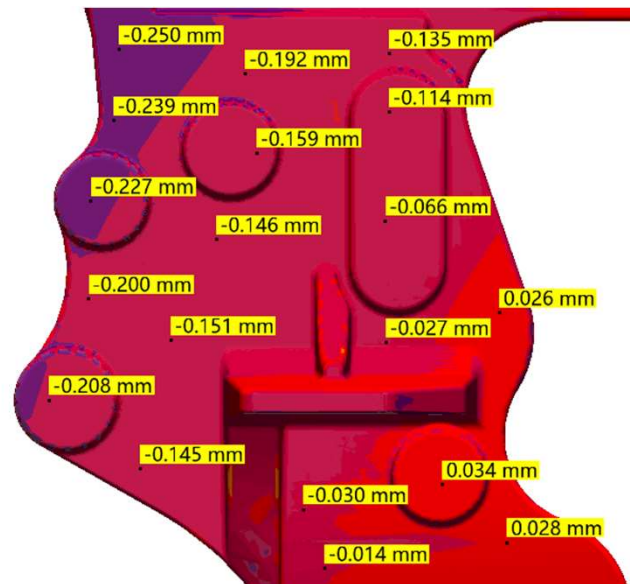
Vistas laterais



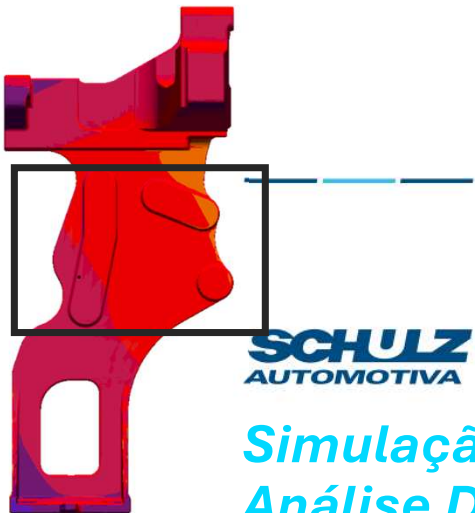
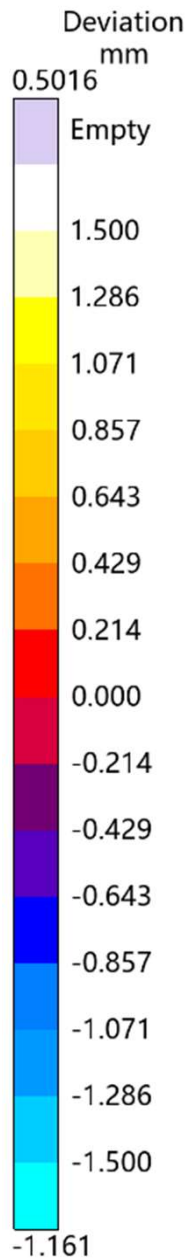
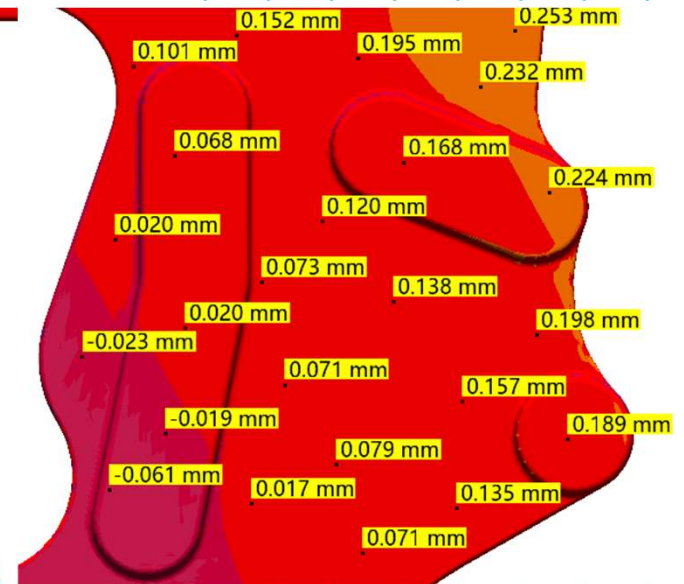
Measure System



Vista inferior



Vista superior

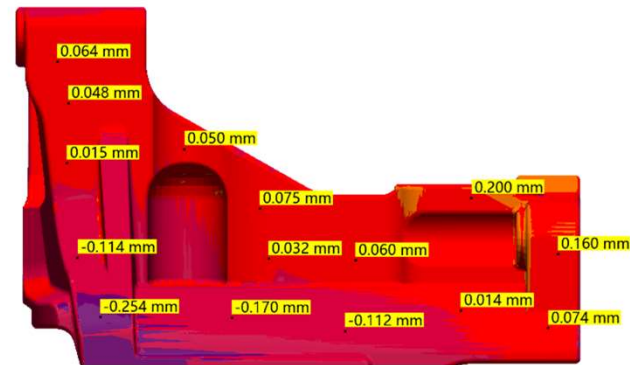


**Simulação Stress –
Análise Dimensional**

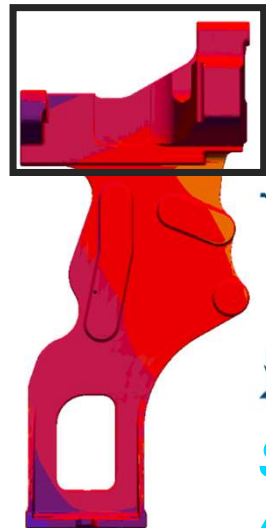
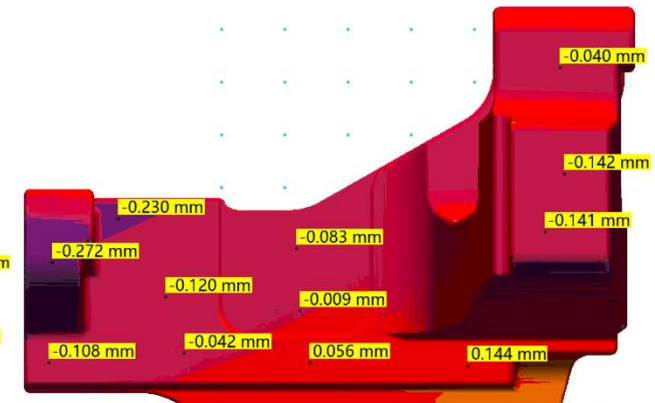
Vistas laterais

Measure System

Vista inferior



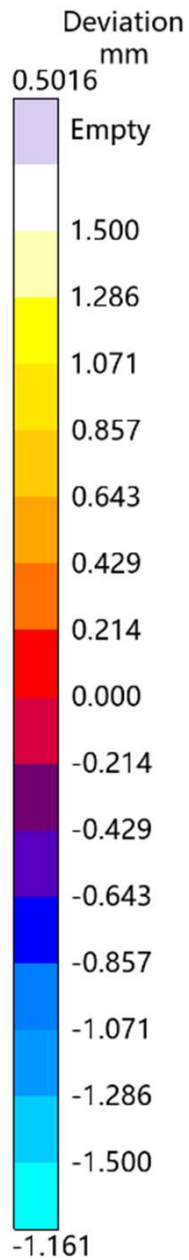
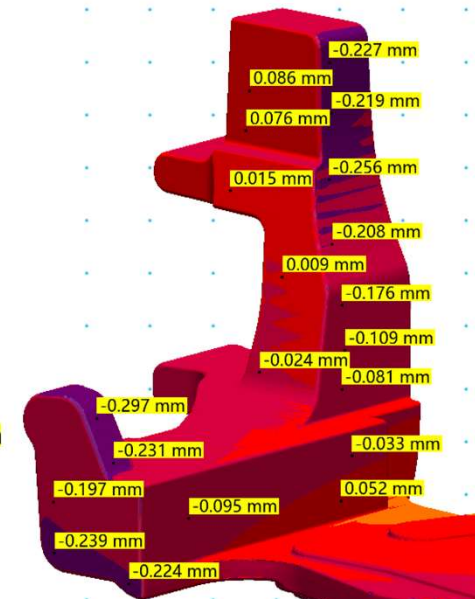
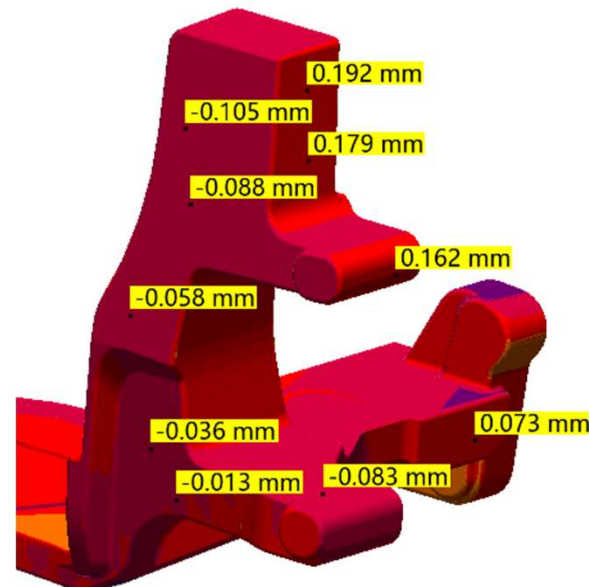
Vista superior



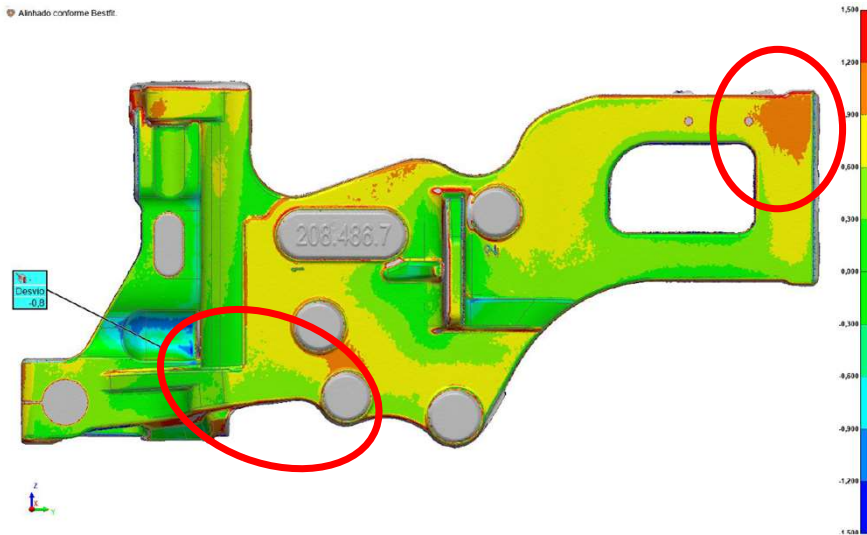
SCHULZ
AUTOMOTIVA

**Simulação Stress –
Análise Dimensional**

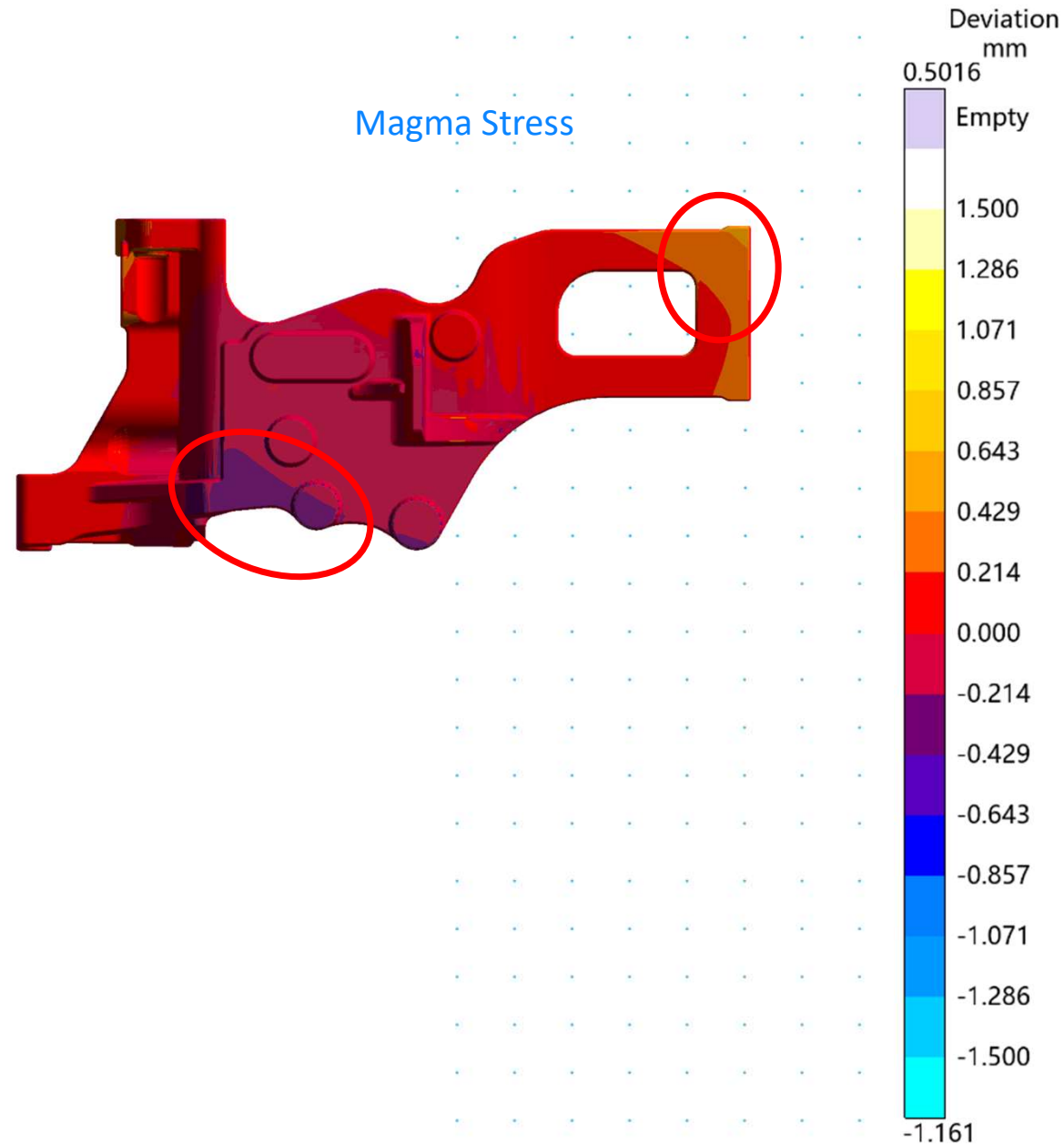
Vistas laterais



Relatório dimensional



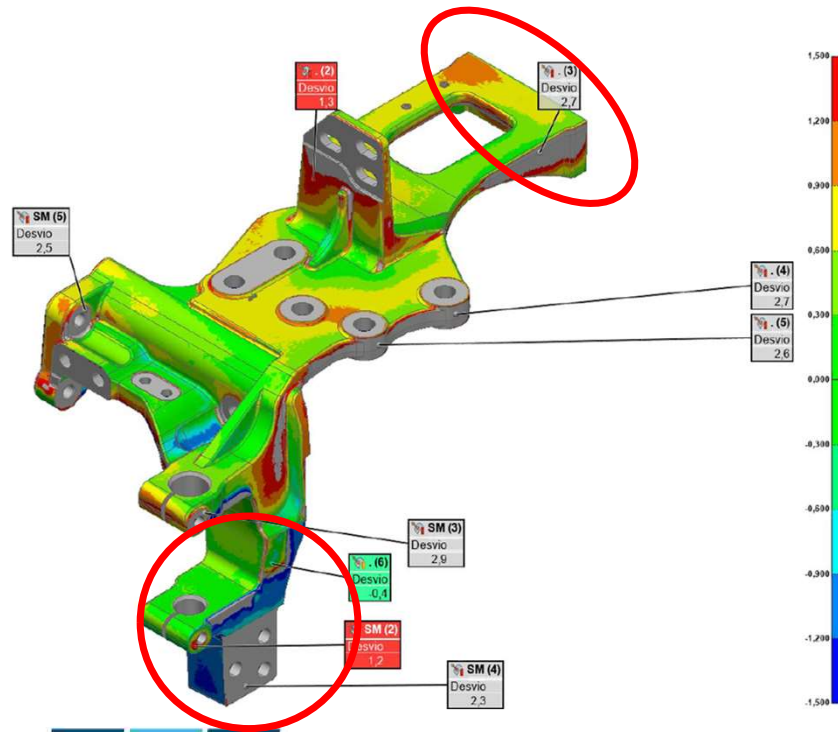
Magma Stress



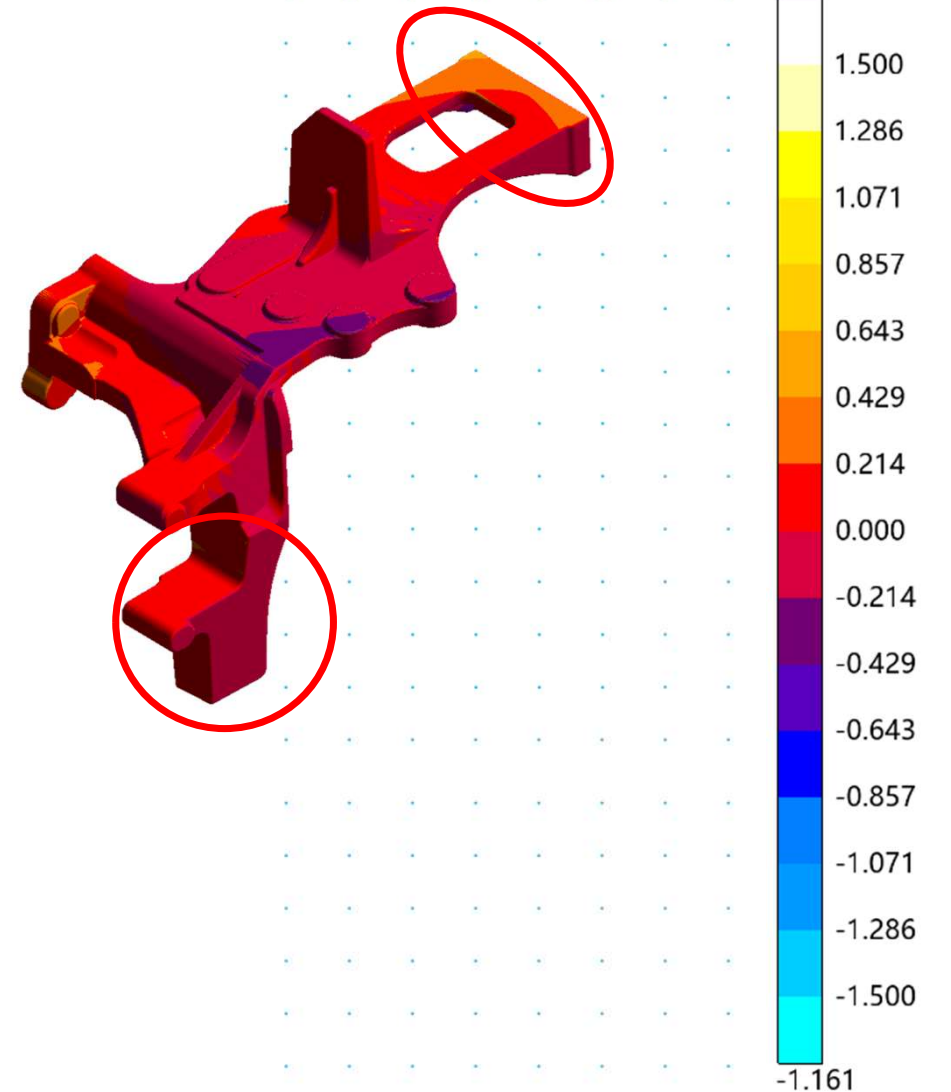
SCHULZ
AUTOMOTIVA

**Simulação Stress –
Análise Dimensional**

Relatório dimensional



Magma Stress

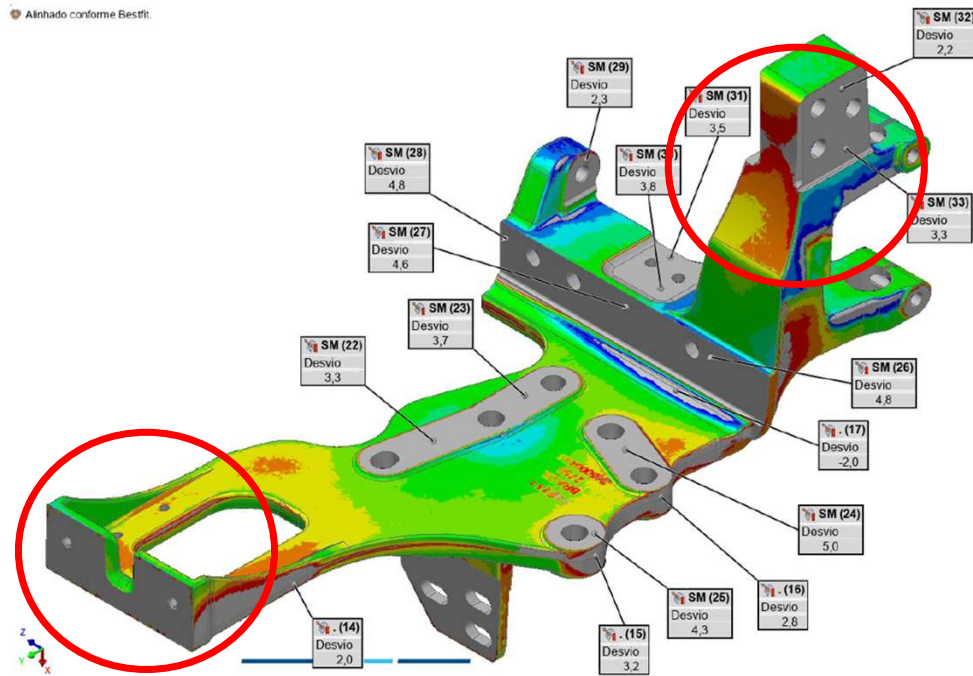


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**Simulação Stress –
Análise Dimensional**

Measure System

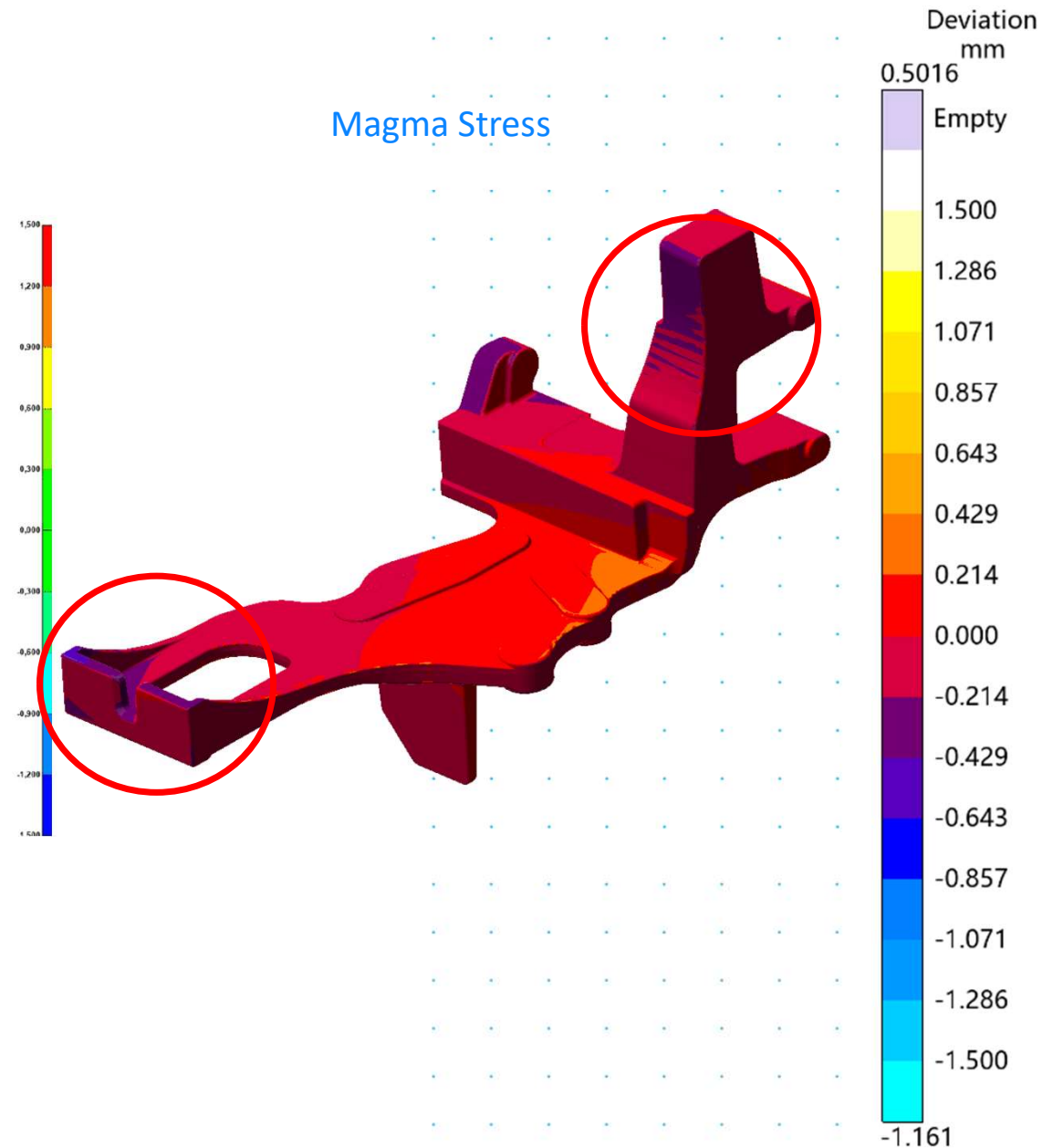
Relatório dimensional



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**Simulação Stress –
Análise Dimensional**

Magma Stress



Obrigado!



SCHULZ
AUTOMOTIVA

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