Castability Study and Reducing Scrap with Optimization of a Steering Housing

2024 Bursa

YEŞİLOVA

COOPERATION & SYNERGY

Name: ***Sefer SEZEN***

Date of birth: 27.05.2000

Education and Experience

Bolu Izzet Baysal University
Mechanical Engineering 2018-2022

Can Metal
Design And Simulation Engineer– 2023

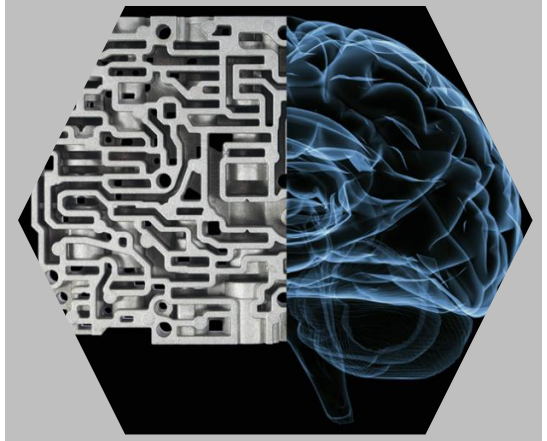
CANMETAL

Contents

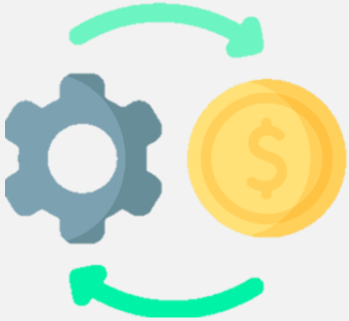
Information About Company

Information About Part

Part Castabilty Study



Optimization Study



9 COMPANIES

CAN ALUMINIUM

CANEL AUTOMOTIVE

CANSAN ALUMINIUM

CAN METAL

YEŞİLOVA R&D CENTER

CANRAY TRANSPORT

CANSAN GmbH

CANEVI TOURISM

YEŞİLOVA INTERNATIONAL

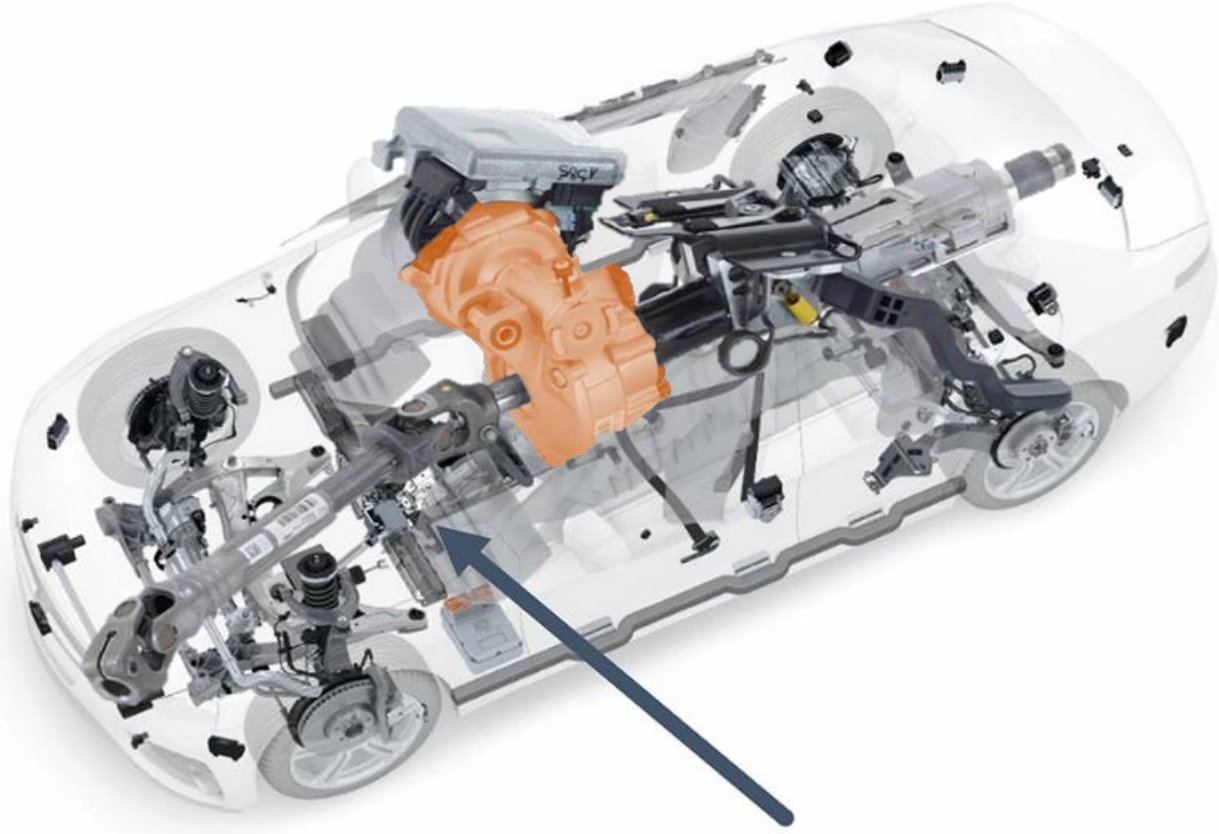
1800
EMPLOYEES

EXPORTING
33 COUNTRIES

Part Information

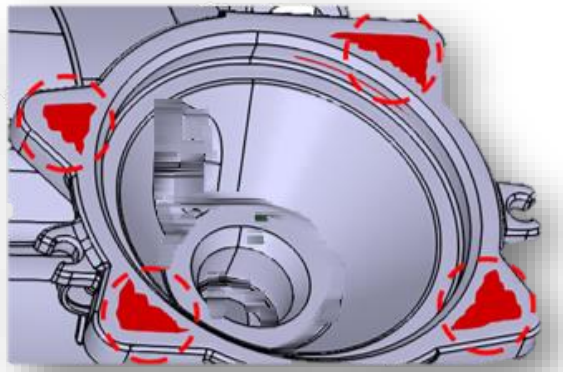
C-EPS is a steering system which uses an electric motor and reduction gear system rather than hydraulic pressure to provide steering assist.

Steering Columns and Intermediate Shafts connect the steering wheel to the steering mechanism to control lateral motion by transferring the driver's input torque from the steering wheel.

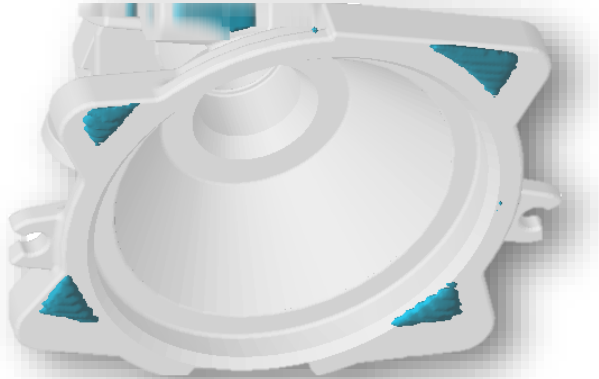


CANMETAL

Part Castabilty Study

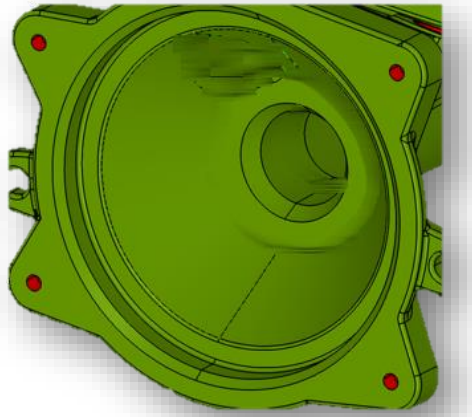


First 3D model received from the customer.

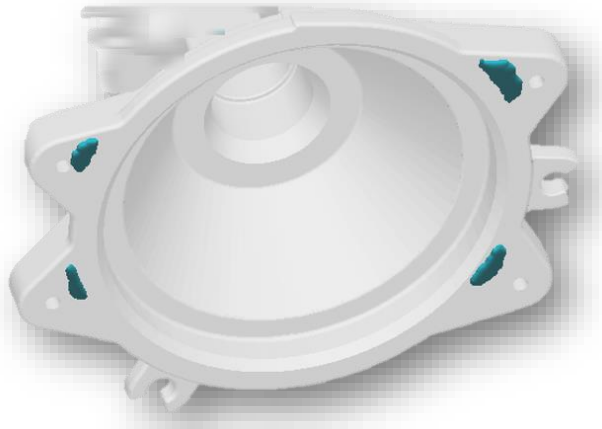


Pre-simulation result for the first model.

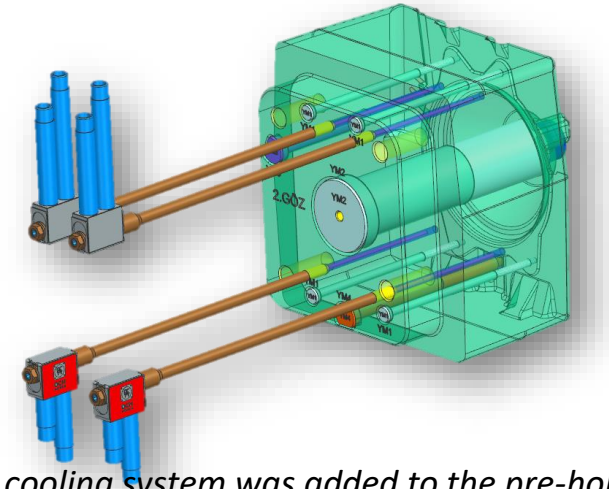
Shrinkage risk was observed in pre-simulation results.



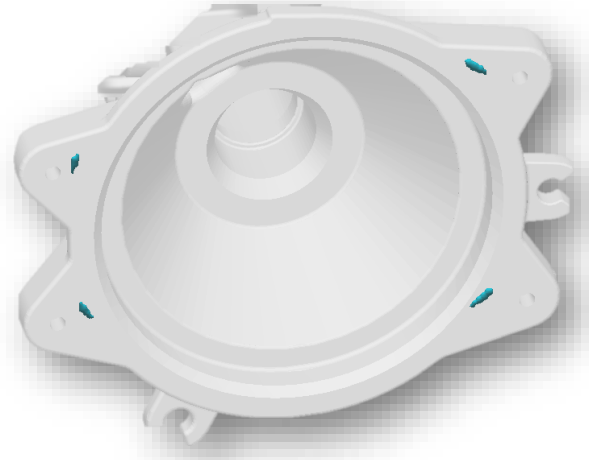
The thickness of the thick areas was reduced by adding a pre-hole on the part.



The risk of shrinkage porosity is reduced after the pre-hole is added.



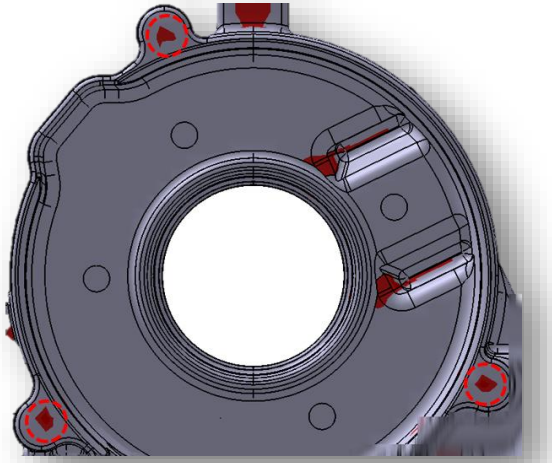
Jet cooling system was added to the pre-holes on the mold.



After the addition of the Jetcool system, the shrinkage porosity risk has reached an acceptable level.

**Areas larger than 8 mm are shown in red.*

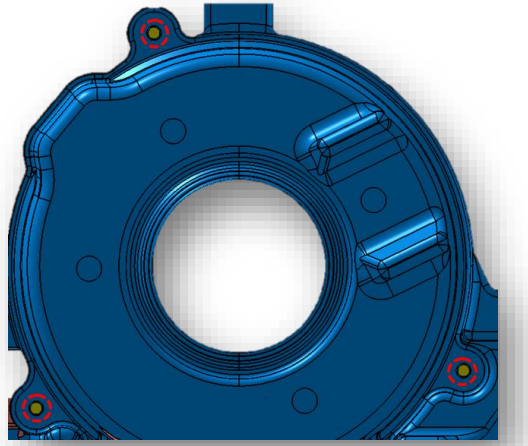
Part Castabilty Study



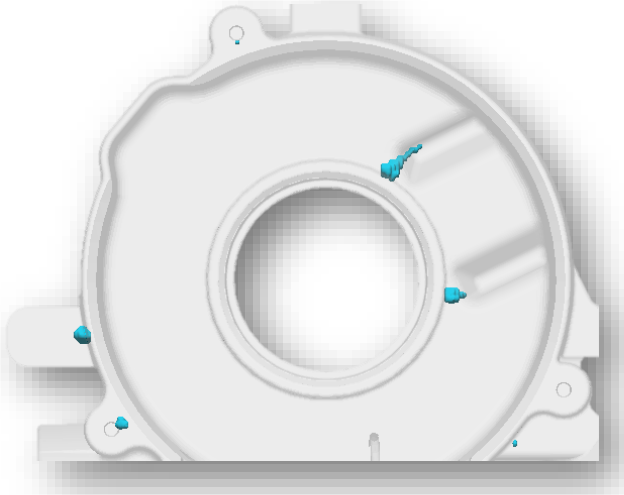
First 3D model received from the customer.

Shrinkage risk was observed in pre-simulation results.

**Areas larger than 8 mm are shown in red.*



The thickness of the thick areas was reduced by adding a pre-hole on the part.

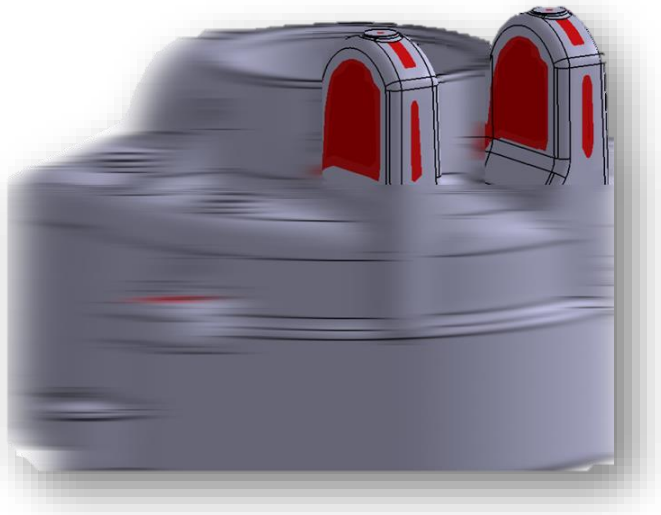


The risk of shrinkage porosity is reduced after the pre-hole is added.

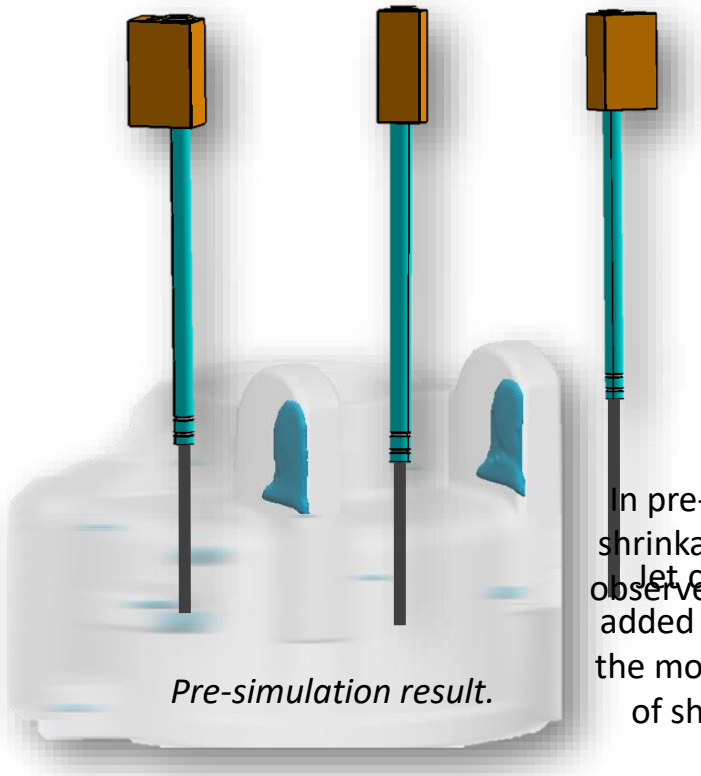
CANMETAL

Part Castabilty Study

First 3D model received from the customer.

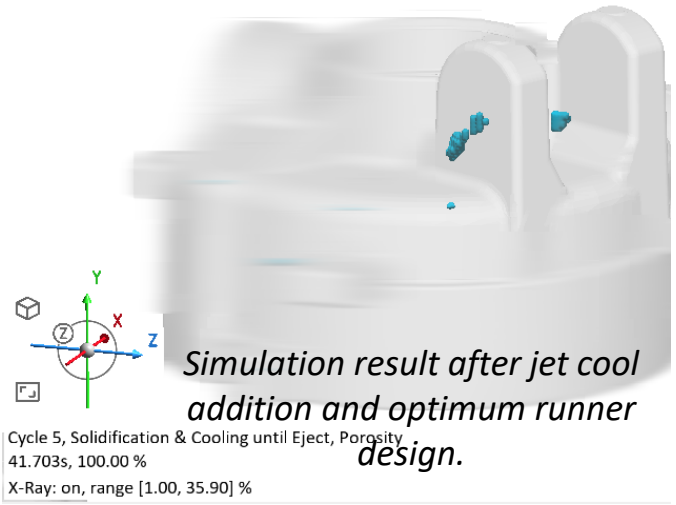


In the areas marked in red, there was a risk of shrinkage porosity due to the high thickness. The same risk was also observed in the pre-simulation results.



Pre-simulation result.

In pre-simulation studies, shrinkage porosity risk was observed in the thick figure. Jet cooling system was added to the thick areas on the mold to prevent the risk of shrinkage porosities.



Simulation result after jet cool addition and optimum runner design.

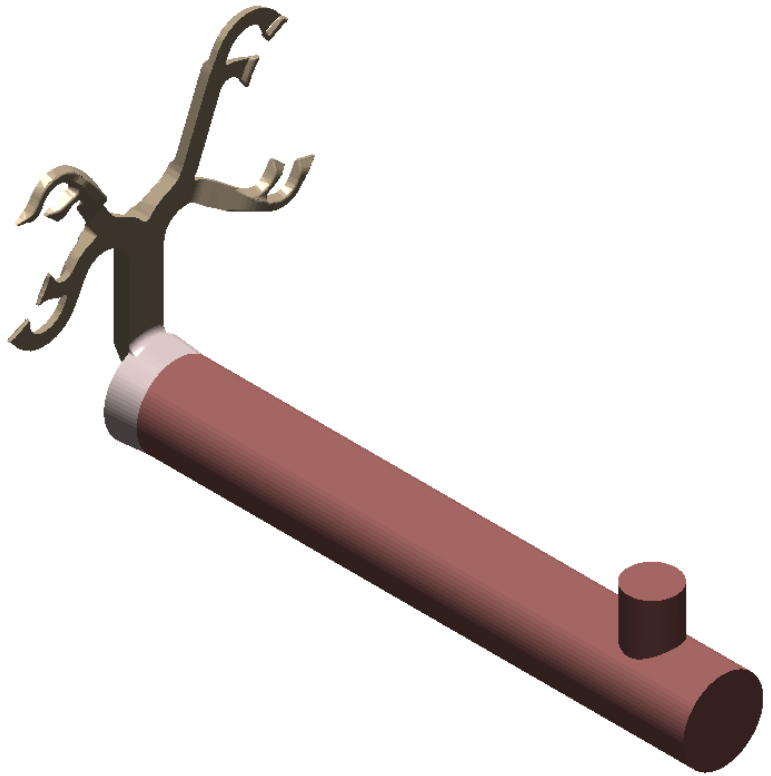
**Areas larger than 8 mm are shown in red.*

CANMETAL

1st Phase Optimization

Purpose of performing 1st phase optimization:

Deciding the 1st phase velocities with the least air left in the shot chamber.



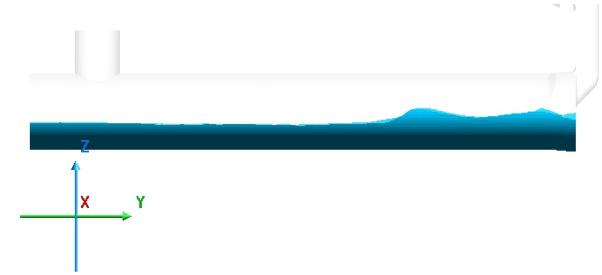
Velocities tested in '1st phase optimization'

Design Variables

Range of Variation		
Lower limit	0.15	m/s
Upper limit	0.3	m/s
Step	0.05	m/s

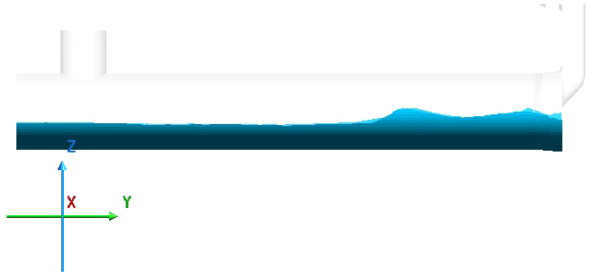
CANMETAL

1st Phase Optimization



v16_d1
Cycle 5, Filling, Absolute Velocity
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,15 m/s***

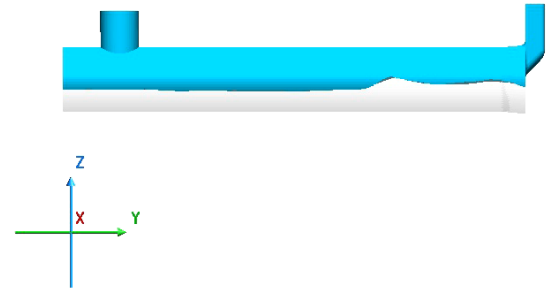


v16_d2
Cycle 5, Filling, Absolute Velocity
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,20 m/s***

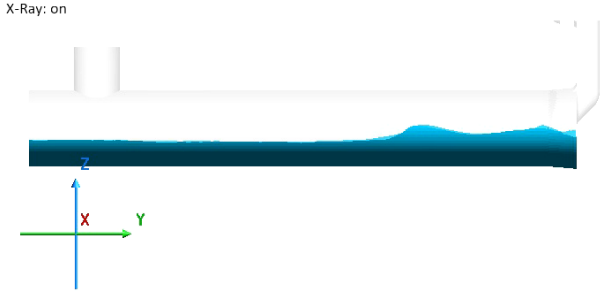
Cycle 5, Filling, Air Pressure
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,15 m/s***



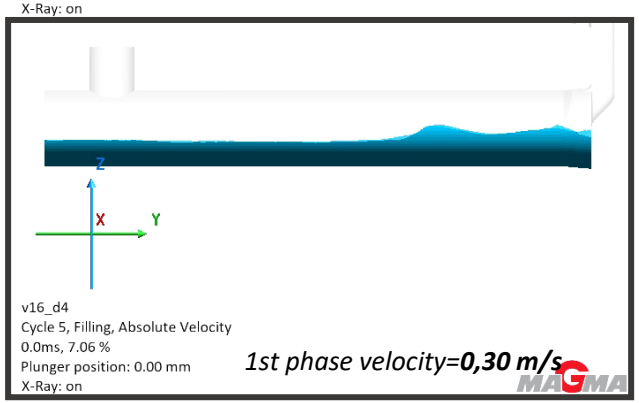
Cycle 5, Filling, Air Pressure
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,20 m/s***



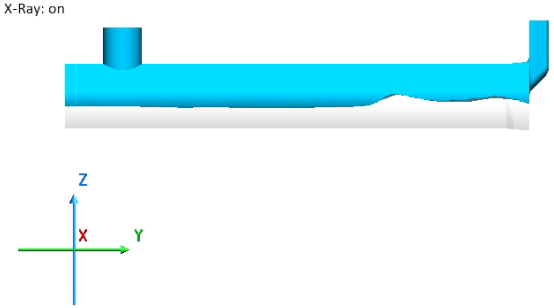
v16_d3
Cycle 5, Filling, Absolute Velocity
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,25 m/s***



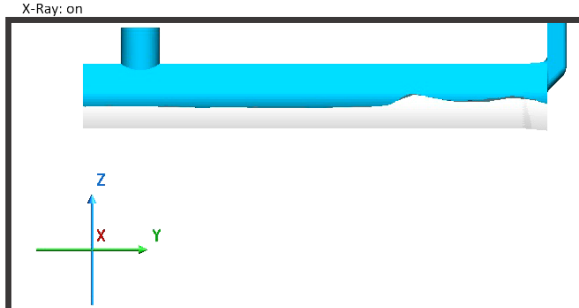
v16_d4
Cycle 5, Filling, Absolute Velocity
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,30 m/s***



Cycle 5, Filling, Air Pressure
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

*1st phase velocity=**0,25 m/s***

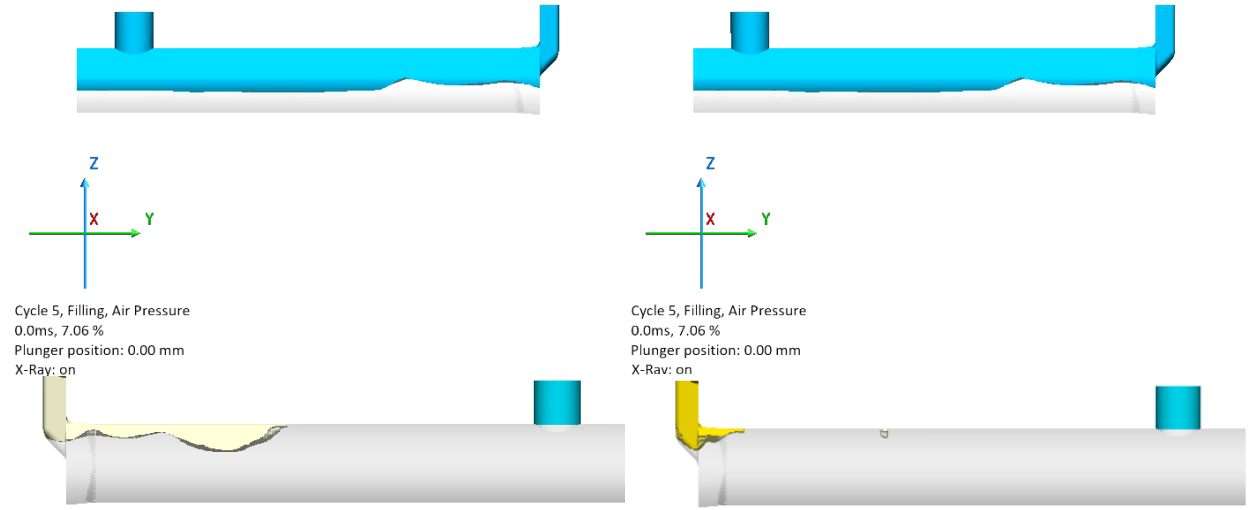


Cycle 5, Filling, Air Pressure
0.0ms, 7.06 %
Plunger position: 0.00 mm
X-Ray: on

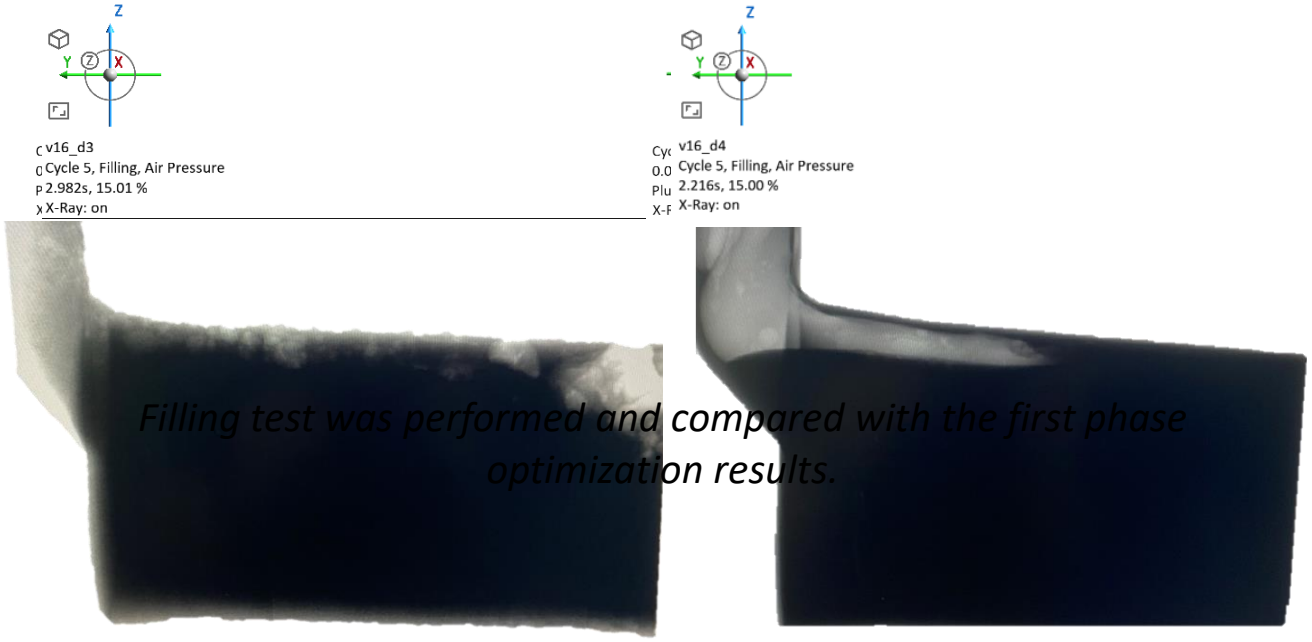
*1st phase velocity=**0,30 m/s***

1st Phase Optimization

Simulation Result



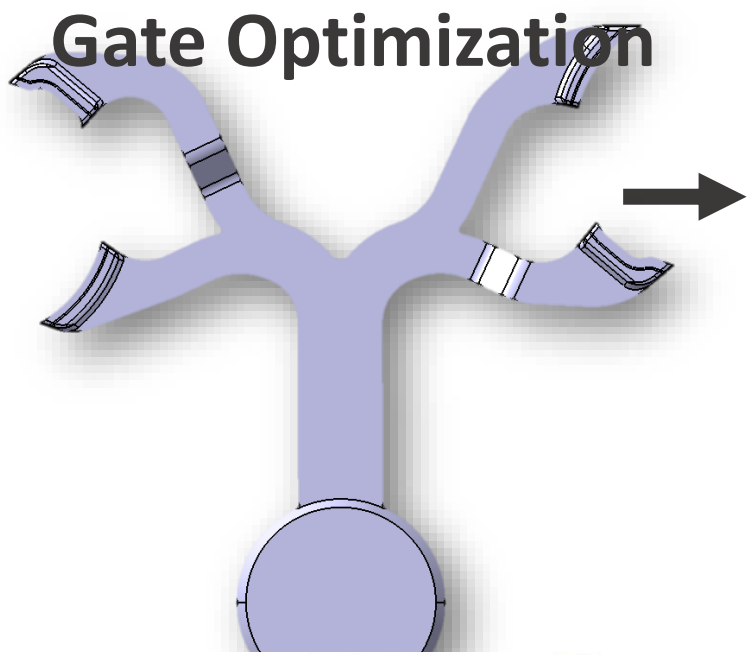
X-Ray Result (Filling Test)

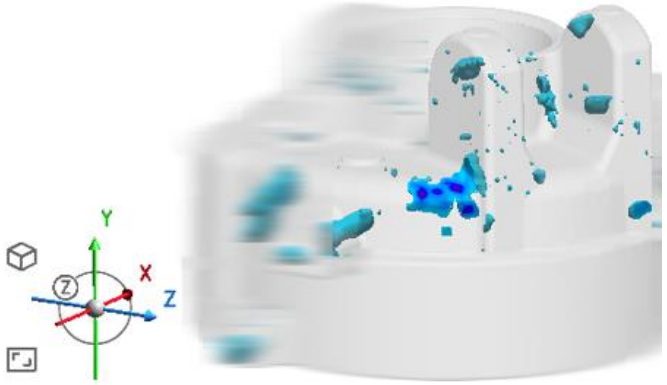


Filling test was performed and compared with the first phase optimization results.

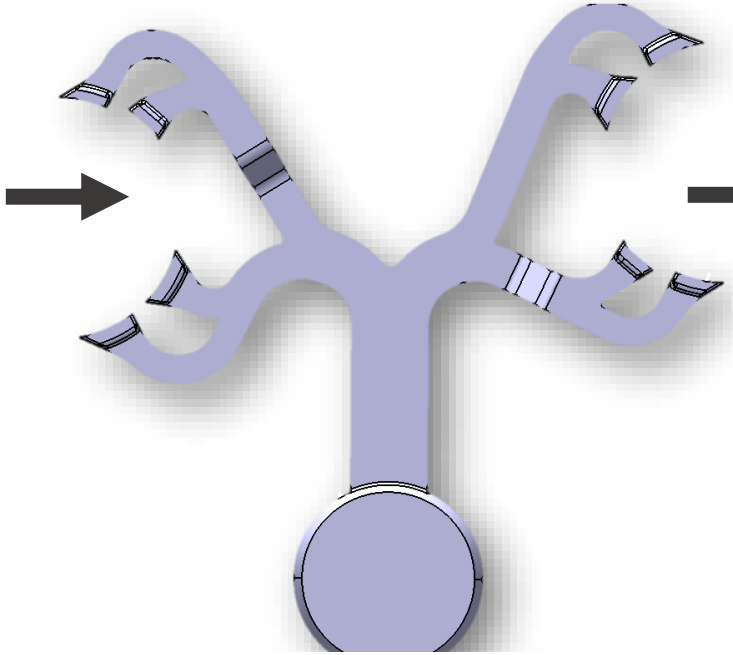
CANMETAL

Gate Optimization

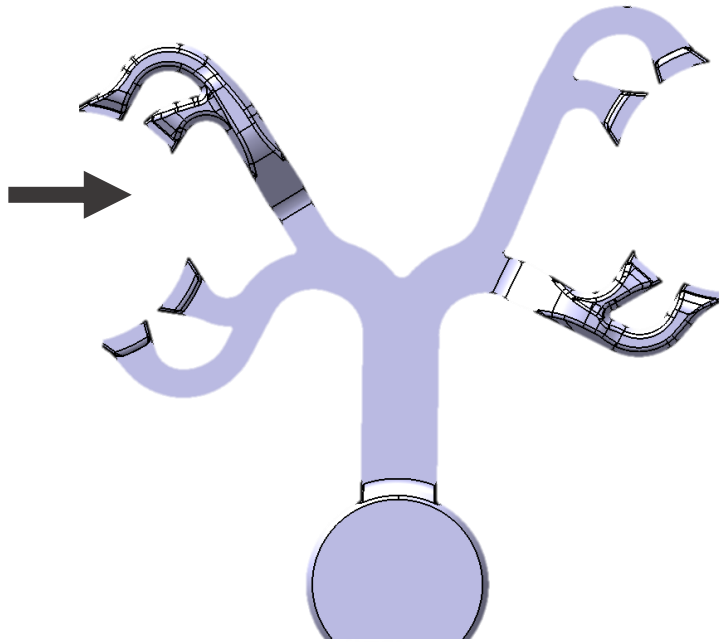


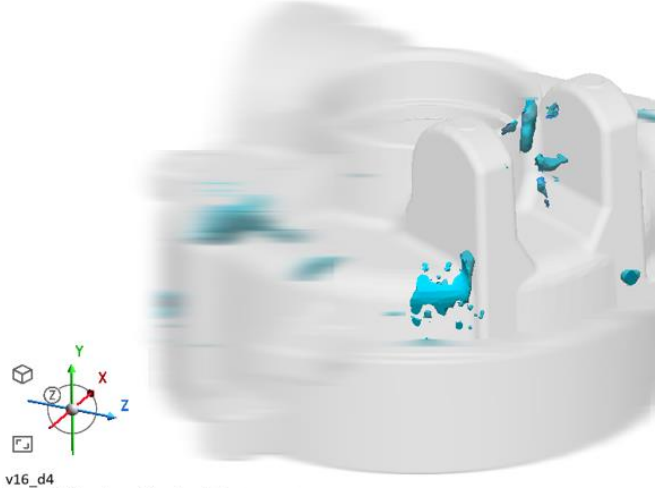


v01
Cycle 4, Filling, Intensification Air Entrapment
3.279s
X-Ray: on, range [1.00, 66.84] %



v06
Cycle 4, Filling, Intensification Air Entrapment
4.502s
X-Ray: on, range [1.00, 32.34] %



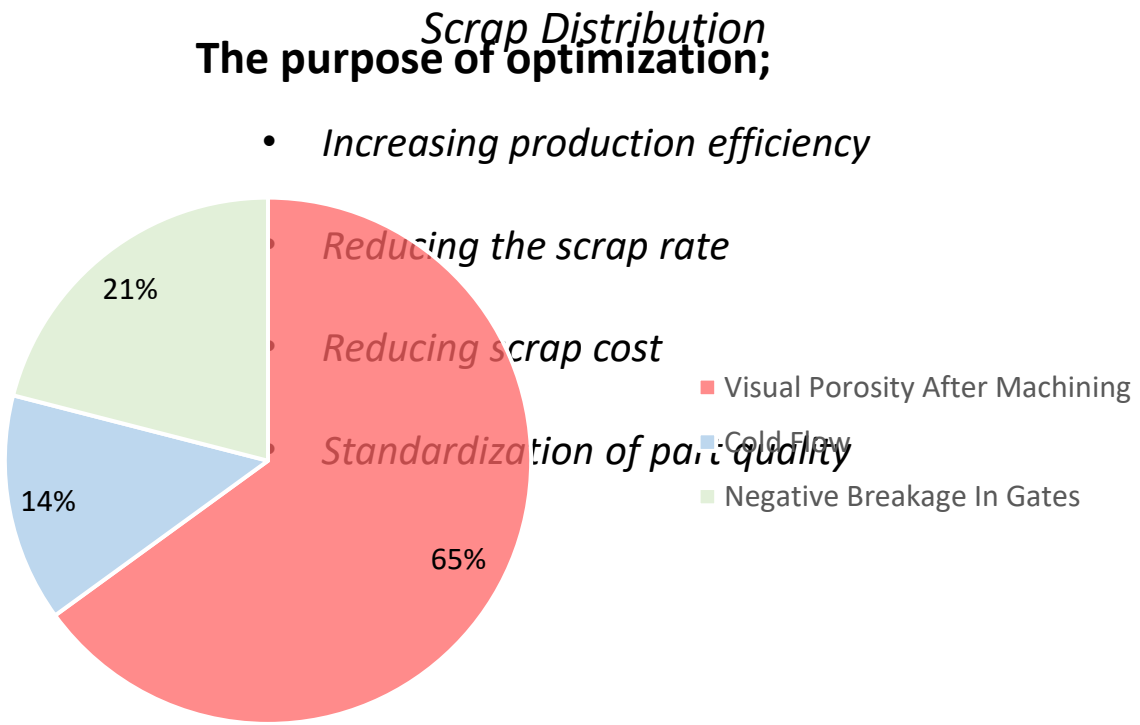


v16_d4
Cycle 5, Filling, Intensification Air Entrapment
2.714s
X-Ray: on, range [1.00, 29.92] %

CANMETAL

Scrap Rate Information

Our aim for this part is to achieve a 3,5% scrap after machining. However, the scrap level after machining is at 9,2% in mass production.



The purpose of optimization;

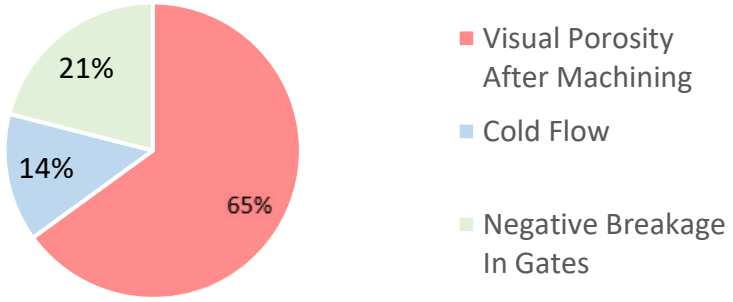
- *Increasing production efficiency*
- *Reducing the scrap rate*
- *Reducing scrap cost*
- *Standardization of part quality*

CANMETAL

Geometry Exchange Optimization

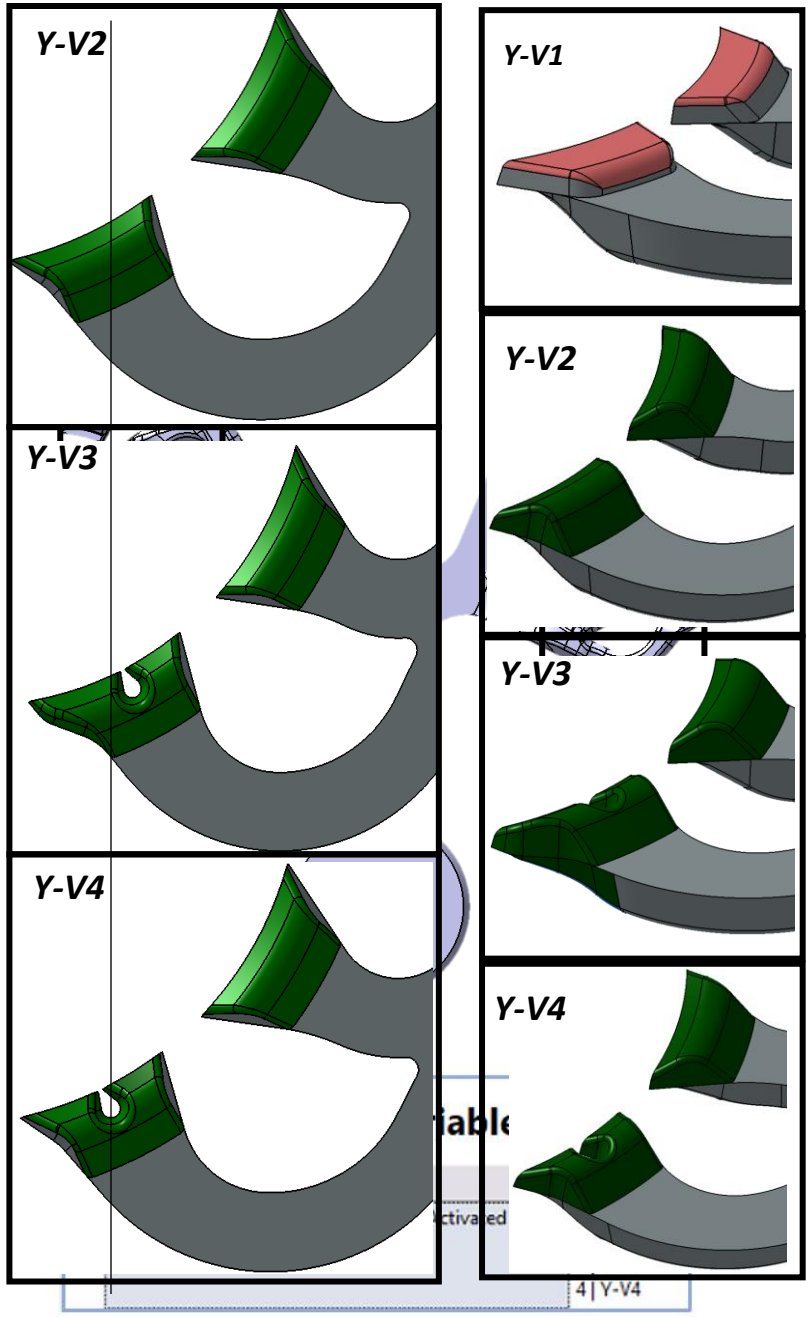
Scrap Distribution

<u>Our optimization aim</u>: Reduce Visual Porosity Scrap Rate



In order to reduce the scrap, an optimization study was carried out with 'geometry exchange' on 4 different gates.

Serial Runner Design



Different types of gates have been designed to prevent the visual porosity problems on the figure.

CANMETAL

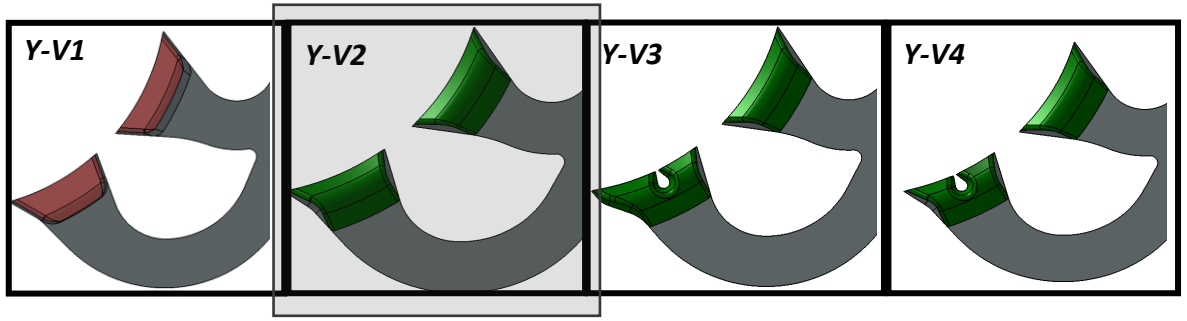
Geometry Exchange Optimization

Results to be evaluated in 'Geometry Exchange' Optimization.

Objectives

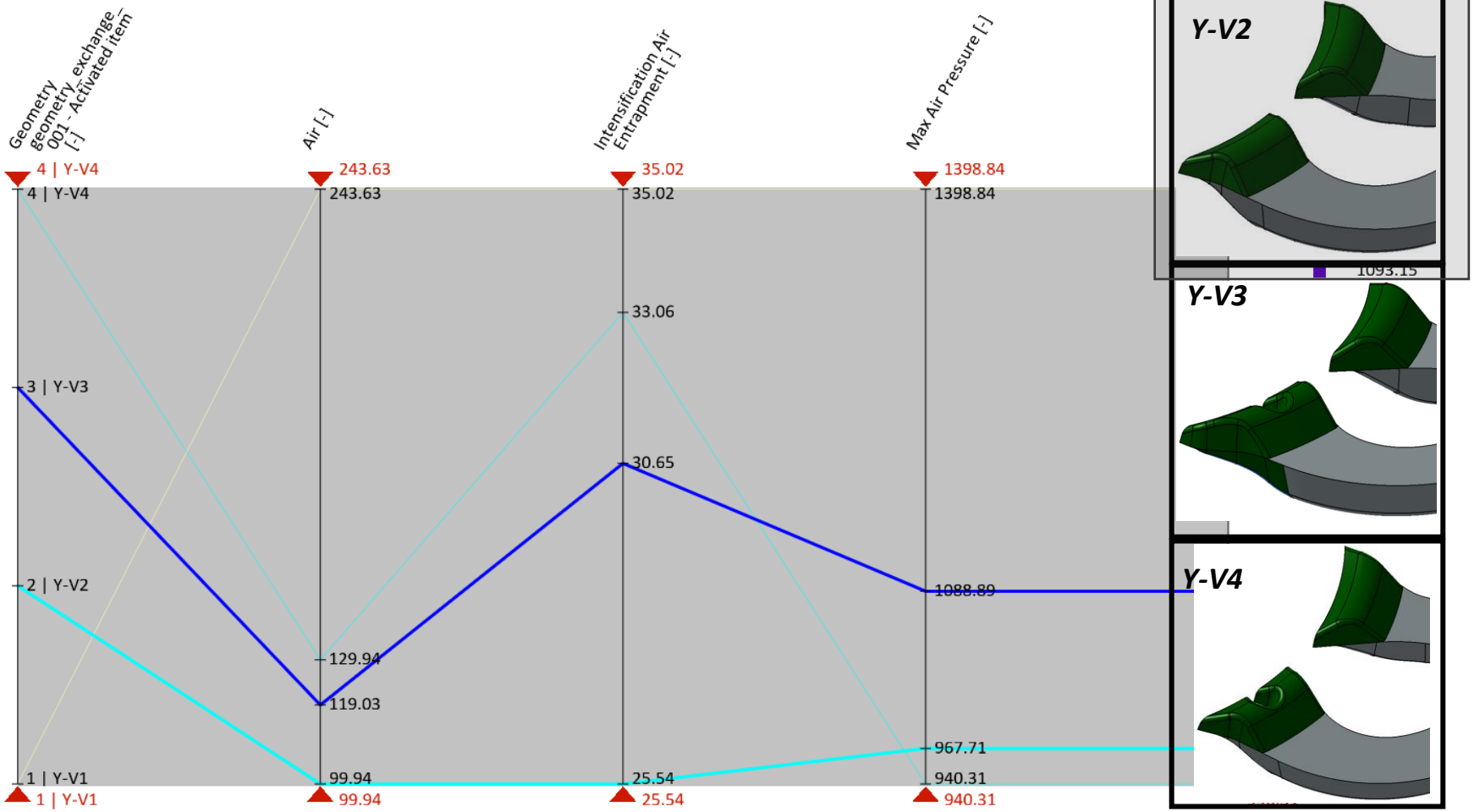
Name	Type	Value	Expression
Reduce Air Pressure	Minimize		{Cycle 5/Filling/Max Air Pressure/End of Filling/Max/Casting All IDs}
Air	Minimize		{Cycle 5/Filling/Air/End of Filling/Max/Casting All IDs}
Intensification Air Entrapment	Minimize		{Cycle 5/Filling/Intensification Air Entrapment/Max/Casting All IDs}
Max Air Pressure	Minimize		{Cycle 5/Filling/Max Air Pressure/End of Filling/Max/Casting All IDs}

Design	Geometry geom...	Air (-)	Intensification Ai...	Max Air Pressure...	Reduce Air Press...
Design 2	2 | Y-V2	99.94	25.54	967.71	967.71
Design 4	4 | Y-V4	129.94	33.06	940.31	940.31
Design 3	3 | Y-V3	119.03	30.65	1088.89	1088.89
Design 1	1 | Y-V1	243.63	35.02	1398.84	1398.84



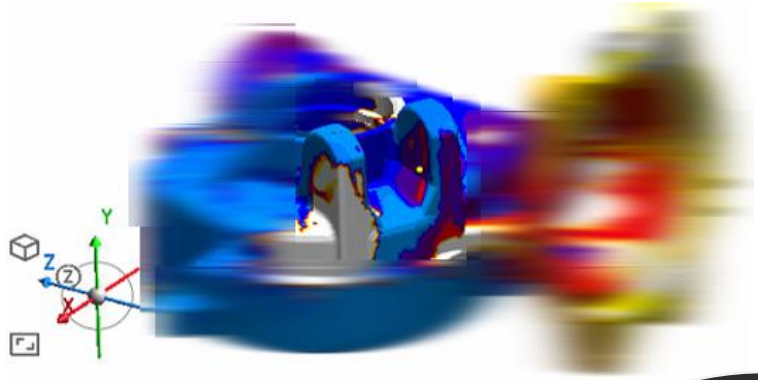
CANMETAL

Geometry Exchange Optimization



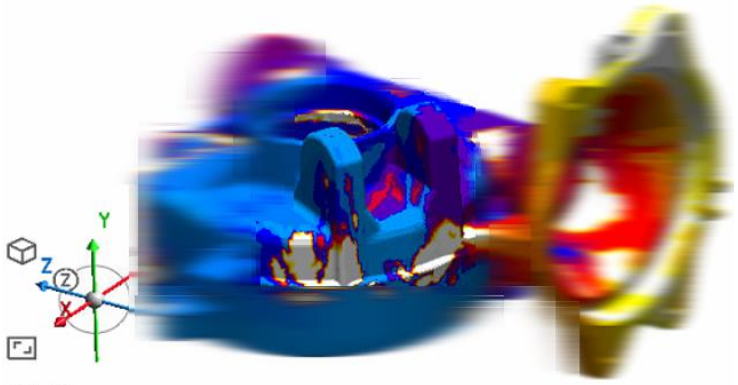
Selected Design(s): 2;3

Geometry Exchange Optimization



v02_d1
Cycle 5, Filling, Max Air Pressure
3.171s, 100.00 %
X-Ray: on

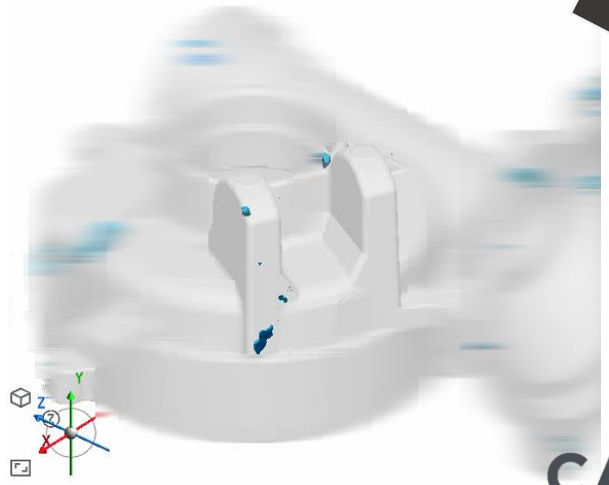
Max Air Pressure



v02_d2
Cycle 5, Filling, Max Air Pressure
3.171s, 100.00 %
X-Ray: on

v02_d1
Cycle 5, Filling, Intensification Air Entrapment
3.171s
X-Ray: on, range [1.00, 35.02] %

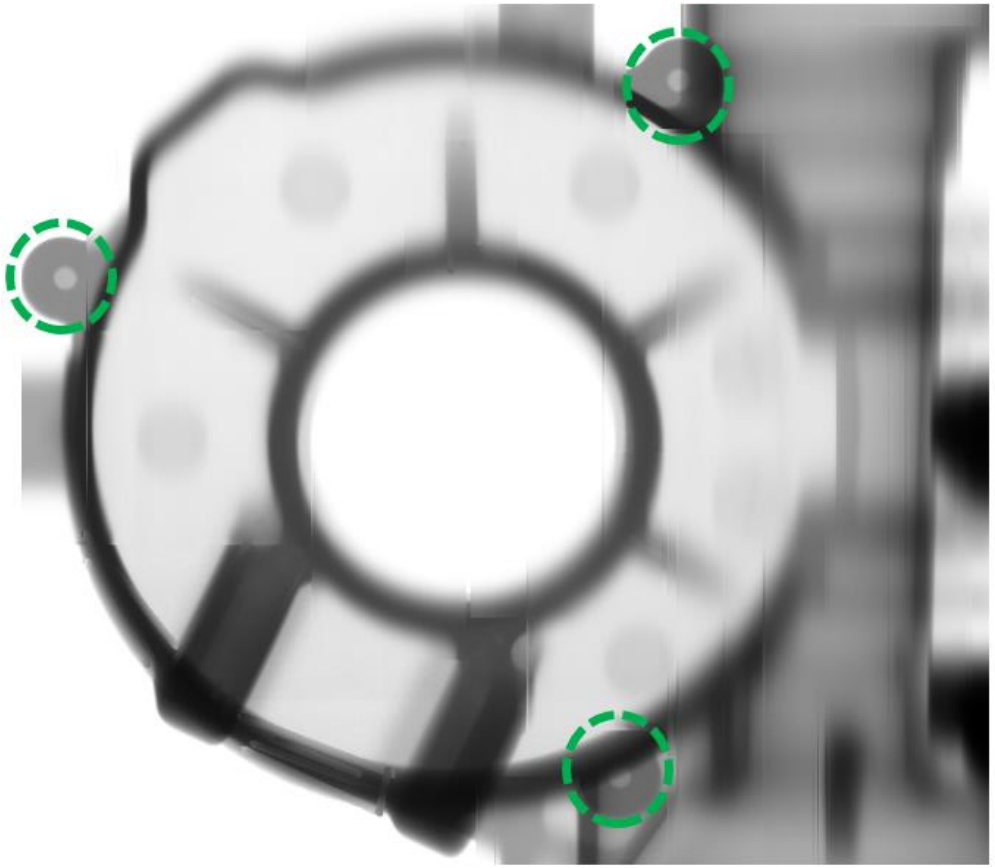
Intensification Air



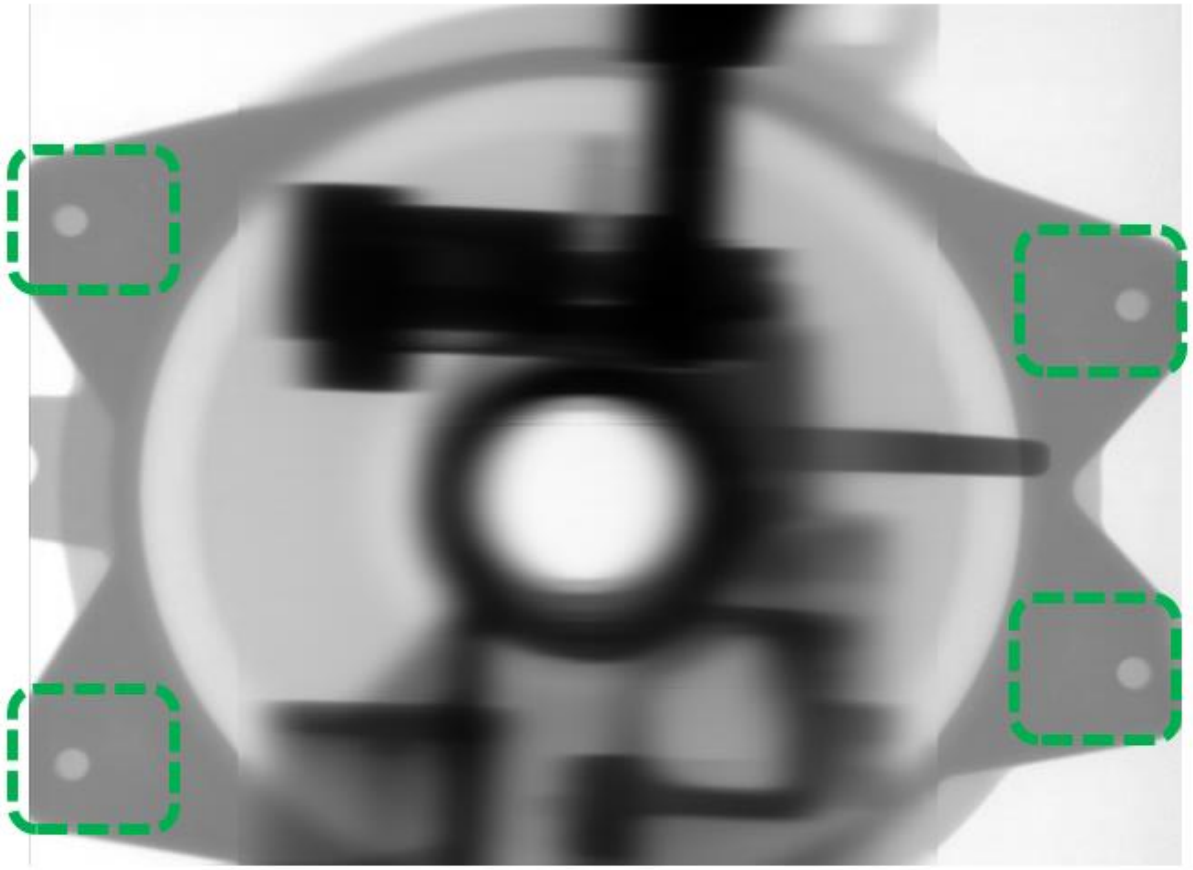
v02_d2
Cycle 5, Filling, Intensification Air Entrapment
3.171s
X-Ray: on, range [1.00, 25.54] %

CANMETAL

X-Ray Result



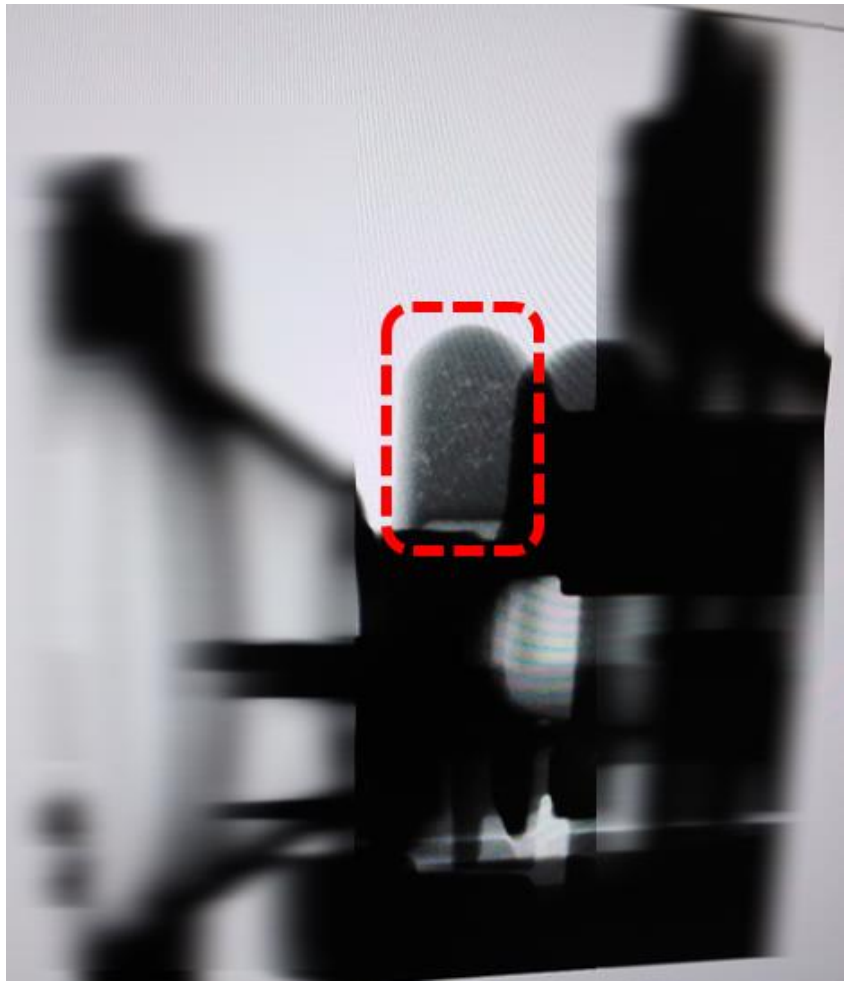
X-ray Result after 'pre hole' addition.



X-ray Result after 'pre hole' and 'jet cool' addition.

CANMETAL

X-Ray Result



Before

After

CANMETAL

Machining Result

Before

After

CANMETAL

Conclusions of Studies

The scrap rate was reduced from 9.2% to 3.7% as a result of the improvements made.

Conclusion of the Studies;

- *Production Efficiency Increased* ↑
- *Scrap cost decreased* ↓
- *Scrap rate decreased* ↓
- *Standardization of part quality was achieved.*

CANMETAL

CANMETAL