

**MAGMA**

# MAGMA Core & Mold | MAGMAeconomics

Complexities of sand core manufacturing related to finances

UGM Brazil 2025

Royal Tulip JP, Ribeirão Preto | SP

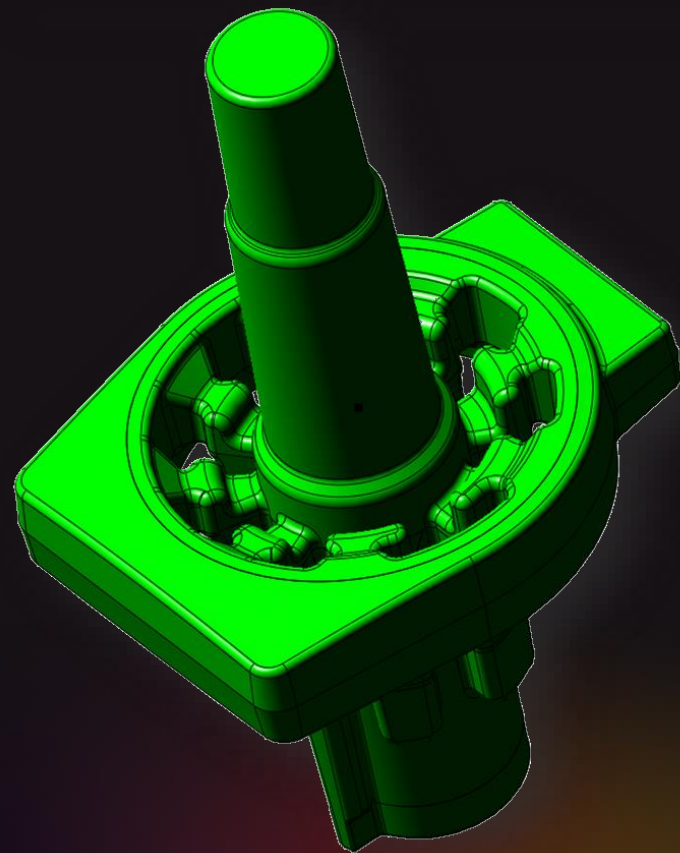
Angelick Dama  
Poitras Foundry

Mauricio Velazquez Blandino  
MAGMA Inc.



# Core 1

Air control to obtain high core compaction



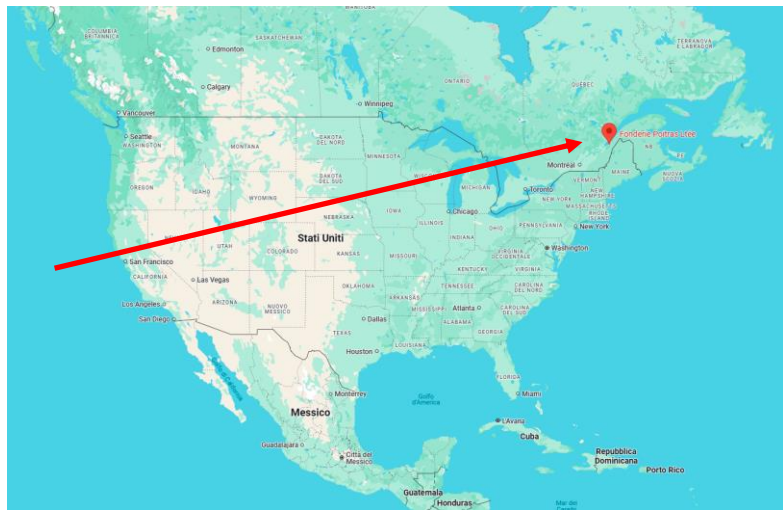
# Poitras Foundry

## Introduction

- Driven by a passion for automotive, 8 years at Poitras, IATF-certified company.
- Metallurgical Engineer by training
- Started as a laboratory manager and progressed into Product and Process development.
- 6 years using MAGMASOFT and leading a multidisciplinary team:
  - Tooling design,
  - Process Control,
  - Quality Assurance
  - Automation



**Angelick Dama**  
Engineering & Process Manager



# Poitras Foundry

## Introduction

- Having team thrives on design and engineering challenges, Poitras produce Drivetrain Castings
- Cold box core making (Laempe) and Vertical molding ( Disamatic)
- At Poitras, we leverage Magmasoft to enhance our tooling designs and ensuring our core and casting integrity.

This is why our Customers trust us!!!

«Leveraging the core award»



# Poitras Core 1

## Predominant issues, defects observed

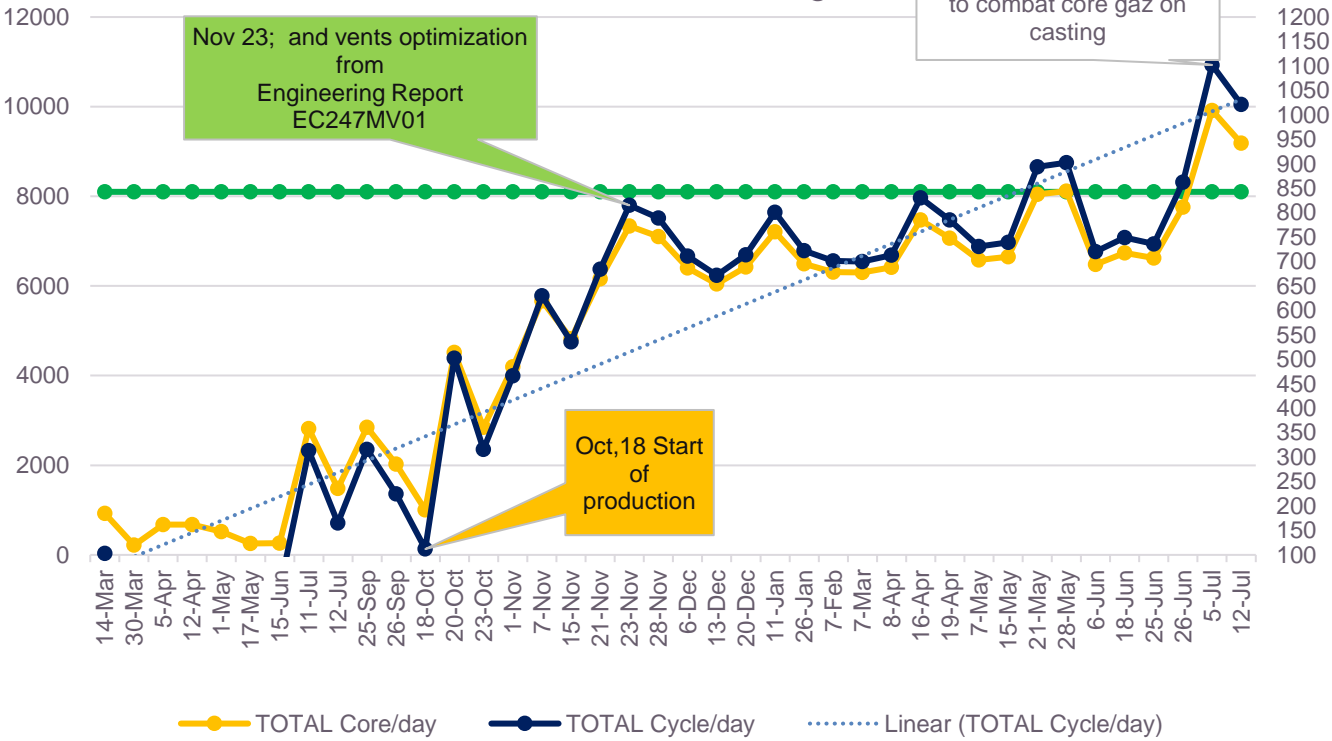
- Missing sand from the core creates casting problems
- Defect occurs from filling deficiencies of the core box
- Current scenario with 75% scrap
- 9 cavity box
- What is the financial impact?
- Rework was done to the casting



# Poitras Core 1

## Predominant issues, defects observed

### Core 1 Coremaking



Daily production

Production starts (101823)  
112 cycles w 502 cores made

After engineering project (112323)  
815 cycles w 7335 cores made



# Poitras Core 1

## Financial Impact

**Job Cost**

**40,379.0852**


Focus Value

**76,435.2624**

Variant

**36,056.1772**

Additional Expenses 89.29 %

Name		Baseline	Worst day
Core Cost	$f(x)$	0.1384 \$	0.1527 \$
Mass of Sand Core ID 1		4.2342 kg	4.2342 kg
Core Sand Loss		1.2 %	1.2 %
Mass of core	$f(x)$	0.4705	0.4705
Number of Cavities		9	9
> Core_Cycle_Time	$f(x)$	78 s	93 s
Cores per hr	$f(x)$	415.3846	348.3871
Core Scrap		2 %	75 %
Core Material Price		0.262 \$	0.262 \$
Actual good cores per hr	$f(x)$	407.0769	87.0968
Number of cycles per shift	$f(x)$	323.0769	270.9677
Core Labor Rate per shift	$f(x)$	368.3077 \$	308.9032 \$
Good cores per day	$f(x)$	8,548.6154	1,829.0323
Labor per core	$f(x)$	0.1267 \$	0.1267 \$
Core Overhead		50 \$/hr	50 \$/hr
Production Requirement P/Y		286,000	286,000
Cores Produced	$f(x)$	291,720	500,500
Job Cost	$f(x)$	40,379.0852	76,435.2624



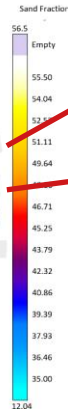
# Poitras Core 1

## Evaluation of filling

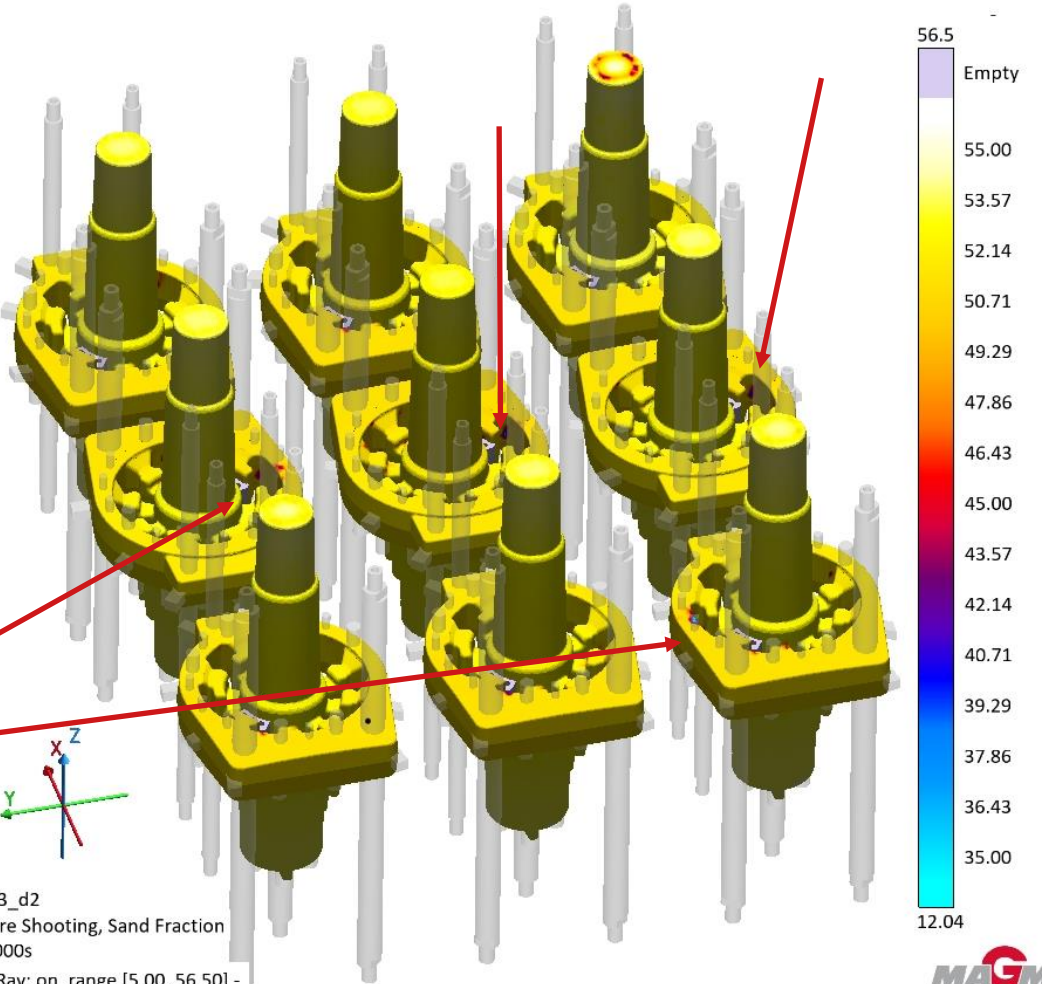
- What is occurring
- After shooting, it is evident that some of the cores in the tooling present low fraction values at various regions in the problematic area.
- Once the scale is adjusted to 35% as a minimum, the defect becomes clear and highlights the problematic area.



v03\_d2  
Core Shooting, Sand Fraction  
2.000s  
X-Ray: on



v03\_d2  
Core Shooting, Sand Fraction  
2.000s  
X-Ray: on, range [5.00, 56.50] -



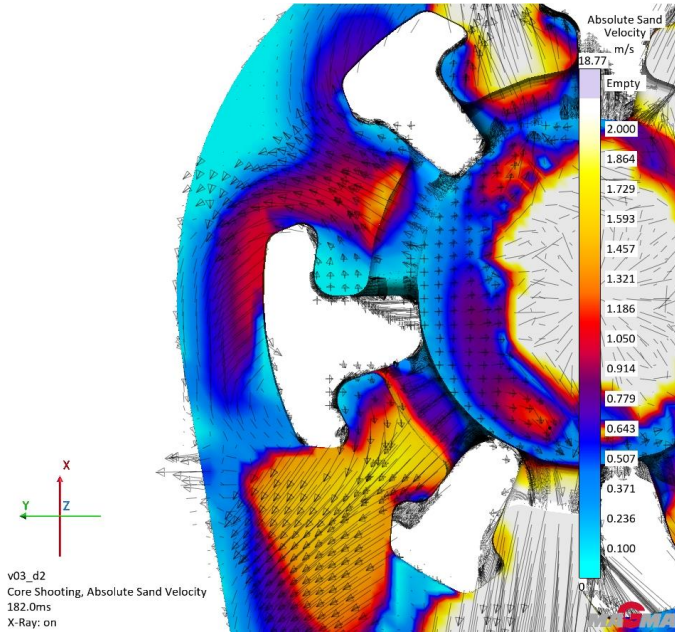
Sand Fraction

56.5  
Empty  
55.00  
53.57  
52.14  
50.71  
49.29  
47.86  
46.43  
45.00  
43.57  
42.14  
40.71  
39.29  
37.86  
36.43  
35.00  
12.04

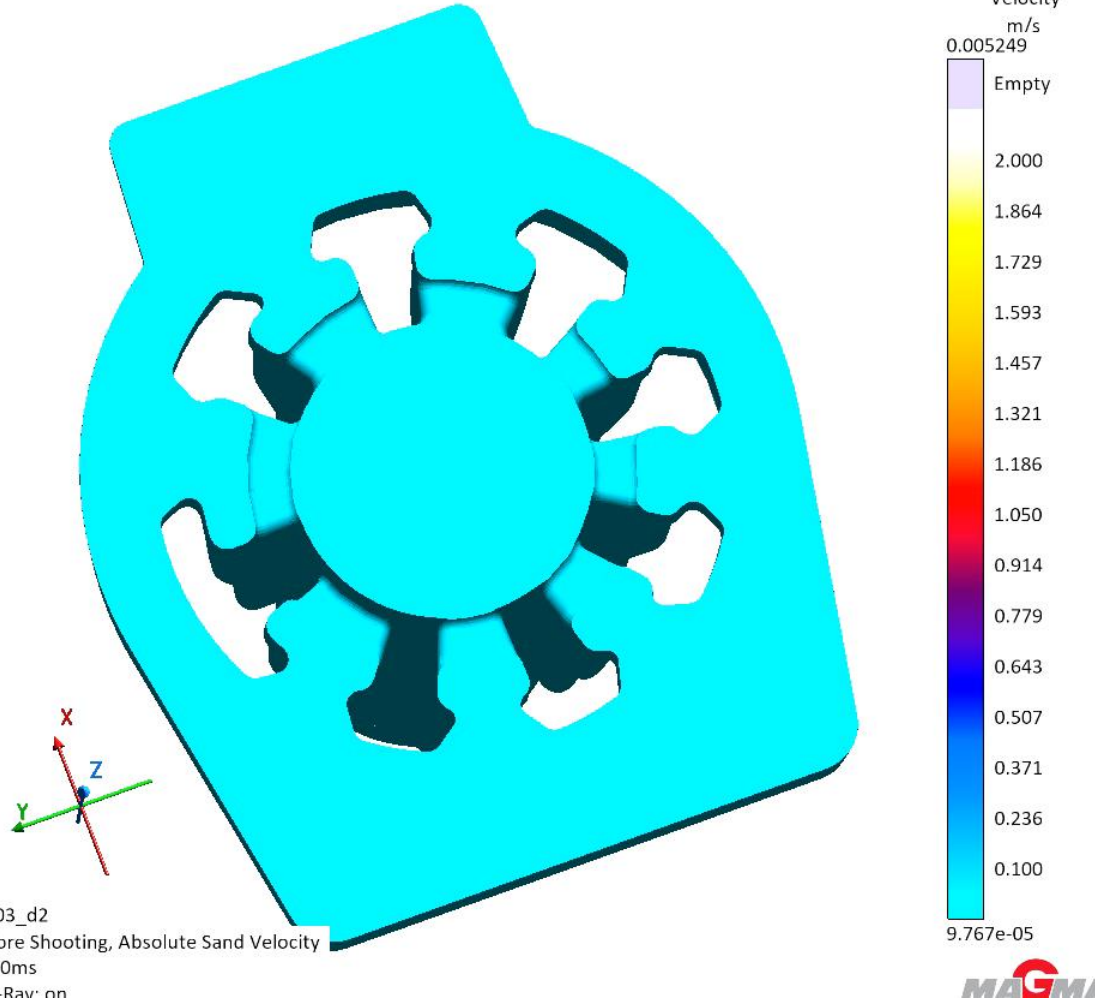
# Poitras Core 1

## Evaluation of filling

- The movement of sand in these regions seems to be deficient compared to other sections



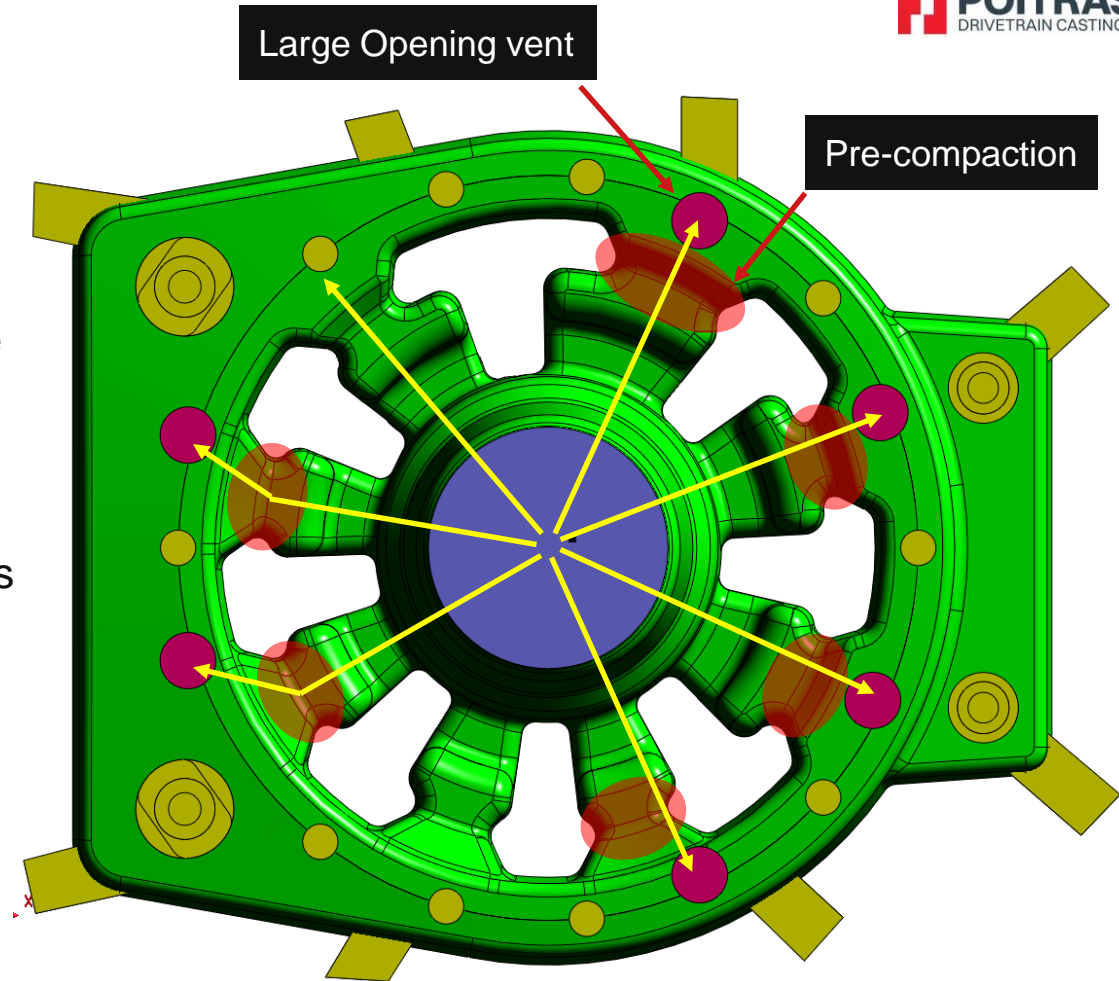
v03\_d2  
Core Shooting, Absolute Sand Velocity  
0.0ms  
X-Ray: on



# Poitras Core 1

## Evaluation of filling

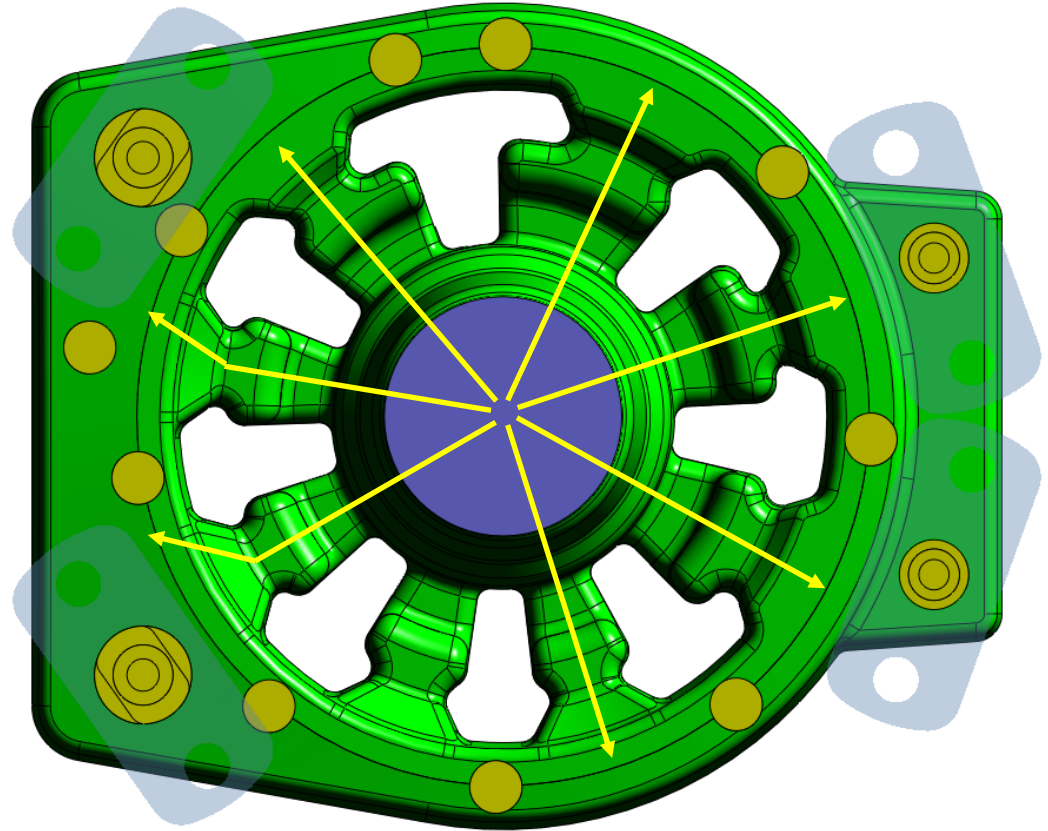
- What causes this behavior?
- Air and sand are being directed into these passages but due to the large size and incorrect location of these vents, sand pre-compacts at these small cross-sections and interrupts the sand flow further into the regions with low compaction



# Poitras Core 1

## Evaluation of filling

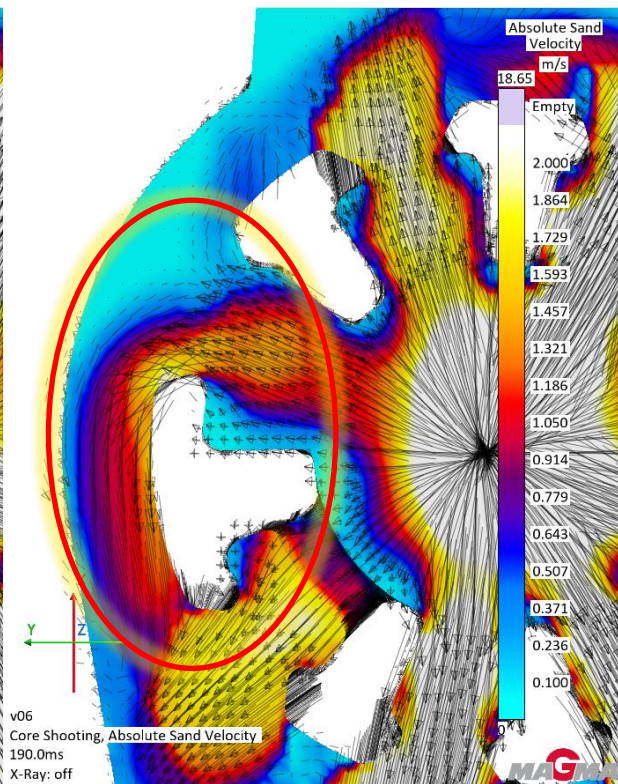
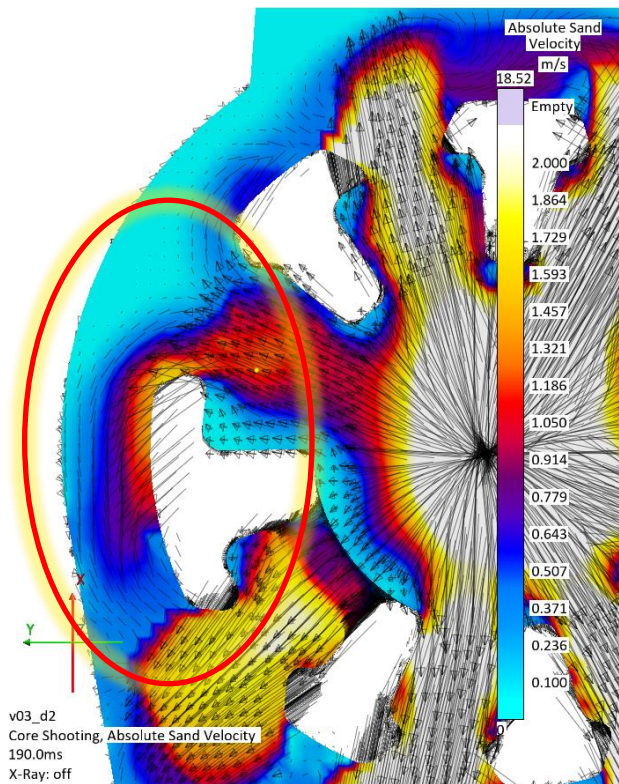
- Proposal to modify location of air exhausting points.
- Removed partition venting





# Poitras Core 1

## Proposals comparison



- Sand velocities increased in areas highlighted

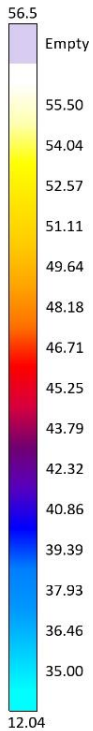
# Comparison of Baseline

## Proposals to avoid pre-compaction and loss of momentum



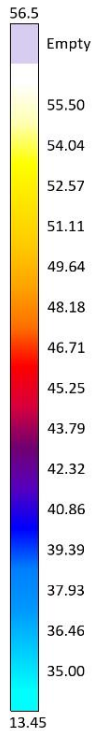
v03\_d2  
Core Shooting, Sand Fraction  
2.000s  
X-Ray: on

Sand Fraction



v06  
Core Shooting, Sand Fraction  
2.000s  
X-Ray: on

Sand Fraction



- There is no longer a bottleneck created at the smallest cross-sectional areas but a free passage flow to compromised zones



# Core results

## Impact of the actions

Before: with defect, castings had to be re-worked



After: No rework



# Casting results

## Impact of the actions

Before: w/rework to remove excess material from core defect

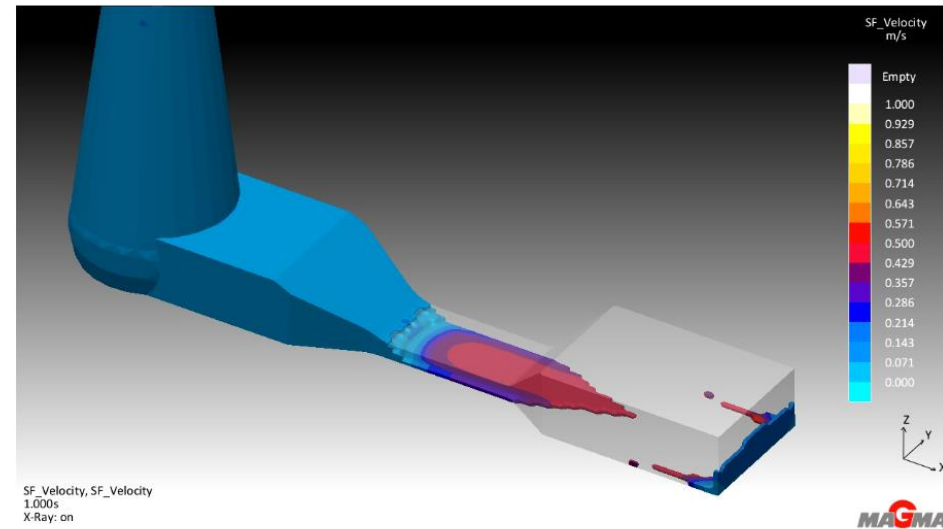
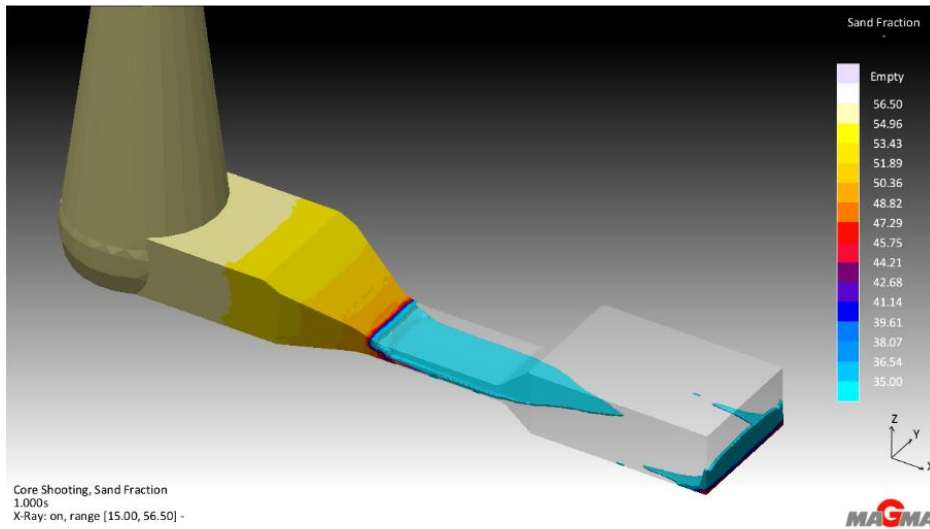


After: No rework

# SAND & AIR FLOW

## Challenges

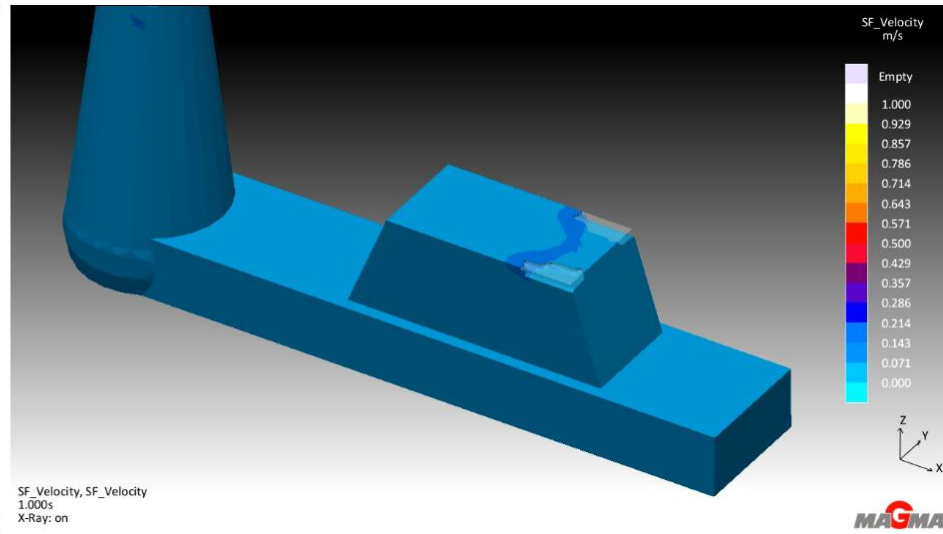
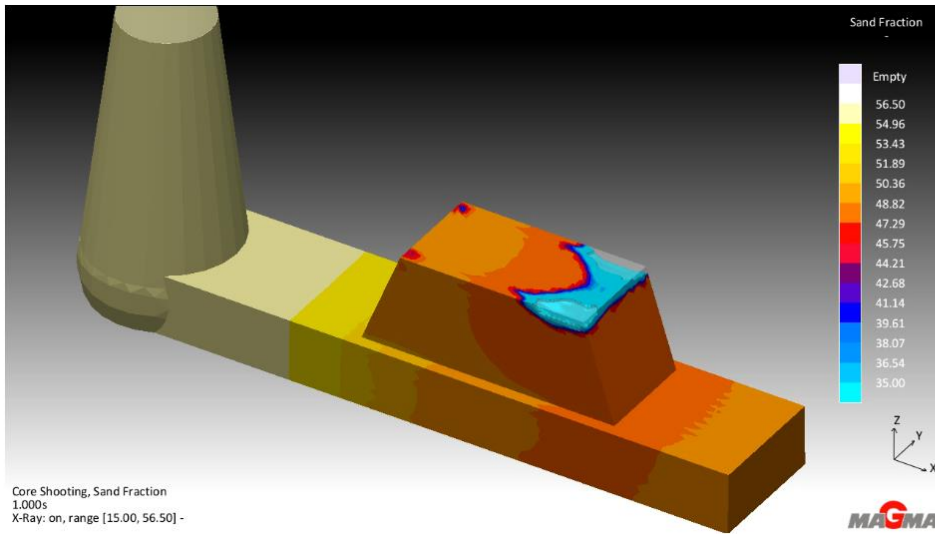
- In narrow pass, sand may pile up and will not fill the core adequately



# SAND & AIR FLOW

## Challenges

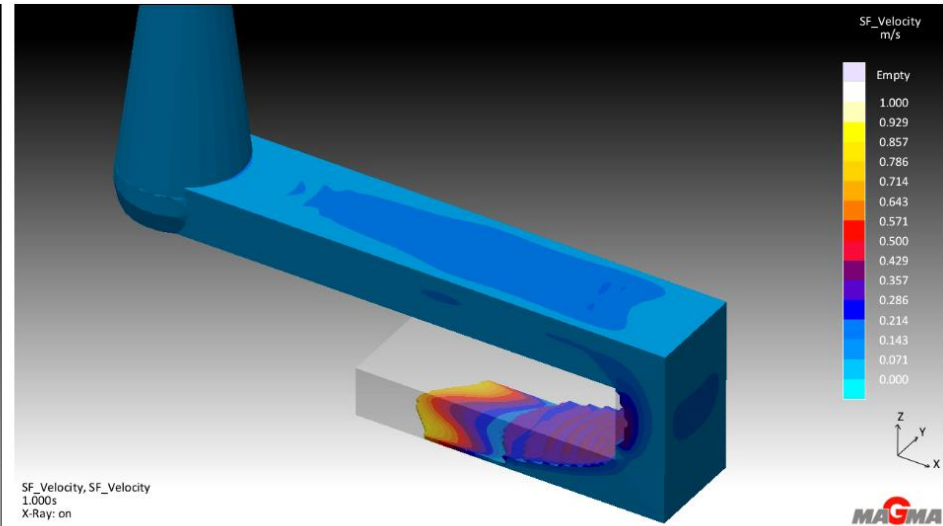
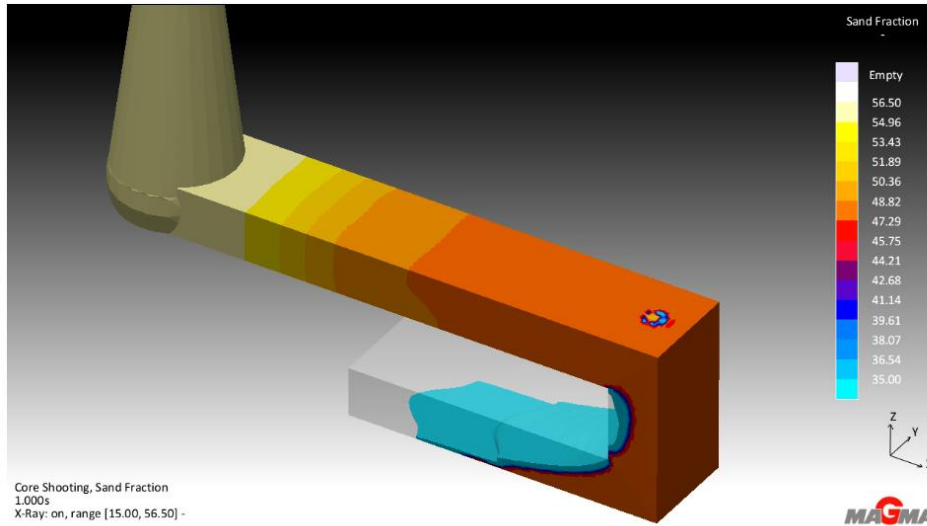
- Upper areas are very difficult to fill and need extra “effort” to get compacted accordingly



# SAND & AIR FLOW

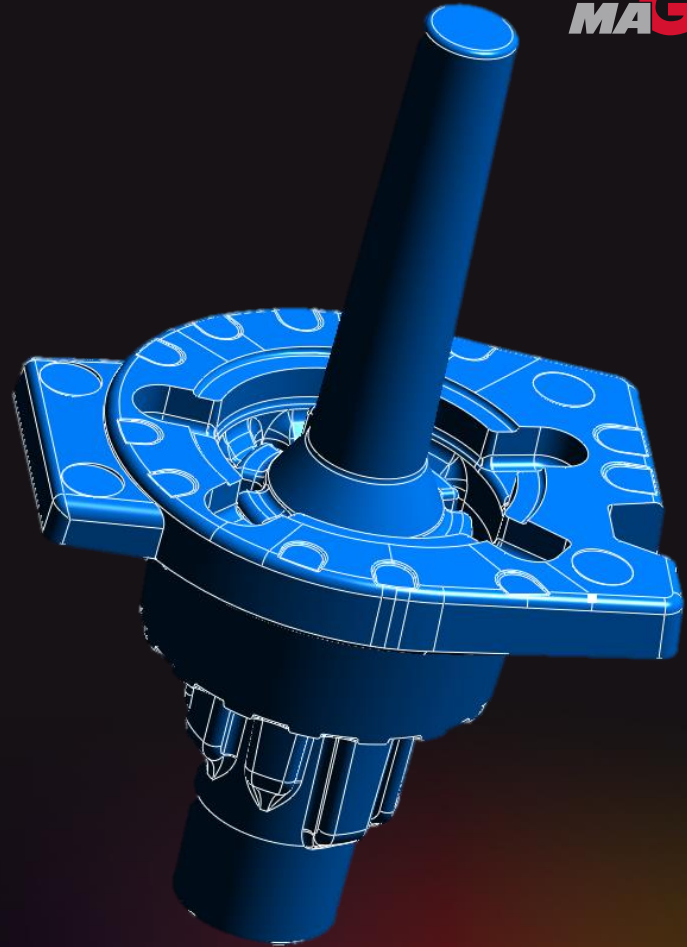
## Challenges – Direction changes

- Sand flow will reduce it's energy at the time of impact to change directions



# Core 2

Tooling performance and optimization

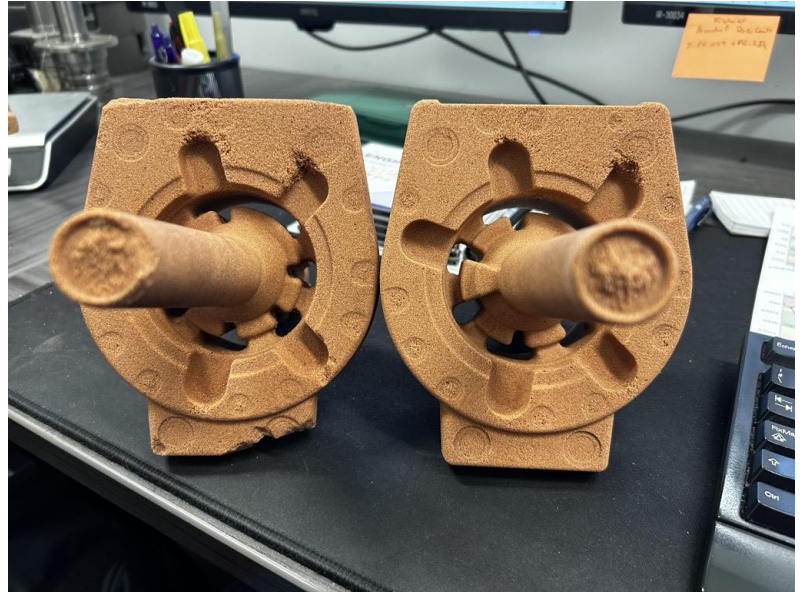




# Core 2

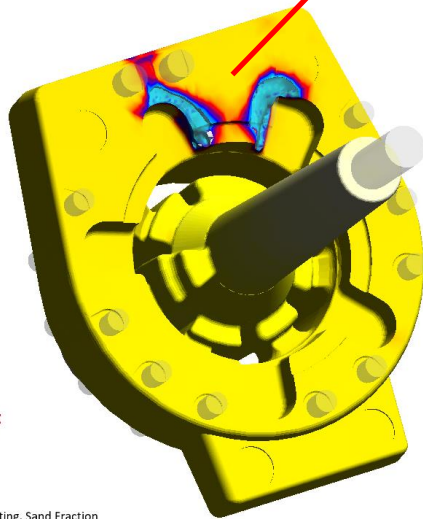
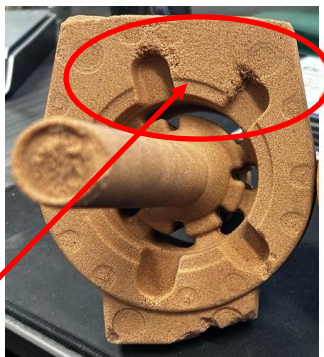
A similar defect a similar solution?

- Previous production with 25% to 35% core scrap.
- Needed rework with putty in defect areas

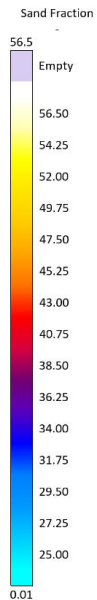


# Core 2

## Shooting defects

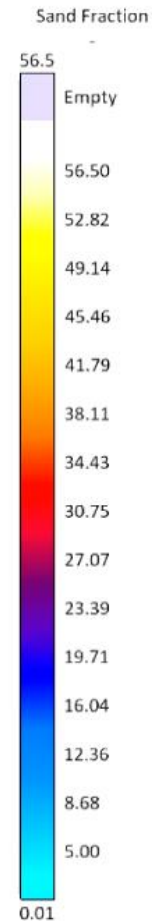
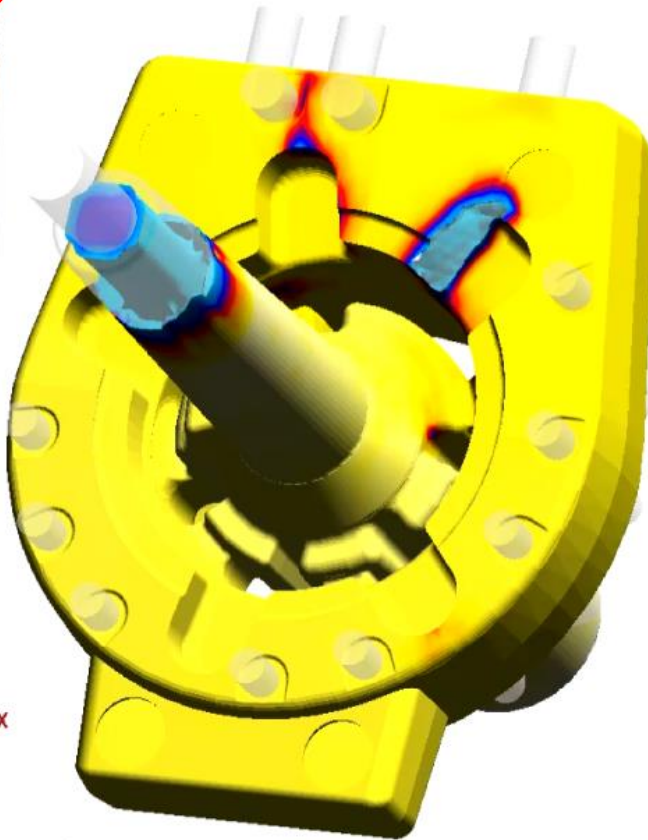


v03  
Cycle 4, Core Shooting, Sand Fraction  
3.000s  
X-Ray: on, range [25.00, 56.50] -



MAGMA

07  
Cycle 1, Core Shooting, Sand Fraction

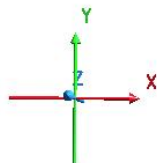


MAGMA



# Core 2

## Gassing defects

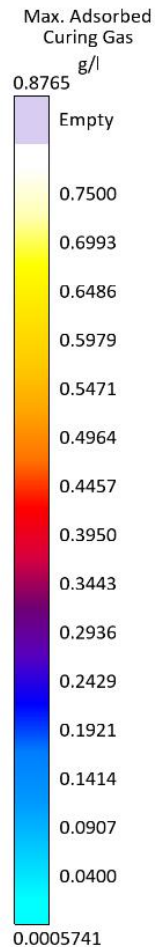
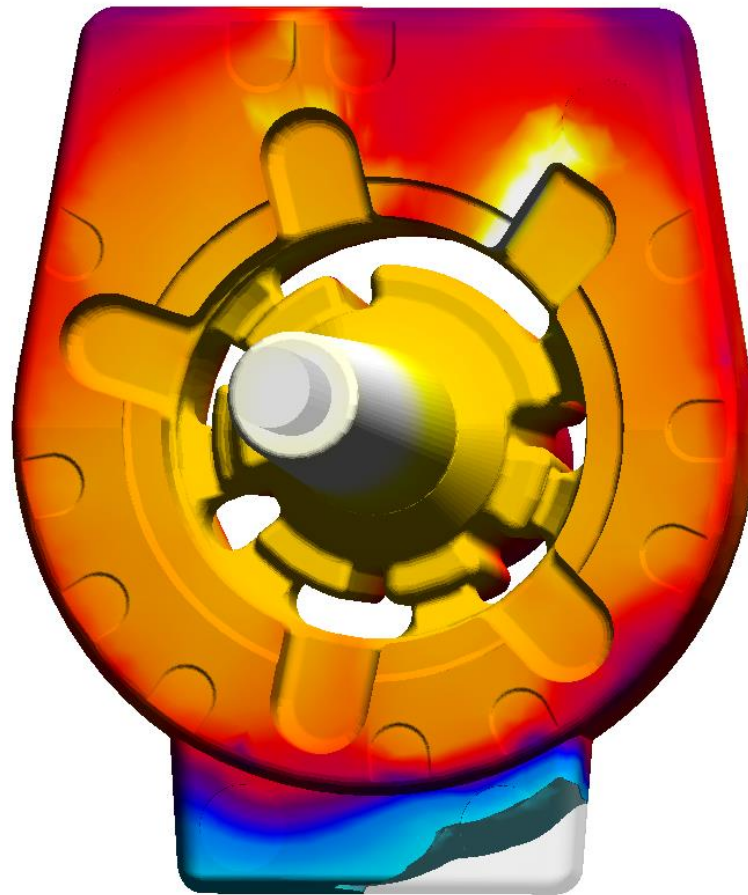


v07

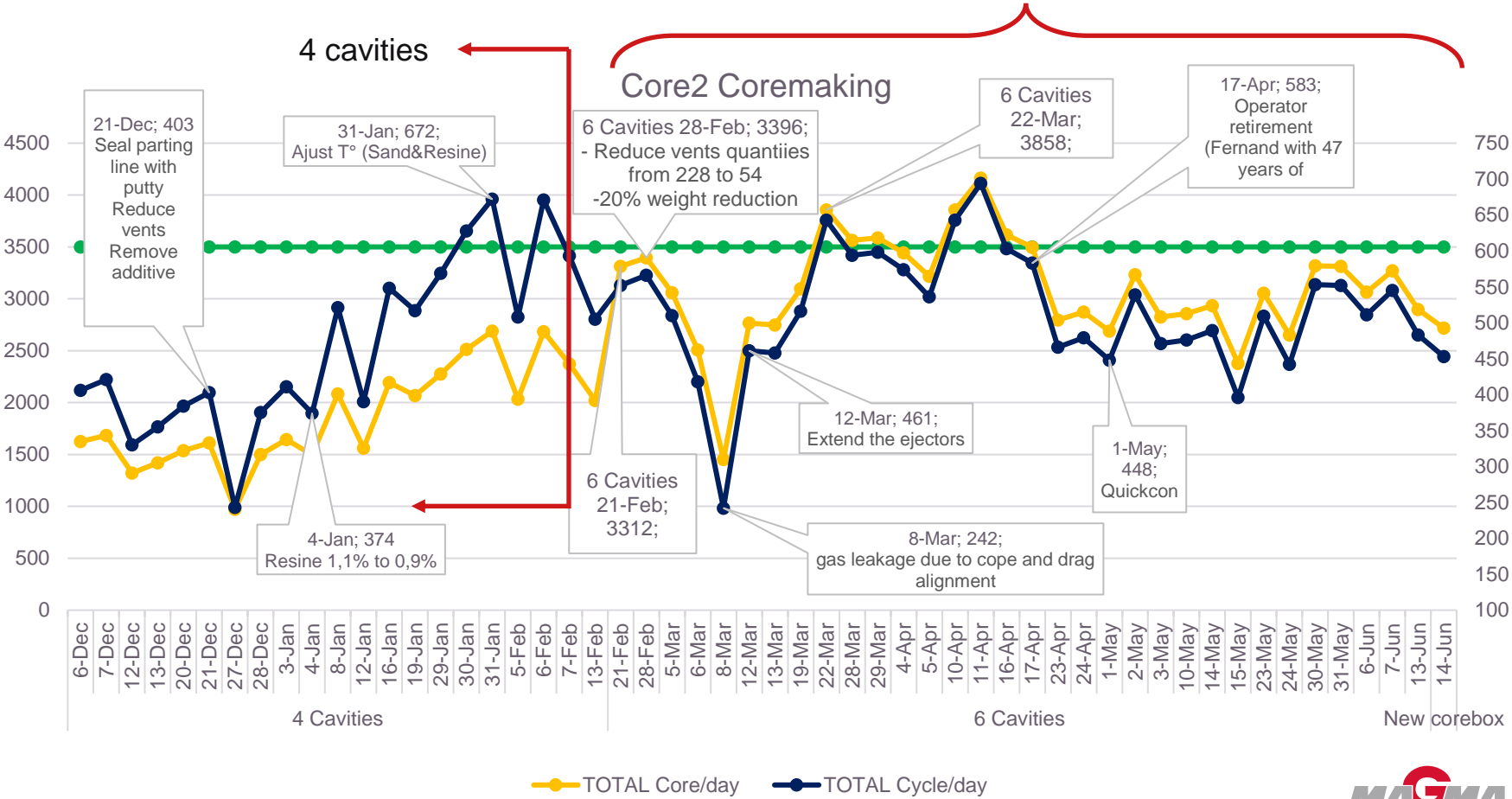
Cycle 1, Core Curing, Max. Adsorbed Curing Gas

2.900s

X-Ray: on, range [0.04, 0.88] g/l



# Production data




# Cost comparison

**Job Cost**

**102,758.7856**  
Focus Value

**164,833.6204**  
Variant

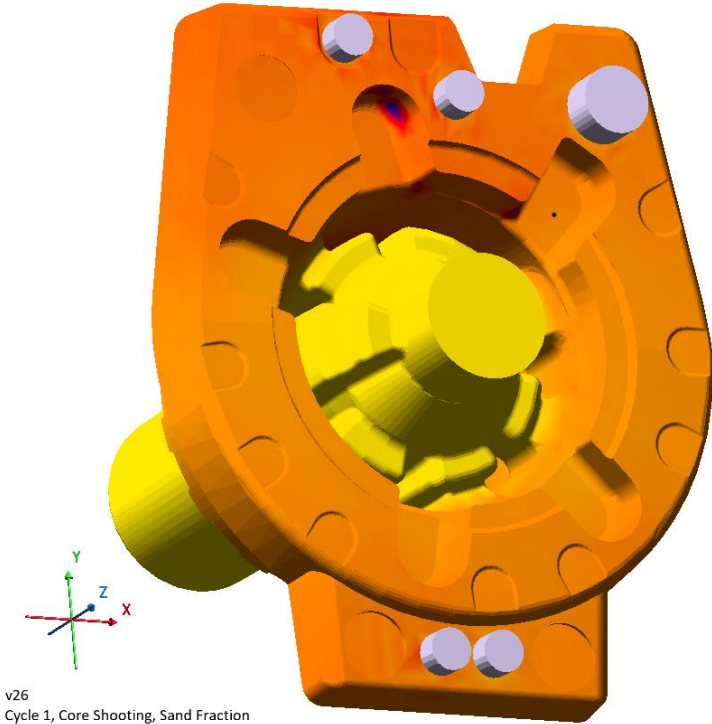
**62,074.8348**  
Additional Expenses 60.41 %

Name		Baseline		Worst case 4 Cavities	
▼	Core Cost	$f(x)$	0.2993 \$	0.4033 \$	
	Mass of Sand Core ID 1		1.3027 kg	1.3027 kg	
	Core Sand Loss		1.2 %	1.2 %	
	Mass of core	$f(x)$	0.2171	0.3257	
	Number of Cavities		6	4	
>	Core_Cycle_Time	$f(x)$	120 s	140 s	
	Cores per hr	$f(x)$	180	102.8571	
	Core Scrap		5 %	25 %	
	Core Material Price		0.19 \$	0.19 \$	
	Actual good cores per hr	$f(x)$	171	77.1429	
	Number of cycles per shift	$f(x)$	210	180	
	Core Labor Rate per shift	$f(x)$	239.4 \$	205.2 \$	
	Good cores per day	$f(x)$	3,591	1,620	
	Labor per core	$f(x)$	0.19 \$	0.285 \$	
	Core Overhead		50 \$/hr	50 \$/hr	
	Production Requirement P/Y		327,000	327,000	
	Cores Produced	$f(x)$	343,350	408,750	
	Job Cost	$f(x)$	102,758.7856	164,833.6204	

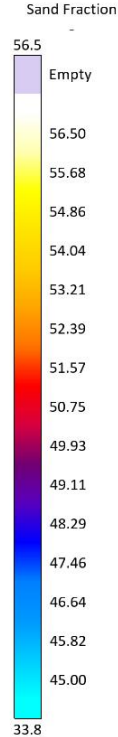
# Reduction of defects/cost

# Comparison of Baseline

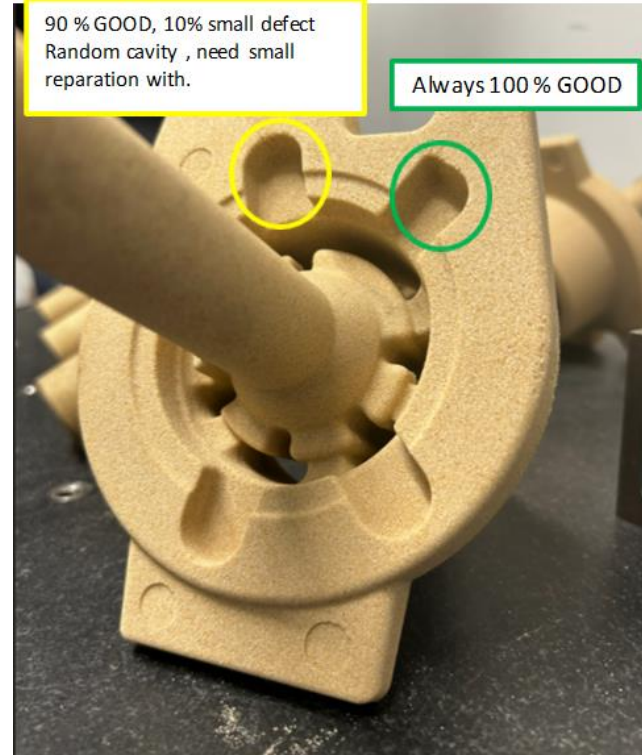
## Proposals to avoid pre-compaction and loss of momentum



v26  
Cycle 1, Core Shooting, Sand Fraction  
3.000s  
X-Ray: off



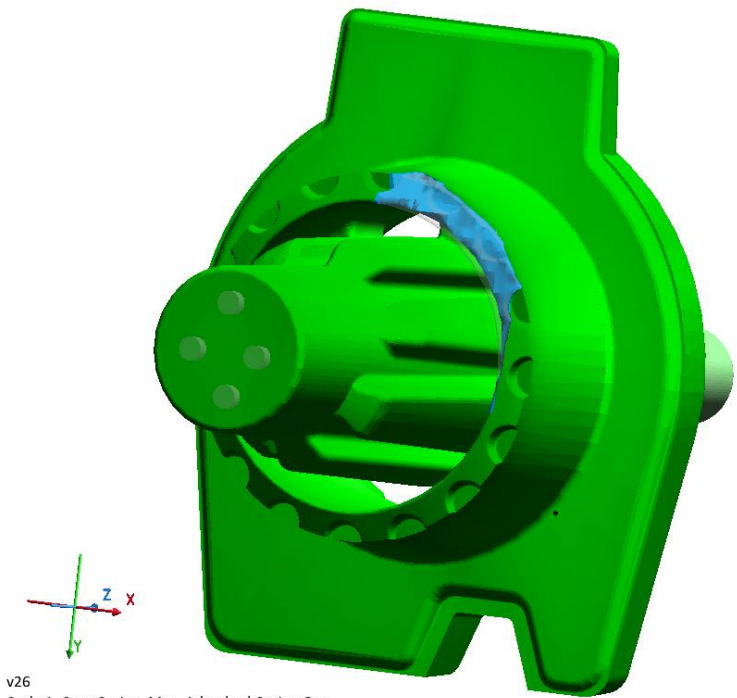
**MAGMA**



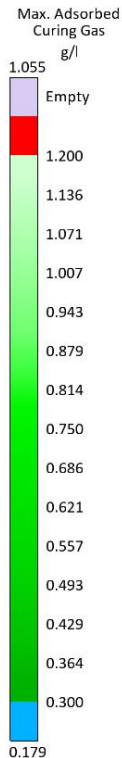
**MAGMA**

# Comparison of Baseline

## Proposals to avoid pre-compaction and loss of momentum



v26  
Cycle 1, Core Curing, Max. Adsorbed Curing Gas  
3,000s  
X-Ray: on, range [0.29, 1.20] g/l



**MAGMA**



75 % GOOD  
25% have low adsorption of amine.  
Need higher gassing time / quantity to have 100% GOOD

**MAGMA**

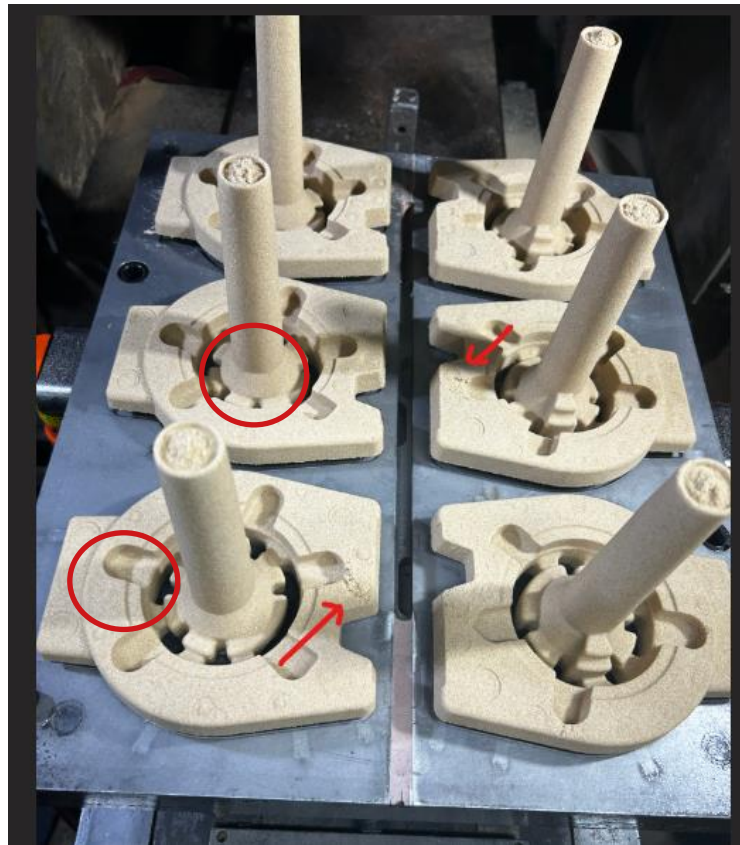


# Comparison of Baseline

Issues after 24 hours of production



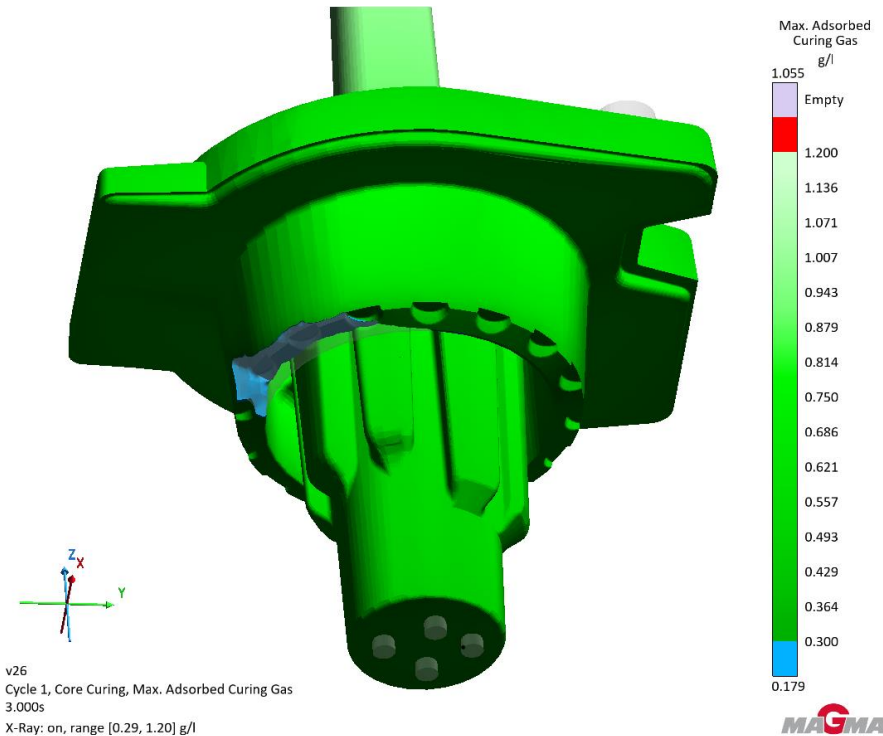
24 hrs later





# Comparison of Baseline

## Issues after 24 hours of production




# Short list of benefits

## Optimized performance

- Core weight was reduced
  - This reduction amounted to around 23% sand mass
- Core quality is much better (85% of time and 15% need to patch with putty)
- The final vents configuration has  $9 \times 6 = 54$  total, before 38 per cavity = 228 total.
- Definitely, vents location is more important than quantity!
- Optimized corebox weight (decreased over 40%).
- Removed the usage of additive

# Cost comparison

Name		Baseline	Worst case 4 Cavities	New Baseline
Core Cost	$f(x)$	0.2993 \$	0.4033 \$	0.2335 \$
Mass of Sand Core ID 1		1.3027 kg	1.3027 kg	<u>1.0363</u> kg
Core Sand Loss		1.2 %	1.2 %	1.2 %
Mass of core	$f(x)$	0.2171	0.3257	0.1727
Number of Cavities		6	<u>4</u>	6
> Core_Cycle_Time	$f(x)$	120 s	140 s	110 s
Cores per hr	$f(x)$	180	102.8571	196.3636
Core Scrap		5 %	<u>25</u> %	5 %
Core Material Price		0.19 \$	0.19 \$	<u>0.18</u> \$
Actual good cores per hr	$f(x)$	171	77.1429	186.5455
Number of cycles per shift	$f(x)$	210	180	229.0909
Core Labor Rate per shift	$f(x)$	239.4 \$	205.2 \$	261.1636 \$
Good cores per day	$f(x)$	3,591	1,620	3,917.4545
Labor per core	$f(x)$	0.19 \$	0.285 \$	0.19 \$
Core Overhead		50 \$/hr	50 \$/hr	50 \$/hr
Production Requirement P/Y		327,000	327,000	327,000
Core Cost	$f(x)$	343,350	408,750	343,350
Job Cost	$f(x)$	102,758.7856	164,833.6204	80,172.8849

Worst case difference of  
+84.6k CA\$

Optimized difference of  
+22.5k CA\$

# Thank you for your attention.

MAGMA Foundry Technologies Inc.