

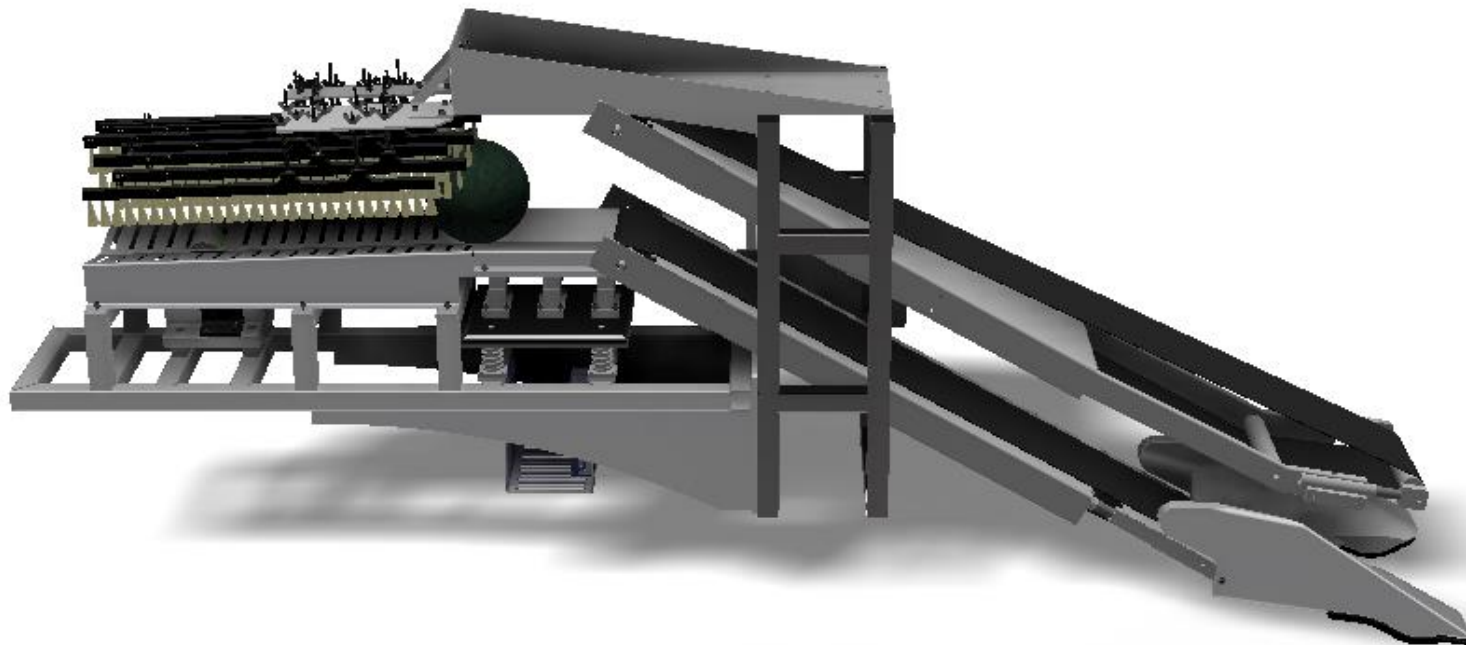
**QR**CITRULINA

**PROJETO - COLHEITADEIRA DE MELANCIA**

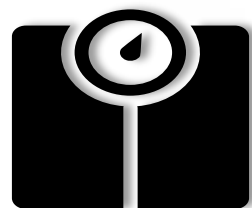


QR CITRULINA

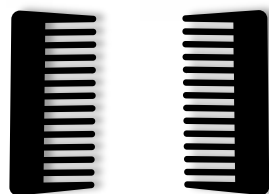
# OBJETIVOS



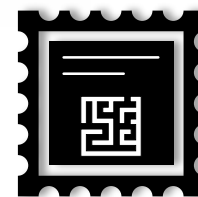
CAPTAÇÃO



PESAGEM



LIMPEZA



ETIQUETAGEM



QR CITRULINA

# INTRODUÇÃO - Melancia no Brasil

- ❖ No Brasil temos as condições ideais para o cultivo da melancia, durante o ano todo. A partir da década de 1990, a melancia teve sua expansão no mercado, devido ser uma opção para alimentos de baixas calorias.

## COLHEITA DE MELANCIA NO BRASIL

**2,2 M**  
TONELADAS

Quantidade de  
melancias  
produzidas

**1,325 BI**  
REAIS

Valor da produção de  
melancias

**102.412**  
HECTARES

Área plantada ou  
destinada à colheita

Fonte: IBGE - Produção de Melancias no Brasil, em 2018.




# PROBLEMÁTICA

 **Esforços excessivos**



Fonte: globo.com - Foto: Marcelino Neto - 2014

 **Problemas ergonômicos  
(Lombalgia)**



Fonte: reumatologia.org.br



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# PROBLEMÁTICA

## ❑ Sistema de Limpeza

➤ Agregar valor ao fruto

➤ Garantir a etiquetagem



## ❑ Sistema de Etiquetagem

➤ Obrigatoriedade de etiquetagem em frutas





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# PROBLEMÁTICA

## ❑ Sistema de Captação

- ❖ Otimização dos projetos anteriores



Fonte: EasyCrop, 2018



Fonte: Citrullus, 2018

## ❑ Sistema de Pesagem

- ❖ Alto custo para o pequeno produtor
- ❖ Pesagem realizada em terceiros

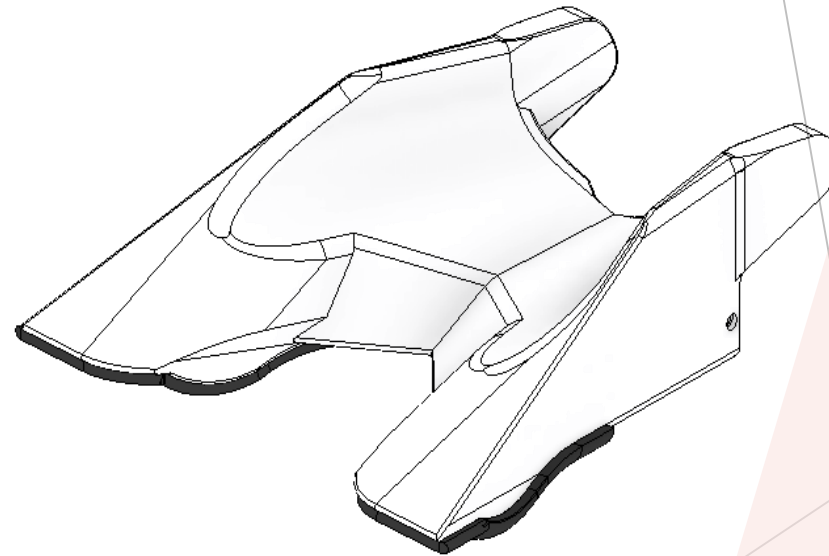
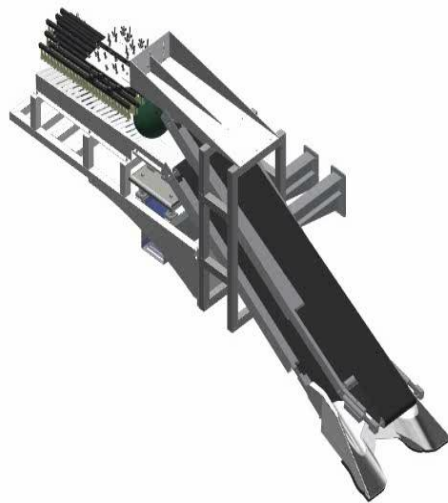


Fonte: Youtube



# SISTEMAS PARA ESTUDO

## CAPTAÇÃO

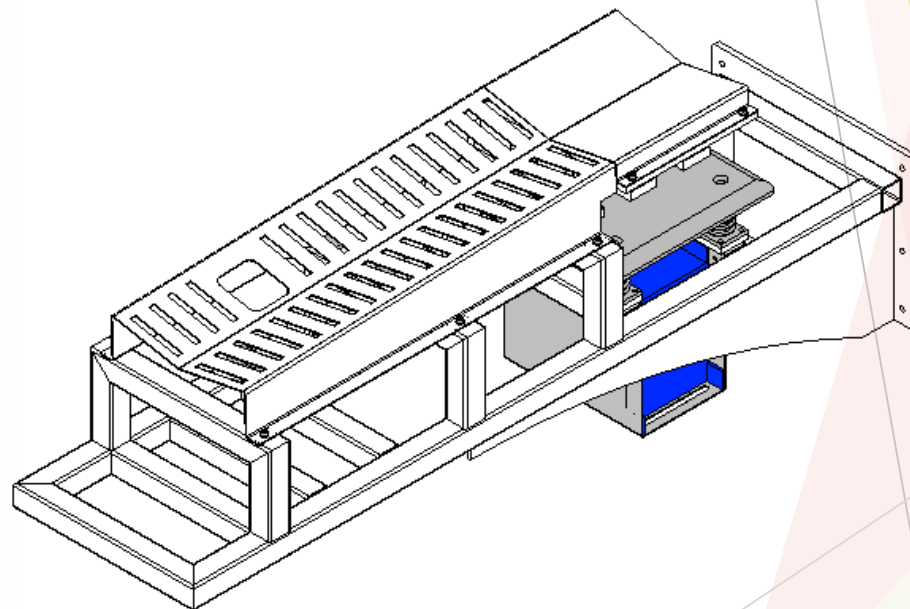
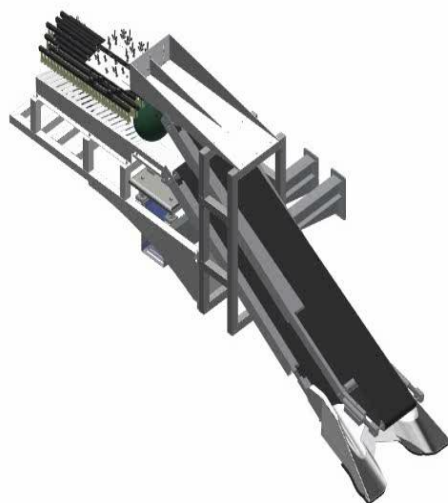




QR CITRULINA

# SISTEMAS PARA ESTUDO

## PESAGEM



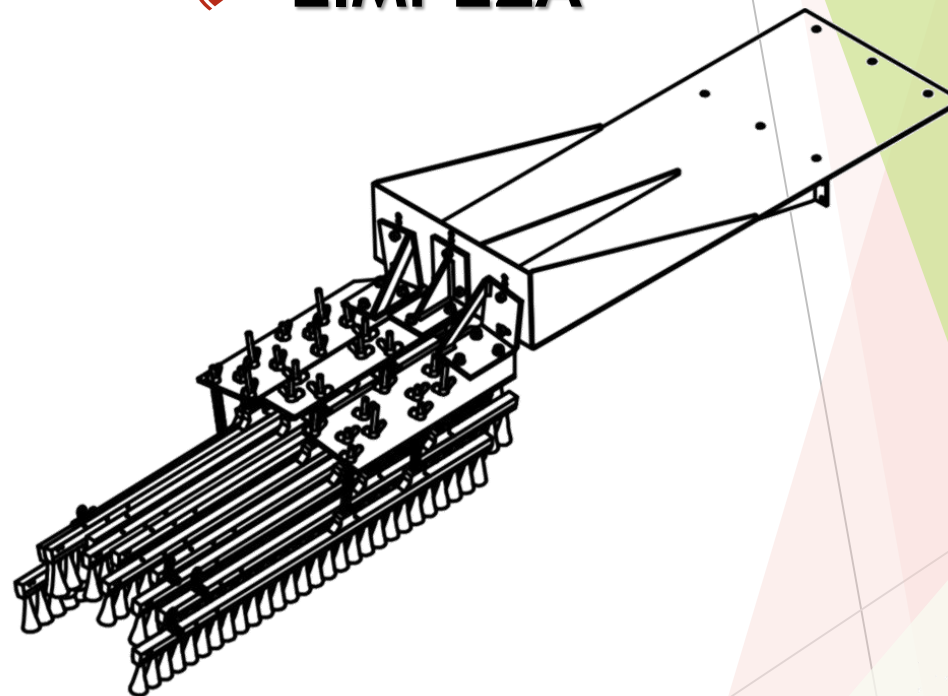
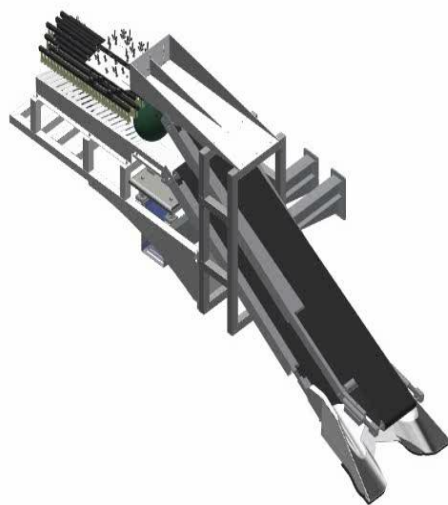




QR CITRULINA

# SISTEMAS PARA ESTUDO

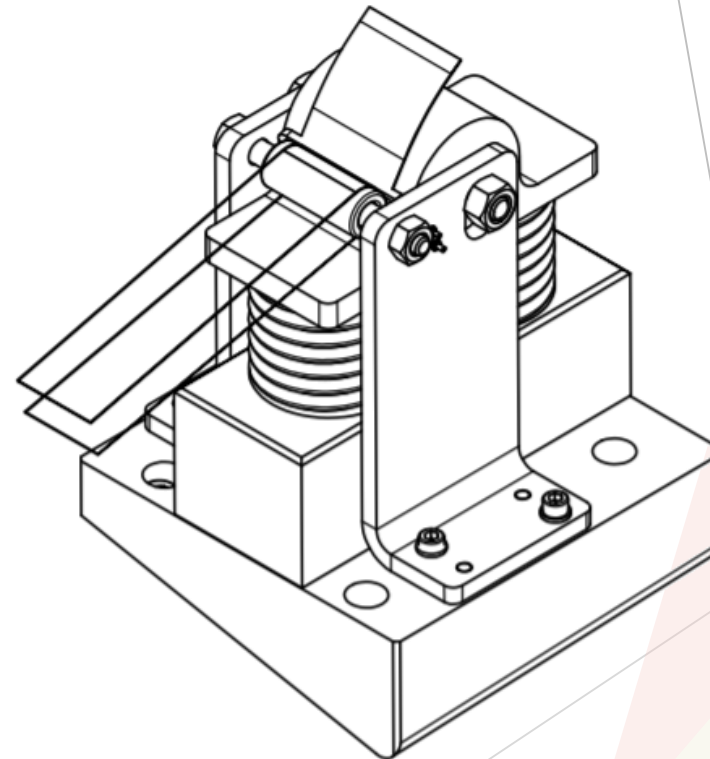
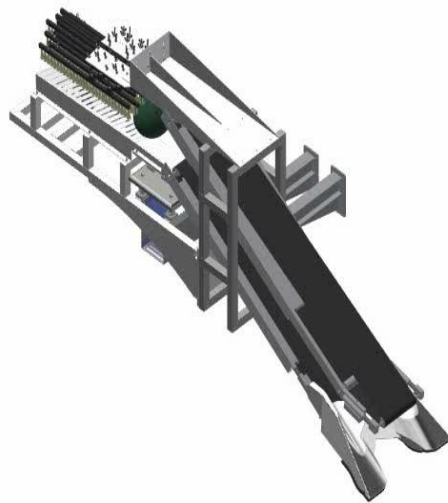
## LIMPEZA





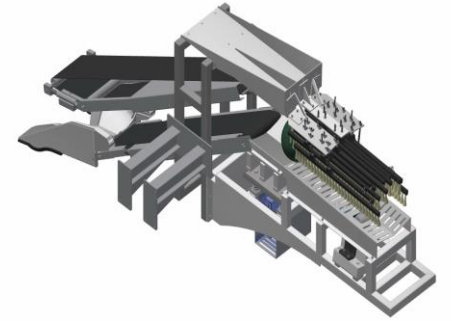
# SISTEMAS PARA ESTUDO

## ETIQUETAGEM

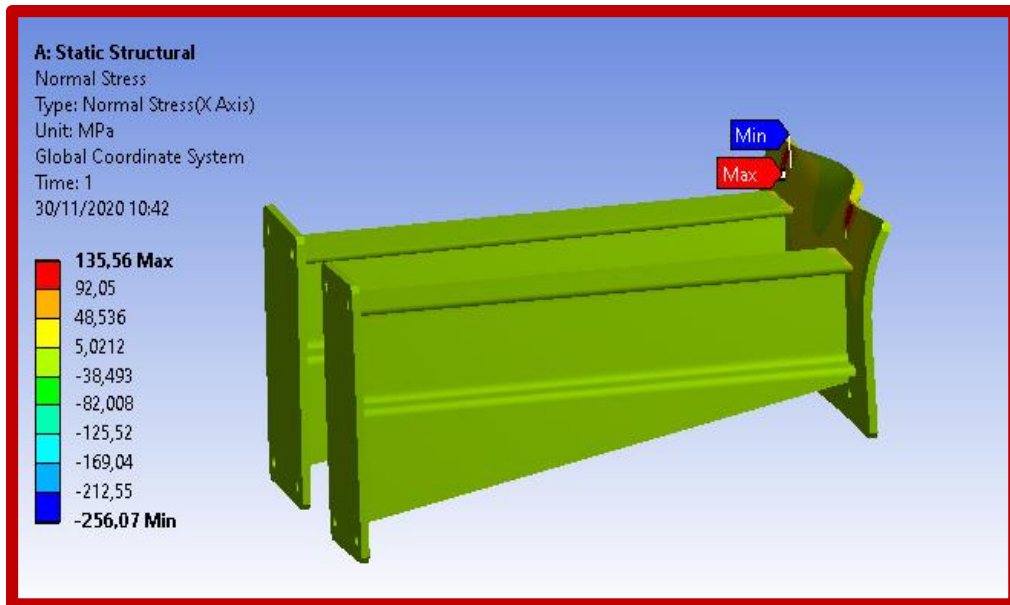




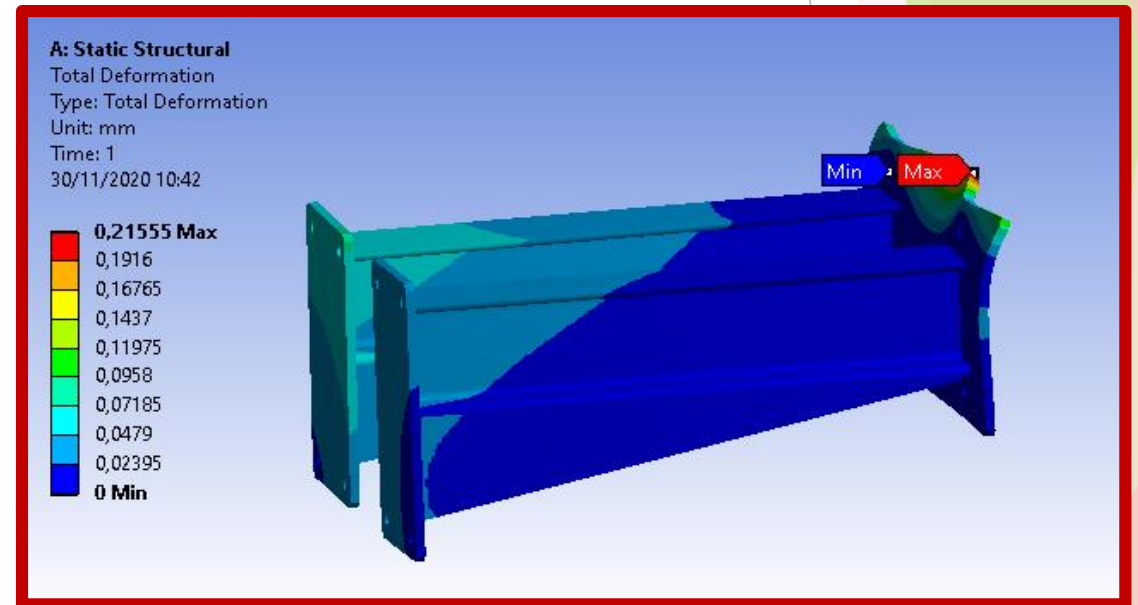
# ANÁLISE PESO



Simulação e verificação do peso dos sistemas Qr\_Citrulina ao acoplamento Citrullus com o trator.



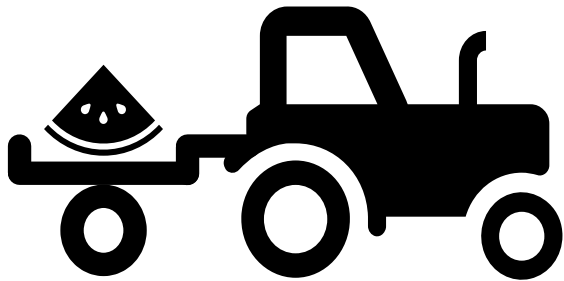
Fonte: Autor



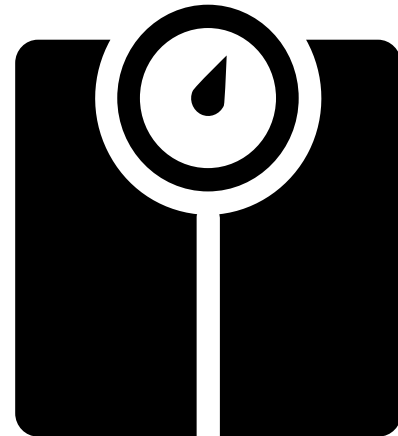
Fonte: Autor



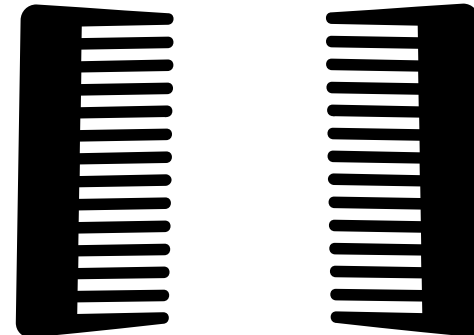
# SISTEMAS PARA ESTUDO



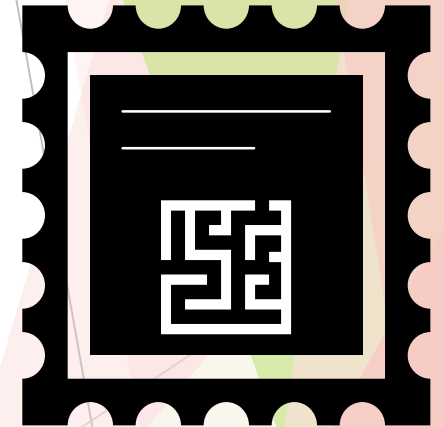
CAPTAÇÃO



PESAGEM



LIMPEZA



ETIQUETAGEM

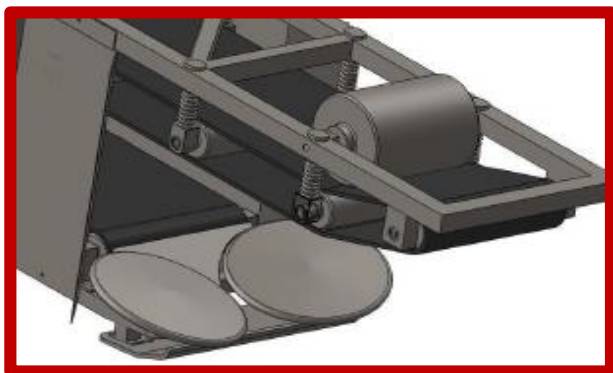


QRCITRULINA

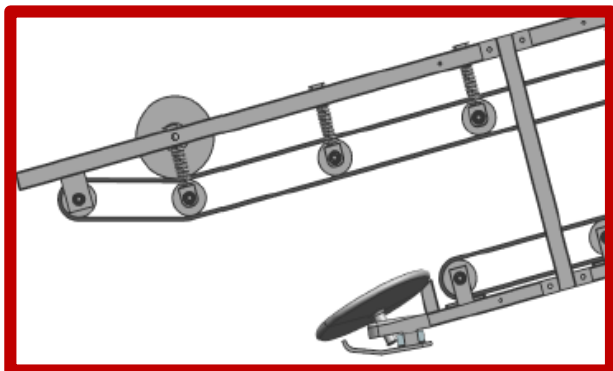
# SISTEMA DE CAPTAÇÃO

## □ PROJETOS ANTERIORES

E  
A  
S  
Y  
C  
R  
O  
P



Fonte: TCC - EasyCrop, 2018

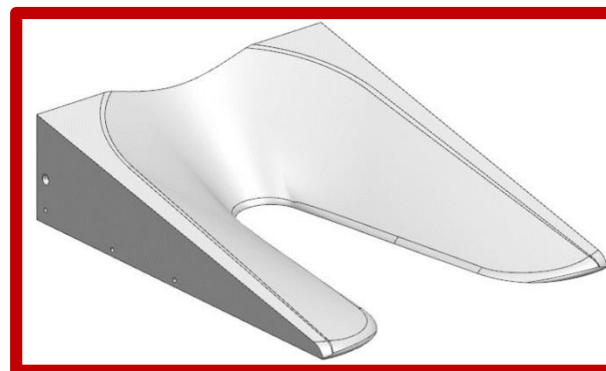


Fonte: TCC - EasyCrop, 2018

C  
I  
T  
R  
U  
L  
L  
U  
S



Fonte: TCC - CITRULLUS 2019



Fonte: TCC - CITRULLUS 2019

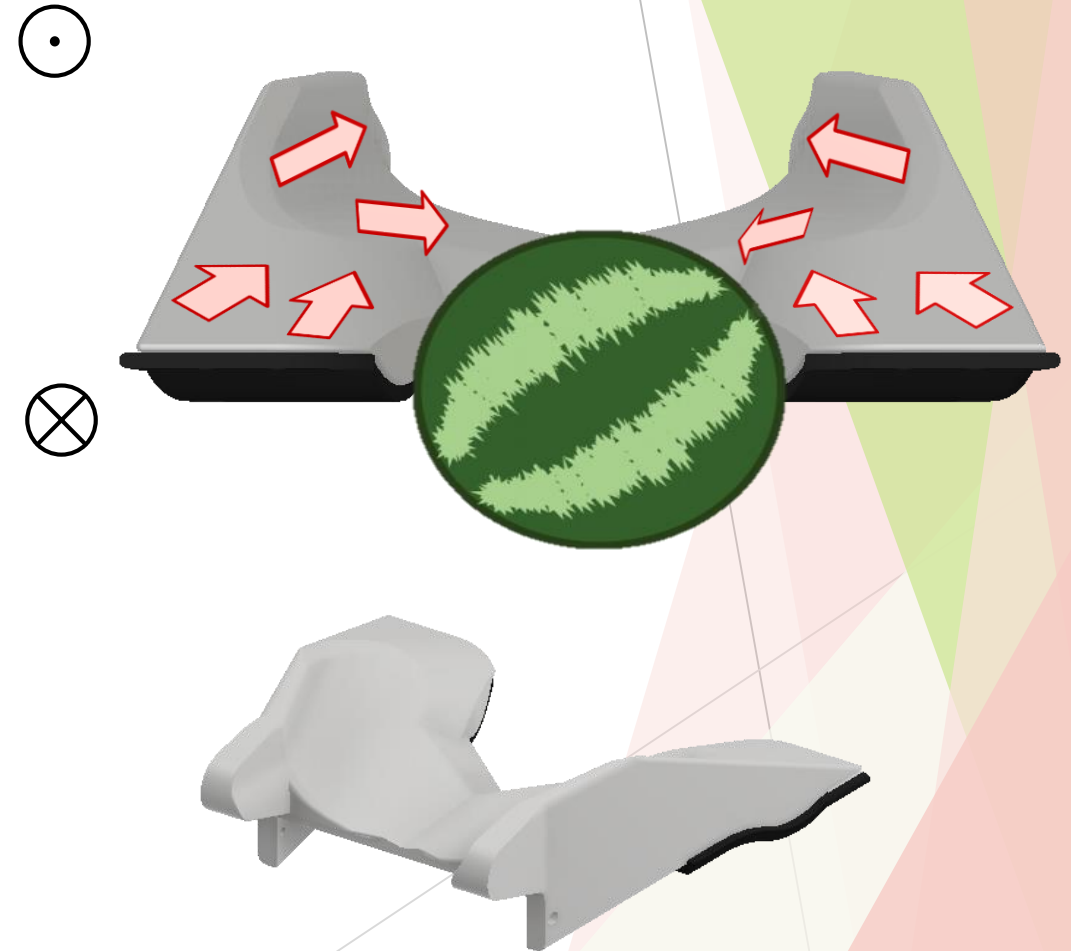


Engenharia



# SISTEMA DE CAPTAÇÃO - EM ESTUDO

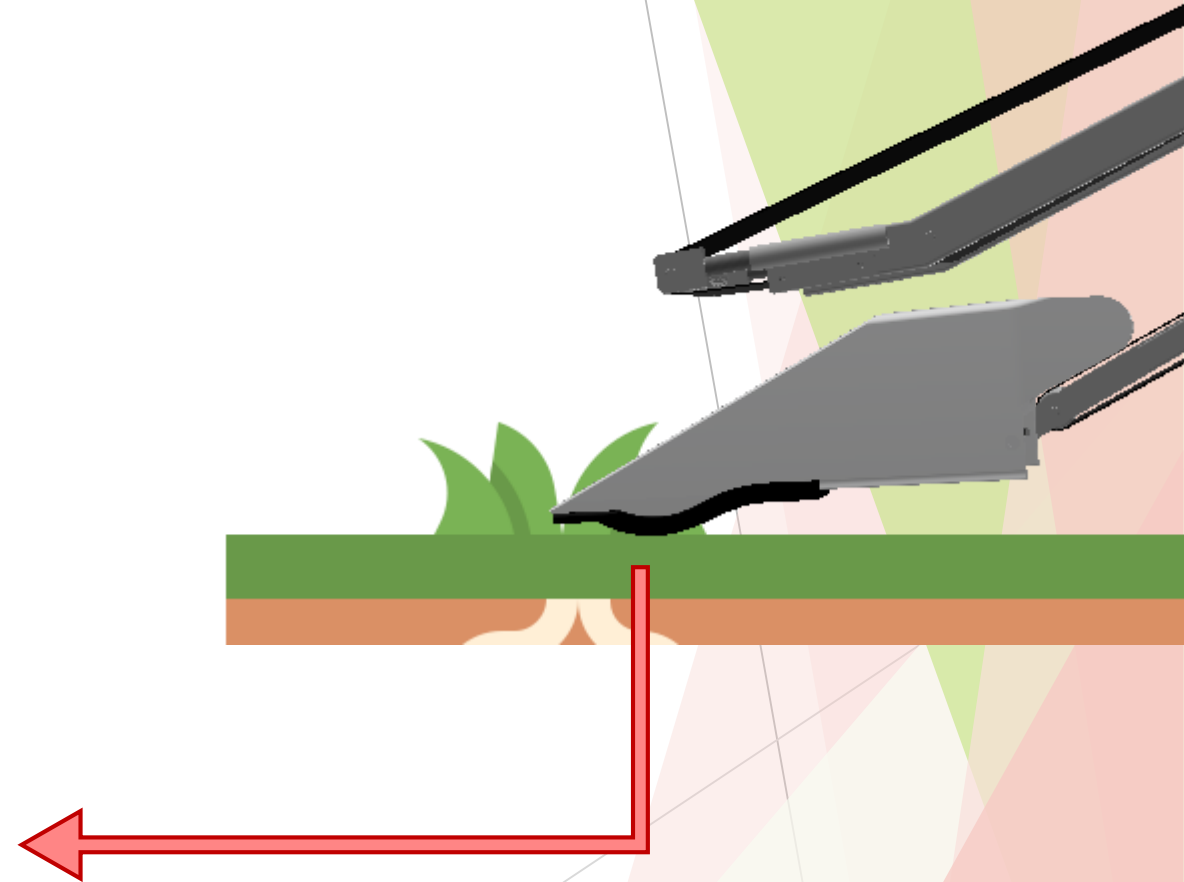
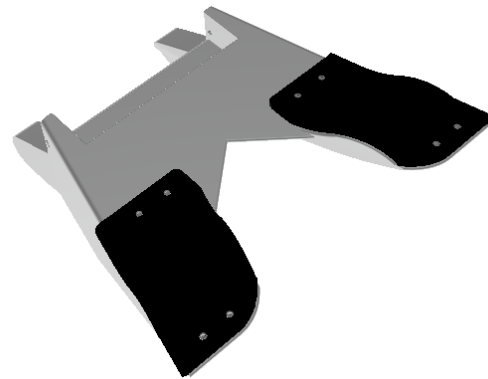
- Geometria do Captor otimizada.
- Afunilamento do canal de captação.
- Direcionamento do fruto.





# SISTEMA DE CAPTAÇÃO - EM ESTUDO

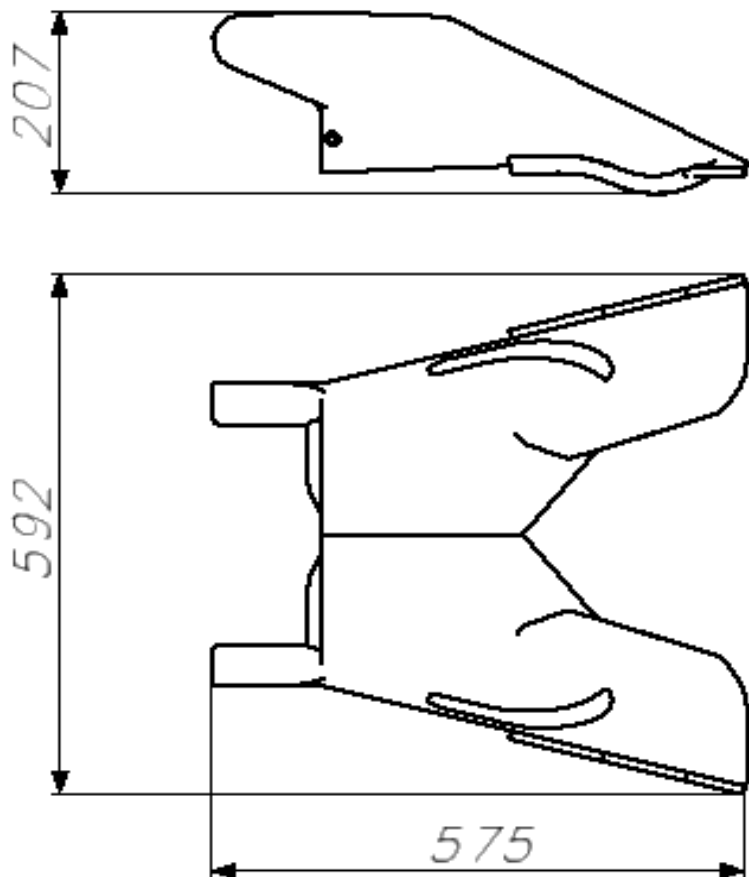
- Proteção para o captor
- Fixação com parafusos
- Intercambiável quando necessário





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# SISTEMA DE CAPTAÇÃO - EM ESTUDO



- ◆ Dimensões básicas do sistema de captação
- ◆ O captor será construído em Alumínio
- ◆ Peso aproximado de 31,4 kg





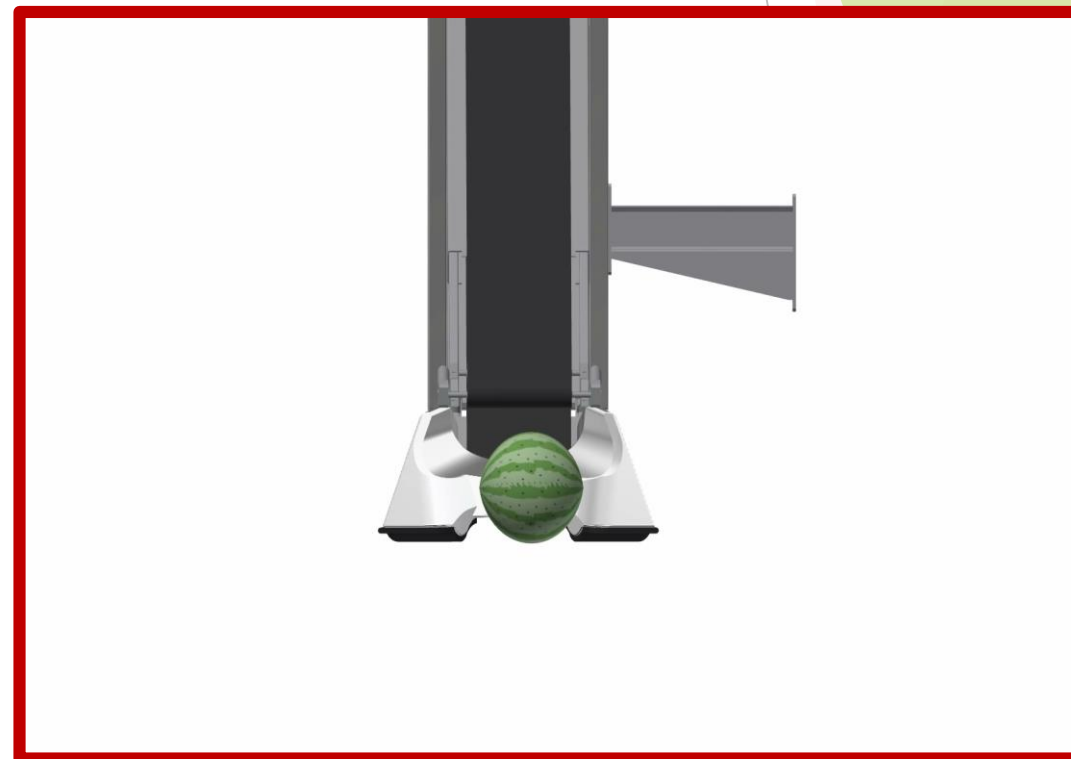
QR CITRULINA

# SISTEMA DE CAPTAÇÃO

## ► Dinâmica do Sistema de Captação



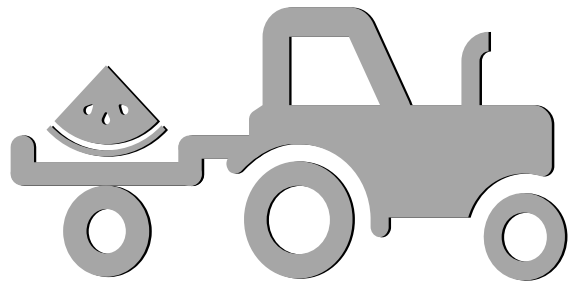
Fonte: Autor



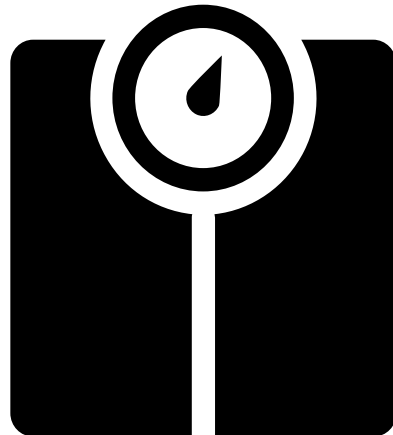
Fonte: Autor



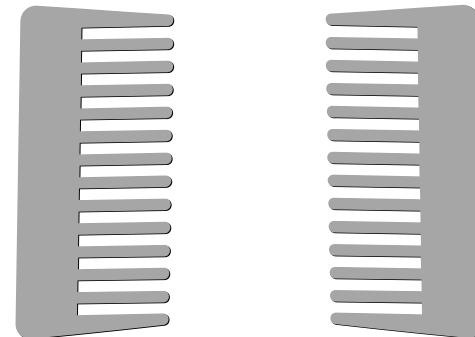
# SISTEMAS PARA ESTUDO



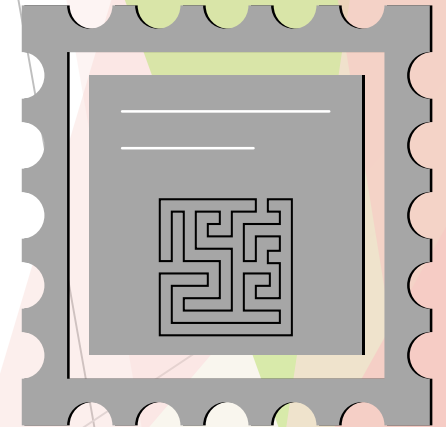
CAPTAÇÃO



PESAGEM



LIMPEZA



ETIQUETAGEM



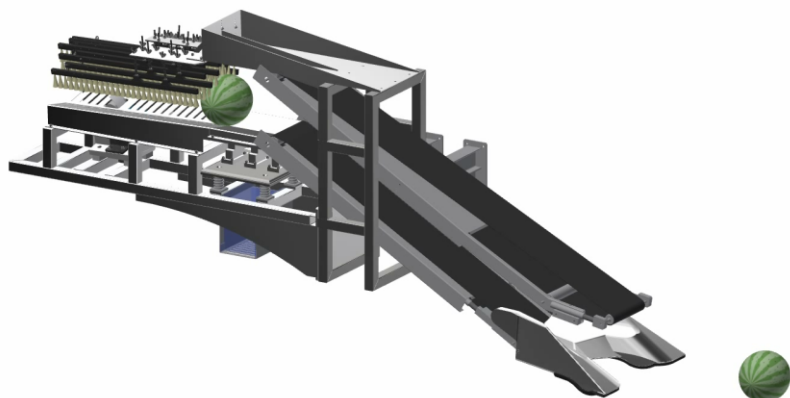
QR CITRULINA

# SISTEMA DE PESAGEM

## ❑ Sistema de Pesagem - Proposto

❖ Sistema composto por três células de carga.

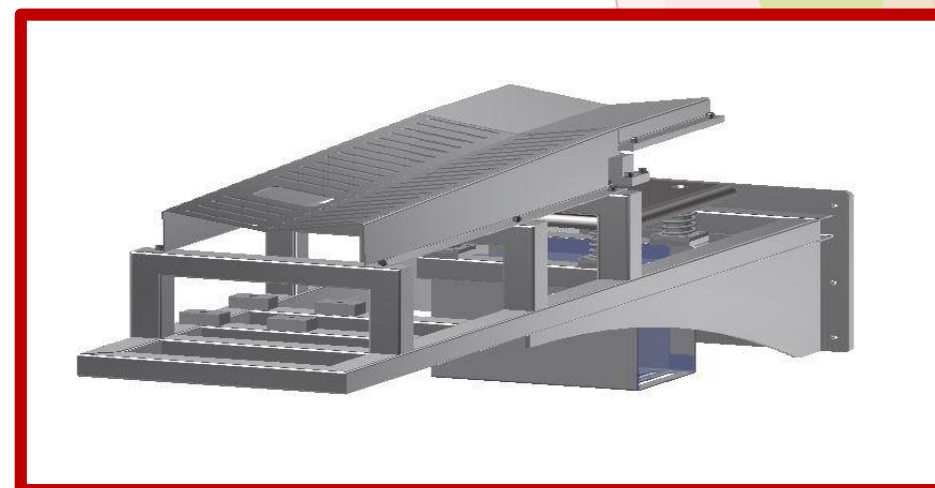
❖ Design prismático guiando a melancia;



Fonte: Autor



Fonte: [www.hbm.com/pt/4824/fit5a-celula-digital-de-carga-o-coracao-das-balancas/](http://www.hbm.com/pt/4824/fit5a-celula-digital-de-carga-o-coracao-das-balancas/)



Fonte: Autor



QR CITRULINA

# SISTEMA DE PESAGEM

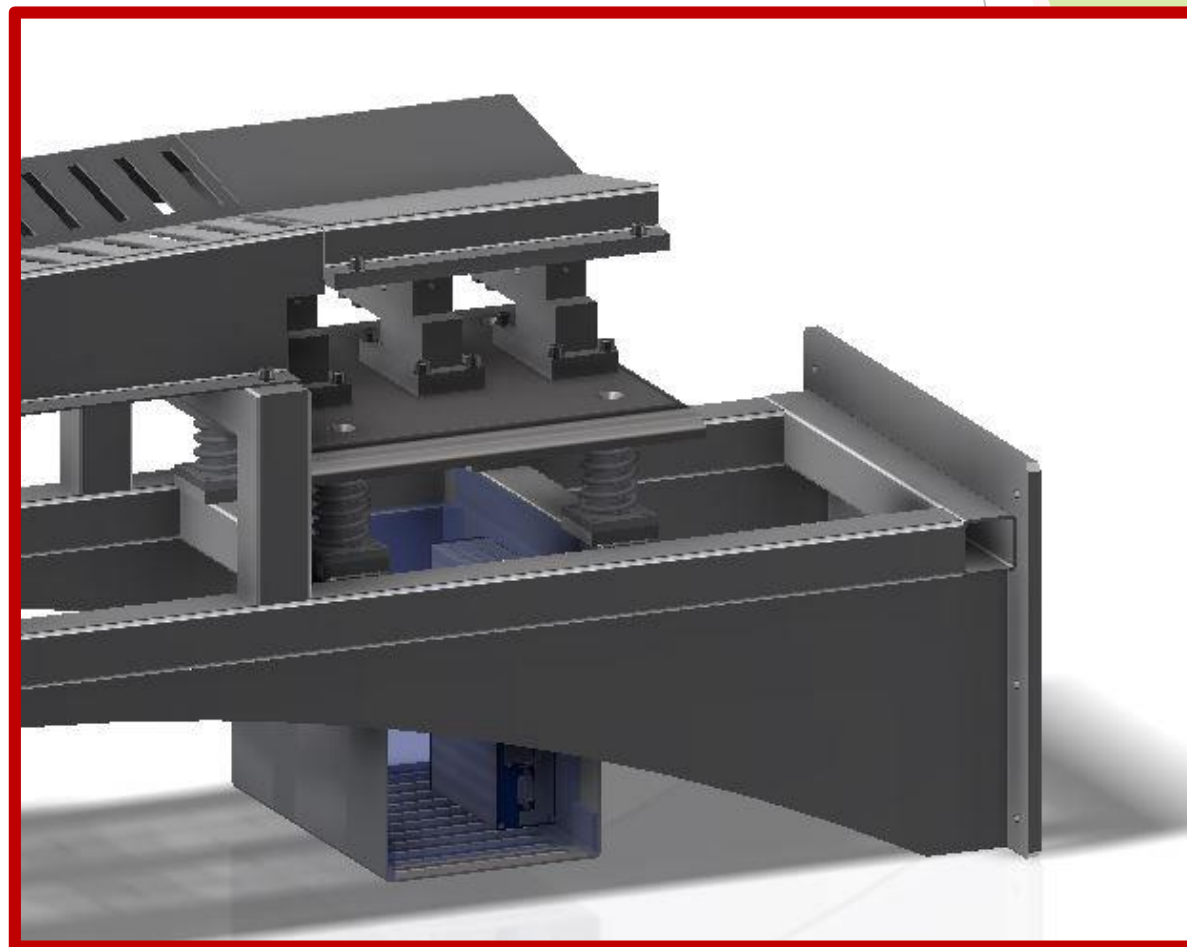
## ❑ Sistema de Pesagem

📡 MESA ANTIVIBRAÇÃO

📡 CÉLULA DE CARGA (HBM FIT 5A)



Fonte: Autor



Fonte: Autor



Engenharia



QR CITRULINA

# SISTEMA DE PESAGEM

## ❑ Sistema de Pesagem

### Célula de Carga FIT 5 A Fornecedor HBM



### Special features

- Accuracy class C3 with OIML R60 test report
- Maximum capacities 5 kg ... 50 kg
- Off-center load compensated (OIML R76)
- Dosing mode
- 4 limit value switches
- Trigger mode (external or level)
- Automatic parameterization for dynamic applications
- Stainless steel
- Integral overload protection
- Degree of protection IP68/IP69K
- PC software for parameter setup and dynamic analysis
- Various options and accessories are available

Fonte: [www.hbm.com/pt/4824/fit5a-celula-digital-de-carga-o-coracao-das-balancas/](http://www.hbm.com/pt/4824/fit5a-celula-digital-de-carga-o-coracao-das-balancas/)



Engenharia

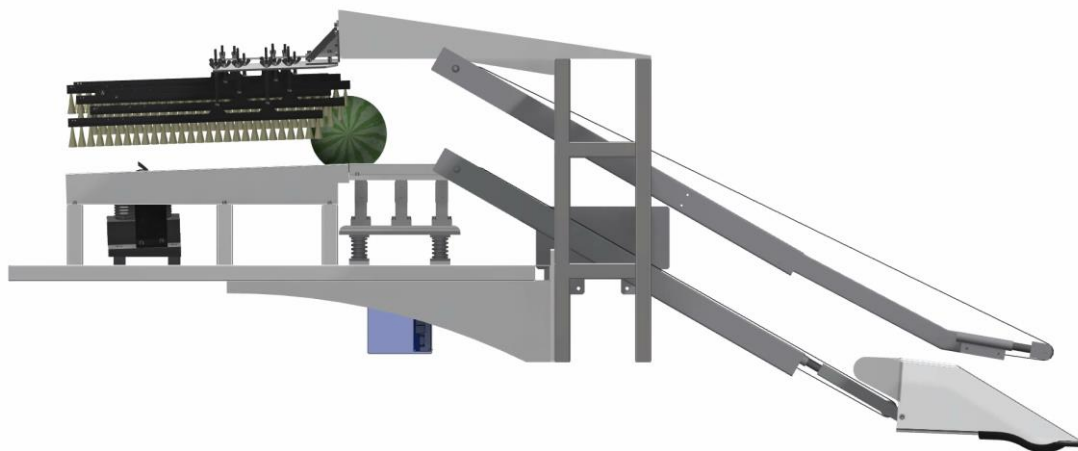


QR CITRULINA

# SISTEMA DE PESAGEM

## ❑ Sistema de Pesagem

### 📡 Aquisição e registro de dados



Fonte: Autor



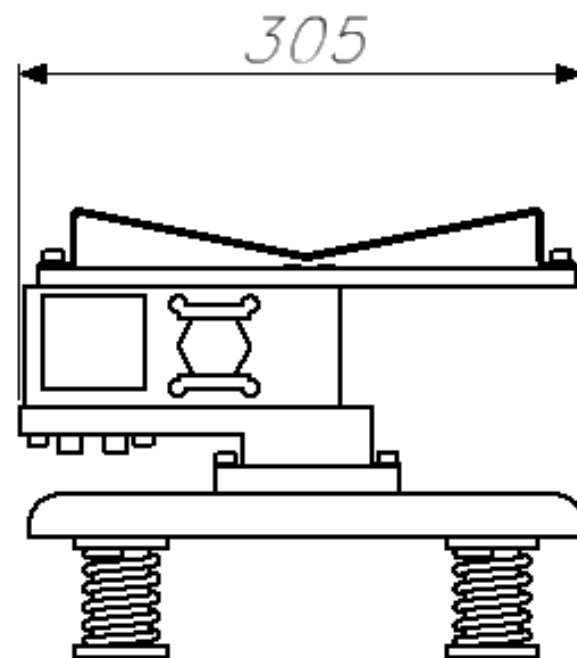
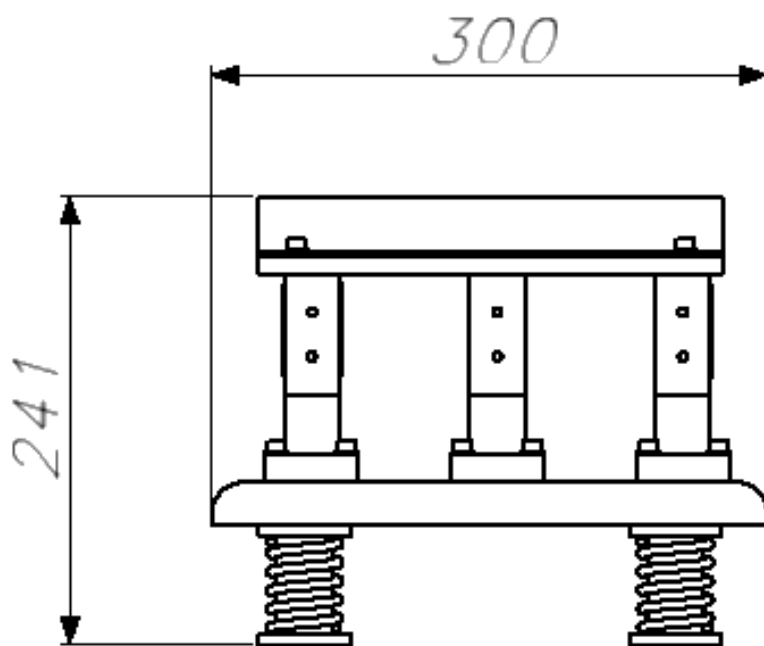
Fonte: [www.hbm.com/pt/2128/quantumx-sistema-de-aquisicao-de-dados-compacto-universal/](http://www.hbm.com/pt/2128/quantumx-sistema-de-aquisicao-de-dados-compacto-universal/)



QR CITRULINA

# SISTEMA DE PESAGEM

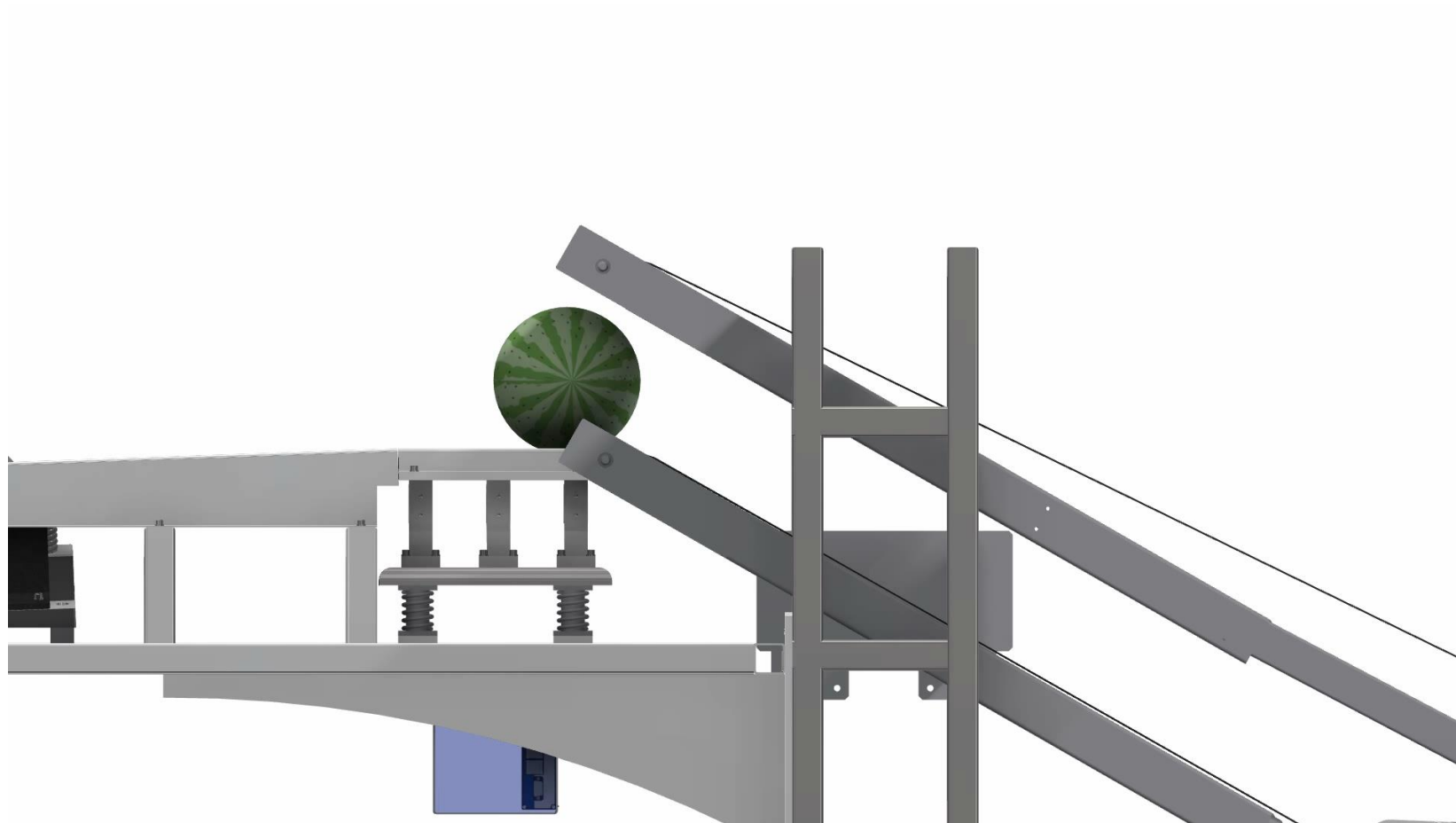
## Dimensões básicas do sistema de pesagem





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# SISTEMA DE PESAGEM

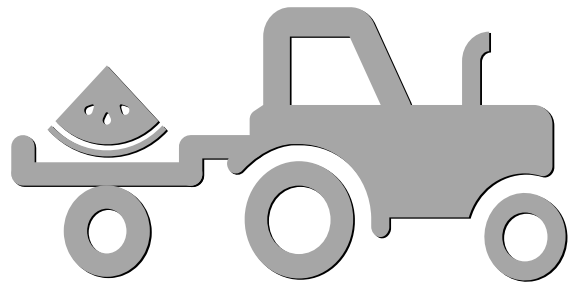


Engenharia

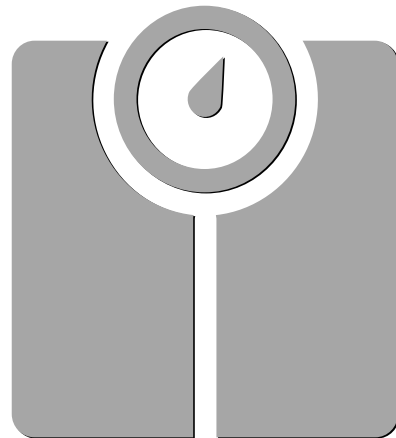




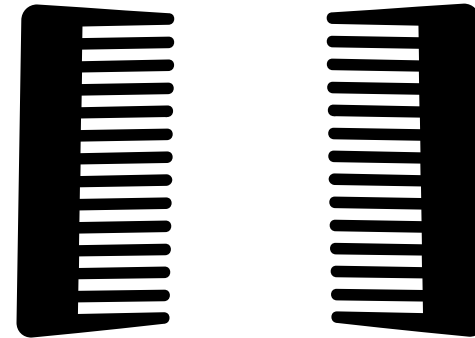
# SISTEMAS PARA ESTUDO



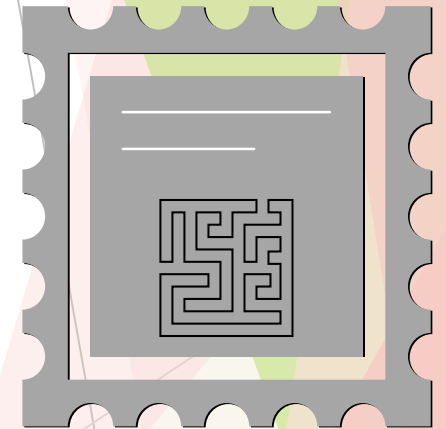
CAPTAÇÃO



PESAGEM



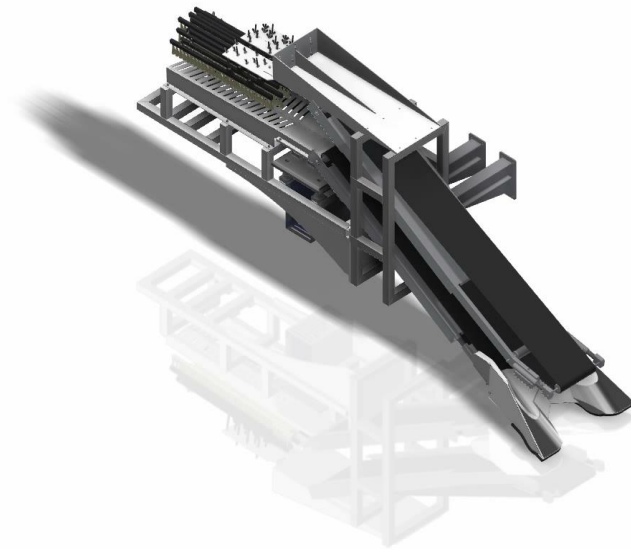
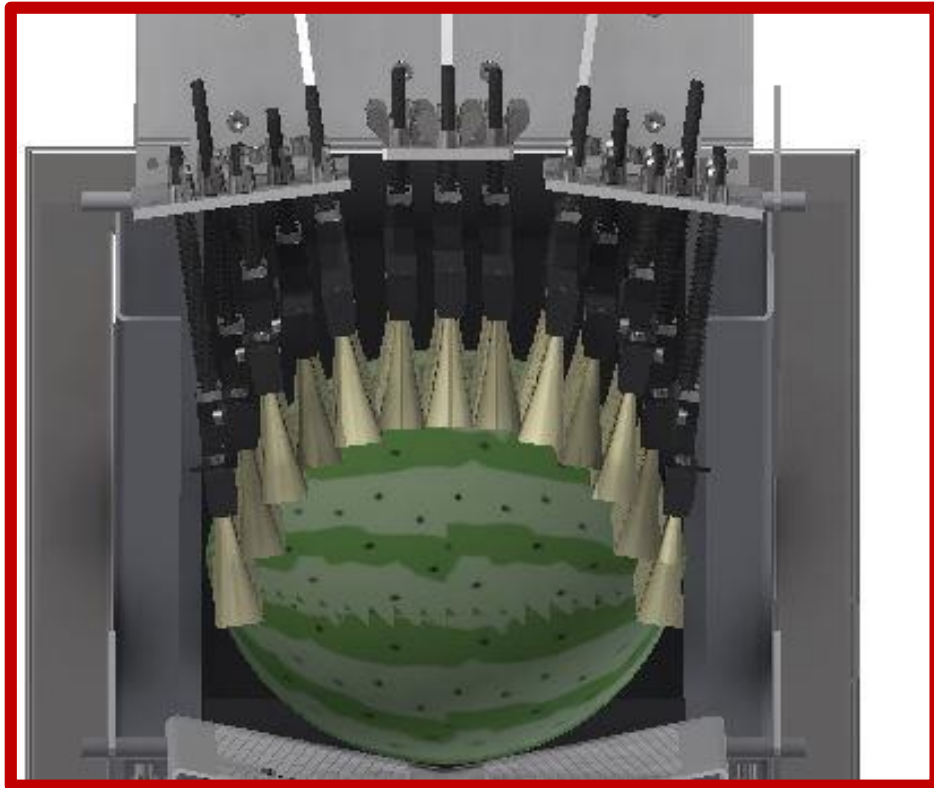
LIMPEZA



ETIQUETAGEM



# SISTEMA DE LIMPEZA

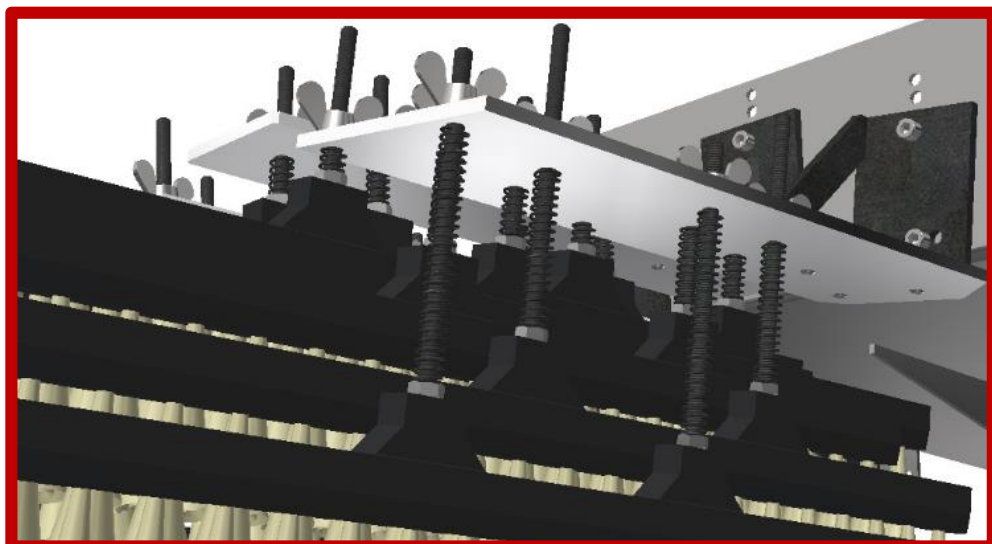


Fonte: Autor



QR CITRULINA

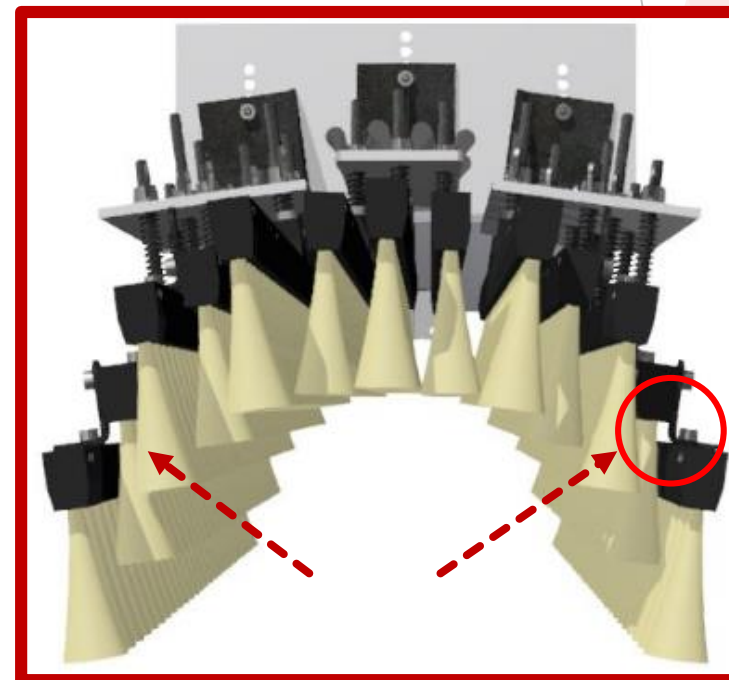
# SISTEMA DE LIMPEZA



Fonte: Autor

## SISTEMA COM REGULAGEM DE ALTURA DAS CERDAS

Fonte: Autor



## CERDAS COMPACTADAS COM UNIÃO

IMPOSSIBILIDADE DE GERAR MOMENTO NAS HASTES



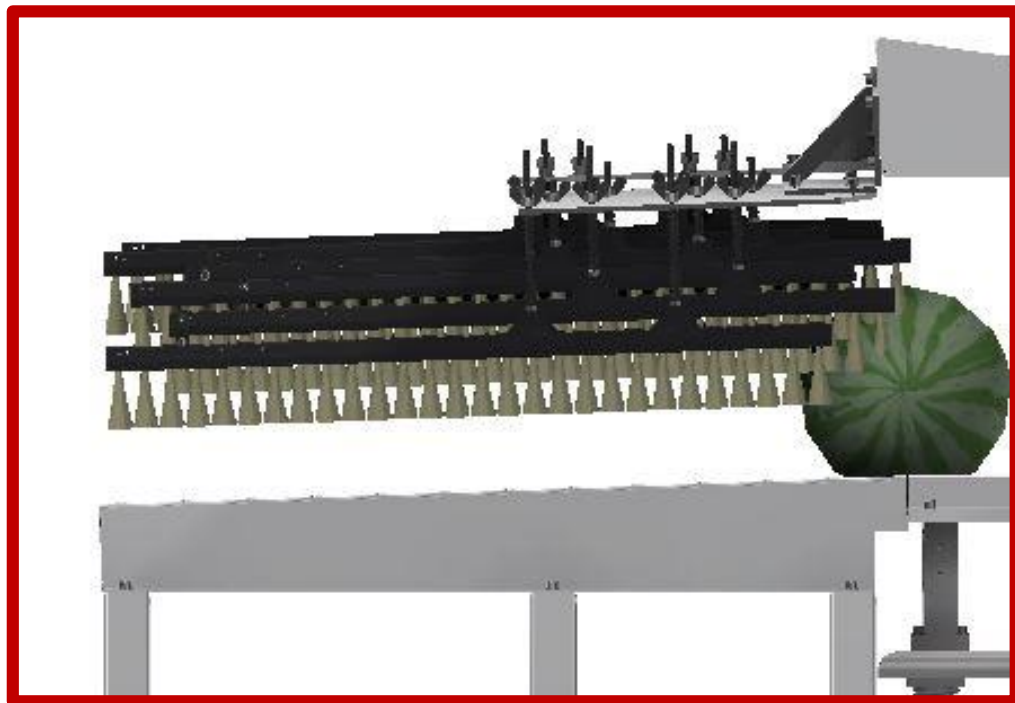
Engenharia



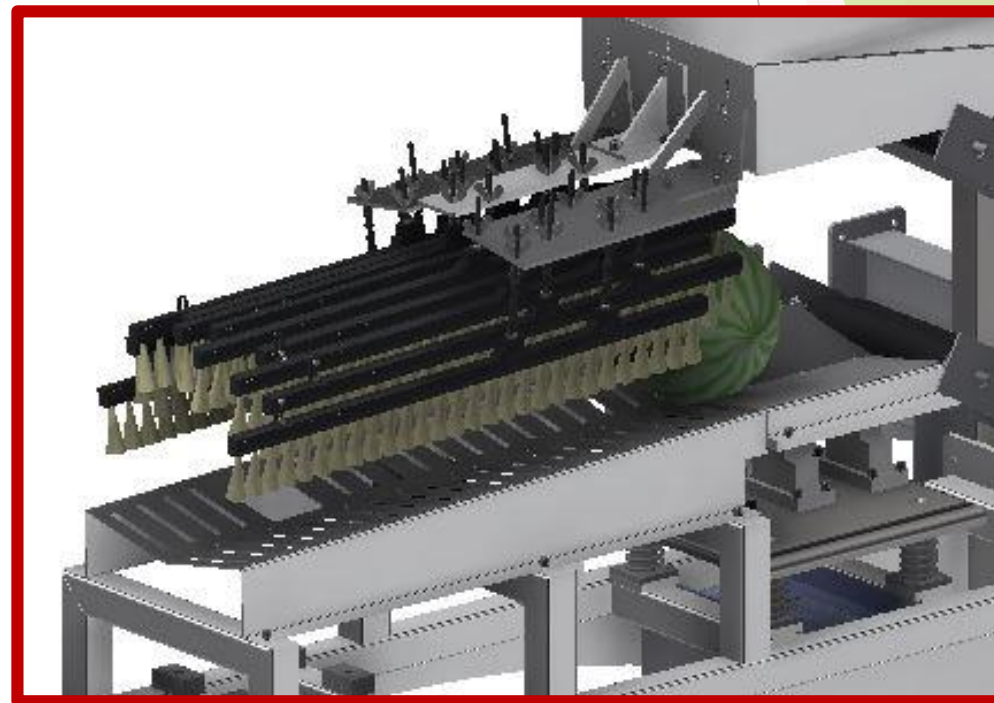
QR CITRULINA

# SISTEMA DE LIMPEZA - EM ESTUDO

## SISTEMA COM A BASE EM ÂNGULO



Fonte: Autor

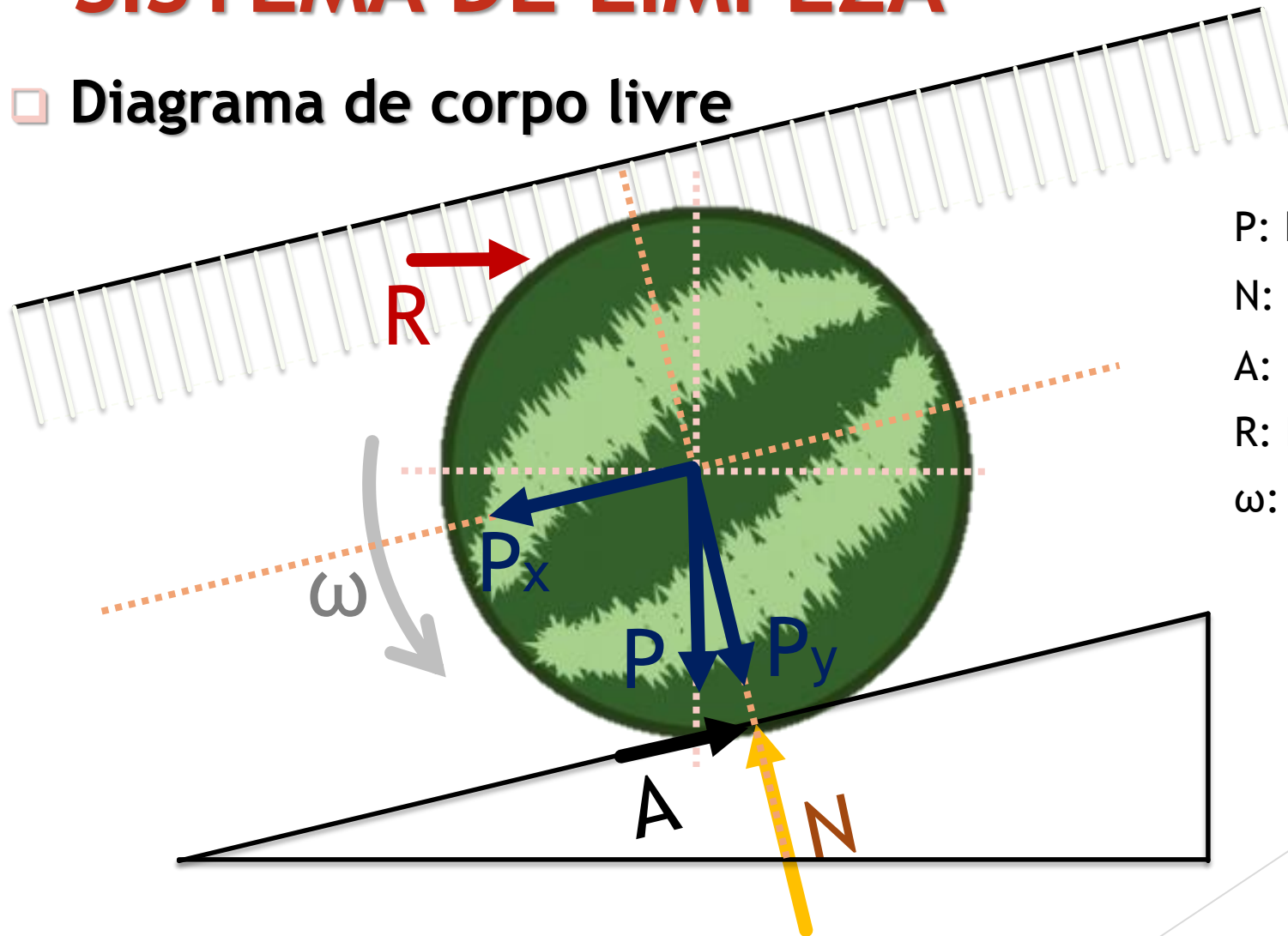


Fonte: Autor



# SISTEMA DE LIMPEZA

## □ Diagrama de corpo livre



P: Força peso

N: Força normal

A: Força de atrito

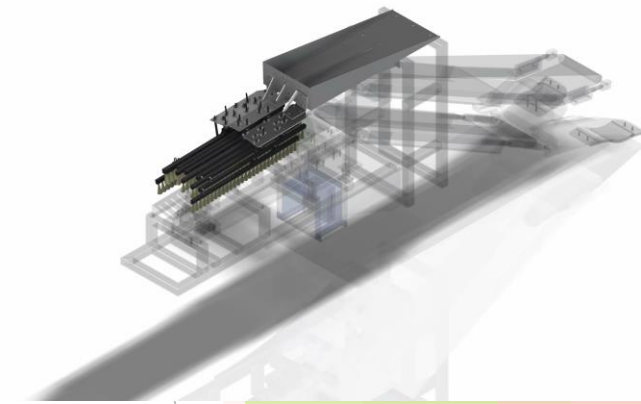
R: Força de reação às cerdas

$\omega$ : Velocidade angular

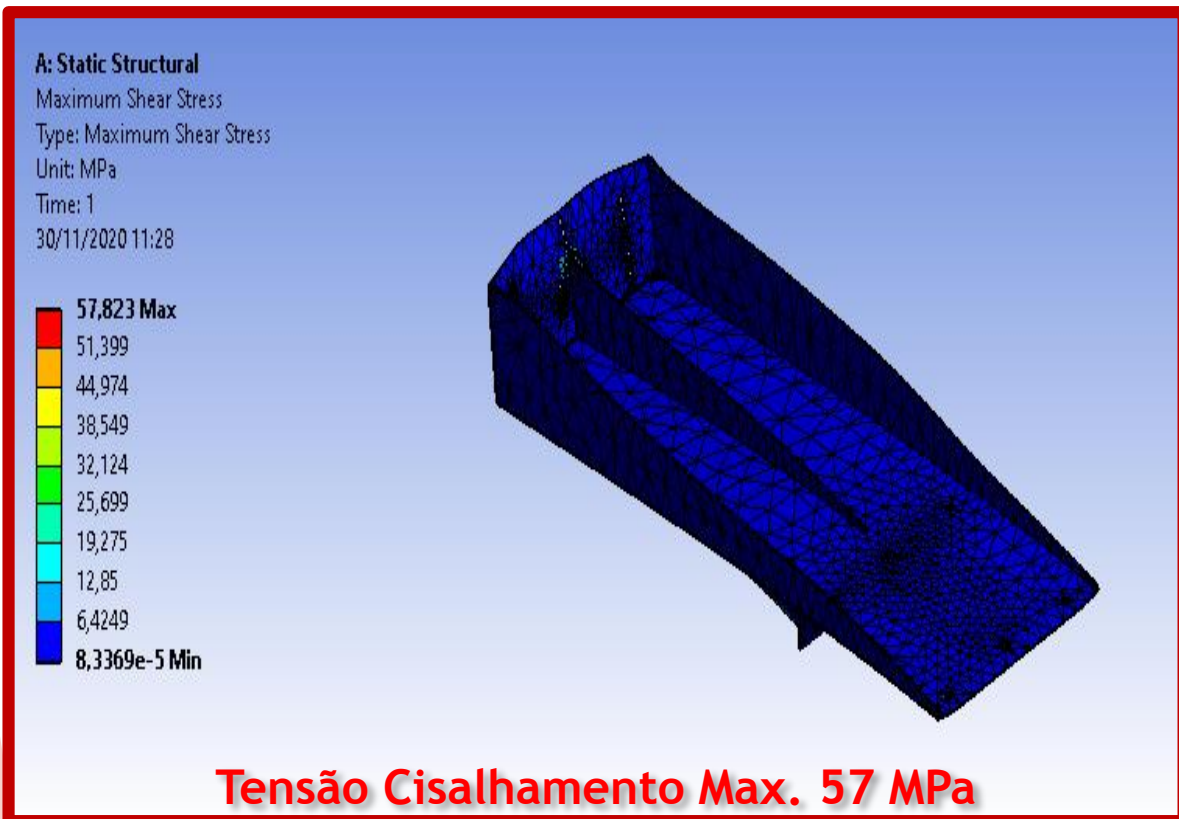


QR CITRULINA

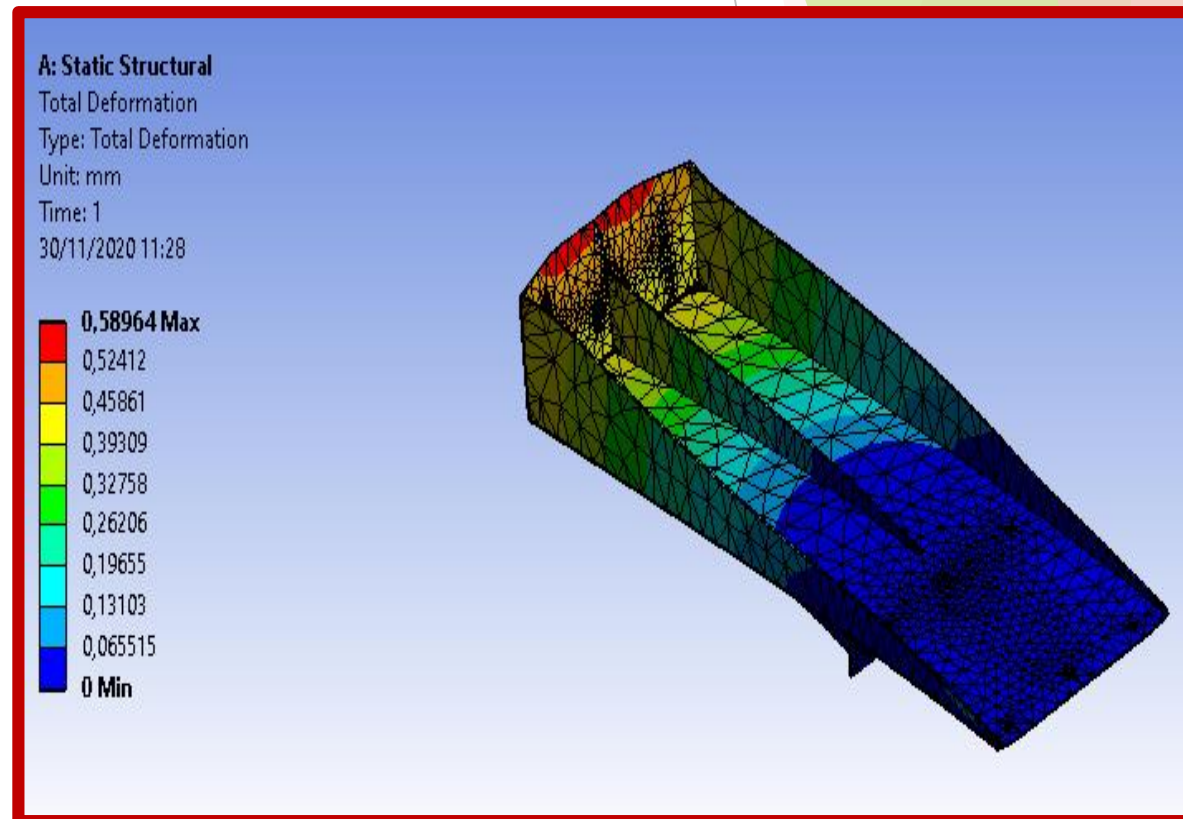
# SISTEMA DE LIMPEZA



## Simulação da Estrutura da Limpeza



Fonte: Autor



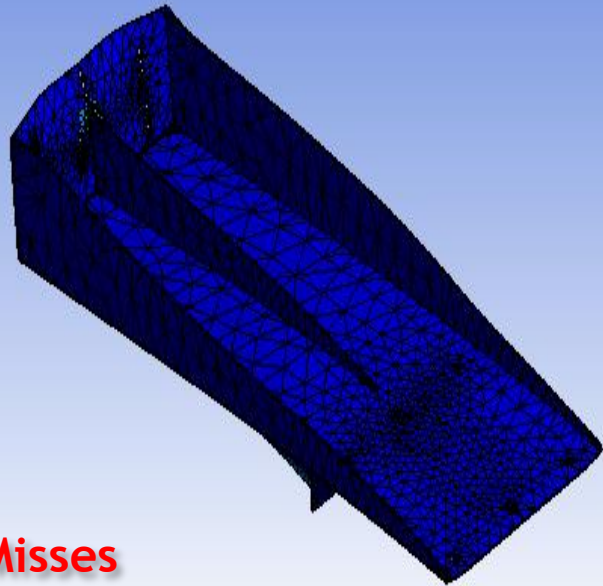
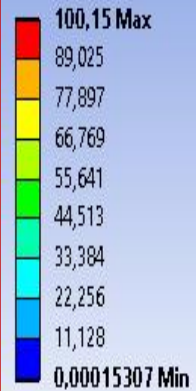


# SISTEMA DE LIMPEZA



## Simulação da Estrutura da Limpeza

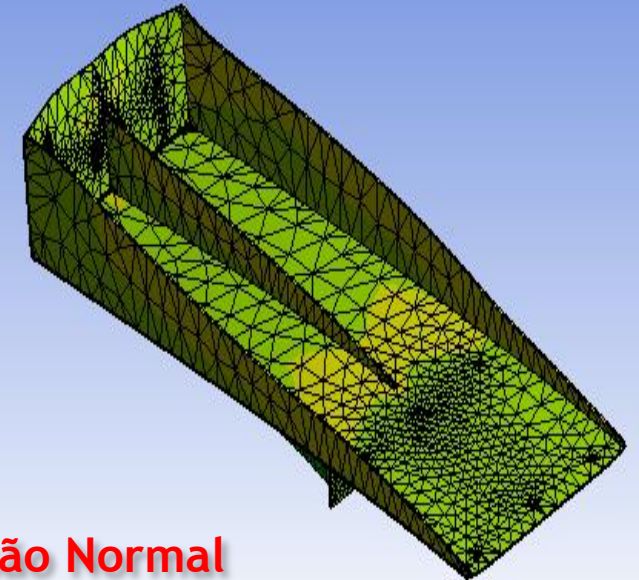
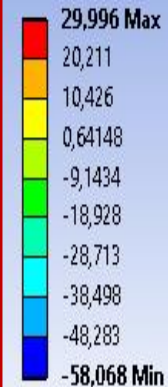
A: Static Structural  
Equivalent Stress  
Type: Equivalent (von-Mises) Stress  
Unit: MPa  
Time: 1  
30/11/2020 11:27



**Von Misses**  
**100 MPa**

Fonte: Autor

A: Static Structural  
Normal Stress  
Type: Normal Stress(X Axis)  
Unit: MPa  
Global Coordinate System  
Time: 1  
30/11/2020 11:27

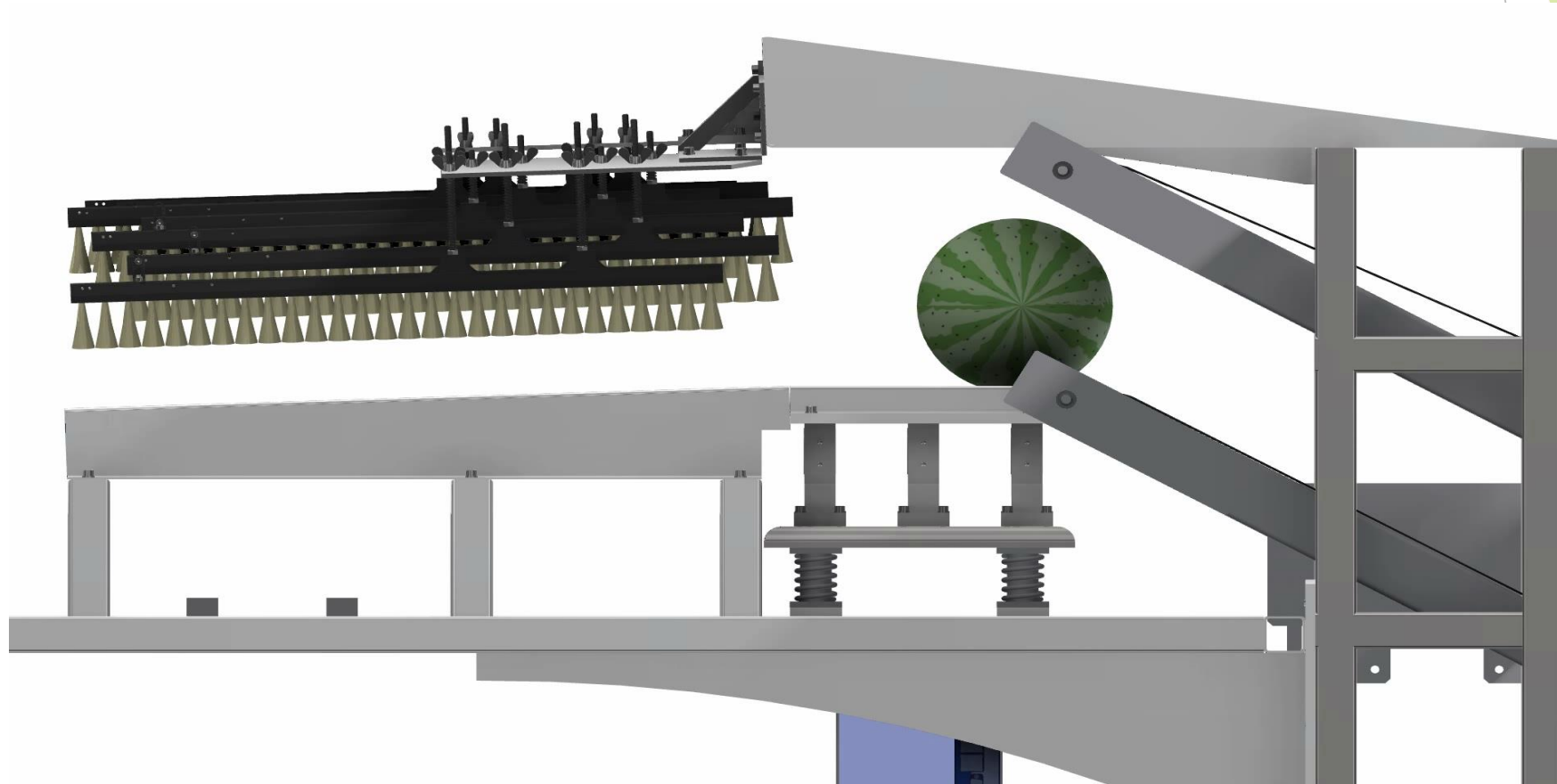


**Tensão Normal**  
**30 MPa**

Fonte: Autor



# SISTEMA DE LIMPEZA

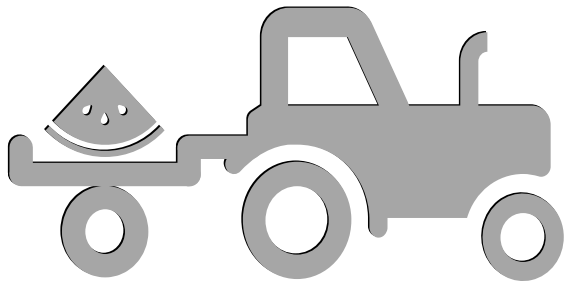


\*Video meramente ilustrativo

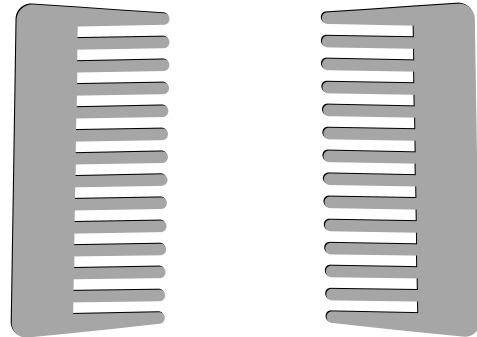




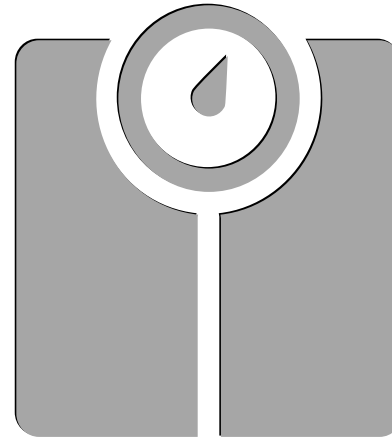
# SISTEMAS PARA ESTUDO



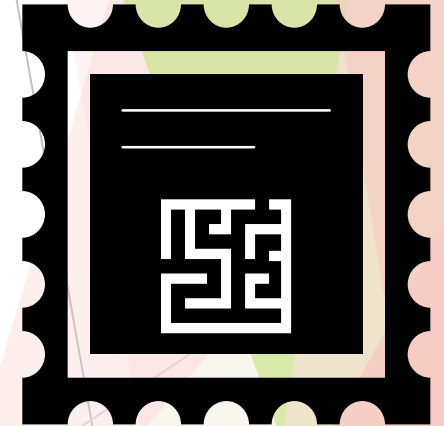
CAPTAÇÃO



LIMPEZA



PESAGEM



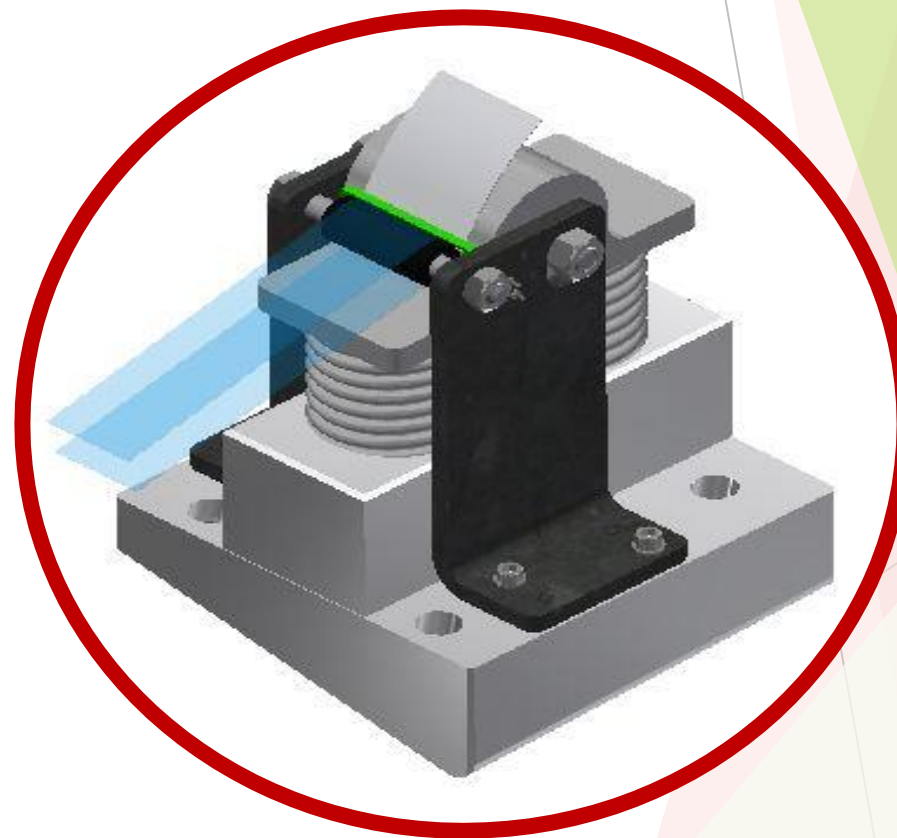
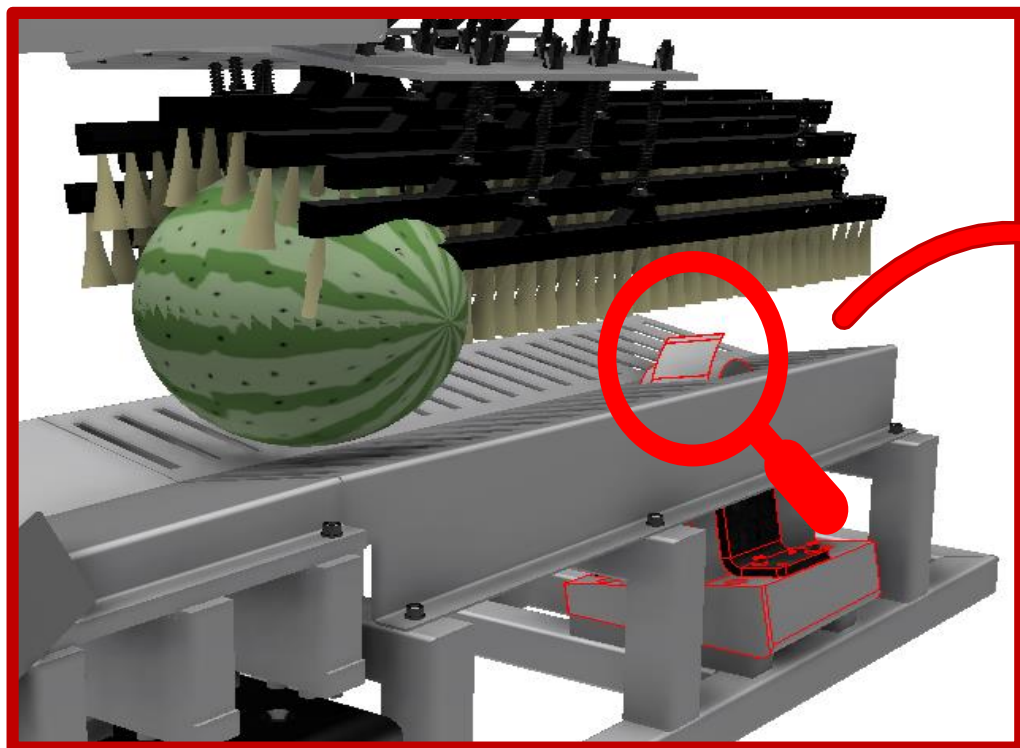
ETIQUETAGEM



QR CITRULINA

# SISTEMA DE ETIQUETAGEM

▶ A etiquetagem será realizada logo após o sistema de Limpeza.



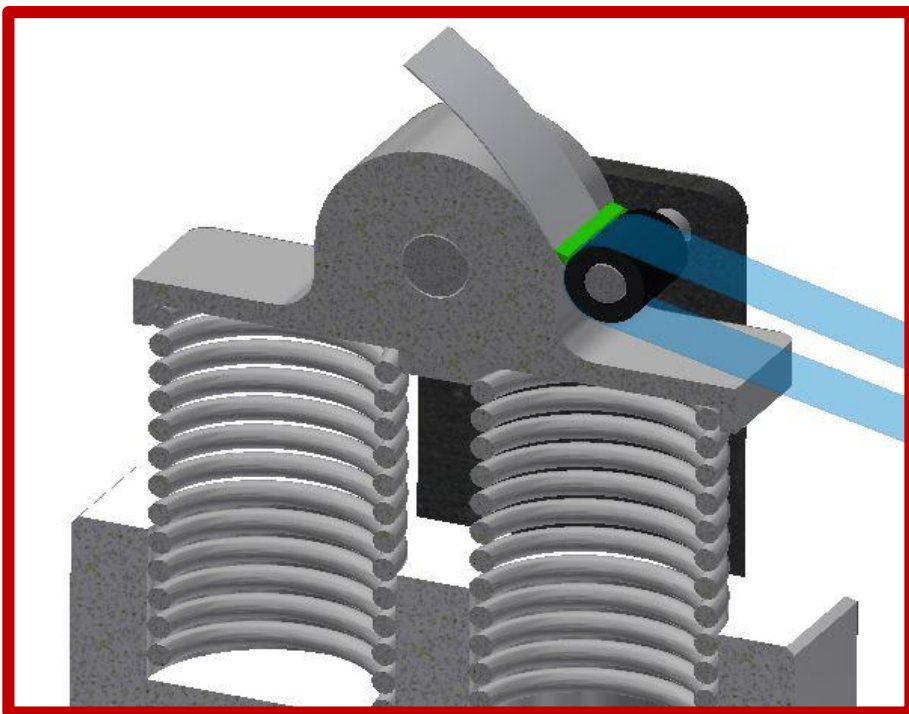
Fonte: Autor



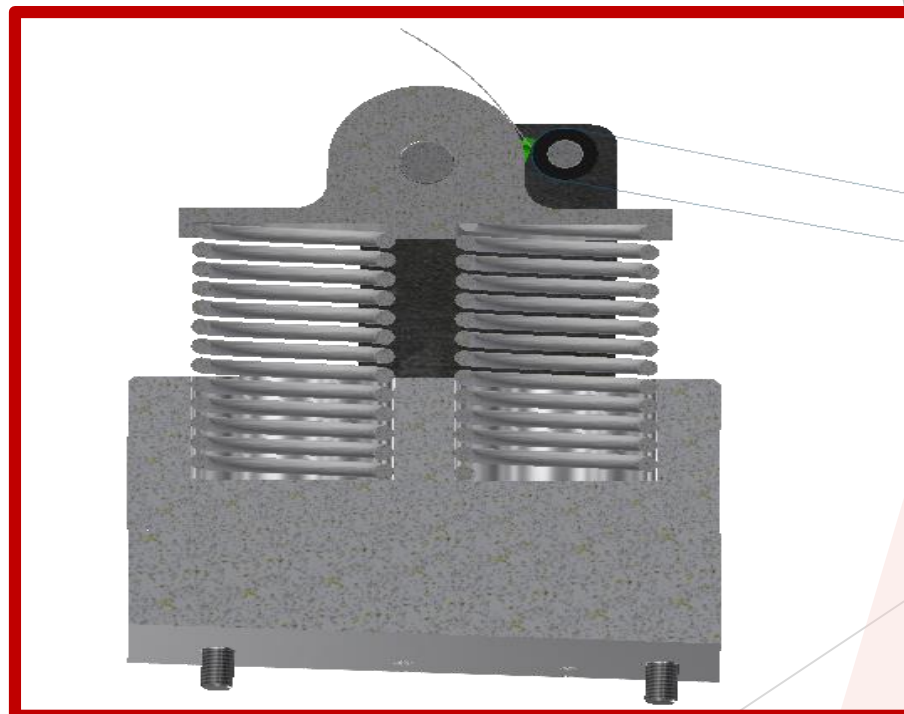
QR CITRULINA

# SISTEMA DE ETIQUETAGEM

- ❖ O sistema desenvolvido, garante a descolagem da etiqueta do rolo
- ❖ Retorno por molas



Fonte: Autor



Fonte: Autor

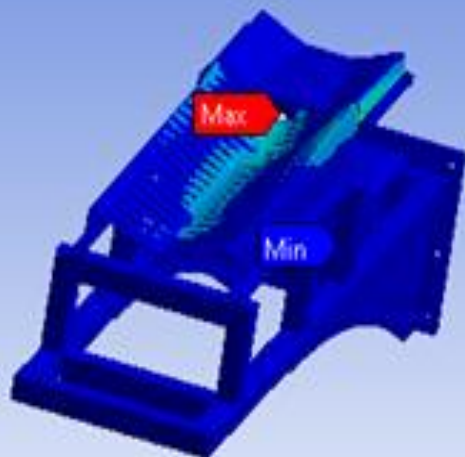
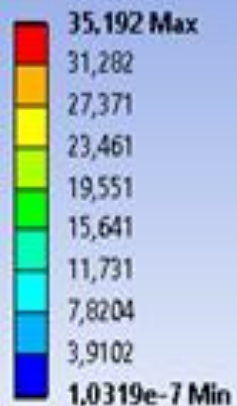


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# SISTEMA DE ETIQUETAGEM

## Simulações rampa de rolagem para a etiquetagem

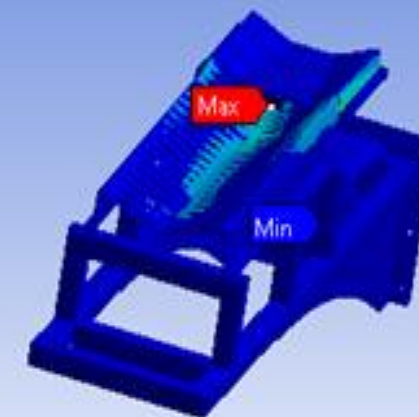
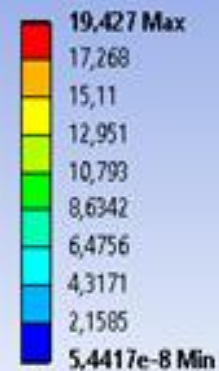
A: Transient Structural  
Equivalent Stress  
Type: Equivalent (von-Mises) Stress  
Unit: MPa  
Time: 2  
30/11/2020 12:28



**Von Misses**  
**35 MPa**

Fonte: Autor

A: Transient Structural  
Maximum Shear Stress  
Type: Maximum Shear Stress  
Unit: MPa  
Time: 2  
30/11/2020 12:29



**Cisalhamento**  
**19,4 MPa**

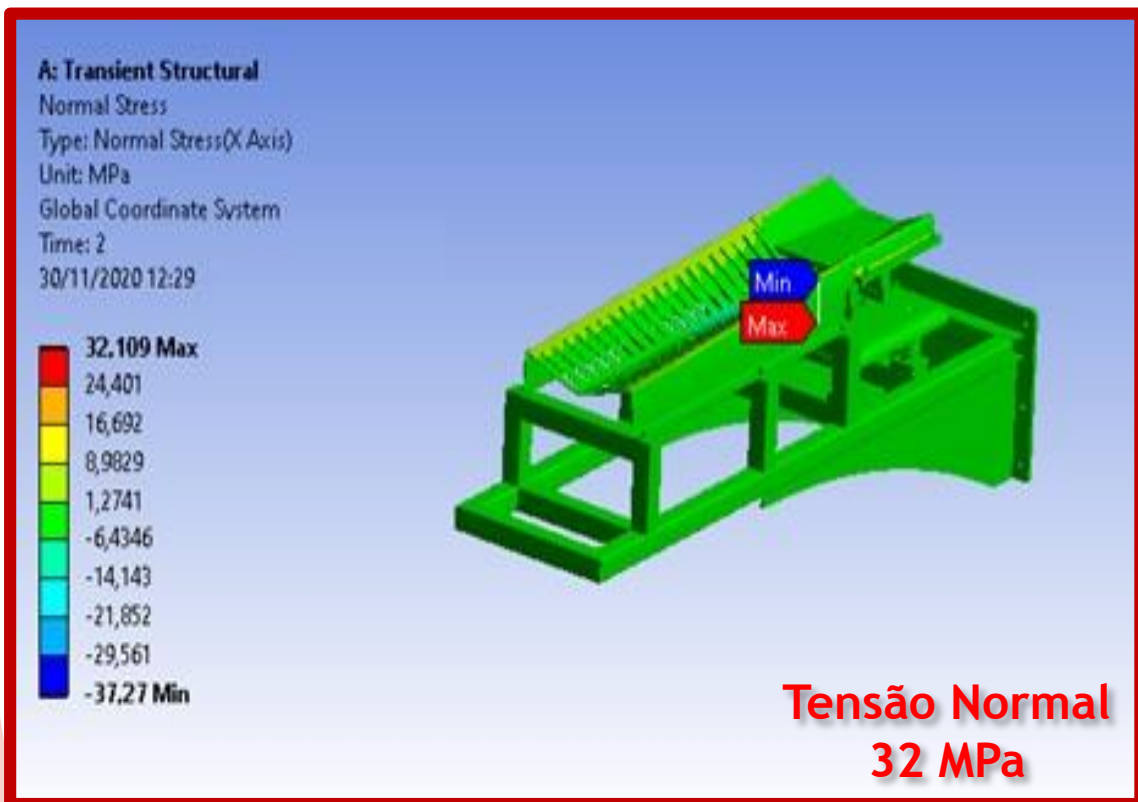
Fonte: Autor



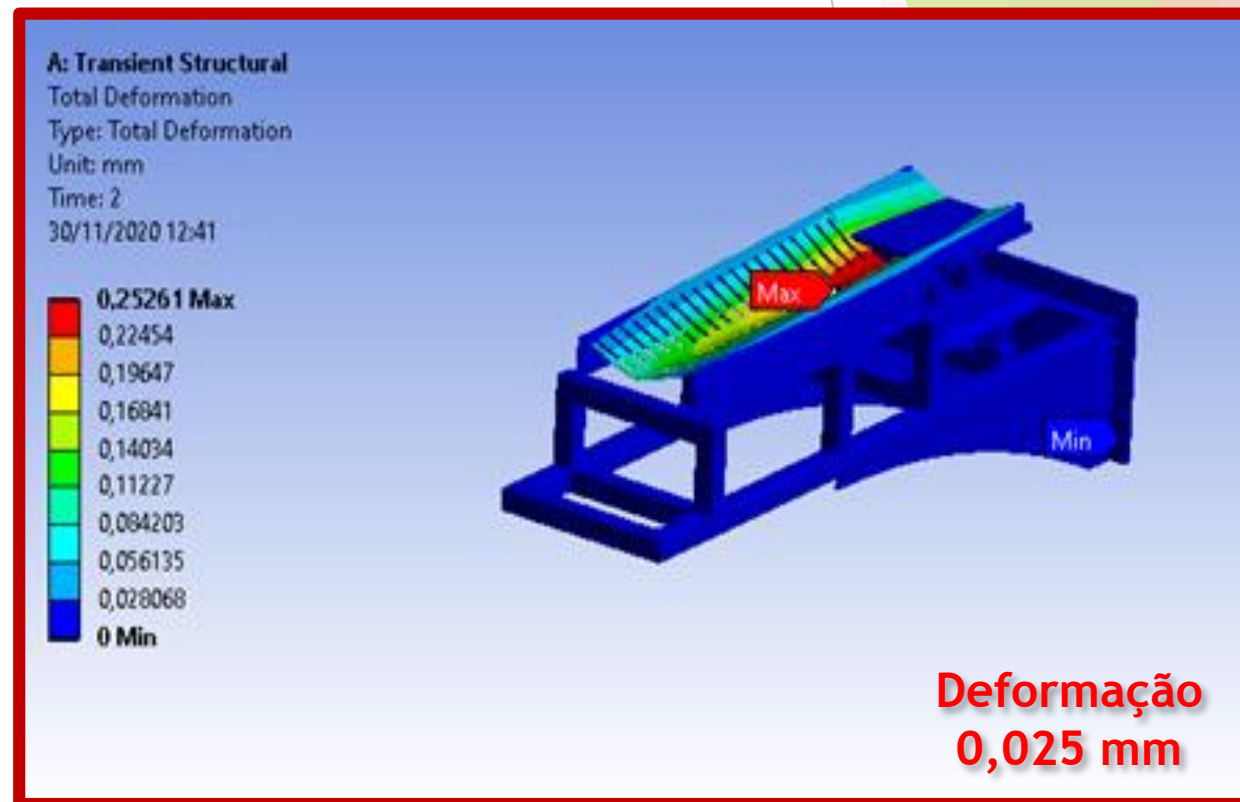
QR CITRULINA

# SISTEMA DE ETIQUETAGEM

## Simulações rampa de rolagem para a etiquetagem



Fonte: Autor



Fonte: Autor

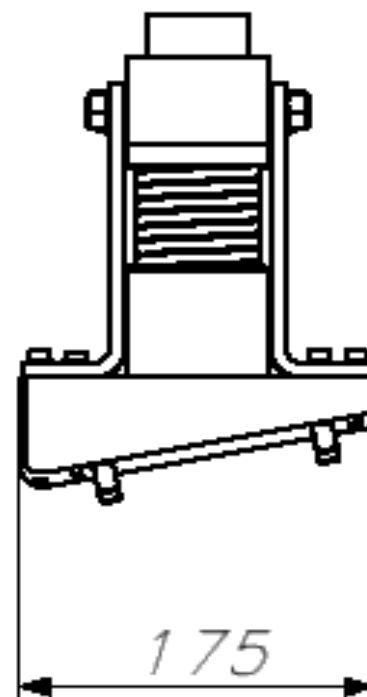
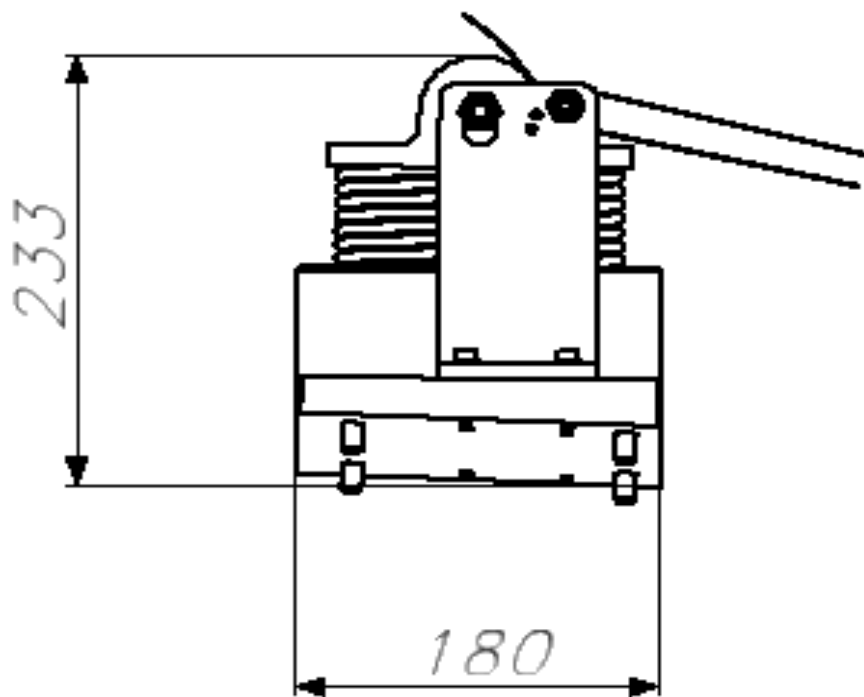


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# SISTEMA DE ETIQUETAGEM

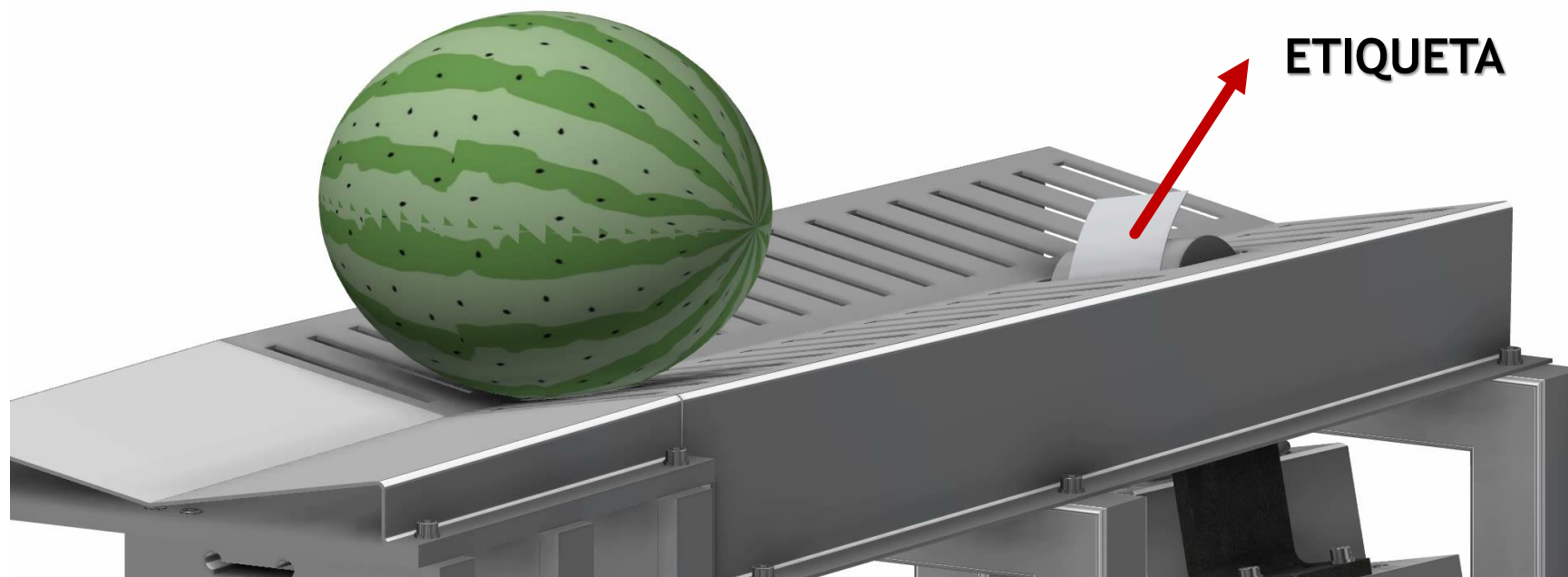


Dimensões básicas do sistema etiquetas





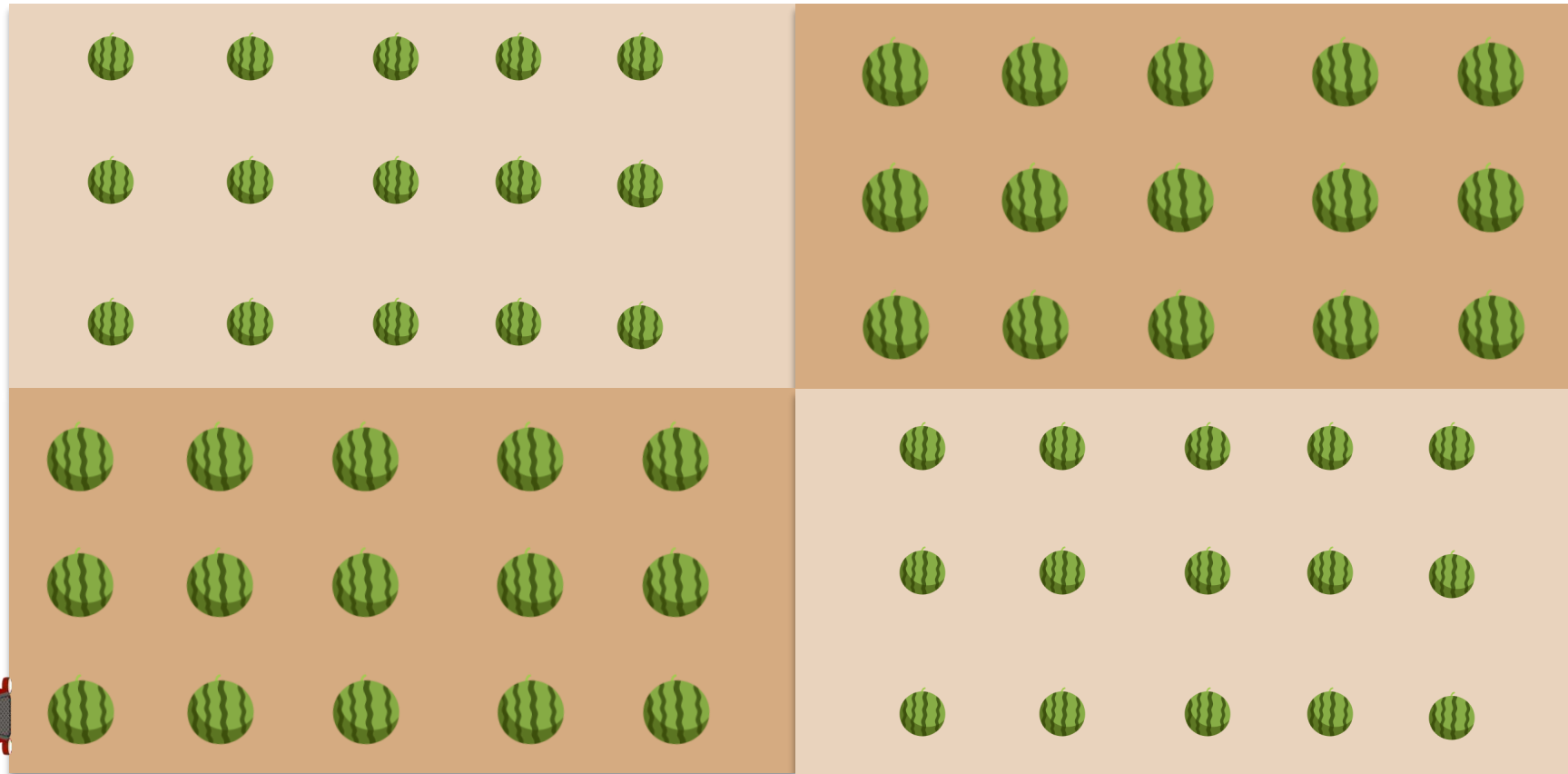
# SISTEMA DE ETIQUETAGEM



\*Video meramente ilustrativo



# DESEMPENHO OPERACIONAL



$$A_{colheita} = 1 \text{ ha}$$

$$v_{trator} = 2 \text{ km/h}$$

$$P_{m\u00e9dio} = 10 \text{ kg}$$





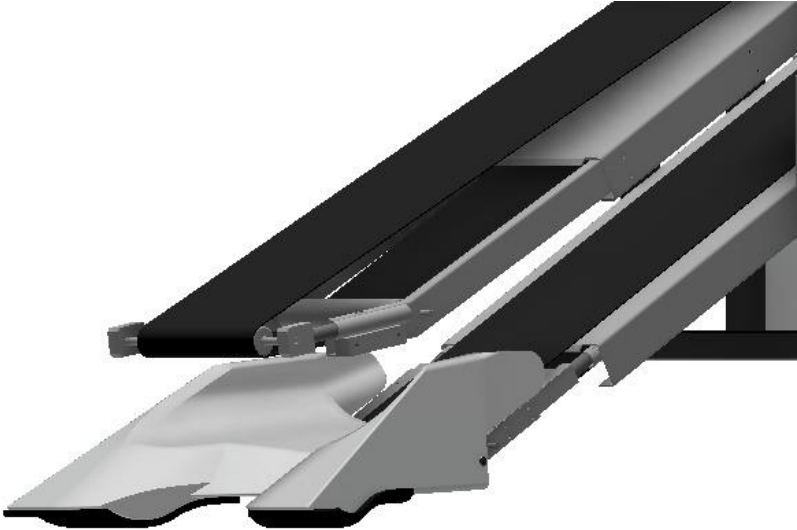
# VANTAGENS DO PROJETO

4 em 1



# VANTAGENS DO PROJETO

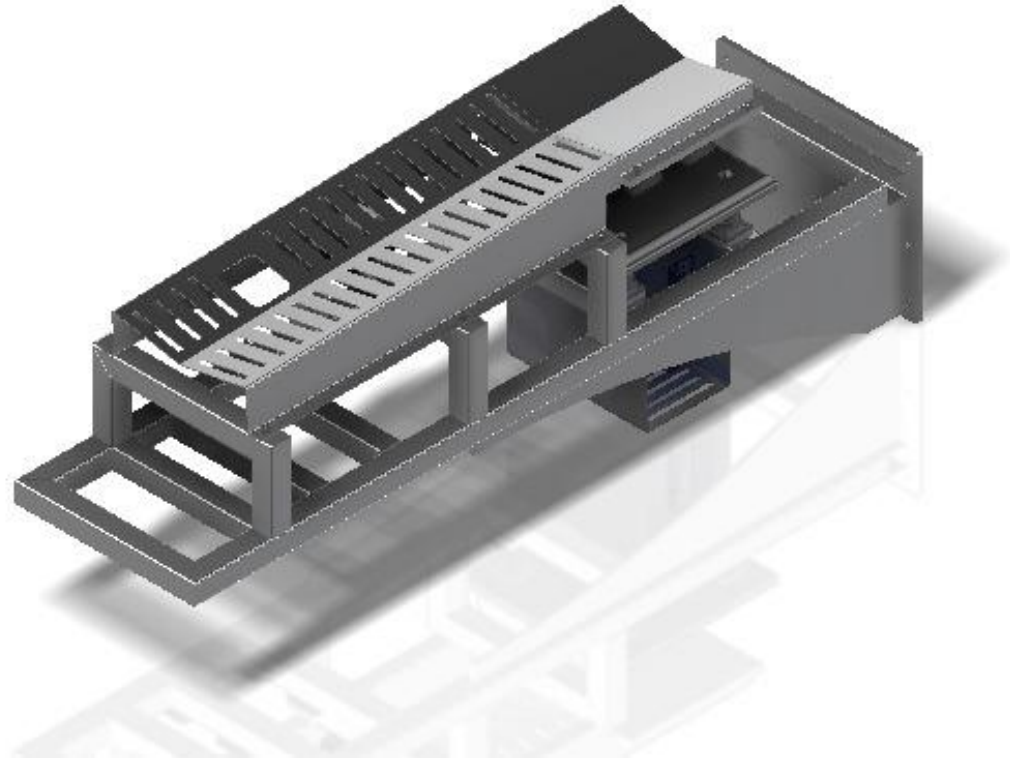
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# VANTAGENS DO PROJETO

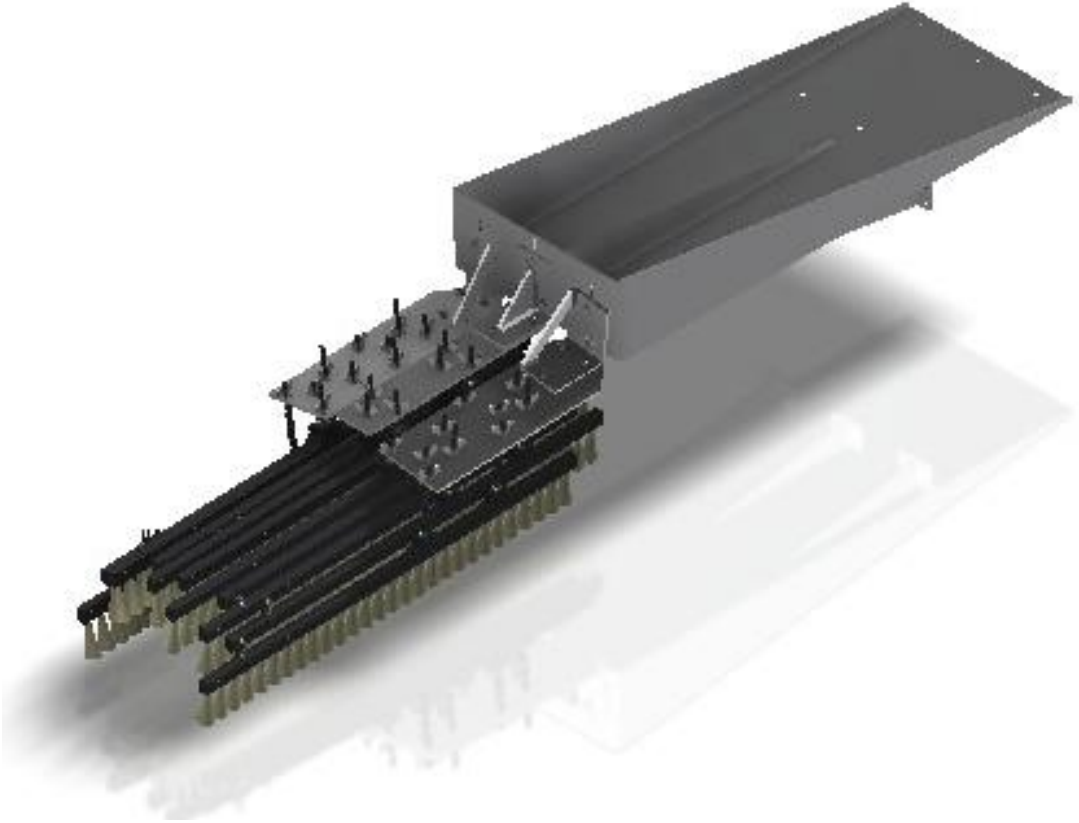
4





# VANTAGENS DO PROJETO

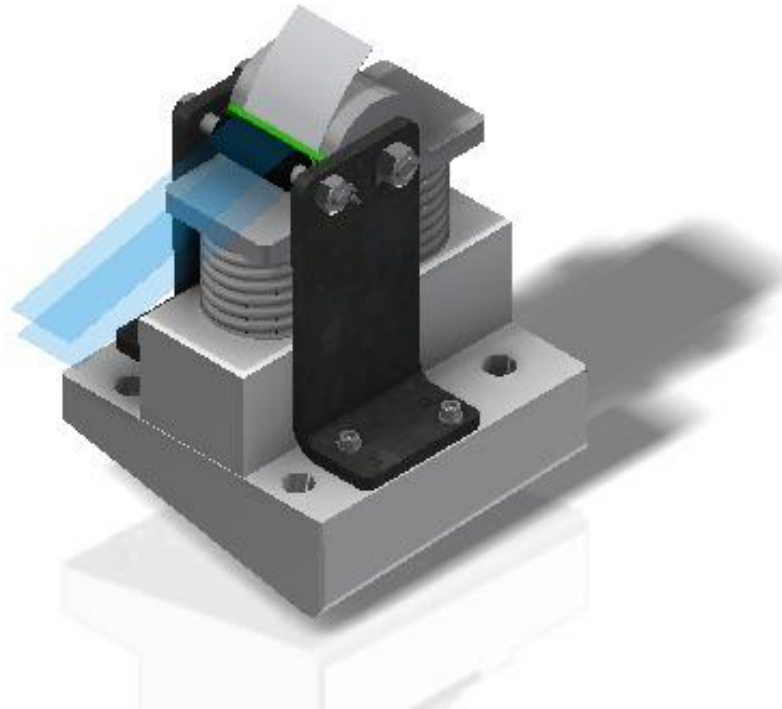
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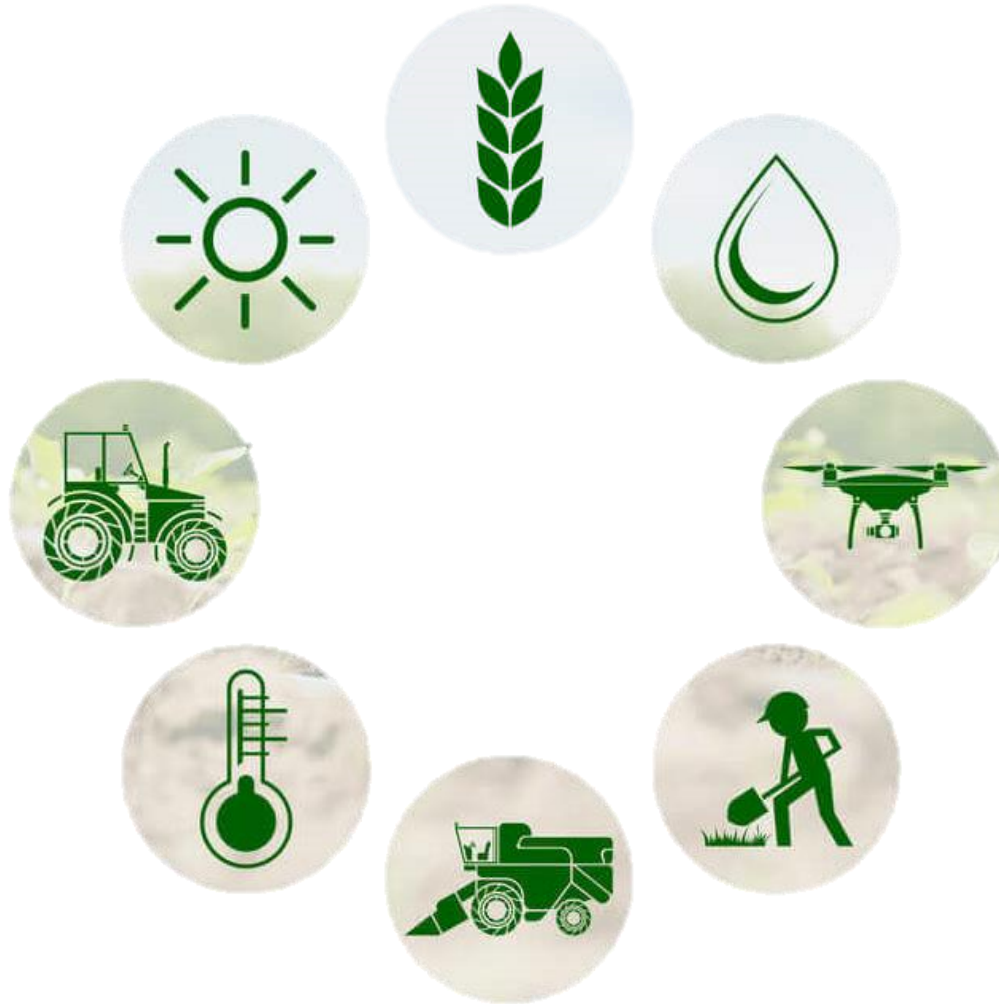
# VANTAGENS DO PROJETO

4



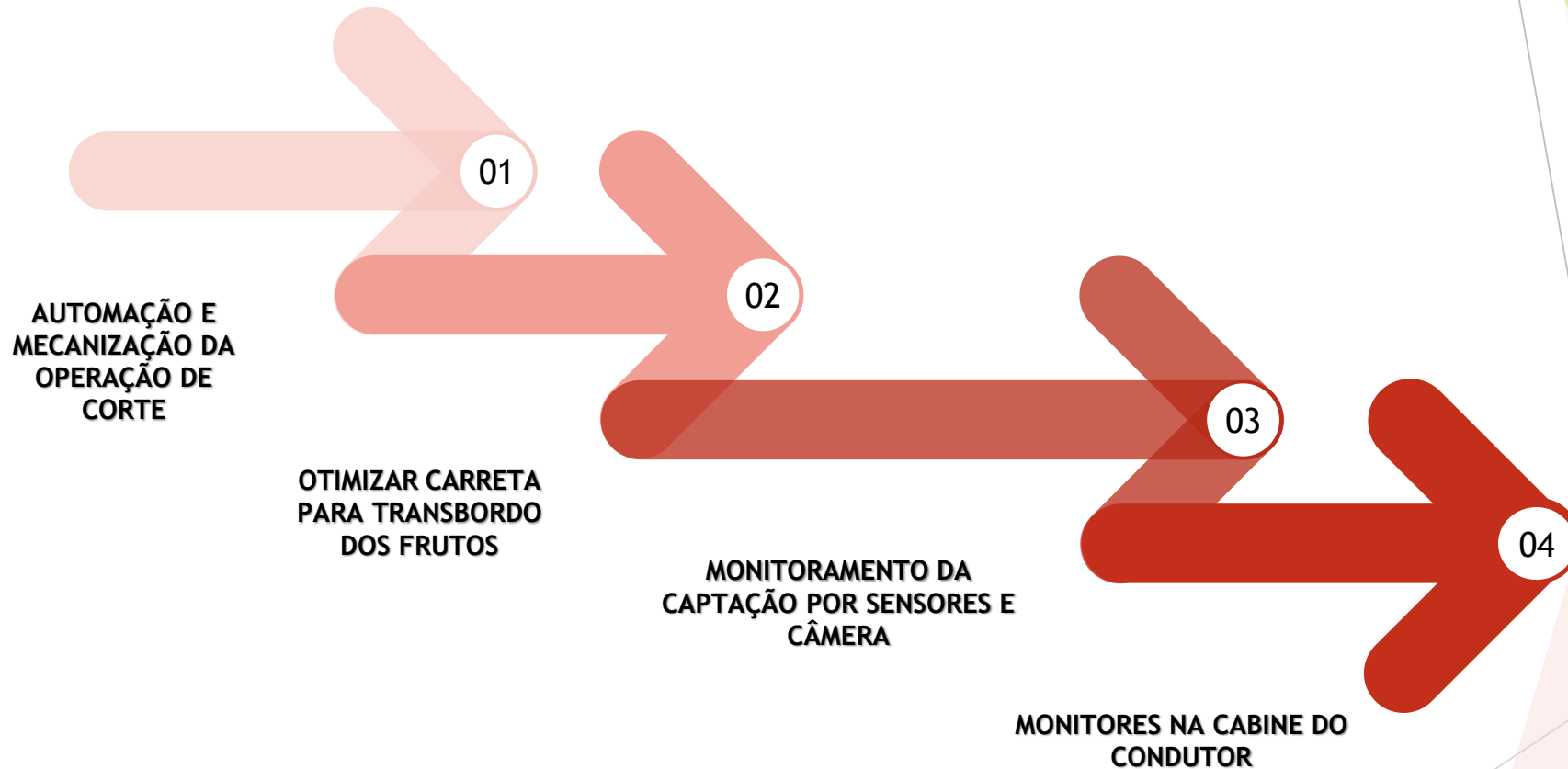


# VANTAGENS DO PROJETO





# DESAFIOS CONTINUIDADE DO PROJETO





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# AGRADECIMENTOS

## ORIENTADOR

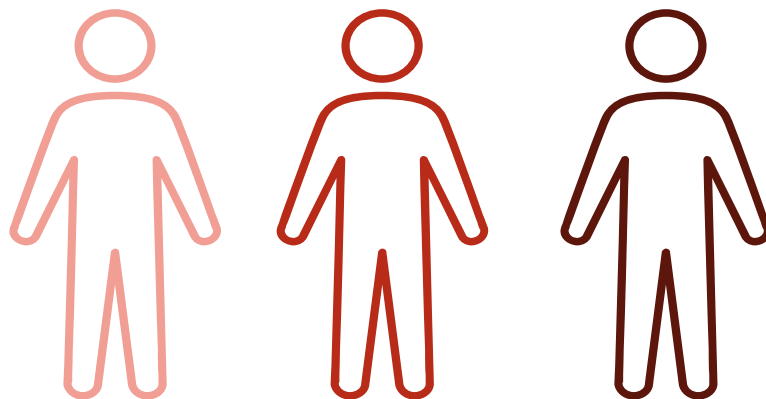
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Dr. Carlos Rodrigues

## CO-ORIENTADOR

Profº.: Arnaldo Forgas

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**12.114.696-3**  
**12.115.503-0**  
**12.214.139-3**  
**12.113.171-8**  
**12.115.510-5**  
**12.118.806-4**

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