

MAGMA

Casting Profits

MAGMA

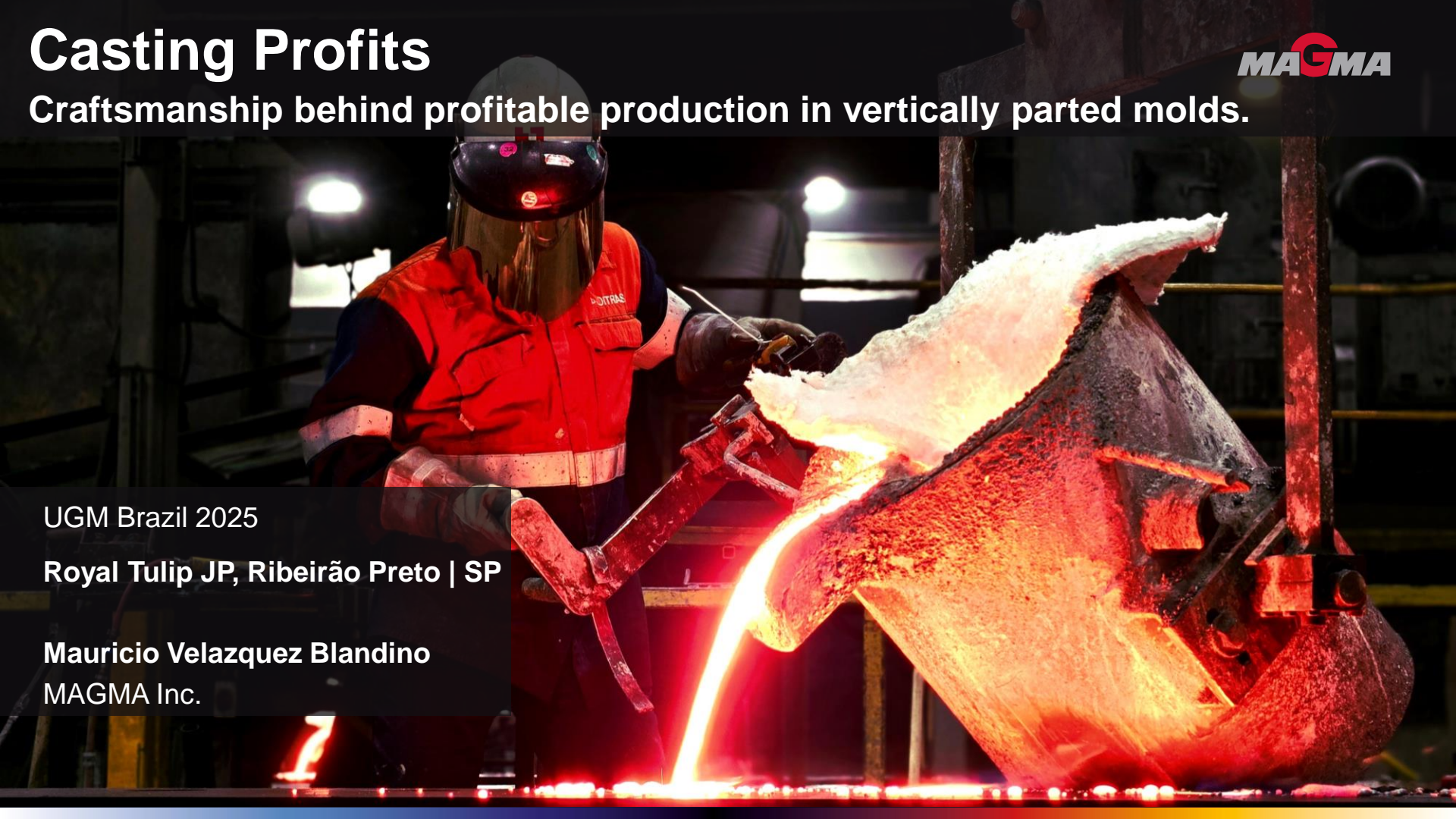
Craftsmanship behind profitable production in vertically parted molds.

UGM Brazil 2025

Royal Tulip JP, Ribeirão Preto | SP

Mauricio Velazquez Blandino

MAGMA Inc.



Introduction

Market trends – a Perspective from North America



Introduction

Overview of the foundry industry

- Key TOP industries driving demand in 2025



Automotive - Aerospace

Construction - Infrastructure

Energy



Automotive

Home Appliances

Agricultural



Mining

Automotive - Aerospace

Industrial Machinery

Introduction

A closer look at performance & business



Automotive - Aerospace

Construction - Infrastructure

Energy

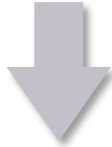
4.6%

\$36.7M
USD

1,628
Companies

Introduction

A closer look at performance & business



Automotive

Home Appliances

Agricultural

4%

\$20M
USD

850
Companies

Introduction

A closer look at performance & business



Mining

Automotive - Aerospace

Industrial Machinery

3%

\$10M
USD

157
Companies

Introduction

Some of the challenges in the industry

Economic

- Rising costs | Energy – Raw Materials volatility
- Global competition put on smaller foundries

Technological

- Automation and Digitalization | Competitiveness Costs
- Sustainability | Environmental standards | Green Initiatives

Geopolitical

- Trade Policies | Tariffs | Trade Agreements
- Supply Chain Disruptions | Shortages - Delays

Labor

- Skilled Workforce Shortage | Recruiting | Retaining
- Training needs | Technology continuous evolution

Market Specific

- Automotive Transition | Shift to EV's
- Mining and Natural Resources
- Consumer goods

Introduction

What we can focus on today

Technological

Labor

- Automation and Digitalization | Competitiveness Costs
- Sustainability | Environmental standards | Green Initiatives

- Skilled Workforce Shortage | Recruiting | Retaining
- Training needs | Technology continuous evolution

- Challenges might differ slightly by region, but a common thread can be found.
 - Embrace Digital transformation and Modernization
 - Training the workforce – Talent Shortage
 - Comply with environmental standards
 - Ensure a stable supply chain
- Innovate
 - Use advance simulation
 - Real time process monitoring
 - Predictive maintenance analytics

Customer Case

The search of profitability

Casting Information

Data to consider

- OEM Part – F150 Pickup Truck
- 380k parts per year
- DISA molding line 131-A
- Conveyor Length – 38.1m
- 100 to 150 Molds p/h
- Mold Thickness – 250mm
- Molding time 13.3s
- Pouring temp – 1427°C
- Alloy 100-70-03



Layout

History | Initial proposal approved

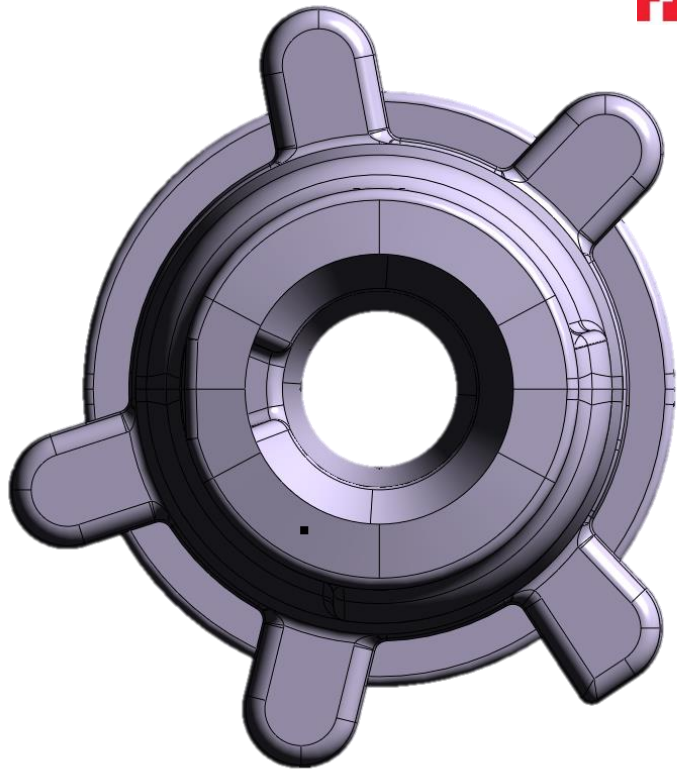
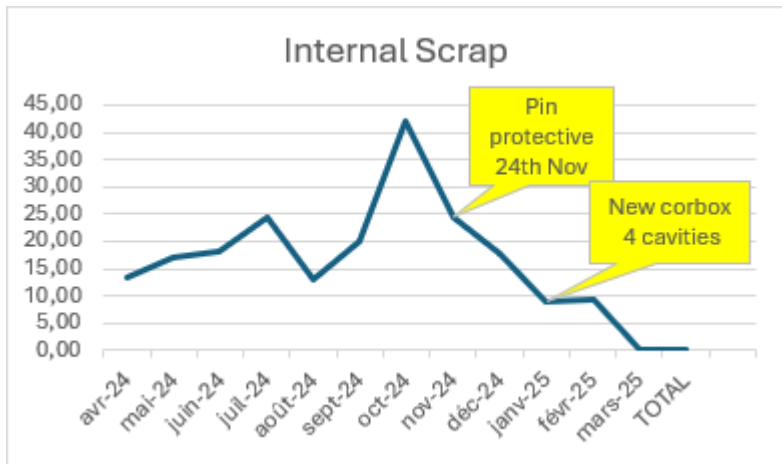
- Molds Per Hour = 150
- Cake Thickness = 250mm
- Yield = 40.2%
- Internal rejects – 17%
- External from 1.3%



Layout

Most predominant Issues

- Scrap problems are related to these “ears” getting damaged at the Didion
- Potentially coming out too hot from shakeout impacting other castings and gating tree

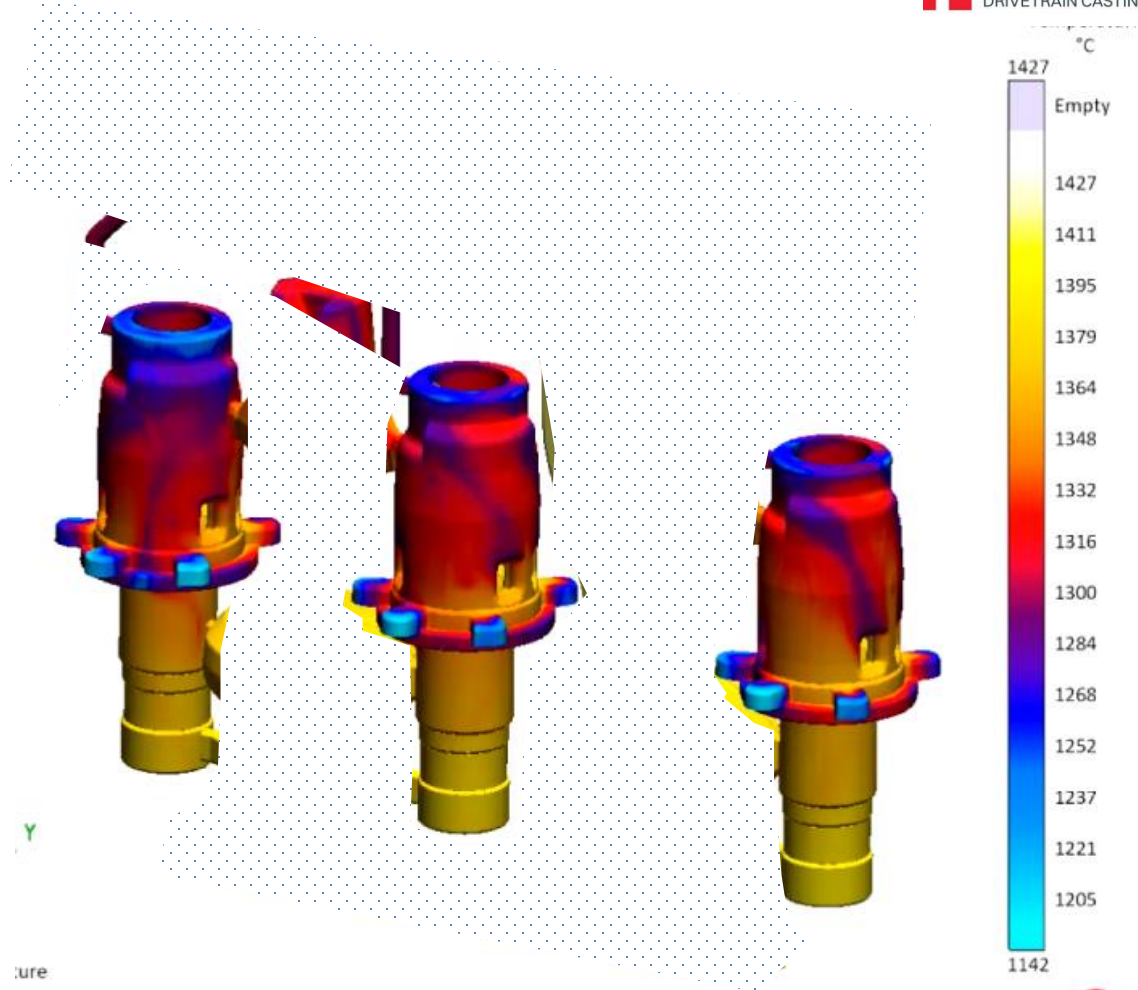


- Internal rejects – 17%
- External from 1.3%

Layout

Filling & Solidification

- Molds Per Hour = 150
- Cake Thickness = 250mm
- Filling time = 10.7s
- Shakeout Max Temp = 684.3°C
- Amount of sand used = 15.2 t/h
- Yield = 40.2%
- Casting Cost = \$19.41



What is impacting profits

What symptoms does the project present?

High Scrap

Low Yield

Poor Productivity



What's next?

Deciding to move forward, optimize, but how...



Choosing the path



Focus on reducing rejects

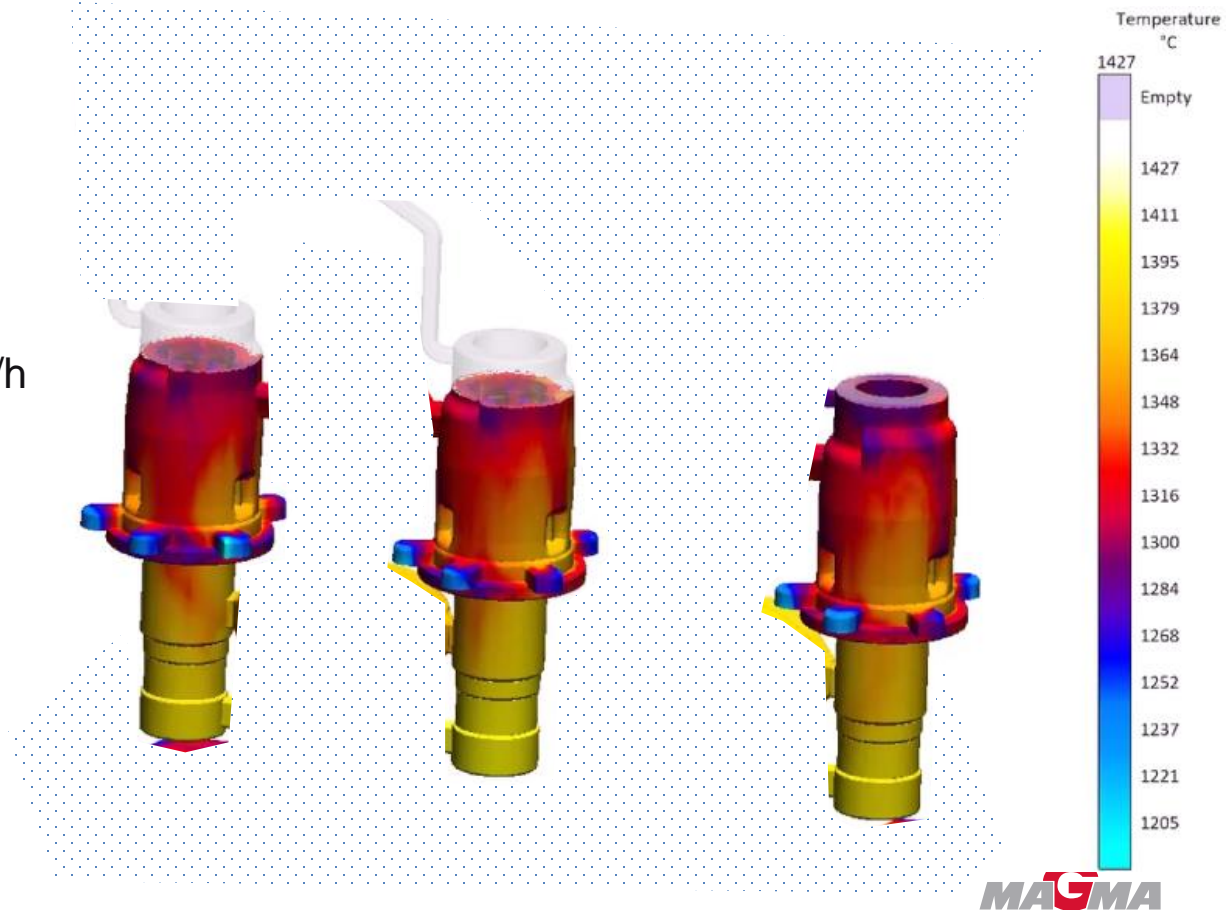
Customer is first – no matter the cost

Addition of Protective
pads & pins



What is the impact on casting cost

- └ Molds Per Hour = 150
- └ Cake Thickness = 250mm
- └ Filling time = 14.1s
- └ Shakeout Max Temp = 703.4°C
- └ Amount of sand used = 15.05 t/h
- └ Yield = 33.75%
- └ Casting Cost = \$21.61



Choosing the path moving forward

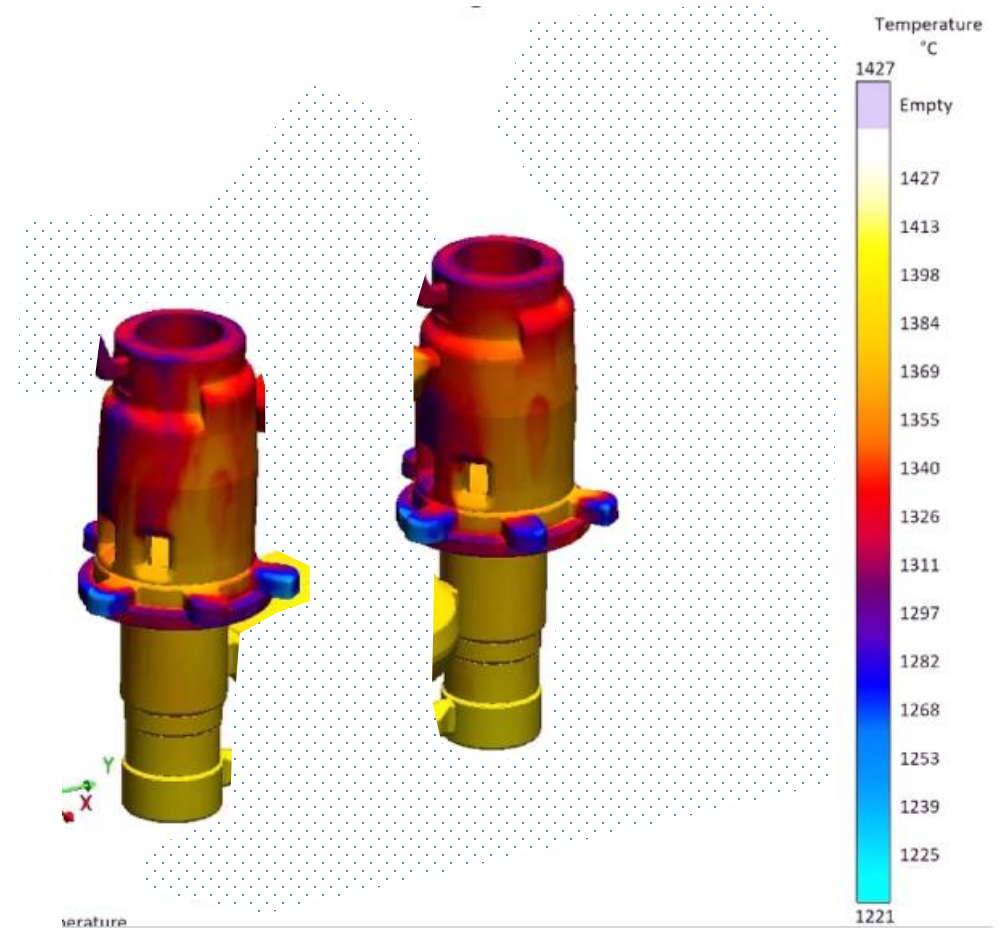


Increase the yield and target scrap



What is the impact on casting cost

- ─ Molds Per Hour = 150
- ─ Cake Thickness = 250mm
- ─ Filling time = 8.89s
- ─ Shakeout Max Temp = 657.2°C
- ─ Amount of sand used = 10.59 t/h
- ─ Yield = 43.05%
- ─ Casting Cost = \$17.31



What is the impact on total project value



Name	Scenario			
> Estimated Values				
> Metal Costs	$f(x)$	8.8365	\$	
> Melting Costs	$f(x)$	2.2775	\$	
> Core ID1 Cost	$f(x)$	0.2258	\$	
> Molding Costs	$f(x)$	3.0864	\$	
> Shot Blasting Costs	$f(x)$	0.2906	\$	
> Finishing Costs	$f(x)$	0.4184	\$	
> Shipping Costs	$f(x)$	0.0872	\$	
> Scrap Costs	$f(x)$	2.5878	\$	
> Burden Costs	$f(x)$	1.6029	\$	
CASTING COST	$f(x)$	19.41	\$	

\$7.37m

Name	Scenario			
> Estimated Values				
> Metal Costs	$f(x)$	9.062	\$	
> Melting Costs	$f(x)$	2.6924	\$	
> Core ID1 Cost	$f(x)$	0.6349	\$	
> Molding Costs	$f(x)$	3.556	\$	
> Shot Blasting Costs	$f(x)$	0.2882	\$	
> Finishing Costs	$f(x)$	0.5656	\$	
> Shipping Costs	$f(x)$	0.0865	\$	
> Scrap Costs	$f(x)$	0.9443	\$	
> Burden Costs	$f(x)$	1.7846	\$	
CASTING COST	$f(x)$	21.61	\$	

\$8.21m

Name	Scenario			
> Estimated Values				
> Metal Costs	$f(x)$	8.7341	\$	
> Melting Costs	$f(x)$	2.128	\$	
> Core ID1 Cost	$f(x)$	0.2327	\$	
> Molding Costs	$f(x)$	3.1667	\$	
> Shot Blasting Costs	$f(x)$	0.2907	\$	
> Finishing Costs	$f(x)$	0.6293	\$	
> Shipping Costs	$f(x)$	0.0872	\$	
> Scrap Costs	$f(x)$	0.6107	\$	
> Burden Costs	$f(x)$	1.4292	\$	
CASTING COST	$f(x)$	17.31	\$	

\$6.57m

Choosing the path moving forward



Increase OEE – Maximize Resources



Mold thickness and Production Rate

The screenshot displays the MAGMA software interface with several key components:

- Left Panel:** A tree view under 'Geometry' showing a hierarchical structure of mold parts including 'neck', 'feeder', 'gate_straight_001', 'Runner', 'Gate', 'rev_001', 'surf_001', 'Ref to rev_001', and 'circular_inlet_001'. Below this is a 'Material' section with 'Casting' selected.
- Center Panel:** The 'Edit DISAMATIC Mold' dialog box. It shows 'DISAMATIC machine' as 'MAGMA/131-A'. The 'Mold thickness' is set to '254.0 mm' with a red arrow pointing to it. Other settings include 'Mold width' (600.0 mm) and 'Mold height' (480.0 mm). The 'Origin placement' is shown as a 3D model of a mold cavity. The 'Adjust on base plane' section has three icons. At the bottom, there are 'Apply', 'OK', and 'Cancel' buttons.
- Right Panel:** The 'DISA Solidification & Cooling Definitions' dialog box. It includes fields for 'Machine' (MAGMA/131-A), 'Molding time' (10.0 s), 'Process control' (Production rate / Conveyor length), 'Production rate' (350), 'Conveyor length' (86.5 m), 'Shake out time' (<Will be calculated> s), 'Shake out temperature' (<Will be calculated> °C), and 'Cooling time' (20.0 s). A red box highlights the 'Production rate' field.
- Bottom Panel:** The 'Edit Geometry Parameter' dialog box. It shows 'Parameter name' as 'D', 'Text for dialog' as 'Mold thickness', 'Unit' as 'Geometry length', and 'Dimension value' as '230.0 mm'. The 'Map to design variable' checkbox is checked. It also includes 'Lower limit' (230.0 mm), 'Upper limit' (250.0 mm), and 'Step' (10.0 mm). At the bottom, there are 'Apply', 'OK', and 'Cancel' buttons.

At the bottom of the screen, there is a status bar showing 'View: 0 | Sel: 1 | Material: 1/1 | global'.

OEE

Using Sheet from the MAGMA Database

Economics Sheet Database

Select an economics sheet.

Filter: DISA Iron **MAGMA Unit System** English (USA)

Database/File Name

- Cost_Die_Casting_Basic
Calculates the estimated manufacturing costs -> Yell
- Cost_Die_Casting_Rotacast_Basic
Calculates the estimated manufacturing costs -> Yell
- Cost_HPDC_Cold_Chamber_Basic
Calculates the roughly estimated manufacturing cost:
- Cost_HPDC_Hot_Chamber_Basic
Calculates the roughly estimated manufacturing cost:
- Cost_LPDC_Basic
Calculates the estimated manufacturing costs -> Yell
- Cost_Sandmold_Casting_Advanced
*Must have unique casting ID's -> Rows marked in y
- Cost_Sandmold_Casting_Basic
Calculates the estimated total costs of manufacturing
- Cost_Semi_Solid_Basic
Calculates the roughly estimated manufacturing cost:
- Cost_Wheel_Basic
Calculates the estimated manufacturing costs -> Yell
- Finance_at_Company
Macro Operations Overview with Pledge Commitment
- Finance_at_Part_My_Engineering_Value
Is working on this project worth my time?
- Resource_at_Part_OEE
Overall Equipment Effectiveness Calculator for many
- UTILITY_FUNCTION_IF_ELSE-IF_ELSE_Example
Demonstrates how to use the if ELSE-IF ELSE.
- UTILITY_FUNCTION_IF_Example
Demonstrates how to use the IF.
- UTILITY_FUNCTION_SWITCH_Example
Demonstrates how to use the SWITCH.

Sheet Title OEE

Sheet description Overall Equipment Effectiveness Calculator for many batch production processes
-> Yellow marked lines are input fields !

Name	Scenario	Scenario 1
Order Volume	12,000 parts	12,000 parts
Number of Casting Materials	2	2
▼ Downtime	3 hrs	3 hrs
Availability	f(x) 95.78 %	95.78 %
▼ Production Speed	250 molds/hr	300 molds/hr
Max Production Speed	350 molds/hr	350 molds/hr
Performance	f(x) 71.43 %	85.71 %
▼ Scrap	3.75 %	3.75 %
Quality	f(x) 96.25 %	96.25 %
OEE	f(x) 65.85 %	79.01 %

Max production lowered as we have cores

View DISAMATIC-Machine of database MAGMA

Data View Memo Help

DISAMATIC-Machine: 131-A

Machine Parameters

Mold height	480.0	mm
Mold width	600.0	mm
Min. mold thickness	120.0	mm
Max. mold thickness	395.0	mm
Max. prod. rate without core	350	mold/h
Max. prod. rate with core	320	mold/h
Conveyor length	86.50	m
Max. cooling time	4200.000	s
Max. amount of sand	47.0000	t/h

Sheet ready for DOE and Scenario Play!

Added Function Expression to track mold sand usage

Optimization

Variables and Objectives

▼ Definition Overview

Template

▼ Design Variables [Possible designs: 33]

DISA Solidification & Cooling - Production Rate

DISA Solidification & Cooling - Mold Thickness

Production Speed

Geometry D - Mold thickness

Measured Data

Objectives

Reduce Porosity

OEE

Volume of Sand Mold Class

Sand

Max Temperature in Boss

Temperature Curve

Constraints

▼ Settings Overview

Start Sequence [Number of designs: 33]

Keep Options

Objectives

	Name	Type	Value	Expression	Des
<input type="checkbox"/>	Reduce Porosity	Minimize	▼	{DISA Solidification & Cooling/Porosity/End of DISA Solidification & Cooling/Weighted Volume/Casting All IDs}	Ad
<input checked="" type="checkbox"/>	OEE	Maximize	▼	{OEE}	
<input type="checkbox"/>	Volume of Sand Mold Class	Minimize	▼	{Volume of Sand Mold Class}	
<input checked="" type="checkbox"/>	Sand	Minimize	▼	{Sand}	
<input type="checkbox"/>	Max Temperature in Boss	Minimize	▼	{DISA Solidification & Cooling/Temperature/End of DISA Solidification & Cooling/Max/Thermocouple TC_13}	
<input checked="" type="checkbox"/>	Temperature Curve	Minimize	▼	{DISA Solidification & Cooling/Temperature Curve/Avg/Thermocouple TC_13}	

Design Variables

Output Values

Geometric Volumes

Economics

Availability

OEE

Performance

Quality

Sand

Casting Process

Treatment after Casting

Economics relation to optimization:
Variables can be considered
Functions can be objectives

Simulation and Economics Production Rates

Using dependency

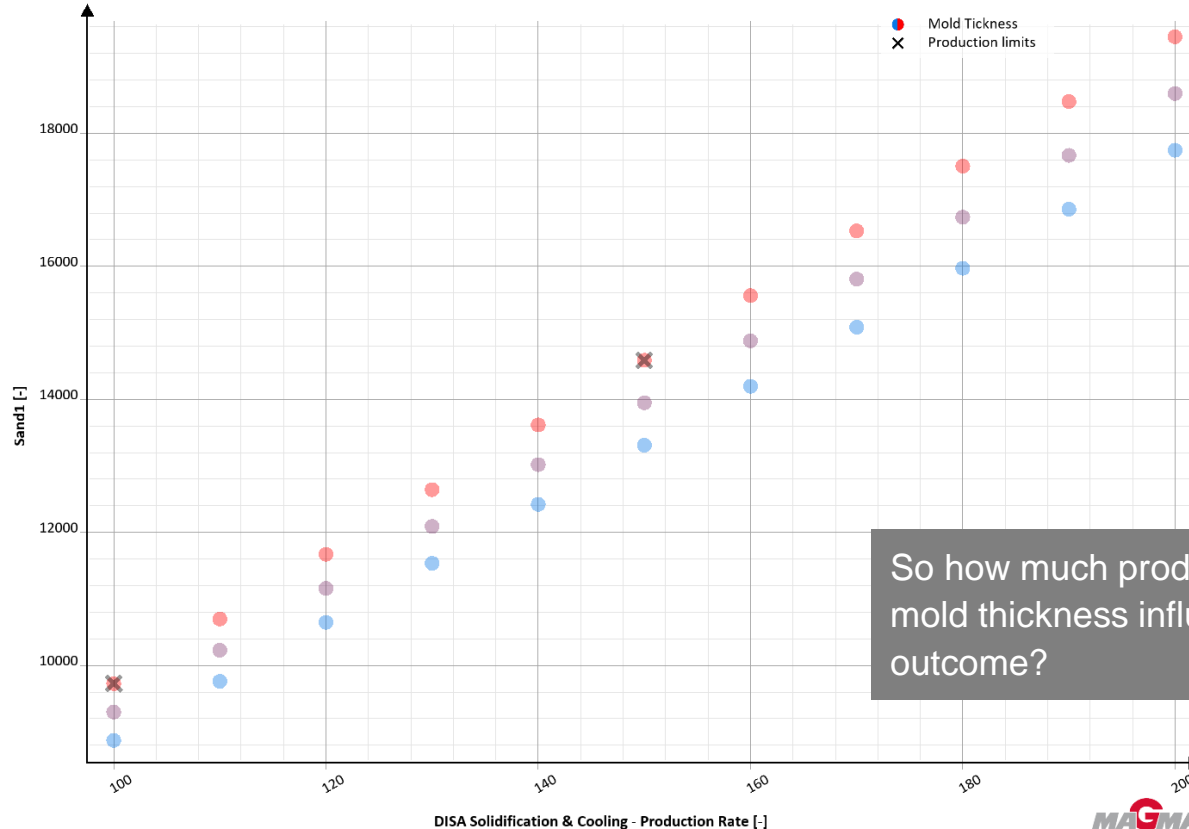
- Definition Overview
 - Template
- Design Variables [Possible designs: 33]
 - DISA Solidification & Cooling - Production Rate
 - DISA Solidification & Cooling - Mold Thickness
 - Production Speed
 - Geometry D - Mold thickness
- Measured Data
- Objectives
 - Reduce Porosity
 - OEE
 - Volume of Sand Mold Class
 - Sand
 - Max Temperature in Boss
 - Temperature Curve
- Constraints
- Settings Overview
 - Start Sequence [Number of designs: 33]
 - Keep Options

Design Variables					
Design Variable	Lower Limit (%)	Upper Limit (%)	Step (%)	Dependency	
<input type="checkbox"/> Cast Alloy Class - C (Carbon)	3.55	3.65	0.05	<None>	
Design Variable	Selection			Dependency	
<input type="checkbox"/> Metallurgical Quality - Inoculation Efficiency	Fair	Good		<None>	
Design Variable	Lower Limit	Upper Limit	Step	Dependency	
<input checked="" type="checkbox"/> DISA Solidification & Cooling - Production Rate	100	200	10	<None>	
Design Variable	Lower Limit (mm)	Upper Limit (mm)	Step (mm)	Dependency	
<input checked="" type="checkbox"/> DISA Solidification & Cooling - Mold Thickness				(Geometry D - Mold thickness)	
Design Variable	Lower Limit (molds/hr)	Upper Limit (molds/hr)	Step (molds/hr)	Dependency	
<input checked="" type="checkbox"/> Production Speed				(DISA Solidification & Cooling - Production Rate)	
Design Variable	Lower Limit (mm)	Upper Limit (mm)	Step (mm)	Dependency	
<input checked="" type="checkbox"/> Geometry D - Mold thickness	230.0	250.0	10.0	<None>	

Now thickness and productions are linked
And OEE will be driven by the DOE!

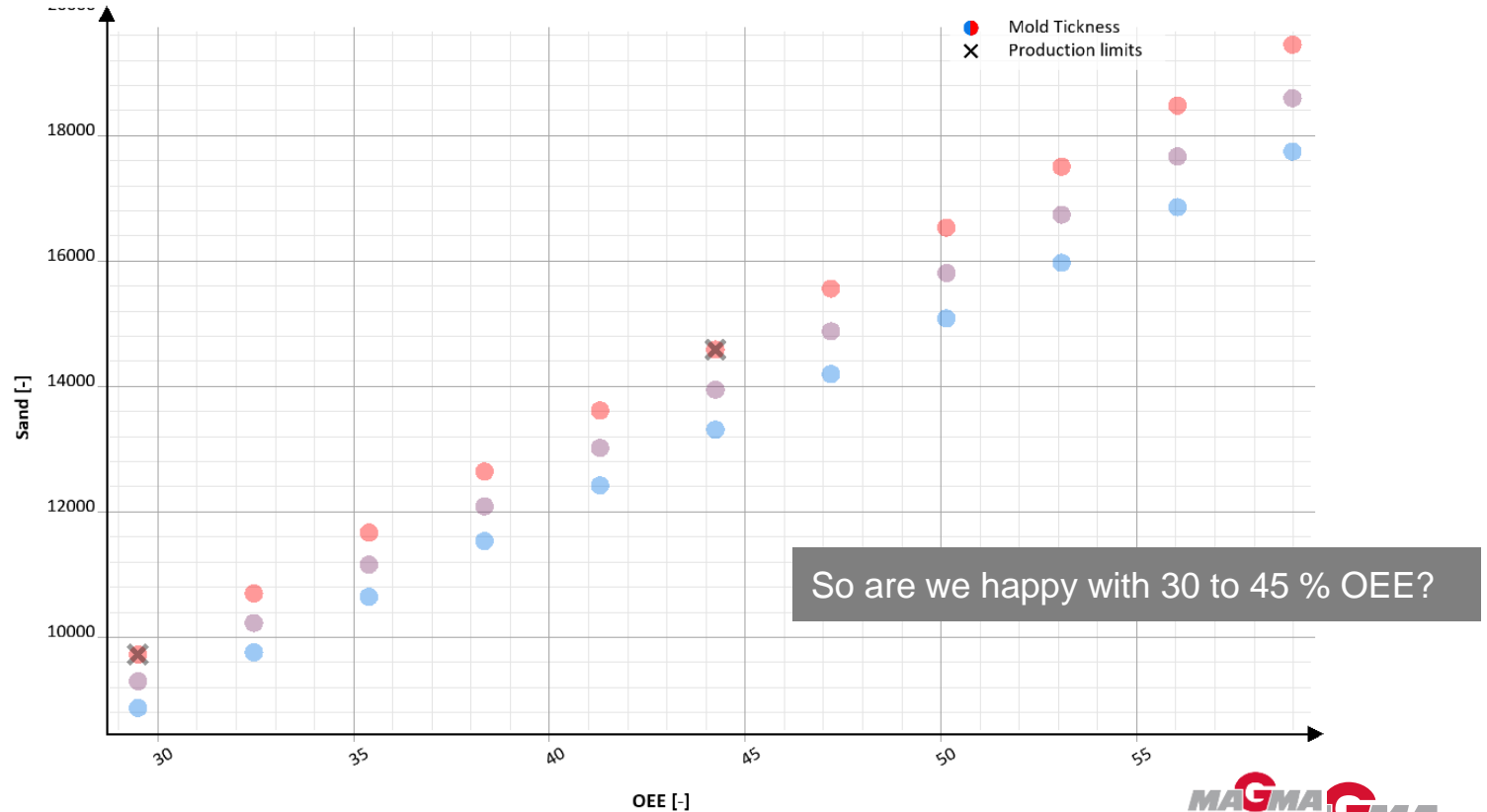
Assessment of ALL 33 designs

Thickness or Production Rate ?



Assessment of ALL 33 designs

Production Rate is the Performance in the OEE



Economics

Compare Designs for 3 different thickness @ 2 production rates

Compare Dialog

Compare your selection

>

Design Variables

>

Objectives

Output Values

Constraints

▼

Economics

Order Volume

380,000

parts

Number of Casting Materials

2

>

Downtime

48

hrs

>

Production Speed

100

molds/hr

>

Scrap

3.75

%

OEE

f(x)

29.49

%

>

Sand

f(x)

8,873.1481

kg/h

Design 1

Design 6

Design 12

Design 17

Design 23

Design 28

</

Economics

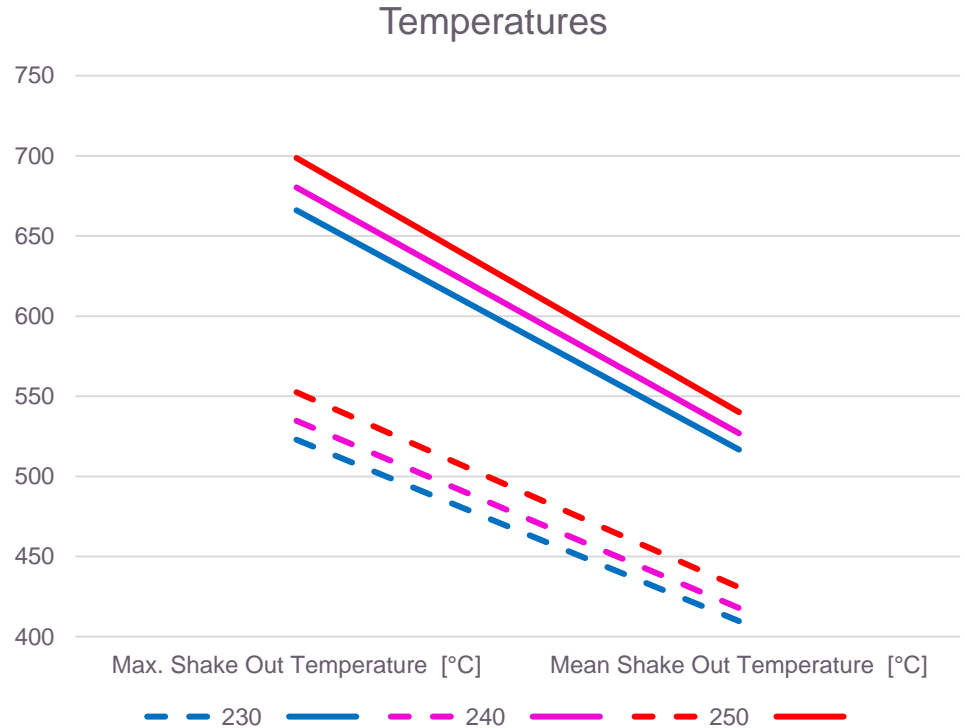
The Big Picture

Mold thickness [mm]	230		240		250	
Production Rate	100	150	100	150	100	150
Conveyor Length [m]	38.1	38.1 m	38.1 m	38.1 m	38.1 m	38.1 m
Shake Out Time [s]	5963.478	3975.6521	5715	3810	5486.3999	3657.6001
Max. Shake Out Temperature [°C]	522.9	666.03	534.7	680.28	552.52	698.68
Min. Shake Out Temperature [°C]	58.71	62.07	58.34	62.24	58.68	63.59
Mean Shake Out Temperature [°C]	409.74	516.73	417.9	526.89	430.79	540.09
Molding Material [t/h]	9.18	13.77	9.6	14.41	10.03	15.05
Sand Conditioning [kJ/h]	3,582,341.63	7,310,532.61	4,210,983.17	9,045,776.38	4,595,495.42	9,563,288.58
Total Remelt [t/h]	1.75	2.62	1.75	2.62	1.75	2.62
Total Cast Alloy [t/h]	0.983	1.47	0.983	1.47	0.983	1.47

Economics

The Big Picture

Mold thickness [mm]	230		240		250	
Production Rate	100	150	100	150	100	150
Conveyor Length [m]	38.1	38.1 m	38.1 m	38.1 m	38.1 m	38.1 m
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Total Cast Alloy [t/h]	0.983	1.47	0.983	1.47	0.983	1.47



Summary

20 mm less sand reduce :
temperature by ~ 30 degrees, ~1 metric ton sand/h and 281 KW
energy!

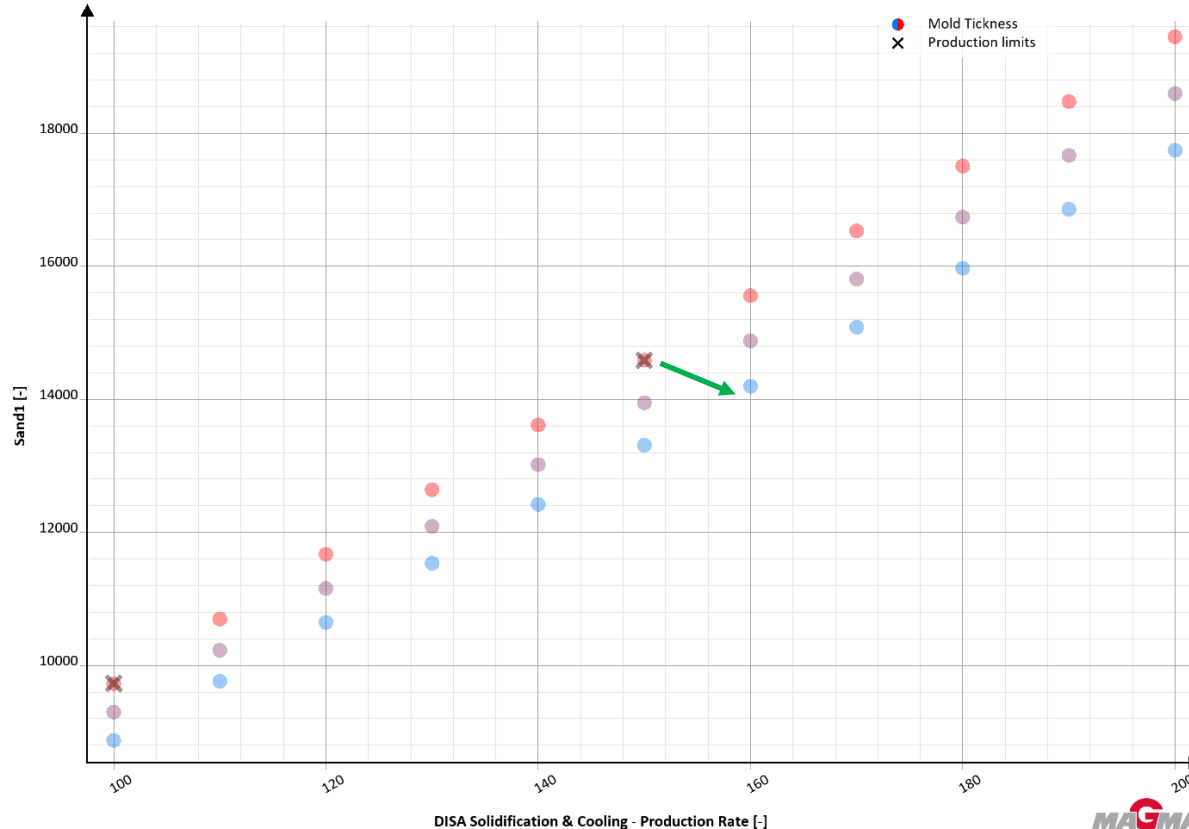


281 KW = 376 HP

(good for 1 hour joy ride on **F-150 2.7L EcoBoost Rated 325 HP**)

Future Ideas

Bump up Production Rate or Go even thinner?

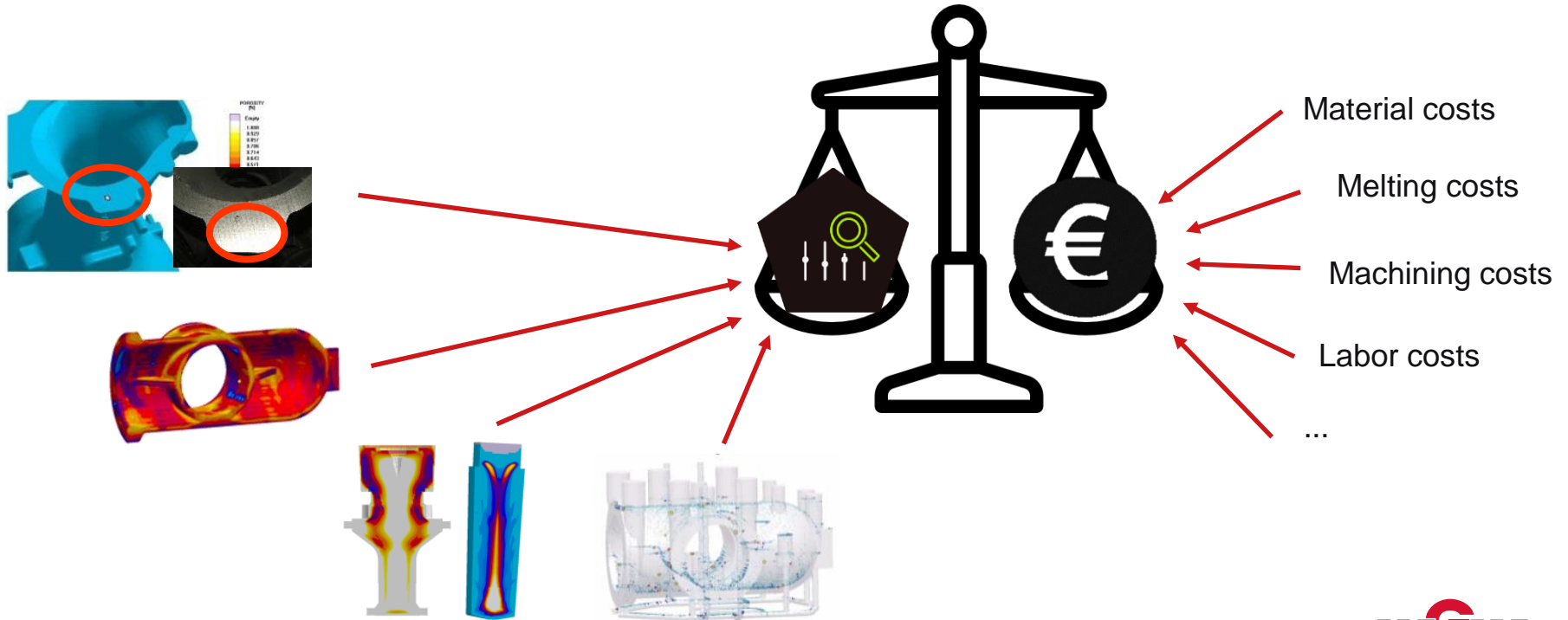


Economics

What is MAGMAeconomics

Evaluate Quality and Cost

- Adding and assessing quantified costs and weighting them against quality



What is MAGMAeconomics

Make Economically and Ecologically Sound Decisions

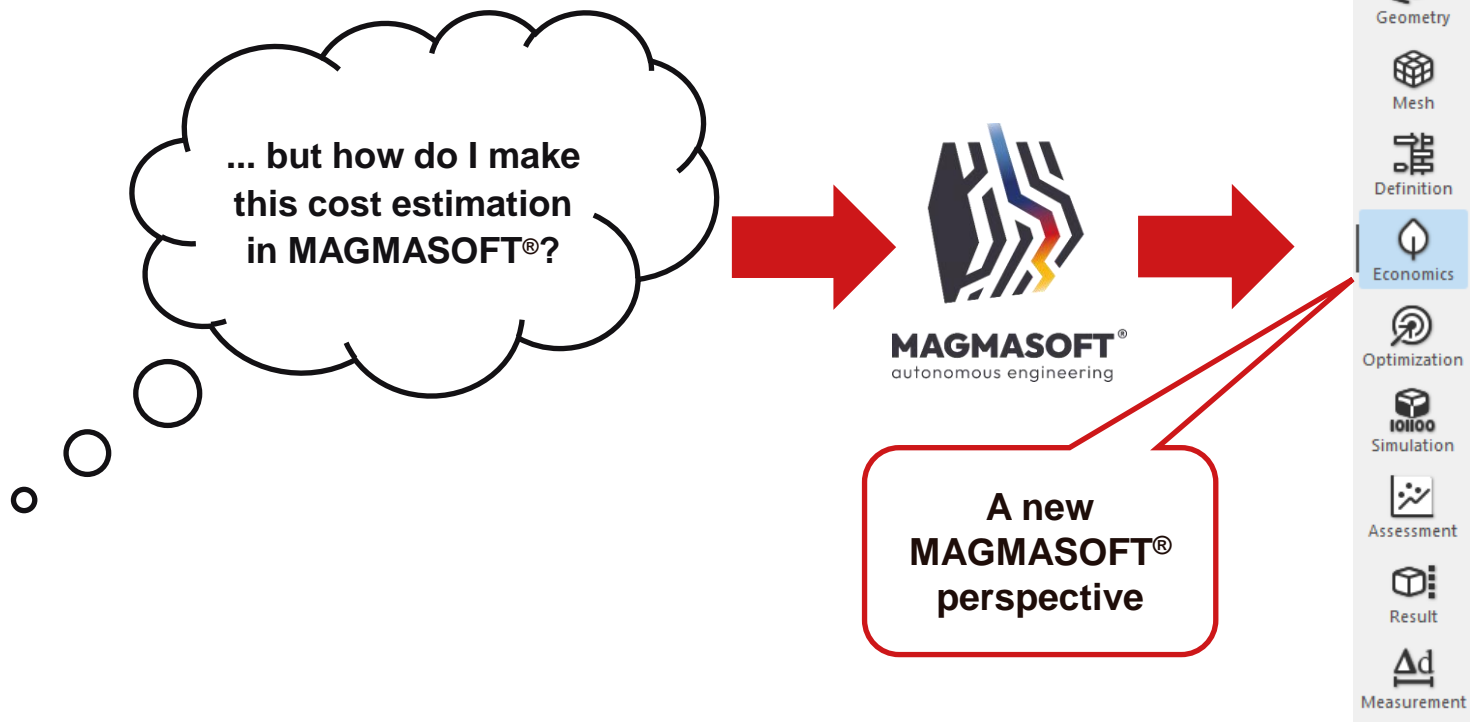
- Economic evaluation of simulation results
- Tool to estimate impact on manufacturing costs and environmental impact (CO₂)
- Bridge the gap between technical and economical info
- Take advantage of information available in MAGMASOFT®
- Economic objectives can be considered in optimization



MAGMA ECONOMICS
provides another criterion for
evaluating the best solution:
costs.

What is MAGMAeconomics

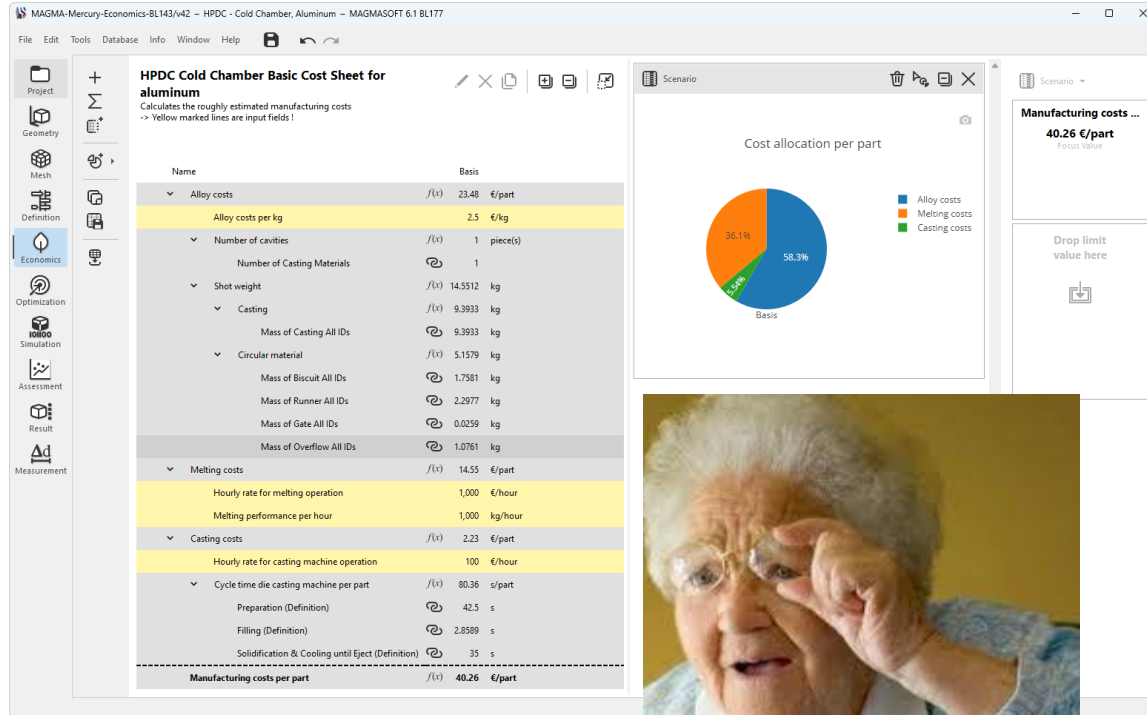
Estimation of Costs / CO₂



MAGMAeconomics

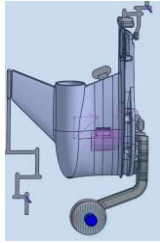
Cost Sheets

- It is a spreadsheet where you can calculate costs
 - You can create it individually from scratch
 - You can load/save it
 - You can use it as a template
 - It is customizable to any foundry or a single department
- ➔ But what is the best cost sheet? ➔ find a common ground



Basic structure of MAGMAeconomics

Input
MAGMASOFT®



Input
User

Casting Properties

Information about volumes, masses and contact areas of materials in process.

Material	Mat ID	Volume (cm³)	Mass (kg)	Mass (kg)
▼ Cast Alloy		5496.18	13.35	14.55
▼ Casting		3547.98	8.62	9.39
Casting	ID 1	3547.98	8.62	9.39
▼ Casting System		1948.20	4.73	5.16

Material costs

Metal price:
e.g.: 2 €/kg

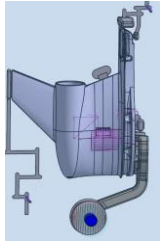
Calculation in MAGMA ECONOMICS

Cost estimation

$$9.39 \text{ kg} \times 2 \text{ €/kg} \\ = \underline{18.78 \text{ €/cast part}}$$

Basic structure of MAGMAeconomics

Input
MAGMASOFT®



Casting Properties

Information about volumes, masses and contact areas of materials in process.

Material	Mat ID	Volume (cm³)	¹Mass (kg)	²Mass (kg)
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Casting	ID 1	3547.98	8.62	9.39
▼ Casting System		1948.20	4.73	5.16

Input
User

Melting costs

Melting capacity
e.g.: 1,000 kg/h

Hourly
machine rate:
e.g.: 1,000 €/h

Material costs:

18.78 €

Calculation in MAGMA ECONOMICS

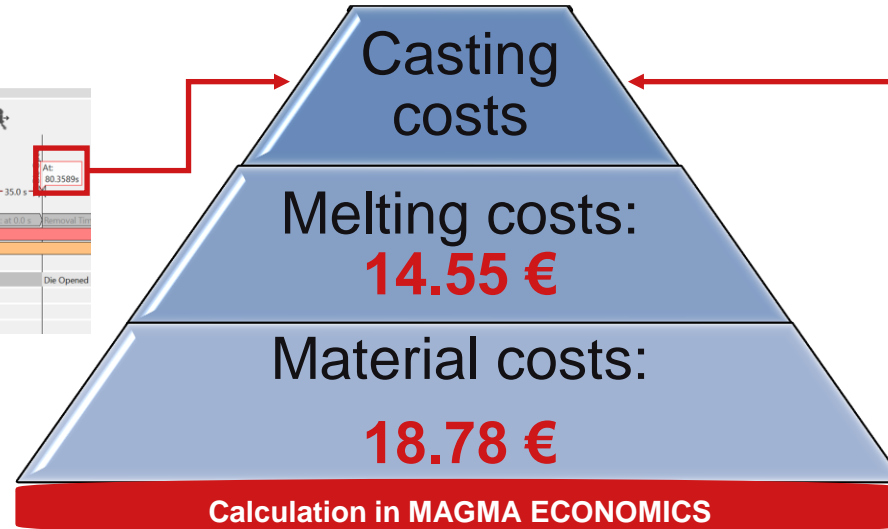
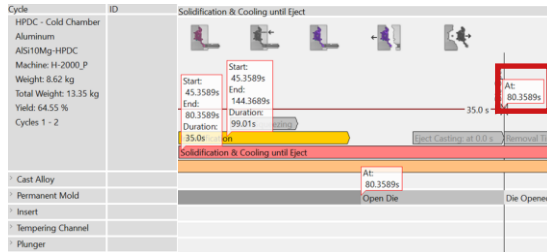
Cost estimation

**14.55 kg x 1€/kg
= 14.55 €/cast part**

Basic structure of MAGMAeconomics

Input
MAGMASOFT®

Input
User



Hourly
machine rate:
e.g.: **100 €/h**

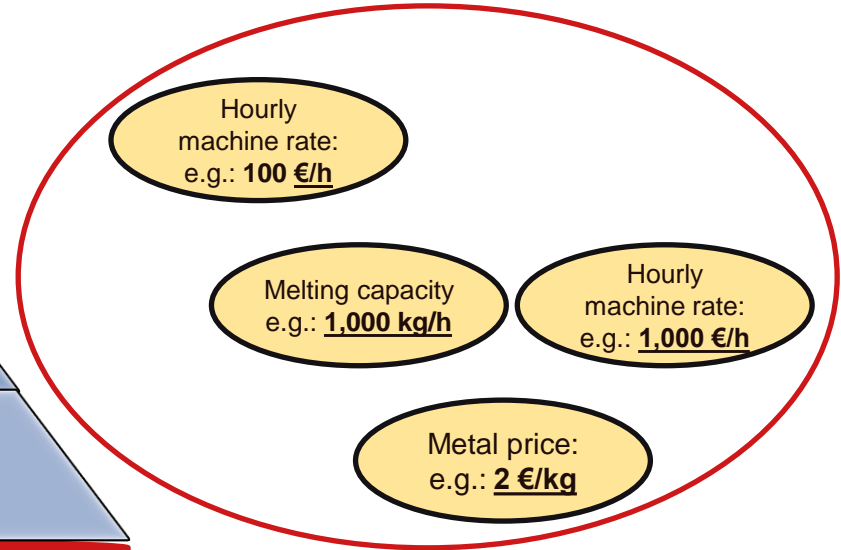
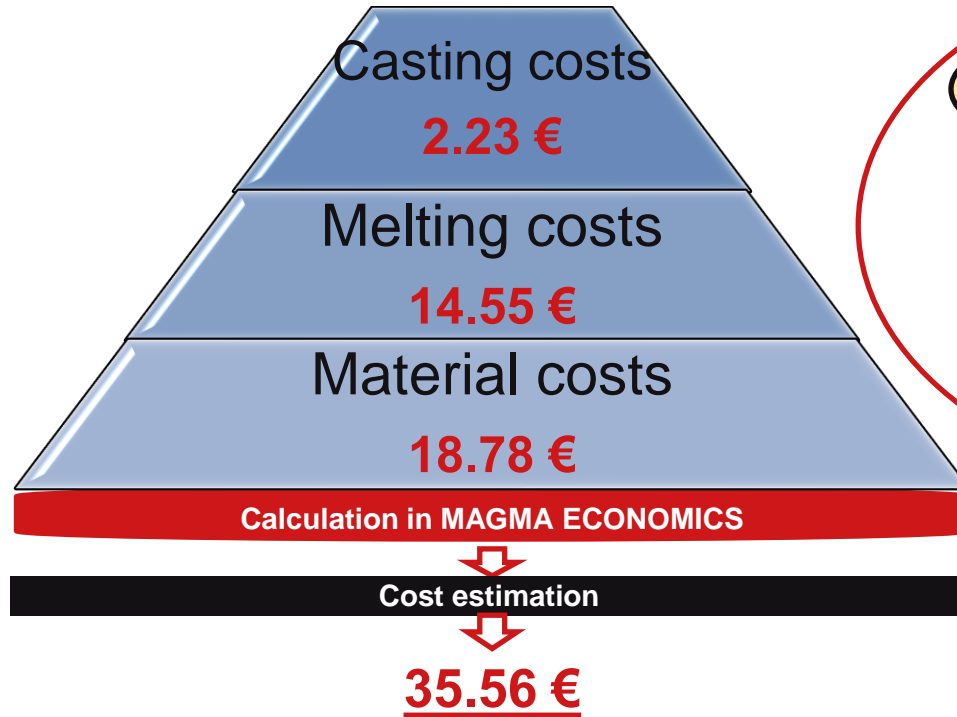
Cost estimation

**80.36 s cycle time
= 44.8 castings/h**

**100 € / 44.8 castings
= 2.23 €/casting**

Basic structure of MAGMAeconomics

Input
User



Thank you for your attention.

MAGMA Foundry Technologies Inc.