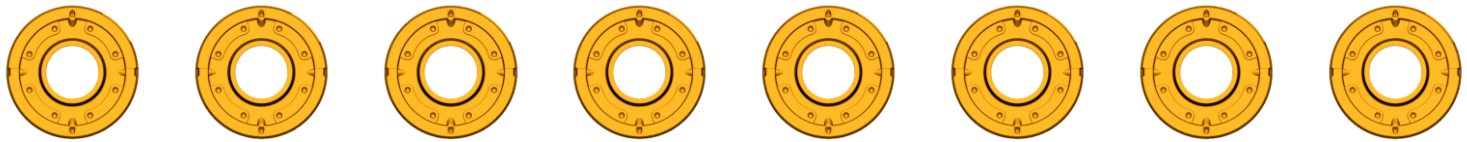
HOW TO ACHIEVE THE BEST COMPACT GATING DESIGN AND BALANCED FILLING FOR MULTI-CAVITY HPDC?



PLANT

KEMALPASA:

Foundry, Machining, Cleaning,Assembly

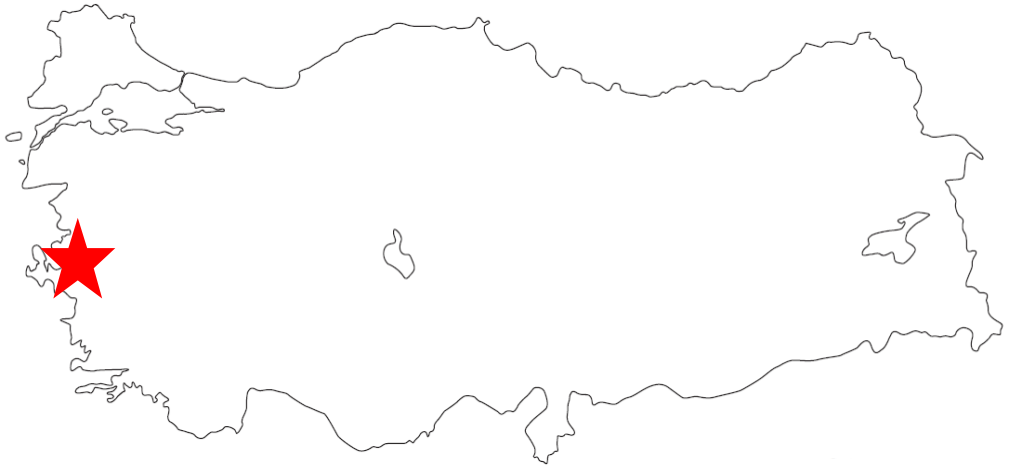
- 27.000 m² Land
- 14.000 m² Closed Area

AEGEAN FREE ZONE:

Pump Assembly line

1.200 m² Closed area

2 Plants in İzmir:



CAPABILITIES – FOUNDRY & MACHINING

FOUNDRY

- 20 casting cell
- 13.000 ton/year Casting Capacity (net)
- Fully automatic cells including trimming press

- 1900 TON
- 1650 TON
- 1350 TON x 2
- 1250 TON x2
- 900 TON x2
- 880 TON x3
- 750 TON
- 720 TON
- 550 TON
- 580 TON
- 550 TON
- 500 TON
- 400 TON x2
- 320 TON

MACHINING

Total 34 machining stations

- 9 Station: 5 Axis - Double Spindle - Double palet
- 15 Station: 4 Axis - Double palet
- 7 Station: 3 Axis - Double palet

CAPABILITIES – QUALITY & ENGINEERING

QUALITY

- X-Ray Machines
  - 1- YXLON -CT Analysis
  - 2- BOSELLO –Xray
- 3D Measuring
  1. ZEISS CONTURA x2
  2. DEA x2
- Optical control unit ZEISS - COMET L3D 2M
- Cleanliness Test Control Laboratory
- Spectrometer (x 2pcs).
- Metalurgical Microscope
- Density & Density Index Measurement Device
- Profile Projector
- Roughness Measurement Equipment
- Industrial Endoscope

ENGINEERING

- PROTOTYPE PRODUCTION
- COMPLETE PART DESIGH
- COMPLETE MOLD DESIGN
- TEST LABORATORY;
  - 2 Pc electric pump performance test station
  - 2 Pcs endurance test stations
  - 1 Pc Dynomometer brake test system
  - 1 Pc Climatic test cabin

MAGMA ANSYS

3DS CATIA PLM Software SIEMENS NX creo®

CUSTOMERS

Audi

RENAULT NISSAN MITSUBISHI

BMW

VOLVO

VOLVO TRUCKS

DAIMLER

Cummins Filtration

Perkins

SOGEFI

CAT

Donaldson
Filtration Solutions

JCB

AFSI
Advanced Filtration Systems Inc.

Evamo Pump Technology Solutions

Otokar

DELPHI

IVECO

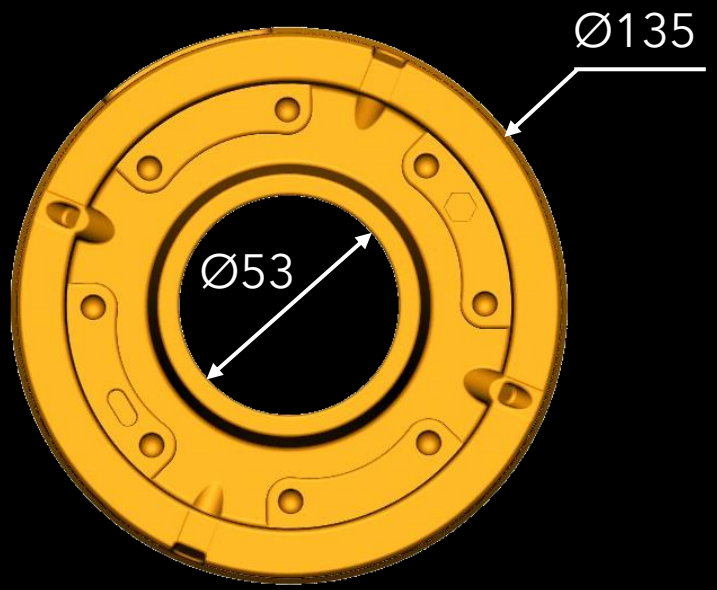
NEW HOLLAND AGRICULTURE

TürkTraktör

VIESSMANN

E.C.A
YILLARCA BERABER

PART DETAILS



Part weight : 280 gr

Projection area of one part : 122 cm^2

- **THE LIMITS;**
- Die will be 8 Cavity
- Machine capacity 1.900 Ton

THE TARGETS;

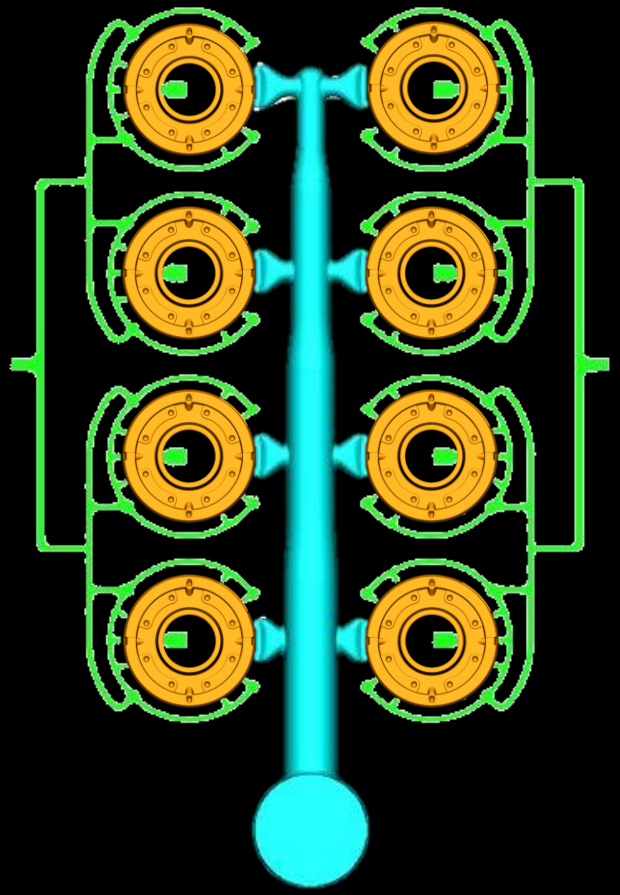
- Total projection area ~1.900 cm^2

Parts 972 cm^2 Rest ~928cm^2

- Equal filling property on each cavity
- Good thermal balance
- Equal ventilation

ALTERNATIVE DESIGNS FOR THE RUNNER

V01



PROS:

- Meet target surface area ~1.890 cm^2
- Ventilation is easy
- Maintaining thermal balance is easy.

CONS:

- No equal filling.

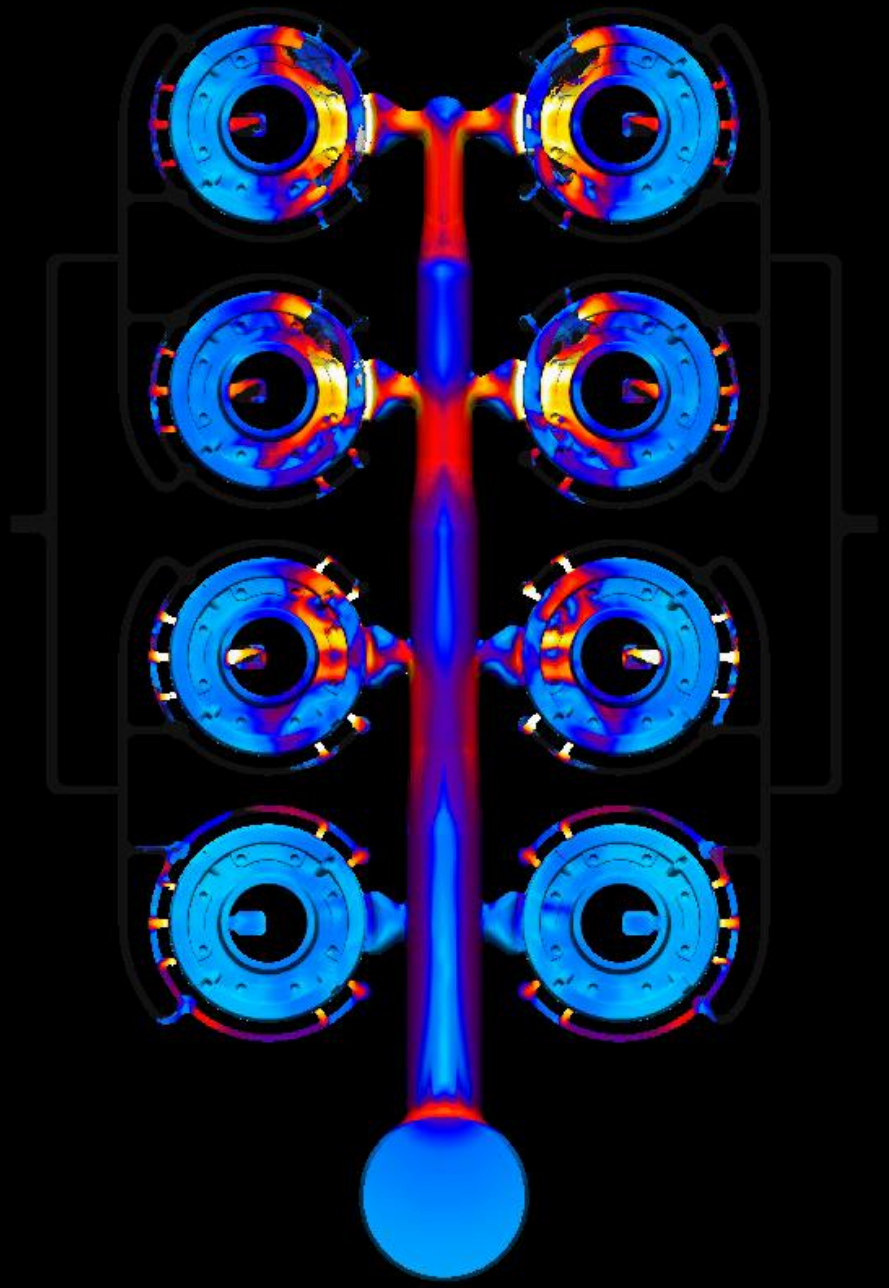
V01

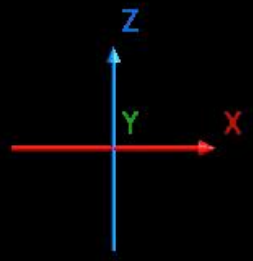
PROS:

- Meet target surface area ~1.890 cm^2
- Ventilation is easy
- Maintaining thermal balance is easy.

CONS:

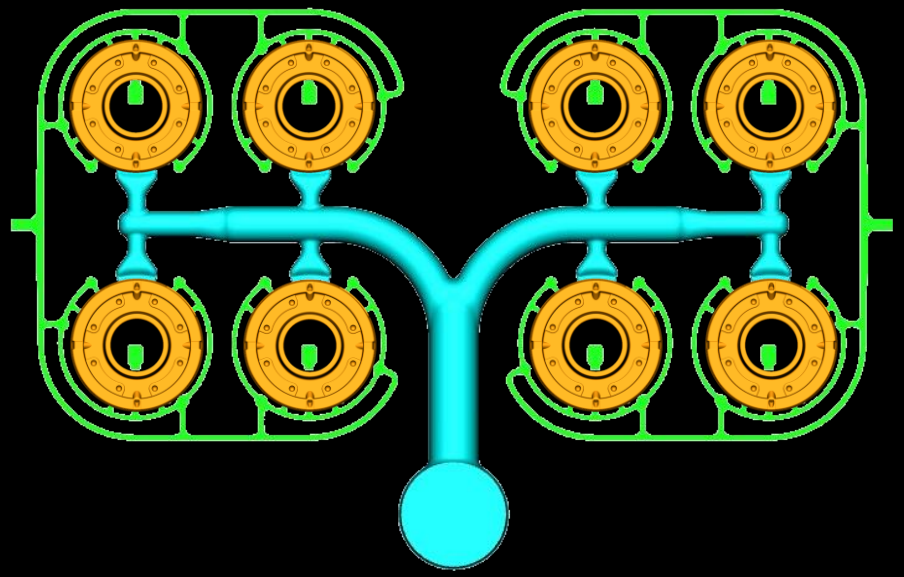
- No equal filling.





Cycle 6, Filling, Absolute Velocity
4.720s, 91.01 %
Plunger position: 547.99 mm
X-Ray: on

V02



PROS:

- Meet target surface area ~1.945 cm^2
- Ventilation is easy

CONS:

- No equal filling.
- Maintaining thermal balance is challenging
- Second phase point is far from the parts.

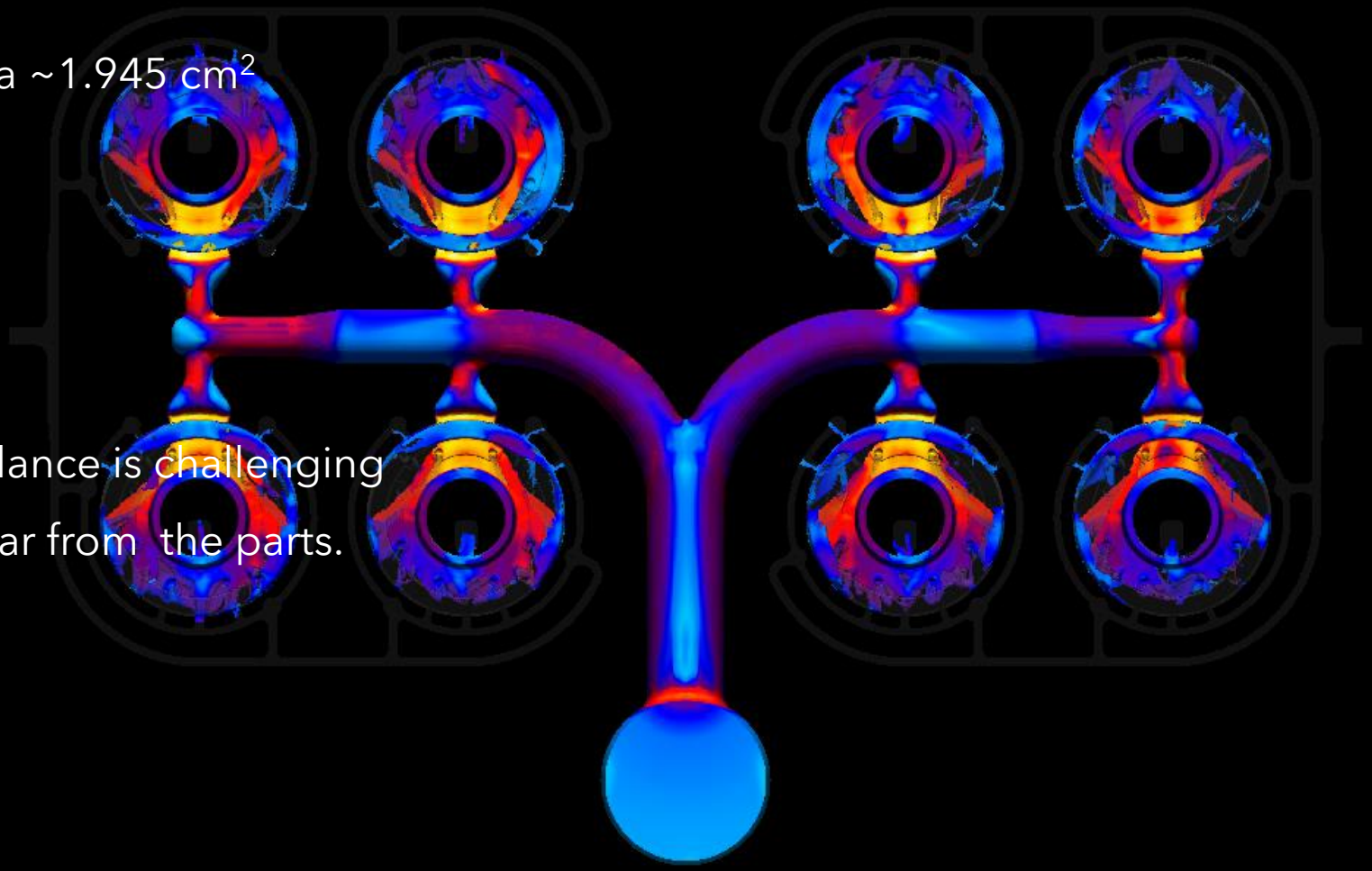
V02

PROS:

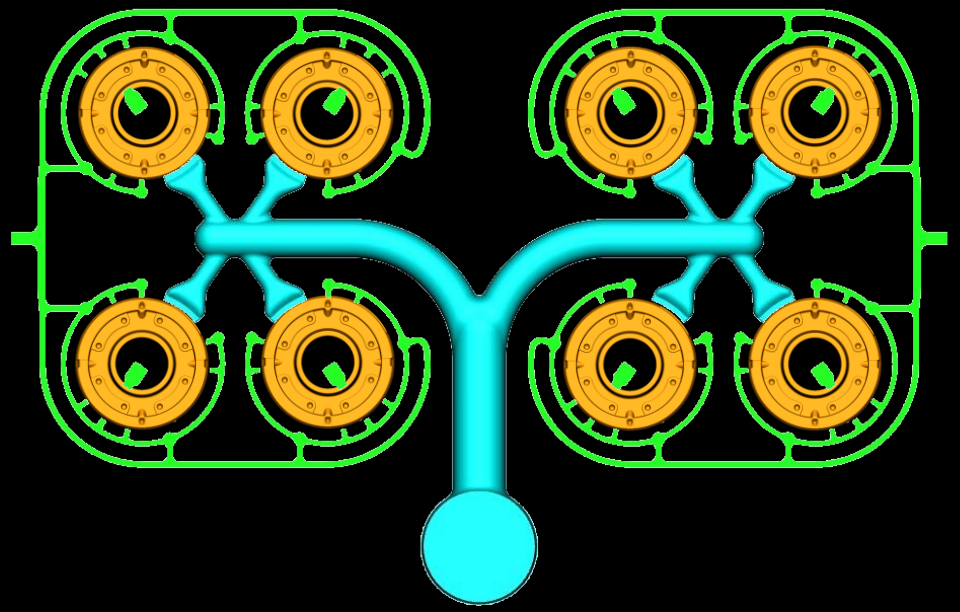
- Meet target surface area ~1.945 cm^2
- Ventilation is easy

CONS:

- No equal filling.
- Maintaining thermal balance is challenging
- Second phase point is far from the parts.



V03



PROS:

- Meet target surface area ~1.960 cm^2
- Nearly equal filling
- Easy ventilation
- Second phase point is close to the parts

CONS:

- Reverse filling on the center parts
- Maintaining thermal balance is challenging

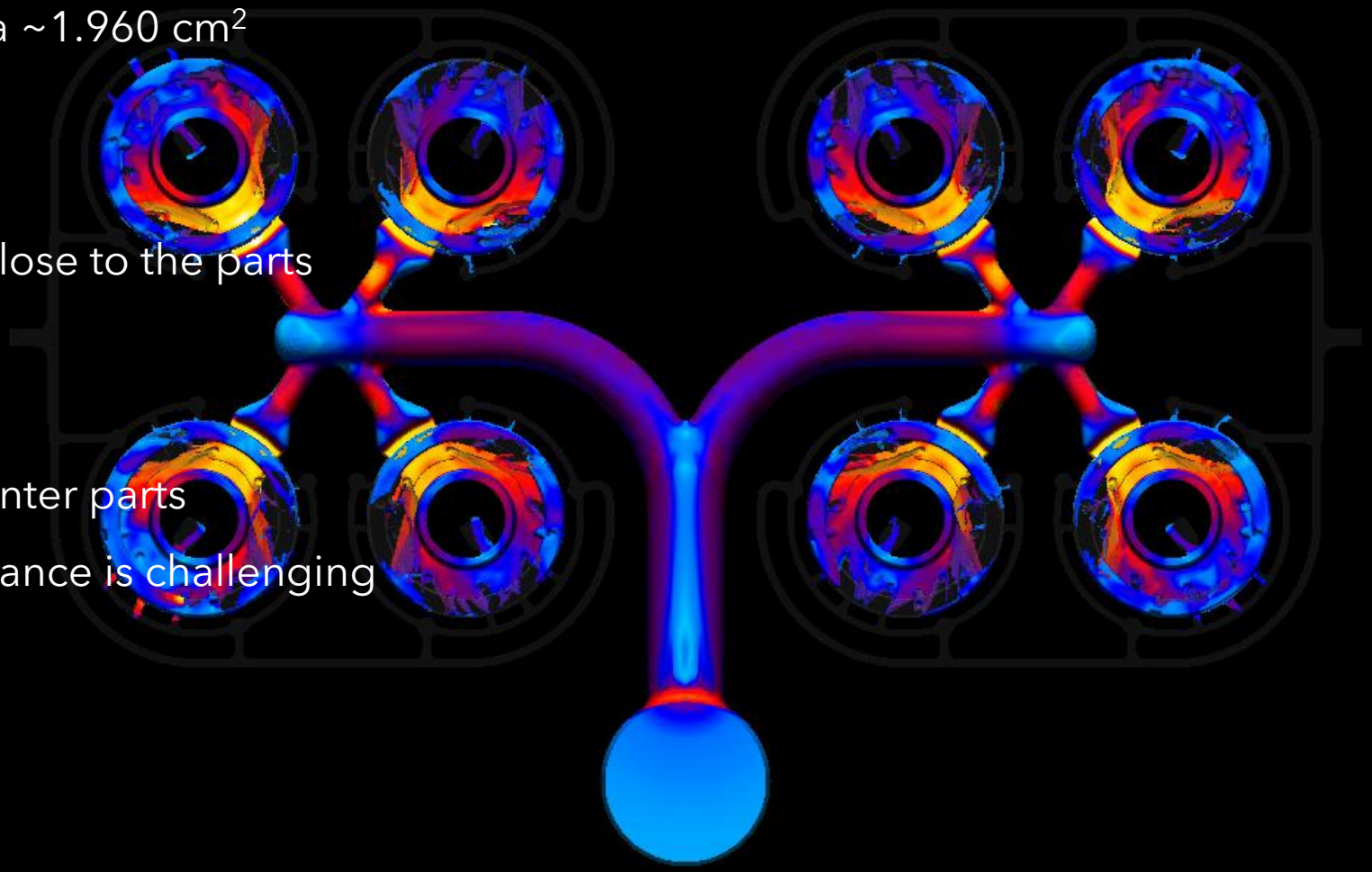
V03

PROS:

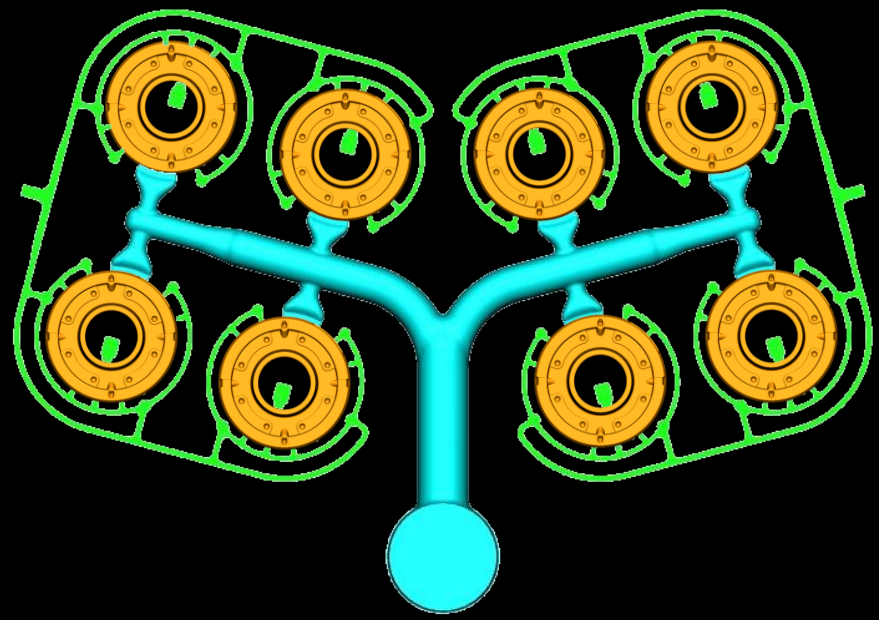
- Meet target surface area ~1.960 cm^2
- Nearly equal filling
- Easy ventilation
- Second phase point is close to the parts

CONS:

- Reverse filling on the center parts
- Maintaining thermal balance is challenging



V04



PROS:

- Meet target surface area ~1.910 cm^2
- Ventilation is easy
- Shorter main runner

CONS:

- Lost equal filling
- Maintaining thermal balance is challenging
- Second phase point is far from the parts

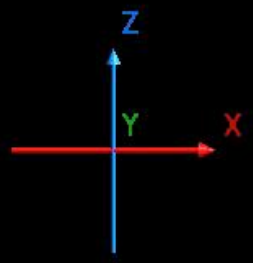
V04

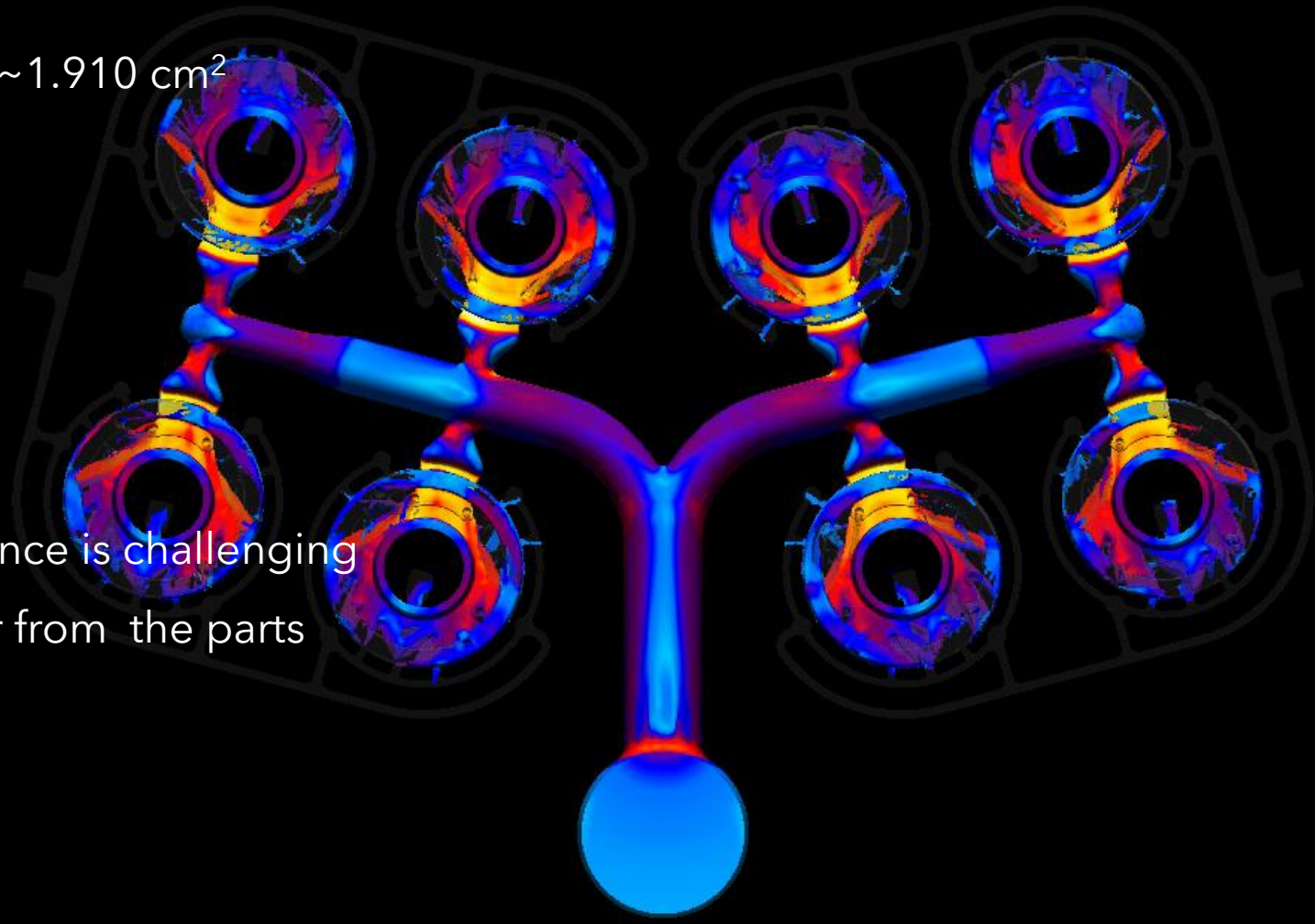
PROS:

- Meet target surface area ~1.910 cm^2
- Ventilation is easy
- Shorter main runner

CONS:

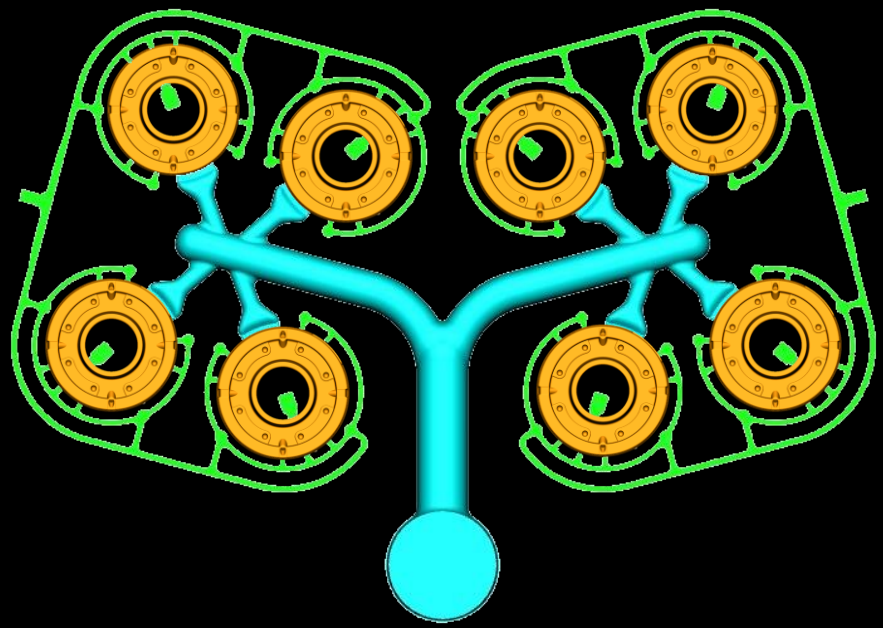
- Lost equal filling
- Maintaining thermal balance is challenging
- Second phase point is far from the parts





Cycle 6, Filling, Absolute Velocity
5.299s, 78.02 %
Plunger position: 511.92 mm
X-Ray: on

V05



PROS:

- Meet target surface area ~1.920 cm^2
- Easy ventilation
- Second phase point is close to the parts
- Shorter main runner

CONS:

- Reverse filling on the center parts
- Maintaining thermal balance is challenging

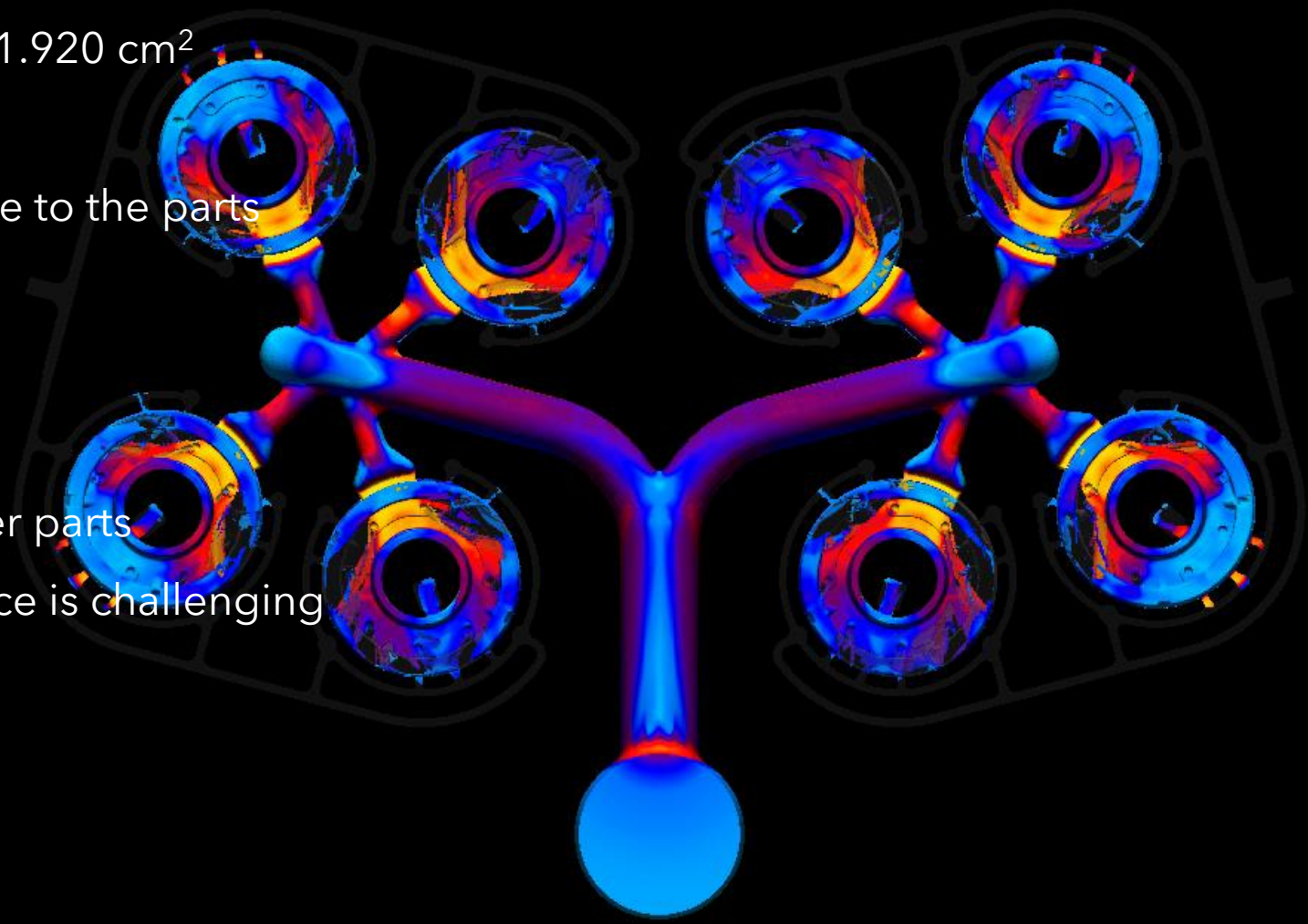
V05

PROS:

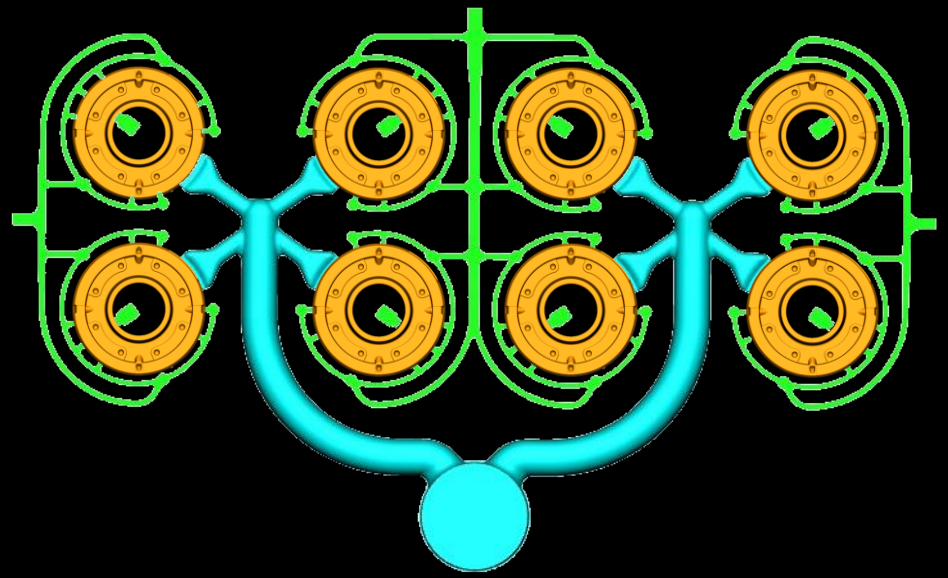
- Meet target surface area ~1.920 cm^2
- Easy ventilation
- Second phase point is close to the parts
- Shorter main runner

CONS:

- Reverse filling on the center parts
- Maintaining thermal balance is challenging



V06



PROS:

- Meet target surface area ~1.930 cm^2
- Equal filling
- Smooth and short upward movement on the main runner.
- Second phase point is close to the parts

CONS:

- Reverse filling on the center parts
- Thermal balance is not good
- Ventilation is challenging in center parts

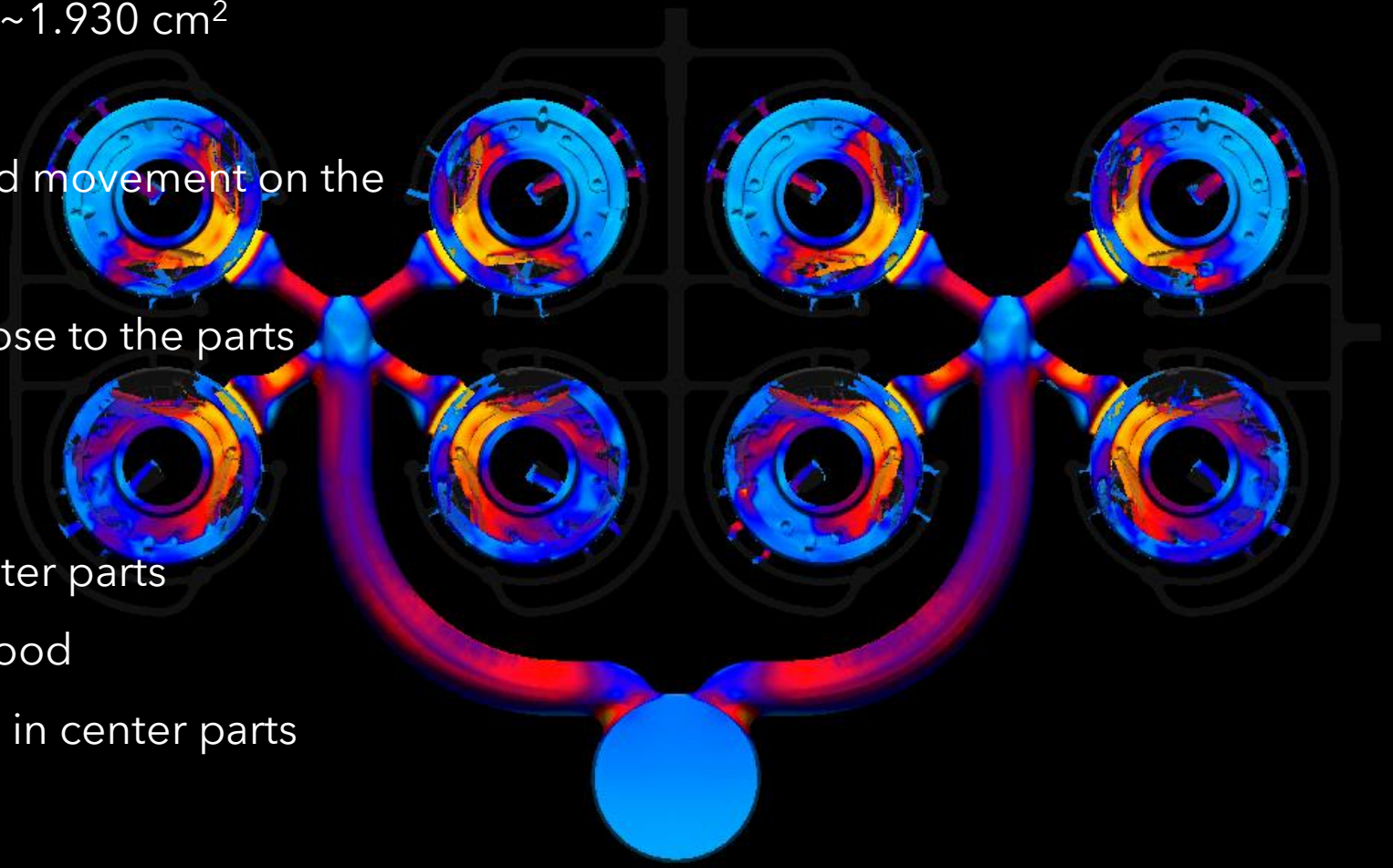
V06

PROS:

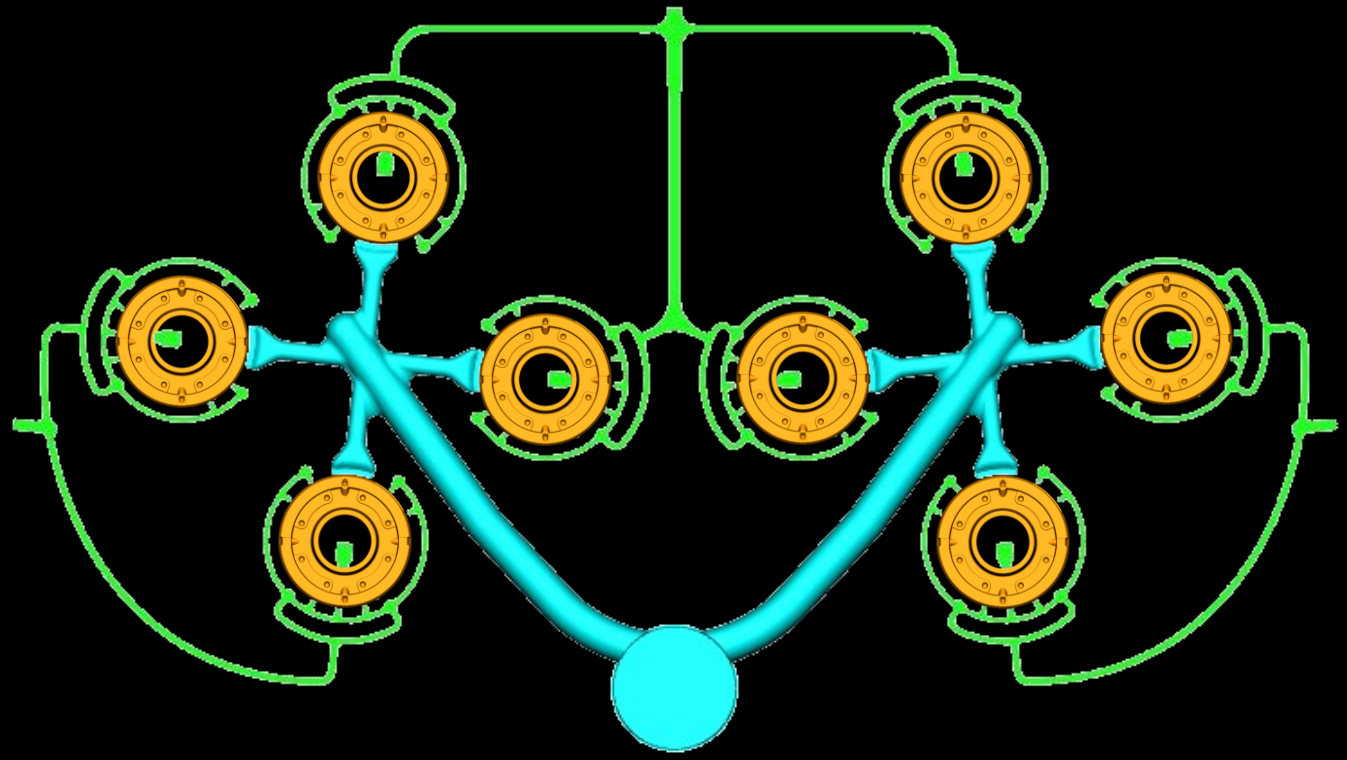
- Meet target surface area ~1.930 cm^2
- Equal filling
- Smooth and short upward movement on the main runner.
- Second phase point is close to the parts

CONS:

- Reverse filling on the center parts
- Thermal balance is not good
- Ventilation is challenging in center parts



V07



PROS:

- Meet target surface area ~1.940 cm^2
- Equal filling
- Smooth and short upward movement on the main runner.
- Ventilation is easy

CONS:

- Reverse filling on the center parts
- Maintaining thermal balance is challenging

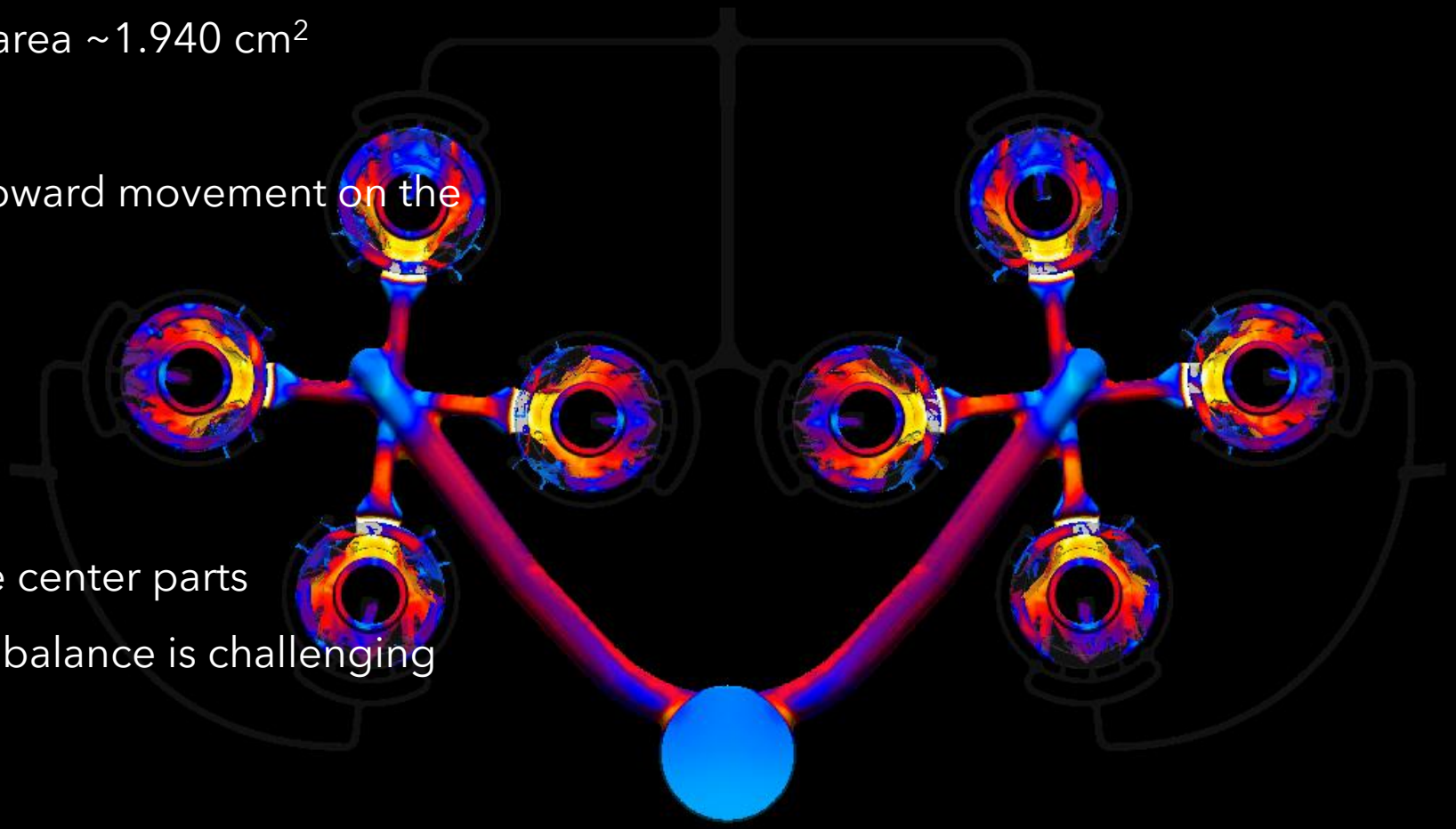
V07

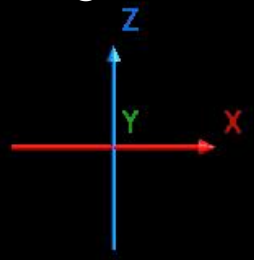
PROS:

- Meet target surface area ~1.940 cm^2
- Equal filling
- Smooth and short upward movement on the main runner.
- Ventilation is easy

CONS:

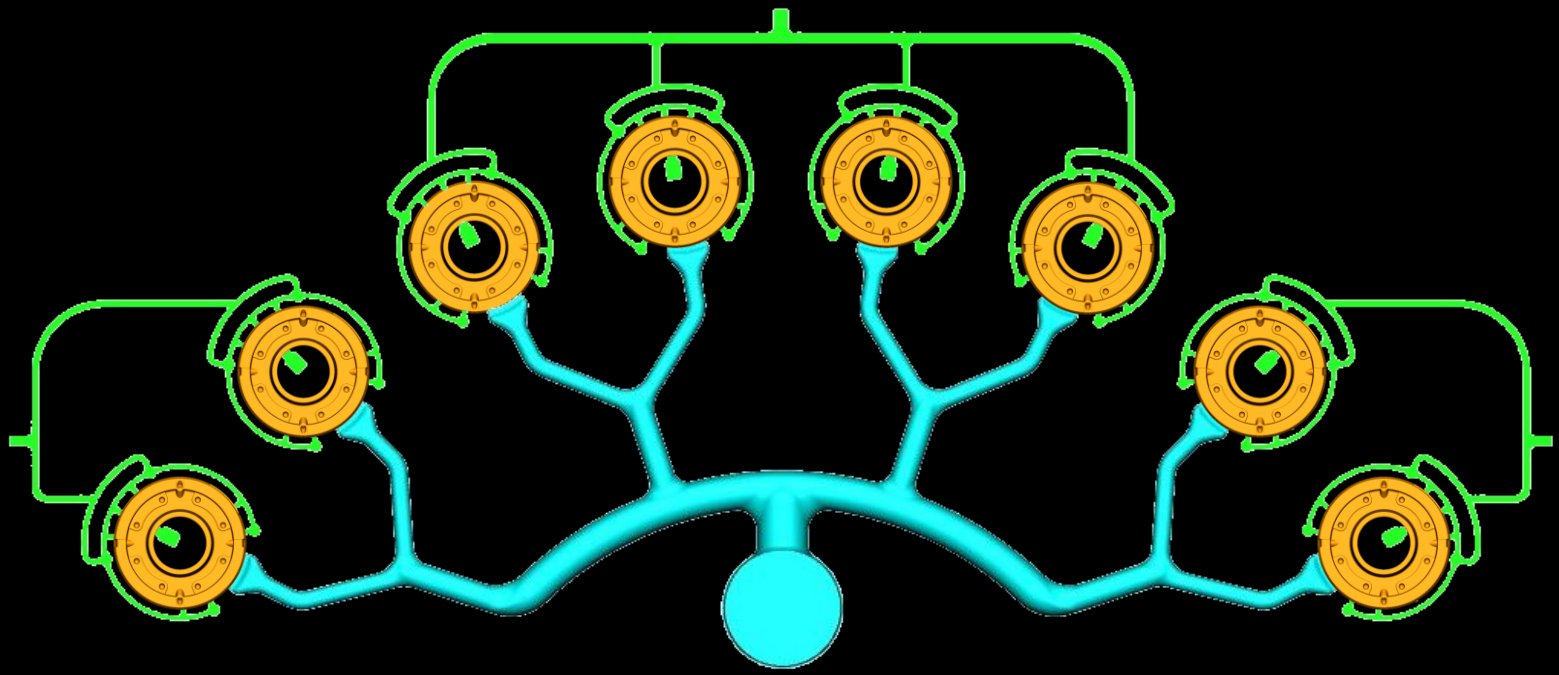
- Reverse filling on the center parts
- Maintaining thermal balance is challenging





Cycle 6, Filling, Absolute Velocity
5.425s, 78.00 %
Plunger position: 517.39 mm
X-Ray: on

V08



PROS:

- Equal filling
- Easy ventilation
- Maintaining thermal balance is easy.

CONS:

- Surface area is over target ~2.260 cm^2
- Second phase point is far from the parts
- Turbulence on the runner.

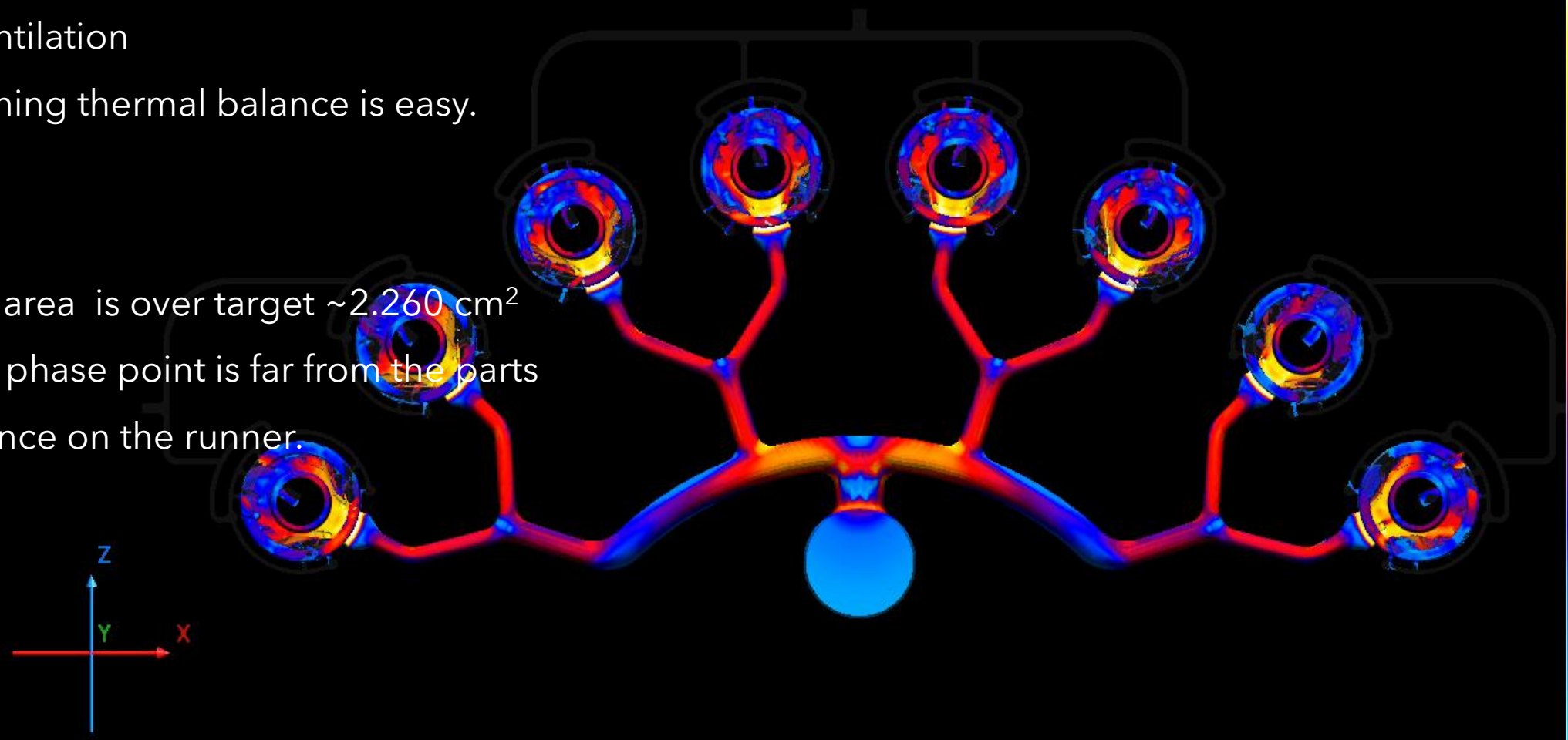
V08

PROS:

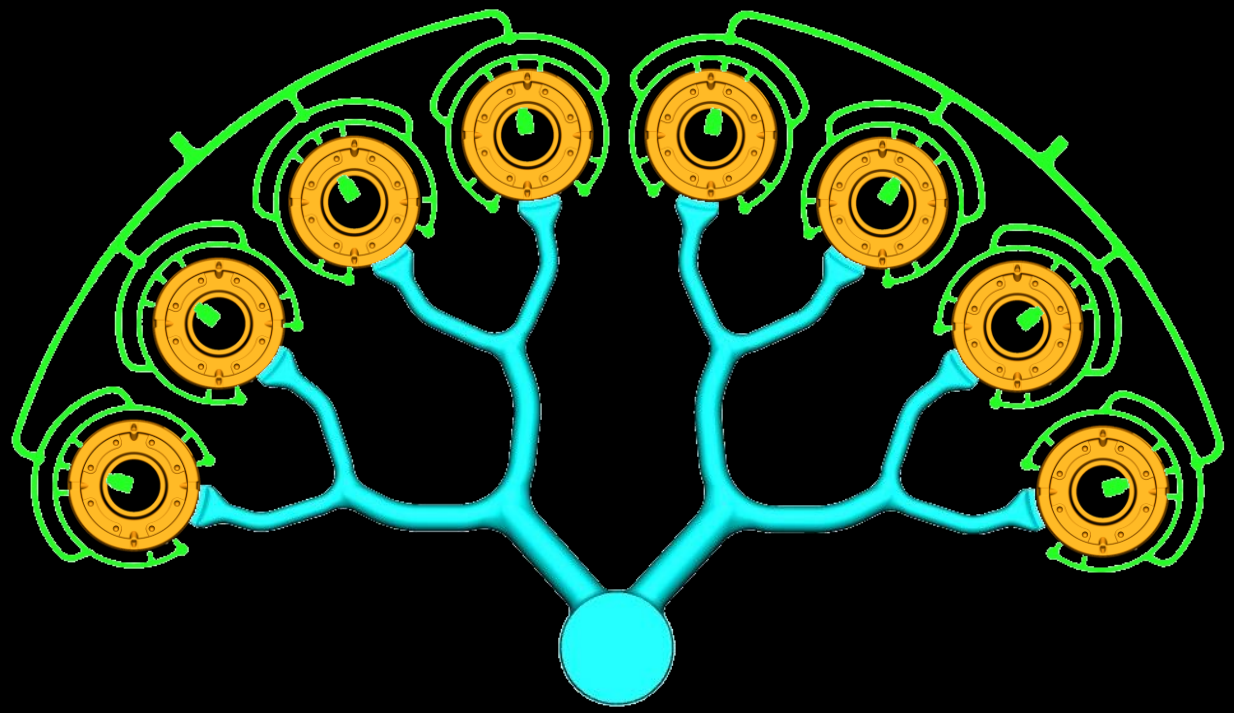
- Equal filling
- Easy ventilation
- Maintaining thermal balance is easy.

CONS:

- Surface area is over target ~2.260 cm^2
- Second phase point is far from the parts
- Turbulence on the runner.



V09



PROS:

- Equal filling
- Smooth upwards movement on the main runner.
- Easy ventilation
- Maintaining thermal balance is easy

CONS:

- Surface area is over target ~2.280 cm^2
- Socond phase point is far from the parts

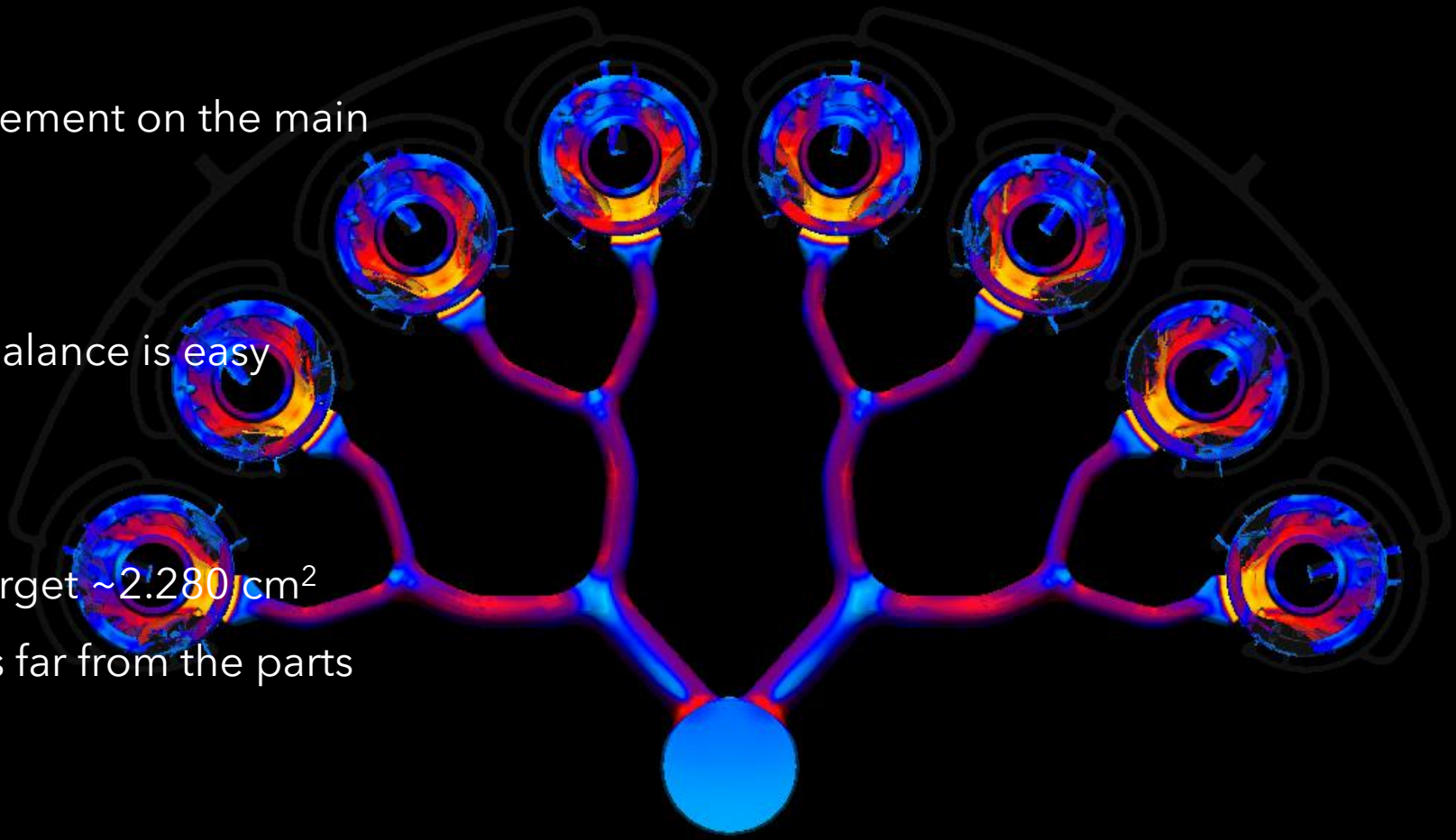
V09

PROS:

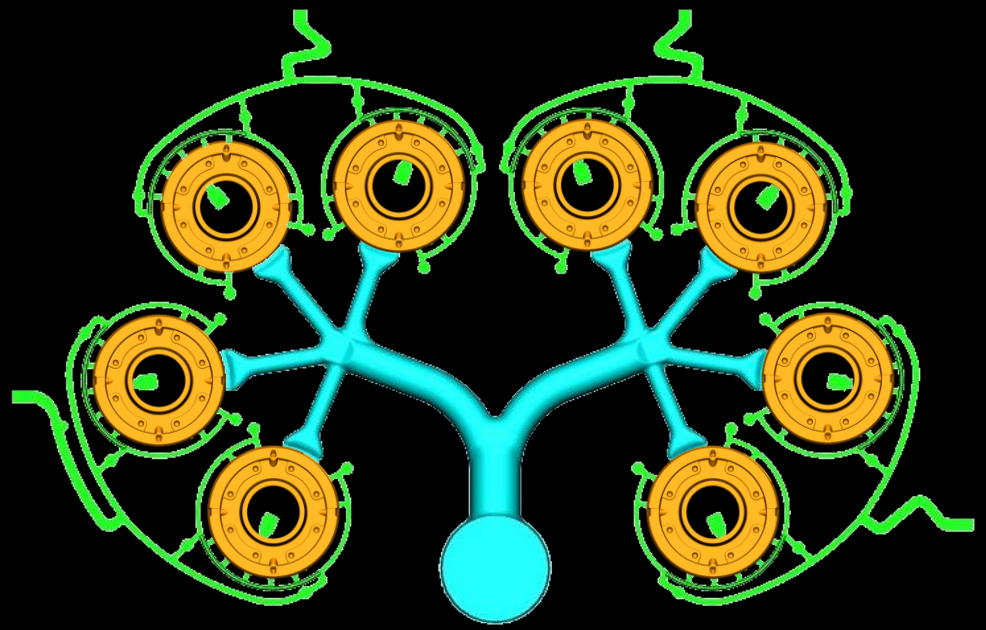
- Equal filling
- Smooth upwards movement on the main runner.
- Easy ventilation
- Maintaining thermal balance is easy

CONS:

- Surface area is over target ~2.280 cm^2
- Socond phase point is far from the parts



V10



PROS:

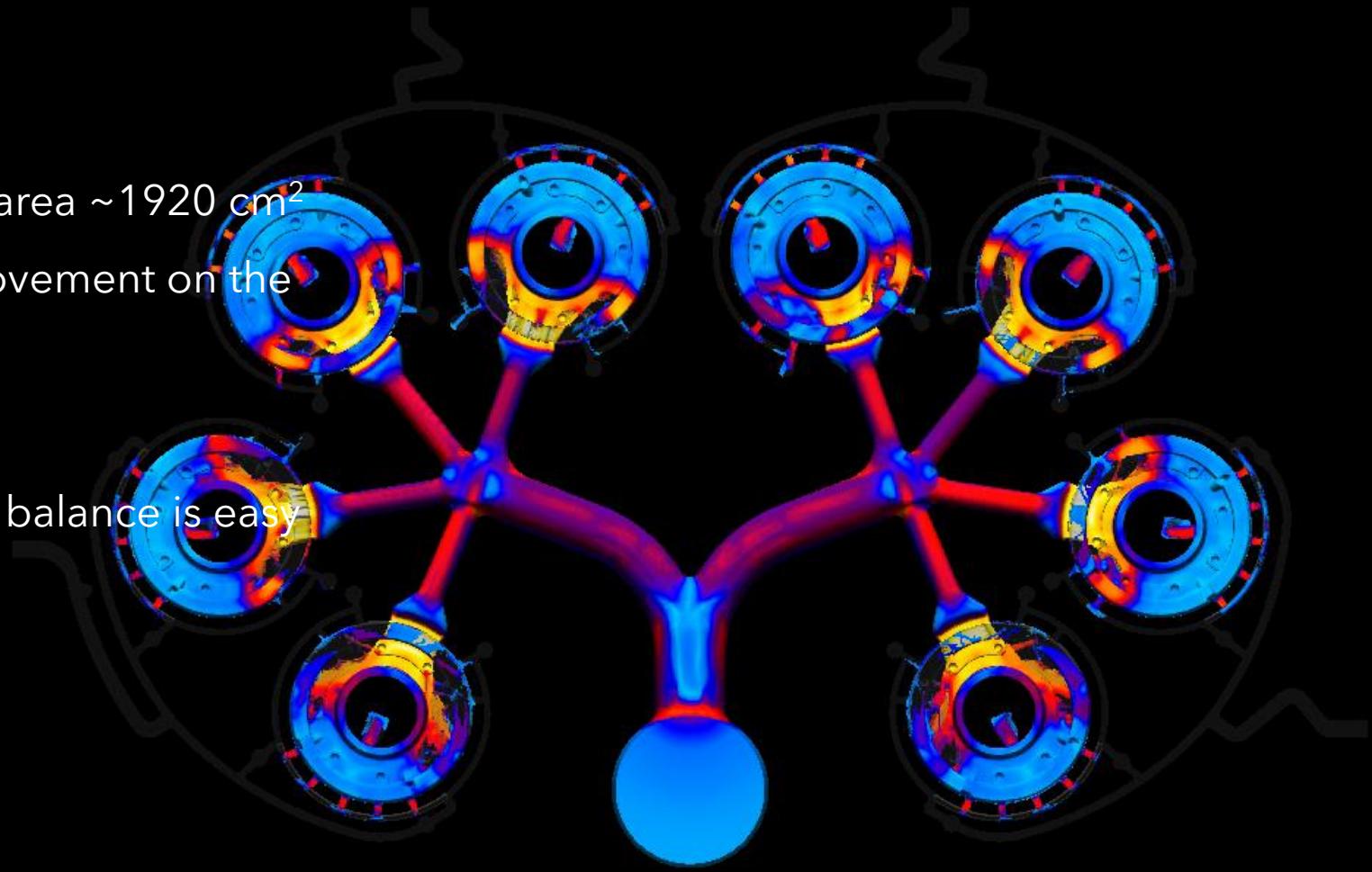
- Equal filling
- Meet target surface area ~1920 cm^2
- Smooth upwards movement on the main runner.
- Easy ventilation
- Maintaining thermal balance is easy

V10

GOOD TO GO !

PROS:

- Equal filling
- Meet target surface area ~1920 cm^2
- Smooth upwards movement on the main runner.
- Easy ventilation
- Maintaining thermal balance is easy



OPTIMIZATION

OPTIMIZATION PARAMETERS

Design Variables

Design Variables

Design Variable	Lower Limit (m/s)	Upper Limit (m/s)	Step (m/s)	Dependency
☑ Filling - First Phase - Final Plunger Velocity	0.1	0.2	0.05	<None>
Design Variable	**Lower Limit (mm)**	**Upper Limit (mm)**	**Step (mm)**	**Dependency**
☑ Filling - Acceleration Phase - Start - At Plunger Position	395.0	405.0	5.0	<None>

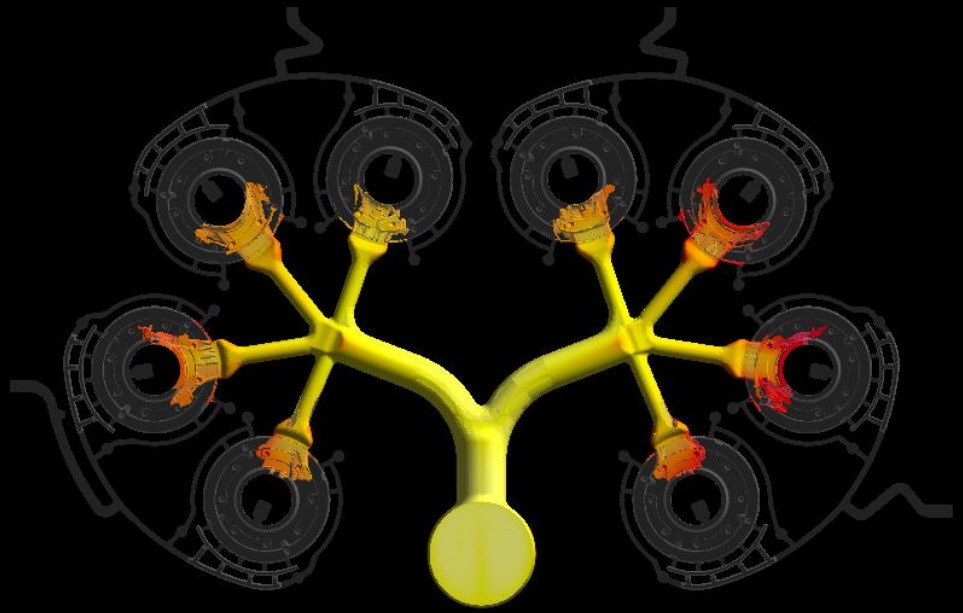
Data Table

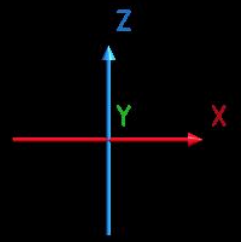
All designs
<Pareto Set>
Marked

Rank	Design	Filling - Acceleration P...	Filling - First Phase - Fi...	Air (-)	Balanced Filling (-)	Smooth Filling (-)
Rank 1	Design 6	400.0	0.2	40.04	862.03	67741.54
Rank 2	Design 3	395.0	0.2	112.78	863.35	67573.45
Rank 3	Design 5	400.0	0.15	94.93	862.64	69476.53
Rank 4	Design 8	405.0	0.15	137.94	860.97	70893.16
Rank 5	Design 9	405.0	0.2	254.48	852.96	67437.88
Rank 6	Design 2	395.0	0.15	127.84	874.15	69965.16
Rank 7	Design 1	395.0	0.1	172.83	927.08	70226.06
Rank 8	Design 7	405.0	0.1	55.73	920.67	75461.25
Rank 9	Design 4	400.0	0.1	159.02	923.86	73501.73

ACCELERATION POINT AFTER OPTIMIZATION

DESIGN-6

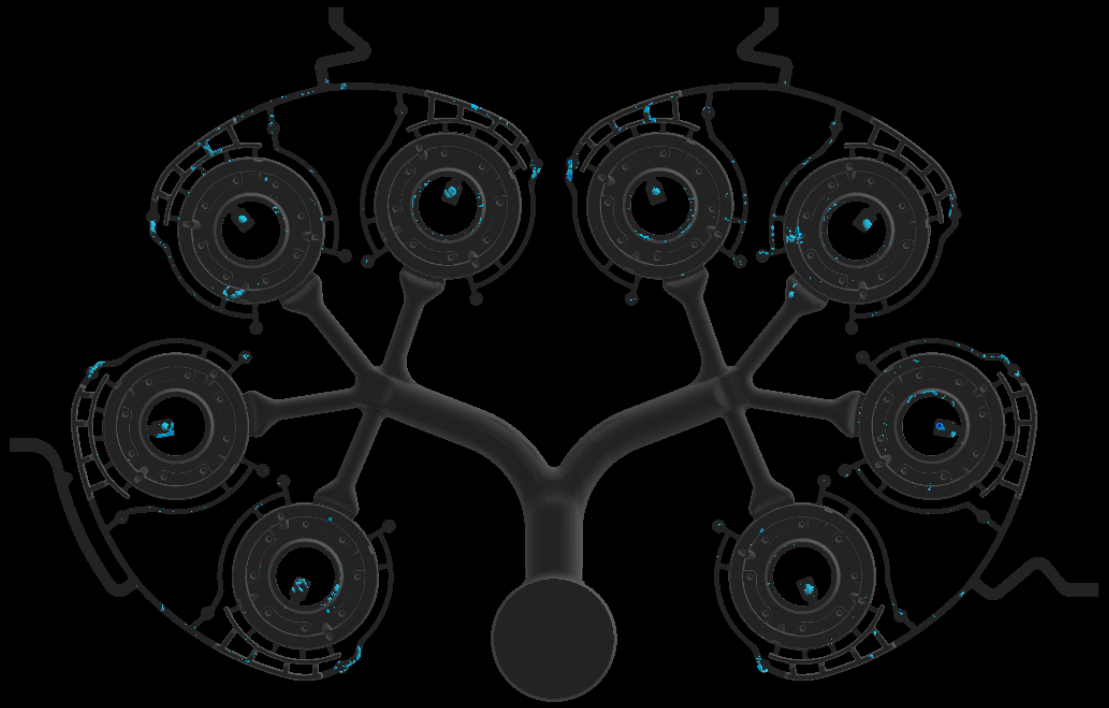


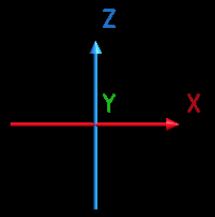


WHT_011_290
Filling, Temperature
4.018s, 56.00 %
Plunger position: 459.53 mm
X-Ray: on

AIR RESULT AFTER OPTIMIZATION

DESIGN-6

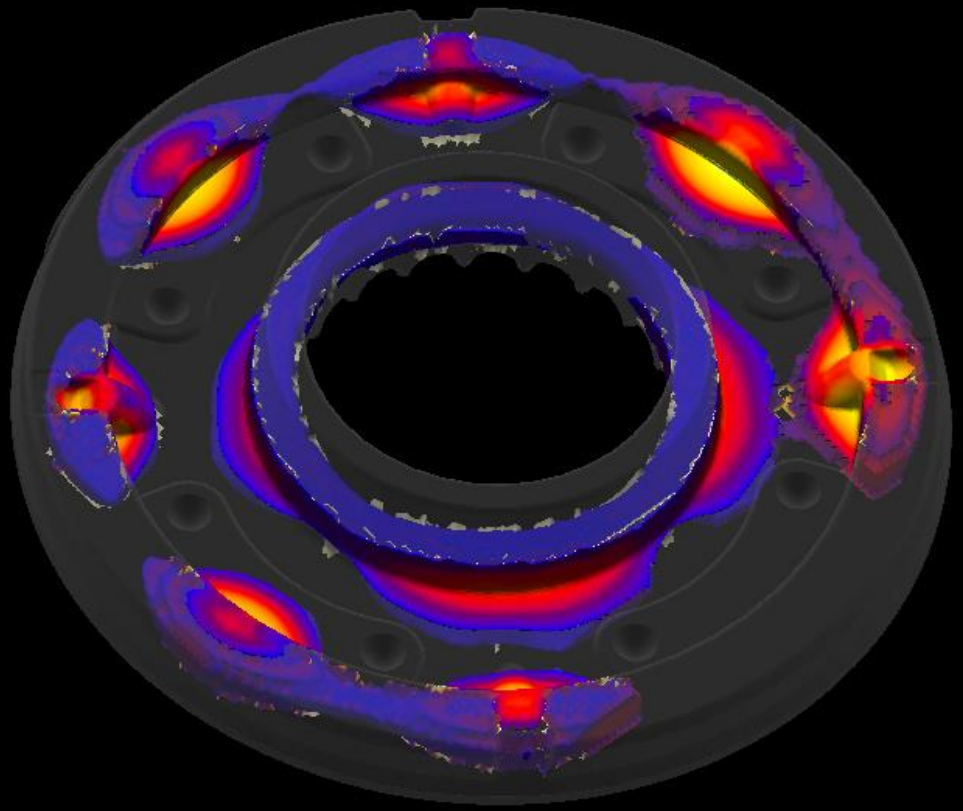


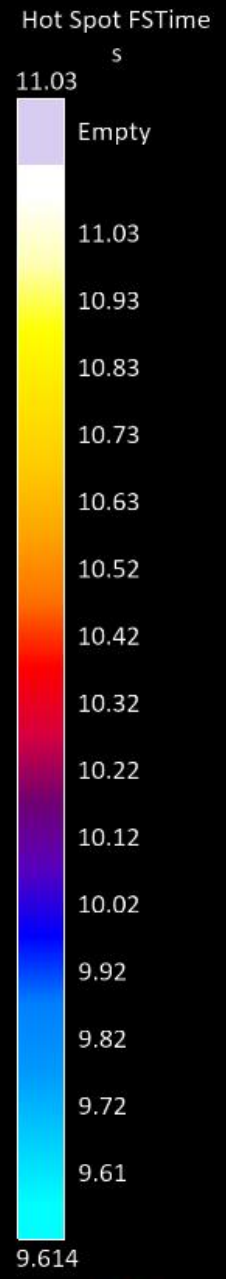


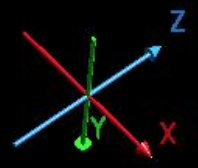
WHT_011_290
Filling, Air
4.047s, 100.00 %
Plunger position: 571.51 mm
X-Ray: on, range [3.00, 99.72] kg/m³

SOLIDIFICATION

HOT SPOT

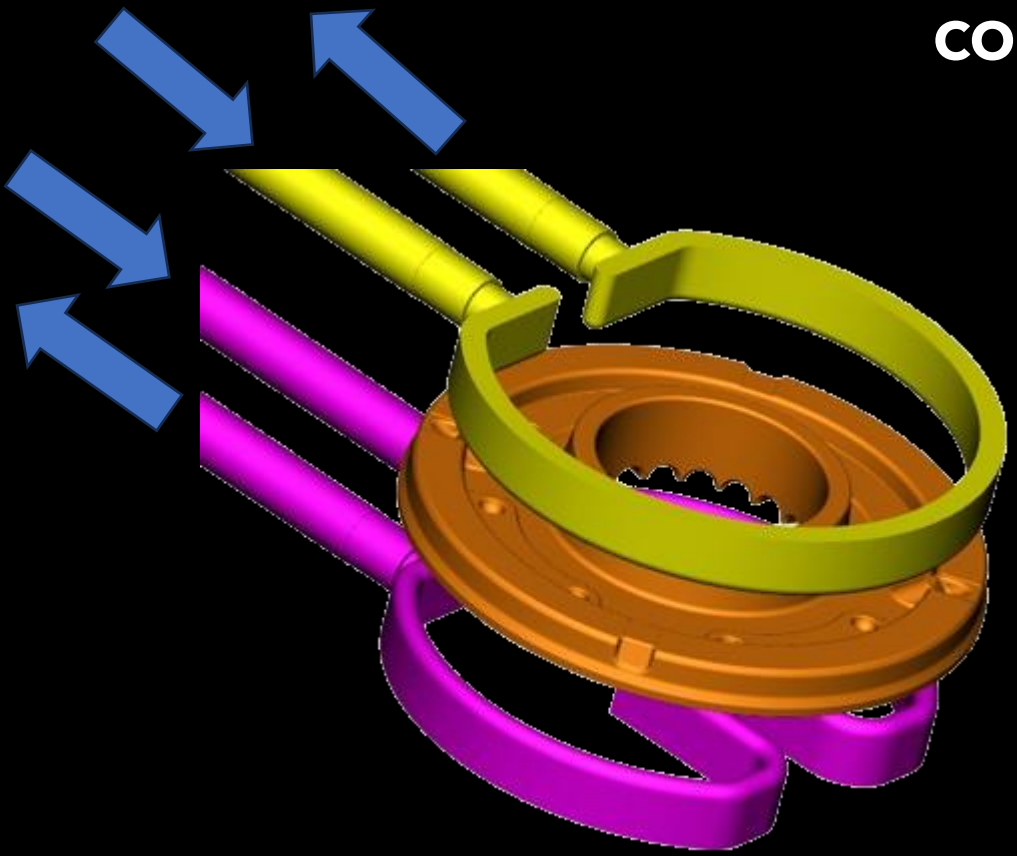


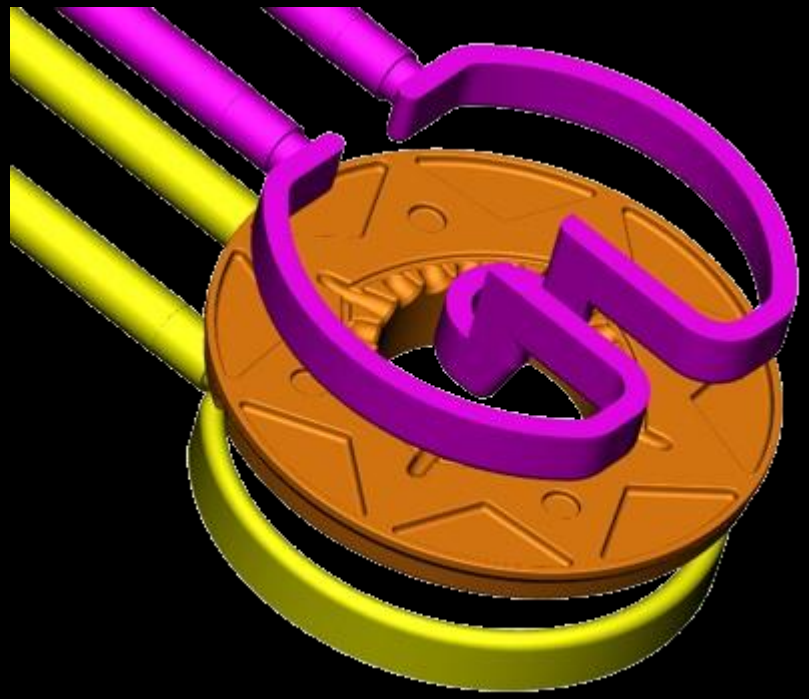


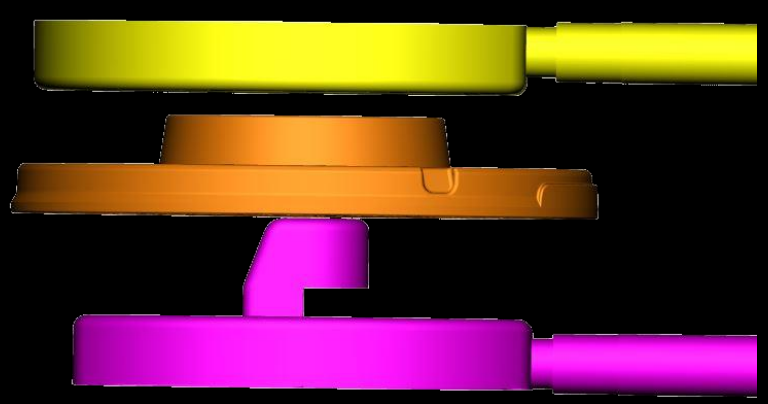


Cycle 6, Solidification & Cooling until Eject, Hot Spot FSTime
1min 43.2s, 92.50 %
X-Ray: on, range [10.00, 11.00] s

COOLING DESIGN



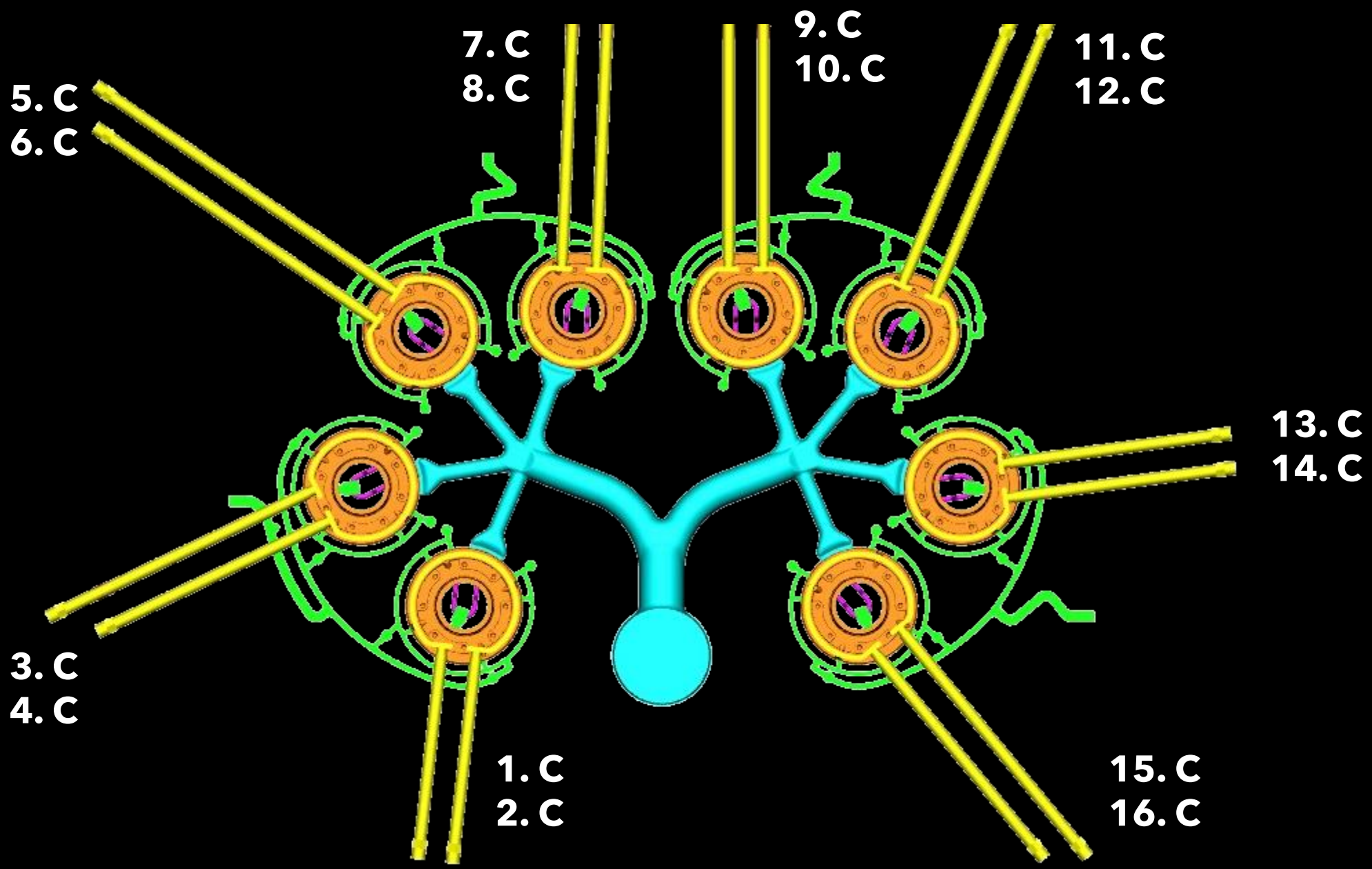




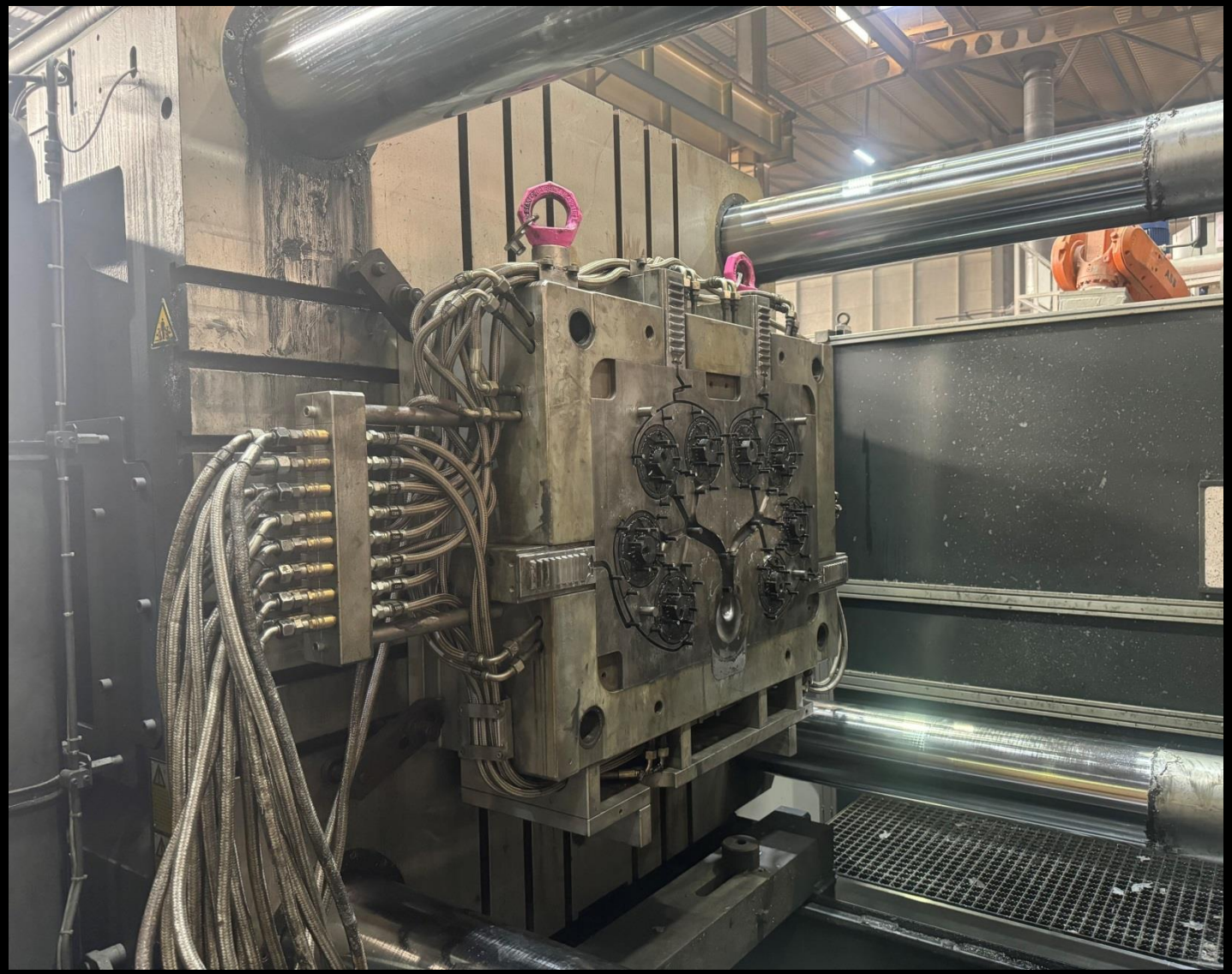
Cooling circuit fix side

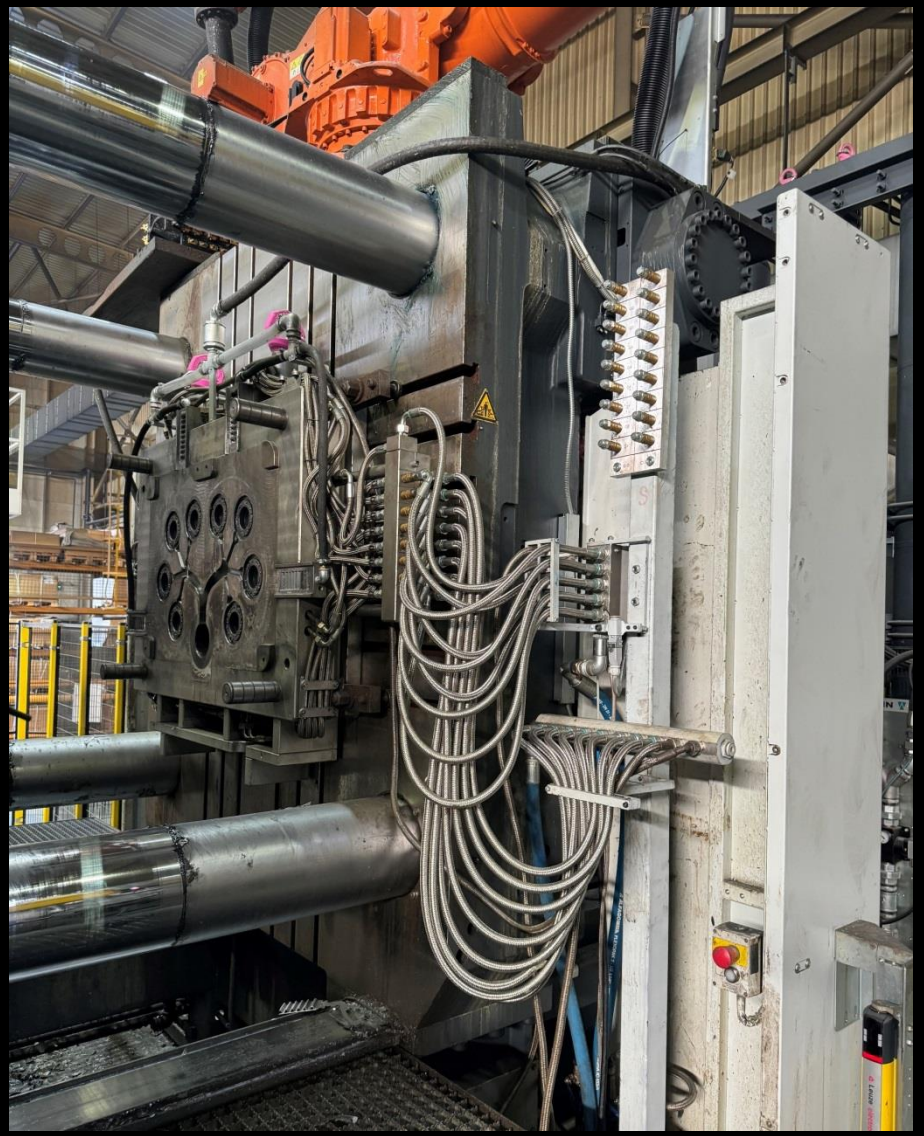
Cooling circuit mobile side

COOLING DESIGN

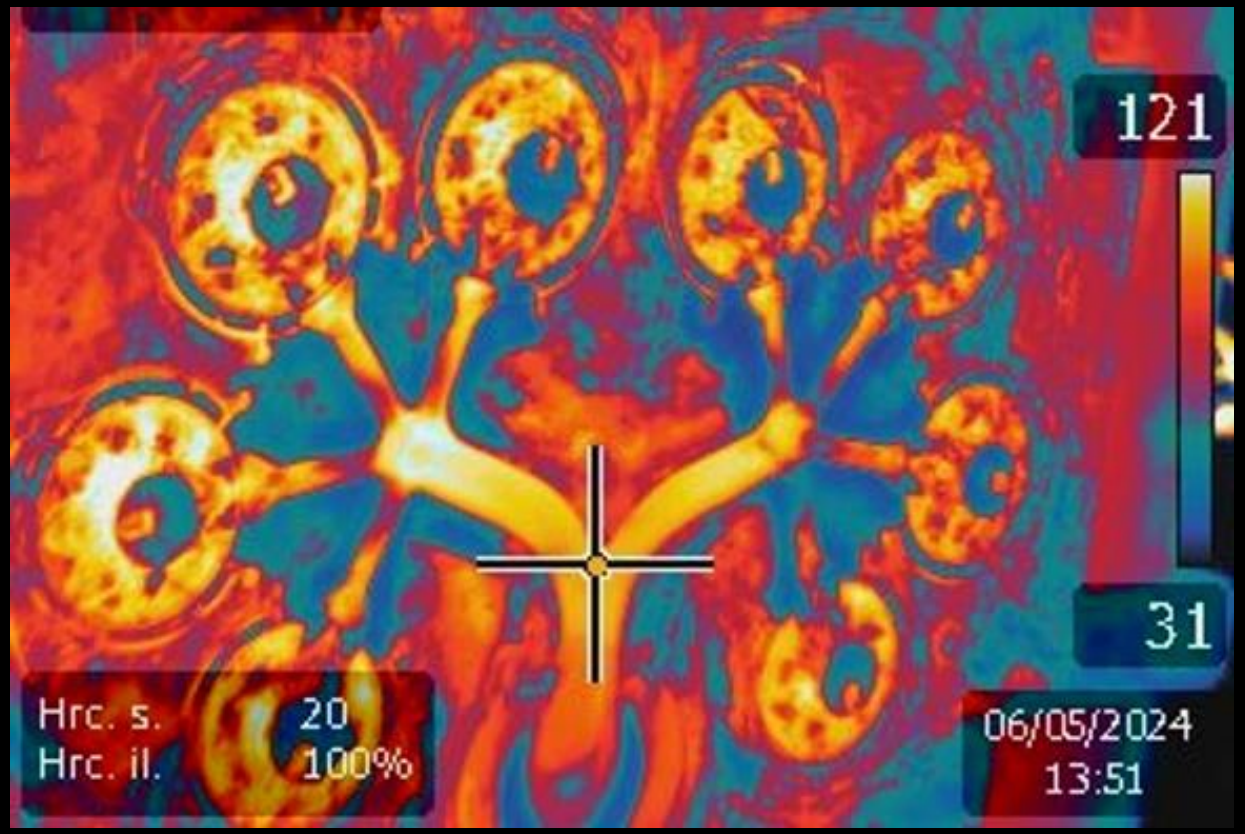


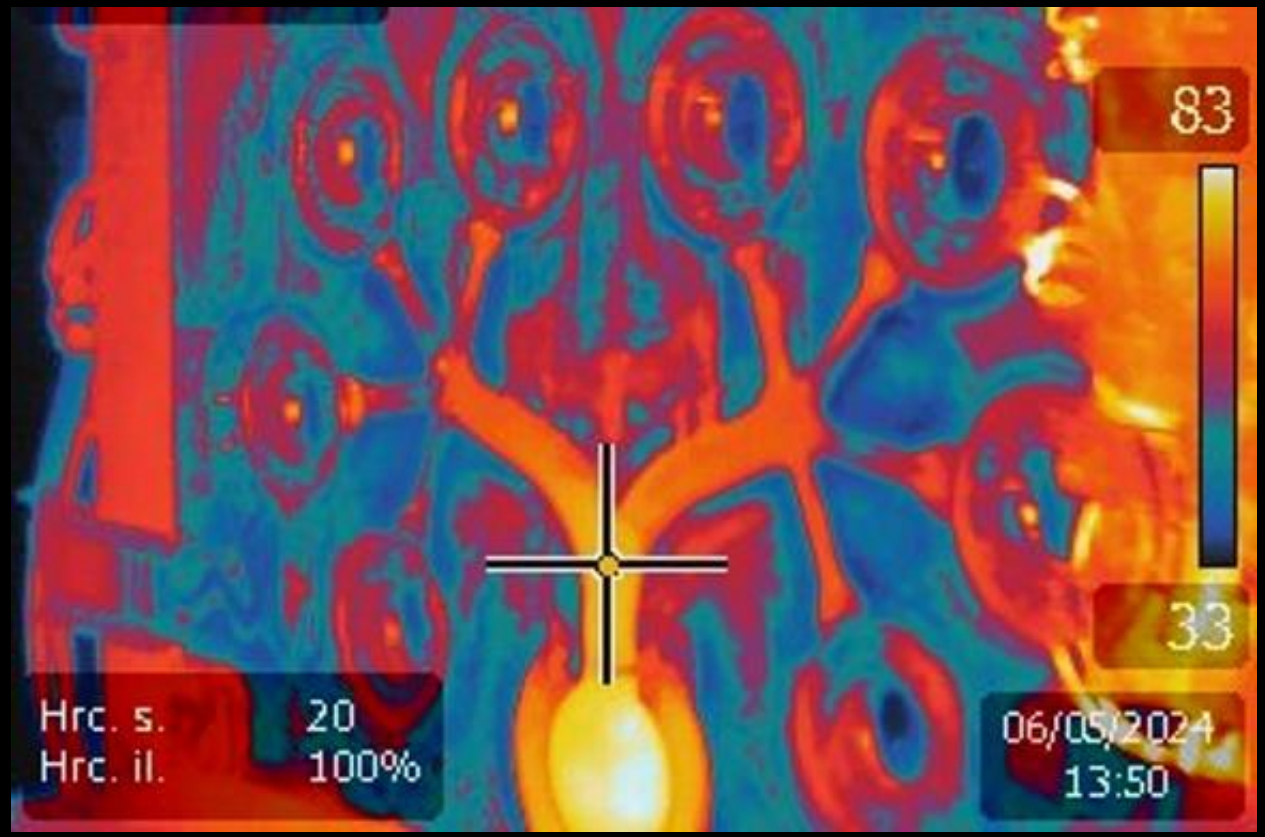
COOLING DESIGN





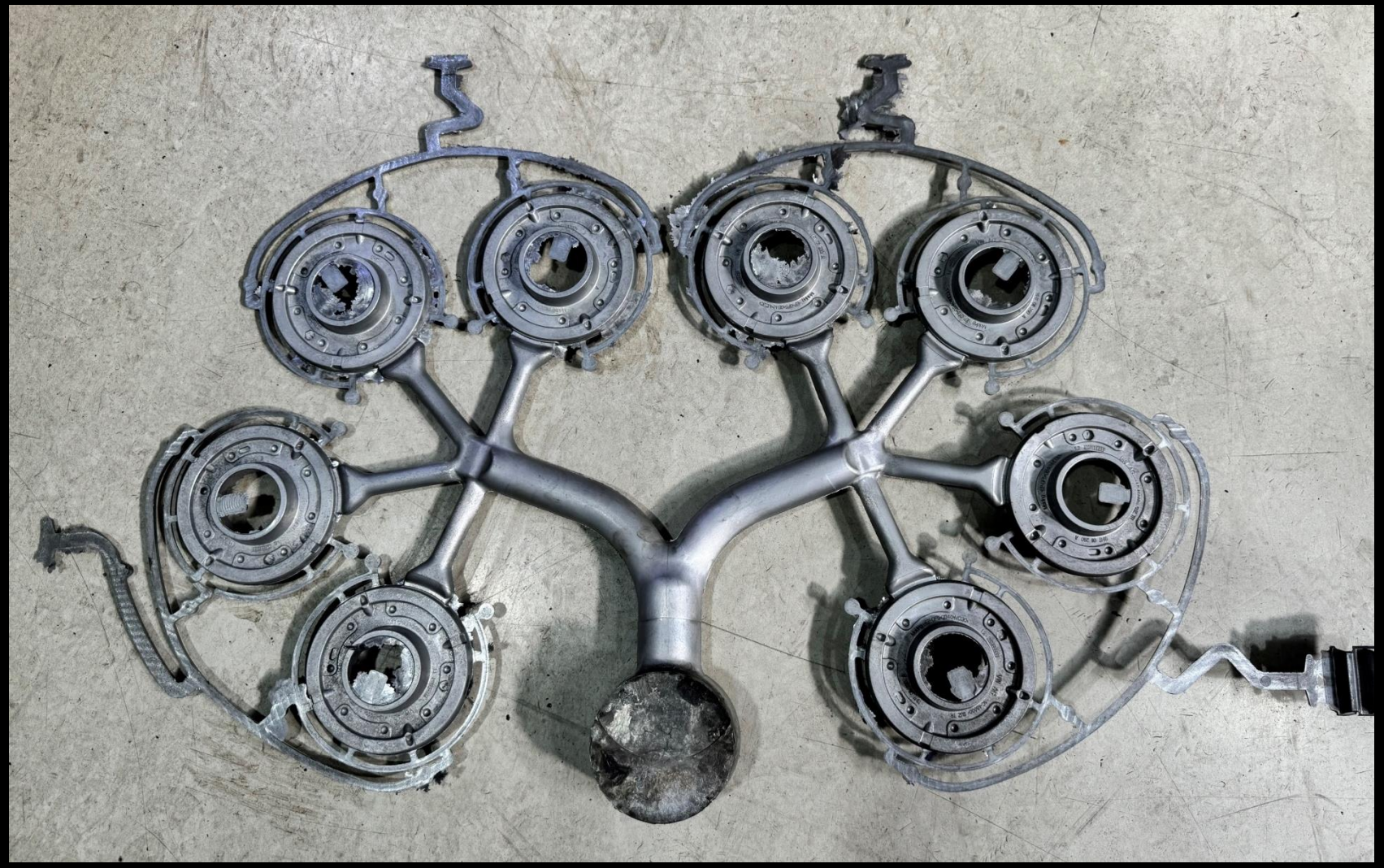
COOLING DESIGN





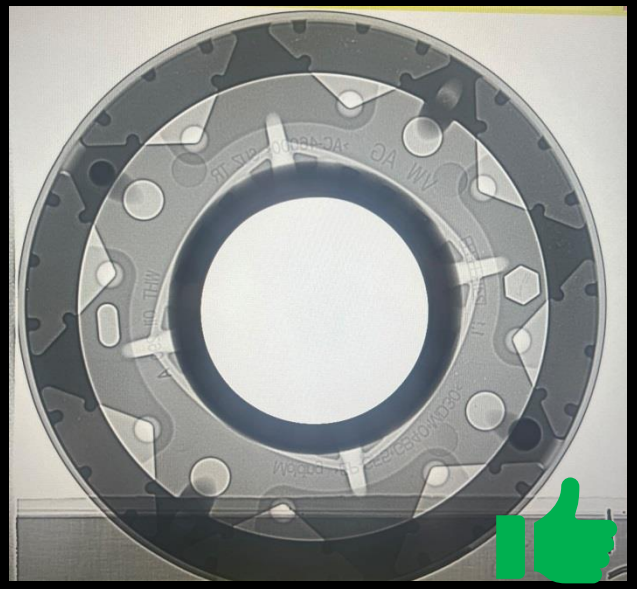
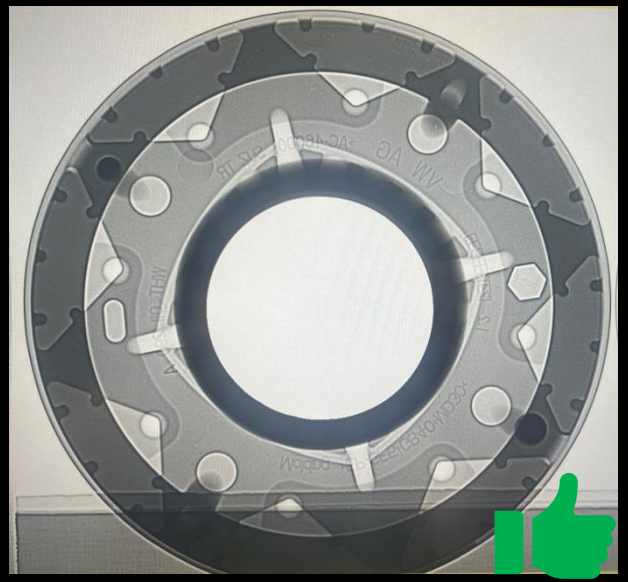
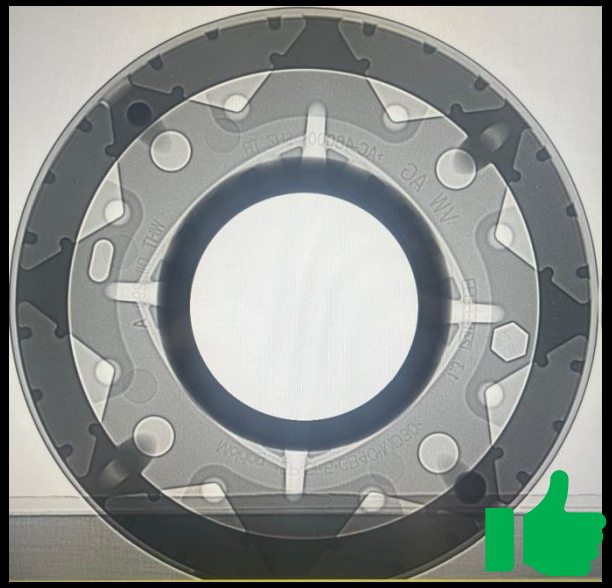
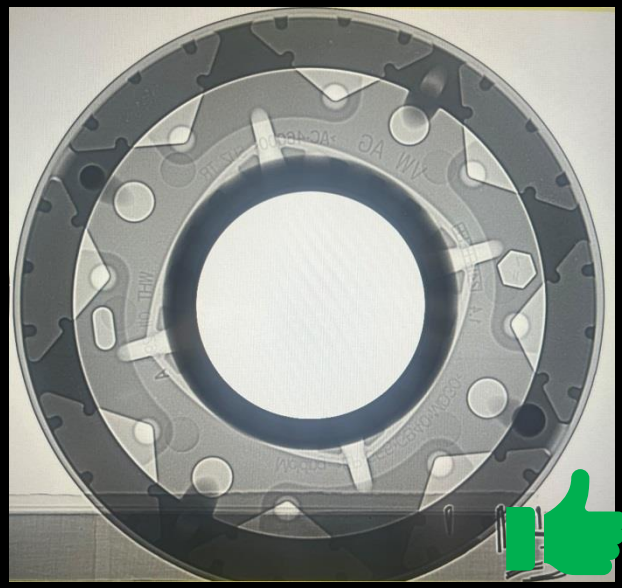
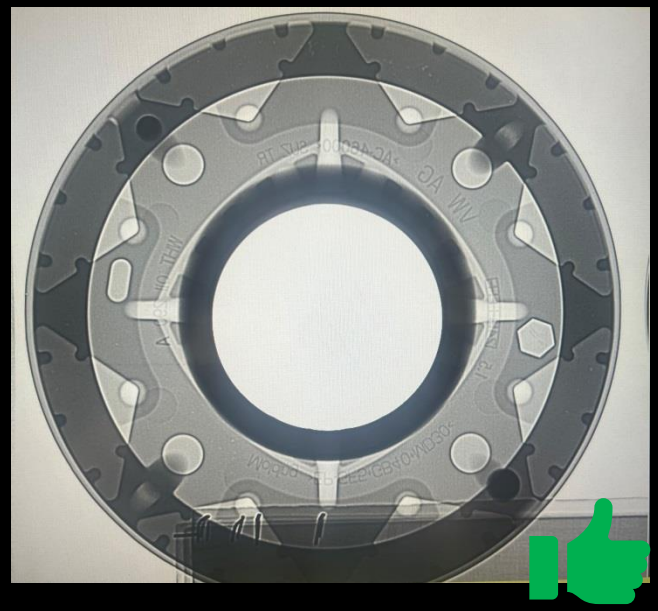
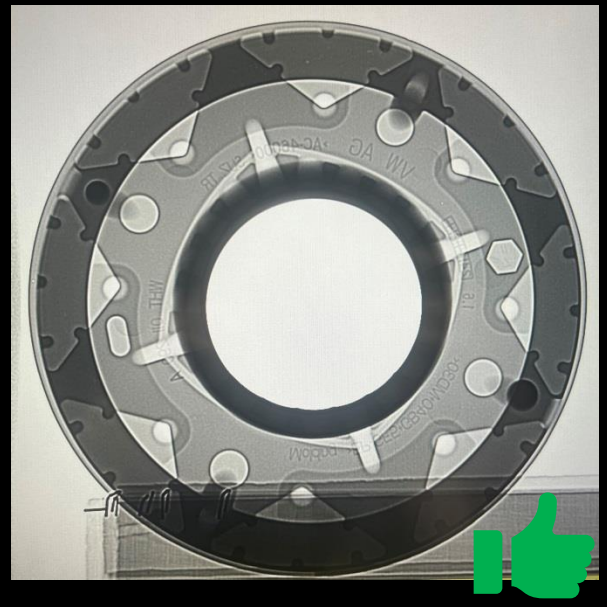
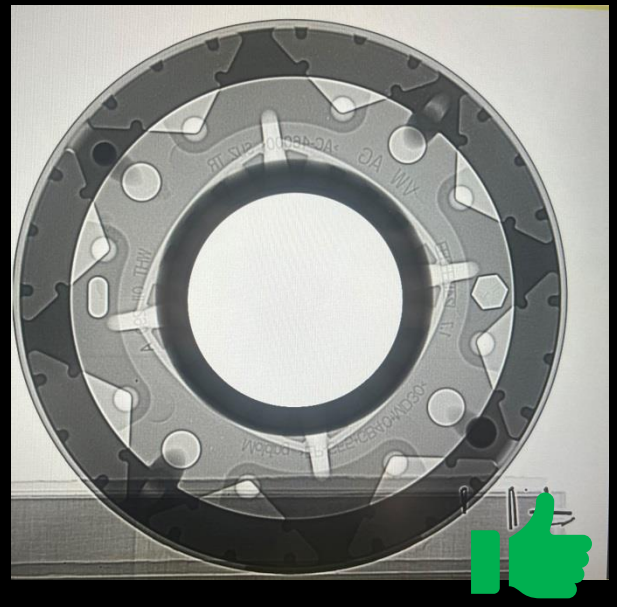
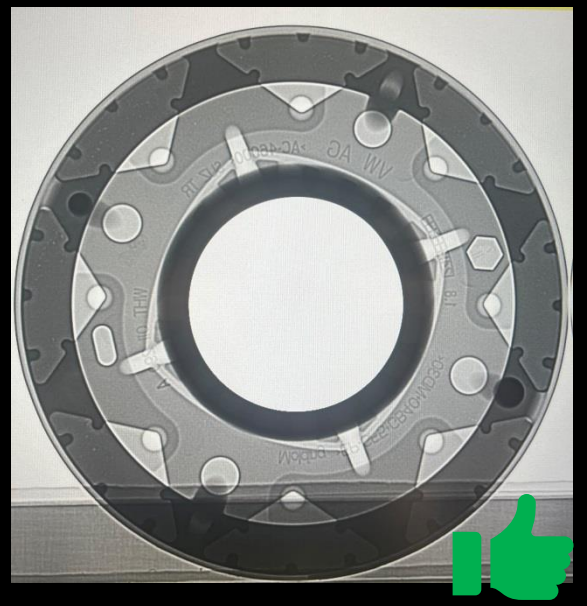
Thermal camera photo of the die after spot cooling

RESULT



From the first tryouts !

RESULT

THANKS !