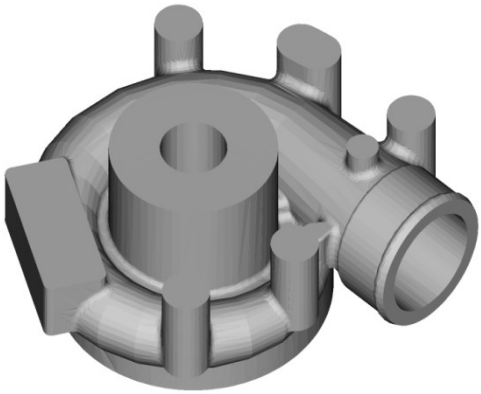
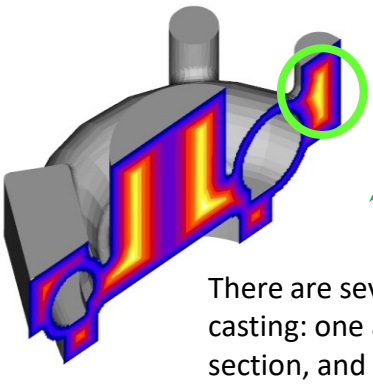
Compressor Case

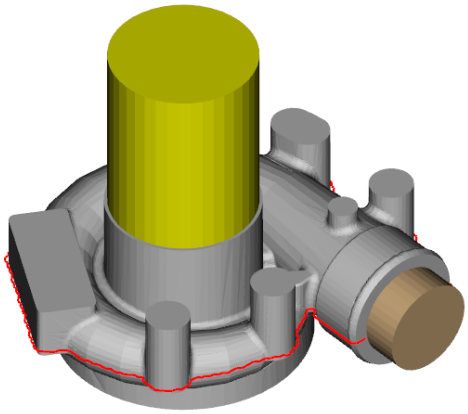
Aluminum Alloy, GDC with Sand Core

***Case*: The aluminum alloy compressor case has overall dimensions 140 mm x 160 mm x 65 mm, and weighs 1.5 kg. This is produced by gravity die casting process using sand cores, in a leading foundry. The casting revealed micro shrinkage at one of the side bosses.**

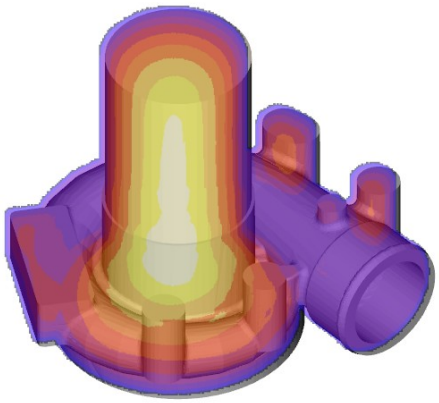


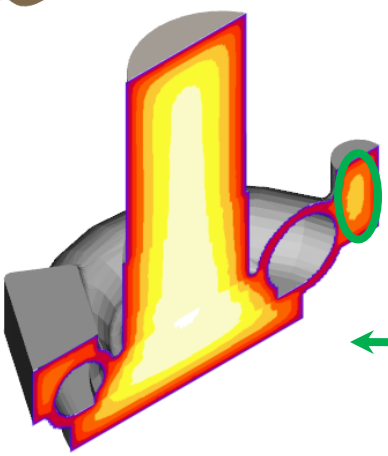


There are several thick regions in the casting: one around the middle section, and others in the bosses. The middle boss of elliptical shape has a thickness of 22 mm (inscribed sphere diameter).



The methoding layout of the part included a central top feeder of height 75 mm and diameter 60 mm, feeding the entire casting.





3 D solidification simulation and the sectional view of the current methods design show an isolated shrinkage defect at the external boss section, which matches the defect found in the actual casting.

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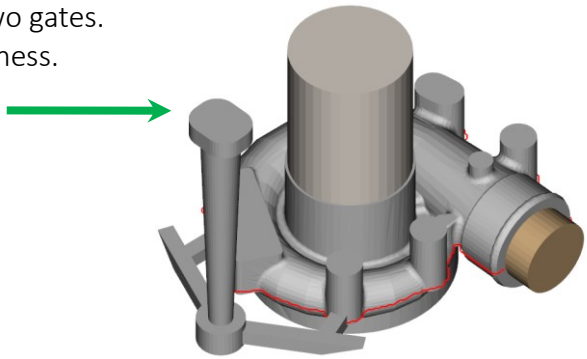
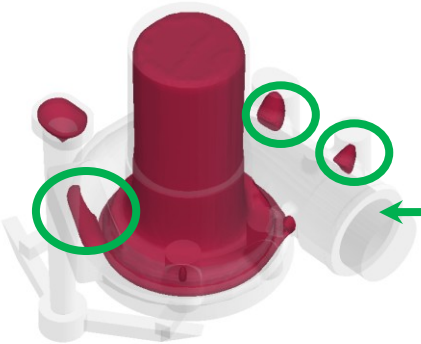
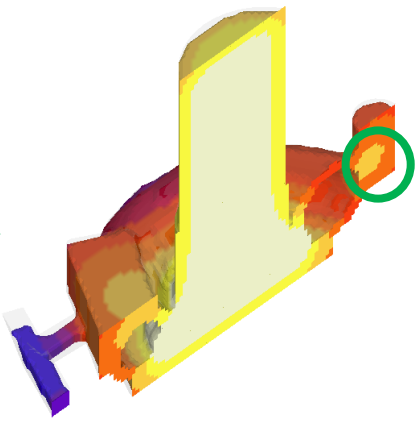
Initial gating system includes two runners and two gates. Gates are connected to section with larger thickness.

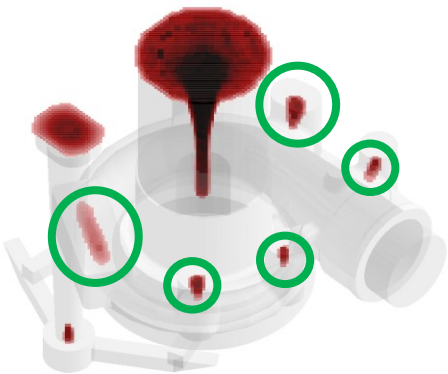




Liquid fraction analysis shows presence of liquid metal in the bosses.

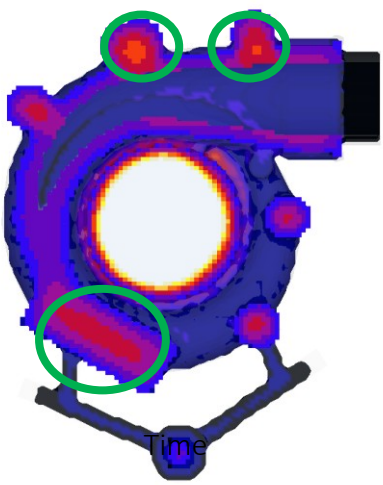
Sectional Solidification analysis displays isolated hot regions inside the boss. This location matches with the defect seen inside the part.





Shrinkage porosity is seen inside the part and bosses. The lighter colour shows micro shrinkages and darker colour shows macro shrinkages.

Solidification Time analysis shows bosses take large time to solidify indicating presence of shrinkage porosity in theses sections.



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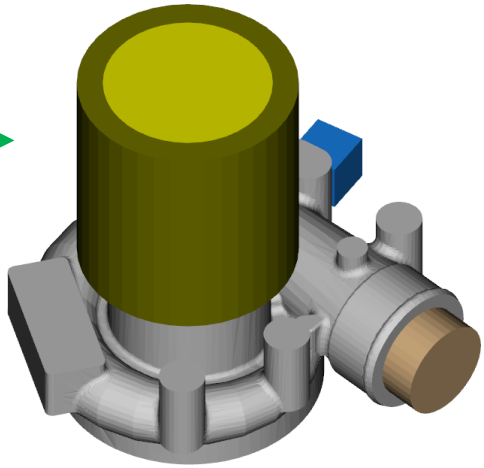
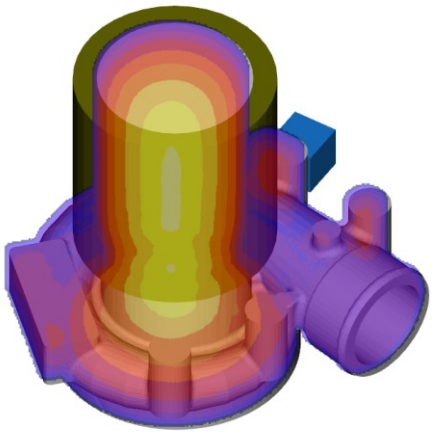
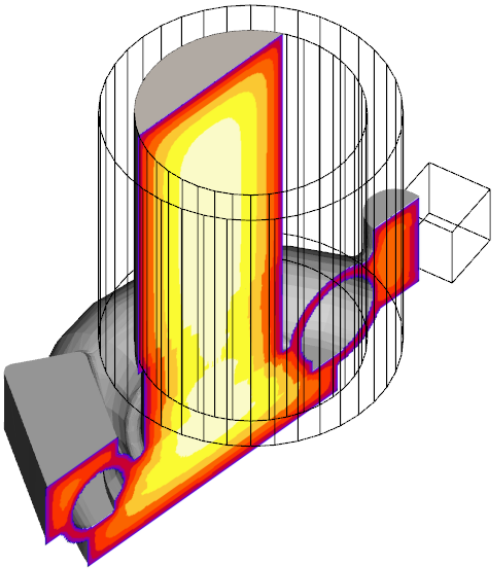
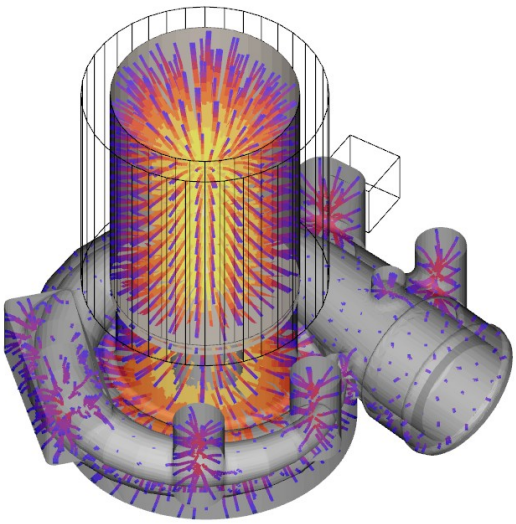
The suggested methoding improvements included a slightly larger central feeder of 90 mm height and 65 mm diameter, with a 10-mm thick insulation sleeve, and a chill on the side boss.





3D solidification simulation and the feed path analysis of the revised methoding show good feeding characteristics, with the feed paths converging inside the feeder.





The sectional solidification view shows no isolated hot spot in the boss section which ensures the casting quality.

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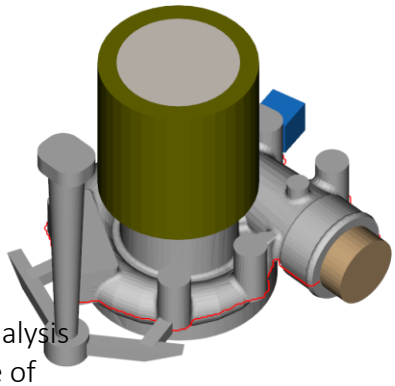
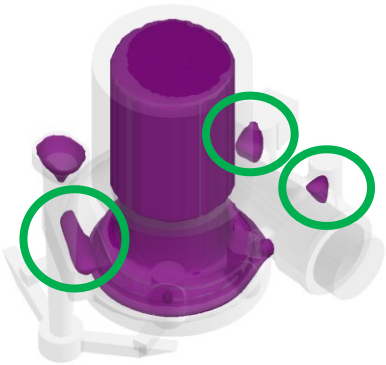
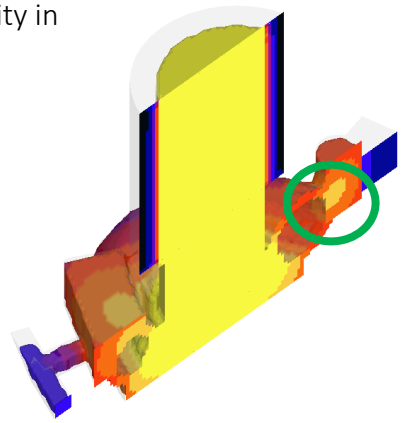
Gating system is kept unchanged for the revised methoding.

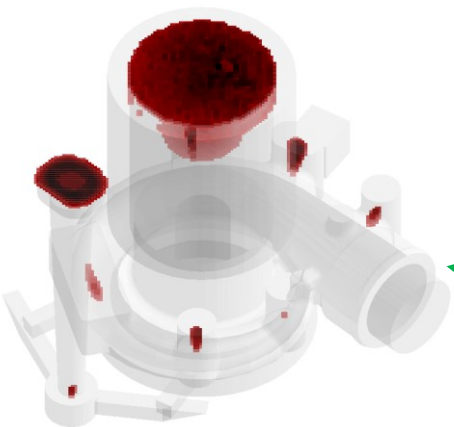




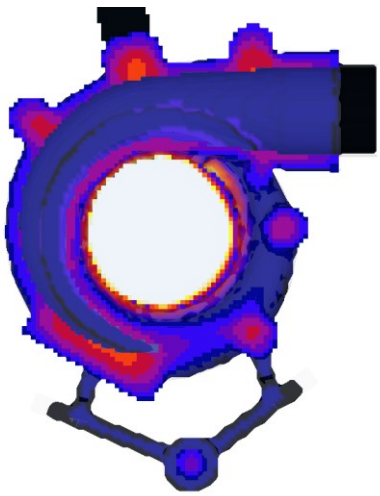
Liquid fraction analysis displays presence of liquid metal inside the part and bosses indicating possibility of shrinkage porosity in these locations.

Sectional solidification analysis suggests isolated hot region inside the boss is present even after the revised methoding.





Shrinkage porosity have reduced after new methoding but it is still observed inside the bosses. Piping shrinkage inside the feeder has reduced.



Solidification Time analysis confirms the results of shrinkage porosity inside the bosses.

Summary: **The revised methoding with external chill near the boss does not eliminate the shrinkage defect inside the bosses.**